Kanata West Block 29 – Servicing and Stormwater Management Report

Stantec Project No. 160401608

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1.0 INTRODUCTION

The revised Site Servicing and Stormwater Management (SWM) report for Block 29 has been prepared to address City comments to the first detailed engineering submission in March 2021. Stormwater subcatchment areas were revised to assume half the roof areas fronting adjacent right-of-ways (ROW's) be considered as uncontrolled flows being directed towards Maize Street and Roger Griffiths Avenue. An overall subdivision model sensitivity analysis was completed to assess the impacts of additional uncontrolled flows to the downstream system.

Richcraft Group of Companies Inc. (Richcraft) has commissioned Stantec Consulting Ltd. (Stantec) to prepare the following Servicing and Stormwater Management Report in support of the Site Plan Application for Block 29 of the Kanata West Subdivision.

The subject site is within the First Registration Phase of the Kanata West Subdivision in the city of Ottawa, bound by Maize Street to the south, Poole Creek to the west and north, and Roger Griffiths Avenue to the east (refer to **Figure 1** below). The First Registration Phase of the Kanata West Subdivision has been approved and is currently under construction. It is expected that Roger Griffiths Avenue and Maize Street will be completed before the servicing works for Block 29 begin.

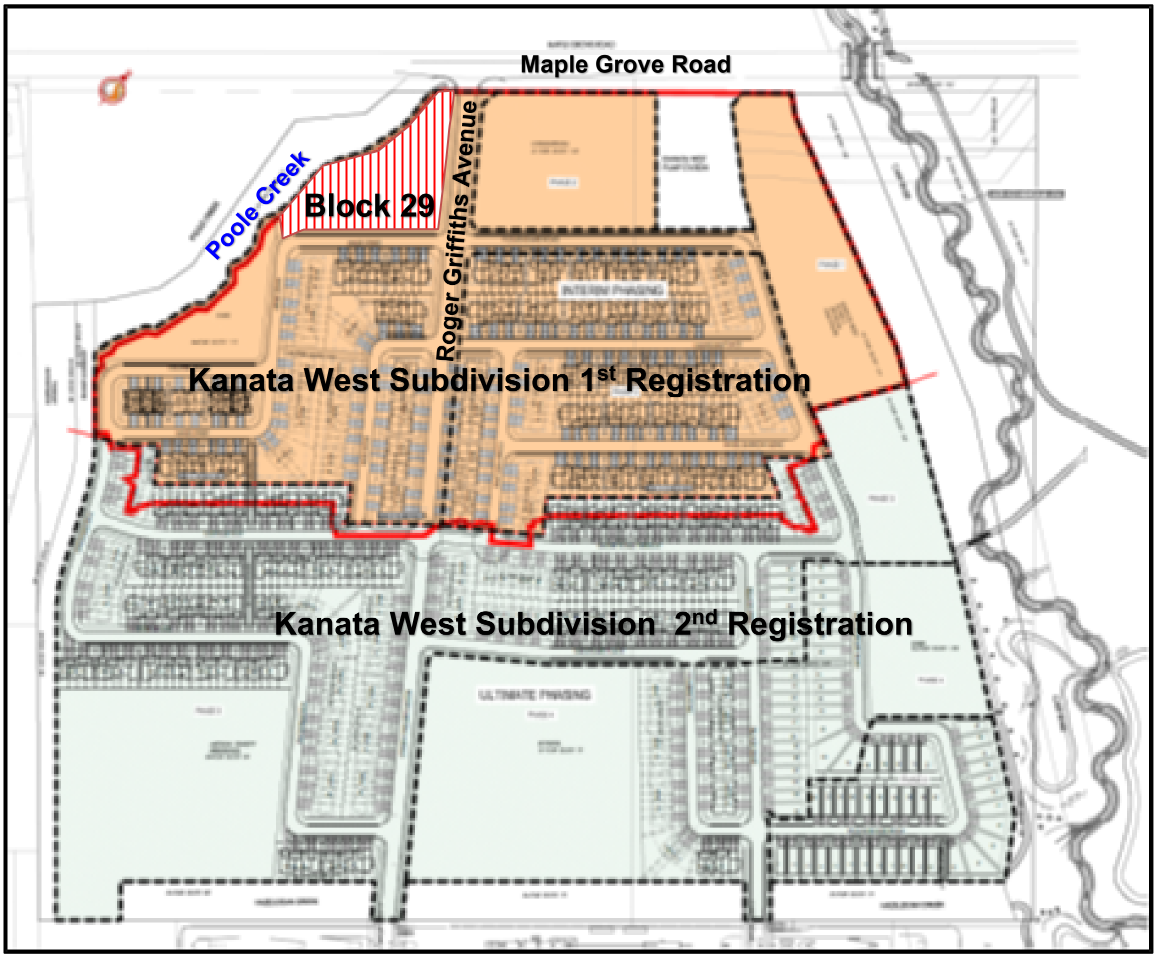


Figure 1: Key Map of Kanata West Block 29

The subject property is currently zoned R4Z (Residential Fourth Density) and occupies 0.74 ha of land. The site is currently undeveloped. The proposed development consists of forty-eight (48) 2-bedroom terrace units as shown in the draft plan included in **Appendix E**.

Preliminary servicing and stormwater management analysis for the Block 29 site was completed as part of the *Kanata West Development First Registration Phase Servicing and Stormwater Management* (SWM) Report completed by Stantec Consulting Ltd. in February 2020 and referenced throughout this report.

1.1 OBJECTIVE

This site servicing and stormwater management (SWM) report has been prepared to present an internal servicing scheme that is free of conflicts, uses existing/approved infrastructure, and meets all design criteria as identified in background documents and City of Ottawa design guidelines.

2.0 REFERENCE DOCUMENTS

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

- *City of Ottawa Sewer Design Guidelines*, 2nd Edition, City of Ottawa, October 2012.
- *City of Ottawa Design Guidelines – Water Distribution*, 1st Edition, Infrastructure Services Department, City of Ottawa, July 2010.
- *Technical Bulletin ISDTB-2014-02 Revision to Ottawa Design Guidelines – Water*, City of Ottawa, May 2014.
- *Technical Bulletin PIEDTB-2016-01 Revisions to Ottawa Design Guidelines – Sewer,* City of Ottawa, September 2016.
- *Technical Bulletin ISTB-2018-01 Revision to Ottawa Design Guidelines – Sewer,* City of Ottawa, March 2018.
- *Technical Bulletin ISTB-2018-02 Revision to Ottawa Design Guidelines – Water Distribution,* City of Ottawa, March 2018.
- *Richcraft Kanata West Development First Registration Phase, 1620 Maple Grove Road (D07-16-04-0017) – Servicing and Stormwater Management Report*, Stantec Consulting Ltd., February 12, 2020.
- *Richcraft Kanata West Development Second Registration Phase, 1620 Maple Grove Road– Servicing and Stormwater Management Report*, Stantec Consulting Ltd., July 7, 2021.
- *Interim Kanata West Pond 5 (with Ultimate Carp River) Design Brief – 1620 Maple Grove Road – D07-16-04-0017*, Stantec Consulting Ltd., July 12, 2019.
- *Geotechnical Investigation – Proposed Residential Development – Kanata West Block 29*, Paterson Group Inc., July 14, 2020.
- *Phase I – Environmental Site Assessment Update – Block 29 of Kanata West Development*, Paterson Group Inc., July 6, 2020.

3.0 POTABLE WATER SERVICING

3.1 BACKGROUND

The proposed development is located within Zone 3W of the City of Ottawa's water distribution system. This zone is fed by the Glen Cairn Pump Station. The site will be fed by a 200 mm diameter watermain on Maize Street, to be constructed as part of the 1st construction phase of the Kanata West Development.

As part of the First Registration Phase of the Kanata West Development, which provides all municipal services for Block 29, three H2OMAP Water hydraulic analyses were completed to assess different build-out scenarios: i) 1st Construction Phase, ii) First Registration Phase (i.e., Interim Condition), and iii) Ultimate Condition (First and Second Registration Phases). To be conservative, boundary conditions from the worst case of these three build-out scenarios have been used in the hydraulic analysis for Block 29.

The Block 29 population was previously estimated as 76 persons in the *Kanata West Development First Registration Phase Servicing and Stormwater Management Report* (Stantec, February 2020).

3.2 PROPOSED WATERMAIN SIZING AND LAYOUT

3.2.1 Connections to Existing Infrastructure

The proposed watermain alignment and sizing for the development is demonstrated on **Drawing SSP-1**. A 204 mm diameter watermain is proposed to follow the alignment of the private roads within the subject property with a connection to the existing 200 mm diameter watermain on Maize Street at the entrance to the Block 29 site. The two dead-end watermains downstream of the hydrant were reduced to diameter 50mm.

Figure 2 shows the layout of the proposed watermain network and the connection to the existing watermain on Maize Street.

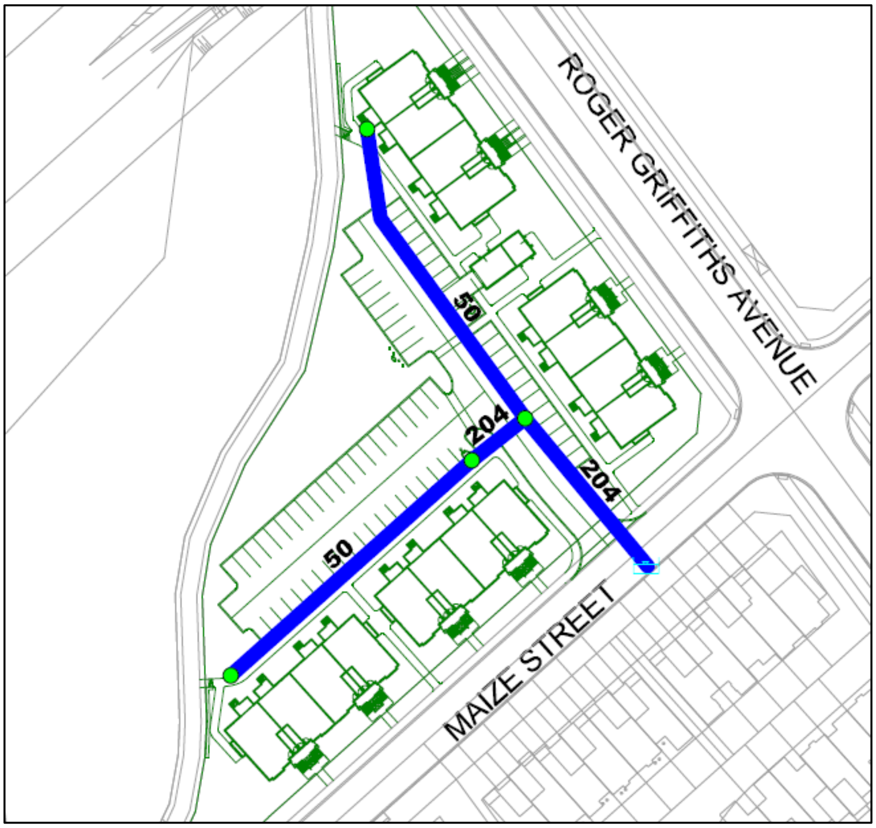


Figure 2: Proposed Watermain Layout and Pipe Diameters (mm)

3.2.2 Ground Elevations

Proposed ground elevations throughout the Block 29 site range from approximately 97.83 m to 98.23 m at nodes in the watermain network.

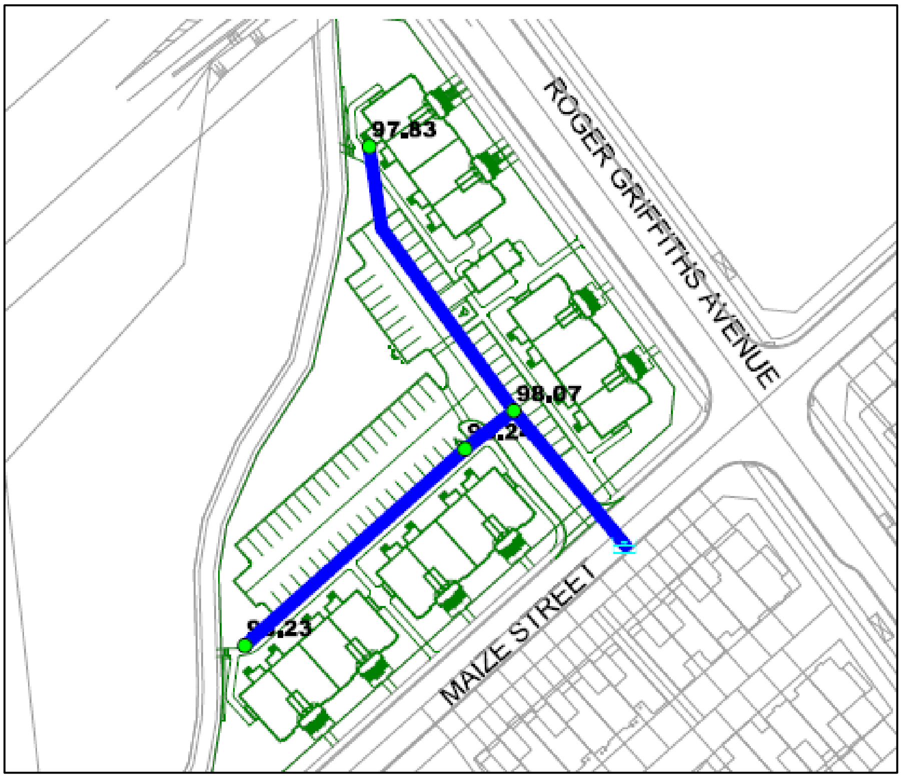


Figure 3: Ground Elevations (m) at Nodes

3.2.3 Domestic Water Demands

Kanata West Block 29 contains a total of forty-eight (48) 2-bedroom terrace units, with an estimated total population of 101 persons. Refer to **Appendix A.1** for detailed domestic water demand calculations.

Water demands for the development were estimated using the City of Ottawa's Water Distribution Design Guidelines. For residential developments, the average day (AVDY) per capita water demand is 350 L/cap/d. For maximum day (MXDY) demand, AVDY was multiplied by a factor of 2.5 and for peak hour (PKHR) demand, MXDY was multiplied by a factor of 2.2. The calculated residential water consumption is represented in **Table 1**.

Table 1: Residential Water Demands for Block 29

Unit Type	Units	Persons/Unit	Population	AVDY (L/s)	MXDY (L/s)	PKHR (L/s)
2-Bedroom Terrace Units	48	2.1	101	0.41	1.02	2.25

3.3 LEVEL OF SERVICE

3.3.1 Allowable Pressures

The City of Ottawa Water Distribution Design Guidelines state that the desired range of system pressures under normal demand conditions (i.e., basic day, maximum day, and peak hour) should be in the range of 350 to 552 kPa (50 to 80 psi) and no less than 275 kPa (40 psi) at the ground elevation on the streets (i.e., at hydrant level). The maximum pressure at any point in the distribution system in occupied areas outside of the public right-of-way is 552 kPa (80 psi). As per the Ontario Building Code (OBC) & Guide for Plumbing, if pressures greater than 552 kPa (80 psi) are anticipated, pressure relief measures are required. The maximum pressure at any point in the distribution system in unoccupied areas shall not exceed 689 kPa (100 psi). Under emergency fire flow conditions, the minimum pressure objective in the distribution system is 138 kPa (20 psi).

3.3.2 Fire Flow Demands

Fire flow calculations were completed using the Fire Underwriters Survey (FUS) methodology. Refer to **Appendix A.2** for detailed FUS calculations. The results of the fire flow calculations are summarized in **Table 2**.

Table 2: Fire Flow Calculations Using FUS Methodology

Unit Type	Description	Required Fire Flow (L/min)	Required Fire Flow (L/s)
2-Bedroom Terrace Units	3-storey building with twelve 2-bedroom terrace units (worst-case exposures: Block 3).	15,000	250

The highest fire flow requirement of 15,000 L/min (250 L/s) is used for the purpose of the fire flow analysis.

3.4 HYDRAULIC ANALYSIS

A hydraulic model for the proposed Block 29 watermain layout was completed using H2OMAP Water with the boundary condition from the hydraulic model prepared for the Richcraft Kanata West Development First Registration Phase Servicing and SWM Report (Stantec, February 2020). Three hydraulic models were prepared for the Kanata West Development as follows: i) 1st Construction Phase, ii) First Registration Phase (i.e., “Interim Condition”), and iii) Ultimate Condition (First and Second Registration Phases).

The boundary conditions from the Kanata West Development hydraulic models at the node nearest to Block 29 (intersection of Roger Griffiths Avenue and Maize Street) are summarized in **Table 3**. The 267 L/s fire flow demand condition from the Kanata West Development hydraulic model serves as a conservative boundary condition for the 250 L/s (15,000 L/min) fire flow demand calculated for the Block 29 site.

Table 3: Boundary Conditions for Block 29 from KW Development Hydraulic Model

	1st Construction Phase	1st Registration Phase (Interim Condition)	Ultimate Condition (1st and 2nd Registration Phases complete)
Maximum HGL (AVDY), Head (m)	161.74	**161.66**	161.38
PKHR, Head (m)	157.73	**157.59**	157.66
MXDY+FF (267 L/s), Head (m)	149.42	**149.27**	153.95

1. Boundary conditions taken from Node 10 in the Kanata West Development H2OMAP Water hydraulic model (Stantec, 2020). Ground elevation at Node 10 = 97.88 m in the model.

The MXDY plus fire flow head is lowest for the First Registration Phase (Interim Condition). Therefore, these values have been used as conservative boundary conditions for Block 29.

The anticipated pressures in this development were assessed to meet minimum servicing requirements (average day and peak hour demands). A fire flow analysis was also performed under maximum day conditions. Detailed results are shown in **Appendix A.3**.

3.4.1 Model Development

New watermains were added to the hydraulic model to simulate the proposed distribution system. Hazen-Williams coefficients ("C-Factors") were applied to the new watermain in accordance with the City of Ottawa's Water Distribution Design Guidelines (**Table 4**).

Table 4: C-Factors Applied Based on Watermain Diameter

Nominal Pipe Diameter (mm)	C-Factor
150	100
200 to 250	110
300 to 600	120
Over 600	130

3.4.1.1 Average Day & Peak Hour

The hydraulic model results show that the maximum pressures (AVDY condition) are anticipated to be approximately 622-626 kPa (90.2-90.7 psi) within the Block 29 site. Minimum pressures during PKHR conditions are anticipated to be approximately 583-586 kPa (84.6-85.0 psi) for Block 29. These pressures are well above the minimum allowable pressure of 276 kPa (40 psi) and will require pressure reducing valves (PRVs) for all proposed units.

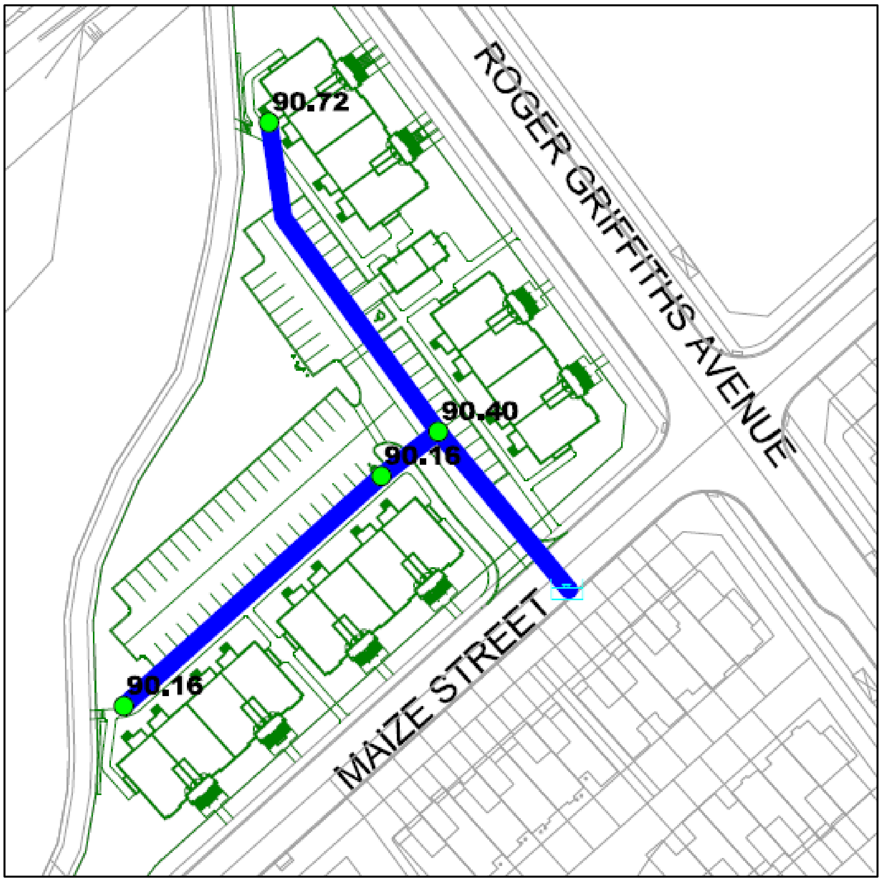


Figure 4 and **Figure 5** below identify the minimum and maximum pressure results for the simulation, respectively.

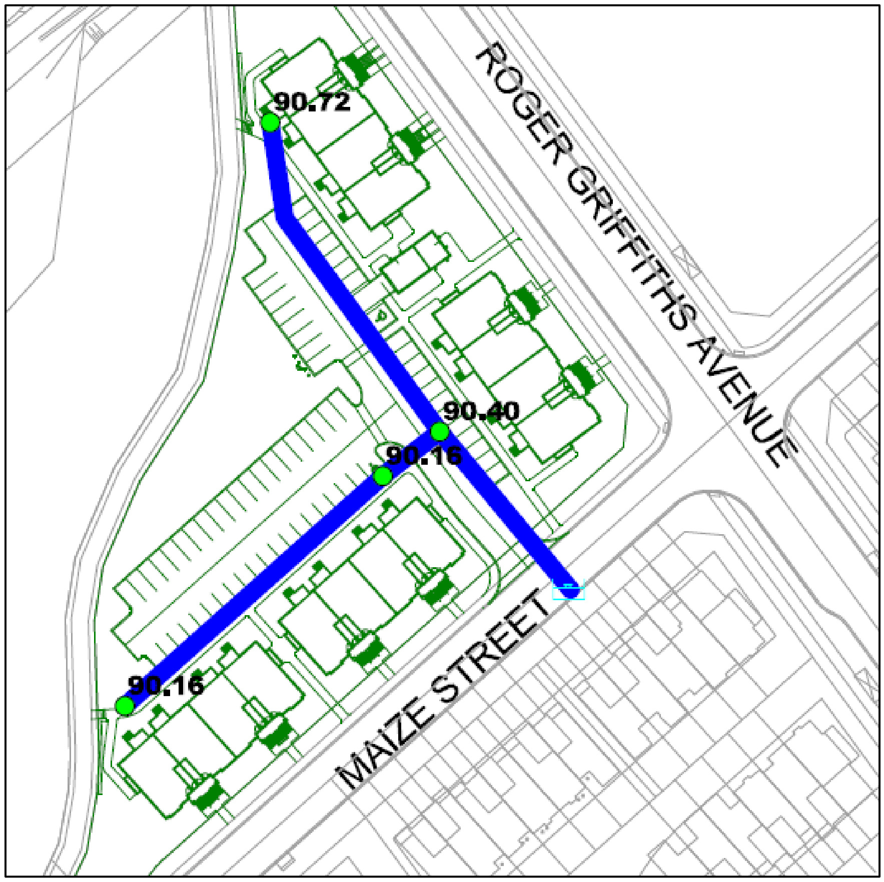


Figure 4: Maximum Pressures (psi) in Block 29 During AVDY Conditions

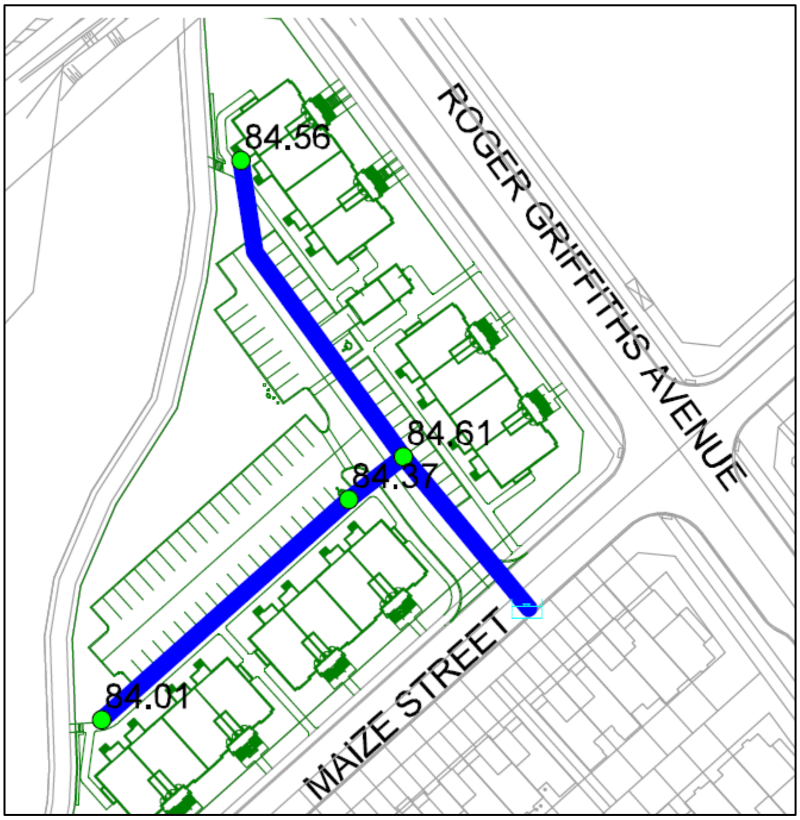


Figure 5: Minimum Pressures (psi) in Block 29 During PKHR Conditions

3.4.1.2 Maximum Day Plus Fire flow

An analysis was carried out using the hydraulic model to determine if the proposed development, under maximum day demands, can achieve a fire flow of 15,000 L/min (250 L/s) while maintaining a residual pressure of 138 kPa (20 psi). This was accomplished using a steady-state maximum day demand scenario along with the automated fire flow simulation feature of H2OMAP Water. The available flows are shown in **Figure 6**.

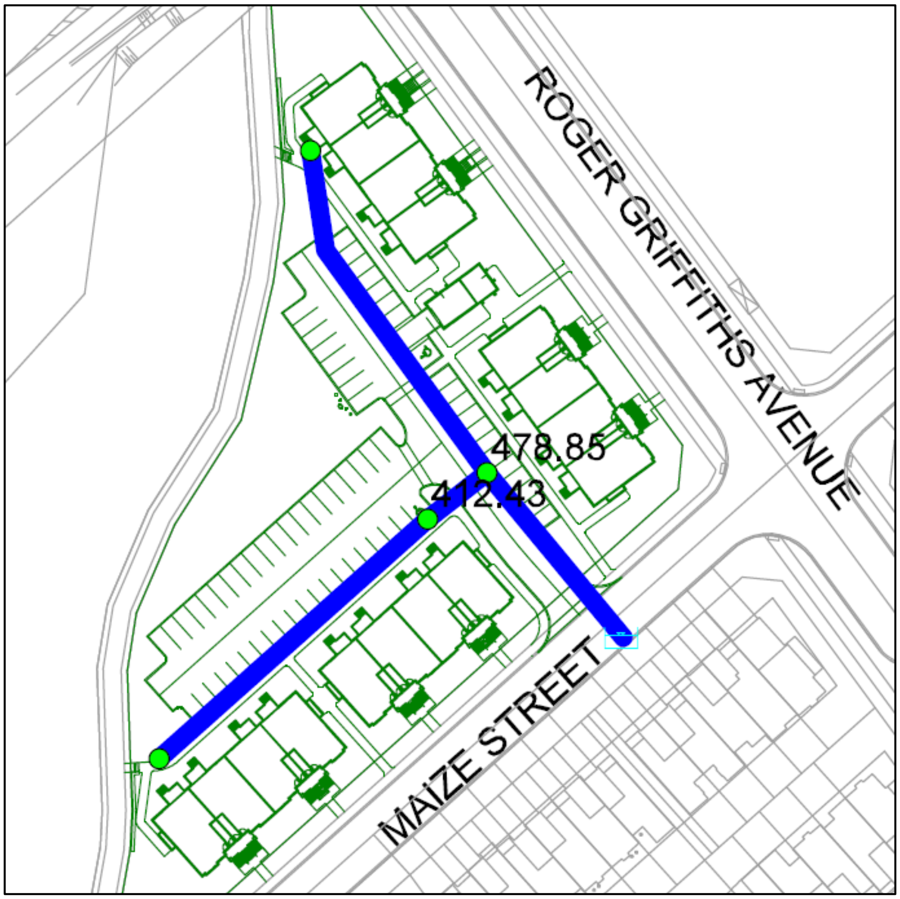


Figure 6: Available Fire Flows (L/s) in Block 29 During MXDY Conditions

Using the proposed pipe layout and sizing, a fire flow of 15,000 L/min (250 L/s) can be achieved while maintaining at least 20 psi residual pressure at all locations upon development of Block 29.

4.0 WASTEWATER SERVICING

4.1 BACKGROUND

As indicated in the *Kanata West Development First Registration Phase Servicing and Stormwater Management Report* (Stantec, February 2020), wastewater from the Kanata West Development is conveyed to the existing 1200 mm diameter sanitary sewer on Maple Grove Road via a free flow gravity trunk sewer. Wastewater from the Kanata West Development is ultimately conveyed to the Kanata West Pump Station.

The *Kanata West Development First Registration Phase Servicing and Stormwater Management Report* (Stantec, February 2020) identifies Block 29 as sanitary drainage area 'R4B.' Furthermore, this report specifies that the sanitary outlet for Block 29 is to be made downstream of SAN MH 4 on Maize Street. The population of Block 29 was previously estimated as 76 persons.

4.2 DESIGN CRITERIA

As outlined in the City of Ottawa Sewer Design Guidelines, the following design parameters were used to calculate wastewater flow rates and to size on-site sanitary sewers:

- Minimum full flow velocity – 0.6 m/s
- Maximum full flow velocity – 3.0 m/s
- Manning's roughness coefficient for all smooth-walled pipes – 0.013
- Single family home persons per unit – 3.4
- Townhouse persons per unit – 2.7
- 2-bedroom apartments persons per unit – 2.1
- Extraneous flow allowance – 0.33 L/s/ha
- Residential average flows – 280 L/cap/day
- Commercial/mixed-use flows – 28,000 L/ha/day
- Maintenance hole spacing – 120 m for pipes under 450 mm diameter, 150 m for pipes 450 mm diameter and larger
- Minimum cover – 2.5 m
- Harmon correction factor – 0.8

In addition, a residential peak factor based on Harmon's Equation was used to determine the peak design flows, per the City of Ottawa Sewer Design Guidelines.

Refer to **Appendix B** for the sanitary sewer design sheet for the proposed Kanata West Block 29 site.

4.3 SANITARY SERVICING DESIGN

200 mm diameter sanitary sewers are proposed throughout the Block 29 site. A 200 mm diameter sanitary sewer on Maize Street will be installed as part of the Kanata West Subdivision First Registration servicing works and will serve as the sanitary outlet for the site. Sanitary flows will then be directed northwards along Roger Griffiths Avenue, then eastwards along Maple Grove Road towards the Kanata

West Pump Station. The proposed sanitary sewers within the Block 29 site will not convey any upstream sanitary flows. The proposed sanitary sewer layout for the subject site is shown in **Drawings SSP-1** and **SA-1** in **Appendix F**. The sanitary sewer design sheet is included in **Appendix B.1**.

The proposed peak flows from Block 29 are summarized in **Table 5** below.

Table 5: Sanitary Peak Flow at Proposed SAN MH 1

MH ID	Total area (ha)	Population	Peak Flow (L/s)	Sewer Diameter (mm)
SAN MH 1, Block 29 contribution	0.74	101	1.4	200

The Servicing and SWM Report for the First Registration of the Kanata West Development assumed a population of 76 for the Block 29 site, which has since been revised to 101 based on the proposed site plan. To ensure that the sanitary sewer on Maize Street is sufficiently sized to accept additional peak flows from the Block 29 development given the population increase, the sanitary sewer design sheet from the First Registration of the Kanata West Subdivision was used to assess the capacity of the approved sanitary sewers. The results are summarized in **Table 6** below. Background information, including the Kanata West Development sanitary sewer design sheet, is provided in **Appendix B.2**.

Table 6: Comparison of Expected Residential Sanitary Peak Flows for Block 29

MH ID	Formerly Expected Population for Block 29 from First Registration KW Subdivision Report	Revised Expected Population for Block 29	Formerly Expected Sanitary Peak Flow (L/s)	Revised Expected Sanitary Peak Flow (L/s)
KW SAN 3	76	101	1.1	1.4

The above table shows a 0.3 L/s increase in the expected sanitary peak flows due to the higher population density of the Block 29 development and as can be seen in the Kanata West Subdivision sanitary sewer design sheet attached in **Appendix B.2**, the residual capacity of the approved downstream sanitary sewers ranges between 12.0 L/s and 252.2 L/s, which is well above the proposed sanitary peak flow increase.

5.0 STORMWATER MANAGEMENT AND STORM SERVICING

The proposed development encompasses approximately 0.74 ha of land within the Block 29 property. The entire development is residential containing three-storey terrace flat units. As shown on **Drawing SD-1**, post-development minor system peak flows from the development will be discharged to the approved 675 mm diameter storm sewer on Maize Street. Overland flows during major storm events will be directed to Maize Street and then along the Ploughshare Road right-of-way to the Kanata West Pond 5, located east of the site. Based on grading restrictions, uncontrolled flows from the site will be directed to Maize Street, Roger Griffiths Avenue and Poole Creek. Stormwater quality control (80% TSS removal) is provided by the existing interim Kanata West Pond 5, as described in the *Interim Kanata West Pond 5 (with Ultimate Carp River) Design Brief* (Stantec, July 2019). Refer to **Appendix C.6** for the storm drainage plan and storm sewer design sheet for the First Registration of the Kanata West Subdivision (Stantec, 2020).

In the existing condition, a portion of the site drains to the northwest into Poole Creek and the remainder of the site drains southwards towards Maize Street. An interim drainage ditch runs through the southern portion of Block 29 draining from west to east.

5.1 BACKGROUND

Stantec Consulting Ltd. completed the detailed design of the First Registration Richcraft Kanata West (KW) Subdivision in February 2020. The design of the storm sewers and KW Pond 5 in the KW site accounted for the future development in Block 29 (previously referred to as Block 115 or MD1).

Major and minor system flows are to be conveyed to the interim Kanata West Pond 5 for quality and quantity control per the *Kanata West Development First Registration Servicing and Stormwater Management Report* (Stantec, February 2020).

Additional SWM criteria from this report are listed in the proceeding sections.

The Richcraft Kanata West Development Second Registration Phase published in July 2021 should be read in conjunction the First Registration Report mentioned above. The most recent report eliminates the need for infiltration on Block 29.

5.2 STORMWATER MANAGEMENT DESIGN

5.2.1 Design Criteria and Constraints

The design methodology for the SWM component of the development is as follows:

General

- Use of the dual drainage principle (City of Ottawa).

- Wherever feasible and practical, site-level measures should be used to reduce and control the volume and rate of runoff (City of Ottawa).
- Using the 3-Hour Chicago design event, assess the impact of the 2-year storm, 100-year storm, and 100-year+20% climate change event, as outlined in the City of Ottawa Sewer Design Guidelines, on the major and minor drainage system (City of Ottawa).

Storm Sewer & Inlet Controls

- Proposed site to discharge to the existing 675 mm diameter storm sewer on Maize Street, downstream of STM MH 123 (*Kanata West Development First Registration Servicing and Stormwater Management Report*, Stantec).
- Minor system discharge rate from Block 29 not to exceed **111** L/s; major system overflows from the site not to exceed **480 L/s** in the 100-year event (*Kanata West Development First Registration Servicing and Stormwater Management Report*, Stantec).
- Size storm sewers to convey the 2-year storm event under free-flow conditions using 2012 City of Ottawa I-D-F parameters. (City of Ottawa).
- 100-year storm hydraulic grade line (HGL) to be a minimum of 0.30 m below underside of footing (City of Ottawa).
- Climate change event HGL to be below underside of footing (City of Ottawa).

Surface Storage & Overland Flow

- Overland flow from Block 29 to be directed to the Maize Street right-of-way (Stantec)
- No surface ponding is permitted within the site during the 2-year storm event (City of Ottawa).
- Maximum depth of flow under either static or dynamic conditions shall be less than 0.35m for design storm events (i.e., up to 100-year storm) (City of Ottawa).
- Minimum clearance depth of 0.15m to be provided from spill elevations within the proposed rights-of-way to building envelopes in proximity of overland flow routes or ponding areas.
- Water must not encroach upon proposed building envelopes and must remain below all proposed building openings during the climate change event (City of Ottawa).
- Provide adequate emergency overflow conveyance off-site (City of Ottawa).
- No rear-yard ponding volumes to be accounted for in SWM model preparation (City of Ottawa).
- The product of depth times velocity on streets not to be greater than 0.6 during the 100-year storm event (City of Ottawa).

The site is to be designed using the “dual drainage” principle, whereby the minor (pipe) system within the site is designed to convey the peak rate of runoff from the 2-year design storm and runoff from larger events is conveyed by both minor (pipe) and major (overland) channels, such as roadways and safely off site without impacting proposed or existing downstream properties.

In keeping with the 2-year inlet restriction criterion, inlet control devices (ICDs) or orifice plates are specified for all street catchbasins to limit the inflow to the minor system. Restricted inlet rates to the sewer are necessary to prevent the hydraulic grade line from surcharging storm sewers into basements during major storms. **Drawing SD-1** outlines the proposed storm sewer alignment and drainage divides.

5.3 POST-DEVELOPMENT MODELLING

Hydrologic and hydraulic modeling of the storm system was completed using PCSWMM modeling software which uses the EPA-SWMM 5.1.014computational engine for analysis. The included models can also be opened and reviewed using the free EPA-SWMM GUI. PCSWMM model layout, input parameters, and example input file are provided in **Appendix C**. Modelling files have been provided as part of the digital submission. The following sections summarize the input parameters used in the post-development model.

5.3.1 Allowable Release Rate

The minor and major system allowable release rates from the Block 29 site are based on the *Kanata West Development First Registration Servicing and Stormwater Management Report* (Stantec, February 2020). The minor and major system target release rates are summarized in **Table 7** below.

Table 7: Block 29 Minor and Major System Target Release Rates

Minor System Target Release Rate (L/s)	Major System Target Release Rate (L/s)
111.0	480.0

1. Block 29 was shown to discharge its minor system to STM MH 123 in the PCSWMM Model for the *Richcraft Kanata West Development First Registration Phase Servicing and Stormwater Management Report* (Stantec, February 2020). Block 29 is now proposed to outlet to proposed STM MH 101, which will be placed immediately downstream of STM MH 123.

5.3.2 Modelling Rationale

A comprehensive hydrologic modeling exercise was completed with PCSWMM, accounting for the estimated major and minor systems to evaluate the storm sewer infrastructure. The use of PCSWMM for modeling of the site hydrology and hydraulics allowed for an analysis of the systems response during various storm events. Surface storage estimates were based on the final grading plan design (see **Drawing GP-1**). The following assumptions were applied to the detailed model:

- Hydrologic parameters as per Ottawa Sewer Design Guidelines, including Manning's 'n', and depression storage values.
- Subcatchment infiltration parameters per Horton Infiltration method per Ottawa Sewer Design Guidelines.
- 3-hour Chicago Storm distribution for the 2-year, 100-year, and 100-year+20% events. Roof runoff is to be directed to parking areas where it will be controlled and adjacent ROW's at an uncontrolled rate.
- To 'stress test' the system, a 'climate change' scenario was created by adding 20% of the individual intensity values of the 100-year Chicago storm event at their specified time step.
- Percent imperviousness (imp.) calculated based on actual soft and hard surfaces on each subcatchment, converted to equivalent Runoff Coefficient (C) using the relationship C = (imp. x 0.7) + 0.2.
- Subcatchment areas are defined from high-point to high-point where sags occur. Subcatchment width determined by multiplying street segment length x 2 (length of overland flow path measured

from high point to high point) for street (double-sided) catchments, multiplying by 1.5 for single-loaded roads, multiplying by 1.0 for single-sided catchments, or by multiplying the subcatchment area by 225m where a street segment flow path has not otherwise been defined.

- Number of catchbasins based on proposed servicing plans (**Drawing SSP-1**)
- Catchbasin inflow restricted with inlet-control devices (ICDs) as necessary to maintain inflow target rate, maximize use of surface storage, and ensure no standing water during the 2-year event (5-year event level of service for collector roads).
- Surface storage within the site was modelled with tabular storage curves. The storage volumes at each ponding area in the site were determined using the conical volume equation based on the ponding areas and depths determined in the grading plan. As PCSWMM uses the trapezoidal equation for determining volumes within storage curves, an equivalent area was calculated to match the volume calculated using the conical volume equation at the maximum static ponding depth identified per the grading plan.
- For Block 29, weirs representing the roadway width were used to model the major system flows between adjacent low points. Active storage volumes were applied at each low point node corresponding to catchbasin surface ponding volumes as noted on **Drawing SD-1**.

5.3.2.1 SWM Dual Drainage Methodology

The proposed development is modelled in one modelling program as a dual conduit system (see **Figure 7**), with: 1) circular conduits representing the sewers and junction nodes representing manholes; 2) weirs representing the spill grade elevations between low points at the top of static ponding, and storage nodes representing catchbasins. The dual drainage systems are connected via orifices from storage node (i.e., CB) to junction (i.e., MH), and represent inlet control devices (ICDs). Subcatchments are linked to the storage node on the surface so that generated hydrographs are directed there first.

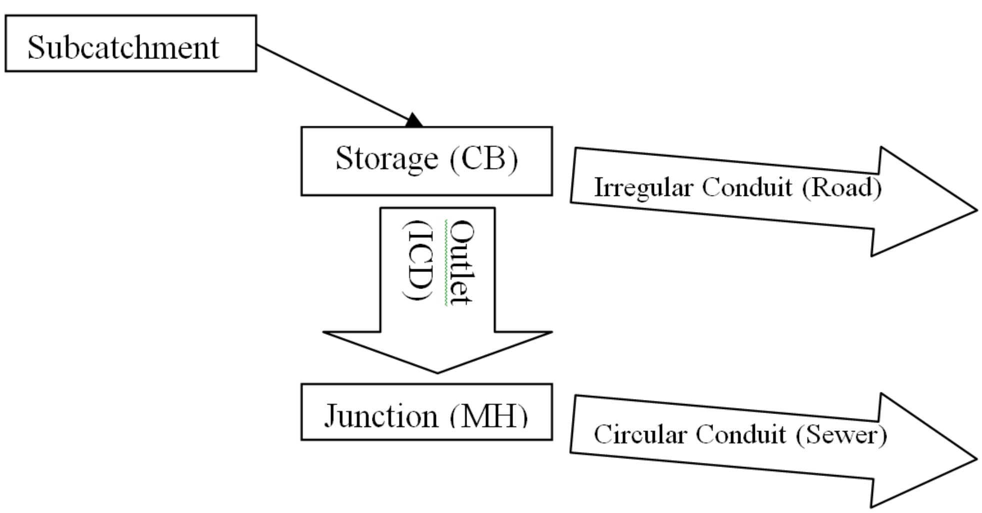


Figure 7: Schematic Representing Model Object Roles

Storage nodes are used in the model to represent catchbasins (CBs). The invert of the storage node represents the invert of the CB and the rim of the storage node represents the top of the CB plus the allowable flow depth on the segment. CB inverts have been set based on actual inverts noted on **Drawing SSP-1**, and a 0.40m buffer has been applied to rim elevations to model surface water depths above the CB.

The proposed Block 29 site conveys its minor system peak flows to the approved 675 mm diameter storm sewer on Maize Street via a connection at a proposed maintenance hole (STM MH 101). The site's major system peak flows are also directed to Maize Street. Due to grading restrictions, a small portion of Block 29 site will drain uncontrolled to Roger Griffiths Avenue, Maize Street, and Poole Creek.

5.3.3 Boundary Conditions

The downstream storm sewer, labelled as Outfall 101, was modelled as an outfall with a fixed boundary condition obtained from the PCSWMM model for the First Registration Kanata West Development (Stantec, 2020) as the maximum HGL at STM MH 123.The fixed boundary conditions for each storm event are summarized in the table below.

Table 8: Fixed Boundary Condition at Block 29 Outlet

Node from KW Development Model (Stantec 2020)	2-year Maximum HGL (m)	100-year Maximum HGL (m)	100-year+20% Maximum HGL (m)
STM MH 123	95.50	95.64	95.74

5.3.4 Modelling Parameters

Table 9 presents the general subcatchment parameters used.

Table 9: General Subcatchment Parameters

Subcatchment Parameter	Value
Infiltration Method	Horton
Max. Infiltration Rate (mm/hr)	76.2
Min. Infiltration Rate (mm/hr)	13.2
Decay Constant (1/hr)	4.14
N Imperv	0.013
N Perv	0.25
Dstore Imperv (mm)	1.57
Dstore Perv (mm)	4.67

Table 10 presents the individual subcatchments' parameters.

Table 10: Subcatchment Parameters

Area ID	Outlet	Area (ha)	Width (m)	Slope (%)	% Impervious	Runoff Coefficient	Subarea Routing	Percent Routed
L103A	L103A-S	0.063	50	2.5	85.71	0.80	OUTLET	100

Area ID	Outlet	Area (ha)	Width (m)	Slope (%)	% Impervious	Runoff Coefficient	Subarea Routing	Percent Routed
L104A	L104A-S	0.130	81	3	81.43	0.77	OUTLET	100
L106A	L106A-S	0.208	115	2	78.57	0.75	OUTLET	100
UNC-1	OF-1	0.106	165	25	8.57	0.26	PERVIOUS	100
UNC-2	OF-2	0.044	44	4.5	52.86	0.57	OUTLET	100
UNC-3	OF-3	0.047	48	5	54.29	0.58	OUTLET	100
UNC-4	OF-4	0.046	55	5	41.43	0.49	OUTLET	100
UNC-5	OF-5	0.094	95	3.5	48.57	0.54	OUTLET	100

Table 11 summarizes the storage node parameters used in the model.

Table 11: Storage Node Parameters

Storage Node	Invert Elevation (m)	Rim Elevation (m)	Total Depth (m)	Curve Name	Static Storage Available (m^3)
L103A-S	96.50	98.40	1.90	L103A-V	14.6
L104A-S	96.54	98.32	1.78	L104A-V	52.4
L106A-S	96.55	98.33	1.78	L106A-V	66.8

1. Rim elevation = (catchbasin top of grate elevation) + 0.4 m.

5.3.4.1 Hydraulic Parameters

As per the Ottawa Sewer Design Guidelines (OSDG 2012), Manning's roughness values of 0.013 were used for sewer modeling and overland flow corridors representing roadways.

Table 12 presents the parameters for the outlet and orifice link objects in the model, which represent inlet control devices (ICDs). All orifices were assigned a discharge coefficient of 0.572 to correspond to manufacturer supplied discharge curves for IPEX Tempest HF/MHF models. Should an approved equivalent model be required, the peak outlet rate of the selected model will be required to match that of the modeled ICD at the maximum head noted in the model results portion of this report.

Table 12: Orifice Parameters

Orifice Name	Inlet	Outlet	Inlet Elevation (m)	Type	Diameter (m)
L103A-IC	L103A-S	103	96.50	CIRCULAR	0.083
L104A-IC1	L104A-S	104	96.54	CIRCULAR	0.083
L104A-IC2	L104A-S	104	96.54	CIRCULAR	0.083
L106A-IC	L106A-S	106	96.55	CIRCULAR	0.152

Exit losses at maintenance holes were set for all pipe segments based on the flow angle through the structure. Exit losses were assigned as per City guidelines (Appendix 6b, Sewer Design Guidelines), as shown in **Table 13**.

Table 13: Exit Loss Coefficients for Bends at Maintenance Holes

Degrees	Coefficient
11	0.060
22	0.140
30	0.210
45	0.390
60	0.640
90	1.320
180	0.020

5.4 MODELLING RESULTS AND DISCUSSION

The following section summarizes the key hydrologic and hydraulic model results. For detailed model results or inputs please refer to the example input file in **Appendix C** and to the model files included in the digital submission.

Table 14 summarizes the minor system peak discharge rate from the proposed Block 29 for the modelled storm events.

Table 14: Storm Event Peak Discharge Rates (Minor System)

Model	Outlet Node	2-yr Peak Flow Rate (L/s)	100-yr Peak Flow Rate (L/s)
Block 29 PCSWMM Model (current)	STM MH 101	77.1	106.9
KW Development Allowable Minor System Release Rate (Stantec, 2020)	STM MH 123[1]	111.0	

1. Block 29 was shown to discharge its minor system to STM MH 123 in the PCSWMM Model for the *Richcraft Kanata West Development First Registration Phase Servicing and Stormwater Management Report* (Stantec, February 2020). Block 29 is now proposed to outlet to proposed STM MH 101, which will be placed immediately downstream of STM MH 123.

The minor system peak flow rate from the proposed Block 29 site is lower than the allowable during all storm events up the 100-year storm event.

Table 15 summarizes the major system peak outflows from the proposed site. The major system peak flows to Pond 5 were determined by adding uncontrolled areas UNC-4 and UNC-5, which sheet drain to Roger Griffith Avenue and Maize Street and ultimately discharge into the interim KW Pond 5. Uncontrolled area UNC-1 discharges directly to Poole Creek and subcatchment areas UNC-2 and UNC-3 are directed from Roger Griffiths Avenue to Maple Grove Road.

As a result of the available surface storage volume within the site, the only major system flows are generated through uncontrolled runoff.

Table 15: 100 Year Storm Event Peak Discharge Rates (Major System)

Model	100-yr Peak Flow Rate (L/s) Directed to Pond 5	100-yr Peak Flow Rate (L/s) Directed to Poole Creek	100-yr Peak Flow Rate (L/s) Directed to Maple Grove Road
Block 29 PCSWMM Model (current)	66.2	48.7	43.2
KW Development Allowable Major System Release Rate (Stantec, 2020)	480.0		

The overall major system flow from Block 29 is well below the allowable value determined in the subdivision design.

Table 16 summarizes the HGL results within the proposed development for the 100-year, 3-hour Chicago storm event and the 'climate change' scenario required by the City of Ottawa Sewer Design Guidelines (2012), where intensities are increased by 20% from the 100-year event.

Table 16: Hydraulic Grade Line (HGL) Results

STM MH or STUB	Lowest USF (m)	100yr 3hr Chicago		100yr + 20% 3hr Chicago	
		HGL (m)	USF-HGL Clearance (m)	HGL (m)	USF-HGL Clearance (m)
102	96.19	95.78	0.41	95.89	0.30
103	96.19	95.84	0.35	95.94	0.25
104	96.21	95.88	0.33	95.99	0.22
106	96.48	96.04	0.44	96.15	0.33
At STM Service for Block 2 (b/w MH 106 and 103)[1]	96.20	95.89	0.31	95.99	0.21

1. This HGL was interpolated using linear interpolation between the maximum HGLs at STM MH 106 and 103.

As is demonstrated in the table above, the worst-case scenario results in HGL elevations that remain at least 0.31 m below the proposed underside of footings in the 100-year event, and HGL elevations remain below the proposed underside of footing elevations during the 'climate change' scenario.

Table 17 presents the proposed ICDs with their corresponding heads and flows in the 2-year and 100-year storm events.

Table 17: 2-year and 100-year Heads and Flow Rates at ICDs

Orifice Name	CB Name	Diameter (mm)	Invert (m)	2-year Head (m)	2-year Flow (L/s)	100-year Head (m)	100-year Flow (L/s)
L103A-IC[1]	CB103A-1	83	96.50	0.85	12.3	1.63	17.3
L104A-IC1	CB104A-1	83	96.54	0.91	12.8	1.54	16.8
L104A-IC2	CB104A-2	83	96.54	0.91	12.8	1.54	16.8

Orifice Name	CB Name	Diameter (mm)	Invert (m)	2-year Head (m)	2-year Flow (L/s)	100-year Head (m)	100-year Flow (L/s)
L103A-IC[1]	CB103A-1	83	96.50	0.85	12.3	1.63	17.3
L106A-IC	CB106A-1	152	96.55	0.84	40.2	1.54	55.6

1. CB L103A-1 and L103A-2 to be interconnected and controlled by a single ICD at CB L103A-1.

Table 18 presents the maximum total surface water depths (static ponding depth + dynamic flow) above the top-of-grate of catchbasins for the 100-year design storm and climate change storm. Based on the model results, the total ponding depth (static + dynamic) does not exceed the 0.35 m maximum in the 100-year event. Total ponding depths during the climate change scenario are below adjacent building openings and are not expected to impact proposed buildings within the development. There is no ponding in the 2-year event (refer to **Appendix C.3**).

Table 18: Maximum Surface Water Depths

Storage Node ID	Invert Elevation (m)	Rim Elevation (m)	100yr 3hr Chicago		100yr 3hr Chicago + 20%		Adjacent Lowest Building Opening (m)
			Max. Surface HGL (m)	Total Surface Water Depth (m)	Max. Surface HGL (m)	Total Surface Water Depth (m)	
L103A-S	96.50	98.40	98.13	0.13	98.16	0.16	98.35
L104A-S	96.54	98.32	98.08	0.16	98.11	0.19	98.37
L106A-S	96.55	98.33	98.09	0.16	98.14	0.21	98.35

2. Rim elevation = (catchbasin top of grate elevation) + 0.4 m.

5.4.1 Deviations from Subdivision Servicing Report

The approved Richcraft Kanata West (KW) Subdivision Servicing Report for the First Registration Phase assumed all major system peak flows from Block 29 would be directed to Maize Street and ultimately directed to the interim Kanata West Pond 5. However, based on the actual site plan grading, uncontrolled major system peak flows from Block 29 will also be directed to Roger Griffiths Avenue to the east and ultimately to Maple Grove Road, as well as to Poole Creek to the west. The overall major system peak flow from Block 29 directed to adjacent ROW's and to Poole Creek is still below the original 480 L/s major system target peak outflow outlined in the subdivision report for Block 29.

Major system peak flows from Block 29 in the KW Subdivision model were intended to be conveyed along Ploughshare Road and ultimately discharge to the Kanata West Pond 5. The detailed design of Block 29 only generated major system flows from uncontrolled areas. The proposed 2 year, 5 year, 100 year and 100year +20% conditions from Blocks 29 were imported into the detailed subdivision PCSWMM model to analyze the flow depth on the streets downstream of Block 29.

Table 19 compares the total flow depths on the streets in the KW subdivision obtained from the approved PCSWMM model to the revised subdivision model with the actual Block 29 development minor and major system peak flows proposed. Modelling results can be found in **Appendix C.4** and **C.5**.

Table 19: Maize Street and Roger Griffiths Avenue 100-year, 3-hour Chicago Flow Depths Comparison

Subdivision Storage Name	Street Name	T/G Elevation	Approved KW Subdivision Max HGL (m)	Approved KW Subdivision Total Surface Water Depth (m)	Proposed Block 29 in KW Subdivision Max HGL (m)	Proposed Block 29 in KW Subdivision Total Surface Water Depth (m)
121AA-S	Roger Griffiths Ave	97.31	97.36	0.05	97.35	0.04
123A-S	Roger Griffiths Ave and Maize Street	97.69	97.84	0.15	97.82	0.13
124A-S	Maize Street	97.93	98.20	0.27	98.18	0.25

Based on the model results, the total ponding depth does not exceed the allowable 0.35 m maximum during the 100-year event. The 100-year flow depths on the streets have been reduced given that there are no major system peak overflows from the proposed site in the 100-year storm event. As such, the overland flows from Block 29 to Roger Griffiths Avenue will not negatively impact the downstream system.

Table 20 summarises flow depths on the adjacent ROW's (Maize Street and Roger Griffiths Ave) in the 2-year and 5-year storm events. Please note that the results generated from the PCSWMM model show a conservative representation of the flow depths on the streets given that the model assumes runoff from the uncontrolled areas sheet flowing onto the adjacent ROWs discharge directly into the street catchbasin, when in fact, runoff from these areas will be distributed uniformly across the street catchments and some surface routing will occur along the street segment before uncontrolled runoff reaches the street catchbasin. The results indicate a maximum of 0.02m ponding above the catchbasins will occur in the 5-year storm (121AA-S and 123A-s) event and 0.01m in the 2-year event (124 A-S). The minimum ponding which occurs for a short period of time in the two storm events will not negatively impact the overall system.

Table 20: Maize Street and Roger Griffiths Avenue 2-year and 5-year, 3-hour Chicago Flow Depths Comparison

Storm Event	Subdivision Storage Name	Street Name	T/G Elevation	Approved KW Subdivision Max HGL (m)	Proposed Block 29 in KW Subdivision Max HGL (m)	Proposed Block 29 in KW Subdivision Total Surface Water Depth (m)
2-year, 3-hour Chicago	124A-S	Maize Street	97.93	97.48	97.94	0.01
5-year, 3-hour Chicago	121AA-S	Roger Griffiths Ave	97.31	96.50	97.33	0.02
	123A-S	Roger Griffiths Ave and Maize Street	97.69	97.39	97.71	0.02

6.0 GEOTECHNICAL CONSIDERATIONS AND GRADING

6.1 GEOTECHNICAL INVESTIGATION

A geotechnical investigation report for Kanata West Block 29 was completed by Paterson Group on July 14, 2020. Field testing consisting of the advancement of three (3) boreholes throughout the subject site was completed on June 24, 2020. Data from an existing borehole immediately northwest of the subject site was also used. The geotechnical investigation report is included in **Appendix D.1**.

The site is undeveloped and mostly covered in grass. The grade across the site is generally level at an elevation of approximately 97 m. The subsurface profile within Block 29 generally consists of 0.2 to 0.5m of brown silty sand fill with some clay and crushed stone, underlain by a silty clay deposit. This silty clay deposit is generally very stiff to stiff brown silty clay crust within the upper 3-4 m below original ground surface. This brown silty clay transitions to a firm, grey silty clay as the depth increases.

Groundwater levels were taken at the three (3) boreholes advanced in 2020. The long-term groundwater table is anticipated to be at a 3 to 4 m depth, subject to seasonal fluctuations.

The site is considered suitable for the proposed development from a geotechnical perspective. Conventional shallow foundations placed on undisturbed stiff to firm silty clay, compacted silty sand to sandy silt, or engineered compacted fill, can be used for the proposed buildings.

A permissible grade raise restriction of 1.5 m above original ground surface is recommended by Paterson due to the silty clay deposit. If higher-than-permissible grade raises are needed, pre-loading, lightweight fill, or other measures should be investigated to reduce the risks of unacceptable long-term total and differential settlements.

6.1.1 Limits of Hazard Lands along Poole Creek

A slope stability analysis was completed as part of the geotechnical investigation to determine the required setback from the top of slope using a factor of safety of 1.5. Toe erosion and 6 m erosion access allowances were also considered in the determination of the limit of hazard lands, which is demonstrated in the geotechnical investigation report.

The existing vegetation on the face of the slope along Poole Creek should not be removed as it provides stability to the slope and reduces erosion.

The limit of hazard lands, 5 m toe erosion allowance, 3 m erosion access allowance, Poole Creek top of valley, and MVCA floodplains are shown on all plans in **Appendix F**.

6.1.2 Proposed Pavement Structure

Table 21 and **Table 22** summarize the recommended pavement structures for the development.

Table 21: Recommended Pavement Structure for Access Lanes

Thickness (mm)	Material Description
40	Wear Course – HL-3 or Superpave 12.5 Asphaltic Concrete
50	Binder Course – HL-8 or Superpave 19.0 Asphaltic Concrete
150	Base – OPSS Granular A Crushed Stone Compacted to Min. 100% SPMDD
450	Subbase – OPSS Granular B Type II Compacted to Min. 100% SPMDD
-	Subgrade – Either fill, in situ soil, or OPSS Granular B Type II material placed over in situ soil or fill. Geoxtextile (such as Terratrack 200 or equivalent) or thicker subbase may be required if soft spots develop in the subgrade.

Table 22: Recommended Pavement Structure for Car-Only Parking Areas

Thickness (mm)	Material Description
50	Wear Course – HL-3 or Superpave 12.5 Asphaltic Concrete
150	Base – OPSS Granular A Crushed Stone Compacted to Min. 100% SPMDD
300	Subbase – OPSS Granular B Type II Compacted to Min. 100% SPMDD
-	Subgrade – Either fill, in situ soil, or OPSS Granular B Type II material placed over in situ soil or fill

6.1.3 Sewer/Watermain Installation

The subsurface soils are considered to be Type 2 and 3 according to the Occupational Health and Safety Act and Regulations for Construction Projects. For excavations up to 3 m deep, 1H:1V slopes or shallower are recommended. A shallow slope should be used if the excavation is below the groundwater table. A trench box is required for all steep or vertical side slopes where workers are present.

At least 150mm of OPSS Granular A crushed stone compacted to 95% SPMDD is recommended as bedding for watermains and sewers, up to the springline of the pipes. The base thickness should be increased to 300 mm in the presence of the firm to stiff grey silty clay. OPSS Granular A crushed stone is to be used as cover material at least 300mm above the obvert of the pipes and compacted to a minimum of 95% SPMDD.

If the excavation and filling operations are carried out in dry weather, the moist brown silty clay is expected to be suitable as backfill material (above the cover material). Wet silty clay materials will be difficult to reuse without an extensive drying period. The trench backfill material within the frost zone (about 1.8 m below finished grade) should match the existing soils at the trench walls. Clay seals are recommended at no more than 60 m intervals in the service trenches and at strategic locations to reduce long-term lowering of the groundwater level in the site.

Open sumps and pumps are anticipated to be sufficient in providing groundwater control for relatively shallow excavations due to the impervious nature of the silty clay present throughout the site. A temporary Permit to Take Water (PTTW) from the Ontario Ministry of the Environment, Conservation and

Parks (MECP) may be required if more than 400,000 L/day of ground and/or surface water need to be pumped during the construction phase (to be determined by the geotechnical consultant). The review/issuance of the permit may take upwards of 4 months. For typical ground/surface water pumping volumes (50,000 L/day to 400,000 L/day), registration on the Environmental Activity and Sector Registry (EASR) will be required. Two to four weeks should be allotted for the completion of this registration and the preparation of a Water Taking and Discharge Plan by a Qualified Person as required under O.Reg. 63/16.

The founding stratum should be protected from freezing temperatures if winter construction is anticipated. The trench excavations should also be completed in a manner that will avoid the introduction of frozen materials into the trenches.

6.2 GRADING PLAN

Proposed grading for Block 29 is shown on **Drawing GP-1**. Proposed grading for the Block 29 site directs most overland flows from the proposed development to Maize Street, as per the intent from the *Kanata West Development First Registration Servicing and Stormwater Management Report* (Stantec, February 2020) and City standards. A small northwestern portion of the site, containing mostly landscaped area, drains uncontrolled to Poole Creek due to grading restrictions with the existing topography. The proposed grading implements sags in the parking areas for surface stormwater detention.

The proposed grading has been developed to match the existing road grades along Maize Street to the south and Roger Griffiths Avenue to the east. The 1.5 m grade raise restriction outlined in the geotechnical investigation report has been generally respected throughout the site, with minor exceedances of 0.3-0.5 m in certain locations. Paterson Group has confirmed that this grade raise exceedance is allowable without any additional measures. Please refer to correspondence included in **Appendix D.2.**

All grading, in-filling and backfilling works are to be completed as per the geotechnical recommendations made in Paterson's geotechnical investigation report (summarized above in **Section 6.1**).

7.0 UTILITIES

Utility infrastructure for Bell, Rogers, Hydro Ottawa, and Enbridge exists within underground plant servicing urbanized rights-of-way adjacent to the subject site. Coordination regarding the exact size, location, and routing of utilities will begin following design circulation.

8.0 APPROVALS

The City of Ottawa will review and approve most development applications as they relate to the provision of water supply, wastewater collection and disposal, and stormwater conveyance and treatment.

An Environmental Compliance Approval (ECA) is not expected to be required from the Ontario Ministry of the Environment, Conservation and Parks (MECP) for the proposed servicing works within the proposed private block so long as part lot control is not pursued for this development (i.e., as long as the property will be held under single ownership). The Mississippi Valley Conservation Authority (MVCA) will be circulated on this submission.

An MECP Permit to Take Water (PTTW) or registration on the Environmental Activity and Sector Registry (EASR) may be required for the site. The geotechnical consultant shall confirm at the time of application whether a PTTW or EASR registration is required.

No other approval requirements from other regulatory agencies are anticipated.

9.0 EROSION CONTROL

In order to protect downstream water quality and prevent sediment build up in catch basins and storm sewers, erosion and sediment control measures must be implemented during construction. The following recommendations will be included in the contract documents and communicated to the Contractor.

1. Implement best management practices to provide appropriate protection of the existing and proposed drainage system and the receiving water course(s).
2. Limit the extent of the exposed soils at any given time.
3. Re-vegetate exposed areas as soon as possible.
4. Minimize the area to be cleared and grubbed.
5. Protect exposed slopes with geotextiles, geogrid, or synthetic mulches.
6. Provide sediment traps and basins during dewatering works.
7. Install sediment traps (such as SiltSack® by Terrafix) between catch basins and frames.
8. Schedule the construction works at times which avoid flooding due to seasonal rains.

The Contractor will also be required to complete inspections and guarantee the proper performance of their erosion and sediment control measures at least after every rainfall. The inspections are to include:

- Verification that water is not flowing under silt barriers.
- Cleaning and changing the sediment traps placed on catch basins.

As described in the geotechnical investigation report for the site (see **Appendix D.1**), the vegetation along the existing slope to Poole Creek should be retained as it serves to stabilize the slope and protect it from erosion.

Refer to **Drawing EC/DS-1** for the proposed location of silt fences, straw bales, and other erosion control measures.

10.0 CONCLUSIONS AND RECOMMENDATIONS

10.1 POTABLE WATER SERVICING

The proposed watermain network is capable of achieving the level of service required by the City. Based on the hydraulic analysis, the following conclusions were made:

- The proposed water distribution system in the Block 29 site is recommended to consist of a 200 mm diameter watermain connecting to the existing 200 mm diameter watermain on Maize Street at a single connection point.
- The Block 29 proposed watermain network operates above the maximum pressure objective of 552 kPa (80 psi) in both the average day (AVDY) and peak hour (PKHR) conditions. Therefore, pressure reducing valves will be required on all water services for the site.
- During maximum day domestic demands with a fire flow demand of 15,000 L/min (250 L/s), the Block 29 proposed watermain network is capable of providing sufficient fire flow while maintaining a residual pressure of 138 kPa (20 psi) in all areas within the development.

10.2 WASTEWATER SERVICING

Wastewater from the proposed Block 29 development will be conveyed to the existing sanitary sewer on Maize Street constructed as part of the Kanata West Development First Registration servicing works. The wastewater will ultimately reach the Kanata West Pump Station off Maple Grove Road.

200 mm diameter sanitary sewers are proposed throughout Block 29. The capacity of the existing sanitary sewers on Maize Street and Roger Griffiths Avenue were verified with the estimated peak wastewater flows from the Block 29 site and their relative increase from the estimates made in the *Kanata West Development First Registration Servicing and Stormwater Management Report* (Stantec, 2020). The analysis confirmed that there is sufficient capacity within the downstream sanitary sewer system to service the Block 29 site.

Peak wastewater flows from Block 29 are expected to be 1.4 L/s.

10.3 STORMWATER MANAGEMENT AND SERVICING

The proposed stormwater management plan is in compliance with the requirements outlined in the background documents, the City of Ottawa Sewer Design Guidelines and the Ontario Ministry of the Environment, Conservation and Parks (MECP) Stormwater Management Planning and Design Manual.

Inlet control devices were defined for each subcatchment to restrict inflow rates to the storm sewers to that of the 2-year runoff for the Block 29 site, as per City and background report design criteria. Major system peak flows from the entire site will be directed to Maize Street, except for a small uncontrolled area in the west which will drain directly to Poole Creek and another small uncontrolled area in the east which will drain to the Roger Griffiths Avenue right-of-way. Minor system peak flows will be directed to the existing 675 mm diameter storm sewer on Maize Street. Quantity and quality control (80% TSS removal) of stormwater runoff will be provided at the downstream Kanata West Pond 5.

10.4 GRADING

Proposed grading for the Block 29 site directs most overland flows from the proposed development to Maize Street, as per the intent from the *Kanata West Development First Registration Servicing and Stormwater Management Report* (Stantec, February 2020) and City standards. A small northwestern portion of the site, containing mostly landscaped area, drains uncontrolled to Poole Creek due to grading restrictions with the existing topography. Another small eastern portion of the site drains uncontrolled to the Roger Griffiths Avenue right-of-way. The proposed grading implements sags in the parking areas for surface stormwater detention.

The existing grades along Maize Street to the south of the site and along Roger Griffiths Avenue to the east of the site are to be maintained. All grading, in-filling and backfilling works are to be completed as per the geotechnical recommendations made in Paterson Group's geotechnical investigation report for the site (summarized in **Section 6.1**).

10.5 APPROVALS/PERMITS

An MECP Environmental Compliance Approval (ECA) may be required for the installation of the proposed storm and sanitary sewers within the private Block 29 site should part lot control be pursued to sever the property into separate parcels at a later date. A Permit to Take Water or registration on the EASR may be required for dewatering works during sewer/watermain installation, pending confirmation by the geotechnical consultant. The Mississippi Valley Conservation Authority (MVCA) will need to be consulted in order to obtain municipal approval for site development. No other approval requirements from other regulatory agencies are anticipated.

10.6 UTILITIES

Utility infrastructure for Bell, Rogers, Hydro Ottawa, and Enbridge exists within underground plant servicing urbanized rights-of-way adjacent to the subject site. Coordination regarding the exact size, location, and routing of utilities will begin following design circulation.

APPENDICES

Appendix A - POTABLE WATER SERVICING

A.1 DOMESTIC WATER DEMAND CALCULATIONS

Kanata West Block 29 - Domestic Water Demand Estimates

Based on Site Plan prepared by M. David Blakely Architect Inc. dated March 17, 2021
Last updated on March 19, 2021

Population densities as per City of Ottawa Guidelines:

2-Bedroom Apt.	2.1	ppu

Building ID	Number of Units	Population	Daily Demand Rate (L/cap/day)	Avg. Day Demand		Max. Day Demand [1]		Peak Hour Demand [1]	
				(L/min)	(L/s)	(L/min)	(L/s)	(L/min)	(L/s)
2-Bedroom Terrace Units	48	101	350	24.5	0.41	61.3	1.02	134.8	2.25
Total Site :	**48**	**101**		**24.5**	**0.41**	**61.3**	**1.02**	**134.8**	**2.25**

1 Water demand criteria used to estimate peak demand rates for residential areas are as follows:
maximum daily demand rate = 2.5 x average day demand rate
peak hour demand rate = 2.2 x maximum day demand rate

2 Terrace units assumed to be 2-bedroom units.

A.2 FUS CALCULATION SHEETS

Stantec

FUS Fire Flow Calculation Sheet

Stantec Project #: 160401608
Project Name: Kanata West Block 29
Date: 2021-03-24
Fire Flow Calculation #: 1
Description: 12-unit terrace flats (Block 1).

Notes: 3-storey building with 412 m2 footprint and 12 2-bedroom units (4 adjoining units each stacked 3 high).

Step	Task	Notes						Value Used	Req'd Fire Flow (L/min)
1	Determine Type of Construction	Wood Frame						1.5	-
2	Determine Ground Floor Area of One Unit	-						104	-
	Determine Number of Adjoining Units	Includes adjacent wood frame structures separated by 3m or less						4	-
3	Determine Height in Storeys	Does not include floors >50% below grade or open attic space						3	-
4	Determine Required Fire Flow	($F = 220 \times C \times A^{1/2}$). Round to nearest 1000 L/min						-	12000
5	Determine Occupancy Charge	Limited Combustible						-15%	10200
6	Determine Sprinkler Reduction	None						0%	0
		Non-Standard Water Supply or N/A						0%	
		Not Fully Supervised or N/A						0%	
		% Coverage of Sprinkler System						0%	
7	Determine Increase for Exposures (Max. 75%)	Direction	Exposure Distance (m)	Exposed Length (m)	Exposed Height (Stories)	Length-Height Factor (m x stories)	Construction of Adjacent Wall	-	-
		North	> 45	32.4	3	91-120	Wood Frame or Non-Combustible	0%	2856
		East	3.1 to 10	12.8	3	31-60	Wood Frame or Non-Combustible	18%	
		South	20.1 to 30	32.4	3	91-120	Wood Frame or Non-Combustible	10%	
		West	> 45	12.8	3	31-60	Wood Frame or Non-Combustible	0%	
8	Determine Final Required Fire Flow	Total Required Fire Flow in L/min, Rounded to Nearest 1000L/min							13000
		Total Required Fire Flow in L/s							216.7
		Required Duration of Fire Flow (hrs)							2.50
		Required Volume of Fire Flow (m^3)							1950

Stantec

FUS Fire Flow Calculation Sheet

Stantec Project #: 160401608
Project Name: Kanata West Block 29
Date: 2021-03-24
Fire Flow Calculation #: 2
Description: 12-unit terrace flats (Block 2).

Notes: 3-storey building with 412 m2 footprint and 12 2-bedroom units (4 adjoining units each stacked 3 high).

Step	Task	Notes						Value Used	Req'd Fire Flow (L/min)
1	Determine Type of Construction	Wood Frame						1.5	-
2	Determine Ground Floor Area of One Unit	-						104	-
	Determine Number of Adjoining Units	Includes adjacent wood frame structures separated by 3m or less						4	-
3	Determine Height in Storeys	Does not include floors >50% below grade or open attic space						3	-
4	Determine Required Fire Flow	(F = 220 x C x $A^{1/2}$). Round to nearest 1000 L/min						-	12000
5	Determine Occupancy Charge	Limited Combustible						-15%	10200
6	Determine Sprinkler Reduction	None						0%	0
		Non-Standard Water Supply or N/A						0%	
		Not Fully Supervised or N/A						0%	
		% Coverage of Sprinkler System						0%	
7	Determine Increase for Exposures (Max. 75%)	Direction	Exposure Distance (m)	Exposed Length (m)	Exposed Height (Stories)	Length-Height Factor (m x stories)	Construction of Adjacent Wall	-	-
		North	> 45	32.4	3	91-120	Wood Frame or Non-Combustible	0%	4182
		East	10.1 to 20	12.8	3	31-60	Wood Frame or Non-Combustible	13%	
		South	20.1 to 30	32.4	3	91-120	Wood Frame or Non-Combustible	10%	
		West	3.1 to 10	12.8	3	31-60	Wood Frame or Non-Combustible	18%	
8	Determine Final Required Fire Flow	Total Required Fire Flow in L/min, Rounded to Nearest 1000L/min							14000
		Total Required Fire Flow in L/s							233.3
		Required Duration of Fire Flow (hrs)							3.00
		Required Volume of Fire Flow (m^3)							2520

Stantec

FUS Fire Flow Calculation Sheet

Stantec Project #: 160401608
Project Name: Kanata West Block 29
Date: 2021-03-24
Fire Flow Calculation #: 3
Description: 12-unit terrace flats (Block 3).

Notes: 3-storey building with 412 m2 footprint and 12 2-bedroom units (4 adjoining units each stacked 3 high).

Step	Task	Notes						Value Used	Req'd Fire Flow (L/min)
1	Determine Type of Construction	Wood Frame						1.5	-
2	Determine Ground Floor Area of One Unit	-						104	-
	Determine Number of Adjoining Units	Includes adjacent wood frame structures separated by 3m or less						4	-
3	Determine Height in Storeys	Does not include floors >50% below grade or open attic space						3	-
4	Determine Required Fire Flow	(F = 220 x C x $A^{1/2}$). Round to nearest 1000 L/min						-	12000
5	Determine Occupancy Charge	Limited Combustible						-15%	10200
6	Determine Sprinkler Reduction	None						0%	0
		Non-Standard Water Supply or N/A						0%	
		Not Fully Supervised or N/A						0%	
		% Coverage of Sprinkler System						0%	
7	Determine Increase for Exposures (Max. 75%)	Direction	Exposure Distance (m)	Exposed Length (m)	Exposed Height (Stories)	Length-Height Factor (m x stories)	Construction of Adjacent Wall	-	-
		North	3.1 to 10	12.8	3	31-60	Wood Frame or Non-Combustible	18%	4692
		East	30.1 to 45	32.4	3	91-120	Wood Frame or Non-Combustible	5%	
		South	20.1 to 30	12.8	3	31-60	Wood Frame or Non-Combustible	8%	
		West	10.1 to 20	32.4	3	91-120	Wood Frame or Non-Combustible	15%	
8	Determine Final Required Fire Flow	Total Required Fire Flow in L/min, Rounded to Nearest 1000L/min							15000
		Total Required Fire Flow in L/s							250.0
		Required Duration of Fire Flow (hrs)							3.00
		Required Volume of Fire Flow (m^3)							2700

Stantec

FUS Fire Flow Calculation Sheet

Stantec Project #: 160401608
Project Name: Kanata West Block 29
Date: 2021-03-24
Fire Flow Calculation #: 4
Description: 12-unit terrace flats (Block 4).

Notes: 3-storey building with 412 m2 footprint and 12 2-bedroom units (4 adjoining units each stacked 3 high).

Step	Task	Notes						Value Used	Req'd Fire Flow (L/min)
1	Determine Type of Construction	Wood Frame						1.5	-
2	Determine Ground Floor Area of One Unit	-						104	-
	Determine Number of Adjoining Units	Includes adjacent wood frame structures separated by 3m or less						4	-
3	Determine Height in Storeys	Does not include floors >50% below grade or open attic space						3	-
4	Determine Required Fire Flow	(F = 220 x C x $A^{1/2}$). Round to nearest 1000 L/min						-	12000
5	Determine Occupancy Charge	Limited Combustible						-15%	10200
6	Determine Sprinkler Reduction	None						0%	0
		Non-Standard Water Supply or N/A						0%	
		Not Fully Supervised or N/A						0%	
		% Coverage of Sprinkler System						0%	
7	Determine Increase for Exposures (Max. 75%)	Direction	Exposure Distance (m)	Exposed Length (m)	Exposed Height (Stories)	Length-Height Factor (m x stories)	Construction of Adjacent Wall	-	-
		North	> 45	12.8	3	31-60	Wood Frame or Non-Combustible	0%	2346
		East	30.1 to 45	32.4	3	91-120	Wood Frame or Non-Combustible	5%	
		South	3.1 to 10	11.5	3	31-60	Wood Frame or Non-Combustible	18%	
		West	> 45	32.4	3	91-120	Wood Frame or Non-Combustible	0%	
8	Determine Final Required Fire Flow	**Total Required Fire Flow in L/min, Rounded to Nearest 1000L/min**							**13000**
		Total Required Fire Flow in L/s							**216.7**
		Required Duration of Fire Flow (hrs)							**2.50**
		Required Volume of Fire Flow (m^3)							**1950**

A.3 WATERMAIN HYDRAULIC ANALYSIS RESULTS

Kanata West Block 29

H2OMAP Water - Hydraulic Modelling Results

Stantec Project No. 160401608

Model last revised on 2021-07-19

Hydraulic Modelling Results - Average Day (AVDY) Demands

Junction Results

ID	Demand	Elevation	Head	Pressure	
	(L/s)	(m)	(m)	(psi)	(kPa)
1	0.20	98.07	161.66	90.40	623.29
2	0.10	98.23	161.65	90.16	621.64
3	0.10	97.83	161.65	90.72	625.50
5	0.00	98.24	161.66	90.16	621.64

Pipe Results

ID	From Node	To Node	Length	Diameter	Roughness	Flow	Velocity
			(m)	(mm)		(L/s)	(m/s)
1	1000	1	35.56	204	110	0.40	0.01
2	1	5	11.03	204	110	0.10	0.00
3	1	3	62.59	50	100	0.10	0.05
5	5	2	60.29	50	100	0.10	0.05

Hydraulic Modelling Results - Peak Hour (PKHR) Demands

Junction Results

ID	Demand	Elevation	Head	Pressure	
	(L/s)	(m)	(m)	(psi)	(kPa)
1	1.13	98.07	157.59	84.61	583.37
2	0.56	98.23	157.33	84.01	579.23
3	0.56	97.83	157.32	84.56	583.02
5	0.00	98.24	157.59	84.37	581.71

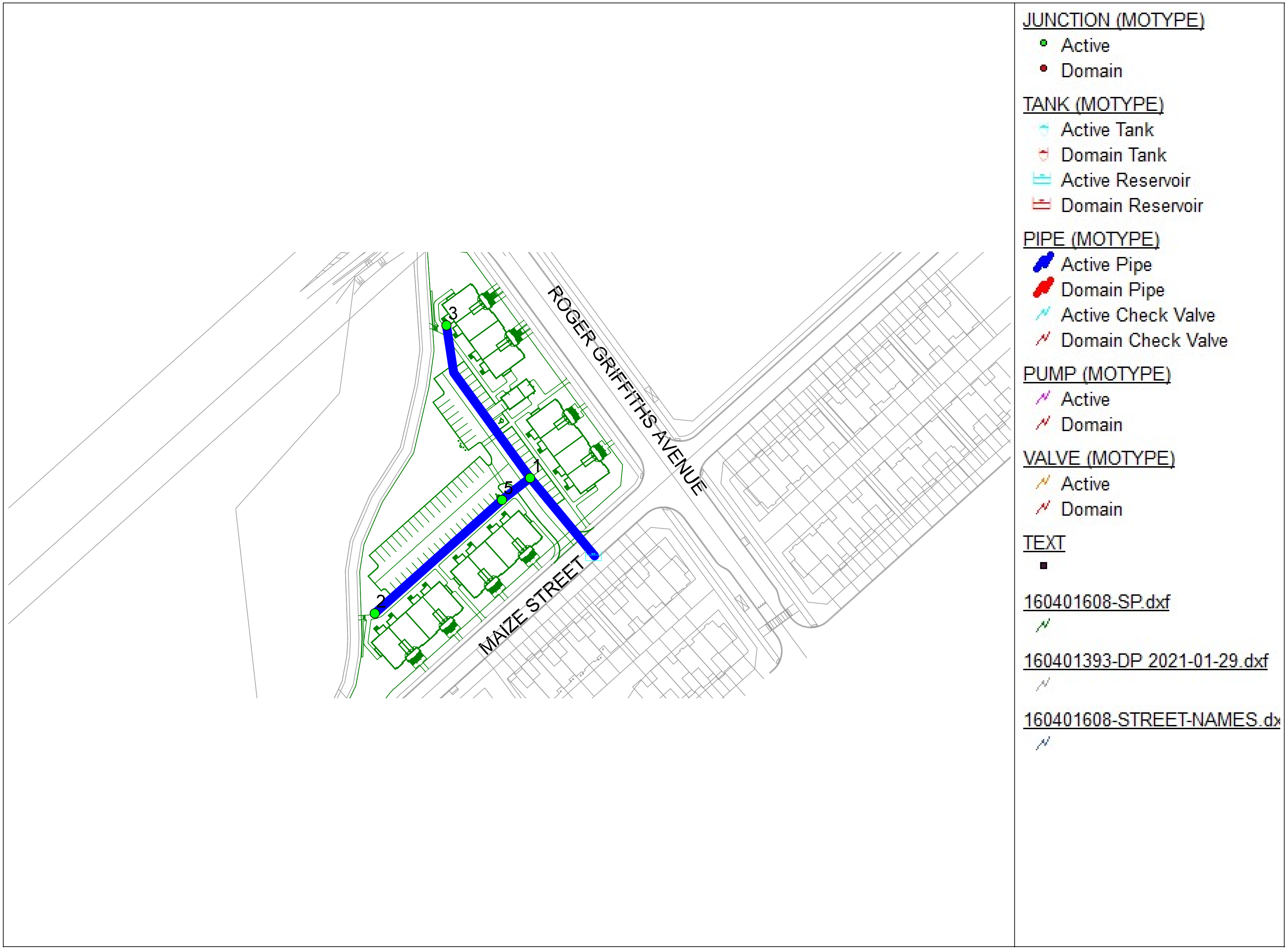
Pipe Results

ID	From Node	To Node	Length	Diameter	Roughness	Flow	Velocity
			(m)	(mm)		(L/s)	(m/s)
1	1000	1	35.56	204	110	2.25	0.07
2	1	5	11.03	204	110	0.56	0.02
3	1	3	62.59	50	100	0.56	0.29
5	5	2	60.29	50	100	0.56	0.29

Hydraulic Modelling Results - Maximum Day + Fire Flow (250 L/s) Analysis

ID	Static Demand	Static Pressure		Static Head	Fireflow Demand	Residual Pressure		Available Flow at Hydrant	Available Flow Pressure	
	(L/s)	(psi)	(kPa)	(m)	(L/s)	(psi)	(kPa)	(L/s)	(psi)	(KPa)
1	0.51	72.78	501.80	149.27	250	56.86	392.04	478.85	20.00	137.90
5	0.00	72.54	500.15	149.27	250	51.70	356.46	412.43	20.00	137.90

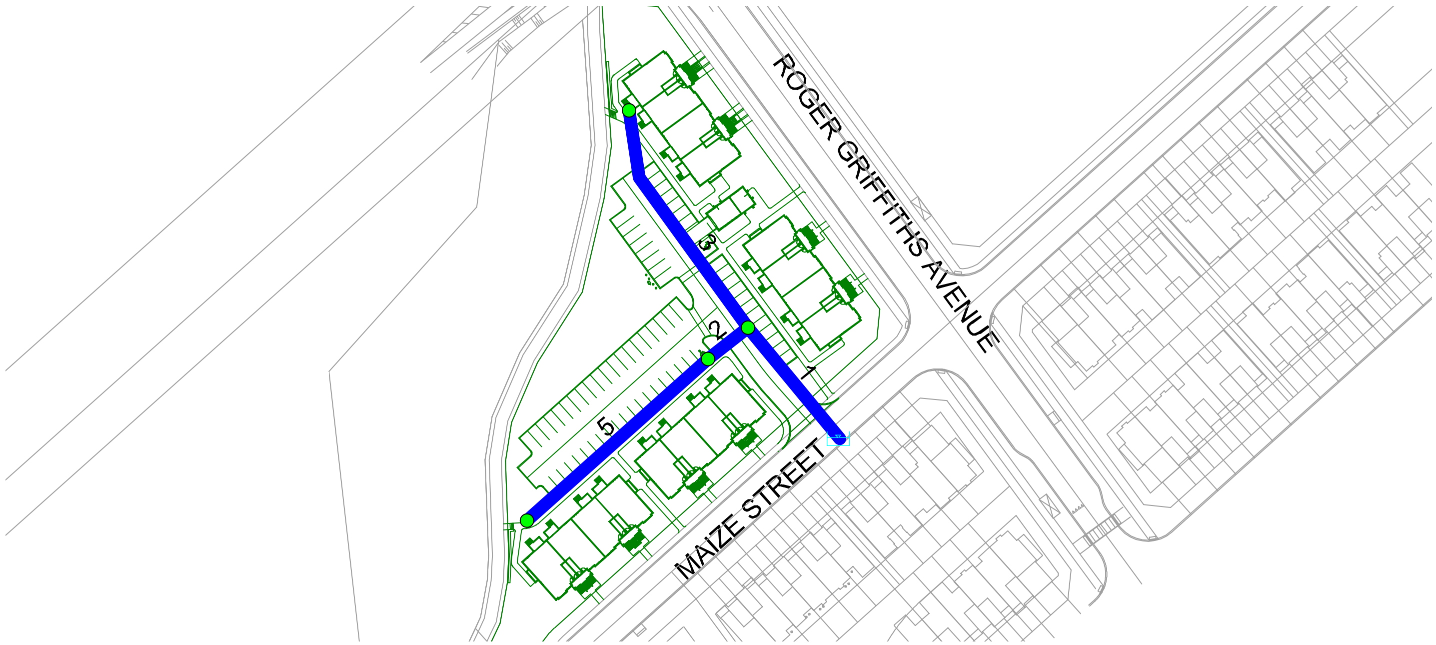
anl_2021-07-08_wtr - BLOCK 29 - JUNCTION ID



Prepared By:

Date: 7/21/2021 7:07:27 AM

anl_2021-07-08_wtr- BLOCK 29 - PIPE ID



JUNCTION (MOTYPE)
- Active
- Domain

TANK (MOTYPE)
- Active Tank
- Domain Tank
- Active Reservoir
- Domain Reservoir

PIPE (MOTYPE)
- Active Pipe
- Domain Pipe
- Active Check Valve
- Domain Check Valve

PUMP (MOTYPE)
- Active
- Domain

VALVE (MOTYPE)
- Active
- Domain

TEXT

160401608-SP.dxf

160401393-DP 2021-01-29.dxf

160401608-STREET-NAMES.dx

Prepared By:

Date: 7/21/2021 7:07:57 AM

A.4 POTABLE WATER EXCERPTS FROM KANATA WEST DEVELOPMENT FIRST REGISTRATION PHASE REPORT (STANTEC, FEBRUARY 2020)

2.0 POTABLE WATER

Detailed potable water servicing analyses have been completed and are included in **Appendix A.** Three separate analyses were created to evaluate the proposed potable water distribution network during the first construction phase, the proposed first registration phase(interim condition), and ultimate development conditions of the Richcraft Kanata West Development.

2.1 BACKGROUND

The proposed development is located between Maple Grove Road to the North, Hazeldean Road to the South, Terry Fox Drive to the East, and Huntmar Road to the West. The proposed development is within Zone 3W of the city of Ottawa water distribution system. This zone is fed by the Glen Cairn Pump Station. The ultimate development consists of a mix of single-family units and townhouse units, a school, two parks, a commercial block, and two medium density residential private blocks.

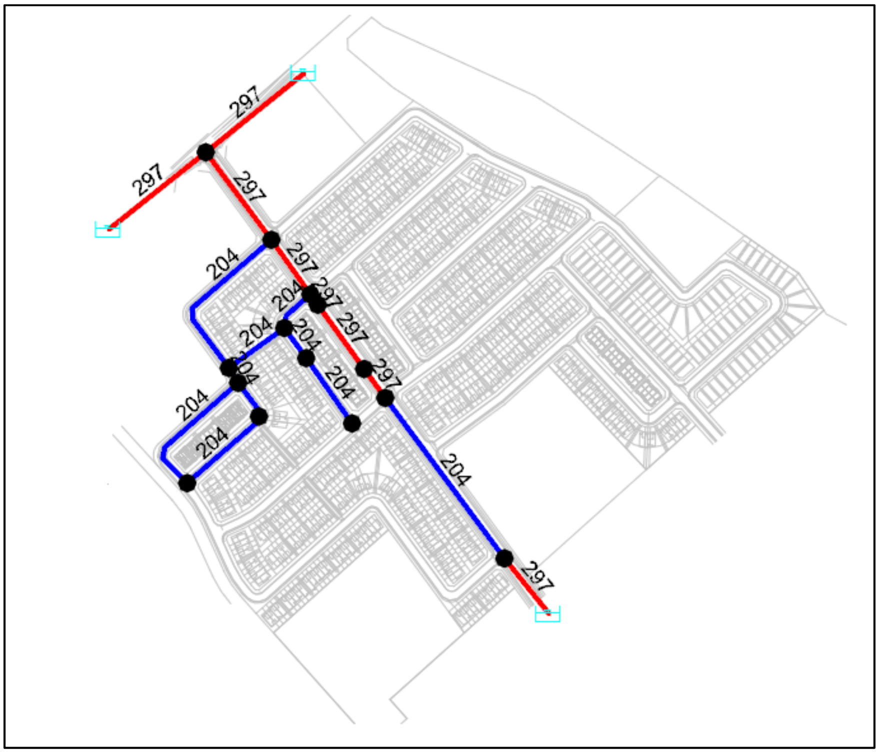
A 300 mm diameter watermain on Maple Grove Road will be extended from the Kanata West Pump Station across the subdivision frontage and connected to the existing 300 mm diameter watermain located at the intersection of Maple Grove Road and the future north-south arterial to service the proposed development from the north as shown on **Drawing OSSP-2**. In the ultimate development condition, the proposed water distribution network will be looped through the internal roadway network to connect to the 914 mm diameter feeder main on Hazeldean Road through two connections to the watermain network within the Trinity commercial development to the south (see **Figure 2.3** and Drawing WM-1 from the KWMSS included in **Appendix D.1**).

The first construction phase and proposed first registration phase (interim condition) will have only one connection through the Trinity development as shown on **Drawing OSSP-1, Figure 2.1** and **Figure 2.2**. Due to construction constraints during ultimate development conditions, it is not feasible to install the ultimate development condition watermain along the future alignment of Roger Griffiths Avenue to connect to the Trinity development watermain network. As a result, a temporary 200 mm diameter watermain will be installed adjacent to the future alignment of Roger Griffiths Avenue from Cartage Way to the future Holstein Road intersection. The temporary watermain will be connected to a proposed 300 mm diameter watermain that will connect to the Trinity development watermain network to service the site under all development conditions. Prior to ultimate build out, a 300 mm diameter watermain will be installed along the future Roger Griffiths Avenue and the temporary 200 mm diameter watermain will be decommissioned.

Although the watermains within the Trinity Development are currently private, these private roadways and the associated infrastructure are planned to be transferred over to the City of Ottawa prior to the watermain connections for the Richcraft Kanata West Development.

For the purpose of modelling the proposed watermain network, the specific connection points provided in the boundary conditions by the City were used in the analysis as shown in **Figure 2.1** to **Figure 2.3**.

Figure 2.1: First Construction Phase Proposed Potable Water Distribution Network



It should be noted that during the proposed first registration phase of the development there will be two temporary dead ends; one on Sheaf Row and a second one on Corn Husk Lane. However, as can be seen on **Drawing OSSP-1,** only thirty one (31) units will be connected to the temporary dead end on Sheaf Row and only sixteen (16) units will be connected to the temporary dead end on Corn Husk Lane. Water age calculations for these temporary dead ends are provided in **Section 2.6.**

Figure 2.2: Interim Development (First Registration) Proposed Potable Water Distribution Network

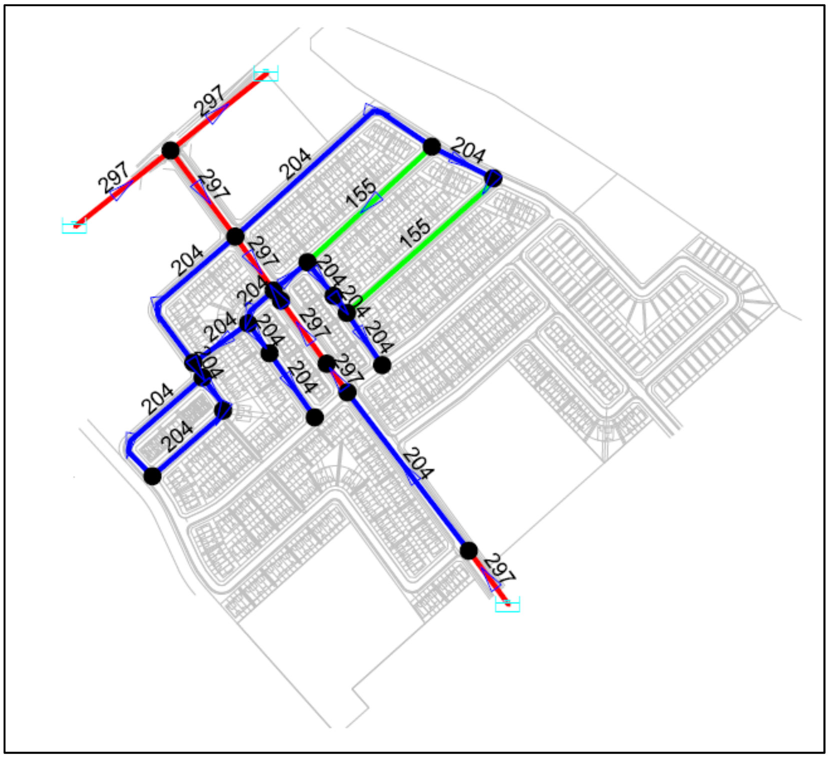
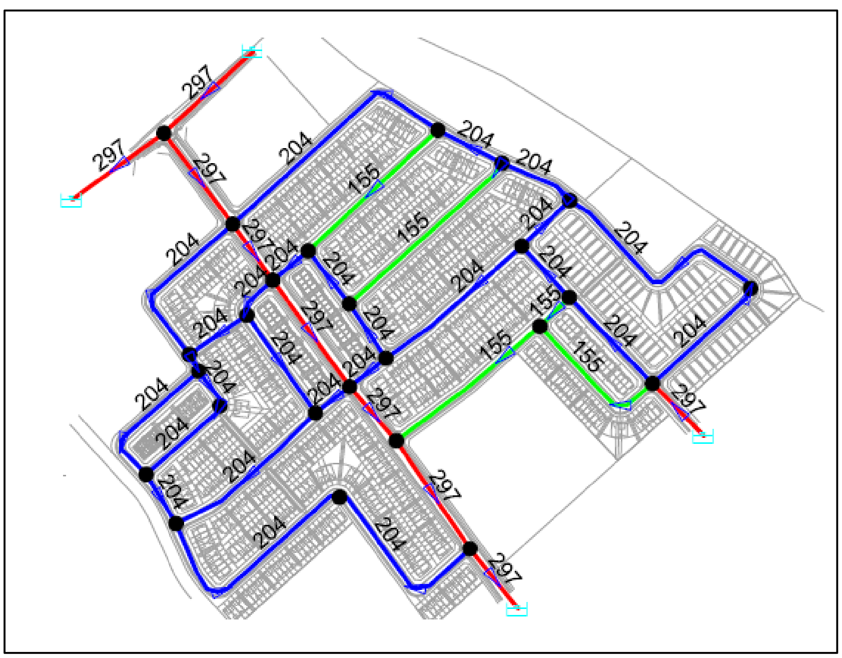


Figure 2.3: Ultimate Development Proposed Potable Water Distribution Network



with a minimum two-hour fire-resistance rating that comply with OBC Div. B, Subsection 3.1.10, are constructed to separate townhouse blocks to the lesser of seven dwelling units and 600 m^2 of building area, and that a minimum 10 m separation exists between rear yards (see Technical Bulletin ISDTB-2014-02 in **Appendix D.1**). As a result, fire flow requirements for most of the proposed development have been capped at 10,000 L/min, and FUS calculations have been provided for all other townhomes and back to back units that do not meet these conditions as described in the following sections.

In addition, the KWMSS allowed a greater maximum pressure of 100 psi within the watermain network for peak hour conditions while the current guidelines state that as per the Ontario Building Code, the static pressure at any fixture shall not exceed 552 kPa (80 psi).

2.3 WATER DEMANDS

Water demands for the first construction phase, interim (proposed first registration phase), and ultimate development scenarios were estimated using the City of Ottawa Water Distribution Design Guidelines. A daily rate of 28,000 L/ha/d was used for the proposed school and the commercial block. The population for the medium density residential blocks was estimated based on a density of 38 units/ha. See **Appendix A** for detailed domestic water demand estimates.

In the ultimate development condition, the average day demand (AVDY) was determined to be 10.8 L/s. The maximum daily demand (MXDY) was determined to be 25.6 L/s and was calculated as 1.5 times the AVDY for school and commercial blocks and 2.5 times the AVDY for all other residential areas. The peak hour demand (PKHR) totaled 55.5 L/s and was calculated as 1.8 times the MXDY for school and commercial blocks, and 2.2 times the MXDY for all other residential areas.

Similarly, the average day demand (AVDY) for the first construction phase and the proposed interim phase development was determined to be 1.7 L/s and 4.2 L/s, while the maximum daily demand (MXDY) was determined to be 4.3 L/s and 9.9 L/s, and the peak hour demand (PKHR) totaled 9.4 L/s and 21.5 L/s. The calculated residential, Institutional and commercial water consumption for the ultimate development scenario is shown in **Table 2.3** and **Table 2.4**.

Table 2.3: Ultimate Development Residential Water Demands

Unit Type	Units	Area (ha)	Person/Unit	Population	AVDY (L/s)	MXDY (L/s)	PKHR (L/s)
Singles	72	-	3.4	245	0.99	2.48	5.45
Townhomes	503	-	2.7	1358	5.50	13.75	30.26
Back-to-back	130	-	2.7	351	1.42	3.55	7.82
MD1	-	0.74	-	76	0.31	0.76	1.68
MD2	-	2.80	-	287	1.16	2.91	6.40

distribution system in unoccupied areas shall not exceed 689 kPa (100 psi). Under emergency fire flow conditions, the minimum pressure objective in the distribution system is 138 kPa (20 psi).

Model Development

New watermains were added to the hydraulic model to simulate the proposed distribution system under the different development conditions. Hazen-Williams coefficients ("C-Factors") were applied to the new watermain in accordance with the City of Ottawa's Water Distribution Design Guidelines (**Table 2.6**).

Table 2.6: Proposed Watermain C-Factors

Pipe Diameter (mm)	C-Factor
150	100
200 to 250	110
300 to 600	120
> 600	130

2.5 HYDRAULIC MODEL RESULTS

Three hydraulic models were created to simulate the first construction phase, the proposed first registration phase (interim condition), and the ultimate development condition based on boundary conditions provided by the City of Ottawa. The hydraulic analyses were completed with H2OMAP Water Software and assessed the internal network and connections to the surrounding infrastructure. The models were tested under peak hour, average day, and maximum day plus fire flow conditions.

First Construction Phase Scenario

The results from the first construction phase scenario show that the maximum pressure modeled was approximately 93.4 psi (643 kPa) and the minimum pressure during the peak hour scenario was approximately 81.0 psi (558 kPa) as shown in **Figure 2.4** and **Figure 2.5** respectively. These pressures are above the serviceable limit of 50 to 80 psi (345 to 552 kPa) and therefore all units will require pressure reducing valves.

Figure 2.4: AVDY Pressure Results for the First Construction Phase Condition Scenario (psi)

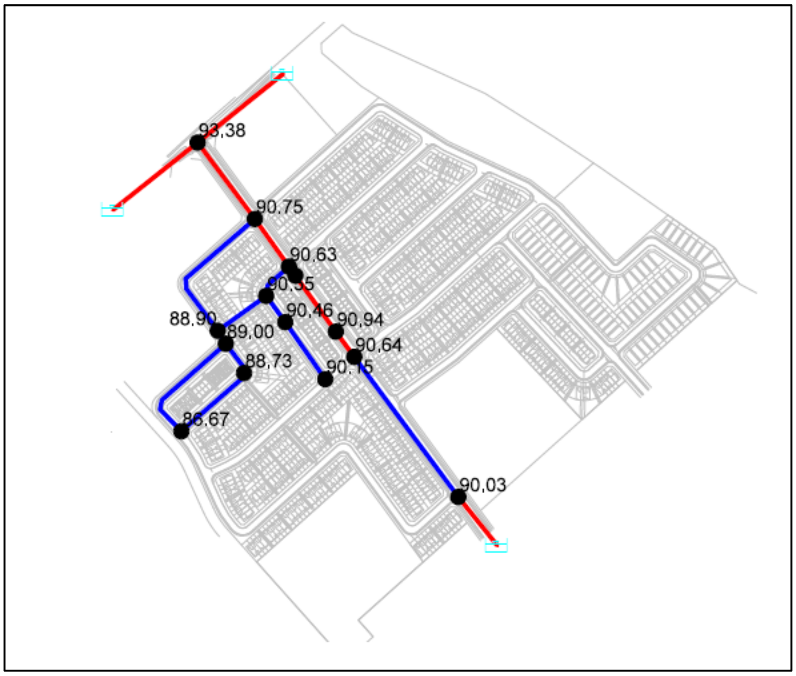
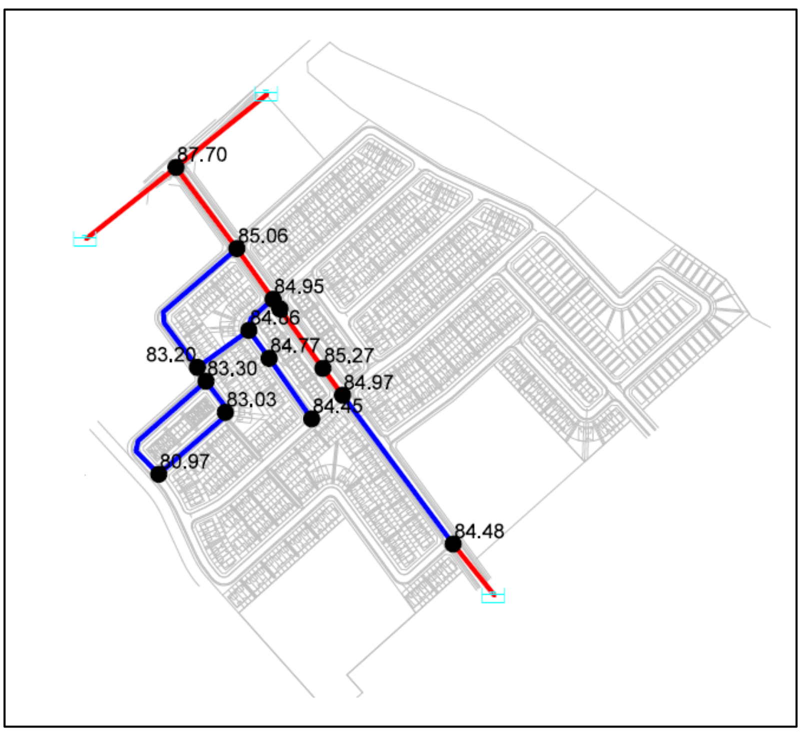


Figure 2.5: PKHR Pressure Results for the First Construction Phase Condition Scenario (psi)



A hydraulic model was used to assess the fire flow conditions of the first construction phase of the proposed development. The model was carried out to determine the anticipated amount of flow that could be provided under maximum day demands and a fire flow requirement of 267 L/s for Block 46 on Sheaf Row (nodes 29 and 30) as shown in **Appendix A.1**. As mentioned above all other fire flow requirements are just under 200 L/s.

Results of the modeling analysis indicate that flows in excess of 12,633 L/min (211 L/s) can be delivered for the units that require 200 L/s or less, and 16,214 L/min (270 L/s can be delivered to units that require 267 L/s while still maintaining a residual pressure of 140 kPa (20 psi). The residual pressures for the different fire flow analyses are shown in **Figure 2.6** and **Figure 2.7**. Results of the hydraulic modeling are included for reference in **Appendix A1**.

Figure 2.6: MXDY + 200 L/s Fire Flow Results for the First Construction Phase Condition Scenario (Residual Pressure (psi))

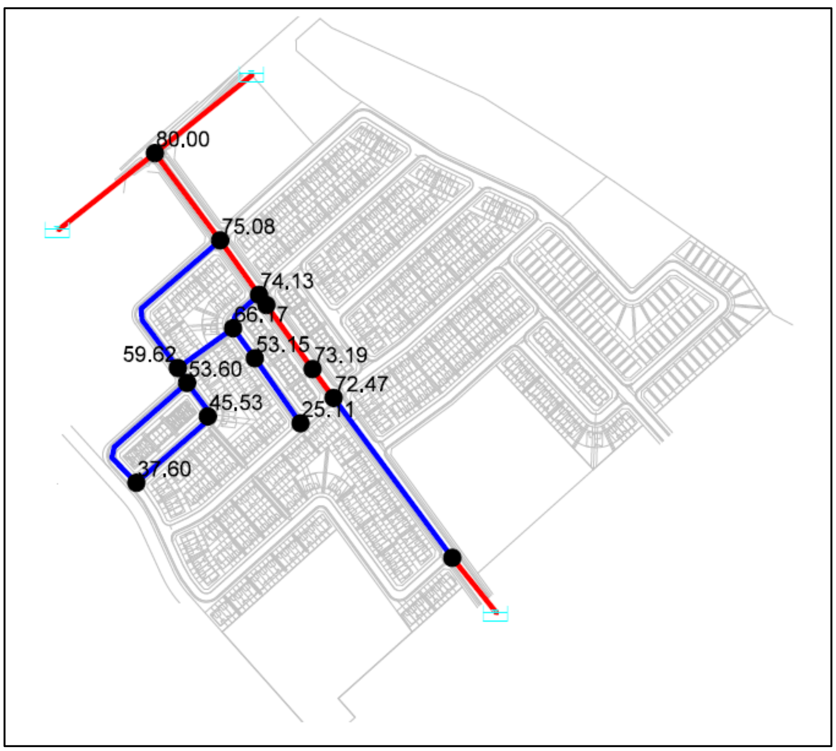
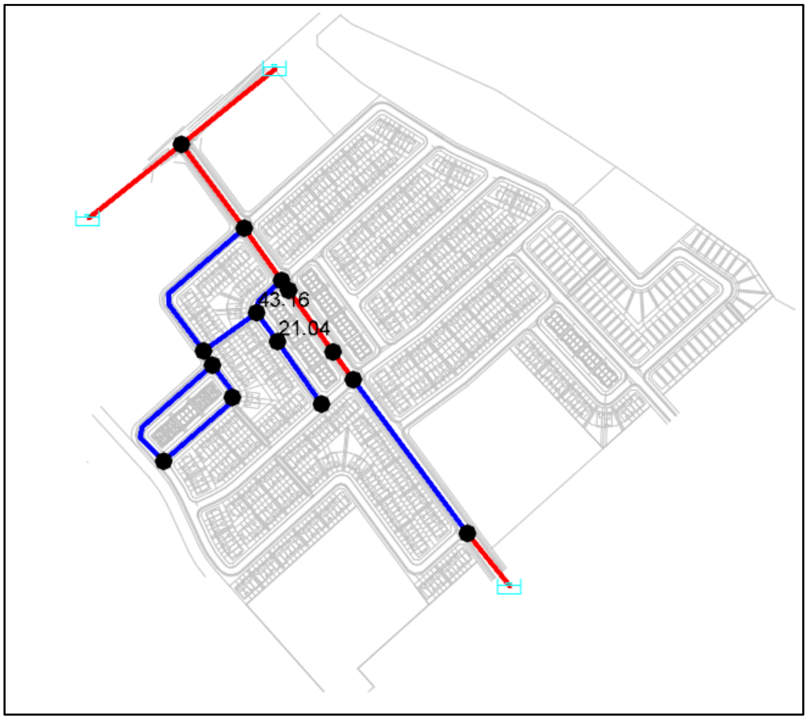


Figure 2.7: MXDY + 267 L/s Fire Flow Results for the First Construction Phase Condition Scenario (Residual Pressure (psi))



Proposed First Phase Registration - Interim Scenario

The maximum pressure modeled during the average day scenario was approximately 93.4 psi (644 kPa), and the minimum pressure during the peak hour scenario was approximately 80.8 psi (557 kPa)as shown in **Figure 2.8** and **Figure 2.9** respectively. These pressures are above the serviceable limit of 50 to 80 psi (345 to 552 kPa) and therefore, all the proposed units will require pressure reducing valves. Results of the hydraulic modeling are included for reference in **Appendix A.2**.

Figure 2.8: AVDY Pressure Results for Interim Condition Scenario (psi)

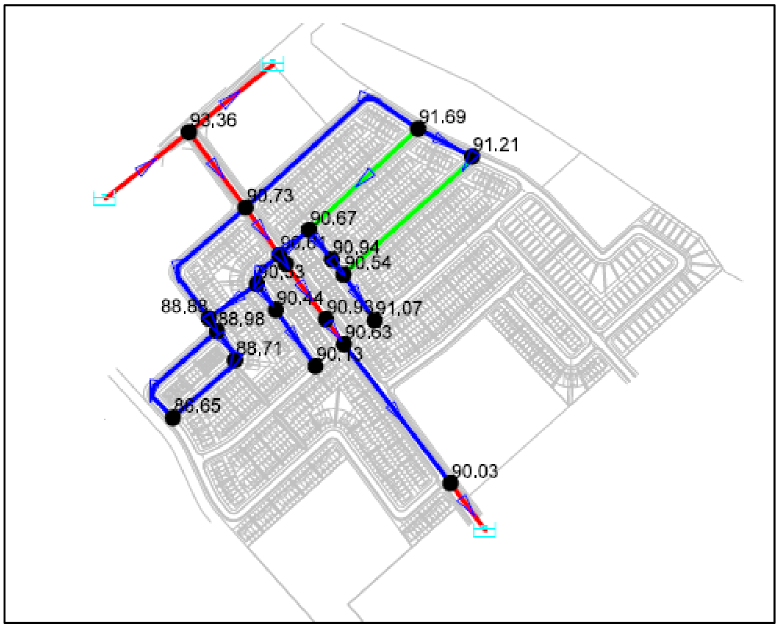
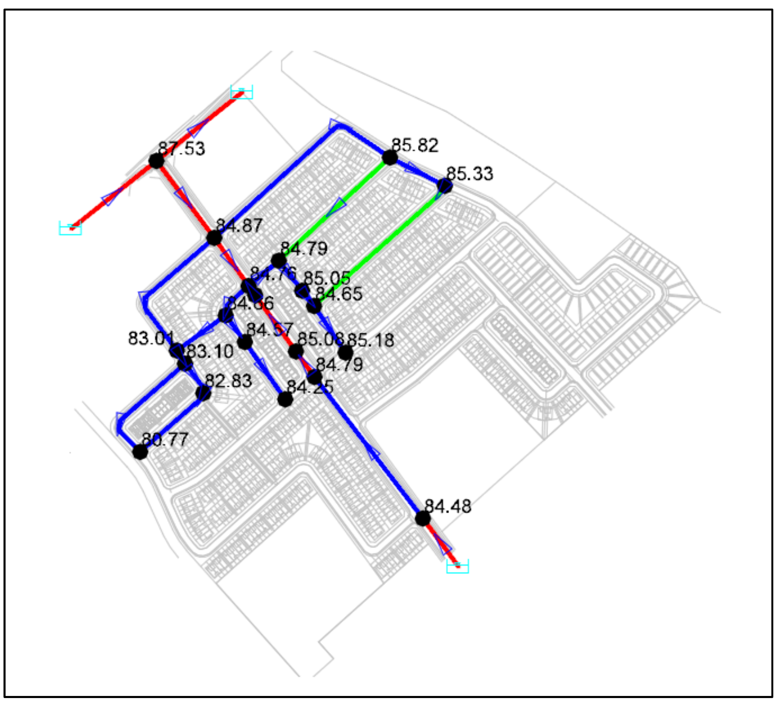
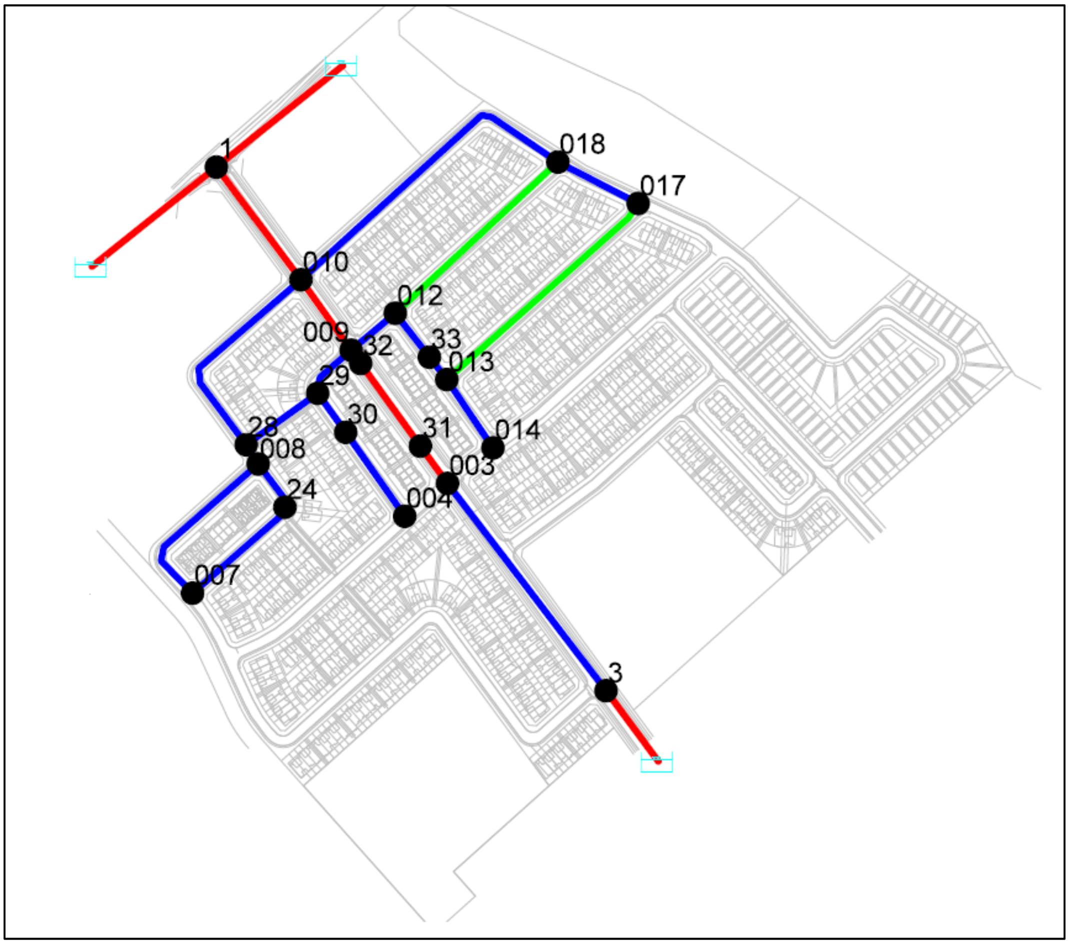


Figure 2.9: PKHR Pressure Results for Interim Condition Scenario (psi)



Due to phasing and construction restrictions in the proposed interim condition, two temporary dead ends are located on Sheaf Row and Corn Husk Lane. Both temporary dead-ends service less than 49 units. Alternative looping options were considered along winter Wheat Terrace; however, due to future deep sanitary and storm servicing along Winter Wheat Terrace in the ultimate condition scenario, the addition of a watermain to connect the interim dead ends would result in throw away pipe. **Figure 2.10** shows the node IDs used in the interim condition model.

Figure 2.10: Interim Condition Scenario Node ID



A fire flow analysis was carried out in the hydraulic model to determine the anticipated amount of flow that could be provided across the proposed watermain network under maximum day demands and a fire flow requirement of 200 L/s and 267 L/s as per the worst-case conditions for the back-to-back units and townhome blocks.

As mentioned above, additional FUS calculation were provided for Block 1 and Block 2 as the rear yard separation distance to the adjacent side yard was measured to be less than 10 m.

Results of the interim condition modeling analysis indicate that flows in excess of 12,595 L/min (210 L/s) can be delivered for the units that require 200 L/s or less, and 16,180 L/min (270 L/s) can be delivered to the proposed back to back units on Sheaf Row and Cornhusk Lane, which require 267 L/s while still maintaining a residual pressure greater than 140 kPa (20 psi). The resulting residual pressures for the proposed first registration phase of the development are shown in **Figure 2.11** and **Figure 2.12**. Results of the hydraulic modeling are included for reference in **Appendix A.2.**

Figure 2.11: MXDY + 200 L/s Fire Flow Results for Interim Condition Scenario (Residual Pressure (psi))

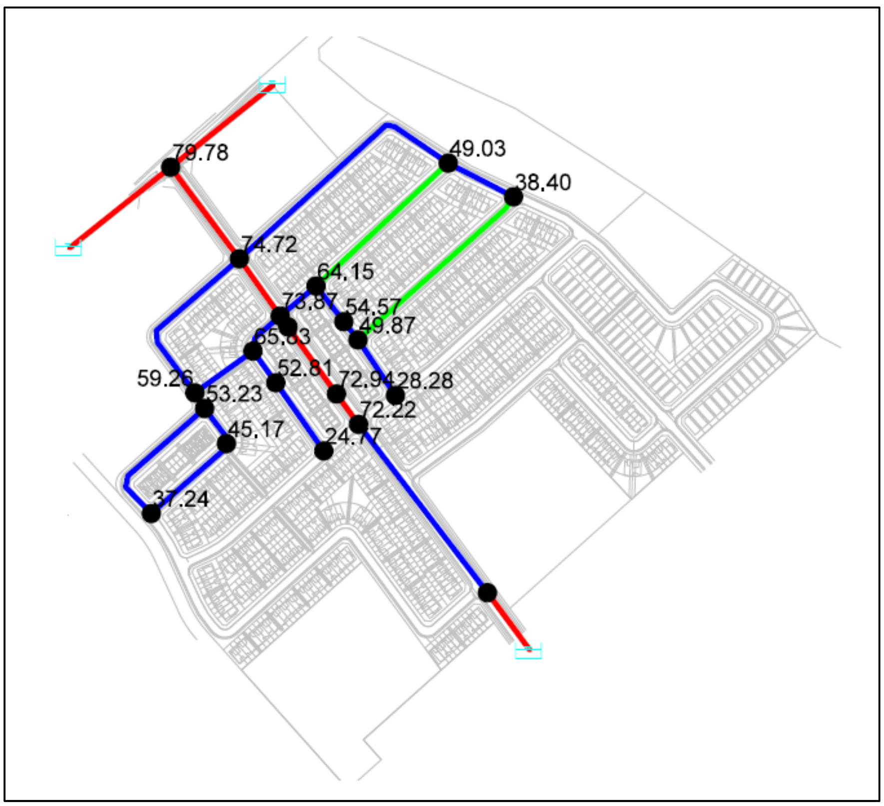
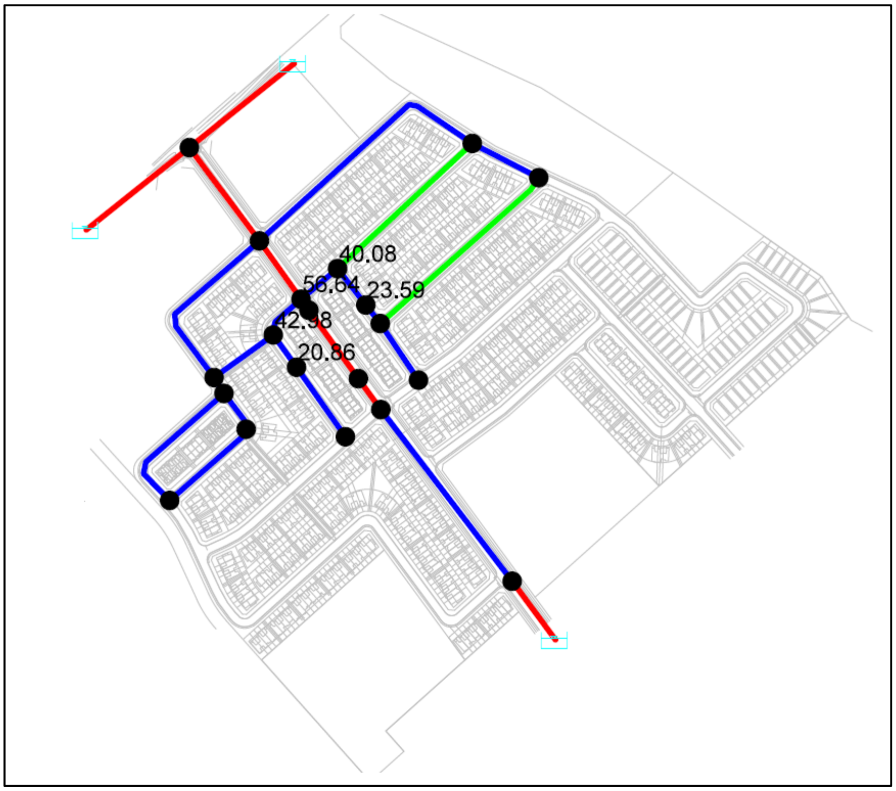


Figure 2.12: MXDY + 267 L/s Fire Flow Results Interim Condition Scenario (Residual Pressure (psi))



Ultimate Condition Scenario

In the ultimate development condition, the maximum pressure modeled was approximately 91.3 psi (630 kPa) and the minimum pressure during the peak hour scenario was approximately 80.9 psi (557 kPa) as shown in **Figure 2.13** and **Figure 2.14** respectively. These pressures are above the serviceable limit of 50 to 80 psi (345 to 552 kPa) and therefore all units will require pressure reducing valves.

Figure 2.13: AVDY Pressure Results for Ultimate Condition Scenario (psi)

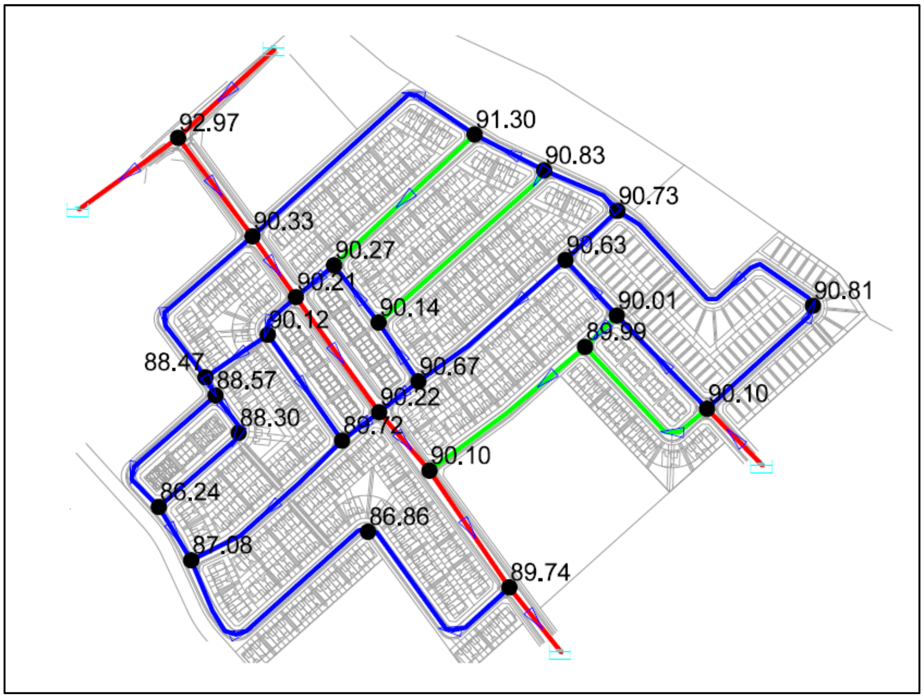
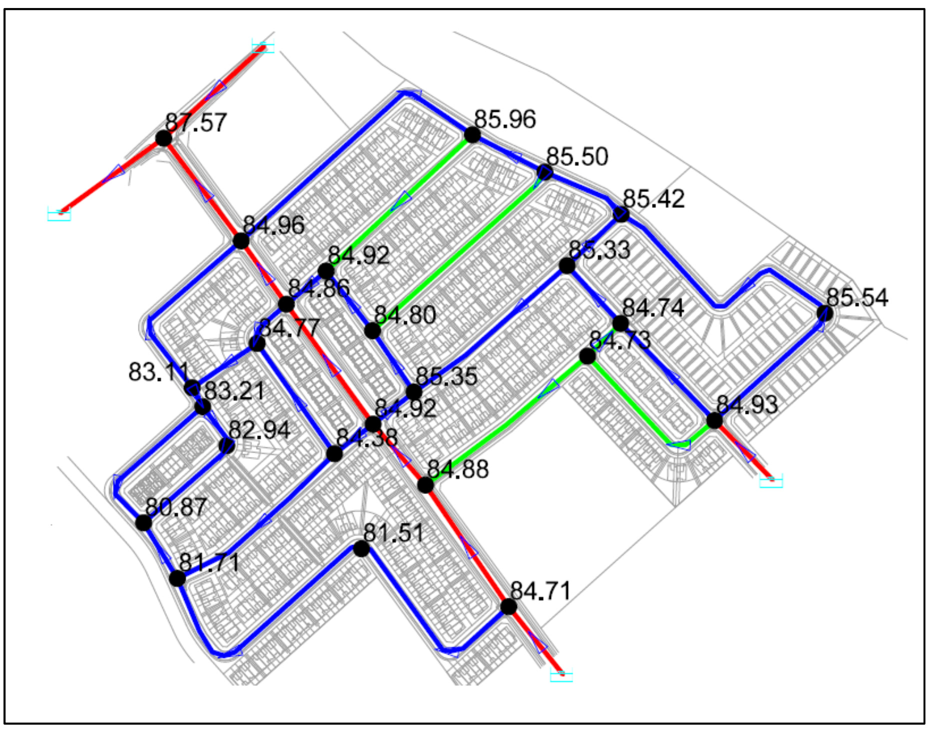


Figure 2.14: PKHR Pressure Results for Ultimate Condition Scenario (psi)



Similar to the previous two scenarios, a fire flow analysis was carried out in the hydraulic model to determine the anticipated amount of flow that could be provided for the proposed development under maximum day demands and a fire flow requirements of 200 L/s, and 267 L/s for the back to back units.

Results of the ultimate conditions modeling analysis indicate that flows in excess of 20,220 L/min (337 L/s) can be delivered for the units that require 200 L/s or less, and 32,700 L/min (545 L/s) can be delivered to units that require 267 L/s while still maintaining a residual pressure of 140 kPa (20 psi). The residual pressures for the different fire flow analyses are shown in **Figure 2.15, Figure 2.16**. Results of the hydraulic modeling are included for reference in **Appendix A3**.

Figure 2.15: MXDY + 200 L/s Fire Flow Results for Ultimate Condition Scenario (Residual Pressure (psi))

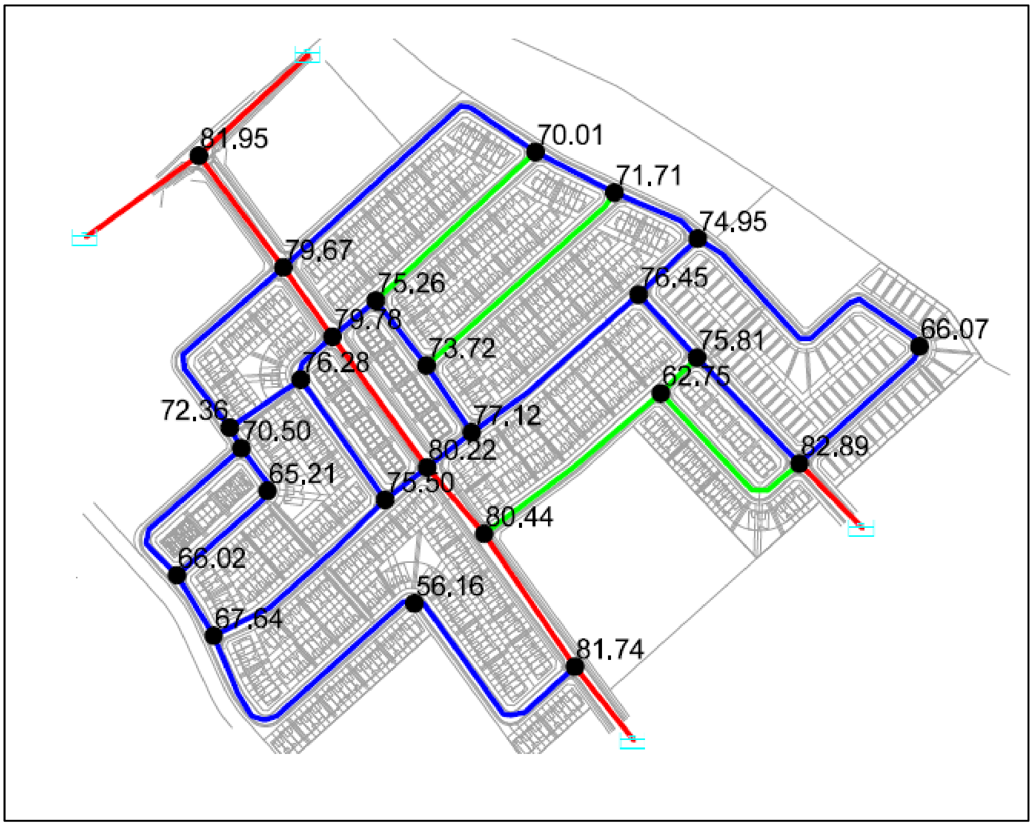
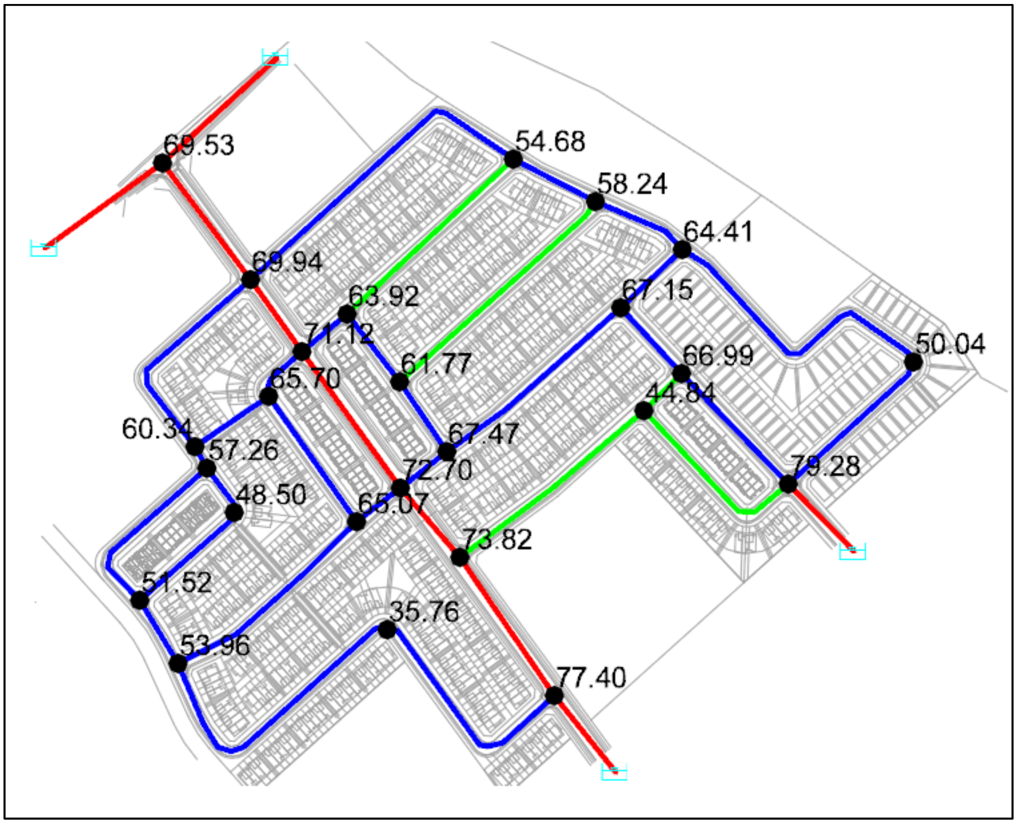


Figure 2.16:MXDY + 267 L/s Fire Flow Results for Ultimate Condition Scenario (Residual Pressure (psi))



2.6 WATER AGE CALCULATIONS

Estimated daily consumption for the first construction phase and interim conditions is based on an average usage of 350 L/c/d and 2.7 people per townhome and back-to-back unit.

2.6.1 First Construction Phase

Total Site

The water volume calculation is based on the length and size of all watermain piping within the first construction phase. The average daily consumption is anticipated to be more than the total pipe volume of the first construction phase.

Volume of 204 mm diameter pipe = 33.14 m^3

Volume of 297 mm diameter pipe = 35.38 m^3

Total Pipe Volume = 68.52 m^3

Appendix B - WASTEWATER SERVICING CALCULATIONS

B.1 SANITARY SEWER DESIGN SHEET

Stantec

SUBDIVISION:

Kanata West Block 29

DATE:	2021-07-21
REVISION:	1
DESIGNED BY:	WAJ
CHECKED BY:	TKR

SANITARY SEWER DESIGN SHEET
(City of Ottawa)

FILE NUMBER: 160401608

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 / 2BR TERRACE FLAT	2.1	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	
AREA ID NUMBER	FROM M.H.	TO M.H.	AREA (ha)	UNITS SINGLE	UNITS 2BR	UNITS APT	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)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)
R5A	5	4	0.09	0	6	0	13	0.09	13	3.72	0.2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
R4A	4	3	0.19	0	12	0	25	0.28	38	3.67	0.4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
R6A	6	3	0.36	0	24	0	50	0.36	50	3.65	0.6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
R3A	3	2	0.06	0	6	0	13	0.70	101	3.59	1.2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
R2A	2	1A	0.04	0	0	0	0	0.74	101	3.59	1.2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	1A	1	0.00	0	0	0	0	0.74	101	3.59	1.2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

LOCATION			C+I+I	INFILTRATION			TOTAL	PIPE								
AREA ID NUMBER	FROM M.H.	TO M.H.	PEAK FLOW (l/s)	TOTAL AREA (ha)	ACCU. AREA (ha)	INFILT. FLOW (l/s)	FLOW (l/s)	LENGTH (m)	DIA (mm)	MATERIAL	CLASS	SLOPE (%)	CAP. (FULL) (l/s)	CAP. V PEAK FLOW (%)	VEL. (FULL) (m/s)	VEL. (ACT.) (m/s)
R5A	5	4	0.0	0.09	0.09	0.0	0.2	17.6	200	PVC	SDR 35	0.65	27.0	**0.67%**	0.85	0.21
R4A	4	3	0.0	0.19	0.28	0.1	0.5	43.0	200	PVC	SDR 35	0.50	23.5	**2.30%**	0.74	0.26
R6A	6	3	0.0	0.36	0.36	0.1	0.7	70.2	200	PVC	SDR 35	0.50	23.5	**3.04%**	0.74	0.28
R3A	3	2	0.0	0.06	0.70	0.2	1.4	13.9	200	PVC	SDR 35	0.50	23.5	**5.97%**	0.74	0.34
R2A	2	1A	0.0	0.04	0.74	0.2	1.4	10.9	200	PVC	SDR 35	0.50	23.5	**6.02%**	0.74	0.34
	1A	1	0.0	0.00	0.74	0.2	1.4	11.6	200	PVC	SDR 35	0.50	23.6	**6.00%**	0.74	0.34
									200							

B.2 SANITARY EXCERPTS FROM KANATA WEST DEVELOPMENT FIRST REGISTRATION PHASE REPORT (STANTEC, FEBRUARY 2020)

the ultimate condition were 281 m³ and 810 m³ respectively, while the wet weather peak flow of 1,250 L/s was used as the pumping rate.

4.5.4 Sanitary HGL Analysis Results

The following tables summarize the HGL results from the catastrophic failure (annual parameters) scenarios and the normal operating conditions (rare parameters) scenario across the proposed first registration phase of the Richcraft KW Development. Table summarizing the HGL results across the entire Richcarft KW site have been included in **Appendix C.2**.

Table 4.4: Catastrophic Pump Station Failure Sanitary HGL – Annual Parameters

MH ID	Road Grade (m)	USF (m)	Catastrophic HGL and USF – HGL Clearance							
			Scenario 1		Scenario 2		Scenario 3		Scenario 4	
			HGL (m)	Clearance (m)	HGL (m)	Clearance (m)	HGL (m)	Clearance (m)	HGL (m)	Clearance (m)
1A	96.20	N/A	95.35	-	95.29	-	95.32	-	95.21	-
1B	96.60	N/A	95.31	-	95.27	-	95.28	-	95.17	-
1C	95.30	N/A	95.24	-	95.22	-	95.23	-	95.10	-
2	97.45	N/A	95.36	-	95.30	-	95.33	-	95.22	-
3	97.89	95.79	95.39	0.40	95.33	0.46	95.36	0.43	95.25	0.54
4	98.19	96.40	95.40	1.00	95.34	1.06	95.36	1.04	95.26	1.14
5	98.63	96.64	95.43	1.21	95.43	1.21	95.43	1.21	95.43	1.21
6	98.67	96.99	95.52	1.47	95.52	1.47	95.52	1.47	95.52	1.47
7	99.11	96.99	96.01	0.98	96.01	0.98	96.01	0.98	96.01	0.98
8	100.21	97.69	97.15	0.54	97.15	0.54	97.15	0.54	97.15	0.54
9	99.23	97.44	96.21	1.23	96.21	1.23	96.21	1.23	96.21	1.23
10	99.43	97.67	96.31	1.36	96.31	1.36	96.31	1.36	96.31	1.36
11	100.75	97.67	96.90	0.77	96.90	0.77	96.90	0.77	96.90	0.77
12	100.60	98.39	97.03	1.36	97.03	1.36	97.03	1.36	97.03	1.36
3A	97.75	95.71	95.39	0.32	95.33	0.38	95.36	0.35	95.25	0.46
3B	97.66	95.71	95.39	0.32	95.33	0.38	95.36	0.35	95.25	0.46
3C	97.53	95.71	95.39	0.32	95.33	0.38	95.36	0.35	95.25	0.46
14	97.61	N/A	95.40	-	95.34	-	95.37	-	95.26	-
16	97.35	95.71	95.41	0.30	95.35	0.36	95.38	0.33	95.27	0.44
17	97.29	N/A	95.41	-	95.35	-	95.38	-	95.27	-
17A	97.32	95.63	95.41	0.22	95.35	0.28	95.38	0.25	95.27	0.36
17B	97.37	95.63	95.41	0.22	95.35	0.28	95.38	0.25	95.27	0.36

MH ID	Road Grade (m)	USF (m)	Catastrophic HGL and USF – HGL Clearance							
			Scenario 1		Scenario 2		Scenario 3		Scenario 4	
			HGL (m)	Clearance (m)	HGL (m)	Clearance (m)	HGL (m)	Clearance (m)	HGL (m)	Clearance (m)
18	97.17	95.63	95.42	0.21	95.36	0.27	95.38	0.25	95.28	0.35
18A	97.65	95.69	95.42	0.27	95.36	0.33	95.38	0.31	95.28	0.41
19	97.43	95.63	95.42	0.21	95.36	0.27	95.39	0.24	95.28	0.35
20	97.50	95.63	95.43	0.20	95.37	0.26	95.40	0.23	95.29	0.34
22	97.96	96.15	95.41	0.74	95.35	0.80	95.38	0.77	95.27	0.88
22A	97.83	96.10	95.41	0.69	95.35	0.75	95.38	0.72	95.27	0.83
22B	97.84	96.10	95.41	0.69	95.35	0.75	95.38	0.72	95.27	0.83
23	98.10	96.54	95.41	1.13	95.35	1.19	95.38	1.16	95.27	1.27
24	98.05	96.30	95.41	0.89	95.35	0.95	95.38	0.92	95.27	1.03
25	98.00	96.30	95.41	0.89	95.35	0.95	95.38	0.92	95.27	1.03
26	98.10	96.30	95.41	0.89	95.35	0.95	95.38	0.92	95.27	1.03
27	97.92	95.75	95.41	0.34	95.35	0.40	95.38	0.37	95.27	0.48
30	98.01	95.90	95.41	0.49	95.35	0.55	95.38	0.52	95.27	0.63
31	97.52	95.70	95.43	0.27	95.37	0.33	95.40	0.30	95.29	0.41
32	97.68	95.90	95.43	0.47	95.37	0.53	95.40	0.50	95.29	0.61
33	97.62	96.00	95.41	0.59	95.35	0.65	95.38	0.62	95.27	0.73
35	97.96	96.04	95.43	0.61	95.37	0.67	95.40	0.64	95.29	0.75
35A	97.94	N/A	95.42	-	95.36	-	95.39	-	95.28	-

As can be seen in the above table, the worst-case annual HGL (Scenario 1) remains below the proposed USF elevations across the proposed development.

Table 4.5: Normal Operating Conditions Sanitary HGL

Sanitary Manhole	Rim Elevation (m)	USF (m)	HGL (m)	USF - HGL Clearance
1A	96.20	N/A	88.79	-
1B	96.60	N/A	88.61	-
1C	95.30	N/A	87.66	-
2	97.45	N/A	89.01	-
3	97.89	95.79	91.11	4.68
4	98.19	96.40	94.10	2.30

Stantec

SUBDIVISION:

Richcraft Kanata West Subdivision - First Registration Phase

DATE:	8/27/2019
REVISION:	3
DESIGNED BY:	WAJ
CHECKED BY:	AMP

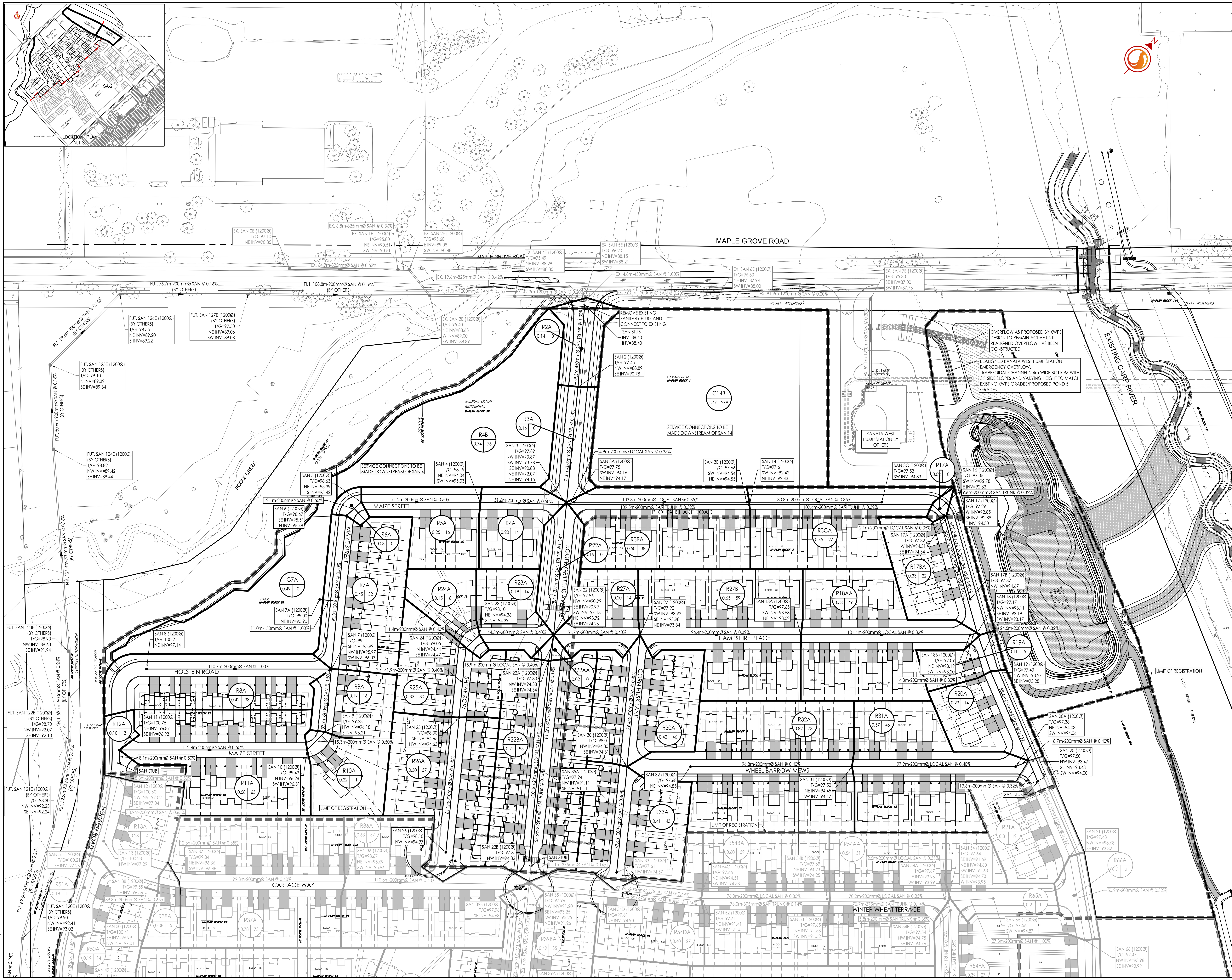
SANITARY SEWER DESIGN SHEET
(City of Ottawa)

FILE NUMBER: 160401393

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	Medium Denisty Residential Blcoks	38 units/ha		

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 (ha)	UNITS SINGLE	UNITS TOWN	UNITS APT	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)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	PEAK FLOW (L/s)	TOTAL AREA (ha)	ACCU. AREA (ha)	INFILT. FLOW (L/s)	FLOW (L/s)	LENGTH (m)	DIA (mm)	MATERIAL	CLASS	SLOPE (%)	CAP. (FULL) (l/s)	CAP. V PEAK FLOW (%)	VEL. (FULL) (m/s)	VEL. (ACT.) (m/s)
PROPOSED FIRST REGISTRATION PHASE																																			
R8A	8	7	0.42	0	14	0	38	0.42	38	3.67	0.4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.42	0.42	0.1	0.6	110.7	200	PVC	SDR 35	1.00	33.4	1.8%	1.05	0.34
FUT R13A	*13*	*12*	*0.28*	*0*	*5*	*0*	*14*	*0.28*	*14*	*3.72*	*0.2*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.0*	*0.28*	*0.28*	*0.1*	*0.3*	*38.9*	*200*	*PVC*	*SDR 35*	*0.65*	*27.0*	*0.9%*	*0.85*	*0.23*
R12A	12	11	0.10	0	1	0	3	0.38	16	3.71	0.2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.10	0.38	0.1	0.3	16.8	200	PVC	SDR 35	0.50	23.6	1.4%	0.74	0.21
R11A	11	10	0.58	0	24	0	65	0.96	81	3.61	0.9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.58	0.96	0.3	1.3	112.4	200	PVC	SDR 35	0.50	23.6	5.4%	0.74	0.33
R10A	10	9	0.22	0	4	0	11	1.18	92	3.60	1.1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.22	1.18	0.4	1.5	15.3	200	PVC	SDR 35	0.50	23.6	6.2%	0.74	0.34
R9A	9	7	0.19	0	6	0	16	1.37	108	3.59	1.3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.19	1.37	0.5	1.7	37.9	200	PVC	SDR 35	0.50	23.6	7.2%	0.74	0.36
G7A, R7A	7	6	0.45	0	12	0	32	2.24	178	3.53	2.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.49	0.49	0.0	0.93	2.73	0.9	2.9	92.3	200	PVC	SDR 35	0.50	23.6	12.4%	0.74	0.42
R6A	6	5	0.03	0	0	0	0	2.27	178	3.53	2.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.49	0.0	0.03	2.76	0.9	3.0	12.1	200	PVC	SDR 35	0.50	23.6	12.5%	0.74	0.42
R5A	5	4	0.25	0	6	0	16	2.53	194	3.52	2.2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.49	0.0	0.25	3.01	1.0	3.2	71.2	200	PVC	SDR 35	0.50	23.6	13.6%	0.74	0.43
R4A, R4B	4	3	0.94	0	5	0	90	3.47	284	3.47	3.2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.49	0.0	0.94	3.95	1.3	4.5	51.6	200	PVC	SDR 35	0.50	23.7	19.0%	0.74	0.48
R33A	33	30	0.41	0	16	0	43	0.41	43	3.66	0.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.41	0.41	0.1	0.6	63.6	200	PVC	SDR 35	0.40	21.1	3.1%	0.67	0.25
R30A	30	27	0.42	0	17	0	46	0.83	89	3.61	1.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.42	0.83	0.3	1.3	79.4	200	PVC	SDR 35	0.40	21.1	6.2%	0.67	0.31
R27A	27	22	0.20	0	5	0	14	1.02	103	3.59	1.2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.20	1.02	0.3	1.5	51.7	200	PVC	SDR 35	0.40	21.1	7.2%	0.67	0.32
	35	35A	0.00	0	0	0	0	13.99	1196	3.20	12.4	0.00	13.19	0.00	0.00	0.00	0.00	0.00	3.99	0.00	1.28	8.4	0.00	32.44	10.7	31.5	68.7	375	PVC	SDR 35	0.14	60.1	52.4%	0.57	0.49
	35A	22	0.00	0	0	0	0	13.99	1196	3.20	12.4	0.00	13.19	0.00	0.00	0.00	0.00	0.00	3.99	0.00	1.28	8.4	0.00	32.44	10.7	31.5	81.6	375	PVC	SDR 35	0.14	60.7	51.8%	0.58	0.50
R26A	26	25	0.50	0	21	0	57	0.50	57	3.64	0.7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.50	0.50	0.2	0.8	81.2	200	PVC	SDR 35	0.40	21.1	3.9%	0.67	0.27
R25A	25	24	0.32	0	11	0	30	0.82	86	3.61	1.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.32	0.82	0.3	1.3	41.9	200	PVC	SDR 35	0.40	21.2	6.0%	0.67	0.30
R24A	24	23	0.15	0	3	0	8	0.97	95	3.60	1.1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.15	0.97	0.3	1.4	11.4	200	PVC	SDR 35	0.40	21.1	6.7%	0.67	0.31
R23A	23	22	0.19	0	5	0	14	1.16	108	3.59	1.3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.19	1.16	0.4	1.6	44.3	200	PVC	SDR 35	0.40	21.1	7.7%	0.67	0.33
R22BA	22B	22A	0.71	0	35	0	95	0.71	95	3.60	1.1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.71	0.71	0.2	1.3	120.0	200	PVC	SDR 35	0.40	21.1	6.3%	0.67	0.31
R22AA	22A	22	0.02	0	0	0	0	0.73	95	3.60	1.1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.02	0.73	0.2	1.3	15.9	200	PVC	SDR 35	0.40	21.1	6.4%	0.67	0.31
R22A	22	3	0.16	0	0	0	0	17.06	1501	3.14	15.3	0.00	13.19	0.00	0.00	0.00	0.00	0.00	3.99	0.00	1.28	8.4	0.16	35.52	11.7	35.4	78.4	375	PVC	SDR 35	0.14	61.3	57.7%	0.58	0.52
R32A	32	31	0.82	0	27	0	73	0.82	73	3.62	0.9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.82	0.82	0.3	1.1	96.8	200	PVC	SDR 35	0.40	21.1	5.3%	0.67	0.29
R31A	31	20A	0.57	0	17	0	46	1.39	119	3.58	1.4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.57	1.39	0.5	1.8	97.9	200	PVC	SDR 35	0.40	21.1	8.7%	0.67	0.34
	20A	20	0.00	0	0	0	0	1.39	119	3.58	1.4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.00	1.39	0.5	1.8	8.7	200	PVC	SDR 35	0.40	21.1	8.7%	0.67	0.34
R20A	20	19	0.23	0	5	0	14	4.67	328	3.45	3.7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.97	0.0	0.23	5.64	1.9	5.5	58.4	200	PVC	SDR 35	0.32	18.9	29.2%	0.60	0.43
R19A	19	18	0.11	0	2	0	5	4.78	333	3.45	3.7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.97	0.0	0.11	5.75	1.9	5.6	24.5	200	PVC	SDR 35	0.32	18.9	29.7%	0.60	0.43
R27B	27	18A	0.65	0	22	0	59	0.65	59	3.64	0.7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.65	0.65	0.2	0.9	96.4	200	PVC	SDR 35	0.32	18.9	4.8%	0.60	0.25
R18AA	18A	18B	0.58	0	18	0	49	1.24	108	3.59	1.3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.58	1.24	0.4	1.7	101.4	200	PVC	SDR 35	0.32	18.9	8.8%	0.60	0.30
	18B	18	0.00	0	0	0	0	1.24	108	3.59	1.3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.00	1.24	0.4	1.7	4.3	200	PVC	SDR 35	0.32	18.9	8.8%	0.60	0.30
	18	17	0.00	0	0	0	0	6.02	441	3.40	4.9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.97	0.0	0.00	6.99	2.3	7.2	73.1	200	PVC	SDR 35	0.32	18.9	37.9%	0.60	0.47
R17BA	17B	17A	0.33	0	8	0	22	0.33	22	3.70	0.3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.33	0.33	0.1	0.4	51.0	200	PVC	SDR 35	0.65	27.0	1.4%	0.85	0.24
	17A	17	0.00	0	0	0	0	0.33	22	3.70	0.3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.00	0.33	0.1	0.4	2.1	200	PVC	SDR 35	0.35	19.8	1.9%	0.62	0.20
R17A	17	16	0.02	0	0	0	0	6.36	463	3.39	5.1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.97	0.0	0.02	7.33	2.4	7.5	9.6	200	PVC	SDR 35	0.32	18.9	39.7%	0.60	0.47
	16	14	0.00	0	0	0	0	6.36	463	3.39	5.1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.97	0.0	0.00	7.33	2.4	7.5	109.6	200	PVC	SDR 35	0.32	18.9	39.7%	0.60	0.47
C14B	14	3	0.00	0	0	0	0	6.36	463	3.39	5.1	1.47	1.47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.97	0.5	1.47	8.80	2.9	8.5	109.5	200	PVC	SDR 35	0.32	18.9	44.8%	0.60	0.49
R3CA	3C	3B	0.45	0	10	0	27	0.45	27	3.69	0.3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.45	0.45	0.1	0.5	80.8	200	PVC	SDR 35	0.35	19.8	2.4%	0.62	0.21
R3BA	3B	3A	0.50	0	14	0	38	0.95	65	3.63	0.8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.50	0.95	0.3	1.1	103.3	200	PVC	SDR 35	0.35	19.8	5.4%	0.62	0.27
	3A	3	0.00	0	0	0	0	0.95	65	3.63	0.8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.00	0.95	0.3	1.1	4.9	200	PVC	SDR 35	0.35	19.8	5.4%	0.62	0.27
R3A	3	2	0.16	0	0	0	0	28.00	2313	3.03	22.7	0.00	14.66	0.00	0.00	0.00	0.00	0.00	3.99	0.00	2.74	9.1	0.16	49.39	16.3	48.1	71.0	375	PVC	SDR 35	0.14	60.1	80.0%	0.57	0.56
R2A	2	1A	0.14	0	0	0	0	28.14	2313	3.03	22.7	0.00	14.66	0.00	0.00	0.00	0.00	0.00	3.99	0.00	2.74	9.1	0.14	49.52	16.3	48.1	49.3	450	PVC	SDR 35	1.00	300.3	16.0%	1.83	1.11
	1A	1	0.00	0	0	0	0	28.14	2313	3.03	22.7	0.00	14.66	0.00	0.00	0.00	0.00	0.00	3.99	0.00	2.74	9.1	0.00	49.52	16.3	48.1	4.8	450	PVC	SDR 35	1.00	300.1	16.0%	1.83	1.11
																												450							



Stantec

Stantec Consulting Ltd.
400 - 1331 Clyde Avenue
Ottawa ON
Tel. 613.722.4420
www.stantec.com

Legend

- SANITARY DRAINAGE AREA ID#
- POPULATION
- SANITARY DRAINAGE AREA ha.
- SANITARY DRAINAGE AREA
- PROPOSED SANITARY SEWER
- EXISTING SANITARY SEWER

1. CONTROLLED SETTLEMENT JOINTS TO BE USED ON EACH BUILDING SERVICE CONNECTION AS PER CITY STANDARD S11

	Revision	By	Appd.	YY.MM.DD
9	ISSUED FOR ECA APPROVAL	WAJ	SGG	20.02.12
8	REVISED AS PER CITY COMMENTS	WAJ	SGG	20.01.31
7	ISSUED FOR TENDER	WAJ	KJH	20.01.09
6	REVISED AS PER CITY COMMENTS	WAJ	SGG	19.11.18
5	REVISED CROSSING DESIGN	WAJ	SGG	19.09.23
4	REVISED AS PER CITY COMMENTS	WAJ	SGG	19.08.30
3	REVISED AS PER CITY COMMENTS	WAJ	SGG	19.05.10
2	REVISED AS PER CITY COMMENTS	WAJ	SGG	18.12.10
1	ISSUED FOR FIRST SUBMISSION	WAJ	SGG	18.03.02

File Name: 1060401393-DB	Dwn.	Chkd.	Dsgn.	YY.MM.DD
	WAJ	SGG	WAJ	17.12.20

Permit-Seal

Client/Project

RICHCRAFT HOMES
1st REGISTRATION

RICHCRAFT KANATA WEST
1620 MAPLE GROVE ROAD

OTTAWA, ON

Title

SANITARY DRAINAGE AREA PLAN

Project No. 160401393

Scale 1:1000 (0 10 30 50m)

Drawing No. SA-1

Sheet 42 of 44

Revision 9

CITY FILE No. D07-16-04-0017 CITY PLAN No. 17529

W:\active\160401393_Kanata West Richcraft\design\drawing\160401393SA.dwg
2020/02/12 1:52 PM By: Gillis, Sheridan

Appendix C - STORMWATER MANAGEMENT

C.1 STORM SEWER DESIGN SHEET

Stantec

Kanata West Block 29	
DATE:	2021-07-21
REVISION:	2
DESIGNED BY:	WAJ
CHECKED BY:	TKR

STORM SEWER DESIGN SHEET
(City of Ottawa)

FILE NUMBER: **160401608**

DESIGN PARAMETERS

$I = a / (t+b)^c$ (As per City of Ottawa Guidelines, 2012)

	1:2 yr	1:5 yr	1:10 yr	1:100 yr
a =	732.951	998.071	1174.184	1735.688
b =	6.199	6.053	6.014	6.014
c =	0.810	0.814	0.816	0.820

MANNING'S n = 0.013 BEDDING CLASS = B

MINIMUM COVER: 2.00 m

TIME OF ENTRY 10 min

LOCATION / **DRAINAGE AREA**

AREA ID NUMBER	FROM M.H.	TO M.H.	AREA (2-YEAR) (ha)	AREA (5-YEAR) (ha)	AREA (10-YEAR) (ha)	AREA (100-YEAR) (ha)	AREA (ROOF) (ha)	C (2-YEAR) (-)	C (5-YEAR) (-)	C (10-YEAR) (-)	C (100-YEAR) (-)	A x C (2-YEAR) (ha)	ACCUM AxC (2YR) (ha)	A x C (5-YEAR) (ha)	ACCUM. AxC (5YR) (ha)	A x C (10-YEAR) (ha)	ACCUM. AxC (10YR) (ha)	A x C (100-YEAR) (ha)	ACCUM. AxC (100YR) (ha)
L104A	104	103	0.13	0.00	0.00	0.00	0.00	0.77	0.00	0.00	0.00	0.100	0.100	0.000	0.000	0.000	0.000	0.000	0.000
L106A	106	103	0.21	0.00	0.00	0.00	0.00	0.75	0.00	0.00	0.00	0.158	0.158	0.000	0.000	0.000	0.000	0.000	0.000
L103A	103	102	0.06	0.00	0.00	0.00	0.00	0.80	0.00	0.00	0.00	0.048	0.306	0.000	0.000	0.000	0.000	0.000	0.000
	102	101A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.306	0.000	0.000	0.000	0.000	0.000	0.000
	101A	101	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.306	0.000	0.000	0.000	0.000	0.000	0.000

DRAINAGE AREA (continued) / **PIPE SELECTION**

FROM M.H.	TO M.H.	T of C (min)	I_{2-YEAR} (mm/h)	I_{5-YEAR} (mm/h)	$I_{10-YEAR}$ (mm/h)	$I_{100-YEAR}$ (mm/h)	$Q_{CONTROL}$ (L/s)	ACCUM. $Q_{CONTROL}$ (L/s)	Q_{ACT} (CIA/360) (L/s)	LENGTH (m)	PIPE WIDTH OR DIAMETE (mm)	PIPE HEIGHT (mm)	PIPE SHAPE (-)	MATERIAL (-)	CLASS (-)	SLOPE %	Q_{CAP} (FULL) (L/s)	% FULL (-)	VEL. (FULL) (m/s)	VEL. (ACT) (m/s)	TIME OF FLOW (min)
104	103	10.00	76.81	104.19	122.14	178.56	0.0	0.0	21.4	38.7	300	300	CIRCULAR	PVC	SDR 35	0.50	68.0	**31.41%**	0.97	0.71	0.90
		10.90																			
106	103	10.00	76.81	104.19	122.14	178.56	0.0	0.0	33.6	50.1	300	300	CIRCULAR	PVC	SDR 35	0.50	68.0	**49.42%**	0.97	0.83	1.01
		11.01																			
103	102	11.01	73.13	99.14	116.19	169.82	0.0	0.0	62.1	13.9	375	375	CIRCULAR	PVC	SDR 35	0.50	116.6	**53.26%**	1.11	0.96	0.24
102	101A	11.25	72.31	98.02	114.87	167.87	0.0	0.0	61.4	13.6	375	375	CIRCULAR	PVC	SDR 35	0.50	116.6	**52.67%**	1.11	0.96	0.24
101A	101	11.49	71.53	96.94	113.60	166.02	0.0	0.0	60.7	8.1	375	375	CIRCULAR	PVC	SDR 35	0.50	116.6	**52.10%**	1.11	0.95	0.14
		11.63									675	675									

C.2 SAMPLE PCSWMM INPUT FILE

```
[TITLE]
;;Project Title/Notes

[OPTIONS]
;;Option             Value
FLOW_UNITS           LPS
INFILTRATION         HORTON
FLOW_ROUTING         DYNWAVE
LINK_OFFSETS         ELEVATION
MIN_SLOPE            0
ALLOW_PONDING        NO
SKIP_STEADY_STATE    NO

START_DATE           02/22/2021
START_TIME           00:00:00
REPORT_START_DATE    02/22/2021
REPORT_START_TIME    00:00:00
END_DATE             02/22/2021
END_TIME             08:00:00
SWEEP_START          01/01
SWEEP_END            12/31
DRY_DAYS             0
REPORT_STEP          00:01:00
WET_STEP             00:05:00
DRY_STEP             00:05:00
ROUTING_STEP         10
RULE_STEP            00:00:00

INERTIAL_DAMPING     PARTIAL
NORMAL_FLOW_LIMITED  BOTH
FORCE_MAIN_EQUATION  H-W
VARIABLE_STEP        0.75
LENGTHENING_STEP     0
MIN_SURFAREA         0
MAX_TRIALS           8
HEAD_TOLERANCE       0.0015
SYS_FLOW_TOL         5
LAT_FLOW_TOL         5
MINIMUM_STEP         0.5
```

```
THREADS              4

[FILES]
;;Interfacing Files
USE HOTSTART "C:\2021\1608 - Block 29\100C.HSF"

[EVAPORATION]
;;Data Source    Parameters
;;-------------- ----------------
CONSTANT         0.0
DRY_ONLY         NO

[RAINGAGES]
;;Name           Format    Interval SCF      Source
;;-------------- --------- -------- -------- ----------
RG1              INTENSITY 0:10     1.0      TIMESERIES Chicago_100yr_3hr_10m_Ottawa

[SUBCATCHMENTS]
;;Name           Rain Gage        Outlet           Area     %Imperv  Width    %Slope   CurbLen  SnowPack

;;-------------- ---------------- ---------------- -------- -------- -------- -------- --------
----------------
;0.82
L103A            RG1              L103A-S          0.063366 85.71    50       2.5      0

;0.82
L104A            RG1              L104A-S          0.130132 81.43    81       3        0

;0.75
L106A            RG1              L106A-S          0.208333 78.57    115      2        0

;0.27
UNC-1            RG1              OF-1             0.105515 8.57     165      25       0

UNC-2            RG1              OF-2             0.043759 52.86    44       4.5      0

UNC-3            RG1              OF-3             0.046584 54.29    48       5        0

UNC-4            RG1              OF-4             0.045854 41.43    55       5        0
```

```
UNC-5            RG1              OF-5             0.093838 48.57    95       3.5      0


[SUBAREAS]
;;Subcatchment   N-Imperv   N-Perv     S-Imperv   S-Perv     PctZero    RouteTo    PctRouted
;;-------------- ---------- ---------- ---------- ---------- ---------- ---------- ----------
L103A            0.013      0.25       1.57       4.67       0          OUTLET
L104A            0.013      0.25       1.57       4.67       0          OUTLET
L106A            0.013      0.25       1.57       4.67       0          OUTLET
UNC-1            0.013      0.25       1.57       4.67       0          PERVIOUS   100
UNC-2            0.013      0.25       1.57       4.67       0          OUTLET
UNC-3            0.013      0.25       1.57       4.67       0          OUTLET
UNC-4            0.013      0.25       1.57       4.67       0          OUTLET
UNC-5            0.013      0.25       1.57       4.67       0          OUTLET

[INFILTRATION]
;;Subcatchment   MaxRate    MinRate    Decay      DryTime    MaxInfil
;;-------------- ---------- ---------- ---------- ---------- ----------
L103A            76.2       13.2       4.14       7          0
L104A            76.2       13.2       4.14       7          0
L106A            76.2       13.2       4.14       7          0
UNC-1            76.2       13.2       4.14       7          0
UNC-2            76.2       13.2       4.14       7          0
UNC-3            76.2       13.2       4.14       7          0
UNC-4            76.2       13.2       4.14       7          0
UNC-5            76.2       13.2       4.14       7          0

[OUTFALLS]
;;Name           Elevation  Type       Stage Data       Gated    Route To
;;-------------- ---------- ---------- ---------------- -------- ----------------
;Minor system outlet
101              95.1       FIXED      95.64            NO
;Maize Overland Flow
MAIZE            97.9       FREE                        NO
OF-1             0          FREE                        NO
OF-2             0          FREE                        NO
OF-3             0          FREE                        NO
OF-4             0          FREE                        NO

OF-5             0          FREE                        NO

[STORAGE]
;;Name           Elev.    MaxDepth   InitDepth  Shape      Curve Name/Params            N/A      Fevap
Psi      Ksat     IMD
;;-------------- -------- ---------- ---------- ---------- ---------------------------- -------- --------
       -------- --------
101A             94.84    3.283      0          FUNCTIONAL 0         0        1.13     0        0
102              94.918   3.185      0          FUNCTIONAL 0         0        1.13     0        0
103              95       3.212      0          FUNCTIONAL 0         0        1.13     0        0
104              95.261   2.987      0          FUNCTIONAL 0         0        1.13     0        0
106              95.324   2.91       0          FUNCTIONAL 0         0        1.13     0        0
;T/G at CB=98.00
L103A-S          96.5     1.9        0          TABULAR    L103A-V                    0        0
;T/G at CB=97.92
L104A-S          96.54    1.78       0          TABULAR    L104A-V                    0        0
;T/G at CB=97.93
L106A-S          96.55    1.78       0          TABULAR    L106A-V                    0        0

[CONDUITS]
;;Name           From Node        To Node          Length     Roughness  InOffset   OutOffset  InitFlow
MaxFlow
;;-------------- ---------------- ---------------- ---------- ---------- ---------- ---------- ----------
----------
101A-101         101A             101              8.1        0.013      95.14      95.1       0          0

102-101A         102              101A             13.6       0.013      95.218     95.15      0          0

103-102          103              102              13.9       0.013      95.3       95.23      0          0

104-103          104              103              38.7       0.013      95.561     95.368     0          0

106-103          106              103              50.1       0.013      95.624     95.368     0          0


[ORIFICES]
;;Name           From Node        To Node          Type         Offset     Qcoeff     Gated    CloseTime
;;-------------- ---------------- ---------------- ------------ ---------- ---------- -------- ----------
L103A-IC         L103A-S          103              SIDE         96.5       0.572      NO       0
```

```
;Single ICD
L104A-IC1       L104A-S         104             SIDE         96.54      0.572      NO       0
;Single ICD
L104A-IC2       L104A-S         104             SIDE         96.54      0.572      NO       0
;Single ICD
L106A-IC        L106A-S         106             SIDE         96.55      0.572      NO       0

[WEIRS]
;;Name          From Node       To Node         Type         CrestHt    Qcoeff     Gated    EndCon
EndCoeff   Surcharge  RoadWidth  RoadSurf   Coeff. Curve
;;-------------- ---------------- ---------------- ------------ ---------- ---------- -------- --------
---------- ---------- ---------- ---------- ----------------
;Overland Flow
W103A           L103A-S         MAIZE           TRANSVERSE   98.2       1.74       NO       0        0
       YES
;Overland Flow
W104A           L104A-S         L103A-S         TRANSVERSE   98.22      1.74       NO       0        0
       YES
;Overland Flow
W106A           L106A-S         L103A-S         TRANSVERSE   98.21      1.74       NO       0        0
       YES

[XSECTIONS]
;;Link          Shape        Geom1            Geom2      Geom3      Geom4      Barrels    Culvert
;;-------------- ------------ ---------------- ---------- ---------- ---------- ---------- ----------
101A-101        CIRCULAR     0.375            0          0          0          1
102-101A        CIRCULAR     0.375            0          0          0          1
103-102         CIRCULAR     0.375            0          0          0          1
104-103         CIRCULAR     0.3              0          0          0          1
106-103         CIRCULAR     0.3              0          0          0          1
L103A-IC        CIRCULAR     0.083            0          0          0
L104A-IC1       CIRCULAR     0.083            0          0          0
L104A-IC2       CIRCULAR     0.083            0          0          0
L106A-IC        CIRCULAR     0.152            0          0          0
W103A           RECT_OPEN    0.15             6.7        0          0
W104A           RECT_OPEN    0.15             14.8       0          0
W106A           RECT_OPEN    0.15             8          0          0

[TRANSECTS]
```

```
;;Transect Data in HEC-2 format
;
NC 0.013    0.025    0.013
X1 Access            6        0.0      9.5      0.0      0.0      0.0      0.0      0.0
GR 0.28     0        0.25     1.5      0.1      1.5      0        9.5      0.15     9.5
GR 0.21     12.5

[LOSSES]
;;Link          Kentry     Kexit      Kavg       Flap Gate  Seepage
;;-------------- ---------- ---------- ---------- ---------- ----------
101A-101        0          1.32       0          NO         0
102-101A        0          0.02       0          NO         0
103-102         0          0.02       0          NO         0
104-103         0          0.02       0          NO         0
106-103         0          1.32       0          NO         0

[CURVES]
;;Name          Type       X-Value    Y-Value
;;-------------- ---------- ---------- ----------
L103A-V         Storage    0          0
L103A-V                    1.5        0
L103A-V                    1.7        146
L103A-V                    1.71       146
L103A-V                    1.9        146

L104A-V         Storage    0          0
L104A-V                    1.38       0
L104A-V                    1.68       349.3
L104A-V                    1.681      349.3
L104A-V                    1.78       349.3

L106A-V         Storage    0          0
L106A-V                    1.38       0
L106A-V                    1.66       477.1
L106A-V                    1.661      477.1
L106A-V                    1.78       477.1

[TIMESERIES]
;;Name          Date       Time       Value
```

```
;;-------------- ---------- ---------- ----------
Chicago_100yr_3hr_10m_Ottawa           0:00       6.05
Chicago_100yr_3hr_10m_Ottawa           0:10       7.54
Chicago_100yr_3hr_10m_Ottawa           0:20       10.16
Chicago_100yr_3hr_10m_Ottawa           0:30       15.97
Chicago_100yr_3hr_10m_Ottawa           0:40       40.65
Chicago_100yr_3hr_10m_Ottawa           0:50       178.56
Chicago_100yr_3hr_10m_Ottawa           1:00       54.04
Chicago_100yr_3hr_10m_Ottawa           1:10       27.32
Chicago_100yr_3hr_10m_Ottawa           1:20       18.24
Chicago_100yr_3hr_10m_Ottawa           1:30       13.73
Chicago_100yr_3hr_10m_Ottawa           1:40       11.06
Chicago_100yr_3hr_10m_Ottawa           1:50       9.29
Chicago_100yr_3hr_10m_Ottawa           2:00       8.02
Chicago_100yr_3hr_10m_Ottawa           2:10       7.08
Chicago_100yr_3hr_10m_Ottawa           2:20       6.35
Chicago_100yr_3hr_10m_Ottawa           2:30       5.76
Chicago_100yr_3hr_10m_Ottawa           2:40       5.28
Chicago_100yr_3hr_10m_Ottawa           2:50       4.88

Chicago_100yr+20%_3hr_10m_Ottawa           0:00       7.26
Chicago_100yr+20%_3hr_10m_Ottawa           0:10       9.05
Chicago_100yr+20%_3hr_10m_Ottawa           0:20       12.19
Chicago_100yr+20%_3hr_10m_Ottawa           0:30       19.16
Chicago_100yr+20%_3hr_10m_Ottawa           0:40       48.79
Chicago_100yr+20%_3hr_10m_Ottawa           0:50       214.27
Chicago_100yr+20%_3hr_10m_Ottawa           1:00       64.86
Chicago_100yr+20%_3hr_10m_Ottawa           1:10       32.78
Chicago_100yr+20%_3hr_10m_Ottawa           1:20       21.89
Chicago_100yr+20%_3hr_10m_Ottawa           1:30       16.48
Chicago_100yr+20%_3hr_10m_Ottawa           1:40       13.27
Chicago_100yr+20%_3hr_10m_Ottawa           1:50       11.14
Chicago_100yr+20%_3hr_10m_Ottawa           2:00       9.63
Chicago_100yr+20%_3hr_10m_Ottawa           2:10       8.5
Chicago_100yr+20%_3hr_10m_Ottawa           2:20       7.62
Chicago_100yr+20%_3hr_10m_Ottawa           2:30       6.91
Chicago_100yr+20%_3hr_10m_Ottawa           2:40       6.34
Chicago_100yr+20%_3hr_10m_Ottawa           2:50       5.85
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Chicago_2yr_3hr_10m_Ottawa           0:10       2.81
Chicago_2yr_3hr_10m_Ottawa           0:20       3.5
Chicago_2yr_3hr_10m_Ottawa           0:30       4.69
Chicago_2yr_3hr_10m_Ottawa           0:40       7.3
Chicago_2yr_3hr_10m_Ottawa           0:50       18.21
Chicago_2yr_3hr_10m_Ottawa           1:00       76.81
Chicago_2yr_3hr_10m_Ottawa           1:10       24.08
Chicago_2yr_3hr_10m_Ottawa           1:20       12.36
Chicago_2yr_3hr_10m_Ottawa           1:30       8.32
Chicago_2yr_3hr_10m_Ottawa           1:40       6.3
Chicago_2yr_3hr_10m_Ottawa           1:50       5.09
Chicago_2yr_3hr_10m_Ottawa           2:00       4.29
Chicago_2yr_3hr_10m_Ottawa           2:10       3.72
Chicago_2yr_3hr_10m_Ottawa           2:20       3.29
Chicago_2yr_3hr_10m_Ottawa           2:30       2.95
Chicago_2yr_3hr_10m_Ottawa           2:40       2.68
Chicago_2yr_3hr_10m_Ottawa           2:50       2.46
Chicago_2yr_3hr_10m_Ottawa           3:00       2.28

[REPORT]
;;Reporting Options
INPUT      YES
CONTROLS   NO
SUBCATCHMENTS ALL
NODES ALL
LINKS ALL

[TAGS]
Node       101              MIN
Node       MAIZE            MAJ
Node       101A             MIN
Node       102              MIN
Node       103              MIN
Node       104              MIN
Node       106              MIN
Node       L103A-S          MAJ
Node       L104A-S          MAJ
Node       L106A-S          MAJ
Link       101A-101         MIN
```

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Link       102-101A         MIN
Link       103-102          MIN
Link       104-103          MIN
Link       106-103          MIN
Link       L104A-IC1        RoadCB
Link       L104A-IC2        RoadCB
Link       L106A-IC         RoadCB
Link       W103A            MAJ
Link       W104A            MAJ
Link       W106A            MAJ

[MAP]
DIMENSIONS       350809.934291288 5017019.48289364 350923.034956779 5017207.03104882
UNITS            Meters

[COORDINATES]
;;Node           X-Coord            Y-Coord
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MAIZE            350899.395         5017096.477
OF-1             350828.486         5017121.445
OF-2             350875.554         5017185.875
OF-3             350896.408         5017158.491
OF-4             350917.894         5017117.836
OF-5             350876.943         5017080.391
101A             350889.849         5017096.954
102              350881.6           5017106
103              350872.3           5017119
104              350848.9           5017151
106              350834.2           5017085
L103A-S          350884.17          5017114.403
L104A-S          350863.549         5017143.636
L106A-S          350849.499         5017104.206

[VERTICES]
;;Link           X-Coord            Y-Coord
;;-------------- ------------------ ------------------
L104A-IC1        350857.097         5017149.08
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[POLYGONS]
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L103A            350895.065         5017112.533
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L103A            350886.794         5017106.123
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L103A            350884.57          5017103.995
L103A            350882.649         5017102.091
L103A            350882.649         5017102.091
L103A            350880.564         5017100.102
L103A            350880.564         5017100.102
L103A            350879.739         5017101.023
L103A            350879.739         5017101.023
L103A            350874.856         5017106.47
L103A            350874.856         5017106.47
L103A            350871.944         5017103.859
L103A            350871.944         5017103.859
L103A            350869.909         5017106.128
L103A            350869.909         5017106.128
L103A            350870.903         5017110.715
L103A            350870.903         5017110.715
L103A            350869.047         5017115.775
L103A            350869.047         5017115.775
L103A            350864.92          5017122.24
L103A            350864.92          5017122.24
L103A            350870.552         5017122.244
L103A            350870.552         5017122.244
L103A            350873.048         5017124.245
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L103A	350880.707	5017131.895
L103A	350886.195	5017135.921
L104A	350842.599	5017124.843
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L104A	350847.217	5017140.188
L104A	350844.269	5017144.208
L104A	350844.269	5017144.208
L104A	350847.817	5017146.81
L104A	350847.817	5017146.81
L104A	350847.989	5017147.928
L104A	350847.989	5017147.928
L104A	350844.872	5017152.178
L104A	350844.872	5017152.178
L104A	350850.032	5017155.963
L104A	350850.032	5017155.963
L104A	350850.315	5017155.578
L104A	350850.315	5017155.578
L104A	350851.433	5017155.406
L104A	350851.433	5017155.406
L104A	350854.981	5017158.008
L104A	350854.981	5017158.008
L104A	350856.843	5017159.192
L104A	350856.843	5017159.192
L104A	350859.341	5017161.025
L104A	350859.341	5017161.025
L104A	350847.534	5017177.123
L104A	350847.534	5017177.123
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L104A	350853.374	5017181.406
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L104A	350868.191	5017160.94
L104A	350872.381	5017155.154
L104A	350872.381	5017155.154
L104A	350871.659	5017154.624
L104A	350871.659	5017154.624

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L104A	350874.907	5017150.866
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L104A	350873.505	5017149.777
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L104A	350876.425	5017145.225
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L104A	350881.55	5017142.656
L104A	350886.195	5017135.921
L104A	350886.195	5017135.921
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L104A	350881.127	5017131.322
L104A	350881.127	5017131.322
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L104A	350863.747	5017122.592
L104A	350863.747	5017122.592
L104A	350861.157	5017125.481
L104A	350861.157	5017125.481
L104A	350842.599	5017124.843
L106A	350851.783	5017076.163
L106A	350827.732	5017054.437
L106A	350827.732	5017054.437
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L106A	350822.868	5017059.863
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L106A	350826.508	5017077.9
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L106A	350821.769	5017083.187
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L106A	350825.016	5017086.097
L106A	350825.077	5017087.227
L106A	350825.077	5017087.227
L106A	350822.14	5017090.503
L106A	350822.14	5017090.503
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L106A	350824.316	5017093.263
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L106A	350842.599	5017124.843
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L106A	350861.157	5017125.481
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L106A	350863.747	5017122.592
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UNC-1	350834.098	5017112.249
UNC-1	350824.316	5017093.263
UNC-1	350824.316	5017093.263
UNC-1	350822.14	5017090.503
UNC-1	350822.14	5017090.503
UNC-1	350825.077	5017087.227
UNC-1	350825.077	5017087.227
UNC-1	350825.016	5017086.097
UNC-1	350825.016	5017086.097
UNC-1	350821.769	5017083.187
UNC-1	350821.769	5017083.187
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UNC-1	350826.508	5017077.9
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UNC-1	350827.03	5017078.368
UNC-1	350828.159	5017078.306
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UNC-1	350831.096	5017075.03
UNC-1	350831.096	5017075.03
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UNC-1	350832.084	5017073.9
UNC-1	350834.934	5017070.681
UNC-1	350834.934	5017070.681
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UNC-1	350822.868	5017059.863
UNC-1	350827.732	5017054.437
UNC-1	350827.732	5017054.437
UNC-1	350821.891	5017043.352
UNC-1	350821.891	5017043.352
UNC-1	350818.148	5017036.004

UNC-1	350818.148	5017036.004
UNC-1	350815.075	5017039.432
UNC-1	350815.075	5017039.432
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UNC-1	350820.447	5017094.391
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UNC-1	350854.981	5017158.008

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UNC-1	350851.433	5017155.406
UNC-1	350850.315	5017155.578
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UNC-1	350850.032	5017155.963
UNC-1	350850.032	5017155.963
UNC-1	350844.872	5017152.178
UNC-1	350844.872	5017152.178
UNC-1	350847.989	5017147.928
UNC-1	350847.989	5017147.928
UNC-1	350847.817	5017146.81
UNC-1	350847.817	5017146.81
UNC-1	350844.269	5017144.208
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UNC-1	350847.217	5017140.188
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UNC-1	350842.599	5017124.843
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UNC-2	350856.653	5017197.072
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UNC-4	350911.441	5017122.373
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UNC-4	350884.57	5017103.995
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UNC-4	350886.794	5017106.123
UNC-4	350886.794	5017106.123
UNC-4	350886.904	5017107.645
UNC-4	350886.904	5017107.645

UNC-4	350890.004	5017109.919
UNC-4	350890.004	5017109.919
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UNC-5	350884.57	5017103.995
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UNC-5	350830.689	5017043.283
UNC-5	350830.463	5017043.061
UNC-5	350830.24	5017042.836
UNC-5	350830.022	5017042.606
UNC-5	350829.807	5017042.373
UNC-5	350829.597	5017042.136
UNC-5	350829.391	5017041.895
UNC-5	350829.189	5017041.651
UNC-5	350828.992	5017041.403
UNC-5	350828.799	5017041.151
UNC-5	350828.61	5017040.897
UNC-5	350828.426	5017040.639
UNC-5	350828.246	5017040.378
UNC-5	350828.072	5017040.113
UNC-5	350827.901	5017039.846
UNC-5	350827.736	5017039.576
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UNC-5	350827.122	5017038.467
UNC-5	350826.981	5017038.183
UNC-5	350826.845	5017037.897
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UNC-5	350826.467	5017037.025

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UNC-5            350825.769        5017034.921
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UNC-5            350825.617        5017034.306
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UNC-5            350825.488        5017033.685
UNC-5            350825.431        5017033.374
UNC-5            350825.38         5017033.061
UNC-5            350825.334        5017032.747
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UNC-5            350825.259        5017032.118
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UNC-5            350825.207        5017031.486
UNC-5            350825.189        5017031.17
UNC-5            350825.177        5017030.853
UNC-5            350825.17         5017030.537
UNC-5            350825.169        5017030.22
UNC-5            350825.173        5017029.903
UNC-5            350825.183        5017029.586
UNC-5            350825.199        5017029.27
UNC-5            350825.22         5017028.953
UNC-5            350825.247        5017028.638
UNC-5            350825.279        5017028.322
UNC-5            350825.317        5017028.008
UNC-5            350825.317        5017028.008
UNC-5            350825.317        5017028.008
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UNC-5            350818.148        5017036.004
UNC-5            350821.891        5017043.352
UNC-5            350821.891        5017043.352
UNC-5            350827.732        5017054.437
UNC-5            350827.732        5017054.437
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UNC-5            350851.783        5017076.163
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UNC-5            350854.826        5017080.258
UNC-5            350855.608        5017079.386
UNC-5            350855.608        5017079.386
UNC-5            350879.739        5017101.023
UNC-5            350879.739        5017101.023
UNC-5            350880.564        5017100.102
UNC-5            350880.564        5017100.102
UNC-5            350882.649        5017102.091

[SYMBOLS]
;;Gage           X-Coord            Y-Coord
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```

C.3 SAMPLE PCSWMM OUTPUT FILE

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.014)

****
Element Count
****

Number of rain gages 1
Number of subcatchments ... 8
Number of nodes 15
Number of links 12
Number of pollutants 0
Number of land uses 0

****
Raingage Summary
****

Name	Data Source	Data Type	Recording Interval
RG1	Chicago_100yr_3hr_10m_Ottawa	INTENSITY	10 min.

****
Subcatchment Summary
****

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
L103A	0.06	50.00	85.71	2.5000	RG1	L103A-S
L104A	0.13	81.00	81.43	3.0000	RG1	L104A-S
L106A	0.21	115.00	78.57	2.0000	RG1	L106A-S
UNC-1	0.11	165.00	8.57	25.0000	RG1	OF-1
UNC-2	0.04	44.00	52.86	4.5000	RG1	OF-2
UNC-3	0.05	48.00	54.29	5.0000	RG1	OF-3
UNC-4	0.05	55.00	41.43	5.0000	RG1	OF-4
UNC-5	0.09	95.00	48.57	3.5000	RG1	OF-5

****
Node Summary
****

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
101	OUTFALL	95.10	0.38	0.0	
MAIZE	OUTFALL	97.90	0.00	0.0	
OF-1	OUTFALL	0.00	0.00	0.0	
OF-2	OUTFALL	0.00	0.00	0.0	
OF-3	OUTFALL	0.00	0.00	0.0	
OF-4	OUTFALL	0.00	0.00	0.0	
OF-5	OUTFALL	0.00	0.00	0.0	
101A	STORAGE	94.84	3.28	0.0	
102	STORAGE	94.92	3.19	0.0	
103	STORAGE	95.00	3.21	0.0	
104	STORAGE	95.26	2.99	0.0	
106	STORAGE	95.32	2.91	0.0	
L103A-S	STORAGE	96.50	1.90	0.0	
L104A-S	STORAGE	96.54	1.78	0.0	
L106A-S	STORAGE	96.55	1.78	0.0	

****
Link Summary
****

Name	From Node	To Node	Type	Length	%Slope	Roughness
101A-101	101A	101	CONDUIT	8.1	0.4938	0.0130
102-101A	102	101A	CONDUIT	13.6	0.5000	0.0130
103-102	103	102	CONDUIT	13.9	0.5036	0.0130
104-103	104	103	CONDUIT	38.7	0.4987	0.0130
106-103	106	103	CONDUIT	50.1	0.5110	0.0130
L103A-IC	L103A-S	103	ORIFICE			
L104A-IC1	L104A-S	104	ORIFICE			
L104A-IC2	L104A-S	104	ORIFICE			
L106A-IC	L106A-S	106	ORIFICE			

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W103A           L103A-S         MAIZE           WEIR
W104A           L104A-S         L103A-S         WEIR
W106A           L106A-S         L103A-S         WEIR


*********************
Cross Section Summary
*********************
                                        Full     Full     Hyd.     Max.   No. of     Full
Conduit         Shape                  Depth     Area     Rad.    Width  Barrels     Flow
---------------------------------------------------------------------------------------
101A-101        CIRCULAR                0.38     0.11     0.09     0.38        1   123.22
102-101A        CIRCULAR                0.38     0.11     0.09     0.38        1   123.99
103-102         CIRCULAR                0.38     0.11     0.09     0.38        1   124.43
104-103         CIRCULAR                0.30     0.07     0.07     0.30        1    68.29
106-103         CIRCULAR                0.30     0.07     0.07     0.30        1    69.13


****************
Transect Summary
****************

Transect Access
Area:
           0.0006     0.0023     0.0052     0.0093     0.0145
           0.0209     0.0284     0.0371     0.0470     0.0580
           0.0702     0.0835     0.0980     0.1137     0.1305
           0.1485     0.1676     0.1879     0.2086     0.2294
           0.2501     0.2708     0.2915     0.3122     0.3329
           0.3537     0.3744     0.3956     0.4176     0.4403
           0.4637     0.4878     0.5127     0.5383     0.5646
           0.5916     0.6194     0.6478     0.6763     0.7047
           0.7332     0.7617     0.7902     0.8187     0.8472
           0.8763     0.9062     0.9367     0.9680     1.0000
Hrad:
           0.0168     0.0336     0.0504     0.0672     0.0840
           0.1009     0.1177     0.1345     0.1513     0.1681
           0.1849     0.2017     0.2185     0.2353     0.2521
           0.2690     0.2858     0.3049     0.3381     0.3711
           0.4041     0.4370     0.4697     0.5024     0.5350
           0.5676     0.6000     0.6316     0.6616     0.6902
           0.7174     0.7433     0.7680     0.7916     0.8141
           0.8357     0.8563     0.8768     0.8981     0.9198
           0.9420     0.9644     0.9872     1.0102     1.0218
           1.0141     1.0082     1.0040     1.0013     1.0000
Width:
           0.0358     0.0717     0.1075     0.1434     0.1792
           0.2150     0.2509     0.2867     0.3226     0.3584
           0.3942     0.4301     0.4659     0.5018     0.5376
           0.5734     0.6093     0.6400     0.6400     0.6400
           0.6400     0.6400     0.6400     0.6400     0.6400
           0.6400     0.6448     0.6672     0.6896     0.7120
           0.7344     0.7568     0.7792     0.8016     0.8240
           0.8464     0.8688     0.8800     0.8800     0.8800
           0.8800     0.8800     0.8800     0.8800     0.8880
           0.9104     0.9328     0.9552     0.9776     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
Surcharge Method ......... EXTRAN
Starting Date ............ 02/22/2021 00:00:00
Ending Date .............. 02/22/2021 08:00:00
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 ........ 10.00 sec
Variable Time Step ....... YES
Maximum Trials ........... 8
Number of Threads ........ 1
Head Tolerance ........... 0.001500 m


**************************        Volume         Depth
Runoff Quantity Continuity     hectare-m            mm
**************************     ---------       -------
Initial LID Storage ......         0.001         0.950
Total Precipitation ......         0.053        71.663
Evaporation Loss .........         0.000         0.000
Infiltration Loss ........         0.010        13.848
Surface Runoff ...........         0.043        58.381
Final Storage ............         0.001         0.950
Continuity Error (%) .....        -0.780


**************************        Volume        Volume
Flow Routing Continuity        hectare-m      10^6 ltr
**************************     ---------     ---------
Dry Weather Inflow .......         0.000         0.000
Wet Weather Inflow .......         0.043         0.431
Groundwater Inflow .......         0.000         0.000
RDII Inflow ..............         0.000         0.000
External Inflow ..........         0.000         0.003
External Outflow .........         0.043         0.433
Flooding Loss ............         0.000         0.000
Evaporation Loss .........         0.000         0.000
Exfiltration Loss ........         0.000         0.000
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```
Initial Stored Volume ....         0.001         0.010
Final Stored Volume ......         0.001         0.010
Continuity Error (%) .....         0.147


***************************
Time-Step Critical Elements
***************************
Link 103-102 (54.68%)


********************************
Highest Flow Instability Indexes
********************************
Link 102-101A (22)
Link 101A-101 (21)
Link 103-102 (18)
Link 104-103 (11)
Link 106-103 (8)


*************************
Routing Time Step Summary
*************************
Minimum Time Step           :     0.50 sec
Average Time Step           :     6.55 sec
Maximum Time Step           :    10.00 sec
Percent in Steady State     :    -0.00
Average Iterations per Step :     3.31
Percent Not Converging      :     0.16


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

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Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Imperv Runoff mm	Perv Runoff mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff LPS	Runoff Coeff
L103A	71.66	0.00	0.00	4.93	61.50	5.47	66.97	0.04	31.09	0.935
L104A	71.66	0.00	0.00	6.43	58.44	7.14	65.58	0.09	63.62	0.915
L106A	71.66	0.00	0.00	7.45	56.41	8.24	64.66	0.13	101.48	0.902
UNC-1	71.66	0.00	0.00	32.68	6.14	39.75	39.75	0.04	48.67	0.555
UNC-2	71.66	0.00	0.00	16.35	37.91	18.15	56.05	0.02	20.89	0.782
UNC-3	71.66	0.00	0.00	15.84	38.93	17.59	56.52	0.03	22.28	0.789
UNC-4	71.66	0.00	0.00	20.31	29.70	22.55	52.25	0.02	21.68	0.729
UNC-5	71.66	0.00	0.00	17.88	34.83	19.79	54.62	0.05	44.54	0.762

****
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
101	OUTFALL	0.54	0.54	95.64	0 00:00	0.54
MAIZE	OUTFALL	0.00	0.00	97.90	0 00:00	0.00
OF-1	OUTFALL	0.00	0.00	0.00	0 00:00	0.00
OF-2	OUTFALL	0.00	0.00	0.00	0 00:00	0.00
OF-3	OUTFALL	0.00	0.00	0.00	0 00:00	0.00
OF-4	OUTFALL	0.00	0.00	0.00	0 00:00	0.00
OF-5	OUTFALL	0.00	0.00	0.00	0 00:00	0.00
101A	STORAGE	0.80	0.89	95.73	0 01:04	0.89
102	STORAGE	0.73	0.87	95.78	0 01:04	0.87
103	STORAGE	0.65	0.84	95.84	0 01:05	0.84
104	STORAGE	0.39	0.62	95.88	0 01:04	0.62
106	STORAGE	0.35	0.72	96.04	0 01:04	0.72
L103A-S	STORAGE	0.09	1.63	98.13	0 01:03	1.63
L104A-S	STORAGE	0.10	1.54	98.08	0 01:03	1.54
L106A-S	STORAGE	0.10	1.54	98.09	0 01:03	1.54

****
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
101	OUTFALL	0.00	106.88	0 01:05	0	0.267	0.000
MAIZE	OUTFALL	0.00	0.00	0 00:00	0	0	0.000 ltr
OF-1	OUTFALL	48.67	48.67	0 01:00	0.042	0.042	0.000
OF-2	OUTFALL	20.89	20.89	0 01:00	0.0246	0.0246	0.000
OF-3	OUTFALL	22.28	22.28	0 01:00	0.0264	0.0264	0.000
OF-4	OUTFALL	21.68	21.68	0 01:00	0.024	0.024	0.000
OF-5	OUTFALL	44.54	44.54	0 01:00	0.0513	0.0513	0.000
101A	STORAGE	0.00	107.08	0 01:04	0	0.269	-0.052
102	STORAGE	0.00	106.83	0 01:05	0	0.267	0.048
103	STORAGE	0.00	106.47	0 01:04	0	0.267	-0.026
104	STORAGE	0.00	33.59	0 01:03	0	0.0886	-0.028
106	STORAGE	0.00	55.62	0 01:03	0	0.136	-0.047
L103A-S	STORAGE	31.09	31.09	0 01:00	0.0425	0.0425	0.874
L104A-S	STORAGE	63.62	63.62	0 01:00	0.0855	0.0855	-0.315
L106A-S	STORAGE	101.48	101.48	0 01:00	0.135	0.135	0.512

****
Node Surcharge Summary
****

No nodes were surcharged.

****
Node Flooding Summary
****

No nodes were flooded.

****
Storage Volume Summary
****

Storage Unit	Average Volume 1000 m3	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 m3	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow LPS
101A	0.001	24	0	0	0.001	27	0 01:04	106.88
102	0.001	23	0	0	0.001	27	0 01:04	107.08
103	0.001	20	0	0	0.001	26	0 01:05	106.83
104	0.000	13	0	0	0.001	21	0 01:04	37.15
106	0.000	12	0	0	0.001	25	0 01:04	55.61
L103A-S	0.000	0	0	0	0.006	14	0 01:03	17.27
L104A-S	0.000	0	0	0	0.015	17	0 01:03	33.59
L106A-S	0.000	0	0	0	0.022	17	0 01:03	55.62

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow LPS	Max Flow LPS	Total Volume 10^6 ltr
101	100.00	10.30	106.88	0.267
MAIZE	0.00	0.00	0.00	0.000
OF-1	19.00	6.19	48.67	0.042
OF-2	59.61	1.50	20.89	0.025
OF-3	59.64	1.62	22.28	0.026
OF-4	59.59	1.41	21.68	0.024
OF-5	60.07	3.08	44.54	0.051
System	51.13	24.11	44.54	0.436

****
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
101A-101	CONDUIT	106.88	0 01:05	0.97	0.87	1.00
102-101A	CONDUIT	107.08	0 01:04	0.97	0.86	1.00
103-102	CONDUIT	106.83	0 01:05	0.97	0.86	1.00
104-103	CONDUIT	37.15	0 01:18	0.56	0.54	1.00
106-103	CONDUIT	55.61	0 01:04	0.79	0.80	1.00
L103A-IC	ORIFICE	17.27	0 01:03			1.00
L104A-IC1	ORIFICE	16.79	0 01:03			1.00
L104A-IC2	ORIFICE	16.79	0 01:03			1.00
L106A-IC	ORIFICE	55.62	0 01:03			1.00
W103A	WEIR	0.00	0 00:00			0.00
W104A	WEIR	0.00	0 00:00			0.00
W106A	WEIR	0.00	0 00:00			0.00

****
Flow Classification Summary
****

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 ----------								
101A-101	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
102-101A	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
103-102	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
104-103	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
106-103	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.34	0.00

****
Conduit Surcharge Summary
****

Conduit	Hours Full Both Ends	Hours Full Upstream	Hours Full Dnstream	Hours Above Full Normal Flow	Hours Capacity Limited
101A-101	8.00	8.00	8.00	0.01	0.43
102-101A	8.00	8.00	8.00	0.01	0.01
103-102	0.47	0.47	8.00	0.01	0.01
104-103	0.34	0.34	0.48	0.01	0.01
106-103	0.39	0.39	0.48	0.01	0.01

Analysis begun on: Tue Jul 20 11:41:18 2021
Analysis ended on: Tue Jul 20 11:41:18 2021
Total elapsed time: < 1 sec

C.4 KW SUBDIVISION ASSESSMENT PCSWMM INPUT FILE

```
[TITLE]
;;Project Title/Notes
Ultimate Kanata West Pond 5

[OPTIONS]
;;Option             Value
FLOW_UNITS           LPS
INFILTRATION         HORTON
FLOW_ROUTING         DYNWAVE
LINK_OFFSETS         ELEVATION
MIN_SLOPE            0
ALLOW_PONDING        YES
SKIP_STEADY_STATE    NO

START_DATE           07/23/2009
START_TIME           00:00:00
REPORT_START_DATE    07/23/2009
REPORT_START_TIME    00:00:00
END_DATE             07/25/2009
END_TIME             00:00:00
SWEEP_START          01/01
SWEEP_END            12/31
DRY_DAYS             0
REPORT_STEP          00:01:00
WET_STEP             00:01:00
DRY_STEP             01:00:00
ROUTING_STEP         5
RULE_STEP            00:00:00

INERTIAL_DAMPING     PARTIAL
NORMAL_FLOW_LIMITED  BOTH
FORCE_MAIN_EQUATION  D-W
VARIABLE_STEP        0
LENGTHENING_STEP     7
MIN_SURFAREA         0
MAX_TRIALS           8
HEAD_TOLERANCE       0.0015
SYS_FLOW_TOL         5
LAT_FLOW_TOL         5
```

```
MINIMUM_STEP         0.5
THREADS              4

[FILES]
;;Interfacing Files
USE HOTSTART "C:\2021\1608 - Block 29\SWM\Ana Subdivision
Design\160401393-BLK29_100CHI_2021-07-16_ULT_FIXED_files\100CHI_FIXED.HSF"

[EVAPORATION]
;;Data Source    Parameters
;;-------------- ----------------
CONSTANT         0.0
DRY_ONLY         NO

[RAINGAGES]
;;Name           Format    Interval SCF      Source
;;-------------- --------- -------- -------- ----------
RG1              INTENSITY 0:10     1.0      TIMESERIES Chicago100y_3h_10m_City

[SUBCATCHMENTS]
;;Name           Rain Gage        Outlet           Area     %Imperv  Width    %Slope   CurbLen  SnowPack

;;-------------- ---------------- ---------------- -------- -------- -------- -------- --------
----------------
;10yr
Arterial         RG1              Transitway-S     3.19     71.429   1314     1        0

;0.60
B-1              RG1              B1-S             1.098331 57.143   186      1        0

;0.70
B-2              RG1              B2-S             0.693403 71.429   186      1        0

;0.69
C107A            RG1              107A-S(1)        0.185359 70       52       1        0

;0.69
C109A            RG1              109A-S           0.43013  70       160      1        0
```

```
;0.71
C109B         RG1        109B-S          0.378527 72.857   138      1       0

;0.67
C110A         RG1        110A-S          0.118382 67.143   39       1       0

;0.68
C121A         RG1        121A-S(2)       0.384285 68.571   95       1       0

;0.65
C121AA        RG1        121AA-S         0.090818 64.286   37       1.5     0

;0.67
C123A         RG1        123A-S          0.199218 67.143   43.244   1       0

;0.67
C205A         RG1        205A-S(1)       0.263069 67.143   71.16    3       0

;0.70
C206B         RG1        206B-S(1)       0.170307 71.429   68       3       0

;0.68
C219A         RG1        219A-S(1)       0.089546 68.571   79.8     2       0

;0.73
C220A         RG1        220A-S          0.406575 75.714   131.8    2       0

;0.69
C222A         RG1        222A-S          0.520835 70       257      4       0

;0.71
C223A         RG1        223A-S          0.160134 72.857   59       3       0

;2yr
Comm          RG1        Comm-S          1.9912   92.857   448      1       0

;0.63
EXT1          RG1        EXT-1A-S(1)     0.124871 61.429   59       1.5     0

;0.67
EXT2          RG1        EXT2-S          0.072046 67.143   29       2       0

;0.60
EXT3          RG1        EXT3-S          0.098006 57.143   44       3       0

;0.58
EXT4          RG1        EXT4-S          0.521459 54.286   307      4       0

;0.37
EXT5          RG1        EXT5-S          0.114323 24.286   77       4       0

;0.48
EXT6          RG1        EXT6-S          0.115535 40       78.75    4       0

;0.55
F101A-1A      RG1        F101A-S         0.692256 50       155      1       0

;0.40
G234A         RG1        G234A-S         0.971602 28.571   218      1       0

;10yr
Hazeldean     RG1        HZD-S           3.95     71.429   1764     1       0

;0.61
L102A         RG1        102A-S(1)       0.227479 58.571   82.41    1       0

;0.70
L103A         RG1        103A-S          0.388512 71.429   161.8    1       0

;0.82
L103A-29      RG1        L103A-S-29      0.063366 85.71    50       2.5     0

;0.62
L103B         RG1        103B-S          0.203104 60       63.176   1       0

;0.48
L103C         RG1        RY103C-S        0.63865  40       300      1       0
```

```
;0.46
L103D           RG1             RY103D-S        0.552254 37.143   278     1        0

;0.68
L104A           RG1             104A-S          0.333862 68.571   122.73  1        0

;0.82
L104A-29        RG1             L104A-S-29      0.130132 81.43    81      3        0

;0.72
L105A           RG1             105A-S(1)       0.323559 74.286   153.18  1        0

;0.73
L106A           RG1             106A-S(1)       0.243756 75.714   97.272  1        0

;0.75
L106A-29        RG1             L106A-S-29      0.208333 78.57    115     2        0

;0.69
L106B           RG1             106B-S          0.073514 70       26.6    1        0

;0.67
L112A           RG1             112A-S(1)       0.413699 67.143   167.73  1        0

;0.69
L113A           RG1             113A-S(1)       0.328527 70       127     1        0

;0.42
L113B           RG1             RY113B-S        0.494662 31.429   280     1        0

;0.68
L114A           RG1             114A-S          0.057286 68.571   63.174  1        0

;0.68
L115A           RG1             115A-S          0.165096 68.571   58.04   1        0

;0.69
L116A           RG1             116A-S          0.222674 70       83.98   1        0
```

```
;0.71
L117A           RG1             117A-S          0.424565 72.857   173.74  1        0

;0.58
L117B           RG1             117B-S          0.145678 54.286   49.3    1        0

;0.46
L117C           RG1             RY117C-S        0.662633 37.143   360     1        0

;0.66
L118A           RG1             118A-S          0.443447 65.714   167.34  1        0

;0.69
L119A           RG1             119A-S          0.311731 70       89.76   1        0

;0.85
L121B           RG1             121B-S          1.467114 92.857   331     1        0

;0.66
L124A           RG1             124A-S          0.232046 65.714   116.1   1        0

;0.43
L124B           RG1             RY124B-S        0.398402 32.857   246     1        0

;0.73
L126A           RG1             126A-S          0.031736 75.714   30      1        0

;0.70
L126B           RG1             126B-S(1)       0.263339 71.429   85.365  1        0

;0.25
L126C           RG1             126C-S          0.463032 7.143    104     1        0

;0.66
L127A           RG1             127A-S(1)       0.382018 65.714   144.16  1        0

;0.66
L128A           RG1             128A-S(1)       0.318529 65.714   72.1    1        0
```

```
;0.69
L130A           RG1             130A-S          0.454243 70       170.7    1        0

;0.46
L130B           RG1             RY130B-S        0.225263 40       200      1        0

;0.59
L202A           RG1             202A-S(1)       0.208064 55.714   76.7     2        0

;0.55
L202B           RG1             RY202B-S        0.245154 50       152      3        0

;0.69
L204A           RG1             204A-S(1)       0.42131  75.714   174.69   3        0

;0.73
L204B           RG1             204BS(1)        0.388347 70       164      3        0

;0.45
L205B           RG1             RY205B-S        0.480989 35.714   236      3        0

;0.73
L206A           RG1             206A-S(1)       0.309319 75.714   127.2    3        0

;0.63
L207A           RG1             207A-S(1)       0.581227 64.286   202.33   3        0

;0.69
L209A           RG1             209A-S          0.350096 70       153.4    2        0

;0.67
L209B           RG1             209B-S          0.158384 67.143   159      2        0

;0.47
L209C           RG1             RY209C-S        0.406932 38.571   200      3        0

;0.67
L210A           RG1             210A-S          0.252067 67.143   80.1     3        0
```

```
;0.47
L210B           RG1             RY210B-S        0.260041 38.571   168      3        0

;0.72
L211A           RG1             211A-S(1)       0.399505 74.286   177.158  3        0

;0.69
L213A           RG1             213A-S          0.263167 70       93.25    2        0

;0.71
L214A           RG1             214A-S(1)       0.550699 72.857   221      4        0

;0.68
L217A           RG1             217A-S          0.401215 68.571   196      3        0

;0.70
L218A           RG1             L218A-S         2.679261 71.429   664      1        0

;0.45
L218B           RG1             RY218B-S        0.250341 35.714   166      3        0

;0.68
L219B           RG1             219B-S          0.361686 68.571   111.73   2        0

;0.44
L220A           RG1             RY220A-S        0.86664  34.286   480      2.5      0

;0.68
L225A           RG1             225A-S          0.273345 71.429   134.612  2.5      0

;0.80
L225B           RG1             L225B-S         2.597954 85.714   619      2        0

;0.70
L226A           RG1             226A-S          0.30306  71.429   85.611   2.5      0

;0.70
L228A           RG1             228A-S          0.35329  71.429   96       2.5      0
```

```
;0.70
L229A            RG1              229A-S           0.205096 71.429   66       3        0

;0.69
L234A            RG1              234A-S           0.327327 70       82.6     4        0

;0.69
L234B            RG1              234B-S           0.227552 70       81.14    4        0

;0.66
L237A            RG1              237A-S           0.2659   65.714   121.94   4        0

;0.57
L238A            RG1              RY238A-S         0.652991 52.857   376      2.5      0

;0.72
L240A            RG1              240A-S           0.239826 74.286   109.7    4        0

;0.71
L240B            RG1              240B-S           0.363173 72.857   153.56   4        0

;0.69
L241A            RG1              241A-S           0.308749 70       190      4        0

POND             RG1              POND-S1          2.558117 60       576      1        0

;0.70
UNC-1            RG1              219B-S           0.061933 71.429   120      4        0

;0.27
UNC-1-29         RG1              OF-1-29          0.105515 8.57     165      25       0

;0.70
UNC-2            RG1              RY218B-S         0.065616 71.429   120      4        0

UNC-2-29         RG1              121AA-S          0.043759 52.86    44       4.5      0

;0.70
UNC-3            RG1              CREEK            0.071548 71.429   120      4        0
```

```
UNC-3-29         RG1              121AA-S          0.046584 54.29    48       5        0

;0.70
UNC-4            RG1              222A-S           0.070173 71.429   120      4        0

UNC-4-29         RG1              123A-S           0.045854 41.43    55       5        0

;0.80
UNC-5            RG1              229A-S           0.303387 85.714   188      3        0

UNC-5-29         RG1              124A-S           0.093838 48.57    95       3.5      0

;0.80
UNC-6            RG1              226A-S           0.155451 85.714   160      3        0

;0.80
UNC-7            RG1              CREEK-1          0.157236 85.714   160      3        0

;0.80
UNC-8            RG1              Transitway-S     0.096717 85.714   200      3        0

[SUBAREAS]
;;Subcatchment   N-Imperv   N-Perv     S-Imperv   S-Perv     PctZero    RouteTo    PctRouted
;;-------------- ---------- ---------- ---------- ---------- ---------- ---------- ----------
Arterial         0.013      0.25       1.57       4.67       0          OUTLET
B-1              0.013      0.25       1.57       4.67       0          PERVIOUS   30
B-2              0.013      0.25       1.57       4.67       0          OUTLET
C107A            0.013      0.25       1.57       4.67       0          OUTLET
C109A            0.013      0.25       1.57       4.67       0          OUTLET
C109B            0.013      0.25       1.57       4.67       0          OUTLET
C110A            0.013      0.25       1.57       4.67       0          OUTLET
C121A            0.013      0.25       1.57       4.67       0          OUTLET
C121AA           0.013      0.25       1.57       4.67       0          OUTLET
C123A            0.013      0.25       1.57       4.67       0          OUTLET
C205A            0.013      0.25       1.57       4.67       0          OUTLET
C206B            0.013      0.25       1.57       4.67       0          OUTLET
C219A            0.013      0.25       1.57       4.67       0          OUTLET
```

C220A	0.013	0.25	1.57	4.67	0	OUTLET	
C222A	0.013	0.25	1.57	4.67	0	OUTLET	
C223A	0.013	0.25	1.57	4.67	0	OUTLET	
Comm	0.013	0.25	1.57	4.67	0	OUTLET	
EXT1	0.013	0.25	1.57	4.67	0	OUTLET	
EXT2	0.013	0.25	1.57	4.67	0	OUTLET	
EXT3	0.013	0.25	1.57	4.67	0	OUTLET	
EXT4	0.013	0.25	1.57	4.67	0	PERVIOUS	100
EXT5	0.013	0.25	1.57	4.67	0	PERVIOUS	100
EXT6	0.013	0.25	1.57	4.67	0	PERVIOUS	100
F101A-1A	0.013	0.25	1.57	4.67	0	PERVIOUS	100
G234A	0.013	0.25	1.57	4.67	0	PERVIOUS	100
Hazeldean	0.013	0.25	1.57	4.67	0	OUTLET	
L102A	0.013	0.25	1.57	4.67	0	OUTLET	
L103A	0.013	0.25	1.57	4.67	0	OUTLET	
L103A-29	0.013	0.25	1.57	4.67	0	OUTLET	
L103B	0.013	0.25	1.57	4.67	0	OUTLET	
L103C	0.013	0.25	1.57	4.67	0	PERVIOUS	100
L103D	0.013	0.25	1.57	4.67	0	PERVIOUS	100
L104A	0.013	0.25	1.57	4.67	0	OUTLET	
L104A-29	0.013	0.25	1.57	4.67	0	OUTLET	
L105A	0.013	0.25	1.57	4.67	0	OUTLET	
L106A	0.013	0.25	1.57	4.67	0	OUTLET	
L106A-29	0.013	0.25	1.57	4.67	0	OUTLET	
L106B	0.013	0.25	1.57	4.67	0	OUTLET	
L112A	0.013	0.25	1.57	4.67	0	OUTLET	
L113A	0.013	0.25	1.57	4.67	0	OUTLET	
L113B	0.013	0.25	1.57	4.67	0	PERVIOUS	100
L114A	0.013	0.25	1.57	4.67	0	OUTLET	
L115A	0.013	0.25	1.57	4.67	0	OUTLET	
L116A	0.013	0.25	1.57	4.67	0	OUTLET	
L117A	0.013	0.25	1.57	4.67	0	OUTLET	
L117B	0.013	0.25	1.57	4.67	0	OUTLET	
L117C	0.013	0.25	1.57	4.67	0	PERVIOUS	100
L118A	0.013	0.25	1.57	4.67	0	OUTLET	
L119A	0.013	0.25	1.57	4.67	0	OUTLET	
L121B	0.013	0.25	1.57	4.67	0	OUTLET	
L124A	0.013	0.25	1.57	4.67	0	OUTLET	
L124B	0.013	0.25	1.57	4.67	0	PERVIOUS	100

L126A	0.013	0.25	1.57	4.67	0	OUTLET	
L126B	0.013	0.25	1.57	4.67	0	OUTLET	
L126C	0.013	0.25	1.57	4.67	0	PERVIOUS	100
L127A	0.013	0.25	1.57	4.67	0	OUTLET	
L128A	0.013	0.25	1.57	4.67	0	OUTLET	
L130A	0.013	0.25	1.57	4.67	0	OUTLET	
L130B	0.013	0.25	1.57	4.67	0	PERVIOUS	100
L202A	0.013	0.25	1.57	4.67	0	OUTLET	
L202B	0.013	0.25	1.57	4.67	0	PERVIOUS	100
L204A	0.013	0.25	1.57	4.67	0	OUTLET	
L204B	0.013	0.25	1.57	4.67	0	OUTLET	
L205B	0.013	0.25	1.57	4.67	0	PERVIOUS	100
L206A	0.013	0.25	1.57	4.67	0	OUTLET	
L207A	0.013	0.25	1.57	4.67	0	OUTLET	
L209A	0.013	0.25	1.57	4.67	0	OUTLET	
L209B	0.013	0.25	1.57	4.67	0	OUTLET	
L209C	0.013	0.25	1.57	4.67	0	PERVIOUS	100
L210A	0.013	0.25	1.57	4.67	0	OUTLET	
L210B	0.013	0.25	1.57	4.67	0	PERVIOUS	100
L211A	0.013	0.25	1.57	4.67	0	OUTLET	
L213A	0.013	0.25	1.57	4.67	0	OUTLET	
L214A	0.013	0.25	1.57	4.67	0	OUTLET	
L217A	0.013	0.25	1.57	4.67	0	OUTLET	
L218A	0.013	0.25	1.57	4.67	0	PERVIOUS	30
L218B	0.013	0.25	1.57	4.67	0	PERVIOUS	100
L219B	0.013	0.25	1.57	4.67	0	OUTLET	
L220A	0.013	0.25	1.57	4.67	0	PERVIOUS	100
L225A	0.013	0.25	1.57	4.67	0	OUTLET	
L225B	0.013	0.25	1.57	4.67	0	PERVIOUS	30
L226A	0.013	0.25	1.57	4.67	0	OUTLET	
L228A	0.013	0.25	1.57	4.67	0	OUTLET	
L229A	0.013	0.25	1.57	4.67	0	OUTLET	
L234A	0.013	0.25	1.57	4.67	0	OUTLET	
L234B	0.013	0.25	1.57	4.67	0	OUTLET	
L237A	0.013	0.25	1.57	4.67	0	OUTLET	
L238A	0.013	0.25	1.57	4.67	0	PERVIOUS	100
L240A	0.013	0.25	1.57	4.67	0	OUTLET	
L240B	0.013	0.25	1.57	4.67	0	OUTLET	
L241A	0.013	0.25	1.57	4.67	0	OUTLET	

```
POND             0.013      0.25       1.57       4.67       0          PERVIOUS   60
UNC-1            0.013      0.25       1.57       4.67       0          OUTLET
UNC-1-29         0.013      0.25       1.57       4.67       0          PERVIOUS   100
UNC-2            0.013      0.25       1.57       4.67       0          OUTLET
UNC-2-29         0.013      0.25       1.57       4.67       0          OUTLET
UNC-3            0.013      0.25       1.57       4.67       0          OUTLET
UNC-3-29         0.013      0.25       1.57       4.67       0          OUTLET
UNC-4            0.013      0.25       1.57       4.67       0          OUTLET
UNC-4-29         0.013      0.25       1.57       4.67       0          OUTLET
UNC-5            0.013      0.25       1.57       4.67       0          OUTLET
UNC-5-29         0.013      0.25       1.57       4.67       0          OUTLET
UNC-6            0.013      0.25       1.57       4.67       0          OUTLET
UNC-7            0.013      0.25       1.57       4.67       0          OUTLET
UNC-8            0.013      0.25       1.57       4.67       0          OUTLET

[INFILTRATION]
;;Subcatchment   MaxRate    MinRate    Decay      DryTime    MaxInfil
;;-------------- ---------- ---------- ---------- ---------- ----------
Arterial         76.2       13.2       4.14       7          0
B-1              76.2       13.2       4.14       7          0
B-2              76.2       13.2       4.14       7          0
C107A            76.2       13.2       4.14       7          0
C109A            76.2       13.2       4.14       7          0
C109B            76.2       13.2       4.14       7          0
C110A            76.2       13.2       4.14       7          0
C121A            76.2       13.2       4.14       7          0
C121AA           76.2       13.2       4.14       7          0
C123A            76.2       13.2       4.14       7          0
C205A            76.2       13.2       4.14       7          0
C206B            76.2       13.2       4.14       7          0
C219A            76.2       13.2       4.14       7          0
C220A            76.2       13.2       4.14       7          0
C222A            76.2       13.2       4.14       7          0
C223A            76.2       13.2       4.14       7          0
Comm             76.2       13.2       4.14       7          0
EXT1             76.2       13.2       4.14       7          0
EXT2             76.2       13.2       4.14       7          0
EXT3             76.2       13.2       4.14       7          0
EXT4             76.2       13.2       4.14       7          0
```

```
EXT5             76.2       13.2       4.14       7          0
EXT6             76.2       13.2       4.14       7          0
F101A-1A         76.2       13.2       4.14       7          0
G234A            76.2       13.2       4.14       7          0
Hazeldean        76.2       13.2       4.14       7          0
L102A            76.2       13.2       4.14       7          0
L103A            76.2       13.2       4.14       7          0
L103A-29         76.2       13.2       4.14       7          0
L103B            76.2       13.2       4.14       7          0
L103C            76.2       13.2       4.14       7          0
L103D            76.2       13.2       4.14       7          0
L104A            76.2       13.2       4.14       7          0
L104A-29         76.2       13.2       4.14       7          0
L105A            76.2       13.2       4.14       7          0
L106A            76.2       13.2       4.14       7          0
L106A-29         76.2       13.2       4.14       7          0
L106B            76.2       13.2       4.14       7          0
L112A            76.2       13.2       4.14       7          0
L113A            76.2       13.2       4.14       7          0
L113B            76.2       13.2       4.14       7          0
L114A            76.2       13.2       4.14       7          0
L115A            76.2       13.2       4.14       7          0
L116A            76.2       13.2       4.14       7          0
L117A            76.2       13.2       4.14       7          0
L117B            76.2       13.2       4.14       7          0
L117C            76.2       13.2       4.14       7          0
L118A            76.2       13.2       4.14       7          0
L119A            76.2       13.2       4.14       7          0
L121B            76.2       13.2       4.14       7          0
L124A            76.2       13.2       4.14       7          0
L124B            76.2       13.2       4.14       7          0
L126A            76.2       13.2       4.14       7          0
L126B            76.2       13.2       4.14       7          0
L126C            76.2       13.2       4.14       7          0
L127A            76.2       13.2       4.14       7          0
L128A            76.2       13.2       4.14       7          0
L130A            76.2       13.2       4.14       7          0
L130B            76.2       13.2       4.14       7          0
L202A            76.2       13.2       4.14       7          0
```

```
L202B            76.2       13.2       4.14       7          0
L204A            76.2       13.2       4.14       7          0
L204B            76.2       13.2       4.14       7          0
L205B            76.2       13.2       4.14       7          0
L206A            76.2       13.2       4.14       7          0
L207A            76.2       13.2       4.14       7          0
L209A            76.2       13.2       4.14       7          0
L209B            76.2       13.2       4.14       7          0
L209C            76.2       13.2       4.14       7          0
L210A            76.2       13.2       4.14       7          0
L210B            76.2       13.2       4.14       7          0
L211A            76.2       13.2       4.14       7          0
L213A            76.2       13.2       4.14       7          0
L214A            76.2       13.2       4.14       7          0
L217A            76.2       13.2       4.14       7          0
L218A            76.2       13.2       4.14       7          0
L218B            76.2       13.2       4.14       7          0
L219B            76.2       13.2       4.14       7          0
L220A            76.2       13.2       4.14       7          0
L225A            76.2       13.2       4.14       7          0
L225B            76.2       13.2       4.14       7          0
L226A            76.2       13.2       4.14       7          0
L228A            76.2       13.2       4.14       7          0
L229A            76.2       13.2       4.14       7          0
L234A            76.2       13.2       4.14       7          0
L234B            76.2       13.2       4.14       7          0
L237A            76.2       13.2       4.14       7          0
L238A            76.2       13.2       4.14       7          0
L240A            76.2       13.2       4.14       7          0
L240B            76.2       13.2       4.14       7          0
L241A            76.2       13.2       4.14       7          0
POND             76.2       13.2       4.14       7          0
UNC-1            76.2       13.2       4.14       7          0
UNC-1-29         76.2       13.2       4.14       7          0
UNC-2            76.2       13.2       4.14       7          0
UNC-2-29         76.2       13.2       4.14       7          0
UNC-3            76.2       13.2       4.14       7          0
UNC-3-29         76.2       13.2       4.14       7          0
UNC-4            76.2       13.2       4.14       7          0
```

```
UNC-4-29         76.2       13.2       4.14       7          0
UNC-5            76.2       13.2       4.14       7          0
UNC-5-29         76.2       13.2       4.14       7          0
UNC-6            76.2       13.2       4.14       7          0
UNC-7            76.2       13.2       4.14       7          0
UNC-8            76.2       13.2       4.14       7          0

[JUNCTIONS]
;;Name           Elevation  MaxDepth   InitDepth  SurDepth   Aponded
;;-------------- ---------- ---------- ---------- ---------- ----------
J6               94.56      0.54       0          0          0
J9               92.75      2.42       0          0          0

[OUTFALLS]
;;Name           Elevation  Type       Stage Data       Gated    Route To
;;-------------- ---------- ---------- ---------------- -------- ----------------
CREEK            0          FREE                        NO
CREEK-1          0          FREE                        NO
OF10             95         FREE                        NO
OF11             100        FREE                        NO
OF-1-29          0          FREE                        NO
OF13             97.7       FREE                        NO
OF14             97.7       FREE                        NO
OF2              93.01      FIXED      94.6             NO
OF3              95.9       FREE                        NO
OF4              96.91      FREE                        NO
OF5              98.35      FREE                        NO
OF6              97         FREE                        NO
OF7              99         FREE                        NO
OF8              92.6       FIXED      94.6             NO
OF9              95         FREE                        NO

[STORAGE]
;;Name           Elev.    MaxDepth   InitDepth  Shape      Curve Name/Params            N/A      Fevap
Psi      Ksat     IMD
;;-------------- -------- ---------- ----------- ---------- ---------------------------- -------- --------
       -------- --------
100A             91.49    4.8        0          FUNCTIONAL 0         0         1.13     0        0
100B             91.5     5.24       0          FUNCTIONAL 0         0         1.13     0        0
```

100C	92.9	3.72	0	FUNCTIONAL	0	0	1.13	0	0
100D	92.84	4.43	0	FUNCTIONAL	0	0	1.13	0	0
100E	93.5	3.62	0	FUNCTIONAL	0	0	1.13	0	0
101	92.982	4.416	0	FUNCTIONAL	0	0	1.13	0	0
101A-29	94.84	3.283	0	FUNCTIONAL	0	0	1.13	0	0
102	93.123	4.028	0	FUNCTIONAL	0	0	1.13	0	0
102-29	94.918	3.185	0	FUNCTIONAL	0	0	1.13	0	0
102A	93.582	3.51	0	FUNCTIONAL	0	0	0	0	0
102A-S	97.35	0.35	0	FUNCTIONAL	0	0	0	0	0
102A-S(1)	95.76	1.73	0	FUNCTIONAL	0	0	0	0	0
102A-S(2)	97.42	0.35	0	FUNCTIONAL	0	0	0	0	0
103	93.68	3.897	0	FUNCTIONAL	0	0	1.13	0	0
103-29	95	3.212	0	FUNCTIONAL	0	0	1.13	0	0
103A-S	95.88	1.73	0	FUNCTIONAL	0	0	0	0	0
103A-S(1)	97.45	0.35	0	FUNCTIONAL	0	0	0	0	0
103B-S	95.64	1.73	0	FUNCTIONAL	0	0	0	0	0
104	94.054	3.823	0	FUNCTIONAL	0	0	1.13	0	0
104-29	95.261	2.987	0	FUNCTIONAL	0	0	1.13	0	0
104A-S	96.08	1.73	0	FUNCTIONAL	0	0	0	0	0
104A-S(1)	97.65	0.35	0	FUNCTIONAL	0	0	0	0	0
105	94.513	3.442	0	FUNCTIONAL	0	0	1.13	0	0
105A-S	97.79	0.35	0	FUNCTIONAL	0	0	0	0	0
105A-S(1)	96.11	1.73	0	FUNCTIONAL	0	0	0	0	0
106	94.715	2.876	0	FUNCTIONAL	0	0	1.13	0	0
106-29	95.324	2.91	0	FUNCTIONAL	0	0	1.13	0	0
106A-S	97.88	0.35	0	FUNCTIONAL	0	0	0	0	0
106A-S(1)	96.27	1.73	0	FUNCTIONAL	0	0	0	0	0
106A-S(2)	97.71	0.35	0	FUNCTIONAL	0	0	0	0	0
106B-S	95.14	2.73	0	FUNCTIONAL	0	0	0	0	0
107	94.308	3.618	0	FUNCTIONAL	0	0	1.13	0	0
107A-S	97.8	0.35	0	FUNCTIONAL	0	0	0	0	0
107A-S(1)	96.21	1.73	0	FUNCTIONAL	0	0	0	0	0
108	94.468	3.313	0	FUNCTIONAL	0	0	1.13	0	0
109	94.952	2.837	0	FUNCTIONAL	0	0	1.13	0	0
109A-S	96.2	1.73	0	FUNCTIONAL	0	0	0	0	0
109A-S(1)	97.79	0.35	0	FUNCTIONAL	0	0	0	0	0
109B-S	96.21	1.73	0	FUNCTIONAL	0	0	0	0	0
109B-S(1)	97.87	0.35	0	FUNCTIONAL	0	0	0	0	0
109B-S(3)	98.01	0.35	0	FUNCTIONAL	0	0	0	0	0
110	94.688	3.347	0	FUNCTIONAL	0	0	1.13	0	0
110A-S	96.37	1.73	0	FUNCTIONAL	0	0	0	0	0
111	94.762	3.23	0	FUNCTIONAL	0	0	1.13	0	0
112	94.958	2.989	0	FUNCTIONAL	0	0	1.13	0	0
112A-S	98.09	0.35	0	FUNCTIONAL	0	0	0	0	0
112A-S(1)	96.4	1.73	0	FUNCTIONAL	0	0	0	0	0
113	95.302	2.756	0	FUNCTIONAL	0	0	1.13	0	0
113A-S	98.17	0.35	0	FUNCTIONAL	0	0	0	0	0
113A-S(1)	96.47	1.73	0	FUNCTIONAL	0	0	0	0	0
114	93.924	3.48	0	FUNCTIONAL	0	0	1.13	0	0
114A-S	95.69	1.93	0	FUNCTIONAL	0	0	0	0	0
115	94.118	3.367	0	FUNCTIONAL	0	0	1.13	0	0
115A	94.192	3.046	0	FUNCTIONAL	0	0	0	0	0
115A-S	95.79	1.73	0	FUNCTIONAL	0	0	0	0	0
115A-S(1)	97.33	0.35	0	FUNCTIONAL	0	0	0	0	0
116	94.798	2.634	0	FUNCTIONAL	0	0	1.13	0	0
116A-S	95.82	1.73	0	FUNCTIONAL	0	0	0	0	0
116A-S(1)	97.41	0.35	0	FUNCTIONAL	0	0	0	0	0
117	94.41	3.052	0	FUNCTIONAL	0	0	1.13	0	0
117A-S	95.88	1.73	0	FUNCTIONAL	0	0	0	0	0
117A-S(1)	97.52	0.35	0	FUNCTIONAL	0	0	0	0	0
117B-S	95.81	1.73	0	FUNCTIONAL	0	0	0	0	0
118	94.952	2.674	0	FUNCTIONAL	0	0	1.13	0	0
118A-S	96	1.73	0	FUNCTIONAL	0	0	0	0	0
118A-S(1)	97.57	0.35	0	FUNCTIONAL	0	0	0	0	0
119	93.5	4.078	0	FUNCTIONAL	0	0	1.13	0	0
119A-S	95.84	1.73	0	FUNCTIONAL	0	0	0	0	0
120A-S(1)	97.62	0.35	0	FUNCTIONAL	0	0	0	0	0
121	94.283	3.551	0	FUNCTIONAL	0	0	1.13	0	0
121A	95.02	2.687	0	FUNCTIONAL	0	0	1.13	0	0
121AA-S	95.93	1.73	0	FUNCTIONAL	0	0	0	0	0
121A-S	97.72	0.35	0	FUNCTIONAL	0	0	0	0	0
121A-S(1)	98.05	0.35	0	FUNCTIONAL	0	0	0	0	0
121A-S(2)	95.98	1.73	0	FUNCTIONAL	0	0	0	0	0
121B-S	95.85	2.5	0	TABULAR	120AA-S			0	0
123	94.712	3.472	0	FUNCTIONAL	0	0	1.13	0	0
123A-S	96.31	1.73	0	FUNCTIONAL	0	0	0	0	0
124	95.572	3.009	0	FUNCTIONAL	0	0	1.13	0	0
124A-S	96.55	1.73	0	FUNCTIONAL	0	0	0	0	0

124A-S(1)	98.1	0.35	0	FUNCTIONAL	0	0	0	0	0
125	95.696	2.929	0	FUNCTIONAL	0	0	1.13	0	0
126	96.096	2.971	0	FUNCTIONAL	0	0	1.13	0	0
126A-S	97.53	1.73	0	FUNCTIONAL	0	0	0	0	0
126B-S	99.05	0.35	0	FUNCTIONAL	0	0	0	0	0
126B-S(1)	96.99	1.73	0	FUNCTIONAL	0	0	0	0	0
126B-S(2)	98.57	0.35	0	FUNCTIONAL	0	0	0	0	0
126C-S	96.49	3.13	0	FUNCTIONAL	0	0	0	0	0
127	97.429	2.75	0	FUNCTIONAL	0	0	1.13	0	0
127A-S	100.62	0.35	0	FUNCTIONAL	0	0	0	0	0
127A-S(1)	97.77	1.73	0	FUNCTIONAL	0	0	0	0	0
128	96.445	2.727	0	FUNCTIONAL	0	0	1.13	0	0
128A-S(1)	97.49	1.73	0	FUNCTIONAL	0	0	0	0	0
129	96.536	2.837	0	FUNCTIONAL	0	0	1.13	0	0
130	97.136	3.559	0	FUNCTIONAL	0	0	1.13	0	0
130A-S	97.94	1.73	0	FUNCTIONAL	0	0	0	0	0
130A-S(1)	99.39	0.35	0	FUNCTIONAL	0	0	0	0	0
131	97.308	3.238	0	FUNCTIONAL	0	0	1.13	0	0
132	97.561	2.636	0	FUNCTIONAL	0	0	1.13	0	0
201	91.46	6.067	0	FUNCTIONAL	0	0	1.13	0	0
202	91.578	6.019	0	FUNCTIONAL	0	0	1.13	0	0
202A-S	97.56	0.35	0	FUNCTIONAL	0	0	0	0	0
202A-S(1)	95.89	1.73	0	FUNCTIONAL	0	0	0	0	0
203A-S	97.61	0.35	0	FUNCTIONAL	0	0	0	0	0
204	92.462	5.127	0	FUNCTIONAL	0	0	1.13	0	0
204A-S	97.66	0.35	0	FUNCTIONAL	0	0	0	0	0
204A-S(1)	96.01	1.73	0	FUNCTIONAL	0	0	0	0	0
204BS(1)	95.97	1.73	0	FUNCTIONAL	0	0	0	0	0
205	92.775	5.089	0	FUNCTIONAL	0	0	1.13	0	0
205A-S	97.51	0.35	0	FUNCTIONAL	0	0	0	0	0
205A-S(1)	96.07	1.73	0	FUNCTIONAL	0	0	0	0	0
206	92.944	5.687	0	FUNCTIONAL	0	0	1.13	0	0
206A-S	98.88	0.35	0	FUNCTIONAL	0	0	0	0	0
206A-S(1)	96.91	1.73	0	FUNCTIONAL	0	0	0	0	0
206B-S	98.42	0.35	0	FUNCTIONAL	0	0	0	0	0
206B-S(1)	96.39	1.73	0	FUNCTIONAL	0	0	0	0	0
206B-Sl	97.95	0.35	0	FUNCTIONAL	0	0	0	0	0
207	94.242	5.091	0	FUNCTIONAL	0	0	1.13	0	0
207A-S(1)	97.3	1.73	0	FUNCTIONAL	0	0	0	0	0

209	94.7	5.408	0	FUNCTIONAL	0	0	1.13	0	0
209A-S	98.21	1.73	0	FUNCTIONAL	0	0	0	0	0
209B-S	98.65	1.73	0	FUNCTIONAL	0	0	0	0	0
209B-S(1)	100.5	0.35	0	FUNCTIONAL	0	0	0	0	0
210	91.911	6.134	0	FUNCTIONAL	0	0	1.13	0	0
210A-S	95.99	1.73	0	FUNCTIONAL	0	0	0	0	0
211	92.241	5.892	0	FUNCTIONAL	0	0	1.13	0	0
211A-S	98.01	0.35	0	FUNCTIONAL	0	0	0	0	0
211A-S(1)	96.37	1.73	0	FUNCTIONAL	0	0	0	0	0
211A-S(2)	98.21	0.35	0	FUNCTIONAL	0	0	0	0	0
212	92.392	4.608	0	FUNCTIONAL	0	0	1.13	0	0
213	93.461	4.649	0	FUNCTIONAL	0	0	1.13	0	0
213A-S	96.44	1.73	0	FUNCTIONAL	0	0	0	0	0
214	94.435	3.604	0	FUNCTIONAL	0	0	1.13	0	0
214A-S	98.02	0.35	0	FUNCTIONAL	0	0	0	0	0
214A-S(1)	96.3	1.73	0	FUNCTIONAL	0	0	0	0	0
214A-S(2)	98.26	0.35	0	FUNCTIONAL	0	0	0	0	0
215	95.023	3.147	0	FUNCTIONAL	0	0	1.13	0	0
216	95.112	2.961	0	FUNCTIONAL	0	0	1.13	0	0
217	95.298	2.597	0	FUNCTIONAL	0	0	1.13	0	0
217A-S	96.43	1.73	0	FUNCTIONAL	0	0	0	0	0
217A-S(1)	98.11	0.35	0	FUNCTIONAL	0	0	0	0	0
217A-S(2)	98.11	0.35	0	FUNCTIONAL	0	0	0	0	0
218	93.672	4.415	0	FUNCTIONAL	0	0	1.13	0	0
219	93.897	4.051	0	FUNCTIONAL	0	0	1.13	0	0
219A-S	98.07	0.35	0	FUNCTIONAL	0	0	0	0	0
219A-S(1)	96.44	1.73	0	FUNCTIONAL	0	0	0	0	0
219A-S(2)	98.22	0.35	0	FUNCTIONAL	0	0	0	0	0
219B-S	96.6	1.9	0	FUNCTIONAL	0	0	0	0	0
219B-S(1)	98.32	0.35	0	FUNCTIONAL	0	0	0	0	0
220	95.076	2.872	0	FUNCTIONAL	0	0	1.13	0	0
220A-S	96.36	1.73	0	FUNCTIONAL	0	0	0	0	0
220A-S(1)	97.87	0.35	0	FUNCTIONAL	0	0	0	0	0
221	94.48	3.483	0	FUNCTIONAL	0	0	1.13	0	0
222	94.955	3.408	0	FUNCTIONAL	0	0	1.13	0	0
222A-S	96.44	1.81	0	FUNCTIONAL	0	0	0	0	0
222A-S(1)	98.22	0.35	0	FUNCTIONAL	0	0	0	0	0
222A-S(2)	98.82	0.35	0	FUNCTIONAL	0	0	0	0	0
223	95.278	3.904	0	FUNCTIONAL	0	0	1.13	0	0

223A-S	96.79	1.73	0	FUNCTIONAL	0	0	0	0	0
224	95.35	3.795	0	FUNCTIONAL	0	0	1.13	0	0
225	95.583	4.042	0	FUNCTIONAL	0	0	1.13	0	0
225A-S	97.65	1.73	0	FUNCTIONAL	0	0	0	0	0
225A-S(1)	99.16	0.35	0	FUNCTIONAL	0	0	0	0	0
226	96.16	4.073	0	FUNCTIONAL	0	0	1.13	0	0
226A-S	98.08	1.73	0	FUNCTIONAL	0	0	0	0	0
226A-S(1)	99.63	0.35	0	FUNCTIONAL	0	0	0	0	0
227	96.277	3.957	0	FUNCTIONAL	0	0	1.13	0	0
228	96.538	3.893	0	FUNCTIONAL	0	0	1.13	0	0
228A-S	98.61	1.73	0	FUNCTIONAL	0	0	0	0	0
228A-S(1)	100.2	0.35	0	FUNCTIONAL	0	0	0	0	0
229	96.906	3.616	0	FUNCTIONAL	0	0	1.13	0	0
229A-S	98.82	1.73	0	FUNCTIONAL	0	0	0	0	0
229A-S(1)	100.42	0.35	0	FUNCTIONAL	0	0	0	0	0
230	97.117	3.402	0	FUNCTIONAL	0	0	1.13	0	0
231	97.334	3.034	0	FUNCTIONAL	0	0	1.13	0	0
232	97.563	2.594	0	FUNCTIONAL	0	0	1.13	0	0
233	92.392	5.031	0	FUNCTIONAL	0	0	1.13	0	0
234	92.777	4.754	0	FUNCTIONAL	0	0	1.13	0	0
234A-S	95.97	1.73	0	FUNCTIONAL	0	0	0	0	0
234A-S(1)	97.56	0.35	0	FUNCTIONAL	0	0	0	0	0
234B-S	95.92	1.73	0	FUNCTIONAL	0	0	0	0	0
234B-S(1)	97.49	0.35	0	FUNCTIONAL	0	0	0	0	0
235	93.041	4.565	0	FUNCTIONAL	0	0	1.13	0	0
236	93.293	4.173	0	FUNCTIONAL	0	0	1.13	0	0
237	93.355	4.097	0	FUNCTIONAL	0	0	1.13	0	0
237A-S	95.98	1.73	0	FUNCTIONAL	0	0	0	0	0
237A-S(1)	97.6	0.35	0	FUNCTIONAL	0	0	0	0	0
238	93.744	3.817	0	FUNCTIONAL	0	0	1.13	0	0
239	93.818	3.687	0	FUNCTIONAL	0	0	1.13	0	0
240	94.074	3.651	0	FUNCTIONAL	0	0	1.13	0	0
240A-S	96.21	1.73	0	FUNCTIONAL	0	0	0	0	0
240A-S(1)	97.69	0.35	0	FUNCTIONAL	0	0	0	0	0
240B-S	96.02	1.73	0	FUNCTIONAL	0	0	0	0	0
240B-S(1)	97.64	0.35	0	FUNCTIONAL	0	0	0	0	0
241	94.495	3.377	0	FUNCTIONAL	0	0	1.13	0	0
241A-S	96.19	1.73	0	FUNCTIONAL	0	0	0	0	0
241A-S(1)	97.8	0.35	0	FUNCTIONAL	0	0	0	0	0

B1-S	94.43	2.5	0	TABULAR	B1-S			0	0
;10yr									
B2-S	94.4	2.5	0	TABULAR	B2-S			0	0
;2yr									
Comm-S	97.4	2.5	0	TABULAR	StorCommE			0	0
EXT-1A-S	97.92	0.35	0	FUNCTIONAL	0	0	0	0	0
EXT-1A-S(1)	95.97	0.35	0	FUNCTIONAL	0	0	0	0	0
EXT2-S	98.39	0.35	0	FUNCTIONAL	0	0	0	0	0
EXT3-S	96.94	0.35	0	FUNCTIONAL	0	0	0	0	0
EXT4-S	98	0.35	0	FUNCTIONAL	0	0	0	0	0
EXT5-S	98	0.35	0	FUNCTIONAL	0	0	0	0	0
EXT6-S	99.6	0.35	0	FUNCTIONAL	0	0	0	0	0
F101A(1)	94.2	2.2	0	FUNCTIONAL	0	0	0	0	0
F101A(2)	94	2.2	0	FUNCTIONAL	0	0	0	0	0
F101A-S	93.43	1.87	0	FUNCTIONAL	0	0	0	0	0
;2yr									
G234A-S	93.33	5.04	0	FUNCTIONAL	0	0	0	0	0
HW7	93.65	2.35	0	FUNCTIONAL	0	0	1.13	0	0
HZD-S	98	2.5	0	TABULAR	Hazeldean-s			0	0
J2	94.1	2.9	0	FUNCTIONAL	0	0	1.13	0	0
J3	93.7	2.59	0	FUNCTIONAL	0	0	1.13	0	0
J4	94.1	2.9	0	FUNCTIONAL	0	0	1.13	0	0
;T/G at CB=98.00									
L103A-S-29	96.5	1.9	0	TABULAR	L103A-V			0	0
;T/G at CB=97.92									
L104A-S-29	96.54	1.78	0	TABULAR	L104A-V			0	0
;T/G at CB=97.93									
L106A-S-29	96.55	1.78	0	TABULAR	L106A-V			0	0
;2yr									
L218A-S	96	2.5	0	TABULAR	INST			0	0
L225B-S	97.2	2.5	0	TABULAR	224AA-S			0	0
POND-S1	90.7	4.6	0	TABULAR	PondStorageULT			0	0
RY103C-S	96.24	1.8	0	FUNCTIONAL	0	0	0	0	0
RY103D-S	96.2	1.8	0	FUNCTIONAL	0	0	0	0	0
RY113B-S	96.66	1.8	0	FUNCTIONAL	0	0	0	0	0
RY117C-S	96.17	1.8	0	FUNCTIONAL	0	0	0	0	0
RY124B-S	96.91	1.8	0	FUNCTIONAL	0	0	0	0	0
RY130B-S	98.38	1.6	0	FUNCTIONAL	0	0	0	0	0
RY202B-S	96.3	1.8	0	FUNCTIONAL	0	0	0	0	0

RY205B-S	95.46	2.6	0	FUNCTIONAL	0	0	0	0	0
RY209C-S	97.41	2.34	0	FUNCTIONAL	0	0	0	0	0
RY210B-S	95.62	2.6	0	FUNCTIONAL	0	0	0	0	0
RY218B-S	96.29	2.6	0	FUNCTIONAL	0	0	0	0	0
RY220A-S	95.88	2.6	0	FUNCTIONAL	0	0	0	0	0
RY238A-S	95.61	2.44	0	FUNCTIONAL	0	0	0	0	0
SU	97.2	0.35	0	FUNCTIONAL	0	0	0	0	0
Transitway-S	97	2.5	0	TABULAR	transit-S			0	0

[CONDUITS]

;;Name	From Node	To Node	Length	Roughness	InOffset	OutOffset	InitFlow	MaxFlow
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101A-101-29	101A-29	123	8.1	0.013	95.14	95.1	0	0
102-101A-29	102-29	101A-29	13.6	0.013	95.218	95.15	0	0
103-102-29	103-29	102-29	13.9	0.013	95.3	95.23	0	0
104-103-29	104-29	103-29	38.7	0.013	95.561	95.368	0	0
106-103-29	106-29	103-29	50.1	0.013	95.624	95.368	0	0
C1	EXT-1A-S(1)	OF3	15.6	0.013	95.97	95.9	0	0
C10	206B-Sl	109A-S(1)	31.94	0.013	97.95	97.79	0	0
C100	118A-S	118A-S(1)	37.89	0.013	97.38	97.57	0	0
C101	118A-S(1)	117A-S	52.21	0.013	97.57	97.26	0	0
C102	117A-S	117A-S(1)	34.6	0.013	97.26	97.52	0	0
C103	117A-S(1)	117B-S	31.1	0.013	97.52	97.19	0	0
C104	117B-S	116A-S(1)	15.86	0.013	97.19	97.41	0	0
C105	109A-S(1)	205A-S(1)	32.75	0.013	97.79	97.45	0	0
C106	205A-S(1)	205A-S	13.25	0.013	97.45	97.51	0	0
C107	205A-S	204A-S	30.53	0.013	97.51	97.66	0	0
C108	204A-S	204A-S(1)	43.19	0.013	97.66	97.39	0	0
C109	204A-S(1)	203A-S	45.7	0.013	97.39	97.61	0	0
C11	220A-S	206B-Sl	23.84	0.013	97.74	97.95	0	0
C110	203A-S	204BS(1)	43.6	0.013	97.61	97.35	0	0
C111	204BS(1)	202A-S	38	0.013	97.35	97.56	0	0
C112	202A-S	202A-S(1)	57.34	0.013	97.56	97.27	0	0
C113	202A-S(1)	234B-S(1)	14.5	0.013	97.27	97.49	0	0
C114	210A-S	202A-S	9.25	0.013	97.37	97.56	0	0
C115	211A-S	210A-S	67.52	0.013	98.01	97.37	0	0
C116	211A-S(1)	211A-S	52.38	0.013	97.75	98.01	0	0
C117	211A-S(2)	211A-S(1)	37.56	0.013	98.21	97.75	0	0
C118	211A-S(2)	217A-S(1)	47.6	0.013	98.21	98.11	0	0
C119	217A-S(2)	217A-S	6.77	0.013	98.11	97.81	0	0
C12	220A-S(1)	220A-S	25.22	0.013	97.87	97.74	0	0
C120	217A-S(2)	EXT3-S	16.5	0.013	98.11	96.94	0	0
C121	219A-S(1)	220A-S(1)	8.8	0.013	97.82	97.87	0	0
C122	219A-S(2)	219A-S(1)	42.15	0.013	98.22	98.82	0	0

C123	219B-S	219A-S(2)	30.45	0.013	97.98	98.22	0	0
C124	219B-S(1)	219B-S	82.2	0.013	98.32	97.98	0	0
C125	219B-S(1)	214A-S	43.75	0.013	98.32	98.02	0	0
C126	214A-S	213A-S	35.75	0.013	98.02	97.82	0	0
C127	213A-S	211A-S	9.51	0.013	97.82	98.01	0	0
C128	RY103C-S	103B-S	5	0.025	97.44	97.17	0	0
C129	RY103D-S	103B-S	5	0.025	97.4	97.17	0	0
C13	219A-S	220A-S(1)	39	0.013	98.07	97.87	0	0
C130	RY117C-S	117B-S	5	0.025	97.37	97.19	0	0
C131	RY210B-S	210A-S	5	0.025	97.62	97.37	0	0
C132	RY205B-S	205A-S(1)	5	0.025	97.46	97.45	0	0
C133	L218A-S	219B-S	50	0.025	98.15	98.05	0	0
C134	RY218B-S	219B-S	5	0.025	98.29	98	0	0
C135	EXT5-S	OF13	10	0.025	98	97.7	0	0
C136	EXT3-S	OF4	6	0.025	96.94	96.91	0	0
C137	EXT4-S	OF14	10	0.025	98	97.7	0	0
C138	G234A-S	234A-S(1)	2	0.025	97.77	97.71	0	0
C139	RY202B-S	202A-S(1)	5	0.013	97.5	97.27	0	0
C14	222A-S	219A-S	44.18	0.013	97.82	98.07	0	0
C140	RY238A-S	234A-S	30.5	0.013	97.9	97.73	0	0
C142	121B-S	EXT-1A-S(1)	10	0.013	98	97.9	0	0
C143	126C-S	126A-S	2	0.025	99.02	98.91	0	0
C144	RY124B-S	124A-S	2	0.025	98.11	97.93	0	0
C145	RY113B-S	113A-S(1)	5	0.025	97.86	97.85	0	0
C146	RY130B-S	207A-S(1)	35	0.013	99.38	99	0	0
C147	RY209C-S	207A-S(1)	30.5	0.013	99.5	99.09	0	0
C148	RY220A-S	220A-S	5	0.013	97.88	97.74	0	0
C15	222A-S(1)	222A-S	65.36	0.013	98.22	97.82	0	0
C150	L225B-S	225A-S	10	0.013	99.35	99.25	0	0
C151	F101A-S	F101A(2)	25.19	0.025	94.7	94.5	0	0
C152	EXT6-S	EXT2-S	6	0.025	99.6	98.39	0	0
C153	EXT2-S	OF5	6	0.025	98.39	98.35	0	0
C154	201	100B	15	0.013	91.76	91.74	0	0
C155	100B	POND-S1	18	0.013	91.73	91.7	0	0
C156	100B	100A	49.8	0.013	92.93	92.88	0	0
C157	100A	POND-S1	28.1	0.013	91.79	91.76	0	0
C158	101	100D	15.7	0.013	93.28	93.26	0	0
C159	100D	100E	15.27	0.013	94.04	93.89	0	0
C16	222A-S(2)	222A-S(1)	39.94	0.013	98.82	98.22	0	0

C160	100E	POND-S1	15.8	0.013	93.86	93.46	0	0
C161	100D	100C	26.4	0.013	93.21	93.17	0	0
C162	100C	POND-S1	13.5	0.013	93.11	93.08	0	0
C163	B1-S	OF9	10	0.025	96.58	95	0	0
C164	B2-S	OF10	10	0.013	96.55	95	0	0
C165	J6	OF8	70	0.013	94.56	92.6	0	0
C166	114A-S	POND-S1	30.4	0.025	97.22	93.44	0	0
C167	F101A(1)	F101A(2)	30.11	0.035	94.2	94	0	0
C168	SU	114A-S	4.25	0.013	97.2	97.07	0	0
C169	117	115A	94.9	0.013	94.71	94.52	0	0
C17	222A-S(2)	EXT2-S	29.89	0.013	98.82	98.39	0	0
C170	115A	115	11	0.013	94.49	94.47	0	0
C171	103	102A	97.9	0.013	93.98	93.89	0	0
C172	J4	J3	219	0.013	94.4	94.07	0	0
C173	HW7	POND-S1	18.1	0.013	93.66	93.45	0	0
C174	Comm-S	OF7	5	0.013	99.55	99	0	0
C175	Transitway-S	OF6	238.7	0.013	99.15	97	0	0
C176	F101A(2)	HW7	44.18	0.035	94	93.65	0	0
C177	J2	J3	244	0.013	94.43	94.07	0	0
C178	J3	F101A(2)	29.9	0.013	94.04	94	0	0
C179	121A	121	54	0.013	95.32	95.18	0	0
C18	127A-S	130A-S	91.45	0.013	100.62	99.32	0	0
C180	121AA-S	EXT-1A-S(1)	58.2	0.013	97.31	95.93	0	0
C181	HZD-S	OF11	30	0.013	100.15	100	0	0
C182	102A	102	8.7	0.013	93.88	93.87	0	0
C183	107	121	80.3	0.013	94.46	94.38	0	0
C19	130A-S	130A-S(1)	10.3	0.013	99.32	99.39	0	0
C2	EXT-1A-S	121AA-S	36.5	0.013	97.92	97.31	0	0
C20	130A-S(1)	128A-S(1)	40.4	0.013	99.39	98.87	0	0
C21	128A-S(1)	126A-S	19.97	0.013	98.87	98.91	0	0
C22	126A-S	126B-S	14.63	0.013	98.91	99.05	0	0
C23	126B-S	126B-S(1)	45	0.013	99.05	98.37	0	0
C24	126B-S(1)	126B-S(2)	40	0.013	98.37	98.57	0	0
C25	126B-S(2)	124A-S	50	0.013	98.57	97.93	0	0
C26	124A-S	124A-S(1)	35.1	0.013	97.93	98.1	0	0
C27	124A-S(1)	123A-S	30	0.013	98.1	97.69	0	0
C28	123A-S	121A-S	8.32	0.013	97.69	97.72	0	0
C29	113A-S(1)	113A-S	36.45	0.013	97.85	98.17	0	0
C3	EXT-1A-S	121A-S	24.6	0.013	97.92	97.72	0	0

C30	112A-S	113A-S(1)	34.9	0.013	98.09	97.85	0	0
C31	112A-S	112A-S(1)	32.9	0.013	98.09	97.78	0	0
C32	112A-S(1)	109B-S(3)	47.1	0.013	97.78	98.01	0	0
C33	109B-S(3)	110A-S	26	0.013	98.01	97.75	0	0
C34	110A-S	107A-S	8.5	0.013	97.75	97.8	0	0
C35	127A-S(1)	126A-S	25.57	0.013	99.15	98.91	0	0
C36	127A-S	127A-S(1)	140.1	0.013	100.62	99.15	0	0
C37	127A-S	209B-S	66.17	0.013	100.62	100.03	0	0
C38	209B-S(1)	209B-S	94.9	0.013	100.5	100.03	0	0
C39	209B-S(1)	229A-S	35.61	0.013	100.5	100.2	0	0
C4	121A-S(1)	121A-S	47.84	0.013	98.05	97.72	0	0
C40	229A-S	229A-S(1)	44.39	0.013	100.2	100.42	0	0
C41	229A-S(1)	228A-S	57.91	0.013	100.42	99.99	0	0
C42	228A-S	228A-S(1)	42.09	0.013	99.99	100.2	0	0
C43	228A-S(1)	226A-S	50.01	0.013	100.2	99.46	0	0
C44	226A-S	226A-S(1)	35	0.013	99.46	99.63	0	0
C45	226A-S(1)	225A-S	43.3	0.013	99.63	99.03	0	0
C46	225A-S	225A-S(1)	22.62	0.013	99.03	99.16	0	0
C47	225A-S(1)	223A-S	47	0.013	99.16	98.17	0	0
C48	223A-S	222A-S(1)	6.6	0.013	98.17	98.22	0	0
C49	209B-S	209A-S	20.75	0.013	100.03	99.59	0	0
C5	121A-S(1)	107A-S	32.04	0.013	98.05	97.8	0	0
C50	209A-S	207A-S(1)	62.5	0.013	99.59	98.68	0	0
C51	207A-S(1)	206A-S	37.5	0.013	98.68	98.88	0	0
C52	206A-S	206A-S(1)	39.3	0.013	98.88	98.29	0	0
C53	206A-S(1)	206B-S	25.55	0.013	98.29	98.42	0	0
C54	206B-S	113A-S	16.72	0.013	98.42	98.17	0	0
C55	113A-S	206B-S(1)	35.75	0.013	98.17	97.77	0	0
C56	206B-S(1)	109A-S(1)	10.49	0.013	97.77	97.79	0	0
C57	214A-S(1)	214A-S	34.85	0.013	97.68	98.02	0	0
C58	214A-S(2)	214A-S(1)	71.9	0.013	98.26	97.68	0	0
C59	214A-S(2)	217A-S	57	0.013	98.26	97.81	0	0
C6	109B-S	107A-S	41.26	0.013	97.59	97.8	0	0
C60	217A-S	217A-S(1)	9.54	0.013	97.81	98.11	0	0
C61	105A-S(1)	105A-S	35.56	0.013	97.49	97.79	0	0
C62	106A-S	105A-S(1)	39.57	0.013	97.88	97.49	0	0
C63	106A-S(1)	106A-S	36.23	0.013	97.65	97.88	0	0
C64	106A-S(2)	106A-S(1)	11.68	0.013	97.71	97.65	0	0
C65	106A-S(2)	106B-S	9.7	0.013	97.71	97.52	0	0

C66	106B-S	205A-S	12.6	0.013	97.52	97.51	0	0
C67	121A-S	121A-S(2)	35.93	0.013	97.72	97.36	0	0
C68	121A-S(2)	120A-S(1)	53.8	0.013	97.36	97.62	0	0
C69	120A-S(1)	119A-S	57	0.013	97.62	97.22	0	0
C7	109B-S(1)	109B-S	27.52	0.013	97.87	97.59	0	0
C70	119A-S	102A-S(2)	33	0.013	97.22	97.42	0	0
C71	102A-S(2)	102A-S(1)	57	0.013	97.42	97.14	0	0
C72	102A-S(1)	102A-S	25	0.013	97.14	97.35	0	0
C73	102A-S	114A-S	37.77	0.013	97.35	97.07	0	0
C74	115A-S(1)	114A-S	26.34	0.013	97.33	97.07	0	0
C75	115A-S	115A-S(1)	33.89	0.013	97.17	97.33	0	0
C76	116A-S(1)	115A-S	24.62	0.013	97.41	97.17	0	0
C77	116A-S	116A-S(1)	30.68	0.013	97.2	97.41	0	0
C78	234B-S(1)	116A-S	53.39	0.013	97.49	97.2	0	0
C79	234B-S	234B-S(1)	32.51	0.013	97.3	97.49	0	0
C8	109B-S(1)	109A-S	38.48	0.013	97.87	97.58	0	0
C80	234A-S(1)	234B-S	48.8	0.013	97.56	97.3	0	0
C81	234A-S	234A-S(1)	30	0.013	97.35	97.56	0	0
C82	237A-S(1)	234A-S	50	0.013	97.6	97.35	0	0
C83	237A-S	237A-S(1)	40	0.013	97.36	97.6	0	0
C84	240B-S(1)	237A-S	40	0.013	97.64	97.36	0	0
C85	240B-S	240B-S(1)	47.2	0.013	97.4	97.64	0	0
C86	240A-S(1)	240B-S	32.8	0.013	97.69	97.4	0	0
C87	240A-S	240A-S(1)	16	0.013	97.59	97.69	0	0
C88	241A-S(1)	240A-S	39	0.013	97.8	97.59	0	0
C89	241A-S	241A-S(1)	23.79	0.013	97.57	97.8	0	0
C9	109A-S	109A-S(1)	41.52	0.013	97.58	97.79	0	0
C90	217A-S(1)	241A-S	30.26	0.013	98.11	97.57	0	0
C91	107A-S	107A-S(1)	12.24	0.013	97.8	97.59	0	0
C92	107A-S(1)	105A-S	34.01	0.013	97.59	97.79	0	0
C93	105A-S	104A-S	41.49	0.013	97.79	97.46	0	0
C94	104A-S	104A-S(1)	37.85	0.013	97.46	97.65	0	0
C95	104A-S(1)	103A-S	45.8	0.013	97.65	97.26	0	0
C96	103A-S	103A-S(1)	33.2	0.013	97.26	97.45	0	0
C97	103A-S(1)	103B-S	32.25	0.013	97.45	97.02	0	0
C98	103B-S	SU	6.12	0.013	97.02	97.2	0	0
C99	106A-S	118A-S	62	0.013	97.88	97.38	0	0
F101A-IC	F101A-S	101	16.3	0.013	93.43	93.35	0	0
outlet	J9	OF2	7.8	0.013	93.05	93.01	0	0

Pipe_-_(234)	108	107	18.945	0.013	94.766	94.681	0	0
Pipe_-_(234)_(1)	109	108	116.815	0.013	95.185	94.777	0	0
Pipe_-_(235)	107	104	51.748	0.013	95.59	95.383	0	0
Pipe_-_(238)	206	205	109.96	0.013	93.099	92.93	0	0
Pipe_-_(240)	207	206	99.158	0.013	94.55	94.249	0	0
Pipe_-_(241)_(1)	209	207	49.667	0.013	95	94.86	0	0
Pipe_-_(245)	127	126	110.836	0.013	97.731	96.623	0	0
Pipe_-_(253)	113	112	84.212	0.013	95.57	95.238	0	0
Pipe_-_(263)	202	201	74.953	0.013	91.878	91.765	0	0
Pipe_-_(264)	204	202	149.899	0.013	92.762	92.538	0	0
Pipe_-_(267)	205	204	108.144	0.013	92.929	92.767	0	0
Pipe_-_(329)	125	124	12.188	0.013	95.998	95.949	0	0
Pipe_-_(330)	126	125	92.464	0.013	96.398	96.028	0	0
Pipe_-_(331)	128	126	39.463	0.013	96.672	96.473	0	0
Pipe_-_(332)	129	128	12.261	0.013	96.838	96.777	0	0
Pipe_-_(333)	130	129	113.92	0.013	97.438	96.868	0	0
Pipe_-_(334)	131	130	19.451	0.013	97.61	97.513	0	0
Pipe_-_(335)	132	131	35.88	0.013	97.863	97.629	0	0
Pipe_-_(337)	105	104	79.381	0.013	94.816	94.658	0	0
Pipe_-_(338)	106	105	63.485	0.013	95.018	94.891	0	0

Pipe_-_(344)	116	115	65.711	0.013	95.118	94.789	0	0
Pipe_-_(345)	115	114	54.688	0.013	94.414	94.305	0	0
Pipe_-_(346)	114	102	28.243	0.013	94.23	94.173	0	0
Pipe_-_(347)	102	101	79.783	0.013	93.423	93.344	0	0
Pipe_-_(349)	119	101	115.054	0.013	93.826	93.654	0	0
Pipe_-_(350)	121	119	113.166	0.013	94	93.831	0	0
Pipe_-_(351)	123	121	51.295	0.013	95.014	94.886	0	0
Pipe_-_(352)	124	123	71.391	0.013	95.874	95.589	0	0
Pipe_-_(354)	104	103	99.774	0.013	94.358	94.208	0	0
Pipe_-_(360)	118	117	96.757	0.013	95.254	95.012	0	0
Pipe_-_(366)	210	202	85.512	0.013	92.06	91.94	0	0
Pipe_-_(367)	211	210	115.944	0.013	92.39	92.21	0	0
Pipe_-_(368)	212	211	97.797	0.013	92.69	92.55	0	0
Pipe_-_(4)	110	107	44.394	0.013	94.911	94.756	0	0
Pipe_-_(43)	213	210	55.346	0.013	93.28	93.17	0	0
Pipe_-_(44)	218	213	102.115	0.013	93.82	93.62	0	0
Pipe_-_(45)	219	218	110.65	0.013	94.19	93.97	0	0
Pipe_-_(47)	221	219	76.765	0.013	94.77	94.49	0	0
Pipe_-_(48)	222	221	71.448	0.013	95.25	95	0	0

Pipe_-_(49)	220	219	71.8	0.013	95.15	94.79	0	0
Pipe_-_(5)	111	110	11.163	0.013	95.03	94.986	0	0
Pipe_-_(50)	223	222	75.276	0.013	95.57	95.31	0	0
Pipe_-_(51)	224	223	11.94	0.013	95.64	95.6	0	0
Pipe_-_(52)	225	224	67.701	0.013	95.88	95.67	0	0
Pipe_-_(52)_(1)	226	225	62.212	0.013	96.45	96.27	0	0
Pipe_-_(53)	227	226	14.08	0.013	96.57	96.53	0	0
Pipe_-_(54)	228	227	77.156	0.013	96.83	96.6	0	0
Pipe_-_(54)_(1)	229	228	88.923	0.013	97.2	96.84	0	0
Pipe_-_(55)	230	229	12.106	0.013	97.41	97.35	0	0
Pipe_-_(56)	231	230	37.413	0.013	97.63	97.44	0	0
Pipe_-_(57)	232	231	42.775	0.013	97.86	97.64	0	0
Pipe_-_(58)	214	213	70.631	0.013	94.74	94.51	0	0
Pipe_-_(58)_(1)	215	214	57.473	0.013	95.25	94.96	0	0
Pipe_-_(59)	216	215	11.874	0.013	95.34	95.28	0	0
Pipe_-_(6)	112	111	41.88	0.013	95.226	95.06	0	0
Pipe_-_(60)	217	216	31.248	0.013	95.52	95.37	0	0
Pipe_-_(73)	233	201	26.629	0.013	92.692	92.586	0	0
Pipe_-_(77)	234	233	106.856	0.013	93.077	92.703	0	0
Pipe_-_(81)	235	234	11.24	0.013	93.341	93.302	0	0
Pipe_-_(82)	236	235	50.684	0.013	93.593	93.416	0	0
Pipe_-_(83)	237	236	9.073	0.013	93.655	93.623	0	0
Pipe_-_(84)	238	237	68.12	0.013	93.92	93.69	0	0
Pipe_-_(85)	239	238	12.777	0.013	94.118	94.074	0	0
Pipe_-_(86)	240	239	64.55	0.013	94.374	94.148	0	0
Pipe_-_(87)	241	240	77.251	0.013	94.795	94.524	0	0

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[ORIFICES]
;;Name          From Node        To Node          Type         Offset     Qcoeff     Gated    CloseTime
;;-------------- ---------------- ---------------- ------------ ---------- ---------- -------- ----------
C107A-IC(1)     107A-S(1)        107              SIDE         96.21      0.572      NO       0
C107A-IC(2)     107A-S(1)        107              SIDE         96.21      0.572      NO       0
C109A-IC(1)     109A-S           109              SIDE         96.2       0.572      NO       0
C109A-IC(2)     109A-S           109              SIDE         96.2       0.572      NO       0
C109B-IC(1)     109B-S           109              SIDE         96.21      0.572      NO       0
C109B-IC(2)     109B-S           109              SIDE         96.21      0.572      NO       0
C110A-IC(1)     110A-S           110              SIDE         96.37      0.572      NO       0
C121AA-IC(1)    121AA-S          121A             SIDE         95.93      0.572      NO       0
C121AA-IC(2)    121AA-S          121A             SIDE         95.93      0.572      NO       0
C121A-IC(1)     121A-S(2)        121              SIDE         95.98      0.572      NO       0
C121A-IC(2)     121A-S(2)        121              SIDE         95.98      0.572      NO       0
C123A-IC(1)     123A-S           123              SIDE         96.31      0.572      NO       0
C123A-IC(2)     123A-S           123              SIDE         96.31      0.572      NO       0
C205A-IC(1)     205A-S(1)        205              SIDE         96.07      0.572      NO       0
C205A-IC(2)     205A-S(1)        205              SIDE         96.07      0.572      NO       0
C219-IC         219A-S(1)        219              SIDE         96.44      0.572      NO       0
C220A-IC(1)     220A-S           220              SIDE         96.36      0.572      NO       0
C220A-IC(2)     220A-S           220              SIDE         96.36      0.572      NO       0
C222A-IC(1)     222A-S           222              SIDE         96.44      0.572      NO       0
C222A-IC(2)     222A-S           222              SIDE         96.44      0.572      NO       0
C223A-IC(1)     223A-S           223              SIDE         96.79      0.572      NO       0
G234A-IC        G234A-S          234              SIDE         93.33      0.572      NO       0
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L102A-IC(1)	102A-S(1)	102	SIDE	95.76	0.572	NO	0
L102A-IC(2)	102A-S(1)	102	SIDE	95.76	0.572	NO	0
L103A-IC(1)	103A-S	103	SIDE	95.88	0.572	NO	0
L103A-IC(2)	103A-S	103	SIDE	95.88	0.572	NO	0
L103A-IC-29	L103A-S-29	103-29	SIDE	96.5	0.572	NO	0
L103B-IC(1)	103B-S	103	SIDE	95.64	0.572	NO	0
L103B-IC(2)	103B-S	103	SIDE	95.64	0.572	NO	0
L103C-IC	RY103C-S	103	SIDE	96.24	0.572	NO	0
L103D-IC	RY103D-S	103	SIDE	96.2	0.572	NO	0
L104A-IC(1)	104A-S	104	SIDE	96.08	0.572	NO	0
L104A-IC(2)	104A-S	104	SIDE	96.08	0.572	NO	0
;Single ICD							
L104A-IC1-29	L104A-S-29	104-29	SIDE	96.54	0.572	NO	0
;Single ICD							
L104A-IC2-29	L104A-S-29	104-29	SIDE	96.54	0.572	NO	0
L105A-IC(1)	105A-S(1)	105	SIDE	96.11	0.572	NO	0
L105A-IC(2)	105A-S(1)	105	SIDE	96.11	0.572	NO	0
L106A-IC(1)	106A-S(1)	106	SIDE	96.27	0.572	NO	0
L106A-IC(2)	106A-S(1)	106	SIDE	96.27	0.572	NO	0
;Single ICD							
L106A-IC-29	L106A-S-29	106-29	SIDE	96.55	0.572	NO	0
L106B-IC(1)	106B-S	106	SIDE	95.14	0.572	NO	0
L112A-IC(1)	112A-S(1)	112	SIDE	96.4	0.572	NO	0
L112A-IC(2)	112A-S(1)	112	SIDE	96.4	0.572	NO	0
L113A-IC(1)	113A-S(1)	113	SIDE	96.47	0.572	NO	0
L113A-IC(2)	113A-S(1)	113	SIDE	96.47	0.572	NO	0
L113B-IC	RY113B-S	113	SIDE	96.66	0.572	NO	0
L114A-IC	114A-S	114	SIDE	95.69	0.572	NO	0
L115A-IC(1)	115A-S	115	SIDE	95.79	0.572	NO	0
L115A-IC(2)	115A-S	115	SIDE	95.79	0.572	NO	0
L116A-IC(1)	116A-S	116	SIDE	95.82	0.572	NO	0
L116A-IC(2)	116A-S	116	SIDE	95.82	0.572	NO	0
L117A-IC(1)	117A-S	117	SIDE	95.88	0.572	NO	0
L117A-IC(2)	117A-S	117	SIDE	95.88	0.572	NO	0
L117B-IC(1)	117B-S	117	SIDE	95.81	0.572	NO	0
L117B-IC(2)	117B-S	117	SIDE	95.81	0.572	NO	0
L117C-IC	RY117C-S	117	SIDE	96.17	0.572	NO	0
L118A-IC(1)	118A-S	118	SIDE	96	0.572	NO	0
L118A-IC(2)	118A-S	118	SIDE	96	0.572	NO	0

L119A-IC(1)	119A-S	119	SIDE	95.84	0.572	NO	0
L119A-IC(2)	119A-S	119	SIDE	95.84	0.572	NO	0
L124A-IC(1)	124A-S	124	SIDE	96.55	0.572	NO	0
L124A-IC(2)	124A-S	124	SIDE	96.55	0.572	NO	0
L124B-IC	RY124B-S	124	SIDE	96.91	0.572	NO	0
L126A-IC(1)	126A-S	126	SIDE	97.53	0.572	NO	0
L126B-IC(1)	126B-S(1)	126	SIDE	96.99	0.572	NO	0
L126B-IC(2)	126B-S(1)	126	SIDE	96.99	0.572	NO	0
L126C-IC	126C-S	126	SIDE	96.49	0.572	NO	0
L127A-IC(1)	127A-S(1)	127	SIDE	97.77	0.572	NO	0
L127A-IC(2)	127A-S(1)	127	SIDE	97.77	0.572	NO	0
L128A-IC(1)	128A-S(1)	128	SIDE	97.49	0.572	NO	0
L128A-IC(2)	128A-S(1)	128	SIDE	97.49	0.572	NO	0
L130A-IC(1)	130A-S	130	SIDE	97.94	0.572	NO	0
L130A-IC(2)	130A-S	130	SIDE	97.94	0.572	NO	0
L130B-IC	RY130B-S	130	SIDE	98.38	0.572	NO	0
L202A-IC(1)	202A-S(1)	202	SIDE	95.89	0.572	NO	0
L202A-IC(2)	202A-S(1)	202	SIDE	95.89	0.572	NO	0
L202B-IC	RY202B-S	202	SIDE	96.3	0.572	NO	0
L204A-IC(1)	204A-S(1)	204	SIDE	96.01	0.572	NO	0
L204A-IC(2)	204A-S(1)	204	SIDE	96.01	0.572	NO	0
L204B-IC(1)	204BS(1)	204	SIDE	95.97	0.572	NO	0
L204B-IC(2)	204BS(1)	204	SIDE	95.97	0.572	NO	0
L205B-IC	RY205B-S	205	SIDE	95.46	0.572	NO	0
L206A-IC(1)	206A-S(1)	206	SIDE	96.91	0.572	NO	0
L206A-IC(2)	206A-S(1)	206	SIDE	96.91	0.572	NO	0
L206B-IC(1)	206B-S(1)	206	SIDE	96.39	0.572	NO	0
L207A-IC(1)	207A-S(1)	207	SIDE	97.3	0.572	NO	0
L207A-IC(2)	207A-S(1)	207	SIDE	97.3	0.572	NO	0
L209A-IC(1)	209A-S	209	SIDE	98.21	0.572	NO	0
L209A-IC(2)	209A-S	209	SIDE	98.21	0.572	NO	0
L209B-IC	209B-S	209	SIDE	98.65	0.572	NO	0
L209C-IC	RY209C-S	209	SIDE	97.41	0.572	NO	0
L210A-IC(1)	210A-S	210	SIDE	95.99	0.572	NO	0
L210A-IC(2)	210A-S	210	SIDE	95.99	0.572	NO	0
L210B-IC	RY210B-S	210	SIDE	95.62	0.572	NO	0
L211A-IC(1)	211A-S(1)	211	SIDE	96.37	0.572	NO	0
L211A-IC(2)	211A-S(1)	211	SIDE	96.37	0.572	NO	0
L213A-IC(1)	213A-S	213	SIDE	96.44	0.572	NO	0

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L213A-IC(2)      213A-S           213              SIDE         96.44      0.572      NO       0
L214A-IC(1)      214A-S(1)        214              SIDE         96.3       0.572      NO       0
L214A-IC(2)      214A-S(1)        214              SIDE         96.3       0.572      NO       0
L217A-IC(1)      217A-S           217              SIDE         96.43      0.572      NO       0
L217A-IC(2)      217A-S           217              SIDE         96.43      0.572      NO       0
L218B-IC         RY218B-S         218              SIDE         96.29      0.572      NO       0
L219B-IC(1)      219B-S           219              SIDE         96.6       0.572      NO       0
L219B-IC(2)      219B-S           219              SIDE         96.6       0.572      NO       0
L220A-S          RY220A-S         220              SIDE         95.88      0.572      NO       0
L225A-IC(1)      225A-S           225              SIDE         97.65      0.572      NO       0
L225A-IC(2)      225A-S           225              SIDE         97.65      0.572      NO       0
L226A-IC(1)      226A-S           226              SIDE         98.08      0.572      NO       0
L226A-IC(2)      226A-S           226              SIDE         98.08      0.572      NO       0
L228A-IC(1)      228A-S           228              SIDE         98.61      0.572      NO       0
L228A-IC(2)      228A-S           228              SIDE         98.61      0.572      NO       0
L229A-IC(1)      229A-S           229              SIDE         98.82      0.572      NO       0
L229A-IC(2)      229A-S           229              SIDE         98.82      0.572      NO       0
L234A-IC(1)      234A-S           234              SIDE         95.97      0.572      NO       0
L234A-IC(2)      234A-S           234              SIDE         95.97      0.572      NO       0
L234B-IC(1)      234B-S           234              SIDE         95.92      0.572      NO       0
L234B-IC(2)      234B-S           234              SIDE         95.92      0.572      NO       0
L237A-IC(1)      237A-S           237              SIDE         95.98      0.572      NO       0
L237A-IC(2)      237A-S           237              SIDE         95.98      0.572      NO       0
L238A-IC         RY238A-S         238              SIDE         95.61      0.572      NO       0
L240A-IC(1)      240A-S           240              SIDE         96.21      0.572      NO       0
L240A-IC(2)      240A-S           240              SIDE         96.21      0.572      NO       0
L240B-IC(1)      240B-S           240              SIDE         96.02      0.572      NO       0
L240B-IC(2)      240B-S           240              SIDE         96.02      0.572      NO       0
L241A-IC(1)      241A-S           241              SIDE         96.19      0.572      NO       0
L241A-IC(2)      241A-S           241              SIDE         96.19      0.572      NO       0
OR1              POND-S1          J9               SIDE         93.44      0.61       NO       0

[WEIRS]
;;Name           From Node        To Node          Type         CrestHt    Qcoeff     Gated    EndCon
EndCoeff   Surcharge  RoadWidth  RoadSurf   Coeff. Curve
;;-------------- ---------------- ---------------- ------------ ---------- ---------- -------- --------
---------- ---------- ---------- ---------- ----------------
Spillway         POND-S1          J6               TRANSVERSE   94.6       1.76       NO       0        0
       YES
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;Overland Flow
W103A-29         L103A-S-29       123A-S           TRANSVERSE   98.2       1.74       NO       0        0
       YES
;Overland Flow
W104A-29         L104A-S-29       L103A-S-29       TRANSVERSE   98.22      1.74       NO       0        0
       YES
;Overland Flow
W106A-29         L106A-S-29       L103A-S-29       TRANSVERSE   98.21      1.74       NO       0        0
       YES
W2               POND-S1          J9               TRANSVERSE   93.85      1.74       NO       0        0
       YES

[OUTLETS]
;;Name           From Node        To Node          Offset     Type             QTable/Qcoeff    Qexpon
Gated
;;-------------- ---------------- ---------------- ---------- ---------------- ---------------- ----------
--------
ART-IC           Transitway-S     209              97         TABULAR/HEAD     Transit
NO
B1-IC            B1-S             J2               94.43      TABULAR/DEPTH    B1
NO
B2-IC            B2-S             J4               94.4       TABULAR/DEPTH    B2
NO
COMM-IC          Comm-S           209              97.4       TABULAR/HEAD     CommE
NO
HZD-IC           HZD-S            209              98         TABULAR/HEAD     Hazeldean
NO
L121B-IC         121B-S           121              95.85      TABULAR/HEAD     L121BIC
NO
L218A-IC         L218A-S          218              96         TABULAR/HEAD     L218AAIC
NO
L225B-IC         L225B-S          225              97.2       TABULAR/HEAD     L225BIC
NO

[XSECTIONS]
;;Link           Shape        Geom1            Geom2      Geom3      Geom4      Barrels    Culvert
;;-------------- ------------ ---------------- ---------- ---------- ---------- ---------- ----------
101A-101-29      CIRCULAR     0.375            0          0          0          1
102-101A-29      CIRCULAR     0.375            0          0          0          1
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103-102-29	CIRCULAR	0.375	0	0	0	1
104-103-29	CIRCULAR	0.3	0	0	0	1
106-103-29	CIRCULAR	0.3	0	0	0	1
C1	IRREGULAR	24mROW	0	0	0	1
C10	IRREGULAR	24mROW	0	0	0	1
C100	IRREGULAR	18mROW	0	0	0	1
C101	IRREGULAR	18mROW	0	0	0	1
C102	IRREGULAR	18mROW	0	0	0	1
C103	IRREGULAR	18mROW	0	0	0	1
C104	IRREGULAR	18mROW	0	0	0	1
C105	IRREGULAR	18mROW	0	0	0	1
C106	IRREGULAR	18mROW	0	0	0	1
C107	IRREGULAR	18mROW	0	0	0	1
C108	IRREGULAR	18mROW	0	0	0	1
C109	IRREGULAR	18mROW	0	0	0	1
C11	IRREGULAR	24mROW	0	0	0	1
C110	IRREGULAR	18mROW	0	0	0	1
C111	IRREGULAR	18mROW	0	0	0	1
C112	IRREGULAR	18mROW	0	0	0	1
C113	IRREGULAR	18mROW	0	0	0	1
C114	IRREGULAR	20mROW	0	0	0	1
C115	IRREGULAR	20mROW	0	0	0	1
C116	IRREGULAR	20mROW	0	0	0	1
C117	IRREGULAR	20mROW	0	0	0	1
C118	IRREGULAR	20mROW	0	0	0	1
C119	IRREGULAR	20mROW	0	0	0	1
C12	IRREGULAR	24mROW	0	0	0	1
C120	IRREGULAR	20mROW	0	0	0	1
C121	IRREGULAR	18mROW	0	0	0	1
C122	IRREGULAR	18mROW	0	0	0	1
C123	IRREGULAR	18mROW	0	0	0	1
C124	IRREGULAR	18mROW	0	0	0	1
C125	IRREGULAR	18mROW	0	0	0	1
C126	IRREGULAR	18mROW	0	0	0	1
C127	IRREGULAR	18mROW	0	0	0	1
C128	TRIANGULAR	0.6	3.6	0	0	1
C129	TRIANGULAR	0.6	3.6	0	0	1
C13	IRREGULAR	24mROW	0	0	0	1
C130	TRIANGULAR	0.6	3.6	0	0	1
C131	TRIANGULAR	0.6	3.6	0	0	1
C132	TRIANGULAR	0.6	3.6	0	0	1
C133	IRREGULAR	8.5mROW	0	0	0	1
C134	TRIANGULAR	0.6	3.5	0	0	1
C135	TRIANGULAR	0.6	3.6	0	0	1
C136	TRAPEZOIDAL	0.15	2	44	44	1
C137	TRIANGULAR	0.6	3.6	0	0	1
C138	TRIANGULAR	0.6	3.6	0	0	1
C139	TRIANGULAR	0.6	3.6	0	0	1
C14	IRREGULAR	24mROW	0	0	0	1
C140	IRREGULAR	Block94-107	0	0	0	1
C142	IRREGULAR	18mROW	0	0	0	1
C143	TRIANGULAR	0.6	3.6	0	0	1
C144	TRIANGULAR	0.6	3.6	0	0	1
C145	TRIANGULAR	0.6	3.6	0	0	1
C146	TRAPEZOIDAL	0.6	3	5	5	1
C147	IRREGULAR	Block94-107	0	0	0	1
C148	TRIANGULAR	0.6	3.6	0	0	1
C15	IRREGULAR	24mROW	0	0	0	1
C150	IRREGULAR	8.5mROW	0	0	0	1
C151	TRIANGULAR	0.6	3.6	0	0	1
C152	TRIANGULAR	0.6	3.6	0	0	1
C153	TRAPEZOIDAL	0.15	2	41	41	1
C154	RECT_CLOSED	1.8	3	0	0	1
C155	CIRCULAR	1.8	0	0	0	1
C156	CIRCULAR	2.4	0	0	0	1
C157	CIRCULAR	2.4	0	0	0	1
C158	CIRCULAR	1.5	0	0	0	1
C159	CIRCULAR	1.35	0	0	0	1
C16	IRREGULAR	24mROW	0	0	0	1
C160	CIRCULAR	1.35	0	0	0	1
C161	CIRCULAR	1.05	0	0	0	1
C162	CIRCULAR	1.05	0	0	0	1
C163	TRIANGULAR	0.6	3.6	0	0	1
C164	IRREGULAR	24mROW	0	0	0	1
C165	TRAPEZOIDAL	0.5	20	3	3	1
C166	TRAPEZOIDAL	0.4	3	10	10	1
C167	TRAPEZOIDAL	2.2	2.4	3	3	1
C168	IRREGULAR	18mROW_half	0	0	0	1

C169	CIRCULAR	0.675	0	0	0	1
C17	IRREGULAR	24mROW	0	0	0	1
C170	CIRCULAR	0.675	0	0	0	1
C171	CIRCULAR	1.05	0	0	0	1
C172	CIRCULAR	0.6	0	0	0	1
C173	CIRCULAR	0.9	0	0	0	1
C174	IRREGULAR	8.5mROW	0	0	0	1
C175	IRREGULAR	24mROW	0	0	0	1
C176	TRAPEZOIDAL	2.2	2.4	3	3	1
C177	CIRCULAR	0.6	0	0	0	1
C178	CIRCULAR	0.75	0	0	0	1
C179	CIRCULAR	0.375	0	0	0	1
C18	IRREGULAR	18mROW	0	0	0	1
C180	IRREGULAR	24mROW	0	0	0	1
C181	IRREGULAR	24mROW	0	0	0	1
C182	CIRCULAR	1.05	0	0	0	1
C183	CIRCULAR	0.825	0	0	0	1
C19	IRREGULAR	18mROW	0	0	0	1
C2	IRREGULAR	24mROW	0	0	0	1
C20	IRREGULAR	18mROW	0	0	0	1
C21	IRREGULAR	18mROW	0	0	0	1
C22	IRREGULAR	18mROW	0	0	0	1
C23	IRREGULAR	18mROW	0	0	0	1
C24	IRREGULAR	18mROW	0	0	0	1
C25	IRREGULAR	18mROW	0	0	0	1
C26	IRREGULAR	18mROW	0	0	0	1
C27	IRREGULAR	18mROW	0	0	0	1
C28	IRREGULAR	18mROW	0	0	0	1
C29	IRREGULAR	18mROW	0	0	0	1
C3	IRREGULAR	24mROW	0	0	0	1
C30	IRREGULAR	18mROW	0	0	0	1
C31	IRREGULAR	18mROW	0	0	0	1
C32	IRREGULAR	18mROW	0	0	0	1
C33	IRREGULAR	18mROW	0	0	0	1
C34	IRREGULAR	18mROW	0	0	0	1
C35	IRREGULAR	18mROW	0	0	0	1
C36	IRREGULAR	18mROW	0	0	0	1
C37	IRREGULAR	18mROW	0	0	0	1
C38	IRREGULAR	18mROW	0	0	0	1

C39	IRREGULAR	18mROW	0	0	0	1
C4	IRREGULAR	24mROW	0	0	0	1
C40	IRREGULAR	18mROW	0	0	0	1
C41	IRREGULAR	18mROW	0	0	0	1
C42	IRREGULAR	18mROW	0	0	0	1
C43	IRREGULAR	18mROW	0	0	0	1
C44	IRREGULAR	18mROW	0	0	0	1
C45	IRREGULAR	18mROW	0	0	0	1
C46	IRREGULAR	18mROW	0	0	0	1
C47	IRREGULAR	18mROW	0	0	0	1
C48	IRREGULAR	18mROW	0	0	0	1
C49	IRREGULAR	18mROW	0	0	0	1
C5	IRREGULAR	24mROW	0	0	0	1
C50	IRREGULAR	18mROW	0	0	0	1
C51	IRREGULAR	18mROW	0	0	0	1
C52	IRREGULAR	18mROW	0	0	0	1
C53	IRREGULAR	18mROW	0	0	0	1
C54	IRREGULAR	18mROW	0	0	0	1
C55	IRREGULAR	18mROW	0	0	0	1
C56	IRREGULAR	18mROW	0	0	0	1
C57	IRREGULAR	18mROW	0	0	0	1
C58	IRREGULAR	18mROW	0	0	0	1
C59	IRREGULAR	18mROW	0	0	0	1
C6	IRREGULAR	24mROW	0	0	0	1
C60	IRREGULAR	18mROW	0	0	0	1
C61	IRREGULAR	18mROW	0	0	0	1
C62	IRREGULAR	18mROW	0	0	0	1
C63	IRREGULAR	18mROW	0	0	0	1
C64	IRREGULAR	18mROW	0	0	0	1
C65	IRREGULAR	18mROW	0	0	0	1
C66	IRREGULAR	18mROW	0	0	0	1
C67	IRREGULAR	18mROW	0	0	0	1
C68	IRREGULAR	18mROW	0	0	0	1
C69	IRREGULAR	18mROW	0	0	0	1
C7	IRREGULAR	24mROW	0	0	0	1
C70	IRREGULAR	18mROW	0	0	0	1
C71	IRREGULAR	18mROW	0	0	0	1
C72	IRREGULAR	18mROW	0	0	0	1
C73	IRREGULAR	18mROW	0	0	0	1

C74	IRREGULAR	18mROW	0	0	0	1
C75	IRREGULAR	18mROW	0	0	0	1
C76	IRREGULAR	18mROW	0	0	0	1
C77	IRREGULAR	18mROW	0	0	0	1
C78	IRREGULAR	18mROW	0	0	0	1
C79	IRREGULAR	18mROW	0	0	0	1
C8	IRREGULAR	24mROW	0	0	0	1
C80	IRREGULAR	18mROW	0	0	0	1
C81	IRREGULAR	18mROW	0	0	0	1
C82	IRREGULAR	18mROW	0	0	0	1
C83	IRREGULAR	18mROW	0	0	0	1
C84	IRREGULAR	18mROW	0	0	0	1
C85	IRREGULAR	18mROW	0	0	0	1
C86	IRREGULAR	18mROW	0	0	0	1
C87	IRREGULAR	18mROW	0	0	0	1
C88	IRREGULAR	18mROW	0	0	0	1
C89	IRREGULAR	18mROW	0	0	0	1
C9	IRREGULAR	24mROW	0	0	0	1
C90	IRREGULAR	18mROW	0	0	0	1
C91	IRREGULAR	18mROW	0	0	0	1
C92	IRREGULAR	18mROW	0	0	0	1
C93	IRREGULAR	18mROW	0	0	0	1
C94	IRREGULAR	18mROW	0	0	0	1
C95	IRREGULAR	18mROW	0	0	0	1
C96	IRREGULAR	18mROW	0	0	0	1
C97	IRREGULAR	18mROW	0	0	0	1
C98	IRREGULAR	18mROW	0	0	0	1
C99	IRREGULAR	18mROW	0	0	0	1
F101A-IC	CIRCULAR	0.6	0	0	0	1
outlet	RECT_CLOSED	1.5	1.8	0	0	1
Pipe_-_(234)	CIRCULAR	0.6	0	0	0	1
Pipe_-_(234)_(1)	CIRCULAR	0.6	0	0	0	1
Pipe_-_(235)	CIRCULAR	0.3	0	0	0	1
Pipe_-_(238)	CIRCULAR	2.1	0	0	0	1
Pipe_-_(240)	CIRCULAR	1.65	0	0	0	1
Pipe_-_(241)_(1)	CIRCULAR	1.65	0	0	0	1
Pipe_-_(245)	CIRCULAR	0.3	0	0	0	1
Pipe_-_(253)	CIRCULAR	0.45	0	0	0	1
Pipe_-_(263)	Rect_Closed	1.8	3	0	0	1

Pipe_-_(264)	CIRCULAR	2.1	0	0	0	1
Pipe_-_(267)	CIRCULAR	2.1	0	0	0	1
Pipe_-_(329)	CIRCULAR	0.525	0	0	0	1
Pipe_-_(330)	CIRCULAR	0.525	0	0	0	1
Pipe_-_(331)	CIRCULAR	0.45	0	0	0	1
Pipe_-_(332)	CIRCULAR	0.375	0	0	0	1
Pipe_-_(333)	CIRCULAR	0.375	0	0	0	1
Pipe_-_(334)	CIRCULAR	0.3	0	0	0	1
Pipe_-_(335)	CIRCULAR	0.3	0	0	0	1
Pipe_-_(337)	CIRCULAR	0.525	0	0	0	1
Pipe_-_(338)	CIRCULAR	0.45	0	0	0	1
Pipe_-_(344)	CIRCULAR	0.3	0	0	0	1
Pipe_-_(345)	CIRCULAR	0.675	0	0	0	1
Pipe_-_(346)	CIRCULAR	0.75	0	0	0	1
Pipe_-_(347)	CIRCULAR	1.5	0	0	0	1
Pipe_-_(349)	CIRCULAR	1.2	0	0	0	1
Pipe_-_(350)	CIRCULAR	1.2	0	0	0	1
Pipe_-_(351)	CIRCULAR	0.675	0	0	0	1
Pipe_-_(352)	CIRCULAR	0.6	0	0	0	1
Pipe_-_(354)	CIRCULAR	0.825	0	0	0	1
Pipe_-_(360)	CIRCULAR	0.375	0	0	0	1
Pipe_-_(366)	CIRCULAR	1.95	0	0	0	1
Pipe_-_(367)	CIRCULAR	1.8	0	0	0	1
Pipe_-_(368)	CIRCULAR	1.65	0	0	0	1
Pipe_-_(4)	CIRCULAR	0.525	0	0	0	1
Pipe_-_(43)	CIRCULAR	1.5	0	0	0	1
Pipe_-_(44)	CIRCULAR	1.5	0	0	0	1
Pipe_-_(45)	CIRCULAR	1.35	0	0	0	1
Pipe_-_(47)	CIRCULAR	1.05	0	0	0	1
Pipe_-_(48)	CIRCULAR	0.825	0	0	0	1
Pipe_-_(49)	CIRCULAR	0.75	0	0	0	1
Pipe_-_(5)	CIRCULAR	0.45	0	0	0	1
Pipe_-_(50)	CIRCULAR	0.825	0	0	0	1
Pipe_-_(51)	CIRCULAR	0.825	0	0	0	1
Pipe_-_(52)	CIRCULAR	0.825	0	0	0	1
Pipe_-_(52)_(1)	CIRCULAR	0.525	0	0	0	1
Pipe_-_(53)	CIRCULAR	0.45	0	0	0	1
Pipe_-_(54)	CIRCULAR	0.45	0	0	0	1
Pipe_-_(54)_(1)	CIRCULAR	0.45	0	0	0	1

Pipe_-_(55)	CIRCULAR	0.3	0	0	0	1
Pipe_-_(56)	CIRCULAR	0.3	0	0	0	1
Pipe_-_(57)	CIRCULAR	0.3	0	0	0	1
Pipe_-_(58)	CIRCULAR	0.6	0	0	0	1
Pipe_-_(58)_(1)	CIRCULAR	0.375	0	0	0	1
Pipe_-_(59)	CIRCULAR	0.375	0	0	0	1
Pipe_-_(6)	CIRCULAR	0.45	0	0	0	1
Pipe_-_(60)	CIRCULAR	0.375	0	0	0	1
Pipe_-_(73)	CIRCULAR	0.975	0	0	0	1
Pipe_-_(77)	CIRCULAR	0.975	0	0	0	1
Pipe_-_(81)	CIRCULAR	0.75	0	0	0	1
Pipe_-_(82)	CIRCULAR	0.675	0	0	0	1
Pipe_-_(83)	CIRCULAR	0.675	0	0	0	1
Pipe_-_(84)	CIRCULAR	0.675	0	0	0	1
Pipe_-_(85)	CIRCULAR	0.525	0	0	0	1
Pipe_-_(86)	CIRCULAR	0.525	0	0	0	1
Pipe_-_(87)	CIRCULAR	0.375	0	0	0	1
C107A-IC(1)	CIRCULAR	0.095	0	0	0	
C107A-IC(2)	CIRCULAR	0.095	0	0	0	
C109A-IC(1)	CIRCULAR	0.165	0	0	0	
C109A-IC(2)	CIRCULAR	0.165	0	0	0	
C109B-IC(1)	CIRCULAR	0.178	0	0	0	
C109B-IC(2)	CIRCULAR	0.178	0	0	0	
C110A-IC(1)	CIRCULAR	0.108	0	0	0	
C121AA-IC(1)	CIRCULAR	0.083	0	0	0	
C121AA-IC(2)	CIRCULAR	0.083	0	0	0	
C121A-IC(1)	CIRCULAR	0.152	0	0	0	
C121A-IC(2)	CIRCULAR	0.152	0	0	0	
C123A-IC(1)	CIRCULAR	0.102	0	0	0	
C123A-IC(2)	CIRCULAR	0.102	0	0	0	
C205A-IC(1)	CIRCULAR	0.127	0	0	0	
C205A-IC(2)	CIRCULAR	0.152	0	0	0	
C219-IC	CIRCULAR	0.102	0	0	0	
C220A-IC(1)	CIRCULAR	0.191	0	0	0	
C220A-IC(2)	CIRCULAR	0.191	0	0	0	
C222A-IC(1)	CIRCULAR	0.203	0	0	0	
C222A-IC(2)	CIRCULAR	0.203	0	0	0	
C223A-IC(1)	CIRCULAR	0.178	0	0	0	
G234A-IC	CIRCULAR	0.083	0	0	0	

L102A-IC(1)	CIRCULAR	0.083	0	0	0
L102A-IC(2)	CIRCULAR	0.083	0	0	0
L103A-IC(1)	CIRCULAR	0.127	0	0	0
L103A-IC(2)	CIRCULAR	0.127	0	0	0
L103A-IC-29	CIRCULAR	0.083	0	0	0
L103B-IC(1)	CIRCULAR	0.083	0	0	0
L103B-IC(2)	CIRCULAR	0.083	0	0	0
L103C-IC	CIRCULAR	0.14	0	0	0
L103D-IC	CIRCULAR	0.127	0	0	0
L104A-IC(1)	CIRCULAR	0.108	0	0	0
L104A-IC(2)	CIRCULAR	0.108	0	0	0
L104A-IC1-29	CIRCULAR	0.083	0	0	0
L104A-IC2-29	CIRCULAR	0.083	0	0	0
L105A-IC(1)	CIRCULAR	0.108	0	0	0
L105A-IC(2)	CIRCULAR	0.108	0	0	0
L106A-IC(1)	CIRCULAR	0.102	0	0	0
L106A-IC(2)	CIRCULAR	0.102	0	0	0
L106A-IC-29	CIRCULAR	0.152	0	0	0
L106B-IC(1)	CIRCULAR	0.083	0	0	0
L112A-IC(1)	CIRCULAR	0.127	0	0	0
L112A-IC(2)	CIRCULAR	0.127	0	0	0
L113A-IC(1)	CIRCULAR	0.108	0	0	0
L113A-IC(2)	CIRCULAR	0.108	0	0	0
L113B-IC	CIRCULAR	0.108	0	0	0
L114A-IC	CIRCULAR	0.108	0	0	0
L115A-IC(1)	CIRCULAR	0.083	0	0	0
L115A-IC(2)	CIRCULAR	0.083	0	0	0
L116A-IC(1)	CIRCULAR	0.095	0	0	0
L116A-IC(2)	CIRCULAR	0.095	0	0	0
L117A-IC(1)	CIRCULAR	0.127	0	0	0
L117A-IC(2)	CIRCULAR	0.127	0	0	0
L117B-IC(1)	CIRCULAR	0.083	0	0	0
L117B-IC(2)	CIRCULAR	0.083	0	0	0
L117C-IC	CIRCULAR	0.14	0	0	0
L118A-IC(1)	CIRCULAR	0.127	0	0	0
L118A-IC(2)	CIRCULAR	0.127	0	0	0
L119A-IC(1)	CIRCULAR	0.108	0	0	0
L119A-IC(2)	CIRCULAR	0.108	0	0	0
L124A-IC(1)	CIRCULAR	0.095	0	0	0

```
L124A-IC(2)      CIRCULAR     0.095           0          0          0
L124B-IC         CIRCULAR     0.095           0          0          0
L126A-IC(1)      CIRCULAR     0.083           0          0          0
L126B-IC(1)      CIRCULAR     0.102           0          0          0
L126B-IC(2)      CIRCULAR     0.102           0          0          0
L126C-IC         CIRCULAR     0.083           0          0          0
L127A-IC(1)      CIRCULAR     0.127           0          0          0
L127A-IC(2)      CIRCULAR     0.127           0          0          0
L128A-IC(1)      CIRCULAR     0.102           0          0          0
L128A-IC(2)      CIRCULAR     0.102           0          0          0
L130A-IC(1)      CIRCULAR     0.127           0          0          0
L130A-IC(2)      CIRCULAR     0.127           0          0          0
L130B-IC         CIRCULAR     0.108           0          0          0
L202A-IC(1)      CIRCULAR     0.083           0          0          0
L202A-IC(2)      CIRCULAR     0.083           0          0          0
L202B-IC         CIRCULAR     0.108           0          0          0
L204A-IC(1)      CIRCULAR     0.127           0          0          0
L204A-IC(2)      CIRCULAR     0.127           0          0          0
L204B-IC(1)      CIRCULAR     0.127           0          0          0
L204B-IC(2)      CIRCULAR     0.127           0          0          0
L205B-IC         CIRCULAR     0.127           0          0          0
L206A-IC(1)      CIRCULAR     0.108           0          0          0
L206A-IC(2)      CIRCULAR     0.108           0          0          0
L206B-IC(1)      CIRCULAR     0.14            0          0          0
L207A-IC(1)      CIRCULAR     0.152           0          0          0
L207A-IC(2)      CIRCULAR     0.152           0          0          0
L209A-IC(1)      CIRCULAR     0.127           0          0          0
L209A-IC(2)      CIRCULAR     0.127           0          0          0
L209B-IC         CIRCULAR     0.102           0          0          0
L209C-IC         CIRCULAR     0.108           0          0          0
L210A-IC(1)      CIRCULAR     0.102           0          0          0
L210A-IC(2)      CIRCULAR     0.102           0          0          0
L210B-IC         CIRCULAR     0.108           0          0          0
L211A-IC(1)      CIRCULAR     0.127           0          0          0
L211A-IC(2)      CIRCULAR     0.127           0          0          0
L213A-IC(1)      CIRCULAR     0.095           0          0          0
L213A-IC(2)      CIRCULAR     0.095           0          0          0
L214A-IC(1)      CIRCULAR     0.152           0          0          0
L214A-IC(2)      CIRCULAR     0.152           0          0          0
```

```
L217A-IC(1)      CIRCULAR     0.127           0          0          0
L217A-IC(2)      CIRCULAR     0.127           0          0          0
L218B-IC         CIRCULAR     0.095           0          0          0
L219B-IC(1)      CIRCULAR     0.127           0          0          0
L219B-IC(2)      CIRCULAR     0.127           0          0          0
L220A-S          CIRCULAR     0.178           0          0          0
L225A-IC(1)      CIRCULAR     0.127           0          0          0
L225A-IC(2)      CIRCULAR     0.108           0          0          0
L226A-IC(1)      CIRCULAR     0.127           0          0          0
L226A-IC(2)      CIRCULAR     0.108           0          0          0
L228A-IC(1)      CIRCULAR     0.152           0          0          0
L228A-IC(2)      CIRCULAR     0.127           0          0          0
L229A-IC(1)      CIRCULAR     0.127           0          0          0
L229A-IC(2)      CIRCULAR     0.127           0          0          0
L234A-IC(1)      CIRCULAR     0.108           0          0          0
L234A-IC(2)      CIRCULAR     0.108           0          0          0
L234B-IC(1)      CIRCULAR     0.095           0          0          0
L234B-IC(2)      CIRCULAR     0.095           0          0          0
L237A-IC(1)      CIRCULAR     0.102           0          0          0
L237A-IC(2)      CIRCULAR     0.102           0          0          0
L238A-IC         CIRCULAR     0.203           0          0          0
L240A-IC(1)      CIRCULAR     0.102           0          0          0
L240A-IC(2)      CIRCULAR     0.102           0          0          0
L240B-IC(1)      CIRCULAR     0.127           0          0          0
L240B-IC(2)      CIRCULAR     0.127           0          0          0
L241A-IC(1)      CIRCULAR     0.108           0          0          0
L241A-IC(2)      CIRCULAR     0.108           0          0          0
OR1              CIRCULAR     0.45            0          0          0
Spillway         RECT_OPEN    0.6             20         10         10
W103A-29         RECT_OPEN    0.15            6.7        0          0
W104A-29         RECT_OPEN    0.15            14.8       0          0
W106A-29         RECT_OPEN    0.15            8          0          0
W2               RECT_OPEN    0.8             2          0          0

[TRANSECTS]
;;Transect Data in HEC-2 format
;
;Full street, width = 10m, curb = 0.15m , cross-slope = 0.02m/m, bank-slope = 0.02m/m, bank-height = 0.23m.
NC 0.02     0.02     0.014
```

```
X1 10mROW           7       4       14      0.0     0.0     0.0     0.0     0.0
GR 0.23     0       0.15    4       0       4       0.1     9       0       14
GR 0.15     14      0.23    18
;
;Full street, width = 8.5m, curb = 0.15m , cross-slope = 0.02m/m, bank-slope = 0.02m/m, bank-height =
0.23m.
NC 0.02     0.02    0.013
X1 16.5mROW         7       4       12.5    0.0     0.0     0.0     0.0     0.0
GR 0.23     0       0.15    4       0       4       0.13    8.25    0       12.5
GR 0.15     12.5    0.23    16.5
;
;Half street, width = 4.25m, curb = 0.15m , cross-slope = 0.03m/m, bank-slope = 0.02m/m, bank-height =
0.23m.
NC 0.02     0.02    0.013
X1 16.5mROW_half    4       0.0     4.25    0.0     0.0     0.0     0.0     0.0
GR 0.13     0       0       4.25    0.15    4.25    0.23    8.25
;
;Full street, width = 8.5m, curb = 0.15m , cross-slope = 0.03m/m, bank-slope = 0.02m/m, bank-height =
0.245m.
NC 0.025    0.025   0.013
X1 18mROW           7       10      18.5    0.0     0.0     0.0     0.0     0.0
GR 0.35     0       0.15    10      0       10      0.13    14.25   0       18.5
GR 0.15     18.5    0.35    28.5
;
;Half street, width = 4.25m, curb = 0.15m , cross-slope = 0.03m/m, bank-slope = 0.02m/m, bank-height =
0.245m.
NC 0.02     0.02    0.013
X1 18mROW_half      4       0.0     4.25    0.0     0.0     0.0     0.0     0.0
GR 0.13     0       0       4.25    0.15    4.25    0.25    9
;
;Full street, width = 8.5m, curb = 0.15m , cross-slope = 0.03m/m, bank-slope = 0.02m/m, bank-height =
0.27m.
NC 0.025    0.025   0.013
X1 20mROW           7       10      18.5    0.0     0.0     0.0     0.0     0.0
GR 0.35     0       0.15    10      0       10      0.13    14.25   0       18.5
GR 0.15     18.5    0.35    28.5
;
;Half street, width = 4.25m, curb = 0.15m , cross-slope = 0.03m/m, bank-slope = 0.02m/m, bank-height =
0.27m.
```

```
NC 0.02     0.02    0.013
X1 20mROW_half      4       0.0     4.25    0.0     0.0     0.0     0.0     0.0
GR 0.13     0       0       4.25    0.15    4.25    0.27    10
;
;Full street, width = 24m, curb = 0.15m , cross-slope = 0.016m/m, bank-slope = 0.02m/m, bank-height =
0.23m.
NC 0.025    0.025   0.014
X1 24mROW           7       10      21      0.0     0.0     0.0     0.0     0.0
GR 0.35     0       0.15    10      0       10      0.165   15.5    0       21
GR 0.15     21      0.35    31
;
;Half street, width = 5.5m, curb = 0.15m , cross-slope = 0.03m/m, bank-slope = 0.02m/m, bank-height =
0.28m.
NC 0.02     0.02    0.013
X1 24mROW_half      4       0.0     5.5     0.0     0.0     0.0     0.0     0.0
GR 0.17     0       0       5.5     0.15    5.5     0.28    12
;
;Full street, width = 5.5m, curb = 0.15m , cross-slope = 0.03m/m, bank-slope = 0.02m/m, bank-height =
0.23m.
NC 0.025    0.025   0.013
X1 8.5mROW          7       10      15.5    0.0     0.0     0.0     0.0     0.0
GR 0.35     0       0.15    10      0       10      0.13    12.75   0       15.5
GR 0.15     15.5    0.35    25.5
;
;Half street, width = 2.75m, curb = 0.15m , cross-slope = 0.03m/m, bank-slope = 0.02m/m, bank-height =
0.18m.
NC 0.02     0.02    0.013
X1 8.5mROW_half     4       0.0     2.75    0.0     0.0     0.0     0.0     0.0
GR 0.08     0       0       2.75    0.15    2.75    0.18    4.25
;
NC 0.013    0.025   0.013
X1 Access           6       0.0     9.5     0.0     0.0     0.0     0.0     0.0
GR 0.28     0       0.25    1.5     0.1     1.5     0       9.5     0.15    9.5
GR 0.21     12.5
;
NC 0.025    0.025   0.013
X1 Block94-107      6       3       6       0.0     0.0     0.0     0.0     0.0
GR 0.15     0       0       1.5     0       3       0       6       0       7.5
GR 0.15     9
```

C.5 KW SUBDIVISION ASSESSMENT PCSWMM OUTPUT FILE

```
EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.014)
--------------------------------------------------------------

Ultimate Kanata West Pond 5

WARNING 03: negative offset ignored for Link C180
WARNING 03: negative offset ignored for Link Pipe_-_(350)
WARNING 03: negative offset ignored for Link Pipe_-_(43)

*********************************************************
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 ........ YES
  Water Quality .......... NO
Infiltration Method ...... HORTON
Flow Routing Method ...... DYNWAVE
Surcharge Method ......... EXTRAN
Starting Date ............ 07/23/2009 00:00:00
Ending Date .............. 07/25/2009 00:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:01:00
Wet Time Step ............ 00:01:00
Dry Time Step ............ 01:00:00
Routing Time Step ........ 5.00 sec
Variable Time Step ....... NO
```

```
Maximum Trials ........... 8
Number of Threads ........ 4
Head Tolerance ........... 0.001500 m


**************************        Volume         Depth
Runoff Quantity Continuity     hectare-m            mm
**************************     ---------       -------
Initial LID Storage ......         0.050         1.033
Total Precipitation ......         4.141        85.997
Evaporation Loss .........         0.000         0.000
Infiltration Loss ........         0.832        17.281
Surface Runoff ...........         3.314        68.818
Final Storage ............         0.050         1.033
Continuity Error (%) .....        -0.117


**************************        Volume        Volume
Flow Routing Continuity        hectare-m      10^6 ltr
**************************     ---------     ---------
Dry Weather Inflow .......         0.000         0.000
Wet Weather Inflow .......         3.314        33.137
Groundwater Inflow .......         0.000         0.000
RDII Inflow ..............         0.000         0.000
External Inflow ..........         2.931        29.311
External Outflow .........         6.247        62.473
Flooding Loss ............         0.000         0.000
Evaporation Loss .........         0.000         0.000
Exfiltration Loss ........         0.000         0.000
Initial Stored Volume ....         3.175        31.749
Final Stored Volume ......         3.177        31.775
Continuity Error (%) .....        -0.054


*************************
Highest Continuity Errors
*************************
Node 131 (-4.55%)
Node 209B-S (-4.52%)
```

Node J4 (-4.15%)
Node 209A-S (-3.55%)
Node 222A-S(1) (-3.40%)

****
Highest Flow Instability Indexes
****
Link G234A-IC (83)
Link W2 (45)
Link OR1 (45)
Link B2-IC (43)
Link outlet (40)

****
Routing Time Step Summary
****
Minimum Time Step : 5.00 sec
Average Time Step : 5.00 sec
Maximum Time Step : 5.00 sec
Percent in Steady State : 0.00
Average Iterations per Step : 5.79
Percent Not Converging : 41.11

****
Subcatchment Runoff Summary
****

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Imperv Runoff mm	Perv Runoff mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff LPS	Runoff Coeff
Arterial	86.00	0.00	0.00	13.44	61.51	11.15	72.65	2.32	1784.71	0.845
B-1	86.00	0.00	0.00	22.78	49.19	28.85	63.28	0.70	490.63	0.736
B-2	86.00	0.00	0.00	13.57	61.49	11.02	72.51	0.50	377.03	0.843
C107A	86.00	0.00	0.00	14.25	60.26	11.57	71.83	0.13	100.28	0.835
C109A	86.00	0.00	0.00	14.16	60.27	11.66	71.94	0.31	237.67	0.836
C109B	86.00	0.00	0.00	12.79	62.73	10.57	73.30	0.28	211.66	0.852
C110A	86.00	0.00	0.00	15.58	57.81	12.70	70.51	0.08	63.83	0.820
C121A	86.00	0.00	0.00	15.00	59.03	12.04	71.07	0.27	203.64	0.826
C121AA	86.00	0.00	0.00	16.81	55.36	13.93	69.29	0.06	49.89	0.806
C123A	86.00	0.00	0.00	15.77	57.80	12.50	70.30	0.14	103.07	0.817
C205A	86.00	0.00	0.00	15.46	57.82	12.82	70.64	0.19	145.67	0.821
C206B	86.00	0.00	0.00	13.35	61.52	11.25	72.77	0.12	97.21	0.846
C219A	86.00	0.00	0.00	14.62	59.07	12.46	71.52	0.06	51.33	0.832
C220A	86.00	0.00	0.00	11.38	65.20	9.53	74.73	0.30	232.03	0.869
C222A	86.00	0.00	0.00	13.97	60.30	11.86	72.16	0.38	298.44	0.839
C223A	86.00	0.00	0.00	12.68	62.75	10.69	73.44	0.12	91.53	0.854
Comm	86.00	0.00	0.00	3.33	79.92	2.82	82.75	1.65	1173.68	0.962
EXT1	86.00	0.00	0.00	18.14	52.91	15.06	67.97	0.08	68.50	0.790

EXT2	86.00	0.00	0.00	15.41	57.83	12.87	70.70	0.05	40.33	0.822
EXT3	86.00	0.00	0.00	20.09	49.22	16.80	66.02	0.06	53.97	0.768
EXT4	86.00	0.00	0.00	25.46	46.76	60.68	60.68	0.32	298.04	0.706
EXT5	86.00	0.00	0.00	38.17	20.90	47.93	47.93	0.05	60.82	0.557
EXT6	86.00	0.00	0.00	31.89	34.45	54.23	54.23	0.06	64.50	0.631
F101A-1A	86.00	0.00	0.00	28.42	43.05	57.67	57.67	0.40	306.94	0.671
G234A	86.00	0.00	0.00	38.31	24.61	47.75	47.75	0.46	305.08	0.555
Hazeldean	86.00	0.00	0.00	13.43	61.51	11.17	72.68	2.87	2219.07	0.845
L102A	86.00	0.00	0.00	19.71	50.44	15.94	66.37	0.15	117.42	0.772
L103A	86.00	0.00	0.00	13.44	61.51	11.15	72.66	0.28	217.49	0.845
L103A-29	86.00	0.00	0.00	6.62	73.83	5.70	79.53	0.05	37.13	0.925
L103B	86.00	0.00	0.00	19.10	51.66	15.32	66.98	0.14	103.87	0.779
L103C	86.00	0.00	0.00	32.36	34.45	53.74	53.74	0.34	317.86	0.625
L103D	86.00	0.00	0.00	33.54	31.99	52.56	52.56	0.29	272.58	0.611
L104A	86.00	0.00	0.00	14.85	59.04	12.20	71.24	0.24	183.03	0.828
L104A-29	86.00	0.00	0.00	8.62	70.14	7.38	77.53	0.10	75.86	0.901
L105A	86.00	0.00	0.00	12.05	63.97	10.08	74.05	0.24	184.03	0.861
L106A	86.00	0.00	0.00	11.40	65.19	9.50	74.70	0.18	138.44	0.869
L106A-29	86.00	0.00	0.00	9.97	67.67	8.48	76.16	0.16	120.80	0.886
L106B	86.00	0.00	0.00	14.17	60.27	11.65	71.93			

								0.05	40.54	0.836
L112A	86.00	0.00	0.00	15.51	57.82	12.77	70.59	0.29	226.83	0.821
L113A	86.00	0.00	0.00	14.15	60.27	11.67	71.95	0.24	181.98	0.837
L113B	86.00	0.00	0.00	35.86	27.07	50.24	50.24	0.25	239.05	0.584
L114A	86.00	0.00	0.00	14.63	59.07	12.44	71.50	0.04	32.79	0.831
L115A	86.00	0.00	0.00	14.86	59.04	12.18	71.23	0.12	90.21	0.828
L116A	86.00	0.00	0.00	14.15	60.27	11.67	71.94	0.16	123.15	0.837
L117A	86.00	0.00	0.00	12.76	62.73	10.60	73.34	0.31	238.82	0.853
L117B	86.00	0.00	0.00	21.86	46.75	17.47	64.22	0.09	72.22	0.747
L117C	86.00	0.00	0.00	33.49	31.99	52.61	52.61	0.35	332.74	0.612
L118A	86.00	0.00	0.00	16.22	56.58	13.29	69.87	0.31	240.00	0.812
L119A	86.00	0.00	0.00	14.24	60.27	11.58	71.84	0.22	169.01	0.835
L121B	86.00	0.00	0.00	3.33	79.92	2.82	82.75	1.21	864.79	0.962
L124A	86.00	0.00	0.00	16.13	56.59	13.38	69.97	0.16	128.27	0.814
L124B	86.00	0.00	0.00	35.20	28.30	50.90	50.90	0.20	198.81	0.592
L126A	86.00	0.00	0.00	11.30	65.22	9.62	74.84	0.02	18.35	0.870
L126B	86.00	0.00	0.00	13.51	61.50	11.08	72.58	0.19	145.19	0.844
L126C	86.00	0.00	0.00	47.84	6.15	38.19	38.19	0.18	97.10	0.444
L127A	86.00	0.00	0.00	16.22	56.58	13.29	69.87	0.27	206.76	0.812
L128A	86.00	0.00	0.00	16.46	56.57	13.04	69.61	0.22	163.72	0.809

L130A	86.00	0.00	0.00	14.15	60.27	11.67	71.94	0.33	251.16	0.837
L130B	86.00	0.00	0.00	32.03	34.45	54.09	54.09	0.12	123.13	0.629
L202A	86.00	0.00	0.00	20.92	47.99	17.19	65.18	0.14	110.14	0.758
L202B	86.00	0.00	0.00	27.55	43.07	58.59	58.59	0.14	138.95	0.681
L204A	86.00	0.00	0.00	11.32	65.21	9.59	74.80	0.32	242.87	0.870
L204B	86.00	0.00	0.00	14.01	60.29	11.82	72.11	0.28	221.23	0.839
L205B	86.00	0.00	0.00	33.84	30.76	52.27	52.27	0.25	257.05	0.608
L206A	86.00	0.00	0.00	11.32	65.21	9.59	74.80	0.23	178.29	0.870
L207A	86.00	0.00	0.00	16.76	55.37	13.98	69.35	0.40	323.14	0.806
L209A	86.00	0.00	0.00	14.04	60.29	11.79	72.08	0.25	198.45	0.838
L209B	86.00	0.00	0.00	15.27	57.83	13.03	70.87	0.11	90.70	0.824
L209C	86.00	0.00	0.00	32.65	33.22	53.47	53.47	0.22	220.35	0.622
L210A	86.00	0.00	0.00	15.42	57.83	12.86	70.69	0.18	140.87	0.822
L210B	86.00	0.00	0.00	32.55	33.22	53.57	53.57	0.14	143.55	0.623
L211A	86.00	0.00	0.00	11.99	63.98	10.16	74.14	0.30	229.89	0.862
L213A	86.00	0.00	0.00	14.08	60.28	11.74	72.02	0.19	147.89	0.838
L214A	86.00	0.00	0.00	12.65	62.75	10.72	73.47	0.40	316.24	0.854
L217A	86.00	0.00	0.00	14.67	59.06	12.40	71.46	0.29	228.63	0.831
L218A	86.00	0.00	0.00	15.57	61.49	27.47	70.52	1.89	1477.18	0.820
L218B	86.00	0.00	0.00	33.71	30.76	52.40	52.40	0.13	137.17	0.609
L219B	86.00	0.00	0.00	14.80	59.05	12.25	71.30	0.26	200.62	0.829
L220A	86.00	0.00	0.00	34.41	29.53	51.70	51.70	0.45	461.52	0.601
L225A	86.00	0.00	0.00	13.33	61.52	11.27	72.80	0.20	156.44	0.846
L225B	86.00	0.00	0.00	8.24	73.79	26.20	77.86	2.02	1526.76	0.905
L226A	86.00	0.00	0.00	13.43	61.51	11.17	72.68	0.22	170.26	0.845
L228A	86.00	0.00	0.00	13.43	61.51	11.16	72.67	0.26	198.09	0.845
L229A	86.00	0.00	0.00	13.38	61.52	11.22	72.73	0.15	116.30	0.846
L234A	86.00	0.00	0.00	14.08	60.28	11.74	72.03	0.24	184.00	0.838
L234B	86.00	0.00	0.00	14.02	60.29	11.81	72.11	0.16	129.54	0.838
L237A	86.00	0.00	0.00	16.00	56.60	13.52	70.13	0.19	150.89	0.815
L238A	86.00	0.00	0.00	26.22	45.53	59.91	59.91	0.39	370.78	0.697
L240A	86.00	0.00	0.00	11.97	63.99	10.18	74.16	0.18	138.30	0.862
L240B	86.00	0.00	0.00	12.65	62.76	10.73	73.48	0.27	208.72	0.854
L241A	86.00	0.00	0.00	13.95	60.30	11.89	72.19	0.22	177.34	0.839
POND	86.00	0.00	0.00	22.37	51.65	43.05	63.72	1.63	1273.89	0.741
UNC-1	86.00	0.00	0.00	13.22	61.48	11.43	72.91	0.05	35.73	0.848
UNC-1-29	86.00	0.00	0.00	43.42	7.37	42.79	42.79	0.05	56.74	0.498
UNC-2	86.00	0.00	0.00	13.22	61.49	11.42	72.91	0.05	37.85	0.848
UNC-2-29	86.00	0.00	0.00	21.91	45.51	18.70	64.21	0.03	24.64	0.747

UNC-3	86.00	0.00	0.00	13.22	61.49	11.42	72.91	0.05	41.27	0.848
UNC-3-29	86.00	0.00	0.00	21.23	46.74	18.15	64.89	0.03	26.30	0.755
UNC-4	86.00	0.00	0.00	13.22	61.49	11.42	72.91	0.05	40.48	0.848
UNC-4-29	86.00	0.00	0.00	27.22	35.66	23.24	58.90	0.03	25.47	0.685
UNC-5	86.00	0.00	0.00	6.62	73.83	5.69	79.52	0.24	177.76	0.925
UNC-5-29	86.00	0.00	0.00	23.93	41.82	20.36	62.18	0.06	52.40	0.723
UNC-6	86.00	0.00	0.00	6.61	73.83	5.71	79.54	0.12	91.10	0.925
UNC-7	86.00	0.00	0.00	6.61	73.83	5.71	79.54	0.13	92.15	0.925
UNC-8	86.00	0.00	0.00	6.60	73.80	5.73	79.53	0.08	56.67	0.925

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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
J6	JUNCTION	0.04	0.21	94.77	0	01:12	0.21
J9	JUNCTION	1.84	1.87	94.62	0	16:17	1.87
CREEK	OUTFALL	0.00	0.00	0.00	0	00:00	0.00
CREEK-1	OUTFALL	0.00	0.00	0.00	0	00:00	0.00
OF10	OUTFALL	0.00	0.05	95.05	0	01:00	0.05
OF11	OUTFALL	0.00	0.17	100.17	0	01:00	0.17
OF-1-29	OUTFALL	0.00	0.00	0.00	0	00:00	0.00
OF13	OUTFALL	0.00	0.14	97.84	0	01:00	0.13
OF14	OUTFALL	0.00	0.25	97.95	0	01:00	0.25
OF2	OUTFALL	1.59	1.59	94.60	0	00:00	1.59
OF3	OUTFALL	0.00	0.08	95.98	0	01:00	0.08
OF4	OUTFALL	0.00	0.03	96.94	0	01:00	0.03
OF5	OUTFALL	0.00	0.05	98.40	0	01:00	0.05
OF6	OUTFALL	0.00	0.14	97.14	0	01:00	0.14
OF7	OUTFALL	0.00	0.03	99.03	0	01:04	0.03
OF8	OUTFALL	2.00	2.00	94.60	0	00:00	2.00
OF9	OUTFALL	0.00	0.07	95.07	0	01:15	0.07
100A	STORAGE	3.12	3.63	95.12	0	01:13	3.63
100B	STORAGE	3.11	3.65	95.15	0	01:10	3.65
100C	STORAGE	1.71	2.22	95.12	0	01:12	2.22
100D	STORAGE	1.77	2.30	95.14	0	01:12	2.30
100E	STORAGE	1.11	1.61	95.11	0	01:12	1.61
101	STORAGE	1.63	2.26	95.24	0	01:13	2.26
101A-29	STORAGE	0.31	1.03	95.87	0	01:13	1.03
102	STORAGE	1.49	2.14	95.27	0	01:14	2.14
102-29	STORAGE	0.31	1.00	95.92	0	01:13	1.00
102A	STORAGE	1.03	1.69	95.27	0	01:14	1.69
102A-S	STORAGE	0.00	0.05	97.40	0	01:23	0.05
102A-S(1)	STORAGE	0.05	1.65	97.41	0	01:23	1.65
102A-S(2)	STORAGE	0.00	0.07	97.49	0	01:18	0.07
103	STORAGE	0.94	1.61	95.29	0	01:13	1.61
103-29	STORAGE	0.31	0.97	95.97	0	01:13	0.97
103A-S	STORAGE	0.03	1.62	97.50	0	01:01	1.62
103A-S(1)	STORAGE	0.00	0.05	97.50	0	01:02	0.05
103B-S	STORAGE	0.04	1.72	97.36	0	01:01	1.72
104	STORAGE	0.56	1.26	95.32	0	01:13	1.26
104-29	STORAGE	0.31	0.76	96.02	0	01:13	0.76
104A-S	STORAGE	0.03	1.62	97.70	0	01:13	1.62
104A-S(1)	STORAGE	0.00	0.05	97.70	0	01:14	0.05
105	STORAGE	0.32	0.90	95.41	0	01:14	0.90
105A-S	STORAGE	0.00	0.06	97.85	0	01:11	0.06
105A-S(1)	STORAGE	0.04	1.71	97.82	0	01:19	1.71
106	STORAGE	0.31	0.73	95.45	0	01:14	0.73
106-29	STORAGE	0.31	0.85	96.18	0	01:14	0.85
106A-S	STORAGE	0.00	0.00	97.88	0	00:00	0.00
106A-S(1)	STORAGE	0.02	1.53	97.80	0	01:11	1.52
106A-S(2)	STORAGE	0.00	0.08	97.79	0	01:11	0.08
106B-S	STORAGE	0.04	2.65	97.79	0	01:10	2.65
107	STORAGE	0.31	1.43	95.74	0	01:14	1.43

107A-S	STORAGE	0.00	0.07	97.87	0	01:08	0.07
107A-S(1)	STORAGE	0.03	1.65	97.86	0	01:10	1.65
108	STORAGE	0.32	1.38	95.85	0	01:14	1.38
109	STORAGE	0.25	1.16	96.11	0	01:14	1.16
109A-S	STORAGE	0.03	1.70	97.90	0	01:08	1.70
109A-S(1)	STORAGE	0.00	0.11	97.90	0	01:09	0.11
109B-S	STORAGE	0.02	1.54	97.75	0	01:00	1.54
109B-S(1)	STORAGE	0.00	0.03	97.90	0	01:08	0.03
109B-S(3)	STORAGE	0.00	0.10	98.11	0	01:07	0.10
110	STORAGE	0.24	1.20	95.89	0	01:14	1.20
110A-S	STORAGE	0.02	1.55	97.92	0	01:07	1.55
111	STORAGE	0.29	1.19	95.95	0	01:15	1.19
112	STORAGE	0.29	1.18	96.13	0	01:15	1.18
112A-S	STORAGE	0.00	0.11	98.20	0	01:04	0.11
112A-S(1)	STORAGE	0.03	1.72	98.12	0	01:07	1.72
113	STORAGE	0.28	0.91	96.21	0	01:15	0.91
113A-S	STORAGE	0.00	0.09	98.26	0	01:02	0.09
113A-S(1)	STORAGE	0.04	1.74	98.21	0	01:03	1.74
114	STORAGE	0.69	1.37	95.30	0	01:14	1.37
114A-S	STORAGE	0.04	1.60	97.29	0	01:02	1.60
115	STORAGE	0.50	1.26	95.38	0	01:14	1.26
115A	STORAGE	0.43	1.19	95.39	0	01:14	1.19
115A-S	STORAGE	0.04	1.67	97.46	0	01:12	1.67
115A-S(1)	STORAGE	0.00	0.10	97.43	0	01:13	0.10
116	STORAGE	0.33	0.73	95.53	0	01:15	0.73
116A-S	STORAGE	0.05	1.71	97.53	0	01:11	1.71
116A-S(1)	STORAGE	0.00	0.11	97.52	0	01:11	0.11
117	STORAGE	0.32	1.06	95.47	0	01:15	1.06
117A-S	STORAGE	0.03	1.67	97.55	0	01:08	1.67
117A-S(1)	STORAGE	0.00	0.03	97.55	0	01:10	0.03
117B-S	STORAGE	0.04	1.71	97.52	0	01:11	1.71
118	STORAGE	0.31	0.71	95.67	0	01:15	0.71
118A-S	STORAGE	0.03	1.61	97.61	0	01:03	1.61
118A-S(1)	STORAGE	0.00	0.04	97.61	0	01:02	0.04
119	STORAGE	1.12	1.92	95.42	0	01:13	1.92
119A-S	STORAGE	0.04	1.65	97.49	0	01:18	1.65
120A-S(1)	STORAGE	0.00	0.08	97.70	0	01:13	0.08
121	STORAGE	0.34	1.30	95.58	0	01:13	1.30
121A	STORAGE	0.31	0.57	95.59	0	01:10	0.57

121AA-S	STORAGE	0.02	1.43	97.36	0	01:00	1.43
121A-S	STORAGE	0.00	0.09	97.81	0	01:10	0.09
121A-S(1)	STORAGE	0.00	0.00	98.05	0	00:00	0.00
121A-S(2)	STORAGE	0.03	1.72	97.70	0	01:13	1.72
121B-S	STORAGE	0.05	2.19	98.04	0	01:04	2.19
123	STORAGE	0.32	1.07	95.78	0	01:12	1.07
123A-S	STORAGE	0.03	1.54	97.85	0	01:09	1.54
124	STORAGE	0.32	0.77	96.34	0	01:02	0.77
124A-S	STORAGE	0.04	1.66	98.21	0	01:08	1.66
124A-S(1)	STORAGE	0.00	0.09	98.19	0	01:09	0.09
125	STORAGE	0.32	0.78	96.48	0	01:01	0.78
126	STORAGE	0.32	0.87	96.96	0	01:01	0.87
126A-S	STORAGE	0.03	1.63	99.16	0	01:02	1.63
126B-S	STORAGE	0.00	0.09	99.14	0	01:03	0.09
126B-S(1)	STORAGE	0.04	1.67	98.66	0	01:07	1.67
126B-S(2)	STORAGE	0.00	0.08	98.65	0	01:07	0.08
126C-S	STORAGE	0.03	2.61	99.10	0	01:32	2.61
127	STORAGE	0.31	0.50	97.93	0	00:53	0.50
127A-S	STORAGE	0.00	0.00	100.62	0	00:00	0.00
127A-S(1)	STORAGE	0.02	1.45	99.22	0	01:00	1.45
128	STORAGE	0.24	0.61	97.06	0	01:01	0.61
128A-S(1)	STORAGE	0.04	1.67	99.16	0	01:02	1.67
129	STORAGE	0.31	0.60	97.13	0	01:02	0.60
130	STORAGE	0.31	0.57	97.70	0	00:58	0.57
130A-S	STORAGE	0.02	1.55	99.49	0	01:00	1.55
130A-S(1)	STORAGE	0.00	0.07	99.46	0	01:00	0.07
131	STORAGE	0.30	0.40	97.70	0	00:57	0.40
132	STORAGE	0.00	0.00	97.56	0	00:00	0.00
201	STORAGE	3.15	3.82	95.28	0	01:08	3.82
202	STORAGE	3.04	3.86	95.44	0	01:08	3.86
202A-S	STORAGE	0.00	0.09	97.65	0	01:17	0.09
202A-S(1)	STORAGE	0.05	1.72	97.61	0	01:13	1.72
203A-S	STORAGE	0.00	0.10	97.71	0	01:14	0.10
204	STORAGE	2.16	3.27	95.74	0	01:07	3.27
204A-S	STORAGE	0.00	0.11	97.77	0	01:11	0.11
204A-S(1)	STORAGE	0.04	1.72	97.73	0	01:13	1.72
204BS(1)	STORAGE	0.04	1.69	97.66	0	01:16	1.69
205	STORAGE	1.85	3.18	95.96	0	01:03	3.18
205A-S	STORAGE	0.00	0.28	97.79	0	01:10	0.28

205A-S(1)	STORAGE	0.03	1.72	97.79	0	01:10	1.72
206	STORAGE	1.68	3.25	96.20	0	01:02	3.25
206A-S	STORAGE	0.00	0.11	98.99	0	01:01	0.11
206A-S(1)	STORAGE	0.03	1.67	98.58	0	01:01	1.67
206B-S	STORAGE	0.00	0.11	98.53	0	01:02	0.11
206B-S(1)	STORAGE	0.02	1.53	97.92	0	01:03	1.53
206B-Sl	STORAGE	0.00	0.13	98.08	0	01:07	0.13
207	STORAGE	0.41	2.75	97.00	0	01:01	2.75
207A-S(1)	STORAGE	0.03	1.73	99.03	0	01:00	1.73
209	STORAGE	0.37	2.76	97.46	0	01:01	2.76
209A-S	STORAGE	0.02	1.45	99.66	0	01:00	1.45
209B-S	STORAGE	0.02	1.43	100.08	0	01:00	1.43
209B-S(1)	STORAGE	0.00	0.00	100.50	0	00:00	0.00
210	STORAGE	2.71	3.77	95.68	0	01:08	3.77
210A-S	STORAGE	0.04	1.66	97.65	0	01:17	1.66
211	STORAGE	2.38	3.49	95.74	0	01:09	3.49
211A-S	STORAGE	0.00	0.03	98.04	0	01:01	0.03
211A-S(1)	STORAGE	0.03	1.65	98.02	0	01:05	1.65
211A-S(2)	STORAGE	0.00	0.00	98.21	0	00:00	0.00
212	STORAGE	2.23	3.41	95.80	0	01:09	3.41
213	STORAGE	1.16	2.37	95.83	0	01:09	2.37
213A-S	STORAGE	0.03	1.60	98.04	0	01:00	1.60
214	STORAGE	0.33	1.50	95.93	0	01:09	1.49
214A-S	STORAGE	0.00	0.04	98.06	0	01:10	0.04
214A-S(1)	STORAGE	0.03	1.67	97.97	0	01:10	1.67
214A-S(2)	STORAGE	0.00	0.00	98.26	0	00:00	0.00
215	STORAGE	0.24	1.03	96.05	0	01:10	1.03
216	STORAGE	0.24	0.97	96.09	0	01:10	0.97
217	STORAGE	0.23	0.87	96.17	0	01:10	0.87
217A-S	STORAGE	0.03	1.62	98.05	0	01:03	1.62
217A-S(1)	STORAGE	0.00	0.00	98.11	0	00:00	0.00
217A-S(2)	STORAGE	0.00	0.00	98.11	0	00:00	0.00
218	STORAGE	0.95	2.24	95.91	0	01:09	2.23
219	STORAGE	0.73	2.09	95.99	0	01:09	2.09
219A-S	STORAGE	0.00	0.14	98.21	0	01:05	0.14
219A-S(1)	STORAGE	0.02	1.65	98.09	0	01:07	1.65
219A-S(2)	STORAGE	0.00	0.17	98.39	0	01:07	0.16
219B-S	STORAGE	0.05	1.78	98.38	0	01:07	1.78
219B-S(1)	STORAGE	0.00	0.07	98.39	0	01:09	0.07

220	STORAGE	0.09	0.98	96.06	0	01:09	0.98
220A-S	STORAGE	0.02	1.73	98.09	0	01:07	1.73
220A-S(1)	STORAGE	0.00	0.22	98.09	0	01:07	0.22
221	STORAGE	0.32	1.72	96.20	0	01:10	1.72
222	STORAGE	0.32	1.64	96.60	0	01:10	1.64
222A-S	STORAGE	0.03	1.79	98.23	0	01:04	1.79
222A-S(1)	STORAGE	0.00	0.18	98.40	0	01:00	0.18
222A-S(2)	STORAGE	0.00	0.00	98.82	0	00:00	0.00
223	STORAGE	0.32	1.75	97.03	0	01:11	1.75
223A-S	STORAGE	0.02	1.64	98.43	0	01:01	1.64
224	STORAGE	0.32	1.78	97.13	0	01:12	1.78
225	STORAGE	0.32	1.82	97.40	0	01:12	1.82
225A-S	STORAGE	0.02	1.73	99.38	0	01:00	1.73
225A-S(1)	STORAGE	0.00	0.14	99.30	0	01:00	0.14
226	STORAGE	0.31	1.43	97.59	0	01:14	1.42
226A-S	STORAGE	0.03	1.63	99.71	0	01:00	1.63
226A-S(1)	STORAGE	0.00	0.07	99.70	0	01:01	0.07
227	STORAGE	0.31	1.39	97.67	0	01:14	1.39
228	STORAGE	0.31	1.43	97.97	0	01:17	1.43
228A-S	STORAGE	0.03	1.62	100.23	0	01:06	1.62
228A-S(1)	STORAGE	0.00	0.03	100.23	0	01:07	0.03
229	STORAGE	0.31	1.14	98.04	0	01:17	1.14
229A-S	STORAGE	0.03	1.67	100.49	0	01:00	1.67
229A-S(1)	STORAGE	0.00	0.07	100.49	0	01:01	0.07
230	STORAGE	0.30	0.93	98.04	0	01:17	0.93
231	STORAGE	0.30	0.71	98.04	0	01:18	0.71
232	STORAGE	0.29	0.48	98.04	0	01:18	0.48
233	STORAGE	2.22	2.93	95.32	0	01:09	2.93
234	STORAGE	1.84	2.60	95.38	0	01:09	2.60
234A-S	STORAGE	0.04	1.71	97.68	0	01:01	1.71
234A-S(1)	STORAGE	0.00	0.12	97.68	0	01:01	0.12
234B-S	STORAGE	0.05	1.69	97.61	0	01:11	1.69
234B-S(1)	STORAGE	0.00	0.12	97.61	0	01:11	0.12
235	STORAGE	1.58	2.37	95.41	0	01:09	2.36
236	STORAGE	1.32	2.23	95.52	0	01:09	2.23
237	STORAGE	1.26	2.20	95.56	0	01:10	2.20
237A-S	STORAGE	0.04	1.69	97.67	0	01:06	1.69
237A-S(1)	STORAGE	0.00	0.08	97.68	0	01:01	0.08
238	STORAGE	0.88	1.92	95.66	0	01:10	1.92

239	STORAGE	0.80	1.89	95.71	0	01:10	1.89
240	STORAGE	0.55	1.79	95.86	0	01:10	1.79
240A-S	STORAGE	0.02	1.55	97.76	0	01:00	1.55
240A-S(1)	STORAGE	0.00	0.06	97.75	0	01:00	0.06
240B-S	STORAGE	0.03	1.66	97.68	0	01:03	1.66
240B-S(1)	STORAGE	0.00	0.04	97.68	0	01:04	0.04
241	STORAGE	0.32	1.45	95.95	0	01:11	1.45
241A-S	STORAGE	0.03	1.66	97.85	0	01:00	1.66
241A-S(1)	STORAGE	0.00	0.05	97.85	0	01:01	0.05
B1-S	STORAGE	0.23	2.22	96.65	0	01:15	2.22
B2-S	STORAGE	0.21	2.20	96.60	0	01:00	2.20
Comm-S	STORAGE	0.05	2.18	99.58	0	01:04	2.18
EXT-1A-S	STORAGE	0.00	0.00	97.92	0	00:00	0.00
EXT-1A-S(1)	STORAGE	0.00	0.08	96.05	0	01:00	0.08
EXT2-S	STORAGE	0.00	0.06	98.45	0	01:00	0.06
EXT3-S	STORAGE	0.00	0.05	96.99	0	01:00	0.05
EXT4-S	STORAGE	0.01	0.25	98.25	0	01:00	0.25
EXT5-S	STORAGE	0.00	0.14	98.14	0	01:00	0.14
EXT6-S	STORAGE	0.00	0.11	99.71	0	01:00	0.11
F101A(1)	STORAGE	0.41	0.93	95.13	0	01:12	0.93
F101A(2)	STORAGE	0.61	1.13	95.13	0	01:12	1.13
F101A-S	STORAGE	1.18	1.71	95.14	0	01:12	1.71
G234A-S	STORAGE	1.36	4.68	98.01	0	01:00	4.68
HW7	STORAGE	0.96	1.48	95.13	0	01:12	1.48
HZD-S	STORAGE	0.02	2.32	100.32	0	01:00	2.32
J2	STORAGE	0.52	1.14	95.24	0	01:11	1.14
J3	STORAGE	0.91	1.45	95.15	0	01:09	1.44
J4	STORAGE	0.52	1.29	95.39	0	01:09	1.29
L103A-S-29	STORAGE	0.02	1.67	98.17	0	01:01	1.67
L104A-S-29	STORAGE	0.02	1.57	98.11	0	01:01	1.57
L106A-S-29	STORAGE	0.02	1.58	98.13	0	01:01	1.58
L218A-S	STORAGE	0.05	2.38	98.38	0	01:10	2.38
L225B-S	STORAGE	0.04	2.32	99.52	0	01:00	2.32
POND-S1	STORAGE	3.91	4.41	95.11	0	01:12	4.41
RY103C-S	STORAGE	0.02	1.41	97.65	0	01:00	1.41
RY103D-S	STORAGE	0.02	1.41	97.61	0	01:00	1.41
RY113B-S	STORAGE	0.03	1.55	98.21	0	01:03	1.55
RY117C-S	STORAGE	0.03	1.44	97.61	0	01:00	1.44
RY124B-S	STORAGE	0.02	1.37	98.28	0	01:00	1.37
RY130B-S	STORAGE	0.01	1.04	99.42	0	01:00	1.04
RY202B-S	STORAGE	0.02	1.33	97.63	0	01:12	1.33
RY205B-S	STORAGE	0.04	2.33	97.79	0	01:10	2.33
RY209C-S	STORAGE	0.03	2.13	99.54	0	01:00	2.13
RY210B-S	STORAGE	0.02	2.15	97.77	0	01:00	2.15
RY218B-S	STORAGE	0.03	2.17	98.46	0	01:00	2.17
RY220A-S	STORAGE	0.03	2.25	98.13	0	01:09	2.24
RY238A-S	STORAGE	0.02	2.35	97.96	0	01:00	2.35
SU	STORAGE	0.00	0.14	97.34	0	01:01	0.14
Transitway-S	STORAGE	0.03	2.29	99.29	0	01:00	2.29

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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
J6	JUNCTION	0.00	11721.51	0	01:12	0	36.5	0.003
J9	JUNCTION	0.00	3097.91	0	01:12	0	28.5	1.355
CREEK	OUTFALL	41.27	41.27	0	01:00	0.0522	0.0522	0.000
CREEK-1	OUTFALL	92.15	92.15	0	01:00	0.125	0.125	0.000
OF10	OUTFALL	0.00	175.88	0	01:00	0	0.0499	0.000
OF11	OUTFALL	0.00	1017.17	0	01:00	0	0.305	0.000
OF-1-29	OUTFALL	56.74	56.74	0	01:00	0.0451	0.0451	0.000
OF13	OUTFALL	0.00	60.66	0	01:00	0	0.0548	0.000
OF14	OUTFALL	0.00	297.97	0	01:00	0	0.316	0.000
OF2	OUTFALL	0.00	3098.00	0	01:12	0	25.1	0.000
OF3	OUTFALL	0.00	134.64	0	01:00	0	0.131	0.000
OF4	OUTFALL	0.00	53.62	0	01:00	0	0.0647	0.000
OF5	OUTFALL	0.00	104.43	0	01:00	0	0.114	0.000
OF6	OUTFALL	0.00	784.92	0	01:00	0	0.244	0.000
OF7	OUTFALL	0.00	37.60	0	01:04	0	0.0176	0.000
OF8	OUTFALL	0.00	11721.92	0	01:13	0	36.5	0.000
OF9	OUTFALL	0.00	22.45	0	01:15	0	0.0227	0.000

100A	STORAGE	0.00	6427.52	0	01:07	0	25.9	-0.005	
100B	STORAGE	0.00	12712.66	0	01:07	0	50.9	-0.004	
100C	STORAGE	0.00	776.73	0	01:15	0	5.22	-0.013	
100D	STORAGE	0.00	2018.10	0	01:15	0	11.6	-0.003	
100E	STORAGE	0.00	1259.39	0	00:58	0	7.44	-0.000	
101	STORAGE	0.00	2301.97	0	01:15	0	11.2	-0.005	
101A-29	STORAGE	0.00	108.97	0	01:21	0	0.311	0.004	
102	STORAGE	0.00	804.48	0	01:16	0	4.23	-0.001	
102-29	STORAGE	0.00	107.74	0	01:16	0	0.31	-0.063	
102A	STORAGE	0.00	415.22	0	01:16	0	2.14	-0.006	
102A-S	STORAGE	0.00	55.90	0	01:22	0	0.0492	2.317	
102A-S(1)	STORAGE	117.42	117.45	0	01:00	0.151	0.241	-0.589	
102A-S(2)	STORAGE	0.00	97.30	0	01:16	0	0.0918	0.364	
103	STORAGE	0.00	413.07	0	01:15	0	1.89	-0.003	
103-29	STORAGE	0.00	106.47	0	01:15	0	0.309	-0.339	
103A-S	STORAGE	217.49	229.09	0	01:00	0.282	0.33	-0.232	
103A-S(1)	STORAGE	0.00	64.96	0	01:00	0	0.0383	3.541	
103B-S	STORAGE	103.87	634.68	0	01:00	0.136	0.558	-0.546	
104	STORAGE	0.00	218.73	0	01:15	0	0.896	-0.175	
104-29	STORAGE	0.00	33.94	0	01:01	0	0.101	0.176	
104A-S	STORAGE	183.03	183.03	0	01:00	0.238	0.294	-0.338	
104A-S(1)	STORAGE	0.00	52.21	0	00:59	0	0.0503	3.435	
105	STORAGE	0.00	131.57	0	01:21	0	0.533	0.240	
105A-S	STORAGE	0.00	164.22	0	01:10	0	0.114	0.617	
105A-S(1)	STORAGE	184.03	184.03	0	01:00	0.24	0.296	-0.781	
106	STORAGE	0.00	71.73	0	01:00	0	0.235	0.194	
106-29	STORAGE	0.00	56.38	0	01:01	0	0.16	0.578	
106A-S	STORAGE	0.00	0.00	0	00:00	0	0	0.000	ltr
106A-S(1)	STORAGE	138.44	138.44	0	01:00	0.182	0.198	0.204	
106A-S(2)	STORAGE	0.00	86.10	0	01:00	0	0.052	-1.742	
106B-S	STORAGE	40.54	125.75	0	01:00	0.0529	0.116	1.032	
107	STORAGE	0.00	532.74	0	01:16	0	1.85	0.013	
107A-S	STORAGE	0.00	300.09	0	01:08	0	0.231	-0.086	
107A-S(1)	STORAGE	100.28	230.58	0	01:08	0.133	0.287	0.047	
108	STORAGE	0.00	288.38	0	01:13	0	0.782	-0.549	
109	STORAGE	0.00	289.76	0	01:10	0	0.783	0.055	
109A-S	STORAGE	237.67	332.34	0	01:00	0.309	0.434	0.927	
109A-S(1)	STORAGE	0.00	616.68	0	01:05	0	0.484	-0.831	
109B-S	STORAGE	211.66	222.01	0	01:00	0.277	0.362	0.066	
109B-S(1)	STORAGE	0.00	52.47	0	01:06	0	0.00887	12.853	
109B-S(3)	STORAGE	0.00	309.71	0	01:07	0	0.24	0.523	
110	STORAGE	0.00	207.05	0	01:21	0	0.785	-0.118	
110A-S	STORAGE	63.83	328.41	0	01:07	0.0835	0.322	-0.024	
111	STORAGE	0.00	187.75	0	01:35	0	0.695	0.060	
112	STORAGE	0.00	174.84	0	01:34	0	0.695	0.052	
112A-S	STORAGE	0.00	373.56	0	01:03	0	0.278	-0.122	
112A-S(1)	STORAGE	226.83	455.01	0	01:03	0.292	0.57	-0.259	
113	STORAGE	0.00	88.74	0	01:03	0	0.363	-0.006	
113A-S	STORAGE	0.00	548.02	0	01:02	0	0.321	-0.048	
113A-S(1)	STORAGE	181.98	564.29	0	01:00	0.236	0.541	-0.761	
114	STORAGE	0.00	360.19	0	01:26	0	1.7	-0.004	
114A-S	STORAGE	32.79	644.36	0	01:01	0.041	0.976	-0.294	
115	STORAGE	0.00	328.60	0	01:26	0	1.5	0.014	
115A	STORAGE	0.00	243.85	0	01:26	0	0.995	-0.278	
115A-S	STORAGE	90.21	408.91	0	01:10	0.118	0.672	0.093	
115A-S(1)	STORAGE	0.00	366.57	0	01:12	0	0.506	0.305	
116	STORAGE	0.00	46.34	0	01:12	0	0.244	-0.039	
116A-S	STORAGE	123.15	389.72	0	01:10	0.16	0.712	0.494	
116A-S(1)	STORAGE	0.00	389.10	0	01:10	0	0.604	-0.251	
117	STORAGE	0.00	242.88	0	01:01	0	0.946	-0.298	
117A-S	STORAGE	238.82	250.68	0	01:00	0.311	0.332	-1.289	
117A-S(1)	STORAGE	0.00	44.58	0	01:01	0	0.00933	5.582	
117B-S	STORAGE	72.22	357.38	0	01:00	0.0936	0.322	-0.877	
118	STORAGE	0.00	79.96	0	01:03	0	0.293	1.083	
118A-S	STORAGE	240.00	240.00	0	01:00	0.31	0.312	-0.877	
118A-S(1)	STORAGE	0.00	61.04	0	01:00	0	0.0225	4.748	
119	STORAGE	0.00	1501.10	0	01:12	0	6.52	-0.007	
119A-S	STORAGE	169.01	186.95	0	01:13	0.224	0.365	-0.703	
120A-S(1)	STORAGE	0.00	160.04	0	01:11	0	0.144	1.096	
121	STORAGE	0.00	1447.81	0	01:10	0	5.78	-0.053	
121A	STORAGE	0.00	32.29	0	01:00	0	0.0883	1.038	
121AA-S	STORAGE	100.82	100.82	0	01:00	0.121	0.121	-2.510	
121A-S	STORAGE	0.00	265.53	0	01:00	0	0.315	-1.145	
121A-S(1)	STORAGE	0.00	0.00	0	00:00	0	0	0.000	ltr
121A-S(2)	STORAGE	203.64	397.46	0	01:00	0.273	0.595	0.387	
121B-S	STORAGE	864.79	864.79	0	01:00	1.21	1.21	-0.647	
123	STORAGE	0.00	527.52	0	01:02	0	1.86	0.172	
123A-S	STORAGE	128.54	320.71	0	01:00	0.167	0.486	-0.141	

124	STORAGE	0.00	375.75	0	01:01	0	1.38	-0.005	
124A-S	STORAGE	180.66	357.34	0	01:00	0.221	0.534	-0.347	
124A-S(1)	STORAGE	0.00	270.29	0	01:08	0	0.319	0.327	
125	STORAGE	0.00	309.84	0	01:01	0	1.09	0.050	
126	STORAGE	0.00	311.50	0	01:00	0	1.1	-0.095	
126A-S	STORAGE	18.35	360.89	0	01:00	0.0238	0.323	0.701	
126B-S	STORAGE	0.00	279.73	0	01:02	0	0.229	-0.607	
126B-S(1)	STORAGE	145.19	341.35	0	01:02	0.191	0.422	0.407	
126B-S(2)	STORAGE	0.00	210.59	0	01:06	0	0.183	1.264	
126C-S	STORAGE	97.10	97.10	0	01:00	0.177	0.186	0.008	
127	STORAGE	0.00	73.60	0	00:51	0	0.204	1.029	
127A-S	STORAGE	0.00	0.00	0	00:00	0	0	0.000	ltr
127A-S(1)	STORAGE	206.76	206.76	0	01:00	0.267	0.267	-2.896	
128	STORAGE	0.00	156.75	0	01:04	0	0.543	0.106	
128A-S(1)	STORAGE	163.72	313.57	0	01:00	0.222	0.328	0.915	
129	STORAGE	0.00	101.84	0	00:59	0	0.309	-0.164	
130	STORAGE	0.00	101.43	0	00:59	0	0.311	0.488	
130A-S	STORAGE	251.16	251.16	0	01:00	0.327	0.328	-0.701	
130A-S(1)	STORAGE	0.00	156.90	0	01:00	0	0.0807	-2.375	
131	STORAGE	0.00	3.58	0	00:52	0	0.000864	-4.356	
132	STORAGE	0.00	0.00	0	00:00	0	0	0.000	ltr
201	STORAGE	0.00	12738.61	0	01:07	0	50.6	0.000	
202	STORAGE	0.00	12306.23	0	01:06	0	48.6	-0.001	
202A-S	STORAGE	0.00	218.97	0	01:15	0	0.254	0.510	
202A-S(1)	STORAGE	110.14	279.58	0	01:00	0.136	0.437	-0.872	
203A-S	STORAGE	0.00	282.75	0	01:13	0	0.289	0.442	
204	STORAGE	0.00	8409.17	0	00:59	0	24.1	-0.002	
204A-S	STORAGE	0.00	346.99	0	01:10	0	0.334	0.098	
204A-S(1)	STORAGE	242.87	399.10	0	01:10	0.315	0.649	-0.994	
204BS(1)	STORAGE	221.23	314.90	0	01:13	0.28	0.571	0.136	
205	STORAGE	0.00	8290.85	0	00:59	0	22.8	-0.004	
205A-S	STORAGE	0.00	424.33	0	01:10	0	0.404	-0.019	
205A-S(1)	STORAGE	145.67	533.73	0	01:09	0.186	0.719	0.031	
206	STORAGE	0.00	8180.28	0	00:59	0	21.6	-0.328	
206A-S	STORAGE	0.00	553.68	0	01:00	0	0.295	0.396	
206A-S(1)	STORAGE	178.29	666.34	0	01:00	0.231	0.525	0.147	
206B-S	STORAGE	0.00	547.73	0	01:01	0	0.322	0.000	
206B-S(1)	STORAGE	97.21	326.72	0	01:02	0.124	0.297	-0.050	
206B-Sl	STORAGE	0.00	430.74	0	01:07	0	0.32	0.174	

207	STORAGE	0.00	8097.02	0	00:57	0	21	0.403	
207A-S(1)	STORAGE	323.14	793.62	0	01:00	0.403	0.691	0.288	
209	STORAGE	5337.00	7996.77	0	00:57	13.8	20.5	0.023	
209A-S	STORAGE	198.45	264.42	0	01:00	0.252	0.293	-3.424	
209B-S	STORAGE	90.70	90.70	0	01:00	0.112	0.112	-4.321	
209B-S(1)	STORAGE	0.00	0.00	0	00:00	0	0	0.000	ltr
210	STORAGE	0.00	4697.88	0	01:12	0	24.2	-0.001	
210A-S	STORAGE	140.87	259.44	0	01:00	0.178	0.281	-1.151	
211	STORAGE	0.00	2413.12	0	01:07	0	15.2	0.000	
211A-S	STORAGE	0.00	56.12	0	00:58	0	0.028	4.025	
211A-S(1)	STORAGE	229.89	236.30	0	01:00	0.296	0.307	0.274	
211A-S(2)	STORAGE	0.00	0.00	0	00:00	0	0	0.000	ltr
212	STORAGE	2331.00	2331.00	0	01:07	14.8	14.8	-0.000	
213	STORAGE	0.00	2228.67	0	01:14	0	8.68	-0.001	
213A-S	STORAGE	147.89	147.89	0	01:00	0.19	0.213	-0.036	
214	STORAGE	0.00	201.01	0	01:29	0	0.734	-0.190	
214A-S	STORAGE	0.00	75.86	0	01:09	0	0.0534	3.403	
214A-S(1)	STORAGE	316.24	320.14	0	01:00	0.405	0.434	-2.233	
214A-S(2)	STORAGE	0.00	0.00	0	00:00	0	0	0.000	ltr
215	STORAGE	0.00	84.23	0	01:29	0	0.291	0.444	
216	STORAGE	0.00	80.86	0	01:13	0	0.291	-0.159	
217	STORAGE	0.00	80.17	0	01:03	0	0.291	0.262	
217A-S	STORAGE	228.63	228.63	0	01:00	0.287	0.287	-1.555	
217A-S(1)	STORAGE	0.00	0.00	0	00:00	0	0	0.000	ltr
217A-S(2)	STORAGE	0.00	0.00	0	00:00	0	0	0.000	ltr
218	STORAGE	0.00	1959.00	0	01:14	0	7.37	-0.013	
219	STORAGE	0.00	1471.88	0	01:14	0	4.92	-0.270	
219A-S	STORAGE	0.00	560.39	0	01:04	0	0.307	1.342	
219A-S(1)	STORAGE	51.33	110.24	0	01:03	0.064	0.096	0.190	
219A-S(2)	STORAGE	0.00	178.19	0	01:00	0	0.0436	1.881	
219B-S	STORAGE	236.34	1110.62	0	01:00	0.303	0.692	-3.191	
219B-S(1)	STORAGE	0.00	172.29	0	01:02	0	0.0598	3.567	
220	STORAGE	0.00	276.87	0	01:06	0	0.724	0.589	
220A-S	STORAGE	232.03	670.11	0	01:04	0.304	0.861	-0.534	
220A-S(1)	STORAGE	0.00	578.28	0	01:05	0	0.365	0.078	
221	STORAGE	0.00	1077.18	0	01:15	0	3.46	0.192	
222	STORAGE	0.00	1071.64	0	01:15	0	3.46	0.135	
222A-S	STORAGE	338.92	1495.79	0	01:00	0.427	0.954	1.852	
222A-S(1)	STORAGE	0.00	1425.33	0	01:00	0	0.513	-3.286	

222A-S(2)	STORAGE	0.00	0.00	0	00:00	0	0	0.000	ltr
223	STORAGE	0.00	869.00	0	00:58	0	2.84	0.079	
223A-S	STORAGE	91.53	1258.07	0	01:00	0.118	0.676	-0.274	
224	STORAGE	0.00	798.45	0	00:58	0	2.67	-0.072	
225	STORAGE	0.00	805.64	0	00:58	0	2.67	0.088	
225A-S	STORAGE	156.44	1278.37	0	01:00	0.199	0.744	-0.787	
225A-S(1)	STORAGE	0.00	1185.13	0	01:00	0	0.551	-0.318	
226	STORAGE	0.00	310.66	0	01:21	0	0.92	-0.421	
226A-S	STORAGE	261.36	261.36	0	01:00	0.344	0.354	-0.070	
226A-S(1)	STORAGE	0.00	142.60	0	01:00	0	0.0755	5.042	
227	STORAGE	0.00	228.14	0	01:22	0	0.64	-0.240	
228	STORAGE	0.00	208.42	0	01:22	0	0.64	0.102	
228A-S	STORAGE	198.09	283.10	0	01:00	0.257	0.315	-0.300	
228A-S(1)	STORAGE	0.00	47.07	0	01:02	0	0.0121	14.124	
229	STORAGE	0.00	101.62	0	01:23	0	0.346	0.100	
229A-S	STORAGE	294.07	294.07	0	01:00	0.39	0.393	-0.934	
229A-S(1)	STORAGE	0.00	134.55	0	01:00	0	0.0595	0.136	
230	STORAGE	0.00	16.18	0	01:22	0	0.0149	2.349	
231	STORAGE	0.00	10.67	0	01:11	0	0.007	2.067	
232	STORAGE	0.00	7.58	0	01:11	0	0.00131	-15.231	
233	STORAGE	0.00	502.19	0	01:12	0	2.03	-0.001	
234	STORAGE	0.00	493.04	0	01:10	0	2.01	0.047	
234A-S	STORAGE	184.00	453.97	0	00:56	0.236	0.428	-1.111	
234A-S(1)	STORAGE	0.00	413.82	0	01:00	0	0.416	-0.930	
234B-S	STORAGE	129.54	470.96	0	01:00	0.164	0.555	0.746	
234B-S(1)	STORAGE	0.00	373.39	0	01:10	0	0.525	-0.072	
235	STORAGE	0.00	365.19	0	01:10	0	1.33	-0.004	
236	STORAGE	0.00	363.60	0	01:10	0	1.32	0.000	
237	STORAGE	0.00	360.78	0	01:10	0	1.3	0.000	
237A-S	STORAGE	150.89	248.21	0	01:00	0.186	0.256	0.944	
237A-S(1)	STORAGE	0.00	148.07	0	01:00	0	0.0787	-0.557	
238	STORAGE	0.00	306.77	0	01:10	0	1.04	0.001	
239	STORAGE	0.00	199.63	0	01:14	0	0.752	-0.012	
240	STORAGE	0.00	192.21	0	01:14	0	0.693	0.009	
240A-S	STORAGE	138.30	160.74	0	01:00	0.178	0.193	-0.281	
240A-S(1)	STORAGE	0.00	93.87	0	01:00	0	0.0438	-2.142	
240B-S	STORAGE	208.72	292.73	0	01:00	0.267	0.313	0.485	
240B-S(1)	STORAGE	0.00	84.91	0	01:00	0	0.0225	3.123	
241	STORAGE	0.00	58.79	0	01:00	0	0.208	-0.065	
241A-S	STORAGE	177.34	177.34	0	01:00	0.223	0.224	0.063	
241A-S(1)	STORAGE	0.00	55.29	0	01:00	0	0.0163	7.357	
B1-S	STORAGE	490.63	490.63	0	01:00	0.695	0.766	1.115	
B2-S	STORAGE	377.03	377.03	0	01:00	0.503	0.838	4.708	
Comm-S	STORAGE	1173.68	1173.68	0	01:00	1.65	1.65	0.360	
EXT-1A-S	STORAGE	0.00	0.00	0	00:00	0	0	0.000	ltr
EXT-1A-S(1)	STORAGE	68.50	136.51	0	01:00	0.0849	0.132	0.289	
EXT2-S	STORAGE	40.33	104.77	0	01:00	0.0509	0.114	0.012	
EXT3-S	STORAGE	53.97	53.97	0	01:00	0.0647	0.0647	0.037	
EXT4-S	STORAGE	298.04	298.04	0	01:00	0.316	0.316	0.045	
EXT5-S	STORAGE	60.82	60.82	0	01:00	0.0548	0.0548	0.055	
EXT6-S	STORAGE	64.50	64.50	0	01:00	0.0627	0.0627	0.048	
F101A(1)	STORAGE	0.00	58.06	0	00:56	0	0.109	0.055	
F101A(2)	STORAGE	0.00	747.56	0	01:03	0	2.7	0.019	
F101A-S	STORAGE	306.94	469.43	0	01:04	0.399	1.07	-0.053	
G234A-S	STORAGE	305.08	305.08	0	01:00	0.464	0.466	-0.144	
HW7	STORAGE	0.00	649.12	0	01:09	0	2.81	-0.003	
HZD-S	STORAGE	2219.07	2219.07	0	01:00	2.87	2.87	0.162	
J2	STORAGE	0.00	116.00	0	01:02	0	0.865	-0.777	
J3	STORAGE	0.00	303.63	0	01:09	0	1.54	-0.083	
J4	STORAGE	0.00	199.00	0	00:55	0	0.886	-3.986	
L103A-S-29	STORAGE	37.13	37.13	0	01:00	0.0504	0.0504	-0.037	
L104A-S-29	STORAGE	75.86	75.86	0	01:00	0.101	0.101	0.550	
L106A-S-29	STORAGE	120.80	120.80	0	01:00	0.159	0.159	-0.383	
L218A-S	STORAGE	1477.18	1477.18	0	01:00	1.89	2.08	0.034	
L225B-S	STORAGE	1526.76	1526.76	0	01:00	2.02	2.02	-0.028	
POND-S1	STORAGE	1273.89	16309.79	0	01:07	1.63	95.7	-0.354	
RY103C-S	STORAGE	317.86	317.86	0	01:00	0.343	0.343	0.162	
RY103D-S	STORAGE	272.58	272.58	0	01:00	0.29	0.29	0.354	
RY113B-S	STORAGE	239.05	239.05	0	01:00	0.249	0.256	0.133	
RY117C-S	STORAGE	332.74	332.74	0	01:00	0.349	0.362	0.398	
RY124B-S	STORAGE	198.81	198.81	0	01:00	0.203	0.203	-0.107	
RY130B-S	STORAGE	123.13	123.13	0	01:00	0.122	0.122	-0.091	
RY202B-S	STORAGE	138.95	138.95	0	01:00	0.144	0.16	0.173	
RY205B-S	STORAGE	257.05	257.05	0	01:00	0.251	0.271	0.554	
RY209C-S	STORAGE	220.35	220.35	0	01:00	0.218	0.218	0.019	
RY210B-S	STORAGE	143.55	143.55	0	01:00	0.139	0.14	-0.004	
RY218B-S	STORAGE	175.02	175.02	0	01:00	0.179	0.181	0.047	
RY220A-S	STORAGE	461.52	461.52	0	01:00	0.448	0.46	0.319	

RY238A-S	STORAGE	370.78	370.78	0	01:00	0.391	0.391	-0.716
SU	STORAGE	0.00	547.34	0	01:01	0	0.407	0.158
Transitway-S	STORAGE	1841.38	1841.38	0	01:00	2.39	2.39	0.001

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Node Surcharge Summary
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No nodes were surcharged.

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Node Flooding Summary
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No nodes were flooded.

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Storage Volume Summary
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Storage Unit	Average Volume 1000 m3	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 m3	Max Pcnt Full	Time of Max Occurrence days	Time of Max Occurrence hr:min	Maximum Outflow LPS
100A	0.004	65	0	0	0.004	76	0	01:13	6420.49
100B	0.004	59	0	0	0.004	70	0	01:10	12699.53
100C	0.002	46	0	0	0.003	60	0	01:12	777.23
100D	0.002	40	0	0	0.003	52	0	01:12	2019.57
100E	0.001	31	0	0	0.002	45	0	01:12	1244.72
101	0.002	37	0	0	0.003	51	0	01:13	2304.90
101A-29	0.000	10	0	0	0.001	31	0	01:13	110.94
102	0.002	37	0	0	0.002	53	0	01:14	806.49
102-29	0.000	10	0	0	0.001	31	0	01:13	108.97
102A	0.000	0	0	0	0.000	0	0	00:00	416.62
102A-S	0.000	0	0	0	0.000	0	0	00:00	54.71
102A-S(1)	0.000	0	0	0	0.000	0	0	00:00	90.63
102A-S(2)	0.000	0	0	0	0.000	0	0	00:00	94.47
103	0.001	24	0	0	0.002	41	0	01:13	415.22
103-29	0.000	10	0	0	0.001	30	0	01:13	107.74
103A-S	0.000	0	0	0	0.000	0	0	00:00	145.00
103A-S(1)	0.000	0	0	0	0.000	0	0	00:00	51.45
103B-S	0.000	0	0	0	0.000	0	0	00:00	582.84
104	0.001	15	0	0	0.001	33	0	01:13	220.18
104-29	0.000	10	0	0	0.001	25	0	01:13	38.01
104A-S	0.000	0	0	0	0.000	0	0	00:00	109.94
104A-S(1)	0.000	0	0	0	0.000	0	0	00:00	47.54
105	0.000	9	0	0	0.001	26	0	01:14	134.36
105A-S	0.000	0	0	0	0.000	0	0	00:00	160.26
105A-S(1)	0.000	0	0	0	0.000	0	0	00:00	59.67
106	0.000	11	0	0	0.001	26	0	01:14	71.92
106-29	0.000	11	0	0	0.001	29	0	01:14	56.16
106A-S	0.000	0	0	0	0.000	0	0	00:00	0.00
106A-S(1)	0.000	0	0	0	0.000	0	0	00:00	136.27
106A-S(2)	0.000	0	0	0	0.000	0	0	00:00	85.64
106B-S	0.000	0	0	0	0.000	0	0	00:00	78.82
107	0.000	9	0	0	0.002	40	0	01:14	535.64
107A-S	0.000	0	0	0	0.000	0	0	00:00	298.78
107A-S(1)	0.000	0	0	0	0.000	0	0	00:00	209.76
108	0.000	10	0	0	0.002	42	0	01:14	289.11
109	0.000	9	0	0	0.001	41	0	01:14	288.38
109A-S	0.000	0	0	0	0.000	0	0	00:00	189.74
109A-S(1)	0.000	0	0	0	0.000	0	0	00:00	610.48
109B-S	0.000	0	0	0	0.000	0	0	00:00	152.13
109B-S(1)	0.000	0	0	0	0.000	0	0	00:00	25.37
109B-S(3)	0.000	0	0	0	0.000	0	0	00:00	306.84
110	0.000	7	0	0	0.001	36	0	01:14	210.47
110A-S	0.000	0	0	0	0.000	0	0	00:00	328.50
111	0.000	9	0	0	0.001	37	0	01:15	189.55
112	0.000	10	0	0	0.001	39	0	01:15	187.75
112A-S	0.000	0	0	0	0.000	0	0	00:00	369.51
112A-S(1)	0.000	0	0	0	0.000	0	0	00:00	392.40
113	0.000	10	0	0	0.001	33	0	01:15	96.05
113A-S	0.000	0	0	0	0.000	0	0	00:00	545.08
113A-S(1)	0.000	0	0	0	0.000	0	0	00:00	433.87

114	0.001	20	0	0	0.002	39	0	01:14	362.69
114A-S	0.000	0	0	0	0.000	0	0	00:00	631.27
115	0.001	15	0	0	0.001	37	0	01:14	331.60
115A	0.000	0	0	0	0.000	0	0	00:00	246.90
115A-S	0.000	0	0	0	0.000	0	0	00:00	401.58
115A-S(1)	0.000	0	0	0	0.000	0	0	00:00	366.00
116	0.000	13	0	0	0.001	28	0	01:15	50.06
116A-S	0.000	0	0	0	0.000	0	0	00:00	384.07
116A-S(1)	0.000	0	0	0	0.000	0	0	00:00	387.08
117	0.000	10	0	0	0.001	35	0	01:15	243.85
117A-S	0.000	0	0	0	0.000	0	0	00:00	125.53
117A-S(1)	0.000	0	0	0	0.000	0	0	00:00	10.60
117B-S	0.000	0	0	0	0.000	0	0	00:00	313.24
118	0.000	12	0	0	0.001	27	0	01:15	81.66
118A-S	0.000	0	0	0	0.000	0	0	00:00	140.84
118A-S(1)	0.000	0	0	0	0.000	0	0	00:00	30.33
119	0.001	27	0	0	0.002	47	0	01:13	1500.97
119A-S	0.000	0	0	0	0.000	0	0	00:00	156.03
120A-S(1)	0.000	0	0	0	0.000	0	0	00:00	153.54
121	0.000	9	0	0	0.001	37	0	01:13	1442.62
121A	0.000	11	0	0	0.001	21	0	01:10	34.09
121AA-S	0.000	0	0	0	0.000	0	0	00:00	100.05
121A-S	0.000	0	0	0	0.000	0	0	00:00	260.16
121A-S(1)	0.000	0	0	0	0.000	0	0	00:00	0.00
121A-S(2)	0.000	0	0	0	0.000	0	0	00:00	278.09
121B-S	0.003	0	0	0	0.316	40	0	01:04	320.32
123	0.000	9	0	0	0.001	31	0	01:12	524.11
123A-S	0.000	0	0	0	0.000	0	0	00:00	315.99
124	0.000	11	0	0	0.001	26	0	01:02	375.62
124A-S	0.000	0	0	0	0.000	0	0	00:00	315.91
124A-S(1)	0.000	0	0	0	0.000	0	0	00:00	269.77
125	0.000	11	0	0	0.001	27	0	01:01	309.73
126	0.000	11	0	0	0.001	29	0	01:01	309.84
126A-S	0.000	0	0	0	0.000	0	0	00:00	297.02
126B-S	0.000	0	0	0	0.000	0	0	00:00	277.53
126B-S(1)	0.000	0	0	0	0.000	0	0	00:00	263.34
126B-S(2)	0.000	0	0	0	0.000	0	0	00:00	207.25
126C-S	0.000	0	0	0	0.000	0	0	00:00	106.34
127	0.000	11	0	0	0.001	18	0	00:53	74.57

127A-S	0.000	0	0	0	0.000	0	0	00:00	0.00
127A-S(1)	0.000	0	0	0	0.000	0	0	00:00	201.87
128	0.000	9	0	0	0.001	22	0	01:01	159.28
128A-S(1)	0.000	0	0	0	0.000	0	0	00:00	205.30
129	0.000	11	0	0	0.001	21	0	01:02	104.08
130	0.000	9	0	0	0.001	16	0	00:58	101.84
130A-S	0.000	0	0	0	0.000	0	0	00:00	235.13
130A-S(1)	0.000	0	0	0	0.000	0	0	00:00	154.04
131	0.000	9	0	0	0.000	12	0	00:57	5.61
132	0.000	0	0	0	0.000	0	0	00:00	0.00
201	0.004	52	0	0	0.004	63	0	01:08	12712.66
202	0.003	50	0	0	0.004	64	0	01:08	12274.37
202A-S	0.000	0	0	0	0.000	0	0	00:00	209.90
202A-S(1)	0.000	0	0	0	0.000	0	0	00:00	231.59
203A-S	0.000	0	0	0	0.000	0	0	00:00	280.21
204	0.002	42	0	0	0.004	64	0	01:07	8349.17
204A-S	0.000	0	0	0	0.000	0	0	00:00	341.94
204A-S(1)	0.000	0	0	0	0.000	0	0	00:00	365.26
204BS(1)	0.000	0	0	0	0.000	0	0	00:00	300.84
205	0.002	36	0	0	0.004	63	0	01:03	8248.55
205A-S	0.000	0	0	0	0.000	0	0	00:00	409.59
205A-S(1)	0.000	0	0	0	0.000	0	0	00:00	524.73
206	0.002	30	0	0	0.004	57	0	01:02	8148.82
206A-S	0.000	0	0	0	0.000	0	0	00:00	542.91
206A-S(1)	0.000	0	0	0	0.000	0	0	00:00	606.78
206B-S	0.000	0	0	0	0.000	0	0	00:00	548.02
206B-S(1)	0.000	0	0	0	0.000	0	0	00:00	322.96
206B-Sl	0.000	0	0	0	0.000	0	0	00:00	428.60
207	0.000	8	0	0	0.003	54	0	01:01	8075.04
207A-S(1)	0.000	0	0	0	0.000	0	0	00:00	671.83
209	0.000	7	0	0	0.003	51	0	01:01	7980.03
209A-S	0.000	0	0	0	0.000	0	0	00:00	262.07
209B-S	0.000	0	0	0	0.000	0	0	00:00	90.26
209B-S(1)	0.000	0	0	0	0.000	0	0	00:00	0.00
210	0.003	44	0	0	0.004	61	0	01:08	4726.52
210A-S	0.000	0	0	0	0.000	0	0	00:00	158.73
211	0.003	40	0	0	0.004	59	0	01:09	2433.31
211A-S	0.000	0	0	0	0.000	0	0	00:00	25.53
211A-S(1)	0.000	0	0	0	0.000	0	0	00:00	80.79

211A-S(2)	0.000	0	0	0	0.000	0	0	00:00	0.00
212	0.003	48	0	0	0.004	74	0	01:09	2332.34
213	0.001	25	0	0	0.003	51	0	01:09	2245.25
213A-S	0.000	0	0	0	0.000	0	0	00:00	124.41
214	0.000	9	0	0	0.002	42	0	01:09	211.73
214A-S	0.000	0	0	0	0.000	0	0	00:00	64.78
214A-S(1)	0.000	0	0	0	0.000	0	0	00:00	116.25
214A-S(2)	0.000	0	0	0	0.000	0	0	00:00	0.00
215	0.000	8	0	0	0.001	33	0	01:10	88.45
216	0.000	8	0	0	0.001	33	0	01:10	84.23
217	0.000	9	0	0	0.001	34	0	01:10	80.86
217A-S	0.000	0	0	0	0.000	0	0	00:00	80.17
217A-S(1)	0.000	0	0	0	0.000	0	0	00:00	0.00
217A-S(2)	0.000	0	0	0	0.000	0	0	00:00	0.00
218	0.001	22	0	0	0.003	51	0	01:09	1978.66
219	0.001	18	0	0	0.002	52	0	01:09	1490.46
219A-S	0.000	0	0	0	0.000	0	0	00:00	535.31
219A-S(1)	0.000	0	0	0	0.000	0	0	00:00	90.60
219A-S(2)	0.000	0	0	0	0.000	0	0	00:00	56.96
219B-S	0.000	0	0	0	0.000	0	0	00:00	333.59
219B-S(1)	0.000	0	0	0	0.000	0	0	00:00	85.24
220	0.000	3	0	0	0.001	34	0	01:09	283.27
220A-S	0.000	0	0	0	0.000	0	0	00:00	616.46
220A-S(1)	0.000	0	0	0	0.000	0	0	00:00	597.14
221	0.000	9	0	0	0.002	49	0	01:10	1084.41
222	0.000	9	0	0	0.002	48	0	01:10	1077.18
222A-S	0.000	0	0	0	0.000	0	0	00:00	773.38
222A-S(1)	0.000	0	0	0	0.000	0	0	00:00	1255.07
222A-S(2)	0.000	0	0	0	0.000	0	0	00:00	0.00
223	0.000	8	0	0	0.002	45	0	01:11	865.08
223A-S	0.000	0	0	0	0.000	0	0	00:00	1503.55
224	0.000	8	0	0	0.002	47	0	01:12	791.74
225	0.000	8	0	0	0.002	45	0	01:12	798.45
225A-S	0.000	0	0	0	0.000	0	0	00:00	1256.62
225A-S(1)	0.000	0	0	0	0.000	0	0	00:00	1182.84
226	0.000	8	0	0	0.002	35	0	01:14	328.60
226A-S	0.000	0	0	0	0.000	0	0	00:00	211.88
226A-S(1)	0.000	0	0	0	0.000	0	0	00:00	130.77
227	0.000	8	0	0	0.002	35	0	01:14	243.11
228	0.000	8	0	0	0.002	37	0	01:17	228.14
228A-S	0.000	0	0	0	0.000	0	0	00:00	143.92
228A-S(1)	0.000	0	0	0	0.000	0	0	00:00	15.74
229	0.000	8	0	0	0.001	31	0	01:17	113.71
229A-S	0.000	0	0	0	0.000	0	0	00:00	216.02
229A-S(1)	0.000	0	0	0	0.000	0	0	00:00	109.47
230	0.000	9	0	0	0.001	27	0	01:17	22.27
231	0.000	10	0	0	0.001	23	0	01:18	16.18
232	0.000	11	0	0	0.001	19	0	01:18	7.87
233	0.003	44	0	0	0.003	58	0	01:09	511.19
234	0.002	39	0	0	0.003	55	0	01:09	502.19
234A-S	0.000	0	0	0	0.000	0	0	00:00	337.31
234A-S(1)	0.000	0	0	0	0.000	0	0	00:00	385.41
234B-S	0.000	0	0	0	0.000	0	0	00:00	329.34
234B-S(1)	0.000	0	0	0	0.000	0	0	00:00	358.39
235	0.002	35	0	0	0.003	52	0	01:09	365.42
236	0.001	32	0	0	0.003	53	0	01:09	365.19
237	0.001	31	0	0	0.002	54	0	01:10	363.60
237A-S	0.000	0	0	0	0.000	0	0	00:00	113.66
237A-S(1)	0.000	0	0	0	0.000	0	0	00:00	127.01
238	0.001	23	0	0	0.002	50	0	01:10	307.94
239	0.001	22	0	0	0.002	51	0	01:10	204.61
240	0.001	15	0	0	0.002	49	0	01:10	199.63
240A-S	0.000	0	0	0	0.000	0	0	00:00	144.66
240A-S(1)	0.000	0	0	0	0.000	0	0	00:00	89.81
240B-S	0.000	0	0	0	0.000	0	0	00:00	165.83
240B-S(1)	0.000	0	0	0	0.000	0	0	00:00	31.49
241	0.000	9	0	0	0.002	43	0	01:11	63.60
241A-S	0.000	0	0	0	0.000	0	0	00:00	114.04
241A-S(1)	0.000	0	0	0	0.000	0	0	00:00	34.59
B1-S	0.004	1	0	0	0.238	46	0	01:15	138.45
B2-S	0.000	0	0	0	0.027	42	0	01:00	374.88
Comm-S	0.004	0	0	0	0.416	40	0	01:04	436.60
EXT-1A-S	0.000	0	0	0	0.000	0	0	00:00	0.00
EXT-1A-S(1)	0.000	0	0	0	0.000	0	0	00:00	134.64
EXT2-S	0.000	0	0	0	0.000	0	0	00:00	104.43
EXT3-S	0.000	0	0	0	0.000	0	0	00:00	53.62
EXT4-S	0.000	0	0	0	0.000	0	0	00:00	297.97
EXT5-S	0.000	0	0	0	0.000	0	0	00:00	60.66

EXT6-S	0.000	0	0	0	0.000	0	0	00:00	64.43
F101A(1)	0.000	0	0	0	0.000	0	0	00:00	25.74
F101A(2)	0.000	0	0	0	0.000	0	0	00:00	664.74
F101A-S	0.000	0	0	0	0.000	0	0	00:00	468.83
G234A-S	0.000	0	0	0	0.000	0	0	00:00	307.64
HW7	0.001	41	0	0	0.002	63	0	01:12	633.77
HZD-S	0.001	0	0	0	0.172	67	0	01:00	2204.17
J2	0.001	18	0	0	0.001	39	0	01:11	124.42
J3	0.001	35	0	0	0.002	56	0	01:09	295.24
J4	0.001	18	0	0	0.001	44	0	01:09	192.59
L103A-S-29	0.000	0	0	0	0.010	23	0	01:01	17.48
L104A-S-29	0.000	0	0	0	0.022	25	0	01:01	33.94
L106A-S-29	0.000	0	0	0	0.034	27	0	01:01	56.38
L218A-S	0.004	1	0	0	0.324	78	0	01:10	1222.67
L225B-S	0.001	0	0	0	0.141	66	0	01:00	1525.43
POND-S1	27.439	73	0	0	34.563	93	0	01:12	14819.38
RY103C-S	0.000	0	0	0	0.000	0	0	00:00	316.88
RY103D-S	0.000	0	0	0	0.000	0	0	00:00	271.64
RY113B-S	0.000	0	0	0	0.000	0	0	00:00	236.26
RY117C-S	0.000	0	0	0	0.000	0	0	00:00	332.07
RY124B-S	0.000	0	0	0	0.000	0	0	00:00	198.31
RY130B-S	0.000	0	0	0	0.000	0	0	00:00	122.35
RY202B-S	0.000	0	0	0	0.000	0	0	00:00	139.24
RY205B-S	0.000	0	0	0	0.000	0	0	00:00	255.14
RY209C-S	0.000	0	0	0	0.000	0	0	00:00	218.69
RY210B-S	0.000	0	0	0	0.000	0	0	00:00	143.35
RY218B-S	0.000	0	0	0	0.000	0	0	00:00	174.81
RY220A-S	0.000	0	0	0	0.000	0	0	00:00	459.91
RY238A-S	0.000	0	0	0	0.000	0	0	00:00	369.67
SU	0.000	0	0	0	0.000	0	0	00:00	554.87
Transitway-S	0.001	0	0	0	0.147	61	0	01:00	1720.73

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Outfall Loading Summary
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Outfall Node	Flow Freq Pcnt	Avg Flow LPS	Max Flow LPS	Total Volume 10^6 ltr
CREEK	6.49	4.65	41.27	0.052
CREEK-1	6.89	10.50	92.15	0.125
OF10	0.28	102.96	175.88	0.050
OF11	0.35	504.69	1017.17	0.305
OF-1-29	2.35	11.13	56.74	0.045
OF13	3.24	9.78	60.66	0.055
OF14	4.89	37.41	297.97	0.316
OF2	99.99	145.55	3098.00	25.150
OF3	7.45	10.20	134.64	0.131
OF4	6.95	5.38	53.62	0.065
OF5	7.03	9.35	104.43	0.114
OF6	0.42	334.20	784.92	0.244
OF7	0.52	19.50	37.60	0.018
OF8	96.52	219.12	11721.92	36.548
OF9	1.25	10.51	22.45	0.023
System	16.31	1434.94	22.45	63.241

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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
101A-101-29	CONDUIT	110.94	0	01:21	1.00	0.90	1.00
102-101A-29	CONDUIT	108.97	0	01:21	0.99	0.88	1.00
103-102-29	CONDUIT	107.74	0	01:16	1.11	0.87	1.00
104-103-29	CONDUIT	38.01	0	01:22	0.88	0.56	1.00
106-103-29	CONDUIT	56.16	0	00:54	1.00	0.81	1.00
C1	CHANNEL	134.64	0	01:00	0.60	0.02	0.24
C10	CHANNEL	428.60	0	01:07	0.96	0.06	0.34
C100	CHANNEL	61.04	0	01:00	0.13	0.01	0.40

C101	CHANNEL	30.33	0	01:02	0.12	0.00	0.47
C102	CHANNEL	44.58	0	01:01	0.13	0.01	0.45
C103	CHANNEL	10.60	0	01:10	0.01	0.00	0.50
C104	CHANNEL	278.01	0	01:00	0.24	0.02	0.62
C105	CHANNEL	450.12	0	01:09	0.27	0.05	0.65
C106	CHANNEL	424.33	0	01:10	0.29	0.07	0.89
C107	CHANNEL	346.99	0	01:10	0.28	0.05	0.56
C108	CHANNEL	341.94	0	01:11	0.22	0.05	0.63
C109	CHANNEL	282.75	0	01:13	0.18	0.04	0.63
C11	CHANNEL	430.74	0	01:07	0.20	0.04	0.68
C110	CHANNEL	280.21	0	01:14	0.21	0.04	0.59
C111	CHANNEL	218.97	0	01:15	0.17	0.03	0.57
C112	CHANNEL	178.60	0	01:17	0.13	0.03	0.61
C113	CHANNEL	178.55	0	01:18	0.12	0.02	0.65
C114	CHANNEL	106.78	0	01:00	0.24	0.01	0.53
C115	CHANNEL	14.81	0	01:01	0.12	0.00	0.43
C116	CHANNEL	10.72	0	01:01	0.12	0.00	0.42
C117	CHANNEL	0.00	0	00:00	0.00	0.00	0.38
C118	CHANNEL	0.00	0	00:00	0.00	0.00	0.00
C119	CHANNEL	0.00	0	00:00	0.00	0.00	0.35
C12	CHANNEL	520.86	0	01:06	0.23	0.07	0.81
C120	CHANNEL	0.00	0	00:00	0.00	0.00	0.07
C121	CHANNEL	93.51	0	01:03	0.26	0.01	0.70
C122	CHANNEL	0.00	0	00:00	0.00	0.00	0.24
C123	CHANNEL	178.19	0	01:00	0.13	0.02	0.74
C124	CHANNEL	172.29	0	01:02	0.14	0.03	0.59
C125	CHANNEL	75.86	0	01:09	0.83	0.01	0.15
C126	CHANNEL	27.92	0	01:10	0.16	0.00	0.38
C127	CHANNEL	56.12	0	00:58	0.24	0.00	0.36
C128	CONDUIT	271.68	0	01:00	2.02	0.06	0.35
C129	CONDUIT	234.42	0	01:00	1.83	0.06	0.35
C13	CHANNEL	535.31	0	01:05	0.51	0.07	0.51
C130	CONDUIT	286.36	0	01:00	1.52	0.08	0.46
C131	CONDUIT	109.71	0	01:00	1.38	0.03	0.33
C132	CONDUIT	211.40	0	01:00	0.95	0.25	0.56
C133	CHANNEL	779.67	0	01:00	0.59	0.26	0.80
C134	CONDUIT	148.64	0	01:00	1.65	0.03	0.41
C135	CONDUIT	60.66	0	01:00	1.11	0.02	0.23
C136	CONDUIT	53.62	0	01:00	0.34	0.08	0.28
C137	CONDUIT	297.97	0	01:00	1.65	0.09	0.41
C138	CONDUIT	284.74	0	01:00	1.64	0.09	0.40
C139	CONDUIT	113.08	0	01:00	2.12	0.01	0.39
C14	CHANNEL	560.39	0	01:04	0.26	0.07	0.70
C140	CHANNEL	246.65	0	01:00	0.65	0.21	0.38
C142	CHANNEL	21.32	0	01:04	0.51	0.00	0.10
C143	CONDUIT	95.64	0	01:03	0.95	0.02	0.33
C144	CONDUIT	177.63	0	01:00	1.57	0.03	0.37
C145	CONDUIT	207.98	0	01:00	0.82	0.25	0.60
C146	CONDUIT	99.33	0	01:00	0.85	0.01	0.06
C147	CHANNEL	185.24	0	01:00	0.74	0.10	0.26
C148	CONDUIT	367.63	0	01:00	2.27	0.06	0.50
C15	CHANNEL	1255.07	0	01:00	0.56	0.16	0.76
C150	CHANNEL	1008.43	0	01:00	1.63	0.15	0.50
C151	CONDUIT	468.83	0	01:03	0.81	0.28	0.87
C152	CONDUIT	64.43	0	01:00	2.85	0.01	0.14
C153	CONDUIT	104.43	0	01:00	0.44	0.13	0.37
C154	CONDUIT	12712.66	0	01:07	2.35	1.23	1.00
C155	CONDUIT	6272.35	0	01:07	2.46	1.34	1.00
C156	CONDUIT	6427.52	0	01:07	1.48	0.82	0.93
C157	CONDUIT	6420.49	0	01:07	1.42	0.79	1.00
C158	CONDUIT	2018.10	0	01:15	1.14	0.80	1.00
C159	CONDUIT	1259.39	0	00:58	1.20	0.24	0.86
C16	CHANNEL	0.00	0	00:00	0.00	0.00	0.26
C160	CONDUIT	1244.72	0	01:16	0.92	0.15	0.96
C161	CONDUIT	776.73	0	01:15	0.90	0.73	1.00
C162	CONDUIT	777.23	0	01:15	0.90	0.60	1.00
C163	CONDUIT	22.45	0	01:15	1.62	0.00	0.11
C164	CHANNEL	175.88	0	01:00	2.29	0.00	0.14
C165	CONDUIT	11721.92	0	01:13	1.56	0.14	0.71
C166	CONDUIT	602.37	0	01:02	0.47	0.04	0.59
C167	CONDUIT	58.06	0	00:56	0.02	0.00	0.47
C168	CHANNEL	554.87	0	01:01	1.28	0.16	0.72
C169	CONDUIT	243.85	0	01:26	1.02	0.65	1.00
C17	CHANNEL	0.00	0	00:00	0.00	0.00	0.09
C170	CONDUIT	246.90	0	01:26	0.76	0.69	1.00
C171	CONDUIT	415.22	0	01:16	0.48	0.50	1.00
C172	CONDUIT	192.59	0	01:08	0.68	0.81	1.00
C173	CONDUIT	633.77	0	01:11	1.00	0.32	1.00

C174	CHANNEL	37.60	0	01:04	1.60	0.00	0.09
C175	CHANNEL	784.92	0	01:00	1.14	0.08	0.41
C176	CONDUIT	649.12	0	01:09	0.08	0.01	0.59
C177	CONDUIT	124.42	0	01:44	0.48	0.53	1.00
C178	CONDUIT	295.24	0	01:09	0.67	0.73	1.00
C179	CONDUIT	34.09	0	01:00	0.76	0.38	0.86
C18	CHANNEL	0.00	0	00:00	0.00	0.00	0.24
C180	CHANNEL	67.76	0	01:00	0.67	0.00	0.19
C181	CHANNEL	1017.17	0	01:00	0.98	0.14	0.50
C182	CONDUIT	416.62	0	01:16	0.48	0.45	1.00
C183	CONDUIT	510.19	0	01:19	0.95	1.13	1.00
C19	CHANNEL	156.90	0	01:00	0.34	0.02	0.34
C2	CHANNEL	0.00	0	00:00	0.00	0.00	0.07
C20	CHANNEL	154.04	0	01:00	0.17	0.01	0.51
C21	CHANNEL	152.62	0	01:01	0.39	0.04	0.78
C22	CHANNEL	279.73	0	01:02	0.31	0.03	0.48
C23	CHANNEL	277.53	0	01:03	0.29	0.02	0.53
C24	CHANNEL	210.59	0	01:06	0.19	0.03	0.53
C25	CHANNEL	207.25	0	01:07	0.20	0.02	0.51
C26	CHANNEL	270.29	0	01:08	0.25	0.04	0.52
C27	CHANNEL	269.77	0	01:09	0.56	0.02	0.35
C28	CHANNEL	265.53	0	01:00	0.55	0.05	0.35
C29	CHANNEL	256.03	0	01:02	0.16	0.03	0.63
C3	CHANNEL	0.00	0	00:00	0.00	0.00	0.13
C30	CHANNEL	373.56	0	01:03	0.22	0.05	0.65
C31	CHANNEL	369.51	0	01:04	0.25	0.04	0.63
C32	CHANNEL	309.71	0	01:07	0.20	0.05	0.63
C33	CHANNEL	306.84	0	01:07	0.52	0.03	0.38
C34	CHANNEL	300.09	0	01:08	0.61	0.04	0.35
C35	CHANNEL	128.81	0	01:00	0.64	0.01	0.44
C36	CHANNEL	0.00	0	00:00	0.00	0.00	0.10
C37	CHANNEL	0.00	0	00:00	0.00	0.00	0.07
C38	CHANNEL	0.00	0	00:00	0.00	0.00	0.07
C39	CHANNEL	0.00	0	00:00	0.00	0.00	0.42
C4	CHANNEL	0.00	0	00:00	0.00	0.00	0.13
C40	CHANNEL	134.55	0	01:00	0.13	0.02	0.52
C41	CHANNEL	109.47	0	01:01	0.18	0.01	0.42
C42	CHANNEL	47.07	0	01:02	0.12	0.01	0.38
C43	CHANNEL	15.74	0	01:07	0.19	0.00	0.37
C44	CHANNEL	142.60	0	01:00	0.58	0.02	0.45
C45	CHANNEL	130.77	0	01:01	0.26	0.01	0.59
C46	CHANNEL	1185.13	0	01:00	0.60	0.16	0.70
C47	CHANNEL	1182.84	0	01:00	1.09	0.09	0.56
C48	CHANNEL	1425.33	0	01:00	1.07	0.17	0.61
C49	CHANNEL	65.97	0	01:00	0.86	0.00	0.17
C5	CHANNEL	0.00	0	00:00	0.00	0.00	0.11
C50	CHANNEL	186.34	0	01:00	0.42	0.02	0.60
C51	CHANNEL	553.68	0	01:00	0.33	0.08	0.65
C52	CHANNEL	542.91	0	01:01	0.42	0.05	0.57
C53	CHANNEL	547.73	0	01:01	1.42	0.08	0.58
C54	CHANNEL	548.02	0	01:02	1.57	0.05	0.30
C55	CHANNEL	289.05	0	01:02	0.58	0.03	0.35
C56	CHANNEL	275.75	0	01:02	0.56	0.07	0.36
C57	CHANNEL	36.87	0	01:10	0.21	0.00	0.48
C58	CHANNEL	0.00	0	00:00	0.00	0.00	0.42
C59	CHANNEL	0.00	0	00:00	0.00	0.00	0.35
C6	CHANNEL	101.67	0	01:08	0.42	0.01	0.33
C60	CHANNEL	0.00	0	00:00	0.00	0.00	0.35
C61	CHANNEL	81.31	0	01:11	0.11	0.01	0.54
C62	CHANNEL	0.00	0	00:00	0.00	0.00	0.46
C63	CHANNEL	0.00	0	00:00	0.00	0.00	0.21
C64	CHANNEL	86.10	0	01:00	0.98	0.01	0.33
C65	CHANNEL	85.64	0	01:00	0.54	0.01	0.51
C66	CHANNEL	97.61	0	01:04	0.23	0.04	0.79
C67	CHANNEL	260.16	0	01:10	0.26	0.03	0.62
C68	CHANNEL	160.04	0	01:11	0.15	0.02	0.61
C69	CHANNEL	153.54	0	01:13	0.16	0.02	0.50
C7	CHANNEL	18.22	0	01:08	0.23	0.00	0.27
C70	CHANNEL	97.30	0	01:16	0.14	0.01	0.49
C71	CHANNEL	94.47	0	01:18	0.11	0.01	0.48
C72	CHANNEL	55.90	0	01:22	0.07	0.01	0.46
C73	CHANNEL	54.71	0	01:23	0.13	0.01	0.37
C74	CHANNEL	366.00	0	01:13	0.45	0.04	0.46
C75	CHANNEL	366.57	0	01:12	0.30	0.06	0.56
C76	CHANNEL	387.08	0	01:11	0.31	0.04	0.57
C77	CHANNEL	337.73	0	01:14	0.22	0.04	0.62
C78	CHANNEL	358.39	0	01:11	0.22	0.05	0.64
C79	CHANNEL	283.41	0	01:03	0.24	0.04	0.61

C8	CHANNEL	52.47	0	01:06	0.12	0.01	0.51
C80	CHANNEL	385.41	0	01:01	0.31	0.06	0.60
C81	CHANNEL	131.38	0	01:00	0.18	0.02	0.64
C82	CHANNEL	148.07	0	01:00	0.16	0.02	0.58
C83	CHANNEL	127.01	0	01:01	0.14	0.02	0.54
C84	CHANNEL	31.49	0	01:04	0.11	0.00	0.51
C85	CHANNEL	84.91	0	01:00	0.13	0.01	0.47
C86	CHANNEL	89.81	0	01:00	0.12	0.01	0.48
C87	CHANNEL	93.87	0	01:00	1.22	0.01	0.34
C88	CHANNEL	34.59	0	01:01	0.15	0.00	0.32
C89	CHANNEL	55.29	0	01:00	0.13	0.01	0.46
C9	CHANNEL	242.96	0	01:05	0.19	0.03	0.62
C90	CHANNEL	0.00	0	00:00	0.00	0.00	0.40
C91	CHANNEL	197.11	0	01:08	0.22	0.02	0.50
C92	CHANNEL	164.22	0	01:10	0.19	0.02	0.48
C93	CHANNEL	78.95	0	01:11	0.15	0.01	0.43
C94	CHANNEL	52.21	0	00:59	0.11	0.01	0.42
C95	CHANNEL	47.54	0	01:14	0.19	0.01	0.40
C96	CHANNEL	64.96	0	01:00	0.13	0.01	0.41
C97	CHANNEL	51.45	0	01:02	0.05	0.00	0.55
C98	CHANNEL	547.34	0	01:01	0.29	0.03	0.68
C99	CHANNEL	0.00	0	00:00	0.00	0.00	0.33
F101A-IC	CONDUIT	287.22	0	01:15	1.02	0.67	1.00
outlet	CONDUIT	3098.00	0	01:12	1.15	0.38	1.00
Pipe_-_(234)	CONDUIT	289.11	0	01:16	1.13	0.70	1.00
Pipe_-_(234)_(1)	CONDUIT	288.38	0	01:13	1.33	0.79	1.00
Pipe_-_(235)	CONDUIT	29.83	0	01:14	0.91	0.49	0.47
Pipe_-_(238)	CONDUIT	8148.82	0	00:59	2.35	1.20	1.00
Pipe_-_(240)	CONDUIT	8075.04	0	00:59	3.78	1.61	1.00
Pipe_-_(241)_(1)	CONDUIT	7980.03	0	00:57	3.73	1.65	1.00
Pipe_-_(245)	CONDUIT	74.57	0	00:54	1.42	0.77	0.82
Pipe_-_(253)	CONDUIT	96.05	0	01:35	0.97	0.54	1.00
Pipe_-_(263)	CONDUIT	12274.37	0	01:07	2.27	1.12	1.00
Pipe_-_(264)	CONDUIT	8349.17	0	01:00	2.41	1.25	1.00
Pipe_-_(267)	CONDUIT	8248.55	0	00:59	2.38	1.23	1.00
Pipe_-_(329)	CONDUIT	309.73	0	01:01	1.61	1.14	0.83
Pipe_-_(330)	CONDUIT	309.84	0	01:01	1.48	1.14	0.93
Pipe_-_(331)	CONDUIT	159.28	0	01:03	1.25	0.79	0.93
Pipe_-_(332)	CONDUIT	104.08	0	01:04	1.27	0.84	0.76
Pipe_-_(333)	CONDUIT	101.84	0	00:59	1.27	0.82	0.70
Pipe_-_(334)	CONDUIT	5.61	0	01:19	0.27	0.08	0.48
Pipe_-_(335)	CONDUIT	0.00	0	00:00	0.00	0.00	0.13
Pipe_-_(337)	CONDUIT	134.36	0	01:21	0.94	0.70	1.00
Pipe_-_(338)	CONDUIT	71.92	0	01:21	0.79	0.56	0.98
Pipe_-_(344)	CONDUIT	50.06	0	01:37	1.07	0.73	1.00
Pipe_-_(345)	CONDUIT	331.60	0	01:26	0.93	0.88	1.00
Pipe_-_(346)	CONDUIT	362.69	0	01:26	0.82	0.73	1.00
Pipe_-_(347)	CONDUIT	806.49	0	01:16	0.46	0.36	1.00
Pipe_-_(349)	CONDUIT	1500.97	0	01:14	1.33	1.00	1.00
Pipe_-_(350)	CONDUIT	1442.62	0	01:12	1.28	0.59	1.00
Pipe_-_(351)	CONDUIT	524.11	0	01:02	1.76	1.25	1.00
Pipe_-_(352)	CONDUIT	375.62	0	01:02	1.72	0.97	0.72
Pipe_-_(354)	CONDUIT	220.18	0	01:16	0.41	0.40	1.00
Pipe_-_(360)	CONDUIT	81.66	0	01:24	1.02	0.93	1.00
Pipe_-_(366)	CONDUIT	4726.52	0	01:12	1.58	0.89	1.00
Pipe_-_(367)	CONDUIT	2433.31	0	01:10	0.96	0.54	1.00
Pipe_-_(368)	CONDUIT	2332.34	0	01:07	1.09	0.68	1.00
Pipe_-_(4)	CONDUIT	210.47	0	01:26	1.18	0.83	1.00
Pipe_-_(43)	CONDUIT	2245.25	0	01:13	1.27	0.44	1.00
Pipe_-_(44)	CONDUIT	1978.66	0	01:14	1.12	0.63	1.00
Pipe_-_(45)	CONDUIT	1490.46	0	01:14	1.04	0.63	1.00
Pipe_-_(47)	CONDUIT	1084.41	0	01:14	1.51	0.66	1.00
Pipe_-_(48)	CONDUIT	1077.18	0	01:15	2.14	1.27	1.00
Pipe_-_(49)	CONDUIT	283.27	0	00:53	1.31	0.36	1.00
Pipe_-_(5)	CONDUIT	189.55	0	01:35	1.32	1.06	1.00
Pipe_-_(50)	CONDUIT	865.08	0	01:15	1.64	1.03	1.00
Pipe_-_(51)	CONDUIT	791.74	0	00:58	1.48	0.95	1.00
Pipe_-_(52)	CONDUIT	798.45	0	00:58	1.49	1.00	1.00
Pipe_-_(52)_(1)	CONDUIT	328.60	0	01:21	1.57	1.42	1.00
Pipe_-_(53)	CONDUIT	243.11	0	01:21	1.53	1.60	1.00
Pipe_-_(54)	CONDUIT	228.14	0	01:22	1.43	1.47	1.00
Pipe_-_(54)_(1)	CONDUIT	113.71	0	01:22	0.96	0.63	1.00
Pipe_-_(55)	CONDUIT	22.27	0	01:23	0.32	0.33	1.00
Pipe_-_(56)	CONDUIT	16.18	0	01:22	0.28	0.23	1.00
Pipe_-_(57)	CONDUIT	7.87	0	01:20	0.17	0.11	0.81
Pipe_-_(58)	CONDUIT	211.73	0	01:34	0.92	0.60	1.00
Pipe_-_(58)_(1)	CONDUIT	88.45	0	01:34	1.21	0.71	1.00
Pipe_-_(59)	CONDUIT	84.23	0	01:29	1.18	0.68	1.00

Pipe_-_(6)	CONDUIT	187.75	0	01:35	1.23	1.05	1.00
Pipe_-_(60)	CONDUIT	80.86	0	01:13	1.15	0.67	1.00
Pipe_-_(73)	CONDUIT	511.19	0	01:12	0.68	0.36	1.00
Pipe_-_(77)	CONDUIT	502.19	0	01:12	0.67	0.38	1.00
Pipe_-_(81)	CONDUIT	365.42	0	01:10	0.83	0.56	1.00
Pipe_-_(82)	CONDUIT	365.19	0	01:10	1.02	0.74	1.00
Pipe_-_(83)	CONDUIT	363.60	0	01:10	1.02	0.73	1.00
Pipe_-_(84)	CONDUIT	307.94	0	01:10	0.86	0.63	1.00
Pipe_-_(85)	CONDUIT	204.61	0	01:13	0.95	0.81	1.00
Pipe_-_(86)	CONDUIT	199.63	0	01:14	0.92	0.78	1.00
Pipe_-_(87)	CONDUIT	63.60	0	01:19	0.58	0.61	1.00
C107A-IC(1)	ORIFICE	22.77	0	01:10			1.00
C107A-IC(2)	ORIFICE	22.77	0	01:10			1.00
C109A-IC(1)	ORIFICE	68.97	0	01:08			1.00
C109A-IC(2)	ORIFICE	68.97	0	01:08			1.00
C109B-IC(1)	ORIFICE	76.06	0	01:01			1.00
C109B-IC(2)	ORIFICE	76.06	0	01:01			1.00
C110A-IC(1)	ORIFICE	28.41	0	01:07			1.00
C121AA-IC(1)	ORIFICE	16.15	0	01:00			1.00
C121AA-IC(2)	ORIFICE	16.15	0	01:00			1.00
C121A-IC(1)	ORIFICE	59.04	0	01:13			1.00
C121A-IC(2)	ORIFICE	59.04	0	01:13			1.00
C123A-IC(1)	ORIFICE	25.24	0	01:09			1.00
C123A-IC(2)	ORIFICE	25.24	0	01:09			1.00
C205A-IC(1)	ORIFICE	41.36	0	01:10			1.00
C205A-IC(2)	ORIFICE	59.03	0	01:10			1.00
C219-IC	ORIFICE	26.21	0	01:07			1.00
C220A-IC(1)	ORIFICE	92.86	0	01:07			1.00
C220A-IC(2)	ORIFICE	92.86	0	01:07			1.00
C222A-IC(1)	ORIFICE	106.50	0	01:04			1.00
C222A-IC(2)	ORIFICE	106.50	0	01:04			1.00
C223A-IC(1)	ORIFICE	78.50	0	01:01			1.00
G234A-IC	ORIFICE	23.66	0	01:54			1.00
L102A-IC(1)	ORIFICE	17.37	0	01:23			1.00
L102A-IC(2)	ORIFICE	17.37	0	01:23			1.00
L103A-IC(1)	ORIFICE	40.03	0	01:01			1.00
L103A-IC(2)	ORIFICE	40.03	0	01:01			1.00
L103A-IC-29	ORIFICE	17.48	0	01:01			1.00
L103B-IC(1)	ORIFICE	17.75	0	01:01			1.00
L103B-IC(2)	ORIFICE	17.75	0	01:01			1.00
L103C-IC	ORIFICE	45.20	0	01:00			1.00
L103D-IC	ORIFICE	37.22	0	01:00			1.00
L104A-IC(1)	ORIFICE	29.07	0	01:13			1.00
L104A-IC(2)	ORIFICE	29.07	0	01:13			1.00
L104A-IC1-29	ORIFICE	16.97	0	01:01			1.00
L104A-IC2-29	ORIFICE	16.97	0	01:01			1.00
L105A-IC(1)	ORIFICE	29.83	0	01:19			1.00
L105A-IC(2)	ORIFICE	29.83	0	01:19			1.00
L106A-IC(1)	ORIFICE	25.15	0	01:11			1.00
L106A-IC(2)	ORIFICE	25.15	0	01:11			1.00
L106A-IC-29	ORIFICE	56.38	0	01:01			1.00
L106B-IC(1)	ORIFICE	21.61	0	01:01			1.00
L112A-IC(1)	ORIFICE	41.34	0	01:07			1.00
L112A-IC(2)	ORIFICE	41.34	0	01:07			1.00
L113A-IC(1)	ORIFICE	30.16	0	01:03			1.00
L113A-IC(2)	ORIFICE	30.16	0	01:03			1.00
L113B-IC	ORIFICE	28.43	0	01:03			1.00
L114A-IC	ORIFICE	28.90	0	01:02			1.00
L115A-IC(1)	ORIFICE	17.51	0	01:12			1.00
L115A-IC(2)	ORIFICE	17.51	0	01:12			1.00
L116A-IC(1)	ORIFICE	23.17	0	01:12			1.00
L116A-IC(2)	ORIFICE	23.17	0	01:12			1.00
L117A-IC(1)	ORIFICE	40.65	0	01:08			1.00
L117A-IC(2)	ORIFICE	40.65	0	01:08			1.00
L117B-IC(1)	ORIFICE	17.69	0	01:11			1.00
L117B-IC(2)	ORIFICE	17.69	0	01:11			1.00
L117C-IC	ORIFICE	45.72	0	01:00			1.00
L118A-IC(1)	ORIFICE	39.98	0	01:03			1.00
L118A-IC(2)	ORIFICE	39.98	0	01:03			1.00
L119A-IC(1)	ORIFICE	29.37	0	01:18			1.00
L119A-IC(2)	ORIFICE	29.37	0	01:18			1.00
L124A-IC(1)	ORIFICE	22.81	0	01:09			1.00
L124A-IC(2)	ORIFICE	22.81	0	01:09			1.00
L124B-IC	ORIFICE	20.69	0	01:00			1.00
L126A-IC(1)	ORIFICE	17.29	0	01:02			1.00
L126B-IC(1)	ORIFICE	26.38	0	01:07			1.00
L126B-IC(2)	ORIFICE	26.38	0	01:07			1.00
L126C-IC	ORIFICE	21.08	0	01:32			1.00

L127A-IC(1)	ORIFICE	36.80	0	00:51	1.00
L127A-IC(2)	ORIFICE	36.80	0	00:51	1.00
L128A-IC(1)	ORIFICE	26.37	0	01:02	1.00
L128A-IC(2)	ORIFICE	26.37	0	01:02	1.00
L130A-IC(1)	ORIFICE	39.11	0	01:00	1.00
L130A-IC(2)	ORIFICE	39.11	0	01:00	1.00
L130B-IC	ORIFICE	23.01	0	01:00	1.00
L202A-IC(1)	ORIFICE	17.75	0	01:13	1.00
L202A-IC(2)	ORIFICE	17.75	0	01:13	1.00
L202B-IC	ORIFICE	26.27	0	01:12	1.00
L204A-IC(1)	ORIFICE	41.26	0	01:13	1.00
L204A-IC(2)	ORIFICE	41.26	0	01:13	1.00
L204B-IC(1)	ORIFICE	40.94	0	01:16	1.00
L204B-IC(2)	ORIFICE	40.94	0	01:16	1.00
L205B-IC	ORIFICE	47.73	0	01:21	1.00
L206A-IC(1)	ORIFICE	29.53	0	01:01	1.00
L206A-IC(2)	ORIFICE	29.53	0	01:01	1.00
L206B-IC(1)	ORIFICE	47.20	0	01:03	1.00
L207A-IC(1)	ORIFICE	59.07	0	01:00	1.00
L207A-IC(2)	ORIFICE	59.07	0	01:00	1.00
L209A-IC(1)	ORIFICE	37.87	0	01:00	1.00
L209A-IC(2)	ORIFICE	37.87	0	01:00	1.00
L209B-IC	ORIFICE	24.29	0	01:00	1.00
L209C-IC	ORIFICE	33.44	0	01:00	1.00
L210A-IC(1)	ORIFICE	26.27	0	01:17	1.00
L210A-IC(2)	ORIFICE	26.27	0	01:17	1.00
L210B-IC	ORIFICE	33.64	0	01:00	1.00
L211A-IC(1)	ORIFICE	40.40	0	01:05	1.00
L211A-IC(2)	ORIFICE	40.40	0	01:05	1.00
L213A-IC(1)	ORIFICE	22.39	0	01:00	1.00
L213A-IC(2)	ORIFICE	22.39	0	01:00	1.00
L214A-IC(1)	ORIFICE	58.13	0	01:10	1.00
L214A-IC(2)	ORIFICE	58.13	0	01:10	1.00
L217A-IC(1)	ORIFICE	40.08	0	01:03	1.00
L217A-IC(2)	ORIFICE	40.08	0	01:03	1.00
L218B-IC	ORIFICE	26.16	0	01:00	1.00
L219B-IC(1)	ORIFICE	42.10	0	01:07	1.00
L219B-IC(2)	ORIFICE	42.10	0	01:07	1.00
L220A-S	ORIFICE	92.30	0	01:00	1.00

L225A-IC(1)	ORIFICE	41.44	0	01:00	1.00
L225A-IC(2)	ORIFICE	30.05	0	01:00	1.00
L226A-IC(1)	ORIFICE	40.15	0	01:00	1.00
L226A-IC(2)	ORIFICE	29.13	0	01:00	1.00
L228A-IC(1)	ORIFICE	57.13	0	01:06	1.00
L228A-IC(2)	ORIFICE	40.04	0	01:06	1.00
L229A-IC(1)	ORIFICE	40.74	0	01:00	1.00
L229A-IC(2)	ORIFICE	40.74	0	01:00	1.00
L234A-IC(1)	ORIFICE	29.87	0	01:01	1.00
L234A-IC(2)	ORIFICE	29.87	0	01:01	1.00
L234B-IC(1)	ORIFICE	23.03	0	01:11	1.00
L234B-IC(2)	ORIFICE	23.03	0	01:11	1.00
L237A-IC(1)	ORIFICE	26.53	0	01:06	1.00
L237A-IC(2)	ORIFICE	26.53	0	01:06	1.00
L238A-IC	ORIFICE	123.02	0	01:00	1.00
L240A-IC(1)	ORIFICE	25.39	0	01:00	1.00
L240A-IC(2)	ORIFICE	25.39	0	01:00	1.00
L240B-IC(1)	ORIFICE	40.62	0	01:03	1.00
L240B-IC(2)	ORIFICE	40.62	0	01:03	1.00
L241A-IC(1)	ORIFICE	29.39	0	01:00	1.00
L241A-IC(2)	ORIFICE	29.39	0	01:00	1.00
OR1	ORIFICE	304.92	0	01:12	1.00
Spillway	WEIR	11721.51	0	01:12	0.85
W103A-29	WEIR	0.00	0	00:00	0.00
W104A-29	WEIR	0.00	0	00:00	0.00
W106A-29	WEIR	0.00	0	00:00	0.00
W2	WEIR	2792.99	0	01:12	1.00
ART-IC	DUMMY	953.00	0	00:54	
B1-IC	DUMMY	116.00	0	01:02	
B2-IC	DUMMY	199.00	0	00:55	
COMM-IC	DUMMY	399.00	0	01:02	
HZD-IC	DUMMY	1187.00	0	00:54	
L121B-IC	DUMMY	299.00	0	00:57	
L218A-IC	DUMMY	443.00	0	00:55	
L225B-IC	DUMMY	517.00	0	00:53	

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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
101A-101-29	1.87	0.00	0.00	0.00	0.04	0.00	0.00	0.96	0.00	0.00
102-101A-29	1.12	0.00	0.00	0.00	0.06	0.00	0.00	0.94	0.00	0.00
103-102-29	1.10	0.00	0.00	0.00	0.02	0.00	0.00	0.98	0.00	0.00
104-103-29	1.00	0.00	0.00	0.00	0.02	0.00	0.00	0.98	0.00	0.00
106-103-29	1.00	0.00	0.00	0.00	0.01	0.00	0.00	0.99	0.00	0.00
C1	1.00	0.00	0.00	0.00	0.87	0.13	0.00	0.00	0.00	0.00
C10	1.00	0.00	0.00	0.00	0.99	0.01	0.00	0.00	0.98	0.00
C100	1.00	0.00	0.00	0.00	0.01	0.00	0.00	0.99	0.01	0.00
C101	1.00	0.00	0.00	0.00	0.02	0.00	0.00	0.98	0.02	0.00
C102	1.00	0.00	0.00	0.00	0.02	0.00	0.00	0.98	0.01	0.00
C103	1.00	0.00	0.00	0.00	0.03	0.00	0.00	0.97	0.03	0.00
C104	1.19	0.00	0.00	0.00	0.03	0.00	0.00	0.97	0.01	0.00
C105	1.00	0.00	0.00	0.00	0.02	0.00	0.00	0.98	0.02	0.00
C106	1.02	0.00	0.00	0.00	0.02	0.00	0.00	0.98	0.00	0.00
C107	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.97	0.00
C108	1.00	0.00	0.00	0.00	0.02	0.00	0.00	0.98	0.02	0.00
C109	1.00	0.00	0.00	0.00	0.02	0.00	0.00	0.98	0.01	0.00
C11	1.00	0.00	0.00	0.00	0.01	0.00	0.00	0.99	0.00	0.00
C110	1.00	0.00	0.00	0.00	0.02	0.00	0.00	0.98	0.02	0.00
C111	1.00	0.00	0.00	0.00	0.02	0.00	0.00	0.98	0.01	0.00
C112	1.00	0.00	0.00	0.00	0.03	0.00	0.00	0.97	0.03	0.00
C113	1.35	0.00	0.00	0.00	0.03	0.00	0.00	0.97	0.01	0.00
C114	2.35	0.00	0.00	0.00	0.02	0.00	0.00	0.98	0.01	0.00
C115	1.00	0.00	0.00	0.00	0.02	0.00	0.00	0.98	0.02	0.00
C116	1.00	0.00	0.00	0.00	0.02	0.00	0.00	0.98	0.02	0.00
C117	1.00	0.98	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C118	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C119	4.28	0.98	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C12	1.00	0.00	0.00	0.00	0.01	0.00	0.00	0.99	0.00	0.00
C120	2.12	0.70	0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C121	1.63	0.00	0.00	0.00	0.01	0.00	0.00	0.99	0.00	0.00
C122	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C123	1.00	0.00	0.00	0.00	0.02	0.00	0.00	0.98	0.01	0.00
C124	1.00	0.00	0.00	0.00	0.02	0.00	0.00	0.98	0.02	0.00
C125	1.00	0.00	0.00	0.00	0.68	0.32	0.00	0.00	0.96	0.00
C126	1.00	0.00	0.00	0.00	0.02	0.00	0.00	0.98	0.02	0.00
C127	2.26	0.00	0.00	0.00	0.02	0.00	0.00	0.98	0.01	0.00
C128	5.74	0.98	0.01	0.00	0.00	0.00	0.00	0.01	0.97	0.00
C129	5.43	0.98	0.01	0.00	0.00	0.00	0.00	0.01	0.98	0.00
C13	1.00	0.00	0.00	0.00	0.93	0.07	0.00	0.00	0.98	0.00
C130	5.00	0.97	0.00	0.00	0.01	0.00	0.01	0.00	0.00	0.00
C131	5.59	0.98	0.01	0.00	0.00	0.00	0.01	0.00	0.01	0.00
C132	2.49	0.98	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00
C133	1.00	0.98	0.00	0.00	0.01	0.00	0.01	0.00	0.00	0.00
C134	5.88	0.98	0.01	0.00	0.01	0.00	0.00	0.00	0.01	0.00
C135	2.36	0.00	0.00	0.00	0.97	0.03	0.00	0.00	0.02	0.00
C136	1.22	0.86	0.00	0.00	0.13	0.00	0.00	0.00	0.01	0.00
C137	2.36	0.00	0.00	0.00	0.95	0.05	0.00	0.00	0.04	0.00
C138	11.79	0.98	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00
C139	8.86	0.97	0.01	0.00	0.01	0.00	0.01	0.00	0.00	0.00
C14	1.00	0.00	0.00	0.00	0.01	0.00	0.00	0.99	0.01	0.00
C140	1.00	0.99	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00
C142	1.70	0.99	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00
C143	14.45	0.98	0.00	0.00	0.00	0.00	0.01	0.00	0.97	0.00
C144	17.30	0.98	0.01	0.00	0.01	0.00	0.00	0.00	0.01	0.00
C145	2.49	0.98	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00
C146	1.00	0.99	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00
C147	1.00	0.99	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00
C148	7.29	0.99	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00
C15	1.00	0.00	0.00	0.00	0.01	0.00	0.00	0.99	0.01	0.00
C150	1.53	0.99	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00
C151	1.00	0.00	0.97	0.00	0.03	0.00	0.00	0.00	0.97	0.00
C152	7.97	0.00	0.00	0.00	0.96	0.04	0.00	0.00	0.96	0.00
C153	1.29	0.86	0.00	0.00	0.14	0.00	0.00	0.00	0.01	0.00
C154	2.04	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
C155	1.68	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
C156	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
C157	1.18	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
C158	1.68	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
C159	2.40	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
C16	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

C160	3.03	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
C161	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
C162	1.74	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
C163	4.32	0.99	0.00	0.00	0.00	0.01	0.00	0.00	0.97	0.00
C164	4.74	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C165	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.02	0.00
C166	1.19	0.00	0.98	0.00	0.02	0.00	0.00	0.00	0.98	0.00
C167	1.03	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
C168	5.34	0.00	0.00	0.00	0.02	0.00	0.00	0.98	0.01	0.00
C169	1.00	0.00	0.37	0.00	0.63	0.00	0.00	0.00	0.97	0.00
C17	1.00	0.69	0.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C170	1.63	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
C171	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
C172	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
C173	1.67	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
C174	7.46	0.99	0.00	0.00	0.00	0.01	0.00	0.00	0.98	0.00
C175	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C176	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
C177	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
C178	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
C179	1.00	0.00	0.00	0.00	0.01	0.00	0.00	0.99	0.00	0.00
C18	1.00	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C180	1.00	0.00	0.99	0.00	0.01	0.00	0.00	0.00	0.98	0.00
C181	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C182	2.46	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
C183	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
C19	1.47	0.00	0.00	0.00	0.01	0.00	0.00	0.99	0.00	0.00
C2	1.00	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C20	1.00	0.00	0.00	0.00	0.02	0.00	0.00	0.98	0.02	0.00
C21	1.00	0.98	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00
C22	1.15	0.00	0.00	0.00	0.02	0.00	0.00	0.98	0.01	0.00
C23	1.00	0.00	0.00	0.00	0.02	0.00	0.00	0.98	0.02	0.00
C24	1.00	0.00	0.00	0.00	0.02	0.00	0.00	0.98	0.01	0.00
C25	1.00	0.00	0.00	0.00	0.02	0.00	0.00	0.98	0.02	0.00
C26	1.00	0.00	0.00	0.00	0.02	0.00	0.00	0.98	0.01	0.00
C27	1.00	0.00	0.00	0.00	0.01	0.00	0.00	0.99	0.01	0.00
C28	1.52	0.00	0.00	0.00	0.01	0.00	0.00	0.99	0.00	0.00
C29	1.00	0.00	0.00	0.00	0.02	0.00	0.00	0.98	0.02	0.00
C3	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C30	1.00	0.00	0.00	0.00	0.02	0.00	0.00	0.98	0.01	0.00
C31	1.00	0.00	0.00	0.00	0.02	0.00	0.00	0.98	0.02	0.00
C32	1.00	0.00	0.00	0.00	0.02	0.00	0.00	0.98	0.01	0.00
C33	1.00	0.00	0.00	0.00	0.01	0.00	0.00	0.99	0.01	0.00
C34	1.70	0.00	0.00	0.00	0.01	0.00	0.00	0.99	0.00	0.00
C35	1.00	0.98	0.01	0.00	0.01	0.00	0.00	0.00	0.98	0.00
C36	1.00	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C37	1.00	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C38	1.00	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C39	1.00	0.98	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C4	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C40	1.00	0.00	0.00	0.00	0.02	0.00	0.00	0.98	0.01	0.00
C41	1.00	0.00	0.00	0.00	0.01	0.00	0.00	0.99	0.01	0.00
C42	1.00	0.00	0.00	0.00	0.01	0.00	0.00	0.99	0.01	0.00
C43	1.00	0.00	0.00	0.00	0.01	0.00	0.00	0.99	0.01	0.00
C44	1.00	0.00	0.00	0.00	0.01	0.00	0.00	0.99	0.01	0.00
C45	1.00	0.00	0.00	0.00	0.01	0.00	0.00	0.99	0.01	0.00
C46	1.00	0.00	0.00	0.00	0.01	0.00	0.00	0.99	0.00	0.00
C47	1.00	0.00	0.00	0.00	0.01	0.00	0.00	0.99	0.01	0.00
C48	2.36	0.00	0.00	0.00	0.01	0.00	0.00	0.99	0.00	0.00
C49	1.06	0.99	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00
C5	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C50	1.00	0.99	0.01	0.00	0.01	0.00	0.00	0.00	0.98	0.00
C51	1.00	0.00	0.00	0.00	0.01	0.00	0.00	0.99	0.01	0.00
C52	1.00	0.00	0.00	0.00	0.01	0.00	0.00	0.99	0.01	0.00
C53	1.00	0.00	0.00	0.00	0.01	0.00	0.00	0.99	0.00	0.00
C54	1.16	0.00	0.00	0.00	0.93	0.07	0.00	0.00	0.97	0.00
C55	1.00	0.00	0.00	0.00	0.01	0.00	0.00	0.99	0.01	0.00
C56	1.04	0.00	0.00	0.00	0.01	0.00	0.00	0.99	0.00	0.00
C57	1.00	0.00	0.00	0.00	0.02	0.00	0.00	0.98	0.02	0.00
C58	1.00	0.98	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C59	1.00	0.98	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C6	1.00	0.00	0.00	0.00	0.01	0.00	0.00	0.99	0.01	0.00
C60	2.66	0.98	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C61	1.00	0.00	0.00	0.00	0.02	0.00	0.00	0.98	0.02	0.00
C62	1.00	0.98	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C63	1.00	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C64	1.19	0.00	0.00	0.00	0.01	0.00	0.00	0.99	0.00	0.00
C65	2.20	0.00	0.00	0.00	0.01	0.00	0.00	0.99	0.01	0.00

C66	1.00	0.00	0.98	0.00	0.01	0.00	0.00	0.00	0.00	0.00
C67	1.00	0.00	0.00	0.00	0.02	0.00	0.00	0.98	0.02	0.00
C68	1.00	0.00	0.00	0.00	0.02	0.00	0.00	0.98	0.01	0.00
C69	1.00	0.00	0.00	0.00	0.02	0.00	0.00	0.98	0.02	0.00
C7	1.00	0.00	0.00	0.00	0.01	0.00	0.00	0.99	0.01	0.00
C70	1.00	0.00	0.00	0.00	0.02	0.00	0.00	0.98	0.01	0.00
C71	1.00	0.00	0.00	0.00	0.03	0.00	0.00	0.97	0.03	0.00
C72	1.00	0.00	0.00	0.00	0.03	0.00	0.00	0.97	0.02	0.00
C73	1.00	0.00	0.00	0.00	0.02	0.00	0.00	0.98	0.02	0.00
C74	1.00	0.00	0.00	0.00	0.02	0.00	0.00	0.98	0.02	0.00
C75	1.00	0.00	0.00	0.00	0.02	0.00	0.00	0.98	0.01	0.00
C76	1.00	0.00	0.00	0.00	0.02	0.00	0.00	0.98	0.02	0.00
C77	1.00	0.00	0.00	0.00	0.03	0.00	0.00	0.97	0.01	0.00
C78	1.00	0.00	0.00	0.00	0.03	0.00	0.00	0.97	0.03	0.00
C79	1.00	0.00	0.00	0.00	0.03	0.00	0.00	0.97	0.01	0.00
C8	1.00	0.00	0.00	0.00	0.01	0.00	0.00	0.99	0.01	0.00
C80	1.00	0.00	0.00	0.00	0.03	0.00	0.00	0.97	0.03	0.00
C81	1.00	0.00	0.00	0.00	0.02	0.00	0.00	0.98	0.01	0.00
C82	1.00	0.00	0.00	0.00	0.02	0.00	0.00	0.98	0.02	0.00
C83	1.00	0.00	0.00	0.00	0.02	0.00	0.00	0.98	0.02	0.00
C84	1.00	0.00	0.00	0.00	0.02	0.00	0.00	0.98	0.02	0.00
C85	1.00	0.00	0.00	0.00	0.02	0.00	0.00	0.98	0.01	0.00
C86	1.00	0.00	0.00	0.00	0.02	0.00	0.00	0.98	0.02	0.00
C87	1.00	0.00	0.00	0.00	0.01	0.00	0.00	0.99	0.00	0.00
C88	1.00	0.00	0.00	0.00	0.01	0.00	0.00	0.99	0.01	0.00
C89	1.00	0.00	0.00	0.00	0.01	0.00	0.00	0.99	0.01	0.00
C9	1.00	0.00	0.00	0.00	0.01	0.00	0.00	0.99	0.01	0.00
C90	1.00	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C91	1.66	0.00	0.00	0.00	0.02	0.00	0.00	0.98	0.02	0.00
C92	1.00	0.00	0.00	0.00	0.02	0.00	0.00	0.98	0.01	0.00
C93	1.00	0.00	0.00	0.00	0.02	0.00	0.00	0.98	0.02	0.00
C94	1.00	0.00	0.00	0.00	0.02	0.00	0.00	0.98	0.01	0.00
C95	1.00	0.00	0.00	0.00	0.02	0.00	0.00	0.98	0.02	0.00
C96	1.00	0.00	0.00	0.00	0.02	0.00	0.00	0.98	0.01	0.00
C97	1.00	0.00	0.00	0.00	0.02	0.00	0.00	0.98	0.02	0.00
C98	4.04	0.00	0.00	0.00	0.02	0.00	0.00	0.98	0.01	0.00
C99	1.00	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F101A-IC	1.21	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
outlet	4.41	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00

Pipe_-_(234)	1.02	0.00	0.00	0.00	0.03	0.00	0.00	0.97	0.00	0.00
Pipe_-_(234)_(1)	1.00	0.00	0.00	0.00	0.04	0.00	0.00	0.96	0.01	0.00
Pipe_-_(235)	1.00	0.99	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00
Pipe_-_(238)	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
Pipe_-_(240)	1.00	0.00	0.00	0.00	0.99	0.00	0.00	0.01	0.26	0.00
Pipe_-_(241)_(1)	1.00	0.00	0.00	0.00	0.01	0.00	0.00	0.99	0.00	0.00
Pipe_-_(245)	1.00	0.00	0.00	0.00	0.01	0.01	0.00	0.98	0.02	0.00
Pipe_-_(253)	1.00	0.00	0.00	0.00	0.07	0.00	0.00	0.93	0.05	0.00
Pipe_-_(263)	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
Pipe_-_(264)	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
Pipe_-_(267)	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
Pipe_-_(329)	1.45	0.00	0.00	0.00	0.01	0.00	0.00	0.99	0.00	0.00
Pipe_-_(330)	1.00	0.00	0.00	0.00	0.02	0.00	0.00	0.98	0.00	0.00
Pipe_-_(331)	1.00	0.00	0.00	0.00	0.02	0.00	0.00	0.98	0.01	0.00
Pipe_-_(332)	1.24	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00
Pipe_-_(333)	1.00	0.00	0.00	0.00	0.01	0.00	0.00	0.99	0.00	0.00
Pipe_-_(334)	1.00	0.00	0.00	0.00	0.03	0.00	0.00	0.97	0.98	0.00
Pipe_-_(335)	1.00	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pipe_-_(337)	1.00	0.00	0.00	0.00	0.03	0.00	0.00	0.97	0.00	0.00
Pipe_-_(338)	1.00	0.00	0.00	0.00	0.03	0.00	0.00	0.97	0.01	0.00
Pipe_-_(344)	1.00	0.00	0.00	0.00	0.02	0.00	0.00	0.98	0.00	0.00
Pipe_-_(345)	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
Pipe_-_(346)	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
Pipe_-_(347)	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
Pipe_-_(349)	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
Pipe_-_(350)	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
Pipe_-_(351)	1.00	0.00	0.00	0.00	0.01	0.00	0.00	0.99	0.00	0.00
Pipe_-_(352)	1.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00
Pipe_-_(354)	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
Pipe_-_(360)	1.00	0.00	0.00	0.00	0.01	0.00	0.00	0.99	0.00	0.00
Pipe_-_(366)	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
Pipe_-_(367)	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
Pipe_-_(368)	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
Pipe_-_(4)	1.00	0.00	0.00	0.00	0.02	0.00	0.00	0.98	0.00	0.00
Pipe_-_(43)	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
Pipe_-_(44)	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
Pipe_-_(45)	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
Pipe_-_(47)	1.00	0.00	0.31	0.00	0.68	0.00	0.00	0.01	0.96	0.00
Pipe_-_(48)	1.00	0.00	0.00	0.00	0.01	0.00	0.00	0.99	0.00	0.00

Pipe_-_(49)	1.00	0.00	0.00	0.00	0.02	0.00	0.00	0.98	0.01	0.00
Pipe_-_(5)	1.45	0.00	0.00	0.00	0.02	0.00	0.00	0.98	0.00	0.00
Pipe_-_(50)	1.00	0.00	0.00	0.00	0.01	0.00	0.00	0.99	0.00	0.00
Pipe_-_(51)	1.84	0.00	0.00	0.00	0.03	0.00	0.00	0.97	0.00	0.00
Pipe_-_(52)	1.00	0.00	0.00	0.00	0.03	0.00	0.00	0.97	0.00	0.00
Pipe_-_(52)_(1)	1.00	0.00	0.00	0.00	0.01	0.00	0.00	0.99	0.00	0.00
Pipe_-_(53)	1.09	0.00	0.00	0.00	0.02	0.00	0.00	0.98	0.00	0.00
Pipe_-_(54)	1.00	0.00	0.00	0.00	0.02	0.00	0.00	0.98	0.00	0.00
Pipe_-_(54)_(1)	1.00	0.00	0.00	0.00	0.08	0.00	0.00	0.92	0.06	0.00
Pipe_-_(55)	1.11	0.00	0.00	0.00	0.02	0.00	0.00	0.98	0.01	0.00
Pipe_-_(56)	1.00	0.00	0.00	0.00	0.01	0.00	0.00	0.99	0.00	0.00
Pipe_-_(57)	1.00	0.02	0.00	0.00	0.01	0.00	0.00	0.97	0.00	0.00
Pipe_-_(58)	1.00	0.00	0.57	0.00	0.43	0.00	0.00	0.00	0.97	0.00
Pipe_-_(58)_(1)	1.00	0.00	0.00	0.00	0.02	0.00	0.00	0.98	0.00	0.00
Pipe_-_(59)	1.28	0.00	0.00	0.00	0.01	0.00	0.00	0.99	0.00	0.00
Pipe_-_(6)	1.00	0.00	0.00	0.00	0.02	0.00	0.00	0.98	0.00	0.00
Pipe_-_(60)	1.00	0.00	0.00	0.00	0.01	0.00	0.00	0.99	0.00	0.00
Pipe_-_(73)	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
Pipe_-_(77)	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
Pipe_-_(81)	1.87	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
Pipe_-_(82)	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
Pipe_-_(83)	2.19	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
Pipe_-_(84)	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
Pipe_-_(85)	1.34	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
Pipe_-_(86)	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
Pipe_-_(87)	1.00	0.00	0.68	0.00	0.32	0.00	0.00	0.00	0.98	0.00

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Conduit Surcharge Summary
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Conduit	--------- Hours Full Both Ends	Hours Full Upstream	Hours Full Dnstream --------	Hours Above Full Normal Flow	Hours Capacity Limited
101A-101-29	0.55	0.55	0.58	0.01	0.52
102-101A-29	0.52	0.52	0.54	0.01	0.01
103-102-29	0.49	0.49	0.51	0.01	0.01
104-103-29	0.34	0.34	0.49	0.01	0.01
106-103-29	0.42	0.42	0.49	0.01	0.01
C11	0.01	0.01	0.02	0.01	0.01
C12	0.01	0.01	0.02	0.01	0.01
C123	0.01	0.01	0.38	0.01	0.01
C124	0.01	0.01	0.38	0.01	0.01
C14	0.01	0.01	0.18	0.01	0.01
C15	0.01	0.01	0.18	0.01	0.01
C151	0.01	0.01	0.25	0.01	0.01
C154	48.00	48.00	48.00	0.39	0.80
C155	48.00	48.00	48.00	0.51	0.51
C157	48.00	48.00	48.00	0.01	0.01
C158	1.15	1.16	1.19	0.01	0.93
C160	0.01	0.01	1.01	0.01	0.01
C161	48.00	48.00	48.00	0.01	0.01
C162	48.00	48.00	48.00	0.01	0.01
C165	0.01	0.01	48.00	0.01	0.01
C166	0.01	0.01	47.04	0.01	0.01
C169	0.36	0.36	0.60	0.01	0.01
C170	0.63	0.63	0.64	0.01	0.01
C171	0.70	0.70	0.82	0.01	0.01
C172	0.74	0.74	1.91	0.01	0.01
C173	48.00	48.00	48.00	0.01	0.01
C177	0.74	0.74	1.91	0.01	0.01
C178	1.12	1.12	1.26	0.01	0.01
C179	0.01	0.01	0.18	0.01	0.01
C182	0.84	0.84	0.86	0.01	0.01
C183	0.65	0.66	0.67	0.38	0.62
C29	0.01	0.01	0.10	0.01	0.01
C30	0.01	0.01	0.10	0.01	0.01
F101A-IC	48.00	48.00	48.00	0.01	0.01
outlet	48.00	48.00	48.00	0.01	0.01
Pipe_-_(234)	0.63	0.63	0.66	0.01	0.34
Pipe_-_(234)_(1)	0.37	0.37	0.62	0.01	0.01
Pipe_-_(238)	0.67	0.67	0.77	0.27	0.30
Pipe_-_(240)	0.25	0.32	0.25	0.41	0.25
Pipe_-_(241)_(1)	0.25	0.29	0.25	0.42	0.25
Pipe_-_(245)	0.01	0.01	0.14	0.01	0.01

Pipe_-_(253)	0.38	0.38	0.63	0.01	0.01
Pipe_-_(263)	48.00	48.00	48.00	0.25	0.33
Pipe_-_(264)	0.98	0.98	2.53	0.31	0.32
Pipe_-_(267)	0.77	0.77	0.94	0.30	0.32
Pipe_-_(329)	0.01	0.01	0.01	0.32	0.01
Pipe_-_(330)	0.01	0.14	0.01	0.33	0.01
Pipe_-_(331)	0.01	0.01	0.14	0.01	0.01
Pipe_-_(337)	0.28	0.28	0.47	0.01	0.01
Pipe_-_(338)	0.01	0.01	0.28	0.01	0.01
Pipe_-_(344)	0.43	0.43	0.71	0.01	0.01
Pipe_-_(345)	0.71	0.71	0.78	0.01	0.01
Pipe_-_(346)	0.78	0.78	0.85	0.01	0.01
Pipe_-_(347)	0.85	0.85	0.99	0.01	0.01
Pipe_-_(349)	0.77	0.77	0.97	0.01	0.32
Pipe_-_(350)	0.32	0.32	0.77	0.01	0.01
Pipe_-_(351)	0.15	0.26	0.15	0.49	0.15
Pipe_-_(354)	0.47	0.47	0.70	0.01	0.01
Pipe_-_(360)	0.19	0.19	0.35	0.01	0.01
Pipe_-_(366)	48.00	48.00	48.00	0.01	0.63
Pipe_-_(367)	48.00	48.00	48.00	0.01	0.01
Pipe_-_(368)	48.00	48.00	48.00	0.01	0.01
Pipe_-_(4)	0.64	0.64	0.66	0.01	0.16
Pipe_-_(43)	0.91	0.91	2.13	0.01	0.01
Pipe_-_(44)	0.65	0.65	0.77	0.01	0.01
Pipe_-_(45)	0.51	0.51	0.65	0.01	0.01
Pipe_-_(47)	0.42	0.42	0.51	0.01	0.01
Pipe_-_(48)	0.42	0.46	0.42	0.52	0.41
Pipe_-_(49)	0.28	0.28	0.51	0.01	0.01
Pipe_-_(5)	0.64	0.66	0.64	0.16	0.62
Pipe_-_(50)	0.40	0.49	0.41	0.18	0.39
Pipe_-_(51)	0.47	0.50	0.47	0.01	0.47
Pipe_-_(52)	0.47	0.48	0.48	0.01	0.41
Pipe_-_(52)_(1)	0.43	0.49	0.45	0.30	0.13
Pipe_-_(53)	0.48	0.60	0.48	0.40	0.48
Pipe_-_(54)	0.54	0.59	0.55	0.40	0.42
Pipe_-_(54)_(1)	0.36	0.36	0.59	0.01	0.01
Pipe_-_(55)	0.33	0.33	0.36	0.01	0.01
Pipe_-_(56)	0.17	0.17	0.30	0.01	0.01
Pipe_-_(57)	0.01	0.01	0.16	0.01	0.01
Pipe_-_(58)	0.68	0.68	0.77	0.01	0.01
Pipe_-_(58)_(1)	0.55	0.55	0.69	0.01	0.01
Pipe_-_(59)	0.51	0.51	0.53	0.01	0.01
Pipe_-_(6)	0.62	0.64	0.64	0.05	0.49
Pipe_-_(60)	0.41	0.41	0.48	0.01	0.01
Pipe_-_(73)	48.00	48.00	48.00	0.01	0.01
Pipe_-_(77)	48.00	48.00	48.00	0.01	0.01
Pipe_-_(81)	48.00	48.00	48.00	0.01	0.01
Pipe_-_(82)	48.00	48.00	48.00	0.01	0.01
Pipe_-_(83)	48.00	48.00	48.00	0.01	0.21
Pipe_-_(84)	47.87	47.87	48.00	0.01	0.01
Pipe_-_(85)	2.46	2.46	43.43	0.01	0.27
Pipe_-_(86)	0.98	0.98	1.98	0.01	0.01
Pipe_-_(87)	0.72	0.72	0.98	0.01	0.01

Analysis begun on: Tue Jul 20 16:28:37 2021
Analysis ended on: Tue Jul 20 16:28:51 2021
Total elapsed time: 00:00:14

C.6 SWM EXCERPTS FROM KANATA WEST DEVELOPMENT FIRST REGISTRATION PHASE REPORT (STANTEC, FEBRUARY 2020)

3.0 STORM DRAINAGE

The following sections describe the stormwater management (SWM) design for the Richcraft Kanata West Development in the context of the background documents and governing criteria.

3.1 PROPOSED CONDITIONS

The initial 15.9 ha phase of the overall 36.5 ha development comprises a mixture of townhomes and back to back units, a park, a commercial block, and a medium density residential block. The commercial block and medium density residential private block will be developed as separate site plan applications.

The Kanata West Pond 5 is to be constructed in two stages, interim and ultimate conditions. In the interim development condition, it is proposed to construct an interim KW SWM Pond 5 to provide quality and quantity control for runoff from the proposed first registration phase of the Richcraft Kanata West Development, as well as runoff from the Kanata West Pumping Station (KWPS) for a total interim drainage area to the interim KW SWM Pond 5 of 15.5 ha at 61% imperviousness as shown on **Figure 1.3**. The interim pond will eventually become part of the ultimate KW SWM Pond 5 in the future. The KW Pond 5 will be designed to provide 'Normal' level of quality control of stormwater runoff which corresponds to 70% TSS removal prior to discharging into the Carp River. The *Interim Kanata West Pond 5 (with Ultimate Carp River) Design Brief* (Stantec, April 2019) has been submitted under separate cover and should be read in conjunction with this report.

Site storm sewers for the proposed interim phase will be directed to the interim Kanata West Pond 5 through the west forebay, while a future trunk sewer along Cartage Way and Winter Wheat Terrace will direct runoff from the future phase of the Richcraft Kanata West Development to the east forebay of the ultimate Kanata West Pond 5 which will also service the existing Mattamy and Trinity developments, as well as an existing section of Hazeldean Road once their respective interim SWM facilities are decommissioned. In addition, the ultimate condition KW Pond 5 and future site trunk sewers will service the future transitway/arterial road, and a future commercial block as shown on **Figure 1.4**.

The ultimate development condition with the ultimate KW Pond 5 configuration and the inclusion of runoff from external areas results in the worst-case scenario for the proposed first registration phase of the Richcraft Kanata West Development and as such, the results of the SWM analyses presented in this report correspond to the ultimate development conditions.

The overall approach for storm servicing and stormwater management for the Richcraft Kanata West Development was initially outlined in the Kanata West Master Servicing Study (KWMSS) prepared by Stantec in 2006. In accordance with this document, inlet control devices have been used at road low points to restrict inflow rates to the storm sewers and to provide attenuating surface storage. The major overland system comprising of swales, roadway sags, streets, etc. has been designed to handle peak flows beyond the storm sewer capacity up to the 100-year storm and to be directed to the KW Pond 5.

3.2 STORMWATER BACKGROUND AND DESIGN CRITERIA

3.2.1 Kanata West Master Servicing Study SWM Criteria

The KWMSS established the SWM criteria for the Kanata West community, the SWM pond locations and their respective outlet locations. The following summarizes the design requirements outlined in the KWMSS for the future developments as shown in the report excerpts included in **Appendix D.2**.

- Width parameter: Twice the street length to be used for arterial roadways, and 225 m/ha to be used for residential and mixed-use developments where no street layout is available.
- Major system storage: major system storage of 40 m^3/ha and 50 m^3/ha was assumed for arterial roads and residential/non-residential lands respectively.
- Inlet control devices to be used to restrict runoff to 85 L/s/ha on average for residential and non-residential lands.
- The capture rates for arterial roadways to be equal to the10-year storm design.
- Sizing of local storm sewers to use inlet times of 15 minutes for typical split-lot drainage in residential developments.
- All sewer hydraulic analysis is to use a static boundary condition equal to the MVC 1983 flood limit of 94.60 m.
- Pond 5 is proposed upstream of the confluence of Poole Creek and the Carp River along the south-west bank of the Carp River. Pond 5 will service residential and retail developments between Poole Creek, the Carp River and Hazeldean Road. Normal and 100-year water levels in the pond are 93.44 m and 94.94 m, respectively.
- The Carp River Watershed/Subwatershed Study (Robinson Consultants, November 2004) proposed target infiltration rates of 104 mm/year and 73 mm/year for areas of moderate and low recharge respectively within the KW Community. Post development infiltration rates are to be increased by 25% above the pre-development rate. This rate of infiltration was established to compensate for those areas (i.e. Roadway corridors) that can not provide infiltration. The Richcraft Kanata West subdivision is identified as having an estimated infiltration rate between 50-70 mm/yr.

3.2.2 Proposed Deviations from the Kanata West Master Servicing Study

The proposed SWM design for the Richcraft Kanata West Development contains deviations from the KWMSS. Firstly, an interim pond has been introduced to support the development of the first registration phase of the Richcraft Development which will be serviced through the proposed west forebay trunk sewer, prior to constructing a second forebay to the east and corresponding system segments in the ultimate development condition. The use of PCSWMM for modeling of the site hydrology and hydraulics allowed for an analysis of the systems' response during various storm events. The following assumptions were applied to the detailed model:

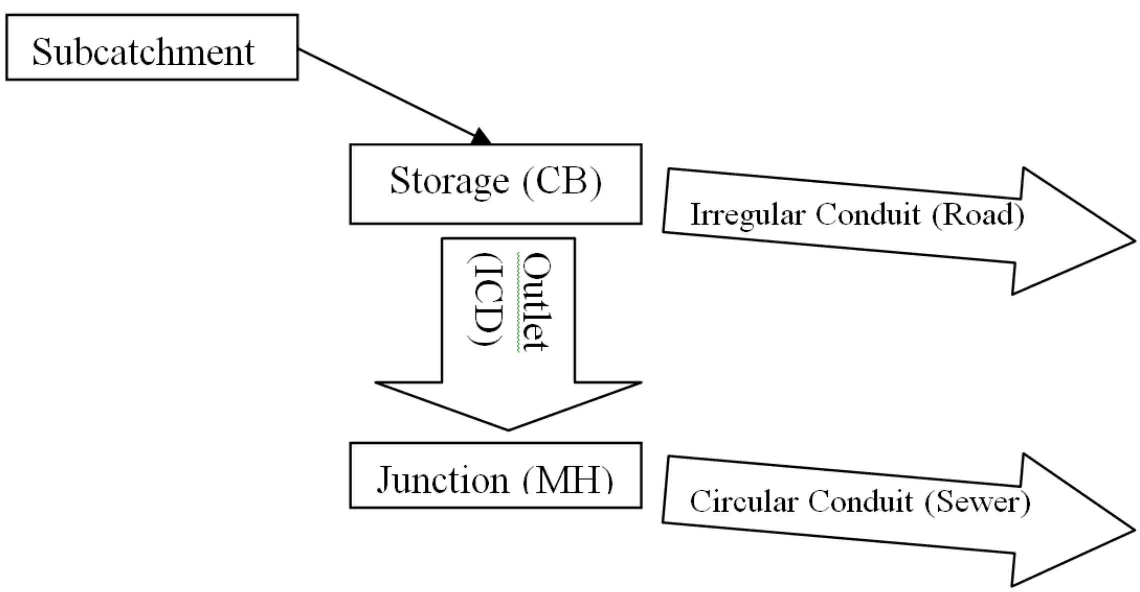
- Hydrologic parameters as per Ottawa Sewer Design Guidelines, including Horton infiltration, Manning's 'n', and depression storage values.
- 3-hour Chicago Storm distribution for the 2-year, 5-year, and 10-year to determine inlet capture rates for the different catchments.
- Minor and major system response assessed for the 100-year using the 3-hour Chicago Storm Distribution and the 12-hour SCS Type II distribution with a fixed water level in the Carp River of 94.60 m.
- To 'stress test' the system a 'climate change' scenario was created by adding 20% of the individual intensity values of the 100-year storms at their specified time step.
- Assess the minor and major systems response during the July 1, 1979 historical with a fixed water level in the Carp River of 94.60 m.
- Percent imperviousness calculated based on actual soft and hard surfaces for representative catchments and converted to equivalent runoff coefficient using the relationship C = (Imp. x 0.7) + 0.2.
- Runoff coefficients for future medium density residential and school blocks of 0.70, and 0.85 for commercial blocks.
- Subcatchment areas are defined from high-point to high-point where sags occur, and detailed grading is available.
- Width parameter was taken as twice the length of the street/swale segment for two-sided catchments and as the length of the street/swale segment for one-sided catchments.
- Where detailed grading was not available, subcatchment areas were defined by the limits of the future development blocks and the width of the subcatchment was defined as 225 m/ha as per the City of Ottawa Sewer Design Guidelines.
- Catchbasin inflow restricted with inlet-control devices (ICDs) as per City guidelines.
- Surface ponding in sag storage calculated based on grading plans (**Drawings PD-1** - **PD-6**).
- Different segment cross-section types defined, accounting for varying right-of-way widths with 3% cross slope, swales, and spillways.
- Future school block (area L218A) to restrict minor system peak flows up to the 100-year storm to 443 L/s and to restrict 100-year overflows to Shropshire Place to 565 L/s.

- Future medium density residential blocks, areas L123B and L225B, to limit minor system peak flows up to the 100-year storm to 111 L/s and to 389 L/s and to restrict 100-year overflows to Maize Street and Holstein Road to 480 L/s and 799 L/s respectively.
- Future commercial block, area L121B, to restrict minor system peak flows up to the 100-year storm to 299 L/s and to provide on-site storage for 100-year overflows.
- Inlet control devices (ICDs) to have a minimum orifice diameter of 83 mm.

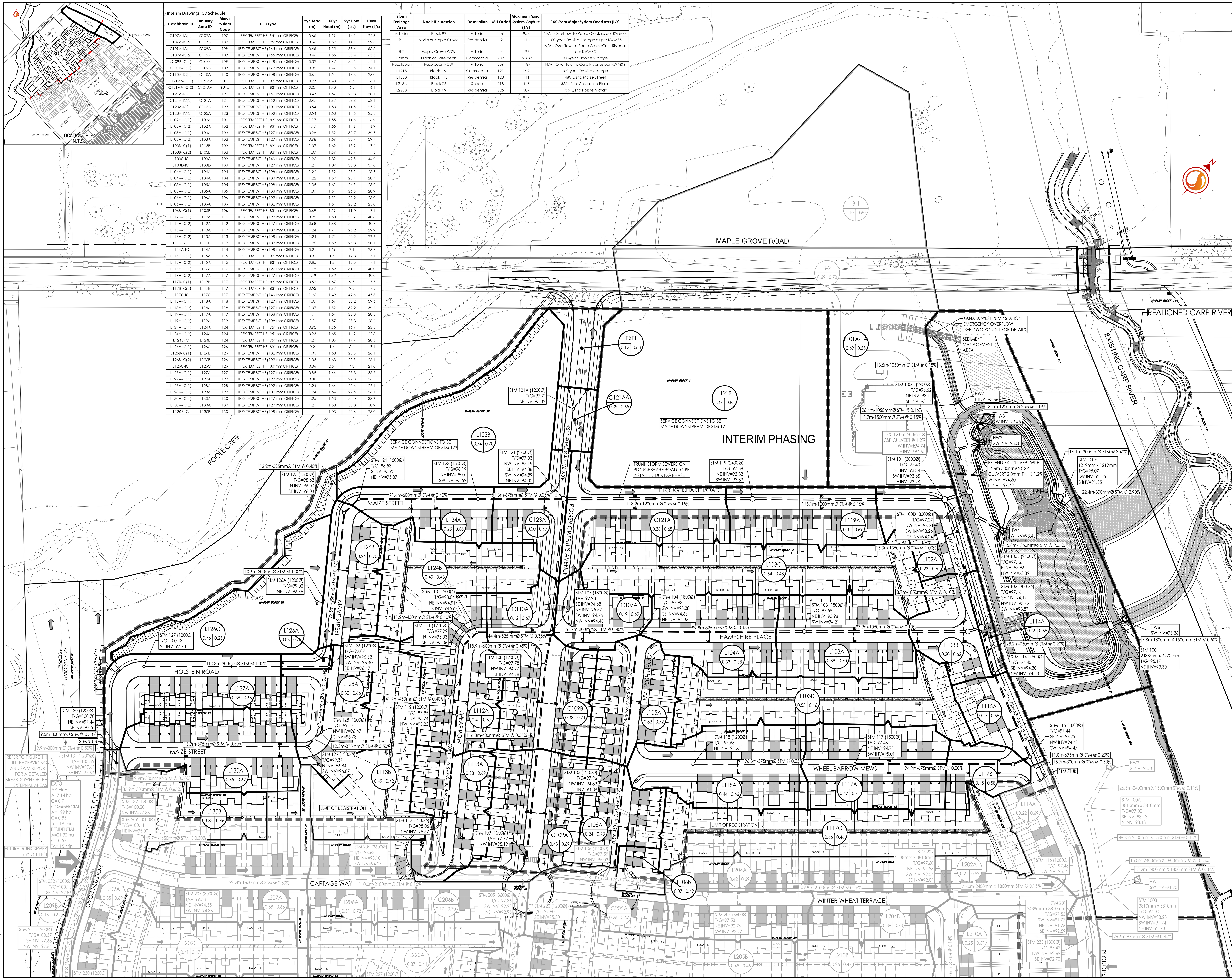
3.4.1 SWMM Dual Drainage Methodology

The proposed development is modeled in one modeling program as a dual conduit system (see **Figure 3.1**), with: 1) circular conduits representing the sewers & storage nodes representing manholes; 2) irregular conduits using street-shaped cross-sections to represent the saw-toothed overland road network from high-point to low-point and storage nodes representing catchbasins and high points. The dual drainage systems are connected via orifice link objects from storage node (i.e. CB) to junction (i.e. MH), and represent inlet control devices (ICDs). Subcatchments are linked to the storage node on the surface so that generated hydrographs are directed there firstly.

Figure 3.1: Schematic Representing Model Object Roles



Storage nodes are used in the model to represent catchbasins as well as major system junctions. For storage nodes representing catchbasins (CBs), the invert of the storage node represents the invert of the CB and the rim of the storage node represents the maximum allowable flow depth elevation above the storage node (equal to the top of the CB plus an additional 0.35 m or



Interim Drawings ICD Schedule

Catchbasin ID	Tributary Area ID	Minor System Node	ICD Type	2yr Head (m)	100yr Head (m)	2yr Flow (L/s)	100yr Flow (L/s)
C107A-IC(1)	C107A	107	IPEX TEMPEST HF (95"mm ORIFICE)	0.66	1.59	14.1	22.3
C107A-IC(2)	C107A	107	IPEX TEMPEST HF (95"mm ORIFICE)	0.66	1.59	14.1	22.3
C109A-IC(1)	C109A	109	IPEX TEMPEST HF (165"mm ORIFICE)	0.46	1.55	33.4	65.5
C109A-IC(2)	C109A	109	IPEX TEMPEST HF (165"mm ORIFICE)	0.46	1.55	33.4	65.5
C109B-IC(1)	C109B	109	IPEX TEMPEST HF (178"mm ORIFICE)	0.32	1.47	30.5	74.1
C109B-IC(2)	C109B	109	IPEX TEMPEST HF (178"mm ORIFICE)	0.32	1.47	30.5	74.1
C110A-IC(1)	C110A	110	IPEX TEMPEST HF (108"mm ORIFICE)	0.61	1.51	17.3	28.0
C121AA-IC(1)	C121AA	SU15	IPEX TEMPEST HF (83"mm ORIFICE)	0.27	1.43	6.5	16.1
C121AA-IC(2)	C121AA	SU15	IPEX TEMPEST HF (83"mm ORIFICE)	0.27	1.43	6.5	16.1
C121A-IC(1)	C121A	121	IPEX TEMPEST HF (152"mm ORIFICE)	0.47	1.67	28.8	58.1
C121A-IC(2)	C121A	121	IPEX TEMPEST HF (152"mm ORIFICE)	0.47	1.67	28.8	58.1
C123A-IC(1)	C123A	123	IPEX TEMPEST HF (102"mm ORIFICE)	0.54	1.53	14.5	25.2
C123A-IC(2)	C123A	123	IPEX TEMPEST HF (102"mm ORIFICE)	0.54	1.53	14.5	25.2
L102A-IC(1)	L102A	102	IPEX TEMPEST HF (83"mm ORIFICE)	1.17	1.55	14.6	16.9
L102A-IC(2)	L102A	102	IPEX TEMPEST HF (83"mm ORIFICE)	1.17	1.55	14.6	16.9
L103A-IC(1)	L103A	103	IPEX TEMPEST HF (127"mm ORIFICE)	0.98	1.59	30.7	39.7
L103A-IC(2)	L103A	103	IPEX TEMPEST HF (127"mm ORIFICE)	0.98	1.59	30.7	39.7
L103B-IC(1)	L103B	103	IPEX TEMPEST HF (83"mm ORIFICE)	1.07	1.69	13.9	17.6
L103B-IC(2)	L103B	103	IPEX TEMPEST HF (83"mm ORIFICE)	1.07	1.69	13.9	17.6
L103C-IC	L103C	103	IPEX TEMPEST HF (140"mm ORIFICE)	1.26	1.39	42.5	44.9
L103D-IC	L103D	103	IPEX TEMPEST HF (127"mm ORIFICE)	1.25	1.39	35.0	37.0
L104A-IC(1)	L104A	104	IPEX TEMPEST HF (108"mm ORIFICE)	1.22	1.59	25.1	28.7
L104A-IC(2)	L104A	104	IPEX TEMPEST HF (108"mm ORIFICE)	1.22	1.59	25.1	28.7
L105A-IC(1)	L105A	105	IPEX TEMPEST HF (108"mm ORIFICE)	1.35	1.61	26.5	28.9
L105A-IC(2)	L105A	105	IPEX TEMPEST HF (108"mm ORIFICE)	1.35	1.61	26.5	28.9
L106A-IC(1)	L106A	106	IPEX TEMPEST HF (102"mm ORIFICE)	1	1.51	20.2	25.0
L106A-IC(2)	L106A	106	IPEX TEMPEST HF (102"mm ORIFICE)	1	1.51	20.2	25.0
L106B-IC(1)	L106B	106	IPEX TEMPEST HF (83"mm ORIFICE)	0.69	1.59	11.0	17.1
L112A-IC(1)	L112A	112	IPEX TEMPEST HF (127"mm ORIFICE)	0.98	1.68	30.7	40.8
L112A-IC(2)	L112A	112	IPEX TEMPEST HF (127"mm ORIFICE)	0.98	1.68	30.7	40.8
L113A-IC(1)	L113A	113	IPEX TEMPEST HF (108"mm ORIFICE)	1.24	1.71	25.2	29.9
L113A-IC(2)	L113A	113	IPEX TEMPEST HF (108"mm ORIFICE)	1.24	1.71	25.2	29.9
L113B-IC	L113B	113	IPEX TEMPEST HF (108"mm ORIFICE)	1.28	1.52	25.8	28.1
L114A-IC	L114A	114	IPEX TEMPEST HF (108"mm ORIFICE)	0.21	1.59	9.1	28.7
L115A-IC(1)	L115A	115	IPEX TEMPEST HF (83"mm ORIFICE)	0.85	1.6	12.3	17.1
L115A-IC(2)	L115A	115	IPEX TEMPEST HF (83"mm ORIFICE)	0.85	1.6	12.3	17.1
L117A-IC(1)	L117A	117	IPEX TEMPEST HF (127"mm ORIFICE)	1.19	1.62	34.1	40.0
L117A-IC(2)	L117A	117	IPEX TEMPEST HF (127"mm ORIFICE)	1.19	1.62	34.1	40.0
L117B-IC(1)	L117B	117	IPEX TEMPEST HF (83"mm ORIFICE)	0.53	1.67	9.5	17.5
L117B-IC(2)	L117B	117	IPEX TEMPEST HF (83"mm ORIFICE)	0.53	1.67	9.5	17.5
L117C-IC	L117C	117	IPEX TEMPEST HF (140"mm ORIFICE)	1.26	1.42	42.6	45.3
L118A-IC(1)	L118A	118	IPEX TEMPEST HF (127"mm ORIFICE)	1.07	1.59	32.2	39.6
L118A-IC(2)	L118A	118	IPEX TEMPEST HF (127"mm ORIFICE)	1.07	1.59	32.2	39.6
L119A-IC(1)	L119A	119	IPEX TEMPEST HF (108"mm ORIFICE)	1.1	1.57	23.8	28.6
L119A-IC(2)	L119A	119	IPEX TEMPEST HF (108"mm ORIFICE)	1.1	1.57	23.8	28.6
L124A-IC(1)	L124A	124	IPEX TEMPEST HF (95"mm ORIFICE)	0.93	1.65	16.9	22.8
L124A-IC(2)	L124A	124	IPEX TEMPEST HF (95"mm ORIFICE)	0.93	1.65	16.9	22.8
L124B-IC	L124B	124	IPEX TEMPEST HF (95"mm ORIFICE)	1.25	1.36	19.7	20.6
L126A-IC(1)	L126A	126	IPEX TEMPEST HF (83"mm ORIFICE)	0.2	1.6	5.4	17.1
L126B-IC(1)	L126B	126	IPEX TEMPEST HF (102"mm ORIFICE)	1.03	1.63	20.5	26.1
L126B-IC(2)	L126B	126	IPEX TEMPEST HF (102"mm ORIFICE)	1.03	1.63	20.5	26.1
L126C-IC	L126C	126	IPEX TEMPEST HF (83"mm ORIFICE)	0.36	2.64	4.3	21.0
L127A-IC(1)	L127A	127	IPEX TEMPEST HF (127"mm ORIFICE)	0.88	1.44	27.8	36.6
L127A-IC(2)	L127A	127	IPEX TEMPEST HF (127"mm ORIFICE)	0.88	1.44	27.8	36.6
L128A-IC(1)	L128A	128	IPEX TEMPEST HF (102"mm ORIFICE)	1.24	1.64	22.6	26.1
L128A-IC(2)	L128A	128	IPEX TEMPEST HF (102"mm ORIFICE)	1.24	1.64	22.6	26.1
L130A-IC(1)	L130A	130	IPEX TEMPEST HF (127"mm ORIFICE)	1.25	1.53	35.0	38.9
L130A-IC(2)	L130A	130	IPEX TEMPEST HF (127"mm ORIFICE)	1.25	1.53	35.0	38.9
L130B-IC	L130B	130	IPEX TEMPEST HF (108"mm ORIFICE)	1	1.03	22.6	23.0

Storm Drainage Area	Block ID/Location	Description	MH Outlet	Maximum Minor System Capture (L/s)	100-Year Major System Overflows (L/s)
Arterial	Block 99	Arterial	209	953	N/A - Overflow to Poole Creek as per KWMSS
B-1	North of Maple Grove	Residential	J2	116	100-year On-Site Storage as per KWMSS
B-2	Maple Grove ROW	Arterial	J4	199	N/A - Overflow to Poole Creek/Carp River as per KWMSS
Comm	North of Hazeldean	Commercial	209	398.88	100-year On-Site Storage
Hazeldean	Hazeldean ROW	Arterial	209	1187	N/A - Overflow to Carp River as per KWMSS
L121B	Block 136	Commercial	121	299	100-year On-Site Storage
L123B	Block 115	Residential	123	111	480 L/s to Maize Street
L218A	Block 76	School	218	443	565 L/s to Shropshire Place
L225B	Block 89	Residential	225	389	799 L/s to Holstein Road

Stantec

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www.stantec.com

Legend

- PROPOSED STORM SEWER
- PROPOSED DRAINAGE BOUNDARY
- PROPOSED CATCHBASIN
- ST101A: STORM DRAINAGE AREA ID#
- 0.38: C-COEFFICIENT VALUE
- 0.70: DRAINAGE AREA (HA)

DRAINAGE AREA PREFIX
- L: LOCAL ROAD, 2-YEAR DESIGN EVENT
- C: COLLECTOR ROAD, 5-YEAR DESIGN EVENT
- F: FULL CAPTURE AREA, 100-YEAR DESIGN EVENT
- EXT: EXTERNAL DRAINAGE AREA
- DIRECTION OF OVERLAND FLOW
- EXTERNAL DRAINAGE
- CIRCULAR ORIFICE (SEE DWG SD-1)
- SERVICE LATERAL LOCATION
- PROPOSED BIOSWALE (SEE NOTE 5)

NOTES:
1. PROPOSED IPEX TEMPEST HF ICDS ARE TO HAVE CIRCULAR ORIFICES AS SPECIFIED AND ARE REQUIRED TO BE VERTICAL SLIDING TYPE WITH FLOATABLE TRAP.

		By	Appd.	YY.MM.DD
9	ISSUED FOR ECA APPROVAL	WAJ	SGG	20.02.12
8	REVISED AS PER CITY COMMENTS	WAJ	SGG	20.01.31
7	ISSUED FOR TENDER	WAJ	KJH	20.01.09
6	REVISED AS PER CITY COMMENTS	WAJ	SGG	19.11.18
5	REVISED CROSSING DESIGN	WAJ	SGG	19.09.23
4	REVISED AS PER CITY COMMENTS	WAJ	SGG	19.08.30
3	REVISED AS PER CITY COMMENTS	WAJ	SGG	19.05.10
2	REVISED AS PER CITY COMMENTS	WAJ	SGG	18.12.10
1	ISSUED FOR FIRST SUBMISSION	WAJ	SGG	18.03.02

Revision

File Name: 1060401393-DB	WAJ	SGG	WAJ	17.12.20
	Dwn.	Chkd.	Dsgn.	YY.MM.DD

Permit-Seal

Client/Project

RICHCRAFT HOMES
1st REGISTRATION

RICHCRAFT KANATA WEST
1620 MAPLE GROVE ROAD
OTTAWA, ON

Title

ULTIMATE CONDITION
STORM DRAINAGE AREA PLAN

Project No. 160401393

Scale 1:1000 (0, 10, 30, 50m)

Drawing No. SD-1

Sheet 40 of 44

Revision 9

CITY FILE No. D07-16-04-0017 CITY PLAN No. 17529

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2020/02/12 1:51 PM By: Gillis, Sheridan

ORIGINAL SHEET - ARCH D

C.7 EXCERPTS FROM INTERIM KANATA WEST POND 5 (WITH ULTIMATE CARP RIVER) DESIGN BRIEF (STANTEC, JULY 2019)

1.0 INTRODUCTION AND BACKGROUND

1.1 OVERVIEW

This revised Interim Kanata West Pond 5 (with ultimate Carp River) design brief has been prepared to address City comments to the previous submission dated April 1, 2019. A letter summarizing the City comments and Stantec's responses has been included in **Appendix I**. Specifically, the pond calculations have been revised to show that sufficient storage can be provided in the proposed interim pond to provide 'Enhanced' level of quality treatment and as such the Environmental Compliance Approval (ECA) application has been revised to go through the Transfer of Review program. In addition, the ultimate condition overflow weir has been revised to include a concrete cut-off wall, and the block number references in this report and on the drawings have been revised to reflect the latest 4M-Draft Plan in support of registration of Phase 1. The integrity of the design remains the same as that previously submitted.

Stantec Consulting Ltd. has been retained to complete the design of the interim Kanata West stormwater management Pond 5 (KW SWM Pond 5). The interim facility will be designed as an off-line SWM facility to provide end-of-pipe treatment for the initial phases of the Richcraft Kanata West development located between the Carp River and the future transitway and bounded at the north by Poole Creek and at the south by future Cartage Way/Winter Wheat Terrace as shown in **Figure 1** and **Drawing PH-1**. The 14.8 ha initial development area consists of medium density residential areas, a private commercial block (Block 1), a park block (Block 28), a private medium density residential block (Block 29), and a stormwater management (SWM) block (Block 11). The location of the interim KW SWM Pond 5 is consistent with the information presented in the June 16, 2006 Kanata West Master Servicing Study (KWMSS) by Stantec Consulting Ltd. and IBI Group. Refer to **Drawing OSDI-1** for details.

The Kanata West Pond 5 is to be constructed in two stages, interim and ultimate conditions (see **Drawing PH-1** and **Drawing POND-5**). In the interim development condition, it is proposed to construct an interim KW SWM Pond 5 (Block 11) to provide quality and quantity control for runoff from the initial phases of the Richcraft Kanata West Development, as well as runoff from the Kanata West Pumping Station (KWPS) for a total interim drainage area to the interim KW SWM Pond 5 of 15.5 ha at 61% imperviousness. The interim pond will eventually become part of the ultimate KW SWM Pond 5 (Block 144) in the future. **Figure 1** below indicates the general tributary area and the location of the Interim KW SWM Pond 5 while **Figure 2** shows the overall drainage areas to the ultimate KW SWM Pond 5.

2.0 PROPOSED DEVELOPMENT STORMWATER MANAGEMENT PLAN

The following sections summarize the stormwater management (SWM) plan for the initial phases of the Richcraft KW Development tributary to the proposed interim KW SWM Pond 5.

2.1 PROPOSED DEVELOPMENT CONDITIONS

The interim SWM facility will receive runoff from 15.5 ha of land from the initial phases of the Richcraft KW Development, the interim SWM pond footprint area, and the Kanata West pump station. The interim facility will provide quantity and quality control (80% TSS removal) of runoff before discharging to the Carp River.

Detailed design of the interim SWM pond has been done using a detailed hydrologic/hydraulic model of the proposed development phases to determine the inflow rates to the pond. Subdivision and sewer design modelling used the "dual drainage" principle, whereby the minor (pipe) system is designed to convey the peak rate of runoff based on a 2-year return period storm capture rate for local streets and a 5-year return period storm capture rate for collector roads as per the City design criteria. Runoff from larger events will be conveyed via engineered channels (roadways, pathways and swales) to a proposed spillway that will discharge into the Interim SWM Pond 5. Outlet links and orifices have been specified in the model to limit the inlet capture rate to the minor system and thus control the hydraulic grade line during major storms.

Drawing OSDI-1 shows the overall major and minor flow paths as well as the proposed interim SWM Pond layout.

2.2 FACILITY DESIGN CRITERIA

2.2.1 Water Quality Control

The Interim KW SWM Pond 5 achieves 'enhanced' level of treatment of urban runoff according to Ministry of the Environment, Conservation and Parks(MECP) criteria – representing a 80% removal of total suspended solids (TSS). However, 'Normal' level of treatment which corresponds to 70% removal of total suspended solids (TSS) was established as the treatment criteria based on the Carp River Watershed/Subwatershed Study (Robinson Consultants, December 2004).

The facility, as outlined in **Section 3.0**, has been designed with sufficient permanent pool and extended detention storage to provide 'Enhanced' level of quality control. The end-of-pipe facility has been designed according to the recommendations of the Ministry of the Environment Stormwater Management Planning and Design Manual, as provided in **Section 3.4**, and therefore no quality control infrastructure is required within the proposed development tributary to the pond.

2.2.2 Water Quantity Control

The proposed interim SWM Pond will service the initial phases of the Richcraft development and discharge into the fully-restored Carp River. The Richcraft lands to the south, future commercial block between Hazeldean Road and the existing Trinity development, as well as the future transitway and arterial road to the south will remain undeveloped in the interim condition (see **Figure 2**). Additionally, the interim Fairwinds and Trinity Ponds will remain in place under the proposed condition.

As specified in the PCSWMM Model Documentation and as outlined in correspondence obtained from the City (see correspondence in **Appendix J**), all applications within the Kanata West Development are required to demonstrate that the 2 to 100-year discharges from the proposed development are consistent with the target hydrographs from the Carp River ultimate condition model. If any departures from the assumptions supporting the ultimate condition model are proposed, and/or the detailed design response does not match the target hydrographs, the proponent will be required to update the model with a simplified/lumped version of the site's detailed dual drainage model and to provide the following information:

- a comparison of the site's detailed design output hydrographs with the future condition model target hydrographs;
- an updated simplified/lumped version of the site's detailed dual drainage/SWM pond modeling that provides the same response as the proposed outlets;
- 100-year peak flow and water level summaries at key locations along the Carp River.

The proposed interim conditions are considered a departure from the assumptions supporting the future condition model, hence the City required to create a Carp River full restoration model that represents the proposed interim development condition as described above.

Similarly, in the ultimate condition, the development on 2731 Hazeldean Road (identified as the Welling's Development) which was originally planned to be serviced through the ultimate KW Pond 5, will discharge directly into Poole Creek (see **Figure 2**). This is also considered a departure from the assumptions supporting the City's Carp River Ultimate Condition model and as such, the City recommended the model be revised as part of this submission to reflect the revised outlet for the 2731 Hazeldean Road site.

2.2.2.1 Carp River Full Restoration/Interim Development Model

The new Carp River full restoration interim development model was created as follows. A detailed breakdown of the Carp River model changes made is provided in **Appendix C.**

C.8 SWM EXCERPTS FROM KANATA WEST DEVELOPMENT SECOND REGISTRATION PHASE REPORT (STANTEC, JULY 2021)

3.0 STORM DRAINAGE

The following sections describe the stormwater management (SWM) design for the Richcraft Kanata West Development in the context of the background documents and governing criteria.

3.1 PROPOSED CONDITIONS

The Second Registration Phase of the KW Development comprises approximately 21.6 ha of land and consists of a mixture of single homes, townhomes and back to back units, a park, a school block, and a medium density residential block. The school block and medium density residential private block will be developed as separate site plan applications.

The interim KW SWM Pond 5 has been constructed to provide quality and quantity control for runoff from the approved First Registration Phase of the KW Development , as well as runoff from the Kanata West Pumping Station (KWPS) for a total interim drainage area to the interim KW SWM Pond 5 of 15.5 ha at 61% imperviousness. Construction of the ultimate condition KW SWM Pond 5 is proposed as part of the Second Registration Phase of the Development. The KW Pond 5 has been designed to provide 'Normal' level of quality control of stormwater runoff which corresponds to 70% TSS removal prior to discharging into the Carp River. The *Ultimate Kanata West Pond 5 Design Brief* (Stantec, June 2021) has been submitted under separate cover and should be read in conjunction with this report.

Site storm sewers from the proposed phase will be directed along Cartage Way and Winter Wheat Terrace to the proposed east forebay of the Kanata West Pond 5. The ultimate Kanata West Pond 5 will also service the existing Mattamy and Trinity developments, as well as an existing section of Hazeldean Road once their respective interim SWM facilities are decommissioned. In addition, the ultimate condition KW Pond 5 and proposed trunk sewers will service the future transitway/arterial road, and a future commercial block as shown on **Figure 1.3**.

The ultimate development condition with the proposed ultimate KW Pond 5 configuration and the inclusion of runoff from future external and the approved first registration phase areas results in the worst-case scenario for the proposed Second Registration Phase of the Richcraft Kanata West Development and as such, the results of the SWM analysis presented in this report correspond to the ultimate development conditions.

The overall approach for storm servicing and stormwater management for the Richcraft Kanata West Development was initially outlined in the Kanata West Master Servicing Study (KWMSS) prepared by Stantec in 2006. In accordance with this document, inlet control devices have been used at road low points to restrict inflow rates to the storm sewers and to provide attenuating surface storage. The major overland system comprising of swales, roadway sags, streets, etc. has been designed to handle peak flows beyond the storm sewer capacity up to the 100-year storm and to be directed to the ultimate KW Pond 5.

3.2 STORMWATER BACKGROUND AND DESIGN CRITERIA

3.2.1 Kanata West Master Servicing Study SWM Criteria

The KWMSS established the SWM criteria for the Kanata West community, the SWM pond locations and their respective outlet locations. The following summarizes the design requirements outlined in the KWMSS for the future developments as shown in the report excerpts included in **Appendix D.2**.

- Width parameter: Twice the street length to be used for arterial roadways, and 225 m/ha to be used for residential and mixed-use developments where no street layout is available.
- Major system storage: major system storage of 40 m^3/ha and 50 m^3/ha was assumed for arterial roads and residential/non-residential lands respectively.
- Inlet control devices to be used to restrict runoff to 85 L/s/ha on average for residential and non-residential lands.
- The capture rates for arterial roadways to be equal to the10-year storm design.
- Sizing of local storm sewers to use inlet times of 15 minutes for typical split-lot drainage in residential developments.
- All sewer hydraulic analysis is to use a static boundary condition equal to the MVC 1983 flood limit of 94.60 m.
- Pond 5 is proposed upstream of the confluence of Poole Creek and the Carp River along the south-west bank of the Carp River. Pond 5 will service residential and retail developments between Poole Creek, the Carp River and Hazeldean Road. Normal and 100-year water levels in the pond are 93.44 m and 94.94 m, respectively.
- The Carp River Watershed/Subwatershed Study (Robinson Consultants, November 2004) proposed target infiltration rates of 104 mm/year and 73 mm/year for areas of moderate and low recharge respectively within the KW Community. Post development infiltration rates are to be increased by 25% above the pre-development rate. This rate of infiltration was established to compensate for those areas (i.e., Roadway corridors) that can not provide infiltration. The Richcraft Kanata West subdivision is identified as having an estimated infiltration rate between 50-70 mm/yr.

3.2.2 Proposed Deviations from the Kanata West Master Servicing Study

The proposed SWM design for the Richcraft Kanata West Development contains deviations from the KWMSS. Firstly, an interim pond has been introduced to support the development of the approved first registration phase of the Richcraft Development which will be serviced through the west forebay trunk sewer/ prior to constructing a second forebay to the east and corresponding trunk sewer which will service the second registration phase of the Richcraft

Development, the existing Fairwinds and Trinity developments, the existing section of Hazeldean Road, as well as future development areas.

The size of the ultimate conditions KW SWM Pond 5 has been increased to reflect the latest City of Ottawa Sewer Design Guidelines minor system capture rates which correspond to the 2-year runoff for local streets, the 5-year runoff for collector roads and the 10-year runoff for arterial roads (see excerpts from the technical bulletin included in **Appendix D.2**). These minor system capture rates are generally higher than the 85 L/s/ha capture rate used in the KWMSS. Similarly, storm sewers have been sized assuming free flow conditions with an inlet time of 10 minutes, instead of the varying inlet times used in the KWMSS which ranged from 15 minutes to 23 minutes. Excerpts from the KWMSS SWM section highlighting the SWM criteria as well as excerpts from the City of Ottawa Technical Bulletin with the new minor system sizing criteria have been provided in **Appendix D.2**.

The ultimate condition drainage area to the KW Pond 5 has been reduced given that the proposed development on 5731 Hazeldean Road which was originally included to go to the KW Pond 5 will now discharge directly into Poole Creek (see **Figure 1.3**).

Minor system peak flows from a medium density residential area north of Maple Grove Road as well as the section of Maple Grove Road between Poole Creek and the Carp River were originally intended to be conveyed through the site storm sewers to the KW Pond 5 in the KWMSS. However, upon further investigation of the existing grades in these areas as well as the expected grade raise restrictions, it was concluded that in order to service these areas through the site storm sewers within the first registration phase, grade raises in excess of 2.0 m would be required for the residential area and/or the site storm sewers would need to be lowered by approximately 1.5 m which would cause submerged sewers across most of the site area tributary to the west forebay. As a result, an alternative approach was proposed during the detailed design stage of the first registration phase to service these areas. Emergency overflows from the Kanata West Pump Station (KWPS) are directed to the SWM pond through a grassed channel and a storm sewer as shown on **Drawing OSSP-2.** This channel will serve as an outlet for the future storm sewer from Maple Grove Road.

3.2.3 City of Ottawa Sewer Design Guidelines and Technical Bulletins

The City of Ottawa published Technical Bulletin PIEDTB-2016-01 to revise the storm sewer and stormwater management elements of the Ottawa Design Guidelines – Sewer. The following is a summary of the design criteria obtained from the City Sewer Guidelines and subsequent technical bulletins.

- Use of the dual drainage principle.
- Size storm sewers to fully capture 2-year storm event under free-flow conditions (i.e. no ponding during 2-year storm event) using 2012 City of Ottawa Sewer Design Guidelines I-

D-F parameters for local streets, the 5-year storm event for collector streets, and the 10-year storm event for arterial roads.

- Assess impact of 2-year storm, 5-year storm, the worst case 100-year storm event, and the climate change scenario (worst case 100-year storm event with a 20% increase of rainfall intensity) on the major & minor drainage systems.
- Separation of at least 0.3 m between the 100-year hydraulic grade line (HGL) and building under side of footing (USF) must be provided.
- Maximum 'climate change' HGL to be lower than proposed basement elevations.
- No rear-yard ponding volumes to be accounted for in SWM model preparation. However, the effect of flow routing can be accounted for by assuming a constant slope ditch/swale draining to the street with a minimum slope of 1.5% and a minimum depth of 150 mm. The maximum allowable depth of a swale /ditch shall be 600 mm. The maximum side slopes of swales/ditches shall be 3 horizontal to 1 vertical.
- Depth of flow may extend adjacent to the right-of-way provided that the water level does not touch any part of the building envelope and remains below the lowest building opening during the stress test event (100-year increased by 20%).
- Total maximum depth of flow under static and dynamic conditions shall be less than 0.35 m during the 100-year event.
- There must be at least 15 cm of vertical clearance between the spill elevation on the street and the ground elevation at the building envelope that is in the proximity of the flow route or ponding area.
- There must be at least 30 cm of vertical clearance between the spill elevation on rear yard swales and the ground elevation at the building envelope that is in the proximity of the flow route or ponding area.
- Minimum swale grades at 1.5% (subgrade provided for grades < 1.5%).
- Minimum roadway profile grades at 0.5%.
- Minimum roadway slope of 0.1% from crest-to-crest for overland flow route.
- Provide adequate emergency overflow conveyance off-site.

3.3 DESIGN METHODOLOGY

The design methodology for the SWM component of the development is as follows:

- Create a PCSWMM model that generates major and minor system hydrographs and assesses the minor system hydraulic grade line and the major system flow depths under worst-case conditions (full build-out).

- Ensure that the resulting 100-year hydraulic grade line does not encroach within 0.30 m of the proposed underside of footings (USF) for the proposed units.
- Ensure that total dynamic and static surface ponding depths do not exceed 0.35 m during the 100-year storm scenario.
- Confirm that climate change storm simulation does not result in flooding of properties.
- Design bioswales along the proposed rear yards as appropriate to match the infiltration targets outlined in the KWMSS.

The site is designed using the "dual drainage" principle, whereby the minor (pipe) system is designed to convey the peak rate of runoff from the 2-year design storm for local streets, the 5-year for collector roads, and the 10-year storm for arterial roads, while runoff from larger events is conveyed by both minor (pipe) and major (overland) channels, such as roadways and walkways, safely to the KW Pond 5 without impacting the proposed units.

Inlet Control Devices (ICDs) or orifice plates have been specified for all street and rear-yard catchbasins to limit the inflow to the minor system. Restricted inlet rates to the sewer are necessary to prevent the hydraulic grade line from surcharging storm sewers into basements during major storms. Rear-yard catchbasins will have inlet controls placed at the downstream-most structure before entering the storm sewer. Solid covers will be installed on all manholes located in ponding areas to limit inflows to the minor system to that of the ICD.

The minor and major system for the site are directed to the KW Pond 5. Design assumptions have been made for external areas and for future development blocks within the Richcraft KW Development, while the approved PCSWMM model and design assumptions were used for the areas within the approved first registration phase of the KW development. For instance, minor system peak flows from the future development blocks (i.e. medium density residential, and school block) will be restricted to the 2-year storm. The school block within the proposed phase will provide 100 m^3/ha of on-site storage, while the medium density residential block will provide 50 m^3/ha of on-site storage. Quality and quantity control of runoff will be provided in the future ultimate KW Pond 5.

Drawings SD-1, and **SD-2** outline the proposed storm sewer alignment, proposed ICD locations, drainage divides, and KW Pond 5 location. **Drawings PD-1** to **PD-4** show the proposed grading and ponding areas. The storm sewer design sheet is included in **Appendix B.1**.

3.4 MODELING RATIONALE

A comprehensive hydrologic modeling exercise was completed with PCSWMM, accounting for the estimated major and minor systems to evaluate the storm sewer infrastructure and major system segments in the ultimate development condition. The use of PCSWMM for modeling of the site hydrology and hydraulics allowed for an analysis of the systems' response during various storm events. The following assumptions were applied to the detailed model:

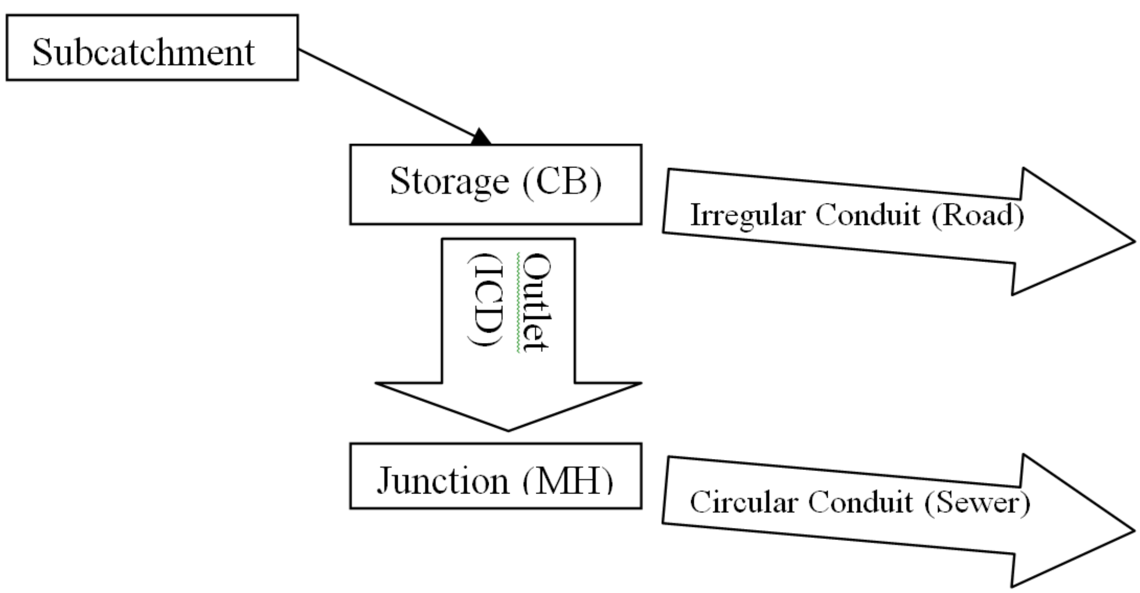
- Hydrologic parameters as per Ottawa Sewer Design Guidelines, including Horton infiltration, Manning's 'n', and depression storage values.
- 3-hour Chicago Storm distribution for the 2-year, 5-year, and 10-year to determine inlet capture rates for the different catchments.
- Minor and major system response assessed for the 100-year using the 3-hour Chicago Storm Distribution and the 12-hour SCS Type II distribution with a fixed water level in the Carp River of 94.60 m.
- To 'stress test' the system a 'climate change' scenario was created by adding 20% of the individual intensity values of the 100-year storms at their specified time step.
- Assess the minor and major systems response during the July 1, 1979 historical with a fixed water level in the Carp River of 94.60 m.
- Percent imperviousness calculated based on actual soft and hard surfaces for representative catchments and converted to equivalent runoff coefficient using the relationship C = (Imp. x 0.7) + 0.2.
- Runoff coefficients for future medium density residential block (Block 78) of 0.80, 0.70 for the school block, and 0.85 for commercial blocks.
- Subcatchment areas are defined from high-point to high-point where sags occur, and detailed grading is available.
- Width parameter was taken as twice the length of the street/swale segment for two-sided catchments and as the length of the street/swale segment for one-sided catchments.
- Where detailed grading was not available, subcatchment areas were defined by the limits of the future development blocks with some assumed uncontrolled areas and the width of the subcatchment was defined as 225 m/ha as per the City of Ottawa Sewer Design Guidelines.
- Catchbasin inflow restricted with inlet-control devices (ICDs) as per City guidelines.
- Surface ponding in sag storage calculated based on grading plans (**Drawings PD-1** - **PD-4**).
- Different segment cross-section types defined, accounting for varying right-of-way widths with 3% cross slope, swales, and spillways.
- Future school block (area L218A) to restrict minor system peak flows up to the 100-year storm to 443 L/s and to restrict 100-year overflows to Shropshire Place to 329 L/s.

- Future medium density residential blocks, areas L123B and L225B, to limit minor system peak flows up to the 100-year storm to 111 L/s and to 517 L/s and to restrict 100-year overflows to Maize Street and Holstein Road to 462 L/s and 749 L/s respectively.
- Future commercial block, area L121B, to restrict minor system peak flows up to the 100-year storm to 299 L/s and to provide on-site storage for 100-year overflows.
- Inlet control devices (ICDs) to have a minimum orifice diameter of 83 mm.

3.4.1 SWMM Dual Drainage Methodology

The proposed development is modeled in one modeling program as a dual conduit system (see **Figure 3.1**), with: 1) circular conduits representing the sewers & storage nodes representing manholes; 2) irregular conduits using street-shaped cross-sections to represent the saw-toothed overland road network from high-point to low-point and storage nodes representing catchbasins and high points. The dual drainage systems are connected via orifice link objects from storage node (i.e. CB) to junction (i.e. MH), and represent inlet control devices (ICDs). Subcatchments are linked to the storage node on the surface so that generated hydrographs are directed there firstly.

Figure 3.1: Schematic Representing Model Object Roles



Storage nodes are used in the model to represent catchbasins as well as major system junctions. For storage nodes representing catchbasins (CBs), the invert of the storage node represents the invert of the CB and the rim of the storage node represents the maximum allowable flow depth elevation above the storage node (equal to the top of the CB plus an additional 0.35 m or higher). The additional depth has been added to rim elevations to allow routing from one surface storage to the next. Storage nodes that represent catchbasins at sags, are surrounded by two transects that represent the road segments forming the sag. The storage value assigned to the storage node represents only the volume available within the structure. If the available storage volume in a storage node is exceeded, flows spill above the storage node and into the sag in the irregular conduits (representing roads). The volume stored within the road sags is represented as flood volume in the model and includes the total static volume and the ponded depth above the node representing the dynamic flow depth. Flow storage volumes exceeding the sag storage available in the transect (roadway) will spill at the downstream highpoint into the next sag and continue routing through the system until ultimately flows either re-enter the minor system or reach the outfall of the major system. Storage nodes representing high points are assigned an invert elevation equal to the transect invert (spill elevation at edge of pavement) and a rim elevation equal to the maximum allowable flow depth elevation above the storage node (equal to the spill elevation at edge of pavement plus an additional 0.35 m). A Storage value of 0 has been assigned to these nodes to disable linear volume calculations. No storage has been accounted for within storage nodes at high points. In this manner, storage will accumulate according to the actual ponding depths before spilling along the roadway conduit, and to the next downstream road conduit.

Inlet control devices, as represented by orifice links, use a user-specified diameter and discharge coefficient taken from manufacturer's specifications for the chosen ICD model (IPEX Tempest HF model with circular opening and floatable and odour control). A minimum orifice diameter of 83 mm has been specified.

3.4.2 Boundary Conditions

The worst case scenario for the proposed second registration phase of the Richcraft Kanata West Development will occur under the ultimate development conditions once the ultimate KW Pond 5 is built and runoff from the external areas is conveyed through the ultimate development storm sewer system to the east forebay of the ultimate KW Pond 5. The following table summarizes the ultimate KW Pond 5 water levels that drive the hydraulic grade line (HGL) elevations across the proposed development.

Table 3.1: Ultimate KW Pond 5 Water Levels

Boundary Condition	Storm Event	Ultimate Pond Water Level (m)
Carp Model Time Series	2yr12hrSCS	94.39
Carp Model Time Series	5yr12hrSCS	94.60
Carp Model Time Series	10yr12hrSCS	94.72
Carp Model Time Series	25yr12hrSCS	94.84
Carp Model Time Series	100yr12hrSCS	94.97
Fixed = 94.60 m	100yr3hrChicago	95.06

The detailed PCSWMM hydrology, the approved storm sewers and ICDs within the first registration phase, design assumptions and hydrology for external areas, and the proposed storm sewers and ICDs for the proposed second registration phase were used to assess the peak inflows and hydraulic grade line (HGL) in the proposed development. The detailed design of the ultimate KW Pond 5 as depicted in the Ultimate Kanata West Pond 5 Design Brief (Stantec, June 2021) was included in the PCSWMM model. Static backwater elevations at the Carp River outlet corresponding to the 2-year (93.52 m), 5-year (93.73 m), and 25-year (94.02 m) water levels as obtained from the post restoration Ultimate Development Conditions Carp River model have been used as boundary conditions downstream of the ultimate condition SWM Pond for the 2-year, 5-year, and 25-year (25% sediment-filled pipe) models respectively, while a static backwater elevation of 94.60 m as per the MVC 1983 100-year flood elevation for the Carp River has been used for the 100 year, 100 year +20% and historical 1979 storm models.

3.4.3 Hydrologic Parameters

Drawings SD-1, and **SD-2** summarize the discretized subcatchments used in the analysis of the proposed development and outline the major overland flow paths. All parameters were assigned as per applicable OSDG, MECP and background report requirements.

Key parameters for the subject area are summarized below; an example input file is provided for the 100-year, 3hr Chicago storm which indicates all other parameters (see **Appendix B.3**). For all other input files and results of storm scenarios, please examine the electronic model files included in the digital submission. This analysis was performed using PCSWMM, which is a front-end GUI to the EPA-SWMM engine. Model files can be examined in any program which can read EPA-SWMM files version 5.1.015.

Table 3.2 presents the general subcatchment parameters used:

Table 3.2: General Subcatchment Parameters

Subcatchment Parameter	Value
Infiltration Method	Horton
Max. Infil. Rate (mm/hr)	76.2
Min. Infil. Rate (mm/hr)	13.2
Decay Constant (1/hr)	4.14
N Imperv	0.013
N Perv	0.25
Dstore Imperv (mm)	1.57
Dstore Perv (mm)	4.67

Table 3.3 presents the individual parameters that vary for each of the proposed subcatchments. Subcatchment parameters for external areas and approved development areas are summarized in **Appendix B.3**.

Table 3.3: Proposed Phase Subcatchment Parameters

Area ID	Area (ha)	Width (m)	Slope (%)	% Impervious	Runoff Coefficient
C205A	0.26	71.2	3.0	67.1%	0.67
C206B	0.17	68.0	3.0	71.4%	0.70
C219A	0.09	79.8	2.0	68.6%	0.68
C220A	0.41	131.8	2.0	75.7%	0.73
C222A	0.52	257.0	4.0	70.0%	0.69
C223A	0.16	59.0	3.0	72.9%	0.71
EXT2	0.07	29.0	2.0	67.1%	0.67
EXT3	0.10	44.0	3.0	57.1%	0.60
EXT4	0.52	307.0	4.0	54.3%	0.58
EXT5	0.11	77.0	4.0	24.3%	0.37
EXT6	0.12	78.8	4.0	40.0%	0.48
G234A	0.97	218.0	1.0	28.6%	0.40
L116A	0.22	84.0	1.0	70.0%	0.69
L202A	0.21	76.7	2.0	55.7%	0.59
L202B	0.25	152.0	3.0	50.0%	0.55
L204A	0.42	174.7	3.0	75.7%	0.73
L204B	0.39	164.0	3.0	70.0%	0.69
L205B	0.48	236.0	3.0	35.7%	0.45
L206A	0.31	127.2	3.0	75.7%	0.73
L207A	0.58	202.3	3.0	64.3%	0.65
L209A	0.35	153.4	2.0	70.0%	0.69
L209B	0.16	159.0	2.0	67.1%	0.67
L209C	0.41	200.0	3.0	38.6%	0.47
L210A	0.25	80.1	3.0	67.1%	0.67
L210B	0.26	168.0	3.0	38.6%	0.47
L211A	0.40	177.2	3.0	74.3%	0.72
L213A	0.26	93.3	2.0	70.0%	0.69
L214A	0.55	221.0	4.0	72.9%	0.71
L217A	0.40	196.0	3.0	68.6%	0.68
L218A	2.68	664.0	1.0	71.4%	0.70
L218B	0.25	166.0	3.0	35.7%	0.45
L219B	0.36	111.7	2.0	68.6%	0.68
L220A	0.87	480.0	2.5	34.3%	0.44
L225A	0.27	134.6	2.5	71.4%	0.70
L225B	2.60	619.0	2.0	85.7%	0.80
L226A	0.30	85.6	2.5	71.4%	0.70
L228A	0.35	96.0	2.5	71.4%	0.70
L229A	0.21	66.0	3.0	71.4%	0.70
L234A	0.33	82.6	4.0	70.0%	0.69
L234B	0.23	81.1	4.0	70.0%	0.69
L237A	0.27	121.9	4.0	65.7%	0.66
L238A	0.65	376.0	2.5	52.9%	0.57
L240A	0.24	109.7	4.0	74.3%	0.72

Area ID	Area (ha)	Width (m)	Slope (%)	% Impervious	Runoff Coefficient
L240B	0.36	153.6	4.0	72.9%	0.71
L241A	0.31	190.0	4.0	70.0%	0.69
POND	2.56	576.0	1.0	60.0%	0.62
UNC-1	0.06	120.0	4.0	71.4%	0.70
UNC-2	0.07	120.0	4.0	71.4%	0.70
UNC-3	0.07	120.0	4.0	71.4%	0.70
UNC-4	0.07	120.0	4.0	71.4%	0.70
UNC-5	0.30	188.0	3.0	85.7%	0.80
UNC-6	0.16	160.0	3.0	85.7%	0.80
UNC-7	0.16	160.0	3.0	85.7%	0.80
UNC-8	0.10	200.0	3.0	85.7%	0.80

The subcatchment layer of PSWMM includes a 'subarea routing' parameter to choose internal routing of runoff between pervious and impervious areas, as well as a 'percent routed' parameter which allocates the percent of runoff routed between subareas. Pervious 'subarea routing' has been used for all rear yard catchments, future residential blocks, future school block, and park areas to simulate runoff from the impervious portion of the catchment being routed through the pervious portion of the catchment (not directly connected imperviousness). 100% routing has been used for rearyard and park catchments to account for 0% directly connected imperviousness, while 30% routing has been used for future residential and school blocks.

Table 3.4 summarizes the storage node parameters used in the model. No surface storage was assumed within the rear-yard areas for modeling purposes. Static ponding depths, areas, and volumes within the proposed development area are as per **Drawings PD-1** to **PD-4** but are not explicitly included in the PCSWMM model as per methodology presented in **Section 3.4.1**. Approximately 862 m^3 of surface storage have been provided within the proposed second registration phase of the development (not including private blocks), which corresponds to approximately 56 m^3/ha. Storage node parameters for approved phase areas, external areas and future development areas are summarized in **Appendix B.3**.

Table 3.4: Storage Node Parameters

Storage Node	Invert Elevation (m)	Rim Elevation (m)	Total Depth (m)
205A-S(1)	96.07	97.80	1.73
206B-S(1)	96.39	98.12	1.73
219A-S(1)	96.44	98.17	1.73
220A-S	96.36	98.09	1.73
222A-S	96.44	98.25	1.81
223A-S	96.79	98.52	1.73
EXT2-S	98.39	98.74	0.35

Storage Node	Invert Elevation (m)	Rim Elevation (m)	Total Depth (m)
EXT3-S	96.94	97.29	0.35
EXT4-S	98.00	98.35	0.35
EXT5-S	98.00	98.35	0.35
EXT6-S	99.60	99.95	0.35
G234A-S	93.33	98.37	5.04
116A-S	95.82	97.55	1.73
202A-S(1)	95.89	97.62	1.73
RY202B-S	96.30	98.10	1.80
204A-S(1)	96.01	97.74	1.73
204BS(1)	95.97	97.70	1.73
RY205B-S	95.46	98.06	2.60
206A-S(1)	96.91	98.64	1.73
207A-S(1)	97.30	99.03	1.73
209A-S	98.21	99.94	1.73
209B-S	98.65	100.38	1.73
RY209C-S	97.41	99.75	2.34
210A-S	95.99	97.72	1.73
RY210B-S	95.62	98.22	2.60
211A-S(1)	96.37	98.10	1.73
213A-S	96.44	98.17	1.73
214A-S(1)	96.30	98.03	1.73
217A-S	96.43	98.16	1.73
L218A-S	96.00	98.50	2.50
RY218B-S	96.29	98.89	2.60
219B-S	96.60	98.50	1.90
RY220A-S	95.88	98.48	2.60
225A-S	97.65	99.38	1.73
L225B-S	97.20	99.70	2.50
226A-S	98.08	99.81	1.73
228A-S	98.61	100.34	1.73
229A-S	98.82	100.55	1.73
234A-S	95.97	97.70	1.73
234B-S	95.92	97.65	1.73
237A-S	95.98	97.71	1.73
RY238A-S	95.61	98.05	2.44
240A-S	96.21	97.94	1.73
240B-S	96.02	97.75	1.73
241A-S	96.19	97.92	1.73
POND-S1	90.70	95.30	4.60

3.4.4 Hydraulic Parameters

As per the OSDG 2012, Manning's roughness values of 0.013 were used for sewer modeling and overland flow corridors representing roadways. Any grassed swales were modeled using Manning's roughness values of 0.025.

Storm sewers were modeled to confirm flow capacities and assess hydraulic grade lines (HGLs). The detailed storm sewer design sheet is included in **Appendix B.1**.

The table below presents the parameters for the orifice link objects within the proposed phase which represent ICDs. A coefficient of 0.572 was applied when using orifices to conform to head/discharge curves as supplied by the manufacturer for IPEX Tempest HF model ICDs with circular openings and floatable and odour control.

Table 3.5: Orifice Parameters for Proposed Catchments

Orifice Name	Tributary Area ID	Minor System Node	ICD Type
C205A-IC(1)	C205A	205	IPEX TEMPEST HF (127"mm ORIFICE)
C205A-IC(2)	C205A	205	IPEX TEMPEST HF (152"mm ORIFICE)
C219-IC	C219A	219	IPEX TEMPEST HF (102"mm ORIFICE)
C220A-IC(1)	C220A	220	IPEX TEMPEST HF (191"mm ORIFICE)
C220A-IC(2)	C220A	220	IPEX TEMPEST HF (191"mm ORIFICE)
C222A-IC(1)	C222A	222	IPEX TEMPEST HF (203"mm ORIFICE)
C222A-IC(2)	C222A	222	IPEX TEMPEST HF (203"mm ORIFICE)
C223A-IC(1)	C223A	223	IPEX TEMPEST HF (178"mm ORIFICE)
G234A-IC	G234A	234	IPEX TEMPEST HF (83"mm ORIFICE)
L116A-IC(1)	L116A	116	IPEX TEMPEST HF (95"mm ORIFICE)
L116A-IC(2)	L116A	116	IPEX TEMPEST HF (95"mm ORIFICE)
L202A-IC(1)	L202A	202	IPEX TEMPEST HF (83"mm ORIFICE)
L202A-IC(2)	L202A	202	IPEX TEMPEST HF (83"mm ORIFICE)
L202B-IC	L202B	202	IPEX TEMPEST HF (108"mm ORIFICE)
L204A-IC(1)	L204A	204	IPEX TEMPEST HF (127"mm ORIFICE)
L204A-IC(2)	L204A	204	IPEX TEMPEST HF (127"mm ORIFICE)
L204B-IC(1)	L204B	204	IPEX TEMPEST HF (127"mm ORIFICE)
L204B-IC(2)	L204B	204	IPEX TEMPEST HF (127"mm ORIFICE)
L205B-IC	L205B	205	IPEX TEMPEST HF (127"mm ORIFICE)
L206A-IC(1)	L206A	206	IPEX TEMPEST HF (108"mm ORIFICE)
L206A-IC(2)	L206A	206	IPEX TEMPEST HF (108"mm ORIFICE)
L206B-IC(1)	C206B	206	IPEX TEMPEST HF (140"mm ORIFICE)
L207A-IC(1)	L207A	207	IPEX TEMPEST HF (152"mm ORIFICE)
L207A-IC(2)	L207A	207	IPEX TEMPEST HF (152"mm ORIFICE)
L209A-IC(1)	L209A	209	IPEX TEMPEST HF (127"mm ORIFICE)
L209A-IC(2)	L209A	209	IPEX TEMPEST HF (127"mm ORIFICE)
L209B-IC	L209B	209	IPEX TEMPEST HF (102"mm ORIFICE)

Orifice Name	Tributary Area ID	Minor System Node	ICD Type
L209C-IC	L209C	209	IPEX TEMPEST HF (108"mm ORIFICE)
L210A-IC(1)	L210A	210	IPEX TEMPEST HF (102"mm ORIFICE)
L210A-IC(2)	L210A	210	IPEX TEMPEST HF (102"mm ORIFICE)
L210B-IC	L210B	210	IPEX TEMPEST HF (108"mm ORIFICE)
L211A-IC(1)	L211A	211	IPEX TEMPEST HF (127"mm ORIFICE)
L211A-IC(2)	L211A	211	IPEX TEMPEST HF (127"mm ORIFICE)
L213A-IC(1)	L213A	213	IPEX TEMPEST HF (95"mm ORIFICE)
L213A-IC(2)	L213A	213	IPEX TEMPEST HF (95"mm ORIFICE)
L214A-IC(1)	L214A	214	IPEX TEMPEST HF (152"mm ORIFICE)
L214A-IC(2)	L214A	214	IPEX TEMPEST HF (152"mm ORIFICE)
L217A-IC(1)	L217A	217	IPEX TEMPEST HF (127"mm ORIFICE)
L217A-IC(2)	L217A	217	IPEX TEMPEST HF (127"mm ORIFICE)
L218B-IC	L218B	218	IPEX TEMPEST HF (95"mm ORIFICE)
L219B-IC(1)	L219B	219	IPEX TEMPEST HF (127"mm ORIFICE)
L219B-IC(2)	L219B	219	IPEX TEMPEST HF (127"mm ORIFICE)
L220A-S	L220A	220	IPEX TEMPEST HF (178"mm ORIFICE)
L225A-IC(1)	L225A	225	IPEX TEMPEST HF (127"mm ORIFICE)
L225A-IC(2)	L225A	225	IPEX TEMPEST HF (108"mm ORIFICE)
L226A-IC(1)	L226A	226	IPEX TEMPEST HF (127"mm ORIFICE)
L226A-IC(2)	L226A	226	IPEX TEMPEST HF (108"mm ORIFICE)
L228A-IC(1)	L228A	228	IPEX TEMPEST HF (152"mm ORIFICE)
L228A-IC(2)	L228A	228	IPEX TEMPEST HF (127"mm ORIFICE)
L229A-IC(1)	L229A	229	IPEX TEMPEST HF (127"mm ORIFICE)
L229A-IC(2)	L229A	229	IPEX TEMPEST HF (127"mm ORIFICE)
L234A-IC(1)	L234A	234	IPEX TEMPEST HF (108"mm ORIFICE)
L234A-IC(2)	L234A	234	IPEX TEMPEST HF (108"mm ORIFICE)
L234B-IC(1)	L234B	234	IPEX TEMPEST HF (95"mm ORIFICE)
L234B-IC(2)	L234B	234	IPEX TEMPEST HF (95"mm ORIFICE)
L237A-IC(1)	L237A	237	IPEX TEMPEST HF (102"mm ORIFICE)
L237A-IC(2)	L237A	237	IPEX TEMPEST HF (102"mm ORIFICE)
L238A-IC	L238A	238	IPEX TEMPEST HF (203"mm ORIFICE)
L240A-IC(1)	L240A	240	IPEX TEMPEST HF (102"mm ORIFICE)
L240A-IC(2)	L240A	240	IPEX TEMPEST HF (102"mm ORIFICE)
L240B-IC(1)	L240B	240	IPEX TEMPEST HF (127"mm ORIFICE)
L240B-IC(2)	L240B	240	IPEX TEMPEST HF (127"mm ORIFICE)
L241A-IC(1)	L241A	241	IPEX TEMPEST HF (108"mm ORIFICE)
L241A-IC(2)	L241A	241	IPEX TEMPEST HF (108"mm ORIFICE)

Table 3.6 below presents the parameters for the outlet link objects in the model, which represent the minor system capture rate for the future private blocks within the Richcraft KW Development and the future external areas.

Table 3.6: SWM Criteria for Future Areas

Storm Drainage Area	Block ID/Location	Description	MH Outlet	Maximum Minor System Capture (L/s)	100-Year Major System Overflows (L/s)
Arterial	Block 99	Arterial	209	953	N/A - Overflow to Poole Creek as per KWMSS
B-1	North of Maple Grove	Residential	J2	116	100-year On-Site Storage as per KWMSS
B-2	Maple Grove ROW	Arterial	J4	199	N/A - Overflow to Poole Creek/Carp River as per KWMSS
Comm	North of Hazeldean	Commercial	209	399	100-year On-Site Storage
Hazeldean	Hazeldean ROW	Arterial	209	1187	N/A - Overflow to Carp River/Poole Creek as per KWMSS
L121B	Block 1	Commercial	121	299	100-year On-Site Storage
L123B	Block 29	Residential	123	111	462 L/s to Maize Street
L218A	Block 76	School	218	443	329 L/s to Shropshire Place
L225B	Block 78	Residential	225	517	749 L/s to Holstein Road

1. School block area L218A to provide 603 m^3/year of infiltration.

3.5 MODEL RESULTS AND DISCUSSION

The following section summarizes the key hydrologic and hydraulic model results for the proposed development area based on ultimate conditions. For detailed model results or inputs please refer to the example input file in **Appendix B.3** and the electronic model files on the enclosed CD.

3.5.1 Hydrology

Table 3.7 summarizes the orifice/outlet link maximum flow rates and heads across the proposed development.

Table 3.7: Proposed Phase Orifice Link Results

Orifice Name	Tributary Area ID	ICD Type	2yr Head (m)	100yr Head (m)	2yr Flow (L/s)	100yr Flow (L/s)
C205A-IC(1)	C205A	IPEX TEMPEST HF (127"mm ORIFICE)	0.31	1.65	15.9	40.4
C205A-IC(2)	C205A	IPEX TEMPEST HF (152"mm ORIFICE)	0.31	1.65	15.9	40.4
C219-IC	C219A	IPEX TEMPEST HF (102"mm ORIFICE)	0.46	1.58	13.3	25.6
C220A-IC(1)	C220A	IPEX TEMPEST HF (191"mm ORIFICE)	0.30	1.65	33.2	90.6
C220A-IC(2)	C220A	IPEX TEMPEST HF (191"mm ORIFICE)	0.30	1.65	33.2	90.6

Orifice Name	Tributary Area ID	ICD Type	2yr Head (m)	100yr Head (m)	2yr Flow (L/s)	100yr Flow (L/s)
C222A-IC(1)	C222A	IPEX TEMPEST HF (203"mm ORIFICE)	0.41	1.71	45.4	104.2
C222A-IC(2)	C222A	IPEX TEMPEST HF (203"mm ORIFICE)	0.41	1.71	45.4	104.2
C223A-IC(1)	C223A	IPEX TEMPEST HF (178"mm ORIFICE)	0.25	1.61	25.2	77.8
G234A-IC	G234A	IPEX TEMPEST HF (83"mm ORIFICE)	2.40	4.65	18.0	23.7
L116A-IC(1)	L116A	IPEX TEMPEST HF (95"mm ORIFICE)	0.91	1.65	16.7	22.8
L116A-IC(2)	L116A	IPEX TEMPEST HF (95"mm ORIFICE)	0.91	1.65	16.7	22.8
L202A-IC(1)	L202A	IPEX TEMPEST HF (83"mm ORIFICE)	1.13	1.67	14.3	17.5
L202A-IC(2)	L202A	IPEX TEMPEST HF (83"mm ORIFICE)	1.13	1.67	14.3	17.5
L202B-IC	L202B	IPEX TEMPEST HF (108"mm ORIFICE)	1.25	1.31	25.4	26.0
L204A-IC(1)	L204A	IPEX TEMPEST HF (127"mm ORIFICE)	1.21	1.63	34.3	40.2
L204A-IC(2)	L204A	IPEX TEMPEST HF (127"mm ORIFICE)	1.21	1.63	34.3	40.2
L204B-IC(1)	L204B	IPEX TEMPEST HF (127"mm ORIFICE)	0.90	1.60	29.3	39.8
L204B-IC(2)	L204B	IPEX TEMPEST HF (127"mm ORIFICE)	0.90	1.60	29.3	39.8
L205B-IC	L205B	IPEX TEMPEST HF (127"mm ORIFICE)	1.30	2.26	35.6	47.4
L206A-IC(1)	L206A	IPEX TEMPEST HF (108"mm ORIFICE)	1.23	1.63	25.2	29.2
L206A-IC(2)	L206A	IPEX TEMPEST HF (108"mm ORIFICE)	1.23	1.63	25.2	29.2
L206B-IC(1)	C206B	IPEX TEMPEST HF (140"mm ORIFICE)	0.52	1.50	26.2	46.7
L207A-IC(1)	L207A	IPEX TEMPEST HF (152"mm ORIFICE)	0.85	1.69	40.3	58.5
L207A-IC(2)	L207A	IPEX TEMPEST HF (152"mm ORIFICE)	0.85	1.69	40.3	58.5
L209A-IC(1)	L209A	IPEX TEMPEST HF (127"mm ORIFICE)	0.74	1.45	26.4	37.7
L209A-IC(2)	L209A	IPEX TEMPEST HF (127"mm ORIFICE)	0.74	1.45	26.4	37.7
L209B-IC	L209B	IPEX TEMPEST HF (102"mm ORIFICE)	1.26	1.42	22.8	24.3
L209C-IC	L209C	IPEX TEMPEST HF (108"mm ORIFICE)	1.92	2.12	31.7	33.4
L210A-IC(1)	L210A	IPEX TEMPEST HF (102"mm ORIFICE)	0.82	1.60	18.2	25.8
L210A-IC(2)	L210A	IPEX TEMPEST HF (102"mm ORIFICE)	0.82	1.60	18.2	25.8
L210B-IC	L210B	IPEX TEMPEST HF (108"mm ORIFICE)	1.14	2.14	24.2	33.5
L211A-IC(1)	L211A	IPEX TEMPEST HF (127"mm ORIFICE)	1.06	1.61	32.0	39.9
L211A-IC(2)	L211A	IPEX TEMPEST HF (127"mm ORIFICE)	1.06	1.61	32.0	39.9
L213A-IC(1)	L213A	IPEX TEMPEST HF (95"mm ORIFICE)	1.25	1.59	19.7	22.3
L213A-IC(2)	L213A	IPEX TEMPEST HF (95"mm ORIFICE)	1.25	1.59	19.7	22.3
L214A-IC(1)	L214A	IPEX TEMPEST HF (152"mm ORIFICE)	0.97	1.61	43.4	57.0
L214A-IC(2)	L214A	IPEX TEMPEST HF (152"mm ORIFICE)	0.97	1.61	43.4	57.0
L217A-IC(1)	L217A	IPEX TEMPEST HF (127"mm ORIFICE)	0.92	1.57	29.7	39.4
L217A-IC(2)	L217A	IPEX TEMPEST HF (127"mm ORIFICE)	0.92	1.57	29.7	39.4
L218B-IC	L218B	IPEX TEMPEST HF (95"mm ORIFICE)	2.04	2.15	25.4	26.1
L219B-IC(1)	L219B	IPEX TEMPEST HF (127"mm ORIFICE)	1.03	1.71	31.6	41.2
L219B-IC(2)	L219B	IPEX TEMPEST HF (127"mm ORIFICE)	1.03	1.71	31.6	41.2
L220A-S	L220A	IPEX TEMPEST HF (178"mm ORIFICE)	1.14	2.20	64.7	91.6
L225A-IC(1)	L225A	IPEX TEMPEST HF (127"mm ORIFICE)	1.25	1.70	35.0	41.1
L225A-IC(2)	L225A	IPEX TEMPEST HF (108"mm ORIFICE)	1.25	1.70	35.0	41.1
L226A-IC(1)	L226A	IPEX TEMPEST HF (127"mm ORIFICE)	1.11	1.61	32.8	40.0
L226A-IC(2)	L226A	IPEX TEMPEST HF (108"mm ORIFICE)	1.11	1.61	32.8	40.0
L228A-IC(1)	L228A	IPEX TEMPEST HF (152"mm ORIFICE)	1.26	1.54	50.1	55.7

Orifice Name	Tributary Area ID	ICD Type	2yr Head (m)	100yr Head (m)	2yr Flow (L/s)	100yr Flow (L/s)
L228A-IC(2)	L228A	IPEX TEMPEST HF (127"mm ORIFICE)	1.26	1.54	50.1	55.7
L229A-IC(1)	L229A	IPEX TEMPEST HF (127"mm ORIFICE)	0.83	1.65	28.0	40.4
L229A-IC(2)	L229A	IPEX TEMPEST HF (127"mm ORIFICE)	0.83	1.65	28.0	40.4
L234A-IC(1)	L234A	IPEX TEMPEST HF (108"mm ORIFICE)	1.18	1.69	24.6	29.7
L234A-IC(2)	L234A	IPEX TEMPEST HF (108"mm ORIFICE)	1.18	1.69	24.6	29.7
L234B-IC(1)	L234B	IPEX TEMPEST HF (95"mm ORIFICE)	0.96	1.65	17.1	22.7
L234B-IC(2)	L234B	IPEX TEMPEST HF (95"mm ORIFICE)	0.96	1.65	17.1	22.7
L237A-IC(1)	L237A	IPEX TEMPEST HF (102"mm ORIFICE)	0.88	1.61	18.9	25.8
L237A-IC(2)	L237A	IPEX TEMPEST HF (102"mm ORIFICE)	0.88	1.61	18.9	25.8
L238A-IC	L238A	IPEX TEMPEST HF (203"mm ORIFICE)	1.38	2.34	92.9	122.7
L240A-IC(1)	L240A	IPEX TEMPEST HF (102"mm ORIFICE)	0.91	1.54	19.2	25.3
L240A-IC(2)	L240A	IPEX TEMPEST HF (102"mm ORIFICE)	0.91	1.54	19.2	25.3
L240B-IC(1)	L240B	IPEX TEMPEST HF (127"mm ORIFICE)	0.86	1.62	28.6	40.0
L240B-IC(2)	L240B	IPEX TEMPEST HF (127"mm ORIFICE)	0.86	1.62	28.6	40.0
L241A-IC(1)	L241A	IPEX TEMPEST HF (108"mm ORIFICE)	1.07	1.63	23.4	29.1
L241A-IC(2)	L241A	IPEX TEMPEST HF (108"mm ORIFICE)	1.07	1.63	23.4	29.1

3.5.2 Proposed Development Hydraulic Grade Line Analysis

As mentioned previously, the worst-case HGL across the site occurs in the ultimate development conditions once runoff from approved, proposed and external development areas is routed through the proposed site minor system to the ultimate KW Pond 5.

As shown in **Figure 1.3**, a portion of the proposed storm sewer system will be partially submerged. Specifically, approximately 138 m of storm sewer tributary to the west forebay (approved first registration phase) and approximately 1,027 m of storm sewer tributary to the east forebay (proposed ultimate condition) will be partially submerged. Figure 5.5 from the KWMSS has been included in **Appendix D,** which shows the extent of submerged sewers. As can be seen, the extent of submerged sewers obtained in the KWMSS is comparable if not more than in the proposed Richcraft Kanata West Development, which is to be expected given that the pond bottom and permanent pool elevation have remained as per the KWMSS.

As per the above, the worst case 100-year hydraulic grade line (HGL) elevation across the proposed development was estimated using the proposed ultimate KW Pond 5 PCSWMM model for the 100-year, 3-hour Chicago and 12-hour SCS Type II storms with a static backwater elevation of 94.60 m as per the MVC 1983 100-year flood elevation for the Carp River. **Table 3.8** below presents the clearance between the trunk sewer worst case HGL and the proposed and approved under side of footings (USF) within the Richcraft Kanata West development. The storm sewer design sheet is included in **Appendix B.1**. The 'climate change' scenarios required by the City of Ottawa Sewer Design Guidelines (2012), where 100-year intensities are increased by 20% were also assessed. 100-Year HGL profiles from PCSWMM have been included in **Appendix B.4**.

Table 3.8: Proposed Phase - Ultimate Condition Hydraulic Grade Line Results

STM MH	Prop/App. USF Elevation (m)	100-Year HGL				100-year + 20%			
		12-hr SCS HGL (m)	3-hr Chicago HGL (m)	Worst Case 100YR HGL (m)	USF – HGL Clearance (m)	12-hr SCS HGL (m)	3-hr Chicago HGL (m)	Worst Case 100YR+20 % HGL (m)	USF –HGL Clearance (m)
100A	N/A	95.07	95.07	95.07	-	95.11	95.12	95.12	-
100B	N/A	95.10	95.10	95.10	-	95.14	95.15	95.15	-
100C	N/A	95.07	95.07	95.07	-	95.11	95.12	95.12	-
100D	N/A	95.09	95.09	95.09	-	95.13	95.14	95.14	-
100E	N/A	95.06	95.06	95.06	-	95.10	95.11	95.11	-
101	95.74	95.17	95.18	95.18	0.56	95.22	95.24	95.24	0.50
102	95.63	95.19	95.20	95.20	0.43	95.24	95.27	95.27	0.36
103	95.69	95.22	95.22	95.22	0.47	95.27	95.29	95.29	0.40
104	95.75	95.23	95.23	95.23	0.52	95.29	95.32	95.32	0.43
105	96.00	95.31	95.31	95.31	0.69	95.38	95.41	95.41	0.59
106	96.00	95.34	95.34	95.34	0.66	95.41	95.45	95.45	0.55
107	96.10	95.55	95.58	95.58	0.52	95.68	95.74	95.74	0.36
108	96.10	95.59	95.63	95.63	0.47	95.76	95.85	95.85	0.25
+50m	96.25	95.62	95.72	95.72	0.53	95.84	95.96	95.96	0.29
+86m	96.33	95.64	95.78	95.78	0.55	95.90	96.04	96.04	0.29
109	96.23	95.66	95.84	95.84	0.39	95.95	96.11	96.11	0.12
110	96.54	95.68	95.73	95.73	0.81	95.83	95.89	95.89	0.65
111	96.30	95.73	95.79	95.79	0.51	95.89	95.95	95.95	0.35
112	96.30	95.90	95.97	95.97	0.33	96.07	96.13	96.13	0.17
+51m	96.34	95.94	96.02	96.02	0.32	96.12	96.18	96.18	0.16
113	96.37	95.97	96.05	96.05	0.32	96.15	96.21	96.21	0.16
114	95.63	95.22	95.23	95.23	0.40	95.27	95.30	95.30	0.33
115	95.71	95.30	95.30	95.30	0.41	95.35	95.38	95.38	0.33
116	95.75	95.44	95.45	95.45	0.30	95.50	95.53	95.53	0.22
117	95.70	95.38	95.39	95.39	0.31	95.44	95.47	95.47	0.23
118	95.90	95.54	95.55	95.55	0.35	95.62	95.67	95.67	0.23
119	95.70	95.33	95.34	95.34	0.36	95.40	95.42	95.42	0.28
+51m	95.79	95.39	95.40	95.40	0.39	95.47	95.49	95.49	0.30
121	96.20	95.46	95.47	95.47	0.73	95.55	95.58	95.58	0.62
121A	N/A	95.46	95.50	95.50	-	95.55	95.59	95.59	-
123	96.40	95.67	95.64	95.67	0.73	95.76	95.78	95.78	0.62
124	96.64	96.34	96.34	96.34	0.30	96.34	96.34	96.34	0.30
125	96.99	96.48	96.47	96.48	0.51	96.49	96.48	96.49	0.50
+69m	97.15	96.84	96.83	96.84	0.31	96.86	96.84	96.86	0.29
126	97.44	96.96	96.95	96.96	0.48	96.98	96.96	96.98	0.46
+41m	97.69	97.32	97.31	97.32	0.37	97.33	97.32	97.33	0.36
+71m	98.00	97.58	97.58	97.58	0.42	97.59	97.58	97.59	0.41
127	98.35	97.92	97.93	97.93	0.42	97.93	97.93	97.93	0.42
128	97.44	97.05	97.04	97.05	0.39	97.07	97.06	97.07	0.37
129	97.49	97.13	97.12	97.13	0.36	97.14	97.13	97.14	0.35
+31m	97.67	97.29	97.28	97.29	0.38	97.29	97.29	97.29	0.38
+65m	98.17	97.46	97.45	97.46	0.71	97.46	97.46	97.46	0.71
130	98.35	97.70	97.70	97.70	0.65	97.70	97.70	97.70	0.65

STM MH	Prop/App. USF Elevation (m)	100-Year HGL				100-year + 20%			
		12-hr SCS HGL (m)	3-hr Chicago HGL (m)	Worst Case 100YR HGL (m)	USF – HGL Clearance (m)	12-hr SCS HGL (m)	3-hr Chicago HGL (m)	Worst Case 100YR+20% HGL (m)	USF –HGL Clearance (m)
131	98.39	97.70	97.70	97.70	0.69	97.70	97.70	97.70	0.69
132	98.39	97.56	97.56	97.56	0.83	97.56	97.56	97.56	0.83
201	95.96	95.21	95.21	95.21	0.75	95.27	95.28	95.28	0.68
210	95.91	95.53	95.56	95.56	0.35	95.63	95.68	95.68	0.23
+35m	95.86	95.41	95.44	95.44	0.42	95.50	95.54	95.54	0.32
202	95.76	95.33	95.35	95.35	0.41	95.41	95.44	95.44	0.32
+75m	95.84	95.44	95.49	95.49	0.35	95.56	95.59	95.59	0.25
204	95.93	95.55	95.63	95.63	0.30	95.70	95.74	95.74	0.19
+54m	96.04	95.63	95.73	95.73	0.31	95.80	95.85	95.85	0.19
205	96.13	95.72	95.83	95.83	0.30	95.91	95.96	95.96	0.17
+82m	96.74	95.84	95.99	95.99	0.75	96.06	96.14	96.14	0.60
206	97.17	95.88	96.04	96.04	1.13	96.11	96.20	96.20	0.97
207	97.43	96.39	96.71	96.71	0.72	96.76	97.00	97.00	0.43
209	N/A	96.69	97.13	97.13	-	97.14	97.46	97.46	-
211	95.91	95.58	95.61	95.61	0.30	95.68	95.74	95.74	0.17
212	N/A	95.63	95.66	95.66	-	95.74	95.80	95.80	-
213	96.18	95.66	95.70	95.70	0.48	95.77	95.83	95.83	0.35
214	96.18	95.75	95.80	95.80	0.38	95.87	95.93	95.93	0.25
215	96.28	95.86	95.92	95.92	0.36	95.98	96.05	96.05	0.23
216	96.39	95.89	95.95	95.95	0.44	96.02	96.09	96.09	0.30
217	96.59	95.97	96.03	96.03	0.56	96.10	96.17	96.17	0.42
218	96.20	95.72	95.78	95.78	0.42	95.85	95.91	95.91	0.29
220	96.24	95.85	95.94	95.94	0.30	96.00	96.06	96.06	0.18
+38m	96.21	95.82	95.91	95.91	0.30	95.97	96.03	96.03	0.18
219	96.28	95.79	95.87	95.87	0.41	95.93	95.99	95.99	0.29
+62m	96.38	95.92	96.04	96.04	0.34	96.11	96.16	96.16	0.22
221	96.40	95.95	96.08	96.08	0.32	96.15	96.20	96.20	0.20
222	96.93	96.28	96.47	96.47	0.46	96.55	96.60	96.60	0.33
+52m	97.19	96.58	96.77	96.77	0.42	96.85	96.90	96.90	0.29
223	97.48	96.71	96.91	96.91	0.57	96.99	97.03	97.03	0.45
224	97.48	96.81	97.02	97.02	0.46	97.09	97.13	97.13	0.35
225	97.65	97.09	97.29	97.29	0.36	97.36	97.40	97.40	0.25
226	98.34	97.23	97.46	97.46	0.88	97.54	97.58	97.58	0.76
227	98.29	97.29	97.55	97.55	0.74	97.62	97.67	97.67	0.62
228	98.29	97.48	97.83	97.83	0.46	97.90	97.97	97.97	0.32
229	98.51	97.53	97.89	97.89	0.62	97.98	98.04	98.04	0.47
230	98.55	97.54	97.89	97.89	0.66	97.98	98.04	98.04	0.51
231	98.41	97.33	97.90	97.90	0.51	97.98	98.04	98.04	0.37
232	98.41	97.56	97.82	97.82	0.59	97.98	98.04	98.04	0.37
233	95.60	95.25	95.25	95.25	0.35	95.31	95.32	95.32	0.28
234	95.60	95.30	95.30	95.30	0.30	95.36	95.38	95.38	0.22
235	95.95	95.33	95.33	95.33	0.62	95.39	95.41	95.41	0.54
236	95.92	95.44	95.44	95.44	0.48	95.50	95.52	95.52	0.40
237	95.85	95.47	95.47	95.47	0.38	95.54	95.56	95.56	0.29
238	95.90	95.57	95.57	95.57	0.33	95.64	95.66	95.66	0.24

STM MH	Prop/App. USF Elevation (m)	100-Year HGL				100-year + 20%			
		12-hr SCS HGL (m)	3-hr Chicago HGL (m)	Worst Case 100YR HGL (m)	USF – HGL Clearance (m)	12-hr SCS HGL (m)	3-hr Chicago HGL (m)	Worst Case 100YR+20% HGL (m)	USF –HGL Clearance (m)
239	95.92	95.62	95.61	95.62	0.30	95.69	95.71	95.71	0.21
+28m	96.02	95.68	95.68	95.68	0.34	95.76	95.78	95.78	0.24
240	96.07	95.75	95.76	95.76	0.31	95.84	95.86	95.86	0.21
+51m	96.11	95.80	95.82	95.82	0.29	95.89	95.92	95.92	0.19
+58m	96.15	95.81	95.83	95.83	0.32	95.90	95.93	95.93	0.22
241	96.18	95.83	95.85	95.85	0.33	95.92	95.95	95.95	0.23

1. HGL values have been interpolated between manholes where the worst-case HGL did not meet the 0.3m clearance to the lowest USF between manholes.

The model results indicate that there is sufficient clearance between the worst case 100-year HGL and the proposed and approved under side of footings (USFs).

An additional sensitivity test has also been undertaken to assess the hydraulic grade line (HGL) elevation across the proposed storm sewer network under ultimate development conditions, during the 25-year, 3-hour Chicago storm with accumulation of sediment in the portions of the proposed storm sewer pipes submerged by the permanent pool of the SWM pond (93.44 m). Storm sewer pipes partially submerged by the permanent pool of the ultimate KW SWM Pond 5 were modelled as smaller diameter pipes, in order to replicate the impact of sediment accumulation (assumed to be 25% of submerged area) in the submerged portions of the pipes. The pipe parameters used in the sediment accumulation HGL analysis for the ultimate condition development are summarized in **Appendix B.5.**

Table 3.9 shows the results of the sediment accumulation HGL analysis for the Ultimate condition development during the 25-year, 3-hour Chicago storm.

Table 3.9: Proposed Phase - Ultimate Development Sediment Accumulation HGL Results

STM MH	Prop. USF (m)	25-Year, 3 HR Chicago HGL (m)	USF - HGL Clearance (m)
100A	N/A	94.76	N/A
100B	N/A	94.76	N/A
100C	N/A	94.76	N/A
100D	N/A	94.77	N/A
100E	N/A	94.74	N/A
101	95.74	94.84	0.90
102	95.63	94.85	0.78
103	95.69	94.86	0.83

STM MH	Prop. USF (m)	25-Year, 3 HR Chicago HGL (m)	USF - HGL Clearance (m)
104	95.75	94.87	0.88
105	96.00	95.18	0.82
106	96.00	95.26	0.74
107	96.10	95.17	0.93
108	96.10	95.28	0.82
109	96.23	95.56	0.67
110	96.54	95.34	1.20
111	96.30	95.41	0.89
112	96.30	95.61	0.69
113	96.37	95.79	0.58
114	95.63	94.87	0.76
115	95.71	94.94	0.77
116	95.91	95.29	0.62
117	95.70	95.10	0.60
118	95.90	95.54	0.36
119	95.70	94.91	0.79
121	96.20	94.97	1.23
121A	N/A	95.49	N/A
123	96.40	95.61	0.79
124	96.64	96.34	0.30
125	96.99	96.48	0.51
+69m	97.15	96.84	0.31
126	97.44	96.96	0.48
+41m	97.69	97.32	0.37
+71m	98.00	97.58	0.42
127	98.35	97.93	0.42
128	97.44	97.04	0.40
129	97.49	97.12	0.37
+31m	97.67	97.28	0.39
+65m	98.17	97.45	0.72
130	98.35	97.70	0.65
131	98.39	97.70	0.69
132	98.39	97.56	0.83

STM MH	Prop. USF (m)	25-Year, 3 HR Chicago HGL (m)	USF - HGL Clearance (m)
201	95.96	94.78	1.18
202	95.94	94.79	1.15
204	95.94	94.80	1.14
205	96.14	94.80	1.34
206	96.59	94.81	1.78
207	97.43	95.42	2.01
209	N/A	95.87	N/A
210	96.30	94.93	1.37
211	96.25	94.95	1.30
212	N/A	94.99	N/A
213	96.35	95.05	1.30
214	96.35	95.13	1.22
215	96.57	95.47	1.10
216	96.59	95.57	1.02
217	96.59	95.76	0.83
218	96.30	95.09	1.21
219	96.48	95.15	1.33
220	96.39	95.49	0.90
221	96.48	95.56	0.92
222	96.93	96.09	0.84
223	96.93	96.54	0.39
224	97.48	96.65	0.83
225	97.65	96.94	0.71
226	98.34	97.12	1.22
227	98.29	97.20	1.09
228	98.29	97.47	0.82
229	98.51	97.52	0.99
230	98.55	97.53	1.02
231	98.41	97.33	1.08
232	98.41	97.56	0.85
233	95.60	94.79	0.81
234	95.60	94.80	0.80
235	95.95	94.82	1.13

STM MH	Prop. USF (m)	25-Year, 3 HR Chicago HGL (m)	USF - HGL Clearance (m)
236	95.92	94.88	1.04
237	95.85	94.90	0.95
238	95.90	94.96	0.94
239	95.91	95.00	0.91
240	96.07	95.13	0.94
241	96.18	95.21	0.97

The results show that sufficient clearance is provided between the proposed and approved USFs and the 25-year HGL assuming 25% of the submerged section of pipe is filled with sediment.

3.5.3 Overland Flow

Major system peak flows from the proposed development will be directed to the KW Pond 5. **Drawings SD-1** and **SD-2** show the proposed overland flow route.

The proposed ICDs have been sized to capture the 2-year runoff from local street catchments (areas named L-), and the 5-year runoff from collector road catchments (areas named C-), while still meeting the 0.3 m required 100-year HGL clearance to the USFs. A summary table showing the total surface water depths for the 2-year and 5-year design storms for the proposed phase areas of the Richcraft Kanata West Development has been included in **Appendix B.3.** The following table shows the target capture rate based on the 2-year/5-year runoff from the catchment as explained above, the actual 2 and 5-year ICD capture rate (based on City approved ICD sizes), along with the capture difference between the two for the proposed phase catchments.

Table 3.10: Proposed Phase - Minor System Capture Rate Comparison

Tributary Area ID	ICD Type	2yr ICD Capture (L/s)	5yr ICD Capture (L/s)	2/5yr Runoff (L/s)	2/5yr Runoff - ICD Capture Difference (L/s)
C205A	IPEX TEMPEST HF (127"mm ORIFICE)	15.9	36.8	58.6	-15.0
C205A	IPEX TEMPEST HF (127"mm ORIFICE)	15.9	36.8		
C219A	IPEX TEMPEST HF (102"mm ORIFICE)	13.3	20.8	22.1	1.3
C220A	IPEX TEMPEST HF (191"mm ORIFICE)	33.2	76.1	99.4	-52.8
C220A	IPEX TEMPEST HF (191"mm ORIFICE)	33.2	76.1		
C222A	IPEX TEMPEST HF (203"mm ORIFICE)	45.4	72.5	145.9	0.8
C222A	IPEX TEMPEST HF (203"mm ORIFICE)	45.4	72.5		
C223A	IPEX TEMPEST HF (178"mm ORIFICE)	25.2	38.6	38.9	0.4
G234A	IPEX TEMPEST HF (83"mm ORIFICE)	18.0	26.1	18.8	0.8

Tributary Area ID	ICD Type	2yr ICD Capture (L/s)	5yr ICD Capture (L/s)	2/5yr Runoff (L/s)	2/5yr Runoff - ICD Capture Difference (L/s)
L116A	IPEX TEMPEST HF (95"mm ORIFICE)	16.7	21.1	33.6	0.2
L116A	IPEX TEMPEST HF (95"mm ORIFICE)	16.7	21.1		
L202A	IPEX TEMPEST HF (83"mm ORIFICE)	14.3	16.4	25.2	-3.5
L202A	IPEX TEMPEST HF (83"mm ORIFICE)	14.3	16.4		
L202B	IPEX TEMPEST HF (108"mm ORIFICE)	25.4	25.7	35.4	10.0
L204A	IPEX TEMPEST HF (127"mm ORIFICE)	34.3	38.2	69.2	0.5
L204A	IPEX TEMPEST HF (127"mm ORIFICE)	34.3	38.2		
L204B	IPEX TEMPEST HF (127"mm ORIFICE)	29.3	37.7	59.1	0.5
L204B	IPEX TEMPEST HF (127"mm ORIFICE)	29.3	37.7		
L205B	IPEX TEMPEST HF (127"mm ORIFICE)	35.6	46.5	38.6	3.0
L206A	IPEX TEMPEST HF (108"mm ORIFICE)	25.2	27.7	50.8	0.5
L206A	IPEX TEMPEST HF (108"mm ORIFICE)	25.2	27.7		
C206B	IPEX TEMPEST HF (140"mm ORIFICE)	26.2	40.0	41.1	1.1
L207A	IPEX TEMPEST HF (152"mm ORIFICE)	40.3	54.7	81.1	0.4
L207A	IPEX TEMPEST HF (152"mm ORIFICE)	40.3	54.7		
L209A	IPEX TEMPEST HF (127"mm ORIFICE)	26.4	37.2		
L209A	IPEX TEMPEST HF (127"mm ORIFICE)	26.4	37.2	53.1	0.3
L209B	IPEX TEMPEST HF (102"mm ORIFICE)	22.8	24.1	23.5	0.7
L209C	IPEX TEMPEST HF (108"mm ORIFICE)	31.7	33.3	36.8	5.1
L210A	IPEX TEMPEST HF (102"mm ORIFICE)	18.2	24.4	36.6	0.3
L210A	IPEX TEMPEST HF (102"mm ORIFICE)	18.2	24.4		
L210B	IPEX TEMPEST HF (108"mm ORIFICE)	24.2	33.1	27.4	3.2
L211A	IPEX TEMPEST HF (127"mm ORIFICE)	32.0	37.9	64.5	0.5
L211A	IPEX TEMPEST HF (127"mm ORIFICE)	32.0	37.9		
L213A	IPEX TEMPEST HF (95"mm ORIFICE)	19.7	21.5	39.8	0.4
L213A	IPEX TEMPEST HF (95"mm ORIFICE)	19.7	21.5		
L214A	IPEX TEMPEST HF (152"mm ORIFICE)	43.4	54.0	87.3	0.5
L214A	IPEX TEMPEST HF (152"mm ORIFICE)	43.4	54.0		
L217A	IPEX TEMPEST HF (127"mm ORIFICE)	29.7	37.7	60.0	0.5
L217A	IPEX TEMPEST HF (127"mm ORIFICE)	29.7	37.7		
L218B	IPEX TEMPEST HF (95"mm ORIFICE)	25.4	25.8	34.9	9.5
L219B	IPEX TEMPEST HF (127"mm ORIFICE)	31.6	38.2	63.7	0.6
L219B	IPEX TEMPEST HF (127"mm ORIFICE)	31.6	38.2		
L220A	IPEX TEMPEST HF (178"mm ORIFICE)	64.7	89.6	66.8	2.1
L225A	IPEX TEMPEST HF (102"mm ORIFICE)	35.0	38.3	42.5	-27.5
L225A	IPEX TEMPEST HF (102"mm ORIFICE)	35.0	38.3		
L226A	IPEX TEMPEST HF (102"mm ORIFICE)	32.8	37.9	76.0	10.4
L226A	IPEX TEMPEST HF (102"mm ORIFICE)	32.8	37.9		
L228A	IPEX TEMPEST HF (127"mm ORIFICE)	50.1	54.5		
L228A	IPEX TEMPEST HF (127"mm ORIFICE)	50.1	54.5	54.4	-45.7
L229A	IPEX TEMPEST HF (127"mm ORIFICE)	28.0	37.6		
L229A	IPEX TEMPEST HF (127"mm ORIFICE)	28.0	37.6	88.3	32.3

Tributary Area ID	ICD Type	2yr ICD Capture (L/s)	5yr ICD Capture (L/s)	2/5yr Runoff (L/s)	2/5yr Runoff - ICD Capture Difference (L/s)
L234A	IPEX TEMPEST HF (127"mm ORIFICE)	24.6	27.8	49.5	0.4
L234A	IPEX TEMPEST HF (108"mm ORIFICE)	24.6	27.8		
L234B	IPEX TEMPEST HF (108"mm ORIFICE)	17.1	21.2	34.6	0.4
L234B	IPEX TEMPEST HF (95"mm ORIFICE)	17.1	21.2		
L237A	IPEX TEMPEST HF (95"mm ORIFICE)	18.9	24.3	38.2	0.5
L237A	IPEX TEMPEST HF (102"mm ORIFICE)	18.9	24.3		
L238A	IPEX TEMPEST HF (102"mm ORIFICE)	92.9	121.8	95.5	2.6
L240A	IPEX TEMPEST HF (203"mm ORIFICE)	19.2	24.4	38.8	0.4
L240A	IPEX TEMPEST HF (102"mm ORIFICE)	19.2	24.4		
L240B	IPEX TEMPEST HF (102"mm ORIFICE)	28.6	37.6	57.6	0.5
L240B	IPEX TEMPEST HF (127"mm ORIFICE)	28.6	37.6		
L241A	IPEX TEMPEST HF (127"mm ORIFICE)	23.4	27.7	47.5	0.7
L241A	IPEX TEMPEST HF (108"mm ORIFICE)	23.4	27.7		

Table 3.11 presents the maximum total surface water depths (static ponding depth + dynamic flow) above the top-of-grate of the proposed street catchbasins for the 100-year, 3-hr Chicago storm and the 'climate change' storm. Based on the model results, the total ponding depth (static + dynamic) does not exceed the required 0.35 m maximum during the 100-year event.

Table 3.11: Proposed Phase – Ultimate Maximum Static and Dynamic Surface Water Depths

Storage node ID	Top of Grate Elevation (m)	Lowest Adjacent Building Opening (m)	100-year, 3-hour Chicago		100-year, 3-hour Chicago+20%	
			Max HGL (m)	Total Surface Ponding Depth (m)	Max HGL (m)	Total Surface Ponding Depth (m)
205A-S(1)	97.45	98.15	97.72	0.27	97.79	0.34
206B-S(1)	97.77	98.50	97.89	0.12	97.92	0.15
219A-S(1)	97.82	98.09	98.02	0.20	98.09	0.27
220A-S	97.74	98.30	98.01	0.27	98.09	0.35
222A-S	97.82	98.45	98.15	0.33	98.23	0.41
223A-S	98.17	99.10	98.40	0.23	98.43	0.26
116A-S	97.20	97.87	97.47	0.27	97.53	0.33
202A-S(1)	97.27	97.82	97.56	0.29	97.61	0.34
204A-S(1)	97.39	98.01	97.64	0.25	97.73	0.34
204BS(1)	97.35	97.92	97.57	0.22	97.66	0.31
206A-S(1)	98.29	98.85	98.54	0.25	98.58	0.29
207A-S(1)	98.68	99.35	98.99	0.31	99.03	0.35
209A-S	99.59	100.23	99.66	0.07	99.66	0.07

Storage node ID	Top of Grate Elevation (m)	Lowest Adjacent Building Opening (m)	100-year, 3-hour Chicago		100-year, 3-hour Chicago+20%	
			Max HGL (m)	Total Surface Ponding Depth (m)	Max HGL (m)	Total Surface Ponding Depth (m)
209B-S	100.03	N/A	100.07	0.04	100.08	0.05
210A-S	97.37	97.94	97.59	0.22	97.65	0.28
211A-S(1)	97.75	98.25	97.98	0.23	98.02	0.27
213A-S	97.82	98.30	98.03	0.21	98.04	0.22
214A-S(1)	97.68	98.35	97.91	0.23	97.97	0.29
217A-S	97.81	98.50	98.00	0.19	98.05	0.24
219B-S	97.98	98.43	98.31	0.33	98.38	0.40
225A-S	99.03	99.57	99.35	0.32	99.38	0.35
226A-S	99.46	99.85	99.69	0.23	99.71	0.25
228A-S	99.99	100.40	100.15	0.16	100.23	0.24
229A-S	100.20	100.62	100.47	0.27	100.49	0.29
234A-S	97.35	97.85	97.66	0.31	97.68	0.33
234B-S	97.30	97.77	97.57	0.27	97.61	0.31
237A-S	97.36	97.85	97.59	0.23	97.67	0.31
240A-S	97.59	98.10	97.75	0.16	97.77	0.18
240B-S	97.40	97.91	97.64	0.24	97.68	0.28
241A-S	97.57	98.11	97.82	0.25	97.85	0.28

3.6 WATER BALANCE – INFILTRATION REQUIREMENTS

As per the KWMSS, all developments in the Kanata West Community are required to provide infiltration measures to meet pre-development infiltration rates. Detailed geotechnical work completed for the Kanata West MSS and the existing Fairwinds Subdivision outlined the target infiltration rates for the Kanata West Development as 50-100 mm/yr. The Richcraft Kanata West Development is identified as having an estimated infiltration rate between 50-70 mm/yr. It is noted that infiltration requirements were established to provide base flow to the Carp River in post-development conditions. The KWMSS recommends the pre-development infiltration is increased by 25% in order to account for future right of ways with no opportunity for infiltration.

Based on a target infiltration rate of 50 mm/yr for the overall 36.53 ha Richcraft Kanata West site, on-site infiltration measures are required to infiltrate approximately 22,831 m^3/year (Pre-development infiltration increased by 25%). Infiltration, evapotranspiration and runoff values were established based on results of previous hydrogeologic and geotechnical investigations for areas in the City's west end that maintain similar subsurface soils conditions. Detailed water balance calculations are included in **Appendix B.6**.

As the development will receive an extensive soils pre-loading and/or surcharge program to permit proposed grading at or near permissible grade raise recommendations, it can be reasonably expected that the upper 1m of soil may be entirely replaced with fill to permit shallow rear yard infiltration swales. Other potential practices for groundwater infiltration include:

- Direct roof leaders to rear yard areas
- bioswales underlying drainage swales in park and open space areas
- The use of fine sandy loam topsoil in parks and residential lawns
- Infiltration of runoff captured by rear yard catch basins

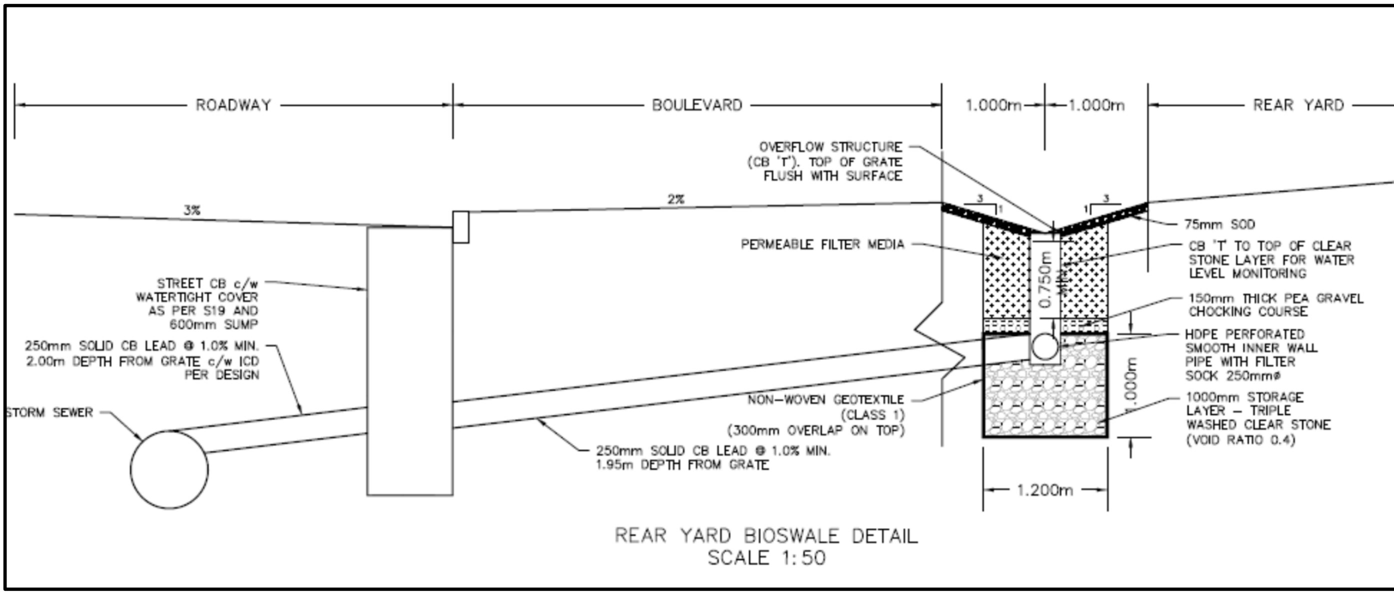
Per the above, proposed roof eaves troughs will be directed to rear yard pervious areas, and rear yards will maintain perforated pipe subdrains and bioswales as per the approved cross section for the First Registration Phase (see **Figure 3.2**).

Of the total site area, 21.72 ha (59.4%) will be converted to impervious area with no infiltration. The proposed ultimate SWM pond footprint is approximately 2.56 ha, while approximately 12.26 ha will consist of parks, lawns and open space areas. The inclusion of a sandy loam topsoil in proposed residential rearyards and parks (~2.96ha) is expected to provide additional infiltrative capacity to surficial soils in order to increase post development infiltration rate from pervious areas to 13,245 m^3/year (see detailed calculations within **Appendix B.6**). Rear-yard bioswales within the approved and proposed phases of the development are required to provide the additional <u>9,586 m^3/year</u>.

Based on average precipitation data available (2000-2011), approximately 31 rainfall events/yr have a rainfall depth that ranges between 6 mm and 25 mm, for an average depth of 12.2 mm. Based on the roof area tributary to the rear yard bioswales in the approved and proposed phases (23,969 m^2 based on half roofs directed to rearyards), the annual volume of runoff from the roofs to the bioswales is approximately <u>8,983 m^3</u> (based on an average rainfall depth of 12.2 mm). The remaining 603 m^3/yr required to infiltrate will be provided within the school block (Block 76). Detailed water balance calculations are included in **Appendix B.6**.

The following figure shows the typical cross section of the bioswales as agreed upon with the City of Ottawa during the detailed design stage of the First Registration Phase of the KW Development.

Figure 3.2: Typical Bioswale Cross Section



The minimum required footprint area of the bioswales was estimated for each bioswale based on MECP guidelines (Equation 4.3) for a retention time of 24 hours and an average infiltration rate of the native soil equal to 19 mm/hr as recommended by Paterson in their technical memo PG4624-MEMO.07 dated June 28, 2019 (see **Appendix D**). However, for conservatism, the proposed infiltration measures have not been included in the PCSWMM model for the proposed development. **Table 3.12** summarizes the design characteristics of the proposed bioswales. A table summarizing the bioswale assumptions for the approved and proposed phase rear yard areas has been included in **Appendix B.6**.

Table 3.12: Proposed Bioswale Characteristics

Drainage Area ID	Drainage Area (ha)	Impervious-ness (%)	Required Volume for 25mm Event (m^3)	Bioswale Length (m)	Bioswale Width (m)	Storage Layer Depth (m)	Maximum Storage Available (m)
L207B	0.30	40%	30	76	1.2	0.75	30
L209C	0.41	39%	40	105	1.2	0.75	41
L205B	0.48	36%	43	130	1.2	0.75	51
L210B	0.26	39%	25	83	1.2	0.75	32
L202B	0.25	50%	31	75	1.2	0.75	29
L238A	0.65	53%	86	220	1.2	0.75	86
L218B	0.25	36%	22	131	1.2	0.75	51

Drainage Area ID	Drainage Area (ha)	Impervious-ness (%)	Required Volume for 25mm Event (m^3)	Bioswale Length (m)	Bioswale Width (m)	Storage Layer Depth (m)	Maximum Storage Available (m)
L220A	0.87	34%	75	192	1.2	0.75	75

3.7 HAZELDEAN CREEK CROSSINGS

Two road crossings are proposed along the re-aligned Hazeldean Creek to provide traffic and service connections with the Trinity commercial development to the south; one at Roger Griffiths Avenue and a second at Tillage Street.

3.7.1 Background Information

Approximately 1,000 m of Hazeldean Creek downstream of Hazeldean Road were designed by Stantec in April 2008 as part of the Trinity Development Group commercial site detailed design. The project involved the construction of the new channel and the conceptual design of culvert crossings to accommodate future development on the site. A hydraulic analysis was completed using HEC-RAS with flow rates and downstream starting water levels as obtained from the "Flow Characterization and Flood Level Analysis Carp River, Feedmill Creek and Poole Creek" (CH2M Hill, October 2005). The starting water level from the Carp River was 94.60 m and the flowrate used for the channel design was the 100-year, 12-hour SCS Type II storm peak flow rate of 4.69 m^3/s.

In March 2009, a third party review was conducted of all the modeling completed for the Carp River, which outlined modeling concerns and provided revised existing and future conditions models created for the Carp River watershed. The XPSWMM and HEC-RAS models from the third party review identified the 100-year peak flows in Hazeldean Creek upstream of Hazeldean Road as 7.91 m^3/s under existing conditions and 10.38 m^3/s under future conditions.

In January 2010, IBI Group completed the Hazeldean Creek Improvements and Hazeldean Road Widening Design Brief which included detailed design of the Hazeledean Road culvert replacement, the future North-South Arterial Road culvert design and the Hazeldean Creek tie-in design between the culverts. The culvert size which satisfied the design criteria was determined to be a 4500 x 1800 mm concrete box culvert. A typical section of the realigned channel consisted of a channel with a bottom width of 2.5 m (narrowing from the culvert openings), a trapezoidal section at 3:1 side slopes then armour stone walls on either side of the channel as required.

3.7.2 Culvert Crossings

The drainage area contribution to Hazeldean Creek upstream of Hazeldean Road is approximately 62 ha with a total 100-year peak flow of 10.38 m^3/s. Detailed sizing for the proposed crossings was done using the software HY8 (Output files have been included in **Appendix B.7**).

The culvert at each crossing has been designed with a perpendicular headwall and wingwalls. Both culverts will be embedded 0.3 m below the invert of the creek and rip-rap riverstone will be placed along the length of the culverts to 0.3 m depth.

The culvert size which satisfies the conveyance capacity for the design peak flow and the cover requirements based on proposed road grades was determined to be a 6000 x 1500 mm concrete box culvert. The following table summarizes the proposed culvert characteristics and the freeboard clearances. Detail calculations are presented in **Appendix B.7** and the design is presented on **Drawing DS-3** and **Drawing DS-4**.

Table 3.13: Ultimate Condition - Summary of Culvert Design Details for 100-Year Design Storm

Culvert Characteristics	Roger Griffiths Avenue	Tillage Street
Size (span x height) mm x mm	6000 x 1500	6000 x 1500
Length (m)	30.1	26.0
Downstream Invert (m)[1]	96.59	95.18
Upstream Invert (m)[1]	96.83	95.28
Upstream Water Level (m)	98.10	96.70
Proposed Road Elevation (m)	98.81	97.49
Freeboard (m)	0.71	0.79

1. Upstream and downstream inverts correspond to 0.3m above the bottom of the culvert due to embedment depth.

3.7.3 Existing Channel Realignment

Based on available survey information, the existing section of Hazeldean creek at the proposed Tillage Street crossing is running practically flat with localized low points (see **Drawing GP-4**). As a result, it is proposed to regrade a 42 m section of the creek downstream of the crossing to provide 0.6% longitudinal slope.

The channel cross section is presented on **Drawing DS-3**. A typical section of the channel consists of a channel with a bottom width of 2.5 m (narrowing from the culvert openings) and a trapezoidal section at 3:1 side slopes on either side of the channel. The southern grades will tie into the existing Trinity Commercial Development. It is anticipated that the 3:1 side slopes will be finished with 0.3 m depth of hydric soils. See **Appendix B.7** for channel conveyance capacity calculations.

Appendix D - GEOTECHNICAL INFORMATION

D.1 GEOTECHNICAL INVESTIGATION REPORT (PATERSON GROUP, JULY 14, 2020)

Geotechnical Engineering

Environmental Engineering

Hydrogeology

Geological Engineering

Materials Testing

Building Science

Archaeological Services

patersongroup

Geotechnical Investigation

Proposed Residential Development
Kanata West - Block 29 - Ottawa

Prepared For

Richcraft Group of Companies

July 14, 2020

Report: PG5398-1

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- Atterberg Limits Results
- Grain Size Distribution Results
- Analytical Testing Results

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- Figure 4 - Section C - Static Conditions
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1.0 Introduction

Paterson Group (Paterson) was commissioned by Richcraft Group of Companies to conduct a geotechnical investigation for Block 29 of the proposed Kanata West development to be located along Maple Grove Road, in the City of Ottawa (refer to Figure 1 - Key Plan presented in Appendix 2).

The objectives of the geotechnical investigation were to:

- ❑ determine the subsoil and groundwater conditions at this site by means of test holes.
- ❑ provide geotechnical recommendations for the design of the proposed development including construction considerations which may affect its design.

The following report has been prepared specifically and solely for the aforementioned project which is described herein. It contains our findings and includes geotechnical recommendations pertaining to the design and construction of the subject development as they are understood at the time of writing this report.

2.0 Proposed Development

It is understood that the proposed development will consist of 4 townhouse blocks, each with one basement level. The proposed townhouse blocks will be surrounded by asphalt paved access lanes and parking areas with landscaped margins. It is also understood that the site will be municipally serviced.

3.0 Method of Investigation

3.1 Field Investigation

The field program for the current geotechnical investigation was carried out on June 24, 2020 and consisted of advancing 3 boreholes (BH 1 to BH 3) to a maximum depth of 6.7 m below existing ground surface. One borehole from a previous investigation (BH 7) was also located within the boundaries of the subject site. The test hole locations were determined in the field by Paterson personnel taking into consideration site features and underground services. The test hole locations are presented on Drawing PG5398-1 - Test Hole Location Plan included in Appendix 2.

The test holes were advanced using a track-mounted auger drill rig operated by a two-person crew. All fieldwork was conducted under the full-time supervision of personnel from Paterson's geotechnical division under the direction of a senior engineer. The drilling procedure consisted of augering to the required depths at the selected locations and sampling the overburden.

Sampling and In Situ Testing

Soil samples from the current and previous investigations were recovered using a 50 mm diameter split-spoon sampler or 73 mm diameter thin walled Shelby tubes in combination with a piston sampler. Auger cutting samples were recovered from surficial soils. The split-spoon and auger samples were classified on site and placed in sealed plastic bags. The Shelby tubes were sealed at both ends. All samples were transported to our laboratory. The depths at which the auger, split-spoon and Shelby tube samples were recovered from the test holes are shown as AU, SS and TW, respectively, on the applicable Soil Profile and Test Data sheets in Appendix 1.

The Standard Penetration Test (SPT) was conducted in conjunction with the recovery of the split-spoon samples. The SPT results are recorded as "N" values on the Soil Profile and Test Data sheets. The "N" value is the number of blows required to drive the split-spoon sampler 300 mm into the soil after a 150 mm initial penetration using a 63.5 kg hammer falling from a height of 760 mm.

Undrained shear strength testing was carried out at regular depth intervals in cohesive soils.

Overburden thickness was evaluated during the course of the current and previous investigations by dynamic cone penetration testing (DCPT) at BH 2 and BH 7. The DCPT consists of driving a steel drill rod, equipped with a 50 mm diameter cone at the tip, using a 63.5 kg hammer falling from a height of 760 mm. The number of blows required to drive the cone into the soil is recorded for each 300 mm increment. Due to the low resistance exerted by the silty clay in some boreholes, the cone was pushed using the hydraulic head of the drill rig until resistance to penetration was encountered. The hammer was then used to further advance the cone to practical refusal.

The subsurface conditions observed in the test holes were recorded in detail in the field. The soil profiles are presented on the Soil Profile and Test Data sheets in Appendix 1.

Sample Storage

All samples from the current investigation will be stored in the laboratory for a period of one month after issuance of this report. They will then be discarded unless we are otherwise directed. All samples from the previous investigations have been discarded.

3.2 Field Survey

The test holes from the current investigation were located and surveyed in the field by Paterson personnel. The locations and ground surface elevations for the current investigation were determined using a hand held GPS unit and are referenced to a geodetic datum. Test hole BH 7, from the previous investigation, was located and surveyed by Annis, Vollebekk and O'Sullivan, and is understood to be referenced to a geodetic datum.

The locations of the test holes and the ground surface elevation at each test hole location are presented on Drawing PG5398-1 - Test Hole Location Plan included in Appendix 2.

3.3 Laboratory Testing

The soil samples recovered from the test holes were examined in our laboratory to review the results of the field logging. From the 3 current test holes, 13 split spoon samples were submitted for moisture content testing. Among these samples, 3 samples were submitted for Atterberg Limits testing, and 1 sample was submitted for grain size distribution testing.

One (1) soil sample from the previous borehole BH 7 was also submitted for unidimensional consolidation testing. This is discussed further in Section 5.3.

The results of the Atterberg Limits testing, grain size distribution testing, and unidimensional consolidation testing are presented in Appendix 1 and are further discussed in Sections 4 and 5.

3.4 Analytical Testing

One (1) soil sample was submitted for analytical testing to assess the corrosion potential for exposed ferrous metals and the potential of sulphate attacks against subsurface concrete structures. The sample was submitted to determine the concentration of sulphate and chloride, the resistivity and the pH of the sample. The results are presented in Appendix 1 and are discussed further in Subsection 6.7.

4.0 Observations

4.1 Surface Conditions

The subject site, Block 29, is currently vacant and grass covered across the majority of the site. The site, which has an approximate triangular shape, is bordered by Maple Grove Road to the north, Poole Creek to the northwest, and vacant undeveloped lands to the south and west. The existing ground surface across the site is generally level at approximate geodetic elevation 97 m.

4.2 Subsurface Profile

Generally, the subsurface profile encountered at the borehole locations consists of an approximate 0.2 to 0.5 m thickness of fill underlying the existing ground surface. The fill was generally observed to consist of a brown silty sand with some clay and crushed stone. An approximate 140 mm thickness of topsoil was also encountered underlying the fill at BH 1.

On the northwest end of the site, within BH 1 and BH 7, a layer of loose to compact, brown silty sand to sandy silt was encountered underlying the fill and/or topsoil, extending to an approximate depth of 1.5 m below the existing ground surface.

A silty clay deposit was encountered underlying the fill, topsoil, and/or silty sand to sandy silt. The silty clay deposit had a very stiff to stiff, brown silty clay crust in the upper 3 to 4 m, becoming a stiff to firm, grey silty clay with depth. Boreholes BH 1 through BH 3 were terminated in the silty clay deposit at approximate depths of 5.9 to 6.7 m below the existing ground surface.

A glacial till deposit was encountered in BH 7 underlying the silty clay at an approximate depth of 7 m. The glacial till was generally observed to consist of a compact, grey silty sand with gravel. Borehole BH 7 was terminated in the glacial till deposit at an approximate depth of 8.2 m below the existing ground surface.

Practical refusal to the DCPT was encountered at depths ranging from 9.1 m in BH 7, at the northwest end of the site, to 16 m at BH 2, located at the southeast end of the site.

Reference should be made to the Soil Profile and Test Data sheets in Appendix 1 for specific details of the soil profiles encountered at each test hole location.

Laboratory Testing

Atterberg limits testing, as well as associated moisture content testing, was completed on the recovered silty clay samples at 3 selected locations throughout the subject site.

The results of the Atterberg limits tests are presented in Table 1 and on the Atterberg Limits Results sheet in Appendix 1. The tested silty clay samples classify as inorganic clays of low plasticity (CL) in accordance with the Unified Soil Classification System.

Table 1 - Atterberg Limits Results

Sample	Depth (m)	LL (%)	PL (%)	PI (%)	Classification
BH 1	2.0	33	20	13	CL
BH 2	2.6	42	19	23	CL
BH 3	2.6	39	20	19	CL

Notes: LL: Liquid Limit; PL: Plastic Limit; PI: Plasticity Index; w: water content;
CH: Inorganic Clay of High Plasticity

The results of the shrinkage limit test indicate a shrinkage limit of 20% and a shrinkage ratio of 1.77.

Grain size distribution (sieve and hydrometer analysis) was also completed on one selected soil sample. The result of the grain size analysis is summarized in Table 2 and presented on the Grain Size Distribution Results sheet in Appendix 1.

Table 2 - Summary of Grain Size Distribution Analysis

Test Hole	Sample	Gravel (%)	Sand (%)	Silt & Clay (%)
BH 2	SS 4	0.0	13.9	86.1

Bedrock

Based on available geological mapping, the bedrock in this area consists of interbedded limestone and shale of the Verulam Formation with an overburden drift thickness of approximately 10 to 15 m depth.

4.3 Groundwater

Based on groundwater level measurements, field observations during excavation, knowledge of the groundwater within the local area of the subject site, and the recovered soil samples' moisture levels, consistency and colouring, the long-term groundwater table can be expected between a 3 to 4 m depth. It should be noted that groundwater levels are subject to seasonal fluctuations. Therefore, the groundwater level could vary at the time of construction.

5.0 Discussion

5.1 Geotechnical Assessment

From a geotechnical perspective, the subject site is suitable for the proposed development. It is recommended that the proposed buildings be founded on conventional shallow foundations bearing on the undisturbed, stiff to firm silty clay, compact silty sand to sandy silt, or on engineered fill which is placed and compacted directly over the undisturbed stiff to firm silty clay or compact silty sand to sandy silt.

Due to the presence of a silty clay deposit, the subject site will be subjected to a permissible grade raise restriction.

The above and other considerations are further discussed in the following sections.

5.2 Site Grading and Preparation

Stripping Depth

Topsoil, asphalt, and deleterious fill, such as material containing a high content of organic materials, should be stripped from under the proposed building footprints and other settlement sensitive structures.

Fill Placement

Fill used for grading beneath the proposed buildings should consist of clean imported granular fill, such as Ontario Provincial Standard Specifications (OPSS) Granular A or Granular B Type II. This material should be tested and approved prior to delivery to the site. The fill should be placed in lifts no greater than 300 mm thick and compacted using suitable compaction equipment for the lift thickness. Fill placed beneath the building and paved areas should be compacted to at least 98% of the material's standard Proctor maximum dry density (SPMDD).

Non-specified existing fill, along with site-excavated soil, can be used as general landscaping fill where settlement of the ground surface is of minor concern. This material should be spread in thin lifts and at least compacted by the tracks of the spreading equipment to minimize voids. If this material is to be used to build up the subgrade level for areas to be paved, it should be compacted in thin lifts to at least 95% of the material's SPMDD.

Non-specified existing fill and site-excavated soils are not suitable for use as backfill against foundation walls unless used in conjunction with a composite drainage membrane.

5.3 Foundation Design

Using continuously applied loads, footings for the proposed buildings can be designed with the following bearing resistance values presented in Table 3.

Table 3 - Bearing Resistance Values

Undisturbed Bearing Surface	Bearing Resistance Value at SLS (kPa)	Factored Bearing Resistance Value at ULS (kPa)
Compact Silty Sand/Sandy Silt	100	150
Stiff Silty Clay	120	180
Firm Silty Clay	80	120
Engineered Fill	100	150

Note: Strip footings, up to 2 m wide, and pad footings, up to 3 m wide, placed over an undisturbed, silty clay bearing surface can be designed using the abovenoted bearing resistance values.

If the silty sand subgrade is observed to be in a loose state of compactness, the material should be proof rolled using suitable vibratory equipment making several passes under dry conditions and above freezing temperatures and approved by Paterson at the time of construction.

An undisturbed soil bearing surface consists of one from which all topsoil and deleterious materials, such as loose, frozen or disturbed soil, have been removed prior to the placement of concrete for footings.

The bearing resistance value at SLS given for footings will be subjected to potential post construction total and differential settlements of 25 and 20 mm, respectively.

Lateral Support

The bearing medium under footing-supported structures is required to be provided with adequate lateral support with respect to excavations and different foundation levels. Adequate lateral support is provided to a silty clay, silty sand to sandy silt, or engineered fill bearing surface above the groundwater table when a plane extending down and out from the bottom edge of the footing at a minimum of 1.5H:1V passes only through in situ soil of the same or higher capacity as the bearing medium soil.

Settlement/Grade Raise

During the previous investigations, 1 consolidation test was completed within the boundaries of the subject site. The results of the consolidation test from the previous investigation are presented in Table 4 and in Appendix 1.

The value for p'_c is the preconsolidation pressure and p'_o is the effective overburden pressure of the test sample. The difference between these values is the available preconsolidation. The increase in stress on the soil due to the cumulative effects of the fill surcharge, the footing pressures, the slab loadings and the lowering of the groundwater should not exceed the available preconsolidation if unacceptable settlements are to be avoided.

The values for C_{cr} and C_c are the recompression and compression indices, respectively. These soil parameters are a measure of the compressibility due to stress increases below and above the preconsolidation pressures. The higher values for the C_c, as compared to the C_{cr}, illustrate the increased settlement potential above, as compared to below, the preconsolidation pressure.

Table 4 - Summary of Consolidation Test Results

Borehole	Sample	Elevation (m)	p'_c (kPa)	p'_o (kPa)	C_{cr}	C_c
BH7	TW 6	91.56	107	79	0.025	0.742

The values of p'_c, p'_o, C_{cr} and C_c are determined using standard engineering testing procedures and are estimates only. Natural variations within the soil deposit will affect the results. The p'_o parameter is directly influenced by the groundwater level. Groundwater levels were measured during the site investigation. Groundwater levels vary seasonally which has an impact on the available preconsolidation. Lowering the groundwater level increases the p'_o and therefore reduces the available preconsolidation. Unacceptable settlements could be induced by a significant lowering of the groundwater level. The p'_o values for the consolidation tests during the investigation are based on the long term groundwater level being at 0.5 m below the existing groundwater table. The groundwater level is based on the colour and undrained shear strength profile of the silty clay.

The total and differential settlements will be dependent on characteristics of the proposed buildings. For design purposes, the total and differential settlements are estimated to be 25 and 20 mm, respectively. A post-development groundwater lowering of 0.5 m was assumed.

The potential post construction total and differential settlements are dependent on the position of the long term groundwater level when buildings are situated over deposits of compressible silty clay. Efforts can be made to reduce the impacts of the proposed development on the long term groundwater level by placing clay dykes in the service trenches, reducing the sizes of paved areas, leaving green spaces to allow for groundwater recharge or limiting planting of trees to areas away from the buildings. However, it is not economically possible to control the groundwater level.

Buildings on silty clay deposits increases the likelihood of movements and therefore of cracking. The use of steel reinforcement in foundations placed at key structural locations will tend to reduce foundation cracking compared to unreinforced foundations.

Based on the test hole information and consolidation testing results, a permissible grade raise restriction of **1.5 m** is recommended for grading within the subject site.

If higher than permissible grade raises are required, preloading with or without a surcharge, lightweight fill, and/or other measures should be investigated to reduce the risks of unacceptable long-term post construction total and differential settlements.

5.4 Design for Earthquakes

The site class for seismic site response can be taken as **Class D**. Soils underlying the subject site are not susceptible to liquefaction. Reference should be made to the latest revision of the Ontario Building Code 2012 for a full discussion of the earthquake design requirements.

5.5 Basement Slab Construction

With the removal of all topsoil and fill, containing significant amounts of deleterious or organic materials, the existing fill or native soil subgrade approved by the geotechnical consultant at the time of excavation will be considered an acceptable subgrade surface on which to commence backfilling for basement slab construction. Where the subgrade consists of existing fill, a vibratory drum roller should complete several passes over the subgrade surface as a proof-rolling program. Any poor performing areas should be removed and reinstated with an engineered fill, such as Granular B Type II.

It is recommended that the upper 200 mm of subfloor fill consists of 19 mm clear crushed stone. All backfill material within the footprints of the proposed buildings should be placed in maximum 300 mm thick loose layers and compacted to at least 95% of its MPMDD.

A sub-slab drainage system, consisting of lines of perforated drainage pipe subdrains connected to a positive outlet, should be provided under the basement slabs. The spacing of the sub-slab drainage pipes can be determined at the time of construction to confirm groundwater infiltration levels, if any. This is discussed further in Subsection 6.1.

5.6 Basement Wall

There are several combinations of backfill materials and retained soils that could be applicable for the basement walls of the subject structure. However, the conditions can be well-represented by assuming the retained soil consists of a material with an angle of internal friction of 30 degrees and a bulk (drained) unit weight of 20 kN/m^3. The applicable effective (undrained) unit weight of the retained soil can be taken as 13 kN/m^3, where applicable. A hydrostatic pressure should be added to the total static earth pressure when using the effective unit weight.

Lateral Earth Pressures

The static horizontal earth pressure (p_o) can be calculated using a triangular earth pressure distribution equal to $K_o \cdot \gamma \cdot H$ where:

K_o = at-rest earth pressure coefficient of the applicable retained soil, 0.5
γ = unit weight of fill of the applicable retained soil (kN/m^3)
H = height of the wall (m)

An additional pressure having a magnitude equal to $K_o \cdot q$ and acting on the entire height of the wall should be added to the above diagram for any surcharge loading, q (kPa), that may be placed at ground surface adjacent to the wall. The surcharge pressure will only be applicable for static analyses and should not be used in conjunction with the seismic loading case.

Actual earth pressures could be higher than the “at-rest” case if care is not exercised during the compaction of the backfill materials to maintain a minimum separation of 0.3 m from the walls with the compaction equipment.

Seismic Earth Pressures

The total seismic force (P_{AE}) includes both the earth force component (P_o) and the seismic component (ΔP_{AE}). The seismic earth force (ΔP_{AE}) can be calculated using $0.375 \cdot a_c \cdot \gamma \cdot H^2/g$ where:

a_c = $(1.45\text{-}a_{max}/g)a_{max}$
γ = unit weight of fill of the applicable retained soil (kN/m^3)
H = height of the wall (m)
g = gravity, 9.81 m/s^2

The peak ground acceleration, (a_{max}), for the Ottawa area is 0.32g according to OBC 2012. Note that the vertical seismic coefficient is assumed to be zero.

The earth force component (P_o) under seismic conditions can be calculated using $P_o = 0.5\ K_o\ \gamma\ H^2$, where K_o = 0.5 for the soil conditions noted above.

The total earth force (P_{AE}) is considered to act at a height, h (m), from the base of the wall, where:

$h = \{P_o\cdot(H/3)+\Delta P_{AE}\cdot(0.6\cdot H)\}/P_{AE}$

The earth forces calculated are unfactored. For the ULS case, the earth loads should be factored as live loads, as per OBC 2012.

5.7 Pavement Structure

Where required at the subject site, the recommended pavement structures for car only parking areas and access lanes are shown in Tables 5 and 6.

Table 5 - Recommended Pavement Structure - Car Only Parking Areas	
Thickness (mm)	**Material Description**
50	**Wear Course** - HL-3 or Superpave 12.5 Asphaltic Concrete
150	**BASE** - OPSS Granular A Crushed Stone
300	**SUBBASE** - OPSS Granular B Type II
SUBGRADE - Either fill, in situ soil or OPSS Granular B Type I or II material placed over in situ soil or fill	

Table 6 - Recommended Pavement Structure - Access Lanes

Thickness (mm)	Material Description
40	**Wear Course** - HL-3 or Superpave 12.5 Asphaltic Concrete
50	**Binder Course** - HL-8 or Superpave 19.0 Asphaltic Concrete
150	**BASE** - OPSS Granular A Crushed Stone
450	**SUBBASE** - OPSS Granular B Type II
SUBGRADE - Either fill, in situ soil, or OPSS Granular B Type I or II material placed over in situ soil or fill	

Minimum Performance Graded (PG) 58-34 asphalt cement should be used for this project.

If soft spots develop in the subgrade during compaction or due to construction traffic, the affected areas should be excavated and replaced with OPSS Granular B Type I or II material. Weak subgrade conditions may be experienced over service trench fill materials. This may require the use of a geotextile, such as Terratrack 200 or equivalent, thicker subbase or other measures that can be recommended at the time of construction as part of the field observation program.

The pavement granular base and subbase should be placed in maximum 300 mm thick lifts and compacted to a minimum of 100% of the material's SPMDD using suitable vibratory equipment.

Pavement Structure Drainage

Satisfactory performance of the pavement structure is largely dependent on keeping the contact zone between the subgrade material and the base stone in a dry condition. Failure to provide adequate drainage under conditions of heavy wheel loading can result in the fine subgrade soil being pumped into the voids in the stone subbase, thereby reducing its load carrying capacity.

Due to the impervious nature of the subgrade materials consideration should be given to installing subdrains during the pavement construction. These drains should be installed at each catch basin, be at least 3 m long and should extend in four orthogonal directions or longitudinally when placed along a curb. The subdrain inverts should be approximately 300 mm below subgrade level. The subgrade surface should be shaped to promote water flow to the drainage lines.

6.0 Design and Construction Precautions

6.1 Foundation Drainage and Backfill

Foundation Drainage

It is recommended that a perimeter foundation drainage system be provided for the proposed structure. The system should consist of a 150 mm diameter perforated corrugated plastic pipe, surrounded on all sides by 150 mm of 19 mm clear crushed stone which is placed at the footing level around the exterior perimeter of each structure. The pipe should have a positive outlet, such as a gravity connection to the storm sewer.

Sub-slab Drainage

Sub-slab drainage is recommended to control water infiltration. For preliminary design purposes, we recommend that 150 mm diameter perforated pipes be placed at approximate 6 m centres underlying the basement slabs. The spacing of the sub-slab drainage system should be confirmed at the time of completing the excavation when water infiltration can be better assessed.

Foundation Backfill

Backfill against the exterior sides of the foundation walls should consist of free-draining non frost susceptible granular materials. The greater part of the site excavated materials will be frost susceptible and, as such, are not recommended for re-use as backfill against the foundation walls, unless used in conjunction with a drainage geocomposite, such as Miradrain G100N or Delta Drain 6000, connected to the perimeter foundation drainage system. Imported granular materials, such as clean sand or OPSS Granular B Type I granular material, should otherwise be used for this purpose.

6.2 Protection Against Frost Action

Perimeter footings of heated structures are required to be insulated against the deleterious effect of frost action. A minimum of 1.5 m thick soil cover (or equivalent) should be provided in this regard.

Exterior unheated footings, such as those for isolated exterior piers, are more prone to deleterious movement associated with frost action than the exterior walls of the heated structure and require additional protection, such as soil cover of 2.1 m or an equivalent combination of soil cover and foundation insulation.

6.3 Excavation Side Slopes

The side slopes of excavations in the soil and fill overburden materials should either be cut back at acceptable slopes or should be retained by shoring systems from the start of the excavation until the structure is backfilled. However, it is expected that sufficient room will be available for the greater part of the excavation to be undertaken by open-cut methods (i.e. unsupported excavations).

The excavation side slopes above the groundwater level extending to a maximum depth of 3 m should be excavated at 1H:1V or shallower. The shallower slope is required for excavation below groundwater level. The subsurface soils are considered to be a Type 2 and 3 soil according to the Occupational Health and Safety Act and Regulations for Construction Projects.

Excavated soil should not be stockpiled directly at the top of excavations and heavy equipment should be kept away from the excavation sides.

Slopes in excess of 3 m in height should be periodically inspected by the geotechnical consultant in order to detect if the slopes are exhibiting signs of distress.

It is recommended that a trench box be used at all times to protect personnel working in trenches with steep or vertical sides. It is expected that services will be installed by “cut and cover” methods and excavations will not be left open for extended periods of time.

6.4 Pipe Bedding and Backfill

Bedding and backfill materials should be in accordance with the most recent Material Specifications & Standard Detail Drawings from the Department of Public Works and Services, Infrastructure Services Branch of the City of Ottawa.

The pipe bedding for sewer and water pipes should consist of a minimum of 150 mm of OPSS Granular A material. Where the bedding is located within the firm to stiff grey silty clay, the thickness of the bedding material should be increased to a minimum of 300 mm. The material should be placed in a maximum 225 mm thick loose lifts and compacted to a minimum of 95% of its SPMDD. The bedding material should extent at least to the spring line of the pipe.

The cover material, which should consist of OPSS Granular A, should extend from the spring line of the pipe to at least 300 mm above the obvert of the pipe. The material should be placed in a maximum 225 mm thick loose lifts and compacted to a minimum of 95% of its SPMDD.

It should generally be possible to re-use the moist (not wet) brown silty clay above the cover material if the excavation and filling operations are carried out in dry weather conditions. Wet silty clay materials will be difficult to re-use, as the high water contents make compacting impractical without an extensive drying period.

Where hard surface areas are considered above the trench backfill, the trench backfill material within the frost zone (about 1.8 m below finished grade) should match the soils exposed at the trench walls to minimize differential frost heaving. The trench backfill should be placed in a maximum 300 mm thick loose lifts and compacted to a minimum of 95% of the material's SPMDD.

To reduce long-term lowering of the groundwater level at this site, clay seals should be provided in the service trenches. The seals should be at least 1.5 m long and should extend from trench wall to trench wall. Generally, the seals should extend from the frost line and fully penetrate the bedding, subbedding and cover material. The barriers should consist of relatively dry and compactable brown silty clay placed in a maximum 225 mm thick loose lifts and compacted to a minimum of 95% of the material's SPMDD. The clay seals should be placed at the site boundaries and at strategic locations at no more than 60 m intervals in the service trenches.

6.5 Groundwater Control

Due to the relatively impervious nature of the silty clay and existing groundwater level, it is anticipated that groundwater infiltration into the excavations should be low to medium and controllable using open sumps. A perched groundwater condition may be encountered within the silty sand to sandy silt deposit which may produce significant temporary groundwater infiltration levels. Pumping from open sumps should be sufficient to control the groundwater influx through the sides of shallow excavations.

A temporary Ministry of Environment, Conservation and Parks (MECP) permit to take water (PTTW) may be required if more than 400,000 L/day of ground and/or surface water are to be pumped during the construction phase. At least 4 to 5 months should be allowed for completion of the application and issuance of the permit by the MECP.

For typical ground or surface water volumes being pumped during the construction phase, typically between 50,000 to 400,000 L/day, it is required to register on the Environmental Activity and Sector Registry (EASR). A minimum of two to four weeks should be allotted for completion of the EASR registration and the Water Taking and Discharge Plan to be prepared by a Qualified Person as stipulated under O.Reg. 63/16.

If a project qualifies for a PTTW based upon anticipated conditions, an EASR will not be allowed as a temporary dewatering measure while awaiting the MECP review of the PTTW application.

The contractor should be prepared to direct water away from all bearing surfaces and subgrades, regardless of the source, to prevent disturbance to the founding medium.

Long-term Groundwater Control

Our recommendations for the long-term groundwater control for proposed construction are presented in Subsection 6.1. Any groundwater encountered along the proposed structure's perimeter or sub-slab drainage system will be directed to the proposed structure's sump pit. It is expected that groundwater flow will be low (i.e.- less than 10,000 L/day) with peak periods noted after rain events.

6.6 Winter Construction

The subsoil conditions at this site mostly consist of frost susceptible materials. In the presence of water and freezing conditions, ice could form within the soil mass. Heaving and settlement upon thawing could occur. Precautions should be taken if winter construction is considered for this project.

In the event of construction during below zero temperatures, the founding stratum should be protected from freezing temperatures by the use of straw, propane heaters, tarpaulins or other suitable means. In this regard, the base of the excavations should be insulated from sub-zero temperatures immediately upon exposure and until such time as heat is adequately supplied to the building and the footings are protected with sufficient soil cover to prevent freezing at founding level.

The trench excavations should be carried out in a manner that will avoid the introduction of frozen materials into the trenches. As well, pavement construction is difficult during winter. The subgrade consists of frost susceptible soils which will experience total and differential frost heaving as the work takes place. In addition, the introduction of frost, snow or ice into the pavement materials, which is difficult to avoid, could adversely affect the performance of the pavement structure. Additional information could be provided, if required.

6.7 Corrosion Potential and Sulphate

The results on analytical testing show that the sulphate content is less than 0.1%. The results are indicative that Type 10 Portland Cement would be appropriate for this site. The chloride content and the pH of the sample indicate that they are not significant factors in creating a corrosive environment for exposed ferrous metals at this site, whereas the resistivity in indicative of a moderate to slightly aggressive corrosive environment.

6.8 Landscaping Considerations

Tree Planting Setbacks

In accordance with the City of Ottawa Tree Planting in Sensitive Marine Clay Soils (2017 Guidelines), Paterson completed a soils review of the site to determine applicable tree planting setbacks. Atterberg limits testing was completed for recovered silty clay samples at selected locations throughout the subject site. Grain size distribution testing was also completed on a selected soil sample from BH 2. The above-noted soil samples were recovered from elevations below the anticipated design underside of footing elevation and 3.5 m depth below anticipated finished grade. The results of our testing are presented in Subsection 4.2 and in Appendix 1.

Based on the results of our review, a low to medium sensitivity clay soil is present within the proposed development.

Low/Medium Sensitivity Clay Soils

Based on our Atterberg Limits test results, the modified plasticity limit does not exceed 40% at the subject site. The following tree planting setbacks are recommended for the low to medium sensitivity area. Large trees (mature height over 14 m) can be planted within these areas provided a tree to foundation setback equal to the full mature height of the tree can be provided (e.g. in a park or other green space). Tree planting setback limits may be reduced to **4.5 m** for small (mature tree height up to 7.5 m) and medium size trees (mature tree height 7.5 m to 14 m) provided that the conditions noted below are met:

❏ The underside of footing (USF) is 2.1 m or greater below the lowest finished grade must be satisfied for footings within 10 m from the tree, as measured from the centre of the tree trunk and verified by means of the Grading Plan as indicated procedural changes below.

❏ A small tree must be provided with a minimum of 25 m^3 of available soil volume while a medium tree must be provided with a minimum of 30 m^3 of available soil volume, as determined by the Landscape Architect. The developer is to ensure that the soil is generally un-compacted when backfilling in street tree planting locations.

❏ The tree species must be small (mature tree height up to 7.5 m) to medium size (mature tree height 7.5 m to 14 m) as confirmed by the Landscape Architect.

❏ The foundation walls are to be reinforced at least nominally (minimum of two upper and two lower 15M bars in the foundation wall).

- ❑ Grading surround the tree must promote drainage to the tree root zone (in such a manner as not to be detrimental to the tree), as noted on the subdivision Grading Plan.

Swimming Pools

The in-situ soils are considered to be acceptable for in-ground swimming pools. Above ground swimming pools must be placed at least 5 m away from the residence foundation and neighbouring foundations. Otherwise, pool construction is considered routine, and can be constructed in accordance with the manufacturer`s requirements.

Aboveground Hot Tubs

Additional grading around the hot tub should not exceed permissible grade raises. Otherwise, hot tub construction is considered routine, and could be constructed in accordance with the manufacturer’s specifications.

Installation of Decks or Additions

Additional grading around proposed deck or addition should not exceed permissible grade raises. Otherwise, standard construction practices are considered acceptable.

6.9 Limit of Hazard Lands

Poole Creek

A section of Poole Creek is located within the west portion of the site. The slope condition was reviewed by Paterson field personnel as part of the geotechnical investigation. One (1) slope cross-section (Section B) was studied as the worst case scenario, where Poole Creek has meandered in close proximity (less than 1 m) from the toe of the upper slope or valley corridor. In addition, a second slope cross-section (Section C) was also analyzed at Block 29. The cross section locations are presented on Drawing PG5398-2 - Limit of Hazard Lands in Appendix 2. The subject section of Poole Creek is approximately 2 to 3 m wide, approximately 0.3 to 0.6 m depth, and meanders across the valley floor.

Poole Creek is observed within a 15 to 25 m wide flood plain. A 3 to 4 m high stable slope confines the flood plain. The upper slope is observed to be well vegetated and stable with little to no signs of active erosion. Signs of erosion were noted along the subject section of Poole Creek where the watercourse has meandered in close proximity to the toe of the corridor wall. The majority of the subject slope was shaped between a 2.2H:1V to 3.5H:1V slope.

A slope stability analysis was carried out to determine the required stable slope allowance setback from the top of slope based on a factor of safety of 1.5. A toe erosion and 6 m erosion access allowances were also considered in the determination of Limit of Hazard Lands and are discussed on the following pages. The proposed Limit of Hazard Lands, including the stable slope allowance, where required, toe erosion allowance, 6 m erosion access allowance, and top of slope are shown on Drawing PG5398-2 - Limit of Hazard Lands in Appendix 2.

Slope Stability Assessment

The analysis of slope stability was carried out using SLIDE, a computer program that permits a two-dimensional slope stability analysis using several methods, including the Bishop's method, which is a widely used and accepted analysis method. The program calculates a factor of safety, which represents the ratio of the forces resisting failure to those favouring failure. Theoretically, a factor of safety of 1.0 represents a condition where the slope is stable. However, due to intrinsic limitations of the calculation methods and the variability of the subsoil and groundwater conditions, a factor of safety greater than one is usually required to ascertain than the risks of failure are acceptable. A minimum factor of safety of 1.5 is generally recommended for conditions where the failure of the slope would endanger permanent structures.

An analysis considering seismic loading was also completed. A horizontal acceleration of 0.16 g was considered for the sections for the seismic loading condition. A factor of safety of 1.1 is considered to be satisfactory for stability analyses including seismic loading.

The cross-sections were analyzed taking into account a groundwater level at ground surface, which represents a worse-case scenario that can be reasonably expected to occur in cohesive soils. The stability analysis assumes full saturation of the soil with groundwater flow parallel to the slope face. Subsoil conditions at the cross-sections were inferred based on the findings at borehole locations along the top of slope and general knowledge of the area's geology.

Stable Slope Allowance

The results of the stability analysis for static conditions at Sections B and C are presented in Figures 2 and 4 in Appendix 2. Section B requires a stable slope allowance due to the slope stability factor of safety being less than 1.5. It should be noted that the cross-section was analyzed as the worst case scenario for the subject slope. The remainder of the slope reviewed along the subject section of Poole Creek was noted to be shaped to at least a 3H:1V profile.

Based on the soil conditions observed and slope profile along the subject section of Poole Creek, the remainder of the slope has a slope stability factor of safety of greater than 1.5 and does not require a stable slope allowance.

The results of the analyses including seismic loading are shown in Figures 3 and 5 for the slope sections. The results indicate that the factor of safety for the sections are greater than 1.1 for the sections.

The existing vegetation on the slope face should not be removed as it contributes to the stability of the slope and reduces erosion. If the existing vegetation needs to be removed, it is recommended that a 100 to 150 mm of topsoil mixed with a hardy seed or an erosional control blanket be placed across the exposed slope face.

Toe Erosion and Erosion Access Allowance

The toe erosion allowance for the valley corridor wall slope was based on the cohesive nature of the soils, the observed current erosional activities and the width and location of the current watercourse. Signs of erosion were noted along the subject section of Poole Creek where the watercourse has meandered in close proximity to the toe of the corridor wall.

It is considered that in areas where the water course has meandered in close proximity (less than 15 m) to the toe of the upper slope, a toe erosion allowance of 5 m and an erosion access allowance of 6 m are required from the top of slope. Where the watercourse is greater than 15 m from the toe of the slope, the toe erosion allowance should be taken from the watercourse edge. The Limit of Hazard Lands, which includes these allowances, is indicated on Drawing PG5398-2 - Limit of Hazard Lands in Appendix 2.

Minimum Setback Requirements of the Official Plan

Minimum setbacks have been established by Council for the Official Plan for rivers, lakes, streams and other surface water features. It should be noted that where a council-approved watershed, sub-watershed or environmental management plan does not exist, the minimum setback will be the greater of the following:

❏ Development limits as established by the regulatory flood line

❏ Development limits as established by the geotechnical Limit of the Hazard Lands

❏ 30 m from normal high water mark of rivers, lakes and streams as determined in consultation with the conservation authority, or

- 15 m from existing top of bank, where there is a defined bank.

However, it should also be noted that where the geotechnical Limit of Hazard Lands line and regulatory flood line are within 15 m of top of slope, the development limits can be established as the geotechnical limit of hazard lands line provided the Conservation Authority approves.

7.0 Recommendations

It is a requirement for the foundation design data provided herein to be applicable that the following material testing and observation program be performed by the geotechnical consultant.

- ❑ A review of the final grading plan should be completed from a geotechnical perspective.
- ❑ Observation of all bearing surfaces prior to the placement of concrete.
- ❑ Sampling and testing of the concrete and fill materials used.
- ❑ Periodic observation of the condition of unsupported excavation side slopes in excess of 3 m in height, if applicable.
- ❑ Observation of all subgrades prior to backfilling.
- ❑ Field density tests to determine the level of compaction achieved.
- ❑ Sampling and testing of the bituminous concrete including mix design reviews.

A report confirming that these works have been conducted in general accordance with our recommendations could be issued, upon request, following the completion of a satisfactory material testing and observation program by the geotechnical consultant.

8.0 Statement of Limitations

The recommendations provided in this report are in accordance with our present understanding of the project. We request permission to review our recommendations when the drawings and specifications are completed.

A geotechnical investigation of this nature is a limited sampling of a site. Should any conditions at the site be encountered which differ from those at the test locations, we request immediate notification to permit reassessment of our recommendations.

The recommendations provided herein should only be used by the design professionals associated with this project. They are not intended for contractors bidding on or undertaking the work. The latter should evaluate the factual information provided in this report and determine its suitability and completeness for their intended construction schedule and methods. Additional testing may be required for their purposes.

The present report applies only to the project described in this document. Use of this report for purposes other than those described herein or by person(s) other than Richcraft Group of Companies or their agents is not authorized without review by Paterson Group for the applicability of our recommendations to the altered use of the report.

Paterson Group

Yolanda Tang, M.Sc.Eng

Scott S. Dennis, P.Eng.

Report Distribution:

- ❑ Richcraft Group of Companies
- ❑ Paterson Group

APPENDIX 1

SOIL PROFILE AND TEST DATA SHEETS

SYMBOLS AND TERMS

UNIDIMENSIONAL CONSOLIDATION TEST SHEETS

ATTERBERG LIMITS RESULTS

GRAIN SIZE DISTRIBUTION RESULTS

ANALYTICAL TESTING RESULTS

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Kanata West Block 29 - Maple Grove Road
Ottawa, Ontario

DATUM Geodetic

FILE NO. **PG5398**

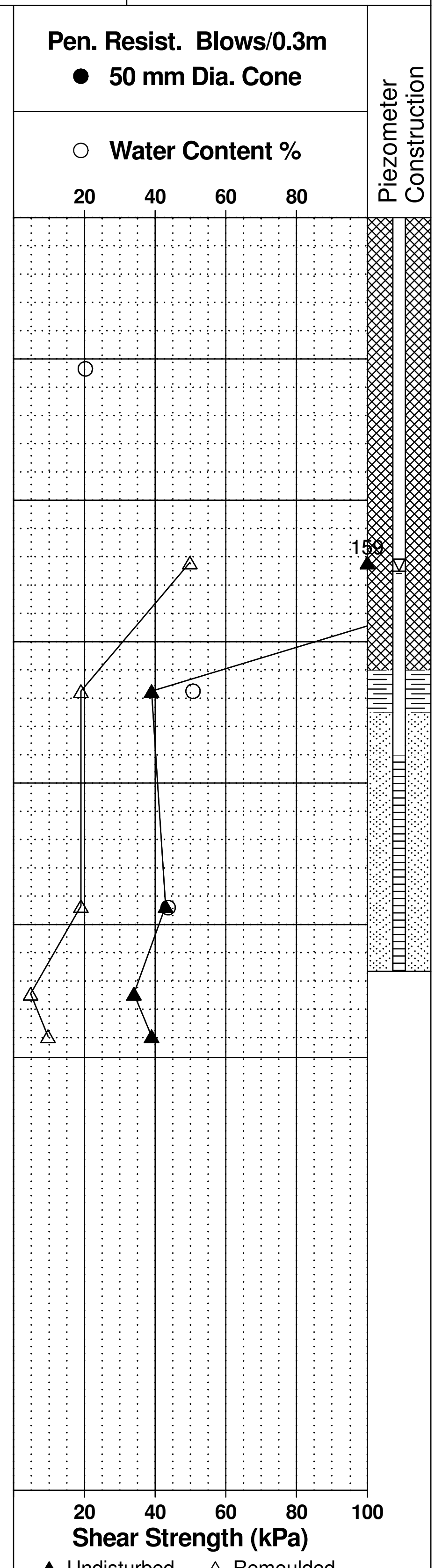
REMARKS

HOLE NO. **BH 1**

BORINGS BY Track-Mount Power Auger

DATE June 24, 2020

SOIL DESCRIPTION	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE					0	96.70
FILL: Brown silty sand, some crushed stone (to 0.46)	AU	1				
TOPSOIL (to 0.60)						
Compact, brown **SANDY SILT,** trace clay to **CLAYEY SILT** (to 1.52)	SS	2	58	16	1	95.70
Very stiff to stiff, brown **SILTY CLAY,** trace sand - firm and grey by 3.0m depth (to 5.94)	SS	3	83	2	2	94.70
	SS	4	100	P	3	93.70
					4	92.70
	SS	5	100	P	5	91.70
End of Borehole (GWL @ 2.5m depth based on field observations)						



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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Kanata West Block 29 - Maple Grove Road
Ottawa, Ontario

DATUM Geodetic

FILE NO. PG5398

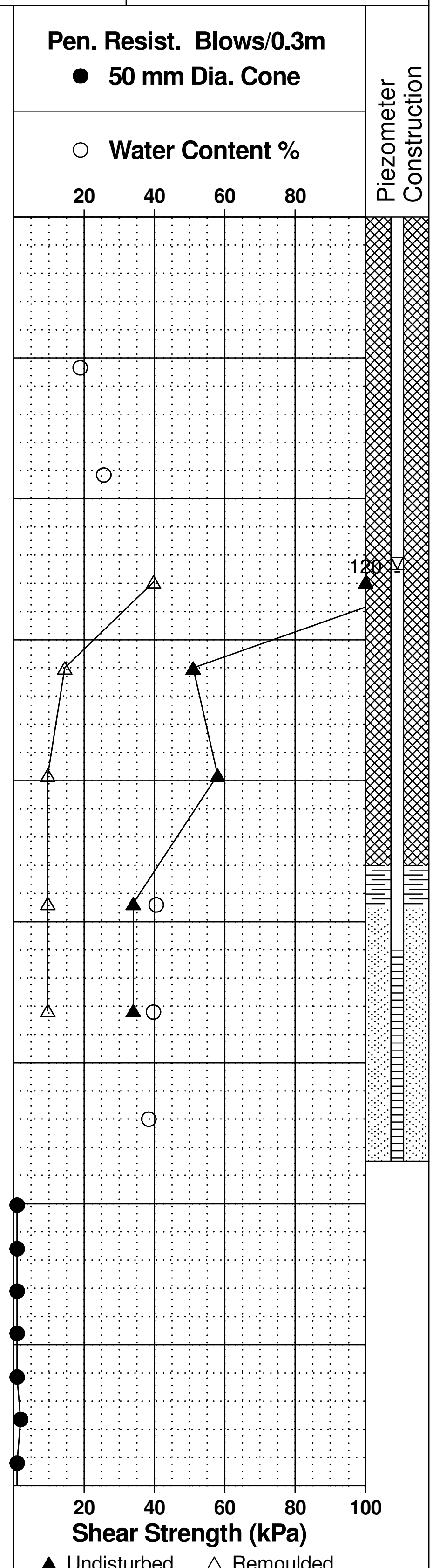
REMARKS

HOLE NO. BH 2

BORINGS BY Track-Mount Power Auger

DATE June 24, 2020

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	97.08
FILL: Brown silty sand, some clay, crushed stone and boulders (to 0.36)		AU	1				
Brown **CLAYEY SILT,** trace sand (to 2.20)		SS	2	58	19	1	96.08
		SS	3	67	7	2	95.08
Very stiff to stiff, brown **SILTY CLAY,** trace sand - stiff to firm and grey by 3.0m depth (to 6.70)		SS	4	100	P	3	94.08
						4	93.08
		SS	5	100	P	5	92.08
		SS	6	100	P	6	91.08
		SS	7	100	P		
Dynamic Cone Penetration Test commenced at 6.70m depth.						7	90.08
						8	89.08
						9	88.08



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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Kanata West Block 29 - Maple Grove Road
Ottawa, Ontario

DATUM Geodetic

FILE NO. **PG5398**

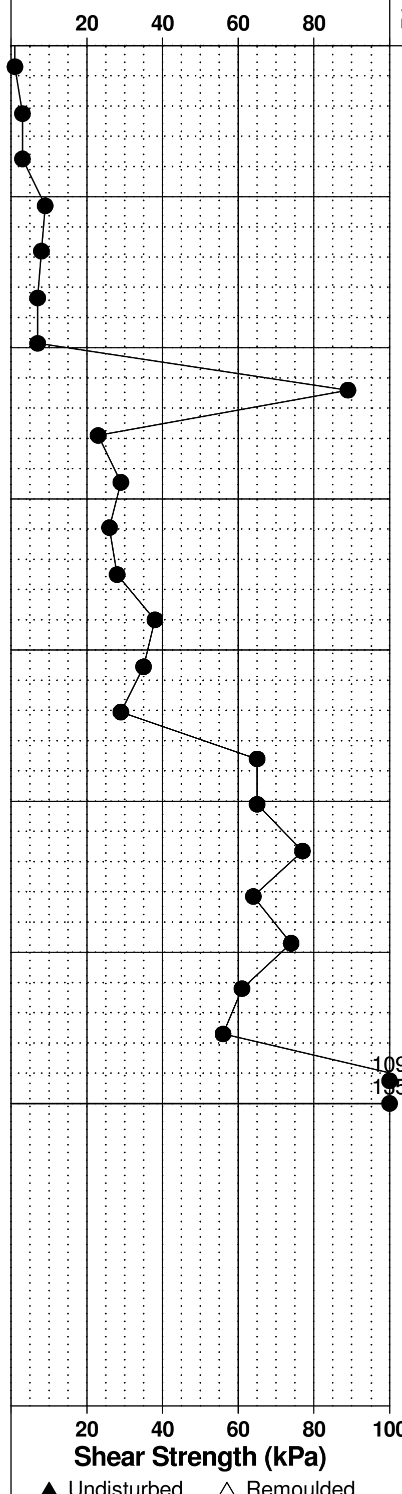
REMARKS

HOLE NO. **BH 2**

BORINGS BY Track-Mount Power Auger

DATE June 24, 2020

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content %	Piezometer Construction
GROUND SURFACE									
						9	88.08		
						10	87.08		
						11	86.08		
						12	85.08		
						13	84.08		
						14	83.08		
						15	82.08		
16.00						16	81.08		
End of Borehole Practical DCPT refusal at 16.00m depth (GWL @ 2.5m depth based on field observations)									



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Kanata West Block 29 - Maple Grove Road
Ottawa, Ontario

DATUM Geodetic

REMARKS

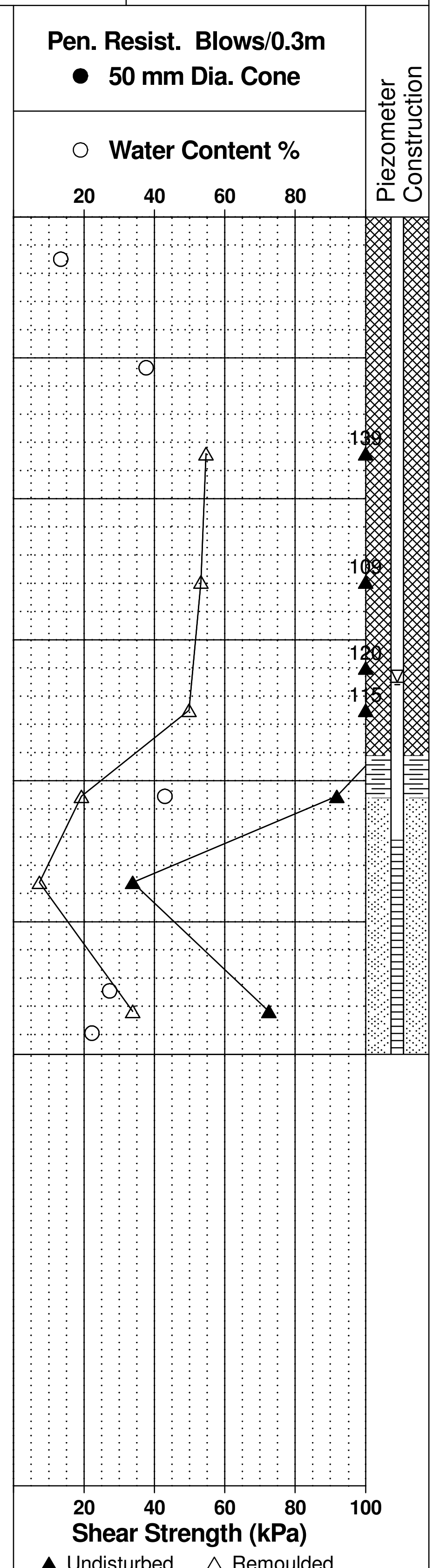
BORINGS BY Track-Mount Power Auger

DATE June 24, 2020

FILE NO. PG5398

HOLE NO. BH 3

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	97.24
FILL: Brown silty sand, trace crushed stone — 0.20		SS	1	17	6		
		SS	2	75	6	1	96.24
Very stiff to stiff, brown **SILTY CLAY,** trace sand						2	95.24
		SS	3	100	P		
						3	94.24
- firm to stiff and grey by 3.8m depth							
		SS	4	100		4	93.24
						5	92.24
— 5.94		SS	5	50	3		
End of Borehole							
(GWL @ 3.3m depth based on field observations)							



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154 Colonnade Road, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Supplemental Geotechnical Investigation
Proposed Kanata West Subdivision
Ottawa (Kanata), Ontario

DATUM Geodetic

REMARKS

BORINGS BY CME 75 Power Auger

DATE Aug 1, 03

FILE NO. G9012

HOLE NO. BH 7

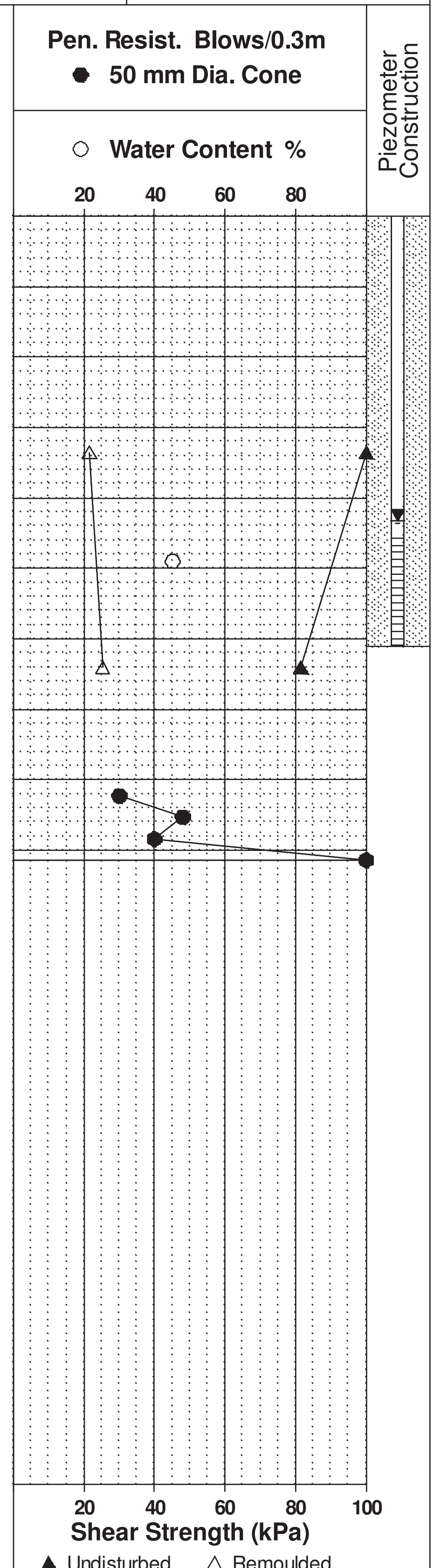
SOIL DESCRIPTION	Depth to base (m)	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD
GROUND SURFACE					
TOPSOIL	0.23				
Loose, brown **SILTY** fine **SAND**	1.45	SS	15	29	8
Very stiff to stiff, brown **SILTY CLAY** - grey by 4.0m depth	7.01	SS	16	96	5
		TW	6		
GLACIAL TILL: Compact, grey silty fine sand with gravel	8.23	SS	17	75	18
Dynamic Cone Penetration Test commenced @ 8.23m depth Inferred **GLACIAL TILL**	9.14				

End of Borehole

DCPT refusal @ 9.14m depth

(GWL @ 4.33m-Aug. 18/03)

DEPTH (m)	ELEV. (m)
0	96.46
1	95.46
2	94.46
3	93.46
4	92.46
5	91.46
6	90.46
7	89.46
8	88.46
9	87.46



SYMBOLS AND TERMS

SOIL DESCRIPTION

Behavioural properties, such as structure and strength, take precedence over particle gradation in describing soils. Terminology describing soil structure are as follows:

Desiccated	-	having visible signs of weathering by oxidation of clay minerals, shrinkage cracks, etc.
Fissured	-	having cracks, and hence a blocky structure.
Varved	-	composed of regular alternating layers of silt and clay.
Stratified	-	composed of alternating layers of different soil types, e.g. silt and sand or silt and clay.
Well-Graded	-	Having wide range in grain sizes and substantial amounts of all intermediate particle sizes (see Grain Size Distribution).
Uniformly-Graded	-	Predominantly of one grain size (see Grain Size Distribution).

The standard terminology to describe the strength of cohesionless soils is the relative density, usually inferred from the results of the Standard Penetration Test (SPT) 'N' value. The SPT N value is the number of blows of a 63.5 kg hammer, falling 760 mm, required to drive a 51 mm O.D. split spoon sampler 300 mm into the soil after an initial penetration of 150 mm.

Relative Density	'N' Value	Relative Density %
Very Loose	<4	<15
Loose	4-10	15-35
Compact	10-30	35-65
Dense	30-50	65-85
Very Dense	>50	>85

The standard terminology to describe the strength of cohesive soils is the consistency, which is based on the undisturbed undrained shear strength as measured by the in situ or laboratory vane tests, penetrometer tests, unconfined compression tests, or occasionally by Standard Penetration Tests.

Consistency	Undrained Shear Strength (kPa)	'N' Value
Very Soft	<12	<2
Soft	12-25	2-4
Firm	25-50	4-8
Stiff	50-100	8-15
Very Stiff	100-200	15-30
Hard	>200	>30

SYMBOLS AND TERMS (continued)

SOIL DESCRIPTION (continued)

Cohesive soils can also be classified according to their “sensitivity”. The sensitivity is the ratio between the undisturbed undrained shear strength and the remoulded undrained shear strength of the soil.

Terminology used for describing soil strata based upon texture, or the proportion of individual particle sizes present is provided on the Textural Soil Classification Chart at the end of this information package.

ROCK DESCRIPTION

The structural description of the bedrock mass is based on the Rock Quality Designation (RQD).

The RQD classification is based on a modified core recovery percentage in which all pieces of sound core over 100 mm long are counted as recovery. The smaller pieces are considered to be a result of closely-spaced discontinuities (resulting from shearing, jointing, faulting, or weathering) in the rock mass and are not counted. RQD is ideally determined from NXL size core. However, it can be used on smaller core sizes, such as BX, if the bulk of the fractures caused by drilling stresses (called “mechanical breaks”) are easily distinguishable from the normal in situ fractures.

RQD %	ROCK QUALITY
90-100	Excellent, intact, very sound
75-90	Good, massive, moderately jointed or sound
50-75	Fair, blocky and seamy, fractured
25-50	Poor, shattered and very seamy or blocky, severely fractured
0-25	Very poor, crushed, very severely fractured

SAMPLE TYPES

SS	-	Split spoon sample (obtained in conjunction with the performing of the Standard Penetration Test (SPT))
TW	-	Thin wall tube or Shelby tube
PS	-	Piston sample
AU	-	Auger sample or bulk sample
WS	-	Wash sample
RC	-	Rock core sample (Core bit size AXT, BXL, etc.). Rock core samples are obtained with the use of standard diamond drilling bits.

SYMBOLS AND TERMS (continued)

GRAIN SIZE DISTRIBUTION

MC%	-	Natural moisture content or water content of sample, %
LL	-	Liquid Limit, % (water content above which soil behaves as a liquid)
PL	-	Plastic limit, % (water content above which soil behaves plastically)
PI	-	Plasticity index, % (difference between LL and PL)
Dxx	-	Grain size which xx% of the soil, by weight, is of finer grain sizes These grain size descriptions are not used below 0.075 mm grain size
D10	-	Grain size at which 10% of the soil is finer (effective grain size)
D60	-	Grain size at which 60% of the soil is finer
Cc	-	Concavity coefficient = $(D30)^2$ / (D10 x D60)
Cu	-	Uniformity coefficient = D60 / D10

Cc and Cu are used to assess the grading of sands and gravels:
Well-graded gravels have: 1 < Cc < 3 and Cu > 4
Well-graded sands have: 1 < Cc < 3 and Cu > 6
Sands and gravels not meeting the above requirements are poorly-graded or uniformly-graded.
Cc and Cu are not applicable for the description of soils with more than 10% silt and clay (more than 10% finer than 0.075 mm or the #200 sieve)

CONSOLIDATION TEST

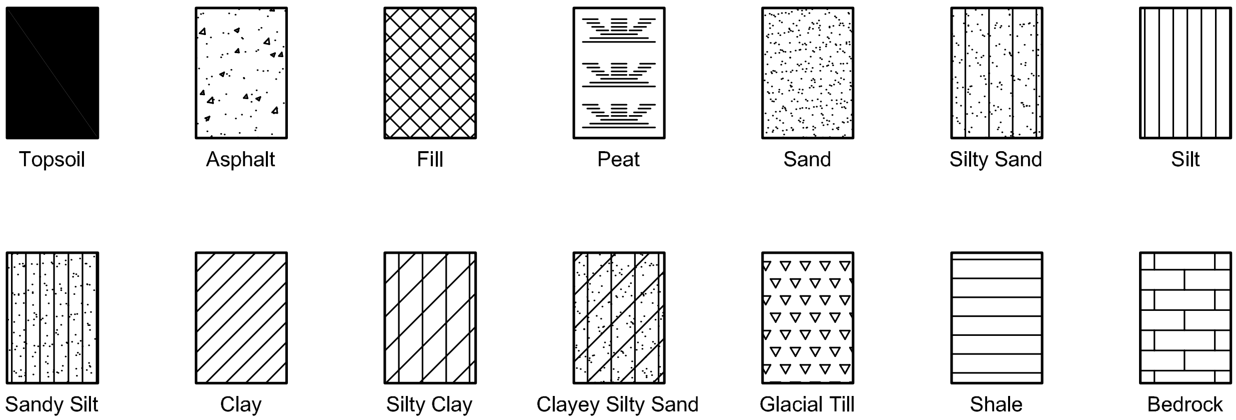
p'_o	-	Present effective overburden pressure at sample depth
p'_c	-	Preconsolidation pressure of (maximum past pressure on) sample
Ccr	-	Recompression index (in effect at pressures below p'_c)
Cc	-	Compression index (in effect at pressures above p'_c)
OC Ratio		Overconsolidaton ratio = p'_c / p'_o
Void Ratio		Initial sample void ratio = volume of voids / volume of solids
Wo	-	Initial water content (at start of consolidation test)

PERMEABILITY TEST

k	-	Coefficient of permeability or hydraulic conductivity is a measure of the ability of water to flow through the sample. The value of k is measured at a specified unit weight for (remoulded) cohesionless soil samples, because its value will vary with the unit weight or density of the sample during the test.

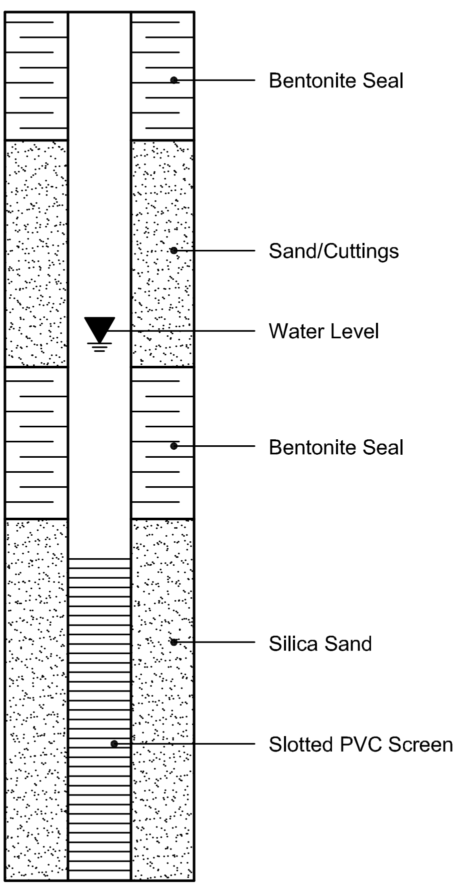
SYMBOLS AND TERMS (continued)

STRATA PLOT

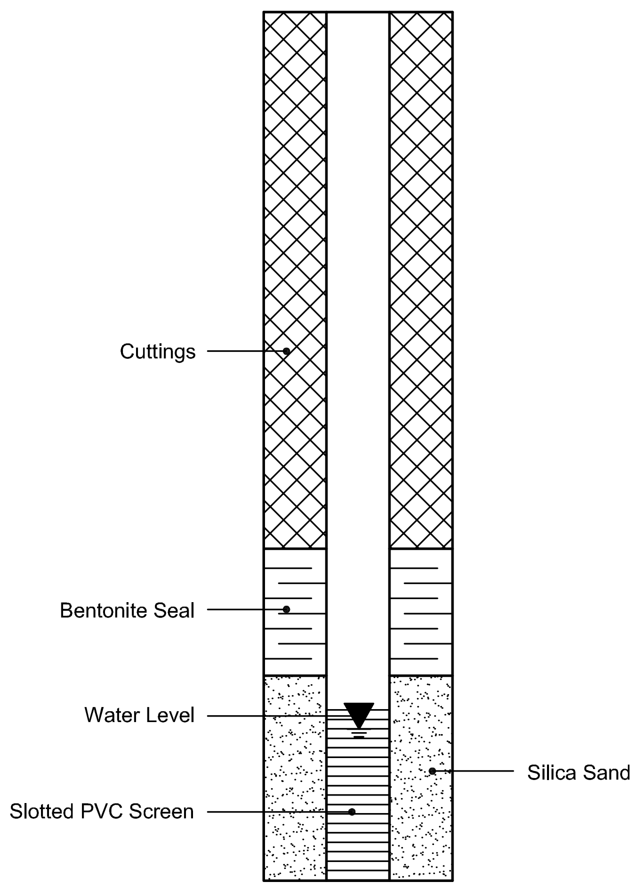


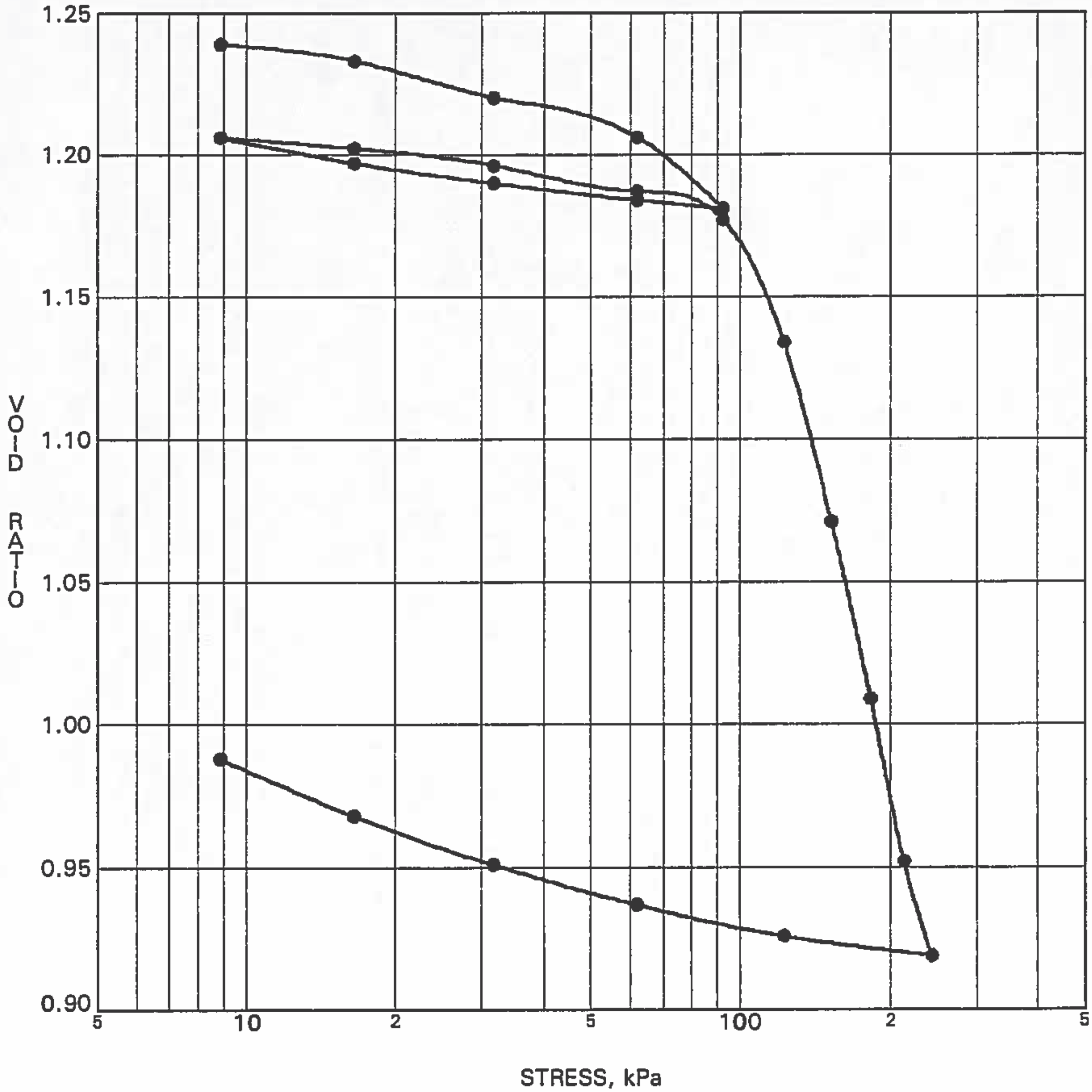
MONITORING WELL AND PIEZOMETER CONSTRUCTION

MONITORING WELL CONSTRUCTION



PIEZOMETER CONSTRUCTION





CONSOLIDATION TEST DATA SUMMARY					
Borehole No.	BH 7	p'_o	79 kPa	Ccr	0.025
Sample No.	TW 6	p'_c	107 kPa	Cc	0.742
Sample Depth	4.90 m	OC Ratio	1.4	Wo	45.1 %
Sample Elev.	91.56 m	Void Ratio	1.240	Unit Wt.	17.5 kN/m^3

CLIENT Richcraft Homes

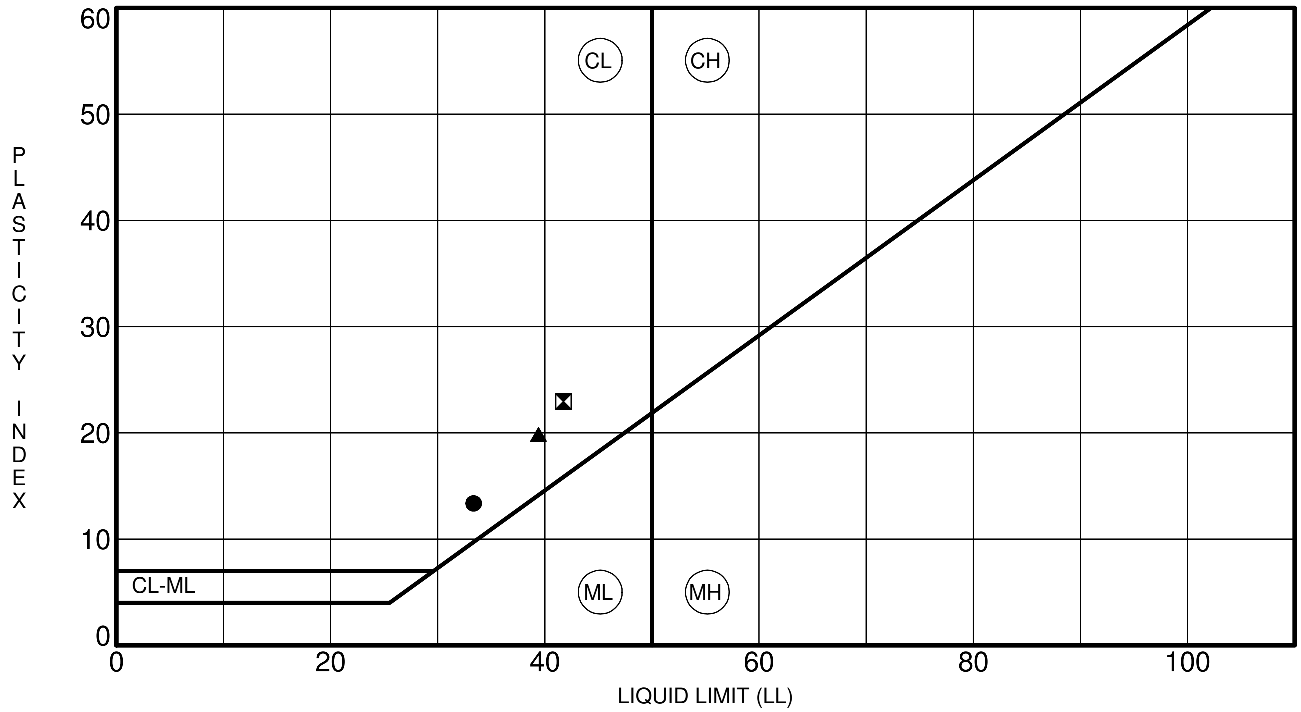
PROJECT Geotechnical Investigation - Proposed Kanata West Subdivision

FILE NO. G9012

DATE 19/08/03

CONSOLIDATION TEST

JOHN D. PATERSON & ASSOCIATES LTD.
Unit 1, 28 Concourse Gate, Nepean, Ontario K2E 7T7



	Specimen Identification		LL	PL	PI	Fines	Classification
●	**BH 1**	**SS 3**	**33**	**20**	**13**		**CL - Inorganic clays of low plasticity**
⧗	**BH 2**	**SS 4**	**42**	**19**	**23**		**CL - Inorganic clays of low plasticity**
▲	**BH 3**	**SS 3**	**39**	**20**	**20**		**CL - Inorganic clays of low plasticity**

CLIENT **Richcraft Homes**

FILE NO. **PG5398**

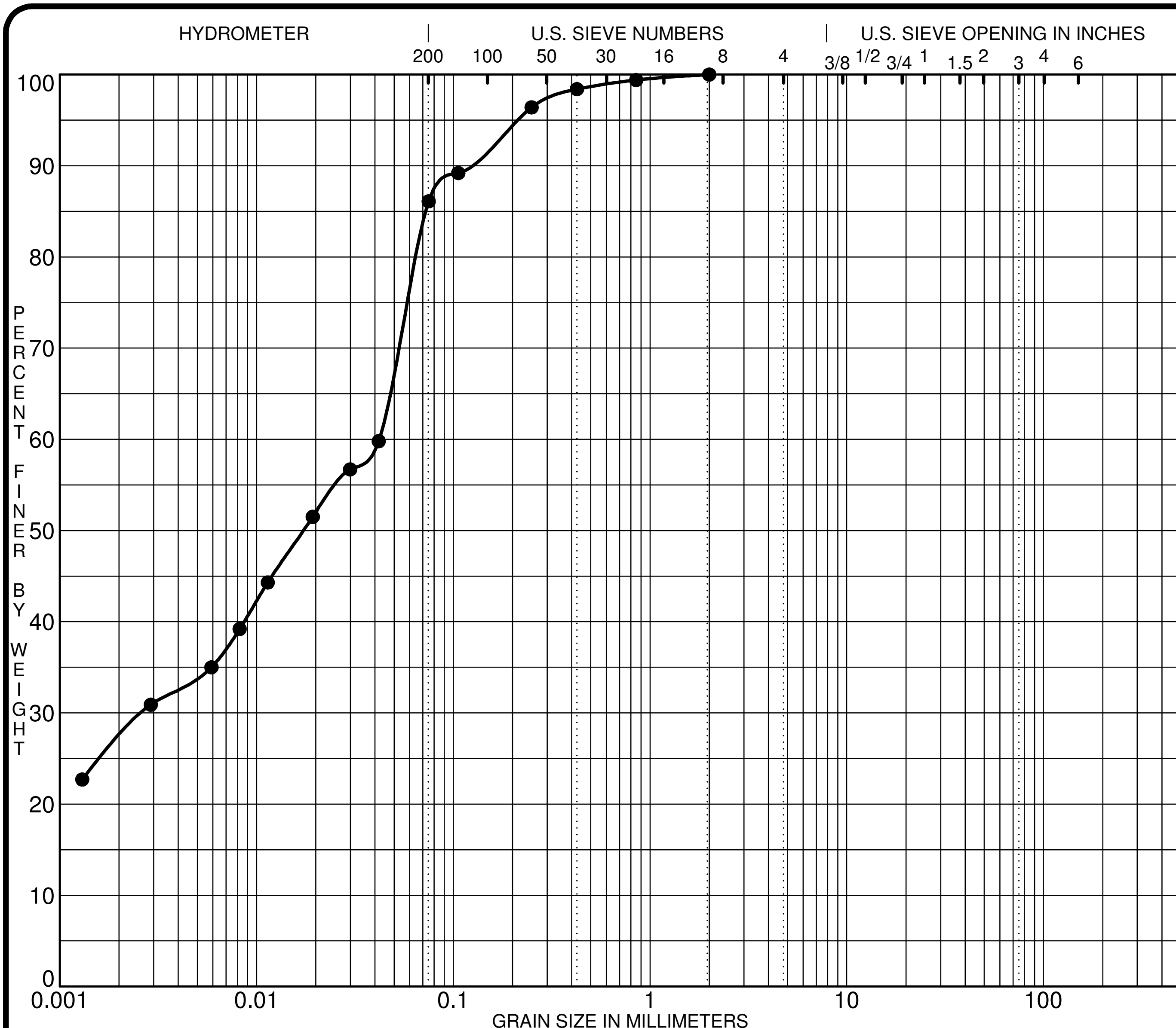
PROJECT **Geotechnical Investigation - Kanata West Block 29 - Maple Grove Road**

DATE **24 Jun 20**

patersongroup **Consulting Engineers**

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

ATTERBERG LIMITS' RESULTS



SILT OR CLAY	SAND			GRAVEL		COBBLES
	fine	medium	coarse	fine	coarse	

	Specimen Identification		Classification	MC%	LL	PL	PI	Cc	Cu
●	**BH 2**	**SS 4**	**CL - Inorganic clays of low plasticity**						

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**BH 2**	**SS 4**	**2.00**	**0.04**	**0.003**		**0.0**	**13.9**	**86.1**	

CLIENT **Richcraft Homes**

FILE NO. **PG5398**

PROJECT **Geotechnical Investigation - Kanata West Block 29 - Maple Grove Road**

DATE **24 Jun 20**

patersongroup **Consulting Engineers**

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

GRAIN SIZE DISTRIBUTION

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 29945

Report Date: 02-Jul-2020

Order Date: 25-Jun-2020

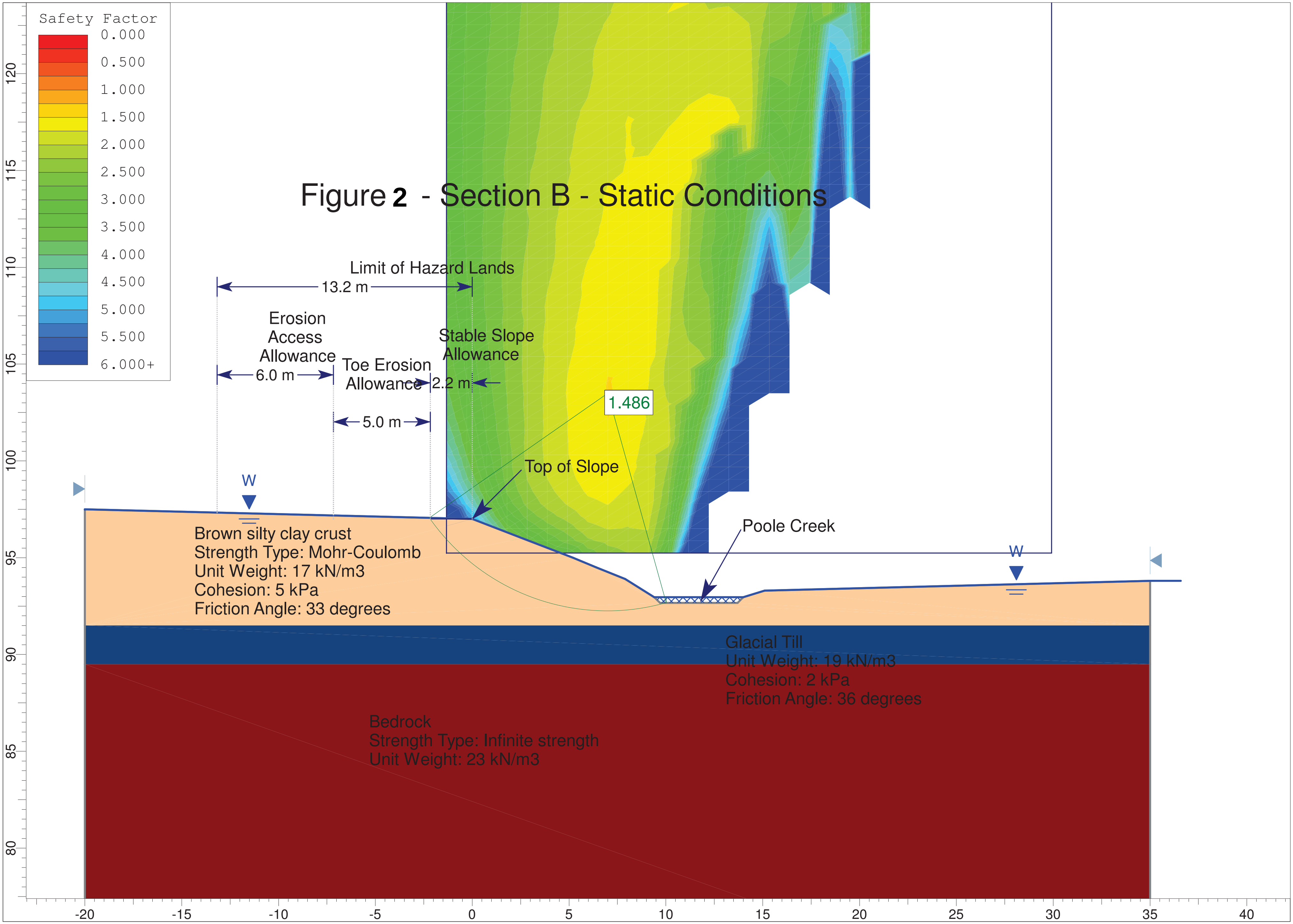
Project Description: PG5398

	Client ID:	BH3-SS2	-	-	-
	Sample Date:	24-Jun-20 12:00	-	-	-
	Sample ID:	2026396-01	-	-	-
	MDL/Units	Soil	-	-	-
Physical Characteristics					
% Solids	0.1 % by Wt.	76.7	-	-	-
General Inorganics					
pH	0.05 pH Units	7.27	-	-	-
Resistivity	0.10 Ohm.m	135	-	-	-
Anions					
Chloride	5 ug/g dry	11	-	-	-
Sulphate	5 ug/g dry	6	-	-	-

APPENDIX 2

FIGURE 1

KEY PLAN



Safety Factor
0.000
0.500
1.000
1.500
2.000
2.500
3.000
3.500
4.000
4.500
5.000
5.500
6.000+
Figure 2 - Section B - Static Conditions
Limit of Hazard Lands
13.2 m
Erosion Access Allowance
6.0 m
Toe Erosion Allowance
5.0 m
Stable Slope Allowance
2.2 m
1.486
Top of Slope
W
Poole Creek
Brown silty clay crust
Strength Type: Mohr-Coulomb
Unit Weight: 17 kN/m3
Cohesion: 5 kPa
Friction Angle: 33 degrees
Glacial Till
Unit Weight: 19 kN/m3
Cohesion: 2 kPa
Friction Angle: 36 degrees
Bedrock
Strength Type: Infinite strength
Unit Weight: 23 kN/m3

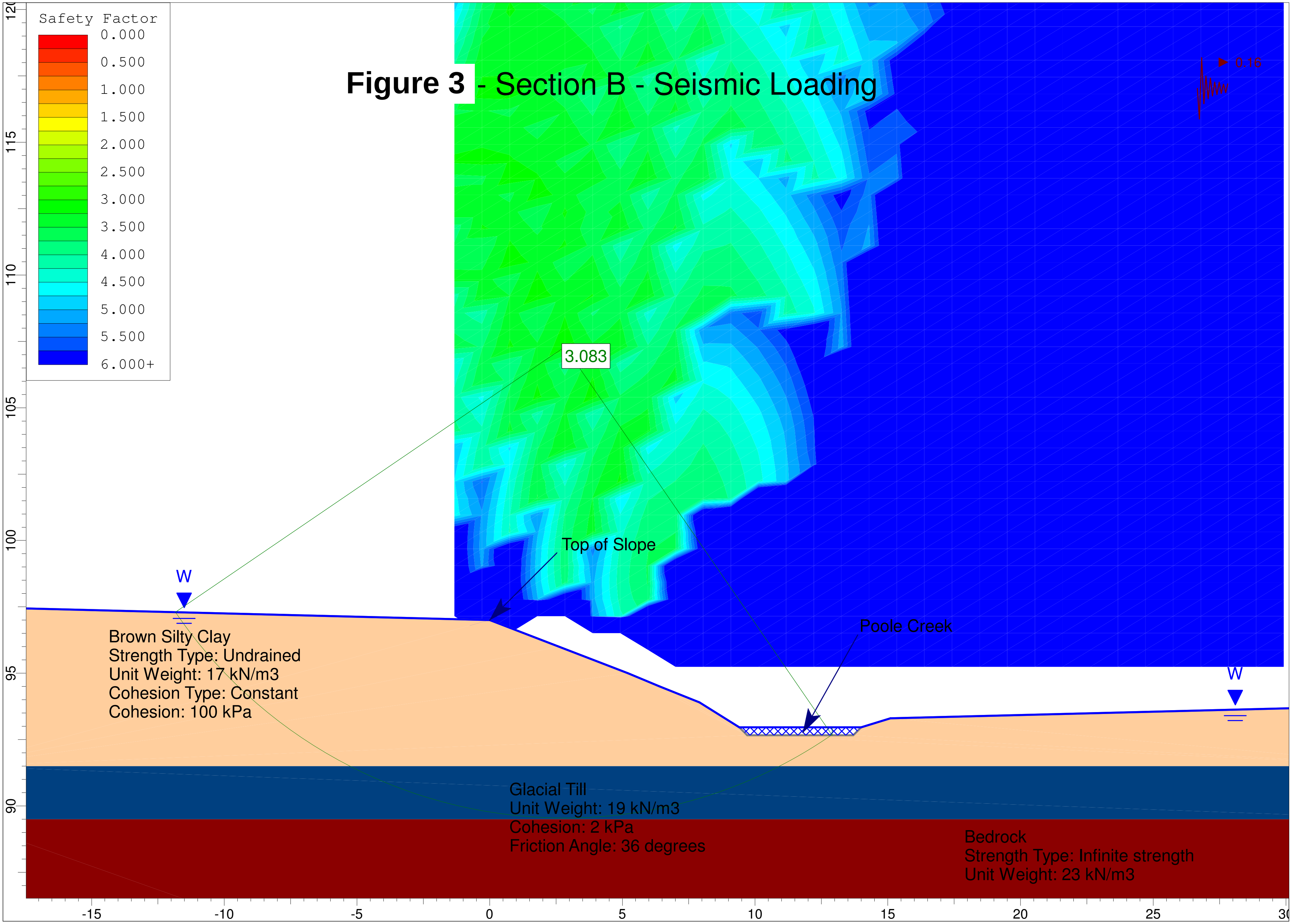


Figure 3 - Section B - Seismic Loading

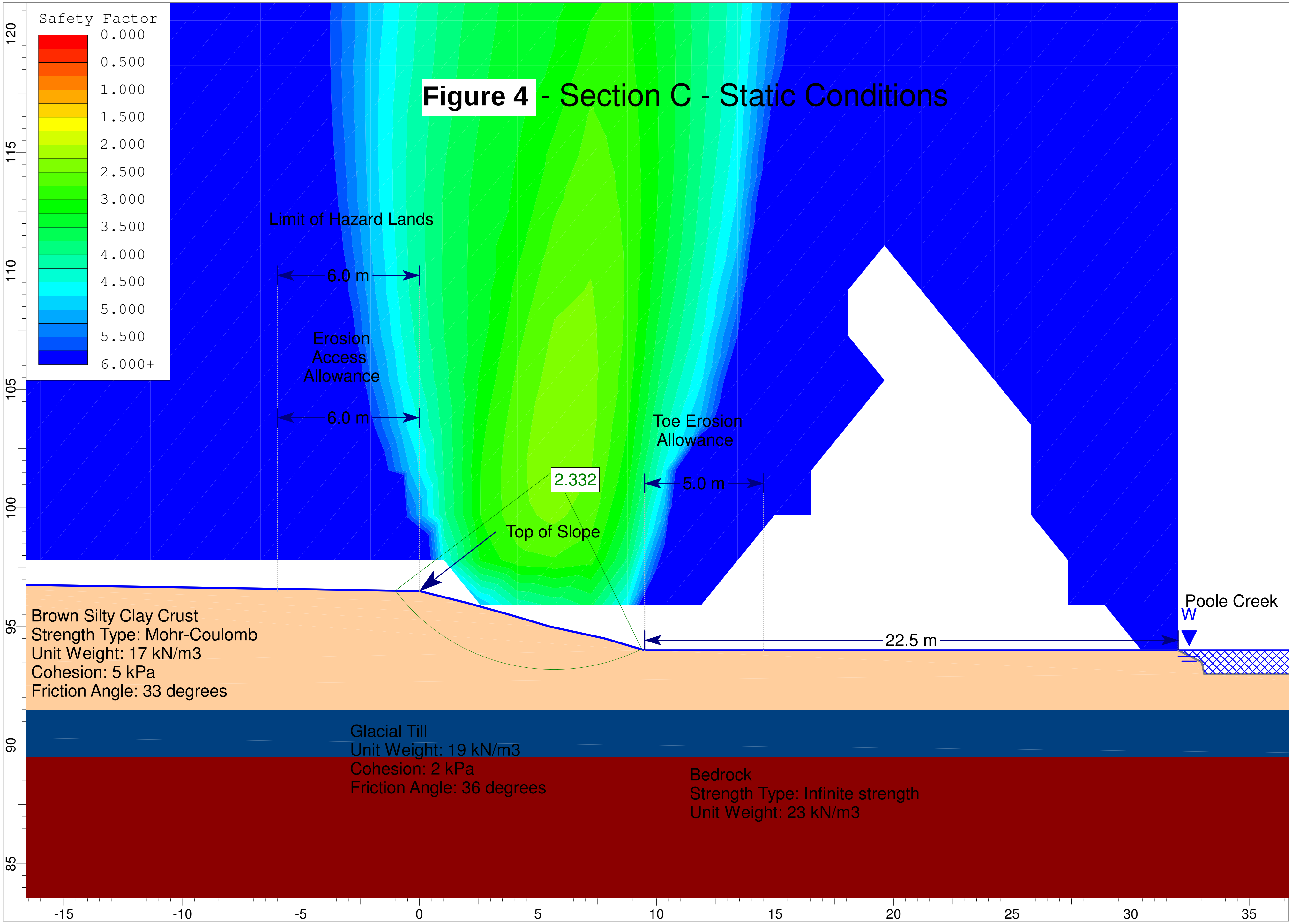


Figure 4 - Section C - Static Conditions
Safety Factor
0.000
0.500
1.000
1.500
2.000
2.500
3.000
3.500
4.000
4.500
5.000
5.500
6.000+
Limit of Hazard Lands
6.0 m
Erosion
Access
Allowance
6.0 m
Toe Erosion
Allowance
2.332
5.0 m
Top of Slope
Poole Creek
W
22.5 m
Brown Silty Clay Crust
Strength Type: Mohr-Coulomb
Unit Weight: 17 kN/m3
Cohesion: 5 kPa
Friction Angle: 33 degrees
Glacial Till
Unit Weight: 19 kN/m3
Cohesion: 2 kPa
Friction Angle: 36 degrees
Bedrock
Strength Type: Infinite strength
Unit Weight: 23 kN/m3
120
115
110
105
100
95
90
85
-15
-10
-5
0
5
10
15
20
25
30
35

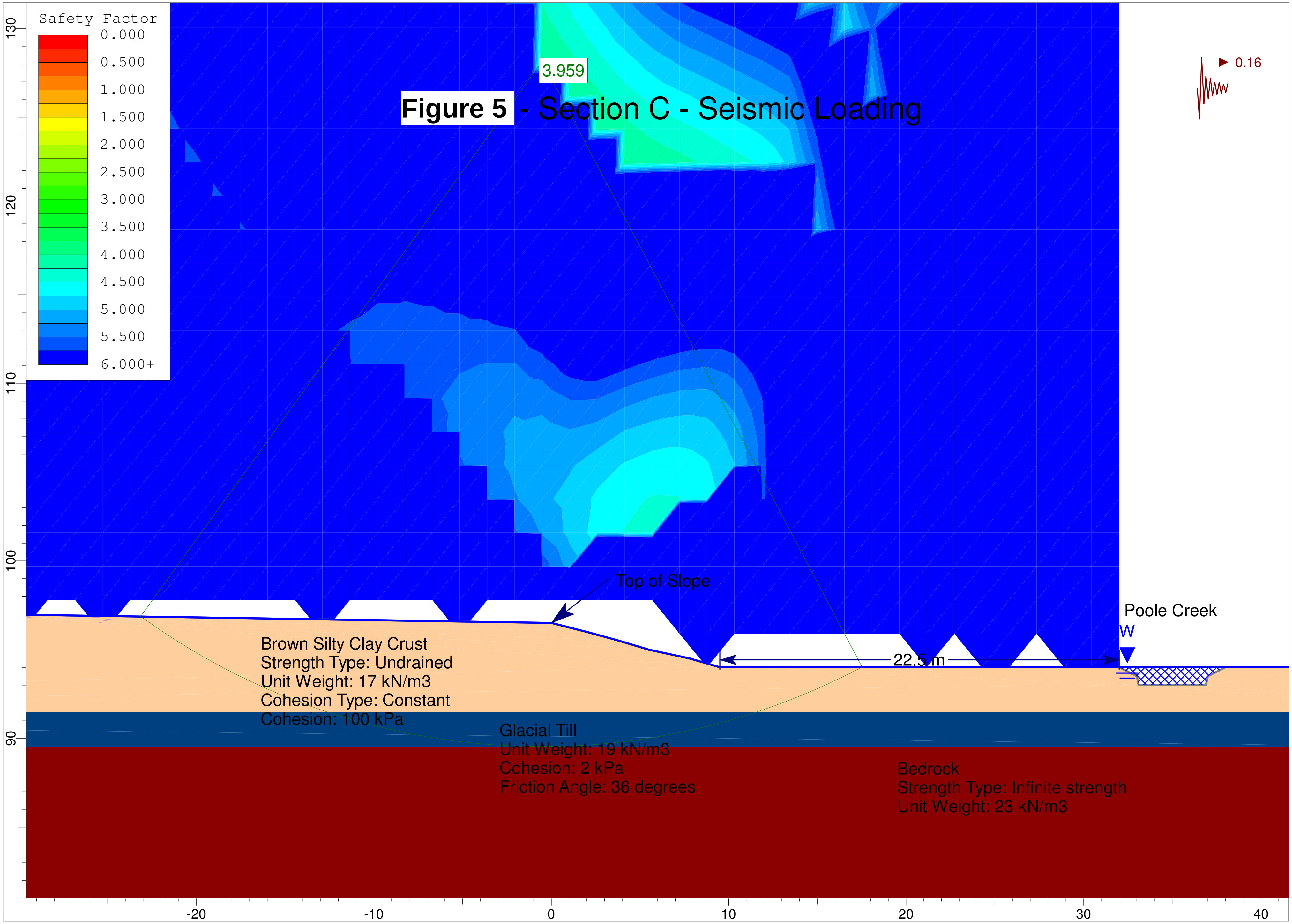
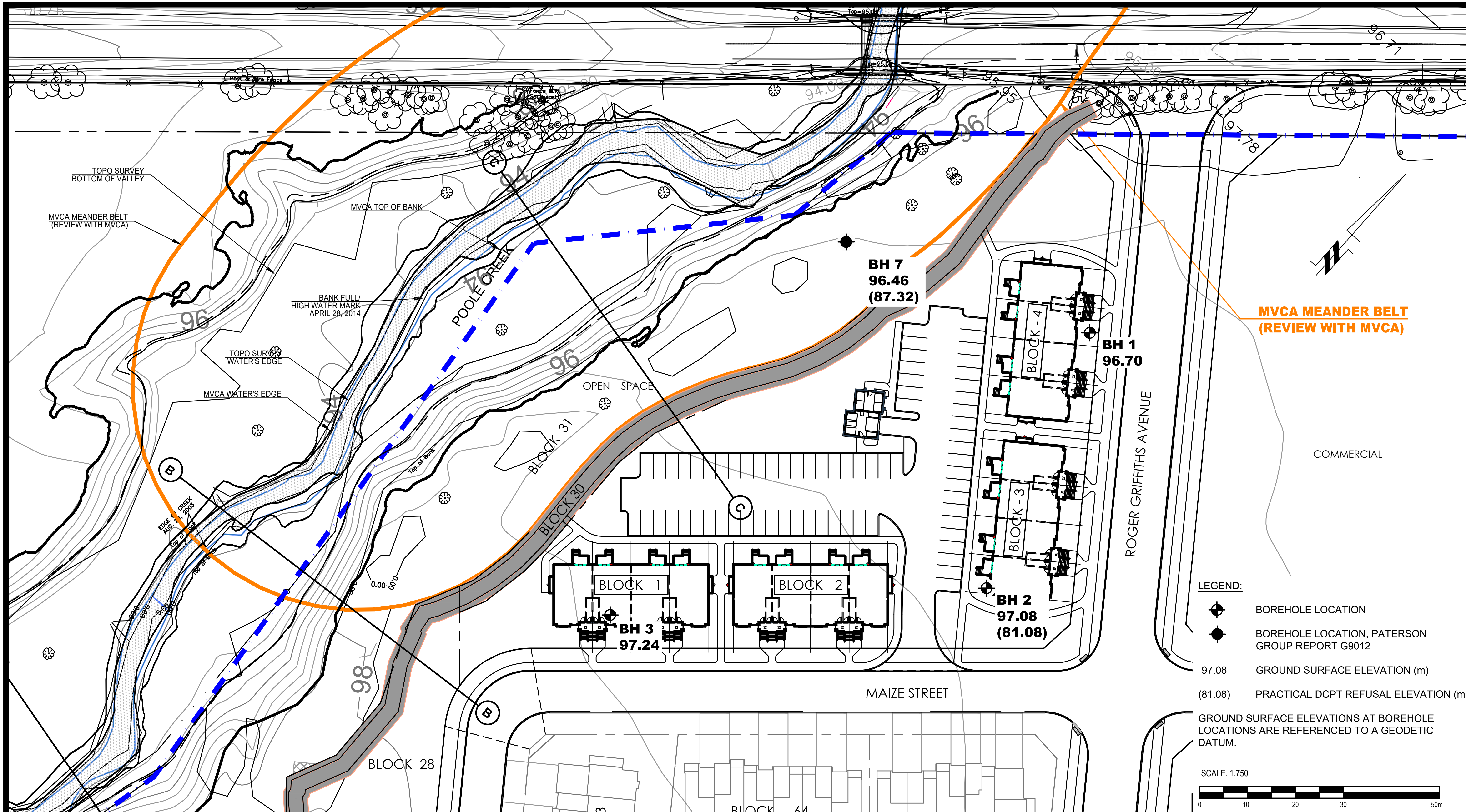


Figure 5 - Section C - Seismic Loading



patersongroup
consulting engineers

154 Colonnade Road South
Ottawa, Ontario K2E 7J5
Tel: (613) 226-7381 Fax: (613) 226-6344

NO.	REVISIONS	DATE	INITIAL
0			

RICHCRAFT HOMES

GEOTECHNICAL INVESTIGATION
KANATA WEST - BLOCK 29 - MAPLE GROVE ROAD

OTTAWA, ONTARIO

Title:

TEST HOLE LOCATION PLAN

Scale: 1:750	Date: 07/2020
Drawn by: MPG	Report No.: PG5398-1
Checked by: YT	Dwg. No.: PG5398-1
Approved by: SD	Revision No.:

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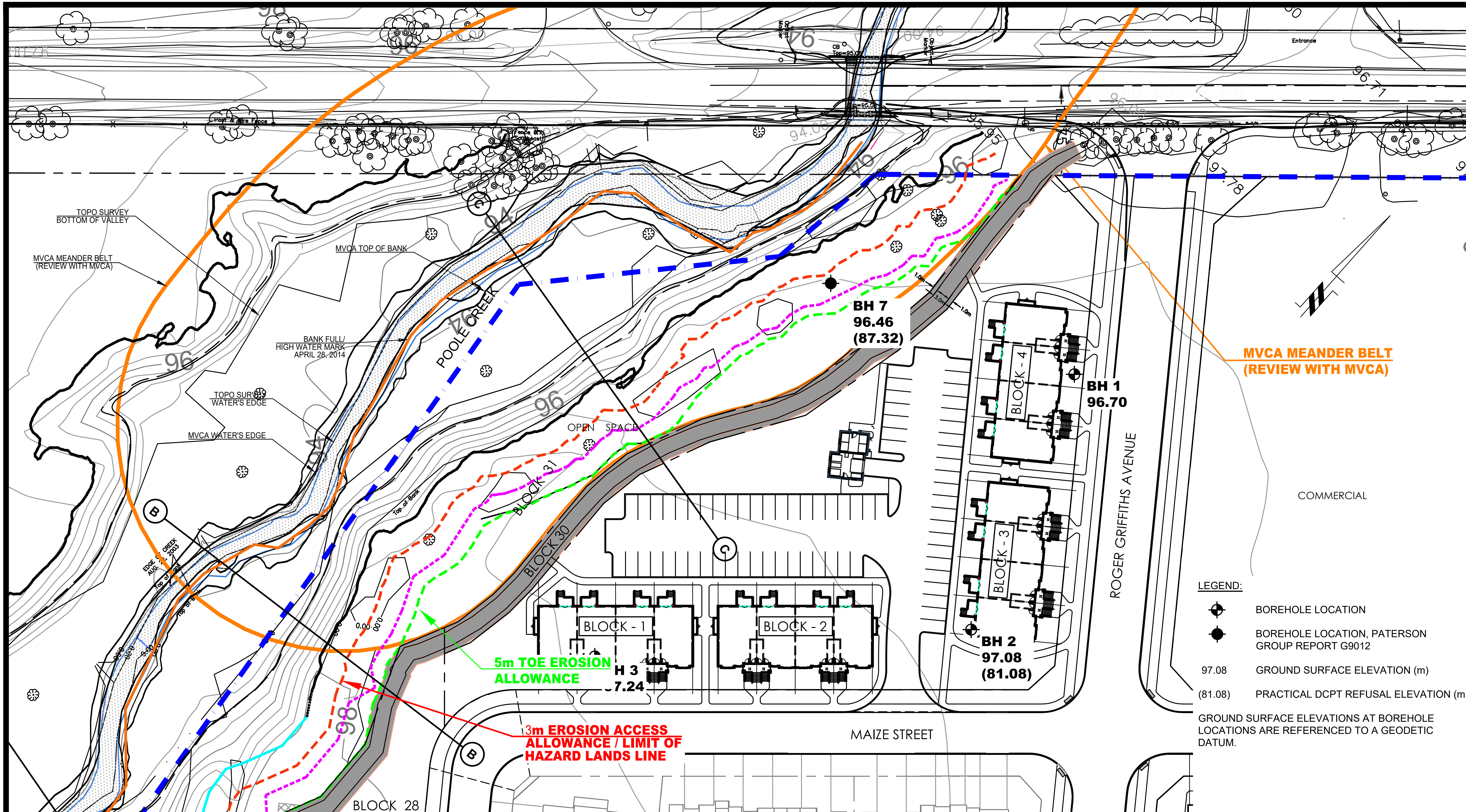
11x17



patersongroup
consulting engineers

154 Colonnade Road South
Ottawa, Ontario K2E 7J5
Tel: (613) 226-7381 Fax: (613) 226-6344

NO.	REVISIONS	DATE	INITIAL
0			

RICHCRAFT HOMES
GEOTECHNICAL INVESTIGATION
KANATA WEST - BLOCK 29 - MAPLE GROVE ROAD
OTTAWA, ONTARIO

Title:
LIMIT OF HAZARD LANDS

Scale: 1:750	Date: 07/2020
Drawn by: MPG	Report No.: PG5398-1
Checked by: YT	Dwg. No.: PG5398-2
Approved by: SD	Revision No.:

p:\autocad drawings\geotechnical\pg53xx\pg5398\pg5398-1 thlp.dwg

11x17

D.2 CONFIRMATION OF GRADE RAISE SUITABILITY BY PATERSON GROUP

From: Scott Dennis
To: Johnson, Warren
Cc: Gillis, Sheridan
Subject: RE: Kanata West Block 29
Date: Monday, February 08, 2021 1:12:21 PM

Warren,

See below my responses in red:

- Can you confirm the required number of foundation drains for the proposed buildings?

In addition to 1 perimeter drain for each building, it is recommended to have 1 sub-slab drain running lengthwise through the center of each block.

- The site slightly exceeds the grade raise restriction of 1.5m in some areas by 0.3-0.5m. Please let me know if you see any issues based on the attached grading plan (existing grades in red) or if this variance will be acceptable.

This variance will be accepted. However, if the grade raises get any higher, lightweight fill will likely be required.

Regards,

Scott S. Dennis, P.Eng.
patersongroup
solution oriented engineering
over 60 years serving our clients

154 Colonnade Road South
Ottawa, Ontario, K2E 7J5
Tel: (613) 226-7381 Ext. 332

From: Johnson, Warren <Warren.Johnson@stantec.com>
Sent: February 5, 2021 11:52 AM
To: Scott Dennis <sdennis@Patersongroup.ca>
Cc: Gillis, Sheridan <Sheridan.Gillis@stantec.com>
Subject: Kanata West Block 29

Hi Scott,

See attached working drawings for Block 29. As we are working through the design there are two items we would appreciate your feedback on.

- Can you confirm the required number of foundation drains for the proposed buildings?
- The site slightly exceeds the grade raise restriction of 1.5m in some areas by 0.3-0.5m. Please let me know if you see any issues based on the attached grading plan (existing grades in red) or if this variance will be acceptable.

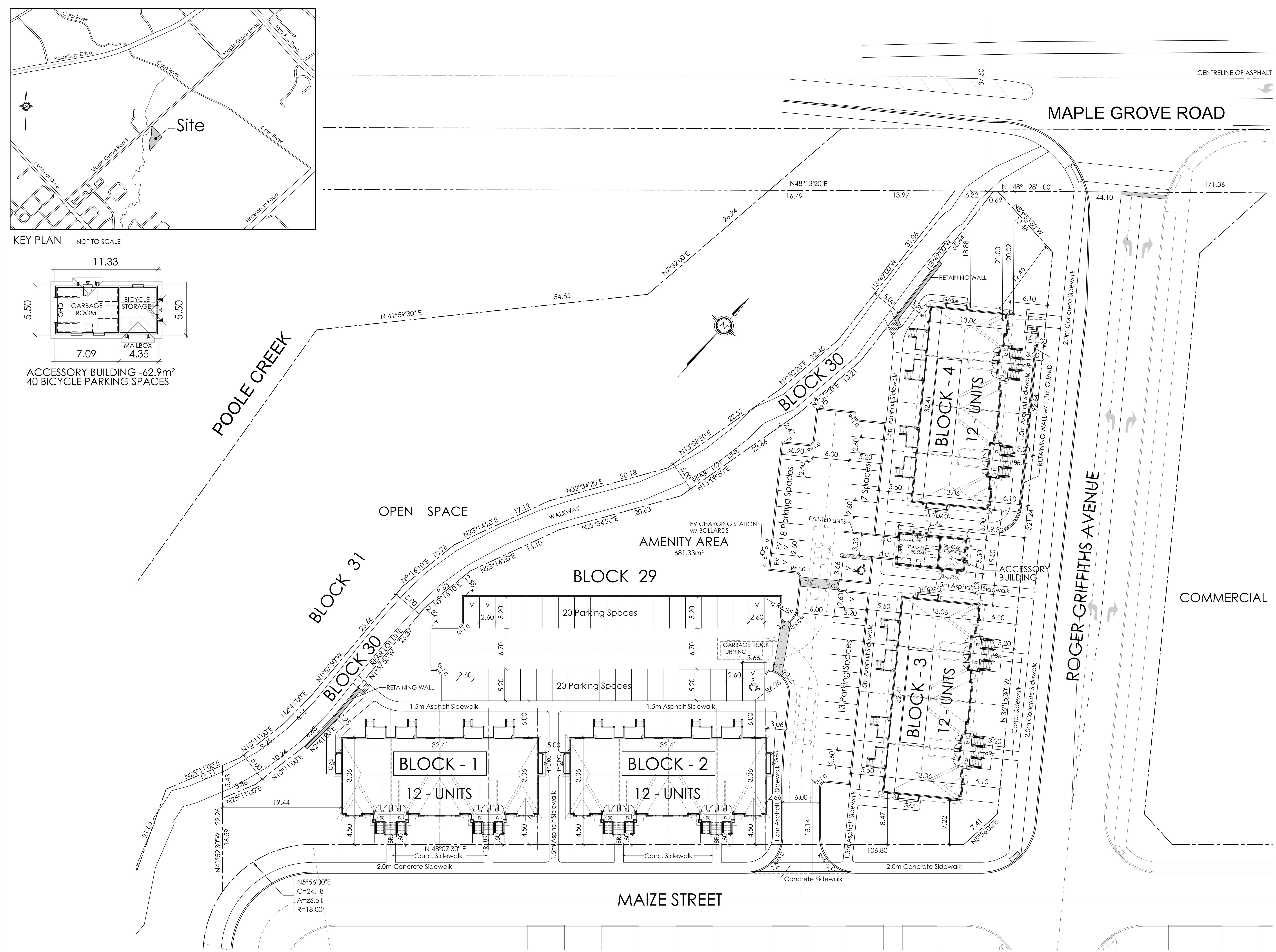
Thanks,

Warren Johnson C.E.T.
Civil Engineering Technologist

Direct: 613-784-2272
Mobile: 613-868-8692
warren.johnson@stantec.com

Stantec
400 - 1331 Clyde Avenue
Ottawa ON K2C 3G4

Appendix E - PROPOSED SITE PLAN



SITE INFORMATION :

PROPOSED ZONING : R4Z - PERMITTED USES : - PLANNED UNIT DEVELOPMENT

SITE AREA : 7,373.84 m²
TOTAL BUILDING AREA : 1,710.90 m²

PROPOSED ZONING:	R4Z	PROVIDED:
LOT AREA (MIN.):	1,400.0 m²	7,373.84 m² (0.73 ha)
LOT WIDTH (MIN.):	n/a	0.69 m (Maple Grove Rd.)
FRONT YARD (MIN.) :	3.0 m	17.80 m
CORNER SIDE YARD (MIN.) :	3.0 m	4.50 m
INTERIOR SIDE YARD (MIN.) :		
Within 21m of Front Lot Line		
Bldg. Ht. Less Than 11m	1.5 m	3.39 m
Bldg. Ht. Greater Than 11m	3.0 m	
All Other	6.0 m	3.25 m
REAR YARD (MIN.) :	6.0 m - 4.5m [135]	4.50 m
BUILDING SPACING :		
BETWEEN BUILDING & PRIVATE WAY	1.8 m	2.86 m
BETWEEN GARAGE & PRIVATE WAY	5.2 m	n/a
BETWEEN BUILDINGS	1.2 m	5.00 m
MINIMUM LANDSCAPED AREA :	30.0%	51.5 % (3,801.5m²)
BUILDING HEIGHT (MAX.):	11.0 m	9.45 m
PORCH STAIR TO LOT LINE (SECTION 65)	0.60 m	1.60 m

TOTAL AMENITY AREA REQUIRED :
- STACKED DWELLING 6.0m² x 48 = 288.0 m²

COMMUNAL AMENITY AREA REQ'D. (MIN.):
50% of 288 m² = 144.0 m²

- PRIVATE AMENITY AREA -
(BALCONIES & PATIOS) 6.5m² x 48 = 312.0 m²
- COMMUNAL AMENITY AREA - 681.3 m²
TOTAL AMENITY AREA PROVIDED : 993.3 m²

ACCESSORY BUILDING	R4Z	PROVIDED:
BUILDING HEIGHT (MAX.):	4.5 m	3.6 m
FLOOR AREA (MAX.) :	200.0 m²	62.90 m²

TERRACE FLATS PARKING :
PARKING REQUIRED : 1.2 Spaces / (48) d.u. + 0.2 / (48) d.u. (Visitor) = 57.6 + 9.6 = 67.2 Spaces
PARKING PROVIDED : 58 Spaces + 10 Visitor Spaces = 68 Spaces

BICYCLE PARKING REQUIRED : 48 (0.5 / (96) d.u.) = 24.0 Spaces
BICYCLE PARKING PROVIDED : 40 Interior Spaces

TWO STOREY - THREE LEVEL TOWNHOMES :

BLOCK No. :		BUILDING AREA:	GROSS FLOOR AREA:	No. UNITS:
BLOCK 1 =	TERRACE FLATS	412.0 m²	1,219.0 m²	12 UNITS
BLOCK 2 =	TERRACE FLATS	412.0 m²	1,219.0 m²	12 UNITS
BLOCK 3 =	TERRACE FLATS	412.0 m²	1,219.0 m²	12 UNITS
BLOCK 4 =	TERRACE FLATS	412.0 m²	1,219.0 m²	12 UNITS
BICYCLE / GARBAGE =		62.9 m²		
TOTAL =		1,710.9 m²	4,876.0 m	48 UNITS

SNOW STORAGE : SNOW STORAGE WILL BE OFF SITE.

NOTE:
SITE PLAN TO BE READ IN CONJUNCTION WITH :
- SITE SERVICING PLAN PREPARED BY ______________________________.
- LANDSCAPING PLAN PREPARED BY ______________________________.
- BOUNDARIES DERIVED FROM: PLAN _M - ___ PART OF LOTS 28 AND 29 CONCESSION 12, GEOGRAPHIC TOWNSHIP OF GOULBOURN, CITY OF OTTAWA PLAN PREPARED BY ANNIS O'SULLIVAN VOLLEBEKK LTD. DATED JUNE 10, 2019 REV. No. 3.

LEGEND:
D.C. - DEPRESSED CURB
- WALL MOUNT LIGHT FIXTURE

M. David Blakely
Architect Inc.
2200 Prince of Wales Dr. - Suite 101
Ottawa, Ontario K2E 6Z9
Phone (613) 226-8811 Fax (613) 226-7942

GENERAL NOTES:
1. THE CONTRACTOR IS RESPONSIBLE FOR CHECKING AND VERIFYING ALL DIMENSIONS, ANY DISCREPANCY MUST BE REPORTED TO M. DAVID BLAKELY ARCHITECT INC.
2. ALL WORK AND MATERIALS TO BE IN COMPLIANCE WITH ALL CODES, REGULATIONS, AND BY-LAWS.
3. ADDITIONAL DRAWINGS MAY BE ISSUED FOR CLARIFICATION TO ASSIST THE PROPER EXECUTION OF WORK. SUCH DRAWINGS WILL HAVE THE SAME MEANING AND INTENT AS IF THEY WERE INCLUDED WITH THE PLANS IN CONTRACT DOCUMENTS.
4. DO NOT SCALE DRAWINGS.
5. THIS DRAWING SHALL NOT BE USED FOR PERMIT OR CONSTRUCTION UNLESS THE DRAWING BEARS THE ARCHITECT'S SEAL AND SIGNATURE.
6. THIS REPRODUCTION SHALL NOT BE ALTERED

CONSTRUCTION NORTH

SEAL

No.	DATE	DESCRIPTION	INIT.
10.			
9.			
8.	17/03/21	RELOCATED BLKS. 3, 4 & SIDEWALK	SM
7.	09/02/21	ACCESSORY BLDG. DETAIL ADDED	SM
6.	22/01/21	RELOCATED BLOCKS 3 & 4, 0.5m WEST	SM
5.	07/12/20	REVISED AS PER RICHCRAFT	SM
4.	05/11/20	REVISED AS PER RICHCRAFT	SM
3.	10/09/20	GATEWAY FEATURE ADDED	SM
2.	31/08/20	FOR REVIEW	SM
1.	26/05/20	FOR REVIEW	SM

REVISIONS

No.	DATE	DESCRIPTION	INIT.
20.			
19.			
18.			
17.			
16.			
15.			
14.			
13.			
12.			
11.			

REVISIONS

PROJECT
BLOCK 29, KANATA WEST
PLANNED UNIT DEVELOPMENT
OTTAWA, ONT.

CLIENT
RICHCRAFT
Group Of Companies

DRAWING TITLE
SITE PLAN

DATE: MAY., 2020.
SCALE: 1:300
SHEET No. SP-1
DRAWN BY: SBM
CHECKED: MDB

Appendix F - DRAWINGS