David Schaeffer Engineering Ltd.
120 Iber Road, Suite 103
Stittsville, ON K2S 1E9
613-836-0856
dsel.ca

FUNCTIONAL SERVICING REPORT

FOR

TAMARACK (CARDINAL CREEK) CORPORATION
CARDINAL CREEK VILLAGE SOUTH

CITY OF OTTAWA

PROJECT NO.: 19-1153

JUNE 2022 – FIRST SUBMISSION

FUNCTIONAL SERVICING REPORT
FOR
TAMARACK (CARDINAL CREEK) CORPORATION
CARDINAL CREEK VILLAGE SOUTH

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1.0 INTRODUCTION

Tamarack (Cardinal Creek) Corporation has retained David Schaeffer Engineering Ltd. (DSEL) to prepare a Functional Servicing Report (FSR) in support of the Draft Plan of Subdivision application for the Cardinal Creek Village South development. The study area is comprised of portions of 1296 & 1400 Old Montreal Road and is located west of Cox Country Road, south of Old Montreal Road, and north of the Cardinal Creek South Tributary within the City of Ottawa, in the Cumberland Ward. The study area measures approximately 46.3 ha and is currently zoned Rural Countryside (RU) Zone, Rural Institutional (RI) Zone, and Arterial Mainstreet (AM) Zone. The study area is depicted in ***Figure 1*****.**

The development of the study area has been previously contemplated in background studies.

- The study area falls within the *Cardinal Creek Village Concept Plan (*Walker, Nott, Dragicevic Associates Limited, July 2013) area. The overarching *Concept Plan* and associated Official Plan Amendment were adopted in August 2013.
- To support the *Concept Plan* and associated Official Plan Amendment, a *Master Servicing Study* (DSEL, July 2013) was prepared to identify the preferred water, wastewater, and stormwater management systems needed to support the development. The *Master Servicing Study* (DSEL, July 2013) was prepared in accordance with the integration provisions of the Municipal Engineers Association's *Municipal Class Environmental Assessment* (June 2000, as amended in 2007 & 2011), which combined requirements under the *Planning Act* and the *Environmental Assessment Act*. The *Master Servicing Study* was approved on August 21, 2013, clearing the servicing infrastructure projects identified in the report for future planning, design, and construction activities.

As a next step in the Planning Act approvals process, Tamarack (Cardinal Creek) Corporation is seeking approval of the Draft Plan of Subdivision. The proposed Draft Plan

of Subdivision would allow for the development of two school blocks, a park block, a stormwater management pond, various residential units, and a road network.

This FSR includes stormwater management analysis provided by J.F. Sabourin and Associates Inc. and watermain analysis provided by GeoAdvice Inc. Transportation input has also been coordinated with CGH Transportation Inc. This *FSR* was prepared per the City Servicing Study Guidelines for Development Applications (***Appendix A***) to:

- Provide sufficient detail to demonstrate that development of the study area will be adequately supported by municipal services, as set out in the Master Servicing Study (MSS) (DSEL, July 2013) and the Cardinal Creek Village Concept Plan (CDP) (Walker, Nott, Dragicevic Associates Limited, July 2013);
- Link the requirements outlined in the MSS with the current Plan of Subdivision;
- Define the course of subsequent detailed design, review, and acceptance of the development services;
- Demonstrate conformance with the current Ministry of Environment, Conservation, and Parks (MECP), City of Ottawa, and other applicable servicing design criteria;
- Demonstrate that there is sufficient capacity in the water, wastewater, and stormwater systems to accommodate the proposed development; and
- Demonstrate good engineering practices for the protection of public safety, the environment, and sustainable operation.

1.1 Existing Conditions and Development Constraints

The study area is within the Cardinal Creek subwatershed (part of the Ottawa River East watershed), which is located within the eastern portion of the Rideau Valley Source Protection Area and is within the jurisdiction of the Rideau Valley Conservation Authority (RVCA).

The existing elevations within the study area generally range from 86 m to 95 m. Bedrock is present at depths between 0 to 10 m below existing ground and groundwater levels are 3 to 4 m below the existing surface per the *Geotechnical Investigation – Cardinal Creek Village South* (Paterson Group November 29, 2021). The overburden generally consists of topsoil or fill overlying stiff to very stiff silty clay deposits.

Select excavated materials from the construction of the existing phases of the Cardinal Creek Village development are currently being stored in piles within the study area. The piles will need to be either relocated or approved to be used for fill by a geotechnical engineer prior to construction.

Per the *Geotechnical Investigation – Cardinal Creek Village South* (Paterson Group November 29, 2021), the site has a permissible grade raise restriction of 2 m for lots and 2.5 m for roads in areas where the silty clay deposit is located below the design footing level. As shown in the *Geotechnical Investigation – Cardinal Creek Village South*

(Paterson Group November 29, 2021), the grade raise restriction applies to the western and southern portions of the study area.

The Cardinal Creek South Tributary is located to the south of the study area. The tributary has been monitored per the requirements described in the *MSS*, the aquatic habitat in the tributary has been classified and thermal mitigation measures are to be considered as part of the detailed design of Stormwater Management Pond 2.

There are existing headwater drainage features located within the study area directing flows towards the Cardinal Creek South Tributary. The closure of the features was assessed in the *Cardinal Creek Village – South Side Headwater Drainage Feature Assessment* (Bowfin Environmental Consulting Inc., March 2021) and the *Environmental Impact Statement and Tree Conservation Report* (Muncaster Environmental Planning, December 22, 2021). Consistent with the *MSS* and *CDP*, these features are to be closed as part of the CCV South Development. As summarized in the *Environmental Impact Statement and Tree Conservation Report* (Muncaster Environmental Planning, December 22, 2021), the study area's stormwater management be designed to direct outflows to the South Tributary while ensuring they are not negatively impacting the watercourse in terms of quantity and quality.

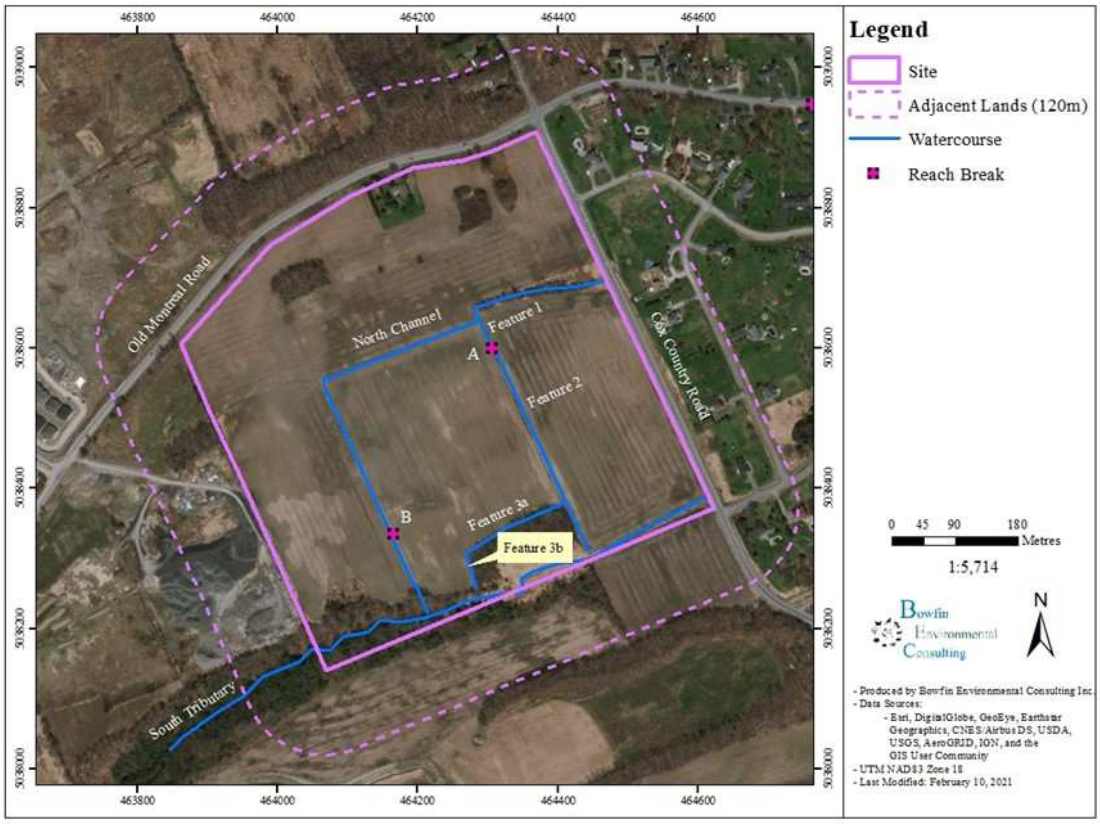

Figure A: Headwater Channels Assessed (Bowfin Environmental Consulting Inc., March 2021)

The Site-Specific Water Budget Report – Cardinal Creek Village Development (PECG, June 2013), identified a significant groundwater recharge area in the northeast corner of the study area. Per the *MSS*, the introduction of impervious surfaces in this area is expected to reduce infiltration from pre-development levels, however, it is not essential to maintain pre-development infiltration levels as the natural flow regime of the South Tributary is to be maintained via the stormwater management plans for the proposed developments. Therefore, this is not considered a development constraint for the purpose of this *FSR*.

1.2 Development Concept

The proposed draft plan of subdivision contemplates 304 single detached units, 286 townhomes, and 168 back-to-back (B2B) townhomes. The study area also contemplates two school blocks, a park block, and a stormwater management pond block. The roads are proposed to consist of 26 m, 22 m, 18 m, and 14.8 m wide Right-of-Ways (ROW). The proposed plan can be seen in ***Appendix A***. Corresponding development statistics are summarized in ***Table 1*** below.

Table 1: Development Statistics (Tamarack Homes, Oct 2021)

Land Use	Total Area (Ha)	Projected Residential Units	Residential Population per Unit	Population
Residential & Roads	36.2	304 Singles	3.4	2260
		286 Townhomes	2.7	
		168 B2B Townhomes	2.7	
Schools	5.6	-	-	-
Stormwater Management Pond	2.0	-	-	-
Park	2.5	-	-	-
Total	**46.3**	**758**	**-**	**2260**

It is understood that there are plans for Old Montreal Road to be widened in the vicinity of the study area. Based on input from CGH Transportation Inc., who has provided design information for the interim and ultimate conditions of the widened Old Montreal Road, blocks have been provided on the north side of the study area to allow for the required grading, roadwork, and ROW widening for Old Montreal in the future.

There are two properties adjacent to the study area and Old Montreal Road that have been identified for potential development as part of the *CDP* and *MSS*. The eastern property (PIN 14526-0019) is an existing residential property and was considered to be a part of the surrounding residential development in the *CDP* and *MSS*. The western property (PIN 14526-2259) is currently vacant and was considered to be a mixed-use block in the *CDP* and *MSS*. For the purpose of the grading plans in this *FSR*, these

parcels are considered to remain undeveloped, however, servicing allowances for future development conditions have been accommodated in accordance with the *CDP* and *MSS.*

To the south of the Cardinal Creek South Tributary, there is a planned future development. Per the City of Ottawa's latest Official Plan (November 2021), the boundary for the planned future development has been updated since the time of the *MSS*. For the purposes of this *FSR*, development stats for the planned future development have been based on the unit densities from the proposed CCV South development.

Servicing easements have been shown in the accompanying figures to accommodate the proposed watermain, sanitary and storm sewer networks. It is expected that the Draft Plan of Subdivision will be updated to reflect these easements prior to approval.

The limit of development in relation to the Cardinal Creek South Tributary has been set per the *Geotechnical Investigation – Cardinal Creek Village South* (Paterson Group November 29, 2021) and the *Environmental Impact Statement and Tree Conservation Report* (Muncaster, December 22, 2021). It is understood that additional details related to the justification of the proposed development setback are provided in the Planning Rationale to be submitted to the City for the Draft Plan of Subdivision application. Please note that the geotechnical setback limits have been incorporated into the preliminary figures prepared by DSEL, for ease of City review of the preliminary grading and drainage plans.

1.3 Required Permits / Approvals

The approvals and permits listed in ***Table 2*** could be expected to be required prior to construction of the municipal infrastructure detailed herein. Please note that other permits and approvals may be required, as detailed in the other studies submitted as part of the *Planning Act* development applications (e.g., *Tree Conservation Report, Environmental Impact Statement, Phase 1 Environmental Site Assessment, etc.).*

The Environmental Compliance Approvals for the existing sanitary trunk sewer infrastructure within Cardinal Creek Phase 4 (ECA #7792-ASJR4M) and the existing Stormwater Management Pond 1 servicing the Cardinal Creek Village development (ECA #9999-BRWK2C) can be found in ***Appendix B***.

Table 2: Required Permits/Approvals

Agency	Permit / Approval Required	Trigger	Remarks
MECP/City of Ottawa	Environmental Compliance Approval **(ECA)**	Construction of proposed new stormwater management pond, sanitary & storm sewers.	The MECP/City of Ottawa is expected to review the stormwater collection system, wastewater collection system, and stormwater management pond in accordance with the City of Ottawa's ECA agreements with MECP at the time of detailed design (e.g., per upcoming linear ECA).
MECP	Permit to Take Water **(PTTW)**	Construction of proposed land uses (e.g., basements for residential homes) and services.	Pumping of groundwater may be required during construction, given groundwater conditions and proposed land uses and on-site/off-site municipal infrastructure.
City of Ottawa	MECP Form 1 – Record of Watermains Authorized as a Future Alteration.	Construction of proposed new watermains.	The City of Ottawa is expected to review the watermains on behalf of the MECP through Form 1 – Record of Watermains Authorized as a Future Alteration.
RVCA	Permit under Ontario Regulation 174/06, RVCA's Development, Interference with Wetlands and Alterations to Shorelines and Watercourses Regulation	Ditches requiring closure due to development and new stormwater management pond & outlet to the Cardinal Creek South Tributary	Proposed land uses & municipal infrastructure require grading within the subject lands and result in the closure of existing ditches. New outlet required to Cardinal Creek South Tributary from proposed SWM Pond 2.
City of Ottawa	Commence Work Notification (CWN)	Construction of proposed new watermains, sanitary sewers, and storm sewers throughout the subdivision. Construction of proposed SWM Pond 2.	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.

1.4 Pre-Application Consultation

Pre-application consultation was conducted with City of Ottawa staff on January 20, 2021. The municipal servicing approach and development concept were discussed. Pre-

application consultation correspondence with the City of Ottawa is provided in ***Appendix A.***

Additionally, a pre-application consultation meeting was held with RVCA staff on February 24, 2021, to discuss setbacks from the watercourses among other topics. RVCA staff confirmed that the setbacks established under the approved *MSS,* and *CDP* are expected to govern in this area.

Per the City of Ottawa's current Transfer of Review Agreement No. TOR-OTT-E-2019-01, it is assumed that MECP pre-application consultation is not required, as the proposed works fall under Schedule A of the agreement. However, as detailed designs progress for the study area, consultation requirements and ECA requirements related to the proposed municipal infrastructure ought to be confirmed.

2.0 GUIDELINES, PREVIOUS STUDIES, AND REPORTS

2.1 Existing Studies, Guidelines, and Reports

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

- **Ottawa Sewer Design Guidelines,**
  City of Ottawa, SDG002, October 2012
  (City Sewer Standards)

  - **Technical Bulletin ISDTB-2014-01, Revisions to Ottawa Design Guidelines – Sewer,**
    City of Ottawa, February 5, 2014.
    (ISDTB-2014-01)

  - **Technical Bulletin PIEDTB-2016-01, Revisions to Ottawa Design Guidelines – Sewer,**
    City of Ottawa, September 6, 2016.
    (PIEDTB-2016-01)

  - **Technical Bulletin ISTB-2018-01, Revisions to Ottawa Design Guidelines – Sewer,**
    City of Ottawa, March 21, 2018.
    (ISTB-2018-01)

  - **Technical Bulletin ISTB-2019-02, Revisions to Ottawa Design Guidelines – Sewer,**
    City of Ottawa, July 8, 2019.
    (ISTB-2019-02)

- **Ottawa Design Guidelines – Water Distribution,**
  City of Ottawa, July 2010.
  (City Water Supply Guidelines)

  - **Technical Bulletin ISD-2010-2**
    City of Ottawa, December 15, 2010.
    (ISDTB-2010-2)

  - **Technical Bulletin ISDTB-2014-02**
    City of Ottawa, May 27, 2014.
    (ISDTB-2014-02)

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

  - **Technical Bulletin ISTB-2021-03**
    City of Ottawa, August 18, 2021
    (ISDTB-2021-03)

- **Fire Underwriters Survey, 1999.**
  (FUS)

- **Design Guidelines for Sewage Works,**
  Ministry of the Environment, 2008.
  (MECP Design Guidelines)

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

- **Cardinal Creek Village Master Servicing Study,**
  Tamarack (Queen Street) Corporation, July 2013,
  (MSS)

- **Cardinal Creek Village Concept Plan**
  Walker, Nott, Dragicevic Associates Limited, July 2013,
  (CDP)

- **Greater Cardinal Creek Subwatershed Management Plan,**
  AECOM, May 2014,
  (Subwatershed Study)

- **Ontario Building Code Compendium,**
  Ministry of Municipal Affairs and Housing Building Development Branch,
  January 1, 2012, as updated from time to time.
  (OBC)

- **Mississippi-Rideau Source Water Protection Plan,**
  MVCA & RVCA, August 2014

- **Evaluation of Karst at Cardinal Creek Village,**
  Worthington Groundwater, June 2013

- **Cardinal Creek Village Concept Plan,**
  Walker, Nott, Dragicevic Associates Limited, July 2013

- **Site Specific Water Budget Report – Cardinal Creek Village Development,**
  Palmer Environmental Consulting Group Inc., June 2013

- **Cardinal Creek Village Water Balance Analysis,**
  J.F. Sabourin and Associates Inc., June 2013

- **Cardinal Creek Village – South Side Headwater Drainage Feature Assessment,**
  Bowfin Environmental Consulting Inc., March 2021

- **Geotechnical Investigation – Cardinal Creek Village South, Revision 5**
  Paterson Group, November 29, 2021

- **Preliminary Geotechnical Review – Proposed SWMP, Revision 1**
  Paterson Group, November 29, 2021

- **Cardinal Creek Village South Preliminary Stormwater Management Plan and Stormwater Management Facility Design**
  JFSA, December 21, 2021

- **Environmental Impact Statement and Tree Conservation Report**
  Muncaster Environmental Planning Inc., December 22, 2021

3.0 WATER SUPPLY SERVICING

3.1 Existing Water Supply Services

The study area lies within the existing City of Ottawa 2E pressure zone. Existing watermain infrastructure in the surrounding area is shown in ***Figure 4.***

2E watermains service the existing Cardinal Creek Village Phase 4, located north of the study area. A 400 mm diameter watermain stub is provided on Old Montreal Road at Cardinal Creek Drive, as well as on Old Montreal Road near Cartographe Street.

3.2 Water Supply Servicing Design

Water supply servicing for the study area was contemplated as part of the *MSS*. The *MSS* considered a watermain network consisting of 400 mm diameter 2E trunk watermains extending along Old Montreal Road and Cardinal Creek Drive, forming a looped system following the road network in the western portion of the study area. A 400 mm diameter stub was provided for a future connection under the south tributary. The eastern portion of the development was proposed to be serviced by 300 mm diameter 2E watermains, following the local road network. See ***Appendix B*** for details.

Potable water will be supplied to the study area through pressurized watermains on each street, connecting the existing City of Ottawa 2E pressure zone watermains on Cardinal Creek Drive and Old Montreal Road as shown in ***Figure 4***. Existing 400 mm diameter watermain stubs are available for connection at the intersection of Cardinal Creek Drive and Old Montreal Road, and on Old Montreal Road near Cartographe Street.

As part of the *MSS*, a maximum service elevation of 95 m for pressure zone 2E and low pressures were reported in the northeast corner of the study area under the peak hour design condition. Per the *MSS*, the following recommendations were provided for this area:

- Detailed design of the site grading should minimize the ground floor elevations as much as possible;
- 25 mm service connections be utilized for any future service connections;
- Detailed design include internal plumbing considerations to minimize hydraulic pressure losses. Note that the minimum allowable pressure at any given fixture is generally 69 kPa (10 psi) according to the Ontario Building Code; and,
- Pressure monitoring after the first phases of construction be undertaken, to validate and/or calibrate the model and further refine requirements.

These recommendations are proposed to be carried forward to the detailed design of the study area.

Table 3: Water Supply Design Criteria

Design Parameter	Value
Residential – Single-Family	3.4 p/unit
Residential – Townhome/ Semi	2.7 p/unit
Residential Average Daily Demand	280 L/d/p
Residential – Maximum Daily Demand	2 x Average Daily Demand
Residential – Maximum Hourly Demand	3 x Maximum Daily Demand
Residential – Minimum Hourly Demand	0.5 x Average Daily Demand
Commercial/Institutional Average Daily Demand	28,000 L/gross ha/day
Park Average Daily Demand	28,000 L/gross ha/day
Commercial/Institutional/Park Maximum Daily Demand	1.5 x Average Daily Demand
Commercial/Institutional/Park Maximum Hour Demand	1.8 x Maximum Daily Demand
Commercial/Institutional/Park Minimum Hourly Demand	0.5 x Average Daily Demand
Minimum Watermain Size	150 mm diameter
Minimum Depth of Cover	2.4 m from top of watermain to finished grade
During normal operating conditions desired operating pressure is within	350 kPa and 480 kPa
During normal operating conditions pressure must not drop below	275 kPa
During normal operating conditions pressure must not exceed	552 kPa
During fire flow operating pressure must not drop below	140 kPa

Notes:

- *Extracted from Section 4: Ottawa Design Guidelines, Water Distribution (July 2010), Table 3-1 – Peaking Factors for populations between 3,001-10,000.*
- *Park water demands are assumed based on classification and potential for community facilities, etc.*
- *Residential Average Daily Demand assumed to be 280 L/d/P in accordance with 2018 changes to Sanitary Design Guidelines, see Section 4.0.*

Boundary conditions have been provided by the City of Ottawa based on the consumption rates detailed in ***Table 3***. Water demands for the study area are summarized in ***Table 4*** and the boundary conditions request can be found in ***Appendix C***. Note, that demands from future development areas were included in the boundary conditions request and the *Capacity and Modeling Analysis for the Cardinal Creek Village South Development (GeoAdvice Report)* (GeoAdvice, June 16, 2022) to ensure the proposed network provides adequate service upon full buildout of the surrounding area. See ***Appendix C*** for further details and demands for the external developments.

Table 4: Summary of Water Demands

Dwelling Type	Number of Units	Persons per unit	**Population**	**Allocated Demand** (L/unit/d)	**Avg Day** (L/s)	**Max Day** (L/s)	**Peak Hour** (L/s)
Single Detached	304	3.4	1,036	280	3.36	6.71	10.07
Townhomes	286	2.7	775	280	2.51	5.02	7.53
Back-to-Back Townhomes	160	2.7	434	280	1.55	3.87	8.51
Land Use Type	Area (ha)			**Allocated Demand** (L/ha/d)	**Avg Day** (L/s)	**Max Day** (L/s)	**Peak Hour** (L/s)
Park	2.49	-	-	28,000	0.81	1.21	2.18
Schools	5.62	-	-	28,000	1.82	2.73	4.92
				TOTAL	**10.05**	**19.54**	**33.21**

Single-detached dwellings and traditional townhomes are expected to meet the requirements to apply the City of Ottawa's cap of 10,000 L/min (167 L/s), as outlined in *ISDTB-2014-02*. Firewalls will be required in the back-to-back townhomes to limit the required fire flow to 200 L/s. A sample calculation, in accordance with the Fire Underwriters Survey's Water Supply for Public Fire Protection Guideline (1999) as amended by *ISTB-2014-02* & *ISTB-2018-02* can be found in ***Appendix C***.

A range of fire flows (167 L/s to 283 L/s) was included in the boundary conditions request. Hydraulic gradelines (HGL) for intermediate flows between 167 L/s and 283 L/s have been interpolated using the boundary conditions provided by the City.

The fire flow demands for the institutional blocks were assumed as 150 L/s, as per the Master Municipal Construction Documents (MMCD). Where multiple fire flow conditions were present, the most conservative fire flow requirement was assigned.

Demands from the two properties adjacent to the study area that were previously identified for development were considered in the hydraulic analysis, should future connections be required. The eastern property was treated as future residential, with the same water demands and unit density as the surrounding residential area. The western property was treated as a Mixed-Use block, consistent with the *CDP* and *MSS,* with 26% of the block considered residential (135 pop/ha) and the remaining area considered as commercial. Demand rates from ***Table 3*** were applied to these assumed land uses.

The demands for the future development south of the Cardinal Creek South Tributary were also considered in the hydraulic analysis, applying the water demand rates used at the time of the *MSS*. As shown in ***Figure 4***, watermain stubs have been included in the design to service future development south of the Cardinal Creek South Tributary, consistent with the *MSS*. Three stubs have been shown to accommodate the updated future development limits to the south and to ensure redundancy.

The boundary conditions provided by the City of Ottawa for use in the hydraulic analysis related to the Cardinal Creek Village South development are summarized in *Error! Reference source not found.* and the associated *Error! Reference source not found.* below.

Table 5: Boundary Conditions

Condition	**Connection 1 HGL (m)** Old Montreal Road	**Connection 2 HGL (m)** Old Montreal Road at Cardinal Creek Drive
Average Day (max. pressure)	130.0	130.0
Peak Hour (min. pressure)	124.5	124.4
Max Day + Fire Flow (167 L/s)	123.9	123.7
Max Day + Fire Flow (200 L/s)	122.7	122.5
Max Day + Fire Flow (250 L/s)	120.8	120.4

The watermain network has been sized to ensure serviceability in the ultimate development scenario and consists of watermains ranging in diameter from 200mm to 400mm. Please see the *GeoAdvice Report* in **Appendix C** and **Figure 4** for more information on the proposed watermain network.

Upon analysis, it was determined that the proposed watermain network can meet the required pressure range under the anticipated demands during the average day, peak hour, and fire flow conditions.

Figure B: Boundary Conditions

3.3 Watermain Modeling

A preliminary hydraulic analysis has been completed for the study area within the *GeoAdvice Report*. The analysis, including the watermain network configuration and sizing, is provided in ***Appendix C***. As part of the analysis, all phases of the CCV South development were considered to demonstrate serviceability from initial development to full buildout of the development. The development is to advance in phases according to the landowner's preferred timing.

Modeling was carried out for the average day, peak hour, and fire flow conditions. Modeling results shown in ***Table 6*** indicate that the development can be adequately serviced for average day and peak hour criteria.

Table 6: Summary of Available Service Pressures

Average Day Demand Maximum Pressure (kPa)	Peak Hour Demand Minimum Pressure (kPa)
500	278

Per ***Table 3***, the minimum allowable pressure under fire flow conditions is 140 kPa at the location of the fire. A summary of available fire flows for CCV South is shown below in ***Table 7*** Further details can be found in ***Appendix C.***

Table 7: Summary of Available Fire Flows

Required Fire Flow (L/s)	Minimum Available Flow (L/s)
167	256
200	281
250	>500

3.4 Water Supply Servicing Conclusion

The City's 2E pressurized water supply network will be expanded at connections on Old Montreal Road and Cardinal Creek Drive to provide potable water to the study area through the proposed pressurized watermain network.

The proposed watermain network conforms to all relevant City and MECP *Water Supply Guidelines*. The hydraulic analysis of the proposed watermain network, completed within the *GeoAdvice Report*, concludes that all required domestic and fire flows can be met throughout the study area.

Anticipated fire flow requirements can be met throughout the development lands according to City Guidelines and ISTB-2018-02. Firewalls are proposed within the back-to-back townhouses in order to limit the required fire flow to 200 L/s.

4.0 WASTEWATER SERVICING

4.1 Existing Wastewater Services

Existing sanitary sewers service Cardinal Creek Village Phase 4, to the north of the study area. An existing 375 mm diameter sanitary trunk sewer, installed as part of phase 4 of Cardinal Creek Village, runs along Cardinal Creek Drive and crosses Old Montreal Road, offering a connection point to service the study area.

Existing wastewater servicing infrastructure in the surrounding area is shown in ***Figure 3***.

4.2 Wastewater Design

The wastewater servicing strategy for the study area outlined in the *MSS* directs sanitary flows from the study area towards the existing Cardinal Creek Village Phase 4 north of Old Montreal Road. The flows are ultimately directed through the Cardinal Creek Village development towards the Trim Road collector sewer.

Consistent with the *MSS*, the wastewater flows from the study area and its external drainage areas are to be directed towards the existing 375 mm diameter sanitary trunk sewer at Cardinal Creek Drive and Old Montreal Road. The study area will be serviced by a network of internal gravity sewers, ranging from 200 mm to 375 mm in diameter, generally following the local road network. See ***Figure 3*** for the proposed sanitary sewer network.

The proposed sanitary sewer network was designed in accordance with the wastewater design parameters from *ISTB-2018-01* and the *Sewer Design Guidelines*, summarized in ***Table 8*** below. Sanitary sewer design sheets can be found in ***Appendix D***.

Demands from the two properties adjacent to the study area that were previously identified for development were considered in the design of the sanitary network, should future connections be required. The eastern property was treated as future residential, with the same sanitary demands and population density as the surrounding residential area. The western property was treated as mixed-use, consistent with the *CDP* and *MSS*, assuming a high-density residential area would account for 26% of the total area, and the remaining area considered as commercial. Demand rates from the *Sewer Design Guidelines* were applied to these assumed land uses.

Consistent with the *MSS*, demands from the future development south of the Cardinal Creek South Tributary have been included in the wastewater design of the study area. The boundary of the future development has been updated since the time of the *MSS* per the City's latest Official Plan. The revised boundary has been considered in the proposed design and the anticipated future connection point is now located in the southeast corner of the study area on Street 9, to allow for the future sanitary connection to cross the South Tributary further upstream, avoiding unnecessary deep sewers.

In specific areas, high- and low-level sanitary sewers are proposed to allow for the trunk sewer to provide service to the future development lands to the south of the Cardinal Creek South Tributary and to allow for residential services within the study area to connect to the high-level sewer. Further details can be found in ***Figures 3 & 6-8***. Drop pipes are expected to be required in specific manholes. The exact locations and details regarding drop pipes will be confirmed as part of detailed design.

Table 8: Wastewater Design Criteria

Design Parameter	Value
Residential - Single Family	3.4 p/unit
Residential – Townhome/ Back-to-Back	2.7 p/unit
Average Daily Demand	280 L/d/per
Peaking Factor	Harmon's Peaking Factor, where K=0.8
Commercial / Institutional Flows	28,000 L/ha/day
Commercial / Institutional Peak Factor	1.5 if contribution area >20%, otherwise 1.0
Infiltration and Inflow Allowance	0.33 L/s/ha for all areas
Park Flows	28,000 L/ha/d
Park Peaking Factor	1.0
Sanitary sewers are to be sized employing the Manning's Equation	$Q = \frac{1}{n} AR^{2/3} S^{1/2}$
Minimum Sewer Size	200mm diameter
Minimum Manning's 'n'	0.013
Minimum Depth of Cover	2.5m from the crown of the sewer to grade
Minimum Full Flowing Velocity	0.6m/s
Maximum Full Flowing Velocity	3.0m/s
Extracted from Sections 4 and 6 of the City of Ottawa Sewer Design Guidelines, October 2012, technical bulletins, and recent residential subdivisions in the City of Ottawa.	

More recently than the *MSS*, the Cardinal Creek Village Phase 4 detailed design included consideration for the study area's wastewater flows. See ***Appendix D*** for details. A summary of the assumed land uses and peak flows from the study area and its external drainage areas can be found in ***Table 9*** below. Note, the Cardinal Creek Village Phase 4 detailed design used sanitary design parameters which have since been updated by the City of Ottawa.

Table 9: Wastewater Design Comparison

Outlet	Design	Residential Area (Pop)	Park Area	Commercial / Institutional Area	Peak Flow
Existing MH200A	MSS (July 2013)	53.38 (3802 pop.)	2.80 ha	4.36 ha	84.56 L/s*
	CCV Ph 4 (November 2017)	55.48 Ha (4018 pop.)	2.42 ha	7.19 ha	79.06 L/s
	CCV South FSR (June 2022)	85.37 Ha (6088 pop.)	4.98 ha	9.18 ha	89.32 L/s

MSS* used different sanitary sewer design parameters from the ones summarized in ***Table 8*. See *MSS* for details.

As shown in ***Table 9*** above, the proposed peak sanitary flow directed to the sanitary sewer stub is 89.32 L/s, which represents a 13% increase compared to the peak flow considered in the Cardinal Creek Village Phase 4 design.

Given the proposed 10.26 L/s increase in peak flow directed towards the existing sanitary sewer network, an analysis of the downstream network was completed. See ***Appendix D*** for details. It was determined that despite the flow increase, there is sufficient capacity in the downstream sewer to accommodate the additional flows. As shown in ***Appendix D***, all of the downstream sanitary sewers were found to be below 79% capacity when considering the proposed flows from the study area and its external drainage areas.

4.3 Wastewater Servicing Conclusions

A network of gravity sewers is proposed within the study area to convey wastewater flow to the existing trunk sanitary sewer in Cardinal Creek Drive, installed as part of Cardinal Creek Village Phase 4. The sewers are to be designed in conformance with all relevant City of Ottawa and MECP Guidelines and Policies.

The flows are ultimately directed through the existing Cardinal Creek Village development towards the Trim Road collector sewer. Capacity in the downstream trunk sewer has been confirmed to accommodate flows from the study area and its external drainage areas.

5.0 STORMWATER MANAGEMENT

5.1 Existing Stormwater Drainage

The study area is located within the Cardinal Creek subwatershed. Existing drainage catchments within the study area were delineated in the *MSS*, as shown in ***Appendix B***. The study area's pre-development drainage is split between two receivers, with the majority of the site draining to the Cardinal Creek South Tributary, and the remaining area draining to the Cardinal Creek North Tributary. As part of the existing phases of CCV north of Old Montreal Road, portions of the Cardinal Creek North Tributary have been closed and the pre-development drainage from CCV South has been accommodated in the existing storm sewer network.

Existing Stormwater Management Pond 1 services the existing phases of Cardinal Creek Village and is located north of the study area and just south of Regional Road 174. The design of Stormwater Management Pond 1 considers a portion of the pre-development drainage from CCV South and an allowance for post-development conditions.

An existing 1350 mm diameter storm sewer, installed as part of Cardinal Creek Village Phase 4, runs along Cardinal Creek Drive and ultimately directs flows to Stormwater Management Pond 1. Existing storm sewer infrastructure in the surrounding area is shown in ***Figure 2***.

5.2 Stormwater Management Strategy

Stormwater management requirements for the study area have been adopted from the *MSS*. Stormwater runoff from the study area was planned to be split and directed towards two stormwater management ponds:

- The northwestern portion of the study area (~6 ha) along Old Montreal Road was planned to be treated by Stormwater Management Pond 1 for Enhanced quality control before discharge to the Ottawa River.
- The remaining portion of the study area was planned to be treated by Stormwater Management Pond 2, located in the southwest corner of the study area, for Enhanced quality control, erosion control, and quantity control before discharge to the Cardinal Creek South Tributary.
- Stormwater Management Pond 1 has been constructed under ECA No. 9999-BFWK2C, (see ***Appendix B*** for reference) and has been sized to receive partial drainage from the study area per the detailed design of the pond, and in accordance with the *MSS*. Stormwater Management Pond 1 has also been designed to accept pre-development drainage in the interim condition.

For stormwater runoff destined to the Cardinal Creek South Tributary via Stormwater Management Pond 2:

- Quantity control is required to match pre-development rates for events up to the 100-year storm, and adhere to an erosion threshold of 0.43 m^3/s (match post-

development hydrographs to pre-development hydrographs for events up to and including the 2-year storm); and

- Quality control is to be provided to treat development runoff to the MECP Enhanced level of protection (long-term average removal of 80% of total suspended solids) to protect aquatic habitat.

The following key City standards will be required for stormwater management within the subject lands and conveyance to the proposed stormwater management ponds, among other requirements:

- Storm sewers on local roads are to be designed to provide a minimum 2-year level of service per the City's Technical Bulletin PIEDTB-2016-01.
- Storm sewers on collector roads are to be designed to provide a minimum 5-year level of service per the City's Technical Bulletin PIEDTB-2016-01.
- Storm sewers on arterial roads are to be designed to provide a minimum 10-year level of service.
- For less frequent storms (i.e., larger than the minimum level of service), the minor system sewer capture will be restricted with the use of inlet control devices to prevent excessive hydraulic surcharges.
- Under full flow conditions, the allowable velocity in storm sewers is to be no less than 0.80 m/s and no greater than 6.0 m/s.
- For the 100-year storm and local and collector roads, the maximum depth of water (static and/or dynamic) on streets, rear yards, public spaces, and parking areas shall not exceed 0.35 m at the gutter.
- The major system shall be designed with sufficient capacity to allow the excess runoff of a 100-year storm to be conveyed within the public ROW or adjacent to the right-of-way provided that the water level must not touch any part of the building envelope, must remain below all building openings during the stress test event (100-year + 20%), and must maintain 15 cm vertical clearance between spill elevation on the street and the ground elevation at the nearest building envelope.
- When catch basins are installed in rear yards, safe overland flow routes are to be provided to allow the release of excess flows from such areas. A minimum of 30 cm of vertical clearance is required between the rear yard spill elevation and the ground elevation at the adjacent building envelope.
- The product of the maximum flow depths on streets and maximum flow velocity must be less than 0.60 m2/s on all roads.

5.3 Stormwater Management Design

Consistent with the *MSS*, the study area's minor and major systems are to be split between existing Stormwater Management Pond 1 and Stormwater Management Pond

2. It is proposed that Pond 2 be constructed within the study area as part of the first phase of construction.

Table 10: Stormwater Management Design Criteria

Design Parameter	Value
Minor System Design Return Period	2-Year (Local Streets), 5-Year (Collector Streets), 10-Year (Arterial Streets) – PIEDTB-2016-01
Major System Design Return Period	100-Year
Intensity Duration Frequency Curve (IDF) 2-year storm event: A = 723.951, B = 6.199, C = 0.810 5-year storm event: A = 998.071, B = 6.053, C = 0.814	$i = \frac{A}{(t_c + B)^C}$
Minimum Time of Concentration	10 minutes
Rational Method	$Q = CiA$
Runoff coefficient for paved and roof areas	0.90
Runoff coefficient for landscaped areas	0.20
Storm sewers are to be sized employing the Manning's Equation	$Q = \frac{1}{n} AR^{2/3} S^{1/2}$
Minimum Sewer Size	250 mm diameter
Minimum Manning's 'n'	0.013
Service Lateral Size	100 mm dia PVC SDR 28 with a minimum slope of 1.0%.
Minimum Depth of Cover	2 m from the crown of the sewer to grade (or 1.5m where USF freeboard to HGL is not a constraint, such as in slab-on-grade products)
Minimum Full Flowing Velocity	0.8 m/s
Maximum Full Flowing Velocity	6.0 m/s
Clearance from 100-Year Hydraulic Grade Line to Building Opening	0.30 m
Max. Allowable Flow Depth on Municipal Roads	35 cm above gutter (PIEDTB-2016-01)
Extent of Major System	To be contained within the municipal right-of-way or adjacent to the right-of-way provided that the water level must not touch any part of the building envelope and must remain below the lowest building opening during the stress test event (100-year + 20%) and 15cm vertical clearance is maintained between spill elevation on the street and the ground elevation at the nearest building envelope (PIEDTB-2016-01)
Stormwater Management Model	SWMHYMO (v5.5) and HEC-RAS (v5.0).
Model Parameters	Fo = 76.2 mm/hr, Fc = 13.2 mm/hr, DCAY = 4.14/hr, D.Stor.Imp. = 1.57 mm, D.Stor.Per. = 4.67 mm
Imperviousness	Based on runoff coefficient (C) where Percent Imperviousness = (C - 0.2) / 0.7 x 100%.
Design Storms	Chicago 3-hour Design Storms and 24-hour SCS Type II Design Storms. Maximum intensity averaged over 10 minutes.
Historical Events	July 1st, 1979, August 4th, 1988, and August 8th, 1996
Climate Change Street Test	20% increase in the 100-year, 3-hour Chicago storm
Extracted from City of Ottawa Sewer Design Guidelines, October 2012, as amended by PIEDTB-2016-01, *and based on recently approved residential subdivision designs in the City of Ottawa.*	

The study area will be serviced by an internal gravity storm sewer network that generally follows the local road network, as shown in ***Figure 2***. The proposed preliminary network ranges in diameter from 300 mm to 1650 mm. The rational method design sheet can be found in ***Appendix D***.

A runoff coefficient of 0.68 was determined for singles, townhouses, and back-to-back units based on existing phases of Cardinal Creek development to the north of Old Montreal Road. Runoff coefficients of 0.7 and 0.4 were applied to the schools and park respectively, consistent with the MSS. All runoff coefficients will be further reviewed and confirmed as part of the detailed design of the study area.

Runoff from the two properties adjacent to the study area that were previously identified for development was considered in the design of the preliminary storm network should future connections be required. The eastern property was treated as future residential, with the same runoff coefficient as the surrounding residential area. The western property was treated as mixed-use, and a runoff coefficient of 0.9 was assumed consistent with the *CDP* and *MSS*.

Table 10 summarizes the standards that will be employed in the detailed design of the storm sewer network, meeting the requirements in ***Section 5.2***.

Inlet control devices (ICD) will be employed to ensure that storm flows entering the minor system are limited to the flows described above. 100-year capture is proposed in the specific locations adjacent to Old Montreal Road to prevent the major system from crossing the arterial Old Montreal Road.

5.3.1 Proposed Outlet - Stormwater Management Pond 1

The minor and major system flows from a 6.29 ha portion of the study area are planned to be directed to the existing Stormwater Management Pond 1. As mentioned in ***Section 5.2***, the runoff from a portion of the study area was considered to drain to Stormwater Management Pond 1 in the *MSS*. More recently, drainage from the study area was considered as part of the detailed design of *Cardinal Creek Village Phase 5 and in the Stormwater Management Report for Phases 5 and 6 of Cardinal Creek Village* (JFSA, January 2020). See ***Appendix E*** for excerpts from the report. ECA approval for the latest Pond 1 drainage area can be found in ***Appendix B***.

Table 11: Stormwater Management Pond 1 Drainage Comparison

Outlet	Design	Area (Ha)	Avg. Runoff Coefficient	A*C
Existing MH200	CCV Ph 5 & 6 (Jan 2020)	11.84	0.43	5.07
	CCV South FSR (June 2022)	6.97	0.72	5.02

As shown in ***Table 11***, the product of the tributary area and average runoff from the proposed drainage diversion represents a 1% decrease compared to the previously considered drainage area. As such, there is capacity in the existing downstream sewer network and Pond 1.

There is a 0.68 ha portion of external land to the west of the study area that is currently draining to Pond 1 via overland flow and the drainage swales on Old Montreal Road. The land was identified for potential redevelopment as part of the *MSS*, and upon redevelopment, the *MSS* considered the area to be redirected to Pond 2. Given the land's natural drainage, and the study area's drainage pattern, the area is proposed to continue draining to Pond 1 upon any potential redevelopment of the lands. See ***Figure 12*** for details.

5.3.2 Proposed Outlet - Stormwater Management Pond 2

The minor and major system flows from a 38.08 ha portion of the study area are planned to be directed to the proposed Stormwater Management Pond 2, which is to be located in the southwest corner of the study area and outlets to the Cardinal Creek South Tributary.

Per the MSS, Pond 2 is to provide quality, quantity, and erosion controls before release to the Cardinal Creek South Tributary. Specifically, permanent pool volumes are to be sized to provide an enhanced protection level (80% average long-term suspended solids removal) per the SWMP Design Manual. Quantity control for Pond 2 is to be provided based on the requirement to maintain flow release rates post-to pre-development for the 2-to 100-year storm events. Target release rates were set in the MSS based on the South Tributary erosion threshold of 0.43 m3/s.

The proposed Stormwater Management Pond 2 is planned to service 38.08 Ha of the study area while adhering to the quality, quantity, and erosion control requirements set out in the MSS. The proposed pond can be seen in ***Figure 9***, and design details can be found in the Cardinal Creek Village South Preliminary Stormwater Management Plan and Stormwater Management Facility Design (JFSA, December 21, 2021), provided under separate cover. A comparison of the MSS and proposed Pond 2 operating characteristics can be found in ***Table 12***.

Table 12: Comparison of SWM Pond 2 Drainage Area & Storage Requirements

Design	Area (ha	Imperv. (%)	Perm. Pool Depth (m)	Required Storage (m^3)		
				Perm. Pool	Qual. Control	Eros. Control
MSS (July 2013)	39.08	72	2.5	7361	1563	6509
CCV South FSR (June 2022)	38.08	66	2.5	6689	1523	5495

The *MSS* reports that extended detention of the 25 mm storm in Pond 2, with a drawdown time of approximately 96 hours is required for erosion control. Per the *Cardinal Creek*

Village South Preliminary Stormwater Management Plan and Stormwater Management Facility Design (JFSA, December 21, 2021), a drawdown time of 95.92 hours is provided by the proposed pond.

As suggested in the *MSS*, the proposed Pond 2 design will consider the implementation of thermal mitigation measures to help control temperature impacts of the stormwater flows entering the South Tributary from Pond 2. The planned measures to be considered include, but are not limited to, ensuring there is a tree planting strategy to provide maximum shade, providing a deeper permanent pool depth than required under the MECP SWM Guidelines (2003), and providing an outfall to diffuse flow before it enters the South Tributary.

A bottom draw outlet is also being proposed to aid with thermal mitigation of outlet flows. Specifically, a 300 mm diameter reverse outlet pipe has also been included in the design of Pond 2. Preliminary details can be seen in ***Figure 10***. The perforated intake pipe is to be located at the south end of the pond in a 0.5 m deep pool, which results in a permanent pool depth of 3 m at the outlet pipe. Further details are to be provided as part of the detailed design.

Rear yards backing onto the Cardinal Creek South Tributary are to drain directly into the watercourse. These rear yard flows are expected to help mitigate the closure of the headwater feature within the study area. The erosion threshold of the South Tributary is to be respected during the detailed design of the study area.

A site-specific water budget was completed as part of the MSS (July 2013), and per the approved report, no Low Impact Development (LID) measures beyond the use of backyard perforated pipes are required to be implemented within the study area.

An additional stormwater management facility that outlets to the Cardinal Creek South Tributary will be required to service the runoff from the future development south of the Cardinal Creek South Tributary.

5.3.3 Hydraulic Grade Line

A preliminary hydraulic gradeline (HGL) analysis has been completed for the proposed storm sewer network as detailed in the *Cardinal Creek Village South Preliminary Stormwater Management Plan and Stormwater Management Facility Design* (JFSA, December 21, 2021), provided under separate cover. The results of the analysis found that a 0.30 m freeboard can be achieved between the hydraulic gradeline and the estimated underside of footing elevations (assumed 1.9 m below ground level) throughout the study area.

A detailed HGL analysis based on the 100-year 3-hour Chicago and 24-hour SCS design storms will be prepared and further analyzed at the detailed design stage, and the storm sewer network and proposed grading will be refined accordingly.

5.4 Grading and Drainage

A preliminary grading plan has been developed to respect grade raise restrictions, minimize earthworks on-site and provide major system conveyance. See ***Figure 5*** for the concept level grading plan demonstrating proposed grades in the development.

The proposed grading plan has been based on a maximum grade raise restriction of 2 m for residential lots, as described in ***Section 1.1*** and the *Geotechnical Investigation – Cardinal Creek Village South* (Paterson Group, November 29, 2021), provided under separate cover. The road grades and slopes shown in ***Figure 5*** represent the centerline of road low points. At detailed design, high points, road sags, and sawtoothing will be included in the detailed grading plans.

The following grading criteria will be applied to detailed design where possible, per *City of Ottawa Sewer Design Guidelines:*

- Driveway slopes will have a maximum slope of 6%;
- Slope in grassed areas will be between 2% and 5%;
- Grades in excess of 7% will require terracing to a maximum of a 3:1 slope;
- Swales are to be 0.15m deep with 3:1 side slopes unless otherwise indicated on the drawings; and,
- Perforated pipe will be required for drainage swales if they are less than 1.5% in slope.

Old Montreal Road grading was considered in the proposed grading plan based on input from the transportation consultant, for interim and ultimate design conditions.

Similar to Cardinal Creek Drive in the existing Cardinal Creek Village Phases 4 and 5, Street 1 is proposed to have a road slope exceeding 5% in order to tie into the Old Montreal Road elevation, respect grade raise restrictions, and minimize earthworks on site. This is required in order to work with the existing topography, which has a steep rise south of Old Montreal Road. As such, a retaining wall is expected to be required between Street 2 and Street 1. As part of detailed design, detailed recommendations will be provided by a geotechnical engineer to support the proposed retaining wall.

There are two existing 900 mm diameter culverts under Cox Country Road directing runoff from the land to the east under the roadway. The northern culvert was found to convey runoff from a 1.30 Ha area towards an existing headwater feature within the study area before ultimately draining to the Cardinal Creek South Tributary. The southern culvert was found to convey runoff from a 73 Ha area directly into the Cardinal Creek South Tributary. See ***Figure 2*** for details.

Given the proposed closure of the headwater feature, the existing norther culvert is to be decommissioned and the eastern Cox Country Road roadside ditch is proposed to be regraded to direct flows from the entire 74.3 ha external drainage area towards the south

culvert. Ditch capacity calculations can be found in ***Appendix E*** and the culvert freeboard confirmation can be found in the *Cardinal Creek Village South Preliminary Stormwater Management Plan and Stormwater Management Facility Design* (JFSA, December 21, 2021).

Additional culverts will be required on Cox Country Road and Old Montreal Road to accommodate road connections and maintain drainage patterns. Sizing of these culverts will be confirmed as part of detailed design.

5.5 Stormwater Management Conclusions

The proposed minor and major systems direct a portion of the study area's runoff towards the existing Stormwater Management Pond 1 and the remaining runoff towards the proposed Stormwater Management Pond 2. The proposed stormwater system will conform to all relevant City Standards and MECP Guidelines and Policies.

The study area is proposed to be serviced by a gravity storm sewer network following local roads and servicing easements. Capacity in the downstream sewer network and Stormwater Management Pond 1 has been confirmed to accommodate runoff from a portion of the study area. Stormwater Management Pond 2 will be designed to meet all criteria set in the *MSS* as well as all relevant City of Ottawa and MECP Guidelines and Policies.

6.0 UTILITIES

Utility services extending to the site may require connections to multiple existing infrastructure points: consultation with Enbridge gas, Hydro Ottawa, Rogers, and Bell is required as part of the detailed design process to confirm the servicing plan for the subject lands. Through preliminary consultation with utility providers, it has been determined that infrastructure system capacity exists to service Cardinal Creek Village South (preliminary correspondence can be found in **Appendix A**).

Hydro One has an existing feeder in front of the development area and has been aware of the study area when designing the existing Cardinal Creek Village subdivision phases. Any need for system enhancement will be assessed by Hydro One as the loading details for the study area and surrounding area become clearer.

There is existing Bell service in the area and an extension of service will be required to service the study area. Rogers has existing aerial fiber cable as well as coax cable along the south side of Old Montreal Road, which is planned to be extended to service the study area with Fiber to Home technology.

There is existing gas infrastructure operating at intermediate pressure on the north side of Old Montreal Road near Laporte Avenue and at the intersection of Old Montreal Road and Cox Country Road. No capacity issues are expected for servicing the study area and a district station is not required.

The overhead lines south of the Old Montreal Road ROW interfere with the development area and will need to be relocated. This has been relayed to all utility agencies. Further coordination with the transportation engineers (for OMR ROW information) as well as the utility agencies will be required as detailed designs progress.

7.0 EROSION AND SEDIMENT CONTROL

Soil erosion occurs naturally and is a function of soil type, climate, and topography. The extent of erosion losses is exaggerated during construction where vegetation has been removed and the top layer of soil becomes agitated.

Before topsoil stripping, earthworks, or underground construction, erosion and sediment controls will be implemented and will be maintained throughout construction.

A silt fence will be installed around the perimeter of the active part of the site and will be cleaned and maintained throughout construction. The silt fence will remain in place until the working areas have been stabilized and re-vegetated.

Catch basins will have catch basin inserts installed during construction to protect from silt entering the storm sewer system.

An erosion and sediment control plan will be prepared as part of the detailed design package, and the following specific recommendations to the contractor will be included:

- Limit the extent of exposed soils at any given time.
- Re-vegetate exposed areas as soon as possible.
- Minimize the area to be cleared and grubbed.
- Protect exposed slopes with plastic or synthetic mulches.
- Install silt fence to prevent sediment from leaving the site and entering existing ditches.
- Install mud mat to prevent mud tracking onto adjacent roads.
- No refueling or cleaning of equipment near existing watercourses.
- Provide sediment traps and basins during dewatering.
- Install catch basin inserts.
- Plan construction at the proper time to avoid flooding.

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

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

8.0 CONCLUSIONS AND RECOMMENDATIONS

The overall municipal servicing strategy for the study area was contemplated as part of the *Cardinal Creek Village Master Servicing Study* (*MSS*) (DSEL, July 2013).

This Functional Servicing Report (*FSR*) (DSEL, June 2022) provides details on the planned municipal services for the study area, highlights proposed deviations from the *MSS,* and demonstrates that adequate municipal infrastructure capacity is expected to be available for the planned development of the study area.

The key features of the servicing plan for Cardinal Creek Village South are:

- Water supply is to be provided through extensions of the City's existing 2E Pressure Zone through connections to existing watermain infrastructure on Old Montreal Road and Cardinal Creek Drive. The watermain network is to be designed per the Ottawa Water Distribution Guidelines.
- Sanitary service is to be provided through gravity sewers that outlet to the existing Cardinal Creek Village Phase 4 sanitary sewer system. The sewers are to be designed in conformance with all relevant City of Ottawa and MECP Guidelines and Policies.
- Stormwater service is provided through gravity sewers that discharge to the Cardinal Creek Village Phase 4 storm sewer systems, ultimately discharging to the existing Stormwater Management Pond 1, and the proposed Stormwater Management Pond 2. The storm sewer network is to be designed per MECP & Ottawa Sewer Design Guidelines.
- Flows that are not captured by the gravity sewer system are conveyed overland to the existing and proposed stormwater management ponds. The overland flow routes are to be designed per MECP & City of Ottawa Sewer Design Guidelines.
- Stormwater Management Pond 2 will be designed to meet all quality, quantity, and erosion control criteria set in the *MSS*, as well as all relevant City of Ottawa and MECP Guidelines and Policies.
- Allowances for planned future developments adjacent to the study area have been considered in the preliminary design of the study area.

Before the detailed design of the infrastructure presented in this report, this *FSR* will require approval under the Planning Act as supporting information for the Draft Plan of Subdivision application. Project-specific approvals are also expected to be required for the infrastructure presented in this report from the City of Ottawa, Ministry of Environment, Conservation and Parks, and Rideau Valley Conservation Authority.

Prepared by,
David Schaeffer Engineering Ltd.

Per: Braden Kaminski, E.I.T.

Reviewed by,
David Schaeffer Engineering Ltd.

Per: Matt Wingate, P.Eng

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Appendix A

- Servicing Guidelines Checklist (DSEL, June 2022)
- Draft Plan of Subdivision (AOV, Dec 7, 2021)
- Pre-Consultation Notes with City of Ottawa Staff (various)
- Preliminary Consultation Notes with Utility Agencies (various)

DEVELOPMENT SERVICING STUDY CHECKLIST

4.1 General Content		
☐	Executive Summary (for larger reports only).	N/A
☐	Date and revision number of the report.	Title Page
☐	Location map and plan showing municipal address, boundary, and layout of proposed development.	Appendix A
☐	Plan showing the site and location of all existing services.	Figure 2, 3, 4
☐	Development statistics, land use, density, adherence to zoning and official plan, and reference to applicable subwatershed and watershed plans that provide context to applicable subwatershed and watershed plans that provide context to which individual developments must adhere.	Section 1.0
☐	Summary of Pre-consultation Meetings with City and other approval agencies.	Section 1.4 & Appendix A
☐	Reference and confirm conformance to higher level studies and reports (Master Servicing Studies, Environmental Assessments, Community Design Plans), or in the case where it is not in conformance, the proponent must provide justification and develop a defendable design criteria.	All sections
☐	Statement of objectives and servicing criteria.	Section 1.0 & Section 3.2, Section 4.2, and Section 5.3
☐	Identification of existing and proposed infrastructure available in the immediate area.	Sections 3.1, Section 4.1, and Section 5.1
☐	Identification of Environmentally Significant Areas, watercourses and Municipal Drains potentially impacted by the proposed development (Reference can be made to the Natural Heritage Studies, if available).	Sections 1.1
☐	Concept level master grading plan to confirm existing and proposed grades in the development. This is required to confirm the feasibility of proposed stormwater management and drainage, soil removal and fill constraints, and potential impacts to neighbouring properties. This is also required to confirm that the proposed grading will not impede existing major system flow paths.	Figure 5
☐	Identification of potential impacts of proposed piped services on private services (such as wells and septic fields on adjacent lands) and mitigation required to address potential impacts.	*Paterson Rpt* (Nov 29, 2021)
☐	Proposed phasing of the development, if applicable.	N/A at FSR stage
☐	Reference to geotechnical studies and recommendations concerning servicing.	Section 1.1
☐	All preliminary and formal site plan submissions should have the following information: -Metric scale -North arrow (including construction North) -Key plan -Name and contact information of applicant and property owner -Property limits including bearings and dimensions -Existing and proposed structures and parking areas -Easements, road widening and rights-of-way -Adjacent street names	Figures

4.2 Development Servicing Report: Water		
☐	Confirm consistency with Master Servicing Study, if available	Section 3.2
☐	Availability of public infrastructure to service proposed development	MSS & Section 3.2
☐	Identification of system constraints	MSS & Section 3.2
☐	Identify boundary conditions	Appendix C
☐	Confirmation of adequate domestic supply and pressure	MSS & GeoAdvice Rpt (June 2022)

*Extracted from the City of Ottawa-Servicing Study Guidelines for Development Applications

☐	Confirmation of adequate fire flow protection and confirmation that fire flow is calculated as per the Fire Underwriter's Survey. Output should show available fire flow at locations throughout the development.	MSS & GeoAdvice Rpt (June 2022)
☐	Provide a check of high pressures. If pressure is found to be high, an assessment is required to confirm the application of pressure reducing valves.	MSS & GeoAdvice Rpt (June 2022)
☐	Definition of phasing constraints. Hydraulic modeling is required to confirm servicing for all defined phases of the project including the ultimate design	MSS & GeoAdvice Rpt (June 2022)
☐	Address reliability requirements such as appropriate location of shut-off valves	MSS & GeoAdvice Rpt (June 2022)
☐	Check on the necessity of a pressure zone boundary modification	MSS
☐	Reference to water supply analysis to show that major infrastructure is capable of delivering sufficient water for the proposed land use. This includes data that shows that the expected demands under average day, peak hour and fire flow conditions provide water within the required pressure range	MSS & GeoAdvice Rpt (June 2022)
☐	Description of the proposed water distribution network, including locations of proposed connections to the existing system, provisions for necessary looping, and appurtenances (valves, pressure reducing valves, valve chambers, and fire hydrants) including special metering provisions.	MSS, Section 3.2 & Figure 4
☐	Description of off-site required feedermains, booster pumping stations, and other water infrastructure that will be ultimately required to service proposed development, including financing, interim facilities, and timing of implementation.	MSS
☐	Confirmation that water demands are calculated based on the City of Ottawa Design Guidelines.	Section 3.2
☐	Provision of a model schematic showing the boundary conditions locations, streets, parcels, and building locations for reference.	Appendix C

4.3 Development Servicing Report: Wastewater

☐	Summary of proposed design criteria (Note: Wet-weather flow criteria should not deviate from the City of Ottawa Sewer Design Guidelines. Monitored flow data from relatively new infrastructure cannot be used to justify capacity requirements for proposed infrastructure).	Section 4.2
☐	Confirm consistency with Master Servicing Study and/or justifications for deviations.	Section 4.2
☐	Consideration of local conditions that may contribute to extraneous flows that are higher than the recommended flows in the guidelines. This includes groundwater and soil conditions, and age and condition of sewers.	MSS
☐	Description of existing sanitary sewer available for discharge of wastewater from proposed development.	Section 4.2
☐	Verify available capacity in downstream sanitary sewer and/or identification of upgrades necessary to service the proposed development. (Reference can be made to previously completed Master Servicing Study if applicable)	MSS, Section 4.2, Appendix D
☐	Calculations related to dry-weather and wet-weather flow rates from the development in standard MOE sanitary sewer design table (Appendix 'C') format.	Appendix D
☐	Description of proposed sewer network including sewers, pumping stations, and forcemains.	MSS, Section 4.2 & Appendix D
☐	Discussion of previously identified environmental constraints and impact on servicing (environmental constraints are related to limitations imposed on the development in order to preserve the physical condition of watercourses, vegetation, soil cover, as well as protecting against water quantity and quality).	MSS

*Extracted from the City of Ottawa-Servicing Study Guidelines for Development Applications

☐	Pumping stations: impacts of proposed development on existing pumping stations or requirements for new pumping station to service development.	MSS
☐	Forcemain capacity in terms of operational redundancy, surge pressure and maximum flow velocity.	N/A
☐	Identification and implementation of the emergency overflow from sanitary pumping stations in relation to the hydraulic grade line to protect against basement flooding.	MSS
☐	Special considerations such as contamination, corrosive environment etc.	MSS

4.4 Development Servicing Report: Stormwater Checklist

☐	Description of drainage outlets and downstream constraints including legality of outlets (i.e. municipal drain, right-of-way, watercourse, or private property)	Section 1.1 & Section 5.1
☐	Analysis of available capacity in existing public infrastructure.	Secton 5.3
☐	A drawing showing the subject lands, its surroundings, the receiving watercourse, existing drainage patterns, and proposed drainage pattern.	Appendix B
☐	Water quantity control objective (e.g. controlling post-development peak flows to pre-development level for storm events ranging from the 2 or 5 year event (dependent on the receiving sewer design) to 100 year return period); if other objectives are being applied, a rationale must be included with reference to hydrologic analyses of the potentially affected subwatersheds, taking into account long-term cumulative effects.	MSS, Section 5.2 & *Stormwater Management Report* (JFSA, Dec 2021)
☐	Water Quality control objective (basic, normal or enhanced level of protection based on the sensitivities of the receiving watercourse) and storage requirements.	MSS & Section 5.2
☐	Description of the stormwater management concept with facility locations and descriptions with references and supporting information	Section 5.3 & Figures 2 & 9
☐	Set-back from private sewage disposal systems.	N/A
☐	Watercourse and hazard lands setbacks.	MSS, Section 1.2 & *Paterson Rpt* (Nov 29, 2021)
☐	Record of pre-consultation with the Ontario Ministry of Environment and the Conservation Authority that has jurisdiction on the affected watershed.	Section 1.4
☐	Confirm consistency with sub-watershed and Master Servicing Study, if applicable study exists.	MSS, Section 5.2, Section 5.3 & Section 5.4
☐	Storage requirements (complete with calculations) and conveyance capacity for minor events (1:5 year return period) and major events (1:100 year return period).	N/A at FSR stage
☐	Identification of watercourses within the proposed development and how watercourses will be protected, or, if necessary, altered by the proposed development with applicable approvals.	Section 1.2
☐	Calculate pre and post development peak flow rates including a description of existing site conditions and proposed impervious areas and drainage catchments in comparison to existing conditions.	MSS
☐	Any proposed diversion of drainage catchment areas from one outlet to another.	MSS, Section 5.3
☐	Proposed minor and major systems including locations and sizes of stormwater trunk sewers, and stormwater management facilities.	Section 5.3, Appendix E & Figure 2
☐	If quantity control is not proposed, demonstration that downstream system has adequate capacity for the post-development flows up to and including the 100-year return period storm event.	MSS
☐	Identification of potential impacts to receiving watercourses	MSS, *Stormwater Management Report* (JFSA, Dec 2021)

*Extracted from the City of Ottawa-Servicing Study Guidelines for Development Applications

☐	Identification of municipal drains and related approval requirements.	N/A
☐	Descriptions of how the conveyance and storage capacity will be achieved for the development.	N/A at FSR stage
☐	100 year flood levels and major flow routing to protect proposed development from flooding for establishing minimum building elevations (MBE) and overall grading.	MSS
☐	Inclusion of hydraulic analysis including hydraulic grade line elevations.	*Stormwater Management Report* (JFSA, Dec 2021)
☐	Description of approach to erosion and sediment control during construction for the protection of receiving watercourse or drainage corridors.	Section 7.0
☐	Identification of floodplains – proponent to obtain relevant floodplain information from the appropriate Conservation Authority. The proponent may be required to delineate floodplain elevations to the satisfaction of the Conservation Authority if such information is not available or if information does not match current conditions.	MSS
☐	Identification of fill constraints related to floodplain and geotechnical investigation.	MSS

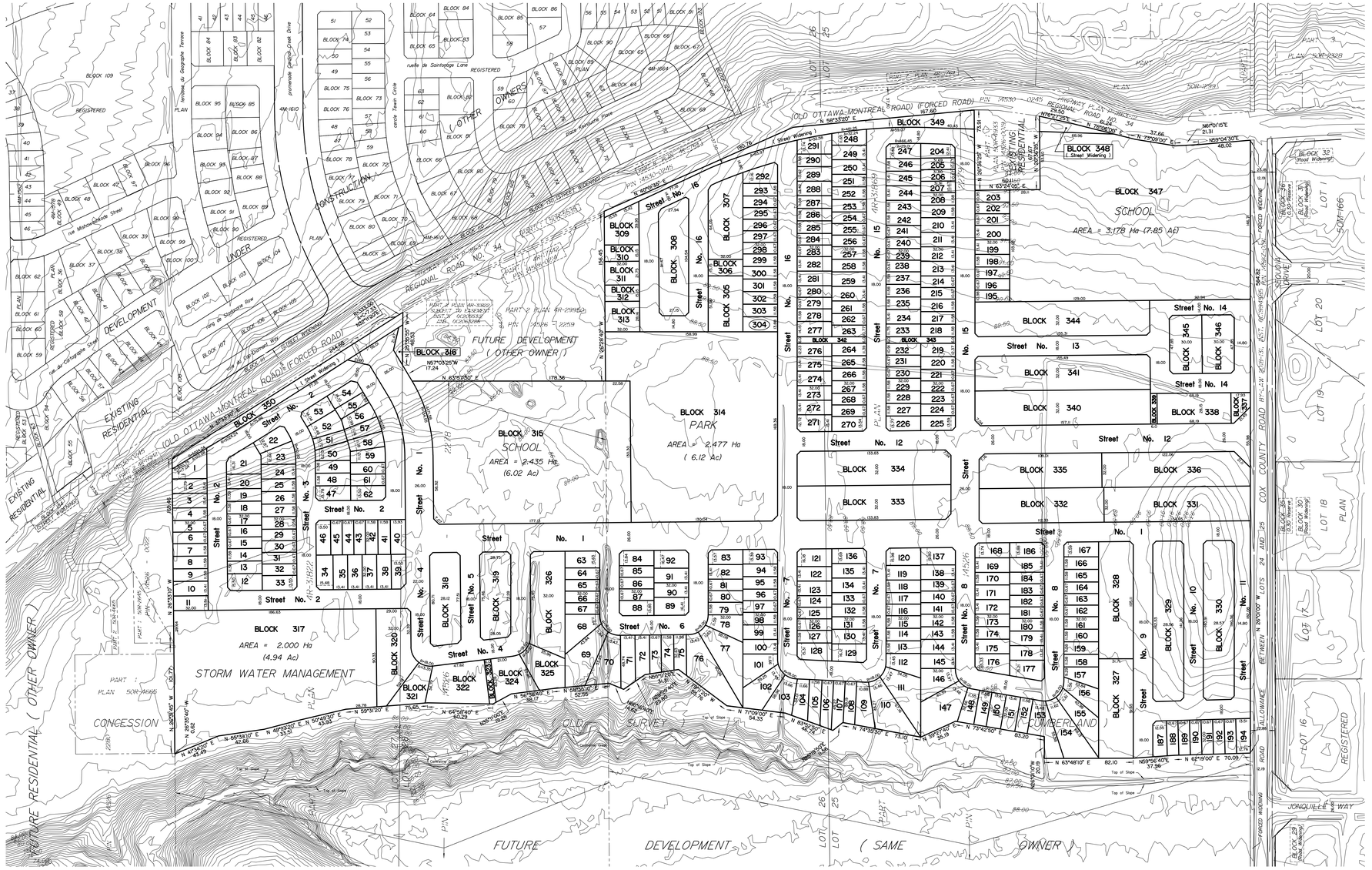
4.5 Approval and Permit Requirements: Checklist

☐	Conservation Authority as the designated approval agency for modification of floodplain, potential impact on fish habitat, proposed works in or adjacent to a watercourse, cut/fill permits and Approval under Lakes and Rivers Improvement Act. The Conservation Authority is not the approval authority for the Lakes and Rivers Improvement ct. Where there are Conservation Authority regulations in place, approval under the Lakes and Rivers Improvement Act is not required, except in cases of dams as defined in the Act.	Section 1.3
☐	Application for Certificate of Approval (CofA) under the Ontario Water Resources Act.	N/A
☐	Changes to Municipal Drains.	N/A
☐	Other permits (National Capital Commission, Parks Canada, Public Works and Government Services Canada, Ministry of Transportation etc.)	Section 1.3

4.6 Conclusion Checklist

☐	Clearly stated conclusions and recommendations	Section 8.0
☐	Comments received from review agencies including the City of Ottawa and information on how the comments were addressed. Final sign-off from the responsible reviewing agency.	N/A
☐	All draft and final reports shall be signed and stamped by a professional Engineer registered in Ontario	Section 8.0

*Extracted from the City of Ottawa-Servicing Study Guidelines for Development Applications



DRAFT PLAN OF SUBDIVISION OF

PART OF LOTS 25, 26 and 27
CONCESSION 1 (OLD SURVEY)
Geographic Township of Cumberland
CITY OF OTTAWA

Prepared by Annis , O'Sullivan , Vollebekk Ltd.

Scale 1 : 1500

60 45 30 15 0 30 60 Metres

Metric

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

SURVEYOR'S CERTIFICATE

I CERTIFY THAT :

The boundaries of the lands to be subdivided and their relationship to adjoining lands have been accurately and correctly shown.

Date

T. Hartwick
Ontario Land Surveyor

OWNER'S CERTIFICATE

This is to certify that we are the owners of the lands to be subdivided and that this plan was prepared in accordance with our instructions.

Date

Chris Taggart
Tamarack Homes
I have authority to bind the corporation.

ADDITIONAL INFORMATION REQUIRED UNDER SECTION 51-17 OF THE PLANNING ACT

(a) see plan
(b) see plan
(c) see plan
(d) single and multi-family residential housing, park land, institutional and storm water management lands
(e) see plan
(f) see plan
(g) see plan
(h) City of Ottawa
(i) see soils report
(j) see plan
(k) sanitary, storm sewers, municipal water, bell, hydro, cable and gas to be available
(l) see plan

TABLE TO ILLUSTRATE PROPOSED LAND USE

PROPOSE USE	LOTS / BLOCKS	NO. OF UNITS	AREA sqm (Ac)
SINGLE FAMILY	1 - 304	304	130 315 (32.2)
TOWNHOMES	305, 307, 309, 311, 313, 320, 322, 324, 326, 327, 328, 331-336, 340, 341, 344, 345 and 346	276	65 368 (16.2)
SEMI-DETACHED	306, 310, 312, 321 and 325	10	3 534 (0.9)
BACK 2 BACKS	308, 318, 319, 329, 330 and 338	168	17 762 (4.4)
PARK	314		24 769 (6.1)
OPEN SPACE	337		386 (0.1)
WALKWAY	323, 339, 342 and 343		1 183 (0.3)
INSTITUTIONAL	315 and 347		56 130 (13.9)
STORM WATER MANAGEMENT	317		19 999 (4.9)
STREETS	1 - 16		113 239 (28.0)
WIDENINGS	348, 349 and 350		5 686 (1.4)
OTHER	316		190 (0.1)
TOTAL		750	438 561 (108.4)

ANNIS, O'SULLIVAN, VOLLEBEKK LTD.
1rd Concourse Gate, Suite 500
Nepean, Ont. K2E 7S6
Phone: (613) 727-0850 / Fax: (613) 727-1079
Email: Nepean@aovltd.com

Ontario Land Surveyors

Job No. 22004-20 Tamarack Pt Lts 26-27 CI OS OJ DPS.DII N

Braden Kaminski

From: Braden Kaminski
Sent: Wednesday, December 15, 2021 7:02 PM
To: Braden Kaminski
Subject: FW: 1153 - Summary of Pre-application Consultation Meeting - 1296 & 1400 Old Montreal Road (PC2021-0002)
Attachments: Site Plan - D07-19-17-0005.pdf; Submission Requirements ZBA,1296 & 1400 Old Montreal Road, 08 Feb 21.pdf; Pre-con Servicing Memo.docx; Submission Requirements SUBD, 1296 & 1400 Old Montreal Road, 08 Feb 21.pdf

From: Boughton, Michael [mailto:Michael.Boughton@ottawa.ca]
Sent: Tuesday, February 9, 2021 7:36 AM
To: Peter Hume <peter.hume@hpurban.ca>
Cc: Giampa, Mike <Mike.Giampa@ottawa.ca>; Young, Mark <Mark.Young@ottawa.ca>; Rehman, Sami <Sami.Rehman@ottawa.ca>; Richardson, Mark <Mark.Richardson@ottawa.ca>; Wood, Mary Ellen <MaryEllen.Wood@ottawa.ca>; Baird, Natasha <Natasha.Baird@ottawa.ca>; Michelle Taggart <mtaggart@taggart.ca>; Tim Lee <tim.lee@tamarackhomes.com>; Laura Maxwell <LMaxwell@dsel.ca>; Christopher Gordon <christopher.gordon@cghtransportation.com>
Subject: Summary of Pre-application Consultation Meeting - 1296 & 1400 Old Montreal Road (PC2021-0002)

Good morning Peter,

In follow up to our pre-application consultation meeting on 20 January 2021, I have summarized for you City staff's understanding of your proposed subdivision development along with City staff's comments and lists of the submission requirements for your future zoning amendment and draft plan of subdivision applications when you and your client decide to proceed.

PROPOSAL SUMMARY:

To briefly summarize the proposed development, Tamarack (Cardinal Creek) Corp. plans to subdivide the lands south of Old Montreal Road, excluding the "McGarry Lands", in conformity with the Cardinal Creek Village Concept Plan (2013) and to rezone the lands from "Rural Countryside" (RU), "Rural Institutional" (RI5), "Arterial Mainstreet" (AM[2139]) and "Parks and Open Space" (O1) to a range of Residential uses, Minor Institutional, Parks and Open Space, Environmental Protection and potentially commercial all in accordance with the proposed draft plan of subdivision. The proposed draft plan of subdivision would be expected to implement the policy direction of the Concept Plan, including the residential densities, projected unit targets and mix of residential uses, school allocations, parkland dedication and environmental protections. No commercial (Mainstreet) component is to be expected south of Old Montreal Road. All commercial development is to be concentrated along Highway 174 within the designated mixed-use blocks in the Concept Plan. A draft plan of subdivision in general conformity within the draft CDP preferred land use plan was not available for discussion purposes during the meeting.

STAFF COMMENTS:

1. Planning Comments.

- *Subdivision Design* – In the absence of a preliminary draft of the plan of subdivision, specific comments on the proposed draft plan of subdivision cannot be provided other than to state that Development Review staff generally would support a proposed draft plan of subdivision that is consistent with the direction of the

approved Concept Plan, Land Use and Greenspace Plans, and the Transportation Master Plan, Environmental Master Plan, Subwatershed Management Plan and Master Servicing Plan.

- A Planning Rationale is required in support of the draft plan of subdivision application. Among the usual requirements and specifications for a Planning Rationale, it is to address the conceptual Future Transit Corridor identified on Schedule D of the Official Plan and comment on how the transit corridor and subdivision will relate. The transportation consultant is advised to consult with Frank McKinney to discuss this matter, the results of which are to be contained in the Transportation Impact Assessment.
- *Concept Plan* – In addition to the above comment, it is noted the development proponents and City staff should remain aware of the directions contained in Section 6 of the Concept Plan – Implementation and Interpretation – particularly should the proposed draft plan of subdivision include what may be deemed to be a "major change" to the Concept Plan. A discussion on this matter may be necessary once City staff are provided with and have reviewed the proposed draft plan of subdivision.
- Cross-sections from Old Montreal Road through the subdivision lands at various locations along Old Montreal Road (at 1:1 scale) will be required to provide a clear demonstration of the subdivision and public road edge condition.
- It is requested that a separate plan clearly showing the pedestrian network be submitted. The plan should highlight the sidewalks within the road allowance, pathway blocks and multi-use pathways.
- The applicant is advised that the owner of 1422 Old Montreal Road has entered into an agreement with a telecommunications provider to install a 65m high monopole telecommunications antenna on his property, which may influence the planned layout of the subdivision. The site plan filed with the City showing the location of the antenna is attached for information purposes.
- *Draft New Official Plan* – For your information and as you are aware, between now and June 2021 when the new draft Official Plan is scheduled to be considered by the Joint Planning and Agriculture and Rural Affairs Committees, any development applications filed with the City will be evaluated against the existing Official Plan. Applications filed *after* the Joint Committee meeting but *before* Council's approval of the final draft Official Plan (slated for Fall 2021), will be evaluated against the policies of both the existing and final draft Official Plans. Once the new final Official Plan is in full force and effect, all development applications will be evaluated solely against the policies of the new OP.
- During the review and evaluation of the proposed Zoning Amendment Application, consideration will be given to whether the City should also initiate a rezoning of the "McGarry Lands" to run separately, but concurrent with, Tamarack (Cardinal Creek) Corp.'s zoning amendment application.

2. Parkland Comments.

- The comments provided by the City's Parks and Recreation staff are attached for your consideration and action. Should you have any questions or require clarification, please contact Mary Ellen Wood directly.

3. Natural Systems/Environmental Comments. The following comments are provided by Sami Rehman, Environmental Planner.

- The Subwatershed Study (Greater Cardinal Creek Subwatershed Management Plan, Aecom, Aug 2014) identifies:
    - the forested ravine as part of the Natural Heritage System – significant woodlands; and
    - the watercourse in the ravine is prescribed "protection" category (Fig. 2.3) – which requires a minimum setback based on the greater of (p.14):
        - Regulatory flood line
        - Geotechnical limit of hazard lands
        - 30 m from normal high water mark
        - 25 m from top of bank
        - Setback as determined through an Environmental Impact Statement
        - Setback as determined through a Drain Engineer's Report
- Schedule K of the City's Official Plan (OP) identifies the subject area as having unstable slopes.
- Schedule L1 of the OP identifies the subject area as part of the Natural Heritage System (NHS) and more specifically, it is identified as:
    - Significant Woodlands;

    - Significant Valley lands; and
    - Significant Wildlife habitat.
- The subject lands may also provide significant habitat for threatened or endangered species. Approved methodologies will be required to determine the presence/absence of potential significant habitat and specimens.
- The subject lands have a watercourse within the ravine and a watercourse traversing the property, as per the subwatershed study. The watercourse traversing the property will require a headwater features assessment, and the appropriate setbacks will be required in accordance with the subwatershed study.
- It is advised that the Rideau Valley Conservation Authority should be consulted early in the design process to determine whether any permits or approvals are required under the Regulations.
- In the absence of a proposed draft plan subdivision, the applicant is advised that a Harmful Alteration, Disruption or Destruction of Fish Habitat (HADD) authorization from the Department of Fisheries and Oceans (DFO) may be required.
- The following studies will be required in support of applications for Draft Plan of Subdivision approval and a Zoning By-law Amendment:
    - an Integrated Environmental Review (IER);
    - an Environmental Impact Statement (EIS) to cover all the items identified in the pre-application consultation meeting; and
    - a Tree Conservation Report (TCR) – for the Draft Plan of Subdivision, which can be combined with the EIS to avoid duplications.
- During the meeting the question arose whether a multi-use paths (MUPS) or other trail systems would be permitted within the ravine. While the appropriate studies will need to be completed and more detailed information presented, City staff will consider passive recreational opportunities within the ravine. However, it is strongly recommend that paved MUPs be kept out of the ravine and out of the setbacks.
- Should you have any questions or require clarification of the above matters, please contact Sami Rehman directly.

4. **Forestry.** The following comments are provided by Mark Richardson, Planning Forester.
    1. A Tree Conservation Report (TCR) must be supplied for review along with the suite of other plans/reports required by the City.
        - An approved TCR is a requirement of draft plan of subdivision approval.
        - The TCR may be combined with the EIS.
    2. As of 1 January 2021, any removal of privately- or publicly- (City-) owned trees 10cm or larger in diameter requires a tree permit issued under the Tree Protection Bylaw (Bylaw 2020 – 340); the permit will be based on an approved TCR and made available at or near plan approval.
    3. The Planning Forester from Planning and Growth Management as well as foresters from Forestry Services will review the submitted TCR.
        - If tree removal is required, both municipal and privately-owned trees will be addressed in a single permit issued through the Planning Forester.
        - Compensation may be required for City-owned trees – if so, it will need to be paid *prior* to the release of the tree permit.
    4. The TCR must list all trees on site by species, diameter and health condition; stands or groupings of trees may be considered together using percentages and general descriptions of tree health.
    5. If trees are to be removed, the TCR must clearly show where they are and document the reason they cannot be retained.
    6. All retained trees must be shown and all retained trees within the area impacted by the development process must be protected as per City guidelines listed on Ottawa.ca.
        - The location of tree protection fencing must be shown on a plan.
        - If excavation is to occur within the critical root zone, please show the limits of excavation.
    7. The City encourages the retention of healthy trees; if possible, please seek opportunities for retention of trees that will contribute to the design/function of the site.

8. For more information on the process or help with tree retention options, contact Mark Richardson mark.richardson@ottawa.ca or on City of Ottawa.

5. Conservation Authority.

- Prior to submission of a formal application for draft plan of subdivision approval, a pre-application consultation with the Rideau valley Conservation Authority will be required. Please consult with Jamie Batchelor of the RVCA to determine whether any permits or approvals are required under the Regulations, as advised above, and please provide a copy of those comments to City staff.

6. Transportation/Noise. The following comments are provided by Mike Giampa, Senior Engineer, Infrastructure Applications.

- Front ending the road works for Old Montreal Road and Cardinal Creek Drive is a lengthy process that requires the submission of a functional plan and cost estimate. If there is an intent to do this work, please submit a Front Ending application to the file lead.
- The submission of a Screening Form is required. If a TIA is warranted, proceed to scoping.
    - The application for draft plan of subdivision approval will not be deemed complete until the submission of the draft Step 1-4, including the functional draft RMA package (if applicable) and/or monitoring report (if applicable).
    - Although a full review of the TIA Strategy report (Step 4) is not required prior to an application, it is strongly recommended. Synchro files are required with Step 4.
- The R.O.W. protection along Old Montreal Road is 37.5m, with the following exceptions specific to the south side of Old Montreal Road through the Cardinal Creek Village community, as approved by LPAT following the settlement of the outstanding appeal to Condition 50 of the approved Draft Plan of Subdivision north of Old Montreal Road.

Road	From	To	ROW to be Protected	Classification	Sector
Old Montreal Road	Trim Road	65m west of Famille-Laporte Avenue	37.5m	arterial	urban
Old Montreal Road	65m west of Famille-Laporte Avenue	65m east of Famille-Laporte Avenue	42.5m Note: Subject to unequal widening: North side 18.75m, South side 23.75m. Also, a taper on the south side extending 75m on both sides of the unequal widening is required.	arterial	urban
Old Montreal Road	65m east of	65m west of Cardinal Creek Drive	37.5m	arterial	urban

	Famille-Laporte Avenue				
Old Montreal Road	65m west of Cardinal Creek Drive	65m east of Cardinal Creek Drive	42.5m Note: Subject to unequal widening: North side 18.75m, South side 23.75m. Also, a taper on the south side extending 75m on both sides of the unequal widening is required.	arterial	urban
Old Montreal Road	65m east of Cardinal Creek Drive	East Urban Community east limit	37.5m	arterial	urban

- Geometric Road Design (GRD) drawings will be required with the first submission of underground infrastructure and grading drawings. These drawings should include such items as, but not limited to:
    - Road Signage and Pavement Marking for the subdivision;
    - Intersection control measure at new internal intersections; and
    - Location of depressed curbs and TWSIs.
- Traffic calming measures on roads are to be included within the limits of the subdivision to limit vehicular speed to 30 kph and improve pedestrian safety. These measures may include either vertical or horizontal features.
- Site triangles at the following locations on the final plan will be required:
    - Local Road to Local Road: 3 metres x 3 metres
    - Local Road to Collector Road: 5 metres x 5 metres
    - Collector Road to Collector Road: 5 metres x 5 metres
    - Collector Road to Arterial Road: 5 metres x 5 metres
- A Noise Impact Study is required.

7. Urban Design Comments. The following comments are provided by Mark Young, Senior Planner, Urban Design

- Additional comments will be provided upon receipt of a conceptual draft plan.
- A Design Brief is required for both the draft Plan of Subdivision and Zoning By-law Amendment applications. It can be combined with the Planning Rationale. The Terms of Reference document is attached.
- The Design Brief should reference the general principals of the Cardinal Creek Village Concept Plan.
- Please consider the edge conditions of the subdivision lands early on in the design process and setting of associated grades.
- Please consider sensitivities between Urban and Rural – the eastern border of the subdivision abuts existing estate lot residential development. This would not be a logical location for the highest residential densities.
- Please ensure connectivity is paramount in the community design, with linkages and visibility to the UNF to the south.
- Subject to the environmental restrictions and comments above, consider the connectivity between the subdivision and the UNF.

- If grades are a challenge along Old Montreal Road, alternatives to window streets may be considered, provided they are heavily landscaped.
- Please ensure that soil conditions, building setbacks and right-of-way cross-sections are considered early in the process to allow for tree planting.

8. Servicing Comments.

- The comments provided by Natasha Baird, Senior Engineer, are attached for your consideration and action. Should you have any questions or require clarification, please contact Natasha directly.
- The engineering related submission requirements are identified on the attached list of submission requirements.

REQUIRED PLANS AND REPORTS – SUBDIVISION:

Attached is a list of the submission requirements for the application for draft plan of subdivision approval for your action. It lists the reports and plans that are required in order to deem the draft plan of subdivision application complete. These reports focus on the above and other matters necessary for staff and circulated agencies to provide informed review and comment on the proposed application.

Please note and inform your consultants that all hard copy prints of plans are to be submitted folded on standard A1 sized (594mm x 841mm) drawing sheets, utilizing an appropriate metric scale (1:200, 1:250, 1:300, 1:400, or 1:500). All plans and reports are to be signed and stamped with professional seals (including the survey plan), as necessary.

The following link directs you to a guide for the preparation of the various required reports and plans identified above and in the attachments. All reports and plans are expected to follow these guidelines.

Guide for Preparation of Reports and Plans: https://ottawa.ca/en/planning-development-and-construction/developing-property/development-application-review-process/development-application-submission/guide-preparing-studies-and-plans

ZONING AMENDMENT SUBMISSION REQUIREMENTS:

I have also provided another list of additional submission requirements pertaining to the application to amend the Zoning By-law. In this case, it is assumed that you would file both the zoning amendment application and draft plan of subdivision applications concurrently.

APPLICATION FEES (2021 Rates):

Draft Plan of Subdivision Approval > 250 Dwelling Units:
Fee - $95,317.45, including HST
Initial Engineering Design Review & Inspection Fee - $10,000 (est. value of proposed hard and soft servicing > $300,000)
Conservation Authority Fee - $3,840.00
Total - **$109,157.45**

Zoning By-law Amendment:
Major Zoning Amendment - $21,722.94, including HST
Conservation Authority Fee - $390
Total - **$22,112.94**

Note: A 10% reduction in the planning fee component of each application type will be applied if both applications are filed concurrently.

Link to Draft Plan of Subdivision Application: https://app06.ottawa.ca/online_services/forms/ds/subdivision_en.pdf
Link to Zoning Amendment Application: https://app06.ottawa.ca/online_services/forms/ds/zoning_amendment_en.pdf

OTHER MATTERS:

It is recommended that you contact the Ward Councillor, Catherine Kitts, in advance of submitting your applications to briefly describe your proposal. Her telephone no. is 613-580-2489.

If you have any questions concerning the above information don't hesitate to contact me.

Sincerely,

Michael J. Boughton, MCIP, RPP
Senior Planner | *Urbaniste principal*
Development Review | *Examen des projects d'aménagement*
Planning, Infrastructure and Economic Development | *Service de la planification, de l'infrastructure et du développement économique*
City of Ottawa | Ville d'Ottawa
110 Laurier Avenue West, Ottawa, ON | 110, avenue Laurier Ouest (Ontario) K1P 1J1
613-580-2424, ext/poste 27588; Fax/téléc: 613-560-6006
Michael.Boughton@ottawa.ca

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MEMO

Date: February 8th, 2021

To / Destinataire	Michael Boughton, Planner
From / Expéditeur	Natasha Baird, Project Manager, Infrastructure Approvals
Subject / Objet	**Pre-Application Consultation** **Cardinal Creek Village (South) Draft Plan of Subdivision** File No. PC2021-0002

Please note the following information regarding the engineering design submission for the above noted site:

1. The Servicing Study Guidelines for Development Applications are available at the following address: https://ottawa.ca/en/planning-development-and-construction/developing-property/development-application-review-process/development-application-submission/guide-preparing-studies-and-plans#servicing-study-guidelines-development-applications

2. Servicing and site works shall be in accordance with the following documents:

   - ⇨ Ottawa Sewer Design Guidelines (October 2012)
   - ⇨ Ottawa Design Guidelines – Water Distribution (2010)
   - ⇨ Geotechnical Investigation and Reporting Guidelines for Development Applications in the City of Ottawa (2007)
   - ⇨ City of Ottawa Slope Stability Guidelines for Development Applications (revised 2012)
   - ⇨ City of Ottawa Environmental Noise Control Guidelines (January, 2016)
   - ⇨ City of Ottawa Park and Pathway Development Manual (2012)
   - ⇨ City of Ottawa Accessibility Design Standards (2012)
   - ⇨ Ottawa Standard Tender Documents (latest version)

- ⇨ Ontario Provincial Standards for Roads & Public Works (2013)

3. Record drawings and utility plans are also available for purchase from the City (Contact the City's Information Centre by email at InformationCentre@ottawa.ca or by phone at (613) 580-2424 x.44455).

4. The Functional Servicing Design Report, for the subject site, is to be based on the 2013 Master Servicing Study for Cardinal Creek by DSEL.

5. The Macro Site Servicing Plan and the Macro Grade Control and Drainage Plan can be included in the Functional Servicing Design Report.

6. The Stormwater Management Criteria, for the subject site, is to be based on the 2013 Master Servicing Study for Cardinal Creek by DSEL.

7. Water Boundary condition requests must include the location of the service and the expected loads required by the proposed development. Please provide the following information via email (natasha.baird@ottawa.ca):

    i. Location of service

    ii. Type of development and the amount of fire flow required (as per FUS, 1999).

    iii. Average daily demand: ___ l/s.

    iv. Maximum daily demand: ___l/s.

    v. Maximum hourly daily demand: ___ l/s.

8. Phase 1 ESAs and Phase 2 ESAs must conform to clause 4.8.4 of the Official Plan that requires that development applications conform to Ontario Regulation 153/04.

9. Provide Geotechnical Study Report with settlement surcharge program as mentioned in the Master Servicing Report for Cardinal Creek Village.

10. Provide the Slope Stability Study. All development and pathways must be outside of the limit of hazard lands and respect the regulation set-backs from the Conservation Authority.

11. Provide Draft Plan of Subdivision.

12. Provide the Survey Plan.

13. This application will require Conservation Authority Pre-consultation. Please provide comments.

Should you have any questions or require additional information, please contact me directly at (613) 580-2424, ext. 27995 or by email at natasha.baird@ottawa.ca.

Parks & Facilities Planning
City of Ottawa

To / Destinataire	Michael Boughton Developer Review East	File/N° de fichier: Pre-consultation2021-0002
From / Expéditeur	Mary Ellen Wood, Planner Parks and Facilities Planning	
Subject / Objet	Draft Plan of Subdivision Cardinal Creek South - Tamarak Park Review Comments	Date: February 5 , 2021

Please find below Parks & Facilities Planning comments on the above-noted development application.

Park and Facility Planning Comments:

- PFP requests conveyances of land for parkland dedication.
- The CCV CDP contemplates two neighbhourhood parks south of Old Montreal Road. If the idea is to consolidate these parks into one larger park, please provide rationale and review parkland dedication distribution. The overall parkland dedication is to reflect the CDP parkland allocation of 10 hectares (assuming residential unit counts are similar to what is proposed in the CDP). If unit counts have increased, we will need to reassess parkland dedication.
- Requested parkland conveyance to be centrally located with two public frontages.
- Parkland dedication will not be accepted with floodplain, hazardous slopes, encumbrance etc.
- Parkland dedication will be calculated at a rate of one hectare per 300 units. For any blocks that are being developed for apartments, parkland conveyance will not exceed a maximum of 10% of the land area of the site being developed.
- Parks will reserve comments on parkland dedication until I've had a chance to review a submitted draft plan.

- As discussed at pre-consult, Creek corridor needs to be reviewed/investigated, at this time, unable to comment if creek corridor could handle a recreational trail. Lands developed with a recreational trail would be above and beyond required parkland dedication.

If you have any questions, please let me know.
Regards,
Mary Ellen Wood
Maryellen.wood@ottawa.ca

Hannah Bulmer

From: Hannah Bulmer
Sent: October 29, 2021 2:30 PM
To: 'Sarah.Szymczak@HydroOne.com'
Cc: Wade.Chapman@HydroOne.com
Subject: RE: 1153 Utility Start-Up

Hi Sarah,

Thank you for getting back to me, and forwarding my request to the distribution planner for comment.

DSEL will assume there are no external upgrades required, that capacity has been confirmed, and no further action is required on behalf of the developer until time for detailed design and construction.

Regards,

Hannah Bulmer, B.A.Sc.(Civil Eng)
Project Coordinator

DSEL
david schaeffer engineering ltd.

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

cell: (613) 898-4266
email: hbulmer@DSEL.ca

From: Sarah.Szymczak@HydroOne.com <Sarah.Szymczak@HydroOne.com>
Sent: October 28, 2021 1:03 PM
To: Hannah Bulmer <HBulmer@dsel.ca>
Cc: Wade.Chapman@HydroOne.com
Subject: RE: 1153 Utility Start-Up

Hello, Hannah;

I have sent your site plan off to Hydro One's distribution planner for comment and will forward it on as soon as received. However, I can note that Hydro One has an existing 27.6kV feeder in front of the site and has been aware of the potential for future development when assessing the previous subdivision phases. Any need for system enhancement will need to be assessed at the time of the subdivision applications as the loading details for each phase become more clear.

Thank-you;

Sarah

Sarah Szymczak (she/her)
Supervising Planning Technician
Distribution Design Services|Subdivisions|BAF
Hydro One Networks Inc.
M: 705 795 1160
420 Welham Road Barrie, ON L4N 8Z2
sarah.szymczak@hydroone.com
www.HydroOne.com

From: Hannah Bulmer [mailto:HBulmer@dsel.ca]
Sent: Thursday, October 28, 2021 10:21 AM
To: jdubeau@rci.rogers.com; CHAPMAN Wade
Cc: Laura Maxwell; Braden Kaminski; Anthony Temelini; Tim Lee; Peter Hume
Subject: RE: 1153 Utility Start-Up

Hello,

Checking in to see if you've had a chance to review the request below.

As a reminder we are hoping to get feedback by the end of day tomorrow, so that your input can be included in the draft plan of subdivision application.

Please let me know if you have any questions.

Thanks,

Hannah Bulmer, B.A.Sc.(Civil Eng)
Project Coordinator

DSEL
david schaeffer engineering ltd.

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

cell: (613) 898-4266
email: hbulmer@DSEL.ca

From: Hannah Bulmer
Sent: October 19, 2021 2:33 PM
To: d.levert@bell.ca; jdubeau@rci.rogers.com; Wade Chapman (Wade.Chapman@HydroOne.com)

<Wade.Chapman@HydroOne.com>; David Lal (David.Lal@enbridge.com) <David.Lal@enbridge.com>
Cc: Laura Maxwell <LMaxwell@dsel.ca>; Braden Kaminski <BKaminski@dsel.ca>; Anthony Temelini <ATemelini@dsel.ca>
Subject: 1153 Utility Start-Up

Hello,

We are beginning the preliminary planning of the Cardinal Creek Village South (CCV South) development, south of the existing Cardinal Creek Village development, in support of a future draft plan of subdivision application. We are reaching out on behalf of Tamarack, to gain an understanding of the general utility servicing approach at this time. As shown in the attached markup, CCV South is located south of Old Montreal Road, west of Cox County Road (formerly Frank Kenny Road), and north of the Cardinal Creek South Tributary.

CCV South is comprised of approximately 874 residential units (singles, townhouses and back-to-backs), two school blocks, a stormwater management pond, and a park block. The development will be developed in phases, which are yet to be confirmed. Both the development concept and units are likely to change throughout the development application process, however the information/numbers provided here offer a good starting point.

Servicing of this development has previously been discussed (with Hydro One, Enbridge, Rogers and Bell), as part of the 2013 Cardinal Creek Village Master Servicing Study.

There are existing overhead lines on the south side of Old Montreal Road that appear to be outside of the ROW within the subject property, that we expect will require further coordination.

It was identified in the Draft Plan of Conditions for the Cardinal Creek Village Subdivision (April 2017) that Enbridge will need to provide a 3m x 3m pressure reducing regulator station, however, the final location and size of the regulator station is to be confirmed by Enbridge.

In the future, development is planned to continue south of the proposed CCV South development and should be considered when determining a servicing strategy. Based on projected densities from the draft official plan and tamarack development statistics, we were able to predict future residential populations. Again, these values are likely to change as development advances but can be used as a starting point. Please see the attached figure for the location of surrounding future development areas, and corresponding unit projections.

In advance of our detailed utility design we are asking for you to please identify your general plan of servicing for this site, confirm that your infrastructure has capacity to service these lands, and identify any existing infrastructure on or near the site.

Please confirm if you are the appropriate contact for this project. If you are not, could you please kindly forward this email to the correct contact.

It would be greatly appreciated if you could respond to this email by next **Friday October 29**, so that your input can be included in the draft plan of subdivision application.

Feel free to contact me should you have any questions.

Thank you,

Hannah Bulmer, B.A.Sc.(Civil Eng)
Project Coordinator

DSEL
david schaeffer engineering ltd.

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

cell: (613) 898-4266
email: hbulmer@DSEL.ca

Hannah Bulmer

From: Levert, Daniel <d.levert@bell.ca>
Sent: October 21, 2021 4:08 PM
To: Hannah Bulmer
Subject: RE: 1153 Utility Start-Up
Attachments: Facilites.pdf

Hello Hannah

In regards to servicing that are we are going to need to add more facilities for sure but that is going to be added as we build each area. This is decided when we get the CUP.

I have attached where our facilities are. These are all in service. The 2 are for feeding customers homes. The one Cox County Road is a remote. (This is a major facilities for the cooper service.)

Please let is me if you have any question or concerns.

Thanks

Dan Levert
613-742-5179
Access Network Coordinator
Network Provisioning
Bell

From: Hannah Bulmer <HBulmer@dsel.ca>
Sent: Tuesday, October 19, 2021 2:11 PM
To: Levert, Daniel <d.levert@bell.ca>; jdubeau@rci.rogers.com; Wade Chapman (Wade.Chapman@HydroOne.com) <Wade.Chapman@HydroOne.com>; David Lal (David.Lal@enbridge.com) <David.Lal@enbridge.com>
Cc: Laura Maxwell <LMaxwell@dsel.ca>; Braden Kaminski <BKaminski@dsel.ca>; Anthony Temelini <ATemelini@dsel.ca>
Subject: [EXT]1153 Utility Start-Up

Hello,

We are beginning the preliminary planning of the Cardinal Creek Village South (CCV South) development, south of the existing Cardinal Creek Village development, in support of a future draft plan of subdivision application. We are reaching out on behalf of Tamarack, to gain an understanding of the general utility servicing approach at this time. As shown in the attached markup, CCV South is located south of Old Montreal Road, west of Cox County Road (formerly Frank Kenny Road), and north of the Cardinal Creek South Tributary.

CCV South is comprised of approximately 874 residential units (singles, townhouses and back-to-backs), two school blocks, a stormwater management pond, and a park block. The development will be developed in phases, which are yet to be confirmed. Both the development concept and units are likely to change throughout the development application process, however the information/numbers provided here offer a good starting point.

Servicing of this development has previously been discussed (with Hydro One, Enbridge, Rogers and Bell), as part of the 2013 Cardinal Creek Village Master Servicing Study.

There are existing overhead lines on the south side of Old Montreal Road that appear to be outside of the ROW within the subject property, that we expect will require further coordination.

It was identified in the Draft Plan of Conditions for the Cardinal Creek Village Subdivision (April 2017) that Enbridge will need to provide a 3m x 3m pressure reducing regulator station, however, the final location and size of the regulator station is to be confirmed by Enbridge.

In the future, development is planned to continue south of the proposed CCV South development and should be considered when determining a servicing strategy. Based on projected densities from the draft official plan and tamarack development statistics, we were able to predict future residential populations. Again, these values are likely to change as development advances but can be used as a starting point. Please see the attached figure for the location of surrounding future development areas, and corresponding unit projections.

In advance of our detailed utility design we are asking for you to please identify your general plan of servicing for this site, confirm that your infrastructure has capacity to service these lands, and identify any existing infrastructure on or near the site.

Please confirm if you are the appropriate contact for this project. If you are not, could you please kindly forward this email to the correct contact.

It would be greatly appreciated if you could respond to this email by next **Friday October 29**, so that your input can be included in the draft plan of subdivision application.

Feel free to contact me should you have any questions.

Thank you,

Hannah Bulmer, B.A.Sc.(Civil Eng)
Project Coordinator

DSEL
david schaeffer engineering ltd.

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

cell: (613) 898-4266
email: hbulmer@DSEL.ca

Hannah Bulmer

From: Hannah Bulmer
Sent: October 29, 2021 2:26 PM
To: 'Jeanne Dubeau'
Cc: Laura Maxwell; Braden Kaminski; Anthony Temelini; Tim Lee; Peter Hume
Subject: RE: 1153 Utility Start-Up

Hi Jeanne,

Thank you for getting back to me.

DSEL will assume there are no external upgrades required, that capacity has been confirmed, and no further action is required on behalf of the developer until time for detailed design and construction.

Regards,

Hannah Bulmer, B.A.Sc.(Civil Eng)
Project Coordinator

DSEL
david schaeffer engineering ltd.

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

cell: (613) 898-4266
email: hbulmer@DSEL.ca

From: Jeanne Dubeau <jdubeau@rci.rogers.com>
Sent: October 28, 2021 10:43 AM
To: Hannah Bulmer <HBulmer@dsel.ca>
Cc: Laura Maxwell <LMaxwell@dsel.ca>; Braden Kaminski <BKaminski@dsel.ca>; Anthony Temelini <ATemelini@dsel.ca>; Tim Lee <tim.lee@tamarackhomes.com>; Peter Hume <peter.hume@hpurban.ca>
Subject: RE: 1153 Utility Start-Up

Hi Hannah,

Please note that I will be your contact for this project.

Rogers has aerial fiber cable as well as coax cable along the south side of Old Montreal Road and I plan on servicing this new project with our Fiber to the Home technology, the exact location of our fiber feed will only be known once a cup plan is provided.

Thank you!

Regards,

Jeanne

Jeanne Dubeau
System Planner
Outside Planning & Engineering - Ottawa

Rogers Communications Canada Inc.
475 Richmond Road
Ottawa, Ontario K2A 3Y8

jeanne.dubeau@rci.rogers.com
o 613-759-8523 **m** 613-220-0853

ROGERS

From: Hannah Bulmer <HBulmer@dsel.ca>
Sent: October 28, 2021 10:21 AM
To: Jeanne Dubeau <jdubeau@rci.rogers.com>; Wade Chapman (Wade.Chapman@HydroOne.com) <Wade.Chapman@HydroOne.com>
Cc: Laura Maxwell <LMaxwell@dsel.ca>; Braden Kaminski <BKaminski@dsel.ca>; Anthony Temelini <ATemelini@dsel.ca>; Tim Lee <tim.lee@tamarackhomes.com>; Peter Hume <peter.hume@hpurban.ca>
Subject: RE: 1153 Utility Start-Up

Hello,

Checking in to see if you've had a chance to review the request below.

As a reminder we are hoping to get feedback by the end of day tomorrow, so that your input can be included in the draft plan of subdivision application.

Please let me know if you have any questions.

Thanks,

Hannah Bulmer, B.A.Sc.(Civil Eng)
Project Coordinator

DSEL
david schaeffer engineering ltd.

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

cell: (613) 898-4266
email: hbulmer@DSEL.ca

From: Hannah Bulmer
Sent: October 19, 2021 2:33 PM
To: d.levert@bell.ca; jdubeau@rci.rogers.com; Wade Chapman (Wade.Chapman@HydroOne.com) <Wade.Chapman@HydroOne.com>; David Lal (David.Lal@enbridge.com) <David.Lal@enbridge.com>
Cc: Laura Maxwell <LMaxwell@dsel.ca>; Braden Kaminski <BKaminski@dsel.ca>; Anthony Temelini <ATemelini@dsel.ca>
Subject: 1153 Utility Start-Up

Hello,

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It would be greatly appreciated if you could respond to this email by next **Friday October 29**, so that your input can be included in the draft plan of subdivision application.

Feel free to contact me should you have any questions.

Thank you,

Hannah Bulmer, B.A.Sc.(Civil Eng)

Project Coordinator

DSEL
david schaeffer engineering ltd.

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

cell: (613) 898-4266
email: hbulmer@DSEL.ca

Hannah Bulmer

From: David Lal <David.Lal@enbridge.com>
Sent: October 20, 2021 9:37 AM
To: Hannah Bulmer
Subject: RE: 1153 Utility Start-Up
Attachments: Atlas Plot_Old Montreal Rd.PDF

Morning Hannah,
There is an existing 6" plastic gas main on the North side of Old Montreal Rd at Laporte Ave and 4" plastic gas main at the intersection of Old Montreal Rd and Cox Country Rd. I see no capacity issues with servicing the developments as they progress. Both gas mains mentioned operate at intermediate pressure. A district station (pressure reducer) is not required.

David

David Lal
Connections Representative
Customer Connections
ENBRIDGE GAS
TEL: 613-748-6764
david.lal@enbridge.com
400 Coventry Rd, Ottawa, On, K1K 2C7
enbridge.com
Safety. Integrity. Respect. Inclusion.

From: Hannah Bulmer <HBulmer@dsel.ca>
Sent: Tuesday, October 19, 2021 2:11 PM
To: d.levert@bell.ca; jdubeau@rci.rogers.com; Wade Chapman (Wade.Chapman@HydroOne.com) <Wade.Chapman@HydroOne.com>; David Lal <David.Lal@enbridge.com>
Cc: Laura Maxwell <LMaxwell@dsel.ca>; Braden Kaminski <BKaminski@dsel.ca>; Anthony Temelini <ATemelini@dsel.ca>
Subject: [External] 1153 Utility Start-Up

Hello,

We are beginning the preliminary planning of the Cardinal Creek Village South (CCV South) development, south of the existing Cardinal Creek Village development, in support of a future draft plan of subdivision application. We are reaching out on behalf of Tamarack, to gain an understanding of the general utility servicing approach at this time. As shown in the attached markup, CCV South is located south of Old Montreal Road, west of Cox County Road (formerly Frank Kenny Road), and north of the Cardinal Creek South Tributary.

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It was identified in the Draft Plan of Conditions for the Cardinal Creek Village Subdivision (April 2017) that Enbridge will need to provide a 3m x 3m pressure reducing regulator station, however, the final location and size of the regulator station is to be confirmed by Enbridge.

In the future, development is planned to continue south of the proposed CCV South development and should be considered when determining a servicing strategy. Based on projected densities from the draft official plan and tamarack development statistics, we were able to predict future residential populations. Again, these values are likely to change as development advances but can be used as a starting point. Please see the attached figure for the location of surrounding future development areas, and corresponding unit projections.

In advance of our detailed utility design we are asking for you to please identify your general plan of servicing for this site, confirm that your infrastructure has capacity to service these lands, and identify any existing infrastructure on or near the site.

Please confirm if you are the appropriate contact for this project. If you are not, could you please kindly forward this email to the correct contact.

It would be greatly appreciated if you could respond to this email by next **Friday October 29**, so that your input can be included in the draft plan of subdivision application.

Feel free to contact me should you have any questions.

Thank you,

Hannah Bulmer, B.A.Sc.(Civil Eng)
Project Coordinator

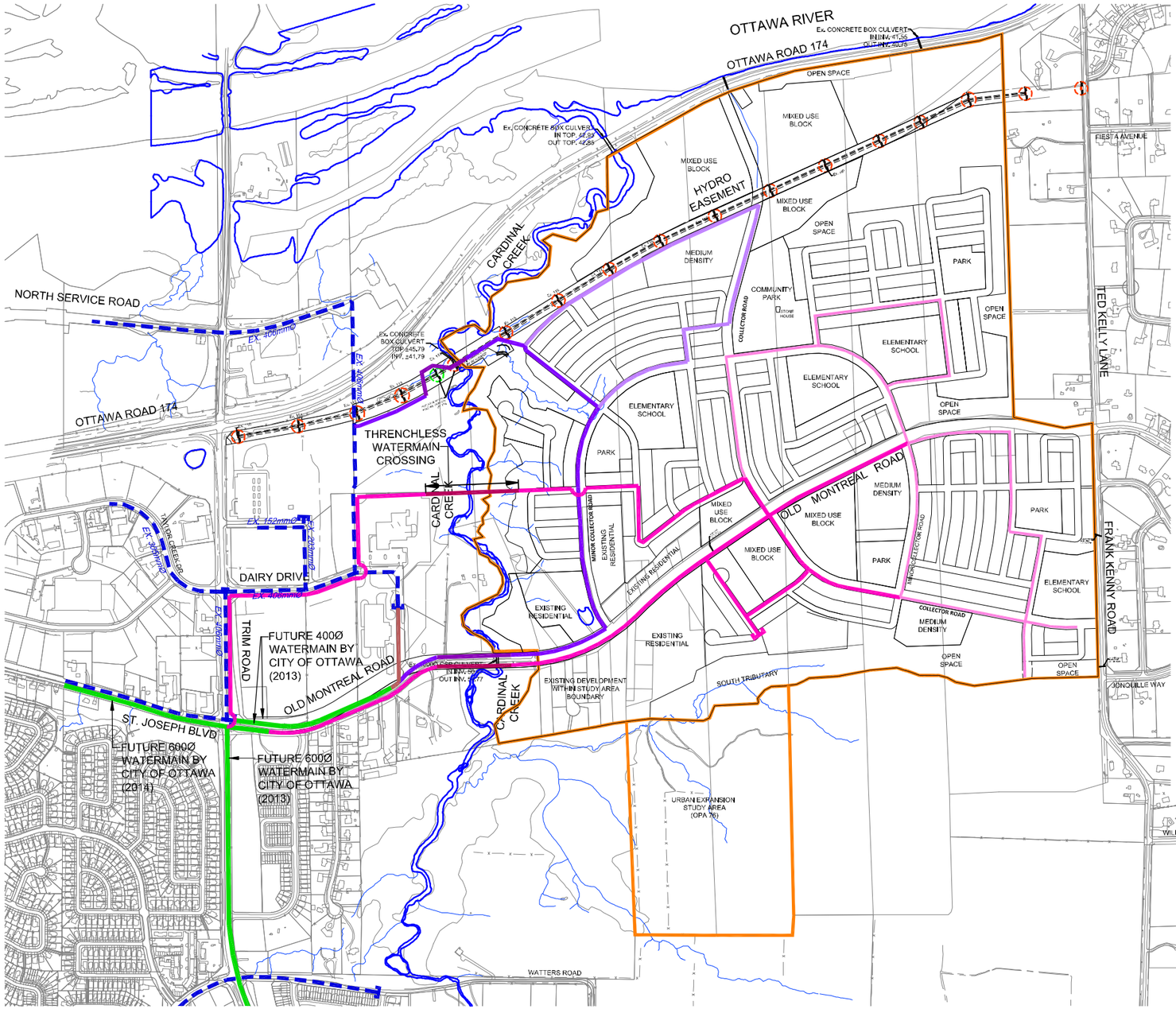
DSEL
david schaeffer engineering ltd.

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

cell: (613) 898-4266
email: hbulmer@DSEL.ca

Appendix B

- Excerpts from Cardinal Creek Village MSS (DSEL, July 2013)
- ECA #9999-BFWK2C (MECP, Sept 20, 2019)



LEGEND:

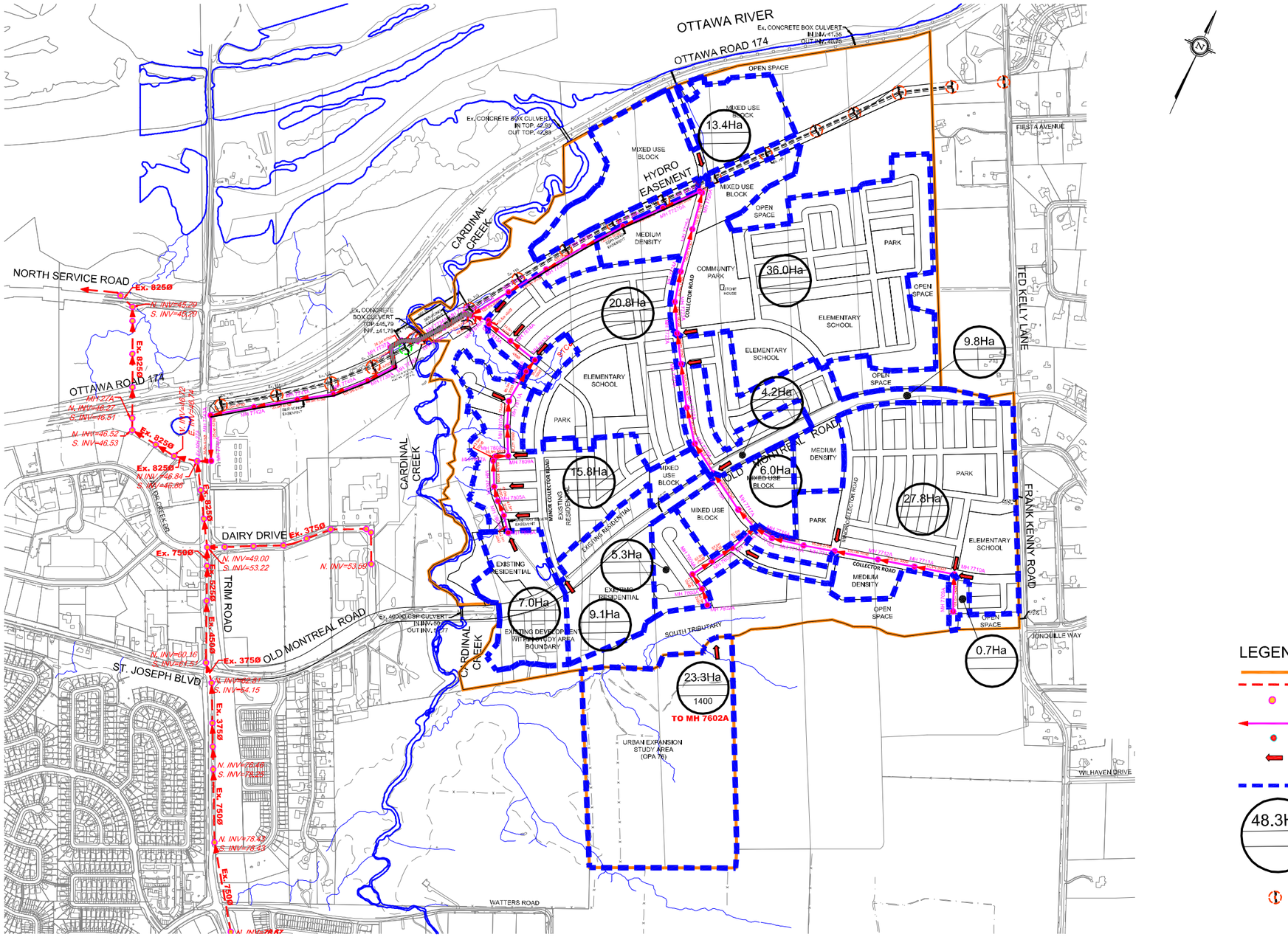
- SUBJECT LANDS
- EXISTING WATERMAIN
- EXISTING WATERMAIN PLUG
- MAJOR WATERMAIN SUPPLY 393mm (1E)
- MAJOR WATERMAIN SUPPLY 328mm(1E)
- MAJOR WATERMAIN SUPPLY 297mm(1E)
- MAJOR WATERMAIN SUPPLY 393mm (2E)
- MAJOR WATERMAIN SUPPLY 328mm (2E)
- MAJOR WATERMAIN SUPPLY 297mm (2E)
- FUTURE WATERMAIN (BY CITY OF OTTAWA)
- FUTURE WATERMAIN (BY OTHERS)
- HYDRO ONE POLE AND CLEARANCE REQUIREMENT

david schaeffer engineering ltd

120 Iber Road, Unit 203
Stittsville, ON K2S 1E9
TEL: (613) 836-0856
FAX: (613) 836-7183
www.DSEL.ca

CARDINAL VILLAGE
PREFERRED WATER SUPPLY NETWORK
CITY OF OTTAWA

PROJECT No.:	11-513
SCALE:	1:12000
DATE:	JUNE 2013
FIGURE:	7



LEGEND:

- SUBJECT LANDS
- EXISTING SANITARY MAIN
- EXISTING SANITARY MANHOLE
- SANITARY TRUNK
- SANITARY MANHOLE
- SANITARY SYSTEM FLOW DIRECTION
- SANITARY DRAINAGE BOUNDARY
- 48.3Ha — SANITARY DRAINAGE AREA
- HYDRO ONE POLE AND CLEARANCE REQUIREMENT

david schaeffer engineering ltd

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TEL: (613) 836-0856
FAX: (613) 836-7183
www.DSEL.ca

CARDINAL VILLAGE
PREFERRED SANITARY COLLECTION SYSTEM
CITY OF OTTAWA

PROJECT No.:	11-513
SCALE:	1:12000
DATE:	JUNE 2013
FIGURE:	10

NOTE:
ADDITIONAL REHABILITATION WORKS IN CARDINAL CREEK MAY BE REQUIRED, SUBJECT TO ON-GOING EROSION ASSESSMENT STUDIES.

OTTAWA RIVER
OTTAWA ROAD 174
7.4Ha 0.25
3.3Ha 0.25
OPEN SPACE
MIXED USE BLOCK
HYDRO EASEMENT
CUT-OFF SWALE
DITCH
CUT-OFF SWALE
FIESTA AVENUE
TRUNK 6B
PARK
31.5Ha 0.25
131.0Ha 0.70
MEDIUM DENSITY
COMMUNITY PARK
COLLECTOR ROAD
STONE HOUSE
ELEMENTARY SCHOOL
OPEN SPACE
TED KELLY LANE
TRUNK 6A
ELEMENTARY SCHOOL
OPEN SPACE
2.1Ha 0.25
TRUNK 1A
TRUNK 2
TRUNK 1B
ELEMENTARY SCHOOL
PARK
AREA TO STC 10.1Ha 0.70
MIXED USE BLOCK
OLD MONTREAL ROAD
MEDIUM DENSITY
PARK
MINOR COLLECTOR ROAD
EXISTING RESIDENTIAL
MIXED USE BLOCK
MIXED USE BLOCK
PARK
TRUNK 3A
TRUNK 3B
40.9Ha 0.70
ELEMENTARY SCHOOL
FRANK KENNY ROAD
EXISTING RESIDENTIAL
EXISTING RESIDENTIAL
COLLECTOR ROAD
MEDIUM DENSITY
OPEN SPACE
OPEN SPACE
EXTERNAL (TO SOUTH TRIBUTARY) 52.3Ha 0.25
JONQUILLE WAY
6.8Ha 0.70
EXISTING DEVELOPMENT WITHIN STUDY AREA BOUNDARY
SOUTH TRIBUTARY
EXTERNAL (TO SOUTH TRIBUTARY) 40.8Ha 0.25
23.3Ha 0.70
URBAN EXPANSION STUDY AREA (OPA 76)
8.6Ha 0.25
WILHAVEN DRIVE
CARDINAL CREEK
CARDINAL CREEK
CARDINAL CREEK
OTTAWA ROAD 174

LEGEND:

- SUBJECT LANDS
- STORM SEWER TRUNK
- DRAINAGE AREA BOUNDARY
- 39.9Ha / 0.70 — DRAINAGE AREA / RUN-OFF COEFFICENT
- 23.2Ha / 0.70 — EXTERNAL DRAINAGE AREA / RUN-OFF COEFFICENT
- AREA TO STC 10.1Ha / 0.70 — SPECIFIED DRAINAGE AREA / RUN-OFF COEFFICENT
- EROSION MITIGATION MEASURES
- STC — OIL & GRIT SEPERATOR UNIT
- OTTAWA RIVER
- CARDINAL CREEK
- NORTH TRIBUTARY OF CARDINAL CREEK
- SOUTH TRIBUTARY OF CARDINAL CREEK

DSEL
david schaeffer engineering ltd
120 Iber Road, Unit 203
Stittsville, ON K2S 1E9
Tel. (613) 836-0856
Fax. (613) 836-7183
www.DSEL.ca

CARDINAL VILLAGE
CONCEPTUAL STORM DRAINAGE (MINOR SYSTEM)
CITY OF OTTAWA

DATE: JUNE 2013
SCALE: 1:8000
PROJECT No.: 11-513
FIGURE: 17

NOTE:
ADDITIONAL REHABILITATION WORKS IN CARDINAL CREEK MAY BE REQUIRED, SUBJECT TO ON-GOING EROSION ASSESSMENT STUDIES.

OTTAWA RIVER
OTTAWA ROAD 174
Ex. CONCRETE BOX CULVERT
IN INV. 41.55
OUT INV. 40.75
3.3Ha
OVERLAND AREA TO OTTAWA RIVER
7.4Ha
OVERLAND AREA TO EXISTING CHANNEL
Ex. CONCRETE BOX CULVERT
IN TOP. 42.95
OUT TOP. 42.85
OPEN SPACE
MIXED USE BLOCK
FIESTA AVENUE
HYDRO EASEMENT
CUT-OFF SWALE
DITCH
MIXED USE BLOCK
OPEN SPACE
TRUNK 6B
PARK
CUT-OFF SWALE
31.5Ha
OTTAWA ROAD 174
CARDINAL CREEK
MEDIUM DENSITY
101.4Ha
OVERLAND AREA TO POND
COMMUNITY PARK
STONE HOUSE
COLLECTOR ROAD
OPEN SPACE
TED KELLY LANE
2.1Ha
OVERLAND AREA TO EXISTING CHANNEL
ELEMENTARY SCHOOL
TRUNK 6A
ELEMENTARY SCHOOL
TRUNK 1B
TRUNK 1A
TRUNK 2
ELEMENTARY SCHOOL
OPEN SPACE
PARK
OLD MONTREAL ROAD
CARDINAL CREEK
29.6Ha
OVERLAND AREA TO EXISTING CHANNEL
MINOR COLLECTOR ROAD
EXISTING RESIDENTIAL
MIXED USE BLOCK
MIXED USE BLOCK
MEDIUM DENSITY
40.9Ha
PARK
FRANK KENNY ROAD
TRUNK 3A
TRUNK 3B
MINOR COLLECTOR ROAD
ELEMENTARY SCHOOL
EXISTING RESIDENTIAL
COLLECTOR ROAD
MEDIUM DENSITY
EXISTING RESIDENTIAL
6.8Ha
OVERLAND AREA TO EXISTING CHANNEL
OPEN SPACE
OPEN SPACE
52.3Ha
JONQUILLE WAY
Ex. 4000Ø CSP CULVERT
IN INV. 50.77
OUT INV. 50.77
CARDINAL CREEK
EXISTING DEVELOPMENT WITHIN STUDY AREA BOUNDARY
SOUTH TRIBUTARY
40.8Ha
23.3Ha
URBAN EXPANSION STUDY AREA (OPA 76)
8.6Ha
WILHAVEN DRIVE

LEGEND:

- SUBJECT LANDS
- DRAINAGE AREA BOUNDARY
- 39.9Ha — DRAINAGE AREA
- OVERLAND FLOW ROUTE
- 23.2Ha — EXTERNAL DRAINAGE AREA / RUN-OFF COEFFICENT
- EROSION MITIGATION MEASURES
- SOUTH TRIBUTARY OF CARDINAL CREEK
- OTTAWA RIVER
- CARDINAL CREEK
- NORTH TRIBUTARY OF CARDINAL CREEK
- STC — OIL & GRIT SEPERATOR UNIT

DSEL
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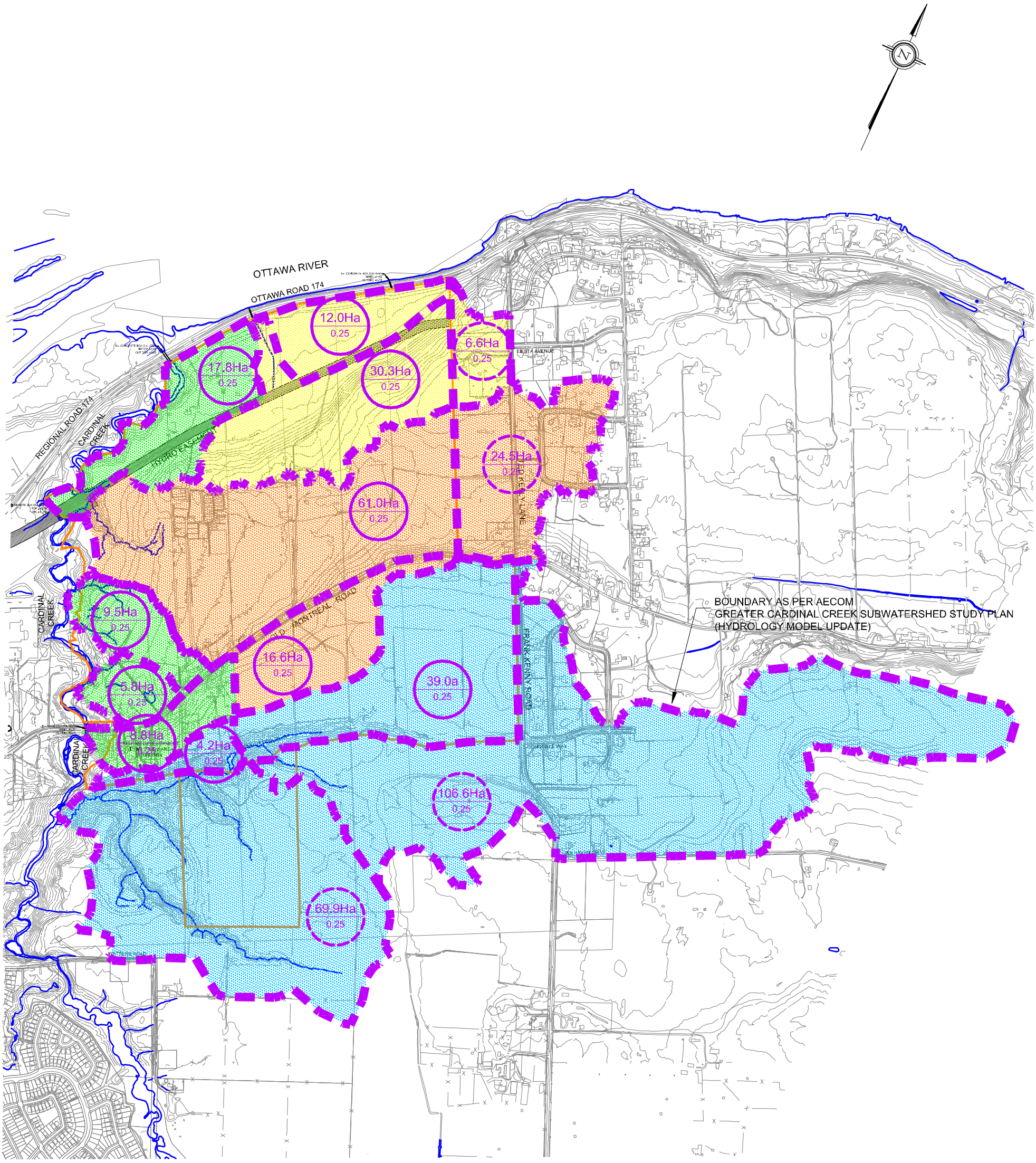
Fax. (613) 836-7183
www.DSEL.ca

CARDINAL VILLAGE
CONCEPTUAL STORM DRAINAGE (MAJOR SYSTEM)
CITY OF OTTAWA

DATE: JUNE 2013
SCALE: 1:8000
PROJECT No.: 11-513
FIGURE: 18



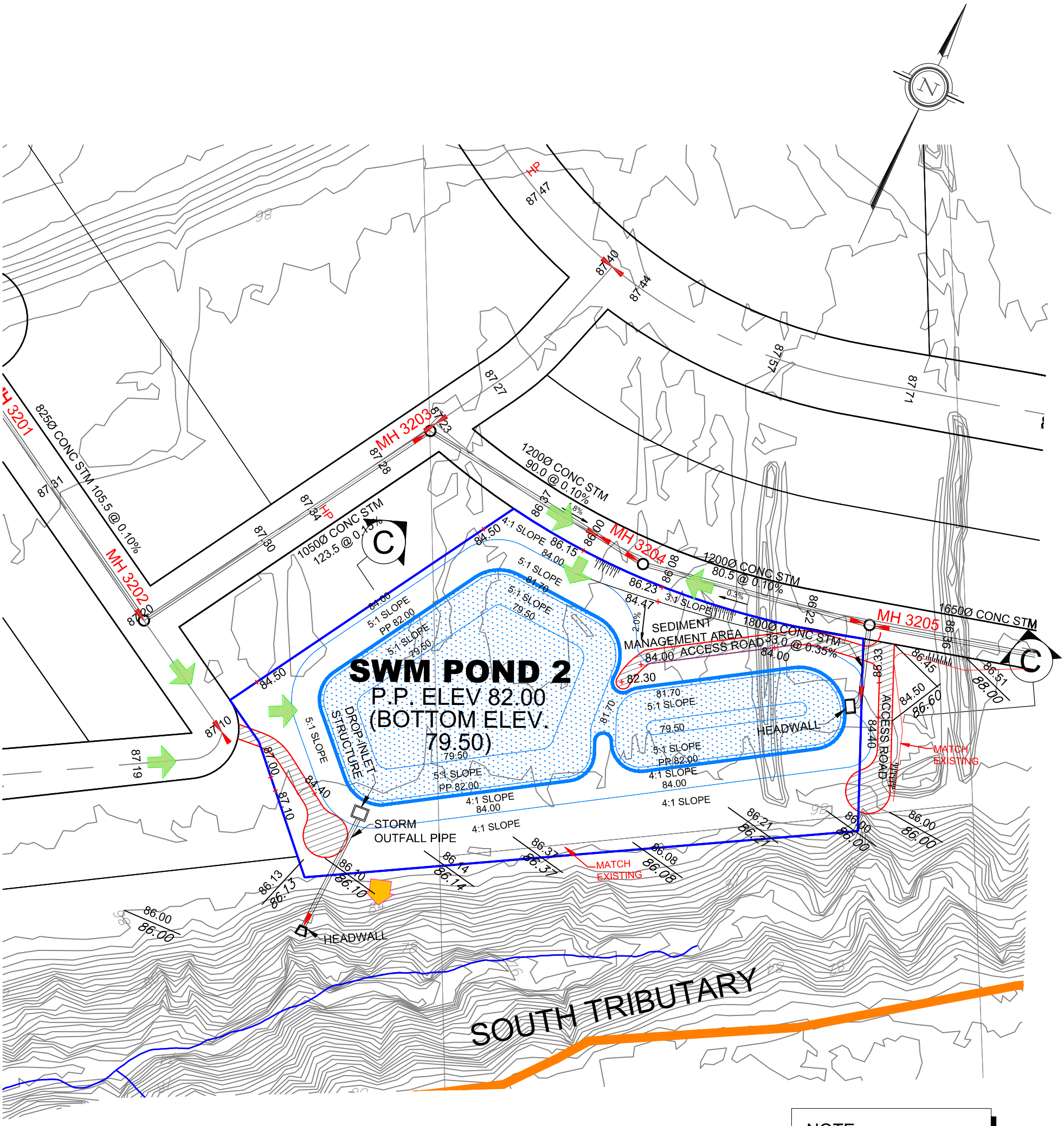
LEGEND:

- SUBJECT LANDS
- PRELIMINARY DRAINAGE AREA BOUNDARY
- 35.6Ha / 0.25 — PRE-DEVELOPMENT DRAINAGE AREA / RUN-OFF COEFFICENT
- OTTAWA RIVER
- CARDINAL CREEK
- NORTH TRIBUTARY OF CARDINAL CREEK
- SOUTH TRIBUTARY OF CARDINAL CREEK

david schaeffer engineering ltd
120 Iber Road, Unit 203
Stittsville, ON K2S 1E9
Tel. (613) 836-0856
Fax. (613) 836-7183
www.DSEL.ca

CARDINAL VILLAGE
PRE-DEVELOPMENT DRAINAGE AREAS
CITY OF OTTAWA

DATE: JUNE 2013
SCALE: 1:14000
PROJECT No.: 11-513
FIGURE: 13



NOTE:
FOR CROSS SECTIONS C–C, REFER TO DRAWING No. 22.

LEGEND:

- SUBJECT LANDS
- EMERGENCY OVERFLOW DIRECTION

POND CHARACTERISTICS			
	LOWER ELEVATION (m)	UPPER ELEVATION (m)	VOLUME PROVIDED (m^3)
PERMANENT POOL	79.50	82.00	14,138
QUALITY CONTROL	82.00	82.20	1,753
ACTIVE STORAGE	82.00	82.75	6,998
2 YR W.L.	82.00	82.93	8,822
5 YR W.L.	82.00	83.20	11,732
50 YR W.L.	82.00	83.79	18,670
100 YR W.L.	82.00	83.97	20,913

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120 Iber Road Unit 203
Stittsville, Ontario, K2S 1E9
Tel. (613) 836-0856
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CARDINAL VILLAGE
CONCEPT POND FACILITY LAYOUT
POND 2
CITY OF OTTAWA

DATE: JUNE 2013
SCALE: 1:1500
PROJECT No.: 11-513
FIGURE: 21

Ontario

Ministry of the Environment, Conservation and Parks
Ministère de l'Environnement, de la Protection de la nature et des Parcs

AMENDED ENVIRONMENTAL COMPLIANCE APPROVAL

NUMBER 9999-BFWK2C
Issue Date: September 20, 2019

Tamarack (Cardinal Creek) Corporation
3187 Albion Road South
Ottawa, Ontario
K1V 8Y3

Site Location: Cardinal Creek Village- Phase 5 and 6
Part of Lots 25 and 26, Concession 1
City of Ottawa, Ontario

You have applied under section 20.2 of Part II.1 of the Environmental Protection Act, R.S.O. 1990, c. E. 19 (Environmental Protection Act) for approval of:

the establishment of wastewater infrastructure Works located in the City of Ottawa, consisting of the following:

- **sanitary sewers** on Cardinal Creek Drive (from Abenaki Avenue to approximately 40 metres south of Abenaki Avenue), discharging to existing sewers, located west of Cardinal Creek Village Phase 5 and 6;
- **sanitary sewers** on Famille Laporte Avenue (from Antonio Farley Street to the limit of Phase 5 and 6), discharging to existing sewers, located west of Cardinal Creek Village Phase 5 and 6;
- **sanitary sewers** on Saintonge Lane (from Famille Laporte Avenue to Pennacook Place), discharging to existing sewers, located west of Cardinal Creek Village Phase 5 and 6;
- **sanitary sewers** on Pennacook Place (from the Pennacook Place cul-de-sac to Famille Laporte Avenue), discharging to existing sewers, located west of Cardinal Creek Village Phase 5 and 6;
- **sanitary sewers** on Antonio Farley Street (from Lévrier Walk to Famille Laporte Avenue), discharging to existing sewers, located west of Cardinal Creek Village Phase 5 and 6;
- **sanitary sewers** on L**é**vrier Walk (from Block 109 to approximately 45 metres east of Antonio Farley Street to Antonio Farley Street), discharging to existing sewers, located west of Cardinal Creek Village Phase 5 and 6;

- **sanitary sewers** on Canot d'Écorce Street (from Block 109 to L**é**vrier Walk), discharging to existing sewers, located west of Cardinal Creek Village Phase 5 and 6;

- **sanitary sewers** on L'Arquebuse Way (from Antonio Farley Street to Antonio Farley Street), discharging to existing sewers, located west of Cardinal Creek Village Phase 5 and 6;

- **sanitary sewers** on Tadoussac Terrace (from the limit of Phase 5 and 6 to Antonio Farley Street), discharging to existing sewers, located west of Cardinal Creek Village Phase 5 and 6;

- **sanitary sewers** on Onimiki Terrace (from Antonio Farley Street to Abenaki Avenue), discharging to existing sewers, located west of Cardinal Creek Village Phase 5 and 6;

- **sanitary sewers** on Abenaki Avenue (from Antonio Farley Street to Cardinal Creek Drive), discharging to existing sewers, located west of Cardinal Creek Village Phase 5 and 6;

- **sanitary sewers** on Servicing Block 109 (from L**é**vrier Walk to Canot d'Écorce Street), discharging to existing sewers, located west of Cardinal Creek Village Phase 5 and 6;

- **sanitary sewers** on Servicing Block 108 (from Canot d'Écorce Street to Antonio Farley Street), discharging to existing sewers, located west of Cardinal Creek Village Phase 5 and 6;

- **sanitary sewers** at sanitary connection to Phase 4 across Cardinal Creek Drive (from Cardinal Creek Drive to approximately 10 metres west of Cardinal Creek Drive), discharging to existing sewers, located west of Cardinal Creek Village Phase 5 and 6;

- **storm sewers** on Cardinal Creek Drive (from approximately 25 metres north of Famille Laporte Avenue to approximately 55 metres north of Abenaki Avenue), discharging to existing sewers, located west of Cardinal Creek Village Phase 5 and 6, the existing storm outfall channel located north of Cardinal Creek Village Phase 5 and 6 and ultimately to the Stormwater Management Facility Pond 1;

- **storm sewers** on Famille Laporte Avenue (from Antonio Farley Street to the limit of Phase 5 and 6), discharging to existing sewers, located west of Cardinal Creek Village Phase 5 and 6, the existing storm outfall channel located north of Cardinal Creek Village Phase 5 and 6 and ultimately to the Stormwater Management Facility Pond 1;

- **storm sewers** on Saintonge Lane (from Famille Laporte Avenue to Pennacook Place), discharging to existing sewers, located west of Cardinal Creek Village Phase 5 and 6, the existing storm outfall channel located north of Cardinal Creek Village Phase 5 and 6 and ultimately to the Stormwater Management Facility Pond 1;

- **storm sewers** on Pennacook Place (from the Pennacook Place cul-de-sac to Famille Laporte Avenue), discharging to existing sewers, located west of Cardinal Creek Village Phase 5 and 6, the existing storm outfall channel located north of Cardinal Creek Village Phase 5 and 6 and ultimately to the Stormwater Management Facility Pond 1;

- **storm sewers** on Antonio Farley Street (from L**é**vrier Walk to Famille Laporte Avenue), discharging to

existing sewers, located west of Cardinal Creek Village Phase 5 and 6, the existing storm outfall channel located north of Cardinal Creek Village Phase 5 and 6 and ultimately to the Stormwater Management Facility Pond 1;

- **storm sewers** on L**é**vrier Walk (from Block 109 to approximately 45 metres east of Antonio Farley Street), discharging to existing sewers, located west of Cardinal Creek Village Phase 5 and 6, the existing storm outfall channel located north of Cardinal Creek Village Phase 5 and 6 and ultimately to the Stormwater Management Facility Pond 1;

- **storm sewers** on Canot d'Écorce Street (from Block 109 to L**é**vrier Walk), discharging to existing sewers, located west of Cardinal Creek Village Phase 5 and 6, the existing storm outfall channel located north of Cardinal Creek Village Phase 5 and 6 and ultimately to the Stormwater Management Facility Pond 1;

- **storm sewers** on L'Arquebuse Way (from Antonio Farley Street to Antonio Farley Street), discharging to existing sewers, located west of Cardinal Creek Village Phase 5 and 6, the existing storm outfall channel located north of Cardinal Creek Village Phase 5 and 6 and ultimately to the Stormwater Management Facility Pond 1;

- **storm sewers** on Onimiki Terrace (from Antonio Farley Street to Abenaki Avenue), discharging to existing sewers, located west of Cardinal Creek Village Phase 5 and 6, the existing storm outfall channel located north of Cardinal Creek Village Phase 5 and 6 and ultimately to the Stormwater Management Facility Pond 1;

- **storm sewers** on Abenaki Avenue (from Antonio Farley Street to Cardinal Creek Drive), discharging to existing sewers, located west of Cardinal Creek Village Phase 5 and 6, the existing storm outfall channel located north of Cardinal Creek Village Phase 5 and 6 and ultimately to the Stormwater Management Facility Pond 1;

- **storm sewers** on Servicing Block 109 (from L**é**vrier Walk to Canot d'Écorce Street), discharging to existing sewers, located west of Cardinal Creek Village Phase 5 and 6, the existing storm outfall channel located north of Cardinal Creek Village Phase 5 and 6 and ultimately to the Stormwater Management Facility Pond 1;

- **storm sewers** on Servicing Block 108 (from Canot d'Écorce Street to Antonio Farley Street), discharging to existing sewers, located west of Cardinal Creek Village Phase 5 and 6, the existing storm outfall channel located north of Cardinal Creek Village Phase 5 and 6 and ultimately to the Stormwater Management Facility Pond 1;

- **storm sewers** on Servicing Block 119 (from approximately 50 metres south of Onimiki Terrace to Onimiki Terrace), discharging to existing sewers, located west of Cardinal Creek Village Phase 5 and 6, the existing storm outfall channel located north of Cardinal Creek Village Phase 5 and 6 and ultimately to the Stormwater Management Facility Pond 1;

- **storm sewers** across Cardinal Creek Drive (from Baie-des-Castors Street to Cardinal Creek Drive), discharging to existing sewers, located west of Cardinal Creek Village Phase 5 and 6, the existing storm outfall channel located north of Cardinal Creek Village Phase 5 and 6 and ultimately to the Stormwater Management Facility Pond 1;

- **storm outfall channel** approximately 42 metres of a temporary cut-off swale located to the north of Cardinal Creek Drive, receiving inflow from the Cardinal Creek Drive storm sewer and discharging to the existing temporary storm outfall;

- **1 corrugated steel pipe culvert** crossing on Old Montreal Road approximately 70 metres east of Cardinal Creek Drive;

- **grassed swales** on the south side of Old Montreal Road (from approximately 300 metres east of Cardinal Creek Drive to approximately 70 metres east of Cardinal Creek Drive), discharging to the the Old Montreal Road culvert;

- **grassed swales** on the north side of Old Montreal Road (from approximately 400 metres east of Cardinal Creek Drive to approximately 150 metres east of Cardinal Creek Drive), discharging to existing swale, located on the north side of Old Montreal Road;

- **grassed swales** on the east of Cardinal Creek Phase 5 and 6 (from approximately 30 metres east of Canot d' Écorce Street to the northern Phase 5 and 6 limit, discharging to undeveloped land, located north of Cardinal Creek Village Phase 5 and 6, and ultimately to the Stormwater Management Facility;

the modifications to existing stormwater management Works to serve Cardinal Creek Village Phase 5 and 6, located in the City of Ottawa, for the collection, transmission, treatment and disposal of stormwater runoff from a total modified catchment area of 143.64 hectares, to provide Enhanced Level water quality protection and erosion control, discharging to the Ottawa River, consisting of the following:

- **stormwater management facility (catchment area 143.64 hectares):** one (1) wet pond with sediment forebay, located on Block 626, north of an existing hydro corridor, west of Ted Kelly Lane, having a permanent storage volume of 20,770 cubic metres, an extended detention volume of 5,851 cubic metres and a total storage volume of approximately 57,471 cubic metres including the permanent pool, at a total depth of 4.55 metres, receiving inflow from the temporary storm outfall channel and 2,550 millimetre diameter and 3,000 millimetre diameter storm sewer to the sediment forebay, and 1,350 millimetre diameter bypass storm sewer to the main cell, and discharging via a concrete outlet structure, a 2,250 millimetre diameter outlet pipe, a secondary outfall structure and main spillway to an existing 2,550 millimetre concrete culvert under Ottawa Road 174 to the Ottawa River;

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 submitted application and supporting documents listed in Schedule "A" forming part of this approval.

Previous Works

Sanitary Sewers servicing Phase 4 of Cardinal Creek Village, discharging to existing sewers in previous Cardinal Creek Village phases as follows:

- **Famillie-Laporte Avenue** from PH 4 Boundary (STA. 1+050.11) to PH4 Boundary (STA. 0+630.56)

- **Baie-des-Castors Street** from 15m east of Future Street (STA. 0+014.82) to 30m east of Honfleur Street (STA. 0+283.14));

- **Cardinal Creek Drive** from 28.5m east of PH4 Boundary (STA. 1+129.52) to Famille-Laporte Avenue (STA. 0+786.84);

- **Tewin Circle** from 156m south of Saintonge Lane (STA. 0+235.40) to Famille-Laporte Avenue (STA. 0+000.00);

- **Cap-Diamant Way (north)** from 78.5m east of Géographe Terrace (STA. 0+082.96) to Géographe Terrace (STA. 0+000.00);

- **Cap-Diamant Way (south)** from 51.5m south of Stadaconé Row (STA. 0+305.98) to Cartographe Street (STA. 0+517.81);

- **Cartographe Street** from Cap-Diamant Way (STA. 0+293.748) to Cap-Diamant Way (STA. 0+0+410.81);

- **Mishawashkode Street** from PH 4 Boundary (STA. 0+277.79) to Géographe Terrace (STA. 0+328.66);

- **Stadaconé Row** from 13m south of Cap-Diamant Way (STA. 0+121.52) to Cap-Diamant Way (STA. 0+000.00);

- **Géographe Terrace** from Cartographe Street (STA. 0+261.37) to Honfleur Street (STA. 0+000.00);

- **Honfleur Street** from 16m north of Future Street (STA. 0+148.14) to Baie-des-Castors Street (STA. 0+017.09); and,

- **Towards Future Phase** from 8m east of Baie-des-castors Street (STA. 0+008.00) to Baie-des-Castors Street (STA. 0+000.00).

Storm Sewers servicing Phase 4 of Cardinal Creek Village, discharging partly to existing sewers in previous Cardinal Creek Village phases, partly to Oil and Grit Separator, and partly to Temporary Storm Outfall Channel, as follows:

- **Famille-Laporte Avenue** from PH 4 Boundary (STA. 0+626.68 to STA. 0+798.76) to PH 4

Boundary (STA. 0+810.36 to STA. 1+050.11);

- **Baie-des-Castors Street (north)** from 89.5m east of Future Street (STA. 0+089.49 to STA. 0+226.58) to 30m east of Honfleur Street (STA. 0+235.03 to STA. 0+283.19);

- **Baie-des-Castors Street (south)** from Street 76.5m east of Honfleur Street (STA. 0+076.57) to Honfleur Street (STA. 0+000.00);

- **Cardinal Creek Drive** from 28.5m east of PH4 Boundary (STA. 1+130.25) to 22.5m north of Famille-Laporte Avenue (STA. 0+764.11);

- **Tewin Circle** from 157.5m south of Saintonge Lane (STA. 0+236.42) to Famille-Laporte Avenue (STA. 0+002.50);

- **Cap-Diamant Way (north)** from 81.5m east of Géographe Terrace (STA. 0+081.45) to Géographe Terrace (STA. -0+002.39);

- **Cap-Diamant Way (south)** from 52m south of Stadaconé Row (STA. 0+307.11) to Cartographe Street (STA. 0+515.79);

- **Cartographe Street** from Cap-Diamant Way (STA. 0+293.75) to Géographe Terrace (STA. 0+409.74);

- **Mishawashkode Street** from PH 4 Boundary (STA. 0+277.79) to Géographe Terrace (STA. 0+325.63);

- **Stadaconé Row** from 13m south of Cap-Diamant Way (STA. 0+123.10) to Block 108 (STA. -0+009.87);

- **Géographe Terrace** from Cartographe Street (STA. 0+263.66) to Honfleur Street (STA. 0+002.50);

- **Honfleur Street** from Famille-Laporte Avenue (STA. 0+251.62) to Baie-des-Castors Street (STA. 0+017.08); and,

- **Temporary Storm Outfall** from Baie-des-Castors Street (STA. 0+001.35) to Temporary Storm Outfall Channel (STA. 0+019.03).

Storm Outfall Channel approximately 461 m of a temporary storm outfall channel located to the north of Cardinal Creek Drive, receiving flow from the 1950mm concrete storm sewer at the north end of Cardinal Creek Drive, discharging via existing temporary storm outfall channel to Pond 1.

Grassed Swales servicing Phase 4 of Cardinal Creek Village, as follows:

- **Future Phase - South of Old Montreal Road –** Approximately 158 m of a temporary cut-off swale discharging to the storm sewer network mentioned above via MH 2000 south of Old Montreal Road;

- **Future Phase –** East of Phase 4 – Approximately 246 m of a temporary cut-off swale discharging to the Temporary Storm Outfall Channel mentioned above via and existing ditch north of Famille-Laporte Avenue; and,

- **Pond 1 Bypass –** east of Pond 1 – Approximately 145 m of a temporary cut-off swale discharging to the existing roadside ditch south of Ottawa Road 174 to maintain existing drainage patterns.

Oil and Grit Separator (the 10 mm storm flows for a catchment area of 4.01 ha): One (1) Hydroguard HG 10 oil/grit separator (OGS), or Equivalent Equipment, designed for Enhanced Level of protection, having a sediment storage capacity of 4.59 m^3, a maximum treatment rate of 252 L/s, receiving inflow from the storm sewer located north of the intersection of Honfleur Street and Famille-Laporte Avenue, discharging to the North Tributary of Cardinal Creek via a 450mm diameter outlet pipe and modifications to the existing North Tributary of Cardinal Creek.

trunk storm sewer: - a 2400 mm diameter storm sewer on the Service Easement (Block 147) from Block 146 (Drawing Number 152) (MH127), across the existing hydro corridor, to Service Easement (Drawing Number 153A), discharging to a temporary storm outfall channel, identified below;

temporary storm outfall channel: - approximately 776 m of a temporary storm outfall channel located in a Service Easement along the north side of an existing hydro corridor, receiving flow from the 2400 mm diameter trunk storm sewer, identified above, discharging via a 2550 mm diameter and 3000 mm diameter storm sewer, and 1350 mm diameter bypass storm sewer, to the stormwater management facility, identified below;

stormwater management facility (Pond 1 - catchment area 89.97 hectares): - one (1) wet pond with a sediment forebay, located on Block 626, north of an existing hydro corridor, west of Ted Kelly Lane, having a permanent pool volume of 20,341 m^3, an extended detention volume of 5,730 m^3, and a total storage volume of approximately 56,286 m^3, including the permanent pool volume, at a total depth of approximately 4.55 m, receiving flow from the temporary storm outfall channel and 2550 mm diameter and 3000 mm diameter storm sewer to the sediment forebay, and 1350 mm diameter bypass storm sewer to the main cell, identified above, and discharging via a concrete outlet structure, a 2250 mm diameter outlet pipe and spillway, and an existing 1.5 m by 1.15 m box culvert and 2100 diameter culvert under Ottawa Road 174 to the Ottawa River;

storm sewers servicing Phase 1 of Cardinal Creek Village, as follows:

- **Avenue de la Famille-Laporte Avenu**e from Old Montreal Road (Sta. 0+001.62) to avenue de la Famille-Laporte Avenue (Temp. dead end) (Sta. 0+630.56);

- **Côte de la Minoterie Ridge** from avenue de la Famille-Laporte Avenue (Sta. 0+015.76) to avenue de la Famille-Laporte Avenue (Sta. 0+381.44);

- **Service Easement Part 1, 2 & 3** from côte de la Minoterie Ridge (Sta. 0+009.63) to rue de la Baie-des-Castors Street (Sta. 0+129.93);

- **Rue Mishawashkode Street** from avenue de la Famille-Laporte Avenue (Sta. 0+001.40) to rue Mishawashkode Street (MH120) (Sta. 0+098.71);

- **Rue Mishawashkode Street** from rue de Cartographe Street (Sta. 0+141.34) to rue Mishawashkode Street (Temp. dead end) (Sta. 0+175.42);

- **Voie de Brouage Way** from côte de la Minoterie Ridge (Sta. -0+002.44) to voie de Brouage Way (Sta. 0+113.945);

- **Rue de Cartographe Street** from avenue de la Famille-Laporte Avenue (Sta. 0+001.47) to rue Mishawashkode Street (Sta. 0+194.29);

- **Rue de Cartographe Street** from rue Mishawashkode Street (Sta. -0+002.07) to rue de Cartographe Street (Temp. dead end) (Sta. 0+221.43);

- **Rue de la Baie-des-Castors Street** from avenue de la Famille-Laporte Avenue (Sta. -0+001.31) to rue de la Baie-des-Castors Street (Temp. dead end) (Sta. 0+463.916);

- **Avenue Mashkig Avenue** from rue de la Baie-des-Castors Street (Sta. -0+002.76) to avenue Mashkig Avenue (MH 1410) (Sta. 0+152.39);

- **Block 146** from rue de la Baie-des-Castors Street (Sta. 0+013.12) to Service Easement (Sta. 0+045.63);

sanitary sewers servicing Phase 1 of Cardinal Creek Village, as follows:

- **Avenue de la Famille-Laporte Avenue** from Old Montreal Road (Sta. -0+005.820) to avenue de la Famille-Laporte Avenue (Temp. dead end) (Sta. 0+630.560);

- **Côte de la Minoterie Ridge** from avenue de la Famille-Laporte Avenue (Sta. 0+013.390) to avenue de la Famille-Laporte Avenue (Sta. 0+392.220);

- **Service Easement Part 1, 2 & 3** from côte de la Minoterie Ridge (Sta. 0+000.000) to rue de la Baie-des-Castors Street (Sta. 0+132.450);

- **Rue Mishawashkode Street** from avenue de la Famille-Laporte Avenue (Sta. 0+001.230) to rue Mishawashkode Street (MH120A) (Sta. 0+100.660);

- **Rue Mishawashkode Street** from rue de Cartographe Street (Sta. 0+143.360) to rue Mishawashkode Street (Temp. dead end) (Sta. 0+173.930);

- **Voie de Brouage Way** from côte de la Minoterie Ridge (Sta. -0+000.370) to avenue de la Famille-Laporte Avenue (Sta. 0+129.610);

- **Rue de Cartographe Street** from avenue de la Famille-Laporte Avenue (Sta. -0+000.250) to rue Mishawashkode Street (Sta. 0+196.240);

- **Rue de Cartographe Street** from rue Mishawashkode Street (Sta. 0+000) to rue de Cartographe Street (Temp. dead end) (Sta. 0+221.430);

- **Rue de la Baie-des-Castors Street** from avenue de la Famille-Laporte Avenue (Sta. 0+000.250) to rue de la Baie-des-Castors Street (Temp. dead end) (Sta. 0+461.980);

- **Rue de la Baie-des-Castors Street** (High Level Sewer) from rue de la Baie-des-Castors Street (Sta. 0+113.370) to rue de la Baie-des-Castors Street (Sta. 0+236.260);

- **Avenue Mashkig Avenue** from rue de la Baie-des-Castors Street (Sta. 0+000) to avenue Mashkig Avenue (MH 1420A) (Sta. 0+152.480);

- **Block 146** from rue de la Baie-des-Castors Street (Sta. 0+003.820) to Service Easement (Sta. 0+054.542);

- **Service Easement** from Block 146 (Drawing 157) (Sta. 0+002.650) to Service Easement (Sta. 0+041.710);

- **Service Easement** from Service Easement (MH1015A) (Sta. 0+259.350) to Service Easement (Drawing 152) MH10160A – (Sta. 0+093.680);

- **Service Easement** from Trim Road (50 m south of Regional Road 174) (MH1103A) (Sta. 0+188.20) to Service Easement (MH10160A) (Sta. 1+053.100);

- **Service Easement (parallel to west side of Trim Road)** from Sanitary Outlet approximately 160 m south of Regional Road 174 (SAMH1100A) (Sta. 0+010.00) to Service Easement (east side of Trim Road) 50 m south of Regional Road 174 (MH1103A) (Sta. 0+188.20);

For the purpose of this environmental compliance approval, the following definitions apply:

Definitions:

1. "Approval" means this entire document and any schedules attached to it, and the application;

2. "Director" means a person appointed by the Minister pursuant to section 5 of the EPA for the purposes of Part II.1 of the EPA;

3. "District Manager" means the District Manager of the appropriate local District Office of the Ministry, where the Works are geographically located;

4. "EPA" means the *Environmental Protection Act,* R.S.O. 1990, c.E.19, as amended;

5. "Equivalent Equipment" means a substituted equipment or like-for-like equipment that

meets the required quality and performance standards of the approved named equipment.

6. "Ministry" means the ministry of the government of Ontario responsible for the EPA and OWRA and includes all officials, employees or other persons acting on its behalf;

7. "Owner" means Tamarack (Cardinal Creek) Corporation, and includes its successors and assignees;

8. "OWRA" means the *Ontario Water Resources Act, R.S.O. 1990, c. O.40* , as amended;

9. "Previous Works" means those portions of the sewage Works previously approved under an Approval;

10. "Works" means the sewage Works described in the Owner's application, and this Approval.

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

TERMS AND CONDITIONS

1. GENERAL CONDITIONS

1. The Owner shall ensure that any person authorized to carry out work on or operate any aspect of the Works is notified of this Approval and the conditions herein and shall take all reasonable measures to ensure any such person complies with the same.

2. 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 Approval, and the application for approval of the Works.

3. Where there is a conflict between a provision of any document in the schedule referred to in this Approval and the conditions of this Approval, the conditions in this Approval shall take precedence, and where there is a conflict between the documents in the schedule, the document bearing the most recent date shall prevail.

4. Where there is a conflict between the documents listed in Schedule "A" and the application, the application shall take precedence unless it is clear that the purpose of the document was to amend the application.

5. The conditions of this Approval are severable. If any condition of this Approval, or the application of any requirement of this Approval to any circumstance, is held invalid or unenforceable, the application of such condition to other circumstances and the remainder of this Approval shall not be affected thereby.

2. EXPIRY OF APPROVAL

1. This Approval will cease to apply to those parts of the Works which have not been constructed within five (5) years of the date of this Approval.

2. In the event that completion and commissioning of any portion of the Works is anticipated to be delayed beyond the specified expiry period, the Owner shall submit an application of extension to the expiry period, at least twelve (12) months prior to the end of the period. The application for extension shall include the reason(s) for the delay, whether there is any design change(s) and a review of whether the standards applicable at the time of Approval of the Works are still applicable at the time of request for extension, to ensure the ongoing protection of the environment.

3. CHANGE OF OWNER

1. 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; or

    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.

2. In the event of any change in ownership of the Works, other than a change to a successor municipality, the Owner shall notify in writing the succeeding owner of the existence of this Approval, and a copy of such notice shall be forwarded to the District Manager and the Director.

3. The Owner shall ensure that all communications made pursuant to this condition refer to the number at the top of this Approval.

4. OPERATION AND MAINTENANCE

1. If applicable, any proposed storm sewers or other stormwater conveyance in this Approval can be constructed but not operated until the proposed stormwater management facilities in this Approval or any other Approval that are designed to service the storm sewers or other stormwater conveyance are in operation.

2. The Owner shall make all necessary investigations, take all necessary steps and obtain all necessary approvals so as to ensure that the physical structure, siting and operations of the Works do not constitute a safety or health hazard to the general public.

3. The Owner shall inspect and ensure that the design minimum liquid retention volume is maintained in the Works at all times, except when maintenance is required.

4. The Owner shall undertake an inspection of the condition of the Works, at least once a year, and undertake any necessary cleaning and maintenance to ensure that sediment, debris and excessive decaying vegetation are removed from the Works to prevent the excessive build-up of sediment, oil/grit, debris and/or decaying vegetation, to avoid reduction of the capacity and/or permeability of the Works, as applicable. The Owner shall also regularly inspect and clean out the inlet to and outlet from the Works to ensure that these are not obstructed.

5. The Owner shall construct, operate and maintain the Works with the objective that the effluent from the Works is essentially free of floating and settleable solids and does not contain oil or any other substance in amounts sufficient to create a visible film, sheen, foam or discoloration on the receiving waters.

6. 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 at the Owner's administrative office 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 and method of clean-out of the Works.

7. The Owner shall prepare an operations manual prior to the commencement of operation of the Works that includes, but is not necessarily limited to, the following information:

    a. operating and maintenance procedures for routine operation of the Works;

    b. inspection programs, including frequency of inspection, for the Works and the methods or tests employed to detect when maintenance is necessary;

    c. repair and maintenance programs, including the frequency of repair and maintenance for the Works;

d. contingency plans and procedures for dealing with potential spills and any other abnormal situations and for notifying the District Manager; and

e. procedures for receiving, responding and recording public complaints, including recording any follow-up actions taken.

8. The Owner shall maintain the operations manual current and retain a copy at the Owner's administrative office for the operational life of the Works. Upon request, the Owner shall make the manual available to Ministry staff.

5. TEMPORARY EROSION AND SEDIMENT CONTROL

1. The Owner shall install and maintain temporary sediment and erosion control measures during construction and conduct inspections once every two (2) weeks and after each significant storm event (a significant storm event is defined as a minimum of 25 mm of rain in any 24 hours period). The inspections and maintenance of the temporary sediment and erosion control measures shall continue until they are no longer required and at which time they shall be removed and all disturbed areas reinstated properly.

2. The Owner shall maintain records of inspections and maintenance which shall be made available for inspection by the Ministry, upon request. The record shall include the name of the inspector, date of inspection, and the remedial measures, if any, undertaken to maintain the temporary sediment and erosion control measures.

6. REPORTING

1. One (1) week prior to the start-up of the operation of the Works, the Owner shall notify the District Manager (in writing) of the pending start-up date.

2. The Owner shall, upon request, make all reports, manuals, plans, records, data, procedures and supporting documentation available to Ministry staff.

3. The Owner shall prepare a performance report within ninety (90) days following the end of the period being reported upon, and submit the report(s) to the District Manager when requested. The first such report shall cover the first annual period following the commencement of operation of the Works and subsequent reports shall be prepared to cover successive annual periods following thereafter. The reports shall contain, but shall not be limited to, the following information:

   a. a description of any operating problems encountered and corrective actions taken;

b. a summary of all maintenance carried out on any major structure, equipment, apparatus, mechanism or thing forming part of the Works, including an estimate of the quantity of any materials removed from the Works;

c. a summary of any complaints received during the reporting period and any steps taken to address the complaints;

d. a summary of all spill or abnormal discharge events; and

e. any other information the District Manager requires from time to time.

7. RECORD KEEPING

1. 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, maintenance and monitoring activities required by this Approval.

Schedule "A"

1. Application for Environmental Compliance Approval, dated July 31, 2019, received on September 3, 2019, submitted by Tamarack (Cardinal Creek) Corporation;

2. Transfer of Review Letter of Recommendation, dated August 22, 2019, revised on September 9, 2019 and signed by Michael J Thivierge, P.Eng., Senior Engineer, Development Review, City of Ottawa, including the following supporting documents:

    a. Final Plans and Specifications prepared by David Schaeffer Engineering Ltd.

    b. Pipe Data Form - Watermain, Storm Sewer, Sanitary Sewer, and Forcemain Design Supplement to Application for Approval for Water and Sewage Works.

    c. Hydraulic Design Sheets prepared by David Schaeffer Engineering Ltd.

    d. Stormwater Management Report prepared by David Schaeffer Engineering Ltd.

3. Email received on September 9, 2019 from Michael J Thivierge, P.Eng., Senior Engineer, Development Review, City of Ottawa.

4. Emails received September 12, 2019 and September 17, 2019 from Braden Kaminski, E.I.T., Junior Project Manager, David Schaeffer Engineering Ltd.

5. Application for Environmental Compliance Approval for Municipal and Private Sewage Works, dated September 15, 2017 and received on October 12, 2017, submitted by Tamarack (Cardinal Creek) Corporation.

6. Transfer of Review Letter of Recommendation, dated October 5, 2017, and signed by Charles Warnock, P. Eng., City of Ottawa.

7. Application for Environmental Compliance Approval for Sanitary and Storm Sewers, dated April 22, 2014 and received on June 6, 2014, including final plans, specifications and documents prepared by David Schaeffer Engineering Ltd.;

8. Application for Environmental Compliance Approval for Trunk Storm Sewer, Temporary Outfall Ditchand Stormwater Management Pond, dated April 22, 2014 and June 6, 2014, submitted by David Schaeffer Engineering Ltd. through the City of Ottawa;

9. Design Brief for Interim Stormwater Management Pond 1 for Phase 1, 2 and 3 in Cardinal CreekVillage , dated May 2014, prepared by David Schaeffer Engineering Ltd. and J.F. Sabourin and Associates Inc.;

10. Copy of memorandum from David Gilbert of Paterson Group Inc. to David Schaeffer Engineering Ltd., dated February 25, 2014;

11. E-mail from Kevin Murphy of David Schaeffer Engineering Ltd. to the Ministry, dated March 24,2014;

12. Revision to Application for Environmental Compliance Submission by letter from Matt Wingate of David Schaeffer Engineering Ltd. through the City of Ottawa to the Ministry, dated September 19,2014;

13. Copy of letter from Florence Robinson of Hydro One Networks Inc. to Matt Wingate of David Schaeffer Engineering Ltd., dated May 29, 2014;

14. Pipe Date Form and Storm Sewer Design Sheet, dated May 27, 2014, prepared by David Schaeffer Engineering Ltd.;

15. Design Brief for Cardinal Creek Village Phases 1A & 1B , dated May 29, 2014, prepared by David Schaeffer Engineering Ltd.;

16. Stormwater Management Report for Phase 1 of Cardinal Creek Village , dated May 2014,prepared by J.F. Sabourin and Associates Inc.;

17. Plan of Subdivision of Part of Lots 25, 26, 27, 28 and 29, Concession 1 (Old Survey), undated,prepared by Stantec Geomatics Ltd.;

18. Plan of Subdivision of Part of Lots 27 and 28, Concession 1 (Old Survey), undated, prepared by Stantec Geomatics Ltd.;

19. Set of Engineering Drawings (30 drawings) for Cardinal Creek Village Phase 1, Pond ECA Application, dated May 27, 2014, prepared by David Schaeffer Engineering Ltd.; including 4 drawings dated May 15, 2014 and 3 drawings dated March 26, 2014, prepared by G.D. Jewell Engineering Inc.;

20. Set of Engineering Drawings (21 drawings) for Cardinal Creek Village Phase 1, ECA Direct Submission Application, Rev 1 Additional Attachments for Storm Sewers & Ditches), dated May 27,2014, prepared by David Schaeffer Engineering Ltd.;

21. E-mail from Matt Wingate of David Schaeffer Engineering Ltd. to the Ministry, dated September 25, 2014;

22. E-mail from Matt Wingate of David Schaeffer Engineering Ltd. to the Ministry, dated September 26,2014.

23. Pipe Data Form;

24. Sanitary Sewer & Storm Sewer Description Sheets, prepared by DSEL, dated September

2017;

25. Sanitary Sewer & Storm Design Sheets, prepared by DSEL, dated September 2017;

26. Engineering Drawings, prepared by DSEL, Revision 1, dated September 12, 2017;

27. Design Brief for Cardinal Creek Village Phase 4 prepared by DSEL, Submission 2, dated September 2017;

28. Stormwater Management Report for Phase 4 of Cardinal Creek Village, prepared by JFSA, dated September 2017;

29. Design Brief for Interim Stormwater Management Pond 1 for Phases 1,2,3, and 4 in Cardinal Creek Village, prepared by JFSA, dated July 2017;

30. Geotechnical Reports

    a. Geotechnical Review – Grading and Services – Cardinal Creek Village - Phase 4 – Old Montreal Road – Ottawa, prepared by Paterson Group, dated July 20, 2017;

    b. Grading Plan Review – Cardinal Creek Village Phase 4 – Old Montreal – Ottawa, prepared by Paterson Group, dated August 29, 2017;

    c. Geotechnical Review – Response to Engineering Comments – Cardinal Creek Village – Phase 4 – Old Montreal Road – Ottawa, prepared by Paterson Group, dated August 31, 2017;

31. Record of MOECC Pre-Consultation:

    a. Pre-submission Consultation Request Form, dated August 3, 2017;

    b. City of Ottawa Confirmation of Transfer of Review, dated September 14, 2017;

32. Conservation Authority Letter of Approval;

33. Articles of Incorporation, dated April 18, 2011;

34. Draft Plan of Subdivision for Cardinal Creek Village (All Phases), prepared by Stantec, dated December 13, 2013;

35. Conditions of Draft Approval – Cardinal Creek Village (All Phases) prepared by City of Ottawa, dated April 7, 2014;

36. Draft of M-Plan for Cardinal Creek Village Phase 4, prepared by Stantec, dated June 14, 2017;

37. Source Protection Maps, prepared by DSEL, dated July 2017:

    a. Environmental Constraints;

    b. Highly Vulnerable Aquifers;

    c. Natural Heritage Areas;

    d. Significant Groundwater Recharge Areas;

    e. Water Intake Protection Areas;

    f. Wellhead Protection Areas;

38. Official Plan Map, prepared by DSEL, dated July 2017;

39. Zoning Map, prepared by DSEL, dated July 2017;

40. Site Location Map, prepared by DSEL, dated August 2017;

41. Past MOECC Approvals:

    a. Environmental Compliance Approval for Cardinal Creek Village – Phase 1 Storm Sewers, Sanitary Sewers, and Stormwater Management Facility [ECA #0029-9P9RLU, dated September 26, 2014];

    b. Environmental Compliance Approval for Cardinal Creek Village – Phase 2 Storm Sewers and Sanitary Sewers [ECA #3548-9UCJYM, dated March 10, 2015];

    c. Environmental Compliance Approval for Cardinal Creek Village – Phase 3 Storm Sewers and Sanitary Sewers [ECA #3610-AAFH8K, dated June 01, 2016];

42. Notice of Completion of Class Environmental Assessment;

43. Agent Letter of Authorization from Owner, Email from Michelle Taggart, dated April 30, 2014;

44. Laporte Agreement with Tamarack (Cardinal Creek) Corporation, dated September 2013; and

45. Questionnaire Regarding Environmental Bill of Rights (EBR) Requirements – Equivalent Public Participation.

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

Reasons:

1. Condition 1 is imposed to ensure that the Works are constructed and operated in the manner in which they were described and upon which approval was granted. This condition is also included to emphasize the precedence of conditions in the Approval 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 the approved Works and to ensure that subsequent owners of the Works are made aware of the Approval and continue to operate the Works in compliance with it.

4. Condition 4 is included as regular inspection and necessary removal of sediment and excessive decaying vegetation from the Works are required to mitigate the impact of sediment, debris and/or decaying vegetation on the treatment capacity of the Works. The Condition also ensures that adequate storage is maintained in the Works at all times as required by the design. Furthermore, this Condition is included to ensure that the Works are operated and maintained to function as designed.

5. Condition 5 is included as installation, regular inspection and maintenance of the temporary sediment and erosion control measures is required to mitigate the impact on the downstream receiving watercourse during construction until they are no longer required.

6. Condition 6 is included to provide a performance record for future references, to ensure that the Ministry is made aware of problems as they arise, and to provide a compliance record for all the terms and conditions outlined in this Approval, so that the Ministry can work with the Owner in resolving any problems in a timely manner.

7. Condition 7 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.

Upon issuance of the environmental compliance approval, I hereby revoke Approval No(s). 7792-ASJR4M issued on October 31, 2017.

In accordance with Section 139 of the Environmental Protection Act, 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 142 of the Environmental Protection Act provides that the Notice requiring the hearing shall state:

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

Pursuant to subsection 139(3) of the Environmental Protection Act, a hearing may not be required with respect to any terms and conditions in this environmental compliance approval, if the terms and conditions are substantially the same as those contained in an approval that is amended or revoked by this environmental compliance approval.

The Notice should also include:

1. The name of the appellant;
2. The address of the appellant;
3. The environmental compliance approval number;
4. The date of the environmental compliance approval;
5. The name of the Director, and;
6. The municipality or municipalities within which the project is to be engaged in.

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, Suite 1500
Toronto, Ontario
M5G 1E5

AND

The Director appointed for the purposes of Part II.1 of the Environmental Protection Act
Ministry of the Environment, Conservation and Parks
135 St. Clair Avenue West, 1st Floor
Toronto, Ontario
M4V 1P5

*** Further information on the Environmental Review Tribunal's requirements for an appeal can be obtained directly from the Tribunal at: Tel: (416) 212-6349, Fax: (416) 326-5370 or www.ert.gov.on.ca**

The above noted activity is approved under s.20.3 of Part II.1 of the Environmental Protection Act.

DATED AT TORONTO this 20th day of September, 2019

Aziz Ahmed, P.Eng.
Director
appointed for the purposes of Part II.1 of the
Environmental Protection Act

RV/
c: District Manager, MECP Ottawa
Clerk, City of Ottawa (File No. D07-16-13-0024)
Michael J Thivierge, P.Eng., Senior Engineer, Development Review, City of Ottawa
Matt Wingate, David Schaeffer Engineering Ltd.

Appendix C

- Water Distribution Network Boundary Condition Request (GeoAdvice, February 24, 2022)
- Hydraulic Capacity and Modeling Analysis Cardinal Creek Village South Development (GeoAdvice, June 16, 2022)

February 24, 2022

Sent by email: BKaminski@dsel.ca

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

Attention: **Mr. Braden Kaminski, E.I.T.**
Junior Project Manager

Re: Water Distribution Network Boundary Condition Request - Revision 2
Cardinal Creek Village South
GeoAdvice Project ID: 2021-077-DSE

Dear Mr. Kaminski,

In order to carry out the watermain analysis and hydraulic modeling for the Cardinal Creek Village (CCV) South development in the City of Ottawa, we request the hydraulic boundary conditions (HGL) for the proposed connection points as shown on the attached schematic. Flow conditions are outlined in the attached consumer water demand calculations.

Scenario 1

Boundary conditions at **Connections 1 and 2** are required for the demand conditions:

- Average day demand = 20.12 L/s
- Maximum day demand = 34.46 L/s
- Maximum day demand + fire flow (100 L/s) = 134.46 L/s
- Maximum day demand + fire flow (167 L/s) = 201.46 L/s
- Maximum day demand + fire flow (200 L/s) = 234.46 L/s
- Maximum day demand + fire flow (250 L/s) = 284.46 L/s
- Maximum day demand + fire flow (283 L/s) = 317.46 L/s
- Peak hour demand = 61.37 L/s

NOTE: The above demands and fire flows should be **allocated entirely to Connection 2 only**. The three (3) proposed 400 mm pipes in the attached Figure 1 should also be modeled.

The following demands should be **allocated and split equally to Connections 3, 4 and 5 only** for the same demand condition scenarios shown above. No boundary conditions are needed for these locations.

- Average day demand 6.56 L/s
- Maximum day demand = 13.13 L/s (demand to be included for all fire flow scenarios as well)
- Peak hour demand = 19.69 L/s

Scenario 2

Boundary conditions at **Connections 1 and 2** are required for the demand conditions:

- Average day demand = 16.22 L/s
- Maximum day demand = 24.98 L/s
- Maximum day demand + fire flow (167 L/s) = 191.98 L/s
- Maximum day demand + fire flow (200 L/s) = 224.98 L/s
- Maximum day demand + fire flow (250 L/s) = 274.98 L/s
- Maximum day demand + fire flow (283 L/s) = 307.98 L/s
- Peak hour demand = 53.85 L/s

Permit to Practice #: 1000623

NOTE: The above demands and fire flows should be **allocated completely to Connection 2 only**. The three (3) proposed 400 mm pipes in the attached figure should also be modeled.

The following demands should be **allocated and split equally to Connections 3, 4, and 5 only** for the same demand condition scenarios shown above. No boundary conditions are needed for these locations.

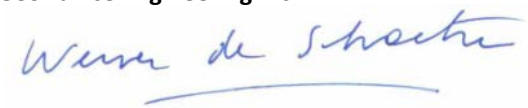
- Average day demand = 4.34 L/s
- Maximum day demand = 8.33 L/s (demand to be included for all fire flow scenarios as well)
- Peak hour demand = 19.65 L/s

For the maximum day demand plus fire flow scenarios, the HGLs for the lowest (100 L/s) and highest (283 L/s) fire flow requirement scenarios should be provided. The HGLs for any intermediate fire flow scenarios will be interpolated. Please confirm if any pumps turn on between the lowest (100 L/s) and highest (283 L/s) fire flow requirement scenarios. If there are any pumps feeding the development area and any additional pumps turning on between the lowest and highest fire flow scenarios, the HGLs **cannot** be interpolate or extrapolated. In this case, boundary conditions should be provided for all fire flow scenarios listed above.

If you have any questions, please do not hesitate to contact me.

Yours truly,

GeoAdvice Engineering Inc.



Werner de Schaetzen, Ph.D., P.Eng.
President and Chief Executive Officer
werner@geoadvice.com
GeoAdvice Engineering Inc.

Attachments: Mark up for connection locations and demand calculations for Scenarios 1 and 2

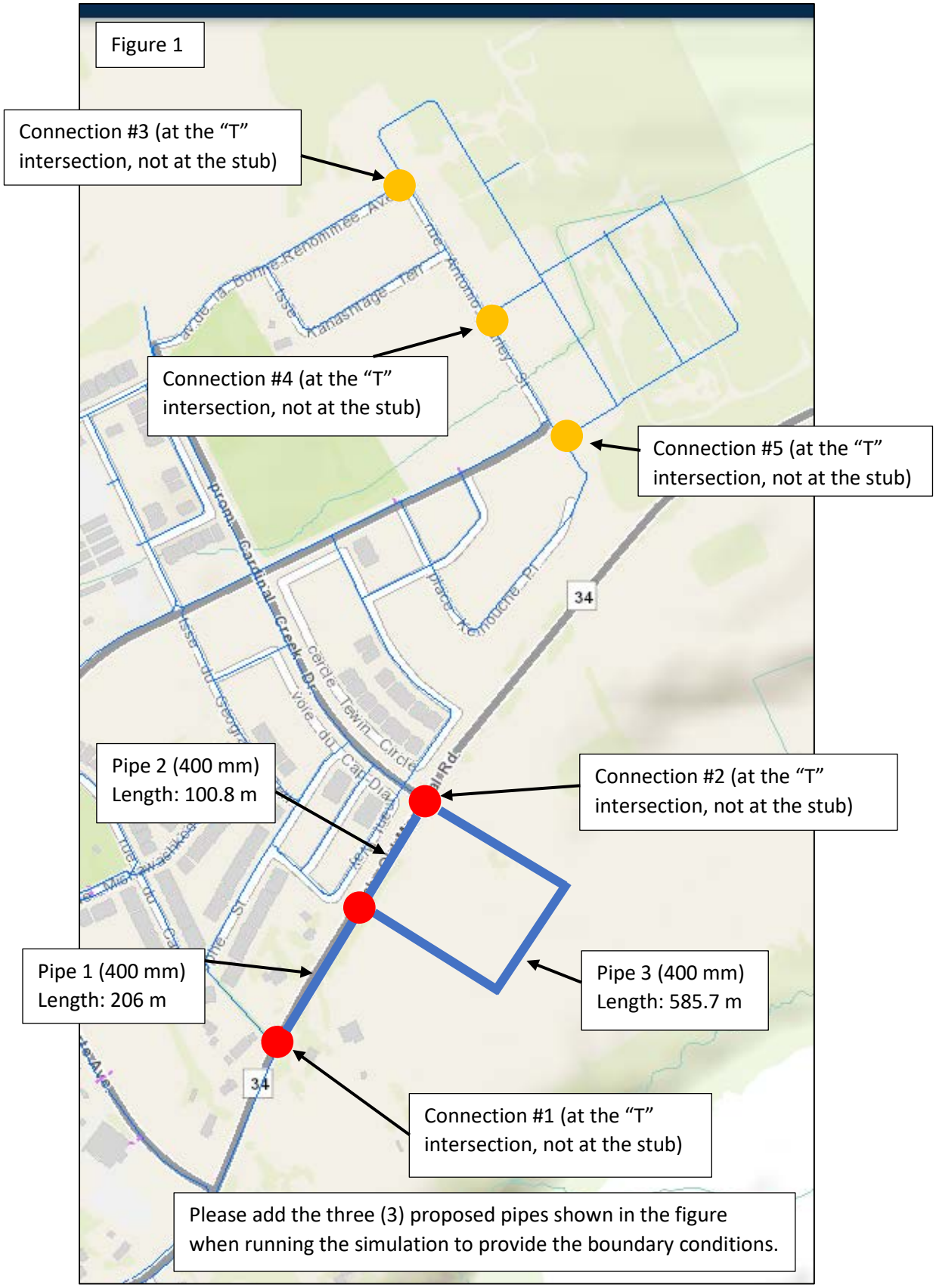
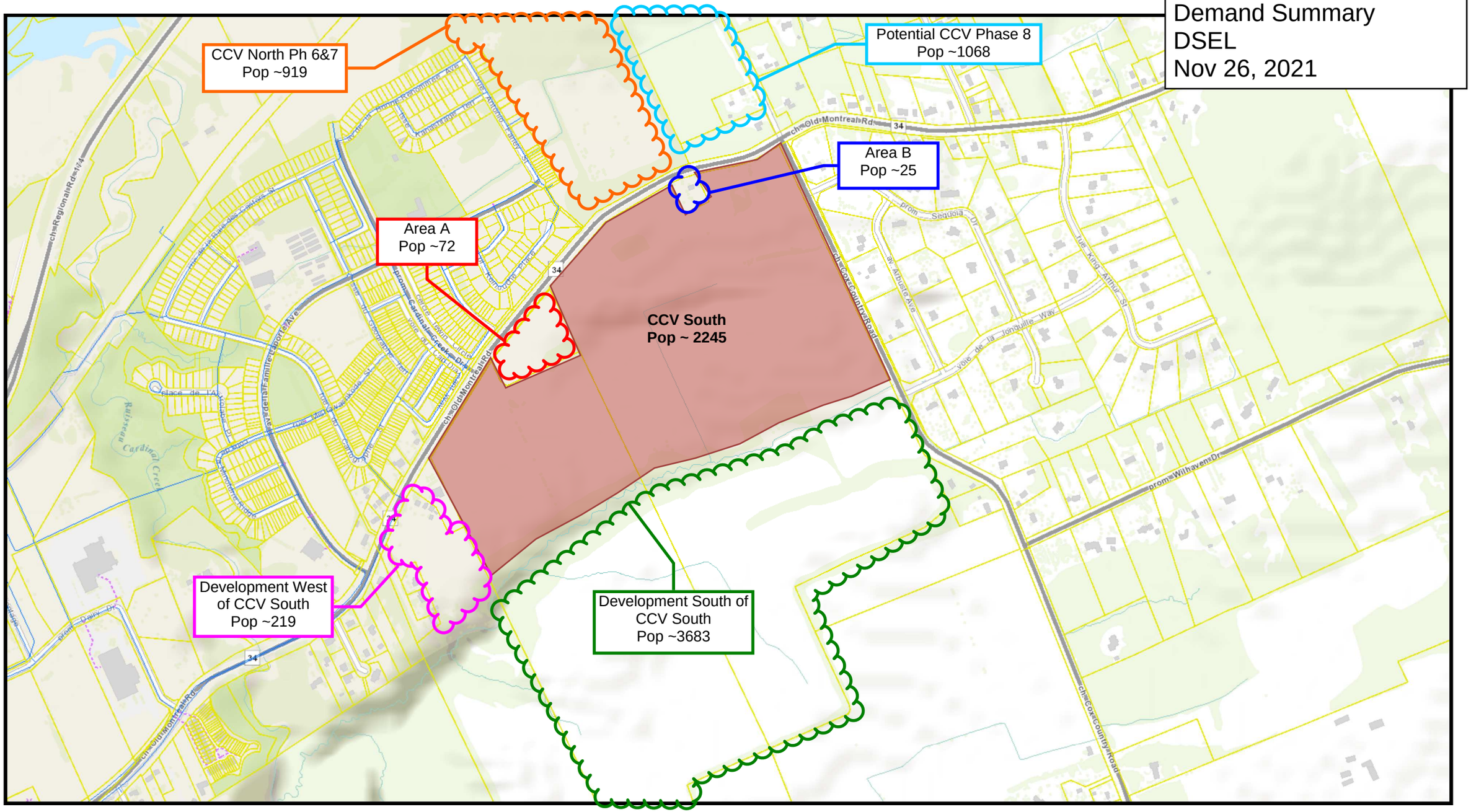


Figure 1
Connection #3 (at the "T" intersection, not at the stub)
Connection #4 (at the "T" intersection, not at the stub)
Connection #5 (at the "T" intersection, not at the stub)
Pipe 2 (400 mm) Length: 100.8 m
Connection #2 (at the "T" intersection, not at the stub)
Pipe 1 (400 mm) Length: 206 m
Pipe 3 (400 mm) Length: 585.7 m
Connection #1 (at the "T" intersection, not at the stub)
Please add the three (3) proposed pipes shown in the figure when running the simulation to provide the boundary conditions.
34
34
Prom. Cardinal
Creek Dr.
Circle Tewin Circle
Rue Antonio Riley St
Place Kenouche Pl.

CCV South - External Demand Summary
DSEL
Nov 26, 2021



Consumer Water Demands

Residential Demands - CCV South Phase 1*

Dwelling Type	Number of Units	Population		Average Day Demand			Max Day	Peak Hour
		Persons per Unit	Population Per Dwelling Type	(L/c/d)	(L/d)	(L/s)	2 x Avg. Day (L/s)	3 x Avg. Day (L/s)
Single Detached	62	3.4	211	280	59,080	0.68	1.37	2.05
Back-to-Back Townhome	40	2.7	108		30,240	0.35	0.70	1.05
Traditional Townhome	35	2.7	95		26,600	0.31	0.62	0.92
Subtotal	**137**		**414**		**115,920**	**1.34**	**2.68**	**4.03**

Non Residential Demands - CCV South Phase 1

Property Type	Area (ha)		Average Day Demand			Max Day	Peak Hour
			(L/ha/d)	(L/d)	(L/s)	1.5 x Avg. Day (L/s)	1.8 x Max Day (L/s)
School (Block 59)	2.44		28,000	68,320	0.79	1.19	2.14
Subtotal	**2.44**			**68,320**	**0.79**	**1.19**	**2.14**

Residential Demands - CCV South Phase 2*

Dwelling Type	Number of Units	Population		Average Day Demand			Max Day	Peak Hour
		Persons per Unit	Population Per Dwelling Type	(L/c/d)	(L/d)	(L/s)	2 x Avg. Day (L/s)	3 x Avg. Day (L/s)
Single Detached	74	3.4	252	280	70,560	0.82	1.63	2.45
Traditional Townhome	76	2.7	206		57,680	0.67	1.34	2.00
Subtotal	**150**		**458**		**128,240**	**1.48**	**2.97**	**4.45**

Non Residential Demands - CCV South Phase 2

Property Type	Area (ha)		Average Day Demand			Max Day	Peak Hour
			(L/ha/d)	(L/d)	(L/s)	1.5 x Avg. Day (L/s)	1.8 x Max Day (L/s)
Park (Block 58)	2.49		28,000	69,720	0.81	1.21	2.18
Subtotal	**2.49**			**69,720**	**0.81**	**1.21**	**2.18**

Residential Demands - CCV South Phase 3*

Dwelling Type	Number of Units	Population		Average Day Demand			Max Day	Peak Hour
		Persons per Unit	Population Per Dwelling Type	(L/c/d)	(L/d)	(L/s)	2 x Avg. Day (L/s)	3 x Avg. Day (L/s)
Single Detached	34	3.4	116	280	32,480	0.38	0.75	1.13
Back-to-Back Townhome	26	2.7	71		19,880	0.23	0.46	0.69
Traditional Townhome	54	2.7	146		40,880	0.47	0.95	1.42
Subtotal	**114**		**333**		**93,240**	**1.08**	**2.16**	**3.24**

Residential Demands - CCV South Phase 4*

Dwelling Type	Number of Units	Population		Average Day Demand			Max Day	Peak Hour
		Persons per Unit	Population Per Dwelling Type	(L/c/d)	(L/d)	(L/s)	2 x Avg. Day (L/s)	3 x Avg. Day (L/s)
Single Detached	58	3.4	198	280	55,440	0.64	1.28	1.93
Back-to-Back Townhome	76	2.7	206		57,680	0.67	1.34	2.00
Traditional Townhome	63	2.7	171		47,880	0.55	1.11	1.66
Subtotal	**197**		**575**		**161,000**	**1.86**	**3.73**	**5.59**

Residential Demands - CCV South Phase 5*

Dwelling Type	Number of Units	Population		Average Day Demand			Max Day	Peak Hour
		Persons per Unit	Population Per Dwelling Type	(L/c/d)	(L/d)	(L/s)	2 x Avg. Day (L/s)	3 x Avg. Day (L/s)
Single Detached	76	3.4	259	280	72,520	0.84	1.68	2.52
Back-to-Back Townhome	18	2.7	49		13,720	0.16	0.32	0.48
Traditional Townhome	58	2.7	157		43,960	0.51	1.02	1.53
Subtotal	**152**		**465**		**130,200**	**1.51**	**3.01**	**4.52**

Non Residential Demands - CCV South Phase 5

Property Type	Area (ha)		Average Day Demand			Max Day	Peak Hour
			(L/ha/d)	(L/d)	(L/s)	1.5 x Avg. Day (L/s)	1.8 x Max Day (L/s)
School (Block 34)	3.18		28,000	88,984	1.03	1.54	2.78
Subtotal	**3.18**			**88,984**	**1.03**	**1.54**	**2.78**

Residential Demands - Area A *

Dwelling Type	Number of Units	Population		Average Day Demand			Max Day 2 x Avg. Day (L/s)	Peak Hour 3 x Avg. Day (L/s)
		Persons per Unit	Population Per Dwelling Type	(L/c/d)	(L/d)	(L/s)		
Multi-Family Residential (area 0.53 ha) ǂ	27.00	2.7	73	280	20,412	0.24	0.47	0.71
Subtotal	**27.00**		**73**		**20,412**	**0.24**	**0.47**	**0.71**

Non Residential Demands - Area A

Property Type	Area (ha)		Average Day Demand			Max Day 1.5 x Avg. Day (L/s)	Peak Hour 1.8 x Max Day (L/s)
			(L/ha/d)	(L/d)	(L/s)		
Commercial ǂ	1.49		28,000	41,720	0.48	0.72	1.30
Subtotal	**1.49**			**41,720**	**0.48**	**0.72**	**1.30**

Residential Demands - Area B*

Dwelling Type	Number of Units	Population		Average Day Demand			Max Day 2 x Avg. Day (L/s)	Peak Hour 3 x Avg. Day (L/s)
		Persons per Unit	Population Per Dwelling Type	(L/c/d)	(L/d)	(L/s)		
Single Family Residential (area 0.43 ha) ǂ	8.00	3.4	27	280	7,616	0.09	0.18	0.26
Subtotal	**8.00**		**27**		**7,616**	**0.09**	**0.18**	**0.26**

Residential Demands - Development west of CCV South*

Dwelling Type	Number of Units	Population		Average Day Demand			Max Day 2 x Avg. Day (L/s)	Peak Hour 3 x Avg. Day (L/s)
		Persons per Unit	Population Per Dwelling Type	(L/c/d)	(L/d)	(L/s)		
Single Detached	22	3.4	75	280	21,000	0.24	0.49	0.73
Back-to-Back Townhome	15	2.7	41		11,480	0.13	0.27	0.40
Traditional Townhome	38	2.7	103		28,840	0.33	0.67	1.00
Subtotal	**75**		**219**		**61,320**	**0.71**	**1.42**	**2.13**

Residential Demands - Future Development south of CCV Southǂ

Dwelling Type	Number of Units	Population		Average Day Demandǂǂ			Max Day (L/s)ǂǂ	Peak Hour (L/s)ǂǂ
		Persons per Unit	Population Per Dwelling Type	(L/unit/d)	(L/d)	(L/s)		
Single Detached	368	3.4	1,252	570	209,760	2.43	6.90	18.13
Back-to-Back Townhome	245	2.7	662	560	137,200	1.59	1.59	2.54
Traditional Townhome	655	2.7	1,769	560	366,800	4.25	4.25	6.79
Subtotal	**1,268**		**3,683**		**713,760**	**8.26**	**12.73**	**27.47**

Non Residential Demands - Future Development south of CCV Southǂ

Property Type	Area (ha)		Average Day Demandǂǂ			Max Day (L/s)ǂǂ	Peak Hour (L/s)ǂǂ
			(L/ha/d)	(L/d)	(L/s)		
School	2.00		8,500	17,000	0.20	0.20	0.26
Park	2.50		8,500	21,250	0.25	0.25	0.32
Subtotal	**4.50**			**38,250**	**0.44**	**0.44**	**0.58**

Residential Demands - CCV North Future Phase 6*

Dwelling Type	Number of Units	Population		Average Day Demand			Max Day 2 x Avg. Day (L/s)	Peak Hour 3 x Avg. Day (L/s)
		Persons per Unit	Population Per Dwelling Type	(L/c/d)	(L/d)	(L/s)		
Single Detached	87	3.4	296	280	82,880	0.96	1.92	2.88
Semi Detached	2	2.7	6		1,680	0.02	0.04	0.06
Traditional Townhome	72	2.7	195		54,600	0.63	1.26	1.90
Subtotal	**161**		**497**		**139,160**	**1.61**	**3.22**	**4.83**

Residential Demands - CCV North Future Phase 7*

Dwelling Type	Number of Units	Population		Average Day Demand			Max Day 2 x Avg. Day (L/s)	Peak Hour 3 x Avg. Day (L/s)
		Persons per Unit	Population Per Dwelling Type	(L/c/d)	(L/d)	(L/s)		
Single Detached	66	3.4	225	280	63,000	0.73	1.46	2.19
Traditional Townhome	87	2.7	235		65,800	0.76	1.52	2.28
Subtotal	**153**		**460**		**128,800**	**1.49**	**2.98**	**4.47**

Residential Demands - CCV North Future Phase 8*

Dwelling Type	Number of Units	Population		Average Day Demand			Max Day 2 x Avg. Day (L/s)	Peak Hour 3 x Avg. Day (L/s)
		Persons per Unit	Population Per Dwelling Type	(L/c/d)	(L/d)	(L/s)		
Single Detached	175	3.4	595	280	166,600	1.93	3.86	5.78
Traditional Townhome	175	2.7	473		132,440	1.53	3.07	4.60
Subtotal	**350**		**1,068**		**299,040**	**3.46**	**6.92**	**10.38**

		Avg. Day	Max Day	Peak Hour
Total (Connection Points 1 & 2)		**20.12**	**34.46**	**61.37**
Total (Connection Points 3, 4, and 5)		**6.56**	**13.13**	**19.69**

*Peaking factors based on development population of 3,001-10,000 capita from the MOE Design Guidelines

‡Provided by DSEL

‡‡MSS factors from the previous Cardinal Creek Village Study (Veritec, 2013)

Consumer Water Demands

Residential Demands - CCV South Phase 1‡‡

Dwelling Type	Number of Units	Population		Average Day Demand				Max Day (L/s)	Peak Hour (L/s)
		Persons per Unit	Population Per Dwelling Type	(L/unit/d)	(L/unit/d)	(L/d)	(L/s)		
Single Detached	62	3.4	211	570	1,050	35,340	0.41	1.16	3.05
Back-to-Back Townhome	40	2.7	108	560	-	22,400	0.26	0.26	0.41
Traditional Townhome	35	2.7	95	560	-	19,600	0.23	0.23	0.36
Subtotal	**137**		**414**			**77,340**	**0.90**	**1.65**	**3.83**

Non Residential Demands - CCV South Phase 1‡‡

Property Type	Area (ha)		Average Day Demand				Max Day (L/s)	Peak Hour (L/s)
			(L/ha/d)		(L/d)	(L/s)		
School (Block 59)	2.44		8,500		20,740	0.24	0.24	0.31
Subtotal	**2.44**				**20,740**	**0.24**	**0.24**	**0.31**

Residential Demands - CCV South Phase 2‡‡

Dwelling Type	Number of Units	Population		Average Day Demand				Max Day (L/s)‡‡	Peak Hour (L/s)‡‡
		Persons per Unit	Population Per Dwelling Type	(L/unit/d)	(L/unit/d)	(L/d)	(L/s)		
Single Detached	74	3.4	252	570	1,050	42,180	0.49	1.39	3.65
Traditional Townhome	76	2.7	206	560	-	42,560	0.49	0.49	0.39
Subtotal	**150**		**458**			**84,740**	**0.98**	**1.88**	**4.03**

Non Residential Demands - CCV South Phase 2 ‡‡

Property Type	Area (ha)		Average Day Demand				Max Day (L/s)‡‡	Peak Hour (L/s)‡‡
			(L/ha/d)		(L/d)	(L/s)		
Park (Block 58)	2.49		8,500		21,165	0.24	0.24	0.32
Subtotal	**2.49**				**21,165**	**0.24**	**0.24**	**0.32**

Residential Demands - CCV South Phase 3‡‡

Dwelling Type	Number of Units	Population		Average Day Demand				Max Day (L/s)‡‡	Peak Hour (L/s)‡‡
		Persons per Unit	Population Per Dwelling Type	(L/unit/d)	(L/unit/d)	(L/d)	(L/s)		
Single Detached	34	3.4	116	570	1,050	19,380	0.22	0.64	1.68
Back-to-Back Townhome	26	2.7	71	560	-	14,560	0.17	0.17	0.27
Traditional Townhome	54	2.7	146	560		30,240	0.35	0.35	0.56
Subtotal	**114**		**333**			**64,180**	**0.74**	**1.16**	**2.50**

Residential Demands - CCV South Phase 4‡‡

Dwelling Type	Number of Units	Population		Average Day Demand				Max Day (L/s)‡‡	Peak Hour (L/s)‡‡
		Persons per Unit	Population Per Dwelling Type	(L/unit/d)	(L/unit/d)	(L/d)	(L/s)		
Single Detached	58	3.4	198	570	1,050	33,060	0.38	1.09	2.86
Back-to-Back Townhome	76	2.7	206	560	-	42,560	0.49	0.49	0.79
Traditional Townhome	63	2.7	171	560	-	35,280	0.41	0.41	0.65
Subtotal	**197**		**575**			**110,900**	**1.28**	**1.99**	**4.30**

Residential Demands - CCV South Phase 5‡‡

Dwelling Type	Number of Units	Population		Average Day Demand				Max Day (L/s)‡‡	Peak Hour (L/s)‡‡
		Persons per Unit	Population Per Dwelling Type	(L/unit/d)	(L/unit/d)	(L/d)	(L/s)		
Single Detached	76	3.4	259	570	1,050	43,320	0.50	1.43	3.74
Back-to-Back Townhome	18	2.7	49	560	-	10,080	0.12	0.12	0.19
Traditional Townhome	58	2.7	157	560		32,480	0.38	0.38	0.60
Subtotal	**152**		**465**			**85,880**	**0.99**	**1.92**	**4.53**

Non Residential Demands - CCV South Phase 5‡‡

Property Type	Area (ha)		Average Day Demand				Max Day (L/s)‡‡	Peak Hour (L/s)‡‡
			(L/ha/d)		(L/d)	(L/s)		
School (Block 34)	3.18		8,500		27,013	0.31	0.31	0.41
Subtotal	**3.18**				**27,013**	**0.31**	**0.31**	**0.41**

Residential Demands - Area A‡‡

Dwelling Type	Number of Units	Population		Average Day Demand				Max Day (L/s)‡‡	Peak Hour (L/s)‡‡
		Persons per Unit	Population Per Dwelling Type	(L/unit/d)	(L/unit/d)	(L/d)	(L/s)		
Multi-Family Residential (area 0.53 ha) ‡	27.00	2.7	73	570	1,050	15,390	0.18	0.51	1.33
Subtotal	**27.00**		**73**			**15,390**	**0.18**	**0.51**	**1.33**

Non Residential Demands - Area A‡‡

Property Type	Area (ha)		Average Day Demand				Max Day (L/s)‡‡	Peak Hour (L/s)‡‡
			(L/ha/d)		(L/d)	(L/s)		
Commercial ‡	1.49		8,500		12,665	0.15	0.15	0.19
Subtotal	**1.49**				**12,665**	**0.15**	**0.15**	**0.19**

Residential Demands - Area B‡‡

Dwelling Type	Number of Units	Population		Average Day Demand				Max Day (L/s)‡‡	Peak Hour (L/s)‡‡
		Persons per Unit	Population Per Dwelling Type	(L/unit/d)	(L/unit/d)	(L/d)	(L/s)		
Single Family Residential (area 0.43 ha) ‡	8.00	3.4	27	560	-	4,480	0.05	0.05	0.19
Subtotal	**8.00**		**27**			**4,480**	**0.05**	**0.05**	**0.19**

Residential Demands - Development west of CCV South‡‡

Dwelling Type	Number of Units	Population		Average Day Demand				Max Day (L/s)‡‡	Peak Hour (L/s)‡‡
		Persons per Unit	Population Per Dwelling Type	(L/unit/d)	(L/unit/d)	(L/d)	(L/s)		
Single Detached	22	3.4	75	570	1,050	42,750	0.49	0.76	2.34
Back-to-Back Townhome	15	2.7	41	560	-	23,370	0.27	0.27	0.43
Traditional Townhome	38	2.7	103	560		58,710	0.68	0.68	1.09
Subtotal	**75**		**219**			**124,830**	**1.44**	**1.71**	**3.86**

Residential Demands - Future Development south of CCV South‡

Dwelling Type	Number of Units	Population		Average Day Demand‡‡				Max Day (L/s)‡‡	Peak Hour (L/s)‡‡
		Persons per Unit	Population Per Dwelling Type	(L/unit/d)	(L/unit/d)	(L/d)	(L/s)		
Single Detached	368	3.4	1,252	570	1,050	209,760	2.43	6.90	18.13
Back-to-Back Townhome	245	2.7	662	560	-	137,200	1.59	1.59	2.54
Traditional Townhome	655	2.7	1,769	560		366,800	4.25	4.25	6.79
Subtotal	**1,268**		**3,683**			**713,760**	**8.26**	**12.73**	**27.47**

Non Residential Demands - Future Development south of CCV South‡

Property Type	Area (ha)		Average Day Demand‡‡				Max Day (L/s)‡‡	Peak Hour (L/s)‡‡
			(L/ha/d)		(L/d)	(L/s)		
School	2.00		8,500		17,000	0.20	0.20	0.26
Park	2.50		8,500		21,250	0.25	0.25	0.32
Subtotal	**4.50**				**38,250**	**0.44**	**0.44**	**0.58**

Residential Demands - CCV North Future Phase 6‡‡

Dwelling Type	Number of Units	Population		Average Day Demand				Max Day (L/s)‡‡	Peak Hour (L/s)‡‡
		Persons per Unit	Population Per Dwelling Type	(L/unit/d)	(L/unit/d)	(L/d)	(L/s)		
Single Detached	87	3.4	296	570	1,050	49,590	0.57	1.63	4.29
Semi Detached	2	2.7	6	560	-	1,120	0.01	0.01	0.02
Traditional Townhome	72	2.7	195	560		40,320	0.47	0.47	0.75
Subtotal	**161**		**497**			**91,030**	**1.05**	**2.11**	**5.05**

Residential Demands - CCV North Future Phase 7‡‡

Dwelling Type	Number of Units	Population		Average Day Demand				Max Day (L/s)‡‡	Peak Hour (L/s)‡‡
		Persons per Unit	Population Per Dwelling Type	(L/unit/d)	(L/unit/d)	(L/d)	(L/s)		
Single Detached	66	3.4	225	570	1,050	37,620	0.44	1.24	3.25
Traditional Townhome	87	2.7	235	560	-	48,720	0.56	0.56	0.90
Subtotal	**153**		**460**			**86,340**	**1.00**	**1.80**	**4.15**

Residential Demands - CCV North Future Phase 8‡‡

Dwelling Type	Number of Units	Population		Average Day Demand				Max Day (L/s)‡‡	Peak Hour (L/s)‡‡
		Persons per Unit	Population Per Dwelling Type	(L/unit/d)	(L/unit/d)	(L/d)	(L/s)		
Single Detached	175	3.4	595	570	1,050	99,750	1.15	3.28	8.62
Traditional Townhome	175	2.7	473	560	-	98,000	1.13	1.13	1.81
Subtotal	**350**		**1,068**			**197,750**	**2.29**	**4.42**	**10.44**

		Avg. Day	Max Day	Peak Hour
Total (Connection Points 1 & 2)		**16.22**	**24.98**	**53.85**
Total (Connection Points 3, 4, and 5)		**4.34**	**8.33**	**19.65**

‡Provided by DSEL

‡‡MSS factors from the previous Cardinal Creek Village Study (Veritec, 2013)

Hydraulic Capacity and Modeling Analysis Cardinal Creek Village South Development

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: June 16, 2022

Contact: Mr. Werner de Schaetzen, Ph.D., P.Eng.
Project: 2021-077-DSE

Document History and Version Control

Revision No.	Date	Document Description	Revised By	Reviewed By
R0	January 31, 2022	Draft	Ben Loewen	Werner de Schaetzen
R1	May 31, 2022	Updated Draft	Ben Loewen/Cole Dinsdale	Werner de Schaetzen
R2	June 16, 2022	Final	Ben Loewen/Cole Dinsdale	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

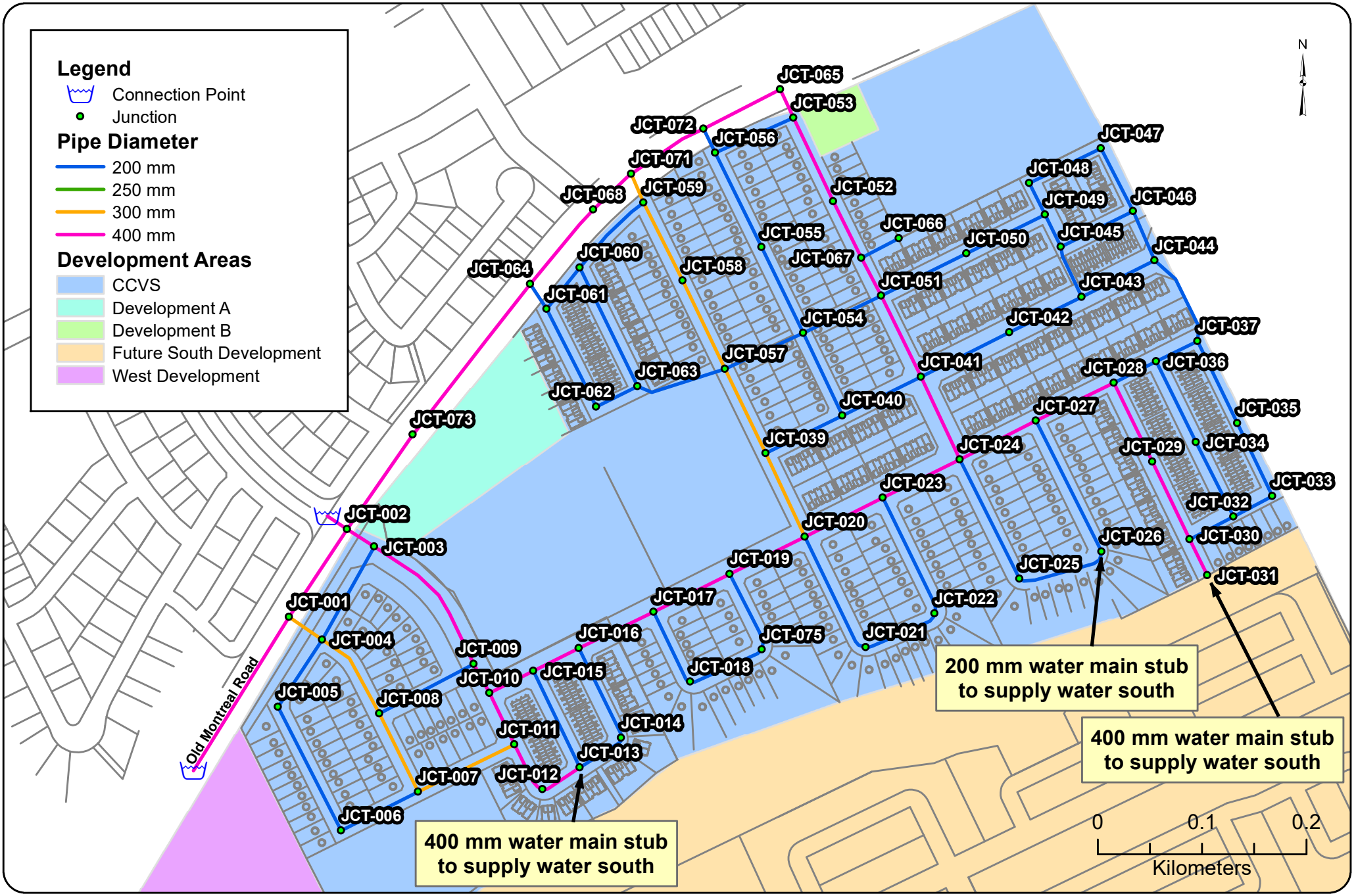
1 Introduction

GeoAdvice Engineering Inc. ("GeoAdvice") was retained by David Schaeffer Engineering Ltd. ("DSEL") to size the proposed water main network for the Cardinal Creek Village South (CCVS) development ("Development") in the City of Ottawa, ON ("City").

The development will have multiple connections to the City's water distribution system along Old Montreal Road. The development site is shown in **Figure 1.1** on the following page, with the final recommended pipe diameters.

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**
Cardinal Creek Village South
Client: **David Schaeffer Engineering Ltd.**
Date: **June 2022**
Created by: **BL**
Reviewed by: **WdS**

Site Layout and Connection Points

Figure 1.1

2 Modeling Considerations

2.1 Water Main Configuration

The water main network was modeled based on drawings prepared by DSEL (2021-11-16_Concept_Plan_World_Coords.dwg) and provided to GeoAdvice on November 24th, 2021. The water main network has been revised since the previous water main hydraulic analysis (Veritec report, April 2013), which is further discussed in **Section 2.6**. Trunk water main sizes were provided by DSEL on April 27, 2022, for the purpose of providing additional fire flow to the CCVS development and the planned urban development to the south (per the City's 2021 Official Plan) beyond the rates in the Cardinal Creek Village Master Servicing Study (MSS), to meet current City level of service standards.

2.2 Elevations

Elevations of the modeled junctions were assigned according to a preliminary site grading plan at road level, which was prepared by DSEL (1153_grad_coord.dwg) and provided to GeoAdvice on November 30th, 2021.

2.3 Consumer Demands

The proposed residential demands for the CCVS development were based on a demand rate of 280 L/cap/d as per City of Ottawa technical bulletin ISTB 2018-01. The park and school rate of 28,000 L/ha/d was assumed as per the City of Ottawa design guidelines and are consistent with similar previously completed developments within the City of Ottawa. Demand factors used for this analysis were taken according to the peaking factors based on development population of 3,001-10,000 capita from the MOE Design Guidelines. Population densities were assigned according to *Table 4.1 Per Unit Populations* from the City of Ottawa Design Guidelines. A summary of these tables highlighting relevant data for this development is shown in **Table 2.1**.

Furthermore, demands for the future development located to the south of the CCVS development were included and were based on the demand rates from the Cardinal Creek Village Master Servicing Study (Veritec report, April 2013), as provided by DSEL. Three (3) additional adjacent development areas (Developments A, B, and West) were also included as part of the CCVS development analysis because their development locations are downstream of the boundary conditions provided by the City. The additional developments are shown in **Figure 1.1** on the previous page and summarized in **Appendix A**.

Table 2.1: City of Ottawa and MOE Demand Factors

Demand Type	Amount	Units
Average Day Demand		
Residential	280	L/c/d
Park	28,000	L/ha/d
School	28,000	L/ha/d
Maximum Daily Demand		
Residential	2.0 x avg. day	L/c/d
Park	1.5 x avg. day	L/ha/d
School	1.5 x avg. day	L/ha/d
Peak Hour Demand		
Residential	3.0 x avg. day	L/c/d
Park	1.8 x max. day	L/ha/d
School	1.8 x max. day	L/ha/d
Minimum Hour Demand		
Residential	0.5 x avg. day	L/c/d
Park	0.5 x avg. day	L/ha/d
School	0.5 x avg. day	L/ha/d

Table 2.2 and **Table 2.3** summarize the water demand calculations for CCVS development.

Table 2.2: Development Population and Demand Calculations – CCVS Development ǂ

Dwelling Type	Number of Units	Persons Per Unit*	Population	Average Day Demand (L/s)	Maximum Day Demand (L/s)	Peak Hour Demand (L/s)
Single Detached	304	3.4	1,036	3.36	6.71	10.07
Traditional Townhome	286	2.7	775	2.51	5.02	7.53
Back-to-Back Townhome	160	2.7	434	1.55	3.87	8.51
Total	**750**		**2,245**	**7.42**	**15.61**	**26.12**

*City of Ottawa Design Guidelines.
ǂ Peaking factors based on development population of 3,001-10,000 capita from the MOE Design Guidelines.

Table 2.3: Non Residential Demand Calculations – CCVS Development ǂ

Land Use Type	Area (ha)	Average Day Demand (L/s)	Maximum Day Demand (L/s)	Peak Hour Demand (L/s)
Park	2.49	0.81	1.21	2.18
School	5.67	1.82	2.73	4.92

ǂ Peaking factors based on the City of Ottawa Design Guidelines

Table 2.4 and **Table 2.5** summarize the water demand calculations for the future development south of the CCVS development.

The future development area to the south has increased in size and projected population due to City of Ottawa's 2021 Official Plan. As such, the demands from the Cardinal Creek Village Master Servicing Study (Veritec report, April 2013) have been updated based on the revised projections using the same rates as the MSS.

Table 2.4: Development Population and Demand Calculations – Future Development South of CCVS ǂ

Dwelling Type	Number of Units	Average Day Demand (L/s)	Maximum Day Demand (L/s)	Peak Hour Demand (L/s)
Single Detached	368	2.43	6.90	18.13
Traditional Townhome	655	4.25	4.25	6.79
Back-to-Back Townhome	245	1.59	1.59	2.54
Total	**1,268**	**8.26**	**12.73**	**27.47**

ǂ Peaking factors based on the previous water main hydraulic analysis (Veritec report, April 2013)

Table 2.5: Non Residential Demand Calculations – Future Development South of CCVS ǂ

Land Use Type	Area (ha)	Average Day Demand (L/s)	Maximum Day Demand (L/s)	Peak Hour Demand (L/s)
Park	2.50	0.25	0.25	0.32
School	2.00	0.20	0.20	0.26

ǂ Peaking factors based on the previous water main hydraulic analysis (Veritec report, April 2013)

Table 2.6 and **Table 2.7** summarize the water demand calculations for the additional development areas adjacent to the CCVS development.

Table 2.6: Development Population and Demand Calculations – Additional Developments ǂ

Development	Dwelling Type	Number of Units	Average Day Demand (L/s)	Maximum Day Demand (L/s)	Peak Hour Demand (L/s)
Development A	Residential	27	0.24	0.47	0.71
Development B	Residential	8	0.09	0.18	0.26
West Development	Single Detached	22	0.24	0.49	0.73
	Traditional Townhome	38	0.33	0.67	1.00
	Back-to-Back Townhome	15	0.13	0.27	0.40

ǂ Peaking factors based on development population of 3,001-10,000 capita from the MOE Design Guidelines

Table 2.7: Non Residential Demand Calculations – Additional Developments ǂ

Development	Land Use Type	Area (ha)	Average Day Demand (L/s)	Maximum Day Demand (L/s)	Peak Hour Demand (L/s)
Development A	Commercial	1.49	0.48	0.72	1.30

ǂ Peaking factors based on the City of Ottawa Design Guidelines.

Demands were grouped into demand polygons then uniformly distributed to the model nodes located within each polygon. Detailed calculations of demands as well as the illustrated allocation areas are shown in **Appendix A**.

2.4 Fire Flow Demand

Fire flow calculations were completed in accordance with the Fire Underwriters Survey's (FUS) Water Supply for Public Fire Protection Guideline (1999) and City of Ottawa Technical Bulletin ISTB-2018-02 for the back-to-back townhomes. DSEL confirmed that there will be 10 m of backing for single detached and traditional townhomes, and as such, these dwelling types meet Technical Bulletin ISTB-2018-02 requirements, and the required fire flow value was capped at 10,000 L/min (167 L/s).

Fire flow simulations were completed at each model node under the required fire flow scenarios listed below. The locations of nodes do not necessarily represent hydrant locations.

- 167 L/s (single family and traditional townhouse units)
- 200 L/s (back-to-back townhouse units, accounting for one (1) firewall)
- 250 L/s (required fire flow of Area A, shown in **Figure 1.1**, as confirmed by DSEL)

Please note that the required fire flow for the school blocks have been assumed as 150 L/s, as per the Master Municipal Construction Documents (MMCD). Where multiple fire flow conditions were present, the most conservative fire flow requirement was assigned.

Detailed FUS calculations and figures illustrating the spatial allocation of the required fire flows are shown in **Appendix B**.

2.5 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: Old Montreal Road
- Connection 2: Old Montreal Road at Cardinal Creek Drive

The connections are illustrated in **Figure 1.1**.

Boundary conditions were provided for Peak Hour (PHD), Maximum Day plus Fire (MDD+FF) and Average Day (high pressure check, ADD) demand conditions.

The City boundary conditions were provided to GeoAdvice on April 19, 2022 and can be found in **Appendix C**.

The demands from the future development south of the CCVS development and the additional Developments A, B and West were included in the boundary condition request as they are located downstream from the connection points used in the boundary conditions. Furthermore, development demands for Cardinal Creek Village North (CCVN) Phases 6-8 were only calculated and included to determine the boundary conditions for the CCVS development, because the City noted that demands for these areas were not currently accounted for in the City's model.

Table 2.8 summarizes the City of Ottawa boundary conditions used to size the water network.

Table 2.8: Boundary Conditions

Condition	Connection 1 HGL (m)	Connection 2 HGL (m)
Average Day (max. pressure)	130.0	130.0
Peak Hour (min. pressure)	124.5	124.4
Max Day + Fire Flow (167 L/s)	123.9	123.7
Max Day + Fire Flow (200 L/s)	122.7	122.5
Max Day + Fire Flow (250 L/s)	120.8	120.4

2.6 Previous Cardinal Creek Village Analysis

The previous hydraulic analysis for the Cardinal Creek Village was conducted as part of the Cardinal Creek Master Servicing Study by Veritec Consulting Inc. (Veritec) and is discussed within their report "Watermain Network Hydraulic Analysis, April 4, 2013".

There are multiple factors that have been revised since the original analysis completed in 2013 and are listed below and discussed briefly:

1. Fire Flow Requirements: The original fire flow requirements for low density (i.e., single family) and medium density (i.e. townhomes) were 100 L/s and 167 L/s, respectively. The current minimum fire flow requirement for single family blocks that adhere to the minimum 10 m backing criteria and townhouse bocks that adhere to the minimum 10 m backing criteria and minimum building footprint area requirements under the City of Ottawa Technical Bulletin ISTB-218-02 can be capped at 167 L/s.
2. The Water Main Layout: The original water main and road layout consists of different connections to the CCVS development, including a connection north of Old Montreal Road in line with Antonio Farley to the Cardinal Creek Village North (CCVN) development. Due to current City level of service standards, water main diameters throughout the CCVS development are also different.
3. Development Demands: Demand rates and unit counts for the CCVS area are different, in addition to the demands for the Cardinal Creek Village area north of Old Montreal Road. Additional demands south of the CCVS development have now been accommodated for in accordance with the City of Ottawa's 2021 Official Plan. For details on the previous provided City demand rates used, refer to Veritec report "Watermain Network Hydraulic Analysis, April 4, 2013".
4. Boundary Conditions: The boundary conditions were provided at different locations and may reflect different system conditions upstream of the CCVS development.
5. Development Elevations: The currently proposed development elevations may vary from the elevations used in the previous analysis. The MSS flagged that the eastern portion of the site was a known local high point where pressure issues were expected to be addressed and accommodated as part of the detailed design. It was reported that elevations below approximately 92.5 m can achieve adequate pressures of 276 kPa (40 psi).

Each of the factors listed above contribute to the network updates discussed throughout this report.

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

Modeled service pressures for the proposed CCVS 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
73 psi (500 kPa)	40 psi (278 kPa)

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 within the distribution system in occupied areas outside of the public right-of-way shall not exceed 552 kPa (80 psi) and the minimum pressure at any point within the distribution system shall not fall below 270 kPa (40 psi). The maximum service pressure is 73 psi and is below the maximum 80 psi threshold, therefore no PRVs are required for the proposed development.

Detailed capacity result tables and figures can be found in **Appendix E**.

4.2 Development Fire Flow Analysis

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

Table 4.2: Summary of the Minimum Available Fire Flows

Required Fire Flow	Minimum Available Flow*	Junction ID
167 L/s	256 L/s	JCT-047
200 L/s	281 L/s	JCT-035
250 L/s	>500 L/s	JCT-073

*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. High available fire flows (>500 L/s) are theoretical values. Actual available fire flow is limited by the hydraulic losses through the hydrant lateral and hydrant port sizes.

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

Summaries of the residual pressures in the CCVS development are shown 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 the Residual Pressures (MDD + FF)

Minimum Residual Pressure	Average Residual Pressure	Maximum Residual Pressure
32 psi (221 kPa)	44 psi (300 kPa)	63 psi (437 kPa)

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 E**.

5 Other Servicing Considerations

5.1 Water Supply Security

The City of Ottawa Design Guidelines allow single feed systems for developments up to a total average day demand of 50 m^3/day and require two (2) feeds if the development exceeds 50 m^3/day for supply security, according to Technical Bulletin ISDTB-2018-02.

The CCVS development services a total average day demand of 1,738 m^3/day; as such, two (2) feeds are required. Two (2) feeds to the CCVS development from Old Montreal Road were modeled as part of the analysis.

5.2 Valves

No comment has been made in this report with respect to exact placement of isolation valves within the distribution network for the development other than to summarize the City of Ottawa Design Guidelines for number, location, and spacing of isolation valves:

- Tee intersection – two (2) valves
- Cross intersection – three (3) valves
- Valves shall be located 2 m away from the intersection
- 300 m spacing for 150 mm to 400 mm diameter valves
- Gate valves for 100 mm to 300 mm diameter mains
- Butterfly valves for 400 mm and larger diameter mains

Drain valves are not strictly required under the City of Ottawa Design Guidelines for water mains under 600 mm in diameter. The Guidelines indicate that “small diameter water mains shall be drained through hydrant via pumping if needed.”

Air valves are not strictly required under the City of Ottawa Design Guidelines for water mains up to and including 400 mm in diameter. The Guidelines indicate that air removal “can be accomplished by the strategic positioning of hydrant at the high points to remove the air or by installing or utilizing available 50 mm chlorination nozzles in 300 mm and 400 mm chambers.”

The detailed engineering drawings for the development are expected to identify valves in accordance with the requirements noted above.

5.3 Hydrants

No additional comment has been made in this report with respect to exact placement of hydrants within the distribution network for the development other than to summarize the City of Ottawa Design Guidelines for maximum hydrant spacing:

- 125 m for single family unit residential areas on lots where frontage at the street line is 15 m or longer
- 110 m for single family unit residential areas on lots where frontage at the street line is less than 15 m and for residential areas zoned for row housing, doubles or duplexes
- 90 m for institutional, commercial, industrial, apartments and high-density areas

Additionally, based on the FUS document *Water Supply for Public Fire Protection (1999)*, the hydrant coverage areas for the following fire flows are:

- 167 L/s: 11,990 m^2 (radial coverage of 62 m)
- 200 L/s: 11,000 m^2 (radial coverage of 59 m)
- 250 L/s: 9,750 m^2 (radial coverage of 56 m)

The detailed engineering drawings for the development are expected to identify hydrant locations in accordance with the requirements noted above.

5.4 Water Quality

The turnover rate of the water within the CCVS development network, calculated from the connections to the development is about 7.0 hours (ADD is 1,738 m^3/day).

The above rate is based on the volume of the development network and the development average day demand.

A separate phasing analysis will be conducted as part of detailed design to ensure that water quality requirements are met during each phase of the development. Mitigation strategies (i.e. auto flushers or temporary flushing programs) may be required to address interim water quality issues.

6 Conclusions

The hydraulic capacity and modeling analysis of the Cardinal Creek Village South development yielded the following conclusions:

- The proposed water main network can deliver all domestic flows under the ADD and PHD conditions. Service pressures are expected to range between 40 psi (278 kPa) and 73 psi (500 kPa).
- The proposed water main network is able to deliver required fire flows at all junctions while maintaining at least a minimum pressure of 20 psi.

Submission

Prepared by:

Ben Loewen, P.Eng., PMP.
Hydraulic Modeler / Project Engineer

Cole Dinsdale, E.I.T.
Hydraulic Modeler

Approved by:

June 16, 2022

LICENSED PROFESSIONAL ENGINEER
W. B. F. de Schaetzen
100116349
PROVINCE OF ONTARIO

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

Appendix A Domestic Water Demand Calculations and Allocation

Consumer Water Demands

Residential Demands - CCV South Phase 1*

Dwelling Type	Number of Units	Population		Average Day Demand			Max Day	Peak Hour
		Persons per Unit	Population Per Dwelling Type	(L/c/d)	(L/d)	(L/s)	2 x Avg. Day (L/s)	3 x Avg. Day (L/s)
Single Detached	62	3.4	211	280	59,080	0.68	1.37	2.05
Back-to-Back Townhome	40	2.7	108		30,240	0.35	0.70	1.05
Traditional Townhome	35	2.7	95		26,600	0.31	0.62	0.92
Subtotal	**137**		**414**		**115,920**	**1.34**	**2.68**	**4.03**

Non Residential Demands - CCV South Phase 1

Property Type	Area (ha)		Average Day Demand			Max Day	Peak Hour
			(L/ha/d)	(L/d)	(L/s)	1.5 x Avg. Day (L/s)	1.8 x Max Day (L/s)
School (Block 59)	2.44		28,000	68,320	0.79	1.19	2.14
Subtotal	**2.44**			**68,320**	**0.79**	**1.19**	**2.14**

Residential Demands - CCV South Phase 2*

Dwelling Type	Number of Units	Population		Average Day Demand			Max Day	Peak Hour
		Persons per Unit	Population Per Dwelling Type	(L/c/d)	(L/d)	(L/s)	2 x Avg. Day (L/s)	3 x Avg. Day (L/s)
Single Detached	74	3.4	252	280	70,560	0.82	1.63	2.45
Traditional Townhome	76	2.7	206		57,680	0.67	1.34	2.00
Subtotal	**150**		**458**		**128,240**	**1.48**	**2.97**	**4.45**

Non Residential Demands - CCV South Phase 2

Property Type	Area (ha)		Average Day Demand			Max Day	Peak Hour
			(L/ha/d)	(L/d)	(L/s)	1.5 x Avg. Day (L/s)	1.8 x Max Day (L/s)
Park (Block 58)	2.49		28,000	69,720	0.81	1.21	2.18
Subtotal	**2.49**			**69,720**	**0.81**	**1.21**	**2.18**

Residential Demands - CCV South Phase 3*

Dwelling Type	Number of Units	Population		Average Day Demand			Max Day	Peak Hour
		Persons per Unit	Population Per Dwelling Type	(L/c/d)	(L/d)	(L/s)	2 x Avg. Day (L/s)	3 x Avg. Day (L/s)
Single Detached	34	3.4	116	280	32,480	0.38	0.75	1.13
Back-to-Back Townhome	26	2.7	71		19,880	0.23	0.46	0.69
Traditional Townhome	54	2.7	146		40,880	0.47	0.95	1.42
Subtotal	**114**		**333**		**93,240**	**1.08**	**2.16**	**3.24**

Residential Demands - CCV South Phase 4*

Dwelling Type	Number of Units	Population		Average Day Demand			Max Day	Peak Hour
		Persons per Unit	Population Per Dwelling Type	(L/c/d)	(L/d)	(L/s)	2 x Avg. Day (L/s)	3 x Avg. Day (L/s)
Single Detached	58	3.4	198	280	55,440	0.64	1.28	1.93
Back-to-Back Townhome	76	2.7	206		57,680	0.67	1.34	2.00
Traditional Townhome	63	2.7	171		47,880	0.55	1.11	1.66
Subtotal	**197**		**575**		**161,000**	**1.86**	**3.73**	**5.59**

Residential Demands - CCV South Phase 5*

Dwelling Type	Number of Units	Population		Average Day Demand			Max Day	Peak Hour
		Persons per Unit	Population Per Dwelling Type	(L/c/d)	(L/d)	(L/s)	2 x Avg. Day (L/s)	3 x Avg. Day (L/s)
Single Detached	76	3.4	259	280	72,520	0.84	1.68	2.52
Back-to-Back Townhome	18	2.7	49		13,720	0.16	0.32	0.48
Traditional Townhome	58	2.7	157		43,960	0.51	1.02	1.53
Subtotal	**152**		**465**		**130,200**	**1.51**	**3.01**	**4.52**

Non Residential Demands - CCV South Phase 5

Property Type	Area (ha)		Average Day Demand			Max Day	Peak Hour
			(L/ha/d)	(L/d)	(L/s)	1.5 x Avg. Day (L/s)	1.8 x Max Day (L/s)
School (Block 34)	3.18		28,000	88,984	1.03	1.54	2.78
Subtotal	**3.18**			**88,984**	**1.03**	**1.54**	**2.78**

Residential Demands - Area A *

Dwelling Type	Number of Units	Population		Average Day Demand			Max Day 2 x Avg. Day (L/s)	Peak Hour 3 x Avg. Day (L/s)
		Persons per Unit	Population Per Dwelling Type	(L/c/d)	(L/d)	(L/s)		
Multi-Family Residential (area 0.53 ha) ǂ	27.00	2.7	73	280	20,412	0.24	0.47	0.71
Subtotal	**27.00**		**73**		**20,412**	**0.24**	**0.47**	**0.71**

Non Residential Demands - Area A

Property Type	Area (ha)		Average Day Demand			Max Day 1.5 x Avg. Day (L/s)	Peak Hour 1.8 x Max Day (L/s)
			(L/ha/d)	(L/d)	(L/s)		
Commercial ǂ	1.49		28,000	41,720	0.48	0.72	1.30
Subtotal	**1.49**			**41,720**	**0.48**	**0.72**	**1.30**

Residential Demands - Area B*

Dwelling Type	Number of Units	Population		Average Day Demand			Max Day 2 x Avg. Day (L/s)	Peak Hour 3 x Avg. Day (L/s)
		Persons per Unit	Population Per Dwelling Type	(L/c/d)	(L/d)	(L/s)		
Single Family Residential (area 0.43 ha) ǂ	8.00	3.4	27	280	7,616	0.09	0.18	0.26
Subtotal	**8.00**		**27**		**7,616**	**0.09**	**0.18**	**0.26**

Residential Demands - Development west of CCV South*

Dwelling Type	Number of Units	Population		Average Day Demand			Max Day 2 x Avg. Day (L/s)	Peak Hour 3 x Avg. Day (L/s)
		Persons per Unit	Population Per Dwelling Type	(L/c/d)	(L/d)	(L/s)		
Single Detached	22	3.4	75	280	21,000	0.24	0.49	0.73
Back-to-Back Townhome	15	2.7	41		11,480	0.13	0.27	0.40
Traditional Townhome	38	2.7	103		28,840	0.33	0.67	1.00
Subtotal	**75**		**219**		**61,320**	**0.71**	**1.42**	**2.13**

Residential Demands - Future Development south of CCV Southǂ

Dwelling Type	Number of Units	Population		Average Day Demandǂǂ			Max Day (L/s)ǂǂ	Peak Hour (L/s)ǂǂ
		Persons per Unit	Population Per Dwelling Type	(L/unit/d)	(L/d)	(L/s)		
Single Detached	368	3.4	1,252	570	209,760	2.43	6.90	18.13
Back-to-Back Townhome	245	2.7	662	560	137,200	1.59	1.59	2.54
Traditional Townhome	655	2.7	1,769	560	366,800	4.25	4.25	6.79
Subtotal	**1,268**		**3,683**		**713,760**	**8.26**	**12.73**	**27.47**

Non Residential Demands - Future Development south of CCV Southǂ

Property Type	Area (ha)		Average Day Demandǂǂ			Max Day (L/s)ǂǂ	Peak Hour (L/s)ǂǂ
			(L/ha/d)	(L/d)	(L/s)		
School	2.00		8,500	17,000	0.20	0.20	0.26
Park	2.50		8,500	21,250	0.25	0.25	0.32
Subtotal	**4.50**			**38,250**	**0.44**	**0.44**	**0.58**

Residential Demands - CCV North Future Phase 6*

Dwelling Type	Number of Units	Population		Average Day Demand			Max Day 2 x Avg. Day (L/s)	Peak Hour 3 x Avg. Day (L/s)
		Persons per Unit	Population Per Dwelling Type	(L/c/d)	(L/d)	(L/s)		
Single Detached	87	3.4	296	280	82,880	0.96	1.92	2.88
Semi Detached	2	2.7	6		1,680	0.02	0.04	0.06
Traditional Townhome	72	2.7	195		54,600	0.63	1.26	1.90
Subtotal	**161**		**497**		**139,160**	**1.61**	**3.22**	**4.83**

Residential Demands - CCV North Future Phase 7*

Dwelling Type	Number of Units	Population		Average Day Demand			Max Day 2 x Avg. Day (L/s)	Peak Hour 3 x Avg. Day (L/s)
		Persons per Unit	Population Per Dwelling Type	(L/c/d)	(L/d)	(L/s)		
Single Detached	66	3.4	225	280	63,000	0.73	1.46	2.19
Traditional Townhome	87	2.7	235		65,800	0.76	1.52	2.28
Subtotal	**153**		**460**		**128,800**	**1.49**	**2.98**	**4.47**

Residential Demands - CCV North Future Phase 8*

Dwelling Type	Number of Units	Population		Average Day Demand			Max Day 2 x Avg. Day (L/s)	Peak Hour 3 x Avg. Day (L/s)
		Persons per Unit	Population Per Dwelling Type	(L/c/d)	(L/d)	(L/s)		
Single Detached	175	3.4	595	280	166,600	1.93	3.86	5.78
Traditional Townhome	175	2.7	473		132,440	1.53	3.07	4.60
Subtotal	**350**		**1,068**		**299,040**	**3.46**	**6.92**	**10.38**

		Avg. Day	Max Day	Peak Hour
Total (Connection Points 1 & 2)		**20.12**	**34.46**	**61.37**
Total (Connection Points 3, 4, and 5)		**6.56**	**13.13**	**19.69**

*Peaking factors based on development population of 3,001-10,000 capita from the MOE Design Guidelines

‡Provided by DSEL

‡‡MSS factors from the previous Cardinal Creek Village Study (Veritec, 2013)

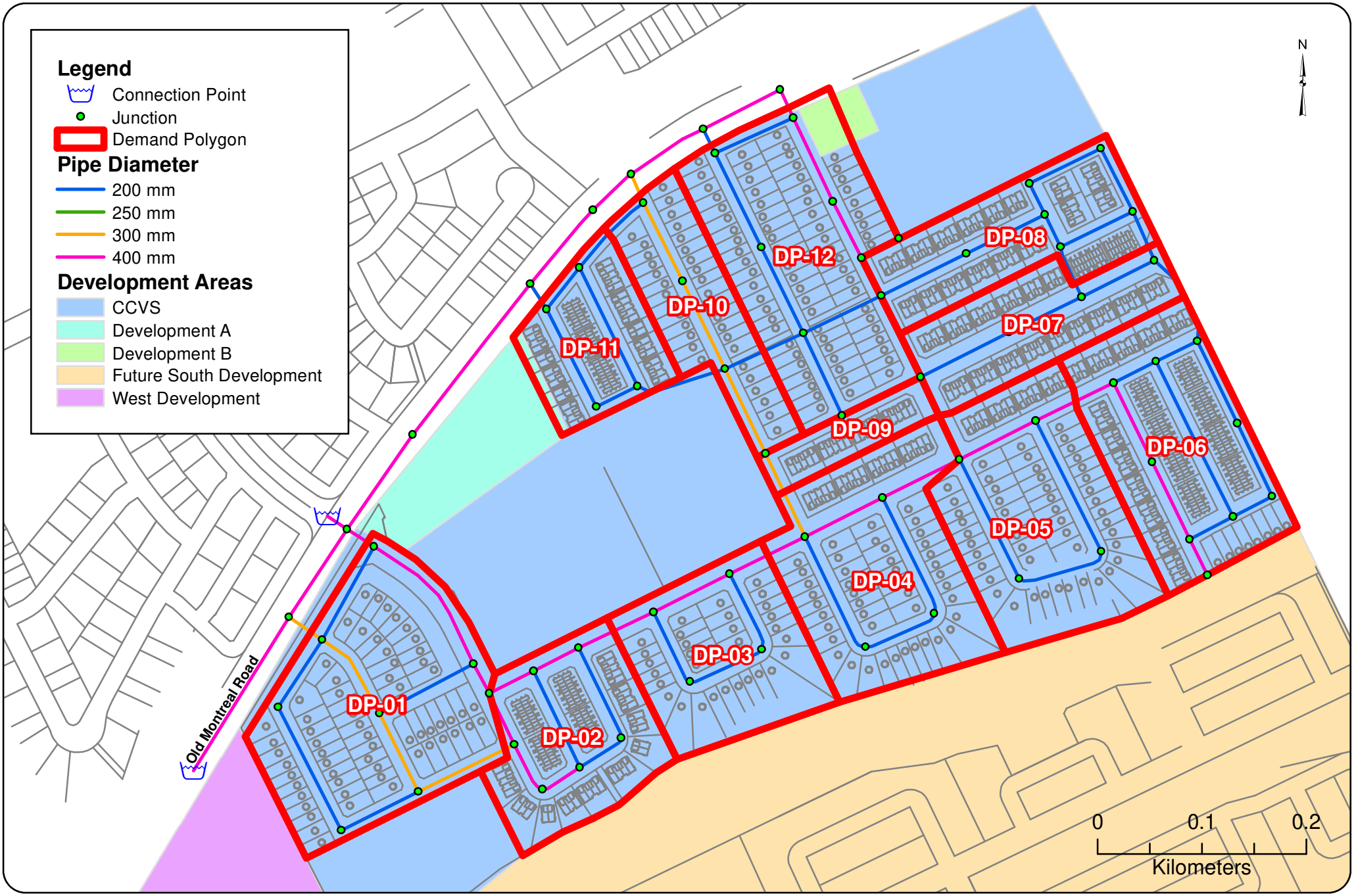
Domestic Demand Calculations and Allocation

Cardinal Creek Village South Domestic Demands

Demand Polygon	Junction ID	Dwelling Type	Number of Units	Population	Average Day Demand			Max Day (L/s)	Peak Hour (L/s)	Min Hour (L/s)
					L/c/d	L/d	L/s			
DP-01	JCT-003	Single Detached	62	211	280	8,440	0.10	0.20	0.29	0.05
	JCT-004					8,440	0.10	0.20	0.29	0.05
	JCT-005					8,440	0.10	0.20	0.29	0.05
	JCT-006					8,440	0.10	0.20	0.29	0.05
	JCT-007					8,440	0.10	0.20	0.29	0.05
	JCT-008					8,440	0.10	0.20	0.29	0.05
	JCT-009					8,440	0.10	0.20	0.29	0.05
DP-02	JCT-010	Traditional Townhouse	35	95	280	8,120	0.09	0.19	0.28	0.05
	JCT-011					8,120	0.09	0.19	0.28	0.05
	JCT-012					8,120	0.09	0.19	0.28	0.05
	JCT-013	Back-to-Back Townhouse	40	108	280	8,120	0.09	0.19	0.28	0.05
	JCT-014					8,120	0.09	0.19	0.28	0.05
	JCT-015					8,120	0.09	0.19	0.28	0.05
	JCT-016					8,120	0.09	0.19	0.28	0.05
DP-03	JCT-017	Single Detached	30	102	280	7,151	0.08	0.17	0.25	0.04
	JCT-018					7,151	0.08	0.17	0.25	0.04
	JCT-019					7,151	0.08	0.17	0.25	0.04
	JCT-075					7,151	0.08	0.17	0.25	0.04
DP-04	JCT-020	Single Detached	44	150	280	14,283	0.17	0.33	0.50	0.08
	JCT-021					14,283	0.17	0.33	0.50	0.08
	JCT-022	Traditional Townhouse	20	54	280	14,283	0.17	0.33	0.50	0.08
	JCT-023					14,283	0.17	0.33	0.50	0.08
DP-05	JCT-024	Single Detached	50	171	280	14,988	0.17	0.35	0.52	0.09
	JCT-025					14,988	0.17	0.35	0.52	0.09
	JCT-026	Traditional Townhouse	16	43	280	14,988	0.17	0.35	0.52	0.09
	JCT-027					14,988	0.17	0.35	0.52	0.09
DP-06	JCT-028	Single Detached	8	27	280	11,227	0.13	0.26	0.39	0.06
	JCT-029					11,227	0.13	0.26	0.39	0.06
	JCT-030					11,227	0.13	0.26	0.39	0.06
	JCT-032	Traditional Townhouse	47	128	280	11,227	0.13	0.26	0.39	0.06
	JCT-033					11,227	0.13	0.26	0.39	0.06
	JCT-034					11,227	0.13	0.26	0.39	0.06
	JCT-035					11,227	0.13	0.26	0.39	0.06
	JCT-036	Back-to-Back Townhouse	76	206	280	11,227	0.13	0.26	0.39	0.06
	JCT-037					11,227	0.13	0.26	0.39	0.06
DP-07	JCT-041	Traditional Townhouse	56	152	280	10,625	0.12	0.25	0.37	0.06
	JCT-042					10,625	0.12	0.25	0.37	0.06
	JCT-043					10,625	0.12	0.25	0.37	0.06
	JCT-044					10,625	0.12	0.25	0.37	0.06
DP-08	JCT-045	Traditional Townhouse	58	157	280	9,613	0.11	0.22	0.33	0.06
	JCT-046					9,613	0.11	0.22	0.33	0.06
	JCT-047					9,613	0.11	0.22	0.33	0.06
	JCT-048	Back-to-Back Townhouse	18	49	280	9,613	0.11	0.22	0.33	0.06
	JCT-049					9,613	0.11	0.22	0.33	0.06
	JCT-050					9,613	0.11	0.22	0.33	0.06
DP-09	JCT-039	Traditional Townhouse	20	54	280	5,047	0.06	0.12	0.18	0.03
	JCT-040					5,047	0.06	0.12	0.18	0.03
	JCT-041					5,047	0.06	0.12	0.18	0.03
DP-10	JCT-057	Single Detached	34	116	280	10,827	0.13	0.25	0.38	0.06
	JCT-058					10,827	0.13	0.25	0.38	0.06
	JCT-059					10,827	0.13	0.25	0.38	0.06
DP-11	JCT-060	Traditional Townhouse	34	92	280	11,405	0.13	0.26	0.40	0.07
	JCT-061					11,405	0.13	0.26	0.40	0.07
	JCT-062	Back-to-Back Townhouse	26	71	280	11,405	0.13	0.26	0.40	0.07
	JCT-063					11,405	0.13	0.26	0.40	0.07
DP-12	JCT-051	Single Detached	76	259	280	10,360	0.12	0.24	0.36	0.06
	JCT-052					10,360	0.12	0.24	0.36	0.06
	JCT-053					10,360	0.12	0.24	0.36	0.06
	JCT-054					10,360	0.12	0.24	0.36	0.06
	JCT-055					10,360	0.12	0.24	0.36	0.06
	JCT-056					10,360	0.12	0.24	0.36	0.06
	JCT-067					10,360	0.12	0.24	0.36	0.06
Area A	JCT-073	Residential		73	280	20,412	0.24	0.47	0.71	0.12
Area B	JCT-053	Residential		27	280	7,616	0.09	0.18	0.26	0.04
Existing West Development	JCT-001	Single Detached	22	75	280	61,320	0.71	1.42	2.13	0.35
		Back-to-Back Townhome	15	41	280					
		Traditional Townhome	38	103	280					
Future South Development	JCT-013	Single Detached	368	1252		237,920	2.75	4.24	9.16	1.38
	JCT-026	Back-to-Back Townhome	245	662		237,920	2.75	4.24	9.16	1.38
	JCT-031	Traditional Townhome	655	1769		237,920	2.75	4.24	9.16	1.38
Total:						**1,431,708**	**16.57**	**29.35**	**52.39**	**8.29**

Cardinal Creek Vilage South Non-Domestic Demands

Property Type	Junction ID	Phase	Area (ha)	Average Day Demand			Max Day (L/s)	Peak Hour (L/s)	Min Hour (L/s)
				(L/ha/d)	(L/d)	(L/s)			
School (Block 59)	JCT-015	Phase 1	2.44	28,000	68,320	0.79	1.19	2.14	0.40
Park (Block 58)	JCT-019	Phase 2	2.49	28,000	69,720	0.81	1.21	2.18	0.40
School (Block 34)	JCT-066	Phase 5	3.18	28,000	88,984	1.03	1.54	2.78	0.51
Commercial	JCT-073	Area A	1.49	28,000	41,720	0.48	0.72	1.30	0.24
School	JCT-013	Future South Development	2.00	8,500	5,667	0.07	0.07	0.09	0.03
	JCT-026	Future South Development		8,500	5,667	0.07	0.07	0.09	0.03
	JCT-031	Future South Development		8,500	5,667	0.07	0.07	0.09	0.03
Park	JCT-013	Future South Development	2.50	8,500	7,083	0.08	0.08	0.11	0.04
	JCT-026	Future South Development		8,500	7,083	0.08	0.08	0.11	0.04
	JCT-031	Future South Development		8,500	7,083	0.08	0.08	0.11	0.04
Total:			**14.10**		**306,994**	**3.55**	**5.11**	**8.98**	**1.78**



GeoAdvice Engineering Inc.

Project: **Hydraulic Capacity and Modeling Analysis**
Cardinal Creek Village South
Client: **David Schaeffer Engineering Ltd.**
Date: **May 2022**
Created by: **BL**
Reviewed by: **WdS**

Demand Allocation

Figure A.1

Appendix B FUS Calculations and Required Fire Flow Allocation

FUS Required Fire Flow Calculation

Client: David Schaeffer Engineering Ltd.
Project: 2021-077-DSE
Development: Cardinal Creek Village South
Zoning: Multi Family Residential
Date: May 31, 2022

Calculations Based on "Water Supply for Public Fire Protection", Fire Underwriters Survey, 1999.

10-unit back-to-back townhouse
Note: For other back-to-back townhouse blocks, a similar fire flow as calculated below will be used.

A. Type of Construction: Wood Frame Construction

B. Ground Floor Area: 292 m^2

C. Number of Storeys: 3

Note: The back-to-back townhouse dwellings are separated by less than 3 m; therefore, they must be considered as one fire area. The combined area of 6 units is considered in this calculation.

D. Required Fire Flow*: $F = 220C\sqrt{A}$

C: Coefficient related to the type of construction — **C =** 1.5

A: Effective area — **A =** 876 m^2 (Combined area of 10 units)

The total floor area in m^2 in the building being considered

F = 9,769 L/min **D =** 10,000 L/min*

E. Occupancy

Occupancy content hazard: Limited Combustible — -15 % of **D** **-1,500** L/min **E =** 8,500 L/min

F. Sprinkler Protection

Automatic sprinkler protection: None — 0 % of **E** **0** L/min **F =** 8,500 L/min

G. Exposures

Side	Separation Distance	Length-Height Factor - Adjacent Structure	Construction Type - Adjacent Structure	Exposure
North	Fire Wall	31-60 m-storeys	Wood Frame or Non-Combustible	10%
East	20.1 to 30 m	31-60 m-storeys	Wood Frame or Non-Combustible	8%
South	3.1 to 10 m	31-60 m-storeys	Wood Frame or Non-Combustible	18%
West	20.1 to 30 m	31-60 m-storeys	Wood Frame or Non-Combustible	8%
			Total	**44%**

% of **E** **+ 3,740** L/min **G =** 12,240 L/min

H. Wood Shake Charge — No — **0** L/min **H =** 12,240 L/min

For wood shingle or shake roofs

Total Fire Flow Required	**12,000**	**L/min****
	200	**L/s**
Required Duration of Fire Flow	**2.5**	**Hrs**
Required Volume of Fire Flow	**1,800**	**m^3**

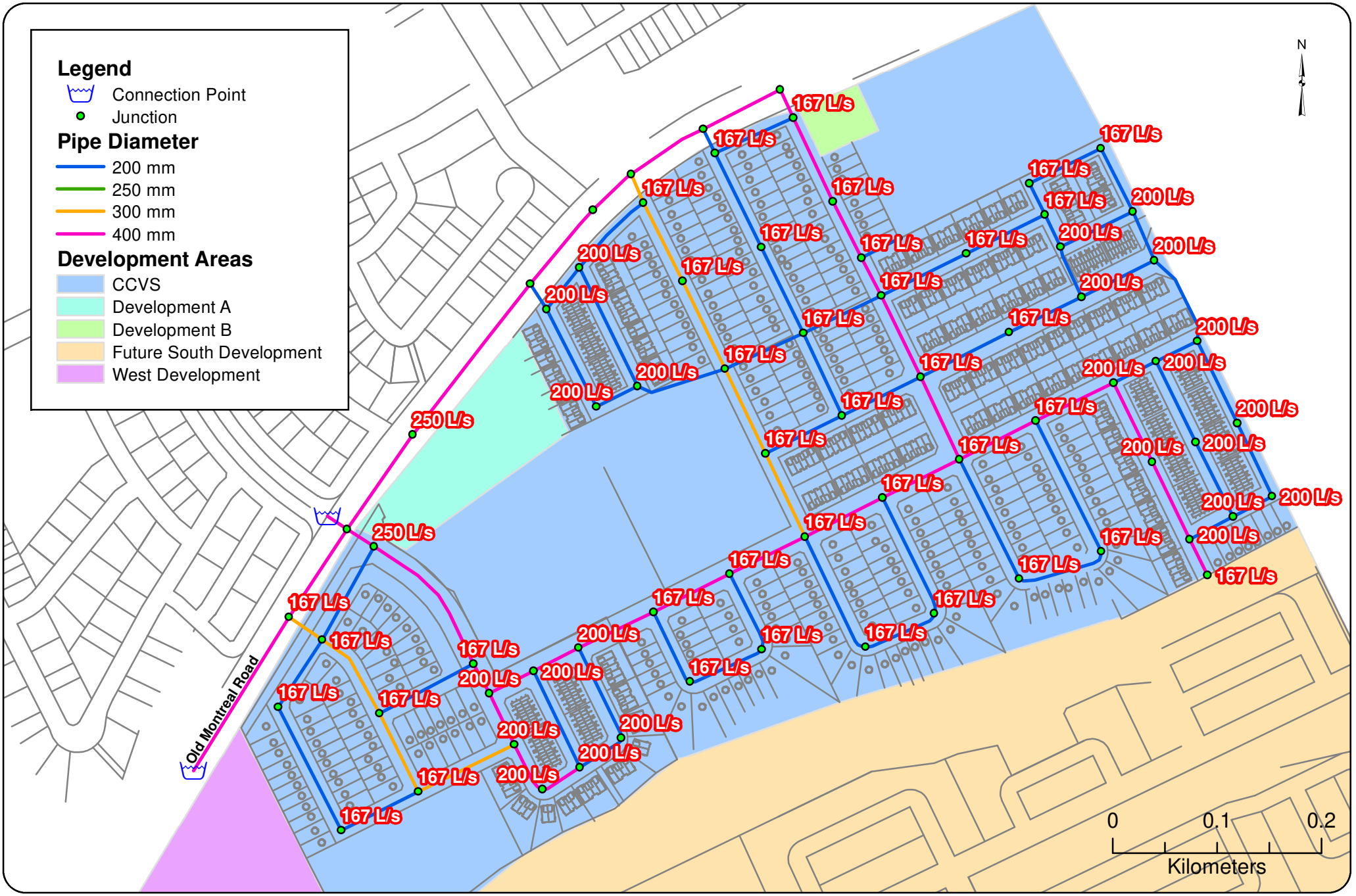
*Rounded to the nearest 1,000 L/min

The Total Required Fire Flow for the Cardinal Creek Village South development should be reviewed when drawings and site plans have been finalized. The Total Required Fire Flow may be reduced or increased depending on area, construction, occupancy, exposures, and level of sprinkler protection. If any of these items change, the Total Required Fire Flow should be reviewed to determine the impact.

Consideration should be given for fire prevention during construction phases as the required fire flows during construction of buildings is substantially higher than after the buildings are occupied. This is due to exposed framing and inactive sprinkler systems. Fires starting in unprotected portion of buildings quickly become too strong for sprinkler systems in protected portion of buildings. As such, special precautions should be taken any time construction is occurring.

* The amount and rate of water application required in firefighting to confine and control the fires possible in a building or group of buildings which comprise essentially the same fire area by virtue of immediate exposure.

** Rounded to the nearest 1,000 L/min



GeoAdvice Engineering Inc.

Project: **Hydraulic Capacity and Modeling Analysis**
Cardinal Creek Village South
Client: **David Schaeffer Engineering Ltd.**
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Reviewed by: **WdS**

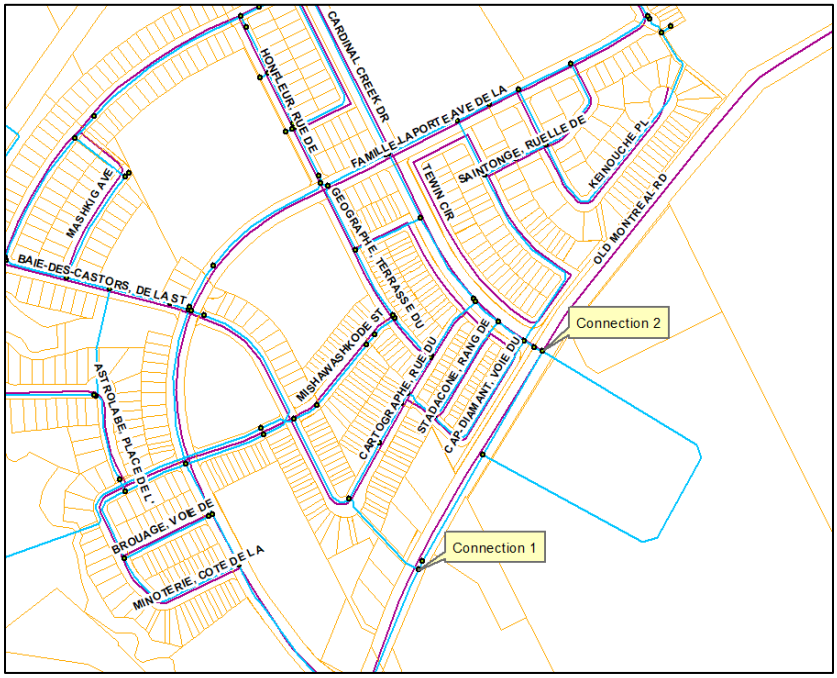
Required Fire Flow

Figure B.1

Appendix C Boundary Conditions

Boundary Conditions
Cardinal Creek Village South

Location



Provided Information – Scenario 1

Scenario 1 – Connection 1, 2	Demand	
	L/min	L/s
Average Daily Demand	1,207	20.12
Maximum Daily Demand	2,068	34.46
Peak Hour	3,682	61.37
Fire Flow Demand #1	6,000	100.00
Fire Flow Demand #2	10,000	166.67
Fire Flow Demand #3	12,000	200.00
Fire Flow Demand #4	15,000	250.00
Fire Flow Demand #5	17,000	283.33
Scenario 1 – Connection 3, 4, 5	**Demand**	
	L/min	**L/s**
Average Daily Demand	394	6.56
Maximum Daily Demand	788	13.13
Peak Hour	1,181	19.69

Results – Scenario 1

Connection 1 – Old Montreal Rd.

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	130.0	80.4
Peak Hour	124.5	72.5

Max Day plus Fire 1	125.8	74.4
Max Day plus Fire 2	123.9	71.7
Max Day plus Fire 3	122.7	70.0
Max Day plus Fire 4	120.8	67.2
Max Day plus Fire 5	119.4	65.2

Ground Elevation = 73. m

Connection 2 – Old Montreal Rd. / Cardinal Creek Dr.

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	130.0	74.5
Peak Hour	124.4	66.5
Max Day plus Fire 1	125.7	68.4
Max Day plus Fire 2	123.7	65.5
Max Day plus Fire 3	122.5	63.8
Max Day plus Fire 4	120.4	60.9
Max Day plus Fire 5	118.9	58.7

Ground Elevation = 77.6 m

Provided Information – Scenario 2

Scenario 2 – Connection 1, 2	Demand	
	L/min	L/s
Average Daily Demand	973	16.22
Maximum Daily Demand	1,499	24.98
Peak Hour	3,231	53.85
Fire Flow Demand #1	10,000	166.67
Fire Flow Demand #2	12,000	200.00
Fire Flow Demand #3	15,000	250.00
Fire Flow Demand #4	17,000	283.33
Scenario 2 – Connection 3, 4, 5	**Demand**	
	L/min	**L/s**
Average Daily Demand	260	4.34
Maximum Daily Demand	500	8.33
Peak Hour	1,179	19.65

Results – Scenario 2

Connection 1 – Old Montreal Rd.

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	129.9	80.2
Peak Hour	125.1	73.4
Max Day plus Fire 1	124.7	72.8
Max Day plus Fire 2	123.4	71.0
Max Day plus Fire 3	121.9	68.8
Max Day plus Fire 4	120.5	66.8

Ground Elevation = 73. m

Connection 2 – Old Montreal Rd. / Cardinal Creek Dr.

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	129.9	74.4
Peak Hour	125.1	67.5
Max Day plus Fire 1	124.5	66.7
Max Day plus Fire 2	123.2	64.8
Max Day plus Fire 3	121.5	62.4
Max Day plus Fire 4	120.0	60.3

Ground Elevation = 77.6 m

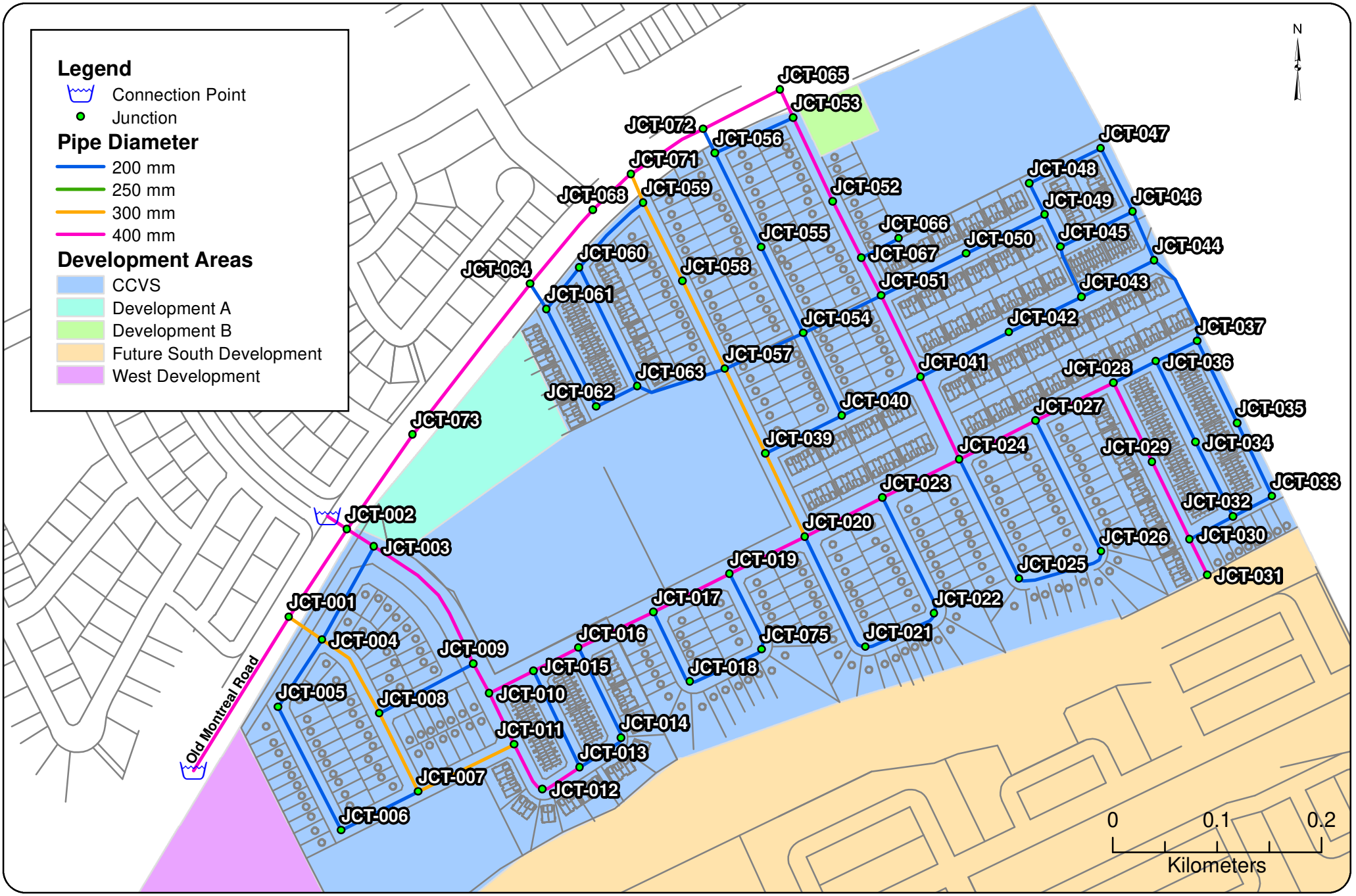
Notes

1. The 400mm watermain on Old Montreal Road was extended between Connection 1 and 2 for modelling purposes.
2. As per the Ontario Building Code in areas that may be occupied, the static pressure at any fixture shall not exceed 552 kPa (80 psi.) Pressure control measures to be considered are as follows, in order of preference:
    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



GeoAdvice Engineering Inc.

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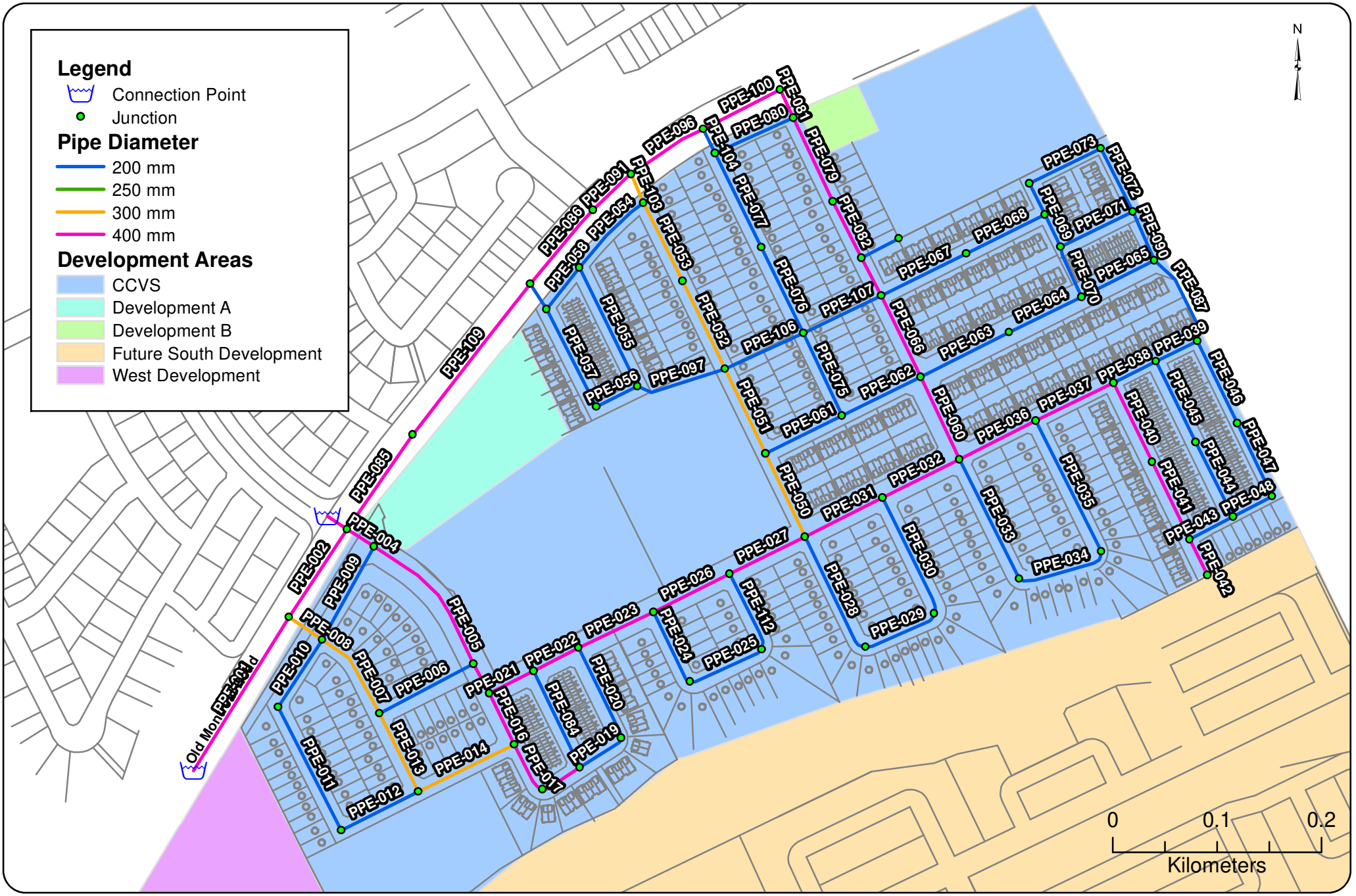
Cardinal Creek Village South
Client: **David Schaeffer Engineering Ltd.**
Date: **May 2022**
Created by: **BL**
Reviewed by: **WdS**

Junction IDs

Figure D.1



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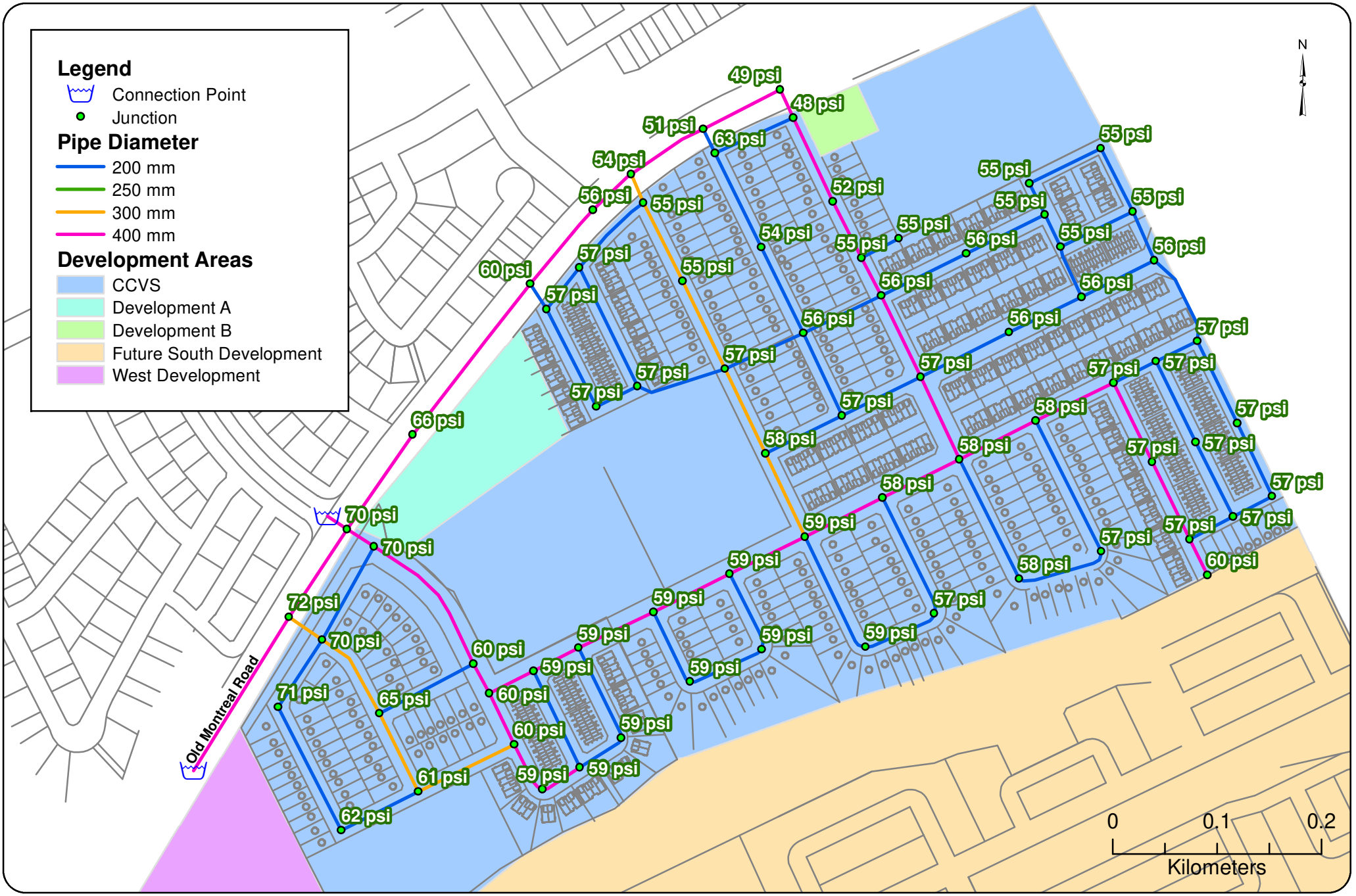
Pipe IDs

Figure D.2

Appendix E ADD and PHD Model Results



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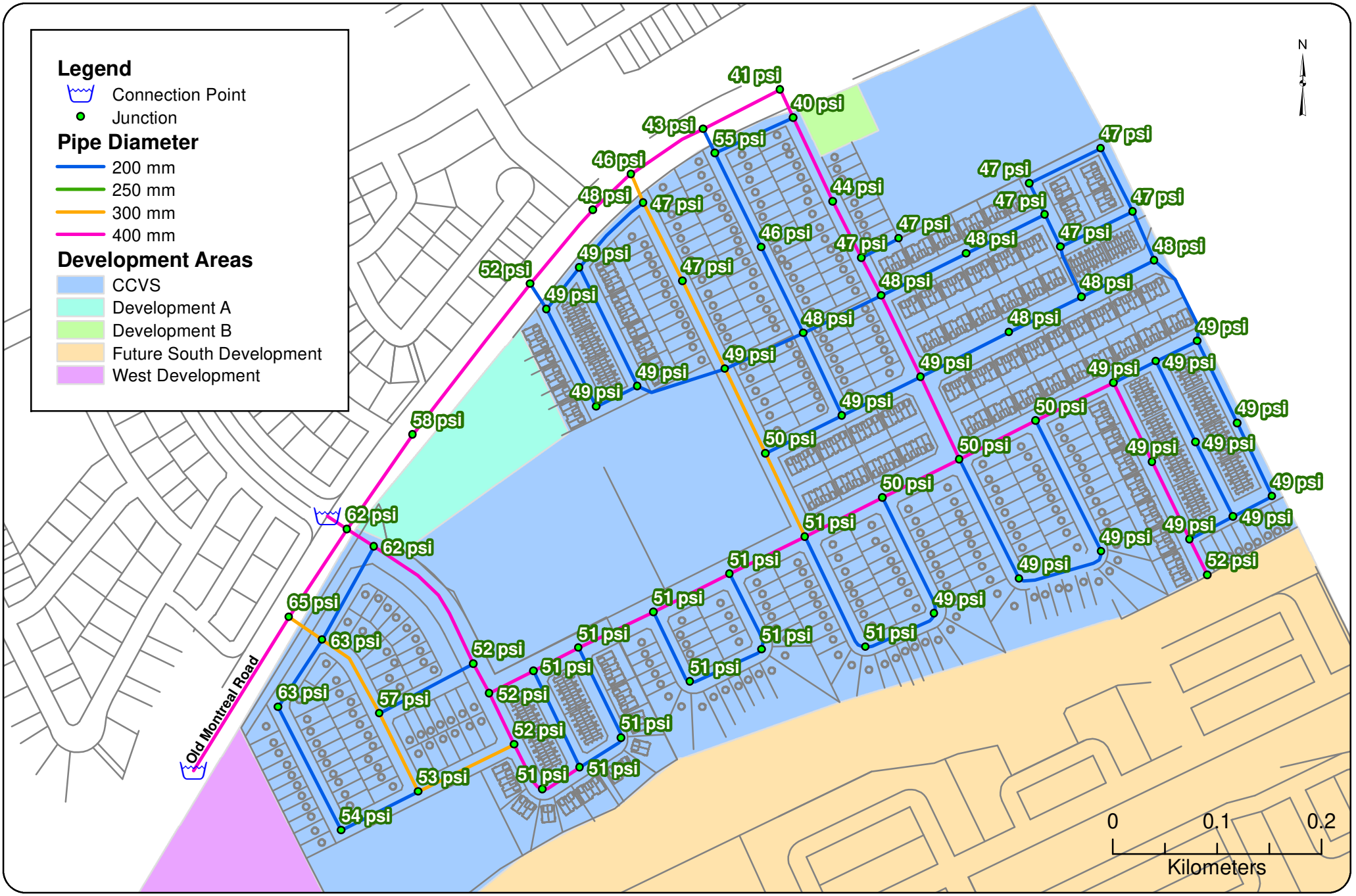
ADD Pressure Results

Figure E.1



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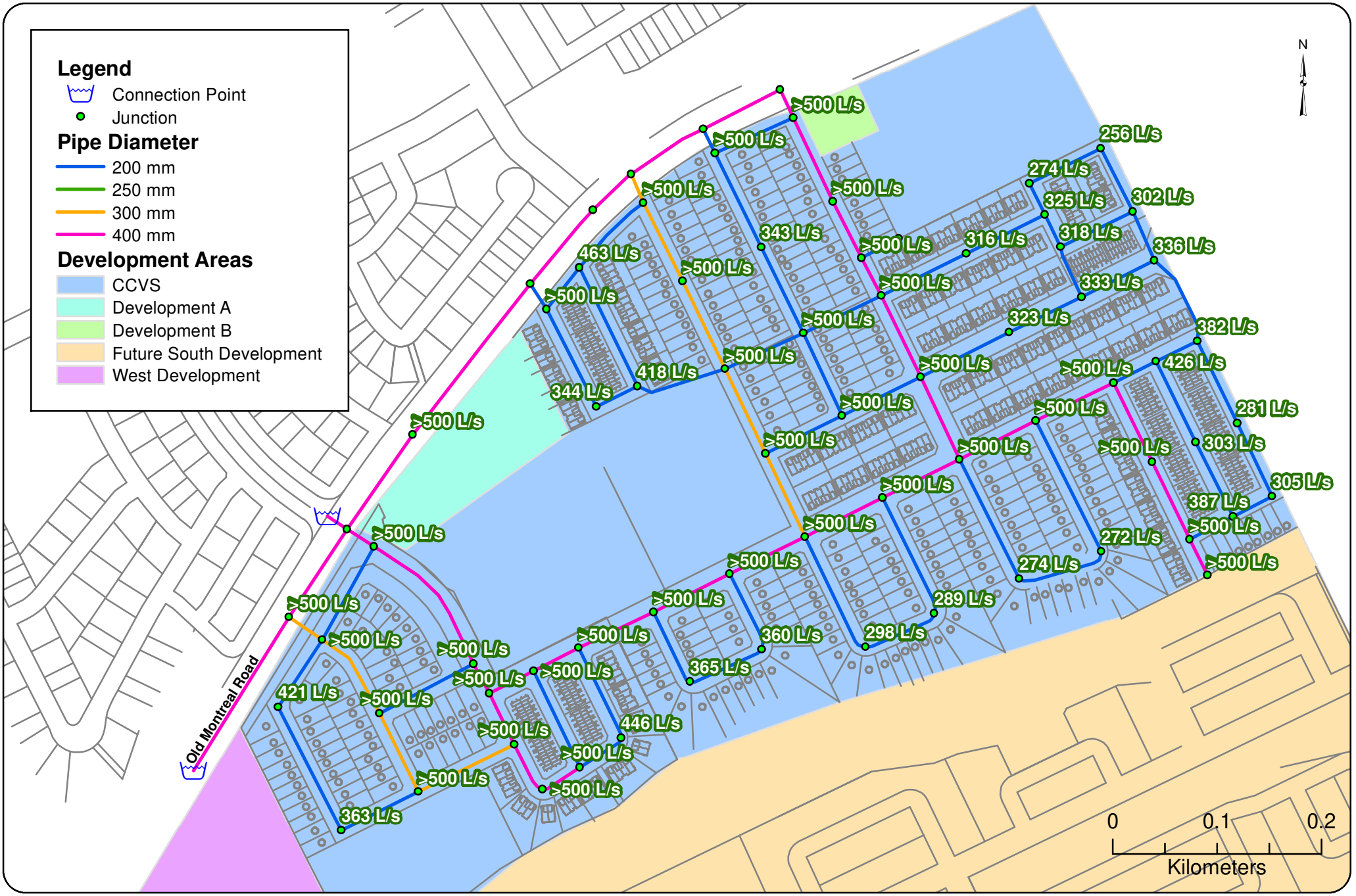
PHD Pressure Results

Figure E.2

Appendix F MDD+FF Model Results



GeoAdvice Engineering Inc.

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Cardinal Creek Village South
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Date: **May 2022**
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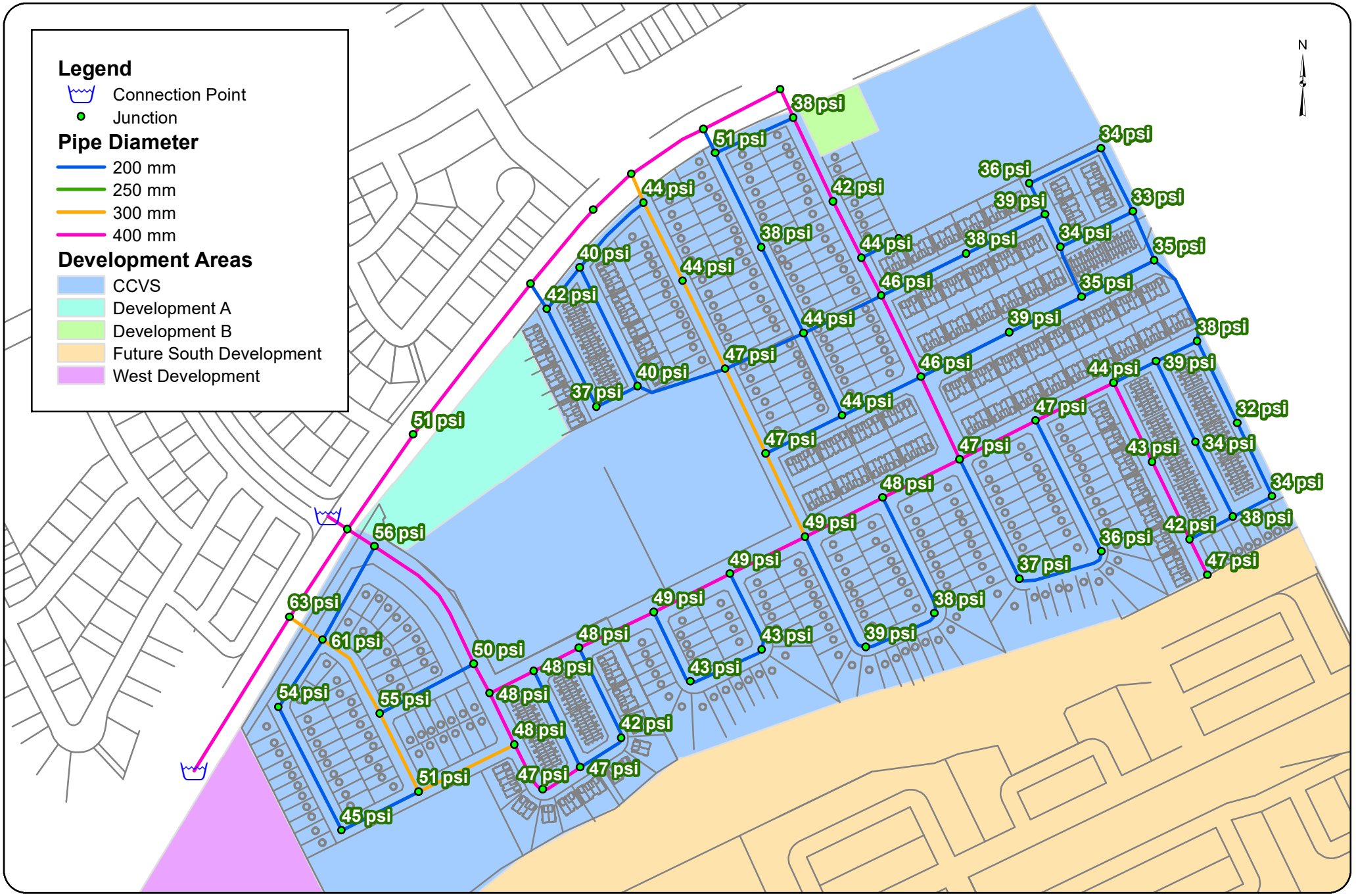
Available Fire Flow

Figure F.1



GeoAdvice Engineering Inc.

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Cardinal Creek Village South
Client: **David Schaeffer Engineering Ltd.**
Date: **May 2022**
Created by: **BL**
Reviewed by: **WdS**

Residual Pressure @ Available Fire Flow

Figure F.2

Appendix D

- Sanitary Design Sheet (DSEL, Dec 2021)
- CCV PH 4 Sanitary Design Sheet (DSEL, Nov 2017)
- CCV PH 4 Sanitary Drainage Plan (DSEL, Nov 2017)
- Trunk Sanitary Sewer Analysis Figure & Design Sheet (DSEL, Feb 2022)

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)
STREET 6																											
	63A	64A	0.57		39	0.57	39	3.7	0.46		0.00		0.00		0.00	0.00	0.57	0.57	0.19	0.65	74.0	200	0.65	26.44	0.02	0.84	0.35
To STREET 12, Pipe 64A - 68A						0.57	39				0.00		0.00		0.00			0.57									
	63A	65A	0.32		22	0.32	22	3.7	0.26		0.00		0.00		0.00	0.00	0.32	0.32	0.11	0.37	11.0	200	0.65	26.44	0.01	0.84	0.29
	65A	66A	0.34		23	0.66	45	3.7	0.53		0.00		0.00		0.00	0.00	0.34	0.66	0.22	0.75	66.5	200	0.35	19.40	0.04	0.62	0.29
	66A	67A	0.25		17	0.91	62	3.6	0.73		0.00		0.00		0.00	0.00	0.25	0.91	0.30	1.03	11.5	200	0.35	19.40	0.05	0.62	0.33
	67A	68A	0.58		39	1.49	101	3.6	1.18		0.00		0.00		0.00	0.00	0.58	1.49	0.49	1.67	74.0	200	0.35	19.40	0.09	0.62	0.37
To STREET 12, Pipe 68A - 70A						1.49	101				0.00		0.00		0.00			1.49									
STREET 14																											
	40A	41A	0.92		62	0.92	62	3.6	0.73		0.00		0.00		0.00	0.00	0.92	0.92	0.30	1.03	92.0	200	4.00	65.60	0.02	2.09	0.76
	41A	42A	0.76		51	1.68	113	3.6	1.31		0.00		0.00		0.00	0.00	0.76	1.68	0.55	1.87	91.5	200	2.40	50.81	0.04	1.62	0.77
	42A	44A	0.67		45	2.35	158	3.5	1.82		0.00		0.00		0.00	0.00	0.67	2.35	0.78	2.59	91.5	200	0.35	19.40	0.13	0.62	0.43
To STREET 15, Pipe 44A - 58A						2.35	158				0.00		0.00		0.00			2.35									
STREET 17																											
	45A	47A	0.77		52	0.77	52	3.6	0.61		0.00		0.00		0.00	0.00	0.77	0.77	0.25	0.87	101.0	200	0.65	26.44	0.03	0.84	0.38
	47A	48A	0.04		3	0.81	55	3.6	0.65		0.00		0.00		0.00	0.00	0.04	0.81	0.27	0.92	34.5	200	0.35	19.40	0.05	0.62	0.31
To SERVICING BLOCK 2, Pipe 48A - 55A						0.81	55				0.00		0.00		0.00			0.81									
	49A	50A	0.08		5	0.08	5	3.8	0.06		0.00		0.00		0.00	0.00	0.08	0.08	0.03	0.09	35.5	200	3.00	56.81	0.00	1.81	0.29
	50A	51A	0.14		10	0.22	15	3.7	0.18		0.00		0.00		0.00	0.00	0.14	0.22	0.07	0.25	51.5	200	0.80	29.34	0.01	0.93	0.28
	51A	52A	0.36		24	0.58	39	3.7	0.46		0.00		0.00		0.00	0.00	0.36	0.58	0.19	0.66	61.0	200	0.35	19.40	0.03	0.62	0.29
	52A	53A	0.48		33	1.06	72	3.6	0.85		0.00		0.00		0.00	0.00	0.48	1.06	0.35	1.20	59.5	200	0.35	19.40	0.06	0.62	0.34
To SERVICING BLOCK 2, Pipe 53A - 55A						1.06	72				0.00		0.00		0.00			1.06									
SERVICING BLOCK 2																											
Contribution From STREET 17, Pipe 52A - 53A						1.06	72				0.00		0.00		0.00		1.06	1.06									
	53A	55A				1.06	72	3.6	0.85		0.00		0.00		0.00	0.00	0.00	1.06	0.35	1.20	16.0	200	0.35	19.40	0.06	0.62	0.34
Contribution From STREET 17, Pipe 47A - 48A						0.81	55				0.00		0.00		0.00		0.81	0.81									
	48A	55A				0.81	55	3.6	0.65		0.00		0.00		0.00	0.00	0.00	0.81	0.27	0.92	12.5	200	0.35	19.40	0.05	0.62	0.31
	55A	57A				1.87	127	3.6	1.47		0.00		0.00		0.00	0.00	0.00	1.87	0.62	2.09	81.0	200	0.35	19.40	0.11	0.62	0.40
To STREET 17, Pipe 57A - 58A						1.87	127				0.00		0.00		0.00			1.87									
STREET 17																											
	49A	56A	0.75		51	0.75	51	3.7	0.60		0.00		0.00		0.00	0.00	0.75	0.75	0.25	0.85	82.5	200	0.65	26.44	0.03	0.84	0.38
	56A	57A	0.63		43	1.38	94	3.6	1.10		0.00		0.00		0.00	0.00	0.63	1.38	0.46	1.55	82.5	200	2.70	53.89	0.03	1.72	0.75
Contribution From SERVICING BLOCK 2, Pipe 55A - 57A						1.87	127				0.00		0.00		0.00		1.87	3.25									
	57A	58A	0.51		35	3.76	256	3.5	2.89		0.00		0.00	2.48	2.48	0.80	2.99	6.24	2.06	5.75	103.0	200	0.35	19.40	0.30	0.62	0.54
Contribution From STREET 15, Pipe 44A - 58A						3.12	210				0.00		0.00		0.00		3.12	9.36									
	58A	62A	0.14		10	7.02	476	3.4	5.23		0.00		0.00		2.48	0.80	0.14	9.50	3.14	9.17	86.0	200	3.25	59.13	0.16	1.88	1.36
To STREET 12, Pipe 62A - 64A						7.02	476				0.00		0.00		2.48			9.50									
STREET 7																											
	38A	39A	0.91		61	0.91	61	3.6	0.72		0.00		0.00		0.00	0.00	0.91	0.91	0.30	1.02	118.0	200	0.70	27.44	0.04	0.87	0.41
To STREET 12, Pipe 39A - 62A						0.91	61				0.00		0.00		0.00			0.91									

DESIGN PARAMETERS

Park Flow =	28000	L/ha/da	0.32407	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: **Cardinal Creek Village South FSR**		
Checked: SLM	LOCATION: **City of Ottawa**		
Dwg. Reference: Sanitary Drainage Plan, Dwgs. No. 3	File Ref: 19-1153	Date: **30 Nov 2021**	Sheet No. 1 of 5

LICENSED PROFESSIONAL ENGINEER
S.L. MERRICK
100186523
2021-12-16
PROVINCE OF ONTARIO

1153_SAN.xlsx

JOB # 19-1153

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	UNITS	POP.	CUMULATIVE AREA	CUMULATIVE POP.	PEAK FACT.	PEAK FLOW	AREA	ACCU. AREA	AREA	ACCU. AREA	AREA	ACCU. AREA	PEAK FLOW	TOTAL AREA	ACCU. AREA	INFILT. FLOW	TOTAL FLOW	DIST	DIA	SLOPE	CAP. (FULL)	RATIO Q act/Q cap	VEL. (FULL)	VEL. (ACT.)
				(ha)			(ha)			(l/s)		(ha)		(ha)		(ha)	(l/s)	(ha)	(ha)	(l/s)	(l/s)	(m)	(mm)	(%)	(l/s)		(m/s)	(m/s)
		38A	59A	0.27		18	0.27	18	3.7	0.22		0.00		0.00		0.00	0.00	0.27	0.27	0.09	0.31	12.5	200	5.90	79.67	0.00	2.54	0.61
		59A	60A	0.40		27	0.67	45	3.7	0.53		0.00		0.00		0.00	0.00	0.40	0.67	0.22	0.75	66.5	200	0.55	24.32	0.03	0.77	0.35
		60A	61A	0.18		12	0.85	57	3.6	0.67		0.00		0.00		0.00	0.00	0.18	0.85	0.28	0.95	11.0	200	0.35	19.40	0.05	0.62	0.32
		61A	62A	0.90		61	1.75	118	3.6	1.37		0.00		0.00		0.00	0.00	0.90	1.75	0.58	1.95	115.5	200	0.35	19.40	0.10	0.62	0.39
To STREET 12, Pipe 62A - 64A							1.75	118				0.00		0.00		0.00			1.75									
STREET 15																												
		30A	31A	0.97		65	0.97	65	3.6	0.77		0.00		0.00		0.00	0.00	0.97	0.97	0.32	1.09	115.5	200	0.65	26.44	0.04	0.84	0.41
		31A	32A	1.03		70	2.00	135	3.6	1.56		0.00		0.00		0.00	0.00	1.03	2.00	0.66	2.22	115.5	200	0.35	19.40	0.11	0.62	0.41
To STREET 13, Pipe 32A - 37A							2.00	135				0.00		0.00		0.00			2.00									
		43A	44A	0.41		28	0.41	28	3.7	0.33		0.00		0.00		0.00	0.00	0.41	0.41	0.14	0.47	66.0	200	1.00	32.80	0.01	1.04	0.36
Contribution From STREET 14, Pipe 42A - 44A							2.35	158				0.00		0.00		0.00		2.35	2.76									
		44A	58A	0.36		24	3.12	210	3.5	2.39		0.00		0.00		0.00	0.00	0.36	3.12	1.03	3.42	82.0	200	0.35	19.40	0.18	0.62	0.46
To STREET 17, Pipe 58A - 62A							3.12	210				0.00		0.00		0.00			3.12									
STREET 19																												
		22A	23A	0.09		7	0.09	7	3.7	0.08		0.00	3.23	3.23		0.00	1.05	3.32	3.32	1.10	2.23	53.5	200	0.65	26.44	0.08	0.84	0.51
		23A	24A				0.09	7	3.7	0.08		0.00		3.23		0.00	1.05	0.00	3.32	1.10	2.23	11.0	200	0.35	19.40	0.11	0.62	0.41
		24A	25A	0.14		10	0.23	17	3.7	0.20		0.00		3.23		0.00	1.05	0.14	3.46	1.14	2.39	27.5	200	0.35	19.40	0.12	0.62	0.42
To STREET 18, Pipe 25A - 26A							0.23	17				0.00		3.23		0.00			3.46									
STREET 19																												
		17A	18A	0.26		18	0.26	18	3.7	0.22		0.00		0.00		0.00	0.00	0.26	0.26	0.09	0.30	47.5	200	0.65	26.44	0.01	0.84	0.28
		18A	19A	0.07		5	0.33	23	3.7	0.28		0.00		0.00		0.00	0.00	0.07	0.33	0.11	0.38	11.0	200	0.35	19.40	0.02	0.62	0.24
		19A	20A	0.35		24	0.68	47	3.7	0.56		0.00		0.00		0.00	0.00	0.35	0.68	0.22	0.78	60.5	200	0.35	19.40	0.04	0.62	0.30
		20A	21A				0.68	47	3.7	0.56		0.00		0.00		0.00	0.00	0.00	0.68	0.22	0.78	11.0	200	0.35	19.40	0.04	0.62	0.30
		21A	25A	0.14		10	0.82	57	3.6	0.67		0.00		0.00		0.00	0.00	0.14	0.82	0.27	0.94	27.5	200	0.35	19.40	0.05	0.62	0.32
To STREET 18, Pipe 25A - 26A							0.82	57				0.00		0.00		0.00			0.82									
STREET 18																												
Contribution From STREET 19, Pipe 21A - 25A							0.82	57				0.00		0.00		0.00		0.82	0.82									
Contribution From STREET 19, Pipe 24A - 25A							0.23	17				0.00		3.23		0.00		3.46	4.28									
		25A	26A	0.67		45	1.72	119	3.6	1.38		0.00		3.23		0.00	1.05	0.67	4.95	1.63	4.06	90.0	200	0.35	19.40	0.21	0.62	0.49
		26A	29A	0.67		45	2.39	164	3.5	1.88		0.00		3.23		0.00	1.05	0.67	5.62	1.85	4.78	90.0	200	0.35	19.40	0.25	0.62	0.51
To STREET 13, Pipe 29A - 32A							2.39	164				0.00		3.23		0.00			5.62									
STREET 13																												
				0.43		29	0.43	29				0.00		0.00		0.00		0.43	0.43									
		27A	28A	0.76		51	1.19	80	3.6	0.94		0.00		0.00		0.00	0.00	0.76	1.19	0.39	1.33	92.5	200	4.35	68.41	0.02	2.18	0.85
		28A	29A	0.63		43	1.82	123	3.6	1.42		0.00		0.00		0.00	0.00	0.63	1.82	0.60	2.03	92.5	200	2.45	51.34	0.04	1.63	0.79
Contribution From STREET 18, Pipe 26A - 29A							2.39	164				0.00		3.23		0.00		5.62	7.44									
		29A	32A	0.36		24	4.57	311	3.5	3.48		0.00		3.23		0.00	1.05	0.36	7.80	2.57	7.11	86.0	200	0.35	19.40	0.37	0.62	0.57
Contribution From STREET 15, Pipe 31A - 32A							2.00	135				0.00		0.00		0.00		2.00	9.80									
		32A	37A	0.19		13	6.76	459	3.4	5.05		0.00		3.23		0.00	1.05	0.19	9.99	3.30	9.39	86.0	200	0.85	30.24	0.31	0.96	0.85
To STREET 12, Pipe 37A - 39A							6.76	459				0.00		3.23		0.00			9.99									

DESIGN PARAMETERS

Park Flow =	28000	L/ha/da	0.32407	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. 3

PROJECT: **Cardinal Creek Village South FSR**

LOCATION: **City of Ottawa**

File Ref: 19-1153

Date: **30 Nov 2021**

Sheet No 2 of 5

LICENSED PROFESSIONAL ENGINEER S. L. MERRICK 100186523 2021-12-16 PROVINCE OF ONTARIO

1153_SAN.xlsx

Job # 19-1153

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)
STREET 8																											
	14A	15A	0.63		43	0.63	43	3.7	0.51		0.00		0.00		0.00	0.00	0.63	0.63	0.21	0.72	71.0	200	0.65	26.44	0.03	0.84	0.36
	15A	16A	0.49		33	1.12	76	3.6	0.89		0.00		0.00		0.00	0.00	0.49	1.12	0.37	1.26	67.5	200	0.35	19.40	0.06	0.62	0.34
To STREET 12, Pipe 16A - 37A						1.12	76				0.00		0.00		0.00			1.12									
	14A	33A	0.24		16	0.24	16	3.7	0.19		0.00		0.00		0.00	0.00	0.24	0.24	0.08	0.27	12.5	200	2.30	49.74	0.01	1.58	0.41
	33A	35A	0.56		38	0.80	54	3.6	0.64		0.00		0.00		0.00	0.00	0.56	0.80	0.26	0.90	73.5	200	0.35	19.40	0.05	0.62	0.31
	35A	36A	0.60		41	1.40	95	3.6	1.11		0.00		0.00		0.00	0.00	0.60	1.40	0.46	1.57	70.0	200	0.35	19.40	0.08	0.62	0.37
	36A	37A	0.43		29	1.83	124	3.6	1.44		0.00		0.00		0.00	0.00	0.43	1.83	0.60	2.04	63.5	200	0.35	19.40	0.11	0.62	0.40
To STREET 12, Pipe 37A - 39A						1.83	124				0.00		0.00		0.00			1.83									
STREET 10																											
	5A	6A	0.35		24	0.35	24	3.7	0.29		0.00		0.00		0.00	0.00	0.35	0.35	0.12	0.40	77.0	200	0.65	26.44	0.02	0.84	0.30
	6A	7A	0.33		22	0.68	46	3.7	0.55		0.00		0.00		0.00	0.00	0.33	0.68	0.22	0.77	77.0	200	0.35	19.40	0.04	0.62	0.30
To STREET 9, Pipe 7A - 9A						0.68	46				0.00		0.00		0.00			0.68									
STREET 9																											
	1A	2A	0.21		14	0.21	14	3.7	0.17		0.00		0.00		0.00	0.00	0.21	0.21	0.07	0.24	73.0	200	0.65	26.44	0.01	0.84	0.26
	2A	3A	0.22		15	0.43	29	3.7	0.35		0.00		0.00		0.00	0.00	0.22	0.43	0.14	0.49	80.5	200	0.35	19.40	0.03	0.62	0.26
	3A	7A	0.27		18	0.70	47	3.7	0.56		0.00		0.00		0.00	0.00	0.27	0.70	0.23	0.79	46.0	250	0.25	29.73	0.03	0.61	0.26
Contribution From STREET 10, Pipe 6A - 7A						0.68	46				0.00		0.00		0.00		0.68	1.38									
	7A	9A	0.18		12	1.56	105	3.6	1.22		0.00		0.00		0.00	0.00	0.18	1.56	0.51	1.74	46.5	250	0.25	29.73	0.06	0.61	0.33
To STREET 9, Pipe 9A - 10A						1.56	105				0.00		0.00		0.00			1.56									
STREET 9																											
			0.18		12	0.18	12				0.00	2.00	2.00	2.50	2.50		4.68	4.68									
	8A	9A	50.70		3700	50.88	3712	2.9	34.76		0.00		2.00		2.50	1.46	50.70	55.38	18.28	54.50	40.5	375	0.20	78.41	0.70	0.71	0.77
Contribution From STREET 9, Pipe 7A - 9A						1.56	105				0.00		0.00		0.00		1.56	56.94									
	9A	10A	0.53		36	52.97	3853	2.9	35.94		0.00		2.00		2.50	1.46	0.53	57.47	18.97	56.36	83.5	375	0.20	78.41	0.72	0.71	0.77
	10A	13A	0.52		35	53.49	3888	2.9	36.23		0.00		2.00		2.50	1.46	0.52	57.99	19.14	56.83	83.5	375	0.20	78.41	0.72	0.71	0.77
To STREET 12, Pipe 13A - 16A						53.49	3888				0.00		2.00		2.50			57.99									
STREET 12																											
	11A	12A	0.27		18	0.27	18	3.7	0.22		0.00		0.00		0.00	0.00	0.27	0.27	0.09	0.31	46.0	200	0.70	27.44	0.01	0.87	0.28
	12A	13A	0.16		11	0.43	29	3.7	0.35		0.00		0.00		0.00	0.00	0.16	0.43	0.14	0.49	46.5	200	0.65	26.44	0.02	0.84	0.32
Contribution From STREET 9, Pipe 10A - 13A						53.49	3888				0.00		2.00		2.50		57.99	58.42									
	13A	16A	0.49		33	54.41	3950	2.9	36.75		0.00		2.00		2.50	1.46	0.49	58.91	19.44	57.64	82.0	375	0.20	78.41	0.74	0.71	0.78
Contribution From STREET 8, Pipe 15A - 16A						1.12	76				0.00		0.00		0.00		1.12	60.03									
	16A	37A	0.32		22	55.85	4048	2.9	37.56		0.00		2.00		2.50	1.46	0.32	60.35	19.92	58.93	82.0	375	0.25	87.67	0.67	0.79	0.85
Contribution From STREET 13, Pipe 32A - 37A						6.76	459				0.00		3.23		0.00		9.99	70.34									
Contribution From STREET 8, Pipe 36A - 37A						1.83	124				0.00		0.00		0.00		1.83	72.17									
	37A	39A	0.41		28	64.85	4659	2.8	42.56		0.00		5.23		2.50	2.51	0.41	72.58	23.95	69.01	82.0	375	0.30	96.03	0.72	0.87	0.94
Contribution From STREET 7, Pipe 38A - 39A						0.91	61				0.00		0.00		0.00		0.91	73.49									
	39A	62A	0.42		29	66.18	4749	2.8	43.29		0.00		5.23		2.50	2.51	0.42	73.91	24.39	70.18	82.0	375	0.30	96.03	0.73	0.87	0.95
Contribution From STREET 17, Pipe 58A - 62A						7.02	476				0.00		0.00		2.48		9.50	83.41									
Contribution From STREET 7, Pipe 61A - 62A						1.75	118				0.00		0.00		0.00		1.75	85.16									
	62A	64A	0.19		13	75.14	5356	2.8	48.15		0.00		5.23		4.98	3.31	0.19	85.35	28.17	79.62	82.0	375	0.40	110.89	0.72	1.00	1.09

DESIGN PARAMETERS

Park Flow =	28000	L/ha/da	0.32407	l/s/Ha
Average Daily Flow =	280	l/p/day		
Comm/Inst Flow =	28000	L/ha/da	0.3241	l/s/Ha
Industrial Flow =	35000	L/ha/da	0.40509	l/s/Ha
Max Res. Peak Factor =	4.00			
Commercial/Inst./Park Peak Factor =	1.00			
Institutional =	0.32	l/s/Ha		

Industrial Peak Factor = as per MOE Graph
Extraneous Flow = 0.330 L/s/ha
Minimum Velocity = 0.600 m/s
Manning's n = (Conc) 0.013 (Pvc) 0.013
Townhouse coeff= 2.7
Single house coeff= 3.4

Designed: GGG
Checked: SLM
Dwg. Reference: Sanitary Drainage Plan, Dwgs. No. 3

PROJECT: **Cardinal Creek Village South FSR**
LOCATION: **City of Ottawa**
File Ref: 19-1153
Date: **30 Nov 2021**
Sheet No. 3 of 5

LICENSED PROFESSIONAL ENGINEER
S. MERRICK
100186523
2021-12-16
PROVINCE OF ONTARIO

1153_SAN.xlsx
JOB # 19-1153

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 6, Pipe 63A - 64A						0.57	39				0.00		0.00		0.00		0.57	85.92									
	64A	68A	0.20		14	75.91	5409	2.8	48.57		0.00	2.44	7.67		4.98	4.10	2.64	88.56	29.22	81.89	82.0	375	0.40	110.89	0.74	1.00	1.10
Contribution From STREET 6, Pipe 67A - 68A						1.49	101				0.00		0.00		0.00		1.49	90.05									
	68A	70A	0.20		14	77.60	5524	2.8	49.48		0.00		7.67		4.98	4.10	0.20	90.25	29.78	83.36	82.0	375	0.45	117.62	0.71	1.06	1.15
Contribution From STREET 4, Pipe 69A - 70A						0.21	14				0.00		0.00		0.00		0.21	90.46									
	70A	72A	0.11		7	77.92	5545	2.8	49.64		0.00		7.67		4.98	4.10	0.11	90.57	29.89	83.63	47.0	375	0.45	117.62	0.71	1.06	1.15
Contribution From STREET 5, Pipe 71A - 72A						0.18	12				0.00		0.00		0.00		0.18	90.75									
	72A	73A	0.10		7	78.20	5564	2.8	49.79		0.00		7.67		4.98	4.10	0.10	90.85	29.98	83.87	47.0	375	0.45	117.62	0.71	1.06	1.15
To STREET 1, Pipe 73A - 74A						78.20	5564				0.00		7.67		4.98			90.85									
STREET 1																											
Contribution From STREET 12, Pipe 72A - 73A						78.20	5564				0.00		7.67		4.98		90.85	90.85									
	73A	74A	0.22		15	78.42	5579	2.8	49.91		0.00		7.67		4.98	4.10	0.22	91.07	30.05	84.06	89.0	375	0.45	117.62	0.71	1.06	1.16
	74A	75A	0.10		7	78.52	5586	2.8	49.96		0.00		7.67		4.98	4.10	0.10	91.17	30.09	84.15	40.5	375	0.45	117.62	0.72	1.06	1.16
			0.24		16	78.76	5602			1.51	1.51		7.67		4.98		1.75	92.92									
	75A	2000A	0.53		72	79.29	5674	2.8	50.66		1.51		7.67		4.98	4.59	0.53	93.45	30.84	86.08	69.0	375	3.10	308.70	0.28	2.80	2.39
STREET 3																											
Contribution From STREET 2, Pipe 82A - 83A						2.32	158				0.00		0.00		0.00		2.32	2.32									
	83A	85A	0.42		29	2.74	187	3.5	2.14		0.00		0.00		0.00	0.00	0.42	2.74	0.90	3.04	82.0	200	2.05	46.96	0.06	1.49	0.83
Contribution From STREET 2, Pipe 84A - 85A						0.42	29				0.00		0.00		0.00		0.42	3.16									
	85A	86A	0.42		29	3.58	245	3.5	2.77		0.00		0.00		0.00	0.00	0.42	3.58	1.18	3.95	56.5	200	3.80	63.94	0.06	2.04	1.11
	86A	87A	0.11		7	3.69	252	3.5	2.85		0.00		0.00		0.00	0.00	0.11	3.69	1.22	4.07	11.0	200	2.95	56.33	0.07	1.79	1.04
	87A	91A	0.18		12	3.87	264	3.5	2.98		0.00		0.00		0.00	0.00	0.18	3.87	1.28	4.26	29.0	200	1.00	32.80	0.13	1.04	0.71
To STREET 2, Pipe 91A - 92A						3.87	264				0.00		0.00		0.00			3.87									
STREET 5																											
	71A	78A	0.22		15	0.22	15	3.7	0.18		0.00		0.00		0.00	0.00	0.22	0.22	0.07	0.25	57.0	200	1.00	32.80	0.01	1.04	0.30
To STREET 4, Pipe 78A - 80A						0.22	15				0.00		0.00		0.00			0.22									
	71A	72A	0.18		12	0.18	12	3.7	0.14		0.00		0.00		0.00	0.00	0.18	0.18	0.06	0.20	48.0	200	0.65	26.44	0.01	0.84	0.24
To STREET 12, Pipe 72A - 73A						0.18	12				0.00		0.00		0.00			0.18									
STREET 4																											
	69A	70A	0.21		14	0.21	14	3.7	0.17		0.00		0.00		0.00	0.00	0.21	0.21	0.07	0.24	42.5	200	0.65	26.44	0.01	0.84	0.26
To STREET 12, Pipe 70A - 72A						0.21	14				0.00		0.00		0.00			0.21									
	81A	82A	0.17		12	0.17	12	3.7	0.14		0.00		0.00		0.00	0.00	0.17	0.17	0.06	0.20	42.5	200	0.65	26.44	0.01	0.84	0.24
To STREET 2, Pipe 82A - 83A						0.17	12				0.00		0.00		0.00			0.17									
	69A	76A	0.36		24	0.36	24	3.7	0.29		0.00		0.00		0.00	0.00	0.36	0.36	0.12	0.41	56.5	200	0.65	26.44	0.02	0.84	0.30
	76A	78A	0.35		24	0.71	48	3.7	0.57		0.00		0.00		0.00	0.00	0.35	0.71	0.23	0.80	46.0	200	0.35	19.40	0.04	0.62	0.30
Contribution From STREET 5, Pipe 71A - 78A						0.22	15				0.00		0.00		0.00		0.22	0.93									
	78A	80A	0.37		25	1.30	88	3.6	1.03		0.00		0.00		0.00	0.00	0.37	1.30	0.43	1.46	46.0	200	0.35	19.40	0.08	0.62	0.36
	80A	82A	0.41		28	1.71	116	3.6	1.35		0.00		0.00		0.00	0.00	0.41	1.71	0.56	1.91	54.5	200	4.10	66.41	0.03	2.11	0.93
To STREET 2, Pipe 82A - 83A						1.71	116				0.00		0.00		0.00			1.71									

DESIGN PARAMETERS

Park Flow =	28000	L/ha/da	0.32407	l/s/Ha
Average Daily Flow =	280	l/p/day		
Comm/Inst Flow =	28000	L/ha/da	0.3241	l/s/Ha
Industrial Flow =	35000	L/ha/da	0.40509	l/s/Ha
Max Res. Peak Factor =	4.00			
Commercial/Inst./Park Peak Factor =	1.00			
Institutional =	0.32	l/s/Ha		

Industrial Peak Factor = as per MOE Graph

Extraneous Flow = 0.330 L/s/ha

Minimum Velocity = 0.600 m/s

Manning's n = (Conc) 0.013 (Pvc) 0.013

Townhouse coeff= 2.7

Single house coeff= 3.4

Designed: GGG

Checked: SLM

Dwg. Reference: Sanitary Drainage Plan, Dwgs. No. 3

PROJECT: **Cardinal Creek Village South FSR**

LOCATION: **City of Ottawa**

File Ref: 19-1153

Date: **30 Nov 2021**

Sheet No. 4 of 5

LICENSED PROFESSIONAL ENGINEER S. L. MERRICK 100186523 2021-12-16 PROVINCE OF ONTARIO

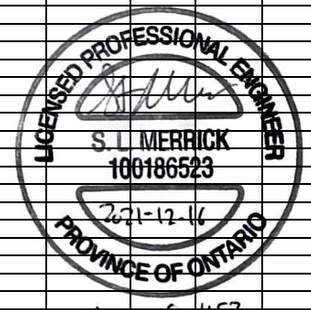
1153_SAN.xlsx

Job # 19-1153

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)
STREET 2																											
	84A	85A	0.42		29	0.42	29	3.7	0.35		0.00		0.00		0.00	0.00	0.42	0.42	0.14	0.48	85.5	200	0.65	26.44	0.02	0.84	0.32
To STREET 3, Pipe 85A - 86A						0.42	29				0.00		0.00		0.00			0.42									
	93A	94A	0.24		16	0.24	16	3.7	0.19		0.00		0.00		0.00	0.00	0.24	0.24	0.08	0.27	47.5	200	3.35	60.03	0.00	1.91	0.46
	94A	95A	0.14		10	0.38	26	3.7	0.31		0.00		0.00		0.00	0.00	0.14	0.38	0.13	0.44	34.5	200	1.90	45.21	0.01	1.44	0.44
	95A	96A	0.19		13	0.57	39	3.7	0.46		0.00		0.00		0.00	0.00	0.19	0.57	0.19	0.65	40.0	200	1.90	45.21	0.01	1.44	0.50
To SERVICING BLOCK 1, Pipe 96A - 98A						0.57	39				0.00		0.00		0.00			0.57									
Contribution From STREET 4, Pipe 80A - 82A						1.71	116				0.00		0.00		0.00		1.71	1.71									
Contribution From STREET 4, Pipe 81A - 82A						0.17	12				0.00		0.00		0.00		0.17	1.88									
	82A	83A	0.44		30	2.32	158	3.5	1.82		0.00		0.00		0.00	0.00	0.44	2.32	0.77	2.58	103.5	200	0.35	19.40	0.13	0.62	0.43
To STREET 3, Pipe 83A - 85A						2.32	158				0.00		0.00		0.00			2.32									
	88A	89A	1.22		82	1.22	82	3.6	0.96		0.00		0.00		0.00	0.00	1.22	1.22	0.40	1.36	122.0	200	4.20	67.22	0.02	2.14	0.83
	89A	91A	0.19		13	1.41	95	3.6	1.11		0.00		0.00		0.00	0.00	0.19	1.41	0.47	1.57	75.5	200	0.35	19.40	0.08	0.62	0.37
Contribution From STREET 3, Pipe 87A - 91A						3.87	264				0.00		0.00		0.00		3.87	5.28									
	91A	92A	0.23		16	5.51	375	3.4	4.17		0.00		0.00		0.00	0.00	0.23	5.51	1.82	5.98	62.0	200	0.35	19.40	0.31	0.62	0.54
To SERVICING BLOCK 1, Pipe 92A - 98A						5.51	375				0.00		0.00		0.00			5.51									
SERVICING BLOCK 1																											
Contribution From STREET 2, Pipe 91A - 92A						5.51	375				0.00		0.00		0.00		5.51	5.51									
	92A	98A				5.51	375	3.4	4.17		0.00		0.00		0.00	0.00	0.00	5.51	1.82	5.98	21.0	200	0.35	19.40	0.31	0.62	0.54
Contribution From STREET 2, Pipe 95A - 96A						0.57	39				0.00		0.00		0.00		0.57	0.57									
	96A	98A				0.57	39	3.7	0.46		0.00		0.00		0.00	0.00	0.00	0.57	0.19	0.65	21.0	200	0.35	19.40	0.03	0.62	0.29
	98A	2000A				6.08	414	3.4	4.58		0.00		0.00		0.00	0.00	0.00	6.08	2.01	6.58	23.5	200	0.35	19.40	0.34	0.62	0.56



DESIGN PARAMETERS

Park Flow =	28000	L/ha/da	0.32407	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: **Cardinal Creek Village South FSR**		
Checked: SLM	LOCATION: **City of Ottawa**		
Dwg. Reference: Sanitary Drainage Plan, Dwgs. No. 3	File Ref: 19-1153	Date: **30 Nov 2021**	Sheet No. 5 of 5

SANITARY SEWER CALCULATION SHEET

Manning's n=0.013

LOCATION			RESIDENTIAL AREA AND POPULATION							COMM		INDUST		INSTIT		C+I+I	INFILTRATION				PIPE					
STREET	FROM M.H.	TO M.H.	AREA (ha)	UNITS	POP.	CUMULATIVE AREA (ha)	CUMULATIVE POP.	PEAK FACT.	PEAK FLOW (l/s)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	PEAK FLOW (l/s)	TOTAL AREA (ha)	ACCU. AREA (ha)	INFILT. FLOW (l/s)	TOTAL FLOW (l/s)	DIST (m)	DIA (mm)	SLOPE (%)	CAP. (FULL) (l/s)	RATIO Q act/Q cap	VEL. (FULL) (m/s)
PHASE 4																										
cercle Tewin Circle																										
		0.11	1	3.4	0.11	3.4											0.11	0.11								
	3043A	3042A	0.44	9	24.3	0.55	27.7	4.00	0.45								0.44	0.55	0.15	0.60	45.5	200	2.15	48.09	0.01	1.53
			0.31	9	24.3	0.86	52.0										0.31	0.86								
	3042A	3041A	0.05	1	3.4	0.91	55.4	4.00	0.90								0.05	0.91	0.25	1.15	45.0	200	2.15	48.09	0.02	1.53
			0.07	2	5.4	0.98	60.8										0.07	0.98								
	3041A	3040A	0.41	7	23.8	1.39	84.6	4.00	1.37								0.41	1.39	0.39	1.76	66.0	200	1.40	38.81	0.05	1.24
			0.07			1.46	84.6										0.07	1.46								
			0.24	4	13.6	1.70	98.2										0.24	1.70								
	3040A	305A	0.25	6	16.2	1.95	114.4	4.00	1.85								0.25	1.95	0.55	2.40	79.0	200	1.25	36.67	0.07	1.17
To avenue de la Famille-Laporte Avenue, Pipe 305A - 1004A						1.95	114.4											1.95								
promenade Cardinal Creek Drive																										
Contribution From Future Phase (MIXED USE BLOCK)			0.57		78.0	0.57	78.0	4.00	1.26	1.88	1.88					1.63	2.45	2.45	0.69	3.58	15.0	375	1.00	175.33	0.02	1.59
Contribution From External (FUTURE RESIDENTIAL)			31.68		2540.0									5.31	5.31	4.61	36.99	36.99	10.36	14.97						
Contribution From External (FUTURE RESIDENTIAL)			23.23		1400.0												23.23	23.23	6.50	6.50						
Contribution From Future Phase (PARK)														2.42	2.42	0.39	2.42	2.42	0.68	1.07						
		0.12			55.60	4018.0				1.88				7.73		0.12	65.21									
		0.11			55.71	4018.0				1.88				7.73		0.11	65.32									
	2000A	1000A	3.14			58.85	4018.0	3.33	54.20		1.88				7.73	6.63	3.14	68.46	19.17	80.00	32.5	375	0.60	135.81	0.59	1.23
	1000A	1001A	0.62	6	16.2	59.47	4034.2	3.33	54.42		1.88				7.73	6.63	0.62	69.08	19.34	80.39	77.0	375	2.75	290.75	0.28	2.63
	1001A	1002A	0.73	13	35.1	60.20	4069.3	3.33	54.89		1.88				7.73	6.63	0.73	69.81	19.55	81.07	71.0	375	1.45	211.13	0.38	1.91
		0.18	2	6.8	60.38	4076.1				1.88				7.73		0.18	69.99									
	1002A	1003A	0.66	14	37.8	61.04	4113.9	3.32	55.33		1.88				7.73	6.63	0.66	70.65	19.78	81.74	75.5	375	0.55	130.03	0.63	1.18
		0.11	2	5.4	61.15	4119.3				1.88				7.73		0.11	70.76									
	1003A	1004A	0.38	3	10.2	61.53	4129.5	3.32	55.54		1.88				7.73	6.63	0.38	71.14	19.92	82.09	85.0	375	0.55	130.03	0.63	1.18
To avenue de la Famille-Laporte Avenue, Pipe 1004A - 218A						61.53	4129.5			1.88				7.73				71.14								
rang de Stadaconé Row																										
	323A	324A	0.50	28	75.6	0.50	75.6	4.00	1.23								0.50	0.50	0.14	1.37	106.0	200	0.70	27.44	0.05	0.87
	324A	322A	0.04	1	2.7	0.54	78.3	4.00	1.27								0.04	0.54	0.15	1.42	15.5	200	1.10	34.40	0.04	1.09
To voie du Cap-Diamant Way, Pipe 322A - 149A						0.54	78.3											0.54								
rue Mishawashkode Street																										
	222A	2200A	0.14	4	10.8	0.14	10.8	4.00	0.18								0.14	0.14	0.04	0.22	31.0	200	1.00	32.80	0.01	1.04
	2200A	220A	0.09	2	5.4	0.23	16.2	4.00	0.26								0.09	0.23	0.06	0.32	21.0	200	1.00	32.80	0.01	1.04
To terrasse du Géographe Terrace, Pipe 220A - 221A						0.23	16.2											0.23								

Drainage from OMR that is not considered in comparison

LICENSED PROFESSIONAL ENGINEER
W. LIU
100167932
Nov 1, 2017
PROVINCE OF ONTARIO

DESIGN PARAMETERS

Average Daily Flow =	350	l/p/day	Industrial Peak Factor = as per MOE Graph		
Commercial/Institution Flow =	50000	L/ha/da	Extraneous Flow =	0.280	L/s/ha
Industrial Flow =	35000	L/ha/da	Minimum Velocity =	0.60	m/s
Max Res. Peak Factor =	4.00		Manning's n =	0.013	
Commercial/Institution peak Factor =	1.50		Townhouse/Semi coeff=	2.7	
Park Average Flow =	9300	L/ha/da	Single house coeff=	3.4	

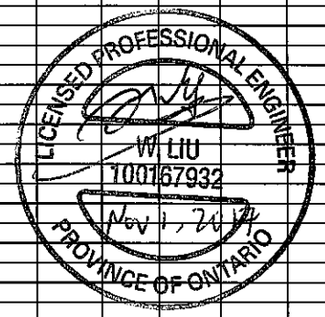
Designed: K.M.	PROJECT: CARDINAL CREEK VILLAGE - PHASE 4		
Checked: W.L.	LOCATION: City of Ottawa		
Dwg. Reference: Sanitary Drainage Plan, Dwg. No.38 & 39	File Ref: 16-864	Date: November, 2017	Sheet No. 1 of 3

SANITARY SEWER CALCULATION SHEET

Ottawa

Manning's n=0.013

LOCATION			RESIDENTIAL AREA AND POPULATION							COMM		INDUST		INSTIT		C+I+I	INFILTRATION				PIPE					
STREET	FROM M.H.	TO M.H.	AREA (ha)	UNITS	POP.	CUMULATIVE AREA (ha)	CUMULATIVE POP.	PEAK FACT.	PEAK FLOW (l/s)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	PEAK FLOW (l/s)	TOTAL AREA (ha)	ACCU. AREA (ha)	INFILT. FLOW (l/s)	TOTAL FLOW (l/s)	DIST (m)	DIA (mm)	SLOPE (%)	CAP. (FULL) (l/s)	RATIO Q act/Q cap	VEL. (FULL) (m/s)
voie du Cap-Diamant Way																										
	2170A	217A	0.40	10	27.0	0.40	27.0	4.00	0.44								0.40	0.40	0.11	0.55	83.0	200	0.65	26.44	0.02	0.84
To terrasse du Géographe Terrace, Pipe 217A - 218A						0.40	27.0											0.40								
	319A	320A	0.34	15	40.5	0.34	40.5	4.00	0.66								0.34	0.34	0.10	0.76	117.5	200	0.90	31.12	0.02	0.99
	320A	321A	0.02			0.36	40.5	4.00	0.66								0.02	0.36	0.10	0.76	13.0	200	0.90	31.12	0.02	0.99
	321A	322A	0.05			0.41	40.5	4.00	0.66								0.05	0.41	0.11	0.77	38.5	200	0.90	31.12	0.02	0.99
Contribution From rang de Stadaconé Row, Pipe 324A -322A						0.54	78.3										0.54									
	322A	149A	0.05			1.00	118.8	4.00	1.93								0.05	1.00	0.28	2.21	44.0	200	0.50	23.19	0.10	0.74
To rue du Cartographe Street, Pipe 149A - 326A						1.00	118.8											1.00								
rue du Cartographe Street																										
Contribution From voie du Cap-Diamant Way, Pipe 322A -149A						1.00	118.8										1.00									
	149A	326A	0.22	8	21.6	1.22	140.4	4.00	2.28								0.22	1.22	0.34	2.62	58.5	200	1.25	36.67	0.07	1.17
To terrasse du Géographe Terrace, Pipe 326A - 219A						1.22	140.4											1.22								
	325A	326A	0.21	8	21.6	0.21	21.6	4.00	0.35								0.21	0.21	0.06	0.41	57.0	200	1.00	32.80	0.01	1.04
To terrasse du Géographe Terrace, Pipe 326A - 219A						0.21	21.6											0.21								
terrasse du Géographe Terrace																										
Contribution From rue du Cartographe Street, Pipe 149A -326A						1.22	140.4										1.22									
Contribution From rue du Cartographe Street, Pipe 325A -326A						0.21	21.6										0.21									
	326A	219A	0.10	2	5.4	1.53	167.4	4.00	2.71								0.10	1.53	0.43	3.14	19.5	200	1.00	32.80	0.10	1.04
	219A	220A	0.42	13	35.1	1.95	202.5	4.00	3.28								0.42	1.95	0.55	3.83	56.0	200	1.00	32.80	0.12	1.04
Contribution From rue Mishawashkode Street, Pipe 2200A -220A						0.23	16.2										0.23									
	220A	221A	0.19	5	13.5	2.37	232.2	4.00	3.76								0.19	2.37	0.66	4.42	40.5	200	0.80	29.34	0.15	0.93
	221A	217A	0.26	7	18.9	2.63	251.1	4.00	4.07								0.26	2.63	0.74	4.81	60.5	200	0.35	19.40	0.25	0.62
Contribution From voie du Cap-Diamant Way, Pipe 2170A -217A						0.40	27.0										0.40									
	217A	218A	0.12			3.15	278.1	4.00	4.51								0.12	3.15	0.88	5.39	74.0	200	0.35	19.40	0.28	0.62
	218A	2100A				3.15	278.1	4.00	4.51								0.00	3.15	0.88	5.39	15.5	200	0.35	19.40	0.28	0.62
To avenue de la Famille-Laporte Avenue, Pipe 2100A - 210A						3.15	278.1											3.15								
avenue de la Famille-Laporte Avenue																										
Contribution From Future Phase						5.89	284.7										5.89									
	PLUG	305A	0.09			5.98	284.7	4.00	4.61								0.09	5.98	1.67	6.28	41.0	250	0.50	42.05	0.15	0.86
Contribution From cercle Tewin Circle, Pipe 3040A - 305A						1.95	114.4										1.95									
	305A	1004A	0.32			8.25	399.1	4.00	6.47								0.32	8.25	2.31	8.78	97.5	250	0.50	42.05	0.21	0.86
Contribution From promenade Cardinal Creek Drive, Pipe 1003A - 1004A						61.53	4129.5			1.88				7.73			71.14									
			0.13			69.91	4528.6				1.88				7.73	6.63	0.13	79.52								
	1004A	2100A	0.76	12	40.8	70.67	4569.4	3.28	60.71		1.88				7.73	6.63	0.76	80.28	22.48	89.82	109.5	375	1.60	221.78	0.40	2.01
Contribution From terrasse du Géographe Terrace, Pipe 218A - 2100A						3.15	278.1										3.15									
	2100A	210A	0.34	4	13.6	74.16	4861.1	3.26	64.20		1.88				7.73	6.63	0.34	83.77	23.46	94.29	55.0	375	1.00	175.33	0.54	1.59
	210A	211A	0.39	5	17.0	74.55	4878.1	3.26	64.42		1.88				7.73	6.63	0.39	84.16	23.56	94.61	68.5	375	3.25	316.08	0.30	2.86
	211A	*Ex. 212A*	0.26	3	10.2	74.81	4888.3	3.25	64.36		1.88				7.73	6.63	0.26	84.42	23.64	94.63	47.5	375	3.40	323.29	0.29	2.93



DESIGN PARAMETERS

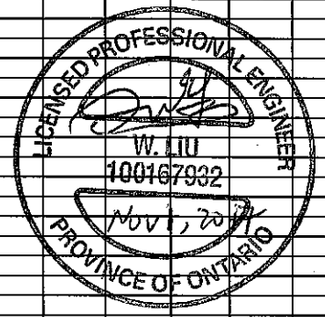
Average Daily Flow =	350	l/p/day	Industrial Peak Factor = as per MOE Graph		
Commercial/Institution Flow =	50000	L/ha/da	Extraneous Flow =	0.280	L/s/ha
Industrial Flow =	35000	L/ha/da	Minimum Velocity =	0.60	m/s
Max Res. Peak Factor =	4.00		Manning's n =	0.013	
Commercial/Institution peak Factor =	1.50		Townhouse/Semi coeff=	2.7	
Park Average Flow =	9300	L/ha/da	Single house coeff=	3.4	

Designed: K.M.	PROJECT: CARDINAL CREEK VILLAGE - PHASE 4		
Checked: W.L.	LOCATION: City of Ottawa		
Dwg. Reference: Sanitary Drainage Plan, Dwg. No.38 & 39	File Ref: 16-864	Date: November, 2017	Sheet No. 2 of 3

SANITARY SEWER CALCULATION SHEET

Manning's n=0.013

LOCATION			RESIDENTIAL AREA AND POPULATION							COMM		INDUST		INSTIT		C+I+I	INFILTRATION				PIPE					
STREET	FROM M.H.	TO M.H.	AREA (ha)	UNITS	POP.	CUMULATIVE AREA (ha)	CUMULATIVE POP.	PEAK FACT.	PEAK FLOW (l/s)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	PEAK FLOW (l/s)	TOTAL AREA (ha)	ACCU. AREA (ha)	INFILT. FLOW (l/s)	TOTAL FLOW (l/s)	DIST (m)	DIA (mm)	SLOPE (%)	CAP. (FULL) (l/s)	RATIO Q act/Q cap	VEL. (FULL) (m/s)
Contribution from BLOCK 109 (School)														2.09	2.09	1.81	2.09	2.09	0.59	2.40	14.0	200	1.00	32.80	0.07	1.04
			0.08	1	3.4	74.89	4891.7										0.08	86.59								
	Ex. 212A	*Ex. 144A*	0.27	3	10.2	75.16	4901.9	3.25	64.54		1.88				9.82	8.45	0.27	86.86	24.32	97.31	57.0	375	1.70	228.60	0.43	2.07
To rue de la Baie-des-Castors Street, Pipe *Ex. 144A - Ex. 145A*						75.16	4901.9				1.88				9.82			86.86								
rue de Honfleur Street																										
	7000A	710A	0.37	5	17.0	0.37	17.0	4.00	0.28								0.37	0.37	0.10	0.38	66.0	200	1.80	44.00	0.01	1.40
	710A	*Ex. Plug*	0.37	5	17.0	0.74	34.0	4.00	0.55								0.37	0.74	0.21	0.76	65.0	200	2.99	56.71	0.01	1.81
	Ex. Plug	*Ex. 706A*				0.74	34.0	4.00	0.55								0.00	0.74	0.21	0.76	17.0	200	2.99	56.71	0.01	1.81
To rue de la Baie-des-Castors Street, Pipe *Ex. 706A - Ex. 707A*						0.74	34.0											0.74								
rue de la Baie-des-Castors Street																										
	700A	701A	0.31	5	17.0	0.31	17.0	4.00	0.28								0.31	0.31	0.09	0.37	57.5	200	0.65	26.44	0.01	0.84
	701A	702A	0.07	1	3.4	0.38	20.4	4.00	0.33								0.07	0.38	0.11	0.44	11.0	200	0.40	20.74	0.02	0.66
	702A	703A	0.33	5	17.0	0.71	37.4	4.00	0.61								0.33	0.71	0.20	0.81	73.5	200	0.40	20.74	0.04	0.66
	703A	704A	0.33	5	17.0	1.04	54.4	4.00	0.88								0.33	1.04	0.29	1.17	73.5	200	3.10	57.75	0.02	1.84
Contribution from Future Park														4.10	4.10	0.66	4.10	4.10	1.15	1.81	8.0	200	1.00	32.80	0.06	1.04
	704A	705A	0.08	1	3.4	1.12	57.8	4.00	0.94						4.10	0.66	0.08	5.22	1.46	3.06	12.0	200	0.40	20.74	0.15	0.66
	705A	*Ex. Plug*	0.38	6	20.4	1.50	78.2	4.00	1.27						4.10	0.66	0.38	5.60	1.57	3.50	42.0	200	0.39	20.48	0.17	0.65
	Ex. Plug	Ex. 706A				1.50	78.2	4.00	1.27						4.10	0.66	0.00	5.60	1.57	3.50	30.0	200	0.39	20.48	0.17	0.65
Contribution From rue de Honfleur Street, Pipe Ex. Plug -Ex. 706A						0.74	34.0										0.74									
			0.06	1	3.4	2.30	115.6								4.10		0.06	6.40								
	Ex. 706A	*Ex. 707A*	0.59	11	37.4	2.89	153.0	4.00	2.48						4.10	0.66	0.59	6.99	1.96	5.10	78.0	200	0.40	20.74	0.25	0.66
To rue de la Baie-des-Castors Street, Pipe *Ex. 707A - Ex. 708A*						2.89	153.0								4.10			6.99								



DESIGN PARAMETERS

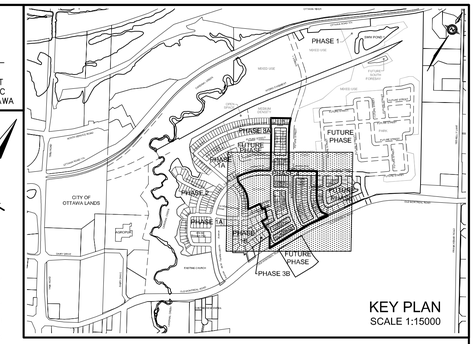
Average Daily Flow =	350	l/p/day	Industrial Peak Factor =	as per MOE Graph	
Commercial/Institution Flow =	50000	L/ha/da	Extraneous Flow =	0.280	L/s/ha
Industrial Flow =	35000	L/ha/da	Minimum Velocity =	0.60	m/s
Max Res. Peak Factor =	4.00		Manning's n =	0.013	
Commercial/Institution peak Factor =	1.50		Townhouse/Semi coeff=	2.7	
Park Average Flow =	9300	L/ha/da	Single house coeff=	3.4	

Designed: K.M.	PROJECT: **CARDINAL CREEK VILLAGE - PHASE 4**		
Checked: W.L.	LOCATION: **City of Ottawa**		
Dwg. Reference: Sanitary Drainage Plan, Dwg. No.38 & 39	File Ref: 16-864	Date: November, 2017	Sheet No. 3 of 3

APPROVED ☐ REFUSED ☐

THIS ____ DAY OF_____, 20____

JEFF MCEWEN, P.ENG
MANAGER DEVELOPMENT REVIEW – EAST
PLANNING, INFRASTRUCTURE & ECONOMIC
DEVELOPMENT DEPARTMENT, CITY OF OTTAWA



KEY PLAN
SCALE 1:15000

LEGEND

- SANITARY DRAINAGE BOUNDARY
- SANITARY SUB-DRAINAGE BOUNDARY
- UPSTREAM MH TO DOWNSTREAM MH — 43A - 44A
- AREA IN HECTARES — 0.78
- POPULATION — 61
- EXTERNAL AREA IN HECTARES — A=53.63
- EXTERNAL POPULATION — 207
- DENSITY (PERSONS/HECTARE) — POP=5736
- EXTERNAL LAND USE — RESIDENTIAL
- UPSTREAM MH TO DOWNSTREAM MH — 43A - 44A
- AREA IN OTHER PHASES IN HECTARES — 0.78
- POPULATION — 61
- MAINTENANCE HOLE — 200mm SAN — MH202A
- CAP
- OTHER PHASES
- LIMIT OF HAZARD LANDS
- 6m EROSION ACCESS ALLOWANCE
- 100YR W.L. CARDINAL CREEK

TOPOGRAPHIC INFORMATION

TOPOGRAPHIC INFORMATION PROVIDED BY STANTEC GEOMATICS LTD, PROJECT No. 161611900-111 RECEIVED ON JULY 6, 2012 AND PROJECT No. 16162924-111 RECEIVED ON OCTOBER 24, 2013 AND NOVEMBER 29, 2013 AND PROJECT No. 161613473-111 RECEIVED ON MAY 10, 2016

LEGAL INFORMATION

CALCULATED M-PLAN PROVIDED BY STANTEC GEOMATICS LTD, PROJECT No. 161613653-132 RECEIVED ON JUNE 14, 2017. R-PLAN PROVIDED BY STANTEC GEOMATICS LTD., PROJECT No. 161613473-114 DATED JUNE 15, 2016

3rd SUBMISSION 17-11-01

ELEVATION NOTE

ELEVATIONS HEREON ARE GEODETIC AND ARE DERIVED FROM THE CAN-NET VRS NETWORK.

No.	DATE	BY	DESCRIPTION	BY
3.	17-11-01	W.L.	3rd SUBMISSION	
2.	17-09-12	W.L.	2nd SUBMISSION	
1.	17-07-24	W.L.	1st SUBMISSION	

Ottawa CITY OF OTTAWA

PROJECT No. 16-864 B1

LICENSED PROFESSIONAL ENGINEER
W. LIU
100167932
17-11-01
PROVINCE OF ONTARIO

SANITARY DRAINAGE PLAN

© DSEL

TAMARACK (CARDINAL CREEK) CORPORATION

CARDINAL CREEK VILLAGE PHASE 4

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

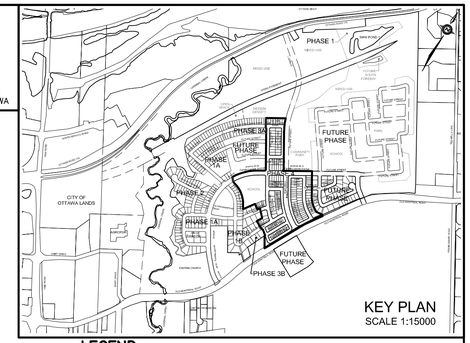
DRAWN BY: A.F/A.B	CHECKED BY: C.M/W.L	DRAWING NO.	SHEET NO.
DESIGNED BY: C.M/W.L	CHECKED BY: K.M.		39
SCALE: 1:1000	DATE: JULY 2017		

CITY FILE No. D07-16-13-0024PH4 CITY PLAN No.

APPROVED ☐ REFUSED ☐

THIS ____ DAY OF _____, 20____

JEFF MCEWEN, P.ENG
MANAGER DEVELOPMENT REVIEW – EAST
PLANNING, INFRASTRUCTURE & ECONOMIC
DEVELOPMENT DEPARTMENT, CITY OF OTTAWA



KEY PLAN
SCALE 1:15000

LEGEND

STORM DRAINAGE BOUNDARY
SUB-DRAINAGE BOUNDARY
UPSTREAM MH TO DOWNSTREAM MH — 42 - 43
AREA IN HECTARES — 0.37 | 0.74
RUNOFF COEFFICIENT
EXTERNAL 2.78AC = — 2.78AC=3.09
EXTERNAL TIME OF CONCENTRATION — TC=12.50 MIN
EXTERNAL BLENDED RUNOFF COEFFICIENT — C= 0.65 | 2YR
EXTERNAL RETURN FREQUENCY CAPTURE
UPSTREAM MH TO DOWNSTREAM MH — 21 - 23
AREA IN OTHER PHASES IN HECTARES — 0.28 | 0.78
RUNOFF COEFFICIENT
STREET CATCHBASIN & LEAD
STREET CATCHBASIN WITH CLOSED LID & LEAD MAINTENANCE HOLE — MH202
CURB INLET CATCHBASIN & LEAD CATCHBASIN/ MAINTENANCE HOLE — CBMH201
INTERCONNECTED CATCH BASIN & LEADS CAP
OVERLAND FLOW DIRECTION
EXTERNAL OVERLAND FLOW DIRECTION
OTHER PHASES
LIMIT OF HAZARD LANDS
6m EROSION ACCESS ALLOWANCE
100YR W.L. CARDINAL CREEK
STORM ST

TOPOGRAPHIC INFORMATION

TOPOGRAPHIC INFORMATION PROVIDED BY STANTEC GEOMATICS LTD, PROJECT No. 161611900-111 RECEIVED ON JULY 6, 2012 AND PROJECT No. 16162924-111 RECEIVED ON OCTOBER 24, 2013 AND NOVEMBER 29, 2013 AND PROJECT No. 161613473-111 RECEIVED ON MAY 10, 2016

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CALCULATED M-PLAN PROVIDED BY STANTEC GEOMATICS LTD, PROJECT No. 161613653-132 RECEIVED ON JUNE 14, 2017. R-PLAN PROVIDED BY STANTEC GEOMATICS LTD., PROJECT No. 161613473-114 DATED JUNE 15, 2016

3rd SUBMISSION 17-11-01

ELEVATION NOTE

ELEVATIONS HEREON ARE GEODETIC AND ARE DERIVED FROM THE CAN-NET VRS NETWORK.

No.	DATE	BY	DESCRIPTION	BY
3.	17-11-01	W.L.	3rd SUBMISSION	
2.	17-09-12	W.L.	2nd SUBMISSION	
1.	17-07-24	W.L.	1st SUBMISSION	

CITY OF OTTAWA

LICENSED PROFESSIONAL ENGINEER
W. LIU
100167932
17-11-01
PROVINCE OF ONTARIO

PROJECT No. 16-864 B1

EXTERNAL SANITARY DRAINAGE PLAN

© DSEL

TAMARACK (CARDINAL CREEK) CORPORATION

CARDINAL CREEK VILLAGE PHASE 4

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

DRAWN BY: A.F./A.B	CHECKED BY: C.M./W.L	DRAWING NO.	SHEET NO.
DESIGNED BY: C.M./W.L	CHECKED BY: K.M.		40
SCALE: 1:2500	DATE: JULY 2017		

CITY FILE No. D07-16-13-0024PH4 CITY PLAN No. _____

RES. AREA = 15.53 Ha
POPULATION = 3775
COMMERCIAL AREA = 4.00 Ha

TO MH 128A

RES. AREA = 18.34 Ha
POPULATION = 1070
EXTERNAL FUT. AREA = 3.50 Ha
EXTERNAL FUT. POPULATION = 315

TO MH 125A

RES. AREA = 4.63Ha
POPULATION = 276

TO MH 147A

RES. AREA = 15.57 Ha
POPULATION = 946
INSTITUTIONAL AREA = 2.84 Ha
PARK AREA = 4.12 Ha
EXTERNAL FUT. AREA = 6.50 Ha
EXTERNAL FUT. POPULATION = 585

TO MH 1004A

PARK AREA = 2.09Ha
TO MH 212A

RES. AREA = 26.98 Ha
POPULATION = 1820
PARK AREA = 1.29 Ha

TO MH 146A

RES. AREA = 3.15Ha
POPULATION = 279

TO MH 2100A

RES. AREA = 4.45Ha
POPULATION = 306

TO MH 144A

FUT. MIXED USE RES. AREA = 0.53 Ha
FUT. MIXED USE POPULATION = 72
FUT. MIXED USE COMMERCIAL AREA = 1.51 Ha

CCV SOUTH RES. AREA = 34.14 Ha
CCV SOUTH POPULATION = 2316
CCV SOUTH INSTITUTIONAL AREA = 5.67 Ha
CCV SOUTH PARK AREA = 2.48 Ha

FUT. SOUTH OF TRIB RES. AREA = 50.70 Ha
FUT. SOUTH OF TRIB POPULATION = 3700
FUT. SOUTH OF TRIB INSTITUTIONAL AREA = 2.00 Ha
FUT. SOUTH OF TRIB PARK AREA = 2.50 Ha

TO MH 2000A

FUTURE RESIDENTIAL

FUTURE RESIDENTIAL

LEGEND

BULK SANITARY DRAINAGE AREA DIRECTED TO SANITARY TRUNK

SANITARY TRUNK DRAINAGE BOUNDARY

200Ø SAN 72.00 @ 0.35%

SANITARY TRUNK SEWER

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

CARDINAL CREEK VILLAGE SOUTH
CITY OF OTTAWA

TRUNK SANITARY SEWER ANALYSIS

SCALE:	1:2500	PROJECT No.:	19-1153
DATE:	FEBRUARY 2022	FIGURE:	App. D

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)	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)
Cardinal Creek Drive																										
Contribution from Fut Phase (MIXED USE BLOCK)			0.53	72.000	0.53	72	3.62	0.85	1.510	1.51		0.00		0.00	0.49	2.04	2.04	0.67	2.01							
Contribution from Fut Lands (South of Trib)			50.70	3700.00	51.23	3772	2.88	35.26		1.51	2.000	2.00	2.50	2.50	1.41	55.20	57.24	18.89	55.56							
CCV South per DSEL December 2021 FSR			34.14	2316	85.37	6088	2.73	53.90		1.51	5.670	7.67	2.48	4.98	3.51	42.29	99.53	32.84	90.25							
			0.12		85.49	6088	2.73	53.90		1.51		7.67		4.98		0.12	99.65									
			0.11		85.60	6088	2.73	53.90		1.51		7.67		4.98		0.11	99.76									
	2000A	1000A	3.14		88.74	6088	2.73	53.90		1.51		7.67		4.98	3.51	3.14	102.90	33.96	91.36	32.5	375	0.6	135.81	0.67	1.23	1.32
	1000A	1001A	0.62	17	89.36	6105.0	2.73	54.03		1.51		7.67		4.98	3.51	0.62	103.52	34.16	91.70	77	375	2.8	290.75	0.32	2.63	2.33
	1001A	1002A	0.73	36	90.09	6141.0	2.73	54.31		1.51		7.67		4.98	3.51	0.73	104.25	34.40	92.22	71	375	1.45	211.13	0.44	1.91	1.84
			0.18	7	90.27	6147.8				1.51		7.67		4.98		0.18	104.43	34.46								
	1002A	1003A	0.66	38	90.93	6185.8	2.73	54.66		1.51		7.67		4.98	3.51	0.66	105.09	34.68	92.85	75.5	375	0.55	130.03	0.71	1.18	1.28
			0.11	6	91.04	6191.8				1.51		7.67		4.98		0.11	105.20	34.72								
	1003A	1004A	0.38	11	91.42	6202.8	2.73	54.79		1.51		7.67		4.98	3.51	0.38	105.58	34.84	93.14	85.0	375	0.55	130.03	0.72	1.18	1.28
Famille-Laporte Avenue																										
Contribution to MH 1004A from MH 305A					15.57	946.0						2.84		4.12		22.53	22.53									
Contribution to MH 1004A from External Lands					6.50	585.0											6.50									
			0.13		22.20	1531.0				0.00		2.84		4.12		0.13	29.16									
	1004A	2100A	0.76	41	114.38	7774.8	2.65	66.77		1.51		10.51		9.10	4.87	0.76	135.50	44.72	116.36	109.5	375	1.60	221.78	0.52	2.01	2.02
Contribution to MH 2100A from MH 218A					3.15	278.1										3.15	3.15									
	2100A	210A	0.34	14.0	117.87	8066.9	2.64	68.95		1.51		10.51		9.10	4.87	0.34	138.99	45.87	119.69	55.0	375	1.00	175.33	0.68	1.59	1.71
	210A	211A	0.39	17.0	118.26	8083.9	2.64	69.07		1.51		10.51		9.10	4.87	0.39	139.38	46.00	119.94	68.5	375	3.25	316.08	0.38	2.86	2.66
	211A	212A	0.26	11.0	118.52	8094.9	2.64	69.16		1.51		10.51		9.10	4.87	0.26	139.64	46.08	120.11	47.5	375	3.40	323.29	0.37	2.93	2.70
Contribution to MH 212A from CTRL MH 201A												2.09				2.09	2.09									
			0.08	4.0	118.60	8098.9				1.51		12.60		9.10		0.08	141.81	46.80								
	212A	144A	0.27	11.0	118.87	8109.9	2.64	69.27		1.51		12.60		9.10	5.55	0.27	142.08	46.89	121.71	57.0	375	1.70	228.60	0.53	2.07	2.10
Baie-des-Castors Street																										
Contribution to MH 144A from MH 209A					4.45	306.0										4.45	4.45									
	144A	145A	0.03		123.35	8416	2.62	71.54		1.51		12.60		9.10	5.55	0.03	146.83	48.45	125.54	21.5	375	1.00	175.33	0.72	1.59	1.72
			0.75	0.0	0.75	0.0				0.00		0.00		0.00		0.75	0.75	0.25								
	145A	146A	0.16		124.26	8416	2.62	71.54		1.51		12.60		9.10	5.55	0.16	147.74	48.75	125.84	88.5	375	2.00	247.95	0.51	2.25	2.25
Contribution to MH 146A from MH 204A					26.98	1820.0								1.29		28.27	28.27									
	146A	147A	0.28	14.0	151.52	10249.9	2.56	84.88		1.51		12.60		10.39	5.69	0.28	176.29	58.18	153.74	59.5	450	0.90	270.48	0.57	1.70	1.75
Contribution to MH 147A from MH 143A					4.63	275.1										4.63	4.63									
	147A	148A	0.31	14.0	156.46	10539	2.55	86.94		1.51		12.60		10.39	5.69	0.31	181.23	59.81	157.44	66.5	450	0.90	270.48	0.58	1.70	1.76
	148A	125A	0.04		156.50	10539	2.55	86.94		1.51		12.60		10.39	5.69	0.04	181.27	59.82	157.45	15.5	450	0.90	270.48	0.58	1.70	1.76
Contribution to MH 125A from MH 124A					18.34	1070.0										18.34	18.34									
Contribution to MH 125A from External Lands					3.50	315											6.50									
	125A	126A			178.34	11924.0	2.50	96.71		1.51		12.60		10.39	5.69	0.00	206.11	68.02	175.42	10.0	450	0.90	270.48	0.65	1.70	1.81
	126A	127A	0.06		178.40	11924.0	2.50	96.71		1.51		12.60		10.39	5.69	0.06	206.17	68.04	175.44	32.5	450	0.90	270.48	0.65	1.70	1.81
	127A	128A	0.05		178.45	11924.0	2.50	96.71		1.51		12.60		10.39	5.69	0.05	206.22	68.05	175.46	39.0	450	2.70	468.48	0.37	2.95	2.72
Servicing Outlet																										
Contribution to MH 128A from MH 10160A					15.53	3774.6				4.00						19.53	19.53									
	128A	129A	0.02		194.00	15698.6	2.41	122.44		5.51		12.60		10.39	6.99	0.02	225.77	74.50	208.93	23.5	675	0.12	291.19	0.72	0.81	0.88
	129A	130A	0.14		194.14	15698.6	2.41	122.44		5.51		12.60		10.39	6.99	0.14	225.91	74.55	208.98	115.0	675	0.12	291.19	0.72	0.81	0.88
	130A	131A	0.04		194.18	15698.6	2.41	122.44		5.51		12.60		10.39	6.99	0.04	225.95	74.56	208.99	36.5	675	0.12	291.19	0.72	0.81	0.88
	131A	132A	0.04		194.22	15698.6	2.41	122.44		5.51		12.60		10.39	6.99	0.04	225.99	74.58	209.00	35.5	675	0.12	291.19	0.72	0.81	0.88
	132A	133A	0.05		194.27	15698.6	2.41	122.44		5.51		12.60		10.39	6.99	0.05	226.04	74.59	209.02	41.5	675	0.12	291.19	0.72	0.81	0.88
	133A	134A	0.06		194.33	15698.6	2.41	122.44		5.51		12.60		10.39	6.99	0.06	226.10	74.61	209.04	52.5	675	0.12	291.19	0.72	0.81	0.88
	134A	135A	0.10		194.43	15698.6	2.41	122.44		5.51		12.60		10.39	6.99	0.10	226.20	74.65	209.07	82.0	675	0.12	291.19	0.72	0.81	0.88
	135A	136A	0.11		194.54	15698.6	2.41	122.44		5.51		12.60		10.39	6.99	0.11	226.31	74.68	209.11	96.0	675	0.12	291.19	0.72	0.81	0.88
	136A	137A	0.10		194.64	15698.6	2.41	122.44		5.51		12.60		10.39	6.99	0.10	226.41	74.72	209.14	105.0	675	0.12	291.19	0.72	0.81	0.88
	137A	1104A (B.O.)	0.10		194.74	15698.6	2.41	122.44		5.51		12.60		10.39	6.99	0.10	226.51	74.75	209.17	109.5	675	0.12	291.19	0.72	0.81	0.88
	1104A (B.O.)	1103A (B.O.)	0.10		194.84	15698.6	2.41	122.44		5.51		12.60		10.39	6.99	0.10	226.61	74.78	209.21	110.0	675	0.12	291.19	0.72	0.81	0.88
	1103A (B.O.)	1102A (B.O.)	0.06		194.90	15698.6	2.41	122.44		5.51		12.60		10.39	6.99	0.06	226.67	74.80	209.23	63.1	675	0.12	291.19	0.72	0.81	0.88
	1102A (B.O.)	1101A (B.O.)	0.07		194.97	15698.6	2.41	122.44		5.51		12.60		10.39	6.99	0.07	226.74	74.82	209.25	89.0	675	0.12	291.19	0.72	0.81	0.88
	1101A (B.O.)	1100A (B.O.)			194.97	15698.6	2.41	122.44		5.51		12.60		10.39	6.99	0.00	226.74	74.82	209.25	12.5	675	0.12	291.19	0.72	0.81	0.88
To EXISTING SANITARY, Pipe 1100A (B.O.) - 30A					194.97	15698.6				5.51		12.60		10.39			226.74		209.25							

DESIGN PARAMETERS

Park Flow =	9300	L/ha/da	0.10764				
Average Daily Flow =	280	l/p/day		Industrial Peak Factor = as per MOE Graph			
Comm/Inst Flow =	28000	L/ha/da	0.3241	Extraneous Flow =	0.330	L/s/ha	
Industrial Flow =	35000	L/ha/da	0.40509	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:	CCV SOUTH
Checked:	SLM	LOCATION:	City of Ottawa
Dwg. Reference:		File Ref: 19-1153	Date: Feb-22
		Sheet No.	1 of 1

LICENSED PROFESSIONAL ENGINEER
S. L. MERRICK
100186523
2022-02-16
PROVINCE OF ONTARIO

JOB # 19-1153

Appendix E

- Rational Method Storm Design Sheet (DSEL, Dec 2021)
- Excerpt from CCV SWM Pond 1 Ultimate Conditions (JFSA, Jan 2020)
- Cox Country Roadside Ditch Capacity Calculations (DSEL, Dec 2021)

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
STREET 1																																	
	102	103			0.00	0.00	0.22	0.68	0.42	0.42			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	43	300	300	PVC	4.00	70.0	193.4015	2.7361	0.4264	0.224
	103	104			0.00	0.00	0.11	0.68	0.21	0.62			0.00	0.00			0.00	0.00	10.43	75.21	101.99	119.55	174.75	64	300	300	PVC	4.00	43.0	193.4015	2.7361	0.2619	0.329
					0.00	0.00			0.00	0.62			0.00	0.00	2.04	0.80	4.54	4.54	12.00														
					0.00	0.00	-0.59	0.68	-1.12	-0.49			0.00	0.00			0.00	4.54															
					0.00	0.00	0.26	0.68	0.49	0.00			0.00	0.00			0.00	4.54															
	104	EX MH 2000			0.00	0.00			0.00	0.00			0.00	0.00	0.59	0.68	1.12	5.65	12.00	69.89	94.70	110.96	162.13	916	825	825	CONC	1.20	66.5	1572.4410	2.9416	0.3768	0.583
STREET 3																																	
	90	91	0.33	0.68	0.62	0.62			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	48	300	300	PVC	3.90	66.0	190.9687	2.7017	0.4072	0.251
Contribution From STREET 2, Pipe 89 - 91						0.81				0.00				0.00				0.00	11.41														
	91	92	0.41	0.68	0.78	2.21			0.00	0.00			0.00	0.00			0.00	0.00	11.41	71.79	97.30	114.02	166.63	159	375	375	PVC	3.55	59.0	330.3473	2.9910	0.3288	0.481
	92	93	0.11	0.68	0.21	2.42			0.00	0.00			0.00	0.00			0.00	0.00	11.74	70.72	95.83	112.30	164.10	171	375	375	PVC	3.55	10.0	330.3473	2.9910	0.0557	0.518
	93	94	0.15	0.68	0.28	2.70			0.00	0.00			0.00	0.00			0.00	0.00	11.79	70.54	95.59	112.01	163.68	191	450	450	CONC	1.00	31.5	285.1061	1.7926	0.2929	0.669
To STREET 2, Pipe 94 - 95						2.70				0.00				0.00				0.00	12.09														
SERVICING BLOCK 1																																	
Contribution From STREET 2, Pipe 94 - 95						-1.10				0.00				0.00				6.92	12.81														
	95	101			0.00	-1.10	0.00		0.00	0.00			0.00	0.00			0.00	6.92	12.81	67.47	91.37	107.05	156.39	1008	1050	1050	CONC	0.25	17.0	1365.3626	1.5768	0.1797	0.738
Contribution From STREET 2, Pipe 98 - 99						1.10				0.00				0.00				0.00	11.05														
	99	101			0.00	1.10	0.00		0.00	0.00			0.00	0.00			0.00	0.00	11.05	73.01	98.97	115.99	169.52	80	375	375	PVC	0.40	19.5	110.8885	1.0040	0.3237	0.722
	101	EX MH 2000			0.00	0.00			0.00	0.00			0.00	0.00			0.00	6.92	12.99	66.96	90.67	106.22	155.18	1074	1050	1050	CONC	0.30	17.5	1495.6798	1.7273	0.1689	0.718
STREET 5																																	
	74	79	0.20	0.68	0.38	0.38			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	29	300	300	PVC	0.35	54.0	57.2089	0.8093	1.1120	0.508
To STREET 4, Pipe 79 - 81						0.38				0.00				0.00				0.00	11.11														
	74	75	0.20	0.68	0.38	0.38			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	29	300	300	PVC	0.65	51.0	77.9626	1.1029	0.7707	0.372
To STREET 12, Pipe 75 - 76						0.38				0.00				0.00				0.00	10.77														
STREET 6																																	
	66	67	0.51	0.68	0.96	0.96			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	74	450	450	CONC	0.20	78.5	127.5033	0.8017	1.6320	0.581
To STREET 12, Pipe 67 - 71						0.96				0.00				0.00				0.00	11.63														
	66	68	0.14	0.68	0.26	0.26			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	20	300	300	PVC	0.35	13.5	57.2089	0.8093	0.2780	0.355
	68	69	0.29	0.68	0.55	0.81			0.00	0.00			0.00	0.00			0.00	0.00	10.28	75.75	102.75	120.44	176.06	62	375	375	PVC	0.30	69.0	96.0323	0.8695	1.3226	0.641
	69	70	0.10	0.68	0.19	1.00			0.00	0.00			0.00	0.00			0.00	0.00	11.60	71.16	96.44	113.01	165.14	71	375	375	PVC	0.30	14.0	96.0323	0.8695	0.2684	0.742
	70	71	0.58	0.68	1.10	2.10			0.00	0.00			0.00	0.00			0.00	0.00	11.87	70.30	95.26	111.62	163.11	148	600	600	CONC	0.15	78.0	237.8056	0.8411	1.5457	0.620
To STREET 12, Pipe 71 - 73						2.10				0.00				0.00				0.00	13.41														
STREET 14																																	
	27	55	0.19	0.68	0.36	0.36			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	28	300	300	PVC	0.35	76.0	57.2089	0.8093	1.5651	0.482
	55	57	0.80	0.68	1.51	1.87			0.00	0.00			0.00	0.00			0.00	0.00	11.57	71.28	96.59	113.19	165.42	133	300	300	PVC	3.45	94.0	179.6137	2.5410	0.6166	0.743
	57	58	0.76	0.68	1.44	3.31			0.00	0.00			0.00	0.00			0.00	0.00	12.18	69.33	93.93	110.05	160.80	229	450	450	CONC	1.75	91.0	377.1600	2.3714	0.6396	0.608
	58	60	0.71	0.68	1.34	4.65			0.00	0.00			0.00	0.00			0.00	0.00	12.82	67.44	91.33	106.99	156.31	314	675	675	CONC	0.25	91.0	420.2941	1.1745	1.2913	0.746
To STREET 15, Pipe 60 - 61						4.65				0.00				0.00				0.00	14.11														
STREET 17																																	
	41	43	0.07	0.68	0.13	0.13			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	10	300	300	PVC	0.35	35.5	57.2089	0.8093	0.7310	0.178
	43	45	0.73	0.68	1.38	1.51			0.00	0.00			0.00	0.00			0.00	0.00	10.73	74.11	100.48	117.77	172.14	112	525	525	CONC	0.20	105.0	192.3297	0.8885	1.9697	0.583
	45	46	0.06	0.68	0.11	1.63			0.00	0.00			0.00	0.00			0.00	0.00	12.70	67.79	91.81	107.56	157.14	110	525	525	CONC	0.20	30.0	192.3297	0.8885	0.5628	0.573
To SERVICING BLOCK 2, Pipe 46 - 52						1.63				0.00				0.00				0.00	13.26														
	47	48	0.07	0.68	0.13	0.13			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	10	300	300	PVC	2.85	31.5	163.2497	2.3095	0.2273	0.062
	48	49	0.10	0.68	0.19	0.32			0.00	0.00			0.00	0.00			0.00	0.00	10.23	75.94	103.01	120.74	176.51	24	300	300	PVC	0.90	55.5	91.7384	1.2978	0.7127	0.266
	49	50	0.82	0.68	1.55	1.87			0.00	0.00			0.00	0.00			0.00	0.00	10.94	73.37	99.48	116.59	170.40	137	525	525	CONC	0.20	118.5	192.3297	0.8885	2.2229	0.714
To SERVICING BLOCK 2, Pipe 50 - 52						1.87				0.00				0.00				0.00	13.16														

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

LICENSED PROFESSIONAL ENGINEER
S. L. MERRICK
100186523
2021-12-16
PROVINCE OF ONTARIO

ToR # 19-1153

Designed: GGG	PROJECT: Cardinal Creek Village South FSR	
Checked: SLM	LOCATION: City of Ottawa	
Dwg. Reference: 2	File Ref: 19-1153	Date: 25 Nov 2021
		Sheet No. SHEET 1 OF 5

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
SERVICING BLOCK 2																																	
Contribution From STREET 17, Pipe 49 - 50						1.87				0.00				0.00				0.00	13.16														
	50	52			0.00	1.87			0.00	0.00			0.00	0.00			0.00	0.00	13.16	66.47	90.00	105.44	154.03	124	525	525	CONC	0.20	10.0	192.3297	0.8885	0.1876	0.647
Contribution From STREET 17, Pipe 45 - 46						1.63				0.00				0.00				0.00	13.26														
	46	52			0.00	1.63			0.00	0.00			0.00	0.00			0.00	0.00	13.26	66.19	89.62	104.99	153.37	108	525	525	CONC	0.20	15.5	192.3297	0.8885	0.2908	0.560
	52	54			0.00	3.50			0.00	0.00			0.00	0.00			0.00	0.00	13.55	65.40	88.54	103.71	151.50	229	675	675	CONC	0.15	75.5	325.5584	0.9098	1.3831	0.703
To STREET 17, Pipe 54 - 61						3.50				0.00				0.00				0.00	14.94														
STREET 17																																	
	47	53	0.67	0.68	1.27	1.27			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	97	450	450	CONC	0.25	74.5	142.5531	0.8963	1.3853	0.682
	53	54	0.66	0.68	1.25	2.51			0.00	0.00			0.00	0.00			0.00	0.00	11.39	71.87	97.40	114.15	166.82	181	450	450	CONC	2.05	81.0	408.2099	2.5667	0.5260	0.443
Contribution From SERVICING BLOCK 2, Pipe 52 - 54						3.50				0.00				0.00				0.00	14.94														
					0.00	6.01	2.48	0.40	2.76	2.76			0.00	0.00			0.00	0.00	13.00														
	54	61	0.56	0.68	1.06	7.07			0.00	2.76			0.00	0.00			0.00	0.00	14.94	61.92	83.76	98.09	143.24	669	900	900	CONC	0.25	105.5	905.1556	1.4228	1.2358	0.739
Contribution From STREET 15, Pipe 60 - 61						6.01				0.00				0.00				0.00	15.10														
	61	65	0.14	0.68	0.26	13.35			0.00	2.76			0.00	0.00			0.00	0.00	16.17	59.13	79.95	93.61	136.67	1010	900	900	CONC	0.60	86.0	1402.2610	2.2042	0.6503	0.720
To STREET 12, Pipe 65 - 67						13.35				2.76				0.00				0.00	16.82														
STREET 7																																	
	38	39	0.55	0.68	1.04	1.04			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	80	450	450	CONC	0.20	61.5	127.5033	0.8017	1.2785	0.626
	39	40	0.36	0.68	0.68	1.72			0.00	0.00			0.00	0.00			0.00	0.00	11.28	72.22	97.89	114.72	167.66	124	450	450	CONC	1.15	60.5	305.7423	1.9224	0.5245	0.406
To STREET 12, Pipe 40 - 65						1.72				0.00				0.00				0.00	11.80														
	38	62	0.10	0.68	0.19	0.19			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	0.50	15.0	68.3778	0.9673	0.2584	0.212
	62	63	0.25	0.68	0.47	0.66			0.00	0.00			0.00	0.00			0.00	0.00	10.26	75.83	102.85	120.56	176.23	50	300	300	PVC	0.50	69.0	68.3778	0.9673	1.1888	0.734
	63	64	0.08	0.68	0.15	0.81			0.00	0.00			0.00	0.00			0.00	0.00	11.45	71.66	97.12	113.82	166.33	58	375	375	PVC	0.30	13.0	96.0323	0.8695	0.2492	0.607
	64	65	0.91	0.68	1.72	2.53			0.00	0.00			0.00	0.00			0.00	0.00	11.70	70.85	96.01	112.51	164.41	179	600	600	CONC	0.20	120.0	274.5943	0.9712	2.0594	0.654
To STREET 12, Pipe 65 - 67						2.53				0.00				0.00				0.00	13.76														
STREET 15																																	
	30	31			0.00	0.00	1.07	0.68	2.02	2.02			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	211	600	600	CONC	0.35	118.5	363.2541	1.2847	1.5373	0.580
	31	32			0.00	0.00	1.04	0.68	1.97	3.99			0.00	0.00			0.00	0.00	11.54	71.37	96.72	113.34	165.63	386	675	675	CONC	0.45	118.5	563.8837	1.5758	1.2534	0.684
To STREET 13, Pipe 32 - 37						0.00				3.99				0.00				0.00	12.79														
	59	60	0.35	0.68	0.66	0.66			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	0.30	57.0	96.0323	0.8695	1.0926	0.529
Contribution From STREET 14, Pipe 58 - 60						4.65				0.00				0.00				0.00	14.11														
	60	61	0.37	0.68	0.70	6.01			0.00	0.00			0.00	0.00			0.00	0.00	14.11	63.94	86.54	101.36	148.04	384	675	675	CONC	0.40	88.0	531.6346	1.4856	0.9872	0.723
To STREET 17, Pipe 61 - 65						6.01				0.00				0.00				0.00	15.10														
STREET 19																																	
					0.00	0.00	3.23	0.70	6.29	6.29			0.00	0.00			0.00	0.00	15.00														
	22	23	0.10	0.68	0.19	0.19			0.00	6.29			0.00	0.00			0.00	0.00	15.00	61.77	83.56	97.85	142.89	537	825	825	CONC	0.25	56.5	717.7178	1.3426	0.7014	0.748
	23	24	0.14	0.68	0.26	0.45			0.00	6.29			0.00	0.00			0.00	0.00	15.70	60.16	81.36	95.27	139.10	539	825	825	CONC	0.25	13.5	717.7178	1.3426	0.1676	0.751
	24	25			0.00	0.45			0.00	6.29			0.00	0.00			0.00	0.00	15.87	59.79	80.85	94.67	138.22	535	825	825	CONC	0.25	25.5	717.7178	1.3426	0.3165	0.746
To STREET 18, Pipe 25 - 26						0.45				6.29				0.00				0.00	16.19														
STREET 19																																	
	17	18	0.25	0.68	0.47	0.47			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	36	300	300	PVC	0.35	50.5	57.2089	0.8093	1.0399	0.634
	18	19	0.06	0.68	0.11	0.59			0.00	0.00			0.00	0.00			0.00	0.00	11.04	73.03	99.00	116.03	169.58	43	300	300	PVC	0.35	13.5	57.2089	0.8093	0.2780	0.748
	19	20	0.22	0.68	0.42	1.00			0.00	0.00			0.00	0.00			0.00	0.00	11.32	72.09	97.71	114.51	167.35	72	450	450	CONC	0.20	63.0	127.5033	0.8017	1.3097	0.566
	20	21	0.16	0.68	0.30	1.30			0.00	0.00			0.00	0.00			0.00	0.00	12.63	68.00	92.10	107.90	157.64	89	450	450	CONC	0.20	13.5	127.5033	0.8017	0.2807	0.696
	21	25			0.00	1.30			0.00	0.00			0.00	0.00			0.00	0.00	12.91	67.19	90.99	106.59	155.72	88	450	450	CONC	0.20	31.5	127.5033	0.8017	0.6549	0.687
To STREET 18, Pipe 25 - 26						1.30				0.00				0.00				0.00	13.56														

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

LICENSED PROFESSIONAL ENGINEER
S. L. MERRICK
100186523
2021-12-16
PROVINCE OF ONTARIO

JOB # 19-1153

Designed: GGG	PROJECT: Cardinal Creek Village South FSR		
Checked: SLM	LOCATION: City of Ottawa		
Dwg. Reference: 2	File Ref: 19-1153	Date: 25 Nov 2021	Sheet No. SHEET 2 OF 5

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
STREET 18																																	
Contribution From STREET 19, Pipe 21 - 25					1.30					0.00				0.00				0.00	13.56														
Contribution From STREET 19, Pipe 24 - 25					0.45					6.29				0.00				0.00	16.19														
	25	26	0.67	0.68	1.27	3.02			0.00	6.29			0.00	0.00			0.00	0.00	16.19	59.10	79.91	93.57	136.61	681	975	975	CONC	0.20	90.0	1002.2295	1.3424	1.1174	0.680
	26	29	0.67	0.68	1.27	4.29			0.00	6.29			0.00	0.00			0.00	0.00	17.30	56.82	76.79	89.89	131.21	726	975	975	CONC	0.20	90.0	1002.2295	1.3424	1.1174	0.725
To STREET 13, Pipe 29 - 32						4.29				6.29				0.00				0.00	18.42														
STREET 13																																	
			0.43	0.68	0.81	0.81			0.00	0.00			0.00	0.00			0.00	0.00															
	27	28	0.60	0.68	1.13	1.95			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	150	375	375	PVC	3.40	92.0	323.2928	2.9271	0.5238	0.463
	28	29	0.68	0.68	1.29	3.23			0.00	0.00			0.00	0.00			0.00	0.00	10.52	74.85	101.50	118.98	173.91	242	450	450	CONC	1.65	97.0	366.2255	2.3027	0.7021	0.661
Contribution From STREET 18, Pipe 26 - 29						4.29				6.29				0.00				0.00	18.42														
	29	32	0.40	0.68	0.76	8.28			0.00	6.29			0.00	0.00			0.00	0.00	18.42	54.72	73.92	86.52	126.27	918	975	975	CONC	0.30	86.0	1227.4754	1.6440	0.8718	0.748
Contribution From STREET 15, Pipe 31 - 32						0.00				3.99				0.00				0.00	12.79														
	32	37			0.00	8.28	0.20	0.68	0.38	10.65			0.00	0.00			0.00	0.00	19.29	53.20	71.84	84.08	122.69	1206	975	975	CONC	0.70	86.0	1874.9997	2.5113	0.5707	0.643
To STREET 12, Pipe 37 - 40						8.28				10.65				0.00				0.00	19.86														
STREET 8																																	
	14	15	0.63	0.68	1.19	1.19			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	91	450	450	CONC	0.20	74.0	127.5033	0.8017	1.5384	0.717
	15	16	0.49	0.68	0.93	2.12			0.00	0.00			0.00	0.00			0.00	0.00	11.54	71.36	96.71	113.33	165.62	151	525	525	CONC	0.25	68.5	215.0311	0.9933	1.1493	0.703
To STREET 12, Pipe 16 - 37						2.12				0.00				0.00				0.00	12.69														
	14	33	0.09	0.68	0.17	0.17			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	13	300	300	PVC	0.35	15.5	57.2089	0.8093	0.3192	0.228
	33	34	0.27	0.68	0.51	0.68			0.00	0.00			0.00	0.00			0.00	0.00	10.32	75.60	102.54	120.19	175.69	51	450	450	CONC	0.20	77.5	127.5033	0.8017	1.6112	0.404
	34	36	0.62	0.68	1.17	1.85			0.00	0.00			0.00	0.00			0.00	0.00	11.93	70.11	94.99	111.31	162.65	130	525	525	CONC	0.20	74.5	192.3297	0.8885	1.3975	0.675
	36	37	0.44	0.68	0.83	2.68			0.00	0.00			0.00	0.00			0.00	0.00	13.33	66.02	89.38	104.70	152.95	177	600	600	CONC	0.15	64.5	237.8056	0.8411	1.2781	0.745
To STREET 12, Pipe 37 - 40						2.68				0.00				0.00				0.00	14.61														
STREET 10																																	
	5	6	0.34	0.68	0.64	0.64			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	76.5	127.5033	0.8017	1.5904	0.387
	6	7	0.34	0.68	0.64	1.29			0.00	0.00			0.00	0.00			0.00	0.00	11.59	71.19	96.48	113.06	165.22	92	450	450	CONC	0.20	82.5	127.5033	0.8017	1.7151	0.718
To STREET 9, Pipe 7 - 9						1.29				0.00				0.00				0.00	13.31														
STREET 9																																	
	1	2	0.22	0.68	0.42	0.42			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	32	300	300	PVC	0.35	73.0	57.2089	0.8093	1.5033	0.558
	2	3	0.23	0.68	0.43	0.85			0.00	0.00			0.00	0.00			0.00	0.00	11.50	71.48	96.87	113.52	165.89	61	450	450	CONC	0.20	85.0	127.5033	0.8017	1.7671	0.477
	3	7	0.16	0.68	0.30	1.15			0.00	0.00			0.00	0.00			0.00	0.00	13.27	66.18	89.60	104.96	153.32	76	450	450	CONC	0.20	52.0	127.5033	0.8017	1.0810	0.598
Contribution From STREET 10, Pipe 6 - 7						1.29				0.00				0.00				0.00	13.31														
	7	9	0.12	0.68	0.23	2.67			0.00	0.00			0.00	0.00			0.00	0.00	14.35	63.34	85.71	100.39	146.62	169	525	525	CONC	0.30	46.5	235.5548	1.0881	0.7122	0.717
To STREET 9, Pipe 9 - 10						2.67				0.00				0.00				0.00	15.06														
STREET 9																																	
	8	9	0.05	0.68	0.09	0.09			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	7	300	300	PVC	0.35	37.5	57.2089	0.8093	0.7722	0.127
Contribution From STREET 9, Pipe 7 - 9						2.67				0.00				0.00				0.00	15.06														
	9	10	0.53	0.68	1.00	3.76			0.00	0.00			0.00	0.00			0.00	0.00	15.06	61.62	83.35	97.61	142.54	232	675	675	CONC	0.15	89.5	325.5584	0.9098	1.6396	0.712
	10	13	0.51	0.68	0.96	4.73			0.00	0.00			0.00	0.00			0.00	0.00	16.70	58.02	78.43	91.82	134.05	274	675	675	CONC	0.20	83.5	375.9224	1.0505	1.3248	0.729
To STREET 12, Pipe 13 - 16						4.73				0.00				0.00				0.00	18.03														
STREET 12																																	
	11	13	0.53	0.68	1.00	1.00			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	77	375	375	PVC	0.70	92.5	146.6917	1.3282	1.1607	0.525
Contribution From STREET 9, Pipe 10 - 13						4.73				0.00				0.00				0.00	18.03														
	13	16	0.37	0.68	0.70	6.43			0.00	0.00			0.00	0.00			0.00	0.00	18.03	55.44	74.90	87.67	127.96	356	750	750	CONC	0.20	76.0	497.8726	1.1270	1.1240	0.716
Contribution From STREET 8, Pipe 15 - 16						2.12				0.00				0.00				0.00	12.69														
	16	37	0.33	0.68	0.62	9.17			0.00	0.00			0.00	0.00			0.00	0.00	19.15	53.44	72.17	84.46	123.25	490	900	900	CONC	0.15	88.0	701.1305	1.1021	1.3308	0.699
Contribution From STREET 13, Pipe 32 - 37						8.28				10.65				0.00				0.00	19.86														
Contribution From STREET 8, Pipe 36 - 37						2.68				0.00				0.00				0.00	14.61														
	37	40			0.00	20.13	0.40	0.68	0.76	11.41			0.00	0.00			0.00	0.00	20.48	51.27	69.21	80.99	118.16	1822	1200	1200	CONC	0.40	76.0	2465.7735	2.1802	0.5810	0.739

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

LICENSED PROFESSIONAL ENGINEER
S. L. MERRICK
100186523
2021-12-16
PROVINCE OF ONTARIO

Designed: GGG
Checked: SLM
Dwg. Reference: 2

PROJECT: **Cardinal Creek Village South FSR**
LOCATION: **City of Ottawa**
File Ref: 19-1153
Date: 25 Nov 2021
Sheet No. SHEET 3 OF 5

1153_STM_prelim.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

	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
Contribution From STREET 7, Pipe 39 - 40						1.72				0.00				0.00				0.00	11.80														
	40	65			0.00	21.85	0.43	0.68	0.81	12.22			0.00	0.00			0.00	0.00	21.06	50.38	68.00	79.57	116.07	1932	1350	1350	CONC	0.25	88.0	2668.7010	1.8644	0.7867	0.724
Contribution From STREET 17, Pipe 61 - 65						13.35				2.76				0.00				0.00	16.82														
Contribution From STREET 7, Pipe 64 - 65						2.53				0.00				0.00				0.00	13.76														
	65	67			0.00	37.73	0.18	0.68	0.34	15.32			0.00	0.00			0.00	0.00	21.85	49.23	66.43	77.73	113.38	2875	1500	1500	CONC	0.30	76.0	3871.7786	2.1910	0.5781	0.743
Contribution From STREET 6, Pipe 66 - 67						0.96				0.00				0.00				0.00	11.63														
					0.00	38.70	2.44	0.70	4.75	20.07			0.00	0.00			0.00	0.00	15.00														
	67	71			0.00	38.70	0.20	0.68	0.38	20.45			0.00	0.00			0.00	0.00	22.43	48.43	65.34	76.44	111.49	3210	1650	1650	CONC	0.25	88.0	4557.2242	2.1313	0.6882	0.704
Contribution From STREET 6, Pipe 70 - 71						2.10				0.00				0.00				0.00	13.41														
	71	73			0.00	40.79	0.19	0.68	0.36	20.80			0.00	0.00			0.00	0.00	23.12	47.50	64.08	74.96	109.32	3271	1650	1650	CONC	0.25	82.0	4557.2242	2.1313	0.6412	0.718
Contribution From STREET 4, Pipe 72 - 73						0.47				0.00				0.00				0.00	10.66														
	73	75			0.00	41.27	0.10	0.68	0.19	20.99			0.00	0.00			0.00	0.00	23.76	46.68	62.95	73.64	107.39	3248	1650	1650	CONC	0.25	47.0	4557.2242	2.1313	0.3675	0.713
Contribution From STREET 5, Pipe 74 - 75						0.38				0.00				0.00				0.00	10.77														
	75	76			0.00	41.65	0.09	0.68	0.17	21.16			0.00	0.00			0.00	0.00	24.13	46.22	62.33	72.91	106.31	3244	1650	1650	CONC	0.25	41.0	4557.2242	2.1313	0.3206	0.712
To STREET 4, Pipe 76 - 82						41.65				21.16				0.00				0.00	24.45														
STREET 4																																	
	72	73	0.25	0.68	0.47	0.47			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	36	300	300	PVC	0.70	45.5	80.9057	1.1446	0.6625	0.449
To STREET 12, Pipe 73 - 75						0.47				0.00				0.00				0.00	10.66														
	72	77	0.32	0.68	0.60	0.60			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	46	375	375	PVC	0.30	54.0	96.0323	0.8695	1.0351	0.484
	77	79	0.19	0.68	0.36	0.96			0.00	0.00			0.00	0.00			0.00	0.00	11.04	73.05	99.03	116.06	169.62	70	450	450	CONC	0.20	46.5	127.5033	0.8017	0.9667	0.552
Contribution From STREET 5, Pipe 74 - 79						0.38				0.00				0.00				0.00	11.11														
	79	81	0.20	0.68	0.38	1.72			0.00	0.00			0.00	0.00			0.00	0.00	12.00	69.89	94.69	110.95	162.12	120	525	525	CONC	0.20	40.0	192.3297	0.8885	0.7504	0.625
	81	82	0.38	0.68	0.72	2.44			0.00	0.00			0.00	0.00			0.00	0.00	12.75	67.64	91.60	107.32	156.78	165	525	525	CONC	0.30	48.0	235.5548	1.0881	0.7352	0.700
To STREET 2, Pipe 82 - 84						2.44				0.00				0.00				0.00	13.49														
Contribution From STREET 12, Pipe 75 - 76						41.65				21.16				0.00				0.00	24.45														
	76	82	0.18	0.68	0.34	41.99			0.00	21.16			0.00	0.00			0.00	0.00	24.45	45.83	61.79	72.28	105.39	3232	1650	1650	CONC	0.25	61.5	4557.2242	2.1313	0.4809	0.709
To STREET 2, Pipe 82 - 84						41.99				21.16				0.00				0.00	24.93														
STREET 2																																	
	83	84	0.18	0.68	0.34	0.34			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	26	300	300	PVC	0.35	16.0	57.2089	0.8093	0.3295	0.457
To POND INLET, Pipe 84 - HW1						0.34				0.00				0.00				0.00	10.33														
	89	91	0.43	0.68	0.81	0.81			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	62	375	375	PVC	0.45	90.0	117.6150	1.0649	1.4086	0.531
To STREET 3, Pipe 91 - 92						0.81				0.00				0.00				0.00	11.41														
	96	97	0.24	0.68	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	2.70	48.0	158.8956	2.2479	0.3559	0.219
	97	98	0.14	0.68	0.26	0.72			0.00	0.00			0.00	0.00			0.00	0.00	10.36	75.46	102.35	119.97	175.37	54	300	300	PVC	1.95	35.5	135.0353	1.9104	0.3097	0.401
	98	99	0.20	0.68	0.38	1.10			0.00	0.00			0.00	0.00			0.00	0.00	10.67	74.34	100.80	118.15	172.69	82	300	300	PVC	1.80	42.0	129.7377	1.8354	0.3814	0.628
To SERVICING BLOCK 1, Pipe 99 - 101						1.10				0.00				0.00				0.00	11.05														
	86	87	1.22	0.68	2.31	2.31			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	177	375	375	PVC	3.55	125.0	330.3473	2.9910	0.6965	0.536
			-3.66	0.68	-6.92	-4.61			0.00	0.00			0.00	0.00			0.00	0.00															
			0.18	0.68	0.34	-4.27			0.00	0.00			0.00	0.00			0.00	0.00															
	87	94			0.00	-4.27			0.00	0.00			0.00	0.00	3.66	0.68	6.92	6.92	10.70	74.23	100.65	117.97	172.43	876	975	975	CONC	0.30	74.0	1227.4754	1.6440	0.7502	0.714
Contribution From STREET 3, Pipe 93 - 94						2.70				0.00				0.00				0.00	12.09														
	94	95	0.25	0.68	0.47	-1.10			0.00	0.00			0.00	0.00			0.00	6.92	12.09	69.63	94.33	110.53	161.50	1041	1050	1050	CONC	0.30	75.0	1495.6798	1.7273	0.7237	0.696
To SERVICING BLOCK 1, Pipe 95 - 101						-1.10				0.00				0.00				6.92	12.81														
Contribution From STREET 4, Pipe 76 - 82						41.99				21.16				0.00				0.00	24.93														
Contribution From STREET 4, Pipe 81 - 82						2.44				0.00				0.00				0.00	13.49														
	82	84	0.35	0.68	0.66	45.09			0.00	21.16			0.00	0.00			0.00	0.00	24.93	45.25	61.01	71.36	104.05	3332	1650	1650	CONC	0.25	78.0	4557.2242	2.1313	0.6100	0.731
To POND INLET, Pipe 84 - HW1						45.09				21.16				0.00				0.00	25.54														

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:	Cardinal Creek Village South Phase 1
Checked:	SLM	LOCATION:	City of Ottawa
Dwg. Reference:	2	File Ref: 19-1153	Date: 25 Nov 2021

Sheet No: SHEET 4 OF 5

1453_STM_prelim.xlsx

Job # 19-1153

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
POND INLET																																
Contribution From STREET 2, Pipe 82 - 84						45.09				21.16				0.00				0.00	25.54													
Contribution From STREET 2, Pipe 83 - 84						0.34				0.00				0.00				0.00	10.33													
	84	HW1			0.00	45.43			0.00	21.16			0.00	0.00			0.00	0.00	25.54	44.55	60.05	70.23	102.40	3295	1650	1650	CONC	0.25	29.0	4557.2242	2.1313	0.2268	0.723

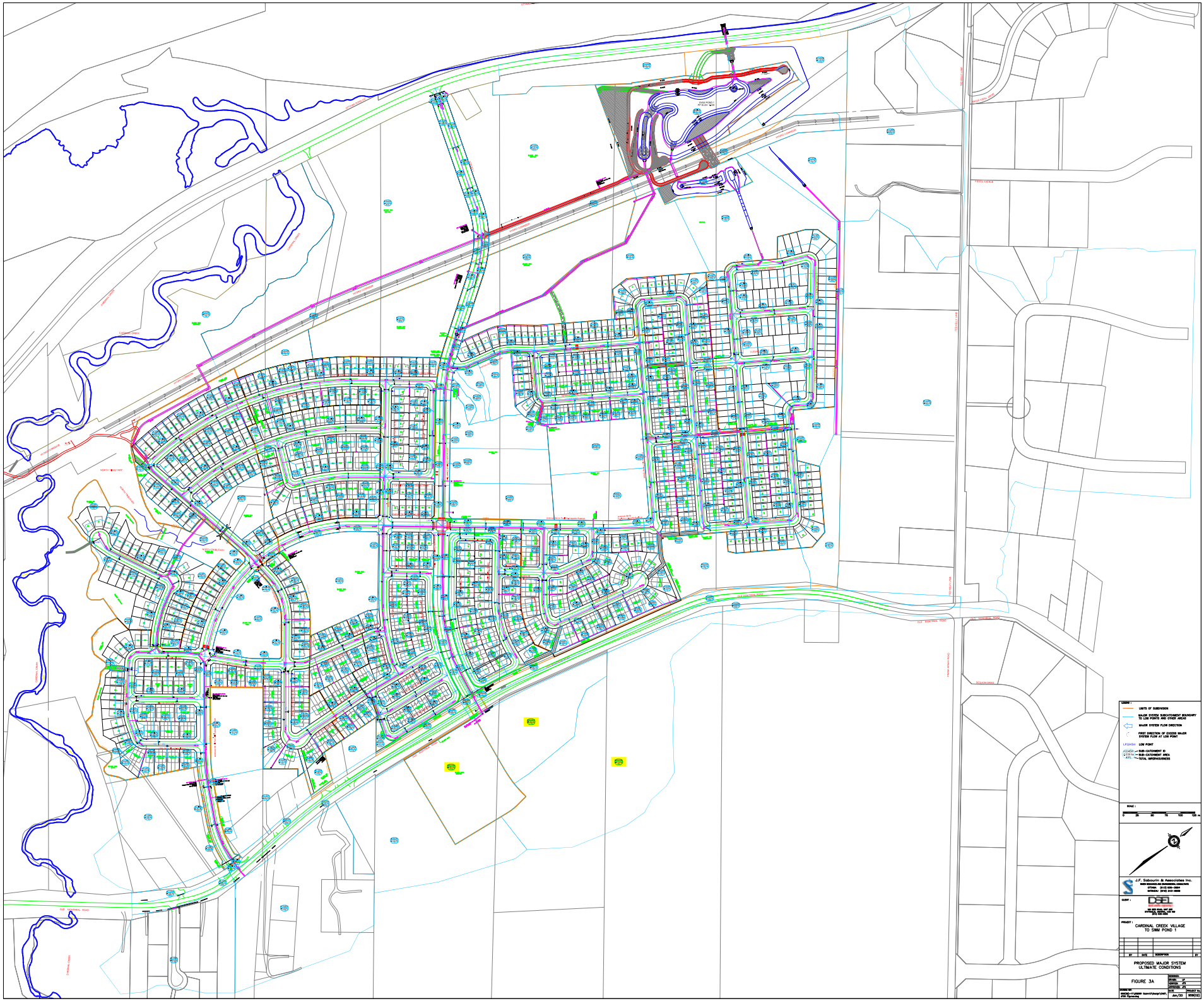
LICENSED PROFESSIONAL ENGINEER
S. L. MERRICK
100186523
2021-12-16
PROVINCE OF ONTARIO
JOB # 19-1153

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
Checked: SLM
Dwg. Reference: 2

PROJECT: **Cardinal Creek Village South FSR**
LOCATION: **City of Ottawa**
File Ref: 19-1153
Date: 25 Nov 2021
Sheet No. SHEET 5 OF 5


LEGEND :
LIMITS OF SUBDIVISION
MAJOR SYSTEM SUBCATCHMENT BOUNDARY TO LOW POINTS AND OTHER AREAS
MAJOR SYSTEM FLOW DIRECTION
FIRST DIRECTION OF EXCESS MAJOR SYSTEM FLOW AT LOW POINT
LP204SW LOW POINT
A204SW SUB-CATCHMENT ID
0.210 ha SUB-CATCHMENT AREA
55% TOTAL IMPERVIOUSNESS
SCALE :
0 25 50 75 100 125 m
J.F. Sabourin & Associates Inc.
DSEL
PROJECT :
CARDINAL CREEK VILLAGE
TO SWM POND 1
NO. DATE DESCRIPTION BY
PROPOSED MAJOR SYSTEM
ULTIMATE CONDITIONS
FIGURE 3A
DESIGNED
DRAWN
CHECKED
APPROVED
DATE
PROJECT No.
Jun/20 9536(02)

Estimated Peak Stormwater Flow Rate
City of Ottawa Sewer Design Guidelines, 2012

Existing Drainage Charateristics

Ex Area to Ditch	1.31	ha	
Additional Area to Ditch	1.30	ha	
Total Area to Ditch	2.61	ha	
C	0.45	Rational Method runoff coefficient	
L	95	m	<-- Length equals longest path of travel to ditch
Up Elev	96.5	m	
Dn Elev	95.50	m	
Slope	1.1	%	
Tc	20.3	min	<-- Does not include travel time in ditch

1) Time of Concentration per Federal Aviation Administration

$$t_c = \frac{1.8(1.1-C)L^{0.5}}{S^{0.333}}$$

tc, in minutes
C, rational method coefficient, (-)
L, length in ft
S, average watershed slope in %

Estimated Peak Flow

	2-year	5-year	100-year	
i	76.8	104.2	178.6	mm/hr
Q	250.6	339.9	728.2	L/s

Note:
C value for the 100-year storm is increased by 25%, to a maximum of 1.0 per Ottawa Sewer Design Guidelines (5.4.5.2.1)

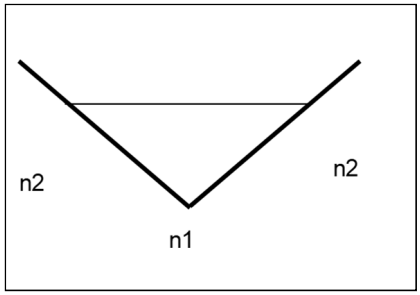
Date: December 2021
File: 19-1153

CCV South - Cox Country Roadside Ditch
Conveyance Calculation

Note: Existing roadside ditch dimensions & slope based on most restrictive section per Topographic Survey prepared by AOV (Job No. 22004-20) received July 23, 2021

Input:

Bottom Width	1.60	m	
Bottom "n1"	0.035		
Side Slope	3	:1	
Side "n2"	0.035		
Flow Depth	0.53	m	
Ditch Min. Dep	1.30	m	**OK**
Slope	0.0010	m/m	



Output:

Flow	**0.746**	**m^3/s**	Capacity
>	**0.728**	**m^3/s**	100Yr Flow refer to rational method calc
	OK		
Velocity	**0.44**	**m/s**	

DRAWINGS & FIGURES

OTTAWA RIVER

OTTAWA ROAD 174

CARDINAL CREEK DRIVE

CARDINAL CREEK
VILLAGE
PHASE 5 & 6

CARDINAL CREEK
VILLAGE
PHASE 4

OLD MONTREAL ROAD

COX COUNTRY ROAD

SOUTH TRIBUTARY
TO CARDINAL CREEK

FUTURE
EXTERNAL LANDS

LEGEND

SITE BOUNDARY

DSEL
120 Iber Road, Unit 103
Stittsville, ON K2S 1E9
TEL: (613) 836-0856
FAX: (613) 836-7183
www.DSEL.ca

SITE LOCATION
CARDINAL CREEK VILLAGE SOUTH

PROJECT No.:	19-1153
SCALE:	1:7500
DATE:	DECEMBER 2021
FIGURE:	1

CARDINAL CREEK VILLAGE PHASE 5&6
CITY FILE NO. D07-16-13-002 PH5PH6
PREPARED BY DSEL, MAY 2021.
CONSTRUCTION COMPLETED.

CARDINAL CREEK VILLAGE PHASE 4
CITY FILE NO. D07-16-13-002 PH4
PREPARED BY DSEL, SEPT. 2017
CONSTRUCTION COMPLETED.

OUTLET STRUCTURE, PIPES AND ARMOUR STONE SPILLWAY SHOWN CONCEPTUALLY, DESIGN OF AMOUR STONE SPILLWAY TO BE PROVIDED BY GEOMORPHIX AT DETAILED DESIGN

EX. 600ø CSP CULVERT
IN INV.=91.92
OUT INV.=91.87

EX. 500ø CSP CULVERT
INV.=91.55

MATCH EXISTING SWALE

ABANDON EXISTING CULVERT

EX. 900ø CSP CULVERT
IN INV.=88.48
OUT INV.=88.53

REGRADE EXISTING SWALE. REMOVE LOW POINT AND DIRECT FLOW FROM DITCH TO SOUTH CULVERT.

EX. 600ø CSP CULVERT
IN INV.=89.09
OUT INV.=89.03

EX. 900ø CULVERT
IN INV=87.31
OUT INV=87.31

EX. CULVERT

1.30 HA DIRECTED TO 900ø CULVERT VIA RE-GRADED DITCH

1.31 HA DIRECTED TO ROADSIDE DITCH

71.69 HA DIRECTED TO 900ø CULVERT

XS 1107.3 PER CARDINAL CREEK 100 YEAR EVENT RISK MAP MARCH 18, 2013 100-YR =77.67

XS 1281.8 PER CARDINAL CREEK 100 YEAR EVENT RISK MAP MARCH 18, 2013 100-YR =80.47

XS 881.4 PER CARDINAL CREEK 100 YEAR EVENT RISK MAP MARCH 18, 2013 100-YR =52.83

XS 951.3 PER CARDINAL CREEK 100 YEAR EVENT RISK MAP MARCH 18, 2013 100-YR =74.04

XS 829.4 PER CARDINAL CREEK 100 YEAR EVENT RISK MAP MARCH 18, 2013 100-YR =73.30

DINAL CREEK 100 YEAR EVENT RISK MAP MARCH 18, 2013 100-YR =71.86

XS 1424.5 PER CARDINAL CREEK 100 YEAR EVENT RISK MAP MARCH 18, 2013 100-YR = 82.59

XS 1590.4 PER CARDINAL CREEK 100 YEAR EVENT RISK MAP MARCH 18, 2013 100-YR = 86.80

SOUTH TRIBUTARY HAZARD LIMITS PER PATERSON GROUP (PROJ# PG5201-1) DATED NOVEMBER 29, 2021

XS 1727.5 PER CARDINAL CREEK 100 YEAR EVENT RISK MAP MARCH 18, 2013 100-YR = 87.64

XS 1852.6 PER CARDINAL CREEK 100 YEAR EVENT RISK MAP MARCH 18, 2013

FUTURE DEVELOPMENT LANDS

LEGEND

- SUBJECT LANDS
- STORM TRUNK
- LOCAL STORM SEWER
- EXISTING STORM SEWER
- STORM DRAINAGE AREA
- EXTERNAL STORM DRAINAGE AREA
- STORM MANHOLE
- EXISTING STORM MANHOLE
- DRAINAGE AREA RUNOFF COEFFICIENT UPSTREAM/DOWNSTREAM MANHOLE STORM FREQUENCY
- EXTERNAL DRAINAGE
- EXTERNAL DRAINAGE AREA IN HECTARES EXTERNAL RUNOFF COEFFICIENT UPSTREAM MH DOWNSTREAM MH STORM FREQUENCY
- INFILL WORK AREA

SOUTH TRIBUTARY HAZARD LIMITS PER PATERSON GROUP (PROJ# PG5201-1) DATED NOVEMBER 29, 2021:

- EROSION ACCESS ALLOWANCE
- TOE EROSION ALLOWANCE/ LIMIT OF HAZARD LANDS
- STABLE SLOPE ALLOWANCE
- HIGH WATER LINE
- TOP OF SLOPE
- 30m SETBACK FROM NHWM

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

CARDINAL CREEK VILLAGE SOUTH

CITY OF OTTAWA

STORM SERVCING PLAN

SCALE:	1:1500	PROJECT No.:	19-1153
DATE:	DECEMBER 2021	DRAWING:	2

CARDINAL CREEK VILLAGE PHASE 4
CITY FILE NO. D07-16-13-002 PH4
PREPARED BY DSEL, SEPT. 2017
CONSTRUCTION COMPLETED.

CARDINAL CREEK VILLAGE PHASE 5&6
CITY FILE NO. D07-16-13-002 PH5PH6
PREPARED BY DSEL, MAY 2021.
CONSTRUCTION COMPLETED.

OUTLET STRUCTURE, PIPES AND ARMOUR STONE SPILLWAY SHOWN CONCEPTUALLY. DESIGN OF AMOUR STONE SPILLWAY TO BE PROVIDED BY GEOMORPHIX AT DETAILED DESIGN

SOUTH TRIBUTARY HAZARD LIMITS PER PATERSON GROUP (PROJ# PG5201-1) DATED NOVEMBER 29, 2021

NETWORK TO BE EXTENDED FOR FUTURE DEVELOPMENTS

FUTURE DEVELOPMENT LANDS

SERVICING BLOCK 1 (9m EASEMENT)
SERVICING BLOCK 2 (9m EASEMENT)
SERVICING BLOCK 3 (6m EASEMENT)
SERVICING BLOCK 4 (6m EASEMENT)
SERVICING BLOCK 5 (6m EASEMENT)
SERVICING BLOCK 6 (6m EASEMENT)

LEGEND

- SUBJECT LANDS
- PROPOSED SANITARY SEWER
- PROPOSED UPPER AND LOWER SANITARY SEWERS
- EXISTING SANITARY SEWER
- SANITARY DRAINAGE BOUNDARY
- EXTERNAL SANITARY DRAINAGE BOUNDARY
- SANITARY MANHOLE
- EXISTING SANITARY MH
- POPULATION PER UNIT / SANITARY DRAINAGE AREA / NUMBER OF UNITS / TOTAL POPULATION / UPSTREAM/DOWNSTREAM MANHOLE
- EXTERNAL POPULATION PER UNIT / EXTERNAL DRAINAGE AREA IN HECTARES / POPULATION PER HA / POPULATION
- FUT. EXTERNAL SANITARY DRAINAGE AREA
- POPULATION
- POPULATION PER HA
- TRIB TYPE
- DOWNSTREAM MANHOLE

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120 Iber Road, Unit 103
Stittsville, Ontario, K2S 1E9
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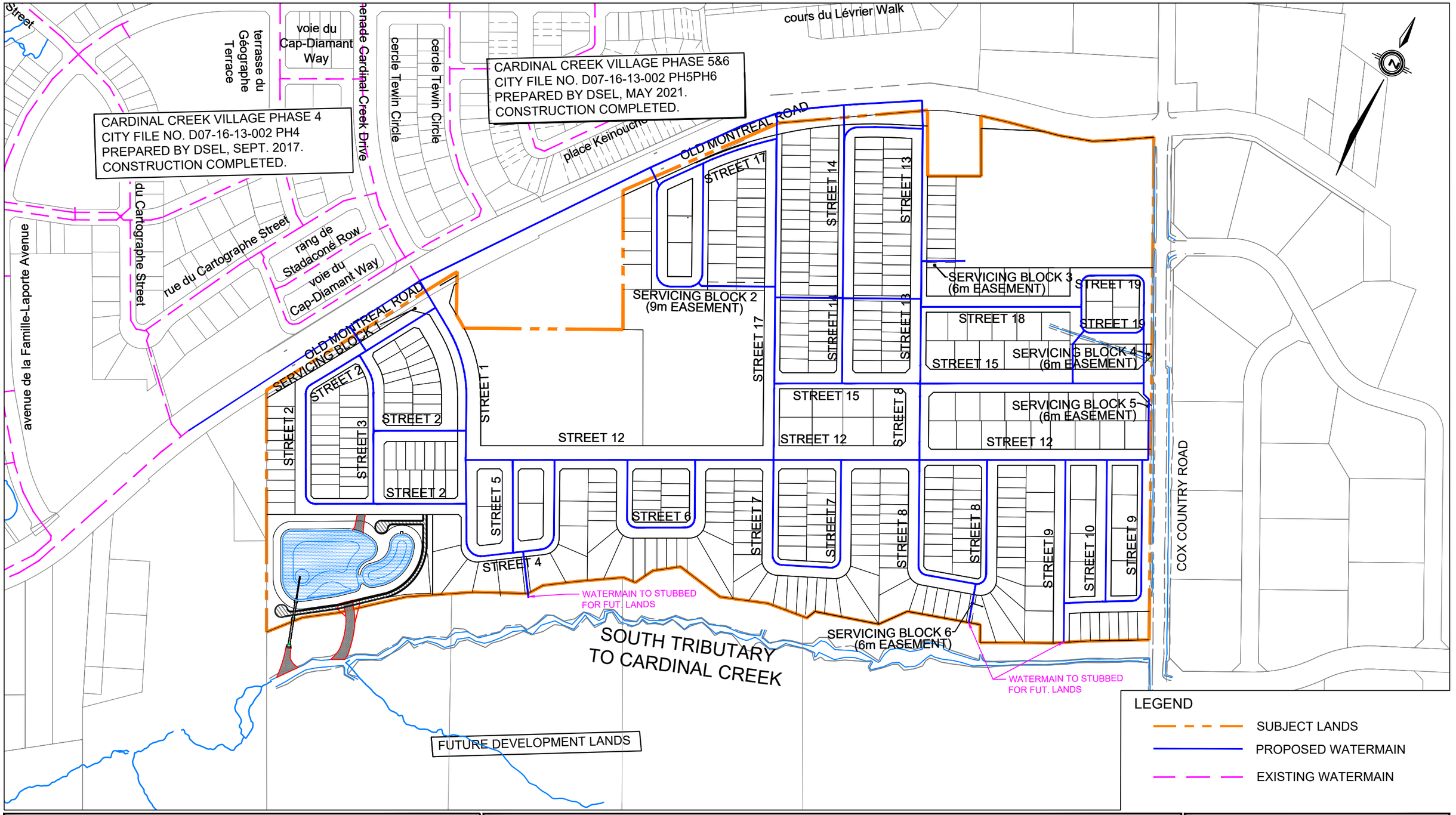
CARDINAL CREEK VILLAGE SOUTH

CITY OF OTTAWA

SANITARY SERVICING PLAN

SCALE:	1:1500	PROJECT No.:	19-1153
DATE:	DECEMBER 2021	DRAWING:	3



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WATERMAIN SERVICING PLAN
CARDINAL CREEK VILLAGE SOUTH

PROJECT No.:	19-1153
SCALE:	1:4000
DATE:	JUNE 2022
FIGURE:	4

GRADING NOTES

- PRELIMINARY GRADING REPRESENTS CENTERLINE OF ROAD LOW POINTS, CENTERLINE GRADES UP TO 0.35m HIGHER AT DETAILED DESIGN TO ACCOUNT FOR ROAD HIGH POINTS, LOT GRADING HIGHER TO BE PROVIDED AT DETAILED DESIGN
- PRELIMINARY GRADING BASED ON MAXIMUM GRADE RAISE OF 2.0m FOR RESIDENTIAL LOTS
- GRADE RAISE RESTRICTIONS AND PLACEMENT OF LIGHTWEIGHT FILL TO BE REVIEWED BY PATERSON GROUP DURING DETAILED DESIGN
- PRELIMINARY GRADING DOES NOT REPRESENT ROAD SAGS, MINIMUM LONGITUDINAL SLOPES OF 0.5% TO BE MAINTAINED DURING DETAILED DESIGN THROUGH SAWTOOTHING
- RETAINING WALLS TO BE DESIGNED BY STRUCTURAL ENGINEER AT DETAILED DESIGN

CARDINAL CREEK VILLAGE PHASE 4
CARDINAL CREEK VILLAGE PHASE 4
CITY FILE NO. D07-16-13-002 PH4
PREPARED BY DSEL, SEPT. 2017
CONSTRUCTION COMPLETED.

CARDINAL CREEK VILLAGE PHASE 5&6
CITY FILE NO. D07-16-13-002 PH5PH6
PREPARED BY DSEL, MAY 2021.
CONSTRUCTION COMPLETED.

OUTLET STRUCTURE, PIPES AND ARMOUR STONE SPILLWAY SHOWN CONCEPTUALLY, DESIGN OF AMOUR STONE SPILLWAY TO BE PROVIDED BY GEOMORPHIX AT DETAILED DESIGN

RDINAL CREEK 100 YEAR EVENT RISK MAP MARCH 18, 2013 100-YR =71.86

XS 829.4 PER CARDINAL CREEK 100 YEAR EVENT RISK MAP MARCH 18, 2013 100-YR =73.30

XS 881.4 PER CARDINAL CREEK 100 YEAR EVENT RISK MAP MARCH 18, 2013 100-YR =52.83

XS 1107.3 PER CARDINAL CREEK 100 YEAR EVENT RISK MAP MARCH 18, 2013 100-YR =77.67

XS 951.3 PER CARDINAL CREEK 100 YEAR EVENT RISK MAP MARCH 18, 2013 100-YR =74.04

XS 1281.8 PER CARDINAL CREEK 100 YEAR EVENT RISK MAP MARCH 18, 2013 100-YR =80.47

XS 1424.5 PER CARDINAL CREEK 100 YEAR EVENT RISK MAP MARCH 18, 2013 100-YR = 82.59

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XS 1852.6 PER CARDINAL CREEK 100 YEAR EVENT RISK MAP MARCH 18, 2013

SOUTH TRIBUTARY HAZARD LIMITS PER PATERSON GROUP (PRO.J# PG5201-1) DATED NOVEMBER 29, 2021

FUTURE DEVELOPMENT LANDS

EX. 600ø CSP CULVERT IN INV.=91.92 OUT INV.=91.87

EX. 500ø CSP CULVERT INV.=91.55

MATCH EXISTING SWALE
EX. 900ø CSP CULVERT IN INV.=88.48 OUT INV.=88.53

REGRADE EXISTING SWALE. REMOVE LOW POINT AND DIRECT FLOW FROM DITCH TO SOUTH CULVERT.
EX. 600ø CSP CULVERT IN INV.=89.09 OUT INV.=89.03 (TO BE REMOVED)

EX. 900ø CULVERT IN INV=87.31 OUT INV=87.31

EX. CULVERT

LEGEND

- SUBJECT LANDS
- STORM OVERLAND FLOW ARROW
- 192.851 PROPOSED CENTERLINE ELEVATION
- 193.50 / 193.50 PROPOSED ELEVATION EXISTING ELEVATION
- [192.851] EXISTING CENTERLINE ELEVATION
- INFILL WORK AREA

SOUTH TRIBUTARY HAZARD LIMITS PER PATERSON GROUP (PROJ# PG5201-1 DATED NOVEMBER 29, 2021

- EROSION ACCESS ALLOWANCE
- TOE EROSION ALLOWANCE/ LIMIT OF HAZARD LANDS
- STABLE SLOPE ALLOWANCE
- RETAINING WALL
- HIGH WATER LINE
- TOP OF SLOPE
- 30m SETBACK FROM NHWM

CUT-FILL DEPTH ALONG CENTER LINE:

CUT DEPTH (m)		FILL DEPTH (m)	
0 - 0.5	1.5 - 2.0	0 - 0.5	1.5 - 2.0
0.5 - 1.0	2.0- 2.5	0.5 - 1.0	2.0- 2.5
1.0 - 1.5	> 2.5	1.0 - 1.5	> 2.5

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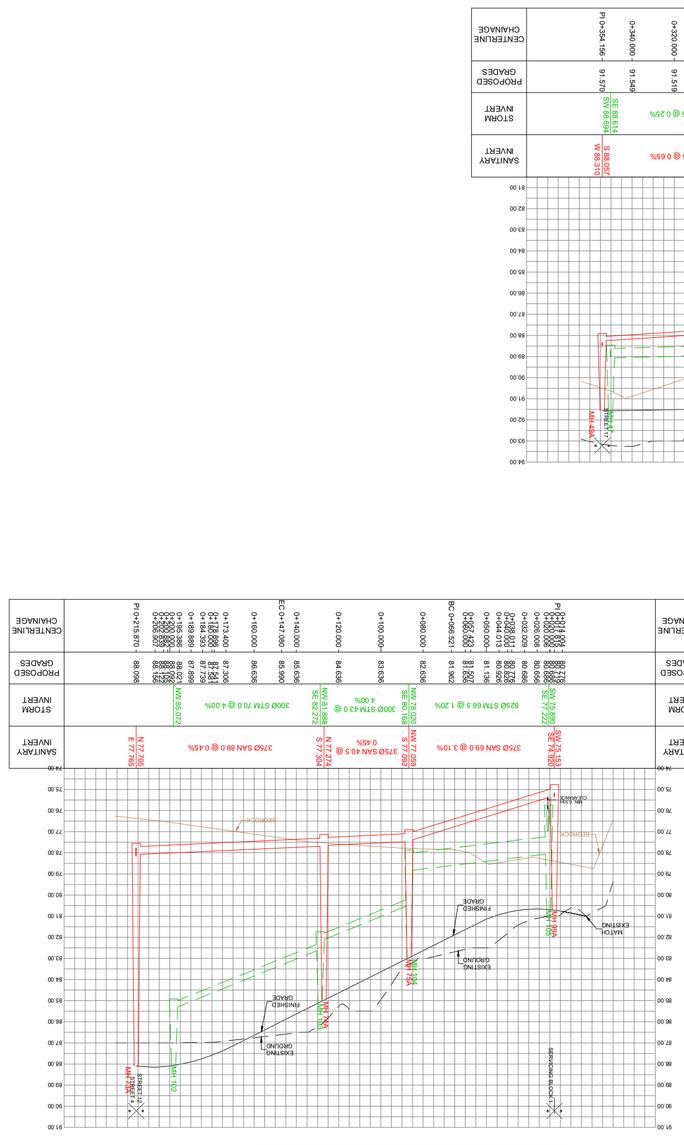
CARDINAL CREEK VILLAGE SOUTH

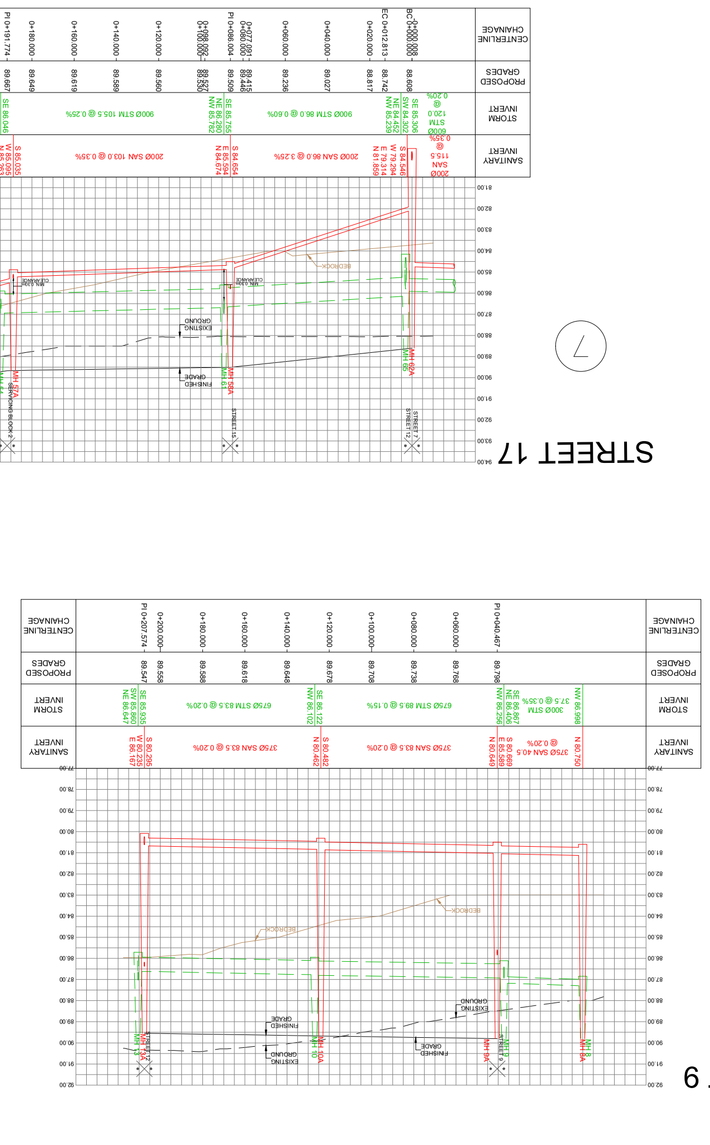
CITY OF OTTAWA

GRADING PLAN

SCALE:	1:1500	PROJECT No.:	19-1153
DATE:	DECEMBER 2021	DRAWING:	5



STREET 1



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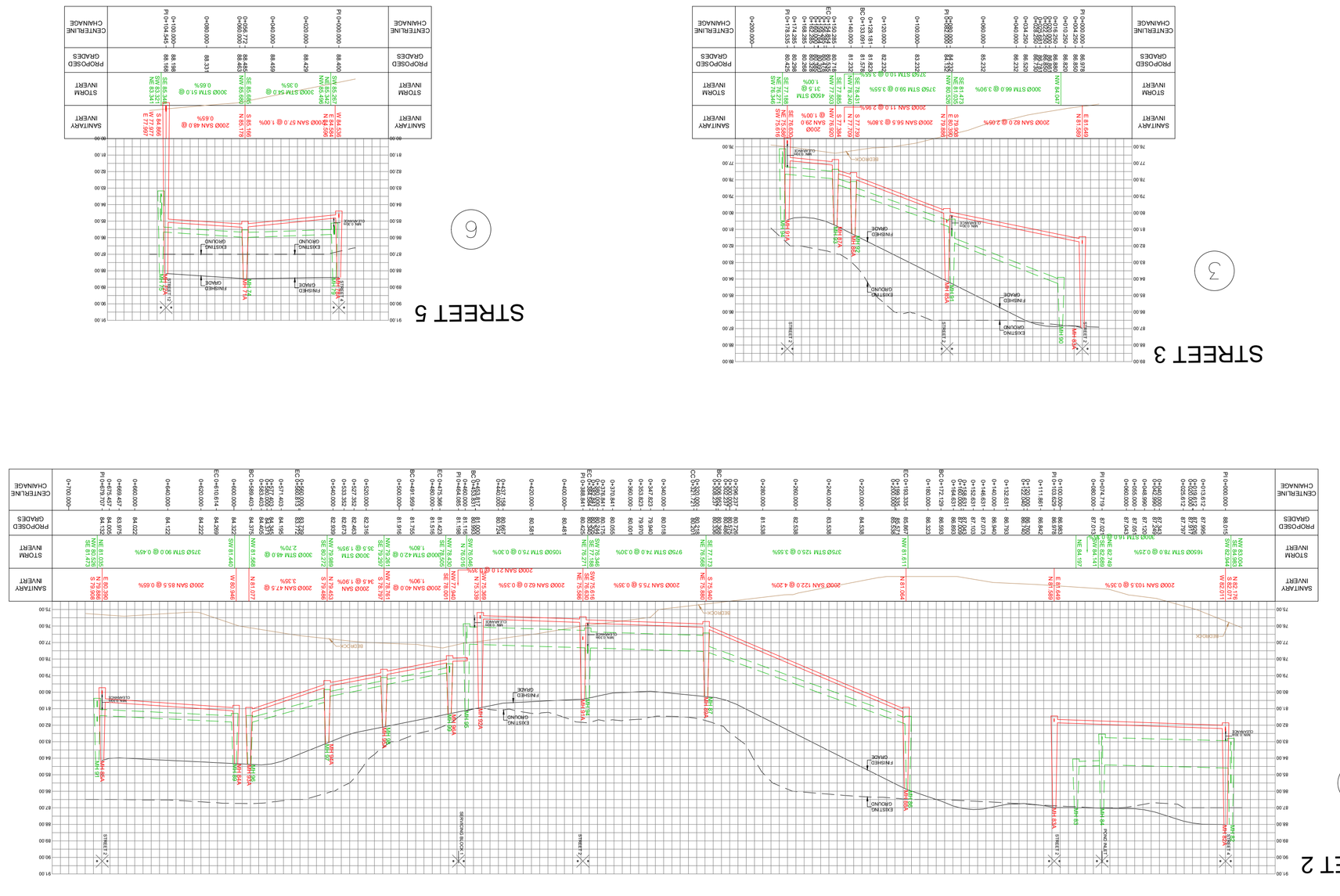


STREET 2

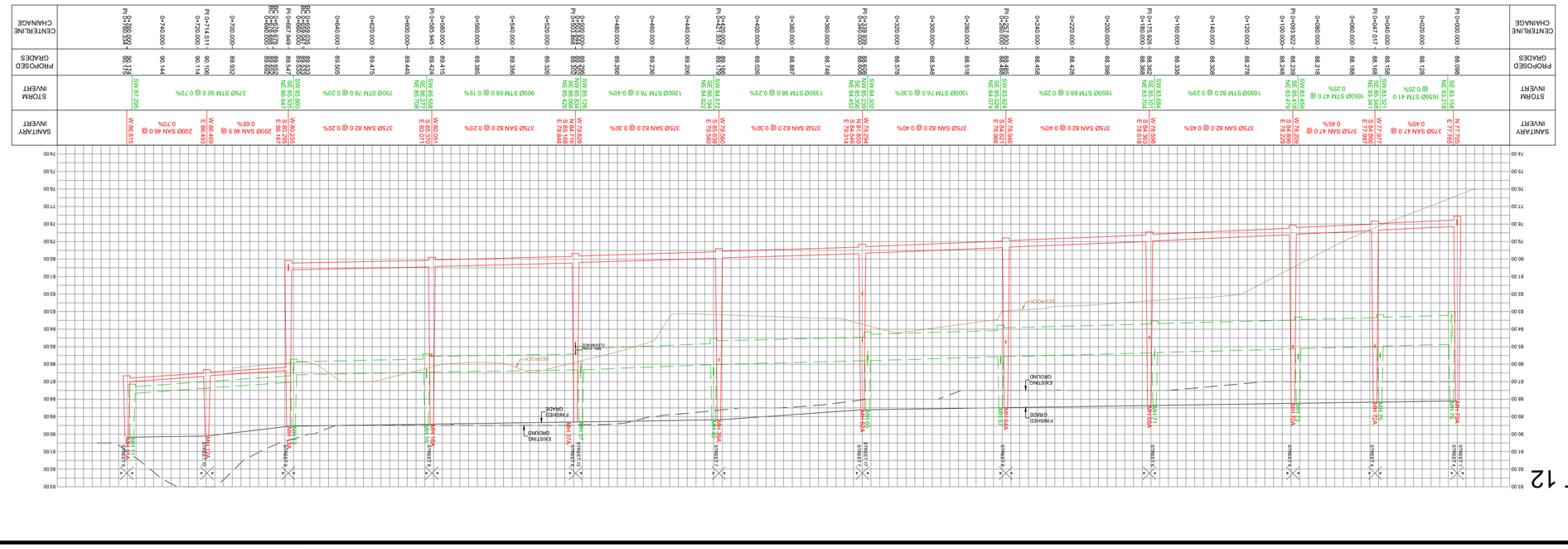
STREET 17

STREET 5

STREET 3

REFER TO OCH REPORT DATED DECEMBER 2021 FOR INTERIM AND ULTIMATE OLD MONTREAL ROAD DESIGN INFORMATION

REFER TO DWG 3 FOR LOCATIONS OF HIGH LEVEL SANITARY SEWERS



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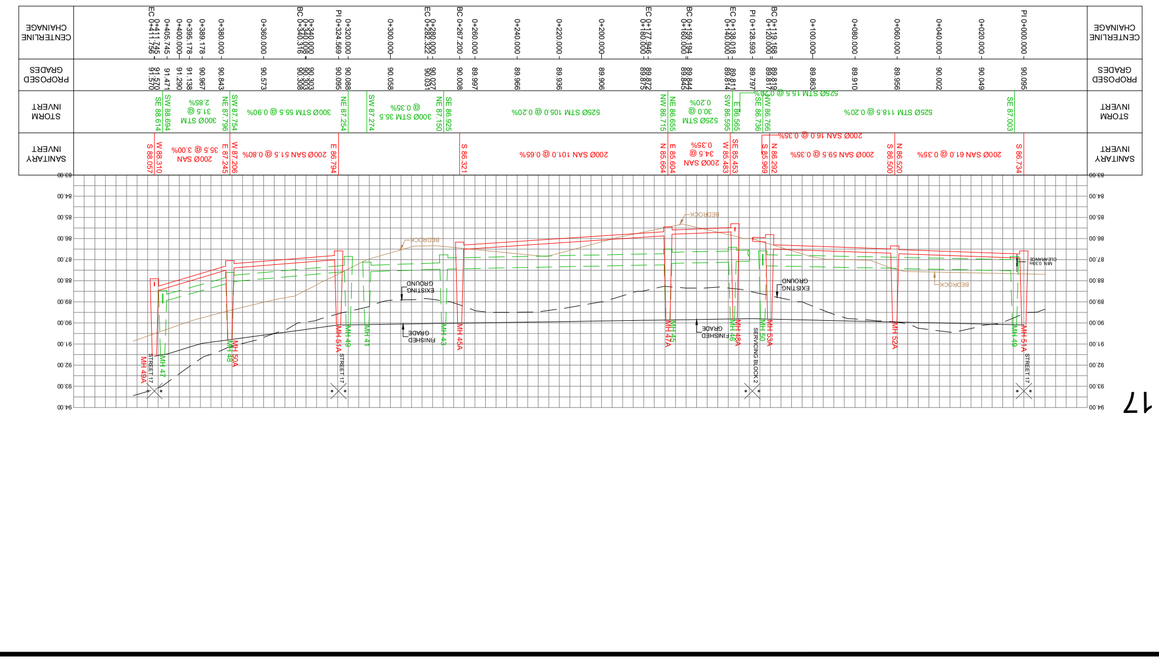

STREET 17

CARDINAL CREEK
VILLAGE SOUTH

CITY OF OTTAWA

PROFILES

SCALE: 1:2000 | PROJECT NO.: 19-1153

DATE: DECEMBER 2021 | DRAWING: 6

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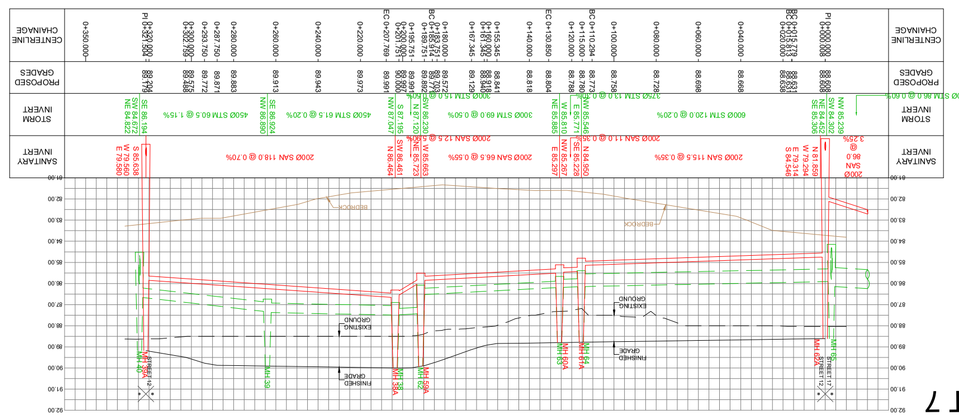

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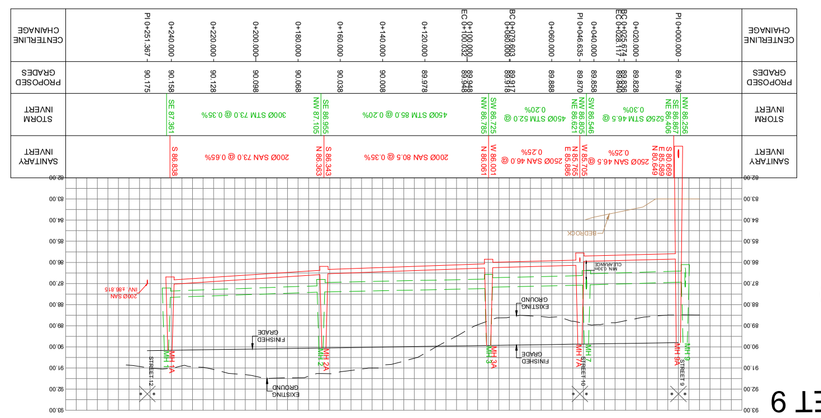

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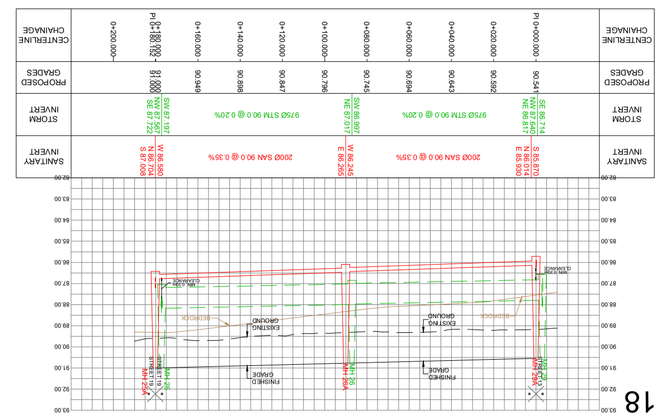

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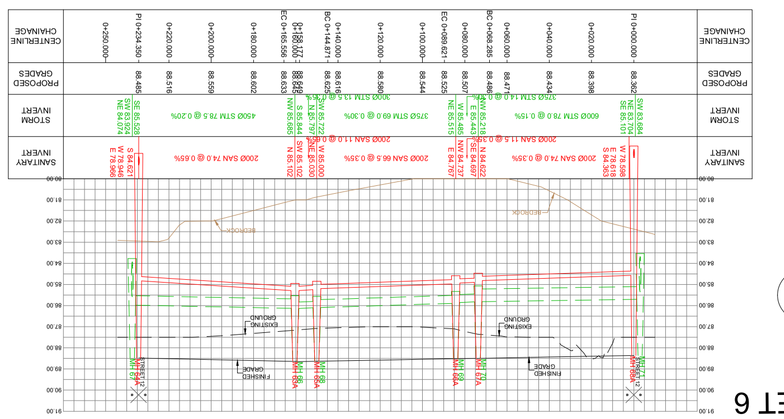

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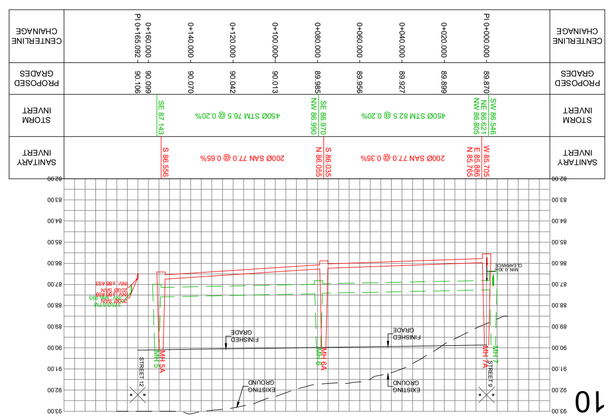

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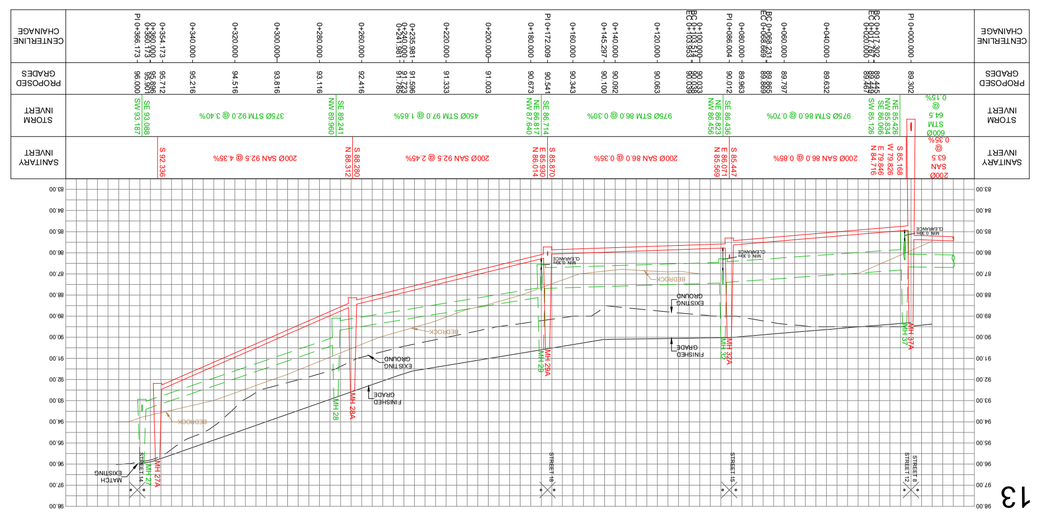

STREET 13

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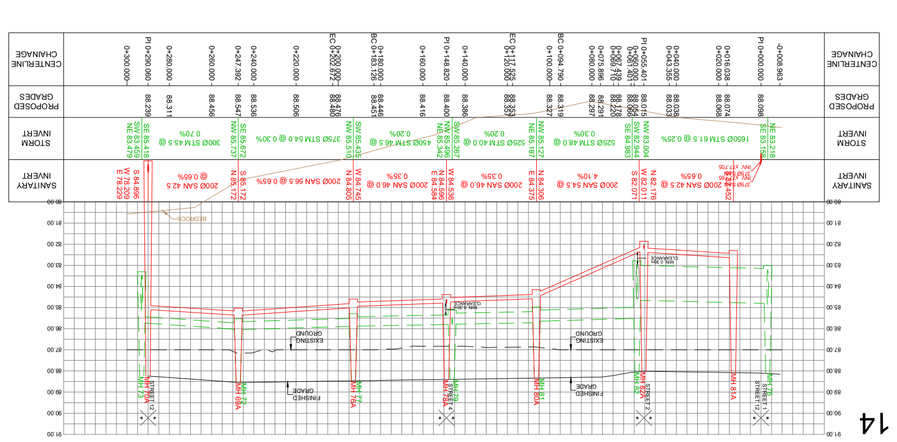

STREET 14

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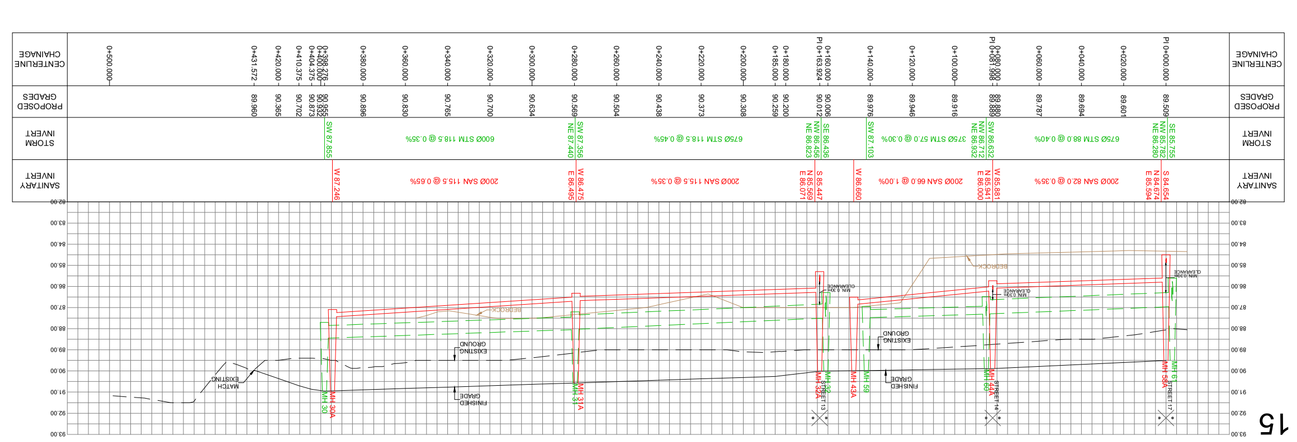

STREET 15

8

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CARDINAL CREEK VILLAGE SOUTH

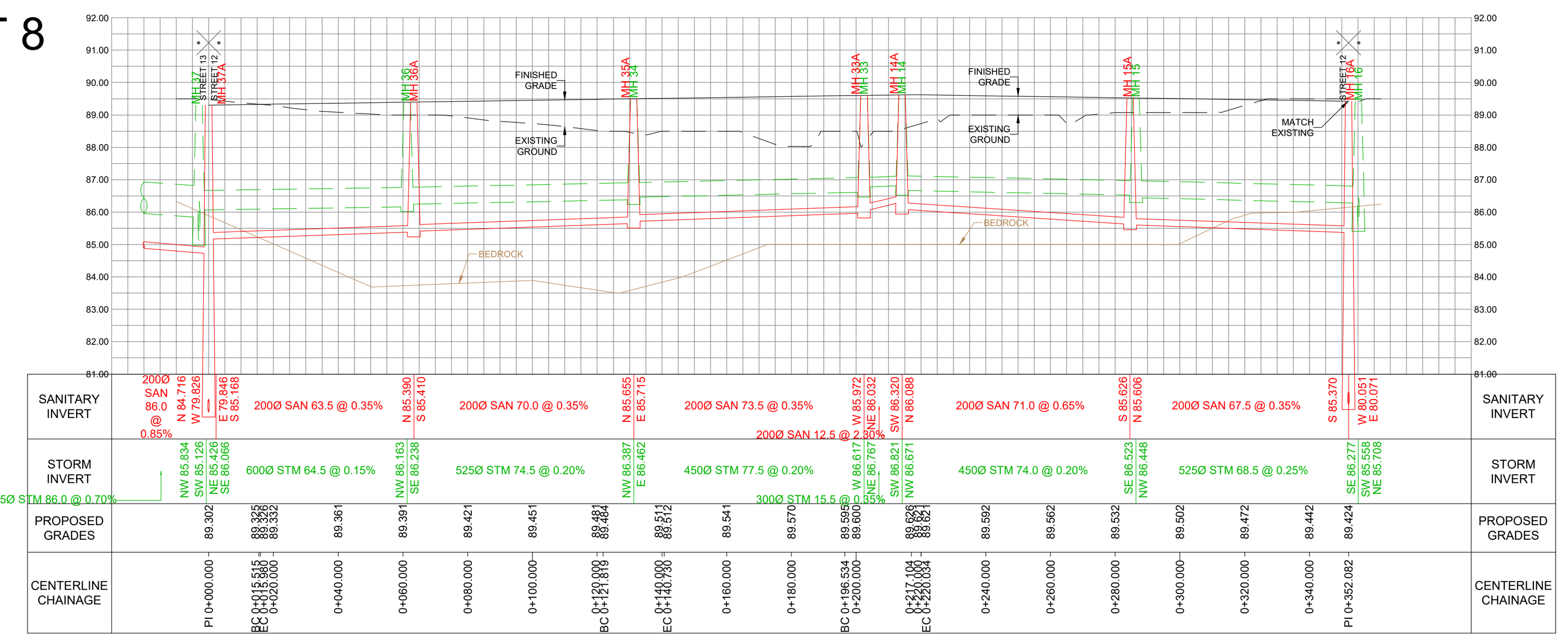
CITY OF OTTAWA

PROFILES

SCALE:	1:2000
PROJECT No.:	19-1153
DATE:	DECEMBER 2021
DRAWING:	7

STREET 8

17



SERVICING BLOCK 2

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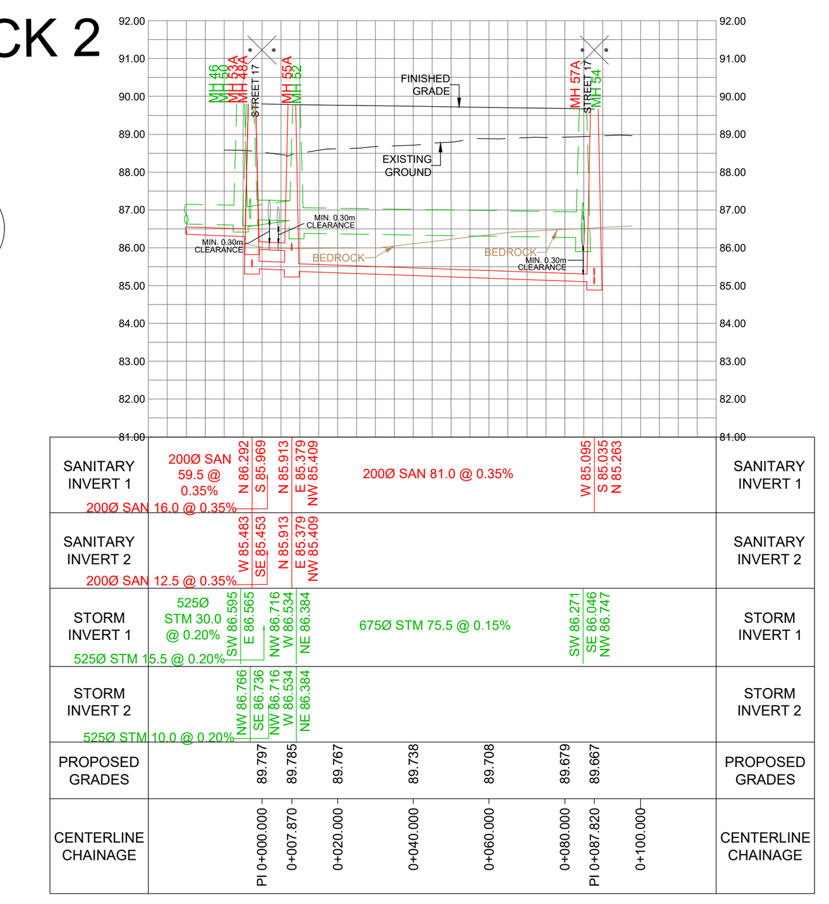

STREET 19-S

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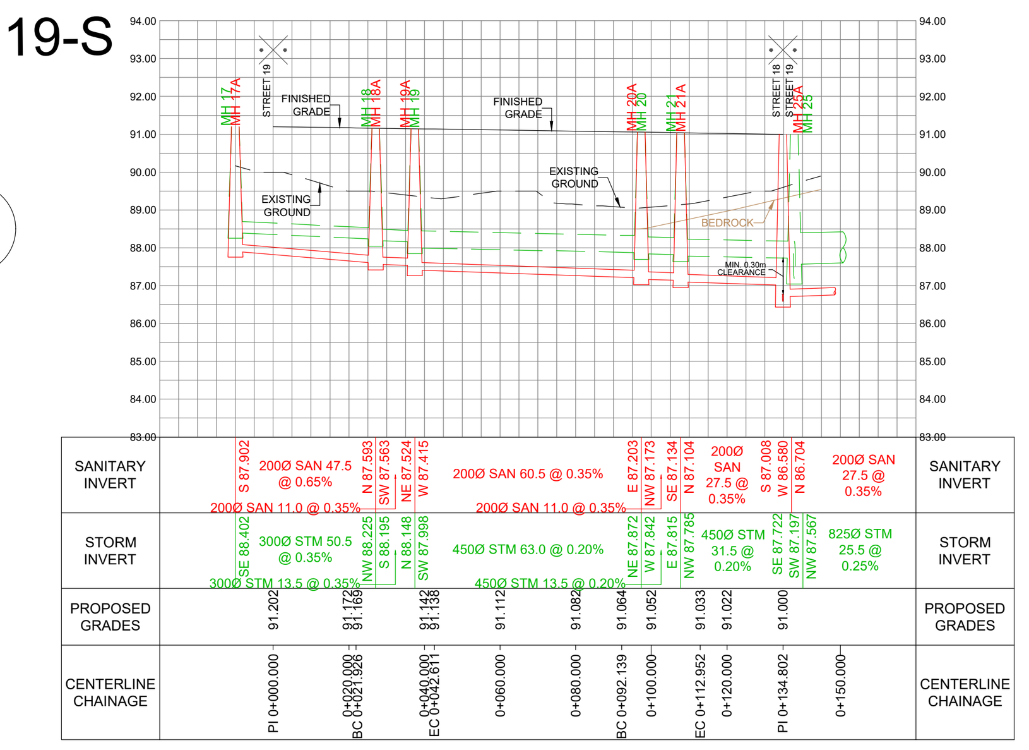

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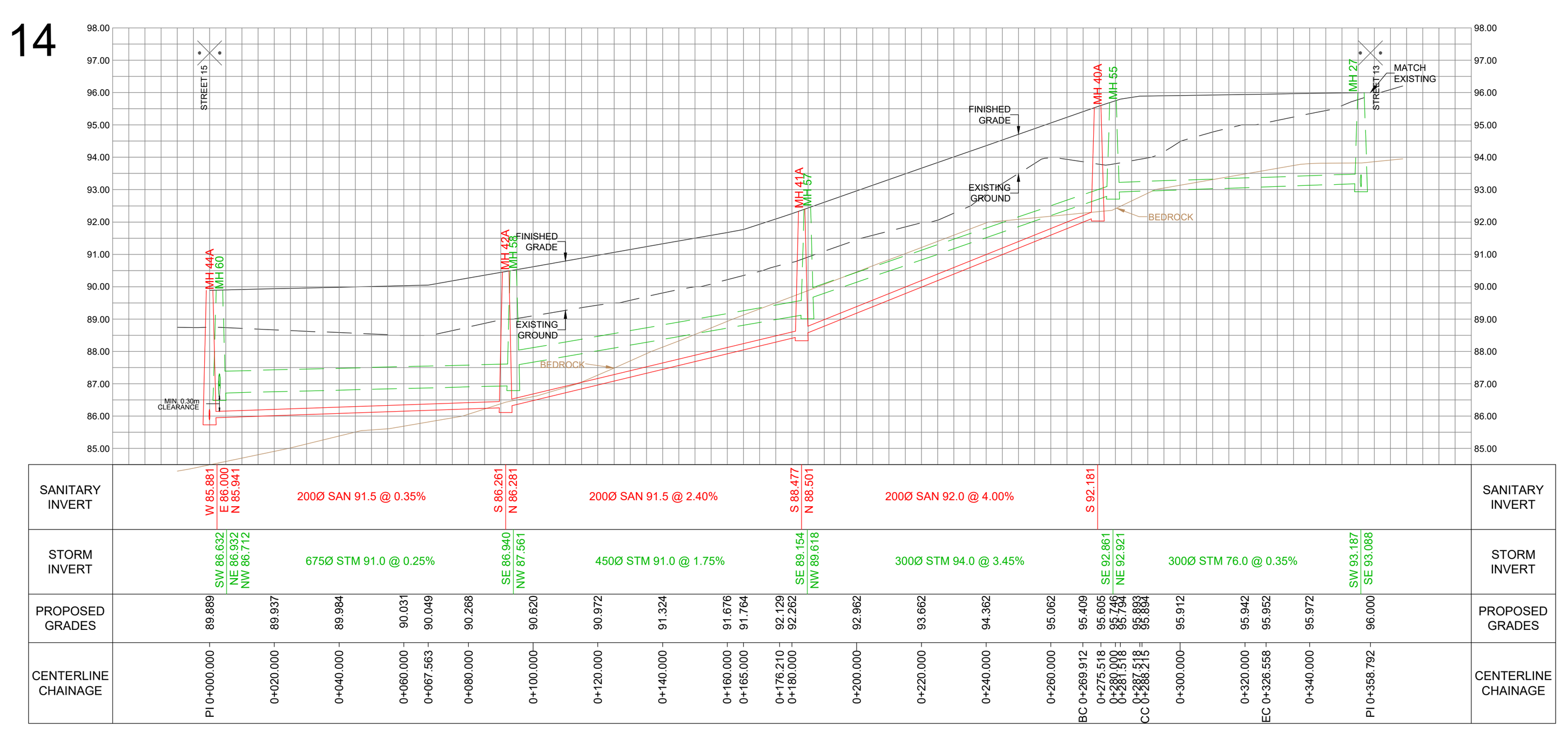

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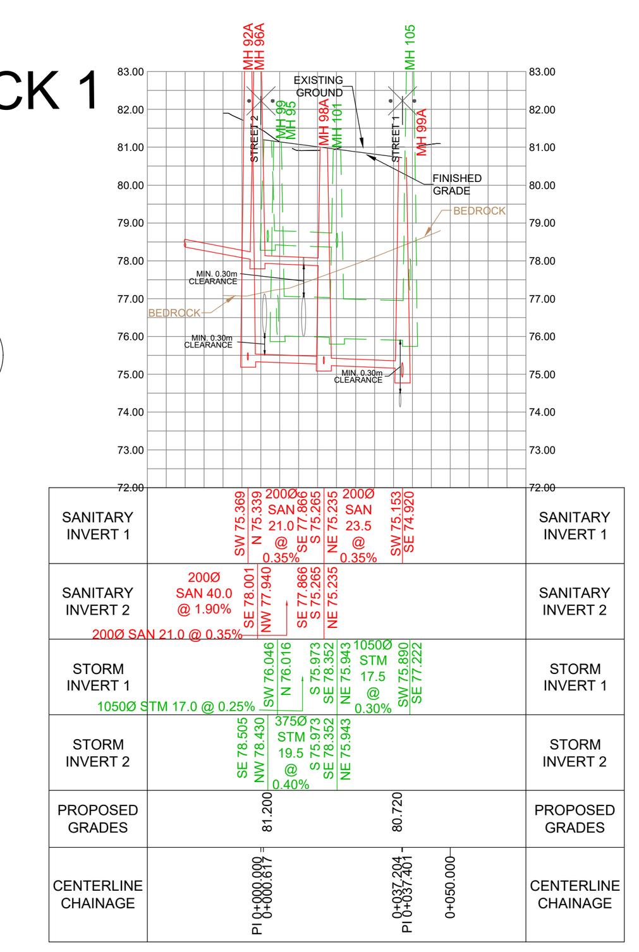
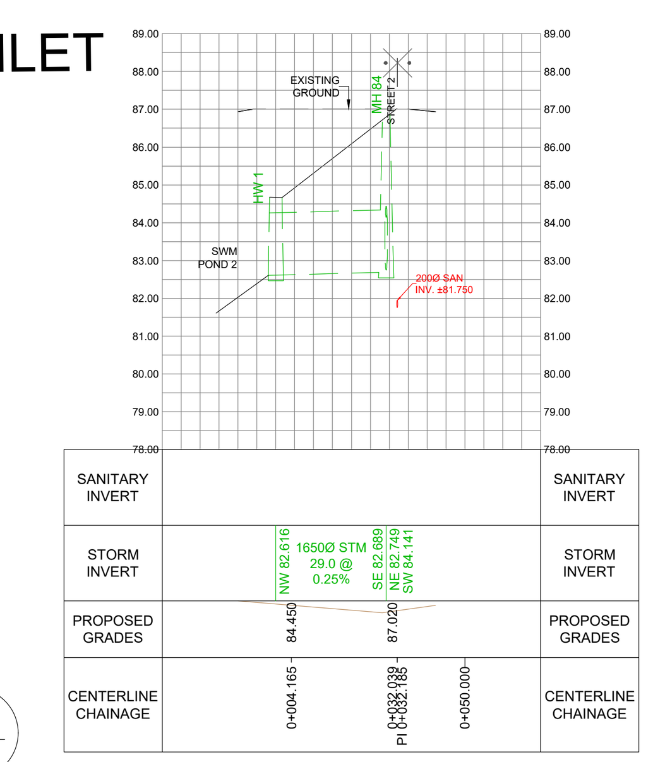


POND INLET

24



STREET 19-N

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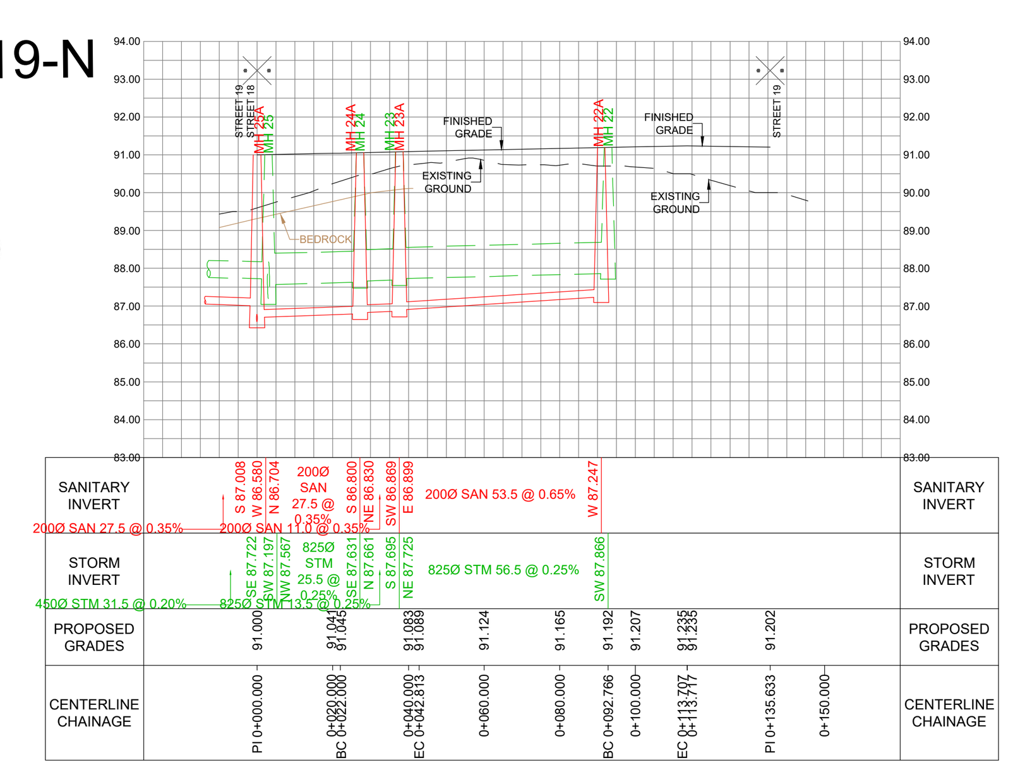

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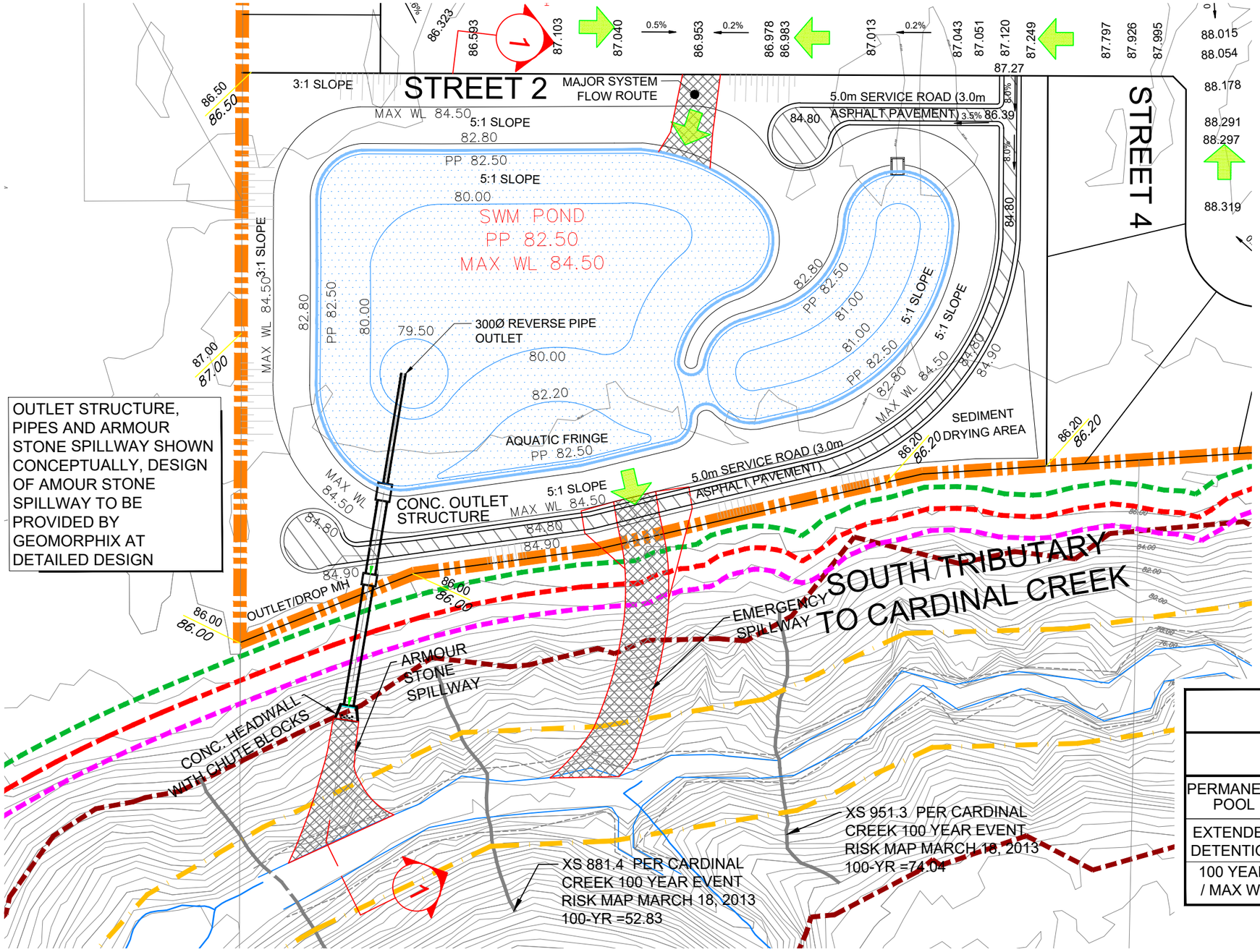
CARDINAL CREEK VILLAGE SOUTH

CITY OF OTTAWA

PROFILES

SCALE:	1:2000	PROJECT No.:	19-1153
DATE:	DECEMBER 2021	DRAWING:	8



OUTLET STRUCTURE, PIPES AND ARMOUR STONE SPILLWAY SHOWN CONCEPTUALLY, DESIGN OF AMOUR STONE SPILLWAY TO BE PROVIDED BY GEOMORPHIX AT DETAILED DESIGN

REFER TO DWG 10 FOR SECTION 1-1

NOTE: SOUTH TRIBUTARY HAZARD LIMITS PER PATERSON GROUP (PROJ# PG5201-1 DATED NOVEMBER 29, 2021

LEGEND

- 30m SETBACK FROM NHWM
- EROSION ACCESS ALLOWANCE
- TOE EROSION ALLOWANCE/ LIMIT OF HAZARD LANDS
- STABLE SLOPE ALLOWANCE
- MEANDER LIMIT
- MAJOR SYSTEM FLOW
- OVERLAND FLOW ROUTE

POND CHARACTERISTICS

	LOWER ELEVATION (m)	UPPER ELEVATION (m)	VOLUME REQUIRED (m^3)	VOLUME PROVIDED (m^3)
PERMANENT POOL	80.00	82.50	6,689	12,419
EXTENDED DETENTION	82.50	83.40	1,523	8,282
100 YEAR / MAX WL	82.50	84.48	20,780	20,975

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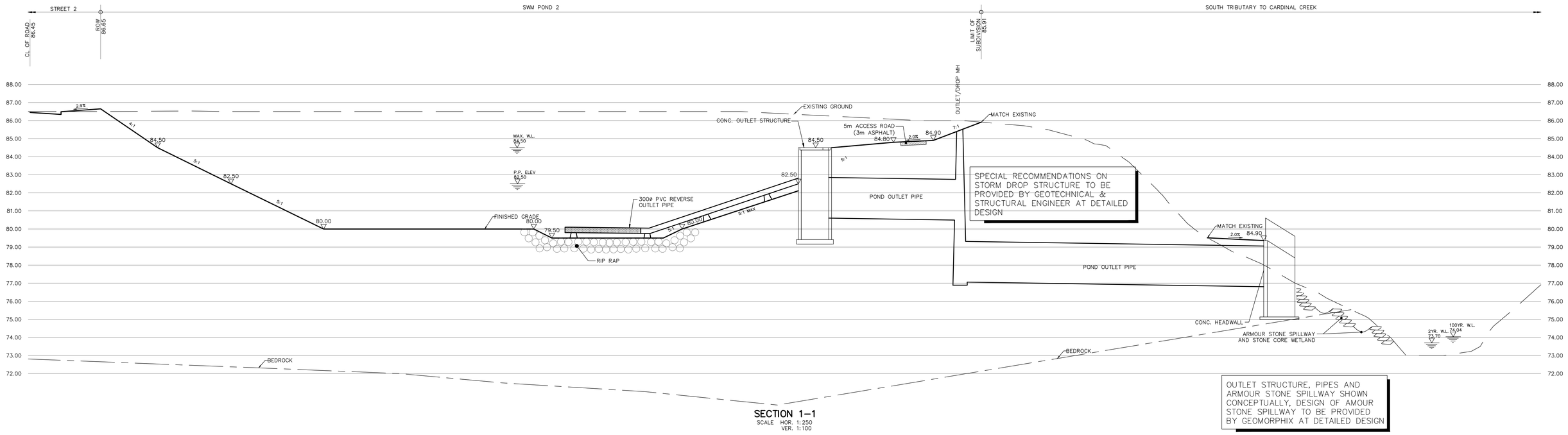
SWM POND
CARDINAL CREEK VILLAGE SOUTH

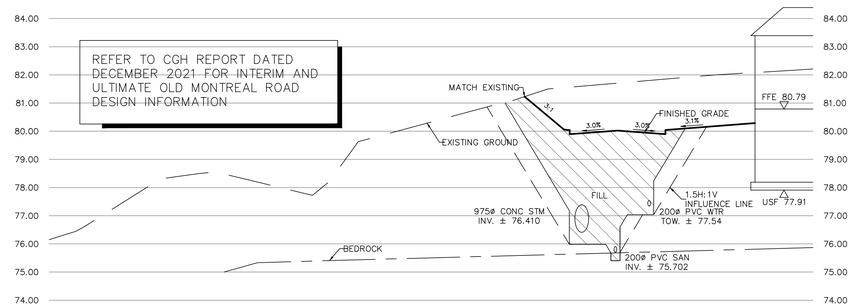
PROJECT No.:	19-1153
SCALE:	1:1000
DATE:	DECEMBER 2021
FIGURE:	9



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

OUTLET STRUCTURE, PIPES AND ARMOUR STONE SPILLWAY SHOWN CONCEPTUALLY, DESIGN OF AMOUR STONE SPILLWAY TO BE PROVIDED BY GEOMORPHIX AT DETAILED DESIGN

SECTION 3–3
SCALE HOR. 1:250
VER. 1:100



SECTION 2–2
SCALE HOR. 1:250
VER. 1:100

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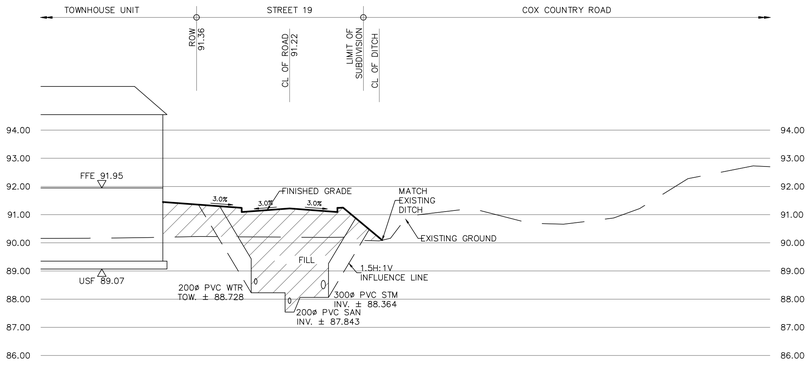
CARDINAL CREEK VILLAGE SOUTH

CITY OF OTTAWA

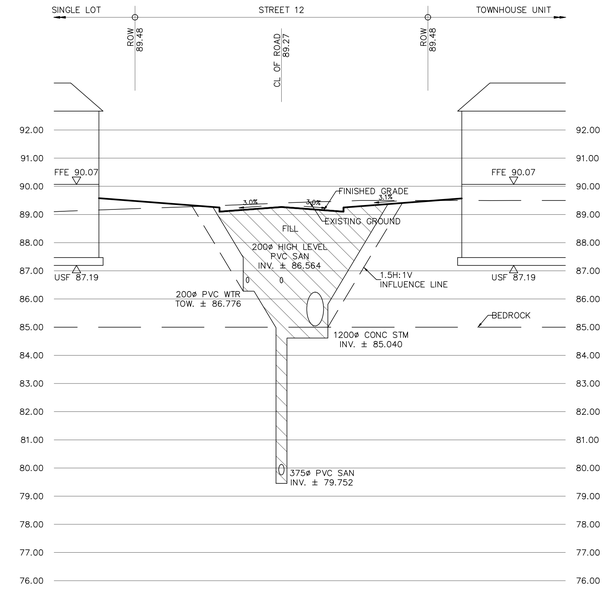
SECTIONS

SCALE:	AS SHOWN	PROJECT No.:	19-1153
DATE:	DECEMBER 2021	DRAWING:	10

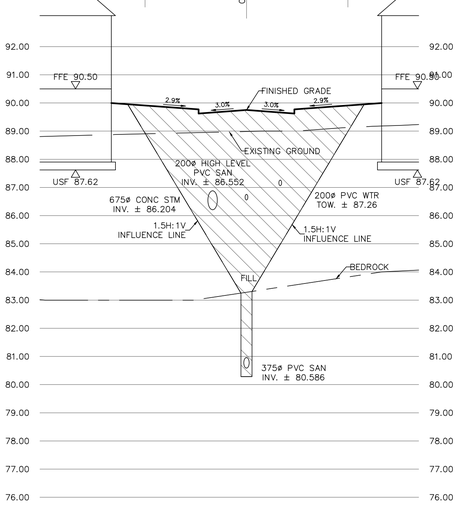


SECTION 4–4
SCALE HOR. 1:250
VER. 1:100

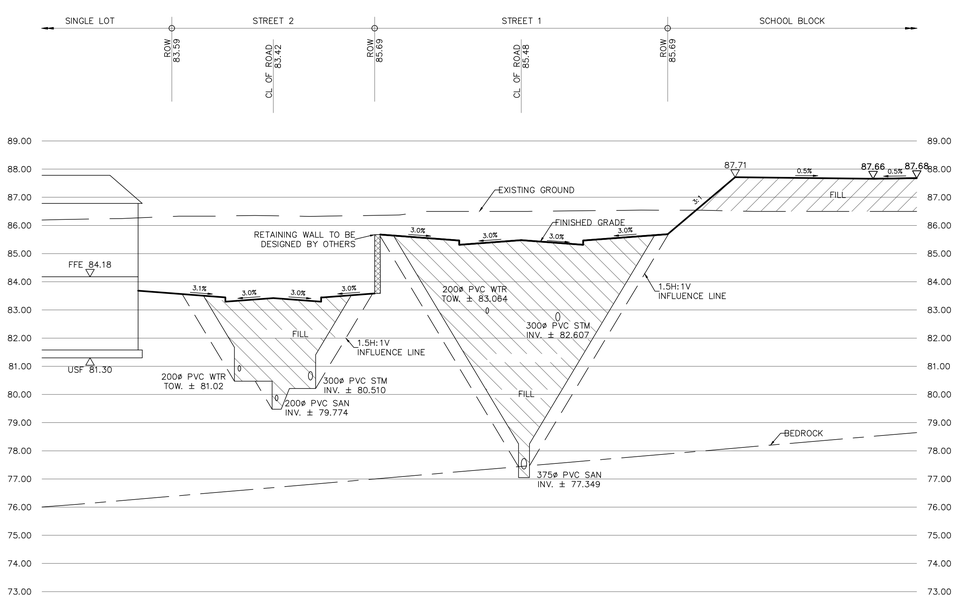
REFER TO PATERSON GROUP REPORT PG5201–1 REV. 5 DATED NOV. 29, 2021 FOR RECOMMENDATIONS ON SUBSURFACE WORK



SECTION 6–6
SCALE HOR. 1:250
VER. 1:100



SECTION 5–5
SCALE HOR. 1:250
VER. 1:100



SECTION 7–7
SCALE HOR. 1:250
VER. 1:100

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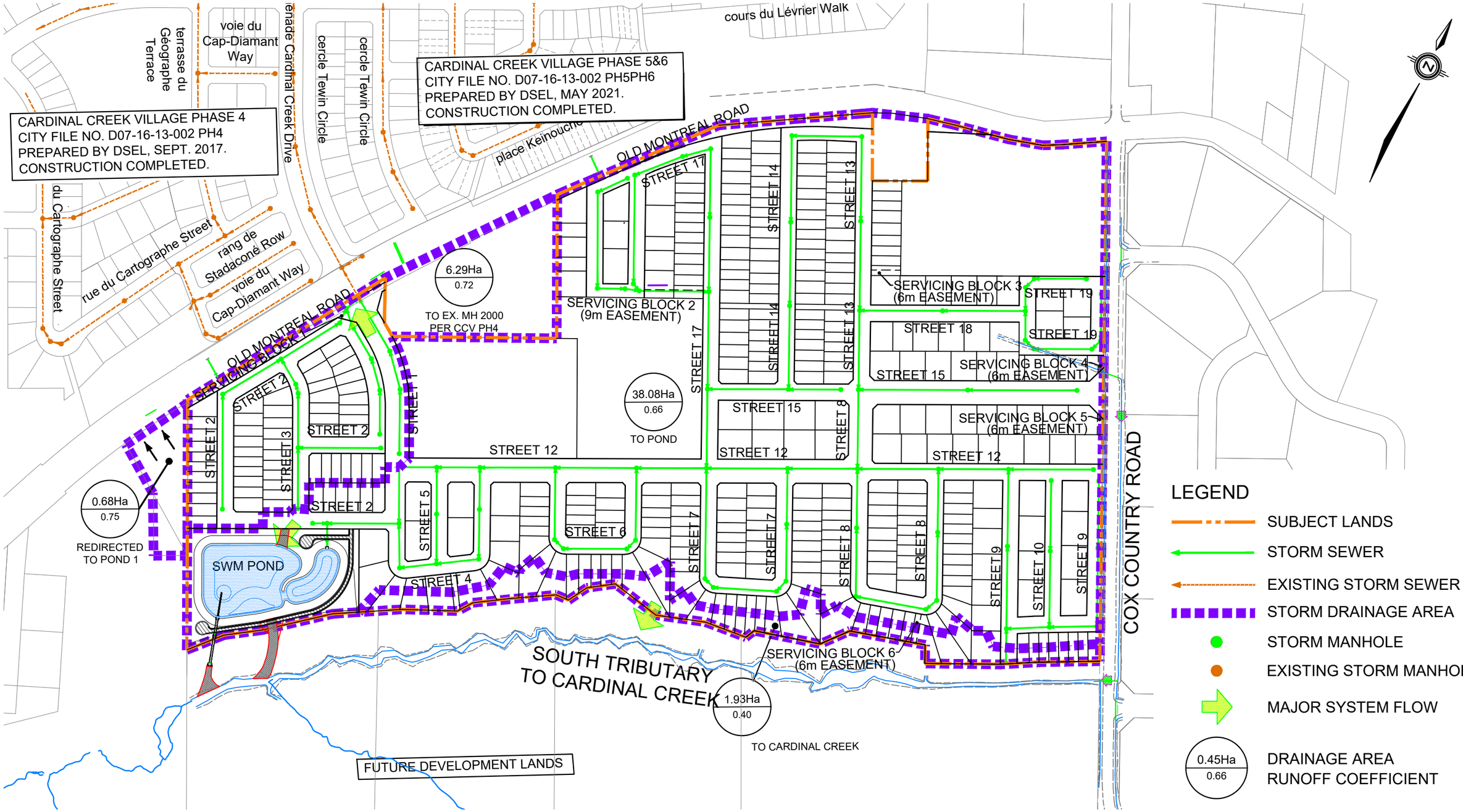
CARDINAL CREEK VILLAGE SOUTH

CITY OF OTTAWA

SECTIONS

SCALE:	AS SHOWN	PROJECT No.:	19-1153
DATE:	DECEMBER 2021	DRAWING:	11



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POND DRAINAGE PLAN
CARDINAL CREEK VILLAGE SOUTH

PROJECT No.:	19-1153
SCALE:	1:4000
DATE:	DECEMBER 2021
FIGURE:	12