Richcraft Kanata West Block 1

- 815 Roger Griffiths Avenue

Servicing and Stormwater Management Report

July 30, 2025

Prepared for:

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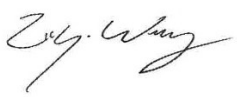
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1 Introduction

Richcraft Homes Ltd. (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 1 (815 Roger Griffiths Avenue) of the Richcraft Kanata West subdivision. The subject site is within the City of Ottawa, bound by Maple Grove Road to the northwest, Roger Griffiths Avenue to the southwest, Ploughshare Road to the southeast and the Kanata West Pump Station (1590 Maple Grove Road) to the northeast as shown in **Figure 1.1** below.



Figure 1.1 Key Map of Richcraft Kanata West Subdivision Block 1

The subject property was zoned as LC (Local Commerical Zone) during the subdivision registration and occupies 1.47 ha of land. Richcraft is proposing to develop the proposed Block 1 as a residental development which consists of a utility building, two (2) amenity areas, two (2) three-storey apartment buildings with fifity-two (52) apartment units and underground parking, six (6) three-storey townhome blocks with sixty-three (63) stacked townhouse units, and associated access road and parking areas as shown in the site plan included in **Appendix E**.

Servicing constraints for the proposed block were identified in the approved *Richcraft Kanata West Development Second Registration Phase – Servicing and Stormwater Management Report, Rev 2* (Stantec, 2022). Findings from the above noted report are 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 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, Feb 12, 2020
- *Richcraft Kanata West Development Second Registration Phase – Servicing and Stormwater Management Report*, *Rev 2*, Stantec, May 10, 2022
- *Richcraft Kanata West Development Second Registration Phase, 1620 Maple Grove Road – Servicing and Stormwater Management Report Addendum*, Stantec, July 10, 2025
- *Ultimate Kanata West Pond 5 Design Brief – 1620 Maple Grove Road*, Stantec, May 4, 2022
- *Geotechnical Investigation, Proposed Residential Development, Mapleton – Block 1*, *[Report PG3062-2]*, Paterson Group, April 7, 2025

3 Potable Water Servicing

3.1 Background

The proposed development is located within Zone 3W of the City of Ottawa's water distribution system. The site will be fed by the existing 200mm diameter watermain on Ploughshare Road with two separate connections to form a looped system.

3.2 Proposed Watermain Sizing and Layout

3.2.1 Connections to Existing Infrastructure

The proposed watermain alignment and sizing for the development is shown on **Drawing SSP-1**. A 200 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 Ploughshare Road at the two entrances to the Block 1 (815 Roger Griffiths Avenue) site. **Figure 3.1** shows the proposed watermain layout and the location of the two (2) connection points to the existing watermain.

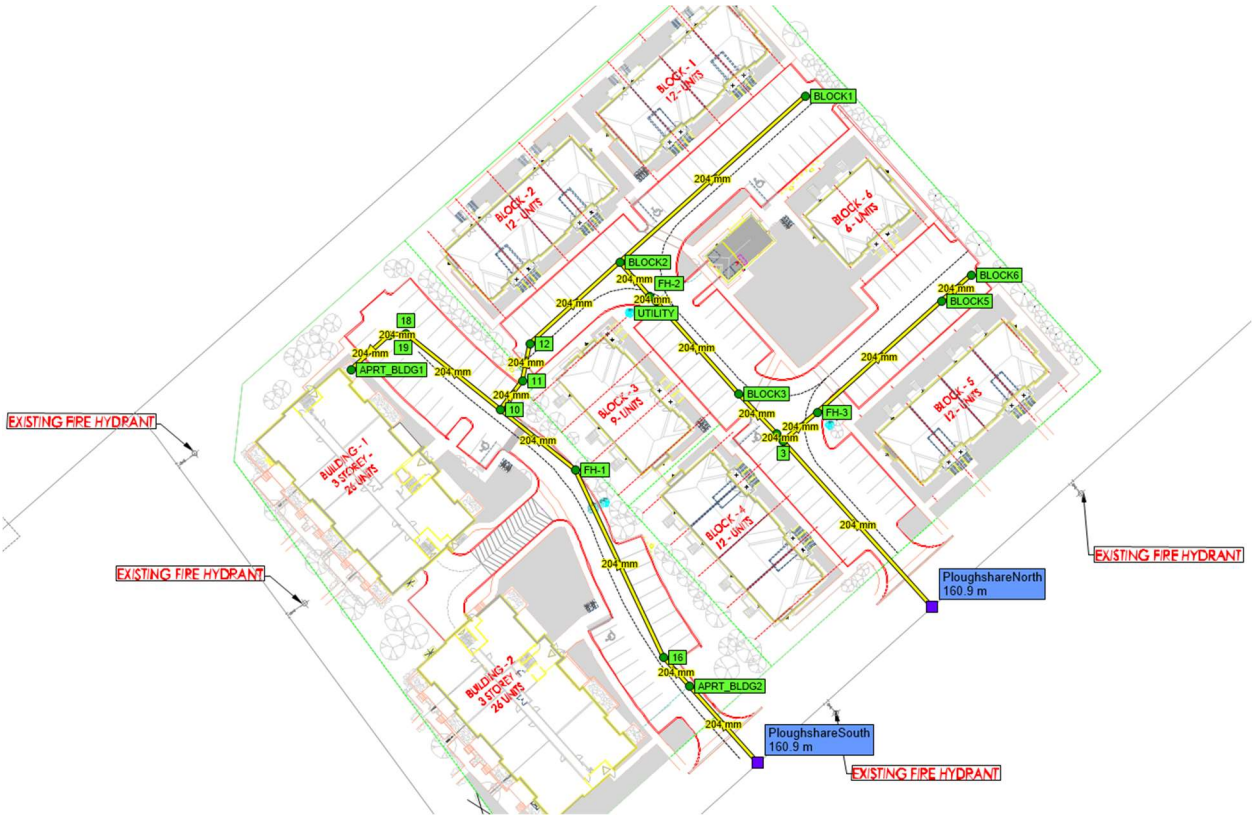


Figure 3.1 Proposed Watermain Layout and Pipe Diameters (mm)

3.2.2 Ground Elevations

Proposed ground elevations throughout the site range from approximately 97.60 m to 98.12 m at nodes along the watermain network.

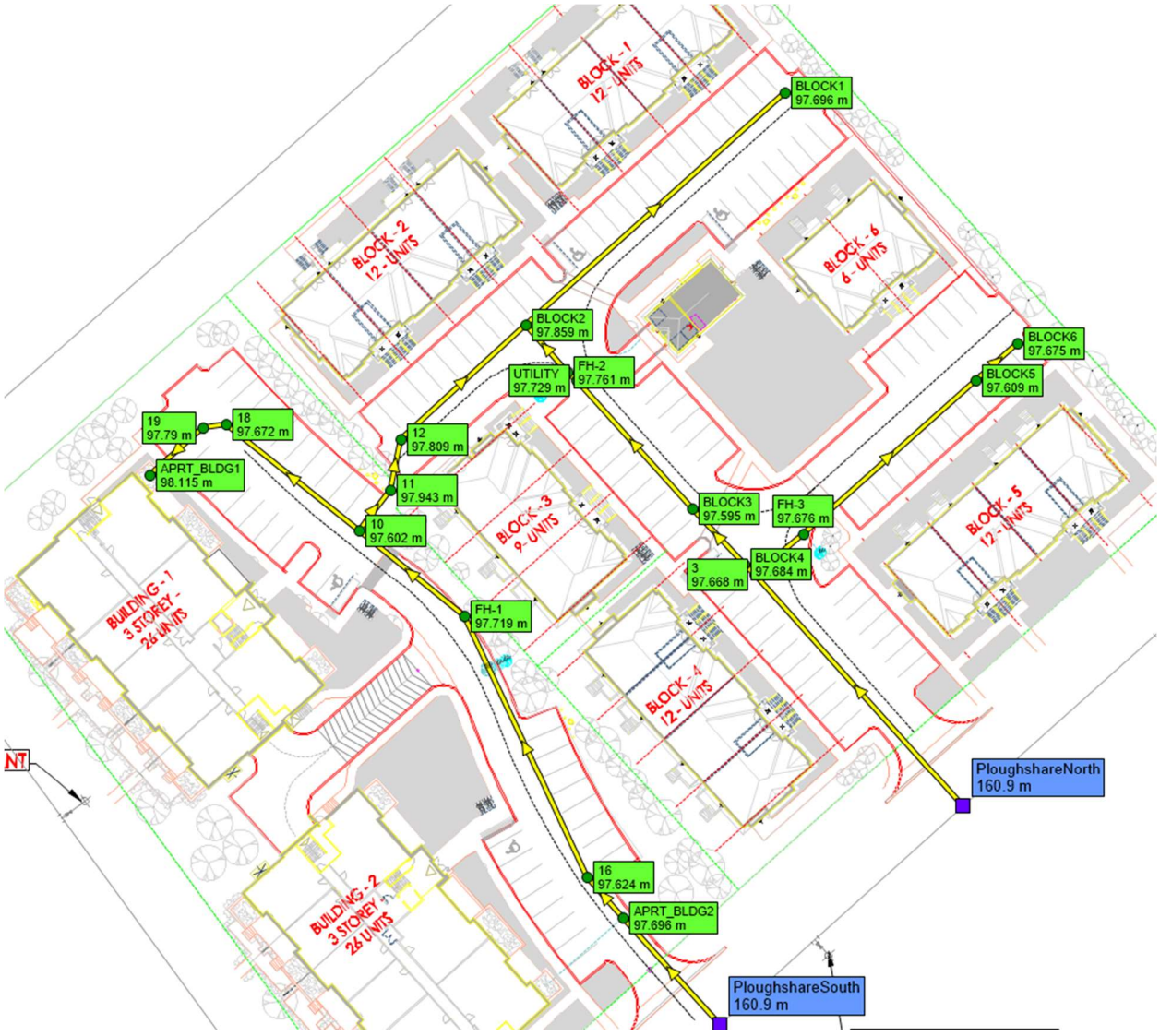


Figure 3.2 Ground Elevations (m) at Nodes

3.2.3 Domestic Water Demands

The proposed site contains a total of sixty-three (63) stacked townhouse units and fifty-two (52) apartment units, with an estimated total population of 264 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 280 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 3.1**.

Table 3.1 Domestic Water Demands for 815 Roger Griffiths

Unit Type	Units	Persons/Unit	Population	AVDY (L/s)	MXDY (L/s)	PKHR (L/s)
Townhouse Units	63	2.7	170	0.55	1.38	3.03
Apartment Units	52	1.8	94	0.30	0.76	1.67
Utility Building				0.003	0.004	0.009
Site Total	**115**		**264**	**0.86**	**2.14**	**4.71**

**As per the City of Ottawa Water Design Guidelines and Technical Bulletin ISTB-2021-03, the persons per unit for Townhouse (row) units is 2.7 and for Apartment is 1.8. The average daily rate of water demand for residential areas is 280 L/cap/day and for commerical area is 28,000 L/ha/day. The commerical demand rate was applied to the proposed 1-storey Utility Building with approximate 80 m^2 footprint area.*

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 for the worst-case townhome blocks and apartment buildings are summarized in **Table 3.2.**

Table 3.2 Fire Flow Calculations Using FUS Methodology

Unit Type	Description	Required Fire Flow (L/min)	Required Fire Flow (L/s)
Terrace Flat Townhouse Units	Three-storey terrace flat townhouses with twelve (12) units (worst case exposures: Block 4)	14,000	233.3
Apartment Building Units	Three-storey Apartment Building with twenty-six (26) units (worst case exposures: Building 2)	18,000	300.0

3.4 Hydraulic Analysis

A hydraulic model of the proposed watermain network was built in PCSWMM using the boundary conditions at the existing 200 mm watermain along Ploughshare Road as obtained from the City of Ottawa staff, refer to **Appendix A.1** . The boundary conditions used for the hydraulic analysis are summarized in **Table 3.3**.

Table 3.3 Boundary Condition for Connection Points for Kanata West Block 1

Location	Max. HGL (AVDY), Head (m)	PKHR, Head (m)	MXDY+FF (233 L/s), Head (m)	MXDY+FF (300 L/s), Head (m)
1 – Southern entrance to Block 1 at Ploughshare Road	160.9	155.9	140.6	130.6
2 – Northern entrance to Block 1 at Ploughshare Road	160.9	155.9	135.2	122.0

The anticipated pressures across the proposed watermain were assessed to meet 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 included in 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, as shown in **Table 3.4**.

Table 3.4 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 615.6-620.7 kPa (89.3-90.0 psi) within the Block 1 site. Minimum pressures during PKHR conditions are anticipated to be approximately 566.5-571.6 kPa (82.2-82.9 psi) for Block 1. These pressures are above the maximum allowable pressure of 80 psi; therefore, pressure reducing valves (PRVs) will be required for the development at the townhouse units and apartment buildings.

Figure 3.3 and Figure 3.4 below identify the minimum (PKHR) and maximum pressure (AVDY) results for the simulation, respectively.

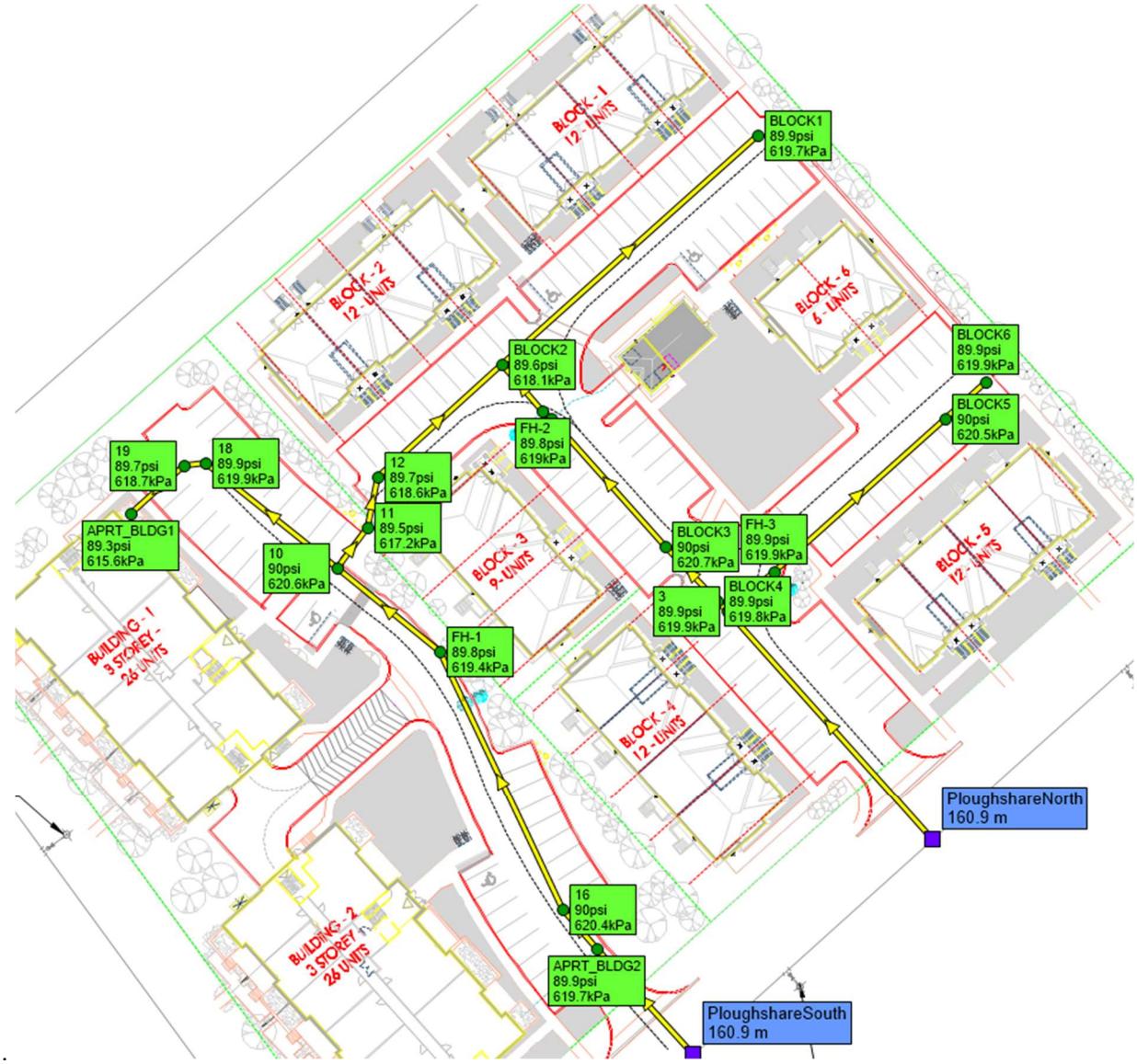


Figure 3.3 Maximum Pressures in Kanata West Block 1 during AVDY Condition

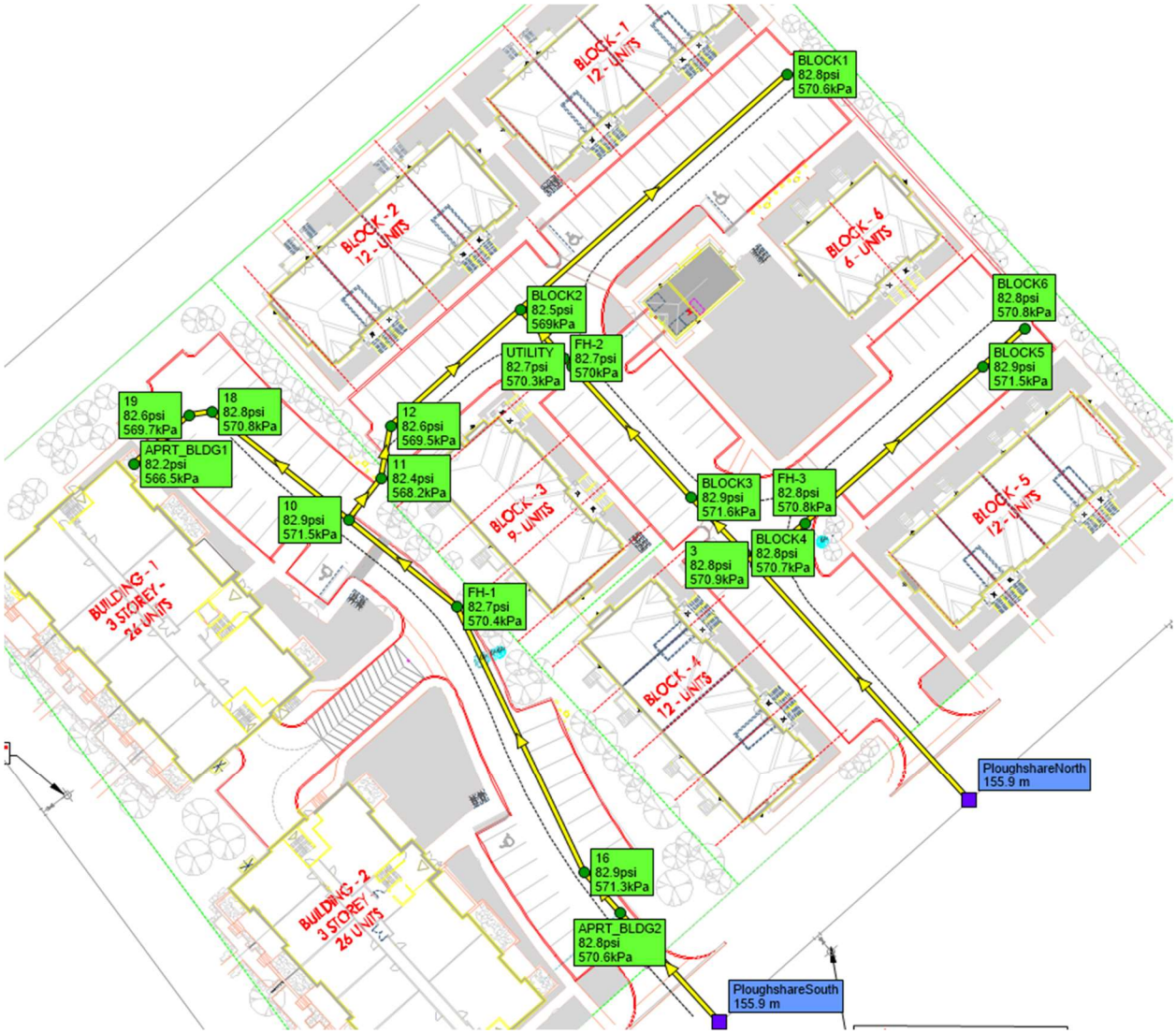


Figure 3.4 Minimum Pressures (psi) in Kanata West Block 1 During PKHR Conditions

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 the fire flow requirements of 14,000 L/min (233 L/s) for the townhome blocks and 18,000 L/min for the apartment buildings 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 in PCSWMM. Using the proposed pipe layout and sizing, a fire flow of 14,000 L/min (233 L/s) can be achieved while maintaining at least 20 psi residual pressure at all locations across the proposed development. The available flows and residual pressures are shown in **Figure 3.5**.

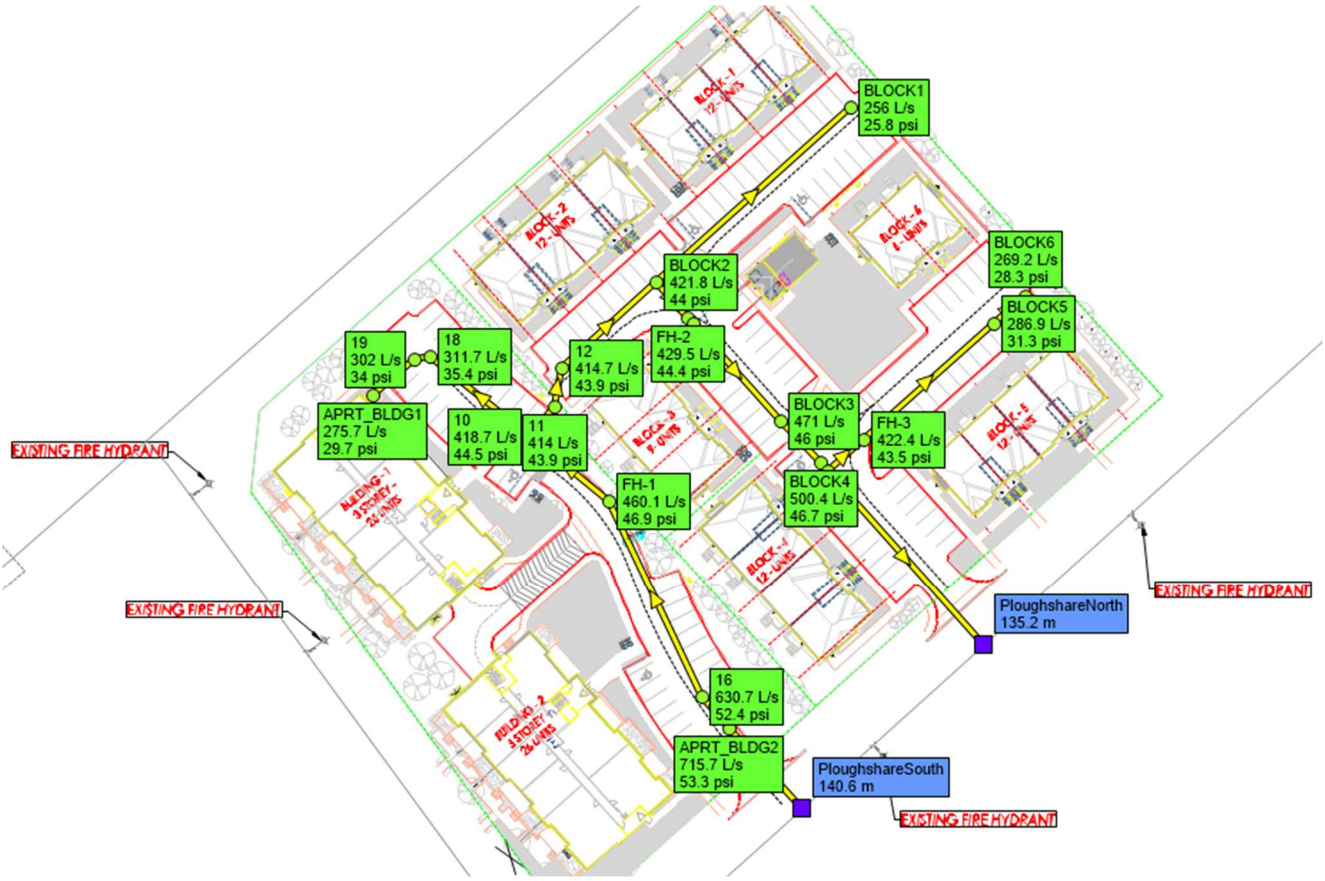


Figure 3.5 Available Fire Flows (L/s) in Block 1 During MXDY Conditions Plus 233 L/s Fire Flow

A separate hydraulic simulation was generated in PCSWMM to assess the watermain network performance under 18,000 L/min (300L/s) fire flow requirements for the proposed apartment buildings. The fire flow simulation results under the 300 L/s fire flow requirements are shown in **Figure 3.6**.

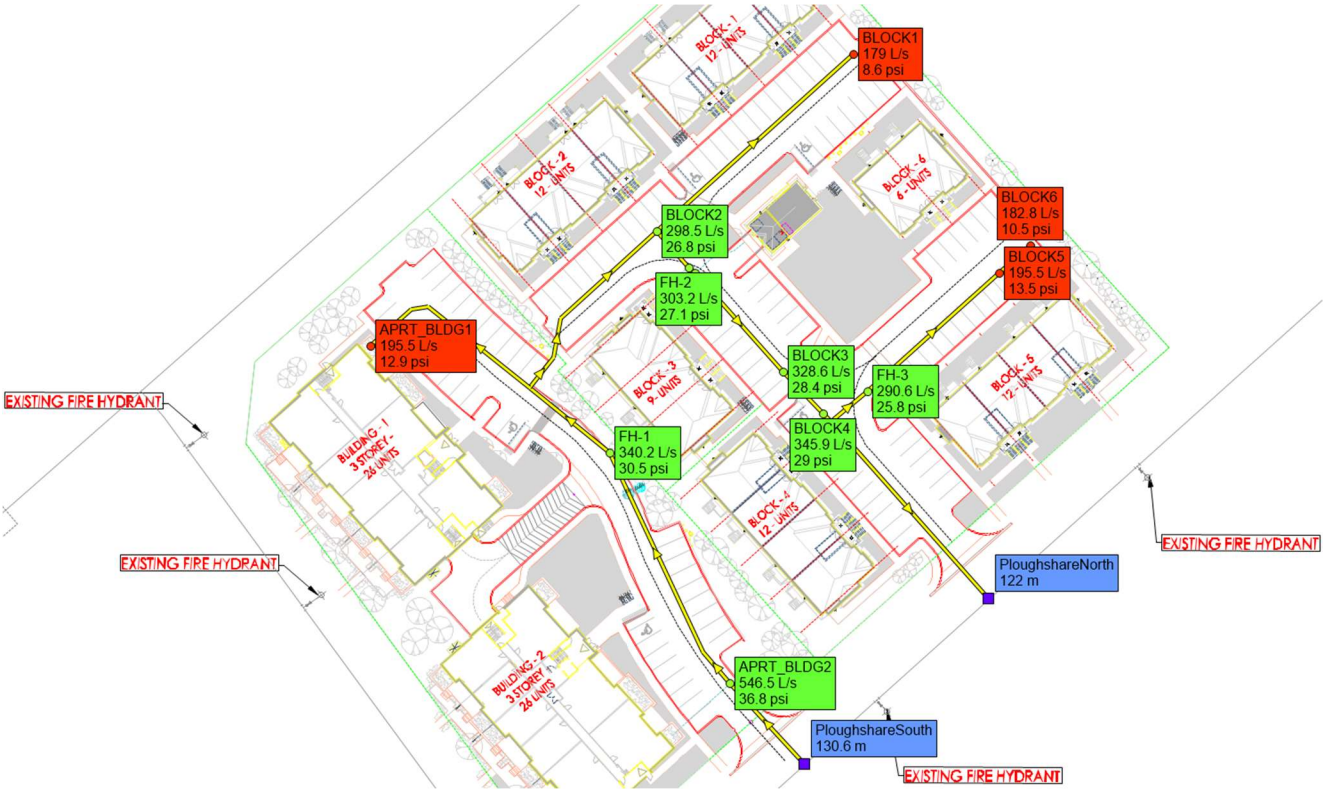


Figure 3.6 Available Fire Flows (L/s) for Fire Flow Condition (300 L/s)

Although the results show a residual pressure less than the allowable pressure (20 psi) at the connection of apartment building 1, the pressure is greater than the minimum 20psi at the supplying hydrants for Apartment block 1, as shown in Figure 3.6. The fire fire hydrants in the vicinity of the proposed apartment buildings are also sufficient to provide the required 18,000 L/min fire flow. There are two proposed on-site fire hydrants, FH-1 and FH-2, which combined with the two existing fire hydrants on Roger Griffiths Avenue can contribute fire flows up to 22,800 L/min (380L/s) as per the fire hydrant information obtained from the Ottawa Water Distribution Design Guidelines and the Technical Bulletin ISTB-2018-02, which is summarized below in **Table 3.3.**

Table 3.5 Maximum Flow to Be Considered from A Given Hydrant

Hydrant Class	Distance to asset/structure/building (m)	Contribution to required fire flow (L/min)
AA	≤ 75	5,700
	> 75 and ≤ 150	3,800
A	≤ 75	3,800
	> 75 and ≤ 150	2,850
B	≤ 75	1,900

Hydrant Class	Distance to asset/structure/building (m)	Contribution to required fire flow (L/min)
	> 75 and ≤ 150	1,500
C	≤ 75	800
	> 75 and ≤ 150	800

4 Wastewater Servicing

4.1 Background

As indicated in the *Richcraft Kanata West Development Second Registration Phase, 1620 Maple Grove Road – Servicing and Stormwater Management Report, Rev 2* (Stantec, 2022), wastewater servicing for the proposed Block 1 development is provided through two connections to the existing deep 200 mm diameter sanitary sewer on Ploughshare Road which discharges into the 1200 mm sanitary trunk sewer on Maple Grove Road via the 450 mm deep sanitary sewer on Roger Griffiths Avenue, and ultimately discharges into the Kanata West Pump Station at the east of the subject site.

The previously approved design report for the Kanata West subdivision was based on the proposed Block 1 as a commercial block that measured 1.47 ha with a daily flow rate of 28,000 L/ha/day.

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
- Apartment persons per unit – 1.8
- 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 site.

4.3 Sanitary Servicing Design

The Block 1 site has 1.47 ha of undeveloped land which previously was zoned as LC (Local Commercial) in the subdivision registration, Richcraft now is proposing to develop a residental development which consists of a utility building, two (2) amenity areas, two (2) three-storey apartment buildings with fifity-two (52) apartment units and underground parking, six (6) three-storey townhome blocks with sixty-three (63) stacked townhouse units, and associated access road and parking areas as shown in the site plan included in **Appendix E**.

The proposed site will be serviced through a network of 200 mm diameter sanitary sewers. Two proposed SAN MH 1 and SAN MH 20 are to be installed to connect to the existing 200 mm deep sanitary sewer on Ploughshare Road. The proposed sanitary sewer layout for the subject site is shown on **Drawing SSP-1** and **Drawing SA-1**.

To estimate the sanitary flow generated from the new development and compare it with the previous approved sanitary design flow during the subdivision registration stage. The population densities are based on the per unit population given by the City of Ottawa's Sewer Design Guidelines. For residential developments, the population density is 2.7 persons per unit for townhouse units and 1.8 persons per unit for apartment units. The proposed peak flows from the Block 1 site are summarized in **Table 4.1** below, showing the sanitary flow generated from the new development to be discharged into the two connection manhole on Ploughshare Road, calculation details are included in the sanitary sewer design sheet; refer to **Appendix B.1**.

Table 4.1 Sanitary Peak Flow at Proposed Connection (SAN MH 1 and SAN MH 20)

Connection MH ID	Total Area (ha)	Population	Peak Flow (L/s)	Sewer Diameter (mm)
SAN MH 1	0.58	94	1.3	200
SAN MH 20	0.88	170	2.2	200
Site Total	**1.46**	**264**	**3.5**	

The *Richcraft Kanata West Development Second Registration Phase, 1620 Maple Grove Road – Servicing and Stormwater Management Report, Rev 2* (Stantec, 2022) assumed a sanitary peak flow generation of 1.0 L/s from the Kanata West Block 1 site with commercial land use. Background information, including the sanitary sewer design sheet for the overall Richcraft Kanata West subdivision, and the sanitary flow calculation based on the expected population, is provided in **Appendix F**.

The above table shows a 2.5 L/s increase in the expected sanitary peak flows over the 1.0 L/s allotted to Block 1 as a result of the land use change from commercial to residential development. The residual capacity noted in the previously approved *Richcraft Kanata West Development Second Registration Phase, 1620 Maple Grove Road – Servicing and Stormwater Management Report Addendum* (Stantec, 2023) for the critical sewer run from SAN MH 3 to SAN MH 2 is about 6.97 L/s, which demonstrates that the downstream sewer system maintains sufficient capacity to accept the relatively small increase in the overall subdivision sanitary peak discharge into the trunk sewer.

4.4 Sanitary Hydraulic Grade Line (HGL)

As indicated in the *Richcraft Kanata West Development Second Registration Phase, 1620 Maple Grove Road – Servicing and Stormwater Management Report, Rev 2* (Stantec, 2020), the sanitary flow generated from the Richcraft Kanata West subdivision, including the proposed Block 1 site and the upstream developments, will eventually be conveyed into the Kanata West Pump Station.

To prepare for the worst-case scenario of a pump failure, a sanitary Hydraulic Grade Line (HGL) analysis was conducted in the previously approved report for the overall Richcraft Kanata West subdivision. Given that the peak flow increase from the proposed Block 1 is a very small fraction of the overall sanitary peak flow from the subdivision, it is expected that the sanitary HGL analysis results from the previously approved report remain applicable.

The previously completed HGL analysis calculated the backwater elevation based on the 100-year water level of the Kanata West SWM Pond 5 (95.0 m), which serves as the emergency outlet for the pump station, plus an additional 0.2 m head over the pump station emergency overflow required to convey the design wet weather peak flow of 1,250 L/s under the utilimate pump failure condition (scenario 1). Besides the pump failure condition, the sanitary HGL analysis also included the results for normal operating conditions and the resulting freeboard to the proposed Under Side of Footings (USFs) across the subdivision. **Table 4.2** shows the HGL in the receiving sanitary manholes on Ploughshare Road (SAN MH 14 and SAN MH 3) along with the minimum USF across the proposed townhome blocks within Block 1.

Table 4.2 Sanitary HGL analysis for Upstream and Downstream Manhole

Receiving MH ID	Minimum USF (m)	Catastrophic HGL and USF – HGL Clearance			
		Ultimate Pump Failure (Scenario 1)		Normal Operating Condition	
		HGL (m)	Clearance (m)	HGL (m)	Clearance (m)
3	95.79	95.39	0.40	91.11	4.68
14	95.79	95.40	0.39	92.53	3.26

As outlined in the HGL analysis for the Kanata West Subdivision, the HGL in the receiving manholes during pump failure is 95.40 m, which results in 0.39 m clearance to the minimum proposed USF on site (Block 6). Since underground parking spaces are proposed for the two three-storey apartment buildings, the elevator mechanical room and some area without residential occupancy can be lower than the designed Sanitary HGL If a pump failure happens, backwater valves will be equipped for those two apartment buildings to prevent flooding in the underground area during the pump failure situation. Detailed HGL analysis for the Kanata West Subdivision is included in **Appendix F.**

5 Stormwater Management and Storm Servicing

The proposed development encompasses approximately 1.47 ha of land within Block 1 of the Kanata West subdivision. The entire development is residential containing stacked townhouse units and apartment blocks. As shown on **Drawing SD-1**, post-development minor system peak flows from the development will be discharged to an existing 1200 mm diameter storm sewer on Ploughshare Road. The majority of emergency overland flows during storm events above that of the 100-year design storm event will be directed to the Ploughshare Road Right-of-Way and ultimately discharge to Kanata West Pond 5 located east of the site, with some small uncontrolled areas directed to the Maple Grove and Roger Griffiths Avenue Rights-of-Way. Stormwater quality control (80% TSS removal) is provided by Kanata West Pond 5, as described in the Ultimate Kanata West Pond 5 Design Brief – 1620 Maple Grove Road (Stantec, 2022).

In the existing condition, site runoff sheet flows overland to the northwest towards Maple Grove Road. The site is currently undeveloped.

5.1 Background

Stantec completed the Design Brief of the Kanata West Subdivision in May 2022 with an addendum in July 2025. The design of the storm drainage system and sewer network in the subdivision accounted for development within the proposed Block 1 development.

Based on the 2022 Stantec Design Brief, the 100-year release rate for the site is to be restricted to 299 L/s. On-site quantity control storage is required to retain runoff from the development from design storms up to and including the 100-year storm.

Flows are to be ultimately conveyed to Kanata West Pond 5 for quality and quantity control per the Ultimate Kanata West Pond 5 Design Brief – 1620 Maple Grove Road (Stantec, 2022)

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

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

- Application of the IDF information derived from the Meteorological Services of Canada rainfall data, taken from the MacDonald Cartier Airport, collected 1966 to 1997, as described in Ottawa's Sewer Design Guidelines.
- Minimum time of concentration values applied for each sub catchment cannot be less than 10 minutes.

- 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.
- Quality control has been provided for the site via the existing Kanata West Pond 5.

Storm Sewer & Inlet Controls

- Proposed site to discharge to the existing 1200 mm diameter storm sewer on Ploughshare Road, (Richcraft Kanata West Development Second Registration Phase – Servicing and Stormwater Management Report, Rev 2, Stantec, May 10, 2022 and Richcraft Kanata West Development Second Registration Phase, 1620 Maple Grove Road – Servicing and Stormwater Management Report Addendum, Stantec, July 10, 2025).
- Discharge rate from the entirety of Block 1 not to exceed 299 L/s in the 100-year event (Richcraft Kanata West Development Second Registration Phase – Servicing and Stormwater Management Report, Rev 2, Stantec, May 10, 2022 and Richcraft Kanata West Development Second Registration Phase, 1620 Maple Grove Road – Servicing and Stormwater Management Report Addendum, Stantec, July 10, 2025).
- 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).
- 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.

Surface Storage & Overland Flow

- 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 to building envelopes in proximity of overland flow routes or ponding areas (City of Ottawa).
- Dynamic flow must not touch any part of the building envelope and must remain below the lowest building opening during the stress test event (100-year storm + 20%) (City of Ottawa).
- Provide adequate emergency overflow conveyance off-site (City of Ottawa).

In keeping with the 2-year inlet restriction criterion, inlet control devices (ICDs) or orifice plates are specified for all catch basins 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 Modeling

5.3.1 Allowable Release Rate

The allowable release rate from the Kanata West Block 1 development is not to exceed 299 L/s in the 100-year event (Richcraft Kanata West Development Second Registration Phase – Servicing and Stormwater Management Report, Rev 2, Stantec, May 10, 2022 and Richcraft Kanata West Development Second Registration Phase, 1620 Maple Grove Road – Servicing and Stormwater Management Report Addendum, Stantec, July 10, 2025).

5.3.2 Modeling Rationale

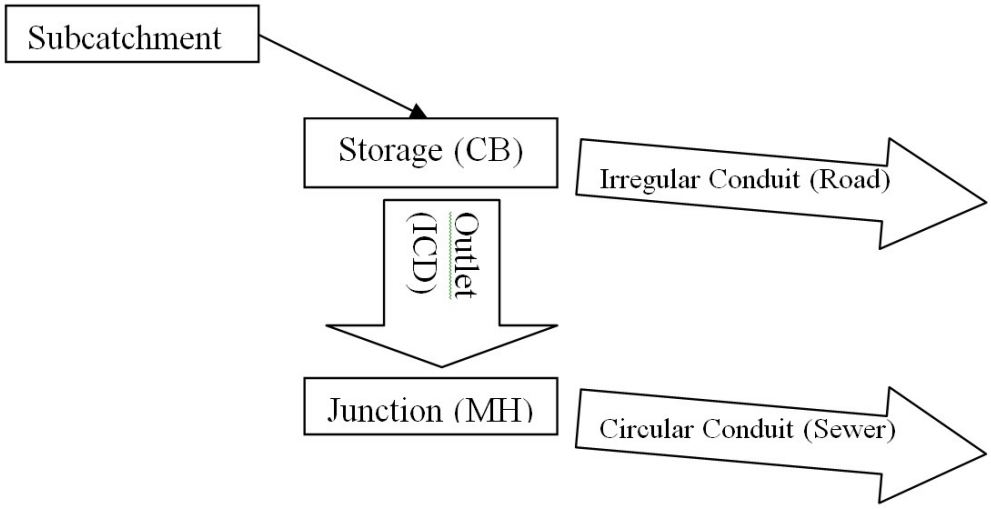
A comprehensive hydrologic modeling exercise was completed with PCSWMM, accounting for the estimated major and minor systems to evaluate the storm sewer infrastructure and major system segments in the ultimate development condition. The use of PCSWMM for modeling of the site hydrology and hydraulics 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 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 with fixed water levels in the receiving sewers as per the Richcraft Kanata West Development Second Registration Phase, 1620 Maple Grove Road – Servicing and Stormwater Management Report Addendum, Stantec, July 10, 2025.
- To 'stress test' the system a 'climate change' scenario was created by adding 20% of the individual intensity values of the 100-year storm at their specified time step.
- 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.
- Subcatchment areas are defined from high-point to high-point where sags occur.
- 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.
- Catchbasin inflow restricted with inlet-control devices (ICDs) as per City guidelines.
- Surface ponding in sag storage calculated based on grading plans (**Drawing GP-1**).
- Inlet control devices (ICDs) to have a minimum orifice diameter of 83 mm.

5.3.3 SWMM Dual Drainage Methodology

The proposed development is modeled in one modeling program as a dual conduit system (see **Figure 5.1**), with: 1) circular conduits representing the sewers & storage nodes representing manholes; 2) irregular conduits using street-shaped cross-sections or weirs to represent the saw-toothed overland road network from high-point to low-point and storage nodes representing catch basins and high points. The dual drainage systems are connected via orifice link objects from storage node (i.e., CB) to storage node (i.e., MH), and represent inlet control devices (ICDs). Subcatchments are linked to the storage node (CB) on the surface so that generated hydrographs are directed there firstly.

Figure 5.1: Schematic Representing Model Object Roles



Storage nodes are used in the model to represent catch basins as well as major system junctions. For storage nodes representing low point catch basins (CB's), 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. Additional depth has been added to rim elevations to allow for dynamic routing from one surface storage to the next. Sag storage within irregular parking areas has been represented with a stage-area curve in the storage node as per **Drawing GP-1**. 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), or through a weir discharging into the downstream road segment for irregular parking areas. Flow storage volumes exceeding the sag storage available 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. Weirs representing high points are assigned an invert elevation equal spill elevation at edge of pavement and a rim elevation equal to the maximum allowable flow depth elevation above the storage node. No storage has been accounted for within weirs 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 a discharge coefficient of 0.61. A minimum orifice diameter of 83 mm has been specified.

5.3.4 Boundary Conditions

Static hydraulic grade lines were obtained from the 2025 Kanata West subdivision PCSWM models to use as boundary conditions at the existing storm maintenance holes STM 200A and STM 100 on Ploughshare Road (STM 121 and STM 119 respectively in the Kanata West subdivision's June 2025 model). The following table summarizes the high-water levels (HWL) used as boundary conditions for the different storm events.

Table 5.1: Stormwater Boundary Conditions

Storm Event	STM 100 HGL (m)	STM 200A HGL (m)
2-year, 3hr Chicago	94.72	94.56
100-year, 3hr Chicago	95.49	95.35
100-year, 3hr Chicago+20%	95.60	95.44

The detailed PCSWMM hydrology, and the proposed storm sewers within the proposed development were used to assess the peak inflows and hydraulic grade line (HGL) in the proposed development.

5.3.5 Hydrologic Parameters

Drawing SD-1 summarizes the discretized subcatchments used in the analysis of the proposed development and outlines the major overland flow paths.

Key parameters for the subject area are summarized below, while an example input file is provided for the 100-year, 3hr Chicago storm which indicates all other parameters (see **Appendix C.2**). For all other input files and results of storm scenarios, please examine the electronic model files included in the digital submission. **Table 5.2** presents the general subcatchment parameters used:

Table 5.2: 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
Zero Imperv (%)	0

Table 5.3 presents the individual parameters that vary for each of the proposed subcatchments.

Table 5.3: Proposed Subcatchment Parameters

Area ID	Area (ha)	Width (m)	Slope (%)	Imperviousness (%)	Runoff Coefficient
F103A	0.04	62.0	2.0	85.71	0.80
L101A	0.17	52.0	3.0	71.43	0.70
L103A	0.16	71.0	2.5	71.43	0.70
L201A	0.09	36.0	4.0	85.71	0.80
L201B	0.08	69.0	4.0	71.43	0.70
L202A	0.14	62.0	3.0	85.71	0.80
L203A	0.08	30.0	1.0	85.71	0.80
L204A	0.16	80.0	2.0	85.71	0.80
L205A	0.14	38.0	3.0	85.71	0.80
UNC-1	0.13	122.0	3.0	57.14	0.60
UNC-2	0.08	53.0	33.0	57.14	0.60
UNC-3	0.08	53.0	3.0	57.14	0.60
UNC-4	0.03	54.0	5.0	57.14	0.60
UNC-5	0.07	84.0	5.0	57.14	0.60
UNC-6	0.03	106.0	33.0	14.29	0.30

Please note that runoff from areas UNC-1 to UNC-6 cannot be captured into the minor system due to grading constraints and have been modeled to sheet flow uncontrolled towards Ploughshare Road, Roger Griffiths Avenue, and Maple Grove Road. Area F103A represents the underground parking garage ramps that will be connected to the buildings' internal plumbing system and discharged uncontrolled (up to the 100-year storm) to the site storm system.

Table 5.4 summarizes the storage node parameters used in the model.

Table 5.4: Storage Node Parameters

Storage Node	Invert Elev. (m)	Rim Elev. (m)	Depth (m)
C101A-1	95.31	97.75	2.44
C103A-1	95.66	97.79	2.13
C201A-1	95.10	97.65	2.55
C201B-2	95.29	97.82	2.53
C202A-1	95.20	97.73	2.53
C203A-2	95.40	97.98	2.58

C204A-1	95.53	97.76	2.23
C205A-2	95.35	97.90	2.55
* Rim elevations shown above are above the proposed grade elevation to account for dynamic flow routing			

5.3.6 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.

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

The table below presents the parameters for the orifice link objects within the proposed development which represent ICDs. A coefficient of 0.61 was applied when using orifices.

Table 5.5: Orifice Parameters for Proposed Catchments

Orifice Name	CB ID	Tributary Area ID	Minor System Node	ICD Type	Inlet Elev. (m)	Discharge Coeff.
C101A-2IC	C101A-2	C101A	101	CIRCULAR (83mm ORIFICE)	95.23	0.61
C103A-2IC	C103A-2	C103A	103	CIRCULAR (83mm ORIFICE)	95.59	0.61
C201A-1IC	C201A-1	C201A	201	CIRCULAR (83mm ORIFICE)	95.10	0.61
C201B-1C	C201B-1	C201B	201	CIRCULAR (83mm ORIFICE)	95.00	0.61
C202A-1IC	C202A-1	C202A	202	CIRCULAR (83mm ORIFICE)	95.20	0.61
C203A-1IC	C203A-2	C203A	203	CIRCULAR (83mm ORIFICE)	95.40	0.61
C204A-1IC	C204A-2	C204A	204	CIRCULAR (83mm ORIFICE)	95.45	0.61
C205A-1IC	C205A-1	C205A	205	CIRCULAR (83mm ORIFICE)	95.25	0.61

5.4 Model Results and Discussion

The following section summarizes the key hydrologic and hydraulic model results for the proposed development. For detailed model results or inputs please refer to the example input file in **Appendix C.2** and the electronic model files included in the digital submission.

5.4.1 Proposed ICD Schedule

The site requires quantity control measures to meet the restrictive stormwater release criteria. The use of controlled surface and subsurface storage is proposed to reduce site peak outflow to the allowable target release rate. It is proposed to detain stormwater on the surface in parking lot areas and underground in stormwater storage pipes using inlet control devices (ICDs) in associated catch basins.

Table 5.6 summarizes the orifice link maximum flow rates and heads across the proposed development.

Table 5.6: Proposed Orifice Link Results

Orifice Name	Tributary Area ID	ICD Type	2yr Head (m)	2yr Flow (L/s)	100yr Head (m)	100yr Flow (L/s)
C101A-2IC	C101A	CIRCULAR (83mm ORIFICE)	1.04	14.58	2.42	21.33
C103A-2IC	C103A	CIRCULAR (83mm ORIFICE)	1.41	17.11	1.41	21.06
C201A-1IC	C201A	CIRCULAR (83mm ORIFICE)	0.60	10.95	0.60	20.95
C201B-1C	C201B	CIRCULAR (83mm ORIFICE)	0.69	11.75	0.69	22.17
C202A-1IC	C202A	CIRCULAR (83mm ORIFICE)	1.45	17.32	1.45	21.47
C203A-1IC	C203A	CIRCULAR (83mm ORIFICE)	0.69	11.77	0.69	22.22
C204A-1IC	C204A	CIRCULAR (83mm ORIFICE)	1.36	16.79	1.36	21.52
C205A-1IC	C205A	CIRCULAR (83mm ORIFICE)	0.76	12.43	0.76	21.72

Table 5.7 summarizes the trench drain maximum flow rates across the proposed development.

Table 5.7: Proposed Trench Drain Results

Building	Tributary Area ID	2yr Flow (L/s)	100yr Flow (L/s)
Building 1 & 2	F103A	7.27	17.34

5.4.2 Hydraulic Grade Line Analysis

The hydraulic grade line (HGL) elevation across the proposed development was estimated using the maximum hydraulic grade lines from the 2025 Kanata West subdivision PCSWMM model in STM 119 and STM 121 within Ploughshare Road as boundary conditions. The ‘climate change’ scenario required by the City of Ottawa Sewer Design Guidelines (2012), where 100-year intensities are increased by 20% was also assessed. The storm sewer design sheet is included in **Appendix C.1**.

Table 5.8 below presents the clearance between the proposed storm sewer HGL and the proposed under side of footings (USFs). However, it should be noted that the elevator pits, mechanical room, and janitor’s closets in the proposed apartment buildings are lower and will require sump pumps for footing drainage.

Table 5.8: Proposed Development Hydraulic Grade Line Results

Manhole ID	USF Elevation	Worst Case 100-year HGL (m)	Prop. USF – HGL Clearance	100-Year 3-hour Chicago +20%	Prop. USF – HGL Clearance
101	96.12	95.54	0.58	95.65	0.47

102	96.12	95.56	0.56	95.67	0.45
103	96.25	95.63	0.62	95.76	0.49
200	95.91	95.38	0.53	95.47	0.44
201	95.79	95.46	0.33	95.55	0.24
202	95.92	95.51	0.41	95.6	0.32
203	95.97	95.53	0.44	95.62	0.35
204	95.92	95.54	0.38	95.63	0.29
205	95.79	95.49	0.30	95.58	0.21

Although a gravity connection is provided from each building for the foundation drains, full port backwater valves will be required on the apartment buildings storm services.

5.4.3 Overland Flow

The SWM design for the Kanata West subdivision assumed that major system peak flows from the proposed site would discharge to Ploughshare Road and would be routed overland to ultimately discharge into Kanata West Pond 5. **Drawing SD-1** shows the proposed emergency overland flow route.

Table 5.9 presents the total surface water depths (static ponding depth + dynamic flow) above the top-of-grate of the proposed street catchbasins for the 2-year storm, 100-year 3-hr Chicago storm, and the 'climate change' storm. Based on the model results, there is no surface ponding within the site during the 2-year storm event and the total ponding depth (static + dynamic) does not exceed 0.35 m during the 100-year event or encroach on the lowest building opening within the 'climate change' event.

Table 5.9: Proposed Development – Maximum Static and Dynamic Surface Water Depths

Storage node ID	Top of Grate Elevation (m)	Lowest Adjacent Building Opening (m)	Max. 2 yr HGL (m)	Total Surface Ponding Depth (m)	Max. 100 yr HGL (m)	Total Surface Ponding Depth (m)	Max. 100 yr + 20% HGL (m)	Total Surface Ponding Depth (m)
C101A-1	97.41	98.00	96.27	0.00	97.64	0.23	97.69	0.28
C103A-1	97.47	98.13	97.00	0.00	97.71	0.24	97.74	0.27
C201A-1	97.40	98.07	95.70	0.00	97.51	0.11	97.60	0.20
C201B-2	97.65	98.02	95.69	0.00	97.75	0.10	97.76	0.11
C202A-1	97.38	98.30	96.65	0.00	97.64	0.26	97.69	0.31
C203A-2	97.70	98.25	96.09	0.00	97.84	0.14	97.90	0.20
C204A-1	97.52	97.90	96.81	0.00	97.68	0.16	97.71	0.19
C205A-2	97.50	97.95	96.01	0.00	97.68	0.18	97.75	0.25

5.4.4 Overall Release Rates

The overall minor system release rates from the proposed development to the existing storm sewer on Ploughshare Road as obtained from the Kanata West subdivision June 2025 PCSWMM model are 299 L/s in the 100-year storm. The uncontrolled areas discharging outside of the Kanata West subdivision (UNC-1 (OF7), UNC-2 (OF6), and UNC-6 (OF5)) have not been considered when comparing the proposed release rate to the allowable release rate since the Kanata West subdivision model did not encompass these areas. **Table 5.10** summarizes the overall site allowable release rates and the proposed development discharges.

Table 5.10: Proposed Development – Peak Outflows

Location	System	Storm Event		
		2-Year 3hr Chicago (L/s)	100-Year 3hr Chicago (L/s)	100-Year, 3hr Chicago +20% (L/s)
100	Minor	36.8	59.3	62.1
200A	Minor	79.4	129.2	128.2
Total On-site Minor System		**116.2**	**188.5**	**190.3**
OF1	Major	0.0	0.0	39.3
OF2	Major	0.0	0.0	29.8
OF3	Major	13.3	39.6	48.1
OF4	Major	17.3	63.3	81.5
Total On-site Major System		**30.6**	**102.9**	**198.7**
Total On-site		**146.8**	**291.4**	**389.0**
On-site 100-year Target		**299.0**		
OF5	Major	5.6	15.5	18.9
OF6	Major	21.1	59.6	72.2
OF7	Major	14.4	37.4	45.2
Total Off-site		**41.1**	**112.5**	**136.3**

*Allowable release rates taken from Richcraft Kanata West Development Second Registration Phase, 1620 Maple Grove Road – Servicing and Stormwater Management Report Addendum dated July 10, 2025 and associated PCSWMM model

As can be seen in the above table, the allowable release rates for both the major and minor system have been met for the on-site 100-year flow to Ploughshare Road. Since the areas discharging off-site are small, mostly landscaped areas with a short distance to the outlet at the Carp River, it is anticipated that they will have a negligible impact on existing downstream infrastructure.



5.5 Water Balance – Infiltration Requirements

As per the event Richcraft Kanata West Development Second Registration Phase – Servicing and Stormwater Management Report (Stantec, 2022) the opportunities for infiltration within the subdivisions private blocks were limited to none. As a result, infiltration requirements for the subdivision were accounted for within the rear yards, school, and park blocks and no infiltration requirements were placed on Block 1.

6 Geotechnical Considerations and Grading

6.1 Geotechnical Investigation

A geotechnical investigation report for Kanata West (Mapleton) Block 1 was completed by Paterson Group on April 7, 2025. Field testing consisting of the advancement of six (6) boreholes with a maximum depth of 6.7 m throughout the subject site was completed on March 21, 2025. The geotechnical investigation report is included in **Appendix D.1**.

The site currently has a temporary granular pad at the west portion with access facing Roger Griffiths Avenue for site trailer parking. The grade across the site is generally level at an elevation of approximately 97 m by the time of field investigation; this may have been raised from the historical data which was around 95 to 96 m due to the ongoing construction activity. The subsurface profile within the subject site 1.7 to 2.2 m fill consists of compact brown silty sand and silty clay with granular crushed stone around the granular pad, followed by compact and brown to grey sandy silt underlying the fill and followed by a firm, grey silty clay layer at an approximate depth of 4.5 m below the existing ground surface. From the geological mapping in this area, the bedrock in this site consists of interbedded limestone and dolomite at about 5 to 15 m depth.

Groundwater levels were taken during the borehole drilling and observed at the depth of 2.19 m to 2.84 m below the existing surface with elevation from 94.40 m to 94.98 m. The long-term groundwater table is anticipated to be at 2 to 3 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 sandy silt, silt or silty clay can be used for the proposed buildings.

Due to the presence of the silty clay deposit, a permissible grade raise restriction of 2.0 m above the original site grade is recommended for grading at this site. Given that higher grade raise is needed, lightweight fill and other measures should be considered to prevent long-term post construction settlement.

6.1.1 Proposed Pavement Structure

Table 6.1 and **Table 6.2** summarize the recommended pavement structures for the development.

Table 6.1 Recommended Pavement Structure for Car-Only Parking

Thickness (mm)	Material Description
40	Wear Course – HL-3 or Superpave 12.5 Asphaltic Concrete
150	Base – OPSS Granular A Crushed Stone Compacted to Min. 99% SPMDD
300	Subbase – OPSS Granular B Type II Compacted to Min. 99% SPMDD
-	Subgrade – fill in situ soil or OPSS Granular B Type I or II material placed over in situ soil

Table 6.2 Recommended Pavement Structure for Access Lanes and Truck Parking Areas

Thickness (mm)	Material Description
40	Wear Course – HL-3 or Superpave 12.5 Asphaltic Concrete
50	Binder Course – HL-8 pr Superpave 19.0 Asphaltic Concrete
150	Base – OPSS Granular A Crushed Stone Compacted to Min. 99% SPMDD
450	Subbase – OPSS Granular B Type II Compacted to Min. 99% SPMDD
-	Subgrade – OPSS Granular B Type II material placed over in situ soil or engineered fill

6.1.2 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. OPSS Granular A crushed stone is to be used as cover material at least 300 mm 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.

A low to moderate volume of groundwater infiltration is expected during excavation, and it is anticipated to be sufficient in providing groundwater control by using open sumps and pumps. Contractor should be prepared to direct any water away from all bearing surfaces and subgrade to avoid disturbance to the founding medium. 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 needs 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 the Kanata West Block 1 site is shown on **Drawing GP-1**. The proposed grading design for the subject site directs the controlled overland flow from most of the site toward Ploughshare Road. A small portion of the site along the west property line, containing mostly landscape and grassed area, drains uncontrolled towards Roger Griffiths Avenue. Another small section of the mainly landscaped area of the proposed townhomes' front yard, north of the site, drains uncontrolled towards Maple Grove Road. 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 Maple Grove Road to the North, Roger Griffiths Avenue to the West and Ploughshare Road to the South. Terracing and a retaining wall are proposed to adjust the elevation difference between the proposed site and the neighbouring pump station property to match the existing grades along the property line.

All grading, infilling and backfilling works are to be completed as per the geotechnical recommendations made in Paterson’s geotechnical investigation report (summarized above in **Section 6**).

7 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 Approvals

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

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.

Approval from the Mississippi Valley Conservation Authority (MVCA) under Section 28 of the Conservation Authorities Act (Ontario Regulation 153/06) will be required for any development (e.g., filling or construction) with the Regulation Limit, as defined on our regulation mapping, and/or alteration to any watercourse (e.g., watercourse crossings). MVCA should be circulated before receiving municipal approval.

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 Erosion Control

In order to protect downstream water quality and prevent sediment build up in catchbasins 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.

- Implement best management practices to provide appropriate protection of the existing and proposed drainage system and the receiving water course(s).
- Limit the extent of the exposed soils at any given time.
- Re-vegetate exposed areas as soon as possible.
- Minimize the area to be cleared and grubbed.
- Protect exposed slopes with geotextiles, geogrid, or synthetic mulches.
- Provide sediment traps and basins during dewatering works.
- Install sediment traps (such as SiltSack® by Terrafix) between catch basins and frames.
- 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.

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

10 Conclusions and Recommendations

10.1 Potable Water Servicing

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

- The proposed water distribution system in the Kanata West Block 1 (815 Roger Griffiths Avenue) is recommended to consist of a 200mm diameter watermain connecting to the existing 200mm diameter watermain on Ploughshare Road at two connection points to loop the system.
- The proposed watermain network will operate above the maximum pressure objective of 552 kPa (80 psi) in the average day (AVDY) and peak hour (PKHR) conditions. Pressure-reducing valves (PRVs) will be required at the building connections.
- During maximum day domestic demands with a fire flow demand of 14,000 L/min (233 L/s) for most of the development and up to 18,000 L/min (300 L/s) for the apartment buildings under the most conservative assumption, the watermain network will provide 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 development will be conveyed to the existing sanitary sewer on Ploughshare Road, constructed as part of the existing Richcraft Kanata West Subdivision, which ultimately discharges to the Kanata West Pumping Station.

200mm diameter sanitary sewers are proposed throughout the site. The capacity of the existing sanitary sewers on Ploughshare Road and further downstream was verified with the estimated peak wastewater flows from the site and their relative increase from the estimates made in the *Richcraft Kanata West Development Second Registration Phase – Servicing and Stormwater Management Report, Rev 2* (Stantec, 2022). The analysis confirmed that there is sufficient capacity within the downstream sanitary sewer system to service the site with the proposed residential land use.

10.3 Stormwater Management and Servicing

The proposed stormwater management plan complies 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 299 L/s for the Kanata West Block 1 site as per City of Ottawa and background report design criteria. Emergency major system peak flows from the site for storm events above that of the 100-year design storm will be directed to the Ploughshare Road ROW. Small uncontrolled areas will drain to the Maple Grove Road and Roger Griffiths Avenue Rights-of-way as per existing conditions. Minor system peak

flows will be directed to the existing 1200 mm diameter storm sewer on Ploughshare Road. 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 site directs emergency major system flows to the surrounding ROWs. The proposed grading implements sags in the parking areas for surface stormwater detention and has been designed to accommodate SWM requirements for the development.

All grading, infilling and backfilling works are to be completed as per the geotechnical recommendations made in the background geotechnical investigation report.

10.5 Approvals/Permits

An MECP Environmental Compliance Approval (ECA) is not expected to be required. 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 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

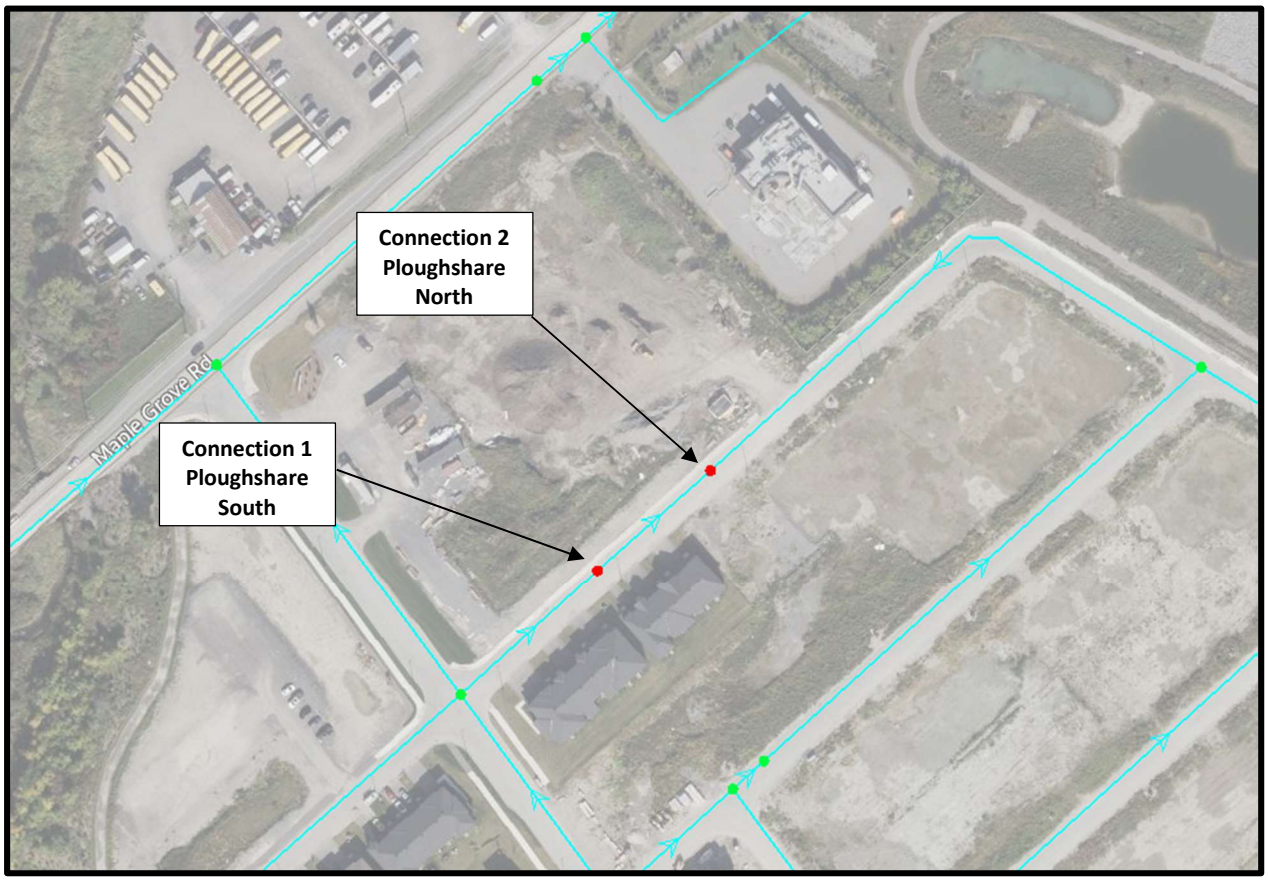
A.1 Boundary Condition Correspondence

Boundary Conditions
815 Roger Griffiths

Provided Information

Scenario	Demand	
	L/min	L/s
Average Daily Demand	51	0.85
Maximum Daily Demand	130	2.17
Peak Hour	282	4.70
Fire Flow Demand #1	14,000	233.33
Fire Flow Demand #2	18,000	300.00

Location



Results

Connection 1 – Ploughshare South

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	160.9	90.8
Peak Hour	155.9	83.7
Max Day plus Fire Flow #1	140.6	61.9
Max Day plus Fire Flow #2	130.6	47.6

[1] Ground Elevation = 97.1 m

Connection 2 – Ploughshare North

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	160.9	90.7
Maximum HGL	155.9	83.6
Max Day plus Fire Flow #1	135.2	54.1
Max Day plus Fire Flow #2	122.0	35.4

[1] Ground Elevation = 97.1 m

Notes

1. The IWSD has recently updated their water modelling software. Any significant difference between previously received BC results and newly received BC results could be attributed to this update.
2. As per the Ontario Building Code in areas that may be occupied, the static pressure at any fixture shall not exceed 552 kPa (80 psi.) Pressure control measures to be considered are as follows, in order of preference:
    - If possible, systems to be designed to residual pressures of 345 to 552 kPa (50 to 80 psi) in all occupied areas outside of the public right-of-way without special pressure control equipment.
    - Pressure reducing valves to be installed immediately downstream of the isolation valve in the home/ building, located downstream of the meter so it is owner maintained.

Disclaimer

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

A.2 Domestic Water Demand Calculations

Roger Griffith Avenue - Block 1, Ottawa, ON - Domestic Water Demand Estimates

Preliminary Site Plan Provided by Richcraft, Feb 2025
Project No. 160402165

Densities as per City Guidelines:		
Personns Per Units[1]		
Row	2.7	ppu
Apartment	1.8	ppu

Type of Unit	No. of Units	Population	Daily Rate of Demand [2] (L/cap/day)	Avg Day Demand		Max Day Demand [3]		Max Hour Demand [3]	
				(L/min)	(L/s)	(L/min)	(L/s)	(L/min)	(L/s)
SP-1a									
Building 1	26	47	280	9.1	0.15	22.8	0.38	50.1	0.83
Building 2	26	47	280	9.1	0.15	22.8	0.38	50.1	0.83
			Subtotal	**18.2**	**0.30**	**45.5**	**0.76**	**100.1**	**1.67**
Sp-1b									
Block 1	12	32	280	6.3	0.11	15.8	0.26	34.7	0.58
Block 2	12	32	280	6.3	0.11	15.8	0.26	34.7	0.58
Block 3	9	24	280	4.7	0.08	11.8	0.20	26.0	0.43
Block 4	12	32	280	6.3	0.11	15.8	0.26	34.7	0.58
Block 5	12	32	280	6.3	0.11	15.8	0.26	34.7	0.58
Block 6	6	16	280	3.2	0.05	7.9	0.13	17.3	0.29
			Subtotal	**33.1**	**0.55**	**82.7**	**1.38**	**181.9**	**3.03**
Total Site :	**115**	**264**		**51.3**	**0.85**	**128.2**	**2.14**	**282.0**	**4.70**

Notes:

1 As per Table 4-1 from the City of Ottawa Water Design Guidelines, the persons per unit for Townhouse (row) units is 2.7 and for Apartment is 1.8

2 As per Table 4-2 from the City of Ottawa Water Design Guidelines and Technical Bulletin ISTB-2021-03, the average daily rate of water demand for residential areas: 280 L/cap/day

3 As per Table 4.2 from the City of Ottawa Water Design Guidelines, the 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

maximum hour demand rate = 2.2 x maximum day demand rate

A.3 FUS Calculations

FUS Fire Flow Calculation Sheet - 2020 FUS Guidelines

Stantec Project #: 160402165
Project Name: Kanata West Block 1
Date: 5/28/2025
Fire Flow Calculation #: 1
Description: Building 1 - 3 storey(26 Unit) Apartment Building without fire wall

Notes: Site Plan provided by M.David Blakely Architect Inc., Rev 3, dated May 21, 2025

Step	Task	Notes										Value Used	Req'd Fire Flow (L/min)
1	Determine Type of Construction	Type V - Wood Frame / Type IV-D - Mass Timber Construction										1.5	-
2	Determine Effective Floor Area	Sum of All Floor Areas										-	-
		807	807	807								2422	-
3	Determine Required Fire Flow	($F = 220 \times C \times A^{1/2}$). Round to nearest 1000 L/min										-	16000
4	Determine Occupancy Charge	Limited Combustible										-15%	13600
5	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%	
6	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	Firewall / Sprinklered ?				-	-
		North	> 30	24	3	61-80	Type V	NO				0%	3128
		East	20.1 to 30	40	3	> 100	Type V	NO				10%	
		South	10.1 to 20	22	3	61-80	Type V	NO				13%	
		West	> 30	40	3	> 100	Type V	NO				0%	
7	Determine Final Required Fire Flow	Total Required Fire Flow in L/min, Rounded to Nearest 1000L/min											17000
		Total Required Fire Flow in L/s											283.3
		Required Duration of Fire Flow (hrs)											3.50
		Required Volume of Fire Flow (m^3)											3570

FUS Fire Flow Calculation Sheet - 2020 FUS Guidelines

Stantec Project #: 160402165
Project Name: Kanata West Block 1
Date: 5/28/2025
Fire Flow Calculation #: 2
Description: Building 1 - 3 storey(26 Unit) Apartment Building with fire wall

Notes: Site Plan provided by M.David Blakely Architect Inc., Rev 3, dated May 21, 2025

Step	Task	Notes										Value Used	Req'd Fire Flow (L/min)
1	Determine Type of Construction	Type V - Wood Frame / Type IV-D - Mass Timber Construction										1.5	-
2	Determine Effective Floor Area	Sum of All Floor Areas										-	-
		404	404	404								1211	-
3	Determine Required Fire Flow	($F = 220 \times C \times A^{1/2}$). Round to nearest 1000 L/min										-	11000
4	Determine Occupancy Charge	Limited Combustible										-15%	9350
5	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%	
6	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	Firewall / Sprinklered ?				-	-
		North	> 30	24	3	61-80	Type V	NO				0%	2151
		East	20.1 to 30	40	3	> 100	Type V	NO				10%	
		South	10.1 to 20	22	3	61-80	Type V	NO				13%	
		West	> 30	40	3	> 100	Type V	NO				0%	
7	Determine Final Required Fire Flow	Total Required Fire Flow in L/min, Rounded to Nearest 1000L/min											12000
		Total Required Fire Flow in L/s											200.0
		Required Duration of Fire Flow (hrs)											2.50
		Required Volume of Fire Flow (m^3)											1800

FUS Fire Flow Calculation Sheet - 2020 FUS Guidelines

Stantec Project #: 160402165
Project Name: Kanata West Block 1
Date: 5/28/2025
Fire Flow Calculation #: 3
Description: Building 2 - 3 storey(26 Unit) Apartment Building without fire wall

Notes: Site Plan provided by M.David Blakely Architect Inc., Rev 3, dated May 21, 2025

Step	Task	Notes										Value Used	Req'd Fire Flow (L/min)
1	Determine Type of Construction	Type V - Wood Frame / Type IV-D - Mass Timber Construction										1.5	-
2	Determine Effective Floor Area	Sum of All Floor Areas										-	-
		807	807	807								2422	-
3	Determine Required Fire Flow	($F = 220 \times C \times A^{1/2}$). Round to nearest 1000 L/min										-	16000
4	Determine Occupancy Charge	Limited Combustible										-15%	13600
5	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%	
6	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	Firewall / Sprinklered ?				-	-
		North	10.1 to 20	22	3	61-80	Type V	NO				13%	3944
		East	20.1 to 30	40	3	> 100	Type V	NO				10%	
		South	20.1 to 30	22	3	61-80	Type V	NO				6%	
		West	> 30	40	0	0-20	Type V	NO				0%	
7	Determine Final Required Fire Flow	Total Required Fire Flow in L/min, Rounded to Nearest 1000L/min											18000
		Total Required Fire Flow in L/s											300.0
		Required Duration of Fire Flow (hrs)											4.00
		Required Volume of Fire Flow (m^3)											4320

FUS Fire Flow Calculation Sheet - 2020 FUS Guidelines

Stantec Project #: 160402165
Project Name: Kanata West Block 1
Date: 5/28/2025
Fire Flow Calculation #: 4
Description: Building 2 - 3 storey(26 Unit) Apartment Building with fire wall

Notes: Site Plan provided by M.David Blakely Architect Inc., Rev 3, dated May 21, 2025

Step	Task	Notes										Value Used	Req'd Fire Flow (L/min)
1	Determine Type of Construction	Type V - Wood Frame / Type IV-D - Mass Timber Construction										1.5	-
2	Determine Effective Floor Area	Sum of All Floor Areas										-	-
		404	404	404								1211	-
3	Determine Required Fire Flow	($F = 220 \times C \times A^{1/2}$). Round to nearest 1000 L/min										-	11000
4	Determine Occupancy Charge	Limited Combustible										-15%	9350
5	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%	
6	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	Firewall / Sprinklered ?				-	-
		North	10.1 to 20	22	3	61-80	Type V	NO				13%	2712
		East	20.1 to 30	40	3	> 100	Type V	NO				10%	
		South	20.1 to 30	22	3	61-80	Type V	NO				6%	
		West	> 30	40	0	0-20	Type V	NO				0%	
7	Determine Final Required Fire Flow	Total Required Fire Flow in L/min, Rounded to Nearest 1000L/min											12000
		Total Required Fire Flow in L/s											200.0
		Required Duration of Fire Flow (hrs)											2.50
		Required Volume of Fire Flow (m^3)											1800

FUS Fire Flow Calculation Sheet - 2020 FUS Guidelines

Stantec Project #: 160402165
Project Name: Kanata West Block 1
Date: 5/28/2025
Fire Flow Calculation #: 5
Description: Block 1 - Three Level Terrace flat (12 Unit) townhouse with no fire wall

Notes: Site Plan provided by M.David Blakely Architect Inc., Rev 3, dated May 21, 2025

Step	Task	Notes										Value Used	Req'd Fire Flow (L/min)
1	Determine Type of Construction	Type V - Wood Frame / Type IV-D - Mass Timber Construction										1.5	-
2	Determine Effective Floor Area	Sum of All Floor Areas										-	-
		416	416	416								1248	-
3	Determine Required Fire Flow	($F = 220 \times C \times A^{1/2}$). Round to nearest 1000 L/min										-	12000
4	Determine Occupancy Charge	Limited Combustible										-15%	10200
5	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%	
6	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	Firewall / Sprinklered ?				-	-
		North	> 30	34	0	0-20	Type V	NO				0%	2652
		East	> 30	13	3	21-49	Type V	NO				0%	
		South	20.1 to 30	34	3	> 100	Type V	NO				10%	
		West	3.1 to 10	13	3	21-49	Type V	NO				16%	
7	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

FUS Fire Flow Calculation Sheet - 2020 FUS Guidelines

Stantec Project #: 160402165
Project Name: Kanata West Block 1
Date: 5/28/2025
Fire Flow Calculation #: 6
Description: Block 2 - Three Level Terrace flat (12 Unit) townhouse with no fire wall

Notes: Site Plan provided by M.David Blakely Architect Inc., Rev 3, dated May 21, 2025

Step	Task	Notes										Value Used	Req'd Fire Flow (L/min)
1	Determine Type of Construction	Type V - Wood Frame / Type IV-D - Mass Timber Construction										1.5	-
2	Determine Effective Floor Area	Sum of All Floor Areas										-	-
		416	416	416								1248	-
3	Determine Required Fire Flow	($F = 220 \times C \times A^{1/2}$). Round to nearest 1000 L/min										-	12000
4	Determine Occupancy Charge	Limited Combustible										-15%	10200
5	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%	
6	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	Firewall / Sprinklered ?				-	-
		North	> 30	34	3	> 100	Type V	NO				0%	3366
		East	3.1 to 10	13	3	21-49	Type V	NO				16%	
		South	10.1 to 20	34	3	> 100	Type V	NO				15%	
		West	20.1 to 30	13	3	21-49	Type V	NO				2%	
7	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

FUS Fire Flow Calculation Sheet - 2020 FUS Guidelines

Stantec Project #: 160402165
Project Name: Kanata West Block 1
Date: 5/28/2025
Fire Flow Calculation #: 7
Description: Block 3 - Three Level Terrace flat (9 Unit) townhouse with no fire wall

Notes: Site Plan provided by M.David Blakely Architect Inc., Rev 3, dated May 21, 2025

Step	Task	Notes										Value Used	Req'd Fire Flow (L/min)
1	Determine Type of Construction	Type V - Wood Frame / Type IV-D - Mass Timber Construction										1.5	-
2	Determine Effective Floor Area	Sum of All Floor Areas										-	-
		313	313	313								939	-
3	Determine Required Fire Flow	($F = 220 \times C \times A^{1/2}$). Round to nearest 1000 L/min										-	10000
4	Determine Occupancy Charge	Limited Combustible										-15%	8500
5	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%	
6	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	Firewall / Sprinklered ?				-	-
		North	10.1 to 20	13	3	21-49	Type V	NO				11%	3910
		East	10.1 to 20	26	3	61-80	Type V	NO				13%	
		South	3.1 to 10	13	3	21-49	Type V	NO				16%	
		West	20.1 to 30	26	3	61-80	Type V	NO				6%	
7	Determine Final Required Fire Flow	Total Required Fire Flow in L/min, Rounded to Nearest 1000L/min											12000
		Total Required Fire Flow in L/s											200.0
		Required Duration of Fire Flow (hrs)											2.50
		Required Volume of Fire Flow (m^3)											1800

FUS Fire Flow Calculation Sheet - 2020 FUS Guidelines

Stantec Project #: 160402165
Project Name: Kanata West Block 1
Date: 5/28/2025
Fire Flow Calculation #: 8
Description: Block 4 - Three Level Terrace flat (12 Unit) townhouse with no fire wall

Notes: Site Plan provided by M.David Blakely Architect Inc., Rev 3, dated May 21, 2025

Step	Task	Notes										Value Used	Req'd Fire Flow (L/min)
1	Determine Type of Construction	Type V - Wood Frame / Type IV-D - Mass Timber Construction										1.5	-
2	Determine Effective Floor Area	Sum of All Floor Areas										-	-
		416	416	416								1248	-
3	Determine Required Fire Flow	($F = 220 \times C \times A^{1/2}$). Round to nearest 1000 L/min										-	12000
4	Determine Occupancy Charge	Limited Combustible										-15%	10200
5	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%	
6	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	Firewall / Sprinklered ?				-	-
		North	3.1 to 10	13	3	21-49	Type V	NO				16%	3774
		East	20.1 to 30	34	3	> 100	Type V	NO				10%	
		South	10.1 to 20	13	2	21-49	Type V	NO				11%	
		West	> 30	34	3	> 100	Type V	NO				0%	
7	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

FUS Fire Flow Calculation Sheet - 2020 FUS Guidelines

Stantec Project #: 160402165
Project Name: Kanata West Block 1
Date: 5/28/2025
Fire Flow Calculation #: 9
Description: Block 5 - Three Level Terrace flat (12 Unit) townhouse with no fire wall

Notes: Site Plan provided by M.David Blakely Architect Inc., Rev 3, dated May 21, 2025

Step	Task	Notes										Value Used	Req'd Fire Flow (L/min)
1	Determine Type of Construction	Type V - Wood Frame / Type IV-D - Mass Timber Construction										1.5	-
2	Determine Effective Floor Area	Sum of All Floor Areas										-	-
		416	416	416								1248	-
3	Determine Required Fire Flow	($F = 220 \times C \times A^{1/2}$). Round to nearest 1000 L/min										-	12000
4	Determine Occupancy Charge	Limited Combustible										-15%	10200
5	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%	
6	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	Firewall / Sprinklered ?				-	-
		North	20.1 to 30	34	3	> 100	Type V	NO				10%	2550
		East	20.1 to 30	13	3	21-49	Type I-II - Unprotected Openings	YES				0%	
		South	10.1 to 20	34	2	61-80	Type V	NO				13%	
		West	20.1 to 30	13	3	21-49	Type V	NO				2%	
7	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

FUS Fire Flow Calculation Sheet - 2020 FUS Guidelines

Stantec Project #: 160402165
Project Name: Kanata West Block 1
Date: 5/28/2025
Fire Flow Calculation #: 10
Description: Block 6 - Three Level Terrace flat (6 Unit) townhouse with no fire wall

Notes: Site Plan provided by M.David Blakely Architect Inc., Rev 3, dated May 21, 2025

Step	Task	Notes										Value Used	Req'd Fire Flow (L/min)
1	Determine Type of Construction	Type V - Wood Frame / Type IV-D - Mass Timber Construction										1.5	-
2	Determine Effective Floor Area	Sum of All Floor Areas										-	-
		208	208	208								624	-
3	Determine Required Fire Flow	($F = 220 \times C \times A^{1/2}$). Round to nearest 1000 L/min										-	8000
4	Determine Occupancy Charge	Limited Combustible										-15%	6800
5	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%	
6	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	Firewall / Sprinklered ?				-	-
		North	20.1 to 30	18	3	41-60	Type V	NO				4%	2176
		East	> 30	13	3	21-49	Type I-II - Unprotected Openings	YES				0%	
		South	10.1 to 20	18	3	41-60	Type V	NO				12%	
		West	3.1 to 10	13	3	21-49	Type V	NO				16%	
7	Determine Final Required Fire Flow	Total Required Fire Flow in L/min, Rounded to Nearest 1000L/min											9000
		Total Required Fire Flow in L/s											150.0
		Required Duration of Fire Flow (hrs)											2.00
		Required Volume of Fire Flow (m^3)											1080

A.4 Watermain Hydraulic Analysis Results

PCSWMM Watermain Hydraulic Analysis Result
Junction Results - Basic Day

ID	Demand (L/s)	Elevation (m)	Head (m)	Pressure (m)	Pressure (psi)2	Pressure (kPa)
UTILITY	0.003	97.73	160.90	63.17	89.83	619.34
FH-3	0.00	97.68	160.90	63.22	89.90	619.86
FH-2	0.00	97.76	160.90	63.14	89.78	619.02
FH-1	0.00	97.72	160.90	63.18	89.84	619.44
BLOCK6	0.05	97.68	160.90	63.23	89.90	619.87
BLOCK5	0.11	97.61	160.90	63.29	90.00	620.51
BLOCK4	0.11	97.68	160.90	63.22	89.89	619.78
BLOCK3	0.08	97.60	160.90	63.31	90.02	620.65
BLOCK2	0.11	97.86	160.90	63.04	89.64	618.06
BLOCK1	0.11	97.70	160.90	63.20	89.87	619.66
APRT_BLDG1	0.15	98.12	160.90	62.79	89.28	615.55
APRT_BLDG2	0.15	97.70	160.90	63.20	89.87	619.66
3	0.00	97.67	160.90	63.23	89.91	619.94
19	0.00	97.79	160.90	63.11	89.74	618.74
18	0.00	97.67	160.90	63.23	89.91	619.90
16	0.00	97.62	160.90	63.28	89.98	620.37
12	0.00	97.81	160.90	63.09	89.71	618.55
11	0.00	97.94	160.90	62.96	89.52	617.24
10	0.00	97.60	160.90	63.30	90.01	620.58

Link Results - Basic Day

ID	FROM	TO	Length (m)	Diameter (mm)	Roughness	Flow (L/s)	Velocity (m/s)
1016	10	FH-1	41.52	204	110	0.258	0.008
1015	FH-1	16	39.23	204	110	0.258	0.008
1014	16	APRT_BLDG2	7.18	204	110	0.258	0.008
1013	APRT_BLDG2	PloughshareN	19.74	204	110	0.408	0.012
1012	BLOCK1	BLOCK2	47.21	204	110	0.110	0.003
1011	BLOCK2	12	22.91	204	110	0.108	0.003
1010	12	11	7.47	204	110	0.108	0.003
1009	11	10	6.93	204	110	0.108	0.003
1008	BLOCK2	FH-2	8.53	204	110	0.112	0.003
1007	FH-2	UTILITY	1.68	204	110	0.112	0.003
1005	BLOCK3	BLOCK4	10.35	204	110	0.195	0.006
1004	BLOCK4	3	2.04	204	110	0.305	0.009
1002	3	FH-3	8.73	204	110	0.160	0.005
1001	FH-3	BLOCK5	31.59	204	110	0.160	0.005
1000	BLOCK5	BLOCK6	7.48	204	110	0.050	0.002
1006	UTILITY	BLOCK3	23.55	204	110	0.115	0.004
1003	3	PloughshareS	42.26	204	110	0.465	0.014
1017	19	18	3.08	204	110	0.150	0.005
1018	APRT_BLDG1	19	9.78	204	110	0.150	0.005
C1	18	10	23.16	204	110	0.150	0.005

PCSWMM Watermain Hydraulic Analysis Result
Junction Results - Peak Hour

ID	Demand (L/s)	Elevation (m)	Head (m)	Pressure (m)	Pressure (psi)2	Pressure (kPa)
UTILITY	0.01	97.73	155.90	58.17	82.72	570.31
FH-3	0.00	97.68	155.90	58.22	82.79	570.80
FH-2	0.00	97.76	155.90	58.14	82.67	570.01
FH-1	0.00	97.72	155.90	58.18	82.73	570.40
BLOCK6	0.29	97.68	155.90	58.22	82.79	570.80
BLOCK5	0.58	97.61	155.90	58.29	82.89	571.48
BLOCK4	0.58	97.68	155.90	58.21	82.77	570.70
BLOCK3	0.43	97.60	155.90	58.30	82.90	571.58
BLOCK2	0.58	97.86	155.90	58.04	82.53	569.03
BLOCK1	0.58	97.70	155.90	58.20	82.76	570.60
APRT_BLDG1	0.83	98.12	155.90	57.78	82.16	566.48
APRT_BLDG2	0.83	97.70	155.90	58.20	82.76	570.60
3	0.00	97.67	155.90	58.23	82.80	570.90
19	0.00	97.79	155.90	58.11	82.63	569.72
18	0.00	97.67	155.90	58.23	82.80	570.90
16	0.00	97.62	155.90	58.27	82.86	571.29
12	0.00	97.81	155.90	58.09	82.60	569.52
11	0.00	97.94	155.90	57.95	82.40	568.15
10	0.00	97.60	155.90	58.30	82.90	571.58

Link Results - Peak Hour

ID	FROM	TO	Length (m)	Diameter (mm)	Roughness	Flow (L/s)	Velocity (m/s)
1016	10	FH-1	41.52	204	110	1.385	0.042
1015	FH-1	16	39.23	204	110	1.385	0.042
1014	16	APRT_BLDG2	7.18	204	110	1.385	0.042
1013	APRT_BLDG2	PloughshareS	19.74	204	110	2.215	0.068
1012	BLOCK1	BLOCK2	47.21	204	110	0.580	0.018
1011	BLOCK2	12	22.91	204	110	0.555	0.017
1010	12	11	7.47	204	110	0.555	0.017
1009	11	10	6.93	204	110	0.555	0.017
1008	BLOCK2	FH-2	8.53	204	110	0.605	0.019
1007	FH-2	UTILITY	1.68	204	110	0.605	0.019
1005	BLOCK3	BLOCK4	10.35	204	110	1.044	0.032
1004	BLOCK4	3	2.04	204	110	1.624	0.050
1002	3	FH-3	8.73	204	110	0.870	0.027
1001	FH-3	BLOCK5	31.59	204	110	0.870	0.027
1000	BLOCK5	BLOCK6	7.48	204	110	0.290	0.009
1006	UTILITY	BLOCK3	23.55	204	110	0.614	0.019
1003	3	PloughshareN	42.26	204	110	2.494	0.076
1017	19	18	3.08	204	110	0.830	0.025
1018	APRT_BLDG1	19	9.78	204	110	0.830	0.025
C1	18	10	23.16	204	110	0.830	0.025

PCSWMM Watermain Hydraulic Analysis Result
Fire Flow Results - Max Day + 233 L/s

ID	Static Demand (L/s)	Static Pressure (m)	Static Pressure (psi)	Static Pressure (kPa)	Static Head (m)	Fire Flow Demand (L/s)	Residual Pressure (m)	Residual Pressure (psi)	Available Flow (L/s)	Available Pressure (psi)
UTILITY	0.004	39.23	55.79	384.65	136.962	233	31.29	44.49	431.51	20
FH-3	0.00	38.47	54.70	377.13	136.142	233	30.62	43.54	422.39	20
FH-2	0.00	39.24	55.80	384.71	137.001	233	31.22	44.39	429.54	20
FH-1	0.00	41.32	58.76	405.11	139.039	233	33.01	46.94	460.11	20
BLOCK6	0.13	38.47	54.70	377.14	136.142	233	19.87	28.25	269.23	20
BLOCK5	0.26	38.53	54.79	377.78	136.142	233	21.99	31.27	286.86	20
BLOCK4	0.26	38.50	54.75	377.50	136.188	233	32.88	46.75	500.42	20
BLOCK3	0.20	38.83	55.21	380.68	136.423	233	32.35	46.00	471.01	20
BLOCK2	0.26	39.34	55.94	385.67	137.196	233	30.94	44.00	421.75	20
BLOCK1	0.26	39.50	56.17	387.26	137.196	233	18.12	25.77	255.96	20
APRT_BLDG1	0.38	39.95	56.80	391.66	138.063	233	20.88	29.69	275.73	20
APRT_BLDG2	0.38	42.44	60.34	416.04	140.131	233	37.5	53.32	715.73	20
3	0.00	38.47	54.71	377.20	136.142	233	33.03	46.97	508.17	20
19	0.00	40.27	57.27	394.84	138.063	233	23.9	33.99	301.95	20
18	0.00	40.39	57.43	396.00	138.063	233	24.86	35.35	311.72	20
16	0.00	42.34	60.20	415.09	139.962	233	36.82	52.36	630.73	20
12	0.00	39.92	56.77	391.38	137.729	233	30.9	43.94	414.67	20
11	0.00	39.96	56.82	391.76	137.902	233	30.84	43.85	414.03	20
10	0.00	40.46	57.53	396.69	138.063	233	31.31	44.52	418.74	20

PCSWMM Watermain Hydraulic Analysis Result
Fire Flow Results - Max Day + 300 L/s

ID	Static Demand (L/s)	Static Pressure (m)	Static Pressure (psi)	Static Pressure (kPa)	Static Head (m)	Fire Flow Demand (L/s)	Residual Pressure (m)	Residual Pressure (psi)	Available Flow (L/s)	Available Pressure (psi)
UTILITY	0.004	27.09	38.53	265.63	124.82	300	19.12	27.19	304.52	20
FH-3	0.00	25.84	36.74	253.31	123.51	300	18.12	25.77	290.56	20
FH-2	0.00	27.12	38.57	265.93	124.89	300	19.06	27.11	303.22	20
FH-1	0.00	30.41	43.24	298.10	128.13	300	21.42	30.45	340.16	20
BLOCK6	0.13	25.84	36.74	253.32	123.51	300	7.37	10.48	182.80	20
BLOCK5	0.26	25.90	36.83	253.97	123.51	300	9.49	13.50	195.52	20
BLOCK4	0.26	25.903	36.83	253.96	123.59	300	20.40	29.01	345.87	20
BLOCK3	0.20	26.368	37.49	258.52	123.96	300	19.98	28.41	328.57	20
BLOCK2	0.26	27.337	38.87	268.02	125.20	300	18.86	26.81	298.54	20
BLOCK1	0.26	27.5	39.10	269.61	125.20	300	6.03	8.58	179.02	20
APRT_BLDG1	0.38	28.461	40.47	279.04	126.58	300	9.05	12.87	195.49	20
APRT_BLDG2	0.38	32.161	45.73	315.31	129.86	300	25.91	36.85	546.47	20
3	0.00	25.845	36.75	253.39	123.51	300	20.53	29.20	350.81	20
19	0.00	28.786	40.93	282.22	126.58	300	12.07	17.16	216.27	20
18	0.00	28.904	41.10	283.38	126.58	300	13.03	18.53	224.01	20
16	0.00	31.965	45.45	313.39	129.59	300	24.69	35.10	478.98	20
12	0.00	28.235	40.15	276.82	126.04	300	18.97	26.98	297.38	20
11	0.00	28.377	40.35	278.21	126.32	300	18.97	26.97	297.31	20
10	0.00	28.974	41.20	284.07	126.58	300	19.48	27.70	303.60	20

Appendix B Wastewater Servicing Calculations

B.1 Sanitary Sewer Design Sheet

Stantec

SUBDIVISION:

Job Name

DATE: 7/23/2025
REVISION: 1
DESIGNED BY: -
CHECKED BY: -

SANITARY SEWER DESIGN SHEET
(City of Ottawa)

FILE NUMBER: 16040XXXX

DESIGN PARAMETERS

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

LOCATION			RESIDENTIAL AREA AND POPULATION									COMMERCIAL		INDUSTRIAL (L)		INDUSTRIAL (H)		INSTITUTIONAL		GREEN / UNUSED		C+I+I	INFILTRATION			TOTAL	PIPE								
AREA ID NUMBER	FROM M.H.	TO M.H.	AREA	SINGLE	UNITS TOWN	APT	POP.	CUMULATIVE AREA	CUMULATIVE POP.	PEAK FACT.	PEAK FLOW	AREA	ACCU. AREA	AREA	ACCU. AREA	AREA	ACCU. AREA	AREA	ACCU. AREA	AREA	ACCU. AREA	PEAK FLOW	TOTAL AREA	ACCU. AREA	INFILT. FLOW	FLOW	LENGTH	DIA	MATERIAL	CLASS	SLOPE	CAP. (FULL)	CAP. V PEAK FLOW	VEL. (FULL)	VEL. (ACT.)
			(ha)					(ha)			(l/s)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(l/s)	(ha)	(ha)	(l/s)	(l/s)	(m)	(mm)			(%)	(l/s)	(%)	(m/s)	(m/s)
R23A	23	22	0.11	0	9	0	24	0.1124	24	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	0.11	0.11	0.0	0.3	26.5	200	PVC	SDR 35	0.65	27.0	**1.22%**	0.85	0.24
R24A	24	22	0.22	0	15	0	41	0.2217	41	3.67	0.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.22	0.22	0.1	0.6	45.6	200	PVC	SDR 35	0.65	27.0	**2.06%**	0.85	0.28
R22A	22	21	0.18	0	12	0	32	0.5181	97	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	0.18	0.52	0.2	1.3	40.7	200	PVC	SDR 35	0.40	21.1	**6.17%**	0.67	0.30
R25A	25	21	0.20	0	18	0	49	0.1998	49	3.65	0.6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.20	0.20	0.1	0.6	46.5	200	PVC	SDR 35	0.65	27.0	**2.38%**	0.85	0.29
R21A	21	20A	0.17	0	9	0	24	0.8844	170	3.54	2.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.17	0.88	0.3	2.2	32.0	200	PVC	SDR 35	0.40	21.2	**10.60%**	0.67	0.36
	20A	20	0.00	0	0	0	0	0.8844	170	3.54	2.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.00	0.88	0.3	2.2	11.4	200	PVC	SDR 35	0.40	21.2	**10.60%**	0.67	0.36
																												200							
R4A	4	3	0.29	0	0	26	47	0.2874	47	3.66	0.6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.29	0.29	0.1	0.6	46.0	200	PVC	SDR 35	0.40	21.1	**3.07%**	0.67	0.25
R3A	3	2	0.29	0	0	26	47	0.5809	94	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	0.29	0.58	0.2	1.3	39.0	200	PVC	SDR 35	0.40	21.1	**6.07%**	0.67	0.30
	2	1A	0.00	0	0	0	0	0.5809	94	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	0.00	0.58	0.2	1.3	14.6	200	PVC	SDR 35	0.40	21.1	**6.07%**	0.67	0.30
	1A	1	0.00	0	0	0	0	0.5809	94	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	0.00	0.58	0.2	1.3	11.3	200	PVC	SDR 35	0.40	21.1	**6.07%**	0.67	0.30
																												200							

Appendix C Stormwater Management

C.1 Storm Sewer Design Sheet

Stantec

Kanata West Block 1

DATE: 2025-07-29
REVISION: 1
DESIGNED BY: JP
CHECKED BY: AMP

FILE NUMBER: 160401393

STORM SEWER DESIGN SHEET
(City of Ottawa)

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																						PIPE SELECTION										
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)	T of C (min)	$I_{2\text{-YEAR}}$ (mm/h)	$I_{5\text{-YEAR}}$ (mm/h)	$I_{10\text{-YEAR}}$ (mm/h)	$I_{100\text{-YEAR}}$ (mm/h)	$Q_{CONTROL}$ (L/s)	ACCUM. $Q_{CONTROL}$ (L/s)	Q_{ACT} (CIA/360) (L/s)	LENGTH (m)	PIPE WIDTH OR DIAMETEI (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)
L203A	203	202	0.08	0.00	0.00	0.00	0.00	0.80	0.00	0.00	0.00	0.061	0.061	0.000	0.000	0.000	0.000	0.000	0.000	10.00	76.81	104.19	122.14	178.56	0.0	0.0	12.9	29.1	300	300	CIRCULAR	PVC	-	0.40	60.8	**21.29%**	0.86	0.57	0.85
																				10.85																			
L204A	204	202	0.16	0.00	0.00	0.00	0.00	0.80	0.00	0.00	0.00	0.130	0.130	0.000	0.000	0.000	0.000	0.000	0.000	10.00	76.81	104.19	122.14	178.56	0.0	0.0	27.8	41.4	300	300	CIRCULAR	PVC	-	0.40	60.8	**45.73%**	0.86	0.72	0.96
																				10.96																			
L202A	202	201	0.14	0.00	0.00	0.00	0.00	0.80	0.00	0.00	0.00	0.109	0.300	0.000	0.000	0.000	0.000	0.000	0.000	10.96	73.30	99.38	116.47	170.23	0.0	0.0	61.1	37.7	375	375	CIRCULAR	PVC	-	0.40	104.3	**58.65%**	0.99	0.88	0.71
																				11.67																			
L205A	205	201	0.14	0.00	0.00	0.00	0.00	0.80	0.00	0.00	0.00	0.114	0.114	0.000	0.000	0.000	0.000	0.000	0.000	10.00	76.81	104.19	122.14	178.56	0.0	0.0	24.3	43.2	300	300	CIRCULAR	PVC	-	0.40	60.8	**39.89%**	0.86	0.69	1.05
																				11.05																			
L201A, L201B	201	200	0.17	0.00	0.00	0.00	0.00	0.75	0.00	0.00	0.00	0.126	0.540	0.000	0.000	0.000	0.000	0.000	0.000	11.67	70.93	96.12	112.63	164.59	0.0	0.0	106.4	34.5	450	450	CIRCULAR	CONCRETE	-	0.40	188.1	**56.58%**	1.15	1.02	0.57
	200	200A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.540	0.000	0.000	0.000	0.000	0.000	0.000	12.24	69.16	93.68	109.77	160.39	0.0	0.0	103.8	8.2	450	450	CIRCULAR	CONCRETE	-	0.40	188.1	**55.17%**	1.15	1.01	0.14
																				12.38									450	450									
F103A, L103A	103	102	0.16	0.00	0.00	0.04	0.00	0.70	0.00	0.00	0.80	0.111	0.111	0.000	0.000	0.000	0.000	0.028	0.028	10.00	76.81	104.19	122.14	178.56	0.0	0.0	37.7	44.9	300	300	CIRCULAR	PVC	-	0.40	60.8	**61.93%**	0.86	0.79	0.95
	102	101	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.111	0.000	0.000	0.000	0.000	0.000	0.028	10.95	73.35	99.44	116.55	170.34	0.0	0.0	36.0	37.6	375	375	CIRCULAR	PVC	-	0.40	104.3	**34.49%**	0.99	0.75	0.83
L101A	101	100	0.17	0.00	0.00	0.00	0.00	0.70	0.00	0.00	0.00	0.119	0.230	0.000	0.000	0.000	0.000	0.000	0.028	11.78	70.58	95.64	112.07	163.77	0.0	0.0	58.0	23.6	375	375	CIRCULAR	PVC	-	0.40	104.3	**55.61%**	0.99	0.88	0.45
																				12.23									375	375									

C.2 PCSWMM Input File Example

```
[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           10/12/2022
START_TIME           00:00:00
REPORT_START_DATE    10/12/2022
REPORT_START_TIME    00:00:00
END_DATE             10/13/2022
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             00:01:00
ROUTING_STEP         1
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              8

[FILES]
;;Interfacing Files
USE HOTSTART "C:\Users\wajohnson\Desktop\PCSWMM\160401393\Block 1\2025-07\Block
1_100C_HSF.HSF"

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

```
[RAINGAGES]
;;Name           Format    Interval SCF      Source
;;-------------- --------- -------- -------- ----------
RG1              INTENSITY 0:10     1.0      TIMESERIES 100YRCHI

[SUBCATCHMENTS]
;;Name           Rain Gage        Outlet           Area     %Imperv  Width
%Slope   CurbLen  SnowPack
;;-------------- ---------------- ---------------- -------- -------- --------
-------- -------- ----------------
F103A            RG1              103              0.035405 85.714   62       2
    0
L101A            RG1              C101A-1          0.17042  71.429   52       3
    0
L103A            RG1              C103A-1          0.158102 71.429   71       2.5
    0
L201A            RG1              C201A-1          0.085816 85.714   36       4
    0
L201B            RG1              C201B-2          0.082233 71.429   69       4
    0
L202A            RG1              C202A-1          0.136568 85.714   62       3
    0
L203A            RG1              C203A-2          0.075865 85.714   30       1
    0
L204A            RG1              C204A-1          0.162936 85.714   80       2
    0
L205A            RG1              C205A-2          0.142143 85.714   38       3
    0
UNC-1            RG1              OF6              0.125322 57.143   122      3
    0
UNC-2            RG1              OF7              0.07835  57.143   53       33
    0
UNC-3            RG1              OF3              0.083986 57.143   53       3
    0
UNC-4            RG1              OF4              0.028272 57.143   54       5
    0
UNC-5            RG1              OF4              0.067592 57.143   84       5
    0
UNC-6            RG1              OF5              0.033816 14.286   106      33
    0

[SUBAREAS]
;;Subcatchment   N-Imperv   N-Perv     S-Imperv   S-Perv     PctZero    RouteTo
PctRouted
;;-------------- ---------- ---------- ---------- ---------- ---------- ----------
----------
F103A            0.013      0.25       1.57       4.67       0          OUTLET
L101A            0.013      0.25       1.57       4.67       0          OUTLET
L103A            0.013      0.25       1.57       4.67       0          OUTLET
L201A            0.013      0.25       1.57       4.67       0          OUTLET
```

```
L201B            0.013      0.25       1.57       4.67       0          OUTLET
L202A            0.013      0.25       1.57       4.67       0          OUTLET
L203A            0.013      0.25       1.57       4.67       0          OUTLET
L204A            0.013      0.25       1.57       4.67       0          OUTLET
L205A            0.013      0.25       1.57       4.67       0          OUTLET
UNC-1            0.013      0.25       1.57       4.67       0          OUTLET
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
UNC-6            0.013      0.25       1.57       4.67       0          OUTLET

[INFILTRATION]
;;Subcatchment   Param1     Param2     Param3     Param4     Param5
;;-------------- ---------- ---------- ---------- ---------- ----------
F103A            76.2       13.2       4.14       7          0
L101A            76.2       13.2       4.14       7          0
L103A            76.2       13.2       4.14       7          0
L201A            76.2       13.2       4.14       7          0
L201B            76.2       13.2       4.14       7          0
L202A            76.2       13.2       4.14       7          0
L203A            76.2       13.2       4.14       7          0
L204A            76.2       13.2       4.14       7          0
L205A            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
UNC-6            76.2       13.2       4.14       7          0

[OUTFALLS]
;;Name           Elevation  Type       Stage Data       Gated    Route To
;;-------------- ---------- ---------- ---------------- -------- ----------------
100              94.765     FIXED      95.49            NO
200A             94.638     FIXED      95.35            NO
OF1              97.55      FREE                        NO
OF2              97.65      FREE                        NO
OF3              97.8       FREE                        NO
OF4              97.7       FREE                        NO
OF5              96.5       FREE                        NO
OF6              96         FREE                        NO
OF7              97         FREE                        NO

[STORAGE]
;;Name           Elev.    MaxDepth   InitDepth  Shape       Curve Name/Params
      SurDepth Fevap    Psi      Ksat     IMD
;;-------------- -------- ---------- ---------- -----------
---------------------------- -------- -------- -------- -------- --------
101              94.86    2.653      0          FUNCTIONAL  0         0
1.13     0        0

102              95.042   2.735      0          FUNCTIONAL  0         0
1.13     0        0
103              95.297   2.595      0          FUNCTIONAL  0         0
1.13     0        0
200              94.638   3.144      0          FUNCTIONAL  0         0
1.13     0        0
201              94.836   2.827      0          FUNCTIONAL  0         0
1.13     0        0
202              95.062   2.728      0          FUNCTIONAL  0         0
1.13     0        0
203              95.253   2.677      0          FUNCTIONAL  0         0
1.13     0        0
204              95.302   2.222      0          FUNCTIONAL  0         0
1.13     0        0
205              95.159   2.572      0          FUNCTIONAL  0         0
1.13     0        0
C101A-1          95.31    2.44       0          TABULAR     C101A
      0        0
C101A-2          95.23    2.81       0          FUNCTIONAL  0         0         0
      0        0
C103A-1          95.66    2.13       0          TABULAR     C103A
      0        0
C103A-2          95.59    2.48       0          FUNCTIONAL  0         0         0
      0        0
C201A-1          95.1     2.55       0          TABULAR     C201A
      0        0
C201A-2          95.18    2.8        0          FUNCTIONAL  0         0         0
      0        0
C201B-1          95       3.07       0          FUNCTIONAL  0         0         0
      0        0
C201B-2          95.29    2.53       0          TABULAR     C201B
      0        0
C202A-1          95.2     2.53       0          TABULAR     C202A
      0        0
C202A-2          95.28    2.69       0          FUNCTIONAL  0         0         0
      0        0
C203A-1          95.48    3.03       0          FUNCTIONAL  0         0         0
      0        0
C203A-2          95.4     2.58       0          TABULAR     C203A
      0        0
C204A-1          95.53    2.23       0          TABULAR     C204A
      0        0
C204A-2          95.45    2.64       0          FUNCTIONAL  0         0         0
      0        0
C205A-1          95.25    2.85       0          FUNCTIONAL  0         0         0
      0        0
C205A-2          95.35    2.55       0          TABULAR     C205A
      0        0

[CONDUITS]
;;Name           From Node        To Node          Length     Roughness  InOffset
```

```
 OutOffset  InitFlow   MaxFlow
;;-------------- ---------------- ---------------- ---------- ----------
---------- ---------- ---------- ----------
C1               C103A-1          C103A-2          10         0.013      95.66
 95.65      0          0
C2               C101A-1          C101A-2          15         0.013      95.31
 95.3       0          0
C3               C201A-2          C201A-1          11         0.013      95.18
 95.17      0          0
C4               C201B-2          C201B-1          6.5        0.013      95.29
 95.28      0          0
C5               C204A-1          C204A-2          15         0.013      95.53
 95.52      0          0
C6               C205A-2          C205A-1          20         0.013      95.35
 95.33      0          0
C7               C202A-2          C202A-1          10         0.013      95.28
 95.27      0          0
C8               C203A-1          C203A-2          5          0.013      95.48
 95.47      0          0
Pipe_12          101              100              23.625     0.013      94.86
 94.765     0          0
Pipe_13          102              101              37.562     0.013      95.042
 94.891     0          0
Pipe_15          103              102              44.939     0.013      95.297
 95.117     0          0
Pipe_17          201              200              34.548     0.013      94.836
 94.698     0          0
Pipe_17_(1)      200              200A             8.216      0.013      94.67
 94.638     0          0
Pipe_18          202              201              37.743     0.013      95.062
 94.911     0          0
Pipe_19          203              202              29.052     0.013      95.253
 95.137     0          0
Pipe_20          204              202              41.357     0.013      95.302
 95.137     0          0
Pipe_21          205              201              43.2       0.013      95.159
 94.986     0          0

[ORIFICES]
;;Name           From Node        To Node          Type         Offset     Qcoeff
   Gated    CloseTime
;;-------------- ---------------- ---------------- ------------ ----------
---------- -------- ----------
C101A-2IC        C101A-2          101              SIDE         95.23      0.61
   NO       0
C103A-2IC        C103A-2          103              SIDE         95.59      0.61
   NO       0
C201A-1IC        C201A-1          201              SIDE         95.1       0.61
   NO       0
C201B-1C         C201B-1          201              SIDE         95         0.61
   NO       0
C202A-1IC        C202A-1          202              SIDE         95.2       0.61
   NO       0
C203A-1IC        C203A-2          203              SIDE         95.4       0.61
   NO       0
C204A-1IC        C204A-2          204              SIDE         95.45      0.61
   NO       0
C205A-1IC        C205A-1          205              SIDE         95.25      0.61
   NO       0

[WEIRS]
;;Name           From Node        To Node          Type         CrestHt    Qcoeff
   Gated    EndCon   EndCoeff   Surcharge  RoadWidth  RoadSurf   Coeff. Curve
;;-------------- ---------------- ---------------- ------------ ----------
---------- -------- -------- ---------- ---------- ---------- ----------
----------------
W13              C205A-2          C201A-1          TRANSVERSE   97.8       1.67
   NO       0        0          YES
W15              C201A-1          OF1              TRANSVERSE   97.55      1.67
   NO       0        0          YES
W18              C202A-1          C201A-1          TRANSVERSE   97.63      1.67
   NO       0        0          YES
W2               C103A-1          C101A-1          TRANSVERSE   97.69      1.67
   NO       0        0          YES
W3               C201B-2          OF4              TRANSVERSE   97.72      1.67
   NO       0        0          YES
W4               C101A-1          OF2              TRANSVERSE   97.65      1.67
   NO       0        0          YES
W7               C203A-2          C202A-1          TRANSVERSE   97.88      1.67
   NO       0        0          YES
W8               C204A-1          C202A-1          TRANSVERSE   97.66      1.67
   NO       0        0          YES

[XSECTIONS]
;;Link           Shape        Geom1            Geom2      Geom3      Geom4
Barrels    Culvert
;;-------------- ------------ ---------------- ---------- ---------- ----------
---------- ----------
C1               CIRCULAR     0.9              0          0          0          1

C2               CIRCULAR     0.9              0          0          0          1

C3               CIRCULAR     0.9              0          0          0          1

C4               CIRCULAR     0.9              0          0          0          1

C5               CIRCULAR     0.9              0          0          0          1

C6               CIRCULAR     0.9              0          0          0          1

C7               CIRCULAR     0.9              0          0          0          1
```

```
C8               CIRCULAR     0.9             0          0          0          1
Pipe_12          CIRCULAR     0.375           0          0          0          1
Pipe_13          CIRCULAR     0.375           0          0          0          1
Pipe_15          CIRCULAR     0.3             0          0          0          1
Pipe_17          CIRCULAR     0.45            0          0          0          1
Pipe_17_(1)      CIRCULAR     0.45            0          0          0          1
Pipe_18          CIRCULAR     0.375           0          0          0          1
Pipe_19          CIRCULAR     0.3             0          0          0          1
Pipe_20          CIRCULAR     0.3             0          0          0          1
Pipe_21          CIRCULAR     0.3             0          0          0          1
C101A-2IC        CIRCULAR     0.083           0          0          0
C103A-2IC        CIRCULAR     0.083           0          0          0
C201A-1IC        CIRCULAR     0.083           0          0          0
C201B-1C         CIRCULAR     0.083           0          0          0
C202A-1IC        CIRCULAR     0.083           0          0          0
C203A-1IC        CIRCULAR     0.083           0          0          0
C204A-1IC        CIRCULAR     0.083           0          0          0
C205A-1IC        CIRCULAR     0.083           0          0          0
W13              RECT_OPEN    0.1             2          0          0
W15              RECT_OPEN    0.25            2          0          0
W18              RECT_OPEN    0.15            2          0          0
W2               RECT_OPEN    0.18            2          0          0
W3               RECT_OPEN    0.33            2          0          0
W4               RECT_OPEN    0.16            2          0          0
W7               RECT_OPEN    0.22            2          0          0
W8               RECT_OPEN    0.16            2          0          0

[LOSSES]
;;Link            Kentry     Kexit      Kavg       Flap Gate  Seepage
;;--------------- ---------- ---------- ---------- ---------- ----------
Pipe_12          0          1.344      0          NO         0
Pipe_13          0          0.094      0          NO         0
Pipe_15          0          0.199      0          NO         0
Pipe_17          0          0.27       0          NO         0
Pipe_17_(1)      0          0.405      0          NO         0
Pipe_18          0          0.022      0          NO         0
Pipe_19          0          1.344      0          NO         0
Pipe_20          0          1.344      0          NO         0
Pipe_21          0          1.344      0          NO         0

[CURVES]
;;Name           Type       X-Value    Y-Value
;;-------------- ---------- ---------- ----------
C101A            Storage    0          0
C101A                       2.1        0
C101A                       2.34       252

C103A            Storage    0          0
C103A                       1.81       0
C103A                       2.03       181

C201A            Storage    0          0
C201A                       2.3        0
C201A                       2.45       105

C201B            Storage    0          0
C201B                       2.36       0
C201B                       2.43       6

C202A            Storage    0          0
C202A                       2.18       0
C202A                       2.43       156

C203A            Storage    0          0
C203A                       2.3        0
C203A                       2.48       61

C204A            Storage    0          0
C204A                       1.89       0
C204A                       2.13       165

C205A            Storage    0          0
C205A                       2.17       0
C205A                       2.47       287

C206A            Storage    0          0
C206A                       2          0
C206A                       2.2        137

[TIMESERIES]
;;Name           Date       Time       Value
;;-------------- ---------- ---------- ----------
100YR+20CHI                 0:00       0
100YR+20CHI                 0:10       7.26
100YR+20CHI                 0:20       9.048
100YR+20CHI                 0:30       12.192
100YR+20CHI                 0:40       19.164
100YR+20CHI                 0:50       48.78
100YR+20CHI                 1:00       214.272
100YR+20CHI                 1:10       64.86
100YR+20CHI                 1:20       32.784
100YR+20CHI                 1:30       21.888
```

```
100YR+20CHI             1:40        16.488
100YR+20CHI             1:50        13.272
100YR+20CHI             2:00        11.148
100YR+20CHI             2:10        9.624
100YR+20CHI             2:20        8.496
100YR+20CHI             2:30        7.62
100YR+20CHI             2:40        6.912
100YR+20CHI             2:50        6.336
100YR+20CHI             3:00        5.856

100YRCHI                0:00        0
100YRCHI                0:10        6.05
100YRCHI                0:20        7.54
100YRCHI                0:30        10.16
100YRCHI                0:40        15.97
100YRCHI                0:50        40.65
100YRCHI                1:00        178.56
100YRCHI                1:10        54.05
100YRCHI                1:20        27.32
100YRCHI                1:30        18.24
100YRCHI                1:40        13.74
100YRCHI                1:50        11.06
100YRCHI                2:00        9.29
100YRCHI                2:10        8.02
100YRCHI                2:20        7.08
100YRCHI                2:30        6.35
100YRCHI                2:40        5.76
100YRCHI                2:50        5.28
100YRCHI                3:00        4.88

2YRCHI                  0:00        0
2YRCHI                  0:10        2.81
2YRCHI                  0:20        3.5
2YRCHI                  0:30        4.69
2YRCHI                  0:40        7.3
2YRCHI                  0:50        18.21
2YRCHI                  1:00        76.81
2YRCHI                  1:10        24.08
2YRCHI                  1:20        12.36
2YRCHI                  1:30        8.32
2YRCHI                  1:40        6.3
2YRCHI                  1:50        5.09
2YRCHI                  2:00        4.29
2YRCHI                  2:10        3.72
2YRCHI                  2:20        3.29
2YRCHI                  2:30        2.95
2YRCHI                  2:40        2.68
2YRCHI                  2:50        2.46
2YRCHI                  3:00        2.28

[REPORT]
```

```
;;Reporting Options
INPUT      YES
CONTROLS   NO
SUBCATCHMENTS ALL
NODES ALL
LINKS ALL

[TAGS]
Node       100             MN
Node       200A            MN
Node       101             MN
Node       102             MN
Node       103             MN
Node       200             MN
Node       201             MN
Node       202             MN
Node       203             MN
Node       204             MN
Node       205             MN
Node       C101A-1         MJ
Node       C101A-2         UG
Node       C103A-1         MJ
Node       C103A-2         UG
Node       C201A-1         MJ
Node       C201A-2         UG
Node       C201B-1         UG
Node       C201B-2         MJ
Node       C202A-1         MJ
Node       C202A-2         UG
Node       C203A-1         UG
Node       C203A-2         MJ
Node       C204A-1         MJ
Node       C204A-2         UG
Node       C205A-1         UG
Node       C205A-2         MJ
Link       C1              UG
Link       C2              UG
Link       C3              UG
Link       C4              UG
Link       C5              UG
Link       C6              UG
Link       C7              UG
Link       C8              UG
Link       W13             MJ
Link       W15             MJ
Link       W18             MJ
Link       W2              MJ
Link       W4              MJ
Link       W7              MJ
Link       W8              MJ
```

```
[MAP]
DIMENSIONS       350864.9038      5017129.2014     351047.5082      5017317.8426

UNITS            Meters

[COORDINATES]
;;Node           X-Coord            Y-Coord
;;-------------- ------------------ ------------------
100              350967.5           5017157
200A             351010.3           5017195
OF1              351003.114         5017198.139
OF2              350960.858         5017163.493
OF3              350898.527         5017176.264
OF4              351016.766         5017206.025
OF5              351012.832         5017263.934
OF6              350925.565         5017275.032
OF7              350873.204         5017210.828
101              350951.9           5017175
102              350936.3           5017209
103              350901.2           5017237
200              351002.3           5017197
201              350979             5017223
202              350953.8           5017251
203              350932.2           5017231
204              350984.6           5017278
205              351011.1           5017252
C101A-1          350945.66          5017185.11
C101A-2          350952.209         5017166.611
C103A-1          350913.424         5017234.617
C103A-2          350925.616         5017228.378
C201A-1          350994.327         5017208.034
C201A-2          350985.286         5017220.314
C201B-1          350996.037         5017195.7
C201B-2          350976.26          5017176.921
C202A-1          350972.648         5017230.938
C202A-2          350964.5           5017240.457
C203A-1          350932.348         5017229.458
C203A-2          350939.277         5017236.539
C204A-1          350985.149         5017275.132
C204A-2          350971.758         5017264.694
C205A-1          350980.245         5017226.877
C205A-2          350997.602         5017241.46
```

Appendix D Geotechnical Information

D.1 Geotechnical Investigation Report Excerpts

PATERSON GROUP

Geotechnical Investigation

Proposed Residential Development

Mapleton – Block 1
Ottawa, Ontario

Prepared for Richcraft

Report PG3062-2 dated April 7, 2025

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1.0 Introduction

Paterson Group (Paterson) was commissioned by Richcraft to conduct a geotechnical investigation for the proposed Mapleton - Block 1 residential development to be located along Maple Grove Road in the City of Ottawa (reference should be made to Figure 1 – Key Plan in Appendix 2 of this report for the general site location).

The objectives of the geotechnical investigation were to:

- Determine the subsoil and groundwater conditions at this site by means of boreholes.
- Provide geotechnical recommendations pertaining to the design of the proposed development including construction considerations which may affect the design.

This 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

Based on the available conceptual plan, it is understood that the proposed development will consist of two 3-storey residential buildings with one underground parking level each, six townhouse blocks with at-grade parking, and an accessory building.

Further, it is understood that the remainder of the site will generally be occupied by asphalt-paved access lanes and landscaped areas. It is also expected that the proposed development will be municipally serviced.

3.0 Method of Investigation

3.1 Field Investigation

Field Program

The field program for the current geotechnical investigation was carried out on March 21, 2025, and consisted of advancing a total of 6 boreholes to a maximum depth of 6.7 m below the existing ground surface. A previous geotechnical investigation by Paterson also included borehole BH 14 and test pit TP-8 within Block 1.

The test hole locations were determined in the field by Paterson personnel and distributed in a manner to provide general coverage of the subject site, taking into consideration existing site features and underground utilities. The test hole locations are presented on Drawing PG3062-9 – Test Hole Location Plan included in Appendix 2.

The boreholes were advanced with a low-clearance track-mounted drill rig operated by a two-person crew. All fieldwork was conducted under the full-time supervision of Paterson personnel under the direction of a senior engineer from the geotechnical division. The drilling procedure consisted of augering to the required depth at the selected location, sampling, and testing the overburden.

Sampling and In Situ Testing

Soil samples were recovered from the boreholes using a 50 mm diameter split-spoon sampler or from the auger flights. The split spoon, and auger samples were classified on site and placed in sealed plastic bags. All soil samples were transported to our laboratory for further review. The depths at which the split spoon, and auger samples were recovered from the boreholes are shown as SS, and AU, respectively, on the 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 in cohesive soils using a field vane apparatus in all boreholes.

The overburden thickness was evaluated by a dynamic cone penetration test (DCPT) at borehole BH 4-25, completed during the current field program. 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 often 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.

Subsurface conditions observed in the test holes were recorded in detail in the field. Reference should be made to the Soil Profile and Test Data sheets presented in Appendix 1 for specific details of the soil profile encountered at the test hole locations.

Groundwater

Boreholes BH 1-25, BH 2-25, BH 4-25 and BH 5-25 were fitted with a flexible polyethylene standpipe to allow groundwater level monitoring. The groundwater level readings were obtained after a suitable stabilization period subsequent to the completion of the field investigation.

The groundwater observations are discussed in Section 4.3 and presented in 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 1 month after the issuance of this report. They will then be discarded unless directed otherwise.

3.2 Field Survey

The borehole locations and ground surface elevation at each borehole location were surveyed by Paterson using a high-precision handheld GPS and referenced to a geodetic datum. The locations of the boreholes, and the ground surface elevation at each borehole location, are presented on Drawing PG3062-9 – Test Hole Location Plan 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 current boreholes, two samples were submitted for Atterberg Limits testing, one sample was submitted for grain size distribution testing and one sample was submitted for shrinkage testing.

The results of the Atterberg Limits testing, grain size distribution testing, and shrinkage testing are presented in Appendix 1 and are further discussed in Sections 4.2.

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 Section 6.7.

4.0 Observations

4.1 Surface Conditions

The subject site is currently occupied by site trailers along the western portion of the subject site, which were placed on a temporary granular pad facing Roger Griffith Avenue. The eastern part of the site is covered with several soil stockpiles.

The site is bordered by Roger Griffith Avenue to the west, Ploughshare Road to the south, an industrial building to the east, and Maple Grove Road to the north. The ground surface elevation across the subject site is currently relatively level at approximate geodetic elevation 97 m, although the older test holes indicate the site grade was previously around geodetic elevation 95 to 96 m.

4.2 Subsurface Profile

Generally, the subsurface profile encountered at the borehole locations consists of an approximate 1.7 to 2.2 m thickness of fill, which was generally observed to consist of compact, brown silty sand to silty clay. However, where the granular pad is present, the fill was observed to consist of granular crushed stone.

The fill was generally underlain by a loose to compact, brown sandy silt, turning grey with depth. A layer of firm, grey silty clay was encountered beneath the sandy silt layer at an approximate depth of 4.5 m below the existing ground surface.

A DCPT was conducted at borehole BH 4-25. Practical refusal to the DCPT was encountered at the borehole location at 15.8 m below ground surface.

Specific details of the soil profile at each test hole location are presented on the Soil Profile and Test Data sheets in Appendix 1.

Bedrock

Based on available geological mapping, the bedrock in the subject area is part of the Verulam formation, which consists of interbedded limestone and dolomite with an overburden drift thickness ranging between 5 to 15 m.

Atterberg Limits Testing

Atterberg limits testing was completed on the recovered silty clay samples at select borehole locations. The results of the Atterberg limits test are presented in Table 1 and on the Atterberg Limits Results sheet in Appendix 1.

Table 1 – Atterberg Limits Results

Sample	Depth (m)	LL (%)	PL (%)	PI (%)	Classification
BH 1-25 SS4	2.30	21	15	6	CL
BH 4-25 SS6	3.80	35	18	17	CL

Notes: LL: Liquid Limit; PL: Plastic Limit; PI: Plasticity Index.
CL: Inorganic Clay of Low Plasticity, CH: Inorganic Clays of High Plasticity

Grain Size Distribution and Hydrometer Testing

Grain size distribution analysis was completed on 1 selected recovered sandy silt deposit sample from the current investigation. The results of the grain size distribution analysis is presented in Table 2 and on the Grain Size Distribution sheets in Appendix 1.

Table 2 – Grain Size Distribution Results

Sample	Depth (m)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
BH 2-25 SS4	2.30	0.0	31.9	63.3	4.8

Shrinkage Testing

Linear shrinkage testing was completed on one sample recovered at a depth of 2.30 m from BH 5-25. The shrinkage limit and shrinkage ratio of the tested sandy silt sample were found to be 19.38% and 1.806, respectively. The results of the linear shrinkage testing are presented in Appendix 1.

4.3 Groundwater

Groundwater levels were recorded at each borehole location and are presented in Table 3 below. The groundwater level readings are also presented in the Soil Profile and Test Data sheets in Appendix 1.

Table 3 – Summary of Groundwater Levels

Borehole Number	Ground Surface Elevation (m)	Measured Groundwater Level		Date Recorded
		Depth (m)	Elevation (m)	
BH 1-25	97.24	2.84	94.40	March 31, 2025
BH 2-25	96.99	2.19	94.80	

Table 3 – Summary of Groundwater Levels

Borehole Number	Ground Surface Elevation (m)	Measured Groundwater Level		Date Recorded
		Depth (m)	Elevation (m)	
BH 4-25	97.40	2.87	94.53	
BH 5-25	97.10	Blocked	-	

Note: The ground surface elevation at each borehole location was surveyed using a handheld GPS using a geodetic datum.

It should be noted that surface water can become trapped within a backfilled borehole that can lead to higher than typical groundwater level observations. The long-term groundwater levels can also be estimated based on the observed colour and consistency of the recovered soil samples.

Based on these observations, the long-term groundwater table can be expected at a depth of approximately **2 to 3 m** below the existing ground surface.

However, groundwater levels are subject to seasonal fluctuations. Therefore, the groundwater levels could vary at the time of construction.

5.0 Discussion

5.1 Geotechnical Assessment

From a geotechnical perspective, the subject site is considered suitable for the proposed development. The proposed buildings are recommended to be founded on conventional spread footings placed on the undisturbed sandy silt, silt, and/or silty clay.

Due to the presence of the silty clay deposit, the subject site is subject to grade raise restrictions. The permissible grade raise recommendations are discussed in Section 5.3.

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

5.2 Grading and Preparation

Stripping Depth

Asphalt, topsoil, construction debris, and deleterious fill, such as those containing organic materials, should be removed from within the perimeters of the proposed buildings and from under paved areas, pipe bedding or other settlement sensitive structures.

Care should be taken not to disturb adequate bearing soils below the founding level during site preparation activities. Disturbance of the subgrade may result in having to sub-excavate the disturbed material and the placement of additional suitable fill material.

Fill Placement

Fill placed for grading beneath the proposed buildings should consist, unless otherwise specified, of clean imported granular fill such as Ontario Provincial Standard Specifications (OPSS) Granular A or Granular B Type II. The imported fill material should be tested and approved prior to delivery. The fill should be placed in maximum 300 mm thick loose lifts and compacted by suitable compaction equipment. Fill placed beneath the proposed building should be compacted to a minimum of 98% of the material's standard Proctor maximum dry density (SPMDD).

Non-specified site-excavated soil could be placed as general landscaping fill and beneath paved areas. In landscaped areas, these materials should be spread in lifts with a maximum thickness of 300 mm and compacted by the tracks of the spreading equipment to minimize voids. In areas to be paved, the site-excavated soils should be compacted to a minimum of 98% of the material's standard Proctor maximum dry density (SPMDD).

Vibration Considerations

Construction operations could cause vibrations, and possibly, sources of nuisance to the community. Therefore, means to reduce the vibration levels as much as possible should be incorporated in the construction operations to maintain a cooperative environment with the residents.

The following construction equipment could be the source of vibrations: hoe ram, compactor, dozer, crane, truck traffic, etc. Vibrations, whether caused by blasting operations or by construction operations, could be the source of detrimental vibrations on the nearby buildings and structures. Therefore, all vibrations are recommended to be limited.

Two parameters are used to determine the permissible vibrations, namely, the maximum peak particle velocity and the frequency. For low frequency vibrations, the maximum allowable peak particle velocity is less than that for high frequency vibrations. As a guideline for construction activities, the peak particle velocity should be less than 19 mm/s between frequencies of 4 to 15 Hz, and 50 mm/s above a frequency of 40 Hz (interpolate between 15 and 40 Hz).

5.3 Foundation Design

Conventional Spread Footings

Footings placed on the undisturbed sandy silt, silt, or silty clay can be designed using a bearing resistance value at serviceability limit states (SLS) of **100 kPa** and a factored bearing resistance value at ultimate limit states (ULS) of **150 kPa**. A geotechnical resistance factor of 0.5 was applied to the bearing resistance value at ULS.

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, in the dry, prior to the placement of concrete for footings.

Footings designed using the bearing resistance values at SLS given above will be subjected to potential post construction total and differential settlements of 25 and 20 mm, respectively.

Permissible Grade Raise Recommendations

Due to the presence of the silty clay deposit, a permissible grade raise restriction of **2.0 m** above the **original site grade** is recommended for grading at 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.

Lateral Support

The bearing medium under footing- and raft-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 the in-situ bearing medium soils 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.

5.4 Design for Earthquakes

The seismic site designation is **Class X_D** as referenced the Ontario Building Code (OBC) 2024. The soils underlying the subject site are not susceptible to liquefaction. Reference should be made to the latest revision of the Ontario Building Code (OBC) 2024 for a full discussion of the earthquake design requirements.

5.5 Basement Slab

With the removal of all topsoil and deleterious materials within the footprint of the proposed building, a compact fill or native soil subgrade, approved by Paterson, is considered an acceptable subgrade surface on which to commence backfilling for the floor slab construction.

For the buildings with underground parking, the recommended pavement structure noted in Section 5.8 will be applicable. Further, it is recommended underslab drainage be provided for the proposed buildings with underground parking. This is discussed further in Section 6.1.

For the townhouses, the upper 200 mm of sub-slab fill is recommended to consist of 19 mm clear crushed stone.

For the accessory building, which is anticipated to have a slab-on-grade, it is recommended that the sub-slab fill consist of a 200 mm thickness of OPSS Granular A.

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 total earth pressure (P_{AE}) includes the static earth pressure component (P_o) and the seismic component (ΔP_{AE}).

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 = $(1.45-a_{max}/g)\ a_{max}$
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 area of the subject site, is 0.353 g according to the OBC 2024. 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 pressures calculated are unfactored. For the ULS case, the earth loads should be factored as live loads, as per the OBC 2024.

5.7 Pavement Design

Flexible Pavement Structure for Surface Parking

For design purposes, the following pavement structures, presented below, are recommended for the design of car only parking areas, access lanes, and heavy truck parking areas at the subject site.

Table 4 – 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 in situ soil, fill or OPSS Granular B Type I or II material placed over in situ soil.	

Table 5 – Recommended Pavement Structure - Access Lanes and Heavy Truck Parking Areas	
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 in situ soil, fill or OPSS Granular B Type I or II material placed over in situ soil.	

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 II material.

The pavement granular (base and subbase) should be placed in maximum 300 mm thick lifts and compacted to a minimum of 99% of the material's SPMDD using suitable compaction equipment.

Rigid Pavement Structure for Underground Parking

For design purposes, it is recommended that the rigid pavement structure for the underground parking consist of Category C2, 32 MPa concrete at 28 days with air entrainment of 5 to 8%. The recommended rigid pavement structure is presented below in Table 6.

Table 6 – Recommended Rigid Pavement Structure – Lower Parking Level	
Thickness (mm)	**Material Description**
125	**Exposure Class C2 - 32 MPa Concrete** (5 to 8% Air Entrainment)
300	**Base** – OPSS Granular A Crushed Stone
SUBGRADE - Either in situ soil, fill or OPSS Granular B Type I or II material placed over in situ soil.	

To control cracking due to shrinking of the concrete floor slab, it is recommended that strategically located saw cuts be used to create control joints within the concrete floor slab of the lower underground parking level.

The control joints are generally recommended to be located at the center of the column lines and spaced at approximately 24 to 36 times the slab thickness (for example; a 0.15 m thick slab should have control joints spaced between 3.6 and 5.4 m). The joints should be cut between 25 and 30% of the thickness of the concrete floor slab and completed as early as 4 hours after the concrete has been poured during warm temperatures, and up to 12 hours during cooler temperatures.

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 structures. The system should consist of a 100 mm diameter perforated and corrugated plastic pipe, surrounded on all sides by 150 mm of 19 mm clear crushed stone, and which is placed at the footing level around the exterior perimeter of the structure. The clear crushed stone should be wrapped in a non-woven geotextile. The pipe should have a positive outlet, such as a gravity connection to the storm sewer or sump pump pit.

Underslab Drainage

For the 3-storey apartment buildings with underground parking, underslab drainage will be required to control water infiltration. For design purposes, we recommend that 100 mm diameter perforated pipes be placed at 6 m centers below the lowest level floor slab. The spacing of the underfloor 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 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 of Footings Against Frost Action

Perimeter footings of heated structures are required to be insulated against the deleterious effects of frost action. A minimum 1.5 m thick soil cover alone, or a combination of soil cover in conjunction with foundation insulation, should be provided in this regard.

Other exterior unheated footings (such as those for isolated exterior piers, or underground parking garage access ramp footings) or footings adjacent to garage

bay doors which may be open to exterior conditions for extended periods of time (such as the entrance to the underground parking garage), are more prone to deleterious movement associated with frost action than the exterior walls of the proper structure. These footings should be provided with a minimum 2.1 m thick soil cover, or an equivalent combination of soil cover and foundation insulation.

6.3 Excavation Side Slopes

The temporary excavation side slopes anticipated should either be excavated to acceptable slopes or retained by shoring systems from the beginning of the excavation until the structure is backfilled. It is anticipated that sufficient space will be available from property lines such that the excavations can be sloped.

The excavation side slopes above the groundwater level extending to a maximum depth of 3 m should be cut back at 1H:1V or flatter. The flatter slope is required for excavation below groundwater level.

The subsurface soil is considered to be mainly 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 maintain a safe working distance 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 and standard detail drawings from the department of public works and services, infrastructure services branch of the City of Ottawa.

A minimum of 150 mm of OPSS Granular A should be placed for bedding for sewer or water pipes when placed on a soil subgrade. The bedding should extend to the spring line of the pipe. Cover material, from the spring line to a minimum of 300 mm

above the obvert of the pipe, should consist of OPSS Granular A or Granular B Type II with a maximum size of 25 mm. The bedding layer should be increased to a minimum thickness of 300 mm where the subgrade consists of grey silty clay. The bedding and cover materials should be placed in maximum 300 mm thick lifts and compacted to 98% of the SPMDD.

It should generally be possible to re-use the moist (not wet) site-generated fill above the cover material if the excavation and filling operations are carried out in dry weather conditions. All cobbles larger than 200 mm in their longest direction should be segregated from re-use as trench backfill.

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 maximum 300 mm thick loose lifts and compacted to a minimum of 95% of the material's SPMDD. All cobbles larger than 200 mm in their longest direction should be segregated from re-use as trench backfill.

To reduce long-term lowering of the groundwater level, clay seals should be provided in the service trenches. The seals should be a minimum of 1.5 m long (in the trench direction) and should extend from trench wall to trench wall. The seals should extend from the frost line and fully penetrate the bedding, subbedding and cover material. The barriers should consist of relatively dry impervious material placed in maximum 225 mm thick loose lifts and compacted to a minimum of 95% of the SPMDD. The clay seals should be placed at the site boundaries and at strategic locations at a maximum of 60 m intervals in the service trenches.

6.5 Groundwater Control

Groundwater Control for Building Construction

Based on our observations, it is anticipated that groundwater infiltration into the excavations should be low to moderate and controllable using open sumps.

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

Permit to Take Water

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 Persons 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.

Impacts on Neighboring Properties

The excavation for the proposed buildings is not expected to extend significantly below the groundwater level. Therefore, impacts to adjacent properties are not expected as a result of minor, localized dewatering which may occur at this site.

6.6 Winter Construction

Precautions must be taken if winter construction is considered for this project.

The subsoil conditions at this site 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.

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 and 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.

Trench excavations and pavement construction are also difficult activities to complete during freezing conditions without introducing frost in the subgrade or in the excavation walls and bottoms. Precautions should be taken if such activities are to be carried out during freezing conditions. Additional information could be provided, if required.

Precaution must be taken where excavations are carried in proximity of existing structures which may be adversely affected due to the freezing conditions. In particular, it should be recognized that where a shoring system is used, the soil behind the shoring system will be subjected to freezing conditions and could result in heaving of the structure(s) placed within or above frozen soil. Provisions should be made in the contract document to protect the walls of the excavations from freezing, if applicable.

6.7 Corrosion Potential and Sulphate

The results of analytical testing show that the sulphate content is less than 0.1%. This result is indicative that Type 10 Portland cement (GU – General Use cement) would be appropriate for this site. The chloride content and pH of the sample indicate that they are not a significant factor in creating a corrosive environment for exposed ferrous metals at this site, whereas the resistivity is indicative of low to slightly aggressive corrosive environment.

6.8 Tree Planting Restrictions

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. Based on the results of our review, a low to medium sensitivity soil was encountered, and the modified plasticity index does not exceed 40%. Therefore, the following tree planting setbacks are recommended for the low to medium sensitivity area as per City Guidelines.

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 height up to 7.5 m) and medium size trees (mature height 7.5 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. This footing level 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.

- A small tree must be provided with a minimum 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 height up to 7.5 m) to medium size (mature 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) to provide ductility.

- ❒ Grading surrounding the tree must promote drainage to the tree root zone (in such a manner as not to be detrimental to the tree).

6.9 Corrosion Potential and Sulphate

The analytical test results of the soil sample indicate that the sulphate content is less than 0.1%. These results along with the chloride and pH value are indicative that Type 10 Portland cement (Type GU) would be appropriate for this site. The chloride content and the pH of the sample indicate they are not significant factors in creating a corrosive environment for exposed ferrous metals at this site, whereas the resistivity is indicative of a moderately corrosive environment.

7.0 Recommendations

It is recommended that the following be carried out by Paterson once preliminary and/or detailed designs of the proposed development have been prepared:

- ❑ Review detailed grading, servicing, landscaping, and structural plan(s) from a geotechnical perspective.

In addition, it is a requirement for the foundation design data provided herein to be applicable that a material testing and observation program be performed by the geotechnical consultant. The following aspects of the program should be performed by Paterson:

- ❑ Review and inspection of the installation of the foundation drainage systems.
- ❑ 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 materials testing and observation program by the geotechnical consultant.

All excess soils, with the exception of engineered crushed stone fill, generated by construction activities that will be transported on-site or off-site should be handled ***Ontario Regulation 406/19: On-Site and Excess Soil Management*.**

8.0 Statement of Limitations

The recommendations provided in this report are in accordance with the present understanding of the project. Paterson requests permission to review the recommendations when the drawings and specifications are completed.

A soils investigation is a limited sampling of a site. Should any conditions at the site be encountered which differ from those at the test locations, Paterson requests 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 the 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, or their agents, is not authorized without review by Paterson for the applicability of our recommendations to the alternative use of the report.

Paterson Group Inc.



Puneet Bandi, M.Eng.





Scott. S. Dennis, P.Eng.

Report Distribution:

- ❑ Richcraft Homes (Email Copy)
- ❑ Paterson Group (1 Copy)

APPENDIX 1

SOIL PROFILE AND TEST DATA SHEETS

SYMBOLS AND TERMS

ATTERBERG LIMIT TESTING RESULTS

GRAIN SIZE TESTING RESULTS

ANALYTICAL TESTING RESULTS

SOIL PROFILE AND TEST DATA

Geotechnical Investigation

Mapleton - Block 1, Ottawa, ON

COORD. SYS.: MTM Zone 9 **EASTING:** 351006.65 **NORTHING:** 5017215.98 **ELEVATION:** 97.24

PROJECT: Proposed Residential Development

ADVANCED BY: CME-55 Low Clearance Drill

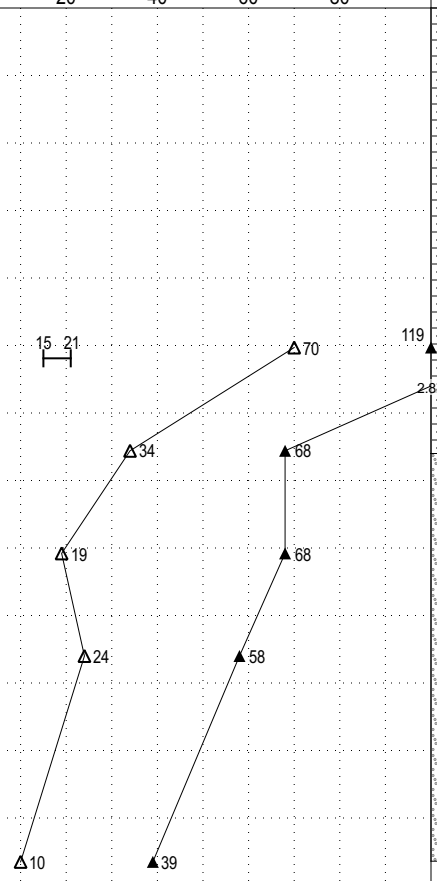
REMARKS:

DATE: March 21, 2025

FILE NO. : PG3062

HOLE NO. : BH 1-25

SAMPLE DESCRIPTION	STRATA PLOT	DEPTH (m)	SAMPLE TYPE AND NO.	SAMPLE RECOVERY (%)	SAMPLE N OR RQD	WATER CONTENT (%)	PEN. RESIST. (BLOWS/0.3m) DCPT (50mm DIA. CONE) 20 40 60 80	REMOULDED SHEAR STRENGTH (kPa) / UNDRAINED SHEAR STRENGTH (kPa) 20 40 60 80	PL (%) WATER CONTENT (%) LL (%) 20 40 60 80	PIEZOMETER CONSTRUCTION	ELEVATION (m)
GROUND SURFACE											97.24
FILL: Compact, course granular, crushed stone 0.10m [97.14m]		0	AU 1								97
FILL: Compact, brown silty fine sand, some gravel 0.69m [96.55m]											
FILL: Compact, brown sandy slit, trace clay and gravel 1.68m [95.56m]		1	SS 2	50	6-5-11-9 16						96
Very stiff brown **SILTY CLAY** trace gravel 2.21m [95.03m]		2	SS 3	67	2-3-3-4 6						95
Compact, brown **SILT**, some clay, trace sand - Clay content increasing with depth 4.50m [92.74m]		3	SS 4	71	P						94
		4	SS 5	75	P						93
			SS 6	83	P						
Compact, grey **SANDY SILT** 5.31m [91.93m]		5	SS 7	67	P						92
Firm, grey **SILTY CLAY** 6.71m [90.53m]		6	SS 8	100	P						91
			SS 9	100	P						
End of Borehole (GWL at 2.84 m depth - March 31, 2025)		7									90
		8									89
		9									88
		10									



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation

Mapleton - Block 1, Ottawa, ON

COORD. SYS.: MTM Zone 9 **EASTING:** 350949.57 **NORTHING:** 5017222.10 **ELEVATION:** 96.98

PROJECT: Proposed Residential Development

ADVANCED BY: CME-55 Low Clearance Drill

REMARKS:

DATE: March 21, 2025

FILE NO. : PG3062

HOLE NO. : BH 2-25

SAMPLE DESCRIPTION	STRATA PLOT	DEPTH (m)	SAMPLE TYPE AND NO.	SAMPLE RECOVERY (%)	SAMPLE N OR RQD	SAMPLE WATER CONTENT (%)	PEN. RESIST. (BLOWS/0.3m) DCPT (50mm DIA. CONE) 20 40 60 80 / REMOULDED SHEAR STRENGTH (kPa) / UNDRAINED SHEAR STRENGTH (kPa) 20 40 60 80 / PL (%) WATER CONTENT (%) LL (%) 20 40 60 80	PIEZOMETER CONSTRUCTION	ELEVATION (m)
GROUND SURFACE									
FILL: Compact, brown silty clay, trace gravel, crushed stone			AU 1						
0.69m [96.30m]									
FILL: Compact, brown silty fine sand, trace gravel and clay		1	SS 2	85	4-15-50-50 65/0.08				96
1.02m [95.97m]									
FILL: weather shale			SS 3	42	31-50-/-/ 50/0.28				
1.83m [95.16m]									
Compact, brown **SANDY SILT**, trace clay and sand		2	SS 4	79	3-2-2-5 4				95
		3	SS 5	83	2-2-2-2 4				94
- Grey by 3.81 m depth		4	SS 6	83	2-2-2-2 4				93
4.50m [92.48m]									
Firm, grey **SILTY CLAY**		5	SS 7	92	1-2-1-1 3				92
		6	SS 8	100	P		▲34 △5 ▲34		91
6.55m [90.44m]									
End of Borehole		7							90
(GWL at 2.19 m depth - March 31, 2025)		8							89
		9							88
		10							87

2.19 m 2025-03-31

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation

Mapleton - Block 1, Ottawa, ON

COORD. SYS.: MTM Zone 9 **EASTING:** 350897.73 **NORTHING:** 5017214.37 **ELEVATION:** 97.21

PROJECT: Proposed Residential Development

ADVANCED BY: CME-55 Low Clearance Drill

REMARKS:

DATE: March 21, 2025

FILE NO. : PG3062

HOLE NO. : BH 3-25

SAMPLE DESCRIPTION	STRATA PLOT	DEPTH (m)	SAMPLE TYPE AND NO.	SAMPLE RECOVERY (%)	SAMPLE N OR RQD	SAMPLE WATER CONTENT (%)	PEN. RESIST. (BLOWS/0.3m) DCPT (50mm DIA. CONE) 20 40 60 80	REMOULDED SHEAR STRENGTH (kPa) ▲ UNDRAINED SHEAR STRENGTH (kPa) 20 40 60 80	PL (%) WATER CONTENT (%) LL (%) 20 40 60 80	PIEZOMETER CONSTRUCTION	ELEVATION (m)
GROUND SURFACE											
FILL: Compacted granular, crushed stone 0.05m [97.16m]											97
FILL: Compact, brown silty sand with gravel, crushed stone 0.71m [96.50m]			AU 1								96
End of Borehole		1									95
Practical refusal to augering at 0.71 m depth		2									94
		3									93
		4									92
		5									91
		6									90
		7									89
		8									88
		9									
		10									

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation

Mapleton - Block 1, Ottawa, ON

COORD. SYS.: MTM Zone 9 **EASTING:** 350897.73 **NORTHING:** 5017214.37 **ELEVATION:** 97.21

PROJECT: Proposed Residential Development

ADVANCED BY: CME-55 Low Clearance Drill

REMARKS:

DATE: March 21, 2025

FILE NO. : PG3062

HOLE NO. : BH 3A-25

SAMPLE DESCRIPTION	STRATA PLOT	DEPTH (m)	SAMPLE TYPE AND NO.	SAMPLE RECOVERY (%)	SAMPLE N OR RQD	SAMPLE WATER CONTENT (%)	PEN. RESIST. (BLOWS/0.3m) DCPT (50mm DIA. CONE) 20 40 60 80	REMOULDED SHEAR STRENGTH (kPa) ▲ UNDRAINED SHEAR STRENGTH (kPa) 20 40 60 80	PL (%) WATER CONTENT (%) LL (%) 20 40 60 80	PIEZOMETER CONSTRUCTION	ELEVATION (m)
GROUND SURFACE											
FILL: Compacted granular, crushed stone 0.05m [97.16m]											97
FILL: Compact, brown silty sand with gravel, crushed stone, trace clay 0.89m [96.32m]		1	AU 1 SS 2	78	50-/-/-/ 50/0.13						96
End of Borehole Practical refusal to augering at 0.89 m depth		2									95
		3									94
		4									93
		5									92
		6									91
		7									90
		8									89
		9									88
		10									

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation

Mapleton - Block 1, Ottawa, ON

COORD. SYS.: MTM Zone 9 **EASTING:** 350934.73 **NORTHING:** 5017162.09 **ELEVATION:** 97.40

PROJECT: Proposed Residential Development

ADVANCED BY: CME-55 Low Clearance Drill

REMARKS:

DATE: March 21, 2025

FILE NO. : PG3062

HOLE NO. : BH 4-25

SAMPLE DESCRIPTION	STRATA PLOT	DEPTH (m)	SAMPLE TYPE AND NO.	SAMPLE RECOVERY (%)	SAMPLE N OR RQD	WATER CONTENT (%)	PEN. RESIST. (BLOWS/0.3m) DCPT (50mm DIA. CONE) 20 40 60 80 / REMOULDED SHEAR STRENGTH (kPa) / UNDRAINED SHEAR STRENGTH (kPa) 20 40 60 80 / PL (%) WATER CONTENT (%) LL (%) 20 40 60 80	PIEZOMETER CONSTRUCTION	ELEVATION (m)
GROUND SURFACE									97
FILL: Compact granular, crushed stone			AU 1						
0.08m [97.32m]									
FILL: Firm, brown silty clay with gravel, crushed stone									
0.69m [96.71m]									
Compact, brown **SANDY SILT**, trace clay and sand		1	SS 2		3-4-6-5 10				96
		2	SS 3	75	4-5-4-4 9				95
			SS 4	75	1-1-1-1 2				
		3	SS 5	75	1-1-4-3 5				94
3.51m [93.89m]									
Compact, brown **SILTY SAND**									93
3.73m [93.67m]		4	SS 6	100	1-1-1-1 2		18 35 / △5 ▲36 ▲27 △10 ▲39		
Firm, grey **SILTY CLAY**		5							92
		6							91
6.55m [90.85m]									
Dynamic Cone Penetration Test commenced at 6.55 m depth		7							90
		8							89
		9							88
		10							

2.87 m 2025-03-31

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation

Mapleton - Block 1, Ottawa, ON

COORD. SYS.: MTM Zone 9 **EASTING:** 350934.73 **NORTHING:** 5017162.09 **ELEVATION:** 97.40

PROJECT: Proposed Residential Development

ADVANCED BY: CME-55 Low Clearance Drill

REMARKS:

DATE: March 21, 2025

FILE NO. : PG3062

HOLE NO. : BH 4-25

SAMPLE DESCRIPTION	STRATA PLOT	DEPTH (m)	SAMPLE: TYPE AND NO.	SAMPLE: RECOVERY (%)	SAMPLE: N OR RQD	SAMPLE: WATER CONTENT (%)	PEN. RESIST. (BLOWS/0.3m) DCPT (50mm DIA. CONE) 20 40 60 80	REMOULDED SHEAR STRENGTH (kPa) / UNDRAINED SHEAR STRENGTH (kPa) 20 40 60 80	PL (%) WATER CONTENT (%) LL (%) 20 40 60 80	PIEZOMETER CONSTRUCTION	ELEVATION (m)
15.80m [81.60m]		10									87
End of Borehole		11									86
Cone pushed form 6.55 to 14.02 m depth		12									85
Practical refusal to DCPT at 15.8 m depth		13									84
(GWL at 2.87 m depth - March 31, 2025)		14					47				83
							44				
		15					56				82
							60				
		16					66				81
							100				
		17									80
		18									79
		19									78
		20									

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation

Mapleton - Block 1, Ottawa, ON

COORD. SYS.: MTM Zone 9 **EASTING:** 350888.40 **NORTHING:** 5017218.34 **ELEVATION:** 97.10

PROJECT: Proposed Residential Development

ADVANCED BY: CME-55 Low Clearance Drill

REMARKS:

DATE: March 21, 2025

FILE NO. : **PG3062**

HOLE NO. : **BH 5-25**

SAMPLE DESCRIPTION	STRATA PLOT	DEPTH (m)	SAMPLE TYPE AND NO.	SAMPLE RECOVERY (%)	SAMPLE N OR RQD	WATER CONTENT (%)	PEN. RESIST. (BLOWS/0.3m) DCPT (50mm DIA. CONE) 20 40 60 80 / REMOULDED SHEAR STRENGTH (kPa) △ / UNDRAINED SHEAR STRENGTH (kPa) ▲ 20 40 60 80 / PL (%) WATER CONTENT (%) LL (%) 20 40 60 80	PIEZOMETER CONSTRUCTION	ELEVATION (m)
GROUND SURFACE									97
FILL: Compact granular, crushed stone 0.05m [97.05m]			AU 1						
FILL: Compact, brown silty sand with gravel, crushed stone, weatherd shale, trace clay		1	SS 2	100	19-50-/-/ 50/0.13				96
2.21m [94.89m]		2	SS 3	4	5-6-5-6 11				95
Compact, brown **SANDY SILT**, trace clay and sand			SS 4	67	2-2-1-1 3				94
3.43m [93.67m]		3	SS 5	79	1-1-2-3 3				
Compact, brown **SANDY SILT** 3.73m [93.37m]									93
Firm, grey **SILTY CLAY**		4	SS 6	100	P		△5 ▲34 ▲34 △5 ▲39		92
6.55m [90.55m]		5							91
End of Borehole		6							90
		7							89
		8							88
		9							
		10							

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JOHN D. PATERSON & ASSOCIATES LTD.
Consulting Engineers
28 Concourse Gate, Nepean, Ont. K2E 7T7

SOIL PROFILE & TEST DATA

Preliminary Geotechnical Investigation
Proposed Development, Hazeldean Road
Ottawa (Kanata), Ontario

DATUM Ground surface elevations provided by Novatech Engineering Consultants Limited.

FILE NO. G8886

REMARKS

HOLE NO. TP 8

BORINGS BY Hydraulic Excavator DATE 27 MAR 03

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						0	95.24		
TOPSOIL 0.23									
Compact, brown SANDY SILT		G	1			1	94.24		
2.59						2	93.24		
Soft to firm, grey SILTY CLAY						3	92.24		
3.66									
End of Test Pit									
(Open hole GWL @ 3.7m depth)									

Water Content % scale: 20 40 60 80

Shear Strength (kPa) scale: 20 40 60 80 100

▲ Undisturbed △ Remoulded

patersongroup

Consulting Engineers

154 Colonnade Road, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Supplemental Geotechnical Investigation
Proposed Kanata West Subdivision
Ottawa (Kanata), Ontario

DATUM Geodetic

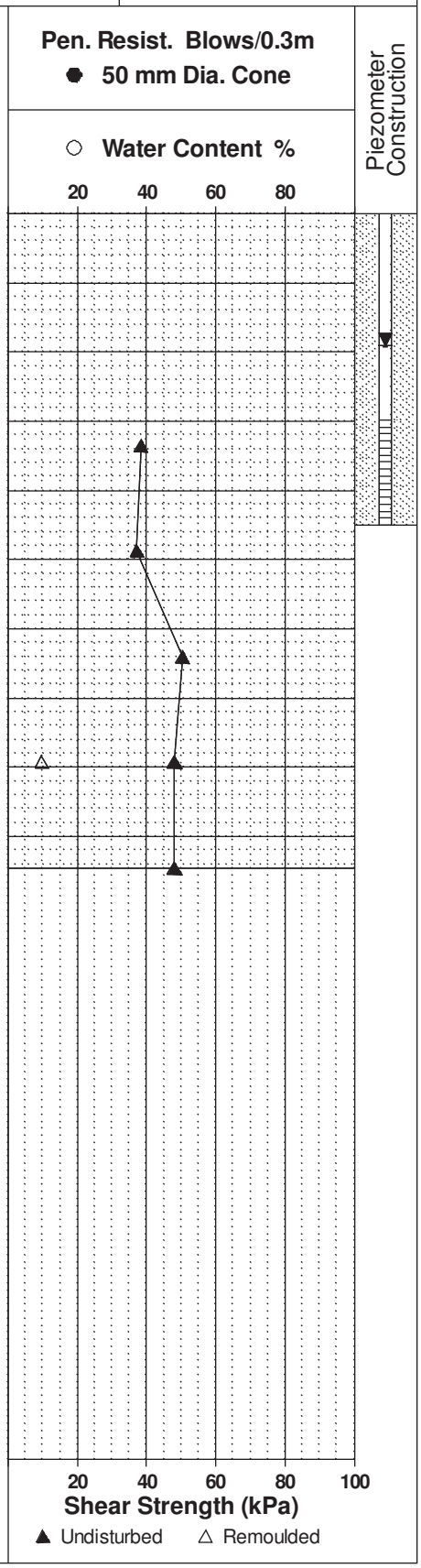
FILE NO. G9012

REMARKS

HOLE NO. BH14

BORINGS BY CME 75 Power Auger **DATE** Aug 6, 03

SOIL DESCRIPTION		STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE							0	95.24
TOPSOIL	0.15							
Loose, brown **SILTY** fine **SAND**			SS	30	96	6	1	94.24
	1.45							
Very loose, greyish brown **SANDY SILT** with clay	2.13		SS	31	100	2	2	93.24
Firm, brown **SILTY CLAY**							3	92.24
- grey by 3.0m depth							4	91.24
							5	90.24
							6	89.24
							7	88.24
							8	87.24
							9	86.24
	9.45							
End of Borehole								
(GWL @ 1.90m-Aug. 18/03)								



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 relative strength of cohesionless soils is the compactness condition, 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. An SPT N value of "P" denotes that the split-spoon sampler was pushed 300 mm into the soil without the use of a falling hammer.

Compactness Condition	'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 shear vane tests, unconfined compression tests, or occasionally by the Standard Penetration Test (SPT). Note that the typical correlations of undrained shear strength to SPT N value (tabulated below) tend to underestimate the consistency for sensitive silty clays, so Paterson reviews the applicable split spoon samples in the laboratory to provide a more representative consistency value based on tactile examination.

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, S_t, is the ratio between the undisturbed undrained shear strength and the remoulded undrained shear strength of the soil. The classes of sensitivity may be defined as follows:

Low Sensitivity:	$S_t < 2$
Medium Sensitivity:	$2 < S_t < 4$
Sensitive:	$4 < S_t < 8$
Extra Sensitive:	$8 < S_t < 16$
Quick Clay:	$S_t > 16$

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 NQ or larger size core. However, it can be used on smaller core sizes, such as BQ, 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, generally recovered using a piston sampler
G	-	"Grab" sample from test pit or surface materials
AU	-	Auger sample or bulk sample
WS	-	Wash sample
RC	-	Rock core sample (Core bit size BQ, NQ, HQ, etc.). Rock core samples are obtained with the use of standard diamond drilling bits.

SYMBOLS AND TERMS (continued)

PLASTICITY LIMITS AND GRAIN SIZE DISTRIBUTION

WC%	-	Natural water 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 at 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

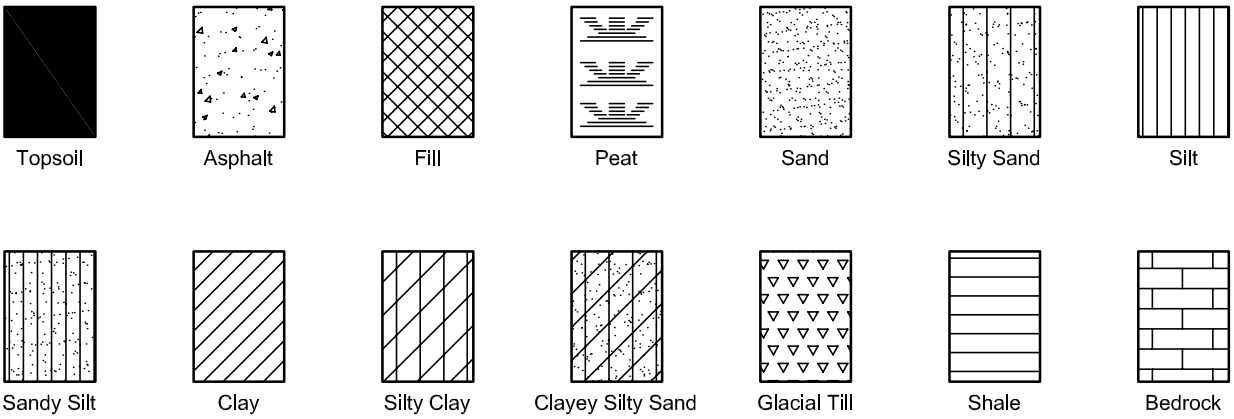
p'_o	-	Present effective overburden pressure at sample depth
p'_c	-	Preconsolidation pressure of (maximum past pressure on) sample
Ccr	-	Recompression index (in effect at pressures below p'_c)
Cc	-	Compression index (in effect at pressures above p'_c)
OC Ratio		Overconsolidaton ratio = p'_c / p'_o
Void 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.

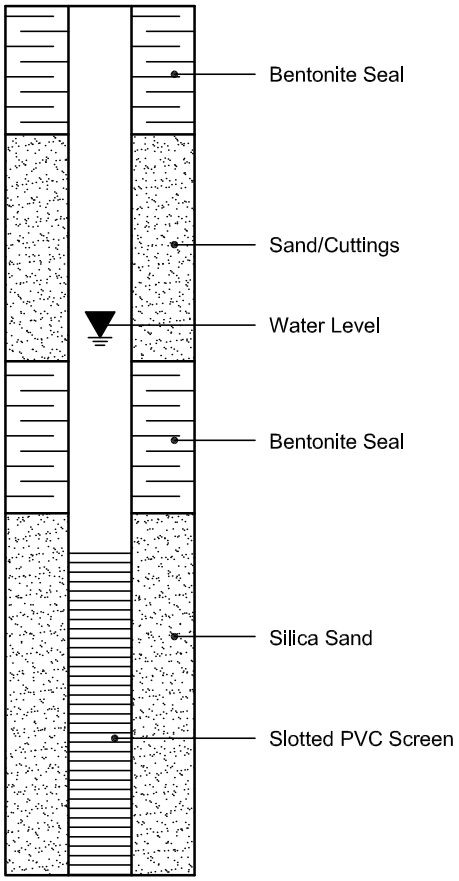
SYMBOLS AND TERMS (continued)

STRATA PLOT

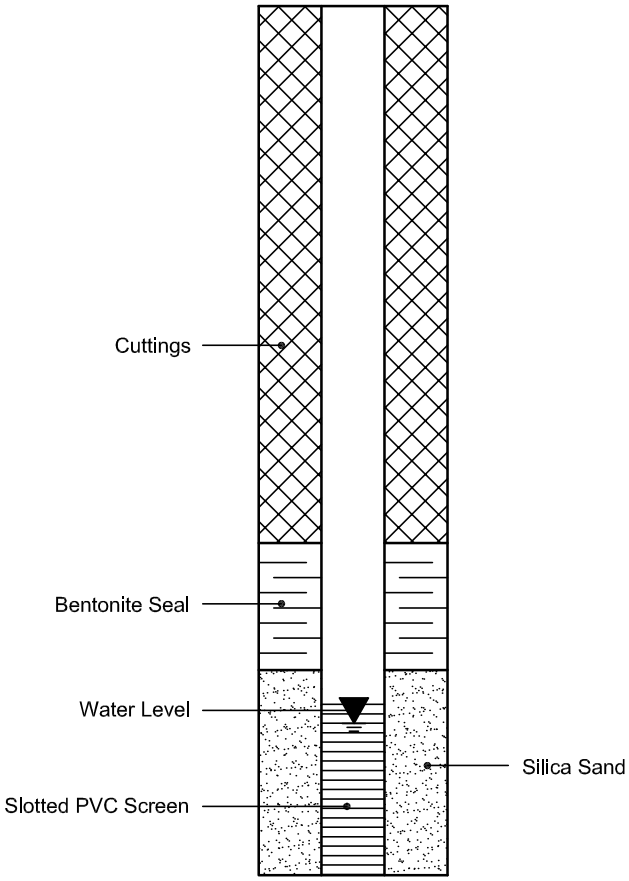


MONITORING WELL AND PIEZOMETER CONSTRUCTION

MONITORING WELL CONSTRUCTION



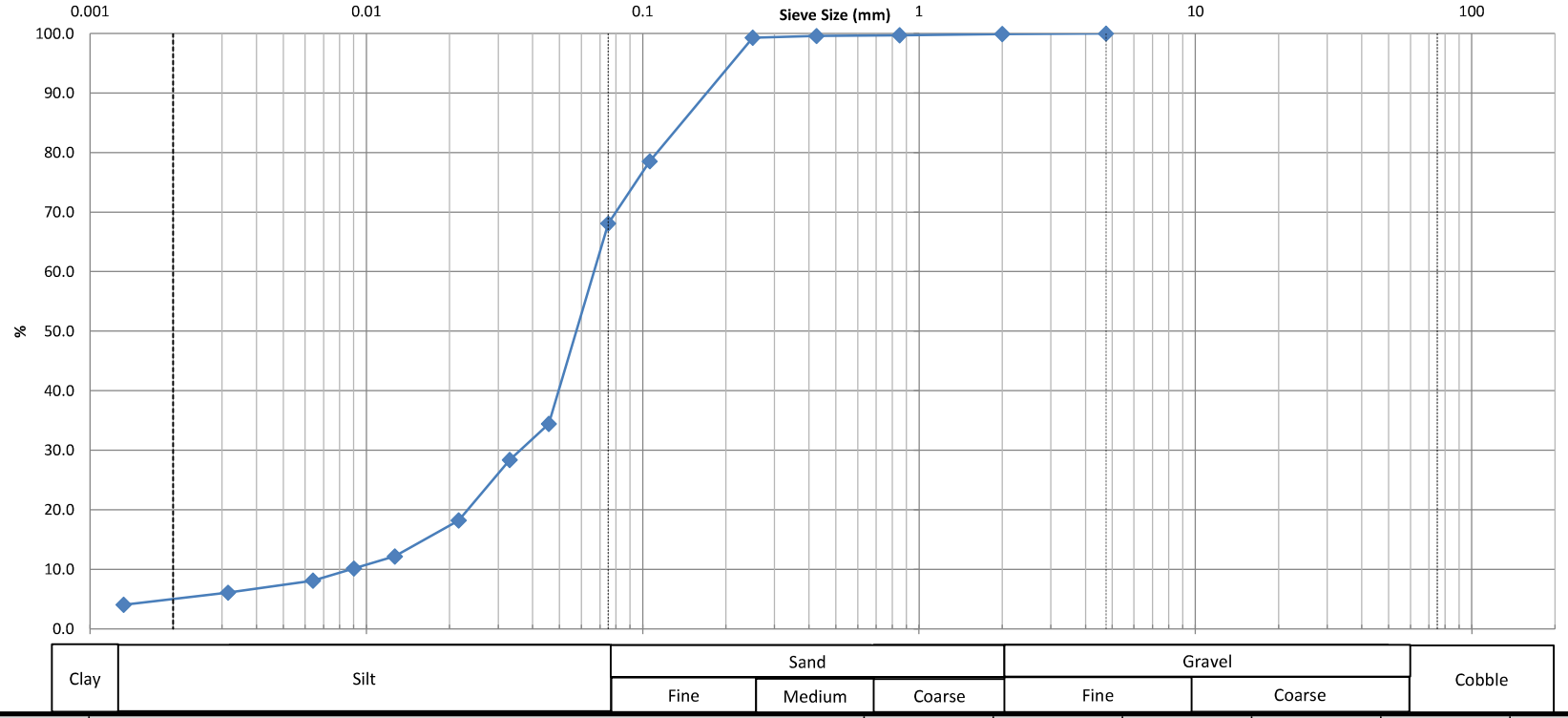
PIEZOMETER CONSTRUCTION



PATERSON GROUP

SIEVE ANALYSIS
ASTM C136

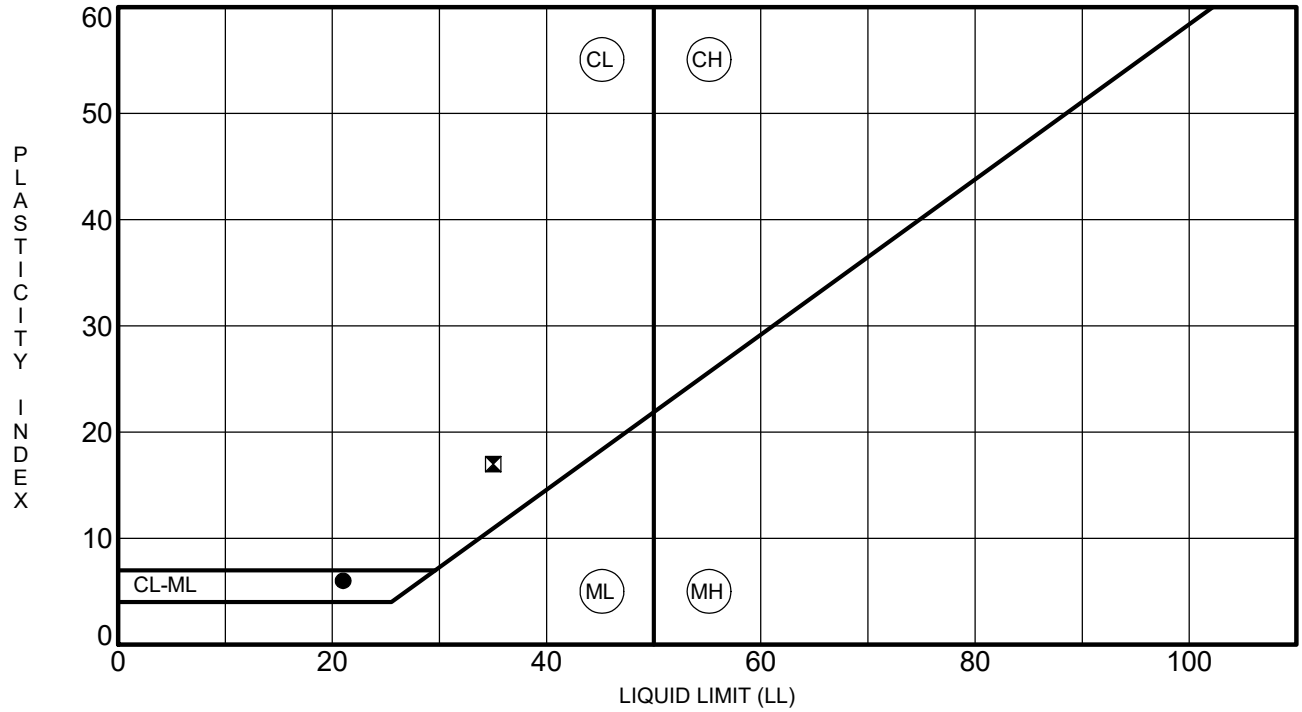
CLIENT:	Richcraft	DEPTH:	BH2-25 SS4	FILE NO:	PG3062
CONTRACT NO.:		BH OR TP No.:	2.3m - 2.9m	LAB NO:	59116
PROJECT:	Maple Grove			DATE RECEIVED:	24-Mar-25
				DATE TESTED:	24-Mar-25
DATE SAMPLED:	21-Mar-25			DATE REPORTED:	31-Mar-25
SAMPLED BY:	M.R.			TESTED BY:	D.K



Identification	Soil Classification					MC(%)	LL	PL	PI	Cc	Cu
						23.3%					
	D100	D60	D30	D10	Gravel (%)	Sand (%)		Silt (%)		Clay (%)	
					0.0	31.9		63.3		4.8	

Comments:

REVIEWED BY:	Curtis Beadow	Joe Forsyth, P. Eng.



Specimen Identification		LL	PL	PI	Fines	Classification
● BH 1-25	SS4	21	15	6		CL-ML Inorganic silts-clays of low plasticity
⊠ BH 4-25	SS6	35	18	17		CL Inorganic clays of low plasticity

CLIENT **Richcraft Group of Companies**

PROJECT **Geotechnical Investigation - Mapleton - Block 1, Ottawa, Ontario**

FILE NO. **PG3062**

DATE **31 Mar 25**

PATERSON GROUP
9 Auriga Drive
Ottawa, Ontario
K2E 7T9
TEL: (613) 226-7381

ATTERBERG LIMITS' RESULTS

PARACEL LABORATORIES LTD.

Order #: 2513087

Certificate of Analysis

Report Date: 27-Mar-2025

Client: Paterson Group Consulting Engineers (Ottawa)

Order Date: 24-Mar-2025

Client PO: 62672

Project Description: PG3062

	Client ID:	PG3062-BH2-25-SS 4	-	-	-		
	Sample Date:	21-Mar-25 09:00	-	-	-	-	-
	Sample ID:	2513087-01	-	-	-		
	Matrix:	Soil	-	-	-		
	MDL/Units						
Physical Characteristics							
% Solids	0.1 % by Wt.	80.0	-	-	-	-	-
General Inorganics							
pH	0.05 pH Units	7.19	-	-	-	-	-
Resistivity	0.1 Ohm.m	55.7	-	-	-	-	-
Anions							
Chloride	10 ug/g	11	-	-	-	-	-
Sulphate	10 ug/g	42	-	-	-	-	-

APPENDIX 2

FIGURE 1 – KEY PLAN

DRAWING PG3062-9 – TEST HOLE LOCATION PLAN

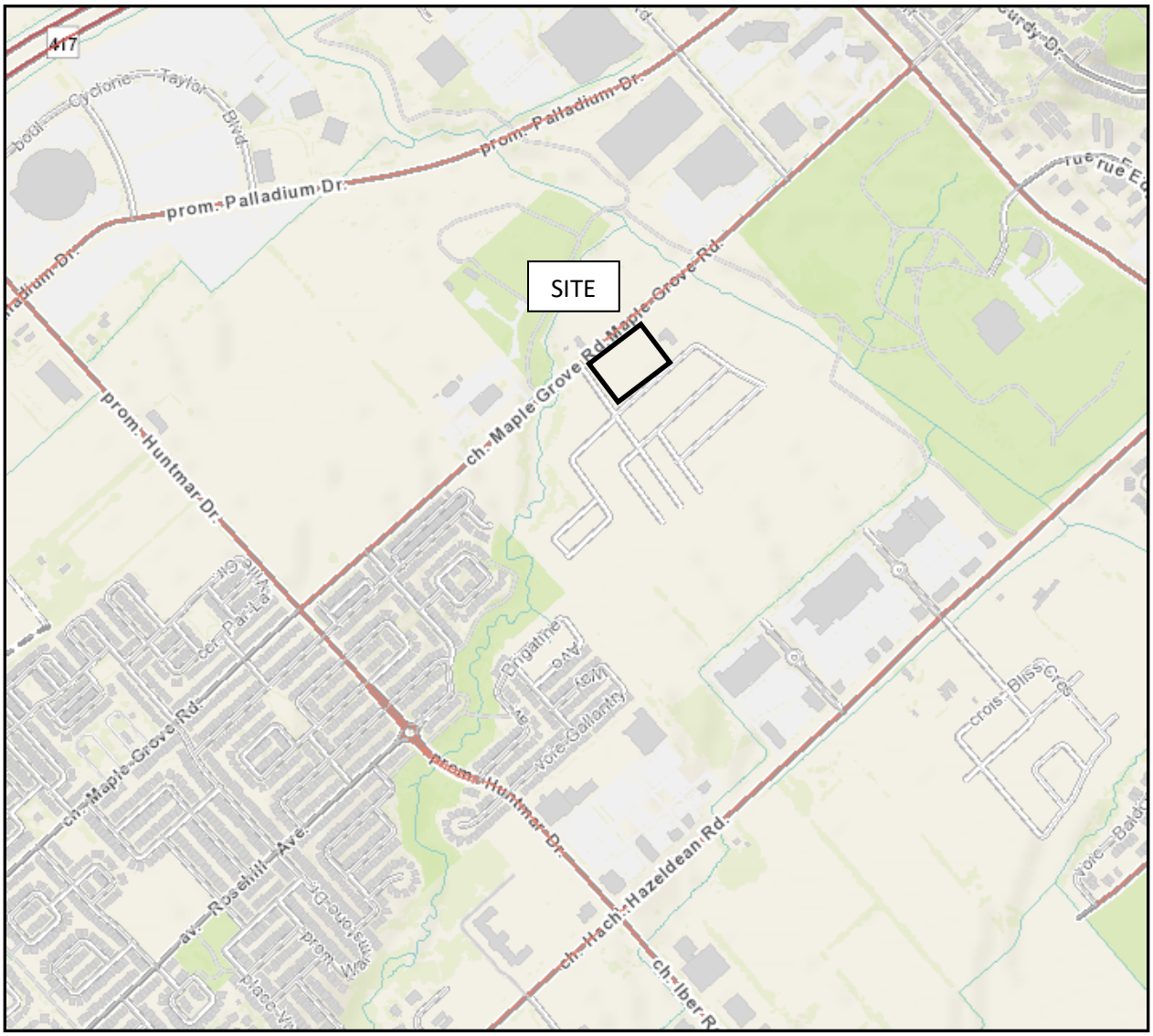
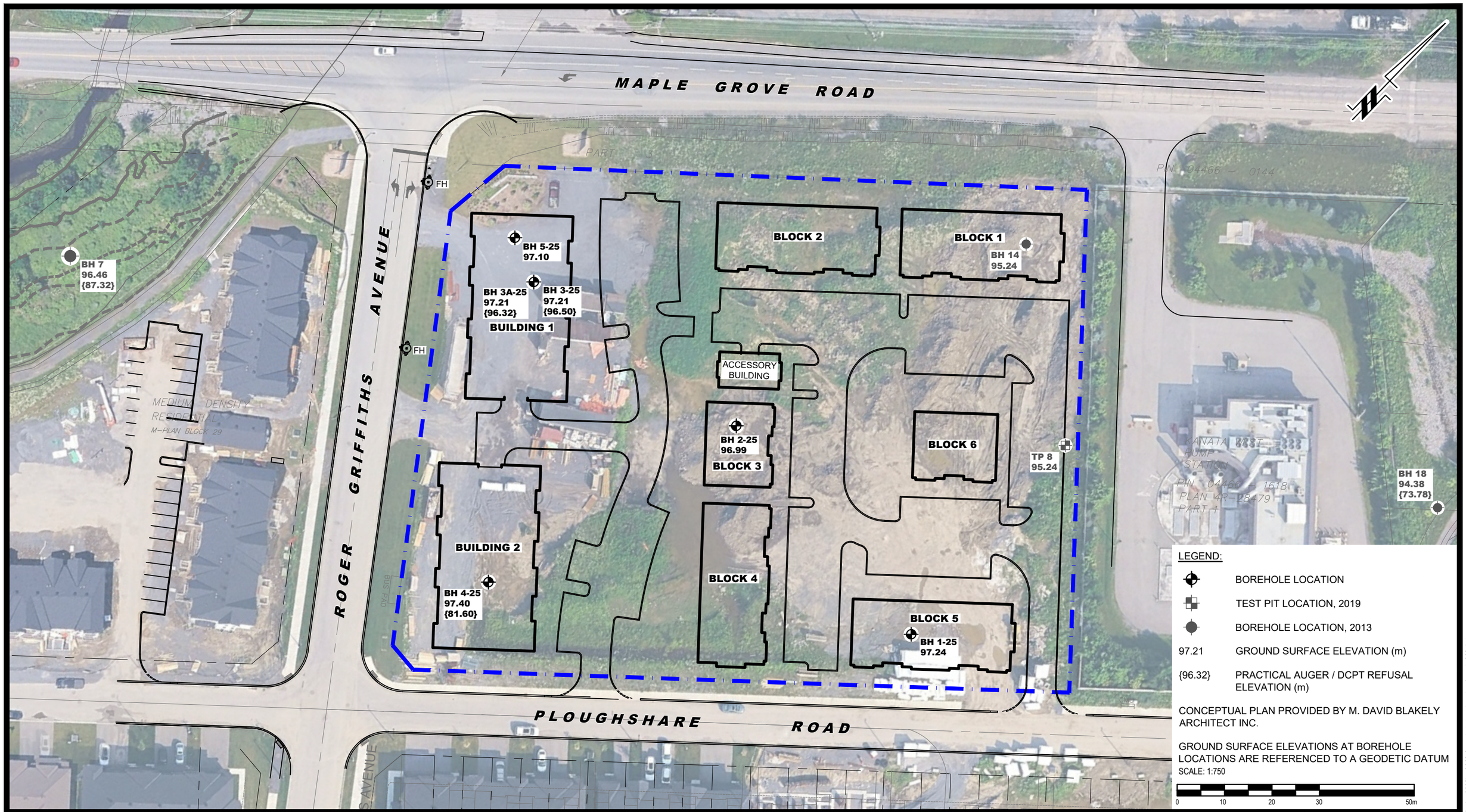


FIGURE 1

KEY PLAN

PATERSON GROUP



LEGEND:

- BOREHOLE LOCATION
- TEST PIT LOCATION, 2019
- BOREHOLE LOCATION, 2013
- 97.21 GROUND SURFACE ELEVATION (m)
- {96.32} PRACTICAL AUGER / DCPT REFUSAL ELEVATION (m)

CONCEPTUAL PLAN PROVIDED BY M. DAVID BLAKELY ARCHITECT INC.

GROUND SURFACE ELEVATIONS AT BOREHOLE LOCATIONS ARE REFERENCED TO A GEODETIC DATUM

SCALE: 1:750

0 10 20 30 50m

PATERSON GROUP
9 AURIGA DRIVE
OTTAWA, ON
K2E 7T9
TEL: (613) 226-7381

NO.	REVISIONS	DATE	INITIAL

RICHCRAFT HOMES
GEOTECHNICAL INVESTIGATION
PROPOSED RESIDENTIAL DEVELOPMENT
MAPLETON - BLOCK 1
OTTAWA, ONTARIO

Title:

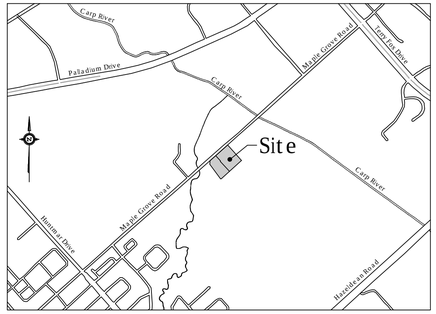
TEST HOLE LOCATION PLAN

Scale: 1:750	Date: 03/2025
Drawn by: YA	Report No.: PG3062-2
Checked by: PB	Dwg. No.: PG3062-9
Approved by: SD	Revision No.:

11x17

p:\autocad drawings\geotechnical\pg30xx\pg3062\pg3062-9-test hole location plan (march 2025).dwg

Appendix E Proposed Site Plan



KEY PLAN NOT TO SCALE


MAPLE GROVE ROAD
CENTRELINE OF ASPHALT AS CONSTRUCTED
Centreline of Road Construction
N 48° 28' 50" E
335.45
SP-1a
SP-1b
N 48° 28' 00" E 122.97
66.53
BLOCK - 2
12 - UNITS
BLOCK - 1
12 - UNITS
BUILDING 1
3 STOREY- 26 UNIT U/G
APARTMENT BUILDING
w/PARKING (21 SPACES)
BUILDING 2
3 STOREY- 26 UNIT U/G
APARTMENT BUILDING
w/PARKING (21 SPACES)
BLOCK - 3
9 - UNITS
BLOCK - 4
12 - UNITS
BLOCK - 6
6 - UNITS
BLOCK - 5
12 - UNITS
AMENITY AREA
230 m²
AMENITY AREA
345 m²
ACCESSORY
BUILDING
80.0m²
12 Parking Spaces
15 Parking Spaces
8 Parking Spaces
7 Parking Spaces
13 Parking Spaces
10 Parking Spaces
9 Parking Spaces
12 Parking Spaces
11 P.S.
8 P.S.
1.5m Asphalt Sidewalk
Curb Ramp
4 Bike Spaces
Bike Space
FIRE ACCESS ROUTE
(2) EV CHARGING STATION w/ BOLLARDS EV
(4) EV CHARGING STATION w/ BOLLARDS
1.5m S/W
Ramp Down
Hydro
CMB
DC
DC V
GAS
ROGER GRIFFITHS AVENUE
2.0m Concrete Sidewalk
BUS PAD
Potential Sign Loctation
Depressed Concrete Sidewalk
2.0m Concrete Sidewalk
Conc. Sidewalk
PLOUGHSHARE ROAD
N 48°07'30" E 101.80
199.29
68.80
N 41°52'30" W
106.19
N 48°07'30" E
83.93
54.57
130.50
75.64
48.27
29.18
28.09
26.09
18.50
N 41°52'30" W 7.41
N 48°07'30" E 2.07
N 41°52'30" W 9.22
N 48°07'30" E 22.42
N 41°52'30" W 14.78
N 48° 08' 46" E 14.78
N 41°52'30" W 0.30
N 48°07'30" E 0.30
N 41°52'30" W 0.30
N 48°07'30" E 0.30
N 41°52'30" W 0.30
N 48°07'30" E 0.30

Appendix F Background Report Excerpts

F.1 Richcraft Kanata West Development Second Registration Phase – Servicing and Stormwater Management Report, Rev 2, Stantec, May 10, 2022

Richcraft Kanata West Development Second Registration Phase, 1620 Maple Grove Road - Servicing and Stormwater Management Report

Job #160401393/83

Prepared for:
Richcraft Homes

Prepared by:
Stantec Consulting Ltd.
1331 Clyde Avenue
Ottawa, Ontario
K2C 3G4

May 10, 2022

Revision	Description	Prepared by		Checked by
2	Site Servicing and Stormwater Management Report	A. Paerez	May 10, 2022	Sheridan Gillis
1	Site Servicing and Stormwater Management Report	A. Paerez / T. Rathnasooriya	July 7, 2021	Sheridan Gillis
0	Site Servicing and Stormwater Management Report	Ana Paerez/	November 20, 2020	Sheridan Gillis

Sign-off Sheet

This document entitled Richcraft Kanata West Development Second Registration Phase, 1620 Maple Grove Road - Servicing and Stormwater Management Report was prepared by Stantec Consulting Ltd. ("Stantec") for the account of Richcraft Homes (the "Client"). Any reliance on this document by any third party is strictly prohibited. The material in it reflects Stantec's professional judgment in light of the scope, schedule and other limitations stated in the document and in the contract between Stantec and the Client. The opinions in the document are based on conditions and information existing at the time the document was published and do not take into account any subsequent changes. In preparing the document, Stantec did not verify information supplied to it by others. Any use which a third party makes of this document is the responsibility of such third party. Such third party agrees that Stantec shall not be responsible for costs or damages of any kind, if any, suffered by it or any other third party as a result of decisions made or actions taken based on this document.



Prepared by_____
(Signature)

Ana M. Paerez, P.Eng.



Reviewed by_____
(Signature)

Sheridan Gillis

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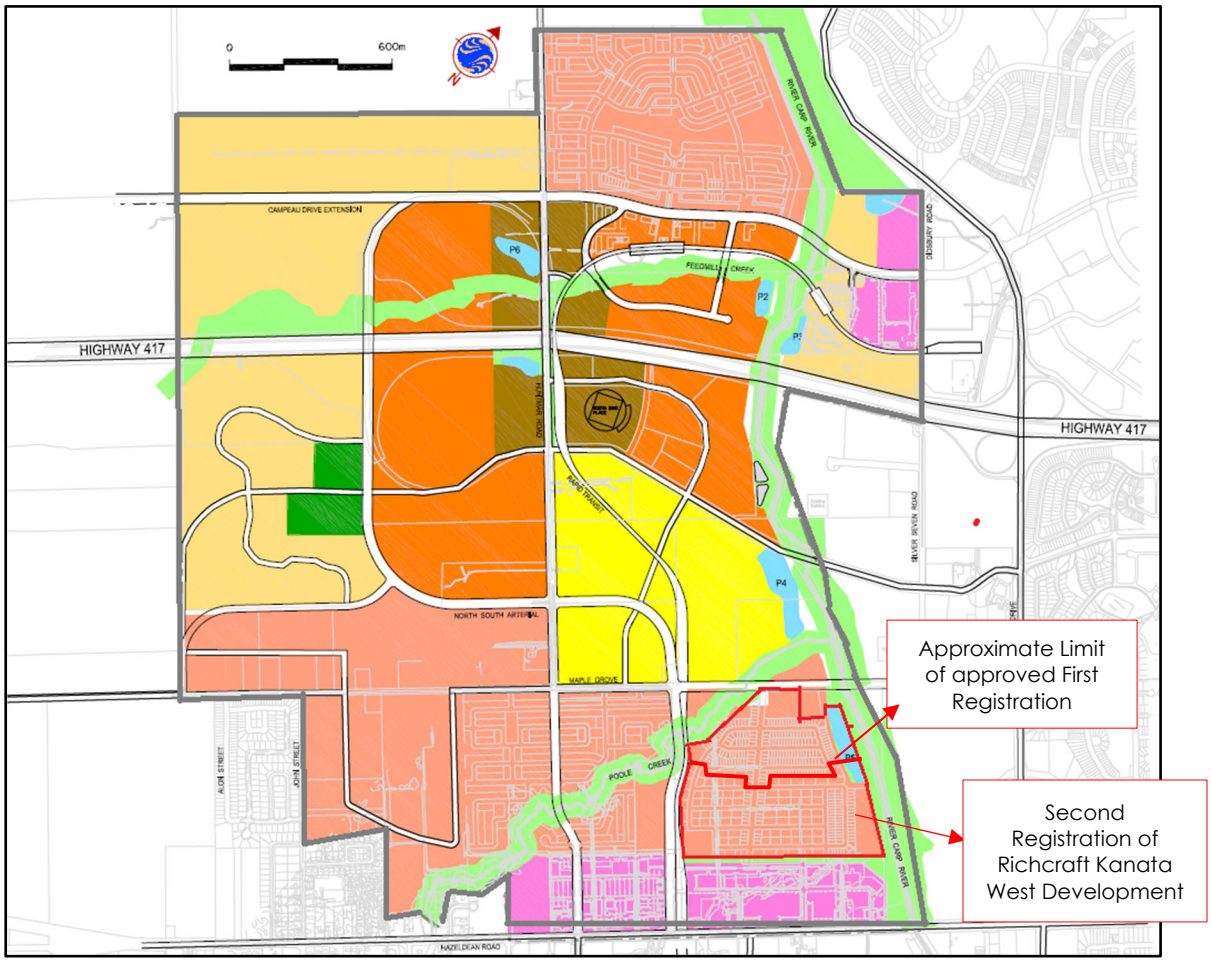
1.0 INTRODUCTION AND BACKGROUND

This revised Site Servicing and Stormwater Management (SWM) Report has been prepared to address City comments to the second engineering submission of July 2021. Specifically the PCSWMM model has been revised to add a pair of catchbasins on Tillage Street and to increase the proposed park block minor system capture rate, conceptual infiltration calculations have been provided for the school site, additional details have been added regarding location and composition of amended soils, and the section on the proposed Hazeldean Creek crossings has been revised to address City comments. A letter response summarizing all comments along with Stantec's responses has been included in **Appendix F**. The drawings have been revised to reflect the changes, while the results of the revised technical analyses are summarized in this report.

Stantec Consulting Ltd. has been commissioned by Richcraft Homes to prepare the following Site Servicing and Stormwater Management Report for the second registration phase of the Richcraft Kanata West Development. The subject property is located within the Kanata West Community (KWC), on the northeast quadrant of Hazeldean Road and the future transitway, south of Poole Creek and west of the Carp River. The property is located in the City of Ottawa, within the Kanata West Concept Plan as indicated in **Figure 1.1.** The proposed second registration phase of the development comprises approximately 21.7 ha of land, and consists of 72 single family homes, 288 townhomes, 32 back-to-back townhomes, a 2.95 ha school block (Block 76), a 0.97 ha park (Block 143), a 3.32 ha medium density residential block (Block 78)and a stormwater management (SWM) block (Block 144) for the ultimate Kanata West Pond 5 expansion. The site includes two (2) private blocks to be developed as separate site plan applications, a school block, and a medium density residential block. A copy of the Draft 4M-Plan for the entire development which includes the approved First Registration Phase is included in **Appendix E.**

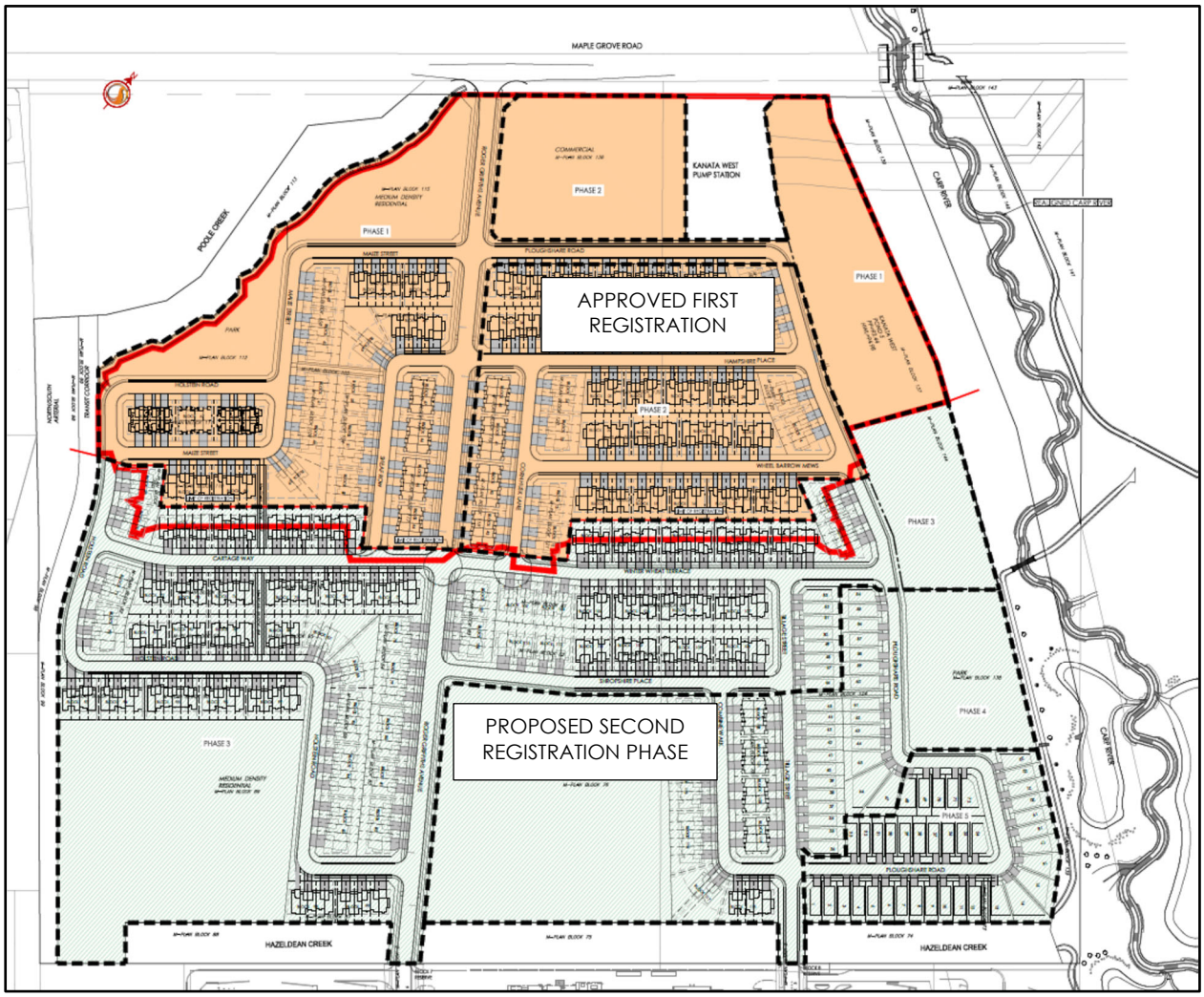
The First Registration Phase of the Development has been approved and it is currently under construction. Similarly, the interim Kanata West Pond 5 has been approved and has been constructed.

Figure 1.1: Approximate Site Location and Kanata West Concept Plan

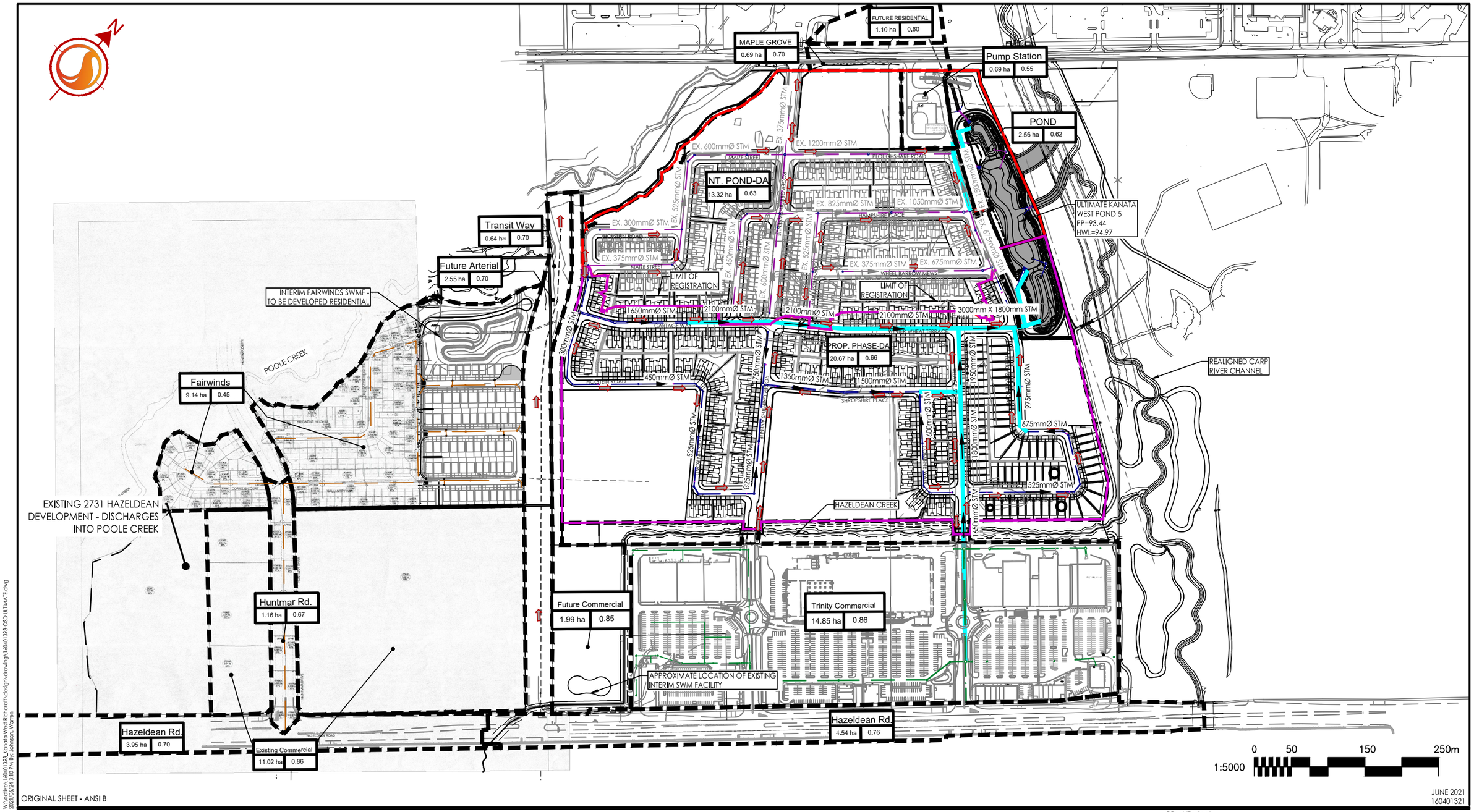


The Richcraft Kanata West development will be built in phases as shown in **Figure 1.2**. The First Registration Phase which has already been approved will be serviced through the interim Kanata West Pond 5, while the proposed Second Registration Phase will require expansion of the interim SWM Pond into the ultimate Kanata West Pond 5 configuration which will comprise expanding the main cell of the interim pond and constructing the second forebay. The overall development at full build-out will be serviced by the Kanata West Pond 5 which will discharge into the fully restored Carp River as shown in **Figure 1.3**. The ultimate Kanata West Pond 5 Design Brief has been submitted by Stantec under separate cover and it should be read in conjunction with this report.

Figure 1.2: Proposed Development Phasing



Following the completion and approval of the Kanata West Class EA in 2006, a number of developments within the ultimate KW SWM Pond 5 catchment area were constructed. The Fairwinds Subdivision, existing commercial developments along Huntmar Road and Huntmar Road as shown in **Figure 1.3** are serviced through an interim SWM Pond that discharges into Poole Creek. Similarly, the Trinity Commercial development and the existing section of Hazeldean Road, east of the future arterial/transitway as shown in **Figure 1.3** are serviced through an interim SWM Pond that discharges into the Carp River. The existing section of Hazeldean Road west of the future arterial/transitway is serviced through an interim SWM Pond that discharges into the realigned Hazeldean Creek.



W:\active\160401393_Kanata West Richcraft\design\drawing\160401393-DSD ULTIMATE.dwg
2021/06/24 5:10 PM By: Johnson, Warren

ORIGINAL SHEET - ANSI B

JUNE 2021
160401321

Stantec

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

Legend

- ULTIMATE KW SWM POND 5 DRAINAGE AREA BOUNDARY
- EXISTING INTERIM KW POND 5 DRAINAGE AREA (APPROVED FIRST REGISTRATION PHASE)
- PROPOSED SECOND REGISTRATION PHASE OF RICHCRAFT KANATA WEST DEVELOPMENT DRAINAGE AREA BOUNDARY
- Catchment 1 / 4.00 ha / 0.99 — SITE ID / AREA (HA) / RUNOFF COEFFICIENT
- PROPOSED STORM SEWER
- EXISTING STORM SEWER (TRINITY COMMERCIAL)
- EXISTING STORM SEWER (FAIRWINDS)
- EXISTING STORM SEWER (KANATA WEST)
- EXTENT OF SUBMERGED SEWERS
- DIRECTION OF OVERLAND FLOW

Client/Project
RICHCRAFT HOMES
ULTIMATE KANATA WEST POND 5

Figure No.
1.3

Title
OVERALL DRAINAGE AREAS TO ULTIMATE KW POND 5

May 10, 2022

The Carp River Watershed/Subwatershed Study, completed by Robinson Consultants in 2004, described degraded existing conditions along the river and recommended restoration efforts to improve conditions. Following approval by Ottawa City Council in May 2006, a series of restoration activities, based on natural channel design principles, were planned for the Carp River system. The objective of the restoration efforts were to improve sediment transport in the channel, minimize erosion, allow for efficient flow conveyance and a natural flow regime, and enhance aquatic and terrestrial habitats.

Carp River Restoration involves full restoration within the Kanata West reach including a change to the channel as well as the following design elements: increased sinuosity, reduction in channel cross-section, creation of ponds and deltas, "nested" channels, varied substrate, riparian vegetation planting, and a pedestrian pathway as part of larger regional and local pathway system.

Poole Creek Restoration involves four areas that require local improvements including channel realignment, removal of an island and channel narrowing, removal of debris and old bridge, valley wall treatment, creation of a delta marsh and riparian plantings.

Feedmill Creek Restoration involves four areas that require local improvements including channel realignment, increased sinuosity, aquatic connections to the Carp River, local bank treatment and riparian plantings.

In early 2008, a number of errors were found in the hydrologic and hydraulic models used to develop the restoration plan and Greenland International Consulting Ltd. (Greenland) was commissioned to complete a Third Party Review (TPR) of the Carp River Restoration Plan for the City of Ottawa, based on the Terms of Reference that were approved by Council and reviewed by an Advisory Committee consisting of Ministry of the Environment, Conservation and Parks (MECP), Ministry of Transportation (MTO), and Mississippi Valley Conservation (MVC) as well as City Staff and an Academic. The Review included all hydrologic and hydraulic models that were used to create the Carp River Restoration Plan and to support the recommendations of the Master Plans and the 22 projects. The TPR assignment also involved assessing various elements of the restoration plan pertaining to flood storage, sediment transport, two-zone floodplain policy application, and positioning of adjacent stormwater management (SWM) facilities. Greenland also provided an opinion on the application of various provincial and municipal policies, and on impacts of the revised models on the 22 Class EA projects. As a result of the TPR, Delcan prepared the Carp River, Poole Creek and Feedmill Creek Restoration Update and Amendment in July 2010.

In 2013, Greenland was tasked with replacing a suite of software packages used to model the Carp River in Kanata with a state-of-the-art model tool. The model originally developed for evaluating the Carp River and the proposed restoration plan between 2004 and 2009 consisted of earlier work compiled in six software packages: DDSWMM, XPSWMM, Qualhymo, SWMHymo,

HECRAS (Dynamic), and HECRAS (static). The PCSWMM software was selected to prepare the new model tool to replace the other models.

A design brief for the ultimate condition KW SWM Pond 5 was submitted by Stantec Consulting Ltd. in 2013 prior to the completion of the final PCSWMM model for the Carp River and the final detailed design for the Carp River restoration. At the time, the City communicated that given that Pond 5 is largely located within the existing floodplain of the Carp River, proceeding with construction of the pond in advance of the restoration was not feasible. As a result, the KW Pond 5 project was put on hold.

In 2014, the City completed the Model Development Program Carp River Restoration Plan which described the compiled PCSWMM models created (pre-development conditions – no restoration, interim condition development – no restoration, and full restoration ultimate conditions), and provided a protocol for use.

Phase 1 and Phase 2 of the Carp River restoration project (south of Hwy 417) have been completed and MVCA has reviewed the as-built information for both phases of the Carp River Restoration Plan and are satisfied with the results. The Carp River restoration work is being reviewed by the City.

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 and provides for functional on-site servicing in accordance with all applicable Ottawa design guidelines and recommendations included in the various background studies outlined in **Section 2.1.** Design objectives for the proposed site include:

1.1.1 Grading Design

- Establish detailed grading with consideration to grading constraints (i.e., high-points, major system relief, sufficient cover, grade raise restrictions), while respecting the natural topography and subsurface soil conditions.

1.1.2 Underground Servicing

- Define and size the internal water distribution system for the proposed development with connections through the First Registration phase of the KW development and the existing Trinity site.
- Define major and minor storm conveyance systems in conjunction with the grade control plan including overland flow corridors.
- Assess the 100-year hydraulic grade line (HGL) in the proposed storm sewers under worst-case conditions (ultimate build-out).

- Define sizing and internal routing of the sanitary collection system in accordance with the Kanata West Master Servicing Study.
- Assess the annual/catastrophic and rare/normal pumping conditions HGL in the proposed sanitary sewer under worst-case conditions (ultimate build-out).

1.2 BACKGROUND RESOURCES

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

- *Geotechnical Response to Engineering Review Comments – Proposed Residential Development, Kanata West Maple Grove Road, Ottawa,* Paterson Group, April 25, 2022
- *Conceptual Design Drawings for Future North-South Arterial "West Transitway Connection",* Delcan, February 21, 2012
- *Deviation Report in Support of Concrete Box Storm Sewer,* Stantec Consulting Ltd., June 2021
- *Ultimate Kanata West Pond 5 Design Brief – Maple Grove Road*, Stantec Consulting Ltd., May 2022
- *Geotechnical Design Summary Details Kanata West Residential Development* – Phase 3, 4 and 5 Maple Grove Road, *Ottawa, PG3062-MEMO.19*, Paterson Group, June 29, 2021
- *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
- *Kanata West Master Servicing Study,* Stantec Consulting Ltd and IBI. Group, June 2006
- *Geotechnical Review Kanata West SWMP 5 – Proposed Residential Development, PG3062-MEMO.03,* Paterson Group, March 15, 2018
- *Interim Kanata West Pond 5 (with Ultimate Carp River) Design Brief – D07-16-04-0017*, Stantec Consulting Ltd., July 2019
- *Geotechnical Investigation Proposed Residential Development Maple Grove Road – Ottawa*, Paterson Group, November 21, 2013
- *Geotechnical Investigation Proposed Residential Development Maple Grove Road – Ottawa, PG3062-1 Revision 4*, Paterson Group, May 24, 2019
- *Geotechnical Design Summary Details Proposed Residential Development Maple Grove Road – Ottawa, PG3062-MEMO.06*, Paterson Group, May 24, 2019
- *Subsoil Infiltration Review Proposed Residential Development Maple Grove Road – Ottawa, PG4624-MEMO.07*, Paterson Group, June 28, 2019
- *Supplemental Geotechnical Investigation*, Proposed Residential Development Kanata West Concept Plan Ottawa, Ontario, Paterson Group, December 2004

- *City of Ottawa Sewer Design Guidelines*, 2nd Ed., City of Ottawa, October 2012
- *Technical Bulletin ISTB-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
- *City of Ottawa Water Distribution Design Guidelines*, City of Ottawa, October 2012
- *Technical Bulletin ISTB-2018-02 Revision to Ottawa Design Guidelines – Water Distribution*, City of Ottawa, March 2018
- *Low Impact Development Construction Guide, Version 1,* Credit Valley Conservation, 2012
- *Highway Drainage Design Standards,* Ministry of Transportation Ontario, January 2008
- *Hazeldean Creek Improvements – Hazeldean Road Widening Design Brief,* IBI Group, January 2010

The sanitary HGL analysis was prepared based on the following background documents provided by the City of Ottawa (see **Appendix C.3**):

- *Alternative 2: Divert Stittsville Trunk Sewer Only Design Sheet Long Term Flows (2031)*, J.L Richard and Associates, December 2014.
- *Fernbank Community – Kizell Lands, Sanitary Drainage Area Plan*, Novatech, February 2018.
- *Fernbank Community – Kizell Lands, Sanitary Sewer Design Sheet*, Novatech, February 2018.
- *Kanata West Master Servicing Study, Sanitary Sewer Design Sheet*, Stantec Consulting Ltd., CCL and IBI, April 2005.
- *Kanata West Concept Plan Master Servicing Study, Preferred Waste-Water Option*, Stantec Consulting Ltd., CCL and IBI, October 2005.
- *Reconstruction of Maple Grove Road, Sanitary Drainage Plan*, DSEL on behalf of the City of Ottawa, July 2011.
- *Reconstruction of Maple Grove Road, Sanitary Sewer Calculation Sheet*, DSEL on behalf of the City of Ottawa, May 2012.
- *Kanata West Serviceability Study, N-S Interceptor Sewer Sanitary Design Sheet*, IBI, June 2016.
- *Maple Grove Expansion Area Excel Sheet*, City of Ottawa.
- *Hazeldean Sanitary Sewer Analysis*, Atrel Engineering Ltd., November 29th, 2017.
- *Kanata West Pumping Station and Forcemains Preliminary Design Report*, Stantec Consulting Ltd., April 13, 2015

- *Kanata West Pumping station and Forcemains – Preliminary Design Report*, Stantec Consulting Ltd., April 2015.

2.0 POTABLE WATER

A detailed potable water servicing analysis has been completed and is included in **Appendix A.** Three separate analyses were created to evaluate the proposed potable water distribution network during the proposed third construction phase, fourth construction phase and ultimate development conditions of the Richcraft Kanata West Development. The models include both the approved First Registration Phase of the Richcraft KW Development as well as the proposed phase at different development stages.

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 condition Richcraft Kanata West development consists of a mix of single-family units, townhouse units, back-to-back units, a school, two parks, a commercial block, and two medium density residential private blocks.

As part of the approved First Registration Phase of the KW Development, a 300 mm diameter watermain on Maple Grove Road was 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**. Similarly, the approved First Registration Phase of the KW Development included installation of a temporary 200 mm diameter watermain adjacent to the future alignment of Roger Griffiths Avenue from Cartage Way to the future Holstein Road intersection. The temporary watermain is connected to a 300 mm diameter watermain that connects to the Trinity development watermain network to service the site under all development conditions.

As part of the proposed Second Registration Phase of the KW Development, a 300 mm diameter watermain will be installed along Roger Griffiths Avenue and the temporary 200 mm diameter watermain will be decommissioned. 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**).

For the purpose of modelling the proposed watermain network at different development stages, 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: Third Construction Phase Development Potable Water Distribution Network

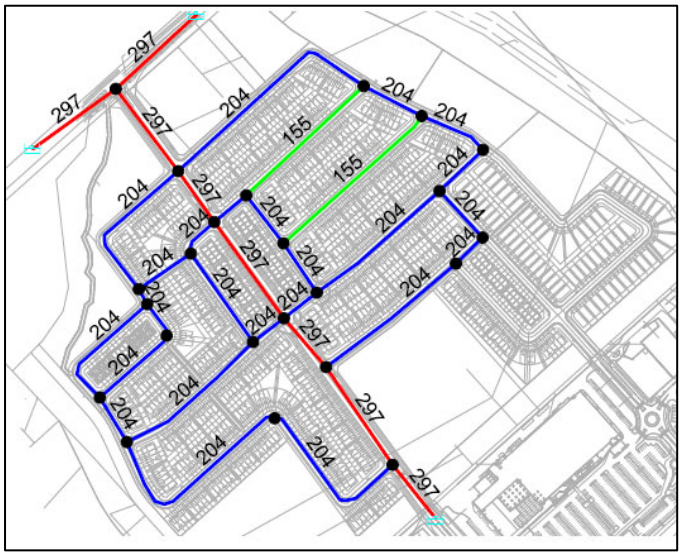
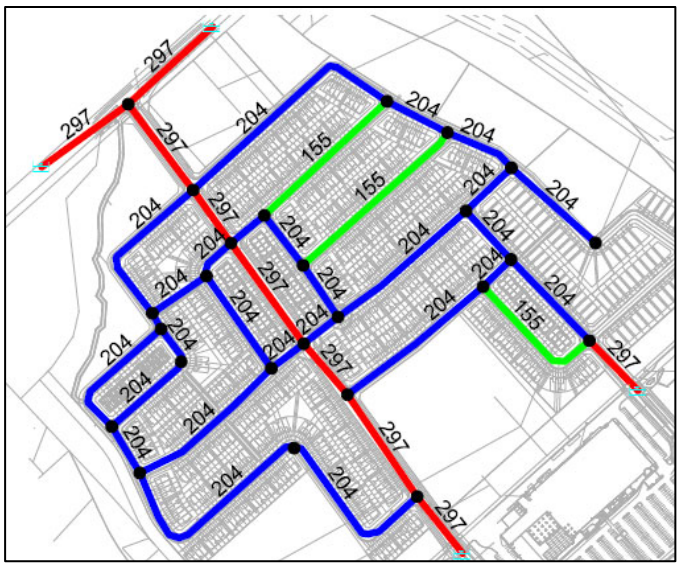
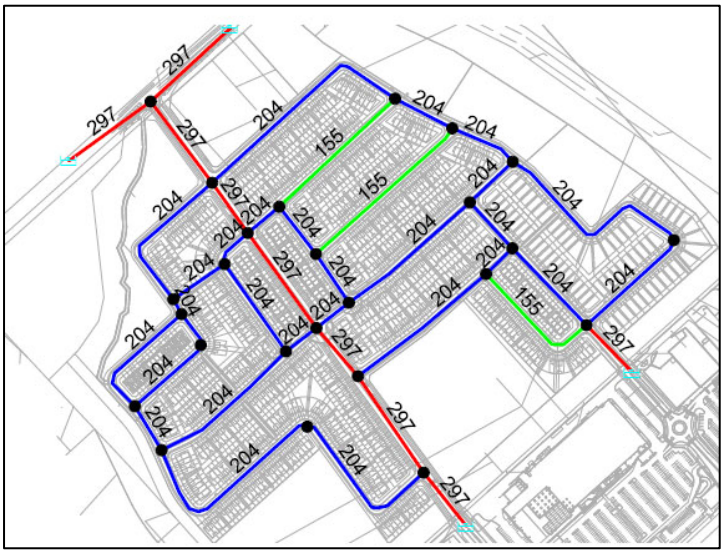


Figure 2.2: Fourth Construction Phase Potable Water Distribution Network



It should be noted that during the proposed fourth construction phase of the development, a temporary dead end is proposed on Ploughshare Road. However, as can be seen on **Drawing OSSP-2**, only fourteen (14) units will be connected to the temporary dead end.

Figure 2.3: Ultimate Development Potable Water Distribution Network


297
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2.2 PROPOSED DEVIATIONS FROM THE KANATA WEST MASTER SERVICING STUDY

The Kanata West Master Servicing Study (KWMSS)completed in 2006 assumed maximum fire flows for residential developments to be 6,500 L/min (108 L/s) and 13,000 L/min (217 L/s) for commercial areas. According to the most recent technical bulletin, detached and side-by-side dwellings fire flow requirements can be capped at 10,000 L/min (167L/s) provided that firewalls 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 singles, 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 entire KW Development for each phase of construction 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 block (Block 29) within the approved First Registration Phase was estimated based on a density of 38 units/ha. The second medium density block (Block 78) is based on the Concept Site Plan for Richcraft prepared by M. David Blakely Architect Inc. on February 2020 (see **Appendix D.1**). See **Appendix A** for detailed domestic water demand estimates.

In the ultimate development condition, the average day demand (AVDY) was determined to be 12.5 L/s. The maximum daily demand (MXDY) was determined to be 29.7 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 64.4 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 third and fourth construction phase was determined to be 10.0 L/s and 11.9 L/s, while the maximum daily demand (MXDY) was determined to be 24.4 L/s and 28.4 L/s, and the peak hour demand (PKHR) totaled 53.4 L/s and 61.5 L/s. The calculated residential, Institutional and commercial water consumption for the ultimate development scenario is shown in **Table 2.2** and **Table 2.3**.

Table 2.2: 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	-	2.74	2.7	686	2.78	6.95	15.28

Table 2.3: Ultimate Development Institutional and Commercial Water Demands

	Area (ha)	Demand (L/day)	AVDY (L/s)	MXDY (L/s)	PKHR (L/s)
Commercial	1.47	28,000	0.48	0.71	1.29
School	3.03	28,000	0.98	1.47	2.65

2.3.1 Fire Flow Requirements

The fire flow requirement for residential properties is capped at 10,000 L/min (167 L/s) as per the City of Ottawa Technical Bulletin ISDTB-2014-02 (May 2014) provided that firewalls 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. For the purposes of this analysis, required fire flows for private residential development blocks, as well as for the majority of proposed townhome blocks and single-family dwellings were assumed at the cap of 10,000 L/min (167 L/s). All reference to unit numbers within the potable water analysis will follow the subdivision plan block numbers. A maximum worst-case fire flow was estimated using FUS calculations (see detailed calculations in **Appendix A.3**) of 16,000 L/min (267 L/s) for back-to-back Block 121, 15,000 L/min (250 L/s) for townhome unit Block 56 which does not meet the 10 m separation between backs/sides of adjacent units(see **Table 2.4** for all townhome units) and 8,000 L/min(133 L/s) for single units 34-36.

As per correspondence with the City of Ottawa, fire flows greater than 15,000 L/min are permissible if there is available flow within the watermain without upsizing it and if there is an adequate number of hydrants in the vicinity of the units to accommodate the required flow.

As per the City's Technical Bulletin ISTB-2018-02, the maximum flow contribution from one given hydrant is 5,700 L/min (95 L/s) within a distance of 75 m, and 3,800 L/min (63 L/s) between 75 m and 150 m. As a result, hydrant placement in the vicinity of the proposed back-to-back units along Tillage Street and Combine Walk was considered to ensure the maximum required fire flow of 16,000 L/min can be achieved. As can be seen on **Drawing SSP-2**, there are eight (8) fire hydrants in the vicinity of Block 121. There are four (4) fire hydrants within 75 m distance and an

additional four (4) hydrants within 75-150 m that can provide a total fire flow of approximately 38,000 L/min.

A series of FUS fire flow calculations were conducted for the worst-case back-to-back, townhome and single units that do not meet the 10,000 L/min capped fire flow requirements based on minimal separation distance from side yards to rear yards. FUS calculations for all units that do not meet the 10 m minimum separation requirement can be found in **Appendix A.3**. **Table 2.4** shows the FUS fire flow required for each unit that does not meet the 10 m minimum separation requirement, the number of hydrants available in the vicinity of the units and the available fire flow within the adjacent hydrants.

Table 2.4: Available Fire Flow Base on Hydrant Location

	FUS Required Fire Flow (L/s)	Number of Hydrants within 75m	Number of Hydrants within 75-150m	Available Fire Flow with Hydrants(L/s)
Single Unit 33	133	2	2	316
Single Units 34-36	133	4	1	443
Townhome Block 53	217	2	1	253
Townhome Block 56	250	2	1	253
Townhome Block 69	167	3	2	411
Townhome Block 70	167	3	4	537
Townhome Block 77	233	3	1	348
Townhome Block 78	183	2	2	316
Townhome Block 100 & 113	183	2	2	316
Townhome Block 101 & 102	183 & 200	3	1	348
Block 121(similar to Blocks 119,120,122)	267	4	4	632

2.4 HYDRAULIC MODEL

Level of Service

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 480 kPa (50 to 70 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).

Model Development

The hydraulic model used to simulate the approved First Registration Phase of the Richcraft KW Development which included the proposed Second Registration Phase distribution system has been modified to represent the different construction phases within the proposed Second Registration Phase. Hazen-Williams coefficients ("C-Factors") were applied to the new watermain in accordance with the City of Ottawa's Water Distribution Design Guidelines (**Table 2.5**).

Table 2.5: 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 third construction phase, fourth construction phase, 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

2.5.1 Third Construction Phase Scenario

The results from the third construction phase scenario show that the maximum pressure modeled was approximately 92.8 psi (640 kPa) and the minimum pressure during the peak hour scenario was approximately 80.5 psi (555 kPa) as shown in **Figure 2.2** and **Figure 2.3** 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 2.2: AVDY Pressure Results for the Third Construction Phase Condition Scenario (psi)

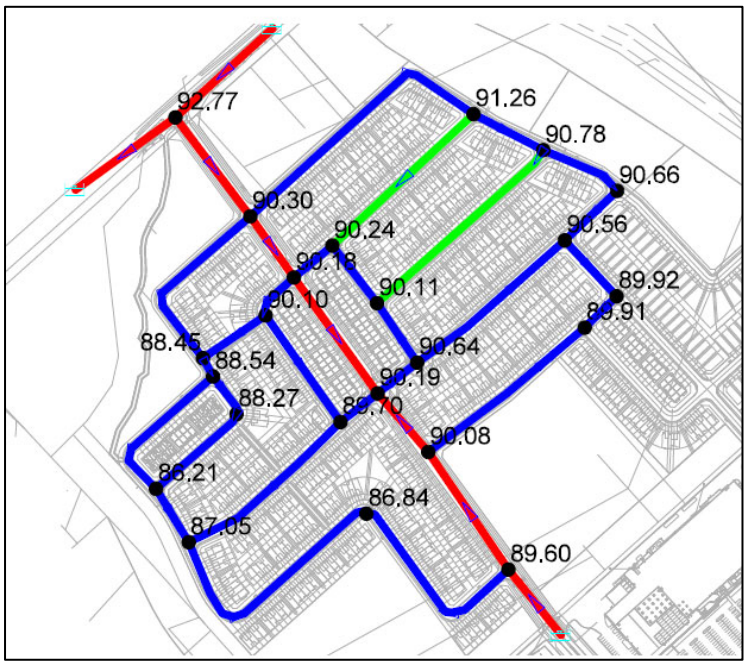
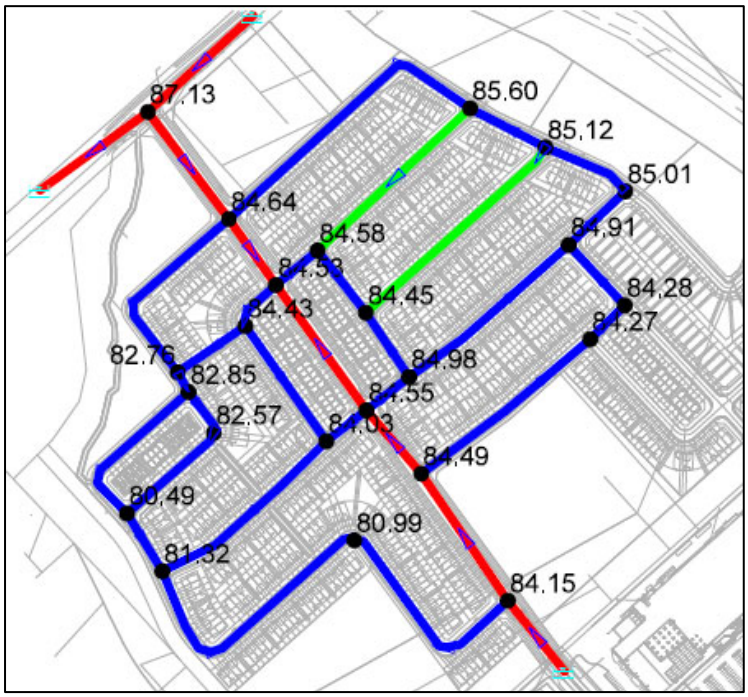


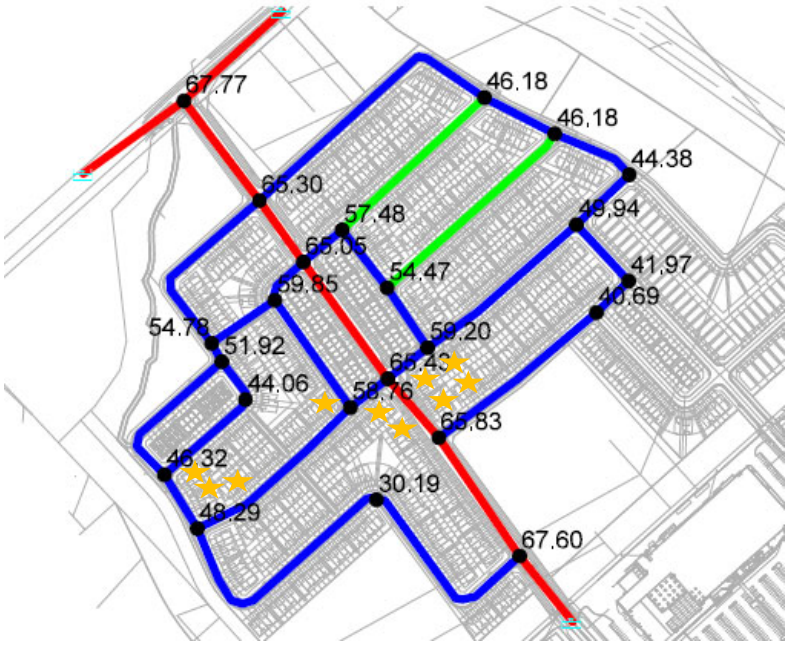
Figure 2.3: PKHR Pressure Results for the Third Construction Phase Condition Scenario (psi)



A hydraulic model was used to assess the fire flow conditions of the third 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 250 L/s based on the worst case townhome Block 56 as shown in **Appendix A.1**. Given that all nodes within the third construction phase had residual pressures above 20 psi when modeling the fire flows of 250 L/s, an additional hydraulic model was not needed to represent required fire flows of 167 L/s.

Results of the modeling analysis indicate that flows in excess of 17,490 L/min (292 L/s) can be delivered to all the units that require 250 L/s or less while still maintaining a residual pressure of 140 kPa (20 psi). The residual pressures for the fire flow analysis are shown in **Figure 2.4**. Results of the hydraulic modeling are included for reference in **Appendix A1**.

Figure 2.4: MXDY + 250 L/s Fire Flow Results for the Third Construction Phase Condition Scenario (Residual Pressure (psi))



★ Represent the Blocks that do not meet the minimum 10 m rear yard to side yard separation requirement.

2.5.2 Fourth Construction Phase Scenario

The maximum pressure modeled during the average day scenario was approximately 92.8 psi (640 kPa), and the minimum pressure during the peak hour scenario was approximately 80.6 psi (556 kPa)as shown in **Figure 2.5** and **Figure 2.6** 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 2.5: AVDY Pressure Results for Fourth Construction Phase Scenario (psi)

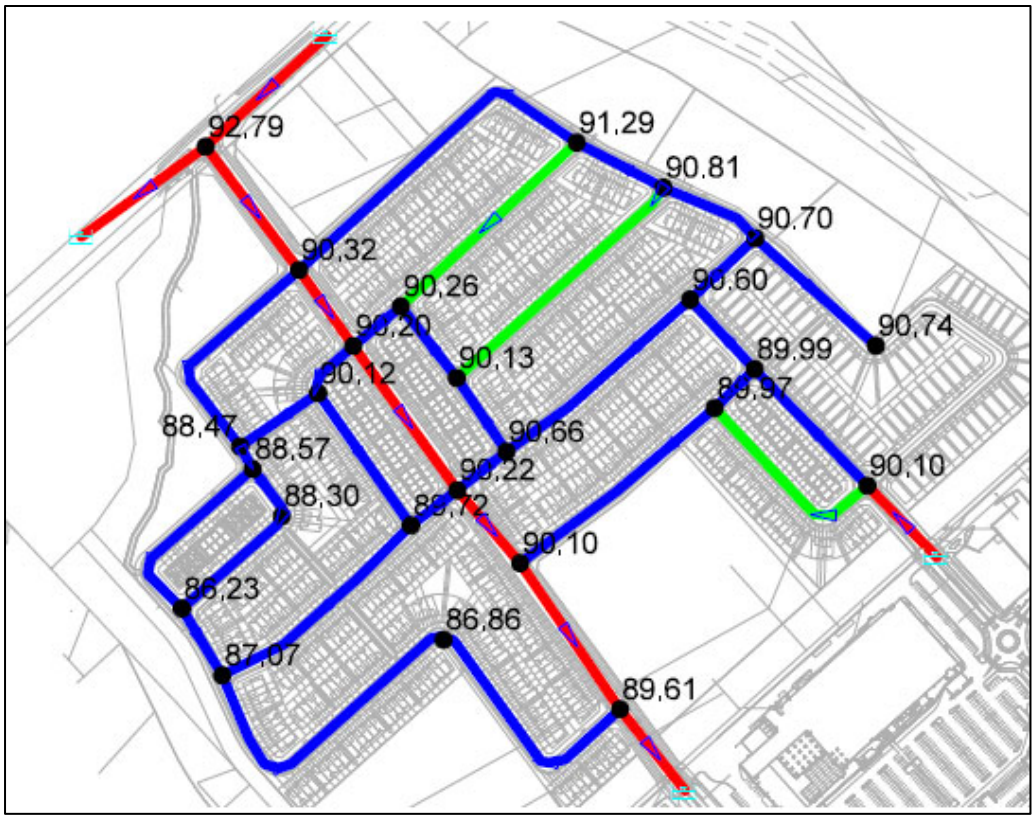
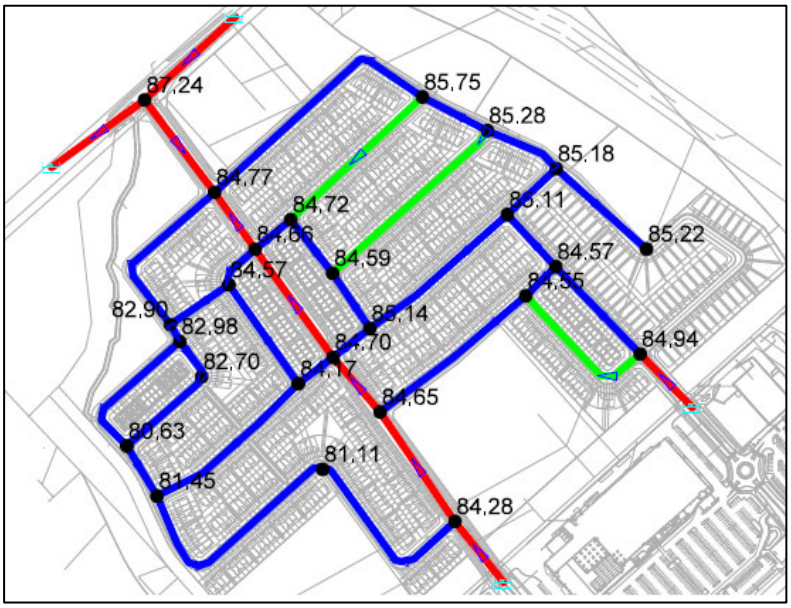
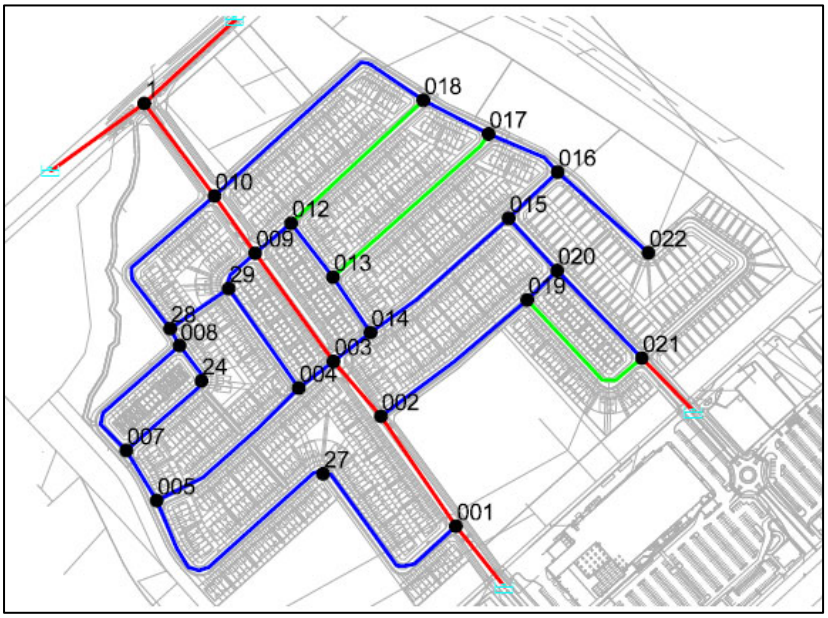


Figure 2.6: PKHR Pressure Results for Fourth Construction Phase Scenario (psi)



Due to phasing and construction restrictions in the proposed fourth construction phase condition, one temporary dead end is proposed on Ploughshare Road (node 22). The temporary dead-end services 14 units, less than the maximum units per single service allowed (49 units). **Figure 2.7** shows the node IDs used in the fourth construction phase model.

Figure 2.7: Fourth Construction Phase Scenario Node ID



A fire flow analysis was carried out in the hydraulic model to determine the anticipated amount of flow that can be provided across the proposed watermain network under maximum day demands and a fire flow requirement of 267 L/s as per the worst-case conditions for the back-to-back units and 167 L/s for single units serviced on the dead end watermain. FUS calculation for all townhome blocks and single units that do not meet the technical bulletin's 10,000 L/min fire flow cap qualifications due to side yard to rear yard separation less than 10 m are included in **Appendix A.2**.

Results of the fourth construction phase modeling analysis indicate that flows in excess of 12,960 L/min (216 L/s) can be delivered for the single units on Ploughshare Road (node 22). All other units were assessed assuming a fire flow of 267 L/s, with available flows within the system ranging between 18,192 L/min (303 L/s) and 72,840 L/min (1,214 L/s) while still maintaining a residual pressure greater than 140 kPa (20 psi). The resulting residual pressures for the proposed fourth construction phase of the development are shown in **Figure 2.8** and

Figure 2.9. Results of the hydraulic modeling are included for reference in **Appendix A.**

Figure 2.8: MXDY + 167 L/s Fire Flow Results for Fourth Construction Phase Scenario (Residual Pressure (psi))

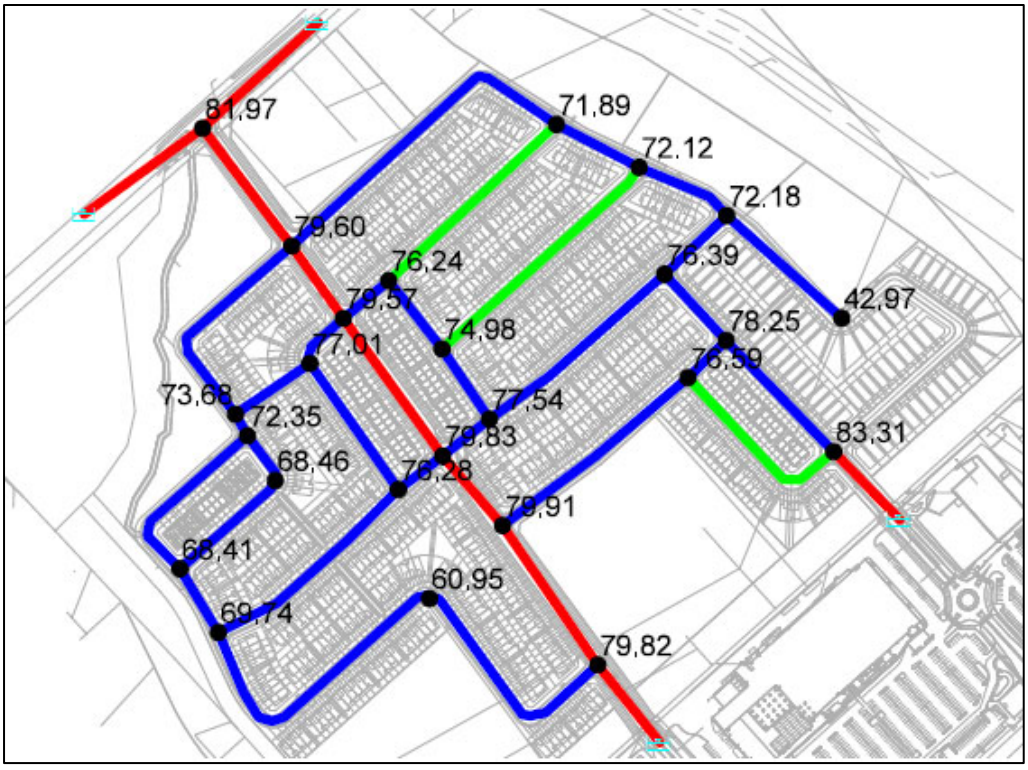
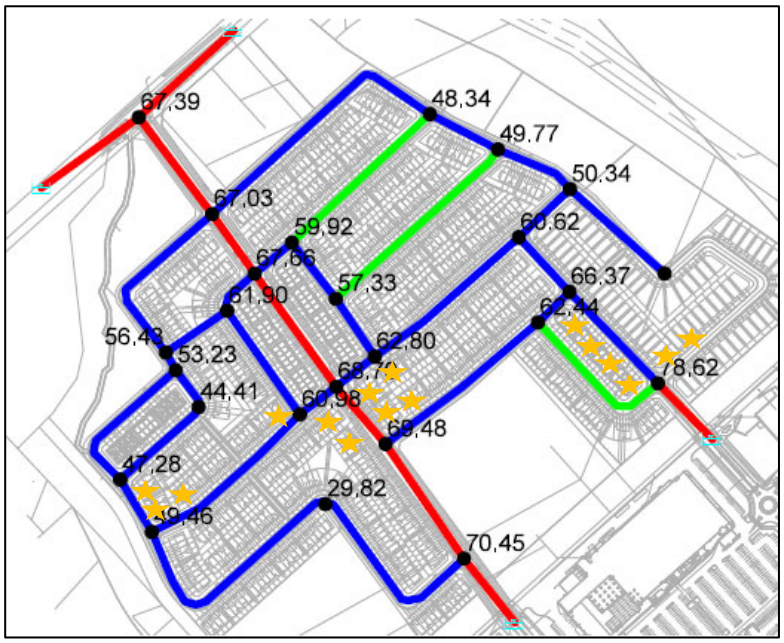


Figure 2.9: MXDY + 267 L/s Fire Flow Results Fourth Construction Phase Scenario (Residual Pressure (psi))



★ Represent the Blocks that do not meet a rear yard to side yard separation of 10m.

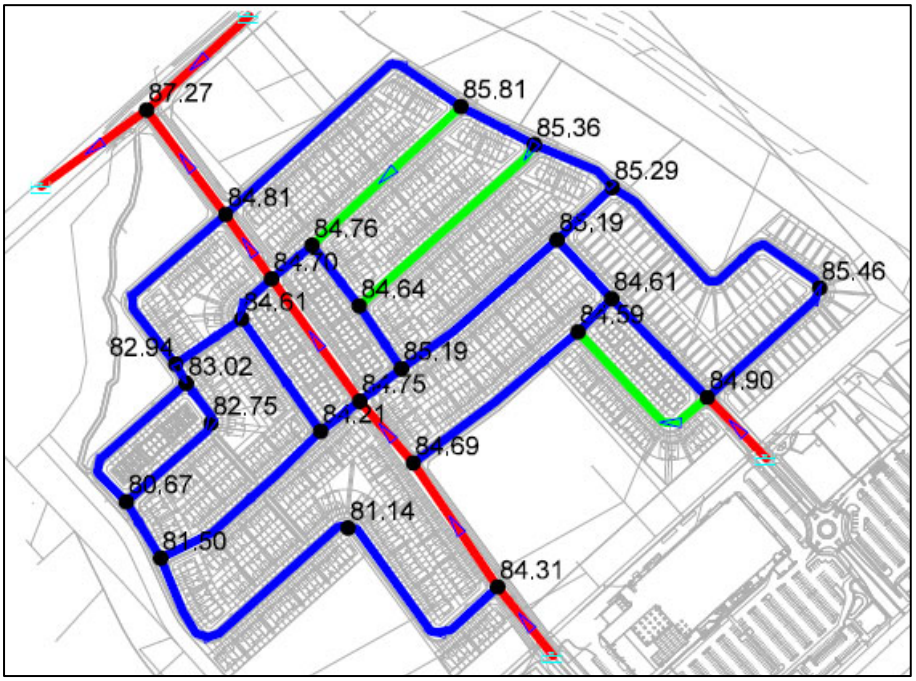
2.5.3 Ultimate Condition Scenario

In the ultimate development condition, the maximum pressure modeled was approximately 92.8 psi (640 kPa) and the minimum pressure during the peak hour scenario was approximately 80.7 psi (556 kPa) as shown in **Figure 2.10** and **Figure 2.11** 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 2.10: AVDY Pressure Results for Ultimate Condition Scenario (psi)



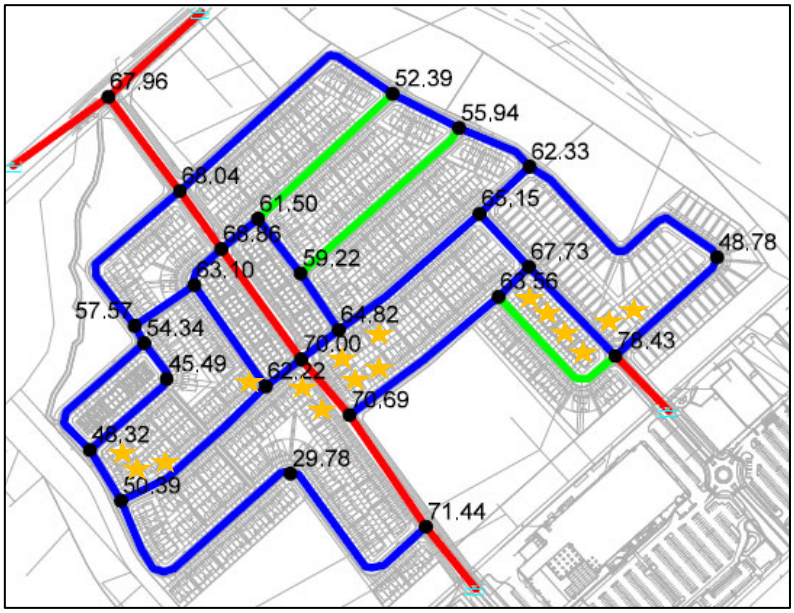
Figure 2.11: PKHR Pressure Results for Ultimate Condition Scenario (psi)



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 requirement of 267 L/s as per the worst-case for back to back units, townhome blocks and single units that do not meet the technical bulletin's 10,000 L/min fire flow cap qualifications based of rear yard to side yard separation. Given all nodes within the ultimate construction phase had residual pressures above 20 psi when modeling the fire flows of 267 L/s, an additional hydraulic model was not needed to represent fire flows of 167 L/s for all capped dwellings.

Results of the ultimate condition modeling analysis indicate that flows in excess of 18,420 L/min (307 L/s) can be delivered for all proposed units while still maintaining a residual pressure of 140 kPa (20 psi). The residual pressures for the fire flow analysis are shown in **Figure 2.12**. Results of the hydraulic modeling are included for reference in **Appendix A**.

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



★ Represent the Blocks that do not meet a rear yard to side yard separation of 10m.

2.6 WATER AGE CALCULATIONS

Estimated daily consumption for the fourth construction phase is based on an average usage of 350 L/c/d and 2.7 people per townhome/back-to-back unit and 3.4 people per single family unit.

2.6.1 Fourth Construction Phase

Total Site

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

Volume of 155 mm diameter pipe = 11.62 m^3

Volume of 204 mm diameter pipe = 106.68 m^3

Volume of 297 mm diameter pipe = 166.03 m^3

Total Pipe Volume = 284.33 m^3

Total Average Daily Demand based on 350 L/c/d and 2181 people:

Total Average Daily Demand = 147.39 m^3/d

Watermain on Ploughshare Road

The water volume calculation is based on the length and size of the 204 mm diameter watermain piping along Ploughshare Road. The average daily consumption is anticipated to be more than the total volume of this segment of watermain at buildout of the fourth construction phase.

Volume of 204 mm diameter pipe = 4.45 m^3

Average Daily Demand Based on 350L/c/d and 48 people:

Total = 16.42 m^3/d

2.7 SUMMARY OF FINDINGS

Based on the findings of the report, the proposed network can service the development area and with the use of pressure reducing valves will meet all servicing requirements as per City of Ottawa standards under typical demand conditions (peak hour and average day conditions) as well as under emergency fire demand conditions (maximum day + fire flow) during the third construction phase, fourth construction phase and ultimate development conditions.

The temporary 200 mm diameter watermain installed adjacent to the future alignment of Roger Griffiths Avenue from Cartage Way to Holstein Road as part of the approved First Registration Phase of the KW Development to connect the first phase watermain network to the existing watermain within the Trinity development to the south will be decommissioned once the proposed 300 mm diameter watermain is installed along Roger Griffiths Avenue.

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. As required in the KW MSS, 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, February 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 94.97 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:

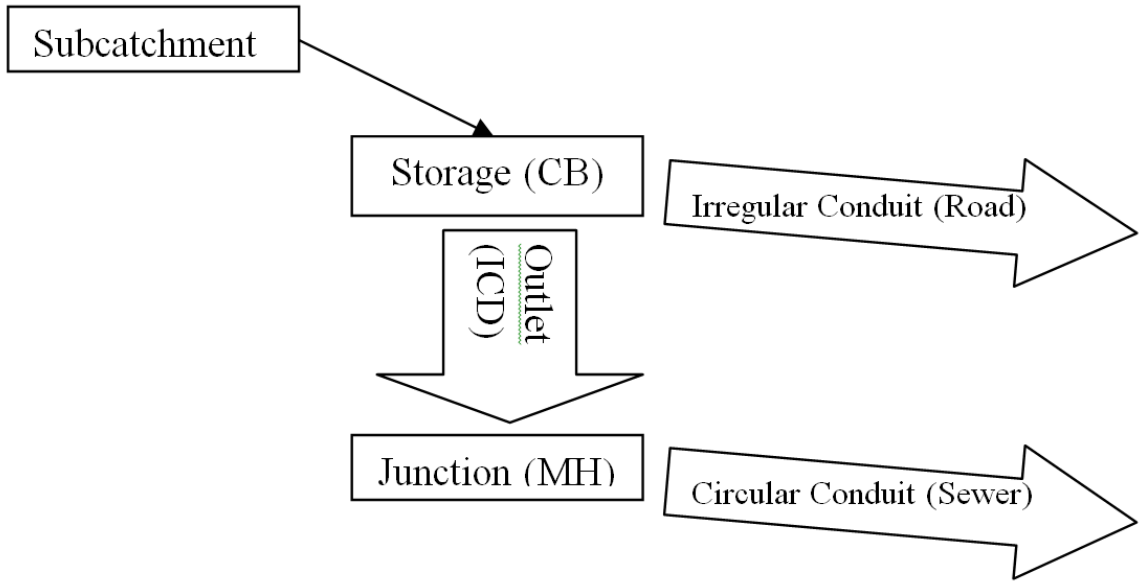
- Hydrologic parameters as per Ottawa Sewer Design Guidelines, including Horton infiltration, Manning's 'n', and depression storage values.
- 3-hour Chicago Storm distribution for the 2-year, 5-year, and 10-year to determine inlet capture rates for the different catchments.
- Minor and major system response 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 storm 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.
- Minor system discharge rate from the Fairwinds Subdivision up to the 100-year storm to be restricted to 4.794 m^3/s.

- Minor system discharge rate from the Trinity Commercial Site up to the 100-year storm to be restricted to 2.118 m^3/s.
- 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 325 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 469 L/s and 748 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	94.73
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

Subcatchment Parameter	Value
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
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
L212A	0.10	44.0	3.0	57.1%	0.60
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

Area ID	Area (ha)	Width (m)	Slope (%)	% Impervious	Runoff Coefficient
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
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
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

Storage Node	Invert Elevation (m)	Rim Elevation (m)	Total Depth (m)
240B-S	96.02	97.75	1.73
241A-S	96.19	97.92	1.73
L212A-s	95.56	97.29	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**. **Drawing OSSP-2** shows conceptual storm sewer information for the future north-south arterial as obtained from the conceptual design drawings titled "West Transitway Connection" prepared by Delcan on February 21, 2012. These conceptual storm sewers have not been included in the PCSWMM model for the proposed development and have been shown on the drawings with the sole purpose of checking that a gravity connection with adequate cover can be provided at manhole STM 209.

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 (102"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)

Orifice Name	Tributary Area ID	Minor System Node	ICD Type
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)
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)
L212A-IC1	L212A	212	IPEX TEMPEST HF (83"mm ORIFICE)
L212A-IC2	L212A	212	IPEX TEMPEST HF (83"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)

Orifice Name	Tributary Area ID	Minor System Node	ICD Type
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 79 & 80	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	1,187	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	469 L/s to Maize Street
L218A	Block 76	School	218	443	325 L/s to Shropshire Place
L225B	Block 78	Residential	225	517	748 L/s to Holstein Road

1. School block area L218A to provide 647 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 included in the digital submission.

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	40.5
C205A-IC(2)	C205A	IPEX TEMPEST HF (152"mm ORIFICE)	0.31	1.65	22.1	57.7
C219-IC	C219A	IPEX TEMPEST HF (102"mm ORIFICE)	0.46	1.58	13.2	25.6
C220A-IC(1)	C220A	IPEX TEMPEST HF (191"mm ORIFICE)	0.30	1.65	33.1	90.6
C220A-IC(2)	C220A	IPEX TEMPEST HF (191"mm ORIFICE)	0.30	1.65	33.1	90.6
C222A-IC(1)	C222A	IPEX TEMPEST HF (203"mm ORIFICE)	0.41	1.72	45.3	104.2
C222A-IC(2)	C222A	IPEX TEMPEST HF (203"mm ORIFICE)	0.41	1.72	45.3	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 (102"mm ORIFICE)	1.44	4.64	18.0	35.4
L116A-IC(1)	L116A	IPEX TEMPEST HF (95"mm ORIFICE)	0.91	1.65	16.7	22.7
L116A-IC(2)	L116A	IPEX TEMPEST HF (95"mm ORIFICE)	0.91	1.65	16.7	22.7
L202A-IC(1)	L202A	IPEX TEMPEST HF (83"mm ORIFICE)	1.11	1.67	14.2	17.5
L202A-IC(2)	L202A	IPEX TEMPEST HF (83"mm ORIFICE)	1.11	1.67	14.2	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)	1.27	2.26	35.3	47.4
L206A-IC(1)	L206A	IPEX TEMPEST HF (108"mm ORIFICE)	1.23	1.63	25.1	29.2
L206A-IC(2)	L206A	IPEX TEMPEST HF (108"mm ORIFICE)	1.23	1.63	25.1	29.2
L206B-IC(1)	C206B	IPEX TEMPEST HF (140"mm ORIFICE)	0.52	1.51	26.2	46.8
L207A-IC(1)	L207A	IPEX TEMPEST HF (152"mm ORIFICE)	0.84	1.69	40.3	58.5
L207A-IC(2)	L207A	IPEX TEMPEST HF (152"mm ORIFICE)	0.84	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)	1.89	2.16	31.5	33.7
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)	1.13	2.14	24.0	33.5
L211A-IC(1)	L211A	IPEX TEMPEST HF (127"mm ORIFICE)	1.05	1.61	31.9	39.9
L211A-IC(2)	L211A	IPEX TEMPEST HF (127"mm ORIFICE)	1.05	1.61	31.9	39.9
L212A-IC1	L212A	IPEX TEMPEST HF (83"mm ORIFICE)	0.24	1.41	6.0	16.0
L212A-IC2	L212A	IPEX TEMPEST HF (83"mm ORIFICE)	0.24	1.41	6.0	16.0
L213A-IC(1)	L213A	IPEX TEMPEST HF (95"mm ORIFICE)	1.25	1.59	19.7	22.3

Orifice Name	Tributary Area ID	ICD Type	2yr Head (m)	100yr Head (m)	2yr Flow (L/s)	100yr Flow (L/s)
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)	0.96	1.61	43.3	57.0
L214A-IC(2)	L214A	IPEX TEMPEST HF (152"mm ORIFICE)	0.96	1.61	43.3	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	31.5	41.1
L219B-IC(2)	L219B	IPEX TEMPEST HF (127"mm ORIFICE)	1.03	1.71	31.5	41.1
L220A-S	L220A	IPEX TEMPEST HF (178"mm ORIFICE)	1.12	2.20	64.0	91.6
L225A-IC(1)	L225A	IPEX TEMPEST HF (127"mm ORIFICE)	0.64	1.70	34.9	41.1
L225A-IC(2)	L225A	IPEX TEMPEST HF (108"mm ORIFICE)	0.64	1.70	25.4	29.8
L226A-IC(1)	L226A	IPEX TEMPEST HF (127"mm ORIFICE)	1.44	1.59	32.8	39.7
L226A-IC(2)	L226A	IPEX TEMPEST HF (108"mm ORIFICE)	1.44	1.59	23.8	28.8
L228A-IC(1)	L228A	IPEX TEMPEST HF (152"mm ORIFICE)	0.55	1.61	50.0	56.9
L228A-IC(2)	L228A	IPEX TEMPEST HF (127"mm ORIFICE)	0.55	1.61	35.1	39.9
L229A-IC(1)	L229A	IPEX TEMPEST HF (127"mm ORIFICE)	1.45	1.57	28.0	39.5
L229A-IC(2)	L229A	IPEX TEMPEST HF (127"mm ORIFICE)	1.45	1.57	28.0	39.5
L234A-IC(1)	L234A	IPEX TEMPEST HF (108"mm ORIFICE)	1.17	1.68	24.6	29.7
L234A-IC(2)	L234A	IPEX TEMPEST HF (108"mm ORIFICE)	1.17	1.68	24.6	29.7
L234B-IC(1)	L234B	IPEX TEMPEST HF (95"mm ORIFICE)	0.95	1.65	17.1	22.7
L234B-IC(2)	L234B	IPEX TEMPEST HF (95"mm ORIFICE)	0.95	1.65	17.1	22.7
L237A-IC(1)	L237A	IPEX TEMPEST HF (102"mm ORIFICE)	0.88	1.60	18.8	25.8
L237A-IC(2)	L237A	IPEX TEMPEST HF (102"mm ORIFICE)	0.88	1.60	18.8	25.8
L238A-IC	L238A	IPEX TEMPEST HF (203"mm ORIFICE)	1.37	2.34	92.5	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)	0.85	1.62	28.5	40.0
L240B-IC(2)	L240B	IPEX TEMPEST HF (127"mm ORIFICE)	0.85	1.62	28.5	40.0
L241A-IC(1)	L241A	IPEX TEMPEST HF (108"mm ORIFICE)	1.07	1.63	23.3	29.1
L241A-IC(2)	L241A	IPEX TEMPEST HF (108"mm ORIFICE)	1.07	1.63	23.3	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: 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	95.08	95.08	95.08	-	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	95.07	95.07	95.07	-	95.10	95.12	95.12	-
101	95.74	95.17	95.18	95.18	0.56	95.22	95.25	95.25	0.49
102	95.63	95.20	95.20	95.20	0.43	95.25	95.27	95.27	0.36
103	95.69	95.23	95.23	95.23	0.46	95.28	95.31	95.31	0.38
104	95.75	95.25	95.25	95.25	0.50	95.30	95.34	95.34	0.41
105	96.00	95.33	95.32	95.33	0.67	95.39	95.43	95.43	0.57
106	96.00	95.36	95.35	95.36	0.64	95.42	95.47	95.47	0.53
107	96.10	95.57	95.59	95.59	0.51	95.68	95.75	95.75	0.35
108	96.10	95.61	95.66	95.66	0.44	95.76	95.86	95.86	0.24
+50m	96.25	95.64	95.75	95.75	0.50	95.84	95.97	95.97	0.28
+86m	96.33	95.67	95.82	95.82	0.51	95.90	96.05	96.05	0.28
109	96.23	95.69	95.88	95.88	0.35	95.95	96.12	96.12	0.11
110	96.54	95.70	95.74	95.74	0.80	95.83	95.90	95.90	0.64
111	96.30	95.76	95.80	95.80	0.50	95.89	95.96	95.96	0.34
112	96.30	95.93	95.98	95.98	0.32	96.08	96.14	96.14	0.16
+51m	96.34	95.97	96.03	96.03	0.31	96.13	96.19	96.19	0.15
113	96.37	96.00	96.06	96.06	0.31	96.16	96.22	96.22	0.15
114	95.63	95.22	95.23	95.23	0.40	95.27	95.30	95.30	0.33
115	95.71	95.30	95.31	95.31	0.40	95.36	95.38	95.38	0.33

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)
116	95.75	95.44	95.45	95.45	0.30	95.50	95.53	95.53	0.22
117	95.70	95.41	95.42	95.42	0.28	95.47	95.50	95.50	0.20
118	95.90	95.57	95.58	95.58	0.32	95.67	95.70	95.70	0.20
119	95.70	95.33	95.34	95.34	0.36	95.40	95.43	95.43	0.27
+51m	95.79	95.39	95.40	95.40	0.39	95.47	95.51	95.51	0.28
121	96.20	95.47	95.48	95.48	0.72	95.55	95.60	95.60	0.60
121A	N/A	95.48	95.49	95.49	-	95.55	95.60	95.60	-
123	96.40	95.68	95.65	95.68	0.72	95.76	95.81	95.81	0.59
124	96.64	96.34	96.34	96.34	0.30	96.34	96.35	96.35	0.29
125	96.99	96.48	96.47	96.48	0.51	96.49	96.49	96.49	0.50
+69m	97.15	96.84	96.83	96.84	0.31	96.86	96.86	96.86	0.29
126	97.44	96.96	96.95	96.96	0.48	96.98	96.98	96.98	0.46
+41m	97.69	97.32	97.31	97.32	0.37	97.33	97.33	97.33	0.36
+71m	98.00	97.58	97.58	97.58	0.42	97.59	97.59	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	97.08	97.08	0.36
129	97.49	97.13	97.12	97.13	0.36	97.14	97.14	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
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	95.29	95.29	0.67
210	95.91	95.53	95.57	95.57	0.34	95.63	95.69	95.69	0.22
+35m	95.86	95.41	95.44	95.44	0.42	95.50	95.55	95.55	0.31
202	95.76	95.33	95.35	95.35	0.41	95.41	95.44	95.44	0.32
+75m	95.84	95.45	95.49	95.49	0.35	95.56	95.59	95.59	0.25
204	95.93	95.56	95.63	95.63	0.30	95.71	95.74	95.74	0.19
+54m	96.04	95.64	95.73	95.73	0.31	95.81	95.85	95.85	0.19
205	96.14	95.72	95.84	95.84	0.30	95.91	95.96	95.96	0.18
+82m	96.74	95.85	95.99	95.99	0.75	96.07	96.14	96.14	0.60
206	97.17	95.89	96.04	96.04	1.13	96.12	96.20	96.20	0.97
207	97.43	96.40	96.72	96.72	0.71	96.76	97.00	97.00	0.43
209	N/A	96.70	97.13	97.13	-	97.14	97.47	97.47	-
211	95.91	95.58	95.61	95.61	0.30	95.68	95.74	95.74	0.17
212	N/A	95.64	95.67	95.67	-	95.75	95.81	95.81	-
213	96.18	95.66	95.71	95.71	0.47	95.77	95.83	95.83	0.35
214	96.18	95.76	95.80	95.80	0.38	95.87	95.94	95.94	0.24
215	96.28	95.86	95.92	95.92	0.36	95.99	96.06	96.06	0.22
216	96.39	95.90	95.95	95.95	0.44	96.02	96.09	96.09	0.30

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)
217	96.59	95.97	96.03	96.03	0.56	96.10	96.17	96.17	0.42
218	96.20	95.73	95.79	95.79	0.41	95.85	95.91	95.91	0.29
220	96.24	95.85	95.94	95.94	0.30	96.01	96.07	96.07	0.17
+38m	96.21	95.82	95.91	95.91	0.30	95.98	96.04	96.04	0.17
219	96.28	95.79	95.87	95.87	0.41	95.94	96.00	96.00	0.28
+62m	96.38	95.93	96.04	96.04	0.34	96.11	96.17	96.17	0.21
221	96.40	95.96	96.08	96.08	0.32	96.15	96.21	96.21	0.19
222	96.93	96.28	96.48	96.48	0.45	96.55	96.60	96.60	0.33
+52m	97.19	96.58	96.78	96.78	0.41	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	96.82	97.02	97.02	0.46	97.10	97.14	97.14	0.34
225	97.65	97.10	97.29	97.29	0.36	97.37	97.41	97.41	0.24
226	98.34	97.24	97.47	97.47	0.87	97.55	97.59	97.59	0.75
227	98.29	97.29	97.55	97.55	0.74	97.63	97.67	97.67	0.62
228	98.29	97.48	97.83	97.83	0.46	97.91	97.97	97.97	0.32
229	98.51	97.54	97.89	97.89	0.62	97.98	98.04	98.04	0.47
230	98.55	97.55	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	95.33	95.33	0.27
234	95.64	95.30	95.31	95.31	0.33	95.37	95.38	95.38	0.26
235	95.95	95.33	95.34	95.34	0.61	95.40	95.42	95.42	0.53
236	95.92	95.44	95.44	95.44	0.48	95.51	95.53	95.53	0.39
237	95.85	95.48	95.48	95.48	0.37	95.54	95.56	95.56	0.29
238	95.90	95.58	95.57	95.58	0.32	95.65	95.67	95.67	0.23
239	95.92	95.62	95.62	95.62	0.30	95.70	95.72	95.72	0.20
+28m	96.02	95.68	95.68	95.68	0.34	95.76	95.79	95.79	0.23
240	96.07	95.76	95.76	95.76	0.31	95.84	95.87	95.87	0.20
+51m	96.12	95.81	95.82	95.82	0.30	95.90	95.93	95.93	0.19
+58m	96.15	95.82	95.83	95.83	0.32	95.91	95.94	95.94	0.21
241	96.18	95.84	95.85	95.85	0.33	95.93	95.96	95.96	0.22

1. HGL values have been interpolated between proposed 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: 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	94.77	N/A
100B	N/A	94.77	N/A
100C	N/A	94.77	N/A
100D	N/A	94.78	N/A
100E	N/A	94.75	N/A
101	95.74	94.84	0.90
102	95.63	94.86	0.77
103	95.69	94.87	0.82
104	95.75	94.88	0.87
105	96.00	95.18	0.82
106	96.00	95.26	0.74
107	96.10	95.17	0.93
108	96.10	95.27	0.83
109	96.23	95.56	0.67
110	96.54	95.33	1.21
111	96.30	95.41	0.89
112	96.30	95.61	0.69
113	96.37	95.79	0.58
114	95.63	94.88	0.75
115	95.71	94.94	0.77
116	95.91	95.29	0.62
117	95.70	95.11	0.59
118	95.90	95.54	0.36

STM MH	Prop. USF (m)	25-Year, 3 HR Chicago HGL (m)	USF - HGL Clearance (m)
119	95.70	94.92	0.78
121	96.20	94.98	1.22
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
201	95.96	94.79	1.17
202	95.94	94.82	1.12
204	95.94	94.83	1.11
205	96.14	94.84	1.30
206	96.59	94.85	1.74
207	97.43	95.42	2.01
209	N/A	95.87	N/A
210	96.30	95.08	1.22
211	96.25	95.12	1.13
212	N/A	95.17	N/A
213	96.35	95.21	1.14
214	96.35	95.29	1.06
215	96.57	95.47	1.10
216	96.59	95.57	1.02
217	96.59	95.76	0.83

STM MH	Prop. USF (m)	25-Year, 3 HR Chicago HGL (m)	USF - HGL Clearance (m)
218	96.30	95.26	1.04
219	96.48	95.31	1.17
220	96.39	95.49	0.90
221	96.48	95.59	0.89
222	96.93	96.09	0.84
223	96.93	96.54	0.39
224	97.48	96.65	0.83
225	97.65	96.95	0.70
226	98.34	97.13	1.21
227	98.29	97.21	1.08
228	98.29	97.50	0.79
229	98.51	97.55	0.96
230	98.55	97.55	1.00
231	98.41	97.33	1.08
232	98.41	97.56	0.85
233	95.60	94.82	0.78
234	95.60	94.86	0.74
235	95.95	94.88	1.07
236	95.92	94.94	0.98
237	95.85	94.97	0.88
238	95.90	95.02	0.88
239	95.91	95.07	0.84
240	96.07	95.19	0.88
241	96.18	95.27	0.91

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. The following table

shows the target capture rate based on the 2-year/5-year runoff from the catchment as obtained from PCSWMM, 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)	ICD Capture - 2/5yr Runoff Difference (L/s)
C205A	IPEX TEMPEST HF (127"mm ORIFICE)	15.9	36.7	58.6	30.4
C205A	IPEX TEMPEST HF (152"mm ORIFICE)	22.1	52.3		
C219A	IPEX TEMPEST HF (102"mm ORIFICE)	13.2	20.8	22.0	-1.3
C220A	IPEX TEMPEST HF (191"mm ORIFICE)	33.1	75.9	99.3	52.4
C220A	IPEX TEMPEST HF (191"mm ORIFICE)	33.1	75.9		
C222A & UNC-4	IPEX TEMPEST HF (203"mm ORIFICE)	45.3	72.4	145.7	-0.8
	IPEX TEMPEST HF (203"mm ORIFICE)	45.3	72.4		
C223A	IPEX TEMPEST HF (178"mm ORIFICE)	25.2	38.5	38.9	-0.4
G234A	IPEX TEMPEST HF (102"mm ORIFICE)	18.0	39.0	18.4	-0.4
L116A	IPEX TEMPEST HF (95"mm ORIFICE)	16.7	21.1	33.5	-0.2
L116A	IPEX TEMPEST HF (95"mm ORIFICE)	16.7	21.1		
L202A	IPEX TEMPEST HF (83"mm ORIFICE)	14.2	16.4	25.1	3.3
L202A	IPEX TEMPEST HF (83"mm ORIFICE)	14.2	16.4		
L202B	IPEX TEMPEST HF (108"mm ORIFICE)	25.4	25.7	35.2	-9.8
L204A	IPEX TEMPEST HF (127"mm ORIFICE)	34.3	38.2	69.1	-0.5
L204A	IPEX TEMPEST HF (127"mm ORIFICE)	34.3	38.2		
L204B	IPEX TEMPEST HF (127"mm ORIFICE)	29.3	37.7	59.0	-0.4
L204B	IPEX TEMPEST HF (127"mm ORIFICE)	29.3	37.7		
L205B	IPEX TEMPEST HF (127"mm ORIFICE)	35.3	46.5	38.2	-2.9
L206A	IPEX TEMPEST HF (108"mm ORIFICE)	25.1	27.7	50.7	-0.4
L206A	IPEX TEMPEST HF (108"mm ORIFICE)	25.1	27.7		
C206B	IPEX TEMPEST HF (140"mm ORIFICE)	26.2	39.9	41.0	-1.1
L207A	IPEX TEMPEST HF (152"mm ORIFICE)	40.3	54.5	80.9	-0.4
L207A	IPEX TEMPEST HF (152"mm ORIFICE)	40.3	54.5		
L209A	IPEX TEMPEST HF (127"mm ORIFICE)	26.4	37.3		
L209A	IPEX TEMPEST HF (127"mm ORIFICE)	26.4	37.3	53.0	-0.3
L209B	IPEX TEMPEST HF (102"mm ORIFICE)	22.8	24.1	23.4	-0.6
L209C	IPEX TEMPEST HF (108"mm ORIFICE)	31.5	33.3	36.4	-5.0
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)	24.0	33.1	27.2	-3.2
L211A	IPEX TEMPEST HF (127"mm ORIFICE)	31.9	37.9	64.3	-0.5
L211A	IPEX TEMPEST HF (127"mm ORIFICE)	31.9	37.9		
L212A	IPEX TEMPEST HF (83"mm ORIFICE)	6.0	9.8	12.2	-0.1

Tributary Area ID	ICD Type	2yr ICD Capture (L/s)	5yr ICD Capture (L/s)	2/5yr Runoff (L/s)	ICD Capture - 2/5yr Runoff Difference (L/s)
L212A	IPEX TEMPEST HF (83"mm ORIFICE)	6.0	9.8		
L213A	IPEX TEMPEST HF (95"mm ORIFICE)	19.7	21.5	39.8	-0.3
L213A	IPEX TEMPEST HF (95"mm ORIFICE)	19.7	21.5		
L214A	IPEX TEMPEST HF (152"mm ORIFICE)	43.3	54.0	87.1	-0.5
L214A	IPEX TEMPEST HF (152"mm ORIFICE)	43.3	54.0		
L217A	IPEX TEMPEST HF (127"mm ORIFICE)	29.7	37.7	59.8	-0.5
L217A	IPEX TEMPEST HF (127"mm ORIFICE)	29.7	37.7		
L218B & UNC-2	IPEX TEMPEST HF (95"mm ORIFICE)	25.4	25.8	34.6	-9.3
L219B & UNC-1	IPEX TEMPEST HF (127"mm ORIFICE)	31.5	38.2	63.6	-0.6
	IPEX TEMPEST HF (127"mm ORIFICE)	31.5	38.2		
L220A	IPEX TEMPEST HF (178"mm ORIFICE)	64.0	89.6	66.1	-2.0
L225A & ½ UNC-6	IPEX TEMPEST HF (127"mm ORIFICE)	34.9	38.3	57.0	3.3
	IPEX TEMPEST HF (108"mm ORIFICE)	25.4	27.8		
L226A & ½ UNC-6	IPEX TEMPEST HF (127"mm ORIFICE)	32.8	37.9	61.2	-4.6
	IPEX TEMPEST HF (108"mm ORIFICE)	23.8	27.5		
L228A & ½ UNC-5	IPEX TEMPEST HF (152"mm ORIFICE)	50.0	54.5	82.6	2.5
	IPEX TEMPEST HF (127"mm ORIFICE)	35.1	38.2		
L229A & ½ UNC-5	IPEX TEMPEST HF (127"mm ORIFICE)	28.0	37.6	59.9	-3.9
	IPEX TEMPEST HF (127"mm ORIFICE)	28.0	37.6		
L234A	IPEX TEMPEST HF (108"mm ORIFICE)	24.6	27.7	49.5	-0.4
L234A	IPEX TEMPEST HF (108"mm ORIFICE)	24.6	27.7		
L234B	IPEX TEMPEST HF (95"mm ORIFICE)	17.1	21.2	34.5	-0.3
L234B	IPEX TEMPEST HF (95"mm ORIFICE)	17.1	21.2		
L237A	IPEX TEMPEST HF (102"mm ORIFICE)	18.8	24.3	38.1	-0.5
L237A	IPEX TEMPEST HF (102"mm ORIFICE)	18.8	24.3		
L238A	IPEX TEMPEST HF (203"mm ORIFICE)	92.5	121.8	95.1	-2.6
L240A	IPEX TEMPEST HF (102"mm ORIFICE)	19.2	24.4	38.7	-0.4
L240A	IPEX TEMPEST HF (102"mm ORIFICE)	19.2	24.4		
L240B	IPEX TEMPEST HF (127"mm ORIFICE)	28.5	37.6	57.5	-0.4
L240B	IPEX TEMPEST HF (127"mm ORIFICE)	28.5	37.6		
L241A	IPEX TEMPEST HF (108"mm ORIFICE)	23.3	27.7	47.4	-0.7
L241A	IPEX TEMPEST HF (108"mm ORIFICE)	23.3	27.7		

1. A negative value implies that the ICD capture rate is lower than the catchment runoff. However, slight negative values do not result in surface ponding as shown in the 2-year and 5-year total flow depth summary table included in **Appendix B.3**.

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. 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**

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	97.80	0.35
206B-S(1)	97.77	98.50	97.90	0.13	97.93	0.16
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	98.16	0.34	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
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	99.67	0.21	99.70	0.24
228A-S	99.99	100.40	100.22	0.23	100.25	0.26
229A-S	100.20	100.62	100.39	0.19	100.44	0.24
234A-S	97.35	97.85	97.65	0.30	97.68	0.33
234B-S	97.30	97.77	97.57	0.27	97.61	0.31
237A-S	97.36	97.85	97.58	0.22	97.67	0.31
240A-S	97.59	98.10	97.75	0.16	97.76	0.17
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
L212A-S	96.94	N/A	96.97	0.03	96.97	0.03

As requested by the City, the table below summarizes drawdown times for the 5-year, 3hr Chicago storm event for specific subcatchments with large static ponding areas.

Table 3.12: 5-year Drawdown Time

Drainage Area ID	Catchbasin ID	Catchbasin T/G Elevation (m)	Drawdown Time (minutes)
L217A	CB 217 A-1 & 2	97.81	11
L240B	CB 240 A-1 & 2	97.40	9

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 is proposed that the upper 20 cm layer of soil within the proposed rearyard areas (Second Registration Phase), and within landscaped areas in the proposed park (Second Registration Phase) be constructed with amended soils to promote infiltration and evapotranspiration. It is also recommended that the underlying soils below the proposed amended topsoil layer be scarified to a depth of 45 cm to promote additional infiltration.

Other practices for groundwater infiltration include:

- Direct roof leaders to rear yard areas
- bioswales underlying drainage swales in proposed rearyard areas
- The use of amended planting topsoil in parks and residential backyards
- 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, 21.80 ha will be converted to impervious area with no infiltration, which excludes the proposed ultimate SWM pond footprint of 2.56 ha that will not provide infiltration either. Approximately 12.17 ha will consist of parks, lawns and open space areas. The inclusion of amended planting topsoil in proposed residential rearyards and the proposed park area (total of 2.96 ha) is expected to provide additional infiltrative capacity to surficial soils in order to increase post development infiltration rate from pervious areas to 13,202 m^3/year (9,630 m^3/year to be infiltrated elsewhere). The practice of applying a deeper layer of organic topsoil has the potential to absorb runoff and increase infiltration, as well as to promote evapotranspiration, thus reducing runoff volumes overall. Due to the impervious nature of the native clay soils, it is expected that the addition of amended soils to the rearyard landscaped areas within the proposed phase as well as within the proposed park landscaped areas will promote shallow groundwater movement to the Carp River and Hazeldean Creek.

The recommended minimum topsoil depth and quality standards as per the Toronto and Region Conservation Authority is as follows.

Table 3.13: Amended Planting Soil Minimum Depth and Quality Standards

Planting Area Type	Subsoil Scarifying Depth (cm)	Topsoil Organic Matter (%dry wt.)	Topsoil PH	Planting Soil Depth (cm)	Total Uncompacted Soil Depth (cm)
Turf Area	45	5 to 10	6.0 to 8.0	20	65
Planting Bed of Tree Pit	45	10 to 15	6.0 to 8.0	20	65

Rear-yard bioswales within the approved and proposed phases of the development are required to provide the additional 9,630 m^3/year.

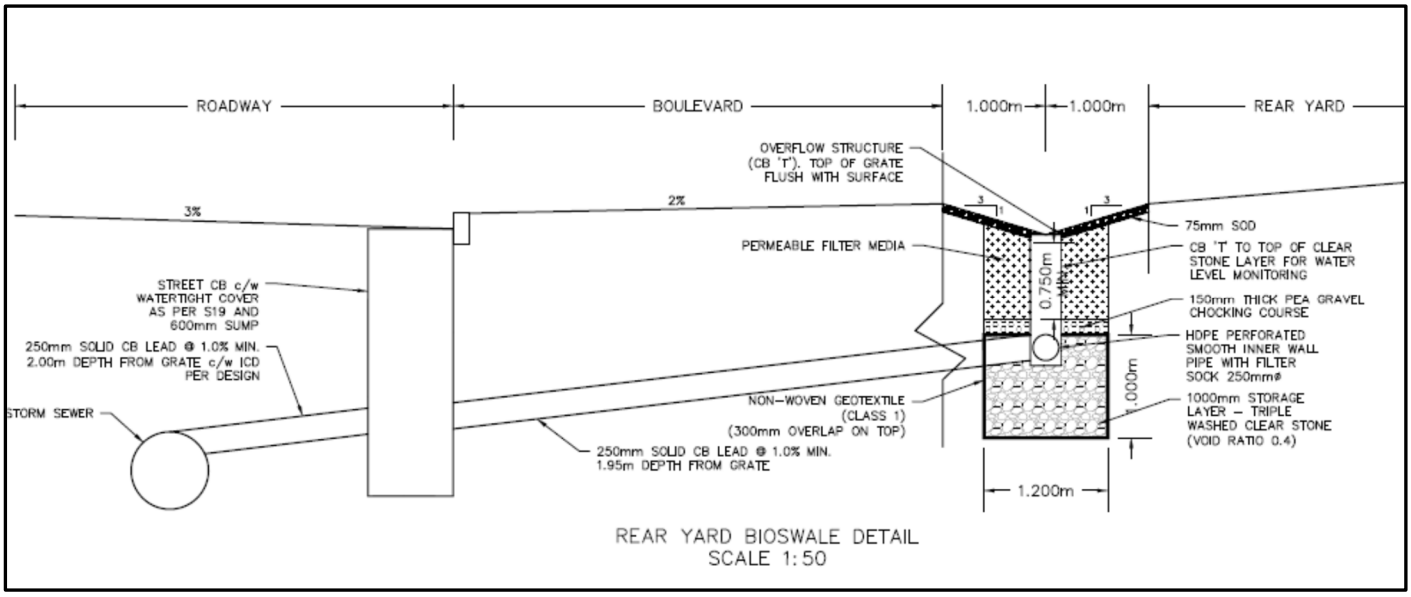
Based on average precipitation data available (2000-2011), approximately 31 rainfall events/yr have a rainfall depth that ranges between 6 mm and 25 mm, for an average depth of 12.2 mm. Based on the roof area tributary to the rear yard bioswales in the approved and proposed phases (23,969 m^2 based on half roofs directed to rearyards), the annual volume of runoff from the roofs to the bioswales is approximately 8,983 m^3 (647 m^3/year to be infiltrated elsewhere).

Based on available site plans for the approved and proposed private residential blocks, the opportunities for infiltration within the private blocks are limited to none. This is reflected in the revised/increased runoff coefficient for the future residential block (area L225B) of 0.80. As a result, the remaining 647 m^3/yr required to infiltrate will be provided within the school block (Block 76).

Detailed water balance calculations including conceptual school infiltration calculations which show that the future school block could provide approximately 1,106 m^3/year 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 3.14** 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 3.14: Proposed Bioswale Characteristics

Drainage Area ID	Drainage Area (ha)	Imperviousness (%)	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

Drainage Area ID	Drainage Area (ha)	Imperviousness (%)	Required Volume for 25mm Event (m^3)	Bioswale Length (m)	Bioswale Width (m)	Storage Layer Depth (m)	Maximum Storage Available (m)
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
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 (TPR) 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 TPR 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 of conveying the 10.38 m^3/s 100-year peak flow without overtopping the road 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 Design Criteria

As per the Ministry of Transportation Drainage Design Standards (MTO, January 2008), the design flow return period for the proposed crossing at Roger Griffiths Avenue, designated as a collector road is 50-years (total span greater than 6m) and for the proposed crossing at Tillage Street, designated as a local street is 25 years (total span greater than 6m). However, both crossings will be designed to convey the 100-year peak design flow of 10.38 m^3/s without overtopping the road.

The most-up-to-date ultimate condition Carp River Model results in 5.0 m^3/s being discharged into Hazeldean Creek during the 25-year SCS Type II storm, which will be used as the design peak flow for the proposed crossing at Tillage Street. Given that the Carp River Model was not run using the 50-year storm, the 100-year SCS Type II storm peak flow of 8.2 m^3/s obtained from the Carp River model will be used as the design flow for the proposed crossing at Roger Griffiths Avenue.

Hazeldean Creek has been identified as a fish-bearing watercourse and as a result, a Request For Review will be submitted to DFO (by others) under separate cover.

3.7.3 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. Boundary conditions along Hazeldean Creek (i.e., 100-eyar water levels) were interpolated from the most-up-to-date Carp River Model for the 100-year, 12hr SCS Type II storms as 95.21m downstream of the Tillage Street crossing and 98.00m downstream of the Roger Griffiths Avenue crossing. 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 riprap 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 3.15: 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
Peak Design Flow (m^3/s)	8.2	5.0
Upstream Design Water Level (m)	98.18	96.00
Outlet Design velocity (m/s)	1.14	2.01
100-year Upstream Water Level (m)	98.28	96.41
Proposed Edge of Road Elevation (m)	98.91	97.58
Freeboard (m)	0.63	1.17

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

3.7.4 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 that varies between 1.5m to 12.0m (narrowing from the culvert openings) and a trapezoidal section with maximum side slopes at 3:1 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.

4.0 WASTEWATER

The proposed second registration phase of the Richcraft Kanata West Development will be serviced through the approved sanitary sewers within the first registration phase that ultimately discharge into the existing 1200 mm diameter sanitary sewer on Maple Grove Road. The proposed sanitary trunk sewers have been sized for the ultimate development condition which includes sewage peak flows from the existing Trinity Development to the south.

4.1 BACKGROUND

The Kanata West Master Servicing Study (Stantec, 2006) outlined the servicing requirements for the subject property. As outlined in the KWMSS, sewage peak flows from the entire Richcraft Kanata West Development and the existing Trinity development to the south will be conveyed via the existing 1200 mm diameter sanitary trunk sewer on Maple Grove Road to the Kanata West Pump Station (KWPS) as shown on **Drawing OSSP-2**.

Modelling of the proposed sanitary sewer system is required as per the KWMSS to assess maximum HGLs during critical failure of the KWPS. In addition, as outlined in the City's "Technical Bulletin ISTB-2018-01", a sanitary HGL analysis is required to assess the maximum HGL in the sanitary sewer system under normal pumping station conditions. The HGL across the proposed site has been assessed under the worst-case scenario which occurs during full build-out of the Richcraft Kanata West Development, and once a sanitary connection has been provided for the existing Trinity Development through the proposed site.

4.2 PROPOSED DEVIATIONS FROM THE KANATA WEST MASTER SERVICING STUDY

The following table shows a comparison of the sanitary sewer design criteria outlined in the 2006 KWMSS and the revised design criteria used for the proposed development as per the latest City of Ottawa design guidelines and technical bulletins. Relevant excerpts from the KWMSS and the City of Ottawa guidelines are included in **Appendix D.3**.

Table 4.1: KWMSS and Proposed Design Criteria Comparison

Design Parameter	2006 KWMSS	Revised Criteria as per City Guidelines
Residential Average Daily Flow Rate (L/p/day)	350	280
Harmon Correction Factor	1.0	0.8
Employment Area Flow Rate (L/ha/day)	50,000	28,000
Business Park/Employment Peak Factor	1.5	1.5/1[1]
Infiltration Rate (L/s/ha)	0.28	0.33

Design Parameter	2006 KWMSS	Revised Criteria as per City Guidelines
Manhole Spacing	120 m maximum	120m for pipes under 450mm dia., 150m for pipes over 450mm dia.

1. ICI Peak Factor= 1.5 if ICI in contributing area is >20%; ICI Peak Factor =1.0 if ICI in contributing area <20%

4.3 DESIGN CRITERIA

The following design guidelines were obtained from the City's "Technical Bulletin ISTB-2018-01" and were used to estimate wastewater flow rates from the proposed development and to size the sanitary sewers.

- Minimum Full Flow Velocity – 0.6 m/s
- Maximum Full Flow Velocity – 3.0 m/s
- Manning roughness coefficient for all smooth wall pipes – 0.013
- Single Family Persons per unit – 3.4
- Townhouse unit – 2.7
- Per Capita Residential Average Daily Flow – 280 L/p/day
- Commercial and Institutional Average Daily Flow - 28,000 L/ha/day
- Peaking Factor for Commercial and Institutional Areas – 1.5 if ICI in contributing area is >20%; ICI Peak Factor =1.0 if ICI in contributing area <20%
- Extraneous Flow Allowance – 0.33 L/s/ha
- Manhole Spacing – 120m for pipes under 450mm dia., 150m for pipes over 450mm dia.
- Minimum Cover – 2.5 m

In addition, a unit density of 38 units/ha was used for the medium density residential block 1, and a residential peak factor based on Harmon's Equation with a correction factor of 0.8 was used to determine the residential peak design flows.

4.4 PROPOSED SANITARY SEWERS

The proposed sanitary sewer system has been designed as a network of gravity sewers which will direct wastewater flows from the approved and proposed phases of the Richcraft Kanata West Subdivision and the existing Trinity Development (approximately **51.7 L/s** including **12.1 L/s** from the existing Trinity commercial site) to the Maple Grove trunk sewer and ultimately to the Kanata West Pump Station (KWPS). The overall drainage areas, wastewater peak flows and sanitary sewers within the approved and proposed development areas are shown on **Drawings SA-1** and **SA-2** and in the sanitary sewer design sheet included in **Appendix C.1.** Unit density for the private medium density residential block (Block 78) was assumed as 254 townhome units as per the concept plan included in **Appendix D.3**.

The existing sanitary sewer stub at the Trinity Development has an invert elevation of 92.30 m, which is roughly 5.6 m below the proposed grades of the Richcraft Kanata West Development. Every effort was made during the detailed design stage of the approved first registration phase of the development to raise the sanitary sewer system within the Richcraft KW Development, while avoiding crossing conflicts and still providing a gravity outlet for the existing Trinity Development. However, the proposed sanitary sewer depth along sections of Ploughshare Road, Tillage Street, Winter Wheat Terrace and Roger Griffiths Avenue range between 4.4 m and 6.6 m. As a result, separate local sanitary sewers have been provided between the proposed sanitary manholes 54G to 54, and 54D to 54 to service the proposed units and avoid deep service connections to the main trunk sewer which exceeds 4 m depth. The proposed drainage pattern is in accordance with the KWMSS and is detailed on **Drawings SA-1** and **SA-2.** The sanitary sewer design sheet is included in **Appendix C**.

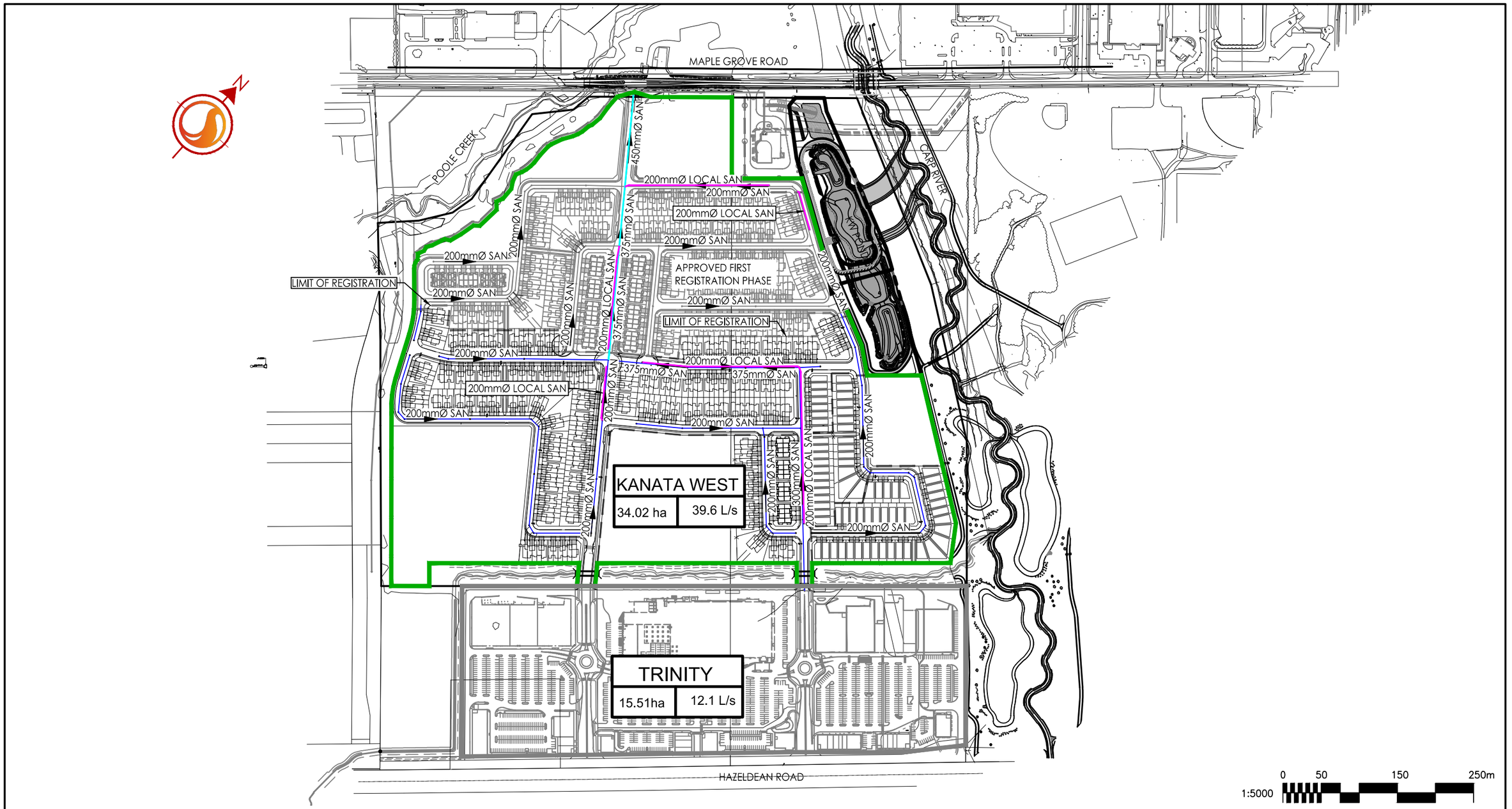
Modified Right of Way (ROW) cross-sections as shown on **Drawing DS-1** have been proposed and reviewed and approved by the City as part of the first registration phase detailed design stage. The modified cross-sections accommodate a high-level sanitary sewer by laying the deep sanitary sewer closer to the watermain which allows the sanitary sewers to be offset, while ensuring that the elevation of the crown of the sewer is at least 0.5 m below the invert of the watermain in accordance with MOE F-6-1 Procedures to Govern Separation of Sewers and Watermain. In addition, consideration has been given to the separation proposed between the storm and the local/high-level sanitary sewer as the minimum distance, depending on the size of the storm sewer, shall be as per standard S7.

The potential total and differential settlements for the proposed underground services will be within the tolerable levels provided that current and future settlement surcharge programs are successfully completed.
The recommendations for deep underground services are provided in Subsection 6.3 - Excavation Side Slopes and Subsection 6.4 - Pipe Bedding and Backfill in the latest Geotechnical Report PG3062-1 Revision 4 dated May 24, 2019. For safety purposes, all deep excavation should be supported by temporary shoring, such as stacked trench boxes designed by a structural engineer.

Given the depth of the proposed sanitary sewer which will be below the ground water level in some areas, it is recommended that controlled settlement joints be used on each building service connection as per City Standard S11 and that clay seals be installed as per City standard drawing No. S8. In addition, the proposed sanitary sewers have been sized to include an infiltration peak flow rate equal to 0.33 L/s/ha as per City of Ottawa guidelines.

The proposed sanitary sewer consists of PVC SDR 35 pipes. As per Paterson memo PG3062-MEMO.09, It is expected that site servicing for the proposed development will be considered conventional for the Ottawa area using conventional open-cut methods and do not require SDR26 or SDR16 PVC sewers to mitigate the potential for pipe warping. As per technical information provided by the pipe manufacturer, IPEX's Ring-Tite piping systems SDR-35 meet the

requirements of CSA B182.2, with additional requirement that gasket joints shall withstand 345 kPa (50psi) hydrostatic pressure, and negative vacuum pressure of -75kPa (-11psi) or 22' of mercury, in compliance with CSA B182.2 and ASTM D3034.



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Legend

- EXISTING SANITARY DRAINAGE BOUNDARY
- PROPOSED OVERALL SANITARY DRAINAGE BOUNDARY
- Catchment 1 | 4.00 ha | 50L/s — SITE ID / AREA (HA) / QPEAK (L/s)
- PROPOSED SANITARY SEWER
- APPROVED FIRST REGISTRATION PHASE SANITARY SEWER
- PROPOSED DEEP TRUNK SANITARY SEWER (DEEPER THAN 6.0m)
- PROPOSED HIGH LEVEL LOCAL SANITARY SEWER

Client/Project
RICHCRAFT HOMES
RICHCRAFT KANATA WEST

Figure No.
4.1

Title
PROPOSED SANITARY SEWER NETWORK AND EXTERNAL DRAINAGE EXTENT

4.5 SANITARY HGL ANALYSIS

This section summarizes the results of the sanitary hydraulic grade line (HGL) analysis for the proposed second registration phase of the Richcraft Kanata West Development. The worst-case HGL occurs at full build-out of the Richcraft KW Development and as such, the HGL analysis includes the approved and proposed sanitary sewers within the entire Richcraft KW Development, external wastewater flows from the existing Trinity Development, as well as the existing 1200 mm diameter sanitary trunk sewer on Maple Grove Road from the subdivision outlet to the Kanata West Pumping Station (KWPS) located at the southwest intersection of Maple Grove Road and Terry Fox Drive.

The sanitary HGL across the proposed Richcraft subdivision has been assessed assuming ultimate development conditions for the KWPS catchment area under both catastrophic failure and normal operating conditions of the KWPS. The sanitary HGL analysis was prepared based on the following background documents provided by the City of Ottawa (see **Appendix C.3**).

- *Alternative 2: Divert Stittsville Trunk Sewer Only Design Sheet Long Term Flows (2031)*, J.L Richard and Associates, December 2014.
- *Fernbank Community – Kizell Lands, Sanitary Drainage Area Plan*, Novatech, February 2018.
- *Fernbank Community – Kizell Lands, Sanitary Sewer Design Sheet*, Novatech, February 2018.
- *Kanata West Master Servicing Study, Sanitary Sewer Design Sheet*, Stantec Consulting Ltd., CCL and IBI, April 2005.
- *Kanata West Concept Plan Master Servicing Study, Preferred Waste-Water Option*, Stantec Consulting Ltd., CCL and IBI, October 2005.
- *Reconstruction of Maple Grove Road, Sanitary Drainage Plan*, DSEL on behalf of the City of Ottawa, July 2011.
- *Reconstruction of Maple Grove Road, Sanitary Sewer Calculation Sheet,* DSEL on behalf of the City of Ottawa, May 2012.
- *Kanata West Serviceability Study, N-S Interceptor Sewer Sanitary Design Sheet*, IBI, June 2016.
- *Maple Grove Expansion Area Excel Sheet*, City of Ottawa.
- *Hazeldean Sanitary Sewer Analysis*, Atrel Engineering Ltd., November 29th, 2017.
- *Kanata West Pumping Station and Forcemains Preliminary Design Report*, Stantec Consulting Ltd., April 13, 2015
- *Kanata West Pumping station and Forcemains – Preliminary Design Report*, Stantec Consulting Ltd., April 2015.

4.5.1 Sanitary HGL Analysis Criteria

As per the City of Ottawa's Technical bulletin from March 2018, a sanitary HGL analysis must be performed assuming both catastrophic failure and normal operating conditions of the KWPS.

Annual flow parameters are to be used to assess the HGL in the sanitary system assuming a catastrophic failure of the pump station with wet weather peak flows being discharged through

the emergency overflow into the ultimate condition Kanata West Pond 5 under 100-year water level. The HGL under this scenario cannot touch the proposed under side of footing (USF).

As per the KWPS overflow weir design calculations, a 20 cm head over the overflow weir crest is required to convey the design wet weather peak flow of 1,250 L/s to the KW Pond 5. The 20 cm head has been used to estimate the boundary conditions in the Catastrophic event scenarios for conservatism.

Additional scenarios have been run assuming catastrophic failure of the KWPS as described below.

- Scenario 1 assumes a conservative design peak flow of 583 L/s from the Stittsville trunk sewer diversion and a fixed backwater boundary condition of 95.20 m at the ultimate KW Pond 5 (100-year water level plus 20 cm head over the KWPS overflow weir).
- Scenario 2 assumes the ultimate condition IMP peak flow of 360 L/s from the Stittsville trunk sewer diversion and a fixed backwater boundary condition of 95.20 m at the ultimate KW Pond 5.
- Scenario 3 assumes the interim condition IMP peak flow of 465 L/s from the Stittsville trunk sewer diversion and a fixed backwater boundary condition of 95.20 m at the ultimate KW Pond 5.
- Scenario 4 assumes a conservative design peak flow of 583 L/s from the Stittsville trunk sewer diversion and a fixed backwater boundary condition of 95.06 m at the ultimate KW Pond 5 (25-year water level plus 20 cm head over the PS overflow weir).

Rare flow parameters are to be used to assess the maximum HGL in the sanitary system under normal pumping station conditions. Under this scenario, the HGL must be at least 0.3 m below the USF.

4.5.2 Design Parameters and Assumptions

The following table summarizes the design annual and rare flow parameters as obtained from the City's "Technical Bulletin ISTB-2018-01 Revision to Ottawa Design Guidelines - Sewer".

Table 4.2: Wastewater Annual and Rare Flow Parameters

Parameters	Annual	Rare
Res. Per Capita	200	200
Commercial	17,000	17,000
Institutional	17,000	17,000
Industrial	10,000	10,000
I/I Dry	0.02	0.02
I/I Wet	0.28	0.53
Total I/I	0.30	0.55
Harmon – Correction Factor	0.6	0.6
ICI Peak Factor	1	1

Sanitary inflows from the proposed and approved phases of the KW Development were obtained from the detailed sanitary drainage plans included in **Appendix F**, while sanitary inflows from all external areas under ultimate development conditions were obtained from background documents provided by the City of Ottawa as shown in **Appendix C.3**. **Appendix C.2** includes the rare and annual sewage inflow calculations as well as a figure identifying each of the subareas used. **Table 4.3** summarizes the populations and areas obtained from the background documents as well as the assumptions made for any other areas.

Table 4.3: Wastewater Population and Area Assumptions

Segment	Population	Residential Area (ha)	Commercial /Industrial/I nstitutional Area (ha)	Annual Peak Inflows (L/s)	Rare Peak Inflows (L/s)	Additional Assumptions
Stittsville Trunk	28,031	526.60	76.0 ha Commercial and 40.5 ha Industrial	583.0 Scenario 1 360.0 Scenario 2 465.0 Scenario 3 583.0 Scenario 4	503.0	The peak design flow of 583 L/s was used in the catastrophic event Scenario 1 for conservatism, the ultimate condition IMP model peak flow of 360 L/s was used for the catastrophic event scenario 2, while the interim condition IMP model peak flow of 465 L/s was used for the catastrophic event scenario 3. A peak flow estimated using rare event parameters of 503 L/s was used for the normal operating condition analysis.
Kizell Lands	3,585	52.56	11.82	41.8	57.9	-
Huntmar and Hazeldean	6,357	111.52	65.44	103.9	151.6	Population and areas as obtained from Huntmar/Hazeldean Design Sheet based on KWMSS assumptions for areas 16, 20, 17, 21, 19A, 23, 24 and 19
Additional Hazeldean	296	13.62	5.39	8.7	13.5	-
Maple Grove Sewer	10,501	137.54	-	93.8	128.2	-

Segment	Population	Residential Area (ha)	Commercial /Industrial/I nstitutional Area (ha)	Annual Peak Inflows (L/s)	Rare Peak Inflows (L/s)	Additional Assumptions
Maple Grove Expansion	3,549	84.43	-	42.9	61.9	Number of units and gross area based on spreadsheet provided by the City, with 90% of gross area contributing to I/I and 198 employees generating 83L/emp/day added to total flow
Future North-South Collector	4,936	28.44	165.28	147.5	195.9	Population and areas were obtained based on IBI Design Sheet areas A to F and 21.13 ha of area G. A 30L/s fixed flow was added to the total peak flow.
North of Richcraft Kanata Site	113	1.10	-	1.1	1.4	Assumed medium density residential area to have 38 units/ha and 2.7person/unit.
Richcraft Kanata West Development / Existing Trinity	2,313	28.14	18.65	34.5	46.8	-

Based on the above assumptions plus the peak flows estimated for the detailed sanitary catchments across the Richcraft KW Development as shown in **Appendix C.2**, the worst-case peak annual flow is 1,057 L/s (Scenario 1) and the peak rare flow is 1,160 L/s were obtained.

4.5.3 Boundary Conditions

The catastrophic HGL scenarios 1 through 3 which use annual flow parameters to calculate peak inflows into the sanitary system were assessed assuming a fixed backwater of 95.2 m based on a 100-year water level in the ultimate KW Pond 5 equal to 95.0 m plus an additional 0.2 m head over the KWPS emergency overflow weir (head required to convey the design wet weather peak flow of 1,250 L/s as obtained from the KWPS design brief). An additional catastrophic HGL scenario (Scenario 4) was assessed assuming a fixed backwater of 95.06 m based on a 25-year water level in the ultimate KW Pond 5 equal to 94.86 m plus an additional 0.2 m head over the KWPS emergency overflow weir.

The normal operating condition HGL analysis which uses rare flow parameters to calculate peak inflows into the sanitary system was done assuming startup and shutoff elevations in the KWPS of 84.25 m and 82.90 m respectively. The minimum and maximum wet well volumes assumed for

the ultimate condition were 281 m^3 and 810 m^3 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 Richcraft 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

Sanitary Manhole	Rim Elevation (m)	USF (m)	HGL (m)	USF - HGL Clearance
5	98.63	96.64	95.44	1.20
6	98.67	96.99	95.53	1.46
7	99.11	96.99	96.02	0.97
8	100.21	97.69	97.15	0.54
9	99.23	97.44	96.21	1.23
10	99.43	97.67	96.32	1.35
11	100.75	97.67	96.90	0.77
12	100.60	98.39	97.03	1.36
3A	97.75	95.71	94.19	1.52
3B	97.66	95.71	94.57	1.14
3C	97.53	95.71	94.85	0.86
14	97.61	N/A	92.53	-
16	97.35	95.71	92.87	2.84
17	97.29	N/A	92.95	-
17A	97.32	95.63	94.32	1.31
17B	97.37	95.63	94.68	0.95
18	97.17	95.63	93.21	2.42
18A	97.65	95.69	93.58	2.11
19	97.43	95.63	93.35	2.28
20	97.50	95.63	93.54	2.09
22	97.96	96.15	91.18	4.97
22A	97.83	96.10	94.36	1.74
22B	97.84	96.10	94.85	1.25
23	98.10	96.54	94.40	2.14
24	98.05	96.30	94.47	1.83
25	98.00	96.30	94.67	1.63
26	98.10	96.30	95.00	1.30
27	97.92	95.75	93.88	1.87
30	98.01	95.90	94.33	-
31	97.52	95.70	94.49	1.21
32	97.68	95.90	94.88	1.02
33	97.62	96.00	94.59	1.41
35	97.96	96.04	91.38	4.66
35A	97.94	N/A	91.28	-

The above table shows that the 0.3 m required clearance to the normal operating condition HGL is achieved across the proposed development.

5.0 GEOTECHNICAL CONSIDERATIONS

A revised geotechnical report was prepared by Paterson Group Ltd. in May 2019 to address City of Ottawa comments. The report summarizes the existing soil conditions within the subject area and provides construction recommendations. For details which are not summarized below, please see Paterson Report PG3062-1, Revision 4 dated May 24, 2019.

The subsurface soil profile at the test hole locations consists primarily of topsoil overlying sandy silt to silty sand and/or grey silty clay. A clayey silt to silty clay underlies the silty sand layer, followed by a glacial till. Practical refusal to DCPT was encountered at depths varying between 8.6 and 22.9 m.

Based on available geological mapping, the bedrock in this area mostly consists of interbedded limestone and dolomite of the Gull River formation with an overburden drift thickness of approximately 5 to 25 m depth.

Groundwater level measurements were recorded at the borehole locations. The groundwater levels across the site range from 0.5 m deep to 3.9 m deep. It should be noted that surface water can be trapped with a backfilled borehole, which can lead to higher than normal groundwater level readings. The long-term groundwater level can also be estimated based on the observed colour, moisture levels and consistency of the recovered soil samples. Based on these observations, the long-term groundwater is expected between 2 to 3 m depth. Groundwater levels are subject to seasonal fluctuations and therefore could vary during time of construction. It is expected that construction may occur below the existing groundwater table and therefore a permit to take water may be required.

From a geotechnical perspective, the subject site is adequate for the proposed residential development. However, due to the presence of the sensitive silty clay layer, the proposed development will be subjected to grade raise restrictions. Based on the existing borehole coverage, permissible grade raise areas were determined and are presented in Drawing PG3062-2 within the Paterson Group geotechnical report. The permissible grade raise varies across the site from 1.2 m to 2.0 m.

The grade raise restriction was accounted for in the grading design of the roadways, and detailed grading plans were reviewed by the Geotechnical Consultant as detailed in Paterson's PG3062-MEMO.19 dated June 29, 2021 (see **Appendix D.5**). The geotechnical review concluded that a significant portion of the site exceeds the permissible grade raise recommendations.

A settlement surcharge monitoring program began in July 2012 within a portion of the subject site. Details on the current settlement surcharge monitoring program are included in Section 5.4 of Paterson Report PG3062-1, Revision 4 dated May 24, 2019.

It should be noted that the site is currently undergoing several settlement surcharge monitoring programs within portions of the proposed roadway alignments and blocks within the east portion of the site which exceed the permissible grade raise recommendations. Please refer to Paterson's PG3062-MEMO.19 for detailed lightweight fill recommendations for the applicable blocks and lots under the surcharge program scenario.

Engineered fill is anticipated to be required to provide a suitable bearing surface for some footing foundations. Estimated engineered fill requirements were calculated by comparing the original or existing ground surface and stripping 300 mm of topsoil below the proposed underside of footing or stripping 600 mm of material in surcharge areas. The estimated fill thickness is presented in Paterson's PG3062-MEMO.19. Paterson's grading summary and lightweight fill recommendations have taken into considerations the additional loading due to the engineered fill. It is understood that if engineered fill is to be used below the footing of any other residential units within this development, that Paterson will be notified, and lightweight fill requirements will be revised on a lot by lot basis.

The required pavement structure for the local roadways is outlined in **Table 5.1** below.

Table 5.1: Pavement Structure – Local Roadways

Thickness (mm)	Material Description
40	Wear Course - Superpave 12.5 AC
50	Binder Course - Superpave 19.0 AC
150	OPSS Granular 'A' crushed stone
400	OPSS Granular 'B' Type II
	Subgrade – in situ soil or OPSS Granular B Type I or II material place over in situ soil or fill.

Table 5.2: Pavement Structure – Car Only Parking Areas

Thickness (mm)	Material Description
50	Wear Course – HL-3 or Superpave 12.5 AC
150	Base - OPSS Granular 'A' crushed stone
300	Subbase - OPSS Granular 'B' Type II
	Subgrade – in situ soil or OPSS Granular B Type I or II material place over in situ soil or fill.

Table 5.3: Pavement Structure – Roadway with Bus Traffic

Thickness (mm)	Material Description
40	Wear Course – Superpave 12.5 AC
50	Upper Binder Course – Superpave 19.0 AC
50	Lower Binder Course – Superpave 19.0 AC
150	Base - OPSS Granular 'A' crushed stone
600	Subbase - OPSS Granular 'B' Type II

Thickness (mm)	Material Description
	Subgrade – in situ soil or OPSS Granular B Type I or II material place over in situ soil or fill.

Paterson Group (Paterson) prepared a memorandum report, PG4624-MEMO.07 on June 28, 2019 to provide expected infiltration rates to be encountered within the native soil of the proposed Kanata West Subdivision based on Paterson's geotechnical investigation completed on April 5, 2018. Permeameter testing was not completed as part of the geotechnical investigations for the proposed development. However, typical percolation and infiltration rates for the native soil profile were used based upon previous experience at similar sites in the area with similar stratigraphy and typical published values as shown in **Table 5.4**.

Table 5.4: Estimated Infiltration Rates

Material	Hydraulic Conductivity k (m/sec)	Percolation (T – Time) – (min/cm)	Infiltration Rate (mm/hr)
Sandy Silt/Silty Sand	1×10^{-6} to 1×10^{-4}	4 to 12	50 to 150
Brown Clayey Silt/Silty Clay	1×10^{-9} to 1×10^{-7}	20 to 85	7 to 30
Grey Silty Clay	1×10^{-12} to 1×10^{-9}	85 to 400	1.5 to 7

1. Values are based upon typical material properties.
2. A safety correction factor was not applied to the infiltration rates
3. Hydraulic conductivity values have been conservatively estimated based on published values from Freeze, R.A and J.A. Cherry. 1979. Groundwater, Prentice Hall Inc., New Jersey.
4. Percolation and infiltration rates are based on published values from the Site Evaluation & Soil Testing Protocol, Appendix C of the Low Impact Development Stormwater Management Planning and Design Guide (CVC, 2011).

It should be noted that infiltration rates for the above-noted soil material are based on unsaturated loading conditions and does not account for evapotranspiration or runoff during precipitation events. Based on the Kanata West Master Servicing Study (June 2004), the estimated infiltration rates of the native soil at the subject site are anticipated to exceed the infiltration target of 50 to 70 mm/year (0.006 to 0.008 mm/hr) and is considered a low infiltration target.

Based on the hydraulic conductivity estimates and the existing soil profile, the deep silty clay deposit across the site is generally considered to act as a confining layer. As a result, groundwater will generally flow laterally through the upper layer of topsoil/weathered brown silty clay, as opposed to vertically upwards or downwards through overburden soils with lower hydraulic conductivity such as the grey silty clay. While small amounts of groundwater recharge and discharge could potentially take place on a localized scale where overburden thickness is minimal and/or contains silty sand near surface, neither the topographical or geological conditions are suitable for recharge or discharge to be occurring on a large scale at the subject site.

As previously discussed, existing conditions at the subject site currently allow for only minimal volumes of recharge to occur. As such, the applicability of secondary infiltration measures is considered limited for Low Impact Development Measures (LIDs), such as rear yard catch basins and/or amended topsoil finishes. It should also be noted that previous attempts within the City of Ottawa to induce additional surface water infiltration in similarly low permeability soils have resulted in detrimental effects to both homeowners and their properties due to poorly maintained drainage systems. While some loss of infiltration can be expected as a result of impervious surfaces, such as rooftops and roadways, directing drainage to municipal services, the majority of the existing infiltration potential is expected to be maintained through urban lawns and landscaped areas.

5.1 HAZELDEAN CREEK CROSSINGS

Two (2) box culverts are currently being proposed for the two (2) Hazeldean Creek crossings along the south boundary of the site. Based on the subsoil information recovered during the geotechnical investigation and general knowledge of the area's geology, it is expected that the subgrade surface is anticipated to consist of a stiff to firm grey silty clay. Therefore, a non-woven geotextile liner, such as a Terrafix 360R or equivalent, should be placed over the subgrade prior to placing the granular bedding. A minimum 500 mm thick layer of engineered fill should be placed as a bedding layer for the culvert. Engineered fill should be placed under dry conditions and should consist of Granular B Type II material placed in maximum 300 mm thick loose lifts and compacted to a minimum of 98% of the standard Proctor maximum dry density (SPMDD) with a minimum 150 mm thick layer of Granular A crushed stone placed at the culvert bedding level.

The culvert manufacturer may have specific backfill material requirements as well as, specific material placement requirements. These specific requirements should be met to ensure the proper performance of the proposed structure. Generally, only light compaction equipment should be used immediately beside the walls of the structure to avoid excessive compaction induced earth pressure on the wall, and the backfill materials should be placed in a manner to avoid a differential of more than approximately 300 mm between the levels of the backfill materials on both sides of the culvert. An engineered fill, such as a Granular B Type I (pit run), Granular B Type II or Granular A crushed stone can be used for backfilling purposes above the proposed box culvert. Also, unless otherwise specified, the backfill placed beneath the pavement granulars should be compacted to at least 95% of the SPMDD.

It is recommended that a 50 mm thick SM rigid insulation board be installed between the subgrade and the bedding layer. The insulation shall be the same width and extending the entire length of the culvert.

It is recommended that a frost taper be provided as part of the backfilling program. It is recommended that a frost taper starting at the frost line (approximately 2.1 m below finished grade) extend along a minimum 5H:1V slope leading to subgrade level of the pavement

structure. Backfill within the frost taper should consist of clean imported granular fill, such as OPSS Granular A or Granular B Type I (pit run) or II. The trench backfill should be placed in maximum lift thickness of 300 mm and compacted to a minimum 95% of its SPMDD.

6.0 GRADING AND DRAINAGE

Detailed grading plans (see **Drawings GP-1** to **GP-4**) have been prepared to show the proposed grades along the road profiles and the proposed rearyards to satisfy the stormwater management requirements and optimized to be as close as possible to the grade raise restrictions for the site. Road profiles have been established to provide an overland flow route required for stormwater management directed towards the on-site KW SWM Pond 5 in accordance with the KWMSS (Stantec/IBI, 2006), as well as to provide minimum cover requirements for storm sewers directed towards the KW Pond 5.

Road grades for the site have been established in consideration of existing topography around the site and servicing connections to the approved first registration phase of the development and to the existing Trinity Development to the south, as well as West Transitway Connection drawings as provided by Delcan (Drawing TO3065TOD Sheets 04-07) created for the West Transitway's EA process. The proposed finished floor and underside of footing elevations have been set to ensure proposed underside of footing elevations maintain a minimum 0.30 m separation from anticipated HGL elevations in the region (i.e., storm and sanitary).

Due to elevated storm and sanitary sewer hydraulic grade lines in the region, grading for a significant portion of the site exceeds the maximum permissible grade raise for the site. Paterson prepared a memorandum report PG3062-MEMO.19 to provide the geotechnical design summary details for the proposed Kanata West Residential Development after their review of the proposed grading plans. Paterson's memo outlined that the lots and blocks outside of the current settlement surcharge areas that exceed the recommended permissible grade raise will require further settlement surcharge programs to be initiated or lightweight fill (LWF) to be placed at the time of building construction. Please refer to Paterson's memo PG3062-MEMO.19 and revised geotechnical report for design details of the subject blocks and lots.

7.0 EROSION CONTROL DURING CONSTRUCTION

In order to control erosion and migration of sediment-laden runoff during construction, an erosion and sediment control plan will be required for the development. Therefore, an appropriate inspection and maintenance program is necessary that will be employed by the contractor, and will consider the following goals:

- Implementation of best management practices to provide appropriate protection of the existing and proposed drainage system and the receiving water course(s);
- Immediate stabilization and containment of any exposed soil and/or stock piles;
- Minimization of areas to be cleared and grubbed;
- Protection of exposed slopes with plastic or synthetic mulches;
- Provision of sediment traps and basins during dewatering;
- Installation of sediment traps (such as SiltSack® by Terrafix) between catch basins and frames;
- Frequent inspection of all controls during construction and after significant rainfall events (greater than 13 mm) for sediment accumulation and erosion;
- Immediate repair of all noticeable erosion, with investigation into the cause so implementation of mitigation measures to prevent recurrence will be more successful;
- Maintenance of the erosion control measures during construction;
- Preparation of monitoring reports outlining the condition of erosion control works, their overall performance, and any actions such as repairs, replacement, or modification.

The contractor will, at every rainfall, complete inspections and guarantee proper performance. The inspection is to include:

- Verification that water is not flowing under silt barriers.
- Clean and change silt traps at catch basins.

Drawings EC-1 and **EC-2** outline the erosion and sediment control plan.

7.1 BIOSWALE CONSTRUCTION

Low impact development (LID) is a new approach in stormwater management and urban design for Ontario. As a result, Credit Valley Conservation (CVC) teamed up with a U.S. consultant, Emmons & Olivier Resources Inc. (EOR) to develop the Low Impact Development Construction Guide (C&I Guide) in 2012. The following is a summary of the construction recommendations included in the C&I Guide pertaining to bioswale construction.

7.1.1 Site Preparation

- In order to minimize sedimentation and compaction during construction due to heavy construction equipment traffic, the location of infiltration practices must be clearly identified on the construction plans and marked during the initial stage of construction.
- Perimeter controls around LID practices may consist of compost biofilter socks, sand or pea gravel bags, straw logs and bales and silt fences.
- LID perimeter controls are to remain in place, inspected and reestablished as necessary until LID practice drainage areas are stabilized.

7.1.2 Infiltration Practice Grading

Fill Areas

- Remove topsoil and lower permeability soils located above the target infiltration soils where the practice was designed to function. Fill the area above the target soils with soils of a higher permeability than the in-situ soil. Fill this area to a height greater than the surrounding grades.
- Raise the surrounding grades to the elevation of the infiltration feature, but do not exceed height of the infiltration fill material. Fill additional high permeability soils over the infiltration feature such that the site of the infiltration feature is at a greater elevation than the surrounding grades.
- Repeat until finished grade of the BMP is achieved, then the surrounding area can be raised to finished grade (refer to C&I Guide for details).
- Following stabilization, the practice should be cut to designed subgrade elevation and replaced with filter media as per **Drawing DS-3**.
- Bioswales need to be offline and protected until the site is stabilized.

Cut Areas

- Excavate the LID feature footprint and surrounding area to finished grade.
- Following stabilization of the tributary area, the practice should be cut to designed subgrade elevation and replaced with filter media as per **Drawing DS-3**.
- Bioswales need to be offline and protected until the site is stabilized.

7.1.3 Construction Considerations

- The contributing drainage area must be stabilized and finalized with landscaping or hardscaping prior to finishing work on the LID practice.
- Diversions of construction runoff from BMPs should be installed and maintained prior and during the construction of the practice.
- All finished grading activities in the infiltration BMP should be performed during dry conditions to prevent soil smearing and compaction. Dewatering may be necessary prior to commencing work.
- Excavation of the infiltration BMP should be done from the outside reaching in when possible, using a backhoe or bucket with an extension arm.
- Once excavated to subgrade, the infiltration BMP bottom and side slopes should be scarified or tilled to loosen compacted soils.
- Any underdrains, aggregate storage layer, filter media, and/or observation wells should be installed at this point.

7.1.4 LID Practice Materials

- Filter media (see details on **Drawing EC-3**) should be done offsite by a reputable supplier that can certify that the engineered soil contains proper component ratios.
- Soil media should be delivered to the site once the facility is ready for final soil placement. Engineered soil media should not be stored on-site for extended periods of time.
- Three samples of soil should be tested from every batch prepared by the supplier: a sample from the top, middle and bottom of the pile.
- No soil media should be brought to the site until the lab tests have been approved by the site engineer.
- The mixture should be free of stones, stumps, roots, or other similar objects larger than 50 mm.
- Soil mix will settle as much as 20% over time. Natural settlement over time is preferred if construction schedule allows, but soil can be saturated with water to speed up compaction.

7.2 HAZELDEAN CREEK CROSSINGS

Construction staging, dewatering plan and sediment and erosion control measures are the responsibility of the contractor. It is recommended that the contractor consult all permits and documents and provide a comprehensive plan for the proposed culverts' placement and channel works. It is recommended that construction be completed in the dry or during more stable and drier weather typical during August and September or during the winter months.

Erosion and sediment control measures recommended include the use of a sedimentation trap and rock check dam, heavy duty silt fence around the site and a sedimentation basin to be used if the site requires pumping. The excavation works would require that the contractor keep vehicles out of the water and ensure that they are in proper working order (i.e., no fluid leaks).

As mentioned previously, it is the responsibility of the contractor to submit a detailed construction schedule and appropriate dewatering and sediment and erosion control plans to the Contract Administrator and the regulatory agencies prior to commencement of work.

8.0 APPROVALS

Ontario Ministry of Environment, Conservation and Parks(MECP) Environmental Compliance Approvals (ECA) will be required for the proposed development related to stormwater management, inlet control devices, storm sewers and sanitary sewers (direct submission).

A Permit to Take Water may also be required depending on pumping requirements for sewer installation. Approval from the MVCA under Section 28 of the Conservation Authorities Act (Ontario Regulation 153/06) will be required for any development (e.g., filling or construction) with the Regulation Limit, as defined on our regulation mapping, and/or alteration to any watercourse (e.g., watercourse crossings). DFO/MNR approval will be required for the creek crossings at the south property line. No other approvals from other regulatory agencies are required.

9.0 CONCLUSIONS

9.1 WATER SERVICING

Based on the findings of the report, the proposed network is capable of servicing the development area and with the use of pressure reducing valves will meet all servicing requirements as per City of Ottawa standards under typical demand conditions (peak hour and average day conditions) as well as under emergency fire demand conditions (maximum day + fire flow) during the third construction phase, fourth construction phase and ultimate development conditions.

The temporary 200 mm diameter watermain installed adjacent to the future alignment of Roger Griffiths Avenue from Cartage Way to Holstein Road as part of the approved First Registration Phase of the KW Development to connect the first phase watermain network to the existing watermain within the Trinity development to the south will be decommissioned once the proposed 300 mm diameter watermain is installed along Roger Griffiths Avenue.

9.2 STORMWATER SERVICING

The proposed stormwater management plan is in compliance with the goals specified in the background reports and the 2012 City of Ottawa Sewer Guidelines. Inlet control devices are proposed to limit inflow from the site area into the minor system to the 2-year for local streets and to the 5-year storm for collector roads based on City of Ottawa IDF curves. Detailed grading of the proposed site will be done to ensure the storm sewer hydraulic grade line is maintained at least 0.30 m below the proposed underside of footings in the subdivision during the 100-year design storm events. All dynamic surface water depths are less than 0.35 m during the 100-year storm event. Quality control and further quantity control of runoff from the proposed development will be provided in the ultimate KW Pond 5.

9.3 SANITARY SERVICING

The proposed sanitary sewer network is sufficiently sized to provide gravity drainage of the site and external tributary areas. The proposed network connects to the approved sanitary sewer system within the first registration phase of the development that discharges into the existing Maple Grove Trunk sanitary sewer which will ultimately outlets to the Kanata West Pump Station (KWPS). The proposed drainage pattern is in accordance with the KWMSS.

The worst-case annual HGL remains below the proposed USF elevations across the proposed development.
Given the depth of the proposed sanitary sewer which will be below the ground water level in some areas, it is recommended that controlled settlement joints be used on each building

service connection as per City Standard S11. and that clay seals be installed as per City standard drawing No. S8.

9.4 GRADING

Grading for the site has been designed to provide an overland flow route as per City standards and in its majority, it reflects the grade raise restrictions recommended in Paterson's geotechnical investigation for the site (Paterson, November 2015). Areas where grades are expected to exceed the maximum permissible grade raise will require a pre-loading/surcharge program and/or lightweight fill.

Appendix A POTABLE WATER SERVICING ANALYSIS

A.1 Third Construction Phase Hydraulic Analysis

A.2 Fourth Construction Phase Hydraulic Analysis

A.3 Ultimate Condition Phase Hydraulic Analysis

Appendix A Potable Water Servicing Analysis
May 10, 2022

A.1 THIRD CONSTRUCTION PHASE HYDRAULIC ANALYSIS

1620 Maple Grove Road

Information Provided:

Date provided August, 20, 2018

Scenario	Demand	
	L/min	L/s
Average Daily Demand	641	10.7
Maximum Daily Demand	1515	25.25
Peak Hour	3282	54.7
Fire Flow Demand # 1	17000	283

# of connections	4

Connection Locations:



Figure 1 - Connection points

Results:

Connection 1 - Maple Grove Road and Silver Seven Road

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	162.1	92.7
Peak Hour	157.7	86.4
Max Day plus Fire (10,000 l/min)	154.7	82.7
Max Day plus Fire (17,000 l/min)	150.5	76.3

[1] Ground Elevation = 96.880 m

Connection 2 - Maple Grove Road and Rosehill Ave

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	161.0	88.8
Peak Hour	157.4	83.5
Max Day plus Fire (10,000 l/min)	153.9	75.3
Max Day plus Fire (17,000 l/min)	138.9	57.3

[1] Ground Elevation = 100.900 m

Connection 3 - Hazeldean Road and Kincardine Dr.

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	161.5	90.9
Peak Hour	157.9	85.8
Max Day plus Fire (10,000 l/min)	158.8	87.1
Max Day plus Fire (17,000 l/min)	157.9	85.8

[1] Ground Elevation = 97.490 m

Connection 4 - Hazeldean Road

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	161.4	90.9
Peak Hour	158.0	82.0
Max Day plus Fire (10,000 l/min)	158.7	83.5
Max Day plus Fire (17,000 l/min)	157.8	82.2

[1] Ground Elevation = 99.900 m

Notes:

1) As per the Ontario Building Code in areas that may be occupied, the static pressure at any fixture shall not exceed 552 kPa (80 psi.) Pressure control measures to be considered are as follows, in order of preference:
   a) If possible, systems to be designed to residual pressures of 345 to 552 kPa (50 to 80 psi) in all occupied areas outside of the public right-of-way without special pressure control equipment.
   b) Pressure reducing valves to be installed immediately downstream of the isolation valve in the home/ building, located downstream of the meter so it is owner maintained.
2) Watermain along Maple Grove Road is expected to be constructed.
3) Ownership of existing private roads off of Hazeldean road are expected to be turned over to the City of Ottawa and therefore ownership of watermains along those roads are in turn to be given to the City of Ottawa prior to 1620 Maple Grove watermain connections.

Disclaimer

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

Kanata West Richcraft - Domestic Water Demand Estimates
Construction Phase 3

Densities as per City Guidelines:

LD	3.4	ppu		
MD	2.7	ppu	38	Units/ha
HD	1.8	ppu		

Building ID	Area (m^2)	Population	Daily Rate of Demand [1]	Avg Day Demand [2]		Max Day Demand [3]		Peak Hour Demand [3]	
				(L/min)	(L/s)	(L/min)	(L/s)	(L/min)	(L/s)
MD1	7,350	76	350	18.4	0.31	45.9	0.76	100.9	1.68
Commerical	14,700		28000	28.6	0.48	42.9	0.71	77.2	1.29
Residential 1		97	350	23.6	0.39	59.1	0.98	129.9	2.17
Total				**70.6**	**1.2**	**147.8**	**2.5**	**308.0**	**5.1**
Residential 2		59	350	14.4	0.24	36.1	0.60	79.4	1.32
Residential 3		127	350	30.8	0.51	77.1	1.29	169.6	2.83
Residential 4		127	350	30.8	0.51	77.1	1.29	169.6	2.83
Residential 5		41	350	9.8	0.16	24.6	0.41	54.1	0.90
Residential 6		167	350	40.7	0.68	101.7	1.70	223.8	3.73
Residential 7		92	350	22.4	0.37	55.9	0.93	123.0	2.05
Residential 8		119	350	28.9	0.48	72.2	1.20	158.8	2.65
Residential 9		78	350	19.0	0.32	47.6	0.79	104.7	1.74
Residential 13		181	350	44.0	0.73	109.9	1.83	241.8	4.03
MD2	27,400	686	350	166.7	2.78	416.7	6.95	916.8	15.28
Total				**210.7**	**3.5**	**526.6**	**8.8**	**1158.6**	**19.3**
Residential 14		100	350	24.3	0.40	60.7	1.01	133.5	2.23
Residential 15		68	350	16.4	0.27	41.0	0.68	90.2	1.50
Residential 16		105	350	25.6	0.43	64.0	1.07	140.8	2.35
Residential 17		100	350	24.3	0.40	60.7	1.01	133.5	2.23
Residential 18		119	350	28.9	0.48	72.2	1.20	158.8	2.65
Total Site :				**597.6**	**10.0**	**1465.4**	**24.4**	**3206.6**	**53.4**

1 Average day water demand for residential areas equal to 350 L/cap/d and 28,000 L/ha/d for the school block

2 City of Ottawa water demand criteria used to estimate peak demand rates for residential areas are as follows:
maximum day demand rate = 2.5 x average day demand rate for residential, 1.5 for Institutional
maximum hour demand rate = 2.2 x maximum day demand rate for residential, 1.8 for institutional

3 Unit counts for unmarked Medium Density Residential areas are equal to 38 Units/ha

4 Unit counts for unmarked Medium Density Residential area 2 (MD2) are based on the Concept Site Plan for Richcraft prepared by M. David Blakely Architch Inc. on Febuary 2020

Third Construction Phase
Hydraulic Model Results - Average Day Analysis

Junction Results

ID	Demand	Elevation	Head	Pressure	
	(L/s)	(m)	(m)	(psi)	(Kpa)
1	0.40	98.37	161.40	89.60	617.77
2	0.00	98.03	161.40	90.08	621.08
3	0.27	97.95	161.40	90.19	621.84
4	0.43	98.30	161.40	89.70	618.46
5	0.40	100.16	161.39	87.05	600.19
7	0.48	100.75	161.39	86.21	594.40
8	0.24	99.11	161.40	88.54	610.47
9	0.51	97.96	161.40	90.18	621.77
10	1.20	97.88	161.40	90.30	622.60
12	0.51	97.92	161.40	90.24	622.19
13	0.68	98.01	161.40	90.11	621.29
14	0.48	97.64	161.40	90.64	624.94
15	0.37	97.69	161.40	90.56	624.39
16	0.00	97.62	161.40	90.66	625.08
17	0.00	97.54	161.40	90.78	625.91
18	0.16	97.20	161.40	91.26	629.22
19	0.32	98.15	161.40	89.91	619.91
20	0.00	98.14	161.40	89.92	619.98
1	0.00	96.15	161.41	92.77	639.63
24	0.00	99.30	161.40	88.27	608.60
27	3.50	100.30	161.39	86.84	598.74
28	0.00	99.18	161.40	88.45	609.85
29	0.00	98.02	161.40	90.10	621.22

Pipe Results

ID	From Node	To Node	Length	Diameter	Roughness	Flow	Velocity
			(m)	(mm)		(L/s)	(m/s)
302	1	290.00	297	120	2.94	0.04	0.04
1	2	149.15	297	120	0.51	0.01	0.01
2	3	81.27	297	120	0.22	0.00	0.00
3	4	49.14	204	110	0.93	0.03	0.03
4	5	204.86	204	110	0.96	0.03	0.03
5	7	65.67	204	110	-0.91	0.03	0.03
8	28	21.85	204	110	-1.63	0.05	0.05
3	9	149.76	297	120	-1.57	0.02	0.02
3	14	52.56	204	110	0.59	0.02	0.02
14	13	75.08	204	110	0.04	0.00	0.00
13	12	76.47	204	110	-0.52	0.02	0.02
12	9	52.38	204	110	-0.91	0.03	0.03
9	10	78.67	297	120	-4.03	0.06	0.06
10	18	304.89	204	110	0.73	0.02	0.02
12	18	202.33	155	100	-0.12	0.01	0.01
18	17	82.35	204	110	0.45	0.01	0.01
13	17	237.37	155	100	-0.12	0.01	0.01
17	16	89.96	204	110	0.33	0.01	0.01
14	15	201.16	204	110	0.06	0.00	0.00
15	16	75.48	204	110	-0.33	0.01	0.01
15	20	79.81	204	110	0.03	0.00	0.00
2	19	209.67	204	110	0.29	0.01	0.01
19	20	46.99	204	110	-0.03	0.00	0.00
7	24	115.59	204	110	-0.70	0.02	0.02
24	8	48.04	204	110	-0.70	0.02	0.02
8	7	168.69	204	110	0.69	0.02	0.02
1	10	134.80	297	120	7.01	0.10	0.10
9	29	53.89	204	110	1.04	0.03	0.03
5	27	277.63	204	110	1.47	0.05	0.04
27	1	217.87	204	110	-2.03	0.06	0.06
28	10	205.69	204	110	-1.06	0.03	0.03
29	4	136.30	204	110	0.46	0.01	0.01
28	29	79.48	204	110	-0.57	0.02	0.02
300	1	577.90	297	120	-27.23	0.39	0.39
301	1	645.00	297	120	34.24	0.49	0.49

Hydraulic Model Results -Peak Hour Analysis

Junction Results

ID	Demand	Elevation	Head	Pressure	
	(L/s)	(m)	(m)	(psi)	(Kpa)
1	2.23	98.37	157.56	84.15	580.20
2	0.00	98.03	157.47	84.49	582.54
3	1.50	97.95	157.43	84.55	582.96
4	2.35	98.30	157.41	84.03	579.37
5	2.23	100.16	157.36	81.32	560.69
7	2.65	100.75	157.37	80.49	554.96
8	1.32	99.11	157.39	82.85	571.23
9	2.83	97.96	157.42	84.53	582.82
10	5.10	97.88	157.42	84.64	583.58
12	2.83	97.92	157.41	84.58	583.16
13	3.73	98.01	157.41	84.45	582.27
14	2.65	97.64	157.42	84.98	585.92
15	2.05	97.69	157.42	84.91	585.44
16	0.00	97.62	157.42	85.01	586.13
17	0.00	97.54	157.42	85.12	586.89
18	0.90	97.20	157.42	85.60	590.19
19	1.74	98.15	157.43	84.27	581.02
20	0.00	98.14	157.42	84.28	581.09
1	0.00	96.15	157.44	87.13	600.74
24	0.00	99.30	157.38	82.57	569.30
27	19.30	100.30	157.27	80.99	558.41
28	0.00	99.18	157.40	82.76	570.61
29	0.00	98.02	157.41	84.43	582.13

Pipe Results

ID	From Node	To Node	Length	Diameter	Roughness	Flow	Velocity
			(m)	(mm)		(L/s)	(m/s)
101	302	1	290.00	297	120	41.19	0.59
102	1	2	149.15	297	120	25.86	0.37
103	2	3	81.27	297	120	21.34	0.31
104	3	4	49.14	204	110	6.95	0.21
105	4	5	204.86	204	110	4.94	0.15
108	5	7	65.67	204	110	-3.49	0.11
111	8	28	21.85	204	110	-7.46	0.23
115	3	9	149.76	297	120	7.81	0.11
116	3	14	52.56	204	110	5.08	0.16
117	14	13	75.08	204	110	2.39	0.07
118	13	12	76.47	204	110	-0.87	0.03
119	12	9	52.38	204	110	-3.25	0.10
120	9	10	78.67	297	120	-2.69	0.04
121	10	18	304.89	204	110	1.04	0.03
122	12	18	202.33	155	100	-0.44	0.02
123	18	17	82.35	204	110	-0.30	0.01
124	13	17	237.37	155	100	-0.48	0.03
125	17	16	89.96	204	110	-0.78	0.02
126	14	15	201.16	204	110	0.04	0.00
127	15	16	75.48	204	110	0.78	0.02
128	15	20	79.81	204	110	-2.79	0.09
129	2	19	209.67	204	110	4.53	0.14
130	19	20	46.99	204	110	2.79	0.09
139	7	24	115.59	204	110	-3.10	0.09
140	24	8	48.04	204	110	-3.10	0.09
146	8	7	168.69	204	110	3.05	0.09
147	1	10	134.80	297	120	12.22	0.18
148	9	29	53.89	204	110	4.41	0.14
149	5	27	277.63	204	110	6.21	0.19
151	27	1	217.87	204	110	-13.09	0.40
155	28	10	205.69	204	110	-3.40	0.10
157	29	4	136.30	204	110	0.34	0.01
159	28	29	79.48	204	110	-4.07	0.12
2	300	1	577.90	297	120	-7.89	0.11
3	301	1	645.00	297	120	20.11	0.29

Hydraulic Model Results -Fire Flow Analysis (250 L/s)

ID	Static Demand	Static Pressure		Static Head	Fire-Flow Demand	Residual Pressure		Available Flow at Hydrant	Available Flow Pressure	
	(L/s)	(psi)	(Kpa)	(m)	(L/s)	(psi)	(Kpa)	(L/s)	(psi)	(Kpa)
1	1.01	79.83	550.41	154.53	250	67.60	466.09	801.31	20	137.90
2	0.00	78.67	542.41	153.37	250	65.83	453.88	734.06	20	137.90
3	0.68	78.12	538.62	152.90	250	65.43	451.13	738.21	20	137.90
4	1.07	77.50	534.35	152.82	250	58.76	405.14	535.56	20	137.90
5	1.01	74.86	516.14	152.82	250	48.29	332.95	401.08	20	137.90
7	1.20	73.85	509.18	152.70	250	46.32	319.37	387.55	20	137.90
8	0.60	76.07	524.49	152.62	250	51.92	357.98	435.26	20	137.90
9	1.29	77.57	534.83	152.53	250	65.05	448.51	746.08	20	137.90
10	2.50	77.17	532.07	152.16	250	65.30	450.23	782.85	20	137.90
12	1.29	77.70	535.73	152.58	250	57.48	396.31	504.43	20	137.90
13	1.70	77.71	535.79	152.67	250	54.47	375.56	457.60	20	137.90
14	1.20	78.44	540.83	152.81	250	59.20	408.17	530.88	20	137.90
15	0.93	78.38	540.41	152.82	250	49.94	344.33	399.30	20	137.90
16	0.00	78.37	540.35	152.75	250	44.38	305.99	351.53	20	137.90
17	0.00	78.36	540.28	152.66	250	46.18	318.40	365.42	20	137.90
18	0.41	78.70	542.62	152.56	250	46.18	318.40	364.59	20	137.90
19	0.79	78.00	537.79	153.02	250	40.69	280.55	329.57	20	137.90
20	0.00	77.91	537.17	152.94	250	41.97	289.37	336.62	20	137.90
1	0.00	78.06	538.21	151.06	250	67.77	467.26	923.04	20	137.90
24	0.00	75.83	522.83	152.64	250	44.06	303.78	357.40	20	137.90
27	8.80	75.57	521.04	153.46	250	30.19	208.15	291.50	20	137.90
28	0.00	75.92	523.45	152.59	250	54.78	377.70	477.96	20	137.90
29	0.00	77.58	534.90	152.59	250	59.85	412.65	553.84	20	137.90

Stantec

FUS Fire Flow Calculation Sheet

Stantec Project #: 160401393
Project Name: Kanata West Richcraft
Date: 11/23/2020
Fire Flow Calculation #: 2
Description: Residential Back-to-Back Units

Notes: Worst case back-to-back units - max. ground floor area of 600m2. (Block 121)

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	-						55.6	-
	Determine Number of Adjoining Units	Includes adjacent wood frame structures separated by 3m or less						8	-
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	3.1 to 10	19	3	31-60	Wood Frame or Non-Combustible	18%	5508
		East	20.1 to 30	25	3	61-90	Wood Frame or Non-Combustible	9%	
		South	3.1 to 10	19	3	31-60	Wood Frame or Non-Combustible	18%	
		West	20.1 to 30	25	3	61-90	Wood Frame or Non-Combustible	9%	
8	Determine Final Required Fire Flow	Total Required Fire Flow in L/min, Rounded to Nearest 1000L/min							16000
		Total Required Fire Flow in L/s							266.7
		Required Duration of Fire Flow (hrs)							3.50
		Required Volume of Fire Flow (m^3)							3360

Stantec

FUS Fire Flow Calculation Sheet

Stantec Project #: 160401393
Project Name: Kanata West Richcraft
Date: 11/23/2020
Fire Flow Calculation #: 2
Description: Residential - Townhomes Units

Notes: Townhome unit with less than 10m seperation between the backs of adjacent units (Block 53)

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	-						492.0	-
	Determine Number of Adjoining Units	Includes adjacent wood frame structures separated by 3m or less						1	-
3	Determine Height in Storeys	Does not include floors >50% below grade or open attic space						2	-
4	Determine Required Fire Flow	($F = 220 \times C \times A^{1/2}$). Round to nearest 1000 L/min						-	10000
5	Determine Occupancy Charge	Limited Combustible						-15%	8500
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	30	2	31-60	Wood Frame or Non-Combustible	18%	4420
		East	20.1 to 30	16	2	31-60	Wood Frame or Non-Combustible	8%	
		South	20.1 to 30	30	2	31-60	Wood Frame or Non-Combustible	8%	
		West	3.1 to 10	16	2	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							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 #: 160401393
Project Name: Kanata West Richcraft
Date: 11/23/2020
Fire Flow Calculation #: 3
Description: Residential - Townhomes Units

Notes: Townhome unit with less than 10m seperation between the backs of adjacent units (Block 56)

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	-						563.0	-
	Determine Number of Adjoining Units	Includes adjacent wood frame structures separated by 3m or less						1	-
3	Determine Height in Storeys	Does not include floors >50% below grade or open attic space						2	-
4	Determine Required Fire Flow	($F = 220 \times C \times A^{1/2}$). Round to nearest 1000 L/min						-	11000
5	Determine Occupancy Charge	Limited Combustible						-15%	9350
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	10.1 to 20	37	2	61-90	Wood Frame or Non-Combustible	14%	5984
		East	3.1 to 10	16	2	31-60	Wood Frame or Non-Combustible	18%	
		South	10.1 to 20	37	2	61-90	Wood Frame or Non-Combustible	14%	
		West	3.1 to 10	16	2	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							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 #: 160401393
Project Name: Kanata West Richcraft
Date: 11/23/2020
Fire Flow Calculation #: 4
Description: Residential - Townhomes Units

Notes: Townhome unit with less than 10m seperation between the backs of adjacent units (Block 69)

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	-						297.0	-
	Determine Number of Adjoining Units	Includes adjacent wood frame structures separated by 3m or less						1	-
3	Determine Height in Storeys	Does not include floors >50% below grade or open attic space						2	-
4	Determine Required Fire Flow	($F = 220 \times C \times A^{1/2}$). Round to nearest 1000 L/min						-	8000
5	Determine Occupancy Charge	Limited Combustible						-15%	6800
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	20.1 to 30	16	2	31-60	Wood Frame or Non-Combustible	8%	2992
		East	3.1 to 10	20	2	31-60	Wood Frame or Non-Combustible	18%	
		South	3.1 to 10	16	2	31-60	Wood Frame or Non-Combustible	18%	
		West	> 45	20	2	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							10000
		Total Required Fire Flow in L/s							166.7
		Required Duration of Fire Flow (hrs)							2.00
		Required Volume of Fire Flow (m^3)							1200

Stantec

FUS Fire Flow Calculation Sheet

Stantec Project #: 160401393
Project Name: Kanata West Richcraft
Date: 11/23/2020
Fire Flow Calculation #: 5
Description: Residential - Townhomes Units

Notes: Townhome unit with less than 10m seperation between the backs of adjacent units (Block 70)

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	-						297.0	-
	Determine Number of Adjoining Units	Includes adjacent wood frame structures separated by 3m or less						1	-
3	Determine Height in Storeys	Does not include floors >50% below grade or open attic space						2	-
4	Determine Required Fire Flow	($F = 220 \times C \times A^{1/2}$). Round to nearest 1000 L/min						-	8000
5	Determine Occupancy Charge	Limited Combustible						-15%	6800
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	16	2	31-60	Wood Frame or Non-Combustible	18%	2992
		East	3.1 to 10	20	2	31-60	Wood Frame or Non-Combustible	18%	
		South	20.1 to 30	16	2	31-60	Wood Frame or Non-Combustible	8%	
		West	> 45	20	2	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							10000
		Total Required Fire Flow in L/s							166.7
		Required Duration of Fire Flow (hrs)							2.00
		Required Volume of Fire Flow (m^3)							1200

Stantec

FUS Fire Flow Calculation Sheet

Stantec Project #: 160401393
Project Name: Kanata West Richcraft
Date: 11/23/2020
Fire Flow Calculation #: 6
Description: Residential - Townhomes Units

Notes: Townhome unit with less than 10m seperation between the backs of adjacent units (Block 77)

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	-						586.0	-
	Determine Number of Adjoining Units	Includes adjacent wood frame structures separated by 3m or less						1	-
3	Determine Height in Storeys	Does not include floors >50% below grade or open attic space						2	-
4	Determine Required Fire Flow	($F = 220 \times C \times A^{1/2}$). Round to nearest 1000 L/min						-	11000
5	Determine Occupancy Charge	Limited Combustible						-15%	9350
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	20.1 to 30	36	2	61-90	Wood Frame or Non-Combustible	9%	4769
		East	30.1 to 45	16	2	31-60	Wood Frame or Non-Combustible	5%	
		South	3.1 to 10	36	2	61-90	Wood Frame or Non-Combustible	19%	
		West	3.1 to 10	16	2	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 #: 160401393
Project Name: Kanata West Richcraft
Date: 11/23/2020
Fire Flow Calculation #: 7
Description: Residential - Townhomes Units

Notes: Townhome unit with less than 10m seperation between the backs of adjacent units (Block 78)

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	-						372.0	-
	Determine Number of Adjoining Units	Includes adjacent wood frame structures separated by 3m or less						1	-
3	Determine Height in Storeys	Does not include floors >50% below grade or open attic space						2	-
4	Determine Required Fire Flow	($F = 220 \times C \times A^{1/2}$). Round to nearest 1000 L/min						-	9000
5	Determine Occupancy Charge	Limited Combustible						-15%	7650
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	16	2	31-60	Wood Frame or Non-Combustible	18%	3749
		East	30.1 to 45	24	2	31-60	Wood Frame or Non-Combustible	5%	
		South	3.1 to 10	16	2	31-60	Wood Frame or Non-Combustible	18%	
		West	20.1 to 30	24	2	31-60	Wood Frame or Non-Combustible	8%	
8	Determine Final Required Fire Flow	Total Required Fire Flow in L/min, Rounded to Nearest 1000L/min							11000
		Total Required Fire Flow in L/s							183.3
		Required Duration of Fire Flow (hrs)							2.00
		Required Volume of Fire Flow (m^3)							1320

Stantec

FUS Fire Flow Calculation Sheet

Stantec Project #: 160401393
Project Name: Kanata West Richcraft
Date: 11/23/2020
Fire Flow Calculation #: 8
Description: Residential - Townhomes Units

Notes: Townhome unit with less than 10m seperation between the backs of adjacent units (Block 100)

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	-						372.0	-
	Determine Number of Adjoining Units	Includes adjacent wood frame structures separated by 3m or less						1	-
3	Determine Height in Storeys	Does not include floors >50% below grade or open attic space						2	-
4	Determine Required Fire Flow	($F = 220 \times C \times A^{1/2}$). Round to nearest 1000 L/min						-	9000
5	Determine Occupancy Charge	Limited Combustible						-15%	7650
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	16	2	31-60	Wood Frame or Non-Combustible	18%	3137
		East	3.1 to 10	26	2	31-60	Wood Frame or Non-Combustible	18%	
		South	> 45	16	2	31-60	Wood Frame or Non-Combustible	0%	
		West	30.1 to 45	26	2	31-60	Wood Frame or Non-Combustible	5%	
8	Determine Final Required Fire Flow	Total Required Fire Flow in L/min, Rounded to Nearest 1000L/min							11000
		Total Required Fire Flow in L/s							183.3
		Required Duration of Fire Flow (hrs)							2.00
		Required Volume of Fire Flow (m^3)							1320

Stantec

FUS Fire Flow Calculation Sheet

Stantec Project #: 160401393
Project Name: Kanata West Richcraft
Date: 11/23/2020
Fire Flow Calculation #: 9
Description: Residential - Townhomes Units

Notes: Townhome unit with less than 10m seperation between the backs of adjacent units (Block 101)

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	-						372.0	-
	Determine Number of Adjoining Units	Includes adjacent wood frame structures separated by 3m or less						1	-
3	Determine Height in Storeys	Does not include floors >50% below grade or open attic space						2	-
4	Determine Required Fire Flow	($F = 220 \times C \times A^{1/2}$). Round to nearest 1000 L/min						-	9000
5	Determine Occupancy Charge	Limited Combustible						-15%	7650
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	20.1 to 30	16	2	31-60	Wood Frame or Non-Combustible	8%	3749
		East	3.1 to 10	26	2	31-60	Wood Frame or Non-Combustible	18%	
		South	3.1 to 10	16	2	31-60	Wood Frame or Non-Combustible	18%	
		West	30.1 to 45	26	2	31-60	Wood Frame or Non-Combustible	5%	
8	Determine Final Required Fire Flow	Total Required Fire Flow in L/min, Rounded to Nearest 1000L/min							11000
		Total Required Fire Flow in L/s							183.3
		Required Duration of Fire Flow (hrs)							2.00
		Required Volume of Fire Flow (m^3)							1320

Stantec

FUS Fire Flow Calculation Sheet

Stantec Project #: 160401393
Project Name: Kanata West Richcraft
Date: 11/23/2020
Fire Flow Calculation #: 10
Description: Residential - Townhomes Units

Notes: Townhome unit with less than 10m seperation between the backs of adjacent units (Block 102)

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	-						372.0	-
	Determine Number of Adjoining Units	Includes adjacent wood frame structures separated by 3m or less						1	-
3	Determine Height in Storeys	Does not include floors >50% below grade or open attic space						2	-
4	Determine Required Fire Flow	($F = 220 \times C \times A^{1/2}$). Round to nearest 1000 L/min						-	9000
5	Determine Occupancy Charge	Limited Combustible						-15%	7650
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	20.1 to 30	26	2	31-60	Wood Frame or Non-Combustible	8%	4361
		East	3.1 to 10	16	2	31-60	Wood Frame or Non-Combustible	18%	
		South	10.1 to 20	26	2	31-60	Wood Frame or Non-Combustible	13%	
		West	3.1 to 10	16	2	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							12000
		Total Required Fire Flow in L/s							200.0
		Required Duration of Fire Flow (hrs)							2.50
		Required Volume of Fire Flow (m^3)							1800

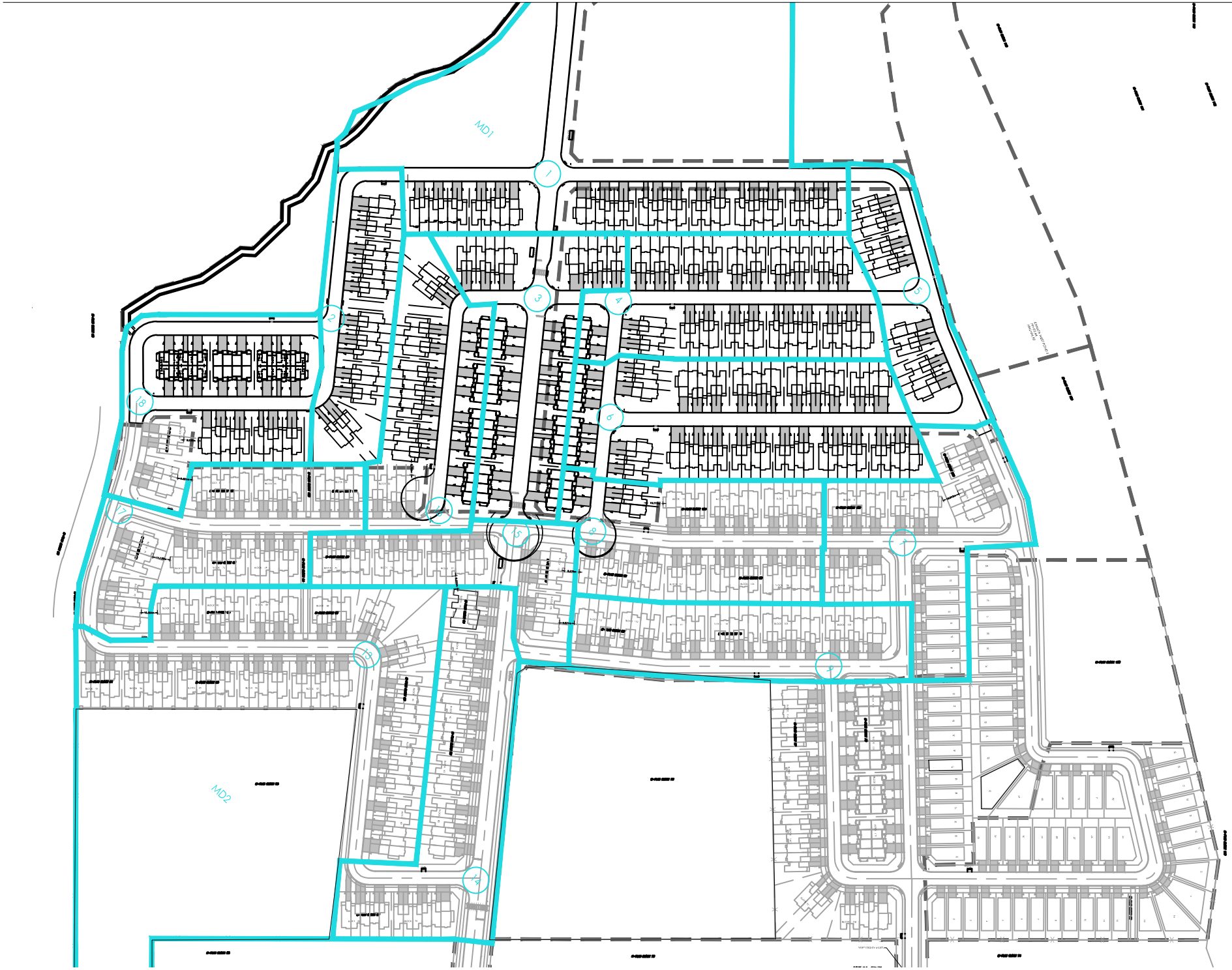
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FUS Fire Flow Calculation Sheet

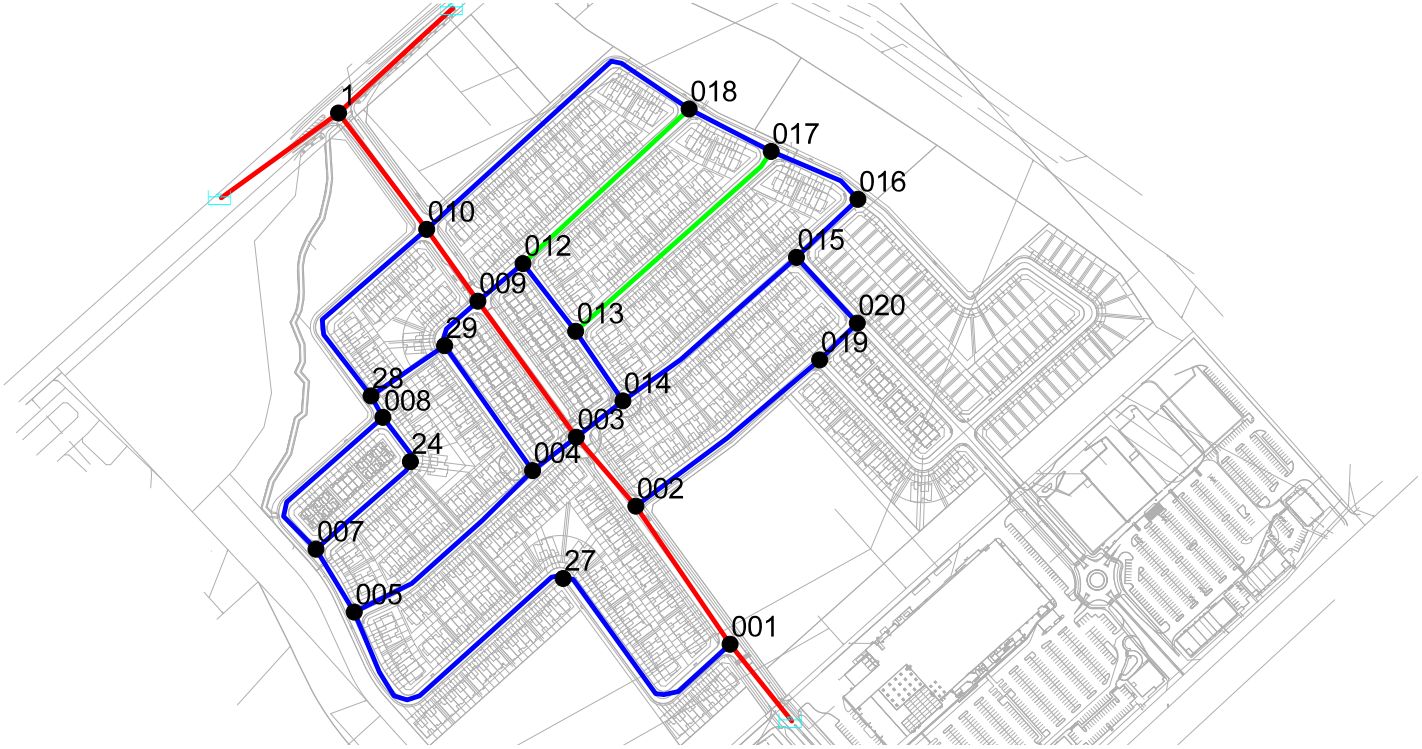
Stantec Project #: 160401393
Project Name: Kanata West Richcraft
Date: 11/23/2020
Fire Flow Calculation #: 11
Description: Residential - Townhomes Units

Notes: Townhome unit with less than 10m seperation between the backs of adjacent units (Block 113)

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	-						372.0	-
	Determine Number of Adjoining Units	Includes adjacent wood frame structures separated by 3m or less						1	-
3	Determine Height in Storeys	Does not include floors >50% below grade or open attic space						2	-
4	Determine Required Fire Flow	($F = 220 \times C \times A^{1/2}$). Round to nearest 1000 L/min						-	9000
5	Determine Occupancy Charge	Limited Combustible						-15%	7650
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	10.1 to 20	26	2	31-60	Wood Frame or Non-Combustible	13%	3749
		East	3.1 to 10	16	2	31-60	Wood Frame or Non-Combustible	18%	
		South	> 45	26	2	31-60	Wood Frame or Non-Combustible	0%	
		West	3.1 to 10	16	2	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							11000
		Total Required Fire Flow in L/s							183.3
		Required Duration of Fire Flow (hrs)							2.00
		Required Volume of Fire Flow (m^3)							1320


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PH3-2020-11-09



JUNCTION (MOTYPE)
- Active
- Domain

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

PIPE (VALUE)
- less than 202.33
- 202.33 ~ 249.66
- greater than 249.66

PUMP (MOTYPE)
- Active
- Domain

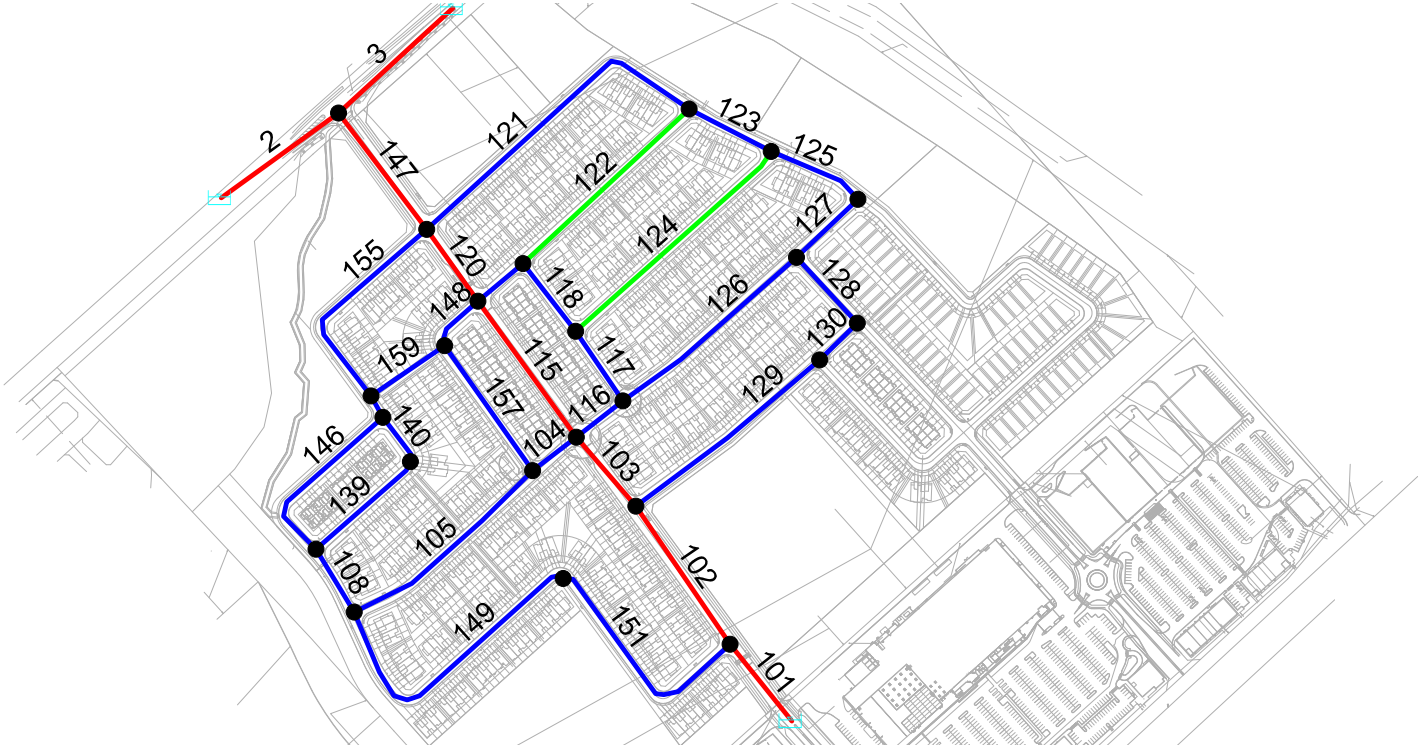
VALVE (MOTYPE)
- Active
- Domain

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Prepared By:

Date: 11/18/2020 2:06:36 PM

PH3-2020-11-09



JUNCTION (MOTYPE)
- Active
- Domain

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

PIPE (VALUE)
- less than 202.33
- 202.33 ~ 249.66
- greater than 249.66

PUMP (MOTYPE)
- Active
- Domain

VALVE (MOTYPE)
- Active
- Domain

ACAD-160401393-DP.dxf

Prepared By:

Date: 11/18/2020 2:10:09 PM

Third Construction Phase
Hydraulic Model Results - Average Day Analysis

Junction Results

ID	Demand	Elevation	Head	Pressure	
	(L/s)	(m)	(m)	(psi)	(Kpa)
1	0.40	98.37	161.40	89.60	617.77
2	0.00	98.03	161.40	90.08	621.08
3	0.27	97.95	161.40	90.19	621.84
4	0.43	98.30	161.40	89.70	618.46
5	0.40	100.16	161.39	87.05	600.19
7	0.48	100.75	161.39	86.21	594.40
8	0.24	99.11	161.40	88.54	610.47
9	0.51	97.96	161.40	90.18	621.77
10	1.20	97.88	161.40	90.30	622.60
12	0.51	97.92	161.40	90.24	622.19
13	0.68	98.01	161.40	90.11	621.29
14	0.48	97.64	161.40	90.64	624.94
15	0.37	97.69	161.40	90.56	624.39
16	0.00	97.62	161.40	90.66	625.08
17	0.00	97.54	161.40	90.78	625.91
18	0.16	97.20	161.40	91.26	629.22
19	0.32	98.15	161.40	89.91	619.91
20	0.00	98.14	161.40	89.92	619.98
1	0.00	96.15	161.41	92.77	639.63
24	0.00	99.30	161.40	88.27	608.60
27	3.50	100.30	161.39	86.84	598.74
28	0.00	99.18	161.40	88.45	609.85
29	0.00	98.02	161.40	90.10	621.22

Pipe Results

ID	From Node	To Node	Length	Diameter	Roughness	Flow	Velocity
			(m)	(mm)		(L/s)	(m/s)
302	1	290.00	297	120	2.94	0.04	0.04
1	2	149.15	297	120	0.51	0.01	0.01
2	3	81.27	297	120	0.22	0.00	0.00
3	4	49.14	204	110	0.93	0.03	0.03
4	5	204.86	204	110	0.96	0.03	0.03
5	7	65.67	204	110	-0.91	0.03	0.03
8	28	21.85	204	110	-1.63	0.05	0.05
3	9	149.76	297	120	-1.57	0.02	0.02
3	14	52.56	204	110	0.59	0.02	0.02
14	13	75.08	204	110	0.04	0.00	0.00
13	12	76.47	204	110	-0.52	0.02	0.02
12	9	52.38	204	110	-0.91	0.03	0.03
9	10	78.67	297	120	-4.03	0.06	0.06
10	18	304.89	204	110	0.73	0.02	0.02
12	18	202.33	155	100	-0.12	0.01	0.01
18	17	82.35	204	110	0.45	0.01	0.01
13	17	237.37	155	100	-0.12	0.01	0.01
17	16	89.96	204	110	0.33	0.01	0.01
14	15	201.16	204	110	0.06	0.00	0.00
15	16	75.48	204	110	-0.33	0.01	0.01
15	20	79.81	204	110	0.03	0.00	0.00
2	19	209.67	204	110	0.29	0.01	0.01
19	20	46.99	204	110	-0.03	0.00	0.00
7	24	115.59	204	110	-0.70	0.02	0.02
24	8	48.04	204	110	-0.70	0.02	0.02
8	7	168.69	204	110	0.69	0.02	0.02
1	10	134.80	297	120	7.01	0.10	0.10
9	29	53.89	204	110	1.04	0.03	0.03
5	27	277.63	204	110	1.47	0.05	0.04
27	1	217.87	204	110	-2.03	0.06	0.06
28	10	205.69	204	110	-1.06	0.03	0.03
29	4	136.30	204	110	0.46	0.01	0.01
28	29	79.48	204	110	-0.57	0.02	0.02
300	1	577.90	297	120	-27.23	0.39	0.39
301	1	645.00	297	120	34.24	0.49	0.49

Hydraulic Model Results -Peak Hour Analysis

Junction Results

ID	Demand	Elevation	Head	Pressure	
	(L/s)	(m)	(m)	(psi)	(Kpa)
1	2.23	98.37	157.56	84.15	580.20
2	0.00	98.03	157.47	84.49	582.54
3	1.50	97.95	157.43	84.55	582.96
4	2.35	98.30	157.41	84.03	579.37
5	2.23	100.16	157.36	81.32	560.69
7	2.65	100.75	157.37	80.49	554.96
8	1.32	99.11	157.39	82.85	571.23
9	2.83	97.96	157.42	84.53	582.82
10	5.10	97.88	157.42	84.64	583.58
12	2.83	97.92	157.41	84.58	583.16
13	3.73	98.01	157.41	84.45	582.27
14	2.65	97.64	157.42	84.98	585.92
15	2.05	97.69	157.42	84.91	585.44
16	0.00	97.62	157.42	85.01	586.13
17	0.00	97.54	157.42	85.12	586.89
18	0.90	97.20	157.42	85.60	590.19
19	1.74	98.15	157.43	84.27	581.02
20	0.00	98.14	157.42	84.28	581.09
1	0.00	96.15	157.44	87.13	600.74
24	0.00	99.30	157.38	82.57	569.30
27	19.30	100.30	157.27	80.99	558.41
28	0.00	99.18	157.40	82.76	570.61
29	0.00	98.02	157.41	84.43	582.13

Pipe Results

ID	From Node	To Node	Length	Diameter	Roughness	Flow	Velocity
			(m)	(mm)		(L/s)	(m/s)
101	302	1	290.00	297	120	41.19	0.59
102	1	2	149.15	297	120	25.86	0.37
103	2	3	81.27	297	120	21.34	0.31
104	3	4	49.14	204	110	6.95	0.21
105	4	5	204.86	204	110	4.94	0.15
108	5	7	65.67	204	110	-3.49	0.11
111	8	28	21.85	204	110	-7.46	0.23
115	3	9	149.76	297	120	7.81	0.11
116	3	14	52.56	204	110	5.08	0.16
117	14	13	75.08	204	110	2.39	0.07
118	13	12	76.47	204	110	-0.87	0.03
119	12	9	52.38	204	110	-3.25	0.10
120	9	10	78.67	297	120	-2.69	0.04
121	10	18	304.89	204	110	1.04	0.03
122	12	18	202.33	155	100	-0.44	0.02
123	18	17	82.35	204	110	-0.30	0.01
124	13	17	237.37	155	100	-0.48	0.03
125	17	16	89.96	204	110	-0.78	0.02
126	14	15	201.16	204	110	0.04	0.00
127	15	16	75.48	204	110	0.78	0.02
128	15	20	79.81	204	110	-2.79	0.09
129	2	19	209.67	204	110	4.53	0.14
130	19	20	46.99	204	110	2.79	0.09
139	7	24	115.59	204	110	-3.10	0.09
140	24	8	48.04	204	110	-3.10	0.09
146	8	7	168.69	204	110	3.05	0.09
147	1	10	134.80	297	120	12.22	0.18
148	9	29	53.89	204	110	4.41	0.14
149	5	27	277.63	204	110	6.21	0.19
151	27	1	217.87	204	110	-13.09	0.40
155	28	10	205.69	204	110	-3.40	0.10
157	29	4	136.30	204	110	0.34	0.01
159	28	29	79.48	204	110	-4.07	0.12
2	300	1	577.90	297	120	-7.89	0.11
3	301	1	645.00	297	120	20.11	0.29

Hydraulic Model Results -Fire Flow Analysis (250 L/s)

ID	Static Demand	Static Pressure		Static Head	Fire-Flow Demand	Residual Pressure		Available Flow at Hydrant	Available Flow Pressure	
	(L/s)	(psi)	(Kpa)	(m)	(L/s)	(psi)	(Kpa)	(L/s)	(psi)	(Kpa)
1	1.01	79.83	550.41	154.53	250	67.60	466.09	801.31	20	137.90
2	0.00	78.67	542.41	153.37	250	65.83	453.88	734.06	20	137.90
3	0.68	78.12	538.62	152.90	250	65.43	451.13	738.21	20	137.90
4	1.07	77.50	534.35	152.82	250	58.76	405.14	535.56	20	137.90
5	1.01	74.86	516.14	152.82	250	48.29	332.95	401.08	20	137.90
7	1.20	73.85	509.18	152.70	250	46.32	319.37	387.55	20	137.90
8	0.60	76.07	524.49	152.62	250	51.92	357.98	435.26	20	137.90
9	1.29	77.57	534.83	152.53	250	65.05	448.51	746.08	20	137.90
10	2.50	77.17	532.07	152.16	250	65.30	450.23	782.85	20	137.90
12	1.29	77.70	535.73	152.58	250	57.48	396.31	504.43	20	137.90
13	1.70	77.71	535.79	152.67	250	54.47	375.56	457.60	20	137.90
14	1.20	78.44	540.83	152.81	250	59.20	408.17	530.88	20	137.90
15	0.93	78.38	540.41	152.82	250	49.94	344.33	399.30	20	137.90
16	0.00	78.37	540.35	152.75	250	44.38	305.99	351.53	20	137.90
17	0.00	78.36	540.28	152.66	250	46.18	318.40	365.42	20	137.90
18	0.41	78.70	542.62	152.56	250	46.18	318.40	364.59	20	137.90
19	0.79	78.00	537.79	153.02	250	40.69	280.55	329.57	20	137.90
20	0.00	77.91	537.17	152.94	250	41.97	289.37	336.62	20	137.90
1	0.00	78.06	538.21	151.06	250	67.77	467.26	923.04	20	137.90
24	0.00	75.83	522.83	152.64	250	44.06	303.78	357.40	20	137.90
27	8.80	75.57	521.04	153.46	250	30.19	208.15	291.50	20	137.90
28	0.00	75.92	523.45	152.59	250	54.78	377.70	477.96	20	137.90
29	0.00	77.58	534.90	152.59	250	59.85	412.65	553.84	20	137.90

Fourth Construction Phase
Hydraulic Model Results - Average Day Analysis

Junction Results

ID	Demand	Elevation	Head	Pressure	
	(L/s)	(m)	(m)	(psi)	(Kpa)
1	0.00	98.37	161.41	89.61	617.84
2	1.30	98.03	161.41	90.10	621.22
3	0.27	97.95	161.41	90.22	622.05
4	0.43	98.30	161.41	89.72	618.60
5	0.40	100.16	161.41	87.07	600.33
7	0.48	100.75	161.41	86.23	594.54
8	0.24	99.11	161.41	88.57	610.67
9	0.51	97.96	161.41	90.20	621.91
10	1.20	97.88	161.41	90.32	622.74
12	0.51	97.92	161.41	90.26	622.32
13	0.68	98.01	161.41	90.13	621.43
14	0.49	97.64	161.41	90.66	625.08
15	0.26	97.69	161.42	90.60	624.67
16	0.00	97.62	161.42	90.70	625.36
17	0.00	97.54	161.42	90.81	626.12
18	0.16	97.20	161.42	91.29	629.43
19	0.47	98.15	161.44	89.97	620.33
20	0.45	98.14	161.44	89.99	620.46
21	0.31	98.11	161.49	90.10	621.22
22	0.19	97.59	161.42	90.74	625.63
1	0.00	96.15	161.42	92.79	639.77
24	0.00	99.30	161.41	88.30	608.81
27	3.60	100.30	161.40	86.86	598.88
28	0.00	99.18	161.41	88.47	609.98
29	0.00	98.02	161.41	90.12	621.36

Pipe Results

ID	From Node	To Node	Length	Diameter	Roughness	Flow	Velocity
			(m)	(mm)		(L/s)	(m/s)
101	302	1	290.00	297	120	-3.76	0.05
102	1	2	149.15	297	120	-5.49	0.08
103	2	3	81.27	297	120	-3.05	0.04
104	3	4	49.14	204	110	0.87	0.03
105	4	5	204.86	204	110	1.11	0.03
108	5	7	65.67	204	110	-1.16	0.04
111	8	28	21.85	204	110	-1.88	0.06
115	3	9	149.76	297	120	-2.58	0.04
116	3	14	52.56	204	110	-1.61	0.05
117	14	13	75.08	204	110	0.22	0.01
118	13	12	76.47	204	110	0.13	0.00
119	12	9	52.38	204	110	0.14	0.00
120	9	10	78.67	297	120	-4.30	0.06
121	10	18	304.89	204	110	-0.59	0.02
122	12	18	202.33	155	100	-0.52	0.03
123	18	17	82.35	204	110	-1.27	0.04
124	13	17	237.37	155	100	-0.58	0.03
125	17	16	89.96	204	110	-1.85	0.06
126	14	15	201.16	204	110	-2.32	0.07
127	15	16	75.48	204	110	2.04	0.06
128	15	20	79.81	204	110	-4.62	0.14
129	2	19	209.67	204	110	-3.74	0.11
130	19	20	46.99	204	110	-1.61	0.05
131	19	21	176.52	155	100	-2.60	0.14
132	303	21	290.00	297	120	9.59	0.14
133	21	20	136.68	204	110	6.68	0.20
135	16	22	136.17	204	110	0.19	0.01
139	7	24	115.59	204	110	-0.83	0.03
140	24	8	48.04	204	110	-0.83	0.03
146	8	7	168.69	204	110	0.81	0.02
147	1	10	134.80	297	120	6.12	0.09
148	9	29	53.89	204	110	1.34	0.04
149	5	27	277.63	204	110	1.87	0.06
151	27	1	217.87	204	110	-1.73	0.05
155	28	10	205.69	204	110	-1.21	0.04
157	29	4	136.30	204	110	0.67	0.02
159	28	29	79.48	204	110	-0.68	0.02
2	300	1	577.90	297	120	-27.74	0.40
3	301	1	645.00	297	120	33.86	0.49

Hydraulic Model Results -Peak Hour Analysis

Junction Results

ID	Demand	Elevation	Head	Pressure	
	(L/s)	(m)	(m)	(psi)	(Kpa)
1	0.00	98.37	157.65	84.28	581.09
2	4.20	98.03	157.58	84.65	583.64
3	1.50	97.95	157.53	84.70	583.99
4	2.35	98.30	157.51	84.17	580.34
5	2.23	100.16	157.46	81.45	561.58
7	2.65	100.75	157.47	80.63	555.93
8	1.32	99.11	157.48	82.98	572.13
9	2.83	97.96	157.51	84.66	583.71
10	5.10	97.88	157.51	84.77	584.47
12	2.83	97.92	157.51	84.72	584.13
13	3.73	98.01	157.52	84.59	583.23
14	2.71	97.64	157.53	85.14	587.02
15	1.44	97.69	157.56	85.11	586.82
16	0.00	97.62	157.54	85.18	587.30
17	0.00	97.54	157.53	85.28	587.99
18	0.90	97.20	157.52	85.75	591.23
19	2.59	98.15	157.63	84.55	582.96
20	2.48	98.14	157.63	84.57	583.09
21	1.68	98.11	157.86	84.94	585.64
22	1.06	97.59	157.54	85.22	587.57
1	0.00	96.15	157.51	87.24	601.50
24	0.00	99.30	157.48	82.70	570.20
27	20.00	100.30	157.35	81.11	559.24
28	0.00	99.18	157.49	82.90	571.58
29	0.00	98.02	157.51	84.57	583.09

Pipe Results

ID	From Node	To Node	Length	Diameter	Roughness	Flow	Velocity
			(m)	(mm)		(L/s)	(m/s)
101	302	1	290.00	297	120	36.21	0.52
102	1	2	149.15	297	120	22.84	0.33
103	2	3	81.27	297	120	23.73	0.34
104	3	4	49.14	204	110	8.09	0.25
105	4	5	204.86	204	110	5.20	0.16
108	5	7	65.67	204	110	-3.66	0.11
111	8	28	21.85	204	110	-7.63	0.23
115	3	9	149.76	297	120	11.02	0.16
116	3	14	52.56	204	110	3.11	0.10
117	14	13	75.08	204	110	4.36	0.13
118	13	12	76.47	204	110	1.58	0.05
119	12	9	52.38	204	110	-0.52	0.02
120	9	10	78.67	297	120	3.79	0.05
121	10	18	304.89	204	110	-1.46	0.04
122	12	18	202.33	155	100	-0.72	0.04
123	18	17	82.35	204	110	-3.08	0.09
124	13	17	237.37	155	100	-0.95	0.05
125	17	16	89.96	204	110	-4.03	0.12
126	14	15	201.16	204	110	-3.96	0.12
127	15	16	75.48	204	110	5.09	0.16
128	15	20	79.81	204	110	-10.49	0.32
129	2	19	209.67	204	110	-5.09	0.16
130	19	20	46.99	204	110	-1.93	0.06
131	19	21	176.52	155	100	-5.75	0.30
132	303	21	290.00	297	120	22.33	0.32
133	21	20	136.68	204	110	14.90	0.46
135	16	22	136.17	204	110	1.06	0.03
139	7	24	115.59	204	110	-3.18	0.10
140	24	8	48.04	204	110	-3.18	0.10
146	8	7	168.69	204	110	3.13	0.10
147	1	10	134.80	297	120	3.06	0.04
148	9	29	53.89	204	110	3.88	0.12
149	5	27	277.63	204	110	6.63	0.20
151	27	1	217.87	204	110	-13.37	0.41
155	28	10	205.69	204	110	-3.21	0.10
157	29	4	136.30	204	110	-0.54	0.02
159	28	29	79.48	204	110	-4.42	0.14
2	300	1	577.90	297	120	-13.74	0.20
3	301	1	645.00	297	120	16.80	0.24

Hydraulic Model Results -Fire Flow Analysis (167 L/s)

ID	Static Demand	Static Pressure		Static Head	Fire-Flow Demand	Residual Pressure		Available Flow at Hydrant	Available Flow Pressure	
	(L/s)	(psi)	(Kpa)	(m)	(L/s)	(psi)	(Kpa)	(L/s)	(psi)	(Kpa)
22	1.79	84.40	581.92	156.96	167	42.97	296.27	216.00	20	137.90

Hydraulic Model Results -Fire Flow Analysis (267 L/s)

ID	Static Demand	Static Pressure		Static Head	Fire-Flow Demand	Residual Pressure		Available Flow at Hydrant	Available Flow Pressure	
	(L/s)	(psi)	(Kpa)	(m)	(L/s)	(psi)	(Kpa)	(L/s)	(psi)	(Kpa)
1	0.00	81.40	561.24	155.63	267	70.45	485.74	929.17	20	137.90
2	2.10	80.85	557.44	154.91	267	69.48	479.05	920.89	20	137.90
3	0.68	80.11	552.34	154.30	267	68.70	473.67	929.11	20	137.90
4	1.07	79.36	547.17	154.12	267	60.98	420.44	593.99	20	137.90
5	0.98	76.70	528.83	154.11	267	49.46	341.02	422.10	20	137.90
7	1.20	75.59	521.18	153.93	267	47.28	325.99	406.68	20	137.90
8	0.60	77.76	536.14	153.81	267	53.23	367.01	459.26	20	137.90
9	1.29	79.22	546.21	153.69	267	67.66	466.50	914.87	20	137.90
10	2.50	78.40	540.55	153.03	267	67.03	462.16	937.58	20	137.90
12	1.29	79.49	548.07	153.84	267	59.92	413.14	562.65	20	137.90
13	1.70	79.69	549.45	154.07	267	57.33	395.28	505.02	20	137.90
14	1.23	80.53	555.24	154.29	267	62.80	432.99	617.45	20	137.90
15	0.66	81.10	559.17	154.74	267	60.62	417.96	532.73	20	137.90
16	0.00	80.76	556.82	154.43	267	50.34	347.08	406.52	20	137.90
17	0.00	80.41	554.41	154.10	267	49.77	343.15	403.34	20	137.90
18	0.41	80.53	555.24	153.85	267	48.34	333.29	392.12	20	137.90
19	1.18	81.75	563.65	155.66	267	62.44	430.51	547.68	20	137.90
20	1.13	81.78	563.86	155.67	267	66.37	457.61	635.60	20	137.90
21	0.77	84.71	584.06	157.70	267	78.62	542.07	1213.99	20	137.90
1	0.00	77.97	537.59	150.99	267	67.39	464.64	1015.50	20	137.90
24	0.00	77.54	534.62	153.84	267	44.41	306.20	373.57	20	137.90
27	5.00	77.47	534.14	154.79	267	29.82	205.60	303.20	20	137.90
28	0.00	77.59	534.97	153.76	267	56.43	389.07	512.96	20	137.90
29	0.00	79.26	546.48	153.77	267	61.90	426.79	617.70	20	137.90

Ultimate Conditions
Hydraulic Model Results - Average Day Analysis

Junction Results

ID	Demand	Elevation	Head	Pressure	
	(L/s)	(m)	(m)	(psi)	(Kpa)
1	0.00	98.37	161.41	89.62	617.91
2	1.30	98.03	161.42	90.11	621.29
3	0.27	97.95	161.42	90.23	622.12
4	0.43	98.30	161.42	89.73	618.67
5	0.40	100.16	161.42	87.08	600.40
7	0.48	100.75	161.42	86.24	594.61
8	0.24	99.11	161.42	88.58	610.74
9	0.51	97.96	161.42	90.22	622.05
10	1.20	97.88	161.42	90.33	622.81
12	0.51	97.92	161.42	90.27	622.39
13	0.68	98.01	161.42	90.15	621.57
14	0.49	97.64	161.42	90.67	625.15
15	0.26	97.69	161.44	90.63	624.88
16	0.00	97.62	161.44	90.73	625.57
17	0.00	97.54	161.43	90.83	626.25
18	0.16	97.20	161.43	91.31	629.56
19	0.47	98.15	161.45	89.98	620.39
20	0.45	98.14	161.45	90.00	620.53
21	0.31	98.11	161.49	90.10	621.22
22	0.72	97.59	161.47	90.80	626.05
1	0.00	96.15	161.43	92.80	639.84
24	0.00	99.30	161.42	88.31	608.88
27	3.60	100.30	161.40	86.86	598.88
28	0.00	99.18	161.42	88.48	610.05
29	0.00	98.02	161.42	90.13	621.43

Pipe Results

ID	From Node	To Node	Length	Diameter	Roughness	Flow	Velocity
			(m)	(mm)		(L/s)	(m/s)
101	302	1	290.00	297	120	-5.25	0.08
102	1	2	149.15	297	120	-6.79	0.10
103	2	3	81.27	297	120	-4.29	0.06
104	3	4	49.14	204	110	0.81	0.02
105	4	5	204.86	204	110	1.17	0.04
108	5	7	65.67	204	110	-1.29	0.04
111	8	28	21.85	204	110	-2.01	0.06
115	3	9	149.76	297	120	-3.13	0.05
116	3	14	52.56	204	110	-2.24	0.07
117	14	13	75.08	204	110	0.31	0.01
118	13	12	76.47	204	110	0.52	0.02
119	12	9	52.38	204	110	0.78	0.02
120	9	10	78.67	297	120	-4.37	0.06
121	10	18	304.89	204	110	-1.21	0.04
122	12	18	202.33	155	100	-0.77	0.04
123	18	17	82.35	204	110	-2.14	0.07
124	13	17	237.37	155	100	-0.90	0.05
125	17	16	89.96	204	110	-3.04	0.09
126	14	15	201.16	204	110	-3.04	0.09
127	15	16	75.48	204	110	-0.07	0.00
128	15	20	79.81	204	110	-3.22	0.10
129	2	19	209.67	204	110	-3.81	0.12
130	19	20	46.99	204	110	-2.03	0.06
131	19	21	176.52	155	100	-2.25	0.12
132	303	21	290.00	297	120	12.09	0.17
133	21	20	136.68	204	110	5.70	0.17
134	21	22	156.78	204	110	3.83	0.12
135	22	16	274.25	204	110	3.11	0.10
139	7	24	115.59	204	110	-0.89	0.03
140	24	8	48.04	204	110	-0.89	0.03
146	8	7	168.69	204	110	0.88	0.03
147	1	10	134.80	297	120	5.64	0.08
148	9	29	53.89	204	110	1.51	0.05
149	5	27	277.63	204	110	2.05	0.06
151	27	1	217.87	204	110	-1.55	0.05
155	28	10	205.69	204	110	-1.28	0.04
157	29	4	136.30	204	110	0.78	0.02
159	28	29	79.48	204	110	-0.73	0.02
2	300	1	577.90	297	120	-28.01	0.40
3	301	1	645.00	297	120	33.65	0.49

Hydraulic Model Results -Peak Hour Analysis

Junction Results

ID	Demand	Elevation	Head	Pressure	
	(L/s)	(m)	(m)	(psi)	(Kpa)
1	0.00	98.37	157.68	84.31	581.30
2	4.20	98.03	157.61	84.69	583.92
3	1.50	97.95	157.57	84.75	584.33
4	2.35	98.30	157.54	84.21	580.61
5	2.23	100.16	157.49	81.50	561.93
7	2.65	100.75	157.5	80.67	556.20
8	1.32	99.11	157.51	83.02	572.41
9	2.83	97.96	157.54	84.70	583.99
10	5.10	97.88	157.54	84.81	584.75
12	2.83	97.92	157.55	84.76	584.40
13	3.73	98.01	157.55	84.64	583.58
14	2.71	97.64	157.56	85.19	587.37
15	1.44	97.69	157.62	85.19	587.37
16	0.00	97.62	157.62	85.29	588.06
17	0.00	97.54	157.58	85.36	588.54
18	0.90	97.20	157.56	85.81	591.64
19	2.59	98.15	157.65	84.59	583.23
20	2.48	98.14	157.66	84.61	583.37
21	1.68	98.11	157.83	84.90	585.37
22	3.94	97.59	157.71	85.46	589.23
1	0.00	96.15	157.54	87.27	601.71
24	0.00	99.30	157.51	82.75	570.54
27	20.00	100.30	157.38	81.14	559.44
28	0.00	99.18	157.52	82.94	571.85
29	0.00	98.02	157.54	84.61	583.37

Pipe Results

ID	From Node	To Node	Length	Diameter	Roughness	Flow	Velocity
			(m)	(mm)		(L/s)	(m/s)
101	302	1	290.00	297	120	35.01	0.51
102	1	2	149.15	297	120	21.76	0.31
103	2	3	81.27	297	120	22.63	0.33
104	3	4	49.14	204	110	8.22	0.25
105	4	5	204.86	204	110	5.27	0.16
108	5	7	65.67	204	110	-3.70	0.11
111	8	28	21.85	204	110	-7.67	0.23
115	3	9	149.76	297	120	11.25	0.16
116	3	14	52.56	204	110	1.66	0.05
117	14	13	75.08	204	110	4.49	0.14
118	13	12	76.47	204	110	2.47	0.08
119	12	9	52.38	204	110	1.02	0.03
120	9	10	78.67	297	120	5.51	0.08
121	10	18	304.89	204	110	-2.75	0.08
122	12	18	202.33	155	100	-1.38	0.07
123	18	17	82.35	204	110	-5.03	0.15
124	13	17	237.37	155	100	-1.71	0.09
125	17	16	89.96	204	110	-6.73	0.21
126	14	15	201.16	204	110	-5.54	0.17
127	15	16	75.48	204	110	0.67	0.02
128	15	20	79.81	204	110	-7.65	0.23
129	2	19	209.67	204	110	-5.07	0.16
130	19	20	46.99	204	110	-2.69	0.08
131	19	21	176.52	155	100	-4.98	0.26
132	303	21	290.00	297	120	29.48	0.43
133	21	20	136.68	204	110	12.82	0.39
134	21	22	156.78	204	110	10.00	0.31
135	22	16	274.25	204	110	6.06	0.19
139	7	24	115.59	204	110	-3.20	0.10
140	24	8	48.04	204	110	-3.20	0.10
146	8	7	168.69	204	110	3.15	0.10
147	1	10	134.80	297	120	-0.01	0.00
148	9	29	53.89	204	110	3.92	0.12
149	5	27	277.63	204	110	6.75	0.21
151	27	1	217.87	204	110	-13.25	0.41
155	28	10	205.69	204	110	-3.15	0.10
157	29	4	136.30	204	110	-0.60	0.02
159	28	29	79.48	204	110	-4.52	0.14
2	300	1	577.90	297	120	-15.42	0.22
3	301	1	645.00	297	120	15.41	0.22

Hydraulic Model Results -Fire Flow Analysis (267 L/s)

ID	Static Demand	Static Pressure		Static Head	Fire-Flow Demand	Residual Pressure		Available Flow at Hydrant	Available Flow Pressure	
	(L/s)	(psi)	(Kpa)	(m)	(L/s)	(psi)	(Kpa)	(L/s)	(psi)	(Kpa)
1	0.00	81.69	563.24	155.83	267	71.44	492.56	951.34	20	137.90
2	2.20	81.29	560.48	155.21	267	70.69	487.39	959.30	20	137.90
3	0.68	80.63	555.93	154.67	267	70.00	482.64	980.18	20	137.90
4	1.07	79.84	550.48	154.46	267	62.22	428.99	607.31	20	137.90
5	1.01	77.14	531.86	154.42	267	50.39	347.43	427.41	20	137.90
7	1.20	76.05	524.35	154.24	267	48.32	333.16	412.50	20	137.90
8	0.60	78.22	539.31	154.14	267	54.34	374.66	466.53	20	137.90
9	1.29	79.72	549.65	154.04	267	68.86	474.78	967.33	20	137.90
10	2.50	78.82	543.45	153.32	267	68.04	469.12	985.72	20	137.90
12	1.29	80.09	552.20	154.26	267	61.50	424.03	581.10	20	137.90
13	1.70	80.32	553.79	154.51	267	59.22	408.31	523.82	20	137.90
14	1.23	81.09	559.10	154.68	267	64.82	446.92	648.24	20	137.90
15	0.66	82.17	566.55	155.49	267	65.15	449.20	602.60	20	137.90
16	0.00	82.23	566.96	155.46	267	62.33	429.75	535.55	20	137.90
17	0.00	81.43	561.44	154.82	267	55.94	385.70	454.28	20	137.90
18	0.41	81.32	560.69	154.4	267	52.39	361.22	418.91	20	137.90
19	1.18	82.25	567.10	156.01	267	63.56	438.23	557.57	20	137.90
20	1.13	82.30	567.44	156.03	267	67.73	466.98	656.17	20	137.90
21	0.77	84.48	582.47	157.53	267	78.43	540.76	1,273.74	20	137.90
22	1.79	84.06	579.58	156.72	267	48.78	336.33	376.90	20	137.90
1	0.00	78.07	538.28	151.07	267	67.96	468.57	1,040.95	20	137.90
24	0.00	78.00	537.79	154.17	267	45.49	313.64	378.71	20	137.90
27	9.10	77.64	535.31	154.92	267	29.78	205.33	307.04	20	137.90
28	0.00	78.06	538.21	154.09	267	57.57	396.93	520.97	20	137.90
29	0.00	79.74	549.79	154.11	267	63.10	435.06	633.50	20	137.90

A.2 FOURTH CONSTRUCTION PHASE HYDRAULIC ANALYSIS

1620 Maple Grove Road

Information Provided:

Date provided August, 20, 2018

Scenario	Demand	
	L/min	L/s
Average Daily Demand	641	10.7
Maximum Daily Demand	1515	25.25
Peak Hour	3282	54.7
Fire Flow Demand # 1	17000	283

# of connections	4

Connection Locations:



Figure 1 - Connection points

Results:

Connection 1 - Maple Grove Road and Silver Seven Road

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	162.1	92.7
Peak Hour	157.7	86.4
Max Day plus Fire (10,000 l/min)	154.7	82.7
Max Day plus Fire (17,000 l/min)	150.5	76.3

[1] Ground Elevation = 96.880 m

Connection 2 - Maple Grove Road and Rosehill Ave

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	161.0	88.8
Peak Hour	157.4	83.5
Max Day plus Fire (10,000 l/min)	153.9	75.3
Max Day plus Fire (17,000 l/min)	138.9	57.3

[1] Ground Elevation = 100.900 m

Connection 3 - Hazeldean Road and Kincardine Dr.

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	161.5	90.9
Peak Hour	157.9	85.8
Max Day plus Fire (10,000 l/min)	158.8	87.1
Max Day plus Fire (17,000 l/min)	157.9	85.8

[1] Ground Elevation = 97.490 m

Connection 4 - Hazeldean Road

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	161.4	90.9
Peak Hour	158.0	82.0
Max Day plus Fire (10,000 l/min)	158.7	83.5
Max Day plus Fire (17,000 l/min)	157.8	82.2

[1] Ground Elevation = 99.900 m

Notes:

1) As per the Ontario Building Code in areas that may be occupied, the static pressure at any fixture shall not exceed 552 kPa (80 psi.) Pressure control measures to be considered are as follows, in order of preference:
   a) If possible, systems to be designed to residual pressures of 345 to 552 kPa (50 to 80 psi) in all occupied areas outside of the public right-of-way without special pressure control equipment.
   b) Pressure reducing valves to be installed immediately downstream of the isolation valve in the home/ building, located downstream of the meter so it is owner maintained.
2) Watermain along Maple Grove Road is expected to be constructed.
3) Ownership of existing private roads off of Hazeldean road are expected to be turned over to the City of Ottawa and therefore ownership of watermains along those roads are in turn to be given to the City of Ottawa prior to 1620 Maple Grove watermain connections.

Disclaimer

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

Kanata West Richcraft - Domestic Water Demand Estimates
Construction Phase 4

Densities as per City Guidelines:

LD	3.4	ppu		
MD	2.7	ppu	38	Units/ha
HD	1.8	ppu		

Building ID	Area (m^2)	Population	Daily Rate of Demand [1]	Avg Day Demand [2]		Max Day Demand [3]		Peak Hour Demand [3]	
				(L/min)	(L/s)	(L/min)	(L/s)	(L/min)	(L/s)
MD1	7,350	76	350	18.4	0.31	45.9	0.76	100.9	1.68
Commerical	14,700		28000	28.6	0.48	42.9	0.71	77.2	1.29
Residential 1		97	350	23.6	0.39	59.1	0.98	129.9	2.17
Total				**70.6**	**1.2**	**147.8**	**2.5**	**308.0**	**5.1**
Residential 2		59	350	14.4	0.24	36.1	0.60	79.4	1.32
Residential 3		127	350	30.8	0.51	77.1	1.29	169.6	2.83
Residential 4		127	350	30.8	0.51	77.1	1.29	169.6	2.83
Residential 5		41	350	9.8	0.16	24.6	0.41	54.1	0.90
Residential 6		167	350	40.7	0.68	101.7	1.70	223.8	3.73
Residential 7		65	350	15.8	0.26	39.4	0.66	86.6	1.44
Residential 8		119	350	28.9	0.48	72.2	1.20	158.8	2.65
Residential 9		116	350	28.2	0.47	70.5	1.18	155.2	2.59
Residential 10		111	350	27.0	0.45	67.6	1.13	148.7	2.48
Residential 11		76	350	18.4	0.31	45.9	0.77	101.1	1.68
Residential 12		48	350	11.6	0.19	28.9	0.48	63.6	1.06
Residential 13		211	350	51.2	0.85	128.0	2.13	281.5	4.69
MD2	27,400	686	350	166.7	2.78	416.7	6.95	916.8	15.28
Total				**217.9**	**3.6**	**544.7**	**9.1**	**1198.3**	**20.0**
Residential 14		70	350	17.1	0.28	42.7	0.71	93.8	1.56
School	30,250		28000	58.8	0.98	88.2	1.47	158.8	2.65
Total				**75.9**	**1.3**	**130.9**	**2.2**	**252.7**	**4.2**
Residential 15		68	350	16.4	0.27	41.0	0.68	90.2	1.50
Residential 16		105	350	25.6	0.43	64.0	1.07	140.8	2.35
Residential 17		100	350	24.3	0.40	60.7	1.01	133.5	2.23
Residential 18		119	350	28.9	0.48	72.2	1.20	158.8	2.65
Total Site :				**715.9**	**11.9**	**1702.5**	**28.4**	**3693.0**	**61.5**

1 Average day water demand for residential areas equal to 350 L/cap/d and 28,000 L/ha/d for the school block

2 City of Ottawa water demand criteria used to estimate peak demand rates for residential areas are as follows:
maximum day demand rate = 2.5 x average day demand rate for residential, 1.5 for Institutional
maximum hour demand rate = 2.2 x maximum day demand rate for residential, 1.8 for institutional

3 Unit counts for unmarked Medium Density Residential areas are equal to 38 Units/ha

4 Unit counts for unmarked Medium Density Residential area 2 (MD2) are based on the Concept Site Plan for Richcraft prepared by M. David Blakely Architch Inc. on Febuary 2020

Fourth Construction Phase
Hydraulic Model Results - Average Day Analysis

Junction Results

ID	Demand	Elevation	Head	Pressure	
	(L/s)	(m)	(m)	(psi)	(Kpa)
1	0.00	98.37	161.41	89.61	617.84
2	1.30	98.03	161.41	90.10	621.22
3	0.27	97.95	161.41	90.22	622.05
4	0.43	98.30	161.41	89.72	618.60
5	0.40	100.16	161.41	87.07	600.33
7	0.48	100.75	161.41	86.23	594.54
8	0.24	99.11	161.41	88.57	610.67
9	0.51	97.96	161.41	90.20	621.91
10	1.20	97.88	161.41	90.32	622.74
12	0.51	97.92	161.41	90.26	622.32
13	0.68	98.01	161.41	90.13	621.43
14	0.49	97.64	161.41	90.66	625.08
15	0.26	97.69	161.42	90.60	624.67
16	0.00	97.62	161.42	90.70	625.36
17	0.00	97.54	161.42	90.81	626.12
18	0.16	97.20	161.42	91.29	629.43
19	0.47	98.15	161.44	89.97	620.33
20	0.45	98.14	161.44	89.99	620.46
21	0.31	98.11	161.49	90.10	621.22
22	0.19	97.59	161.42	90.74	625.63
1	0.00	96.15	161.42	92.79	639.77
24	0.00	99.30	161.41	88.30	608.81
27	3.60	100.30	161.40	86.86	598.88
28	0.00	99.18	161.41	88.47	609.98
29	0.00	98.02	161.41	90.12	621.36

Pipe Results

ID	From Node	To Node	Length	Diameter	Roughness	Flow	Velocity
			(m)	(mm)		(L/s)	(m/s)
101	302	1	290.00	297	120	-3.76	0.05
102	1	2	149.15	297	120	-5.49	0.08
103	2	3	81.27	297	120	-3.05	0.04
104	3	4	49.14	204	110	0.87	0.03
105	4	5	204.86	204	110	1.11	0.03
108	5	7	65.67	204	110	-1.16	0.04
111	8	28	21.85	204	110	-1.88	0.06
115	3	9	149.76	297	120	-2.58	0.04
116	3	14	52.56	204	110	-1.61	0.05
117	14	13	75.08	204	110	0.22	0.01
118	13	12	76.47	204	110	0.13	0.00
119	12	9	52.38	204	110	0.14	0.00
120	9	10	78.67	297	120	-4.30	0.06
121	10	18	304.89	204	110	-0.59	0.02
122	12	18	202.33	155	100	-0.52	0.03
123	18	17	82.35	204	110	-1.27	0.04
124	13	17	237.37	155	100	-0.58	0.03
125	17	16	89.96	204	110	-1.85	0.06
126	14	15	201.16	204	110	-2.32	0.07
127	15	16	75.48	204	110	2.04	0.06
128	15	20	79.81	204	110	-4.62	0.14
129	2	19	209.67	204	110	-3.74	0.11
130	19	20	46.99	204	110	-1.61	0.05
131	19	21	176.52	155	100	-2.60	0.14
132	303	21	290.00	297	120	9.59	0.14
133	21	20	136.68	204	110	6.68	0.20
135	16	22	136.17	204	110	0.19	0.01
139	7	24	115.59	204	110	-0.83	0.03
140	24	8	48.04	204	110	-0.83	0.03
146	8	7	168.69	204	110	0.81	0.02
147	1	10	134.80	297	120	6.12	0.09
148	9	29	53.89	204	110	1.34	0.04
149	5	27	277.63	204	110	1.87	0.06
151	27	1	217.87	204	110	-1.73	0.05
155	28	10	205.69	204	110	-1.21	0.04
157	29	4	136.30	204	110	0.67	0.02
159	28	29	79.48	204	110	-0.68	0.02
2	300	1	577.90	297	120	-27.74	0.40
3	301	1	645.00	297	120	33.86	0.49

Hydraulic Model Results -Peak Hour Analysis

Junction Results

ID	Demand	Elevation	Head	Pressure	
	(L/s)	(m)	(m)	(psi)	(Kpa)
1	0.00	98.37	157.65	84.28	581.09
2	4.20	98.03	157.58	84.65	583.64
3	1.50	97.95	157.53	84.70	583.99
4	2.35	98.30	157.51	84.17	580.34
5	2.23	100.16	157.46	81.45	561.58
7	2.65	100.75	157.47	80.63	555.93
8	1.32	99.11	157.48	82.98	572.13
9	2.83	97.96	157.51	84.66	583.71
10	5.10	97.88	157.51	84.77	584.47
12	2.83	97.92	157.51	84.72	584.13
13	3.73	98.01	157.52	84.59	583.23
14	2.71	97.64	157.53	85.14	587.02
15	1.44	97.69	157.56	85.11	586.82
16	0.00	97.62	157.54	85.18	587.30
17	0.00	97.54	157.53	85.28	587.99
18	0.90	97.20	157.52	85.75	591.23
19	2.59	98.15	157.63	84.55	582.96
20	2.48	98.14	157.63	84.57	583.09
21	1.68	98.11	157.86	84.94	585.64
22	1.06	97.59	157.54	85.22	587.57
1	0.00	96.15	157.51	87.24	601.50
24	0.00	99.30	157.48	82.70	570.20
27	20.00	100.30	157.35	81.11	559.24
28	0.00	99.18	157.49	82.90	571.58
29	0.00	98.02	157.51	84.57	583.09

Pipe Results

ID	From Node	To Node	Length	Diameter	Roughness	Flow	Velocity
			(m)	(mm)		(L/s)	(m/s)
101	302	1	290.00	297	120	36.21	0.52
102	1	2	149.15	297	120	22.84	0.33
103	2	3	81.27	297	120	23.73	0.34
104	3	4	49.14	204	110	8.09	0.25
105	4	5	204.86	204	110	5.20	0.16
108	5	7	65.67	204	110	-3.66	0.11
111	8	28	21.85	204	110	-7.63	0.23
115	3	9	149.76	297	120	11.02	0.16
116	3	14	52.56	204	110	3.11	0.10
117	14	13	75.08	204	110	4.36	0.13
118	13	12	76.47	204	110	1.58	0.05
119	12	9	52.38	204	110	-0.52	0.02
120	9	10	78.67	297	120	3.79	0.05
121	10	18	304.89	204	110	-1.46	0.04
122	12	18	202.33	155	100	-0.72	0.04
123	18	17	82.35	204	110	-3.08	0.09
124	13	17	237.37	155	100	-0.95	0.05
125	17	16	89.96	204	110	-4.03	0.12
126	14	15	201.16	204	110	-3.96	0.12
127	15	16	75.48	204	110	5.09	0.16
128	15	20	79.81	204	110	-10.49	0.32
129	2	19	209.67	204	110	-5.09	0.16
130	19	20	46.99	204	110	-1.93	0.06
131	19	21	176.52	155	100	-5.75	0.30
132	303	21	290.00	297	120	22.33	0.32
133	21	20	136.68	204	110	14.90	0.46
135	16	22	136.17	204	110	1.06	0.03
139	7	24	115.59	204	110	-3.18	0.10
140	24	8	48.04	204	110	-3.18	0.10
146	8	7	168.69	204	110	3.13	0.10
147	1	10	134.80	297	120	3.06	0.04
148	9	29	53.89	204	110	3.88	0.12
149	5	27	277.63	204	110	6.63	0.20
151	27	1	217.87	204	110	-13.37	0.41
155	28	10	205.69	204	110	-3.21	0.10
157	29	4	136.30	204	110	-0.54	0.02
159	28	29	79.48	204	110	-4.42	0.14
2	300	1	577.90	297	120	-13.74	0.20
3	301	1	645.00	297	120	16.80	0.24

Hydraulic Model Results -Fire Flow Analysis (167 L/s)

ID	Static Demand	Static Pressure		Static Head	Fire-Flow Demand	Residual Pressure		Available Flow at Hydrant	Available Flow Pressure	
	(L/s)	(psi)	(Kpa)	(m)	(L/s)	(psi)	(Kpa)	(L/s)	(psi)	(Kpa)
22	1.79	84.40	581.92	156.96	167	42.97	296.27	216.00	20	137.90

Hydraulic Model Results -Fire Flow Analysis (267 L/s)

ID	Static Demand	Static Pressure		Static Head	Fire-Flow Demand	Residual Pressure		Available Flow at Hydrant	Available Flow Pressure	
	(L/s)	(psi)	(Kpa)	(m)	(L/s)	(psi)	(Kpa)	(L/s)	(psi)	(Kpa)
1	0.00	81.40	561.24	155.63	267	70.45	485.74	929.17	20	137.90
2	2.10	80.85	557.44	154.91	267	69.48	479.05	920.89	20	137.90
3	0.68	80.11	552.34	154.30	267	68.70	473.67	929.11	20	137.90
4	1.07	79.36	547.17	154.12	267	60.98	420.44	593.99	20	137.90
5	0.98	76.70	528.83	154.11	267	49.46	341.02	422.10	20	137.90
7	1.20	75.59	521.18	153.93	267	47.28	325.99	406.68	20	137.90
8	0.60	77.76	536.14	153.81	267	53.23	367.01	459.26	20	137.90
9	1.29	79.22	546.21	153.69	267	67.66	466.50	914.87	20	137.90
10	2.50	78.40	540.55	153.03	267	67.03	462.16	937.58	20	137.90
12	1.29	79.49	548.07	153.84	267	59.92	413.14	562.65	20	137.90
13	1.70	79.69	549.45	154.07	267	57.33	395.28	505.02	20	137.90
14	1.23	80.53	555.24	154.29	267	62.80	432.99	617.45	20	137.90
15	0.66	81.10	559.17	154.74	267	60.62	417.96	532.73	20	137.90
16	0.00	80.76	556.82	154.43	267	50.34	347.08	406.52	20	137.90
17	0.00	80.41	554.41	154.10	267	49.77	343.15	403.34	20	137.90
18	0.41	80.53	555.24	153.85	267	48.34	333.29	392.12	20	137.90
19	1.18	81.75	563.65	155.66	267	62.44	430.51	547.68	20	137.90
20	1.13	81.78	563.86	155.67	267	66.37	457.61	635.60	20	137.90
21	0.77	84.71	584.06	157.70	267	78.62	542.07	1213.99	20	137.90
1	0.00	77.97	537.59	150.99	267	67.39	464.64	1015.50	20	137.90
24	0.00	77.54	534.62	153.84	267	44.41	306.20	373.57	20	137.90
27	5.00	77.47	534.14	154.79	267	29.82	205.60	303.20	20	137.90
28	0.00	77.59	534.97	153.76	267	56.43	389.07	512.96	20	137.90
29	0.00	79.26	546.48	153.77	267	61.90	426.79	617.70	20	137.90

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FUS Fire Flow Calculation Sheet

Stantec Project #: 160401393
Project Name: Kanata West Richcraft
Date: 11/23/2020
Fire Flow Calculation #: 2
Description: Residential Back-to-Back Units

Notes: Worst case back-to-back units - max. ground floor area of 600m2. (Block 121)

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	-						55.6	-
	Determine Number of Adjoining Units	Includes adjacent wood frame structures separated by 3m or less						8	-
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	3.1 to 10	19	3	31-60	Wood Frame or Non-Combustible	18%	5508
		East	20.1 to 30	25	3	61-90	Wood Frame or Non-Combustible	9%	
		South	3.1 to 10	19	3	31-60	Wood Frame or Non-Combustible	18%	
		West	20.1 to 30	25	3	61-90	Wood Frame or Non-Combustible	9%	
8	Determine Final Required Fire Flow	Total Required Fire Flow in L/min, Rounded to Nearest 1000L/min							16000
		Total Required Fire Flow in L/s							266.7
		Required Duration of Fire Flow (hrs)							3.50
		Required Volume of Fire Flow (m^3)							3360

Stantec

FUS Fire Flow Calculation Sheet

Stantec Project #: 160401393
Project Name: Kanata West Richcraft
Date: 11/23/2020
Fire Flow Calculation #: 2
Description: Residential - Townhomes Units

Notes: Townhome unit with less than 10m seperation between the backs of adjacent units (Block 53)

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	-						492.0	-
	Determine Number of Adjoining Units	Includes adjacent wood frame structures separated by 3m or less						1	-
3	Determine Height in Storeys	Does not include floors >50% below grade or open attic space						2	-
4	Determine Required Fire Flow	($F = 220 \times C \times A^{1/2}$). Round to nearest 1000 L/min						-	10000
5	Determine Occupancy Charge	Limited Combustible						-15%	8500
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	30	2	31-60	Wood Frame or Non-Combustible	18%	4420
		East	20.1 to 30	16	2	31-60	Wood Frame or Non-Combustible	8%	
		South	20.1 to 30	30	2	31-60	Wood Frame or Non-Combustible	8%	
		West	3.1 to 10	16	2	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							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 #: 160401393
Project Name: Kanata West Richcraft
Date: 11/23/2020
Fire Flow Calculation #: 3
Description: Residential - Townhomes Units

Notes: Townhome unit with less than 10m seperation between the backs of adjacent units (Block 56)

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	-						563.0	-
	Determine Number of Adjoining Units	Includes adjacent wood frame structures separated by 3m or less						1	-
3	Determine Height in Storeys	Does not include floors >50% below grade or open attic space						2	-
4	Determine Required Fire Flow	($F = 220 \times C \times A^{1/2}$). Round to nearest 1000 L/min						-	11000
5	Determine Occupancy Charge	Limited Combustible						-15%	9350
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	10.1 to 20	37	2	61-90	Wood Frame or Non-Combustible	14%	5984
		East	3.1 to 10	16	2	31-60	Wood Frame or Non-Combustible	18%	
		South	10.1 to 20	37	2	61-90	Wood Frame or Non-Combustible	14%	
		West	3.1 to 10	16	2	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							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

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FUS Fire Flow Calculation Sheet

Stantec Project #: 160401393
Project Name: Kanata West Richcraft
Date: 11/23/2020
Fire Flow Calculation #: 4
Description: Residential - Townhomes Units

Notes: Townhome unit with less than 10m seperation between the backs of adjacent units (Block 69)

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	-						297.0	-
	Determine Number of Adjoining Units	Includes adjacent wood frame structures separated by 3m or less						1	-
3	Determine Height in Storeys	Does not include floors >50% below grade or open attic space						2	-
4	Determine Required Fire Flow	($F = 220 \times C \times A^{1/2}$). Round to nearest 1000 L/min						-	8000
5	Determine Occupancy Charge	Limited Combustible						-15%	6800
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	20.1 to 30	16	2	31-60	Wood Frame or Non-Combustible	8%	2992
		East	3.1 to 10	20	2	31-60	Wood Frame or Non-Combustible	18%	
		South	3.1 to 10	16	2	31-60	Wood Frame or Non-Combustible	18%	
		West	> 45	20	2	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							10000
		Total Required Fire Flow in L/s							166.7
		Required Duration of Fire Flow (hrs)							2.00
		Required Volume of Fire Flow (m^3)							1200

Stantec

FUS Fire Flow Calculation Sheet

Stantec Project #: 160401393
Project Name: Kanata West Richcraft
Date: 11/23/2020
Fire Flow Calculation #: 5
Description: Residential - Townhomes Units

Notes: Townhome unit with less than 10m seperation between the backs of adjacent units (Block 70)

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	-						297.0	-
	Determine Number of Adjoining Units	Includes adjacent wood frame structures separated by 3m or less						1	-
3	Determine Height in Storeys	Does not include floors >50% below grade or open attic space						2	-
4	Determine Required Fire Flow	($F = 220 \times C \times A^{1/2}$). Round to nearest 1000 L/min						-	8000
5	Determine Occupancy Charge	Limited Combustible						-15%	6800
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	16	2	31-60	Wood Frame or Non-Combustible	18%	2992
		East	3.1 to 10	20	2	31-60	Wood Frame or Non-Combustible	18%	
		South	20.1 to 30	16	2	31-60	Wood Frame or Non-Combustible	8%	
		West	> 45	20	2	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							10000
		Total Required Fire Flow in L/s							166.7
		Required Duration of Fire Flow (hrs)							2.00
		Required Volume of Fire Flow (m^3)							1200

Stantec

FUS Fire Flow Calculation Sheet

Stantec Project #: 160401393
Project Name: Kanata West Richcraft
Date: 11/23/2020
Fire Flow Calculation #: 6
Description: Residential - Townhomes Units

Notes: Townhome unit with less than 10m seperation between the backs of adjacent units (Block 77)

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	-						586.0	-
	Determine Number of Adjoining Units	Includes adjacent wood frame structures separated by 3m or less						1	-
3	Determine Height in Storeys	Does not include floors >50% below grade or open attic space						2	-
4	Determine Required Fire Flow	($F = 220 \times C \times A^{1/2}$). Round to nearest 1000 L/min						-	11000
5	Determine Occupancy Charge	Limited Combustible						-15%	9350
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	20.1 to 30	36	2	61-90	Wood Frame or Non-Combustible	9%	4769
		East	30.1 to 45	16	2	31-60	Wood Frame or Non-Combustible	5%	
		South	3.1 to 10	36	2	61-90	Wood Frame or Non-Combustible	19%	
		West	3.1 to 10	16	2	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 #: 160401393
Project Name: Kanata West Richcraft
Date: 11/23/2020
Fire Flow Calculation #: 7
Description: Residential - Townhomes Units

Notes: Townhome unit with less than 10m seperation between the backs of adjacent units (Block 78)

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	-						372.0	-
	Determine Number of Adjoining Units	Includes adjacent wood frame structures separated by 3m or less						1	-
3	Determine Height in Storeys	Does not include floors >50% below grade or open attic space						2	-
4	Determine Required Fire Flow	($F = 220 \times C \times A^{1/2}$). Round to nearest 1000 L/min						-	9000
5	Determine Occupancy Charge	Limited Combustible						-15%	7650
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	16	2	31-60	Wood Frame or Non-Combustible	18%	3749
		East	30.1 to 45	24	2	31-60	Wood Frame or Non-Combustible	5%	
		South	3.1 to 10	16	2	31-60	Wood Frame or Non-Combustible	18%	
		West	20.1 to 30	24	2	31-60	Wood Frame or Non-Combustible	8%	
8	Determine Final Required Fire Flow	Total Required Fire Flow in L/min, Rounded to Nearest 1000L/min							11000
		Total Required Fire Flow in L/s							183.3
		Required Duration of Fire Flow (hrs)							2.00
		Required Volume of Fire Flow (m^3)							1320

Stantec

FUS Fire Flow Calculation Sheet

Stantec Project #: 160401393
Project Name: Kanata West Richcraft
Date: 11/23/2020
Fire Flow Calculation #: 8
Description: Residential - Townhomes Units

Notes: Townhome unit with less than 10m seperation between the backs of adjacent units (Block 100)

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	-						372.0	-
	Determine Number of Adjoining Units	Includes adjacent wood frame structures separated by 3m or less						1	-
3	Determine Height in Storeys	Does not include floors >50% below grade or open attic space						2	-
4	Determine Required Fire Flow	($F = 220 \times C \times A^{1/2}$). Round to nearest 1000 L/min						-	9000
5	Determine Occupancy Charge	Limited Combustible						-15%	7650
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	16	2	31-60	Wood Frame or Non-Combustible	18%	3137
		East	3.1 to 10	26	2	31-60	Wood Frame or Non-Combustible	18%	
		South	> 45	16	2	31-60	Wood Frame or Non-Combustible	0%	
		West	30.1 to 45	26	2	31-60	Wood Frame or Non-Combustible	5%	
8	Determine Final Required Fire Flow	Total Required Fire Flow in L/min, Rounded to Nearest 1000L/min							11000
		Total Required Fire Flow in L/s							183.3
		Required Duration of Fire Flow (hrs)							2.00
		Required Volume of Fire Flow (m^3)							1320

Stantec

FUS Fire Flow Calculation Sheet

Stantec Project #: 160401393
Project Name: Kanata West Richcraft
Date: 11/23/2020
Fire Flow Calculation #: 9
Description: Residential - Townhomes Units

Notes: Townhome unit with less than 10m seperation between the backs of adjacent units (Block 101)

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	-						372.0	-
	Determine Number of Adjoining Units	Includes adjacent wood frame structures separated by 3m or less						1	-
3	Determine Height in Storeys	Does not include floors >50% below grade or open attic space						2	-
4	Determine Required Fire Flow	($F = 220 \times C \times A^{1/2}$). Round to nearest 1000 L/min						-	9000
5	Determine Occupancy Charge	Limited Combustible						-15%	7650
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	20.1 to 30	16	2	31-60	Wood Frame or Non-Combustible	8%	3749
		East	3.1 to 10	26	2	31-60	Wood Frame or Non-Combustible	18%	
		South	3.1 to 10	16	2	31-60	Wood Frame or Non-Combustible	18%	
		West	30.1 to 45	26	2	31-60	Wood Frame or Non-Combustible	5%	
8	Determine Final Required Fire Flow	Total Required Fire Flow in L/min, Rounded to Nearest 1000L/min							11000
		Total Required Fire Flow in L/s							183.3
		Required Duration of Fire Flow (hrs)							2.00
		Required Volume of Fire Flow (m^3)							1320

Stantec

FUS Fire Flow Calculation Sheet

Stantec Project #: 160401393
Project Name: Kanata West Richcraft
Date: 11/23/2020
Fire Flow Calculation #: 10
Description: Residential - Townhomes Units

Notes: Townhome unit with less than 10m seperation between the backs of adjacent units (Block 102)

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	-						372.0	-
	Determine Number of Adjoining Units	Includes adjacent wood frame structures separated by 3m or less						1	-
3	Determine Height in Storeys	Does not include floors >50% below grade or open attic space						2	-
4	Determine Required Fire Flow	($F = 220 \times C \times A^{1/2}$). Round to nearest 1000 L/min						-	9000
5	Determine Occupancy Charge	Limited Combustible						-15%	7650
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	20.1 to 30	26	2	31-60	Wood Frame or Non-Combustible	8%	4361
		East	3.1 to 10	16	2	31-60	Wood Frame or Non-Combustible	18%	
		South	10.1 to 20	26	2	31-60	Wood Frame or Non-Combustible	13%	
		West	3.1 to 10	16	2	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							12000
		Total Required Fire Flow in L/s							200.0
		Required Duration of Fire Flow (hrs)							2.50
		Required Volume of Fire Flow (m^3)							1800

Stantec

FUS Fire Flow Calculation Sheet

Stantec Project #: 160401393
Project Name: Kanata West Richcraft
Date: 11/23/2020
Fire Flow Calculation #: 11
Description: Residential - Townhomes Units

Notes: Townhome unit with less than 10m seperation between the backs of adjacent units (Block 113)

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	-						372.0	-
	Determine Number of Adjoining Units	Includes adjacent wood frame structures separated by 3m or less						1	-
3	Determine Height in Storeys	Does not include floors >50% below grade or open attic space						2	-
4	Determine Required Fire Flow	($F = 220 \times C \times A^{1/2}$). Round to nearest 1000 L/min						-	9000
5	Determine Occupancy Charge	Limited Combustible						-15%	7650
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	10.1 to 20	26	2	31-60	Wood Frame or Non-Combustible	13%	3749
		East	3.1 to 10	16	2	31-60	Wood Frame or Non-Combustible	18%	
		South	> 45	26	2	31-60	Wood Frame or Non-Combustible	0%	
		West	3.1 to 10	16	2	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							11000
		Total Required Fire Flow in L/s							183.3
		Required Duration of Fire Flow (hrs)							2.00
		Required Volume of Fire Flow (m^3)							1320

Stantec

FUS Fire Flow Calculation Sheet

Stantec Project #: 160401393
Project Name: Kanata West Richcraft
Date: 11/23/2020
Fire Flow Calculation #: 12
Description: Residential - Single Units

Notes: Unit 33 with less than 10m side to rearyard seperation

Step	Task							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	-						156.0	-
	Determine Number of Adjoining Units	Includes adjacent wood frame structures separated by 3m or less						1	-
3	Determine Height in Storeys	Does not include floors >50% below grade or open attic space						2	-
4	Determine Required Fire Flow	($F = 220 \times C \times A^{1/2}$). Round to nearest 1000 L/min						-	6000
5	Determine Occupancy Charge	Limited Combustible						-15%	5100
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	10.1 to 20	7	2	0-30	Wood Frame or Non-Combustible	12%	2856
		East	3.1 to 10	22	2	31-60	Wood Frame or Non-Combustible	18%	
		South	20.1 to 30	7	2	0-30	Wood Frame or Non-Combustible	8%	
		West	3.1 to 10	22	2	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							8000
		Total Required Fire Flow in L/s							133.3
		Required Duration of Fire Flow (hrs)							2.00
		Required Volume of Fire Flow (m^3)							960

Stantec

FUS Fire Flow Calculation Sheet

Stantec Project #: 160401393
Project Name: Kanata West Richcraft
Date: 11/23/2020
Fire Flow Calculation #: 13
Description: Residential - Single Units

Notes: Unit 34 with less than 10m side to rearyard seperation

Step	Task							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	-						174.0	-
	Determine Number of Adjoining Units	Includes adjacent wood frame structures separated by 3m or less						1	-
3	Determine Height in Storeys	Does not include floors >50% below grade or open attic space						2	-
4	Determine Required Fire Flow	($F = 220 \times C \times A^{1/2}$). Round to nearest 1000 L/min						-	6000
5	Determine Occupancy Charge	Limited Combustible						-15%	5100
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	22	2	31-60	Wood Frame or Non-Combustible	18%	2601
		East	3.1 to 10	7	2	0-30	Wood Frame or Non-Combustible	17%	
		South	20.1 to 30	22	2	31-60	Wood Frame or Non-Combustible	8%	
		West	20.1 to 30	7	2	0-30	Wood Frame or Non-Combustible	8%	
8	Determine Final Required Fire Flow	**Total Required Fire Flow in L/min, Rounded to Nearest 1000L/min**							**8000**
		Total Required Fire Flow in L/s							**133.3**
		Required Duration of Fire Flow (hrs)							**2.00**
		Required Volume of Fire Flow (m^3)							**960**

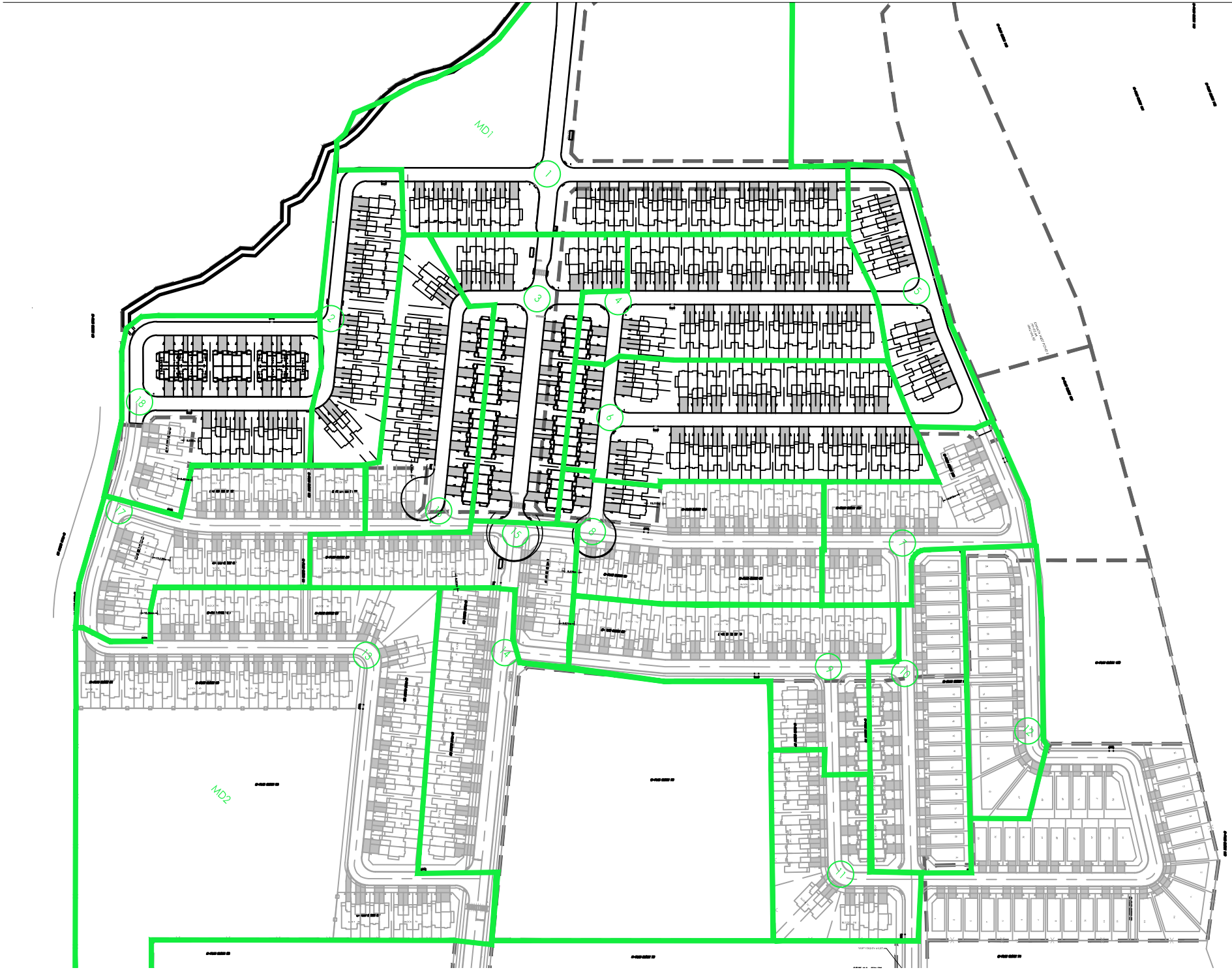
Stantec

FUS Fire Flow Calculation Sheet

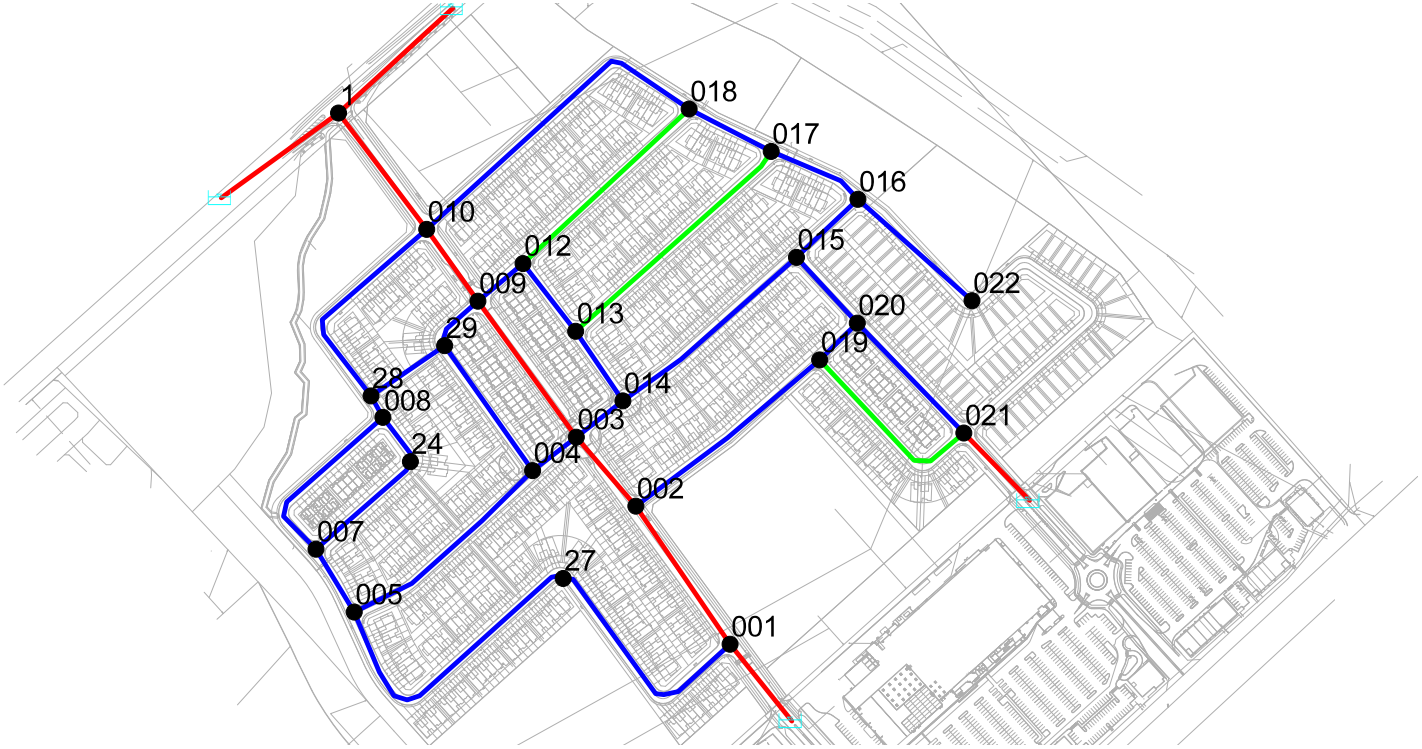
Stantec Project #: 160401393
Project Name: Kanata West Richcraft
Date: 11/23/2020
Fire Flow Calculation #: 14
Description: Residential - Single Units

Notes: Unit 35 & 36 with less than 10m side to rearyard seperation

Step	Task							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	-						156.0	-
	Determine Number of Adjoining Units	Includes adjacent wood frame structures separated by 3m or less						1	-
3	Determine Height in Storeys	Does not include floors >50% below grade or open attic space						2	-
4	Determine Required Fire Flow	($F = 220 \times C \times A^{1/2}$). Round to nearest 1000 L/min						-	6000
5	Determine Occupancy Charge	Limited Combustible						-15%	5100
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	22	2	31-60	Wood Frame or Non-Combustible	18%	3111
		East	3.1 to 10	7	2	0-30	Wood Frame or Non-Combustible	17%	
		South	3.1 to 10	22	2	31-60	Wood Frame or Non-Combustible	18%	
		West	20.1 to 30	7	2	0-30	Wood Frame or Non-Combustible	8%	
8	Determine Final Required Fire Flow	**Total Required Fire Flow in L/min, Rounded to Nearest 1000L/min**							**8000**
		Total Required Fire Flow in L/s							**133.3**
		Required Duration of Fire Flow (hrs)							**2.00**
		Required Volume of Fire Flow (m^3)							**960**


MD1
MD2
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18

PH4-2020-11-09



JUNCTION (MOTYPE)
- Active
- Domain

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

PIPE (VALUE)
- less than 202.33
- 202.33 ~ 249.66
- greater than 249.66

PUMP (MOTYPE)
- Active
- Domain

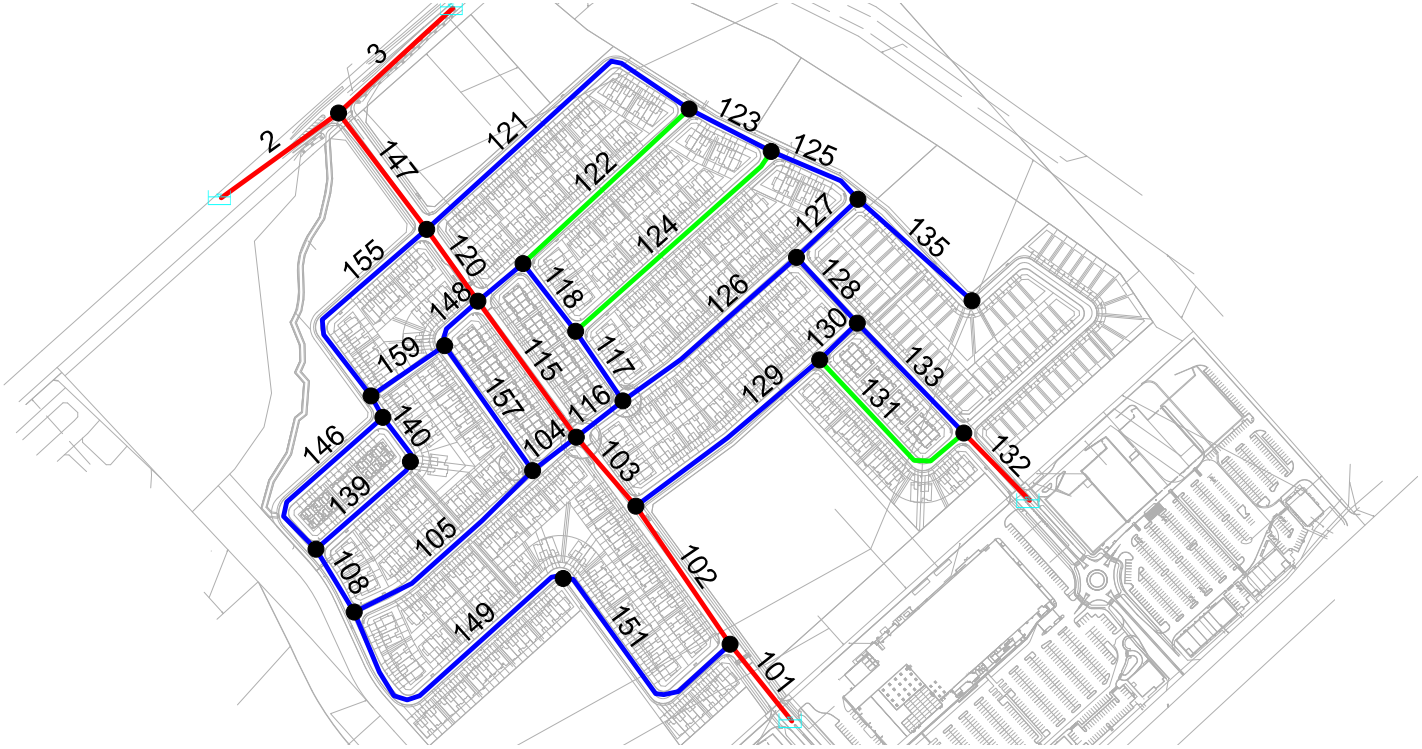
VALVE (MOTYPE)
- Active
- Domain

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Prepared By:

Date: 11/18/2020 2:31:53 PM

PH4-2020-11-09



JUNCTION (MOTYPE)
- Active
- Domain

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

PIPE (VALUE)
- less than 202.33
- 202.33 ~ 249.66
- greater than 249.66

PUMP (MOTYPE)
- Active
- Domain

VALVE (MOTYPE)
- Active
- Domain

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Prepared By:

Date: 11/18/2020 2:32:35 PM

A.3 ULTIMATE CONDITION HYDRAULIC ANALYSIS

1620 Maple Grove Road

Information Provided:

Date provided August, 20, 2018

Scenario	Demand	
	L/min	L/s
Average Daily Demand	641	10.7
Maximum Daily Demand	1515	25.25
Peak Hour	3282	54.7
Fire Flow Demand # 1	17000	283

# of connections	4

Connection Locations:



Figure 1 - Connection points

Results:

Connection 1 - Maple Grove Road and Silver Seven Road

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	162.1	92.7
Peak Hour	157.7	86.4
Max Day plus Fire (10,000 l/min)	154.7	82.7
Max Day plus Fire (17,000 l/min)	150.5	76.3

[1] Ground Elevation = 96.880 m

Connection 2 - Maple Grove Road and Rosehill Ave

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	161.0	88.8
Peak Hour	157.4	83.5
Max Day plus Fire (10,000 l/min)	153.9	75.3
Max Day plus Fire (17,000 l/min)	138.9	57.3

[1] Ground Elevation = 100.900 m

Connection 3 - Hazeldean Road and Kincardine Dr.

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	161.5	90.9
Peak Hour	157.9	85.8
Max Day plus Fire (10,000 l/min)	158.8	87.1
Max Day plus Fire (17,000 l/min)	157.9	85.8

[1] Ground Elevation = 97.490 m

Connection 4 - Hazeldean Road

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	161.4	90.9
Peak Hour	158.0	82.0
Max Day plus Fire (10,000 l/min)	158.7	83.5
Max Day plus Fire (17,000 l/min)	157.8	82.2

[1] Ground Elevation = 99.900 m

Notes:

1) As per the Ontario Building Code in areas that may be occupied, the static pressure at any fixture shall not exceed 552 kPa (80 psi.) Pressure control measures to be considered are as follows, in order of preference:
   a) If possible, systems to be designed to residual pressures of 345 to 552 kPa (50 to 80 psi) in all occupied areas outside of the public right-of-way without special pressure control equipment.
   b) Pressure reducing valves to be installed immediately downstream of the isolation valve in the home/ building, located downstream of the meter so it is owner maintained.
2) Watermain along Maple Grove Road is expected to be constructed.
3) Ownership of existing private roads off of Hazeldean road are expected to be turned over to the City of Ottawa and therefore ownership of watermains along those roads are in turn to be given to the City of Ottawa prior to 1620 Maple Grove watermain connections.

Disclaimer

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

Kanata West Richcraft - Domestic Water Demand Estimates
Ultimate

Densities as per City Guidelines:

LD	3.4	ppu		
MD	2.7	ppu	38	Units/ha
HD	1.8	ppu		

Building ID	Area (m^2)	Population	Daily Rate of Demand [1]	Avg Day Demand [2]		Max Day Demand [3]		Peak Hour Demand [3]	
				(L/min)	(L/s)	(L/min)	(L/s)	(L/min)	(L/s)
MD1	7,350	76	350	18.4	0.31	45.9	0.76	100.9	1.68
Commerical	14,700		28000	28.6	0.48	42.9	0.71	77.2	1.29
Residential 1		97	350	23.6	0.39	59.1	0.98	129.9	2.17
Total				**70.6**	**1.2**	**147.8**	**2.5**	**308.0**	**5.1**
Residential 2		59	350	14.4	0.24	36.1	0.60	79.4	1.32
Residential 3		127	350	30.8	0.51	77.1	1.29	169.6	2.83
Residential 4		127	350	30.8	0.51	77.1	1.29	169.6	2.83
Residential 5		41	350	9.8	0.16	24.6	0.41	54.1	0.90
Residential 6		167	350	40.7	0.68	101.7	1.70	223.8	3.73
Residential 7		65	350	15.8	0.26	39.4	0.66	86.6	1.44
Residential 8		119	350	28.9	0.48	72.2	1.20	158.8	2.65
Residential 9		116	350	28.2	0.47	70.5	1.18	155.2	2.59
Residential 10		111	350	27.0	0.45	67.6	1.13	148.7	2.48
Residential 11		76	350	18.4	0.31	45.9	0.77	101.1	1.68
Residential 12		177	350	43.0	0.72	107.4	1.79	236.3	3.94
Residential 13		211	350	51.2	0.85	128.0	2.13	281.5	4.69
MD2	27,400	686	350	166.7	2.78	416.7	6.95	916.8	15.28
Total				**217.9**	**3.6**	**544.7**	**9.1**	**1198.3**	**20.0**
Residential 14		70	350	17.1	0.28	42.7	0.71	93.8	1.56
School	30,250		28000	58.8	0.98	88.2	1.47	158.8	2.65
Total				**75.9**	**1.3**	**130.9**	**2.2**	**252.7**	**4.2**
Residential 15		68	350	16.4	0.27	41.0	0.68	90.2	1.50
Residential 16		105	350	25.6	0.43	64.0	1.07	140.8	2.35
Residential 17		100	350	24.3	0.40	60.7	1.01	133.5	2.23
Residential 18		119	350	28.9	0.48	72.2	1.20	158.8	2.65
Total Site :				**747.3**	**12.5**	**1781.0**	**29.7**	**3865.7**	**64.4**

1 Average day water demand for residential areas equal to 350 L/cap/d and 28,000 L/ha/d for the school block

2 City of Ottawa water demand criteria used to estimate peak demand rates for residential areas are as follows:
maximum day demand rate = 2.5 x average day demand rate for residential, 1.5 for Institutional
maximum hour demand rate = 2.2 x maximum day demand rate for residential, 1.8 for institutional

3 Unit counts for unmarked Medium Density Residential area 1 (MD1) are equal to 38 Units/ha

4 Unit counts for unmarked Medium Density Residential area 2 (MD2) are based on the Concept Site Plan for Richcraft prepared by M. David Blakely Architch Inc. on Febuary 2020

Ultimate Conditions
Hydraulic Model Results - Average Day Analysis

Junction Results

ID	Demand	Elevation	Head	Pressure	
	(L/s)	(m)	(m)	(psi)	(Kpa)
1	0.00	98.37	161.41	89.62	617.91
2	1.30	98.03	161.42	90.11	621.29
3	0.27	97.95	161.42	90.23	622.12
4	0.43	98.30	161.42	89.73	618.67
5	0.40	100.16	161.42	87.08	600.40
7	0.48	100.75	161.42	86.24	594.61
8	0.24	99.11	161.42	88.58	610.74
9	0.51	97.96	161.42	90.22	622.05
10	1.20	97.88	161.42	90.33	622.81
12	0.51	97.92	161.42	90.27	622.39
13	0.68	98.01	161.42	90.15	621.57
14	0.49	97.64	161.42	90.67	625.15
15	0.26	97.69	161.44	90.63	624.88
16	0.00	97.62	161.44	90.73	625.57
17	0.00	97.54	161.43	90.83	626.25
18	0.16	97.20	161.43	91.31	629.56
19	0.47	98.15	161.45	89.98	620.39
20	0.45	98.14	161.45	90.00	620.53
21	0.31	98.11	161.49	90.10	621.22
22	0.72	97.59	161.47	90.80	626.05
1	0.00	96.15	161.43	92.80	639.84
24	0.00	99.30	161.42	88.31	608.88
27	3.60	100.30	161.40	86.86	598.88
28	0.00	99.18	161.42	88.48	610.05
29	0.00	98.02	161.42	90.13	621.43

Pipe Results

ID	From Node	To Node	Length	Diameter	Roughness	Flow	Velocity
			(m)	(mm)		(L/s)	(m/s)
101	302	1	290.00	297	120	-5.25	0.08
102	1	2	149.15	297	120	-6.79	0.10
103	2	3	81.27	297	120	-4.29	0.06
104	3	4	49.14	204	110	0.81	0.02
105	4	5	204.86	204	110	1.17	0.04
108	5	7	65.67	204	110	-1.29	0.04
111	8	28	21.85	204	110	-2.01	0.06
115	3	9	149.76	297	120	-3.13	0.05
116	3	14	52.56	204	110	-2.24	0.07
117	14	13	75.08	204	110	0.31	0.01
118	13	12	76.47	204	110	0.52	0.02
119	12	9	52.38	204	110	0.78	0.02
120	9	10	78.67	297	120	-4.37	0.06
121	10	18	304.89	204	110	-1.21	0.04
122	12	18	202.33	155	100	-0.77	0.04
123	18	17	82.35	204	110	-2.14	0.07
124	13	17	237.37	155	100	-0.90	0.05
125	17	16	89.96	204	110	-3.04	0.09
126	14	15	201.16	204	110	-3.04	0.09
127	15	16	75.48	204	110	-0.07	0.00
128	15	20	79.81	204	110	-3.22	0.10
129	2	19	209.67	204	110	-3.81	0.12
130	19	20	46.99	204	110	-2.03	0.06
131	19	21	176.52	155	100	-2.25	0.12
132	303	21	290.00	297	120	12.09	0.17
133	21	20	136.68	204	110	5.70	0.17
134	21	22	156.78	204	110	3.83	0.12
135	22	16	274.25	204	110	3.11	0.10
139	7	24	115.59	204	110	-0.89	0.03
140	24	8	48.04	204	110	-0.89	0.03
146	8	7	168.69	204	110	0.88	0.03
147	1	10	134.80	297	120	5.64	0.08
148	9	29	53.89	204	110	1.51	0.05
149	5	27	277.63	204	110	2.05	0.06
151	27	1	217.87	204	110	-1.55	0.05
155	28	10	205.69	204	110	-1.28	0.04
157	29	4	136.30	204	110	0.78	0.02
159	28	29	79.48	204	110	-0.73	0.02
2	300	1	577.90	297	120	-28.01	0.40
3	301	1	645.00	297	120	33.65	0.49

Hydraulic Model Results -Peak Hour Analysis

Junction Results

ID	Demand	Elevation	Head	Pressure	
	(L/s)	(m)	(m)	(psi)	(Kpa)
1	0.00	98.37	157.68	84.31	581.30
2	4.20	98.03	157.61	84.69	583.92
3	1.50	97.95	157.57	84.75	584.33
4	2.35	98.30	157.54	84.21	580.61
5	2.23	100.16	157.49	81.50	561.93
7	2.65	100.75	157.5	80.67	556.20
8	1.32	99.11	157.51	83.02	572.41
9	2.83	97.96	157.54	84.70	583.99
10	5.10	97.88	157.54	84.81	584.75
12	2.83	97.92	157.55	84.76	584.40
13	3.73	98.01	157.55	84.64	583.58
14	2.71	97.64	157.56	85.19	587.37
15	1.44	97.69	157.62	85.19	587.37
16	0.00	97.62	157.62	85.29	588.06
17	0.00	97.54	157.58	85.36	588.54
18	0.90	97.20	157.56	85.81	591.64
19	2.59	98.15	157.65	84.59	583.23
20	2.48	98.14	157.66	84.61	583.37
21	1.68	98.11	157.83	84.90	585.37
22	3.94	97.59	157.71	85.46	589.23
1	0.00	96.15	157.54	87.27	601.71
24	0.00	99.30	157.51	82.75	570.54
27	20.00	100.30	157.38	81.14	559.44
28	0.00	99.18	157.52	82.94	571.85
29	0.00	98.02	157.54	84.61	583.37

Pipe Results

ID	From Node	To Node	Length	Diameter	Roughness	Flow	Velocity
			(m)	(mm)		(L/s)	(m/s)
101	302	1	290.00	297	120	35.01	0.51
102	1	2	149.15	297	120	21.76	0.31
103	2	3	81.27	297	120	22.63	0.33
104	3	4	49.14	204	110	8.22	0.25
105	4	5	204.86	204	110	5.27	0.16
108	5	7	65.67	204	110	-3.70	0.11
111	8	28	21.85	204	110	-7.67	0.23
115	3	9	149.76	297	120	11.25	0.16
116	3	14	52.56	204	110	1.66	0.05
117	14	13	75.08	204	110	4.49	0.14
118	13	12	76.47	204	110	2.47	0.08
119	12	9	52.38	204	110	1.02	0.03
120	9	10	78.67	297	120	5.51	0.08
121	10	18	304.89	204	110	-2.75	0.08
122	12	18	202.33	155	100	-1.38	0.07
123	18	17	82.35	204	110	-5.03	0.15
124	13	17	237.37	155	100	-1.71	0.09
125	17	16	89.96	204	110	-6.73	0.21
126	14	15	201.16	204	110	-5.54	0.17
127	15	16	75.48	204	110	0.67	0.02
128	15	20	79.81	204	110	-7.65	0.23
129	2	19	209.67	204	110	-5.07	0.16
130	19	20	46.99	204	110	-2.69	0.08
131	19	21	176.52	155	100	-4.98	0.26
132	303	21	290.00	297	120	29.48	0.43
133	21	20	136.68	204	110	12.82	0.39
134	21	22	156.78	204	110	10.00	0.31
135	22	16	274.25	204	110	6.06	0.19
139	7	24	115.59	204	110	-3.20	0.10
140	24	8	48.04	204	110	-3.20	0.10
146	8	7	168.69	204	110	3.15	0.10
147	1	10	134.80	297	120	-0.01	0.00
148	9	29	53.89	204	110	3.92	0.12
149	5	27	277.63	204	110	6.75	0.21
151	27	1	217.87	204	110	-13.25	0.41
155	28	10	205.69	204	110	-3.15	0.10
157	29	4	136.30	204	110	-0.60	0.02
159	28	29	79.48	204	110	-4.52	0.14
2	300	1	577.90	297	120	-15.42	0.22
3	301	1	645.00	297	120	15.41	0.22

Hydraulic Model Results -Fire Flow Analysis (267 L/s)

ID	Static Demand	Static Pressure		Static Head	Fire-Flow Demand	Residual Pressure		Available Flow at Hydrant	Available Flow Pressure	
	(L/s)	(psi)	(Kpa)	(m)	(L/s)	(psi)	(Kpa)	(L/s)	(psi)	(Kpa)
1	0.00	81.69	563.24	155.83	267	71.44	492.56	951.34	20	137.90
2	2.20	81.29	560.48	155.21	267	70.69	487.39	959.30	20	137.90
3	0.68	80.63	555.93	154.67	267	70.00	482.64	980.18	20	137.90
4	1.07	79.84	550.48	154.46	267	62.22	428.99	607.31	20	137.90
5	1.01	77.14	531.86	154.42	267	50.39	347.43	427.41	20	137.90
7	1.20	76.05	524.35	154.24	267	48.32	333.16	412.50	20	137.90
8	0.60	78.22	539.31	154.14	267	54.34	374.66	466.53	20	137.90
9	1.29	79.72	549.65	154.04	267	68.86	474.78	967.33	20	137.90
10	2.50	78.82	543.45	153.32	267	68.04	469.12	985.72	20	137.90
12	1.29	80.09	552.20	154.26	267	61.50	424.03	581.10	20	137.90
13	1.70	80.32	553.79	154.51	267	59.22	408.31	523.82	20	137.90
14	1.23	81.09	559.10	154.68	267	64.82	446.92	648.24	20	137.90
15	0.66	82.17	566.55	155.49	267	65.15	449.20	602.60	20	137.90
16	0.00	82.23	566.96	155.46	267	62.33	429.75	535.55	20	137.90
17	0.00	81.43	561.44	154.82	267	55.94	385.70	454.28	20	137.90
18	0.41	81.32	560.69	154.4	267	52.39	361.22	418.91	20	137.90
19	1.18	82.25	567.10	156.01	267	63.56	438.23	557.57	20	137.90
20	1.13	82.30	567.44	156.03	267	67.73	466.98	656.17	20	137.90
21	0.77	84.48	582.47	157.53	267	78.43	540.76	1,273.74	20	137.90
22	1.79	84.06	579.58	156.72	267	48.78	336.33	376.90	20	137.90
1	0.00	78.07	538.28	151.07	267	67.96	468.57	1,040.95	20	137.90
24	0.00	78.00	537.79	154.17	267	45.49	313.64	378.71	20	137.90
27	9.10	77.64	535.31	154.92	267	29.78	205.33	307.04	20	137.90
28	0.00	78.06	538.21	154.09	267	57.57	396.93	520.97	20	137.90
29	0.00	79.74	549.79	154.11	267	63.10	435.06	633.50	20	137.90

Stantec

FUS Fire Flow Calculation Sheet

Stantec Project #: 160401393
Project Name: Kanata West Richcraft
Date: 11/23/2020
Fire Flow Calculation #: 2
Description: Residential Back-to-Back Units

Notes: Worst case back-to-back units - max. ground floor area of 600m2. (Block 121)

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	-						55.6	-
	Determine Number of Adjoining Units	Includes adjacent wood frame structures separated by 3m or less						8	-
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	3.1 to 10	19	3	31-60	Wood Frame or Non-Combustible	18%	5508
		East	20.1 to 30	25	3	61-90	Wood Frame or Non-Combustible	9%	
		South	3.1 to 10	19	3	31-60	Wood Frame or Non-Combustible	18%	
		West	20.1 to 30	25	3	61-90	Wood Frame or Non-Combustible	9%	
8	Determine Final Required Fire Flow	Total Required Fire Flow in L/min, Rounded to Nearest 1000L/min							16000
		Total Required Fire Flow in L/s							266.7
		Required Duration of Fire Flow (hrs)							3.50
		Required Volume of Fire Flow (m^3)							3360

Stantec

FUS Fire Flow Calculation Sheet

Stantec Project #: 160401393
Project Name: Kanata West Richcraft
Date: 11/23/2020
Fire Flow Calculation #: 2
Description: Residential - Townhomes Units

Notes: Townhome unit with less than 10m seperation between the backs of adjacent units (Block 53)

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	-						492.0	-
	Determine Number of Adjoining Units	Includes adjacent wood frame structures separated by 3m or less						1	-
3	Determine Height in Storeys	Does not include floors >50% below grade or open attic space						2	-
4	Determine Required Fire Flow	($F = 220 \times C \times A^{1/2}$). Round to nearest 1000 L/min						-	10000
5	Determine Occupancy Charge	Limited Combustible						-15%	8500
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	30	2	31-60	Wood Frame or Non-Combustible	18%	4420
		East	20.1 to 30	16	2	31-60	Wood Frame or Non-Combustible	8%	
		South	20.1 to 30	30	2	31-60	Wood Frame or Non-Combustible	8%	
		West	3.1 to 10	16	2	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							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 #: 160401393
Project Name: Kanata West Richcraft
Date: 11/23/2020
Fire Flow Calculation #: 3
Description: Residential - Townhomes Units

Notes: Townhome unit with less than 10m seperation between the backs of adjacent units (Block 56)

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	-						563.0	-
	Determine Number of Adjoining Units	Includes adjacent wood frame structures separated by 3m or less						1	-
3	Determine Height in Storeys	Does not include floors >50% below grade or open attic space						2	-
4	Determine Required Fire Flow	($F = 220 \times C \times A^{1/2}$). Round to nearest 1000 L/min						-	11000
5	Determine Occupancy Charge	Limited Combustible						-15%	9350
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	10.1 to 20	37	2	61-90	Wood Frame or Non-Combustible	14%	5984
		East	3.1 to 10	16	2	31-60	Wood Frame or Non-Combustible	18%	
		South	10.1 to 20	37	2	61-90	Wood Frame or Non-Combustible	14%	
		West	3.1 to 10	16	2	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							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 #: 160401393
Project Name: Kanata West Richcraft
Date: 11/23/2020
Fire Flow Calculation #: 4
Description: Residential - Townhomes Units

Notes: Townhome unit with less than 10m seperation between the backs of adjacent units (Block 69)

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	-						297.0	-
	Determine Number of Adjoining Units	Includes adjacent wood frame structures separated by 3m or less						1	-
3	Determine Height in Storeys	Does not include floors >50% below grade or open attic space						2	-
4	Determine Required Fire Flow	($F = 220 \times C \times A^{1/2}$). Round to nearest 1000 L/min						-	8000
5	Determine Occupancy Charge	Limited Combustible						-15%	6800
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	20.1 to 30	16	2	31-60	Wood Frame or Non-Combustible	8%	2992
		East	3.1 to 10	20	2	31-60	Wood Frame or Non-Combustible	18%	
		South	3.1 to 10	16	2	31-60	Wood Frame or Non-Combustible	18%	
		West	> 45	20	2	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							10000
		Total Required Fire Flow in L/s							166.7
		Required Duration of Fire Flow (hrs)							2.00
		Required Volume of Fire Flow (m^3)							1200

Stantec

FUS Fire Flow Calculation Sheet

Stantec Project #: 160401393
Project Name: Kanata West Richcraft
Date: 11/23/2020
Fire Flow Calculation #: 5
Description: Residential - Townhomes Units

Notes: Townhome unit with less than 10m seperation between the backs of adjacent units (Block 70)

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	-						297.0	-
	Determine Number of Adjoining Units	Includes adjacent wood frame structures separated by 3m or less						1	-
3	Determine Height in Storeys	Does not include floors >50% below grade or open attic space						2	-
4	Determine Required Fire Flow	($F = 220 \times C \times A^{1/2}$). Round to nearest 1000 L/min						-	8000
5	Determine Occupancy Charge	Limited Combustible						-15%	6800
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	16	2	31-60	Wood Frame or Non-Combustible	18%	2992
		East	3.1 to 10	20	2	31-60	Wood Frame or Non-Combustible	18%	
		South	20.1 to 30	16	2	31-60	Wood Frame or Non-Combustible	8%	
		West	> 45	20	2	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							10000
		Total Required Fire Flow in L/s							166.7
		Required Duration of Fire Flow (hrs)							2.00
		Required Volume of Fire Flow (m^3)							1200

Stantec

FUS Fire Flow Calculation Sheet

Stantec Project #: 160401393
Project Name: Kanata West Richcraft
Date: 11/23/2020
Fire Flow Calculation #: 6
Description: Residential - Townhomes Units

Notes: Townhome unit with less than 10m seperation between the backs of adjacent units (Block 77)

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	-						586.0	-
	Determine Number of Adjoining Units	Includes adjacent wood frame structures separated by 3m or less						1	-
3	Determine Height in Storeys	Does not include floors >50% below grade or open attic space						2	-
4	Determine Required Fire Flow	($F = 220 \times C \times A^{1/2}$). Round to nearest 1000 L/min						-	11000
5	Determine Occupancy Charge	Limited Combustible						-15%	9350
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	20.1 to 30	36	2	61-90	Wood Frame or Non-Combustible	9%	4769
		East	30.1 to 45	16	2	31-60	Wood Frame or Non-Combustible	5%	
		South	3.1 to 10	36	2	61-90	Wood Frame or Non-Combustible	19%	
		West	3.1 to 10	16	2	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 #: 160401393
Project Name: Kanata West Richcraft
Date: 11/23/2020
Fire Flow Calculation #: 7
Description: Residential - Townhomes Units

Notes: Townhome unit with less than 10m seperation between the backs of adjacent units (Block 78)

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	-						372.0	-
	Determine Number of Adjoining Units	Includes adjacent wood frame structures separated by 3m or less						1	-
3	Determine Height in Storeys	Does not include floors >50% below grade or open attic space						2	-
4	Determine Required Fire Flow	($F = 220 \times C \times A^{1/2}$). Round to nearest 1000 L/min						-	9000
5	Determine Occupancy Charge	Limited Combustible						-15%	7650
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	16	2	31-60	Wood Frame or Non-Combustible	18%	3749
		East	30.1 to 45	24	2	31-60	Wood Frame or Non-Combustible	5%	
		South	3.1 to 10	16	2	31-60	Wood Frame or Non-Combustible	18%	
		West	20.1 to 30	24	2	31-60	Wood Frame or Non-Combustible	8%	
8	Determine Final Required Fire Flow	Total Required Fire Flow in L/min, Rounded to Nearest 1000L/min							11000
		Total Required Fire Flow in L/s							183.3
		Required Duration of Fire Flow (hrs)							2.00
		Required Volume of Fire Flow (m^3)							1320

Stantec

FUS Fire Flow Calculation Sheet

Stantec Project #: 160401393
Project Name: Kanata West Richcraft
Date: 11/23/2020
Fire Flow Calculation #: 8
Description: Residential - Townhomes Units

Notes: Townhome unit with less than 10m seperation between the backs of adjacent units (Block 100)

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	-						372.0	-
	Determine Number of Adjoining Units	Includes adjacent wood frame structures separated by 3m or less						1	-
3	Determine Height in Storeys	Does not include floors >50% below grade or open attic space						2	-
4	Determine Required Fire Flow	($F = 220 \times C \times A^{1/2}$). Round to nearest 1000 L/min						-	9000
5	Determine Occupancy Charge	Limited Combustible						-15%	7650
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	16	2	31-60	Wood Frame or Non-Combustible	18%	3137
		East	3.1 to 10	26	2	31-60	Wood Frame or Non-Combustible	18%	
		South	> 45	16	2	31-60	Wood Frame or Non-Combustible	0%	
		West	30.1 to 45	26	2	31-60	Wood Frame or Non-Combustible	5%	
8	Determine Final Required Fire Flow	Total Required Fire Flow in L/min, Rounded to Nearest 1000L/min							11000
		Total Required Fire Flow in L/s							183.3
		Required Duration of Fire Flow (hrs)							2.00
		Required Volume of Fire Flow (m^3)							1320

Stantec

FUS Fire Flow Calculation Sheet

Stantec Project #: 160401393
Project Name: Kanata West Richcraft
Date: 11/23/2020
Fire Flow Calculation #: 9
Description: Residential - Townhomes Units

Notes: Townhome unit with less than 10m seperation between the backs of adjacent units (Block 101)

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	-						372.0	-
	Determine Number of Adjoining Units	Includes adjacent wood frame structures separated by 3m or less						1	-
3	Determine Height in Storeys	Does not include floors >50% below grade or open attic space						2	-
4	Determine Required Fire Flow	($F = 220 \times C \times A^{1/2}$). Round to nearest 1000 L/min						-	9000
5	Determine Occupancy Charge	Limited Combustible						-15%	7650
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	20.1 to 30	16	2	31-60	Wood Frame or Non-Combustible	8%	3749
		East	3.1 to 10	26	2	31-60	Wood Frame or Non-Combustible	18%	
		South	3.1 to 10	16	2	31-60	Wood Frame or Non-Combustible	18%	
		West	30.1 to 45	26	2	31-60	Wood Frame or Non-Combustible	5%	
8	Determine Final Required Fire Flow	Total Required Fire Flow in L/min, Rounded to Nearest 1000L/min							11000
		Total Required Fire Flow in L/s							183.3
		Required Duration of Fire Flow (hrs)							2.00
		Required Volume of Fire Flow (m^3)							1320

Stantec

FUS Fire Flow Calculation Sheet

Stantec Project #: 160401393
Project Name: Kanata West Richcraft
Date: 11/23/2020
Fire Flow Calculation #: 10
Description: Residential - Townhomes Units

Notes: Townhome unit with less than 10m seperation between the backs of adjacent units (Block 102)

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	-						372.0	-
	Determine Number of Adjoining Units	Includes adjacent wood frame structures separated by 3m or less						1	-
3	Determine Height in Storeys	Does not include floors >50% below grade or open attic space						2	-
4	Determine Required Fire Flow	($F = 220 \times C \times A^{1/2}$). Round to nearest 1000 L/min						-	9000
5	Determine Occupancy Charge	Limited Combustible						-15%	7650
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	20.1 to 30	26	2	31-60	Wood Frame or Non-Combustible	8%	4361
		East	3.1 to 10	16	2	31-60	Wood Frame or Non-Combustible	18%	
		South	10.1 to 20	26	2	31-60	Wood Frame or Non-Combustible	13%	
		West	3.1 to 10	16	2	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							12000
		Total Required Fire Flow in L/s							200.0
		Required Duration of Fire Flow (hrs)							2.50
		Required Volume of Fire Flow (m^3)							1800

Stantec

FUS Fire Flow Calculation Sheet

Stantec Project #: 160401393
Project Name: Kanata West Richcraft
Date: 11/23/2020
Fire Flow Calculation #: 11
Description: Residential - Townhomes Units

Notes: Townhome unit with less than 10m seperation between the backs of adjacent units (Block 113)

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	-						372.0	-
	Determine Number of Adjoining Units	Includes adjacent wood frame structures separated by 3m or less						1	-
3	Determine Height in Storeys	Does not include floors >50% below grade or open attic space						2	-
4	Determine Required Fire Flow	($F = 220 \times C \times A^{1/2}$). Round to nearest 1000 L/min						-	9000
5	Determine Occupancy Charge	Limited Combustible						-15%	7650
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	10.1 to 20	26	2	31-60	Wood Frame or Non-Combustible	13%	3749
		East	3.1 to 10	16	2	31-60	Wood Frame or Non-Combustible	18%	
		South	> 45	26	2	31-60	Wood Frame or Non-Combustible	0%	
		West	3.1 to 10	16	2	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							11000
		Total Required Fire Flow in L/s							183.3
		Required Duration of Fire Flow (hrs)							2.00
		Required Volume of Fire Flow (m^3)							1320

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FUS Fire Flow Calculation Sheet

Stantec Project #: 160401393
Project Name: Kanata West Richcraft
Date: 11/23/2020
Fire Flow Calculation #: 12
Description: Residential - Single Units

Notes: Unit 33 with less than 10m side to rearyard seperation

Step	Task							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	-						156.0	-
	Determine Number of Adjoining Units	Includes adjacent wood frame structures separated by 3m or less						1	-
3	Determine Height in Storeys	Does not include floors >50% below grade or open attic space						2	-
4	Determine Required Fire Flow	($F = 220 \times C \times A^{1/2}$). Round to nearest 1000 L/min						-	6000
5	Determine Occupancy Charge	Limited Combustible						-15%	5100
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	10.1 to 20	7	2	0-30	Wood Frame or Non-Combustible	12%	2856
		East	3.1 to 10	22	2	31-60	Wood Frame or Non-Combustible	18%	
		South	20.1 to 30	7	2	0-30	Wood Frame or Non-Combustible	8%	
		West	3.1 to 10	22	2	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							8000
		Total Required Fire Flow in L/s							133.3
		Required Duration of Fire Flow (hrs)							2.00
		Required Volume of Fire Flow (m^3)							960

Stantec

FUS Fire Flow Calculation Sheet

Stantec Project #: 160401393
Project Name: Kanata West Richcraft
Date: 11/23/2020
Fire Flow Calculation #: 13
Description: Residential - Single Units

Notes: Unit 34 with less than 10m side to rearyard seperation

Step	Task							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	-						174.0	-
	Determine Number of Adjoining Units	Includes adjacent wood frame structures separated by 3m or less						1	-
3	Determine Height in Storeys	Does not include floors >50% below grade or open attic space						2	-
4	Determine Required Fire Flow	($F = 220 \times C \times A^{1/2}$). Round to nearest 1000 L/min						-	6000
5	Determine Occupancy Charge	Limited Combustible						-15%	5100
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	22	2	31-60	Wood Frame or Non-Combustible	18%	2601
		East	3.1 to 10	7	2	0-30	Wood Frame or Non-Combustible	17%	
		South	20.1 to 30	22	2	31-60	Wood Frame or Non-Combustible	8%	
		West	20.1 to 30	7	2	0-30	Wood Frame or Non-Combustible	8%	
8	Determine Final Required Fire Flow	**Total Required Fire Flow in L/min, Rounded to Nearest 1000L/min**							**8000**
		Total Required Fire Flow in L/s							**133.3**
		Required Duration of Fire Flow (hrs)							**2.00**
		Required Volume of Fire Flow (m^3)							**960**

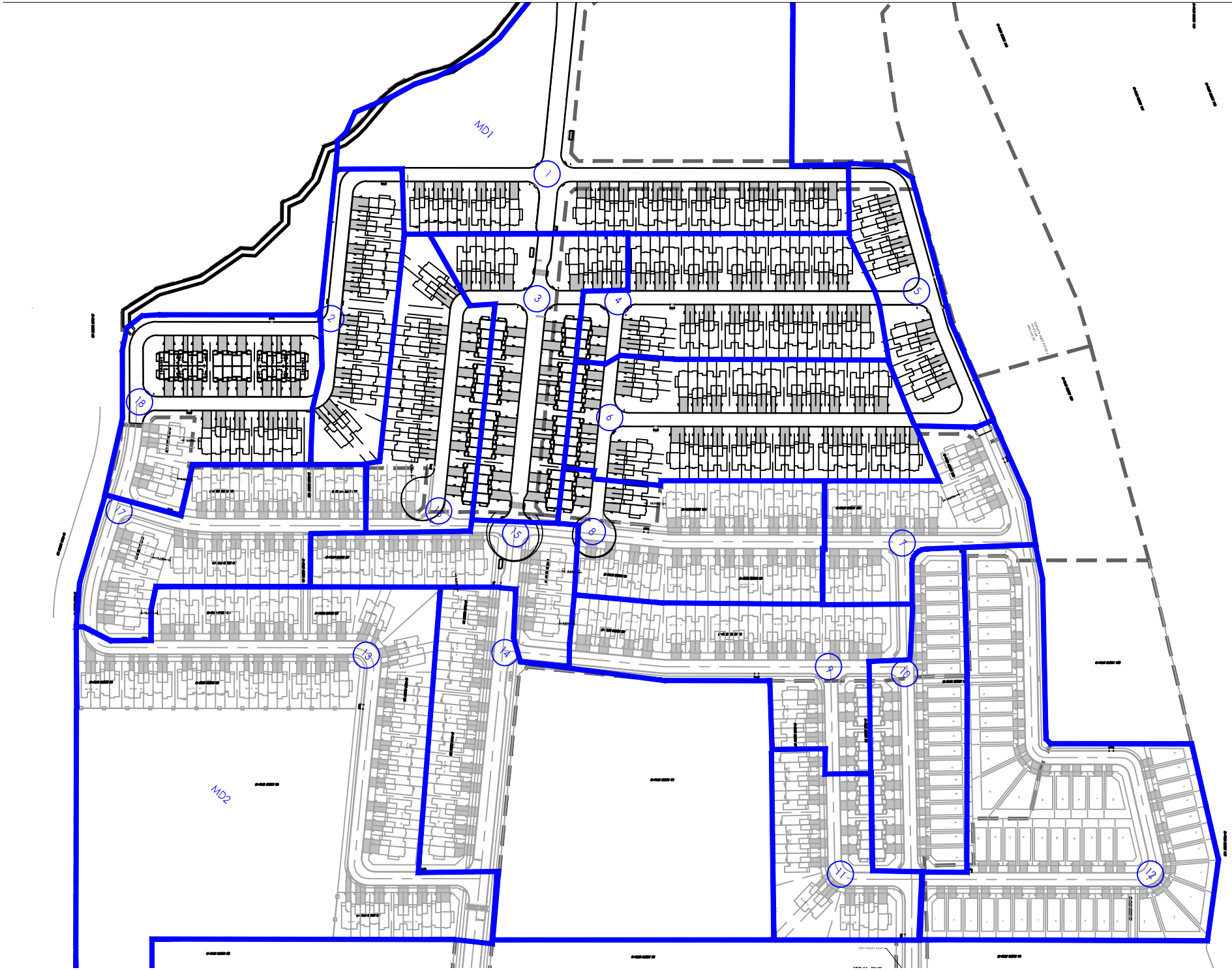
Stantec

FUS Fire Flow Calculation Sheet

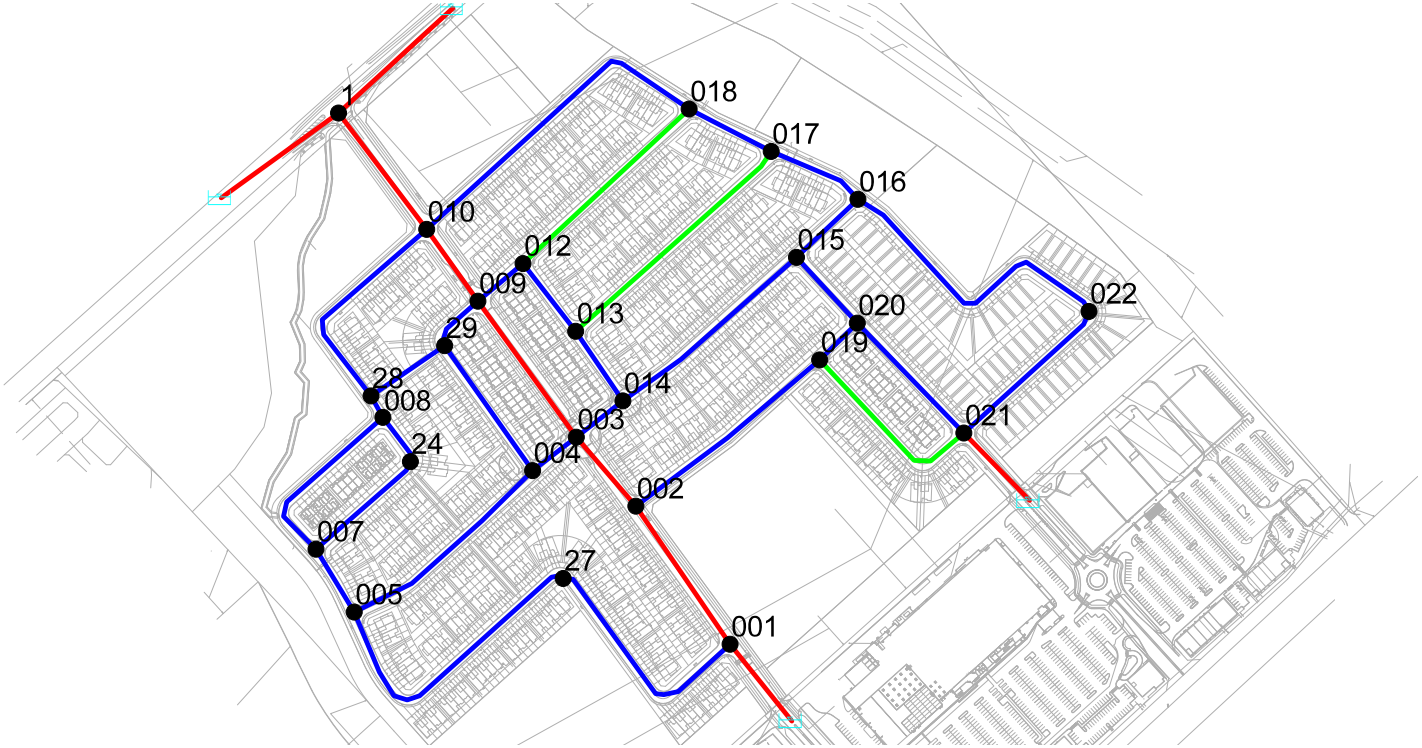
Stantec Project #: 160401393
Project Name: Kanata West Richcraft
Date: 11/23/2020
Fire Flow Calculation #: 14
Description: Residential - Single Units

Notes: Unit 35 & 36 with less than 10m side to rearyard seperation

Step	Task							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	-						156.0	-
	Determine Number of Adjoining Units	Includes adjacent wood frame structures separated by 3m or less						1	-
3	Determine Height in Storeys	Does not include floors >50% below grade or open attic space						2	-
4	Determine Required Fire Flow	($F = 220 \times C \times A^{1/2}$). Round to nearest 1000 L/min						-	6000
5	Determine Occupancy Charge	Limited Combustible						-15%	5100
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	22	2	31-60	Wood Frame or Non-Combustible	18%	3111
		East	3.1 to 10	7	2	0-30	Wood Frame or Non-Combustible	17%	
		South	3.1 to 10	22	2	31-60	Wood Frame or Non-Combustible	18%	
		West	20.1 to 30	7	2	0-30	Wood Frame or Non-Combustible	8%	
8	Determine Final Required Fire Flow	**Total Required Fire Flow in L/min, Rounded to Nearest 1000L/min**							**8000**
		Total Required Fire Flow in L/s							**133.3**
		Required Duration of Fire Flow (hrs)							**2.00**
		Required Volume of Fire Flow (m^3)							**960**


MD1
MD2
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18

Ultimate-2nd Registration-2020-11-09



ANNO25

JUNCTION (MOTYPE)
- Active
- Domain

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

PIPE (VALUE)
- less than 202.33
- 202.33 ~ 249.66
- greater than 249.66

PUMP (MOTYPE)
- Active
- Domain

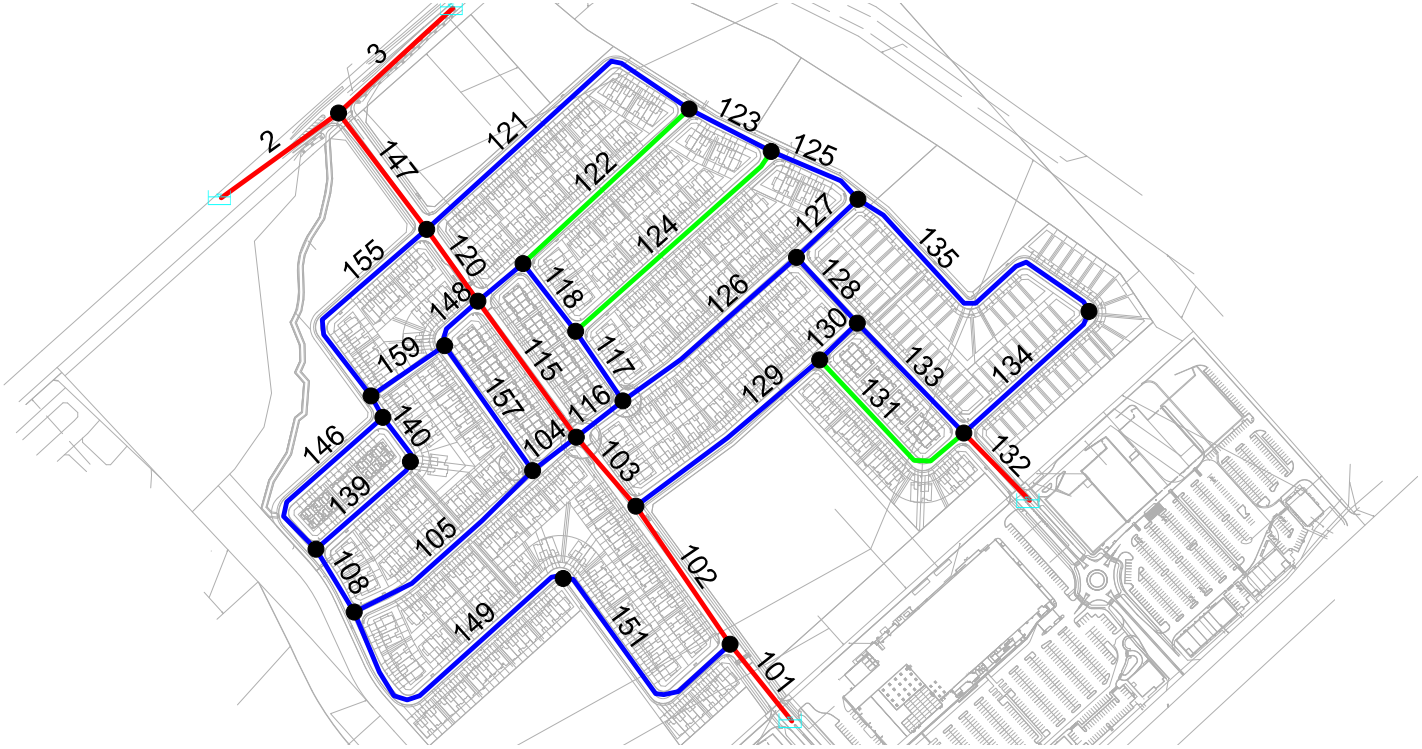
VALVE (MOTYPE)
- Active
- Domain

ACAD-160401393-DP.dxf

Prepared By:

Date: 11/18/2020 3:00:29 PM

Ultimate-2nd Registration-2020-11-09



JUNCTION (MOTYPE)
- Active
- Domain

ANNO25

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

PIPE (VALUE)
- less than 202.33
- 202.33 ~ 249.66
- greater than 249.66

PUMP (MOTYPE)
- Active
- Domain

VALVE (MOTYPE)
- Active
- Domain

ACAD-160401393-DP.dxf

Prepared By:

Date: 11/18/2020 3:00:58 PM

Appendix B STORMWATER MANAGEMENT CALCULATIONS

B.1 Storm Sewer Design Sheet

B.2 Runoff Coefficient Sample Calculations

B.3 PCSWMM Model Input

B.4 PCSWMM – 100-Year HGL Profiles

B.5 Sediment Accumulation HGL Parameters

B.6 Infiltration Calculations

B.7 Hazeldean Creek Crossings' Calculations

Appendix B Stormwater Management Calculations
May 10, 2022

B.1 STORM SEWER DESIGN SHEET

Stantec

Second Registration Phase - Richcraft Kanata West

DATE: 2022-02-10
REVISION: 2
DESIGNED BY: WAJ
CHECKED BY: AMP

STORM SEWER DESIGN SHEET
(City of Ottawa)

FILE NUMBER: 160401393

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																					PIPE SELECTION										
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)	T of C (min)	$I_{2\text{-YEAR}}$ (mm/h)	$I_{5\text{-YEAR}}$ (mm/h)	$I_{10\text{-YEAR}}$ (mm/h)	$I_{100\text{-YEAR}}$ (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)
Pond Outlet Pipe (Sized for 100-year Ultimate Pond Outflows)	100	HW6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	10.00	76.81	104.19	122.14	178.56	3829.7	3829.7	3829.7	7.8	1800	1500	RECTANGULAR	CONCRETE	-	0.50	8093.2	**47.3%**	3.0	2.51	0.05
																				10.05									1800	1500									
L116A (Ploughshare Road, L)	116	115	0.22	0.00	0.00	0.00	0.00	0.69	0.00	0.00	0.00	0.154	0.154	0.000	0.000	0.000	0.000	0.000	0.000	10.00	76.81	104.19	122.14	178.56	0.0	0.0	32.8	65.7	300	300	CIRCULAR	PVC	-	0.50	68.0	**48.2%**	1.0	0.82	1.34
																				11.34																			
Approved First Registration Phase Storm Sewers - Tributary to Interim Kanata West Pond 5																																							
L118A (Wheel Barrow Mews, L)	*118*	*117*	*0.44*	*0.00*	*0.00*	*0.00*	*0.00*	*0.66*	*0.00*	*0.00*	*0.00*	*0.293*	*0.293*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*10.00*	*76.81*	*104.19*	*122.14*	*178.56*	*0.0*	*0.0*	*62.4*	*96.8*	*375*	*375*	*CIRCULAR*	*PVC*	*-*	*0.25*	*82.4*	***75.8%***	*0.8*	*0.76*	*2.13*
L117A, L117B, L117C (Wheel Barrow Mews, L)	*117*	*115A*	*1.23*	*0.00*	*0.00*	*0.00*	*0.00*	*0.56*	*0.00*	*0.00*	*0.00*	*0.691*	*0.983*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*12.13*	*69.49*	*94.14*	*110.30*	*161.17*	*0.0*	*0.0*	*189.8*	*94.9*	*675*	*675*	*CIRCULAR*	*CONCRETE*	*-*	*0.20*	*392.2*	***48.4%***	*1.1*	*0.90*	*1.76*
(Wheel Barrow Mews, L)	*115A*	*115*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.000*	*0.983*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*13.89*	*64.51*	*87.32*	*102.28*	*149.39*	*0.0*	*0.0*	*176.2*	*11.0*	*675*	*675*	*CIRCULAR*	*CONCRETE*	*-*	*0.20*	*392.2*	***44.9%***	*1.1*	*0.88*	*0.21*
																				14.10																			
L115A (Ploughshare Road, L)	*115*	*114*	*0.17*	*0.00*	*0.00*	*0.00*	*0.00*	*0.68*	*0.00*	*0.00*	*0.00*	*0.112*	*1.249*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*14.10*	*63.98*	*86.58*	*101.41*	*148.12*	*0.0*	*0.0*	*222.0*	*54.7*	*675*	*675*	*CIRCULAR*	*CONCRETE*	*-*	*0.20*	*392.2*	***56.6%***	*1.1*	*0.94*	*0.97*
L114A (Ploughshare Road, L)	*114*	*102*	*0.06*	*0.00*	*0.00*	*0.00*	*0.00*	*0.68*	*0.00*	*0.00*	*0.00*	*0.039*	*1.288*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*15.07*	*61.61*	*83.34*	*97.59*	*142.51*	*0.0*	*0.0*	*220.5*	*28.2*	*750*	*750*	*CIRCULAR*	*CONCRETE*	*-*	*0.20*	*519.4*	***42.4%***	*1.1*	*0.93*	*0.51*
																				15.58																			
C107A (Hampshire Place, L)	*107*	*104*	*0.00*	*0.19*	*0.00*	*0.00*	*0.00*	*0.00*	*0.69*	*0.00*	*0.00*	*0.000*	*0.000*	*0.128*	*0.128*	*0.000*	*0.000*	*0.000*	*0.000*	*10.00*	*76.81*	*104.19*	*122.14*	*178.56*	*0.0*	*0.0*	*37.0*	*51.7*	*300*	*300*	*CIRCULAR*	*PVC*	*-*	*0.40*	*60.8*	***60.9%***	*0.9*	*0.78*	*1.10*
																				11.10																			
L106A, L106B (Corn Husk Lane, L)	*106*	*105*	*0.32*	*0.00*	*0.00*	*0.00*	*0.00*	*0.72*	*0.00*	*0.00*	*0.00*	*0.229*	*0.229*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*10.00*	*76.81*	*104.19*	*122.14*	*178.56*	*0.0*	*0.0*	*48.8*	*63.5*	*450*	*450*	*CIRCULAR*	*CONCRETE*	*-*	*0.20*	*133.0*	***36.7%***	*0.8*	*0.63*	*1.68*
L105A (Corn Husk Lane, L)	*105*	*104*	*0.32*	*0.00*	*0.00*	*0.00*	*0.00*	*0.72*	*0.00*	*0.00*	*0.00*	*0.233*	*0.462*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*11.68*	*70.91*	*96.09*	*112.60*	*164.54*	*0.0*	*0.0*	*90.9*	*79.4*	*525*	*525*	*CIRCULAR*	*CONCRETE*	*-*	*0.20*	*200.6*	***45.3%***	*0.9*	*0.75*	*1.77*
																				13.45																			
L104A (Hampshire Place, L)	*104*	*103*	*0.33*	*0.00*	*0.00*	*0.00*	*0.00*	*0.68*	*0.00*	*0.00*	*0.00*	*0.227*	*0.689*	*0.000*	*0.128*	*0.000*	*0.000*	*0.000*	*0.000*	*13.45*	*65.68*	*88.91*	*104.15*	*152.14*	*0.0*	*0.0*	*157.2*	*99.8*	*825*	*825*	*CIRCULAR*	*CONCRETE*	*-*	*0.15*	*580.0*	***27.1%***	*1.1*	*0.75*	*2.23*
L103C, L103A, L103B, L103D (Hampshire Place, L)	*103*	*102A*	*1.78*	*0.00*	*0.00*	*0.00*	*0.00*	*0.54*	*0.00*	*0.00*	*0.00*	*0.958*	*1.647*	*0.000*	*0.128*	*0.000*	*0.000*	*0.000*	*0.000*	*15.68*	*60.21*	*81.42*	*95.34*	*139.21*	*0.0*	*0.0*	*304.4*	*97.9*	*1050*	*1050*	*CIRCULAR*	*CONCRETE*	*-*	*0.10*	*900.9*	***33.8%***	*1.0*	*0.77*	*2.13*
(Hampshire Place, L)	*102A*	*102*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.000*	*1.647*	*0.000*	*0.128*	*0.000*	*0.000*	*0.000*	*0.000*	*17.81*	*55.84*	*75.45*	*88.32*	*128.91*	*0.0*	*0.0*	*282.3*	*8.7*	*1050*	*1050*	*CIRCULAR*	*CONCRETE*	*-*	*0.10*	*900.9*	***31.3%***	*1.0*	*0.75*	*0.19*
																				18.01																			
L102A (Ploughshare Road, L)	*102*	*101*	*0.23*	*0.00*	*0.00*	*0.00*	*0.00*	*0.61*	*0.00*	*0.00*	*0.00*	*0.139*	*3.074*	*0.000*	*0.128*	*0.000*	*0.000*	*0.000*	*0.000*	*18.01*	*55.48*	*74.95*	*87.74*	*128.06*	*0.0*	*0.0*	*500.4*	*79.8*	*1500*	*1500*	*CIRCULAR*	*CONCRETE*	*-*	*0.10*	*2332.0*	***21.5%***	*1.3*	*0.84*	*1.58*
																				19.58																			
L127A (Holstein Road, L)	*127*	*126*	*0.38*	*0.00*	*0.00*	*0.00*	*0.00*	*0.66*	*0.00*	*0.00*	*0.00*	*0.252*	*0.252*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*10.00*	*76.81*	*104.19*	*122.14*	*178.56*	*0.0*	*0.0*	*53.8*	*110.8*	*300*	*300*	*CIRCULAR*	*PVC*	*-*	*1.00*	*96.2*	***55.9%***	*1.4*	*1.21*	*1.53*
																				11.53																			
(Holstein Road, L)	*132*	*131*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*10.00*	*76.81*	*104.19*	*122.14*	*178.56*	*0.0*	*0.0*	*0.0*	*35.9*	*300*	*300*	*CIRCULAR*	*PVC*	*-*	*0.65*	*77.5*	***0.0%***	*1.1*	*0.00*	*0.00*
(Holstein Road, L)	*131*	*130*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*10.00*	*76.81*	*104.19*	*122.14*	*178.56*	*0.0*	*0.0*	*0.0*	*19.5*	*300*	*300*	*CIRCULAR*	*PVC*	*-*	*0.50*	*68.0*	***0.0%***	*1.0*	*0.00*	*0.00*
L130A, L130B (Maize Street, L)	*130*	*129*	*0.68*	*0.00*	*0.00*	*0.00*	*0.00*	*0.61*	*0.00*	*0.00*	*0.00*	*0.419*	*0.419*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*10.00*	*76.81*	*104.19*	*122.14*	*178.56*	*0.0*	*0.0*	*89.4*	*113.9*	*375*	*375*	*CIRCULAR*	*PVC*	*-*	*0.50*	*116.6*	***76.7%***	*1.1*	*1.08*	*1.76*
(Maize Street, L)	*129*	*128*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.000*	*0.419*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*11.76*	*70.64*	*95.72*	*112.16*	*163.90*	*0.0*	*0.0*	*82.2*	*12.3*	*375*	*375*	*CIRCULAR*	*PVC*	*-*	*0.50*	*116.6*	***70.6%***	*1.1*	*1.05*	*0.19*
L128A (Maize Street, L)	*128*	*126*	*0.32*	*0.00*	*0.00*	*0.00*	*0.00*	*0.66*	*0.00*	*0.00*	*0.00*	*0.210*	*0.629*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*11.96*	*70.02*	*94.87*	*111.17*	*162.44*	*0.0*	*0.0*	*122.4*	*39.5*	*450*	*450*	*CIRCULAR*	*CONCRETE*	*-*	*0.50*	*211.2*	***58.0%***	*1.3*	*1.15*	*0.57*
																				12.53																			
L126C, L126B, L126A (Maize Street, L)	*126*	*125*	*0.76*	*0.00*	*0.00*	*0.00*	*0.00*	*0.43*	*0.00*	*0.00*	*0.00*	*0.323*	*1.205*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*12.53*	*68.28*	*92.49*	*108.36*	*158.32*	*0.0*	*0.0*	*228.5*	*92.5*	*525*	*525*	*CIRCULAR*	*CONCRETE*	*-*	*0.40*	*283.8*	***80.5%***	*1.3*	*1.25*	*1.23*
(Maize Street, L)	*125*	*124*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.000*	*1.205*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*13.76*	*64.85*	*87.78*	*102.82*	*150.18*	*0.0*	*0.0*	*217.0*	*12.2*	*525*	*525*	*CIRCULAR*	*CONCRETE*	*-*	*0.40*	*283.8*	***76.5%***	*1.3*	*1.24*	*0.16*
L124B, L124A (Maize Street, L)	*124*	*123*	*0.63*	*0.00*	*0.00*	*0.00*	*0.00*	*0.51*	*0.00*	*0.00*	*0.00*	*0.324*	*1.529*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*13.93*	*64.42*	*87.19*	*102.13*	*149.17*	*0.0*	*0.0*	*273.7*	*71.4*	*600*	*600*	*CIRCULAR*	*CONCRETE*	*-*	*0.40*	*405.1*	***67.5%***	*1.4*	*1.30*	*0.92*
C123A, L123B (Maize Street, L)	*123*	*121*	*0.74*	*0.20*	*0.00*	*0.00*	*0.00*	*0.70*	*0.67*	*0.00*	*0.00*	*0.518*	*2.047*	*0.133*	*0.133*	*0.000*	*0.000*	*0.000*	*0.000*	*14.84*	*62.14*	*84.07*	*98.45*	*143.78*	*0.0*	*0.0*	*384.6*	*51.3*	*675*	*675*	*CIRCULAR*	*CONCRETE*	*-*	*0.25*	*438.5*	***87.7%***	*1.2*	*1.20*	*0.71*
																				15.55																			
C121AA (Roger Griffiths Avenue, C)	*121A*	*121*	*0.00*	*0.09*	*0.00*	*0.00*	*0.00*	*0.00*	*0.65*	*0.00*	*0.00*	*0.000*	*0.000*	*0.059*	*0.059*	*0.000*	*0.000*	*0.000*	*0.000*	*10.00*	*76.81*	*104.19*	*122.14*	*178.56*	*0.0*	*0.0*	*17.1*	*54.0*	*375*	*375*	*CIRCULAR*	*PVC*	*-*	*0.25*	*82.4*	***20.7%***	*0.8*	*0.52*	*1.75*
																				11.75																			
C109A, C109B (Roger Griffiths Avenue, C)	*109*	*108*	*0.00*	*0.81*	*0.00*	*0.00*	*0.00*	*0.00*	*0.70*	*0.00*	*0.00*	*0.000*	*0.000*	*0.566*	*0.566*	*0.000*	*0.000*	*0.000*	*0.000*	*10.00*	*76.81*	*104.19*	*122.14*	*178.56*	*0.0*	*0.0*	*163.7*	*116.8*	*600*	*600*	*CIRCULAR*	*CONCRETE*	*-*	*0.35*	*379.0*	***43.2%***	*1.3*	*1.07*	*1.82*
(Roger Griffiths Avenue, C)	*108*	*107*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.000*	*0.000*	*0.000*	*0.566*	*0.000*	*0.000*	*0.000*	*0.000*	*11.82*	*70.44*	*95.45*	*111.85*	*163.44*	*0.0*	*0.0*	*150.0*	*18.9*	*600*	*600*	*CIRCULAR*	*CONCRETE*	*-*	*0.45*	*429.7*	***34.9%***	*1.5*	*1.13*	*0.28*
																				12.10																			
L113A, L113B (Sheaf Road, L)	*113*	*112*	*0.82*	*0.00*	*0.00*	*0.00*	*0.00*	*0.53*	*0.00*	*0.00*	*0.00*	*0.434*	*0.434*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*10.00*	*76.81*	*104.19*	*122.14*	*178.56*	*0.0*	*0.0*	*92.7*	*84.2*	*450*	*450*	*CIRCULAR*	*CONCRETE*	*-*	*0.40*	*187.0*	***49.6%***	*1.1*	*0.97*	*1.44*
L112A (Sheaf Road, L)	*112*	*111*	*0.41*	*0.00*	*0.00*	*0.00*	*0.00*	*0.67*	*0.00*	*0.00*	*0.00*	*0.277*	*0.712*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*11.44*	*71.68*	*97.15*	*113.85*	*166.38*	*0.0*	*0.0*	*141.7*	*41.9*	*450*	*450*	*CIRCULAR*	*CONCRETE*	*-*	*0.40*	*187.0*	***75.8%***	*1.1*	*1.10*	*0.63*
(Sheaf Road, L)	*111*	*110*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.000*	*0.712*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*12.07*	*69.66*	*94.38*	*110.58*	*161.58*	*0.0*	*0.0*	*137.7*	*11.2*	*450*	*450*	*CIRCULAR*	*CONCRETE*	*-*	*0.40*	*187.0*	***73.7%***	*1.1*	*1.10*	*0.17*
C110A (Sheaf Road, L)	*110*	*107*	*0.00*	*0.12*	*0.00*	*0.00*	*0.00*	*0.00*	*0.67*	*0.00*	*0.00*	*0.000*	*0.712*	*0.079*	*0.079*	*0.000*	*0.000*	*0.000*	*0.000*	*12.24*	*69.14*	*93.66*	*109.74*	*160.35*	*0.0*	*0.0*	*157.3*	*44.4*	*525*	*525*	*CIRCULAR*	*CONCRETE*	*-*	*0.35*	*265.4*	***59.3%***	*1.2*	*1.07*	*0.69*
																				12.94																			
(Roger Griffiths Avenue, C)	*107*	*121*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.000*	*0.712*	*0.000*	*0.645*	*0.000*	*0.000*	*0.000*	*0.000*	*12.94*	*67.11*	*90.88*	*106.47*	*155.54*	*0.0*	*0.0*	*295.5*	*80.3*	*825*	*825*	*CIRCULAR*	*CONCRETE*	*-*	*0.10*	*473.6*	***62.4%***	*0.9*	*0.79*	*1.70*
																				14.64																			
L121B, C121A (Ploughshare Road, L)	*121*	*119*	*1.47*	*0.38*	*0.00*	*0.00*	*0.00*	*0.85*	*0.68*	*0.00*	*0.00*	*1.247*	*4.006*	*0.261*	*1.099*	*0.000*	*0.000*	*0.000*	*0.000*	*15.55*	*60.49*	*81.81*	*95.79*	*139.87*	*0.0*	*0.0*	*922.8*	*113.2*	*1200*	*1200*	*CIRCULAR*	*CONCRETE*	*-*	*0.15*	*1575.3*	***58.6%***	*1.3*	*1.21*	*1.56*
L119A (Ploughshare Road, L)	*119*	*101*	*0.31*	*0.00*	*0.00*	*0.00*	*0.00*	*0.69*	*0.00*	*0.00*	*0.00*	*0.215*	*4.221*	*0.000*	*1.099*	*0.000*	*0.000*	*0.000*	*0.000*	*17.12*	*57.18*	*77.28*	*90.48*	*132.07*	*0.0*	*0.0*	*906.3*	*115.1*	*1200*	*1200*	*CIRCULAR*	*CONCRETE*	*-*	*0.15*	*1575.3*	***57.5%***	*1.3*	*1.21*	*1.59*
																				18.71																			
F101A-A1 (Kanata West Pump Station)	*101A-1*	*101*	*0.00*	*0.00*	*0.00*	*0.69*	*0.00*	*0.00*	*0.00*	*0.00*	*0.55*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.381*	*0.381*	*10.00*	*76.81*	*104.19*	*122.14*	*178.56*	*0.0*	*0.0*	*188.8*	*16.3*	*600*	*600*	*CIRCULAR*	*CONCRETE*	*-*	*0.50*	*453.0*	***41.7%***	*1.6*	*1.25*	*0.22*
																				10.22																			
	101	*100D*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.000*	*7.295*	*0.000*	*1.227*	*0.000*	*0.000*	*0.000*	*0.381*	*19.58*	*52.71*	*71.18*	*83.30*	*121.55*	*0.0*	*0.0*	*1439.2*	*15.7*	*1500*	*1500*	*CIRCULAR*	*CONCRETE*	*-*	*0.15*	*2826.0*	***50.9%***	*1.5*	*1.34*	*0.20*
West Forebay Inlet (Sized for 25mm)	*100D*	*100C*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*19.78*	*52.39*	*70.74*	*82.78*	*120.79*	*1103.1*	*1103.1*	*1103.1*	*26.4*	*1050*	*1050*	*CIRCULAR*	*CONCRETE*	*-*	*0.16*	*1139.6*	***96.8%***	*1.3*	*1.33*	*0.33*
	100C	*HW2*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*20.11*	*51.85*	*70.01*	*81.93*	*119.53*	*0.0*	*1103.1*	*1103.1*	*13.5*	*1050*	*1050*	*CIRCULAR*	*CONCRETE*	*-*	*0.18*	*1223.4*	***90.2%***	*1.4*	*1.40*	*0.16*
																				20.27																			
Bypass sewer to Maincell (Sized for difference between upstream flows and forebay inlet)	*100D*	*100E*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.000*	*7.295*	*0.000*	*1.227*	*0.000*	*0.000*	*0.000*	*0.381*	*19.78*	*52.39*	*70.74*	*82.78*	*120.79*	*0.0*	*0.0*	*327.3*	*15.3*	*1350*	*1350*	*CIRCULAR*	*CONCRETE*	*-*	*1.00*	*5568.4*	***5.9%***	*3.8*	*1.71*	*0.15*
	100E	*HW4*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.000*	*7.295*	*0.000*	*1.227*	*0.000*	*0.000*	*0.000*	*0.381*	*19.93*	*52.15*	*70.41*	*82.40*	*120.22*	*0.0*	*0.0*	*320.7*	*15.8*	*1350*	*1350*	*CIRCULAR*	*CONCRETE*	*-*	*2.55*	*8887.6*	***3.6%***	*6.0*	*2.38*	*0.11*
																				20.04																			
			11.64	*1.79*	*0.00*	*0.69*	*0.00*					*7.30*		*1.23*		*0.00*		*0.38*																						
B-1, B-2, (KW Pump Station Overflow)	*HW7*	*HW8*	*1.10*	*0.00*	*0.69*	*0.00*	*0.00*	*0.60*	*0.00*	*0.70*	*0.00*	*0.660*	*0.660*	*0.000*	*0.000*	*0.483*	*0.483*	*0.000*	*0.000*	*10.00*	*76.81*	*104.19*	*122.14*	*178.56*	*1200.0*	*1200.0*	*1504.7*	*18.1*	*1200*	*1200*	*CIRCULAR*	*CONCRETE*	*-*	*1.19*	*4430.7*	***34.0%***	*3.8*	*2.88*	*0.10*
																				10.10									1200	1200									

Stantec

Second Registration Phase - Richcraft Kanata West

DATE: 2022-02-10
REVISION: 2
DESIGNED BY: WAJ
CHECKED BY: AMP

STORM SEWER DESIGN SHEET
(City of Ottawa)

FILE NUMBER: 160401393

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																						PIPE SELECTION										
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)	T of C (min)	$I_{2\text{-YEAR}}$ (mm/h)	$I_{5\text{-YEAR}}$ (mm/h)	$I_{10\text{-YEAR}}$ (mm/h)	$I_{100\text{-YEAR}}$ (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)
Proposed Second Registration Phase Storm Sewers - to East Forebay of Ultimate KW Pond 5																																			
L209B, L209A, L209C, UNC-8, EXT8-Fairwinds/Arterial/Commercial (Cartage Way, L)	209	207	1.02	23.31	7.14	0.00	0.00	0.61	0.59	0.70	0.00	0.619	0.619	13.844	13.844	4.998	4.998	0.000	0.000	15.00	61.77	83.56	97.85	142.89	0.0	0.0	4677.9	49.7	1650	1650	CIRCULAR	CONCRETE	-	0.30	5208.1	**89.8%**	2.4	2.41	0.34
L207A (Cartage Way, L)	207	206	0.58	0.00	0.00	0.00	0.00	0.63	0.00	0.00	0.00	0.365	0.984	0.000	13.844	0.000	4.998	0.000	0.000	15.34	60.97	82.46	96.57	141.01	0.0	0.0	4678.5	99.2	1650	1650	CIRCULAR	CONCRETE	-	0.30	5208.0	**89.8%**	2.4	2.41	0.69
L206A, C206B (Cartage Way, L)	206	205	0.31	0.17	0.00	0.00	0.00	0.73	0.70	0.00	0.00	0.226	1.210	0.119	13.963	0.000	4.998	0.000	0.000	16.03	59.44	80.37	94.11	137.40	0.0	0.0	4623.6	110.0	2100	2100	CIRCULAR	CONCRETE	-	0.15	7005.7	**66.0%**	2.0	1.82	1.01
L205B, C205A (Cartage Way, L)	205	204	0.48	0.26	0.00	0.00	0.00	0.45	0.67	0.00	0.00	0.216	1.427	0.176	14.139	0.000	4.998	0.000	0.000	17.04	57.35	77.51	90.74	132.46	0.0	0.0	4531.2	108.1	2100	2100	CIRCULAR	CONCRETE	-	0.15	7007.1	**64.7%**	2.0	1.81	1.00
L204A, L204B (Cartage Way, L)	204	202	0.81	0.00	0.00	0.00	0.00	0.71	0.00	0.00	0.00	0.574	2.001	0.000	14.139	0.000	4.998	0.000	0.000	18.03	55.43	74.89	87.66	127.94	0.0	0.0	4466.3	149.9	2100	2100	CIRCULAR	CONCRETE	-	0.15	7005.8	**63.8%**	2.0	1.81	1.38
																				19.42																		
L212A, EXT9 - Trinity/Hazeldean (Tillage Street, L)	212	211	0.10	12.31	4.54	0.00	2.54	0.60	0.86	0.76	0.00	0.060	0.060	10.587	10.587	3.450	3.450	0.000	0.000	21.58	49.62	66.96	78.35	114.29	76.4	76.4	2804.8	97.8	1650	1650	CIRCULAR	CONCRETE	-	0.15	3682.7	**76.2%**	1.7	1.61	1.01
L211A (Tillage Street, L)	211	210	0.40	0.00	0.00	0.00	0.00	0.72	0.00	0.00	0.00	0.288	0.348	0.000	10.587	0.000	3.450	0.000	0.000	22.59	48.21	65.04	76.09	110.97	0.0	76.4	2764.7	115.9	1800	1800	CIRCULAR	CONCRETE	-	0.16	4722.9	**58.5%**	1.8	1.61	1.20
																				23.79																		
(Holstein Road, L)	232	231	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	10.00	76.81	104.19	122.14	178.56	0.0	0.0	0.0	42.8	300	300	CIRCULAR	CONCRETE	-	0.50	68.0	**0.0%**	1.0	0.00	0.00
(Holstein Road, L)	231	230	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	10.00	76.81	104.19	122.14	178.56	0.0	0.0	0.0	37.4	300	300	CIRCULAR	CONCRETE	-	0.50	68.0	**0.0%**	1.0	0.00	0.00
(Holstein Road, L)	230	229	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	10.00	76.81	104.19	122.14	178.56	0.0	0.0	0.0	12.1	300	300	CIRCULAR	CONCRETE	-	0.50	68.0	**0.0%**	1.0	0.00	0.00
L229A, UNC-5 (Holstein Road, L)	229	228	0.51	0.00	0.00	0.00	0.00	0.76	0.00	0.00	0.00	0.387	0.387	0.000	0.000	0.000	0.000	0.000	0.000	10.00	76.81	104.19	122.14	178.56	0.0	0.0	82.6	88.9	450	450	CIRCULAR	CONCRETE	-	0.40	188.1	**43.9%**	1.1	0.94	1.57
L228A (Holstein Road, L)	228	227	0.35	0.00	0.00	0.00	0.00	0.70	0.00	0.00	0.00	0.245	0.632	0.000	0.000	0.000	0.000	0.000	0.000	11.57	71.25	96.56	113.15	165.35	0.0	0.0	125.1	77.2	450	450	CIRCULAR	CONCRETE	-	0.30	162.9	**76.8%**	1.0	0.97	1.33
(Holstein Road, L)	227	226	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.632	0.000	0.000	0.000	0.000	0.000	0.000	12.90	67.20	91.00	106.61	155.75	0.0	0.0	118.0	14.1	450	450	CIRCULAR	CONCRETE	-	0.30	162.9	**72.4%**	1.0	0.95	0.25
L226A, UNC-6 (Holstein Road, L)	226	225	0.46	0.00	0.00	0.00	0.00	0.73	0.00	0.00	0.00	0.338	0.970	0.000	0.000	0.000	0.000	0.000	0.000	13.15	66.50	90.05	105.48	154.10	0.0	0.0	179.2	62.2	525	525	CIRCULAR	CONCRETE	-	0.30	245.7	**72.9%**	1.1	1.05	0.99
L225A, L225B (Holstein Road, L)	225	224	2.87	0.00	0.00	0.00	0.00	0.79	0.00	0.00	0.00	2.269	3.239	0.000	0.000	0.000	0.000	0.000	0.000	14.14	63.88	86.45	101.25	147.88	0.0	0.0	574.7	67.7	825	825	CIRCULAR	CONCRETE	-	0.30	820.2	**70.1%**	1.5	1.41	0.80
(Holstein Road, L)	224	223	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	3.239	0.000	0.000	0.000	0.000	0.000	0.000	14.94	61.91	83.76	98.09	143.24	0.0	0.0	557.0	11.9	825	825	CIRCULAR	CONCRETE	-	0.35	886.0	**62.9%**	1.6	1.47	0.14
C223A (Holstein Road, L)	223	222	0.00	0.16	0.00	0.00	0.00	0.00	0.71	0.00	0.00	0.000	3.239	0.114	0.114	0.000	0.000	0.000	0.000	15.07	61.59	83.32	97.57	142.48	0.0	0.0	580.5	75.3	825	825	CIRCULAR	CONCRETE	-	0.35	885.9	**65.5%**	1.6	1.49	0.84
C222A, UNC-4 (Roger Griffiths Avenue, C)	222	221	0.07	0.52	0.00	0.00	0.00	0.70	0.69	0.00	0.00	0.049	3.288	0.359	0.473	0.000	0.000	0.000	0.000	15.91	59.69	80.71	94.51	137.99	0.0	0.0	651.2	71.4	825	825	CIRCULAR	CONCRETE	-	0.35	885.9	**73.5%**	1.6	1.54	0.77
(Roger Griffiths Avenue, C)	221	219	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	3.288	0.000	0.473	0.000	0.000	0.000	0.000	16.69	58.06	78.48	91.88	134.13	0.0	0.0	633.4	76.8	1050	1050	CIRCULAR	CONCRETE	-	0.37	1728.6	**36.6%**	1.9	1.50	0.85
																				17.54																		
C220A, L220A (Roger Griffiths Avenue, C)	220	219	0.87	0.41	0.00	0.00	0.00	0.44	0.73	0.00	0.00	0.381	0.381	0.297	0.297	0.000	0.000	0.000	0.000	10.00	76.81	104.19	122.14	178.56	0.0	0.0	167.3	71.8	750	750	CIRCULAR	CONCRETE	-	0.50	821.2	**20.4%**	1.8	1.17	1.02
																				11.02																		
C219A, L219B, UNC-1 (Shropshire Place, L)	219	218	0.42	0.09	0.00	0.00	0.00	0.68	0.68	0.00	0.00	0.288	3.957	0.061	0.831	0.000	0.000	0.000	0.000	17.54	56.36	76.17	89.16	130.15	0.0	0.0	795.3	110.7	1350	1350	CIRCULAR	CONCRETE	-	0.20	2475.0	**32.1%**	1.7	1.26	1.47
L218A, L218B, UNC-2 (Shropshire Place, L)	218	213	3.00	0.00	0.00	0.00	0.00	0.68	0.00	0.00	0.00	2.038	5.995	0.000	0.831	0.000	0.000	0.000	0.000	19.01	53.69	72.51	84.87	123.85	0.0	0.0	1061.4	102.1	1500	1500	CIRCULAR	CONCRETE	-	0.20	3304.3	**32.1%**	1.8	1.36	1.25
																				20.26																		
L217A (Combine Walk, L)	217	216	0.40	0.00	0.00	0.00	0.00	0.68	0.00	0.00	0.00	0.273	0.273	0.000	0.000	0.000	0.000	0.000	0.000	10.00	76.81	104.19	122.14	178.56	0.0	0.0	58.2	31.2	375	375	CIRCULAR	PVC	-	0.50	116.6	**49.9%**	1.1	0.95	0.55
(Combine Walk, L)	216	215	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.273	0.000	0.000	0.000	0.000	0.000	0.000	10.55	74.75	101.37	118.82	173.67	0.0	0.0	56.7	11.9	375	375	CIRCULAR	PVC	-	0.50	116.6	**48.6%**	1.1	0.94	0.21
(Combine Walk, L)	215	214	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.273	0.000	0.000	0.000	0.000	0.000	0.000	10.76	74.00	100.33	117.59	171.88	0.0	0.0	56.1	57.5	375	375	CIRCULAR	PVC	-	0.50	116.6	**48.1%**	1.1	0.94	1.02
L214A (Combine Walk, L)	214	213	0.55	0.00	0.00	0.00	0.00	0.71	0.00	0.00	0.00	0.391	0.664	0.000	0.000	0.000	0.000	0.000	0.000	11.79	70.57	95.62	112.05	163.73	0.0	0.0	130.1	70.6	600	600	CIRCULAR	CONCRETE	-	0.32	360.5	**36.1%**	1.2	0.96	1.23
																				13.01																		
L213A (Shropshire Place, L)	213	210	0.26	0.00	0.00	0.00	0.00	0.69	0.00	0.00	0.00	0.182	6.840	0.000	0.831	0.000	0.000	0.000	0.000	20.26	51.62	69.69	81.55	118.98	0.0	0.0	1141.6	55.3	1500	1500	CIRCULAR	CONCRETE	-	0.20	3295.3	**34.6%**	1.8	1.39	0.66
																				20.92																		
L210A, L210B (Tillage Street, L)	210	202	0.51	0.00	0.00	0.00	0.00	0.57	0.00	0.00	0.00	0.291	7.479	0.000	11.417	0.000	3.450	0.000	0.000	23.79	46.64	62.90	73.57	107.29	0.0	76.4	3745.1	85.5	1950	1950	CIRCULAR	CONCRETE	-	0.14	5640.5	**66.4%**	1.8	1.70	0.84
																				24.63																		
L202B, L202A (Winter Wheat Terrace, L)	202	201	0.45	0.00	0.00	0.00	0.00	0.57	0.00	0.00	0.00	0.258	9.737	0.000	25.557	0.000	8.448	0.000	0.000	24.63	45.61	61.49	71.92	104.87	0.0	76.4	7363.3	75.0	3000	1800	RECTANGULAR	CONCRETE	-	0.15	10962.8	**67.2%**	2.0	1.90	0.66
																				25.29																		
L241A (Ploughshare Road, L)	241	240	0.31	0.00	0.00	0.00	0.00	0.69	0.00	0.00	0.00	0.213	0.213	0.000	0.000	0.000	0.000	0.000	0.000	10.00	76.81	104.19	122.14	178.56	0.0	0.0	45.5	77.3	375	375	CIRCULAR	PVC	-	0.35	97.0	**46.9%**	0.9	0.77	1.67
L240A, L240B (Ploughshare Road, L)	240	239	0.60	0.00	0.00	0.00	0.00	0.71	0.00	0.00	0.00	0.431	0.644	0.000	0.000	0.000	0.000	0.000	0.000	11.67	70.94	96.13	112.65	164.61	0.0	0.0	126.8	64.5	525	525	CIRCULAR	CONCRETE	-	0.35	265.4	**47.8%**	1.2	1.01	1.07
(Ploughshare Road, L)	239	238	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.644	0.000	0.000	0.000	0.000	0.000	0.000	12.74	67.68	91.65	107.38	156.88	0.0	0.0	121.0	12.8	525	525	CIRCULAR	CONCRETE	-	0.35	265.4	**45.6%**	1.2	0.99	0.22
L238A (Ploughshare Road, L)	238	237	0.65	0.00	0.00	0.00	0.00	0.57	0.00	0.00	0.00	0.372	1.016	0.000	0.000	0.000	0.000	0.000	0.000	12.95	67.06	90.80	106.38	155.41	0.0	0.0	189.2	68.1	675	675	CIRCULAR	CONCRETE	-	0.35	518.8	**36.5%**	1.4	1.09	1.04
L237A (Ploughshare Road, L)	237	236	0.27	0.00	0.00	0.00	0.00	0.66	0.00	0.00	0.00	0.175	1.191	0.000	0.000	0.000	0.000	0.000	0.000	13.99	64.25	86.95	101.85	148.76	0.0	0.0	212.6	9.1	675	675	CIRCULAR	CONCRETE	-	0.35	518.8	**41.0%**	1.4	1.13	0.13
(Ploughshare Road, L)	236	235	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	1.191	0.000	0.000	0.000	0.000	0.000	0.000	14.13	63.90	86.48	101.29	147.95	0.0	0.0	211.5	50.7	675	675	CIRCULAR	CONCRETE	-	0.35	518.8	**40.8%**	1.4	1.13	0.75
(Ploughshare Road, L)	235	234	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	1.191	0.000	0.000	0.000	0.000	0.000	0.000	14.88	62.06	83.96	98.33	143.59	0.0	0.0	205.4	11.2	750	750	CIRCULAR	CONCRETE	-	0.35	687.1	**29.9%**	1.5	1.10	0.17
L234B, G234A, L234A (Ploughshare Road, L)	234	233	1.53	0.00	0.00	0.00	0.00	0.51	0.00	0.00	0.00	0.772	1.963	0.000	0.000	0.000	0.000	0.000	0.000	15.05	61.66	83.41	97.68	142.64	0.0	0.0	336.2	106.9	975	975	CIRCULAR	CONCRETE	-	0.35	1383.1	**24.3%**	1.8	1.24	1.44
(Ploughshare Road, L)	233	201	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	1.963	0.000	0.000	0.000	0.000	0.000	0.000	16.48	58.48	79.05	92.56	135.12	0.0	0.0	318.8	26.6	975	975	CIRCULAR	CONCRETE	-	0.40	1478.6	**21.6%**	1.9	1.27	0.35
																				16.83																		
	201	100B	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	11.700	0.000	25.557	0.000	8.448	0.000	0.000	25.29	44.83	60.44	70.69	103.06	0.0	76.4	7483.2	15.0	3000	1800	RECTANGULAR	CONCRETE	-	0.15	10961.6	**68.3%**	2.0	1.91	0.13
Forebay Inlet (Sized for 25mm)	100B	HW1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	25.42	44.68	60.24	70.45	102.71	3536.1	3536.1	3536.1	18.0	1800	1800	CIRCULAR	CONCRETE	-	0.18	5055.2	**70.0%**	1.9	1.83	0.16
																				25.58										1800	1800							
Bypass sewer to Maincell	100B	100A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	11.700	0.000	25.557	0.000	8.448	0.000	0.000	25.58	44.50	59.98	70.15	102.27	0.0	76.4	7426.9	49.8	2440	2440	CIRCULAR	CONCRETE	-	0.10	8013.1	**92.7%**	1.7	1.77	0.47
	100A	HW3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	11.700	0.000	25.557	0.000	8.448	0.000	0.000	26.05	43.97	59.27	69.31	101.05	0.0	76.4	7339.4	28.1	2440	2440	CIRCULAR	CONCRETE	-	0.11	8726.3	**84.1%**	1.9	1.87	0.25
																				26.30										2440	2440							
			17.78	37.23	11.68	0.00	2.54					11.70		25.56		8.45		0.00																			

Notes:

1. The proposed streets are all classified as local streets with the exception of Roger Griffiths Avenue which is classified as a collector road.
2. Storm sewers within local streets have been sized for a 2-year storm with the exception of catchments at the intersection with Roger Griffiths Avenue for which storm sewers have been sized for the 5-year capture to avoid 5-year ponding on collector roads.
3. Existing residential and commercial developments (Fairwinds and Trinity), areas EXT-8 & EXT-9 have been included in the proposed storm sewer sizing for the 5-year storm as per previous City of Ottawa guidelines.
4. The development includes two residential block areas L123B & L225B (Block 29 & Block 78) , one commercial block area L121B (Block 1), a school block area L218A (Block 76) and two park block areas G234A & L126C (Block 143 & Block 28) .

B.2 RUNOFF COEFFICIENT SAMPLE CALCULATIONS

Project No. 160401393
Richcraft Kanata West Development
Runoff Coefficient Calculations

Runoff Coeeficient for Hard Areas, C=0.90
Runoff Coeeficient for Soft Areas, C=0.20

ID	Total Area (m^2)	Hard Area (m^2)	Soft Area (m^2)	C-Value
B-1	10983			0.60
B-2	6934			0.70
C107A	1854	1288	566	0.69
C109A	4301	3037	1264	0.69
C109B	3785	2758	1027	0.71
C110A	1281	851	430	0.67
C121A	3843	2645	1198	0.68
C121AA	908	589	319	0.65
C123A	2064	1386	678	0.67
C205A	2631	1758	873	0.67
C206B	1703	1216	487	0.70
C219A	895	617	278	0.68
C220A	4066	2944	1122	0.71
C222A	5208	3632	1576	0.69
C223A	1601	1168	433	0.71
EXT1	1249	768	481	0.63
EXT2	720	479	241	0.67
EXT3	980	557	423	0.60
EXT4	5215	2862	2353	0.58
EXT5	1143	283	860	0.37
EXT6	1155	467	688	0.48
F101A	6923			0.55
G234A	9716			0.25
L102A	2275	1347	928	0.61
L102B	573	394	179	0.68
L103A	3885	2792	1093	0.70
L103B	2031	1229	802	0.62
L103C	6397	2539	3858	0.48
L103D	5523	2014	3509	0.46
L104A	3335	2273	1062	0.68
L105A	3236	2415	821	0.72
L106A	2440	1846	594	0.73
L106B	735	510	225	0.69
L112A	4137	2797	1340	0.67
L113A	3285	2311	974	0.69
L113B	4947	1552	3395	0.42
L115A	1651	1122	529	0.68
L116A	2227	1565	662	0.69
L117A	4246	3092	1154	0.71

Project No. 160401393
Richcraft Kanata West Development
Runoff Coefficient Calculations

Runoff Coeeficient for Hard Areas, C=0.90
Runoff Coeeficient for Soft Areas, C=0.20

ID	Total Area (m^2)	Hard Area (m^2)	Soft Area (m^2)	C-Value
L117B	1457	787	670	0.58
L117C	6623	2491	4132	0.46
L118A	4434	2921	1513	0.66
L119A	3110	2182	928	0.69
L121B	14671			0.85
L123B	7404			0.70
L124A	2320	1518	802	0.66
L124B	3815	1252	2563	0.43
L126A	317	239	78	0.73
L126B	2633	1879	754	0.70
L126C	4630			0.25
L127A	3820	2537	1283	0.66
L128A	3185	2115	1070	0.66
L130A	4541	3164	1377	0.69
L202A	2081	1154	927	0.59
L202B	2452	1227	1225	0.55
L204A	4213	2920	1293	0.69
L204B	3883	2919	964	0.73
L205B	4810	1726	3084	0.45
L206A	3093	2321	772	0.73
L207A	5812	3599	2213	0.63
L130B	2253	849	1404	0.46
L207C	4069	1577	2492	0.47
L209A	3501	2452	1049	0.69
L209B	1584	1058	526	0.67
L210A	2521	1680	841	0.67
L210B	2600	1014	1586	0.47
L211A	3995	2993	1002	0.72
L213A	2632	1849	783	0.69
L214A	5507	4027	1480	0.71
L217A	4012	2777	1235	0.68
L218A	29485			0.70
L218B	2503	890	1613	0.45
L219B	3617	2484	1133	0.68
L220A	8666	2958	5708	0.44
L225A	2733	1861	872	0.68
L225B	27536			0.70
L226A	3031	2181	850	0.70
L226B	2522	918	1604	0.45
L228A	4935	3495	1440	0.70
L229A	3648	2599	1049	0.70
L234A	3273	2288	985	0.69
L234B	2276	1593	683	0.69
207S	6530	3475	3055	0.57
L237A	2659	1740	919	0.66
L240A	2413	1792	621	0.72
L240B	3632	2653	979	0.71
L241A	3087	2162	925	0.69

B.3 PCSWMM MODEL INPUT

Summary of Subcatchment Parameters

Individual Proposed Subcatchment Parameters (Site Servicing and SWM Report)

Area ID	Area (ha)	Width (m)	Slope (%)	%IMP	Runoff Coefficient	Subarea Routing	% Routed	Description
Arterial	3.19	1314.0	1.0	71.4%	0.70	OUTLET	100	Arterial
B-1	1.10	186.0	1.0	57.1%	0.60	PERVIOUS	30	Residential
B-2	0.69	186.0	1.0	71.4%	0.70	OUTLET	100	Arterial
C107A	0.19	52.0	1.0	70.0%	0.69	OUTLET	100	Road
C109A	0.43	160.0	1.0	70.0%	0.69	OUTLET	100	Road
C109B	0.38	138.0	1.0	72.9%	0.71	OUTLET	100	Road
C110A	0.12	39.0	1.0	67.1%	0.67	OUTLET	100	Road
C121A	0.38	95.0	1.0	68.6%	0.68	OUTLET	100	Road
C121AA	0.09	37.0	1.5	64.3%	0.65	OUTLET	100	Road
C123A	0.20	43.2	1.0	67.1%	0.67	OUTLET	100	Road
C205A	0.26	71.2	3.0	67.1%	0.67	OUTLET	100	Road
C206B	0.17	68.0	3.0	71.4%	0.70	OUTLET	100	Road
C219A	0.09	79.8	2.0	68.6%	0.68	OUTLET	100	Road
C220A	0.41	131.8	2.0	75.7%	0.73	OUTLET	100	Road
C222A	0.52	257.0	4.0	70.0%	0.69	OUTLET	100	Road
C223A	0.16	59.0	3.0	72.9%	0.71	OUTLET	100	Road
Comm	1.99	448.0	1.0	92.9%	0.85	OUTLET	100	Commercial
EXT1	0.12	59.0	1.5	61.4%	0.63	OUTLET	100	Road
EXT2	0.07	29.0	2.0	67.1%	0.67	OUTLET	100	Road
EXT4	0.52	307.0	4.0	54.3%	0.58	PERVIOUS	100	RY
EXT5	0.11	77.0	4.0	24.3%	0.37	PERVIOUS	100	RY
EXT6	0.12	78.8	4.0	40.0%	0.48	PERVIOUS	100	RY
F101A-1A	0.69	155.0	1.0	50.0%	0.55	PERVIOUS	100	KWPumpStation
G234A	0.97	218.0	1.0	28.6%	0.40	PERVIOUS	100	Park
Hazeldean	3.95	1764.0	1.0	71.4%	0.70	OUTLET	100	Arterial
L102A	0.23	82.4	1.0	58.6%	0.61	OUTLET	100	Road
L103A	0.39	161.8	1.0	71.4%	0.70	OUTLET	100	Road
L103B	0.20	63.2	1.0	60.0%	0.62	OUTLET	100	Road
L103C	0.64	300.0	1.0	40.0%	0.48	PERVIOUS	100	RY
L103D	0.55	278.0	1.0	37.1%	0.46	PERVIOUS	100	RY
L104A	0.33	122.7	1.0	68.6%	0.68	OUTLET	100	Road
L105A	0.32	153.2	1.0	74.3%	0.72	OUTLET	100	Road
L106A	0.24	97.3	1.0	75.7%	0.73	OUTLET	100	Road
L106B	0.07	26.6	1.0	70.0%	0.69	OUTLET	100	Road
L112A	0.41	167.7	1.0	67.1%	0.67	OUTLET	100	Road
L113A	0.33	127.0	1.0	70.0%	0.69	OUTLET	100	Road
L113B	0.49	280.0	1.0	31.4%	0.42	PERVIOUS	100	RY
L114A	0.06	63.2	1.0	68.6%	0.68	OUTLET	100	Road
L115A	0.17	58.0	1.0	68.6%	0.68	OUTLET	100	Road
L116A	0.22	84.0	1.0	70.0%	0.69	OUTLET	100	Road
L117A	0.42	173.7	1.0	72.9%	0.71	OUTLET	100	Road
L117B	0.15	49.3	1.0	54.3%	0.58	OUTLET	100	Road
L117C	0.66	360.0	1.0	37.1%	0.46	PERVIOUS	100	RY
L118A	0.44	167.3	1.0	65.7%	0.66	OUTLET	100	Road
L119A	0.31	89.8	1.0	70.0%	0.69	OUTLET	100	Road
L121B	1.47	331.0	1.0	92.9%	0.85	OUTLET	100	Commercial
L123B	0.74	167.0	1.0	71.4%	0.70	PERVIOUS	30	Residential
L124A	0.23	116.1	1.0	65.7%	0.66	OUTLET	100	Road
L124B	0.40	246.0	1.0	32.9%	0.43	PERVIOUS	100	RY
L126A	0.03	30.0	1.0	75.7%	0.73	OUTLET	100	Road
L126B	0.26	85.4	1.0	71.4%	0.70	OUTLET	100	Road
L126C	0.46	104.0	1.0	7.1%	0.25	PERVIOUS	100	Park

Rational Method Comparison

2yr/5yr Capture Rate (L/s)	Available Ponding (cu.m)	Static Ponding Depth (m)		Tc (min)	Intensity (mm/hr)	Q (L/s)	Qrat-Qswm	LOS
933.69	127.6	40	m3/ha	10	122.14	**757.6**	-176.1	10yr
105.68	154.0	100-YEAR	DRY POND	10	76.81	**140.6**	**34.9**	2yr
195.28	27.7	40	m3/ha	10	122.14	**164.7**	-30.6	10yr
41.02	25.9	0.2		10	104.19	**37.0**	-4.0	5yr
97.17	27.1	0.17		10	104.19	**85.9**	-11.3	5yr
88.27	38.1	0.2		10	104.19	**77.8**	-10.5	5yr
25.58	0.6	0.04		10	104.19	**23.0**	-2.6	5yr
82.8	79.1	0.26		10	104.19	**75.6**	-7.2	5yr
19.65	**0.0**	-		10	104.19	**17.1**	-2.6	5yr
41.75	23	0.19		10	104.19	**38.6**	-3.1	5yr
58.55	56.9	0.21		10	104.19	**51.0**	-7.5	5yr
41.03	0.3	0.02		10	104.19	**34.5**	-6.5	5yr
22.04	0.0	0.12		10	104.19	**17.6**	-4.4	5yr
99.3	47.6	0.2		10	104.19	**85.9**	-13.4	5yr
127.32	64.2	0.24		10	104.19	**104.0**	-23.3	5yr
38.88	0.3	0.04		10	104.19	**32.9**	-6.0	5yr
392.51	N/A	100-year		15	83.56	**392.8**	0.3	5yr
-	0.0							
-	0.0							
-	0.0							
-	0.0							
-	0.0							
232.19	0.0							
18.42	0.0	C=	0.33	24.5	45.76	**40.8**	**22.3**	2yr
1164.24	158.0	40	m3/ha	10	122.14	**938.1**	-226.1	10yr
28.71	32.5	0.21		10	76.81	**29.6**	0.9	2yr
59.75	25.3	0.19		10	76.81	**58.0**	-1.7	2yr
26.21	16.3	0.18		10	76.81	**26.9**	0.7	2yr
41.21	0	-		10	76.81	**65.4**	**24.2**	2yr
32.79	0.0	-		10	76.81	**54.2**	**21.4**	2yr
49.25	29.4	0.19		10	76.81	**48.4**	-0.8	2yr
51.8	23.3	0.18		10	76.81	**49.7**	-2.1	2yr
39.69	0.8	0.06		10	76.81	**38.0**	-1.7	2yr
11.07	0.8	0.12		10	76.81	**10.8**	-0.2	2yr
59.83	45.7	0.23		10	76.81	**59.1**	-0.7	2yr
49.48	29	0.19		10	76.81	**48.4**	-1.1	2yr
24.05	0	-		10	76.81	**44.3**	**20.3**	2yr
8.59	3.2	0.13		10	76.81	**8.3**	-0.3	2yr
24.34	16.2	0.16		10	76.81	**24.0**	-0.4	2yr
33.53	37.4	0.21		10	76.81	**32.8**	-0.8	2yr
66.57	61.8	0.26		10	76.81	**64.3**	-2.3	2yr
17.04	9.9	0.15		10	76.81	**18.0**	1.0	2yr
41.5	0.0			10	76.81	**65.0**	**23.5**	2yr
62.73	29.5	0.19		10	76.81	**62.4**	-0.3	2yr
46.8	28.1	0.2		10	76.81	**45.9**	-0.9	2yr
289.23	N/A	100-year		10	76.81	**266.1**	-23.2	2yr
101.44	37.0	50	m3/ha	10	76.81	**110.6**	**9.1**	2yr
32.93	17.2	0.17		10	76.81	**32.7**	-0.3	2yr
22.2	0.0			10	76.81	**36.5**	**14.3**	2yr
5.23	0.0	0.14		10	76.81	**4.9**	-0.3	2yr
40.39	23.9	0.2		10	76.81	**39.3**	-1.1	2yr
1.3	0.0			10	76.81	**24.7**	**23.4**	2yr

Individual Proposed Subcatchment Parameters (Site Servicing and SWM Report)

Rational Method Comparison

Area ID	Area (ha)	Width (m)	Slope (%)	%IMP	Runoff Coefficient	Subarea Routing	% Routed	Description	2yr/5yr Capture Rate (L/s)	Available Ponding (cu.m)	Static Ponding Depth (m)		Tc (min)	Intensity (mm/hr)	Q (L/s)	Qrat-Qswm	LOS
L127A	0.38	144.2	1.0	65.7%	0.66	OUTLET	100	Road	54.04	0.0	0.00		10	76.81	**53.8**	-0.2	2yr
L128A	0.32	72.1	1.0	65.7%	0.66	OUTLET	100	Road	44.79	29.8	0.18		10	76.81	**44.9**	0.1	2yr
L130A	0.45	170.7	1.0	70.0%	0.69	OUTLET	100	Road	68.4	0.7	0.1		10	76.81	**66.9**	-1.5	2yr
L130B	0.23	200.0	1.0	40.0%	0.48	PERVIOUS	100	RY	21.86	0	-		10	76.81	**23.1**	**1.2**	2yr
L202A	0.21	76.7	2.0	55.7%	0.59	OUTLET	100	Road	25.11	15.7	0.16		10	76.81	**26.2**	**1.1**	2yr
L202B	0.25	152.0	3.0	50.0%	0.55	PERVIOUS	100	RY	35.24	-	-		10	76.81	**28.8**	-6.5	2yr
L204A	0.42	174.7	3.0	75.7%	0.73	OUTLET	100	Road	69.07	49.5	0.22		10	76.81	**65.6**	-3.5	2yr
L204B	0.39	164.0	3.0	70.0%	0.69	OUTLET	100	Road	58.96	22.7	0.18		10	76.81	**57.2**	-1.8	2yr
L205B	0.48	236.0	3.0	35.7%	0.45	PERVIOUS	100	RY	38.24	0	-		10	76.81	**46.2**	**7.9**	2yr
L206A	0.31	127.2	3.0	75.7%	0.73	OUTLET	100	Road	50.7	9.2	0.13		10	76.81	**48.2**	-2.5	2yr
L207A	0.58	202.3	3.0	64.3%	0.65	OUTLET	100	Road	80.92	**26.8**	0.20		10	76.81	**80.6**	-0.3	2yr
L209A	0.35	153.4	2.0	70.0%	0.69	OUTLET	100	Road	53.02	0.0			10	76.81	**51.5**	-1.5	2yr
L209B	0.16	159.0	2.0	67.1%	0.67	OUTLET	100	Road	23.42	**3.7**	0.13		10	76.81	**22.6**	-0.8	2yr
L209C	0.41	200.0	3.0	38.6%	0.47	PERVIOUS	100	RY	36.44	0	-		10	76.81	**40.8**	**4.4**	2yr
L210A	0.25	80.1	3.0	67.1%	0.67	OUTLET	100	Road	36.58	7.8	0.14		10	76.81	**36.0**	-0.5	2yr
L210B	0.26	168.0	3.0	38.6%	0.47	PERVIOUS	100	RY	27.23	**0.0**			10	76.81	**26.1**	-1.2	2yr
L211A	0.40	177.2	3.0	74.3%	0.72	OUTLET	100	Road	64.34	33.2	0.21		10	76.81	**61.4**	-3.0	2yr
L212A	0.10	44.0	3.0	57.1%	0.60	OUTLET	100	Road	12.21	0.0	0.00		10	76.81	**12.5**	0.3	2yr
L213A	0.26	93.3	2.0	70.0%	0.69	OUTLET	100	Road	39.75	8.9	0.13		10	76.81	**38.7**	-1.0	2yr
L214A	0.55	221.0	4.0	72.9%	0.71	OUTLET	100	Road	87.08	71	0.27		10	76.81	**83.4**	-3.7	2yr
L217A	0.40	196.0	3.0	68.6%	0.68	OUTLET	100	Road	59.84	69	0.3		10	76.81	**58.2**	-1.6	2yr
L218A	2.68	664.0	1.0	71.4%	0.70	PERVIOUS	30	School	**434**	267.9	100	m3/ha	10	76.81	**400.1**	-33.9	2yr
L218B	0.25	166.0	3.0	35.7%	0.45	PERVIOUS	100	RY	23.95	0.0			10	76.81	**24.0**	0.1	2yr
L219B	0.36	111.7	2.0	68.6%	0.68	OUTLET	100	Road	53.45	70.1	0.24		10	76.81	**52.5**	-1.0	2yr
L220A	0.87	480.0	2.5	34.3%	0.44	PERVIOUS	100	RY	66.07	0.0	-		10	76.81	**81.4**	**15.3**	2yr
L225A	0.27	134.6	2.5	71.4%	0.70	OUTLET	100	Road	42.37	9	0.14		10	76.81	**40.8**	-1.5	2yr
L225B	2.60	619.0	2.0	85.7%	0.80	PERVIOUS	30	Med-Resid	**470**	129.9	50	m3/ha	10	76.81	**443.4**	-26.6	2yr
L226A	0.30	85.6	2.5	71.4%	0.70	OUTLET	100	Road	46.64	16.5	0.17		10	76.81	**45.3**	-1.4	2yr
L228A	0.35	96.0	2.5	71.4%	0.70	OUTLET	100	Road	54.35	33.6	0.21		10	76.81	**52.8**	-1.6	2yr
L229A	0.21	66.0	3.0	71.4%	0.70	OUTLET	100	Road	31.64	41.7	0.22		10	76.81	**30.6**	-1.0	2yr
L234A	0.33	82.6	4.0	70.0%	0.69	OUTLET	100	Road	49.45	37.2	0.21		10	76.81	**48.2**	-1.3	2yr
L234B	0.23	81.1	4.0	70.0%	0.69	OUTLET	100	Road	34.53	14.3	0.15		10	76.81	**33.5**	-1.0	2yr
L237A	0.27	121.9	4.0	65.7%	0.66	OUTLET	100	Road	38.1	33	0.21		10	76.81	**37.4**	-0.7	2yr
L238A	0.65	376.0	2.5	52.9%	0.57	PERVIOUS	100	RY	95.08				10	76.81	**79.4**	-15.7	2yr
L240A	0.24	109.7	4.0	74.3%	0.72	OUTLET	100	Road	38.74	3.7	0.2		10	76.81	**36.8**	-1.9	2yr
L240B	0.36	153.6	4.0	72.9%	0.71	OUTLET	100	Road	57.48	51	0.24		10	76.81	**55.0**	-2.5	2yr
L241A	0.31	190.0	4.0	70.0%	0.69	OUTLET	100	Road	47.36	27.8	0.23		10	76.81	**45.5**	-1.9	2yr
POND	2.56	576.0	1.0	60.0%	0.62	PERVIOUS	60	Ult_pond5	-	-							
UNC-1	0.06	120.0	4.0	71.4%	0.70	OUTLET	100	UNC-SCHOOL									
UNC-2	0.07	120.0	4.0	71.4%	0.70	OUTLET	100	UNC-SCHOOL									
UNC-3	0.07	120.0	4.0	71.4%	0.70	OUTLET	100	UNC-SCHOOL									
UNC-4	0.07	120.0	4.0	71.4%	0.70	OUTLET	100	UNC-SCHOOL									
UNC-5	0.30	188.0	3.0	85.7%	0.80	OUTLET	100	UNC-RES									
UNC-6	0.16	160.0	3.0	85.7%	0.80	OUTLET	100	UNC-RES									
UNC-7	0.16	160.0	3.0	85.7%	0.80	OUTLET	100	UNC-RES									
UNC-8	0.10	200.0	3.0	85.7%	0.80	OUTLET	100	UNC-RES									
	48.15			**66.0%**	**0.66**				**7663.5**	**1479.30**	**58**	**m^3/ha**					

25.51	ha - Proposed Subdivision Area (Not including private blocks)			
36.54	ha - Proposed Development Area (Including SWM and private blocks)	**63.9%**		
2.56	ha - Ultimate Pond Block	**60.0%**		
13.32	ha - Approved First Registration Development Area (Including SWM and private blocks)	**62.1%**	**617.20**	**46 m^3/ha**
20.66	ha - Proposed Second Registration Development Area (Including SWM and private blocks)	**65.6%**	**862.10**	**56 m^3/ha** does not include 0.94ha pond block
3.19	ha - Future Arterial/Transitway	71.4%		
1.10	ha - Future Med. Density Residential Area north of Maple Grove	57.1%		
0.69	ha - Future Maple Grove	71.4%		
1.99	ha - Future Commercial Block	92.9%		
3.95	ha - Existing Hazeldean to Interim SWMF discharging to Hazeldean Creek	71.4%		
0.69	ha - Kanata West Pump Station	50.0%		
9.14	ha - Existing Fairwinds Development	35.7%		
11.02	ha - Existing Commercial Development to Fairwinds Interim SWMF	94.3%		
1.16	ha - Existing Huntmar Road to Fairwinds Interim SWMF	67.1%		
14.85	ha - Existing Trinity Development	94.3%		
4.54	ha - Existing Hazeldean Road to Trinity Interim SWMF	80.0%		
88.86	**Total Drainage Area to Ultimate Kanata West Pond 5**	**71.8%**		

Total Surface Flow Depth

Storage node ID	Structure ID	Top of Grate Elevation (m)	Lowest Adjacent Building Opening (m)	Rim Elevation (m)	100 year, 3 hour Chicago		100 year, 3 hour Chicago+20%		5 year, 3 hour Chicago		2 year, 3 hour Chicago	
					Max Surface HGL (m)	Total Surface Ponding Depth (m)	Max Surface HGL (m)	Total Surface Ponding Depth (m)	Max Surface HGL (m)	Total Surface Ponding Depth (m)	Max Surface HGL (m)	Total Surface Ponding Depth (m)
205A-S(1)	CB 205 A-1 & 2	97.45	98.15	97.80	97.72	0.27	97.80	0.35	97.44	0.00	96.38	0.00
206B-S(1)	CB 206 B-1	97.77	98.50	98.12	97.90	0.13	97.93	0.16	97.51	0.00	96.91	0.00
219A-S(1)	CB 219 A-1	97.82	98.09	98.17	98.02	0.20	98.09	0.27	97.50	0.00	96.90	0.00
220A-S	CB 220 A-1 & 2	97.74	98.30	98.09	98.01	0.27	98.09	0.35	97.55	0.00	96.66	0.00
222A-S	CB 222 A-1 & 2	97.82	98.45	98.25	98.16	0.34	98.23	0.41	97.32	0.00	96.85	0.00
223A-S	CB 223 A-1	98.17	99.10	98.52	98.40	0.23	98.43	0.26	97.25	0.00	97.04	0.00
G234A-S	CBMH 234A	97.77	N/A	98.37	97.97	0.20	98.01	0.24	97.86	0.09	94.77	0.00
116A-S	CB 116 A-1 & 2	97.20	97.87	97.55	97.47	0.27	97.53	0.33	97.24	0.04	96.73	0.00
202A-S(1)	CB 202 A-1 & 2	97.27	97.82	97.62	97.56	0.29	97.61	0.34	97.37	0.10	97.00	0.00
204A-S(1)	CB 204 A-1 & 2	97.39	98.01	97.74	97.64	0.25	97.73	0.34	97.49	0.10	97.22	0.00
204BS(1)	CB 204 B-1 & 2	97.35	97.92	97.70	97.57	0.22	97.66	0.31	97.41	0.06	96.87	0.00
206A-S(1)	CB 206 A-1 & 2	98.29	98.85	98.64	98.54	0.25	98.58	0.29	98.39	0.10	98.14	0.00
207A-S(1)	CB 207 A-1 & 2	98.68	99.35	99.03	98.99	0.31	99.03	0.35	98.78	0.10	98.14	0.00
209A-S	CB 209 A-1 & 2	99.59	100.23	99.94	99.66	0.07	99.66	0.07	99.62	0.03	98.95	0.00
209B-S	CB 209 B-2	100.03	N/A	100.38	100.07	0.04	100.08	0.05	100.06	0.03	99.91	0.00
210A-S	CB 210 A-1 & 2	97.37	97.94	97.72	97.59	0.22	97.65	0.28	97.42	0.05	96.81	0.00
211A-S(1)	CB 211 A-1 & 2	97.75	98.25	98.10	97.98	0.23	98.02	0.27	97.83	0.08	97.42	0.00
213A-S	CB 213 A-1 & 2	97.82	98.30	98.17	98.03	0.21	98.04	0.22	97.91	0.09	97.69	0.00
214A-S(1)	CB 214 A-1 & 2	97.68	98.35	98.03	97.91	0.23	97.97	0.29	97.75	0.07	97.26	0.00
217A-S	CB 217 A-1 & 2	97.81	98.50	98.16	98.00	0.19	98.05	0.24	97.87	0.06	97.35	0.00
219B-S	CB 219 B-1 & 2	97.98	98.43	98.50	98.31	0.33	98.38	0.40	98.08	0.10	97.63	0.00
225A-S	CB 225 A-1 & 2	99.03	99.57	99.38	99.35	0.32	99.38	0.35	99.14	0.11	98.90	0.00
226A-S	CB 226 A-1 & 2	99.46	99.85	99.81	99.67	0.21	99.70	0.24	99.54	0.08	99.19	0.00
228A-S	CB 228 A-1 & 2	99.99	100.40	100.34	100.22	0.23	100.25	0.26	100.09	0.10	99.87	0.00
229A-S	CB 229 A-1 & 2	100.20	100.62	100.55	100.39	0.19	100.44	0.24	100.25	0.05	99.64	0.00
234A-S	CB 234 A-1 & 2	97.35	97.85	97.70	97.65	0.30	97.68	0.33	97.45	0.10	97.14	0.00
234B-S	CB 234 B-1 & 2	97.30	97.77	97.65	97.57	0.27	97.61	0.31	97.35	0.05	96.87	0.00
237A-S	CB 237 A-1 & 2	97.36	97.85	97.71	97.58	0.22	97.67	0.31	97.41	0.05	96.86	0.00
240A-S	CB 240 A-1 & 2	97.59	98.10	97.94	97.75	0.16	97.76	0.17	97.65	0.06	97.12	0.00
240B-S	CB 240 B-1 & 2	97.40	97.91	97.75	97.64	0.24	97.68	0.28	97.45	0.05	96.87	0.00
241A-S	CB 241 A-1 & 2	97.57	98.11	97.92	97.82	0.25	97.85	0.28	97.67	0.10	97.26	0.00
L212A-S	CB 212 A-1 & 2	96.94	N/A	97.29	96.97	0.03	96.97	0.03	96.11	0.00	95.80	0.00

```
[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:\Users\apaerez\Documents\ana's\1604\KW
RICHCRAFT\PCSWMM\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
;0.58
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
;0.62
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
;0.72
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
;0.69
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
;0.70
L123B           RG1             123B-S          0.740371 71.429   167      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
;0.60
L212A           RG1             L212A-S         0.098006 57.143   44       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
;0.70
UNC-2 RG1 RY218B-S 0.065616 71.429 120 4
0
;0.70
UNC-3 RG1 CREEK 0.071548 71.429 120 4
0
;0.70
UNC-4 RG1 222A-S 0.070173 71.429 120 4
0
;0.80
UNC-5 RG1 229A-S(1) 0.303387 85.714 188 3
0
;0.80
UNC-6 RG1 226A-S(1) 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
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
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
L105A	0.013	0.25	1.57	4.67	0	OUTLET
L106A	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
L123B	0.013	0.25	1.57	4.67	0	PERVIOUS
30						
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
L212A	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-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
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   Param1     Param2     Param3     Param4     Param5
;;-------------- ---------- ---------- ---------- ---------- ----------
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
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
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
L105A	76.2	13.2	4.14	7	0
L106A	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
L123B	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
L212A            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-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
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
```

```
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
102              93.123   4.028      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
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
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
105	94.513	3.442	0	FUNCTIONAL	0	0	1.13	0
105A-S	97.79	0.35	0	FUNCTIONAL	0	0	0	0
105A-S(1)	96.11	1.73	0	FUNCTIONAL	0	0	0	0
106	94.715	2.876	0	FUNCTIONAL	0	0	1.13	0
106A-S	97.88	0.35	0	FUNCTIONAL	0	0	0	0
106A-S(1)	96.27	1.73	0	FUNCTIONAL	0	0	0	0
106A-S(2)	97.71	0.35	0	FUNCTIONAL	0	0	0	0
106B-S	95.14	2.73	0	FUNCTIONAL	0	0	0	0
107	94.308	3.618	0	FUNCTIONAL	0	0	1.13	0
107A-S	97.8	0.35	0	FUNCTIONAL	0	0	0	0
107A-S(1)	96.21	1.73	0	FUNCTIONAL	0	0	0	0
108	94.468	3.313	0	FUNCTIONAL	0	0	1.13	0
109	94.952	2.837	0	FUNCTIONAL	0	0	1.13	0
109A-S	96.2	1.73	0	FUNCTIONAL	0	0	0	0
109A-S(1)	97.79	0.35	0	FUNCTIONAL	0	0	0	0
109B-S	96.21	1.73	0	FUNCTIONAL	0	0	0	0
109B-S(1)	97.87	0.35	0	FUNCTIONAL	0	0	0	0
109B-S(3)	98.01	0.35	0	FUNCTIONAL	0	0	0	0
110	94.688	3.347	0	FUNCTIONAL	0	0	1.13	0
110A-S	96.37	1.73	0	FUNCTIONAL	0	0	0	0
111	94.762	3.23	0	FUNCTIONAL	0	0	1.13	0
112	94.958	2.989	0	FUNCTIONAL	0	0	1.13	0
112A-S	98.09	0.35	0	FUNCTIONAL	0	0	0	0
112A-S(1)	96.4	1.73	0	FUNCTIONAL	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	3.834	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
121A-S(1)	98.05	0.35	0	FUNCTIONAL	0	0	0	0
121A-S(2)	95.98	1.73	0	FUNCTIONAL	0	0	0	0
121B-S	95.85	2.5	0	TABULAR	120AA-S			0
123	94.712	3.472	0	FUNCTIONAL	0	0	1.13	0
123A-S	96.31	1.73	0	FUNCTIONAL	0	0	0	0
123B-S	96	2.5	0	TABULAR	123AA-S			0
124	95.572	3.009	0	FUNCTIONAL	0	0	1.13	0
124A-S	96.55	1.73	0	FUNCTIONAL	0	0	0	0
124A-S(1)	98.1	0.35	0	FUNCTIONAL	0	0	0	0
125	95.696	2.929	0	FUNCTIONAL	0	0	1.13	0
126	96.096	2.971	0	FUNCTIONAL	0	0	1.13	0
126A-S	97.53	1.73	0	FUNCTIONAL	0	0	0	0
126B-S	99.05	0.35	0	FUNCTIONAL	0	0	0	0
126B-S(1)	96.99	1.73	0	FUNCTIONAL	0	0	0	0
126B-S(2)	98.57	0.35	0	FUNCTIONAL	0	0	0	0
126C-S	96.49	3.13	0	FUNCTIONAL	0	0	0	0
127	97.429	2.75	0	FUNCTIONAL	0	0	1.13	0
127A-S	100.62	0.35	0	FUNCTIONAL	0	0	0	0
127A-S(1)	97.77	1.73	0	FUNCTIONAL	0	0	0	0
128	96.445	2.727	0	FUNCTIONAL	0	0	1.13	0
128A-S(1)	97.49	1.73	0	FUNCTIONAL	0	0	0	0
129	96.536	2.837	0	FUNCTIONAL	0	0	1.13	0
130	97.136	3.559	0	FUNCTIONAL	0	0	1.13	0
130A-S	97.94	1.73	0	FUNCTIONAL	0	0	0	0

130A-S(1)	99.39	0.35	0	FUNCTIONAL	0	0	0	0
131	97.308	3.238	0	FUNCTIONAL	0	0	1.13	0
132	97.561	2.636	0	FUNCTIONAL	0	0	1.13	0
201	91.46	6.067	0	FUNCTIONAL	0	0	1.13	0
202	91.578	6.019	0	FUNCTIONAL	0	0	1.13	0
202A-S	97.56	0.35	0	FUNCTIONAL	0	0	0	0
202A-S(1)	95.89	1.73	0	FUNCTIONAL	0	0	0	0
203A-S	97.61	0.35	0	FUNCTIONAL	0	0	0	0
204	92.462	5.127	0	FUNCTIONAL	0	0	1.13	0
204A-S	97.66	0.35	0	FUNCTIONAL	0	0	0	0
204A-S(1)	96.01	1.73	0	FUNCTIONAL	0	0	0	0
204BS(1)	95.97	1.73	0	FUNCTIONAL	0	0	0	0
205	92.775	5.089	0	FUNCTIONAL	0	0	1.13	0
205A-S	97.51	0.35	0	FUNCTIONAL	0	0	0	0
205A-S(1)	96.07	1.73	0	FUNCTIONAL	0	0	0	0
206	92.944	5.687	0	FUNCTIONAL	0	0	1.13	0
206A-S	98.88	0.35	0	FUNCTIONAL	0	0	0	0
206A-S(1)	96.91	1.73	0	FUNCTIONAL	0	0	0	0
206B-S	98.42	0.35	0	FUNCTIONAL	0	0	0	0
206B-S(1)	96.39	1.73	0	FUNCTIONAL	0	0	0	0
206B-Sl	97.95	0.35	0	FUNCTIONAL	0	0	0	0
207	94.242	5.091	0	FUNCTIONAL	0	0	1.13	0
207A-S(1)	97.3	1.73	0	FUNCTIONAL	0	0	0	0
209	94.7	5.408	0	FUNCTIONAL	0	0	1.13	0
209A-S	98.21	1.73	0	FUNCTIONAL	0	0	0	0

209B-S	98.65	1.73	0	FUNCTIONAL	0	0	0	0
209B-S(1)	100.5	0.35	0	FUNCTIONAL	0	0	0	0
210	91.911	6.134	0	FUNCTIONAL	0	0	1.13	0
210A-S	95.99	1.73	0	FUNCTIONAL	0	0	0	0
211	92.241	5.892	0	FUNCTIONAL	0	0	1.13	0
211A-S	98.01	0.35	0	FUNCTIONAL	0	0	0	0
211A-S(1)	96.37	1.73	0	FUNCTIONAL	0	0	0	0
211A-S(2)	98.21	0.35	0	FUNCTIONAL	0	0	0	0
212	92.392	4.608	0	FUNCTIONAL	0	0	1.13	0
213	93	5.11	0	FUNCTIONAL	0	0	1.13	0
213A-S	96.44	1.73	0	FUNCTIONAL	0	0	0	0
214	94.435	3.604	0	FUNCTIONAL	0	0	1.13	0
214A-S	98.02	0.35	0	FUNCTIONAL	0	0	0	0
214A-S(1)	96.3	1.73	0	FUNCTIONAL	0	0	0	0
214A-S(2)	98.26	0.35	0	FUNCTIONAL	0	0	0	0
215	95.023	3.147	0	FUNCTIONAL	0	0	1.13	0
216	95.112	2.961	0	FUNCTIONAL	0	0	1.13	0
217	95.298	2.597	0	FUNCTIONAL	0	0	1.13	0
217A-S	96.43	1.73	0	FUNCTIONAL	0	0	0	0
217A-S(1)	98.11	0.35	0	FUNCTIONAL	0	0	0	0
217A-S(2)	98.11	0.35	0	FUNCTIONAL	0	0	0	0
218	93.672	4.415	0	FUNCTIONAL	0	0	1.13	0
219	93.897	4.051	0	FUNCTIONAL	0	0	1.13	0
219A-S	98.07	0.35	0	FUNCTIONAL	0	0	0	0
219A-S(1)	96.44	1.73	0	FUNCTIONAL	0	0	0	0

219A-S(2)	98.22	0.35	0	FUNCTIONAL	0	0	0	0
219B-S	96.6	1.9	0	FUNCTIONAL	0	0	0	0
219B-S(1)	98.32	0.35	0	FUNCTIONAL	0	0	0	0
220	95.076	2.872	0	FUNCTIONAL	0	0	1.13	0
220A-S	96.36	1.73	0	FUNCTIONAL	0	0	0	0
220A-S(1)	97.87	0.35	0	FUNCTIONAL	0	0	0	0
221	94.48	3.483	0	FUNCTIONAL	0	0	1.13	0
222	94.955	3.408	0	FUNCTIONAL	0	0	1.13	0
222A-S	96.44	1.81	0	FUNCTIONAL	0	0	0	0
222A-S(1)	98.22	0.35	0	FUNCTIONAL	0	0	0	0
222A-S(2)	98.82	0.35	0	FUNCTIONAL	0	0	0	0
223	95.278	3.904	0	FUNCTIONAL	0	0	1.13	0
223A-S	96.79	1.73	0	FUNCTIONAL	0	0	0	0
224	95.35	3.795	0	FUNCTIONAL	0	0	1.13	0
225	95.583	4.042	0	FUNCTIONAL	0	0	1.13	0
225A-S	97.65	1.73	0	FUNCTIONAL	0	0	0	0
225A-S(1)	99.16	0.35	0	FUNCTIONAL	0	0	0	0
226	96.16	4.073	0	FUNCTIONAL	0	0	1.13	0
226A-S	98.08	1.73	0	FUNCTIONAL	0	0	0	0
226A-S(1)	99.63	0.35	0	FUNCTIONAL	0	0	0	0
227	96.277	3.957	0	FUNCTIONAL	0	0	1.13	0
228	96.538	3.893	0	FUNCTIONAL	0	0	1.13	0
228A-S	98.61	1.73	0	FUNCTIONAL	0	0	0	0
228A-S(1)	100.2	0.35	0	FUNCTIONAL	0	0	0	0
229	96.906	3.616	0	FUNCTIONAL	0	0	1.13	0

229A-S	98.82	1.73	0	FUNCTIONAL	0	0	0	0
229A-S(1)	100.42	0.35	0	FUNCTIONAL	0	0	0	0
230	97.117	3.402	0	FUNCTIONAL	0	0	1.13	0
231	97.334	3.034	0	FUNCTIONAL	0	0	1.13	0
232	97.563	2.594	0	FUNCTIONAL	0	0	1.13	0
233	92.392	5.031	0	FUNCTIONAL	0	0	1.13	0
234	92.777	4.754	0	FUNCTIONAL	0	0	1.13	0
234A-S	95.97	1.73	0	FUNCTIONAL	0	0	0	0
234A-S(1)	97.56	0.35	0	FUNCTIONAL	0	0	0	0
234B-S	95.92	1.73	0	FUNCTIONAL	0	0	0	0
234B-S(1)	97.49	0.35	0	FUNCTIONAL	0	0	0	0
235	93.041	4.565	0	FUNCTIONAL	0	0	1.13	0
236	93.293	4.173	0	FUNCTIONAL	0	0	1.13	0
237	93.355	4.097	0	FUNCTIONAL	0	0	1.13	0
237A-S	95.98	1.73	0	FUNCTIONAL	0	0	0	0
237A-S(1)	97.6	0.35	0	FUNCTIONAL	0	0	0	0
238	93.744	3.817	0	FUNCTIONAL	0	0	1.13	0
239	93.818	3.687	0	FUNCTIONAL	0	0	1.13	0
240	94.074	3.651	0	FUNCTIONAL	0	0	1.13	0
240A-S	96.21	1.73	0	FUNCTIONAL	0	0	0	0
240A-S(1)	97.69	0.35	0	FUNCTIONAL	0	0	0	0
240B-S	96.02	1.73	0	FUNCTIONAL	0	0	0	0
240B-S(1)	97.64	0.35	0	FUNCTIONAL	0	0	0	0
241	94.495	3.377	0	FUNCTIONAL	0	0	1.13	0
241A-S	96.19	1.73	0	FUNCTIONAL	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)     95.93   0.39    0       FUNCTIONAL 0       0       0
   0       0
EXT2-S          98.39   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
L212A-S         95.56   1.73    0       FUNCTIONAL 0       0       0
   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
;;-------------- ---------------- ---------------- ---------- ---------- ----------
---------- ---------- ----------
C1              EXT-1A-S(1)      OF3              15.6       0.013      95.93
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
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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)	L212A-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		L212A-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				
C141		123B-S	124A-S	10	0.013	98.15
98	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

[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				
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				
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					
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					
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				
L212A-IC1	L212A-S	212	SIDE	95.56	0.572
NO	0				
L212A-IC2	L212A-S	212	SIDE	95.56	0.572
NO	0				
L213A-IC(1)	213A-S	213	SIDE	96.44	0.572
NO	0				
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				

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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
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
L123B-IC         123B-S           123              96         TABULAR/HEAD
L123BIC                     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
;;-------------- ------------ ---------------- ---------- ---------- ----------
---------- ----------
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	Block88&149	0	0	0	1
C141	IRREGULAR	18mROW	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	Block88&149	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	0.102	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
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
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
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
L212A-IC1	CIRCULAR	0.083	0	0	0
L212A-IC2	CIRCULAR	0.083	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

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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
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 0.025    0.025    0.013
X1 Block88&149       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
;
NC 0.25     0.25     0.25
X1 RYswale           3        0        2        0.0      0.0      0.0      0.0
0.0
GR 0.3      0        0        1        0.3      2

[LOSSES]
;;Link           Kentry     Kexit      Kavg       Flap Gate  Seepage
;;-------------- ---------- ---------- ---------- ---------- ----------
C152             0          0.64       0          NO         0
C154             0          0.39       0          NO         0
C156             0          0.06       0          NO         0
C158             0          1.32       0          NO         0
C159             0          0.64       0          NO         0
C161             0          0.02       0          NO         0
C169             0          0.06       0          NO         0
C170             0          1.32       0          NO         0
C171             0          0.06       0          NO         0
C172             0          1.32       0          NO         0
C177             0          1.32       0          NO         0
C178             0          0.21       0          NO         0
C179             0          1.32       0          NO         0
C182             0          1.32       0          NO         0
C183             0          1.32       0          NO         0
F101A-IC         0          1.32       0          NO         0
Pipe_-_(234)     0          1.32       0          NO         0
Pipe_-_(234)_(1) 0          0.06       0          NO         0
Pipe_-_(235)     0          0.06       0          NO         0
Pipe_-_(238)     0          0.06       0          NO         0
Pipe_-_(240)     0          0.06       0          NO         0
Pipe_-_(241)_(1) 0          0.14       0          NO         0
Pipe_-_(245)     0          1.32       0          NO         0
Pipe_-_(253)     0          0.06       0          NO         0
Pipe_-_(263)     0          0.06       0          NO         0
Pipe_-_(264)     0          0.06       0          NO         0
Pipe_-_(267)     0          0.06       0          NO         0
Pipe_-_(329)     0          0.39       0          NO         0
Pipe_-_(330)     0          0.39       0          NO         0
Pipe_-_(331)     0          0.06       0          NO         0
Pipe_-_(332)     0          0.39       0          NO         0
Pipe_-_(333)     0          0.39       0          NO         0
Pipe_-_(334)     0          1.32       0          NO         0
```

```
Pipe_-_(335)     0          0.14       0          NO         0
Pipe_-_(337)     0          1.32       0          NO         0
Pipe_-_(338)     0          0.06       0          NO         0
Pipe_-_(344)     0          0.06       0          NO         0
Pipe_-_(345)     0          0.06       0          NO         0
Pipe_-_(346)     0          0.06       0          NO         0
Pipe_-_(347)     0          1.32       0          NO         0
Pipe_-_(349)     0          0.14       0          NO         0
Pipe_-_(350)     0          0.06       0          NO         0
Pipe_-_(351)     0          0.06       0          NO         0
Pipe_-_(352)     0          0.06       0          NO         0
Pipe_-_(354)     0          0.06       0          NO         0
Pipe_-_(360)     0          0.06       0          NO         0
Pipe_-_(366)     0          1.32       0          NO         0
Pipe_-_(367)     0          0.06       0          NO         0
Pipe_-_(368)     0          0.06       0          NO         0
Pipe_-_(4)       0          1.32       0          NO         0
Pipe_-_(43)      0          1.32       0          NO         0
Pipe_-_(44)      0          0.06       0          NO         0
Pipe_-_(45)      0          0.06       0          NO         0
Pipe_-_(47)      0          1.32       0          NO         0
Pipe_-_(48)      0          0.06       0          NO         0
Pipe_-_(49)      0          1.32       0          NO         0
Pipe_-_(5)       0          0.39       0          NO         0
Pipe_-_(50)      0          1.32       0          NO         0
Pipe_-_(51)      0          0.64       0          NO         0
Pipe_-_(52)      0          0.64       0          NO         0
Pipe_-_(52)_(1)  0          0.06       0          NO         0
Pipe_-_(53)      0          0.64       0          NO         0
Pipe_-_(54)      0          0.39       0          NO         0
Pipe_-_(54)_(1)  0          0.06       0          NO         0
Pipe_-_(55)      0          0.64       0          NO         0
Pipe_-_(56)      0          0.64       0          NO         0
Pipe_-_(57)      0          0.14       0          NO         0
Pipe_-_(58)      0          1.32       0          NO         0
Pipe_-_(58)_(1)  0          0.06       0          NO         0
Pipe_-_(59)      0          0.39       0          NO         0
Pipe_-_(6)       0          0.64       0          NO         0
Pipe_-_(60)      0          0.64       0          NO         0
Pipe_-_(73)      0          1.32       0          NO         0
Pipe_-_(77)      0          0.06       0          NO         0
Pipe_-_(81)      0          0.64       0          NO         0
Pipe_-_(82)      0          0.39       0          NO         0
Pipe_-_(83)      0          0.39       0          NO         0
Pipe_-_(84)      0          0.39       0          NO         0
Pipe_-_(85)      0          0.64       0          NO         0
Pipe_-_(86)      0          0.64       0          NO         0
Pipe_-_(87)      0          0.06       0          NO         0

[INFLOWS]
```

```
;;Node           Constituent      Time Series      Type     Mfactor  Sfactor
Baseline Pattern
;;-------------- ---------------- ---------------- -------- -------- --------
-------- --------
209              FLOW             Fairwinds_100CHI_mod FLOW     1.0      1        0

212              FLOW             Trinity_100CHI   FLOW     1.0      1        0


[CURVES]
;;Name           Type       X-Value    Y-Value
;;-------------- ---------- ---------- ----------
B1               Rating     0          0
B1                          1.8        114
B1                          2.15       116
B1                          2.5        116

B2               Rating     0          0
B2                          1.8        195
B2                          2.15       199
B2                          2.5        199

C115AIC          Rating     0          0
C115AIC                     1.8        117
C115AIC                     2.15       118

C116AIC          Rating     0          0
C116AIC                     1.8        52
C116AIC                     2.15       54

C117AIC          Rating     0          0
C117AIC                     1.8        99
C117AIC                     2.15       99

C118AIC          Rating     0          0
C118AIC                     1.8        91
C118AIC                     2.15       91

C203AIC          Rating     0          0
C203AIC                     1.8        41
C203AIC                     2.15       41

C203CIC          Rating     0          0
C203CIC                     1.8        222
C203CIC                     2.15       223

C204AIC          Rating     0          0
C204AIC                     1.8        88
C204AIC                     2.15       88
```

C205AIC	Rating	0	0
C205AIC		1.8	99
C205AIC		2.15	99
C206AIC	Rating	0	0
C206AIC		1.8	66
C206AIC		2.15	66
C206B-IC	Rating	0	0
C206B-IC		1.8	366
C206B-IC		2.15	366
C207BIC	Rating	0	0
C207BIC		1.8	43
C207BIC		2.15	43
C212A-IC	Rating	0	0
C212A-IC		1.8	27
C212A-IC		2.15	28
CommE	Rating	0	0
CommE		1.8	397
CommE		2.15	399
CommE		2.5	399
Commercial	Rating	0	0
Commercial		1.8	297
Commercial		2.1	297
F101	Rating	0	0
F101		1.38	178
F101		1.73	182
F101		1.78	182
G233AAIC	Rating	0	0
G233AAIC		1.38	0.5
G233AAIC		1.73	0.6
G233AAIC		1.78	0.6
Hazeldean	Rating	0	0
Hazeldean		1.8	1164
Hazeldean		2.15	1187
Hazeldean		2.5	1187
L102AIC	Rating	0	0
L102AIC		1.8	33
L102AIC		2.15	34
L103AIC	Rating	0	0

L103AIC		1.8	39
L103AIC		2.15	40
L103BIC	Rating	0	0
L103BIC		1.8	60
L103BIC		2.15	62
L103CIC	Rating	0	0
L103CIC		1.8	37
L103CIC		2.4	37
L103DIC	Rating	0	0
L103DIC		1.8	44
L103DIC		2.4	44
L104A-IC	Rating	0	0
L104A-IC		1.8	128
L104A-IC		2.15	130
L106AIC	Rating	0	0
L106AIC		1.8	45
L106AIC		2.15	47
L107AIC	Rating	0	0
L107AIC		1.8	63
L107AIC		2.15	64
L107B-IC	Rating	0	0
L107B-IC		1.8	53
L107B-IC		2.4	53
L108AIC	Rating	0	0
L108AIC		1.8	43
L108AIC		2.15	45
L109BIC	Rating	0	0
L109BIC		1.8	58
L109BIC		2.15	60
L111AIC	Rating	0	0
L111AIC		1.8	35
L111AIC		2.15	37
L111BIC	Rating	0	0
L111BIC		1.8	47
L111BIC		2.15	49
L114AIC	Rating	0	0
L114AIC		1.8	48
L114AIC		2.15	50

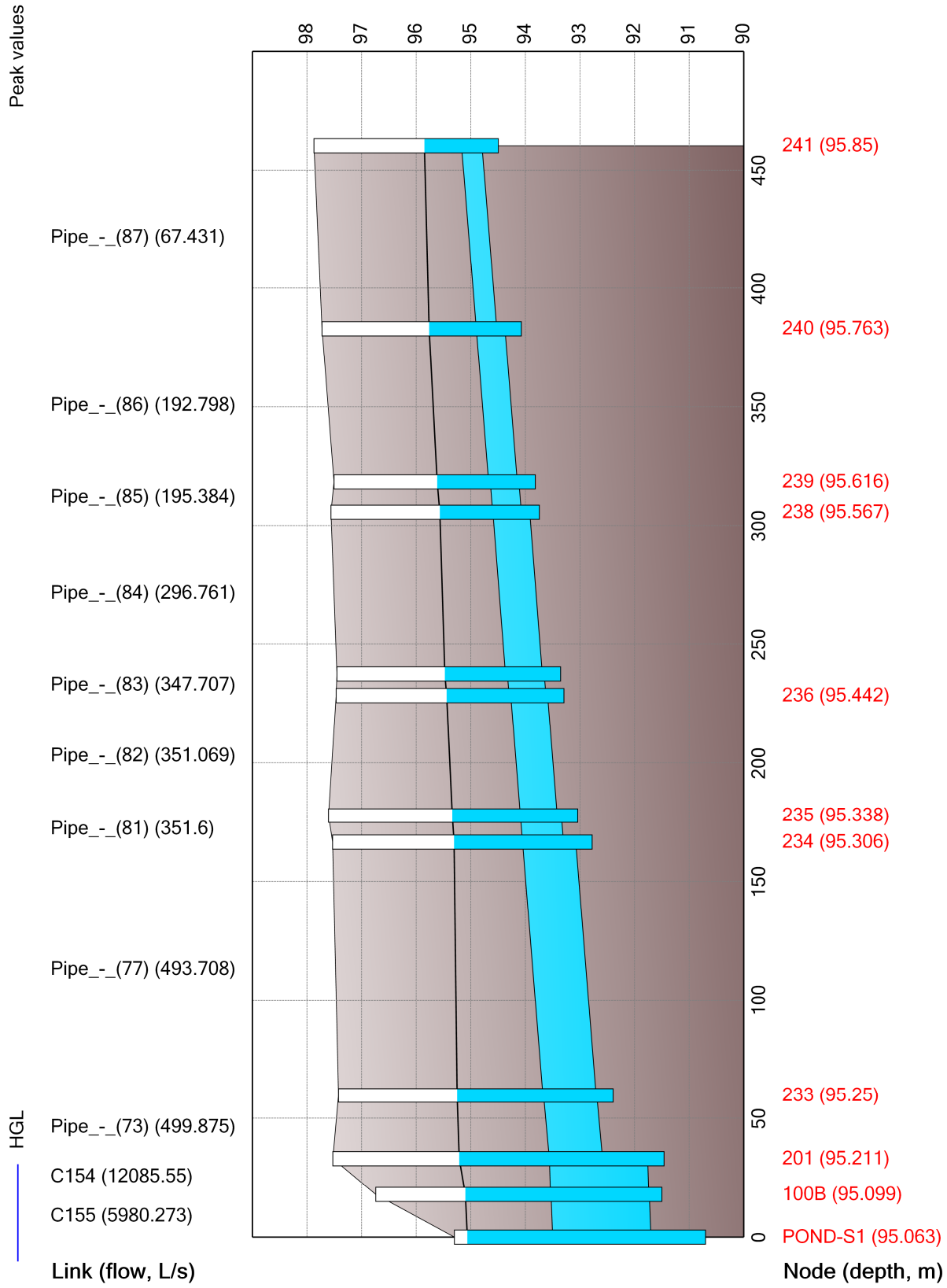
L120AAIC	Rating	0	0
L120AAIC		1.8	293
L120AAIC		2.15	299
L120AAIC		2.5	299
L120AIC	Rating	0	0
L120AIC		1.8	79
L120AIC		2.15	80
L121AIC	Rating	0	0
L121AIC		1.8	74
L121AIC		2.15	76
L121BIC	Rating	0	0
L121BIC		1.8	293
L121BIC		2.1	299
L121BIC		2.5	299
L122AIC	Rating	0	0
L122AIC		1.8	23
L122AIC		2.15	24
L123BIC	Rating	0	0
L123BIC		1.8	109
L123BIC		2.15	111
L123BIC		2.5	111
L124AIC	Rating	0	0
L124AIC		1.8	99
L124AIC		2.15	101
L125AIC	Rating	0	0
L125AIC		1.8	59
L125AIC		2.15	61
L128AIC	Rating	0	0
L128AIC		1.8	71
L128AIC		2.15	73
L130AIC	Rating	0	0
L130AIC		1.8	29
L130AIC		2.15	30
L202BIC	Rating	0	0
L202BIC		1.8	328
L202BIC		2.15	330
L203BIC	Rating	0	0
L203BIC		1.8	77

L203BIC		2.4	80
L203DIC	Rating	0	0
L203DIC		1.8	402
L203DIC		2.15	404
L207AIC	Rating	0	0
L207AIC		1.8	49
L207AIC		2.15	50
L208AIC	Rating	0	0
L208AIC		1.8	32
L208AIC		2.15	33
L208BIC	Rating	0	0
L208BIC		1.8	50
L208BIC		2.15	52
L209AIC	Rating	0	0
L209AIC		1.8	48
L209AIC		2.15	50
L209BIC	Rating	0	0
L209BIC		1.8	388
L209BIC		2.15	388
L218AAIC	Rating	0	0
L218AAIC		1.8	434
L218AAIC		2.15	443
L218AAIC		2.5	443
L225BIC	Rating	0	0
L225BIC		1.8	470
L225BIC		2.15	517
L225BIC		2.5	517
School	Rating	0	0
School		1.8	663
School		2.1	663
Transit	Rating	0	0
Transit		1.8	934
Transit		2.15	953
Transit		2.5	953
116A-STORE	Storage	0	0
116A-STORE		1.8	0
116A-STORE		2.15	652
116A-STORE		2.5	652

116B-comm	Storage	0	0
116B-comm		1.8	0
116B-comm		2.15	1200
116B-comm		2.5	1200
120AA-S	Storage	0	0
120AA-S		1.8	0
120AA-S		2.15	1500
120AA-S		2.5	1500
123AA-S	Storage	0	0
123AA-S		1.8	0
123AA-S		2.15	150
123AA-S		2.5	150
224AA-S	Storage	0	0
224AA-S		1.8	0
224AA-S		2.15	405
224AA-S		2.5	405
B1-S	Storage	0	0
B1-S		1.8	0
B1-S		2.15	980
B1-S		2.5	980
B2-S	Storage	0	0
B2-S		1.8	0
B2-S		2.15	122
B2-S		2.5	122
Hazeldean-s	Storage	0	0
Hazeldean-s		1.8	0
Hazeldean-s		2.15	493
Hazeldean-s		2.5	493
INST	Storage	0	0
INST		1.8	0.1
INST		2.15	790
INST		2.5	790
L206C-S	Storage	0	0
L206C-S		1.8	0
L206C-S		2.15	1000
L206C-S		2.5	1000
PondStorageULT	Storage	0	2073
PondStorageULT		0.8	3245
PondStorageULT		1.3	4392
PondStorageULT		1.9	5567

PondStorageULT		2.14	6038
PondStorageULT		2.44	6627
PondStorageULT		2.74	10231
PondStorageULT		2.9	10988
PondStorageULT		3.15	12170
PondStorageULT		3.34	12768
PondStorageULT		3.5	13082
PondStorageULT		3.9	13871
PondStorageULT		4.3	14642
PondStorageULT		4.6	14642
StorCommE	Storage	0	0
StorCommE		1.8	0
StorCommE		2.15	2000
StorCommE		2.5	2000
transit-S	Storage	0	0
transit-S		1.8	0
transit-S		2.15	462
transit-S		2.5	462
TW	Storage	0	0
TW		1.8	0
TW		2.1	800

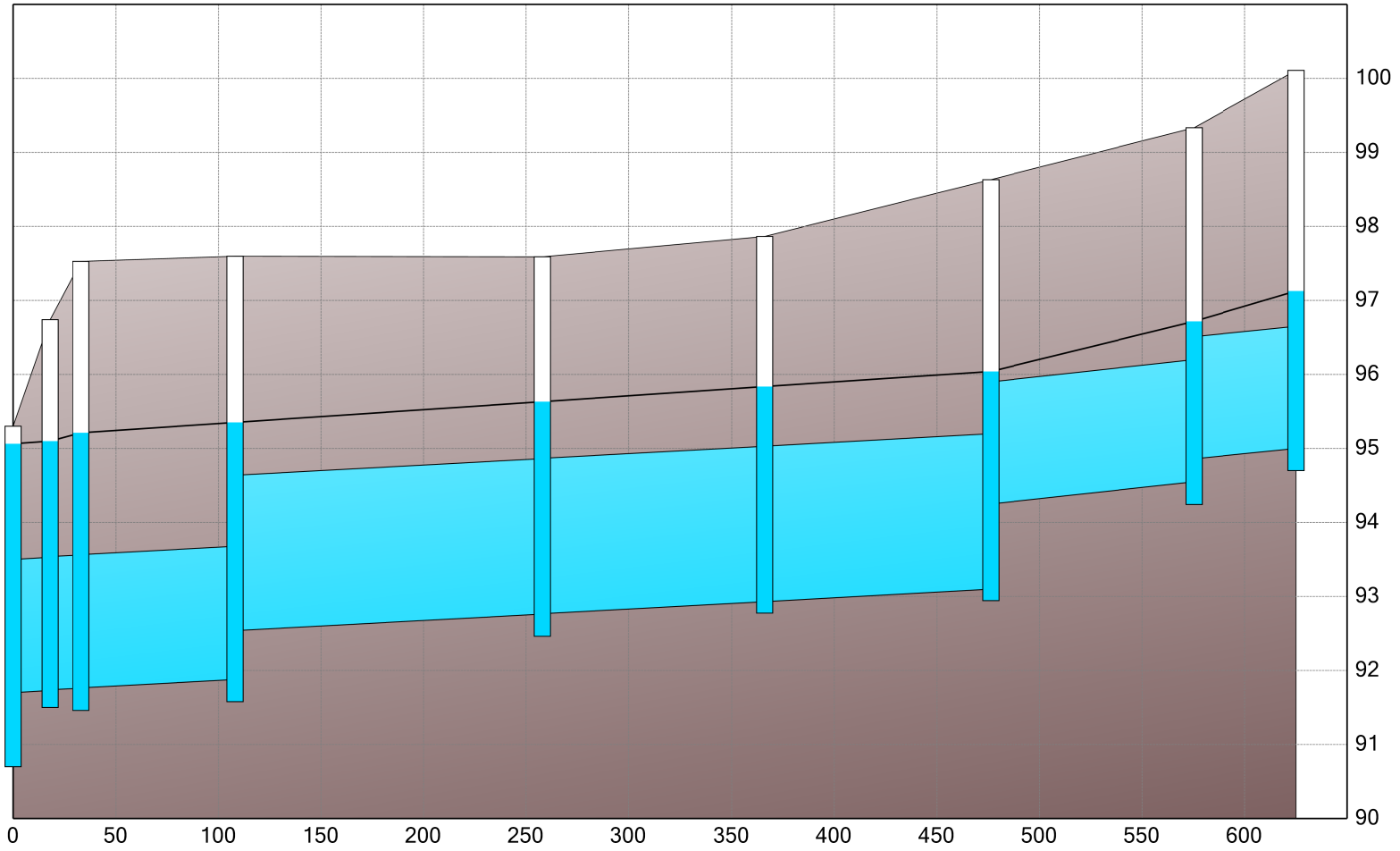
B.4 PCSWMM – 100-YEAR HGL PROFILES


Peak values
98
97
96
95
94
93
92
91
90
450
400
350
300
250
200
150
100
50
0
241 (95.85)
240 (95.763)
239 (95.616)
238 (95.567)
236 (95.442)
235 (95.338)
234 (95.306)
233 (95.25)
201 (95.211)
100B (95.099)
POND-S1 (95.063)
Pipe_-_(87) (67.431)
Pipe_-_(86) (192.798)
Pipe_-_(85) (195.384)
Pipe_-_(84) (296.761)
Pipe_-_(83) (347.707)
Pipe_-_(82) (351.069)
Pipe_-_(81) (351.6)
Pipe_-_(77) (493.708)
Pipe_-_(73) (499.875)
C154 (12085.55)
C155 (5980.273)
HGL
Link (flow, L/s)
Node (depth, m)

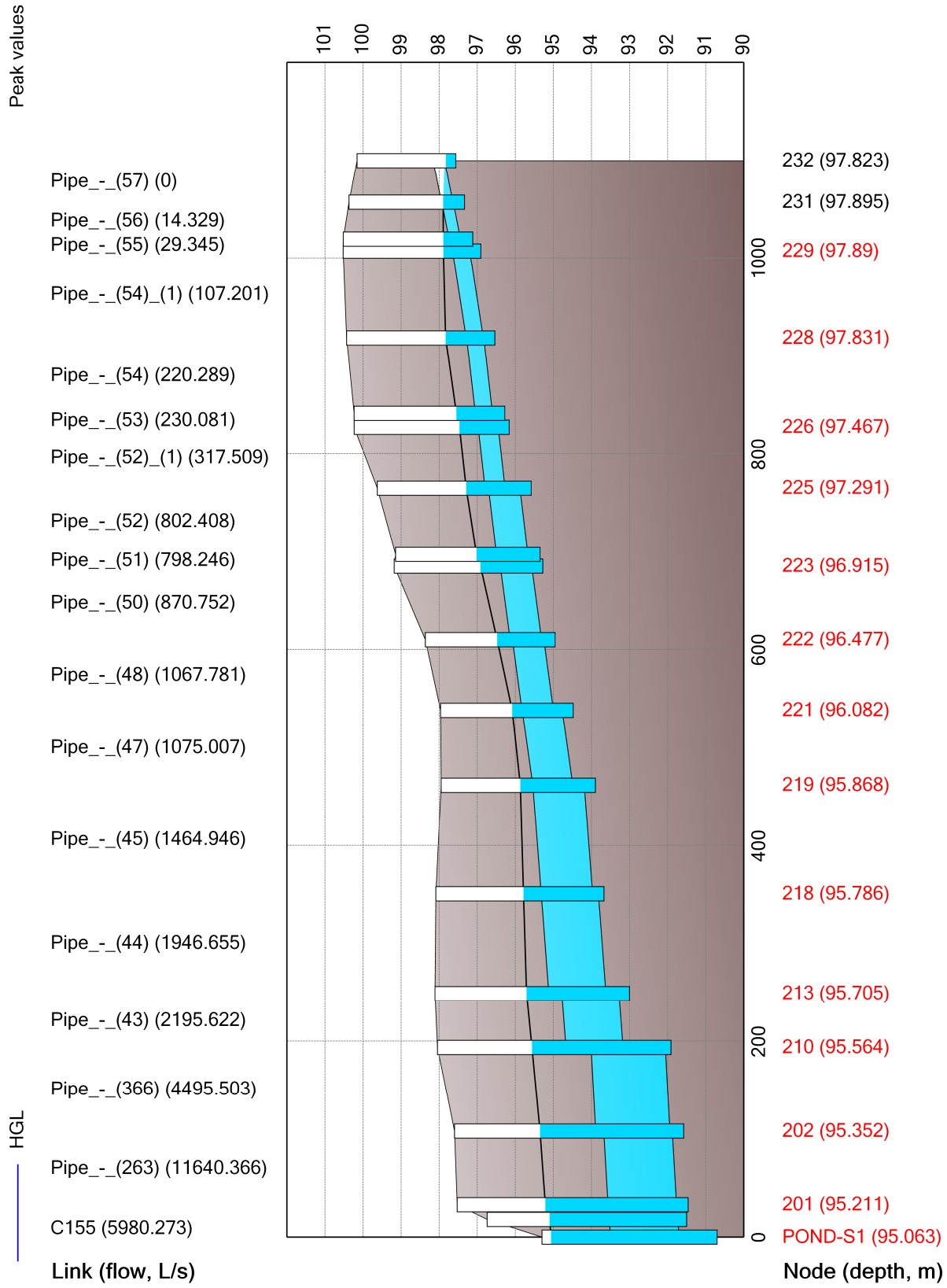
HGL

Peak values

Links:	C155	C154	Pipe_-_(263)	Pipe_-_(264)	Pipe_-_(267)	Pipe_-_(238)	Pipe_-_(240)	Pipe_-_(241)_(1)
Q:	5980.273 L/s	12085.55 L/s	11640.366 L/s	7831.45 L/s	7720.596 L/s	7620.3 L/s	7552.789 L/s	7458.026 L/s



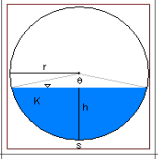
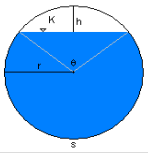
Nodes:	Storage POND-S1	Storage 100B	Storage 201	Storage 202	Storage 204	Storage 205	Storage 206	Storage 207	Storage 209
H:	95.06306 m	95.09899 m	95.21146 m	95.35162 m	95.63173 m	95.83637 m	96.03945 m	96.71702 m	97.12696 m


Peak values
101
100
99
98
97
96
95
94
93
92
91
90
Pipe_-_(57) (0)
Pipe_-_(56) (14.329)
Pipe_-_(55) (29.345)
Pipe_-_(54)_(1) (107.201)
Pipe_-_(54) (220.289)
Pipe_-_(53) (230.081)
Pipe_-_(52)_(1) (317.509)
Pipe_-_(52) (802.408)
Pipe_-_(51) (798.246)
Pipe_-_(50) (870.752)
Pipe_-_(48) (1067.781)
Pipe_-_(47) (1075.007)
Pipe_-_(45) (1464.946)
Pipe_-_(44) (1946.655)
Pipe_-_(43) (2195.622)
Pipe_-_(366) (4495.503)
Pipe_-_(263) (11640.366)
C155 (5980.273)
HGL
Link (flow, L/s)
232 (97.823)
231 (97.895)
229 (97.89)
228 (97.831)
226 (97.467)
225 (97.291)
223 (96.915)
222 (96.477)
221 (96.082)
219 (95.868)
218 (95.786)
213 (95.705)
210 (95.564)
202 (95.352)
201 (95.211)
POND-S1 (95.063)
1000
800
600
400
200
0
Node (depth, m)

B.5 SEDIMENT ACCUMULATION HGL PARAMETERS

Ultimate Kanata West SWM Pond 5 - Sediment Accumulation in Storm Sewer Pipes Submerged by Permanent Pool

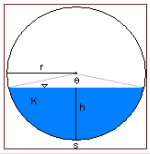
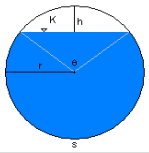
Permanent Pool Elevation = 93.44 m

step	solve for	*if flow depth < radius*	*if flow depth ≥ radius*
			
1	circular segment height	$h = d$	$h = 2r - d$
2	central angle	$\theta = 2\arccos\left(\frac{r-h}{r}\right)$	$\theta = 2\arccos\left(\frac{r-h}{r}\right)$
3	circular segment area	$K = \frac{r^2(\theta - \sin\theta)}{2}$	$K = \frac{r^2(\theta - \sin\theta)}{2}$

Name	Upstream Node Name	Downstream Node Name	Diameter (Height) (m)	Upstream Invert Elevation	Downstream Invert Elevation	Pipe Area (m^2)	Submerged Depth (m) [1]	Central Angle [2]	Submerged Area (m^2) [3]	Pipe Area - 25% Submerged Area (m^2)	Reduced Diameter (m)	PipeLength (m)	Length of Submerged Pipe (m)
Pipe_-_(87)	241	240	0.375	94.80	94.52	0.110	0.00	0.000	0.000	N/A	N/A	77.25	0.00
Pipe_-_(86)	240	239	0.525	94.37	94.15	0.216	0.00	0.000	0.000	N/A	N/A	64.55	0.00
Pipe_-_(85)	239	238	0.525	94.12	94.07	0.216	0.00	0.000	0.000	N/A	N/A	12.78	0.00
Pipe_-_(84)	238	237	0.675	93.92	93.69	0.358	0.00	0.000	0.000	N/A	N/A	68.12	0.00
Pipe_-_(83)	237	236	0.675	93.66	93.62	0.358	0.00	0.000	0.000	N/A	N/A	9.07	0.00
Pipe_-_(82)	236	235	0.675	93.59	93.42	0.358	-0.06	-	-	N/A	N/A	50.68	0.00
Pipe_-_(81)	235	234	0.750	93.34	93.30	0.442	0.12	1.635	0.045	0.431	0.740	11.24	11.24
Pipe_-_(77)	234	233	0.975	93.08	92.70	0.747	0.55	2.884	0.434	0.638	0.901	106.86	106.86
Pipe_-_(73)	233	201	0.975	92.69	92.59	0.747	0.80	1.745	0.656	0.583	0.861	26.63	26.63
Pipe_-_(60)	217	216	0.375	95.46	95.31	0.110	0.00	0.000	0.000	N/A	N/A	31.25	0.00
Pipe_-_(6)	112	111	0.450	95.23	95.06	0.159	0.00	0.000	0.000	N/A	N/A	41.88	0.00
Pipe_-_(59)	216	215	0.375	95.28	95.22	0.110	0.00	0.000	0.000	N/A	N/A	11.87	0.00
Pipe_-_(58)_(1)	215	214	0.375	95.19	94.90	0.110	0.00	0.000	0.000	N/A	N/A	57.47	0.00
Pipe_-_(58)	214	213	0.600	94.67	94.45	0.283	0.00	0.000	0.000	N/A	N/A	70.63	0.00
Pipe_-_(57)	232	231	0.300	97.80	97.58	0.071	0.00	0.000	0.000	N/A	N/A	42.78	0.00
Pipe_-_(56)	231	230	0.300	97.57	97.38	0.071	0.00	0.000	0.000	N/A	N/A	37.41	0.00
Pipe_-_(55)	230	229	0.300	97.35	97.29	0.071	0.00	0.000	0.000	N/A	N/A	12.11	0.00
Pipe_-_(54)_(1)	229	228	0.450	97.14	96.78	0.159	0.00	0.000	0.000	N/A	N/A	88.92	0.00
Pipe_-_(54)	228	227	0.450	96.77	96.54	0.159	0.00	0.000	0.000	N/A	N/A	77.16	0.00
Pipe_-_(53)	227	226	0.450	96.51	96.47	0.159	0.00	0.000	0.000	N/A	N/A	14.08	0.00
Pipe_-_(52)_(1)	226	225	0.525	96.39	96.21	0.216	0.00	0.000	0.000	N/A	N/A	62.21	0.00
Pipe_-_(52)	225	224	0.825	95.82	95.61	0.535	0.00	0.000	0.000	N/A	N/A	67.70	0.00
Pipe_-_(51)	224	223	0.825	95.58	95.54	0.535	0.00	0.000	0.000	N/A	N/A	11.94	0.00
Pipe_-_(50)	223	222	0.825	95.51	95.25	0.535	0.00	0.000	0.000	N/A	N/A	75.28	0.00
Pipe_-_(5)	111	110	0.450	95.03	94.99	0.159	0.00	0.000	0.000	N/A	N/A	11.16	0.00
Pipe_-_(49)	220	219	0.750	95.09	94.73	0.442	0.00	0.000	0.000	N/A	N/A	71.80	0.00
Pipe_-_(48)	222	221	0.825	95.21	94.96	0.535	0.00	0.000	0.000	N/A	N/A	71.45	0.00
Pipe_-_(47)	221	219	1.050	94.74	94.46	0.866	0.00	0.000	0.000	N/A	N/A	76.77	0.00
Pipe_-_(45)	219	218	1.350	94.13	93.91	1.431	0.00	0.000	0.000	N/A	N/A	110.65	0.00
Pipe_-_(44)	218	213	1.500	93.76	93.56	1.767	0.00	0.000	0.000	N/A	N/A	102.12	0.00
Pipe_-_(43)	213	210	1.500	93.22	93.11	1.767	0.28	1.770	0.222	1.712	1.476	55.35	55.35
Pipe_-_(4)	110	107	0.525	94.91	94.76	0.216	0.00	0.000	0.000	N/A	N/A	44.39	0.00
Pipe_-_(368)	212	211	1.650	92.63	92.48	2.138	0.88	2.996	1.168	1.846	1.533	97.80	97.80
Pipe_-_(367)	211	210	1.800	92.33	92.15	2.545	1.20	2.462	1.802	2.094	1.633	115.94	115.94
Pipe_-_(366)	210	202	1.950	92.00	91.88	2.986	1.50	2.004	2.465	2.370	1.737	85.51	85.51
Pipe_-_(360)	118	117	0.375	95.25	95.01	0.110	0.00	0.000	0.000	N/A	N/A	96.76	0.00
Pipe_-_(354)	104	103	0.825	94.36	94.21	0.535	0.00	0.000	0.000	N/A	N/A	99.77	0.00
Pipe_-_(352)	124	123	0.600	95.87	95.59	0.283	0.00	0.000	0.000	N/A	N/A	71.39	0.00
Pipe_-_(351)	123	121	0.675	95.01	94.89	0.358	0.00	0.000	0.000	N/A	N/A	51.30	0.00
Pipe_-_(350)	121	119	1.200	94.00	93.83	1.131	0.00	0.000	0.000	N/A	N/A	113.17	0.00
Pipe_-_(349)	119	101	1.200	93.83	93.65	1.131	0.00	0.000	0.000	N/A	N/A	115.05	0.00
Pipe_-_(347)	102	101	1.500	93.42	93.34	1.767	0.06	0.781	0.022	1.762	1.498	79.78	79.78

Ultimate Kanata West SWM Pond 5 - Sediment Accumulation in Storm Sewer Pipes Submerged by Permanent Pool

Permanent Pool Elevation = 93.44 m

step	solve for	*if flow depth < radius*	*if flow depth ≥ radius*
			
1	circular segment height	$h = d$	$h = 2r - d$
2	central angle	$\theta = 2\arccos\left(\frac{r-h}{r}\right)$	$\theta = 2\arccos\left(\frac{r-h}{r}\right)$
3	circular segment area	$K = \frac{r^2(\theta - \sin\theta)}{2}$	$K = \frac{r^2(\theta - \sin\theta)}{2}$

Name	Upstream Node Name	Downstream Node Name	Diameter (Height) (m)	Upstream Invert Elevation	Downstream Invert Elevation	Pipe Area (m^2)	Submerged Depth (m) [1]	Central Angle [2]	Submerged Area (m^2) [3]	Pipe Area - 25% Submerged Area (m^2)	Reduced Diameter (m)	PipeLength (m)	Length of Submerged Pipe (m)
Pipe_-_(346)	114	102	0.750	94.23	94.17	0.442	0.00	0.000	0.000	N/A	N/A	28.24	0.00
Pipe_-_(345)	115	114	0.675	94.41	94.31	0.358	0.00	0.000	0.000	N/A	N/A	54.69	0.00
Pipe_-_(344)	116	115	0.300	95.12	94.79	0.071	0.00	0.000	0.000	N/A	N/A	65.71	0.00
Pipe_-_(338)	106	105	0.450	95.02	94.89	0.159	0.00	0.000	0.000	N/A	N/A	63.49	0.00
Pipe_-_(337)	105	104	0.525	94.82	94.66	0.216	0.00	0.000	0.000	N/A	N/A	79.38	0.00
Pipe_-_(335)	132	131	0.300	97.86	97.63	0.071	0.00	0.000	0.000	N/A	N/A	35.88	0.00
Pipe_-_(334)	131	130	0.300	97.61	97.51	0.071	0.00	0.000	0.000	N/A	N/A	19.45	0.00
Pipe_-_(333)	130	129	0.375	97.44	96.87	0.110	0.00	0.000	0.000	N/A	N/A	113.92	0.00
Pipe_-_(332)	129	128	0.375	96.84	96.78	0.110	0.00	0.000	0.000	N/A	N/A	12.26	0.00
Pipe_-_(331)	128	126	0.450	96.67	96.47	0.159	0.00	0.000	0.000	N/A	N/A	39.46	0.00
Pipe_-_(330)	126	125	0.525	96.40	96.03	0.216	0.00	0.000	0.000	N/A	N/A	92.46	0.00
Pipe_-_(329)	125	124	0.525	96.00	95.95	0.216	0.00	0.000	0.000	N/A	N/A	12.19	0.00
Pipe_-_(267)	205	204	2.100	92.93	92.77	3.464	0.59	2.239	0.801	3.263	2.038	108.14	108.14
Pipe_-_(264)	204	202	2.100	92.76	92.54	3.464	0.79	2.641	1.191	3.166	2.008	149.90	149.90
Pipe_-_(263)	202	201	1.800	91.88	91.77	2.545	1.62	1.293	2.411	1.942	1.572	74.95	74.95
Pipe_-_(253)	113	112	0.450	95.57	95.24	0.159	0.00	0.000	0.000	N/A	N/A	84.21	0.00
Pipe_-_(245)	127	126	0.300	97.73	96.62	0.071	0.00	0.000	0.000	N/A	N/A	110.84	0.00
Pipe_-_(241)_(1)	209	207	1.650	95.00	94.85	2.138	0.00	0.000	0.000	N/A	N/A	49.67	0.00
Pipe_-_(240)	207	206	1.650	94.55	94.25	2.138	0.00	0.000	0.000	N/A	N/A	99.16	0.00
Pipe_-_(238)	206	205	2.100	93.10	92.93	3.464	0.43	1.868	0.502	3.338	2.062	109.96	109.96
Pipe_-_(235)	107	104	0.300	95.59	95.38	0.071	0.00	0.000	0.000	N/A	N/A	51.75	0.00
Pipe_-_(234)_(1)	109	108	0.600	95.19	94.78	0.283	0.00	0.000	0.000	N/A	N/A	116.82	0.00
Pipe_-_(234)	108	107	0.600	94.77	94.68	0.283	0.00	0.000	0.000	N/A	N/A	18.95	0.00
F101A-IC	F101A-S	101	0.600	93.43	93.35	0.283	0.05	1.171	0.011	0.280	0.597	16.30	16.30
C173	HW7	POND-S1	0.900	93.66	93.45	0.636	0.00	0.000	0.000	N/A	N/A	18.10	0.00
C159	100D	100E	1.350	94.04	93.89	1.431	0.00	0.000	0.000	N/A	N/A	15.27	0.00
C158	101	100D	1.500	93.28	93.26	1.767	0.17	1.373	0.110	1.740	1.488	15.70	15.70
C157	100A	POND-S1	2.400	91.79	91.76	4.524	1.66	2.346	3.349	3.687	2.167	28.10	28.10
C155	100B	POND-S1	1.800	91.73	91.70	2.545	1.72	0.822	2.508	1.918	1.563	18.00	18.00
C154	201	100B	1.800	91.76	91.74	2.545	1.69	0.999	2.481	1.925	1.565	15.00	15.00
C156	100B	100A	2.400	92.93	92.88	4.524	0.53	1.967	0.752	4.336	2.350	49.8	49.8
													1165.0

B.6 INFILTRATION CALCULATIONS

Project No. 160401393
Richcraft Kanata West Subdivision Infiltration Calculations

Required Infiltration Rate	50	mm/yr		
Proposed Site Area	36.53	ha	63.9%	Imperviousness
Pre-Development Infiltration	18265	m^3/yr		
25% Infiltration Augmentation (KWMSS)	**22831**	**m^3/yr**	**Target Infiltration for Overall Site**	

Proposed Condition Infiltration Calculation Breakdown

Proposed Land Use	Total Area	%IMP	%BMP (Amended Soil)	Imp. Area (ha)	Lawns (w/BMP) (ha)	Lawns (w/o BMP) (ha)	SWMF
School Blocks	2.95	71.4	0	2.11	0.00	0.84	0.00
App. Commercial Blocks	1.47	92.9	0	1.36	0.00	0.11	0.00
Approved Phase Residential Block	0.74	71.4	0	0.53	0.00	0.21	0.00
Prop. Phase Residential Block	3.31	85.7	0	2.84	0.00	0.47	0.00
Approved Rear Yard	2.97	36.4	0	1.08	0.00	1.89	0.00
Prop. Rear Yard	3.91	41.9	100	1.64	2.27	0.00	0.00
ROW / Front Yard Areas	17.19	69.4	0	11.93	0.00	5.26	0.00
SWMF (Pond 5)	2.56	-	-	-	-	-	2.56
Approved Phase Parks	0.46	7.1	0	0.03	0.00	0.43	0.00
Proposed Phase Park	0.97	28.6	100	0.28	0.69	0.00	0.00
Total	**36.53**			**21.80**	**2.96**	**9.21**	**2.56**

Overall Richcraft Kanata West Development

Land Use	Soil Type	Area ha	Area %	Individual Precip. (mm)	ET (mm)	Infil. (mm)	Runoff (mm)	
Meadows	Clay	0.00	0.0%	943	577	50	316	
SWMF	Clay (SWMF)	2.56	7.0%	943	640	0	303	
Lawns (w/ BMP)	Topsoil / Sandy Loam	2.96	8.1%	943	480	290	173	228
Lawns (w/o BMP)	Topsoil / Clay	9.21	25.2%	943	525	50	368	
Impervious	Impervious	21.80	59.7%	943	150	0	793	
Total		**36.53**	**100.0%**					

*Infiltration for native soil assumed as 50mm/year as per KWMSS and detailed geotech recommendations

** Evapotransporation by Land Classess obtained from Carp River Watershed Water Balance Table 3.5.2 (Robinsons, 2004)

Post Development Infiltration in Pervious Areas	13202	m^3/yr	(Based on the pervious areas with the infiltration values shown above)
Post Development Infiltration Needed in Basins	9630	m^3/yr	

Number of Rainfall Events/yr 6mm< x <25mm	31		*based on average precip 2000-2011
Average days between events	9		
Average depth 6mm<x<25mm	12.19	mm	Assume this is the average depth of rainfall that will recharge the infiltration galleries.

Rearyard Bioswale Storage

Roof area feeding rearyard bioswales	23969	m^2	Calculated based on rearyard area C value (i.e., half roofs)
Total Annual depth of rainfall 6mm<x<25mm	374.8	mm	number of events * 12mm
Annual volume of runoff from roofs to Bioswales	8983	m^3/yr	for events with rainfall 6mm< x <25mm
Store up to 25mm event from roof in bioswales			
Total Storage Required (25mm) =	599	m^3	water storage
Total Bioswale Storage Provided (25mm) =	691	m^3	(see detailed calculations for each rearyard bioswale)
Post Development Infiltration to be Provided in the School Block	647	m^3/yr	for events with rainfall 6mm< x <25mm
Below are preliminary infiltration calculations for the school block based on assumptions.			
School Block Area	2.95	ha	
Assumed Roof Area	2950	m^2	(10% of total school block)
Total Annual depth of rainfall 6mm<x<25mm	374.8	mm	number of events * 12mm
Annual volume of runoff from school roof to infiltration LID	1106	m^3/yr	for events with rainfall 6mm< x <25mm

Project No. 160401393

Richcraft Kanata West Subdivision Infiltration Calculations

Bioswales with Storage Volume Calculations Based on Infiltration Trench Design Calculations (Based on section 4.5.8 of MOE 2003 SWM Guidelines)

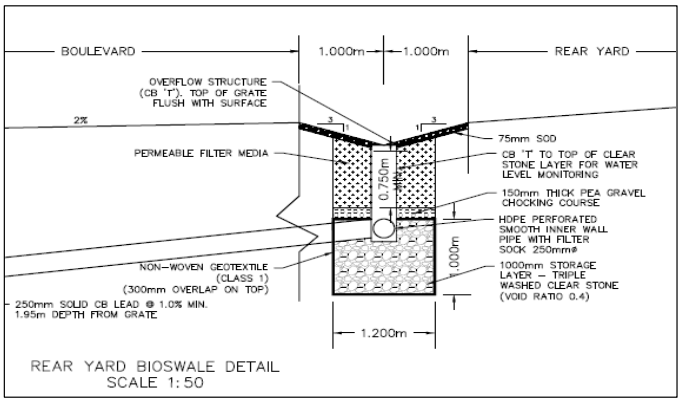
Equation 4.3: Infiltration Trench Bottom Area

$$A = \frac{1{,}000V}{Pn\Delta t}$$

where A = bottom area of the trench (m²)
V = runoff volume to be infiltrated (Table 3.2)
P = percolation rate of surrounding native soil (mm/h)
n = porosity of the storage media (0.4 for clear stone)
Δt = retention time (24 to 48 hours)

Storage Volume (cu.m/ha) for Impervious Level

	35%	55%	70%	85%
Enhanced (80% TSS removal)	25	30	35	40
Normal (70% TSS removal)	20	20	25	30
Basic (60% TSS removal)	20	20	20	20



Subsurface Trench Width = 1.2 m

Soil Infiltration Rate (Paterson PG3062-MEMO.07) = 19 mm/hr

REARYARD AREA L103C

Input

Drainage Area	=	0.64	ha
Runoff Co-efficient	=	0.48	
Roof Area	=	0.26	ha
Level of Treatment	=	Enhanced (80% TSS removal)	
Storage Media	=	50mm diameter clear stone	
Media Porosity, n	=	0.4	typical (range 0.25-0.40)
Percolation Rate	=	19	mm/h
Retention Time	=	24	h
Subdrain size	=	250	mm
Length	=	159	m
Subsurface Trench Width	=	1.2	m
Maximum Depth of Subsurface Trench, dt	=	0.75	m

Calculations

Imperviousness	=	40%	
Required Quality Treatment Volume	=	19.2 m^3	(MECP)
Required 25mm Infiltration Volume	=	64 m^3	

Bioswale Configuration

Required Bottom Area of trench, A	=	105.3 m^2	
Provided Bottom Area of trench	=	190.3 m^2	
Infiltration Rate	=	1.0 L/s	
Drawdown Time of Quality Treatment Volume	=	5.3 hr	
Maximum Subsurface Volume Available, Vss	=	61.8 m^3	rectangular trench

REARYARD AREA L124B

Input

Drainage Area	=	0.40	ha
Runoff Co-efficient	=	0.43	
Roof Area	=	0.13	ha
Level of Treatment	=	Enhanced (80% TSS removal)	
Storage Media	=	50mm diameter clear stone	
Media Porosity, n	=	0.4	typical (range 0.25-0.40)
Percolation Rate	=	19	mm/h
Retention Time	=	24	h
Subdrain size	=	250	mm
Length	=	130	m
Subsurface Trench Width	=	1.2	m
Maximum Depth of Subsurface Trench, dt	=	0.75	m

Calculations

Imperviousness	=	33%	
Required Quality Treatment Volume	=	10 m^3	(MECP)
Required 25mm Infiltration Volume	=	33 m^3	

Bioswale Configuration

Required Bottom Area of trench, A	=	54.8 m^2	
Provided Bottom Area of trench	=	155.4 m^2	
Infiltration Rate	=	0.8 L/s	
Drawdown Time of Quality Treatment Volume	=	3.4 hr	
Maximum Subsurface Volume Available, Vss	=	50.4 m^3	rectangular trench

Project No. 160401393

Richcraft Kanata West Subdivision Infiltration Calculations

Bioswales with Storage Volume Calculations Based on Infiltration Trench Design Calculations (Based on section 4.5.8 of MOE 2003 SWM Guidelines)

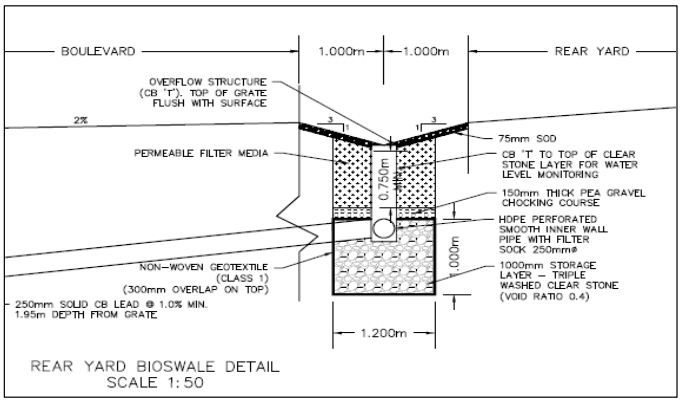
$$A = \frac{1{,}000V}{Pn\Delta t}$$

Equation 4.3: Infiltration Trench Bottom Area

where A = bottom area of the trench (m^2)
V = runoff volume to be infiltrated (Table 3.2)
P = percolation rate of surrounding native soil (mm/h)
n = porosity of the storage media (0.4 for clear stone)
Δt = retention time (24 to 48 hours)

Storage Volume (cu.m/ha) for Impervious Level

	35%	55%	70%	85%
Enhanced (80% TSS removal)	25	30	35	40
Normal (70% TSS removal)	20	20	25	30
Basic (60% TSS removal)	20	20	20	20



REAR YARD BIOSWALE DETAIL
SCALE 1:50

Subsurface Trench Width = 1.2 m

Soil Infiltration Rate (Paterson PG3062-MEMO.07) = 19 mm/hr

REARYARD AREA L113B

Input

Drainage Area	=	0.49	ha
Runoff Co-efficient	=	0.42	
Roof Area	=	0.15	ha
Level of Treatment	=	Enhanced (80% TSS removal)	
Storage Media	=	50mm diameter clear stone	
Media Porosity, n	=	0.4	typical (range 0.25-0.40)
Percolation Rate	=	19	mm/h
Retention Time	=	24	h
Subdrain size	=	250	mm
Length	=	98	m
Subsurface Trench Width	=	1.2	m
Maximum Depth of Subsurface Trench, dt	=	0.75	m

Calculations

Imperviousness	=	31%	
Required Quality Treatment Volume	=	12.25 m^3	(MECP)
Required 25mm Infiltration Volume	=	39 m^3	

Bioswale Configuration

Required Bottom Area of trench, A	=	67.2 m^2	
Provided Bottom Area of trench	=	117.5 m^2	
Infiltration Rate	=	0.6	L/s
Drawdown Time of Quality Treatment Volume	=	5.5	hr
Maximum Subsurface Volume Available, Vss	=	38.1 m^3	rectangular trench

REARYARD AREA L103D

Input

Drainage Area	=	0.55	ha
Runoff Co-efficient	=	0.46	
Roof Area	=	0.20	ha
Level of Treatment	=	Enhanced (80% TSS removal)	
Storage Media	=	50mm diameter clear stone	
Media Porosity, n	=	0.4	typical (range 0.25-0.40)
Percolation Rate	=	19	mm/h
Retention Time	=	24	h
Subdrain size	=	250	mm
Length	=	167	m
Subsurface Trench Width	=	1.2	m
Maximum Depth of Subsurface Trench, dt	=	0.75	m

Calculations

Imperviousness	=	37%	
Required Quality Treatment Volume	=	16.5 m^3	(MECP)
Required 25mm Infiltration Volume	=	51 m^3	

Bioswale Configuration

Required Bottom Area of trench, A	=	90.5 m^2	
Provided Bottom Area of trench	=	200.4 m^2	
Infiltration Rate	=	1.1	L/s
Drawdown Time of Quality Treatment Volume	=	4.3	hr
Maximum Subsurface Volume Available, Vss	=	65.0 m^3	rectangular trench

REARYARD AREA L117C

Input

Drainage Area	=	0.66	ha
Runoff Co-efficient	=	0.46	
Roof Area	=	0.25	ha
Level of Treatment	=	Enhanced (80% TSS removal)	
Storage Media	=	50mm diameter clear stone	
Media Porosity, n	=	0.4	typical (range 0.25-0.40)
Percolation Rate	=	19	mm/h
Retention Time	=	24	h
Subdrain size	=	250	mm
Length	=	210	m
Subsurface Trench Width	=	1.2	m
Maximum Depth of Subsurface Trench, dt	=	0.75	m

Calculations

Imperviousness	=	37%	
Required Quality Treatment Volume	=	19.8 m^3	(MECP)
Required 25mm Infiltration Volume	=	61 m^3	

Bioswale Configuration

Required Bottom Area of trench, A	=	108.6 m^2	
Provided Bottom Area of trench	=	252.0 m^2	
Infiltration Rate	=	1.3	L/s
Drawdown Time of Quality Treatment Volume	=	4.1	hr
Maximum Subsurface Volume Available, Vss	=	81.8 m^3	rectangular trench

REARYARD AREA L207B

Input

Drainage Area	=	0.30	ha
Runoff Co-efficient	=	0.48	
Roof Area	=	0.12	ha
Level of Treatment	=	Enhanced (80% TSS removal)	
Storage Media	=	50mm diameter clear stone	
Media Porosity, n	=	0.4	typical (range 0.25-0.40)
Percolation Rate	=	19	mm/h
Retention Time	=	24	h
Subdrain size	=	250	mm
Length	=	76	m
Subsurface Trench Width	=	1.2	m
Maximum Depth of Subsurface Trench, dt	=	0.75	m

Calculations

Imperviousness	=	40%	
Required Quality Treatment Volume	=	9 m^3	(MECP)
Required 25mm Infiltration Volume	=	30 m^3	

Bioswale Configuration

Required Bottom Area of trench, A	=	49.3 m^2	
Provided Bottom Area of trench	=	91.2 m^2	
Infiltration Rate	=	0.5	L/s
Drawdown Time of Quality Treatment Volume	=	5.2	hr
Maximum Subsurface Volume Available, Vss	=	29.6 m^3	rectangular trench

Project No. 160401393

Richcraft Kanata West Subdivision Infiltration Calculations

Bioswales with Storage Volume Calculations Based on Infiltration Trench Design Calculations (Based on section 4.5.8 of MOE 2003 SWM Guidelines)

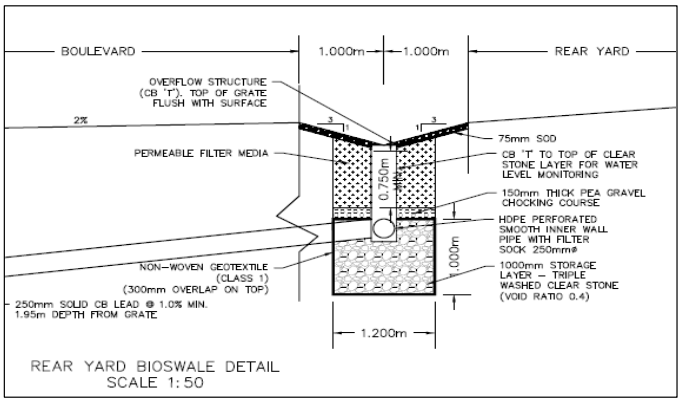
Equation 4.3: Infiltration Trench Bottom Area

$$A = \frac{1{,}000V}{Pn\Delta t}$$

where A = bottom area of the trench (m^2)
V = runoff volume to be infiltrated (Table 3.2)
P = percolation rate of surrounding native soil (mm/h)
n = porosity of the storage media (0.4 for clear stone)
Δt = retention time (24 to 48 hours)

Storage Volume (cu.m/ha) for Impervious Level

	35%	55%	70%	85%
Enhanced (80% TSS removal)	25	30	35	40
Normal (70% TSS removal)	20	20	25	30
Basic (60% TSS removal)	20	20	20	20



Subsurface Trench Width = 1.2 m

Soil Infiltration Rate (Paterson PG3062-MEMO.07) = 19 mm/hr

REARYARD AREA L209C

Input

Drainage Area	=	0.41	ha
Runoff Co-efficient	=	0.47	
Roof Area	=	0.16	ha
Level of Treatment	=	Enhanced (80% TSS removal)	
Storage Media	=	50mm diameter clear stone	
Media Porosity, n	=	0.4	typical (range 0.25-0.40)
Percolation Rate	=	19	mm/h
Retention Time	=	24	h
Subdrain size	=	250	mm
Length	=	105	m
Subsurface Trench Width	=	1.2	m
Maximum Depth of Subsurface Trench, dt	=	0.75	m

Calculations

Imperviousness	=	39%	
Required Quality Treatment Volume	=	12.3 m^3	(MECP)
Required 25mm Infiltration Volume	=	40 m^3	

Bioswale Configuration

Required Bottom Area of trench, A	=	67.4 m^2	
Provided Bottom Area of trench	=	126.0 m^2	
Infiltration Rate	=	0.7 L/s	
Drawdown Time of Quality Treatment Volume	=	5.1 hr	
Maximum Subsurface Volume Available, Vss	=	40.9 m^3	rectangular trench

REARYARD AREA L205B

Input

Drainage Area	=	0.48	ha
Runoff Co-efficient	=	0.45	
Roof Area	=	0.17	ha
Level of Treatment	=	Enhanced (80% TSS removal)	
Storage Media	=	50mm diameter clear stone	
Media Porosity, n	=	0.4	typical (range 0.25-0.40)
Percolation Rate	=	19	mm/h
Retention Time	=	24	h
Subdrain size	=	250	mm
Length	=	130	m
Subsurface Trench Width	=	1.2	m
Maximum Depth of Subsurface Trench, dt	=	0.75	m

Calculations

Imperviousness	=	36%	
Required Quality Treatment Volume	=	14.4 m^3	(MECP)
Required 25mm Infiltration Volume	=	43 m^3	

Bioswale Configuration

Required Bottom Area of trench, A	=	78.9 m^2	
Provided Bottom Area of trench	=	155.6 m^2	
Infiltration Rate	=	0.8 L/s	
Drawdown Time of Quality Treatment Volume	=	4.9 hr	
Maximum Subsurface Volume Available, Vss	=	50.5 m^3	rectangular trench

REARYARD AREA L210B

Input

Drainage Area	=	0.26	ha
Runoff Co-efficient	=	0.47	
Roof Area	=	0.10	ha
Level of Treatment	=	Enhanced (80% TSS removal)	
Storage Media	=	50mm diameter clear stone	
Media Porosity, n	=	0.4	typical (range 0.25-0.40)
Percolation Rate	=	19	mm/h
Retention Time	=	24	h
Subdrain size	=	250	mm
Length	=	83	m
Subsurface Trench Width	=	1.2	m
Maximum Depth of Subsurface Trench, dt	=	0.75	m

Calculations

Imperviousness	=	39%	
Required Quality Treatment Volume	=	7.8 m^3	(MECP)
Required 25mm Infiltration Volume	=	25 m^3	

Bioswale Configuration

Required Bottom Area of trench, A	=	42.8 m^2	
Provided Bottom Area of trench	=	99.0 m^2	
Infiltration Rate	=	0.5 L/s	
Drawdown Time of Quality Treatment Volume	=	4.1 hr	
Maximum Subsurface Volume Available, Vss	=	32.1 m^3	rectangular trench

Project No. 160401393

Richcraft Kanata West Subdivision Infiltration Calculations

Bioswales with Storage Volume Calculations Based on Infiltration Trench Design Calculations (Based on section 4.5.8 of MOE 2003 SWM Guidelines)

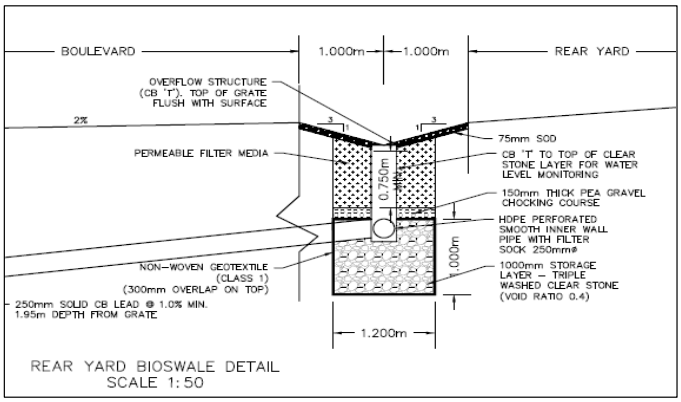
$$A = \frac{1{,}000V}{Pn\Delta t}$$

Equation 4.3: Infiltration Trench Bottom Area

where A = bottom area of the trench (m²)
V = runoff volume to be infiltrated (Table 3.2)
P = percolation rate of surrounding native soil (mm/h)
n = porosity of the storage media (0.4 for clear stone)
Δt = retention time (24 to 48 hours)

Storage Volume (cu.m/ha) for Impervious Level

	35%	55%	70%	85%
Enhanced (80% TSS removal)	25	30	35	40
Normal (70% TSS removal)	20	20	25	30
Basic (60% TSS removal)	20	20	20	20



Subsurface Trench Width = 1.2 m

Soil Infiltration Rate (Paterson PG3062-MEMO.07) = 19 mm/hr

REARYARD AREA L202B

Input

Drainage Area	=	0.25	ha
Runoff Co-efficient	=	0.55	
Roof Area	=	0.13	ha
Level of Treatment	=	Enhanced (80% TSS removal)	
Storage Media	=	50mm diameter clear stone	
Media Porosity, n	=	0.4	typical (range 0.25-0.40)
Percolation Rate	=	19	mm/h
Retention Time	=	24	h
Subdrain size	=	250	mm
Length	=	75	m
Subsurface Trench Width	=	1.2	m
Maximum Depth of Subsurface Trench, dt	=	0.75	m

Calculations

Imperviousness	=	50%	
Required Quality Treatment Volume	=	7.5 m^3	(MECP)
Required 25mm Infiltration Volume	=	31 m^3	

Bioswale Configuration

Required Bottom Area of trench, A	=	41.1 m^2	
Provided Bottom Area of trench	=	90.5 m^2	
Infiltration Rate	=	0.5 L/s	
Drawdown Time of Quality Treatment Volume	=	4.4 hr	
Maximum Subsurface Volume Available, Vss	=	29.4 m^3	rectangular trench

REARYARD AREA L238A

Input

Drainage Area	=	0.65	ha
Runoff Co-efficient	=	0.57	
Roof Area	=	0.34	ha
Level of Treatment	=	Enhanced (80% TSS removal)	
Storage Media	=	50mm diameter clear stone	
Media Porosity, n	=	0.4	typical (range 0.25-0.40)
Percolation Rate	=	19	mm/h
Retention Time	=	24	h
Subdrain size	=	250	mm
Length	=	220	m
Subsurface Trench Width	=	1.2	m
Maximum Depth of Subsurface Trench, dt	=	0.75	m

Calculations

Imperviousness	=	53%	
Required Quality Treatment Volume	=	19.5 m^3	(MECP)
Required 25mm Infiltration Volume	=	86 m^3	

Bioswale Configuration

Required Bottom Area of trench, A	=	106.9 m^2	
Provided Bottom Area of trench	=	264.0 m^2	
Infiltration Rate	=	1.4 L/s	
Drawdown Time of Quality Treatment Volume	=	3.9 hr	
Maximum Subsurface Volume Available, Vss	=	85.7 m^3	rectangular trench

REARYARD AREA L218B

Input

Drainage Area	=	0.25	ha
Runoff Co-efficient	=	0.45	
Roof Area	=	0.09	ha
Level of Treatment	=	Enhanced (80% TSS removal)	
Storage Media	=	50mm diameter clear stone	
Media Porosity, n	=	0.4	typical (range 0.25-0.40)
Percolation Rate	=	19	mm/h
Retention Time	=	24	h
Subdrain size	=	250	mm
Length	=	131	m
Subsurface Trench Width	=	1.2	m
Maximum Depth of Subsurface Trench, dt	=	0.75	m

Calculations

Imperviousness	=	36%	
Required Quality Treatment Volume	=	7.5 m^3	(MECP)
Required 25mm Infiltration Volume	=	22 m^3	

Bioswale Configuration

Required Bottom Area of trench, A	=	41.1 m^2	
Provided Bottom Area of trench	=	157.2 m^2	
Infiltration Rate	=	0.8 L/s	
Drawdown Time of Quality Treatment Volume	=	2.5 hr	
Maximum Subsurface Volume Available, Vss	=	51.0 m^3	rectangular trench

REARYARD AREA L220A

Input

Drainage Area	=	0.87	ha
Runoff Co-efficient	=	0.44	
Roof Area	=	0.30	ha
Level of Treatment	=	Enhanced (80% TSS removal)	
Storage Media	=	50mm diameter clear stone	
Media Porosity, n	=	0.4	typical (range 0.25-0.40)
Percolation Rate	=	19	mm/h
Retention Time	=	24	h
Subdrain size	=	250	mm
Length	=	192	m
Subsurface Trench Width	=	1.2	m
Maximum Depth of Subsurface Trench, dt	=	0.75	m

Calculations

Imperviousness	=	34%	
Required Quality Treatment Volume	=	21.75 m^3	(MECP)
Required 25mm Infiltration Volume	=	75 m^3	

Bioswale Configuration

Required Bottom Area of trench, A	=	119.2 m^2	
Provided Bottom Area of trench	=	230.4 m^2	
Infiltration Rate	=	1.2 L/s	
Drawdown Time of Quality Treatment Volume	=	5.0 hr	
Maximum Subsurface Volume Available, Vss	=	74.8 m^3	rectangular trench

Required 25mm Infiltration Volume = 599 m^3

Maximum Subsurface Volume Available, Vss = 691 m^3

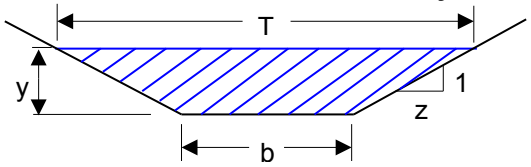
Drainage Area ID	Drainage Area (ha)	Imperviousness (%)	Required Volume for 25mm Event (m^3)[1]	Trench Length (m)	Trench Width (m)	Trench Depth (m)	Maximum Storage Available (m)
REARYARD AREA L103C	0.64	40%	64	159	1.2	0.75	62
REARYARD AREA L124B	0.40	33%	33	130	1.2	0.75	50
REARYARD AREA L113B	0.49	31%	39	98	1.2	0.75	38
REARYARD AREA L103D	0.55	37%	51	167	1.2	0.75	65
REARYARD AREA L117C	0.66	37%	61	210	1.2	0.75	82
REARYARD AREA L207B	0.30	40%	30	76	1.2	0.75	30
REARYARD AREA L209C	0.41	39%	40	105	1.2	0.75	41
REARYARD AREA L205B	0.48	36%	43	130	1.2	0.75	51
REARYARD AREA L210B	0.26	39%	25	83	1.2	0.75	32
REARYARD AREA L202B	0.25	50%	31	75	1.2	0.75	29
REARYARD AREA L238A	0.65	53%	86	220	1.2	0.75	86
REARYARD AREA L218B	0.25	36%	22	131	1.2	0.75	51
REARYARD AREA L220A	0.87	34%	75	192	1.2	0.75	75
		Total:	**599 m^3**				**691 m^3**

B.7 HAZELDEAN CREEK CROSSINGS' CALCULATIONS

Job # 160401393 - Second Registration Phase Richcraft KW Development

Date: 16-Nov-20

Hazeldean Creek - Channel Conveyance Design



$$A = (b + z \cdot y)y$$

$$P = b + 2 \cdot y \cdot \sqrt{1 + z^2}$$

$$R = \frac{A}{P}$$

$$T = b + 2zy$$

$$Q = \frac{A}{n} R^{2/3} \sqrt{S}$$

$$V = \frac{Q}{A}$$

$$Fr = \sqrt{\frac{Q^2 T}{gA^3}}$$

	Expected Flow Depth	w Freeboard
n=	0.025	0.025
z=	3	3
b=	2.5	2.5
y=	0.92	1.10
A=	4.8392	6.38
P=	8.318591	9.457011
R=	0.581733	0.674632
S=	0.006	0.006
T=	8.02	9.1
Q=	**10.449** m^3/s	15.206 m^3/s
V=	2.16 m/s	2.38 m/s
Fr # =	0.887464	0.908774

100 Year Flow Generated = 10.400 m^3/s

Full Flow Channel Capacity = 15.206 m^3/s

Channel OK

HY-8 Culvert Analysis Report

Site Data - Roger-Griffiths

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 m

Inlet Elevation: 96.53 m

Outlet Station: 30.10 m

Outlet Elevation: 96.29 m

Number of Barrels: 1

Culvert Data Summary - Roger-Griffiths

Barrel Shape: Concrete Box

Barrel Span: 6000.00 mm

Barrel Rise: 1500.00 mm

Barrel Material: Concrete

Embedment: 300.00 mm

Barrel Manning's n: 0.0120 (top and sides)

Manning's n: 0.0350 (bottom)

Culvert Type: Straight

Inlet Configuration: 1:1 Bevel Headwall

Inlet Depression: None

Water Surface Profile Plot for Culvert: Roger-Griffiths

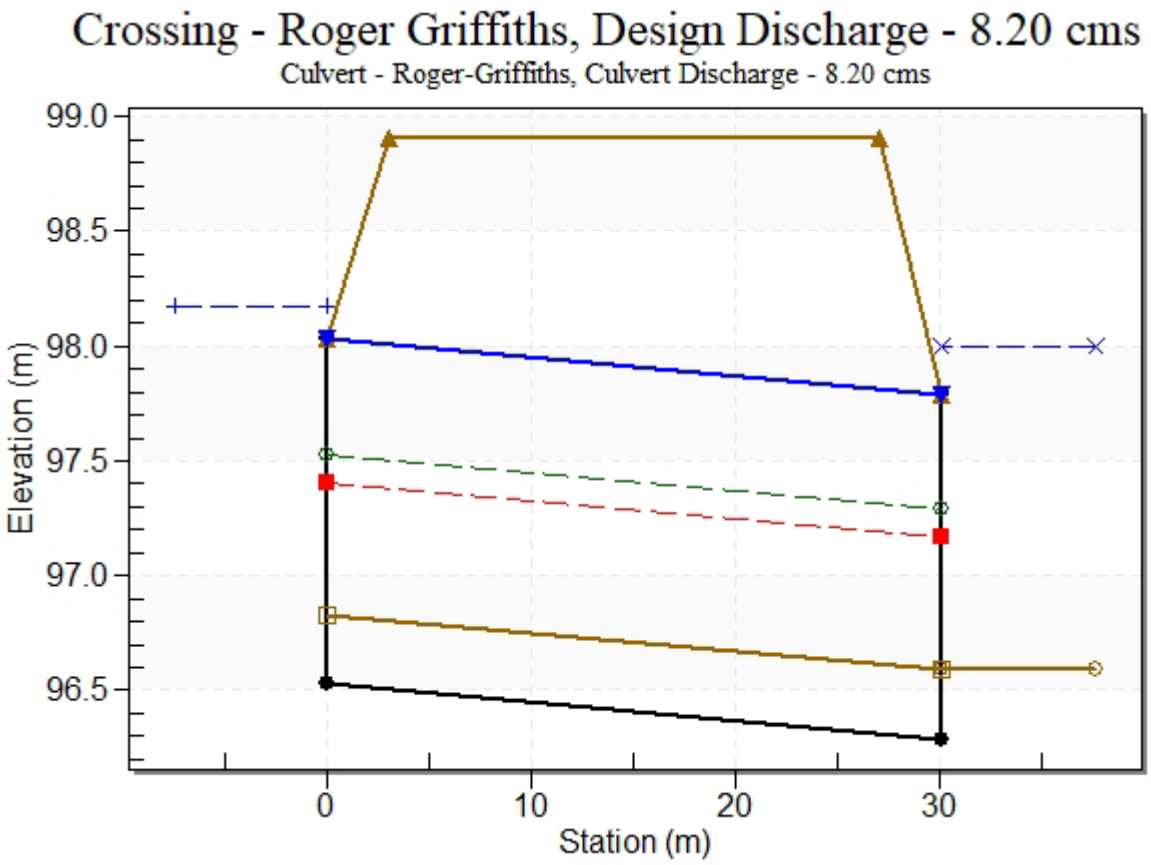


Table 1 - Culvert Summary Table: Roger-Griffiths

Total Discharge (cms)	Culvert Discharge (cms)	Headwater Elevation (m)	Inlet Control Depth (m)	Outlet Control Depth (m)	Flow Type	Normal Depth (m)	Critical Depth (m)	Outlet Depth (m)	Tailwater Depth (m)	Outlet Velocity (m/s)	Tailwater Velocity (m/s)
5.00	5.00	98.05	0.663	1.219	3-M1f	0.517	0.414	1.200	1.410	0.694	0.000
5.54	5.54	98.06	0.706	1.230	3-M1f	0.551	0.443	1.200	1.410	0.769	0.000
6.08	6.08	98.07	0.747	1.242	3-M1f	0.583	0.471	1.200	1.410	0.844	0.000
6.62	6.62	98.12	0.789	1.287	4-FFf	0.614	0.499	1.200	1.410	0.919	0.000
7.16	7.16	98.14	0.829	1.306	4-FFf	0.644	0.526	1.200	1.410	0.994	0.000
7.70	7.70	98.16	0.868	1.326	4-FFf	0.673	0.552	1.200	1.410	1.069	0.000
8.20	8.20	98.18	0.905	1.346	4-FFf	0.699	0.575	1.200	1.410	1.139	0.000
8.78	8.78	98.20	0.946	1.371	4-FFf	0.729	0.602	1.200	1.410	1.219	0.000
9.32	9.32	98.23	0.984	1.396	4-FFf	0.756	0.626	1.200	1.410	1.294	0.000
9.86	9.86	98.25	1.022	1.421	4-FFf	0.783	0.650	1.200	1.410	1.369	0.000
10.40	10.40	98.28	1.059	1.448	4-FFf	0.809	0.674	1.200	1.410	1.444	0.000

****

Straight Culvert

Inlet Elevation (invert): 96.83 m, Outlet Elevation (invert): 96.59 m

Culvert Length: 30.10 m, Culvert Slope: 0.0080

****

Table 2 - Downstream Channel Rating Curve (Crossing: Roger Griffiths)

Flow (cms)	Water Surface Elev (m)	Depth (m)
176.57	98.00	1.41
195.64	98.00	1.41
214.71	98.00	1.41
233.78	98.00	1.41
252.85	98.00	1.41
271.92	98.00	1.41
289.58	98.00	1.41
310.06	98.00	1.41
329.13	98.00	1.41
348.20	98.00	1.41
367.27	98.00	1.41

Tailwater Channel Data - Roger Griffiths

Tailwater Channel Option: Enter Constant Tailwater Elevation

Constant Tailwater Elevation: 98.00 m

Roadway Data for Crossing: Roger Griffiths

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 29.90 m

Crest Elevation: 98.91 m

Roadway Surface: Paved

Roadway Top Width: 24.00 m

Table 3 - Summary of Culvert Flows at Crossing: Roger Griffiths

Headwater Elevation (m)	Total Discharge (cms)	Roger-Griffiths Discharge (cms)	Roadway Discharge (cms)	Iterations
98.05	5.00	5.00	0.00	1
98.06	5.54	5.54	0.00	1
98.07	6.08	6.08	0.00	1
98.12	6.62	6.62	0.00	1
98.14	7.16	7.16	0.00	1
98.16	7.70	7.70	0.00	1
98.18	8.20	8.20	0.00	1
98.20	8.78	8.78	0.00	1
98.23	9.32	9.32	0.00	1
98.25	9.86	9.86	0.00	1
98.28	10.40	10.40	0.00	1
98.91	19.05	19.05	0.00	Overtopping

Site Data - Tillage

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 m

Inlet Elevation: 94.98 m

Outlet Station: 26.00 m

Outlet Elevation: 94.88 m

Number of Barrels: 1

Culvert Data Summary - Tillage

Barrel Shape: Concrete Box

Barrel Span: 6000.00 mm

Barrel Rise: 1500.00 mm

Barrel Material: Concrete

Embedment: 300.00 mm

Barrel Manning's n: 0.0120 (top and sides)

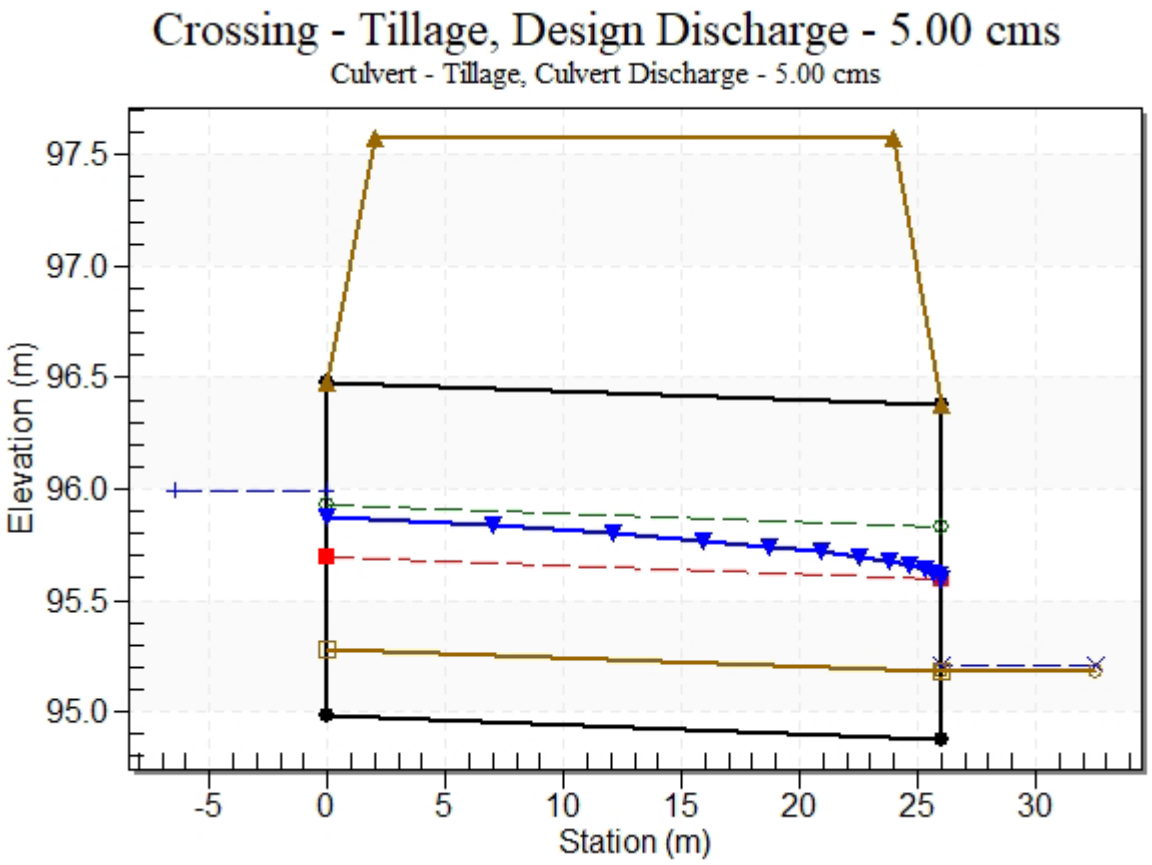
Manning's n: 0.0350 (bottom)

Culvert Type: Straight

Inlet Configuration: 1:1 Bevel Headwall

Inlet Depression: None

Water Surface Profile Plot for Culvert: Tillage



Total Discharge (cms)	Culvert Discharge (cms)	Headwater Elevation (m)	Inlet Control Depth (m)	Outlet Control Depth (m)	Flow Type	Normal Depth (m)	Critical Depth (m)	Outlet Depth (m)	Tailwater Depth (m)	Outlet Velocity (m/s)	Tailwater Velocity (m/s)
4.70	4.70	95.97	0.641	0.688	2-M2c	0.622	0.397	0.397	0.030	1.974	0.000
5.00	5.00	96.00	0.665	0.716	2-M2c	0.646	0.414	0.414	0.030	2.015	0.000
5.84	5.84	96.07	0.731	0.788	2-M2c	0.710	0.459	0.459	0.030	2.121	0.000
6.40	6.40	96.11	0.775	0.835	2-M2c	0.751	0.488	0.488	0.030	2.188	0.000
6.97	6.97	96.16	0.817	0.880	2-M2c	0.791	0.516	0.516	0.030	2.251	0.000
7.54	7.54	96.20	0.859	0.924	2-M2c	0.830	0.544	0.544	0.030	2.310	0.000
8.11	8.11	96.25	0.900	0.967	2-M2c	0.868	0.571	0.571	0.030	2.367	0.000
8.68	8.68	96.29	0.941	1.009	2-M2c	0.905	0.597	0.597	0.030	2.421	0.000
9.24	9.24	96.33	0.981	1.051	2-M2c	0.941	0.623	0.623	0.030	2.473	0.000
9.81	9.81	96.37	1.021	1.091	2-M2c	0.976	0.648	0.648	0.030	2.523	0.000
10.38	10.38	96.41	1.061	1.130	2-M2c	1.011	0.673	0.673	0.030	2.570	0.000

Table 4 - Culvert Summary Table: Tillage

****

Straight Culvert

Inlet Elevation (invert): 95.28 m, Outlet Elevation (invert): 95.18 m

Culvert Length: 26.00 m, Culvert Slope: 0.0038

****

Table 5 - Downstream Channel Rating Curve (Crossing: Tillage)

Flow (cms)	Water Surface Elev (m)	Depth (m)
165.98	95.21	0.03
176.57	95.21	0.03
206.10	95.21	0.03
226.16	95.21	0.03
246.21	95.21	0.03
266.27	95.21	0.03
286.33	95.21	0.03
306.39	95.21	0.03
326.45	95.21	0.03
346.51	95.21	0.03
366.57	95.21	0.03

Tailwater Channel Data - Tillage

Tailwater Channel Option: Enter Constant Tailwater Elevation

Constant Tailwater Elevation: 95.21 m

Roadway Data for Crossing: Tillage

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 29.90 m

Crest Elevation: 97.58 m

Roadway Surface: Paved

Roadway Top Width: 22.00 m

Headwater Elevation (m)	Total Discharge (cms)	Tillage Discharge (cms)	Roadway Discharge (cms)	Iterations
95.97	4.70	4.70	0.00	1
96.00	5.00	5.00	0.00	1
96.07	5.84	5.84	0.00	1
96.11	6.40	6.40	0.00	1
96.16	6.97	6.97	0.00	1
96.20	7.54	7.54	0.00	1
96.25	8.11	8.11	0.00	1
96.29	8.68	8.68	0.00	1
96.33	9.24	9.24	0.00	1
96.37	9.81	9.81	0.00	1
96.41	10.38	10.38	0.00	1
97.58	23.01	23.01	0.00	Overtopping

Table 6 - Summary of Culvert Flows at Crossing: Tillage

Appendix C WASTEWATER CALCULATIONS

C.1 Sanitary Sewer Design Sheet

C.2 Sanitary HGL Analysis Peak Inflows and Figure

C.3 External Areas Background Information

C.4 City Correspondence

Appendix C Wastewater Calculations
May 10, 2022

C.1 SANITARY SEWER DESIGN SHEET

Stantec

SUBDIVISION:
Richcraft Kanata West Subdivision - Second Registration Phase

DATE: 2/10/2022
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	SINGLE	UNITS TOWN	APT	POP.	CUMULATIVE AREA	CUMULATIVE POP.	PEAK FACT.	PEAK FLOW	AREA	ACCU. AREA	AREA	ACCU. AREA	AREA	ACCU. AREA	AREA	ACCU. AREA	AREA	ACCU. AREA	PEAK FLOW	TOTAL AREA	ACCU. AREA	INFILT. FLOW	FLOW	LENGTH	DIA	MATERIAL	CLASS	SLOPE	CAP. (FULL)	CAP. V PEAK FLOW	VEL. (FULL)	VEL. (ACT.)
			(ha)					(ha)			(L/s)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(L/s)	(ha)	(ha)	(L/s)	(L/s)	(m)	(mm)			(%)	(l/s)	(%)	(m/s)	(m/s)
PROPOSED SECOND REGISTRATION PHASE																																		
R64A, EXT-1	64	63	0.17	0	0	0	0	0.17	0	3.80	0.0	13.19	13.19	0.00	0.00	0.00	0.00	1.04	1.04	1.28	1.28	6.9	15.68	15.68	5.2	12.1	93.8	300	PVC	SDR 35	0.19	41.9	**28.9%**	0.59	0.43
	63	55	0.00	0	0	0	0	0.17	0	3.80	0.0	0.00	13.19	0.00	0.00	0.00	0.00	0.00	1.04	0.00	1.28	6.9	0.00	15.68	5.2	12.1	120.0	300	PVC	SDR 35	0.19	41.7	**29.0%**	0.59	0.43
R58A	58	57	0.36	0	8	0	22	0.36	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	0.36	0.36	0.1	0.4	60.6	200	PVC	SDR 35	0.65	27.0	**1.4%**	0.85	0.26
I57B, R57A	57	56	0.51	0	15	0	41	0.87	62	3.64	0.7	0.00	0.00	0.00	0.00	0.00	0.00	2.95	2.95	0.00	0.00	1.4	3.46	3.82	1.3	3.4	105.5	200	PVC	SDR 35	0.40	21.1	**16.2%**	0.67	0.40
R62A	62	61	0.17	0	5	0	14	0.17	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	0.17	0.17	0.1	0.2	30.8	200	PVC	SDR 35	0.65	27.0	**0.8%**	0.85	0.21
R61A	61	60	0.17	0	3	0	8	0.35	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	0.17	0.35	0.1	0.4	11.9	200	PVC	SDR 35	0.50	23.6	**1.6%**	0.74	0.23
R60A	60	59	0.80	0	34	0	92	1.15	113	3.58	1.3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.80	1.15	0.4	1.7	117.1	200	PVC	SDR 35	0.50	23.6	**7.2%**	0.74	0.36
	59	56	0.00	0	0	0	0	1.15	113	3.58	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	1.15	0.4	1.7	11.6	200	PVC	SDR 35	0.40	21.1	**8.0%**	0.67	0.33
R56A	56	55	0.22	0	6	0	16	2.23	192	3.52	2.2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.95	0.00	0.00	1.4	0.22	5.18	1.7	5.3	49.8	200	PVC	SDR 35	0.40	21.1	**25.2%**	0.67	0.46
	55	54	0.00	0	0	0	0	2.41	192	3.52	2.2	0.00	13.19	0.00	0.00	0.00	0.00	0.00	3.99	0.00	1.28	8.4	0.00	20.87	6.9	17.4	79.5	375	PVC	SDR 35	0.14	61.3	**28.4%**	0.58	0.42
R65A	65	54	0.21	0	4	0	11	0.21	11	3.73	0.1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.21	0.21	0.1	0.2	27.3	200	PVC	SDR 35	1.00	33.4	**0.6%**	1.05	0.26
R54GA	54G	54F	0.80	12	16	0	84	0.80	84	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	0.80	0.80	0.3	1.2	119.4	200	PVC	SDR 35	0.35	19.8	**6.3%**	0.62	0.29
R54FA	54F	54E	0.39	8	0	0	27	1.19	111	3.58	1.3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.39	1.19	0.4	1.7	79.3	200	PVC	SDR 35	0.35	19.8	**8.5%**	0.62	0.32
	54E	54	0.00	0	0	0	0	1.19	111	3.58	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	1.19	0.4	1.7	5.8	200	PVC	SDR 35	0.35	19.8	**8.5%**	0.62	0.32
R54DA	54D	54C	0.40	0	10	0	27	0.40	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	0.40	0.40	0.1	0.5	81.8	200	PVC	SDR 35	0.65	27.0	**1.7%**	0.85	0.26
	54C	54B	0.00	0	0	0	0	0.40	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	0.00	0.40	0.1	0.5	76.0	200	PVC	SDR 35	0.35	19.8	**2.3%**	0.62	0.21
R54BA	54B	54A	0.60	0	22	0	59	1.00	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	0.60	1.00	0.3	1.3	70.2	200	PVC	SDR 35	0.35	19.8	**6.8%**	0.62	0.29
R54AA	54A	54	0.54	0	19	0	51	1.54	138	3.56	1.6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.54	1.54	0.5	2.1	2.5	200	PVC	SDR 35	0.35	19.8	**10.6%**	0.62	0.33
	54	53	0.00	0	0	0	0	5.35	451	3.40	5.0	0.00	13.19	0.00	0.00	0.00	0.00	0.00	3.99	0.00	1.28	8.4	0.00	23.80	7.9	21.2	70.7	375	PVC	SDR 35	0.14	60.7	**34.9%**	0.58	0.44
	53	52	0.00	0	0	0	0	5.35	451	3.40	5.0	0.00	13.19	0.00	0.00	0.00	0.00	0.00	3.99	0.00	1.28	8.4	0.00	23.80	7.9	21.2	76.0	375	PVC	SDR 35	0.14	60.7	**34.9%**	0.58	0.44
	52	35	0.00	0	0	0	0	5.35	451	3.40	5.0	0.00	13.19	0.00	0.00	0.00	0.00	0.00	3.99	0.00	1.28	8.4	0.00	23.80	7.9	21.2	104.6	375	PVC	SDR 35	0.14	60.7	**34.9%**	0.58	0.44
R51A	51	50	0.18	0	4	0	11	0.18	11	3.73	0.1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.18	0.18	0.1	0.2	39.8	200	PVC	SDR 35	0.65	27.0	**0.7%**	0.85	0.21
R50A	50	49	0.19	0	5	0	14	0.37	24	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	0.19	0.37	0.1	0.4	36.9	200	PVC	SDR 35	0.65	27.0	**1.5%**	0.85	0.26
R49A	49	48	0.08	0	2	0	5	0.45	30	3.68	0.4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.08	0.45	0.1	0.5	12.1	200	PVC	SDR 35	0.40	21.1	**2.4%**	0.67	0.23
R48A	48	47	0.59	0	20	0	54	1.03	84	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	0.59	1.03	0.3	1.3	85.9	200	PVC	SDR 35	0.40	21.1	**6.2%**	0.67	0.31
R47A	47	46	0.66	0	22	0	59	1.69	143	3.56	1.7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.66	1.69	0.6	2.2	80.2	200	PVC	SDR 35	0.40	21.1	**10.4%**	0.67	0.36
R46A	46	45	0.22	0	4	0	11	1.91	154	3.55	1.8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.22	1.91	0.6	2.4	14.3	200	PVC	SDR 35	0.40	21.1	**11.4%**	0.67	0.36
R45A	45	44	0.33	0	10	0	27	2.24	181	3.53	2.1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.33	2.24	0.7	2.8	62.2	200	PVC	SDR 35	0.40	21.1	**13.3%**	0.67	0.38
R44A, R44B	44	43	3.07	0	263	0	710	5.31	891	3.27	9.4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	3.07	5.31	1.8	11.2	67.7	200	PVC	SDR 35	0.40	21.1	**52.9%**	0.67	0.58
R43A	43	42	0.09	0	2	0	5	5.39	896	3.26	9.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.09	5.39	1.8	11.3	11.7	200	PVC	SDR 35	0.40	21.1	**53.3%**	0.67	0.58
R42A	42	41	0.31	0	9	0	24	5.70	921	3.26	9.7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.31	5.70	1.9	11.6	75.4	200	PVC	SDR 35	0.40	21.1	**54.9%**	0.67	0.58
R41A, R41B	41	40	0.62	0	11	0	30	6.32	950	3.25	10.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.62	6.32	2.1	12.1	85.4	200	PVC	SDR 35	0.40	21.1	**57.2%**	0.67	0.59
R40A	40	39	0.35	0	10	0	27	6.67	977	3.25	10.3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.35	6.67	2.2	12.5	63.2	200	PVC	SDR 35	0.40	21.1	**59.0%**	0.67	0.60
R39BA	39B	39A	0.49	0	13	0	35	0.49	35	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	0.49	0.49	0.2	0.6	65.2	200	PVC	SDR 35	0.35	19.8	**2.9%**	0.62	0.24
	39A	39	0.00	0	0	0	0	0.49	35	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	0.00	0.49	0.2	0.6	3.4	200	PVC	SDR 35	0.35	19.8	**2.9%**	0.62	0.24
	39	35	0.00	0	0	0	0	7.16	1013	3.24	10.6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.00	7.16	2.4	13.0	79.5	200	PVC	SDR 35	0.40	21.1	**61.4%**	0.67	0.60
R38A	38	37	0.08	0	2	0	5	0.08	5	3.75	0.1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.08	0.08	0.0	0.1	12.6	200	PVC	SDR 35	0.65	27.0	**0.3%**	0.85	0.16
R37A	37	36	0.78	0	27	0	73	0.86	78	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	0.78	0.86	0.3	1.2	99.3	200	PVC	SDR 35	0.40	21.1	**5.7%**	0.67	0.30
R36A	36	35	0.63	0	21	0	57	1.49	135	3.56	1.6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.63	1.49	0.5	2.1	110.3	200	PVC	SDR 35	0.40	21.2	**9.7%**	0.67	0.35
R74A	74	73	0.52	12	0	0	41	0.52	41	3.67	0.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.52	0.52	0.2	0.7	80.3	200	PVC	SDR 35	0.65	27.0	**2.4%**	0.85	0.29
R73A	73	72	0.51	11	0	0	37	1.03	78	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	0.51	1.03	0.3	1.3	61.5	200	PVC	SDR 35	0.32	18.9	**6.6%**	0.60	0.28
R72A	72	71	0.20	3	0	0	10	1.23	88	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	0.20	1.23	0.4	1.4	12.3	200	PVC	SDR 35	0.32	18.9	**7.6%**	0.60	0.30
R71A	71	70	0.31	6	0	0	20	1.54	109	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	0.31	1.54	0.5	1.8	65.1	200	PVC	SDR 35	0.32	18.9	**9.4%**	0.60	0.31
R70A	70	69	0.07	1	0	0	3	1.60	112	3.58	1.3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.07	1.60	0.5	1.8	9.6	200	PVC	SDR 35	0.32	18.9	**9.7%**	0.60	0.31
R69A	69	68	0.27	5	0	0	17	1.88	129	3.57	1.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.27	1.88	0.6	2.1	50.7	200	PVC	SDR 35	0.32	18.9	**11.2%**	0.60	0.33
R68A	68	67	0.16	2	0	0	7	2.03	136	3.56	1.6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.16	2.03	0.7	2.2	11.2	200	PVC	SDR 35	0.32	18.9	**11.9%**	0.60	0.33
R67A, G67A	67	66	0.58	11	0	0	37	2.61	173	3.54	2.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.97	0.97	0.0	1.55	3.58	1.2	3.2	106.9	200	PVC	SDR 35	0.32	18.9	**16.8%**	0.60	0.37
R66A	66	21	0.13	1	0	0	3	2.74	177	3.53	2.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.97	0.0	0.13	3.71	1.2	3.2	50.9	200	PVC	SDR 35	0.32	18.9	**17.2%**	0.60	0.37
R21A	21	20	0.31	0	7	0	19	3.05	196	3.52	2.2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.97	0.0	0.31	4.02	1.3	3.6	62.2	200	PVC	SDR 35	0.32	18.9	**18.8%**	0.60	0.38

Stantec

SUBDIVISION:
Richcraft Kanata West Subdivision - Second Registration Phase

DATE: 2/10/2022
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		

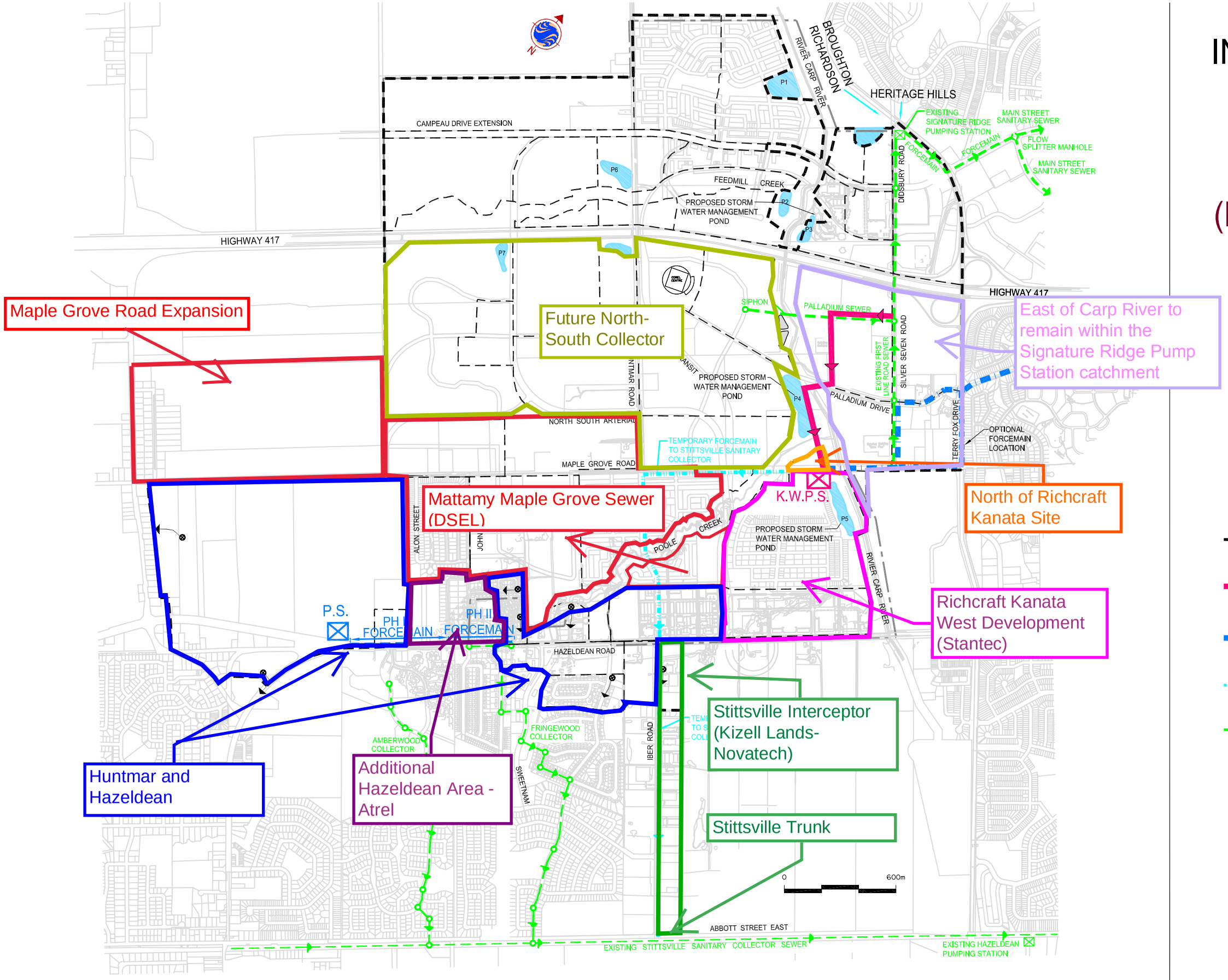
LOCATION			RESIDENTIAL AREA AND POPULATION									COMMERCIAL		INDUSTRIAL (L)		INDUSTRIAL (H)		INSTITUTIONAL		GREEN / UNUSED		C+I+I	INFILTRATION			TOTAL	PIPE							
AREA ID NUMBER	FROM M.H.	TO M.H.	AREA	SINGLE	UNITS TOWN	APT	POP.	CUMULATIVE AREA	CUMULATIVE POP.	PEAK FACT.	PEAK FLOW	AREA	ACCU. AREA	AREA	ACCU. AREA	AREA	ACCU. AREA	AREA	ACCU. AREA	AREA	ACCU. AREA	PEAK FLOW	TOTAL AREA	ACCU. AREA	INFILT. FLOW	FLOW	LENGTH	DIA	MATERIAL	CLASS	SLOPE	CAP. (FULL)	CAP. V PEAK FLOW	VEL. (FULL)	VEL. (ACT.)
			(ha)					(ha)			(L/s)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(L/s)	(ha)	(ha)	(L/s)	(L/s)	(m)	(mm)			(%)	(l/s)	(%)	(m/s)	(m/s)
APPROVED 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	1599	3.13	16.2	0.00	13.19	0.00	0.00	0.00	0.00	0.00	3.99	0.00	1.28	8.4	0.00	32.45	10.7	35.3	68.7	375	PVC	SDR 35	0.14	60.1	**58.7%**	0.57	0.51
	35A	22	0.00	0	0	0	0	13.99	1599	3.13	16.2	0.00	13.19	0.00	0.00	0.00	0.00	0.00	3.99	0.00	1.28	8.4	0.00	32.45	10.7	35.3	81.6	375	PVC	SDR 35	0.14	60.7	**58.1%**	0.58	0.51
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	17.07	1904	3.08	19.0	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	39.1	78.4	375	PVC	SDR 35	0.14	61.3	**63.8%**	0.58	0.54
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	28.01	2716	2.98	26.3	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	51.6	71.0	375	PVC	SDR 35	0.14	60.1	**85.9%**	0.57	0.57
R2A	2	1A	0.14	0	0	0	0	28.15	2716	2.98	26.3	0.00	14.66	0.00	0.00	0.00	0.00	0.00	3.99	0.00	2.74	9.1	0.14	49.53	16.3	51.7	49.3	450	PVC	SDR 35	1.00	300.3	**17.2%**	1.83	1.13
	1A	1	0.00	0	0	0	0	28.15	2716	2.98	26.3	0.00	14.66	0.00	0.00	0.00	0.00	0.00	3.99	0.00	2.74	9.1	0.00	49.53	16.3	51.7	4.8	450	PVC	SDR 35	1.00	300.1	**17.2%**	1.83	1.13
																												450							

C.2 SANITARY HGL ANALYSIS PEAK INFLOWS AND FIGURE

INTERNAL SANITARY SERVICING

ALTERNATIVE IIIA

(PREFERRED OPTION)



- Ultimate Major Drainage Limit
- Proposed Trunk Sewer
- Forcemain
- Temporary Frocemain
- Existing Trunk Sewers
- Existing Pumping Station and Forcemain (To be Decommissioned)
- Pump Station

Stantec

CCL/IBI

MAY 2006

FIG. 4.1-6A

Stantec

SUBDIVISION:

Richcraft Kanata West Development

DATE: 5/13/2019
REVISION: 2
DESIGNED BY: TKR
CHECKED BY: AMP

SANITARY INFLOWS FOR CATASTROPHIC HGL ANALYSIS

FILE NUMBER: 160401393

Annual Parameters as per Technical Bulletin ISTB-2018-01

***Harmon Correction Factor of 0.6**

MAX PEAK FACTOR (RES.)=	4.0	AVG. DAILY FLOW / PERSON	200	L/p/day
MIN PEAK FACTOR (RES.)=	2.0	COMMERCIAL	17,000	L/ha/day
PEAKING FACTOR (INDUSTRIAL):	1.0	INDUSTRIAL (HEAVY)	55,000	L/ha/day
PEAKING FACTOR (COMM., INST.):	1.0	INDUSTRIAL (LIGHT)	10,000	L/ha/day
PERSONS / SINGLE	3.4	INSTITUTIONAL	17,000	L/ha/day
PERSONS / TOWNHOME	2.7	INFILTRATION	0.30	L/s/ha
PERSONS / APARTMENT	1.8	MED. DENSITY RESIDENTIAL POP.	38	units/ha

LOCATION			RESIDENTIAL AREA AND POPULATION							COMMERCIAL	INDUSTRIAL (L)	INDUSTRIAL (H)	INSTITUTIONAL	GREEN / UNUSED	C+I+I	INFILTRATION		TOTAL
AREA ID NUMBER	FROM M.H.	TO M.H.	AREA	UNITS SINGLE	UNITS TOWN	UNITS APT	POP.	PEAK FACT.	PEAK FLOW	AREA	AREA	AREA	AREA	AREA	PEAK FLOW	TOTAL AREA	INFILT. FLOW	FLOW
			(ha)						(L/s)	(ha)	(ha)	(ha)	(ha)	(ha)	(L/s)	(ha)	(L/s)	(L/s)
R8A	8	7	0.42	0	14	0	38	3.00	0.3	0.00	0.00	0.00	0.00	0.00	0.0	0.42	0.1	0.4
R13A	13	12	0.28	0	5	0	14	3.04	0.1	0.00	0.00	0.00	0.00	0.00	0.0	0.28	0.1	0.2
R12A	12	11	0.10	0	1	0	3	3.07	0.0	0.00	0.00	0.00	0.00	0.00	0.0	0.10	0.0	0.0
R11A	11	10	0.58	0	24	0	65	2.97	0.4	0.00	0.00	0.00	0.00	0.00	0.0	0.58	0.2	0.6
R10A	10	9	0.22	0	4	0	11	3.05	0.1	0.00	0.00	0.00	0.00	0.00	0.0	0.22	0.1	0.1
R9A	9	7	0.19	0	6	0	16	3.04	0.1	0.00	0.00	0.00	0.00	0.00	0.0	0.19	0.1	0.2
G7A, R7A	7	6	0.45	0	12	0	32	3.01	0.2	0.00	0.00	0.00	0.00	0.49	0.0	0.93	0.3	0.5
R6A	6	5	0.03	0	0	0	0	3.10	0.0	0.00	0.00	0.00	0.00	0.00	0.0	0.03	0.0	0.0
R5A	5	4	0.25	0	6	0	16	3.04	0.1	0.00	0.00	0.00	0.00	0.00	0.0	0.25	0.1	0.2
R4A, R4B	4	3	0.94	0	5	0	90	2.95	0.6	0.00	0.00	0.00	0.00	0.00	0.0	0.94	0.3	0.9
R33A	33	30	0.41	0	16	0	43	3.00	0.3	0.00	0.00	0.00	0.00	0.00	0.0	0.41	0.1	0.4
R30A	30	27	0.42	0	17	0	46	2.99	0.3	0.00	0.00	0.00	0.00	0.00	0.0	0.42	0.1	0.4
R27A	27	22	0.20	0	5	0	14	3.04	0.1	0.00	0.00	0.00	0.00	0.00	0.0	0.20	0.1	0.2
R64A, EXT-1	64	63	0.17	0	0	0	0	3.10	0.0	13.19	0.00	0.00	1.04	1.28	2.8	15.68	4.7	7.5
R58A	58	57	0.36	0	8	0	22	3.03	0.2	0.00	0.00	0.00	0.00	0.00	0.0	0.36	0.1	0.3
I57B, R57A	57	56	0.51	0	15	0	41	3.00	0.3	0.00	0.00	0.00	2.95	0.00	0.6	3.46	1.0	1.9
R62A	62	61	0.17	0	5	0	14	3.04	0.1	0.00	0.00	0.00	0.00	0.00	0.0	0.17	0.1	0.1
R61A	61	60	0.17	0	3	0	8	3.05	0.1	0.00	0.00	0.00	0.00	0.00	0.0	0.17	0.1	0.1
R60A	60	59	0.80	0	34	0	92	2.95	0.6	0.00	0.00	0.00	0.00	0.00	0.0	0.80	0.2	0.9
R56A	56	55	0.22	0	6	0	16	3.04	0.1	0.00	0.00	0.00	0.00	0.00	0.0	0.22	0.1	0.2
R65A	65	54	0.21	0	4	0	11	3.05	0.1	0.00	0.00	0.00	0.00	0.00	0.0	0.21	0.1	0.1
R54GA	54G	54F	0.80	12	16	0	84	2.96	0.6	0.00	0.00	0.00	0.00	0.00	0.0	0.80	0.2	0.8
R54FA	54F	54E	0.39	8	0	0	27	3.02	0.2	0.00	0.00	0.00	0.00	0.00	0.0	0.39	0.1	0.3
R54DA	54D	54C	0.40	0	10	0	27	3.02	0.2	0.00	0.00	0.00	0.00	0.00	0.0	0.40	0.1	0.3
R54BA	54B	54A	0.60	0	22	0	59	2.98	0.4	0.00	0.00	0.00	0.00	0.00	0.0	0.60	0.2	0.6
R54AA	54A	54	0.54	0	19	0	51	2.99	0.4	0.00	0.00	0.00	0.00	0.00	0.0	0.54	0.2	0.5

Stantec

SUBDIVISION:

Richcraft Kanata West Development

DATE: 5/13/2019
REVISION: 2
DESIGNED BY: TKR
CHECKED BY: AMP

SANITARY INFLOWS FOR CATASTROPHIC HGL ANALYSIS

FILE NUMBER: **160401393**

Annual Parameters as per Technical Bulletin ISTB-2018-01

***Harmon Correction Factor of 0.6**

MAX PEAK FACTOR (RES.)=	4.0	AVG. DAILY FLOW / PERSON	200	L/p/day
MIN PEAK FACTOR (RES.)=	2.0	COMMERCIAL	17,000	L/ha/day
PEAKING FACTOR (INDUSTRIAL):	1.0	INDUSTRIAL (HEAVY)	55,000	L/ha/day
PEAKING FACTOR (COMM., INST.):	1.0	INDUSTRIAL (LIGHT)	10,000	L/ha/day
PERSONS / SINGLE	3.4	INSTITUTIONAL	17,000	L/ha/day
PERSONS / TOWNHOME	2.7	INFILTRATION	0.30	L/s/ha
PERSONS / APARTMENT	1.8	MED. DENSITY RESIDENTIAL POP.	38	units/ha

LOCATION			RESIDENTIAL AREA AND POPULATION							COMMERCIAL	INDUSTRIAL (L)	INDUSTRIAL (H)	INSTITUTIONAL	GREEN / UNUSED	C+I+I	INFILTRATION		TOTAL
AREA ID NUMBER	FROM M.H.	TO M.H.	AREA (ha)	UNITS SINGLE	UNITS TOWN	UNITS APT	POP.	PEAK FACT.	PEAK FLOW (L/s)	AREA (ha)	AREA (ha)	AREA (ha)	AREA (ha)	AREA (ha)	PEAK FLOW (L/s)	TOTAL AREA (ha)	INFILT. FLOW (L/s)	FLOW (L/s)
R51A	51	50	0.18	0	4	0	11	3.05	0.1	0.00	0.00	0.00	0.00	0.00	0.0	0.18	0.1	0.1
R50A	50	49	0.19	0	5	0	14	3.04	0.1	0.00	0.00	0.00	0.00	0.00	0.0	0.19	0.1	0.2
R49A	49	48	0.08	0	2	0	5	3.06	0.0	0.00	0.00	0.00	0.00	0.00	0.0	0.08	0.0	0.1
R48A	48	47	0.59	0	20	0	54	2.98	0.4	0.00	0.00	0.00	0.00	0.00	0.0	0.59	0.2	0.5
R47A	47	46	0.66	0	22	0	59	2.98	0.4	0.00	0.00	0.00	0.00	0.00	0.0	0.66	0.2	0.6
R46A	46	45	0.22	0	4	0	11	3.05	0.1	0.00	0.00	0.00	0.00	0.00	0.0	0.22	0.1	0.1
R45A	45	44	0.33	0	10	0	27	3.02	0.2	0.00	0.00	0.00	0.00	0.00	0.0	0.33	0.1	0.3
R44A, R44B	44	43	3.07	0	9	0	307	2.84	2.0	0.00	0.00	0.00	0.00	0.00	0.0	3.07	0.9	2.9
R43A	43	42	0.09	0	2	0	5	3.06	0.0	0.00	0.00	0.00	0.00	0.00	0.0	0.09	0.0	0.1
R42A	42	41	0.31	0	9	0	24	3.02	0.2	0.00	0.00	0.00	0.00	0.00	0.0	0.31	0.1	0.3
R41A, R41B	41	40	0.53	0	9	0	24	3.02	0.2	0.00	0.00	0.00	0.00	0.00	0.0	0.53	0.2	0.3
R40A	40	39	0.43	0	12	0	32	3.01	0.2	0.00	0.00	0.00	0.00	0.00	0.0	0.43	0.1	0.4
R39BA	39B	39A	0.49	0	13	0	35	3.01	0.2	0.00	0.00	0.00	0.00	0.00	0.0	0.49	0.1	0.4
R38A	38	37	0.08	0	2	0	5	3.06	0.0	0.00	0.00	0.00	0.00	0.00	0.0	0.08	0.0	0.1
R37A	37	36	0.78	0	27	0	73	2.97	0.5	0.00	0.00	0.00	0.00	0.00	0.0	0.78	0.2	0.7
R36A	36	35	0.63	0	21	0	57	2.98	0.4	0.00	0.00	0.00	0.00	0.00	0.0	0.63	0.2	0.6
R26A	26	25	0.50	0	21	0	57	2.98	0.4	0.00	0.00	0.00	0.00	0.00	0.0	0.50	0.1	0.5
R25A	25	24	0.32	0	11	0	30	3.01	0.2	0.00	0.00	0.00	0.00	0.00	0.0	0.32	0.1	0.3
R24A	24	23	0.15	0	3	0	8	3.05	0.1	0.00	0.00	0.00	0.00	0.00	0.0	0.15	0.0	0.1
R23A	23	22	0.19	0	5	0	14	3.04	0.1	0.00	0.00	0.00	0.00	0.00	0.0	0.19	0.1	0.2
R22BA	22B	22A	0.71	0	35	0	95	2.95	0.6	0.00	0.00	0.00	0.00	0.00	0.0	0.71	0.2	0.9
R22AA	22A	22	0.02	0	0	0	0	3.10	0.0	0.00	0.00	0.00	0.00	0.00	0.0	0.02	0.0	0.0
R22A	22	3	0.16	0	0	0	0	3.10	0.0	0.00	0.00	0.00	0.00	0.00	0.0	0.16	0.0	0.0
R74A	74	73	0.52	12	0	0	41	3.00	0.3	0.00	0.00	0.00	0.00	0.00	0.0	0.52	0.2	0.4
R73A	73	72	0.51	11	0	0	37	3.00	0.3	0.00	0.00	0.00	0.00	0.00	0.0	0.51	0.2	0.4
R72A	72	71	0.20	3	0	0	10	3.05	0.1	0.00	0.00	0.00	0.00	0.00	0.0	0.20	0.1	0.1
R71A	71	70	0.31	6	0	0	20	3.03	0.1	0.00	0.00	0.00	0.00	0.00	0.0	0.31	0.1	0.2
R70A	70	69	0.07	1	0	0	3	3.07	0.0	0.00	0.00	0.00	0.00	0.00	0.0	0.07	0.0	0.0
R69A	69	68	0.27	5	0	0	17	3.03	0.1	0.00	0.00	0.00	0.00	0.00	0.0	0.27	0.1	0.2
R68A	68	67	0.16	2	0	0	7	3.06	0.0	0.00	0.00	0.00	0.00	0.00	0.0	0.16	0.0	0.1
R67A, G67A	67	66	0.58	11	0	0	37	3.00	0.3	0.00	0.00	0.00	0.00	0.97	0.0	1.55	0.5	0.7
R66A	66	21	0.13	1	0	0	3	3.07	0.0	0.00	0.00	0.00	0.00	0.00	0.0	0.13	0.0	0.1
R21A	21	20	0.31	0	7	0	19	3.03	0.1	0.00	0.00	0.00	0.00	0.00	0.0	0.31	0.1	0.2
R32A	32	31	0.82	0	27	0	73	2.97	0.5	0.00	0.00	0.00	0.00	0.00	0.0	0.82	0.2	0.7
R31A	31	20A	0.57	0	17	0	46	2.99	0.3	0.00	0.00	0.00	0.00	0.00	0.0	0.57	0.2	0.5
R20A	20	19	0.23	0	5	0	14	3.04	0.1	0.00	0.00	0.00	0.00	0.00	0.0	0.23	0.1	0.2
R19A	19	18	0.11	0	2	0	5	3.06	0.0	0.00	0.00	0.00	0.00	0.00	0.0	0.11	0.0	0.1
R27B	27	18A	0.65	0	22	0	59	2.98	0.4	0.00	0.00	0.00	0.00	0.00	0.0	0.65	0.2	0.6
R18AA	18A	18B	0.58	0	18	0	49	2.99	0.3	0.00	0.00	0.00	0.00	0.00	0.0	0.58	0.2	0.5
R17BA	17B	17A	0.33	0	8	0	22	3.03	0.2	0.00	0.00	0.00	0.00	0.00	0.0	0.33	0.1	0.3
R17A	17	16	0.02	0	0	0	0	3.10	0.0	0.00	0.00	0.00	0.00	0.00	0.0	0.02	0.0	0.0

Stantec

SUBDIVISION:

Richcraft Kanata West Development

DATE: 5/13/2019
REVISION: 2
DESIGNED BY: TKR
CHECKED BY: AMP

SANITARY INFLOWS FOR CATASTROPHIC HGL ANALYSIS

FILE NUMBER: **160401393**

Annual Parameters as per Technical Bulletin ISTB-2018-01

***Harmon Correction Factor of 0.6**

MAX PEAK FACTOR (RES.)=	4.0	AVG. DAILY FLOW / PERSON	200	L/p/day
MIN PEAK FACTOR (RES.)=	2.0	COMMERCIAL	17,000	L/ha/day
PEAKING FACTOR (INDUSTRIAL):	1.0	INDUSTRIAL (HEAVY)	55,000	L/ha/day
PEAKING FACTOR (COMM., INST.):	1.0	INDUSTRIAL (LIGHT)	10,000	L/ha/day
PERSONS / SINGLE	3.4	INSTITUTIONAL	17,000	L/ha/day
PERSONS / TOWNHOME	2.7	INFILTRATION	0.30	L/s/ha
PERSONS / APARTMENT	1.8	MED. DENSITY RESIDENTIAL POP.	38	units/ha

LOCATION			RESIDENTIAL AREA AND POPULATION							COMMERCIAL	INDUSTRIAL (L)	INDUSTRIAL (H)	INSTITUTIONAL	GREEN / UNUSED	C+I+I	INFILTRATION		TOTAL
AREA ID NUMBER	FROM M.H.	TO M.H.	AREA (ha)	UNITS SINGLE	UNITS TOWN	UNITS APT	POP.	PEAK FACT.	PEAK FLOW (L/s)	AREA (ha)	AREA (ha)	AREA (ha)	AREA (ha)	AREA (ha)	PEAK FLOW (L/s)	TOTAL AREA (ha)	INFILT. FLOW (L/s)	FLOW (L/s)
C14B	14	3	0.00	0	0	0	0	3.10	0.0	1.47	0.00	0.00	0.00	0.00	0.3	1.47	0.4	0.7
R3CA	3C	3B	0.45	0	10	0	27	3.02	0.2	0.00	0.00	0.00	0.00	0.00	0.0	0.45	0.1	0.3
R3BA	3B	3A	0.50	0	14	0	38	3.00	0.3	0.00	0.00	0.00	0.00	0.00	0.0	0.50	0.1	0.4
R3A	3	2	0.16	0	0	0	0	3.10	0.0	0.00	0.00	0.00	0.00	0.00	0.0	0.16	0.0	0.0
R2A	2	1A	0.14	0	0	0	0	3.10	0.0	0.00	0.00	0.00	0.00	0.00	0.0	0.14	0.0	0.0
Stittsville Trunk[1]	1A	1B	526.60	0	0	0	28031	2.00	129.8	76.00	40.50	0.00	0.00	0.00	19.6	643.10	192.9	583.0
Stittsville Interceptor (Kizell Lands)	1A	1B	52.56	0	0	0	3585	2.43	20.1	11.82	0.00	0.00	0.00	0.00	2.3	64.38	19.3	41.8
Huntmar and Hazeldean[2]	1A	1B	111.52	0	0	0	6357	2.29	33.7	65.44	0.00	0.00	0.00	0.00	12.9	191.09	57.3	103.9
Additional Hazeldean[6]	1A	1B	13.62	0	0	0	296	2.85	2.0	5.39	0.00	0.00	0.00	0.00	1.1	19.01	5.7	8.7
Mattamy Maple Grove Sewer	1A	1B	137.54	0	0	0	10501	2.16	52.5	0.00	0.00	0.00	0.00	0.00	0.0	137.54	41.3	93.8
Maple Grove Expansion[3]	1A	1B	84.43	657	409	117	3549	2.43	19.9	0.00	0.00	0.00	0.00	0.00	0.0	75.99	22.8	42.9
Future Noth south collector[4]	1B	1C	28.44	0	0	0	4936	2.35	26.9	165.28	0.00	0.00	0.00	0.00	32.5	193.72	58.1	147.5
North of Richcraft Kanata Site[5]	1B	1C	1.10	0	42	0	113	2.94	0.8	0.00	0.00	0.00	0.00	0.00	0.0	1.10	0.3	1.1
									301.51						72.09			1057.08

1. Stittsville trunk sewer annual peak flows equal approximately 342 L/s. However, peak flows equal to 583L/s, 360 L/s and 465 L/s have been assumed for Scenarios 1, 2 and 3 respectively as per the design peak flows obtained by JL Richards and the IMP assumptions made for ultimate and interim conditions respectively.
2. Population and areas as obtained from Huntmar/Hazeldean Design Sheet based on KWMSS assumptions for areas 16, 20, 17, 21, 19A, 23, 24 and 19
3. Maple Grove expansion number of units and gross area based on spreadsheet provided by the City, with 90% of gross area contributing to I/I and 198 employees generating 83L/emp/day added to total flow
4. Future north-south collector population and are estimates based on IBI spreadsheet provided by the City. It includes a 30L/s fixed flow
5. Future medium density residential area, assumed to have 38 units/ha and 2.7person/unit
6. Additional area from existing residential and commercial developments along Hazeldean between Hartin Street and Savage Drive were included in Novemenr 2017 (see Atrel correspondence)

CATASTROPHOC FAILURE OF KWPS ASSUMING

			BC= 95.20 Stittsville= 583 L/s		BC= 95.20 Stittsville= 360 L/s		BC= 95.20 Stittsville= 465 L/s		BC= 95.06 Stittsville= 583 L/s	
			Scenario 1		**Scenario 2**		**Scenario 3**		**Scenario 4**	
San MH	Rim Elev.	Prop. USF (m)	HGL (m)	USF-HGL CLEARANCE	HGL (m)	USF-HGL CLEARANCE	HGL (m)	USF-HGL CLEARANCE	HGL (m)	USF-HGL CLEARANCE
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
13	100.23	98.39	97.30	1.09	97.30	1.09	97.30	1.09	97.30	1.09
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
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
21	97.48	95.60	95.43	0.17	95.37	0.23	95.40	0.20	95.29	0.31
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	-

CATASTROPHOC FAILURE OF KWPS ASSUMING

			BC= 95.20 Stittsville= 583 L/s		BC= 95.20 Stittsville= 360 L/s		BC= 95.20 Stittsville= 465 L/s		BC= 95.06 Stittsville= 583 L/s	
			Scenario 1		**Scenario 2**		**Scenario 3**		**Scenario 4**	
San MH	Rim Elev.	Prop. USF (m)	HGL (m)	USF-HGL CLEARANCE	HGL (m)	USF-HGL CLEARANCE	HGL (m)	USF-HGL CLEARANCE	HGL (m)	USF-HGL CLEARANCE
36	98.67	96.59	95.73	0.86	95.73	0.86	95.73	0.86	95.73	0.86
37	99.34	97.17	96.39	0.78	96.39	0.78	96.39	0.78	96.39	0.78
38	99.55	97.64	96.57	1.07	96.57	1.07	96.57	1.07	96.57	1.07
39	98.03	96.14	95.46	0.68	95.40	0.74	95.43	0.71	95.32	0.82
39A	97.97	96.14	95.46	0.68	95.40	0.74	95.43	0.71	95.32	0.82
39B	97.96	96.04	95.46	0.58	95.40	0.64	95.43	0.61	95.32	0.72
40	98.02	96.34	95.49	0.85	95.43	0.91	95.45	0.89	95.35	0.99
41	98.38	96.40	95.51	0.89	95.45	0.95	95.47	0.93	95.37	1.03
42	99.25	97.19	95.53	1.66	95.47	1.72	95.49	1.70	95.39	1.80
43	99.19	97.65	95.53	2.12	95.47	2.18	95.50	2.15	95.39	2.26
44	99.66	97.65	95.59	2.06	95.59	2.06	95.59	2.06	95.59	2.06
45	100.26	97.74	95.98	1.76	95.98	1.76	95.98	1.76	95.98	1.76
46	100.27	98.29	96.06	2.23	96.06	2.23	96.06	2.23	96.06	2.23
47	100.49	98.51	96.41	2.10	96.41	2.10	96.41	2.10	96.41	2.10
48	100.58	98.67	96.76	1.91	96.76	1.91	96.76	1.91	96.76	1.91
49	100.57	98.55	96.83	1.72	96.83	1.72	96.83	1.72	96.83	1.72
50	100.41	98.41	97.00	1.41	97.00	1.41	97.00	1.41	97.00	1.41
51	100.21	98.41	97.27	1.14	97.27	1.14	97.27	1.14	97.27	1.14
52	97.61	95.76	95.44	0.32	95.38	0.38	95.40	0.36	95.30	0.46
53	97.65	95.76	95.44	0.32	95.38	0.38	95.41	0.35	95.30	0.46
54	97.64	95.76	95.45	0.31	95.39	0.37	95.41	0.35	95.31	0.45
54A	97.67	95.76	95.45	0.31	95.39	0.37	95.41	0.35	95.31	0.45
54B	97.69	95.76	95.45	0.31	95.39	0.37	95.41	0.35	95.31	0.45
54C	97.66	95.76	95.45	0.31	95.39	0.37	95.41	0.35	95.31	0.45
54D	97.61	95.76	95.45	0.31	95.39	0.37	95.41	0.35	95.31	0.45
55	98.09	95.77	95.45	0.32	95.39	0.38	95.42	0.35	95.31	0.46
54E	97.54	95.76	95.45	0.31	95.39	0.37	95.41	0.35	95.31	0.45
54F	98.11	95.77	95.45	0.32	95.39	0.38	95.41	0.36	95.31	0.46
54G	98.17	95.90	95.50	0.40	95.50	0.40	95.50	0.40	95.50	0.40
56	98.16	96.00	95.46	0.54	95.40	0.60	95.42	0.58	95.32	0.68
57	98.13	96.20	95.46	0.74	95.40	0.80	95.43	0.77	95.32	0.88
58	98.24	96.20	95.55	0.65	95.55	0.65	95.55	0.65	95.55	0.65
59	97.98	96.00	95.46	0.54	95.40	0.60	95.42	0.58	95.32	0.68
60	98.23	96.28	95.46	0.82	95.40	0.88	95.42	0.86	95.32	0.96
61	98.13	96.39	95.46	0.93	95.40	0.99	95.42	0.97	95.32	1.07
62	97.95	96.49	95.46	1.03	95.40	1.09	95.42	1.07	95.32	1.17
63	98.15	95.90	95.46	0.44	95.40	0.50	95.42	0.48	95.32	0.58
64	96.99	N/A	95.46	-	95.40	-	95.43	-	95.32	-
65	97.56	95.76	95.45	0.31	95.39	0.37	95.41	0.35	95.31	0.45
66	97.47	95.60	95.44	0.16	95.38	0.22	95.40	0.20	95.30	0.30
67	97.58	95.60	95.44	0.16	95.38	0.22	95.41	0.19	95.30	0.30
68	97.64	95.92	95.44	0.48	95.38	0.54	95.41	0.51	95.30	0.62
69	97.53	95.85	95.44	0.41	95.38	0.47	95.41	0.44	95.30	0.55

CATASTROPHOC FAILURE OF KWPS ASSUMING

			BC= 95.20 Stittsville= 583 L/s		BC= 95.20 Stittsville= 360 L/s		BC= 95.20 Stittsville= 465 L/s		BC= 95.06 Stittsville= 583 L/s	
			Scenario 1		**Scenario 2**		**Scenario 3**		**Scenario 4**	
San MH	Rim Elev.	Prop. USF (m)	HGL (m)	USF-HGL CLEARANCE	HGL (m)	USF-HGL CLEARANCE	HGL (m)	USF-HGL CLEARANCE	HGL (m)	USF-HGL CLEARANCE
70	97.51	95.85	95.44	0.41	95.38	0.47	95.41	0.44	95.30	0.55
71	97.62	95.90	95.44	0.46	95.38	0.52	95.41	0.49	95.30	0.60
72	97.55	95.91	95.44	0.47	95.38	0.53	95.41	0.50	95.30	0.61
73	97.76	95.91	95.44	0.47	95.38	0.53	95.41	0.50	95.30	0.61
74	97.93	96.10	95.74	0.36	95.74	0.36	95.74	0.36	95.74	0.36

Stantec

SUBDIVISION:

Richcraft Kanata West Development

DATE: 5/13/2019
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CHECKED BY: AMP

SANITARY INFLOWS FOR NORMAL HGL ANALYSIS

FILE NUMBER: 160401393

Rare Parameters as per Technical Bulletin ISTB-2018-01

***Harmon Correction Factor of 0.6**

MAX PEAK FACTOR (RES.)=	4.0	AVG. DAILY FLOW / PERSON	200	L/p/day
MIN PEAK FACTOR (RES.)=	2.0	COMMERCIAL	17,000	L/ha/day
PEAKING FACTOR (INDUSTRIAL):	1.0	INDUSTRIAL (HEAVY)	55,000	L/ha/day
PEAKING FACTOR (COMM., INST.):	1.0	INDUSTRIAL (LIGHT)	10,000	L/ha/day
PERSONS / SINGLE	3.4	INSTITUTIONAL	17,000	L/ha/day
PERSONS / TOWNHOME	2.7	INFILTRATION	0.55	L/s/ha
PERSONS / APARTMENT	1.8	MED. DENSITY RESIDENTIAL POP.	38	units/ha

LOCATION			RESIDENTIAL AREA AND POPULATION							COMMERCIAL	INDUSTRIAL (L)	INDUSTRIAL (H)	INSTITUTIONAL	GREEN / UNUSED	C+I+I	INFILTRATION		TOTAL
AREA ID NUMBER	FROM M.H.	TO M.H.	AREA	UNITS SINGLE	UNITS TOWN	UNITS APT	POP.	PEAK FACT.	PEAK FLOW	AREA	AREA	AREA	AREA	AREA	PEAK FLOW	TOTAL AREA	INFILT. FLOW	FLOW
			(ha)						(L/s)	(ha)	(ha)	(ha)	(ha)	(ha)	(L/s)	(ha)	(L/s)	(L/s)
R8A	8	7	0.42	0	14	0	38	3.00	0.3	0.00	0.00	0.00	0.00	0.00	0.0	0.42	0.2	0.5
R13A	13	12	0.28	0	5	0	14	3.04	0.1	0.00	0.00	0.00	0.00	0.00	0.0	0.28	0.2	0.2
R12A	12	11	0.10	0	1	0	3	3.07	0.0	0.00	0.00	0.00	0.00	0.00	0.0	0.10	0.1	0.1
R11A	11	10	0.58	0	24	0	65	2.97	0.4	0.00	0.00	0.00	0.00	0.00	0.0	0.58	0.3	0.8
R10A	10	9	0.22	0	4	0	11	3.05	0.1	0.00	0.00	0.00	0.00	0.00	0.0	0.22	0.1	0.2
R9A	9	7	0.19	0	6	0	16	3.04	0.1	0.00	0.00	0.00	0.00	0.00	0.0	0.19	0.1	0.2
G7A, R7A	7	6	0.45	0	12	0	32	3.01	0.2	0.00	0.00	0.00	0.00	0.49	0.0	0.93	0.5	0.7
R6A	6	5	0.03	0	0	0	0	3.10	0.0	0.00	0.00	0.00	0.00	0.00	0.0	0.03	0.0	0.0
R5A	5	4	0.25	0	6	0	16	3.04	0.1	0.00	0.00	0.00	0.00	0.00	0.0	0.25	0.1	0.3
R4A, R4B	4	3	0.94	0	5	0	90	2.95	0.6	0.00	0.00	0.00	0.00	0.00	0.0	0.94	0.5	1.1
R33A	33	30	0.41	0	16	0	43	3.00	0.3	0.00	0.00	0.00	0.00	0.00	0.0	0.41	0.2	0.5
R30A	30	27	0.42	0	17	0	46	2.99	0.3	0.00	0.00	0.00	0.00	0.00	0.0	0.42	0.2	0.5
R27A	27	22	0.20	0	5	0	14	3.04	0.1	0.00	0.00	0.00	0.00	0.00	0.0	0.20	0.1	0.2
R64A, EXT-1	64	63	0.17	0	0	0	0	3.10	0.0	13.19	0.00	0.00	1.04	1.28	2.8	15.68	8.6	11.4
R58A	58	57	0.36	0	8	0	22	3.03	0.2	0.00	0.00	0.00	0.00	0.00	0.0	0.36	0.2	0.3
I57B, R57A	57	56	0.51	0	15	0	41	3.00	0.3	0.00	0.00	0.00	2.95	0.00	0.6	3.46	1.9	2.8
R62A	62	61	0.17	0	5	0	14	3.04	0.1	0.00	0.00	0.00	0.00	0.00	0.0	0.17	0.1	0.2
R61A	61	60	0.17	0	3	0	8	3.05	0.1	0.00	0.00	0.00	0.00	0.00	0.0	0.17	0.1	0.2
R60A	60	59	0.80	0	34	0	92	2.95	0.6	0.00	0.00	0.00	0.00	0.00	0.0	0.80	0.4	1.1
R56A	56	55	0.22	0	6	0	16	3.04	0.1	0.00	0.00	0.00	0.00	0.00	0.0	0.22	0.1	0.2
R65A	65	54	0.21	0	4	0	11	3.05	0.1	0.00	0.00	0.00	0.00	0.00	0.0	0.21	0.1	0.2
R54GA	54G	54F	0.80	12	16	0	84	2.96	0.6	0.00	0.00	0.00	0.00	0.00	0.0	0.80	0.4	1.0
R54FA	54F	54E	0.39	8	0	0	27	3.02	0.2	0.00	0.00	0.00	0.00	0.00	0.0	0.39	0.2	0.4
R54DA	54D	54C	0.40	0	10	0	27	3.02	0.2	0.00	0.00	0.00	0.00	0.00	0.0	0.40	0.2	0.4
R54BA	54B	54A	0.60	0	22	0	59	2.98	0.4	0.00	0.00	0.00	0.00	0.00	0.0	0.60	0.3	0.7
R54AA	54A	54	0.54	0	19	0	51	2.99	0.4	0.00	0.00	0.00	0.00	0.00	0.0	0.54	0.3	0.7

Stantec

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PEAKING FACTOR (COMM., INST.):	1.0	INDUSTRIAL (LIGHT)	10,000	L/ha/day
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LOCATION			RESIDENTIAL AREA AND POPULATION							COMMERCIAL	INDUSTRIAL (L)	INDUSTRIAL (H)	INSTITUTIONAL	GREEN / UNUSED	C+I+I	INFILTRATION		TOTAL
AREA ID NUMBER	FROM M.H.	TO M.H.	AREA (ha)	UNITS SINGLE	UNITS TOWN	UNITS APT	POP.	PEAK FACT.	PEAK FLOW (L/s)	AREA (ha)	AREA (ha)	AREA (ha)	AREA (ha)	AREA (ha)	PEAK FLOW (L/s)	TOTAL AREA (ha)	INFILT. FLOW (L/s)	FLOW (L/s)
R51A	51	50	0.18	0	4	0	11	3.05	0.1	0.00	0.00	0.00	0.00	0.00	0.0	0.18	0.1	0.2
R50A	50	49	0.19	0	5	0	14	3.04	0.1	0.00	0.00	0.00	0.00	0.00	0.0	0.19	0.1	0.2
R49A	49	48	0.08	0	2	0	5	3.06	0.0	0.00	0.00	0.00	0.00	0.00	0.0	0.08	0.0	0.1
R48A	48	47	0.59	0	20	0	54	2.98	0.4	0.00	0.00	0.00	0.00	0.00	0.0	0.59	0.3	0.7
R47A	47	46	0.66	0	22	0	59	2.98	0.4	0.00	0.00	0.00	0.00	0.00	0.0	0.66	0.4	0.8
R46A	46	45	0.22	0	4	0	11	3.05	0.1	0.00	0.00	0.00	0.00	0.00	0.0	0.22	0.1	0.2
R45A	45	44	0.33	0	10	0	27	3.02	0.2	0.00	0.00	0.00	0.00	0.00	0.0	0.33	0.2	0.4
R44A, R44B	44	43	3.07	0	9	0	307	2.84	2.0	0.00	0.00	0.00	0.00	0.00	0.0	3.07	1.7	3.7
R43A	43	42	0.09	0	2	0	5	3.06	0.0	0.00	0.00	0.00	0.00	0.00	0.0	0.09	0.0	0.1
R42A	42	41	0.31	0	9	0	24	3.02	0.2	0.00	0.00	0.00	0.00	0.00	0.0	0.31	0.2	0.3
R41A, R41B	41	40	0.53	0	9	0	24	3.02	0.2	0.00	0.00	0.00	0.00	0.00	0.0	0.53	0.3	0.5
R40A	40	39	0.43	0	12	0	32	3.01	0.2	0.00	0.00	0.00	0.00	0.00	0.0	0.43	0.2	0.5
R39BA	39B	39A	0.49	0	13	0	35	3.01	0.2	0.00	0.00	0.00	0.00	0.00	0.0	0.49	0.3	0.5
R38A	38	37	0.08	0	2	0	5	3.06	0.0	0.00	0.00	0.00	0.00	0.00	0.0	0.08	0.0	0.1
R37A	37	36	0.78	0	27	0	73	2.97	0.5	0.00	0.00	0.00	0.00	0.00	0.0	0.78	0.4	0.9
R36A	36	35	0.63	0	21	0	57	2.98	0.4	0.00	0.00	0.00	0.00	0.00	0.0	0.63	0.3	0.7
R26A	26	25	0.50	0	21	0	57	2.98	0.4	0.00	0.00	0.00	0.00	0.00	0.0	0.50	0.3	0.7
R25A	25	24	0.32	0	11	0	30	3.01	0.2	0.00	0.00	0.00	0.00	0.00	0.0	0.32	0.2	0.4
R24A	24	23	0.15	0	3	0	8	3.05	0.1	0.00	0.00	0.00	0.00	0.00	0.0	0.15	0.1	0.1
R23A	23	22	0.19	0	5	0	14	3.04	0.1	0.00	0.00	0.00	0.00	0.00	0.0	0.19	0.1	0.2
R22BA	22B	22A	0.71	0	35	0	95	2.95	0.6	0.00	0.00	0.00	0.00	0.00	0.0	0.71	0.4	1.0
R22AA	22A	22	0.02	0	0	0	0	3.10	0.0	0.00	0.00	0.00	0.00	0.00	0.0	0.02	0.0	0.0
R22A	22	3	0.16	0	0	0	0	3.10	0.0	0.00	0.00	0.00	0.00	0.00	0.0	0.16	0.1	0.1
R74A	74	73	0.52	12	0	0	41	3.00	0.3	0.00	0.00	0.00	0.00	0.00	0.0	0.52	0.3	0.6
R73A	73	72	0.51	11	0	0	37	3.00	0.3	0.00	0.00	0.00	0.00	0.00	0.0	0.51	0.3	0.5
R72A	72	71	0.20	3	0	0	10	3.05	0.1	0.00	0.00	0.00	0.00	0.00	0.0	0.20	0.1	0.2
R71A	71	70	0.31	6	0	0	20	3.03	0.1	0.00	0.00	0.00	0.00	0.00	0.0	0.31	0.2	0.3
R70A	70	69	0.07	1	0	0	3	3.07	0.0	0.00	0.00	0.00	0.00	0.00	0.0	0.07	0.0	0.1
R69A	69	68	0.27	5	0	0	17	3.03	0.1	0.00	0.00	0.00	0.00	0.00	0.0	0.27	0.1	0.3
R68A	68	67	0.16	2	0	0	7	3.06	0.0	0.00	0.00	0.00	0.00	0.00	0.0	0.16	0.1	0.1
R67A, G67A	67	66	0.58	11	0	0	37	3.00	0.3	0.00	0.00	0.00	0.00	0.97	0.0	1.55	0.9	1.1
R66A	66	21	0.13	1	0	0	3	3.07	0.0	0.00	0.00	0.00	0.00	0.00	0.0	0.13	0.1	0.1
R21A	21	20	0.31	0	7	0	19	3.03	0.1	0.00	0.00	0.00	0.00	0.00	0.0	0.31	0.2	0.3
R32A	32	31	0.82	0	27	0	73	2.97	0.5	0.00	0.00	0.00	0.00	0.00	0.0	0.82	0.5	1.0
R31A	31	20A	0.57	0	17	0	46	2.99	0.3	0.00	0.00	0.00	0.00	0.00	0.0	0.57	0.3	0.6
R20A	20	19	0.23	0	5	0	14	3.04	0.1	0.00	0.00	0.00	0.00	0.00	0.0	0.23	0.1	0.2
R19A	19	18	0.11	0	2	0	5	3.06	0.0	0.00	0.00	0.00	0.00	0.00	0.0	0.11	0.1	0.1
R27B	27	18A	0.65	0	22	0	59	2.98	0.4	0.00	0.00	0.00	0.00	0.00	0.0	0.65	0.4	0.8
R18AA	18A	18B	0.58	0	18	0	49	2.99	0.3	0.00	0.00	0.00	0.00	0.00	0.0	0.58	0.3	0.7
R17BA	17B	17A	0.33	0	8	0	22	3.03	0.2	0.00	0.00	0.00	0.00	0.00	0.0	0.33	0.2	0.3
R17A	17	16	0.02	0	0	0	0	3.10	0.0	0.00	0.00	0.00	0.00	0.00	0.0	0.02	0.0	0.0

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LOCATION			RESIDENTIAL AREA AND POPULATION							COMMERCIAL	INDUSTRIAL (L)	INDUSTRIAL (H)	INSTITUTIONAL	GREEN / UNUSED	C+I+I	INFILTRATION		TOTAL
AREA ID NUMBER	FROM M.H.	TO M.H.	AREA (ha)	UNITS SINGLE	UNITS TOWN	UNITS APT	POP.	PEAK FACT.	PEAK FLOW (L/s)	AREA (ha)	AREA (ha)	AREA (ha)	AREA (ha)	AREA (ha)	PEAK FLOW (L/s)	TOTAL AREA (ha)	INFILT. FLOW (L/s)	FLOW (L/s)
C14B	14	3	0.00	0	0	0	0	3.10	0.0	1.47	0.00	0.00	0.00	0.00	0.3	1.47	0.8	1.1
R3CA	3C	3B	0.45	0	10	0	27	3.02	0.2	0.00	0.00	0.00	0.00	0.00	0.0	0.45	0.2	0.4
R3BA	3B	3A	0.50	0	14	0	38	3.00	0.3	0.00	0.00	0.00	0.00	0.00	0.0	0.50	0.3	0.5
R3A	3	2	0.16	0	0	0	0	3.10	0.0	0.00	0.00	0.00	0.00	0.00	0.0	0.16	0.1	0.1
R2A	2	1A	0.14	0	0	0	0	3.10	0.0	0.00	0.00	0.00	0.00	0.00	0.0	0.14	0.1	0.1
Stittsville Trunk[1]	1A	1B	526.60	0	0	0	28031	2.00	129.8	76.00	40.50	0.00	0.00	0.00	19.6	643.10	353.7	503.1
Stittsville Interceptor (Kizell Lands)	1A	1B	52.56	0	0	0	3585	2.43	20.1	11.82	0.00	0.00	0.00	0.00	2.3	64.38	35.4	57.9
Huntmar and Hazeldean[2]	1A	1B	111.52	0	0	0	6357	2.29	33.7	65.44	0.00	0.00	0.00	0.00	12.9	191.09	105.1	151.6
Additional Hazeldean[6]	1A	1B	13.62	0	0	0	296	2.85	2.0	5.39	0.00	0.00	0.00	0.00	1.1	19.01	10.5	13.5
Mattamy Maple Grove Sewer	1A	1B	137.54	0	0	0	10501	2.16	52.5	0.00	0.00	0.00	0.00	0.00	0.0	137.54	75.6	128.2
Maple Grove Expansion[3]	1A	1B	84.43	657	409	117	3549	2.43	19.9	0.00	0.00	0.00	0.00	0.00	0.0	75.99	41.8	61.9
Future Noth south collector[4]	1B	1C	28.44	0	0	0	4936	2.35	26.9	165.28	0.00	0.00	0.00	0.00	32.5	193.72	106.5	195.9
North of Richcraft Kanata Site[5]	1B	1C	1.10	0	42	0	113	2.94	0.8	0.00	0.00	0.00	0.00	0.00	0.0	1.10	0.6	1.4
									301.51						72.09			1160.29

1. Stittsville trunk sewer rare peak flows equal approximately 503 L/s, while design peak flows of 583L/s were obtained by JL Richards.
2. Population and areas as obtained from Huntmar/Hazeldean Design Sheet based on KWMSS assumptions for areas 16, 20, 17, 21, 19A, 23, 24 and 19
3. Maple Grove expansion number of units and gross area based on spreadsheet provided by the City, with 90% of gross area contributing to I/I and 198 amployees generating 83L/emp/day added to total flow
4. Future north-south collector population and are estimates based on IBI spreadsheet provided by the City. It includes a 30L/s fixed flow
5. Future medium density residential area, assumed to have 38 units/ha and 2.7person/unit
6. Additional area from existing residential and commercial developments along Hazeldean between Hartin Street and Savage Drive were included in Novemenr 2017 (see Atrel correspondence)

KWPS UNDER NORMAL OPERATING CONDITIONS - RARE EVENT FLOW PARAMETERS

San MH	Rim Elev.	Prop. 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
5	98.63	96.64	95.44	1.20
6	98.67	96.99	95.53	1.46
7	99.11	96.99	96.02	0.97
8	100.21	97.69	97.15	0.54
9	99.23	97.44	96.21	1.23
10	99.43	97.67	96.32	1.35
11	100.75	97.67	96.90	0.77
12	100.60	98.39	97.03	1.36
13	100.23	98.39	97.30	1.09
3A	97.75	95.71	94.19	1.52
3B	97.66	95.71	94.57	1.14
3C	97.53	95.71	94.85	0.86
14	97.61	N/A	92.53	-
16	97.35	95.71	92.87	2.84
17	97.29	N/A	92.95	-
17A	97.32	95.63	94.32	1.31
17B	97.37	95.63	94.68	0.95
18	97.17	95.63	93.21	2.42
18A	97.65	95.69	93.58	2.11
19	97.43	95.63	93.35	2.28
20	97.50	95.63	93.54	2.09
21	97.48	95.60	93.73	1.87
22	97.96	96.15	91.18	4.97
22A	97.83	96.10	94.36	1.74
22B	97.84	96.10	94.85	1.25
23	98.10	96.54	94.40	2.14
24	98.05	96.30	94.47	1.83
25	98.00	96.30	94.67	1.63
26	98.10	96.30	95.00	1.30
27	97.92	95.75	93.88	1.87
30	98.01	95.90	94.33	-
31	97.52	95.70	94.49	1.21

KWPS UNDER NORMAL OPERATING CONDITIONS - RARE EVENT FLOW PARAMETERS

San MH	Rim Elev.	Prop. USF (m)	HGL (m)	USF-HGL CLEARANCE
32	97.68	95.90	94.88	1.02
33	97.62	96.00	94.59	1.41
35	97.96	96.04	91.38	4.66
35A	97.94	N/A	91.28	-
36	98.67	96.59	95.73	0.86
37	99.34	97.17	96.39	0.78
38	99.55	97.64	96.57	1.07
39	98.03	96.14	93.66	2.48
39A	97.97	96.14	94.43	1.71
39B	97.96	96.04	94.70	1.34
40	98.02	96.34	93.98	2.36
41	98.38	96.40	94.72	1.68
42	99.25	97.19	95.08	2.11
43	99.19	97.65	95.16	2.49
44	99.66	97.65	95.61	2.04
45	100.26	97.74	95.99	1.75
46	100.27	98.29	96.07	2.22
47	100.49	98.51	96.42	2.09
48	100.58	98.67	96.76	1.91
49	100.57	98.55	96.83	1.72
50	100.41	98.41	97.01	1.40
51	100.21	98.41	97.28	1.13
52	97.61	95.76	91.57	4.19
53	97.65	95.76	91.66	4.10
54	97.64	95.76	91.77	3.99
54A	97.67	95.76	94.00	1.76
54B	97.69	95.76	94.27	1.49
54C	97.66	95.76	94.53	-
54D	97.61	95.76	94.92	0.84
55	98.09	95.77	91.95	3.82
54E	97.54	95.76	94.79	0.97
54F	98.11	95.77	95.08	0.69
54G	98.17	95.90	95.50	0.40
56	98.16	96.00	92.71	3.29

KWPS UNDER NORMAL OPERATING CONDITIONS - RARE EVENT FLOW PARAMETERS

San MH	Rim Elev.	Prop. USF (m)	HGL (m)	USF-HGL CLEARANCE
57	98.13	96.20	95.18	1.02
58	98.24	96.20	95.55	0.65
59	97.98	96.00	92.79	3.21
60	98.23	96.28	94.59	1.69
61	98.13	96.39	94.66	1.73
62	97.95	96.49	94.88	1.61
63	98.15	95.90	92.23	3.67
64	96.99	N/A	92.41	-
65	97.56	95.76	94.88	0.88
66	97.47	95.60	94.04	1.56
67	97.58	95.60	94.39	1.21
68	97.64	95.92	94.44	1.48
69	97.53	95.85	94.63	1.22
70	97.51	95.85	94.69	1.16
71	97.62	95.90	94.93	0.97
72	97.55	95.91	94.99	0.92
73	97.76	95.91	95.22	0.69
74	97.93	96.10	95.75	0.35

Appendix G Drawings
May 10, 2022

Appendix G DRAWINGS

F.2 Richcraft Kanata West Development Second Registration Phase, 1620 Maple Grove Road – Servicing and Stormwater Management Report Addendum, Stantec, July 10, 2025

December 21, 2023
File: 160401393

Attention: Ms. Rubina Rasool
City of Ottawa
Development Review – East Branch
110 Laurier Avenue West
Ottawa, ON K1P 1J1

Dear Ms. Rasool,

Reference: Richcraft Kanata West Development Second Registration Phase, 1620 Maple Grove Road – Servicing and Stormwater Management Report Addendum

This Servicing and Stormwater Management (SWM) letter report addendum has been prepared to reflect draft plan changes to the approved second registration phase of the Richcraft Kanata West Development. Specifically, the single family homes in the south-eastern corner of the site have been replaced by a medium density residential block, while the rest of the site remains largely unchanged. Results from the revised water hydraulic analysis for ultimate development conditions, sanitary sewer design sheet and sanitary hydraulic grade line (HGL) analysis, as well as the revised storm sewer design sheet and stormwater management (SWM) dual drainage model are summarized in this letter report, and reflected on the revised engineering drawings included in **Appendix E**.

This letter report should be read in conjunction with the approved "*Richcraft Kanata West Development Second Registration Phase, 1620 Maple Grove Road – Servicing and Stormwater Management Report"* prepared by Stantec on May 10, 2022.

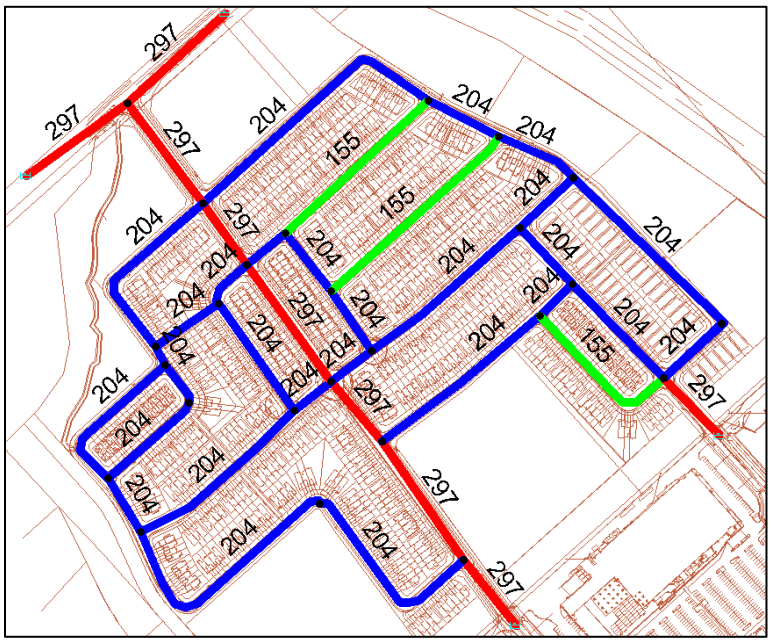
POTABLE WATER

A detailed potable water servicing analysis has been completed and is included in **Appendix A.** The analysis was created to evaluate the proposed potable water distribution network in the ultimate development conditions of the Richcraft Kanata West Development, since it is the only scenario impacted by the proposed draft plan change. The models include both the approved First Registration Phase of the Richcraft KW Development as well as the proposed phase under ultimate development conditions.

Please refer to the "*Richcraft Kanata West Development Second Registration Phase, 1620 Maple Grove Road – Servicing and Stormwater Management Report"* prepared by Stantec on May 10, 2022, for background information and further details and results on the hydraulic analysis scenarios for all construction phases of the 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 1**.

Figure 1: Ultimate Development Potable Water Distribution Network



Proposed ground elevations of the site vary from approximately 100.8 m to 97.2 m. Boundary conditions for the ultimate condition scenario were obtained from the City of Ottawa as included in **Appendix A** and summarized in **Table 1**.

Table 1: Ultimate Condition Hydraulic Analysis Boundary Conditions

Connection	Maximum HGL (m)	Peak Hour HGL (m)	Max. Day plus Fire HGL (m) 167 L/s (10,000 L/min)	Max. Day plus Fire HGL (m) 250 L/s (12,000 L/min)	Max. Day plus Fire HGL (m) 267 L/s (16,000 L/min)	Max. Day plus Fire HGL (m) 283 L/s (17,000 L/min)	Ground Elevation (m)
Maple Grove Road East (Connection #1)	162.1	157.7	154.7	151.7	151.1	150.5	96.88
Maple Grove Road West (Connection #2)	161.0	157.4	153.9	143.2	141.1	138.9	100.90
Hazeldean and Kincardine Dr. (Connection#3)	161.5	157.9	158.8	158.2	158.0	157.9	97.49
Hazeldean Road (Connection #4)	161.4	158.0	158.7	158.1	157.9	157.8	99.90

1. Boundary conditions for Max. Day plus Fire flow of 267 L/s and 250 L/s were interpolated between the values obtained from the City for 167 L/s and 283 L/s

WATER DEMANDS

Water demands for the entire KW Development for each phase of construction 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 block (Block 29) within the approved First Registration Phase was estimated based on a density of 38 units/ha and 2.7 persons per unit. The medium density residential block (Block 75) within the Second Registration Phase was based on the concept site plan prepared by M. David Blakely Architect Inc. in February 2020 (see **Appendix C.3**), which results in a unit density of 93 unit/ha. The unit count for the new medium density residential block (Block 117) has been estimated based on a unit density of 93 units/ha and 2.7 persons per unit. See **Appendix A** for detailed domestic water demand estimates.

In the ultimate development condition, the average day demand (AVDY) was determined to be 13.2 L/s. The maximum day demand (MXDY) was determined to be 31.4 L/s, which 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 68.3 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.

The calculated residential, Institutional and commercial water consumption for the ultimate development scenario is shown in **Table 2** and **Table 3**.

Table 2: Ultimate Development Residential Water Demands

Unit Type	Units	Area (ha)	Person/Unit	Population	AVDY (L/s)	MXDY (L/s)	PKHR (L/s)
Singles	45	-	3.4	153	0.62	1.55	3.41
Townhomes	479	-	2.7	1293	5.24	13.1	28.81
Back-to-back	130	-	2.7	351	1.42	3.55	7.82
MD1 (Block 29)	28	0.74	2.7	76	0.31	0.76	1.68
MD2 (Block 75)	254	2.74	2.7	686	2.78	6.95	15.28
MD3 (Block 117)	122	1.32	2.7	330	1.34	3.34	7.4
Total	**1,013**	**-**	**-**	**2,888**	**11.7**	**29.2**	**64.3**

Table 3: Ultimate Development Institutional and Commercial Water Demands

	Area (ha)	Demand (L/day)	AVDY (L/s)	MXDY (L/s)	PKHR (L/s)
Commercial	1.47	28,000	0.48	0.71	1.29
School	3.03	28,000	0.98	1.47	2.65

Fire Flow Requirements

The fire flow requirement for residential properties is capped at 10,000 L/min (167 L/s) as per the City of Ottawa Technical Bulletin ISDTB-2014-02 (May 2014) provided that firewalls 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. For the purposes of this analysis, required fire flows for private residential development blocks, as well as for the majority of proposed townhome blocks and single-family dwellings were assumed at the cap of 10,000 L/min (167 L/s). As part of the approved

Servicing and SWM Report for the Second Registration Phase (Stantec, May 2022), a maximum worst-case fire flow of 16,000 L/min (267 L/s) was estimated using FUS calculations (see detailed calculations in **Appendix A.3**) for back-to-back units, and 15,000 L/min (250 L/s) for townhome blocks that did not meet the 10 m separation between backs/sides of adjacent units. Please refer to the approved Second Registration Phase Servicing and SWM Report for hydrant spacing analysis and firewall configuration requirements.

Note that in previous submissions from the First Registration Phase, the worst-case fire flow for a 10-unit back to back townhome block was established to be 283 L/s (based on wood frame back-to-back townhome blocks designed without firewalls). Given that the 10-unit back to back townhome blocks were eventually designed with firewalls, the worst-case fire flow of 283 L/s no longer applies. The worst case fire flow demand scenario has now been replaced with a fire flow of 267 L/s based on an 8-unit back to back townhome block designed without firewalls.

HYDRAULIC MODEL

Level of Service

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 480 kPa (50 to 70 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).

Model Development

The hydraulic model used to simulate the approved First Registration Phase of the Richcraft KW Development which included the proposed Second Registration Phase distribution system has been modified to represent the ultimate development conditions based on the revised draft plan. Hazen-William's 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: Proposed Watermain C-Factors

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

HYDRAULIC MODEL RESULTS

A hydraulic model was created to simulate the ultimate development condition based on boundary conditions provided by the City of Ottawa. The hydraulic analysis was completed with H2OMAP Water Software and assessed the internal network and connections to the surrounding infrastructure. The model was tested under peak hour, average day, and maximum day plus fire flow conditions.

In the ultimate development condition, the maximum pressure modeled was approximately 92.8 psi (640 kPa) and the minimum pressure during the peak hour scenario was approximately 80.7 psi (556 kPa) as shown in **Figure 2** and **Figure 3** 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: AVDY Pressure Results for Ultimate Condition Scenario (psi)

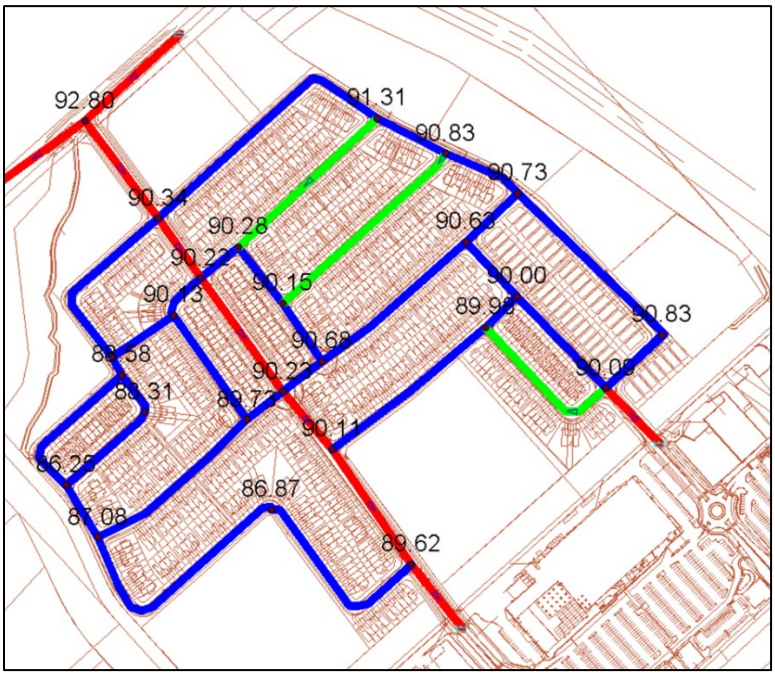
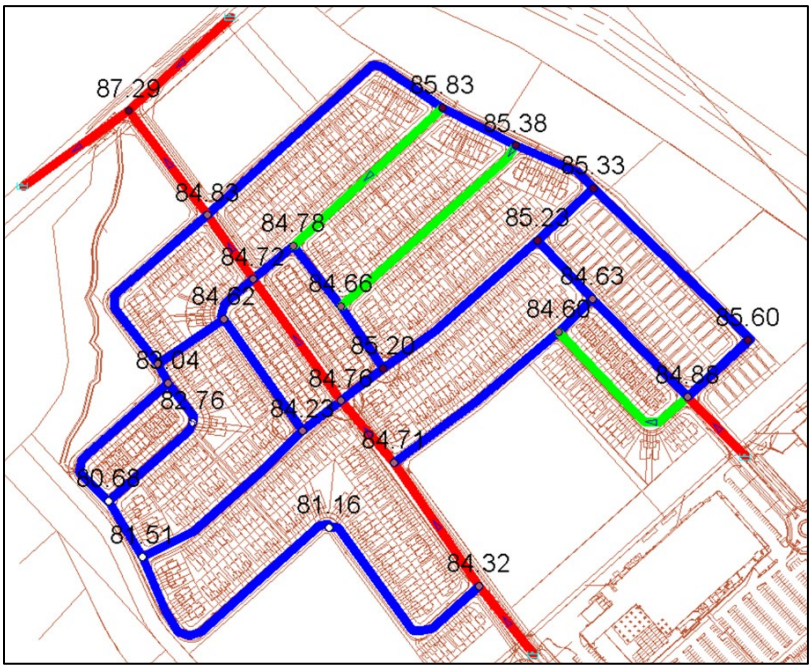


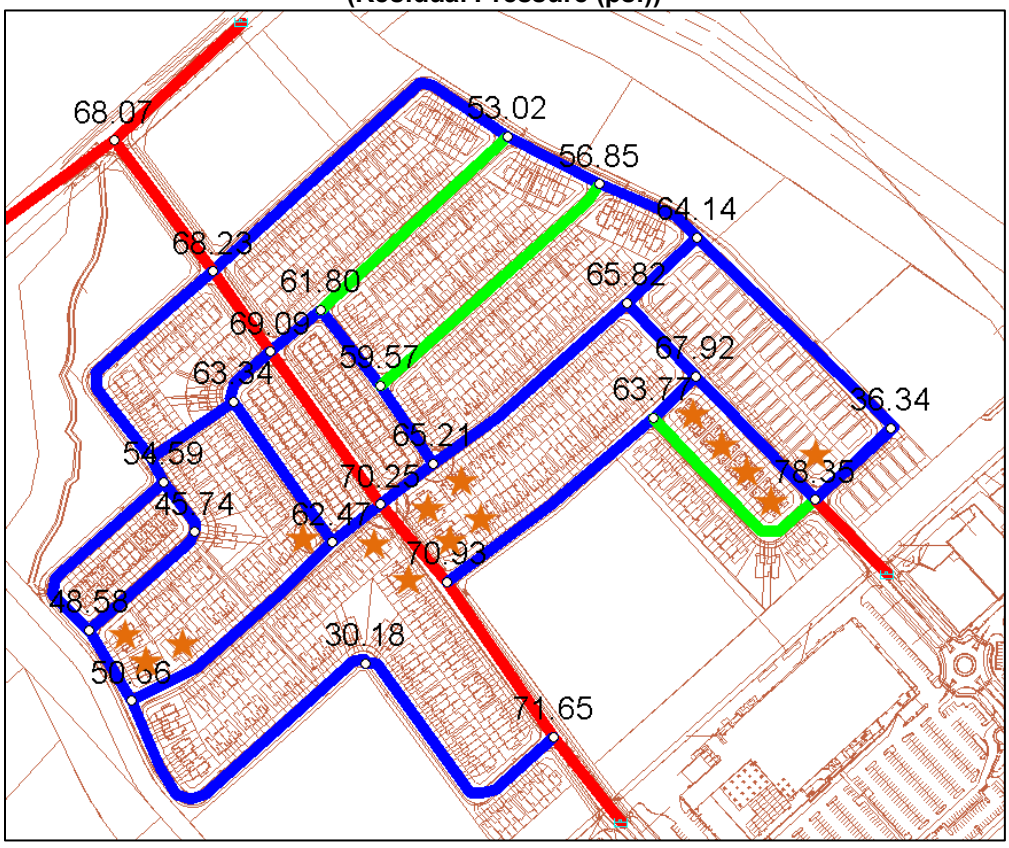
Figure 3: PKHR Pressure Results for Ultimate Condition Scenario (psi)



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 requirement of 267 L/s as per the worst-case for back to back units that do not meet the technical bulletin's 10,000 L/min fire flow cap conditions based on rear yard to side yard separation. Given all nodes within the ultimate construction phase had residual pressures above 20 psi when modeling the fire flows of 267 L/s, an additional hydraulic model was not needed to represent fire flows of 167 L/s for all capped dwellings.

Results of the ultimate condition modeling analysis indicate that flows in excess of 18,420 L/min (307 L/s) can be delivered for all proposed units while still maintaining a residual pressure of 140 kPa (20 psi). The residual pressures for the fire flow analysis are shown in **Figure 4**. Results of the hydraulic modeling are included for reference in **Appendix A**.

Figure 4: MXDY + 267 L/s Fire Flow Results for Ultimate Condition Scenario (Residual Pressure (psi))



★ Represent the Blocks that do not meet a rear yard to side yard separation of 10m.

STORM DRAINAGE

The following sections describe the stormwater management (SWM) design for the Richcraft Kanata West Development in the context of the approved background documents and governing criteria, revised to reflect the proposed draft plan changes.

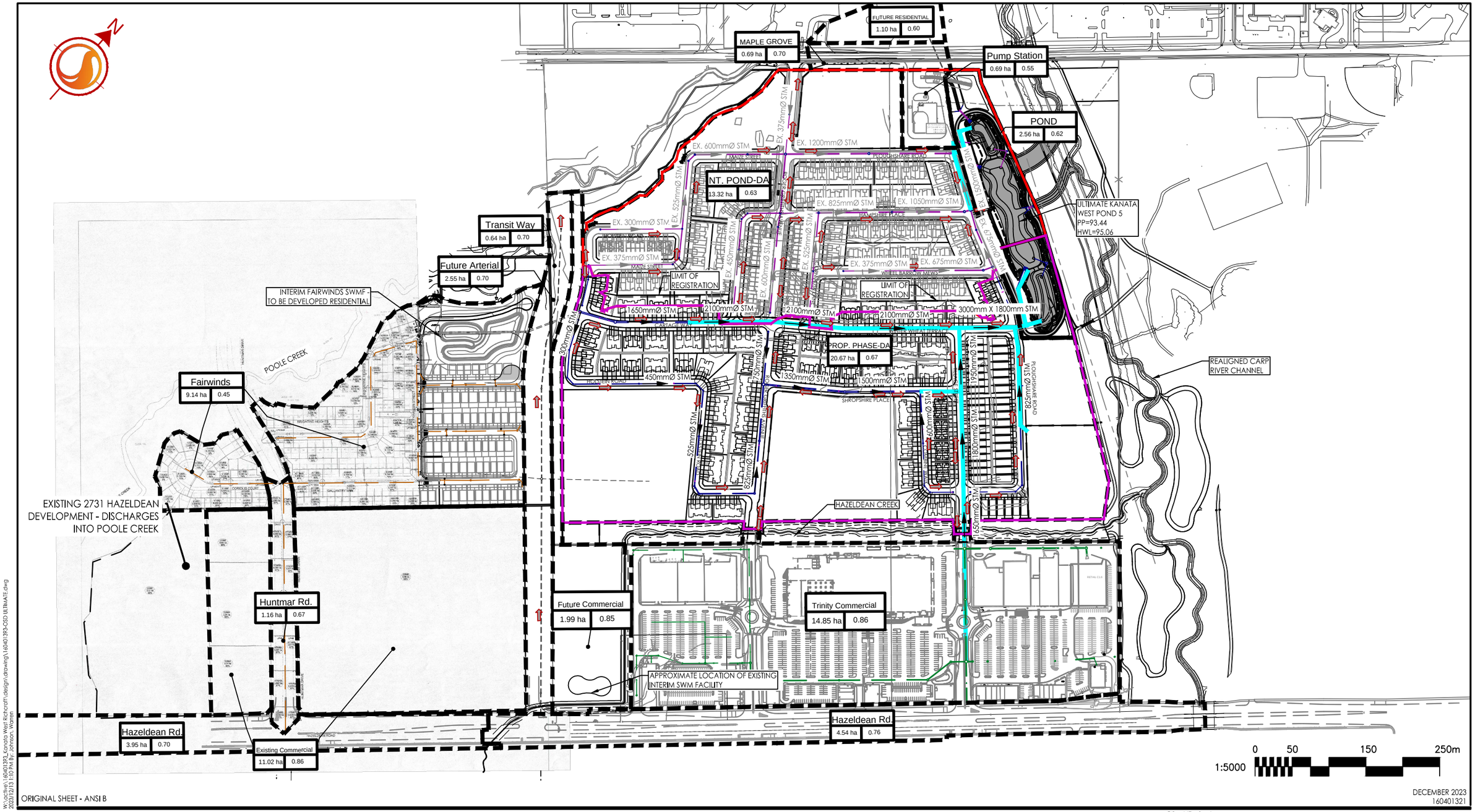
PROPOSED DRAINAGE CONDITIONS

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 two medium density residential blocks. The school block and medium density residential private blocks will be developed as separate site plan applications.

The ultimate KW SWM Pond 5, as well as the storm trunk sewer along Cartage Way and Winter Wheat Terrace have been constructed to service the Mattamy Fairwinds Subdivision to the south. SWM Pond 5 was designed to provide quantity control and 'Normal' level of quality control of stormwater runoff which corresponds to 70% Total Suspended Solids (TSS) removal prior to discharging into the Carp River. Please refer to the *Ultimate Kanata West Pond 5 Design Brief* (Stantec, May 2022) for details on SWM Pond 5 design. **Figure 5** shows the overall drainage area to the ultimate SWM Pond 5.

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, the approved SWM plan for the Richcraft Kanata West Development consisted of inlet control devices designed 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. was 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.

The SWM approach in this letter report consists of sizing inlet control devices (ICDs) for the proposed catchbasins along the revised section of Ploughshare Road (i.e., areas L234B, L234A, L234D and L235A) to meet City of Ottawa guidelines, and establishing minor and major system target peak flows for the proposed medium density residential block (Block 117) in order to restrict peak flows along the section of Ploughshare Road east of the intersection with Winter Wheat Terrace to the previously approved minor and major system peak flows at that location. Please refer to **Drawings SD-1** and **SD-2** for drainage areas, storm sewer information and ICD schedule.



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DECEMBER 2023
160401321

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

Legend

- ULTIMATE KW SWM POND 5 DRAINAGE AREA BOUNDARY
- EXISTING INTERIM KW POND 5 DRAINAGE AREA (APPROVED FIRST REGISTRATION PHASE)
- PROPOSED SECOND REGISTRATION PHASE OF RICHCRAFT KANATA WEST DEVELOPMENT DRAINAGE AREA BOUNDARY
- Catchment 1 / 4.00 ha / 0.99 — SITE ID / AREA (HA) / RUNOFF COEFFICIENT
- PROPOSED STORM SEWER
- EXISTING STORM SEWER (TRINITY COMMERCIAL)
- EXISTING STORM SEWER (FAIRWINDS)
- EXISTING STORM SEWER (KANATA WEST)
- EXTENT OF SUBMERGED SEWERS
- DIRECTION OF OVERLAND FLOW

Client/Project
RICHCRAFT HOMES
ULTIMATE KANATA WEST POND 5

Figure No.
5

Title
OVERALL DRAINAGE AREAS TO ULTIMATE KW POND 5

STORMWATER BACKGROUND AND DESIGN CRITERIA

The approved SWM criteria for the Richcraft Kanata West Development was established in the "*Richcraft Kanata West Development Second Registration Phase, 1620 Maple Grove Road – Servicing and Stormwater Management Report"* prepared by Stantec on May 10, 2022, and is summarized below.

- 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.
- The capture rates for arterial roadways to be equal to the10-year storm design.
- All sewer hydraulic analysis is to use a static boundary condition equal to the MVC 1983 flood limit of 94.60 m.
- 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.
- 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.
- Establish minor system target peak outflows for the proposed medium density residential block (Block 117) to restrict 100-year minor system peak flows in the storm sewer from MH233 to MH201 to 504 L/s as per the previously approved SWM model and thus minimize changes to the hydraulic grade line (HGL) across the site.
- Similarly, on-site storage requirements for the proposed medium density residential block (Block 117) are to be established to restrict the 100-year major system peak flow along Ploughshare Road east of the intersection with Winter Wheat Terrace to 145 L/s and thus minimize negative impacts to total flow depths downstream.

SWM DESIGN METHODOLOGY

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 approved PCSWMM model for the Richcraft Kanata West Development was revised to reflect the proposed draft plan changes within the southeast corner of the site. The vast majority of the model and its parameters remained as per the approved PCSWMM model. The following assumptions were applied as per the approved PCSWMM 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 storm 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 blocks (Block 75 and Block 117) 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.
- Minor system discharge rate from the Fairwinds Subdivision up to the 100-year storm to be restricted to 4.794 m^3/s.
- Minor system discharge rate from the Trinity Commercial Site up to the 100-year storm to be restricted to 2.118 m^3/s.
- 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 355 L/s.
- Future medium density residential blocks, areas L123B, L225B, and L235B to limit minor system peak flows up to the 100-year storm to 111 L/s, 517 L/s and 130 L/s respectively and to restrict 100-year overflows to Maize Street, Holstein Road and Ploughshare Road to 462 L/s, 748 L/s and 349 L/s respectively.
- 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.
- 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).

Boundary Conditions

The worst-case scenario for the second registration phase of the Richcraft Kanata West Development will occur under the ultimate development conditions once the full drainage area to the ultimate KW Pond 5 is built-out. The following table summarizes the approved ultimate KW Pond 5 water levels that drive the hydraulic grade line (HGL) elevations across the proposed development.

Table 5: Ultimate KW Pond 5 Water Levels

Boundary Condition	Storm Event	Ultimate Pond Water Level (m)
Carp Model Time Series	2yr, 12hrSCS	94.39
Carp Model Time Series	5yr, 12hrSCS	94.60
Carp Model Time Series	10yr, 12hrSCS	94.73
Carp Model Time Series	25yr, 12hrSCS	94.84
Carp Model Time Series	100yr, 12hrSCS	94.97
Fixed = 94.60 m	100yr, 3hrChicago	95.06

The detailed PCSWMM hydrology, the approved storm sewers and ICDs within the first and second registration phase, design assumptions and hydrology for external areas, and the proposed storm sewers and ICDs for the revised south-eastern corner within the second registration phase were used to assess the peak inflows and hydraulic grade line (HGL) in the overall 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.

SWM Modeling Parameters

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 6: 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 8 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 7: 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
EXT-4	0.13	79.6	0.5	48.6%	0.54
EXT5	0.11	77.0	4.0	24.3%	0.37
EXT6	0.12	78.8	4.0	40.0%	0.48
G234C	0.97	218.1	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
L212A	0.10	44.0	3.0	57.1%	0.60
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	84.1	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	0.26	78.0	5.0	68.6%	0.68
L234B	0.23	81.1	4.0	70.0%	0.69
L234D	0.37	210.0	3.0	52.9%	0.57
L235A	0.59	232.0	4.0	70.0%	0.69
L235B	0.98	221.4	2.0	85.7%	0.80

Area ID	Area (ha)	Width (m)	Slope (%)	% Impervious	Runoff Coefficient
POND	2.56	576.0	1.0	60.0%	0.62
UNC-1	0.06	120.0	4.0	71.4%	0.70
UNC-10	0.10	102.8	33.0	85.7%	0.80
UNC-11	0.12	119.9	33.0	85.7%	0.80
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
UNC-9	0.12	117.5	3.0	85.7%	0.80

Table 9 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 8: 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 79 & 80	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	1,187	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 70	School	218	443	355 L/s to Shropshire Place
L225B	Block 75	Residential	225	517	748 L/s to Holstein Road
G234A	Block 116	Park	234	34	182 L/s to Ploughshare Road
L235B	Block 117	Med-Density-New	235	130	349 L/s to Holstein Road

1. School block area L218A to provide 671 m^3/year of infiltration.
2. Residential block area L225B to provide 1,471 m^3/year of infiltration.
3. Residential block area L235B to provide 586 m^3/year of infiltration.

The following section summarizes the key hydrologic and hydraulic model results for the second registration phase of the 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 included in the digital submission.

Table 10 summarizes the revised ICD schedule.

Table 9: Second Registration Phase Inlet Control Device 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 (127mm ORIFICE)	0.31	1.65	15.8	40.4
C205A-IC(2)	C205A	IPEX TEMPEST HF (152mm ORIFICE)	0.31	1.65	22.1	57.7
C219-IC	C219A	IPEX TEMPEST HF (102mm ORIFICE)	0.46	1.52	13.2	25.1
C220A-IC(1)	C220A	IPEX TEMPEST HF (191mm ORIFICE)	0.30	1.65	33.0	90.7
C220A-IC(2)	C220A	IPEX TEMPEST HF (191mm ORIFICE)	0.30	1.65	33.0	90.7
C222A-IC(1)	C222A	IPEX TEMPEST HF (203mm ORIFICE)	0.40	1.71	45.0	104.1
C222A-IC(2)	C222A	IPEX TEMPEST HF (203mm ORIFICE)	0.40	1.71	45.0	104.1
C223A-IC(1)	C223A	IPEX TEMPEST HF (178mm ORIFICE)	0.25	1.61	25.1	77.8
G234C-IC	G234C	IPEX TEMPEST HF (102mm ORIFICE)	1.30	4.35	17.0	34.3
L116A-IC(1)	L116A	IPEX TEMPEST HF (95mm ORIFICE)	0.91	1.66	16.6	22.8
L116A-IC(2)	L116A	IPEX TEMPEST HF (95mm ORIFICE)	0.91	1.66	16.6	22.8
L202A-IC(1)	L202A	IPEX TEMPEST HF (83mm ORIFICE)	0.86	1.68	12.4	17.5
L202A-IC(2)	L202A	IPEX TEMPEST HF (83mm ORIFICE)	0.86	1.68	12.4	17.5
L202B-IC	L202B	IPEX TEMPEST HF (108mm ORIFICE)	1.77	2.14	30.4	33.5
L204A-IC(1)	L204A	IPEX TEMPEST HF (127mm ORIFICE)	1.20	1.63	34.2	40.2
L204A-IC(2)	L204A	IPEX TEMPEST HF (127mm ORIFICE)	1.20	1.63	34.2	40.2
L204B-IC(1)	L204B	IPEX TEMPEST HF (127mm ORIFICE)	0.89	1.60	29.2	39.8
L204B-IC(2)	L204B	IPEX TEMPEST HF (127mm ORIFICE)	0.89	1.60	29.2	39.8
L205B-IC	L205B	IPEX TEMPEST HF (127mm ORIFICE)	1.22	2.26	34.6	47.4
L206A-IC(1)	L206A	IPEX TEMPEST HF (108mm ORIFICE)	1.22	1.63	25.1	29.2
L206A-IC(2)	L206A	IPEX TEMPEST HF (108mm ORIFICE)	1.22	1.63	25.1	29.2
L206B-IC(1)	C206B	IPEX TEMPEST HF (140mm ORIFICE)	0.52	1.50	26.1	46.7
L207A-IC(1)	L207A	IPEX TEMPEST HF (152mm ORIFICE)	0.84	1.69	40.2	58.5
L207A-IC(2)	L207A	IPEX TEMPEST HF (152mm ORIFICE)	0.84	1.69	40.2	58.5
L209A-IC(1)	L209A	IPEX TEMPEST HF (127mm ORIFICE)	0.74	1.45	26.3	37.7
L209A-IC(2)	L209A	IPEX TEMPEST HF (127mm ORIFICE)	0.74	1.45	26.3	37.7
L209B-IC	L209B	IPEX TEMPEST HF (102mm ORIFICE)	1.25	1.42	22.7	24.3
L209C-IC	L209C	IPEX TEMPEST HF (108mm ORIFICE)	1.82	2.04	30.9	32.7
L210A-IC(1)	L210A	IPEX TEMPEST HF (102mm ORIFICE)	0.82	1.60	18.1	25.8
L210A-IC(2)	L210A	IPEX TEMPEST HF (102mm ORIFICE)	0.82	1.60	18.1	25.8
L210B-IC	L210B	IPEX TEMPEST HF (108mm ORIFICE)	1.09	2.14	23.6	33.5
L211A-IC(1)	L211A	IPEX TEMPEST HF (127mm ORIFICE)	1.05	1.61	31.9	39.9
L211A-IC(2)	L211A	IPEX TEMPEST HF (127mm ORIFICE)	1.05	1.61	31.9	39.9
L212A-IC1	L212A	IPEX TEMPEST HF (83mm ORIFICE)	0.23	1.41	6.0	16.0
L212A-IC2	L212A	IPEX TEMPEST HF (83mm ORIFICE)	0.23	1.41	6.0	16.0
L213A-IC(1)	L213A	IPEX TEMPEST HF (95mm ORIFICE)	1.25	1.59	19.7	22.3
L213A-IC(2)	L213A	IPEX TEMPEST HF (95mm ORIFICE)	1.25	1.59	19.7	22.3
L214A-IC(1)	L214A	IPEX TEMPEST HF (152mm ORIFICE)	0.96	1.61	43.2	57.0
L214A-IC(2)	L214A	IPEX TEMPEST HF (152mm ORIFICE)	0.96	1.61	43.2	57.0
L217A-IC(1)	L217A	IPEX TEMPEST HF (127mm ORIFICE)	0.91	1.57	29.6	39.4
L217A-IC(2)	L217A	IPEX TEMPEST HF (127mm ORIFICE)	0.91	1.57	29.6	39.4
L218B-IC	L218B	IPEX TEMPEST HF (95mm ORIFICE)	2.03	2.15	25.3	26.1
L219B-IC(1)	L219B	IPEX TEMPEST HF (127mm ORIFICE)	1.02	1.69	31.4	41.0

Orifice Name	Tributary Area ID	ICD Type	2yr Head (m)	100yr Head (m)	2yr Flow (L/s)	100yr Flow (L/s)
L219B-IC(2)	L219B	IPEX TEMPEST HF (127mm ORIFICE)	1.02	1.69	31.4	41.0
L220A-IC	L220A	IPEX TEMPEST HF (178mm ORIFICE)	1.07	2.09	62.5	89.2
L225A-IC(1)	L225A	IPEX TEMPEST HF (127mm ORIFICE)	1.24	1.70	34.9	41.1
L225A-IC(2)	L225A	IPEX TEMPEST HF (108mm ORIFICE)	1.24	1.70	25.3	29.8
L226A-IC(1)	L226A	IPEX TEMPEST HF (127mm ORIFICE)	1.07	1.59	32.3	39.7
L226A-IC(2)	L226A	IPEX TEMPEST HF (108mm ORIFICE)	1.07	1.59	23.4	28.8
L228A-IC(1)	L228A	IPEX TEMPEST HF (152mm ORIFICE)	1.26	1.61	50.0	56.9
L228A-IC(2)	L228A	IPEX TEMPEST HF (127mm ORIFICE)	1.26	1.61	35.1	39.9
L229A-IC(1)	L229A	IPEX TEMPEST HF (127mm ORIFICE)	0.82	1.57	27.9	39.5
L229A-IC(2)	L229A	IPEX TEMPEST HF (127mm ORIFICE)	0.82	1.57	27.9	39.5
L234A-IC1	L234A	IPEX TEMPEST HF (95mm ORIFICE)	1.24	1.64	19.2	22.2
L234A-IC2	L234A	IPEX TEMPEST HF (95mm ORIFICE)	1.24	1.64	19.2	22.2
L234B-IC1	L234B	IPEX TEMPEST HF (95mm ORIFICE)	0.99	1.65	17.1	22.3
L234B-IC2	L234B	IPEX TEMPEST HF (95mm ORIFICE)	0.99	1.65	17.1	22.3
L234D-IC	L234D	IPEX TEMPEST HF (152mm ORIFICE)	1.36	2.12	52.1	65.8
L235A-IC1	L235A	IPEX TEMPEST HF (178mm ORIFICE)	0.87	1.69	55.6	79.9
L235A-IC2	L235A	IPEX TEMPEST HF (178mm ORIFICE)	0.87	1.69	55.6	79.9

Proposed Development Storm 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 SWM Pond 5.

As shown in **Figure 5**, a portion of the proposed storm sewer system will be partially submerged. Specifically, approximately 112 m of storm sewer tributary to the west forebay (approved first registration phase) and approximately 1,123 m of storm sewer tributary to the east forebay (proposed ultimate condition) will be partially submerged.

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 11** 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 10: 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	95.08	95.08	95.08	-	95.11	95.12	95.12	-
100B	N/A	95.10	95.10	95.10	-	95.14	95.15	95.15	-

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)
100C	N/A	95.07	95.07	95.07	-	95.10	95.12	95.12	-
100D	N/A	95.10	95.10	95.10	-	95.14	95.16	95.16	-
100E	N/A	95.07	95.07	95.07	-	95.10	95.12	95.12	-
101	95.74	95.18	95.19	95.19	0.55	95.23	95.26	95.26	0.48
102	95.63	95.21	95.21	95.21	0.42	95.26	95.28	95.28	0.35
103	95.69	95.24	95.24	95.24	0.45	95.29	95.32	95.32	0.37
104	95.75	95.26	95.26	95.26	0.49	95.31	95.35	95.35	0.40
105	96.00	95.35	95.34	95.35	0.65	95.41	95.44	95.44	0.56
106	96.00	95.37	95.36	95.37	0.63	95.44	95.48	95.48	0.52
107	96.10	95.58	95.60	95.60	0.50	95.69	95.75	95.75	0.35
108	96.10	95.62	95.67	95.67	0.43	95.77	95.86	95.86	0.24
+50m	96.25	95.65	95.76	95.76	0.49	95.85	95.97	95.97	0.28
+86m	96.33	95.68	95.83	95.83	0.50	95.91	96.05	96.05	0.28
109	96.23	95.70	95.89	95.89	0.34	95.96	96.12	96.12	0.11
110	96.54	95.71	95.75	95.75	0.79	95.84	95.90	95.90	0.64
111	96.30	95.76	95.81	95.81	0.49	95.90	95.96	95.96	0.34
112	96.30	95.94	95.99	95.99	0.31	96.08	96.14	96.14	0.16
+51m	96.34	95.98	96.04	96.04	0.30	96.13	96.19	96.19	0.15
113	96.37	96.01	96.07	96.07	0.30	96.16	96.22	96.22	0.15
114	95.63	95.23	95.24	95.24	0.39	95.29	95.31	95.31	0.32
115	95.71	95.31	95.32	95.32	0.39	95.37	95.39	95.39	0.32
116	95.75	95.45	95.46	95.46	0.29	95.52	95.54	95.54	0.21
117	95.70	95.42	95.43	95.43	0.27	95.48	95.51	95.51	0.19
118	95.90	95.58	95.60	95.60	0.30	95.68	95.71	95.71	0.19
119	95.70	95.34	95.35	95.35	0.35	95.41	95.44	95.44	0.26
+51m	95.79	95.40	95.41	95.41	0.38	95.48	95.51	95.51	0.28
121	96.20	95.48	95.49	95.49	0.71	95.56	95.59	95.59	0.61
121A	N/A	95.49	95.49	95.49	-	95.56	95.60	95.60	-
123	96.40	95.68	95.66	95.68	0.72	95.78	95.79	95.79	0.61
124	96.64	96.34	96.34	96.34	0.30	96.34	96.34	96.34	0.30
125	96.99	96.48	96.48	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
+71	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
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	95.29	95.29	0.67
210	95.91	95.54	95.57	95.57	0.34	95.63	95.69	95.69	0.22
+35m	95.86	95.42	95.44	95.44	0.42	95.50	95.55	95.55	0.31

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)
202	95.76	95.33	95.35	95.35	0.41	95.41	95.44	95.44	0.32
+75	95.84	95.45	95.49	95.49	0.35	95.56	95.59	95.59	0.25
204	95.93	95.56	95.63	95.63	0.30	95.71	95.74	95.74	0.19
+54m	96.04	95.64	95.73	95.73	0.31	95.81	95.85	95.85	0.19
205	96.14	95.72	95.84	95.84	0.30	95.91	95.96	95.96	0.18
+82m	96.74	95.84	95.99	95.99	0.75	96.07	96.14	96.14	0.60
206	97.17	95.88	96.04	96.04	1.13	96.12	96.20	96.20	0.97
207	97.43	96.39	96.72	96.72	0.71	96.76	97.00	97.00	0.43
209	N/A	96.70	97.13	97.13	-	97.14	97.47	97.47	-
211	95.91	95.58	95.61	95.61	0.30	95.68	95.74	95.74	0.17
212	N/A	95.64	95.67	95.67	-	95.74	95.81	95.81	-
213	96.18	95.67	95.71	95.71	0.47	95.78	95.83	95.83	0.35
214	96.18	95.76	95.81	95.81	0.37	95.87	95.94	95.94	0.24
215	96.28	95.87	95.92	95.92	0.36	95.99	96.06	96.06	0.22
216	96.39	95.90	95.95	95.95	0.44	96.02	96.09	96.09	0.30
217	96.59	95.98	96.03	96.03	0.56	96.10	96.17	96.17	0.42
218	96.20	95.73	95.79	95.79	0.41	95.85	95.91	95.91	0.29
220	96.24	95.86	95.94	95.94	0.30	96.01	96.07	96.07	0.17
+38m	96.21	95.83	95.91	95.91	0.30	95.98	96.04	96.04	0.17
219	96.28	95.80	95.87	95.87	0.41	95.94	96.00	96.00	0.28
+62m	96.38	95.94	96.04	96.04	0.34	96.11	96.17	96.17	0.21
221	96.40	95.97	96.08	96.08	0.32	96.15	96.21	96.21	0.19
222	96.93	96.31	96.48	96.48	0.45	96.55	96.60	96.60	0.33
+52m	97.19	96.61	96.78	96.78	0.41	96.85	96.90	96.90	0.29
223	97.48	96.75	96.92	96.92	0.56	96.99	97.03	97.03	0.45
224	97.48	96.86	97.02	97.02	0.46	97.10	97.14	97.14	0.34
225	97.65	97.14	97.29	97.29	0.36	97.37	97.41	97.41	0.24
226	98.34	97.31	97.47	97.47	0.87	97.55	97.59	97.59	0.75
227	98.29	97.39	97.55	97.55	0.74	97.63	97.67	97.67	0.62
228	98.29	97.63	97.83	97.83	0.46	97.91	97.97	97.97	0.32
229	98.51	97.68	97.89	97.89	0.62	97.98	98.04	98.04	0.47
230	98.55	97.68	97.89	97.89	0.66	97.98	98.04	98.04	0.51
231	98.41	97.68	97.90	97.90	0.51	97.98	98.04	98.04	0.37
232	98.41	97.56	97.84	97.84	0.57	97.98	98.04	98.04	0.37
233	95.60	95.25	95.25	95.25	0.35	95.31	95.33	95.33	0.27
234	95.70	95.36	95.37	95.37	0.33	95.43	95.44	95.44	0.26
235	95.85	95.46	95.47	95.47	0.38	95.53	95.54	95.54	0.31
236	95.90	95.46	95.47	95.47	0.43	95.53	95.54	95.54	0.36
237	95.90	95.46	95.47	95.47	0.43	95.53	95.54	95.54	0.36

1. HGL values have been interpolated between proposed 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 12 shows the results of the sediment accumulation HGL analysis for the Ultimate condition development during the 25-year, 3-hour Chicago storm.

Table 11: 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	94.77	N/A
100B	N/A	94.77	N/A
100C	N/A	94.76	N/A
100D	N/A	94.78	N/A
100E	N/A	94.74	N/A
101	95.74	94.85	0.89
102	95.63	94.86	0.77
103	95.69	94.88	0.81
104	95.75	94.89	0.86
105	96.00	95.18	0.82
106	96.00	95.26	0.74
107	96.10	95.17	0.93
108	96.10	95.27	0.83
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	94.89	0.74
115	95.71	94.95	0.76
116	95.91	95.29	0.62
117	95.70	95.11	0.59
118	95.90	95.54	0.36
119	95.70	94.93	0.77

STM MH	Prop. USF (m)	25-Year, 3 HR Chicago HGL (m)	USF - HGL Clearance (m)
121	96.20	95.02	1.18
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
201	95.96	94.84	1.12
202	95.94	94.87	1.07
204	95.94	94.89	1.05
205	96.14	94.89	1.25
206	96.59	94.90	1.69
207	97.43	95.42	2.01
209	N/A	95.87	N/A
210	96.30	95.15	1.15
211	96.25	95.19	1.06
212	N/A	95.24	N/A
213	96.35	95.28	1.07
214	96.35	95.38	0.97
215	96.57	95.47	1.10
216	96.59	95.57	1.02
217	96.59	95.76	0.83
218	96.30	95.35	0.95

STM MH	Prop. USF (m)	25-Year, 3 HR Chicago HGL (m)	USF - HGL Clearance (m)
219	96.48	95.40	1.08
220	96.39	95.49	0.90
221	96.48	95.63	0.85
222	96.93	96.09	0.84
223	96.93	96.54	0.39
224	97.48	96.65	0.83
225	97.65	96.95	0.70
226	98.34	97.13	1.21
227	98.29	97.21	1.08
228	98.29	97.50	0.79
229	98.51	97.55	0.96
230	98.55	97.55	1.00
231	98.41	97.33	1.08
232	98.41	97.56	0.85
233	95.60	94.89	0.71
234	95.70	95.03	0.67
235	95.85	95.12	0.73
236	95.90	95.12	0.78
237	95.90	95.13	0.77

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.

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. ICD sizing remains the same for the majority of the site, as the approved SWM design for the second registration phase, with the exception of the south-eastern corner areas L235A, L234A and L234D.

Table 13 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. A summary table showing the total surface water depths for the 5-year design storms for the proposed phase areas of the Richcraft Kanata West Development has been included in **Appendix B.3**

Table 12: Proposed Phase – Ultimate Maximum Static and Dynamic Surface Water Depths

Storage node ID	Top of Grate Elevation (m)	Lowest Adjacent Building Opening (m)	2-year, 3-hour Chicago		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)	Max HGL (m)	Total Surface Ponding Depth (m)
205A-S(1)	97.45	98.15	96.38	0.00	97.72	0.27	97.80	0.35
206B-S(1)	97.77	98.50	96.91	0.00	97.89	0.12	97.93	0.16
219A-S(1)	97.82	98.09	96.90	0.00	97.96	0.14	98.04	0.22
220A-S	97.68	98.30	96.60	0.00	97.95	0.27	98.03	0.35
222A-S	97.82	98.45	96.84	0.00	98.15	0.33	98.23	0.41
223A-S	98.17	99.10	97.04	0.00	98.40	0.23	98.43	0.26
G234C-S	97.59	N/A	94.71	0.00	97.76	0.17	97.78	0.19
116A-S	97.20	97.87	96.73	0.00	97.48	0.28	97.54	0.34
202A-S(1)	97.27	97.82	96.75	0.00	97.57	0.30	97.62	0.35
204A-S(1)	97.39	98.01	97.21	0.00	97.64	0.25	97.73	0.34
204BS(1)	97.36	97.92	96.87	0.00	97.58	0.22	97.66	0.30
206A-S(1)	98.29	98.85	98.13	0.00	98.54	0.25	98.58	0.29
207A-S(1)	98.68	99.35	98.14	0.00	98.99	0.31	99.03	0.35
209A-S	99.59	100.23	98.95	0.00	99.66	0.07	99.66	0.07
209B-S	100.03	N/A	99.90	0.00	100.07	0.04	100.08	0.05
210A-S	97.37	97.94	96.81	0.00	97.59	0.22	97.65	0.28
211A-S(1)	97.75	98.25	97.42	0.00	97.98	0.23	98.02	0.27
L212A-S	96.94	N/A	95.79	0.00	96.97	0.03	96.97	0.03
213A-S	97.82	98.30	97.69	0.00	98.03	0.21	98.04	0.22
214A-S(1)	97.65	98.35	97.23	0.00	97.88	0.23	97.94	0.29
217A-S	97.81	98.50	97.34	0.00	98.00	0.19	98.05	0.24
219B-S	97.98	98.43	97.62	0.00	98.29	0.31	98.37	0.39
225A-S	99.03	99.57	98.89	0.00	99.35	0.32	99.38	0.35
226A-S	99.46	99.85	99.15	0.00	99.67	0.21	99.70	0.24
228A-S	99.99	100.40	99.87	0.00	100.22	0.23	100.25	0.26
229A-S	100.20	100.62	99.64	0.00	100.39	0.19	100.44	0.24
234A-S	97.35	97.85	97.21	0.00	97.61	0.26	97.66	0.31
234B-S	97.30	97.77	96.91	0.00	97.57	0.27	97.62	0.32
235A-S	97.36	97.80	96.85	0.00	97.67	0.31	97.71	0.35

WATER BALANCE – INFILTRATION REQUIREMENTS

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 attached.

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 is proposed that the upper 20 cm layer of soil within the proposed front and back landscaped areas (Second Registration Phase), and

within landscaped areas in the proposed park (Second Registration Phase) be constructed with amended soils to promote infiltration and evapotranspiration. It is also recommended that the underlying soils below the proposed amended topsoil layer be scarified to a depth of 45 cm to promote additional infiltration.

Other practices for groundwater infiltration include:

- Direct roof leaders to rear yard areas
- bioswales underlying drainage swales in proposed rearyard areas
- The use of amended planting topsoil in parks and residential backyards
- 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 6**).

Of the total site area, 22.43 ha will be converted to impervious area with no infiltration, which excludes the proposed ultimate SWM pond footprint of 2.56 ha that will not provide infiltration either. Approximately 11.54 ha will consist of parks, lawns and open space areas. The inclusion of amended planting topsoil in proposed residential landscaped areas and the proposed park area (total of 2.66 ha) is expected to provide additional infiltrative capacity to surficial soils in order to increase post development infiltration rate from pervious areas to 12,125 m^3/year (10,706 m^3/year to be infiltrated elsewhere). The practice of applying a deeper layer of organic topsoil has the potential to absorb runoff and increase infiltration, as well as to promote evapotranspiration, thus reducing runoff volumes overall. Due to the impervious nature of the native clay soils, it is expected that the addition of amended soils to the rearyard landscaped areas within the proposed phase as well as within the proposed park landscaped areas will promote shallow groundwater movement to the Carp River and Hazeldean Creek.

The recommended minimum topsoil depth and quality standards as per the Toronto and Region Conservation Authority is as follows.

Table 13: Amended Planting Soil Minimum Depth and Quality Standards

Planting Area Type	Subsoil Scarifying Depth (cm)	Topsoil Organic Matter (%dry wt.)	Topsoil PH	Planting Soil Depth (cm)	Total Uncompacted Soil Depth (cm)
Turf Area	45	5 to 10	6.0 to 8.0	20	65
Planting Bed of Tree Pit	45	10 to 15	6.0 to 8.0	20	65

Rear-yard bioswales within the approved and proposed phases of the development are required to provide the additional 10,706 m^3/year.

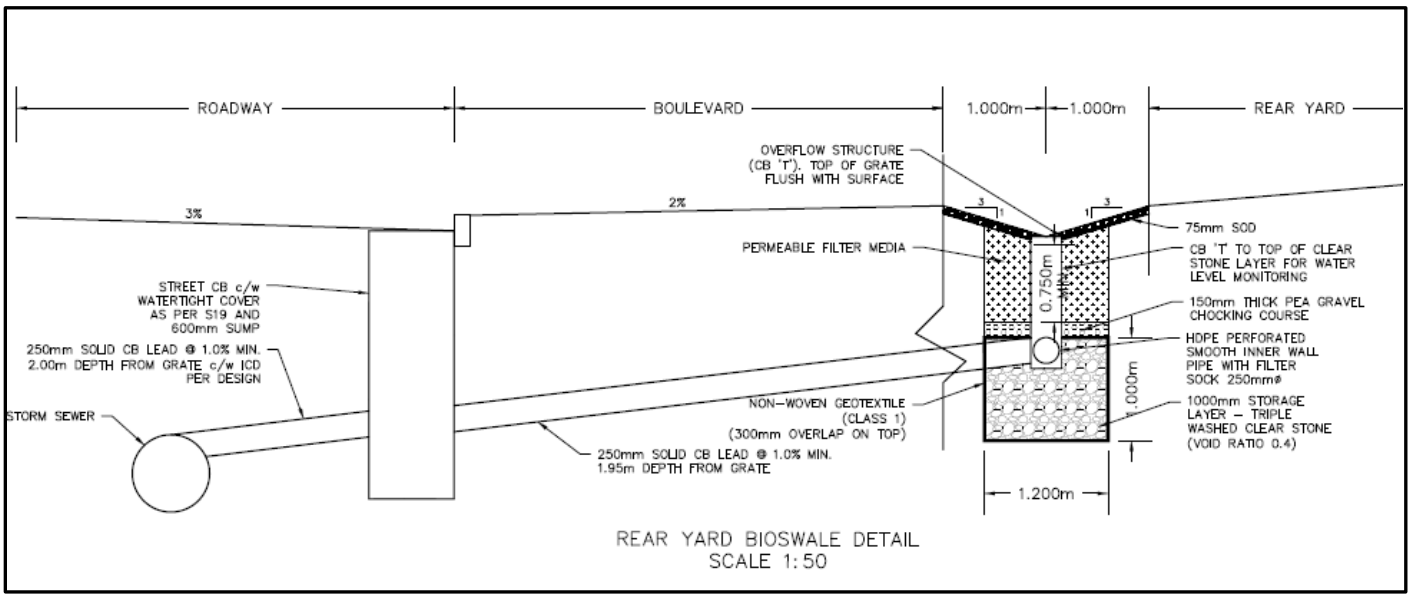
Based on average precipitation data available (2000-2011), approximately 31 rainfall events/yr have a rainfall depth that ranges between 6 mm and 25 mm, for an average depth of 12.2 mm. Based on the roof area tributary to the rear yard bioswales in the approved and proposed phases (21,289 m^2 based on half roofs directed to rearyards), the annual volume of runoff from the roofs to the bioswales is approximately 7,979 m^3 (2,727 m^3/year to be infiltrated elsewhere).

As per the approved SWM plan for the second registration phase of the development, the school block (Block 70) is required to in filtrate 671 m^3/yr and as such, the remainder 2,056 m^3/yr are required to be infiltrated within the two proposed medium density residential blocks (Block 75 and Block 117).

Given that the total area for the two medium density residential blocks is 4.64 ha, an infiltration target of 443 m^3/year has been established for each block (refer to **Table 9** for future block SWM criteria). 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 6: 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. However, for conservatism, the proposed infiltration measures have not been included in the PCSWMM models for the proposed development. **Table 15** summarizes the design characteristics of the proposed bioswales.

Table 14: Proposed Bioswale Characteristics

Drainage Area ID	Drainage Area (ha)	Imperviousness (%)	Required Volume for 25mm Event (m^3)	Bioswale Length (m)	Bioswale Width (m)	Storage Layer Depth (m)	Maximum Storage Available (m)
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

Drainage Area ID	Drainage Area (ha)	Imperviousness (%)	Required Volume for 25mm Event (m^3)	Bioswale Length (m)	Bioswale Width (m)	Storage Layer Depth (m)	Maximum Storage Available (m)
L234D	0.37	53%	49	90	1.2	0.75	35
L218B	0.25	36%	22	131	1.2	0.75	51
L220A	0.87	34%	75	192	1.2	0.75	75

WASTEWATER

The second registration phase of the Richcraft Kanata West Development was previously approved in 2022. However, the draft plan has been revised to replace single family homes in the south-eastern corner of the site by a medium density residential block (Block 117), and as such, the sanitary sewer design sheet and HGL analysis across the entire site have been revised to reflect the revised draft plan changes.

The second registration phase of the Richcraft Kanata West Development will be serviced through the approved sanitary sewers within the first registration phase that ultimately discharge into the existing 1200 mm diameter sanitary sewer on Maple Grove Road and the Kanata West Pump Station (KWPS) as shown on **Drawing OSSP-2**. The proposed sanitary trunk sewers have been sized for the ultimate development condition which includes sewage peak flows from the existing Trinity Development to the south.

Modelling of the proposed sanitary sewer system is required as per the Kanata West Master Servicing Study (Stantec, 2006) to assess maximum HGLs during critical failure of the KWPS. In addition, as outlined in the City's "Technical Bulletin ISTB-2018-01", a sanitary HGL analysis is required to assess the maximum HGL in the sanitary sewer system under normal pumping station conditions. The HGL across the proposed site has been assessed under the worst-case scenario which occurs during full build-out of the Richcraft Kanata West Development, and once a sanitary connection has been provided for the existing Trinity Development through the proposed site.

DESIGN CRITERIA

The following design guidelines were obtained from the City's "Technical Bulletin ISTB-2018-01" and were used to estimate wastewater flow rates from the proposed development and to size the sanitary sewers.

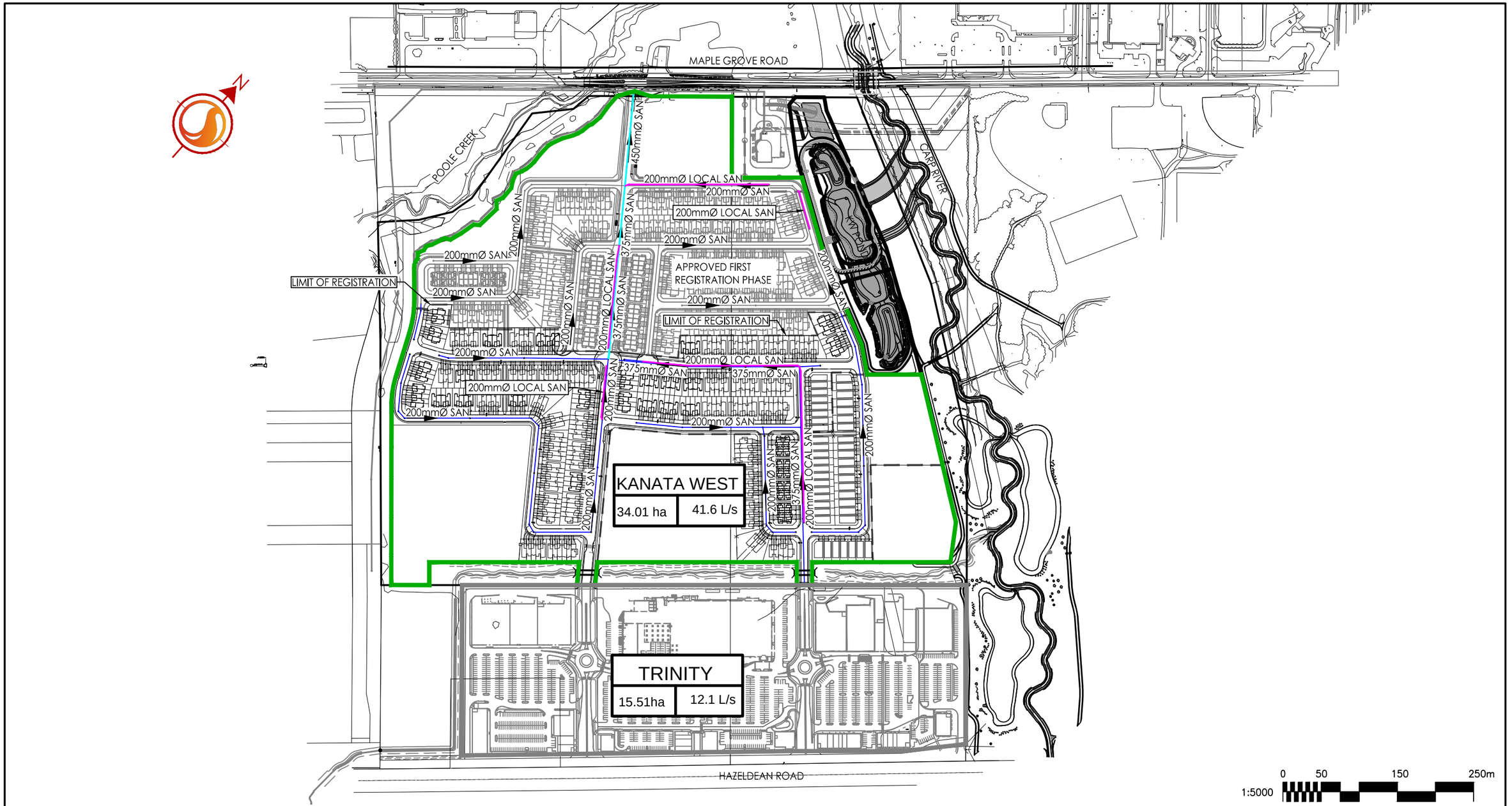
- Minimum Full Flow Velocity – 0.6 m/s
- Maximum Full Flow Velocity – 3.0 m/s
- Manning roughness coefficient for all smooth wall pipes – 0.013
- Single Family Persons per unit – 3.4
- Townhouse unit – 2.7
- Per Capita Residential Average Daily Flow – 280 L/p/day
- Commercial and Institutional Average Daily Flow - 28,000 L/ha/day
- Peaking Factor for Commercial and Institutional Areas – 1.5 if ICI in contributing area is >20%; ICI Peak Factor =1.0 if ICI in contributing area <20%

- Extraneous Flow Allowance – 0.33 L/s/ha
- Manhole Spacing – 120m for pipes under 450mm dia., 150m for pipes over 450mm dia.
- Minimum Cover – 2.5 m

In the approved First Registration phase of the development, a unit density of 38 units/ha was used for the medium density residential block (Block 29). However, the unit density for the medium density residential block (Block 75) within the approved Second Registration Phase of the development was based on an available concept plan, which has been included in **Appendix C.3.** Based on the concept plan, the unit density for medium density residential blocks within the Second Registration Phase has been revised to approximately 93 units/hectare. This unit density was used for both medium density residential blocks (Block 75 and Block 117) within the Second Registration Phase**.** A residential peak factor based on Harmon's Equation with a correction factor of 0.8 was used to determine the residential peak design flows.

PROPOSED SANITARY SEWERS

The proposed sanitary sewer system has been designed as a network of gravity sewers which will direct wastewater flows from the approved and proposed phases of the Richcraft Kanata West Subdivision and the existing Trinity Development (approximately **53.1 L/s** which includes **12.1 L/s** from the existing Trinity commercial site) to the Maple Grove trunk sewer and ultimately to the Kanata West Pump Station (KWPS). The overall external drainage extent is shown on **Figure 7**, while the overall drainage areas, wastewater peak flows and sanitary sewers within the approved and proposed development areas are shown on **Drawings SA-1** and **SA-2** and in the sanitary sewer design sheet included in **Appendix C.1.**



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DECEMBER 2023
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Stantec
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Legend

- EXISTING SANITARY DRAINAGE BOUNDARY
- PROPOSED OVERALL SANITARY DRAINAGE BOUNDARY
- Catchment 1 / 4.00 ha / 50L/s — SITE ID / AREA (HA) / QPEAK (L/s)
- PROPOSED SANITARY SEWER
- APPROVED FIRST REGISTRATION PHASE SANITARY SEWER
- PROPOSED DEEP TRUNK SANITARY SEWER (DEEPER THAN 6.0m)
- PROPOSED HIGH LEVEL LOCAL SANITARY SEWER

Client/Project
RICHCRAFT HOMES
RICHCRAFT KANATA WEST

Figure No.
7

Title
PROPOSED SANITARY SEWER NETWORK AND EXTERNAL DRAINAGE EXTENT

Stantec Consulting Ltd.
300-1331 Clyde Avenue, Ottawa ON K2C 3G4

SANITARY HGL ANALYSIS

This section summarizes the results of the sanitary hydraulic grade line (HGL) analysis for the proposed second registration phase of the Richcraft Kanata West Development, which has been revised to replace the single family homes in the south-eastern corner of the site with a medium density residential block (Block 117). The worst-case HGL occurs at full build-out of the Richcraft KW Development and as such, the HGL analysis includes the approved and proposed sanitary sewers within the entire Richcraft KW Development, external wastewater flows from the existing Trinity Development, as well as the existing 1200 mm diameter sanitary trunk sewer on Maple Grove Road from the subdivision outlet to the Kanata West Pumping Station (KWPS) located at the southwest intersection of Maple Grove Road and Terry Fox Drive.

The sanitary HGL across the proposed Richcraft subdivision has been assessed assuming ultimate development conditions for the KWPS catchment area under both catastrophic failure and normal operating conditions of the KWPS. The sanitary HGL analysis was prepared based on the following background documents provided by the City of Ottawa (see **Appendix C.3**).

- *Alternative 2: Divert Stittsville Trunk Sewer Only Design Sheet Long Term Flows (2031)*, J.L Richard and Associates, December 2014.
- *Fernbank Community – Kizell Lands, Sanitary Drainage Area Plan*, Novatech, February 2018.
- *Fernbank Community – Kizell Lands, Sanitary Sewer Design Sheet*, Novatech, February 2018.
- *Kanata West Master Servicing Study, Sanitary Sewer Design Sheet*, Stantec Consulting Ltd., CCL and IBI, April 2005.
- *Kanata West Concept Plan Master Servicing Study, Preferred Waste-Water Option*, Stantec Consulting Ltd., CCL and IBI, October 2005.
- *Reconstruction of Maple Grove Road, Sanitary Drainage Plan*, DSEL on behalf of the City of Ottawa, July 2011.
- *Reconstruction of Maple Grove Road, Sanitary Sewer Calculation Sheet,* DSEL on behalf of the City of Ottawa, May 2012.
- *Kanata West Serviceability Study, N-S Interceptor Sewer Sanitary Design Sheet*, IBI, June 2016.
- *Maple Grove Expansion Area Excel Sheet*, City of Ottawa.
- *Hazeldean Sanitary Sewer Analysis*, Atrel Engineering Ltd., November 29th, 2017.
- *Kanata West Pumping Station and Forcemains Preliminary Design Report*, Stantec Consulting Ltd., April 13, 2015
- *Kanata West Pumping station and Forcemains – Preliminary Design Report*, Stantec Consulting Ltd., April 2015.

Sanitary HGL Analysis Criteria

As per the City of Ottawa's Technical bulletin from March 2018, a sanitary HGL analysis must be performed assuming both catastrophic failure and normal operating conditions of the KWPS.

Annual flow parameters are to be used to assess the HGL in the sanitary system assuming a catastrophic failure of the pump station with wet weather peak flows being discharged through the emergency overflow into the ultimate condition Kanata West Pond 5 under 100-year water level. The HGL under this scenario cannot touch the proposed under side of footing (USF).

As per the KWPS overflow weir design calculations, a 20 cm head over the overflow weir crest is required to convey the design wet weather peak flow of 1,250 L/s to the KW Pond 5. The 20 cm head has been used to estimate the boundary conditions in the Catastrophic event scenarios for conservatism.

Additional scenarios have been run assuming catastrophic failure of the KWPS as described below.

- Scenario 1 assumes a conservative design peak flow of 583 L/s from the Stittsville trunk sewer diversion and a fixed backwater boundary condition of 95.20 m at the ultimate KW Pond 5 (100-year water level plus 20 cm head over the KWPS overflow weir).
- Scenario 2 assumes the ultimate condition IMP peak flow of 360 L/s from the Stittsville trunk sewer diversion and a fixed backwater boundary condition of 95.20 m at the ultimate KW Pond 5.
- Scenario 3 assumes the interim condition IMP peak flow of 465 L/s from the Stittsville trunk sewer diversion and a fixed backwater boundary condition of 95.20 m at the ultimate KW Pond 5.
- Scenario 4 assumes a conservative design peak flow of 583 L/s from the Stittsville trunk sewer diversion and a fixed backwater boundary condition of 95.06 m at the ultimate KW Pond 5 (25-year water level plus 20 cm head over the PS overflow weir).

Rare flow parameters are to be used to assess the maximum HGL in the sanitary system under normal pumping station conditions. Under this scenario, the HGL must be at least 0.3 m below the USF.

Design Parameters and Assumptions

The following table summarizes the design annual and rare flow parameters as obtained from the City's "Technical Bulletin ISTB-2018-01 Revision to Ottawa Design Guidelines - Sewer".

Table 15: Wastewater Annual and Rare Flow Parameters

Parameters	Annual	Rare
Res. Per Capita	200	200
Commercial	17,000	17,000
Institutional	17,000	17,000
Industrial	10,000	10,000
I/I Dry	0.02	0.02
I/I Wet	0.28	0.53
Total I/I	0.30	0.55
Harmon – Correction Factor	0.6	0.6
ICI Peak Factor	1	1

Sanitary inflows from the proposed and approved phases of the KW Development were obtained from the detailed sanitary drainage plans included in **Appendix E**, while sanitary inflows from all external areas under ultimate development conditions were obtained from background documents provided by the City of Ottawa as shown in **Appendix C.3**. **Appendix C.2** includes the rare and annual sewage inflow calculations as well as a figure identifying each of the subareas used. **Table 16** summarizes the populations and areas obtained from the background documents as well as the assumptions made for any other areas.

Table 16: Wastewater Population and Area Assumptions

Segment	Population	Residential Area (ha)	Commercial/ Industrial/Institutional Area (ha)	Annual Peak Inflows (L/s)	Rare Peak Inflows (L/s)	Additional Assumptions
Stittsville Trunk	28,031	526.60	76.0 ha Commercial and 40.5 ha Industrial	583.0 Scenario 1 360.0 Scenario 2 465.0 Scenario 3 583.0 Scenario 4	503.0	The peak design flow of 583 L/s was used in the catastrophic event Scenario 1 for conservatism, the ultimate condition IMP model peak flow of 360 L/s was used for the catastrophic event scenario 2, while the interim condition IMP model peak flow of 465 L/s was used for the catastrophic event scenario 3. A peak flow estimated using rare event parameters of 503 L/s was used for the normal operating condition analysis.
Kizell Lands	3,585	52.56	11.82	41.8	57.9	-
Huntmar and Hazeldean	6,357	111.52	65.44	103.9	151.6	Population and areas as obtained from Huntmar/Hazeldean Design Sheet based on KWMSS assumptions for areas 16, 20, 17, 21, 19A, 23, 24 and 19
Additional Hazeldean	296	13.62	5.39	8.7	13.5	-
Maple Grove Sewer	10,501	137.54	-	93.8	128.2	-
Maple Grove Expansion	3,549	84.43	-	42.9	61.9	Number of units and gross area based on spreadsheet provided by the City, with 90% of gross area contributing to I/I and 198 employees generating 83L/emp/day added to total flow

Segment	Population	Residential Area (ha)	Commercial/ Industrial/Institutional Area (ha)	Annual Peak Inflows (L/s)	Rare Peak Inflows (L/s)	Additional Assumptions
Future North-South Collector	4,936	28.44	165.28	147.5	195.9	Population and areas were obtained based on IBI Design Sheet areas A to F and 21.13 ha of area G. A 30L/s fixed flow was added to the total peak flow.
North of Richcraft Kanata Site	113	1.10	-	1.1	1.4	Assumed medium density residential area to have 38 units/ha and 2.7person/unit.
Richcraft Kanata West Development / Existing Trinity	2,313	28.14	18.65	34.5	46.8	-

Based on the above assumptions plus the peak flows estimated for the detailed sanitary catchments across the Richcraft KW Development as shown in **Appendix C.2**, the worst-case peak annual flow is 1,061 L/s (Scenario 1) and the peak rare flow is 1,164 L/s were obtained.

Boundary Conditions

The catastrophic HGL scenarios 1 through 3 which use annual flow parameters to calculate peak inflows into the sanitary system were assessed assuming a fixed backwater of 95.2 m based on a 100-year water level in the ultimate KW Pond 5 equal to 95.0 m plus an additional 0.2 m head over the KWPS emergency overflow weir (head required to convey the design wet weather peak flow of 1,250 L/s as obtained from the KWPS design brief). An additional catastrophic HGL scenario (Scenario 4) was assessed assuming a fixed backwater of 95.06 m based on a 25-year water level in the ultimate KW Pond 5 equal to 94.86 m plus an additional 0.2 m head over the KWPS emergency overflow weir.

The normal operating condition HGL analysis which uses rare flow parameters to calculate peak inflows into the sanitary system was done assuming startup and shutoff elevations in the KWPS of 84.25 m and 82.90 m respectively. The minimum and maximum wet well volumes assumed for the ultimate condition were 281 m^3 and 810 m^3 respectively, while the wet weather peak flow of 1,250 L/s was used as the pumping rate.

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 Richcraft KW Development.

Reference: **Richcraft Kanata West Development Second Registration Phase, 1620 Maple Grove Road – Servicing and Stormwater Management Report Addendum**

Table 17: 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	96.22	N/A	95.35	-	95.29	-	95.32	-	95.21	-
1B	96.60	N/A	95.31	-	95.27	-	95.29	-	95.17	-
1C	95.30	N/A	95.24	-	95.22	-	95.23	-	95.1	-
2	97.46	N/A	95.37	-	95.31	-	95.33	-	95.23	-
3	97.89	95.79	95.40	0.39	95.34	0.45	95.37	0.42	95.26	0.53
4	98.19	96.40	95.41	0.99	95.34	1.06	95.37	1.03	95.27	1.13
5	98.63	96.68	95.43	1.25	95.43	1.25	95.43	1.25	95.43	1.25
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	97.18	0.51	97.18	0.51	97.18	0.51	97.18	0.51
9	99.23	97.44	96.21	1.23	96.21	1.23	96.21	1.23	96.21	1.23
10	99.43	97.51	96.32	1.19	96.32	1.19	96.32	1.19	96.32	1.19
11	100.75	97.69	96.90	0.79	96.9	0.79	96.9	0.79	96.9	0.79
12	100.60	98.46	97.04	1.42	97.04	1.42	97.04	1.42	97.04	1.42
13	100.23	98.46	97.30	1.16	97.3	1.16	97.3	1.16	97.3	1.16
3A	97.75	95.79	95.40	0.39	95.34	0.45	95.37	0.42	95.26	0.53
3B	97.66	95.74	95.40	0.34	95.34	0.40	95.37	0.37	95.26	0.48
3C	97.53	95.74	95.40	0.34	95.34	0.40	95.37	0.37	95.26	0.48
14	97.61	N/A	95.42	-	95.36	-	95.39	-	95.28	-
16	97.35	95.74	95.43	0.31	95.37	0.37	95.4	0.34	95.29	0.45
17	97.29	N/A	95.43	-	95.37	-	95.4	-	95.29	-
17A	97.32	95.68	95.43	0.25	95.37	0.31	95.4	0.28	95.29	0.39
17B	97.37	95.68	95.43	0.25	95.37	0.31	95.4	0.28	95.29	0.39
18	97.17	95.63	95.44	0.19	95.38	0.25	95.41	0.22	95.3	0.33
18A	97.65	95.69	95.44	0.25	95.38	0.31	95.4	0.29	95.3	0.39
18B	97.09	95.63	95.44	0.19	95.38	0.25	95.41	0.22	95.3	0.33
19	97.43	95.63	95.45	0.18	95.39	0.24	95.41	0.22	95.31	0.32
20	97.50	95.63	95.47	0.16	95.41	0.22	95.43	0.20	95.33	0.30

Reference: **Richcraft Kanata West Development Second Registration Phase, 1620 Maple Grove Road – Servicing and Stormwater Management Report Addendum**

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)
20A	97.37	95.63	95.47	0.16	95.41	0.22	95.43	0.20	95.33	0.30
21	97.48	95.60	95.47	0.13	95.41	0.19	95.44	0.16	95.33	0.27
22	97.96	96.15	95.42	0.73	95.36	0.79	95.39	0.76	95.28	0.87
22A	97.83	96.10	95.42	0.68	95.36	0.74	95.39	0.71	95.28	0.82
22B	97.81	96.10	95.42	0.68	95.36	0.74	95.39	0.71	95.28	0.82
23	98.10	96.54	95.42	1.12	95.36	1.18	95.39	1.15	95.28	1.26
24	98.05	96.30	95.42	0.88	95.36	0.94	95.39	0.91	95.28	1.02
25	98.00	96.30	95.42	0.88	95.36	0.94	95.39	0.91	95.28	1.02
26	98.10	96.34	95.42	0.92	95.36	0.98	95.39	0.95	95.28	1.06
27	97.92	95.79	95.43	0.36	95.37	0.42	95.4	0.39	95.29	0.50
30	98.01	95.90	95.43	0.47	95.37	0.53	95.4	0.50	95.29	0.61
31	97.52	95.77	95.47	0.30	95.41	0.36	95.43	0.34	95.33	0.44
32	97.68	95.90	95.47	0.43	95.41	0.49	95.43	0.47	95.33	0.57
33	97.62	96.00	95.43	0.57	95.37	0.63	95.4	0.60	95.29	0.71
35	97.97	96.59	95.45	1.14	95.39	1.20	95.42	1.17	95.31	1.28
35A	97.94	N/A	95.44	-	95.38	-	95.4	-	95.3	-
36	98.67	96.59	95.73	0.86	95.73	0.86	95.73	0.86	95.73	0.86
37	99.34	97.17	96.39	0.78	96.39	0.78	96.39	0.78	96.39	0.78
38	99.55	97.79	96.57	1.22	96.57	1.22	96.57	1.22	96.57	1.22
39	98.03	96.34	95.51	0.83	95.45	0.89	95.47	0.87	95.37	0.97
39A	97.97	96.21	95.51	0.70	95.45	0.76	95.47	0.74	95.37	0.84
39B	98.01	96.21	95.51	0.70	95.45	0.76	95.47	0.74	95.37	0.84
40	98.10	96.34	95.56	0.78	95.5	0.84	95.53	0.81	95.42	0.92
41	98.38	96.40	95.60	0.80	95.54	0.86	95.57	0.83	95.46	0.94
42	99.25	97.19	95.65	1.54	95.59	1.60	95.61	1.58	95.51	1.68
43	99.19	97.65	95.66	1.99	95.6	2.05	95.62	2.03	95.52	2.13
44	99.66	97.65	95.69	1.96	95.63	2.02	95.65	2.00	95.61	2.04
45	100.26	98.59	95.98	2.61	95.98	2.61	95.98	2.61	95.98	2.61
46	100.27	98.29	96.06	2.23	96.06	2.23	96.06	2.23	96.06	2.23

Reference: **Richcraft Kanata West Development Second Registration Phase, 1620 Maple Grove Road – Servicing and Stormwater Management Report Addendum**

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)
47	100.49	98.29	96.41	1.88	96.41	1.88	96.41	1.88	96.41	1.88
48	100.58	98.55	96.76	1.79	96.76	1.79	96.76	1.79	96.76	1.79
49	100.57	98.55	96.83	1.72	96.83	1.72	96.83	1.72	96.83	1.72
50	100.41	98.46	97.09	1.37	97.09	1.37	97.09	1.37	97.09	1.37
51	100.21	98.46	97.37	1.09	97.37	1.09	97.37	1.09	97.37	1.09
52	97.61	N/A	95.46	-	95.4	-	95.42	-	95.32	-
53	97.65	N/A	95.46	-	95.4	-	95.43	-	95.32	-
54	97.63	95.76	95.47	0.29	95.41	0.35	95.43	0.33	95.33	0.43
54A	97.67	95.76	95.47	0.29	95.41	0.35	95.43	0.33	95.33	0.43
54B	97.70	95.76	95.47	0.29	95.41	0.35	95.43	0.33	95.33	0.43
54C	97.66	95.93	95.47	0.46	95.41	0.52	95.43	0.50	95.33	0.60
54D	97.69	95.93	95.47	0.46	95.41	0.52	95.43	0.50	95.33	0.60
55	98.09	N/A	95.47	-	95.41	-	95.44	-	95.33	-
54E	97.54	95.86	95.47	0.39	95.41	0.45	95.43	0.43	95.33	0.53
54F	98.10	95.91	95.47	0.44	95.41	0.50	95.43	0.48	95.33	0.58
54G	98.17	95.91	95.50	0.41	95.5	0.41	95.5	0.41	95.5	0.41
56	98.16	96.19	95.48	0.71	95.42	0.77	95.44	0.75	95.34	0.85
57	98.13	96.20	95.48	0.72	95.42	0.78	95.45	0.75	95.34	0.86
58	98.24	96.20	95.55	0.65	95.55	0.65	95.55	0.65	95.55	0.65
59	97.99	96.14	95.48	0.66	95.42	0.72	95.44	0.70	95.34	0.80
60	98.23	96.14	95.48	0.66	95.42	0.72	95.44	0.70	95.34	0.80
61	98.13	96.39	95.48	0.91	95.42	0.97	95.44	0.95	95.34	1.05
62	97.95	96.59	95.48	1.11	95.42	1.17	95.44	1.15	95.34	1.25
63	98.15	N/A	95.48	-	95.42	-	95.44	-	95.34	-
64	97.29	N/A	95.48	-	95.42	-	95.45	-	95.34	-
65	97.56	95.76	95.47	0.29	95.41	0.35	95.43	0.33	95.33	0.43
66	97.47	95.60	95.48	0.12	95.42	0.18	95.45	0.15	95.34	0.26
67	97.58	95.60	95.50	0.10	95.44	0.16	95.46	0.14	95.36	0.24
68	97.49	95.87	95.50	0.37	95.44	0.43	95.47	0.40	95.36	0.51

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)
69	97.56	95.90	95.50	0.40	95.44	0.46	95.47	0.43	95.36	0.54
70	97.95	95.90	95.50	0.40	95.44	0.46	95.47	0.43	95.36	0.54

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 18: Normal Operating Conditions Sanitary HGL

Sanitary Manhole	Rim Elevation (m)	USF (m)	HGL (m)	USF - HGL Clearance
1A	96.22	N/A	88.79	-
1B	96.60	N/A	88.62	-
1C	95.30	N/A	87.66	-
2	97.46	N/A	89.01	-
3	97.89	95.79	91.12	4.67
4	98.19	96.40	94.10	2.30
5	98.63	96.68	95.44	1.24
6	98.67	96.99	95.53	1.46
7	99.11	96.99	96.02	0.97
8	100.21	97.69	97.18	0.51
9	99.23	97.44	96.22	1.22
10	99.43	97.51	96.33	1.18
11	100.75	97.69	96.90	0.79
12	100.60	98.46	97.04	1.42
13	100.23	98.46	97.30	1.16
3A	97.75	95.79	94.19	1.60
3B	97.66	95.74	94.57	1.17
3C	97.53	95.74	94.85	0.89
14	97.61	N/A	92.54	-
16	97.35	95.74	92.88	2.86

Reference: **Richcraft Kanata West Development Second Registration Phase, 1620 Maple Grove Road – Servicing and Stormwater Management Report Addendum**

Sanitary Manhole	Rim Elevation (m)	USF (m)	HGL (m)	USF - HGL Clearance
17	97.29	N/A	92.96	-
17A	97.32	95.68	94.32	1.36
17B	97.37	95.68	94.68	1.00
18	97.17	95.63	93.19	2.44
18A	97.65	95.69	93.57	2.12
18B	97.09	95.63	93.19	2.44
19	97.43	95.63	93.30	2.33
20	97.50	95.63	93.52	2.11
20A	97.37	95.63	94.01	1.62
21	97.48	95.60	93.70	1.90
22	97.96	96.15	91.18	4.97
22A	97.83	96.10	94.33	1.77
22B	97.81	96.10	94.87	1.23
23	98.10	96.54	94.40	2.14
24	98.05	96.30	94.47	1.83
25	98.00	96.30	94.69	1.61
26	98.10	96.34	95.01	1.33
27	97.92	95.79	93.88	1.91
30	98.01	95.90	94.30	1.60
31	97.52	95.77	94.45	1.32
32	97.68	95.90	94.85	1.05
33	97.62	96.00	94.62	1.38
35	97.97	96.59	91.43	5.16
35A	97.94	N/A	91.29	-
36	98.67	96.59	95.73	0.86
37	99.34	97.17	96.39	0.78
38	99.55	97.79	96.57	1.22
39	98.03	96.34	93.67	2.67
39A	97.97	96.21	94.43	1.78
39B	98.01	96.21	94.69	1.52
40	98.10	96.34	93.94	2.40
41	98.38	96.40	94.73	1.67
42	99.25	97.19	95.10	2.09

Reference: **Richcraft Kanata West Development Second Registration Phase, 1620 Maple Grove Road – Servicing and Stormwater Management Report Addendum**

Sanitary Manhole	Rim Elevation (m)	USF (m)	HGL (m)	USF - HGL Clearance
43	99.19	97.65	95.17	2.48
44	99.66	97.65	95.62	2.03
45	100.26	98.59	95.98	2.61
46	100.27	98.29	96.06	2.23
47	100.49	98.29	96.41	1.88
48	100.58	98.55	96.76	1.79
49	100.57	98.55	96.83	1.72
50	100.41	98.46	97.09	1.37
51	100.21	98.46	97.37	1.09
52	97.61	N/A	91.65	-
53	97.65	N/A	91.74	-
54	97.63	95.76	91.84	3.92
54A	97.67	95.76	94.00	1.76
54B	97.70	95.76	94.27	1.49
54C	97.66	95.93	94.54	1.39
54D	97.69	95.93	95.08	0.85
55	98.09	N/A	92.02	-
54E	97.54	95.86	94.79	1.07
54F	98.10	95.91	95.08	0.83
54G	98.17	95.91	95.50	0.41
56	98.16	96.19	92.71	3.48
57	98.13	96.20	95.18	1.02
58	98.24	96.20	95.56	0.64
59	97.99	96.14	92.78	3.36
60	98.23	96.14	94.58	1.56
61	98.13	96.39	94.66	1.73
62	97.95	96.59	94.88	1.71
63	98.15	N/A	92.23	-
64	97.29	N/A	92.40	-
65	97.56	95.76	94.88	0.88
66	97.47	95.60	94.05	1.55
67	97.58	95.60	94.40	1.20
68	97.49	95.87	94.67	1.20

Sanitary Manhole	Rim Elevation (m)	USF (m)	HGL (m)	USF - HGL Clearance
69	97.56	95.90	94.70	1.20
70	97.95	95.90	94.93	0.97

The above table shows that the 0.3 m required clearance to the normal operating condition HGL is achieved across the proposed development.

CONCLUSIONS

POTABLE WATER

Based on the findings of the report, the proposed change to the draft plan does not impact the overall potable water results. The proposed network can service the development area and with the use of pressure reducing valves will meet all servicing requirements as per City of Ottawa standards under typical demand conditions (peak hour and average day conditions), as well as under emergency fire demand conditions (maximum day + fire flow) during the ultimate development conditions.

STORMWATER MANAGEMENT

The proposed stormwater management plan is in compliance with the goals specified in the background reports and the 2012 City of Ottawa Sewer Guidelines. Inlet control devices are proposed to limit inflow from the site area into the minor system to the 2-year for local streets and to the 5-year storm for collector roads based on City of Ottawa IDF curves. The worst-case 100-year HGL remains 0.3 m below proposed USFs across the site. All dynamic surface water depths are less than 0.35 m during the 100-year storm event. Quality control and further quantity control of runoff from the proposed development will be provided in the ultimate KW Pond 5.

Minor and major system target peak flows for the proposed medium density residential block (Block 117) have been established in order to restrict peak flows along the section of Ploughshare Road, east of the intersection with Winter Wheat Terrace, to the previously approved minor and major system peak flows at that location.

SANITARY SERVICING

The proposed sanitary sewer network is sufficiently sized to provide gravity drainage for the site and external tributary areas. The proposed network connects to the approved sanitary sewer system within the first registration phase of the development that discharges into the existing Maple Grove Trunk sanitary sewer which will ultimately outlets to the Kanata West Pump Station (KWPS). The proposed drainage pattern is in accordance with the KWMSS.

The worst-case annual HGL remains below the proposed USF elevations across the proposed development.

Reference: **Richcraft Kanata West Development Second Registration Phase, 1620 Maple Grove Road – Servicing and Stormwater Management Report Addendum**

Regards,

Stantec Consulting Ltd.

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Attachment: Appendix A: Water Calculations and background, Appendix B: SWM Calculations and Background, Appendix C: Sanitary Calculations and Background, Appendix D: Draft 4M-Plan, Appendix E: Drawings

c. C.C.

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APPENDIX A

Potable Water Calculations and Background

1620 Maple Grove Road

Information Provided:

Date provided August, 20, 2018

Scenario	Demand	
	L/min	L/s
Average Daily Demand	641	10.7
Maximum Daily Demand	1515	25.25
Peak Hour	3282	54.7
Fire Flow Demand # 1	17000	283

# of connections	4

Connection Locations:



Figure 1 - Connection points

Results:

Connection 1 - Maple Grove Road and Silver Seven Road

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	162.1	92.7
Peak Hour	157.7	86.4
Max Day plus Fire (10,000 l/min)	154.7	82.7
Max Day plus Fire (17,000 l/min)	150.5	76.3

[1] Ground Elevation = 96.880 m

Connection 2 - Maple Grove Road and Rosehill Ave

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	161.0	88.8
Peak Hour	157.4	83.5
Max Day plus Fire (10,000 l/min)	153.9	75.3
Max Day plus Fire (17,000 l/min)	138.9	57.3

[1] Ground Elevation = 100.900 m

Connection 3 - Hazeldean Road and Kincardine Dr.

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	161.5	90.9
Peak Hour	157.9	85.8
Max Day plus Fire (10,000 l/min)	158.8	87.1
Max Day plus Fire (17,000 l/min)	157.9	85.8

[1] Ground Elevation = 97.490 m

Connection 4 - Hazeldean Road

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	161.4	90.9
Peak Hour	158.0	82.0
Max Day plus Fire (10,000 l/min)	158.7	83.5
Max Day plus Fire (17,000 l/min)	157.8	82.2

[1] Ground Elevation = 99.900 m

Notes:

1) As per the Ontario Building Code in areas that may be occupied, the static pressure at any fixture shall not exceed 552 kPa (80 psi.) Pressure control measures to be considered are as follows, in order of preference:
   a) If possible, systems to be designed to residual pressures of 345 to 552 kPa (50 to 80 psi) in all occupied areas outside of the public right-of-way without special pressure control equipment.
   b) Pressure reducing valves to be installed immediately downstream of the isolation valve in the home/ building, located downstream of the meter so it is owner maintained.
2) Watermain along Maple Grove Road is expected to be constructed.
3) Ownership of existing private roads off of Hazeldean road are expected to be turned over to the City of Ottawa and therefore ownership of watermains along those roads are in turn to be given to the City of Ottawa prior to 1620 Maple Grove watermain connections.

Disclaimer

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

Kanata West Richcraft - Domestic Water Demand Estimates
Ultimate

Densities as per City Guidelines:

LD	3.4	ppu
MD	2.7	ppu
HD	1.8	ppu

Medium Density Residential Blocks Unit Densities per Registration Phase

First Registration	38	Units/ha
Second Registration	93	Units/ha

Building ID	Area (m^2)	Population	Daily Rate of Demand [1]	Avg Day Demand [2]		Max Day Demand [3]		Peak Hour Demand [3]	
				(L/min)	(L/s)	(L/min)	(L/s)	(L/min)	(L/s)
MD1 (Blk 29)	7,350	76	350	18.4	0.31	45.9	0.76	100.9	1.68
Commerical	14,700		28000	28.6	0.48	42.9	0.71	77.2	1.29
Residential 1		97	350	23.6	0.39	59.1	0.98	129.9	2.17
Total				**70.6**	**1.2**	**147.8**	**2.5**	**308.0**	**5.1**
Residential 2		59	350	14.4	0.24	36.1	0.60	79.4	1.32
Residential 3		127	350	30.8	0.51	77.1	1.29	169.6	2.83
Residential 4		127	350	30.8	0.51	77.1	1.29	169.6	2.83
Residential 5		41	350	9.8	0.16	24.6	0.41	54.1	0.90
Residential 6		167	350	40.7	0.68	101.7	1.70	223.8	3.73
Residential 7		70	350	17.1	0.28	42.7	0.71	93.8	1.56
Residential 8		122	350	29.5	0.49	73.8	1.23	162.4	2.71
Residential 9		116	350	28.2	0.47	70.5	1.18	155.2	2.59
Residential 10		111	350	27.0	0.45	67.6	1.13	148.7	2.48
Residential 11		76	350	18.4	0.31	45.9	0.77	101.1	1.68
Residential 12		85	350	20.7	0.34	51.6	0.86	113.6	1.89
MD3 (Blk 117)	13,200	330	350	80.2	1.34	200.6	3.34	441.3	7.35
Total				**100.9**	**1.7**	**252.2**	**4.2**	**554.9**	**9.2**
Residential 13		140	350	34.1	0.57	85.3	1.42	187.7	3.13
MD2 (Blk 75)	27,400	685	350	166.5	2.78	416.3	6.94	915.8	15.26
Total				**200.6**	**3.3**	**501.6**	**8.4**	**1103.5**	**18.4**
Residential 14		70	350	17.1	0.28	42.7	0.71	93.8	1.56
School	30,250		28000	58.8	0.98	88.2	1.47	158.8	2.65
Total				**75.9**	**1.3**	**130.9**	**2.2**	**252.7**	**4.2**
Residential 15		68	350	16.4	0.27	41.0	0.68	90.2	1.50
Residential 16		105	350	25.6	0.43	64.0	1.07	140.8	2.35
Residential 17		97	350	23.6	0.39	59.1	0.98	129.9	2.17
Residential 18		119	350	28.9	0.48	72.2	1.20	158.8	2.65
Total Site :		**2888**		**789.3**	**13.2**	**1886.0**	**31.4**	**4096.7**	**68.3**

Unit and Population Breakdown Excluding MD Blocks

Building	Node ID	Singles	Towns	Population
1	10		36	97
2	8		22	59
3	9		47	127
4	12		47	127
5	18		15	41
6	13		62	167
7	15		26	70
8	14		45	122
9	19		43	116
10	20	20	16	111
11	21		28	76
12	22	25		85
13	27		52	140
14	2		26	70
15	3		25	68
16	4		39	105
17	5		36	97
18	7		44	119
Sub Total		**45**	**609**	**1797**

MD Blocks within First Registration (38 Units/ha)

Block	Area (ha)	Towns	Population
29	0.74	28	75

MD Blocks within Second Registration (93 Units/ha)

117	1.32	122	330
75	2.74	254	685
MD Sub Total		**404**	**1090**
Site Total		**1013**	**2888**

1 Average day water demand for residential areas equal to 350 L/cap/d and 28,000 L/ha/d for the school block

2 City of Ottawa water demand criteria used to estimate peak demand rates for residential areas are as follows:
maximum day demand rate = 2.5 x average day demand rate for residential, 1.5 for Institutional
maximum hour demand rate = 2.2 x maximum day demand rate for residential, 1.8 for institutional

3 Unit counts for unmarked Medium Density Residential area 1 (MD1) are equal to 38 Units/ha

4 Unit counts for unmarked Medium Density Residential area 2 (MD2) are based on the Concept Site Plan for Richcraft prepared by M. David Blakely Architch Inc. on Febuary 2020

5 Unit counts for unmarked Medium Density Residential area 3 (MD3) derived from 250 persons/ha established for MD2.

6 Building IDs identified in attached Hydraulic Analysis Map in Appendices

Ultimate Conditions
Hydraulic Model Results - Average Day Analysis

Junction Results

ID	Demand	Elevation	Head	Pressure	
	(L/s)	(m)	(m)	(psi)	(Kpa)
1	0.00	98.37	161.41	89.62	617.91
2	1.30	98.03	161.42	90.11	621.29
3	0.27	97.95	161.42	90.23	622.12
4	0.43	98.30	161.42	89.73	618.67
5	0.39	100.16	161.42	87.08	600.40
7	0.48	100.75	161.42	86.25	594.68
8	0.24	99.11	161.42	88.58	610.74
9	0.51	97.96	161.42	90.22	622.05
10	1.20	97.88	161.43	90.34	622.88
12	0.51	97.92	161.42	90.28	622.46
13	0.68	98.01	161.42	90.15	621.57
14	0.49	97.64	161.42	90.68	625.22
15	0.28	97.69	161.44	90.63	624.88
16	0.00	97.62	161.44	90.73	625.57
17	0.00	97.54	161.44	90.83	626.25
18	0.16	97.20	161.43	91.31	629.56
19	0.47	98.15	161.45	89.98	620.39
20	0.45	98.14	161.45	90.00	620.53
21	0.31	98.11	161.48	90.09	621.15
22	1.70	97.59	161.48	90.83	626.25
1	0.00	96.15	161.43	92.80	639.84
24	0.00	99.30	161.42	88.31	608.88
27	3.30	100.30	161.41	86.87	598.95
28	0.00	99.18	161.42	88.48	610.05
29	0.00	98.02	161.42	90.13	621.43

Pipe Results

ID	From Node	To Node	Length	Diameter	Roughness	Flow	Velocity
			(m)	(mm)		(L/s)	(m/s)
101	302	1	290.00	297	120	-5.69	0.08
102	1	2	149.15	297	120	-6.99	0.10
103	2	3	81.27	297	120	-4.51	0.07
104	3	4	49.14	204	110	0.76	0.02
105	4	5	204.86	204	110	1.13	0.03
108	5	7	65.67	204	110	-1.26	0.04
111	8	28	21.85	204	110	-1.98	0.06
115	3	9	149.76	297	120	-3.20	0.05
116	3	14	52.56	204	110	-2.34	0.07
117	14	13	75.08	204	110	0.32	0.01
118	13	12	76.47	204	110	0.58	0.02
119	12	9	52.38	204	110	0.88	0.03
120	9	10	78.67	297	120	-4.34	0.06
121	10	18	304.89	204	110	-1.30	0.04
122	12	18	202.33	155	100	-0.80	0.04
123	18	17	82.35	204	110	-2.26	0.07
124	13	17	237.37	155	100	-0.94	0.05
125	17	16	89.96	204	110	-3.20	0.10
126	14	15	201.16	204	110	-3.16	0.10
127	15	16	75.48	204	110	-0.67	0.02
128	15	20	79.81	204	110	-2.77	0.08
129	2	19	209.67	204	110	-3.78	0.12
130	19	20	46.99	204	110	-2.13	0.07
131	19	21	176.52	155	100	-2.12	0.11
132	303	21	83.98	297	120	13.34	0.19
133	21	20	136.68	204	110	5.35	0.16
134	22	21	82.69	204	110	-1.70	0.05
135	16	21	289.34	204	110	-3.87	0.12
139	7	24	115.59	204	110	-0.88	0.03
140	24	8	48.04	204	110	-0.88	0.03
146	8	7	168.69	204	110	0.86	0.03
147	1	10	134.80	297	120	5.51	0.08
148	9	29	53.89	204	110	1.51	0.05
149	5	27	277.63	204	110	2.00	0.06
151	27	1	217.87	204	110	-1.30	0.04
155	28	10	205.69	204	110	-1.27	0.04
157	29	4	136.30	204	110	0.80	0.02
159	28	29	79.48	204	110	-0.71	0.02
2	300	1	577.90	297	120	-28.08	0.41
3	301	1	645.00	297	120	33.59	0.48

Hydraulic Model Results -Peak Hour Analysis

Junction Results

ID	Demand	Elevation	Head	Pressure	
	(L/s)	(m)	(m)	(psi)	(Kpa)
1	0.00	98.37	157.69	84.32	581.37
2	4.20	98.03	157.62	84.71	584.06
3	1.50	97.95	157.58	84.77	584.47
4	2.35	98.30	157.55	84.23	580.75
5	2.17	100.16	157.51	81.52	562.06
7	2.65	100.75	157.51	80.70	556.41
8	1.32	99.11	157.53	83.05	572.61
9	2.83	97.96	157.56	84.72	584.13
10	5.10	97.88	157.55	84.83	584.89
12	2.83	97.92	157.56	84.78	584.54
13	3.73	98.01	157.56	84.66	583.71
14	2.71	97.64	157.58	85.21	587.51
15	1.56	97.69	157.64	85.22	587.57
16	0.00	97.62	157.64	85.32	588.26
17	0.00	97.54	157.6	85.38	588.68
18	0.90	97.20	157.58	85.83	591.78
19	2.59	98.15	157.66	84.60	583.30
20	2.48	98.14	157.66	84.62	583.44
21	1.68	98.11	157.81	84.86	585.09
22	9.20	97.59	157.75	85.52	589.64
1	0.00	96.15	157.55	87.29	601.85
24	0.00	99.30	157.52	82.77	570.68
27	18.40	100.30	157.42	81.21	559.93
28	0.00	99.18	157.54	82.96	571.99
29	0.00	98.02	157.55	84.63	583.51

Pipe Results

ID	From Node	To Node	Length	Diameter	Roughness	Flow	Velocity
			(m)	(mm)		(L/s)	(m/s)
101	302	1	290.00	297	120	34.29	0.49
102	1	2	149.15	297	120	21.82	0.31
103	2	3	81.27	297	120	22.32	0.32
104	3	4	49.14	204	110	8.03	0.25
105	4	5	204.86	204	110	4.90	0.15
108	5	7	65.67	204	110	-3.19	0.10
111	8	28	21.85	204	110	-7.16	0.22
115	3	9	149.76	297	120	11.40	0.16
116	3	14	52.56	204	110	1.39	0.04
117	14	13	75.08	204	110	4.53	0.14
118	13	12	76.47	204	110	2.60	0.08
119	12	9	52.38	204	110	1.23	0.04
120	9	10	78.67	297	120	6.26	0.09
121	10	18	304.89	204	110	-2.95	0.09
122	12	18	202.33	155	100	-1.46	0.08
123	18	17	82.35	204	110	-5.31	0.16
124	13	17	237.37	155	100	-1.80	0.10
125	17	16	89.96	204	110	-7.11	0.22
126	14	15	201.16	204	110	-5.84	0.18
127	15	16	75.48	204	110	-1.24	0.04
128	15	20	79.81	204	110	-6.16	0.19
129	2	19	209.67	204	110	-4.71	0.14
130	19	20	46.99	204	110	-2.82	0.09
131	19	21	176.52	155	100	-4.47	0.24
132	303	21	83.98	297	120	35.17	0.51
133	21	20	136.68	204	110	11.47	0.35
134	22	21	82.69	204	110	-9.20	0.28
135	16	21	289.34	204	110	-8.35	0.26
139	7	24	115.59	204	110	-2.95	0.09
140	24	8	48.04	204	110	-2.95	0.09
146	8	7	168.69	204	110	2.90	0.09
147	1	10	134.80	297	120	-1.26	0.02
148	9	29	53.89	204	110	3.54	0.11
149	5	27	277.63	204	110	5.92	0.18
151	27	1	217.87	204	110	-12.48	0.38
155	28	10	205.69	204	110	-2.85	0.09
157	29	4	136.30	204	110	-0.78	0.02
159	28	29	79.48	204	110	-4.31	0.13
2	300	1	577.90	297	120	-16.07	0.23
3	301	1	645.00	297	120	14.81	0.21

Hydraulic Model Results -Fire Flow Analysis (267 L/s)

ID	Static Demand	Static Pressure		Static Head	Fire-Flow Demand	Residual Pressure		Available Flow at Hydrant	Available Flow Pressure	
	(L/s)	(psi)	(Kpa)	(m)	(L/s)	(psi)	(Kpa)	(L/s)	(psi)	(Kpa)
1	0.00	81.77	563.79	155.89	267	71.65	494.01	956.03	20	137.90
2	2.20	81.39	561.17	155.28	267	70.93	489.05	966.76	20	137.90
3	0.68	80.74	556.69	154.75	267	70.25	484.36	989.87	20	137.90
4	1.07	79.94	551.17	154.54	267	62.47	430.72	609.82	20	137.90
5	0.98	77.24	532.55	154.5	267	50.66	349.29	428.98	20	137.90
7	1.20	76.15	525.04	154.32	267	48.58	334.95	413.96	20	137.90
8	0.60	78.33	540.07	154.21	267	54.59	376.39	468.19	20	137.90
9	1.29	79.82	550.34	154.11	267	69.09	476.36	976.82	20	137.90
10	2.50	78.90	544.00	153.38	267	68.23	470.43	994.21	20	137.90
12	1.29	80.20	552.96	154.34	267	61.80	426.10	584.02	20	137.90
13	1.70	80.44	554.62	154.6	267	59.57	410.72	527.12	20	137.90
14	1.23	81.21	559.93	154.76	267	65.21	449.61	653.45	20	137.90
15	0.71	82.39	568.06	155.65	267	65.82	453.82	614.06	20	137.90
16	0.00	82.48	568.68	155.64	267	64.14	442.23	564.87	20	137.90
17	0.00	81.61	562.68	154.95	267	56.85	391.97	462.69	20	137.90
18	0.41	81.47	561.72	154.51	267	53.02	365.56	423.17	20	137.90
19	1.18	82.35	567.79	156.07	267	63.77	439.68	558.72	20	137.90
20	1.13	82.40	568.13	156.11	267	67.92	468.29	658.60	20	137.90
21	0.77	84.40	581.92	157.48	267	78.35	540.21	1,281.59	20	137.90
22	4.20	85.12	586.89	157.47	267	36.34	250.56	319.03	20	137.90
1	0.00	78.08	538.35	151.08	267	68.07	469.33	1,045.30	20	137.90
24	0.00	78.10	538.48	154.24	267	45.74	315.37	379.89	20	137.90
27	8.40	77.76	536.14	155	267	30.18	208.09	307.66	20	137.90
28	0.00	78.16	538.90	154.16	267	57.81	398.59	522.84	20	137.90
29	0.00	79.84	550.48	154.18	267	63.34	436.72	636.48	20	137.90

Stantec

FUS Fire Flow Calculation Sheet

Stantec Project #: 160401393
Project Name: Kanata West Richcraft
Date: 11/23/2020
Fire Flow Calculation #: 2
Description: Residential Back-to-Back Units

Notes: Worst case back-to-back units - max. ground floor area of 600m2. (Block 121)

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	-						55.6	-
	Determine Number of Adjoining Units	Includes adjacent wood frame structures separated by 3m or less						8	-
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	3.1 to 10	19	3	31-60	Wood Frame or Non-Combustible	18%	5508
		East	20.1 to 30	25	3	61-90	Wood Frame or Non-Combustible	9%	
		South	3.1 to 10	19	3	31-60	Wood Frame or Non-Combustible	18%	
		West	20.1 to 30	25	3	61-90	Wood Frame or Non-Combustible	9%	
8	Determine Final Required Fire Flow	Total Required Fire Flow in L/min, Rounded to Nearest 1000L/min							16000
		Total Required Fire Flow in L/s							266.7
		Required Duration of Fire Flow (hrs)							3.50
		Required Volume of Fire Flow (m^3)							3360

Stantec

FUS Fire Flow Calculation Sheet

Stantec Project #: 160401393
Project Name: Kanata West Richcraft
Date: 11/23/2020
Fire Flow Calculation #: 2
Description: Residential - Townhomes Units

Notes: Townhome unit with less than 10m seperation between the backs of adjacent units (Block 53)

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	-						492.0	-
	Determine Number of Adjoining Units	Includes adjacent wood frame structures separated by 3m or less						1	-
3	Determine Height in Storeys	Does not include floors >50% below grade or open attic space						2	-
4	Determine Required Fire Flow	($F = 220 \times C \times A^{1/2}$). Round to nearest 1000 L/min						-	10000
5	Determine Occupancy Charge	Limited Combustible						-15%	8500
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	30	2	31-60	Wood Frame or Non-Combustible	18%	4420
		East	20.1 to 30	16	2	31-60	Wood Frame or Non-Combustible	8%	
		South	20.1 to 30	30	2	31-60	Wood Frame or Non-Combustible	8%	
		West	3.1 to 10	16	2	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							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 #: 160401393
Project Name: Kanata West Richcraft
Date: 11/23/2020
Fire Flow Calculation #: 3
Description: Residential - Townhomes Units

Notes: Townhome unit with less than 10m seperation between the backs of adjacent units (Block 56)

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	-						563.0	-
	Determine Number of Adjoining Units	Includes adjacent wood frame structures separated by 3m or less						1	-
3	Determine Height in Storeys	Does not include floors >50% below grade or open attic space						2	-
4	Determine Required Fire Flow	($F = 220 \times C \times A^{1/2}$). Round to nearest 1000 L/min						-	11000
5	Determine Occupancy Charge	Limited Combustible						-15%	9350
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	10.1 to 20	37	2	61-90	Wood Frame or Non-Combustible	14%	5984
		East	3.1 to 10	16	2	31-60	Wood Frame or Non-Combustible	18%	
		South	10.1 to 20	37	2	61-90	Wood Frame or Non-Combustible	14%	
		West	3.1 to 10	16	2	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							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 #: 160401393
Project Name: Kanata West Richcraft
Date: 11/23/2020
Fire Flow Calculation #: 4
Description: Residential - Townhomes Units

Notes: Townhome unit with less than 10m seperation between the backs of adjacent units (Block 69)

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	-						297.0	-
	Determine Number of Adjoining Units	Includes adjacent wood frame structures separated by 3m or less						1	-
3	Determine Height in Storeys	Does not include floors >50% below grade or open attic space						2	-
4	Determine Required Fire Flow	($F = 220 \times C \times A^{1/2}$). Round to nearest 1000 L/min						-	8000
5	Determine Occupancy Charge	Limited Combustible						-15%	6800
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	20.1 to 30	16	2	31-60	Wood Frame or Non-Combustible	8%	2992
		East	3.1 to 10	20	2	31-60	Wood Frame or Non-Combustible	18%	
		South	3.1 to 10	16	2	31-60	Wood Frame or Non-Combustible	18%	
		West	> 45	20	2	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							10000
		Total Required Fire Flow in L/s							166.7
		Required Duration of Fire Flow (hrs)							2.00
		Required Volume of Fire Flow (m^3)							1200

Stantec

FUS Fire Flow Calculation Sheet

Stantec Project #: 160401393
Project Name: Kanata West Richcraft
Date: 11/23/2020
Fire Flow Calculation #: 5
Description: Residential - Townhomes Units

Notes: Townhome unit with less than 10m seperation between the backs of adjacent units (Block 70)

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	-						297.0	-
	Determine Number of Adjoining Units	Includes adjacent wood frame structures separated by 3m or less						1	-
3	Determine Height in Storeys	Does not include floors >50% below grade or open attic space						2	-
4	Determine Required Fire Flow	($F = 220 \times C \times A^{1/2}$). Round to nearest 1000 L/min						-	8000
5	Determine Occupancy Charge	Limited Combustible						-15%	6800
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	16	2	31-60	Wood Frame or Non-Combustible	18%	2992
		East	3.1 to 10	20	2	31-60	Wood Frame or Non-Combustible	18%	
		South	20.1 to 30	16	2	31-60	Wood Frame or Non-Combustible	8%	
		West	> 45	20	2	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							10000
		Total Required Fire Flow in L/s							166.7
		Required Duration of Fire Flow (hrs)							2.00
		Required Volume of Fire Flow (m^3)							1200

Stantec

FUS Fire Flow Calculation Sheet

Stantec Project #: 160401393
Project Name: Kanata West Richcraft
Date: 11/23/2020
Fire Flow Calculation #: 6
Description: Residential - Townhomes Units

Notes: Townhome unit with less than 10m seperation between the backs of adjacent units (Block 77)

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	-						586.0	-
	Determine Number of Adjoining Units	Includes adjacent wood frame structures separated by 3m or less						1	-
3	Determine Height in Storeys	Does not include floors >50% below grade or open attic space						2	-
4	Determine Required Fire Flow	($F = 220 \times C \times A^{1/2}$). Round to nearest 1000 L/min						-	11000
5	Determine Occupancy Charge	Limited Combustible						-15%	9350
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	20.1 to 30	36	2	61-90	Wood Frame or Non-Combustible	9%	4769
		East	30.1 to 45	16	2	31-60	Wood Frame or Non-Combustible	5%	
		South	3.1 to 10	36	2	61-90	Wood Frame or Non-Combustible	19%	
		West	3.1 to 10	16	2	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 #: 160401393
Project Name: Kanata West Richcraft
Date: 11/23/2020
Fire Flow Calculation #: 7
Description: Residential - Townhomes Units

Notes: Townhome unit with less than 10m seperation between the backs of adjacent units (Block 78)

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	-						372.0	-
	Determine Number of Adjoining Units	Includes adjacent wood frame structures separated by 3m or less						1	-
3	Determine Height in Storeys	Does not include floors >50% below grade or open attic space						2	-
4	Determine Required Fire Flow	($F = 220 \times C \times A^{1/2}$). Round to nearest 1000 L/min						-	9000
5	Determine Occupancy Charge	Limited Combustible						-15%	7650
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	16	2	31-60	Wood Frame or Non-Combustible	18%	3749
		East	30.1 to 45	24	2	31-60	Wood Frame or Non-Combustible	5%	
		South	3.1 to 10	16	2	31-60	Wood Frame or Non-Combustible	18%	
		West	20.1 to 30	24	2	31-60	Wood Frame or Non-Combustible	8%	
8	Determine Final Required Fire Flow	Total Required Fire Flow in L/min, Rounded to Nearest 1000L/min							11000
		Total Required Fire Flow in L/s							183.3
		Required Duration of Fire Flow (hrs)							2.00
		Required Volume of Fire Flow (m^3)							1320

Stantec

FUS Fire Flow Calculation Sheet

Stantec Project #: 160401393
Project Name: Kanata West Richcraft
Date: 11/23/2020
Fire Flow Calculation #: 8
Description: Residential - Townhomes Units

Notes: Townhome unit with less than 10m seperation between the backs of adjacent units (Block 100)

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	-						372.0	-
	Determine Number of Adjoining Units	Includes adjacent wood frame structures separated by 3m or less						1	-
3	Determine Height in Storeys	Does not include floors >50% below grade or open attic space						2	-
4	Determine Required Fire Flow	($F = 220 \times C \times A^{1/2}$). Round to nearest 1000 L/min						-	9000
5	Determine Occupancy Charge	Limited Combustible						-15%	7650
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	16	2	31-60	Wood Frame or Non-Combustible	18%	3137
		East	3.1 to 10	26	2	31-60	Wood Frame or Non-Combustible	18%	
		South	> 45	16	2	31-60	Wood Frame or Non-Combustible	0%	
		West	30.1 to 45	26	2	31-60	Wood Frame or Non-Combustible	5%	
8	Determine Final Required Fire Flow	Total Required Fire Flow in L/min, Rounded to Nearest 1000L/min							11000
		Total Required Fire Flow in L/s							183.3
		Required Duration of Fire Flow (hrs)							2.00
		Required Volume of Fire Flow (m^3)							1320

Stantec

FUS Fire Flow Calculation Sheet

Stantec Project #: 160401393
Project Name: Kanata West Richcraft
Date: 11/23/2020
Fire Flow Calculation #: 9
Description: Residential - Townhomes Units

Notes: Townhome unit with less than 10m seperation between the backs of adjacent units (Block 101)

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	-						372.0	-
	Determine Number of Adjoining Units	Includes adjacent wood frame structures separated by 3m or less						1	-
3	Determine Height in Storeys	Does not include floors >50% below grade or open attic space						2	-
4	Determine Required Fire Flow	($F = 220 \times C \times A^{1/2}$). Round to nearest 1000 L/min						-	9000
5	Determine Occupancy Charge	Limited Combustible						-15%	7650
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	20.1 to 30	16	2	31-60	Wood Frame or Non-Combustible	8%	3749
		East	3.1 to 10	26	2	31-60	Wood Frame or Non-Combustible	18%	
		South	3.1 to 10	16	2	31-60	Wood Frame or Non-Combustible	18%	
		West	30.1 to 45	26	2	31-60	Wood Frame or Non-Combustible	5%	
8	Determine Final Required Fire Flow	Total Required Fire Flow in L/min, Rounded to Nearest 1000L/min							11000
		Total Required Fire Flow in L/s							183.3
		Required Duration of Fire Flow (hrs)							2.00
		Required Volume of Fire Flow (m^3)							1320

Stantec

FUS Fire Flow Calculation Sheet

Stantec Project #: 160401393
Project Name: Kanata West Richcraft
Date: 11/23/2020
Fire Flow Calculation #: 10
Description: Residential - Townhomes Units

Notes: Townhome unit with less than 10m seperation between the backs of adjacent units (Block 102)

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	-						372.0	-
	Determine Number of Adjoining Units	Includes adjacent wood frame structures separated by 3m or less						1	-
3	Determine Height in Storeys	Does not include floors >50% below grade or open attic space						2	-
4	Determine Required Fire Flow	($F = 220 \times C \times A^{1/2}$). Round to nearest 1000 L/min						-	9000
5	Determine Occupancy Charge	Limited Combustible						-15%	7650
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	20.1 to 30	26	2	31-60	Wood Frame or Non-Combustible	8%	4361
		East	3.1 to 10	16	2	31-60	Wood Frame or Non-Combustible	18%	
		South	10.1 to 20	26	2	31-60	Wood Frame or Non-Combustible	13%	
		West	3.1 to 10	16	2	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							12000
		Total Required Fire Flow in L/s							200.0
		Required Duration of Fire Flow (hrs)							2.50
		Required Volume of Fire Flow (m^3)							1800

Stantec

FUS Fire Flow Calculation Sheet

Stantec Project #: 160401393
Project Name: Kanata West Richcraft
Date: 11/23/2020
Fire Flow Calculation #: 11
Description: Residential - Townhomes Units

Notes: Townhome unit with less than 10m seperation between the backs of adjacent units (Block 113)

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	-						372.0	-
	Determine Number of Adjoining Units	Includes adjacent wood frame structures separated by 3m or less						1	-
3	Determine Height in Storeys	Does not include floors >50% below grade or open attic space						2	-
4	Determine Required Fire Flow	($F = 220 \times C \times A^{1/2}$). Round to nearest 1000 L/min						-	9000
5	Determine Occupancy Charge	Limited Combustible						-15%	7650
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	10.1 to 20	26	2	31-60	Wood Frame or Non-Combustible	13%	3749
		East	3.1 to 10	16	2	31-60	Wood Frame or Non-Combustible	18%	
		South	> 45	26	2	31-60	Wood Frame or Non-Combustible	0%	
		West	3.1 to 10	16	2	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							11000
		Total Required Fire Flow in L/s							183.3
		Required Duration of Fire Flow (hrs)							2.00
		Required Volume of Fire Flow (m^3)							1320

Stantec

FUS Fire Flow Calculation Sheet

Stantec Project #: 160401393
Project Name: Kanata West Richcraft
Date: 11/23/2020
Fire Flow Calculation #: 12
Description: Residential - Single Units

Notes: Unit 33 with less than 10m side to rearyard seperation

Step	Task							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	-						156.0	-
	Determine Number of Adjoining Units	Includes adjacent wood frame structures separated by 3m or less						1	-
3	Determine Height in Storeys	Does not include floors >50% below grade or open attic space						2	-
4	Determine Required Fire Flow	($F = 220 \times C \times A^{1/2}$). Round to nearest 1000 L/min						-	6000
5	Determine Occupancy Charge	Limited Combustible						-15%	5100
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	10.1 to 20	7	2	0-30	Wood Frame or Non-Combustible	12%	2856
		East	3.1 to 10	22	2	31-60	Wood Frame or Non-Combustible	18%	
		South	20.1 to 30	7	2	0-30	Wood Frame or Non-Combustible	8%	
		West	3.1 to 10	22	2	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							8000
		Total Required Fire Flow in L/s							133.3
		Required Duration of Fire Flow (hrs)							2.00
		Required Volume of Fire Flow (m^3)							960

Stantec

FUS Fire Flow Calculation Sheet

Stantec Project #: 160401393
Project Name: Kanata West Richcraft
Date: 11/23/2020
Fire Flow Calculation #: 13
Description: Residential - Single Units

Notes: Unit 34 with less than 10m side to rearyard seperation

Step	Task							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	-						174.0	-
	Determine Number of Adjoining Units	Includes adjacent wood frame structures separated by 3m or less						1	-
3	Determine Height in Storeys	Does not include floors >50% below grade or open attic space						2	-
4	Determine Required Fire Flow	($F = 220 \times C \times A^{1/2}$). Round to nearest 1000 L/min						-	6000
5	Determine Occupancy Charge	Limited Combustible						-15%	5100
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	22	2	31-60	Wood Frame or Non-Combustible	18%	2601
		East	3.1 to 10	7	2	0-30	Wood Frame or Non-Combustible	17%	
		South	20.1 to 30	22	2	31-60	Wood Frame or Non-Combustible	8%	
		West	20.1 to 30	7	2	0-30	Wood Frame or Non-Combustible	8%	
8	Determine Final Required Fire Flow	**Total Required Fire Flow in L/min, Rounded to Nearest 1000L/min**							**8000**
		Total Required Fire Flow in L/s							**133.3**
		Required Duration of Fire Flow (hrs)							**2.00**
		Required Volume of Fire Flow (m^3)							**960**

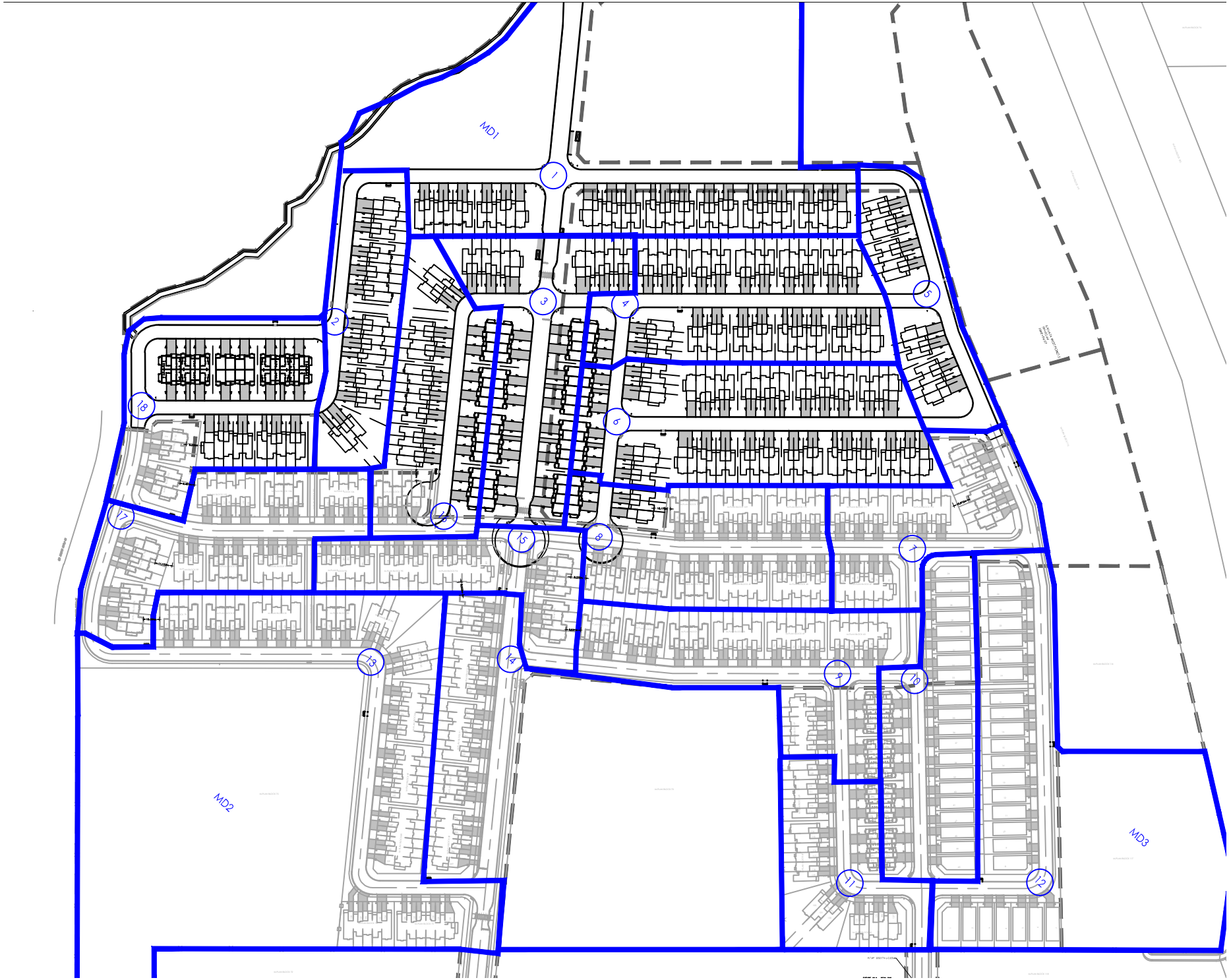
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FUS Fire Flow Calculation Sheet

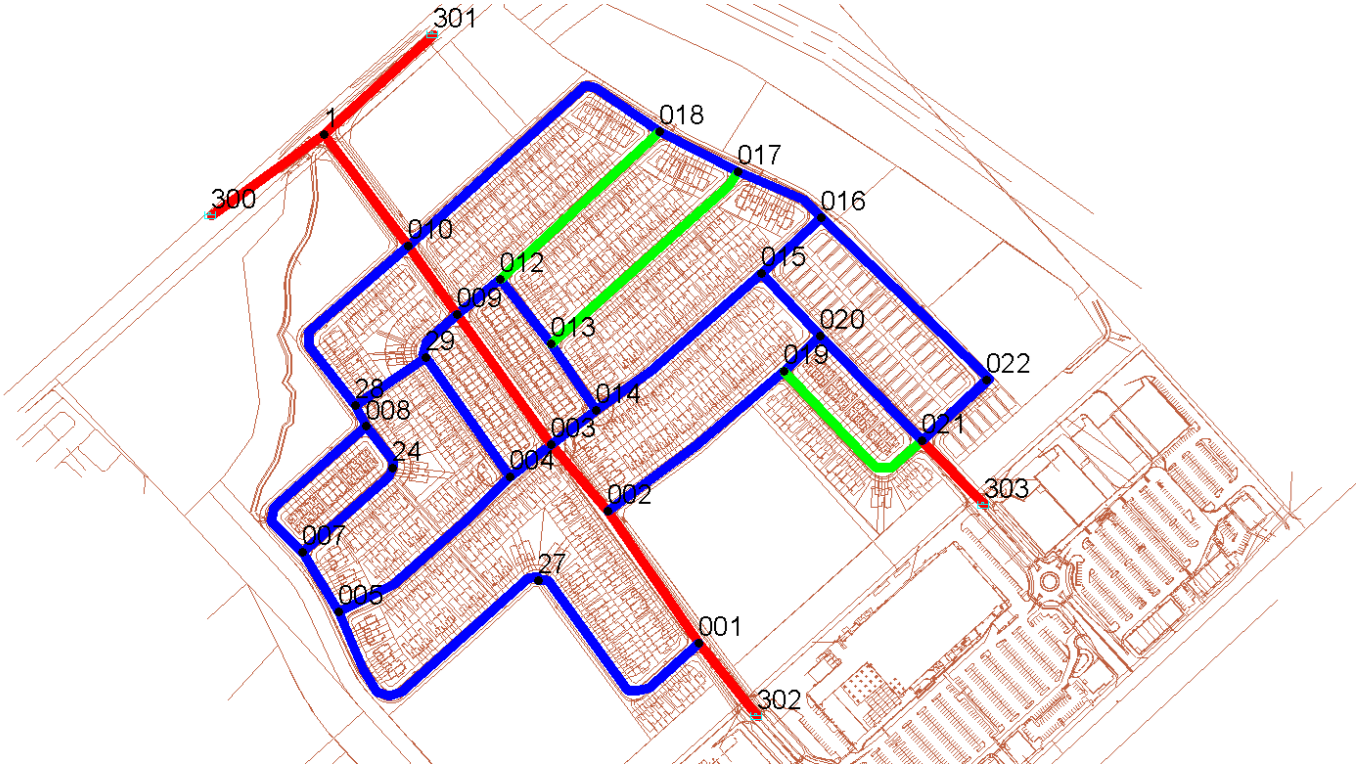
Stantec Project #: 160401393
Project Name: Kanata West Richcraft
Date: 11/23/2020
Fire Flow Calculation #: 14
Description: Residential - Single Units

Notes: Unit 35 & 36 with less than 10m side to rearyard seperation

Step	Task							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	-						156.0	-
	Determine Number of Adjoining Units	Includes adjacent wood frame structures separated by 3m or less						1	-
3	Determine Height in Storeys	Does not include floors >50% below grade or open attic space						2	-
4	Determine Required Fire Flow	($F = 220 \times C \times A^{1/2}$). Round to nearest 1000 L/min						-	6000
5	Determine Occupancy Charge	Limited Combustible						-15%	5100
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	22	2	31-60	Wood Frame or Non-Combustible	18%	3111
		East	3.1 to 10	7	2	0-30	Wood Frame or Non-Combustible	17%	
		South	3.1 to 10	22	2	31-60	Wood Frame or Non-Combustible	18%	
		West	20.1 to 30	7	2	0-30	Wood Frame or Non-Combustible	8%	
8	Determine Final Required Fire Flow	**Total Required Fire Flow in L/min, Rounded to Nearest 1000L/min**							**8000**
		Total Required Fire Flow in L/s							**133.3**
		Required Duration of Fire Flow (hrs)							**2.00**
		Required Volume of Fire Flow (m^3)							**960**


MD1
MD2
MD3
1
2
3
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5
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15
16
17
18

Ultimate-2nd Registration-2023-11-16



ANNO25

JUNCTION (MOTYPE)
- Active
- Domain

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

PIPE (VALUE)
- less than 202.33
- 202.33 ~ 249.66
- greater than 249.66

PUMP (MOTYPE)
- Active
- Domain

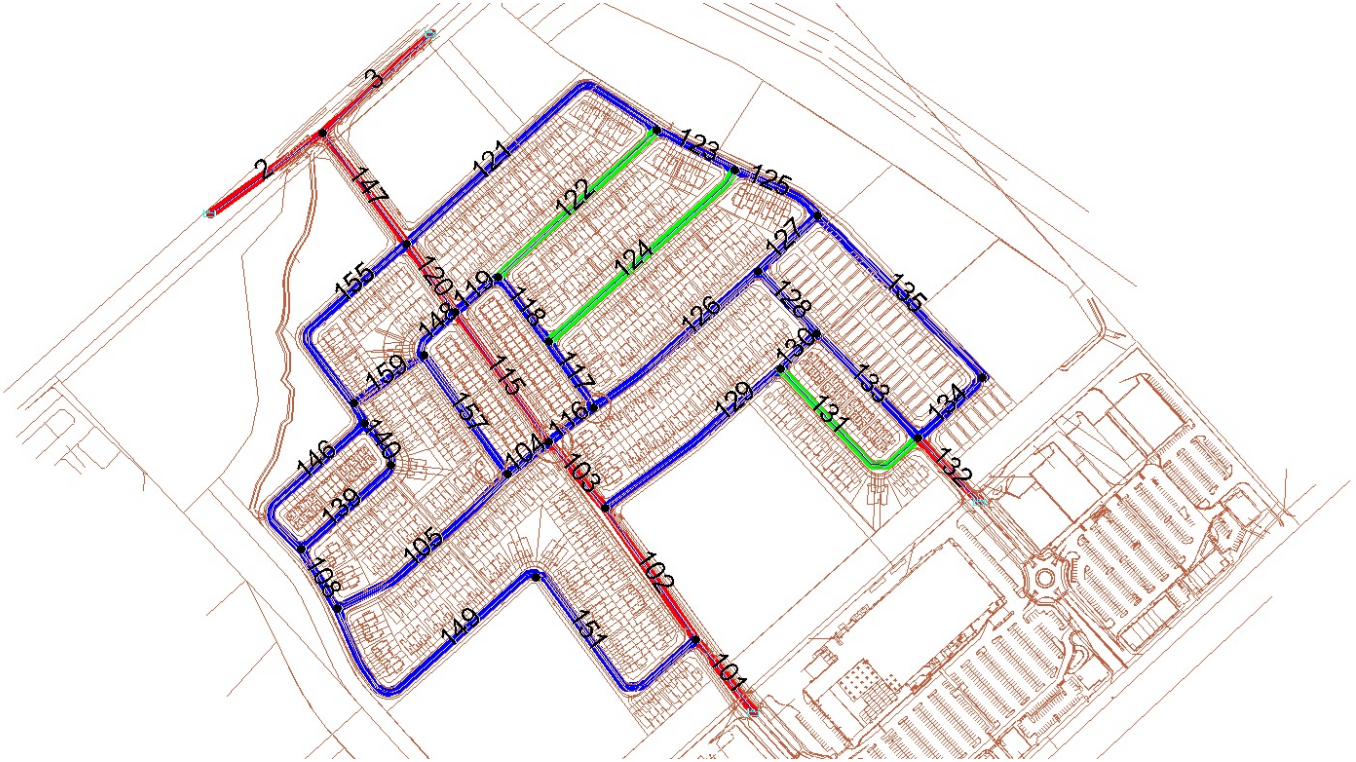
VALVE (MOTYPE)
- Active
- Domain

ACAD-160401393-DP.dxf

Prepared By:

Date: 11/16/2023

Ultimate-2nd Registration-2023-11-16



JUNCTION (MOTYPE)
- Active
- Domain

ANNO25

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

PIPE (VALUE)
- less than 202.33
- 202.33 ~ 249.66
- greater than 249.66

PUMP (MOTYPE)
- Active
- Domain

VALVE (MOTYPE)
- Active
- Domain

ACAD-160401393-DP.dxf

Prepared By:

Date: 11/16/2023

APPENDIX B

Stormwater Management Calculations

Appendix B1: Storm Sewer Design Sheet

Stantec

Second Registration Phase - Richcraft Kanata West	
DATE:	2023-12-13
REVISION:	2
DESIGNED BY:	WAJ
CHECKED BY:	AMP
FILE NUMBER:	160401393

STORM SEWER DESIGN SHEET
(City of Ottawa)

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																						PIPE SELECTION											
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)	T of C (min)	$I_{2\text{-YEAR}}$ (mm/h)	$I_{5\text{-YEAR}}$ (mm/h)	$I_{10\text{-YEAR}}$ (mm/h)	$I_{100\text{-YEAR}}$ (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)
Proposed Second Registration Phase Storm Sewers - to East Forebay of Ultimate KW Pond 5																																			
L209B, L209A, L209C, UNC-8, EXT8-Fairwinds/Arterial/Commercial (Cartage Way, L)	209	207	1.02	23.31	7.14	0.00	0.00	0.61	0.59	0.70	0.00	0.619	0.619	13.844	13.844	4.998	4.998	0.000	0.000	15.00	61.77	83.56	97.85	142.89	0.0	0.0	4677.9	49.7	1650	1650	CIRCULAR	CONCRETE	-	0.30	5208.1	**89.8%**	2.4	2.41	0.34
L207A (Cartage Way, L)	207	206	0.58	0.00	0.00	0.00	0.00	0.63	0.00	0.00	0.00	0.365	0.984	0.000	13.844	0.000	4.998	0.000	0.000	15.34	60.97	82.46	96.57	141.01	0.0	0.0	4678.5	99.2	1650	1650	CIRCULAR	CONCRETE	-	0.30	5208.0	**89.8%**	2.4	2.41	0.69
L206A, C206B (Cartage Way, L)	206	205	0.31	0.17	0.00	0.00	0.00	0.73	0.70	0.00	0.00	0.226	1.210	0.119	13.963	0.000	4.998	0.000	0.000	16.03	59.44	80.37	94.11	137.40	0.0	0.0	4623.6	110.0	2100	2100	CIRCULAR	CONCRETE	-	0.15	7005.7	**66.0%**	2.0	1.82	1.01
L205B, C205A (Cartage Way, L)	205	204	0.48	0.26	0.00	0.00	0.00	0.45	0.67	0.00	0.00	0.216	1.427	0.176	14.139	0.000	4.998	0.000	0.000	17.04	57.35	77.51	90.74	132.46	0.0	0.0	4531.2	108.1	2100	2100	CIRCULAR	CONCRETE	-	0.15	7007.1	**64.7%**	2.0	1.81	1.00
L204A, L204B (Cartage Way, L)	204	202	0.81	0.00	0.00	0.00	0.00	0.71	0.00	0.00	0.00	0.574	2.001	0.000	14.139	0.000	4.998	0.000	0.000	18.03	55.43	74.89	87.66	127.94	0.0	0.0	4466.3	149.9	2100	2100	CIRCULAR	CONCRETE	-	0.15	7005.8	**63.8%**	2.0	1.81	1.38
																				19.42																		
L212A, EXT9 - Trinity/Hazeldean (Tillage Street, L)	212	211	0.10	12.31	4.54	0.00	2.54	0.60	0.86	0.76	0.00	0.060	0.060	10.587	10.587	3.450	3.450	0.000	0.000	21.58	49.62	66.96	78.35	114.29	76.4	76.4	2804.8	97.8	1650	1650	CIRCULAR	CONCRETE	-	0.15	3682.7	**76.2%**	1.7	1.61	1.01
L211A (Tillage Street, L)	211	210	0.40	0.00	0.00	0.00	0.00	0.72	0.00	0.00	0.00	0.288	0.348	0.000	10.587	0.000	3.450	0.000	0.000	22.59	48.21	65.04	76.09	110.97	0.0	76.4	2764.7	115.9	1800	1800	CIRCULAR	CONCRETE	-	0.16	4722.9	**58.5%**	1.8	1.61	1.20
																				23.79																		
(Holstein Road, L)	232	231	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	10.00	76.81	104.19	122.14	178.56	0.0	0.0	0.0	42.8	300	300	CIRCULAR	CONCRETE	-	0.50	68.0	**0.0%**	1.0	0.00	0.00
(Holstein Road, L)	231	230	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	10.00	76.81	104.19	122.14	178.56	0.0	0.0	0.0	37.4	300	300	CIRCULAR	CONCRETE	-	0.50	68.0	**0.0%**	1.0	0.00	0.00
(Holstein Road, L)	230	229	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	10.00	76.81	104.19	122.14	178.56	0.0	0.0	0.0	12.1	300	300	CIRCULAR	CONCRETE	-	0.50	68.0	**0.0%**	1.0	0.00	0.00
L229A, UNC-5 (Holstein Road, L)	229	228	0.51	0.00	0.00	0.00	0.00	0.76	0.00	0.00	0.00	0.387	0.387	0.000	0.000	0.000	0.000	0.000	0.000	10.00	76.81	104.19	122.14	178.56	0.0	0.0	82.6	88.9	450	450	CIRCULAR	CONCRETE	-	0.40	188.1	**43.9%**	1.1	0.94	1.57
L228A (Holstein Road, L)	228	227	0.35	0.00	0.00	0.00	0.00	0.70	0.00	0.00	0.00	0.245	0.632	0.000	0.000	0.000	0.000	0.000	0.000	11.57	71.25	96.56	113.15	165.35	0.0	0.0	125.1	77.2	450	450	CIRCULAR	CONCRETE	-	0.30	162.9	**76.8%**	1.0	0.97	1.33
(Holstein Road, L)	227	226	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.632	0.000	0.000	0.000	0.000	0.000	0.000	12.90	67.20	91.00	106.61	155.75	0.0	0.0	118.0	14.1	450	450	CIRCULAR	CONCRETE	-	0.30	162.9	**72.4%**	1.0	0.95	0.25
L226A, UNC-6 (Holstein Road, L)	226	225	0.46	0.00	0.00	0.00	0.00	0.73	0.00	0.00	0.00	0.338	0.970	0.000	0.000	0.000	0.000	0.000	0.000	13.15	66.50	90.05	105.48	154.10	0.0	0.0	179.2	62.2	525	525	CIRCULAR	CONCRETE	-	0.30	245.7	**72.9%**	1.1	1.05	0.99
L225A, L225B (Holstein Road, L)	225	224	2.87	0.00	0.00	0.00	0.00	0.79	0.00	0.00	0.00	2.269	3.239	0.000	0.000	0.000	0.000	0.000	0.000	14.14	63.88	86.45	101.25	147.88	0.0	0.0	574.7	67.7	825	825	CIRCULAR	CONCRETE	-	0.30	820.2	**70.1%**	1.5	1.41	0.80
(Holstein Road, L)	224	223	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	3.239	0.000	0.000	0.000	0.000	0.000	0.000	14.94	61.91	83.76	98.09	143.24	0.0	0.0	557.0	11.9	825	825	CIRCULAR	CONCRETE	-	0.35	886.0	**62.9%**	1.6	1.47	0.14
C223A (Holstein Road, L)	223	222	0.00	0.16	0.00	0.00	0.00	0.00	0.71	0.00	0.00	0.000	3.239	0.114	0.114	0.000	0.000	0.000	0.000	15.07	61.59	83.32	97.57	142.48	0.0	0.0	580.5	75.3	825	825	CIRCULAR	CONCRETE	-	0.35	885.9	**65.5%**	1.6	1.49	0.84
C222A, UNC-4 (Roger Griffiths Avenue, C)	222	221	0.07	0.52	0.00	0.00	0.00	0.70	0.69	0.00	0.00	0.049	3.288	0.359	0.473	0.000	0.000	0.000	0.000	15.91	59.69	80.71	94.51	137.99	0.0	0.0	651.2	71.4	825	825	CIRCULAR	CONCRETE	-	0.35	885.9	**73.5%**	1.6	1.54	0.77
(Roger Griffiths Avenue, C)	221	219	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	3.288	0.000	0.473	0.000	0.000	0.000	0.000	16.69	58.06	78.48	91.88	134.13	0.0	0.0	633.4	76.8	1050	1050	CIRCULAR	CONCRETE	-	0.37	1728.6	**36.6%**	1.9	1.50	0.85
																				17.54																		
C220A, L220A (Roger Griffiths Avenue, C)	220	219	0.87	0.41	0.00	0.00	0.00	0.44	0.73	0.00	0.00	0.381	0.381	0.297	0.297	0.000	0.000	0.000	0.000	10.00	76.81	104.19	122.14	178.56	0.0	0.0	167.3	71.8	750	750	CIRCULAR	CONCRETE	-	0.50	821.2	**20.4%**	1.8	1.17	1.02
																				11.02																		
C219A, L219B, UNC-1 (Shropshire Place, L)	219	218	0.42	0.09	0.00	0.00	0.00	0.68	0.68	0.00	0.00	0.288	3.957	0.061	0.831	0.000	0.000	0.000	0.000	17.54	56.36	76.17	89.16	130.15	0.0	0.0	795.3	110.7	1350	1350	CIRCULAR	CONCRETE	-	0.20	2475.0	**32.1%**	1.7	1.26	1.47
L218A, L218B, UNC-2 (Shropshire Place, L)	218	213	3.00	0.00	0.00	0.00	0.00	0.68	0.00	0.00	0.00	2.038	5.995	0.000	0.831	0.000	0.000	0.000	0.000	19.01	53.69	72.51	84.87	123.85	0.0	0.0	1061.4	102.1	1500	1500	CIRCULAR	CONCRETE	-	0.20	3304.3	**32.1%**	1.8	1.36	1.25
																				20.26																		
L217A (Combine Walk, L)	217	216	0.40	0.00	0.00	0.00	0.00	0.68	0.00	0.00	0.00	0.273	0.273	0.000	0.000	0.000	0.000	0.000	0.000	10.00	76.81	104.19	122.14	178.56	0.0	0.0	58.2	31.2	375	375	CIRCULAR	PVC	-	0.50	116.6	**49.9%**	1.1	0.95	0.55
(Combine Walk, L)	216	215	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.273	0.000	0.000	0.000	0.000	0.000	0.000	10.55	74.75	101.37	118.82	173.67	0.0	0.0	56.7	11.9	375	375	CIRCULAR	PVC	-	0.50	116.6	**48.6%**	1.1	0.94	0.21
(Combine Walk, L)	215	214	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.273	0.000	0.000	0.000	0.000	0.000	0.000	10.76	74.00	100.33	117.59	171.88	0.0	0.0	56.1	57.5	375	375	CIRCULAR	PVC	-	0.50	116.6	**48.1%**	1.1	0.94	1.02
L214A (Combine Walk, L)	214	213	0.55	0.00	0.00	0.00	0.00	0.71	0.00	0.00	0.00	0.391	0.664	0.000	0.000	0.000	0.000	0.000	0.000	11.79	70.57	95.62	112.05	163.73	0.0	0.0	130.1	70.6	600	600	CIRCULAR	CONCRETE	-	0.32	360.5	**36.1%**	1.2	0.96	1.23
																				13.01																		
L213A (Shropshire Place, L)	213	210	0.26	0.00	0.00	0.00	0.00	0.69	0.00	0.00	0.00	0.182	6.840	0.000	0.831	0.000	0.000	0.000	0.000	20.26	51.62	69.69	81.55	118.98	0.0	0.0	1141.6	55.3	1500	1500	CIRCULAR	CONCRETE	-	0.20	3295.3	**34.6%**	1.8	1.39	0.66
																				20.92																		
L210A, L210B (Tillage Street, L)	210	202	0.51	0.00	0.00	0.00	0.00	0.57	0.00	0.00	0.00	0.291	7.479	0.000	11.417	0.000	3.450	0.000	0.000	23.79	46.64	62.90	73.57	107.29	0.0	76.4	3745.1	85.5	1950	1950	CIRCULAR	CONCRETE	-	0.14	5640.5	**66.4%**	1.8	1.70	0.84
																				24.63																		
L202B, L202A (Winter Wheat Terrace, L)	202	201	0.45	0.00	0.00	0.00	0.00	0.57	0.00	0.00	0.00	0.258	9.737	0.000	25.557	0.000	8.448	0.000	0.000	24.63	45.61	61.49	71.92	104.87	0.0	76.4	7363.3	75.0	3000	1800	RECTANGULAR	CONCRETE	-	0.15	10962.8	**67.2%**	2.0	1.90	0.66
																				25.29																		
(Ploughshare Road, L)	237	236	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	10.00	76.81	104.19	122.14	178.56	0.0	0.0	0.0	61.3	300	300	CIRCULAR	PVC	-	0.35	56.9	**0.0%**	0.8	0.00	0.00
(Ploughshare Road, L)	236	235	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	10.00	76.81	104.19	122.14	178.56	0.0	0.0	0.0	12.7	300	300	CIRCULAR	PVC	-	0.35	56.9	**0.0%**	0.8	0.00	0.00
L235A, L235B, UNC-9 (Ploughshare Road, L)	235	234	1.69	0.00	0.00	0.00	0.00	0.70	0.00	0.00	0.00	1.191	1.191	0.000	0.000	0.000	0.000	0.000	0.000	10.00	76.81	104.19	122.14	178.56	0.0	0.0	254.1	80.8	675	675	CIRCULAR	CONCRETE	-	0.35	518.8	**49.0%**	1.4	1.19	1.13
L234B, G234C, L234A, L234D (Ploughshare Road, L)	234	233	1.83	0.00	0.00	0.00	0.00	0.51	0.00	0.00	0.00	0.934	2.126	0.000	0.000	0.000	0.000	0.000	0.000	11.13	72.72	98.57	115.52	168.83	0.0	0.0	429.3	106.9	825	825	CIRCULAR	CONCRETE	-	0.35	885.9	**48.5%**	1.6	1.36	1.31
(Ploughshare Road, L)	233	201	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	2.126	0.000	0.000	0.000	0.000	0.000	0.000	12.44	68.55	92.85	108.79	158.94	0.0	0.0	404.7	26.6	825	825	CIRCULAR	CONCRETE	-	0.40	947.1	**42.7%**	1.7	1.40	0.32
																				12.76																		
	201	100B	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	11.863	0.000	25.557	0.000	8.448	0.000	0.000	25.29	44.83	60.44	70.69	103.06	0.0	76.4	7503.5	15.0	3000	1800	RECTANGULAR	CONCRETE	-	0.15	10961.6	**68.5%**	2.0	1.91	0.13
Forebay Inlet (Sized for 25mm)	100B	HW1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	25.42	44.68	60.24	70.45	102.71	3536.1	3536.1	3536.1	18.0	1800	1800	CIRCULAR	CONCRETE	-	0.18	5055.2	**70.0%**	1.9	1.83	0.16
																				25.58									1800	1800								
Bypass sewer to Maincell	100B	100A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	11.863	0.000	25.557	0.000	8.448	0.000	0.000	25.58	44.50	59.98	70.15	102.27	0.0	76.4	7447.0	49.8	2440	2440	CIRCULAR	CONCRETE	-	0.10	8013.1	**92.9%**	1.7	1.77	0.47
	100A	HW3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	11.863	0.000	25.557	0.000	8.448	0.000	0.000	26.05	43.97	59.27	69.31	101.05	0.0	76.4	7359.3	28.1	2440	2440	CIRCULAR	CONCRETE	-	0.11	8726.3	**84.3%**	1.9	1.87	0.25
																				26.30									2440	2440								
Total to West Forebay Inlet			**17.94**	**37.23**	**11.68**	**0.00**	**2.54**					**11.86**		**25.56**		**8.45**		**0.00**																					

Notes:

1. The proposed streets are all classified as local streets with the exception of Roger Griffiths Avenue which is classified as a collector road.
2. Storm sewers within local streets have been sized for a 2-year storm with the exception of catchments at the intersection with Roger Griffiths Avenue for which storm sewers have been sized for the 5-year capture to avoid 5-year ponding on collector roads.
3. Existing residential and commercial developments (Fairwinds and Trinity), areas EXT-8 & EXT-9 have been included in the proposed storm sewer sizing for the 5-year storm as per previous City of Ottawa guidelines.
4. The development includes three residential block areas L123B & L225B, L235B (Block 29, Block 75 & 117) , one commercial block area L121B (Block 1), a school block area L218A (Block 70) and two park block areas G234A & L126C (Block 116 & Block 28) .

Appendix B2: Stormwater Input Parameters

Project No. 160401393
Richcraft Kanata West Development
Runoff Coefficient Calculations

Runoff Coeeficient for Hard Areas, C=0.90
Runoff Coeeficient for Soft Areas, C=0.20

ID	Total Area (m^2)	Hard Area (m^2)	Soft Area (m^2)	C-Value
B-1	10983			0.60
B-2	6934			0.70
C107A	1854	1288	566	0.69
C109A	4301	3037	1264	0.69
C109B	3785	2758	1027	0.71
C110A	1281	851	430	0.67
C121A	3843	2645	1198	0.68
C121AA	908	589	319	0.65
C123A	2064	1386	678	0.67
C205A	2631	1758	873	0.67
C206B	1703	1216	487	0.70
C219A	895	617	278	0.68
C220A	4066	2944	1122	0.71
C222A	5208	3632	1576	0.69
C223A	1601	1168	433	0.71
EXT1	1249	768	481	0.63
EXT2	720	479	241	0.67
EXT4	5215	2862	2353	0.58
EXT5	1143	283	860	0.37
EXT6	1155	467	688	0.48
F101A	6923			0.55
G234A	9716			0.25
L102A	2275	1347	928	0.61
L103A	3885	2792	1093	0.70
L103B	2031	1229	802	0.62
L103C	6397	2539	3858	0.48
L103D	5523	2014	3509	0.46
L104A	3335	2273	1062	0.68
L105A	3236	2415	821	0.72
L106A	2440	1846	594	0.73
L106B	735	510	225	0.69
L112A	4137	2797	1340	0.67
L113A	3285	2311	974	0.69
L113B	4947	1552	3395	0.42
L115A	1651	1122	529	0.68
L116A	2227	1565	662	0.69
L117A	4246	3092	1154	0.71

Project No. 160401393
Richcraft Kanata West Development
Runoff Coefficient Calculations

Runoff Coeeficient for Hard Areas, C=0.90
Runoff Coeeficient for Soft Areas, C=0.20

ID	Total Area (m^2)	Hard Area (m^2)	Soft Area (m^2)	C-Value
L117B	1457	787	670	0.58
L117C	6623	2491	4132	0.46
L118A	4434	2921	1513	0.66
L119A	3110	2182	928	0.69
L121B	14671			0.85
L123B	7404			0.70
L124A	2320	1518	802	0.66
L124B	3815	1252	2563	0.43
L126A	317	239	78	0.73
L126B	2633	1879	754	0.70
L126C	4630			0.25
L127A	3820	2537	1283	0.66
L128A	3185	2115	1070	0.66
L130A	4541	3164	1377	0.69
L202A	2081	1154	927	0.59
L202B	2452	1227	1225	0.55
L204A	4213	2920	1293	0.69
L204B	3883	2919	964	0.73
L205B	4810	1726	3084	0.45
L206A	3093	2321	772	0.73
L207A	5812	3599	2213	0.63
L130B	2253	849	1404	0.46
L207C	4069	1577	2492	0.47
L209A	3501	2452	1049	0.69
L209B	1584	1058	526	0.67
L210A	2521	1680	841	0.67
L210B	2600	1014	1586	0.47
L211A	3995	2993	1002	0.72
L213A	2632	1849	783	0.69
L214A	5507	4027	1480	0.71
L217A	4012	2777	1235	0.68
L218A	29485			0.70
L218B	2503	890	1613	0.45
L219B	3617	2484	1133	0.68
L220A	8666	2958	5708	0.44
L225A	2733	1861	872	0.68
L226A	3031	2181	850	0.70
L228A	3458	2453	1005	0.70
L229A	2114	1504	610	0.70
L234A	2589	1831	758	0.70
L234B	2276	1593	683	0.69
L234D	3685	1970	1715	0.57
L235A	5889	4100	1789	0.69

Summary of Subcatchment Parameters

Individual Proposed Subcatchment Parameters (Site Servicing and SWM Report)

Area ID	Area (ha)	Width (m)	Slope (%)	%IMP	Runoff Coefficient	Subarea Routing	% Routed	Description	2yr/5yr Capture Rate (L/s)	Available Ponding (cu.m)	Static Ponding Depth (m)	
Arterial	3.19	1314.0	1.0	71.4%	0.70	OUTLET	100	Arterial	933.69	127.6	40	m3/ha
B-1	1.10	186.0	1.0	57.1%	0.60	PERVIOUS	30	Residential	104.93	154.0	100-YEAR	DRY POND
B-2	0.69	186.0	1.0	71.4%	0.70	OUTLET	100	Arterial	195.28	27.7	40	m3/ha
C107A	0.19	52.0	1.0	70.0%	0.69	OUTLET	100	Road	40.89	25.9	0.2	
C109A	0.43	160.0	1.0	70.0%	0.69	OUTLET	100	Road	96.82	27.1	0.17	
C109B	0.38	138.0	1.0	72.9%	0.71	OUTLET	100	Road	87.97	38.1	0.2	
C110A	0.12	39.0	1.0	67.1%	0.67	OUTLET	100	Road	25.49	0.6	0.04	
C121A	0.38	95.0	1.0	68.6%	0.68	OUTLET	100	Road	82.54	79.1	0.26	
C121AA	0.09	37.0	1.5	64.3%	0.65	OUTLET	100	Road	19.55	**0.0**	-	
C123A	0.20	43.2	1.0	67.1%	0.67	OUTLET	100	Road	41.63	23	0.19	
C205A	0.26	71.2	3.0	67.1%	0.67	OUTLET	100	Road	58.29	56.9	0.21	
C206B	0.17	68.0	3.0	71.4%	0.70	OUTLET	100	Road	40.86	0.3	0.02	
C219A	0.09	79.8	2.0	68.6%	0.68	OUTLET	100	Road	21.94	0.0	0.12	
C220A	0.41	131.8	2.0	75.7%	0.73	OUTLET	100	Road	98.97	47.6	0.2	
C222A	0.52	257.0	4.0	70.0%	0.69	OUTLET	100	Road	126.75	64.2	0.24	
C223A	0.16	59.0	3.0	72.9%	0.71	OUTLET	100	Road	38.73	0.3	0.04	
Comm	1.99	448.0	1.0	92.9%	0.85	OUTLET	100	Commercial	392.14	N/A	100-year	
EXT1	0.12	59.0	1.5	61.4%	0.63	OUTLET	100	Road	-	0.0		
EXT2	0.07	29.0	2.0	67.1%	0.67	OUTLET	100	Road	-	0.0		
EXT-4	0.13	79.6	0.5	48.6%	0.54	OUTLET	100	RY-rev	-	0.0		
EXT5	0.11	77.0	4.0	24.3%	0.37	PERVIOUS	100	RY	-	0.0		
EXT6	0.12	78.8	4.0	40.0%	0.48	PERVIOUS	100	RY	-	0.0		
F101A-1A	0.69	155.0	1.0	50.0%	0.55	PERVIOUS	100	KWPumpStation	232.23	0.0		
G234C	0.97	218.1	1.0	28.6%	0.40	PERVIOUS	100	Park	17.53	0.0	C=	0.33
Hazeldean	3.95	1764.0	1.0	71.4%	0.70	OUTLET	100	Arterial	1164.24	158.0	40	m3/ha
L102A	0.23	82.4	1.0	58.6%	0.61	OUTLET	100	Road	28.63	32.5	0.21	
L103A	0.39	161.8	1.0	71.4%	0.70	OUTLET	100	Road	59.61	25.3	0.19	
L103B	0.20	63.2	1.0	60.0%	0.62	OUTLET	100	Road	26.15	16.3	0.18	
L103C	0.64	300.0	1.0	40.0%	0.48	PERVIOUS	100	RY	40.25	0	-	
L103D	0.55	278.0	1.0	37.1%	0.46	PERVIOUS	100	RY	31.95	0.0	-	
L104A	0.33	122.7	1.0	68.6%	0.68	OUTLET	100	Road	49.14	29.4	0.19	
L105A	0.32	153.2	1.0	74.3%	0.72	OUTLET	100	Road	51.66	23.3	0.18	
L106A	0.24	97.3	1.0	75.7%	0.73	OUTLET	100	Road	39.61	0.8	0.06	
L106B	0.07	26.6	1.0	70.0%	0.69	OUTLET	100	Road	11.04	0.8	0.12	
L112A	0.41	167.7	1.0	67.1%	0.67	OUTLET	100	Road	59.68	45.7	0.23	
L113A	0.33	127.0	1.0	70.0%	0.69	OUTLET	100	Road	49.37	29	0.19	
L113B	0.49	280.0	1.0	31.4%	0.42	PERVIOUS	100	RY	23.28	0	-	
L114A	0.06	63.2	1.0	68.6%	0.68	OUTLET	100	Road	8.54	3.2	0.13	
L115A	0.17	58.0	1.0	68.6%	0.68	OUTLET	100	Road	24.29	16.2	0.16	
L116A	0.22	84.0	1.0	70.0%	0.69	OUTLET	100	Road	33.46	37.4	0.21	
L117A	0.42	173.7	1.0	72.9%	0.71	OUTLET	100	Road	66.42	61.8	0.26	
L117B	0.15	49.3	1.0	54.3%	0.58	OUTLET	100	Road	17	9.9	0.15	
L117C	0.66	360.0	1.0	37.1%	0.46	PERVIOUS	100	RY	40.46	0.0		
L118A	0.44	167.3	1.0	65.7%	0.66	OUTLET	100	Road	62.58	29.5	0.19	
L119A	0.31	89.8	1.0	70.0%	0.69	OUTLET	100	Road	46.72	28.1	0.2	
L121B	1.47	331.0	1.0	92.9%	0.85	OUTLET	100	Commercial	288.95	N/A	100-year	
L123B	0.74	167.0	1.0	71.4%	0.70	PERVIOUS	30	Residential	100.71	37.0	50	m3/ha
L124A	0.23	116.1	1.0	65.7%	0.66	OUTLET	100	Road	32.83	17.2	0.17	
L124B	0.40	246.0	1.0	32.9%	0.43	PERVIOUS	100	RY	21.55	0.0		
L126A	0.03	30.0	1.0	75.7%	0.73	OUTLET	100	Road	5.2	0.0	0.14	
L126B	0.26	85.4	1.0	71.4%	0.70	OUTLET	100	Road	40.32	23.9	0.2	
L126C	0.46	104.0	1.0	7.1%	0.25	PERVIOUS	100	Park	1.13	0.0		

Individual Proposed Subcatchment Parameters (Site Servicing and SWM Report)

Area ID	Area (ha)	Width (m)	Slope (%)	%IMP	Runoff Coefficient	Subarea Routing	% Routed	Description	2yr/5yr Capture Rate (L/s)	Available Ponding (cu.m)	Static Ponding Depth (m)	
L127A	0.38	144.2	1.0	65.7%	0.66	OUTLET	100	Road	53.92	0.0	0.00	
L128A	0.32	72.1	1.0	65.7%	0.66	OUTLET	100	Road	44.72	29.8	0.18	
L130A	0.45	170.7	1.0	70.0%	0.69	OUTLET	100	Road	68.25	0.7	0.1	
L130B	0.23	200.0	1.0	40.0%	0.48	PERVIOUS	100	RY	21.45	0	-	
L202A	0.21	76.7	2.0	55.7%	0.59	OUTLET	100	Road	25.01	15.7	0.16	
L202B	0.25	152.0	3.0	50.0%	0.55	PERVIOUS	100	RY	34.89	-	-	
L204A	0.42	174.7	3.0	75.7%	0.73	OUTLET	100	Road	68.82	49.5	0.22	
L204B	0.39	164.0	3.0	70.0%	0.69	OUTLET	100	Road	58.72	22.7	0.18	
L205B	0.48	236.0	3.0	35.7%	0.45	PERVIOUS	100	RY	37.34	0	-	
L206A	0.31	127.2	3.0	75.7%	0.73	OUTLET	100	Road	50.52	9.2	0.13	
L207A	0.58	202.3	3.0	64.3%	0.65	OUTLET	100	Road	80.61	**26.8**	0.20	
L209A	0.35	153.4	2.0	70.0%	0.69	OUTLET	100	Road	52.84	0.0		
L209B	0.16	159.0	2.0	67.1%	0.67	OUTLET	100	Road	23.24	**3.7**	0.13	
L209C	0.41	200.0	3.0	38.6%	0.47	PERVIOUS	100	RY	35.69	0	-	
L210A	0.25	80.1	3.0	67.1%	0.67	OUTLET	100	Road	36.46	7.8	0.14	
L210B	0.26	168.0	3.0	38.6%	0.47	PERVIOUS	100	RY	26.74	**0.0**		
L211A	0.40	177.2	3.0	74.3%	0.72	OUTLET	100	Road	64.09	33.2	0.21	
L212A	0.10	44.0	3.0	57.1%	0.60	OUTLET	100	Road	12.14	0.0	0.00	
L213A	0.26	93.3	2.0	70.0%	0.69	OUTLET	100	Road	39.64	8.9	0.13	
L214A	0.55	221.0	4.0	72.9%	0.71	OUTLET	100	Road	86.71	71	0.27	
L217A	0.40	196.0	3.0	68.6%	0.68	OUTLET	100	Road	59.55	69	0.3	
L218A	2.68	664.0	1.0	71.4%	0.70	PERVIOUS	30	School	**434**	267.9	100	m3/ha
L218B	0.25	166.0	3.0	35.7%	0.45	PERVIOUS	100	RY	23.45	0.0		
L219B	0.36	111.7	2.0	68.6%	0.68	OUTLET	100	Road	53.31	70.1	0.24	
L220A	0.87	480.0	2.5	34.3%	0.44	PERVIOUS	100	RY	64.41	0.0	-	
L225A	0.27	134.6	2.5	71.4%	0.70	OUTLET	100	Road	42.19	9	0.14	
L225B	2.60	619.0	2.0	85.7%	0.80	PERVIOUS	30	Med-Resid	**470**	129.9	50	m3/ha
L226A	0.30	84.1	2.5	71.4%	0.70	OUTLET	100	Road-Rev	45.7	16.5	0.17	
L228A	0.35	96.0	2.5	71.4%	0.70	OUTLET	100	Road	54.22	33.6	0.21	
L229A	0.21	66.0	3.0	71.4%	0.70	OUTLET	100	Road	31.55	41.7	0.22	
L234A	0.26	78.0	5.0	68.6%	0.68	OUTLET	100	Road-rev	38.7	37.2	0.21	
L234B	0.23	81.1	4.0	70.0%	0.69	OUTLET	100	Road	34.39	14.3	0.15	
L234D	0.37	210.0	3.0	52.9%	0.57	PERVIOUS	100	RY-revL238A	54.94	33	0.21	
L235A	0.59	232.0	4.0	70.0%	0.69	OUTLET	100	Road-revL241A	89.72	55.6	0.24	
L235B	0.98	221.4	2.0	85.7%	0.80	PERVIOUS	30	Med-Density-rev	**115**	88.6	90	m3/ha
POND	2.56	576.0	1.0	60.0%	0.62	PERVIOUS	60	Ult_pond5				
UNC-1	0.06	120.0	4.0	71.4%	0.70	OUTLET	100	UNC-SCHOOL				
UNC-10	0.10	102.8	33.0	85.7%	0.80	OUTLET	100	Unc-L235B-rev				
UNC-11	0.12	119.9	33.0	85.7%	0.80	OUTLET	100	Unc-L235B-rev				
UNC-2	0.07	120.0	4.0	71.4%	0.70	OUTLET	100	UNC-SCHOOL				
UNC-3	0.07	120.0	4.0	71.4%	0.70	OUTLET	100	UNC-SCHOOL				
UNC-4	0.07	120.0	4.0	71.4%	0.70	OUTLET	100	UNC-SCHOOL				
UNC-5	0.30	188.0	3.0	85.7%	0.80	OUTLET	100	UNC-RES				
UNC-6	0.16	160.0	3.0	85.7%	0.80	OUTLET	100	UNC-RES				
UNC-7	0.16	160.0	3.0	85.7%	0.80	OUTLET	100	UNC-RES				
UNC-8	0.10	200.0	3.0	85.7%	0.80	OUTLET	100	UNC-RES				
UNC-9	0.12	117.5	3.0	85.7%	0.80	OUTLET	100	Unc-L235B-rev				
	48.15			**66.6%**	**0.67**				**7613.9**	**1452.40**		**60 m^3/ha**

24.18	ha - Proposed Subdivision Area (Not including private blocks)		
36.53	ha - Proposed Development Area (Including SWM and private blocks)	**64.7%**	
2.56	ha - Ultimate Pond Block	**60.0%**	
13.32	ha - Approved First Registration Development Area (Including private blocks)	**62.1%**	**617.20** **46 m^3/ha**
20.66	ha - Proposed Second Registration Development Area (Including private blocks)	**67.0%**	**835.20** **54 m^3/ha**
3.19	ha - Future Arterial/Transitway	71.4%	
1.10	ha - Future Med. Density Residential Area north of Maple Grove	57.1%	
0.69	ha - Future Maple Grove	71.4%	
1.99	ha - Future Commercial Block	92.9%	
3.95	ha - Existing Hazeldean to Interim SWMF discharging to Hazeldean Creek	71.4%	
0.69	ha - Kanata West Pump Station	50.0%	
9.14	ha - Existing Fairwinds Development	35.7%	
11.02	ha - Existing Commercial Development to Fairwinds Interim SWMF	94.3%	
1.16	ha - Existing Huntmar Road to Fairwinds Interim SWMF	67.1%	
14.85	ha - Existing Trinity Development	94.3%	
4.54	ha - Existing Hazeldean Road to Trinity Interim SWMF	80.0%	
88.86	**Total Drainage Area to Ultimate Kanata West Pond 5**	**72.2%**	

Appendix B3: PCSWMM Input Example and Flow Depth Results

```
[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:\Users\apaerez\Documents\ana's\1604\KW
RICHCRAFT\PCSWMM\2023\160401393_100CHI_2023-11-16_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
;0.54
EXT-4 RG1 EXT-4-S 0.128242 48.571 79.6 0.5
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
G234C RG1 G234C-S 0.972065 28.571 218.103 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
;0.62
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
;0.72
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
;0.69
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
;0.70
L123B            RG1             123B-S          0.740371 71.429   167      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
;0.60
L212A           RG1             L212A-S         0.098006 57.143   44       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          0.297682 71.429   84.091   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
;0.68
L234A           RG1             234A-S          0.261524 68.571   78       5
   0
;0.69
L234B           RG1             234B-S          0.227552 70       81.14    4
   0
;0.57
L234D           RG1             RY234D-S        0.371868 52.857   210      3
   0
;0.69
L235A           RG1             235A-S          0.592903 70       232      4
   0
;0.80
L235B           RG1             L235B-S         0.983962 85.714   221.38   2
   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
;0.80
UNC-10          RG1             OF14            0.102763 85.714   102.75   33
   0
;0.80
UNC-11          RG1             OF14            0.119911 85.714   119.9    33
   0
;0.70
UNC-2           RG1             RY218B-S        0.065616 71.429   120      4
   0
;0.70
UNC-3           RG1             CREEK           0.071548 71.429   120      4
   0
;0.70
UNC-4           RG1             222A-S          0.070173 71.429   120      4
   0
;0.80
UNC-5           RG1             229A-S(1)       0.303387 85.714   188      3
   0
;0.80
UNC-6           RG1             226A-S(1)       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
;0.80
UNC-9             RG1              235A-S           0.117501 85.714   117.5    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
EXT-4             0.013      0.25       1.57       4.67       0          OUTLET
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
G234C             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
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
L105A	0.013	0.25	1.57	4.67	0	OUTLET
L106A	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
L123B	0.013	0.25	1.57	4.67	0	PERVIOUS 30
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
L212A              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
L234D              0.013      0.25       1.57       4.67       0          PERVIOUS
100
L235A              0.013      0.25       1.57       4.67       0          OUTLET
L235B              0.013      0.25       1.57       4.67       0          PERVIOUS
30
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-10             0.013      0.25       1.57       4.67       0          OUTLET
UNC-11             0.013      0.25       1.57       4.67       0          OUTLET
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
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
UNC-9              0.013      0.25       1.57       4.67       0          OUTLET

[INFILTRATION]
;;Subcatchment   Param1     Param2     Param3     Param4     Param5
;;-------------- ---------- ---------- ---------- ---------- ----------
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
EXT-4	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
G234C	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
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
L105A	76.2	13.2	4.14	7	0
L106A	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
L123B	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
L212A             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
L234D             76.2       13.2       4.14       7          0
L235A             76.2       13.2       4.14       7          0
L235B             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-10            76.2       13.2       4.14       7          0
UNC-11            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
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
UNC-9             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
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
102              93.123   4.028      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
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						
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						
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	3.834	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
123B-S           96       2.5        0          TABULAR    123AA-S
    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)		95.98	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		97.9	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	5.11	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)		96.27	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	1.73	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	96.3	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              92.927   4.604      0          FUNCTIONAL 0         0         0
    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              93.363   4.072      0          FUNCTIONAL 0         0         0
    0        0
235A-S           95.98    1.73       0          FUNCTIONAL 0         0         0
    0        0
235A-S(1)        97.6     0.35       0          FUNCTIONAL 0         0         0
    0        0
236              93.777   3.724      0          FUNCTIONAL 0         0         0
    0        0
237              94.02    3.875      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)      95.93    0.39       0          FUNCTIONAL 0         0         0
    0        0
EXT2-S           98.39    0.35       0          FUNCTIONAL 0         0         0
```

```
    0        0
EXT-4-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
G234C-S          93.41    4.78       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
L212A-S          95.56    1.73       0          FUNCTIONAL 0         0         0
    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
L235B-S          95.55    2.5        0          TABULAR    235B-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         95.5     2.6        0          FUNCTIONAL 0         0         0
```

```
    0        0
RY205B-S         95.46    2.6        0          FUNCTIONAL 0         0         0
    0        0
RY209C-S         97.41    2.6        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    2.43       0          FUNCTIONAL 0         0         0
    0        0
RY234D-S         95.49    2.6        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
;;-------------- ---------------- ---------------- ---------- ---------- ----------
---------- ---------- ----------
C1               EXT-1A-S(1)      OF3              15.6       0.013      95.93
95.9       0          0
C10              206B-Sl          109A-S(1)        14.6       0.013      97.9
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          28.7       0.013      97.68
97.9       0          0
;2023_rev_MJ
```

```
C110            203A-S          204BS(1)        50.8        0.013       97.61
97.36       0           0
;2023_rev_MJ'
C111            204BS(1)        202A-S          30.9        0.013       97.36
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          40.6        0.013       97.75
98.01       0           0
C117            211A-S(2)       211A-S(1)       48.5        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          38          0.013       97.87
97.68       0           0
C120            217A-S(2)       L212A-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)       43          0.013       97.98
98.22       0           0
C124            219B-S(1)       219B-S          69.7        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
97.98 0 0
C134 RY218B-S 219B-S 5 0.025 98.29
97.98 0 0
C135 EXT5-S OF13 10 0.025 98
97.7 0 0
C136 L212A-S OF4 6 0.025 96.94
96.91 0 0
C138 G234C-S 234B-S 2 0.025 97.59
97.4 0 0
C139 RY202B-S 202A-S(1) 5 0.025 97.5
97.27 0 0
C14 222A-S 219A-S 45.9 0.013 97.82
98.07 0 0
C141 123B-S 124A-S 10 0.013 98.15
98 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 99.41
99.09 0 0
C148 RY220A-S 220A-S 5 0.013 97.71
97.68 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 53.4 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 49.75 0.013 97.65
98.02 0 0
;2023_rev_MJ
C58 214A-S(2) 214A-S(1) 57 0.013 98.26
97.65 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		235A-S(1)	234A-S	50	0.013	97.6
97.35	0	0				

C83		235A-S	235A-S(1)	44.1	0.013	97.36	
97.6	0	0					
C84		217A-S(1)	235A-S	87.3	0.013	98.11	
97.36	0	0					
C85		EXT-4-S	OF14	10	0.025	98	
97.7	0	0					
C88		L235B-S	235A-S	10	0.013	97.7	
97.36	0	0					
C89		RY234D-S	234A-S	33	0.013	97.49	
97.35	0	0					
C9		109A-S	109A-S(1)	41.52	0.013	97.58	
97.79	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	93.227	92.853	0	0

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Pipe_-_(84)      235              234              80.815     0.013      93.663
93.38      0          0
Pipe_-_(85)      236              235              12.657     0.013      94.077
94.033     0          0
Pipe_-_(87)      237              236              61.251     0.013      94.32
94.106     0          0

[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         96.3       0.572
  NO       0
C220A-IC(2)      220A-S           220              SIDE         96.3       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				
G234C-IC	G234C-S	234	SIDE	93.41	0.572
NO	0				
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				
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				
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				
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				

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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
;2023_rev
L202B-IC        RY202B-S        202             SIDE        95.5       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        95.98      0.572
  NO       0
L204B-IC(2)     204BS(1)        204             SIDE        95.98      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
L212A-IC1       L212A-S         212             SIDE        95.56      0.572
  NO       0
L212A-IC2       L212A-S         212             SIDE        95.56      0.572
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NO	0				
L213A-IC(1)	213A-S	213	SIDE	96.44	0.572
NO	0				
L213A-IC(2)	213A-S	213	SIDE	96.44	0.572
NO	0				
L214A-IC(1)	214A-S(1)	214	SIDE	96.27	0.572
NO	0				
L214A-IC(2)	214A-S(1)	214	SIDE	96.27	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-IC	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-IC1	234A-S	234	SIDE	95.97	0.572
NO	0				
L234A-IC2	234A-S	234	SIDE	95.97	0.572
NO	0				
L234B-IC1	234B-S	234	SIDE	95.92	0.572
NO	0				
L234B-IC2	234B-S	234	SIDE	95.92	0.572
NO	0				
L234D-IC	RY234D-S	234	SIDE	95.49	0.572
NO	0				
L235A-IC1	235A-S	235	SIDE	95.98	0.572
NO	0				
L235A-IC2	235A-S	235	SIDE	95.98	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
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
L123B-IC         123B-S           123              96         TABULAR/HEAD
L123BIC                     NO
L218A-IC         L218A-S          218              96         TABULAR/HEAD
L218AAIC                    NO
L225B-IC         L225B-S          225              97.2       TABULAR/HEAD
L225BIC                     NO
L235B-IC         L235B-S          235              95.55      TABULAR/HEAD
L235BIC                     NO

[XSECTIONS]
;;Link            Shape        Geom1            Geom2      Geom3      Geom4
Barrels    Culvert
;;-------------- ------------ ---------------- ---------- ---------- ----------
---------- ----------
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
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
C141	IRREGULAR	18mROW	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	Block88&149	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	TRIANGULAR	0.6	3.6	0	0	1
C88	IRREGULAR	8.5mROW	0	0	0	1
C89	IRREGULAR	Block88&149	0	0	0	1
C9	IRREGULAR	24mROW	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	0.825	0	0	0	1
Pipe_-_(84)	CIRCULAR	0.675	0	0	0	1
Pipe_-_(85)	CIRCULAR	0.3	0	0	0	1
Pipe_-_(87)	CIRCULAR	0.3	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	
G234C-IC	CIRCULAR	0.102	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
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
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
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
L212A-IC1        CIRCULAR     0.083           0          0          0
L212A-IC2        CIRCULAR     0.083           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-IC         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-IC1        CIRCULAR     0.094           0          0          0
L234A-IC2        CIRCULAR     0.094           0          0          0
L234B-IC1        CIRCULAR     0.094           0          0          0
L234B-IC2        CIRCULAR     0.094           0          0          0
L234D-IC         CIRCULAR     0.152           0          0          0
L235A-IC1        CIRCULAR     0.178           0          0          0
L235A-IC2        CIRCULAR     0.178           0          0          0
OR1              CIRCULAR     0.45            0          0          0
Spillway         RECT_OPEN    0.6             20         10         10
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 0.025    0.025    0.013
X1 Block88&149       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
;
NC 0.25     0.25     0.25
X1 RYswale           3        0        2        0.0      0.0      0.0      0.0
```

0.0
GR 0.3 0 0 1 0.3 2

[LOSSES]

;;Link	Kentry	Kexit	Kavg	Flap Gate	Seepage
C152	0	0.64	0	NO	0
C154	0	0.39	0	NO	0
C156	0	0.06	0	NO	0
C158	0	1.344	0	NO	0
C159	0	0.64	0	NO	0
C161	0	1.344	0	NO	0
C169	0	0.06	0	NO	0
C170	0	1.344	0	NO	0
C171	0	0.06	0	NO	0
C172	0	1.32	0	NO	0
C177	0	1.32	0	NO	0
C178	0	0.216	0	NO	0
C179	0	1.344	0	NO	0
C182	0	1.344	0	NO	0
C183	0	1.32	0	NO	0
F101A-IC	0	1.323	0	NO	0
Pipe_-_(234)	0	1.32	0	NO	0
Pipe_-_(234)_(1)	0	0.06	0	NO	0
Pipe_-_(235)	0	0.06	0	NO	0
Pipe_-_(238)	0	0.06	0	NO	0
Pipe_-_(240)	0	0.06	0	NO	0
Pipe_-_(241)_(1)	0	0.14	0	NO	0
Pipe_-_(245)	0	1.32	0	NO	0
Pipe_-_(253)	0	0.06	0	NO	0
Pipe_-_(263)	0	0.06	0	NO	0
Pipe_-_(264)	0	0.06	0	NO	0
Pipe_-_(267)	0	0.06	0	NO	0
Pipe_-_(329)	0	0.405	0	NO	0
Pipe_-_(330)	0	0.39	0	NO	0
Pipe_-_(331)	0	0.06	0	NO	0
Pipe_-_(332)	0	0.39	0	NO	0
Pipe_-_(333)	0	0.405	0	NO	0
Pipe_-_(334)	0	1.32	0	NO	0
Pipe_-_(335)	0	0.14	0	NO	0
Pipe_-_(337)	0	1.32	0	NO	0
Pipe_-_(338)	0	0.06	0	NO	0
Pipe_-_(344)	0	0.06	0	NO	0
Pipe_-_(345)	0	0.06	0	NO	0
Pipe_-_(346)	0	0.06	0	NO	0
Pipe_-_(347)	0	1.344	0	NO	0
Pipe_-_(349)	0	0.14	0	NO	0
Pipe_-_(350)	0	0.06	0	NO	0
Pipe_-_(351)	0	0.06	0	NO	0
Pipe_-_(352)	0	0.06	0	NO	0

```
Pipe_-_(354)     0          0.06       0          NO         0
Pipe_-_(360)     0          0.06       0          NO         0
Pipe_-_(366)     0          1.32       0          NO         0
Pipe_-_(367)     0          0.06       0          NO         0
Pipe_-_(368)     0          0.06       0          NO         0
Pipe_-_(4)       0          1.32       0          NO         0
Pipe_-_(43)      0          1.344      0          NO         0
Pipe_-_(44)      0          0.06       0          NO         0
Pipe_-_(45)      0          0.06       0          NO         0
Pipe_-_(47)      0          1.32       0          NO         0
Pipe_-_(48)      0          0.06       0          NO         0
Pipe_-_(49)      0          1.32       0          NO         0
Pipe_-_(5)       0          0.39       0          NO         0
Pipe_-_(50)      0          1.32       0          NO         0
Pipe_-_(51)      0          0.64       0          NO         0
Pipe_-_(52)      0          0.64       0          NO         0
Pipe_-_(52)_(1)  0          0.06       0          NO         0
Pipe_-_(53)      0          0.64       0          NO         0
Pipe_-_(54)      0          0.39       0          NO         0
Pipe_-_(54)_(1)  0          0.06       0          NO         0
Pipe_-_(55)      0          0.64       0          NO         0
Pipe_-_(56)      0          0.64       0          NO         0
Pipe_-_(57)      0          0.14       0          NO         0
Pipe_-_(58)      0          1.32       0          NO         0
Pipe_-_(58)_(1)  0          0.06       0          NO         0
Pipe_-_(59)      0          0.39       0          NO         0
Pipe_-_(6)       0          0.64       0          NO         0
Pipe_-_(60)      0          0.64       0          NO         0
Pipe_-_(73)      0          1.32       0          NO         0
Pipe_-_(77)      0          0.02       0          NO         0
Pipe_-_(84)      0          0.021      0          NO         0
Pipe_-_(85)      0          0.39       0          NO         0
Pipe_-_(87)      0          0.39       0          NO         0

[INFLOWS]
;;Node           Constituent      Time Series      Type     Mfactor  Sfactor
Baseline Pattern
;;-------------- ---------------- ---------------- -------- -------- --------
-------- --------
209              FLOW             Fairwinds_100CHI_mod FLOW     1.0      1        0

212              FLOW             Trinity_100CHI   FLOW     1.0      1        0


[CURVES]
L102AIC          Rating     0          0
L102AIC                     1.8        33
L102AIC                     2.15       34

L103AIC          Rating     0          0
```

L103AIC		1.8	39
L103AIC		2.15	40
L103BIC	Rating	0	0
L103BIC		1.8	60
L103BIC		2.15	62
L103CIC	Rating	0	0
L103CIC		1.8	37
L103CIC		2.4	37
L103DIC	Rating	0	0
L103DIC		1.8	44
L103DIC		2.4	44
L104A-IC	Rating	0	0
L104A-IC		1.8	128
L104A-IC		2.15	130
L106AIC	Rating	0	0
L106AIC		1.8	45
L106AIC		2.15	47
L107AIC	Rating	0	0
L107AIC		1.8	63
L107AIC		2.15	64
L107B-IC	Rating	0	0
L107B-IC		1.8	53
L107B-IC		2.4	53
L108AIC	Rating	0	0
L108AIC		1.8	43
L108AIC		2.15	45
L109BIC	Rating	0	0
L109BIC		1.8	58
L109BIC		2.15	60
L111AIC	Rating	0	0
L111AIC		1.8	35
L111AIC		2.15	37
L111BIC	Rating	0	0
L111BIC		1.8	47
L111BIC		2.15	49
L114AIC	Rating	0	0
L114AIC		1.8	48
L114AIC		2.15	50

L120AAIC	Rating	0	0
L120AAIC		1.8	293
L120AAIC		2.15	299
L120AAIC		2.5	299
L120AIC	Rating	0	0
L120AIC		1.8	79
L120AIC		2.15	80
L121AIC	Rating	0	0
L121AIC		1.8	74
L121AIC		2.15	76
L121BIC	Rating	0	0
L121BIC		1.8	293
L121BIC		2.1	299
L121BIC		2.5	299
L122AIC	Rating	0	0
L122AIC		1.8	23
L122AIC		2.15	24
L123BIC	Rating	0	0
L123BIC		1.8	109
L123BIC		2.15	111
L123BIC		2.5	111
L124AIC	Rating	0	0
L124AIC		1.8	99
L124AIC		2.15	101
L125AIC	Rating	0	0
L125AIC		1.8	59
L125AIC		2.15	61
L128AIC	Rating	0	0
L128AIC		1.8	71
L128AIC		2.15	73
L130AIC	Rating	0	0
L130AIC		1.8	29
L130AIC		2.15	30
L202BIC	Rating	0	0
L202BIC		1.8	328
L202BIC		2.15	330
L203BIC	Rating	0	0
L203BIC		1.8	77

L203BIC		2.4	80
L203DIC	Rating	0	0
L203DIC		1.8	402
L203DIC		2.15	404
L207AIC	Rating	0	0
L207AIC		1.8	49
L207AIC		2.15	50
L208AIC	Rating	0	0
L208AIC		1.8	32
L208AIC		2.15	33
L208BIC	Rating	0	0
L208BIC		1.8	50
L208BIC		2.15	52
L209AIC	Rating	0	0
L209AIC		1.8	48
L209AIC		2.15	50
L209BIC	Rating	0	0
L209BIC		1.8	388
L209BIC		2.15	388
L218AAIC	Rating	0	0
L218AAIC		1.8	434
L218AAIC		2.15	443
L218AAIC		2.5	443
L225BIC	Rating	0	0
L225BIC		1.8	470
L225BIC		2.15	517
L225BIC		2.5	517
L235BIC	Rating	0	0
L235BIC		1.2	0
L235BIC		1.8	115
L235BIC		2.15	130
L235BIC		2.5	130
Multiples	Rating	0	0
Multiples		1.8	356
Multiples		2.1	356
Park104D	Rating	0	0
Park104D		1.8	56
Park104D		2.1	56

RearYard104E	Rating	0	0
RearYard104E		1.8	22
RearYard104E		2.1	22
RearYard118	Rating	0	0
RearYard118		1.8	66
RearYard118		2.1	66
RearYard125	Rating	0	0
RearYard125		1.8	39
RearYard125		2.1	39
RearYard127	Rating	0	0
RearYard127		1.8	18
RearYard127		2.1	18
RearYard129	Rating	0	0
RearYard129		1.8	48
RearYard129		2.1	48
RearYard130	Rating	0	0
RearYard130		1.8	43
RearYard130		2.1	43
RearYard131	Rating	0	0
RearYard131		1.8	49
RearYard131		2.1	49
RearYard132	Rating	0	0
RearYard132		1.8	46
RearYard132		2.1	46
RearYard134	Rating	0	0
RearYard134		1.8	46
RearYard134		2.1	46
RearYard135	Rating	0	0
RearYard135		1.8	45
RearYard135		2.1	45
RearYard136	Rating	0	0
RearYard136		1.8	47
RearYard136		2.1	47
RearYard137	Rating	0	0
RearYard137		1.8	42
RearYard137		2.1	42
RearYard139	Rating	0	0
RearYard139		1.8	35

RearYard139		2.1	35
RearYard140	Rating	0	0
RearYard140		1.8	40
RearYard140		2.1	40
RearYard152	Rating	0	0
RearYard152		1.8	45
RearYard152		2.1	45
RearYard153	Rating	0	0
RearYard153		1.8	40
RearYard153		2.1	40
RearYard158	Rating	0	0
RearYard158		1.8	46
RearYard158		2.1	46
ReaYrad104B	Rating	0	0
ReaYrad104B		1.8	70
ReaYrad104B		2.1	70
School	Rating	0	0
School		1.8	663
School		2.1	663
Transit	Rating	0	0
Transit		1.8	934
Transit		2.15	953
Transit		2.5	953
116A-STORE	Storage	0	0
116A-STORE		1.8	0
116A-STORE		2.15	652
116A-STORE		2.5	652
116B-comm	Storage	0	0
116B-comm		1.8	0
116B-comm		2.15	1200
116B-comm		2.5	1200
120AA-S	Storage	0	0
120AA-S		1.8	0
120AA-S		2.15	1500
120AA-S		2.5	1500
123AA-S	Storage	0	0
123AA-S		1.8	0
123AA-S		2.15	150
123AA-S		2.5	150

224AA-S	Storage	0	0
224AA-S		1.8	0
224AA-S		2.15	405
224AA-S		2.5	405
235B-S	Storage	0	0
235B-S		1.2	0
235B-S		1.8	180
235B-S		1.81	0
235B-S		2.15	130
235B-S		2.5	130
B1-S	Storage	0	0
B1-S		1.8	0
B1-S		2.15	980
B1-S		2.5	980
B2-S	Storage	0	0
B2-S		1.8	0
B2-S		2.15	122
B2-S		2.5	122
Hazeldean-s	Storage	0	0
Hazeldean-s		1.8	0
Hazeldean-s		2.15	493
Hazeldean-s		2.5	493
INST	Storage	0	0
INST		1.8	0.1
INST		2.15	790
INST		2.5	790
L206C-S	Storage	0	0
L206C-S		1.8	0
L206C-S		2.15	1000
L206C-S		2.5	1000
PondStorageULT	Storage	0	2073
PondStorageULT		0.8	3245
PondStorageULT		1.3	4392
PondStorageULT		1.9	5567
PondStorageULT		2.14	6038
PondStorageULT		2.44	6627
PondStorageULT		2.74	10231
PondStorageULT		2.9	10988
PondStorageULT		3.15	12170
PondStorageULT		3.34	12768
PondStorageULT		3.5	13082
PondStorageULT		3.9	13871

```
PondStorageULT              4.3         14642
PondStorageULT              4.6         14642

StorCommE         Storage   0           0
StorCommE                   1.8         0
StorCommE                   2.15        2000
StorCommE                   2.5         2000

transit-S         Storage   0           0
transit-S                   1.8         0
transit-S                   2.15        462
transit-S                   2.5         462

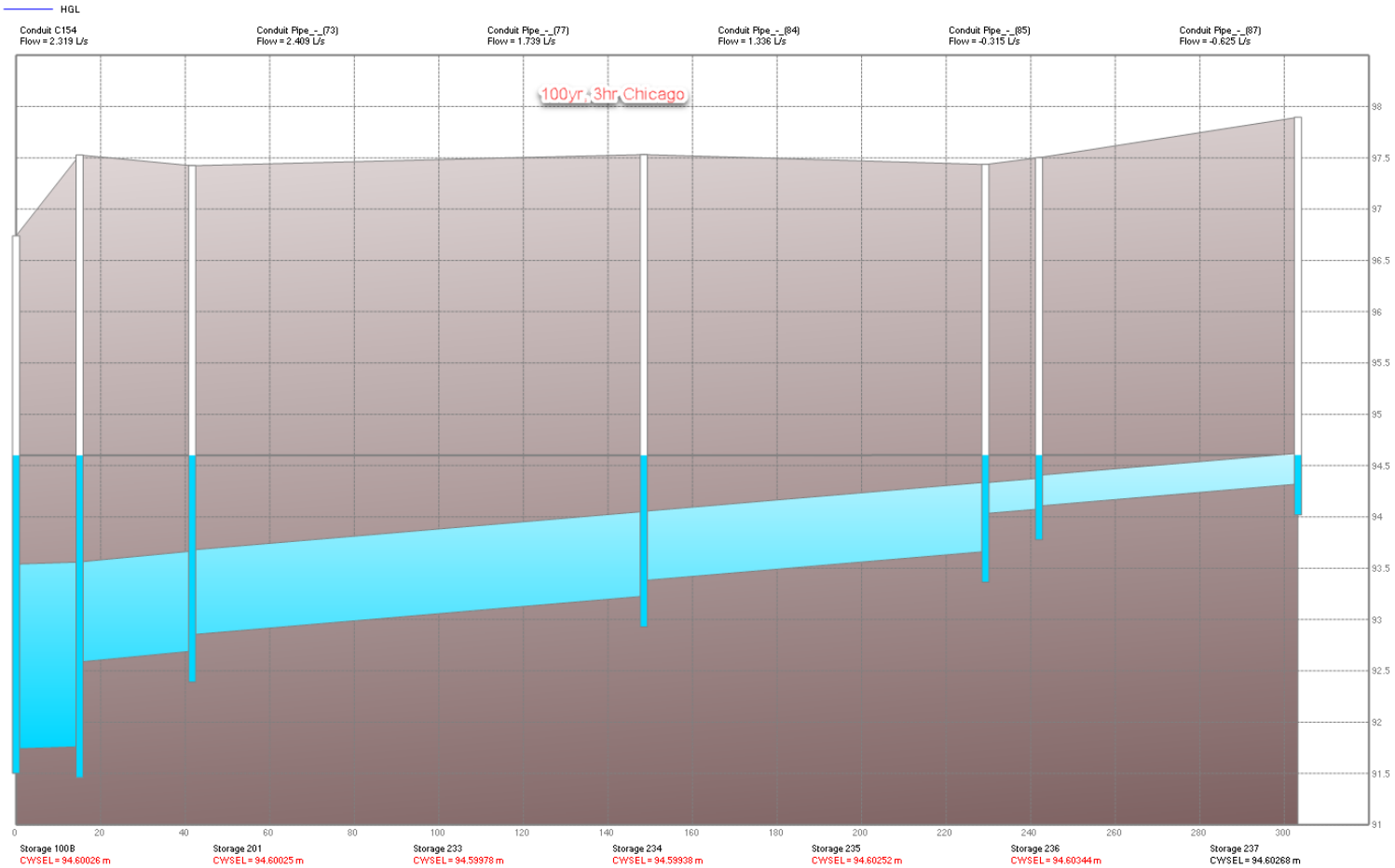
TW                Storage   0           0
TW                          1.8         0
TW                          2.1         800

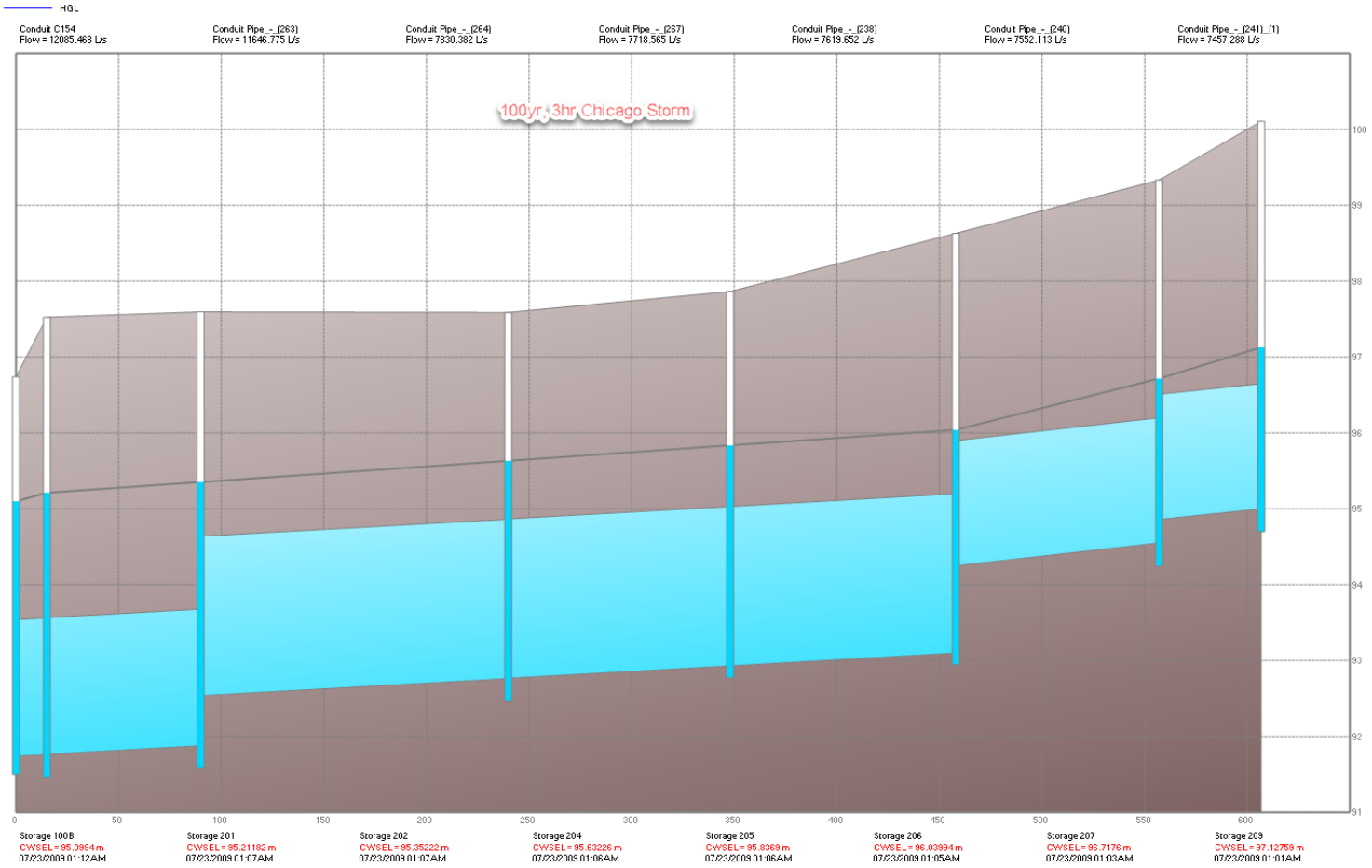
[TIMESERIES]
```

Total Surface Flow Depth

Storage node ID	Structure ID	Top of Grate Elevation (m)	Lowest Adjacent Building Opening (m)	Rim Elevation (m)	100 year, 3 hour Chicago		100 year, 3 hour Chicago+20%		5 year, 3 hour Chicago		2 year, 3 hour Chicago	
					Max Surface HGL (m)	Total Surface Ponding Depth (m)	Max Surface HGL (m)	Total Surface Ponding Depth (m)	Max Surface HGL (m)	Total Surface Ponding Depth (m)	Max Surface HGL (m)	Total Surface Ponding Depth (m)
205A-S(1)	CB 205 A-1 & 2	97.45	98.15	97.80	97.72	0.27	97.80	0.35	97.41	0.00	96.38	0.00
206B-S(1)	CB 206 B-1	97.77	98.50	98.12	97.89	0.12	97.93	0.16	97.50	0.00	96.91	0.00
219A-S(1)	CB 219 A-1	97.82	98.09	98.17	97.96	0.14	98.04	0.22	97.49	0.00	96.90	0.00
220A-S	CB 220 A-1 & 2	97.68	98.30	98.03	97.95	0.27	98.03	0.35	97.49	0.00	96.60	0.00
222A-S	CB 222 A-1 & 2	97.82	98.45	98.25	98.15	0.33	98.23	0.41	97.32	0.00	96.84	0.00
223A-S	CB 223 A-1	98.17	99.10	98.52	98.40	0.23	98.43	0.26	97.25	0.00	97.04	0.00
G234C-S	CBMH 234A	97.59	N/A	98.19	97.76	0.17	97.78	0.19	97.66	0.07	94.71	0.00
116A-S	CB 116 A-1 & 2	97.20	97.87	97.55	97.48	0.28	97.54	0.34	97.24	0.04	96.73	0.00
202A-S(1)	CB 202 A-1 & 2	97.27	97.82	97.62	97.57	0.30	97.62	0.35	97.35	0.08	96.75	0.00
204A-S(1)	CB 204 A-1 & 2	97.39	98.01	97.74	97.64	0.25	97.73	0.34	97.49	0.10	97.21	0.00
204BS(1)	CB 204 B-1 & 2	97.36	97.92	97.71	97.58	0.22	97.66	0.30	97.42	0.06	96.87	0.00
206A-S(1)	CB 206 A-1 & 2	98.29	98.85	98.64	98.54	0.25	98.58	0.29	98.39	0.10	98.13	0.00
207A-S(1)	CB 207 A-1 & 2	98.68	99.35	99.03	98.99	0.31	99.03	0.35	98.79	0.11	98.14	0.00
209A-S	CB 209 A-1 & 2	99.59	100.23	99.94	99.66	0.07	99.66	0.07	99.62	0.03	98.95	0.00
209B-S	CB 209 B-2	100.03	N/A	100.38	100.07	0.04	100.08	0.05	100.05	0.02	99.90	0.00
210A-S	CB 210 A-1 & 2	97.37	97.94	97.72	97.59	0.22	97.65	0.28	97.42	0.05	96.81	0.00
211A-S(1)	CB 211 A-1 & 2	97.75	98.25	98.10	97.98	0.23	98.02	0.27	97.83	0.08	97.42	0.00
L212A-S	CB 212 A-1 & 2	96.94	N/A	97.29	96.97	0.03	96.97	0.03	96.11	0.00	95.79	0.00
213A-S	CB 213 A-1 & 2	97.82	98.30	98.17	98.03	0.21	98.04	0.22	97.91	0.09	97.69	0.00
214A-S(1)	CB 214 A-1 & 2	97.65	98.35	98.00	97.88	0.23	97.94	0.29	97.72	0.07	97.23	0.00
217A-S	CB 217 A-1 & 2	97.81	98.50	98.16	98.00	0.19	98.05	0.24	97.87	0.06	97.34	0.00
219B-S	CB 219 B-1 & 2	97.98	98.43	98.33	98.29	0.31	98.37	0.39	98.07	0.09	97.62	0.00
225A-S	CB 225 A-1 & 2	99.03	99.57	99.38	99.35	0.32	99.38	0.35	99.14	0.11	98.89	0.00
226A-S	CB 226 A-1 & 2	99.46	99.85	99.81	99.67	0.21	99.70	0.24	99.54	0.08	99.15	0.00
228A-S	CB 228 A-1 & 2	99.99	100.40	100.34	100.22	0.23	100.25	0.26	100.09	0.10	99.87	0.00
229A-S	CB 229 A-1 & 2	100.20	100.62	100.55	100.39	0.19	100.44	0.24	100.25	0.05	99.64	0.00
234A-S	CB 234 A-1 & 2	97.35	97.85	97.70	97.61	0.26	97.66	0.31	97.42	0.07	97.21	0.00
234B-S	CB 234 B-1 & 2	97.30	97.77	97.65	97.57	0.27	97.62	0.32	97.36	0.06	96.91	0.00
235A-S	CB 235 A-1 & 2	97.36	97.80	97.71	97.67	0.31	97.71	0.35	97.42	0.06	96.85	0.00

Appendix B4: PCSWMM HGL Profiles

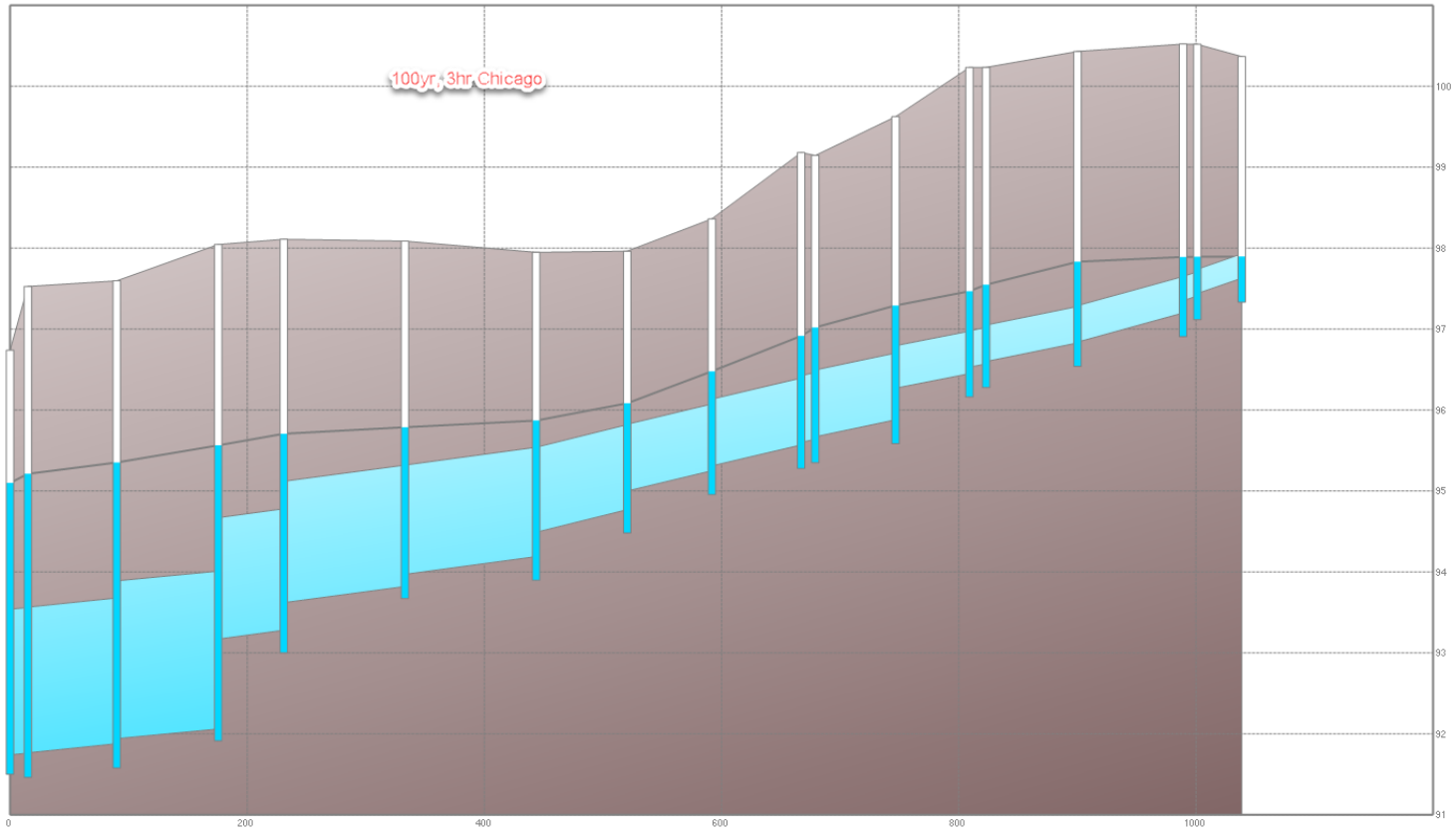

HGL
Conduit C154
Flow = 2.319 L/s
Conduit Pipe_-_(73)
Flow = 2.409 L/s
Conduit Pipe_-_(77)
Flow = 1.739 L/s
Conduit Pipe_-_(84)
Flow = 1.336 L/s
Conduit Pipe_-_(85)
Flow = -0.315 L/s
Conduit Pipe_-_(87)
Flow = -0.625 L/s
100yr_3hr_Chicago
98
97.5
97
96.5
96
95.5
95
94.5
94
93.5
93
92.5
92
91.5
91
0
20
40
60
80
100
120
140
160
180
200
220
240
260
280
300
Storage 100B
CWSEL = 94.60026 m
Storage 201
CWSEL = 94.60025 m
Storage 233
CWSEL = 94.59978 m
Storage 234
CWSEL = 94.59938 m
Storage 235
CWSEL = 94.60252 m
Storage 236
CWSEL = 94.60344 m
Storage 237
CWSEL = 94.60268 m


HGL
Conduit C154
Flow = 12085.468 L/s
Conduit Pipe_-_(263)
Flow = 11646.775 L/s
Conduit Pipe_-_(264)
Flow = 7830.382 L/s
Conduit Pipe_-_(267)
Flow = 7718.565 L/s
Conduit Pipe_-_(238)
Flow = 7619.652 L/s
Conduit Pipe_-_(240)
Flow = 7552.113 L/s
Conduit Pipe_-_(241)_(1)
Flow = 7457.288 L/s
100yr, 3hr Chicago Storm
100
99
98
97
96
95
94
93
92
91
0
50
100
150
200
250
300
350
400
450
500
550
600
Storage 100B
CWSEL = 95.0994 m
07/23/2009 01:12AM
Storage 201
CWSEL = 95.21182 m
07/23/2009 01:07AM
Storage 202
CWSEL = 95.35222 m
07/23/2009 01:07AM
Storage 204
CWSEL = 95.63226 m
07/23/2009 01:06AM
Storage 205
CWSEL = 95.8369 m
07/23/2009 01:06AM
Storage 206
CWSEL = 96.03994 m
07/23/2009 01:05AM
Storage 207
CWSEL = 96.7176 m
07/23/2009 01:03AM
Storage 209
CWSEL = 97.12759 m
07/23/2009 01:01AM

HGL

Links:

C154	Pipe_-_(263)	Pipe_-_(366)	Pipe_-_(43)	Pipe_-_(44)	Pipe_-_(45)	Pipe_-_(47)	Pipe_-_(48)	Pipe_-_(50)	Pipe_-_(51)	Pipe_-_(52)	Pipe_-_(52)_(1)	Pipe_-_(53)	Pipe_-_(54)	Pipe_-_(54)_(1)	Pipe_-_(55)	Pipe_-_(56)
Q=12085.468 L/s	Q=11646.775 L/s	Q=4493.104 L/s	Q=2193.23 L/s	Q=1944.745 L/s	Q=1463.348 L/s	Q=1074.453 L/s	Q=1067.506 L/s	Q=870.613 L/s	Q=798.123 L/s	Q=802.331 L/s	Q=314.224 L/s	Q=230.902 L/s	Q=219.871 L/s	Q=106.771 L/s	Q=30.272 L/s	Q=14.364 L/s



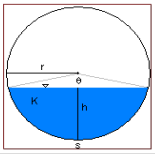
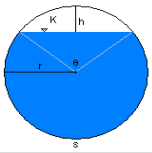
Nodes:

100B	201	202	210	213	218	219	221	222	223	224	225	226	227	228	229	230	231
H=95.0994 m	H=95.21182 m	H=95.35222 m	H=95.56392 m	H=95.70696 m	H=95.78752 m	H=95.86984 m	H=96.08368 m	H=96.47872 m	H=96.91567 m	H=97.02104 m	H=97.29195 m	H=97.4682 m	H=97.54903 m	H=97.83222 m	H=97.89088 m	H=97.8932 m	H=97.89579 m

Appendix B5: Sediment HGL Analysis Parameters

Ultimate Kanata West SWM Pond 5 - Sediment Accumulation in Storm Sewer Pipes Submerged by Permanent Pool

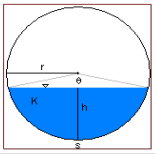
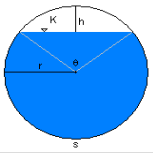
Permanent Pool Elevation = 93.44 m

step	solve for	*if flow depth < radius*	*if flow depth ≥ radius*
			
1	circular segment height	$h = d$	$h = 2r - d$
2	central angle	$\theta = 2\arccos\left(\frac{r-h}{r}\right)$	$\theta = 2\arccos\left(\frac{r-h}{r}\right)$
3	circular segment area	$K = \frac{r^2(\theta - \sin\theta)}{2}$	$K = \frac{r^2(\theta - \sin\theta)}{2}$

Name	Upstream Node Name	Downstream Node Name	Diameter (Height) (m)	Upstream Invert Elevation	Downstream Invert Elevation	Pipe Area (m^2)	Submerged Depth (m) [1]	Central Angle [2]	Submerged Area (m^2) [3]	Pipe Area - 25% Submerged Area (m^2)	Reduced Diameter (m)	PipeLength (m)	Length of Submerged Pipe (m)
Pipe_-_(87)	237	236	0.300	94.32	94.11	0.071	0.00	0.000	0.000	N/A	N/A	61.25	0.00
Pipe_-_(85)	236	235	0.300	94.08	94.03	0.071	0.00	0.000	0.000	N/A	N/A	12.66	0.00
Pipe_-_(84)	235	234	0.675	93.66	93.38	0.358	0.06	1.211	0.016	0.354	0.671	80.82	80.82
Pipe_-_(77)	234	233	0.825	93.23	92.85	0.535	0.40	3.081	0.257	0.470	0.774	106.86	106.86
Pipe_-_(73)	233	201	0.975	92.69	92.59	0.747	0.80	1.745	0.656	0.583	0.861	26.63	26.63
Pipe_-_(60)	217	216	0.375	95.52	95.37	0.110	0.00	0.000	0.000	N/A	N/A	31.25	0.00
Pipe_-_(6)	112	111	0.450	95.23	95.06	0.159	0.00	0.000	0.000	N/A	N/A	41.88	0.00
Pipe_-_(59)	216	215	0.375	95.34	95.28	0.110	0.00	0.000	0.000	N/A	N/A	11.87	0.00
Pipe_-_(58)_(1)	215	214	0.375	95.25	94.96	0.110	0.00	0.000	0.000	N/A	N/A	57.47	0.00
Pipe_-_(58)	214	213	0.600	94.74	94.51	0.283	0.00	0.000	0.000	N/A	N/A	70.63	0.00
Pipe_-_(57)	232	231	0.300	97.86	97.64	0.071	0.00	0.000	0.000	N/A	N/A	42.78	0.00
Pipe_-_(56)	231	230	0.300	97.63	97.44	0.071	0.00	0.000	0.000	N/A	N/A	37.41	0.00
Pipe_-_(55)	230	229	0.300	97.41	97.35	0.071	0.00	0.000	0.000	N/A	N/A	12.11	0.00
Pipe_-_(54)_(1)	229	228	0.450	97.20	96.84	0.159	0.00	0.000	0.000	N/A	N/A	88.92	0.00
Pipe_-_(54)	228	227	0.450	96.83	96.60	0.159	0.00	0.000	0.000	N/A	N/A	77.16	0.00
Pipe_-_(53)	227	226	0.450	96.57	96.53	0.159	0.00	0.000	0.000	N/A	N/A	14.08	0.00
Pipe_-_(52)_(1)	226	225	0.525	96.45	96.27	0.216	0.00	0.000	0.000	N/A	N/A	62.21	0.00
Pipe_-_(52)	225	224	0.825	95.88	95.67	0.535	0.00	0.000	0.000	N/A	N/A	67.70	0.00
Pipe_-_(51)	224	223	0.825	95.64	95.60	0.535	0.00	0.000	0.000	N/A	N/A	11.94	0.00
Pipe_-_(50)	223	222	0.825	95.57	95.31	0.535	0.00	0.000	0.000	N/A	N/A	75.28	0.00
Pipe_-_(5)	111	110	0.450	95.03	94.99	0.159	0.00	0.000	0.000	N/A	N/A	11.16	0.00
Pipe_-_(49)	220	219	0.750	95.15	94.79	0.442	0.00	0.000	0.000	N/A	N/A	71.80	0.00
Pipe_-_(48)	222	221	0.825	95.25	95.00	0.535	0.00	0.000	0.000	N/A	N/A	71.45	0.00
Pipe_-_(47)	221	219	1.050	94.77	94.49	0.866	0.00	0.000	0.000	N/A	N/A	76.77	0.00
Pipe_-_(45)	219	218	1.350	94.19	93.97	1.431	0.00	0.000	0.000	N/A	N/A	110.65	0.00
Pipe_-_(44)	218	213	1.500	93.82	93.62	1.767	0.00	0.000	0.000	N/A	N/A	102.12	0.00
Pipe_-_(43)	213	210	1.500	93.28	93.17	1.767	0.22	1.553	0.156	1.728	1.483	55.35	55.35
Pipe_-_(4)	110	107	0.525	94.91	94.76	0.216	0.00	0.000	0.000	N/A	N/A	44.39	0.00
Pipe_-_(368)	212	211	1.650	92.69	92.55	2.138	0.82	3.129	1.061	1.873	1.544	97.80	97.80
Pipe_-_(367)	211	210	1.800	92.39	92.21	2.545	1.14	2.602	1.699	2.120	1.643	115.94	115.94
Pipe_-_(366)	210	202	1.950	92.06	91.94	2.986	1.44	2.147	2.364	2.395	1.746	85.51	85.51
Pipe_-_(360)	118	117	0.375	95.25	95.01	0.110	0.00	0.000	0.000	N/A	N/A	96.76	0.00
Pipe_-_(354)	104	103	0.825	94.36	94.21	0.535	0.00	0.000	0.000	N/A	N/A	99.77	0.00
Pipe_-_(352)	124	123	0.600	95.87	95.59	0.283	0.00	0.000	0.000	N/A	N/A	71.39	0.00
Pipe_-_(351)	123	121	0.675	95.01	94.89	0.358	0.00	0.000	0.000	N/A	N/A	51.30	0.00
Pipe_-_(350)	121	119	1.200	94.00	93.83	1.131	0.00	0.000	0.000	N/A	N/A	113.17	0.00
Pipe_-_(349)	119	101	1.200	93.83	93.65	1.131	0.00	0.000	0.000	N/A	N/A	115.05	0.00
Pipe_-_(347)	102	101	1.500	93.42	93.34	1.767	0.06	0.781	0.022	1.762	1.498	79.78	79.78

Ultimate Kanata West SWM Pond 5 - Sediment Accumulation in Storm Sewer Pipes Submerged by Permanent Pool

Permanent Pool Elevation = 93.44 m

step	solve for	*if flow depth < radius*	*if flow depth ≥ radius*
			
1	circular segment height	$h = d$	$h = 2r - d$
2	central angle	$\theta = 2\arccos\left(\frac{r-h}{r}\right)$	$\theta = 2\arccos\left(\frac{r-h}{r}\right)$
3	circular segment area	$K = \frac{r^2(\theta - \sin\theta)}{2}$	$K = \frac{r^2(\theta - \sin\theta)}{2}$

Name	Upstream Node Name	Downstream Node Name	Diameter (Height) (m)	Upstream Invert Elevation	Downstream Invert Elevation	Pipe Area (m^2)	Submerged Depth (m) [1]	Central Angle [2]	Submerged Area (m^2) [3]	Pipe Area - 25% Submerged Area (m^2)	Reduced Diameter (m)	PipeLength (m)	Length of Submerged Pipe (m)
Pipe_-_(346)	114	102	0.750	94.23	94.17	0.442	0.00	0.000	0.000	N/A	N/A	28.24	0.00
Pipe_-_(345)	115	114	0.675	94.41	94.31	0.358	0.00	0.000	0.000	N/A	N/A	54.69	0.00
Pipe_-_(344)	116	115	0.300	95.12	94.79	0.071	0.00	0.000	0.000	N/A	N/A	65.71	0.00
Pipe_-_(338)	106	105	0.450	95.02	94.89	0.159	0.00	0.000	0.000	N/A	N/A	63.49	0.00
Pipe_-_(337)	105	104	0.525	94.82	94.66	0.216	0.00	0.000	0.000	N/A	N/A	79.38	0.00
Pipe_-_(335)	132	131	0.300	97.86	97.63	0.071	0.00	0.000	0.000	N/A	N/A	35.88	0.00
Pipe_-_(334)	131	130	0.300	97.61	97.51	0.071	0.00	0.000	0.000	N/A	N/A	19.45	0.00
Pipe_-_(333)	130	129	0.375	97.44	96.87	0.110	0.00	0.000	0.000	N/A	N/A	113.92	0.00
Pipe_-_(332)	129	128	0.375	96.84	96.78	0.110	0.00	0.000	0.000	N/A	N/A	12.26	0.00
Pipe_-_(331)	128	126	0.450	96.67	96.47	0.159	0.00	0.000	0.000	N/A	N/A	39.46	0.00
Pipe_-_(330)	126	125	0.525	96.40	96.03	0.216	0.00	0.000	0.000	N/A	N/A	92.46	0.00
Pipe_-_(329)	125	124	0.525	96.00	95.95	0.216	0.00	0.000	0.000	N/A	N/A	12.19	0.00
Pipe_-_(267)	205	204	2.100	92.93	92.77	3.464	0.59	2.239	0.801	3.263	2.038	108.14	108.14
Pipe_-_(264)	204	202	2.100	92.76	92.54	3.464	0.79	2.641	1.191	3.166	2.008	149.90	149.90
Pipe_-_(263)	202	201	1.800	91.88	91.77	2.545	1.62	0.000	2.545	1.909	1.559	74.95	74.95
Pipe_-_(253)	113	112	0.450	95.57	95.24	0.159	0.00	0.000	0.000	N/A	N/A	84.21	0.00
Pipe_-_(245)	127	126	0.300	97.73	96.62	0.071	0.00	0.000	0.000	N/A	N/A	110.84	0.00
Pipe_-_(241)_(1)	209	207	1.650	95.00	94.86	2.138	0.00	0.000	0.000	N/A	N/A	49.67	0.00
Pipe_-_(240)	207	206	1.650	94.55	94.25	2.138	0.00	0.000	0.000	N/A	N/A	99.16	0.00
Pipe_-_(238)	206	205	2.100	93.10	92.93	3.464	0.43	1.868	0.502	3.338	2.062	109.96	109.96
Pipe_-_(235)	107	104	0.300	95.59	95.38	0.071	0.00	0.000	0.000	N/A	N/A	51.75	0.00
Pipe_-_(234)_(1)	109	108	0.600	95.19	94.78	0.283	0.00	0.000	0.000	N/A	N/A	116.82	0.00
Pipe_-_(234)	108	107	0.600	94.77	94.68	0.283	0.00	0.000	0.000	N/A	N/A	18.95	0.00
F101A-IC	F101A-S	101	0.600	93.43	93.35	0.283	0.05	1.171	0.011	0.280	0.597	16.30	16.30
C173	HW7	POND-S1	0.900	93.66	93.45	0.636	0.00	0.000	0.000	N/A	N/A	18.10	0.00
C159	100D	100E	1.350	94.04	93.89	1.431	0.00	0.000	0.000	N/A	N/A	15.27	0.00
C158	101	100D	1.500	93.28	93.26	1.767	0.17	1.373	0.110	1.740	1.488	15.70	15.70
C157	100A	POND-S1	2.400	91.79	91.76	4.524	1.66	2.346	3.349	3.687	2.167	28.10	28.10
C155	100B	POND-S1	1.800	91.73	91.70	2.545	1.72	0.000	2.545	1.909	1.559	18.00	18.00
C154	201	100B	1.800	91.76	91.74	2.545	1.69	0.000	2.545	1.909	1.559	15.00	15.00
C156	100B	100A	2.400	92.93	92.88	4.524	0.53	1.967	0.752	4.336	2.350	49.8	49.8
													1234.5

Appendix B6: Infiltration Calculations

Project No. 160401393
Richcraft Kanata West Subdivision Infiltration Calculations

Required Infiltration Rate	50	mm/yr	
Proposed Site Area	36.53	ha	63.9% Imperviousness
Pre-Development Infiltration	18265	m^3/yr	
25% Infiltration Augmentation (KWMSS)	**22831**	**m^3/yr**	**Target Infiltration for Overall Site**

Proposed Condition Infiltration Calculation Breakdown

Proposed Land Use	Total Area	%IMP	%BMP (Amended Soil)	Imp. Area (ha)	Lawns (w/BMP) (ha)	Lawns (w/o BMP) (ha)	SWMF
School Blocks	2.95	71.4	0	2.11	0.00	0.84	0.00
App. Commercial Blocks	1.47	92.9	0	1.36	0.00	0.11	0.00
First Registration Private Residential	0.74	71.4	0	0.53	0.00	0.21	0.00
Second Registration Private Residential	4.64	83.7	0	3.88	0.00	0.76	0.00
First Reg. Rear Yard	2.97	36.4	0	1.08	0.00	1.89	0.00
Second Reg. Rear Yard	3.24	39.2	100	1.27	1.97	0.00	0.00
Approved Phase 1 ROW / Front Yard Areas	7.68	68.5	0	5.26	0.00	2.42	0.00
Proposed Phase 2 ROW / Front Yard Areas	8.85	74.9	100	6.62	2.23	0.00	0.00
SWMF (Pond 5)	2.56	-	-	-	-	-	2.56
Approved Phase Parks	0.46	7.1	0	0.03	0.00	0.43	0.00
Proposed Phase Park	0.97	28.6	100	0.28	0.69	0.00	0.00
Total	**36.53**			**22.43**	**4.89**	**6.65**	**2.56**

Overall Richcraft Kanata West Development

Land Use	Soil Type	Area ha	Area %	Individual Precip. (mm)	ET (mm)	Infil. (mm)	Runoff (mm)	
Meadows	Clay	0.00	0.0%	943	577	50	316	
SWMF	Clay (SWMF)	2.56	7.0%	943	640	0	303	
Lawns (w/ BMP)	Topsoil / Sandy Loam	4.89	13.4%	943	480	180	283	228
Lawns (w/o BMP)	Topsoil / Clay	6.65	18.2%	943	525	50	368	
Impervious	Impervious	22.43	61.4%	943	150	0	793	
Total		**36.53**	**100.0%**					

*Infiltration for native soil assumed as 50mm/year as per KWMSS and detailed geotech recommendations

** Evapotransporation by Land Classess obtained from Carp River Watershed Water Balance Table 3.5.2 (Robinsons, 2004)

Post Development Infiltration in Pervious Areas	12125	m^3/yr	(Based on the pervious areas with the infiltration values shown above)
Post Development Infiltration Needed in Basins	10706	m^3/yr	

Number of Rainfall Events/yr 6mm< x <25mm	31		*based on average precip 2000-2011
Average days between events	9		
Average depth 6mm<x<25mm	12.19	mm	Assume this is the average depth of rainfall that will recharge the infiltration galleries.

Rearyard Bioswale Storage

Roof area feeding rearyard bioswales	21289	m^2	Calculated based on rearyard area C value (i.e., half roofs)
Total Annual depth of rainfall 6mm<x<25mm	374.8	mm	number of events * 12mm
Annual volume of runoff from roofs to Bioswales	7979	m^3/yr	for events with rainfall 6mm< x <25mm
Store up to 25mm event from roof in bioswales			
Total Storage Required (25mm) =	532	m^3	water storage
Total Bioswale Storage Provided (25mm) =	611	m^3	(see detailed calculations for each rearyard bioswale)
Post Development Infiltration for School Block - As per Previously Approved	671	m^3/yr	for events with rainfall 6mm< x <25mm
Below are preliminary infiltration calculations for the school block based on assumptions.			
School Block Area	2.95	ha	
Assumed Roof Area	2950	m^2	(10% of total school block)
Total Annual depth of rainfall 6mm<x<25mm	374.8	mm	number of events * 12mm
Annual volume of runoff from school roof to infiltration LID	1106	m^3/yr	for events with rainfall 6mm< x <25mm
Post Development Infiltration for Medium Residential Blocks (Block 75 and Block 117)	2056	m^3/yr	Total Residential Block Area (Second Phase) = 4.64 ha (443 m^3/yr/ha)

Project No. 160401393

Richcraft Kanata West Subdivision Infiltration Calculations

Bioswales with Storage Volume Calculations Based on Infiltration Trench Design Calculations (Based on section 4.5.8 of MOE 2003 SWM Guidelines)

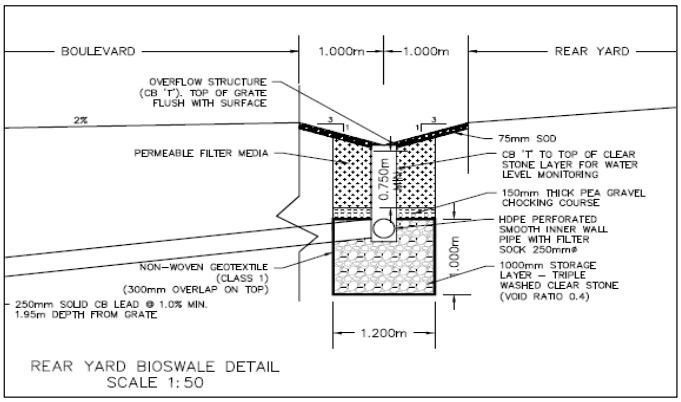
$$A = \frac{1{,}000V}{Pn\Delta t}$$

Equation 4.3: Infiltration Trench Bottom Area

where A = bottom area of the trench (m²)
V = runoff volume to be infiltrated (Table 3.2)
P = percolation rate of surrounding native soil (mm/h)
n = porosity of the storage media (0.4 for clear stone)
Δt = retention time (24 to 48 hours)

Storage Volume (cu.m/ha) for Impervious Level

	35%	55%	70%	85%
Enhanced (80% TSS removal)	25	30	35	40
Normal (70% TSS removal)	20	20	25	30
Basic (60% TSS removal)	20	20	20	20



Subsurface Trench Width = 1.2 m

Soil Infiltration Rate (Paterson PG3062-MEMO.07) = 19 mm/hr

REARYARD AREA L103C

Input

Drainage Area	=	0.64	ha
Runoff Co-efficient	=	0.48	
Roof Area	=	0.26	ha
Level of Treatment	=	Enhanced (80% TSS removal)	
Storage Media	=	50mm diameter clear stone	
Media Porosity, n	=	0.4	typical (range 0.25-0.40)
Percolation Rate	=	19	mm/h
Retention Time	=	24	h
Subdrain size	=	250	mm
Length	=	159	m
Subsurface Trench Width	=	1.2	m
Maximum Depth of Subsurface Trench, dt	=	0.75	m

Calculations

Imperviousness	=	40%	
Required Quality Treatment Volume	=	19.2 m^3	(MECP)
Required 25mm Infiltration Volume	=	64 m^3	

Bioswale Configuration

Required Bottom Area of trench, A	=	105.3 m^2	
Provided Bottom Area of trench	=	190.3 m^2	
Infiltration Rate	=	1.0 L/s	
Drawdown Time of Quality Treatment Volume	=	5.3 hr	
Maximum Subsurface Volume Available, Vss	=	61.8 m^3	rectangular trench

REARYARD AREA L124B

Input

Drainage Area	=	0.40	ha
Runoff Co-efficient	=	0.43	
Roof Area	=	0.13	ha
Level of Treatment	=	Enhanced (80% TSS removal)	
Storage Media	=	50mm diameter clear stone	
Media Porosity, n	=	0.4	typical (range 0.25-0.40)
Percolation Rate	=	19	mm/h
Retention Time	=	24	h
Subdrain size	=	250	mm
Length	=	130	m
Subsurface Trench Width	=	1.2	m
Maximum Depth of Subsurface Trench, dt	=	0.75	m

Calculations

Imperviousness	=	33%	
Required Quality Treatment Volume	=	10 m^3	(MECP)
Required 25mm Infiltration Volume	=	33 m^3	

Bioswale Configuration

Required Bottom Area of trench, A	=	54.8 m^2	
Provided Bottom Area of trench	=	155.4 m^2	
Infiltration Rate	=	0.8 L/s	
Drawdown Time of Quality Treatment Volume	=	3.4 hr	
Maximum Subsurface Volume Available, Vss	=	50.4 m^3	rectangular trench

Project No. 160401393

Richcraft Kanata West Subdivision Infiltration Calculations

Bioswales with Storage Volume Calculations Based on Infiltration Trench Design Calculations (Based on section 4.5.8 of MOE 2003 SWM Guidelines)

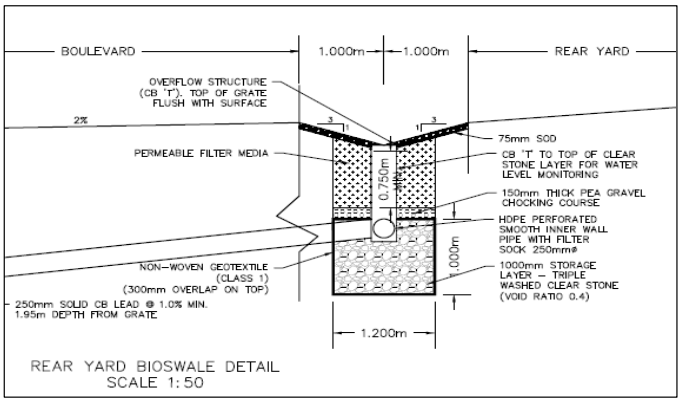
Equation 4.3: Infiltration Trench Bottom Area

$$A = \frac{1{,}000V}{Pn\Delta t}$$

where A = bottom area of the trench (m²)
V = runoff volume to be infiltrated (Table 3.2)
P = percolation rate of surrounding native soil (mm/h)
n = porosity of the storage media (0.4 for clear stone)
Δt = retention time (24 to 48 hours)

Storage Volume (cu.m/ha) for Impervious Level

	35%	55%	70%	85%
Enhanced (80% TSS removal)	25	30	35	40
Normal (70% TSS removal)	20	20	25	30
Basic (60% TSS removal)	20	20	20	20



REAR YARD BIOSWALE DETAIL
SCALE 1:50

Subsurface Trench Width = 1.2 m

Soil Infiltration Rate (Paterson PG3062-MEMO.07) = 19 mm/hr

REARYARD AREA L113B

Input

Drainage Area	=	0.49	ha
Runoff Co-efficient	=	0.42	
Roof Area	=	0.15	ha
Level of Treatment	=	Enhanced (80% TSS removal)	
Storage Media	=	50mm diameter clear stone	
Media Porosity, n	=	0.4	typical (range 0.25-0.40)
Percolation Rate	=	19	mm/h
Retention Time	=	24	h
Subdrain size	=	250	mm
Length	=	98	m
Subsurface Trench Width	=	1.2	m
Maximum Depth of Subsurface Trench, dt	=	0.75	m

Calculations

Imperviousness	=	31%	
Required Quality Treatment Volume	=	12.25 m^3	(MECP)
Required 25mm Infiltration Volume	=	39 m^3	

Bioswale Configuration

Required Bottom Area of trench, A	=	67.2 m^2	
Provided Bottom Area of trench	=	117.5 m^2	
Infiltration Rate	=	0.6	L/s
Drawdown Time of Quality Treatment Volume	=	5.5	hr
Maximum Subsurface Volume Available, Vss	=	38.1 m^3	rectangular trench

REARYARD AREA L103D

Input

Drainage Area	=	0.55	ha
Runoff Co-efficient	=	0.46	
Roof Area	=	0.20	ha
Level of Treatment	=	Enhanced (80% TSS removal)	
Storage Media	=	50mm diameter clear stone	
Media Porosity, n	=	0.4	typical (range 0.25-0.40)
Percolation Rate	=	19	mm/h
Retention Time	=	24	h
Subdrain size	=	250	mm
Length	=	167	m
Subsurface Trench Width	=	1.2	m
Maximum Depth of Subsurface Trench, dt	=	0.75	m

Calculations

Imperviousness	=	37%	
Required Quality Treatment Volume	=	16.5 m^3	(MECP)
Required 25mm Infiltration Volume	=	51 m^3	

Bioswale Configuration

Required Bottom Area of trench, A	=	90.5 m^2	
Provided Bottom Area of trench	=	200.4 m^2	
Infiltration Rate	=	1.1	L/s
Drawdown Time of Quality Treatment Volume	=	4.3	hr
Maximum Subsurface Volume Available, Vss	=	65.0 m^3	rectangular trench

REARYARD AREA L117C

Input

Drainage Area	=	0.66	ha
Runoff Co-efficient	=	0.46	
Roof Area	=	0.25	ha
Level of Treatment	=	Enhanced (80% TSS removal)	
Storage Media	=	50mm diameter clear stone	
Media Porosity, n	=	0.4	typical (range 0.25-0.40)
Percolation Rate	=	19	mm/h
Retention Time	=	24	h
Subdrain size	=	250	mm
Length	=	210	m
Subsurface Trench Width	=	1.2	m
Maximum Depth of Subsurface Trench, dt	=	0.75	m

Calculations

Imperviousness	=	37%	
Required Quality Treatment Volume	=	19.8 m^3	(MECP)
Required 25mm Infiltration Volume	=	61 m^3	

Bioswale Configuration

Required Bottom Area of trench, A	=	108.6 m^2	
Provided Bottom Area of trench	=	252.0 m^2	
Infiltration Rate	=	1.3	L/s
Drawdown Time of Quality Treatment Volume	=	4.1	hr
Maximum Subsurface Volume Available, Vss	=	81.8 m^3	rectangular trench

Project No. 160401393

Richcraft Kanata West Subdivision Infiltration Calculations

Bioswales with Storage Volume Calculations Based on Infiltration Trench Design Calculations (Based on section 4.5.8 of MOE 2003 SWM Guidelines)

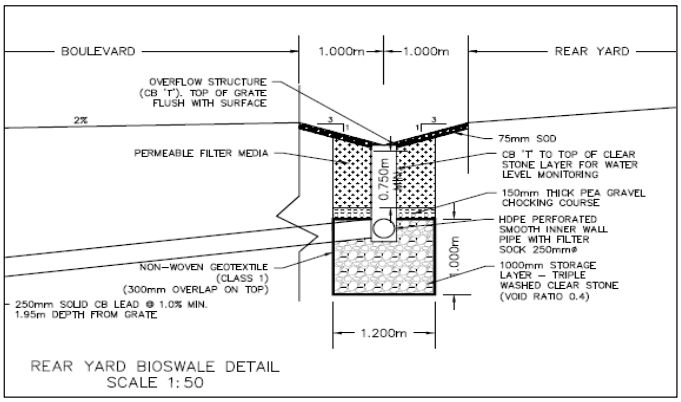
Equation 4.3: Infiltration Trench Bottom Area

$$A = \frac{1{,}000V}{Pn\Delta t}$$

where A = bottom area of the trench (m²)
V = runoff volume to be infiltrated (Table 3.2)
P = percolation rate of surrounding native soil (mm/h)
n = porosity of the storage media (0.4 for clear stone)
Δt = retention time (24 to 48 hours)

Storage Volume (cu.m/ha) for Impervious Level

	35%	55%	70%	85%
Enhanced (80% TSS removal)	25	30	35	40
Normal (70% TSS removal)	20	20	25	30
Basic (60% TSS removal)	20	20	20	20



Subsurface Trench Width = 1.2 m

Soil Infiltration Rate (Paterson PG3062-MEMO.07) = 19 mm/hr

REARYARD AREA L209C

Input

Drainage Area	=	0.41	ha
Runoff Co-efficient	=	0.47	
Roof Area	=	0.16	ha
Level of Treatment	=	Enhanced (80% TSS removal)	
Storage Media	=	50mm diameter clear stone	
Media Porosity, n	=	0.4	typical (range 0.25-0.40)
Percolation Rate	=	19	mm/h
Retention Time	=	24	h
Subdrain size	=	250	mm
Length	=	105	m
Subsurface Trench Width	=	1.2	m
Maximum Depth of Subsurface Trench, dt	=	0.75	m

Calculations

Imperviousness	=	39%	
Required Quality Treatment Volume	=	12.3	m^3 (MECP)
Required 25mm Infiltration Volume	=	40	m^3

Bioswale Configuration

Required Bottom Area of trench, A	=	67.4	m^2
Provided Bottom Area of trench	=	126.0	m^2
Infiltration Rate	=	0.7	L/s
Drawdown Time of Quality Treatment Volume	=	5.1	hr
Maximum Subsurface Volume Available, Vss	=	40.9	m^3 rectangular trench

REARYARD AREA L205B

Input

Drainage Area	=	0.48	ha
Runoff Co-efficient	=	0.45	
Roof Area	=	0.17	ha
Level of Treatment	=	Enhanced (80% TSS removal)	
Storage Media	=	50mm diameter clear stone	
Media Porosity, n	=	0.4	typical (range 0.25-0.40)
Percolation Rate	=	19	mm/h
Retention Time	=	24	h
Subdrain size	=	250	mm
Length	=	130	m
Subsurface Trench Width	=	1.2	m
Maximum Depth of Subsurface Trench, dt	=	0.75	m

Calculations

Imperviousness	=	36%	
Required Quality Treatment Volume	=	14.4	m^3 (MECP)
Required 25mm Infiltration Volume	=	43	m^3

Bioswale Configuration

Required Bottom Area of trench, A	=	78.9	m^2
Provided Bottom Area of trench	=	155.6	m^2
Infiltration Rate	=	0.8	L/s
Drawdown Time of Quality Treatment Volume	=	4.9	hr
Maximum Subsurface Volume Available, Vss	=	50.5	m^3 rectangular trench

REARYARD AREA L210B

Input

Drainage Area	=	0.26	ha
Runoff Co-efficient	=	0.47	
Roof Area	=	0.10	ha
Level of Treatment	=	Enhanced (80% TSS removal)	
Storage Media	=	50mm diameter clear stone	
Media Porosity, n	=	0.4	typical (range 0.25-0.40)
Percolation Rate	=	19	mm/h
Retention Time	=	24	h
Subdrain size	=	250	mm
Length	=	83	m
Subsurface Trench Width	=	1.2	m
Maximum Depth of Subsurface Trench, dt	=	0.75	m

Calculations

Imperviousness	=	39%	
Required Quality Treatment Volume	=	7.8	m^3 (MECP)
Required 25mm Infiltration Volume	=	25	m^3

Bioswale Configuration

Required Bottom Area of trench, A	=	42.8	m^2
Provided Bottom Area of trench	=	99.0	m^2
Infiltration Rate	=	0.5	L/s
Drawdown Time of Quality Treatment Volume	=	4.1	hr
Maximum Subsurface Volume Available, Vss	=	32.1	m^3 rectangular trench

Project No. 160401393

Richcraft Kanata West Subdivision Infiltration Calculations

Bioswales with Storage Volume Calculations Based on Infiltration Trench Design Calculations (Based on section 4.5.8 of MOE 2003 SWM Guidelines)

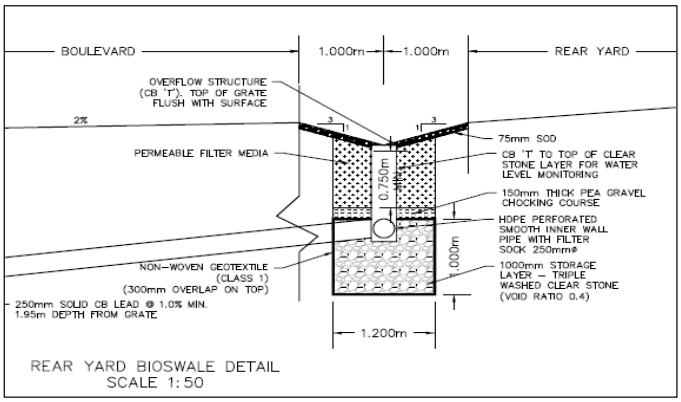
$$A = \frac{1{,}000V}{Pn\Delta t}$$

Equation 4.3: Infiltration Trench Bottom Area

where A = bottom area of the trench (m²)
V = runoff volume to be infiltrated (Table 3.2)
P = percolation rate of surrounding native soil (mm/h)
n = porosity of the storage media (0.4 for clear stone)
Δt = retention time (24 to 48 hours)

Storage Volume (cu.m/ha) for Impervious Level

	35%	55%	70%	85%
Enhanced (80% TSS removal)	25	30	35	40
Normal (70% TSS removal)	20	20	25	30
Basic (60% TSS removal)	20	20	20	20



Subsurface Trench Width = 1.2 m

Soil Infiltration Rate (Paterson PG3062-MEMO.07) = 19 mm/hr

REARYARD AREA L202B

Input

Drainage Area	=	0.25	ha
Runoff Co-efficient	=	0.55	
Roof Area	=	0.13	ha
Level of Treatment	=	Enhanced (80% TSS removal)	
Storage Media	=	50mm diameter clear stone	
Media Porosity, n	=	0.4	typical (range 0.25-0.40)
Percolation Rate	=	19	mm/h
Retention Time	=	24	h
Subdrain size	=	250	mm
Length	=	75	m
Subsurface Trench Width	=	1.2	m
Maximum Depth of Subsurface Trench, dt	=	0.75	m

Calculations

Imperviousness	=	50%	
Required Quality Treatment Volume	=	7.5 m^3	(MECP)
Required 25mm Infiltration Volume	=	31 m^3	

Bioswale Configuration

Required Bottom Area of trench, A	=	41.1 m^2	
Provided Bottom Area of trench	=	90.5 m^2	
Infiltration Rate	=	0.5 L/s	
Drawdown Time of Quality Treatment Volume	=	4.4 hr	
Maximum Subsurface Volume Available, Vss	=	29.4 m^3	rectangular trench

REARYARD AREA L234D

Input

Drainage Area	=	0.37	ha
Runoff Co-efficient	=	0.57	
Roof Area	=	0.20	ha
Level of Treatment	=	Enhanced (80% TSS removal)	
Storage Media	=	50mm diameter clear stone	
Media Porosity, n	=	0.4	typical (range 0.25-0.40)
Percolation Rate	=	19	mm/h
Retention Time	=	24	h
Subdrain size	=	250	mm
Length	=	90	m
Subsurface Trench Width	=	1.2	m
Maximum Depth of Subsurface Trench, dt	=	0.75	m

Calculations

Imperviousness	=	53%	
Required Quality Treatment Volume	=	11.1 m^3	(MECP)
Required 25mm Infiltration Volume	=	49 m^3	

Bioswale Configuration

Required Bottom Area of trench, A	=	60.9 m^2	
Provided Bottom Area of trench	=	108.0 m^2	
Infiltration Rate	=	0.6 L/s	
Drawdown Time of Quality Treatment Volume	=	5.4 hr	
Maximum Subsurface Volume Available, Vss	=	35.1 m^3	rectangular trench

REARYARD AREA L218B

Input

Drainage Area	=	0.25	ha
Runoff Co-efficient	=	0.45	
Roof Area	=	0.09	ha
Level of Treatment	=	Enhanced (80% TSS removal)	
Storage Media	=	50mm diameter clear stone	
Media Porosity, n	=	0.4	typical (range 0.25-0.40)
Percolation Rate	=	19	mm/h
Retention Time	=	24	h
Subdrain size	=	250	mm
Length	=	131	m
Subsurface Trench Width	=	1.2	m
Maximum Depth of Subsurface Trench, dt	=	0.75	m

Calculations

Imperviousness	=	36%	
Required Quality Treatment Volume	=	7.5 m^3	(MECP)
Required 25mm Infiltration Volume	=	22 m^3	

Bioswale Configuration

Required Bottom Area of trench, A	=	41.1 m^2	
Provided Bottom Area of trench	=	157.2 m^2	
Infiltration Rate	=	0.8 L/s	
Drawdown Time of Quality Treatment Volume	=	2.5 hr	
Maximum Subsurface Volume Available, Vss	=	51.0 m^3	rectangular trench

REARYARD AREA L220A

Input

Drainage Area	=	0.87	ha
Runoff Co-efficient	=	0.44	
Roof Area	=	0.30	ha
Level of Treatment	=	Enhanced (80% TSS removal)	
Storage Media	=	50mm diameter clear stone	
Media Porosity, n	=	0.4	typical (range 0.25-0.40)
Percolation Rate	=	19	mm/h
Retention Time	=	24	h
Subdrain size	=	250	mm
Length	=	192	m
Subsurface Trench Width	=	1.2	m
Maximum Depth of Subsurface Trench, dt	=	0.75	m

Calculations

Imperviousness	=	34%	
Required Quality Treatment Volume	=	21.75 m^3	(MECP)
Required 25mm Infiltration Volume	=	75 m^3	

Bioswale Configuration

Required Bottom Area of trench, A	=	119.2 m^2	
Provided Bottom Area of trench	=	230.4 m^2	
Infiltration Rate	=	1.2 L/s	
Drawdown Time of Quality Treatment Volume	=	5.0 hr	
Maximum Subsurface Volume Available, Vss	=	74.8 m^3	rectangular trench

Required 25mm Infiltration Volume = 532 m^3

Maximum Subsurface Volume Available, Vss = 611 m^3

Drainage Area ID	Drainage Area (ha)	Imperviousness (%)	Required Volume for 25mm Event (m^3)[1]	Trench Length (m)	Trench Width (m)	Trench Depth (m)	Maximum Storage Available (m)
REARYARD AREA L103C	0.64	40%	64	159	1.2	0.75	62
REARYARD AREA L124B	0.40	33%	33	130	1.2	0.75	50
REARYARD AREA L113B	0.49	31%	39	98	1.2	0.75	38
REARYARD AREA L103D	0.55	37%	51	167	1.2	0.75	65
REARYARD AREA L117C	0.66	37%	61	210	1.2	0.75	82
REARYARD AREA L209C	0.41	39%	40	105	1.2	0.75	41
REARYARD AREA L205B	0.48	36%	43	130	1.2	0.75	51
REARYARD AREA L210B	0.26	39%	25	83	1.2	0.75	32
REARYARD AREA L202B	0.25	50%	31	75	1.2	0.75	29
REARYARD AREA L234D	0.37	53%	49	90	1.2	0.75	35
REARYARD AREA L218B	0.25	36%	22	131	1.2	0.75	51
REARYARD AREA L220A	0.87	34%	75	192	1.2	0.75	75
		Total:	**532 m^3**				**611 m^3**

APPENDIX C

Wastewater Calculations and Background

Appendix C1: Sanitary Sewer Design Sheet

Stantec

SUBDIVISION:
Richcraft Kanata West Subdivision - Second Registration

DATE: 12/12/2023
REVISION: 5
DESIGNED BY: WAJ
CHECKED BY: MW

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				

LOCATION			RESIDENTIAL AREA AND POPULATION									COMMERCIAL		INDUSTRIAL (L)		INDUSTRIAL (H)		INSTITUTIONAL		GREEN / UNUSED		C+I+I	INFILTRATION			TOTAL	PIPE								
AREA ID NUMBER	FROM M.H.	TO M.H.	AREA	SINGLE	UNITS TOWN	APT	POP.	CUMULATIVE AREA	CUMULATIVE POP.	PEAK FACT.	PEAK FLOW	AREA	ACCU. AREA	AREA	ACCU. AREA	AREA	ACCU. AREA	AREA	ACCU. AREA	AREA	ACCU. AREA	PEAK FLOW	TOTAL AREA	ACCU. AREA	INFILT. FLOW	FLOW	LENGTH	DIA	MATERIAL	CLASS	SLOPE	CAP. (FULL)	CAP. V PEAK FLOW	VEL. (FULL)	VEL. (ACT.)
			(ha)					(ha)			(L/s)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(L/s)	(ha)	(ha)	(L/s)	(L/s)	(m)	(mm)			(%)	(l/s)	(%)	(m/s)	(m/s)
PROPOSED SECOND REGISTRATION PHASE																																		
R64A, EXT-1	64	63	0.17	0	0	0	0	0.17	0	3.80	0.0	13.19	13.19	0.00	0.00	0.00	0.00	1.04	1.04	1.28	1.28	6.9	15.68	15.68	5.2	12.1	87.0	400	PVC	SDR 26	0.19	67.8	**17.8%**	0.6	0.4
	63	55	0.00	0	0	0	0	0.17	0	3.80	0.0	0.00	13.19	0.00	0.00	0.00	0.00	0.00	1.04	0.00	1.28	6.9	0.00	15.68	5.2	12.1	120.0	400	PVC	SDR 26	0.19	67.6	**17.9%**	0.6	0.4
R58A	58	57	0.36	0	8	0	22	0.36	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	0.36	0.36	0.1	0.4	60.6	200	PVC	SDR 35	0.65	27.0	**1.4%**	0.8	0.3
I57B, R57A	57	56	0.51	0	15	0	41	0.87	62	3.64	0.7	0.00	0.00	0.00	0.00	0.00	0.00	2.95	2.95	0.00	0.00	1.4	3.46	3.82	1.3	3.4	105.5	200	PVC	SDR 35	0.40	21.1	**16.2%**	0.7	0.4
R62A	62	61	0.17	0	5	0	14	0.17	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	0.17	0.17	0.1	0.2	30.8	200	PVC	SDR 35	0.65	27.0	**0.8%**	0.8	0.2
R61A	61	60	0.17	0	3	0	8	0.35	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	0.17	0.35	0.1	0.4	11.9	200	PVC	SDR 35	0.50	23.6	**1.6%**	0.7	0.2
R60A	60	59	0.80	0	34	0	92	1.15	113	3.58	1.3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.80	1.15	0.4	1.7	117.1	200	PVC	SDR 35	0.50	23.6	**7.2%**	0.7	0.4
	59	56	0.00	0	0	0	0	1.15	113	3.58	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	1.15	0.4	1.7	11.6	200	PVC	SDR 35	0.40	21.1	**8.0%**	0.7	0.3
R56A	56	55	0.22	0	6	0	16	2.23	192	3.52	2.2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.95	0.00	0.00	1.4	0.22	5.18	1.7	5.3	49.8	200	PVC	SDR 35	0.40	21.1	**25.2%**	0.7	0.5
	55	54	0.00	0	0	0	0	2.41	192	3.52	2.2	0.00	13.19	0.00	0.00	0.00	0.00	0.00	3.99	0.00	1.28	8.4	0.00	20.87	6.9	17.4	79.5	400	PVC	SDR 26	0.14	58.7	**29.7%**	0.6	0.4
R65A	65	54	0.21	0	4	0	11	0.21	11	3.73	0.1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.21	0.21	0.1	0.2	27.3	200	PVC	SDR 35	1.00	33.4	**0.6%**	1.1	0.3
R54GA	54G	54F	0.80	12	16	0	84	0.80	84	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	0.80	0.80	0.3	1.2	119.4	200	PVC	SDR 35	0.35	19.8	**6.3%**	0.6	0.3
R54FA	54F	54E	0.39	8	0	0	27	1.19	111	3.58	1.3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.39	1.19	0.4	1.7	79.3	200	PVC	SDR 35	0.35	19.8	**8.5%**	0.6	0.3
	54E	54	0.00	0	0	0	0	1.19	111	3.58	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	1.19	0.4	1.7	5.8	200	PVC	SDR 35	0.35	19.8	**8.5%**	0.6	0.3
R54DA	54D	54C	0.40	0	10	0	27	0.40	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	0.40	0.40	0.1	0.5	81.8	200	PVC	SDR 35	0.65	27.0	**1.7%**	0.8	0.3
	54C	54B	0.00	0	0	0	0	0.40	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	0.00	0.40	0.1	0.5	76.0	200	PVC	SDR 35	0.35	19.8	**2.3%**	0.6	0.2
R54BA	54B	54A	0.60	0	23	0	62	1.00	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	0.60	1.00	0.3	1.4	70.2	200	PVC	SDR 35	0.35	19.8	**6.9%**	0.6	0.3
R54AA	54A	54	0.54	0	19	0	51	1.54	140	3.56	1.6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.54	1.54	0.5	2.1	2.5	200	PVC	SDR 35	0.35	19.8	**10.8%**	0.6	0.3
	54	53	0.00	0	0	0	0	5.35	454	3.40	5.0	0.00	13.19	0.00	0.00	0.00	0.00	0.00	3.99	0.00	1.28	8.4	0.00	23.80	7.9	21.2	70.7	400	PVC	SDR 26	0.14	58.2	**36.4%**	0.6	0.4
	53	52	0.00	0	0	0	0	5.35	454	3.40	5.0	0.00	13.19	0.00	0.00	0.00	0.00	0.00	3.99	0.00	1.28	8.4	0.00	23.80	7.9	21.2	76.0	400	PVC	SDR 26	0.14	58.2	**36.4%**	0.6	0.4
	52	35	0.00	0	0	0	0	5.35	454	3.40	5.0	0.00	13.19	0.00	0.00	0.00	0.00	0.00	3.99	0.00	1.28	8.4	0.00	23.80	7.9	21.2	104.6	400	PVC	SDR 26	0.14	58.2	**36.4%**	0.6	0.4
R51A	51	50	0.18	0	4	0	11	0.18	11	3.73	0.1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.18	0.18	0.1	0.2	39.8	200	PVC	SDR 35	0.65	27.0	**0.7%**	0.8	0.2
R50A	50	49	0.19	0	5	0	14	0.37	24	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	0.19	0.37	0.1	0.4	36.9	200	PVC	SDR 35	0.65	27.0	**1.5%**	0.8	0.3
R49A	49	48	0.08	0	0	0	0	0.45	24	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	0.08	0.45	0.1	0.4	12.1	200	PVC	SDR 35	0.40	21.1	**2.1%**	0.7	0.2
R48A	48	47	0.59	0	7	0	19	1.03	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	0.59	1.03	0.3	0.9	85.9	200	PVC	SDR 35	0.40	21.1	**4.0%**	0.7	0.3
R47A	47	46	0.66	0	11	0	30	1.69	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	0.66	1.69	0.6	1.4	80.2	200	PVC	SDR 35	0.40	21.1	**6.7%**	0.7	0.3
R46A	46	45	0.22	0	4	0	11	1.91	84	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	0.22	1.91	0.6	1.6	14.3	200	PVC	SDR 35	0.40	21.1	**7.6%**	0.7	0.3
R45A	45	44	0.33	0	10	0	27	2.24	111	3.58	1.3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.33	2.24	0.7	2.0	62.2	200	PVC	SDR 35	0.40	21.1	**9.6%**	0.7	0.3
R44A, R44B[1]	44	43	3.07	0	263	0	710	5.31	821	3.28	8.7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	3.07	5.31	1.8	10.5	67.7	200	PVC	SDR 35	0.40	21.1	**49.6%**	0.7	0.6
R43A	43	42	0.09	0	2	0	5	5.39	826	3.28	8.8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.09	5.39	1.8	10.6	11.7	200	PVC	SDR 35	0.40	21.1	**50.0%**	0.7	0.6
R42A	42	41	0.31	0	9	0	24	5.70	851	3.28	9.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.31	5.70	1.9	10.9	75.4	200	PVC	SDR 35	0.40	21.1	**51.6%**	0.7	0.6
R41A, R41B	41	40	0.62	0	11	0	30	6.32	880	3.27	9.3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.62	6.32	2.1	11.4	85.4	200	PVC	SDR 35	0.40	21.1	**53.9%**	0.7	0.6
R40A	40	39	0.35	0	10	0	27	6.67	907	3.26	9.6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.35	6.67	2.2	11.8	63.2	200	PVC	SDR 35	0.40	21.1	**55.7%**	0.7	0.6

Stantec

SUBDIVISION:
Richcraft Kanata West Subdivision - Second Registration

DATE: 12/12/2023
REVISION: 5
DESIGNED BY: WAJ
CHECKED BY: MW

SANITARY SEWER DESIGN SHEET
(City of Ottawa)

FILE NUMBER: 160401393

DESIGN PARAMETERS

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PEAKING FACTOR (ICI >20%):	1.5	INDUSTRIAL (LIGHT)	35,000 L/ha/day	BEDDING CLASS	B
PERSONS / SINGLE	3.4	INSTITUTIONAL	28,000 L/ha/day	MINIMUM COVER	2.50 m
PERSONS / TOWNHOME	2.7	INFILTRATION	0.33 L/s/ha	HARMON CORRECTION FACTOR	0.8
PERSONS / APARTMENT	1.8				

LOCATION			RESIDENTIAL AREA AND POPULATION								COMMERCIAL		INDUSTRIAL (L)		INDUSTRIAL (H)		INSTITUTIONAL		GREEN / UNUSED		C+I+I	INFILTRATION			TOTAL	PIPE								
AREA ID NUMBER	FROM M.H.	TO M.H.	AREA (ha)	SINGLE	UNITS TOWN	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)
R39BA	39B	39A	0.49	0	13	0	35	0.49	35	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	0.49	0.49	0.2	0.6	65.2	200	PVC	SDR 35	0.35	19.8	2.9%	0.6	0.2
	39A	39	0.00	0	0	0	0	0.49	35	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	0.00	0.49	0.2	0.6	3.4	200	PVC	SDR 35	0.35	19.8	2.9%	0.6	0.2
	39	35	0.00	0	0	0	0	7.16	942	3.25	9.9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.00	7.16	2.4	12.3	79.5	200	PVC	SDR 35	0.40	21.1	58.1%	0.7	0.6
R38A	38	37	0.08	0	2	0	5	0.08	5	3.75	0.1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.08	0.08	0.0	0.1	12.6	200	PVC	SDR 35	0.65	27.0	0.3%	0.8	0.2
R37A	37	36	0.78	0	26	0	70	0.86	76	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	0.78	0.86	0.3	1.2	99.3	200	PVC	SDR 35	0.40	21.1	5.5%	0.7	0.3
R36A	36	35	0.63	0	21	0	57	1.49	132	3.57	1.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.63	1.49	0.5	2.0	110.3	200	PVC	SDR 35	0.40	21.2	9.6%	0.7	0.3
R70A	70	69	0.28	5	0	0	17	0.28	17	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	0.28	0.28	0.1	0.3	61.5	200	PVC	SDR 35	0.32	18.9	1.6%	0.6	0.2
R69A	69	68	0.10	2	0	0	7	0.38	24	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	0.10	0.38	0.1	0.4	12.5	200	PVC	SDR 35	0.32	18.9	2.2%	0.6	0.2
R68A, R68B[1]	68	67	1.69	7	122	0	353	2.07	377	3.43	4.2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	1.69	2.07	0.7	4.9	77.8	200	PVC	SDR 35	0.32	18.9	25.7%	0.6	0.4
R67A, G67A	67	66	0.53	10	0	0	34	2.60	411	3.41	4.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.97	0.97	0.0	1.50	3.57	1.2	5.7	106.9	200	PVC	SDR 35	0.32	18.9	30.3%	0.6	0.4
R66A	66	21	0.13	1	0	0	3	2.73	414	3.41	4.6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.97	0.0	0.13	3.70	1.2	5.8	50.9	200	PVC	SDR 35	0.32	18.9	30.7%	0.6	0.4
R21A	21	20	0.31	0	8	0	22	3.04	436	3.40	4.8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.97	0.0	0.31	4.01	1.3	6.1	62.2	200	PVC	SDR 35	0.32	18.9	32.4%	0.6	0.4
APPROVED 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%*	*1.1*	*0.3*
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%	0.8	0.2
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*	*0.62*	*26.3*	*1.2%*	*0.83*	*0.24*
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[1]	*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*	*1529*	*3.14*	*15.6*	*0.00*	*13.19*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*3.99*	*0.00*	*1.28*	*8.4*	*0.00*	*32.45*	*10.7*	*34.6*	*68.7*	*400*	*PVC*	*SDR 35*	*0.34*	*90.7*	*38.2%*	*0.86*	*0.68*
	35A	*22*	*0.00*	*0*	*0*	*0*	*0*	*13.99*	*1529*	*3.14*	*15.6*	*0.00*	*13.19*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*3.99*	*0.00*	*1.28*	*8.4*	*0.00*	*32.45*	*10.7*	*34.6*	*81.6*	*375*	*PVC*	*SDR 35*	*0.14*	*60.7*	*57.0%*	*0.58*	*0.51*
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*	*17.07*	*1834*	*3.09*	*18.4*	*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*	*38.4*	*78.4*	*375*	*PVC*	*SDR 35*	*0.14*	*61.3*	*62.7%*	*0.58*	*0.53*
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*	*4.66*	*568*	*3.36*	*6.2*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.97*	*0.0*	*0.23*	*5.63*	*1.9*	*8.0*	*58.4*	*200*	*PVC*	*SDR 35*	*0.32*	*18.9*	*42.5%*	*0.60*	*0.48*
R19A	*19*	*18*	*0.11*	*0*	*2*	*0*	*5*	*4.77*	*574*	*3.35*	*6.2*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.97*	*0.0*	*0.11*	*5.74*	*1.9*	*8.1*	*24.5*	*200*	*PVC*	*SDR 35*	*0.32*	*18.9*	*43.0%*	*0.60*	*0.48*
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*	*6.01*	*682*	*3.32*	*7.3*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.97*	*0.0*	*0.00*	*6.98*	*2.3*	*9.6*	*73.1*	*200*	*PVC*	*SDR 35*	*0.32*	*18.9*	*51.0%*	*0.60*	*0.51*
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*	*6.35*	*703*	*3.31*	*7.6*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.97*	*0.0*	*0.02*	*7.32*	*2.4*	*10.0*	*9.6*	*200*	*PVC*	*SDR 35*	*0.32*	*18.9*	*52.7%*	*0.60*	*0.52*
	16	*14*	*0.00*	*0*	*0*	*0*	*0*	*6.35*	*703*	*3.31*	*7.6*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.97*	*0.0*	*0.00*	*7.32*	*2.4*	*10.0*	*109.6*	*200*	*PVC*	*SDR 35*	*0.32*	*18.9*	*52.7%*	*0.60*	*0.52*
C14B	*14*	*3*	*0.00*	*0*	*0*	*0*	*0*	*6.35*	*703*	*3.31*	*7.6*	*1.47*	*1.47*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.97*	*0.5*	*1.47*	*8.79*	*2.9*	*10.9*	*109.5*	*200*	*PVC*	*SDR 35*	*0.32*	*18.9*	*57.8%*	*0.60*	*0.53*
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*	*2886*	*2.97*	*27.7*	*0.00*	*14.66*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*3.99*	*0.00*	*2.74*	*9.1*	*0.16*	*49.38*	*16.3*	*53.1*	*71.0*	*375*	*PVC*	*SDR 35*	*0.14*	*60.1*	*88.4%*	*0.57*	*0.58*
R2A	*2*	*1A*	*0.14*	*0*	*0*	*0*	*0*	*28.13*	*2886*	*2.97*	*27.7*	*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*	*53.1*	*49.3*	*450*	*PVC*	*SDR 35*	*1.00*	*300.3*	*17.7%*	*1.83*	*1.15*
	1A	*1*	*0.00*	*0*	*0*	*0*	*0*	*28.13*	*2886*	*2.97*	*27.7*	*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*	*53.1*	*4.8*	*450*	*PVC*	*SDR 35*	*1.00*	*300.1*	*17.7%*	*1.83*	*1.15*

Notes:
1. In the 1st registration a unit density of 38 units/ha was used for the medium density residential block (R4B). Based on a revised concept plan for R44B the unit density for the 2nd registration was revised to approximately 93 units/hectare. This unit density was used for both medium density residential blocks (R44B and R68B).

Appendix C2: Sanitary HGL Parameters

Stantec

SUBDIVISION:
Richcraft Kanata West Subdivision Second Registration Phase

DATE: 12/14/2023
REVISION: 5
DESIGNED BY: WAJ
CHECKED BY: MN

SANITARY INFLOWS FOR CATASTROPHIC HGL ANALYSIS

FILE NUMBER: 160401393

Annual Parameters as per Technical Bulletin ISTB-2018-01

*Harmon Correction Factor of 0.8

MAX PEAK FACTOR (RES.)=	4.0	AVG. DAILY FLOW / PERSON	200 L/p/day
MIN PEAK FACTOR (RES.)=	2.0	COMMERCIAL	17,000 L/ha/day
PEAKING FACTOR (INDUSTRIAL):	1.0	INDUSTRIAL (HEAVY)	55,000 L/ha/day
PEAKING FACTOR (COMM., INST.):	1.0	INDUSTRIAL (LIGHT)	10,000 L/ha/day
PERSONS / SINGLE	3.4	INSTITUTIONAL	17,000 L/ha/day
PERSONS / TOWNHOME	2.7	INFILTRATION	0.30 L/s/ha
PERSONS / APARTMENT	1.8	1st REGISTRATION MED. DENSITY RESIDENTIAL POP.[7]	38 units/ha
		2nd REGISTRATIONMED. DENSITY RESIDENTIAL POP.[7]	93 units/ha

LOCATION			RESIDENTIAL AREA AND POPULATION							COMMERCIAL	INDUSTRIAL (L)	INDUSTRIAL (H)	INSTITUTIONAL	GREEN / UNUSED	C+I+I	INFILTRATION		TOTAL
AREA ID NUMBER	FROM M.H.	TO M.H.	AREA	UNITS SINGLE	UNITS TOWN	UNITS APT	POP.	PEAK FACT.	PEAK FLOW	AREA	AREA	AREA	AREA	AREA	PEAK FLOW	TOTAL AREA	INFILT. FLOW	FLOW
			(ha)						(L/s)	(ha)	(ha)	(ha)	(ha)	(ha)	(L/s)	(ha)	(L/s)	(L/s)
R64A, EXT-1	64	63	0.17	0	0	0	0	3.10	0.0	13.19	0.00	0.00	1.04	1.28	2.8	15.68	4.7	7.5
R58A	58	57	0.36	0	8	0	22	3.03	0.2	0.00	0.00	0.00	0.00	0.00	0.0	0.36	0.1	0.3
I57B, R57A	57	56	0.51	0	15	0	41	3.00	0.3	0.00	0.00	0.00	2.95	0.00	0.6	3.46	1.0	1.9
R62A	62	61	0.17	0	5	0	14	3.04	0.1	0.00	0.00	0.00	0.00	0.00	0.0	0.17	0.1	0.1
R61A	61	60	0.17	0	3	0	8	3.05	0.1	0.00	0.00	0.00	0.00	0.00	0.0	0.17	0.1	0.1
R60A	60	59	0.80	0	34	0	92	2.95	0.6	0.00	0.00	0.00	0.00	0.00	0.0	0.80	0.2	0.9
R56A	56	55	0.22	0	6	0	16	3.04	0.1	0.00	0.00	0.00	0.00	0.00	0.0	0.22	0.1	0.2
R65A	65	54	0.21	0	4	0	11	3.05	0.1	0.00	0.00	0.00	0.00	0.00	0.0	0.21	0.1	0.1
R54GA	54G	54F	0.80	12	16	0	84	2.96	0.6	0.00	0.00	0.00	0.00	0.00	0.0	0.80	0.2	0.8
R54FA	54F	54E	0.39	8	0	0	27	3.02	0.2	0.00	0.00	0.00	0.00	0.00	0.0	0.39	0.1	0.3
R54DA	54D	54C	0.40	0	10	0	27	3.02	0.2	0.00	0.00	0.00	0.00	0.00	0.0	0.40	0.1	0.3
R54BA	54B	54A	0.60	0	23	0	62	2.98	0.4	0.00	0.00	0.00	0.00	0.00	0.0	0.60	0.2	0.6
R54AA	54A	54	0.54	0	19	0	51	2.99	0.4	0.00	0.00	0.00	0.00	0.00	0.0	0.54	0.2	0.5
R51A	51	50	0.18	0	4	0	11	3.05	0.1	0.00	0.00	0.00	0.00	0.00	0.0	0.18	0.1	0.1
R50A	50	49	0.19	0	5	0	14	3.04	0.1	0.00	0.00	0.00	0.00	0.00	0.0	0.19	0.1	0.2
R49A	49	48	0.08	0	0	0	0	3.10	0.0	0.00	0.00	0.00	0.00	0.00	0.0	0.08	0.0	0.0
R48A	48	47	0.59	0	7	0	19	3.03	0.1	0.00	0.00	0.00	0.00	0.00	0.0	0.59	0.2	0.3
R47A	47	46	0.66	0	11	0	30	3.01	0.2	0.00	0.00	0.00	0.00	0.00	0.0	0.66	0.2	0.4
R46A	46	45	0.22	0	4	0	11	3.05	0.1	0.00	0.00	0.00	0.00	0.00	0.0	0.22	0.1	0.1
R45A	45	44	0.33	0	10	0	27	3.02	0.2	0.00	0.00	0.00	0.00	0.00	0.0	0.33	0.1	0.3
R44A, R44B[7]	44	43	3.07	0	263	0	710	2.73	4.5	0.00	0.00	0.00	0.00	0.00	0.0	3.07	0.9	5.4
R43A	43	42	0.09	0	2	0	5	3.06	0.0	0.00	0.00	0.00	0.00	0.00	0.0	0.09	0.0	0.1
R42A	42	41	0.31	0	9	0	24	3.02	0.2	0.00	0.00	0.00	0.00	0.00	0.0	0.31	0.1	0.3
R41A, R41B	41	40	0.62	0	11	0	30	3.01	0.2	0.00	0.00	0.00	0.00	0.00	0.0	0.62	0.2	0.4
R40A	40	39	0.35	0	10	0	27	3.02	0.2	0.00	0.00	0.00	0.00	0.00	0.0	0.35	0.1	0.3
R39BA	39B	39A	0.49	0	13	0	35	3.01	0.2	0.00	0.00	0.00	0.00	0.00	0.0	0.49	0.1	0.4
R38A	38	37	0.08	0	2	0	5	3.06	0.0	0.00	0.00	0.00	0.00	0.00	0.0	0.08	0.0	0.1
R37A	37	36	0.78	0	26	0	70	2.97	0.5	0.00	0.00	0.00	0.00	0.00	0.0	0.78	0.2	0.7
R36A	36	35	0.63	0	21	0	57	2.98	0.4	0.00	0.00	0.00	0.00	0.00	0.0	0.63	0.2	0.6
R70A	70	69	0.28	5	0	0	17	3.03	0.1	0.00	0.00	0.00	0.00	0.00	0.0	0.28	0.1	0.2
R69A	69	68	0.10	2	0	0	7	3.06	0.0	0.00	0.00	0.00	0.00	0.00	0.0	0.10	0.0	0.1
R68A, R68B[7]	68	67	1.69	7	0	0	354	2.83	2.3	0.00	0.00	0.00	0.00	0.00	0.0	1.69	0.5	2.8
R67A, G67A	67	66	0.53	10	0	0	34	3.01	0.2	0.00	0.00	0.00	0.00	0.97	0.0	1.50	0.5	0.7
R66A	66	21	0.13	1	0	0	3	3.07	0.0	0.00	0.00	0.00	0.00	0.00	0.0	0.13	0.0	0.1
R21A	21	20	0.31	0	8	0	22	3.03	0.2	0.00	0.00	0.00	0.00	0.00	0.0	0.31	0.1	0.2
R8A	*8*	*7*	*0.42*	*0*	*14*	*0*	*38*	3.00	0.3	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	0.0	*0.42*	0.1	0.4
R13A	*13*	*12*	*0.28*	*0*	*5*	*0*	*14*	3.04	0.1	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	0.0	*0.28*	0.1	0.2
R12A	*12*	*11*	*0.10*	*0*	*1*	*0*	*3*	3.07	0.0	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	0.0	*0.10*	0.0	*0.0*
R11A	*11*	*10*	*0.58*	*0*	*24*	*0*	*65*	2.97	0.4	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	0.0	*0.58*	0.2	*0.6*
R10A	*10*	*9*	*0.22*	*0*	*4*	*0*	*11*	3.05	0.1	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	0.0	*0.22*	0.1	*0.1*
R9A	*9*	*7*	*0.19*	*0*	*6*	*0*	*16*	3.04	0.1	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	0.0	*0.19*	0.1	*0.2*
G7A, R7A	*7*	*6*	*0.45*	*0*	*12*	*0*	*32*	3.01	0.2	*0.00*	*0.00*	*0.00*	*0.00*	*0.49*	0.0	*0.93*	0.3	*0.5*
R6A	*6*	*5*	*0.03*	*0*	*0*	*0*	*0*	3.10	0.0	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	0.0	*0.03*	0.0	*0.0*
R5A	*5*	*4*	*0.25*	*0*	*6*	*0*	*16*	3.04	0.1	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	0.0	*0.25*	0.1	*0.2*
R4A, R4B[7]	*4*	*3*	*0.94*	*0*	*5*	*0*	*90*	2.95	0.6	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	0.0	*0.94*	0.3	*0.9*
R33A	*33*	*30*	*0.41*	*0*	*16*	*0*	*43*	3.00	0.3	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	0.0	*0.41*	0.1	*0.4*
R30A	*30*	*27*	*0.42*	*0*	*17*	*0*	*46*	2.99	0.3	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	0.0	*0.42*	0.1	*0.4*
R27A	*27*	*22*	*0.20*	*0*	*5*	*0*	*14*	3.04	0.1	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	0.0	*0.20*	0.1	*0.2*
R26A	*26*	*25*	*0.50*	*0*	*21*	*0*	*57*	2.98	0.4	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	0.0	*0.50*	0.1	*0.5*
R25A	*25*	*24*	*0.32*	*0*	*11*	*0*	*30*	3.01	0.2	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	0.0	*0.32*	0.1	*0.3*
R24A	*24*	*23*	*0.15*	*0*	*3*	*0*	*8*	3.05	0.1	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	0.0	*0.15*	0.0	*0.1*
R23A	*23*	*22*	*0.19*	*0*	*5*	*0*	*14*	3.04	0.1	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	0.0	*0.19*	0.1	*0.2*
R22BA	*22B*	*22A*	*0.71*	*0*	*35*	*0*	*95*	2.95	0.6	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	0.0	*0.71*	0.2	*0.9*
R22AA	*22A*	*22*	*0.02*	*0*	*0*	*0*	*0*	3.10	0.0	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	0.0	*0.02*	0.0	*0.0*
R22A	*22*	*3*	*0.16*	*0*	*0*	*0*	*0*	3.10	0.0	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	0.0	*0.16*	0.0	*0.0*
R32A	*32*	*31*	*0.82*	*0*	*27*	*0*	*73*	2.97	0.5	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	0.0	*0.82*	0.2	*0.7*
R31A	*31*	*20A*	*0.57*	*0*	*17*	*0*	*46*	2.99	0.3	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	0.0	*0.57*	0.2	*0.5*
R20A	*20*	*19*	*0.23*	*0*	*5*	*0*	*14*	3.04	0.1	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	0.0	*0.23*	0.1	*0.2*
R19A	*19*	*18*	*0.11*	*0*	*2*	*0*	*5*	3.06	0.0	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	0.0	*0.11*	0.0	*0.1*
R27B	*27*	*18A*	*0.65*	*0*	*22*	*0*	*59*	2.98	0.4	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	0.0	*0.65*	0.2	*0.6*
R18AA	*18A*	*18B*	*0.58*	*0*	*18*	*0*	*49*	2.99	0.3	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	0.0	*0.58*	0.2	*0.5*
R17BA	*17B*	*17A*	*0.33*	*0*	*8*	*0*	*22*	3.03	0.2	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	0.0	*0.33*	0.1	*0.3*
R17A	*17*	*16*	*0.02*	*0*	*0*	*0*	*0*	3.10	0.0	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	0.0	*0.02*	0.0	*0.0*
C14B	*14*	*3*	*0.00*	*0*	*0*	*0*	*0*	3.10	0.0	*1.47*	*0.00*	*0.00*	*0.00*	*0.00*	0.3	*1.47*	0.4	*0.7*

R3CA	*3C*	*3B*	*0.45*	*0*	*10*	*0*	*27*	3.02	0.2	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	0.0	*0.45*	0.1	*0.3*
R3BA	*3B*	*3A*	*0.50*	*0*	*14*	*0*	*38*	3.00	0.3	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	0.0	*0.50*	0.1	*0.4*
R3A	*3*	*2*	*0.16*	*0*	*0*	*0*	*0*	3.10	0.0	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	0.0	*0.16*	0.0	*0.0*
R2A	*2*	*1A*	*0.14*	*0*	*0*	*0*	*0*	3.10	0.0	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	0.0	*0.14*	0.0	*0.0*
Stittsville Trunk[1]	1A	1B	526.60	0	0	0	28031	2.00	129.8	76.00	40.50	0.00	0.00	0.00	19.6	643.10	192.9	583.0
Stittsville Interceptor (Kizell Lands)	1A	1B	52.56	0	0	0	3585	2.43	20.1	11.82	0.00	0.00	0.00	0.00	2.3	64.38	19.3	41.8
Huntmar and Hazeldean[2]	1A	1B	111.52	0	0	0	6357	2.29	33.7	65.44	0.00	0.00	0.00	0.00	12.9	191.09	57.3	103.9
Additional Hazeldean[6]	1A	1B	13.62	0	0	0	296	2.85	2.0	5.39	0.00	0.00	0.00	0.00	1.1	19.01	5.7	8.7
Mattamy Maple Grove Sewer	1A	1B	137.54	0	0	0	10501	2.16	52.5	0.00	0.00	0.00	0.00	0.00	0.0	137.54	41.3	93.8
Maple Grove Expansion[3]	1A	1B	84.43	657	409	117	3549	2.43	19.9	0.00	0.00	0.00	0.00	0.00	0.0	75.99	22.8	42.9
Future Noth south collector[4]	1B	1C	28.44	0	0	0	4936	2.35	26.9	165.28	0.00	0.00	0.00	0.00	32.5	193.72	58.1	147.5
North of Richcraft Kanata Site[5]	1B	1C	1.10	0	42	0	113	2.94	0.8	0.00	0.00	0.00	0.00	0.00	0.0	1.10	0.3	1.1
															72.09			**1060.60**

1. Stittsville trunk sewer annual peak flows equal approximately 342 L/s. However, peak flows equal to 583L/s, 360 L/s and 465 L/s have been assumed for Scenarios 1, 2 and 3 respectively as per the design peak flows obtained by JL Richards and the IMP assumptions made for ultimate and interim conditions respectively.
2. Population and areas as obtained from Huntmar/Hazeldean Design Sheet based on KWMSS assumptions for areas 16, 20, 17, 21, 19A, 23, 24 and 19
3. Maple Grove expansion number of units and gross area based on spreadsheet provided by the City, with 90% of gross area contributing to I/I and 198 amployees generating 83L/emp/day added to total flow
4. Future north-south collector population and are estimates based on IBI spreadsheet provided by the City. It includes a 30L/s fixed flow
5. Future medium density residential area, assumed to have 38 units/ha and 2.7person/unit
6. Additional area from existing residential and commercial developments along Hazeldean between Hartin Street and Savage Drive were included in Novemenr 2017 (see Atrel correspondence)

Stantec

SUBDIVISION:
Richcraft Kanata West Subdivision Second Registration Phase

DATE: 12/14/2023
REVISION: 5
DESIGNED BY: WAJ
CHECKED BY: MN

SANITARY INFLOWS FOR NORMAL HGL ANALYSIS

FILE NUMBER: 160401393

Annual Parameters as per Technical Bulletin ISTB-2018-01

*Harmon Correction Factor of 0.8

MAX PEAK FACTOR (RES.)=	4.0	AVG. DAILY FLOW / PERSON	200 L/p/day
MIN PEAK FACTOR (RES.)=	2.0	COMMERCIAL	17,000 L/ha/day
PEAKING FACTOR (INDUSTRIAL):	1.0	INDUSTRIAL (HEAVY)	55,000 L/ha/day
PEAKING FACTOR (COMM., INST.):	1.0	INDUSTRIAL (LIGHT)	10,000 L/ha/day
PERSONS / SINGLE	3.4	INSTITUTIONAL	17,000 L/ha/day
PERSONS / TOWNHOME	2.7	INFILTRATION	0.55 L/s/ha
PERSONS / APARTMENT	1.8	1st REGISTRATION MED. DENSITY RESIDENTIAL POP.[7]	38 units/ha
		2nd REGISTRATIONMED. DENSITY RESIDENTIAL POP.[7]	93 units/ha

LOCATION			RESIDENTIAL AREA AND POPULATION							COMMERCIAL	INDUSTRIAL (L)	INDUSTRIAL (H)	INSTITUTIONAL	GREEN / UNUSED	C+I+I	INFILTRATION		TOTAL
AREA ID NUMBER	FROM M.H.	TO M.H.	AREA	UNITS SINGLE	UNITS TOWN	UNITS APT	POP.	PEAK FACT.	PEAK FLOW	AREA	AREA	AREA	AREA	AREA	PEAK FLOW	TOTAL AREA	INFILT. FLOW	FLOW
			(ha)						(L/s)	(ha)	(ha)	(ha)	(ha)	(ha)	(L/s)	(ha)	(L/s)	(L/s)
R64A, EXT-1	64	63	0.17	0	0	0	0	3.10	0.0	13.19	0.00	0.00	1.04	1.28	2.8	15.68	8.6	11.4
R58A	58	57	0.36	0	8	0	22	3.03	0.2	0.00	0.00	0.00	0.00	0.00	0.0	0.36	0.2	0.3
I57B, R57A	57	56	0.51	0	15	0	41	3.00	0.3	0.00	0.00	0.00	2.95	0.00	0.6	3.46	1.9	2.8
R62A	62	61	0.17	0	5	0	14	3.04	0.1	0.00	0.00	0.00	0.00	0.00	0.0	0.17	0.1	0.2
R61A	61	60	0.17	0	3	0	8	3.05	0.1	0.00	0.00	0.00	0.00	0.00	0.0	0.17	0.1	0.2
R60A	60	59	0.80	0	34	0	92	2.95	0.6	0.00	0.00	0.00	0.00	0.00	0.0	0.80	0.4	1.1
R56A	56	55	0.22	0	6	0	16	3.04	0.1	0.00	0.00	0.00	0.00	0.00	0.0	0.22	0.1	0.2
R65A	65	54	0.21	0	4	0	11	3.05	0.1	0.00	0.00	0.00	0.00	0.00	0.0	0.21	0.1	0.2
R54GA	54G	54F	0.80	12	16	0	84	2.96	0.6	0.00	0.00	0.00	0.00	0.00	0.0	0.80	0.4	1.0
R54FA	54F	54E	0.39	8	0	0	27	3.02	0.2	0.00	0.00	0.00	0.00	0.00	0.0	0.39	0.2	0.4
R54DA	54D	54C	0.40	0	10	0	27	3.02	0.2	0.00	0.00	0.00	0.00	0.00	0.0	0.40	0.2	0.4
R54BA	54B	54A	0.60	0	23	0	62	2.98	0.4	0.00	0.00	0.00	0.00	0.00	0.0	0.60	0.3	0.8
R54AA	54A	54	0.54	0	19	0	51	2.99	0.4	0.00	0.00	0.00	0.00	0.00	0.0	0.54	0.3	0.7
R51A	51	50	0.18	0	4	0	11	3.05	0.1	0.00	0.00	0.00	0.00	0.00	0.0	0.18	0.1	0.2
R50A	50	49	0.19	0	5	0	14	3.04	0.1	0.00	0.00	0.00	0.00	0.00	0.0	0.19	0.1	0.2
R49A	49	48	0.08	0	0	0	0	3.10	0.0	0.00	0.00	0.00	0.00	0.00	0.0	0.08	0.0	0.0
R48A	48	47	0.59	0	7	0	19	3.03	0.1	0.00	0.00	0.00	0.00	0.00	0.0	0.59	0.3	0.5
R47A	47	46	0.66	0	11	0	30	3.01	0.2	0.00	0.00	0.00	0.00	0.00	0.0	0.66	0.4	0.6
R46A	46	45	0.22	0	4	0	11	3.05	0.1	0.00	0.00	0.00	0.00	0.00	0.0	0.22	0.1	0.2
R45A	45	44	0.33	0	10	0	27	3.02	0.2	0.00	0.00	0.00	0.00	0.00	0.0	0.33	0.2	0.4
R44A, R44B[7]	44	43	3.07	0	263	0	710	2.73	4.5	0.00	0.00	0.00	0.00	0.00	0.0	3.07	1.7	6.2
R43A	43	42	0.09	0	2	0	5	3.06	0.0	0.00	0.00	0.00	0.00	0.00	0.0	0.09	0.0	0.1
R42A	42	41	0.31	0	9	0	24	3.02	0.2	0.00	0.00	0.00	0.00	0.00	0.0	0.31	0.2	0.3
R41A, R41B	41	40	0.62	0	11	0	30	3.01	0.2	0.00	0.00	0.00	0.00	0.00	0.0	0.62	0.3	0.5
R40A	40	39	0.35	0	10	0	27	3.02	0.2	0.00	0.00	0.00	0.00	0.00	0.0	0.35	0.2	0.4
R39BA	39B	39A	0.49	0	13	0	35	3.01	0.2	0.00	0.00	0.00	0.00	0.00	0.0	0.49	0.3	0.5
R38A	38	37	0.08	0	2	0	5	3.06	0.0	0.00	0.00	0.00	0.00	0.00	0.0	0.08	0.0	0.1
R37A	37	36	0.78	0	26	0	70	2.97	0.5	0.00	0.00	0.00	0.00	0.00	0.0	0.78	0.4	0.9
R36A	36	35	0.63	0	21	0	57	2.98	0.4	0.00	0.00	0.00	0.00	0.00	0.0	0.63	0.3	0.7
R70A	70	69	0.28	5	0	0	17	3.03	0.1	0.00	0.00	0.00	0.00	0.00	0.0	0.28	0.2	0.3
R69A	69	68	0.10	2	0	0	7	3.06	0.0	0.00	0.00	0.00	0.00	0.00	0.0	0.10	0.1	0.1
R68A, R68B[7]	68	67	1.69	7	122	0	353	2.83	2.3	0.00	0.00	0.00	0.00	0.00	0.0	1.69	0.9	3.2
R67A, G67A	67	66	0.53	10	0	0	34	3.01	0.2	0.00	0.00	0.00	0.00	0.97	0.0	1.50	0.8	1.1
R66A	66	21	0.13	1	0	0	3	3.07	0.0	0.00	0.00	0.00	0.00	0.00	0.0	0.13	0.1	0.1
R21A	21	20	0.31	0	8	0	22	3.03	0.2	0.00	0.00	0.00	0.00	0.00	0.0	0.31	0.2	0.3
APPROVED FIRST REGISTRATION PHASE																		
R8A	*8*	*7*	*0.42*	*0*	*14*	*0*	*38*	3.00	0.3	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	0.0	*0.42*	0.2	0.5
R13A	*13*	*12*	*0.28*	*0*	*5*	*0*	*14*	3.04	0.1	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	0.0	*0.28*	0.2	0.2
R12A	*12*	*11*	*0.10*	*0*	*1*	*0*	*3*	3.07	0.0	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	0.0	*0.10*	0.1	*0.1*
R11A	*11*	*10*	*0.58*	*0*	*24*	*0*	*65*	2.97	0.4	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	0.0	*0.58*	0.3	*0.8*
R10A	*10*	*9*	*0.22*	*0*	*4*	*0*	*11*	3.05	0.1	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	0.0	*0.22*	0.1	*0.2*
R9A	*9*	*7*	*0.19*	*0*	*6*	*0*	*16*	3.04	0.1	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	0.0	*0.19*	0.1	*0.2*
G7A, R7A	*7*	*6*	*0.45*	*0*	*12*	*0*	*32*	3.01	0.2	*0.00*	*0.00*	*0.00*	*0.00*	*0.49*	0.0	*0.93*	0.5	*0.7*
R6A	*6*	*5*	*0.03*	*0*	*0*	*0*	*0*	3.10	0.0	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	0.0	*0.03*	0.0	*0.0*
R5A	*5*	*4*	*0.25*	*0*	*6*	*0*	*16*	3.04	0.1	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	0.0	*0.25*	0.1	*0.3*
R4A, R4B[7]	*4*	*3*	*0.94*	*0*	*5*	*0*	*90*	2.95	0.6	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	0.0	*0.94*	0.5	*1.1*
R33A	*33*	*30*	*0.41*	*0*	*16*	*0*	*43*	3.00	0.3	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	0.0	*0.41*	0.2	*0.5*
R30A	*30*	*27*	*0.42*	*0*	*17*	*0*	*46*	2.99	0.3	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	0.0	*0.42*	0.2	*0.5*
R27A	*27*	*22*	*0.20*	*0*	*5*	*0*	*14*	3.04	0.1	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	0.0	*0.20*	0.1	*0.2*
R26A	*26*	*25*	*0.50*	*0*	*21*	*0*	*57*	2.98	0.4	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	0.0	*0.50*	0.3	*0.7*
R25A	*25*	*24*	*0.32*	*0*	*11*	*0*	*30*	3.01	0.2	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	0.0	*0.32*	0.2	*0.4*
R24A	*24*	*23*	*0.15*	*0*	*3*	*0*	*8*	3.05	0.1	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	0.0	*0.15*	0.1	*0.1*
R23A	*23*	*22*	*0.19*	*0*	*5*	*0*	*14*	3.04	0.1	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	0.0	*0.19*	0.1	*0.2*
R22BA	*22B*	*22A*	*0.71*	*0*	*35*	*0*	*95*	2.95	0.6	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	0.0	*0.71*	0.4	*1.0*
R22AA	*22A*	*22*	*0.02*	*0*	*0*	*0*	*0*	3.10	0.0	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	0.0	*0.02*	0.0	*0.0*
R22A	*22*	*3*	*0.16*	*0*	*0*	*0*	*0*	3.10	0.0	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	0.0	*0.16*	0.1	*0.1*
R32A	*32*	*31*	*0.82*	*0*	*27*	*0*	*73*	2.97	0.5	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	0.0	*0.82*	0.5	*1.0*
R31A	*31*	*20A*	*0.57*	*0*	*17*	*0*	*46*	2.99	0.3	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	0.0	*0.57*	0.3	*0.6*
R20A	*20*	*19*	*0.23*	*0*	*5*	*0*	*14*	3.04	0.1	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	0.0	*0.23*	0.1	*0.2*
R19A	*19*	*18*	*0.11*	*0*	*2*	*0*	*5*	3.06	0.0	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	0.0	*0.11*	0.1	*0.1*
R27B	*27*	*18A*	*0.65*	*0*	*22*	*0*	*59*	2.98	0.4	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	0.0	*0.65*	0.4	*0.8*
R18AA	*18A*	*18B*	*0.58*	*0*	*18*	*0*	*49*	2.99	0.3	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	0.0	*0.58*	0.3	*0.7*
R17BA	*17B*	*17A*	*0.33*	*0*	*8*	*0*	*22*	3.03	0.2	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	0.0	*0.33*	0.2	*0.3*
R17A	*17*	*16*	*0.02*	*0*	*0*	*0*	*0*	3.10	0.0	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	0.0	*0.02*	0.0	*0.0*
C14B	*14*	*3*	*0.00*	*0*	*0*	*0*	*0*	3.10	0.0	*1.47*	*0.00*	*0.00*	*0.00*	*0.00*	0.3	*1.47*	0.8	*1.1*

R3CA	*3C*	*3B*	*0.45*	*0*	*10*	*0*	*27*	3.02	0.2	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	0.0	*0.45*	0.2	*0.4*
R3BA	*3B*	*3A*	*0.50*	*0*	*14*	*0*	*38*	3.00	0.3	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	0.0	*0.50*	0.3	*0.5*
R3A	*3*	*2*	*0.16*	*0*	*0*	*0*	*0*	3.10	0.0	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	0.0	*0.16*	0.1	*0.1*
R2A	*2*	*1A*	*0.14*	*0*	*0*	*0*	*0*	3.10	0.0	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	0.0	*0.14*	0.1	*0.1*
Stittsville Trunk[1]	1A	1B	526.60	0	0	0	28031	2.00	129.8	76.00	40.50	0.00	0.00	0.00	19.6	643.10	353.7	*503.1*
Stittsville Interceptor (Kizell Lands)	1A	1B	52.56	0	0	0	3585	2.43	20.1	11.82	0.00	0.00	0.00	0.00	2.3	64.38	35.4	57.9
Huntmar and Hazeldean[2]	1A	1B	111.52	0	0	0	6357	2.29	33.7	65.44	0.00	0.00	0.00	0.00	12.9	191.09	105.1	151.6
Additional Hazeldean[6]	1A	1B	13.62	0	0	0	296	2.85	2.0	5.39	0.00	0.00	0.00	0.00	1.1	19.01	10.5	13.5
Mattamy Maple Grove Sewer	1A	1B	137.54	0	0	0	10501	2.16	52.5	0.00	0.00	0.00	0.00	0.00	0.0	137.54	75.6	128.2
Maple Grove Expansion[3]	1A	1B	84.43	657	409	117	3549	2.43	19.9	0.00	0.00	0.00	0.00	0.00	0.0	75.99	41.8	61.9
Future Noth south collector[4]	1B	1C	28.44	0	0	0	4936	2.35	26.9	165.28	0.00	0.00	0.00	0.00	32.5	193.72	106.5	195.9
North of Richcraft Kanata Site[5]	1B	1C	1.10	0	42	0	113	2.94	0.8	0.00	0.00	0.00	0.00	0.00	0.0	1.10	0.6	1.4
															72.09			**1163.80**

1. Stittsville trunk sewer rare peak flows equal approximately 503 L/s, while design peak flows of 583L/s were obtained by JL Richards.
2. Population and areas as obtained from Huntmar/Hazeldean Design Sheet based on KWMSS assumptions for areas 16, 20, 17, 21, 19A, 23, 24 and 19
3. Maple Grove expansion number of units and gross area based on spreadsheet provided by the City, with 90% of gross area contributing to I/I and 198 amployees generating 83L/emp/day added to total flow
4. Future north-south collector population and are estimates based on IBI spreadsheet provided by the City. It includes a 30L/s fixed flow
5. Future medium density residential area, assumed to have 38 units/ha and 2.7person/unit
6. Additional area from existing residential and commercial developments along Hazeldean between Hartin Street and Savage Drive were included in Novemenr 2017 (see Atrel correspondence)
7. In the 1st registration a unit density of 38 units/ha was used for the medium density residential block (R4B). Based on a revised concept plan for R44B the unit density for the 2nd registration was revised to approximately 93 units/hectare. This unit density was used for both medium density residential blocks (R44B and R68B).

CATASTROPHOC FAILURE OF KWPS ASSUMING

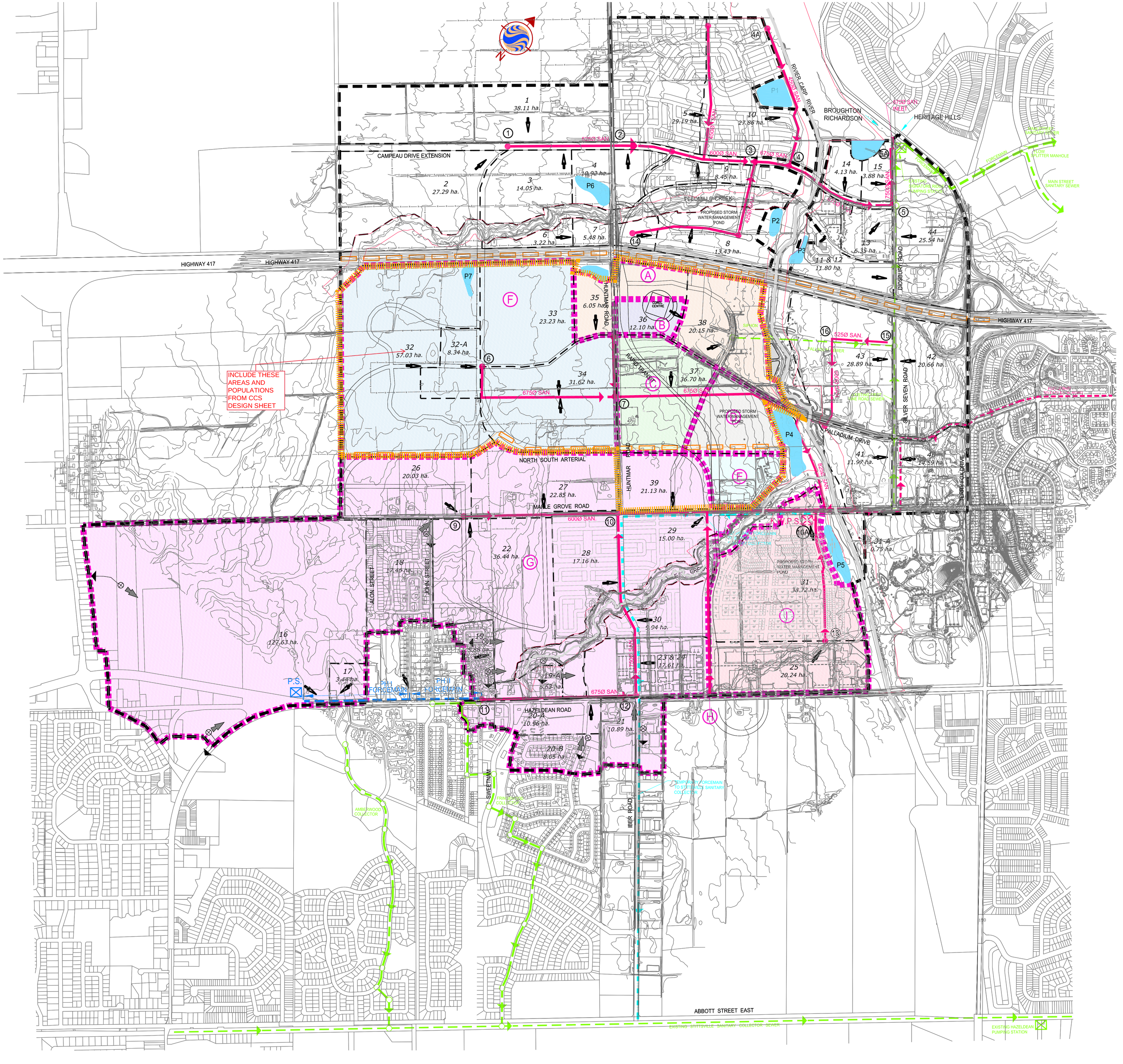
			BC= 95.20 Stittsville= 583 L/s **Scenario 1**		BC= 95.20 Stittsville= 360 L/s **Scenario 2**		BC= 95.20 Stittsville= 465 L/s **Scenario 3**		BC= 95.06 Stittsville= 583 L/s **Scenario 4**	
San MH	Rim Elev.	Prop. USF (m)	HGL (m)	USF-HGL CLEARANCE	HGL (m)	USF-HGL CLEARANCE	HGL (m)	USF-HGL CLEARANCE	HGL (m)	USF-HGL CLEARANCE
1A	96.22	N/A	95.35	-	95.29	-	95.32	-	95.21	-
1B	96.60	N/A	95.31	-	95.27	-	95.29	-	95.17	-
1C	95.30	N/A	95.24	-	95.22	-	95.23	-	95.1	-
2	97.46	N/A	95.37	-	95.31	-	95.33	-	95.23	-
3	97.89	95.79	95.40	0.39	95.34	0.45	95.37	0.42	95.26	0.53
4	98.19	96.40	95.41	0.99	95.34	1.06	95.37	1.03	95.27	1.13
5	98.63	96.68	95.43	1.25	95.43	1.25	95.43	1.25	95.43	1.25
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	97.18	0.51	97.18	0.51	97.18	0.51	97.18	0.51
9	99.23	97.44	96.21	1.23	96.21	1.23	96.21	1.23	96.21	1.23
10	99.43	97.51	96.32	1.19	96.32	1.19	96.32	1.19	96.32	1.19
11	100.75	97.69	96.90	0.79	96.9	0.79	96.9	0.79	96.9	0.79
12	100.60	98.46	97.04	1.42	97.04	1.42	97.04	1.42	97.04	1.42
13	100.23	98.46	97.30	1.16	97.3	1.16	97.3	1.16	97.3	1.16
3A	97.75	95.79	95.40	0.39	95.34	0.45	95.37	0.42	95.26	0.53
3B	97.66	95.74	95.40	0.34	95.34	0.40	95.37	0.37	95.26	0.48
3C	97.53	95.74	95.40	0.34	95.34	0.40	95.37	0.37	95.26	0.48
14	97.61	N/A	95.42	-	95.36	-	95.39	-	95.28	-
16	97.35	95.74	95.43	0.31	95.37	0.37	95.4	0.34	95.29	0.45
17	97.29	N/A	95.43	-	95.37	-	95.4	-	95.29	-
17A	97.32	95.68	95.43	0.25	95.37	0.31	95.4	0.28	95.29	0.39
17B	97.37	95.68	95.43	0.25	95.37	0.31	95.4	0.28	95.29	0.39
18	97.17	95.63	95.44	0.19	95.38	0.25	95.41	0.22	95.3	0.33
18A	97.65	95.69	95.44	0.25	95.38	0.31	95.4	0.29	95.3	0.39
18B	97.09	95.63	95.44	0.19	95.38	0.25	95.41	0.22	95.3	0.33
19	97.43	95.63	95.45	0.18	95.39	0.24	95.41	0.22	95.31	0.32
20	97.50	95.63	95.47	0.16	95.41	0.22	95.43	0.20	95.33	0.30
20A	97.37	95.63	95.47	0.16	95.41	0.22	95.43	0.20	95.33	0.30
21	97.48	95.60	95.47	0.13	95.41	0.19	95.44	0.16	95.33	0.27
22	97.96	96.15	95.42	0.73	95.36	0.79	95.39	0.76	95.28	0.87
22A	97.83	96.10	95.42	0.68	95.36	0.74	95.39	0.71	95.28	0.82
22B	97.81	96.10	95.42	0.68	95.36	0.74	95.39	0.71	95.28	0.82
23	98.10	96.54	95.42	1.12	95.36	1.18	95.39	1.15	95.28	1.26
24	98.05	96.30	95.42	0.88	95.36	0.94	95.39	0.91	95.28	1.02
25	98.00	96.30	95.42	0.88	95.36	0.94	95.39	0.91	95.28	1.02
26	98.10	96.34	95.42	0.92	95.36	0.98	95.39	0.95	95.28	1.06
27	97.92	95.79	95.43	0.36	95.37	0.42	95.4	0.39	95.29	0.50
30	98.01	95.90	95.43	0.47	95.37	0.53	95.4	0.50	95.29	0.61
31	97.52	95.77	95.47	0.30	95.41	0.36	95.43	0.34	95.33	0.44
32	97.68	95.90	95.47	0.43	95.41	0.49	95.43	0.47	95.33	0.57
33	97.62	96.00	95.43	0.57	95.37	0.63	95.4	0.60	95.29	0.71
35	97.97	96.59	95.45	1.14	95.39	1.20	95.42	1.17	95.31	1.28
35A	97.94	N/A	95.44	-	95.38	-	95.4	-	95.3	-
36	98.67	96.59	95.73	0.86	95.73	0.86	95.73	0.86	95.73	0.86
37	99.34	97.17	96.39	0.78	96.39	0.78	96.39	0.78	96.39	0.78

38	99.55	97.79	96.57	1.22	96.57	1.22	96.57	1.22	96.57	1.22
39	98.03	96.34	95.51	0.83	95.45	0.89	95.47	0.87	95.37	0.97
39A	97.97	96.21	95.51	0.70	95.45	0.76	95.47	0.74	95.37	0.84
39B	98.01	96.21	95.51	0.70	95.45	0.76	95.47	0.74	95.37	0.84
40	98.10	96.34	95.56	0.78	95.5	0.84	95.53	0.81	95.42	0.92
41	98.38	96.40	95.60	0.80	95.54	0.86	95.57	0.83	95.46	0.94
42	99.25	97.19	95.65	1.54	95.59	1.60	95.61	1.58	95.51	1.68
43	99.19	97.65	95.66	1.99	95.6	2.05	95.62	2.03	95.52	2.13
44	99.66	97.65	95.69	1.96	95.63	2.02	95.65	2.00	95.61	2.04
45	100.26	98.59	95.98	2.61	95.98	2.61	95.98	2.61	95.98	2.61
46	100.27	98.29	96.06	2.23	96.06	2.23	96.06	2.23	96.06	2.23
47	100.49	98.29	96.41	1.88	96.41	1.88	96.41	1.88	96.41	1.88
48	100.58	98.55	96.76	1.79	96.76	1.79	96.76	1.79	96.76	1.79
49	100.57	98.55	96.83	1.72	96.83	1.72	96.83	1.72	96.83	1.72
50	100.41	98.46	97.09	1.37	97.09	1.37	97.09	1.37	97.09	1.37
51	100.21	98.46	97.37	1.09	97.37	1.09	97.37	1.09	97.37	1.09
52	97.61	N/A	95.46	-	95.4	-	95.42	-	95.32	-
53	97.65	N/A	95.46	-	95.4	-	95.43	-	95.32	-
54	97.63	95.76	95.47	0.29	95.41	0.35	95.43	0.33	95.33	0.43
54A	97.67	95.76	95.47	0.29	95.41	0.35	95.43	0.33	95.33	0.43
54B	97.70	95.76	95.47	0.29	95.41	0.35	95.43	0.33	95.33	0.43
54C	97.66	95.93	95.47	0.46	95.41	0.52	95.43	0.50	95.33	0.60
54D	97.69	95.93	95.47	0.46	95.41	0.52	95.43	0.50	95.33	0.60
55	98.09	N/A	95.47	-	95.41	-	95.44	-	95.33	-
54E	97.54	95.86	95.47	0.39	95.41	0.45	95.43	0.43	95.33	0.53
54F	98.10	95.91	95.47	0.44	95.41	0.50	95.43	0.48	95.33	0.58
54G	98.17	95.91	95.50	0.41	95.5	0.41	95.5	0.41	95.5	0.41
56	98.16	96.19	95.48	0.71	95.42	0.77	95.44	0.75	95.34	0.85
57	98.13	96.20	95.48	0.72	95.42	0.78	95.45	0.75	95.34	0.86
58	98.24	96.20	95.55	0.65	95.55	0.65	95.55	0.65	95.55	0.65
59	97.99	96.14	95.48	0.66	95.42	0.72	95.44	0.70	95.34	0.80
60	98.23	96.14	95.48	0.66	95.42	0.72	95.44	0.70	95.34	0.80
61	98.13	96.39	95.48	0.91	95.42	0.97	95.44	0.95	95.34	1.05
62	97.95	96.59	95.48	1.11	95.42	1.17	95.44	1.15	95.34	1.25
63	98.15	N/A	95.48	-	95.42	-	95.44	-	95.34	-
64	97.29	N/A	95.48	-	95.42	-	95.45	-	95.34	-
65	97.56	95.76	95.47	0.29	95.41	0.35	95.43	0.33	95.33	0.43
66	97.47	95.60	95.48	0.12	95.42	0.18	95.45	0.15	95.34	0.26
67	97.58	95.60	95.50	0.10	95.44	0.16	95.46	0.14	95.36	0.24
68	97.49	95.87	95.50	0.37	95.44	0.43	95.47	0.40	95.36	0.51
69	97.56	95.90	95.50	0.40	95.44	0.46	95.47	0.43	95.36	0.54
70	97.95	95.90	95.50	0.40	95.44	0.46	95.47	0.43	95.36	0.54

KWPS UNDER NORMAL OPERATING CONDITIONS - RARE EVENT FLOW PARAMETERS				
San MH	Rim Elev.	Prop. USF (m)	HGL (m)	USF-HGL CLEARANCE
1A	96.22	N/A	88.79	-
1B	96.60	N/A	88.62	-
1C	95.30	N/A	87.66	-
2	97.46	N/A	89.01	-
3	97.89	95.79	91.12	4.67
4	98.19	96.40	94.10	2.30
5	98.63	96.68	95.44	1.24
6	98.67	96.99	95.53	1.46
7	99.11	96.99	96.02	0.97
8	100.21	97.69	97.18	0.51
9	99.23	97.44	96.22	1.22
10	99.43	97.51	96.33	1.18
11	100.75	97.69	96.90	0.79
12	100.60	98.46	97.04	1.42
13	100.23	98.46	97.30	1.16
3A	97.75	95.79	94.19	1.60
3B	97.66	95.74	94.57	1.17
3C	97.53	95.74	94.85	0.89
14	97.61	N/A	92.54	-
16	97.35	95.74	92.88	2.86
17	97.29	N/A	92.96	-
17A	97.32	95.68	94.32	1.36
17B	97.37	95.68	94.68	1.00
18	97.17	95.63	93.19	2.44
18A	97.65	95.69	93.57	2.12
18B	97.09	95.63	93.19	2.44
19	97.43	95.63	93.30	2.33
20	97.50	95.63	93.52	2.11
20A	97.37	95.63	94.01	1.62
21	97.48	95.60	93.70	1.90
22	97.96	96.15	91.18	4.97
22A	97.83	96.10	94.33	1.77
22B	97.81	96.10	94.87	1.23
23	98.10	96.54	94.40	2.14
24	98.05	96.30	94.47	1.83
25	98.00	96.30	94.69	1.61
26	98.10	96.34	95.01	1.33
27	97.92	95.79	93.88	1.91
30	98.01	95.90	94.30	1.60
31	97.52	95.77	94.45	1.32
32	97.68	95.90	94.85	1.05
33	97.62	96.00	94.62	1.38

35	97.97	96.59	91.43	5.16
35A	97.94	N/A	91.29	-
36	98.67	96.59	95.73	0.86
37	99.34	97.17	96.39	0.78
38	99.55	97.79	96.57	1.22
39	98.03	96.34	93.67	2.67
39A	97.97	96.21	94.43	1.78
39B	98.01	96.21	94.69	1.52
40	98.10	96.34	93.94	2.40
41	98.38	96.40	94.73	1.67
42	99.25	97.19	95.10	2.09
43	99.19	97.65	95.17	2.48
44	99.66	97.65	95.62	2.03
45	100.26	98.59	95.98	2.61
46	100.27	98.29	96.06	2.23
47	100.49	98.29	96.41	1.88
48	100.58	98.55	96.76	1.79
49	100.57	98.55	96.83	1.72
50	100.41	98.46	97.09	1.37
51	100.21	98.46	97.37	1.09
52	97.61	N/A	91.65	-
53	97.65	N/A	91.74	-
54	97.63	95.76	91.84	3.92
54A	97.67	95.76	94.00	1.76
54B	97.70	95.76	94.27	1.49
54C	97.66	95.93	94.54	1.39
54D	97.69	95.93	95.08	0.85
55	98.09	N/A	92.02	-
54E	97.54	95.86	94.79	1.07
54F	98.10	95.91	95.08	0.83
54G	98.17	95.91	95.50	0.41
56	98.16	96.19	92.71	3.48
57	98.13	96.20	95.18	1.02
58	98.24	96.20	95.56	0.64
59	97.99	96.14	92.78	3.36
60	98.23	96.14	94.58	1.56
61	98.13	96.39	94.66	1.73
62	97.95	96.59	94.88	1.71
63	98.15	N/A	92.23	-
64	97.29	N/A	92.40	-
65	97.56	95.76	94.88	0.88
66	97.47	95.60	94.05	1.55
67	97.58	95.60	94.40	1.20
68	97.49	95.87	94.67	1.20
69	97.56	95.90	94.70	1.20
70	97.95	95.90	94.93	0.97

Appendix C3: Sanitary HGL Background



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1770 WOODWARD DR., OTTAWA (613)225-1311

Legend

- ULTIMATE MAJOR DRAINAGE LIMIT
- SUBCATCHMENT AREAS
- PROPOSED TRUNK SEWER
- PROPOSED FORCEMAIN
- TEMPORARY FORCEMAIN
- PROPOSED STITTSVILLE PUMPING STATION AND FORCEMAIN
- EXISTING TRUNK SEWER
- MAJOR DRAINAGE SPLIT
- (1) NODES
- EXISTING PUMPING STATION AND FORCEMAIN (TO BE DECOMMISSIONED)
- 44 / 25.54 ha. INPUT POINT AND AREA IN HECTARES
- EXISTING PUMPING STATION GRAVITY OUTLET

4	REVISED TRUNK SEWER FROM 16 TO KWPS	R.W.W.	R.W.W.	05-10-05
3	ARROWS FOR EXIST. PUMP STATIONS ADDED	R.W.W.	R.W.W.	05-08-09
2	REPORT JUNE 2005	R.W.W.	R.W.W.	05-06-07
1	REPORT APR. 2005	R.W.W.	R.W.W.	05-04-20
Revision		By	Appd.	Date

File Name:

Dsn. Chkd. Dsgn. Date

Seals

Client/Project

Kanata West Concept Plan
Master Servicing Study

Ottawa, Ontario

Title

Preferred Waste-Water Option

Project No. 60400378

Scale 1:7500 (0, 75, 225, 375m)

Drawing No. S-I

Sheet 1 of 1

Revision 4

J:\60400-mf\ent\Geotechnical\Kanata West Concept Plan\Drawings\Working\KWCP-Master Servicing Study\Kanata West Concept Plan Master Servicing Study_S-I-Layout1.dwg
Layout: Layout1 Model
Last Saved By: Bill Taylor Jul 27, 2018 - 11:49am

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SANITARY SEWER DESIGN SHEET
N-S INTERCEPTOR SEWER
Kanata West Serviceability Study
CITY OF OTTAWA

3.4 P/P/U

3.4 P/P/U

LOCATION				ICI AREAS																INFILTRATION ALLOWANCE			FIXED FLOW	TOTAL FLOW	PROPOSED SEWER DESIGN						
				Area - Denisty (units/Ha)				AREA w/o Units (Ha)	POPULATION		PEAK FACTOR	PEAK FLOW (L/s)	COMMERCIAL AREA (Ha)								PEAK FLOW (L/s)	AREA (Ha)		FLOW			CAPACITY	LENGTH	DIA	SLOPE	VELOCITY (full)	AVAILABLE CAPACITY	
													14,400 l/Ha/d		30,000 l/Ha/d		35,000 l/Ha/d		50,000 l/Ha/d													
STREET	AREA ID	FROM MH	TO MH	19	30	50	75		IND	CUM			IND	CUM	IND	CUM	IND	CUM	IND	CUM		IND	CUM	(L/s)	(L/s)	(L/s)	(L/s)	(m)	(mm)	(%)	(m/s)	L/s	(%)
		MH100	MH101					0.00	0.0	0.0	4.00	0.00		0.00		0.00		0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	81.80	89.95	375	0.20	0.717	81.80	100.00%
Cyclone Taylor	A (35, 36A, 38)	MH101	MH102					0.00	0.0	0.0	4.00	0.00	20.15	20.15	6.05	6.05		0.00		0.00	8.19	26.20	26.20	7.34	15.00	30.52	81.80	64.98	375	0.20	0.717	51.28	62.68%
Cyclone Taylor		MH102	MH103					0.00	0.0	0.0	4.00	0.00		20.15		6.05		0.00		0.00	8.19	0.00	26.20	7.34	15.00	30.52	81.80	68.32	375	0.20	0.717	51.28	62.68%
Cyclone Taylor		MH103	MH104					0.00	0.0	0.0	4.00	0.00		20.15		6.05		0.00		0.00	8.19	0.00	26.20	7.34	15.00	30.52	81.80	109.53	375	0.20	0.717	51.28	62.68%
future road	B (36B)	MH104	MH105					0.00	0.0	0.0	4.00	0.00		20.15		6.05		0.00		0.00	8.19	0.00	26.20	7.34	30.00	45.52	81.80	90.64	375	0.20	0.717	36.28	44.35%
future road		MH105	MH106					0.00	0.0	0.0	4.00	0.00		20.15		6.05		0.00		0.00	8.19	0.00	26.20	7.34	30.00	45.52	81.80	58.31	375	0.20	0.717	36.28	44.35%
future road	C (37A)		MH106		9.36			9.36	954.7	954.7	3.81	14.75		0.00		0.00		0.00	12.60	12.60	10.94	21.96	21.96	6.15	0.00	31.83	39.07	25.00	300	0.15	0.535	7.24	18.53%
future road	D (37B)	MH106	MH107			6.24		6.24	1060.8	2015.5	3.58	29.26		20.15		6.05		0.00	8.50	21.10	26.50	14.74	62.90	17.61	30.00	103.37	339.63	94.22	675	0.15	0.919	236.26	69.56%
future road		MH107	MH108					0.00	0.0	2015.5	3.58	29.26		20.15		6.05		0.00		21.10	26.50	0.00	62.90	17.61	30.00	103.37	339.63	94.00	675	0.15	0.919	236.26	69.56%
future road		MH108	MH109					0.00	0.0	2015.5	3.58	29.26		20.15		6.05		0.00		21.10	26.50	0.00	62.90	17.61	30.00	103.37	339.63	94.00	675	0.15	0.919	236.26	69.56%
future road	E (39B)	MH109	MH110			4.50		4.50	765.0	2780.5	3.47	39.09		20.15		6.05	6.10	6.10		21.10	30.21	10.60	73.50	20.58	30.00	119.88	438.47	108.21	675	0.25	1.187	318.59	72.66%
future road		MH110	MH111					0.00	0.0	2780.5	3.47	39.09		20.15		6.05		6.10		21.10	30.21	0.00	73.50	20.58	30.00	119.88	438.47	107.00	675	0.25	1.187	318.59	72.66%
future road		MH111	MH112					0.00	0.0	2780.5	3.47	39.09		20.15		6.05		6.10		21.10	30.21	0.00	73.50	20.58	30.00	119.88	438.47	107.00	675	0.25	1.187	318.59	72.66%
future road		MH112	MH (53)					0.00	0.0	2780.5	3.47	39.09		20.15		6.05		6.10		21.10	30.21	0.00	73.50	20.58	30.00	119.88	438.47	107.00	675	0.25	1.187	318.59	72.66%
			MH200					0.00	0.0	0.0	4.00	0.00		0.00		0.00		0.00	111.88	111.88	97.12	120.22	120.22	33.66	0.00	130.78	620.09	113.49	675	0.50	1.679	489.31	78.91%
Huntmar	F (32, 32A, 33, 34)	MH200	MH201					0.00	0.0	0.0	4.00	0.00		0.00		0.00		0.00		111.88	97.12	0.00	120.22	33.66	0.00	130.78	480.32	82.00	675	0.30	1.300	349.54	72.77%
Huntmar		MH201	MH202					0.00	0.0	0.0	4.00	0.00		0.00		0.00		0.00		111.88	97.12	0.00	120.22	33.66	0.00	130.78	480.32	85.00	675	0.30	1.300	349.54	72.77%
Huntmar		MH202	MH203					0.00	0.0	0.0	4.00	0.00		0.00		0.00		0.00		111.88	97.12	0.00	120.22	33.66	0.00	130.78	480.32	85.00	675	0.30	1.300	349.54	72.77%
North South Arterial		MH203	MH204					0.00	0.0	0.0	4.00	0.00		0.00		0.00		0.00		111.88	97.12	0.00	120.22	33.66	0.00	130.78	392.18	105.00	675	0.20	1.062	261.40	66.65%
North South Arterial		MH204	MH205					0.00	0.0	0.0	4.00	0.00		0.00		0.00		0.00		111.88	97.12	0.00	120.22	33.66	0.00	130.78	392.18	105.00	675	0.20	1.062	261.40	66.65%
North South Arterial		MH205	MH206					0.00	0.0	0.0	4.00	0.00		0.00		0.00		0.00		111.88	97.12	0.00	120.22	33.66	0.00	130.78	392.18	120.00	675	0.20	1.062	261.40	66.65%
North South Arterial		MH206	MH207					0.00	0.0	0.0	4.00	0.00		0.00		0.00		0.00		111.88	97.12	0.00	120.22	33.66	0.00	130.78	392.18	120.00	675	0.20	1.062	261.40	66.65%
North South Arterial		MH207	MH208					0.00	0.0	0.0	4.00	0.00		0.00		0.00		0.00		111.88	97.12	0.00	120.22	33.66	0.00	130.78	392.18	100.00	675	0.20	1.062	261.40	66.65%
North South Arterial		MH208	MH (55)					0.00	0.0	0.0	4.00	0.00		0.00		0.00		0.00		111.88	97.12	0.00	120.22	33.66	0.00	130.78	392.18	120.00	675	0.20	1.062	261.40	66.65%
Maple Grove	G (16-24, 26-30, 39A)	MH (54)	MH (55)	128.98	121.42	4.50	0.00	254.90	21481.9	21481.9	2.62	228.11		0.00		0.00	27.15	27.15	44.39	44.39	55.03	340.57	340.57	95.36	0.00	378.50	935.19	150.35	825	0.39	1.695	556.69	59.53%
Maple Grove		MH (55)	MH (5					0.00	0.0	21481.9	2.62	228.11		0.00		0.00		27.15		156.27	152.15	0.00	460.79	129.02	0.00	509.28	923.12	49.59	825	0.38	1.673	413.84	44.83%
Maple Grove		MH (56)	MH (5					0.00	0.0	21481.9	2.62	228.11		0.00		0.00		27.15		156.27	152.15	0.00	460.79	129.02	0.00	509.28	947.10	179.66	825	0.40	1.716	437.82	46.23%
Maple Grove		MH (52)	MH (5					0.00	0.0	21481.9	2.62	228.11		0.00		0.00		27.15		156.27	152.15	0.00	460.79	129.02	0.00	509.28	2,336.49	7.26	1200	0.33	2.001	1827.20	78.20%
Maple Grove		MH (53)	MH3-Stan					0.00	0.0	24262.5	2.57	252.45		20.15		6.05		33.25		177.37	182.36	0.00	534.29	149.60		584.41	2,264.58	26.22	1200	0.31	1.940	1680.17	74.19%
Fixed Flow from Fernbank Collector 800 l/s per City of Ottawa																																	
North South Arterial	H	MH-JLR123A	MH-JLR124A					0.00	0.0	0.0	4.00	0.00		0.00		0.00		0.00		0.00	0.00	0.00	0.00	0.00	800.00	800.00	1,145.36	120.90	975	0.24	1.486	345.36	30.15%
North South Arterial		MH-JLR124A	MH-JLR125A					0.00	0.0	0.0	4.00	0.00		0.00		0.00		0.00		0.00	0.00	0.00	0.00	0.00	800.00	800.00	1,145.36	91.20	975	0.24	1.486	345.36	30.15%
Maple Grove		MH-JLR125A	MH-JLR126A					0.00	0.0	0.0	4.00	0.00		0.00		0.00		0.00		0.00	0.00	0.00	0.00	0.00	800.00	800.00	1,145.36	86.20	975	0.24	1.486	345.36	30.15%
Maple Grove		MH-JLR126A	MH3-Stan					0.00	0.0	0.0	4.00	0.00		0.00		0.00		0.00		0.00	0.00	0.00	0.00	0.00	800.00	800.00	1,422.12	149.69	975	0.37	1.845	622.12	43.75%
Maple Grove		MH3-Stan	MH4-Stan					0.00	0.0	24262.5	2.57	252.45		20.15		6.05		33.25		177.37	182.36	0.00	534.29	149.60	830.00	1414.41	4,778.00	46.93	1200	1.38	4.093	3363.59	70.40%
Maple Grove		MH4-Stan	MH5-Stan					0.00	0.0	24262.5	2.57	252.45		20.15		6.05		33.25		177.37	182.36	0.00	534.29	149.60	830.00	1414.41	1,818.95	39.92	1200	0.20	1.558	404.55	22.24%
Street 1	I (25, 31)		MH5-Stan		38.72			38.72	3949.4	3949.4	3.34	53.41		0.00		0.00	20.24	20.24		0.00	12.30	58.96	58.96	16.51	0.00	82.22	148.72	47.15	450	0.25	0.906	66.50	44.72%
Maple Grove		MH5-Stan	MH6-Stan					0.00	0.0	28211.9	2.50	286.11		20.15		6.05		53.49		177.37	194.66	0.00	593.25	166.11	830.00	1476.88	1,626.92	97.58	1200	0.16	1.394	150.04	9.22%
Maple Grove		MH6-Stan	MH7-Stan					0.00	0.0	28211.9	2.50	286.11		20.15		6.05		53.49		177.37	194.66	0.00	593.25	166.11	830.00	1476.88	1,992.56	73.33	1200	0.24	1.707	515.68	25.88%
Maple Grove		MH7-Stan	KWPS					0.00	0.0	28211.9	2.50	286.11		20.15		6.05		53.49		177.37	194.66	0.00	593.25	166.11	830.00	1476.88	2,033.65	14.74	1200	0.25	1.742	556.77	27.38%

AREA 39=21.13ha TO BE INCLUDED ASSUME 30 UNITS/HA AND 3.4 P/P/U

2155 p assumed from are 39

fixed flow included in analysis

Design Parameters:

Residential

SF	3.4	p/p/u
TH/SD	2.7	p/p/u
APT	1.8	p/p/u
Other	60	p/p/Ha

ICI Areas

			Peak Factor
COM	14,400	L/Ha/day	1.5
COM	30,000	L/Ha/day	1.5
COM	35,000	L/Ha/day	MOE Chart
COM	50000	L/Ha/day	

0.013
350 L/day 300 L/day
0.28 L/s/Ha

Harmon Formula = 1+(14/(4+P^0.5))
where P = population in thousands

Designed: RM

Checked: DY

Dwg. Reference: 35001-501

No.	Revision	Date
1.	City submission No. 1	6/6/2016

File Reference: 35001.5.7.1 | **Date:** 6/6/2016 | **Sheet No:** 1 of 1

ATREL Engineering Ltd Ltée
Engineers - Ingénieurs
CIVIL MUNICIPAL ENVIRONMENTAL

November 29th, 2017

City of Ottawa
110 Laurier Av. West
Ottawa, (Ontario)
K1P 1J1

Attention: **Ms. Hasnaa Zaknoun, P.Eng M.sc.**
Senior Process Engineer-Wastewater Collection

Dear Madam,

Object: Hazeldean Sanitary Sewer Analysis
Our file No. 131003-4

This letter report provides clarifications with respect to the remaining capacity of the existing sanitary sewer system on Hazeldean Road, located between the Jackson Trails Pumping Station (JTPS) and Savage Drive. We have analyzed the sanitary sewer system using the current conditions with the JTPS pump flow at maximum capacity. We have also analyzed the sanitary system supposing that two pumping stations will be decommissioned in the near future. Sanitary sewer as-built information was obtained from drawings provided by the City which are included in Appendix C and were utilized to complete the study.

The criteria used in the analysis of the sanitary sewers are based on the Ministry of Environment and Climate Change (MOECC), the City of Ottawa design guidelines and current practices in Eastern Ontario.

- Residential average flow – 350 l/cd
- Commercial / institutional average flow – 50,000 l/ha/d
- Residential peaking factor – Harmon formula
- Commercial, Institutional peaking factor – 1.5
- Infiltration inflow – 0.28 l/s/ha

The sanitary drainage area is divided into several sub-basin areas in order to calculate the flow to the sewers. (See Drawing 131003-4-SAN1 in Appendix A)

The studied sanitary network presents a combination of both residential and commercial flows. Fixed flow inputs have been added to the system coming from three sanitary pumping stations. Once the Jackson Trails Pumping Station is upgraded, it will have a rated firm capacity of 120 L/s. The MOE Certificate of Approval for that sanitary pumping station is No.7921-6N7SEA. In addition, the pumping stations on Johnwood Street near Maple Grove Road and on Joseph Circle were shown to have a rated capacity of 21 L/s and 2 L/s, respectively (see E-mail correspondence with City of Ottawa in Appendix B).

The flow for the existing residential development was obtained using the Harmon Formula. The population density used was of 3.4 persons per unit for single dwellings as per the City of Ottawa Sewer Design Guidelines (OSDG) dated October 2012. The commercial flows were calculated using an average daily flow of 50,000 l/ha/day.

Table 1, in Appendix A, includes all three of the above mentioned pumped flows. It was determined that the existing 450 mm diameter sanitary sewer on Hazeldean Road between maintenance hole SA1 and maintenance hole SA2 is adequately sized to convey the peak design flow of 161.40 L/s. The sanitary sewer has a total capacity of 170.86 L/s and a remaining capacity of 5.5%, as per as-built conditions.

Secondly, we were informed by the City that in the future (likely 5 to 10 years from now), the sanitary pumping station on Johnwood St will be decommissioned and the flows will be redirected to Maple Grove; it is also intended to decommission the station on Joseph Circle to redirect the flows east towards the future Pool Creek Village sanitary sewer system (see E-mail correspondence with City of Ottawa in Appendix B). Table 2, in Appendix A, shows that the remaining capacity of the 450 mm pipe on Hazeldean Rd between maintenance hole SA1 and maintenance hole SA2 increases to 19.0% with a peak design flow of 138.40 L/s.

It was found that the capacity of the existing system on Hazeldean Road, between the Jackson Trails Pumping Station (JTPS) and Savage Drive has adequate capacity to convey the additional flow when the JTPS will be upgraded to 120 L/s. Furthermore, the sanitary sewer will have even more capacity once the Johnwood Street and the Joseph Circle pumping stations are decommissioned.

We trust the above letter is satisfactory.

Yours truly,

ATREL ENGINEERING LTD



André Sauvé, P.Eng.



c.c.: Mr. John Bougadis – City of Ottawa
Mr. Santhosh Kuruvilla – City of Ottawa
Mr. Domenic Idone – Minto Communities Inc.
Mr. Curtiss Scarlett – Minto Communities Inc.
Mr. Jean Décoeur – Atrel Engineering Ltd

APPENDIX A

(Prepared by Atrel Engineering Ltd)

Table 1 – Sanitary Sewer Computation Form (Current Conditions)
Table 2 – Sanitary Sewer Computation Form (Projecting Conditions)
131003-4-SAN1 – Hazeldean Road Sanitary Drainage Area Plan

SANITARY SEWER COMPUTATION FORM (Current Conditions)

Table 1

DATE: **November, 2017** | PROJECT: **Hazeldean Road** | q= 350 l/cap.day | Single dwelling= 3.4 person/unit

DESIGNED BY: VLL | CLIENT: Minto Communities Inc. | I= 0.28 l/ha.s

CHECKED BY: AGS | PROJECT #: 131003-4 | PVC/CONC N= 0.013

BY: ATREL ENGINEERING LTD | OTHER N= 0.024

STREET NAMES	LOCATION FROM (Up)		TO (Down)		RESIDENTIAL INDIVIDUAL AREA (ha.)	INDIVIDUAL POP.	CUMULATIVE AREA (ha.)	CUMULATIVE POP.	PEAKING FACTOR M	FLOW Q(p) (L/S)	COMMERCIAL , INSTITUTIONAL INDIVIDUAL AREA (ha.)	INDIVIDUAL POP.	CUMULATIVE AREA (ha.)	CUMULATIVE POP.	PEAKING FACTOR M	FLOW Q(p) (L/S)	PUMPED FLOW Ind. (L/S)	PUMPED FLOW Cum. (L/S)	PEAK EXT.FLOW Q(i) (L/S)	**PEAK DES. Q(d) (L/S)**	SEWER DATA TYPE PIPE	DIA. (N0M) (mm)	(ACT) (MM)	SLOPE (%)	LENGTH (M)	CAP. (L/S)	Remaining Capacity (%)	VEL. (M/S)	UpStream Obv. (M)	UpStream Inv. (M)	Forced drop (M)	DwnStream Obv. (M)	DwnStream Inv. (M)
Hazeldean Road	MH	3	MH	4													120.00	120.00		120.00	CONC	450	457.2	1.50	30.0	364.28	67%	2.22	114.25	113.80	0.01	113.80	113.35
Commercial	MH	50	MH	4							4.23	605.0	4.23	605	1.50	3.68			1.18	4.86	PVC	250	251.5	0.40	10.0	38.20	87%	0.77	113.89	113.64	0.06	113.85	113.60
Hazeldean Road	MH	4	MH	5									4.23	605	1.50	3.68		120.00	1.18	124.86	CONC	450	457.2	0.50	102.0	210.32	41%	1.28	113.79	113.34		113.28	112.83
Hazeldean Road	MH	5	MH	6									4.23	605	1.50	3.68		120.00	1.18	124.86	CONC	450	457.2	0.65	100.0	239.80	48%	1.46	113.28	112.83	0.01	112.63	112.18
Hazeldean Road	MH	6	MH	7									4.23	605	1.50	3.68		120.00	1.18	124.86	CONC	450	457.2	0.65	92.0	239.80	48%	1.46	112.62	112.17	0.04	112.02	111.57
Hazeldean Road	MH	7	MH	385									4.23	605	1.50	3.68		120.00	1.18	124.86	CONC	450	457.2	0.67	13.5	243.46	49%	1.48	111.98	111.53	1.78	111.89	111.44
Hartin Street	MH	54	MH	385	7.30	194.0	7.30	194	4.00	3.14	3.82	546.0	3.82	546	1.50	3.32			3.11	9.57	PVC	300	299.2										110.11	109.81
Hazeldean Road	MH	385	MH	SA1			7.30	194	4.00	3.14			8.05	1151	1.50	6.99		120.00	4.30	134.44	CONC	450	457.2	0.61	113.5	231.92	42%	1.41	110.11	109.66	0.65	109.42	108.97
Johnwoods St	MH	55	MH	SA1	6.32	102.0	6.32	102	4.00	1.65							23.00	23.00	1.77	26.42	PVC	250	251.5										108.77	108.52
Hazeldean Road	MH	SA1	MH	SA2			13.62	296	4.00	4.80	0.47	68.0	8.52	1219	1.50	7.41		143.00	6.20	161.40	CONC	450	457.2	0.33	67.5	170.86	6%	1.04	108.77	108.32	0.01	108.55	108.10
Hazeldean Road	MH	SA2	MH	SA3			13.62	296	4.00	4.80	1.10	158.0	9.62	1377	1.50	8.37		143.00	6.51	162.67	CONC	450	457.2	1.62	60.0	378.57	57%	2.31	108.54	108.09		107.57	107.12



SANITARY SEWER COMPUTATION FORM (5 to 10 year projection)

DATE: **November, 2017**
DESIGNED BY: VLL
CHECKED BY: AGS

PROJECT: **Hazeldean Road**
CLIENT: Minto Communities Inc.
PROJECT #: 131003-4
BY: ATREL ENGINEERING LTD

q= 350 l/cap.day
I= 0.28 l/ha.s
PVC/CONC N= 0.013
OTHER N= 0.024

Single dwelling= 3.4 person/unit

Table 2

STREET NAMES	LOCATION FROM (Up)		LOCATION TO (Down)		RESIDENTIAL INDIVIDUAL AREA (ha.)	RESIDENTIAL INDIVIDUAL POP.	RESIDENTIAL CUMULATIVE AREA (ha.)	RESIDENTIAL CUMULATIVE POP.	RESIDENTIAL PEAKING FACTOR M	RESIDENTIAL FLOW Q(p) (L/S)	COMMERCIAL , INSTITUTIONAL INDIVIDUAL AREA (ha.)	COMMERCIAL , INSTITUTIONAL INDIVIDUAL POP.	COMMERCIAL , INSTITUTIONAL CUMULATIVE AREA (ha.)	COMMERCIAL , INSTITUTIONAL CUMULATIVE POP.	COMMERCIAL , INSTITUTIONAL PEAKING FACTOR M	COMMERCIAL , INSTITUTIONAL FLOW Q(p) (L/S)	PUMPED FLOW Ind. (L/S)	PUMPED FLOW Cum. (L/S)	PEAK EXT.FLOW Q(i) (L/S)	**PEAK DES. Q(d) (L/S)**	SEWER DATA TYPE PIPE	SEWER DATA DIA. (N0M) (mm)	SEWER DATA (ACT) (MM)	SEWER DATA SLOPE (%)	SEWER DATA LENGTH (M)	SEWER DATA CAP. (L/S)	SEWER DATA Remaining Capacity (%)	SEWER DATA VEL. (M/S)	UpStream Obv. (M)	UpStream Inv. (M)	Forced drop (M)	DwnStream Obv. (M)	DwnStream Inv. (M)
Hazeldean Road	MH	3	MH	4													120.00	120.00		120.00	CONC	450	457.2	1.50	30.0	364.28	67%	2.22	114.25	113.80	0.01	113.80	113.35
Commercial	MH	50	MH	4							4.23	605.0	4.23	605	1.50	3.68			1.18	4.86	PVC	250	251.5	0.40	10.0	38.20	87%	0.77	113.89	113.64	0.06	113.85	113.60
Hazeldean Road	MH	4	MH	5									4.23	605	1.50	3.68		120.00	1.18	124.86	CONC	450	457.2	0.50	102.0	210.32	41%	1.28	113.79	113.34		113.28	112.83
Hazeldean Road	MH	5	MH	6									4.23	605	1.50	3.68		120.00	1.18	124.86	CONC	450	457.2	0.65	100.0	239.80	48%	1.46	113.28	112.83	0.01	112.63	112.18
Hazeldean Road	MH	6	MH	7									4.23	605	1.50	3.68		120.00	1.18	124.86	CONC	450	457.2	0.65	92.0	239.80	48%	1.46	112.62	112.17	0.04	112.02	111.57
Hazeldean Road	MH	7	MH	385									4.23	605	1.50	3.68		120.00	1.18	124.86	CONC	450	457.2	0.67	13.5	243.46	49%	1.48	111.98	111.53	1.78	111.89	111.44
Hartin Street	MH	54	MH	385	7.30	194.0	7.30	194	4.00	3.14	3.82	546.0	3.82	546	1.50	3.32			3.11	9.57	PVC	300	299.2										110.11	109.81
Hazeldean Road	MH	385	MH	SA1			7.30	194	4.00	3.14			8.05	1151	1.50	6.99		120.00	4.30	134.44	CONC	450	457.2	0.61	113.5	231.92	42%	1.41	110.11	109.66	0.65	109.42	108.97
Johnwoods St	MH	55	MH	SA1	6.32	102.0	6.32	102	4.00	1.65									1.77	3.42	PVC	250	251.5										108.77	108.52
Hazeldean Road	MH	SA1	MH	SA2			13.62	296	4.00	4.80	0.47	68.0	8.52	1219	1.50	7.41		120.00	6.20	138.40	CONC	450	457.2	0.33	67.5	170.86	19%	1.04	108.77	108.32	0.01	108.55	108.10
Hazeldean Road	MH	SA2	MH	SA3			13.62	296	4.00	4.80	1.10	158.0	9.62	1377	1.50	8.37		120.00	6.51	139.67	CONC	450	457.2	1.62	60.0	378.57	63%	2.31	108.54	108.09		107.57	107.12



LEGEND

- 0.42ha. / Peq.= 20 — SANITARY DRAINAGE SUB AREA
- EQUIVALENT POPULATION BASED ON A POPULATION OF 3.4 PERSON/UNIT OR 50,000 l/s/ha FOR COMMERCIAL LOTS
- DRAINAGE AREA BOUNDARY
- EXISTING SANITARY SEWER
- 13.4 l/s P.S — PUMPED FLOW
- EXISTING SANITARY PUMPING STATION LOCATION

MAPLE GROVE ROAD
HUNTMAR DR
BRADLEY GREEN CT
CEDAROW CT
RESIDENTIAL 6.32ha. Peq.=102
COMMERCIAL 0.47ha. Peq.=68
ROWAN RD
JOHNWOOD ST
COMMERCIAL 1.10ha. Peq.=158
COMMERCIAL 3.82ha. Peq.=546
HARTIN ST
RESIDENTIAL 7.30ha. Peq.=194
VICTOR ST
SAVAGE DR
HAZELDEAN RD
INCLUDED IN HUNTMAR/ HAZELDEAN
COMMERCIAL 4.23ha. Peq.=605
STITTSVILLE MAIN ST
120.0 l/s P.S
The Glen
Amberwood Village Golf & Country Club
NTS

ATREL Engineering Ltd Ltée
Engineers - Ingénieurs

CITY OF OTTAWA

HAZELDEAN RD SANITARY DRAINAGE AREA PLAN
FROM STITTSVILLE MAIN STREET TO SAVAGE DRIVE

SCALE: 1:750	MARCH 2017	131003-4-SANI

APPENDIX B

E-mail correspondence – City of Ottawa "Hazeldean Road Sanitary Sewer Analysis"

Vanessa Lalonde

From: Andre Sauve
Sent: February 6, 2017 9:28 AM
To: Vanessa Lalonde
Subject: FW: Hazeldean Road sanitary sewer analysis

André Sauvé, P.Eng.
Atrel Engineering Ltd
1-2884 Chamberland Street | Rockland, ON K4K 1M6
Tel: (613) 446-7423 ext. 30
Email andresauve@atrel.com

From: Bougadis, John [mailto:John.Bougadis@ottawa.ca]
Sent: Thursday, February 2, 2017 12:56 PM
To: Andre Sauve <andresauve@atrel.com>
Subject: RE: Hazeldean Road sanitary sewer analysis

Hi Andre,

The rated capacity at each station is shown below:

- John St PS (near Maple Grove): 21 l/s
- Joseph Circle PS : Unknown but use 2 l/s. This value has been used in past studies and observed at the station during high inflow conditions The gravity sewer commences immediately west of 15 Joseph Circle.

To complicate matters, The City plans on decommissioning these two stations in the future (likely 5 to 10 years). Flows from the John St PS will be directed to the Maple Grove sanitary sewer while flows from the Joseph Circle PS will be directed east towards the future Pool Creek Village sanitary sewer system.

Thanks

John
x14990

.

From: Andre Sauve [mailto:andresauve@atrel.com]
Sent: Tuesday, January 31, 2017 1:45 PM
To: Bougadis, John
Subject: RE: Hazeldean Road sanitary sewer analysis

Hi John,

We have setup the design sheet of the existing sanitary sewer on Hazeldean Road and we would need the pump flow from the Johnwoods Street and the Joseph Circle pump stations. Also, if you could provide to us the plan of profile of Johnwoods Street and Joseph Circle so we can delineate the dwelling that goes to the pump station vs the ones that are by gravity.

Thanks,

André Sauvé, P.Eng.
Atrel Engineering Ltd
1-2884 Chamberland Street | Rockland, ON K4K 1M6
Tel: (613) 446-7423 ext. 30
Email andresauve@atrel.com

From: Bougadis, John [mailto:John.Bougadis@ottawa.ca]
Sent: Monday, November 21, 2016 12:08 PM
To: Andre Sauve <andresauve@atrel.com>
Subject: RE: Hazeldean Road sanitary sewer analysis

No problem.

I am going to that meeting too.

John
x14990

From: Andre Sauve [mailto:andresauve@atrel.com]
Sent: 2016/11/21 9:17 AM
To: Bougadis, John
Subject: RE: Hazeldean Road sanitary sewer analysis

Hi John,

I'll be at the City tomorrow afternoon. I can pass by your office before 2:00 or after the meeting that should finish around 4:00 to transfer the 44 drawings on my memory stick? Let me know if it works for you.

Thanks,

André Sauvé, P.Eng.
Atrel Engineering Ltd
1-2884 Chamberland Street | Rockland, ON K4K 1M6
Tel: (613) 446-7423 ext. 30
Email andresauve@atrel.com

From: Bougadis, John [mailto:John.Bougadis@ottawa.ca]
Sent: Monday, November 7, 2016 2:10 PM
To: Andre Sauve <andresauve@atrel.com>
Subject: RE: Hazeldean Road sanitary sewer analysis

Hi Andre,

Doesn't work on my end (I have done this countless time with other firms FTP sites) .

The good news is that I have transferred you the following:

- Jackson Trails Pump Station (JTPS) drawings including the receiving 450 mm sewer on Hazeldean Road from the JTPS forcemains to Hartin Drive.
- JTPS design report and memo.
- GIS shapefiles of the sewers draining to Hazeldean as well as parcel and land use information.
- The majority of the 2010 Hazeldean Road Widening Drawings. The FTP site would not allow me to transfer 44 drawings. Perhaps we can pace the files on a memory stick the next time you are at the city.

Another important detail to add is that the City will be decommissioning the John St PS sometime after the KWPS is constructed. For the purpose of your assessment, assume flows from the station will still be pumped south to Hazeldean. The area that requires review is the 450 mm sewer from JTPS to Savage Drive.

Let me know if you have any questions.

Thanks

John
x14990

From: Andre Sauve [mailto:andresauve@atrel.com]
Sent: 2016/11/07 1:34 PM
To: Bougadis, John
Subject: RE: Hazeldean Road sanitary sewer analysis

Hi John,

Yes, you just have to drag the folder and drop it in the ftp site.

Thanks,

André Sauvé, P.Eng.
Atrel Engineering Ltd
1-2884 Chamberland Street | Rockland, ON K4K 1M6
Tel: (613) 446-7423 ext. 30
Email andresauve@atrel.com

From: Bougadis, John [mailto:John.Bougadis@ottawa.ca]
Sent: Monday, November 7, 2016 1:23 PM
To: Andre Sauve <andresauve@atrel.com>
Subject: RE: Hazeldean Road sanitary sewer analysis

Hi Andre,

Is there a way to upload folders on to your FTP site?

John
x14990

From: Andre Sauve [mailto:andresauve@atrel.com]
Sent: 2016/11/07 11:51 AM
To: Bougadis, John
Cc: Marcel Denomme; Jean Decoeur
Subject: RE: Hazeldean Road sanitary sewer analysis

Hi John,

You can upload the information on the following link:

https://files.atrel.com:8443/share.cgi?ssid=0ILppcE

You may have to access the ftp site by accepting to proceed even though it says "unsafe".

Thanks,

André Sauvé, P.Eng.
Atrel Engineering Ltd
1-2884 Chamberland Street | Rockland, ON K4K 1M6
Tel: (613) 446-7423 ext. 30
Email andresauve@atrel.com

From: Bougadis, John [mailto:John.Bougadis@ottawa.ca]
Sent: Monday, November 7, 2016 9:21 AM
To: Andre Sauve <andresauve@atrel.com>
Cc: Marcel Denomme <mdenomme@minto.com>; Jean Decoeur <jeandecoeur@atrel.com>
Subject: RE: Hazeldean Road sanitary sewer analysis

Hi Andre,

I have the information for you. Do you have an FTP site so I can upload the files?

Thanks

John
x14990

From: Andre Sauve [mailto:andresauve@atrel.com]
Sent: 2016/11/04 12:00 PM
To: Bougadis, John
Cc: Marcel Denomme; Jean Decoeur
Subject: Hazeldean Road sanitary sewer analysis

Hi John,

As discussed at Monday's meeting, can you please provide us with the plan and profile of Hazeldean Road showing the existing sanitary sewer from the pumping station up to where we need to analyze the sewer. Also, please provide us the drainage area and the sewer network connecting to the stretch of sewer to be analyzed.

Thanks,

André Sauvé, P.Eng.
Atrel Engineering Ltd
1-2884 Chamberland Street | Rockland, ON K4K 1M6
Tel: (613) 446-7423 ext. 30
Email andresauve@atrel.com

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APPENDIX C

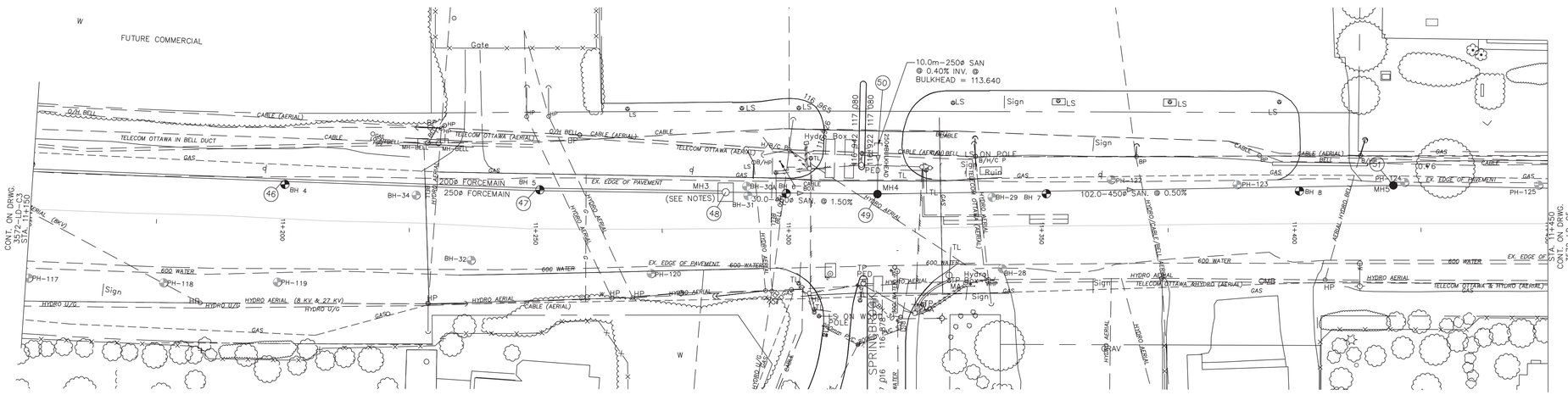
Hazeldean Road Plans and Profiles

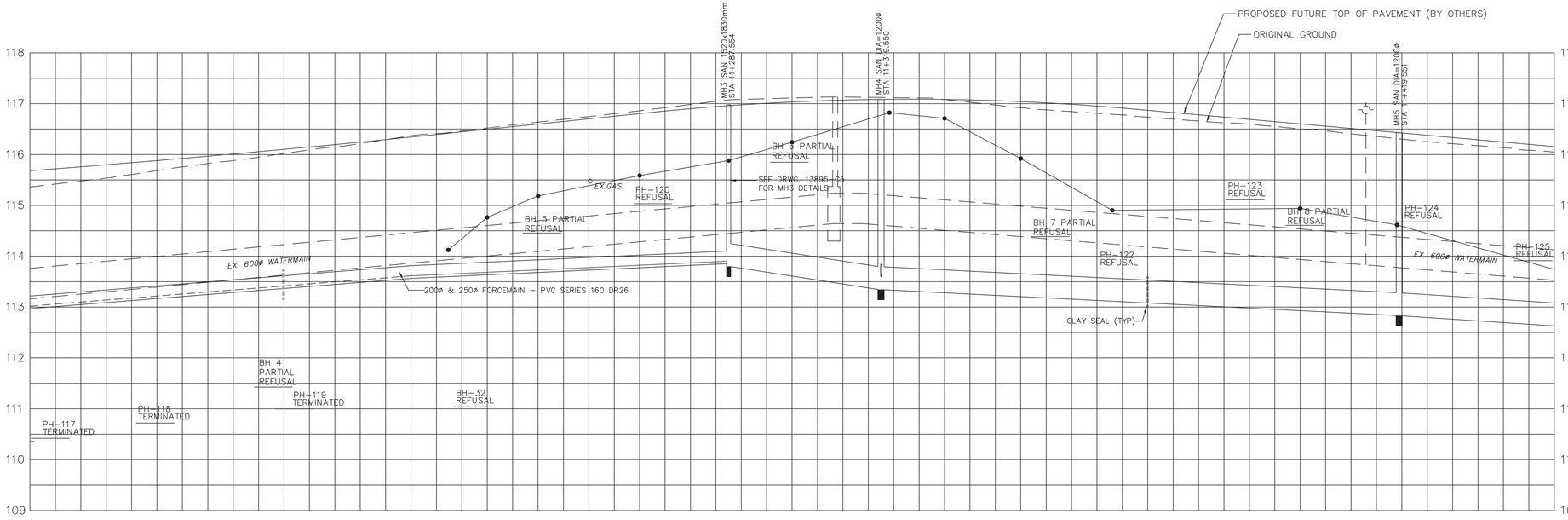
(Prepared by IBI Group)

DWG. NO. 13895-C4	**STA 11+150 to STA 11+450**	*(As built November 2008)*
DWG. NO. 13895-C5	**STA 11+450 to STA 11+675**	*(As built November 2008)*

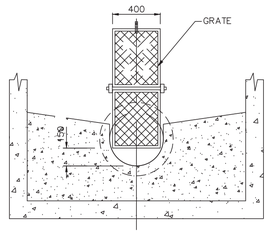
(Prepared by McCormick Rankin Corporation)

DWG. NO. 068	**STA 11+600 to STA 11+900**	*(As built September 2012)*


FUTURE COMMERCIAL
Gate
10.0m–250ø SAN @ 0.40% INV. @ BULKHEAD = 113.640
200ø FORCEMAIN
250ø FORCEMAIN
(SEE NOTES)
30.0–450ø SAN. @ 1.50%
102.0–450ø SAN. @ 0.50%
Hydro Box
MH3
MH4
MH5
BH 4
BH 5
BH 6
BH 7
BH 8
BH–34
BH–31
BH–32
BH–28
BH–29
PH–117
PH–118
PH–119
PH–120
PH–122
PH–123
PH–124
PH–125
600 WATER
EX. EDGE OF PAVEMENT
HYDRO AERIAL
TELECOM OTTAWA (AERIAL)
TELECOM OTTAWA IN BELL DUCT
CABLE (AERIAL)
GAS
CONT. ON DRWG. 3572–LD–C3 STA. 11+150
CONT. ON DRWG. 3572–LD–C5 STA. 11+450
H A Z E L D E A N R O A D

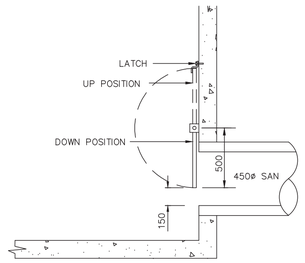

PROPOSED FUTURE TOP OF PAVEMENT (BY OTHERS)
ORIGINAL GROUND
MH3 SAN 1520x1830mm STA 11+287.554
MH4 SAN DIA=1200ø STA 11+319.550
MH5 SAN DIA=1200ø STA 11+419.051
BH 6 PARTIAL REFUSAL
SEE DRWG. 13895-C6 FOR MH3 DETAILS
EX.GAS
PH–120 REFUSAL
BH 5 PARTIAL REFUSAL
EX. 600ø WATERMAIN
200ø & 250ø FORCEMAIN – PVC SERIES 160 DR26
BH 7 PARTIAL REFUSAL
PH–122 REFUSAL
PH–123 REFUSAL
BH 8 PARTIAL REFUSAL
PH–124 REFUSAL
PH–125 REFUSAL
CLAY SEAL (TYP)
BH 4 PARTIAL REFUSAL
PH–119 TERMINATED
PH–118 TERMINATED
PH–117 TERMINATED
BH–32 REFUSAL
118
117
116
115
114
113
112
111
110
109

| | | |



MH3 DETAILS

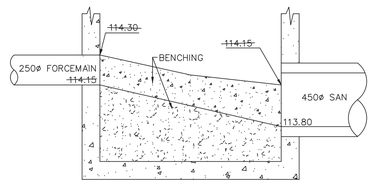
N.T.S.



GRATE DETAIL (MH3)

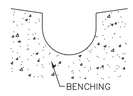
N.T.S.

ALL GRATE MATERIAL TO BE FROM 19mmø ALUMINUM STOCK PATTERN TO BE MINIMUM 50mm OPENINGS ALL BOLTS, NUTS, TO BE 316 s/s.



SECTION B:B
MANHOLE BENCHING

N.T.S.



SECTION A:A
MANHOLE BENCHING

N.T.S.

CCL/IBI
Cumming Cockburn Limited
1770 WOODWARD DR., OTTAWA (613)225-1311

NO.	REVISIONS	BY	DATE
0	ISSUED FOR CITY REVIEW	J.I.M.	05/11/11
1	ISSUED FOR CITY APPROVAL	J.I.M.	05/12/20
2	ISSUED FOR TENDER	J.I.M.	06/02/08
3	ISSUED FOR CONSTRUCTION		06/05/04
4	AS-BUILT BY TAGGART		08/11/17

NOTE:
The location of the utilities is approximate only, the exact location should be determined by consulting the municipal authorities and utility companies concerned.
The contractor shall prove the location of utilities and shall be responsible for adequate protection from damage.

JACKSON TRAILS PUMP STATION

TWIN FORCEMAIN
HAZELDEAN ROAD
FROM STA. 11+450 TO STA. 11+675

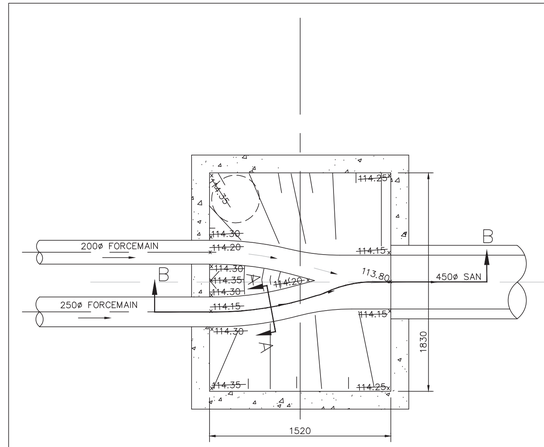
W.R. NEWELL, P.ENG.	W. CLOUTHIER, P.ENG.
Acting Director Infrastructure Services	Manager Construction Services - Development

Dwn:	Chkd:	Des:	Chkd:

Ottawa

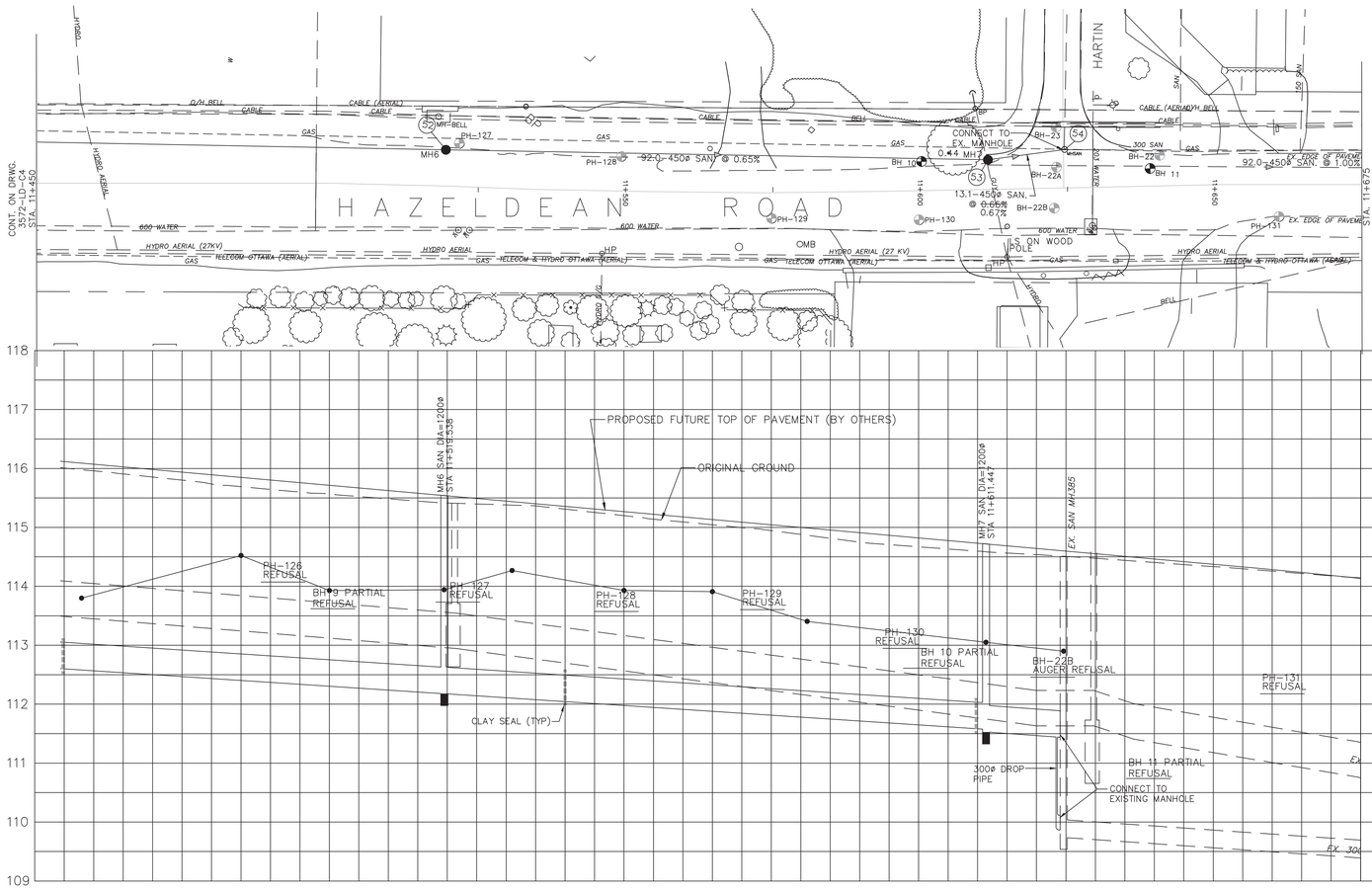
CONTRACT NO.
ISB05-2074
DWG. NO.
13895-C5
SHEET 7 OF 14
Date: NOVEMBER 2005
Scale:
Horizontal 0m 5 10
Vertical 0m 0.5 1

NOTE: 1. FOR LAYOUT REFERENCE SEE DWG C7.
2. INSTALL A CLAY SEAL AS PER CITY OF OTTAWA DRAWING S8 AT STATIONS 11+455, 11+540 AND 11+610.



MH3 (1520x1830)

N.T.S.



| | | |

TITLE FRAME: 709mm x 534mm City of Ottawa 2008

Consultant Drawing Number

These As-Built Drawings have been prepared based on inspections and observations undertaken by MRC staff during key stages of construction and on information submitted, in part, by others. While this information is believed to be reliable, MRC is not responsible for its accuracy, or for errors or omissions that may have been incorporated into this drawing as a result.

HAZELDEAN ROAD WIDENING

100m EAST OF CARP ROAD TO
100m WEST OF IBER ROAD

SANITARY SEWER
STA. 11+600 TO STA. 11+900

Ottawa

Contract No.	Dwg. No.
ISB09-5044	068

Sheet 68 of 148

Asset No.

B. MASON, P.Eng.	S. HARISH, P.Eng.
Manager - Design and Construction West	*Project Manager, Infrastructure Services*

Asset Group: ISB

Des: JZ/DP	Chk'd: PH/MB
Dwn: MS	Chk'd: PH

Utility Circ. No.:

Const. Inspector:

Scale: HORIZONTAL 0m 10 20

NOTE:
The location of utilities is approximate only, the exact location should be determined by consulting the municipal authorities and utility companies concerned, The contractor shall prove the location of utilities and shall be responsible for adequate protection from damage.

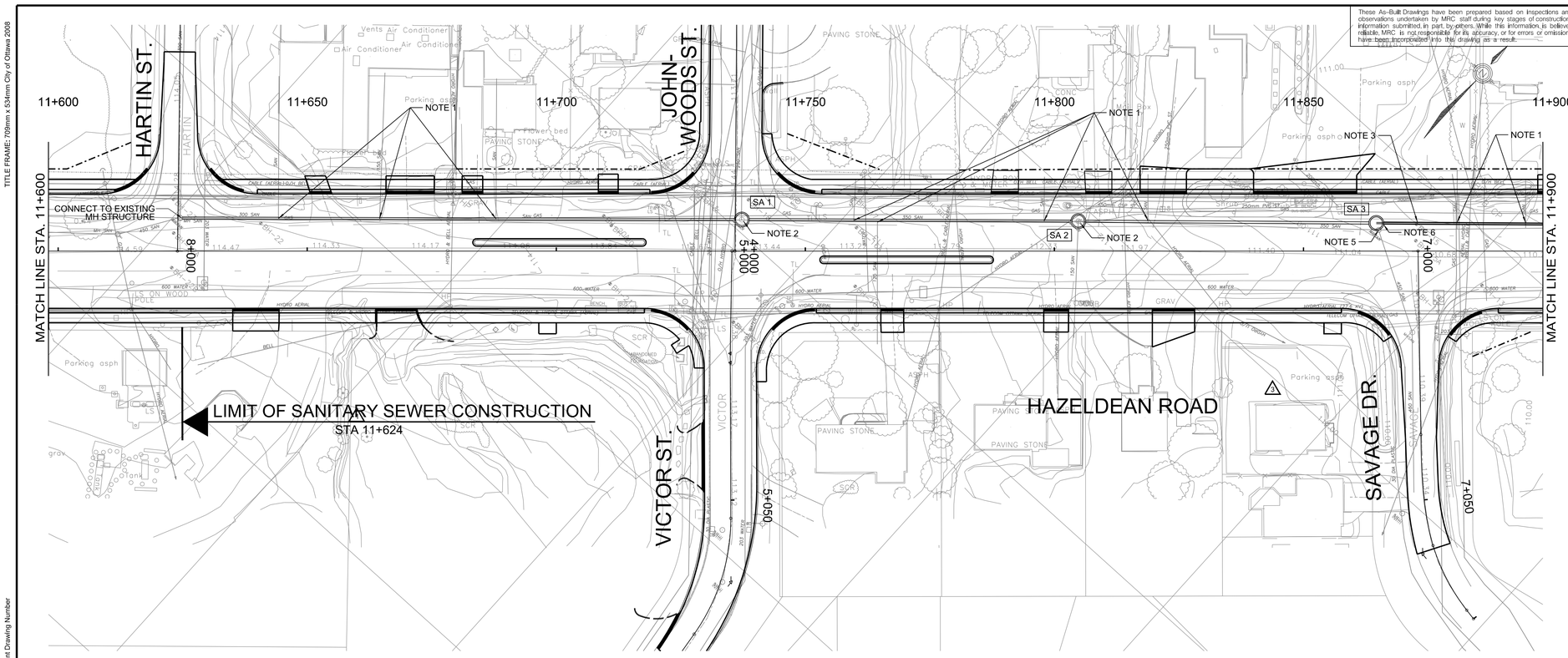
McCORMICK RANKIN CORPORATION
A member of MMM GROUP

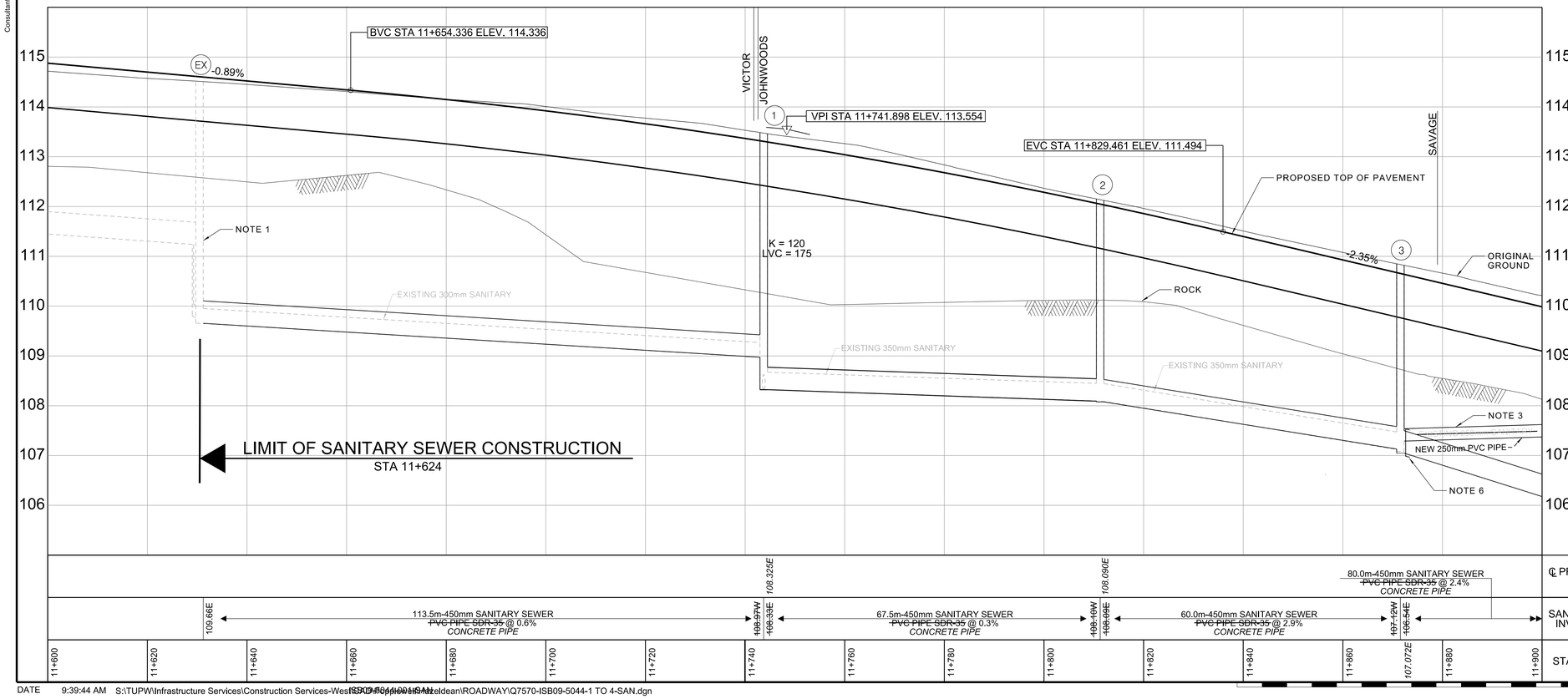
REVISIONS	No.	Description	By	Date
		ISSUED FOR REVIEW	P.H.	24/07/2009
		ISSUED FOR TENDER	P.H.	11/08/2009
		ISSUED FOR MOE SUBMISSION	P.H.	05/09/2009
		ISSUED FOR CONSTRUCTION	P.H.	26/11/2009
		RE-DESIGN FOR GAS CONFLICT	P.H.	26/02/2010

THESE DESIGN DOCUMENTS ARE PREPARED SOLELY FOR THE USE BY THE PARTY WITH WHOM THE DESIGN PROFESSIONAL HAS ENTERED INTO A CONTRACT AND THERE ARE NO REPRESENTATIONS OF ANY KIND MADE BY THE DESIGN PROFESSIONAL TO ANY PARTY WITH WHOM THE DESIGN PROFESSIONAL HAS NOT ENTERED INTO A CONTRACT

AS-BUILT

REVISIONS	No.	Description	By	Date
		REISSUED FOR CONSTRUCTION	M.B.	07/05/2010
		AS-BUILT	B.M.	SEPT 2012





SANITARY MAINTENANCE HOLE DATA

NO.	STATION	OFFSET	COVER	STRUCTURE	ELEVATION T/GRATE	ELEVATION LOW/INV.
SA1	11+737.2	6.3LT	S24	701.01	~~113.25~~ 113.225	~~108.33~~ 108.325
SA2	11+804.8	6.0LT	S24	701.01	111.99	109.09
SA3	11+864.6	5.6LT	S24	701.01	~~110.55~~ 110.602	~~106.54~~ 107.072

NOTES:

1. CONNECT EXISTING SERVICE LATERAL TO NEW SEWER.
2. CONTRACTOR TO VERIFY CONDITION OF EXISTING MH STRUCTURE AND REPLACE AS REQUIRED (IN CONSULTATION WITH THE C.A.). CONNECT ALL EXISTING SERVICE LATERALS / SEWERS TO NEW MH (AS REQUIRED).
3. ~~RE-LAY EXISTING~~ NEW 250mm DIA. SANITARY SEWER IN COMMON TRENCH WITH NEW PROPOSED SEWER.
4. NOT USED
5. EXTEND EXISTING 450mm DIA. SANITARY SEWER TO NEW STRUCTURE.
6. PLUG PROPOSED 450mm DIA. SEWER (EAST OUTLET).

ALL NUMERICAL VALUES THAT ARE NOT STROKED OUT AND REPLACED IN ITALICS ON AS-BUILT DRAWINGS ARE CONSIDERED TO BE DESIGN VALUES ONLY AND NOT MEASURED IN THE FIELD.

DATE 9:39:44 AM S:\TUPW\Infrastructure Services\Construction Services-West\ISB09-5044\Drawings\Hazeldean\ROADWAY\Q7570-ISB09-5044-1 TO 4-SAN.dgn

Expansion Area = 3 Gross Area = 84.43 ha

Type	2011-2021	2021-2031 (Units)	2031-2060	Total
SFH	197	197	263.2	657.2
MTL	122	123	163.6	408.6
APT	35	35	47.2	117.2
Employees	99	99	0	198

PROJECT: 3598-LD-03
DATE: April 2006
DESIGN: JIM
FILE: 3598LD.sewers.XLS

SANITARY SEWER DESIGN SHEET
PROJECT : Kanata West Servicibility Study
LOCATION : CITY OF OTTAWA

MODEL 1 ULTIMATE (population based criteria..ICI simultaneous peaking)

LOCATION				TOTAL AREA	RESIDENTIAL						EMPLOYMENT/RETAIL/BUSINESS PARK/OPEN SPACES							INFILTRATION				TOTAL FLOW	PROPOSED SEWER						HARMON PF	ACTUAL q/Q	va/Vf	ACTUAL VELOCITY
															PEAK FLOW			AREA (Ha)					CAPACITY	VELOCITY (full)	LGTH.	PIPE	GRADE	AVAIL. CAP.				
STREET	FROM MH	TO MH		(Ha)	APPLIC AREA (Ha)	UNIT/Ha	TOTAL UNITS	POPULATION INDIV	POPULATION ACCUM	PEAK FACTOR	PEAK FLOW (l/s)	APPLIC AREA (Ha)	ACCUM AREA (Ha)	TOTAL AREA (Ha)	FLOW RATE (l/Ha/d)	INDIV (l/s)	ACCUM (l/s)	TOTAL (l/s)	INDIV	CUMUL	TOTAL CUMUL	PEAK FLOW (l/s)	(l/s)	l/s	m/s	(m)	(mm)	%	(%)				(m/s)
Campeau Drive Trunk Sewer	1	2	Area 1 (PBP)	38.11								38.11	38.11		35000	23.16	23.16		38.11	38.11											
			Area 2 (PBP)	27.29								27.29	65.40		35000	16.58	39.74		27.29	65.40											
			Area 3 Ext Employment	14.05								14.05	79.45		50000	12.20	51.94		14.05	79.45											
			Area 4 HP Employment	10.93								10.93	90.38	90.38	50000	9.49	61.42	61.42	10.93	90.38	90.38	25.31	86.73	283.79	1.27	525.0	525	0.40	69.44%	3.85		0.730	0.927
	2	3	Area 5 Residential	29.19	29.19	19	555	1664	1664	3.65	24.58			90.38				61.42	29.19	29.19												
			Area 9 Ext Employment	8.45							24.58	8.45	8.45	98.83	50000	7.34	7.34	68.76	8.45	128.02	128.02	35.85	129.18	286.61	0.98	700.0	600	0.20	54.93%			0.451	0.815
	14	3	Area 6/8 Ext Employment	16.65								16.65	16.65		50000	14.45	14.45		16.65	16.65											
			Area 7 HP Employment	5.48								5.48	22.13	22.13	50000	4.76	19.21	19.21	5.48	22.13	22.13	6.20	25.41	148.74	0.91	910.0	450	0.25	82.92%			0.171	0.571
	3	4							1664	3.65	24.58	0.00	0.00	120.96		0.00	0.00	87.97	0.00	0.00	150.15	42.04	154.59	392.29	1.06	300.0	675	0.20	60.59%	3.65	0.394	0.790	0.839
	4A	4	Area 10 Residential	27.86	27.86	19	529	1588	1588	3.66	23.55								27.86	27.86	27.86	7.80	31.36	148.74	0.91	750.0	450	0.25	78.92%	3.66	0.211	0.660	0.598
	4	5	14 Mixed Use	4.13	1.76	50	88	263	3515	3.38	48.17	2.37	2.37	123.33	35000	1.44	1.44	89.41	4.13	4.13	182.14	51.00	188.58	392.29	1.06	450.0	675	0.20	51.93%	3.38	0.461	0.840	0.892
	Queensway	5	Area 13 Community Retail	6.35								6.35	6.35	6.35	35000	3.86	3.86	3.86	6.35											3.88	0.567	0.880	0.762
			Area 11/12 Mixed Use	11.80	5.02	50	251	752	752	3.88	11.81	6.79	13.14	13.14	35000	4.12	7.98	7.98	11.80	18.15	18.15	5.08	24.88	43.88	0.87	420.0	250	0.50	43.31%	3.31			
	5	5A	Area 15 Community Retail	3.88				0	4267	3.31	57.19	3.88			35000	2.36			3.88													
			Area 44	25.54							57.19	25.54	29.42	165.89	35000	15.52	17.88	115.27	25.54	29.42	229.71	64.32	236.77	519.43	1.14	300.0	750	0.20	54.42%			0.456	0.830	0.945
First Line Road Sewer				229.71							57.19							115.27				64.32	236.77							3.23			
		5A	Area 100 Residential	90.20	90.20	19	1714	5141	5141	3.23	67.35	0.00							95.08	95.08	95.08	26.62	98.21										
Signature Ridge		5A	Area 100 Non-Residential	4.88							67.35	4.88	4.88	4.88	50000	4.24	4.24	4.24					65.00										
Signature Ridge		5A																															
Interstitial Lands & Broughton/Richardson		5A																119.51														
Total To SRPS	**5A**	**SRPS**		**324.79**	**154.02**		**3136**		**9409**		**124.54**	**170.77**									**324.79**	**90.94**	**399.98**	**580.53**	**1.27**	**30.0**	**750**	**0.25**	**31.10%**	**2.98**	**0.689**	**0.940**	**1.197**
Palladium Drive Trunk Sewer	6	7	Area 32 (PBP)	57.03								57.03	57.03		50000	49.51	49.51		57.03	57.03													
			Area 32A Park	8.34								8.34	65.37		0	0.00	49.51		8.34	65.37													
			Area 33/34 Ext Employment	54.85								54.85	120.22	120.22	50000	47.61	97.12	97.12	54.85	120.22	120.22										3.53	0.423	0.810	1.000
			se	36.70	15.60	50	780	2340	2340	3.53	33.47	21.10	21.10	141.32	50000	18.32	18.32	115.44	36.70	36.70	156.92	43.94	192.85	455.83	1.13	925.0	675	0.27	57.69%	3.53			
				156.92	15.60		780		2340		33.47	141.32						115.44	156.92		156.92	43.94	192.85										
			ment	6.05								6.05	6.05		30000	3.15	3.15		6.05			30.00										
Corel Centre Etc. (Existing Sewer) *			ure)																			7.34	45.52				*Existing*					
			yment	20.15								26.20	26.20	26.20	14400	5.04	8.19	8.19	20.15	26.20	26.20												
			ent	14.59								14.59			35000	8.87	8.87		14.59	14.59												
First Line Road Sewer				11.97								26.56			35000	7.27	16.14		11.97	26.56											
			Area 41 Employment									20.66	47.22		35000	12.55	28.69		20.66	47.22												
			Area 42 Employment	20.66								28.89	76.11	76.11	35000	17.55	46.25	46.25	28.89	76.11	76.11	21.31	67.56	224.35	1.00	525.0	525	0.25	69.89%		0.301	0.730	0.733
			Area 43 Employment	28.89								102.31	102.31	102.31	0	0.00	54.44	54.44	0.00	102.31	102.31	28.65	113.08	286.61	0.98	400.0	600	0.20	60.54%	3.53	0.395	0.790	0.776
Carp River Trunk	16	8	Nothing To Add	102.31	15.60		780		2340	3.53	33.47	0.00	0.00	243.63		0.00	0.00	169.87	0.00	139.01	259.23	109.92	305.93	579.95	1.05	550.0	825	0.15	47.25%	3.53	0.528	0.860	0.904
Carp River Trunk	8	10A	Nothing To Add	259.23	15.60		780		2340		33.47																			3.03	0.327	0.740	1.027
			Area 18/19 Exist. Residential	23.34	23.34	19	443	1330	1330										23.34											3.20			
Marie Grove Road Trunk Sewer	9	10	Area [illegible] Residential	[illegible]	79.52	[illegible]	[illegible]	[illegible]	8469	3.03	105.82								79.32	[illegible]	102.66	28.74	132.56	405.11	1.39	775.0	600	0.40	67.28%				
																			99.01	99.01												
Hazeldean/Huntmar Trunk Sewer	11	12	Area 16/20 Residential	99.01	99.01	19	1881	5644	5644	3.20	73.06								33.50	132.51													
			Area 16/20 Commercial	33.50								33.50	33.50	33.50	50000	29.08	29.08	29.08	14.13	146.64													
			Area 16/20 Open Space	14.13								14.13							3.44	150.08	150.08	42.02	146.26	554.82	1.50	775.0	675	0.40	73.64%				
			Area 17 Ex. Commercial	3.44							73.06	3.44	36.94	36.94	35000	2.09	31.17	31.17	10.89	10.89													
			Area 21 Exist. Employment	10.89								10.89	10.89	10.89	50000	9.45	9.45		6.63	17.52													
	12	10	Area 19A Exist Residential	6.63	6.63	19	126	378									9.45		17.61	35.13													
			Area 23/24 Community Retail	17.61								17.61	28.50	28.50	35000	10.70	20.15	51.32	27.10	62.23	212.31	59.45	214.49	519.43	1.14	950.0	750	0.20	58.71%	3.03	0.443	0.800	0.911
			Area 28/30 Residential	27.10	27.10	30	813	2439	8460	3.03	103.72	0.00	0.00	65.44				51.32												2.66	0.550	0.870	1.056
			[illegible]	[illegible]	8.98	50	449	1347				12.15	12.15	77.59	35000	7.28	7.28	58.71	15.00	36.13	351.10	98.31	368.56	669.89	1.21	1000.0	825	0.20	44.98%				
Marie Grove Road Trunk Sewer	10	10A	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]								20.24													
			Area 29 Residential	15.00	15.00	30	450	1350	1800	2.66	211.54	20.24	20.24	20.24	35000	12.30	12.30	12.30	38.72	58.96	58.96	16.51	76.61	320.17	1.10	1000.0	600	0.25	76.07%	3.39	0.239	0.680	0.746
Carp River Trunk Sewer	13	10A	Area 25 Community Retail	20.24															0.75	0.75	0.75	0.21	0.86	36.69	0.72	100.0	250	0.35	97.65%		0.023	0.340	0.246
			Area 31 residential	38.72	38.72	30	1162	3485	3485	3.39	47.80	0.75	0.75	0.75	50000	0.65	0.65	0.65												2.55	0.596	0.900	1.283
		10A																241.53												2.41			
Pumping Station 2 to KWPS	**10A**	**KWPS**			**313.70**		**8484**		**25451**		**292.82**	**356.34**									**670.04**	**224.95**	**759.29**	**1273.71**	**1.43**	**30.0**	**1050**	**0.20**	**40.39%**				
STUDY TOTALS					467.72		11620		34860			527.11																				

5.88ha of residential area from area 19

335.16 p based on 3p/ unit and 19 unit/ha

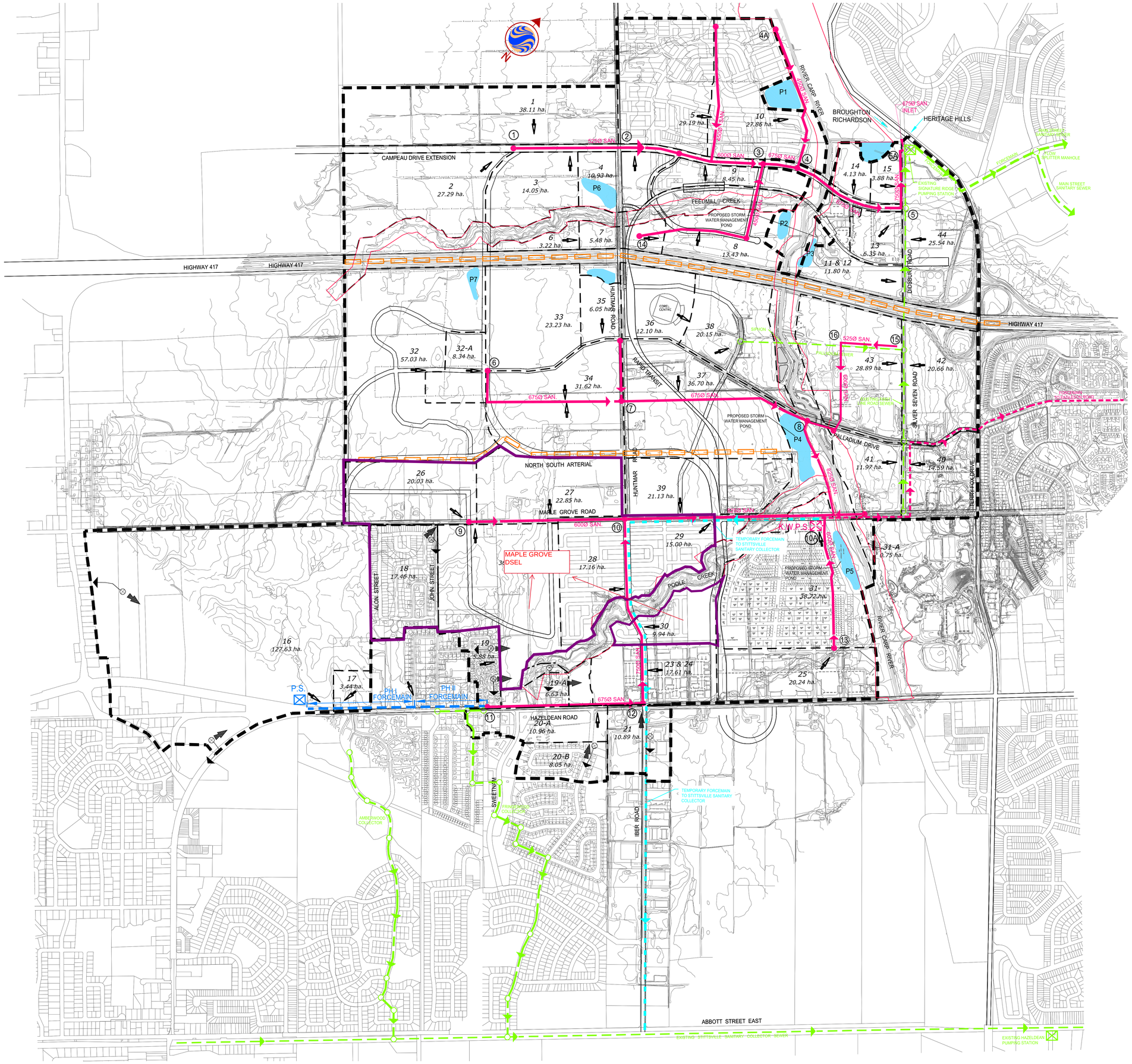
Included in Maple Grove design by DSEL

Average Daily Per capita Flow Rate =	350 l/cap/d
Infiltration Allowance Flow Rate =	0.28 l/sec/Ha
Residential Peaking Factor = 1+(14/(4+(P^0.5))), P=Pop. in 1000's, Max of 4	
Population density per unit =	3.00
Factor of Employment/Retail/Business Park =	1.50
Mixed Uses Assumes: 15% Community Retail, 42.5% Business Park and 42.5% Residential	

Revision No. 1: April 01, 2005
Revision No. 2: April 11, 2005
Revision No. 3: April 21, 2005
Revision No. 4: June 07, 2005
Revision No. 5: August 10, 2005
Revision No. 6: Oct. 14, 2005
Revision No. 7: Nov. 10, 2005
Revision No. 8: Nov. 11, 2005
Revision No. 9: Apr. 19, 2006

CCL/IBI

FIG. 4.2-1


CAMPEAU DRIVE EXTENSION
HIGHWAY 417
HIGHWAY 417
HIGHWAY 417
FEEDMILL CREEK
PROPOSED STORM WATER MANAGEMENT POND
PROPOSED STORM WATER MANAGEMENT POND
PROPOSED STORM WATER MANAGEMENT POND
PROPOSED STORM WATER MANAGEMENT POND
RIVER CARP RIVER
BROUGHTON
RICHARDSON
HERITAGE HILLS
6750 SAN. INLET
EXISTING SIGNATURE RIDGE PUMPING STATION
FORCEMAIN
FORCEMAIN
MAIN STREET SANITARY SEWER
DIOSBURY ROAD
SILVER SEVEN ROAD
TERRY FOX DRIVE
PALLADIUM DRIVE
PALLADIUM DRIVE
SIPHON
CORE CENTRE
HUNTMAR ROAD
HUNTMAR ROAD
RAPID TRANSIT
NORTH SOUTH ARTERIAL
MAPLE GROVE ROAD
MAPLE GROVE TRUNK SEWER
MAPLE GROVE TRUNK SEWER
MAPLE GROVE TRUNK SEWER

ALTERNATIVE 2: DIVERT STITTSVILLE TRUNK SEWER ONLY
DESIGN SHEET
LONG TERM FLOWS (2031)

	MANHOLE NUMBERS			RESIDENTIAL AREA AND POPULATION TOTAL						MIXED USE	MIXED USE	COMMERCIAL	INSTITUTIONAL	Commercial + Institutional TOTAL			INDUSTRIAL Cumulative				INFILTRATION TOTAL		PEAK FLOW	PIPE								
SEWER ID	From	To	@	Area (ha)	Cumul. Area (ha)	Pop.	Cumul. Pop.	Peak Factor	Peak Flow (l/s)	Area (ha)	Accum. Area	Area (ha)	Area (ha)	Accum. Area	Peak Factor	Peak Flow (l/s)	Area (ha)	Cumul. Area (ha)	Peak Factor	Peak Flow (l/s)	Accum. Area	Infilt. Flow (l/s)	TOTAL FLOW (l/s)	Pipe Dia. (mm)	Pipe Type	Slope (%)	Length (m)	Capacity (l/s)	Full Flow Vel. (m/s)	Q/Q_{full} (%)	D/S Invert Elevation (m)
Stittsville Trunk (2006 data)	N/A	N/A	MH-101	526.6	526.6	28031	28031	2.5	284.6	0	0	59.8	16.2	76	1.5	66.0	40.5	40.5	3.17	52.0	643.1	180.1	582.6								98.45
	MH - 101	MH - 102		0	526.6	0	28031	2.5	284.6	0	0	0	0	76	1.5	66.0	0	40.5	3.17	52.0	643.1	180.1	582.6	975	C 100-D	0.16	57.4	935	1.21	62.3%	98.36
	MH - 102	MH - 103		0	526.6	0	28031	2.5	284.6	0	0	0	0	76	1.5	66.0	0	40.5	3.17	52.0	643.1	180.1	582.6	975	C 100-D	0.16	120.0	935	1.21	62.3%	98.17
	MH - 103	MH - 104		0	526.6	0	28031	2.5	284.6	0	0	0	0	76	1.5	66.0	0	40.5	3.17	52.0	643.1	180.1	582.6	975	C 100-D	0.16	120.0	935	1.21	62.3%	97.97
	MH - 104	MH - 105		0	526.6	0	28031	2.5	284.6	0	0	0	0	76	1.5	66.0	0	40.5	3.17	52.0	643.1	180.1	582.6	975	C 100-D	0.16	120.0	935	1.21	62.3%	97.79
	MH - 105	MH - 106		0	526.6	0	28031	2.5	284.6	0	0	0	0	76	1.5	66.0	0	40.5	3.17	52.0	643.1	180.1	582.6	975	C 100-D	0.16	120.0	935	1.21	62.3%	97.60
	MH - 106	MH - 107		0	526.6	0	28031	2.5	284.6	0	0	0	0	76	1.5	66.0	0	40.5	3.17	52.0	643.1	180.1	582.6	975	C 100-D	0.16	120.0	935	1.21	62.3%	97.41
	MH - 107	MH - 108		0	526.6	0	28031	2.5	284.6	0	0	0	0	76	1.5	66.0	0	40.5	3.17	52.0	643.1	180.1	582.6	975	C 100-D	0.16	120.0	935	1.21	62.3%	97.22
	MH - 108	MH - 109		0	526.6	0	28031	2.5	284.6	0	0	0	0	76	1.5	66.0	0	40.5	3.17	52.0	643.1	180.1	582.6	975	C 100-D	0.16	120.0	935	1.21	62.3%	97.02
	MH - 109	MH - 110		0	526.6	0	28031	2.5	284.6	0	0	0	0	76	1.5	66.0	0	40.5	3.17	52.0	643.1	180.1	582.6	975	C 100-D	0.16	120.0	935	1.21	62.3%	96.84
	MH - 110	MH - 111		0	526.6	0	28031	2.5	284.6	0	0	0	0	76	1.5	66.0	0	40.5	3.17	52.0	643.1	180.1	582.6	975	C 100-D	0.16	120.0	935	1.21	62.3%	96.65
	MH - 111	MH - 112		0	526.6	0	28031	2.5	284.6	0	0	0	0	76	1.5	66.0	0	40.5	3.17	52.0	643.1	180.1	582.6	975	C 100-D	0.16	120.0	935	1.21	62.3%	96.46
	MH - 112	MH - 113		0	526.6	0	28031	2.5	284.6	0	0	0	0	76	1.5	66.0	0	40.5	3.17	52.0	643.1	180.1	582.6	975	C 100-D	0.16	120.0	935	1.21	62.3%	96.27
	MH - 113	MH - 114		0	526.6	0	28031	2.5	284.6	0	0	0	0	76	1.5	66.0	0	40.5	3.17	52.0	643.1	180.1	582.6	975	C 100-D	0.16	90.5	935	1.21	62.3%	96.13
	MH - 114	MH - 115		0	526.6	0	28031	2.5	284.6	0	0	0	0	76	1.5	66.0	0	40.5	3.17	52.0	643.1	180.1	582.6	975	C 100-D	0.16	84.7	935	1.21	62.3%	93.75
	MH - 115	MH - 116		0	526.6	0	28031	2.5	284.6	0	0	0	0	76	1.5	66.0	0	40.5	3.17	52.0	643.1	180.1	582.6	975	C 100-D	0.16	91.3	935	1.21	62.3%	93.61
	MH - 116	MH - 117		0	526.6	0	28031	2.5	284.6	0	0	0	0	76	1.5	66.0	0	40.5	3.17	52.0	643.1	180.1	582.6	975	C 100-D	0.16	120.5	935	1.21	62.3%	93.42
	MH - 117	MH - 118A		0	526.6	0	28031	2.5	284.6	0	0	0	0	76	1.5	66.0	0	40.5	3.17	52.0	643.1	180.1	582.6	975	C 100-D	0.24	95.0	1145	1.49	50.9%	93.19
	MH - 118A	MH - 119A		0	526.6	0	28031	2.5	284.6	0	0	0	0	76	1.5	66.0	0	40.5	3.17	52.0	643.1	180.1	582.6	975	C 100-D	0.24	120.0	1145	1.49	50.9%	92.90
	MH - 119A	MH - 120A		0	526.6	0	28031	2.5	284.6	0	0	0	0	76	1.5	66.0	0	40.5	3.17	52.0	643.1	180.1	582.6	975	C 100-D	0.24	67.3	1145	1.49	50.9%	92.74
	MH - 120A	MH - 121A		0	526.6	0	28031	2.5	284.6	0	0	0	0	76	1.5	66.0	0	40.5	3.17	52.0	643.1	180.1	582.6	975	C 100-D	0.24	60.2	1145	1.49	50.9%	92.60
	MH - 121A	MH - 122A		0	526.6	0	28031	2.5	284.6	0	0	0	0	76	1.5	66.0	0	40.5	3.17	52.0	643.1	180.1	582.6	975	C 100-D	0.24	70.5	1145	1.49	50.9%	92.43
	MH - 122A	MH - 123A		0	526.6	0	28031	2.5	284.6	0	0	0	0	76	1.5	66.0	0	40.5	3.17	52.0	643.1	180.1	582.6	975	C 100-D	0.24	103.1	1145	1.49	50.9%	90.33
	MH - 123A	MH - 124A		0	526.6	0	28031	2.5	284.6	0	0	0	0	76	1.5	66.0	0	40.5	3.17	52.0	643.1	180.1	582.6	975	C 100-D	0.24	120.9	1145	1.49	50.9%	90.04
	MH - 124A	MH - 125A		0	526.6	0	28031	2.5	284.6	0	0	0	0	76	1.5	66.0	0	40.5	3.17	52.0	643.1	180.1	582.6	975	C 100-D	0.24	91.6	1145	1.49	50.9%	89.72
	MH - 125A	MH - 126A		0	526.6	0	28031	2.5	284.6	0	0	0	0	76	1.5	66.0	0	40.5	3.17	52.0	643.1	180.1	582.6	975	C 100-D	0.24	86.2	1145	1.49	50.9%	89.51
	MH - 126A	MH - 127A		0	526.6	0	28031	2.5	284.6	0	0	0	0	76	1.5	66.0	0	40.5	3.17	52.0	643.1	180.1	582.6	975	C 100-D	0.24	103.6	1145	1.49	50.9%	89.21
	MH - 127A	MH - 128A		0	526.6	0	28031	2.5	284.6	0	0	0	0	76	1.5	66.0	0	40.5	3.17	52.0	643.1	180.1	582.6	975	C 100-D	0.24	24.5	1145	1.49	50.9%	89.15

Comments

Stittsville Trunk (2031 data) : Information is taken directly from the Fernbank Community Design Plan - Table D-8 Offsite - Sanitary Design Sheets - North Kanata Trunk

Peak Flow 800 L/s: The flow in the sewer would be limited by the diversion structure to 800 L/s

Mixed Use Peak Flow: 50% of the Mixed Use Area is Residential and 50% of Mixed Use Area is Commercial/Institutional Flow.

Del land: Additional flows from the Del land (approximately 102.7 L/s) are anticipated to be added following coordination during preliminary/detailed design.

From: Mark Bissett
To: Bougadis, John
Subject: Kizell Lands - Sanitary Drainage
Date: Monday, July 23, 2018 4:48:49 PM

I noticed that too…Lee actually provided the design flow to me this morning (i.e. 580L/s vs. 495L/s).
I was provided the 495L/s a while ago, and used that as our starting point…I can't speak to where the 580L/s comes from, but I intend to update our design sheets to match the JLR FDR when we make our next submission.
There's loads of conveyance capacity in the pipe, so I'm not too worried at this point. You have any concerns?

Mark Bissett, P.Eng., Senior Project Manager | Land Development & Municipal
NOVATECH Engineers, Planners & Landscape Architects
240 Michael Cowpland Drive, Suite 200, Ottawa, ON, K2M 1P6 | Tel: 613.254.9643 Ext: 237 | Cell: 613.261.4792
The information contained in this email message is confidential and is for exclusive use of the addressee.

From: Bougadis, John [mailto:John.Bougadis@ottawa.ca]
Sent: Monday, July 23, 2018 4:39 PM
To: Mark Bissett <m.bissett@novatech-eng.com>
Subject: RE: Kizell Lands - Sanitary Drainage

I do have one follow up question: the JLR FDR identified a flow rate of 580 l/s from the Stittsville Trunk while your updated sheet shows a flow of 495 l/s. I think this is due to areas redirected to Hazeldean PS.

Thanks again for your quick response.

John
X1490

From: Mark Bissett <m.bissett@novatech-eng.com>
Sent: Monday, July 23, 2018 4:30 PM
To: Bougadis, John <John.Bougadis@ottawa.ca>
Subject: Kizell Lands - Sanitary Drainage

Sanitary Design Sheet as requested.

Mark Bissett, P.Eng., Senior Project Manager | Land Development & Municipal
NOVATECH Engineers, Planners & Landscape Architects
240 Michael Cowpland Drive, Suite 200, Ottawa, ON, K2M 1P6 | Tel: 613.254.9643 Ext: 237 | Cell: 613.261.4792
The information contained in this email message is confidential and is for exclusive use of the addressee.

From: Mark Bissett

Sent: Monday, July 23, 2018 4:25 PM
To: 'Bougadis, John' <John.Bougadis@ottawa.ca>
Cc: Paerez, Ana <Ana.Paerez@stantec.com>; John Riddell (Novatech) <j.riddell@novatech-eng.com>
Subject: Kizell Lands - Sanitary Drainage

John- attached is the latest Sanitary Drainage Area Plan for the Kizell Lands (rev.3 Feb. 23/18). Be advised the concept is not Draft Approved, and with a newly contemplated LRT Station at Hazeldean Road, my client is reviewing the plan.
Always in flux…call if you have any questions, or concerns with the above. Best,

Mark Bissett, P.Eng., Senior Project Manager | Land Development & Municipal
NOVATECH Engineers, Planners & Landscape Architects
240 Michael Cowpland Drive, Suite 200, Ottawa, ON, K2M 1P6 | Tel: 613.254.9643 Ext: 237 | Cell: 613.261.4792
The information contained in this email message is confidential and is for exclusive use of the addressee.

From: Bougadis, John [mailto:John.Bougadis@ottawa.ca]
Sent: Monday, July 23, 2018 3:40 PM
To: Mark Bissett <m.bissett@novatech-eng.com>
Cc: Paerez, Ana <Ana.Paerez@stantec.com>
Subject: FW: Kizell Lands - Sanitary Drainage
Importance: High

Hi Mark,

Could you provide the latest sanitary drainage plan and sewer design sheet for the Kizell lands and Stittsville Interceptor?

The information is required to advance developments (Richcraft) within the Kanata West Pump Station catchment area. Receiving the information sometime this week would be greatly appreciated.

Please feel to contact me if you have any questions or concerns.

Thanks

John Bougadis, M.A.Sc., P.Eng.
Senior Project Manager, Infrastructure Planning
Asset Management Branch
Planning, Infrastructure and Economic Development Department
City of Ottawa
613.580.2424 ext.14990

From: Mark Bissett <m.bissett@novatech-eng.com>

Sent: Friday, November 03, 2017 12:10 PM
To: Bougadis, John <John.Bougadis@ottawa.ca>
Cc: Gillis, Sheridan (Stantec) <Sheridan.Gillis@stantec.com>; Kevin Yemm (Richcraft) <keviny@richcraft.com>; Surprenant, Eric <Eric.Surprenant@ottawa.ca>
Subject: Kizell Lands - Sanitary Drainage

John- attached is the Sanitary Drainage Area Plan (SAN) for the Kizell Lands recently issued with our Draft Plan submission. Also, attached is a coordination figure (DSK-2) that highlights the approx. drainage boundaries.
In sum, the majority of sanitary flow will be routed to the Stittsville Diversion Trunk (SDT), but the precise boundaries are somewhat in flux until design parameters are finalized (such as the road configuration and the SDT elevation).

Regarding the local sanitary on Abbott Street, we have corrected the population in the High Density block to 680 people, so that it agrees with the Fernbank Master Servicing parameters. The affect is to resolve surcharge in the sewer under peak design flow conditions. I've attached the current design sheet for your consideration (excerpt from the Servicing Brief).

I believe this should address city concerns related to the wastewater system. Let me know if I've missed anything, or if there are other concerns.
Sincerely,

Mark Bissett, P.Eng., Senior Project Manager | Land Development & Municipal
NOVATECH Engineers, Planners & Landscape Architects
240 Michael Cowpland Drive, Suite 200, Ottawa, ON, K2M 1P6 | Tel: 613.254.9643 Ext: 237 | Cell: 613.261.4792
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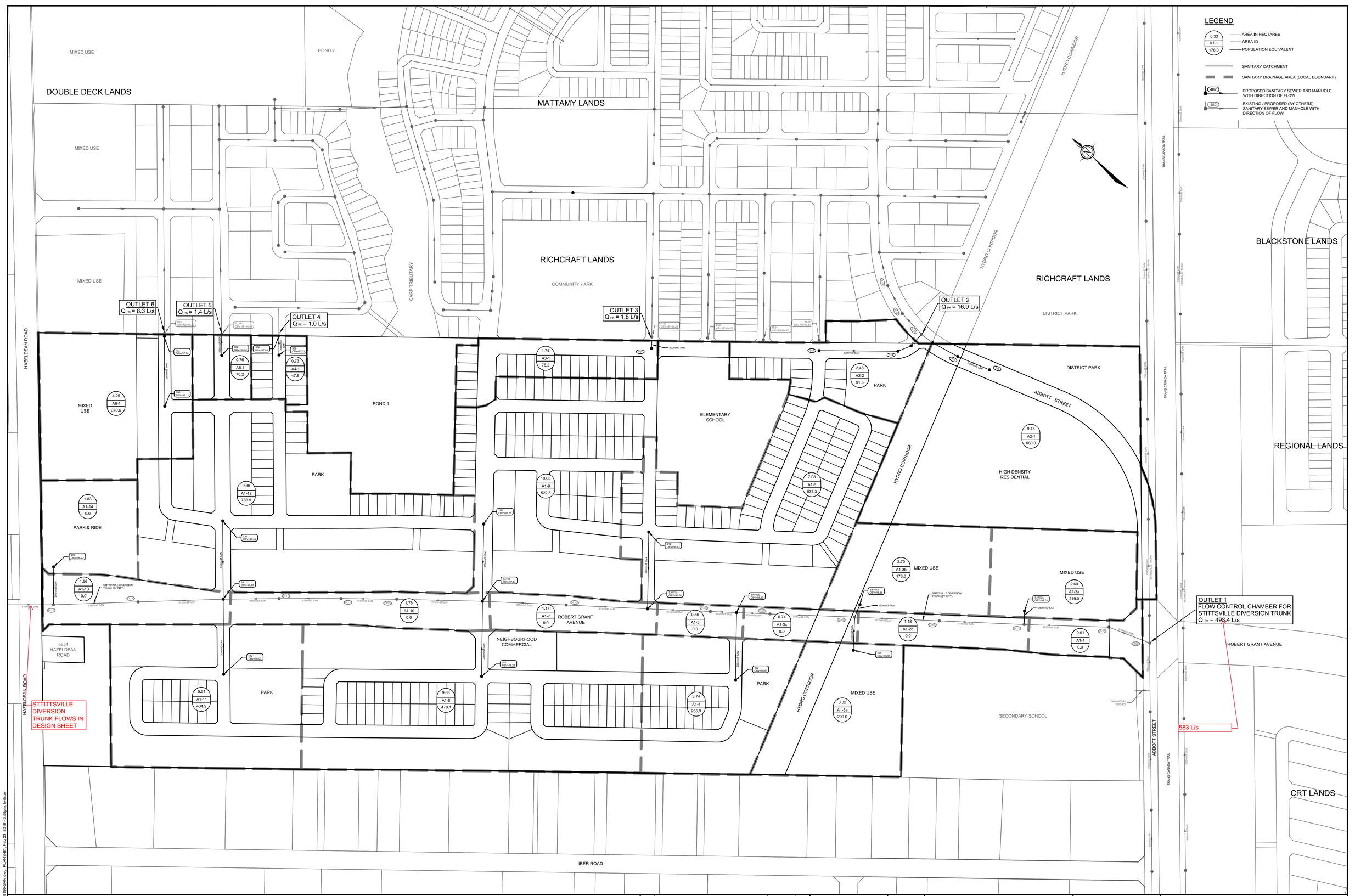
'

FERNBANK COMMUNITY - KIZELL LANDS
SANITARY SEWER DESIGN SHEET

583L/s

AREA			RESIDENTIAL															ICI				INFILTRATION				PIPE					
			SINGLES		TOWNS		STACKED TOWNS		MEDIUM DENISTY		HIGH DENSITY		MIXED USE	TOTAL																	
ID	From	To	Units	Pop.	Units	Pop.	Area	Pop.	Area	Pop.	Units	Pop.	Net Area (ha)	Pop.	Pop.	Accum. Pop.	Peak Factor	Peak Flow (l/s)	Commercial Area (ha)	Institutional Area (ha)	Accum. Area (ha)	Peak Flow (l/s)	Total Area (ha)	Accum. Area (ha)	Infilt. Flow (l/s)	**Total Flow (l/s)**	Size (mm)	Slope (%)	Length (m)	Capacity (l/s)	Full Flow Vel. (m/s)	Q/Q_{full} (%)
Outlet 1																															
Stittsville Diversion Trunk																									493.4						
	SA100	SA101		0.0		0.0								0.0	0.0	0	4.0	0.0			0.00	0.0	0.00	0.00	0.0	493.4	900	0.38	62	1164.2	1.77	42.4%
A1-1	SA101	SA102		0.0		0.0								0.0	0.0	0.0	4.0	0.0			0.00	0.0	0.94	0.94	0.3	493.7	975	0.16	120	935.2	1.21	52.8%
A1-2	SA102	SA104		0.0		0.0							2.60	219.0	219.0	219.0	4.0	3.5	1.17		1.17	1.0	3.71	4.65	1.3	499.3	975	0.16	240	935.2	1.21	53.4%
A1-3	SA104	SA106a		0.0		0.0							4.47	376.0	376.0	595.0	3.9	9.5	2.01		3.18	2.8	6.76	11.41	3.2	508.8	975	0.16	167	935.2	1.21	54.4%
A1-4	222	SA106a	19	64.6		0.0	0.88	116.4	0.64	74.9				0.0	255.9	255.9	4.0	4.1		0.80	0.80	0.7	3.74	3.74	1.0	5.9	200	0.35	96	20.2	0.62	29.1%
A1-5	SA106a	SA107a		0.0		0.0								0.0	0.0	850.9	3.8	13.3			3.98	3.5	0.56	15.71	4.4	514.5	975	0.16	126	935.2	1.21	55.0%
A1-6	212	SA107a	76	258.4	36	97.2			1.51	176.7				0.0	532.3	532.3	4.0	8.5		0.81	0.81	0.7	7.08	7.08	2.0	11.2	200	0.35	109	20.2	0.62	55.4%
A1-7	SA107a	SA108		0.0		0.0								0.0	0.0	1383.2	3.7	20.8			4.79	4.2	1.17	23.96	6.7	525.0	975	0.16	234	935.2	1.21	56.1%
A1-8	148	SA108	68	231.2		0.0	2.26	299.0	2.11	246.9				0.0	478.1	478.1	4.0	7.7	0.55		0.55	0.5	9.63	9.63	2.7	10.9	250	0.35	106	36.7	0.72	29.7%
A1-9	190	SA108	74	251.6	44	118.8			1.30	152.1				0.0	522.5	522.5	4.0	8.4		3.04	3.04	2.6	10.65	10.65	3.0	14.0	300	0.20	109	45.1	0.62	31.1%
A1-10	SA108	SA112		0.0		0.0								0.0	0.0	2383.7	3.5	34.0			8.38	7.3	1.78	46.02	12.9	547.6	975	0.16	367	935.2	1.21	58.6%
A1-11	112	SA112	16	54.4		0.0	1.50	198.5	1.55	181.4				0.0	434.2	434.2	4.0	7.0		0.80	0.80	0.7	5.51	5.51	1.5	9.3	200	0.80	106	30.6	0.94	30.3%
A1-12	120	SA112	28	95.2	127	342.9			2.81	328.8				0.0	766.9	766.9	3.9	12.0		0.81	0.81	0.7	9.36	9.36	2.6	15.4	250	0.25	111	31.0	0.61	49.5%
A1-13	SA112	SA114		0.0		0.0								0.0	0.0	3584.8	3.4	49.0			9.99	8.7	1.66	62.55	17.5	568.6	975	0.16	241	935.2	1.21	60.8%
A1-14	SA114	SA115		0.0		0.0								0.0	0.0	3584.81	3.4	49.0		1.83	11.82	10.3	1.83	64.38	18.0	570.7	975	0.24	92	1145.4	1.49	49.8%
Outlet 2																															
A2-1, A2-2	R20	R19	15	51.0	15	40.5						680		0.0	772	772	3.9	12.1		1.64	1.64	1.4	11.93	11.93	3.3	16.9	300	0.50	43	71.3	0.98	23.6%
Outlet 3																															
A3-1	404	R30	23	78.2		0.0								0.0	78.2	78.2	4.0	1.3			0.00	0.0	1.74	1.74	0.5	1.8	200	0.35	11	20.2	0.62	8.7%
Outlet 4																															
A4-1	502	504	14	47.6		0.0								0.0	47.6	47.6	4.0	0.8			0.00	0.0	0.73	0.73	0.2	1.0	200	0.65	27	27.6	0.85	3.5%
Outlet 5																															
A5-1	602	RCAP1		0.0	26	70.2								0.0	70.2	70.2	4.0	1.1			0.00	0.0	0.76	0.76	0.2	1.4	200	0.75	29	29.6	0.91	4.6%
Outlet 6																															
A6-1	700	702		0.0	48	129.6								0.0	129.6	129.6	4.0	2.1			0.00	0.0	1.39	1.39	0.4	2.5	200	0.35	99	20.2	0.62	12.3%
A6-1	702	R41		0.0		0.0							2.86	241.0	241.0	370.6	4.0	6.0	1.29		1.29	1.1	2.86	4.25	1.2	8.3	250	0.35	3	36.7	0.72	22.6%

Design Parameters:			**Population Density:**			**Project: Kizell Lands (108195)**
Avg Flow/Person =	350	l/day		ppl/unit	units/net ha	Designed: LRW
Comm./Inst. Flow =	50000	l/ha/day	Mixed Use/HDR	1.80	85	Checked: MAB
Infiltration =	0.28	l/s/ha	Singles	3.40		Date: February 23, 2018
Pipe Friction n =	0.013		Towns	2.70		
Residential Peaking Factor = Harmon Equation (max 4, min 2)			Stacked Towns	2.70	49	
Peaking Factor Comm./Inst. =	1.5		Medium Density	1.80	65	



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

No.	REVISION	DATE	BY
3.	DRAFT PLAN RESUBMISSION	FEB 23/18	MAB
2.	REVISED PER CITY COMMENTS	JUL. 20/17	MAB
1.	DRAFT PLAN APPLICATION	NOV., 9/16	MAB

SCALE
1:2000
1:2000
0 20 40 60 80

DESIGN LRW
CHECKED MAB
DRAWN DTD
CHECKED MAB
APPROVED JGR

FOR REVIEW ONLY

LICENSED PROFESSIONAL ENGINEER
L. R. WILSON
100160065
PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER
M.A. BISSETT
2018.02.23
PROVINCE OF ONTARIO

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

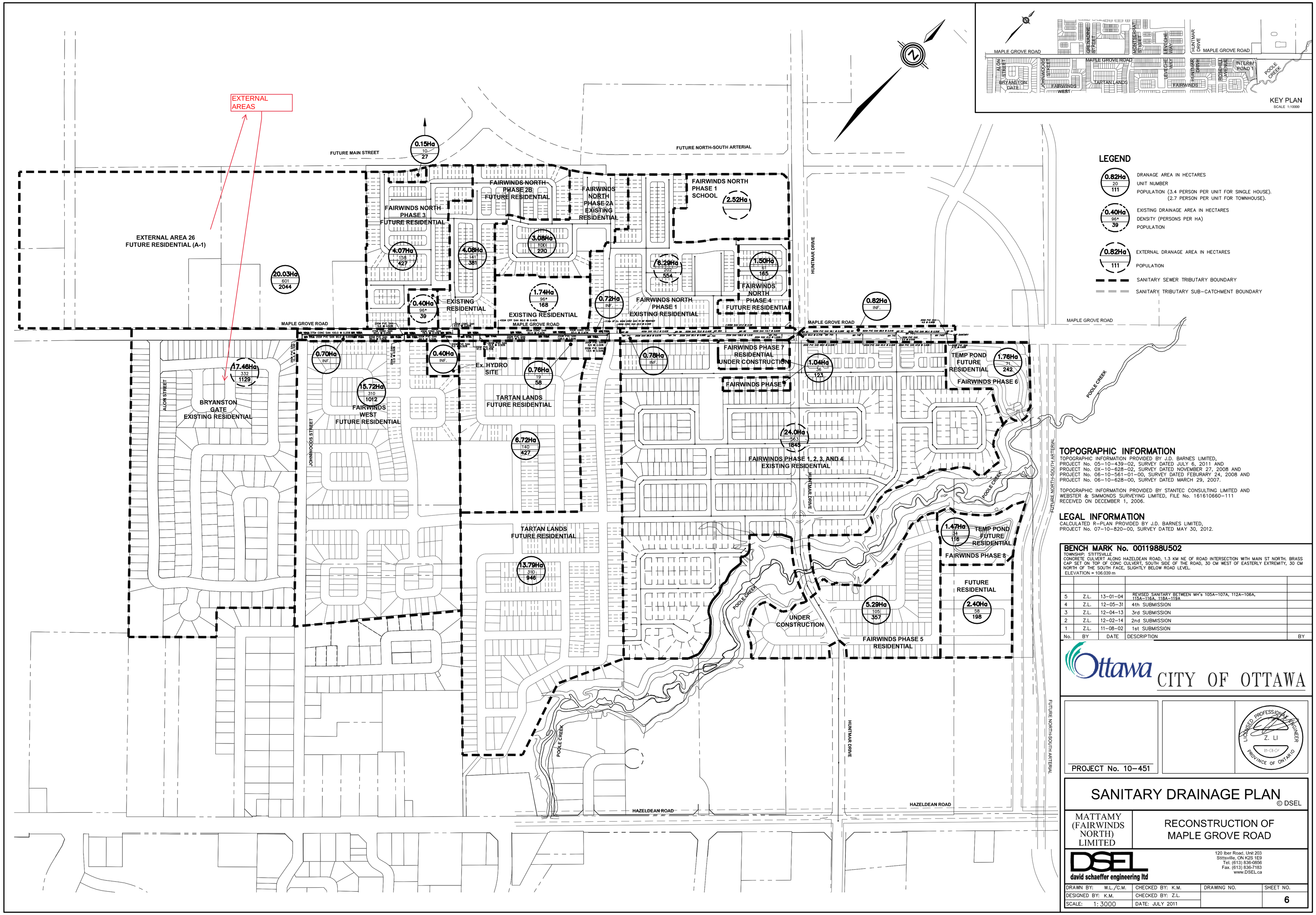
CITY OF OTTAWA
FERNBANK COMMUNITY - KIZELL LANDS

SANITARY DRAINAGE AREA PLAN

PROJECT No. 108195
REV REV # 3
DRAWING No. 108195-SAN

M:\2008\108195\Submission\CAD\Design\108195-SAN.dwg, PLANS-B1 / Feb 23, 2018 - 3:38pm, lwilson

PLANBY.DWG - 1000mm/mm/25mm



LEGEND

- 0.82Ha / 20 / 111 — DRANAGE AREA IN HECTARES; UNIT NUMBER; POPULATION (3.4 PERSON PER UNIT FOR SINGLE HOUSE). (2.7 PERSON PER UNIT FOR TOWNHOUSE).
- 0.40Ha / 96* / 39 — EXISTING DRAINAGE AREA IN HECTARES; DENSITY (PERSONS PER HA); POPULATION
- 0.82Ha / 111 — EXTERNAL DRANAGE AREA IN HECTARES; POPULATION
- SANITARY SEWER TRIBUTARY BOUNDARY
- SANITARY TRIBUTARY SUB-CATCHMENT BOUNDARY

TOPOGRAPHIC INFORMATION

TOPOGRAPHIC INFORMATION PROVIDED BY J.D. BARNES LIMITED,
PROJECT No. 05-10-439-02, SURVEY DATED JULY 6, 2011 AND
PROJECT No. 04-10-628-02, SURVEY DATED NOVEMBER 27, 2008 AND
PROJECT No. 06-10-561-01-00, SURVEY DATED FEBURARY 24, 2008 AND
PROJECT No. 06-10-628-00, SURVEY DATED MARCH 29, 2007.

TOPOGRAPHIC INFORMATION PROVIDED BY STANTEC CONSULTING LIMITED AND WEBSTER & SIMMONDS SURVEYING LIMITED, FILE No. 161610660-111 RECEIVED ON DECEMBER 1, 2006.

LEGAL INFORMATION

CALCULATED R-PLAN PROVIDED BY J.D. BARNES LIMITED,
PROJECT No. 07-10-820-00, SURVEY DATED MAY 30, 2012.

BENCH MARK No. 0011988U502

TOWNSHIP: STITTSVILLE
CONCRETE CULVERT ALONG HAZELDEAN ROAD, 1.3 KM NE OF ROAD INTERSECTION WITH MAIN ST NORTH. BRASS CAP SET ON TOP OF CONC CULVERT, SOUTH SIDE OF THE ROAD, 30 CM WEST OF EASTERLY EXTREMITY, 30 CM NORTH OF THE SOUTH FACE, SLIGHTLY BELOW ROAD LEVEL.
ELEVATION = 106.039 m

No.	BY	DATE	DESCRIPTION	BY
5	Z.L.	13-01-04	REVISED SANITARY BETWEEN MH's 105A-107A, 112A-106A, 115A-116A, 118A-119A	
4	Z.L.	12-05-31	4th SUBMISSION	
3	Z.L.	12-04-13	3rd SUBMISSION	
2	Z.L.	12-02-14	2nd SUBMISSION	
1	Z.L.	11-08-02	1st SUBMISSION	

CITY OF OTTAWA

PROJECT No. 10-451

LICENSED PROFESSIONAL ENGINEER
Z. LI
PROVINCE OF ONTARIO

SANITARY DRAINAGE PLAN

© DSEL

MATTAMY (FAIRWINDS NORTH) LIMITED

RECONSTRUCTION OF MAPLE GROVE ROAD

DSEL
david schaeffer engineering ltd
120 Iber Road, Unit 203
Stittsville, ON K2S 1E9
Tel. (613) 836-0856
Fax. (613) 836-7183
www.DSEL.ca

DRAWN BY: W.L./C.M.	CHECKED BY: K.M.	DRAWING NO.	SHEET NO.
DESIGNED BY: K.M.	CHECKED BY: Z.L.		6
SCALE: 1:3000	DATE: JULY 2011		

SANITARY SEWER CALCULATION SHEET

Manning's n=0.013

LOCATION				RESIDENTIAL AREA AND POPULATION							COMM		INDUST		INSTIT		C+I+I	INFILTRATION				PIPE						
STREET		FROM M.H.	TO M.H.	AREA (ha)	UNITS	POP.	CUMULATIVE AREA (ha)	CUMULATIVE POP.	PEAK FACT.	PEAK FLOW (l/s)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	PEAK FLOW (l/s)	TOTAL AREA (ha)	ACCU. AREA (ha)	INFILT. FLOW (l/s)	TOTAL FLOW (l/s)	DIST (m)	DIA (mm)	SLOPE (%)	CAP. (FULL) (l/s)	RATIO Q act/Q cap	VEL. (FULL) (m/s)	VEL. (ACT.) (m/s)
MAPLE GROVE ROAD																												
				20.03	601	2044	20.03	2044										20.03	20.03									
		104A	105A	17.46	332	1129	37.49	3173	3.42	43.96								17.46	37.49	10.497	54.46	100.0	375	0.25	87.67	0.62	0.79	0.83
		105A	106A	0.70	0	0	38.19	3173	3.42	43.96								0.70	38.19	10.693	54.65	92.0	375	0.25	87.67	0.62	0.79	0.83
				0.40		39	38.59	3212										0.40	38.59									
				0.40	0	0	38.99	3212										0.40	38.99									
		106A	107A	15.72	310	1012	54.71	4224	3.31	56.64								15.72	54.71	15.319	71.96	78.5	450	0.20	127.50	0.56	0.80	0.82
		107A	108A	0.72	0	0	55.43	4224	3.31	56.64								0.72	55.43	15.520	72.16	63.0	450	0.20	127.50	0.57	0.80	0.82
		108A	109A	6.72	140	427	62.15	4651	3.27	61.61								6.72	62.15	17.402	79.01	80.0	450	0.40	180.32	0.44	1.13	1.09
		109A	1090A	1.74		168	63.89	4819	3.26	63.64								1.74	63.89	17.889	81.53	80.0	450	0.40	180.32	0.45	1.13	1.10
		1090A	110A				63.89	4819	3.26	63.64								0.00	63.89	17.889	81.53	83.0	450	0.40	180.32	0.45	1.13	1.10
				0.76	19	58	64.65	4877										0.76	64.65									
		110A	Ex. 88	13.79	310	946	78.44	5823	3.18	75.01								13.79	77.68	21.750	96.76	22.0	600	0.40	388.33	0.25	1.37	1.14
		Ex. 88	Ex. 89	0.78	0	0	79.22	5823	3.18	75.01								0.78	78.46	21.969	96.98	101.3	600	0.40	388.33	0.25	1.37	1.14
				4.07	158	427	83.29	6250										4.07	82.53									
				4.08	141	381	87.37	6631										4.08	86.61									
				3.08	100	270	90.45	6901										3.08	89.69									
				2.52			92.97	6901																				
				6.29	202	554	99.26	7455										6.29	95.98									
		Ex. 89	Ex. 89A	1.50	61	165	100.76	7620	3.07	94.76								1.50	97.48	27.294	122.05	72.8	600	0.40	388.33	0.31	1.37	1.21
		Ex. 89A	Ex. 90				100.76	7620	3.07	94.76								0.00	97.48	27.294	122.05	47.2	600	0.40	388.33	0.31	1.37	1.21
		Ex. 90	Ex. 91				100.76	7620	3.07	94.76								0.00	97.48	27.294	122.05	112.7	600	0.62	483.47	0.25	1.71	1.42
				0.82	0	0	101.58	7620										0.82	98.30									
				1.04	36	123	102.62	7743										1.04	98.52									
				1.76	71	242	104.38	7985										1.76	100.28									
				24.00	563	1845	128.38	9830										24.00	124.28									
				2.40	58	198	130.78	10028										2.40	126.68									
				5.29	105	357	136.07	10385										5.29	131.97									
		Ex. 91	Ex. 92	1.47	34	116	137.54	10501	2.93	124.64								1.47	133.44	37.363	162.00	96.1	825	0.28	759.56	0.21	1.42	1.12
		Ex. 92	Ex. 93				137.54	10501	2.93	124.64								0.00	133.44	37.363	162.00	88.9	825	0.51	1025.11	0.16	1.92	1.39
		Ex. 93	Ex. 94				137.54	10501	2.93	124.64								0.00	133.44	37.363	162.00	96.4	825	0.50	1015.01	0.16	1.90	1.39

DESIGN PARAMETERS

Average Daily Flow =	350 l/p/day	Industrial Peak Factor =	as per MOE Graph
Commercial/Institution Flow =	50000 L/ha/da	Extraneous Flow =	0.280 L/s/ha
Industrial Flow =	35000 L/ha/da	Minimum Velocity =	0.760 m/s
Max Res. Peak Factor =	4.00	Manning's n =	0.013
Commercial/Institution peak Factor =	1.50	Townhouse coeff=	2.7
		Single house coeff=	3.4

Designed: K.M.

Checked: Z.L.

Dwg. Reference: Sanitary Drainage Plan, Dwg. No. 6

PROJECT: **RECONSTRUCTION OF MAPLE GROVE ROAD**

LOCATION: **City of Ottawa**

File Ref: 10-451

Date: May, 2012

Sheet No. 1 of 1

APPENDIX D

Draft 4M Plan

REVISION SCHEDULE			
NO.	REVISION	DATE	BY
9	REMOVED TRANSIT CORRIDOR BLKS	AUG. 23, 2023	N
8	ADDED MED. DENSITY BLK / RELOTTING	DEC. 7, 2022	N
7	LOT/BLOCK LINES mathematics.	NOV. 22, 2022	S
6	LOT/BLOCK LINES ADJ.	NOV. 15, 2022	N
4	REVISIONS	?????	??
1	PLAN PREPARED	JAN 19, 2021	N

APPROVED UNDER SECTION 51 OF THE PLANNING ACT
BY THE CITY OF OTTAWA.

THIS _____ DAY OF _____, 20____

_____
DON HERWEYER, MCIP, RPP.
ACTING GENERAL MANAGER
PLANNING, REAL ESTATE AND ECONOMIC
DEVELOPMENT DEPARTMENT
CITY OF OTTAWA

PLAN 4M-

I CERTIFY THAT THIS PLAN
IS REGISTERED IN THE LAND REGISTRY OFFICE
FOR THE LAND TITLES DIVISION OF OTTAWA-CARLETON NO. 4
AT _____ O'CLOCK ON THE _____ DAY OF _____
AND ENTERED IN THE PARCEL REGISTER FOR
PROPERTY IDENTIFIERS _____
_____
AND THE REQUIRED CONSENTS ARE REGISTERED AS
PLAN DOCUMENT NO._____

_____
REPRESENTATIVE FOR LAND REGISTRAR

This plan comprises all of PINS 04466-1089, 04466-2224, 04466-2225 & 04466-2235.

PART OF BLOCK 145 : SUBJECT TO EASEMENT INST. OC1749425.

PART OF BLOCKS 146, 147, 148 & 150 : SUBJECT TO EASEMENT INST. OC1749427.

PART OF BLOCKS 102, 112, 129 & 130 AND PART OF VOIE CARTAGE WAY, TERRASSE WINTER WHEAT TERRACE & AVENUE ROGER GRIFFITHS AVENUE : SUBJECT TO EASEMENT INST. OC2335280.

PART OF BLOCK 81 : SUBJECT TO EASEMENT INST. OC2342422.

PLAN OF SUBDIVISION OF

PART OF LOTS 28 and 29
CONCESSION 12
Geographic Township of Goulbourn
and
RESERVE BLOCK 33 and
PART OF RESERVE BLOCK 32
REGISTERED PLAN 4M-1675
CITY OF OTTAWA
Surveyed by Annis , O'Sullivan , Vollebekk Ltd.

Scale 1 : 1000
40 30 20 10 0 20 40 Metres

Metric
DISTANCES AND COORDINATES SHOWN ON THIS PLAN ARE IN METRES AND CAN BE CONVERTED TO FEET BY DIVIDING BY 0.3048.

Surveyor's Certificate

I CERTIFY THAT :

1. This survey and plan are correct and in accordance with the Surveys Act and the Surveyors Act and the regulations made under them.
2. The survey was completed on the ___ day of _____, 2023.

_____ _____
Date T. Hartwick
Ontario Land Surveyor

OWNER'S CERTIFICATE

THIS IS TO CERTIFY THAT :

1. Lots 1 to 45, both inclusive, Blocks 46 to 76 both inclusive, 78 to 121, both inclusive, the Streets, namely, voie Cartage Way, cours Combine Walk, chemin Holstein Road, chemin Ploughshare Road, avenue Roger Griffiths Avenue, place Shropshire Place, rue Tillage Street and terrasse Winter Wheat Terrace and the Street Widening, namely, Block 77 have been laid out in accordance with our instructions.
2. The Streets and Street Widening are dedicated as public highways to City of Ottawa.

Dated the _____ day
of _____, 2023

_____
Steve Grandmont, Chief Operating Officer
Richcraft Homes Ltd.
I have authority to bind the corporation.

NOTES AND LEGEND

–○–	denotes	Survey Monument Planted
■	-	Survey Monument Found
SIB	-	Standard Iron Bar
SSIB	-	Short Standard Iron Bar
CC	-	Cut Cross
IB	-	Iron Bar
CLF	-	Chain Link Fence
BF	-	Board Fence
NT	-	Non Tangential
(AOG)	-	Annis, O'Sullivan, Vollebekk Ltd.
(P1)	-	Plan 4R-26588
(P2)	-	Plan 4R-28479
(P3)	-	Registered Plan 4M-1675
(P4)	-	Plan 4R-19015
(P5)	-	Plan 4R-29154
(P6')	-	Plan 4R-31894

All planted survey monuments are IB's unless otherwise noted.

Distances shown on curved limits are Arc distances unless otherwise noted.

Distances shown on this plan are ground distances and can be converted to grid distances by multiplying by the combined scale factor of 0.999915.

Bearings are grid, derived from Can-Net 2016 Real Time Network GPS observations on reference points A and B, shown hereon, having a bearing of N48°28'50"E and are referenced to Specified Control Points 01919750705 and 01919770923, MTM Zone 9 (76°30' West Longitude) NAD-83 (original).

Coordinates are derived from Can-Net 2016 Real Time Network GPS observations referenced to Specified Control Points 01919750705 and 01919770923, MTM Zone 9 (76°30' West Longitude) NAD-83 (original).

Coordinate values are to urban accuracy in accordance with O. Reg. 216/10.

. 01919750705	Northing	5016816.93	Easting 360806.84
. 01919770923	Northing	5013536.21	Easting 346275.92
. Point A	Northing	5017164.64	Easting 350827.52
. Point B	Northing	5017406.98	Easting 351078.69

Caution: Coordinates cannot, in themselves, be used to re-establish corners or boundaries shown on this plan.

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Ontario Land Surveyors

Job No. 22076-21 Richcraft Pt Lts 28 29 C12 G0 Pt2 SUB 09 | S