david schaeffer engineering ltd

120 Iber Road, Suite 103
Ottawa, Ontario K2S 1E9
Tel. (613)836-0856
Fax (613) 836-7183
www.DSEL.ca

FUNCTIONAL SERVICING REPORT

FOR

7000 CAMPEAU DRIVE

CITY OF OTTAWA

MINTO COMMUNITIES ON BEHALF OF CLUBLINK CORPORATION ULC

PROJECT NO.: 18-1061

JUNE 2021 – SUBMISSION 3

FUNCTIONAL SERVICING REPORT
FOR
7000 CAMPEAU DRIVE

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1.0 INTRODUCTION

David Schaeffer Engineering Limited (DSEL) and J.F. Sabourin and Associates (JFSA) have been retained by Minto Communities on behalf of ClubLink Corporation ULC to prepare a Functional Servicing Report (FSR) in support of the redevelopment of the existing Kanata Golf and Country Club lands located at 7000 Campeau Drive, Ottawa. This FSR has been updated where required in response to comments received from first and second submissions to the City of Ottawa. The updates also reflect a revised redevelopment concept plan which has been developed to address City and public concerns.

The subject property is located within the City of Ottawa urban boundary, in the Kanata North Ward. As illustrated in the ***Location Plan*** found in ***Appendix A***, the subject property is comprised of four parcels of land and measures approximately ***70.9 ha*** in area. The parcels are accessed from Campeau Drive and Knudson Drive. Kanata Avenue is to the west and the site is north of Highway 417. The lands are currently zoned Parks and Open Space (O1A).

The planned residential redevelopment involves the construction of single family (detached) homes, townhomes, and medium density products. The current unit breakdown, based on the NAK Design Strategies '*Revised Concept Plan' (dated 25 February 2021)*, attached as ***Figure 2*** in ***Appendix A*** is as follows:

Table 1
Proposed Unit Breakdown

Unit Type		Number of Units	Person per unit (1)	Estimated Population
Single Family		654	3.4	2,224
Front Drive Townhomes		247	2.7	667
Back-to-Back Townhomes		68	2.7	184
Stacked Townhome Block		74	2.3	171
Medium Density		437	2.3	1005
		1,480		4,251

(1) Per unit populations extracted from Section 4.3 of the City of Ottawa Sewer Design Guidelines, October 2012.

The purpose of this functional servicing report is to provide support for the draft plan approval of the subject property. The report will demonstrate that the proposed redevelopment area can be supported by municipal services based on design criteria of the City of Ottawa, the Ontario Ministry of the Environment, Conservation and Parks (MECP) and general industry practice.

1.1 Existing Conditions/Servicing

The proposed redevelopment land area is currently utilized as a golf course facility (Kanata Golf and Country Club) and is owned and operated by ClubLink ULC. The site topography varies, following land contours, and consists of landscaped areas typical of golf course composition.

The existing surrounding community right-of-ways (ROW) contain various sizes of sanitary/storm sewers and watermain infrastructure. The location and sizes are reflected in the servicing drawings included at the rear of this report. Additionally, existing storm and sanitary easements transect the property at various locations. These easements are proposed to be relocated according to the redevelopment plans. Relocation of any trunk servicing infrastructure will ultimately be coordinated with City staff and appropriate MECP Environmental Compliance Approvals.

1.2 Required Permits / Approvals

The following table summarizes a list of potential permits and / or approvals.

Table 2: Required Permits / Approvals

Agency	Approval Type	Trigger	Remarks
City of Ottawa	Application for Zoning Amendment and Plan of Subdivision	Application by Proponent	
City of Ottawa	Site Plan Applications for multi-unit blocks	Application by Proponent	
Ministry of the Environment, Conservation and Parks (MECP)	Environmental Compliance Approval for sanitary and storm sewers	Construction of new sanitary and storm sewers throughout the subdivision.	The MECP will issue an ECA for the sanitary and storm sewer design through the City of Ottawa transfer of review process.
(MECP)	Environmental Compliance Approval for stormwater management	Construction of new stormwater facilities throughout the subdivision.	The MECP will issue an ECA for the stormwater management design through the City of Ottawa transfer of review process.
City of Ottawa	Commence Work Notification (CWN)	Construction of new sanitary and storm sewers throughout the subdivision.	The City of Ottawa will issue a commence work notification for construction of the sanitary and storm sewers once an ECA is issued by the MECP.

City of Ottawa	MECP Form 1 – Record of Watermains Authorized as a Future Alteration	Construction of watermains throughout the subdivision.	The City of Ottawa is expected to review the watermains on behalf of the MECP through the Form 1 – Record of Watermains Authorized as a Future Alteration.

1.3 Existing Studies, Guidelines, and Reports

The following studies were utilized in the preparation of this report:

- Ottawa Sewer Design Guidelines,
  City of Ottawa, *SDG002,* October 2012
  (City Standards)
  - Technical Bulletin ISDTB-2014-01
    City of Ottawa, February 5, 2014
    (ITSB-2014-01)
  - Technical Bulletin PIEDTB-2016-01
    City of Ottawa, September 6, 2016
    (PIEDTB-2016-01)
  - Technical Bulletin ISTB-2018-01
    City of Ottawa, March 21, 2018
    (ISTB-2018-01)
  - Technical Bulletin ISTB-2018-04
    City of Ottawa, June 27, 2018
    (ISTB-2018-04)
  - Technical Bulletin ISTB-2019-02
    City of Ottawa, July 18, 2019
    (ISTB-2019-02)

- Ottawa Design Guidelines – Water Distribution
  City of Ottawa, July 2010.
  (Water Supply Guidelines)
  - Technical Bulletin ISD-2010-2
    City of Ottawa, December 15, 2010.
    (ISD-2010-2)
  - Technical Bulletin ISDTB-2014-2
    City of Ottawa, May 27, 2014.
    (ISDTB-2014-2)

  - Technical Bulletin ISTB-2018-02
    City of Ottawa, March 21, 2018
    (ISTB-2018-02)

- Design Guidelines for Sewage Works,
  Ministry of the Environment, Conservation and Parks, 2008 (formerly MOECC).
  (MECP Design Guidelines*)*

- Stormwater Planning and Design Manual,
  Ministry of the Environment, March 2003. (formerly MOE)
  (SWMP Design Manual)

- Ontario Building Code Compendium
  Ministry of Municipal Affairs and Housing Building Development Branch,
  January 1, 2010 Update *(OBC)*

- Water Supply for Public Fire Protection
  Fire Underwriters Survey, 1999.
  (FUS)

- City of Ottawa Infrastructure Master Plan, 2013

- Kanata North Community Design Plan, Master Servicing Study
  Novatech Engineering, June 28, 2016. *(KNCDP)*

- Geotechnical Investigation, Kanata Lakes Golf and Country Club, 7000 Campeau Drive, Ottawa, Ontario
  Paterson Group, May 2020 (Report: PG4135-2 Rev4) *(Paterson Geotechnical Report)*

- Master Sanitary Servicing Plan – Kanata Lakes, Broughton & Interstitial Lands
  Stantec Consulting Ltd., December 2007. (*Stantec MSSP*)

- West Urban Community (WUC) Wastewater Collection Model Development and System Capacity Assessment
  Stantec Consulting Ltd., May 2012. (*Stantec WUC Model*)

- West Urban Community – Wastewater Collection System Master Servicing Plan
  R.V. Anderson Associates Ltd., July 2012. (*RVAA Wastewater MP)*

- Kanata Golf and Country Club – 2018 Surface Infiltration Testing
  J.F. Sabourin and Associates Inc., February 6, 2019 (*JFSA Infiltration*)

- Kanata Golf & Country Club, 2019 Monitoring & Hydrologic Model Calibration Report
  J.F. Sabourin and Associates Inc., (Updated July 2020) (*JFSA Calibration)*

- 7000 Campeau Drive Subdivision – Preliminary Stormwater Management Plan
  J.F. Sabourin and Associates Inc., June 2021 (*JFSA SWM Plan)*

- Downstream of 7000 Campeau Drive – Hydrologic Assessment
  J.F. Sabourin and Associates Inc., June 2021 (*JFSA Hydrologic Assessment)*

- Kizell Drain Downstream of 7000 Campeau Drive – Geomorphological and Erosion Threshold Assessment, Kanata, Ontario
  GEO Morphix., May 2021 (*GEO Morphix Assessment)*

2.0 WATER SUPPLY SERVICING

The subject property lies within the City of Ottawa 3W pressure zone, as shown by the Pressure Zone map excerpt found in ***Appendix B***.

Potable water pressure is regulated in this pressure zone by the Campeau Drive P.S., Glen Cairn P.S., and the Stittsville Elevated Tank. The Campeau Drive P.S. and Glen Cairn P.S. both have a Nominal Discharge HGL of 160 m, according to the City of Ottawa Infrastructure Master Plan. The facilities combined have a total capacity of 187.5 ML/d and a firm capacity of 107.5 ML/d. The Stittsville Elevated tank is at 161 m and manages 4.5 ML of potable water.

The various design criteria are summarized in the following table.

Table 3: Water Supply Design Criteria

Design Parameter	Value
Residential - Single Family	3.4 p/unit
Residential - Townhome	2.7 p/unit
Residential – Medium Density	1.8 p/unit
Institutional	28,000 L/ha/day
(1) Residential – Basic Day Demand (BSDY)	280 L/cap/day
(1) Residential - Maximum Daily Demand (MXDY)	2.5 x Average Daily Demand
(1) Residential – Peak Hour Demand (PKHR)	2.2 x Maximum Daily Demand
Fire Flow	Calculated as per the Fire Underwriter’s Survey 1999.
Minimum Watermain Size	150 mm diameter
Service Lateral Size	19 mm dia Soft Copper Type ‘K’ or approved equivalent
Minimum Depth of Cover	2.4 m from top of watermain to finished grade
Peak hourly demand operating pressure	275 kPa and 690 kPa
Fire flow operating pressure minimum	140 kPa
(1) Extracted from Section 4: Ottawa Design Guidelines, Water Distribution (July 2010), ISDTB-2010-2	

The internal watermains will connect to existing watermain infrastructure within the adjacent residential development ROWs.

The contemplated and existing watermains are depicted in ***Drawing 1,*** provided in ***Appendix E*** of this report. A preliminary hydraulic analysis was prepared for the water distribution network to confirm that water supply is available within the required pressure range, under the anticipated demand during average day, peak hour and fire flow conditions and was based on boundary conditions requested from the City of Ottawa. Refer to the *Hydraulic Capacity and Modeling Analysis, 7000 Campeau Drive Development Area – Kanata (May 3, 2021)* prepared by GeoAdvice Engineering Inc. ***(GeoAdvice Water Analysis)***, enclosed in ***Appendix B.***

2.1 Fire Flow Demand

Detailed Fire flow calculations for single detached dwellings have not been provided for this functional level analysis. However, typical values for single detached dwellings and traditional townhomes at the City of Ottawa's cap of 10,000 L/min (167 L/s) have been used as outlined in *ISDTB-2014-02*. The required fire flow for higher density back-to-back townhomes is 15,000 L/min (250 L/s) so a conservative fire flow of 250 L/s was assumed, which is a typical requirement for similar land uses.

2.2 Boundary Conditions

Boundary conditions were requested from the City of Ottawa for Peak Hour, Max Day Plus Fire Flow and Maximum HGL (high pressure check) conditions and can be found in the appendices of the ***GeoAdvice Water Analysis***, located in ***Appendix B*** of this report. At the time of the boundary condition request the redevelopment area concept plan was still being developed, as such, a conservative unit density of 28 units/ha was used to assess the potential water demands for the generation of the boundary conditions. This conservative estimate ensured that the analysis completed would be reflective of the ability of the existing water supply network to service the property (i.e. evaluated for a population of approximately 5,600 persons as opposed to the current estimated population of 4,251 noted in Table 1).

The following tables demonstrate that the current redevelopment concept (as per ***Table 1*** of this report) results in a unit and associated population count that is lower than the data used to generate the boundary conditions. As such, the boundary conditions were conservative for the proposed redevelopment area.

Table 4A: Estimated Water Demands (Connections 1 and 2)

Demand Type	Demand	
	Preliminary Demands Submitted for Boundary Conditions (1)	**Refined Demands for Current Concept Plan**
	L/min	**L/min**
Average Daily Demand	282.9	**150.0**
Maximum Daily Demand	707.3	**366.0**
Peak Hour	1556.0	**810.0**
Fire Flow #1 Demand	10,000	**10,000**
(1) Based on Connection Points #1 and #2 as shown in the Boundary Conditions provided by City of Ottawa		

Table 4B: Estimated Water Demands (Connections 3 to 6)

Demand Type	Demand	
	Preliminary Demands Submitted for Boundary Conditions(1)	**Refined Demands for Current Concept Plan**
	L/min	**L/min**
Average Daily Demand	811.6	**642.0**
Maximum Daily Demand	2029.0	**1608.0**
Peak Hour	4463.9	**3534.0**
Fire Flow #1 Demand	15,000	**15,000**
(1) Based on Connection Points #3, 4, 5 & 6 as shown in the Boundary Conditions provided by City of Ottawa		

2.3 Summary of Hydraulic Modeling Analysis

A complete watermain analysis has been prepared to confirm that the proposed redevelopment is serviceable with appropriate sized watermain infrastructure. Preliminary analysis for the network indicates that 200 mm, 250 mm and 300 mm diameter sizes will deliver potable water throughout the proposed redevelopment during average daily, peak hourly, and fire flow scenarios.

Refer to the ***GeoAdvice Water Analysis,*** enclosed in ***Appendix B.***

2.3.1 System Pressures

The modeling indicates that the proposed redevelopment can be adequately serviced by the proposed watermain network. Modeled service pressures for the proposed redevelopment are summarized in the following table while the detailed pipe and junction tables are contained in the ***GeoAdvice Water Analysis,*** enclosed in ***Appendix B.***

Table 5: Summary of Available System Pressures

	Average Day Demand Maximum Pressure		Peak Hour Demand Minimum Pressure	
	kPA	psi	kPA	psi
Development Area	651	94	537	78

The generally accepted best practice is to design new water distribution systems to operate between 350 kPa (50 psi) and 480 kPa (70 psi), as outlined in the City of Ottawa Design Guidelines. Based on the anticipated service pressures, pressure reducing valves may be required in the redevelopment area.

2.3.2 Available Fire Flows

The minimum allowable pressure under fire flow conditions is 140 kPa (20 psi) at the location of the fire. A summary of the available fire flows is presented in ***Table 6,*** below. The detailed fire flow reports are found in the ***GeoAdvice Report*** enclosed in ***Appendix B***.

Table 6: Summary of Available Fire Flows

	Required Fire Flow (L/s)	Minimum Available Flow (L/s)	Junction ID
Development Area	167	221	J-5
	250	270	J-2

As shown in the above table, the model predicts the network will be able to provide all required fire flows based on the boundary conditions provided. Detailed results are included in the ***GeoAdvice Report***, enclosed in ***Appendix B***. In the circumstance of redevelopment phasing, the appropriate analyses would be undertaken to ensure that sufficient fire flows are available at each stage of the redevelopment.

2.4 Water Supply Conclusion

The watermain network must be capable of delivering potable water within the City's recommended pressure ranges during average daily, peak hour, and maximum day plus fire flow demands. Preliminary analysis for the network indicates that a series of contemplated 200 mm, 250 mm and 300 mm diameter sizes will sufficiently deliver potable water throughout the contemplated redevelopment, with connections to existing watermains at Campeau Drive, Knudson Drive and Weslock Way.

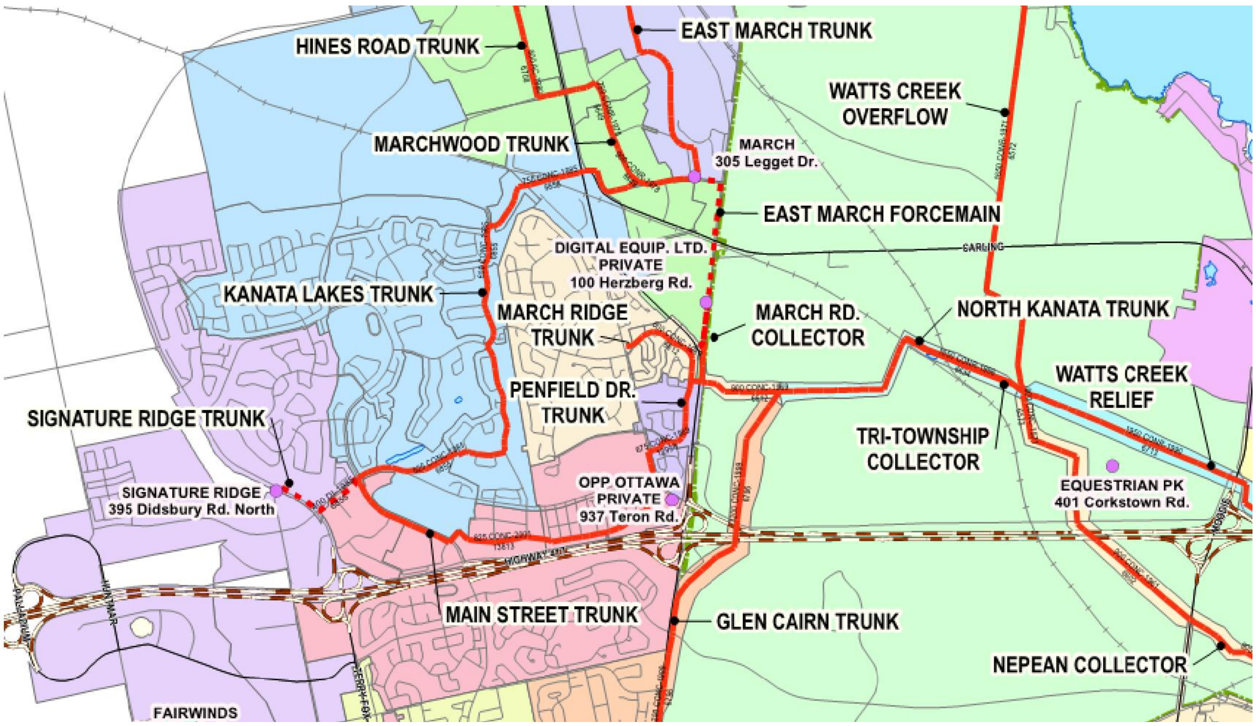
Water supply will be available within the required pressure range under the anticipated demand during average day, peak hour and fire flow conditions. Phase specific analysis would be undertaken to ensure that the system is sufficiently serviced during various stages of redevelopment.

The proposed water supply design conforms to all relevant City guidelines and policies.

3.0 WASTEWATER SERVICING

The subject property is located within the Kanata Lakes Trunk Sewer catchment area. The existing trunk sewer bi-sects the southern portion of the property, in a northeasterly direction, from Campeau Drive to Rosenfield Crescent. This section of the trunk sewer is a 525 mm diameter pipe and ranges between 4 m and 6 m deep.

The following overview image extracted from the City of Ottawa '*Sanitary Trunk Sewers and Collection Area Map*' (April 2014) illustrates the catchment area and trunk sewer routing.



In the current condition, the Kanata Lakes Trunk Sewer conveys flow to the 900 mm Marchwood Trunk Sewer on Legget Drive (west of Schneider Road) where wastewater flows are then conveyed to the March Road Pumping Station (***March P.S.***). The Village of Carp, the existing business park west of Herzberg Road, Morgan's Grant, and Shirley's Brook Communities are tributary to the ***March P.S.*** Flow is conveyed through the ***March P.S.*** by a forcemain within Legget Drive and Herzberg Road to the North Kanata Trunk.

Redevelopment of the subject property will utilize the Kanata Lakes Trunk Sewer and adjacent local sewers to service the property. Connection points and peak wet weather flow are summarized in the following table.

Table 7: Summary of Wastewater Connections

Connection Point Description	Proposed Area (Ha)	Proposed Population	Peak Flow (L/s)	Connection MH (DSEL)[1]	Connection MH (City HGL Analysis)[2]
Relocated Trunk Sewer, North of Campeau Drive	18.13	1412	20.50	---	MHSA00857
Knudson Drive, South of Sherk Crescent	3.50	281	4.32	MH1006A	MHSA00850
Knudson Drive, North of Sherk Crescent	12.29	981	14.37	---	MHSA00841
Knudson Drive, East of Kanata Avenue	9.14	733	10.87	MH4018A	---
Weslock Way, North of Knudson Drive	6.27	503	7.58	---	MHSA00834
Weslock Way, South of Zokol Crescent	9.22	739	10.96	MH4040A	---
Weslock Way, North of Zokol Crescent	5.54	451	6.79	---	MHSA00827
Total	**64.09**	**5100**	**75.39[3]**		

1) Refer to Drawing 2 in Appendix E for DSEL MH identification
2) Refer to HGL Analysis prepared by the City of Ottawa included in ***Appendix C*** for City MH identification
3) Total Peak Wet Weather Flow not summative due to differing time to peak (Harmon's Peaking Factor for Total = 2.77)

The total anticipated wet weather flow contributions from the subject property to the Kanata Lakes Trunk Sewer is ***75.39 L/s***, refer to ***Appendix C*** for anticipated wastewater calculations.

The Kanata Lakes Trunk sewer was previously tributary to the March P.S. However, the potential new development flows will in future be managed by the North Kanata Trunk – Phase 2 (NKT2), currently under construction with completion expected in mid to late 2021. The NKT2 will convey flows from the Marchwood Trunk Sewer to the Watts Creek Relief Sewer (see further discussion later in Section 3.1).

The Kanata North Community Design Plan (***KNCDP)*** for the Kanata North Urban Expansion Area (***KNUEA***) summarizes that the lower-reach of the Marchwood Trunk has a free-flowing capacity of ***1,100 L/s*** with an estimated peak flow of ***230 L/s*** in 2010 and projected flow of ***592 L/s*** in 2031 (which includes the ***KNUEA*** area). The residual capacity in the existing and future condition is sufficient to convey the anticipated flow from the subject property. Excerpts from the ***KNCDP*** are provided in **Appendix C**.

A detailed review of the available capacity within the existing Kanata Lakes Trunk Sewer up to the Marchwood Trunk has been provided in the attached calculation sheets, found in ***Appendix C***. The following City criteria, summarized in the following table, below were used to evaluate the new flows into the existing system.

Table 8: Wastewater Design Criteria

Design Parameter	Value
Residential - Single Family	3.4 persons/unit
Residential - Townhome	2.7 persons/unit
Residential – Stacked Townhome & Medium Density	2.3 persons/unit
Residential - Average Daily Demand	280 L/d/per
Residential - Peaking Factor	Harmon's Peaking Factor. Max 4.0, Min 2.0
Harmon - Correction Factor	0.80
Institutional – Average Flow	28,000 L/ha/day
Institutional – Peaking Factor	1.5 if ICI in contributing area is >20% 1.0 if ICI in contributing area is <20%
Infiltration and Inflow Allowance	0.33 L/s/ha
Park Flow	9,300 L/ha/day
Sanitary sewers are to be sized employing the Manning's Equation	$Q = \frac{1}{n} A R^{2/3} S^{1/2}$
Minimum Sewer Size	200 mm diameter
Minimum Manning's 'n'	0.013
Minimum Depth of Cover	2.5 m from crown of sewer to grade
Minimum Full Flowing Velocity	0.6 m/s
Maximum Full Flowing Velocity	3.0 m/s
Extracted from Sections 4 and 6 of the City of Ottawa Sewer Design Guidelines, October 2012 and Technical Bulletin ISTB-2018-01.	

Refer to the ***Sanitary Servicing and Drainage Plan, Drawing 02D (Appendix E)*** and sanitary sewer design sheet in ***Appendix C*** for details.

Based on the sanitary design sheet, the anticipated wastewater flow from the subject property can be accommodated within the Kanata Lakes Trunk Sewer.

The City of Ottawa provided a Hydraulic Grade Line (HGL) analysis of the Kanata Lakes Trunk Sewer and Marchwood Trunk Sewer up to the ***March P.S.*** (to be the NKT2 in future) for the current (2013) and future (2060) conditions, see ***Appendix C***.

The 2013 model illustrates that sewers up to the ***March P.S.*** result in flows between ***43.83 L/s*** and ***295.67 L/s*** with conduits between ***23%-43%*** full at the critical nodes.

The 2060 model indicates that flows are between ***199.87 L/s*** and ***675.99 L/s*** with conduits between ***57%-80%*** full at critical nodes. The City has found no HGL issues in the 2013 and 2060 model scenarios. It is anticipated the wastewater flow from the subject property can be accommodated without a negative impact to the Kanata Lakes Trunk Sewer HGL.

Based on the above analysis of the ***March P.S.***, Marchwood Trunk and Kanata Lakes Trunk Sewer, there is sufficient capacity in the current condition to accommodate the anticipated flow of ***75.39 L/s*** from the subject property.

3.1 North Kanata Trunk – Phase 2

Based on correspondence with the City of Ottawa in April 2019, included in ***Appendix C***, there are future modifications anticipated to the wastewater trunk infrastructure and pump stations within the vicinity of the contemplated redevelopment, summarized further below.

As described in the *West Urban Community – Wastewater Collection System Master Servicing Plan (RV Anderson & Associates Ltd., 2013)* (***RVAA Wastewater MP***), *City of Ottawa Infrastructure Master Plan (2013)* **(*IMP)*** and *Kanata North Community Design Plan – Master Servicing Study (Novatech, 2016)* (***KNCDP***), a new gravity sanitary sewer from the ***March P.S.*** to the North Kanata Trunk Sewer (NKT2) is being installed. Additionally, the City of Ottawa has provided a conceptual design of the modifications to the ***March P.S.*** and the future North Kanata Trunk – Phase 2 sewer, prepared by Jacobs (formerly CH2M Hill), which is included in ***Appendix C.*** The proposed construction of the NKT2, redirects flow from the Kanata Lakes Trunk and Marchwood Trunk from the ***March P.S.,*** thus providing a gravity connection to the North Kanata Trunk sewer. As a Phase 3 to the NKT2 work, the ***March P.S.*** will be converted to a lift station in order to continue to convey flows from the East March Trunk to the proposed NKT2.

As noted in the *West Urban Community (WUC) Wastewater Collection Model Development and System Capacity Assessment (Stantec 2012)* (***Stantec WUC Model***) report, a diversion structure was designed to limit the flow contributions to 140 L/s from the Signature Ridge catchment area to the Kanata Lakes Trunk. Once the flow level is achieved the excess flows are to be conveyed to the Main Street/Penfield Drive sewers. As per the correspondence in ***Appendix C*** from the City of Ottawa, upgrades to the Signature Ridge Pump Station (***SRPS***) and forcemain will be redirected away from the Kanata Lakes Trunk Sewer to the Penfield Trunk Sewer. Timing of the upgrades is to be confirmed by City of Ottawa. In accordance with the direction provided by the City of Ottawa in April 2019, the sanitary design sheet does not include the 140 L/s from the ***SRPS***.

An excerpt from the CH2M design report *North Kanata Trunk Sewer Phase 2* (February 2018) shows a table with various anticipated sanitary flows being considered. For the various sewer system segments the minimum excess capacity between the “Verified Design” and the “Pipe Capacity” is 116 L/s. The anticipated 75.39 L/s is within this excess capacity.

Based on the review of the contemplated changes to the ***March P.S.*** and ***SRPS***, there is available capacity in the future condition to accommodate the anticipated wastewater flow from the subject property.

3.2 Kanata Lakes Trunk Sewer Realignment

As noted previously, the existing Kanata Lakes Trunk Sewer bi-sects the southern portion of the property, in a northeasterly direction, from Campeau Drive to Rosenfield Crescent (see ***Sanitary Servicing and Drainage Plan***). It is presumed that the chosen alignment was simply the most efficient/direct (least disruptive) routing at that time given that it was traversing a relatively open area. In order to accommodate a more functional redevelopment layout for the property it is proposed to realign the trunk sewer to be within the redevelopment concept ROWs in order to optimize the land use conceptualized.

Based on as-built information available the existing capacity of the trunk sewer through the site is approximately 215 L/s with a full flowing velocity of 0.99m/s (Note: the existing sewers are indicated as being without drops in the manholes). The extent of existing sewer proposed to be realigned is approximately 340 meters. The new contemplated sewer alignment has a total length of approximately 550m with start and end inverts of 96.48m and 95.53m respectively. Based on the upstream and downstream connection elevations, and consideration for drops through manholes, the new average slope will be 0.10%. Therefore, the new sewer capacity would be ~136 L/s with a full flowing velocity of 0.63 m/s. However, as noted above, if consideration to this same allowance of minimizing drops through manholes is made for the realigned sewer (at least in straight sections) the overall average sanitary slope/capacity could be increased.

The City's future conditions model indicates a total flow of 200 L/s with ***SRPS*** flows removed (i.e. 140 L/s).

4.0 STORMWATER MANAGEMENT

The subject lands are tributary to the Kizell Drain Wetland Complex and Watts Creek. Lands west of Knudson Drive and Weslock Way drain to the Kizell Drain Wetland Complex, while the lands to the east are tributary to Watts Creek. Drainage from the entire redevelopment is conveyed to the various outlets through existing storm sewers.

It is proposed that the redevelopment will be serviced by four (4) stormwater management facility (SWMF) locations comprised of (SWM) ponds and one (1) underground storage unit for quantity control. Quality control will be via a proposed Etobicoke Exfiltration System (EES). This sort of approach/configuration has been utilized within other development areas within the City of Ottawa (i.e. Barrhaven South Urban Expansion Area (BSUEA) and the Deer Run Subdivision in Stittsville) and facilitates both quality control and mitigation of impacts to the overall water budget for the site (see Section 4.2 for further discussion of this strategy). The stormwater management (SWM) facilities were strategically located at low points in the redevelopment where each could outlet to the existing storm trunk sewers along Knudson Drive / Weslock Way. The storm system layout, along with proposed EES and various SWMF locations, are illustrated in ***Drawing 03D*** found in ***Appendix E*** (preliminary storm sewer design sheets are in ***Appendix D***). In addition, ***Figure 02F*** has been provided in ***Appendix D*** to illustrate the catchment areas draining to each of the proposed SWM facilities.

To assess the operation of the proposed SWM ponds, the City of Ottawa provided detailed PCSWMM (hydrology & hydraulic) models of the existing major and minor systems that discharge to the Beaver Pond. This is a highly detailed model that was developed using the vast amounts of available City GIS data (topography, minor system, catch basin locations etc.). This model was reviewed with the data obtained from flow monitoring within the Campeau Drive, Weslock Way minor systems completed from June 2019 to October 2019, which showed a good correlation between the two data sets. Under separate cover, JFSA has prepared two studies detailing the stormwater monitoring data:

- "*Kanata Golf & Country Club, 2018 Surface Water and Rainfall Monitoring Program"* (February 2019); and
- "*Kanata Golf & Country Club, 2019 Monitoring & Hydrologic Model Calibration Report*" (July 2020)

The preceding studies outline the data obtained from the flow monitoring programs and explains how the data was used to produce a dependable hydrologic model of the area. Those reports should be referred to for full details.

Note that no major events greater than a 2-year event were observed during this period of monitoring. Based on this finding the highly detailed model was then updated by JFSA to the same level of detail to reflect the inclusion of the proposed redevelopment. These updates included all major system flow routes, all proposed minor system infrastructure and the 4 proposed SWM ponds. The proposed SWM ponds were appropriately sized to ensure the release rates from the ponds would not increase peak flows into the Beaver

Pond and would also not increase peak water levels within the existing infrastructure both upstream and downstream of the redevelopment. The full ***JFSA SWM Plan*** (provided under separate cover) provides the reporting, modelling, analysis and recommendations within the redevelopment. For ease of reference, the body text for the memo associated with the stormwater management pond sizing and preliminary stormwater management plan is provided in ***Appendix D***. For detailed modelling files the full JFSA report should be referenced.

The following table summarizes pond volumes and outflow rates based on the detailed modelling:

Table 9: Pond Size and Outflow Summary (1)

Pond	Tributary Area (ha)	5-Year Chicago (3hr) Peak Outflow (m^3/s)	5-Year Chicago (3hr) Storage (m^3)	100-Year Chicago (3hr) Peak Outflow (m^3/s)	100-Year Chicago (3hr) Storage (m^3)	100-Year SCS (24hr) Peak Outflow (m^3/s)	100-Year SCS (24hr) Storage (m^3)
Pond 1	57.44	0.050	7,895	0.102	18,650	0.116	23,180
Pond 2	26.66	0.073	3,613	0.149	9,366	0.158	10,410
Pond 3	48.37	0.160	6,799	0.318	17,540	0.347	20,560
Pond 4	12.73	0.026	1,880	0.041	5,166	0.043	5,988
Underground Storage	9.31	0.270	420	1.122	1,000	1.183	1,000

1) Pond outflow and storage values are derived directly from the JFSA modelling files provided with the *7000 Campeau Drive Subdivision – Preliminary Stormwater Management Plan* technical memo (See Appendix D for the body of that report).

The following table summarizes peak inflow to the Beaver Pond under pre and post-development conditions based on the detailed PCSWMM modelling.

Table 10: Peak Flow Summary – Inflow to Beaver Pond

Return Period	Pre-Development Peak Inflow (m^3/s)	Pre-Development Inflow Volume (m^3)	Post-Development Peak Inflow (m^3/s)	Post-Development Inflow Volume (m^3)
5 Year (Chicago 3Hr)	5.727	24,930	5.165	29,200
100 Year Chicago (3Hr)	9.218	64,440	8.464	78,870
100 Year SCS (24Hr)	9.413	80,420	9.290	106,600
100 Year SCS (24Hr+20%)	10.030	128,400	10.420	131,600

The proposed redevelopment will discharge to the Beaver Pond which ultimately discharges to Watts Creek. As demonstrated above, the peak inflow to the Beaver Pond for the simulated design storms are either equal to or less than the pre-development conditions. As anticipated, the total inflow volume to the Beaver Pond will be increased due to the redevelopment. The impacts of the increased volume is assessed in JFSA's "*Downstream of 7000 Campeau Drive – Hydrologic Assessment*" (June 2021) and reviews downstream impacts.

4.1 Impacts Downstream of Beaver Pond

To ensure that the redevelopment will have no adverse impacts on the receiving watercourse, the existing and proposed operations of the receiving watercourse were assessed using a higher level hydrologic (SWMHYMO) model per the ***JFSA Hydrologic Assessment***. The model used in this analysis contains all sub-catchments that drain to Watts Creek down to the Rideau River. The original model was developed by MVCA as a part of their 2017 floodplain mapping study of Watts Creek and JFSA has updated the model based on available field data to reflect the inclusion of the proposed redevelopment within it and assess pre and post-development flows on the Kizell Drain and Watts Creek under design storm circumstances (2-year to 100-year events) as well as continuous simulations to assess the potential for erosion concerns.

As a side note, the Environmental Compliance Approval associated with the Beaver Pond (Approval Number 5190-7L6RRY found in ***Appendix D***) specifies a controlled release rate of 0.960m^3/s to the Kizell Drain.

The following is a brief description of the scenarios assessed by JFSA:

MVCA Existing Conditions - (MVCAEX):

MVCA model of record reflective of the current conditions

Existing Conditions - (KWEX):

Reflective of the current conditions (2019) with various model parameters adjusted to reflect the field-collected data more accurately.

KNL Development - (KWEX_KNL9):

Reflective of existing conditions with the inclusion of the KNL Development Stage 9 in place as per IBI's detailed design. Stage 7 & 8 of the KNL have been left undeveloped as directed by City staff.

The Kanata Golf and Country Club Development with SWM controls + EES- (KWEX_KGC-EES):

Reflective of existing conditions with the proposed redevelopment of the Kanata Golf and Country Club in place with dry Storm Water Management (SWM) ponds sized to provide quantity controls and Etobicoke Exfiltration Systems implemented to provided quality controls throughout the site, to mitigate impacts both upstream and downstream of the development.

The Kanata Golf and Country Club Development with SWM controls + EES + KNL Development - (KWEX_KGC-EES_KNL9):

Reflective of existing conditions with the proposed redevelopment of the Kanata Golf and Country Club in place with dry Storm Water Management (SWM) ponds sized to provide quantity controls and Etobicoke Exfiltration Systems implemented to provided quality controls throughout the site, to mitigate impacts both upstream and downstream of the development. Includes the KNL

Development Stage 9 in place as per IBI's detailed design. Stage 7 & 8 of KNL have been left undeveloped as directed by the City.

4.1.1 Erosion Threshold Assessment (Kizell Drain)

GEO Morphix completed an Erosion Threshold Assessment on the Kizell Drain downstream of the Beaver Pond outlet. Section 5.2.1 of the ***GEO Morphix Assessment*** identified two (2) critical erosion locations along the watercourse:

"KDR-4" which extends from the outlet of Beaver Pond to a partially confined wetland area upstream of the CN Rail to the North;

The second location referred to as "KDR-3" extends from March Road to Legget Drive and is located between two large parking areas which drain directly to the riparian zone of the Kizell Drain.

From this analysis it was determined that the bed material has been relatively resilient to erosion over time with the bank materials more susceptible to erosion, as bank undercutting and sloughing were the most common forms of erosion observed throughout the watercourse. The erosion thresholds were calculated for the bank materials at these two locations, as they were determined to be the most sensitive reaches within the watercourse to erosion based on the field observations. The critical discharge to entrain materials within both KDR-4 (just downstream of the Beaver Pond) and KDR-3 (March Road and Legget Drive) was determined to be 0.3 m^3/s in Table 3 of the GEO Morphix report. Full details of this study findings can be found in in the ***GEO Morphix Assessment***.

4.1.2 Beaver Pond Outflow Results

The following table outlines the resulting outflows from the Beaver Pond as taken from the ***JFSA Hydrologic Assessment*** (the full tables and comparisons can be found in ***Appendix D*** for reference) based on the model scenarios summarized in Section 4.1. It is noted that the results from the Chicago 3Hr storm have not been tabulated below since the flows generated are consistently lower than the SCS storms shown and the worst case results are shown.

Table 11A: SCS 12-Hr Peak Outflow from Beaver Pond to Kizell Drain

	Peak Flow (m^3/s) based on SCS 12 hour Design Storm					
Scenario	**2-year**	**5-year**	**10-year**	**25-year**	**50-year**	**100-year**
MVCAEX	0.454	0.615	0.671	0.775	0.859	0.924
KWEX	0.314	0.486	0.599	0.718	0.792	0.854
KWEX_KNL9	0.369	0.538	0.64	0.757	0.826	0.889
KWEX_KGC-EES	0.283	0.463	0.578	0.689	0.749	0.805
KWEX_KGC-EES_KNL9	0.335	0.513	0.618	0.726	0.791	0.842

Table 11B: SCS 24-Hr Peak Outflow from Beaver Pond to Kizell Drain

	Peak Flow (m^3/s) based on SCS 24 hour Design Storm					
Scenario	**2-year**	**5-year**	**10-year**	**25-year**	**50-year**	**100-year**
MVCAEX	n/a	n/a	n/a	n/a	n/a	n/a
KWEX	0.358	0.548	0.642	0.745	0.813	0.881
KWEX_KNL9	0.414	0.589	0.684	0.783	0.846	0.911
KWEX_KGC-EES	0.322	0.521	0.618	0.714	0.776	0.833
KWEX_KGC-EES_KNL9	0.379	0.57	0.658	0.75	0.81	0.868

Table 11C: 100Yr SCS 24-Hr+20% Peak Outflow from Beaver Pond to Kizell Drain

	Peak Flow (m^3/s) based on 100Yr SCS 24 hour + 20% Design Storm
Scenario	
MVCAEX	n/a
KWEX	1.007
KWEX_KNL9	1.039
KWEX_KGC-EES	0.95
KWEX_KGC-EES_KNL9	0.985

The following is summarized from the preceding tables (complete ***JFSA Hydrologic Assessment*** tables can be found in ***Appendix D*** for reference):

- The 2017 MVCA existing conditions model (MVCAEX) is provided for context for the calibration process,
- The updated calibrated existing conditions model (KWEX) is considered as the baseline scenario;
- Scenario KWEX_KNL9 is considered to be the baseline condition for that development

- Comparing KWEX to KWEX_KGC-EES the peak flows are reduced for all events below existing conditions with reduction in the range of 4% to 10% depending on the particular event. The same is observed downstream at the Ottawa River with the scenario KWEX_KGC-EES resulting in a reduction in peak flows from pre-development levels for all events, with reductions in peak flow in the range of 0.0% to 0.6%;
- Comparing the peak flow results of the existing calibrated model (KWEX) to the scenario where only KNL Stage 9 is developed (KWEX_KNL9) an increase in peak flows out of the Beaver Pond is observed for all events in the range of 3% to 24% depending on the event reviewed. This increase continues all the way downstream to the Ottawa River where these increases in peak flows are in the range of 0.0% to 0.6%;
- When both Kanata Golf and Country Club (KGCC) and KNL Stage 9 developments are in place (KWEX_KGC-EES_KNL9), the peak flows for the design storm events are less than KNL Stage 9 alone, but still see an increase from the existing condition out of the Beaver Pond for most events. Though with both KGCC and KNL Stage 9 development the 100-year peak flows out of the Beaver Pond are still less than existing Note that the 100-year peak flows out of the Beaver Pond for KWEX_KGC-EES, KWEX_KNL9 and KWEX_KGC-EES_KNL9 are all less than 0.96 m^3/s as specified in the Certificate of Approval for the Beaver Pond issued in 2008;

The ***JFSA Hydrologic Assessment*** should be referenced for the full modelling, discussion and results summary.

4.2 Infiltration (Low Impact Development)

The City of Ottawa does not have City-wide standards related to the analysis or implementation of Low Impact Development installations (LIDs). As such, on a site-by-site basis, designers are expected to rely on guidance from the MECP, *the Low Impact Development Stormwater Planning and Design Guide* prepared on behalf of the Toronto and Region Conservation Authority (TRCA) and Credit Valley Conservation Authority (CVC) (TRCA/CVC, 2010 or updated Wiki document that is amended from time to time), or other sources. The City has also indicated in the past that any LID used within the sub-catchment to meet retention targets should be within City ownership or within an easement in favour of the City, so that the LID could be maintained if required.

The following are high-level screening questions that can be used to determine appropriateness of implementation of LID targets:

- *Does the site have a pollution hot spot (location on the site with high potential for contaminated runoff)?*
- *What is the Soil Texture and borehole data? Can the underlying soils infiltrate runoff?*
- *What is the water table depth? If water table depth is less than 1m from grade, LID should not be implemented and/or should be flagged for further assessment.*
- *What is the bedrock depth? If too high, infiltration will be difficult. Should be more than 1 m from the lowest point of the LID measure.*

- *How does the topography of the site affect the flow?*
- *Any trees or other features that might affect the installation of an LID measure?*
- *Is there a receiving system that could be connected via buried pipes or under drains?*
- *Is the available space for LID measures too small to yield any benefit of controlling inflows?*

Based on the ***Paterson Geotechnical Investigation*** the site is quite varied in terms of the soil profile. Some areas have bedrock at, or near, the surface while others have stiff silty clay deposits up to 20m below ground surface and glacial tills under the silty clay. Paterson has completed a review of subsoil infiltration rates as outlined in their April 2021 memo titled "*Subsoil Infiltration Review, Proposed Residential Development Kanata Lakes Golf Club – 7000 Campeau Drive – Ottawa*" (provided in ***Appendix D*** for reference).

As per the functional grading plan, found in ***Appendix E,*** the site consists of both fill and cut areas. Ultimately the location of rock, in-situ silty clay soils and imported fill materials will determine the effectiveness, location and type of LID methods to be used.

It is expected that in the post-development condition for the redevelopment area much of the infiltration will be addressed through evapotranspiration and infiltration, using techniques such as:

- Rear-yard swales designed with minimum grades where possible, to promote infiltration;
- Rear-yard catchbasin leads/subdrain will be perforated (except for the last segment connecting to the storm sewer within the right-of-way), to promote infiltration;
- Where eavestroughs are provided on residential units, they are to be directed to landscaped surfaces, to promote infiltration; and
- The main LID measure within the future proposed right-of-ways (ROW) for this site is the EES

4.2.1 Infiltration – Etobicoke Exfiltration System (EES)

In terms of the use of the EES within the City of Ottawa, the ***BSUEA Master Servicing Study***, Section 5.5 of the ***BSUEA MSS*** (and supporting documentation in the Appendices) discussed the various storm servicing strategies for that development area. The ***MSS*** went through the various options to achieve infiltration targets and quality controls with the preferred arrangement being the Etobicoke Exfiltration System (EES) Infiltration Strategy. Similarly for this site, the EES system will serve to mitigate water budget impacts and also manage the quality control requirements for the redevelopment area to reduce the reliance on oil-grit separator units. Other alternatives were reviewed (i.e. reduced lot grading, roof leaders to depressed areas or soakaway pits, pervious catchbasins, infiltration gallery, permeable pavement etc.) However, generally speaking, the EES system is the most suitable for the site given precedent installations within the

City, no reliance on private property installations, as its implementation being able to address multiple development criteria.

JFSA has prepared a design memo entitled "*7000 Campeau Drive: Preliminary Water Balance & Water Quality Controls*" dated April 2021 (***JFSA LID Analysis)*** to assess the infiltration volumes anticipated for the EES system proposed. See ***Appendix D*** for the analysis. As summarized in the analysis, there will be extensive EES installations implemented within the redevelopment area in order to meet water balance infiltration requirements and quality control targets. The EES units will be installed underneath storm sewers within the ROW in specific areas determined as being suitable based on site constraints.

With a pre-development water balance condition of 55% evaporation, 21% infiltration and 25% runoff and a post-development projected condition of 37% evaporation, 32% infiltration and 31% runoff, the post condition is an improvement in terms of infiltration.

For protection measures of the EES system during construction see Section 4.2.3.

4.2.2 EES – Quality Control

In conjunction with the EES, as part of the treatment train approach, catchbasins will be equipped with Goss Traps. The ***JFSA LID Analysis*** evaluation prepared by JFSA demonstrates that an Enhanced Level of Protection can be achieved with proposed EES based on the following rationale (which was also assessed in the ***BSUEA MSS***).

Table 3.2 of the MOECC (now MECP) publication entitled "*Stormwater Management Planning and Design Manual*, March 2003" sets the storage volume requirements for infiltration measures to achieve 80% TSS removal.

Table 3.2 Water Quality Storage Requirements based on Receiving Waters[1, 2]

		Storage Volume (m^3/ha) for Impervious Level			
Protection Level	**SWMP Type**	**35%**	**55%**	**70%**	**85%**
Enhanced 80% long-term S.S. removal	Infiltration	25	30	35	40
	Wetlands	80	105	120	140
	Hybrid Wet Pond/Wetland	110	150	175	195
	Wet Pond	140	190	225	250

[1]*Table 3.2 does not include every available SWMP type. Any SWMP type that can be demonstrated to the approval agencies to meet the required long-term suspended solids removal for the selected protection levels under the conditions of the site is acceptable for water quality objectives. The sizing for these SWMP types is to be determined based on performance results that have been peer-reviewed. The designer and those who review the design should be fully aware of the assumptions and sampling methodologies used in formulating performance predictions and their implications for the design.*

[2]*Hybrid Wet Pond/Wetland systems have 50-60% of their permanent pool volume in deeper portions of the facility (e.g., forebay, wet pond).*

Based on the average imperviousness used in the JFSA modeling (i.e., 65% for the average residential area), the required volume of water quality storage for the EES is approximately 33.3 m³/ha. Based on the sizing approach of the EES (22mm rainfall or 95th percentile event), the storage volume in the proposed extents of the system configuration is on average 104.8m³/ha. Therefore, the proposed EES satisfies the requirements for water quality control in accordance with the MECP for the proposed land use with no further downstream measures required. Detailed design, and any site constraints such as infrastructure crossing conflicts, will ultimately dictate the required extents of the EES.

4.2.3 EES Maintenance

As part of the ***BSUEA MSS*** review of that EES system, J.L. Richards prepared a memorandum (*BSUEA Infiltration System Maintenance Requirements, June 22, 2017*) of general system maintenance requirements and recommendations (provided in ***Appendix D*** for reference). The same rationale is applicable to this redevelopment.

Protection during construction, from the *Low Impact Development Stormwater Management Planning and Design Guide* prepared by CVC and TRCA (ver 1.0, 2010) is suggested as follows:

- Prior to site works, the location of LIDs should be marked and vehicles are to avoid the area other than during the installation of the LID. Drainage not to be directed to the LID;
- To minimize siltation in the newly installed EES system, both the upstream and downstream ends of the EES system should be plugged immediately during the construction phase. The upstream plug is to be removed at approximately an occupancy of 80% similar to other developments within the City;
- Upland drainage areas need to be properly stabilized with vegetation as soon as possible in order to reduce sediment loads;
- The facility should be excavated to design dimensions from the side using a backhoe or excavator. The base of the facility should be level or match the slope of the above storm sewer;
- The bottom of the facility should be scarified to improve infiltration; and
- Geotextile fabric should be correctly installed to optimize system function. When laying the geotextile, the width should include sufficient material to compensate for perimeter irregularities in the facility and a 150mm minimum top overlap.

4.3 Sump Pumps

The City of Ottawa has indicated a number of concerns with respect to proposed functional grading within the development area and the degree of grade raise proposed. As well, concerns were expressed with respect to vertical differences between proposed new homes relative to existing homes. In some circumstances the extent of grade raise is a function of providing appropriate storm sewer elevations relative to estimated underside of footing elevations in order to have gravity connections. Excessive risers at homes create additional grading concerns and therefore it has been suggested that the inclusion of sump pumps in select areas will assist with mitigating the grade raises for the proposed new roadway centrelines.

The City of Ottawa issued Technical Bulletin ISTB-2018-04 and 2019-02 for the amendment of the Ottawa Design Guidelines – Sewer, Second Edition, October 2012 with respect to the screening criteria for the use of sump pump systems for foundation drainage in Greenfield developments on sites with clay soils. In terms of the screening criteria the following is noted:

1. The area being considered is on full services;
2. The area being considered has clay soils present and a suggested grade raise restriction in some areas (ranging from 2.0 to 2.5m);
3. The finished grades that would be required to allow gravity drainage would exceed permissible grade raises. This would be with consideration for the placement of lightweight fill under garages and porches; and
4. Hydraulic grade lines cannot reasonably be lowered any further due to outlet restrictions. The site already has multiple stormwater outlet facilities throughout the development due to varied topography and constrained alternatives for connection to existing storm sewer systems. However, increasing of storm sewer sizes to mitigate any HGL does not achieve the general goal which is the overall mitigation of grade raise throughout the site.

Ultimately, detailed design of grading, overland flow routes and the establishment of underside of footings, will assess the extent of any sump pump implementation for discussion with City staff.

5.0 SERVICING INLETS/OUTLETS

Servicing for the proposed development has incoming sewers within existing easements or blocks of land that will be accommodated within new easements/blocks proposed within the site. As well, there are a number of outlets that will utilize new open space blocks and easements for connections to SWM ponds or proposed connections to existing infrastructure. The following table summarizes these locations:

Table 12: Infrastructure Easements/Blocks

Incoming Infrastructure & Easement/Block Locations (2)	Proposed Infrastructure & Easement/Block Requirements/Locations (2)	
Reference Location 1(2 typ) *Incoming Ex. 450mm dia. STM* *Between 64 & 66 Kenins Cres.* *Ex. Easement = 3m centered on lot line*	Prop. 675mm dia. STM on site Prop. 6m easement centred on Lot line of 417/418 Outlets to Street 10 sewer	
Reference Location 2 (2) *Incoming Ex. 375mm dia. STM* *Between 64 & 66 Langford Crescent* *Ex. Easement = 3m centered*(1)	Prop. 750mm dia. STM on site Prop. 6m easement centred on Lot line of 409/410 Outlets to Street 16 sewer	
Reference Location 3 *Incoming Ex. 675mm dia. STM* *Between 62 & 64 Sherring Crescent* *Ex. Easement = none shown on ex. lot*	Prop. 1500mm dia. STM on site Prop. 6m easement centred on Lot line of 366/367 Outlets to Street 1 sewer	
Reference Location 4 *Incoming Ex. 825mm dia. STM* *Between 20 & 22 Longboat Court* *Ex. Easement = 3m centered*(1)	Prop. 825mm dia. STM on site Prop. 6m easement centred on Lot line of 349/350 Outlets to Street 1 sewer	
Reference Location 5 *Incoming Ex. 600mm dia. STM* *Between 23 & 27 Shaughnessy Cres.* *Ex. Block = 6m pathway block*(1)	Prop. 975mm dia. STM on site Sewer realigned to prop. 6m walkway Block 654 Outlets to Street 7 sewer	
Reference Location 6 *Incoming Ex. 600mm dia. STM* *Between 69 & 71 Shaughnessy Cres.* *Ex. Easement = 2.4m centered*(1)	Prop. 675mm dia. STM on site Prop. 6m easement centred on Lot line of 213/214 Outlets to Street 7 sewer	
Reference Location 7 *Incoming Ex. 450mm dia. STM* *Between 28 & 30 Rosenfeld Crescent* *Ex. Easement = none shown on ex. lot*	Prop. 600mm dia. STM on site Sewer realigned to prop. 6m Open Space Block 650 (South of Lot 101) Outlets to Street 7 sewer	
Reference Location 8 *Incoming Ex. 250mm dia. SAN* *Between 41 & 43 Stonecroft Terrace* *Ex. Easement = none clearly shown on ex. lots*	Prop. 250mm dia. SAN on site. Sewer realigned to prop. 6m Open Space Block 641 Outlets to Street 9 sewer	
Reference Location 9 *Incoming Ex. 525mm dia. STM* *Between 36 & 38 Stonecroft Terrace* *Ex. Easement = none shown on ex. lot*	Prop. 675mm dia. STM on site Prop. 6m easement centred on Lot line of 25/26 Outlets to Street 9 sewer	
Reference Location 10	Outletting from Street 9 Prop. 2100mm dia. STM on site Prop. 200mm dia. SAN on site Prop. 250mm dia. WAT on site Open Space Block 646 (south of 30 Knudson Drive) Narrowest point of Block 646 is ~17.4m Connections to Knudson Drive	
Reference Location 11	Outletting from Street 9 Prop. 2100mm dia. STM on site Between 19 & 25 Knudson Drive *Ex. Block = 10m pathway block* Outlets to proposed SWM Pond	
Reference Location 12	Outletting from Street 17 Prop. 1200mm dia. STM on site Prop. 300mm dia. WAT on site Proposed 6m Block #732 between Lots 591 & 592 *Ex. Block = 6m pathway block*(1) Between 153 & 159 Knudson Drive Connections to Knudson Drive Requires guideline deviation to accommodate.	

Table 12 continued.		
Incoming Infrastructure & Easement/Block Location	**Proposed Infrastructure & Easement/Block Requirements/Locations**	
Reference Location 13	Outletting from Street 7 Prop. 600mm dia. STM on site Prop. 250mm dia. SAN on site Prop. 200mm dia. WAT on site Open Space & SWM Block 640 *Ex. Block = width varies from ~27.8m to ~10m* *North of 162 Knudson Drive* Requires guideline deviation to accommodate. Connections to Knudson Drive	
Reference Location 14	Outletting from Street 17 Prop. 1050mm dia. STM on site Prop. 250mm dia. SAN on site Prop. 300mm dia. WAT on site Open Space Block 649 (north of 205 Knudson Drive) Narrowest point of Block 649 is ~14m Connections to Weslock Way	
Reference Location 15	Outletting from Street 18 Prop. 1650mm dia. STM on site Prop. 250mm dia. SAN on site Prop. 200mm dia. WAT on site Open Space Block 635 *Ex. Block = width varies from ~25.5m to ~17.9m* *Between 8 & 24 Weslock Way* Connections to Weslock Way	
Reference Location 16	Outletting from Street 18 Prop. 1950mm dia. STM on site Open Space & SWM Block 634 Block = Weslock Way frontage of ~30m South of 23 Weslock Way. Outlet to future SWM Pond	
Reference Location 17	Outletting from Open Space & SWM Block 634 Prop. 825mm dia. STM on site Open Space & SWM Block 634 Block outlet width of ~15.6m Between of 49 & 51 Weslock Way. Outlet to Weslock Way	
(1) Legal information as per Stantec's Draft Plan of Subdivision (Project No. 161613944-131, April 01, 2021). (2) See marked up Stantec Draft Plan (labelled as Figure 4) for locations/references (3) Note: Future new ROW road connections are not summarized		

6.0 SITE GRADING

A geotechnical investigation of the subject property was undertaken by Paterson Group and is provided under separate cover. The redevelopment area has locations that will be constrained by grade raise restrictions of 2 m to 2.5m as documented in the investigation. The *Permissible Grade Raise Plans* are provided in ***Appendix E*** for reference. A preliminary overall grading plan is also provided for context.

The servicing and grading have been designed as low as possible, at this FSR level of design, in order to minimize the proposed grade raise required and follow site topography. Should mitigation measures be required due to grade raise exceedance, alternatives are proposed in the ***Paterson Report*** as follows:

1. Lightweight fill around housing units.
2. Preloading or Surcharging within right of way areas.

Details of these options are provided in the ***Paterson Report*** excerpts in ***Appendix E*** along with the *Permissible Grade Raise Plan*.

7.0 CONCLUSION AND RECOMMENDATIONS

Minto Communities on behalf of ClubLink Corporation ULC has proposed the redevelopment of the existing Kanata Golf and Country Club lands. A review of the functional servicing for the subject area yields the following conclusions:

- Based on the review of available background materials, and surrounding water infrastructure boundary conditions, there is sufficient potable water to support the development area;
- Wastewater services will be provided through a network of gravity sewers that will outlet to the Kanata Lakes Trunk sanitary sewer at several locations. Through review of the City of Ottawa modifications to the March Road Pump Station, Signature Ridge Pump Station and analysis of the Kanata Lakes Trunk sanitary sewer, there will be sufficient capacity to accommodate the anticipated wastewater flow from the subject property;
- Stormwater services will be provided through gravity sewers that outlet to four new stormwater management ponds, and an underground storage detention area, for quantity control and an Etobicoke Exfiltration System (EES) in order to provide quality controls, water balance, and to mitigate any impacts on downstream existing infrastructure and facilities. The combination of quality and quantity control measures will be implemented to meet MECP and City of Ottawa criteria;
- The EES systems is a proposed LID to be implemented and would be further coordinated with City staff for various specific details at the time of detailed design;
- An erosion assessment at critical locations along the Kizell Drain by GEO Morphix, along with a hydrologic assessment completed by JFSA, has concluded that there would be no adverse impacts to peak flows out of the Beaver Pond and on the downstream watercourse. Increases in erosion due to the redevelopment have been quantified and were found to be manageable;
- Grade raise restrictions do exist on the subject property. Where they cannot be met, potential mitigation measures detailed within the geotechnical report (ie. preload/surcharging of areas or use of lightweight fill) are suggested.

Prepared by,
David Schaeffer Engineering Ltd.

LICENSED PROFESSIONAL ENGINEER
K.L. MURPHY
90475369
Jun 15/21
PROVINCE OF ONTARIO

Per: Kevin Murphy, P.Eng.

Reviewed by,
David Schaeffer Engineering Ltd.

S. J. PICHETTE
Jun 15

Per: Stephen J. Pichette, P. Eng.

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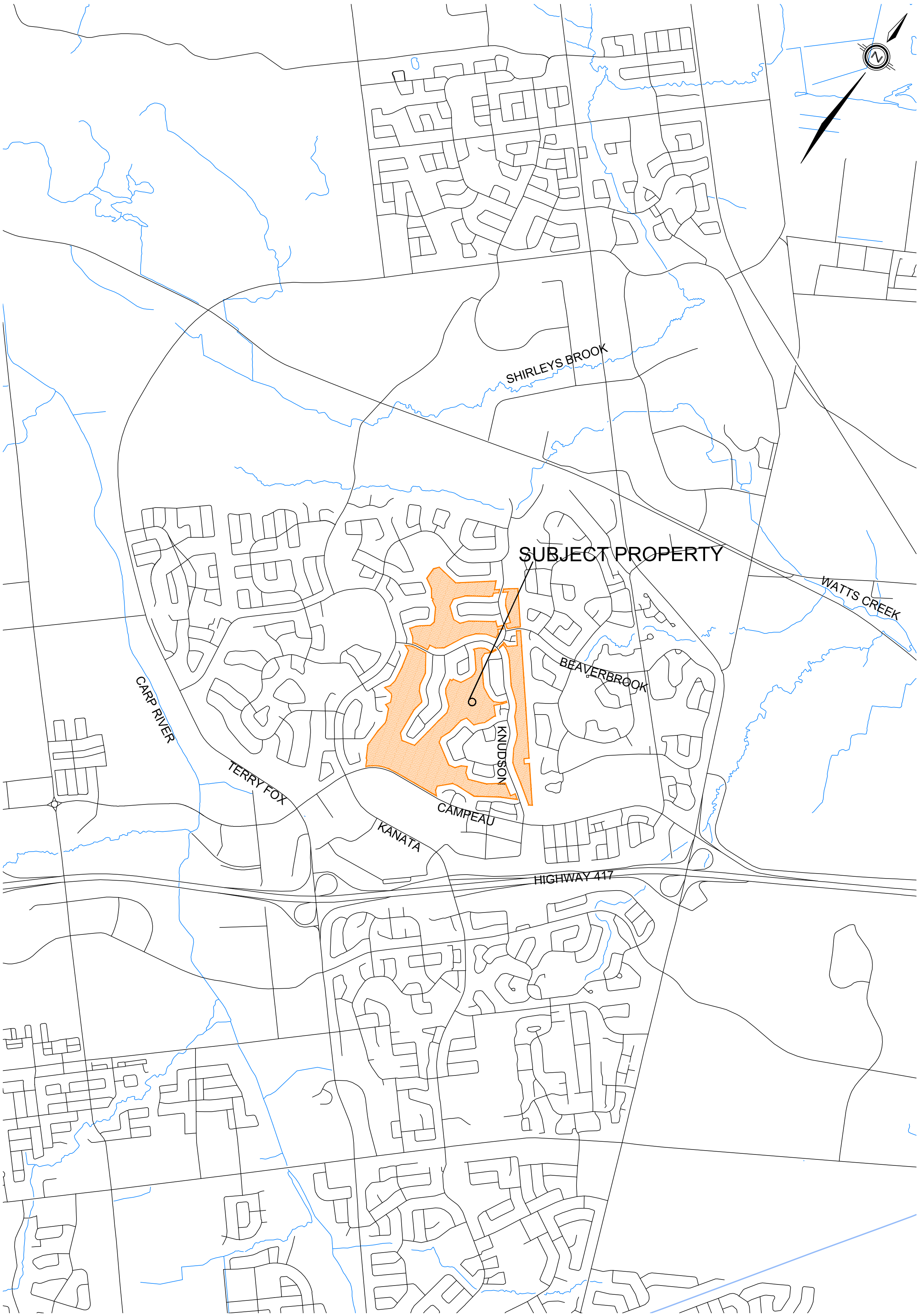
APPENDIX A

GENERAL



DSEL
david schaeffer engineering ltd
120 Iber Road, Unit 103
Stittsville, Ontario, K2S 1E9
Tel. (613) 836-0856
Fax. (613) 836-7183
www.DSEL.ca

7000 CAMPEAU DRIVE

CITY OF OTTAWA

01F_1061_SITE LOCATION

SCALE:	NTS	PROJECT No.:	1061
DATE:	MAY 2020	FIGURE:	01F

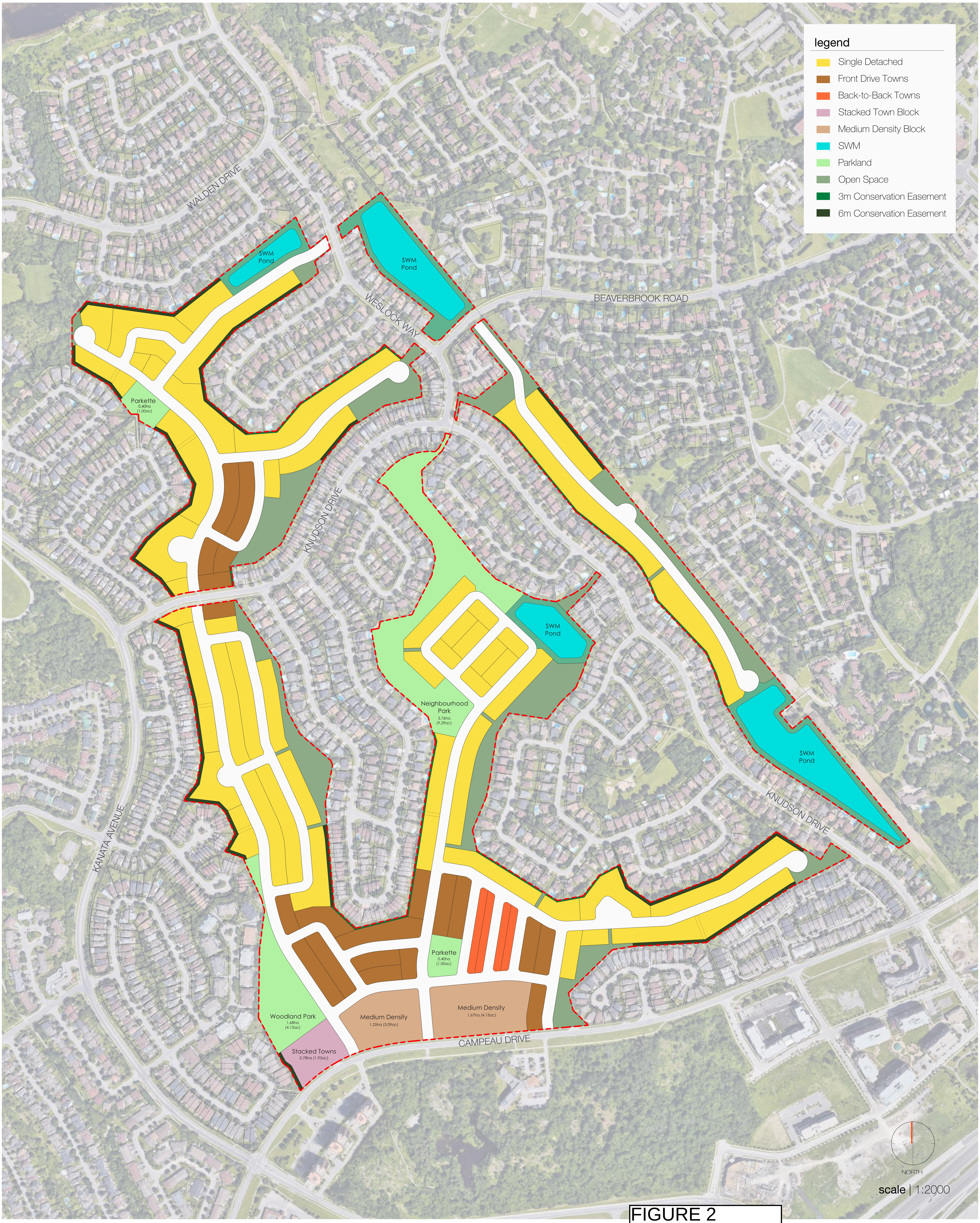


FIGURE 2

CLUBLINK CORPORATION ULC

minto Communities

RICHCRAFT Group of Companies

MINTO | 7000 Campeau Dr

revised concept plan

25 February 2021

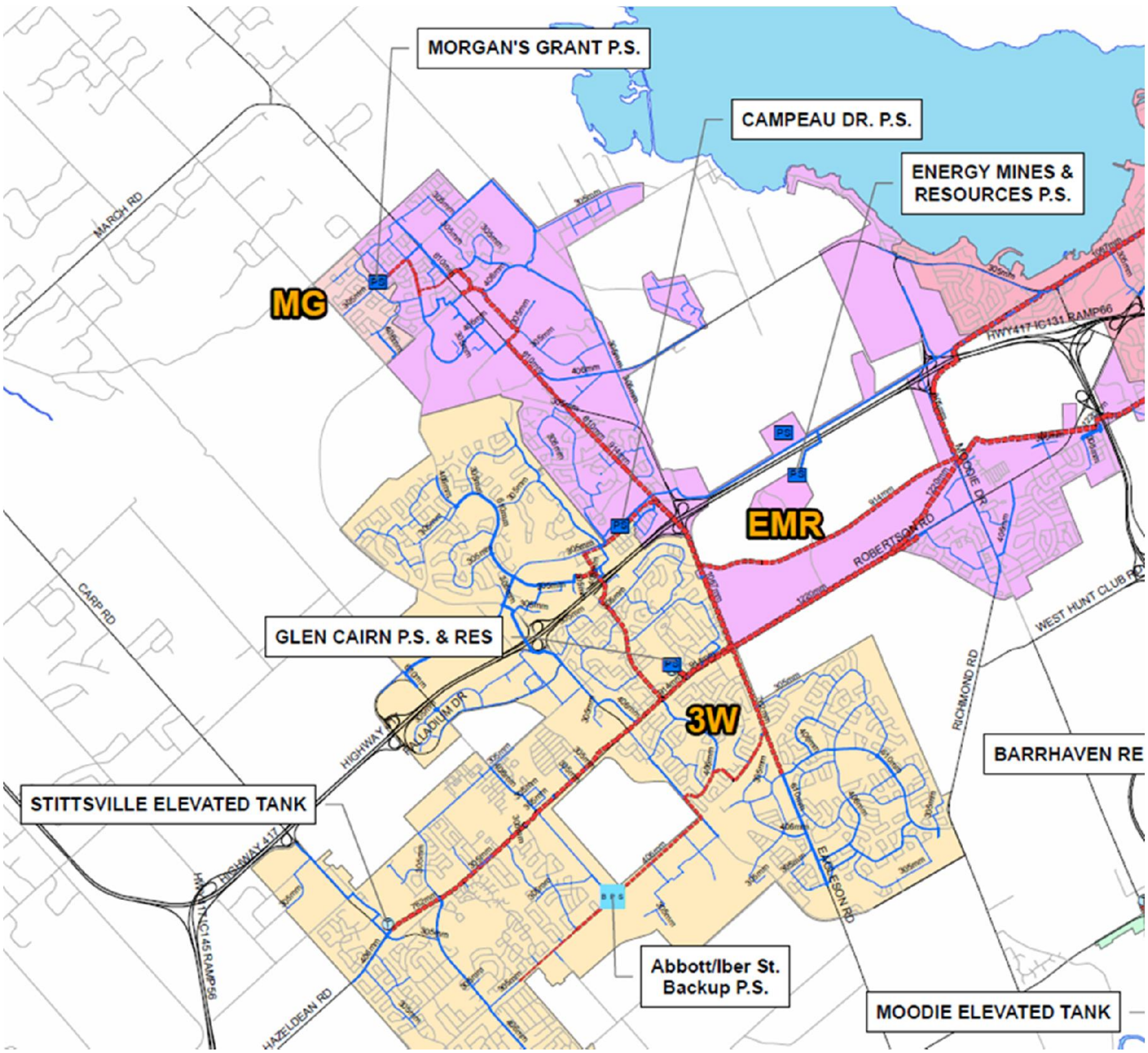
NAK design strategies

APPENDIX B

WATER SUPPLY

City of Ottawa Pressure Zone Map (excerpt)

Water Supply



Hydraulic Capacity and Modeling Analysis 7000 Campeau Drive Development Area - Kanata

Final Report

Prepared for:
David Schaeffer Engineering Ltd.
120 Iber Road, Unit 103
Stittsville, ON K2S 1E9

Prepared by:
GeoAdvice Engineering Inc.
Unit 203, 2502 St. John's Street
Port Moody, BC V3H 2B4

Submission Date: May 3, 2021

Contact: Mr. Werner de Schaetzen, Ph.D., P.Eng.
Project: 2019-054-DSE

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R1	July 19, 2019	Final	Renaud Dufays	Werner de Schaetzen
R2	April 30, 2021	Updated Draft	Ben Loewen	Werner de Schaetzen
R3	May 3, 2021	Final	Ben Loewen	Werner de Schaetzen

Statement of Qualifications and Limitations
This document represents GeoAdvice Engineering Inc. best professional judgment based on the information available at the time of its completion and as appropriate for the project scope of work. Services performed in developing the content of this document have been conducted in a manner consistent with that level and skill ordinarily exercised by a member of the engineering profession currently practicing under similar conditions. No warranty, express or implied is made.

Contents

1 Introduction

GeoAdvice Engineering Inc. ("GeoAdvice") was retained by David Schaeffer Engineering Ltd. ("DSEL") to update the feasibility study of the proposed water main network for the 7000 Campeau Drive development ("Development") project in the Kanata North Ward in the City of Ottawa, ON ("City").

The proposed development consists of 70.9 ha of golf courses lands (zoned O1A) and is planned to be rezoned to accommodate residential development. The updated unit counts for the development involves the construction of 654 single family dwellings, 389 traditional and back-to-back townhomes and 437 medium density buildings. The updated analysis accounts for a total of 1,480 units, whereas the previous analysis considered 1,985 total units.

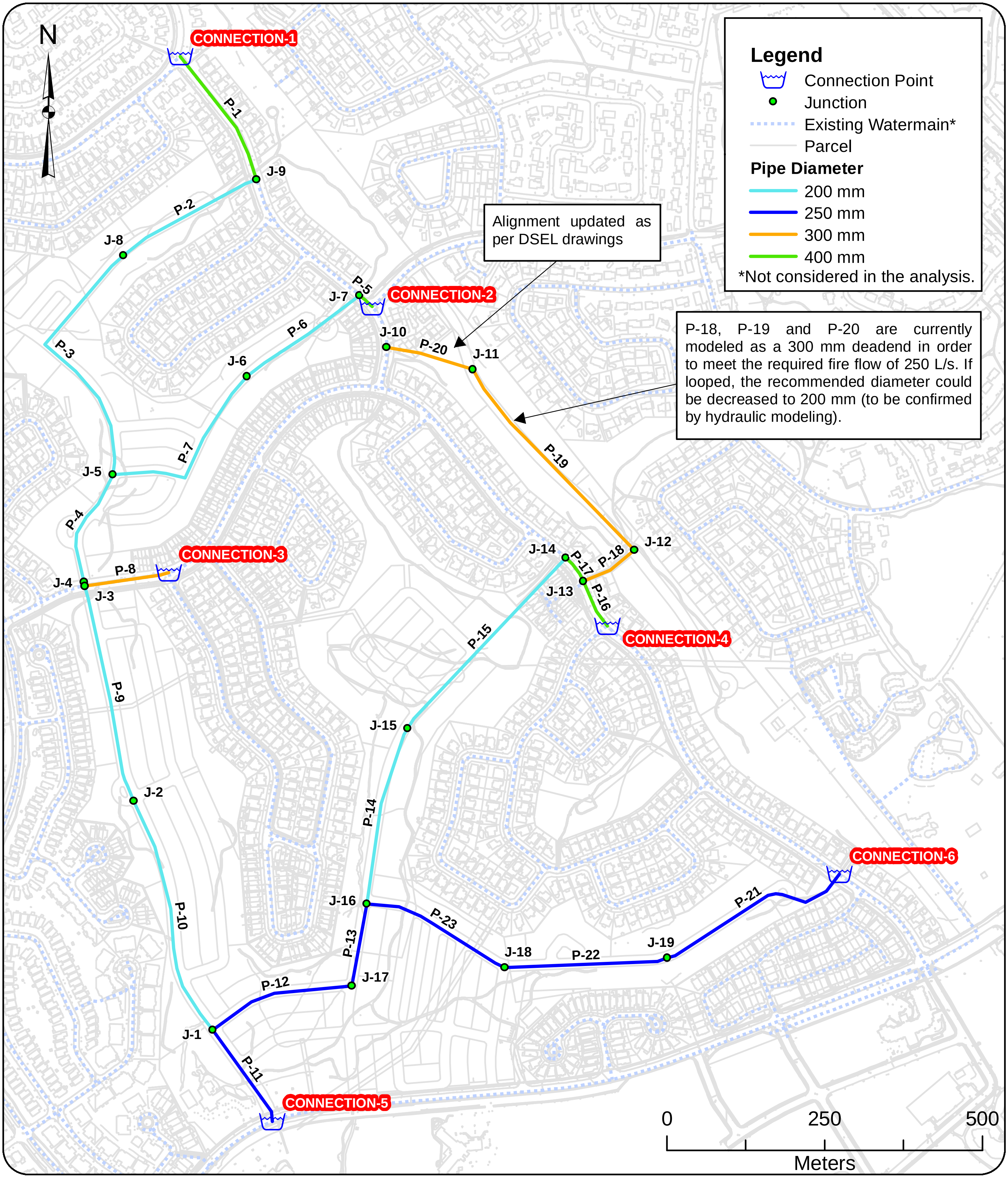
The development will have six (6) connections to the City water distribution system:

- Connection 1: Weslock Way and Walden Drive
- Connection 2: Weslock Way and Beaverbrook Road
- Connection 3: Knudson Drive and Shaugnessy Crescent
- Connection 4: Knudson Drive and Sherk Crescent
- Connection 5: 6738 Campeau Drive
- Connection 6: Knudson Drive and Morenz Terrace

The development site is shown in **Figure 1.1** on the following page, with the recommended pipe diameters. The alignment of P-20 was updated based on updated drawings provided to GeoAdvice on April 27, 2021.

This report describes the assumptions and results of the hydraulic modeling and capacity analysis using InfoWater (Innovyze), a GIS water distribution system modeling and management software application.

The results presented in this report are based on the analysis of steady state simulations. The predicted available fire flows, as calculated by the hydraulic model, represent the flow available in the water main while maintaining a residual pressure of 20 psi at the hydrant. No extended period simulations were completed in this analysis to assess the water quality or to assess the hydraulic impact on storage and pumping.



GeoAdvice Engineering Inc.	Project: **Hydraulic Capacity and Modeling Analysis 7000 Campeau Drive Development - Kanata** Project ID: **2019-054-DSE** Client: **David Schaeffer Engineering Ltd.** Date: **May 2021** Created by: **BL** Reviewed by: **WdS**	DISCLAIMER: GeoAdvice does not warrant in any way the accuracy and completeness of the information shown on this map. Field verification of the accuracy and completeness of the information shown on this map is the sole responsibility of the user.	**Site Layout and Connection Points** **Figure 1.1**

2 Modeling Considerations

2.1 Water Main Configuration

The water main network was modeled based on the pipe network layout prepared by DSEL (2019-05-21_1061_Wtr_coord.dwg) and provided to GeoAdvice on May 21, 2019. The water main network was updated (alignment of pipe P-20) based on updated drawings provided to GeoAdvice on April 27, 2021.

2.2 Elevations

Elevations of the modeled junctions were assigned according to an updated site grading plan prepared by DSEL (04D Preliminary Grading Plan.pdf) and provided to GeoAdvice on April 27, 2021.

2.3 Consumer Demands

Unit counts were provided by DSEL and demand calculations were completed by GeoAdvice. The assumptions used for the demand calculations are summarized in **Table 2.1** below.

Table 2.1: Demand Calculation Assumptions

Item	Assumption
Development Area	70.9 ha
Residential Units	654 Single Family 389 Townhome 437 Medium Density
Population Density	Single Family: 3.4 cap/unit Townhome: 2.7 cap/unit Medium Density: 1.8 cap/unit
Residential Average Day Demand	280 L/cap/day
Residential Maximum Daily Demand	2.5 x avg. day
Residential Peak Hour Demand	2.2 x max. day

Water demands are shown in in **Table 2.2** below.

Table 2.2: Demand Calculations

Demand Area	Connections	Average Day Demand (L/s)	Maximum Day Demand (L/s)	Peak Hour Demand (L/s)
1	1 and 2	2.5	6.1	13.5
2	3, 4, 5 and 6	10.7	26.8	58.9
Total		**13.2**	**32.9**	**72.4**

Demands were grouped in two demand areas and evenly applied to all the nodes within each demand area. For this analysis, the two demand areas are not hydraulically connected to each other. This is due to the boundary conditions provided by the City (see **Section 2.5**). The demand areas are shown in **Appendix A**.

2.4 Fire Flow Demand

Required fire flow calculations were completed by DSEL for each demand area and are summarized in **Table 2.3** below.

Table 2.3: Required Fire Flows

Demand Area	Connections	Required Fire Flow (L/s)
1	1 and 2	167
2	3, 4, 5 and 6	250

Fire flow simulations were completed at each node except for J-4, due to the close proximity of nodes J-3 and J-4. The locations of nodes do not necessarily represent hydrant locations.

The spatial allocation of the required fire flows is shown in **Appendix B**.

2.5 2019 Boundary Conditions

The boundary conditions were provided by the City of Ottawa in the form of Hydraulic Grade Line (HGL) at the following locations:

- Connection 1: Weslock Way and Walden Drive
- Connection 2: Weslock Way and Beaverbrook Road
- Connection 3: Knudson Drive and Shaugnessy Crescent
- Connection 4: Knudson Drive and Sherk Crescent
- Connection 5: 6738 Campeau Drive
- Connection 6: Knudson Drive and Morenz Terrace

The previous boundary conditions requested in 2019 were used for this updated analysis and do no account for the revised unit count totals. Updated boundary conditions would be requested to confirm the capacity analysis results presented within the report

The above connection points are illustrated in **Figure 1.1**.

Boundary conditions were provided for Average Day, Maximum Day plus Fire and Peak Hour Demand conditions and can be found in **Appendix C**.

Table 2.4 summarizes the boundary conditions used to size the water network.

Table 2.4: 2019 Boundary Conditions

Condition	Connection 1 HGL (m)	Connection 2 HGL (m)	Connection 3 HGL (m)	Connection 4 HGL (m)	Connection 5 HGL (m)	Connection 6 HGL (m)
Average Day (max. pressure)	161.7	162.1	162.1	161.7	161.8	161.8
Peak Hour (min. pressure)	158.3	157.3	157.3	158.5	159.1	159.1
Max Day + Fire Flow (167 L/s)	156.4	157.5	-	-	-	-
Max Day + Fire Flow (250 L/s)	-	-	156.1	155.5	157.2	157.2

3 Hydraulic Capacity Design Criteria

3.1 Pipe Characteristics

Pipe characteristics of internal diameter (ID) and Hazen-Williams C factors were assigned in the model according to the City of Ottawa Design Guidelines for PVC water main material. Pipe characteristics used for the development are outlined in **Table 3.1** below.

Table 3.1: Model Pipe Characteristics

Nominal Diameter (mm)	ID PVC (mm)	Hazen Williams C-Factor (/)
150	155	100
200	204	110
250	250	110
300	297	120
400	400	120

3.2 Pressure Requirements

As outlined in the City of Ottawa Design Guidelines, the generally accepted best practice is to design new water distribution systems to operate between 350 kPa (50 psi) and 480 kPa (70 psi). The maximum pressure at any point in the distribution system in occupied areas outside of the public right-of-way shall not exceed 552 kPa (80 psi). Pressure requirements are outlined in **Table 3.2.**

Table 3.2: Pressure Requirements

Demand Condition	Minimum Pressure		Maximum Pressure	
	(kPa)	(psi)	(kPa)	(psi)
Normal Operating Pressure (maximum daily flow)	350	50	480	70
Peak Hour Demand (minimum allowable pressure)	276	40	-	-
Maximum Fixture Pressure (Ontario Building Code)	-	-	552	80
Maximum Distribution Pressure (minimum hour check)	-	-	552	80
Maximum Day Plus Fire	140	20	-	-

4 Hydraulic Capacity Analysis

The proposed water mains within the development were sized to the minimum diameter which would satisfy the greater of maximum day plus fire and peak hour demand. Modeling was carried out for average day, peak hour and maximum day plus fire flow using InfoWater.

Detailed pipe and junction model input data can be found in **Appendix D**.

4.1 Development Pressure Analysis

The modeling results indicate that the development can be adequately serviced by the proposed water main layout shown in **Figure 1.1**. Modeled service pressures for the development are summarized in **Table 4.1** below.

Table 4.1: Summary of Available Service Pressures

Average Day Demand Maximum Pressure	Peak Hour Demand Minimum Pressure
651 kPa (94 psi)	537 kPa (78 psi)

As outlined in the City of Ottawa Design Guidelines, the generally accepted best practice is to design new water distribution systems to operate between 350 kPa (50 psi) and 480 kPa (70 psi). The maximum pressure at any point in the distribution system in occupied areas outside of the public right-of-way shall not exceed 552 kPa (80 psi). As such, based on the City boundary conditions, pressure reducing valves may be required.

Detailed pipe and junction result tables and maps can be found in **Appendix E**.

4.2 Development Fire Flow Analysis

Summaries of the minimum available fire flows are shown below in **Table 4.2**.

Table 4.2: Summary of Minimum Available Fire Flows

Required Fire Flow	Minimum Available Flow	Junction ID
167 L/s	221 L/s	J-5
250 L/s	270 L/s	J-2

As shown in **Table 4.2**, the fire flow requirements can be met at all junctions within the development.

Summaries of the residual pressures are shown below in **Table 4.3**. The minimum allowable pressure under fire flow conditions is 140 kPa (20 psi) at the location of the fire.

Table 4.3: Summary of Residual Pressures (MDD + FF)

Maximum Residual Pressure	Average Residual Pressure	Minimum Residual Pressure
184 kPa (27 psi)	415 kPa (60 psi)	579 kPa (84 psi)

As shown in **Table 4.3**, there is sufficient residual pressure at all the junctions within the development.

Detailed fire flow results and figures illustrating the fire flow results can be found in **Appendix F**.

5 Conclusions

The hydraulic capacity and modeling analysis of the development project in the Kanata North Ward yielded the following conclusions:

- The proposed water main network can deliver all domestic flows, with service pressures expected to range between 537 kPa (78 psi) and 651 kPa (94 psi).
- The proposed water main network is able to deliver fire flows at all junctions.
- Pressure reducing valves may be required, since maximum pressures are predicted to exceed the City of Ottawa Design Guidelines.

Finally, please note that the development was analyzed as two disconnected water networks due to the boundary conditions provided by the City. This analysis may have oversized some water mains. For example, pipes P-18, P-19 and P-20 (proposed size 300 mm) were modeled as a dead-end. Those pipes will likely be looped and may require smaller diameters.

Submission

Prepared by:

Benjamin Loewen

Ben Loewen, E.I.T.
Hydraulic Modeler / Project Engineer

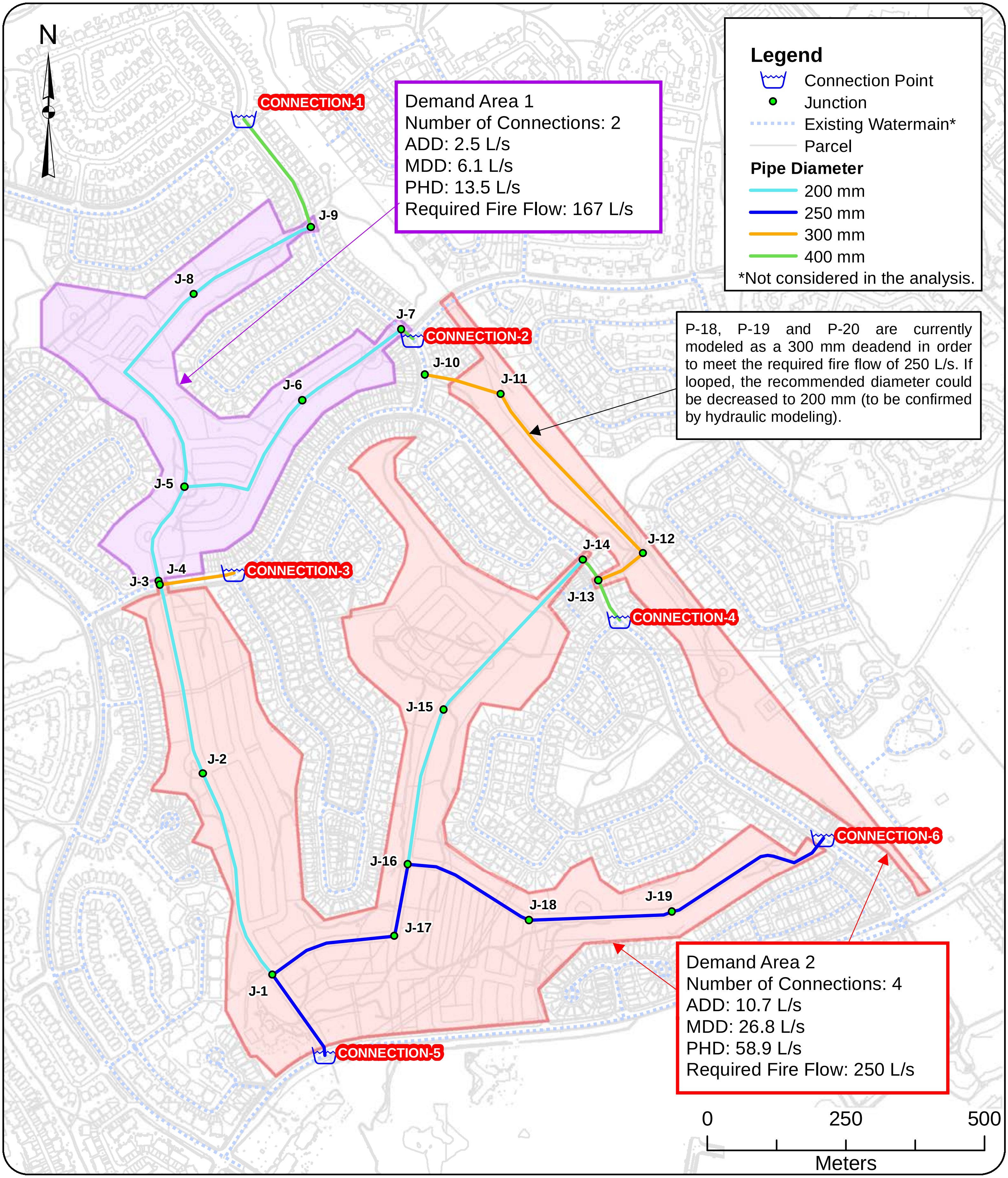
Approved by:

LICENSED PROFESSIONAL ENGINEER
May 3, 2021
W. B. F. de Schaetzen
100116349
PROVINCE OF ONTARIO

Werner de Schaetzen

Werner de Schaetzen, Ph.D., P.Eng.
Senior Modeling Review / Project Manager

Appendix A Domestic Water Demand Calculations and Allocation



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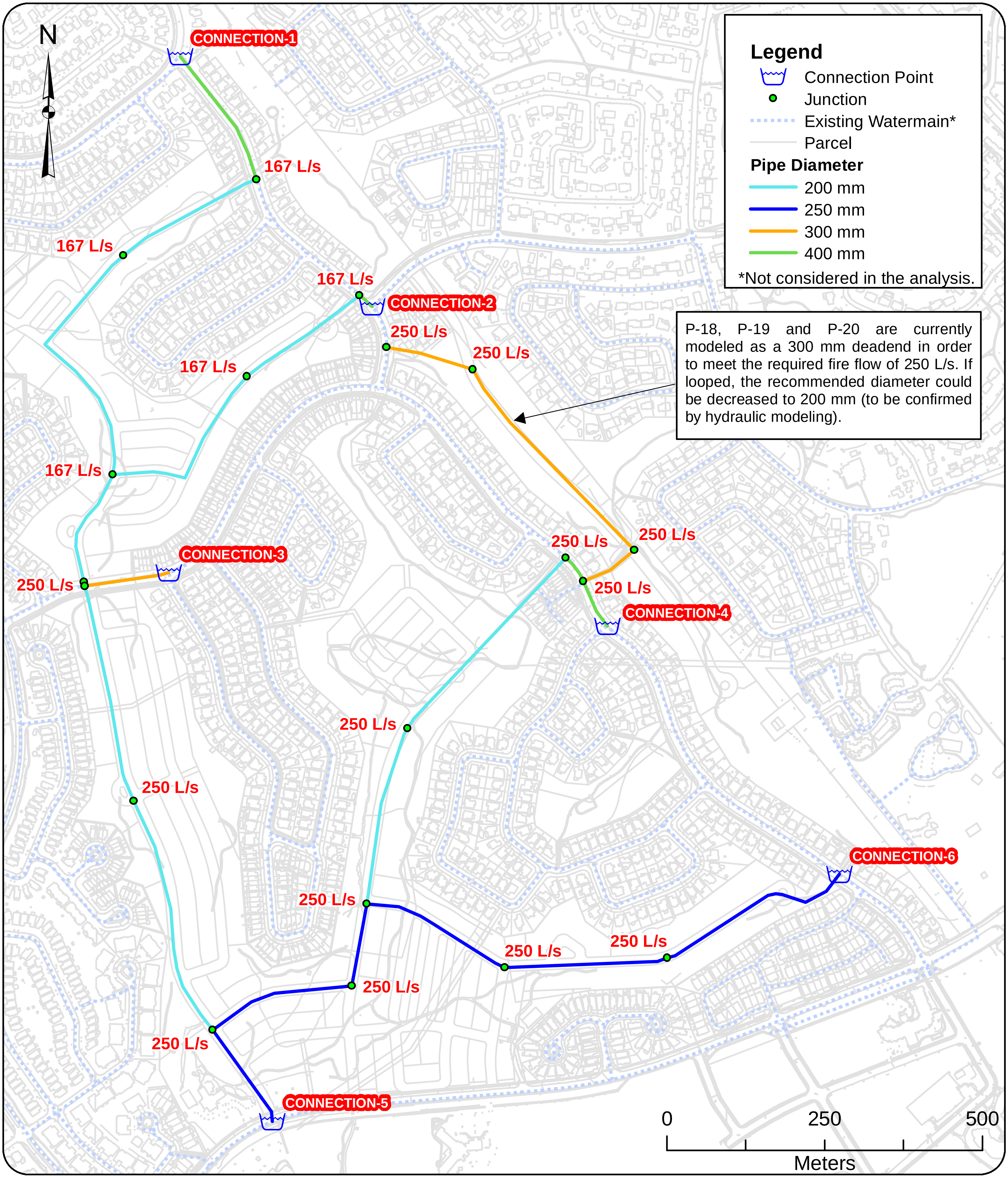
Reviewed by: WdS

Demand Allocation

Figure A.1

Appendix B FUS Fire Flow Calculations and Allocation



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Required Fire Flow

Figure B.1

Appendix C Boundary Conditions

BOUNDARY CONDITIONS

Boundary Conditions For: 1061 7000 Campeau Drive

Date of Boundary Conditions: 2019-Apr-09

Provided Information:

Scenario	Demand	
	L/min	L/s
Average Daily Demand	282.9	4.7
Maximum Daily Demand	707.3	11.8
Peak Hour	1556.0	25.9
Fire Flow #1 Demand	10,000	166.7

Number Of Connections: 2

Scenario	Demand	
	L/min	L/s
Average Daily Demand	811.6	13.5
Maximum Daily Demand	2029.0	33.8
Peak Hour	4463.9	74.4
Fire Flow #1 Demand	15,000	250.0

Number Of Connections: 3

Location:

BOUNDARY CONDITIONS

Results:

Connection #: 1

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	161.7	92.3
Peak Hour	158.3	87.5
Max Day Plus Fire (10,000) L/min	156.4	84.8

[1]Elevation: **96.710 m**

Connection #: 2

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	162.1	93.0
Peak Hour	157.3	86.2
Max Day Plus Fire (10,000) L/min	157.5	86.4

[1]Elevation: **96.620 m**

Connection #: 3

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	162.1	85.2
Peak Hour	157.3	78.4
Max Day Plus Fire (15,000) L/min	156.1	76.7

[1]Elevation: **102.110 m**

Connection #: 4

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	161.7	92.2
Peak Hour	158.5	87.6
Max Day Plus Fire (15,000) L/min	155.5	83.4

BOUNDARY CONDITIONS

[1]Elevation: **96.800 m**

Connection #: 5

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	161.8	85.2
Peak Hour	159.1	81.4
Max Day Plus Fire (15,000) L/min	157.2	78.7

[1]Elevation: **101.790 m**

Connection #: 6

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	161.8	85.4
Peak Hour	159.1	81.6
Max Day Plus Fire (15,000) L/min	157.2	78.9

[1]Elevation: **101.670 m**

Notes:

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

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

Disclaimer

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

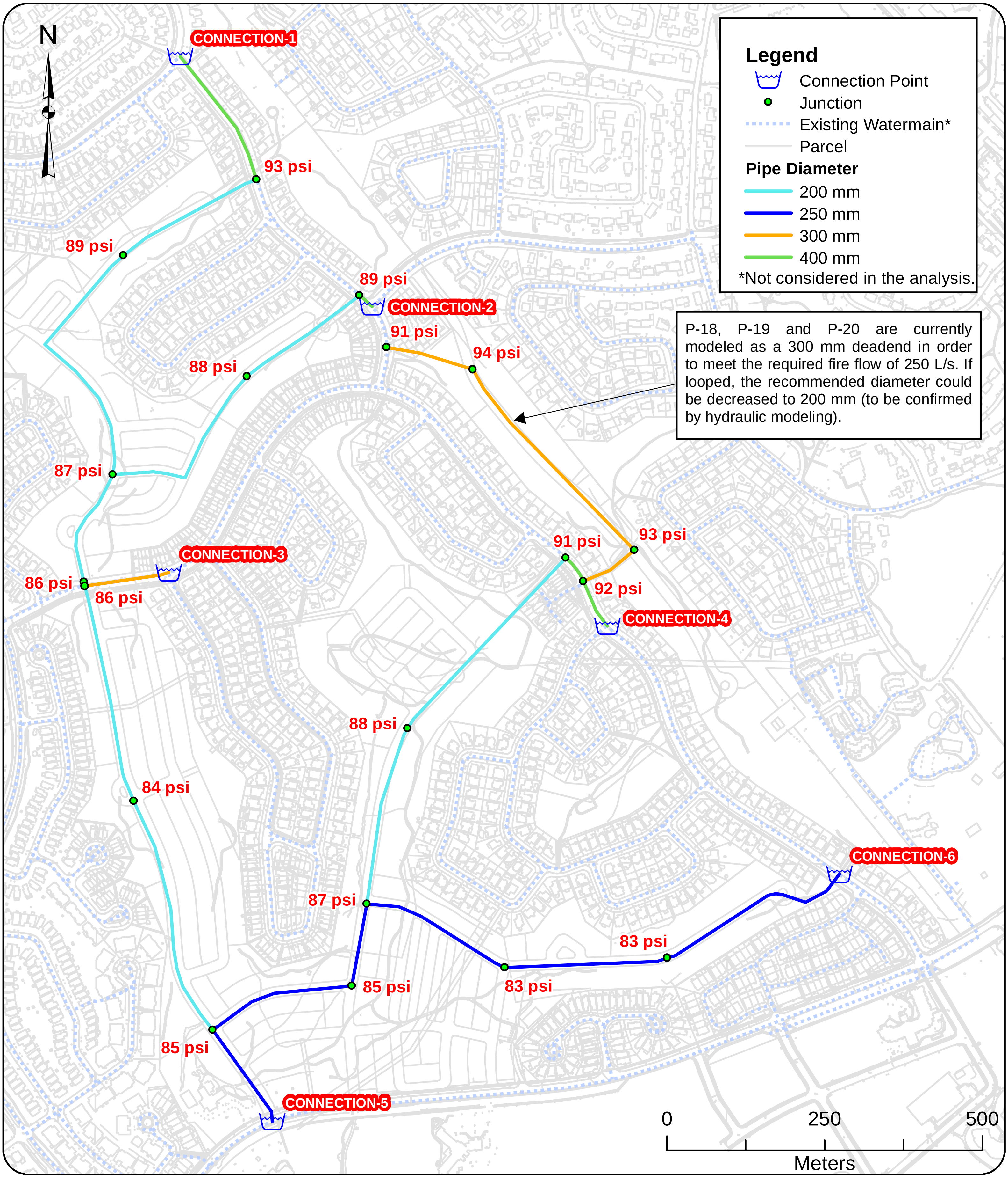
Appendix D Pipe and Junction Model Inputs

Model Inputs

ID	From Node	To Node	Length (m)	Diameter (mm)	Roughness
P-1	CONNECTION-1	J-9	232.0	400	120
P-2	J-9	J-8	243.1	204	110
P-3	J-8	J-5	435.3	204	110
P-4	J-5	J-4	188.6	204	110
P-5	CONNECTION-2	J-7	26.8	400	120
P-6	J-7	J-6	219.7	204	110
P-7	J-6	J-5	304.5	204	110
P-8	CONNECTION-3	J-3	134.7	297	120
P-9	J-3	J-2	349.8	204	110
P-10	J-2	J-1	390.0	204	110
P-11	CONNECTION-5	J-1	174.5	250	110
P-12	J-1	J-17	237.5	250	110
P-13	J-17	J-16	131.9	250	110
P-14	J-16	J-15	286.8	204	110
P-15	J-15	J-14	368.6	204	110
P-16	CONNECTION-4	J-13	81.0	400	120
P-17	J-13	J-14	47.0	400	120
P-18	J-13	J-12	95.7	297	120
P-19	J-12	J-11	385.4	297	120
P-20	J-11	J-10	141.5	297	120
P-21	CONNECTION-6	J-19	321.4	250	110
P-22	J-19	J-18	258.7	250	110
P-23	J-18	J-16	245.0	250	110

ID	Elevation (m)
J-1	102.13
J-2	103.00
J-3	101.36
J-4	101.29
J-5	100.96
J-6	99.99
J-7	99.40
J-8	99.12
J-9	96.38
J-10	97.96
J-11	95.33
J-12	96.37
J-13	96.75
J-14	97.45
J-15	100.04
J-16	100.64
J-17	101.76
J-18	103.40
J-19	103.20

Appendix E ADD and PHD Model Results



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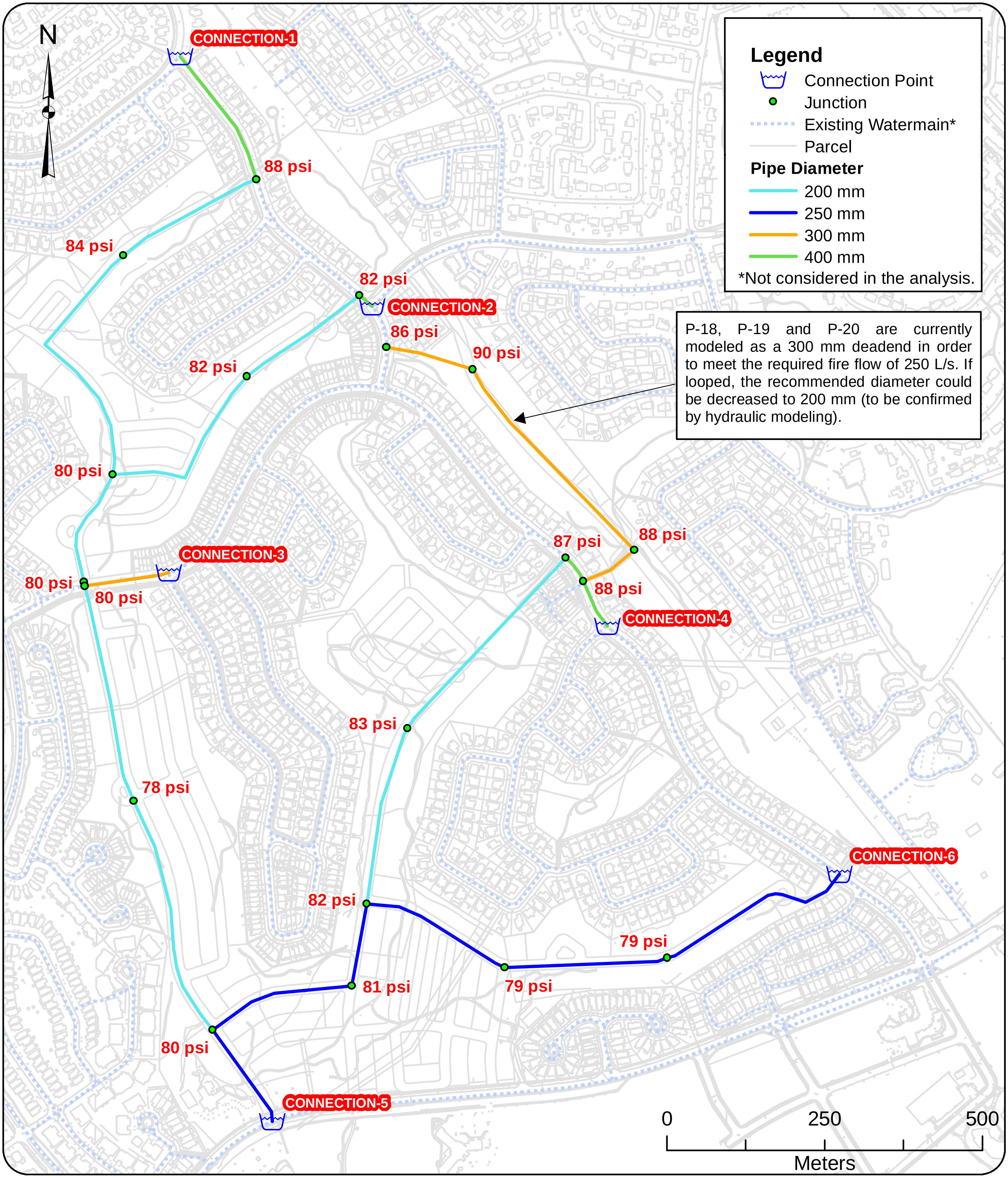
ADD
Pressure Results

Figure E.1

Average Day Demand Modeling Results

ID	From Node	To Node	Length (m)	Diameter (mm)	Roughness	Flow (L/s)	Velocity (m/s)	Headloss (m)	HL/1000 (m/km)
P-1	CONNECTION-1	J-9	232.0	400	120	-4.99	0.04	0.00	0.01
P-2	J-9	J-8	243.1	204	110	-5.40	0.17	0.06	0.26
P-3	J-8	J-5	435.3	204	110	-5.81	0.18	0.13	0.29
P-4	J-5	J-4	188.6	204	110	0.41	0.01	0.00	0.00
P-5	CONNECTION-2	J-7	26.8	400	120	7.45	0.06	0.00	0.02
P-6	J-7	J-6	219.7	204	110	7.04	0.22	0.09	0.42
P-7	J-6	J-5	304.5	204	110	6.63	0.20	0.11	0.38
P-8	CONNECTION-3	J-3	134.7	297	120	8.01	0.12	0.01	0.07
P-9	J-3	J-2	349.8	204	110	7.19	0.22	0.15	0.44
P-10	J-2	J-1	390.0	204	110	6.36	0.19	0.14	0.35
P-11	CONNECTION-5	J-1	174.5	250	110	-1.31	0.03	0.00	0.01
P-12	J-1	J-17	237.5	250	110	4.23	0.09	0.01	0.06
P-13	J-17	J-16	131.9	250	110	3.41	0.07	0.01	0.04
P-14	J-16	J-15	286.8	204	110	4.08	0.12	0.04	0.15
P-15	J-15	J-14	368.6	204	110	3.26	0.10	0.04	0.10
P-16	CONNECTION-4	J-13	81.0	400	120	0.86	0.01	0.00	0.00
P-17	J-13	J-14	47.0	400	120	-2.44	0.02	0.00	0.00
P-18	J-13	J-12	95.7	297	120	2.47	0.04	0.00	0.01
P-19	J-12	J-11	385.4	297	120	1.65	0.02	0.00	0.00
P-20	J-11	J-10	141.5	297	120	0.82	0.01	0.00	0.00
P-21	CONNECTION-6	J-19	321.4	250	110	3.15	0.06	0.01	0.04
P-22	J-19	J-18	258.7	250	110	2.32	0.05	0.01	0.02
P-23	J-18	J-16	245.0	250	110	1.50	0.03	0.00	0.01

ID	Demand (L/s)	Elevation (m)	Head (m)	Pressure (psi)
J-1	0.82	102.13	162	85
J-2	0.82	103.00	162	84
J-3	0.82	101.36	162	86
J-4	0.41	101.29	162	86
J-5	0.41	100.96	162	87
J-6	0.41	99.99	162	88
J-7	0.41	99.40	162	89
J-8	0.41	99.12	162	89
J-9	0.41	96.38	162	93
J-10	0.82	97.96	162	91
J-11	0.82	95.33	162	94
J-12	0.82	96.37	162	93
J-13	0.82	96.75	162	92
J-14	0.82	97.45	162	91
J-15	0.82	100.04	162	88
J-16	0.82	100.64	162	87
J-17	0.82	101.76	162	85
J-18	0.82	103.40	162	83
J-19	0.82	103.20	162	83



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PHD Pressure Results

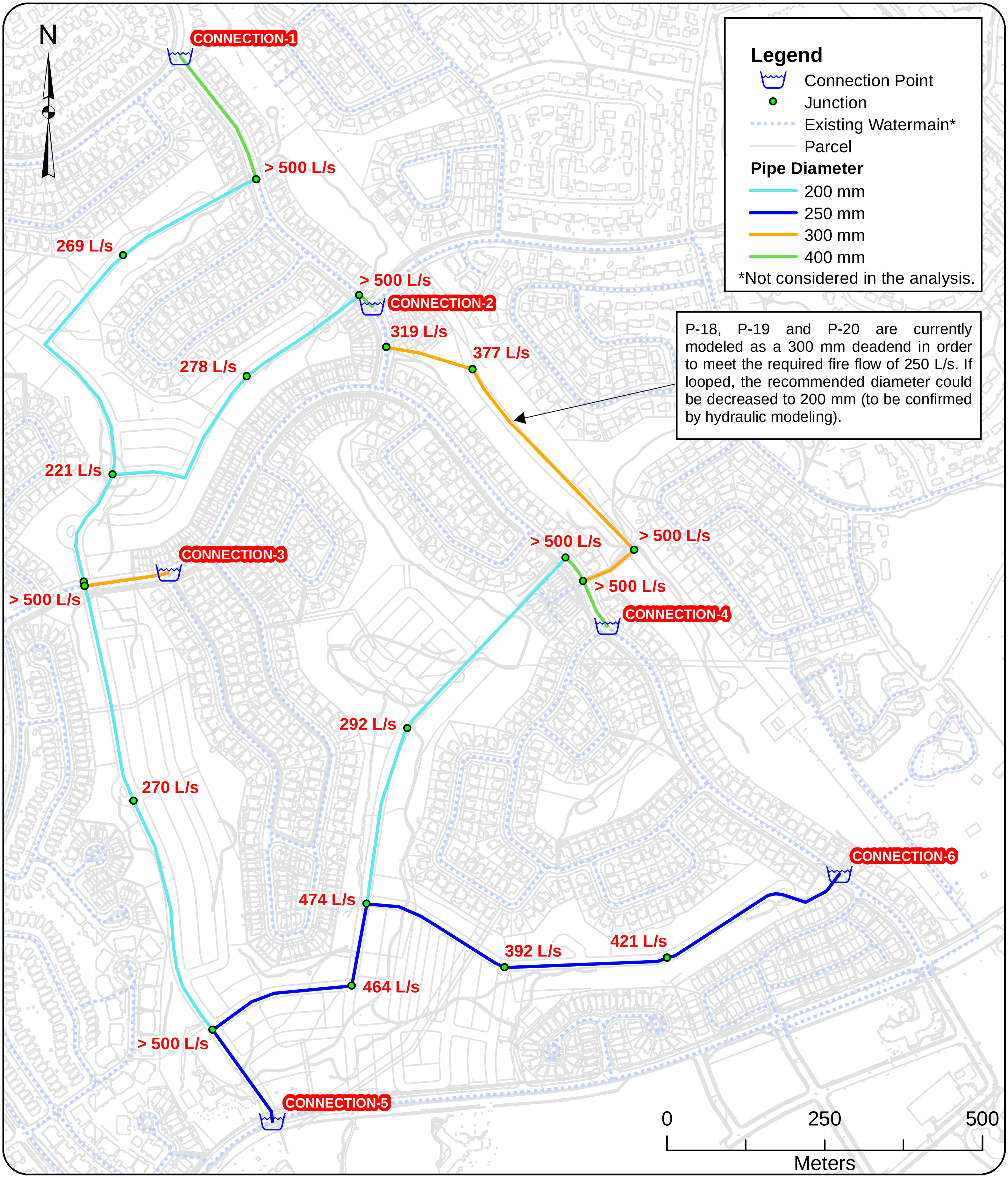
Figure E.2

Peak Hour Demand Modeling Results

ID	From Node	To Node	Length (m)	Diameter (mm)	Roughness	Flow (L/s)	Velocity (m/s)	Headloss (m)	HL/1000 (m/km)
P-1	CONNECTION-1	J-9	232.0	400	120	16.04	0.13	0.01	0.06
P-2	J-9	J-8	243.1	204	110	13.79	0.42	0.36	1.46
P-3	J-8	J-5	435.3	204	110	11.54	0.35	0.46	1.05
P-4	J-5	J-4	188.6	204	110	2.25	0.07	0.01	0.05
P-5	CONNECTION-2	J-7	26.8	400	120	-2.53	0.02	0.00	0.00
P-6	J-7	J-6	219.7	204	110	-4.78	0.15	0.05	0.21
P-7	J-6	J-5	304.5	204	110	-7.04	0.22	0.13	0.42
P-8	CONNECTION-3	J-3	134.7	297	120	-8.71	0.13	0.01	0.09
P-9	J-3	J-2	349.8	204	110	-13.24	0.41	0.47	1.36
P-10	J-2	J-1	390.0	204	110	-17.77	0.54	0.91	2.34
P-11	CONNECTION-5	J-1	174.5	250	110	30.13	0.61	0.40	2.31
P-12	J-1	J-17	237.5	250	110	7.83	0.16	0.05	0.19
P-13	J-17	J-16	131.9	250	110	3.30	0.07	0.01	0.04
P-14	J-16	J-15	286.8	204	110	7.26	0.22	0.13	0.45
P-15	J-15	J-14	368.6	204	110	2.73	0.08	0.03	0.07
P-16	CONNECTION-4	J-13	81.0	400	120	19.92	0.16	0.01	0.09
P-17	J-13	J-14	47.0	400	120	1.80	0.01	0.00	0.00
P-18	J-13	J-12	95.7	297	120	13.59	0.20	0.02	0.19
P-19	J-12	J-11	385.4	297	120	9.06	0.13	0.04	0.09
P-20	J-11	J-10	141.5	297	120	4.53	0.07	0.00	0.03
P-21	CONNECTION-6	J-19	321.4	250	110	17.55	0.36	0.27	0.85
P-22	J-19	J-18	258.7	250	110	13.02	0.27	0.13	0.49
P-23	J-18	J-16	245.0	250	110	8.49	0.17	0.05	0.22

ID	Demand (L/s)	Elevation (m)	Head (m)	Pressure (psi)
J-1	4.53	102.13	159	80
J-2	4.53	103.00	158	78
J-3	4.53	101.36	157	80
J-4	2.25	101.29	157	80
J-5	2.25	100.96	157	80
J-6	2.25	99.99	157	82
J-7	2.25	99.40	157	82
J-8	2.25	99.12	158	84
J-9	2.25	96.38	158	88
J-10	4.53	97.96	158	86
J-11	4.53	95.33	158	90
J-12	4.53	96.37	158	88
J-13	4.53	96.75	158	88
J-14	4.53	97.45	158	87
J-15	4.53	100.04	159	83
J-16	4.53	100.64	159	82
J-17	4.53	101.76	159	81
J-18	4.53	103.40	159	79
J-19	4.53	103.20	159	79

Appendix F MDD+FF Model Results

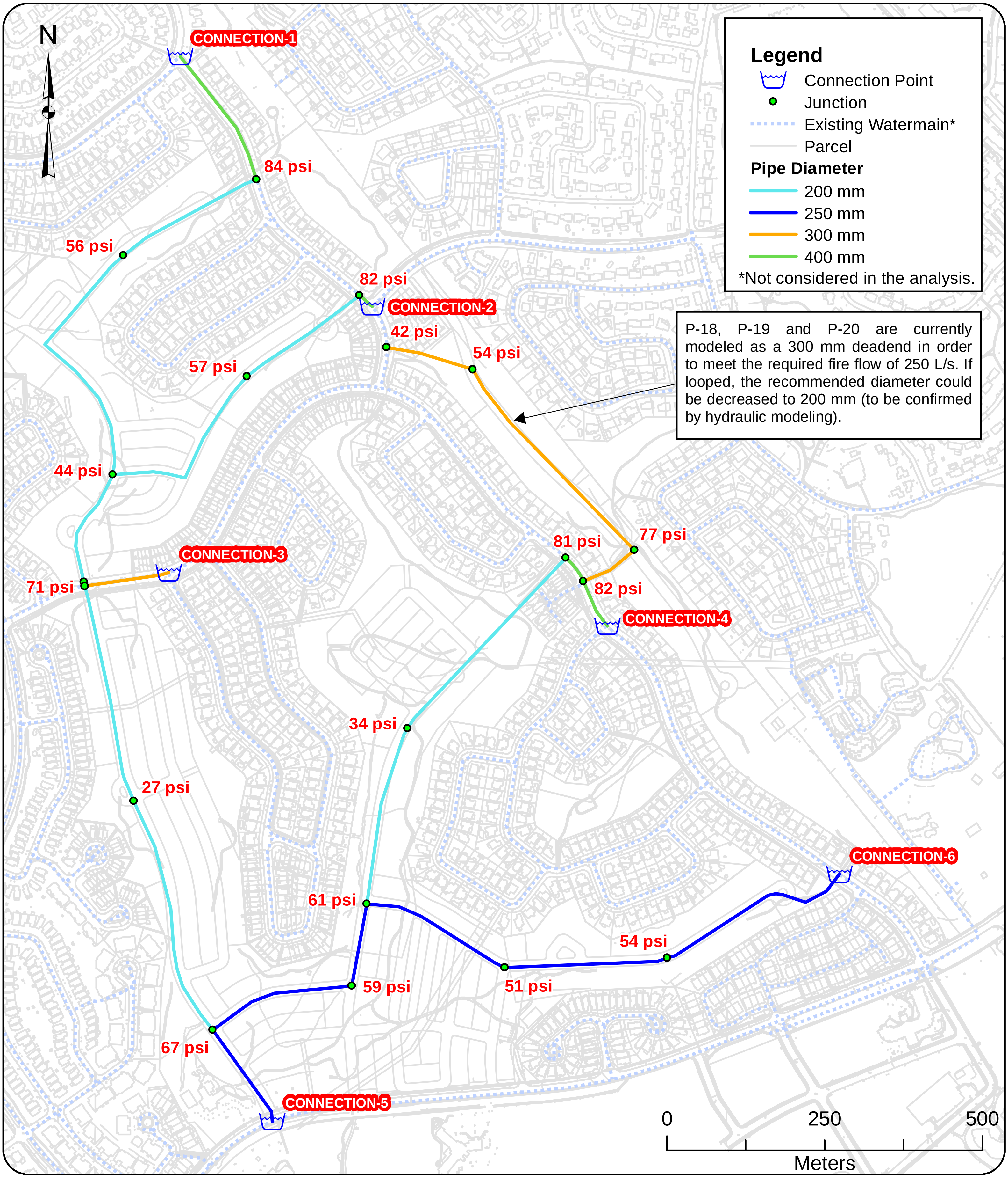


GeoAdvice Engineering Inc.

Project: **Hydraulic Capacity and Modeling Analysis 7000 Campeau Drive Development - Kanata**
Project ID: **2019-054-DSE**
Client: **David Schaeffer Engineering Ltd.**
Date: **May 2021**
Created by: **BL**
Reviewed by: **WdS**

Available Fire Flow @ 20 psi

Figure F.1



GeoAdvice Engineering Inc.

Project: **Hydraulic Capacity and Modeling Analysis**
7000 Campeau Drive Development - Kanata
Project ID: **2019-054-DSE**
Client: **David Schaeffer Engineering Ltd.**
Date: **May 2021**
Created by: **BL**
Reviewed by: **WdS**

Residual Pressure @ Required Fire Flow

Figure F.2

Fire Flow Modeling Results

ID	Static Demand (L/s)	Static Pressure (psi)	Static Head (m)	Fire-Flow Demand (L/s)	Residual Pressure (psi)	Available Flow at Hydrant (L/s)	Available Flow Pressure (psi)
J-1	2.06	78	157	250	67	> 500	20
J-2	2.06	76	156	250	27	270	20
J-3	2.06	78	156	250	71	> 500	20
J-5	1.02	80	157	167	44	221	20
J-6	1.02	81	157	167	57	278	20
J-7	1.02	83	158	167	82	> 500	20
J-8	1.02	82	157	167	56	269	20
J-9	1.02	85	156	167	84	> 500	20
J-10	2.06	82	155	250	42	319	20
J-11	2.06	86	155	250	54	377	20
J-12	2.06	84	156	250	77	> 500	20
J-13	2.06	84	156	250	82	> 500	20
J-14	2.06	83	156	250	81	> 500	20
J-15	2.06	80	156	250	34	292	20
J-16	2.06	80	157	250	61	474	20
J-17	2.06	78	157	250	59	464	20
J-18	2.06	76	157	250	51	392	20
J-19	2.06	76	157	250	54	421	20

Kevin Murphy

From:	Adam Fobert
Sent:	Tuesday, February 05, 2019 2:53 PM
To:	Moodie, Derrick
Cc:	Steve Pichette; Beth Henderson; Susan Murphy
Subject:	1061 Minto - Kanata Golf and Country Club: Water and Wastewater Service Review
Attachments:	kanata_water.pdf

Hello Derrick,

DSEL has been retained by Minto to investigate the availability of services to support the potential redevelopment of the Kanata Lakes Golf and Country Club. Since we have not had a formal pre-consultation with your staff on this application, we are requesting your support in coordinating the following request.

Water Supply
Please see the attached figure illustrating potential connection points.

Connection points 1 and 2 would have the following demands:

Average Daily: 282.9L/min
Max Day: 707.3 L/min
Peak Hour: 1556.0 L/min
Fire Flow: 10,000L/min

Connection points 3, 4, 5, and 6 would have the following demands:

Average Daily: 811.6L/min
Max Day: 2029.0L/min
Peak Hour: 4463.9L/min
Fire Flow: 15,000L/min

Wastewater
We have completed a desktop review of the available capacity in the receiving sanitary sewer system. Does the City have a model of the trunk sewer system? Furthermore, the contemplated development would add 73.71 L/s peak wet weather wastewater flow to the March Road PS. It is my understanding that the March Road PS has gone or is going through upgrades. We would need confirmation of the available capacity in the trunk sewer and receiving pump station.

Thank you for your assistance.

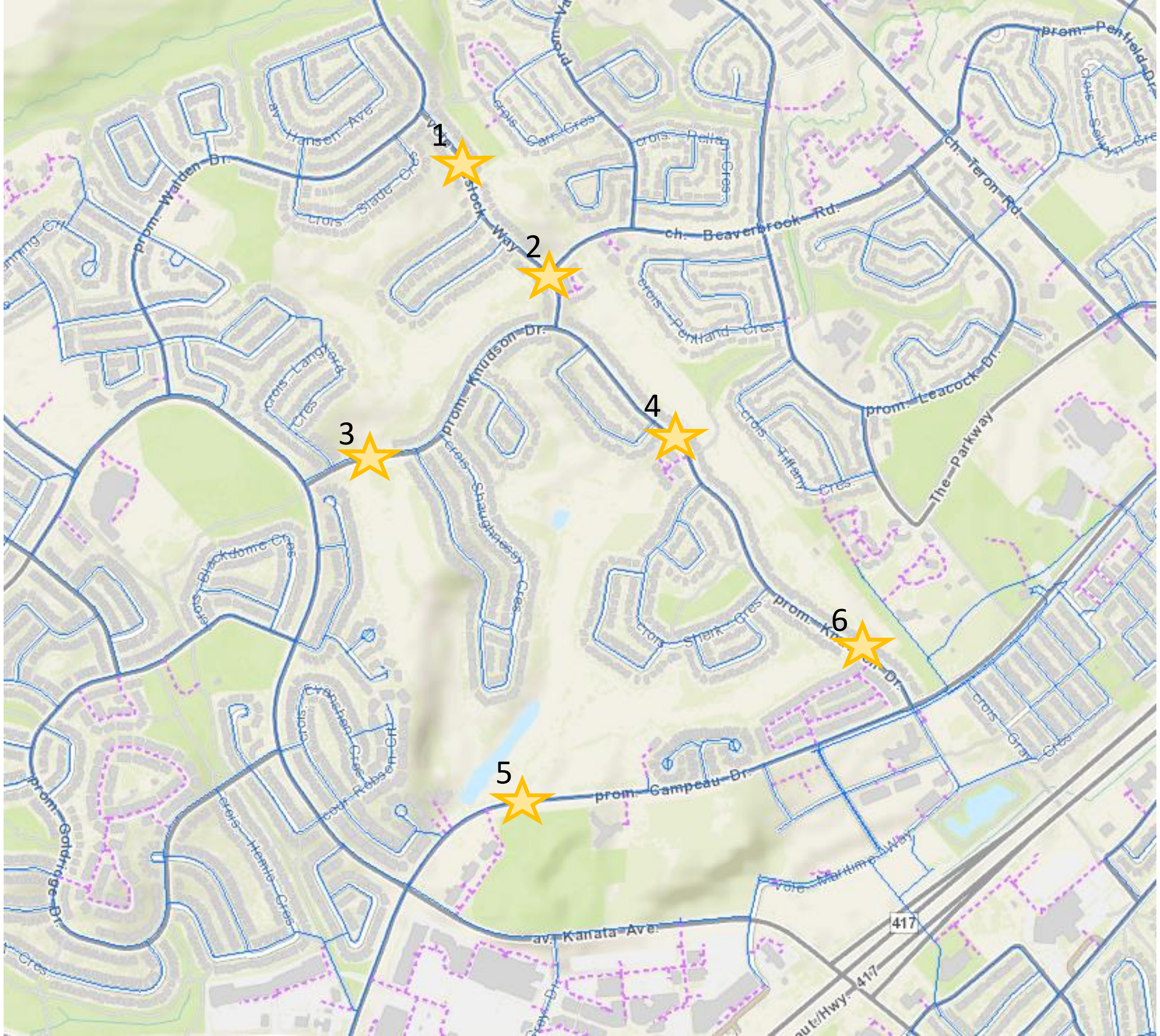
Adam Fobert, P.Eng.

DSEL

david schaeffer engineering ltd.

120 Iber Road, Unit 103
Stittsville, ON K2S 1E9

office: (613) 836-0856
direct: (613) 836-0626
cell: (613) 222-9493
email: afobert@DSEL.ca


1
2
3
4
5
6
prom. Walden Dr.
av. Hansen Ave
crois. Slade Cres
ch. Beaverbrook Rd.
ch. Teron Rd.
prom. Penfield Dr
crois. Carr Cres
crois. Pentland Cres
prom. Knudson Dr.
crois. Langford Cres
crois. Shaughnessy Cres
prom. Leacock Dr.
The Parkway
crois. Tiffany Cres
crois. Blackdome Cres
crois. Stark Cres
prom. Kincaid Dr.
prom. Campeau Dr.
cour Robson Crt
crois. Hemlo Cres
prom. Goldridge Dr.
av. Kanata Ave.
voie Maritime Way
417

APPENDIX C

SANITARY

SANITARY SEWER CALCULATION SHEET - EXISTING CONDITIONS

PROJECT: **Kanata Golf and Country Club**
LOCATION: **7000 Campeau Drive**
FILE REF: **18-1061**
DATE: **28-May-20**

DESIGN PARAMETERS

Avg. Daily Flow Res.	280 L/p/d	Peak Fact Res. Per Harmons: Min = 2.0, Max =4.0		Infiltration / Inflow	0.33 L/s/ha
Avg. Daily Flow Comm.	28,000 L/ha/d	Harmon Correction Factor	0.8	Min. Pipe Velocity	0.60 m/s full flowing
Avg. Daily Flow Instit.	28,000 L/ha/d	Peak Fact. Comm.	1 (< 20% ICI)	Max. Pipe Velocity	3.00 m/s full flowing
Avg. Daily Flow Indust.	35,000 L/ha/d	Peak Fact. Instit.	1 (< 20% ICI)	Mannings N	0.013
Ex. Population Per Hectare*	69 Pop/Ha	Peak Fact. Indust. per MOE graph			

*Based on an average from Areas 2, 12 and 10.

DSEL

Location			Residential Area and Population						Commercial		Institutional		Industrial		Infiltration				Pipe Data											
Area ID	Up	Down	Area (ha)	Pop.	Cumulative Area (ha)	Cumulative Pop.	Peak. Fact. (-)	Q_{res} (L/s)	Area (ha)	Accu. Area (ha)	Area (ha)	Accu. Area (ha)	Area (ha)	Accu. Area (ha)	Q_{C+I+I} (L/s)	Total Area (ha)	Accu. Area (ha)	Infiltration Flow (L/s)	Total Flow (L/s)	DIA (mm)	Upstream Invert (m)	Downstream Invert (m)	Length (m)	Slope (%)	$A_{hydraulic}$ (m^2)	R (m)	Velocity (m/s)	Q_{cap} (L/s)	Q / Q full (-)	Qresidual (L/s)
Campeau Drive																														
	1	2		0	0.000	0	3.80	0.00		0.00		0.00		0.00	0.0	0.000	0.000	0.000	0.00	525	97.57	97.52	16.9	0.296	0.216	0.131	1.08	233.9	0.00	233.9
2	2	3	7.53	520	7.53	520	3.37	5.68	0.07	0.07		0.00		0.00	0.0	7.600	7.600	2.508	8.21	525	97.52	97.33	78.2	0.243	0.216	0.131	0.98	212.0	0.04	203.8
	3	4		0	7.530	520	3.37	5.68		0.07		0.00		0.00	0.0	0.000	7.600	2.508	8.21	525	97.3	97.09	76.4	0.275	0.216	0.131	1.04	225.5	0.04	217.3
4	4	5	12.88	889	20.41	1408	3.16	14.42		0.07		0.00		0.00	0.0	12.880	20.480	6.758	21.20	525	97.09	97.02	24.1	0.290	0.216	0.131	1.07	231.8	0.09	210.6
5	5	6	1.31	0	21.72	1408	3.16	14.42	0.11	0.18		0.00		0.00	0.1	1.420	21.900	7.227	21.70	525	97.02	96.79	91.7	0.251	0.216	0.131	0.99	215.4	0.10	193.7
	6	7		0	21.72	1408	3.16	14.42		0.18		0.00		0.00	0.1	0.000	21.900	7.227	21.70	525	96.76	96.51	100.6	0.249	0.216	0.131	0.99	214.4	0.10	192.7
Private Property																														
	7	8		0	21.72	1408	3.16	14.42		0.18		0.00		0.00	0.1	0.000	21.900	7.227	21.70	525	96.48	96.11	149.6	0.247	0.216	0.131	0.99	213.9	0.10	192.2
	8	9		0	21.72	1408	3.16	14.42		0.18		0.00		0.00	0.1	0.000	21.900	7.227	21.70	525	96.09	95.73	125.4	0.287	0.216	0.131	1.06	230.4	0.09	208.7
9	9	10	5.52	381	27.24	1789	3.10	17.96		0.18		0.00		0.00	0.1	5.520	27.420	9.049	27.07	525	95.73	95.37	149.8	0.240	0.216	0.131	0.97	210.8	0.13	183.8
Rosenfield Crescent																														
10	10	11	3.39	234	30.63	2023	3.07	20.10		0.18		0.00		0.00	0.1	3.390	30.810	10.167	30.32	525	95.29	95.24	19.1	0.262	0.216	0.131	1.02	220.0	0.14	189.7
	11	12		0	30.63	2023	3.07	20.10		0.18		0.00		0.00	0.1	0.000	30.810	10.167	30.32	525	95.19	94.99	80.9	0.247	0.216	0.131	0.99	213.8	0.14	183.5
Sherk Crescent																														
12	12	13	6.53	450	37.16	2473	3.01	24.12		0.18		0.00		0.00	0.1	6.530	37.340	12.322	36.50	525	94.97	94.9	23.2	0.302	0.216	0.131	1.09	236.2	0.15	199.7
	13	14		0	37.16	2473	3.01	24.12		0.18		0.00		0.00	0.1	0.000	37.340	12.322	36.50	525	94.88	94.73	50.5	0.297	0.216	0.131	1.08	234.4	0.16	197.9
	14	15		0	37.16	2473	3.01	24.12		0.18		0.00		0.00	0.1	0.000	37.340	12.322	36.50	525	94.7	94.47	92.2	0.249	0.216	0.131	0.99	214.8	0.17	178.3
	15	16		0	37.16	2473	3.01	24.12		0.18		0.00		0.00	0.1	0.000	37.340	12.322	36.50	525	94.45	94.37	37.8	0.212	0.216	0.131	0.91	197.8	0.18	161.3
	16	17		0	37.16	2473	3.01	24.12		0.18		0.00		0.00	0.1	0.000	37.340	12.322	36.50	525	94.36	94.12	88.5	0.271	0.216	0.131	1.03	224.0	0.16	187.5
Knudson Drive																														
			6.95	480	44.11	2953																								
17&17A	17	18	2.79	193	46.90	3146	2.94	29.97		0.18		0.00		0.00	0.1	9.740	47.080	15.536	45.57	525	94.1	93.97	42.8	0.304	0.216	0.131	1.09	237.0	0.19	191.4
	18	19		0	46.90	3146	2.94	29.97		0.18		0.00		0.00	0.1	0.000	47.080	15.536	45.57	525	93.95	93.71	57.9	0.415	0.216	0.131	1.28	276.9	0.16	231.3
19	19	20	1.86	128	48.76	3274	2.93	31.07		0.18		0.00		0.00	0.1	1.860	48.940	16.150	47.27	525	93.69	93.49	83.5	0.240	0.216	0.131	0.97	210.5	0.22	163.2
	20	21		0	48.76	3274	2.93	31.07		0.18		0.00		0.00	0.1	0.000	48.940	16.150	47.27	525	93.47	93.34	51.2	0.254	0.216	0.131	1.00	216.7	0.22	169.4
	21	22		0	48.76	3274	2.93	31.07		0.18		0.00		0.00	0.1	0.000	48.940	16.150	47.27	525	93.33	93.12	71.9	0.292	0.216	0.131	1.07	232.4	0.20	185.1
22	22	23	5.17	356	53.93	3630	2.90	34.08		0.18		0.00		0.00	0.1	5.170	54.110	17.856	51.99	525	93.1	93	37.5	0.267	0.216	0.131	1.03	222.1	0.23	170.1
	23	25		0	53.93	3630	2.90	34.08		0.18		0.00		0.00	0.1	0.000	54.110	17.856	51.99	600	92.93	92.83	61.6	0.210	0.283	0.150	1.00	281.4	0.18	229.4
	25	26		0	53.93	3630	2.90	34.08		0.18		0.00		0.00	0.1	0.000	54.110	17.856	51.99	600	92.8	92.72	31.3	0.256	0.283	0.150	1.10	310.4	0.17	258.4
26	26	27	4.99	344	58.92	3974	2.87	36.95		0.18		0.00		0.00	0.1	4.990	59.100	19.503	56.51	600	92.67	92.56	57.5	0.191	0.283	0.150	0.95	268.6	0.21	212.0
	27	28		0	58.92	3974	2.87	36.95		0.18		0.00		0.00	0.1	0.000	59.100	19.503	56.51	600	92.54	92.37	51.4	0.331	0.283	0.150	1.25	353.1	0.16	296.6
	28	29		0	58.92	3974	2.87	36.95		0.18		0.00		0.00	0.1	0.000	59.100	19.503	56.51	600	92.37	92.15	100.6	0.219	0.283	0.150	1.02	287.1	0.20	230.6
	29	30		0	58.92	3974	2.87	36.95		0.18		0.00		0.00	0.1	0.000	59.100	19.503	56.51	600	92.13	91.91	94.3	0.233	0.283	0.150	1.05	296.6	0.19	240.1
30	30	31	1.85	127	60.77	4101	2.86	38.00		0.18		0.00		0.00	0.1	1.850	60.950	20.114	58.17	600	91.8	91.69	51.3	0.214	0.283	0.150	1.01	284.3	0.20	226.2
	31	32		0	60.77	4101	2.86	38.00		0.18		0.00		0.00	0.1	0.000	60.950	20.114	58.17	600	91.67	91.56	40.1	0.274	0.283	0.150	1.14	321.6	0.18	263.4
32	101	102	35.65	2460	35.65	2460	3.01	24.01		0.00		0.00		0.00	0.0	35.650	35.650	11.765	35.77	375	95.7	95.59	40.3	0.273	0.110	0.094	0.83	91.6	0.39	55.8
	102	103		0	35.65	2460	3.01	24.01		0.00		0.00		0.00	0.0	0.000	35.650	11.765	35.77	375	95.57	95.27	110.5	0.271	0.110	0.094	0.83	91.4	0.39	55.6
	103	104		0	35.65	2460	3.01	24.01		0.00		0.00		0.00	0.0	0.000	35.650	11.765	35.77	375	95.22	95.14	31.5	0.254	0.110	0.094	0.80	88.4	0.40	52.6
	104	105		0	35.65	2460	3.01	24.01		0.00		0.00		0.00	0.0	0.000	35.650	11.765	35.77	375	95.12	95.04	33.7	0.237	0.110	0.094	0.77	85.4	0.42	49.7
32A	105	106	12.60	870	48.25	3330	2.92	31.54		0.00		0.00		0.00	0.0	12.600	48.250	15.923	47.46	375	94.98	94.87	19.7	0.558	0.110	0.094	1.19	131.0	0.36	83.6
	106	107		0	48.25	3330	2.92	31.54		0.00		0.00		0.00	0.0	0.000	48.250	15.923	47.46	375	94.86	94.82	17.4	0.230	0.110	0.094	0.76	84.1	0.56	36.6
	107	108		0	48.25	3330	2.92	31.54		0.00		0.00		0.00	0.0	0.000	48.250	15.923	47.46	375	94.77	94.6	67.5	0.252	0.110	0.094	0.80	88.0	0.54	40.5
32B	108	109	9.12	630	57.37	3960	2.87	36.83		0.00		0.00		0.00	0.0	9.120	57.370	18.932	55.76	375	94.59	94.38	70.2	0.299	0.110	0.094	0.87	95.9	0.58	40.1
	109	110		0	57.37	3960	2.87	36.83		0.00		0.00		0.00	0.0	0.000	57.370	18.932	55.76	375	94.38	94.22	57.0	0.281	0.110	0.094	0.84	92.9	0.60	37.1

SANITARY SEWER CALCULATION SHEET - EXISTING CONDITIONS

PROJECT: **Kanata Golf and Country Club**
LOCATION: **7000 Campeau Drive**
FILE REF: **18-1061**
DATE: **28-May-20**

DESIGN PARAMETERS

Avg. Daily Flow Res.	280 L/p/d	Peak Fact Res. Per Harmons: Min = 2.0, Max =4.0		Infiltration / Inflow	0.33 L/s/ha
Avg. Daily Flow Comm.	28,000 L/ha/d	Harmon Correction Factor	0.8	Min. Pipe Velocity	0.60 m/s full flowing
Avg. Daily Flow Instit.	28,000 L/ha/d	Peak Fact. Comm.	1 (< 20% ICI)	Max. Pipe Velocity	3.00 m/s full flowing
Avg. Daily Flow Indust.	35,000 L/ha/d	Peak Fact. Instit.	1 (< 20% ICI)	Mannings N	0.013
Ex. Population Per Hectare*	69 Pop/Ha	Peak Fact. Indust. per MOE graph			

*Based on an average from Areas 2, 12 and 10.

DSEL

Location				Residential Area and Population					Commercial		Institutional		Industrial		Infiltration				Pipe Data											
Area ID	Up	Down	Area	Pop.	Cumulative Area	Cumulative Pop.	Peak. Fact.	Q_{res}	Area	Accu. Area	Area	Accu. Area	Area	Accu. Area	Q_{C+I+I}	Total Area	Accu. Area	Infiltration Flow	Total Flow	DIA	Upstream Invert	Downstream Invert	Length	Slope	$A_{hydraulic}$	R	Velocity	Q_{cap}	Q / Q full	Qresidual
			(ha)		(ha)		(-)	(L/s)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(L/s)	(ha)	(ha)	(L/s)	(L/s)	(mm)	(m)	(m)	(m)	(%)	(m^2)	(m)	(m/s)	(L/s)	(-)	(L/s)
	110	111		0	57.37	3960	2.87	36.83		0.00		0.00		0.00	0.0	0.000	57.370	18.932	55.76	375	94.18	93.94	57.0	0.421	0.110	0.094	1.03	113.8	0.49	58.0
	111	112		0	57.37	3960	2.87	36.83		0.00		0.00		0.00	0.0	0.000	57.370	18.932	55.76	375	93.9	93.77	43.0	0.302	0.110	0.094	0.87	96.4	0.58	40.6
	112	113		0	57.37	3960	2.87	36.83		0.00		0.00		0.00	0.0	0.000	57.370	18.932	55.76	375	93.76	93.63	42.0	0.310	0.110	0.094	0.88	97.5	0.57	41.8
	113	32		0	57.37	3960	2.87	36.83		0.00		0.00		0.00	0.0	0.000	57.370	18.932	55.76	375	93.63	93.4	43.0	0.535	0.110	0.094	1.16	128.2	0.43	72.5
Weslock Way																														
	32	33		0	118.14	8061	2.64	68.91		0.18		0.00		0.00	0.1	0.000	118.320	39.046	108.01	600	91.496	91.374	52.0	0.235	0.283	0.150	1.05	297.4	0.36	189.4
	33	34		0	118.14	8061	2.64	68.91		0.18		0.00		0.00	0.1	0.000	118.320	39.046	108.01	600	91.334	91.249	41.0	0.207	0.283	0.150	0.99	279.6	0.39	171.6
	34	35		0	118.14	8061	2.64	68.91		0.18		0.00		0.00	0.1	0.000	118.320	39.046	108.01	600	91.243	91.162	41.9	0.193	0.283	0.150	0.95	270.0	0.40	162.0
	35	36		0	118.14	8061	2.64	68.91		0.18		0.00		0.00	0.1	0.000	118.320	39.046	108.01	600	91.084	90.91	65.2	0.267	0.283	0.150	1.12	317.2	0.34	209.2
	36	37		0	118.14	8061	2.64	68.91		0.18		0.00		0.00	0.1	0.000	118.320	39.046	108.01	600	90.91	90.792	64.6	0.183	0.283	0.150	0.93	262.4	0.41	154.4
37	37	38	3.52	243	121.66	8304	2.63	70.71		0.18		0.00		0.00	0.1	3.520	121.840	40.207	110.98	600	90.792	90.613	45.6	0.393	0.283	0.150	1.36	384.7	0.29	273.7
	38	39		0	121.66	8304	2.63	70.71		0.18		0.00		0.00	0.1	0.000	121.840	40.207	110.98	600	90.61	90.509	38.0	0.266	0.283	0.150	1.12	316.6	0.35	205.6
39	39	40	5.02	349	126.68	8653	2.61	73.29		0.18		0.00		0.00	0.1	5.020	126.860	41.864	115.21	600	90.509	90.278	89.3	0.259	0.283	0.150	1.10	312.3	0.37	197.1
	40	41		0	126.68	8653	2.61	73.29		0.18		0.00		0.00	0.1	0.000	126.860	41.864	115.21	600	90.278	90.14	51.5	0.268	0.283	0.150	1.12	317.8	0.36	202.6
	41	42		0	126.68	8653	2.61	73.29		0.18		0.00		0.00	0.1	0.000	126.860	41.864	115.21	600	90.14	90.02	78.7	0.152	0.283	0.150	0.85	239.8	0.48	124.5
	42	43		0	126.68	8653	2.61	73.29		0.18		0.00		0.00	0.1	0.000	126.860	41.864	115.21	600	90	89.8	79.9	0.250	0.283	0.150	1.09	307.2	0.38	192.0
Walden Drive																														
43	43	44	10.63	733	137.31	9386	2.59	78.65		0.18		0.00		0.00	0.1	10.630	137.490	45.372	124.08	600	89.76	89.6	55.3	0.289	0.283	0.150	1.17	330.3	0.38	206.2
	44	45		0	137.31	9386	2.59	78.65		0.18		0.00		0.00	0.1	0.000	137.490	45.372	124.08	600	89.59	89.48	46.3	0.238	0.283	0.150	1.06	299.4	0.41	175.3
	45	46		0	137.31	9386	2.59	78.65		0.18		0.00		0.00	0.1	0.000	137.490	45.372	124.08	600	89.48	89.141	129.4	0.262	0.283	0.150	1.11	314.3	0.39	190.2
46A	46	47		0	0.00	0	3.80	0.00		0.00	5.22	5.22		0.00	1.7	5.220	142.710	47.094	48.79											
46	46	47	95.85	6613	233.16	15999	2.40	124.44		0.18	0.81	6.03		0.00	2.0	96.660	239.370	78.992	205.44	675	86.294	86.019	84.0	0.327	0.358	0.169	1.34	481.0	0.43	275.5
Kimmins Court																														
	47	48		0	233.16	15999	2.40	124.44		0.18		6.03		0.00	2.0	0.000	239.370	78.992	205.44	675	85.903	85.788	50.8	0.226	0.358	0.169	1.12	399.9	0.51	194.4
48	48	49	2.93	202	236.09	16202	2.40	125.78		0.18		6.03		0.00	2.0	2.930	242.300	79.959	207.75	675	85.788	85.678	31.4	0.351	0.358	0.169	1.39	497.9	0.42	290.2
	49	50		0	236.09	16202	2.40	125.78		0.18		6.03		0.00	2.0	0.000	242.300	79.959	207.75	675	85.678	85.603	26.2	0.286	0.358	0.169	1.26	449.7	0.46	242.0
	50	51		0	236.09	16202	2.40	125.78		0.18		6.03		0.00	2.0	0.000	242.300	79.959	207.75	675	85.603	85.345	93.2	0.277	0.358	0.169	1.24	442.2	0.47	234.5
	51	52		0	236.09	16202	2.40	125.78		0.18		6.03		0.00	2.0	0.000	242.300	79.959	207.75	675	85.315	85.201	40.7	0.280	0.358	0.169	1.24	444.9	0.47	237.1
	52	53		0	236.09	16202	2.40	125.78		0.18		6.03		0.00	2.0	0.000	242.300	79.959	207.75	675	85.168	85.041	65.8	0.193	0.358	0.169	1.03	369.4	0.56	161.7
	53	54		0	236.09	16202	2.40	125.78		0.18		6.03		0.00	2.0	0.000	242.300	79.959	207.75	675	85.01	84.875	54.5	0.248	0.358	0.169	1.17	418.4	0.50	210.6
	54	55		0	236.09	16202	2.40	125.78		0.18		6.03		0.00	2.0	0.000	242.300	79.959	207.75	675	81.286	80.992	47.3	0.622	0.358	0.169	1.85	662.7	0.31	455.0
Station Road																														
Future Development	55	56	180.03	10805	416.12	27007	2.22	194.11		0.18		6.03		0.00	2.0	180.030	422.330	139.369	335.49	750	81.286	80.992	96.4	0.305	0.442	0.188	1.39	614.8	0.55	279.3
	56	57		0	416.12	27007	2.22	194.11		0.18		6.03		0.00	2.0	0.000	422.330	139.369	335.49	750	80.971	80.673	111.1	0.268	0.442	0.188	1.31	576.6	0.58	241.1
	57	57A		0	416.12	27007	2.22	194.11		0.18		6.03		0.00	2.0	0.000	422.330	139.369	335.49	750	80.673	80.096	54.1	1.067	0.442	0.188	2.60	1149.7	0.29	814.2
	57A	58		0	416.12	27007	2.22	194.11		0.18		6.03		0.00	2.0	0.000	422.330	139.369	335.49	750	78.316	78.038	56.5	0.492	0.442	0.188	1.77	780.9	0.43	445.4
58	58	59	11.65	0	427.77	27007	2.22	194.11	2.86	3.04		6.03		0.00	2.9	14.510	436.840	144.157	341.20	750	76.138	75.961	63.4	0.279	0.442	0.188	1.33	588.2	0.58	247.0
	59	60		0	427.77	27007	2.22	194.11		3.04		6.03		0.00	2.9	0.000	436.840	144.157	341.20	750	76.138	75.666	95.1	0.496	0.442	0.188	1.78	784.3	0.44	443.1
60	60	61	24.02	0	451.79	27007	2.22	194.11	4.05	7.09		6.03		0.00	4.3	28.070	464.910	153.420	351.78	750	75.659	75.413	43.1	0.571	0.442	0.188	1.90	841.1	0.42	489.3
	61	62		0	451.79	27007	2.22	194.11		7.09		6.03		0.00	4.3	0.000	464.910	153.420	351.78	750	75.36	75.062	96.8	0.308	0.442	0.188	1.40	617.7	0.57	265.9
62	62	63	2.08	0	453.87	27007	2.22	194.11	1.20	8.29		6.03		0.00	4.6	3.280	468.190	154.503	353.25	750	74.999	74.779	79.8	0.276	0.442	0.188	1.32	584.5	0.60	231.3
	63	64		0	453.87	27007	2.22	194.11		8.29		6.03		0.00	4.6	0.000	468.190	154.503	353.25	750	74.748	74.581	54.3	0.308	0.442	0.188	1.40	617.4	0.57	264.1
	64	65		0	453.87	27007	2.22	194.11		8.29		6.03		0.00	4.6	0.000	468.190	154.503	353.25	750	74.562	74.413	47.1	0.316	0.442	0.188	1.42	626.2	0.56	272.9
	65	66	0.32	22	454.19	27029	2.22	194.24	0.22	8.51		6.03		0.00	4.7	0.540	468.730	154.681	353.63	750	74.368	74.128	76.8	0.312	0.442	0.188	1.41	622.3	0.57	268.7
	66	67		0	454.19	27029	2.22	194.24		8.51		6.03		0.00	4.7	0.000	468.730	154.681	353.63	750	74.121	73.824	81.2	0.366	0.442	0.188	1.52	673.3	0.53	319.7
	67	68		0	454.19	27029	2.22	194.24		8.51		6.03		0.00	4.7	0.000	468.730	154.681	353.63	750	73.787	73.727	17.2	0.349	0.442	0.188	1.49	657.5	0.54	303.9
	68	69		0	454.19	27029	2.22	194.24		8.51		6.03		0.00	4.7	0.000	468.730	154.681	353.63	750	73.7	73.466	81.8	0.286	0.442	0.188	1.35	595.4	0.59	241.8

SANITARY SEWER CALCULATION SHEET

Manning's n=0.013

LOCATION				RESIDENTIAL AREA AND POPULATION							COMM		INSTIT		PARK		C+I+I	INFILTRATION				PIPE						
STREET		FROM M.H.	TO M.H.	AREA (ha)	UNITS	POP.	CUMULATIVE AREA (ha)	CUMULATIVE POP.	PEAK FACT.	PEAK FLOW (l/s)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	PEAK FLOW (l/s)	TOTAL AREA (ha)	ACCU. AREA (ha)	INFILT. FLOW (l/s)	TOTAL FLOW (l/s)	DIST (m)	DIA (mm)	SLOPE (%)	CAP. (FULL) (l/s)	RATIO Q act/Q cap	VEL. (FULL) (m/s)	VEL. (ACT.) (m/s)
CAMPEAU DRIVE																												
CONSTANT FLOW PER KANATA LAKES & MARCHWOOD TRUNK SEWER HGL ANALYSIS PREPARED BY THE CITY OF OTTAWA																					43.8							
		1	2				0.00	0				0.00		0.00		0.00	0.00	0.00	0.00	0.00	43.83	16.9	525	0.296	233.98	0.19	1.08	0.82
2		2	3	7.53		520	7.53	520	3.4	5.68	0.07	0.07		0.00		0.00	0.00	7.60	7.60	2.51	52.02	78.2	525	0.243	212.00	0.25	0.98	0.81
		3	4				7.53	520	3.4	5.68		0.07		0.00		0.00	0.00	0.00	7.60	2.51	52.02	76.4	525	0.275	225.53	0.23	1.04	0.84
4		4	5	12.88		889	20.41	1409	3.2	14.43		0.07		0.00		0.00	0.00	12.88	20.48	6.76	65.01	24.1	525	0.290	231.60	0.28	1.07	0.92
5		5	6	1.31			21.72	1409	3.2	14.43	0.11	0.18		0.00		0.00	0.00	1.42	21.90	7.23	65.48	91.7	525	0.251	215.46	0.30	1.00	0.87
		6	1014A				21.72	1409	3.2	14.43		0.18		0.00		0.00	0.00	0.00	21.90	7.23	65.48	100.6	525	0.249	214.60	0.31	0.99	0.87
		1014A	1015A				21.72	1409	3.2	14.43		0.18		0.00		0.00	0.06	0.00	0.00	0.00	14.48	35.0	525	0.15	166.56	0.09	0.77	0.47
To STREET 7, Pipe 1015A - 1020A							21.72	1409				0.18		0.00		0.00			0.00									
STREET 20																												
		4004A	4005A	0.12		10	0.12	10	3.7	0.12		0.00		0.00		0.00	0.00	0.12	0.12	0.04	0.16	61.0	200	0.65	26.44	0.01	0.84	0.23
To STREET 1, Pipe 4005A - 4006A							0.12	10				0.00		0.00		0.00			0.12									
STREET 2																												
		4000A	4001A	0.25		20	0.25	20	3.7	0.24		0.00		0.00		0.00	0.00	0.25	0.25	0.08	0.32	61.0	200	0.65	26.44	0.01	0.84	0.28
To STREET 1, Pipe 4001A - 4002A							0.25	20				0.00		0.00		0.00			0.25									
		4008A	4009A	0.67		54	0.67	54	3.6	0.64		0.00		0.00		0.00	0.00	0.67	0.67	0.22	0.86	54.0	200	0.65	26.44	0.03	0.84	0.38
		4009A	4010A	0.23		19	0.90	73	3.6	0.86		0.00		0.00		0.00	0.00	0.23	0.90	0.30	1.15	23.0	200	0.35	19.40	0.06	0.62	0.34
		4010A	4011A	0.93		74	1.83	147	3.6	1.69		0.00		0.00		0.00	0.00	0.93	1.83	0.60	2.30	94.5	200	0.40	20.74	0.11	0.66	0.43
		4011A	4012A	0.75		60	2.58	207	3.5	2.36		0.00		0.00		0.00	0.00	0.75	2.58	0.85	3.21	63.0	200	0.45	22.00	0.15	0.70	0.50
		4012A	4013A	0.23		19	2.81	226	3.5	2.57		0.00		0.00		0.00	0.00	0.23	2.81	0.93	3.49	31.0	200	0.35	19.40	0.18	0.62	0.47
		4013A	4014A	0.84		67	3.65	293	3.5	3.29		0.00		0.00		0.00	0.00	0.84	3.65	1.20	4.50	94.5	200	0.45	22.00	0.20	0.70	0.55
		4014A	4015A	0.75		60	4.40	353	3.4	3.93		0.00		0.00		0.00	0.00	0.75	4.40	1.45	5.38	94.5	200	0.45	22.00	0.24	0.70	0.58
		4015A	4016A	0.13		11	4.53	364	3.4	4.05		0.00		0.00		0.00	0.00	0.13	4.53	1.49	5.54	11.0	200	0.35	19.40	0.29	0.62	0.53
		4016A	4017A	0.27		22	4.80	386	3.4	4.28		0.00		0.00		0.00	0.00	0.27	4.80	1.58	5.87	68.0	200	0.35	19.40	0.30	0.62	0.54
To STREET 1, Pipe 4017A - 6018A							4.80	386				0.00		0.00		0.00			4.80									
STREET 3																												
		4027A	4028A	0.55		44	0.55	44	3.7	0.52		0.00		0.00		0.00	0.00	0.55	0.55	0.18	0.70	44.0	200	3.65	62.66	0.01	1.99	0.64
		4028A	4033A	0.49		39	1.04	83	3.6	0.97		0.00		0.00		0.00	0.00	0.49	1.04	0.34	1.31	75.0	200	1.60	41.49	0.03	1.32	0.59
To STREET 19, Pipe 4033A - 4034A							1.04	83				0.00		0.00		0.00			1.04									
		4027A	4026A	0.46		37	0.46	37	3.7	0.44		0.00		0.00		0.00	0.00	0.46	0.46	0.15	0.59	51.5	200	0.65	26.44	0.02	0.84	0.34
		4026A	4025A	0.10		8	0.56	45	3.7	0.53		0.00		0.00		0.00	0.00	0.10	0.56	0.18	0.72	11.0	200	0.35	19.40	0.04	0.62	0.29
		4025A	4024A	0.26		21	0.82	66	3.6	0.78		0.00		0.00		0.00	0.00	0.26	0.82	0.27	1.05	67.5	200	3.25	59.13	0.02	1.88	0.71
To STREET 10, Pipe 4024A - 4023A							0.82	66				0.00		0.00		0.00			0.82									
STREET 19																												
Contribution From STREET 10, Pipe 4022A - 4032A							3.13	252				0.00		0.00		0.00		3.13	3.13									
Contribution From STREET 10, Pipe 4031A - 4032A							1.44	115				0.00		0.00		0.00		1.44	4.57									
		4032A	4033A	0.30		24	4.87	391	3.4	4.34		0.00		0.00		0.00	0.00	0.30	4.87	1.61	5.94	79.5	200	0.35	19.40	0.31	0.62	0.54
STREET 18																												
Contribution From STREET 3, Pipe 4028A - 4033A							1.04	83				0.00		0.00		0.00		1.04	5.91									
		4033A	4034A	0.22		18	6.13	492	3.4	5.39		0.00		0.00		0.00	0.00	0.22	6.13	2.02	7.42	47.5	250	0.25	29.73	0.25	0.61	0.50
		4034A	4035A	0.74		59	6.87	551	3.4	6.00		0.00		0.00		0.00	0.00	0.74	6.87	2.27	8.27	44.0	250	0.25	29.73	0.28	0.61	0.52
		4035A	4036A	0.48		39	7.35	590	3.3	6.40		0.00		0.00		0.00	0.00	0.48	7.35	2.43	8.83	44.5	250	0.25	29.73	0.30	0.61	0.53
		4036A	4037A	0.39		31	7.74	621	3.3	6.72		0.00		0.00		0.00	0.00	0.39	7.74	2.55	9.27	45.0	250	0.25	29.73	0.31	0.61	0.53
		4037A	4038A	0.78		62	8.52	683	3.3	7.35		0.00		0.00		0.00	0.00	0.78	8.52	2.81	10.16	90.5	250	0.25	29.73	0.34	0.61	0.55
To EASM 1024, Pipe 4038A - 4039A							8.52	683				0.00		0.00		0.00			8.52									
EASM 1024																												
Contribution From STREET 18, Pipe 4037A - 4038A							8.52	683				0.00		0.00		0.00		8.52	8.52									
		4038A	4039A	0.70		56	9.22	739	3.3	7.91		0.00		0.00		0.00	0.00	0.70	9.22	3.04	10.96	90.5	250	0.45	39.89	0.27	0.81	0.69
		4039A	4040A				9.22	739	3.3	7.91		0.00		0.00		0.00	0.00	0.00	9.22	3.04	10.96	16.5	250	0.25	29.73	0.37	0.61	0.56
To WESLOCK WAY, Pipe 4040A - MHSA00381							9.22	739				0.00		0.00		0.00			9.22									
STREET 8																												
		2011A	2012A	0.37		30	0.37	30	3.7	0.36		0.00		0.00		0.00	0.00	0.37	0.37	0.12	0.48	64.5	200	0.65	26.44	0.02	0.84	0.32

DESIGN PARAMETERS

Park Flow =	9300	L/ha/da	0.10764	l/s/Ha				
Average Daily Flow =	280	l/p/day			Industrial Peak Factor = as per MOE Graph			
Comm/Inst Flow =	28000	L/ha/da	0.3241	l/s/Ha	Extraneous Flow =		0.330	L/s/ha
Industrial Flow =	35000	L/ha/da	0.40509	l/s/Ha	Minimum Velocity =		0.600	m/s
Max Res. Peak Factor =	4.00				Manning's n =	(Conc)	0.013	(Pvc) 0.013
Commercial/Inst./Park Peak Factor =	1.00				Townhouse coeff=		2.7	
Institutional =	0.32	l/s/Ha			Single house coeff=		3.4	

Designed: GGG	PROJECT: 7000 Campeau Drive		
Checked: SLM	LOCATION: City of Ottawa		
Dwg. Reference: Sanitary Drainage Plan, Dwgs. No. 2D	File Ref: 18-1061	Date: 08 Jun 2021	Sheet No. 1 of 9

1061_SAN.xlsx

SANITARY SEWER CALCULATION SHEET

Manning's n=0.013

LOCATION			RESIDENTIAL AREA AND POPULATION							COMM		INSTIT		PARK		C+I+I	INFILTRATION				PIPE						
STREET	FROM M.H.	TO M.H.	AREA (ha)	UNITS	POP.	CUMULATIVE AREA (ha)	CUMULATIVE POP.	PEAK FACT.	PEAK FLOW (l/s)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	PEAK FLOW (l/s)	TOTAL AREA (ha)	ACCU. AREA (ha)	INFILT. FLOW (l/s)	TOTAL FLOW (l/s)	DIST (m)	DIA (mm)	SLOPE (%)	CAP. (FULL) (l/s)	RATIO Q act/Q cap	VEL. (FULL) (m/s)	VEL. (ACT.) (m/s)
	2012A	2013A	0.28		23	0.65	53	3.6	0.63		0.00		0.00		0.00	0.00	0.28	0.65	0.21	0.84	64.5	200	0.35	19.40	0.04	0.62	0.31
To STREET 7, Pipe 2013A - 2014A						0.65	53				0.00		0.00		0.00			0.65									
EASM 8																											
Contribution From STREET 7, Pipe 2007A - 2014A						6.39	510				0.00		0.00		0.00		6.39	6.39									
Contribution From STREET 7, Pipe 2013A - 2014A						4.64	370				0.00		0.00		0.00		4.64	11.03									
	2014A	2015A				11.03	880	3.3	9.32		0.00		0.00		0.00	0.00	0.00	11.03	3.64	12.96	12.0	250	0.25	29.73	0.44	0.61	0.58
	2015A	2016A				11.03	880	3.3	9.32		0.00		0.00		0.00	0.00	0.00	11.03	3.64	12.96	47.0	250	0.25	29.73	0.44	0.61	0.58
	2016A	2017A				11.03	880	3.3	9.32		0.00		0.00		0.00	0.00	0.00	11.03	3.64	12.96	45.5	250	0.25	29.73	0.44	0.61	0.58
	2017A	2018A				11.03	880	3.3	9.32		0.00		0.00		0.00	0.00	0.00	11.03	3.64	12.96	35.5	250	0.25	29.73	0.44	0.61	0.58
	2018A	2019A	1.12		89	12.15	969	3.2	10.20		0.00		0.00		0.00	0.00	1.12	12.15	4.01	14.21	73.5	250	0.25	29.73	0.48	0.61	0.60
	2019A	2020A	0.11		9	12.26	978	3.2	10.28		0.00		0.00		0.00	0.00	0.11	12.26	4.05	14.33	64.0	250	0.25	29.73	0.48	0.61	0.60
	2020A	2021A	0.03		3	12.29	981	3.2	10.31		0.00		0.00		0.00	0.00	0.03	12.29	4.06	14.37	45.5	250	0.25	29.73	0.48	0.61	0.60
To KNUDSON DRIVE, Pipe MHSA00841 - MHSA00840						12.29	981				0.00		0.00		0.00			12.29									
STREET 17																											
	6000A	6001A	0.35		28	0.35	28	3.7	0.33		0.00		0.00		0.00	0.00	0.35	0.35	0.12	0.45	32.0	200	0.65	26.44	0.02	0.84	0.32
	6001A	6002A	0.08		7	0.43	35	3.7	0.42		0.00		0.00		0.00	0.00	0.08	0.43	0.14	0.56	10.5	200	0.35	19.40	0.03	0.62	0.27
	6002A	6003A	0.76		61	1.19	96	3.6	1.12		0.00		0.00		0.00	0.00	0.76	1.19	0.39	1.51	104.0	200	0.35	19.40	0.08	0.62	0.36
	6003A	6004A	0.66		53	1.85	149	3.6	1.72		0.00		0.00		0.00	0.00	0.66	1.85	0.61	2.33	84.5	250	0.25	29.73	0.08	0.61	0.36
	6004A	6005A	0.62		50	2.47	199	3.5	2.27		0.00		0.00		0.00	0.00	0.62	2.47	0.82	3.08	84.5	250	0.25	29.73	0.10	0.61	0.39
	6005A	6006A	0.40		32	2.87	231	3.5	2.62		0.00		0.00		0.00	0.00	0.40	2.87	0.95	3.57	61.5	250	0.25	29.73	0.12	0.61	0.40
	6006A	6007A	0.56		45	3.43	276	3.5	3.11		0.00		0.00		0.00	0.00	0.56	3.43	1.13	4.24	69.5	250	0.25	29.73	0.14	0.61	0.43
	6007A	6008A	0.73		58	4.16	334	3.4	3.73		0.00		0.00		0.00	0.00	0.73	4.16	1.37	5.10	77.5	250	0.25	29.73	0.17	0.61	0.45
	6008A	6009A	0.65		52	4.81	386	3.4	4.28		0.00		0.00		0.00	0.00	0.65	4.81	1.59	5.87	70.5	250	0.25	29.73	0.20	0.61	0.47
	6009A	6010A	0.71		57	5.52	443	3.4	4.88		0.00		0.00		0.00	0.00	0.71	5.52	1.82	6.70	70.5	250	0.25	29.73	0.23	0.61	0.49
	6010A	6011A	0.15		12	5.67	455	3.4	5.01		0.00		0.00		0.00	0.00	0.15	5.67	1.87	6.88	15.0	250	0.25	29.73	0.23	0.61	0.49
	6011A	6012A	0.16		13	5.83	468	3.4	5.14		0.00		0.00		0.00	0.00	0.16	5.83	1.92	7.07	46.0	250	0.25	29.73	0.24	0.61	0.50
	6012A	6013A	0.44		35	6.27	503	3.4	5.51		0.00		0.00		0.00	0.00	0.44	6.27	2.07	7.58	17.5	250	0.25	29.73	0.25	0.61	0.50
To EASM 649, Pipe 6013A - 6014A						6.27	503				0.00		0.00		0.00			6.27									
EASM 649																											
Contribution From STREET 17, Pipe 6012A - 6013A						6.27	503				0.00		0.00		0.00		6.27	6.27									
	6013A	6014A				6.27	503	3.4	5.51		0.00		0.00		0.00	0.00	0.00	6.27	2.07	7.58	94.5	250	0.25	29.73	0.25	0.61	0.50
	6014A	MHSA00834				6.27	503	3.4	5.51		0.00		0.00		0.00	0.00	0.00	6.27	2.07	7.58	44.5	250	0.25	29.73	0.25	0.61	0.50
To WESLOCK WAY, Pipe 6014A - MHSA00834						6.27	503				0.00		0.00		0.00			6.27									
EASM 646																											
Contribution From STREET 9, Pipe 1003A - 1004A						2.99	239				0.00		0.00		0.00		2.99	2.99									
	1004A	1005A	0.37		30	3.36	269	3.5	3.03		0.00		0.00		0.00	0.00	0.37	3.36	1.11	4.14	59.0	200	1.45	39.49	0.10	1.26	0.81
	1005A	1006A	0.14		12	3.50	281	3.5	3.16		0.00		0.00		0.00	0.00	0.14	3.50	1.16	4.32	49.0	200	0.35	19.40	0.22	0.62	0.50
	1006A	1007A				3.50	281	3.5	3.16		0.00		0.00		0.00	0.00	0.00	3.50	1.16	4.32	13.0	200	0.35	19.40	0.22	0.62	0.50
To KNUDSON DRIVE, Pipe 1006A - 17B						3.50	281				0.00		0.00		0.00			3.50									
STREET 4																											
	5008A	5009A	0.13		11	0.13	11	3.7	0.13		0.00		0.00		0.00	0.00	0.13	0.13	0.04	0.18	18.0	200	0.70	27.44	0.01	0.87	0.24
	5009A	5010A	0.07		6	0.20	17	3.7	0.20		0.00		0.00		0.00	0.00	0.07	0.20	0.07	0.27	15.0	200	0.45	22.00	0.01	0.70	0.23
	5010A	5011A	0.23		19	0.43	36	3.7	0.43		0.00		0.00		0.00	0.00	0.23	0.43	0.14	0.57	12.0	200	0.35	19.40	0.03	0.62	0.27
	5011A	5012A	0.38		31	0.81	67	3.6	0.79		0.00		0.00		0.00	0.00	0.38	0.81	0.27	1.06	48.0	200	0.45	22.00	0.05	0.70	0.35
	5012A	5013A	0.10		8	0.91	75	3.6	0.88		0.00		0.00		0.00	0.00	0.10	0.91	0.30	1.18	10.5	200	0.35	19.40	0.06	0.62	0.34

DESIGN PARAMETERS

Park Flow =	9300	L/ha/da	0.10764	l/s/Ha				
Average Daily Flow =	280	l/p/day			Industrial Peak Factor = as per MOE Graph			
Comm/Inst Flow =	28000	L/ha/da	0.3241	l/s/Ha	Extraneous Flow =		0.330	L/s/ha
Industrial Flow =	35000	L/ha/da	0.40509	l/s/Ha	Minimum Velocity =		0.600	m/s
Max Res. Peak Factor =	4.00				Manning's n =	(Conc)	0.013	(Pvc) 0.013
Commercial/Inst./Park Peak Factor =	1.00				Townhouse coeff=		2.7	
Institutional =	0.32	l/s/Ha			Single house coeff=		3.4	

Designed: GGG	PROJECT: **7000 Campeau Drive**		
Checked: SLM	LOCATION: **City of Ottawa**		
Dwg. Reference: Sanitary Drainage Plan, Dwgs. No. 2D	File Ref: 18-1061	Date: **08 Jun 2021**	Sheet No. 2 of 9

SANITARY SEWER CALCULATION SHEET

Manning's n=0.013

LOCATION: STREET	FROM M.H.	TO M.H.	RESIDENTIAL: AREA (ha)	UNITS	POP.	CUMULATIVE AREA (ha)	CUMULATIVE POP.	PEAK FACT.	PEAK FLOW (l/s)	COMM AREA (ha)	COMM ACCU. AREA (ha)	INSTIT AREA (ha)	INSTIT ACCU. AREA (ha)	PARK AREA (ha)	PARK ACCU. AREA (ha)	C+I+I PEAK FLOW (l/s)	INFILTRATION TOTAL AREA (ha)	INFILTRATION ACCU. AREA (ha)	INFILT. FLOW (l/s)	TOTAL FLOW (l/s)	PIPE DIST (m)	DIA (mm)	SLOPE (%)	CAP. (FULL) (l/s)	RATIO Q act/Q cap	VEL. (FULL) (m/s)	VEL. (ACT.) (m/s)
	5013A	5014A	0.22		18	1.13	93	3.6	1.09		0.00		0.00		0.00	0.00	0.22	1.13	0.37	1.46	39.5	200	1.50	40.17	0.04	1.28	0.60
To STREET 16, Pipe 5014A - 5015A						1.13	93				0.00		0.00		0.00			1.13									
STREET 10																											
	5005A	5007A	0.53		43	0.53	43	3.7	0.51		0.00		0.00		0.00	0.00	0.53	0.53	0.17	0.69	28.0	200	1.00	32.80	0.02	1.04	0.41
To STREET 16, Pipe 5007A - 5014A						0.53	43				0.00		0.00		0.00			0.53									
STREET 16																											
	4029A	4030A	0.68		54	0.68	54	3.6	0.64		0.00		0.00		0.00	0.00	0.68	0.68	0.22	0.86	59.5	200	0.65	26.44	0.03	0.84	0.38
	4030A	4031A	0.54		43	1.22	97	3.6	1.13		0.00		0.00		0.00	0.00	0.54	1.22	0.40	1.53	49.5	200	0.40	20.74	0.07	0.66	0.38
	4031A	4032A	0.22		18	1.44	115	3.6	1.33		0.00		0.00		0.00	0.00	0.22	1.44	0.48	1.81	24.5	200	6.00	80.34	0.02	2.56	1.03
To STREET 19, Pipe 4032A - 4033A						1.44	115				0.00		0.00		0.00			1.44									
STREET 10																											
	5000A	5001A	0.53		43	0.53	43	3.7	0.51		0.00		0.00		0.00	0.00	0.53	0.53	0.17	0.69	28.5	200	0.95	31.97	0.02	1.02	0.41
	5001A	5002A	0.04		4	0.57	47	3.7	0.56		0.00		0.00		0.00	0.00	0.04	0.57	0.19	0.74	11.0	200	2.00	46.38	0.02	1.48	0.53
	5002A	5003A	0.41		33	0.98	80	3.6	0.94		0.00		0.00		0.00	0.00	0.41	0.98	0.32	1.26	70.0	200	0.90	31.12	0.04	0.99	0.48
	5003A	5004A	0.28		23	1.26	103	3.6	1.20		0.00		0.00		0.00	0.00	0.28	1.26	0.42	1.61	38.0	200	0.60	25.41	0.06	0.81	0.45
	5004A	5006A	0.04		4	1.30	107	3.6	1.24		0.00		0.00		0.00	0.00	0.04	1.30	0.43	1.67	22.0	200	0.90	31.12	0.05	0.99	0.52
	5006A	5007A	0.02		2	1.32	109	3.6	1.27		0.00		0.00		0.00	0.00	0.02	1.32	0.44	1.70	14.0	200	2.30	49.74	0.03	1.58	0.73
To STREET 16, Pipe 5007A - 5014A						1.32	109				0.00		0.00		0.00			1.32									
STREET 16																											
	6017A	4019A				0.00					0.00		0.00		0.00	0.00	0.00	0.00	0.00	0.00	37.5	200	0.65	26.44	0.00	0.84	0.05
	4019A	4020A	1.06		85	1.06	85	3.6	0.99		0.00		0.00		0.00	0.00	1.06	1.06	0.35	1.34	52.5	200	0.35	19.40	0.07	0.62	0.35
	4020A	4024A	0.20		16	1.26	101	3.6	1.18		0.00		0.00		0.00	0.00	0.20	1.26	0.42	1.59	26.0	200	0.35	19.40	0.08	0.62	0.37
Contribution From STREET 3, Pipe 4025A - 4024A						0.82	66				0.00		0.00		0.00		0.82	2.08									
	4024A	4023A	0.26		21	2.34	188	3.5	2.15		0.00		0.00		0.00	0.00	0.26	2.34	0.77	2.92	34.0	200	0.35	19.40	0.15	0.62	0.44
	4023A	4022A	0.33		27	2.67	215	3.5	2.45		0.00		0.00		0.00	0.00	0.33	2.67	0.88	3.33	38.5	200	0.35	19.40	0.17	0.62	0.46
	4022A	4032A	0.46		37	3.13	252	3.5	2.85		0.00		0.00		0.00	0.00	0.46	3.13	1.03	3.88	62.5	200	0.35	19.40	0.20	0.62	0.48
To STREET 19, Pipe 4032A - 4033A						3.13	252				0.00		0.00		0.00			3.13									
STREET 16																											
Contribution From STREET 10, Pipe 5005A - 5007A						1.32	109				0.00		0.00		0.00		1.32	1.32									
Contribution From STREET 10, Pipe 5006A - 5007A						0.53	43				0.00		0.00		0.00		0.53	1.85									
	5007A	5014A	0.47		38	2.32	190	3.5	2.17		0.00		0.00		0.00	0.00	0.47	2.32	0.77	2.94	86.0	200	0.45	22.00	0.13	0.70	0.49
Contribution From STREET 4, Pipe 5013A - 5014A						1.13	93				0.00		0.00		0.00		1.13	3.45									
	5014A	5015A	0.80		64	4.25	347	3.4	3.87		0.00		0.00		0.00	0.00	0.80	4.25	1.40	5.27	96.0	200	1.35	38.11	0.14	1.21	0.85
	5015A	5016A	0.59		47	4.84	394	3.4	4.37		0.00		0.00		0.00	0.00	0.59	4.84	1.60	5.96	80.5	200	1.70	42.76	0.14	1.36	0.95
	5016A	5017A	0.41		33	5.25	427	3.4	4.71		0.00		0.00		0.00	0.00	0.41	5.25	1.73	6.45	80.5	200	0.35	19.40	0.33	0.62	0.55
	5017A	5018A	0.16		13	5.41	440	3.4	4.85		0.00		0.00		0.00	0.00	0.16	5.41	1.79	6.64	29.0	200	0.35	19.40	0.34	0.62	0.56
	5018A	5019A	0.06		5	5.47	445	3.4	4.90		0.00		0.00		0.00	0.00	0.06	5.47	1.81	6.71	18.5	200	0.35	19.40	0.35	0.62	0.56
	5019A	MHSA00827	0.07		6	5.54	451	3.4	4.97		0.00		0.00		0.00	0.00	0.07	5.54	1.83	6.79	42.0	200	0.35	19.40	0.35	0.62	0.56
To WESLOCK WAY, Pipe MHSA00827 - MHSA00826						5.54	451				0.00		0.00		0.00			5.54									
STREET 11																											
	1043A	1044A	0.26		21	0.26	21	3.7	0.25		0.00		0.00		0.00	0.00	0.26	0.26	0.09	0.34	21.5	200	0.65	26.44	0.01	0.84	0.28
	1044A	1045A	0.40		32	0.66	53	3.6	0.63		0.00		0.00		0.00	0.00	0.40	0.66	0.22	0.84	64.0	200	0.35	19.40	0.04	0.62	0.31
	1045A	1046A	0.99		79	1.65	132	3.6	1.53		0.00		0.00		0.00	0.00	0.99	1.65	0.54	2.07	102.0	200	0.35	19.40	0.11	0.62	0.40
To STREET 9, Pipe 1046A - 1047A						1.65	132				0.00		0.00		0.00			1.65									

DESIGN PARAMETERS

Park Flow =	9300	L/ha/da	0.10764	l/s/Ha				
Average Daily Flow =	280	l/p/day			Industrial Peak Factor = as per MOE Graph			
Comm/Inst Flow =	28000	L/ha/da	0.3241	l/s/Ha	Extraneous Flow =		0.330	L/s/ha
Industrial Flow =	35000	L/ha/da	0.40509	l/s/Ha	Minimum Velocity =		0.600	m/s
Max Res. Peak Factor =	4.00				Manning's n =	(Conc)	0.013	(Pvc) 0.013
Commercial/Inst./Park Peak Factor =	1.00				Townhouse coeff=		2.7	
Institutional =	0.32	l/s/Ha			Single house coeff=		3.4	

Designed: GGG	PROJECT: 7000 Campeau Drive		
Checked: SLM	LOCATION: City of Ottawa		
Dwg. Reference: Sanitary Drainage Plan, Dwgs. No. 2D	File Ref: 18-1061	Date: 08 Jun 2021	Sheet No. 3 of 9

SANITARY SEWER CALCULATION SHEET

Manning's n=0.013

LOCATION: STREET	FROM M.H.	TO M.H.	RESIDENTIAL AREA (ha)	UNITS	POP.	CUMULATIVE AREA (ha)	CUMULATIVE POP.	PEAK FACT.	PEAK FLOW (l/s)	COMM AREA (ha)	COMM ACCU. AREA (ha)	INSTIT AREA (ha)	INSTIT ACCU. AREA (ha)	PARK AREA (ha)	PARK ACCU. AREA (ha)	C+I+I PEAK FLOW (l/s)	INFILTRATION TOTAL AREA (ha)	INFILTRATION ACCU. AREA (ha)	INFILT. FLOW (l/s)	TOTAL FLOW (l/s)	PIPE DIST (m)	DIA (mm)	SLOPE (%)	CAP. (FULL) (l/s)	RATIO Q act/Q cap	VEL. (FULL) (m/s)	VEL. (ACT.) (m/s)
STREET 12																											
	1040A	1041A	0.65		52	0.65	52	3.6	0.61		0.00		0.00		0.00	0.00	0.65	0.65	0.21	0.83	119.0	200	1.05	33.61	0.02	1.07	0.44
To STREET 9, Pipe 1041A - 1048A						0.65	52				0.00		0.00		0.00			0.65									
STREET 13																											
	1037A	1038A	0.35		28	0.35	28	3.7	0.33		0.00		0.00		0.00	0.00	0.35	0.35	0.12	0.45	74.0	200	0.65	26.44	0.02	0.84	0.32
	1038A	1039A	0.30		24	0.65	52	3.6	0.61		0.00		0.00		0.00	0.00	0.30	0.65	0.21	0.83	74.0	200	0.35	19.40	0.04	0.62	0.31
To STREET 9, Pipe 1039A - 1041A						0.65	52				0.00		0.00		0.00			0.65									
STREET 14																											
	1034A	1035A	0.36		29	0.36	29	3.7	0.35		0.00		0.00		0.00	0.00	0.36	0.36	0.12	0.47	89.5	200	0.65	26.44	0.02	0.84	0.32
	1035A	1036A	0.49		39	0.85	68	3.6	0.80		0.00		0.00		0.00	0.00	0.49	0.85	0.28	1.08	89.5	200	0.35	19.40	0.06	0.62	0.33
To STREET 9, Pipe 1036A - 1039A						0.85	68				0.00		0.00		0.00			0.85									
STREET 15																											
	1022A	1027A				0.00					0.00		0.00		0.00	0.00	0.00	0.00	0.00	0.00	60.0	200	0.65	26.44	0.00	0.84	0.05
To STREET 5, Pipe 1027A - 1028A						0.00	0				0.00		0.00		0.00			0.00									
Contribution From STREET 1, Pipe 1023A - 1024A						0.49	39				0.00		0.00		0.00		0.49	0.49									
	1024A	1025A	0.22		18	0.71	57	3.6	0.67		0.00		0.00		0.00	0.00	0.22	0.71	0.23	0.91	66.5	200	0.35	19.40	0.05	0.62	0.31
	1025A	1026A	0.11		9	0.82	66	3.6	0.78		0.00		0.00		0.00	0.00	0.11	0.82	0.27	1.05	10.5	200	0.35	19.40	0.05	0.62	0.33
	1026A	1027A	0.75		60	1.57	126	3.6	1.46		0.00		0.00		0.00	0.00	0.75	1.57	0.52	1.98	64.5	200	0.35	19.40	0.10	0.62	0.40
To STREET 5, Pipe 1027A - 1028A						1.57	126				0.00		0.00		0.00			1.57									
STREET 5																											
Contribution From STREET 15, Pipe 1022A - 1027A						0.00	0				0.00		0.00		0.00		0.00	0.00									
Contribution From STREET 15, Pipe 1026A - 1027A						1.57	126				0.00		0.00		0.00		1.57	1.57									
	1027A	1028A	0.37		30	1.94	156	3.5	1.79		0.00		0.00		0.00	0.00	0.37	1.94	0.64	2.43	58.5	200	0.35	19.40	0.13	0.62	0.42
	1028A	1029A	0.66		53	2.60	209	3.5	2.38		0.00		0.00		0.00	0.00	0.66	2.60	0.86	3.24	97.5	200	0.35	19.40	0.17	0.62	0.46
To STREET 7, Pipe 1029A - 1030A						2.60	209				0.00		0.00		0.00			2.60									
STREET 1																											
	1010A	1011A	0.99		79	0.99	79	3.6	0.93		0.00		0.00		0.00	0.00	0.99	0.99	0.33	1.25	80.5	200	0.65	26.44	0.05	0.84	0.43
To STREET 6, Pipe 1011A - 1012A						0.99	79				0.00		0.00		0.00			0.99									
	1023A	1024A	0.49		39	0.49	39	3.7	0.46		0.00		0.00		0.00	0.00	0.49	0.49	0.16	0.63	82.0	200	2.50	51.86	0.01	1.65	0.55
To STREET 15, Pipe 1024A - 1025A						0.49	39				0.00		0.00		0.00			0.49									
	1008A	1009A	0.86		69	0.86	69	3.6	0.81		0.00		0.00		0.00	0.00	0.86	0.86	0.28	1.09	67.0	200	0.65	26.44	0.04	0.84	0.41
	1009A	1011A	1.28		102	2.14	171	3.5	1.96		0.00		0.00		0.00	0.00	1.28	2.14	0.71	2.67	67.0	200	0.85	30.24	0.09	0.96	0.59
To STREET 6, Pipe 1011A - 1012A						2.14	171				0.00		0.00		0.00			2.14									
Contribution From STREET 2, Pipe 4000A - 4001A						0.25	20				0.00		0.00		0.00		0.25	0.25									
	4001A	4002A	0.49		39	0.74	59	3.6	0.70		0.00		0.00		0.00	0.00	0.49	0.74	0.24	0.94	84.0	200	0.35	19.40	0.05	0.62	0.31
	4002A	4003A	0.36		29	1.10	88	3.6	1.03		0.00		0.00		0.00	0.00	0.36	1.10	0.36	1.39	25.5	200	0.35	19.40	0.07	0.62	0.36
	4003A	4005A	1.34		107	2.44	195	3.5	2.23		0.00		0.00		0.00	0.00	1.34	2.44	0.81	3.03	119.5	200	0.45	22.00	0.14	0.70	0.49
Contribution From STREET 20, Pipe 4004A - 4005A						0.12	10				0.00		0.00		0.00		0.12	2.56									
	4005A	4006A	0.16		13	2.72	218	3.5	2.48		0.00		0.00		0.00	0.00	0.16	2.72	0.90	3.38	45.0	200	0.35	19.40	0.17	0.62	0.46
	4006A	4007A	0.79		63	3.51	281	3.5	3.16		0.00		0.00		0.00	0.00	0.79	3.51	1.16	4.32	101.5	200	0.35	19.40	0.22	0.62	0.50
	4007A	4017A	0.83		66	4.34	347	3.4	3.87		0.00		0.00		0.00	0.00	0.83	4.34	1.43	5.30	102.0	200	1.45	39.49	0.13	1.26	0.87

DESIGN PARAMETERS

Park Flow =	9300	L/ha/da	0.10764	l/s/Ha				
Average Daily Flow =	280	l/p/day			Industrial Peak Factor = as per MOE Graph			
Comm/Inst Flow =	28000	L/ha/da	0.3241	l/s/Ha	Extraneous Flow =		0.330	L/s/ha
Industrial Flow =	35000	L/ha/da	0.40509	l/s/Ha	Minimum Velocity =		0.600	m/s
Max Res. Peak Factor =	4.00				Manning's n =	(Conc)	0.013	(Pvc) 0.013
Commercial/Inst./Park Peak Factor =	1.00				Townhouse coeff=		2.7	
Institutional =	0.32	l/s/Ha			Single house coeff=		3.4	

Designed: GGG	PROJECT: 7000 Campeau Drive		
Checked: SLM	LOCATION: City of Ottawa		
Dwg. Reference: Sanitary Drainage Plan, Dwgs. No. 2D	File Ref: 18-1061	Date: 08 Jun 2021	Sheet No. 4 of 9

SANITARY SEWER CALCULATION SHEET

Manning's n=0.013

LOCATION			RESIDENTIAL AREA AND POPULATION							COMM		INSTIT		PARK		C+I+I	INFILTRATION				PIPE						
STREET	FROM M.H.	TO M.H.	AREA (ha)	UNITS	POP.	CUMULATIVE AREA (ha)	CUMULATIVE POP.	PEAK FACT.	PEAK FLOW (l/s)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	PEAK FLOW (l/s)	TOTAL AREA (ha)	ACCU. AREA (ha)	INFILT. FLOW (l/s)	TOTAL FLOW (l/s)	DIST (m)	DIA (mm)	SLOPE (%)	CAP. (FULL) (l/s)	RATIO Q act/Q cap	VEL. (FULL) (m/s)	VEL. (ACT.) (m/s)
Contribution From STREET 2, Pipe 4016A - 4017A						4.80	386				0.00		0.00		0.00		4.80	9.14									
	4017A	6018A				9.14	733	3.3	7.85		0.00		0.00		0.00	0.00	0.00	9.14	3.02	10.87	65.5	200	0.35	19.40	0.56	0.62	0.64
	6018A	4018A				9.14	733	3.3	7.85		0.00		0.00		0.00	0.00	0.00	9.14	3.02	10.87	10.5	200	0.35	19.40	0.56	0.62	0.64
To KNUDSON DRIVE, Pipe 4018A - 101						9.14	733				0.00		0.00		0.00			9.14									
STREET 6																											
	1016A	1017A	0.12		10	0.12	10	3.7	0.12		0.00		0.00		0.00	0.00	0.12	0.12	0.04	0.16	61.0	200	2.40	50.81	0.00	1.62	0.36
	1017A	1018A	0.74		59	0.86	69	3.6	0.81		0.00		0.00		0.00	0.00	0.74	0.86	0.28	1.09	47.0	200	2.20	48.65	0.02	1.55	0.62
	1018A	1019A	0.53		43	1.39	112	3.6	1.30		0.00		0.00		0.00	0.00	0.53	1.39	0.46	1.76	47.5	200	0.35	19.40	0.09	0.62	0.38
	1019A	1020A	0.51		41	1.90	153	3.6	1.76		0.00		0.00		0.00	0.00	0.51	1.90	0.63	2.39	68.5	200	0.35	19.40	0.12	0.62	0.42
To STREET 7, Pipe 1020A - 1021A						1.90	153				0.00		0.00		0.00			1.90									
Contribution From STREET 1, Pipe 1009A - 1011A						2.14	171				0.00		0.00		0.00		2.14	2.14									
Contribution From STREET 1, Pipe 1010A - 1011A						0.99	79				0.00		0.00		0.00		0.99	3.13									
	1011A	1012A	0.55		44	3.68	294	3.5	3.30		0.00		0.00		0.00	0.00	0.55	3.68	1.21	4.52	75.0	200	0.35	19.40	0.23	0.62	0.50
	1012A	1013A	0.12		10	3.80	304	3.5	3.41		0.00		0.00		0.00	0.00	0.12	3.80	1.25	4.66	26.0	200	0.35	19.40	0.24	0.62	0.50
	1013A	1020A	1.09		87	4.89	391	3.4	4.34		0.00		0.00		0.00	0.00	1.09	4.89	1.61	5.95	82.0	200	0.35	19.40	0.31	0.62	0.54
To STREET 7, Pipe 1020A - 1021A						4.89	391				0.00		0.00		0.00			4.89									
STREET 7																											
	2004A	2005A	1.09		87	1.09	87	3.6	1.02		0.00		0.00		0.00	0.00	1.09	1.09	0.36	1.38	60.0	200	1.85	44.61	0.03	1.42	0.64
	2005A	2006A	0.90		72	1.99	159	3.5	1.83		0.00		0.00		0.00	0.00	0.90	1.99	0.66	2.48	74.0	200	0.35	19.40	0.13	0.62	0.42
	2008A	2009A	1.69		134	1.69	134	3.6	1.55		0.00		0.00		0.00	0.00	1.69	1.69	0.56	2.11	119.0	200	0.70	27.44	0.08	0.87	0.51
	2009A	2010A	1.50		119	3.19	253	3.5	2.86		0.00		0.00		0.00	0.00	1.50	3.19	1.05	3.91	12.5	200	0.45	22.00	0.18	0.70	0.53
	2010A	2013A	0.54		43	3.73	296	3.5	3.32		0.00		0.00		0.00	0.00	0.54	3.73	1.23	4.55	66.0	200	0.65	26.44	0.17	0.84	0.63
Contribution From STREET 8, Pipe 2012A - 2013A						0.65	53				0.00		0.00		0.00		0.65	4.38									
	2013A	2014A	0.26		21	4.64	370	3.4	4.11		0.00		0.00		0.00	0.00	0.26	4.64	1.53	5.64	74.0	200	0.95	31.97	0.18	1.02	0.76
To EASM 8, Pipe 2014A - 2015A						4.64	370				0.00		0.00		0.00			4.64									
	2000A	2001A	1.03		82	1.03	82	3.6	0.96		0.00		0.00		0.00	0.00	1.03	1.03	0.34	1.30	104.5	200	0.65	26.44	0.05	0.84	0.43
	2001A	2002A	1.16		92	2.19	174	3.5	1.99		0.00		0.00		0.00	0.00	1.16	2.19	0.72	2.72	104.5	200	0.35	19.40	0.14	0.62	0.43
	2002A	2003A				2.19	174	3.5	1.99		0.00		0.00		0.00	0.00	0.00	2.19	0.72	2.72	57.5	200	0.35	19.40	0.14	0.62	0.43
	2003A	2006A	0.48		39	2.67	213	3.5	2.42		0.00		0.00		0.00	0.00	0.48	2.67	0.88	3.30	28.5	200	0.35	19.40	0.17	0.62	0.46
	2006A	2007A	0.68		54	5.34	426	3.4	4.70		0.00		0.00		0.00	0.00	0.68	5.34	1.76	6.47	71.5	200	0.35	19.40	0.33	0.62	0.55
	2007A	2014A	1.05		84	6.39	510	3.4	5.58		0.00		0.00		0.00	0.00	1.05	6.39	2.11	7.69	71.5	200	0.35	19.40	0.40	0.62	0.58
To EASM 8, Pipe 2014A - 2015A						6.39	510				0.00		0.00		0.00			6.39									
Contribution From CAMPEAU DRIVE, Pipe 1014A - 1015A						21.72	1409.00				0.18		0.00		0.00		0.00	0.00		43.80							
	1015A	1020A	0.76		61	22.48	1470	3.1	15.00		0.18		0.00		0.00	0.06	0.76	0.76	0.25	59.11	112.0	525	0.10	136.00	0.43	0.63	0.61
Contribution From STREET 6, Pipe 1013A - 1020A						4.89	391				0.00		0.00		0.00		4.89	5.65									
Contribution From STREET 6, Pipe 1019A - 1020A						1.90	153				0.00		0.00		0.00		1.90	7.55									
			0.56		0	29.83	2014				0.18		0.00		0.00		0.56	8.11		43.80							
	1020A	1021A	0.10		8	29.93	2022	3.1	20.09		0.18		0.00		0.00	0.06	0.10	8.21	2.71	66.66	27.5	525	0.10	179.80	0.37	0.83	0.77
	1021A	1029A				29.93	2022	3.1	20.09		0.18		0.00		0.00	0.06	0.00	8.21	2.71	66.66	47.5	525	0.10	179.80	0.37	0.83	0.77
Contribution From STREET 5, Pipe 1028A - 1029A						2.60	209				0.00		0.00		0.00		2.60	10.81									
	1029A	1030A	0.53		43	33.06	2274	3.0	22.35		0.18		0.00		0.00	0.06	0.53	11.34	3.74	69.96	63.0	525	0.10	179.80	0.39	0.83	0.78

DESIGN PARAMETERS

Park Flow =	9300	L/ha/da	0.10764	l/s/Ha				
Average Daily Flow =	280	l/p/day			Industrial Peak Factor = as per MOE Graph			
Comm/Inst Flow =	28000	L/ha/da	0.3241	l/s/Ha	Extraneous Flow =		0.330	L/s/ha
Industrial Flow =	35000	L/ha/da	0.40509	l/s/Ha	Minimum Velocity =		0.600	m/s
Max Res. Peak Factor =	4.00				Manning's n =	(Conc)	0.013	(Pvc) 0.013
Commercial/Inst./Park Peak Factor =	1.00				Townhouse coeff=		2.7	
Institutional =	0.32	l/s/Ha			Single house coeff=		3.4	

Designed: GGG

Checked: SLM

Dwg. Reference: Sanitary Drainage Plan, Dwgs. No. 2D

PROJECT: **7000 Campeau Drive**

LOCATION: **City of Ottawa**

File Ref: 18-1061

Date: **08 Jun 2021**

Sheet No. 5 of 9

SANITARY SEWER CALCULATION SHEET

Manning's n=0.013

LOCATION			RESIDENTIAL AREA AND POPULATION							COMM		INSTIT		PARK		C+I+I	INFILTRATION				PIPE						
STREET	FROM M.H.	TO M.H.	AREA (ha)	UNITS	POP.	CUMULATIVE AREA (ha)	CUMULATIVE POP.	PEAK FACT.	PEAK FLOW (l/s)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	PEAK FLOW (l/s)	TOTAL AREA (ha)	ACCU. AREA (ha)	INFILT. FLOW (l/s)	TOTAL FLOW (l/s)	DIST (m)	DIA (mm)	SLOPE (%)	CAP. (FULL) (l/s)	RATIO Q act/Q cap	VEL. (FULL) (m/s)	VEL. (ACT.) (m/s)
	1030A	1031A	0.54		43	33.60	2317	3.0	22.74		0.18		0.00		0.00	0.06	0.54	11.88	3.92	70.52	76.0	525	0.10	179.80	0.39	0.83	0.78
To STREET 9, Pipe 1031A - 1032A						33.60	2317				0.18		0.00		0.00			11.88		43.80							
STREET 9																											
	1000A	1001A	0.70		56	0.70	56	3.6	0.66		0.00		0.00		0.00	0.00	0.70	0.70	0.23	0.89	79.0	200	0.65	26.44	0.03	0.84	0.39
	1001A	1002A	1.14		91	1.84	147	3.6	1.69		0.00		0.00		0.00	0.00	1.14	1.84	0.61	2.30	114.5	200	0.50	23.19	0.10	0.74	0.47
	1002A	1003A	0.57		46	2.41	193	3.5	2.20		0.00		0.00		0.00	0.00	0.57	2.41	0.80	3.00	63.5	200	0.45	22.00	0.14	0.70	0.49
	1003A	1004A	0.58		46	2.99	239	3.5	2.71		0.00		0.00		0.00	0.00	0.58	2.99	0.99	3.69	63.5	200	0.45	22.00	0.17	0.70	0.52
To EASM 646, Pipe 1004A - 1005A						2.99	239				0.00		0.00		0.00			2.99									
	1042A	1046A	1.26		100	1.26	100	3.6	1.17		0.00		0.00		0.00	0.00	1.26	1.26	0.42	1.58	102.5	200	1.60	41.49	0.04	1.32	0.62
Contribution From STREET 11, Pipe 1045A - 1046A						1.65	132				0.00		0.00		0.00		1.65	2.91									
	1046A	1047A	0.04		4	2.95	236	3.5	2.67		0.00		0.00		0.00	0.00	0.04	2.95	0.97	3.65	11.0	200	0.50	23.19	0.16	0.74	0.53
	1047A	1048A	0.22		18	3.17	254	3.5	2.87		0.00		0.00		0.00	0.00	0.22	3.17	1.05	3.92	49.5	200	0.35	19.40	0.20	0.62	0.48
To EASM 731, Pipe 1048A - 1049A						3.17	254				0.00		0.00		0.00			3.17									
Contribution From STREET 7, Pipe 1030A - 1031A						33.60	2317				0.18		0.00		0.00		11.88	11.88		43.80							
	1031A	1032A	0.22		18	33.82	2335	3.0	22.90		0.18		0.00		0.00	0.06	0.22	12.10	3.99	70.75	52.0	525	0.10	179.80	0.39	0.83	0.78
	1032A	1033A	0.08		7	33.90	2342	3.0	22.96		0.18		0.00		0.00	0.06	0.08	12.18	4.02	70.84	10.5	525	0.10	179.80	0.39	0.83	0.78
	1033A	1036A	0.07		6	33.97	2348	3.0	23.01		0.18		0.00		0.00	0.06	0.07	12.25	4.04	70.91	14.5	525	0.10	179.80	0.39	0.83	0.78
Contribution From STREET 14, Pipe 1035A - 1036A						0.85	68				0.00		0.00		0.00		0.85	13.10									
	1036A	1039A	0.24		20	35.06	2436	3.0	23.79		0.18		0.00		0.00	0.06	0.24	13.34	4.40	72.06	50.0	525	0.10	179.80	0.40	0.83	0.78
Contribution From STREET 13, Pipe 1038A - 1039A						0.65	52				0.00		0.00		0.00		0.65	13.99									
	1039A	1041A	0.24		20	35.95	2508	3.0	24.43		0.18		0.00		0.00	0.06	0.24	14.23	4.70	72.99	50.0	525	0.10	179.80	0.41	0.83	0.78
Contribution From STREET 12, Pipe 1040A - 1041A						0.65	52				0.00		0.00		0.00		0.65	14.88									
	1041A	1048A	0.08		7	36.68	2567	3.0	24.95		0.18		0.00		0.00	0.06	0.08	14.96	4.94	73.75	18.0	525	0.10	179.80	0.41	0.83	0.79
To EASM 731, Pipe 1048A - 1049A						36.68	2567				0.18		0.00		0.00			14.96		43.80							
EASM 731																											
Contribution From STREET 9, Pipe 1041A - 1048A						36.68	2567				0.18		0.00		0.00		14.96	14.96		43.80							
Contribution From STREET 9, Pipe 1047A - 1048A						3.17	254				0.00		0.00		0.00		3.17	18.13									
	1048A	MHSA00857				39.85	2821	3.0	27.17		0.18		0.00		0.00	0.06	0.00	18.13	5.98	77.01	86.5	525	0.26	263.09	0.29	1.22	1.05
To ROSENFIELD CRESCENT, Pipe MHSA00857 - MHSA00856						39.85	2821				0.18		0.00		0.00			18.13		77.01							
ROSENFIELD CRESCENT																											
Contribution From EASM 731, Pipe 1048A - MHSA00857						39.85	2821				0.18		0.00		0.00		18.13	18.13									
	MHSA00857	MHSA00856	3.39		234	43.24	3055	2.9	29.19		0.18		0.00		0.00	0.06	3.39	21.52	7.10	80.18	19.1	525	0.262	220.13	0.36	1.02	0.93
	MHSA00856	MHSA00855				43.24	3055	2.9	29.19		0.18		0.00		0.00	0.06	0.00	21.52	7.10	80.18	80.9	525	0.247	213.74	0.38	0.99	0.91
To SHERK CRESCENT, Pipe MHSA00855 - MHSA00854						43.24	3055				0.18		0.00		0.00			21.52		80.18							
SHERK CRESCENT																											
Contribution From ROSENFIELD CRESCENT, Pipe MHSA00856 - MHSA00855						43.24	3055				0.18		0.00		0.00		21.52	21.52									
	MHSA00855	MHSA00854	6.53		450	49.77	3505	2.9	33.02		0.18		0.00		0.00	0.06	6.53	28.05	9.26	86.17	23.2	525	0.302	236.34	0.36	1.09	1.00
	MHSA00854	MHSA00853				49.77	3505	2.9	33.02		0.18		0.00		0.00	0.06	0.00	28.05	9.26	86.17	50.5	525	0.297	234.37	0.37	1.08	0.99
	MHSA00853	MHSA00852				49.77	3505	2.9	33.02		0.18		0.00		0.00	0.06	0.00	28.05	9.26	86.17	92.2	525	0.249	214.60	0.40	0.99	0.94
	MHSA00852	MHSA00851				49.77	3505	2.9	33.02		0.18		0.00		0.00	0.06	0.00	28.05	9.26	86.17	37.8	525	0.212	198.02	0.44	0.91	0.88
	MHSA00851	MHSA00850				49.77	3505	2.9	33.02		0.18		0.00		0.00	0.06	0.00	28.05	9.26	86.17	88.5	525	0.271	223.88	0.38	1.03	0.97
To KNUDSON DRIVE, Pipe MHSA00850 - MHSA00849						49.77	3505				0.18		0.00		0.00			28.05		86.17							

DESIGN PARAMETERS

Park Flow =	9300	L/ha/da	0.10764	l/s/Ha				
Average Daily Flow =	280	l/p/day			Industrial Peak Factor = as per MOE Graph			
Comm/Inst Flow =	28000	L/ha/da	0.3241	l/s/Ha	Extraneous Flow =		0.330	L/s/ha
Industrial Flow =	35000	L/ha/da	0.40509	l/s/Ha	Minimum Velocity =		0.600	m/s
Max Res. Peak Factor =	4.00				Manning's n =	(Conc)	0.013	(Pvc) 0.013
Commercial/Inst./Park Peak Factor =	1.00				Townhouse coeff=		2.7	
Institutional =	0.32	l/s/Ha			Single house coeff=		3.4	

Designed: GGG

Checked: SLM

Dwg. Reference: Sanitary Drainage Plan, Dwgs. No. 2D

PROJECT: **7000 Campeau Drive**

LOCATION: **City of Ottawa**

File Ref: 18-1061

Date: **08 Jun 2021**

Sheet No. 6 of 9

SANITARY SEWER CALCULATION SHEET

Manning's n=0.013

LOCATION				RESIDENTIAL AREA AND POPULATION							COMM		INSTIT		PARK		C+I+I	INFILTRATION				PIPE						
STREET		FROM M.H.	TO M.H.	AREA (ha)	UNITS	POP.	CUMULATIVE AREA (ha)	CUMULATIVE POP.	PEAK FACT.	PEAK FLOW (l/s)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	PEAK FLOW (l/s)	TOTAL AREA (ha)	ACCU. AREA (ha)	INFILT. FLOW (l/s)	TOTAL FLOW (l/s)	DIST (m)	DIA (mm)	SLOPE (%)	CAP. (FULL) (l/s)	RATIO Q act/Q cap	VEL. (FULL) (m/s)	VEL. (ACT.) (m/s)
KNUDSON DRIVE																												
		17A	1006A	6.95		480	6.95	480	3.4	5.27		0.00		0.00		0.00	0.00	6.95	6.95	2.29	7.56	81.0	250	0.339	34.62	0.22	0.71	0.56
Contribution From EASM 646, Pipe 1007A - 1006A							3.50	281.00				0.00		0.00		0.00		3.50	3.50									
		1006A	17B				10.45	761	3.3	8.14		0.00		0.00		0.00	0.00	0.00	10.45	3.45	11.58	29.0	250	0.339	34.62	0.33	0.71	0.63
		17B	17				10.45	761	3.3	8.14		0.00		0.00		0.00	0.00	0.00	10.45	3.45	11.58	228.1	250	0.300	32.57	0.36	0.66	0.61
Contribution From SHERK CRESCENT, Pipe MHSA00851 - MHSA00850							49.77	3505.00				0.18		0.00		0.00		28.05	38.50									
		MHSA00850	MHSA00849	2.79		193	63.01	4459	2.8	40.93		0.18		0.00		0.00	0.06	2.79	51.74	17.07	101.89	42.8	525	0.304	237.12	0.43	1.10	1.05
		MHSA00849	MHSA00848				63.01	4459	2.8	40.93		0.18		0.00		0.00	0.06	0.00	51.74	17.07	101.89	57.9	525	0.415	277.05	0.37	1.28	1.18
		MHSA00848	MHSA00847	1.86		128	64.87	4587	2.8	41.97		0.18		0.00		0.00	0.06	1.86	53.60	17.69	103.55	83.5	525	0.240	210.69	0.49	0.97	0.96
		MHSA00847	MHSA00846				64.87	4587	2.8	41.97		0.18		0.00		0.00	0.06	0.00	53.60	17.69	103.55	51.2	525	0.254	216.74	0.48	1.00	0.99
		MHSA00846	MHSA00845				64.87	4587	2.8	41.97		0.18		0.00		0.00	0.06	0.00	53.60	17.69	103.55	71.9	525	0.292	232.39	0.45	1.07	1.04
		MHSA00845	MHSA00844	5.17		356	70.04	4943	2.8	44.85		0.18		0.00		0.00	0.06	5.17	58.77	19.39	108.13	37.5	525	0.267	222.22	0.49	1.03	1.02
		MHSA00844	MHSA00843				70.04	4943	2.8	44.85		0.18		0.00		0.00	0.06	0.00	58.77	19.39	108.13	38.6	600	0.210	281.38	0.38	1.00	0.93
		MHSA00843	MHSA00842				70.04	4943	2.8	44.85		0.18		0.00		0.00	0.06	0.00	58.77	19.39	108.13	23.0	600	0.210	281.38	0.38	1.00	0.93
		MHSA00842	MHSA00841				70.04	4943	2.8	44.85		0.18		0.00		0.00	0.06	0.00	58.77	19.39	108.13	31.3	600	0.256	310.67	0.35	1.10	1.00
Contribution From EASM 8, Pipe 2020A - MHSA00841							12.29	981.00				0.00		0.00		0.00		12.29	12.29									
		MHSA00841	MHSA00840	4.99		344	87.32	6268	2.7	55.29		0.18		0.00		0.00	0.06	4.99	76.05	25.10	124.28	57.5	600	0.191	376.48	0.33	1.33	1.19
		MHSA00840	MHSA00839				87.32	6268	2.7	55.29		0.18		0.00		0.00	0.06	0.00	76.05	25.10	124.28	51.4	600	0.331	353.26	0.35	1.25	1.13
		MHSA00839	MHSA00838				87.32	6268	2.7	55.29		0.18		0.00		0.00	0.06	0.00	76.05	25.10	124.28	100.6	600	0.219	287.34	0.43	1.02	0.97
		MHSA00838	MHSA00837				87.32	6268	2.7	55.29		0.18		0.00		0.00	0.06	0.00	76.05	25.10	124.28	94.3	600	0.233	296.38	0.42	1.05	1.00
		MHSA00837	MHSA00836	1.85		127	89.17	6395	2.7	56.28		0.18		0.00		0.00	0.06	1.85	77.90	25.71	125.87	51.3	600	0.214	284.04	0.44	1.00	0.97
		MHSA00836	MHSA00835				89.17	6395	2.7	56.28		0.18		0.00		0.00	0.06	0.00	77.90	25.71	125.87	40.1	600	0.274	321.40	0.39	1.14	1.06
To WESLOCK WAY, Pipe MHSA00835 - MHSA00834							89.17	6395				0.18		0.00		0.00			77.90									
Contribution From STREET 1, Pipe 6018A - 4018A							9.14	733.00				0.00		0.00		0.00		9.14	9.14									
		4018A	101	35.65		2460	44.79	3193	2.9	30.37		0.00		0.00		0.00	0.00	35.65	44.79	14.78	45.16	12.0	375	0.273	91.61	0.49	0.83	0.83
		101	102				44.79	3193	2.9	30.37		0.00		0.00		0.00	0.00	0.00	44.79	14.78	45.16	40.3	375	0.273	91.61	0.49	0.83	0.83
		102	103				44.79	3193	2.9	30.37		0.00		0.00		0.00	0.00	0.00	44.79	14.78	45.16	110.5	375	0.271	91.27	0.49	0.83	0.82
		103	104				44.79	3193	2.9	30.37		0.00		0.00		0.00	0.00	0.00	44.79	14.78	45.16	31.5	375	0.254	88.36	0.51	0.80	0.80
		104	105				44.79	3193	2.9	30.37		0.00		0.00		0.00	0.00	0.00	44.79	14.78	45.16	33.7	375	0.237	85.36	0.53	0.77	0.78
		105	106	12.60		870	57.39	4063	2.9	37.68		0.00		0.00		0.00	0.00	12.60	57.39	18.94	56.62	19.7	375	0.558	130.97	0.43	1.19	1.14
		106	107				57.39	4063	2.9	37.68		0.00		0.00		0.00	0.00	0.00	57.39	18.94	56.62	17.4	375	0.230	84.09	0.67	0.76	0.82
		107	108				57.39	4063	2.9	37.68		0.00		0.00		0.00	0.00	0.00	57.39	18.94	56.62	67.5	375	0.252	88.02	0.64	0.80	0.84
		108	109	9.12		630	66.51	4693	2.8	42.83		0.00		0.00		0.00	0.00	9.12	66.51	21.95	64.78	70.2	375	0.299	95.87	0.68	0.87	0.93
		109	110				66.51	4693	2.8	42.83		0.00		0.00		0.00	0.00	0.00	66.51	21.95	64.78	57.0	375	0.281	92.94	0.70	0.84	0.91
		110	111				66.51	4693	2.8	42.83		0.00		0.00		0.00	0.00	0.00	66.51	21.95	64.78	57.0	375	0.421	113.76	0.57	1.03	1.06
		111	112				66.51	4693	2.8	42.83		0.00		0.00		0.00	0.00	0.00	66.51	21.95	64.78	43.0	375	0.302	96.35	0.67	0.87	0.94
		112	113				66.51	4693	2.8	42.83		0.00		0.00		0.00	0.00	0.00	66.51	21.95	64.78	42.0	375	0.310	97.62	0.66	0.88	0.95
		113	MHSA00835				66.51	4693	2.8	42.83		0.00		0.00		0.00	0.00	0.00	66.51	21.95	64.78	53.0	375	0.535	128.24	0.51	1.16	1.16
To WESLOCK WAY, Pipe MHSA00835 - MHSA00834							66.51	4693				0.00		0.00		0.00			66.51									

DESIGN PARAMETERS

Park Flow =	9300	L/ha/da	0.10764	l/s/Ha					
Average Daily Flow =	280	l/p/day			Industrial Peak Factor = as per MOE Graph				
Comm/Inst Flow =	28000	L/ha/da	0.3241	l/s/Ha	Extraneous Flow =		0.330	L/s/ha	
Industrial Flow =	35000	L/ha/da	0.40509	l/s/Ha	Minimum Velocity =		0.600	m/s	
Max Res. Peak Factor =	4.00				Manning's n =	(Conc)	0.013	(Pvc)	0.013
Commercial/Inst./Park Peak Factor =	1.00				Townhouse coeff=		2.7		
Institutional =	0.32	l/s/Ha			Single house coeff=		3.4		

Designed: GGG	PROJECT: 7000 Campeau Drive		
Checked: SLM	LOCATION: City of Ottawa		
Dwg. Reference: Sanitary Drainage Plan, Dwgs. No. 2D	File Ref: 18-1061	Date: 08 Jun 2021	Sheet No. 7 of 9

SANITARY SEWER CALCULATION SHEET

Manning's n=0.013

LOCATION			RESIDENTIAL AREA AND POPULATION							COMM		INSTIT		PARK		C+I+I	INFILTRATION				PIPE						
STREET	FROM M.H.	TO M.H.	AREA (ha)	UNITS	POP.	CUMULATIVE AREA (ha)	CUMULATIVE POP.	PEAK FACT.	PEAK FLOW (l/s)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	PEAK FLOW (l/s)	TOTAL AREA (ha)	ACCU. AREA (ha)	INFILT. FLOW (l/s)	TOTAL FLOW (l/s)	DIST (m)	DIA (mm)	SLOPE (%)	CAP. (FULL) (l/s)	RATIO Q act/Q cap	VEL. (FULL) (m/s)	VEL. (ACT.) (m/s)
WESLOCK WAY																											
Contribution From KNUDSON DRIVE, Pipe MHSA00836 - MHSA00835						89.17	6395.00				0.18		0.00		0.00		0.00	77.90									
Contribution From KNUDSON DRIVE, Pipe 113 - MHSA00835						66.51	4693.00				0.00		0.00		0.00		0.00	66.51									
	MHSA00835	MHSA00834				155.68	11088	2.5	90.84		0.18		0.00		0.00	0.06	0.00	144.41	47.66	182.38	52.0	600	0.235	297.65	0.61	1.05	1.11
Contribution From EASM 649, Pipe 6015A - MHSA00834						6.27	503.00				0.00		0.00		0.00		0.00	6.27									
	MHSA00834	MHSA00833				161.95	11591	2.5	94.38		0.18		0.00		0.00	0.06	0.00	150.68	49.72	187.99	41.0	600	0.207	461.74	0.41	1.63	1.54
	MHSA00833	MHSA00832				161.95	11591	2.5	94.38		0.18		0.00		0.00	0.06	0.00	150.68	49.72	187.99	41.9	600	0.193	269.75	0.70	0.95	1.03
	MHSA00832	4040A				161.95	11591	2.5	94.38		0.18		0.00		0.00	0.06	0.00	150.68	49.72	187.99	25.5	600	0.183	262.66	0.72	0.93	1.01
Contribution From EASM 1024, Pipe 4039A - 4040A						9.22	739.00				0.00		0.00		0.00		0.00	9.22									
	4040A	MHSA00831				171.17	12330	2.5	99.54		0.18		0.00		0.00	0.06	0.00	159.90	52.77	196.19	38.9	600	0.183	450.66	0.44	1.59	1.54
	MHSA00831	MHSA00830				171.17	12330	2.5	99.54		0.18		0.00		0.00	0.06	0.00	159.90	52.77	196.19	66.8	600	0.266	316.68	0.62	1.12	1.18
	MHSA00830	MHSA00829	3.52		243	174.69	12573	2.5	101.22		0.18		0.00		0.00	0.06	3.52	163.42	53.93	199.04	45.6	600	0.393	384.92	0.52	1.36	1.37
	MHSA00829	MHSA00828				174.69	12573	2.5	101.22		0.18		0.00		0.00	0.06	0.00	163.42	53.93	199.04	38.0	600	0.266	316.68	0.63	1.12	1.18
	MHSA00828	MHSA00827	5.02		349	179.71	12922	2.5	103.63		0.18		0.00		0.00	0.06	5.02	168.44	55.59	203.11	89.3	600	0.259	312.48	0.65	1.11	1.17
Contribution From STREET 16, Pipe 5019A - MHSA00827						5.54	451.00				0.00		0.00		0.00		0.00	5.54									
	MHSA00827	MHSA00826				185.25	13373	2.5	106.73		0.18		0.00		0.00	0.06	0.00	173.98	57.41	208.03	51.5	600	0.268	520.97	0.40	1.84	1.73
	MHSA00826	MHSA00825				185.25	13373	2.5	106.73		0.18		0.00		0.00	0.06	0.00	173.98	57.41	208.03	78.7	600	0.152	239.39	0.87	0.85	0.95
	MHSA00825	MHSA00824				185.25	13373	2.5	106.73		0.18		0.00		0.00	0.06	0.00	173.98	57.41	208.03	79.9	600	0.250	307.01	0.68	1.09	1.16
To WALDEN DRIVE, Pipe MHSA00824 - MHSA00823						185.25	13373				0.18		0.00		0.00			173.98									
WALDEN DRIVE																											
Contribution From WESLOCK WAY, Pipe MHSA00825 - MHSA00824						185.25	13373.00				0.18		0.00		0.00		0.00	173.98									
	MHSA00824	MHSA00823	10.63		733	195.88	14106	2.4	111.73		0.18		0.00		0.00	0.06	10.63	184.61	60.92	216.54	55.3	600	0.289	330.08	0.66	1.17	1.24
	MHSA00823	MHSA00822				195.88	14106	2.4	111.73		0.18		0.00		0.00	0.06	0.00	184.61	60.92	216.54	46.3	600	0.238	299.55	0.72	1.06	1.15
	MHSA00822	MHSA00821				195.88	14106	2.4	111.73		0.18		0.00		0.00	0.06	0.00	184.61	60.92	216.54	129.4	600	0.262	314.29	0.69	1.11	1.20
	MHSA00821	MHSA00820	95.85		6613	291.73	20719	2.3	155.08		0.18	0.81	0.81		0.00	0.32	96.66	281.27	92.82	292.05	84.0	675	0.327	480.68	0.61	1.34	1.41
To KIMMINS COURT, Pipe MHSA00820 - MHSA00819						291.73	20719				0.18		0.81		0.00			281.27									
KIMMINS COURT																											
Contribution From WALDEN WAY, Pipe MHSA00821 - MHSA00820						291.73	20719.00				0.18		0.81		0.00		0.00	281.27									
	MHSA00820	MHSA00819				291.73	20719	2.3	155.08		0.18		0.81		0.00	0.32	0.00	281.27	92.82	292.05	50.8	675	0.226	399.61	0.73	1.12	1.22
	MHSA00819	MHSA00818	2.93		202	294.66	20921	2.3	156.36		0.18		0.81		0.00	0.32	2.93	284.20	93.79	294.30	31.4	675	0.351	498.01	0.59	1.39	1.45
	MHSA00818	MHSA00817				294.66	20921	2.3	156.36		0.18		0.81		0.00	0.32	0.00	284.20	93.79	294.30	26.2	675	0.286	449.54	0.65	1.26	1.34
	MHSA00817	MHSA00816				294.66	20921	2.3	156.36		0.18		0.81		0.00	0.32	0.00	284.20	93.79	294.30	93.2	675	0.277	442.41	0.67	1.24	1.32
	MHSA00816	MHSA00815				294.66	20921	2.3	156.36		0.18		0.81		0.00	0.32	0.00	284.20	93.79	294.30	40.7	675	0.280	444.80	0.66	1.24	1.33
	MHSA00815	MHSA00814				294.66	20921	2.3	156.36		0.18		0.81		0.00	0.32	0.00	284.20	93.79	294.30	65.8	675	0.193	369.29	0.80	1.03	1.14
	MHSA00814	MHSA00813				294.66	20921	2.3	156.36		0.18		0.81		0.00	0.32	0.00	284.20	93.79	294.30	54.5	675	0.248	418.61	0.70	1.17	1.26
	MHSA00813	MHSA00812				294.66	20921	2.3	156.36		0.18		0.81		0.00	0.32	0.00	284.20	93.79	294.30	47.3	675	0.622	662.95	0.44	1.85	1.79
To STATION ROAD, Pipe MHSA00812 - MHSA00811						294.66	20921				0.18		0.81		0.00			284.20									
STATION ROAD																											
Contribution From KIMMINS COURT, Pipe MHSA00813 - MH SA00812						294.66	20921.00				0.18		0.81		0.00		0.00	284.20									
	MHSA00812	MHSA00811	180.03		10805	474.69	31726	2.2	222.36		0.18		0.81		0.00	0.32	180.03	464.23	153.20	419.71	96.4	750	0.305	614.83	0.68	1.39	1.50
	MHSA00811	MHSA00810				474.69	31726	2.2	222.36		0.18		0.81		0.00	0.32	0.00	464.23	153.20	419.71	111.1	750	0.268	576.33	0.73	1.30	1.42
	MHSA00810	MHSA00809				474.69	31726	2.2	222.36		0.18		0.81		0.00	0.32	0.00	464.23	153.20	419.71	110.6	750	0.492	780.88	0.54	1.77	1.80
	MHSA00809	MHSA00808	11.65			486.34	31726	2.2	222.36	2.86	3.04		0.81		0.00	1.25	14.51	478.74	157.98	425.42	63.4	750	0.279	588.04	0.72	1.33	1.45
	MHSA00808	MHSA00807				486.34	31726	2.2	222.36		3.04		0.81		0.00	1.25	0.00	478.74	157.98	425.42	95.1	750	0.496	784.05	0.54	1.77	1.80
	MHSA00807	MHSA00806	24.02			510.36	31726	2.2	222.36	4.05	7.09		0.81		0.00	2.56	28.07	506.81	167.25	436.00	43.1	750	0.571	841.24	0.52	1.90	1.92

DESIGN PARAMETERS

Park Flow =	9300	L/ha/da	0.10764	l/s/Ha				
Average Daily Flow =	280	l/p/day			Industrial Peak Factor = as per MOE Graph			
Comm/Inst Flow =	28000	L/ha/da	0.3241	l/s/Ha	Extraneous Flow =		0.330	L/s/ha
Industrial Flow =	35000	L/ha/da	0.40509	l/s/Ha	Minimum Velocity =		0.600	m/s
Max Res. Peak Factor =	4.00				Manning's n =	(Conc)	0.013	(Pvc) 0.013
Commercial/Inst./Park Peak Factor =	1.00				Townhouse coeff=		2.7	
Institutional =	0.32	l/s/Ha			Single house coeff=		3.4	

Designed: GGG

Checked: SLM

Dwg. Reference: Sanitary Drainage Plan, Dwgs. No. 2D

PROJECT: **7000 Campeau Drive**

LOCATION: **City of Ottawa**

File Ref: 18-1061

Date: **08 Jun 2021**

Sheet No. 8 of 9

1061_SAN.xlsx

SANITARY SEWER CALCULATION SHEET

Manning's n=0.013

LOCATION			RESIDENTIAL AREA AND POPULATION							COMM		INSTIT		PARK		C+I+I	INFILTRATION				PIPE						
STREET	FROM M.H.	TO M.H.	AREA (ha)	UNITS	POP.	CUMULATIVE AREA (ha)	CUMULATIVE POP.	PEAK FACT.	PEAK FLOW (l/s)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	PEAK FLOW (l/s)	TOTAL AREA (ha)	ACCU. AREA (ha)	INFILT. FLOW (l/s)	TOTAL FLOW (l/s)	DIST (m)	DIA (mm)	SLOPE (%)	CAP. (FULL) (l/s)	RATIO Q act/Q cap	VEL. (FULL) (m/s)	VEL. (ACT.) (m/s)
STATION ROAD																											
	MHSA00806	MHSA00805				510.36	31726	2.2	222.36		7.09		0.81		0.00	2.56	0.00	506.81	167.25	436.00	96.8	750	0.308	617.84	0.71	1.40	1.51
	MHSA00805	MHSA00804	2.08			512.44	31726	2.2	222.36	1.20	8.29		0.81		0.00	2.95	3.28	510.09	168.33	437.47	79.8	750	0.278	586.98	0.75	1.33	1.45
	MHSA00804	MHSA00803				512.44	31726	2.2	222.36		8.29		0.81		0.00	2.95	0.00	510.09	168.33	437.47	54.3	750	0.308	617.84	0.71	1.40	1.52
	MHSA00803	MHSA00802				512.44	31726	2.2	222.36		8.29		0.81		0.00	2.95	0.00	510.09	168.33	437.47	47.1	750	0.316	625.82	0.70	1.42	1.53
	MHSA00802	MHSA00801	0.32			512.76	31726	2.2	222.36	0.22	8.51		0.81		0.00	3.02	0.54	510.63	168.51	437.72	76.8	750	0.312	621.84	0.70	1.41	1.52
	MHSA00801	MHSA00800				512.76	31726	2.2	222.36		8.51		0.81		0.00	3.02	0.00	510.63	168.51	437.72	81.2	750	0.366	673.51	0.65	1.52	1.62
	MHSA00800	MHSA00799				512.76	31726	2.2	222.36		8.51		0.81		0.00	3.02	0.00	510.63	168.51	437.72	17.2	750	0.349	657.68	0.67	1.49	1.59
	MHSA00799	MHSA01113				512.76	31726	2.2	222.36		8.51		0.81		0.00	3.02	0.00	510.63	168.51	437.72	81.8	750	0.286	595.37	0.74	1.35	1.47
To 900mm TRUNK SANITARY						512.76	31726				8.51		0.81		0.00			510.63		437.72							

DESIGN PARAMETERS

Park Flow =	9300	L/ha/da	0.10764	l/s/Ha				
Average Daily Flow =	280	l/p/day			Industrial Peak Factor = as per MOE Graph			
Comm/Inst Flow =	28000	L/ha/da	0.3241	l/s/Ha	Extraneous Flow =		0.330	L/s/ha
Industrial Flow =	35000	L/ha/da	0.40509	l/s/Ha	Minimum Velocity =		0.600	m/s
Max Res. Peak Factor =	4.00				Manning's n =	(Conc)	0.013	(Pvc) 0.013
Commercial/Inst./Park Peak Factor =	1.00				Townhouse coeff=		2.7	
Institutional =	0.32	l/s/Ha			Single house coeff=		3.4	

Designed: GGG	PROJECT: 7000 Campeau Drive		
Checked: SLM	LOCATION: City of Ottawa		
Dwg. Reference: Sanitary Drainage Plan, Dwgs. No. 2D	File Ref: 18-1061	Date: 08 Jun 2021	Sheet No. 9 of 9

1061_SAN.xlsx

NORTH KANATA
TRUNK SEWER - PHASE 2

Ottawa

CIVIL
OVERALL SITE PLAN

Contract No.	ISD12-2011
Dwg. No.	C-003
Sheet	4 of 39
Asset No.	--------
Asset Group	ISD
Des.	M.H.
Chk'd.	P.P.
Dwn.	D.L.
Chk'd.	P.P.
Utility Circ. No.	
Index No.	
Const. Inspector	
Scale:	1:2000 HORIZONTAL 0m 25 50 100

CARINA DUCLOS, P.Eng
MANAGER, DESIGN & CONSTRUCTION BRANCH 2

Justin Kurosky, P.Eng
Project Manager

ch2m

NOTE: The location of utilities is approximate only, the exact location should be determined by consulting the municipal authorities and utility companies concerned. The contractor shall prove the location of utilities and shall be responsible for adequate protection from damage.

REVISIONS

No.	Description	By	Date (yyyy/mm/dd)
1	ISSUED FOR APPROVALS	M.H.	2017/06/23
2	ISSUED FOR UTILITY CIRCULATION	M.H.	2017/06/28

NOT FOR CONSTRUCTION

PLOT TIME: 8:42:03 AM
PLOT DATE: 2017\08\16
FILENAME:ISD12-2011-001-OSP.dgn

Utility Circ

462754


SIGNATURE RIDGE
TRUNK SEWER
① PLAN & PROFILE DWG. NO.
FORCE MAIN
GRAVITY SEWER
TRUNK SEWER LOCATION THROUGH SOUTHERN PORTION OF 7000 CAMPEAU DRIVE PROPERTY.
SEE PROFILE DRAWINGS IN APPENDIX B.
S-2414
RICHARDSON SIDE ROAD
CAMPEAU DRIVE
QUEENSWAY - HIGHWAY Nº 417
TERRY FOX DRIVE
STATION ROAD
LEGGETT DRIVE
MARCH ROAD
SOLANDT DRIVE
CITY OF KANATA
CITY OF NEPEAN
CANADIAN NATIONAL RY.
OHEPC
CYCLONE TAYLOR BOULEVARD
HURTMAR DRIVE
1
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SANITARY TRUNK SEWER THROUGH SOUTHERN PORTION OF 7000 CAMPEAU DRIVE PROPERTY.
FROM CAMPEAU DRIVE TO ROSENFIELD CRESCENT. SEE OVERALL TRUNK SEWER DRAWING FOR LOCATION DETAILS.
CAMPEAU
DRIVE
MATCHLINE SEE DWG S1
MATCHLINE SEE DWG S3
LIMIT OF PROPOSED GOLF PRACTICE FACILITY
MH 105
MH 107
MH 109
SA 525mm
LINE B - B
EDGE OF ROAD
℄ ROW CAMPEAU DRIVE
PROPOSED WM LOCATION
TEMPORARY CONSTRUCTION FENCE
EX 100 Ø GOLF COURSE IRRIGATION PIPE
6.0m PERMANENT EASEMENT
14.0m WORKING EASEMENT
7.0m PERMANENT EASEMENT
13.0m WORKING EASEMENT
GENERAL NOTES
1. FOR LEGAL BOUNDARY INFORMATION OF SEWER EASEMENT REFER TO REGISTERED PLAN 4R-6558 BY ANNIS, O'SULLIVAN, VOLLEBEKK LTD., ONTARIO LAND SURVEYORS.
2. THE LOCATION OF UTILITIES IS APPROXIMATE ONLY. THE LOCATION SHOULD BE DETERMINED BY CONSULTING THE MUNICIPAL AUTHORITIES AND / UTILITY COMPANIES CONCERNED.
THE CONTRACTOR SHALL PROVE THE LOCATION OF UTILITIES AND SHALL BE RESPONSIBLE FOR ADEQUATE PROTECTION FROM DAMAGE.
ELEVATIONS
102
100
98
96
PROPOSED ROAD SECTION (BY OTHERS)
℄ CAMPEAU DR ROW
PROPOSED ROAD GRADE ALONG SANITARY SEWER
EXISTING GROUND ALONG LINE B - B
EXISTING GROUND OVER SANITARY SEWER
ASSUMED ROCK PROFILE
EXISTING ROCK PROFILE
EX PLUG
SANITARY - 150.0m @ 0.25%, 525mm CONC CL. V
SANITARY - 99.5m @ 0.25%, 525mm CONC CL. V
CENTRE LINE ROAD ELEVATION
WATERMAIN TOP ELEVATION
STORM INVERT
SANITARY INVERT
CENTRE LINE SEWER CHAINAGE
96.09 96.07 96.10 96.11
EX PLUG 96.39
96.48 96.51
96.76 96.79
0+250
0+275
0+300
0+350
0+379
0+400
0+425
0+450
0+500
0+524.5
No. DATE REVISIONS BY
2 1/09/89 REV. LOCATION MH 107 TO 115 RGV
1 9/02/89 ADDED TEMPORARY CONSTRUCTION FENCE & IRRIGATION PIPE RGV
0 11/01/89 ISSUED FOR APPROVAL RGV
SCALES
HORIZONTAL 1:500
VERTICAL 1:50
uma
UMA Engineering Ltd
Engineers & Planners
CAMPEAU CORPORATION
KANATA LAKES TRUNK SANITARY SEWER CONNECTION TO ASHFORD MARTIN LANDS
DESIGN L.M.E.
DRAWN R.G.V.
APPROVED B.N.C.
S-2414-6
CITY OF KANATA
DEPARTMENT OF ENGINEERING AND PUBLIC WORKS
SANITARY SEWER EASEMENT
STA 0+275 TO STA 0+524.5
PROJ. No. 4994-012
DATED DECEMBER 1988
DWG. No. S2

SANITARY TRUNK SEWER THROUGH SOUTHERN PORTION OF 7000 CAMPEAU DRIVE PROPERTY.

FROM CAMPEAU DRIVE TO ROSENFIELD CRESCENT. SEE OVERALL TRUNK SEWER DRAWING FOR LOCATION DETAILS.

6.0 WASTEWATER SERVICING

6.1 Introduction

As indicated previously, the subject development is within the City of Ottawa West Urban Community (former City of Kanata). This area is serviced by local gravity sewers and pump stations that discharge to a regional trunk system that carries flows to the Robert O. Pickard Environmental Centre for treatment of wastewater.

There are several trunk sanitary sewers and pump stations servicing the West Urban Community including the East March Trunk, Marchwood Trunk, Kanata Lakes Trunk, North Kanata Trunk, March Pump Station, and the Briar Ridge Pump Station. These all drain into the Watt's Creek Relief Sewer that provides service to the entire West Urban Community and flows into the Acres Road Pump Station. An Existing Wastewater Collection System Schematic (Figure 2) from the 2013 Infrastructure Master Plan is included in **Appendix C-1** for reference.

The outlet for the Kanata North Urban Expansion Area is the existing March Pump Station. The City has indicated that the inlet to the March Pump Station is a reasonable limit for wastewater analysis.

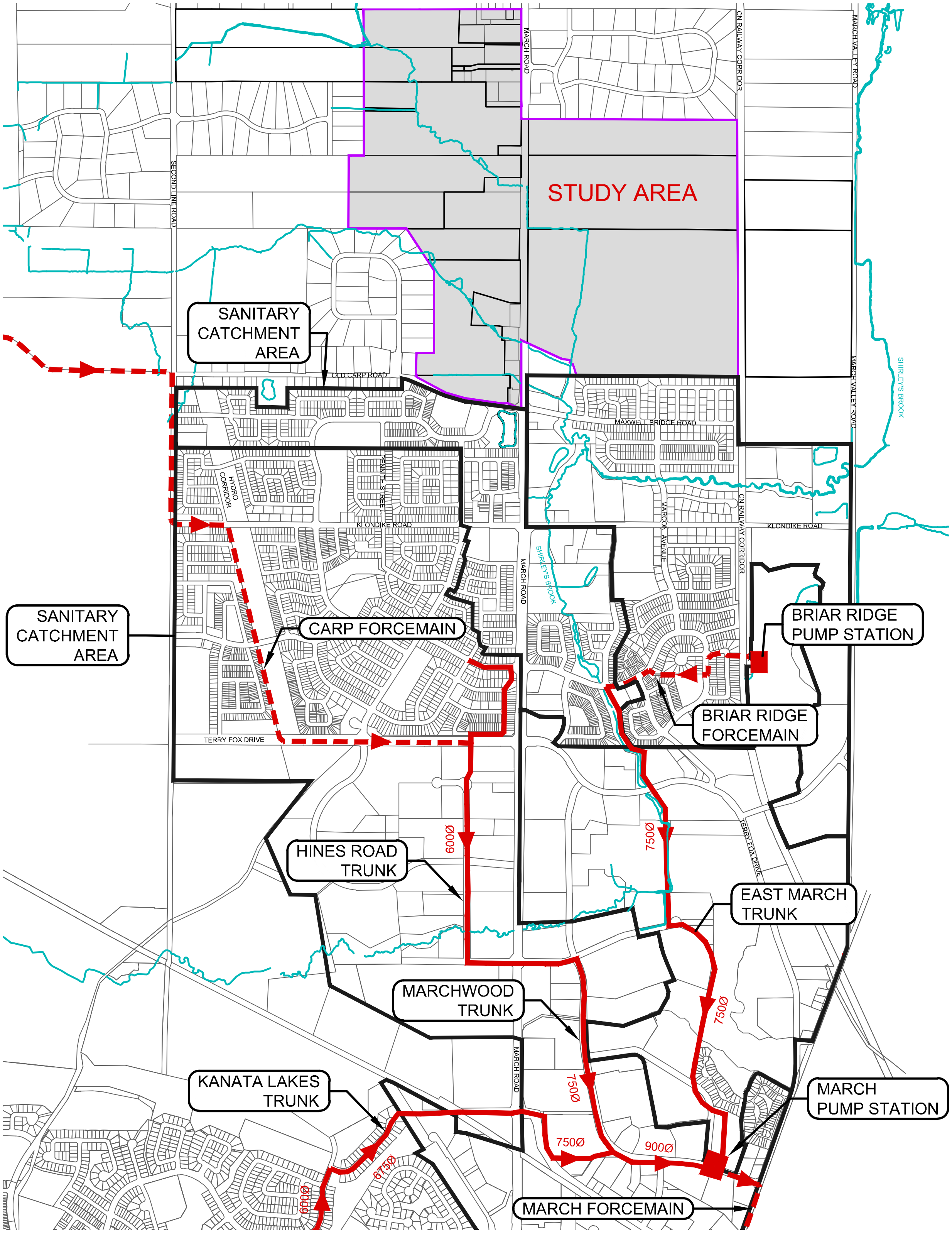
Based on the proposed land use, a probable wastewater flow was calculated to be 182.2L/s. Further details on the calculations of this flow rate are discussed in Section 6.6.1.2.

6.2 Existing Wastewater Infrastructure

There are three trunk sewers that drain to the March Pump Station. These are the East March Trunk, Marchwood Trunk and the Kanata Lakes Trunk. These trunk sewers and their drainage boundaries are shown on **Figure 6.2.** The East March Trunk and Marchwood Trunk sewers are the two most viable options to service development of the KNUEA. The Kanata Lakes Trunk Sewer is located farther from the development area and is not a viable option for servicing the Kanata North Urban Expansion Area.

The following is a brief description of each trunk sewer along with capacity and probable flow rates. The flow generation and wastewater modelling, completed in 2013 on behalf of the City, is provided in the *2013 Infrastructure Master Plan Wastewater Collection System Assessment* (2013 IMP) prepared by Stantec, dated Sept 2013. This document provides the most current sanitary analysis of the entire City and establishes a basis upon which the KNUEA can be evaluated. Where information was not available in the 2013 IMP, namely for trunk sewers, information was obtained from the *West Urban Community – Wastewater Collection System Master Servicing Plan Study* (2012 WUC, RVA, July 2012).

The data obtained from the above noted Master Plans provides flow data for existing flows monitored as of 2010, and projected flows for 2031. The projected flow data in the 2031 IMP has accounted for the full development/buildout of the KNUEA. Therefore during the analysis of KNUEA on existing infrastructure, design KNUEA flows have only been added where 2013 IMP data was not available.



M:\2012\112117\CAD\Design_MSS\FIGURES\FIGURE 7.1 - WASTEWATER COLLECTION INFRASTRUCTURE.dwg, WW COLL, Feb 23, 2016 - 1:40pm, lseely

KANATA NORTH
COMMUNITY DESIGN PLAN

NOVATECH
Engineers, Planners & Landscape Architects

FIGURE NO. 6.2
NORTH KANATA WASTEWATER TRUNK INFRASTRUCTURE

DATE	JOB
FEB 2016	112117
SCALE	
N.T.S.	

SHT8x11.DWG - 216mmx279mm

The **East March Trunk** (EMT) is a 750mm diameter pipe that extends north from the March Pump Station through the Kanata Research Park to Shirley's Brook Drive, with the upper reach generally follows the creek corridor. The pipe has a free-flow capacity of 550 L/s and an obvert elevation of 72.1m at Shirley's Brook Drive. Flow generation and modelling for the City indicates peak flow rates in the EMT of 96 L/s in 2010, and projects a flow of 255 L/s in 2031. Therefore, the EMT is currently flowing at approximately 17% of the free-flow capacity, and will reach 46% at build-out. These values account for the full buildout of the KNUEA.

The **Marchwood Trunk** (MWT) is 750mm to 900mm in diameter, and generally follows Legget Drive. Flow from the Kanata Lakes Trunk combines with the Marchwood Trunk, west of Schneider Road, in a 900mm diameter sewer which conveys all flows to the March Pump Station. Upstream, the MWT decreases in size to a 750mm pipe south of Farrar Road; the trunk continues north on Legget Drive, turning west at Solandt Drive and generally services land on the west side of March Road. The upper reach of the MWT is located at the intersection of Solandt Drive and Hines Road with an obvert elevation of 77.3m. The lower-reach of the MWT has a free-flow capacity of 1,100 L/s. Flow generation by the City has an estimated peak flow of 230 L/s in 2010, and 592 L/s in 2031. This puts the free-flow capacity at approximately 21% (2010) and 54% (2031), including full development of the KNUEA.

The **Hines Road Trunk** (HRT) is essentially a northward continuation of the Marchwood Trunk. The HRT is a 600mm gravity pipe that services lands in North Kanata, and conveys flow from the Carp Forcemain to the Marchwood Trunk and March Pump Station. The upper reach of the HRT is located at the intersection of Morgan's Grant Way and March Road with an obvert elevation of 79.7m. The upper-reach of the MWT has a free-flow capacity of 205 L/s, based on as-built information. The free flow capacity of the HRT is unknown.

The **March Pump Station** (MPS) is located at the downstream end of these trunk sewers with a firm capacity of 490 L/s. City modelling has peak flows of 326 L/s (2010) and 771 L/s (2031). This represents 67% and 157% of the firm capacity. Pumps currently discharge through the March Forcemain, routing flow south along Herzberg Road to the March Road Trunk. There are significant planned changes that will affect how this facility operates, and the reader is directed to the next section on planned infrastructure for details.

The **Briar Ridge Pump Station** (BRPS) is located south of Klondike Road and east of the railway corridor. This facility discharges into the East March Trunk and has a firm design capacity of 183 L/s with three pumps installed. Due to low initial flows, only two of the three pumps are currently installed; as such the station has a temporary firm capacity of 53 L/s. Flow monitoring by City staff will determine when the third pump is required.

Capacities of the various systems are summarized in in **Table 6.2**. This information is taken from the 2013 IMP, 2012 WUC, and supplementary 2013 IMP data provided by the City. Relevant excerpts and supplementary information are included in **Appendix C-2** for reference.

Table 6.2: Existing Capacity and 2031 Wastewater Flow

Infrastructure	Obvert Elevation	Flow	Ex. Capacity	Design Flow	Q/Q_{full} Capacity (%)	Available Flow
		2010 (L/s)	**(L/s)**	**2031 (L/s)**	**2031**	**2031 (L/s)**
March Pump Station	-	**371(2008)**	**416 (IMP)** **586 (upgrade)***	**256**	**44%**	**330**
Briar Ridge Pump Station	61.15	21**	53 (Ex) 183 (Ult) **175 (IMP)**	**124**	**71%**	**51**
East March Trunk	72.1	*96*	*550 (WUC)* *259 (Asbuilt)*****	**255**	98%	5***
MarchWood Trunk	77.3	*230*	*1,100*	**592**	54%	508
Hines Road Trunk	79.7		205	**135**	66%	70

Note values in bold are from the 2013 IMP (and supplementary data), italics are from the 2012 WUC report.

*March Pump Station is scheduled to be upgraded to an ultimate firm capacity of +/-586L/s per March PS Class EA report.

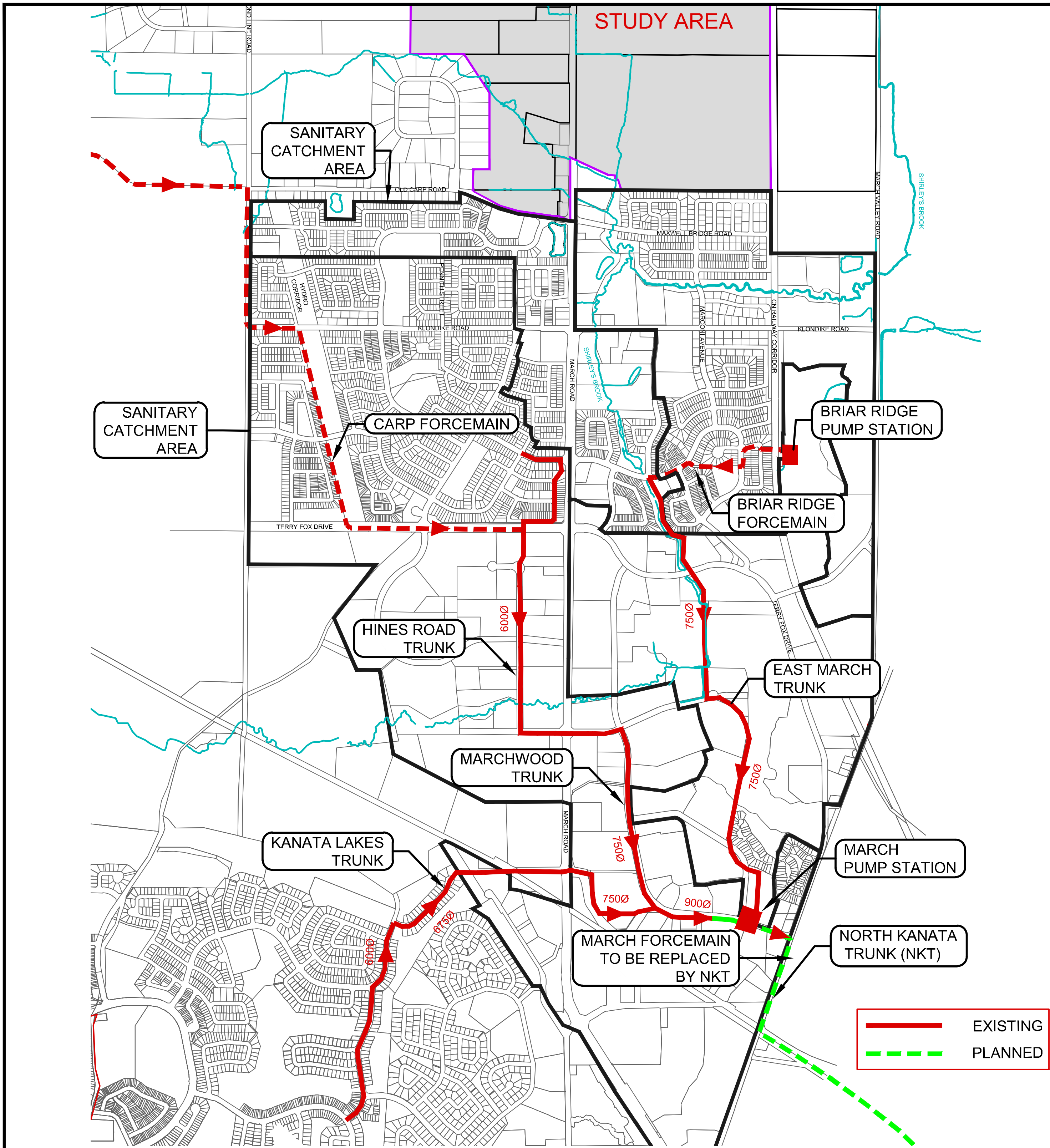
** Based on monitored SCADA data provided by the City included in **Appendix C**.

*** Available Flow based on Novatech analysis of as-built capacity of the existing EMT. Supporting calculations are included in Table C-6e: Sanitary Sewer Capacity Analysis ï East March Trunk, included in **Appendix C**.

6.3 Planned Wastewater Infrastructure

There are two major planned wastewater infrastructure works planned as noted in the Cityô s 2013 Infrastructure Master Plan which will have an impact on the future servicing of the proposed development. The planned wastewater infrastructure works are shown on **Figure 6.3**.

Phase 2 of the **North Kanata Trunk** (NKT) will extend a 1200mm pipe with a design capacity of 1,290 L/s from the March Pump Station (MPS) to the temporary cap where Phase 1 construction ended. A gravity connection will be made from the Marchwood Trunk to the NKT, allowing wastewater to bypass the MPS. This measure will significantly reduce flow to the station, thereby increasing residual capacity at the MPS. Construction of the NKT is expected to be complete by 2018 as per the 2013 IMP.



M:\2012\112117\CAD\Design_MSS\FIGURES\FIGURE 7.3 - PLANNED WASTEWATER INFRASTRUCTURE.dwg, PWW COLL, Feb 11, 2016 - 9:37am, lseely

KANATA NORTH
COMMUNITY DESIGN PLAN

NOVATECH
Engineers, Planners & Landscape Architects

FIGURE NO. 6.3
NORTH KANATA PLANNED WASTEWATER TRUNK INFRASTRUCTURE

DATE FEB 2016
JOB 112117
SCALE N.T.S.

SHT8x11.DWG - 216mmx279mm

The **March Pump Station** (MPS) will be converted to a low-lift facility that connects to the North Kanata Trunk. The March Forcemain will be decommissioned as part of these works. The 2013 IMP indicates that construction would occur sometime between 2013 and 2018. With diversion of the Marchwood Trunk, there will be no urgency to complete this project. The projected 2031 flow from the 2013 IMP in this configuration is 256 L/s, or 44% of the station firm capacity.

Supporting information on the Planned Wastewater Infrastructure work from the 2013 IMP is included in **Appendix C-1** for reference.

6.4 Viable Off-site Trunk Servicing Evaluation

As indicated previously, the Kanata Lakes Trunk Sewer is located farther from the development area and is not a viable option for servicing the proposed development. Therefore, the Hines Road, Marchwood and East March Trunk Sewers and the Briar Ridge Pump Station were evaluated to determine the preferred servicing option for the Kanata North Urban Expansion Area.

6.4.1 Trunk Sewers

There are two initial constraints to review when evaluating these trunk sewers which are elevation and capacity. The elevations were obtained from record drawings provided by the City and the capacities of each trunk sewer was obtained from the *WUC Master Servicing Plan by RVA*.

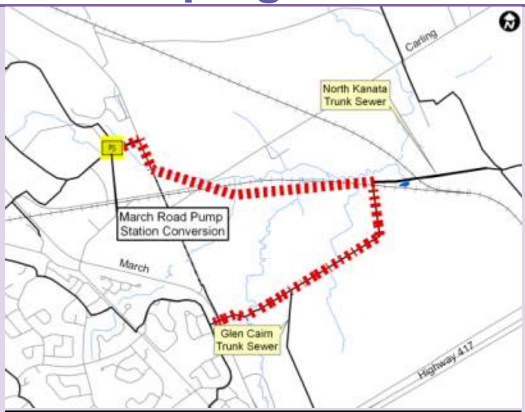
Elevation
Hines Road Trunk (by Morgan's Grant and March) = 79.7m
Marchwood Trunk (by Solandt and Hines) obvert = 77.3m
East March Trunk (by Shirley's Brook Dr.) obvert = 72.1m

Capacity
Hines Road Trunk = 205L/s (upper reach of MWT)
Marchwood Trunk = 1,100L/s, reaching 52% capacity by 2031 with a remaining capacity of 526 L/s.
East March Trunk = 550 L/s, reaching 31% capacity by 2031 with a remaining capacity is 378 L/s.

The capacities are based on the projected 2031 buildout of the existing drainage areas tributary to each trunk sewer and do not include the subject development. There are no indications that there are HGL issues in any of these trunk sewers, therefore HGL was not part of the initial evaluation.

Based on these two constraints the most viable option to provide a wastewater outlet for the subject lands is the East March Trunk Sewer. The connection point to the East March Trunk Sewer is proposed at the intersection of Shirley's Brook Drive and Sandhill Road just east of March Road. The East March Trunk Sewer and its catchment area are shown on **Figure 6.4.1**. There are two possible routes for a sewer to this connection point from the KNUEA. One is southward along March Road and along Shirley's Brook Drive. The second option is to service the development using the Briar Ridge Pump Station. A connection can be made to the existing sanitary sewer that runs along the Ottawa Central Railway corridor to the Briar Ridge Pump Station. The Briar Ridge Forcemain then connects to the East March

March Road Pumping Station Conversion



Scope and Justification

The March Pump Station was built in 1972. Currently the firm capacity of the station with one pump being out of services is rated at 490 L/s. The station pumps wastewater to the 600 mm dia. 1300 m long forcemain discharging to the March Road Trunk Sewer. A Class EA was completed in 2001 for the North Kanata Sanitary Sewage Infrastructure Upgrade Study. It recommended building the Kanata North Gravity Collector Sewer including gravity connection of the March Collector Sewer bypassing the March PS and conversion of the March PS to a low lift station.

The existing March PS can be retrofit to a low lift station or a new wet well can be added and existing structure to be used to house a valve chamber, stand-by power, controls, etc… or alternatively new PS can be built and existing structure be decommissioned and removed. Since the constructing new PS is an alternative option there is a requirement to conduct the Schedule B of the Class Environmental Assessment (EA) planning process. The Class EA for the station is currently under way.

Timing

2013 - 2018: Complete EA, detailed design and build the station.

Action Item Funding

Construction Cost Estimate = $3.4 M

Capital Cost Estimate* = $6.0 M (100% Development Charges, 0% Rate)

**Including construction cost, engineering, city internal costs and contingency allowance. Funding split subject to review as part of 2014 Development Charges By-Law.*

EA Requirements and Consultation

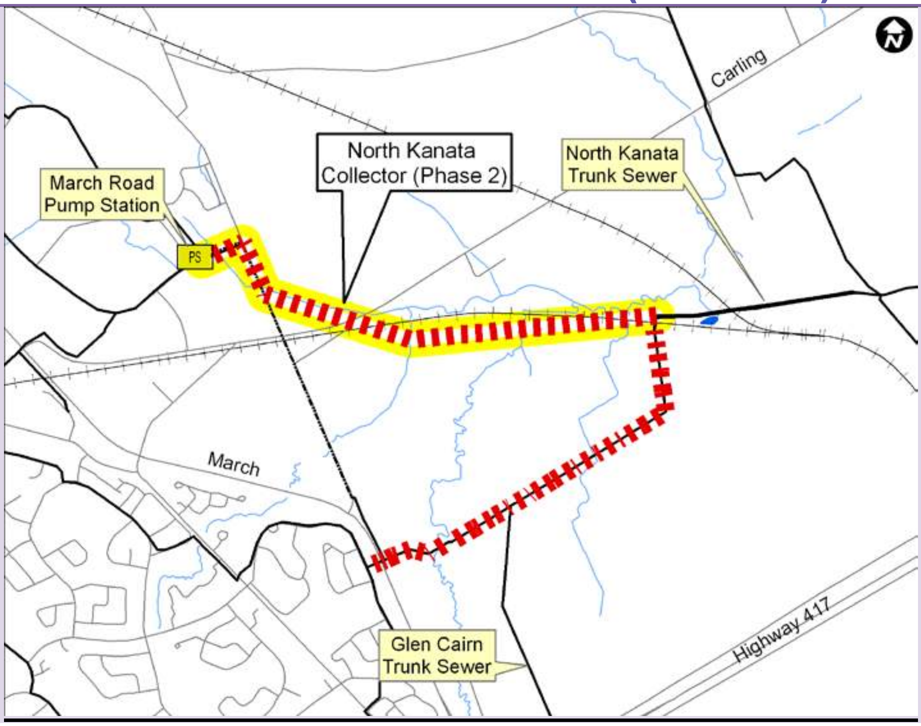
Class EA Schedule B project study is currently underway.

The EA recommendations will be presented to City Council for approval. Once approved by Council the 'Notice of Study Completion' will be posted for the 30 day review period.

Follow Up Actions

Coordinate with Kanata North Collector Sewer Phase 2 project.

North Kanata Collector (Phase 2)



Scope and Justification

Construct the North Kanata Phase 2 Sewer to provide capacity for the North Kanata growth area. This project was identified in the 1997 Wastewater Master Plan to provide infrastructure to convey the projected flows for the planning period. Follow up studies such as the Environmental Assessment (EA), Functional Design and Preliminary Design of sewers in the study area refined and confirmed the infrastructure, phasing, schedule and costing. The Phase 2 sewer will be 1200 mm dia. pipe and approximately 2100 m long.

Timing

2013-2018: Complete detailed design and construct the sewer.

Action Item Funding

Construction Cost Estimate = $5.5 M
Capital Cost Estimate* = $8.7 M (90% Development Charges, 10% Rate)
**Including construction cost, engineering, city internal costs and contingency allowance.*

EA Requirements and Consultation

Schedule B Class EA has been completed and the project is approved.

Follow Up Actions

Tender and Construction

4.3 Design Flow and Pipe Sizing

As part of the background review to confirm future flows in the NKTS2, two key reports were reviewed:

- *North Kanata Sanitary Sewage Infrastructure Upgrade Study – Functional Design Report*, 2001, RV Anderson. This report analysed the condition and capacity of the sanitary sewage infrastructure, and presented the functional design of the North Kanata Trunk Sewer Phase I and Phase II.
- *West Urban Community, Wastewater Collection System Master Servicing Plan Study, FINAL*, 2012, RV Anderson. This study evaluated the entire wastewater system upstream of the Acres Road Pump Station.

In the *North Kanata Sanitary Sewage Infrastructure Upgrade Study – Functional Design Report,* the design flow for build out of the community is 1326 L/s for March Pump Station to Kizell Drain and 1814 L/s for Kizell Drain to the confluence of NKTS2 and TTC. The 2006 estimated average dry weather flow was 101 L/s.

In the *West Urban Community – Wastewater Collection System Master Servicing Plan – Study*, spreadsheet calculations and a hydraulic model were used to estimate the sanitary sewer flows. The 2010 flow to be directed to NKTS2, once it is constructed, is 326 L/s. The predicted 2031 flow is 771 L/s and the 2060 flow is 941 L/s. In the future, the flow contributing to the NKTS2 will be from the Marchwood Trunk and the reconfigured low lift March PS. The predicted flows for the TTC are 2,946 L/s and 3,726 L/s for 2031 and 2060 respectively. Table 1 summarizes the calculated design flows for the existing system and the projected capacity of the proposed sewers.

In August 2017, the City of Ottawa Asset Management Branch (AMB) provided updated flows for the 2060 design event. The flows were generated using a dynamic model of the system with the East March and Marchwood trunk sewers peaking concurrently. The March PS is also modeled conservatively to discharge at the rate of the upstream peaks. The updated flows for the 2060 design event are 586 L/s for the East March Trunk/March PS and 580 L/s for the Marchwood Trunk, resulting in a combined flow of 1,165 L/s for the NKTS2.

With the upstream and downstream invert fixed, a constant slope of 0.12% is achieved. This slope and flow were used to determine the proposed sewer size.

Table 1 - Summary of Design Flows and Proposed Sewer Size/Capacity

Sewer	Functional Design Report (2001)		WUC Master Servicing Plan (2012)			Verified Design	Pipe Size (mm)	Pipe Slope (%)	Pipe Capacity (L/s)
	2001 Flow (L/s)	Build Out Peak Flow (L/s)	2010 Flow (L/s)	2031 Flow (L/s)	2060 Flow (L/s)	2060 Flow (L/s)			
NKTS2	686	1,326	326	771	941	1,165[2]	1,200	0.12	1,427
TTC	925+	1,750+	1,705	2,946	3,726	2,668[3]	1,350[1]	0.25[1]	2,784[1]
Confluence	1,764	3,270	2,031	3,717	4,667	3,833	1,800	0.15	4,644

[1] The TTC is being designed under a separate project. The pipe size and slope may change as the design progresses.
[2] The 2060 Design Flow for the NKTS2 was provided by AMB in August 2017.
[3] The 2060 Design Flow for the TTC was provided by the TTC design team in August 2017.

For additional information related to pipe sizing and design, please refer to the sewer design sheet in Appendix 8.

Constraints that define the minimum slope include:

- Maintaining sufficient cover below the 4 creek crossings (Kizell Drain, Watt's Creek, and the 2 Watt's Creek tributaries)
- Maintaining adequate scour velocity for cleansing at low flows

Excess Capacities:
NKTS2 = +262 L/s
TTD = +116 L/s
Confluence = +811 L/s

Kevin Murphy

Subject: FW: 1061 7000 Campeau Drive - Pre consultation Follow-up

From: Candow, Julie
Sent: April 12, 2019 12:19 PM
To: 'Adam Fobert' <AFobert@dsel.ca>; Warnock, Charles <Charles.Warnock@ottawa.ca>; Moodie, Derrick <Derrick.Moodie@ottawa.ca>
Cc: Susan Murphy <SMurphy@minto.com>; Beth Henderson <BHenderson@minto.com>; mdror@bousfields.ca; Steve Pichette <SPichette@dsel.ca>
Subject: RE: 1061 7000 Campeau Drive - Pre consultation Follow-up

Hi Adam,

Please see outstanding responses in red below. You will receive a second email with a link to an FTP site which will provide the files noted below.

Should you have any questions please do not hesitate to call.

Julie Candow, P.Eng.
Project Manager - Infrastructure Approvals

City of Ottawa
Development Review - West Branch
Planning, Infrastructure and Economic Development Department
110 Laurier Ave., 4th Floor East;
Ottawa ON K1P 1J1
Tel: 613-580-2424 x 13850

From: Adam Fobert <AFobert@dsel.ca>
Sent: March 22, 2019 2:19 PM
To: Warnock, Charles <Charles.Warnock@ottawa.ca>; Moodie, Derrick <Derrick.Moodie@ottawa.ca>; Candow, Julie <julie.candow@ottawa.ca>
Cc: Susan Murphy <SMurphy@minto.com>; Beth Henderson <BHenderson@minto.com>; mdror@bousfields.ca; Steve Pichette <SPichette@dsel.ca>
Subject: 1061 7000 Campeau Drive - Pre consultation Follow-up

Hello City Staff,

As discussed during our pre-consultation regarding 7000 Campeau Drive, please see the below summary of information requests.

Let me know if you have any questions or comments

Water:
Please see the attached figure illustrating potential connection points.

Connection points 1 and 2 would have the following demands:
Average Daily: 282.9L/min

Max Day: 707.3 L/min
Peak Hour: 1556.0 L/min
Fire Flow: 10,000L/min

Connection points 3, 4, 5, and 6 would have the following demands:
Average Daily: 811.6L/min
Max Day: 2029.0L/min
Peak Hour: 4463.9L/min
Fire Flow: 15,000L/min

Wastewater:

- Please provide available calculation sheets for the existing trunk from Campeau Drive to the March Road PS. Design sheets for the Kanata Lakes trunk are shown in the 2007 Serviceability Study (FTP site). Design sheets are not available for the Marchwood Trunk. As-built drawings have been provided for the Kanata Lakes and Marchwood Trunk sewers (FTP site).
- Please provide available models of the existing trunk from Campeau to March Road PS. Existing and future flows and HGLs along the Kanata Lakes/Marchwood Trunk sewers from the golf course to Legget/Schneider are provided in an excel table (FTP site). Modelling of the trunk sewer system is not required. In the future, flows from the Signature Ridge Pump Station will be diverted from the Kanata Lakes sewer to the Penfield Trunk.
- The Infrastructure Master Plan outlined a number of upgrades to the March Road PS. What has taken place? The March PS will be converted to a lift station. The March PS project is on-going and Jacobs presented the 90% design review to City staff in Feb 2019. What is the current capacity of the facility? The rated capacity of the facility is 416 l/s. However, capacity at the station is not relevant to this application since the Marchwood Trunk sewer on Legget will no longer outlet to the March PS (refer to outdated drawings on FTP site that shows the conceptual plan). The North Kanata Trunk Phase 2, which is currently under construction, will convey flows from the Marchwood Trunk to the Watts Creek Relief Sewer. The City will provide an update on the expected completion date of the North Kanata Trunk Phase 2.
- Does the City have flow monitoring data at the March Road PS? If so, please provide. Dry weather flows range from 80 l/s (average) to 140 l/s (peak). Wet weather flows can reach +/- 325 l/s. Additional analysis of the March Pump Station is not required.

Stormwater:

- Please provide available calculation sheet for the existing trunk storm sewer from Campeau to the Beaver Pond. Design sheets are not available.
- Please provide the current model of the storm sewer system to the Beaver Pond. An existing conditions SWMHYMO model (JFSA, Sept 2015) of Kanata Lakes south of Beaver Pond and XP-SWMM/HEC-RAS models of Beaver Pond and Watts Creek (AECOM, 2014) are located on the FTP site. IBI recently updated the XP-SWMM/HEC-RAS models to support KNL Phase 9 (DSEL should obtain the latest models from IBI).
- Has there been a history of flooding / complaints of standing water in the surrounding subdivision?
- Has the City implemented ICD in the surrounding neighborhood?
- Does the City have any monitoring data within the storm sewer system or pond? If so, please provide.
- DSEL would like to request complete monitoring of the existing storm infrastructure at five locations. Please see plan attached.

Adam Fobert, P.Eng.

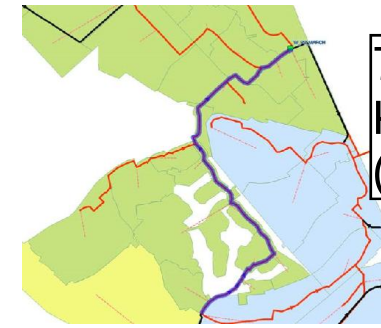
DSEL

david schaeffer engineering ltd.

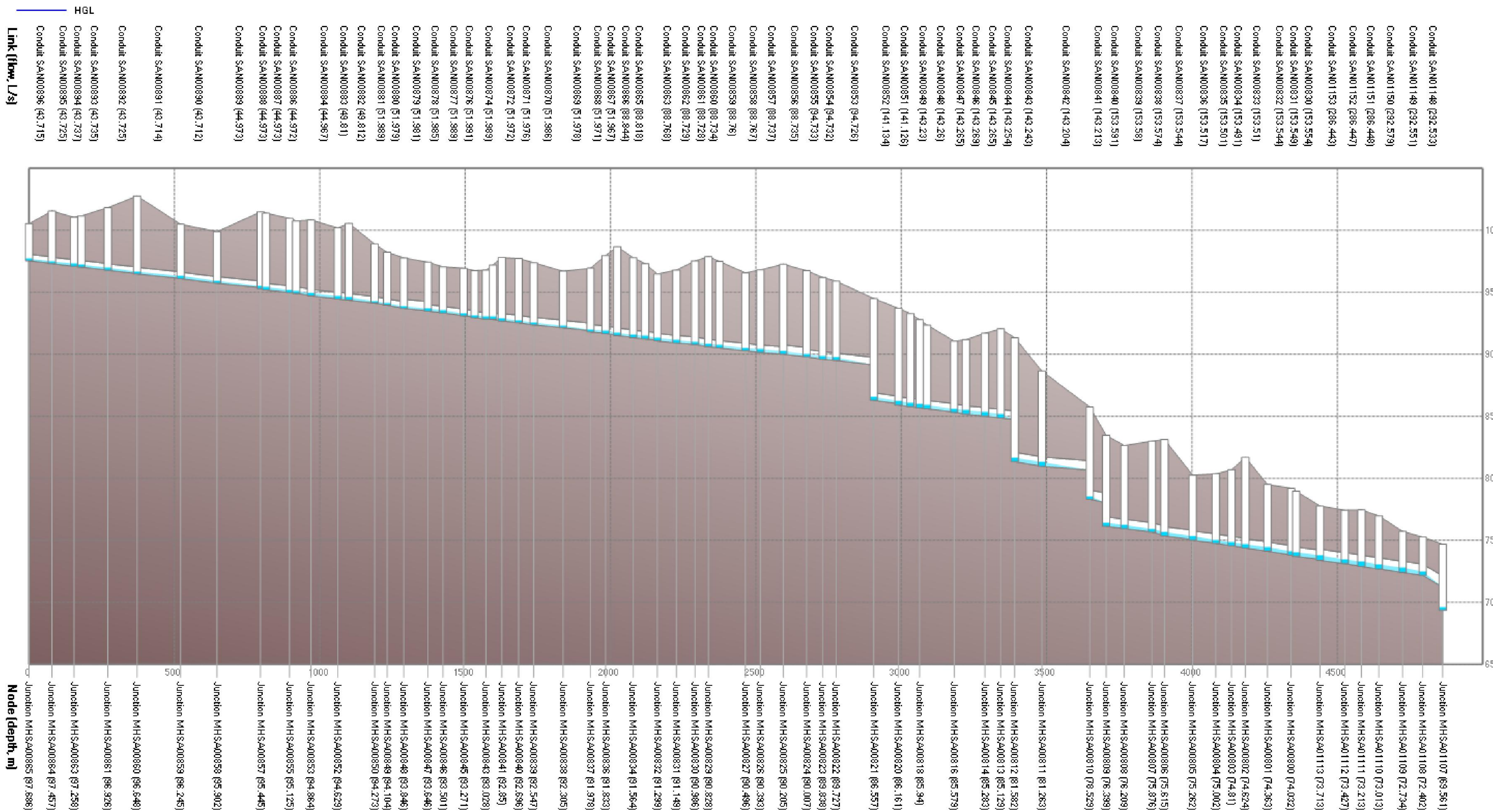
120 Iber Road, Unit 103
Stittsville, ON K2S 1E9

office: (613) 836-0856
direct: (613) 836-0626
cell: (613) 222-9493
email: afobert@DSEL.ca

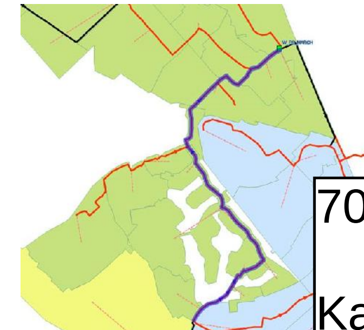
Name	Invert Elev. (m)	Rim Elev. (m)	Depth (m)	Max. Depth (m)	Max. HGL (m)	Max. Total Inflow (L/s)
MHSA00865	97.52	100.53	3.01	0.17	97.69	43.83
MHSA00858	95.73	99.89	4.16	0.17	95.9	44.99
MHSA00852	94.45	100.19	5.74	0.18	94.63	49.82
MHSA00850	94.11	98.89	4.78	0.16	94.27	52
MHSA00835	91.50	98.66	7.16	0.22	91.72	88.87
MHSA00824	89.80	96.75	6.95	0.21	90.01	94.77
MHSA00811	80.97	88.66	7.69	0.29	81.26	143.26
MHSA00818	85.68	92.80	7.12	0.26	85.94	143.28
MHSA00809	76.14	83.47	7.33	0.26	76.4	153.59
MHSA01110	72.68	76.97	4.29	0.33	73.01	292.58
MHSA01107	69.35	74.70	5.35	0.21	69.56	295.67



7000CampeauDr_Wastewater_2013Existing
Kanata Lakes & Marchwood Trunk Sewers - HGL
(From Campeau To Legget/Schneider Rd)



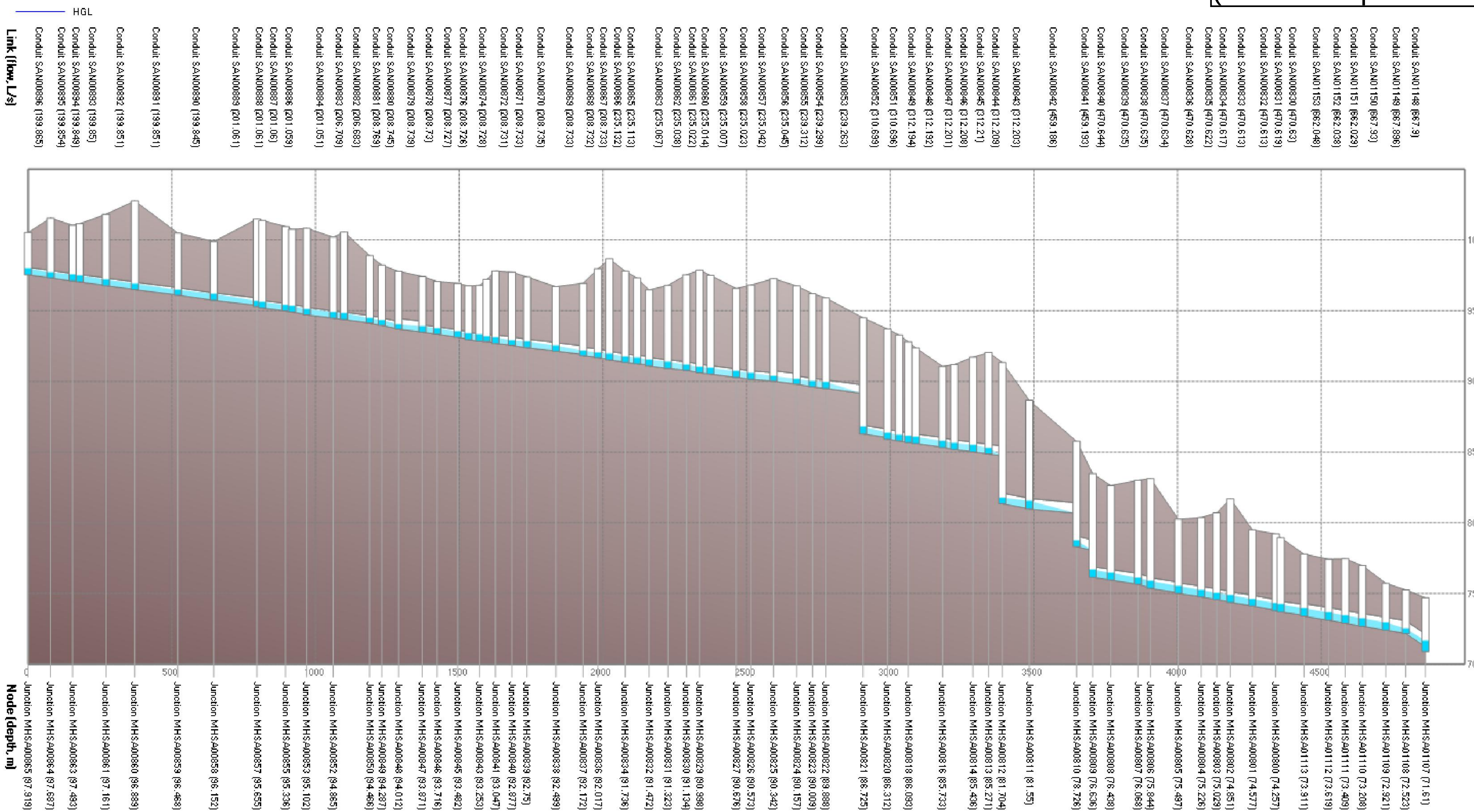
Name	Invert Elev. (m)	Rim Elev. (m)	Depth (m)	Max. Depth (m)	Max. HGL (m)	Max. Total Inflow (L/s)
MHSA00865	97.52	100.53	3.01	0.40	97.92	199.87
MHSA00858	95.73	99.89	4.16	0.42	96.15	201.07
MHSA00852	94.45	100.19	5.74	0.42	94.87	206.72
MHSA00850	94.11	98.89	4.78	0.36	94.47	208.79
MHSA00835	91.50	98.66	7.16	0.39	91.89	235.19
MHSA00824	89.80	96.75	6.95	0.36	90.16	239.32
MHSA00818	85.68	92.80	7.12	0.41	86.09	312.22
MHSA00809	76.14	83.47	7.33	0.50	76.64	470.66
MHSA01110	72.68	76.97	4.29	0.52	73.21	667.96
MHSA01107	70.90	74.70	3.80	0.71	71.61	675.99



Note: MHSA00865 includes flow from Signature Ridge PS
In the future, flows from SRPS will be diverted to the Penfield Tru

7000CampeauDr_Wastewater_2060Future

Kanata Lakes & Marchwood Trunk Sewers - HGL
(From Campeau To Legget/Schneider Rd)



ık Sewer.

APPENDIX D

STORM

Ontario

Ministry of the Environment
Ministère de l'Environnement

CERTIFICATE OF APPROVAL
MUNICIPAL AND PRIVATE SEWAGE WORKS
NUMBER 5190-7L6RRY
Issue Date: November 26, 2008

City of Ottawa
110 Laurier Avenue West
Ottawa, Ontario
K1P 1J1

Site Location: Kanata Lakes Stormwater Management Facility
Lot 6 and 7, Concession 2 and 3, March
City of Ottawa, Ontario

You have applied in accordance with Section 53 of the Ontario Water Resources Act for approval of:

stormwater management *Works* for the treatment and disposal of stormwater runoff from a catchment area of 397 hectares, servicing Kanata Lakes Subdivision, to provide Enhanced (Level 1) water quality protection and to attenuate post-development peak flows in two cells in series, upstream Kizell Cell and downstream Beaver Cell, to a maximum flow rate of 0.96 cubic metres per second for the 100 year storm event, discharging to Kizell Drain, consisting of the following:

Stormwater Management System

Kizell Cell
a stormwater management wet pond, located west of Goulbourn Forced Road, having a minimum liquid retention volume of approximately 10,271 cubic metres at an elevation of 93.30 metres, and a maximum active retention volume of approximately 89,825 cubic metres at an elevation of 94.28 metres for the 100 year storm event, complete with two (2) energy dissipaters at the storm inlets to the cell, and one (1) outlet berm, discharging at a controlled flow rate of 1.16 cubic metres per second for the 100 year storm event to the downstream Beaver Cell;

Beaver Cell
a stormwater management wet pond, located east of Goulbourn Forced Road, having a minimum liquid retention volume of approximately 41,042 cubic metres at an elevation of 90.47 metres, and a maximum active volume of approximately 236,696 cubic metres at an elevation of 92.60 metres for the 100 year storm event, complete with three (3) storm inlets to the cell, two (2) with energy dissipaters, and one (1) outlet structure consists of a 600 millimetre diameter orifice at an invert elevation of 90.47 metres and an overflow weir set at an invert elevation of 92.60 metres, discharging at a controlled flow rate of 0.96 cubic metre per second for the 100 year storm event via an 80 metre long 1200 millimetre diameter culvert to Kizell Drain;

including erosion/sedimentation control measures during construction and all other controls and appurtenances essential for the proper operation of the aforementioned Works;

all in accordance with the following submitted supporting documents:

1. Application for Approval of Municipal and Private Sewage Works submitted by Guy Bourgon, Program manager, Infrastructure Approvals West of City of Ottawa dated October 21, 2008;

2. a letter dated October 9, 2008 and a letter date November 24, 2008 from Peter Spal, P.Eng., Manager - Water Resources of IBI Group, to the Ministry of the Environment;

3. *Kanata Lakes North Serviceability Study* dated June 2006 and prepared by IBI Group, including enclosed drawings

dated June 15, 2006 by IBI Group and Cumming Cockburn Ltd.;

4. *Kanata Lakes, Beaver Pond, Urban Stormwater quality Control,* dated November 1994, prepared by Cumming Cockburn Ltd;

5. *Kanata Lakes Dam & Outlet Structure Operation & Maintenance Manual* dated April 1990, prepared by Oliver, Mangione, McCalla & Associates Limited, Consulting Engineers; and

6. *Kanata Lakes Storm Drainage Report - Campeau Corporation* dated March 1985, prepared by Oliver, Mangione, McCalla & Associates Limited, Consulting Engineers.

For the purpose of this Certificate of Approval and the terms and conditions specified below, the following definitions apply:

1. "*Certificate*" means this entire certificate of approval document, issued in accordance with Section 53 of the Ontario Water Resources Act, and includes any schedules;

2. "*Director*" means any *Ministry* employee appointed by the Minister pursuant to section 5 of the Ontario Water Resources Act;

3. "*District Manager*" means the District Manager of the Ottawa District Office of the *Ministry*;

4. "*Ministry*" means the Ontario Ministry of the Environment;

5. "*Owner*" means City of Ottawa and includes its successors and assignees;

6. "*Works*" means the sewage works described in the *Owner*'s application, this *Certificate* and in the supporting documentation referred to herein, to the extent approved by this *Certificate*.

You are hereby notified that this approval is issued to you subject to the terms and conditions outlined below:

TERMS AND CONDITIONS

1. GENERAL PROVISIONS

(1) Except as otherwise provided by these Conditions, the *Owner* shall design, build, install, operate and maintain the *Works* in accordance with the description given in this *Certificate*, the application for approval of the works and the submitted supporting documents and plans and specifications as listed in this *Certificate*.

(2) Where there is a conflict between a provision of any submitted document referred to in this *Certificate* and the Conditions of this *Certificate*, the Conditions in this *Certificate* shall take precedence, and where there is a conflict between the listed submitted documents, the document bearing the most recent date shall prevail.

(3) Where there is a conflict between the listed submitted documents, and the application, the application shall take precedence unless it is clear that the purpose of the document was to amend the application.

2. EXPIRY OF APPROVAL

The approval issued by this *Certificate* will cease to apply to those parts of the *Works* which have not been constructed within five (5) years of the date of this *Certificate*.

3. CHANGE OF OWNER

The *Owner* shall notify the *District Manager* and the *Director*, in writing, of any of the following changes within thirty (30) days of the change occurring:

(a) change of *Owner*;

(b) change of address of the *Owner*;

(c) change of partners where the *Owner* is or at any time becomes a partnership, and a copy of the most recent declaration filed under the Business Names Act, R.S.O. 1990, c.B17 shall be included in the notification to the *District Manager*; and

(d) change of name of the corporation where the *Owner* is or at any time becomes a corporation, and a copy of the most current information filed under the Corporations Information Act, R.S.O. 1990, c. C39 shall be included in the notification to the *District Manager*.

4. OPERATION AND MAINTENANCE.

(1) The *Owner* shall ensure that the design minimum liquid retention volume(s) is maintained at all times.

(2) The *Owner* shall inspect the *Works* at least once a year and, if necessary, clean and maintain the *Works* to prevent the excessive buildup of sediments and/or vegetation.

(3) The *Owner* shall maintain a logbook to record the results of these inspections and any cleaning and maintenance operations undertaken, and shall keep the logbook available for inspection by the *Ministry*. The logbook shall include the following:

(a) the name of the *Works*; and

(b) the date and results of each inspection, maintenance and cleaning, including an estimate of the quantity of any materials removed.

5. RECORD KEEPING

The *Owner* shall retain for a minimum of five (5) years from the date of their creation, all records and information related to or resulting from the operation and maintenance activities required by this *Certificate*.

The reasons for the imposition of these terms and conditions are as follows:

1. Condition 1 is imposed to ensure that the *Works* are built and operated in the manner in which they were described for review and upon which approval was granted. This condition is also included to emphasize the precedence of Conditions in the *Certificate* and the practice that the Approval is based on the most current document, if several conflicting documents are submitted for review.

2. Condition 2 is included to ensure that, when the *Works* are constructed, the *Works* will meet the standards that apply at the time of construction to ensure the ongoing protection of the environment..

3. Condition 3 is included to ensure that the Ministry records are kept accurate and current with respect to approved works and to ensure that subsequent owners of the works are made aware of the certificate and continue to operate the works in compliance with it.

4. Condition 4 is included to require that the *Works* be properly operated and maintained such that the environment is protected .

5. Condition 5 is included to require that all records are retained for a sufficient time period to adequately evaluate the long-term operation and maintenance of the *Works*.

In accordance with Section 100 of the Ontario Water Resources Act, R.S.O. 1990, Chapter 0.40, as amended, you may by written notice served upon me and the Environmental Review Tribunal within 15 days after receipt of this Notice, require a hearing by the Tribunal. Section 101 of the Ontario Water Resources Act, R.S.O. 1990, Chapter 0.40, provides that the Notice requiring the hearing shall state:

1. The portions of the approval or each term or condition in the approval in respect of which the hearing is required, and;
2. The grounds on which you intend to rely at the hearing in relation to each portion appealed.

The Notice should also include:

3. The name of the appellant;
4. The address of the appellant;
5. The Certificate of Approval number;
6. The date of the Certificate of Approval;
7. The name of the Director;
8. The municipality within which the works are located;

And the Notice should be signed and dated by the appellant.

This Notice must be served upon:

The Secretary*
Environmental Review Tribunal
655 Bay Street, 15th Floor
Toronto, Ontario
M5G 1E5

AND

The Director
Section 53, *Ontario Water Resources Act*
Ministry ofthe Environment
2 St. Clair Avenue West, Floor 12A
Toronto, Ontario
M4V 1L5

*** Further information on the Environmental Review Tribunal's requirements for an appeal can be obtained directly from the Tribunal at: Tel: (416) 314-4600, Fax: (416) 314-4506 or www.ert.gov.on.ca**

The above noted sewage works are approved under Section 53 of the Ontario Water Resources Act.

DATED AT TORONTO this 26th day of November, 2008

Mansoor Mahmood, P.Eng.
Director
Section 53, *Ontario Water Resources Act*

NH/
c: District Manager, MOE Ottawa District Office
Lance Erion, P.Eng., IBI Group

STORM SEWER CALCULATION SHEET (RATIONAL METHOD)

Local Roads Return Frequency = 2 years
Collector Roads Return Frequency = 5 years
Manning 0.013 Arterial Roads Return Frequency = 10 years

Ottawa

LOCATION			AREA (Ha) 2 YEAR				5 YEAR				10 YEAR				100 YEAR				FLOW						SEWER DATA								
Location	From Node	To Node	AREA (Ha)	R	Indiv. 2.78 AC	Accum. 2.78 AC	AREA (Ha)	R	Indiv. 2.78 AC	Accum. 2.78 AC	AREA (Ha)	R	Indiv. 2.78 AC	Accum. 2.78 AC	AREA (Ha)	R	Indiv. 2.78 AC	Accum. 2.78 AC	Time of Conc. (min)	Intensity 2 Year (mm/h)	Intensity 5 Year (mm/h)	Intensity 10 Year (mm/h)	Intensity 100 Year (mm/h)	Peak Flow Q (l/s)	DIA. (mm) (actual)	DIA. (mm) (nominal)	TYPE	SLOPE (%)	LENGTH (m)	CAPACITY (l/s)	VELOCITY (m/s)	TIME OF FLOW (min)	RATIO Q/Q full
Street 4																																	
	5010	5011	0.14	0.65	0.25	0.25			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	19	300	300	PVC	0.75	17.0	83.75	1.18	0.24	0.23
					0.00	0.25	0.09	0.65	0.16	0.16			0.00	0.00			0.00	0.00															
	5011	5012	0.30	0.65	0.54	0.80			0.00	0.16			0.00	0.00			0.00	0.00	10.24	75.90	102.95	120.67	176.40	77	375	375	PVC	0.60	16.0	135.81	1.23	0.22	0.57
	5012	5013			0.00	0.80			0.00	0.16			0.00	0.00			0.00	0.00	10.46	75.10	101.84	119.38	174.49	76	375	375	PVC	0.30	15.0	96.03	0.87	0.29	0.79
					0.00	0.80	0.11	0.65	0.20	0.36			0.00	0.00			0.00	0.00															
	5013	5014	0.48	0.65	0.87	1.66			0.00	0.36			0.00	0.00			0.00	0.00	10.74	74.06	100.42	117.70	172.04	159	450	450	CONC	0.55	50.0	211.44	1.33	0.63	0.75
	5014	5015			0.00	1.66			0.00	0.36			0.00	0.00			0.00	0.00	11.37	71.92	97.47	114.23	166.93	155	450	450	CONC	0.50	10.5	201.60	1.27	0.14	0.77
	5015	5016	0.22	0.65	0.40	2.06			0.00	0.36			0.00	0.00			0.00	0.00	11.51	71.46	96.85	113.49	165.85	182	450	450	CONC	0.65	37.0	229.86	1.45	0.43	0.79
To Street 16, Pipe 5016 - 5017						2.06				0.36				0.00				0.00	11.94														
EASM 1020																																	
	5003	5004			0.00	0.00	3.20	0.65	5.78	5.78			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	602	675	675	CONC	0.65	35.0	677.70	1.89	0.31	0.89
To STREET 10, Pipe 5004 - 5005						0.00				5.78				0.00				0.00	10.31														
To SWM Pond 4																																	
Contribution From Street 16, Pipe 5017 - 5022						8.42				10.53				0.00				0.00	13.01														
Contribution From Street 16, Pipe 5020 - 5022						1.37				0.56				0.00				0.00	12.69														
	5021	5022			0.00	9.79			0.00	11.09			0.00	0.00			0.00	0.00	13.01	66.91	90.60	106.14	155.05	1660	975	975	CONC	0.85	27.5	2066.15	2.77	0.17	0.80
EASM 1023																																	
	4033	4034			0.00	0.00	1.60	0.65	2.89	2.89			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	301	750	750	CONC	0.20	52.0	497.87	1.13	0.77	0.61
To STREET 10, Pipe 4034 - 4035						0.00				2.89				0.00				0.00	10.77														
STREET 3																																	
					0.00	0.00	0.46	0.65	0.83	0.83			0.00	0.00			0.00	0.00															
	4029	4030	1.07	0.65	1.93	1.93			0.00	0.83			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	235	450	450	CONC	1.05	43.5	292.15	1.84	0.39	0.80
	4030	4036	0.49	0.65	0.89	2.82			0.00	0.83			0.00	0.00			0.00	0.00	10.39	75.32	102.15	119.74	175.03	297	525	525	CONC	1.65	77.5	552.42	2.55	0.51	0.54
To STREET 19, Pipe 4036 - 4037						2.82				0.83				0.00				0.00	10.90														
					0.00	0.00	0.10	0.65	0.18	0.18			0.00	0.00			0.00	0.00															
	4029	4028	0.29	0.65	0.52	0.52			0.00	0.18			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	59	300	300	PVC	0.60	49.5	74.90	1.06	0.78	0.79
					0.00	0.52	0.11	0.65	0.20	0.38			0.00	0.00			0.00	0.00															
	4028	4027	0.37	0.65	0.67	1.19			0.00	0.38			0.00	0.00			0.00	0.00	10.78	73.94	100.25	117.50	171.74	126	375	375	PVC	0.95	10.5	170.89	1.55	0.11	0.74
	4027	4026			0.00	1.19			0.00	0.38			0.00	0.00			0.00	0.00	10.89	73.54	99.71	116.86	170.80	126	375	375	PVC	3.45	68.5	325.66	2.95	0.39	0.39
To STREET 10, Pipe 4026 - 4025						1.19				0.38				0.00				0.00	11.28														
EASM 1026																																	
	4009	4010			0.00	0.00	13.13	0.65	23.73	23.73			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	2472	1500	1500	CONC	0.15	85.5	2737.76	1.55	0.92	0.90
To STREET 1, Pipe 4010 - 4019						0.00				23.73				0.00				0.00	10.92														
STREET 20																																	
	4006	4007	0.11	0.65	0.20	0.20			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	15	300	300	PVC	0.35	64.0	57.21	0.81	1.32	0.27
To STREET 1, Pipe 4007 - 4008						0.20				0.00				0.00				0.00	11.32														
EASM 16																																	
	4004	4005			0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	0	825	825	PVC	0.35	35.5	849.22	1.59	0.37	0.00
To STREET 1, Pipe 4005 - 4007						0.00				0.00				0.00				0.00	10.37														
STREET 2																																	
	4000	4001	0.25	0.65	0.45	0.45			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	35	300	300	PVC	0.50	64.0	68.38	0.97	1.10	0.51
To STREET 1, Pipe 4001 - 4002						0.45				0.00				0.00				0.00	11.10														
					0.00	0.00	0.20	0.65	0.36	0.36			0.00	0.00			0.00	0.00															
	4011	4012	0.68	0.65	1.23	1.23			0.00	0.36			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	132	525	525	CONC	0.20	54.5	192.33	0.89	1.02	0.69
					0.00	1.23	0.08	0.65	0.14	0.51			0.00	0.00			0.00	0.00															
	4012	4013	0.23	0.65	0.42	1.64			0.00	0.51			0.00	0.00			0.00	0.00	11.02	73.09	99.09	116.13	169.72	170	600	600	CONC	0.15	50.0	237.81	0.84	0.99	0.72

Definitions:
Q = 2.78 AIR, where
Q = Peak Flow in Litres per second (L/s)
A = Areas in hectares (ha)
I = Rainfall Intensity (mm/h)
R = Runoff Coefficient

Notes:
1) Ottawa Rainfall-Intensity Curve
2) Min. Velocity = 0.80 m/s

Designed: GGG	PROJECT: 7000 Campeau Drive		
Checked: SLM	LOCATION: City of Ottawa		
Dwg. Reference: 03D	File Ref: 18-1061	Date: 15 Jun 2021	Sheet No. SHEET 1 OF 10

STORM SEWER CALCULATION SHEET (RATIONAL METHOD)

Local Roads Return Frequency = 2 years
Collector Roads Return Frequency = 5 years
Manning 0.013 Arterial Roads Return Frequency = 10 years

LOCATION			AREA (Ha)																FLOW						SEWER DATA								
			2 YEAR				5 YEAR				10 YEAR				100 YEAR				Time of	Intensity	Intensity	Intensity	Intensity	Peak Flow	DIA. (mm)	DIA. (mm)	TYPE	SLOPE	LENGTH	CAPACITY	VELOCITY	TIME OF	RATIO
			AREA	R	Indiv.	Accum.	AREA	R	Indiv.	Accum.	AREA	R	Indiv.	Accum.	AREA	R	Indiv.	Accum.	Conc.	2 Year	5 Year	10 Year	100 Year										
Location	From Node	To Node	(Ha)		2.78 AC	2.78 AC	(Ha)		2.78 AC	2.78 AC	(Ha)		2.78 AC	2.78 AC	(Ha)		2.78 AC	2.78 AC	(min)	(mm/h)	(mm/h)	(mm/h)	(mm/h)	Q (l/s)	(actual)	(nominal)		(%)	(m)	(l/s)	(m/s)	LOW (min	Q/Q full
					0.00	1.64	0.25	0.65	0.45	0.96			0.00	0.00			0.00	0.00															
	4013	4014	1.06	0.65	1.92	3.56			0.00	0.96			0.00	0.00			0.00	0.00	12.01	69.85	94.64	110.89	162.04	339	825	825	CONC	0.10	77.0	453.92	0.85	1.51	0.75
					0.00	3.56	0.15	0.65	0.27	1.23			0.00	0.00			0.00	0.00															
	4014	4015	0.86	0.65	1.55	5.11			0.00	1.23			0.00	0.00			0.00	0.00	13.52	65.48	88.65	103.84	151.68	444	975	975	CONC	0.10	83.5	708.68	0.95	1.47	0.63
					0.00	5.11	0.20	0.65	0.36	1.59			0.00	0.00			0.00	0.00															
	4015	4016	0.84	0.65	1.52	6.63			0.00	1.59			0.00	0.00			0.00	0.00	14.99	61.79	83.59	97.89	142.95	543	1050	1050	CONC	0.10	93.5	863.53	1.00	1.56	0.63
					0.00	6.63	0.23	0.65	0.42	2.01			0.00	0.00			0.00	0.00															
	4016	4017	0.76	0.65	1.37	8.01			0.00	2.01			0.00	0.00			0.00	0.00	16.55	58.33	78.85	92.32	134.78	625	1050	1050	CONC	0.10	94.0	863.53	1.00	1.57	0.72
					0.00	8.01	0.13	0.65	0.23	2.24			0.00	0.00			0.00	0.00															
	4017	4018	0.14	0.65	0.25	8.26			0.00	2.24			0.00	0.00			0.00	0.00	18.12	55.26	74.66	87.39	127.54	624	1050	1050	CONC	0.10	10.5	863.53	1.00	0.18	0.72
	4018	4019	0.28	0.65	0.51	8.76			0.00	2.24			0.00	0.00			0.00	0.00	18.30	54.94	74.22	86.87	126.79	648	1200	1200	CONC	0.10	69.0	1232.89	1.09	1.05	0.53
To STREET 1, Pipe 4019 - 4020						8.76				2.24				0.00				0.00	19.35														
STREET 10																																	
			0.38	0.65	0.69	0.69			0.00	0.00			0.00	0.00			0.00	0.00															
	5007	5008			0.00	0.69	0.67	0.65	1.21	1.21			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	179	450	450	CONC	1.00	30.5	285.11	1.79	0.28	0.63
To Street 16, Pipe 5008 - 5009						0.69				1.21				0.00				0.00	10.28														
STREET 16																																	
					0.00	0.00	0.11	0.65	0.20	0.20			0.00	0.00			0.00	0.00															
					0.00	0.00	0.12	0.65	0.22	0.42			0.00	0.00			0.00	0.00															
	4031	4032	0.84	0.65	1.52	1.52			0.00	0.42			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	160	450	450	CONC	0.50	68.0	201.60	1.27	0.89	0.79
	4032	4034			0.00	1.52			0.00	0.42			0.00	0.00			0.00	0.00	10.89	73.53	99.70	116.85	170.78	153	450	450	CONC	0.45	11.0	191.26	1.20	0.15	0.80
Contribution From EASM 1023, Pipe 4033 - 4034						0.00				2.89				0.00				0.00	10.77														
					0.00	1.52	0.06	0.65	0.11	3.42			0.00	0.00			0.00	0.00															
					0.00	1.52	0.07	0.65	0.13	3.54			0.00	0.00			0.00	0.00															
	4034	4035	0.58	0.65	1.05	2.57			0.00	3.54			0.00	0.00			0.00	0.00	11.05	73.01	98.97	115.99	169.53	538	975	975	CONC	0.10	64.0	708.68	0.95	1.12	0.76
To STREET 19, Pipe 4035 - 4036						2.57				3.54				0.00				0.00	12.17														
STREET 10																																	
					0.00	0.00	0.06	0.65	0.11	0.11			0.00	0.00			0.00	0.00															
			0.56	0.65	1.01	1.01			0.00	0.11			0.00	0.00			0.00	0.00															
	5000	5001			0.00	1.01	0.93	0.65	1.68	1.79			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	264	525	525	CONC	0.95	29.5	419.17	1.94	0.25	0.63
	5001	5002			0.00	1.01			0.00	1.79			0.00	0.00			0.00	0.00	10.25	75.84	102.87	120.58	176.27	261	525	525	CONC	1.80	12.0	576.99	2.67	0.08	0.45
					0.00	1.01	0.10	0.65	0.18	1.97			0.00	0.00			0.00	0.00															
	5002	5004	0.40	0.65	0.72	1.73			0.00	1.97			0.00	0.00			0.00	0.00	10.33	75.56	102.49	120.13	175.61	333	600	600	CONC	0.75	68.5	531.75	1.88	0.61	0.63
Contribution From EASM 1020, Pipe 5003 - 5004						0.00				5.78				0.00				0.00	10.31														
					0.00	1.73	0.06	0.65	0.11	7.86			0.00	0.00			0.00	0.00															
	5004	5005	0.28	0.65	0.51	2.24			0.00	7.86			0.00	0.00			0.00	0.00	10.94	73.39	99.50	116.61	170.43	947	825	825	CONC	0.55	39.5	1064.55	1.99	0.33	0.89
					0.00	2.24	0.08	0.65	0.14	8.01			0.00	0.00			0.00	0.00															
	5005	5006	0.34	0.65	0.61	2.86			0.00	8.01			0.00	0.00			0.00	0.00	11.27	72.26	97.95	114.79	167.75	990	825	825	CONC	0.60	22.0	1111.88	2.08	0.18	0.89
	5006	5008			0.00	2.86			0.00	8.01			0.00	0.00			0.00	0.00	11.44	71.68	97.14	113.84	166.36	982	825	825	CONC	0.60	11.0	1111.88	2.08	0.09	0.88
To Street 16, Pipe 5008 - 5009						2.86				8.01				0.00				0.00	11.53														
STREET 16																																	
Contribution From STREET 1, Pipe 4019 - 4020						17.62				28.93				0.00				0.00	20.18														
					0.00	17.62	0.04	0.65	0.07	29.00			0.00	0.00			0.00	0.00															
	4020	4021	0.36	0.65	0.65	18.27			0.00	29.00			0.00	0.00			0.00	0.00	20.18	51.75	69.86	81.76	119.28	2972	1650	1650	CONC	0.20	53.0	4076.11	1.91	0.46	0.73
					0.00	18.27	0.37	0.65	0.67	29.67			0.00	0.00			0.00	0.00															
	4021	4022	1.26	0.65	2.28	20.55			0.00	29.67			0.00	0.00			0.00	0.00	20.64	51.02	68.88	80.59	117.58	3092	1650	1650	CONC	0.25	53.5	4557.22	2.13	0.42	0.68
	4022	4026			0.00	20.55			0.00	29.67			0.00	0.00			0.00	0.00	21.06	50.39	68.01	79.58	116.09	3053	1650	1650	CONC	0.20	29.5	4076.11	1.91	0.26	0.75
Contribution From STREET 3, Pipe 4027 - 4026						1.19				0.38				0.00				0.00	11.28														
					0.00	21.74	0.05	0.65	0.09	30.14			0.00	0.00			0.00	0.00															
	4026	4025	0.25	0.65	0.45	22.19			0.00	30.14			0.00	0.00			0.00	0.00	21.32	50.00	67.49	78.96	115.19	3144	1650	1650	CONC	0.25	31.0	4557.22	2.13	0.24	0.69
					0.00	22.19	0.06	0.65	0.11	30.25			0.00	0.00			0.00	0.00															
	4025	4024	0.33	0.65	0.60	22.79			0.00	30.25			0.00	0.00			0.00	0.00	21.56	49.65	67.00	78.40	114.36	3158	1650	1650	CONC	0.25	37.5	4557.22	2.13	0.29	0.69
					0.00	22.79	0.06	0.65	0.11	30.36			0.00	0.00			0.00	0.00															
	4024	4035	0.48	0.65	0.87	23.65			0.00	30.36			0.00	0.00			0.00	0.00	21.85	49.23	66.43	77.72	113.37	3181	1650	1650	PVC	0.36	77.5	5468.67	2.56	0.51	0.58
To STREET 19, Pipe 4035 - 4036						23.65				30.36				0.00				0.00	22.36														

Definitions:
Q = 2.78 AIR, where
Q = Peak Flow in Litres per second (L/s)
A = Areas in hectares (ha)
I = Rainfall Intensity (mm/h)
R = Runoff Coefficient

Notes:
1) Ottawa Rainfall-Intensity Curve
2) Min. Velocity = 0.80 m/s

Designed: GGG	PROJECT: 7000 Campeau Drive		
Checked: SLM	LOCATION: City of Ottawa		
Dwg. Reference: 03D	File Ref: 18-1061	Date: 15 Jun 2021	Sheet No. SHEET 2 OF 10

STORM SEWER CALCULATION SHEET (RATIONAL METHOD)

Local Roads Return Frequency = 2 years
Collector Roads Return Frequency = 5 years
Manning 0.013 Arterial Roads Return Frequency = 10 years

Location	From Node	To Node	2 YEAR AREA (Ha)	2 YEAR R	2 YEAR Indiv. 2.78 AC	2 YEAR Accum. 2.78 AC	5 YEAR AREA (Ha)	5 YEAR R	5 YEAR Indiv. 2.78 AC	5 YEAR Accum. 2.78 AC	10 YEAR AREA (Ha)	10 YEAR R	10 YEAR Indiv. 2.78 AC	10 YEAR Accum. 2.78 AC	100 YEAR AREA (Ha)	100 YEAR R	100 YEAR Indiv. 2.78 AC	100 YEAR Accum. 2.78 AC	Time of Conc. (min)	Intensity 2 Year (mm/h)	Intensity 5 Year (mm/h)	Intensity 10 Year (mm/h)	Intensity 100 Year (mm/h)	Peak Flow Q (l/s)	DIA. (mm) (actual)	DIA. (mm) (nominal)	TYPE	SLOPE (%)	LENGTH (m)	CAPACITY (l/s)	VELOCITY (m/s)	TIME OF FLOW (min)	RATIO Q/Q full
STREET 19																																	
Contribution From STREET 10, Pipe 4024 - 4035						23.65				30.36				0.00				0.00	22.36														
Contribution From STREET 10, Pipe 4034 - 4035						2.57				3.54				0.00				0.00	12.17														
					0.00	26.22	0.07	0.65	0.13	34.03			0.00	0.00			0.00	0.00															
	4035	4036	0.29	0.65	0.52	26.74			0.00	34.03			0.00	0.00			0.00	0.00	22.36	48.52	65.47	76.59	111.71	3525	1650	1650	CONC	0.30	60.0	4992.19	2.33	0.43	0.71
Contribution From STREET 3, Pipe 4030 - 4036						2.82				0.83				0.00				0.00	10.90														
					0.00	29.56	0.07	0.65	0.13	34.98			0.00	0.00			0.00	0.00															
	4036	4037	0.23	0.65	0.42	29.98			0.00	34.98			0.00	0.00			0.00	0.00	22.79	47.94	64.67	75.66	110.35	3700	1650	1650	CONC	0.30	50.0	4992.19	2.33	0.36	0.74
					0.00	29.98	0.04	0.65	0.07	35.06			0.00	0.00			0.00	0.00															
	4037	4038	0.40	0.65	0.72	30.70			0.00	35.06			0.00	0.00			0.00	0.00	23.14	47.47	64.03	74.90	109.24	3702	1650	1650	CONC	0.30	42.5	4992.19	2.33	0.30	0.74
					0.00	30.70	0.10	0.65	0.18	35.24			0.00	0.00			0.00	0.00															
					0.00	30.70	0.12	0.65	0.22	35.45			0.00	0.00			0.00	0.00															
	4038	4039	0.48	0.65	0.87	31.57			0.00	35.45			0.00	0.00			0.00	0.00	23.45	47.07	63.49	74.27	108.32	3737	1650	1650	CONC	0.30	44.0	4992.19	2.33	0.31	0.75
					0.00	31.57	0.08	0.65	0.14	35.60			0.00	0.00			0.00	0.00															
					0.00	31.57	0.09	0.65	0.16	35.76			0.00	0.00			0.00	0.00															
	4039	4040	0.39	0.65	0.70	32.27			0.00	35.76			0.00	0.00			0.00	0.00	23.76	46.67	62.95	73.63	107.38	3757	1650	1650	CONC	0.30	45.5	4992.19	2.33	0.32	0.75
					0.00	32.27	0.17	0.65	0.31	36.07			0.00	0.00			0.00	0.00															
					0.00	32.27	0.18	0.65	0.33	36.39			0.00	0.00			0.00	0.00															
	4040	4041	0.77	0.65	1.39	33.66			0.00	36.39			0.00	0.00			0.00	0.00	24.09	46.27	62.40	72.98	106.43	3828	1650	1650	CONC	0.30	90.5	4992.19	2.33	0.65	0.77
To EASM 1024, Pipe 4041 - 4042						33.66				36.39				0.00				0.00	24.73														
EASM 1024																																	
Contribution From STREET 19, Pipe 4040 - 4041						33.66				36.39				0.00				0.00	24.73														
					0.00	33.66	0.20	0.65	0.36	36.75			0.00	0.00			0.00	0.00															
					0.00	33.66	0.40	0.65	0.72	37.48			0.00	0.00			0.00	0.00															
	4041	4042	0.70	0.65	1.26	34.93			0.00	37.48			0.00	0.00			0.00	0.00	24.73	45.48	61.33	71.73	104.59	3887	1650	1650	CONC	0.45	90.5	6114.16	2.86	0.53	0.64
	4042	4043			0.00	34.93			0.00	37.48			0.00	0.00			0.00	0.00	25.26	44.87	60.49	70.74	103.14	3834	1950	1950	CONC	0.10	78.0	4499.86	1.51	0.86	0.85
SWM Pond 4 Outlet																																	
					0.00	0.00	0.72	0.65	1.30	1.30			0.00	0.00			0.00	0.00															
	5023	5024	0.86	0.65	1.55	1.55			0.00	1.30			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	255	525	525	CONC	0.55	19.0	318.94	1.47	0.21	0.80
To Street 16, Pipe 5024 - 5025						1.55				1.30				0.00				0.00	10.21														
Street 16																																	
	5019	5020	0.16	0.65	0.29	0.29			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	22	300	300	PVC	0.35	19.0	57.21	0.81	0.39	0.39
					0.00	0.29	0.31	0.65	0.56	0.56			0.00	0.00			0.00	0.00															
	5020	5022	0.60	0.65	1.08	1.37			0.00	0.56			0.00	0.00			0.00	0.00	10.39	75.33	102.17	119.76	175.06	161	600	600	CONC	0.15	116.0	237.81	0.84	2.30	0.68
To SWM POND 4 - 1021, Pipe 5022 - 5021						1.37				0.56				0.00				0.00	12.69														
Contribution From SWM Pond 4 Outlet, Pipe 5023 - 5024						1.55				1.30				0.00				0.00	10.21														
	5024	5025			0.00	1.55			0.00	1.30			0.00	0.00			0.00	0.00	10.21	75.99	103.07	120.82	176.62	252	600	600	CONC	0.50	56.0	434.17	1.54	0.61	0.58
To WESLOCK WAY, Pipe 5025 - 228						1.55				1.30				0.00				0.00	10.82														
Contribution From STREET 10, Pipe 5006 - 5008						2.86				8.01				0.00				0.00	11.53														
Contribution From STREET 10, Pipe 5007 - 5008						0.69				1.21				0.00				0.00	10.28														
	5008	5009	0.08	0.65	0.14	3.69			0.00	9.22			0.00	0.00			0.00	0.00	11.53	71.39	96.75	113.37	165.68	1155	900	900	CONC	0.65	47.0	1459.52	2.29	0.34	0.79
					0.00	3.69	0.08	0.65	0.14	9.36			0.00	0.00			0.00	0.00															
	5009	5016	0.29	0.65	0.52	4.21			0.00	9.36			0.00	0.00			0.00	0.00	11.87	70.29	95.24	111.60	163.08	1187	975	975	CONC	0.55	45.5	1662.01	2.23	0.34	0.71
Contribution From Street 4, Pipe 5015 - 5016						2.06				0.36				0.00				0.00	11.94														
					0.00	6.27	0.10	0.65	0.18	9.90			0.00	0.00			0.00	0.00															
					0.00	6.27	0.16	0.65	0.29	10.19			0.00	0.00			0.00	0.00															
	5016	5017	0.70	0.65	1.26	7.54			0.00	10.19			0.00	0.00			0.00	0.00	12.21	69.24	93.80	109.90	160.58	1478	975	975	CONC	0.95	83.0	2184.31	2.93	0.47	0.68
					0.00	7.54	0.09	0.65	0.16	10.35			0.00	0.00			0.00	0.00															
					0.00	7.54	0.10	0.65	0.18	10.53			0.00	0.00			0.00	0.00															
	5017	5022	0.49	0.65	0.89	8.42			0.00	10.53			0.00	0.00			0.00	0.00	12.69	67.83	91.86	107.63	157.24	1539	975	975	CONC	0.95	56.5	2184.31	2.93	0.32	0.70
To Unknown Road3 - 1021, Pipe 5021 - 5022						8.42				10.53				0.00				0.00	13.01														

Definitions:
Q = 2.78 AIR, where
Q = Peak Flow in Litres per second (L/s)
A = Areas in hectares (ha)
I = Rainfall Intensity (mm/h)
R = Runoff Coefficient

Notes:
1) Ottawa Rainfall-Intensity Curve
2) Min. Velocity = 0.80 m/s

Designed: GGG	PROJECT: **7000 Campeau Drive**	
Checked: SLM	LOCATION: **City of Ottawa**	
Dwg. Reference: 03D	File Ref: 18-1061	Date: 15 Jun 2021 / Sheet No. SHEET 3 OF 10

STORM SEWER CALCULATION SHEET (RATIONAL METHOD)

Local Roads Return Frequency = 2 years
Collector Roads Return Frequency = 5 years
Manning 0.013 Arterial Roads Return Frequency = 10 years

LOCATION			AREA (Ha)																FLOW						SEWER DATA								
			2 YEAR				5 YEAR				10 YEAR				100 YEAR				Time of Conc.	Intensity 2 Year	Intensity 5 Year	Intensity 10 Year	Intensity 100 Year	Peak Flow	DIA. (mm)	DIA. (mm)	TYPE	SLOPE	LENGTH	CAPACITY	VELOCITY	TIME OF FLOW	RATIO
Location	From Node	To Node	AREA (Ha)	R	Indiv. 2.78 AC	Accum. 2.78 AC	AREA (Ha)	R	Indiv. 2.78 AC	Accum. 2.78 AC	AREA (Ha)	R	Indiv. 2.78 AC	Accum. 2.78 AC	AREA (Ha)	R	Indiv. 2.78 AC	Accum. 2.78 AC	(min)	(mm/h)	(mm/h)	(mm/h)	(mm/h)	Q (l/s)	(actual)	(nominal)		(%)	(m)	(l/s)	(m/s)	(min)	Q/Q full
SWM Pond 3 Outlet																																	
	4044	4054			0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	0	825	825	CONC	0.30	69.5	786.22	1.47	0.79	0.00
To WESLOCK WAY, Pipe 4054 - 5025						0.00				0.00				0.00				0.00	10.79														
EASM 649																																	
Contribution From STREET 17, Pipe 6012 - 6014						11.29				1.49				0.00				0.00	20.68														
Contribution From STREET 17, Pipe 6013 - 6014						0.61				0.00				0.00				0.00	12.17														
	6014	6015			0.00	11.91			0.00	1.49			0.00	0.00			0.00	0.00	20.68	50.96	68.79	80.49	117.43	709	1050	1050	CONC	0.10	92.0	863.53	1.00	1.54	0.82
	6015	6017			0.00	11.91			0.00	1.49			0.00	0.00			0.00	0.00	22.22	48.71	65.73	76.90	112.16	678	1050	1050	CONC	0.10	49.5	863.53	1.00	0.83	0.78
To WESLOCK WAY, Pipe 6017 - 212						11.91				1.49				0.00				0.00	23.05														
EASM 8																																	
					0.00	0.00	0.15	0.65	0.27	0.27			0.00	0.00			0.00	0.00															
	2023	2024	1.27	0.65	2.29	2.29			0.00	0.27			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	205	600	600	CONC	0.20	78.0	274.59	0.97	1.34	0.74
	2024	6019			0.00	2.29			0.00	0.27			0.00	0.00			0.00	0.00	11.34	72.02	97.62	114.40	167.18	192	600	600	CONC	0.20	42.0	274.59	0.97	0.72	0.70
To KNUDSON DRIVE, Pipe 6019 - 154						2.29				0.27				0.00				0.00	12.06														
STREET 17																																	
	6013	6014	0.34	0.65	0.61	0.61			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	47	825	825	CONC	0.10	110.5	453.92	0.85	2.17	0.10
To EASM 649, Pipe 6014 - 6015						0.61				0.00				0.00				0.00	12.17														
					0.00	0.00	0.00	0.00	0.00	0.00			0.00	0.00			0.00	0.00						1179									
	1050	1051			0.00	0.00	1.07	0.25	0.74	0.74			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	1256	1200	1200	CONC	0.15	49.5	1509.97	1.34	0.62	0.83
	1051	1052			0.00	0.00			0.00	0.74			0.00	0.00			0.00	0.00	10.62	74.51	101.04	118.43	173.10	1254	1200	1200	CONC	0.15	104.5	1509.97	1.34	1.30	0.83
	1052	1053			0.00	0.00			0.00	0.74			0.00	0.00			0.00	0.00	11.92	70.14	95.03	111.35	162.71	1250	1200	1200	CONC	0.15	66.5	1509.97	1.34	0.83	0.83
	1053	1054			0.00	0.00			0.00	0.74			0.00	0.00			0.00	0.00	12.75	67.64	91.60	107.31	156.78	1247	1200	1200	CONC	0.15	66.5	1509.97	1.34	0.83	0.83
To EASM 732, Pipe 1054 - 1055						0.00				0.74				0.00				0.00	13.58					1179									
					0.00	0.00	0.16	0.25	0.11	0.11			0.00	0.00			0.00	0.00															
	6000	6001	0.43	0.65	0.78	0.78			0.00	0.11			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	71	375	375	PVC	0.30	33.0	96.03	0.87	0.63	0.74
	6001	6002			0.00	0.78			0.00	0.11			0.00	0.00			0.00	0.00	10.63	74.46	100.97	118.34	172.98	69	375	375	PVC	0.30	10.5	96.03	0.87	0.20	0.72
					0.00	0.78	0.22	0.25	0.15	0.26			0.00	0.00			0.00	0.00															
	6002	6003	0.76	0.65	1.37	2.15			0.00	0.26			0.00	0.00			0.00	0.00	10.83	73.75	99.99	117.19	171.28	185	600	600	CONC	0.20	104.5	274.59	0.97	1.79	0.67
					0.00	2.15	0.27	0.25	0.19	0.45			0.00	0.00			0.00	0.00															
	6003	6004	0.66	0.65	1.19	3.34			0.00	0.45			0.00	0.00			0.00	0.00	12.63	68.00	92.10	107.90	157.65	269	600	600	CONC	0.30	84.5	336.31	1.19	1.18	0.80
					0.00	3.34	0.25	0.25	0.17	0.63			0.00	0.00			0.00	0.00															
	6004	6005	0.62	0.65	1.12	4.46			0.00	0.63			0.00	0.00			0.00	0.00	13.81	64.72	87.61	102.61	149.88	344	750	750	CONC	0.20	84.5	497.87	1.13	1.25	0.69
					0.00	4.46	0.14	0.25	0.10	0.72			0.00	0.00			0.00	0.00															
	6005	6006	0.40	0.65	0.72	5.19			0.00	0.72			0.00	0.00			0.00	0.00	15.06	61.62	83.36	97.62	142.56	380	750	750	CONC	0.20	61.0	497.87	1.13	0.90	0.76
					0.00	5.19	0.20	0.25	0.14	0.86			0.00	0.00			0.00	0.00															
	6006	6007	0.56	0.65	1.01	6.20			0.00	0.86			0.00	0.00			0.00	0.00	15.96	59.58	80.57	94.34	137.74	439	750	750	CONC	0.25	69.5	556.64	1.26	0.92	0.79
					0.00	6.20	0.27	0.25	0.19	1.05			0.00	0.00			0.00	0.00															
	6007	6008	0.73	0.65	1.32	7.52			0.00	1.05			0.00	0.00			0.00	0.00	16.88	57.65	77.93	91.24	133.19	515	825	825	CONC	0.20	78.0	641.95	1.20	1.08	0.80
					0.00	7.52	0.21	0.25	0.15	1.20			0.00	0.00			0.00	0.00															
	6008	6009	0.65	0.65	1.17	8.69			0.00	1.20			0.00	0.00			0.00	0.00	17.96	55.55	75.06	87.86	128.24	573	825	825	CONC	0.25	70.5	717.72	1.34	0.88	0.80
					0.00	8.69	0.20	0.25	0.14	1.33			0.00	0.00			0.00	0.00															
	6009	6010	0.64	0.65	1.16	9.85			0.00	1.33			0.00	0.00			0.00	0.00	18.84	53.98	72.90	85.33	124.52	629	825	825	CONC	0.30	70.5	786.22	1.47	0.80	0.80
					0.00	9.85	0.08	0.25	0.06	1.39			0.00	0.00			0.00	0.00															
	6010	6011	0.36	0.65	0.65	10.50			0.00	1.39			0.00	0.00			0.00	0.00	19.64	52.62	71.05	83.15	121.33	651	825	825	CONC	0.35	15.5	849.22	1.59	0.16	0.77
	6011	6012			0.00	10.50			0.00	1.39			0.00	0.00			0.00	0.00	19.80	52.35	70.69	82.73	120.71	648	975	975	CONC	0.15	44.5	867.96	1.16	0.64	0.75
					0.00	10.50	0.14	0.25	0.10	1.49			0.00	0.00			0.00	0.00															
	6012	6014	0.44	0.65	0.80	11.29			0.00	1.49			0.00	0.00			0.00	0.00	20.44	51.33	69.30	81.09	118.31	683	1050	1050	CONC	0.10	14.5	863.53	1.00	0.24	0.79
To EASM 649, Pipe 6014 - 6015						11.29				1.49				0.00				0.00	20.68														
EASM 732																																	
Contribution From STREET 17, Pipe 1053 - 1054						0.00				0.74				0.00				0.00	13.58					1179									
	1054	1055			0.00	0.00			0.00	0.74			0.00	0.00			0.00	0.00	13.58	65.33	88.43	103.59	151.31	1245	1200	1200	CONC	0.15	41.5	1509.97	1.34	0.52	0.82

Definitions:
Q = 2.78 AIR, where
Q = Peak Flow in Litres per second (L/s)
A = Areas in hectares (ha)
I = Rainfall Intensity (mm/h)
R = Runoff Coefficient

Notes:
1) Ottawa Rainfall-Intensity Curve
2) Min. Velocity = 0.80 m/s

Designed: GGG	PROJECT: 7000 Campeau Drive		
Checked: SLM	LOCATION: City of Ottawa		
Dwg. Reference: 03D	File Ref: 18-1061	Date: 15 Jun 2021	Sheet No. SHEET 4 OF 10

STORM SEWER CALCULATION SHEET (RATIONAL METHOD)

Local Roads Return Frequency = 2 years
Collector Roads Return Frequency = 5 years
Manning 0.013 Arterial Roads Return Frequency = 10 years

LOCATION			AREA (Ha) 2 YEAR				5 YEAR				10 YEAR				100 YEAR				FLOW						SEWER DATA								
Location	From Node	To Node	AREA (Ha)	R	Indiv. 2.78 AC	Accum. 2.78 AC	AREA (Ha)	R	Indiv. 2.78 AC	Accum. 2.78 AC	AREA (Ha)	R	Indiv. 2.78 AC	Accum. 2.78 AC	AREA (Ha)	R	Indiv. 2.78 AC	Accum. 2.78 AC	Time of Conc. (min)	Intensity 2 Year (mm/h)	Intensity 5 Year (mm/h)	Intensity 10 Year (mm/h)	Intensity 100 Year (mm/h)	Peak Flow Q (l/s)	DIA. (mm) (actual)	DIA. (mm) (nominal)	TYPE	SLOPE (%)	LENGTH (m)	CAPACITY (l/s)	VELOCITY (m/s)	TIME OF FLOW (min)	RATIO Q/Q full
	1055	1069			0.00	0.00			0.00	0.74			0.00	0.00			0.00	0.00	14.10	63.97	86.58	101.41	148.11	1243	1200	1200	CONC	0.15	56.5	1509.97	1.34	0.71	0.82
To KNUDSON DRIVE, Pipe 1069 - 146						0.00				0.74				0.00				0.00	14.81					1179									
KNUDSON DRIVE																																	
					0.00	0.00	8.99	0.65	16.24	16.24			0.00	0.00			0.00	0.00	20.00														
					0.00	0.00	1.43	0.65	2.58	18.83			0.00	0.00			0.00	0.00	17.00														
					0.00	0.00	0.82	0.65	1.48	20.31			0.00	0.00			0.00	0.00	15.00														
					0.00	0.00	4.76	0.65	8.60	28.91			0.00	0.00			0.00	0.00	13.00														
	209	210			0.00	0.00			0.00	28.91			0.00	0.00			0.00	0.00	20.00	52.03	70.25	82.21	119.95	2031	1200	1200	CONC	0.15	38.0	1509.97	1.34	0.47	1.35
To WESLOCK WAY, Pipe 210 - 6017						0.00				28.91				0.00				0.00	20.47														
					0.00	0.00	6.71	0.70	13.06	13.06			0.00	0.00			0.00	0.00	14.00														
	112	113			0.00	0.00			0.00	13.06			0.00	0.00			0.00	0.00	14.00	64.23	86.93	101.82	148.72	1135	750	750	CONC	0.35	62.8	658.62	1.49	0.70	1.72
	113	114			0.00	0.00			0.00	13.06			0.00	0.00			0.00	0.00	14.70	62.48	84.53	99.00	144.58	1104	750	750	CONC	0.39	64.9	690.77	1.56	0.69	1.60
	114	115			0.00	0.00			0.00	13.06			0.00	0.00			0.00	0.00	15.39	60.85	82.31	96.38	140.74	1075	750	750	CONC	0.35	103.7	655.79	1.48	1.16	1.64
					0.00	0.00	1.26	0.65	2.28	15.33			0.00	0.00			0.00	0.00	10.00														
	115	116			0.00	0.00			0.00	15.33			0.00	0.00			0.00	0.00	16.56	58.32	78.84	92.31	134.76	1209	750	750	CONC	0.60	112.5	859.46	1.95	0.96	1.41
	116	132			0.00	0.00			0.00	15.33			0.00	0.00			0.00	0.00	17.52	56.39	76.21	89.21	130.22	1169	750	750	CONC	0.68	110.8	916.00	2.07	0.89	1.28
					0.00	0.00	5.41	0.65	9.78	25.11			0.00	0.00			0.00	0.00	15.00														
	132	133			0.00	0.00			0.00	25.11			0.00	0.00			0.00	0.00	18.41	54.73	73.94	86.55	126.31	1857	1050	1050	CONC	0.58	45.2	2070.67	2.39	0.32	0.90
					0.00	0.00	3.25	0.25	2.26	27.37			0.00	0.00			0.00	0.00	25.00														
	133	138			0.00	0.00			0.00	27.37			0.00	0.00			0.00	0.00	25.00	45.17	60.90	71.22	103.85	1667	1050	1050	CONC	0.73	61.8	2329.93	2.69	0.38	0.72
					0.00	0.00	1.21	0.65	2.19	29.56			0.00	0.00			0.00	0.00	12.00														
	138	139			0.00	0.00			0.00	29.56			0.00	0.00			0.00	0.00	25.38	44.72	60.29	70.51	102.81	1782	1050	1050	CONC	0.61	78.8	2131.02	2.46	0.53	0.84
	139	140			0.00	0.00			0.00	29.56			0.00	0.00			0.00	0.00	25.92	44.12	59.47	69.55	101.40	1758	1050	1050	CONC	0.57	51.1	2058.03	2.38	0.36	0.85
					0.00	0.00	3.33	0.65	6.02	35.57			0.00	0.00			0.00	0.00	12.00														
	140	144			0.00	0.00			0.00	35.57			0.00	0.00			0.00	0.00	26.28	43.73	58.93	68.92	100.47	2096	1050	1050	CONC	0.65	72.6	2196.49	2.54	0.48	0.95
	144	145			0.00	0.00			0.00	35.57			0.00	0.00			0.00	0.00	26.75	43.21	58.23	68.10	99.27	2072	1050	1050	CONC	0.43	34.9	1790.66	2.07	0.28	1.16
	145	1069			0.00	0.00			0.00	35.57			0.00	0.00			0.00	0.00	27.03	42.91	57.83	67.63	98.58	2057	2100	2100	CONC	0.17	42.5	7043.14	2.03	0.35	0.29
Contribution From EASM 732, Pipe 1055 - 1069						0.00				0.74				0.00				0.00	14.81					1179									
	1069	146			0.00	0.00			0.00	36.32			0.00	0.00			0.00	0.00	27.38	42.55	57.34	67.05	97.73	3261	2100	2100	CONC	0.14	21.2	6417.78	1.85	0.19	0.51
					0.00	0.00	1.49	0.65	2.69	39.01			0.00	0.00			0.00	0.00	20.00														
	146	148			0.00	0.00			0.00	39.01			0.00	0.00			0.00	0.00	27.57	42.36	57.08	66.74	97.28	3405	2100	2100	CONC	0.16	29.2	6957.25	2.01	0.24	0.49
	148	6019			0.00	0.00			0.00	39.01			0.00	0.00			0.00	0.00	27.81	42.11	56.74	66.35	96.71	3392	2100	2100	CONC	0.15	5.2	6804.32	1.96	0.04	0.50
Contribution From EASM 8, Pipe 2024 - 6019						2.29				0.27				0.00				0.00	12.06														
	6019	154			0.00	2.29			0.00	39.28			0.00	0.00			0.00	0.00	27.86	42.07	56.68	66.28	96.60	3502	2100	2100	CONC	0.16	52.1	7000.33	2.02	0.43	0.50
					0.00	2.29	1.13	0.65	2.04	41.32			0.00	0.00			0.00	0.00	12.00														
	154	155			0.00	2.29			0.00	41.32			0.00	0.00			0.00	0.00	28.29	41.65	56.11	65.60	95.61	3593	2100	2100	CONC	0.17	53.7	7149.06	2.06	0.43	0.50
	155	156			0.00	2.29			0.00	41.32			0.00	0.00			0.00	0.00	28.72	41.23	55.54	64.93	94.63	3568	2100	2100	CONC	0.18	96.7	7437.61	2.15	0.75	0.48
					0.00	2.29	3.94	0.65	7.12	48.44			0.00	0.00			0.00	0.00	11.00														
	156	158			0.00	2.29			0.00	48.44			0.00	0.00			0.00	0.00	29.47	40.52	54.58	63.81	92.99	3916	2100	2100	CONC	0.18	101.5	7335.86	2.12	0.80	0.53
	158	159			0.00	2.29			0.00	48.44			0.00	0.00			0.00	0.00	30.27	39.80	53.60	62.66	91.31	3867	2100	2100	CONC	0.21	45.6	8002.29	2.31	0.33	0.48
	159	210			0.00	2.29			0.00	48.44			0.00	0.00			0.00	0.00	30.60	39.51	53.21	62.20	90.63	3847	2100	2100	CONC	0.18	46.1	7397.08	2.14	0.36	0.52
To WESLOCK WAY, Pipe 210 - 6017						2.29				48.44				0.00				0.00	30.96					1179									
WESLOCK WAY																																	
Contribution From KNUDSON DRIVE, Pipe 159 - 210						2.29				48.44				0.00				0.00	30.96					1179									
Contribution From KNUDSON DRIVE, Pipe 209 - 210						0.00				28.91				0.00				0.00	20.47														
	210	6017			0.00	2.29			0.00	77.35			0.00	0.00			0.00	0.00	30.96	39.20	52.79	61.71	89.91	5352	2250	2250	CONC	0.17	55.1	8643.52	2.17	0.42	0.62
Contribution From EASM 649, Pipe 6015 - 6017						11.91				1.49				0.00				0.00	23.05														
	6017	212			0.00	14.20			0.00	78.84			0.00	0.00			0.00	0.00	31.38	38.85	52.30	61.14	89.08	5854	2250	2250	CONC	0.16	39.2	8362.57	2.10	0.31	0.70
	212	213			0.00	14.20			0.00	78.84			0.00	0.00			0.00	0.00	31.69	38.59	51.95	60.73	88.47	5823	2250	2250	CONC	0.16	44.9	8336.55	2.10	0.36	0.70
					0.00	14.20	1.75	0.65	3.16	82.00			0.00	0.00			0.00	0.00	15.00														
	213	220			0.00	14.20			0.00	82.00			0.00	0.00			0.00	0.00	32.05	38.30	51.56	60.26	87.79	5951	2550	2550	CONC	0.36	125.0	17507.92	3.43	0.61	0.34
	220	221			0.00	14.20			0.00	82.00			0.00	0.00			0.00	0.00	32.66	37.81	50.90	59.49	86.66	5890	2550	2550	CONC	0.13	46.4	10451.42	2.05	0.38	0.56
	221	226			0.00	14.20			0.00	82.00			0.00	0.00			0.00	0.00	33.03	37.52	50.49	59.02	85.97	5853	2550	2550	CONC	0.15	42.2	11419.33	2.24	0.31	0.51
	226	4054			0.00	14.20			0.00	82.00			0.00	0.00			0.00	0.00	33.35	37.27	50.17	58.63	85.41	5822	2700	2700	CONC	0.10	70.4	10929.32	1.91	0.61	0.53

Definitions:
Q = 2.78 AIR, where
Q = Peak Flow in Litres per second (L/s)
A = Areas in hectares (ha)
I = Rainfall Intensity (mm/h)
R = Runoff Coefficient

Notes:
1) Ottawa Rainfall-Intensity Curve
2) Min. Velocity = 0.80 m/s

Designed: GGG	PROJECT: 7000 Campeau Drive		
Checked: SLM	LOCATION: City of Ottawa		
Dwg. Reference: 03D	File Ref: 18-1061	Date: 15 Jun 2021	Sheet No. SHEET 5 OF 10

STORM SEWER CALCULATION SHEET (RATIONAL METHOD)

Local Roads Return Frequency = 2 years
Collector Roads Return Frequency = 5 years
Manning 0.013 Arterial Roads Return Frequency = 10 years

Ottawa

LOCATION			AREA (Ha)																FLOW						SEWER DATA								
			2 YEAR				5 YEAR				10 YEAR				100 YEAR				Time of	Intensity	Intensity	Intensity	Intensity	Peak Flow	DIA. (mm)	DIA. (mm)	TYPE	SLOPE	LENGTH	CAPACITY	VELOCITY	TIME OF	RATIO
			AREA	R	Indiv.	Accum.	AREA	R	Indiv.	Accum.	AREA	R	Indiv.	Accum.	AREA	R	Indiv.	Accum.	Conc.	2 Year	5 Year	10 Year	100 Year										
Location	From Node	To Node	(Ha)		2.78 AC	2.78 AC	(Ha)		2.78 AC	2.78 AC	(Ha)		2.78 AC	2.78 AC	(Ha)		2.78 AC	2.78 AC	(min)	(mm/h)	(mm/h)	(mm/h)	(mm/h)	Q (l/s)	(actual)	(nominal)		(%)	(m)	(l/s)	(m/s)	FLOW (min)	Q/Q full
Contribution From SWM Pond 3 Outlet, Pipe 4044 - 4054						0.00				0.00				0.00				0.00	10.79														
	4054	5025			0.00	14.20			0.00	82.00			0.00	0.00			0.00	0.00	33.96	36.81	49.54	57.90	84.33	5764	2700	2700	CONC	0.07	8.1	9237.85	1.61	0.08	0.62
Contribution From Street 16, Pipe 5024 - 5025						1.55				1.30				0.00				0.00	10.82														
	5025	228			0.00	15.76			0.00	83.30			0.00	0.00			0.00	0.00	34.05	36.75	49.45	57.80	84.19	5878	2700	2700	CONC	0.07	59.5	9244.07	1.61	0.61	0.64
					0.00	15.76	9.43	0.65	17.04	100.34			0.00	0.00			0.00	0.00	14.00														
					0.00	15.76	1.47	0.65	2.66	103.00			0.00	0.00			0.00	0.00	10.00														
	228	242			0.00	15.76			0.00	103.00			0.00	0.00			0.00	0.00	34.66	36.30	48.85	57.09	83.14	6782	2700	2700	CONC	0.08	160.6	9465.07	1.65	1.62	0.72
	242	243			0.00	15.76			0.00	103.00			0.00	0.00			0.00	0.00	36.28	35.18	47.32	55.30	80.52	6607	2700	2700	CONC	0.21	55.1	15567.46	2.72	0.34	0.42
	243	244			0.00	15.76			0.00	103.00			0.00	0.00			0.00	0.00	36.62	34.95	47.01	54.94	80.00	6572	2700	2700	CONC	0.10	44.4	10770.53	1.88	0.39	0.61
					0.00	15.76	2.75	0.65	4.97	107.97			0.00	0.00			0.00	0.00	14.00														
					0.00	15.76	1.98	0.65	3.58	111.55			0.00	0.00			0.00	0.00	10.00														
	244	254			0.00	15.76			0.00	111.55			0.00	0.00			0.00	0.00	37.01	34.69	46.66	54.53	79.40	6931	2700	2700	CONC	0.12	132.6	11934.04	2.08	1.06	0.58
	254	255			0.00	15.76			0.00	111.55			0.00	0.00			0.00	0.00	38.07	34.02	45.75	53.46	77.83	6818	2700	2700	CONC	0.05	32.8	7728.20	1.35	0.41	0.88
	255	256			0.00	15.76			0.00	111.55			0.00	0.00			0.00	0.00	38.48	33.77	45.41	53.06	77.25	6777	2700	2700	CONC	0.13	20.2	12405.92	2.17	0.16	0.55
EASM 13																																	
	1042	1043			0.00	0.00	1.80	0.70	3.50	3.50			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	365	750	750	CONC	1.00	58.5	1113.28	2.52	0.39	0.33
To STREET 9, Pipe 1043 - 1044						0.00				3.50				0.00				0.00	10.39														
CAMPEAU DRIVE																																	
					0.00	0.00	21.34	0.65	38.56	38.56			0.00	0.00			0.00	0.00	20.00														
	1032	1033			0.00	0.00			0.00	38.56			0.00	0.00			0.00	0.00	20.00	52.03	70.25	82.21	119.95	2709	1650	1650	CONC	0.15	69.5	3530.01	1.65	0.70	0.77
To STREET 7, Pipe 1033 - 1034						0.00				38.56				0.00				0.00	20.70														
STREET 6																																	
Contribution From STREET 1, Pipe 1026 - 1029						2.87				0.00				0.00				0.00	11.52														
Contribution From STREET 1, Pipe 1028 - 1029						3.81				0.94				0.00				0.00	12.07														
	1029	1030	0.12	0.65	0.22	6.90			0.00	0.94			0.00	0.00			0.00	0.00	12.07	69.68	94.41	110.62	161.64	570	825	825	CONC	0.25	75.0	717.72	1.34	0.93	0.79
	1030	1031	0.12	0.65	0.22	7.12			0.00	0.94			0.00	0.00			0.00	0.00	13.00	66.93	90.63	106.18	155.12	562	825	825	CONC	0.25	29.5	717.72	1.34	0.37	0.78
	1031	1034	0.91	0.65	1.64	8.76			0.00	0.94			0.00	0.00			0.00	0.00	13.36	65.92	89.24	104.54	152.71	662	975	975	CONC	0.15	86.5	867.96	1.16	1.24	0.76
Contribution From STREET 7, Pipe 1033 - 1034						1.34				38.56				0.00				0.00	22.09														
	1034	1035	0.51	0.65	0.92	11.02			0.00	39.50			0.00	0.00			0.00	0.00	22.09	48.89	65.97	77.19	112.59	3145	1800	1800	CONC	0.15	63.0	4451.90	1.75	0.60	0.71
	1035	1036	0.53	0.65	0.96	11.98			0.00	39.50			0.00	0.00			0.00	0.00	22.69	48.07	64.85	75.87	110.65	3138	1800	1800	CONC	0.15	47.5	4451.90	1.75	0.45	0.70
	1036	1037	0.77	0.65	1.39	13.37			0.00	39.50			0.00	0.00			0.00	0.00	23.14	47.47	64.03	74.90	109.24	3164	1800	1800	CONC	0.15	47.0	4451.90	1.75	0.45	0.71
	1037	1038	0.13	0.65	0.23	13.61			0.00	39.50			0.00	0.00			0.00	0.00	23.59	46.89	63.24	73.98	107.88	3136	1800	1800	CONC	0.15	75.0	4451.90	1.75	0.71	0.70
To STREET 11, Pipe 1038 - 1039						13.61				39.50				0.00				0.00	24.31														
STREET 11																																	
					0.00	0.00	3.32	0.20	1.85	1.85			0.00	0.00			0.00	0.00	25.00														
					0.00	0.00	3.11	0.50	4.32	6.17			0.00	0.00			0.00	0.00	13.00														
					0.00	0.00	0.06	0.65	0.11	6.28			0.00	0.00			0.00	0.00															
	1024	1025	0.26	0.65	0.47	0.47			0.00	6.28			0.00	0.00			0.00	0.00	25.00	45.17	60.90	71.22	103.85	403	750	750	CONC	0.25	21.5	556.64	1.26	0.28	0.72
					0.00	0.47	0.09	0.65	0.16	6.44			0.00	0.00			0.00	0.00															
	1025	1038	0.47	0.65	0.85	1.32			0.00	6.44			0.00	0.00			0.00	0.00	25.28	44.84	60.45	70.70	103.07	448	825	825	CONC	0.20	67.0	641.95	1.20	0.93	0.70
Contribution From STREET 6, Pipe 1037 - 1038						13.61				39.50				0.00				0.00	24.31														
					0.00	14.93	0.09	0.65	0.16	46.10			0.00	0.00			0.00	0.00															
	1038	1039	0.82	0.65	1.48	16.41			0.00	46.10			0.00	0.00			0.00	0.00	26.21	43.79	59.02	69.03	100.63	3440	1800	1800	CONC	0.15	102.5	4451.90	1.75	0.98	0.77
To STREET 9, Pipe 1039 - 1040						16.41				46.10				0.00				0.00	27.19														
STREET 12																																	
	1019	1020	0.37	0.65	0.67	0.67			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	51	300	300	PVC	1.05	62.0	99.09	1.40	0.74	0.52
	1020	1021	0.28	0.65	0.51	1.17			0.00	0.00			0.00	0.00			0.00	0.00	10.74	74.09	100.45	117.74	172.09	87	375	375	PVC	1.00	62.0	175.33	1.59	0.65	0.50
To STREET 9, Pipe 1021 - 1022						1.17				0.00				0.00				0.00	11.39														
STREET 13																																	
	1016	1017	0.35	0.65	0.63	0.63			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	49	450	450	CONC	0.20	77.0	127.50	0.80	1.60	0.38

Definitions:
Q = 2.78 AIR, where
Q = Peak Flow in Litres per second (L/s)
A = Areas in hectares (ha)
I = Rainfall Intensity (mm/h)
R = Runoff Coefficient

Notes:
1) Ottawa Rainfall-Intensity Curve
2) Min. Velocity = 0.80 m/s

Designed: GGG	PROJECT: 7000 Campeau Drive		
Checked: SLM	LOCATION: City of Ottawa		
Dwg. Reference: 03D	File Ref: 18-1061	Date: 15 Jun 2021	Sheet No. SHEET 6 OF 10

STORM SEWER CALCULATION SHEET (RATIONAL METHOD)

Local Roads Return Frequency = 2 years
Collector Roads Return Frequency = 5 years
Manning 0.013 Arterial Roads Return Frequency = 10 years

LOCATION			AREA (Ha)																FLOW						SEWER DATA								
			2 YEAR				5 YEAR				10 YEAR				100 YEAR																		
Location	From Node	To Node	AREA (Ha)	R	Indiv. 2.78 AC	Accum. 2.78 AC	AREA (Ha)	R	Indiv. 2.78 AC	Accum. 2.78 AC	AREA (Ha)	R	Indiv. 2.78 AC	Accum. 2.78 AC	AREA (Ha)	R	Indiv. 2.78 AC	Accum. 2.78 AC	Time of Conc. (min)	Intensity 2 Year (mm/h)	Intensity 5 Year (mm/h)	Intensity 10 Year (mm/h)	Intensity 100 Year (mm/h)	Peak Flow Q (l/s)	DIA. (mm) (actual)	DIA. (mm) (nominal)	TYPE	SLOPE (%)	LENGTH (m)	CAPACITY (l/s)	VELOCITY (m/s)	TIME OF LOW (min	RATIO Q/Q full
	1017	1018	0.30	0.65	0.54	1.17			0.00	0.00			0.00	0.00			0.00	0.00	11.60	71.16	96.44	113.01	165.14	84	450	450	CONC	0.20	77.0	127.50	0.80	1.60	0.66
To STREET 9, Pipe 1018 - 1021						1.17				0.00				0.00				0.00	13.20														
STREET 14																																	
	1013	1014	0.37	0.65	0.67	0.67			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	51	375	375	PVC	0.35	92.5	103.73	0.94	1.64	0.50
	1014	1015	0.49	0.65	0.89	1.55			0.00	0.00			0.00	0.00			0.00	0.00	11.64	71.03	96.25	112.79	164.83	110	450	450	CONC	0.30	92.5	156.16	0.98	1.57	0.71
To STREET 9, Pipe 1015 - 1018						1.55				0.00				0.00				0.00	13.21														
STREET 1																																	
					0.00	0.00	0.25	0.65	0.45	0.45			0.00	0.00			0.00	0.00															
	1000	1001	0.51	0.65	0.92	0.92			0.00	0.45			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	118	375	375	PVC	2.45	86.0	274.44	2.48	0.58	0.43
To STREET 15, Pipe 1001 - 1002						0.92				0.45				0.00				0.00	10.58														
	1026	1029	1.59	0.65	2.87	2.87			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	221	675	675	CONC	0.15	83.0	325.56	0.91	1.52	0.68
To STREET 6, Pipe 1029 - 1030						2.87				0.00				0.00				0.00	11.52														
					0.00	0.00	0.23	0.65	0.42	0.42			0.00	0.00			0.00	0.00															
	1027	1028	0.82	0.65	1.48	1.48			0.00	0.42			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	157	525	525	CONC	0.25	65.5	215.03	0.99	1.10	0.73
					0.00	1.48	0.29	0.65	0.52	0.94			0.00	0.00			0.00	0.00															
	1028	1029	1.29	0.65	2.33	3.81			0.00	0.94			0.00	0.00			0.00	0.00	11.10	72.83	98.73	115.70	169.10	370	750	750	CONC	0.20	65.5	497.87	1.13	0.97	0.74
To STREET 6, Pipe 1029 - 1030						3.81				0.94				0.00				0.00	12.07														
Contribution From STREET 2, Pipe 4000 - 4001						0.45				0.00				0.00				0.00	11.10														
					0.00	0.45	0.16	0.65	0.29	0.29			0.00	0.00			0.00	0.00															
	4001	4002	0.48	0.65	0.87	1.32			0.00	0.29			0.00	0.00			0.00	0.00	11.10	72.82	98.71	115.68	169.07	125	450	450	CONC	0.50	81.0	201.60	1.27	1.07	0.62
					0.00	1.32	0.29	0.65	0.52	0.81			0.00	0.00			0.00	0.00															
	4002	4003	0.44	0.65	0.80	2.11			0.00	0.81			0.00	0.00			0.00	0.00	12.17	69.38	93.99	110.12	160.91	223	525	525	CONC	0.45	25.0	288.49	1.33	0.31	0.77
	4003	4005			0.00	2.11			0.00	0.81			0.00	0.00			0.00	0.00	12.48	68.43	92.69	108.60	158.67	220	525	525	CONC	0.40	15.5	272.00	1.26	0.21	0.81
Contribution From EASM 16, Pipe 4004 - 4005						0.00				0.00				0.00				0.00	10.37														
					0.00	2.11	0.59	0.65	1.07	1.88			0.00	0.00			0.00	0.00															
	4005	4007	1.25	0.65	2.26	4.37			0.00	1.88			0.00	0.00			0.00	0.00	12.69	67.83	91.86	107.63	157.24	469	975	975	CONC	0.20	106.5	1002.23	1.34	1.32	0.47
Contribution From STREET 20, Pipe 4006 - 4007						0.20				0.00				0.00				0.00	11.32														
	4007	4008	0.16	0.65	0.29	4.86			0.00	1.88			0.00	0.00			0.00	0.00	14.01	64.21	86.90	101.79	148.67	475	975	975	CONC	0.20	43.0	1002.23	1.34	0.53	0.47
					0.00	4.86	0.20	0.65	0.36	2.24			0.00	0.00			0.00	0.00															
	4008	4010	0.70	0.65	1.26	6.13			0.00	2.24			0.00	0.00			0.00	0.00	14.54	62.87	85.07	99.63	145.50	576	1200	1200	CONC	0.10	86.0	1232.89	1.09	1.31	0.47
Contribution From EASM 1026, Pipe 4009 - 4010						0.00				23.73				0.00				0.00	10.92														
					0.00	6.13	0.25	0.65	0.45	26.42			0.00	0.00			0.00	0.00															
	4010	4019	0.91	0.65	1.64	7.77			0.00	26.42			0.00	0.00			0.00	0.00	15.86	59.82	80.89	94.71	138.29	2602	1650	1650	CONC	0.10	114.5	2882.24	1.35	1.42	0.90
Contribution From STREET 2, Pipe 4018 - 4019						8.76				2.24				0.00				0.00	19.35														
					0.00	16.53	0.15	0.65	0.27	28.93			0.00	0.00			0.00	0.00															
	4019	4020	0.60	0.65	1.08	17.62			0.00	28.93			0.00	0.00			0.00	0.00	19.35	53.09	71.70	83.91	122.45	3010	1650	1650	CONC	0.15	81.5	3530.01	1.65	0.82	0.85
To STREET 10, Pipe 4020 - 4021						17.62				28.93				0.00				0.00	20.18														
STREET 15																																	
	1004	1005	0.32	0.65	0.58	0.58			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	44	300	300	PVC	0.60	64.0	74.90	1.06	1.01	0.59
To STREET 5, Pipe 1005 - 1006						0.58				0.00				0.00				0.00	11.01														
Contribution From STREET 1, Pipe 1000 - 1001						0.92				0.45				0.00				0.00	10.58														
					0.00	0.92	0.02	0.65	0.04	0.49			0.00	0.00			0.00	0.00															
	1001	1002	0.34	0.65	0.61	1.54			0.00	0.49			0.00	0.00			0.00	0.00	10.58	74.66	101.24	118.67	173.45	164	525	525	CONC	0.25	67.5	215.03	0.99	1.13	0.76
	1002	1003			0.00	1.54			0.00	0.49			0.00	0.00			0.00	0.00	11.71	70.81	95.95	112.44	164.31	156	525	525	CONC	0.25	10.5	215.03	0.99	0.18	0.72
					0.00	1.54	0.07	0.65	0.13	0.61			0.00	0.00			0.00	0.00															
	1003	1005	0.42	0.65	0.76	2.29			0.00	0.61			0.00	0.00			0.00	0.00	11.89	70.25	95.19	111.54	162.98	220	525	525	CONC	0.55	59.0	318.94	1.47	0.67	0.69
To STREET 5, Pipe 1005 - 1006						2.29				0.61				0.00				0.00	12.55														

Definitions:
Q = 2.78 AIR, where
Q = Peak Flow in Litres per second (L/s)
A = Areas in hectares (ha)
I = Rainfall Intensity (mm/h)
R = Runoff Coefficient

Notes:
1) Ottawa Rainfall-Intensity Curve
2) Min. Velocity = 0.80 m/s

Designed: GGG	PROJECT: 7000 Campeau Drive		
Checked: SLM	LOCATION: City of Ottawa		
Dwg. Reference: 03D	File Ref: 18-1061	Date: 15 Jun 2021	Sheet No. SHEET 7 OF 10

1061_STMv3.xlsx

STORM SEWER CALCULATION SHEET (RATIONAL METHOD)

Local Roads Return Frequency = 2 years
Collector Roads Return Frequency = 5 years
Manning 0.013 Arterial Roads Return Frequency = 10 years

Ottawa

LOCATION			AREA (Ha) 2 YEAR				5 YEAR				10 YEAR				100 YEAR				FLOW						SEWER DATA								
Location	From Node	To Node	AREA (Ha)	R	Indiv. 2.78 AC	Accum. 2.78 AC	AREA (Ha)	R	Indiv. 2.78 AC	Accum. 2.78 AC	AREA (Ha)	R	Indiv. 2.78 AC	Accum. 2.78 AC	AREA (Ha)	R	Indiv. 2.78 AC	Accum. 2.78 AC	Time of Conc. (min)	Intensity 2 Year (mm/h)	Intensity 5 Year (mm/h)	Intensity 10 Year (mm/h)	Intensity 100 Year (mm/h)	Peak Flow Q (l/s)	DIA. (mm) (actual)	DIA. (mm) (nominal)	TYPE	SLOPE (%)	LENGTH (m)	CAPACITY (l/s)	VELOCITY (m/s)	TIME OF FLOW (min)	RATIO Q/Q full
STREET 5																																	
Contribution From STREET 15, Pipe 1003 - 1005						2.29				0.61				0.00				0.00	12.55														
Contribution From STREET 15, Pipe 1004 - 1005						0.58				0.00				0.00				0.00	11.01														
					0.00	2.87	0.03	0.65	0.05	0.67			0.00	0.00			0.00	0.00															
	1005	1006	0.38	0.65	0.69	3.56			0.00	0.67			0.00	0.00			0.00	0.00	12.55	68.22	92.40	108.25	158.16	305	675	675	CONC	0.25	62.5	420.29	1.17	0.89	0.72
					0.00	3.56	0.12	0.65	0.22	0.89			0.00	0.00			0.00	0.00															
	1006	1008	0.65	0.65	1.17	4.73			0.00	0.89			0.00	0.00			0.00	0.00	13.44	65.71	88.96	104.21	152.23	390	750	750	CONC	0.20	101.0	497.87	1.13	1.49	0.78
To STREET 7, Pipe 1008 - 1009						4.73				0.89				0.00				0.00	14.93														
STREET 9																																	
Contribution From STREET 7, Pipe 1009 - 1010						6.85				1.17				0.00				0.00	16.65														
	1010	1011	0.22	0.65	0.40	7.25			0.00	1.17			0.00	0.00			0.00	0.00	16.65	58.13	78.58	92.00	134.30	513	900	900	CONC	0.15	49.5	701.13	1.10	0.75	0.73
					0.00	7.25	0.05	0.65	0.09	1.26			0.00	0.00			0.00	0.00															
	1011	1012	0.13	0.65	0.23	7.48			0.00	1.26			0.00	0.00			0.00	0.00	17.40	56.63	76.53	89.59	130.77	520	900	900	CONC	0.15	10.5	701.13	1.10	0.16	0.74
	1012	1015			0.00	7.48			0.00	1.26			0.00	0.00			0.00	0.00	17.56	56.32	76.11	89.10	130.05	518	900	900	CONC	0.15	11.0	701.13	1.10	0.17	0.74
Contribution From STREET 14, Pipe 1014 - 1015						1.55				0.00				0.00				0.00	13.21														
					0.00	9.04	0.10	0.65	0.18	1.45			0.00	0.00			0.00	0.00															
	1015	1018	0.24	0.65	0.43	9.47			0.00	1.45			0.00	0.00			0.00	0.00	17.72	56.01	75.68	88.59	129.30	640	900	900	CONC	0.20	50.0	809.60	1.27	0.65	0.79
Contribution From STREET 13, Pipe 1017 - 1018						1.17				0.00				0.00				0.00	13.20														
					0.00	10.64	0.12	0.65	0.22	1.66			0.00	0.00			0.00	0.00															
	1018	1021	0.24	0.65	0.43	11.08			0.00	1.66			0.00	0.00			0.00	0.00	18.38	54.79	74.02	86.64	126.45	730	900	900	CONC	0.30	50.0	991.55	1.56	0.53	0.74
Contribution From STREET 12, Pipe 1020 - 1021						1.17				0.00				0.00				0.00	11.39														
					0.00	12.25	0.10	0.65	0.18	1.84			0.00	0.00			0.00	0.00															
	1021	1022	0.35	0.65	0.63	12.88			0.00	1.84			0.00	0.00			0.00	0.00	18.91	53.85	72.73	85.12	124.22	828	975	975	CONC	0.25	62.0	1120.53	1.50	0.69	0.74
	1022	1039			0.00	12.88			0.00	1.84			0.00	0.00			0.00	0.00	19.60	52.68	71.14	83.25	121.48	810	975	975	CONC	0.25	17.5	1120.53	1.50	0.19	0.72
Contribution From STREET 11, Pipe 1038 - 1039						16.41				46.10				0.00				0.00	27.19														
					0.00	29.29	0.08	0.65	0.14	48.09			0.00	0.00			0.00	0.00															
					0.00	29.29	0.41	0.65	0.74	48.83			0.00	0.00			0.00	0.00															
	1039	1040	1.18	0.65	2.13	31.42			0.00	48.83			0.00	0.00			0.00	0.00	27.19	42.75	57.61	67.37	98.19	4157	2100	2100	CONC	0.10	95.0	5483.08	1.58	1.00	0.76
					0.00	31.42	0.11	0.65	0.20	49.03			0.00	0.00			0.00	0.00															
					0.00	31.42	0.22	0.65	0.40	49.43			0.00	0.00			0.00	0.00															
	1040	1041	0.82	0.65	1.48	32.91			0.00	49.43			0.00	0.00			0.00	0.00	28.19	41.74	56.24	65.75	95.83	4153	2100	2100	CONC	0.10	95.0	5483.08	1.58	1.00	0.76
					0.00	32.91	0.10	0.65	0.18	49.61			0.00	0.00			0.00	0.00															
					0.00	32.91	0.16	0.65	0.29	49.90			0.00	0.00			0.00	0.00															
	1041	1043	0.53	0.65	0.96	33.86			0.00	49.90			0.00	0.00			0.00	0.00	29.19	40.78	54.93	64.23	93.60	4122	2100	2100	CONC	0.10	56.0	5483.08	1.58	0.59	0.75
Contribution From EASM 13, Pipe 1042 - 1043						0.00				3.50				0.00				0.00	10.39														
					0.00	33.86	0.13	0.65	0.23	53.64			0.00	0.00			0.00	0.00															
					0.00	33.86	0.40	0.65	0.72	54.36			0.00	0.00			0.00	0.00															
	1043	1044	0.71	0.65	1.28	35.15			0.00	54.36			0.00	0.00			0.00	0.00	29.78	40.24	54.20	63.36	92.33	4360	2100	2100	CONC	0.10	68.5	5483.08	1.58	0.72	0.80
					0.00	35.15	0.11	0.65	0.20	54.56			0.00	0.00			0.00	0.00															
					0.00	35.15	0.11	0.65	0.20	54.76			0.00	0.00			0.00	0.00															
	1044	1045	0.58	0.65	1.05	36.19			0.00	54.76			0.00	0.00			0.00	0.00	30.50	39.60	53.32	62.34	90.83	4353	2100	2100	CONC	0.10	64.0	5483.08	1.58	0.67	0.79
					0.00	36.19	0.09	0.65	0.16	54.92			0.00	0.00			0.00	0.00															
			0.57	0.65	1.03	37.22			0.00	54.92			0.00	0.00			0.00	0.00															
	1045	1046			0.00	37.22	0.64	0.65	1.16	56.08			0.00	0.00			0.00	0.00	31.18	39.02	52.54	61.41	89.48	4399	2100	2100	CONC	0.15	64.0	6715.38	1.94	0.55	0.65
To EASM 646, Pipe 1046 - 1047						37.22				56.08				0.00				0.00	31.73														
EASM 646																																	
Contribution From STREET 9, Pipe 1045 - 1046						37.22				56.08				0.00				0.00	31.73														
					0.00	37.22	0.10	0.65	0.18	56.26			0.00	0.00			0.00	0.00															
					0.00	37.22	0.22	0.65	0.40	56.65			0.00	0.00			0.00	0.00															
	1046	1047	0.37	0.65	0.67	37.89			0.00	56.65			0.00	0.00			0.00	0.00	31.73	38.56	51.91	60.68	88.41	4402	2100	2100	CONC	0.15	59.0	6715.38	1.94	0.51	0.66
					0.00	37.89	0.07	0.65	0.13	56.78			0.00	0.00			0.00	0.00															
	1047	1048	0.14	0.65	0.25	38.15			0.00	56.78			0.00	0.00			0.00	0.00	32.23	38.15	51.35	60.03	87.45	4371	2100	2100	CONC	0.10	50.5	5483.08	1.58	0.53	0.80
	1048	6020			0.00	38.15			0.00	56.78			0.00	0.00			0.00	0.00	32.76	37.73	50.78	59.35	86.46	4322	2100	2100	CONC	0.10	75.5	5483.08	1.58	0.79	0.79
To SWM Pond 1 Inlet, Pipe 6020 - 1049						38.15				56.78				0.00				0.00	33.56														

Definitions:
Q = 2.78 AIR, where
Q = Peak Flow in Litres per second (L/s)
A = Areas in hectares (ha)
I = Rainfall Intensity (mm/h)
R = Runoff Coefficient

Notes:
1) Ottawa Rainfall-Intensity Curve
2) Min. Velocity = 0.80 m/s

Designed: GGG	PROJECT: **7000 Campeau Drive**			
Checked: SLM	LOCATION: **City of Ottawa**			
Dwg. Reference: 03D	File Ref: 18-1061	Date: 15 Jun 2021	Sheet No. SHEET 8 OF 10	

STORM SEWER CALCULATION SHEET (RATIONAL METHOD)

Local Roads Return Frequency = 2 years
Collector Roads Return Frequency = 5 years
Manning 0.013 Arterial Roads Return Frequency = 10 years

Ottawa

	LOCATION		AREA (Ha)																FLOW						SEWER DATA								
			2 YEAR				5 YEAR				10 YEAR				100 YEAR				Time of	Intensity	Intensity	Intensity	Intensity	Peak Flow	DIA. (mm)	DIA. (mm)	TYPE	SLOPE	LENGTH	CAPACITY	VELOCITY	TIME OF	RATIO
			AREA	R	Indiv.	Accum.	AREA	R	Indiv.	Accum.	AREA	R	Indiv.	Accum.	AREA	R	Indiv.	Accum.	Conc.	2 Year	5 Year	10 Year	100 Year										
Location	From Node	To Node	(Ha)		2.78 AC	2.78 AC	(Ha)		2.78 AC	2.78 AC	(Ha)		2.78 AC	2.78 AC	(Ha)		2.78 AC	2.78 AC	(min)	(mm/h)	(mm/h)	(mm/h)	(mm/h)	Q (l/s)	(actual)	(nominal)		(%)	(m)	(l/s)	(m/s)	FLOW (min)	Q/Q full
SWM Pond 1 Inlet																																	
Contribution From EASM 646, Pipe 1048 - 6020						38.15				56.78				0.00				0.00	33.56														
	6020	1049			0.00	38.15			0.00	56.78			0.00	0.00			0.00	0.00	33.56	37.11	49.95	58.38	85.04	4252	2100	2100	CONC	0.10	27.0	5483.08	1.58	0.28	0.78
STREET 8																																	
	2018	2019	0.38	0.65	0.69	0.69			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	53	450	450	CONC	0.20	66.0	127.50	0.80	1.37	0.41
	2019	2020	0.27	0.65	0.49	1.17			0.00	0.00			0.00	0.00			0.00	0.00	11.37	71.91	97.46	114.22	166.92	84	450	450	CONC	0.20	66.0	127.50	0.80	1.37	0.66
To STREET 7, Pipe 2020 - 2021						1.17				0.00				0.00				0.00	12.74														
EASM 638																																	
	2013	2014			0.00	0.00	4.76	0.65	8.60	8.60			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	896	750	750	CONC	0.38	76.0	686.27	1.55	0.82	1.31
	2014	2015			0.00	0.00			0.00	8.60			0.00	0.00			0.00	0.00	10.82	73.81	100.07	117.29	171.43	861	975	975	CONC	0.25	39.5	1120.53	1.50	0.44	0.77
To STREET 7, Pipe 2015 - 2016						0.00				8.60				0.00				0.00	11.25														
EASM 12																																	
	2003	2004			0.00	0.00	3.56	0.65	6.43	6.43			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	670	750	750	CONC	0.77	32.5	976.90	2.21	0.24	0.69
To STREET 7, Pipe 2004 - 2005						0.00				6.43				0.00				0.00	10.24														
EASM 650																																	
	2001	2002			0.00	0.00	1.48	0.65	2.67	2.67			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	279	600	600	CONC	0.35	68.0	363.25	1.28	0.88	0.77
To STREET 7, Pipe 2002 - 2004						0.00				2.67				0.00				0.00	10.88														
STREET 7																																	
					0.00	0.00	0.30	0.65	0.54	0.54			0.00	0.00			0.00	0.00															
	2008	2009	0.90	0.65	1.63	1.63			0.00	0.54			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	181	375	375	PVC	1.85	63.0	238.47	2.16	0.49	0.76
					0.00	1.63	0.05	0.65	0.09	0.63			0.00	0.00			0.00	0.00															
	2009	2010	0.63	0.65	1.14	2.76			0.00	0.63			0.00	0.00			0.00	0.00	10.49	74.99	101.69	119.20	174.23	272	525	525	CONC	1.20	68.0	471.11	2.18	0.52	0.58
Contribution From CAMPEAU DRIVE, Pipe 1032 - 1033						0.00				38.56				0.00				0.00	20.70														
	1033	1034	0.74	0.65	1.34	1.34			0.00	38.56			0.00	0.00			0.00	0.00	20.70	50.93	68.75	80.44	117.36	2719	1800	1800	CONC	0.10	119.0	3634.96	1.43	1.39	0.75
To STREET 6, Pipe 1034 - 1035						1.34				38.56				0.00				0.00	22.09														
					0.00	0.00	0.17	0.65	0.31	0.31			0.00	0.00			0.00	0.00															
	2012	2015	0.76	0.65	1.37	1.37			0.00	0.31			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	137	375	375	PVC	0.95	20.0	170.89	1.55	0.22	0.80
Contribution From EASM 638, Pipe 2014 - 2015						0.00				8.60				0.00				0.00	11.25														
					0.00	1.37	0.21	0.65	0.38	9.29			0.00	0.00			0.00	0.00															
	2015	2016	1.05	0.65	1.90	3.27			0.00	9.29			0.00	0.00			0.00	0.00	11.25	72.30	98.00	114.85	167.85	1147	1200	1200	CONC	0.15	100.5	1509.97	1.34	1.25	0.76
					0.00	3.27	0.56	0.65	1.01	10.30			0.00	0.00			0.00	0.00															
					0.00	3.27	0.77	0.65	1.39	11.69			0.00	0.00			0.00	0.00															
	2016	2017	1.58	0.65	2.86	6.13			0.00	11.69			0.00	0.00			0.00	0.00	12.51	68.35	92.58	108.47	158.47	1501	1200	1200	CONC	0.25	15.0	1949.37	1.72	0.15	0.77
					0.00	6.13	0.16	0.65	0.29	11.98			0.00	0.00			0.00	0.00															
	2017	2020	0.55	0.65	0.99	7.12			0.00	11.98			0.00	0.00			0.00	0.00	12.65	67.92	91.99	107.78	157.46	1586	1350	1350	CONC	0.15	70.5	2067.17	1.44	0.81	0.77
Contribution From STREET 8, Pipe 2019 - 2020						1.17				0.00				0.00				0.00	12.74														
	2020	2021	0.24	0.65	0.43	8.73			0.00	11.98			0.00	0.00			0.00	0.00	13.47	65.64	88.86	104.09	152.05	1637	1350	1350	CONC	0.15	68.0	2067.17	1.44	0.78	0.79
To SWM Pond 2 Inlet, Pipe 2021 - 2022						8.73				11.98				0.00				0.00	14.25														
	1007	1008	0.31	0.65	0.56	0.56			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	43	300	300	PVC	0.35	67.5	57.21	0.81	1.39	0.75
Contribution From STREET 5, Pipe 1006 - 1008						4.73				0.89				0.00				0.00	14.93														
					0.00	5.29	0.04	0.65	0.07	0.96			0.00	0.00			0.00	0.00															
	1008	1009	0.33	0.65	0.60	5.89			0.00	0.96			0.00	0.00			0.00	0.00	14.93	61.92	83.77	98.10	143.27	445	750	750	CONC	0.30	62.0	609.77	1.38	0.75	0.73
					0.00	5.89	0.12	0.65	0.22	1.17			0.00	0.00			0.00	0.00															
	1009	1010	0.53	0.65	0.96	6.85			0.00	1.17			0.00	0.00			0.00	0.00	15.68	60.20	81.42	95.33	139.20	508	825	825	CONC	0.25	78.0	717.72	1.34	0.97	0.71
To STREET 9, Pipe 1010 - 1011						6.85				1.17				0.00				0.00	16.65														
					0.00	0.00	0.21	0.65	0.38	0.38			0.00	0.00			0.00	0.00															
	2000	2002	0.75	0.65	1.36	1.36			0.00	0.38			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	144	825	825	CONC	0.10	26.0	453.92	0.85	0.51	0.32
Contribution From EASM 650, Pipe 2001 - 2002						0.00				2.67				0.00				0.00	10.88														
	2002	2004			0.00	1.36	0.11	0.65	0.20	3.25			0.00	0.00			0.00	0.00	10.88	73.58	99.75	116.91	170.88	424	900	900	CONC	0.10	51.0	572.47	0.90	0.94	0.74

Definitions:
Q = 2.78 AIR, where
Q = Peak Flow in Litres per second (L/s)
A = Areas in hectares (ha)
I = Rainfall Intensity (mm/h)
R = Runoff Coefficient

Notes:
1) Ottawa Rainfall-Intensity Curve
2) Min. Velocity = 0.80 m/s

Designed: GGG	PROJECT: **7000 Campeau Drive**		
Checked: SLM	LOCATION: **City of Ottawa**		
Dwg. Reference: 03D	File Ref: 18-1061	Date: 15 Jun 2021	Sheet No. SHEET 9 OF 10

STORM SEWER CALCULATION SHEET (RATIONAL METHOD)

Local Roads Return Frequency = 2 years
Collector Roads Return Frequency = 5 years
Manning 0.013 Arterial Roads Return Frequency = 10 years

Ottawa

LOCATION			AREA (Ha)																FLOW						SEWER DATA								
			2 YEAR				5 YEAR				10 YEAR				100 YEAR				Time of Conc.	Intensity 2 Year	Intensity 5 Year	Intensity 10 Year	Intensity 100 Year	Peak Flow	DIA. (mm)	DIA. (mm)	TYPE	SLOPE	LENGTH	CAPACITY	VELOCITY	TIME OF FLOW	RATIO
Location	From Node	To Node	AREA (Ha)	R	Indiv. 2.78 AC	Accum. 2.78 AC	AREA (Ha)	R	Indiv. 2.78 AC	Accum. 2.78 AC	AREA (Ha)	R	Indiv. 2.78 AC	Accum. 2.78 AC	AREA (Ha)	R	Indiv. 2.78 AC	Accum. 2.78 AC	(min)	(mm/h)	(mm/h)	(mm/h)	(mm/h)	Q (l/s)	(actual)	(nominal)		(%)	(m)	(l/s)	(m/s)	(min)	Q/Q full
Contribution From EASM 12, Pipe 2003 - 2004						0.00				6.43				0.00				0.00	10.24														
					0.00	1.36	0.13	0.65	0.23	9.92			0.00	0.00			0.00	0.00															
					0.00	1.36	0.15	0.65	0.27	10.19			0.00	0.00			0.00	0.00															
	2004	2005	0.69	0.65	1.25	2.60			0.00	10.19			0.00	0.00			0.00	0.00	11.83	70.44	95.44	111.84	163.42	1156	1050	1050	CONC	0.30	65.5	1495.68	1.73	0.63	0.77
					0.00	2.60	0.12	0.65	0.22	10.41			0.00	0.00			0.00	0.00															
					0.00	2.60	0.19	0.65	0.34	10.75			0.00	0.00			0.00	0.00															
	2005	2006	0.74	0.65	1.34	3.94			0.00	10.75			0.00	0.00			0.00	0.00	12.46	68.50	92.78	108.70	158.82	1267	1050	1050	CONC	0.35	66.0	1615.52	1.87	0.59	0.78
					0.00	3.94	0.07	0.65	0.13	10.88			0.00	0.00			0.00	0.00															
					0.00	3.94	0.13	0.65	0.23	11.11			0.00	0.00			0.00	0.00															
	2006	2007	0.74	0.65	1.34	5.28			0.00	11.11			0.00	0.00			0.00	0.00	13.05	66.79	90.44	105.95	154.78	1358	1050	1050	CONC	0.40	57.0	1727.06	1.99	0.48	0.79
	2007	2010			0.00	5.28			0.00	11.11			0.00	0.00			0.00	0.00	13.52	65.48	88.65	103.84	151.68	1331	1050	1050	CONC	0.40	28.5	1727.06	1.99	0.24	0.77
					0.00	8.04	0.29	0.65	0.52	12.27			0.00	0.00			0.00	0.00															
	2010	2011	0.74	0.65	1.34	9.38			0.00	12.27			0.00	0.00			0.00	0.00	13.76	64.85	87.78	102.82	150.18	1685	1200	1200	CONC	0.30	78.0	2135.42	1.89	0.69	0.79
					0.00	9.38	0.16	0.65	0.29	12.56			0.00	0.00			0.00	0.00															
	2011	2021	1.00	0.65	1.81	11.19			0.00	12.56			0.00	0.00			0.00	0.00	14.45	63.09	85.37	99.99	146.03	1778	1200	1200	CONC	0.35	71.0	2306.52	2.04	0.58	0.77
To SWM Pond 2 Inlet, Pipe 2021 - 2022						11.19				12.56				0.00				0.00	15.03														
SWM Pond 2 Inlet																																	
Contribution From STREET 7, Pipe 2011 - 2021						11.19				12.56				0.00				0.00	15.03														
Contribution From STREET 7, Pipe 2020 - 2021						8.73				11.98				0.00				0.00	14.25														
	2021	2022			0.00	19.91			0.00	24.54			0.00	0.00			0.00	0.00	15.03	61.69	83.46	97.73	142.72	3276	1350	1350	CONC	0.60	23.0	4134.33	2.89	0.13	0.79

Definitions:
Q = 2.78 AIR, where
Q = Peak Flow in Litres per second (L/s)
A = Areas in hectares (ha)
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R = Runoff Coefficient

Notes:
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Designed: GGG	PROJECT: 7000 Campeau Drive		
Checked: SLM	LOCATION: City of Ottawa		
Dwg. Reference: 03D	File Ref: 18-1061	Date: 15 Jun 2021	Sheet No. SHEET 10 OF 10

J.F. Sabourin and Associates Inc.
52 Springbrook Drive,
Ottawa, ON K2S 1B9
T 613-836-3884 F 613-836-0332

jfsa.com

June 15, 2021 Project Number: P1581-17

David Schaeffer Engineering Ltd
120 Iber Road, Unit 203
Ottawa, Ontario
K2S 1E9

Attention: **Kevin Murphy, P.Eng.**

Subject: **7000 Campeau Drive Subdivision - Preliminary Stormwater Management Plan**

Introduction

The proposed residential development at 7000 Campeau Drive in Kanata, Ontario, consists of four individual parcels equating to approximately 70.9 ha. These lands are a part of the Kanata Golf and Country Club and are currently zoned as Parks and Open Space (O1A). The proposed development will consist of single detached homes, front drive towns, back-to-back towns, stacked towns and medium-density blocks. The proposed development will be serviced by Four (4) dry SWM ponds, and One (1) underground storage unit. The stormwater management facilities have been strategically located at low points within the proposed development, where each facility can outlet to the existing trunk storm sewer that runs along Knudson Drive and Weslock Way. The site will also implement Etobicoke Exfiltration Systems (EES) to provide water quality control to the site and offset any deficits to groundwater contributions due to the increase in impervious areas. Figure 1 provides an overview of the proposed development area relative to existing infrastructure along with the respective locations of the proposed SWM facilities. This memo intends to assess and ensure that the preliminary design of the proposed development meets several fundamental stormwater management requirements.

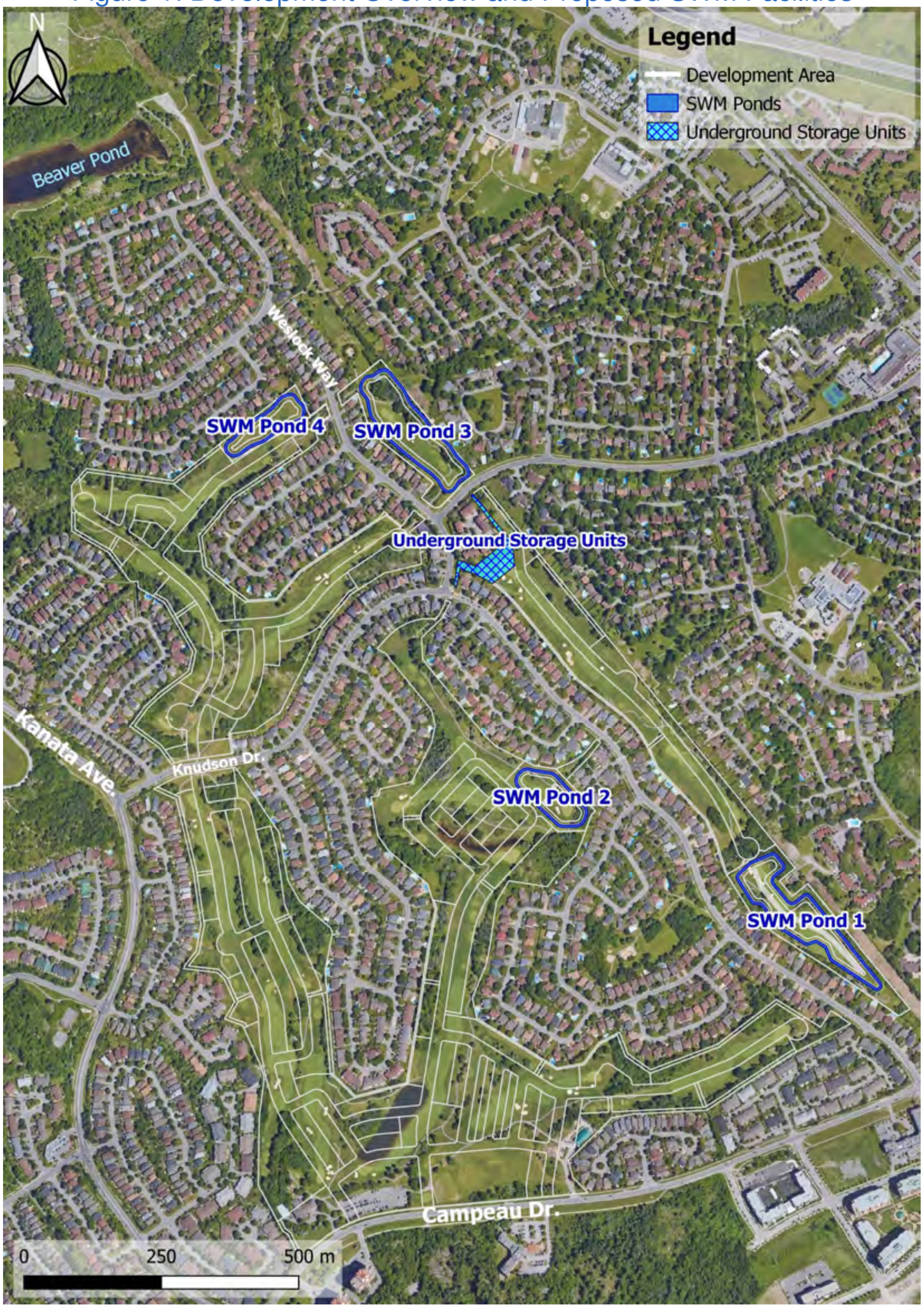
As such, this memo will document and assess:

(i) The adequacy of the proposed minor system to convey the 2- and 100-year storm flows from within the development to the stormwater management (SWM) facilities.
(ii) The capacity of the proposed major system to safely convey the excess 100-year flows to the SWM facilities.
(iii) The operation of the proposed SWM facilities based on quality and quantity control requirements.
(iv) The hydraulic impacts of the proposed subdivision and SWM facilities on the upstream and downstream existing infrastructure.
(v) The peak flows into the Beaver Pond Facility for pre- and post-development conditions.
(vi) The emergency overflow from the proposed development under the 100 Year + 20% stress test.

All analyses documented in this memo were completed using the PCSWMM hydrologic and hydraulic modelling software package. The City of Ottawa provided JFSA with an existing condition PCSWMM model of the study area, which this study has built upon. The following discusses in detail the pre- and post-development PCSWMM modelling components and the findings of this preliminary analysis.

Note that this analysis has been completed to specifically assess the hydrologic and hydraulic operations of the proposed site and impacts on neighbouring properties (local changes to rear yard drainage and storm sewer connections), this model is not intended to be used to assess the entire subwatershed. For the analysis of developments impacts on the greater subwatershed refer to JFSA June 2021 Report titled ." Downstream of 7000 Campeau Drive – Hydrologic Assessment"

Figure 1: Development Overview and Proposed SWM Facilities



Existing Conditions Model

Model Overview

To assess the stormwater operations of the proposed development the City of Ottawa provided JFSA with a detailed PCSWMM (hydrologic & hydraulic) model of the existing major and minor stormwater system that discharges to the Beaver Pond. This model is highly detailed and was developed using the vast amounts of GIS data available to the City (natural topography, minor system pipe network, catch basin locations etc.).The City model consists of two individual models, the Kinematic Wave model and the Dynamic Wave model. The Kinematic Wave model is used to simulate the subcatchment runoff, the major system flow paths and the total flow into the minor system. Note that the representation of the major system flow paths in the Kinematic Wave model is simplistic and does not fully consider the existing grading and topography of the land. The major system in this model simply allows for any excess flow that can not enter a catchbasin to flow to the next nearest catchbasin. The flows diverted to the minor system network simulated by the Kinematic model are then extracted into an Interface File (text file). The Interface File contains approximately 734 individual hydrographs at all inflow locations into the minor system. This interface file is then read into the Dynamic Wave model to simulate the operations of the minor system.

Modifications and Corrections

A few minor errors/issues were noted in the City models as provided. This included minor system pipe inverts that were incorrect (STM12459 & STM11997) which were corrected to reflect as-built values collected by DSEL from the City of Ottawa. One minor system node (MHSTM12321) had an invert elevation of 0 m, which resulted in inflows to pond at this node until the water surface reached the elevation of the outlet pipe invert (98.43 m). A detailed review of the external drainage areas to the Beaver Pond was completed by DSEL, based on City of Ottawa 1K mapping data, which found that there were several locations along the drainage boundary that would drain to external subcatchments and not to the Beaver Pond. This generally included developed lands that had minor system infrastructure that would direct flow to neighbouring watercourses. Some 1.445 ha of land was added to the model's total drainage area and 1.975 ha removed from the model's total drainage area, resulting in a net 0.53 ha (0.2% of the total model drainage area) reduction in the total modelled drainage area. Images of the identified issues addressed above have been documented in Attachment A. Within the City's dynamic model it was identified that there were several locations where flooding was occurring (volume being lost from the model). These locations were reviewed and modified (to allow ponding) to ensure the full runoff volume was contained within the model.

Field Verification

The City model was reviewed against the data obtained from the flow monitoring program completed by JFSA from June 2019 to October 2019 within the Campeau Drive and Weslock Way minor systems. Full details of this monitoring program have been provided in JFSA's July 2020 report titled "Kanata Golf & Country Club - 2019 Monitoring & Hydrologic Model Calibration Report". Refer to Attachment A for plots comparing the simulated and observed flows for all "Significant Events[1]" recorded during the 2019 monitoring period at Campeau Drive and Weslock Way.

[1] A "Significant Event" is defined as a rainfall event with a total rainfall volume greater than 5 mm which was followed by at least 12 hours without any additional rainfall.

From visual inspection of the results, it appears that the City's model does a good job of replicating the overall response and shape of the hydrograph at both locations. Numerically reviewing the two datasets it was found that on average the City model appears to overestimate the peak flows into the minor system by 6% and 30% at Weslock Way and Campeau Drive, respectively. Although the model does not appear to have a significant bias to overestimating peak flows for all simulated events with a minimum peak flow ratio of 0.45 and 0.51 at Weslock and Campeau, respectively. Based on the field data from 2019, it was found that the City model overestimated the total runoff volume into the minor system at both locations for that year, with the simulated total volumes being 48% and 29% larger than the observed volumes at Weslock Way and Campeau Drive, respectively.

Looking at the full hydrographs, the model appears to have a reasonable coefficient of determination (R^2) of 0.56 and 0.60 at Weslock Way and Campeau Drive, respectively, and with a Nash-Sutcliffe model efficiency coefficients of 0.26 and 0.08, respectively. Note that the closer the coefficient of determination (R^2) and Nash-Sutcliffe model efficiency coefficient are to 1.0, the better the statistical fit. Full statistical summaries have been provided in Tables 1 & 2 below. Note that no events greater than the 2-year event were observed during this monitoring period.

Table 1: Weslock Way 2019 Monitoring Summary – Field observations vs City Model

Parameter	Value
Total Rainfall Volume (mm)	264.04
Minimum Peak Flow Ratio (Sim/Meas)	0.45
Average Peak Flow Ratio (Sim/Meas)	1.06
Maximum Peak Flow Ratio (Sim/Meas)	1.51
Measured Volume (m^3)	46696
Simulated Volume (m^3)	69148
Volume Difference (m^3)	22452
Volume Ratio (Sim/Meas)	1.48
R^2	0.56
Nash-Sutcliffe	0.26

Table 2: Campeau Drive 2019 Monitoring Summary – Field observations vs City Model

Parameter	Value
Total Rainfall Volume (mm)	239.43
Minimum Peak Flow Ratio (Sim/Meas)	0.51
Average Peak Flow Ratio (Sim/Meas)	1.30
Maximum Peak Flow Ratio (Sim/Meas)	1.94
Measured Volume (m^3)	11714
Simulated Volume (m^3)	15100
Volume Difference (m^3)	3386
Volume Ratio (Sim/Meas)	1.29
R^2	0.60
Nash-Sutcliffe	0.08

Based on the above findings, it is concluded that the City's model is not a perfect reflection of the existing stormwater operations of the area, as it generally (but not always) tends to slightly overestimate both the peak flows and total runoff volume into the system. Although this model has been considered a reasonable representation for the purposes of this study, as it generally tends to produce a conservative estimate of peak flows and total volume into the existing minor system, based on the field data currently available. As such, this model has been used to establish the existing hydraulic and hydrologic conditions of the study area.

Downstream Boundary Condition and Hot Start File

The City model, as provided, assumed a free outlet at the Beaver Pond. To ensure that the analysis completed in this study is conservative the downstream boundary of the model was fixed to the 100-year peak water level in the Beaver Pond of 92.55 m, based on AECOM's, May 2011 report "*Shirley's Brook & Watt's Creek Phase 1 - Stormwater Management Study*". The new downstream boundary created a backwater that propagates up the existing storm sewer system. To ensure this boundary was stable, a hot start file was generated to allow the backwatered storm sewer to stabilize before a simulated event. After making the above refinements the model was simulated using the 5-year 3-hour Chicago storm, 100-year 24-hour SCS storm and 100-year +20% 24-hour SCS storm. The results of this analysis would function as the existing conditions targets for the proposed development.

Proposed Conditions Model

Model Overview

Like the existing conditions modelling, the proposed condition analysis consisted of two models, the Kinematic Wave model and the Dynamic Wave model. For the proposed conditions, the Kinematic Wave model was adjusted to contain only the existing external lands to the development site, and the area that makes up the proposed development lands was removed, as it would be simulated in the Dynamic Wave model. The following sections document the development of the proposed conditions model and the results of this analysis.

Subcatchments

To ensure that there was no overlap or gaps in subcatchments between the two models, the Kinematic Wave model subcatchment boundaries had to be slightly adjusted to ensure that they would match up with the proposed development boundaries in the Dynamic Wave model. This required either slightly clipping or slightly extending the existing subcatchment boundaries in the Kinematic Wave model, this was primarily completed along the rear yards of the existing residential developments. After ensuring that there were no intersections of subcatchment boundaries between the two models, the drainage areas of the Kinematic Wave model were updated based on their new drainage area. If a subcatchment area changed by more than 10% that subcatchment Width / Flow Length parameter was also recalculated. The remaining subcatchment parameters in the Kinematic Wave model remained unaltered. Figures B1 & B2 in Attachment B provide an overview of the subcatchment areas simulated in the Kinematic and Dynamic models.

The drainage areas within the proposed development were provided by DSEL. As the development is only at the preliminary design stage, the majority of the subcatchments have been assumed to be 64% impervious (Runoff Coefficient = 0.65). Default Manning's values of 0.013, 0.25, have been applied for impervious and pervious surfaces, respectively. City default Horton's infiltration values of 76.2 mm/hr, 13.2 mm/hr, 4.14 1/hr & a 7 Day drying time have also been applied to the model. Subcatchment slopes within the development have been assigned based on the slopes specified within preliminary grading plans. Note that these above parameters also conform to the parameters used in the City's Kinematic Wave model.

Etobicoke Exfiltration Systems (EES)

It is proposed that within the development Etobicoke Exfiltration Systems (EES) will be implemented to provide quality control for the site while also offsetting any groundwater recharge deficits caused by the increase in impervious areas. As specified in John Tran & James Li's "Planning and Design Manual of the Etobicoke Exfiltration System for Stormwater Management", for the EES units to achieve 80% TSS removal, the systems should be designed to treat the 95th percentile rainfall event. Based on the statistical analysis of historical rainfall data recorded at the Ottawa Airport, completed by J.L Richards as a part of the Barrhaven South Master Servicing Study, the 95th percentile rainfall event in Ottawa equates to the 22 mm event.

At this stage of the exact details of each of these EES is not know, but it is known that for the development to achieve 80% TSS removal, these systems will need to be implemented throughout the entirety of the site and designed to capture and infiltrate the 22 mm event. To account for the benefit of these systems within the modelling without replicate the exact design details (which are still unknown), the depression storage for both the impervious and pervious surfaces have been set to 22 mm for all subcatchments within the development, to reflect the runoff reduction from the site that will be caused by the implementation of the EES.

Nodes, Links & Interfacing Files

The entire existing minor system included in the City's PCSWMM model was imported into the development Dynamic Wave model, along with all the "Mid-Point" nodes and associated links. These "Mid-Point" nodes were imported into the Dynamic model to ensure that the flows external to the development simulated in the Kinematic Wave model are appropriately passed and represented in the Dynamic Wave model. In locations where there is an existing major system spill to the golf course, additional nodes were added to the Kinematic Wave model from the Dynamic Wave model. The inclusion of these nodes allows for the external flows onto the golf course simulated by the Kinematic Wave model to be passed to the correct location within the Dynamic Wave model, these include external major system flows into the development.

Development Major system

Preliminary grading of the proposed major system has been included in the model, with generic road cross-section transects reflective of the proposed Right of Way (ROW) at each respective location. Roads with preliminary centreline grades less than 0.65% will be designed with a 'saw tooth' or 'sagged' road profile. The runoff from the development will be conveyed to catchbasins located at low points on the street. Flows above the minor system capture rate will temporarily be stored within the surface storage present within these sags and released slowly to the storm sewers. If the low point storage is surpassed, the flow will be conveyed overland to the next downstream road segment. Note that as the development is only at the preliminary design stage, the exact details of the saw toothing are not known, although it is safe to assume that any road segments with a high point to highpoint slopes of < 0.3% will be able to accommodate such road saw toothing. As such storage nodes have been applied to the model to approximately account for the storage volume provided by these sags. The depth/storage relationships were developed based on a typical 100 m length of road segments. These storage curves were applied to locations within the model's major system that are reflective of slopes of 0.1% - 0.3%. For each location, the depth/storage curve of the 100 m length was adjusted to reflect the actual length of the road segment within the model. For example, for a 40 m long sag section the 100m depth/storage curve values would be multiplied by a factor of 0.40. Note that individual storage curves were derived for 100 m lengths with high point to high point slopes of 0.1%, 0.2% & 0.3 %. The invert elevation of these locations was reduced by 15 cm to approximately account for the depression within these sags.

Note that this is only a conceptual representation of the road sags, and the future inclusion of the detailed road saw toothing will provide greater storage within the development major system than what has been simulated in this model. Refer to Figure B3 in Attachment B for an overview of the major system flow routes within the proposed development. Refer to Figure B5 in Attachment B for a figure of the conceptual proposed road sags grading and the associated depth/storage area curves applied in the model.

As per City standards, for the 100-year storm, the maximum total depth of water (static + dynamic) on all roads shall not exceed 35 cm at the gutter and the product of the maximum flow depths on streets and maximum flow velocity must be less than 0.60 m^2/s on all roads. Table C-1 in Attachment C provides a summary of the maximum major system flow depths and velocity and provides the flow depth velocity product for the 100-year SCS 24 hour and Chicago 3-hour storm. From this preliminary analysis, it was found that the flow depth velocity product is less than 0.60 m^2/s. Table C-2 in Attachment C provides a summary of the maximum major system ponding depths within the development for the 100-year SCS 24 hour and Chicago 3-hour storm. From this preliminary analysis, it was found that the major system ponding depths were either equal to or less than 0.35 m at all locations.

Rear Yard Ditches

The model has been updated to contain conceptual grading of the proposed rear yard ditches that will be implemented to capture runoff from the proposed development as well as runoff from the existing units that have rear yard discharge to the existing golf course. Connections from the rear yards to the proposed storm sewer network have also been included in this modelling Table C3 in Attachment C, provides an overview of the maximum rear yard ponding depths for 100-year SCS 24 hour and Chicago 3-hour storm. From this preliminary analysis, it was found that the major system ponding depths were either equal to or less than 0.35 m at all locations.

Development Minor System

Per the City of Ottawa standards, the minor system has been designed to accommodate, at a minimum, the 2-year post-development flows from within the site. The minor system surrounding the existing development was designed with a 5-year level of service, and as such, any external lands that will discharge to the development's minor system have been sized to ensure that the 5-year level of service will be maintained. Refer to the following section "External Minor system" regarding the checks completed to ensure the same level of service will be provided. The minor system within the development was preliminarily sized based on Rational Method calculations, refer to the Rational Method design sheets provided by DSEL in Attachment B for full details. The pipe sizes determined from the Rational Method calculations were included in the Dynamic Wave model. A Manning's roughness of 0.013 was applied to all proposed pipes within the development and minor system loss coefficients applied to all pipes based on each pipe's respective orientation, refer to Attachment B for the respective minor system loss coefficients applied in this model.

A minor system hydraulic grade line (HGL) analysis was completed for the proposed development based on the 100-year 3-hour Chicago and 100-year 24-hour SCS design storms. From this analysis it was found that the maximum pipe velocities are no greater than 6.0 m/s for all proposed pipes, in locations where the proposed simulated pipe velocities are less than 0.8 m/s, these pipes can be easily downsized at detailed design. Table C4 in Attachment C provided the maximum HGL with the minor system for these design storms. To ensure that the proposed development will provide adequate freeboard to the proposed USF it has been assumed that a minimum freeboard of 1.8 m from the top of the Maintenance Hole is provided for the 100-year events. These results show that on average the maximum depth within the proposed storm sewer is 2.594 m below the top of the maintenance hole.

There are some locations where the 100-year hydraulic grade line is less than 1.8 m below the proposed ground elevation, these locations are either located within the SWM pond block, do not have storm sewer connections to buildings, or the buildings that connect to these locations will be on sump pumps; therefore the high 100-year hydraulic grade line at these locations will not have any negative impacts. Notes identifying these locations have been provided in Table C4. As mentioned above, due to grading constraints within the development sump pumps will be required to service several homes. Further details of these exact locations will be provided at the detailed design stage.

Major/Minor System Connections

Within the development, flows have been passed from the major system to the minor system using outlet links. These outlets have been included in the model to function as an approximate representation of the flow capture provided by the proposed catch basins within the development. Depth/Flow curves for each outlet were generated based on the 2-year peak flow from the proposed development and 5-year peak flow from the existing external rear yards that will discharge to the proposed storm sewer at each respective location. The flow for each of these curves was increased by 14% at a depth of 0.3 m to account for additional inflows due to the increased head applied to standard inlet control devices and catch basins during the 100-year storm. The site has been designed to ensure that no major system flow spills back onto the existing development, for the 100-Year event.

SWM Ponds

The preliminary SWM pond sizes have been based on the "Preliminary Stormwater Management Plan" analysis completed by JFSA in July 2020 and have been updated to reflect dry ponds (the previous submission assumed wet ponds) and also considers the benefits of the proposed EES systems. The total drainage area to each of the SWM Ponds is approximately 57.44 ha, 26.66 ha, 48.37 ha and 12.73 ha for SWM Ponds 1, 2, 3, & 4, respectively. Figure B6 in Attachment B provides an overview of the drainage areas to each of the SWM facilities. As the site will provide quality control via EES, the SWM ponds within the development solely provided erosion and quantity control. Table B1 – B4 outlines the pond stage/storage/outflow for each SWM facility.

The SWM ponds have been represented in the model using storage nodes, which use a depth/area relationship to represent the pond footprint and storage volume provided. Tables 3 - 6 summarize the peak water levels, inflow, outflow and storage volume used in each of the ponds for the 5-year 3-hour Chicago storm, 100-year 3-hour Chicago storm, 100-year 24-hour SCS and 100-year 24-hour SCS +20%.

Table 3: SWM Pond 1 Summary
Drainage Area: 57.44 ha

Event	Max WSE (m)	Max Inflow (m^3/s)	Max Outflow (m^3/s)	Max Storage Volume (m^3)
5 Year Chicago 3Hr	95.333	3.699	0.050	7,895
100 Year Chicago 3hr	96.328	7.570	0.102	18,650
100 Year SCS 24hr	96.692	7.800	0.116	23,180
100 Year SCS 24hr +20%	97.079	8.661	0.222	28,420

Table 4: SWM Pond 2 Summary
Drainage Area 26.66 ha

Event	Max WSE (m)	Max Inflow (m^3/s)	Max Outflow (m^3/s)	Max Storage Volume (m^3)
5 Year Chicago 3Hr	95.978	1.681	0.073	3,613
100 Year Chicago 3hr	97.028	4.543	0.149	9,366
100 Year SCS 24hr	97.200	4.996	0.158	10,410
100 Year SCS 24hr +20%	97.497	6.448	0.981	12,270

Table 5: SWM Pond 3 Summary
Drainage Area: 48.37 ha

Event	Max WSE (m)	Max Inflow (m^3/s)	Max Outflow (m^3/s)	Max Storage Volume (m^3)
5 Year Chicago 3Hr	94.623	3.408	0.160	6,799
100 Year Chicago 3hr	95.479	7.423	0.318	17,540
100 Year SCS 24hr	95.698	7.730	0.347	20,560
100 Year SCS 24hr +20%	96.084	9.221	0.834	26,190

Table 6: SWM Pond 4 Summary
Drainage Area: 12.73 ha

Event	Max WSE (m)	Max Inflow (m^3/s)	Max Outflow (m^3/s)	Max Storage Volume (m^3)
5 Year Chicago 3Hr	95.361	0.979	0.026	1,880
100 Year Chicago 3hr	96.212	2.965	0.041	5,166
100 Year SCS 24hr	96.393	3.043	0.043	5,988
100 Year SCS 24hr +20%	96.771	4.137	0.102	7,877

Underground Storage Units

9.31 ha of proposed development lands downstream of Pond 1, will have an underground storage unit in place to attenuate runoff from these lands into the existing trunk sewer. The underground storage units will be located in the Open Space block located in the northern extent of the development near the intersection of Weslock Way and Catherwood Court. Based on this preliminary analysis the underground storage units will need to provide approximately 1000 m³ of storage volume and will need to be equipped with a 650 mm orifice plate outlet to attenuate the runoff from the site into the existing trunk sewer. Note that due to grading constraints the residential units within this section of the proposed storm sewer system will need to be equipt with sump pumps, and as such the upstream HGL increases created by this storage unit attenuating flow during large events should not negatively affect the operations of these residential units. Tables 7 summarize the peak water levels, inflow, outflow and storage volume used in each of the ponds for the 5-year 3-hour Chicago storm, 100-year 3-hour Chicago storm, 100-year 24-hour SCS and 100-year 24-hour SCS +20%.

Table 7: Underground Storage Unit Summary

Event	Max WSE (m)	Max Inflow (m^3/s)	Max Outflow (m^3/s)	Max Storage Volume (m^3)
5 Year Chicago 3Hr	93.044	0.531	0.270	420
100 Year Chicago 3hr	94.087	1.322	1.122	1,000
100 Year SCS 24hr	94.113	1.183	1.183	1,000
100 Year SCS 24hr +20%	94.139	1.254	1.254	1,000

Stress Test -Emergency Overflow

As a part of this analysis, a design storm stress test has been completed, based on a 20% increase in the intensity of the 100-year 24-hour SCS design storm. Each of the proposed SWM ponds will have emergency flow routes implemented to deal with such an event. Under this stress test, Pond 1 will discharge a peak flow of 0.093 m^3/s (947 m^3) to the proposed road within the development downstream of the pond. Pond 2 will discharge a maximum flow of 0.810 m^3/s (3,210 m^3) to an emergency overflow drop structure that will connect to the existing trunk sewer on Weslock Way. Pond 3 will discharge 0.441 m^3/s (2,200 m^3) to a ditch in Weslock Park, and Pond 4 will spill 0.054 m^3/s (331 m^3) to the road within the development, which will ultimately discharge to the ditch in Weslock Park, after crossing a localized low point on Weslock Way. The above is a preliminary assessment of the emergency overflow measures. A comprehensive assessment of each of these measures will be completed at the detailed design stage.

External Minor System

There are currently eleven (11) locations where the minor system of the existing developed lands can freely discharge to the golf course. Under post-development conditions, these inflows to the site will be picked up by the proposed development's minor system and directed to the respective SWM ponds. The minor system within the development has been sized to ensure that there will be no increases in the existing storm sewer HGL once it is connected to the proposed development's minor system. Table C5 in Attachment C provides a complete summary of the existing and proposed peak HGLs at the outlets of the existing storm sewers. From this analysis, it is seen that there will be no increases in the existing HGL storm sewers due to the connection of these outlets to the proposed development minor system for the various design storms. Note that both MHST11678 & MHST01107 see a slight increase (maximum 5 cm) in HGL for the various design storms, these increases are due to the slight difference created in making the existing development drainage areas abut with the proposed development drainage boundaries in the proposed condition modelling and are simply a modelling artifact and not a true HGL increase. Note that at these locations, even with these increases, the existing storm sewer is not surcharged and should have no negative impacts on existing infrastructure upstream, as there is sufficient freeboard.

Local Downstream Impacts

The peak inflows to the Beaver Pond on the Knudson Drive / Weslock Way trunk sewer have been extracted based on existing and proposed conditions detailed modelling. Table 7 below provides a full summary of the existing and proposed peak flows and total volumes to the Beaver Pond from the Knudson Drive / Weslock Way trunk sewer.

Table 8: Peak flow and total volume into the Beaver Pond from Knudson Drive / Weslock Way trunk storm sewer

Event	Existing Conditions		Proposed Conditions		Difference	
	Peak Flow (m^3/s) [1]	Total Volume (m^3) [2]	Peak Flow (m^3/s) [3]	Total Volume (m^3) [4]	Peak Flow (m^3/s) [3]-[1]	Total Volume (m^3) [4]-[2]
5 Year Chicago 3Hr	5.727	24,930	5.165	29,200	-0.562	4,270
100 Year Chicago 3hr	9.218	64,440	8.464	78,870	-0.754	14,430
100 Year SCS 24hr	9.413	80,420	9.290	106,600	-0.123	26,180
100 Year SCS 24hr +20%	10.030	128,400	10.420	131,600	0.390	3,200

From this analysis it was found that peak flows to the Beaver Pond for the simulated design storms are less than pre-development conditions due to the proposed SWM ponds, except for the stress test (100 Year SCS 24Hr +20%). As expected, the total runoff volume to the Beaver Pond has increased under the proposed conditions. The impacts of these volumetric increases due to the development have been assessed in a separate memo by JFSA "Downstream of 7000 Campeau Drive – Hydrologic Assessment" June 2021, which reviews and quantifies the downstream impacts of the development on the greater Watts Creek watershed.

Table C6 in Attachment C provides a comparison of the existing and proposed HGL in the existing Knudson Drive / Weslock Way trunk sewer at the various SWMF outlet locations. From these results, it is seen that the proposed development either matches or reduces the existing peak HGL in this system up to and including the 100-year event. Under the stress test, it was found that there would be a maximum increase in HGL of this trunk sewer of 10 cm. Although it is important to consider that this increase in HGL will not increase the risk of existing basement flooding, as under this scenario there is still a 4.37 m freeboard from the top of the Maintenance Hole at this location, which is more than enough to ensure that the existing houses that discharge to this system still have a free outlet.

Conclusion

The detailed PCSWMM models provided by the City for the lands draining to the Beaver Pond were updated to correct a few minor issues and compared with field measured flows from 2019. This investigation showed that this model provided a reasonably good correlation with the field observed data, and accordingly this model was used to establish the existing hydraulic and hydrologic conditions of the study area. This model was then updated to reflect the proposed development at 7000 Campeau Drive. Full details of this update have been outlined in this memo. From this analysis, it was found that:

- The proposed minor system within the development is adequately sized to safely convey the 5- and 100-year storm flows to the proposed SWM facilities.
- The proposed major system within the development is adequately sized to safely convey the excess 100-year flows to the proposed SWM facilities.
- The operation of the proposed SWM facilities has been shown to meet quantity control requirements, with quality control requirements assessed at detailed design through the implementation of Etobicoke Exfiltration Systems.
- The proposed development will not result in any HGL increases on the existing stormwater infrastructure upstream or downstream of the proposed development for events up to and including the 100-year event.
- The proposed development peak flows into the Beaver Pond from the Knudson Drive / Weslock Way trunk sewer, are either equal to or less than existing peak flows.
- The peak HGL in the existing Knudson Drive/ Westlock Way will not be increased due to the proposed development for events up to and including the 100-year event.

Yours truly,
J.F Sabourin and Associates Inc.

J Burnett

Jonathon Burnett, B.Eng, P.Eng
Water Resources Engineer

cc: J.F Sabourin, M.Eng, P.Eng
Director of Water Resources Projects

Figures:

Tables:

Attachments:

Table 1A: Beaver Pond Inflow/Outflow Summary

Design Storms	MVCA				KWEX				KWEX_KNL9					KWEX_KGC-EES					KWEX_KGC-EES_KNL9					
	Area (ha)	Qp In (m^3/s)	Qp Out (m^3/s)	Runoff (1000 m^3)	Area (ha)	Qp In (m^3/s)	Qp Out (m^3/s)	Runoff (1000 m^3)	Area (ha)	Qp In (m^3/s)	Qp Out (m^3/s)	Runoff (1000 m^3)	Qp/Qp_{KWEX}	Area (ha)	Qp In (m^3/s)	Qp Out (m^3/s)	Runoff (1000 m^3)	Qp/Qp_{KWEX}	Area (ha)	Qp In (m^3/s)	Qp Out (m^3/s)	Runoff (1000 m^3)	Qp/Qp_{KWEX}	Qp/Qp_{KNL9}
25 mm CHI 4Hr	n/a	n/a	n/a	n/a	415.85	4.626	0.139	14.8	430.02	5.878	0.173	17.3	1.245	320.66	4.593	0.131	16.7	0.942	334.83	5.792	0.161	18.8	1.158	0.93
2Yr SCS 12 hour	477.35	1.352	0.454	86.6	415.85	4.644	0.314	30.6	430.02	5.811	0.369	35.2	1.175	362.97	4.609	0.283	39.1	0.901	377.14	5.776	0.335	43.3	1.067	0.91
5Yr SCS 12 hour	477.35	2.439	0.615	127.9	415.85	7.164	0.486	48.6	430.02	9.071	0.538	55.2	1.107	382.23	6.941	0.463	63.7	0.953	396.40	8.847	0.513	70.1	1.056	0.95
10Yr SCS 12 hour	473.45	3.248	0.671	156.2	415.85	9.686	0.599	65.2	430.02	12.049	0.640	73.3	1.068	390.47	9.071	0.578	85.0	0.965	404.64	11.434	0.618	92.8	1.032	0.97
25Yr SCS 12 hour	466.66	5.342	0.775	192.1	415.85	13.964	0.718	90.3	430.02	16.894	0.757	100.1	1.054	397.17	12.648	0.689	115.3	0.960	411.35	15.578	0.726	124.8	1.011	0.96
50Yr SCS 12 hour	462.31	7.378	0.859	217.8	415.85	17.893	0.792	109.5	429.92	20.057	0.826	120.5	1.043	400.30	15.935	0.749	137.6	0.946	414.47	18.410	0.791	148.3	0.999	0.96
100Yr SCS 12 hour	458.30	9.941	0.924	243.9	415.80	24.521	0.854	129.9	429.46	27.228	0.889	141.9	1.041	402.35	22.183	0.805	160.5	0.943	416.52	24.890	0.842	172.4	0.986	0.95
2Yr SCS 24 hour	n/a	n/a	n/a	n/a	415.85	6.603	0.358	39.0	430.02	8.420	0.414	44.3	1.156	365.28	6.502	0.322	48.0	0.899	379.45	8.320	0.379	53.0	1.059	0.92
5Yr SCS 24 hour	n/a	n/a	n/a	n/a	415.85	10.871	0.548	63.5	430.02	13.567	0.589	70.9	1.075	383.14	10.398	0.521	79.2	0.951	397.31	13.094	0.570	86.3	1.040	0.97
10Yr SCS 24 hour	n/a	n/a	n/a	n/a	415.85	14.605	0.642	82.5	430.02	17.877	0.684	91.2	1.065	390.21	13.588	0.618	102.2	0.963	404.38	16.859	0.658	110.5	1.025	0.96
25Yr SCS 24 hour	n/a	n/a	n/a	n/a	415.85	19.100	0.745	108.5	429.66	23.390	0.783	118.7	1.051	395.75	17.526	0.714	132.3	0.958	409.92	21.815	0.750	142.2	1.007	0.96
50Yr SCS 24 hour	n/a	n/a	n/a	n/a	415.48	23.303	0.813	129.9	428.68	27.929	0.846	141.0	1.041	397.92	20.855	0.776	155.6	0.954	412.10	25.483	0.810	166.8	0.996	0.96
100Yr SCS 24 hour	n/a	n/a	n/a	n/a	415.01	34.161	0.881	153.8	428.23	37.596	0.911	166.1	1.034	400.19	30.800	0.833	181.4	0.946	414.36	34.234	0.868	193.8	0.985	0.95
2Yr CHI 3Hr	n/a	n/a	n/a	n/a	415.85	7.098	0.238	22.0	430.02	8.959	0.288	25.5	1.210	352.07	7.039	0.219	28.2	0.920	366.24	8.870	0.265	31.4	1.113	0.92
5Yr CHI 3Hr	n/a	n/a	n/a	n/a	415.85	12.180	0.437	38.4	430.02	15.038	0.480	43.5	1.098	377.97	11.954	0.419	52.2	0.959	392.14	14.799	0.459	57.0	1.050	0.96
10Yr CHI 3Hr	n/a	n/a	n/a	n/a	415.85	15.175	0.533	50.5	429.78	19.126	0.578	56.6	1.084	386.48	14.594	0.513	69.1	0.962	400.66	18.539	0.562	74.9	1.054	0.97
25Yr CHI 3Hr	n/a	n/a	n/a	n/a	415.68	19.916	0.626	66.5	428.37	24.857	0.667	73.8	1.065	392.22	18.503	0.603	90.6	0.963	406.40	23.442	0.642	97.9	1.026	0.96
50Yr CHI 3Hr	n/a	n/a	n/a	n/a	415.09	25.585	0.692	79.4	427.58	29.438	0.728	87.7	1.052	395.33	23.931	0.659	107.6	0.952	409.51	27.696	0.699	116.0	1.010	0.96
100Yr CHI 3Hr	n/a	n/a	n/a	n/a	414.44	29.457	0.750	93.9	426.98	35.943	0.790	103.2	1.053	397.84	27.321	0.711	126.0	0.948	412.01	33.807	0.750	135.5	1.000	0.95
100Yr SCS 24Hr + 20%	n/a	n/a	n/a	n/a	413.86	50.926	1.007	207.7	427.240	57.648	1.039	222.5	1.032	403.280	46.667	0.950	237.4	0.943	417.450	53.389	0.985	252.3	0.978	0.948

Scenario Summary:

KWEX	JFSA updated Existing Conditions
KWEX_KNL9	JFSA updated Existing Conditions + KNL Stage 9 Development
KWEX_KGC-EES	JFSA updated Existing Conditions + The Kanata Golf and Country Club Development with SWM controls + EES sized to infiltrate up to 22mm event
KWEX_KGC-EES_KNL9	JFSA updated Existing Conditions + The Kanata Golf and Country Club Development with SWM controls + EES sized to infiltrate up to 22mm event + KNL Stage 9 Development

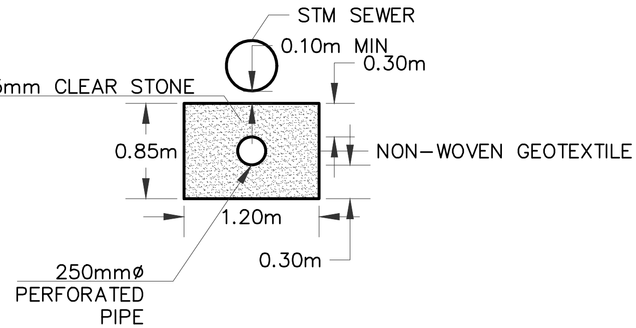
Table excerpts taken from the J.F. Sabourin report:
“Downstream of 7000 Campeau Drive – Hydrologic Assessment” (June 2021)

Table 2A: Outlet to Ottawa River Summary

Design Storms	MVCA			KWEX			KWEX_KNL9				KWEX_KGC-EES				KWEX_KGC-EES_KNL9				
	Area (ha)	Qp (m^3/s)	Runoff (1000 m^3)	Area (ha)	Qp (m^3/s)	Runoff (1000 m^3)	Area (ha)	Qp (m^3/s)	Runoff (1000 m^3)	Qp/Qp_{KWEX}	Area (ha)	Qp (m^3/s)	Runoff (1000 m^3)	Qp/Qp_{KWEX}	Area (ha)	Qp (m^3/s)	Runoff (1000 m^3)	Qp/Qp_{KWEX}	Qp/Qp_{KNL9}
25 mm CHI 4Hr	n/a	n/a	n/a	2550.68	3.572	88.5	2549.94	3.573	102.5	1.000	2448.43	3.568	89.9	0.999	2447.68	3.572	92.8	1.000	1.000
2Yr SCS 12 hour	2590.480	8.051	422.0	2550.68	6.176	194.6	2549.94	6.186	218.5	1.002	2490.74	6.164	202.2	0.998	2489.99	6.181	207.7	1.001	0.999
5Yr SCS 12 hour	2590.480	12.467	649.7	2550.68	9.396	303.0	2549.94	9.437	336.1	1.004	2510.00	9.379	317.5	0.998	2509.25	9.431	324.9	1.004	0.999
10Yr SCS 12 hour	2586.580	15.905	813.7	2550.68	11.946	394.6	2549.94	11.997	433.2	1.004	2518.24	11.924	413.2	0.998	2517.49	11.991	422.4	1.004	0.999
25Yr SCS 12 hour	2579.790	20.780	1029.9	2550.68	16.548	539.5	2549.94	16.645	584.7	1.006	2524.94	16.506	562.8	0.997	2524.20	16.636	573.8	1.005	0.999
50Yr SCS 12 hour	2575.440	24.531	1187.8	2550.57	20.883	660.9	2549.83	21.018	709.9	1.006	2528.07	20.830	686.9	0.997	2527.32	21.008	698.8	1.006	1.000
100Yr SCS 12 hour	2571.430	28.263	1349.5	2550.12	25.754	793.6	2549.38	25.900	845.6	1.006	2530.12	25.701	822.0	0.998	2529.37	25.890	834.7	1.005	1.000
2Yr SCS 24 hour	n/a	n/a	n/a	2550.68	6.225	238.2	2549.94	6.232	264.7	1.001	2493.05	6.213	246.3	0.998	2492.31	6.228	252.5	1.000	0.999
5Yr SCS 24 hour	n/a	n/a	n/a	2550.68	9.900	383.9	2549.94	9.942	419.0	1.004	2510.91	9.866	398.5	0.997	2510.16	9.936	406.6	1.004	0.999
10Yr SCS 24 hour	n/a	n/a	n/a	2550.68	13.432	505.0	2549.94	13.507	544.7	1.006	2517.98	13.395	523.2	0.997	2517.23	13.498	532.4	1.005	0.999
25Yr SCS 24 hour	n/a	n/a	n/a	2550.32	18.763	671.0	2549.58	18.868	715.9	1.006	2523.52	18.716	693.0	0.997	2522.77	18.858	703.6	1.005	0.999
50Yr SCS 24 hour	n/a	n/a	n/a	2549.34	23.492	812.5	2548.60	23.617	859.9	1.005	2525.69	23.437	836.0	0.998	2524.95	23.606	847.6	1.005	1.000
100Yr SCS 24 hour	n/a	n/a	n/a	2548.89	28.781	975.0	2548.15	28.927	1024.6	1.005	2527.96	28.700	1000.1	0.997	2527.21	28.915	1012.4	1.005	1.000
2Yr CHI 3Hr	n/a	n/a	n/a	2550.68	4.959	124.7	2549.94	4.963	144.3	1.001	2479.84	4.951	130.4	0.998	2479.09	4.961	134.6	1.000	1.000
5Yr CHI 3Hr	n/a	n/a	n/a	2550.68	7.749	209.4	2549.94	7.768	238.2	1.002	2505.74	7.734	222.3	0.998	2504.99	7.765	228.5	1.002	1.000
10Yr CHI 3Hr	n/a	n/a	n/a	2550.44	10.781	285.4	2549.70	10.816	320.2	1.003	2514.25	10.759	303.0	0.998	2513.51	10.814	310.2	1.003	1.000
25Yr CHI 3Hr	n/a	n/a	n/a	2549.03	15.301	388.7	2548.29	15.373	430.2	1.005	2519.99	15.270	411.5	0.998	2519.25	15.367	420.5	1.004	1.000
50Yr CHI 3Hr	n/a	n/a	n/a	2548.24	19.003	471.7	2547.50	19.097	518.2	1.005	2523.10	18.966	498.6	0.998	2522.36	19.091	508.5	1.005	1.000
100Yr CHI 3Hr	n/a	n/a	n/a	2547.64	22.967	563.3	2546.89	23.074	614.6	1.005	2525.61	22.931	593.5	0.998	2524.86	23.067	604.7	1.004	1.000
100Yr SCS 24Hr + 20%	n/a	n/a	n/a	2547.90	41.079	1341.2	2547.15	41.245	1393.0	1.004	2531.05	41.016	1367.5	0.998	2530.31	41.230	1381.0	1.004	1.000

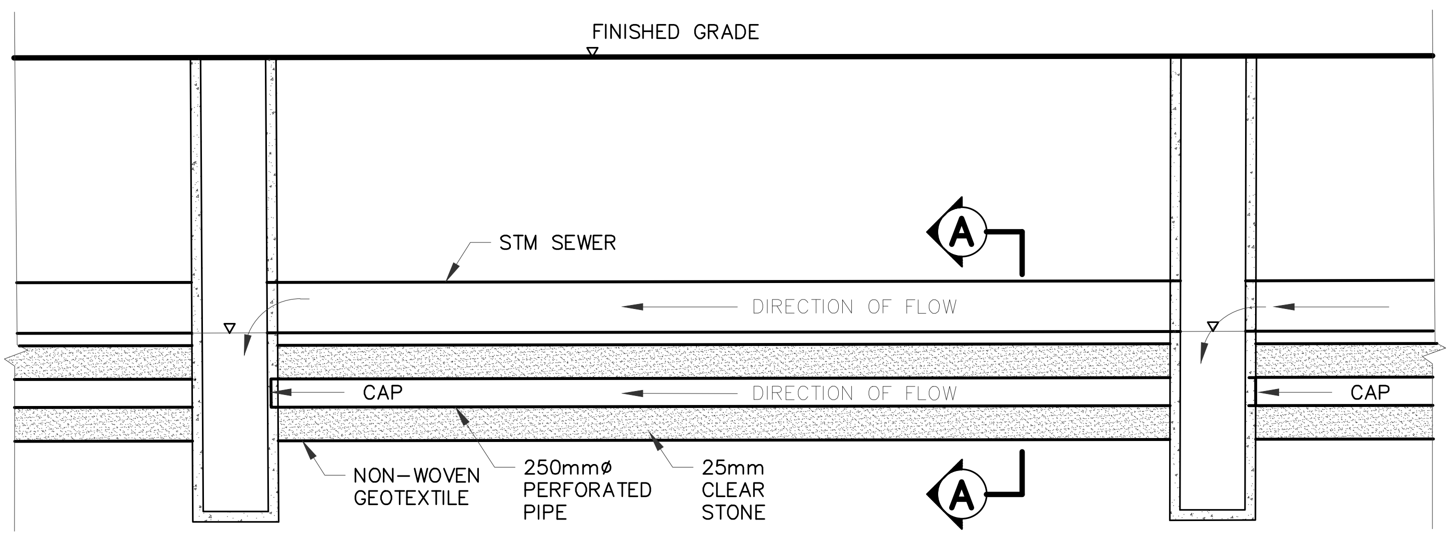
Scenario Summary:

KWEX	JFSA updated Existing Conditions
KWEX_KNL9	JFSA updated Existing Conditions + KNL Stage 9 Development
KWEX_KGC-EES	JFSA updated Existing Conditions + The Kanata Golf and Country Club Development with SWM controls + EES sized to infiltrate up to 22mm event
KWEX_KGC-EES_KNL9	JFSA updated Existing Conditions + The Kanata Golf and Country Club Development with SWM controls + EES sized to infiltrate up to 22mm event + KNL Stage 9 Development



SECTION DETAIL A

SCALE: N.T.S.



PROFILE

SCALE: N.T.S.

DSEL
david schaeffer engineering ltd

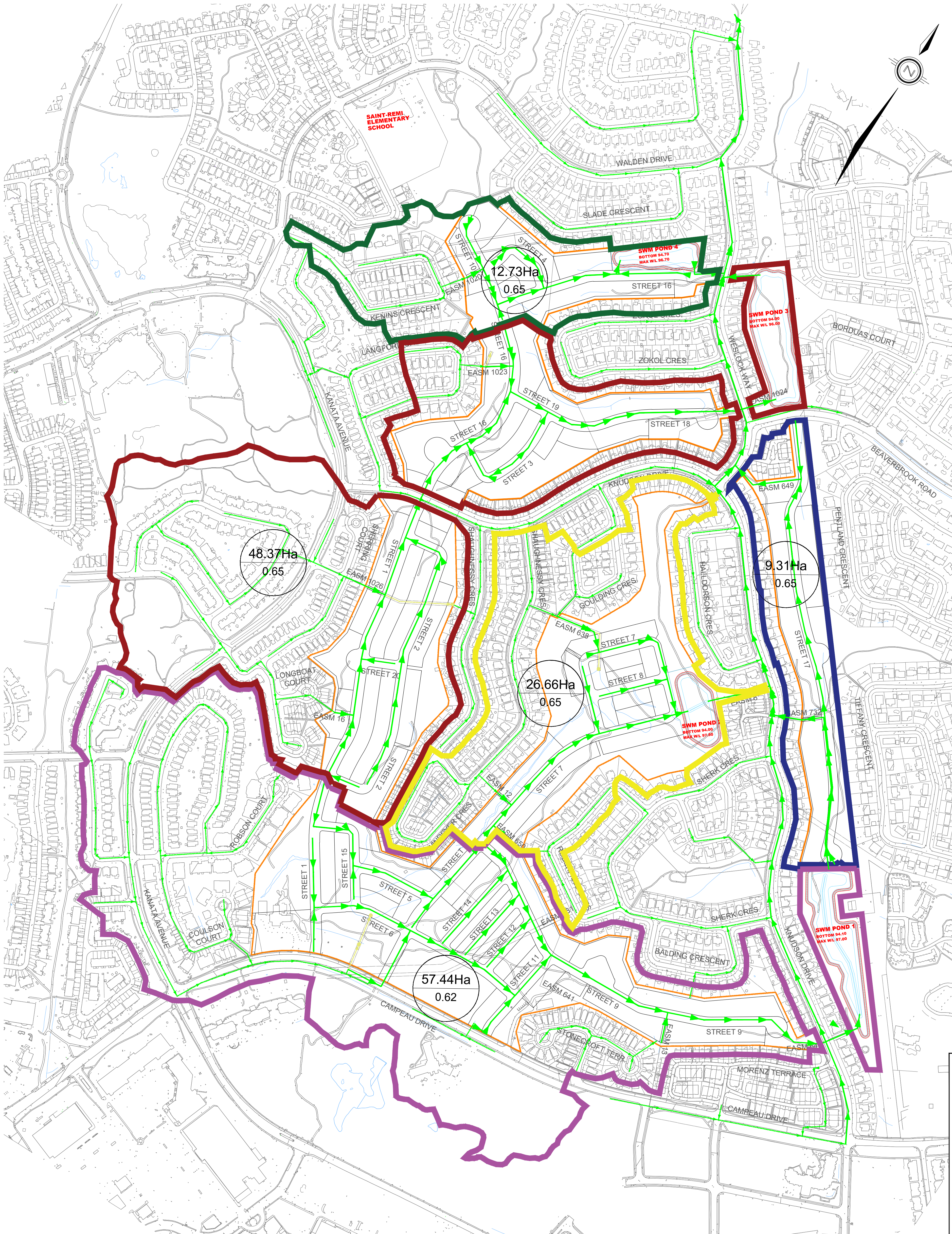
120 Iber Road, Unit 103
Stittsville, Ontario, K2S 1E9
Tel. (613) 836-0856
Fax. (613) 836-7183
www.DSEL.ca

7000 CAMPEAU DRIVE

CITY OF OTTAWA

EXFILTRATION TRENCH DETAIL

SCALE:	NTS	PROJECT No.:	1061
DATE:	APRIL 2021	FIGURE:	03F



LEGEND

(orange dashed line)	SUBJECT LANDS	(purple line)	POND 1 DRAINAGE AREA
(green arrow)	STORM TRUNK	(yellow line)	POND 2 DRAINAGE AREA
(green dashed arrow)	EXISTING STORM SEWER	(blue line)	UNDERGROUND STORAGE DRAINAGE AREA
57.87Ha	DRAINAGE AREA	(dark red line)	POND 3 DRAINAGE AREA
0.62	RUN-OFF COEFFICIENT	(dark green line)	POND 4 DRAINAGE AREA

CITY FILE No. D07-16-19-0026 CITY PLAN No. XXXXX

DSEL
david schaeffer engineering ltd

120 Iber Road, Unit 103
Stittsville, Ontario, K2S 1E9
Tel. (613) 836-0856
Fax. (613) 836-7183
www.DSEL.ca

7000 CAMPEAU DRIVE

CITY OF OTTAWA

STORM DRAINAGE FIGURE

SCALE:	1:7000	PROJECT No.:	1061
DATE:	MAY 2021	FIGURE:	02F

J.L. Richards
ENGINEERS · ARCHITECTS · PLANNERS

J.L. Richards
& Associates Limited
864 Lady Ellen Place
Ottawa, ON Canada
K1Z 5M2
Tel: 613 728 3571
Fax: 613 728 6012

MEMORANDUM

To:	John Bougadis P.Eng. Senior Project Manager, Infrastructure Planning City of Ottawa	Date:	June 22, 2017
		Job No.:	26610
From:	Bobby Pettigrew, P.Eng.	CC:	Hugo Lalonde, MCIP, RPP Land Development Manager Minto Communities - Canada
Re:	BSUEA Infiltration System Maintenance Requirements		

Purpose of Undertaking

The future Barrhaven South Urban Expansion Area (BSUEA) will be developed as a standard suburb subdivision that will include the typical range of land usages; residential, commercial, institutional, parks and a Park and Ride facility. Based on the findings of the Study Area Existing Conditions Reports, the servicing of the Subdivision will need to be developed with measures that will promote infiltration to preserve the pre-infiltration levels. This Memorandum was prepared to address operation and maintenance requirements for a system that would be solely implemented on local roads and that has been described in previous Memoranda as capable to maintain pre-infiltration levels.

Background

On May 24, 2017, a meeting was held at the City of Ottawa (City) to discuss advantages and disadvantages associated with two (2) servicing systems that could be implemented within the BSUEA to promote infiltration of “clean runoff” to maintain pre-infiltration levels. The first part of the meeting consisted of a presentation that described both servicing systems promoting infiltration; the Etobicoke Exfiltration System (EES) and the Clear Water Collector (CWC) system that was implemented in the former City of Vaughan. During the latter part of the meeting, the advantages and disadvantages of both systems were discussed over with operation staff. Both of these systems have been discussed in a previous Modelling Memorandum and were presented to the City on May 24, 2017, a copy of the presentation has been attached.

During the May 24, 2017 meeting, the City has requested further information on the increased maintenance requirements for a stormwater conveyance system that would be designed with infiltration capabilities. From the Operation Staff, it was understood that the current maintenance program for traditional stormwater conveyance systems consist of cleaning of the storm sewers by jet flushing and, subsequently, proceeding with a closed circuit television (CCTV) inspection. This process is generally completed on a 20-year frequency. This Memorandum has, therefore, been prepared using as the baseline condition, the 20-year maintenance frequency.

Reported Maintenance Requirements of Infiltration Systems

The requirements of a maintenance program can be based on experience with previous installations of the EES or CWC systems. The EES was first designed in 1993 in the former City of Etobicoke, now part of the City of Toronto. The system was subsequently constructed later in 1993 and spanning until 1994 as part of the municipality’s road reconstruction projects, which included the installation of 2.1 km of the EES as a means to provide water quality enhancement for existing serviced areas. From the 2.1 km of EES installed, three (3) small sections were subject to monitoring and reporting post-construction; the Princess Margaret and Queen Mary’s Drive sites as well as the Braecrest site (refer to the Table below for details for each of the sites).

The first two (2) sites comprises of an EES with Goss traps similar to what is proposed for the BSUEA while the latter site, Braecrest, is closer to the CWC system with some minor modifications. Each system was designed with capacity to capture the runoff generated from the 15 mm - 1 hour AES rainfall event. For comparison purposes, the system now being proposed for the BSUEA is sized to capture, detain and infiltrate the runoff generated by the 22 mm - 4 hour rainfall event.

Monitoring Sites	Sewer Length (m)	Tributary Area (ha)
Princess Margaret	415	0.4
Queen Mary's Drive	443	13.3[1]
Braecrest	209	2.4

Post construction monitoring of the above-noted systems was initiated on completion of construction. Once completed, the systems were cleaned by jet flushing and subsequently inspected via CCTV. Follow up monitoring was undertaken for a two year period between 1996 and 1998 (SWAMP, 2004) and subsequently by the TRCA in 2013 (presentation slides attached). The 1996-1998 monitoring information was reported; however, the recent monitoring has not been formally reported other than the information attached to the presentation slides.

Prior to the 2013 monitoring, there was no further cleaning undertaken and the infiltration capability of the EES installations were found to be very similar to the original infiltration condition after 18 years of operation. At the Princess Margaret site, the infiltration capability was virtually found to be the same than the original one as the system's drawdown time was found to take approximately only ten (10) minutes longer than found during the 1998 monitoring program. At the Queen Mary site, the 2013 monitoring results were reported after the cleaning phase of the program occurred and it was found that the average water level drawdown rate approximately doubled following the clean out. The information presented by the TRCA (see attached) on the monitoring program suggested that the maintenance frequency would vary depending on design of the EES and catchment characteristics. As a result, inspections should be carried out preferably at least every 5 years to verify that drawdown time does not exceed 48 hours.

The Sustainable Technologies Evaluation Program, led by the TRCA, has prepared a publication entitled “Low Impact Development Stormwater Management Practice Inspection and Maintenance Guide” (PIMG), which includes a section devoted to underground infiltration systems; however, this section of the PIMG does not specifically address the EES or CWC. The PIMG (i.e., Table 7.28, with relative sections extracted below) suggests recommended frequencies for routine maintenance tasks including clean out of sediments (flushing and removal) once an accumulated depth of 100 mm has been reached. Based on inspection photographs of the EES during the 2013 monitoring (see the sewer inspection photographs in the attached TRCA presentation), approximately 100 mm of sediment or less had accumulated over the 20 year period; this accumulation excludes what was accumulated in the catch basins. In addition, the PIMG document recommends maintenance procedures such as removing accumulated trash and debris in the catch basins on a more regular basis, up to twice per year. This inspection work could evidently be combined with an inspection program.

The 2003 Stormwater Management Planning and Design Manual (SWMPDM),from the Ontario Ministry of the Environment and Climate Change (MOECC), provides some guidance on maintenance required for similar infiltration / pervious pipe systems such as the EES that is proposed. Table 6.1 in the Manual identifies the need for general inspection, removal of accumulated sediments, pipe flushing, catchbasin cleaning, trash removal and closing of the system for winter months when in a high salt / sand area. By installing the EES solely along local roads, the maintenance activity of closing the system for the winter months is not required.

According to the Manual, inspections should take place at a greater frequency for the first two years, after every significant storm event, to better understand the system's performance and to ensure that the perforated pipe system is operating as designed. After the first two years, the frequency of inspections could be reduced to annual inspections. In terms of frequency of sediment removal and cleaning, the Manual indicates that the system, including catchbasins, should be cleaned out if there is greater than one third the design depth of water in the catch basin sump 48 hours after a storm or if there is visible accumulation of sediment in the bottom of the catchbasin sump. Cleaning could be carried out by means of standard flushing, radial washing where the pipe is pressurized to force water through the perforations and cleaning out the sediment, or alternatively, jet flushing via a pressurized hose nozzle that directs water under high velocities into the perforations to remove the accumulated sediment.

[1] Of the 13.3 ha tributary area to the monitored section of the Queen Mary's Drive site, only 3.7 ha was immediately tributary to the EES sewers, the remaining area was from conventional sewer systems upstream of the site.

Measures to Reduce Maintenance Requirements

The design of the EES can be carried out by incorporating measures to reduce the maintenance frequency of the system. The measures include; i) using Goss traps in the upstream catchbasins as a pre-treatment measure, and ii) by rotating the angle of perforations to 45^{o} in the perforated pipe

Goss traps are used as standard in some Ontario municipalities including the City of Windsor and the City of Hamilton. They were used in the original sites of the EES in Etobicoke including those subject to the monitoring discussed above. This measure was adopted by the designers to: i) prevent debris collected in the catch basins from entering the perforated pipes, and ii) minimize oil trapped in the catch basins from entering the perforated pipes.

The alignment of the perforated pipe on its longitudinal axis is important in maximizing the efficiency of the system between maintenance visits and reducing the maintenance required. By placing the perforated pipes so that the perforations are not on the bottom of the pipe and are closer to the 4:30 and 7:30 locations on the clock, the perforated pipe will continue to function at full exfiltration capacity while sediment is deposited on the bottom. The need to clean out the sediment can be extended until sufficient sediment has built up to close up the angled perforations.

Recommended Maintenance Procedures and Frequency

Based on historical notes collected during the EES monitoring work, the review of the PIMG document (TRCA), the review of MOECC's SWPDM, best practices in operating conventional storm sewer systems and recent discussions held with stormwater professionals (refer to attached E-Mails), the following maintenance schedule is recommended:

Maintenance Schedule

Task	**Frequency**	**Compared to conventional systems**
Inspection of the system to ensure adequate operation including full drawdown of the sumps to below the perforated pipe invert level and ensuring that the plug part of the Goss trap is functioning properly by only allowing water from the deeper column to enter the catch basin lead	Once or twice per year - 48 hours or more after a significant storm event	Not required in conventional systems although could be considered good practice and preventative
Removal of accumulated trash and debris from sumps and grates	Twice per year	Best practice in conventional systems, part completed annually on grates with spring street clearing
Monitoring of the accumulated sediment depth in catch basins	Once a year	Best practice in conventional systems
Jet pressure wash and CCTV inspection of sewer and perforated pipes	At least every 20 years or when sediment levels reach 150 mm depth	As per conventional systems but only one sewer in conventional systems

From the table above, the increase in the maintenance requirements for an EES would consist of the following:

1. Annual or bi-annual inspections of the system at the manholes to confirm that drawdown is occurring within 48 hours following a storm event. If drawdown is not fully achieved after 48 hours, this could be indicative of the need to schedule flushing of the system; and

2. Jet pressure washing of the conventional storm sewer as well as the two (2) perforated pipes, from manhole to manhole, every 20 years. The increase in maintenance would be associated with the time to remove the mechanical plugs at the downstream end of the perforated pipes and to flush the perforated pipes. The mobilization cost will remain the same when compared to the single conventional sewer.

The additional maintenance requirement associated with item 2 above would not incur a significant time or a significant increase in costs. As previously noted, the time for the crew to mobilize would remain the same as what is anticipated for a conventional system. The additional cost will be associated with jet pressure washing the additional length of sewers (i.e., perforated pipes) and potential for removing additional accumulated sediments, which is likely to occur in the perforated pipes when compared to conventional systems where the sediments can be washed away under self-cleansing flows.

An annual or bi-annual inspection of the EES at manholes would be the more costly of the two increased maintenance requirements as this task (checking drawdown time) is not currently completed and would require additional man-power (i.e, travel time and inspection time).

Estimated Maintenance Costs

A cost analysis of the increased maintenance is summarized below. In the event that the City has more recent costs for these tasks, then these would prevail. It should be noted that the costs listed below are in 2017 dollars.

- Anticipated number of manholes / catch basins for inspection: 250
- Time per manhole / catchbasin: 5 minutes
- Time for site: 21 hours
- Cost per hour: $53
- Total Cost for inspections: $1,120
- Annual cost: $2,240

- Anticipated length of EES sewer: 8.6 km
- Total Combo unit time: 86 hours
- Average cost per hour: $195
- Estimated cleaning cost: $16,770
- Estimated disposal: $500
- Annual equivalent cost: $870

Overall, the annual increase in cost for the City to undertake maintenance of the EES over the conventional storm sewer system is ±$3,500 a year on average for the anticipated sewer length within the CDP, excluding the aggregate extraction areas. It is considered that the increase in maintenance costs of the EES would be considerably less than the maintenance costs incurred with two wet pond structures, which is the alternative to provide similar levels of water quality control.

J.L. RICHARDS & ASSOCIATES LIMITED

Prepared by:

LICENSED PROFESSIONAL ENGINEER
J.R. PETTIGREW
100207693
JUNE 22, 2017
PROVINCE OF ONTARIO

Bobby Pettigrew, P.Eng.,
Water Resources Engineer

Reviewed by:

LICENSED PROFESSIONAL ENGINEER
J. S. G. FORGET
JUNE 22/2017
PROVINCE OF ONTARIO

Guy Forget, P.Eng.,
Senior Water Resources Engineer

J.F. Sabourin and Associates Inc.
52 Springbrook Drive,
Ottawa, ON K2S 1B9
T 613-836-3884 F 613-836-0332

jfsa.com

Ottawa. ON
Paris. ON
Gatineau. QC
Montréal. QC
Québec. QC

April 16, 2021

Project Number: 1581

David Schaeffer Engineering Ltd
120 Iber Road, Unit 103
Ottawa, Ontario
K2S 1E9

Attention: **Kevin Murphy, P.Eng**

Subject: **7000 Campeau Drive:**
Preliminary Water Balance & Water Quality Controls

Introduction

The proposed residential development at 7000 Campeau Drive in Kanata, Ontario, consists of four individual parcels equating to approximately 71 ha. These lands are a part of the Kanata Golf and Country Club and are currently zoned as Parks and Open Space (O1A). The proposed development will consist of single detached homes, front drive towns, back-to-back towns & stacked towns. The proposed development will be serviced by four (4) stormwater management (SWM) dry ponds to meet quantity control requirements, with Etobicoke Exfiltration Systems (EES) implemented throughout all roads within the proposed development (or ultimately to the extent required by detailed analysis) to meet the sites water quality and water balance requirements. The following memo provides an overview of the proposed EES and how they will be implemented to meet both the water quality and water budget requirements for this site.

Etobicoke Exfiltration Systems (EES)

The Etobicoke Exfiltration System, a concept originally proposed by James Li and John Tran, considers the addition of a granular trench located below (and/or around) the main storm sewer system, which allows runoff captured by the developments minor system to exfiltrate back into the ground via these trenches. The EES works by connecting the bottom of the Maintenance Hole (MH) on the upstream side of the trench to the trench via two perforated pipes. These pipes then allow runoff that enters the MH to be dispersed and filtered throughout the granular material in the trench, where it can then exfiltrate back into the soil. If the volume or rate of runoff exceeds the capacity of the EES, the water level in each maintenance hole increases to the point at which the excess flow is carried downstream by the conventional storm sewer system, where it can either enter the next EES, if there is available capacity, or continue unimpeded downstream through the minor system network.

With this configuration, developments can help restore the deficit in groundwater contributions due to the increase in impervious area, while also reducing the total annual runoff volume from the development. As runoff from the development first needs to fill the volume in the trench below the storm sewer before passing downstream, this system also does an effective job at capturing the first flush and providing water quality treatment.

For this development, it is proposed that Etobicoke Exfiltration Systems (EES) will be implemented underneath storm sewers within the right-of-way (ROW) to meet both the water budget (groundwater infiltration) and water quality requirements. For this analysis it has been assumed that each system will consist of two 200 mm diameter perforated pipes surrounded by a 0.9 m deep by 2.5 m wide clear stone trench; note that the specific trench details may be subject to change at detailed design. Detailed drawings of the proposed EES units are provided in Figure 1. Note that there are no LID measures proposed on private property (residential rear yards) or within parklands.

Water Quality Treatment

To ensure that the proposed development will meet the water quality requirements (Enhanced water quality treatment – 80% TSS removal), a treatment train approach is proposed, which will use a combination of deep sump catch basins, goss traps on the lead pipes and EES. As per the available literature, deep sump catch basins can remove/retain 25% of the total suspended sediments (TSS) and the EES can remove at least 80% of TSS. While it may be argued that the objective to remove 80% TSS could be achieved solely by the EES, the use of deep sump catch basins will provide pre-treatment to the EES, preventing the system from being overloaded during construction periods and will reduce cleanout/maintenance frequency, further increasing the longevity of the EES. In addition to this, it is proposed that the catch basin lead pipes will be protected with goss traps. This will prevent floatable pollutants, including oils, from being discharged to the stormwater collection system, although goss traps do provide some form of TSS removal, it has not been included in the total treatment train performance calculation provided below. Based on the below calculations, it is found that the proposed treatment train will provide 85% TSS removal, exceeding The Ministry of the Environment Conservation and Park's (MECP) requirement of 80% TSS removal.

$$Total\ TSS\ removal = 1 - [(1 - Deep\ Sump\ TSS\ Removal\ ) \times (1 - EES\ TSS\ Removal)]$$

$$Total\ TSS\ removal = 1 - [(1 - 0.25) \times (1 - 0.80)]$$

$$Total\ TSS\ removal = 85\%$$

Note that based on "Table 3.2 Water Quality Storage Requirements based on Receiving Waters" per the MECP's Stormwater Management Planning and Design Manual, to achieve 80% TSS removal via infiltration for a site at 65% imperviousness will require 33.33 m^3/ha of infiltration volume to be provided, as documented below in the "Conceptual EES Sizing" section of this report the proposed EES will provide approximately 104.8 m^3/ha, well above the required volume specified by MECP's to meet the site water quality requirement. One additional benefit of the EES worth noting is that, as this water quality treatment system is implemented underground, it results in considerably lower runoff temperatures to the receiving watercourses when compared to similar developments that use the conventional end of pipe treatment systems like wet ponds to provide water quality control.

Water Balance

A pre-and post-development water balance has been completed for the site based on the subsoil sampling infiltration rates determined by Paterson Group as a part of their on-site geotechnical investigations, full details outlined in their April 2021 memo titled "Subsoil Infiltration Review Proposed Residential Development Kanata Lakes Golf Club - 7000 Campeau Drive – Ottawa"; the following section outlines the approach and results of this analysis for the various site conditions.

Pre-Development

Based on Paterson's subsoil sampling, the site primarily consists of Silty Clay, with pockets of bedrock, fill and glacial till. Paterson also provided approximate minimum infiltration rates based on the soil types observed. These rates were compared with the F_c rates outlined in "Table A6-geotechnical investigations" of the SWMHYMO manual, to determine the appropriate SCS soil classification (A-D) for each soil type present within the site. The site's existing water budget parameters have been based on "Table 3.1 - Hydrologic Cycle Component Values" of the MECP's SWM Manual, assuming Urban Lawn (Golf Course) conditions with a soil infiltration factor of 0.2 (medium combinations of clay and loam) applied. Under pre-development conditions, the site has a total imperviousness of approximately 6%.

To determine the total water budget for the site, the proposed development lands have been broken into individual soil types (Silty Clay, Bedrock etc.) and then into pervious and impervious areas. The annual evaporation, runoff and infiltration volumes were calculated for the impervious and pervious lands separately and summated to provide the overall water balance for the site. Based on continuous hydrologic SWMHYMO model simulations using 39 years of historical rainfall data from the Ottawa Airport, City default impervious Initial Abstraction (IA) parameters and an impervious drying time of 45 minutes, it was found that for 100% impervious surfaces, on average, 26% of the annual precipitation will be lost due to evaporation with runoff making up the remaining 74%, these values have been adopted in the water balance calculations for impervious surfaces.

Tables B1-1 to B1-3 outline the calculations of each of these components. Based on the analysis of pre-development conditions for this site, it was found that on average, 54% of the annual precipitation will return to the atmosphere through evaporation and evapotranspiration, 21% will infiltrate and 25% will runoff. For the total site drainage area of 71.03 ha, the site will infiltrate 137,955 m^3/yr. or 194 mm/yr. of the total annual precipitation of 940 mm/yr. This annual infiltration rate has been established as the minimum target for annual infiltration rates under post-development conditions.

Post-Development - Without LIDs

Under post-development conditions, the proposed development lands have been broken into individual soil types (Silty Clay, Bedrock etc.) and then into pervious and impervious areas. Based on the development conceptual plan, the 71.03 ha site will have a total imperviousness of 64% (Runoff Coefficient = 0.7). Note that the percent imperviousness assumed for the development includes the impervious area from the proposed roads within the development. The site's water budget parameters have been updated based on Table 3.1 - Hydrologic Cycle Component Values of the MECP's SWM Manual, assuming Urban Lawn (residential development) conditions with a soil infiltration factor of 0.2 (medium combinations of clay and loam) applied.

As completed under pre-development conditions, each of the soil types have been broken into pervious and impervious areas, and these resulting values summated. Tables B2-1 to B2-3 outline the calculations of each of these components. Based on this analysis it was found that, under post-development conditions (without any LID measures in place), this site on average will evaporate 37.0% of its annual precipitation while 8% will infiltrate and 55% will runoff. Based on the total development area of 71.03 ha, the site will infiltrate 52,176 m^3/yr. or 73 mm/yr. of the total annual rainfall of 940 mm/yr. This is 85,780 m^3/yr. or 121 mm/yr. short of the pre-development conditions. The results observed above are typical for most subdivisions that proposed development without LIDs; annual evapotranspiration rates decrease due to the reduction in vegetated lands, annual infiltrated rates also decrease due to the reduction in pervious surfaces, which in turn results in an increase in annual average runoff volume.

Post-Development – With LIDs

As indicated above, the increase in the impervious area due to the proposed development will result in a decrease in annual infiltration volume. To offset this deficit, it is proposed that LID measures will be implemented throughout the site to capture a portion of the additional runoff and allow it to infiltrate back into the soil. As indicated above, EES are proposed to be implemented throughout this site to offset this deficit.

As a part of the “Barrhaven South Urban Expansion Area Master Servicing Study” completed by J.L. Richards and Associates Inc. (JLR), a detailed historical rainfall analysis was completed to correlate the volume of a single rainfall event in Ottawa to an annual event percentile; for example, based on JLR’s study a 22 mm rainfall event correlates to the 95th percentile of all annual rainfall events in the Ottawa region. Similarly, the 85th, 75th and 65th percentile events correspond to 11.4 mm, 7.5 mm and 5.1 mm rainfall events. Using JLR’s data, further extrapolation/interpolation can be applied to determine the annual percentiles for any particular rainfall event. JLR’s analysis helps determine how much of the annual rainfall volume will be dealt with but is missing a key piece of information; the runoff volume (in mm) generated by such rainfall events, which then can be used to conceptually size LID measures. To provide this missing information, a series of conceptual SWMHYMO models were prepared for various total imperviousness (TIMP) ranging from 40% to 95% with various degrees of directly connected imperviousness (XIMP), all with City Standard parameters. These models were run for the 5 mm, 10 mm, 15 mm, 20 mm, 22 mm, 25 mm and 30 mm design storms. From the results obtained (provided in Attachment C) it is possible to approximate the runoff (in mm) generated from a given TIMP and XIMP, for any of these storms.

It is important to consider that although the 3 mm event equates to approximately 50% of all annual rainfall events, it does not equate to 50% of the total annual runoff; as initial abstraction for pervious surfaces is generally assumed to be 4.67 mm, and a single large rainfall event produces far more runoff than a series of small rainfall events of the same total volume that occur over several days. To account for this in the water budget runoff/infiltration calculations the runoff volume determined for the specific event at a specific imperviousness (per the lookup tables provided in Attachment C) is divided by the design storm capacity, and then multiplied by the annual rainfall percentile and annual runoff volume, to approximate the total infiltrated volume. Using these look-up tables it is found that for a proposed development with a 65% total imperviousness (TIMP) and 55% directly connected imperviousness (XIMP), the 22 mm event would generate approximately 10.03 mm of runoff volume (averaged of 60% and 50% XIMP).

As a part of this preliminary water budget analysis, it is assumed that 100% of the total drainage area within the development will be treated via EES. It has also been assumed that the EES units will be sized to capture and infiltrate up to the 22 mm rainfall event (95% percentile) to meet water quality requirements as outlined above, which is based on the SWMHYMO modelling equates to 10.03mm of runoff. The results of this analysis are summarized in Appendix B Table B2-4 and show that if EES were designed to retain and infiltrate the runoff from the 22 mm storms or less, some additional 160,446 m³/yr. (226 mm/yr.) of runoff volume would be infiltrated. This is an increase in annual infiltration volume of 74,666 m³/yr. (105 mm/yr.) from the pre-development target established above.

Water Budget Scenario Summary

Tables 2-4 summarize the annual average water balance under existing conditions and post-development conditions with and without LID measures in place, as m³/year, mm/year and % of total annual rainfall.

Table 1:Pre-Development Water Balance

Drainage Area (ha)		71.03	Imperviousness:	6%
Annual Average Volume	Precipitation	Evapotranspiration	Infiltration	Runoff
m³	667,663	364,081	137,955	165,626
mm	940	513	194	233
%	100%	54%	21%	25%

Table 2:Post Development Water Balance – Without LIDs

Drainage Area (ha)		71.03	Imperviousness:	64%
Annual Average Volume	Precipitation	Evapotranspiration	Infiltration	Runoff
m³	667,663	245,442	52,176	370,046
mm	940	346	73	521
%	100%	37%	8%	55%

Table 3:Post Development Water Balance – With LIDs

Drainage Area (ha)		71.03	Imperviousness:	64%
Annual Average Volume	Precipitation	Evapotranspiration	Infiltration	Runoff
m³	667,663	245,442	212,622	209,600
mm	940	346	299	295
%	100%	37%	32%	31%

Based on this analysis of pre-development conditions this site will evaporate 54%, infiltrate 21% and runoff 25% of all annual rainfall. Under Post-development conditions without LID, this site will evaporate 37%, infiltrate 8% and runoff 55% of all annual rainfall. Under post-development conditions with LIDs, this site will evaporate 37%, infiltrate 32% and runoff 31% of all annual rainfall, exceeding existing pre-development infiltration rates.

Conceptual EES Sizing

To confirm that the proposed EES can be physically implemented within the development a preliminary sizing analysis has been completed. The EES will be sized to capture runoff from the 22 mm event (95th Percentile rainfall event), which equates to a runoff volume of 10.03 mm based on an average site imperviousness of 65%. Multiplying the 10.03 mm of runoff over the 71.03 ha development results in a total runoff volume of 7,124 m³, which will need to be captured and exfiltrated by the EES.

Based on the latest development plan there is a total of 8,275 linear metres of the proposed road within this development. For now, it is proposed that all EES within the development will be 2.5 m wide with clear stone trenches (40% porosity). To exceed the required volume (7,124 m³) the EES will need to be 0.9 m deep, providing a total EES exfiltration/storage volume of 7,448 m³. Note that this conceptual volumetric analysis of the EES is conservative as it does not consider the volume provided in the system due to the perforated pipes that distribute the runoff throughout the trench. Additionally as outlined above in the Water Budget Scenario Summary section designing the EES units to capture and exfiltrate all runoff up to the 22mm event, exceeds the sites existing annual infiltration volumes. Note that the dimensions assumed as a part of this analysis are conceptual and may differ at detailed design based on site-specific conditions present at each location. A full breakdown of the required storage volume and conceptual EES dimensions have been provided below in Table 4.

Table 4: Conceptual EES sizing

Parameter	Value	Unit
LID Design Rainfall Event	22	mm
Site Total Drainage Area	71.028	ha
Average Site imperviousness	64.3	%
Runoff Volume[1]	10.03	mm
Site Runoff Volume	**7,124**	**m³**
Total Length of EES system (Road)	8275	m
EES Width	2.5	m
EES Depth	0.9	m
Void Ratio	0.4	-
Total LID Volume	**7,448**	**m³**
Total LID Volume	**104.8**	**m³/ha**

1 Refer to "TIMP vs Runoff Volume Summary Tables" in Attachment C for the relationship between design storm imperviousness and runoff

EES Drawdown Times

Assuming all EES units will have a maximum depth of 900 mm with an assumed porosity of 0.4. Based on the minimum site soil infiltration rate of 5 mm/hr determined by Paterson, and assuming only bottom infiltration (conservative assumption), this equates to a full EES having a drawdown time of approximately 72 hours (3 Days). Note that the above soil infiltration rate is the minimum of the values approximated, and the infiltration rates and required dimension of each of the EES units can be reviewed on a location basis at detailed design, the primary goal is to ensure that the required exfiltration volume is provided throughout the site.

It is important to note that based on the “Planning and Design Manual of the Etobicoke Exfiltration System for Stormwater Management” Report by John Ran and James Li, the two EES pilot sites in Etobicoke, had soil infiltration rates of less than 15mm/hr, yet appeared to still meet the site's objectives. One of the pilot sites had a field measured hydraulic conductivity of 1 x 10-7 cm/sec (approximately 7.2 mm/hr) yet peer-reviewed results concluded that the total rate of exfiltration for that system was equivalent to 30 mm/hr.

Conclusion

Based on the above it is determined that the proposed 7000 Campeau development will meet and exceed the quality control requirements of 80% TSS removal, through the implementation of a treatment train of deep sumps, goss traps and Etobicoke Exfiltration Systems (EES) sized to retain and infiltrate up to the 22 mm event (95th percental). A preliminary water balance analysis of the existing site was completed to determine pre-development infiltration rates. A post-development analysis, where no LIDs were implemented, showed that the percentage of annual rainfall infiltrated would decrease by 13%. Implementing EES that are designed to capture and infiltrate up to the 22 mm event would offset this deficit and exceed pre-development conditions by 11%. Based on a conceptual size of the EES, assuming that EES are implemented on all proposed roads throughout this development, it was found that each of the EES trenches would need to be 2.5 m wide and 0.9 m deep. Based on this analysis it has been shown that the proposed development will be able to meet and exceed the existing annual infiltration volumes through the use of EES.

Yours truly,
J.F Sabourin and Associates Inc.

Jonathon Burnett, P.Eng
Water Resources Engineer

LICENSED PROFESSIONAL ENGINEER
J. J. BURNETT
100227734
PROVINCE OF ONTARIO

cc: J.F Sabourin, M.Eng, P.Eng
Director of Water Resources Projects

Figures

Figure 1: Etobicoke Exfiltration Systems Drawing Details

Tables

Table 1: Pre-Development Water Balance
Table 2: Post Development Water Balance – Without LIDs
Table 3: Post Development Water Balance – With LIDs
Table 4: Conceptual EES sizing

Attachments

Attachment A: Quality Control Alternatives – Summary
Attachment B: Water Budget Calculations
Attachment C: TIMP vs Runoff Volume Summary Tables

J.F. Sabourin and Associates Inc.
52 Springbrook Drive,
Ottawa, ON K2S 1B9
T 613-836-3884   F 613-836-0332

jfsa.com

Attachment A

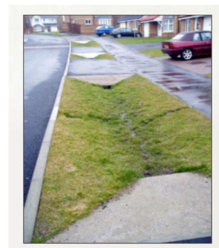
Quality Control Alternatives – Summary

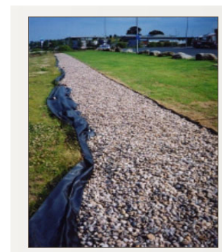
Quality Control Alternatives - Summary of Technologies/ Methods

Prepared by: JFSA (J.F. Sabourin), January 28, 2021

Method/ Approach	TSS Removal (%)	Notes
Street Sweeping (Monthly)	0-10%	Depends on method and frequency (ref Massachusetts, 2008)
Street Sweeping (Weekly)	88%	Elgin Eagle Waterless Sweeper (per pass as tested by ETV Canada)
Street Sweeping (Weekly with Elgin Eagle)*		

Method/ Approach	TSS Removal (%)	Notes
Curb Cut with Grass Swales	+/- 75%	Based on several references
	80%+	if combined with with infiltration trench





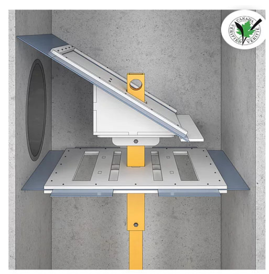
Method/ Approach	TSS Removal (%)	Notes
Catchbasin Inserts	11% to 90%	(1) Cartrige Type, disposible (2) Bag Type, (3) Basket Type


FIGURE 2.2 Cartridge type CBI (Contech Engineered Solutions, 2017).

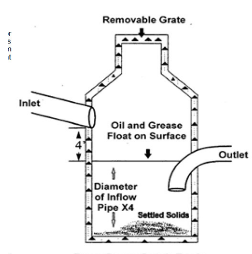

FIGURE 2.3 Bag type CBI (ADS , 2016).


FIGURE 2.4 Basket type CBI (Environmental XPRT, n.d.).

Method/ Approach	TSS Removal (%)	Notes
Catchbasin Inserts (CB Shield)*	27%	CB Shield (as tested by ETV Canada)



Method/ Approach	TSS Removal (%)	Notes
Deep Sump Catch Basin	25%	if sump deep enough and goss trap added to outlet



Method/ Approach	TSS Removal (%)	Notes
Infiltration/ Filtration Trenches**	82% to 85%	as per LSRCA and other references
OGS*	50%	
JellyFish*	85%	

*) TSS Removal as documented by ETV Canada

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Attachment B

Water Budget Calculations

7000 Campeau Drive - Pre Development Water Balance

Table B1-1: Pre Development Conditions - Pervious Areas

Soil Condition	Land Use	Total Area (ha)	Total Imp (%)	Pervious Area (ha)	Impervious Area (ha)	Soil Type	Hydrologic Soil Group	Precipitation (mm/Year)	Evapo-transpiration (mm/Year)	Surplus (mm/Year)	Infiltration Factor*				Infiltration (mm/yr.)	Runoff (mm/yr.)	Infiltration Volume (m³/yr.)	Runoff Volume (m³/yr.)
											Topography Factor	Soils Factor	Cover Factor	Total				
Silty Clay	Golf Course	42.14	3%	40.74	1.39	Silty Clay	B	940	525	415	0.2	0.2	0.1	0.5	207.5	208	84,542	84,542
Bedrock	Golf Course	19.07	5%	18.16	0.91	Bedrock	C	940	536	404	0.2	0.2	0.1	0.5	202	202	36,689	36,689
Fill-Silty Clay	Golf Course	4.61	18%	3.80	0.81	Fill-Silty Clay	C	940	536	404	0.2	0.2	0.1	0.5	202	202	7,684	7,684
Fill-Silty Sand	Golf Course	3.39	23%	2.61	0.79	Fill-Silty Sand	A	940	515	425	0.2	0.2	0.1	0.5	212.5	213	5,538	5,538
Glacial Till	Golf Course	1.81	4%	1.73	0.08	Glacial Till	C	940	536	404	0.2	0.2	0.1	0.5	202	202	3,503	3,503
Total		**71.03**	**6%**	**67.05**	**3.98**												**137,955**	**137,955**

Table B1-2: Pre Development Conditions - Impervious Areas

Condition	Land Use	Total Area (ha)	Total Imp (%)	Pervious Area (ha)	Impervious Area (ha)	Precipitation (mm/Year)	Evaporation* (mm/Year)	Surplus (mm/Year)	Infiltration (mm/yr.)	Runoff (mm/yr.)	Infiltration Volume (m³/yr.)	Runoff Volume (m³/yr.)
Silty Clay	Golf Course	42.14	3%	40.74	1.39	940	244	696	0	696	0	9,690
Bedrock	Golf Course	19.07	5%	18.16	0.91	940	244	696	0	696	0	6,330
Fill-Silty Clay	Golf Course	4.61	18%	3.80	0.81	940	244	696	0	696	0	5,620
Fill-Silty Sand	Golf Course	3.39	23%	2.61	0.79	940	244	696	0	696	0	5,481
Glacial Till	Golf Course	1.81	4%	1.73	0.08	940	244	696	0	696	0	550
Total		**71.03**	**6%**	**67.05**	**3.98**						**0**	**27,671**

* Value based on average annual simulated rates using continuous simulations of 39 years of Ottawa rainfall data and City of Ottawa default model paraments (26% of annual precipitation)

Table B1-3: Pre Development Conditions - Water Budget Summary

Condition	Land Use	Total Area (ha)	Total Imp (%)	Pervious Area (ha)	Impervious Area (ha)	Pervious Runoff Volume (m³/yr.)	Impervious Runoff Volume (m³/yr.)	Runoff Volume (m³/yr.)	Infiltration Volume (m³/yr.)
Silty Clay	Golf Course	42.14	3%	40.74	1.39	84,542	9,690	94,231	84,542
Bedrock	Golf Course	19.07	5%	18.16	0.91	36,689	6,330	43,019	36,689
Fill-Silty Clay	Golf Course	4.61	18%	3.80	0.81	7,684	5,620	13,305	7,684
Fill-Silty Sand	Golf Course	3.39	23%	2.61	0.79	5,538	5,481	11,019	5,538
Glacial Till	Golf Course	1.81	4%	1.73	0.08	3,503	550	4,052	3,503
Total		**71.03**	**6%**	**67.05**	**3.98**			**165,626**	**137,955**

7000 Campeau Drive - Post Development Water Balance

Table B2-1: Post Development Conditions - Pervious Areas

Condition	Land Use	Total Area (ha)	Total Imp (%)	Pervious Area (ha)	Impervious Area (ha)	Soil Type	Hydrologic Soil Group	Precipitation (mm/Year)	Evapo-transpiration (mm/Year)	Surplus (mm/Year)	Infiltration Factor*				Infiltration (mm/yr.)	Runoff (mm/yr.)	Infiltration Volume (m^3/yr.)	Runoff Volume (m^3/yr.)
											Topography Factor	Soils Factor	Cover Factor	Total				
Silty Clay	Residential	42.14	64%	15.04	27.09	Silty Clay	B	940	525	415	0.2	0.2	0.1	0.5	207.5	208	31,213	31,213
Bedrock	Residential	19.07	64%	6.81	12.26	Bedrock	C	940	536	404	0.2	0.2	0.1	0.5	202	202	13,754	13,754
Fill-Silty Clay	Residential	4.61	64%	1.65	2.97	Fill-Silty Clay	C	940	536	404	0.2	0.2	0.1	0.5	202	202	3,326	3,326
Fill-Silty Sand	Residential	3.39	64%	1.21	2.18	Fill-Silty Sand	A	940	515	425	0.2	0.2	0.1	0.5	212.5	213	2,575	2,575
Glacial Till	Residential	1.81	64%	0.65	1.17	Glacial Till	C	940	536	404	0.2	0.2	0.1	0.5	202	202	1,307	1,307
Total		**71.03**		**25.36**	**45.67**												**52,176**	**52,176**

Table B2-2: Post Development Conditions - Impervious Areas

Condition	Land Use	Total Area (ha)	Total Imp (%)	Pervious Area (ha)	Impervious Area (ha)	Precipitation (mm/Year)	Evaporation* (mm/Year)	Surplus (mm/Year)	Infiltration (mm/yr.)	Runoff (mm/yr.)	Infiltration Volume (m^3/yr.)	Runoff Volume (m^3/yr.)
Silty Clay	Residential	42.14	64%	15.04	27.09	940	244	696	0	696	0	188,570
Bedrock	Residential	19.07	64%	6.81	12.26	940	244	696	0	696	0	85,357
Fill-Silty Clay	Residential	4.61	64%	1.65	2.97	940	244	696	0	696	0	20,640
Fill-Silty Sand	Residential	3.39	64%	1.21	2.18	940	244	696	0	696	0	15,189
Glacial Till	Residential	1.81	64%	0.65	1.17	940	244	696	0	696	0	8,114
Total		**71.03**		**25.36**	**45.67**						**0**	**317,870**

* Value based on average annual simulated rates using continuous simulations of 39 years of Ottawa rainfall data and City of Ottawa default model paraments (26% of annual precipitation)

Table B2-3: Post Development Conditions - Water Budget Summary

Condition	Land Use	Total Area (ha)	Total Imp (%)	Pervious Area (ha)	Impervious Area (ha)	Pervious Runoff Volume (m^3/yr.)	Impervious Runoff Volume (m^3/yr.)	Runoff Volume (m^3/yr.)	Infiltration Volume (m^3/yr.)
Silty Clay	Residential	42.14	64%	15.04	27.09	31,213	188,570	219,784	31,213
Bedrock	Residential	19.07	64%	6.81	12.26	13,754	85,357	99,111	13,754
Fill-Silty Clay	Residential	4.61	64%	1.65	2.97	3,326	20,640	23,966	3,326
Fill-Silty Sand	Residential	3.39	64%	1.21	2.18	2,575	15,189	17,764	2,575
Glacial Till	Residential	1.81	64%	0.65	1.17	1,307	8,114	9,421	1,307
Total		**71.03**		**25.36**	**45.67**			**370,046**	**52,176**

Table B2-4: Post Development Conditions - LID Infiltration Requirements

Description	Total Runoff Area (ha)	Area treated by LID (%)	Total Treated Area (ha)	Average Site Runoff (mm/yr.)	LID Storm Design Capacity (mm)	LID Runoff Capture Capacity[1] (mm)	Annual Rainfall Percentile Capture[2]	Captured Runoff (mm/yr.)	LID Infiltrated Volume (m^3/yr.)	Site Infiltration Surplus (m^3/yr.)
LID System	71.0	100%	71.03	521	22.0	10.03	95%	226	160,446	74,666

1 Refer to "TIMP vs Runoff Volume Summary Tables" in Attachment C

2 Refer table B2-5 Ottawa Airport Annual Rainfall Percentiles J.L. Richard - Barrhaven South MSS (2021)

Table B2-5: Ottawa Airport Annual Rainfall Percentiles
J.L. Richard - Barrhaven South MSS (2021)

Event Percentile	Rainfall Depth (mm)
0	0
50	2.9
55	3.4
60	4.2
65	5.1
70	6.2
75	7.5
80	9.1
85	11.4
90	15.1
95	21.6
99	37.1

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Table 3.1: Hydrologic Cycle Component Values

	Water Holding Capacity mm	Hydrologic Soil Group	Precipitation mm	Evapo-transpiration mm	Runoff mm	Infiltration* mm
Urban Lawns/Shallow Rooted Crops (spinach, beans, beets, carrots)						
Fine Sand	50	A	940	515	149	276
Fine Sandy Loam	75	B	940	525	187	228
Silt Loam	125	C	940	536	222	182
Clay Loam	100	CD	940	531	245	164
Clay	75	D	940	525	270	145
Moderately Rooted Crops (corn and cereal grains)						
Fine Sand	75	A	940	525	125	291
Fine Sandy Loam	150	B	940	539	160	241
Silt Loam	200	C	940	543	199	199
Clay Loam	200	CD	940	543	218	179
Clay	150	D	940	539	241	160
Pasture and Shrubs						
Fine Sand	100	A	940	531	102	307
Fine Sandy Loam	150	B	940	539	140	261
Silt Loam	250	C	940	546	177	217
Clay Loam	250	CD	940	546	197	197
Clay	200	D	940	543	218	179
Mature Forests						
Fine Sand	250	A	940	546	79	315
Fine Sandy Loam	300	B	940	548	118	274
Silt Loam	400	C	940	550	156	234
Clay Loam	400	CD	940	550	176	215
Clay	350	D	940	549	196	196

Notes: Hydrologic Soil Group A represents soils with low runoff potential and Soil Group D represents soils with high runoff potential. The evapotranspiration values are for mature vegetation. Streamflow is composed of baseflow and runoff.

* *This is the total infiltration of which some discharges back to the stream as base flow. The infiltration factor is determined by summing a factor for topography, soils and cover.*

Infiltration Factor*		Value
Topography	Flat Land, average slope < 0.6 m/km	0.3
	Rolling Land, average slope 2.8 m to 3.8 m/km	0.2
	Hilly Land, average slope 28 m to 47 m/km	0.1
Soils	Tight impervious clay	0.1
	Medium combinations of clay and loam	0.2
	Open Sandy loam	0.4
Cover	Cultivated Land	0.1
	Woodland	0.2

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Attachment C

TIMP vs Runoff Volume Summary Tables

TIMP vs Runoff Volume Summary Tables

Runoff Volume (mm) Generated for 5 mm event

TIMP	XIMP = % of TIMP										
	1.00	0.90	0.80	0.70	0.60	0.50	0.40	0.30	0.20	0.10	0.01
95.0%	3.26	2.93	2.63	2.50	2.42	2.39	2.39	2.43	2.48	2.54	2.62
90.0%	3.09	2.78	2.47	2.16	1.86	1.69	1.60	1.51	1.43	1.38	1.36
85.0%	2.91	2.62	2.33	2.04	1.75	1.46	1.17	0.97	0.82	0.73	0.66
80.0%	2.74	2.47	2.19	1.92	1.65	1.37	1.10	0.82	0.55	0.30	0.15
75.0%	2.57	2.31	2.06	1.80	1.54	1.29	1.03	0.77	0.51	0.26	0.03
70.0%	2.40	2.16	1.92	1.68	1.44	1.20	0.96	0.72	0.48	0.24	0.02
65.0%	2.23	2.01	1.78	1.56	1.34	1.11	0.89	0.67	0.45	0.22	0.02
60.0%	2.06	1.85	1.65	1.44	1.23	1.03	0.82	0.62	0.41	0.21	0.02
55.0%	1.89	1.70	1.51	1.32	1.13	0.94	0.75	0.57	0.38	0.19	0.02
50.0%	1.71	1.54	1.37	1.20	1.03	0.86	0.69	0.51	0.34	0.17	0.02
45.0%	1.54	1.39	1.23	1.08	0.93	0.77	0.62	0.46	0.31	0.15	0.02
40.0%	1.37	1.23	1.10	0.96	0.82	0.69	0.55	0.41	0.27	0.14	0.01

Runoff Volume (mm) Generated for 10 mm event

TIMP	XIMP = % of TIMP										
	1.00	0.90	0.80	0.70	0.60	0.50	0.40	0.30	0.20	0.10	0.01
95.0%	8.01	7.32	7.02	6.88	6.83	6.85	6.90	6.97	7.06	7.16	7.28
90.0%	7.59	6.83	6.24	5.92	5.65	5.48	5.36	5.29	5.24	5.24	5.25
85.0%	7.17	6.45	5.73	5.20	4.90	4.58	4.34	4.15	3.99	3.88	3.80
80.0%	6.74	6.07	5.39	4.72	4.24	3.91	3.62	3.33	3.08	2.87	2.72
75.0%	6.32	5.69	5.06	4.43	3.79	3.33	2.96	2.69	2.42	2.15	1.90
70.0%	5.90	5.31	4.72	4.13	3.54	2.95	2.48	2.09	1.80	1.54	1.32
65.0%	5.48	4.93	4.38	3.84	3.29	2.74	2.19	1.68	1.32	0.96	0.73
60.0%	5.06	4.55	4.05	3.54	3.03	2.53	2.02	1.52	1.01	0.61	0.31
55.0%	4.64	4.17	3.71	3.25	2.78	2.32	1.85	1.39	0.93	0.46	0.05
50.0%	4.21	3.79	3.37	2.95	2.53	2.11	1.69	1.26	0.84	0.42	0.04
45.0%	3.79	3.41	3.03	2.66	2.28	1.90	1.52	1.14	0.76	0.38	0.04
40.0%	3.37	3.03	2.70	2.36	2.02	1.69	1.35	1.01	0.67	0.34	0.03

Runoff Volume (mm) Generated for 15 mm event

TIMP	XIMP = % of TIMP										
	1.00	0.90	0.80	0.70	0.60	0.50	0.40	0.30	0.20	0.10	0.01
95.0%	12.76	11.96	11.67	11.58	11.58	11.62	11.71	11.83	11.95	12.08	12.19
90.0%	12.09	11.08	10.54	10.18	9.96	9.81	9.74	9.72	9.72	9.75	9.78
85.0%	11.42	10.31	9.68	9.16	8.78	8.49	8.28	8.12	8.00	7.93	7.88
80.0%	10.74	9.67	8.85	8.35	7.85	7.44	7.14	6.87	6.66	6.49	6.36
75.0%	10.07	9.06	8.16	7.54	7.08	6.61	6.20	5.85	5.56	5.30	5.11
70.0%	9.40	8.46	7.52	6.83	6.31	5.87	5.43	5.00	4.65	4.33	4.08
65.0%	8.73	7.86	6.98	6.18	5.59	5.13	4.72	4.32	3.91	3.52	3.22
60.0%	8.06	7.25	6.45	5.64	4.99	4.44	4.01	3.64	3.27	2.89	2.55
55.0%	7.39	6.65	5.91	5.17	4.43	3.89	3.39	2.97	2.62	2.28	1.97
50.0%	6.71	6.04	5.37	4.70	4.03	3.36	2.88	2.43	1.97	1.66	1.38
45.0%	6.04	5.44	4.83	4.23	3.63	3.02	2.42	1.97	1.55	1.15	0.79
40.0%	5.37	4.83	4.30	3.76	3.22	2.69	2.15	1.61	1.14	0.78	0.45

Runoff Volume (mm) Generated for 20 mm event

TIMP	XIMP = % of TIMP										
	1.00	0.90	0.80	0.70	0.60	0.50	0.40	0.30	0.20	0.10	0.01
95.0%	17.51	16.70	16.46	16.41	16.44	16.53	16.65	16.76	16.89	17.02	17.14
90.0%	16.59	15.58	15.02	14.70	14.51	14.43	14.39	14.40	14.42	14.48	14.57
85.0%	15.67	14.60	13.89	13.39	13.04	12.79	12.60	12.49	12.43	12.39	12.37
80.0%	14.74	13.62	12.91	12.28	11.81	11.44	11.16	10.92	10.73	10.60	10.51
75.0%	13.82	12.68	11.98	11.31	10.74	10.30	9.91	9.59	9.35	9.11	8.93
70.0%	12.90	11.79	11.04	10.42	9.80	9.28	8.84	8.44	8.11	7.83	7.61
65.0%	11.98	10.89	10.10	9.52	8.95	8.37	7.87	7.44	7.06	6.72	6.44
60.0%	11.06	9.99	9.24	8.63	8.10	7.57	7.03	6.55	6.13	5.75	5.44
55.0%	10.14	9.12	8.40	7.74	7.25	6.76	6.28	5.79	5.30	4.91	4.56
50.0%	9.21	8.29	7.57	6.94	6.40	5.96	5.52	5.08	4.63	4.19	3.79
45.0%	8.29	7.46	6.73	6.17	5.60	5.15	4.76	4.36	3.97	3.57	3.21
40.0%	7.37	6.63	5.90	5.40	4.89	4.38	3.99	3.65	3.29	2.94	2.62

Runoff Volume (mm) Generated for 22 mm event

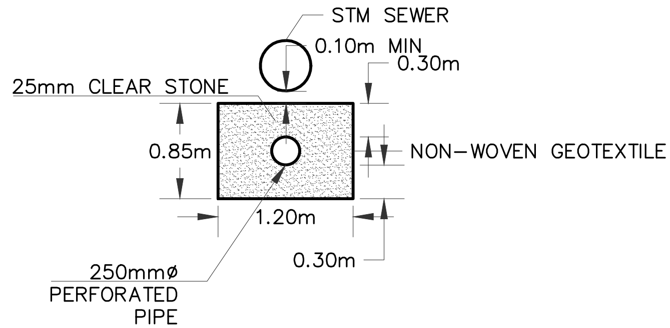
TIMP	XIMP = % of TIMP										
	1.00	0.90	0.80	0.70	0.60	0.50	0.40	0.30	0.20	0.10	0.01
95.0%	19.41	18.62	18.40	18.36	18.41	18.52	18.63	18.75	18.87	19.00	19.12
90.0%	18.39	17.40	16.86	16.55	16.39	16.32	16.29	16.30	16.34	16.43	16.53
85.0%	17.37	16.35	15.63	15.15	14.81	14.56	14.41	14.32	14.26	14.23	14.22
80.0%	16.34	15.33	14.53	13.94	13.47	13.12	12.84	12.62	12.47	12.35	12.29
75.0%	15.32	14.30	13.55	12.86	12.32	11.87	11.51	11.21	10.95	10.73	10.58
70.0%	14.30	13.27	12.58	11.89	11.26	10.76	10.32	9.95	9.64	9.37	9.14
65.0%	13.28	12.30	11.60	10.95	10.31	9.75	9.27	8.85	8.48	8.14	7.88
60.0%	12.26	11.34	10.62	10.03	9.43	8.84	8.31	7.84	7.46	7.08	6.78
55.0%	11.24	10.38	9.64	9.10	8.55	8.01	7.46	6.96	6.53	6.13	5.81
50.0%	10.21	9.42	8.72	8.17	7.68	7.18	6.68	6.19	5.69	5.29	4.93
45.0%	9.19	8.46	7.83	7.24	6.79	6.34	5.90	5.45	5.02	4.56	4.16
40.0%	8.17	7.50	6.93	6.38	5.91	5.52	5.13	4.73	4.33	3.93	3.58

Runoff Volume (mm) Generated for 25 mm event

TIMP	XIMP = % of TIMP										
	1.00	0.90	0.80	0.70	0.60	0.50	0.40	0.30	0.20	0.10	0.01
95.0%	22.29	21.52	21.32	21.30	21.38	21.49	21.60	21.72	21.85	21.98	22.10
90.0%	21.16	20.17	19.65	19.37	19.23	19.18	19.16	19.19	19.28	19.39	19.48
85.0%	20.02	18.99	18.29	17.83	17.50	17.29	17.17	17.09	17.05	17.03	17.04
80.0%	18.88	17.89	17.07	16.49	16.05	15.72	15.45	15.26	15.14	15.04	14.98
75.0%	17.75	16.79	15.94	15.29	14.75	14.33	13.99	13.69	13.45	13.27	13.14
70.0%	16.61	15.69	14.89	14.16	13.58	13.08	12.67	12.31	12.01	11.75	11.53
65.0%	15.47	14.59	13.84	13.10	12.48	11.95	11.47	11.07	10.70	10.41	10.16
60.0%	14.33	13.49	12.81	12.12	11.44	10.89	10.40	9.95	9.55	9.19	8.89
55.0%	13.20	12.40	11.77	11.14	10.50	9.89	9.40	8.91	8.51	8.11	7.79
50.0%	12.06	11.29	10.72	10.16	9.58	9.00	8.45	7.98	7.52	7.14	6.79
45.0%	10.92	10.20	9.68	9.17	8.65	8.13	7.62	7.10	6.67	6.26	5.88
40.0%	9.79	9.13	8.64	8.18	7.72	7.27	6.81	6.34	5.88	5.45	5.11

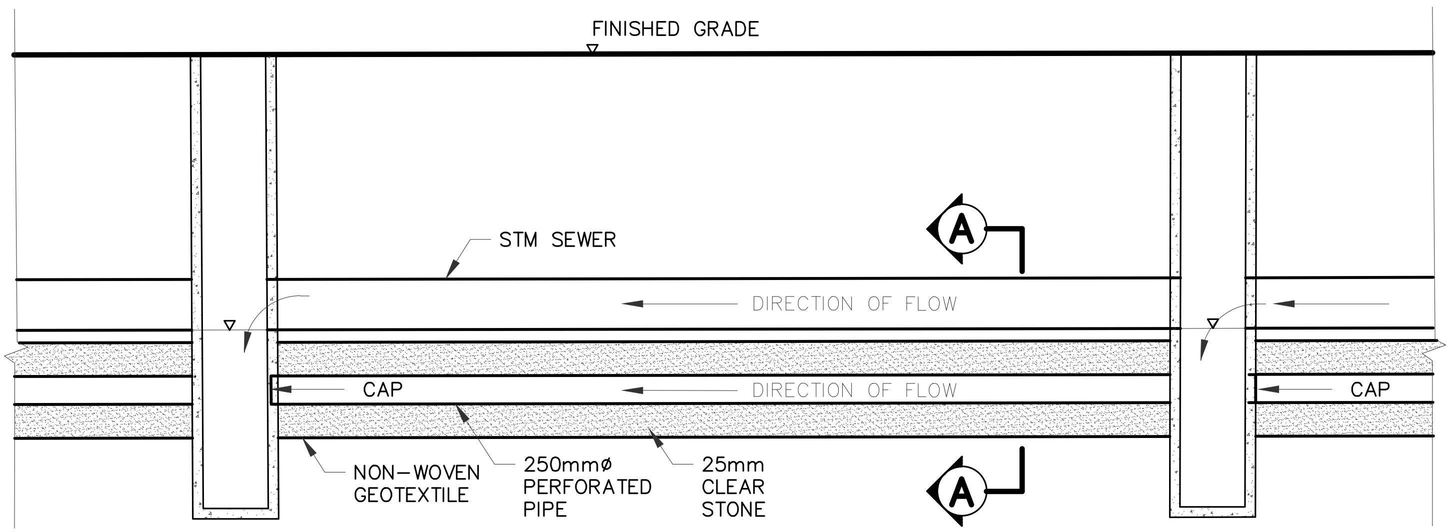
Runoff Volume (mm) Generated for 30 mm event

TIMP	XIMP = % of TIMP										
	1.00	0.90	0.80	0.70	0.60	0.50	0.40	0.30	0.20	0.10	0.01
95.0%	27.14	26.38	26.22	26.24	26.34	26.45	26.57	26.69	26.82	26.95	27.08
90.0%	25.86	24.85	24.36	24.14	24.03	23.99	24.03	24.12	24.21	24.31	24.39
85.0%	24.57	23.49	22.82	22.39	22.12	21.96	21.86	21.80	21.77	21.79	21.85
80.0%	23.28	22.20	21.43	20.87	20.47	20.16	19.95	19.81	19.70	19.63	19.58
75.0%	22.00	20.94	20.12	19.48	18.98	18.59	18.26	18.02	17.83	17.70	17.59
70.0%	20.71	19.73	18.86	18.19	17.62	17.16	16.77	16.43	16.14	15.93	15.77
65.0%	19.42	18.51	17.64	16.94	16.34	15.82	15.39	15.02	14.67	14.38	14.14
60.0%	18.14	17.29	16.45	15.74	15.14	14.59	14.11	13.70	13.31	13.01	12.71
55.0%	16.85	16.08	15.30	14.58	13.96	13.43	12.92	12.48	12.06	11.72	11.41
50.0%	15.56	14.86	14.16	13.45	12.86	12.29	11.81	11.36	10.94	10.53	10.21
45.0%	14.28	13.64	13.01	12.39	11.74	11.24	10.73	10.29	9.87	9.45	9.12
40.0%	12.99	12.44	11.88	11.31	10.74	10.20	9.75	9.29	8.87	8.49	8.14



SECTION DETAIL A

SCALE: N.T.S.



PROFILE

SCALE: N.T.S.

DSEL
david schaeffer engineering ltd

120 Iber Road, Unit 103
Stittsville, Ontario, K2S 1E9
Tel. (613) 836-0856
Fax. (613) 836-7183
www.DSEL.ca

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EXFILTRATION TRENCH DETAIL

SCALE:	NTS	PROJECT No.:	1061
DATE:	APRIL 2021	FIGURE:	1

memorandum

re: **Subsoil Infiltration Review**
Proposed Residential Development
Kanata Lakes Golf Club - 7000 Campeau Drive - Ottawa

to: Minto Communities - **Ms. Beth Henderson** - bhenderson@minto.com

date: April 7, 2021

file: PG4135-MEMO.04

Paterson Group (Paterson) has prepared the current memorandum report to provide anticipated infiltration rates to be encountered within the subsoils below the proposed stormwater exfiltration system. The memo should be read in conjunction with Paterson Report PG4135-2 Revision 5 dated April 12, 2021 and PG4135-LET.01 dated September 29, 2020.

Background Information

At the time of writing this report, it is understood that the proposed development will consist of residential dwellings, local roadways and landscaped areas. Municipal services will also be constructed as part of the proposed development. A stormwater exfiltration system is being considered across the subject site in order to manage stormwater accumulation.

Paterson completed geotechnical investigations at the subject site between December 6, 2017 and March 10, 2020. At that time, a total of 66 boreholes and 190 probe holes were extended to a maximum depth of 10 m below existing ground surface. Relevant test holes completed by others within the south portion of the subject site during April 1998 have also been included in the geotechnical studies.

The results of the geotechnical investigations indicated that, in general, the subsurface profile at the test hole locations consists of a topsoil layer and/or fill material overlying a very stiff to firm silty clay deposit. A compact to dense glacial till was generally found to be encountered below the above noted soils and consists of a silty clay/clayey silt matrix with varying amounts of sand, gravel and cobbles. Based on the field investigations and available geological mapping, the local bedrock consists of Precambrian mafic to ultramafic rocks as well as migmatic rocks. The overburden thickness is anticipated to vary between 0 and 20 m across the subject site.

Based on field observations such as moisture levels, colouring and consistency, the long-term groundwater level can be expected between 2 to 3 m depth. Groundwater levels are subject to seasonal fluctuations and could vary at the time of construction.

Subsoil Infiltration Values

Based on drawings provided by David Schaeffer Engineering Ltd. and field investigations completed by Paterson at the subject site, it is anticipated that the subsurface material underlying the proposed storm service alignment will consist of either fill material, silty clay, glacial till or bedrock throughout the proposed development. The approximate area extents of the anticipated materials along the proposed exfiltration system has been presented in the attached plan. It is recommended the system be placed above the long-term groundwater level to provide optimal conditions for water infiltration to the subsurface material.

The hydraulic conductivity values for the fill material, glacial till and bedrock were conservatively estimated based upon previous experience at similar sites in the area with similar stratigraphy and typical published values. Hydraulic conductivity values of the silty clay, at select borehole locations, were determined based on slug testing completed by Paterson at the subject site. Hydraulic conductivity values and infiltration rates for the subsurface material have been summarized in Table 1. It should be noted that a safety correction factor was not applied to the above noted infiltration rates for calculating the design infiltration rates.

Table 1 - Hydraulic Conductivity and Infiltration Rates

Subsurface Type	K (m/sec)	Infiltration Rate (mm/hr)
Fill Material (Silty Clay)	1.00E-09 to 1.00E-06	7 to 45
Fill Material (Silty Sand)	1.00E-05 to 1.00E-04	85 to 160
Silty Clay*	2.12E-08 to 3.96E-06	15 to 65
Glacial Till	1.00E-10 to 1.00E-06	5 to 45
Bedrock	1.00E-10 to 1.00E-06	5 to 45

* Hydraulic conductivity values based on slug testing completed by Paterson Group.

A permeameter testing program is recommended to obtain site specific infiltration values for the above noted fill material and glacial till. To determine design infiltration rates, it is recommended to complete a series of permeameter tests at the invert elevation of the proposed exfiltration system prior to finalizing the design.

We trust that this information satisfies your requirements.

Best Regards,

Paterson Group Inc.

Apr. 12-2021

LICENSED PROFESSIONAL ENGINEER
D. J. GILBERT
100116130
PROVINCE OF ONTARIO

Nicholas Zulinski, P.Geo., géo.

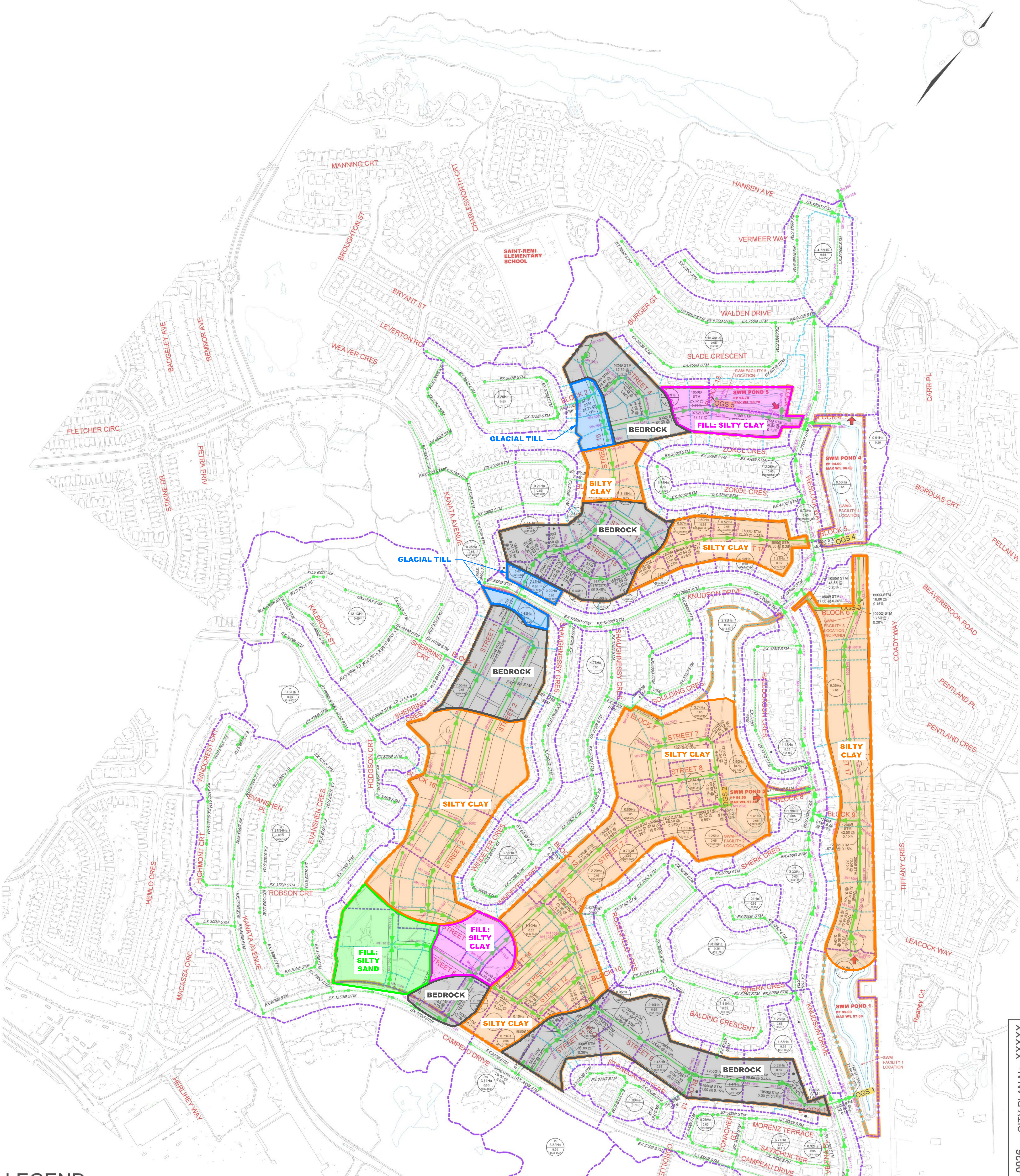
David J. Gilbert, P.Eng.

Paterson Group Inc.

Head Office
154 Colonnade Road South
Ottawa - Ontario - K2E 7J5
Tel: (613) 226-7381

Ottawa Laboratory
1-28 Concourse Gate
Ottawa - Ontario - K2E 7T7
Tel: (613) 226-7381

Northern Office and Laboratory
63 Gibson Street
North Bay - Ontario - P1B 8Z4
Tel: (705) 472-5331



LEGEND

- SUBJECT LANDS
- STORM TRUNK
- LOCAL STORM SEWER
- EXISTING STORM SEWER
- STORM MANHOLE
- EXISTING STORM SEWER TO BE REMOVED
- STORM MANHOLE TO BE REMOVED
- STORM TRUNK DRAINAGE AREA
- STORM SUB-DRAINAGE AREA
- DRAINAGE AREA / RUN-OFF COEFFICIENT / CONTRIBUTING UPSTREAM AND DOWNSTREAM MANHOLES
- POND EMERGENCY OVERLAND FLOW ROUTE
- ACCESS ROAD
- OGS — OIL GRIT SEPARATOR

CITY FILE No. D07-16-19-0026 CITY PLAN No. XXXXX

DSEL
david schaeffer engineering ltd

120 Iber Road, Unit 103
Stittsville, Ontario, K2S 1E9
Tel. (613) 836-0856
Fax. (613) 836-7183
www.DSEL.ca

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CITY OF OTTAWA

STORM SERVICING AND DRAINAGE PLAN

SCALE:	1:2500	PROJECT No.:	1061
DATE:	MAY 2020	DRAWING No.:	03D

APPENDIX E

GRADING AND DRAWINGS

PERMISSIBLE GRADE RAISE

(pink)	UP TO 2.0m
(green)	UP TO 2.5m
(white)	NO GRADE RAISE RESTRICTIONS

LEGEND:

- BOREHOLE LOCATION, CURRENT INVESTIGATION
- BOREHOLE WITH MONITORING WELL LOCATION, CURRENT INVESTIGATION
- PROBEHOLE LOCATION, CURRENT INVESTIGATION
- BOREHOLE LOCATION, PREVIOUS INVESTIGATION, PATERSON GROUP REPORT PG4135, JANUARY 2018
- BOREHOLE LOCATION BY OTHERS

105.20	GROUND SURFACE ELEVATION (m)
[104.29]	BEDROCK SURFACE ELEVATION (m)
(104.40)	PRACTICAL REFUSAL TO AUGERING ELEVATION (m)
{88.83}	ELEVATION AT BOTTOM OF TEST HOLE, REFUSAL NOT ENCOUNTERED (m)

TEST HOLE LOCATIONS AND GROUND SURFACE ELEVATIONS (CURRENT INVESTIGATION) PROVIDED BY STANTEC GEOMATICS LIMITED.

patersongroup
consulting engineers

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

NO.	REVISIONS	DATE	INITIAL
4	REVISED TO LATEST BASE PLAN	05/15/2019	DJG
3	REVISED TO LATEST BASE PLAN	03/17/2019	RG
2	REVISED TO LATEST BASE PLAN	07/26/2019	SD
1	REVISED TO LATEST BASE PLAN - ADDED BOREHOLES AND PROBEHOLES DURING MARCH 2019	04/04/2019	SD

MINTO COMMUNITIES INC.

GEOTECHNICAL INVESTIGATION
KANATA GOLF AND COUNTRY CLUB
OTTAWA, ONTARIO

Title:

PERMISSIBLE GRADE RAISE PLAN

Stamp:

Scale:	1:2000
Drawn by:	MPG
Checked by:	RG
Approved by:	DJG
Date:	03/2019
Report No.:	PG4135
Drawing No.:	PG4135-3
Revision No.:	4

p:\autocad drawings\geotechnical\pg41xx\pg4135\pg4135 permissible grade raise plan rev3(may 2020).dwg

NO.	REVISIONS	DATE	INITIAL
4	REVISED TO LATEST BASE PLAN	05/15/2019	DJG
3	REVISED TO LATEST BASE PLAN - NEW BOREHOLES ADDED	03/17/2019	RG
2	REVISED TO LATEST BASE PLAN	07/26/2019	SD
1	REVISED TO LATEST BASE PLAN - ADDED BOREHOLES AND PROBEHOLES DURING MARCH 2019	04/04/2019	SD

patersongroup
consulting engineers

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

MINTO COMMUNITIES INC.

GEOTECHNICAL INVESTIGATION
KANATA GOLF AND COUNTRY CLUB
OTTAWA, ONTARIO

Title:

PERMISSIBLE GRADE RAISE PLAN

Stamp:

Scale:	1:2000
Drawn by:	MPG
Checked by:	RG
Approved by:	DJG
Date:	03/2019
Report No.:	PG4135
Drawing No.:	PG4135-4
Revision No.:	4

Where a building is founded partly on bedrock and partly on soil, it is recommended to decrease the soil bearing resistance value by 25% for the footings placed on soil bearing media to reduce the potential long term total and differential settlements. Also, at the soil/bedrock and bedrock/soil transitions, it is recommended that the upper 0.5 m of the bedrock be removed for a minimum length of 2 m (on the bedrock side) and replaced with nominally compacted OPSS Granular A or Granular B Type II material. The width of the subexcavation should be at least the proposed footing width plus 0.5 m. Steel reinforcement, extending at least 3 m on both sides of the 2 m long transition, should be placed in the top part of the footings and foundation walls.

Bearing resistance values for footing design should be determined on a per lot basis at the time of construction.

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 sound bedrock bearing medium when a plane extending horizontally and vertically from the footing perimeter at a minimum of 1H:6V (or shallower) passing through sound bedrock or a material of the same or higher capacity as the bedrock, such as concrete.

Adequate lateral support is provided to a firm to stiff silty clay, compact glacial till or engineered fill above the groundwater table when a plane extending horizontally and vertically from the underside of the footing at a minimum of 1.5H:1V passing through in situ soil of the same or higher bearing capacity as the bearing medium soil.

Settlement and Permissible Grade Raise

Consideration must 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 dwellings, a minimum value of 50% of the live load is recommended by Paterson.

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

To reduce potential long term liabilities, consideration should be given to accounting for a larger groundwater lowering and to provide means to reduce long term groundwater lowering (e.g. clay dykes, restriction on planting around the dwellings, etc). Buildings on silty clay deposits increases the likelihood of movements and therefore of cracking. The use of steel reinforcement in foundations placed at key structural locations will tend to reduce foundation cracking compared to unreinforced foundations.

Based on the undrained shear strength values, our experience with Ottawa clays and consolidation testing results, permissible grade raise areas have been defined for the proposed development. The recommended permissible grade raise areas are presented in Drawings PG4135-3 and 4 - Permissible Grade Raise Plan in Appendix 2.

Where proposed grade raises exceed our permissible grade raise recommendations, several options could be considered for the foundation support of the proposed buildings:

Scenario A

Where the grade raise is close to, but below, the maximum permissible grade raise, consideration should be given to using more reinforcement in the design of the foundation (footings and walls) to reduce the risks of cracking in the concrete foundation. The use of control joints within the brick work between the garage and basement area should also be considered.

Scenario B

Where the grade raise cannot be accommodated with soil fill, the following options could be used alone or in combination.

Option 1 - Use of Lightweight Fill

Lightweight fill (LWF) can be used, consisting of EPS (expanded polystyrene) Type 19 or 22 blocks or other light weight materials which allow for raising the grade without adding a significant load to the underlying soils. However, these materials are expensive and, in the case of the EPS, are more difficult to use under the groundwater level, as they are buoyant, and must be protected against potential hydrocarbon spills. Use lightweight fill within the interior of the garage and porch areas to reduce the fill-related loads.

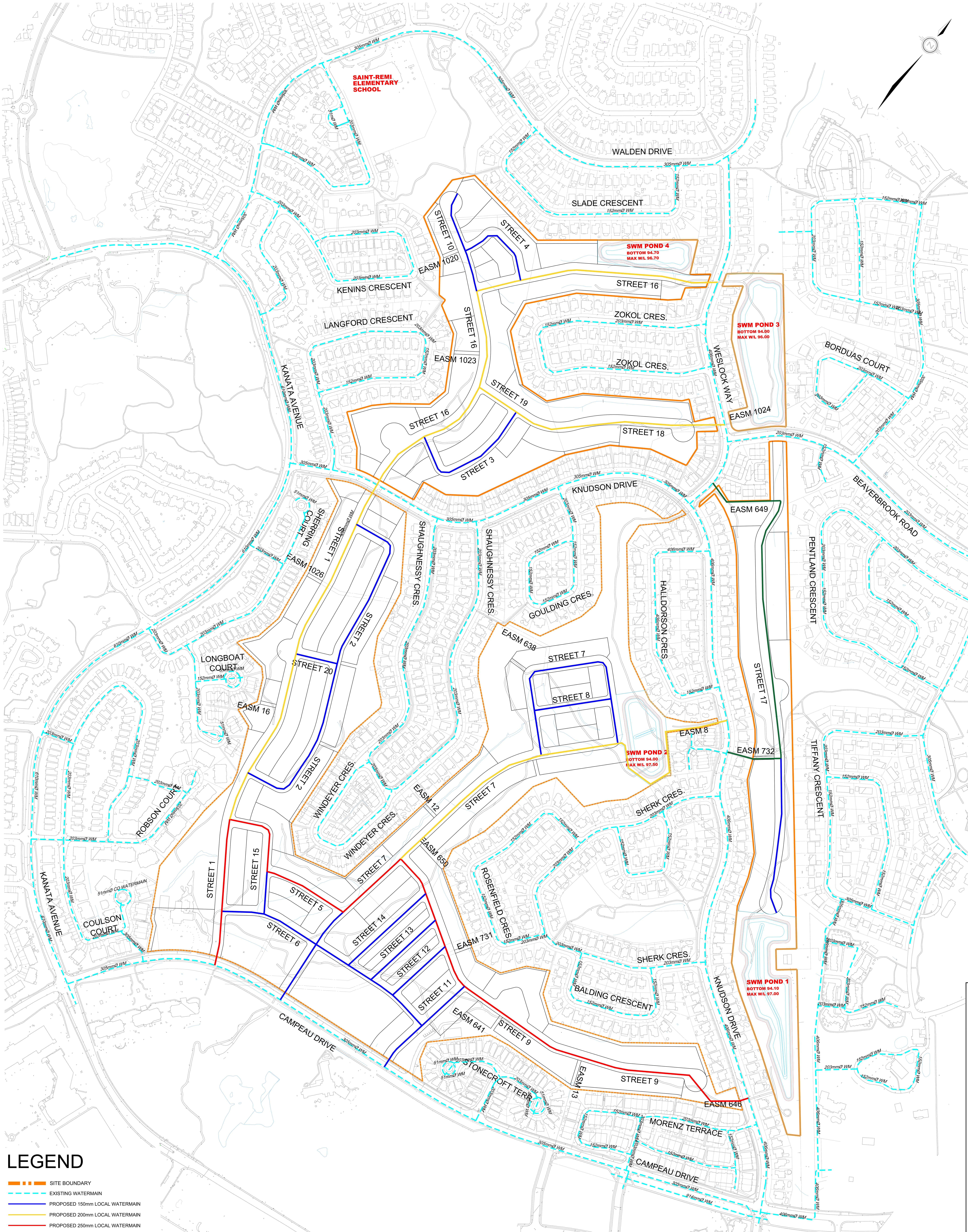
Option 2 - Preloading or Surcharging

It is possible to preload or surcharge the proposed site in localized areas provided sufficient time is available to achieve the desired settlements based on theoretical values from the settlement analysis. If this option is considered, a monitoring program using settlement plates will have to be implemented. This program will determine the amount of settlement in the preloaded or surcharged areas. Obviously, preloading to proposed finished grades will allow for consolidation of the underlying clays over a longer time period. Surcharging the site with additional fill above the proposed finished grade will add additional load to the underlying clays accelerating the consolidation process and allowing for accelerated settlements. Once the desired settlements are achieved, the site can be unloaded and the fill can be used elsewhere on site.

Once the required grade raises are established, the above options could be further discussed along with further recommendations on specific requirements.

5.4 Design for Earthquakes

It should be noted that where foundations are placed over glacial till, engineered fill over bedrock or directly over bedrock, Part 9 of the current OBC 2012 standard should be used for design purposes. Also, where foundations are placed over a silty clay, Part 4 of the current OBC 2012 standard should be used for design purposes. The area requiring permissible grade raise restrictions outlined in Drawings PG4135-3 and 4 - Permissible Grade Raise Plan in Appendix 2 should be used to delineate the houses where silty clay is anticipated below footing level.



CITY FILE No. D07-16-19-0026 CITY PLAN No. XXXXX

DSEL
david schaeffer engineering ltd

120 Iber Road, Unit 103
Stittsville, Ontario, K2S 1E9
Tel. (613) 836-0856
Fax. (613) 836-7183
www.DSEL.ca

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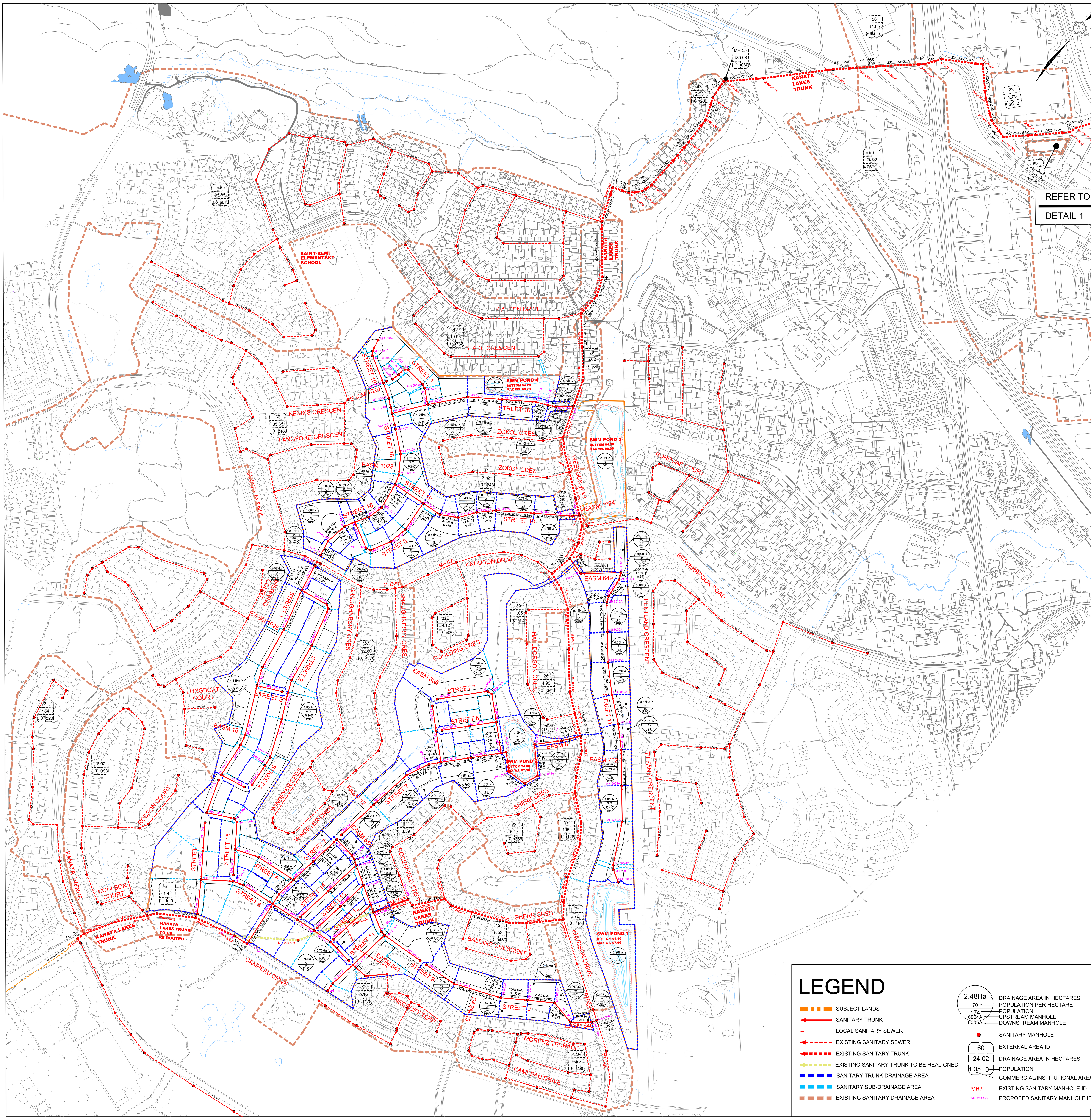
CITY OF OTTAWA

WATERMAIN SERVICING PLAN

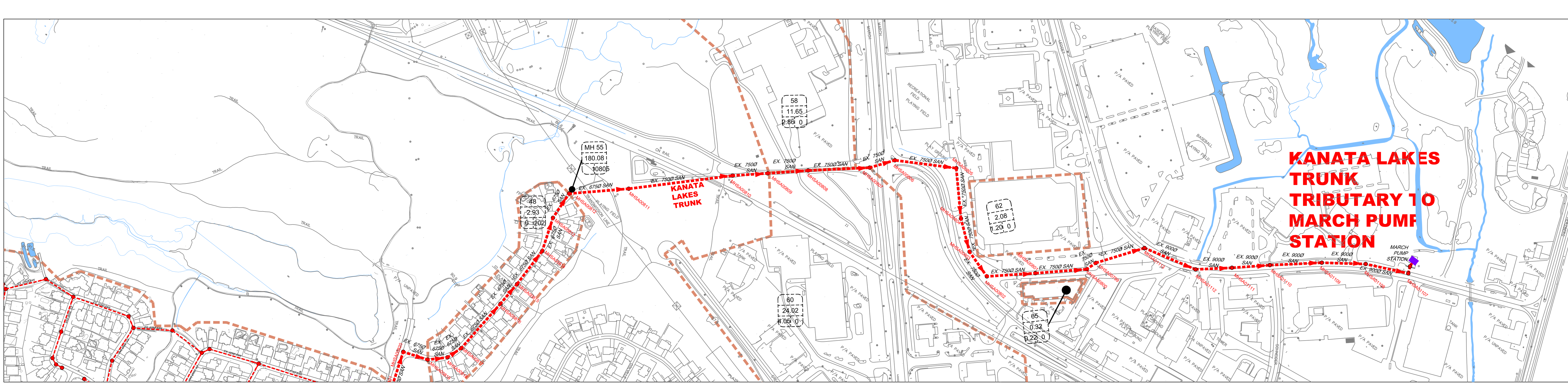
SCALE:	1:2000	PROJECT No.:	1061
DATE:	JUNE 2021	DRAWING No.:	01D



LEGEND

- SUBJECT LANDS
- SANITARY TRUNK
- LOCAL SANITARY SEWER
- EXISTING SANITARY SEWER
- EXISTING SANITARY TRUNK
- EXISTING SANITARY TRUNK TO BE REALIGNED
- SANITARY TRUNK DRAINAGE AREA
- SANITARY SUB-DRAINAGE AREA
- EXISTING SANITARY DRAINAGE AREA

2.48Ha	DRAINAGE AREA IN HECTARES
70	POPULATION PER HECTARE
174	POPULATION
6004A	UPSTREAM MANHOLE
6005A	DOWNSTREAM MANHOLE
●	SANITARY MANHOLE
60	EXTERNAL AREA ID
24.02	DRAINAGE AREA IN HECTARES
0	POPULATION
4.05	COMMERCIAL/INSTITUTIONAL AREA
MH30	EXISTING SANITARY MANHOLE ID
MH 6009A	PROPOSED SANITARY MANHOLE ID



DETAIL 1

CITY FILE No. D07-16-19-0026 CITY PLAN No. XXXXX

DSEL
david schaeffer engineering ltd
120 Iber Road, Unit 103
Stittsville, Ontario, K2S 1E9
Tel. (613) 836-0856
Fax. (613) 836-7183
www.DSEL.ca

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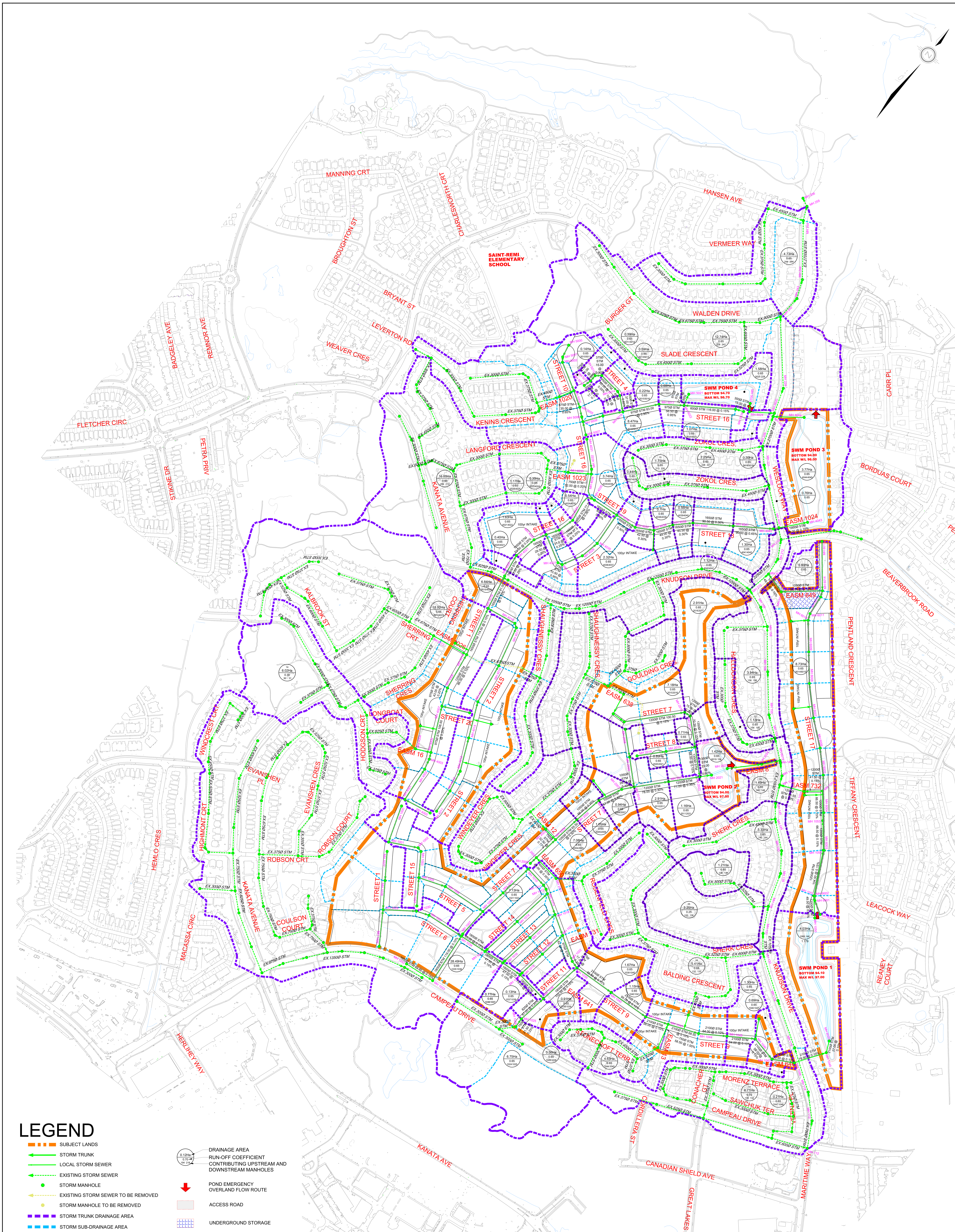
CITY OF OTTAWA

SANITARY SERVICING AND DRAINAGE PLAN

SCALE:	1:3000	PROJECT No.:	1061
DATE:	JUNE 2021	DRAWING No.:	02D



CITY FILE No. D07-16-19-0026	CITY PLAN No. XXXXX

DSEL
david schaeffer engineering ltd

120 Iber Road, Unit 103
Stittsville, Ontario, K2S 1E9
Tel. (613) 836-0856
Fax. (613) 836-7183
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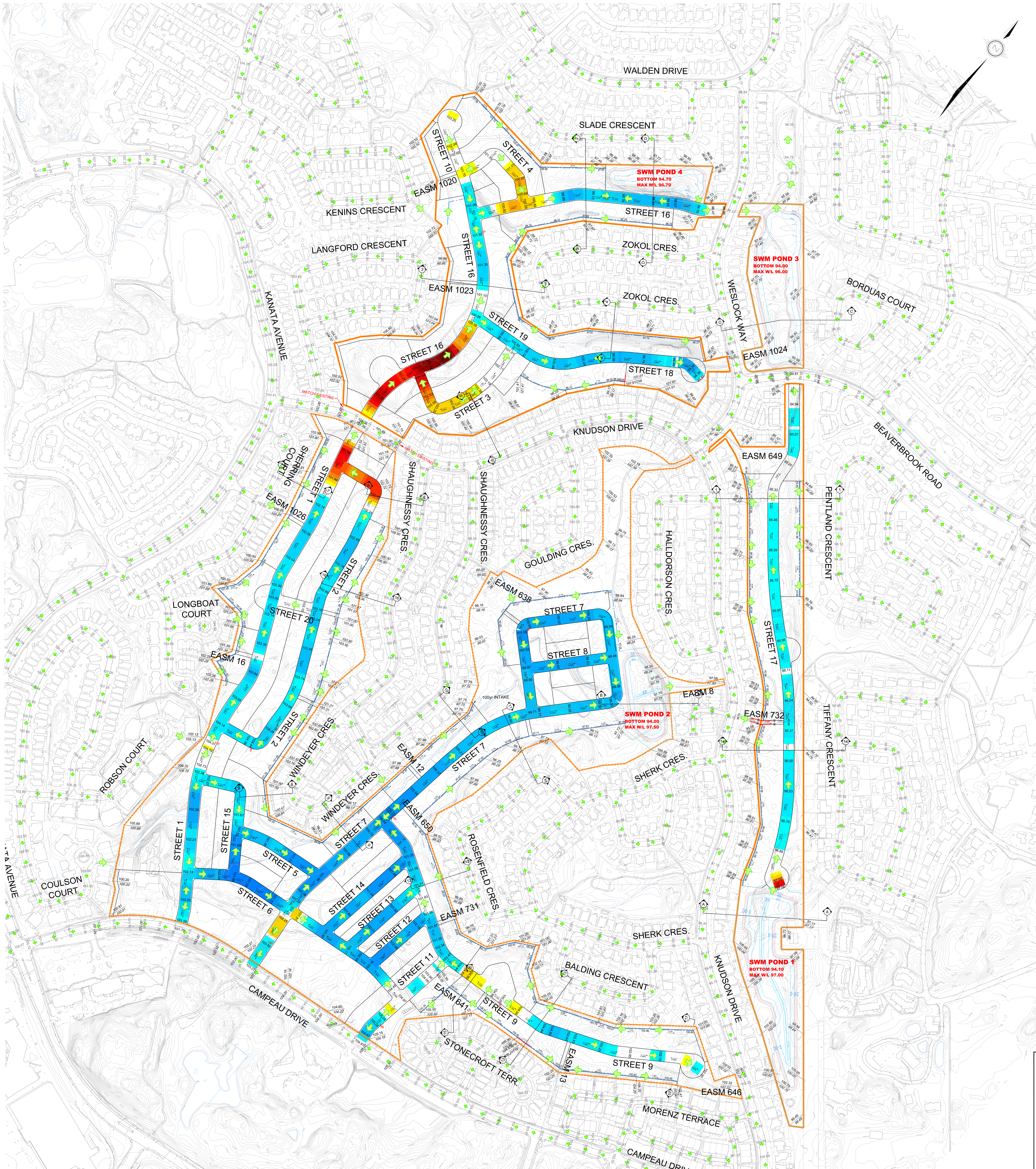
CITY OF OTTAWA

STORM SERVICING AND DRAINAGE PLAN

SCALE:	1:2500	PROJECT No.:	1061
DATE:	JUNE 2021	DRAWING No.:	03D



LEGEND

SITE BOUNDARY
STORM OVERLAND FLOW ARROW
PROPOSED CENTERLINE ELEVATION
EXISTING CENTERLINE ELEVATION
PROPOSED ELEVATION EXISTING ELEVATION
EXISTING CONTOUR ELEVATION
←1.00m— GRADE CHANGE

CUT-FILL DEPTH ALONG CENTER LINE:

CUT DEPTH (m)	FILL DEPTH (m)
0.00~0.50:	0.00~0.50:
0.50~1.00:	0.50~1.00:
1.00~1.50:	1.00~1.50:
1.50~2.00:	1.50~2.00:
2.00~2.50:	2.00~2.50:
2.50~3.00:	2.50~3.00:
3.00~3.50:	3.00~3.50:
3.50~4.00:	3.50~4.00:
4.00~4.50:	
4.50~5.00:	
5.00~5.50:	
5.50~6.00:	
>6.00	

CITY FILE No. D07-16-19-0026 CITY PLAN No. XXXXX

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david schaeffer engineering ltd

120 Iber Road, Unit 103
Stittsville, Ontario, K2S 1E9
Tel. (613) 836-0856
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www.DSEL.ca

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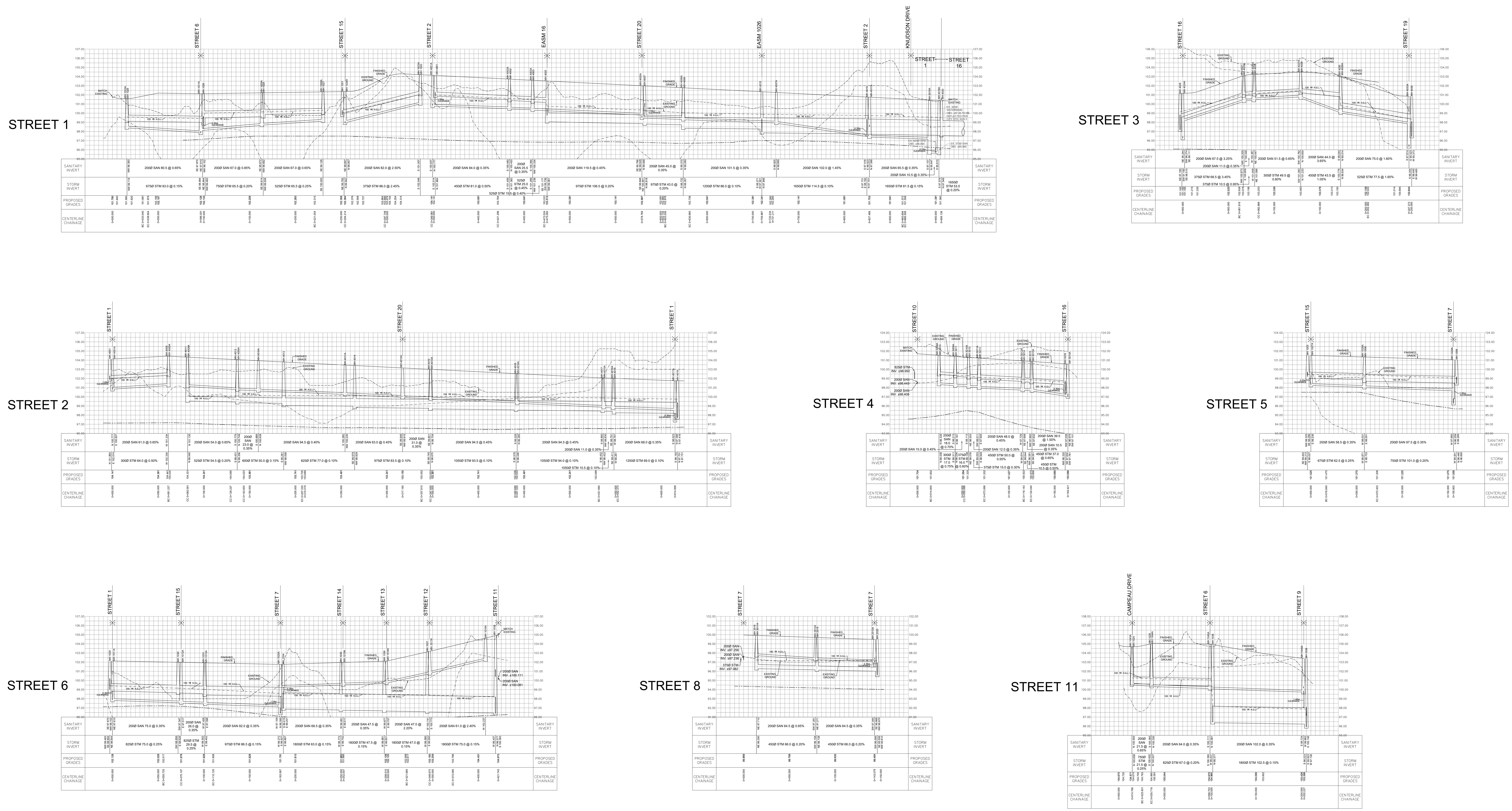
PRELIMINARY GRADING PLAN

SCALE:	1:2000	PROJECT No.:	1061
DATE:	JUNE 2021	DRAWING No.:	04D



LEGEND

- GROUNDWATER ELEVATION
- BEDROCK ELEVATION
- EXISTING GROUND
- PROPOSED GROUND

DSEL
david schaeffer engineering ltd
120 Iber Road, Unit 103 / 600 Alden Road, Suite 500
Stittsville, Ontario, K2S 1E9 / Markham, Ontario, L3R 0E7
Tel. (613) 836-0856 / Tel. (905) 475-0080
Fax. (613) 836-7183 / Fax. (905) 475-3081
www.DSEL.ca

7000 CAMPEAU DRIVE

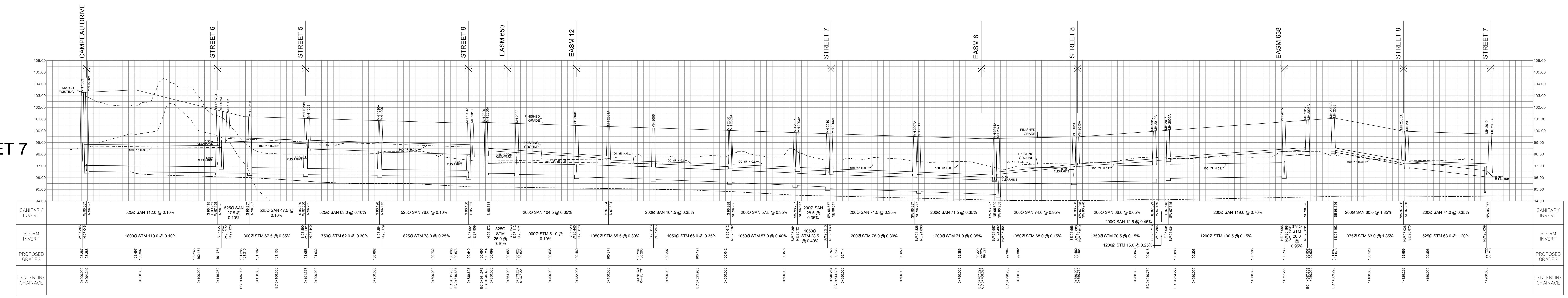
CITY OF OTTAWA

PROFILES

SCALE:	1:2000	PROJECT No.:	1061
DATE:	JUNE 2021	DRAWING:	05D

CITY FILE No. D07-16-19-0026 CITY PLAN No. XXXXX

STREET 7



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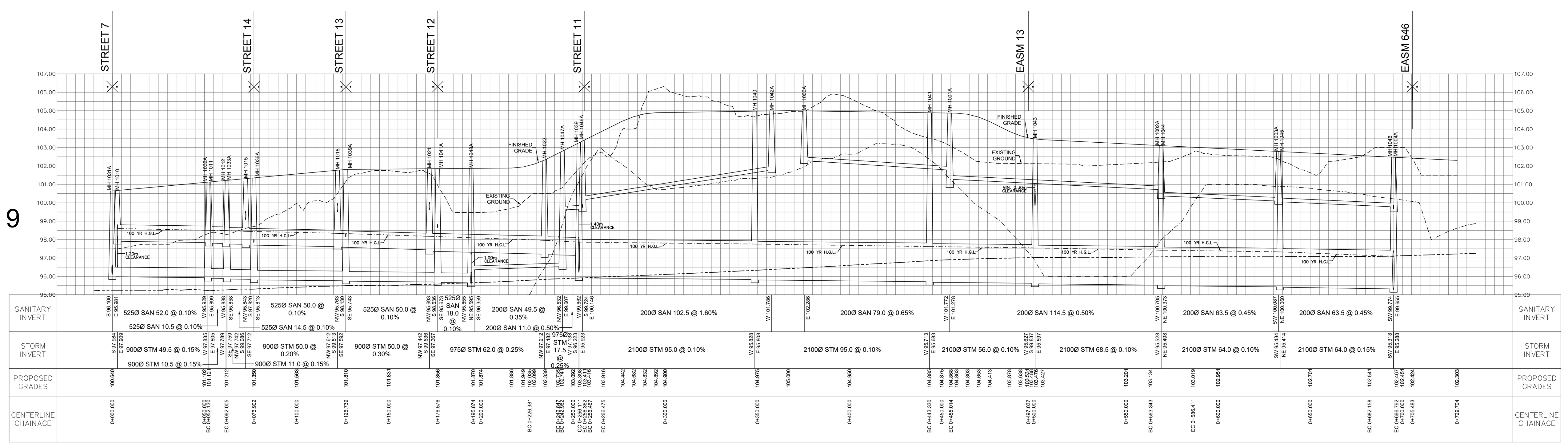

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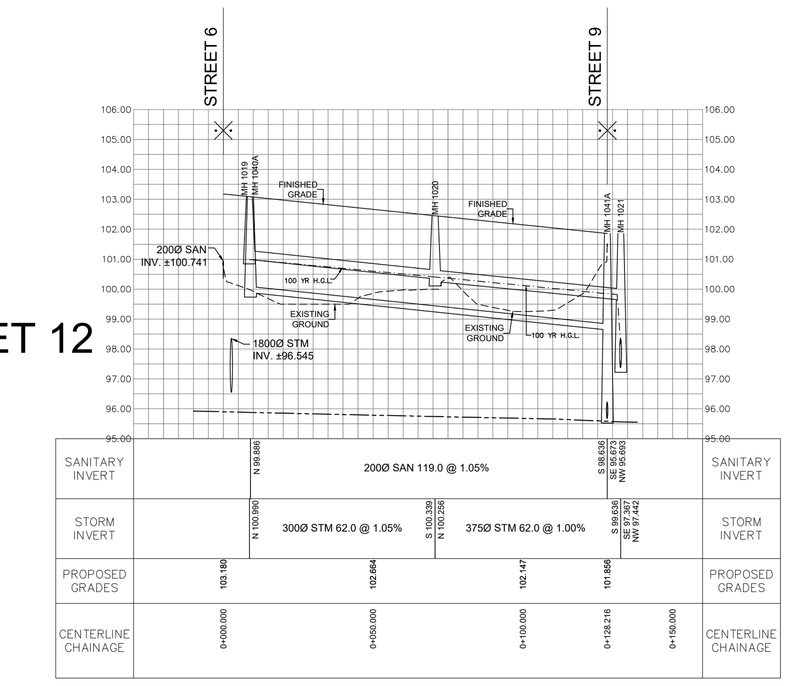

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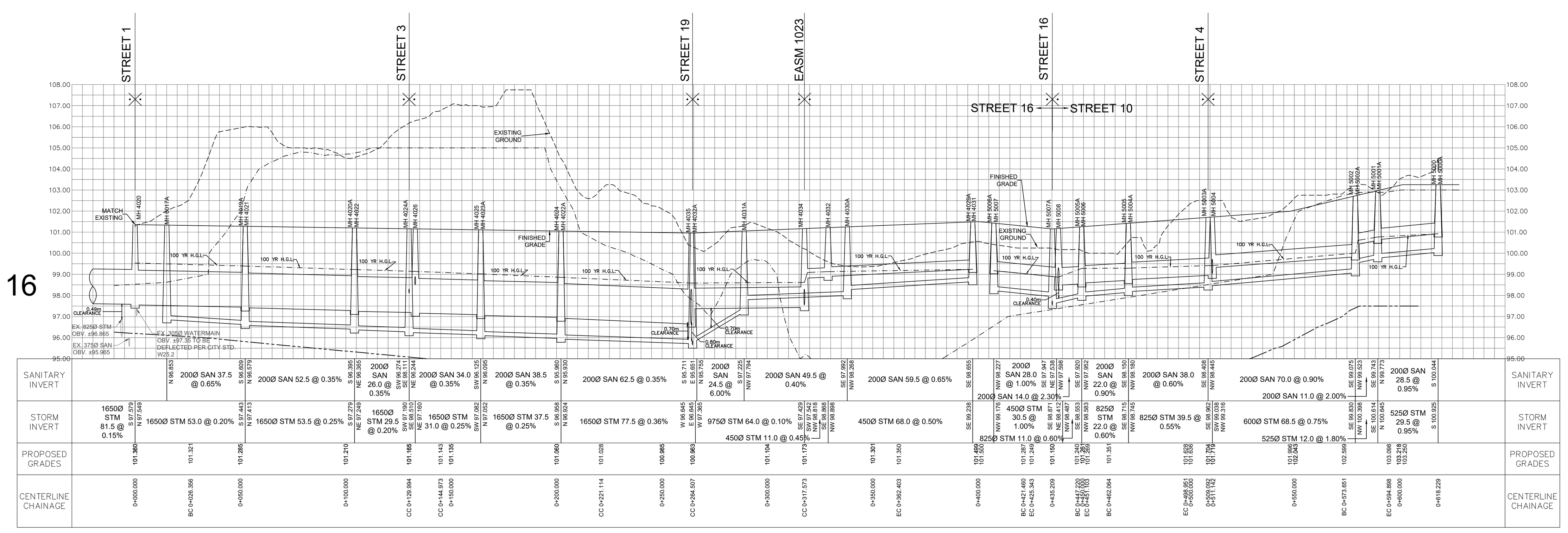

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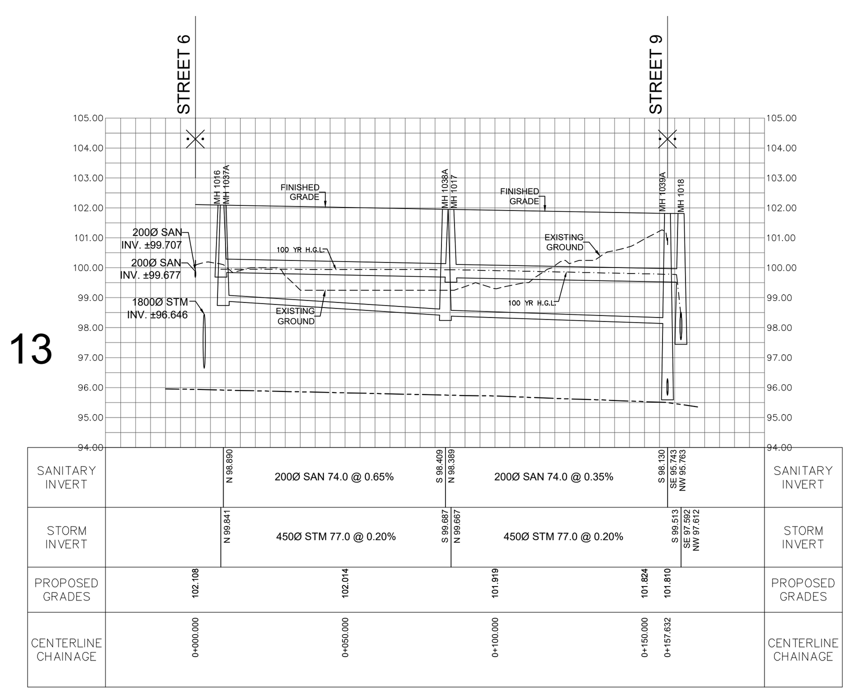

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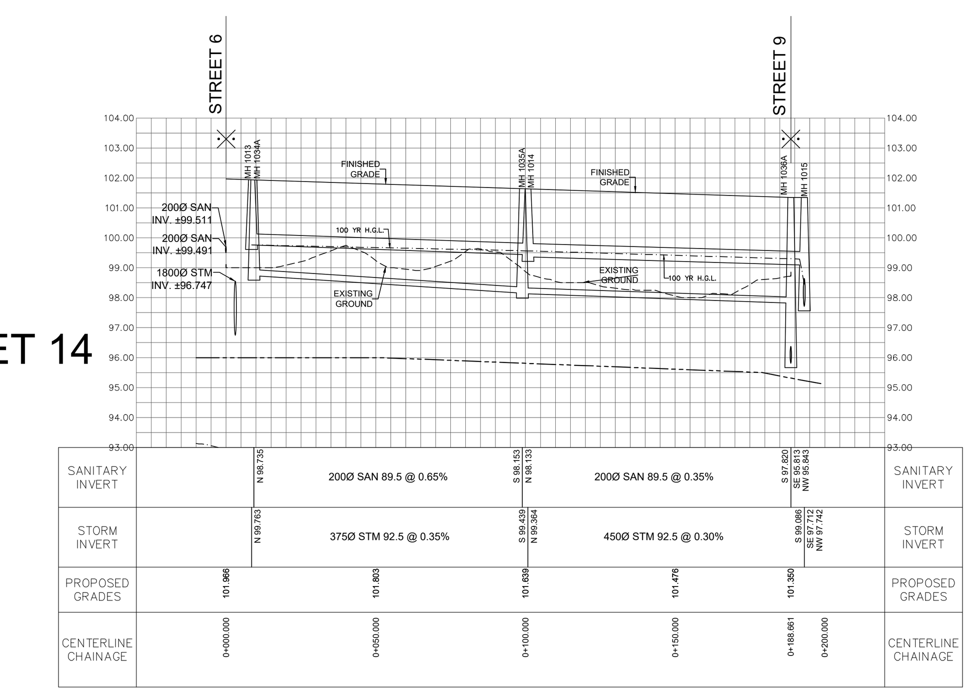

LEGEND

GROUNDWATER ELEVATION
BEDROCK ELEVATION
EXISTING GROUND
PROPOSED GROUND

DSEL
david schaeffer engineering ltd
600 Alden Road, Suite 500
Markham, Ontario, L3R 0E7
Tel. (905) 475-0850
Fax. (905) 475-7083
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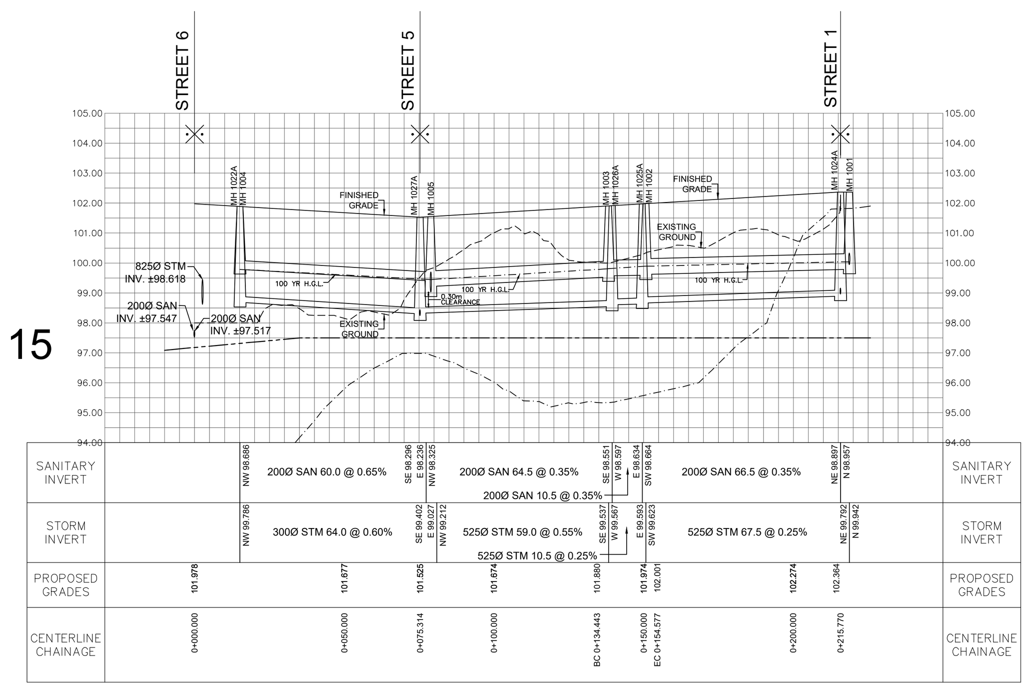
CITY OF OTTAWA

PROFILES

SCALE:	1:2000	PROJECT No.:	1061
DATE:	JUNE 2021	DRAWING:	06D

CITY FILE No. D07-16-19-0026 CITY PLAN No. XXXXX

STREET 15



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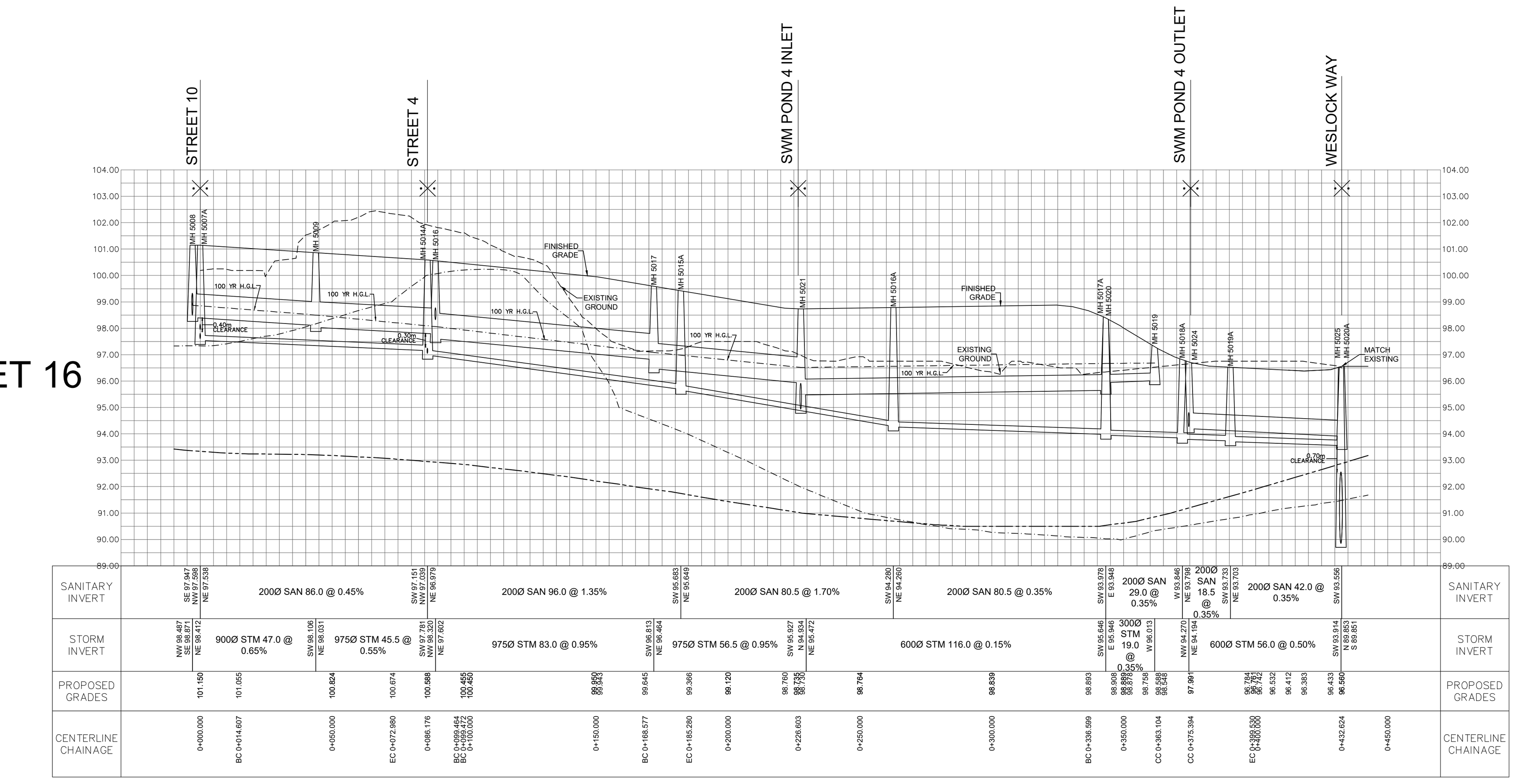

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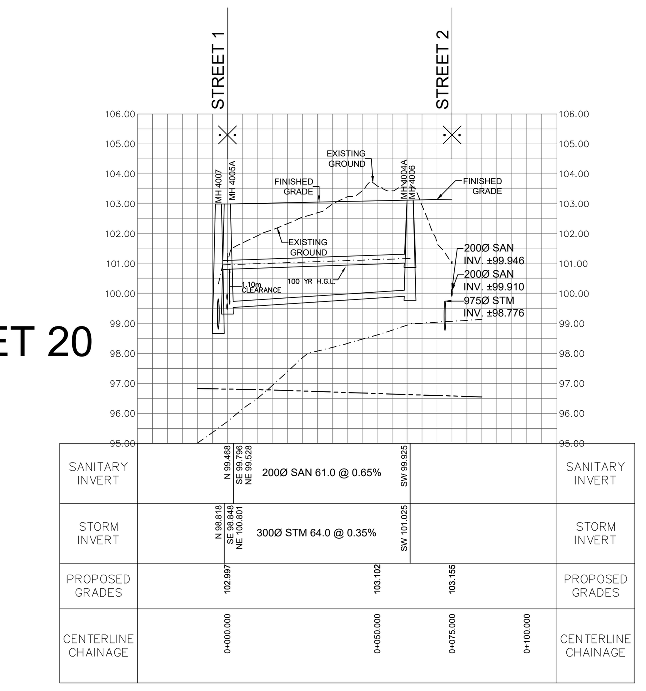

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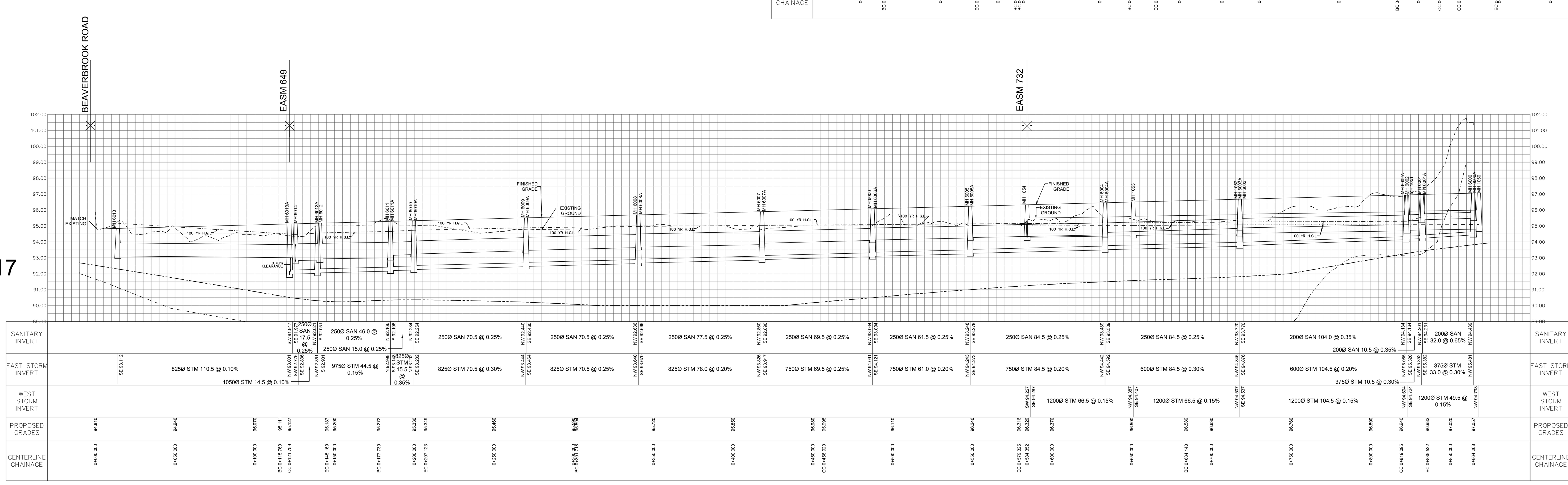
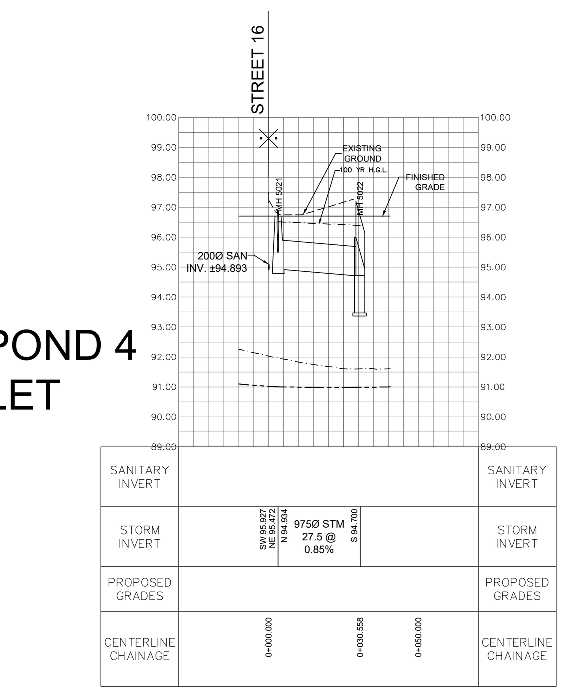


SWM POND 4 INLET



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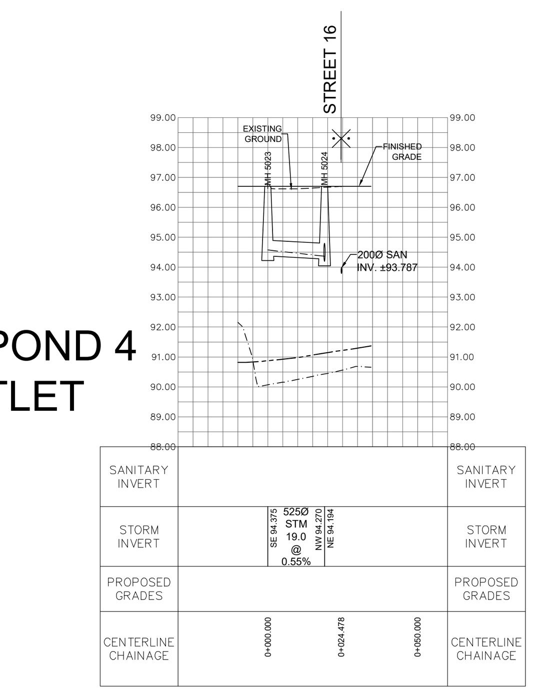

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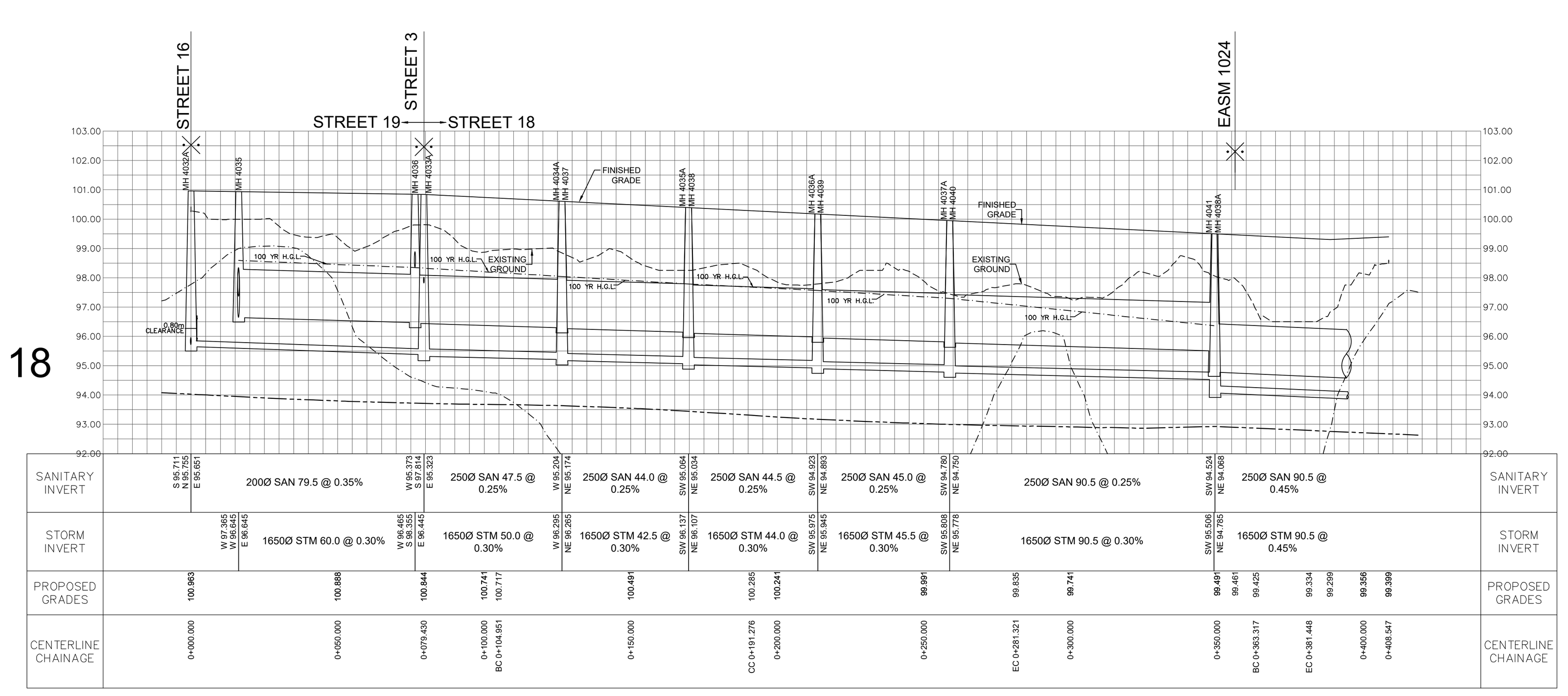
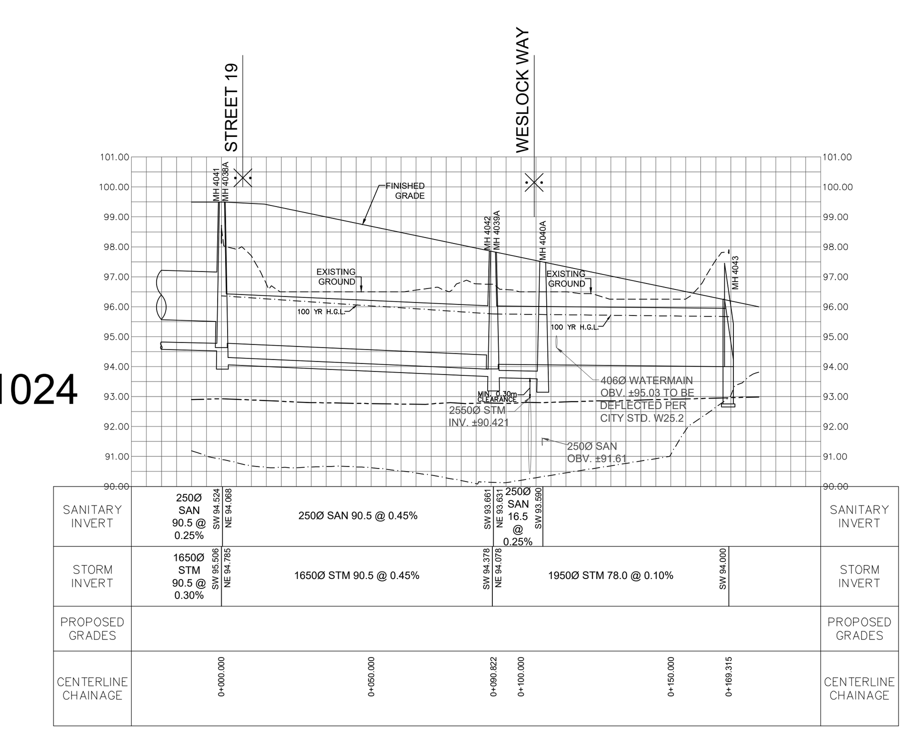


EASM 1024



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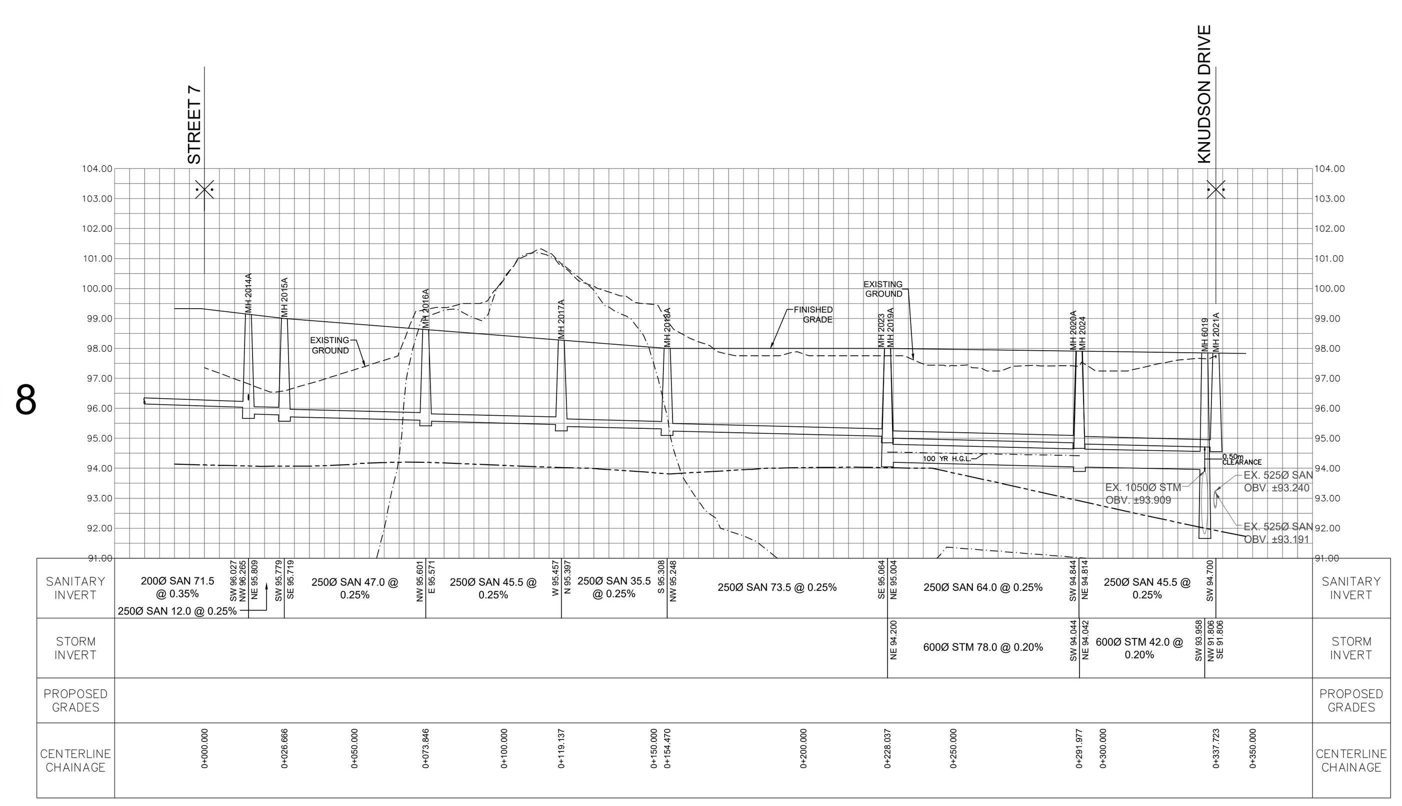

CITY FILE No. D07-16-19-0026 CITY PLAN No. XXXXX

LEGEND

GROUNDWATER ELEVATION
BEDROCK ELEVATION
EXISTING GROUND
PROPOSED GROUND

DSEL
david schaeffer engineering ltd
600 Alden Road, Unit 500
Markham, Ontario, L3R 0E7
Tel. (905) 826-0880
Fax. (905) 826-2083
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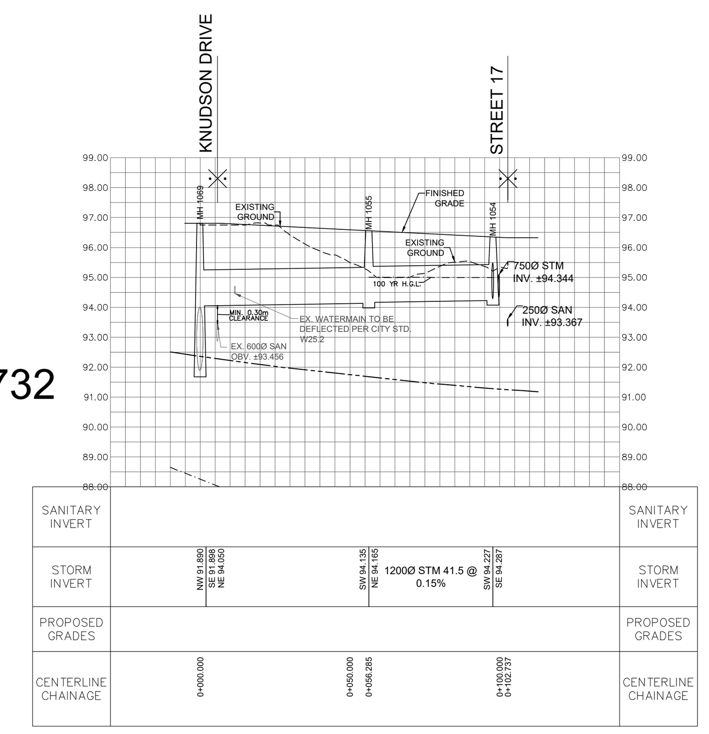
7000 CAMPEAU DRIVE

CITY OF OTTAWA

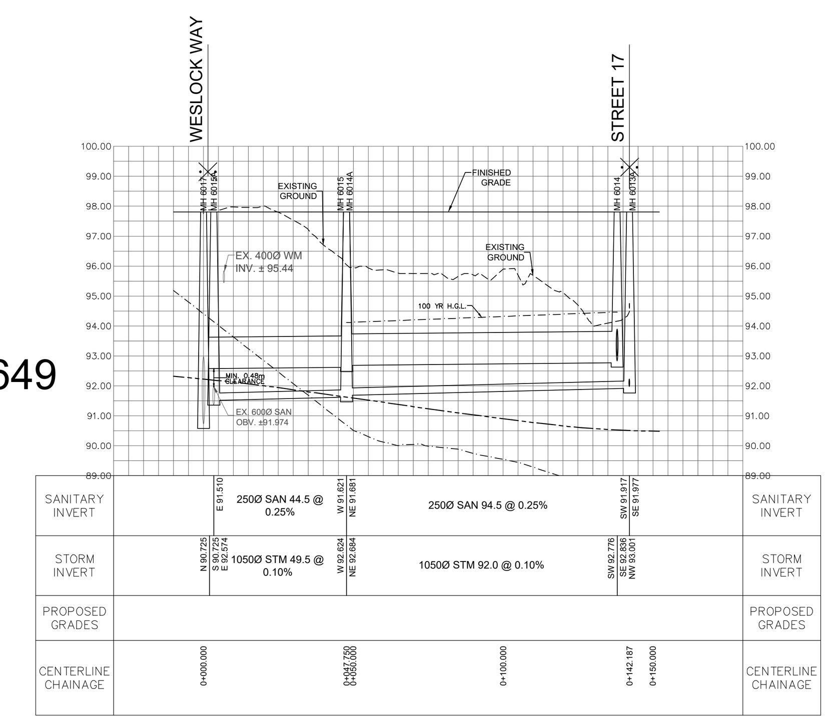
PROFILES

SCALE:	1:2000	PROJECT No.:	1061
DATE:	JUNE 2021	DRAWING:	07D

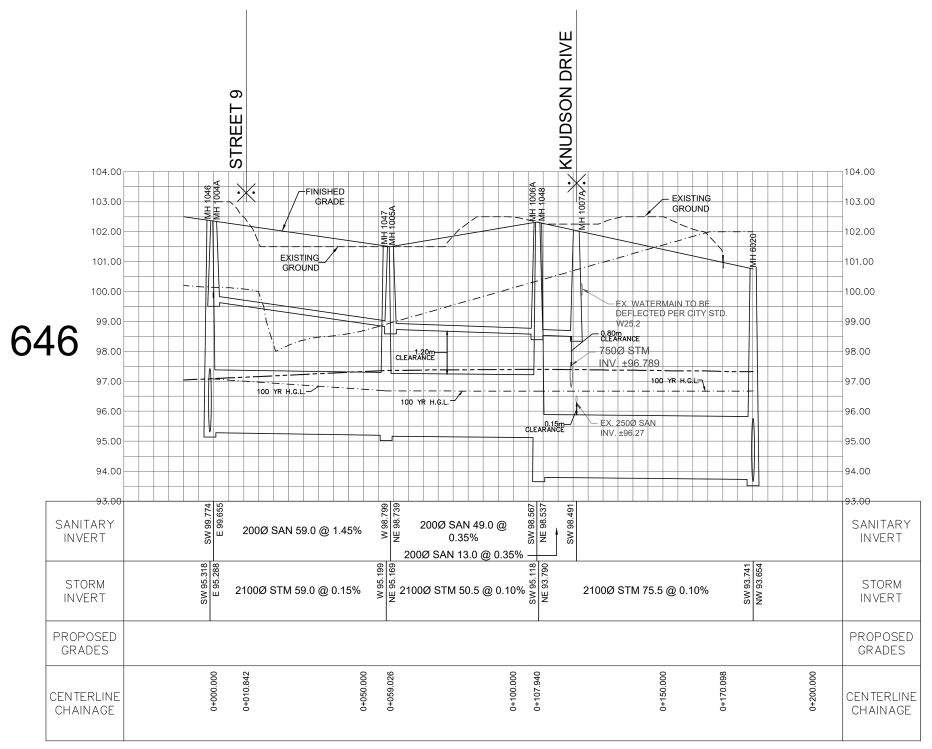
EASM 732



EASM 649



EASM 646



LEGEND

GROUNDWATER ELEVATION
BEDROCK ELEVATION
EXISTING GROUND
PROPOSED GROUND

CITY FILE No. D07-16-19-0026 CITY PLAN No. XXXXX

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david schaeffer engineering ltd
120 Iber Road, Unit 103
Stittsville, Ontario, K2S 1E9
Tel. (613) 836-0856
Fax. (613) 836-7183
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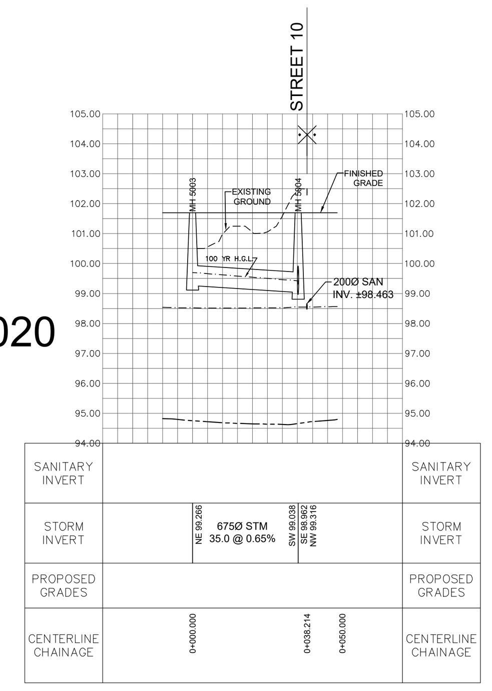
7000 CAMPEAU DRIVE	PROFILES		
CITY OF OTTAWA	SCALE: 1:2000	PROJECT No.: 1061	
	DATE: JUNE 2021	DRAWING: 08D	

EASM 1020



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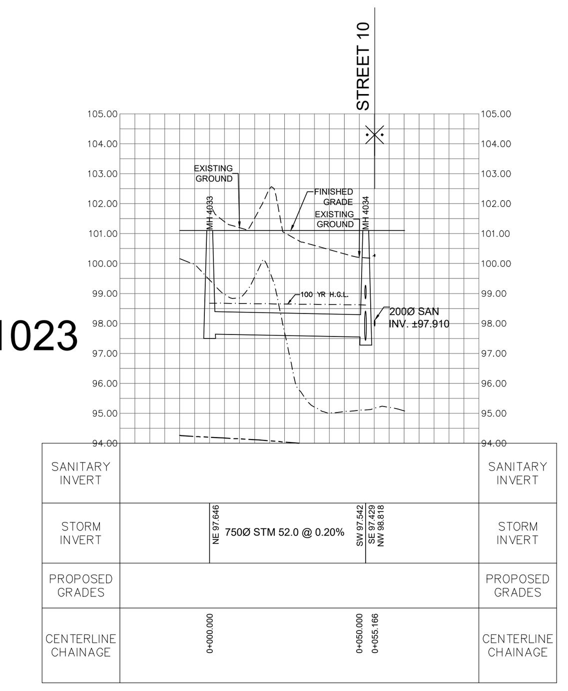
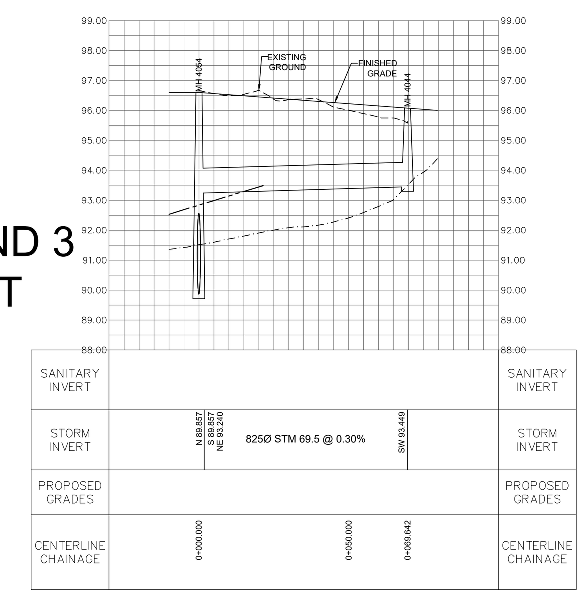


SWM POND 3 OUTLET



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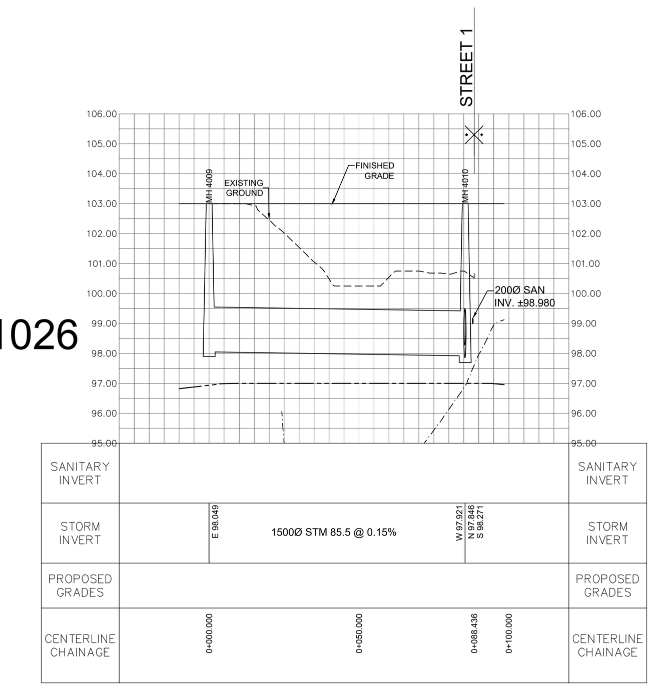

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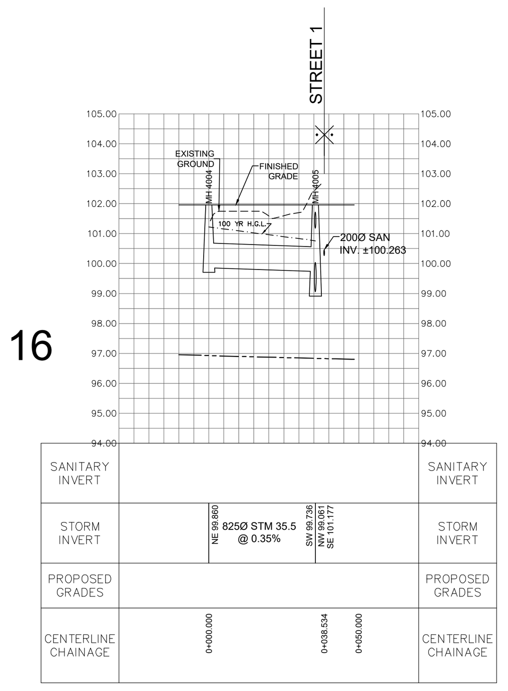

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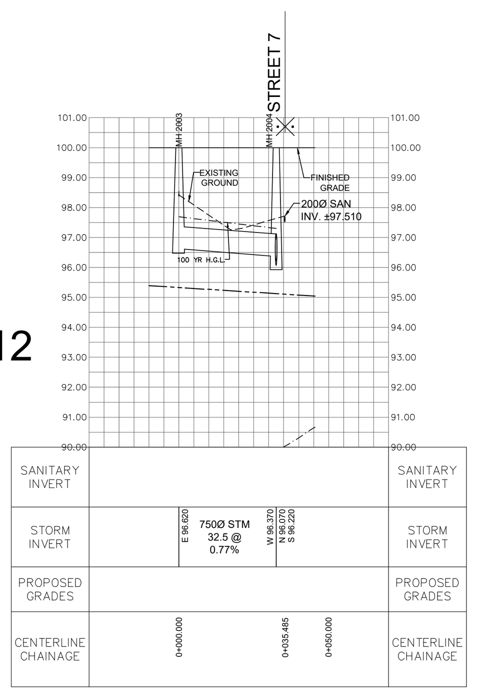

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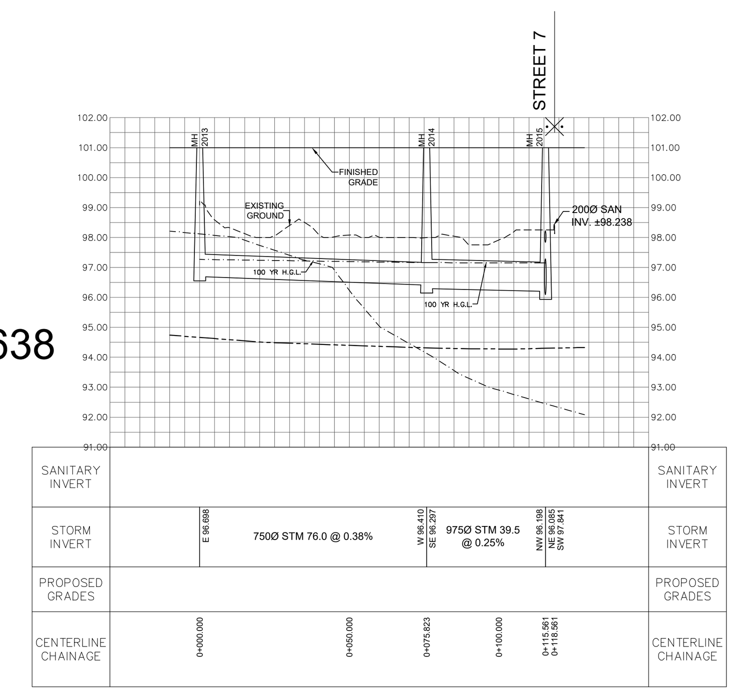

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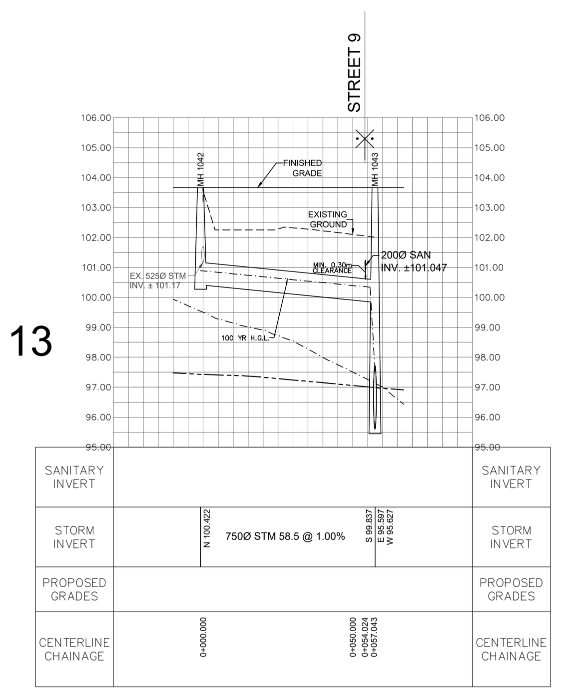
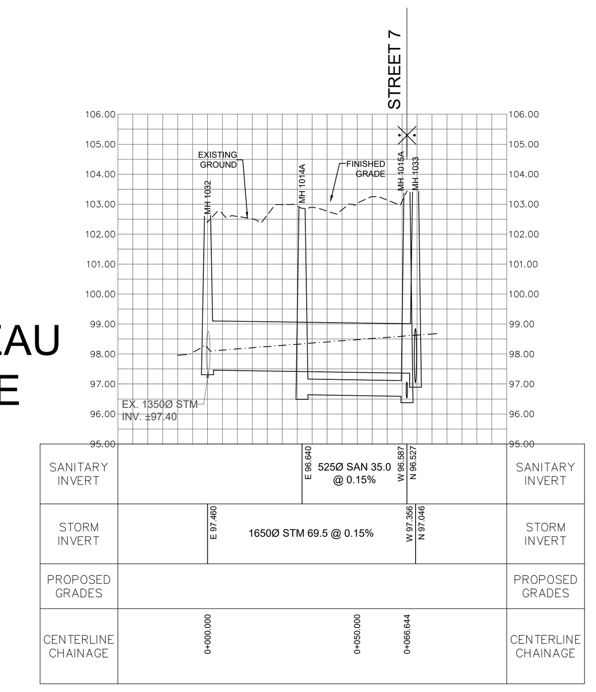
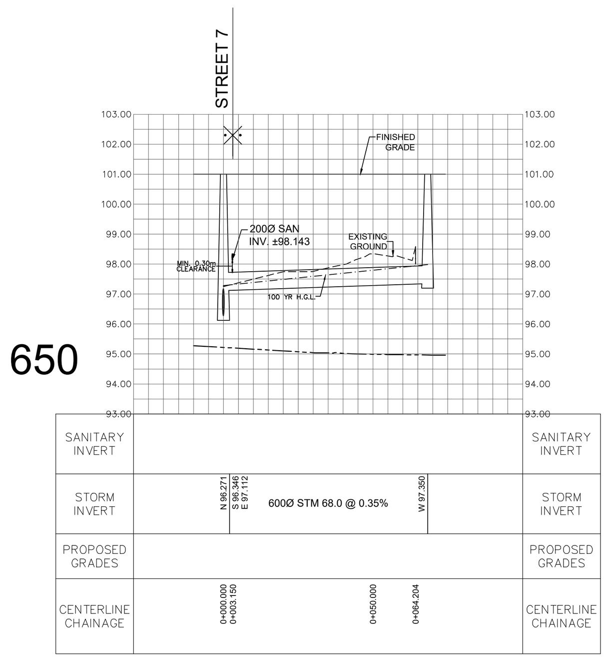


CAMPEAU DRIVE



EASM 650



LEGEND

GROUNDWATER ELEVATION
BEDROCK ELEVATION
EXISTING GROUND
PROPOSED GROUND

CITY FILE No. D07-16-19-0026 CITY PLAN No. XXXXX

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david schaeffer engineering ltd
120 Iber Road, Unit 103
Stittsville, Ontario, K2S 1E9
Tel. (613) 836-0856
Fax. (613) 836-7183
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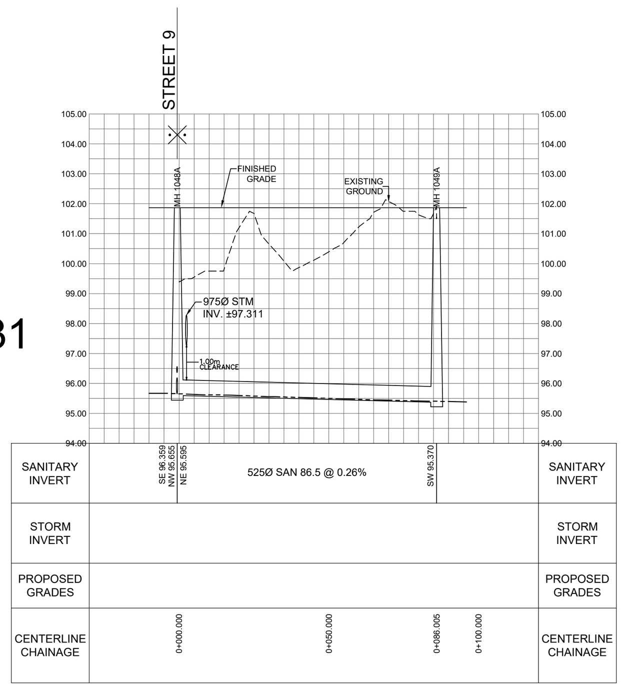
7000 CAMPEAU DRIVE	PROFILES
CITY OF OTTAWA	SCALE: 1:2000 / PROJECT No.: 1061
	DATE: JUNE 2021 / DRAWING: 09D

EASM 731



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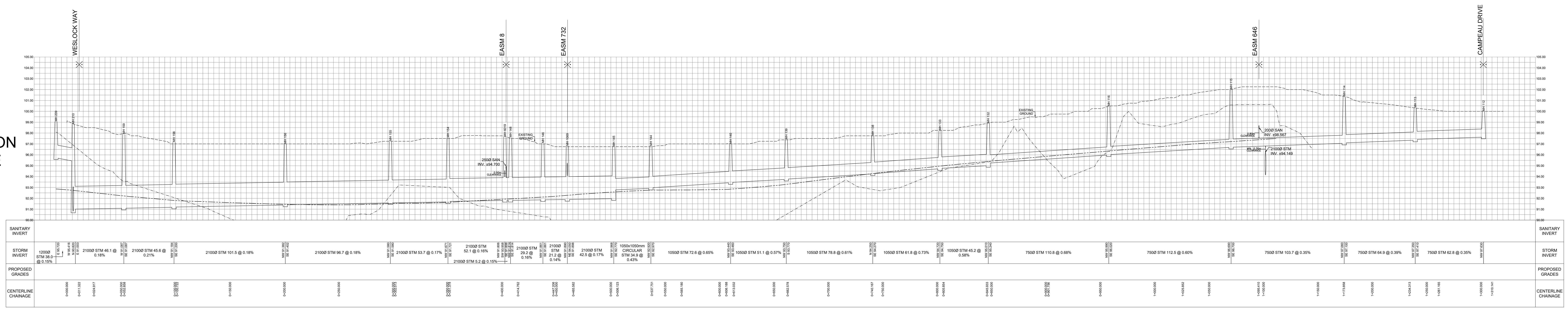
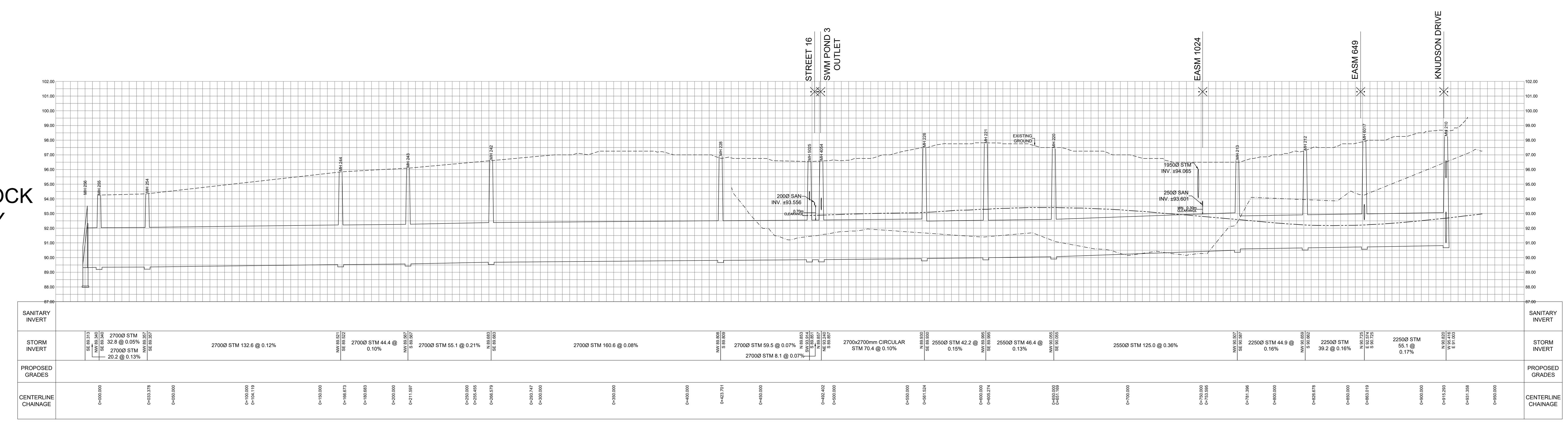


WESLOCK WAY



LEGEND

GROUNDWATER ELEVATION
BEDROCK ELEVATION
EXISTING GROUND
PROPOSED GROUND

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Markham, Ontario, L3R 0E7 / Stittsville, Ontario, K2S 1E9
Tel. (905) 475-0080 / (613) 836-0856
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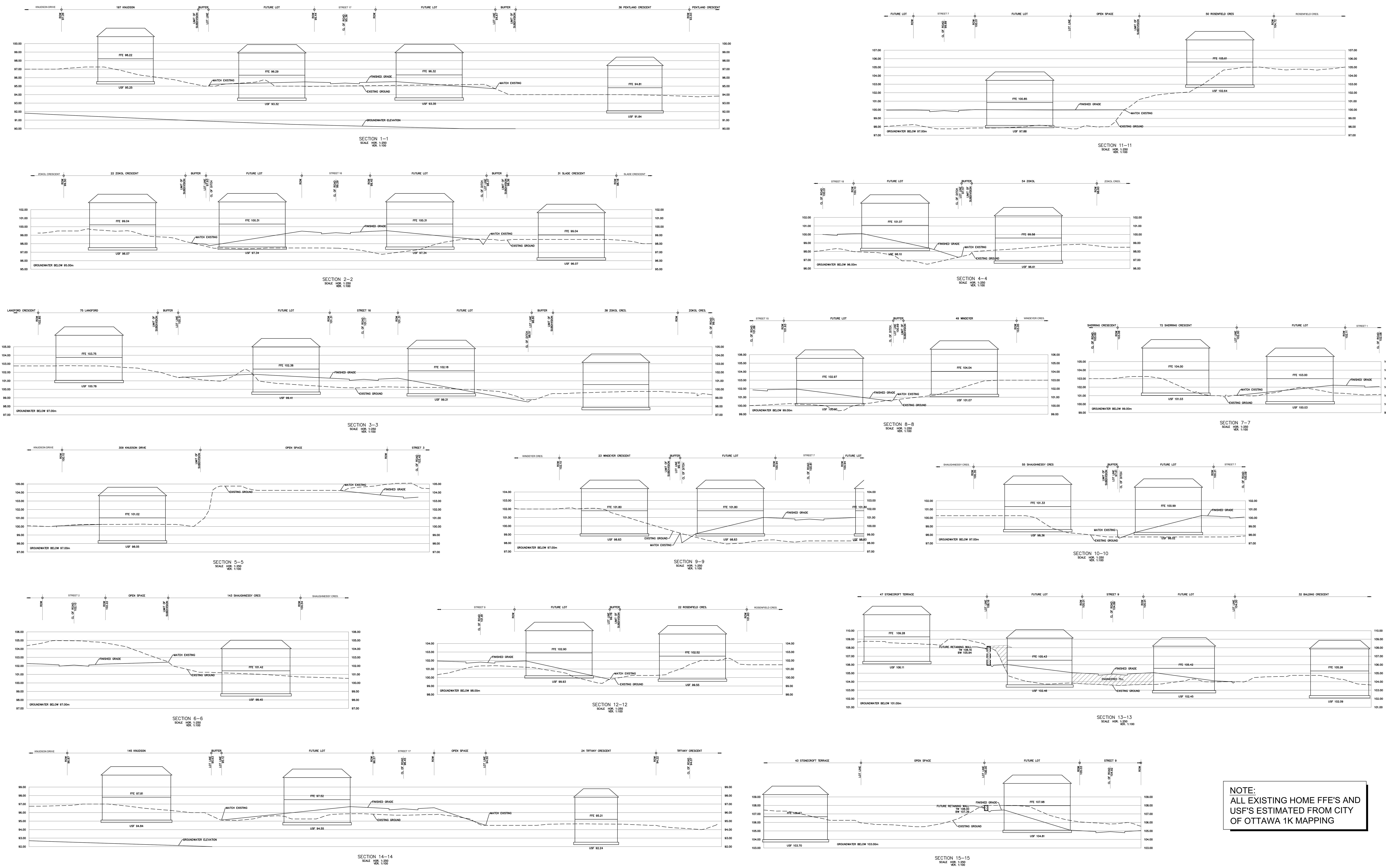
CITY OF OTTAWA

PROFILES

SCALE:	1:2000	PROJECT No.:	1061
DATE:	JUNE 2021	DRAWING:	10D

CITY FILE No. D07-16-19-0026 CITY PLAN No. XXXXX



NOTE:
ALL EXISTING HOME FFE'S AND USF'S ESTIMATED FROM CITY OF OTTAWA 1K MAPPING

CITY FILE No. D07-16-19-0026 CITY PLAN No. XXXXX

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Stittsville, Ontario, K2S 1E9
Tel. (613) 836-0856
Fax. (613) 836-7183
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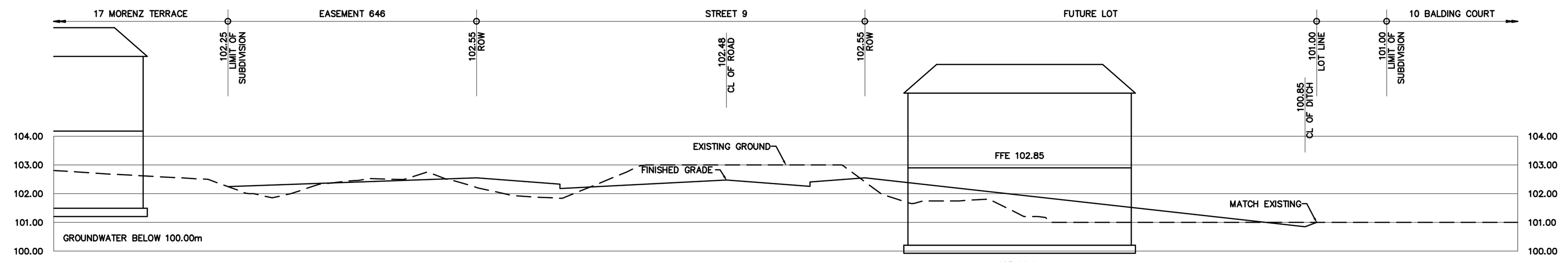
7000 CAMPEAU DRIVE

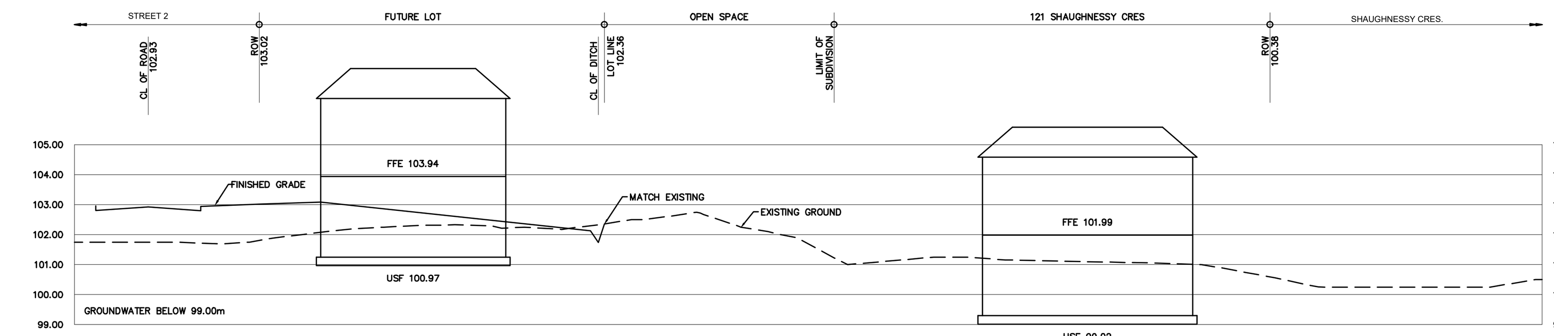
CITY OF OTTAWA

11D - SECTIONS

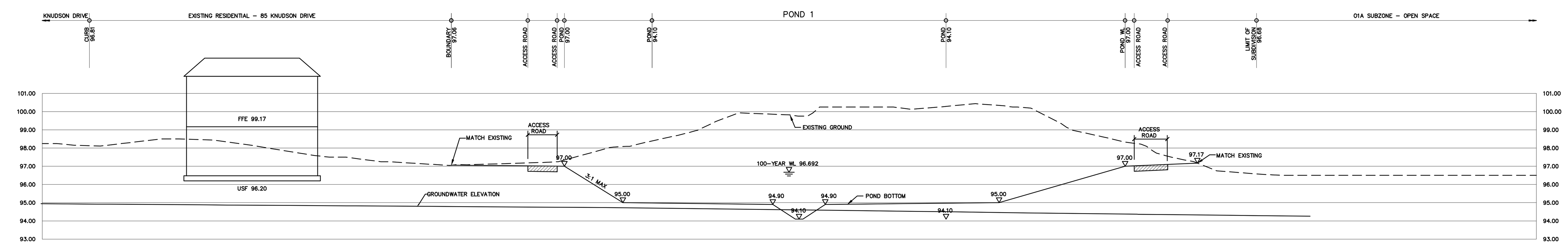
SCALE:	AS SHOWN	PROJECT No.:	1061
DATE:	MAY 2021	DRAWING:	11D



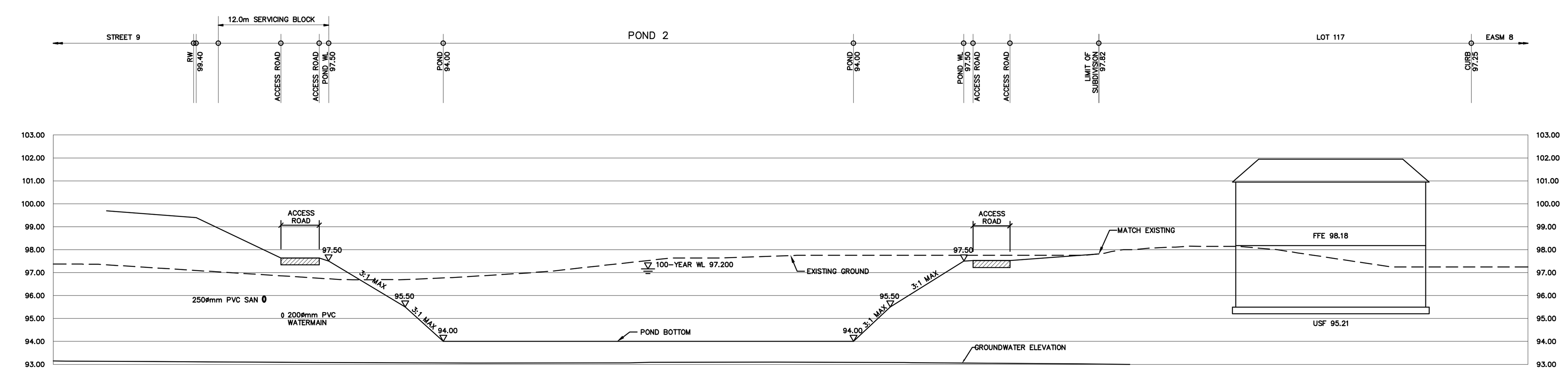
SECTION 17–17
SCALE HOR. 1:250
VER. 1:100



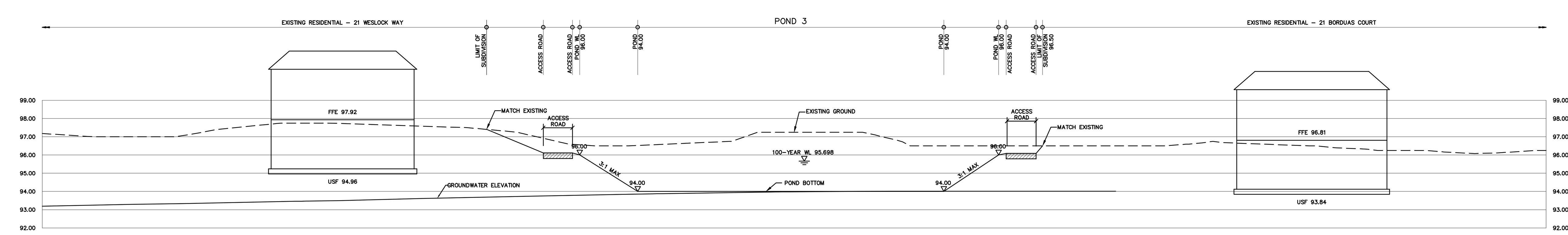
SECTION 16–16
SCALE HOR. 1:250
VER. 1:100



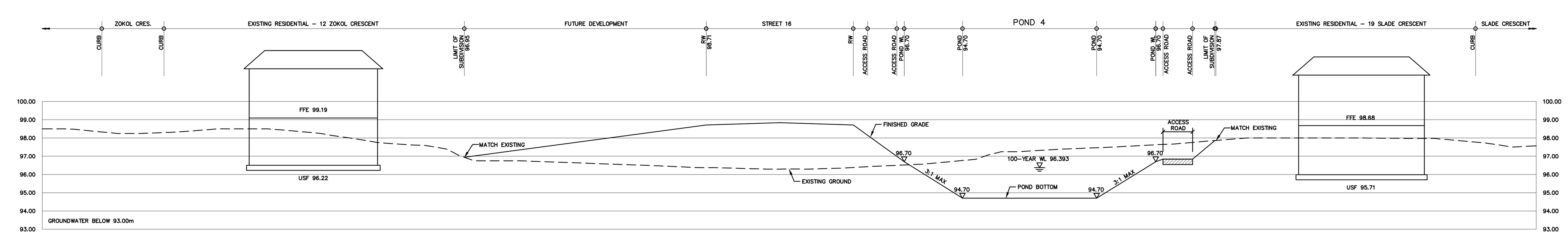
SECTION A–A
SCALE HOR. 1:250
VER. 1:100



SECTION B–B
SCALE HOR. 1:250
VER. 1:100



SECTION C–C
SCALE HOR. 1:250
VER. 1:100



SECTION D–D
SCALE HOR. 1:250
VER. 1:100

NOTE:
ALL EXISTING HOME FFE'S AND USF'S ESTIMATED FROM CITY OF OTTAWA 1K MAPPING

CITY FILE No. D07-16-19-0026 CITY PLAN No. XXXXX

DSEL
david schaeffer engineering ltd
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Tel. (613) 836-0856
Fax. (613) 836-7183
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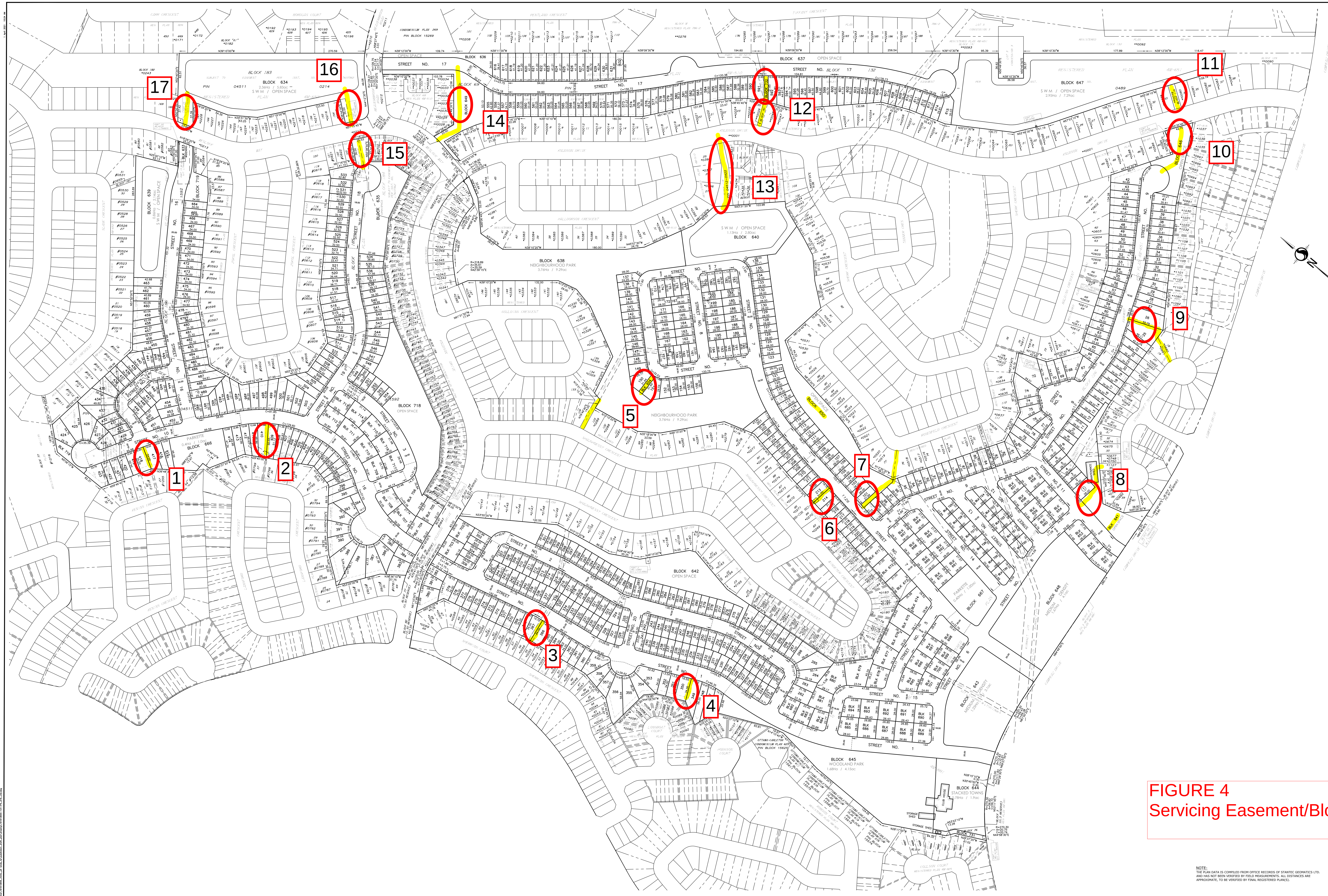
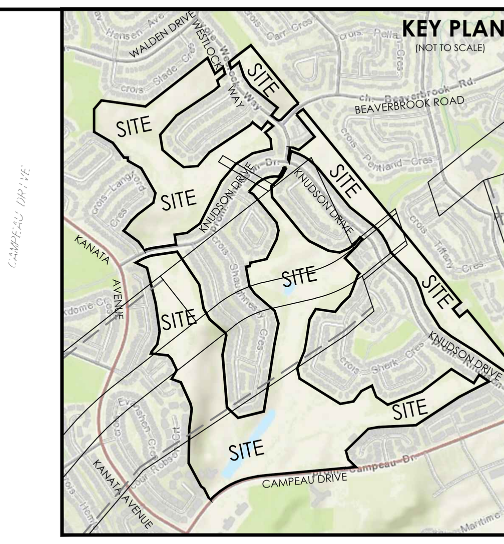
7000 CAMPEAU DRIVE	12D - SECTIONS		
CITY OF OTTAWA	SCALE: AS SHOWN	PROJECT No.: 1061	
	DATE: MAY 2021	DRAWING: 12D	





DRAFT PLAN OF SUBDIVISION OF

BLOCK 69
REGISTERED PLAN 4M-510,
BLOCKS 126 AND 132
REGISTERED PLAN 4M-651,
PART OF BLOCKS 184 AND 192,
ALL OF BLOCKS 183, 185 AND 186
REGISTERED PLAN 4M-652,
BLOCK 160
REGISTERED PLAN 4M-739,
BLOCK 76
REGISTERED PLAN 4M-741,
PART OF BLOCK 76
REGISTERED PLAN 4M-828,
PART OF BLOCK 1
REGISTERED PLAN 4M-881,
PART OF BLOCK 56 AND
ALL OF BLOCK 55
REGISTERED PLAN 4M-883,
PART OF LOTS 5 AND 6 AND
PART OF THE ROAD ALLOWANCE
BETWEEN LOTS 5 AND 6
(CLOSED BY BY-LAW, INST. LT552228)
CONCESSION 3
(GEOGRAPHIC TOWNSHIP OF MARCH)
CITY OF OTTAWA

Scale 1:1500

20 0 20 40 60 80 100 METRES

METRIC CONVERSION

DISTANCES AND COORDINATES SHOWN ON THIS PLAN ARE IN METRES AND CAN BE CONVERTED TO FEET BY DIVIDING BY 0.3048

BEARING NOTE

BEARINGS ARE COMPILED FROM OFFICE RECORDS.

LEGEND:

#	DENOTES	PIN BLOCK 04511
*	"	PIN BLOCK 04512
**	"	PIN BLOCK 04513
01A	"	ZONING

INFORMATION: REQUIRED UNDER

SECTION 51 (17) OF THE PLANNING ACT R.S.O. 1990

a. SEE PLAN
b. SEE PLAN
c. SEE PLAN
d. SEE PROPOSED LAND USE SCHEDULE (ABOVE)
e. SEE PLAN
f. SEE PLAN
g. SEE PLAN
h. CITY WATER AVAILABLE
i. SEE SOIL REPORT
j. SEE TOPOGRAPHICAL INFORMATION
k. ALL CITY SERVICES AVAILABLE
l. SUBJECT TO EASEMENTS PER INST. NO.'S LT607362, LT568249, LT569968, LT438339, LT568246, LT568250, LT568251, LT808272, LT1014950, LT607253, LT568247, LT1365034, LT599218, LT599219, LT1011768, LT866335, LT924341, MH3493, TOGETHER WITH LT10220195

SURVEYOR'S CERTIFICATE

I HEREBY CERTIFY THAT THE BOUNDARIES OF THE SUBJECT LANDS AND THEIR RELATIONSHIP TO ADJOINING LANDS HAVE BEEN ACCURATELY AND CORRECTLY SHOWN.

DATE

FRANCIS LAU
ONTARIO LAND SURVEYOR

FIGURE 4
Servicing Easement/Block Locations

NOTE:
THE PLAN DATA IS COMPILED FROM OFFICE RECORDS OF STANTEC GEOMATICS LTD. AND HAS NOT BEEN VERIFIED BY FIELD MEASUREMENTS. ALL DISTANCES ARE APPROXIMATE, TO BE VERIFIED BY FINAL REGISTERED PLAN(S).

Stantec

Stantec Geomatics Ltd.
CANADA LANDS SURVEYORS
ONTARIO LAND SURVEYORS
1331 CLYDE AVENUE, SUITE 400
OTTAWA, ONTARIO, K2C 3G4
TEL. 613.722.4420 FAX. 613.722.2799
stantec.com

D07 - 16 -19 - 0026

DRAWN: CEC/NJ	CHECKED: BW	PM: BW	FIELD: *	PROJECT No.: 161613944-131