Trailsedge East Block 193-194 – Servicing and Stormwater Management Report

Stantec Project No. 160401585

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Prepared for:

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1.0 INTRODUCTION

Richcraft Group of Companies Inc. (Richcraft) has commissioned Stantec Consulting Ltd. (Stantec) to prepare the following Preliminary Servicing Report for Trailsedge East Block 193-194 in support of its Site Plan Application. The subject site is located in the city of Ottawa, bound by Couloir Road to the south, Fern Casey Street to the west, Brian Coburn Boulevard to the north, and a future north-south local road (currently referred to as Street 23) to the east (refer to **Figure 1** below).

Figure 1: Key Map of Trailsedge East Block 193-194

The existing property is undeveloped and contains several temporary drainage ditches providing drainage to the subject property and adjacent lands to the east.

The subject property is currently zoned DR (Development Reserve) and occupies approximately 2.60 ha of land. The proposed development consists of 90 back-to-back townhouse units and 96 2-bedroom terrace units as shown in the attached draft plan included in **Appendix E**. As part of the Block 193-194 servicing works, it is proposed to complete Street 23 per City of Ottawa ROW standards and to maintain the road as a private street until Trailsedge East Phase 4 Development (located immediately east of the Block 193-194) is registered, at which point it will be conveyed to the City.

2.0 REFERENCE DOCUMENTS

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

- *City of Ottawa Sewer Design Guidelines*, 2nd Edition, City of Ottawa, October 2012.
- *City of Ottawa Design Guidelines – Water Distribution*, First Edition, Infrastructure Services Department, City of Ottawa, July 2010.
- *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.
- *Gloucester East Urban Community (EUC) Infrastructure Servicing Study Update (In Support of the EUC Community Design Plan)*, Stantec Consulting Ltd., March 2005.
- *East Urban Community Pond No.1 Design Brief*, Stantec Consulting Ltd., April 2008.
- *Design Brief – Minto Trailsedge Phase II*, IBI Group, February 2015.
- *Trails Edge East Phase 1 – Functional Servicing and Stormwater Management Report*, Stantec Consulting Ltd., August 2017.
- *Trails Edge East Phase 1 – Servicing and Stormwater Management Report*, Stantec Consulting Ltd., August 2019.
- *Master Servicing Study for East Urban Community Phase 3 Area Community Design Plan (Draft)*, David Schaeffer Engineering Limited (DSEL), June 2020.

3.0 POTABLE WATER SERVICING

3.1 BACKGROUND

The proposed development is located within Zone 2E of the City of Ottawa's water distribution system. This zone is fed by the Forest Ridge Pump Station, with the Innes Road elevated storage tank providing balancing storage for peak flows and demands. The site is fed by an existing 200mm diameter watermain stub on Street 23 and an existing 300mm diameter watermain on Couloir Road.

3.2 PROPOSED WATERMAIN SIZING AND LAYOUT

3.2.1 Connections to Existing Infrastructure

The proposed watermain alignment and sizing for the development is demonstrated on **Drawing SSP-1**. A 204 mm diameter watermain is proposed to follow the alignment of the private roads within the subject property with the following connection points:

1) At the existing 200mm diameter watermain stub on Street 23. This watermain will continue northwards on Street 23 and service the Block 193-194 site at the northern entrance to the site.

2) At the existing 300mm diameter watermain on Couloir Road across from the southern entrance to the site (Couloir Road STA 0+117.8).

Figure 2 shows the location of the two (2) connection points to the existing watermains.

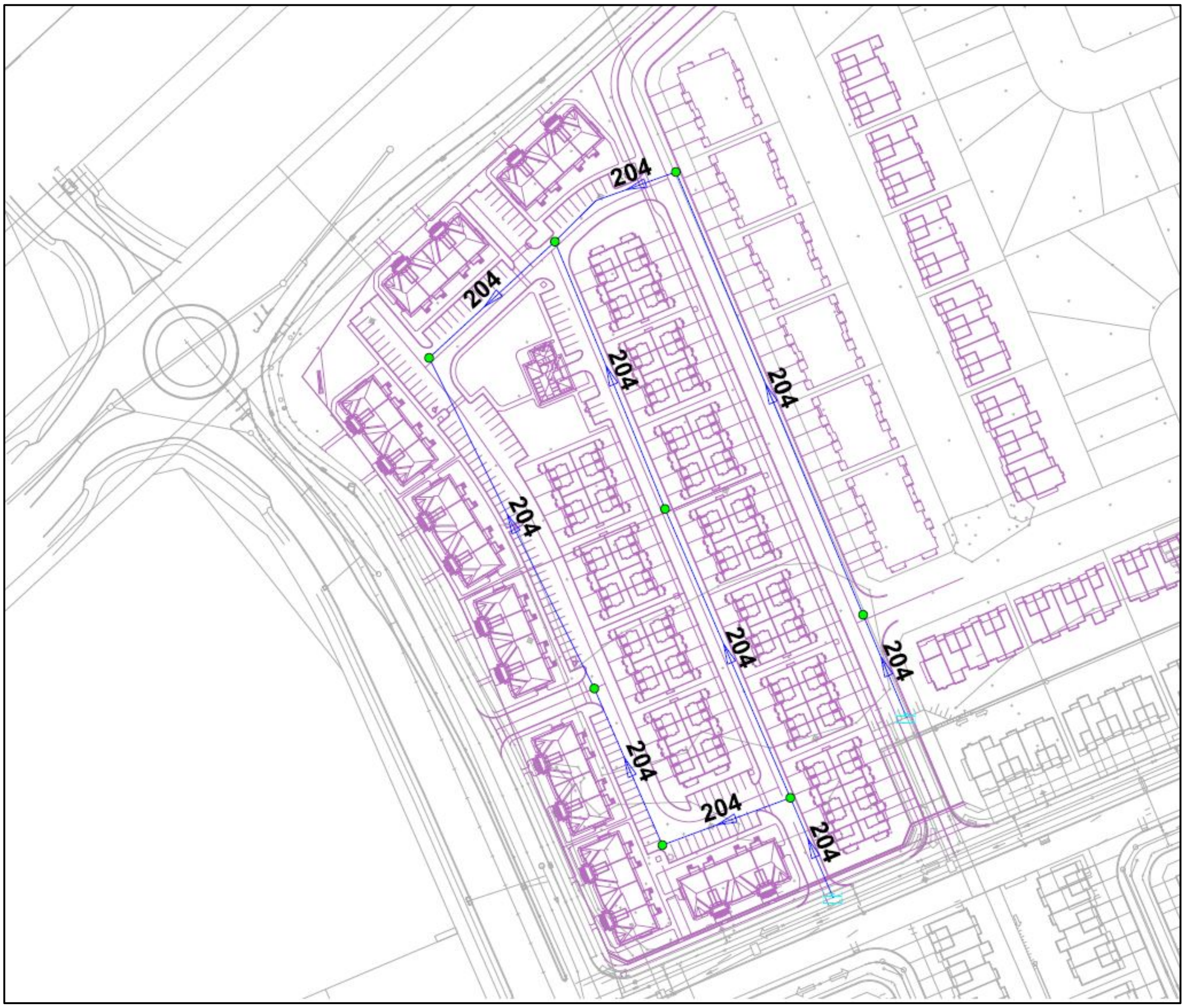

Figure 2: Proposed Watermain Layout and Pipe Diameters (mm)

3.2.2 Phasing

The Trailsedge East Phase 4 Development located immediately east of Block 193-194 will be developed in the future, with the proposed watermain on Street 23 serving both developments. The domestic water demands from the Phase 4 townhouses fronting onto Street 23 have bene included in the hydraulic model for Block 193-194.

3.2.3 Ground Elevations

Proposed ground elevations throughout the Block 193-194 site range from approximately 88.1 m to 88.5 m at nodes in the watermain network. Proposed ground elevations on Street 23 range from approximately 88.5 m to 88.3 m at nodes in the watermain network.

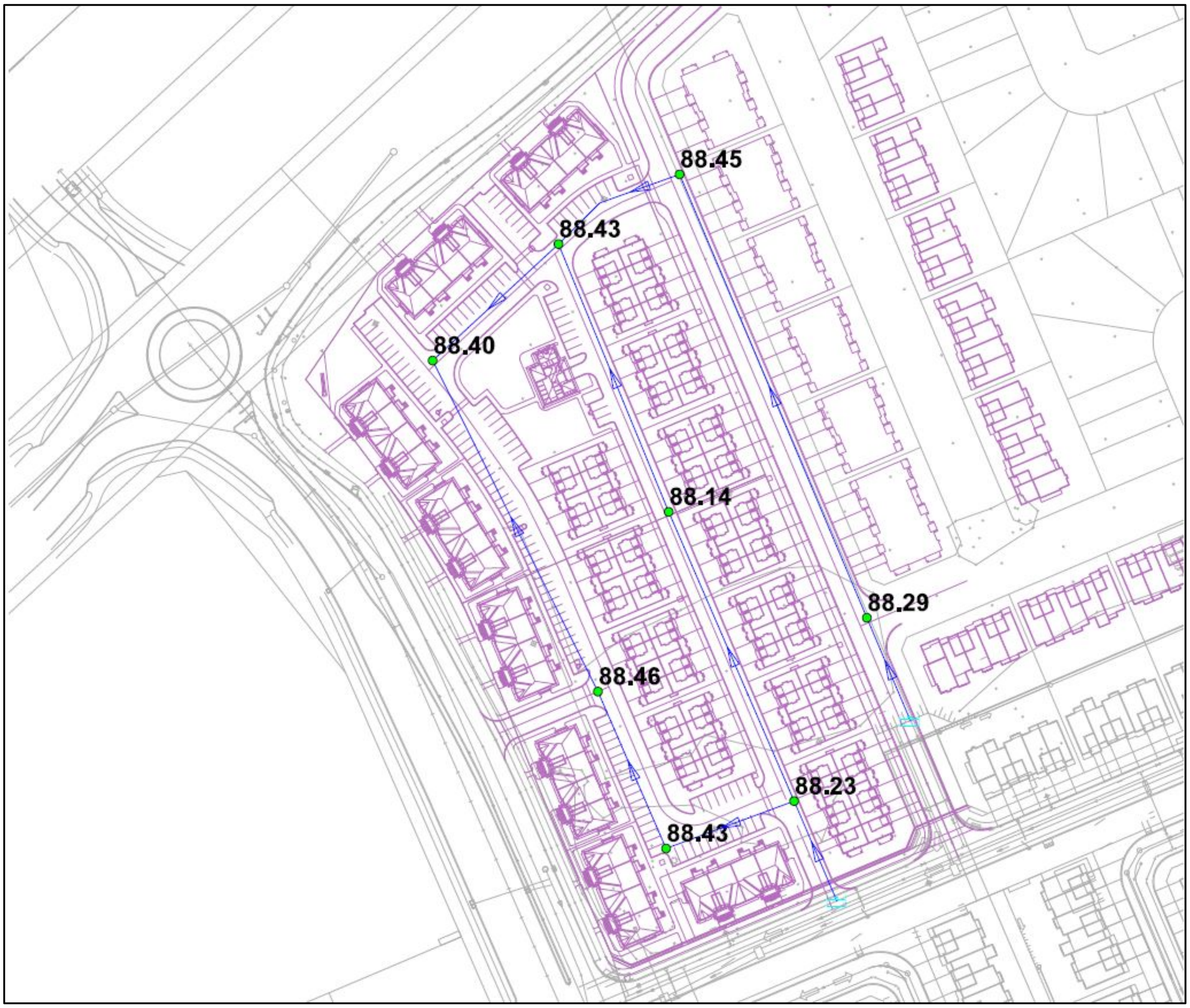

Figure 3: Ground Elevations (m) at Nodes

3.2.4 Domestic Water Demands

Trailsedge East Block 193-194 contains a total of 90 back-to-back townhome units and 96 2-bedroom terrace units, with an estimated total population of 445 persons. These unit counts include the back-to-back townhouse units fronting onto Street 23. Domestic demands from the future back-to-back townhomes on the east side of Street 23 were also accounted for the hydraulic model. Refer to **Appendix A.2** for detailed domestic water demand calculations.

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

(PKHR) demand, MXDY was multiplied by a factor of 2.2. The calculated residential water consumption is represented in **Table 1** below:

Table 1: Residential Water Demands for Block 193-194

Unit Type	Units	Persons/Unit	Population	AVDY (L/s)	MXDY (L/s)	PKHR (L/s)
Back-to-Back Townhomes	90	2.7	243	0.98	2.46	5.41
2-Bedroom Terrace Units	96	2.1	202	0.82	2.04	4.49
		Total	**445**	**1.80**	**4.50**	**9.91**

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 in 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 fireflow conditions, the minimum pressure objective in the distribution system is 138 kPa (20 psi).

3.3.2 Fireflow

Fireflow calculations were completed using the Fire Underwriters Survey (FUS) methodology. The results of the fireflow calculations are summarized in **Table 2** below.

Table 2: Fireflow Calculations Using FUS Methodology

Unit Type	Description	Required Fireflow (L/min)	Required Fireflow (L/s)
Back-to-Back Townhomes	3-storey 10-unit townhome block (Block 1) without a firewall.	16,000	266.7
Back-to-Back Townhomes	3-storey 10-unit townhome block (Block 1) with a 2-hr firewall diving building into 5-unit sections.	10,000	166.7
2-Bedroom Terrace Units	3-storey building with 12 2-bedroom terrace units without a firewall.	15,000	250
2-Bedroom Terrace Units	3-storey building with 12 2-bedroom terrace units with a 2-hr firewall dividing building into 6-unit sections.	9,000	150

The highest fireflow requirement of 16,000 L/min (266.7 L/s) was used for the purpose of the fireflow analysis.

3.4 HYDRAULIC ANALYSIS

A hydraulic model using H2OMAP Water was built by Stantec using the following boundary conditions:

1) Boundary condition at the Couloir Road watermain across from the southern entrance to the Block 193-194 site was provided by the City.

2) Boundary condition at the Street 23 watermain stub was provided by the City. Please note that the fixed-head reservoir elevation used in the Maximum Day + Fireflow (MXDY+FF) scenario for this connection point was taken to be the same as for the connection to the watermain on Couloir Road. The MXDY+FF head provided in the boundary conditions in the City appear to have modelled this node as a stub, which showed an unrealistically low head at this node, due in part to headloss across the previously dead-end section of the existing watermain. The entire length of the watermain from Couloir Road along Street 23 has been incorporated within the current model.

The boundary conditions used for the hydraulic analysis are summarized in **Table 3**.

Table 3: Boundary Conditions for Connection Points for Block 193-194

Location	AVDY (m)	PKHR (m)	MXDY+FF (FF=16,000 L/min) (m)
1 – Couloir Road (southern entrance to Block 193-194 site)	130.6	126.8	51.7
2 – Existing stub on Street 23	130.6	126.8	51.7

The anticipated pressures in this development were assessed to meet minimum servicing requirements (average day and peak hour demands). A fireflow analysis was also performed under maximum day conditions. The analysis herein only assesses conditions for Trailsedge East Block 193-194. Future units east of Street 23 will require FUS fireflow calculations at the time of their design to confirm that adequate fire flow requirements within the block are applicable for the area. Detailed results are shown in **Appendix A.4**.

3.4.1 Model Development

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

Table 4: C-Factors Applied Based on Watermain Diameter

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

3.4.1.1 Average Day & Peak Hour

The hydraulic model results show that the maximum pressures (AVDY condition) are anticipated to be approximately 413.0-416.2 kPa (59.90-60.36 psi) within the Block 193-194/Street 23 site.

Minimum pressures during PKHR are anticipated to be approximately 375.6-378.7 kPa (54.47-54.93 psi) for Block 193-194/Street 23. These pressures are well above the minimum allowable pressure of 276 kPa (40 psi).

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

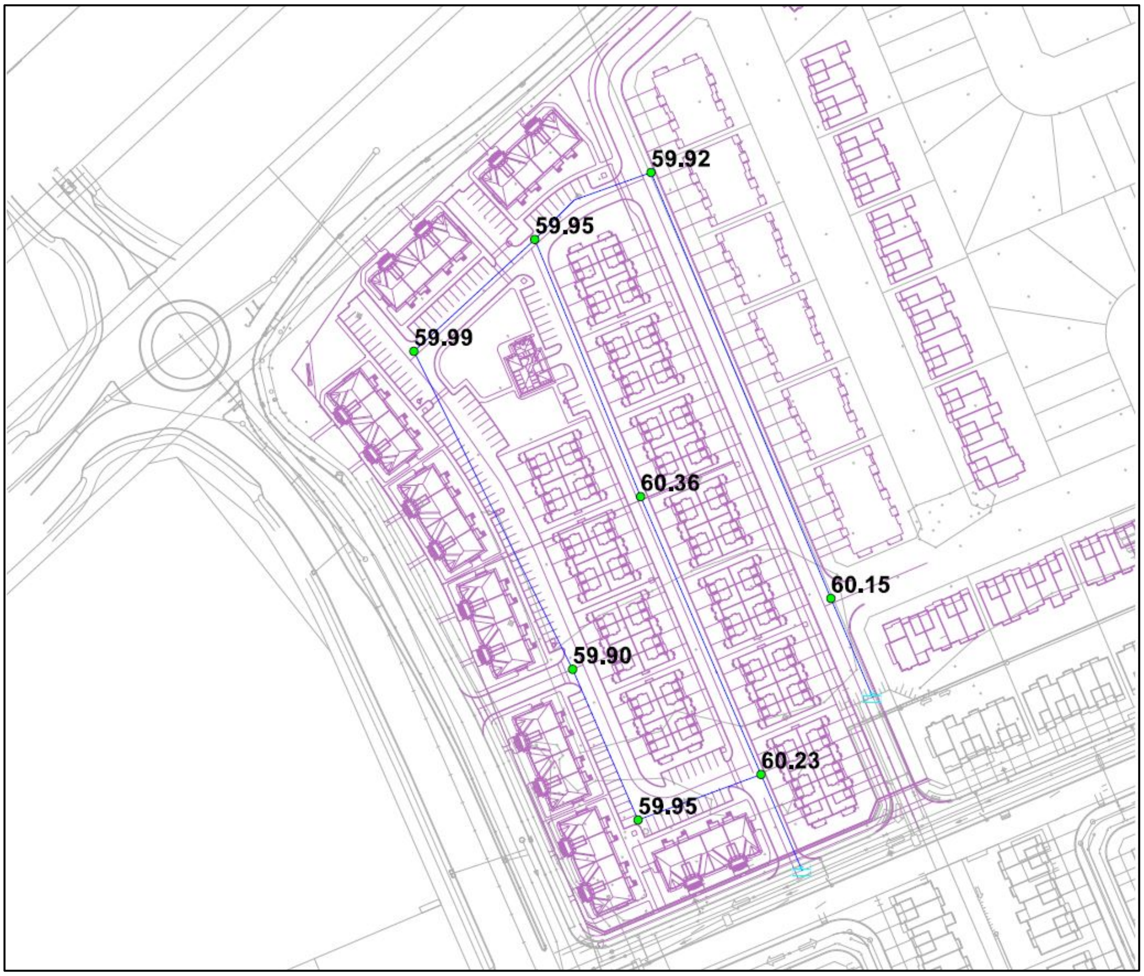

Figure 4: Maximum Pressures (psi) in Block 193-194 During AVDY Conditions

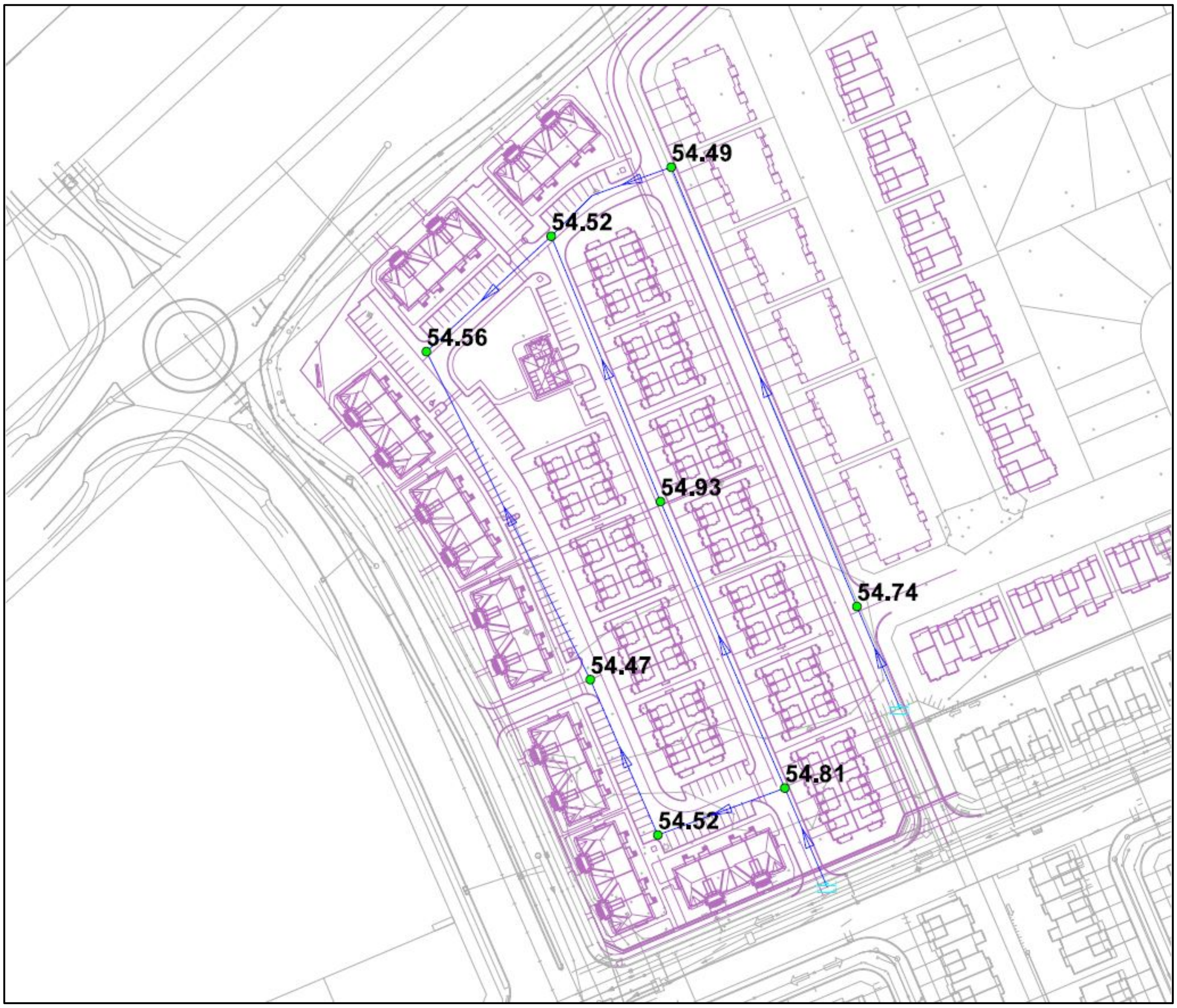

Figure 5: Minimum Pressures (psi) in Block 193-194 During PKHR Conditions

3.4.1.2 Maximum Day Plus Fireflow

An analysis was carried out using the hydraulic model to determine if the proposed development, under maximum day demands, can achieve a fireflow of 16,000 L/min (266.7 L/s) while maintaining a residual pressure of 138 kPa (20 psi). This was accomplished using a steady-state maximum day demand scenario along with the automated fireflow simulation feature of H2OMAP Water. The available flows are shown in **Figure 6**.

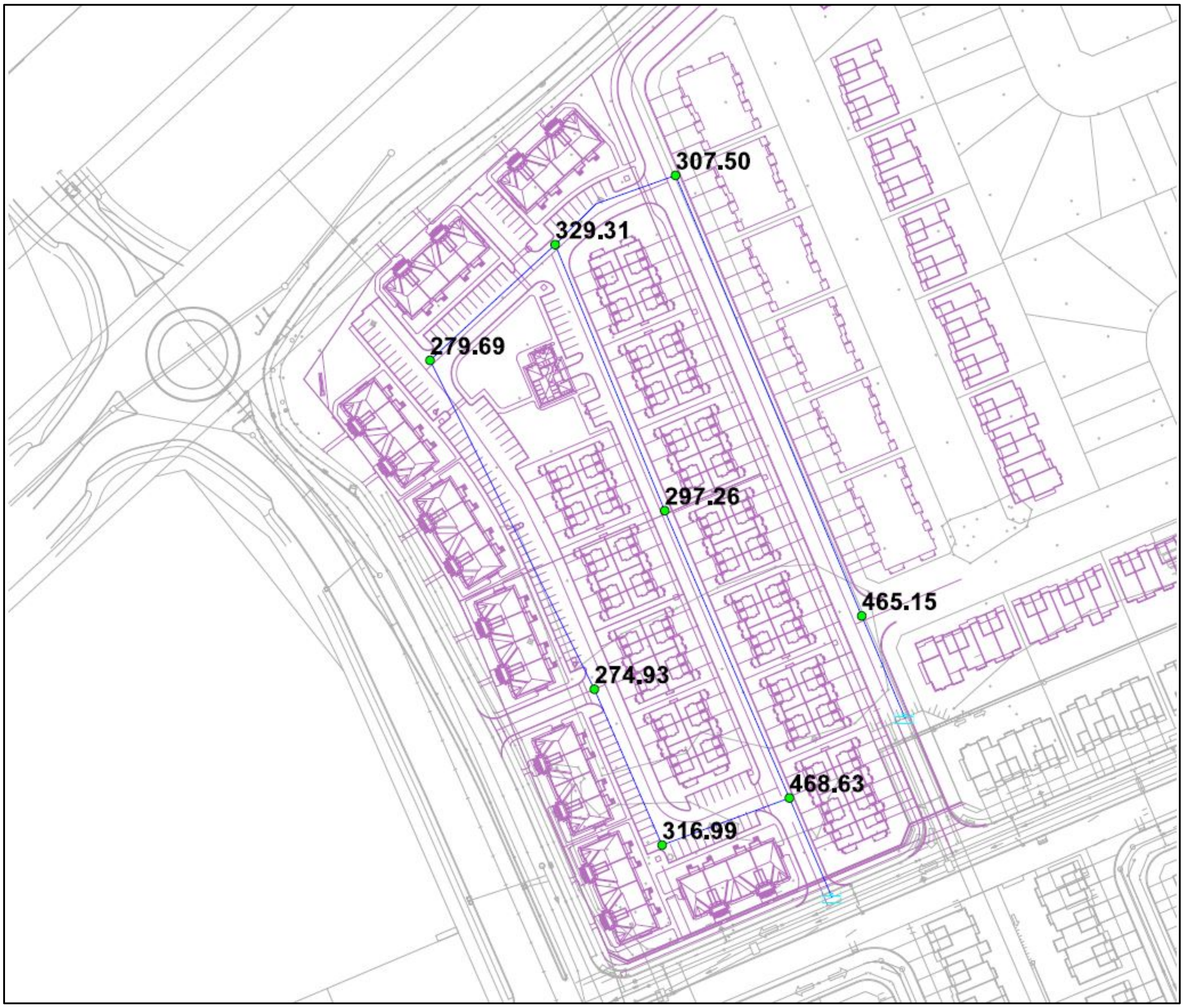

Figure 6: Available Fireflows (L/s) in Block 193-194 During MXDY Conditions

Using the proposed pipe layout and sizing, a fireflow of 16,000 L/min (266.7 L/s) can be achieved while maintaining at least 20 psi residual pressure at all locations upon development of Block 193-194 and Street 23.

4.0 WASTEWATER SERVICING

4.1 BACKGROUND

As indicated in the East Urban Community Master Servicing Study Update (Stantec, 2005), sanitary wastewater in the Trailsedge Development is conveyed to the Forest Valley Trunk (FVT) Sewer via a free flow gravity trunk sewer running along Renaud Road to the Forest Valley Pump Station. The Servicing and Stormwater Management Report for Trailsedge East Phase 1 (Stantec, 2019), whose sanitary sewers will accept drainage from the Block 193-194 site, labelled the subject site as 'Future MUC 1.'

The *Design Brief – Minto Trailsedge Phase II* report (IBI Group, 2015) identifies an external contribution to their subdivision based on a future population of 4212, which includes drainage from the entirety of the Trailsedge East development, as well as future lands forming a mixed-used community (MUC) identified within the EUC Master Servicing Update.

The updated East Urban Community Master Servicing Study (DSEL, June 2020) and the Trailsedge East Phase 1 Servicing Report (Stantec, 2019) identify the sanitary sewer on Couloir Road as the sanitary outlet for the Block 193-194 site. The Trailsedge East Phase 1 Servicing Report identified the future Block 193-194 and Street 23 lands as 'FUTURE MUC 1', with an area of 3.11 ha and a population of 152.

4.2 DESIGN CRITERIA

As outlined in the City's Sewer Design Guidelines, the following design parameters were used to calculate estimated 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 persons per unit – 3.4
- Townhouse persons per unit – 2.7
- 2-bedroom apartments persons per unit – 2.1
- Extraneous Flow Allowance – 0.33 L/s/ha
- Residential Average Flows – 280 L/cap/day
- Commercial/Mixed Use Flows – 28,000 L/ha/day
- Maintenance Hole Spacing – 120 m
- 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 Ottawa's Sewer Design Guidelines.

Refer to **Appendix B** for the sanitary sewer design sheet for the proposed Trailsedge East Block 193-194 site.

4.3 SANITARY SERVICING DESIGN

A network of 200mm diameter sanitary sewers are proposed throughout the Block 193-194 site. An existing 200mm diameter sanitary sewer on Street 23, installed as part of the Trailsedge East Phase 1 servicing works, will serve as the sanitary outlet for the site. Sanitary flows will then be directed westwards along Couloir Road, then southwards along Fern Casey Street. The proposed sanitary sewers within the Block 193-194 site will not convey any upstream sanitary flows. The proposed 200mm diameter sanitary sewer on Street 23 will also service future back-to-back townhouse blocks fronting onto the east side of the street. The back-to-back townhouses are part of the future Trailsedge East Phase 4 development, which is currently in the functional servicing design stage. The proposed sanitary sewer layout for the subject site is shown in **Drawings SSP-1** and **SA-1** in **Appendix F**. The sanitary sewer design sheet is included in **Appendix B.1**.

The peak flows from Block 193-194, Street 23 and external areas to the sanitary outlet are summarized in **Table 5** below.

Table 5: Sanitary Peak Flow from Block 193-194 and Street 23

MH ID	Total area (ha)	Population	Peak Flow (L/s)	Sewer Diameter (mm)
EX. MH 101 (STUB), Block 193-194 contribution	2.60	445	5.6	200
EX. MH 101 (STUB), E side of Street 23 (Phase 4) contribution	0.78	67	1.1	200
EX. MH 101 (STUB), external contributions	0	0	0	-
TOTAL:	**3.38**	**512**	**6.7**	**-**

To ensure that the existing sanitary sewer on Street 23 and Couloir Road was sufficiently sized to accept peak flows from the Block 193-194 development, the as-built sanitary sewer design sheet from Trailsedge East Phase 1 was used to compare the capacity of the existing sanitary sewers to the anticipated peak flows from Block 193-194. The results are summarized in **Table 6** below. Background information, including the Trailsedge East Phase 1 as-built sanitary sewer design sheet, are shown in **Appendix B.2**.

Table 6: Comparison of Expected Residential Sanitary Peak Flows for Block 193-194

MH ID	Formerly Expected Population from 'FUTURE MUC 1' (Block 193-194 forms part), from Trailsedge East Phase 1 Detailed Design Report	Revised Expected Population from 'FUTURE MUC 1' (Block 193-194 forms part), from Block 193-194 Detailed Design Report	Formerly Expected Sanitary Peak Flow (L/s)	Revised Expected Sanitary Peak Flow (L/s)
EX. MH 101 (STUB)	152	512	2.8	6.7

The increase in the expected sanitary peak flows due to the higher population density of the Block 193-194 development can then be compared against the residual capacity in the downstream sanitary sewers based on the as-built grades of these sewers. The results of this analysis are summarized in **Table 7** below.

Table 7: Capacity of Downstream Sanitary Sewers

From MH	To MH	Residual Capacity (L/s) from Trailsedge East Phase 1 As-Built Sanitary Sewer Design Sheet	Increase in Expected Sanitary Peak Flows in Block 193-194 (L/s)	Residual Sewer Capacity After Block 193-194 Development (L/s)
STUB	EX. MH 101	20.8	3.9	16.9
EX. MH 101	EX. MH 100	48.1	3.9	44.2

As shown in the tables above, despite the increase in expected population density for the Block 193-194 site compared to assumptions made in the Trailsedge East Phase 1 Servicing Report, the downstream sewer network has sufficient capacity to accept the expected sanitary peak flows from the proposed development.

5.0 STORMWATER MANAGEMENT AND STORM SERVICING

The proposed development encompasses approximately 2.60 ha of land within the Block 193-194 property, with Street 23 contributing an additional 0.73 ha of storm drainage area. The entire development is residential with a mix of three-storey back-to-back townhomes and three-storey terrace flat units. As shown on **Drawing SD-1**, post-development minor system peak flows from the development will be discharged to the existing storm sewer on Street 23, just north of Couloir Road. Overland flows in the major events will be directed to Couloir Road and then along the Fern Casey Street right-of-way before entering Mud Creek at an existing engineered spillway south of Locust Ridge. Stormwater quality control (70% TSS removal) is provided by the existing Stormwater Management (SWM) Pond 1, located southwest of the site. Refer to **Appendix C.4** for the storm drainage plan and as-built storm design sheet for Trailsedge East Phase 1 (Stantec).

In the existing condition, the site drains generally from north to south, with storm runoff captured via interim construction ditches which ultimately discharge to an existing catchbasin northeast of the Fern Casey Street/Couloir Road intersection (CB L1001A-1 in the Trailsedge East Phase 1 drawings).

The proposed storm sewers in Block 193-194 will not convey stormwater runoff from any upstream sites. Street 23 will accept drainage from the Block 193-194 townhomes fronting onto it, as well as the back-to-back townhouse blocks from the future Trailsedge East Phase 4 on the east side of the street. Major system peak flows from elsewhere in Phase 4 will not be directed to Street 23, but to Arête Street further east in accordance with the EUC MSS (DSEL, 2020) and proposed design for Trailsedge East Phase 1 (Stantec, 2019). The storm sewer design sheet is included in **Appendix C.1**.

The objective of this report is to complete a stormwater management (SWM) plan for the proposed development that meets all relevant design criteria.

5.1 BACKGROUND

Stantec Consulting Ltd. completed the detailed design of the Trailsedge East Phase 1 subdivision in August 2019. The design of the storm sewers, sanitary sewers, and watermains in the Trailsedge East Phase 1 site accounted for the future development parcels to the north (including Block 193-194 and Trailsedge East Phase 4) and to the east (Trailsedge East Phase 2-3).

5.2 STORMWATER MANAGEMENT DESIGN

5.2.1 Design Criteria and Constraints

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

General

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

Storm Sewer & Inlet Controls

- Proposed site to discharge to the existing storm sewer stub on Street 23 (*Trails Edge East Phase 1 Servicing and Stormwater Management Report*, Stantec)
- Total discharge from the site not to exceed **0.606** m^3/s in the 2-year event and **0.928** m^3/s in the 100-year event (*Trails Edge East Phase 1 Servicing and Stormwater Management Report PCSWMM Model*, Stantec)
- Boundary condition for the storm sewer outlet on Street 23 per the PCSWMM modelled prepared for the *Trails Edge East Phase 1 Servicing and Stormwater Management Report* (Stantec, 2019)
- 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, Stantec)
- Peak minor system inflow to be restricted for all contributing areas to capture the 2-year event.
- 100-year Storm HGL to be a minimum of 0.30 m below building foundation footing (City of Ottawa).
- Climate change event HGL to be below building foundation footing (City of Ottawa).

Surface Storage & Overland Flow

- Building openings to be a minimum of 0.15m above the 100-year water level within adjacent ROWs (City of Ottawa).
- Overland flow from the Block 193-194 modelled to be retained on site up to and including the 100-year storm event (Stantec)
- No surface ponding is to be permitted on local roads during the 2-year storm event, and no surface ponding is to be permitted on collector roads during the 5-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 0.30m to be provided from rear yard spill elevation to the ground elevation at the adjacent building envelope (City of Ottawa).
- Minimum clearance depth of 0.15m to be provided from spill elevations within the proposed rights-of-way to building envelopes in proximity of overland flow routes or ponding areas.
- Water must not encroach upon proposed building envelopes, and must remain below all proposed building openings during the climate change event (City of Ottawa).
- Provide adequate emergency overflow conveyance off-site (City of Ottawa).
- No rear-yard ponding volumes to be accounted for in SWM model preparation (City of Ottawa).
- The product of depth times velocity on streets not to be greater than 0.6 during the 100-year storm event (City of Ottawa).
- Major and minor flow to be conveyed to SWM Pond 1 for quality (70% TSS removal) and quantity control (EUC MSS).

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

In keeping with the 2-year inlet restriction criterion (2-year for local streets, 5-year for collector streets, 10-year for arterial roads), inlet control devices (ICDs) or orifice plates are specified for all street catchbasins to limit the inflow to the minor system. Restricted inlet rates to the sewer are necessary to prevent the hydraulic grade line from surcharging storm sewers into basements during major storms.

Drawing SD-1 outlines the proposed storm sewer alignment and drainage divides.

5.3 POST-DEVELOPMENT MODELLING

Hydrologic and hydraulic modeling of the storm system was completed using PCSWMM modeling software which uses the EPA-SWMM 5.1.015 computational engine for analysis. The included models can also be opened and reviewed using the free EPA-SWMM GUI. PCSWMM model layout, input parameters, and example input file are provided in **Appendix C**. Modelling files have been provided as part of the digital submission. The following sections summarize the input parameters used in the post-development model.

5.3.1 Allowable Release Rate

The peak allowable post-development discharge from the Block 193-194 site is based on the PCSWMM modelling files from the *Trails Edge East Phase 1 Servicing and Stormwater Management Report* (Stantec, 2019), which made assumptions regarding flow from the Block 193-194 site and Street 23 right-of-way.

The proposed storm sewer layout involves only one (1) connection to the existing storm sewer network, at the stub on Street 23, north of existing STM MH 1002. The minor system target release rates are summarized in **Table 8** below.

Table 8: Minor System Target Release Rate from Trailsedge East Phase 1 PCSWMM Models

Outlet Node	2-yr Target Flow Rate (m^3/s)	100-yr Target Flow Rate (m^3/s)	100-yr + 20% Target Flow Rate (m^3/s)
EX. STM STUB N of STM MH 1002)	0.606	0.928	0.939 (minor system) + 0.682 (major system)

5.3.2 Modelling Rationale

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

- Hydrologic parameters as per Ottawa Sewer Design Guidelines, including Manning's 'n', and depression storage values.
- Subcatchment infiltration parameters per Horton Infiltration method per Ottawa Sewer Design Guidelines.
- 3-hour Chicago Storm distribution for the 2-year, 100-year, and 100-year + 20% analysis.
- The dynamic boundary condition for the downstream storm sewer stub on Street 23 was taken from the PCSWMM model from the *Trails Edge East Phase 1 Servicing and Stormwater Management Report* (Stantec, 2019).
- To 'stress test' the system a 'climate change' scenario was created by adding 20% of the individual intensity values of the 100-year Chicago storm event at their specified time step.
- Percent imperviousness (imp.) calculated based on actual soft and hard surfaces on each subcatchment, converted to equivalent Runoff Coefficient (C) using the relationship C = (Imp. x 0.7) + 0.2
- Subcatchment areas are defined from high-point to high-point where sags occur. Subcatchment width determined by multiplying street segment length x 2 (length of overland flow path measured from high point to high point) for street (double-sided) catchments, multiplying by 1.5 for single-loaded roads, multiplying by 1.0 for single-sided catchments, or by multiplying the subcatchment area by 225m where a street segment flow path has not otherwise been defined.
- Number of catchbasins based on proposed servicing plans (**Drawing SSP-1**)
- Catchbasin inflow restricted with inlet-control devices (ICDs) as necessary to maintain inflow target rate, maximize use of surface storage, and ensure no standing water during the 2-year event (5-year event level of service for collector roads). Catchbasins are not to be interconnected.
- For storage on roads with defined cross-sections, active storage was modeled based on actual conduit flow using cross-sections as detailed on Drawing DS-1.
- For the Block 194-194 site, weirs representing the roadway width were used to model the major system flows between adjacent low points. Active storage volumes were applied at each low point node corresponding to catchbasin surface ponding volumes as noted on **Drawing SD-1**.
- As per the *Trails Edge East Phase 1 Servicing and Stormwater Management Report* (Stantec, 2019), surface storage has been provided to control differences in peak runoff from the 100 to the 2-year storm event on-site. Additional peak runoff experienced during the climate change event has been modeled as discharging freely to the next downstream overland node.

5.3.2.1 SWM Dual Drainage Methodology

The proposed development is modeled in one modeling program as a dual conduit system (see **Figure 7**), with: 1) circular conduits representing the sewers and junction nodes representing manholes; 2) irregular conduits using street-shaped cross-sections to represent the approximate overland road network and storage nodes representing catchbasins. The dual drainage systems are connected via outlet 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 first.

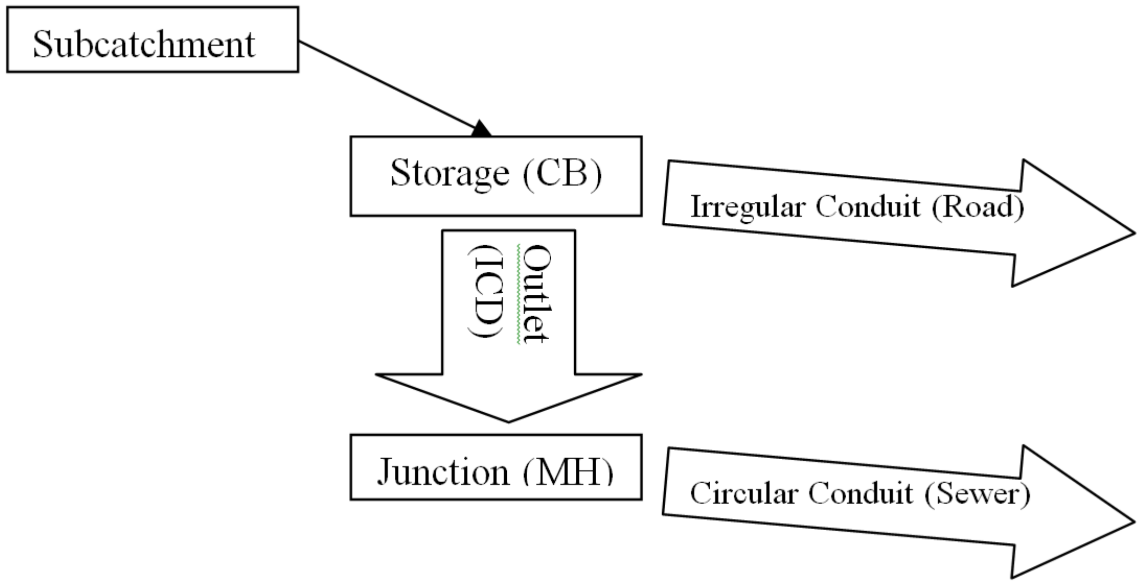

Figure 7: Schematic Representing Model Object Roles

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

The proposed Block 193-194 site conveys its minor system peak flows to the existing storm stub on Street 23 (labelled 1002A in the PCSWMM model). The site's major system outlet is through its proposed connection to Couloir Road. Due to grading restrictions, a small portion of the Block 193-194 site will drain uncontrolled to the Brian Coburn Boulevard, Fern Casey Street, and Couloir Road rights-of-way. Block 193-194 does not accept any upstream stormwater drainage. The portion of Street 23 being developed as part of the Block 193-194 development will direct its minor system flows to the existing storm sewer stub on Street 23 and its major system flows to Couloir Road to the south. Street 23 will not accept any upstream stormwater drainage, with minor and major system flows from the Trailsedge East Phase 4 development being directed further east to the Arête Street storm sewer and right-of-way before being directed westwards on Couloir Road.

As described above in the Design Criteria and Constraints section, the Block 193-194 site and Street 23 ROW were modelled to provide sufficient stormwater storage so that overland flow to the downstream ROWs does not occur in the 2-year and 100-year events, but is permissible in the 100-year + 20% event, as per the PCSWMM model developed for Trailsedge East Phase 1 (Stantec, 2019).

5.3.3 Land Use

The proposed site will be developed as a mixture of back-to-back townhome blocks and three-storey buildings containing 2-bedroom terrace units. The tributary drainage area was divided into drainage areas reflective of the design of the minor system. The post-development drainage scheme is indicated on **Drawing SD-1**.

Runoff coefficients (C values) were calculated for each subcatchment area using a C of 0.2 for soft surfaces (i.e. landscaped areas) and a C of 0.9 for hard surfaces (i.e. roads, roofs, and sidewalks). The overall runoff coefficient for the proposed Trailsedge East Block 193-194 development is approximately 0.73 (76% imperviousness).

5.3.4 Design Storms

The 3-hour Chicago distribution was selected to determine the 2-year capture rates for the proposed subcatchments, and to assess the 100-year HGL across the proposed development. The Chicago distribution was selected due to its tendency to generate high peak flows in urban catchments, which represent well the proposed development. The following storm events were used to evaluate the minor and major systems' performance and assess the HGL across the development:

- 2-year, 3-hour Chicago storm, 10-minute time step (2yr3hrChicago)
- 100-year, 3-hour Chicago storm, 10-minute time step (100yr3hrChicago)
- 100-year + 20%, 3-hour Chicago storm, 10-minute time step (100yr+20%3hrChicago)

5.3.5 Boundary Conditions

The site will discharge to the existing storm sewer stub north of STM 1002 on Couloir Road, which was installed as part of the Trailsedge East Phase 1 servicing works. The downstream storm sewer stub, labelled as node '1002A', was modelled as an outfall with a dynamic boundary condition obtained from the PCSWMM model for Trailsedge East Phase 1 (Stantec, 2019). The dynamic boundary condition for the 2-year, 100-year, and 100-year + 20% Chicago storm events were imported as timeseries with the same duration time step (10 minutes) as used in the Block 193-194 model to simulate surcharge in the previously modelled storm sewer system.

5.3.6 Modelling Parameters

Table 9 presents the general subcatchment parameters used.

Table 9: General Subcatchment Parameters

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

Table 10 presents the individual subcatchments' parameters.

Table 10: Subcatchment Parameters

Area ID	Outlet	Area (ha)	Width (m)	Slope (%)	% Impervious	Runoff Coefficient	Subarea Routing	Percent Routed
L1003A	L1003A-S	0.290	146	1.27	68.57	0.68	OUTLET	100
L1004A	L1004A-S	0.419	148	0.78	65.71	0.66	OUTLET	100
L1004B	L1004B-S	0.422	174	0.96	65.71	0.66	OUTLET	100
L1008A	L1008A-S	0.258	147	1.63	67.14	0.67	OUTLET	100
L1009A	L1009A-S	0.205	89	1.28	67.14	0.67	OUTLET	100
L1010A	L1010A-S	0.216	109	1.16	80	0.76	OUTLET	100
L1010B	L1010B-S	0.283	148	0.9	80	0.76	OUTLET	100
L1012A	L1012A-S	0.210	110	1.64	81.43	0.77	OUTLET	100
L1013A	L1013A-S	0.262	167	1.11	87.14	0.81	OUTLET	100
L1013B	L1013B-S	0.221	111	1.45	81.43	0.77	OUTLET	100
L1014A	L1014A-S	0.172	97	1.27	80	0.76	OUTLET	100
UNC-1	OF-UNC-1	0.101	143	5	85.71	0.80	OUTLET	100
UNC-2	OF-UNC-2	0.205	221	5	85.71	0.80	OUTLET	100
UNC-3	OF-UNC-3	0.074	105	5	85.71	0.80	OUTLET	100

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

Table 11: Storage Node Parameters

Storage Node	Invert Elevation (m)	Rim Elevation (m)	Total Depth (m)	Storage Curve	Curve Name
L1003A-HP	88.36	88.76	0.4	FUNCTIONAL	*
L1003A-S	86.73	88.51	1.78	FUNCTIONAL	*
L1004A-HP	88.8	89.2	0.4	FUNCTIONAL	*
L1004A-S	86.88	88.66	1.78	FUNCTIONAL	*
L1004B-HP	88.45	88.85	0.4	FUNCTIONAL	*
L1004B-S	86.72	88.5	1.78	FUNCTIONAL	*
L1008A-S	86.87	88.65	1.78	TABULAR	L1008A-V
L1009A-S	86.81	88.59	1.78	TABULAR	L1009A-V
L1010A-S	86.76	88.54	1.78	TABULAR	L1010A-V

Storage Node	Invert Elevation (m)	Rim Elevation (m)	Total Depth (m)	Storage Curve	Curve Name
L1010B-S	86.76	88.54	1.78	TABULAR	L1010B-V
L1012A-S	86.65	88.48	1.83	TABULAR	L1012A-V
L1013A-S	86.78	88.56	1.78	TABULAR	L1013A-V
L1013B-S	86.71	88.54	1.83	TABULAR	L1013B-V
L1014A-S	86.65	88.43	1.78	TABULAR	L1014A-V

5.3.6.1 Hydraulic Parameters

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

Storm sewers were modeled to confirm flow capacities and hydraulic grade lines (HGLs) in the ultimate condition with consideration of flow contributions from future areas. The detailed storm sewer design sheet is included in **Appendix C.1**.

Table 12 below presents the parameters for the outlet and orifice link objects in the model, which represent ICDs and existing flow controlled areas based on SWM models as prepared by others, or future flow controlled areas. All orifices were assigned a discharge coefficient of 0.572 to correspond to manufacturer supplied discharge curves for IPEX Tempest HF/MHF models. Should an approved equivalent model be required, the peak outlet rate of the selected model will be required to match that of the modeled ICD at the maximum head noted in the model results portion of this report.

Table 12: Orifice Parameters

Orifice Name	Inlet	Outlet	Inlet Elevation (m)	Type	Diameter (m)
L1003A-IC1	L1003A-S	1003	86.73	CIRCULAR	0.108
L1003A-IC2	L1003A-S	1003	86.73	CIRCULAR	0.108
L1004A-IC1	L1004A-S	1004	86.88	CIRCULAR	0.127
L1004A-IC2	L1004A-S	1004	86.88	CIRCULAR	0.127
L1004B-IC1	L1004B-S	1004	86.72	CIRCULAR	0.127
L1004B-IC2	L1004B-S	1004	86.72	CIRCULAR	0.127
L1008A-IC	L1008A-S	1008	86.87	CIRCULAR	0.127
L1009A-IC	L1009A-S	1009	86.81	CIRCULAR	0.127
L1010A-IC	L1010A-S	1010	86.76	CIRCULAR	0.127
L1010B-IC	L1010B-S	1010	86.76	CIRCULAR	0.152
L1012A-IC	L1012A-S	1012	86.65	CIRCULAR	0.127
L1013A-IC	L1013A-S	1013	86.78	CIRCULAR	0.152
L1013B-IC	L1013B-S	1013	86.71	CIRCULAR	0.127
L1014A-IC	L1014A-S	1014	86.65	CIRCULAR	0.127

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

Table 13: Exit Loss Coefficients for Bends at Maintenance Holes

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

5.4 MODELLING RESULTS AND DISCUSSION

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

5.4.1.1 Hydrologic Results

The following tables demonstrate the peak outflow from each modelled connection point to downstream infrastructure during the design storm (3-hr Chicago 2-100yr+20%) events.

Table 14 summarizes the minor system peak discharge rates based on the modelled storm events and compares them to the values for the site from the Trailsedge East Phase 1 PCSWMM model (Stantec, 2019).

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

Model	Outlet Node	2-yr Peak Flow Rate (m^3/s)	100-yr Peak Flow Rate (m^3/s)	100-yr+20% Peak Flow Rate (m^3/s)
Block 193-194 and Street 23 PCSWMM Model (current):	1002A	0.416	0.765	0.774
Trailsedge East Phase 1 PCSWMM Model (Stantec, 2019):	OR1 *(1002A)*	0.606	0.928	0.939

The minor system peak flow rate for Block 193-194 and Street 23 is lower in all storm scenarios than was accounted for in the Trailsedge East Phase 1 PCSWMM model.

Table 15 summarizes the major system peak discharge rates based on the modelled storm events and compares them to the values for the site from the Trailsedge East Phase 1 PCSWMM model (Stantec, 2019). The total peak flow rates were determined by superimposing the outflow hydrographs for each major system outfall in PCSWMM. Therefore, the totals do not correspond to a direct addition of the individual major system peak flows.

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

Model	Outfall Nodes/Channels	2-yr Peak Flow Rate (m^3/s)	100-yr Peak Flow Rate (m^3/s)	100-yr+20% Peak Flow Rate (m^3/s)
Block 193-194 and Street 23 Model (current):	UNC-1, UNC-2, UNC-3, COULOIR, FERN-CASEY, STREET23	0.071	0.205	0.321
Trailsedge East Phase 1 Model (Stantec, 2019):	W1 *(Street 23)*	**0**	**0**	0.682

While the major system discharge rate from Block 193-194 and Street 23 exceeds the 0 value accounted for the in the 2-year and 100-year events in the Trailsedge East Phase 1 PCSWMM Model, please see the discussion below which compares the total peak flow rates (minor + major systems) between the current PCSWMM model and that from Trailsedge East Phase 1.

Table 16 summarizes the total of the minor and major system peak discharge rates based on the modelled storm events. The total peak flow rates were determined by superimposing the outflow hydrographs for each minor system and major system outfall in PCSWMM. Therefore, the totals do not correspond to a direct addition of the respective minor and major system peak flows in the two preceding tables.

Table 16: Total Storm Event Peak Discharge Rates (Minor and Major Systems)

Model	Outfall Nodes/Channels	2-yr Peak Flow Rate (m^3/s)	100-yr Peak Flow Rate (m^3/s)	100-yr+20% Peak Flow Rate (m^3/s)
Block 193-194 and Street 23 Model (current):	1002A, UNC-1, UNC-2, UNC-3, COULOIR, FERN-CASEY, STREET23	0.482	0.784	0.800
Trailsedge East Phase 1 Model (Stantec, 2019):	OR1 *(1002A)*, W1 *(Street 23)*	0.606	0.928	1.594

As shown in **Table 16** above, the total (minor plus major system) peak flow from the Block 193-194 site and Street 23 are less for each storm event than was accounted for in the Trailsedge East Phase 1 PCSWMM model (Stantec, 2019). Both minor and major system stormwater flows from Block 193-194 and Trailsedge East Phase 1 ultimately outlet to the Fern Casey ROW before entering Mud Creek at an engineered curb cutout spillway. Therefore, adequate capacity exists in the downstream system to accept the anticipated stormwater flows.

5.4.1.2 Hydraulic Results

Table 17 summarizes the HGL results within the development and downstream storm sewer system for the 100-year, 3-hour Chicago storm event and the 'climate change' scenario storm required by the City of

Ottawa Sewer Design Guidelines (2012), where intensities are increased by 20% from the 100-year event.

The City of Ottawa requires that during major storm events, the maximum hydraulic grade line be kept at least 0.30m below the underside-of-footing (USF) of any adjacent units connected to the storm sewer during design storm events. HGLs during the climate change event are not to exceed adjacent USF elevations (freeboard of 0.00m).

Table 17: Modeled Hydraulic Grade Line (HGL) Results

STM MH or STUB	Adjacent USF (m)	100yr 3hr Chicago		100yr + 20% 3hr Chicago	
		HGL (m)	USF-HGL Clearance (m)	HGL (m)	USF-HGL Clearance (m)
1002A	86.43	85.84	0.59	85.84	0.59
1003	86.4	85.92	0.48	85.92	0.48
1004	86.40	85.97	0.43	85.98	0.42
1004A	86.40	86.01	0.39	86.01	0.39
1006	86.40	86.02	0.38	86.02	0.38
1007	86.40	86.04	0.36	86.04	0.36
1008	86.90	86.15	0.75	86.13	0.77
1009	86.50	86.16	0.34	86.17	0.33
1010	86.60	86.20	0.40	86.22	0.38
1011	86.66	86.21	0.45	86.22	0.44
1012	86.52	86.2	0.32	86.22	0.30
1013	86.43	86.13	0.30	86.14	0.29
1014	86.62	86.24	0.38	86.26	0.36

As is demonstrated in the table above, the worst-case scenario results in HGL elevations that remain at least 0.30 m below the proposed and existing underside of footings, and HGL elevations remain below the proposed underside of footing elevations during the 20% increased intensity ‘climate change’ scenario.

Table 18 presents the maximum total surface water depths (static ponding depth + dynamic flow) above the top-of-grate of catchbasins for the 100-year design storm and climate change storm. Based on the model results, the total ponding depth (static + dynamic) does not exceed the required 0.35m maximum during the 100-year event. Total ponding depths during the climate change scenario are below adjacent building openings and are not expected to impact proposed buildings within the development.

Table 18: Maximum Surface Water Depths

Storage Node ID	Invert Elevation (m)	Rim Elevation (m)	100yr 3hr Chicago		100yr 3hr Chicago + 20%		Adjacent Lowest Building Opening (m)
			Max. Surface HGL (m)	Total Surface Water Depth (m)	Max. Surface HGL (m)	Total Surface Water Depth (m)	
L1003A-S	86.73	88.51	88.30	0.19	88.33	0.22	88.67
L1004A-S	86.88	88.66	88.45	0.19	88.48	0.22	88.75
L1004B-S	86.72	88.50	88.30	0.20	88.36	0.26	88.67
L1008A-S	86.87	88.65	88.46	0.21	88.50	0.25	88.75
L1009A-S	86.81	88.59	88.37	0.18	88.41	0.22	88.62
L1010A-S	86.76	88.54	88.33	0.19	88.37	0.23	88.50
L1010B-S	86.76	88.54	87.19	0	87.28	0	88.60
L1012A-S	86.65	88.48	88.25	0.22	88.34	0.31	88.52
L1013A-S	86.78	88.56	88.36	0.20	88.40	0.24	88.55
L1013B-S	86.71	88.54	88.31	0.22	88.36	0.27	88.49
L1014A-S	86.65	88.43	88.26	0.23	88.32	0.29	88.42

6.0 GEOTECHNICAL CONSIDERATIONS AND GRADING

6.1 GEOTECHNICAL INVESTIGATION

A geotechnical investigation report for the Trailsedge East Block 193-194 development was completed by Paterson Group on July 24, 2020. Field testing consisting of four (4) boreholes throughout the subject site was completed on June 29, 2020. An additional three (3) boreholes and one (1) test pit within the site area advanced in 2002 and 2008 as part of previous investigations were relied on as well. The geotechnical investigation report is included in **Appendix D**.

The site is undeveloped and generally vacant, except for a 4-5m tall fill pile within its southern portion. The grade across the site, with the exception of this fill pile, is generally level at approximately 87m. The subsurface profile within the Block 193-194 lands consists of 50-250mm of topsoil underlain by a silty clay deposit. This silty clay deposit is generally very stiff to stiff brown silty clay crust within the upper 3-4m below original ground surface. This brown silty clay transitions to a firm, grey silty clay as the depth increases.

Groundwater levels from the four (4) boreholes advanced in 2020 ranged between 2.32m and 6.10m below ground surface (elevations between 84.63m and 80.98m) while groundwater levels from 2002 and 2008 in the area ranged between 1.42m and 4.23m below ground surface (elevations between 85.88m and 82.57m). The long-term groundwater table is anticipated to be at a 3 to 4m depth, subject to seasonal fluctuations.

The site is considered suitable for the proposed development from a geotechnical perspective. Conventional shallow foundations placed on undisturbed native firm silty clay can be used for the proposed buildings.

A permissible grade raise restriction of 1.2m above original ground surface is recommended by Paterson due to the silty clay deposit. If higher-than-permissible grade raises are needed, pre-loading, lightweight fill, or other measures should be investigated to reduce the risks of unacceptable long-term total and differential settlements. The fill pile within the southern portion of the site will need to be evaluated for use within the proposed development.

6.1.1 Proposed Pavement Structure

Table 19 and **Table 20** summarize the recommended pavement structures for the development.

Table 19: Recommended Pavement Structure for Access Lanes

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

Table 20: Recommended Pavement Structure for Car-Only Parking Areas

Thickness (mm)	Material Description
50	Wear Course – HL-3 or Superpave 12.5 Asphaltic Concrete
150	Base – OPSS Granular A Crushed Stone Compacted to Min. 100% SPMDD
300	Subbase – OPSS Granular B Type II
-	Subgrade – Either fill, in situ soil, or OPSS Granular B Type II material placed over in situ soil or 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 3m 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 300mm above the obvert of the pipes and compacted to a minimum of 95% SPMDD.

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

Open sumps and pumps are anticipated to be sufficient in providing groundwater control for relatively shallow excavations due to the impervious nature of the silty clay present throughout the site. A temporary Permit to Take Water (PTTW) from the Ontario Ministry of the Environment, Conservation and Parks (MECP) may be required if more than 400,000 L/day of ground and/or surface water need to be pumped during the construction phase (to be determined by the geotechnical consultant). The review/issuance of the permit may take upwards of 4 months. For typical ground/surface water pumping volumes (50,000 L/day to 400,000 L/day), registration on the Environmental Activity and Sector Registry (EASR) will be required. Two to four weeks should be allotted for the completion of this registration and the preparation of a Water Taking and Discharge Plan by a Qualified Person as required under O.Reg. 63/16.

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

6.2 GRADING PLAN

Grading for the proposed site has been provided as shown on **Drawing GP-1**. The grading design has been provided to direct overland flows from the proposed development to the existing Couloir Road right-of-way. As described in **Section 5.0**, the provided grading incorporates street sags along the profile of the internal Block 193-194 streets and within Street 23 to provide stormwater storage.

The proposed grading has been developed to match the existing road grades along Couloir Road to the south and Fern Casey Street to the west. The proposed extension of Street 23 will terminate in a dead-end complete with concrete barriers until Trailsedge East Phase 4 is developed. The 1.2m grade raise restriction outlined in the geotechnical investigation report has been respected throughout the site, and will be confirmed by the geotechnical consultant prior to design approval.

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

7.0 UTILITIES

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

8.0 APPROVALS

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

An Environmental Compliance Approval (ECA) is not expected to be required from the Ontario Ministry of the Environment, Conservation and Parks (MECP) for the proposed servicing works within the proposed private block so long as part lot control is not pursued for this development (i.e. as long as the property will be held under single ownership). An MECP ECA under the Transfer of Review (TOR) Program will be required for sewers within Street 23 when the right-of-way is conveyed to the City. The Mississippi Valley Conservation Authority (MVCA) will be circulated on this submission.

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

No other approval requirements from other regulatory agencies are anticipated.

9.0 EROSION CONTROL

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

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

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

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

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

10.0 CONCLUSIONS AND RECOMMENDATIONS

10.1 POTABLE WATER SERVICING

The proposed piping alignment and sizing is capable of achieving the level of service required by the City. Based on the hydraulic analysis, the following conclusions were made:

- The proposed water distribution system in the Block 193-194 site is recommended to consist of a 200mm diameter watermain connecting to an existing stub on Street 23 and to the existing 300mm watermain on Couloir Road;
- During average day (AVDY) conditions, the Block 193-194 proposed watermain network will operate under the maximum pressure objective of 552 kPa (80 psi);
- During peak hour (PKHR) conditions, the Block 193-194 proposed watermain network is capable of operating above the minimum pressure objective of 276 kPa (40 psi);
- During fire conditions with a fire demand of 16,000 L/min (166.67 L/s), the Block 193-194 proposed watermain network is capable of providing sufficient fireflow while maintaining a residual pressure of 138 kPa (20 psi) in all areas within the development;
- Watermain stubs will be constructed to accommodate the future Trailsedge East Phase 4 Development east of the Block 193-194 site.

10.2 WASTEWATER SERVICING

Wastewater from the proposed Block 193-194 development will be conveyed to the existing sanitary sewer on Street 23 constructed as part of the Trailsedge East Phase 1 servicing works. The wastewater will ultimately be collected by the Forest Valley Trunk (FVT) Sewer on Renaud Road.

200mm diameter sanitary sewers are proposed throughout the Block 193-194 site and along Street 23. The capacity of the existing sanitary sewers on Street 23 and Couloir Road were verified with the estimated peak wastewater flows from the Block 193-194 site. The analysis confirmed that there is sufficient capacity within the downstream sanitary sewer system to service the Block 193-194 site.

Peak wastewater flows to the proposed sanitary sewers on Street 23 are expected to be 6.7 L/s.

10.3 STORMWATER MANAGEMENT AND SERVICING

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

Inlet control devices were defined for each catchment to restrict inflow rates to the storm sewers to that of the 2-year runoff for Street 23 and the Block 193-194 site, as per City and background report design criteria. Major system peak flows from the entire site will be directed to Couloir Road, whereas minor system peak flows will be directed to the existing storm sewer on Street 23. Quantity and quality control (70% TSS removal) of stormwater runoff will be provided at the downstream SWM Pond 1.

10.4 GRADING

Proposed grading for the Block 193-194 site and Street 23 directs overland flows from the proposed development to Couloir Road, as per City standards. The provided grading implements street sags for stormwater detention.

The existing grades along Couloir Road, to the south of the site, and along Fern Casey Street, to the west of the site, are to be maintained. All grading, in-filling and backfilling works are to be completed as per the geotechnical recommendations made in Paterson's geotechnical investigation report (summarized in **Section 6.1**).

10.5 APPROVALS/PERMITS

An MECP Environmental Compliance Approval (ECA) is required for the installation of the proposed storm and sanitary sewers within Street 23 under the MECP's Transfer of Review program with the City of Ottawa once the right-of-way is conveyed to the City. Sewers within the private Block 193-194 site may also require an ECA should part lot control be pursued to sever the property into separate parcels at a later date. A Permit to Take Water or registration on the EASR may be required for dewatering works during sewer/watermain installation, pending confirmation by the geotechnical consultant. The Mississippi Valley Conservation Authority (MVCA) will need to be consulted in order to obtain municipal approval for site development. No other approval requirements from other regulatory agencies are anticipated.

10.6 UTILITIES

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

APPENDICES

Appendix A – POTABLE WATER SERVICING

A.1 BOUNDARY CONDITIONS

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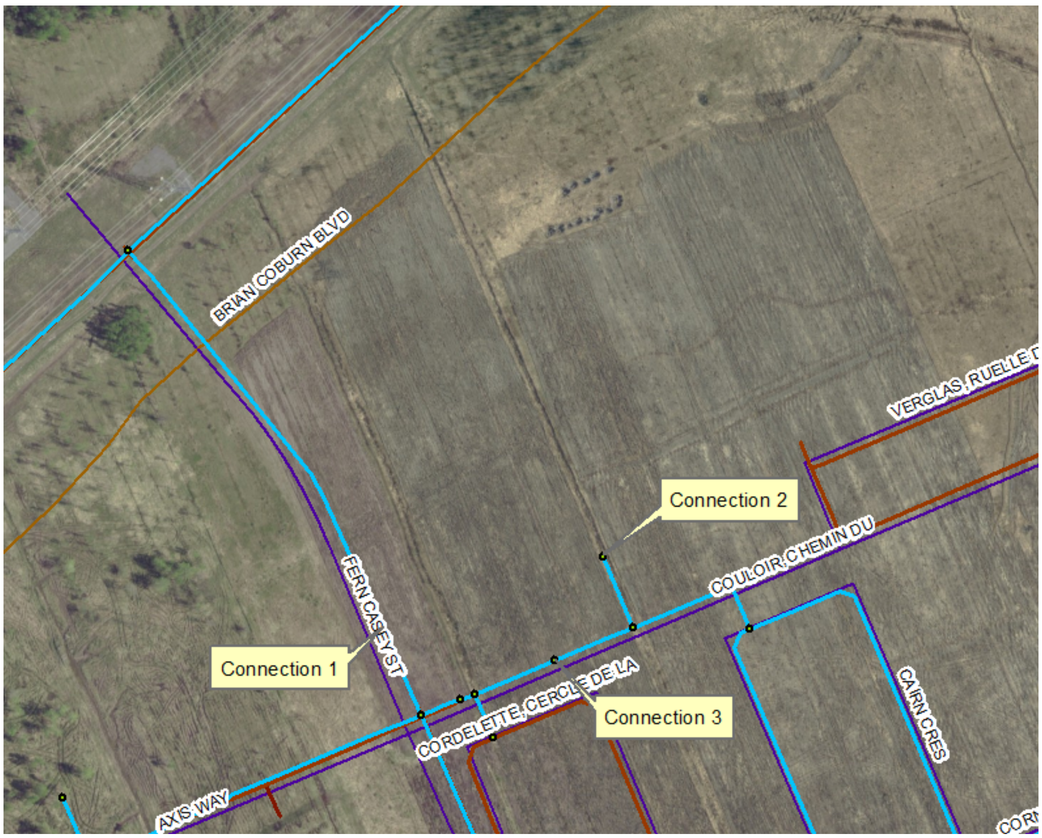
Boundary Conditions
Trailsedge North Block 193-194

Provided Information

Scenario	Demand	
	L/min	L/s
Average Daily Demand	108	1.80
Maximum Daily Demand	270	4.50
Peak Hour	595	9.91
Fire Flow Demand #1	10,000	166.67
Fire Flow Demand #2	16,000	266.67

Location



Results

Connection 1 – Fern Casey St.

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	130.6	61.8
Peak Hour	126.8	56.5
Max Day plus Fire 1	127.6	57.6
Max Day plus Fire 2	125.9	55.2

[1] Ground Elevation = 87.1 m

Connection 2 – Couloir Rd.

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	130.6	61.8
Peak Hour	126.8	56.4
Max Day plus Fire 1	119.4	45.9
Max Day plus Fire 2	106.5	27.5

[1] Ground Elevation = 87.1 m

Connection 3 – Couloir Rd.

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	130.6	62.0
Peak Hour	126.8	56.7
Max Day plus Fire 1	126.5	56.2
Max Day plus Fire 2	123.3	51.7

[1] Ground Elevation = 86.9 m

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.

Chochlinski, Daniel

From: Mashaie, Sara <sara.mashaie@ottawa.ca>
Sent: Thursday, November 12, 2020 3:35 PM
To: Chochlinski, Daniel
Cc: Gillis, Sheridan; Thiffault, Dustin
Subject: RE: 160401585 - Trailsedge North Block 193-194 - Boundary Conditions Request
Attachments: Trailsedge North Block 193-194_09Nov2020.docx

Hi Daniel,

Please find attached the boundary conditions.

Regards,

Sara Mashaie, P.Eng., ing.
Project Manager | Gestionnaire de Projet
Development Review, East Branch | Examen des projets d'aménagement, Secteur est
Planning, Infrastructure and Economic Development Department | Services de la planification, de l'infrastructure et du développement économique
City of Ottawa | Ville d'Ottawa
110 Laurier Avenue West. Ottawa, ON | 110, avenue. Laurier Ouest. Ottawa (Ontario) K1P 1J1
613.580.2424 ext./poste 27885, sara.mashaie@ottawa.ca

From: Chochlinski, Daniel <Daniel.Chochlinski@stantec.com>
Sent: October 30, 2020 10:46 AM
To: Mashaie, Sara <sara.mashaie@ottawa.ca>
Cc: Gillis, Sheridan <Sheridan.Gillis@stantec.com>; Thiffault, Dustin <Dustin.Thiffault@stantec.com>
Subject: 160401585 - Trailsedge North Block 193-194 - Boundary Conditions Request

CAUTION: This email originated from an External Sender. Please do not click links or open attachments unless you recognize the source.

ATTENTION : Ce courriel provient d’un expéditeur externe. Ne cliquez sur aucun lien et n’ouvrez pas de pièce jointe, excepté si vous connaissez l’expéditeur.

Hi Sara,

I’m writing you to request the watermain boundary conditions for Trailsedge North Block 193-194 in Orleans. I have attached the following:

1) Key plan showing the subject site and the three (3) points in the watermain network at which we require boundary conditions.
2) Domestic water demand calculations.
3) FUS Sheets for the calculated fire flow demands (four scenarios with three possible fire flow demands as listed below).

The demands for Trailsedge North Block 193-194 are summarized as follows:

- Average day demand: 108.1 L/min (1.80 L/s)
- Maximum day demand: 270.2 L/min (4.50 L/s)
- Peak hour demand: 594.3 L/min (9.91 L/s)
- Fire flow demands, three (3) scenarios requested to be modelled:
    - 10,000 L/min (166.7 L/s)
    - 15,000 L/min (250 L/s)
    - 16,000 L/min (266.7 L/s)

We understand that your staff must be very busy but we would greatly appreciate receiving the boundary conditions as soon as possible. Thank you in advance for your time and help.

Regards,

Daniel Chochlinski EIT
Engineering Intern, Community Development
Mobile: 343-961-9619
daniel.chochlinski@stantec.com
Stantec
400 - 1331 Clyde Avenue
Ottawa ON K2C 3G4

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'

A.2 DOMESTIC WATER DEMAND CALCULATIONS

Trailsedge North Block 193 & 194 - Domestic Water Demand Estimates

Based on Site Plan from M. David Blakely Architect Inc. Dated September 3, 2020

Population densities as per City of Ottawa Guidelines:

Townhouse (row)	2.7	ppu
2 Bedroom	2.1	ppu

Building ID	Number of Units	Population	Daily Demand Rate (L/cap/day)	Avg. Day Demand		Max. Day Demand [1]		Peak Hour Demand [1]	
				(L/min)	(L/s)	(L/min)	(L/s)	(L/min)	(L/s)
Back-to-Back Townhomes	90	243	350	59.1	0.98	147.7	2.46	324.8	5.41
2 Bedroom Terrace Units	96	202	350	49.0	0.82	122.5	2.04	269.5	4.49
Total Site :	**186**	**445**		**108.1**	**1.80**	**270.2**	**4.50**	**594.3**	**9.91**

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

2 Terrace units assumed to be 2-bedroom units.

A.3 FUS CALCULATION SHEETS

Stantec

FUS Fire Flow Calculation Sheet

Stantec Project #: 160401585
Project Name: Trailsedge North Block 193 & 194
Date: 2020-10-30
Fire Flow Calculation #: 1
Description: 10-unit back-to-back townhouse block (Block 1).

Notes: 3-storey building with basement and 523 m2 footprint. Contains 10 back-to-back townhouse units.

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	-						52.3	-
	Determine Number of Adjoining Units	Includes adjacent wood frame structures separated by 3m or less						10	-
3	Determine Height in Storeys	Does not include floors >50% below grade or open attic space						3	-
4	Determine Required Fire Flow	(F = 220 x C x $A^{1/2}$). Round to nearest 1000 L/min						-	13000
5	Determine Occupancy Charge	Limited Combustible						-15%	11050
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	16.9	3	31-60	Wood Frame or Non-Combustible	18%	5304
		East	20.1 to 30	30.9	3	91-120	Wood Frame or Non-Combustible	10%	
		South	30.1 to 45	16.9	3	31-60	Wood Frame or Non-Combustible	5%	
		West	10.1 to 20	30.9	3	91-120	Wood Frame or Non-Combustible	15%	
8	Determine Final Required Fire Flow	Total Required Fire Flow in L/min, Rounded to Nearest 1000L/min							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

FUS Fire Flow Calculation Sheet

Stantec

Stantec Project #: 160401585
Project Name: Trailsedge North Block 193 & 194
Date: 2020-10-30
Fire Flow Calculation #: 2
Description: 10-unit back-to-back townhouse block (Block 1).
Notes: 3-storey building with basement and 523 m2 footprint. Contains 10 back-to-back townhouse units. 2-hour firewall provided vertically down the midlde of the building, separating building into 5-unit sections.

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	-						52.3	-
	Determine Number of Adjoining Units	Includes adjacent wood frame structures separated by 3m or less						5	-
3	Determine Height in Storeys	Does not include floors >50% below grade or open attic space						3	-
4	Determine Required Fire Flow	(F = 220 x C x $A^{1/2}$). Round to nearest 1000 L/min						-	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	8.5	3	0-30	Wood Frame or Non-Combustible	17%	2831
		East	0 to 3	30.9	3	91-120	Ordinary or Fire Resistive (Blank Wall)	0%	
		South	30.1 to 45	8.5	3	0-30	Wood Frame or Non-Combustible	5%	
		West	10.1 to 20	30.9	3	91-120	Wood Frame or Non-Combustible	15%	
8	Determine Final Required Fire Flow	Total Required Fire Flow in L/min, Rounded to Nearest 1000L/min							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 #: 160401585
Project Name: Trailsedge North Block 193 & 194
Date: 2020-10-30
Fire Flow Calculation #: 3
Description: 12-unit terrace flats (Block 16).

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

Step	Task	Notes						Value Used	Req'd Fire Flow (L/min)
1	Determine Type of Construction	Wood Frame						1.5	-
2	Determine Ground Floor Area of One Unit	-						103	-
	Determine Number of Adjoining Units	Includes adjacent wood frame structures separated by 3m or less						4	-
3	Determine Height in Storeys	Does not include floors >50% below grade or open attic space						3	-
4	Determine Required Fire Flow	(F = 220 x C x $A^{1/2}$). Round to nearest 1000 L/min						-	12000
5	Determine Occupancy Charge	Limited Combustible						-15%	10200
6	Determine Sprinkler Reduction	None						0%	0
		Non-Standard Water Supply or N/A						0%	
		Not Fully Supervised or N/A						0%	
		% Coverage of Sprinkler System						0%	
7	Determine Increase for Exposures (Max. 75%)	Direction	Exposure Distance (m)	Exposed Length (m)	Exposed Height (Stories)	Length-Height Factor (m x stories)	Construction of Adjacent Wall	-	-
		North	3.1 to 10	13.1	3	31-60	Wood Frame or Non-Combustible	18%	4692
		East	20.1 to 30	32.4	3	91-120	Wood Frame or Non-Combustible	10%	
		South	3.1 to 10	13.1	3	31-60	Wood Frame or Non-Combustible	18%	
		West	> 45	32.4	3	91-120	Wood Frame or Non-Combustible	0%	
8	Determine Final Required Fire Flow	Total Required Fire Flow in L/min, Rounded to Nearest 1000L/min							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

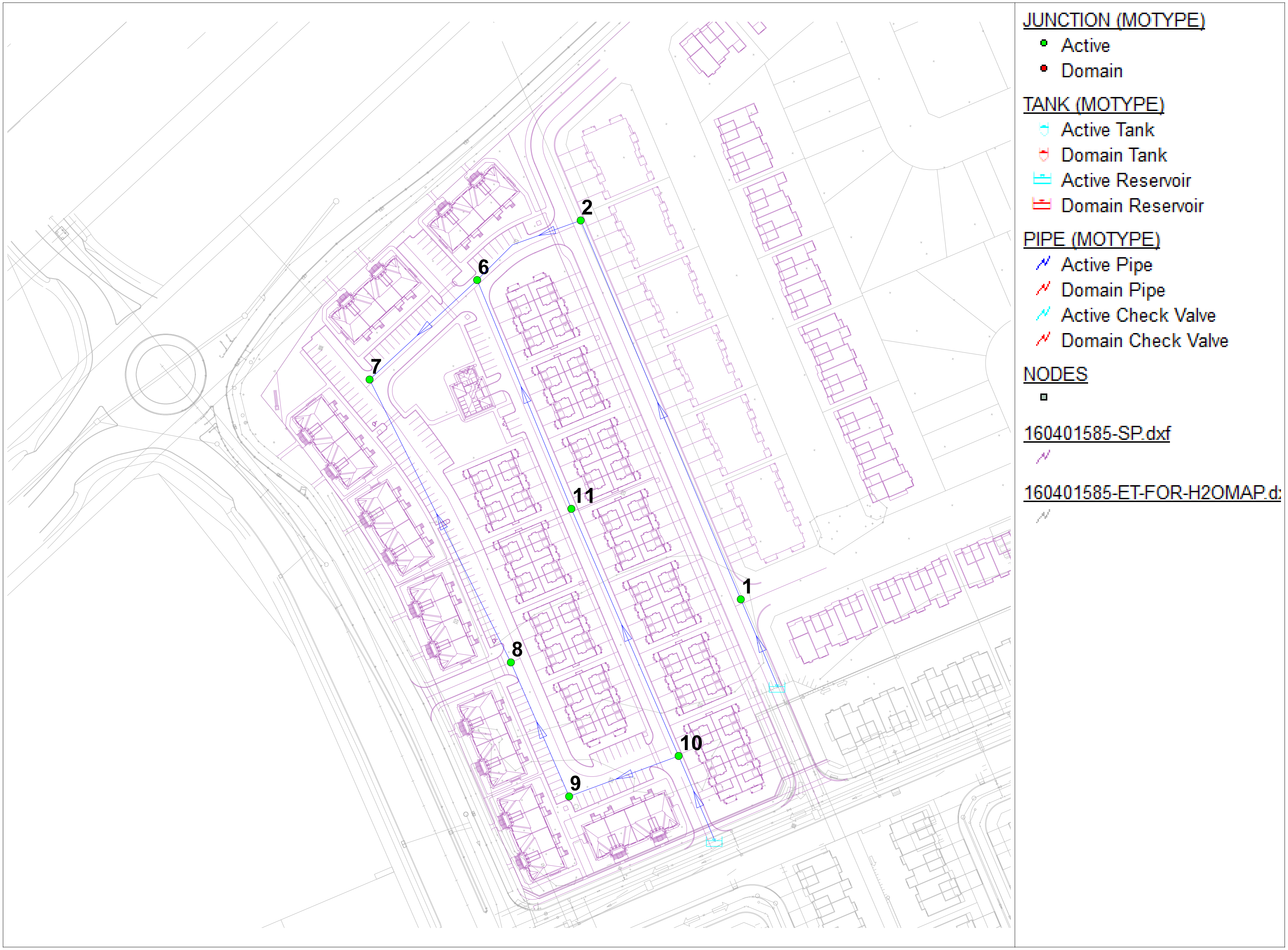
FUS Fire Flow Calculation Sheet

Stantec Project #: 160401585
Project Name: Trailsedge North Block 193 & 194
Date: 2020-10-30
Fire Flow Calculation #: 4
Description: 12-unit terrace flats (Block 16).
Notes: 3-storey building with 412 m2 footprint and 12 2-bedroom units (4 adjoining units each stacked 3 high). 2-hour firewall provided vertically down the midlde of the building, separating building into 6-unit sections.

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	-						103	-
	Determine Number of Adjoining Units	Includes adjacent wood frame structures separated by 3m or less						2	-
3	Determine Height in Storeys	Does not include floors >50% below grade or open attic space						3	-
4	Determine Required Fire Flow	(F = 220 x C x $A^{1/2}$). Round to nearest 1000 L/min						-	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	13.1	3	31-60	Wood Frame or Non-Combustible	18%	1904
		East	20.1 to 30	32.4	3	91-120	Wood Frame or Non-Combustible	10%	
		South	0 to 3	13.1	3	31-60	Ordinary or Fire Resistive (Blank Wall)	0%	
		West	> 45	32.4	3	91-120	Wood Frame or Non-Combustible	0%	
8	Determine Final Required Fire Flow	Total Required Fire Flow in L/min, Rounded to Nearest 1000L/min							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

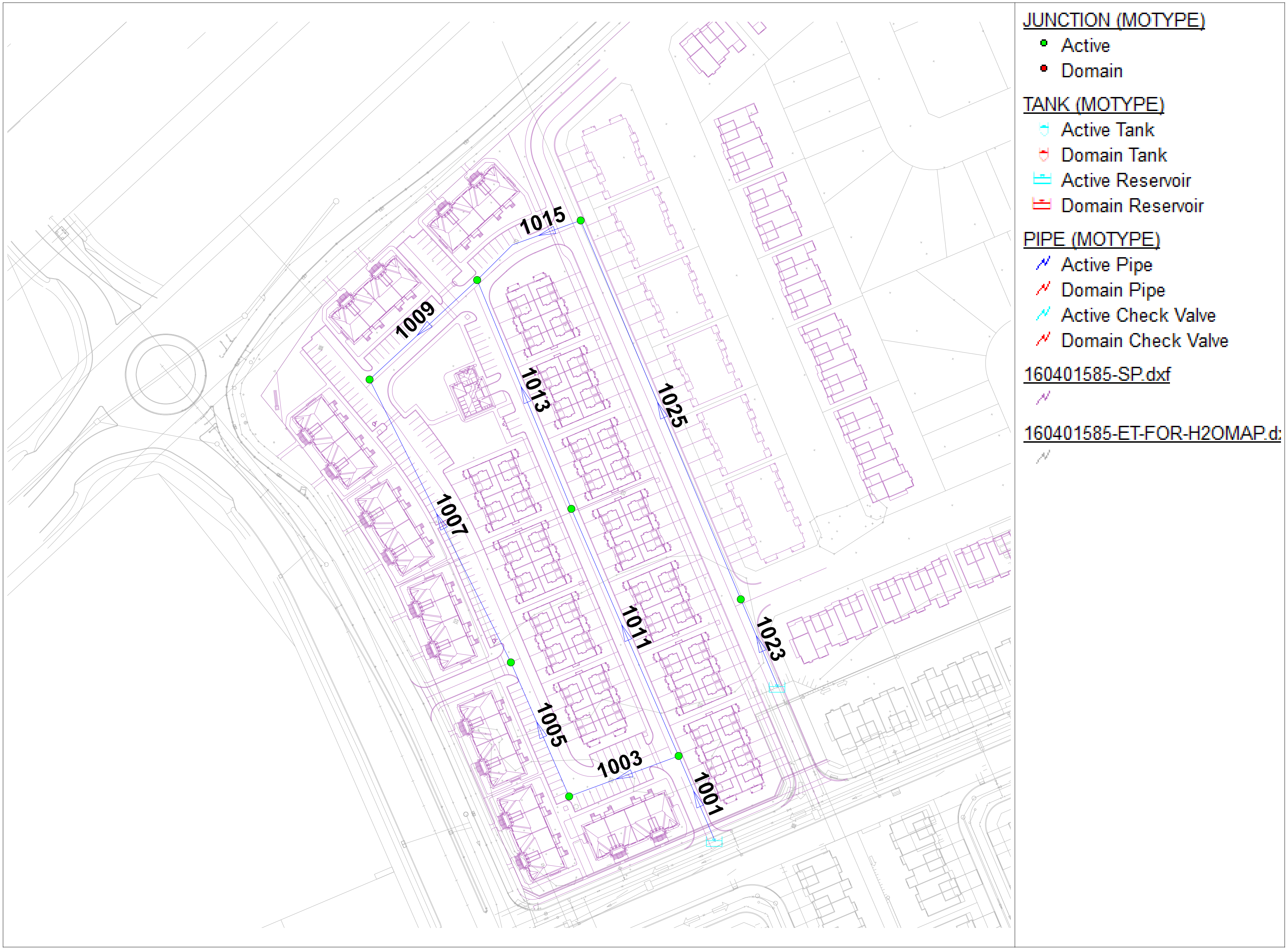
A.4 WATERMAIN HYDRAULIC ANALYSIS RESULTS

Trailsedge North Block 193-194 - Watermain Node IDs

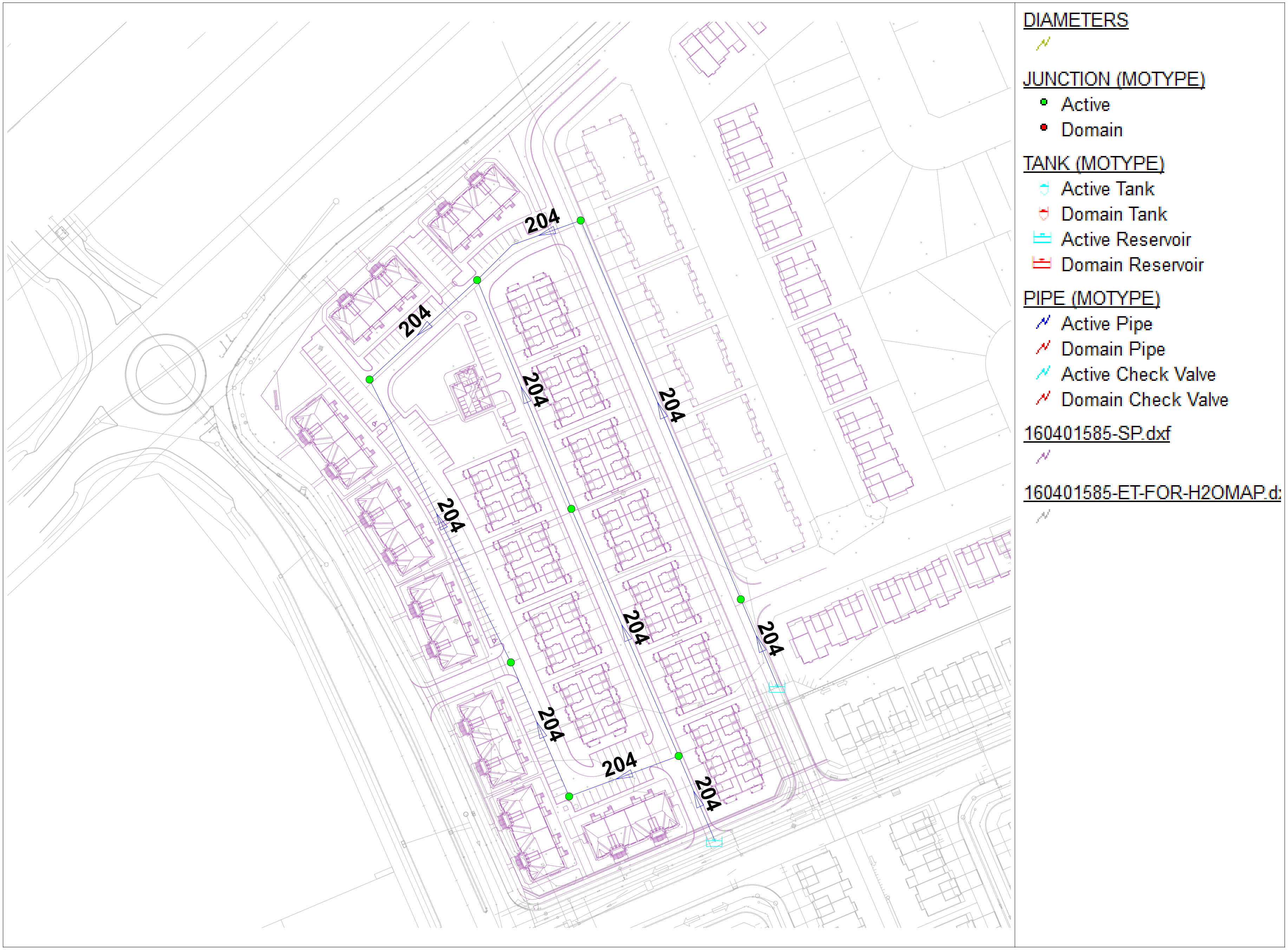


Prepared By: Stantec Consulting Ltd. Stantec Project No. 160401585 Date: Tuesday, December 08, 2020

Trailsedge North Block 193-194 - Watermain Link IDs

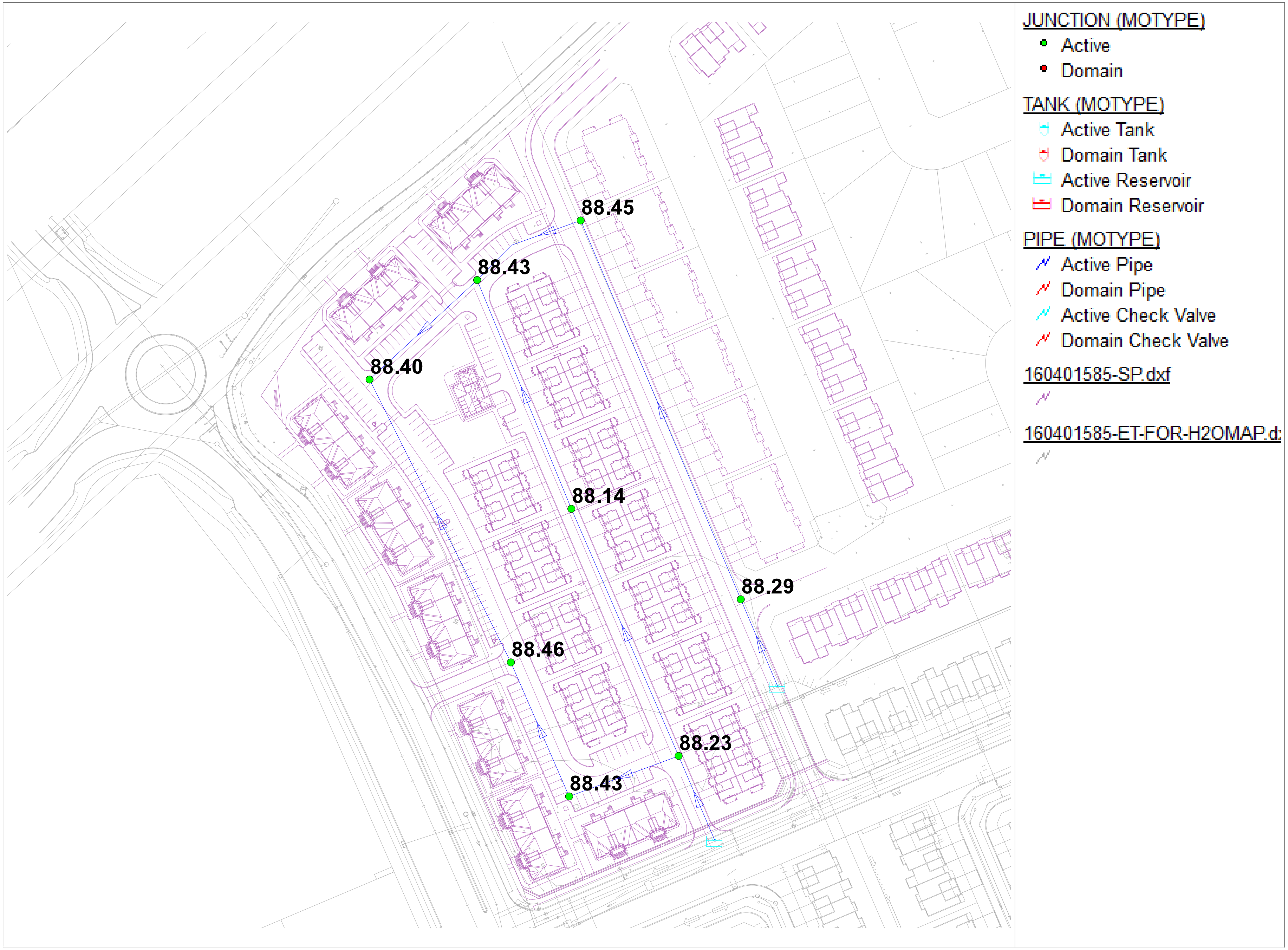


Trailsedge North Block 193-194 - Watermain Diameters (mm)



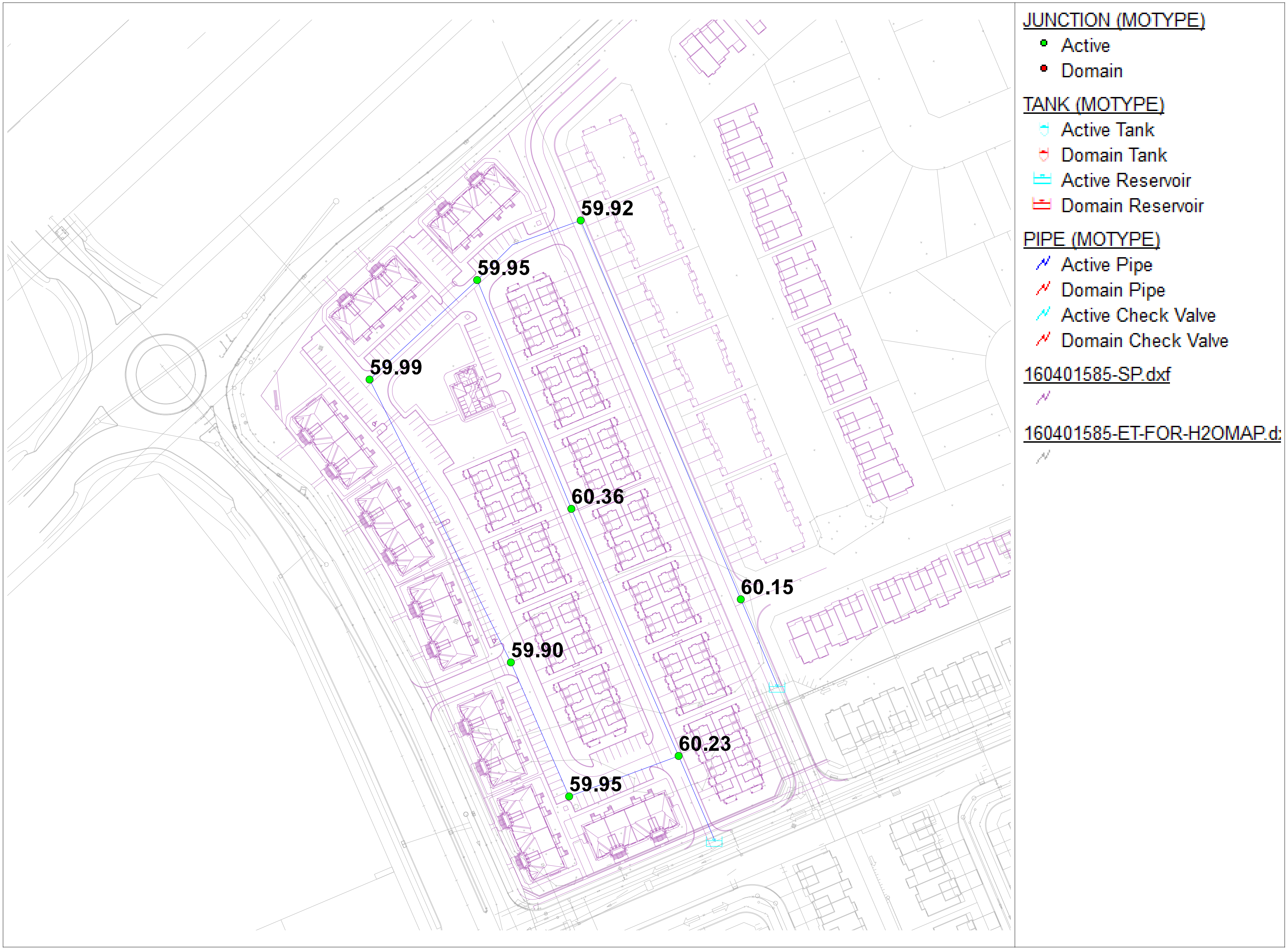
Prepared By: Stantec Consulting Ltd. Stantec Project No. 160401585 Date: Tuesday, December 08, 2020

Trailsedge North Block 193-194 - Ground Elevations (m) at Watermain Nodes



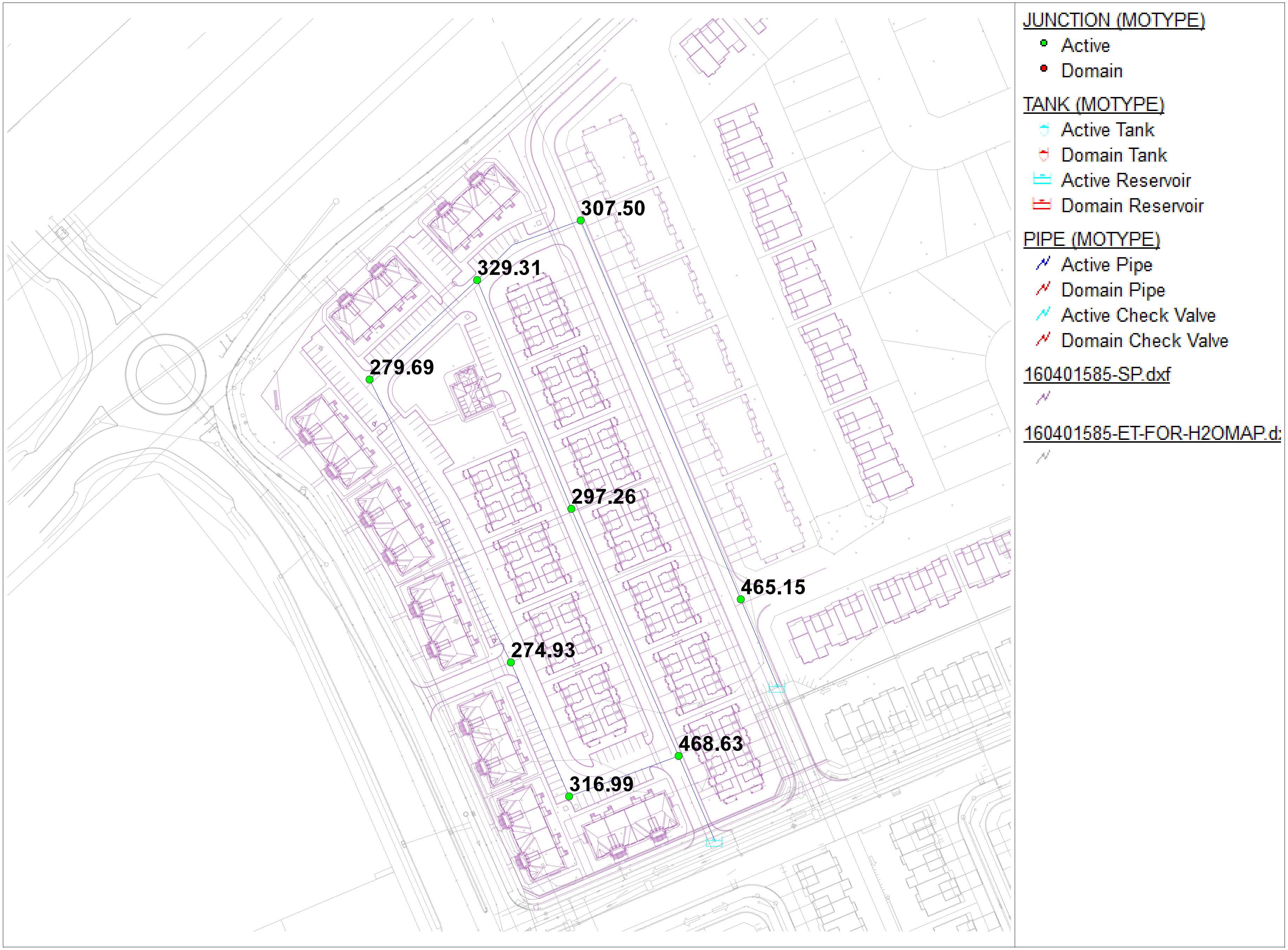
Prepared By: Stantec Consulting Ltd. Stantec Project No. 160401585 Date: Tuesday, December 08, 2020

Trailsedge North Block 193-194 - Average Day (AVDY) Pressures (psi)



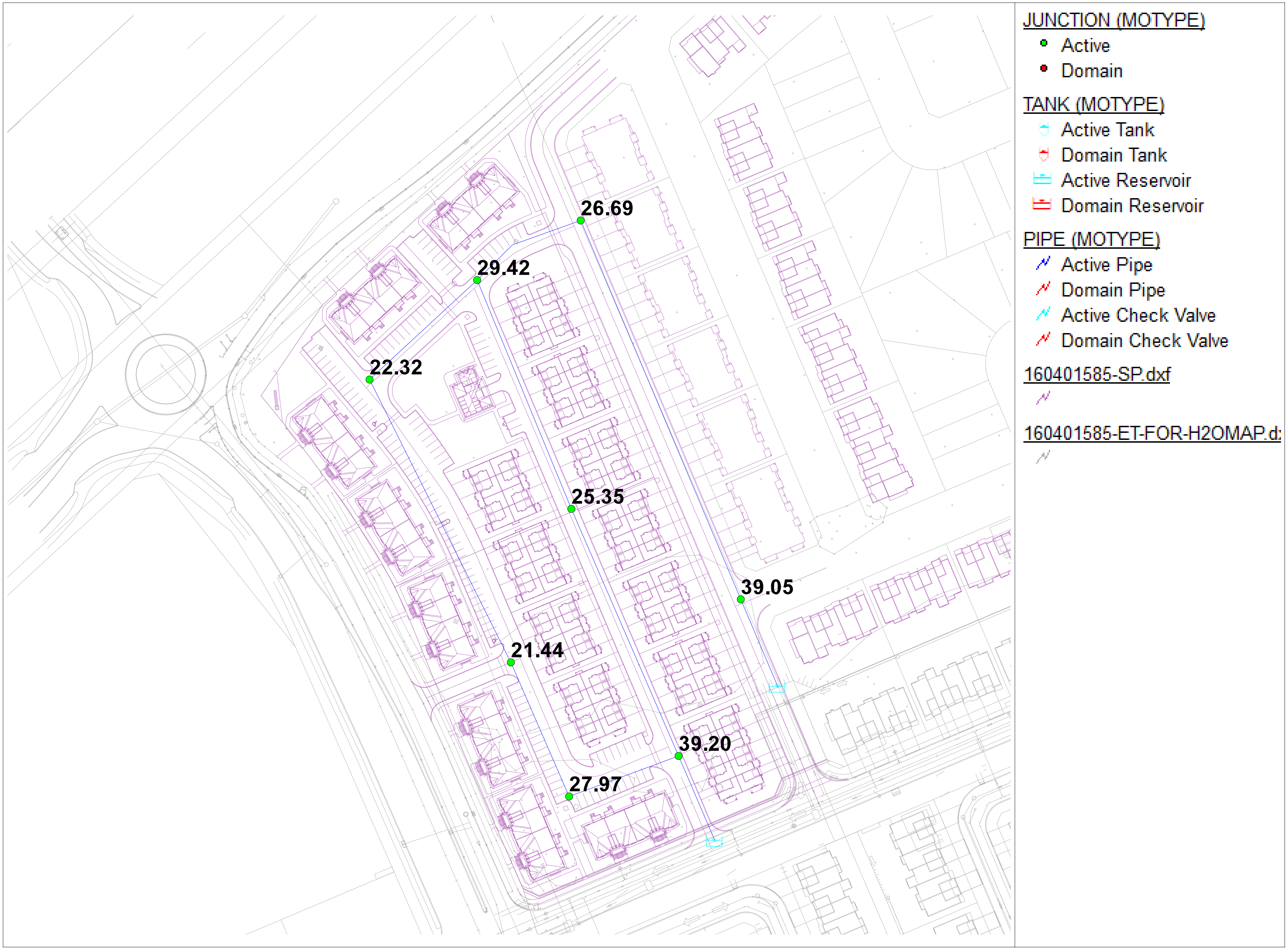
Prepared By: Stantec Consulting Ltd.   Stantec Project No. 160401585   Date: Tuesday, December 08, 2020

Trailsedge North Block 193-194 - Available Fireflows (L/s) in MXDY+FF (FF=266.7 L/s) Scenario



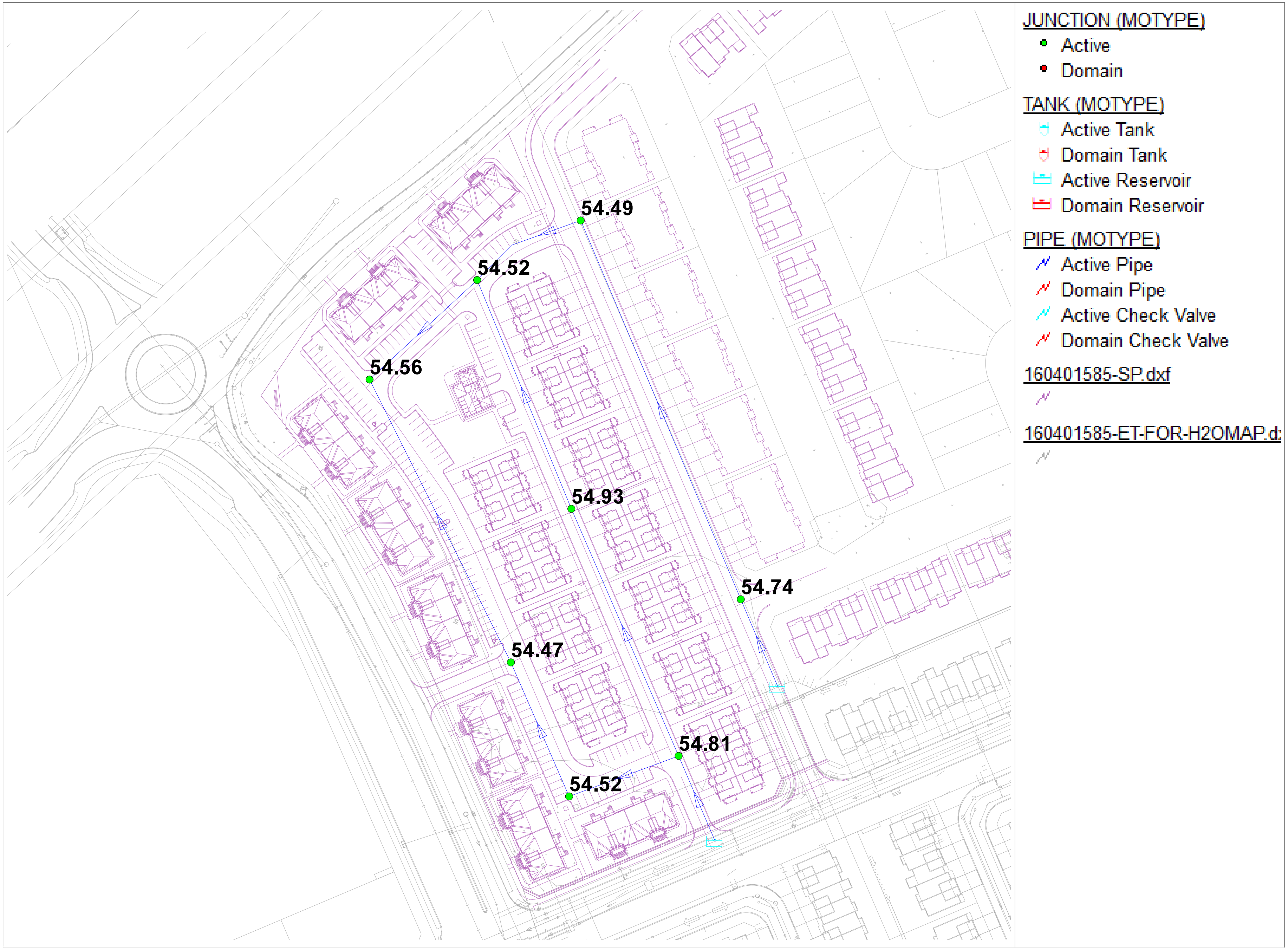
Prepared By: Stantec Consulting Ltd. Stantec Project No. 160401585 Date: Tuesday, December 08, 2020

Trailsedge North Block 193-194 - Residual Pressures (psi) in MXDY+FF (FF=266.7 L/s) Scenario



Prepared By: Stantec Consulting Ltd. Stantec Project No. 160401585 Date: Tuesday, December 08, 2020

Trailsedge North Block 193-194 - Peak Hour (PKHR) Pressures (psi)



Prepared By: Stantec Consulting Ltd. Stantec Project No. 160401585 Date: Tuesday, December 08, 2020

Trailsedge North Block 193-194
H2OMAP Water - Hydraulic Modelling Results
Stantec Project No. 160401585
Model last revised on 2020-12-08

Hydraulic Modelling Results - Average Day (AVDY) Demands

Junction Results

ID	Demand (L/s)	Elevation (m)	Head (m)	Pressure (psi)	Pressure (kPa)
1	0.28	88.29	130.60	60.15	414.72
10	0.23	88.23	130.60	60.23	415.27
11	0.18	88.14	130.60	60.36	416.17
2	0.31	88.45	130.60	59.92	413.14
6	0.19	88.43	130.60	59.95	413.34
7	0.35	88.40	130.60	59.99	413.62
8	0.34	88.46	130.60	59.90	413.00
9	0.20	88.43	130.60	59.95	413.34

Pipe Results

ID	From Node	To Node	Length (m)	Diameter (mm)	Roughness	Flow (L/s)	Velocity (m/s)
1001	2000	10	34.30	204	110	1.26	0.04
1003	10	9	43.03	204	110	0.62	0.02
1005	9	8	53.84	204	110	0.42	0.01
1007	8	7	116.53	204	110	0.08	0.00
1009	7	6	54.01	204	110	-0.27	0.01
1011	10	11	99.32	204	110	0.41	0.01
1013	11	6	91.17	204	110	0.23	0.01
1015	6	2	45.10	204	110	-0.23	0.01
1023	1000	1	35.22	204	110	0.82	0.03
1025	1	2	151.64	204	110	0.54	0.02

Hydraulic Modelling Results - Peak Hour (PKHR) Demands

Junction Results

ID	Demand	Elevation	Head	Pressure	
	(L/s)	(m)	(m)	(psi)	(kPa)
1	1.56	88.29	126.79	54.74	377.42
10	1.26	88.23	126.79	54.81	377.90
11	0.96	88.14	126.78	54.93	378.73
2	1.68	88.45	126.78	54.49	375.70
6	1.04	88.43	126.78	54.52	375.90
7	1.93	88.40	126.78	54.56	376.18
8	1.84	88.46	126.78	54.47	375.56
9	1.12	88.43	126.78	54.52	375.90

Pipe Results

ID	From Node	To Node	Length	Diameter	Roughness	Flow	Velocity
			(m)	(mm)		(L/s)	(m/s)
1001	2000	10	34.30	204	110	6.86	0.21
1003	10	9	43.03	204	110	3.39	0.10
1005	9	8	53.84	204	110	2.27	0.07
1007	8	7	116.53	204	110	0.43	0.01
1009	7	6	54.01	204	110	-1.50	0.05
1011	10	11	99.32	204	110	2.21	0.07
1013	11	6	91.17	204	110	1.25	0.04
1015	6	2	45.10	204	110	-1.29	0.04
1023	1000	1	35.22	204	110	4.53	0.14
1025	1	2	151.64	204	110	2.97	0.09

Hydraulic Modelling Results - Maximum Day + Fireflow (266.7 L/s) Analysis

ID	Static Demand	Static Pressure		Static Head	Fireflow Demand	Residual Pressure		Available Flow at Hydrant	Available Flow Pressure	
	(L/s)	(psi)	(kPa)	(m)	(L/s)	(psi)	(kPa)	(L/s)	(psi)	(KPa)
1	0.71	49.77	343.15	123.30	266.7	39.05	269.24	465.15	20.00	137.90
10	0.57	49.85	343.71	123.30	266.7	39.20	270.28	468.63	20.00	137.90
11	0.44	49.98	344.60	123.30	266.7	25.35	174.78	297.26	20.00	137.90
2	0.77	49.54	341.57	123.30	266.7	26.69	184.02	307.50	20.00	137.90
6	0.47	49.56	341.71	123.30	266.7	29.42	202.85	329.31	20.00	137.90
7	0.88	49.61	342.05	123.29	266.7	22.32	153.89	279.69	20.00	137.90
8	0.84	49.52	341.43	123.30	266.7	21.44	147.82	274.93	20.00	137.90
9	0.51	49.56	341.71	123.30	266.7	27.97	192.85	316.99	20.00	137.90

Appendix B- WASTEWATER SERVICING CALCULATIONS

B.1 SANITARY SEWER DESIGN SHEET

PROJECT: **Trailsedge East Block 193-194**

DATE: 2020-12-14
REVISION: 1
DESIGN BY: DC
CHECKED BY: DT

SANITARY SEWER DESIGN SHEET
(City of Ottawa)

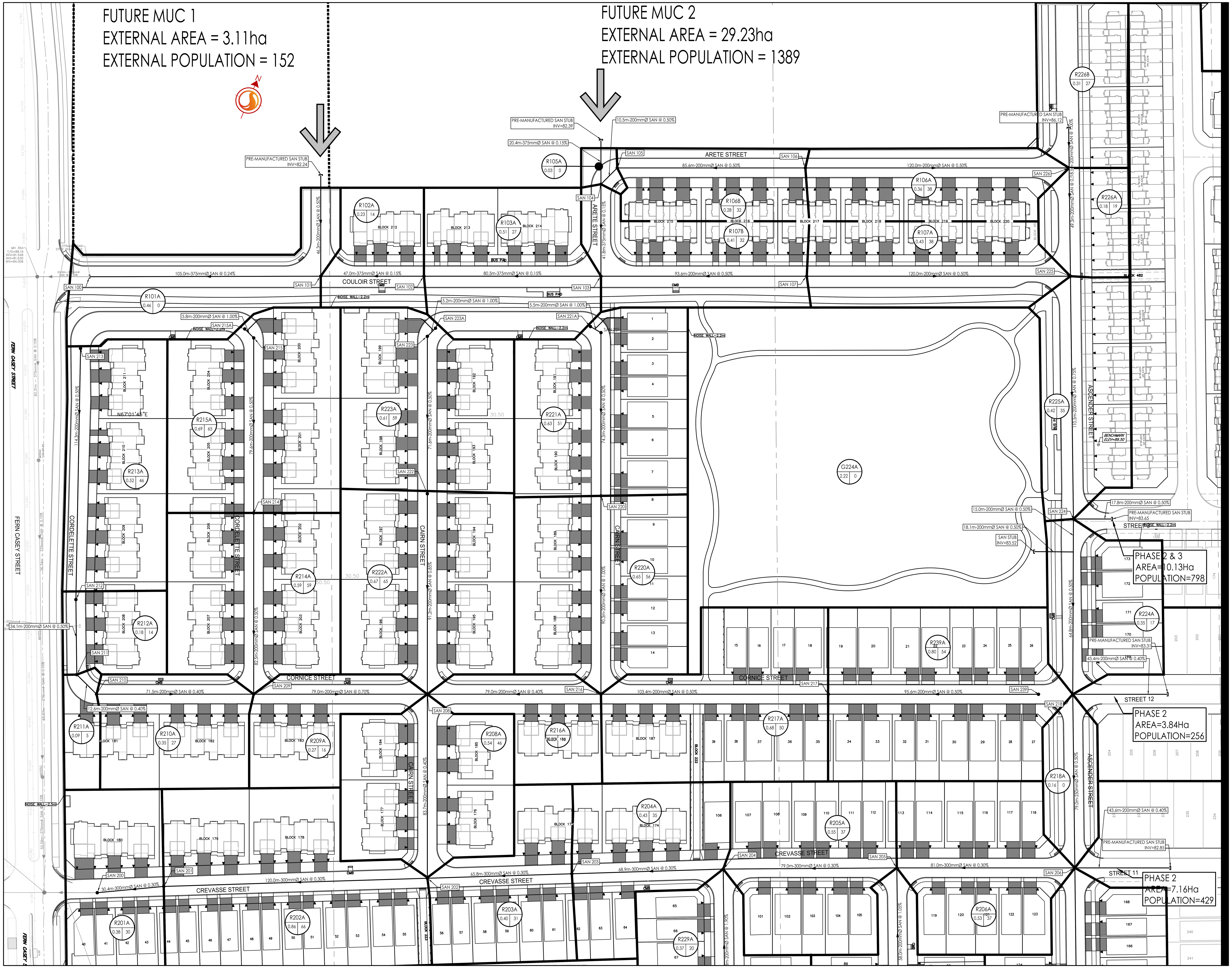
FILE NUMBER: 160401585

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 (COMM., INST.):	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 / 2BR TERRACE FLAT	2.1				

LOCATION			RESIDENTIAL AREA AND POPULATION									COMMERCIAL		INDUSTRIAL (L)		INDUSTRIAL (H)		INSTITUTIONAL		GREEN / UNUSED		C+I+I	INFILTRATION			TOTAL	PIPE								
AREA ID NUMBER	FROM M.H.	TO M.H.	AREA (ha)	UNITS SINGLE	UNITS TOWN	UNITS 2BR	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)
R110A	110	109	0.12	0	0	12	25	0.12	25	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	0.12	0.12	0.0	0.3	23.3	200	PVC	SDR 35	0.65	27.0	**1.26%**	0.85	0.24
R109B	109	108	0.15	0	0	12	25	0.26	50	3.65	0.6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.15	0.26	0.1	0.7	118.6	200	PVC	SDR 35	0.32	18.9	**3.61%**	0.60	0.24
R108A	108	107	0.29	0	1	18	41	0.56	91	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	0.56	0.2	1.2	46.2	200	PVC	SDR 35	0.32	19.0	**6.57%**	0.60	0.28
R107A	107	106	0.27	0	0	12	25	0.82	116	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	0.27	0.82	0.3	1.6	53.9	200	PVC	SDR 35	0.32	18.9	**8.56%**	0.60	0.30
R112A	112	111	0.09	0	5	0	14	0.09	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	0.09	0.09	0.0	0.2	26.8	200	PVC	SDR 35	0.65	27.0	**0.71%**	0.85	0.21
R109A	109	111	0.55	0	15	30	104	0.55	104	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	0.55	0.55	0.2	1.4	40.2	200	PVC	SDR 35	0.32	18.9	**7.32%**	0.60	0.29
R111A	111	113	0.30	0	21	0	57	0.93	174	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	0.30	0.93	0.3	2.3	81.5	200	PVC	SDR 35	0.32	18.9	**12.15%**	0.60	0.33
R113A	113	106	0.38	0	19	0	51	1.31	225	3.50	2.6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.38	1.31	0.4	3.0	100.3	200	PVC	SDR 35	0.32	18.9	**15.79%**	0.60	0.36
R106A	106	105	0.08	0	0	6	13	2.21	354	3.44	3.9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.08	2.21	0.7	4.7	20.2	200	PVC	SDR 35	0.32	18.9	**24.70%**	0.60	0.41
R105A	105	104	0.09	0	0	6	13	2.31	366	3.43	4.1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.09	2.31	0.8	4.8	24.7	200	PVC	SDR 35	0.32	18.9	**25.57%**	0.60	0.42
R104AA	104A	104	0.14	0	4	0	11	0.14	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	0.14	0.14	0.0	0.2	29.5	200	PVC	SDR 35	0.65	27.0	**0.65%**	0.85	0.21
R104A	104	103	0.42	0	24	0	65	2.86	442	3.40	4.9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.42	2.86	0.9	5.8	88.1	200	PVC	SDR 35	0.32	18.9	**30.74%**	0.60	0.44
R103A	103	102	0.39	0	21	0	57	3.25	499	3.38	5.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.39	3.25	1.1	6.5	95.4	200	PVC	SDR 35	0.32	18.9	**34.55%**	0.60	0.46
R102A	102	EX. 101	0.13	0	5	0	14	3.38	512	3.38	5.6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.13	3.38	1.1	6.7	48.0	200	PVC	SDR 35	0.50	23.6	**28.41%**	0.74	0.54

B.2 TRAILSEDGE EAST PHASE 1 REPORT EXCERPTS



Stantec

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

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Legend

- PROPOSED SANITARY SEWER
- R200A — SANITARY DRAINAGE AREA ID#
- 14 — POPULATION
- 0.38 — SANITARY DRAINAGE AREA ha.
- SANITARY DRAINAGE AREA ha.

Notes

8	ISSUED FOR APPROVAL	MJS	DT	19.07.24
7	REVISED ASCENDER OFFSITE SERVICING	AJ	DT/SG	19.05.17
6	ISSUED FOR GRADING APPROVAL	AJ	DT	19.03.11
5	ISSUED FOR CONSTRUCTION	MJS	GR	18.10.25
4	REVISED FIRE HYDRANT LOCATIONS	MJS	DT	18.10.24
3	REVISED AS PER CITY COMMENTS	MJS	DT	18.09.28
2	REVISED AS PER CITY COMMENTS AND DRAFT PLAN	MJS	DT	18.08.23
1	REVISED AS PER CITY COMMENTS	MJS	DT	18.05.30
0	ISSUED TO CITY FOR REVIEW	MJS	DT	18.03.06
Revision		By	Appd.	YY.MM.DD

File Name: 160401250 SA.DWG	JP	MJS	JP	18.02.14
	Dwn.	Chkd.	Dsgn.	YY.MM.DD

Permit-Seal

Client/Project

RICHCRAFT GROUP OF COMPANIES
2280 ST. LAURENT BLVD
OTTAWA, ON, K1G 4K1

TRAILSEDGE EAST SUBDIVISION
OTTAWA, ON, CANADA

Title

SANITARY DRAINAGE PLAN

Project No. 160401250

Scale 1:750 (0, 7.5, 22.5, 37.5m)

Drawing No. SA-1

Sheet 42 of 46

Revision 7

D07-16-16-0021

DWG# 17807

SUBDIVISION:

Trailsedge East Phase 1

DATE: 2019-11-22
REVISION: AS-BUILT (GMR)
DESIGNED BY: MJS/SG
CHECKED BY: DT

SANITARY SEWER
DESIGN SHEET (AS-BUILT)
(City of Ottawa)

FILE NUMBER: 160401250

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)	
AREA ID NUMBER	FROM M.H.	TO M.H.	AREA (ha)	UNITS SINGLE	UNITS TOWN	UNITS APT	POP.	CUMULATIVE AREA (ha)	CUMULATIVE POP.	PEAK FACT.	PEAK FLOW (l/s)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)
R106B	106	105	0.28	0	12	0	32	0.28	32	3.68	0.4	0.00	0.00	0.00	0.00
R105A	105	104	0.03	0	0	0	0	0.31	32	3.68	0.4	0.00	0.00	0.00	0.00
FUTURE MUC2	Stub	104	29.23	0	0	0	1389	29.23	1389	3.16	14.2	0.00	0.00	0.00	0.00
	104	103	0.00	0	0	0	0	29.54	1421	3.16	14.5	0.00	0.00	0.00	0.00
R107B	107	103	0.41	0	12	0	32	0.41	32	3.68	0.4	0.00	0.00	0.00	0.00
FUTURE MUC 1	STUB	101	3.11	0	0	0	152	3.11	152	3.55	1.7	0.00	0.00	0.00	0.00
R103A	103	102	0.51	0	10	0	27	30.47	1481	3.15	15.1	0.00	0.00	0.00	0.00
R102A	102	101	0.23	0	5	0	14	33.80	1646	3.12	16.6	0.00	0.00	0.00	0.00
R101A	101	100	0.46	0	0	0	0	34.26	1646	3.12	16.6	0.00	0.00	0.00	0.00

LOCATION	INDUSTRIAL (H)		INSTITUTIONAL		GREEN / UNUSED		C+I+I	INFILTRATION			TOTAL	PIPE									
AREA ID NUMBER	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 (AS-BUILT) (%)	CAP. (FULL) (l/s)	CAP. V PEAK FLOW (%)	VEL. (FULL) (m/s)	VEL. (ACT.) (m/s)
R106B	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.28	0.28	0.1	0.5	85.6	200	PVC	SDR 35	0.54	24.6	**1.95%**	0.77	0.25
R105A	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.03	0.31	0.1	0.5	10.5	200	PVC	SDR 35	0.50	23.6	**2.07%**	0.74	0.26
FUTURE MUC2	0.00	0.00	0.00	0.00	0.00	0.00	0.0	29.23	29.23	9.6	23.9	23.0	375	PVC	SDR 35	0.30	88.9	**26.86%**	0.84	0.60
	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.00	29.54	9.7	24.3	41.8	375	PVC	SDR 35	0.14	60.7	**40.00%**	0.58	0.46
R107B	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.41	0.41	0.1	0.5	93.6	200	PVC	SDR 35	0.57	25.2	**2.07%**	0.79	0.27
FUTURE MUC 1	0.00	0.00	0.00	0.00	0.00	0.00	0.0	3.11	3.11	1.0	2.8	48.0	200	PVC	SDR 35	0.50	23.6	**11.74%**	0.74	0.42
R103A	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.51	30.47	10.1	25.2	80.5	375	PVC	SDR 35	0.16	64.9	**38.75%**	0.62	0.48
R102A	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.23	33.80	11.2	27.8	47.0	375	PVC	SDR 35	0.15	62.9	**44.23%**	0.60	0.49
R101A	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.46	34.26	11.3	28.0	105.0	375	PVC	SDR 35	0.22	76.1	**36.72%**	0.72	0.56
													375							

Block 193-194 ultimately outlets to SAN MH 101 which then directs sewage to SAN MH 100 on Couloir Road).

Stantec

SUBDIVISION:	Trailsedge East Phase 1
DATE:	2019-11-22
REVISION:	AS-BUILT (GMR)
DESIGNED BY:	MJS/SG
CHECKED BY:	DT

SANITARY SEWER DESIGN SHEET (AS-BUILT)
(City of Ottawa)

FILE NUMBER: 160401250

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 (ha)	UNITS SINGLE	UNITS TOWN	UNITS APT	POP.	CUMULATIVE AREA (ha)	CUMULATIVE POP.	PEAK FACT.	PEAK FLOW (l/s)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	PEAK FLOW (l/s)	TOTAL AREA (ha)	ACCU. AREA (ha)	INFILT. FLOW (l/s)	FLOW (l/s)	LENGTH (m)	DIA (mm)	MATERIAL	CLASS	SLOPE (AS-BUILT) (%)	CAP. (FULL) (l/s)	CAP. V PEAK FLOW (%)	VEL. (FULL) (m/s)	VEL. (ACT.) (m/s)
RENAUD, L237A	237	236	5.19	4	0	0	245	5.19	245	3.49	2.8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	5.19	5.19	1.7	4.5	54.7	200	PVC	SDR 35	0.33	19.2	23.33%	0.60	0.41
R236A	236	235	0.24	5	0	0	17	5.43	262	3.48	3.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.24	5.43	1.8	4.7	26.9	200	PVC	SDR 35	0.48	23.2	20.48%	0.73	0.47
R235A	235	206	0.86	17	0	0	58	6.29	319	3.45	3.6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.86	6.29	2.1	5.6	120.0	200	PVC	SDR 35	0.51	23.9	23.66%	0.75	0.51
Phase 2	Stub	218	3.84	38	47	0	256	3.84	256	3.49	2.9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	3.84	3.84	1.3	4.2	46.4	200	PVC	SDR 35	0.41	21.4	19.43%	0.67	0.43
R107A	107	225	0.43	0	14	0	38	0.43	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	0.43	0.43	0.1	0.6	120.0	200	PVC	SDR 35	0.49	23.4	2.53%	0.74	0.27
R227A	STUB	226	0.14	0	5	0	14	0.14	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	0.14	0.14	0.0	0.2	18.5	200	PVC	SDR 35	1.00	33.4	0.62%	1.05	0.26
R106A	106	226	0.36	0	14	0	38	0.36	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	0.36	0.36	0.1	0.6	120.0	200	PVC	SDR 35	0.44	22.2	2.57%	0.70	0.25
R226A	226	225	0.18	0	6	0	16	0.68	68	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	0.18	0.68	0.2	1.0	49.3	200	PVC	SDR 35	0.51	23.9	4.27%	0.75	0.31
R225A	225	224	0.42	0	14	0	38	1.53	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	0.42	1.53	0.5	2.2	110.5	200	PVC	SDR 35	0.76	29.1	7.39%	0.92	0.44
Phases 2, 3	Stub	224	10.13	13	279	0	798	10.13	798	3.29	8.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	10.13	10.13	3.3	11.8	17.8	200	PVC	SDR 35	0.45	22.4	52.80%	0.71	0.61
G224A	Stub	224	0.00	0	0	0	0	0.00	0	3.80	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.22	2.22	0.0	2.22	2.22	0.7	0.7	18.1	200	PVC	SDR 35	6.41	84.7	0.87%	2.66	0.71
R224A	224	218	0.35	5	0	0	17	12.01	958	3.25	10.1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.22	0.0	0.35	14.23	4.7	14.8	64.8	200	PVC	SDR 35	0.60	25.9	57.07%	0.81	0.72
R218A	218	206	0.16	0	0	0	0	16.01	1214	3.20	12.6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.22	0.0	0.16	18.23	6.0	18.6	79.0	250	PVC	SDR 35	0.49	42.4	43.79%	0.85	0.70
Phase 2	Stub	206	7.16	0	0	0	429	7.16	429	3.41	4.7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	7.16	7.16	2.4	7.1	43.6	200	PVC	SDR 35	0.30	18.3	38.76%	0.58	0.45
R206A	206	205	0.53	11	0	0	37	29.99	2000	3.07	19.9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.22	0.0	0.53	32.21	10.6	30.5	81.0	300	PVC	SDR 35	0.33	55.2	55.32%	0.78	0.69
R232B	232	233	0.17	1	0	0	3	0.17	3	3.76	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.17	0.17	0.1	0.1	9.5	200	PVC	SDR 35	0.95	32.6	0.30%	1.03	0.19
R233A	233	234	0.49	9	0	0	31	0.67	34	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	0.49	0.67	0.2	0.6	68.0	200	PVC	SDR 35	0.49	23.4	2.67%	0.74	0.27
R234A	234	205	0.25	4	0	0	14	0.92	48	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	0.25	0.92	0.3	0.9	58.0	200	PVC	SDR 35	1.05	34.3	2.53%	1.08	0.39
R205A	205	204	0.55	11	0	0	37	31.46	2085	3.06	20.7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.22	0.0	0.55	33.68	11.1	31.8	79.0	300	PVC	SDR 35	0.30	52.6	60.41%	0.75	0.68
R232A	232	231	0.33	5	0	0	17	0.33	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	0.33	0.33	0.1	0.3	64.4	200	PVC	SDR 35	0.65	27.0	1.17%	0.85	0.24
R231A	231	230	0.23	1	0	0	3	0.56	20	3.70	0.2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.23	0.56	0.2	0.4	11.8	200	PVC	SDR 35	0.85	30.8	1.40%	0.97	0.30
R230A	230	229	0.55	10	0	0	34	1.11	54	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	0.55	1.11	0.4	1.0	67.3	200	PVC	SDR 35	0.59	25.7	3.93%	0.81	0.33
R229A	229	204	0.37	6	0	0	20	1.49	75	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	0.37	1.49	0.5	1.4	67.3	200	PVC	SDR 35	1.80	44.9	3.05%	1.41	0.54
R204A	204	203	0.43	4	8	0	35	33.37	2195	3.04	21.6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.22	0.0	0.43	35.59	11.7	33.4	68.9	300	PVC	SDR 35	0.30	52.6	63.49%	0.75	0.69
R203A	203	202	0.40	6	4	0	31	33.77	2226	3.04	21.9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.22	0.0	0.40	35.99	11.9	33.8	65.8	300	PVC	SDR 35	0.33	55.2	61.28%	0.78	0.71
R213A	213	212	0.52	0	17	0	46	0.52	46	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	0.52	0.52	0.2	0.7	114.3	200	PVC	SDR 35	0.47	22.9	3.13%	0.72	0.27
R212A	212	211	0.18	0	5	0	14	0.70	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	0.18	0.70	0.2	0.9	34.1	200	PVC	SDR 35	0.56	25.0	3.73%	0.79	0.31
R211A	211	210	0.09	0	2	0	5	0.79	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	0.09	0.79	0.3	1.0	12.6	200	PVC	SDR 35	0.32	18.9	5.41%	0.60	0.26
R210A	210	209	0.35	0	10	0	27	1.14	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	0.35	1.14	0.4	1.4	71.5	200	PVC	SDR 35	0.40	21.1	6.85%	0.67	0.31
	215A	215	0.00	0	0	0	0	0.00	0	3.80	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.00	0.00	0.0	0.0	5.8	200	PVC	SDR 35	0.86	31.0	0.00%	0.98	0.00
R215A	215	214	0.69	0	24	0	65	0.69	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	0.69	0.69	0.2	1.0	79.6	200	PVC	SDR 35	0.53	24.3	4.06%	0.77	0.31
R214A	214	209	0.59	0	22	0	59	1.28	124	3.57	1.4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.59	1.28	0.4	1.9	82.5	200	PVC	SDR 35	0.50	23.6	7.87%	0.74	0.37
R209A	209	208	0.27	0	6	0	16	2.69	232	3.50	2.6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.27	2.69	0.9	3.5	79.0	200	PVC	SDR 35	0.70	28.0	12.58%	0.88	0.50
R239A	239	217	0.80	16	0	0	54	0.80	54	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	0.80	0.80	0.3	0.9	95.6	200	PVC	SDR 35	0.48	23.2	3.91%	0.73	0.30
R217A	217	216	0.68	9	6	0	47	1.48	101	3.59	1.2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.68	1.48	0.5	1.7	103.4	200	PVC	SDR 35	0.53	24.3	6.84%	0.77	0.36
	221A	221	0.00	0	0	0	0	0.00	0	3.80	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.00	0.00	0.0	0.0	5.5	200	PVC	SDR 35	1.27	37.7	0.00%	1.19	0.00
R221A	221	220	0.63	7	10	0	51	0.63	51	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	0.63	0.63	0.2	0.8	74.3	200	PVC	SDR 35	0.50	23.6	3.42%	0.74	0.29
R220A	220	216	0.65	7	12	0	56	1.28	107	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	0.65	1.28	0.4	1.7	90.3	200	PVC	SDR 35	1.02	33.8	4.93%	1.06	0.45
R216A	216	208	0.25	0	6	0	16	3.01	224	3.50	2.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.25	3.01	1.0	3.5	79.0	200	PVC	SDR 35	0.38	20.6	17.18%	0.65	0.40
	223A	223	0.00	0	0	0	0	0.00	0	3.80	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.00	0.00	0.0	0.0	5.2	200	PVC	SDR 35	1.35	38.9	0.00%	1.22	0.00
R223A	223	222	0.61	0	22	0	59	0.61	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	0.61	0.61	0.2	0.9	71.6	200	PVC	SDR 35	0.48	23.2	3.89%	0.73	0.30
R222A	222	208	0.67	0	24	0	65	1.28	124	3.57	1.4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.67	1.28	0.4	1.9	91.2	200	PVC	SDR 35	0.82	30.3	6.14%	0.95	0.43
R208A	208	202	0.54	0	17	0	46	7.51	627	3.34	6.8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.54	7.51	2.5	9.3	83.7	200	PVC	SDR 35	0.38	20.6	44.91%	0.65	0.54
R202A	202	201	0.86	10	12	0	66	42.14	2919	2.96	28.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.22	0.0	0.86	44.36	14.6	42.7	120.0	300	PVC	SDR 35	0.24	47.0	90.69%	0.67	0.68
R201A	201	200	0.38	4	6	0	30	42.52	2949	2.96	28.3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.22	0.0	0.38	44.74	14.8	43.0	30.4	300	PVC	SDR 35	0.36	57.6	74.71%	0.82	0.79
	200	56	0.00	0	0	0	0	42.52	2949	2.96	28.3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.22	0.0	0.00	44.74	14.8	43.0	27.1	300	PVC	SDR 35	0.52	69.2	62.16%	0.98	0.90

4.0 WASTEWATER SERVICING

4.1 BACKGROUND

As indicated in the EUC Master Servicing Update, wastewater servicing for the Trails Edge Development is conveyed to the Forest Valley Trunk Sewer (FVT) via a free flow gravity trunk running along Renaud Road to the Forest Valley Pumping Station. The MSS also outlines the sanitary servicing requirements for the subject property, which identify an integrated network within Minto and further Richcraft lands to the west, eventually connecting to the newly constructed 600mm trunk sewer extension along Renaud Road recommended by the MSS. The Sanitary Drainage Plan for the existing Trailsedge Phase II is included in **Appendix B.2**. The Master Servicing Update also included an assessment of the residual capacity within the FVT based on a full buildout for the area equivalent to 10,000 residential units.

The Design Brief – Minto Trailsedge Phase II report (IBI Group, 2015) identifies an external contribution to their subdivision based on a future population of 4,212, which includes drainage from the entirety of the Trails Edge East development, as well as future lands forming a mixed-used community (MUC) identified within the EUC Master Servicing Update.

4.2 DESIGN CRITERIA

As outlined in the City's Sewer Design Guidelines, the following design parameters were used to calculate estimated wastewater flow rates and to preliminarily 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 Persons per unit – 3.4
- Townhouse Persons per unit – 2.7
- Extraneous Flow Allowance – 0.33 L/s/ha
- Residential Average Flows – 280 L/cap/day
- Commercial/Mixed Use Flows – 28,000 L/ha/day
- Harmon Correction Factor – 0.8
- Manhole Spacing – 120 m
- Minimum Cover – 2.5m

In addition, a residential peak factor based on Harmon's Equation was used to determine the peak design flows. Institutional and commercial areas were assigned a peaking factor of 1.5 where commercial areas contribute greater than 20% of the total tributary area to each sanitary sewer per Ottawa's Sewer Design Guidelines.

Per the Master Servicing Update, the external contributing MUC area was assessed at a residential density of approximately 25 units/ha and a unit population density of 1.9 persons/unit for a total population of 1,526. The total population was split up into two sections MUC1 and MUC2, given there are two proposed future connections to the system. Based on their area of contribution, the population for MUC1 was determined to be 138 people and MUC2 equates to 1,389 people. Based on the above criteria, the estimated population of Trails Edge East is 4,574 (on-site plus Renaud Road contributing areas).

Appendix C – STORMWATER MANAGEMENT

C.1 STORM SEWER DESIGN SHEET

	Trailsege East Block 193-194	STORM SEWER DESIGN SHEET (City of Ottawa)	DESIGN PARAMETERS
Stantec	DATE: 2020-12-14		I = a / (t+b)^{c} (As per City of Ottawa Guidelines, 2012)
	REVISION: 1		
	DESIGNED BY: DC	FILE NUMBER: 160401585	
	CHECKED BY: DT		

	1:2 yr	1:5 yr	1:10 yr	1:100 yr			
a =	732.951	998.071	1174.184	1735.688	MANNING'S n =	0.013	BEDDING CLASS = B
b =	6.199	6.053	6.014	6.014	MINIMUM COVER:	2.00 m	
c =	0.810	0.814	0.816	0.820	TIME OF ENTRY	10 min	

LOCATION / DRAINAGE AREA

AREA ID NUMBER	FROM M.H.	TO M.H.	AREA (2-YEAR) (ha)	AREA (5-YEAR) (ha)	AREA (10-YEAR) (ha)	AREA (100-YEAR) (ha)	AREA (ROOF) (ha)	C (2-YEAR) (-)	C (5-YEAR) (-)	C (10-YEAR) (-)	C (100-YEAR) (-)	A x C (2-YEAR) (ha)	ACCUM AxC (2YR) (ha)	A x C (5-YEAR) (ha)	ACCUM. AxC (5YR) (ha)	A x C (10-YEAR) (ha)	ACCUM. AxC (10YR) (ha)	A x C (100-YEAR) (ha)	ACCUM. AxC (100YR) (ha)	T of C (min)	I_{2-YEAR} (mm/h)	I_{5-YEAR} (mm/h)	$I_{10-YEAR}$ (mm/h)	$I_{100-YEAR}$ (mm/h)	$Q_{CONTROL}$ (L/s)	ACCUM. $Q_{CONTROL}$ (L/s)	Q_{ACT} (CIA/360) (L/s)
	1011	1010	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
L1010B, L1010A	1010	1009	0.50	0.00	0.00	0.00	0.00	0.76	0.00	0.00	0.00	0.379	0.379	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	80.9
L1009A	1009	1008	0.20	0.00	0.00	0.00	0.00	0.67	0.00	0.00	0.00	0.137	0.516	0.000	0.000	0.000	0.000	0.000	0.000	12.66	67.92	91.98	107.76	157.44	0.0	0.0	97.4
L1008A	1008	1007	0.26	0.00	0.00	0.00	0.00	0.67	0.00	0.00	0.00	0.173	0.689	0.000	0.000	0.000	0.000	0.000	0.000	13.61	65.25	88.32	103.46	151.12	0.0	0.0	124.8
																				14.71							
L1014A	1014	1012	0.17	0.00	0.00	0.00	0.00	0.76	0.00	0.00	0.00	0.131	0.131	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	27.9
																				10.69							
	1010	1012	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	0.00	167.22	230.48	271.61	398.62	0.0	0.0	0.0
																				0.00							
L1012A	1012	1013	0.21	0.00	0.00	0.00	0.00	0.77	0.00	0.00	0.00	0.162	0.293	0.000	0.000	0.000	0.000	0.000	0.000	10.69	74.26	100.69	118.02	172.51	0.0	0.0	60.4
L1013B, L1013A	1013	1007	0.48	0.00	0.00	0.00	0.00	0.79	0.00	0.00	0.00	0.383	0.675	0.000	0.000	0.000	0.000	0.000	0.000	12.70	67.79	91.81	107.56	157.15	0.0	0.0	127.1
																				14.84							
	1007	1006	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	1.364	0.000	0.000	0.000	0.000	0.000	0.000	14.84	62.14	84.07	98.45	143.78	0.0	0.0	235.4
	1006	1004	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	1.364	0.000	0.000	0.000	0.000	0.000	0.000	15.33	61.01	82.51	96.63	141.10	0.0	0.0	231.1
																				15.78							
	STUB	1004	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
																				10.00							
L1004B, L1004A	1004	1003	0.84	0.00	0.00	0.00	0.00	0.66	0.00	0.00	0.00	0.555	1.919	0.000	0.000	0.000	0.000	0.000	0.000	15.78	59.99	81.12	94.98	138.69	0.0	0.0	319.7
L1003A	1003	STUB	0.29	0.00	0.00	0.00	0.00	0.68	0.00	0.00	0.00	0.197	2.116	0.000	0.000	0.000	0.000	0.000	0.000	17.56	56.31	76.10	89.08	130.02	0.0	0.0	330.9
																				19.59							

PIPE SELECTION

AREA ID NUMBER	FROM M.H.	TO M.H.	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)
	1011	1010	26.5	300	300	CIRCULAR	PVC	-	0.34	56.1	**0.00%**	0.80	0.00	0.00
L1010B, L1010A	1010	1009	117.3	450	450	CIRCULAR	CONCRETE	-	0.20	133.0	**60.79%**	0.81	0.74	2.66
L1009A	1009	1008	44.7	450	450	CIRCULAR	CONCRETE	-	0.20	133.0	**73.20%**	0.81	0.78	0.96
L1008A	1008	1007	49.9	525	525	CIRCULAR	CONCRETE	-	0.16	179.5	**69.55%**	0.80	0.76	1.10
L1014A	1014	1012	28.3	300	300	CIRCULAR	PVC	-	0.35	56.9	**49.00%**	0.81	0.68	0.69
	1010	1012	37.0	300	300	CIRCULAR	PVC	-	0.34	56.1	**0.00%**	0.80	0.00	0.00
L1012A	1012	1013	81.2	450	450	CIRCULAR	CONCRETE	-	0.20	133.0	**45.37%**	0.81	0.67	2.01
L1013B, L1013A	1013	1007	96.6	600	600	CIRCULAR	CONCRETE	-	0.16	256.2	**49.62%**	0.88	0.75	2.14
	1007	1006	22.9	750	750	CIRCULAR	CONCRETE	-	0.12	402.3	**58.51%**	0.88	0.79	0.48
	1006	1004	21.4	750	750	CIRCULAR	CONCRETE	-	0.12	402.3	**57.44%**	0.88	0.79	0.45
	STUB	1004	19.6	300	300	CIRCULAR	PVC	-	0.65	77.5	**0.00%**	1.10	0.00	0.00
L1004B, L1004A	1004	1003	84.8	900	900	CIRCULAR	CONCRETE	-	0.10	597.2	**53.54%**	0.91	0.79	1.78
L1003A	1003	STUB	98.7	900	900	CIRCULAR	CONCRETE	-	0.10	605.9	**54.62%**	0.92	0.81	2.03
				900	900									

C.2 SAMPLE PCSWMM INPUT FILE

```
[TITLE]
;; 160401585 – Trailsedge East Block 193-194 – PCSWMM Input File for 2-year 3-hour Chicago Storm

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

START_DATE         12/04/2020
START_TIME         00:00:00
REPORT_START_DATE  12/04/2020
REPORT_START_TIME  00:00:00
END_DATE           12/04/2020
END_TIME           06:00:00
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       3
RULE_STEP          00:00:00

INERTIAL_DAMPING   PARTIAL
```

```
NORMAL_FLOW_LIMITED  BOTH
FORCE_MAIN_EQUATION  H-W
VARIABLE_STEP        0
LENGTHENING_STEP     0
MIN_SURFAREA         0
MAX_TRIALS           8
HEAD_TOLERANCE       0.0015
SYS_FLOW_TOL         5
LAT_FLOW_TOL         5
MINIMUM_STEP         0.5
THREADS              4

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

[RAINGAGES]
;;Name           Format    Interval SCF      Source
;;-------------- --------- -------- -------- ----------
RG1              INTENSITY 0:10     1.0      TIMESERIES 2yr3hrChicago

[SUBCATCHMENTS]
;;Name           Rain Gage        Outlet           Area     %Imperv  Width    %Slope   CurbLen  SnowPack
;;-------------- ---------------- ---------------- -------- -------- -------- -------- -------- ----------------
L1003A           RG1              L1003A-S         0.28954  68.571   146      1.27     0
L1004A           RG1              L1004A-S         0.419258 65.714   148      0.78     0
L1004B           RG1              L1004B-S         0.421726 65.714   174      0.96     0
```

```
L1008A      RG1     L1008A-S    0.25758  67.143  147   1.63   0
L1009A      RG1     L1009A-S    0.204561 67.143  89    1.28   0
L1010A      RG1     L1010A-S    0.215724 80      109   1.16   0
L1010B      RG1     L1010B-S    0.282988 80      148   0.9    0
L1012A      RG1     L1012A-S    0.21028  81.429  110   1.64   0
L1013A      RG1     L1013A-S    0.262174 87.143  167   1.11   0
L1013B      RG1     L1013B-S    0.221014 81.429  111   1.45   0
L1014A      RG1     L1014A-S    0.171909 80      97    1.27   0
;0.80
UNC-1       RG1     OF-UNC-1    0.100679 85.71   143   5      0
;0.80
UNC-2       RG1     OF-UNC-2    0.205312 85.71   221   5      0
;0.80
UNC-3       RG1     OF-UNC-3    0.073672 85.71   105   5      0

[SUBAREAS]
;;Subcatchment  N-Imperv  N-Perv  S-Imperv  S-Perv  PctZero  RouteTo  PctRouted
;;-------------- ---------- ---------- ---------- ---------- ---------- ---------- ----------
L1003A      0.013   0.25    1.57    4.67    0       OUTLET
L1004A      0.013   0.25    1.57    4.67    0       OUTLET
L1004B      0.013   0.25    1.57    4.67    0       OUTLET
L1008A      0.013   0.25    1.57    4.67    0       OUTLET
L1009A      0.013   0.25    1.57    4.67    0       OUTLET
L1010A      0.013   0.25    1.57    4.67    0       OUTLET
L1010B      0.013   0.25    1.57    4.67    0       OUTLET
L1012A      0.013   0.25    1.57    4.67    0       OUTLET
L1013A      0.013   0.25    1.57    4.67    0       OUTLET
L1013B      0.013   0.25    1.57    4.67    0       OUTLET
L1014A      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

[INFILTRATION]

;;Subcatchment Param1 Param2 Param3 Param4 Param5

;;-------------- ---------- ---------- ---------- ---------- ----------

L1003A 76.2 13.2 4.14 7 0

L1004A 76.2 13.2 4.14 7 0

L1004B 76.2 13.2 4.14 7 0

L1008A 76.2 13.2 4.14 7 0

L1009A 76.2 13.2 4.14 7 0

L1010A 76.2 13.2 4.14 7 0

L1010B 76.2 13.2 4.14 7 0

L1012A 76.2 13.2 4.14 7 0

L1013A 76.2 13.2 4.14 7 0

L1013B 76.2 13.2 4.14 7 0

L1014A 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

[OUTFALLS]

;;Name Elevation Type Stage Data Gated Route To

;;-------------- ---------- ---------- ---------------- -------- ----------------

;Stub N of STM1002

1002A 84.77 FREE NO

COULOIR 88.27 FREE NO

FERN-CASEY 88.53 FREE NO

```
;Brian Coburn Blvd
OF-UNC-1        0        FREE                    NO
;Fern Casey St
OF-UNC-2        0        FREE                    NO
;Couloir Rd
OF-UNC-3        0        FREE                    NO
;Street 23 Overland
STREET23        88.26      FREE                    NO

[STORAGE]
;;Name          Elev.    MaxDepth   InitDepth  Shape      Curve Name/Params           N/A      Fevap    Psi
Ksat     IMD
;;-------------- -------- ---------- ----------- ---------- ---------------------------- -------- --------          -------- --------
1003            84.575   3.653      0        FUNCTIONAL 0        0        1.13     0        0
1004            84.662   3.742      0        FUNCTIONAL 0        0        1.13     0        0
;STM Stub
1004A           86.008   2.442      0        FUNCTIONAL 0        0        0        0        0
1006            84.838   3.673      0        FUNCTIONAL 0        0        1.13     0        0
1007            84.869   3.578      0        FUNCTIONAL 0        0        1.13     0        0
1008            85.174   3.315      0        FUNCTIONAL 0        0        1.13     0        0
1009            85.339   3.034      0        FUNCTIONAL 0        0        1.13     0        0
1010            85.579   2.842      0        FUNCTIONAL 0        0        1.13     0        0
1011            85.819   2.825      0        FUNCTIONAL 0        0        1.13     0        0
1012            85.486   2.852      0        FUNCTIONAL 0        0        1.13     0        0
1013            85.174   3.134      0        FUNCTIONAL 0        0        1.13     0        0
1014            85.735   2.62       0        FUNCTIONAL 0        0        1.13     0        0
;HP=88.36 at EP
L1003A-HP       88.36    0.4        0        FUNCTIONAL 0        0        0        0        0
;T/G at CB=88.11
```

```
L1003A-S    86.73   1.78    0    FUNCTIONAL 0    0    0    0    0
;HP=88.50 at EP
L1004A-HP   88.8    0.4     0    FUNCTIONAL 0    0    0    0    0
;T/G at CB=88.26
L1004A-S    86.88   1.78    0    FUNCTIONAL 0    0    0    0    0
;HP=88.45 at EP
L1004B-HP   88.45   0.4     0    FUNCTIONAL 0    0    0    0    0
;T/G at CB=88.10
L1004B-S    86.72   1.78    0    FUNCTIONAL 0    0    0    0    0
;T/G at CB=88.25
L1008A-S    86.87   1.78    0    TABULAR   L1008A-V        0    0
;T/G at CB=88.19
L1009A-S    86.81   1.78    0    TABULAR   L1009A-V        0    0
;T/G at CB=88.14
L1010A-S    86.76   1.78    0    TABULAR   L1010A-V        0    0
;T/G at CB=88.14
L1010B-S    86.76   1.78    0    TABULAR   L1010B-V        0    0
;T/G at CB=88.03
L1012A-S    86.65   1.83    0    TABULAR   L1012A-V        0    0
;T/G at CB=88.16
L1013A-S    86.78   1.78    0    TABULAR   L1013A-V        0    0
;T/G at CB=88.09
L1013B-S    86.71   1.83    0    TABULAR   L1013B-V        0    0
;T/G at CB=88.03
L1014A-S    86.65   1.78    0    TABULAR   L1014A-V        0    0

[CONDUITS]
;;Name         From Node        To Node          Length     Roughness  InOffset   OutOffset  InitFlow   MaxFlow
;;-------------- ---------------- ---------------- ---------- ---------- ---------- ---------- ---------- ----------
```

1003-1002A	1003	1002A	98.664	0.013	84.875	84.77	0	0
1004-1003	1004	1003	84.766	0.013	84.962	84.878	0	0
1004A-1004	1004A	1004	19.612	0.013	85.683	85.556	0	0
1006-1004	1006	1004	21.431	0.013	85.138	85.113	0	0
1007-1006	1007	1006	22.902	0.013	85.169	85.142	0	0
1008-1007	1008	1007	49.888	0.013	85.474	85.394	0	0
1009-1008	1009	1008	44.732	0.013	85.639	85.549	0	0
1010-1009	1010	1009	117.309	0.013	85.879	85.645	0	0
1010-1012	1010	1012	37.011	0.013	86.062	85.936	0	0
1011-1010	1011	1010	26.511	0.013	86.119	86.029	0	0
1012-1013	1012	1013	81.174	0.013	85.786	85.624	0	0
1013-1007	1013	1007	96.571	0.013	85.474	85.319	0	0
1014-1012	1014	1012	28.25	0.013	86.035	85.936	0	0
CL1003A-1	L1003A-HP	L1003A-S	34.9	0.013	88.36	88.11	0	0
CL1003A-2	L1003A-S	STREET23	23	0.013	88.11	88.26	0	0
CL1004A-1	L1004A-HP	L1004A-S	51.1	0.013	88.5	88.26	0	0
CL1004A-2	L1004A-S	L1004B-HP	36.4	0.013	88.26	88.45	0	0
CL1004B-1	L1004B-HP	L1004B-S	34.6	0.013	88.45	88.1	0	0
CL1004B-2	L1004B-S	L1003A-HP	52.2	0.013	88.1	88.36	0	0
CL1010B	L1010B-S	FERN-CASEY	52.618	0.01	86.76	88.53	0	0
CL1014A	L1014A-S	COULOIR	18.421	0.01	88.03	88.27	0	0

[ORIFICES]

;;Name	From Node	To Node	Type	Offset	Qcoeff	Gated	CloseTime
;;--------------	----------------	----------------	------------	----------	----------	--------	----------
L1003A-IC1	L1003A-S	1003	SIDE	86.73	0.572	NO	0
L1003A-IC2	L1003A-S	1003	SIDE	86.73	0.572	NO	0
L1004A-IC1	L1004A-S	1004	SIDE	86.88	0.572	NO	0
L1004A-IC2	L1004A-S	1004	SIDE	86.88	0.572	NO	0

L1004B-IC1 L1004B-S 1004 SIDE 86.72 0.572 NO 0

L1004B-IC2 L1004B-S 1004 SIDE 86.72 0.572 NO 0

;Single ICD

L1008A-IC L1008A-S 1008 SIDE 86.87 0.572 NO 0

;Single ICD

L1009A-IC L1009A-S 1009 SIDE 86.81 0.572 NO 0

;Single ICD

L1010A-IC L1010A-S 1010 SIDE 86.76 0.572 NO 0

;Single ICD

L1010B-IC L1010B-S 1010 SIDE 86.76 0.572 NO 0

L1012A-IC L1012A-S 1012 SIDE 86.65 0.572 NO 0

L1013A-IC L1013A-S 1013 SIDE 86.78 0.572 NO 0

L1013B-IC L1013B-S 1013 SIDE 86.71 0.572 NO 0

L1014A-IC L1014A-S 1014 SIDE 86.65 0.572 NO 0

[WEIRS]

;;Name From Node To Node Type CrestHt Qcoeff Gated EndCon EndCoeff Surcharge RoadWidth RoadSurf Coeff. Curve

;;-------------- ---------------- ---------------- ------------ ---------- ---------- -------- -------- ---------- ---------- ---------- ---------- ----------------

;Overland Flow

WL1008A L1008A-S L1009A-S TRANSVERSE 88.49 1.68 NO 0 0 YES

;Overland Flow

WL1009A L1009A-S L1010A-S TRANSVERSE 88.44 1.68 NO 0 0 YES

;Overland Flow

WL1010A L1010A-S L1010B-S TRANSVERSE 88.39 1.68 NO 0 0 YES

;Overland Flow

WL1010B L1010B-S L1014A-S TRANSVERSE 88.34 1.68 NO 0 0 YES

;Overland Flow

```
WL1012A      L1012A-S     L1014A-S     TRANSVERSE  88.28    1.68     NO     0     0      YES
;Overland Flow
WL1013A      L1013A-S     L1013B-S     TRANSVERSE  88.4     1.68     NO     0     0      YES
;Overland Flow
WL1013B      L1013B-S     L1012A-S     TRANSVERSE  88.34    1.68     NO     0     0      YES

[XSECTIONS]
;;Link        Shape       Geom1         Geom2     Geom3     Geom4     Barrels   Culvert
;;-------------- ------------ ---------------- ---------- ---------- ---------- ---------- ----------
1003-1002A     CIRCULAR    0.9          0       0       0       1
1004-1003      CIRCULAR    0.9          0       0       0       1
1004A-1004     CIRCULAR    0.3          0       0       0       1
1006-1004      CIRCULAR    0.75         0       0       0       1
1007-1006      CIRCULAR    0.75         0       0       0       1
1008-1007      CIRCULAR    0.525        0       0       0       1
1009-1008      CIRCULAR    0.45         0       0       0       1
1010-1009      CIRCULAR    0.45         0       0       0       1
1010-1012      CIRCULAR    0.3          0       0       0       1
1011-1010      CIRCULAR    0.3          0       0       0       1
1012-1013      CIRCULAR    0.45         0       0       0       1
1013-1007      CIRCULAR    0.6          0       0       0       1
1014-1012      CIRCULAR    0.3          0       0       0       1
CL1003A-1      IRREGULAR   18.0m-ROW-MC-MC  0       0       0       1
CL1003A-2      IRREGULAR   18.0m-ROW-MC-MC  0       0       0       1
CL1004A-1      IRREGULAR   18.0m-ROW-MC-MC  0       0       0       1
CL1004A-2      IRREGULAR   18.0m-ROW-MC-MC  0       0       0       1
CL1004B-1      IRREGULAR   18.0m-ROW-MC-MC  0       0       0       1
CL1004B-2      IRREGULAR   18.0m-ROW-MC-MC  0       0       0       1
CL1010B        IRREGULAR   PRIVATE-STREET-2 0       0       0       1
```

CL1014A	IRREGULAR	PRIVATE-STREET-1	0	0	0	1
L1003A-IC1	CIRCULAR	0.108	0	0	0	
L1003A-IC2	CIRCULAR	0.108	0	0	0	
L1004A-IC1	CIRCULAR	0.127	0	0	0	
L1004A-IC2	CIRCULAR	0.127	0	0	0	
L1004B-IC1	CIRCULAR	0.127	0	0	0	
L1004B-IC2	CIRCULAR	0.127	0	0	0	
L1008A-IC	CIRCULAR	0.127	0	0	0	
L1009A-IC	CIRCULAR	0.127	0	0	0	
L1010A-IC	CIRCULAR	0.127	0	0	0	
L1010B-IC	CIRCULAR	0.152	0	0	0	
L1012A-IC	CIRCULAR	0.127	0	0	0	
L1013A-IC	CIRCULAR	0.152	0	0	0	
L1013B-IC	CIRCULAR	0.127	0	0	0	
L1014A-IC	CIRCULAR	0.127	0	0	0	
WL1008A	RECT_OPEN	0.4	6.7	0	0	
WL1009A	RECT_OPEN	0.4	6.7	0	0	
WL1010A	RECT_OPEN	0.4	7.1	0	0	
WL1010B	RECT_OPEN	0.4	13.4	0	0	
WL1012A	RECT_OPEN	0.4	6.7	0	0	
WL1013A	RECT_OPEN	0.4	6.7	0	0	
WL1013B	RECT_OPEN	0.4	6.7	0	0	

[TRANSECTS]

;;Transect Data in HEC-2 format

;

;18.0m ROW w mountable curb on both sides. Pavement width=8.5m, MC=0.05m tall, cross-slope=0.03m/m.

NC 0.025 0.025 0.013

X1 18.0m-ROW-MC-MC 7 4.75 13.25 0.0 0.0 0.0 0.0 0.0

GR 0.35 0 0.05 4.75 0 4.75 0.13 9 0 13.25

GR 0.05 13.25 0.35 18

;

;Private street w barrier curb on both sides. Pavement width=6.7m, BC=0.15m tall, cross-slope=0.021m/m, approx. 4.0m blvd on one side, 6.3m blvd on other side.

NC 0.025 0.025 0.013

X1 PRIVATE-STREET-1 6 4 10.7 0.0 0.0 0.0 0.0 0.0

GR 0.37 0 0.29 4 0.14 4 0 10.7 0.15 10.7

GR 0.44 17

;

;Private street w barrier curb on both sides. Pavement width=6.7m, BC=0.15m tall, cross-slope=0.022m/m, approx. 2.9m blvd on both sides of road.

NC 0.025 0.025 0.013

X1 PRIVATE-STREET-2 6 2.9 9.6 0.0 0.0 0.0 0.0 0.0

GR 0.24 0 0.15 2.9 0 2.9 0 9.6 0.15 9.6

GR 0.21 12.5

[LOSSES]

;;Link Kentry Kexit Kavg Flap Gate Seepage

;;-------------- ---------- ---------- ---------- ---------- ----------

1004-1003 0 0.022 0 NO 0

1006-1004 0 1.344 0 NO 0

1007-1006 0 0.103 0 NO 0

1008-1007 0 0.022 0 NO 0

1009-1008 0 1.174 0 NO 0

1010-1009 0 0.072 0 NO 0

1010-1012 0 1.344 0 NO 0

1011-1010 0 1.151 0 NO 0

```
1012-1013      0       0.021     0       NO       0
1013-1007      0       0.91      0       NO       0
1014-1012      0       0.021     0       NO       0

[CURVES]
;;Name          Type       X-Value    Y-Value
;;-------------- ---------- ---------- ----------
L1008A-V        Storage    0          0
L1008A-V                   1.38       0
L1008A-V                   1.63       455.9
L1008A-V                   1.631      0
L1008A-V                   1.78       0

L1009A-V        Storage    0          0
L1009A-V                   1.38       0
L1009A-V                   1.63       378.8
L1009A-V                   1.631      0
L1009A-V                   1.78       0

L1010A-V        Storage    0          0
L1010A-V                   1.38       0
L1010A-V                   1.63       428.1
L1010A-V                   1.631      0
L1010A-V                   1.78       0

L1010B-V        Storage    0          0
L1010B-V                   1.38       0
L1010B-V                   1.58       463.2
L1010B-V                   1.581      0
```

L1010B-V 1.78 0

L1012A-V Storage 0 0

L1012A-V 1.38 0

L1012A-V 1.63 311.1

L1012A-V 1.631 0

L1012A-V 1.78 0

L1013A-V Storage 0 0

L1013A-V 1.38 0

L1013A-V 1.63 468.4

L1013A-V 1.631 0

L1013A-V 1.78 0

L1013B-V Storage 0 0

L1013B-V 1.38 0

L1013B-V 1.63 355.3

L1013B-V 1.631 0

L1013B-V 1.78 0

L1014A-V Storage 0 0

L1014A-V 1.38 0

L1014A-V 1.62 105.5

L1014A-V 1.621 0

L1014A-V 1.78 0

[TIMESERIES]

;;Name Date Time Value

;;-------------- ---------- ---------- ----------

2yr3hrChicago	0:00	0
2yr3hrChicago	0:10	2.81459
2yr3hrChicago	0:20	3.49825
2yr3hrChicago	0:30	4.68718
2yr3hrChicago	0:40	7.30485
2yr3hrChicago	0:50	18.20881
2yr3hrChicago	1:00	76.805
2yr3hrChicago	1:10	24.07906
2yr3hrChicago	1:20	12.36376
2yr3hrChicago	1:30	8.32403
2yr3hrChicago	1:40	6.30341
2yr3hrChicago	1:50	5.09498
2yr3hrChicago	2:00	4.29133
2yr3hrChicago	2:10	3.71786
2yr3hrChicago	2:20	3.28762
2yr3hrChicago	2:30	2.95254
2yr3hrChicago	2:40	2.68388
2yr3hrChicago	2:50	2.46348
2yr3hrChicago	3:00	2.27921

[REPORT]

;;Reporting Options

INPUT YES

CONTROLS NO

SUBCATCHMENTS ALL

NODES ALL

LINKS ALL

```
[TAGS]
Node     1002A       MIN
Node     STREET23    MAJ
Node     1003        MIN
Node     1004        MIN
Node     1004A       MIN
Node     1006        MIN
Node     1007        MIN
Node     1008        MIN
Node     1009        MIN
Node     1010        MIN
Node     1011        MIN
Node     1012        MIN
Node     1013        MIN
Node     1014        MIN
Node     L1003A-HP   HP
Node     L1003A-S    MAJ
Node     L1004A-HP   HP
Node     L1004A-S    MAJ
Node     L1004B-HP   HP
Node     L1004B-S    MAJ
Node     L1008A-S    MAJ
Node     L1009A-S    MAJ
Node     L1010A-S    MAJ
Node     L1010B-S    MAJ
Node     L1012A-S    MAJ
Node     L1013A-S    MAJ
Node     L1013B-S    MAJ
Node     L1014A-S    MAJ
```

Link 1003-1002A PIPE

Link 1004-1003 PIPE

Link 1004A-1004 PIPE

Link 1006-1004 PIPE

Link 1007-1006 PIPE

Link 1008-1007 PIPE

Link 1009-1008 PIPE

Link 1010-1009 PIPE

Link 1010-1012 PIPE

Link 1011-1010 PIPE

Link 1012-1013 PIPE

Link 1013-1007 PIPE

Link 1014-1012 PIPE

Link CL1003A-1 MAJ

Link CL1003A-2 MAJ

Link CL1004A-1 MAJ

Link CL1004A-2 MAJ

Link CL1004B-1 MAJ

Link CL1004B-2 MAJ

Link CL1010B MAJ

Link CL1014A MAJ

Link L1003A-IC1 RoadCB

Link L1003A-IC2 RoadCB

Link L1004A-IC1 RoadCB

Link L1004A-IC2 RoadCB

Link L1004B-IC1 RoadCB

Link L1004B-IC2 RoadCB

Link L1008A-IC RoadCB

Link L1009A-IC RoadCB

Link	L1010A-IC	RoadCB
Link	L1010B-IC	RoadCB
Link	L1012A-IC	RoadCB
Link	L1013A-IC	RoadCB
Link	L1013B-IC	RoadCB
Link	L1014A-IC	RoadCB
Link	WL1008A	MAJ
Link	WL1009A	MAJ
Link	WL1010A	MAJ
Link	WL1010B	MAJ
Link	WL1012A	MAJ
Link	WL1013A	MAJ
Link	WL1013B	MAJ

C.3 SAMPLE PCSWMM OUTPUT FILE

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.015)

WARNING 03: negative offset ignored for Link 1004A-1004

WARNING 03: negative offset ignored for Link CL1004A-1

****

Element Count

****

Number of rain gages 1

Number of subcatchments ... 14

Number of nodes 33

Number of links 42

Number of pollutants 0

Number of land uses 0

****

Raingage Summary

****

Name	Data Source	Data Type	Recording Interval
RG1	2yr3hrChicago	INTENSITY	10 min.

****

Subcatchment Summary

****

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
L1003A	0.29	146.00	68.57	1.2700	RG1	L1003A-S
L1004A	0.42	148.00	65.71	0.7800	RG1	L1004A-S
L1004B	0.42	174.00	65.71	0.9600	RG1	L1004B-S
L1008A	0.26	147.00	67.14	1.6300	RG1	L1008A-S
L1009A	0.20	89.00	67.14	1.2800	RG1	L1009A-S
L1010A	0.22	109.00	80.00	1.1600	RG1	L1010A-S
L1010B	0.28	148.00	80.00	0.9000	RG1	L1010B-S
L1012A	0.21	110.00	81.43	1.6400	RG1	L1012A-S
L1013A	0.26	167.00	87.14	1.1100	RG1	L1013A-S
L1013B	0.22	111.00	81.43	1.4500	RG1	L1013B-S
L1014A	0.17	97.00	80.00	1.2700	RG1	L1014A-S
UNC-1	0.10	143.00	85.71	5.0000	RG1	OF-UNC-1
UNC-2	0.21	221.00	85.71	5.0000	RG1	OF-UNC-2
UNC-3	0.07	105.00	85.71	5.0000	RG1	OF-UNC-3

****
Node Summary
****

		Invert	Max.	Ponded	External
Name	Type	Elev.	Depth	Area	Inflow
1002A	OUTFALL	84.77	0.90	0.0	
COULOIR	OUTFALL	88.27	0.44	0.0	
FERN-CASEY	OUTFALL	88.53	0.24	0.0	
OF-UNC-1	OUTFALL	0.00	0.00	0.0	

OF-UNC-2	OUTFALL	0.00	0.00	0.0
OF-UNC-3	OUTFALL	0.00	0.00	0.0
STREET23	OUTFALL	88.26	0.35	0.0
1003	STORAGE	84.58	3.65	0.0
1004	STORAGE	84.66	3.74	0.0
1004A	STORAGE	86.01	2.44	0.0
1006	STORAGE	84.84	3.67	0.0
1007	STORAGE	84.87	3.58	0.0
1008	STORAGE	85.17	3.31	0.0
1009	STORAGE	85.34	3.03	0.0
1010	STORAGE	85.58	2.84	0.0
1011	STORAGE	85.82	2.82	0.0
1012	STORAGE	85.49	2.85	0.0
1013	STORAGE	85.17	3.13	0.0
1014	STORAGE	85.73	2.62	0.0
L1003A-HP	STORAGE	88.36	0.40	0.0
L1003A-S	STORAGE	86.73	1.78	0.0
L1004A-HP	STORAGE	88.80	0.40	0.0
L1004A-S	STORAGE	86.88	1.78	0.0
L1004B-HP	STORAGE	88.45	0.40	0.0
L1004B-S	STORAGE	86.72	1.78	0.0
L1008A-S	STORAGE	86.87	1.78	0.0
L1009A-S	STORAGE	86.81	1.78	0.0
L1010A-S	STORAGE	86.76	1.78	0.0
L1010B-S	STORAGE	86.76	1.78	0.0
L1012A-S	STORAGE	86.65	1.83	0.0
L1013A-S	STORAGE	86.78	1.78	0.0
L1013B-S	STORAGE	86.71	1.83	0.0
L1014A-S	STORAGE	86.65	1.78	0.0

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Link Summary

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Name	From Node	To Node	Type	Length	%Slope	Roughness
1003-1002A	1003	1002A	CONDUIT	98.7	0.1064	0.0130
1004-1003	1004	1003	CONDUIT	84.8	0.0991	0.0130
1004A-1004	1004A	1004	CONDUIT	19.6	2.3053	0.0130
1006-1004	1006	1004	CONDUIT	21.4	0.1167	0.0130
1007-1006	1007	1006	CONDUIT	22.9	0.1179	0.0130
1008-1007	1008	1007	CONDUIT	49.9	0.1604	0.0130
1009-1008	1009	1008	CONDUIT	44.7	0.2012	0.0130
1010-1009	1010	1009	CONDUIT	117.3	0.1995	0.0130
1010-1012	1010	1012	CONDUIT	37.0	0.3404	0.0130
1011-1010	1011	1010	CONDUIT	26.5	0.3395	0.0130
1012-1013	1012	1013	CONDUIT	81.2	0.1996	0.0130
1013-1007	1013	1007	CONDUIT	96.6	0.1605	0.0130
1014-1012	1014	1012	CONDUIT	28.3	0.3504	0.0130
CL1003A-1	L1003A-HP	L1003A-S	CONDUIT	34.9	0.7164	0.0130
CL1003A-2	L1003A-S	STREET23	CONDUIT	23.0	-0.6522	0.0130
CL1004A-1	L1004A-HP	L1004A-S	CONDUIT	51.1	1.0568	0.0130
CL1004A-2	L1004A-S	L1004B-HP	CONDUIT	36.4	-0.5220	0.0130
CL1004B-1	L1004B-HP	L1004B-S	CONDUIT	34.6	1.0116	0.0130
CL1004B-2	L1004B-S	L1003A-HP	CONDUIT	52.2	-0.4981	0.0130
CL1010B	L1010B-S	FERN-CASEY	CONDUIT	52.6	-3.3658	0.0130
CL1014A	L1014A-S	COULOIR	CONDUIT	18.4	-1.3030	0.0130
L1003A-IC1	L1003A-S	1003	ORIFICE			

L1003A-IC2	L1003A-S	1003	ORIFICE
L1004A-IC1	L1004A-S	1004	ORIFICE
L1004A-IC2	L1004A-S	1004	ORIFICE
L1004B-IC1	L1004B-S	1004	ORIFICE
L1004B-IC2	L1004B-S	1004	ORIFICE
L1008A-IC	L1008A-S	1008	ORIFICE
L1009A-IC	L1009A-S	1009	ORIFICE
L1010A-IC	L1010A-S	1010	ORIFICE
L1010B-IC	L1010B-S	1010	ORIFICE
L1012A-IC	L1012A-S	1012	ORIFICE
L1013A-IC	L1013A-S	1013	ORIFICE
L1013B-IC	L1013B-S	1013	ORIFICE
L1014A-IC	L1014A-S	1014	ORIFICE
WL1008A	L1008A-S	L1009A-S	WEIR
WL1009A	L1009A-S	L1010A-S	WEIR
WL1010A	L1010A-S	L1010B-S	WEIR
WL1010B	L1010B-S	L1014A-S	WEIR
WL1012A	L1012A-S	L1014A-S	WEIR
WL1013A	L1013A-S	L1013B-S	WEIR
WL1013B	L1013B-S	L1012A-S	WEIR

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Cross Section Summary

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Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow
1003-1002A	CIRCULAR	0.90	0.64	0.23	0.90	1	0.59

1004-1003	CIRCULAR	0.90	0.64	0.23	0.90	1	0.57
1004A-1004	CIRCULAR	0.30	0.07	0.07	0.30	1	0.15
1006-1004	CIRCULAR	0.75	0.44	0.19	0.75	1	0.38
1007-1006	CIRCULAR	0.75	0.44	0.19	0.75	1	0.38
1008-1007	CIRCULAR	0.53	0.22	0.13	0.53	1	0.17
1009-1008	CIRCULAR	0.45	0.16	0.11	0.45	1	0.13
1010-1009	CIRCULAR	0.45	0.16	0.11	0.45	1	0.13
1010-1012	CIRCULAR	0.30	0.07	0.07	0.30	1	0.06
1011-1010	CIRCULAR	0.30	0.07	0.07	0.30	1	0.06
1012-1013	CIRCULAR	0.45	0.16	0.11	0.45	1	0.13
1013-1007	CIRCULAR	0.60	0.28	0.15	0.60	1	0.25
1014-1012	CIRCULAR	0.30	0.07	0.07	0.30	1	0.06
CL1003A-1	18.0m-ROW-MC-MC	0.35	3.85	0.18	18.00	1	8.11
CL1003A-2	18.0m-ROW-MC-MC	0.35	3.85	0.18	18.00	1	7.74
CL1004A-1	18.0m-ROW-MC-MC	0.35	3.85	0.18	18.00	1	9.86
CL1004A-2	18.0m-ROW-MC-MC	0.35	3.85	0.18	18.00	1	6.93
CL1004B-1	18.0m-ROW-MC-MC	0.35	3.85	0.18	18.00	1	9.64
CL1004B-2	18.0m-ROW-MC-MC	0.35	3.85	0.18	18.00	1	6.77
CL1010B	PRIVATE-STREET-2	0.24	1.91	0.19	12.50	1	8.81
CL1014A	PRIVATE-STREET-1	0.44	3.83	0.23	17.00	1	12.47

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Transect Summary

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Transect 18.0m-ROW-MC-MC

Area:

0.0004	0.0017	0.0037	0.0067	0.0104
0.0150	0.0204	0.0268	0.0344	0.0433
0.0534	0.0647	0.0773	0.0911	0.1061
0.1224	0.1399	0.1587	0.1786	0.1990
0.2199	0.2411	0.2628	0.2849	0.3073
0.3302	0.3535	0.3771	0.4012	0.4257
0.4506	0.4759	0.5016	0.5276	0.5541
0.5810	0.6083	0.6361	0.6642	0.6927
0.7216	0.7509	0.7806	0.8108	0.8413
0.8722	0.9036	0.9353	0.9675	1.0000

Hrad:

0.0183	0.0367	0.0550	0.0734	0.0917
0.1100	0.1284	0.1461	0.1620	0.1769
0.1913	0.2055	0.2196	0.2336	0.2477
0.2617	0.2758	0.2900	0.3104	0.3389
0.3668	0.3941	0.4210	0.4473	0.4731
0.4985	0.5234	0.5478	0.5719	0.5955
0.6187	0.6416	0.6641	0.6862	0.7080
0.7295	0.7506	0.7714	0.7919	0.8121
0.8321	0.8517	0.8711	0.8903	0.9091
0.9278	0.9462	0.9643	0.9823	1.0000

Width:

0.0254	0.0509	0.0763	0.1017	0.1271
0.1526	0.1780	0.2140	0.2517	0.2895
0.3272	0.3649	0.4027	0.4404	0.4782
0.5159	0.5537	0.5914	0.6182	0.6306
0.6429	0.6552	0.6675	0.6798	0.6921
0.7044	0.7168	0.7291	0.7414	0.7537
0.7660	0.7783	0.7906	0.8030	0.8153

0.8276	0.8399	0.8522	0.8645	0.8769
0.8892	0.9015	0.9138	0.9261	0.9384
0.9507	0.9631	0.9754	0.9877	1.0000

Transect PRIVATE-STREET-1

Area:

0.0005	0.0019	0.0044	0.0077	0.0121
0.0174	0.0237	0.0309	0.0392	0.0484
0.0585	0.0696	0.0817	0.0948	0.1088
0.1238	0.1392	0.1547	0.1708	0.1872
0.2041	0.2215	0.2392	0.2575	0.2761
0.2952	0.3147	0.3347	0.3551	0.3760
0.3973	0.4190	0.4412	0.4643	0.4889
0.5150	0.5425	0.5715	0.6019	0.6337
0.6670	0.7018	0.7375	0.7737	0.8103
0.8474	0.8849	0.9228	0.9612	1.0000

Hrad:

0.0190	0.0381	0.0571	0.0761	0.0952
0.1142	0.1332	0.1523	0.1713	0.1903
0.2094	0.2284	0.2474	0.2665	0.2855
0.3062	0.3434	0.3801	0.4154	0.4494
0.4821	0.5137	0.5442	0.5737	0.6022
0.6299	0.6567	0.6827	0.7079	0.7324
0.7562	0.7794	0.8020	0.8236	0.8423
0.8586	0.8727	0.8849	0.8955	0.9047
0.9127	0.9196	0.9275	0.9363	0.9457
0.9558	0.9663	0.9772	0.9885	1.0000

Width:

0.0248	0.0495	0.0743	0.0991	0.1239

0.1486	0.1734	0.1982	0.2230	0.2477
0.2725	0.2973	0.3221	0.3468	0.3716
0.3941	0.3941	0.4049	0.4161	0.4273
0.4386	0.4498	0.4611	0.4723	0.4836
0.4948	0.5061	0.5173	0.5286	0.5398
0.5510	0.5623	0.5747	0.6118	0.6490
0.6861	0.7232	0.7603	0.7975	0.8346
0.8717	0.9089	0.9213	0.9325	0.9438
0.9550	0.9663	0.9775	0.9888	1.0000

Transect PRIVATE-STREET-2

Area:

0.0168	0.0336	0.0504	0.0673	0.0841
0.1009	0.1177	0.1345	0.1513	0.1682
0.1850	0.2018	0.2186	0.2354	0.2522
0.2691	0.2859	0.3027	0.3195	0.3363
0.3531	0.3699	0.3868	0.4036	0.4204
0.4372	0.4540	0.4708	0.4877	0.5045
0.5213	0.5384	0.5564	0.5754	0.5954
0.6163	0.6382	0.6611	0.6850	0.7098
0.7356	0.7623	0.7901	0.8188	0.8480
0.8776	0.9076	0.9380	0.9688	1.0000

Hrad:

0.0256	0.0512	0.0766	0.1020	0.1274
0.1526	0.1778	0.2029	0.2280	0.2530
0.2779	0.3027	0.3275	0.3521	0.3768
0.4013	0.4258	0.4502	0.4746	0.4989
0.5231	0.5472	0.5713	0.5953	0.6193
0.6431	0.6670	0.6907	0.7144	0.7380

0.7616 0.7853 0.8073 0.8275 0.8459

0.8627 0.8779 0.8917 0.9042 0.9154

0.9256 0.9347 0.9429 0.9504 0.9584

0.9665 0.9748 0.9831 0.9915 1.0000

Width:

0.5360 0.5360 0.5360 0.5360 0.5360

0.5360 0.5360 0.5360 0.5360 0.5360

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0.5360 0.5360 0.5360 0.5360 0.5360

0.5360 0.5592 0.5901 0.6211 0.6520

0.6829 0.7139 0.7448 0.7757 0.8067

0.8376 0.8685 0.8995 0.9258 0.9381

0.9505 0.9629 0.9753 0.9876 1.0000

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NOTE: The summary statistics displayed in this report are

based on results found at every computational time step,

not just on results from each reporting time step.

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Analysis Options

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Flow Units .... CMS

Process Models:

Rainfall/Runoff .... YES

RDII .... NO

Snowmelt .... NO

Groundwater .... NO

Flow Routing .... YES

Ponding Allowed .... YES

Water Quality .... NO

Infiltration Method ...... HORTON

Flow Routing Method ...... DYNWAVE

Surcharge Method .... EXTRAN

Starting Date 12/04/2020 00:00:00

Ending Date 12/04/2020 06:00:00

Antecedent Dry Days 0.0

Report Time Step 00:01:00

Wet Time Step 00:01:00

Dry Time Step 00:01:00

Routing Time Step .... 3.00 sec

Variable Time Step .... NO

Maximum Trials 8

Number of Threads 4

Head Tolerance .... 0.001500 m

**************************	Volume	Depth
Runoff Quantity Continuity	hectare-m	mm
**************************	---------	-------
Total Precipitation	0.106	31.860
Evaporation Loss	0.000	0.000
Infiltration Loss	0.026	7.938
Surface Runoff	0.076	22.769

Final Storage 0.004 1.181

Continuity Error (%) ..... -0.086

************************* Volume Volume

Flow Routing Continuity hectare-m 10^6 ltr

************************* --------- ---------

Dry Weather Inflow 0.000 0.000

Wet Weather Inflow 0.076 0.760

Groundwater Inflow 0.000 0.000

RDII Inflow 0.000 0.000

External Inflow 0.000 0.000

External Outflow 0.075 0.755

Flooding Loss 0.000 0.000

Evaporation Loss 0.000 0.000

Exfiltration Loss 0.000 0.000

Initial Stored Volume 0.000 0.000

Final Stored Volume 0.001 0.006

Continuity Error (%) ..... -0.182

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Highest Continuity Errors

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Node L1010B-S (2.39%)

Node 1013 (1.22%)

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Highest Flow Instability Indexes

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All links are stable.

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Routing Time Step Summary

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Minimum Time Step : 3.00 sec

Average Time Step : 3.00 sec

Maximum Time Step : 3.00 sec

Percent in Steady State : 0.00

Average Iterations per Step : 2.00

Percent Not Converging : 0.00

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Subcatchment Runoff Summary

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Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Imperv Runoff mm	Perv Runoff mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff CMS	Runoff Coeff
L1003A	31.86	0.00	0.00	9.99	20.79	0.02	20.81	0.06	0.04	0.653
L1004A	31.86	0.00	0.00	10.91	19.92	0.01	19.93	0.08	0.06	0.626
L1004B	31.86	0.00	0.00	10.91	19.92	0.01	19.94	0.08	0.06	0.626
L1008A	31.86	0.00	0.00	10.44	20.36	0.03	20.39	0.05	0.04	0.640

L1009A	31.86	0.00	0.00	10.45	20.36	0.02	20.37	0.04	0.03	0.640
L1010A	31.86	0.00	0.00	6.35	24.25	0.02	24.27	0.05	0.04	0.762
L1010B	31.86	0.00	0.00	6.36	24.25	0.02	24.27	0.07	0.05	0.762
L1012A	31.86	0.00	0.00	5.90	24.69	0.02	24.71	0.05	0.04	0.776
L1013A	31.86	0.00	0.00	4.08	26.42	0.02	26.44	0.07	0.05	0.830
L1013B	31.86	0.00	0.00	5.90	24.69	0.02	24.71	0.05	0.04	0.776
L1014A	31.86	0.00	0.00	6.35	24.26	0.02	24.28	0.04	0.03	0.762
UNC-1	31.86	0.00	0.00	4.51	26.00	0.05	26.06	0.03	0.02	0.818
UNC-2	31.86	0.00	0.00	4.51	26.00	0.05	26.05	0.05	0.04	0.818
UNC-3	31.86	0.00	0.00	4.51	26.00	0.05	26.06	0.02	0.01	0.818

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Node Depth Summary

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Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min	Reported Max Depth Meters
1002A	OUTFALL	0.06	0.37	85.14	0 01:10	0.37
COULOIR	OUTFALL	0.00	0.00	88.27	0 00:00	0.00
FERN-CASEY	OUTFALL	0.00	0.00	88.53	0 00:00	0.00
OF-UNC-1	OUTFALL	0.00	0.00	0.00	0 00:00	0.00
OF-UNC-2	OUTFALL	0.00	0.00	0.00	0 00:00	0.00
OF-UNC-3	OUTFALL	0.00	0.00	0.00	0 00:00	0.00
STREET23	OUTFALL	0.00	0.00	88.26	0 00:00	0.00
1003	STORAGE	0.37	0.80	85.38	0 01:10	0.80

1004	STORAGE	0.36	0.82	85.48	0 01:10	0.82
1004A	STORAGE	0.00	0.00	86.01	0 00:00	0.00
1006	STORAGE	0.35	0.79	85.63	0 01:10	0.79
1007	STORAGE	0.34	0.78	85.65	0 01:10	0.78
1008	STORAGE	0.33	0.60	85.77	0 01:10	0.60
1009	STORAGE	0.33	0.58	85.92	0 01:10	0.58
1010	STORAGE	0.31	0.49	86.07	0 01:10	0.49
1011	STORAGE	0.00	0.00	85.82	0 00:00	0.00
1012	STORAGE	0.30	0.53	86.02	0 01:10	0.53
1013	STORAGE	0.33	0.67	85.84	0 01:10	0.67
1014	STORAGE	0.29	0.45	86.19	0 01:10	0.45
L1003A-HP	STORAGE	0.00	0.00	88.36	0 00:00	0.00
L1003A-S	STORAGE	0.04	0.89	87.62	0 01:10	0.89
L1004A-HP	STORAGE	0.00	0.00	88.80	0 00:00	0.00
L1004A-S	STORAGE	0.05	0.90	87.78	0 01:10	0.90
L1004B-HP	STORAGE	0.00	0.00	88.45	0 00:00	0.00
L1004B-S	STORAGE	0.05	0.92	87.64	0 01:10	0.92
L1008A-S	STORAGE	0.06	1.38	88.25	0 01:10	1.38
L1009A-S	STORAGE	0.05	0.90	87.71	0 01:10	0.90
L1010A-S	STORAGE	0.06	1.38	88.14	0 01:10	1.38
L1010B-S	STORAGE	0.05	0.18	86.94	0 01:20	0.18
L1012A-S	STORAGE	0.06	1.36	88.01	0 01:10	1.36
L1013A-S	STORAGE	0.06	1.21	87.99	0 01:10	1.21
L1013B-S	STORAGE	0.07	1.40	88.11	0 01:10	1.40
L1014A-S	STORAGE	0.05	0.90	87.55	0 01:10	0.90

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Node Inflow Summary

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Node	Type	Maximum Lateral Inflow CMS	Maximum Total Inflow CMS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 ltr	Total Inflow Volume 10^6 ltr	Flow Balance Error Percent
1002A	OUTFALL	0.000	0.416	0 01:10	0	0.656	0.000
COULOIR	OUTFALL	0.000	0.000	0 00:00	0	0	0.000 ltr
FERN-CASEY	OUTFALL	0.000	0.000	0 00:00	0	0	0.000 ltr
OF-UNC-1	OUTFALL	0.019	0.019	0 01:10	0.0262	0.0262	0.000
OF-UNC-2	OUTFALL	0.039	0.039	0 01:10	0.0535	0.0535	0.000
OF-UNC-3	OUTFALL	0.014	0.014	0 01:10	0.0192	0.0192	0.000
STREET23	OUTFALL	0.000	0.000	0 00:00	0	0	0.000 ltr
1003	STORAGE	0.000	0.416	0 01:10	0	0.652	-0.565
1004	STORAGE	0.000	0.377	0 01:10	0	0.593	0.075
1004A	STORAGE	0.000	0.000	0 00:00	0	0	0.000 ltr
1006	STORAGE	0.000	0.262	0 01:10	0	0.424	-0.339
1007	STORAGE	0.000	0.263	0 01:10	0	0.426	0.275
1008	STORAGE	0.000	0.112	0 01:10	0	0.214	0.345
1009	STORAGE	0.000	0.078	0 01:10	0	0.161	-0.500
1010	STORAGE	0.000	0.050	0 01:10	0	0.119	0.079
1011	STORAGE	0.000	0.000	0 00:00	0	0	0.000 ltr
1012	STORAGE	0.000	0.066	0 01:10	0	0.0934	0.692
1013	STORAGE	0.000	0.152	0 01:10	0	0.216	1.233
1014	STORAGE	0.000	0.029	0 01:10	0	0.0417	0.018
L1003A-HP	STORAGE	0.000	0.000	0 00:00	0	0	0.000 ltr
L1003A-S	STORAGE	0.043	0.043	0 01:10	0.0603	0.0603	-0.000

L1004A-HP	STORAGE	0.000	0.000	0	00:00	0	0	0.000 ltr
L1004A-S	STORAGE	0.059	0.059	0	01:10	0.0836	0.0836	0.000
L1004B-HP	STORAGE	0.000	0.000	0	00:00	0	0	0.000 ltr
L1004B-S	STORAGE	0.060	0.060	0	01:10	0.0841	0.0841	-0.000
L1008A-S	STORAGE	0.037	0.037	0	01:10	0.0525	0.0525	-0.002
L1009A-S	STORAGE	0.030	0.030	0	01:10	0.0417	0.0417	0.000
L1010A-S	STORAGE	0.037	0.037	0	01:10	0.0524	0.0524	0.001
L1010B-S	STORAGE	0.049	0.049	0	01:10	0.0687	0.0687	2.452
L1012A-S	STORAGE	0.037	0.037	0	01:10	0.052	0.052	0.000
L1013A-S	STORAGE	0.049	0.049	0	01:10	0.0693	0.0693	0.000
L1013B-S	STORAGE	0.039	0.039	0	01:10	0.0546	0.0546	0.040
L1014A-S	STORAGE	0.030	0.030	0	01:10	0.0417	0.0417	0.000

****

Node Surcharge Summary

****

No nodes were surcharged.

****

Node Flooding Summary

****

No nodes were flooded.

****

Storage Volume Summary

****

Storage Unit	Average Volume 1000 m3	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 m3	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow CMS
1003	0.000	10	0	0	0.001	22	0 01:10	0.416
1004	0.000	10	0	0	0.001	22	0 01:10	0.375
1004A	0.000	0	0	0	0.000	0	0 00:00	0.000
1006	0.000	10	0	0	0.001	21	0 01:10	0.262
1007	0.000	10	0	0	0.001	22	0 01:10	0.262
1008	0.000	10	0	0	0.001	18	0 01:10	0.112
1009	0.000	11	0	0	0.001	19	0 01:10	0.076
1010	0.000	11	0	0	0.001	17	0 01:10	0.049
1011	0.000	0	0	0	0.000	0	0 00:00	0.000
1012	0.000	11	0	0	0.001	19	0 01:10	0.066
1013	0.000	10	0	0	0.001	21	0 01:10	0.151
1014	0.000	11	0	0	0.001	17	0 01:10	0.029
L1003A-HP	0.000	0	0	0	0.000	0	0 00:00	0.000
L1003A-S	0.000	0	0	0	0.000	0	0 00:00	0.043
L1004A-HP	0.000	0	0	0	0.000	0	0 00:00	0.000
L1004A-S	0.000	0	0	0	0.000	0	0 00:00	0.059
L1004B-HP	0.000	0	0	0	0.000	0	0 00:00	0.000
L1004B-S	0.000	0	0	0	0.000	0	0 00:00	0.059
L1008A-S	0.000	0	0	0	0.000	0	0 01:10	0.037
L1009A-S	0.000	0	0	0	0.000	0	0 00:00	0.029
L1010A-S	0.000	0	0	0	0.000	0	0 00:00	0.037

```
L1010B-S        0.000    0    0    0      0.000    0     0  00:00     0.015
L1012A-S        0.000    0    0    0      0.000    0     0  00:00     0.037
L1013A-S        0.000    0    0    0      0.000    0     0  00:00     0.049
L1013B-S        0.000    0    0    0      0.000    1     0  01:10     0.037
L1014A-S        0.000    0    0    0      0.000    0     0  00:00     0.029


***********************
Outfall Loading Summary
***********************

-----------------------------------------------------------
                Flow      Avg      Max      Total
                Freq     Flow     Flow     Volume
Outfall Node    Pcnt      CMS      CMS   10^6 ltr
-----------------------------------------------------------
1002A          88.07    0.034    0.416      0.656
COULOIR         0.00    0.000    0.000      0.000
FERN-CASEY      0.00    0.000    0.000      0.000
OF-UNC-1       45.19    0.003    0.019      0.026
OF-UNC-2       47.11    0.005    0.039      0.053
OF-UNC-3       44.72    0.002    0.014      0.019
STREET23        0.00    0.000    0.000      0.000
-----------------------------------------------------------
System         32.16    0.044    0.483      0.755


********************
Link Flow Summary
```

****

Link	Type	Maximum |Flow| CMS	Time of Max Occurrence days hr:min	Maximum |Veloc| m/sec	Max/ Full Flow	Max/ Full Depth
1003-1002A	CONDUIT	0.416	0 01:10	1.36	0.70	0.49
1004-1003	CONDUIT	0.375	0 01:10	1.01	0.66	0.57
1004A-1004	CONDUIT	0.000	0 00:00	0.00	0.00	0.00
1006-1004	CONDUIT	0.262	0 01:11	1.04	0.69	0.57
1007-1006	CONDUIT	0.262	0 01:10	0.87	0.69	0.64
1008-1007	CONDUIT	0.112	0 01:10	1.00	0.65	0.53
1009-1008	CONDUIT	0.076	0 01:10	0.85	0.59	0.56
1010-1009	CONDUIT	0.049	0 01:10	0.59	0.39	0.52
1010-1012	CONDUIT	0.000	0 01:10	0.02	0.00	0.15
1011-1010	CONDUIT	0.000	0 00:00	0.00	0.00	0.07
1012-1013	CONDUIT	0.066	0 01:10	0.85	0.52	0.50
1013-1007	CONDUIT	0.151	0 01:10	0.95	0.62	0.58
1014-1012	CONDUIT	0.029	0 01:10	0.90	0.51	0.47
CL1003A-1	CHANNEL	0.000	0 00:00	0.00	0.00	0.00
CL1003A-2	CHANNEL	0.000	0 00:00	0.00	0.00	0.00
CL1004A-1	CHANNEL	0.000	0 00:00	0.00	0.00	0.00
CL1004A-2	CHANNEL	0.000	0 00:00	0.00	0.00	0.00
CL1004B-1	CHANNEL	0.000	0 00:00	0.00	0.00	0.00
CL1004B-2	CHANNEL	0.000	0 00:00	0.00	0.00	0.00
CL1010B	CHANNEL	0.000	0 00:00	0.00	0.00	0.37
CL1014A	CHANNEL	0.000	0 00:00	0.00	0.00	0.00
L1003A-IC1	ORIFICE	0.021	0 01:10			1.00

L1003A-IC2	ORIFICE	0.021	0	01:10	1.00
L1004A-IC1	ORIFICE	0.029	0	01:10	1.00
L1004A-IC2	ORIFICE	0.029	0	01:10	1.00
L1004B-IC1	ORIFICE	0.030	0	01:10	1.00
L1004B-IC2	ORIFICE	0.030	0	01:10	1.00
L1008A-IC	ORIFICE	0.037	0	01:10	1.00
L1009A-IC	ORIFICE	0.029	0	01:10	1.00
L1010A-IC	ORIFICE	0.037	0	01:10	1.00
L1010B-IC	ORIFICE	0.015	0	01:20	1.00
L1012A-IC	ORIFICE	0.037	0	01:10	1.00
L1013A-IC	ORIFICE	0.049	0	01:10	1.00
L1013B-IC	ORIFICE	0.037	0	01:10	1.00
L1014A-IC	ORIFICE	0.029	0	01:10	1.00
WL1008A	WEIR	0.000	0	00:00	0.00
WL1009A	WEIR	0.000	0	00:00	0.00
WL1010A	WEIR	0.000	0	00:00	0.00
WL1010B	WEIR	0.000	0	00:00	0.00
WL1012A	WEIR	0.000	0	00:00	0.00
WL1013A	WEIR	0.000	0	00:00	0.00
WL1013B	WEIR	0.000	0	00:00	0.00

****

Flow Classification Summary

****

Adjusted ---------- Fraction of Time in Flow Class ----------

/Actual Up Down Sub Sup Up Down Norm Inlet

Conduit	Length	Dry	Dry	Dry	Crit	Crit	Crit	Crit	Ltd	Ctrl
1003-1002A	1.00	0.12	0.00	0.00	0.88	0.00	0.00	0.00	0.00	0.00
1004-1003	1.00	0.12	0.00	0.00	0.88	0.00	0.00	0.00	0.73	0.00
1004A-1004	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1006-1004	1.00	0.13	0.00	0.00	0.03	0.00	0.00	0.83	0.00	0.00
1007-1006	1.00	0.13	0.00	0.00	0.86	0.00	0.00	0.01	0.42	0.00
1008-1007	1.00	0.12	0.00	0.00	0.02	0.00	0.00	0.86	0.00	0.00
1009-1008	1.00	0.12	0.00	0.00	0.03	0.00	0.00	0.84	0.00	0.00
1010-1009	1.00	0.12	0.00	0.00	0.88	0.00	0.00	0.00	0.84	0.00
1010-1012	1.00	0.96	0.02	0.00	0.01	0.00	0.00	0.00	0.81	0.00
1011-1010	1.00	0.97	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1012-1013	1.00	0.12	0.00	0.00	0.02	0.00	0.00	0.86	0.00	0.00
1013-1007	1.00	0.12	0.00	0.00	0.04	0.00	0.00	0.85	0.00	0.00
1014-1012	1.00	0.12	0.00	0.00	0.00	0.00	0.00	0.88	0.00	0.00
CL1003A-1	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CL1003A-2	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CL1004A-1	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CL1004A-2	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CL1004B-1	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CL1004B-2	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CL1010B	1.00	0.10	0.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CL1014A	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

****

Conduit Surcharge Summary

****

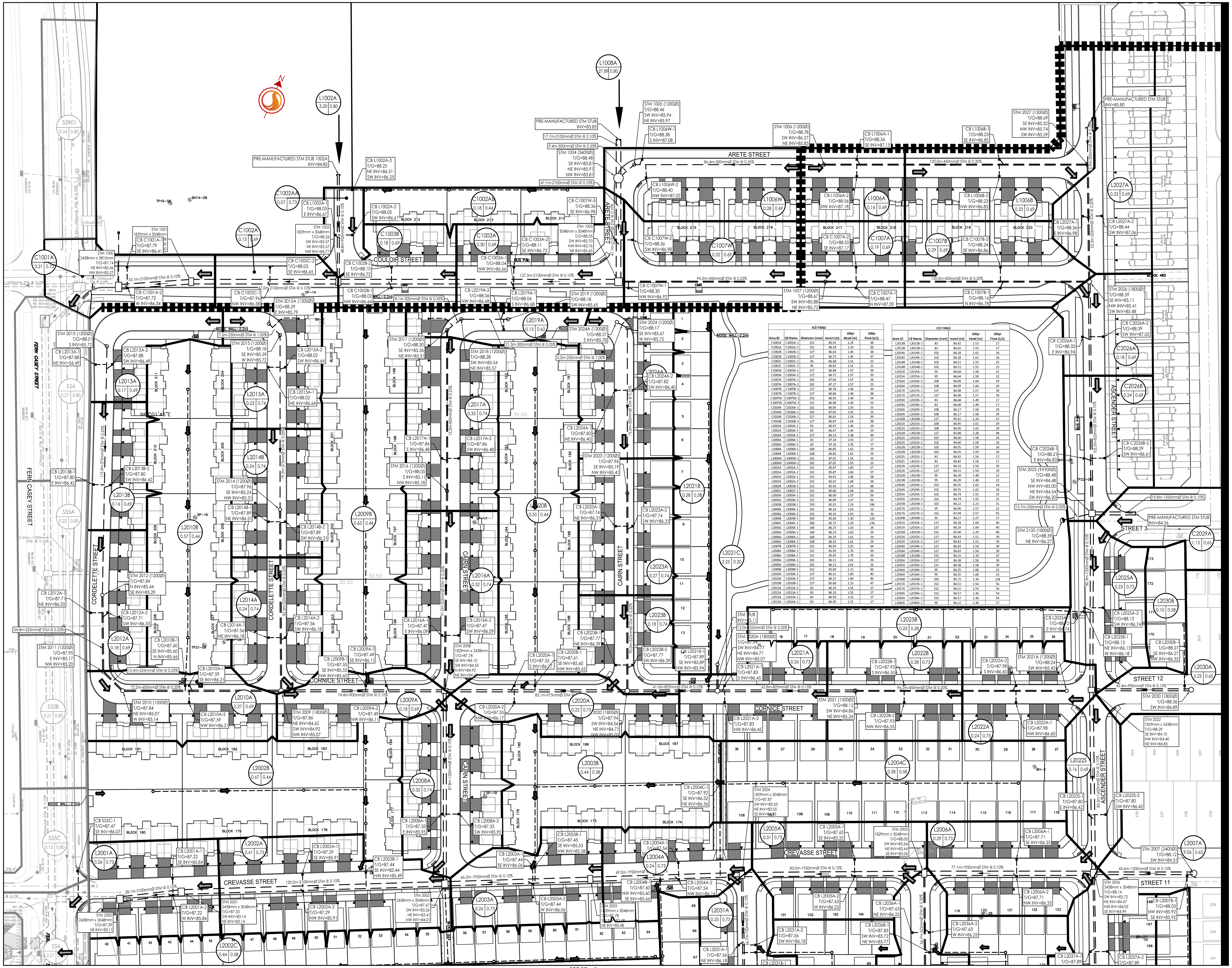
No conduits were surcharged.

Analysis begun on: Wed Dec 9 15:02:02 2020

Analysis ended on: Wed Dec 9 15:02:03 2020

Total elapsed time: 00:00:01

C.4 TRAILSEDGE EAST PHASE 1 REPORT EXCERPTS



ICD TABLE					
Area ID	CB Name	Diameter (mm)	Invert (m)	100yr Head (m)	100yr Flow (L/s)
C1001A	C1001A-1	152	86.41	1.24	48
C1001A	C1001A-2	152	86.34	1.24	50
C1002B	C1002B-1	127	86.64	1.45	38
C1002B	C1002B-2	127	86.72	1.45	37
C1002C	C1002C-1	95	86.58	1.51	22
C1002C	C1002C-2	95	86.65	1.51	21
C1003A	C1003A-1	127	86.68	1.57	39
C1003A	C1003A-2	127	86.71	1.57	39
C1007A	C1007A-1	102	87.09	1.57	26
C1007A	C1007A-2	102	87.17	1.57	25
C1007B	C1007B-1	127	86.78	1.58	39
C1007B	C1007B-2	127	86.86	1.58	38
C1007W	C1007W-1	152	86.92	1.44	54
C1007W	C1007W-2	152	86.98	1.44	53
C2026A	C2026A-1	102	86.95	1.55	25
C2026A	C2026A-2	102	87.02	1.55	25
C2026B	C2026B-1	127	86.81	1.54	39
C2026B	C2026B-2	127	86.87	1.54	38
L1002A	L1002A-1	85	86.67	1.44	19
L1002A	L1002A-2	85	86.67	1.44	19
L1003A	L1003A-1	127	86.14	2.38	49
L1006A	L1006A-1	83	87.18	1.55	17
L1006A	L1006A-2	83	87.18	1.55	17
L1006B	L1006B-1	108	86.85	1.62	29
L1006B	L1006B-2	108	86.85	1.62	29
L1006W	L1006W-1	102	87.02	1.55	25
L1006W	L1006W-2	102	87.02	1.55	25
L2001A	L2001A-1	152	85.87	1.60	57
L2001A	L2001A-2	152	85.87	1.60	57
L2002A	L2002A-1	152	85.91	1.68	58
L2002A	L2002A-2	152	85.91	1.68	58
L2002B	L2002B-1	152	85.43	2.24	68
L2002C	L2002C-1	152	85.80	2.04	64
L2003A	L2003A-1	152	86.09	1.57	56
L2003A	L2003A-2	152	86.09	1.57	56
L2003B	L2003B-1	250	85.52	2.24	196
L2004A	L2004A-1	102	86.16	1.63	26
L2004A	L2004A-2	102	86.16	1.63	26
L2004B	L2004B-1	200	85.60	2.30	128
L2004C	L2004C-1	200	85.72	2.29	128
L2005A	L2005A-1	108	86.25	1.63	29
L2005A	L2005A-2	108	86.25	1.63	29
L2006A	L2006A-1	108	86.33	1.61	29
L2006A	L2006A-2	108	86.33	1.61	29
L2007B	L2007B-1	152	86.03	2.01	64
L2008A	L2008A-1	152	85.95	1.70	59
L2008A	L2008A-2	152	85.95	1.70	59
L2009A	L2009A-1	102	86.11	1.61	26
L2009A	L2009A-2	102	86.11	1.61	26
L2009B	L2009B-1	152	85.69	2.11	66
L2010A	L2010A-1	127	86.21	1.60	40
L2010A	L2010A-2	127	86.21	1.60	40
L2010B	L2010B-1	127	85.60	2.23	47
L2012A	L2012A-1	83	86.33	1.55	17
L2012A	L2012A-2	83	86.33	1.55	17
L2013A	L2013A-1	83	86.50	1.51	17
L2013A	L2013A-2	83	86.50	1.51	17

ICD TABLE					
Area ID	CB Name	Diameter (mm)	Invert (m)	100yr Head (m)	100yr Flow (L/s)
L2013B	L2013B-1	83	86.42	1.53	17
L2013B	L2013B-2	83	86.42	1.53	17
L2014A	L2014A-1	102	86.18	1.61	26
L2014A	L2014A-2	102	86.18	1.61	26
L2014B	L2014B-1	102	86.51	1.55	25
L2014B	L2014B-2	102	86.51	1.55	25
L2015A	L2015A-1	95	86.64	1.58	22
L2015A	L2015A-2	95	86.64	1.58	22
L2016A	L2016A-1	108	86.09	1.64	29
L2016A	L2016A-2	108	86.09	1.64	29
L2017A	L2017A-1	127	86.48	1.57	39
L2017A	L2017A-2	127	86.48	1.57	39
L2019A	L2019A-1	83	86.68	1.49	17
L2019A	L2019A-2	83	86.68	1.49	17
L2020A	L2020A-1	108	86.17	1.58	29
L2020A	L2020A-2	108	86.17	1.58	29
L2020B	L2020B-1	127	85.61	2.24	47
L2021A	L2021A-1	108	86.45	1.61	29
L2021A	L2021A-2	108	86.45	1.61	29
L2021B	L2021B-1	127	85.88	2.28	48
L2022A	L2022A-1	102	86.60	1.58	26
L2022A	L2022A-2	102	86.60	1.58	26
L2022B	L2022B-1	102	86.55	1.59	26
L2022B	L2022B-2	102	86.55	1.59	26
L2022S	L2022S-1	83	86.42	1.56	17
L2022S	L2022S-2	83	86.42	1.56	17
L2023A	L2023A-1	127	86.31	1.54	39
L2023A	L2023A-2	127	86.31	1.54	39
L2023B	L2023B-1	95	86.39	1.48	22
L2023B	L2023B-2	95	86.39	1.48	22
L2024A	L2024A-1	102	86.55	1.62	26
L2024A	L2024A-2	102	86.55	1.62	26
L2025A	L2025A-1	102	86.74	1.55	25
L2025A	L2025A-2	102	86.74	1.55	25
L2025B	L2025B-1	102	86.12	2.23	31
L2027A	L2027A-1	95	86.96	1.57	22
L2027A	L2027A-2	152	87.04	1.57	55
L2030B	L2030B-1	95	86.27	2.27	27
L2031A	L2031A-1	127	86.18	1.64	40
L2031A	L2031A-2	127	86.18	1.64	40
L2031B	L2031B-1	152	85.60	2.29	69
L2032A	L2032A-1	127	86.43	1.51	39
L2032A	L2032A-2	127	86.43	1.51	39
L2034A	L2034A-1	127	86.43	1.54	39
L2034A	L2034A-2	127	86.43	1.54	39
L2034B	L2034B-1	152	86.31	2.19	67
L2035A	L2035A-1	127	86.38	1.58	39
L2035A	L2035A-2	127	86.38	1.58	39
L2036A	L2036A-1	95	86.25	1.68	23
L2036A	L2036A-2	95	86.25	1.68	23
L2036B	L2036B-1	200	85.72	2.30	128
L2037A	L2037A-1	152	86.51	1.54	56
L2037A	L2037A-2	152	86.51	1.54	56
L2039A	L2039A-1	152	86.57	1.46	54
L2039A	L2039A-2	152	86.57	1.46	54
L2040A	L2040A-1	95	86.12	2.28	27

Stantec

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Ottawa ON
Tel. 613.722.4420
www.stantec.com

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Legend

- L202A / 1.13 / 0.60: AREA ID; RUNOFF COEFFICIENT; STORM DRAINAGE AREA ha.
- STORM DRAINAGE BOUNDARY
- EXISTING/FUTURE STORM DRAINAGE BOUNDARY
- S3901: EXISTING/FUTURE DRAINAGE AREA
- TYPICAL SERVICE LATERAL LOCATION
- MAXIMUM PONDING LIMITS
- DIRECTION OF OVERLAND FLOW
- PROPOSED STORM SEWER
- PROPOSED CATCHBASIN MANHOLE
- PROPOSED CATCHBASIN
- PROPOSED DOUBLE CATCH BASIN
- PROPOSED SUB DRAIN CATCH BASIN AS PER CITY OF OTTAWA STANDARD DETAIL DRAWINGS L10 AND L11.
- PROPOSED PERFORATED SUBDRAIN
- EXISTING STORM SEWER
- EXISTING CATCHBASIN MANHOLE
- EXISTING CATCHBASIN
- EXISTING SUBDRAIN CATCHBASIN
- FUTURE STORM SEWER
- FUTURE CATCHBASIN MANHOLE
- FUTURE CATCHBASIN
- FUTURE SUBDRAIN CATCHBASIN
- CIRCULAR ORIFICE (SEE SEE ICD TABLE SD-1/SD-2)
- MAJOR SYSTEM DIVIDE

Notes

8	ISSUED FOR APPROVAL	MJS	DT	19.07.24
7	REVISED ASCENDER OFFSITE SERVICING	AJ	DT/SG	19.05.17
6	ISSUED FOR GRADING APPROVAL	AJ	DT	19.03.11
5	ISSUED FOR CONSTRUCTION	MJS	GR	18.10.25
4	REVISED FIRE HYDRANT LOCATIONS	MJS	DT	18.10.24
3	REVISED AS PER CITY COMMENTS	MJS	DT	18.09.28
2	REVISED AS PER CITY COMMENTS AND DRAFT PLAN	MJS	DT	18.08.23
1	REVISED AS PER CITY COMMENTS	MJS	DT	18.05.30
0	ISSUED TO CITY FOR REVIEW	MJS	DT	18.03.06
Revision		By	Appd.	YY.MM.DD

File Name: 160401250 SD.DWG	JP	MJS	JP	18.02.14
	Dwn.	Chkd.	Dsgn.	YY.MM.DD

Permit-Seal

Client/Project
RICHCRAFT GROUP OF COMPANIES
2280 ST. LAURENT BLVD
OTTAWA, ON, K1G 4K1

TRAILSEDGE EAST SUBDIVISION
OTTAWA, ON, CANADA

Title
STORM DRAINAGE PLAN

Project No. 160401250
Scale 1:750 0 7.5 22.5 37.5m
Drawing No. SD-1
Sheet 40 of 46
Revision 7
D07-16-16-0021

DWG# 17807

W:\active\160401250_Trailsedge East\design\drawing\160401250 SD.dwg
2019/07/24 5:00 PM By: Patangi, Jupiter

Stantec

Trailsedge East Phase 1	
DATE:	2019-11-22
REVISION:	AS-BUILT (GMR)
DESIGNED BY:	DT
CHECKED BY:	GMR

STORM SEWER DESIGN SHEET (AS-BUILT)

(City of Ottawa)

FILE NUMBER: **160401250**

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	MANNING'S n =	0.013	
b =	6.199	6.053	6.014	6.014	MINIMUM COVER:	2.00	m
c =	0.810	0.814	0.816	0.820	TIME OF ENTRY	10	min

BEDDING CLASS = B

LOCATION / DRAINAGE AREA

AREA ID NUMBER	FROM M.H.	TO M.H.	AREA (2-YEAR) (ha)	AREA (5-YEAR) (ha)	AREA (10-YEAR) (ha)	AREA (100-YEAR) (ha)	AREA (ROOF) (ha)	C (2-YEAR) (-)	C (5-YEAR) (-)	C (10-YEAR) (-)	C (100-YEAR) (-)	A x C (2-YEAR) (ha)	ACCUM AxC (2YR) (ha)	A x C (5-YEAR) (ha)	ACCUM. AxC (5YR) (ha)	A x C (10-YEAR) (ha)	ACCUM. AxC (10YR) (ha)	A x C (100-YEAR) (ha)	ACCUM. AxC (100YR) (ha)	T of C (min)	I_{2-YEAR} (mm/h)	I_{5-YEAR} (mm/h)	$I_{10-YEAR}$ (mm/h)	$I_{100-YEAR}$ (mm/h)	$Q_{CONTROL}$ (L/s)	ACCUM. $Q_{CONTROL}$ (L/s)	Q_{ACT} (CIA/360) (L/s)
L1006W	1006	1005	0.28	0.00	0.00	0.00	0.00	0.69	0.00	0.00	0.00	0.194	0.194	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	41.5
	1005	1004	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.194	0.000	0.000	0.000	0.000	0.000	0.000	11.76	70.66	95.74	112.19	163.94	0.0	0.0	38.2
																				12.01							
L1008A	STUB	1004	0.00	27.89	0.00	0.00	0.00	0.00	0.80	0.00	0.00	0.000	0.000	22.312	22.312	0.000	0.000	0.000	0.000	17.75	55.96	75.61	88.51	129.19	0.0	0.0	4686.2
																				17.94							
	1004	1003	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.194	0.000	22.312	0.000	0.000	0.000	0.000	17.94	55.61	75.13	87.95	128.36	0.0	0.0	4686.7
																				18.51							
C1007W	1007	1003	0.00	0.32	0.00	0.00	0.00	0.00	0.69	0.00	0.00	0.000	0.000	0.221	0.221	0.000	0.000	0.000	0.000	10.00	76.81	104.19	122.14	178.56	0.0	0.0	63.9
																				12.29							
C1003A, C1003B	1003	1002	0.48	0.00	0.00	0.00	0.00	0.69	0.00	0.00	0.00	0.331	0.526	0.000	22.533	0.000	0.000	0.000	0.000	18.51	54.57	73.71	86.28	125.91	0.0	0.0	4693.3
L1002A, C1002AA, C1002AB	STUB	1002	0.25	3.20	0.00	0.00	0.00	0.52	0.80	0.00	0.00	0.130	0.130	2.560	2.560	0.000	0.000	0.000	0.000	18.51	54.57	73.71	86.28	125.91	0.0	0.0	543.9
C1002A	1002	1001	0.00	0.13	0.00	0.00	0.00	0.00	0.69	0.00	0.00	0.000	0.526	0.090	22.622	0.000	0.000	0.000	0.000	19.72	52.48	70.86	82.93	121.00	0.0	0.0	4529.5
C1001A	1001	1000	0.00	0.21	0.00	0.00	0.00	0.00	0.73	0.00	0.00	0.000	0.526	0.153	22.776	0.000	0.000	0.000	0.000	20.17	51.76	69.88	81.78	119.31	0.0	0.0	4496.7
																				20.39							

PIPE SELECTION

AREA ID NUMBER	FROM M.H.	TO M.H.	AS-BUILT LENGTH (m)	PIPE WIDTH OR DIAMETER (mm)	PIPE HEIGHT (mm)	PIPE SHAPE (-)	MATERIAL (-)	CLASS (-)	AS-BUILT SLOPE %	Q_{CAP} (FULL) (L/s)	% FULL (-)	VEL. (FULL) (m/s)	VEL. (ACT) (m/s)	TIME OF FLOW (min)
L1006W	1006	1005	86.4	300	300	CIRCULAR	PVC	-	0.41	61.6	**67.37%**	0.87	0.82	1.76
	1005	1004	9.4	300	300	CIRCULAR	PVC	-	0.21	44.1	**86.60%**	0.63	0.63	0.25
L1008A	STUB	1004	17.7	2100	2100	CIRCULAR	CONCRETE	-	0.10	5720.2	**81.92%**	1.60	1.59	0.19
	1004	1003	47.1	2100	2100	CIRCULAR	CONCRETE	-	0.07	4689.1	**99.95%**	1.31	1.38	0.57
C1007W	1007	1003	94.2	450	450	CIRCULAR	CONCRETE	-	0.20	133.0	**48.02%**	0.81	0.69	2.29
C1003A, C1003B	1003	1002	127.5	2100	2100	CIRCULAR	CONCRETE	-	0.13	6522.0	**71.96%**	1.82	1.74	1.22
L1002A, C1002AA, C1002AB	STUB	1002	48.8	900	900	CIRCULAR	CONCRETE	-	0.10	597.2	**91.07%**	0.91	0.93	0.87
C1002A	1002	1001	67.0	2100	2100	CIRCULAR	CONCRETE	-	0.39	11296.4	**40.10%**	3.16	2.51	0.44
C1001A	1001	1000	33.1	2100	2100	CIRCULAR	CONCRETE	-	0.39	11296.4	**39.81%**	3.16	2.51	0.22
				2100	2100									

Subcatchment L1002A represents the Block 193-194 site as well as Street 23.

Stantec	Trailsedge East Phase 1	STORM SEWER DESIGN SHEET (AS-BUILT) (City of Ottawa)	DESIGN PARAMETERS
	DATE: 2019-11-22		I = a / (t+b)^c (As per City of Ottawa Guidelines, 2012)
	REVISION: AS-BUILT (GMR)		
	DESIGNED BY: DT	FILE NUMBER: 160401250	
	CHECKED BY: GMR		

	1:2 yr	1:5 yr	1:10 yr	1:100 yr		
a =	732.951	998.071	1174.184	1735.688	MANNING'S n = 0.013	BEDDING CLASS = B
b =	6.199	6.053	6.014	6.014	MINIMUM COVER: 2.00 m	
c =	0.810	0.814	0.816	0.820	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-YEAR} (mm/h)	I_{5-YEAR} (mm/h)	$I_{10-YEAR}$ (mm/h)	$I_{100-YEAR}$ (mm/h)	$Q_{CONTROL}$ (L/s)	ACCUM. $Q_{CONTROL}$ (L/s)	Q_{ACT} (CIA/360) (L/s)	AS-BUILT LENGTH (m)	PIPE WIDTH OR DIAMETER (mm)	PIPE HEIGHT (mm)	PIPE SHAPE (-)	MATERIAL (-)	CLASS (-)	AS-BUILT SLOPE %	Q_{CAP} (FULL) (L/s)	% FULL (-)	VEL. (FULL) (m/s)	VEL. (ACT) (m/s)	TIME OF FLOW (min)
L2007A, L2007B	2007	2006	9.20	0.00	0.00	0.00	0.00	0.65	0.00	0.00	0.00	5.972	5.972	0.000	0.000	0.000	0.000	0.000	0.000	14.08	64.02	86.64	101.48	148.22	0.0	0.0	1061.9	45.6	1200	1200	CIRCULAR	CONCRETE	-	0.18	1725.6	**61.54%**	1.48	1.34	0.57
																				14.65																			
	STUB	2027	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	16.9	300	300	CIRCULAR	PVC	-	0.36	57.7	**0.00%**	0.82	0.00	0.00
																				10.00																			
L1006B, L1006A	1006	2027	0.51	0.00	0.00	0.00	0.00	0.69	0.00	0.00	0.00	0.355	0.355	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	75.7	120.0	450	450	CIRCULAR	CONCRETE	-	0.23	142.6	**53.10%**	0.87	0.76	2.64
																				12.64																			
L2027A	2027	2026	0.31	0.00	0.00	0.00	0.00	0.69	0.00	0.00	0.00	0.210	0.565	0.000	0.000	0.000	0.000	0.000	0.000	12.64	67.96	92.04	107.83	157.54	0.0	0.0	106.7	53.3	525	525	CIRCULAR	CONCRETE	-	0.21	205.6	**51.92%**	0.92	0.79	1.12
																				13.76																			
C1007A, C1007B	1007	2026	0.00	0.48	0.00	0.00	0.00	0.00	0.69	0.00	0.00	0.000	0.000	0.331	0.331	0.000	0.000	0.000	0.000	10.00	76.81	104.19	122.14	178.56	0.0	0.0	95.8	120.0	450	450	CIRCULAR	CONCRETE	-	0.20	133.0	**72.01%**	0.81	0.77	2.58
																				12.58																			
C2026B, C2026A	2026	2025	0.00	0.42	0.00	0.00	0.00	0.00	0.69	0.00	0.00	0.000	0.565	0.291	0.622	0.000	0.000	0.000	0.000	13.76	64.86	87.79	102.83	150.20	0.0	0.0	253.6	105.5	825	825	CIRCULAR	CONCRETE	-	0.16	599.0	**42.34%**	1.09	0.88	1.99
																				15.75																			
C2029A, L2029A	STUB	2025	8.32	1.13	0.00	0.00	0.00	0.65	0.65	0.00	0.00	5.411	5.411	0.736	0.736	0.000	0.000	0.000	0.000	14.92	61.96	83.83	98.17	143.36	0.0	0.0	1102.8	19.8	1350	1350	CIRCULAR	CONCRETE	-	0.15	2156.5	**51.14%**	1.46	1.26	0.26
																				15.18																			
L2025B, L2025A	2025	2022	0.46	0.00	0.00	0.00	0.00	0.66	0.00	0.00	0.00	0.304	6.281	0.000	1.359	0.000	0.000	0.000	0.000	15.75	60.05	81.20	95.08	138.83	0.0	0.0	1354.1	80.3	1350	1350	CIRCULAR	CONCRETE	-	0.14	2083.4	**64.99%**	1.41	1.30	1.03
																				16.78																			
L2030B, L2030A	2030	2022	3.33	0.00	0.00	0.00	0.00	0.65	0.00	0.00	0.00	2.156	2.156	0.000	0.000	0.000	0.000	0.000	0.000	14.08	64.02	86.64	101.48	148.22	0.0	0.0	383.4	45.4	900	900	CIRCULAR	CONCRETE	-	0.24	925.2	**41.44%**	1.41	1.13	0.67
																				14.75																			
L2022S	2022	2006	0.16	0.00	0.00	0.00	0.00	0.69	0.00	0.00	0.00	0.111	8.548	0.000	1.359	0.000	0.000	0.000	0.000	16.78	57.86	78.21	91.57	133.67	0.0	0.0	1669.0	83.5	1650	1650	CIRCULAR	CONCRETE	-	0.06	2329.1	**71.66%**	1.06	1.01	1.38
																				18.16																			
L2039A	2039	2038	0.24	0.00	0.00	0.00	0.00	0.73	0.00	0.00	0.00	0.172	0.172	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	36.7	39.8	375	375	CIRCULAR	PVC	-	0.60	127.7	**28.75%**	1.21	0.87	0.76
	2038	2037	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.172	0.000	0.000	0.000	0.000	0.000	0.000	10.76	74.01	100.34	117.61	171.90	0.0	0.0	35.4	26.3	525	525	CIRCULAR	CONCRETE	-	0.38	276.6	**12.79%**	1.24	0.71	0.62
																				11.38																			
L2040A	2040	2037	0.10	0.00	0.00	0.00	0.00	0.58	0.00	0.00	0.00	0.060	0.060	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	12.8	44.3	450	450	CIRCULAR	CONCRETE	-	0.23	142.6	**8.94%**	0.87	0.44	1.67
																				11.67																			
L2037A	2037	2006	0.52	0.00	0.00	0.00	0.00	0.73	0.00	0.00	0.00	0.380	0.612	0.000	0.000	0.000	0.000	0.000	0.000	11.67	70.93	96.12	112.63	164.60	0.0	0.0	120.6	119.2	675	675	CIRCULAR	CONCRETE	-	0.18	372.1	**32.41%**	1.01	0.76	2.63
																				14.30																			
L2006A	2006	2005	0.29	0.00	0.00	0.00	0.00	0.73	0.00	0.00	0.00	0.208	15.339	0.000	1.359	0.000	0.000	0.000	0.000	18.16	55.19	74.56	87.28	127.38	0.0	0.0	2633.0	77.1	1950	1950	CIRCULAR	CONCRETE	-	0.08	4198.8	**62.71%**	1.36	1.25	1.03
																				19.19																			
	2034	2035	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	9.5	300	300	CIRCULAR	PVC	-	0.35	56.9	**0.00%**	0.81	0.00	0.00
L2035A	2035	2036	0.33	0.00	0.00	0.00	0.00	0.73	0.00	0.00	0.00	0.239	0.239	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	50.9	68.2	450	450	CIRCULAR	CONCRETE	-	0.25	148.7	**34.23%**	0.91	0.69	1.65
L2036B, L2036A	2036	2005	0.86	0.00	0.00	0.00	0.00	0.61	0.00	0.00	0.00	0.525	0.763	0.000	0.000	0.000	0.000	0.000	0.000	11.65	71.00	96.21	112.74	164.75	0.0	0.0	150.6	56.7	525	525	CIRCULAR	CONCRETE	-	0.20	200.6	**75.03%**	0.90	0.87	1.09
																				12.74																			
L2005A	2005	2004	0.31	0.00	0.00	0.00	0.00	0.73	0.00	0.00	0.00	0.227	16.329	0.000	1.359	0.000	0.000	0.000	0.000	19.19	53.37	72.08	84.36	123.10	0.0	0.0	2692.8	83.0	1950	1950	CIRCULAR	CONCRETE	-	0.14	5554.5	**48.48%**	1.80	1.53	0.91
																				20.10																			
L2034A, L2034B	2034	2033	0.86	0.00	0.00	0.00	0.00	0.63	0.00	0.00	0.00	0.540	0.540	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	115.3	67.1	525	525	CIRCULAR	CONCRETE	-	0.21	205.6	**56.07%**	0.92	0.82	1.37
	2033	2032	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	11.37	71.91	97.47	114.22	166.93	0.0	0.0	107.9	12.3	525	525	CIRCULAR	CONCRETE	-	0.15	173.8	**62.11%**	0.78	0.71	0.29
L2032A	2032	2031	0.23	0.00	0.00	0.00	0.00	0.73	0.00	0.00	0.00	0.168	0.709	0.000	0.000	0.000	0.000	0.000	0.000	11.66	70.97	96.18	112.70	164.69	0.0	0.0	139.7	66.7	600	600	CIRCULAR	CONCRETE	-	0.34	373.5	**37.40%**	1.28	1.01	1.10
L2031A, L2031B	2031	2004	0.66	0.00	0.00	0.00	0.00	0.64	0.00	0.00	0.00	0.419	1.128	0.000	0.000	0.000	0.000	0.000	0.000	12.76	67.61	91.56	107.26	156.71	0.0	0.0	211.8	66.7	750	750	CIRCULAR	CONCRETE	-	0.13	418.8	**50.57%**	0.92	0.79	1.42
																				14.18																			
L2004A, L2004B, L2004C	2004	2003	1.08	0.00	0.00	0.00	0.00	0.61	0.00	0.00	0.00	0.656	18.113	0.000	1.359	0.000	0.000	0.000	0.000	20.10	51.88	70.04	81.96	119.58	0.0	0.0	2874.3	69.0	1950	1950	CIRCULAR	CONCRETE	-	0.13	5352.5	**53.70%**	1.74	1.51	0.76
L2003A, L2003B	2003	2002	0.70	0.00	0.00	0.00	0.00	0.64	0.00	0.00	0.00	0.447	18.559	0.000	1.359	0.000	0.000	0.000	0.000	20.86	50.69	68.42	80.06	116.80	0.0	0.0	2871.5	66.2	1950	1950	CIRCULAR	CONCRETE	-	0.11	4923.6	**58.32%**	1.60	1.43	0.77
																				21.63																			
L2013B, L2013A	2013	2012	0.32	0.00	0.00	0.00	0.00	0.69	0.00	0.00	0.00	0.223	0.223	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	47.6	113.3	375	375	CIRCULAR	PVC	-	0.19	71.9	**66.24%**	0.68	0.63	2.98
L2012A	2012	2011	0.18	0.00	0.00	0.00	0.00	0.69	0.00	0.00	0.00	0.123	0.346	0.000	0.000	0.000	0.000	0.000	0.000	12.98	66.98	90.70	106.26	155.23	0.0	0.0	64.3	34.8	525	525	CIRCULAR	CONCRETE	-	0.34	261.6	**24.59%**	1.17	0.81	0.72
	2011	2010	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.346	0.000	0.000	0.000	0.000	0.000	0.000	13.70	65.02	88.01	103.09	150.59	0.0	0.0	62.4	12.4	525	525	CIRCULAR	CONCRETE	-	0.40	283.8	**22.00%**	1.27	0.85	0.24
L2010B, L2010A	2010	2009	0.83	0.00	0.00	0.00	0.00	0.52	0.00	0.00	0.00	0.434	0.779	0.000	0.000	0.000	0.000	0.000	0.000	13.94	64.38	87.14	102.07	149.08	0.0	0.0	139.4	72.2	600	600	CIRCULAR	CONCRETE	-	0.18	271.8	**51.29%**	0.93	0.80	1.50
																				15.44																			
	2015A	2015	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	7.2	250	250	CIRCULAR	PVC	-	0.69	50.2	**0.00%**	1.01	0.00	0.00
L2015A	2015	2014	0.23	0.00	0.00	0.00	0.00	0.74	0.00	0.00	0.00	0.173	0.173	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	37.0	79.5	375	375	CIRCULAR	PVC	-	0.35	97.5	**37.90%**	0.92	0.73	1.82
L2014A, L2014B	2014	2009	0.48	0.00	0.00	0.00	0.00	0.74	0.00	0.00	0.00	0.355	0.528	0.000	0.000	0.000	0.000	0.000	0.000	11.82	70.45	95.47	111.86	163.46	0.0	0.0	103.3	82.5	525	525	CIRCULAR	CONCRETE	-	0.21	205.6	**50.26%**	0.92	0.79	1.75
																				13.57																			
L2009B, L2009A	2009	2008	0.81	0.00	0.00	0.00	0.00	0.50	0.00	0.00	0.00	0.402	1.709	0.000	0.000	0.000	0.000	0.000	0.000	15.44	60.75	82.17	96.22	140.50	0.0	0.0	288.4	74.4	900	900	CIRCULAR	CONCRETE	-	0.10	597.2	**48.30%**	0.91	0.77	1.61
																				17.05																			
L2019A	2019	2018	0.13	0.00	0.00	0.00	0.00	0.62	0.00	0.00	0.00	0.078	0.078	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	16.7	21.3	300	300	CIRCULAR	PVC	-	0.23	46.1	**36.16%**	0.66	0.51	0.70
	2018	2017	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.078	0.000	0.000	0.000	0.000	0.000	0.000	10.70	74.23	100.65	117.97	172.43	0.0	0.0	16.1	8.1	300	300	CIRCULAR	PVC	-	0.37	58.5	**27.55%**	0.83	0.59	0.23
L2017A	2017	2016	0.33	0.00	0.00	0.00	0.00	0.74	0.00	0.00	0.00	0.243	0.321	0.000	0.000	0.000	0.000	0.000	0.000	10.93	73.43	99.55	116.67	170.52	0.0	0.0	65.6	73.2	450	450	CIRCULAR	CONCRETE	-	0.22	139.5	**46.99%**	0.85	0.71	1.71
L2016A	2016	2008	0.32	0.00	0.00	0.00	0.00	0.74	0.00	0.00	0.00	0.240	0.561	0.000	0.000	0.000	0.000	0.000	0.000	12.64	67.97	92.06	107.85	157.58	0.0	0.0	106.0	91.0	525	525	CIRCULAR	CONCRETE	-	0.27	233.1	**45.47%**	1.04	0.87	1.75
																				14.39																			
L2022A, L2022B	2021A	2021	0.54	0.00	0.00	0.00	0.00	0.73	0.00	0.00	0.00	0.394	0.394	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	84.1	96.2	450	450	CIRCULAR	CONCRETE	-	0.19	129.6	**64.87%**	0.79	0.73	2.20
L2021B, L2021A	2021	2020A	0.56	0.00	0.00	0.00	0.00	0.65	0.00	0.00	0.00	0.368	0.762	0.000	0.000	0.000	0.000	0.000	0.000	12.20	69.27	93.85	109.96	160.67	0.0	0.0	146.7	62.8	825	825	CIRCULAR	CONCRETE	-	0.19	652.7	**22.47%**	1.18	0.79	1.32
																				13.52																			
L2021C	2069	2020A	2.25	0.00	0.00	0.00	0.00	0.20	0.00	0.00	0.00	0.444	0.444	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	94.8	12.0	525	525	CIRCULAR	CONCRETE	-	0.42	290.8	**32.59%**	1.30	0.98	0.21
																				10.21																			
	2020A	2020	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	1.206	0.000	0.000	0.000	0.000	0.000	0.000	13.52	65.49	88.66	103.86	151.71	0.0	0.0	219.5	41.0	825	825	CIRCULAR	CONCRETE	-	0.20	669.7	**32.77%**	1.21	0.91	0.75
																				14.27																			
	2024A	2023	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	5.5	250	250	CIRCULAR	PVC	-	0.91	57.6	**0.00%**	1.16	0.00	0.00
L2024A	2024	2023	0.29	0.00	0.00	0.00	0.00	0.74	0.00	0.00	0.00	0.215	0.215	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	45.8	75.0	300	300	CIRCULAR	PVC	-	0.39	60.0	**76.25%**	0.85	0.83	1.50
L2023B, L2023A	2023	2020	0.45	0.00	0.00	0.00	0.00	0.74	0.00	0.00	0.00	0.333	0.548	0.000	0.000	0.000	0.000	0.000	0.000	11.50	71.47	96.86	113.51	165.88	0.0	0.0	108.7	90.0	525	525	CIRCULAR	CONCRETE	-	0.18	190.3	**57.12%**	0.85	0.76	1.97
																				13.47																			

Stantec	Trailsedge East Phase 1		STORM SEWER DESIGN SHEET (AS-BUILT) (City of Ottawa)
	DATE:	2019-11-22	
	REVISION:	AS-BUILT (GMR)	
	DESIGNED BY:	DT	FILE NUMBER: 160401250
	CHECKED BY:	GMR	

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	MANNING'S n =	0.013	BEDDING CLASS = B
b =	6.199	6.053	6.014	6.014	MINIMUM COVER:	2.00	m
c =	0.810	0.814	0.816	0.820	TIME OF ENTRY	10	min

LOCATION / DRAINAGE AREA

AREA ID NUMBER	FROM M.H.	TO M.H.	AREA (2-YEAR) (ha)	AREA (5-YEAR) (ha)	AREA (10-YEAR) (ha)	AREA (100-YEAR) (ha)	AREA (ROOF) (ha)	C (2-YEAR) (-)	C (5-YEAR) (-)	C (10-YEAR) (-)	C (100-YEAR) (-)	A x C (2-YEAR) (ha)	ACCUM AxC (2YR) (ha)	A x C (5-YEAR) (ha)	ACCUM. AxC (5YR) (ha)	A x C (10-YEAR) (ha)	ACCUM. AxC (10YR) (ha)	A x C (100-YEAR) (ha)	ACCUM. AxC (100YR) (ha)	T of C (min)	I_{2-YEAR} (mm/h)	I_{5-YEAR} (mm/h)	$I_{10-YEAR}$ (mm/h)	$I_{100-YEAR}$ (mm/h)	$Q_{CONTROL}$ (L/s)	ACCUM. $Q_{CONTROL}$ (L/s)	Q_{ACT} (CIA/360) (L/s)
L2020A, L2020B	2020	2008	0.77	0.00	0.00	0.00	0.00	0.52	0.00	0.00	0.00	0.399	2.153	0.000	0.000	0.000	0.000	0.000	0.000	14.27	63.54	85.99	100.71	147.09	0.0	0.0	380.1
																				16.17							
L2008A	2008	2002	0.32	0.00	0.00	0.00	0.00	0.74	0.00	0.00	0.00	0.234	4.658	0.000	0.000	0.000	0.000	0.000	0.000	17.05	57.32	77.47	90.70	132.40	0.0	0.0	741.7
																				18.56							
L2002A, L2002B, L2002C	2002	2001	1.52	0.00	0.00	0.00	0.00	0.56	0.00	0.00	0.00	0.858	24.075	0.000	1.359	0.000	0.000	0.000	0.000	21.63	49.55	66.86	78.23	114.11	0.0	0.0	3565.8
L2001A	2001	2000	0.26	0.00	0.00	0.00	0.00	0.73	0.00	0.00	0.00	0.190	24.265	0.000	1.359	0.000	0.000	0.000	0.000	22.76	47.97	64.72	75.71	110.42	0.0	0.0	3477.7
																				23.13							

PIPE SELECTION

AREA ID NUMBER	AS-BUILT LENGTH (m)	PIPE WIDTH OR DIAMETER (mm)	PIPE HEIGHT (mm)	PIPE SHAPE (-)	MATERIAL (-)	CLASS (-)	AS-BUILT SLOPE %	Q_{CAP} (FULL) (L/s)	% FULL (-)	VEL. (FULL) (m/s)	VEL. (ACT) (m/s)	TIME OF FLOW (min)
L2020A, L2020B	83.1	975	975	CIRCULAR	CONCRETE	-	0.07	618.6	**61.45%**	0.80	0.73	1.90
L2008A	87.8	1350	1350	CIRCULAR	CONCRETE	-	0.10	1760.8	**42.12%**	1.19	0.97	1.51
L2002A, L2002B, L2002C	120.0	2100	2100	CIRCULAR	CONCRETE	-	0.17	7458.2	**47.81%**	2.09	1.77	1.13
L2001A	28.1	2100	2100	CIRCULAR	CONCRETE	-	0.07	4785.8	**72.67%**	1.34	1.28	0.37
		2100	2100									

- Minimum clearance depth of 0.30m to be provided from rear yard spill elevation to the ground elevation at the adjacent building envelope (City of Ottawa).
- Minimum clearance depth of 0.15m to be provided from spill elevations within the proposed rights-of-way to building envelopes in proximity of overland flow routes or ponding areas.
- Water must not encroach upon proposed building envelopes, and must remain below all proposed building openings during the climate change event (City of Ottawa).
- Provide adequate emergency overflow conveyance off-site (City of Ottawa).
- Community park to be graded & controlled to permit 100yr uncontrolled discharge to the minor system (City of Ottawa).
- No rear-yard ponding volumes to be accounted for in SWM model preparation (City of Ottawa).
- The product of depth times velocity on streets not to be greater than 0.6 during the 100-year storm (City of Ottawa).
- Major and minor flow to be conveyed to SWM pond 1 for quality (70% TSS Removal) and quantity control (EUC MSS).

5.3 STORMWATER MANAGEMENT

5.3.1 Allowable Release Rate

Based on XPSWMM modeling files for the Design Brief for the Minto Trailsedge Phase II subdivision (IBI, 2015), the peak post-development discharge from the development including upstream tributary areas (tributary to SWM Pond 1) to the minor system was estimated for three storm sewer connections along Fern Casey Street. The proposed storm sewer layout indicates 2 connection points to the recently constructed Fern Casey Street sewer. The third connection point was provided, but deemed unnecessary based on the proposed road fabric for the Trails Edge East development, and will be decommissioned. Preliminary peak release rates for the subdivision are summarized in **Table 6** below:

Table 6: Preliminary Minor System Release Rate Targets

Outlet Node	5yr Target Flow Rate (m^3/s)	100yr Target Flow Rate (m^3/s)	100yr + 20% Target Flow Rate (m^3/s)
N3900	8.65	11.39	11.97
N55	0.91	1.08	1.10
N56	4.00	5.99	6.27
Total	**13.56**	**18.46**	**19.34**

The existing design of Fern Casey Street incorporates a major system overflow to Mud Creek which consists of a 5m wide conveyance pathway that acts as weir. Per IBI's design brief, the peak flow rate from this weir to Mud Creek during the 100yr storm event is **143L/s**.

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. The use of PCSWMM for modeling of the site hydrology and hydraulics allowed for an analysis of the systems response during various storm events. Surface storage estimates were based on the final grading plan design (see **Drawing GP-1-5**). The following assumptions were applied to the detailed model:

- Hydrologic parameters as per Ottawa Sewer Design Guidelines, including Manning's 'n', and depression storage values.
- Subcatchment infiltration parameters per Horton Infiltration method per Ottawa Sewer Design Guidelines.
- 3-hour Chicago Storm distribution for the 2, 5, and 100-year analysis, the 24 hour SCS Storm distribution for the 100-year event, and historical events July 1979, August 1988, and August 1996 with the downstream system modeled up to the outlet from Pond 1.
- To 'stress test' the system a 'climate change' scenario was created by adding 20% of the individual intensity values of the 100-year Chicago storm event at their specified time step.
- Percent imperviousness calculated based on actual soft and hard surfaces on each subcatchment, 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. Subcatchment width determined by multiplying street segment length x 2 (length of overland flow path measured from high-point to high-point) for street (double-sided) catchments, multiplying by 1.5 for single-loaded roads, multiplying by 1.0 for single-sided catchments, or by multiplying the subcatchment area by 225m where a street segment flow path has not otherwise been defined.
- Number of catchbasins based on proposed servicing plans (**Drawing SSP-1-5**)
- Catchbasin inflow restricted with inlet-control devices (ICDs) as necessary to maintain inflow target rate, maximize use of surface storage, and ensure no standing water during the 2-year event (5-year event level of service for collector roads). Catchbasins are not to be interconnected.
- For storage on roads with defined cross-sections, active storage was modeled based on actual conduit flow using cross-sections as detailed on **Drawing DS-1**.
- Rear-yard swales modeled as triangular cross-sections at a continuous 1.5% grade for continuity purposes.
- Future development phases modeled to discharge up to the 2-year event (5-year event for collector roads) to the minor system, with increases of 12.0% and 13.6% for storage depths of 0.20m (100-year event) and 0.40m (100-year+20% event) respectively. Future MUC area modeled to discharge up to the peak 5-year event to the minor system. Runoff from Renaud Road east of Fern Casey to Mer Bleue is captured at the 5-year rate with the above noted increases for 100-year and 100-year + 20% events.
- Renaud Road major system west of Ascender Street to be directed to Pond 1. Runoff for Renaud Road east of Ascender Street up to the 100-year event will be retained and captured to the minor system draining to Pond 1, with emergency overland outlet to Mer Bleue Road.
- Surface storage for future phases of the development have been identified to control differences in peak runoff from the 100 to the 2-year storm event on-site. Additional peak runoff experienced during the climate change event has been modeled as discharging freely overland to the next downstream node.
- The community park block has been modeled to discharge up to the 100-year event freely to the minor system. Additional peak runoff experienced during the climate change event has been modeled as discharging freely to the next downstream overland node.

Appendix D - GEOTECHNICAL INVESTIGATION

Geotechnical Engineering

Environmental Engineering

Hydrogeology

Geological Engineering

Materials Testing

Building Science

Archaeological Services

Paterson Group Inc.
Consulting Engineers
154 Colonnade Road South
Ottawa (Nepean), Ontario
Canada K2E 7J5

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patersongroup

Geotechnical Investigation
Proposed Residential Development
Trailsedge Block 193 & 194
Ottawa, Ontario

Prepared For

Richcraft Group of Companies

July 24, 2020

Report: PG5397-1

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Appendices

Appendix 1	Soil Profile and Test Data Sheets Symbols and Terms Atterberg Limits Results Grain Size Distribution Results Analytical Testing Results
Appendix 2	Figure 1 - Key Plan Drawing PG5397-1 - Test Hole Location Plan

1.0 Introduction

Paterson Group (Paterson) was commissioned by Richcraft Group of Companies to conduct a geotechnical investigation for the proposed Trailsedge Block 193 and 194 to be located at the intersection of Brian Coburn Boulevard and Fern Casey Street, in the City of Ottawa (refer to Figure 1 - Key Plan presented in Appendix 2).

The objective of the investigation was to:

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

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

2.0 Proposed Development

Based on the available site plan, the proposed development will consist of townhouse blocks, each of which will include a basement level. The townhouse blocks will generally be surrounded by asphalt paved access lanes and parking areas with landscaped margins.

An amenity area with an accessory building will also be located in the central portion of the site. It is understood that the accessory building will be a single-storey structure with a slab-on-grade.

It is also anticipated that the site will be municipally serviced.

3.0 Method of Investigation

3.1 Field Investigation

The field program for the current geotechnical investigation was carried out on June 29, 2020 and consisted of advancing 4 boreholes (BH 1-20 to BH 4-20) to a maximum depth of 7.5 m below existing ground surface. Three (3) boreholes and one (1) test pit from previous investigations (BH 6, BH 7, BH 14-08, and TP 19-08) were also located within, or in the vicinity of, the boundaries of the subject site. The test hole locations were determined in the field by Paterson personnel taking into consideration site features and underground services. The test hole locations are presented on Drawing PG5397-1 - Test Hole Location Plan included in Appendix 2.

The boreholes were advanced using a track-mounted auger drill rig operated by a two-person crew. The drilling procedure consisted of augering to the required depths at the selected locations and sampling the overburden.

The test pit was advanced using a backhoe. The test pit procedure consisted of excavating to the required depth at the selected location and sampling the overburden. The test pit was backfilled with the excavated soil upon completion.

.All fieldwork was conducted under the full-time supervision of personnel from Paterson's geotechnical division under the direction of a senior engineer.

Sampling and In Situ Testing

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

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

Undrained shear strength testing was carried out at regular depth intervals in cohesive soils. Undrained shear strength testing in test pits was completed using a handheld, portable vane apparatus (field inspection vane tester Roctest Model H-60).

Overburden thickness was evaluated during the course of the investigation by dynamic cone penetration testing (DCPT) at BH 1-20 and BH 2-20 from the current investigation and BH 6 and BH 7 from the previous investigation. 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.

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

Groundwater

Flexible stand pipes were installed in all test holes to permit monitoring of the groundwater levels subsequent to the completion of the sampling program.

Sample Storage

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

3.2 Field Survey

The test holes were located and surveyed in the field by Paterson personnel. The locations and ground surface elevations of the boreholes from the current investigation were determined using a hand held GPS and are referenced to a geodetic datum. However, the locations and the ground surface elevations for the boreholes and test pit from the previous investigations were determined by Webster and Simmonds Surveying and Stantec Geomatics, respectively. It is understood that the elevations are referenced to a geodetic datum.

The locations of the test holes and the ground surface elevation at each test hole location are presented on Drawing PG5397-1 - Test Hole Location Plan included in Appendix 2.

3.3 Laboratory Testing

The soil samples recovered from the test holes were examined in our laboratory to review the results of the field logging. From the current test holes, 6 split spoon samples were submitted for moisture content testing. Among these samples, 4 samples were also submitted for Atterberg Limits testing, and 1 sample was submitted for grain size distribution testing and shrinkage limit testing.

The results of the Atterberg Limits testing and grain size distribution testing are presented in Appendix 1 and are further discussed in Sections 4.0.

3.4 Analytical Testing

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

4.0 Observations

4.1 Surface Conditions

The subject site is currently undeveloped and generally vacant, with the exception of an approximate 4 to 5 m high fill pile located on the southern portion of the site. The site is bordered by Brian Coburn Boulevard to the north, Fern Casey Street to the west, du Couloir Road to the south, and vacant land to the east. The existing ground surface across the site is generally level at approximate geodetic elevation 87 m.

4.2 Subsurface Profile

Generally, the subsurface profile encountered at the borehole locations consists of an approximate 50 to 250 mm thickness of topsoil which is underlain by a silty clay deposit.

The upper 3 to 4 m of the silty clay generally consisted of a very stiff to stiff, brown silty clay crust, becoming a firm, grey silty clay with depth. Practical refusal to the DCPT was encountered at depths ranging from 23 m at the south end of the site to 18 m at the north end of the site.

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

Laboratory Testing

Atterberg limits testing, as well as associated moisture content testing, was completed on the recovered silty clay samples at 4 selected locations throughout the subject site.

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

Table 1 - Atterberg Limits Results					
Sample	**Depth (m)**	**LL (%)**	**PL (%)**	**PI (%)**	**Classification**
BH 1-20	1.8	67	28	39	CH
BH 2-20	1.8	65	27	38	CH
BH 3-20	1	63	28	35	CH
BH 4-20	1	69	29	40	CH
Notes: LL: Liquid Limit; PL: Plastic Limit; PI: Plasticity Index; w: water content; CH: Inorganic Clay of High Plasticity					

The results of the shrinkage limit test indicate a shrinkage limit of 21% and a shrinkage ratio of 1.78.

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

Table 2 - Summary of Grain Size Distribution Analysis					
Test Hole	**Sample**	**Gravel (%)**	**Sand (%)**	**Silt (%)**	**Clay (%)**
BH 3	SS 2	0	1.3	37	61.7

Bedrock

Based on available geological mapping, the bedrock in this area consists of interbedded limestone and shale of the Lindsay Formation with an overburden drift thickness of 15 to 25 m depth.

4.3 Groundwater

Groundwater levels were measured in the piezometers at the recent borehole locations on July 9, 2020. The measured groundwater level (GWL) readings, including those from previous geotechnical investigations, are presented in Table 1 below.

Table 3 - Summary of Groundwater Levels			
Borehole Number	**Measured Groundwater Level**		**Recording Date**
	Depth (m)	**Elevation (m)**	
Groundwater Levels Based on Current Investigation (Report PG5397-1)			
BH 1-20	6.10	80.98	July 9, 2020
BH 2-20	5.41	82.04	July 9, 2020
BH 3-20	2.32	84.63	July 9, 2020
BH 4-20	5.32	82.46	July 9, 2020
Groundwater Levels Based on Previous Investigation (Report G8533)			
BH 6	1.42	85.88	March 26, 2002
BH 7	4.23	82.57	March 26, 2002
Groundwater Levels Based on Previous Investigations (Report PG0861)			
BH 14-08	1.45	85.58	October 23, 2008
TP 19-08	1.60	85.43	October 24, 2008

It should be noted that surface water can become trapped within a backfilled borehole and lead to higher than normal groundwater level readings. The long term groundwater level can also be estimated based on the recovered soil samples, moisture levels and consistency. Based on these observations, the long term groundwater table is anticipated to be at a 3 to 4 m depth. It should be noted that groundwater levels are subject to seasonal fluctuations. Therefore, groundwater level 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 can be founded on conventional shallow foundations placed on an undisturbed, very stiff to firm silty clay bearing surface.

Due to the presence of a silty clay deposit, the subject site will be subjected to permissible grade raise restrictions. The existing fill pile noted at the site should be further assessed to determine if the fill material is suitable for reuse as part of the proposed development.

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

5.2 Site Grading and Preparation

Stripping Depth

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

Fill Placement

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

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

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

5.3 Foundation Design

Strip footings, up to 3 m wide, and pad footings, up to 6 m wide, placed on an undisturbed, very stiff to stiff silty clay bearing surface can be designed using a bearing resistance value at SLS of **100 kPa** and a factored bearing resistance value at ULS of **150 kPa** incorporating a geotechnical factor of 0.5 at ULS.

Strip footings, up to 3 m wide, and pad footings, up to 6 m wide, placed on an undisturbed, firm silty clay bearing surface bearing surface can be designed using a bearing resistance value at SLS of **60 kPa** and a factored bearing resistance value at ULS of **125 kPa** incorporating a geotechnical factor of 0.5 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 prior to the placement of concrete for footings.

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

Lateral Support

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

Settlement/Grade Raise

Consideration must also be given to potential settlements which could occur due to the presence of the silty clay deposit and the combined loads from the proposed footings, any groundwater lowering effects, and grade raise fill. The foundation loads to be considered for the settlement case are the continuously applied loads which consist of the unfactored dead loads and the portion of the unfactored live load that is considered to be continuously applied. For buildings, a minimum value of 50% of the live load is often recommended by Paterson. A post-development groundwater lowering of 0.5 m was assumed.

Due to the presence of the silty clay deposit, a permissible grade raise restriction of **1.2 m** 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.

5.4 Design for Earthquakes

The site class for seismic site response can be taken as **Class E**. If a higher seismic site class is required (such as Class D), a site specific shear wave velocity test may be completed to accurately determine the applicable seismic site classification for foundation design of the proposed buildings, as presented in Table 4.1.8.4.A of the Ontario Building Code 2012.

Soils underlying the subject site are not susceptible to liquefaction. Reference should be made to the latest revision of the Ontario Building Code 2012 for a full discussion of the earthquake design requirements.

5.5 Basement Slab/Slab on Grade Construction

With the removal of all topsoil and deleterious fill from within the footprint of the proposed buildings, the existing firm to stiff silty clay will be considered an acceptable subgrade on which to commence backfilling for floor slab construction. Any poor performing areas should be removed and reinstated with engineered fill, such as Granular B Type II and compacted to a minimum 98% of the material's SPMDD.

For structures with slab-on-grade construction, the upper 200 mm of sub-slab fill is recommended to consist of OPSS Granular A crushed stone. All backfill material within the footprint of the proposed buildings should be placed in maximum 300 mm thick loose layers and compacted to a minimum of 98% of the SPMDD. For structures with basement slabs, it is recommended that the upper 200 mm of sub-floor fill consists of 19 mm clear crushed stone.

5.6 Basement Wall

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

A hydrostatic pressure should be added to the total static earth pressure when using the effective unit weight.

Lateral Earth Pressures

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

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

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

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

Seismic Earth Pressures

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

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

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

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

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

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

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

5.7 Pavement Structure

Where required at the subject site, the recommended pavement structures for car only parking areas and access lanes are shown in Tables 4 and 5.

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 fill, in situ soil or OPSS Granular B Type I or II material placed over in situ soil or fill	

Table 5 - Recommended Pavement Structure - Access Lanes

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

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

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

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

Pavement Structure Drainage

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

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

6.0 Design and Construction Precautions

6.1 Foundation Drainage and Backfill

Foundation Drainage

It is recommended that a perimeter foundation drainage system be provided for the proposed structures. The system should consist of a 150 mm diameter perforated corrugated plastic pipe, surrounded on all sides by 150 mm of 19 mm clear crushed stone which is placed at the footing level around the exterior perimeter of each structure. An interior perimeter drainage pipe should be placed along the building perimeter along with a sub-floor drainage system. The perimeter drainage pipe and sub-floor drainage system should direct water to sump pit(s) within the lower garage area.

Foundation Backfill

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

6.2 Protection Against Frost Action

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

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

6.3 Excavation Side Slopes

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

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

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

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

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

6.4 Pipe Bedding and Backfill

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

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

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

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

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

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

6.5 Groundwater Control

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

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

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

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

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

Long-term Groundwater Control

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

6.6 Winter Construction

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

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

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

6.7 Corrosion Potential and Sulphate

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

6.8 Landscaping Considerations

Tree Planting Setbacks

In accordance with the City of Ottawa Tree Planting in Sensitive Marine Clay Soils (2017 Guidelines), Paterson completed a soils review of the site to determine applicable tree planting setbacks. Atterberg limits testing was completed for recovered silty clay samples at selected locations throughout the subject site. Grain size distribution testing were also completed on selected soil sample at BH 3-20. The above-noted soil samples were recovered from elevations below the anticipated design underside of footing elevation and 3.5 m depth below anticipated finished grade. The results of our testing are presented in Subsection 4.2 and in Appendix 1.

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

Low/Medium Sensitivity Clay Soils

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

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

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

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

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

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

Swimming Pools

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

Aboveground Hot Tubs

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

Installation of Decks or Additions

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

7.0 Recommendations

It is a requirement for the foundation design data provided herein to be applicable that the following material testing and observation program be performed by the geotechnical consultant.

- ❑ A review of the final grading plan should be completed from a geotechnical perspective.
- ❑ Observation of all bearing surfaces prior to the placement of concrete.
- ❑ Sampling and testing of the concrete and fill materials used.
- ❑ Periodic observation of the condition of unsupported excavation side slopes in excess of 3 m in height, if applicable.
- ❑ Observation of all subgrades prior to backfilling.
- ❑ Field density tests to determine the level of compaction achieved.
- ❑ Sampling and testing of the bituminous concrete including mix design reviews.

A report confirming that these works have been conducted in general accordance with our recommendations could be issued, upon request, following the completion of a satisfactory material testing and observation program by the geotechnical consultant.

8.0 Statement of Limitations

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

A geotechnical investigation of this nature is a limited sampling of a site. Should any conditions at the site be encountered which differ from those at the test locations, we request immediate notification to permit reassessment of our recommendations.

The recommendations provided herein should only be used by the design professionals associated with this project. They are not intended for contractors bidding on or undertaking the work. The latter should evaluate the factual information provided in this report and determine its suitability and completeness for their intended construction schedule and methods. Additional testing may be required for their purposes.

The present report applies only to the project described in this document. Use of this report for purposes other than those described herein or by person(s) other than Richcraft Group of Companies or their agents is not authorized without review by Paterson Group for the applicability of our recommendations to the altered use of the report.

Paterson Group

Scott S. Dennis, P.Eng.

David J. Gilbert, P.Eng.

Report Distribution:

- ❏ Richcraft Group of Companies
- ❏ Paterson Group

APPENDIX 1

SOIL PROFILE AND TEST DATA SHEETS

SYMBOLS AND TERMS

ATTERBERG LIMITS RESULTS

GRAIN SIZE DISTRIBUTION RESULTS

ANALYTICAL TESTING RESULTS

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Trails Edge East - Blocks 193 & 194 - Brian Coburn Blvd.
Ottawa, Ontario

DATUM Geodetic

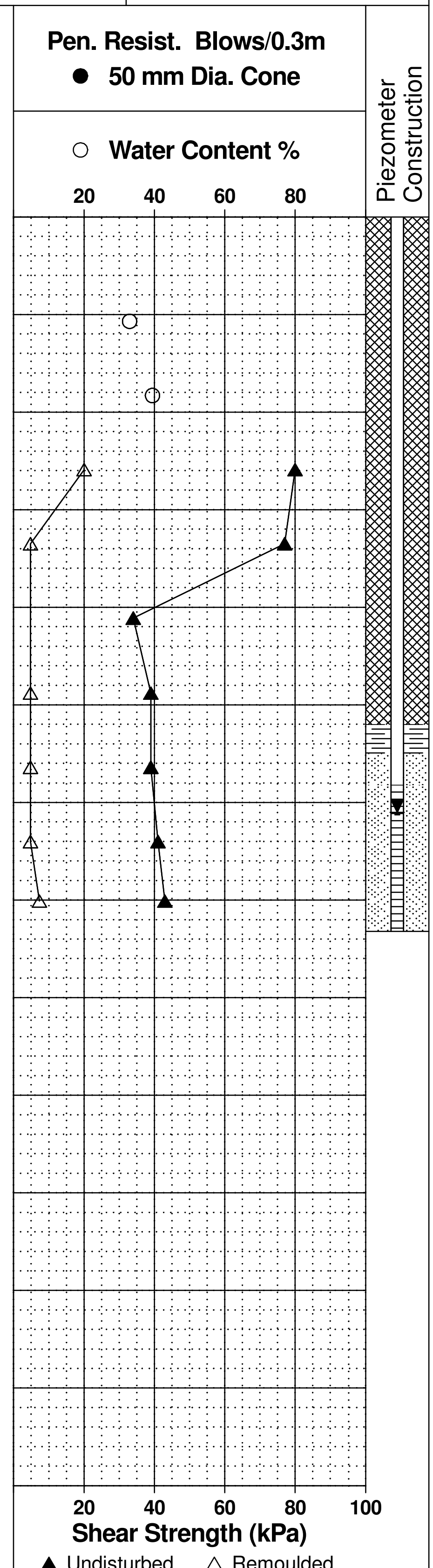
FILE NO. PG5397

REMARKS

HOLE NO. BH 1-20

BORINGS BY Track-Mount Power Auger **DATE** June 29, 2020

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	87.08
TOPSOIL 0.25		AU	1				
		SS	2	54	9	1	86.08
		SS	3	100	9	2	85.08
Very stiff to stiff, brown **SILTY CLAY**						3	84.08
- firm and grey by 3.7m depth						4	83.08
						5	82.08
						6	81.08
7.32						7	80.08
Dynamic Cone Penetration Test commenced at 7.32m depth. Cone pushed to 16.8m depth						8	79.08
						9	78.08
						10	77.08
						11	76.08
						12	75.08
						13	74.08



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REMARKS

HOLE NO. **BH 1-20**

BORINGS BY Track-Mount Power Auger

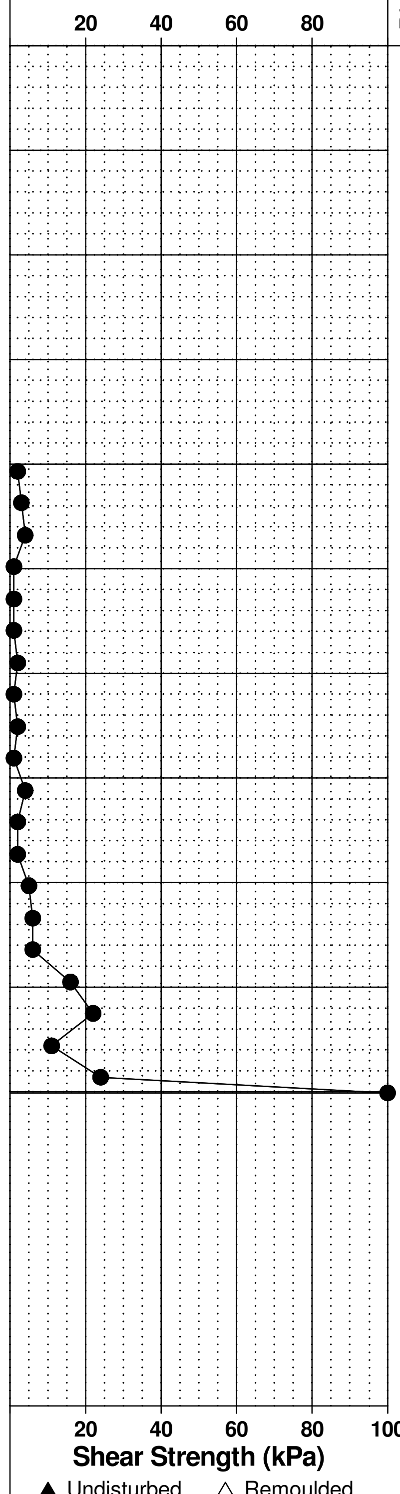
DATE June 29, 2020

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content %	Piezometer Construction
GROUND SURFACE						13	74.08		
						14	73.08		
						15	72.08		
						16	71.08		
						17	70.08		
						18	69.08		
						19	68.08		
						20	67.08		
						21	66.08		
						22	65.08		
23.01						23	64.08		

End of Borehole

Practical DCPT refusal at 23.01m depth.

(GWL @ 6.10m - July 9, 2020)



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REMARKS

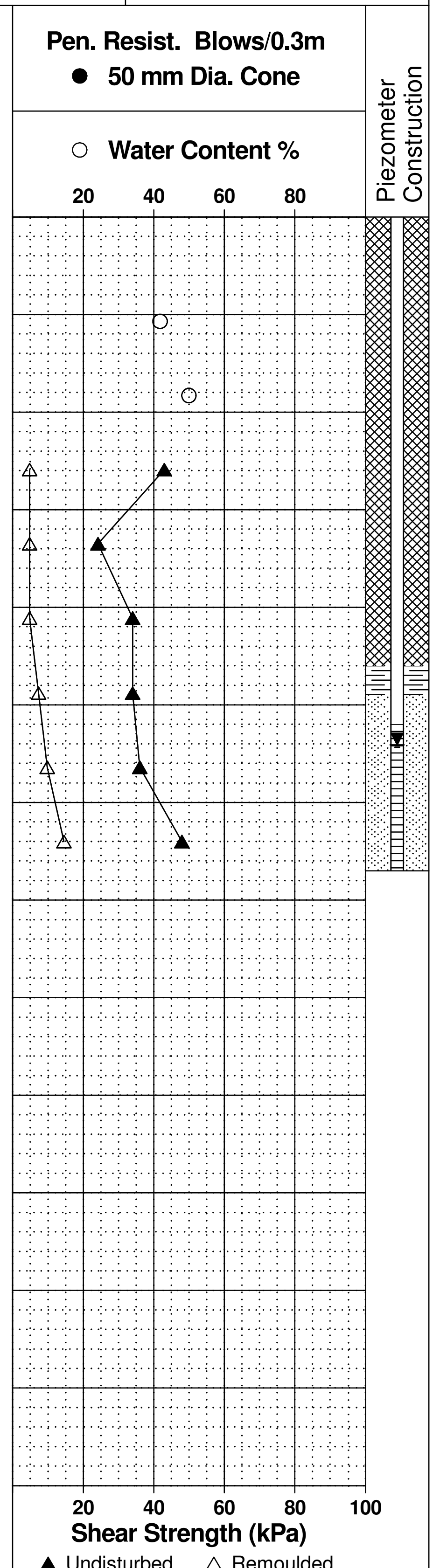
BORINGS BY Track-Mount Power Auger

DATE June 29, 2020

FILE NO. PG5397

HOLE NO. BH 2-20

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	87.45
TOPSOIL (0.20)		AU	1				
Very stiff to stiff, brown **SILTY CLAY**		SS	2	71	8	1	86.45
- grey-brown by 2.3m depth		SS	3	100	2	2	85.45
- firm and grey by 3.0m depth						3	84.45
						4	83.45
						5	82.45
(6.70)						6	81.45
Dynamic Cone Penetration Test commenced at 6.70m depth. Cone pushed to 14.9m depth.						7	80.45
						8	79.45
						9	78.45
						10	77.45
						11	76.45
						12	75.45
						13	74.45



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Ottawa, Ontario

DATUM Geodetic

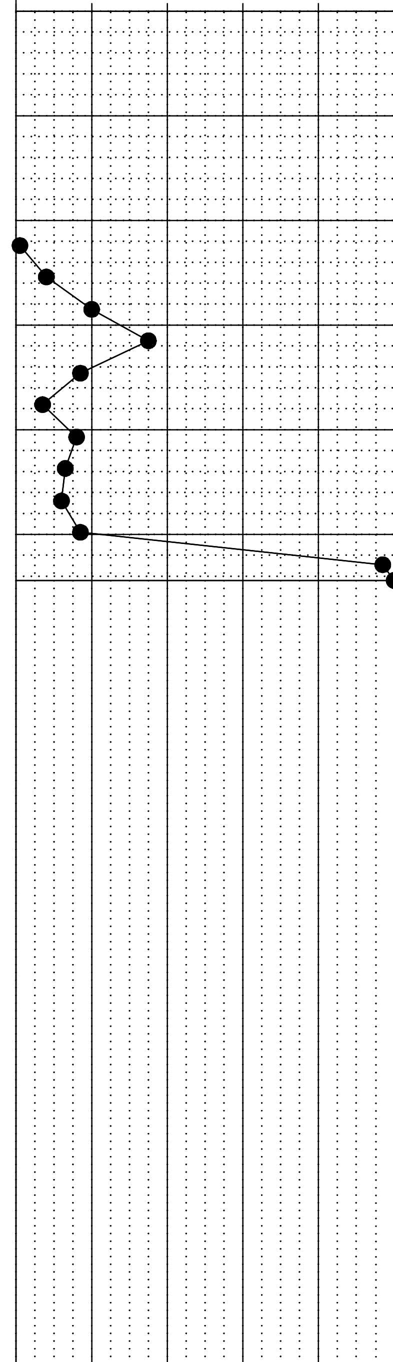
FILE NO. PG5397

REMARKS

HOLE NO. BH 2-20

BORINGS BY Track-Mount Power Auger **DATE** June 29, 2020

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content % (20, 40, 60, 80)	Piezometer Construction
GROUND SURFACE						13	74.45		
						14	73.45		
						15	72.45		
						16	71.45		
						17	70.45		
						18	69.45		
18.44									
End of Borehole Practical DCPT refusal at 18.44m depth. (GWL @ 5.41m - July 9, 2020)									



20 40 60 80 100
Shear Strength (kPa)
▲ Undisturbed △ Remoulded

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SOIL PROFILE AND TEST DATA

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Ottawa, Ontario

DATUM Geodetic

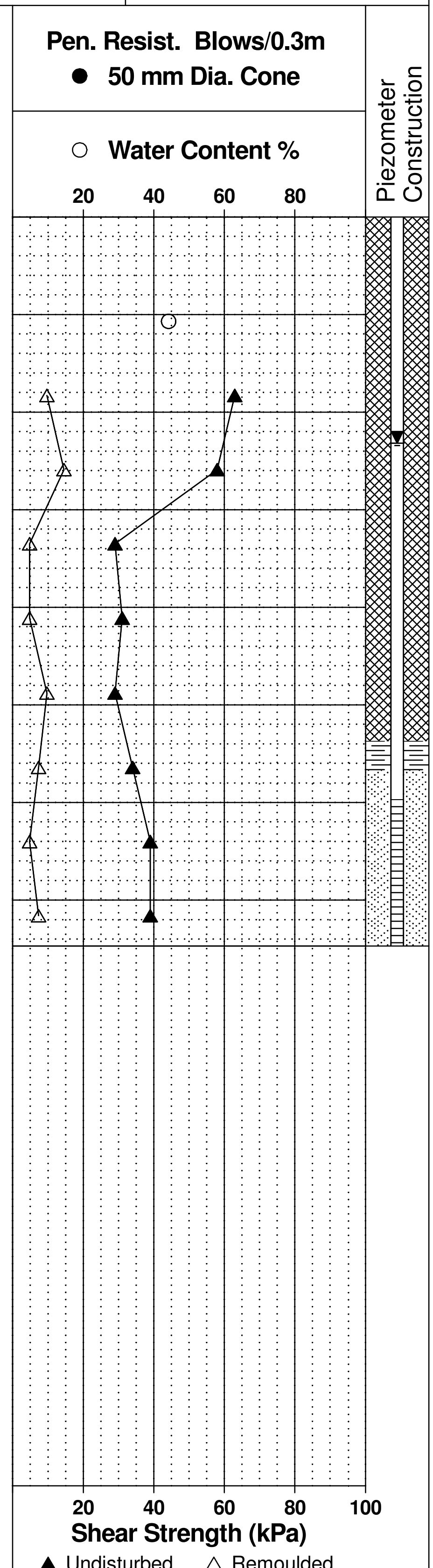
FILE NO. **PG5397**

REMARKS

HOLE NO. **BH 3-20**

BORINGS BY Track-Mount Power Auger **DATE** June 29, 2020

SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE					0	86.95
TOPSOIL 0.05	AU	1				
	SS	2	100	4	1	85.95
Very stiff to stiff, brown **SILTY CLAY**					2	84.95
- firm and grey by 3.0m depth					3	83.95
					4	82.95
					5	81.95
					6	80.95
					7	79.95
7.47						
End of Borehole						
(GWL @ 2.32m - July 9, 2020)						



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REMARKS

BORINGS BY Track-Mount Power Auger

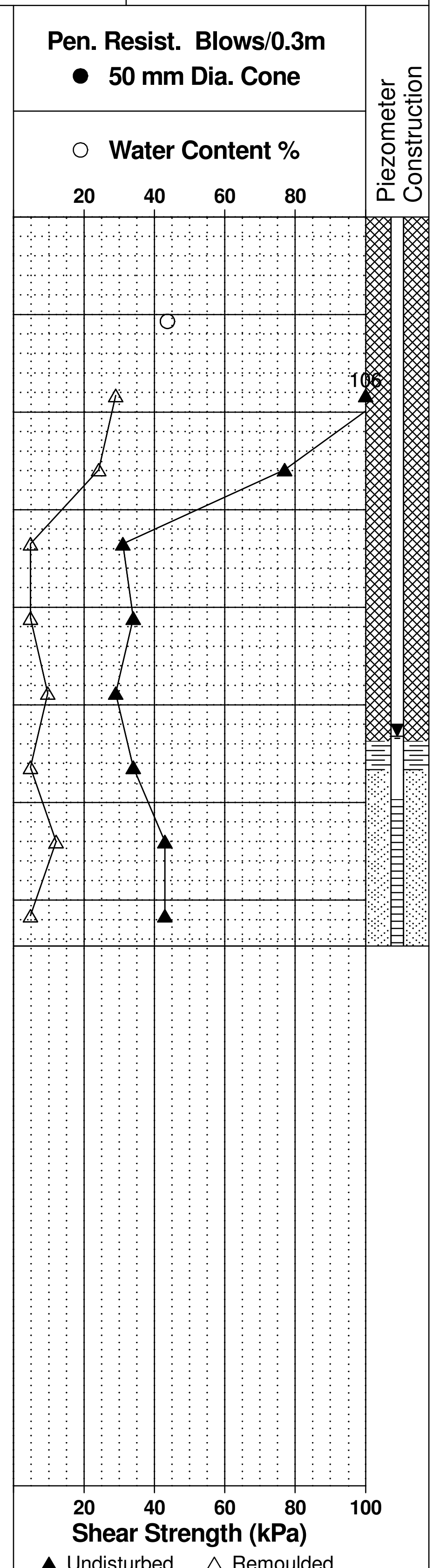
DATE June 29, 2020

FILE NO. PG5397

HOLE NO. BH 4-20

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	87.78
TOPSOIL (0.10)		AU	1				
		SS	2	96	5	1	86.78
Very stiff to stiff, brown **SILTY CLAY**						2	85.78
- firm and grey by 3.0m depth						3	84.78
						4	83.78
						5	82.78
						6	81.78
						7	80.78
(7.47) End of Borehole							

(GWL @ 5.32m - July 9, 2020)



patersongroup Consulting Engineers

28 Concourse Gate, Unit 1, Ottawa, ON K2E 7T7

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Subdivision, 4th Line Road
Ottawa, Ontario

DATUM Approximate geodetic, based on base plan provided by Webster and Simmonds Surveying Ltd.

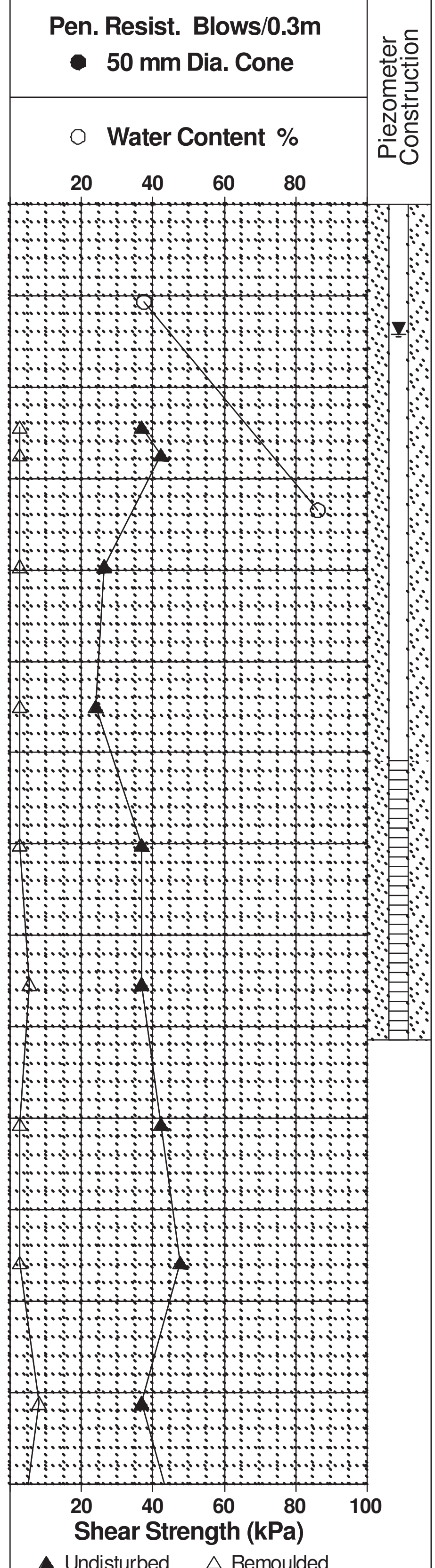
REMARKS

BORINGS BY CME 55 Power Auger **DATE** 13 Mar 02

FILE NO. G8533

HOLE NO. BH 6

SOIL DESCRIPTION	TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE					0	87.30
TOPSOIL 0.15						
Stiff to very stiff, brown-grey **SILTY CLAY**	SS	1	67	11	1	86.30
- firm by 1.5m depth	SS	2	79	2	2	85.30
- grey by 3.0m depth	SS	3	29	1	3	84.30
					4	83.30
	TW	4			5	82.30
	SS	5	100	1	6	81.30
					7	80.30
	SS	6	100	1	8	79.30
					9	78.30
	SS	7	100	1	10	77.30
	SS	8	100	1	11	76.30
					12	75.30
	SS	9	100	1	13	74.30
14.00					14	73.30



patersongroup Consulting Engineers

28 Concourse Gate, Unit 1, Ottawa, ON K2E 7T7

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Subdivision, 4th Line Road
Ottawa, Ontario

DATUM Approximate geodetic, based on base plan provided by Webster and Simmonds Surveying Ltd.

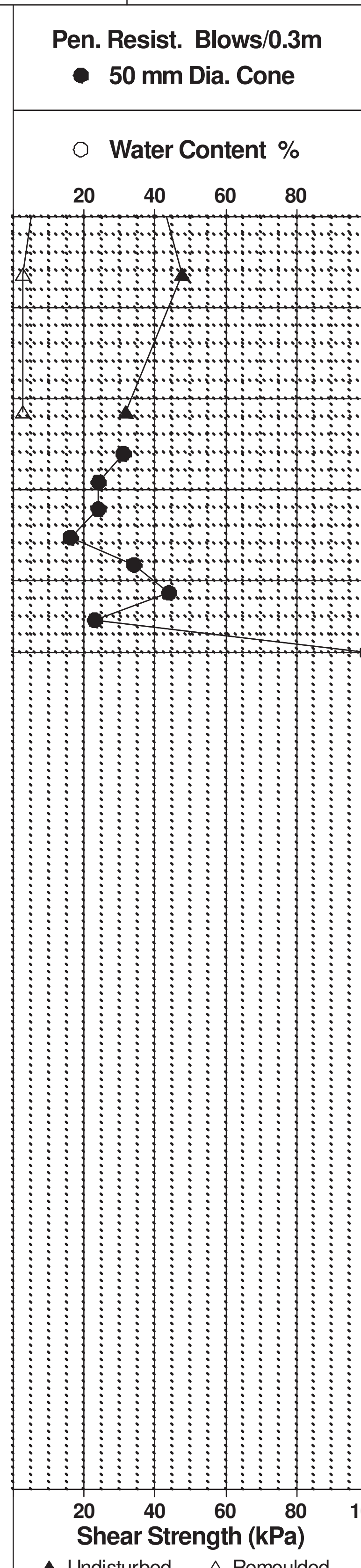
REMARKS

BORINGS BY CME 55 Power Auger **DATE** 13 Mar 02

FILE NO. G8533

HOLE NO. BH 6

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
Firm, grey **SILTY CLAY**		SS	10	100	1	14	73.30
						15	72.30
		SS	11	100	1	16	71.30
16.46							
Dynamic Cone Penetration test commenced @ 16.46m depth						17	70.30
						18	69.30
18.80							
End of Borehole Cone refusal @ 18.80m depth (GWL @ 1.42m-March 26/02)							



Piezometer Construction

patersongroup Consulting Engineers

28 Concourse Gate, Unit 1, Ottawa, ON K2E 7T7

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Subdivision, 4th Line Road
Ottawa, Ontario

DATUM Approximate geodetic, based on base plan provided by Webster and Simmonds Surveying Ltd.

REMARKS

BORINGS BY CME 55 Power Auger

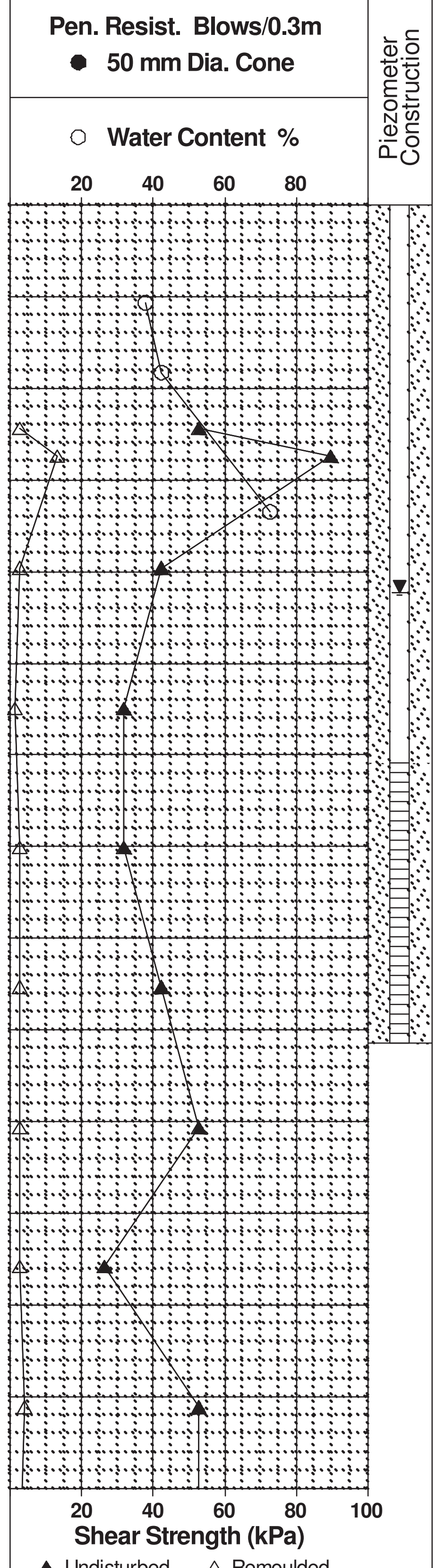
DATE 14 Mar 02

FILE NO. G8533

HOLE NO. BH 7

SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD
GROUND SURFACE				
TOPSOIL (to 0.18)				
Very stiff to stiff, brown-grey **SILTY CLAY**	SS	1	58	10
	SS	2	67	7
- firm and grey by 3.0m depth	SS	3	71	2
	SS	4	100	1
	SS	5	100	1
	SS	6	100	1
	SS	7	100	1
- stiff to firm by 10.0m depth	SS	8	100	1
	SS	9	100	1
(to 14.00)				

DEPTH (m)	ELEV. (m)
0	86.80
1	85.80
2	84.80
3	83.80
4	82.80
5	81.80
6	80.80
7	79.80
8	78.80
9	77.80
10	76.80
11	75.80
12	74.80
13	73.80
14	72.80



patersongroup Consulting Engineers

28 Concourse Gate, Unit 1, Ottawa, ON K2E 7T7

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Subdivision, 4th Line Road
Ottawa, Ontario

DATUM Approximate geodetic, based on base plan provided by Webster and Simmonds Surveying Ltd.

REMARKS

BORINGS BY CME 55 Power Auger

DATE 14 Mar 02

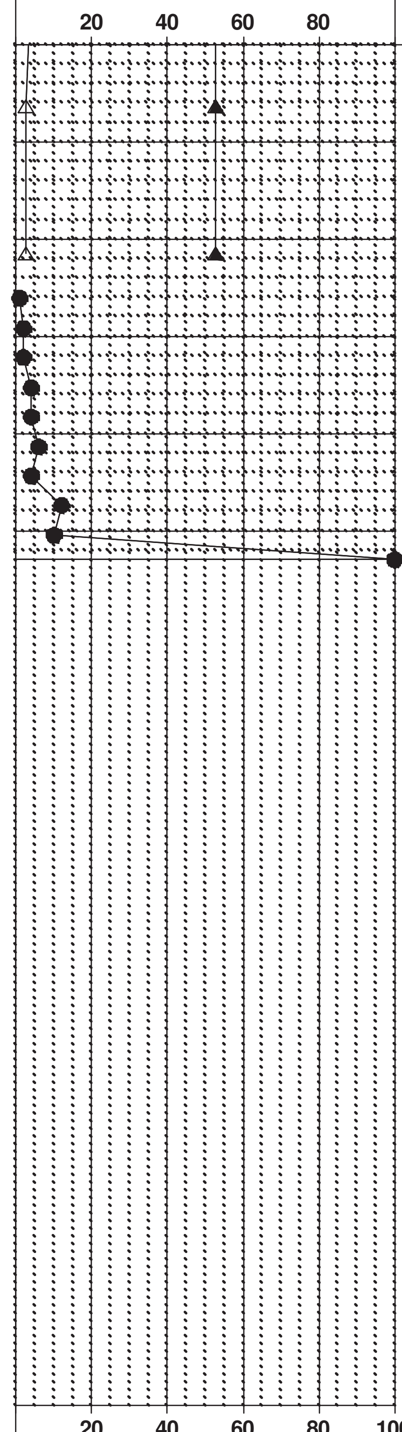
FILE NO. G8533

HOLE NO. BH 7

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
Stiff, grey **SILTY CLAY**		SS	10	100	1	14	72.80
						15	71.80
		SS	11	100	1		
16.46						16	70.80
Dynamic Cone Penetration test commenced @ 16.46m depth						17	69.80
						18	68.80
19.30						19	67.80
End of Borehole Cone refusal @ 19.30m depth (GWL @ 4.23m-March 26/02)							

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone

○ Water Content %



Shear Strength (kPa)

▲ Undisturbed △ Remoulded

Piezometer Construction

patersongroup Consulting Engineers

28 Concourse Gate, Unit 1, Ottawa, ON K2E 7T7

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Residential Development - Eden Park East Portion
Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Geomatics Ltd.

REMARKS

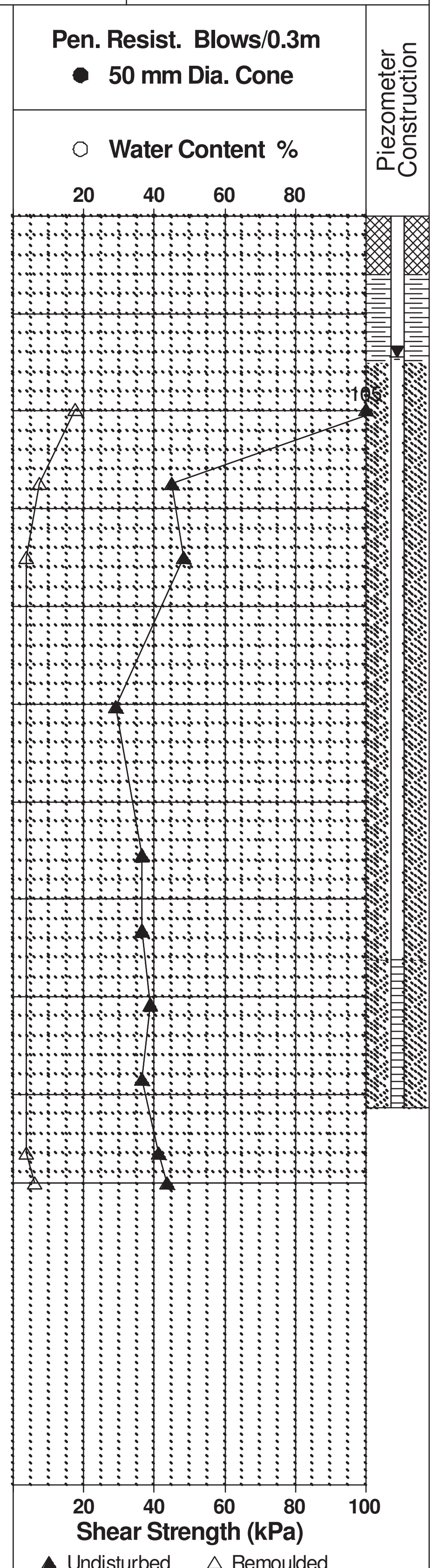
BORINGS BY CME 75 Power Auger

DATE 15 October 2008

FILE NO. PG0861

HOLE NO. BH14-08

SOIL DESCRIPTION	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE					0	87.03
TOPSOIL 0.20	AU	1				
Very stiff to stiff, brown **SILTY CLAY**	SS	2	75	9	1	86.03
- firm and grey by 2.0m depth					2	85.03
					3	84.03
	TW	3	100		4	83.03
					5	82.03
	TW	4	100		6	81.03
					7	80.03
					8	79.03
9.91					9	78.03
End of Borehole						
(GWL @ 1.45m-Oct. 23/08)						



patersongroup Consulting Engineers

28 Concourse Gate, Unit 1, Ottawa, ON K2E 7T7

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Residential Development - Eden Park East Portion
Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Geomatics Ltd.

REMARKS

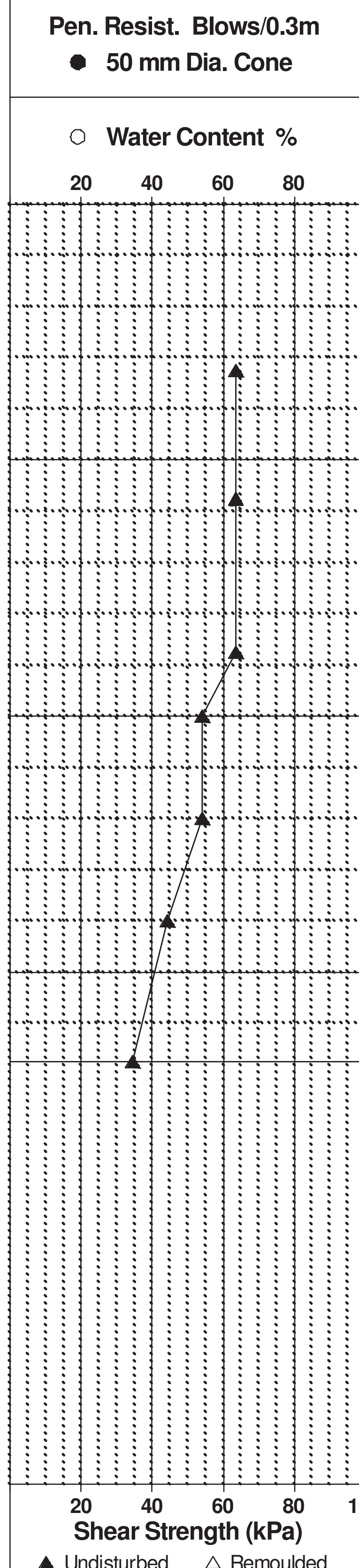
BORINGS BY Backhoe

DATE 24 October 2008

FILE NO. PG0861

HOLE NO. TP19-08

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	87.03		
TOPSOIL 0.15									
Stiff, brown **SILTY CLAY**						1	86.03		⊻
- stiff to firm and grey by 2.3m depth						2	85.03		
3.35						3	84.03		
End of Test Pit (Groundwater infiltration @ 1.6m depth)									



SYMBOLS AND TERMS

SOIL DESCRIPTION

Behavioural properties, such as structure and strength, take precedence over particle gradation in describing soils. Terminology describing soil structure are as follows:

Desiccated	-	having visible signs of weathering by oxidation of clay minerals, shrinkage cracks, etc.
Fissured	-	having cracks, and hence a blocky structure.
Varved	-	composed of regular alternating layers of silt and clay.
Stratified	-	composed of alternating layers of different soil types, e.g. silt and sand or silt and clay.
Well-Graded	-	Having wide range in grain sizes and substantial amounts of all intermediate particle sizes (see Grain Size Distribution).
Uniformly-Graded	-	Predominantly of one grain size (see Grain Size Distribution).

The standard terminology to describe the strength of cohesionless soils is the relative density, usually inferred from the results of the Standard Penetration Test (SPT) 'N' value. The SPT N value is the number of blows of a 63.5 kg hammer, falling 760 mm, required to drive a 51 mm O.D. split spoon sampler 300 mm into the soil after an initial penetration of 150 mm.

Relative Density	'N' Value	Relative Density %
Very Loose	<4	<15
Loose	4-10	15-35
Compact	10-30	35-65
Dense	30-50	65-85
Very Dense	>50	>85

The standard terminology to describe the strength of cohesive soils is the consistency, which is based on the undisturbed undrained shear strength as measured by the in situ or laboratory vane tests, penetrometer tests, unconfined compression tests, or occasionally by Standard Penetration Tests.

Consistency	Undrained Shear Strength (kPa)	'N' Value
Very Soft	<12	<2
Soft	12-25	2-4
Firm	25-50	4-8
Stiff	50-100	8-15
Very Stiff	100-200	15-30
Hard	>200	>30

SYMBOLS AND TERMS (continued)

SOIL DESCRIPTION (continued)

Cohesive soils can also be classified according to their "sensitivity". The sensitivity is the ratio between the undisturbed undrained shear strength and the remoulded undrained shear strength of the soil.

Terminology used for describing soil strata based upon texture, or the proportion of individual particle sizes present is provided on the Textural Soil Classification Chart at the end of this information package.

ROCK DESCRIPTION

The structural description of the bedrock mass is based on the Rock Quality Designation (RQD).

The RQD classification is based on a modified core recovery percentage in which all pieces of sound core over 100 mm long are counted as recovery. The smaller pieces are considered to be a result of closely-spaced discontinuities (resulting from shearing, jointing, faulting, or weathering) in the rock mass and are not counted. RQD is ideally determined from NXL size core. However, it can be used on smaller core sizes, such as BX, if the bulk of the fractures caused by drilling stresses (called "mechanical breaks") are easily distinguishable from the normal in situ fractures.

RQD %	ROCK QUALITY
90-100	Excellent, intact, very sound
75-90	Good, massive, moderately jointed or sound
50-75	Fair, blocky and seamy, fractured
25-50	Poor, shattered and very seamy or blocky, severely fractured
0-25	Very poor, crushed, very severely fractured

SAMPLE TYPES

SS	-	Split spoon sample (obtained in conjunction with the performing of the Standard Penetration Test (SPT))
TW	-	Thin wall tube or Shelby tube
PS	-	Piston sample
AU	-	Auger sample or bulk sample
WS	-	Wash sample
RC	-	Rock core sample (Core bit size AXT, BXL, etc.). Rock core samples are obtained with the use of standard diamond drilling bits.

SYMBOLS AND TERMS (continued)

GRAIN SIZE DISTRIBUTION

MC%	-	Natural moisture content or water content of sample, %
LL	-	Liquid Limit, % (water content above which soil behaves as a liquid)
PL	-	Plastic limit, % (water content above which soil behaves plastically)
PI	-	Plasticity index, % (difference between LL and PL)
Dxx	-	Grain size which xx% of the soil, by weight, is of finer grain sizes These grain size descriptions are not used below 0.075 mm grain size
D10	-	Grain size at which 10% of the soil is finer (effective grain size)
D60	-	Grain size at which 60% of the soil is finer
Cc	-	Concavity coefficient = $(D30)^2$ / (D10 x D60)
Cu	-	Uniformity coefficient = D60 / D10

Cc and Cu are used to assess the grading of sands and gravels:
Well-graded gravels have: 1 < Cc < 3 and Cu > 4
Well-graded sands have: 1 < Cc < 3 and Cu > 6
Sands and gravels not meeting the above requirements are poorly-graded or uniformly-graded.
Cc and Cu are not applicable for the description of soils with more than 10% silt and clay (more than 10% finer than 0.075 mm or the #200 sieve)

CONSOLIDATION TEST

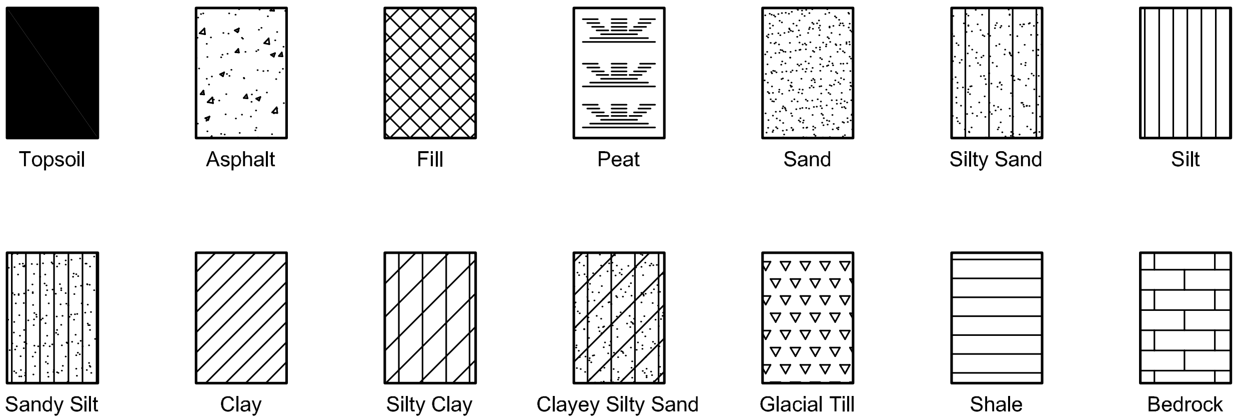
p'_o	-	Present effective overburden pressure at sample depth
p'_c	-	Preconsolidation pressure of (maximum past pressure on) sample
Ccr	-	Recompression index (in effect at pressures below p'_c)
Cc	-	Compression index (in effect at pressures above p'_c)
OC Ratio		Overconsolidaton ratio = p'_c / p'_o
Void Ratio		Initial sample void ratio = volume of voids / volume of solids
Wo	-	Initial water content (at start of consolidation test)

PERMEABILITY TEST

k	-	Coefficient of permeability or hydraulic conductivity is a measure of the ability of water to flow through the sample. The value of k is measured at a specified unit weight for (remoulded) cohesionless soil samples, because its value will vary with the unit weight or density of the sample during the test.

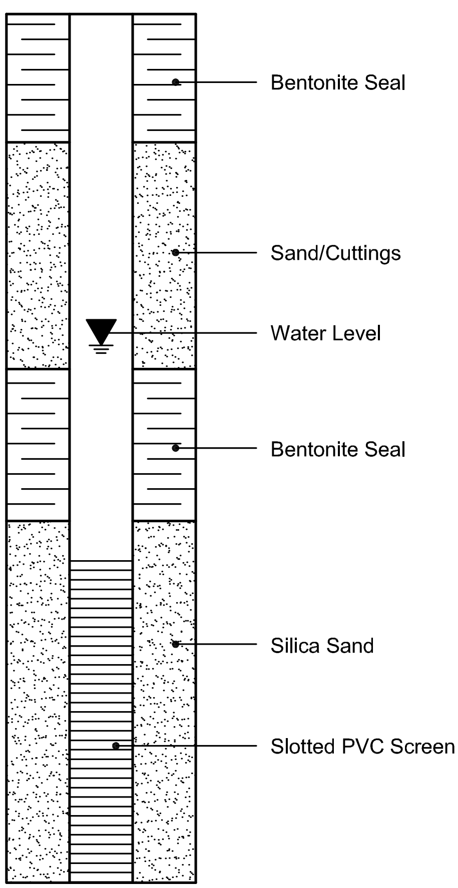
SYMBOLS AND TERMS (continued)

STRATA PLOT

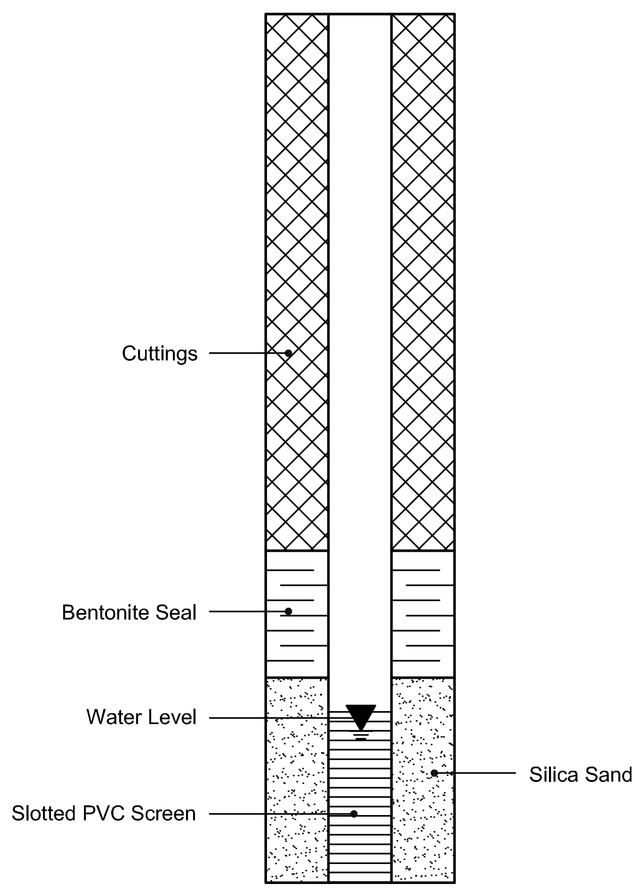


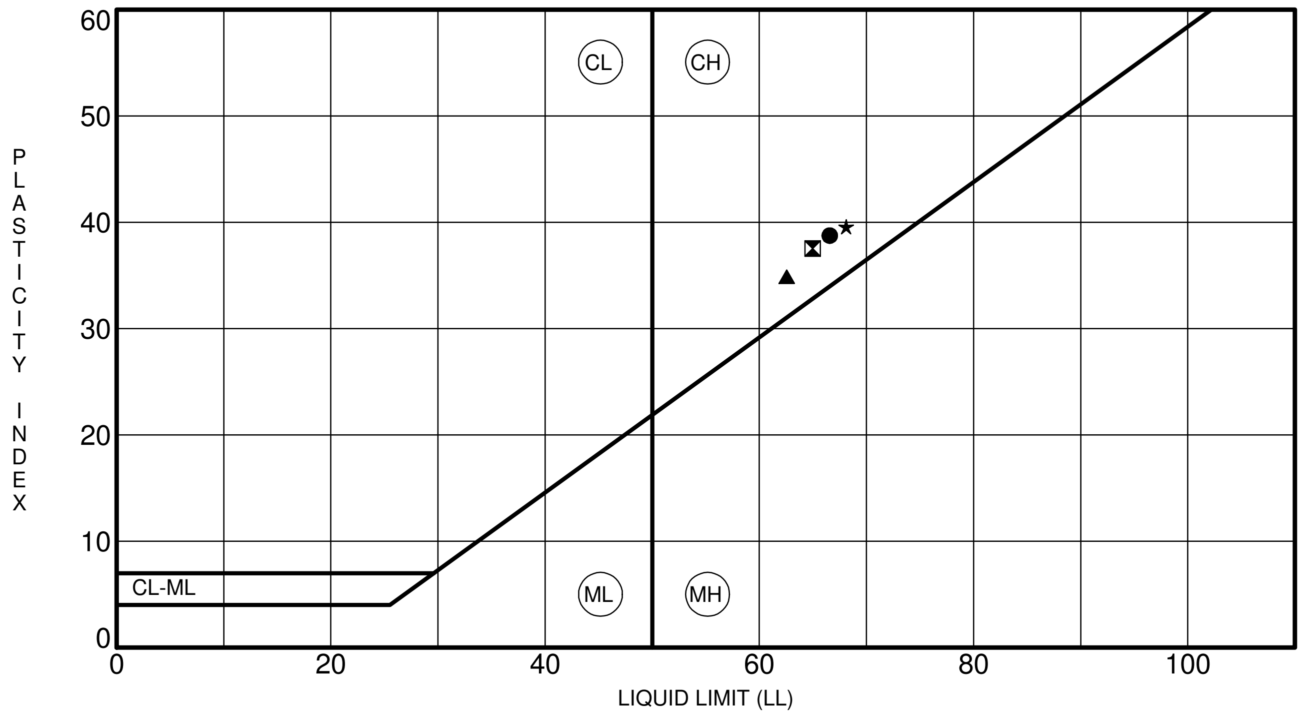
MONITORING WELL AND PIEZOMETER CONSTRUCTION

MONITORING WELL CONSTRUCTION



PIEZOMETER CONSTRUCTION





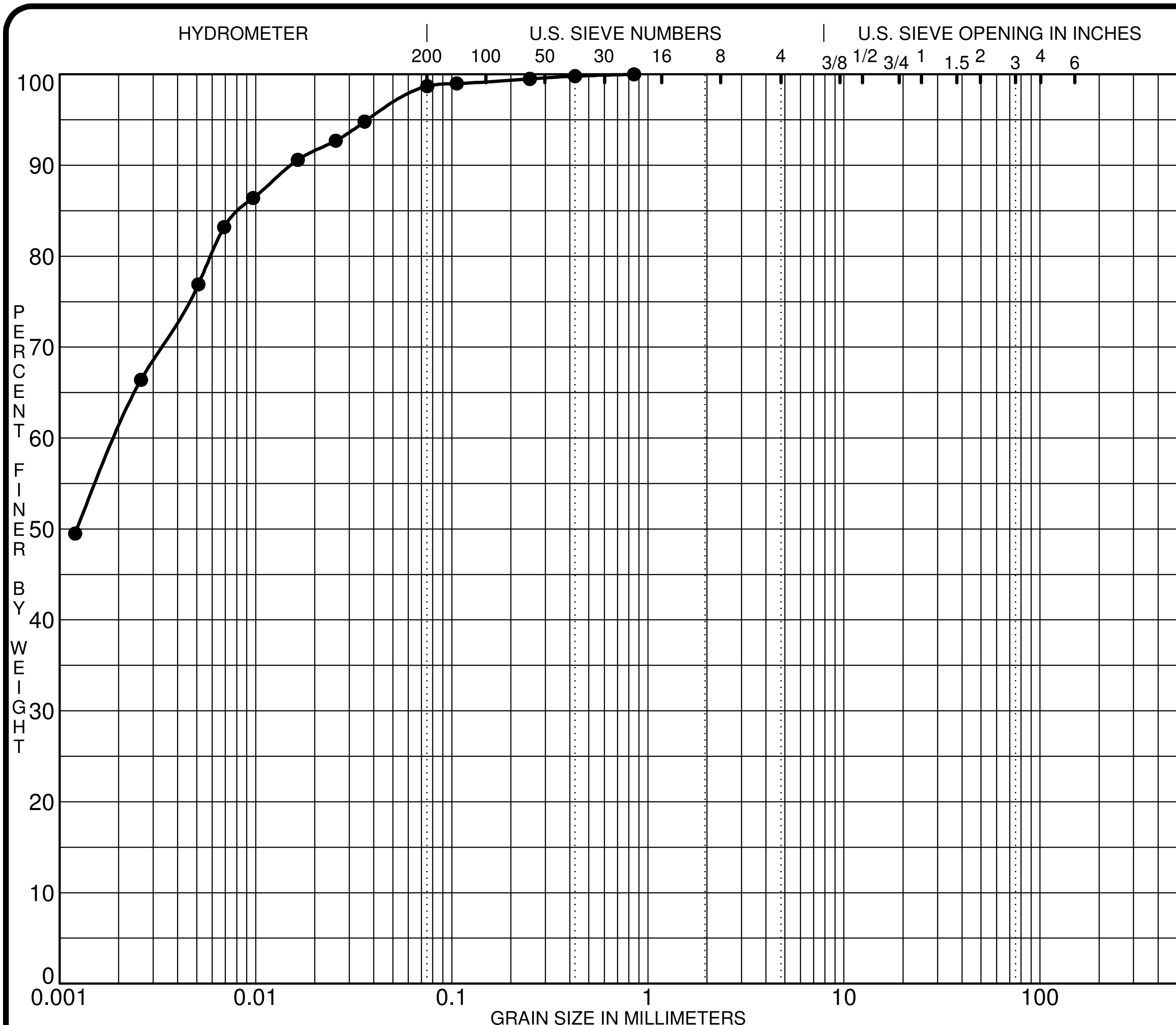
	Specimen Identification		LL	PL	PI	Fines	Classification
●	**BH 1-20**	**SS 3**	**67**	**28**	**39**		**CH - Inorganic clays of high plasticity**
⊠	**BH 2-20**	**SS 3**	**65**	**27**	**38**		**CH - Inorganic clays of high plasticity**
▲	**BH 3-20**	**SS 2**	**63**	**28**	**35**		**CH - Inorganic clays of high plasticity**
★	**BH 4-20**	**SS 2**	**68**	**29**	**40**		**CH - Inorganic clays of high plasticity**

CLIENT	**Richcraft Homes**	FILE NO.	**PG5397**
PROJECT	**Geotechnical Investigation - Trails Edge East - Blocks 193 & 194 - Brian Coburn Blvd.**	DATE	**29 Jun 20**

patersongroup **Consulting Engineers**

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

ATTERBERG LIMITS' RESULTS



SILT OR CLAY	SAND			GRAVEL		COBBLES
	fine	medium	coarse	fine	coarse	

	Specimen Identification		Classification	MC%	LL	PL	PI	Cc	Cu
●	**BH 3-20**	**SS 2**	**CH - Inorganic clays of high plasticity**						

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**BH 3-20**	**SS 2**	**0.85**	**0.00**			**0.0**	**1.3**	**98.7**	

CLIENT **Richcraft Homes**

FILE NO. **PG5397**

PROJECT **Geotechnical Investigation - Trails Edge East - Blocks 193 & 194 - Brian Coburn Blvd.**

DATE **29 Jun 20**

patersongroup **Consulting Engineers**

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

GRAIN SIZE DISTRIBUTION

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 29738

Report Date: 07-Jul-2020

Order Date: 30-Jun-2020

Project Description: PG5397

	Client ID:	BH3-20-SS2	-	-	-
	Sample Date:	29-Jun-20 09:00	-	-	-
	Sample ID:	2027206-01	-	-	-
	MDL/Units	Soil	-	-	-
Physical Characteristics					
% Solids	0.1 % by Wt.	67.4	-	-	-
General Inorganics					
pH	0.05 pH Units	7.39	-	-	-
Resistivity	0.10 Ohm.m	43.8	-	-	-
Anions					
Chloride	5 ug/g dry	26	-	-	-
Sulphate	5 ug/g dry	21	-	-	-

APPENDIX 2

FIGURE 1 - KEY PLAN

DRAWING PG5397-1 - TEST HOLE LOCATION PLAN

FIGURE 1

KEY PLAN

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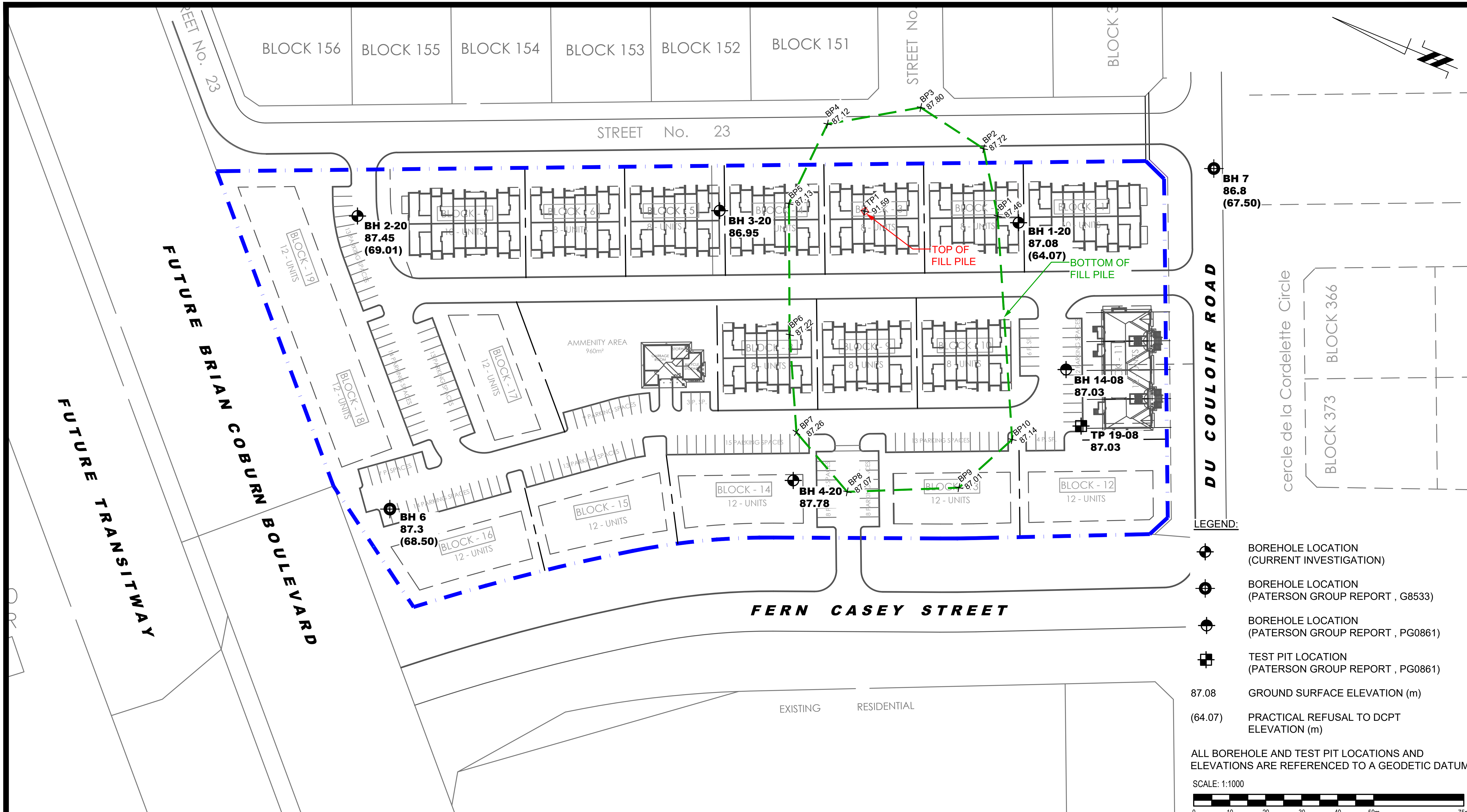


patersongroup
consulting engineers
154 Colonnade Road South
Ottawa, Ontario K2E 7J5
Tel: (613) 226-7381 Fax: (613) 226-6344

NO.	REVISIONS	DATE	INITIAL

RICHCRAFT HOMES
GEOTECHNICAL INVESTIGATION
PROPOSED RESIDENTIAL DEVELOPMENT - TRAILSEDGE EAST - BLOCK 193 AND 194
BRIAN COBURN BOULEVARD AT FERN CASEY STREET
OTTAWA, ONTARIO

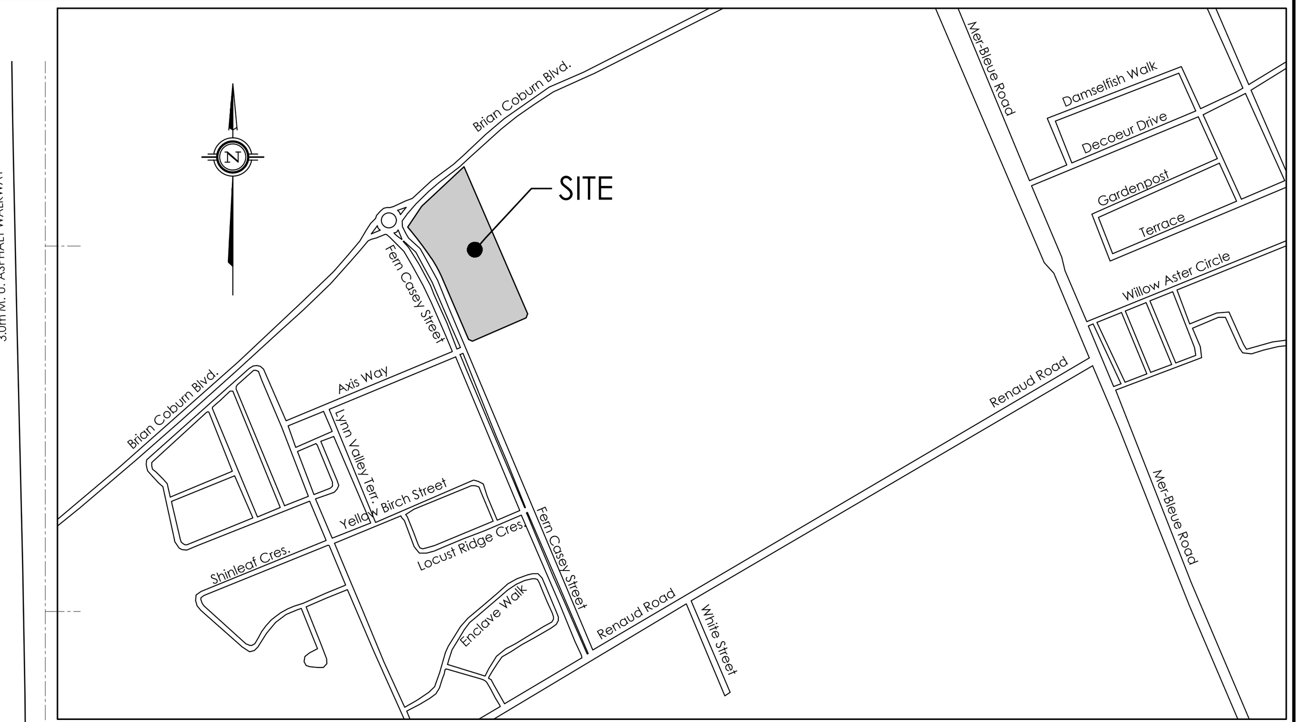
Title:

TEST HOLE LOCATION PLAN

Scale: 1:1000	Date: 07/2020
Drawn by: YA	Report No.: PG5397-1
Checked by: YT	Dwg. No.: PG5397-1
Approved by: SD	Revision No.:

p:\autocad drawings\geotechnical\pg53xx\pg5397\pg5397-1-test hole location plan.dwg

Appendix E - PROPOSED SITE PLAN



KEY PLAN
NOT TO SCALE

SITE INFORMATION :

PROPOSED ZONING : R4F - PERMITTED USES :
- PLANNED UNIT DEVELOPMENT
- STACKED DWELLING
- TOWNHOUSE DWELLING

SITE AREA : 26,051.7 m²
TOTAL BUILDING AREA : 8,357.3 m²

PROPOSED ZONING:	R4F	PROVIDED:
LOT AREA (MIN.):	1,400.0 m²	26,051.70 m² (2.60 ha)
LOT WIDTH (MIN.):	n/a	
FRONT YARD (MIN.) :	3.0 m	4.14 m
CORNER SIDE YARD (MIN.) :	3.0 m	Block 2 - 5.34 m Block 17 - 4.10 m
INTERIOR SIDE YARD (MIN.) :	n/a	
REAR YARD (MIN.) :	n/a	
BUILDING SPACING :		
BETWEEN BUILDING & PRIVATE WAY	1.8 m	4.00 m
BETWEEN GARAGE & PRIVATE WAY	5.2 m	6.71 m
BETWEEN BUILDINGS	1.2 m	3.80 m
MINIMUM LANDSCAPED AREA :	30.0%	45.4 % (11,833.4m²)
BUILDING HEIGHT (MAX.):	11.0 m	9.50 m
PORCH STAIR TO LOT LINE (SECTION 65)	0.60 m	1.14 m
MINIMUM LANDSCAPING for PARKING LOTS (SECTION 110) :	15.0% of PARKING LOT AREA:	PARKING LOT AREA: 4,058.0m² LANDSCAPED AREA: 1,857.0m² 45.7 %

TOTAL AMENITY AREA REQUIRED :
- STACKED DWELLING 6.0m² x 96 = 576.0 m²
COMMUNAL AMENITY AREA REQ'D. (MIN.):
50% of 576 m² = 288.0 m²

- PRIVATE AMENITY AREA -
(BALCONIES & PATIOS) 6.5m² x 96 = 624.0 m²
- COMMUNAL AMENITY AREA - 1,130.0 m²
TOTAL AMENITY AREA PROVIDED : 1,754.0 m²

ACCESSORY BUILDING	R4F	PROVIDED:
BUILDING HEIGHT (MAX.):	4.5 m	4.50 m
FLOOR AREA (MAX.) :	200.0 m²	152.00 m²

TERRACE FLATS PARKING :
PARKING REQUIRED : 1.2 Spaces / (96) d.u. + 0.2 / (96) d.u. (Visitor) = 115.2 + 19.2 = 134.4 Spaces
PARKING PROVIDED : 116 Spaces + 20 Visitor Spaces = 136 Spaces

BICYCLE PARKING REQUIRED : 96 (0.5 / (96) d.u.) = 48.0 Spaces
BICYCLE PARKING PROVIDED : 50 Interior Spaces

STREET BACK to BACK TOWNHOMES :

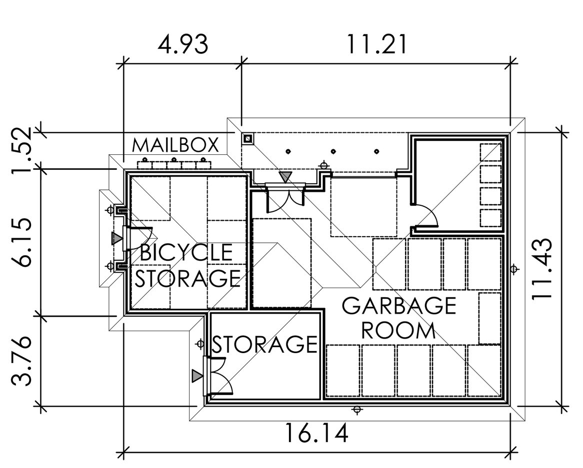
BLOCK No. :		BUILDING AREA:	GROSS FLOOR AREA:	No. UNITS:
BLOCK 1 =	BACK to BACK TOWNHOMES	544.3 m²	1,281.1 m²	10 UNITS
BLOCK 2 =	BACK to BACK TOWNHOMES	436.0 m²	1,026.6 m²	8 UNITS
BLOCK 3 =	BACK to BACK TOWNHOMES	436.0 m²	1,026.6 m²	8 UNITS
BLOCK 4 =	BACK to BACK TOWNHOMES	436.0 m²	1,026.6 m²	8 UNITS
BLOCK 5 =	BACK to BACK TOWNHOMES	436.0 m²	1,026.6 m²	8 UNITS
BLOCK 6 =	BACK to BACK TOWNHOMES	436.0 m²	1,026.6 m²	8 UNITS
BLOCK 7 =	BACK to BACK TOWNHOMES	438.5 m²	1,026.6 m²	8 UNITS
BLOCK 8 =	BACK to BACK TOWNHOMES	436.0 m²	1,026.6 m²	8 UNITS
BLOCK 9 =	BACK to BACK TOWNHOMES	436.0 m²	1,026.6 m²	8 UNITS
BLOCK 10 =	BACK to BACK TOWNHOMES	436.0 m²	1,026.6 m²	8 UNITS
BLOCK 11 =	BACK to BACK TOWNHOMES	438.5 m²	1,026.6 m²	8 UNITS
TOTAL =		4,909.3 m²	11,547.1 m²	90 UNITS

TERRACE FLATS :

BLOCK No. :		BUILDING AREA:	GROSS FLOOR AREA:	No. UNITS:
BLOCK 12 =	TERRACE FLATS	412.0 m²	1,219.0 m²	12 UNITS
BLOCK 13 =	TERRACE FLATS	412.0 m²	1,219.0 m²	12 UNITS
BLOCK 14 =	TERRACE FLATS	412.0 m²	1,219.0 m²	12 UNITS
BLOCK 15 =	TERRACE FLATS	412.0 m²	1,219.0 m²	12 UNITS
BLOCK 16 =	TERRACE FLATS	412.0 m²	1,219.0 m²	12 UNITS
BLOCK 17 =	TERRACE FLATS	412.0 m²	1,219.0 m²	12 UNITS
BLOCK 18 =	TERRACE FLATS	412.0 m²	1,219.0 m²	12 UNITS
BLOCK 19 =	TERRACE FLATS	412.0 m²	1,219.0 m²	12 UNITS
BICYCLE / GARBAGE =		152.0 m²	152.0 m	
TOTAL =		3,448.0 m²	9,904.0 m	96 UNITS

SNOW STORAGE : SNOW STORAGE WILL BE OFF SITE.

NOTE:
SITE PLAN TO BE READ IN CONJUNCTION WITH :
- SITE SERVICING PLAN PREPARED BY ______________________.
- LANDSCAPING PLAN PREPARED BY ______________________.
- BOUNDARIES DERIVED FROM : SITE PLAN ______________________.
PLAN PREPARED BY ______________________.



ACCESSORY BUILDING - 152m²
60 BICYCLE PARKING SPACES

LEGEND:

D.C.	- DEPRESSED CURB
	- WALL MOUNT LIGHT FIXTURE
L. D. LINE	- LIMITING DISTANCE LINE
GM	- GAS METER LOCATION
	- FIRE HYDRANT

5 20 50 100m
0 10 30 75

M. David Blakely
Architect Inc.
2200 Prince of Wales Dr. - Suite 101
Ottawa, Ontario K2E 6Z9
Phone (613) 226-8811 Fax (613) 226-7942

GENERAL NOTES:
1. THE CONTRACTOR IS RESPONSIBLE FOR CHECKING AND VERIFYING ALL DIMENSIONS, ANY DISCREPANCY MUST BE REPORTED TO M. DAVID BLAKELY ARCHITECT INC.
2. ALL WORK AND MATERIALS TO BE IN COMPLIANCE WITH ALL CODES, REGULATIONS, AND BY-LAWS.
3. ADDITIONAL DRAWINGS MAY BE ISSUED FOR CLARIFICATION TO ASSIST THE PROPER EXECUTION OF WORK. SUCH DRAWINGS WILL HAVE THE SAME MEANING AND INTENT AS IF THEY WERE INCLUDED WITH THE PLANS IN CONTRACT DOCUMENTS.
4. DO NOT SCALE DRAWINGS.
5. THIS DRAWING SHALL NOT BE USED FOR PERMIT OR CONSTRUCTION UNLESS THE DRAWING BEARS THE ARCHITECT'S SEAL AND SIGNATURE.
6. THIS REPRODUCTION SHALL NOT BE ALTERED

CONSTRUCTION NORTH

SEAL

REVISIONS

No.	DATE	DESCRIPTION	INIT.
10.	27/08/20	REVISED B/B TOWN LAYOUT	SM
9.	25/08/20	REVISED BLOCK SEPARATIONS	SM
8.	11/08/20	REVISED BLOCK LAYOUT	SM
7.	16/07/20	ADDED ACCESS PATHWAYS	SM
6.	30/06/20	FOR REVIEW	SM
5.	26/03/20	REMOVED TRANSFORMER LOCATIONS	SM
4.	06/03/20	FOR REVIEW	SM
3.	26/02/20	FOR REVIEW	SM
2.	26/09/19	FOR REVIEW	SM
1.	19/09/19	FOR REVIEW	SM

REVISIONS

No.	DATE	DESCRIPTION	INIT.
20.			
19.			
18.			
17.			
16.			
15.	10/12/20	REV. SIDEWALK @ COULOIR ROAD	SM
14.	02/12/20	REV. BLKS. 18&19 PATHWAY	SM
13.	20/11/20	GENERAL REVISIONS	SM
12.	05/11/20	REV. BLKS. 1-7 & ACC. BLDG.	SM
11.	03/09/20	REVISED B/B TOWN LAYOUT	SM

PROJECT
186 UNIT
TERRACE FLATS & B/B TOWNHOMES
TRAILSEDGE BLOCK 193 & 194
OTTAWA, ONT.

DRAWING TITLE
SITE PLAN

CLIENT
RICHCRAFT
Group Of Companies

DATE	SCALE	SHEET No.
SEPT., 2019.	1:500	SP-1
DRAWN BY: SBM	CHECKED MDB	

Appendix F- DRAWINGS