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FUNCTIONAL SERVICING REPORT

FOR

CAIVAN GREENBANK NORTH INC

PROPOSED RESIDENTIAL SUBDIVISION (3717 BORRISOKANE ROAD)

THE RIDGE PHASE 4
CITY OF OTTAWA

PROJECT NO.: 19-1123

JUNE 2023
1ST SUBMISSION

FUNCTIONAL SERVICING REPORT
FOR
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1.0 INTRODUCTION

David Schaeffer Engineering Limited (DSEL) was retained to prepare a Functional Servicing Report in support of Caivan Greenbank North Incorporated's submission for draft plan approval. The subject lands were previously draft plan approved in 2021. Caivan Greenbank North Inc have constructed civil infrastructure to support Phase 3 of the development. This application is submitted in support of proposed modification to Phase 4 of the contemplated development. Refer to ***Drawing 7***, for an illustration of the concept plan and proposed phasing.

Phases 3 and 4 of the Ridge development measure approximately 20.3 ha and are located within the Barrhaven South Urban Expansion Area (***BSUEA***). As illustrated in ***Figure 1*** the site is located north of Barnsdale Road, east of Highway 416 (and Borrisokane Road), south of Cambrian Road and west of the Future Greenbank Road alignment. The prior zoning was Mineral Extraction (ME) and is proposed to be amended to permit low-rise residential uses. The western boundary of the property is bordered by an assembly plant and administration building and a previously proposed/approved stormwater management (SWM) block that will be an outlet for the subject lands.

The lands are proposed to be developed with a mix of townhomes and back-to-back units as well as a road network. The contemplated water, wastewater, and stormwater management servicing strategy for the modified portions of the development is consistent with past approvals.

This Functional Servicing Study was prepared to demonstrate conformance with the design criteria of the City of Ottawa, background studies, including the Master Servicing Study, and general industry practice.

1.1 Existing Conditions

As indicated above, civil servicing is complete for Phase 3 of the subject lands and home construction has commenced. Phase 4 has been rough graded in accordance with the previously approved plans.

1.2 Development Layout

Development statistics for Phase 3 and Phase 4 are summarized in **Table 1**.

Table 1: Development Statistics

Land Use	Projected Residential Units	Residential Population per Unit *	Projected Population
Phase 3: Back-to-back	122	1.8	~220
Phase 3: Townhomes	151	2.7	~408
Phase 3: Singles	61	3.4	~208
Phase 3 Total	**334**		**~836**
Phase 4: Back-to-back	88	1.8	~159
Phase 4: Townhomes	281	2.7	~759
Phase 4: Total	**369**		**~918**

** NOTE: Population projections may differ from population estimates used in background Transportation Studies, Planning Rationale, and other studies.*

1.3 Required Permits / Approvals

Once Draft Plan of Subdivision is obtained, the City of Ottawa must approve detailed engineering design drawings and reports prior to construction of the municipal infrastructure identified in this report.

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

Table 2: Potential Required Permits/Approvals

Agency	Permit/Approval Required	Trigger	Remarks
MECP / City of Ottawa	Environmental Compliance Approval	Construction of new sanitary & storm sewers.	MECP is expected to review the stormwater collection system and wastewater collection system by transfer of review.
MECP	Permit to Take Water	Construction of proposed land uses (e.g. basements for residential homes) and services.	Pumping of groundwater will be required during construction, given groundwater conditions and proposed land uses/ municipal infrastructure.
City of Ottawa	MOE Form 1 – Record of Watermains Authorized as a Future Alteration	Construction of watermains.	The City of Ottawa is expected to review the watermains on behalf of the MECP.

2.0 GUIDELINES, PREVIOUS STUDIES, AND REPORTS

2.1 Existing Studies, Guidelines, and Reports

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

- **Ottawa Sewer Design Guidelines**,
  City of Ottawa, *SDG002,* October 2012.
  (City 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-2018-03, Revisions to Ottawa Design Guidelines – Sewer,**
    City of Ottawa, June, 2018.
    (*ISTB-2018-04*)

  - **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.
  (Water Supply Guidelines)

  - **Technical Bulletin ISD-2010-2**
    City of Ottawa, December 15, 2010.
    (*ISD-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.
    (*ISTB-2018-02*)

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

➢ **Design Guidelines for Sewage Works,**
Ministry of the Environment, 2008.
(MOE* Design Guidelines*)

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

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

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

➢ **Erosion & Sediment Control Guidelines for Urban Construction,**
Greater Golden Horseshoe Area Conservation Authorities, December 2006.

➢ **Geotechnical Investigation – Proposed Residential Development, Drummond lands, Borrisokane Road, Ottawa**
Paterson Group, November 12, 2019
(Geotechnical Report)

➢ **Geotechnical Recommendations – Deep Service Installation, Proposed Residential Development, The Ridge, Borrisokane Road, Ottawa**
Paterson Group, November 15, 2019
(Geotechnical Memorandum)

➢ **Design Brief for Caivan Greenbank North Inc., Proposed Residential Subdivision, Ottawa**
DSEL, May 2022
(Design Brief)

➢ **Stormwater Management Report for the Drummond Subdivision**
JFSA, June 2023
(SWM Report)

➢ **Memo – The Drummond Low Impact Development Design**
JFSA, June 2023
(LID Memo)

➢ **Hydraulic Capacity and Modeling Analysis, Drummond Lands**
GeoAdvice, May 31, 2023
(Hydraulic Report)

- **Master Servicing Study – Barrhaven South Urban Expansion Area, J.L. Richards & Associates Limited, Revision 2, May 2018**
  (BSUEA MSS)

- **Master Servicing Study – Barrhaven South Urban Expansion Area, J.L. Richards & Associates Limited, Revision 2, January 5, 2021**
  (BSUEA MSS Addendum)

3.0 WATER SUPPLY SERVICING

3.1 Existing Water Supply Services

The subject lands are located within the 3SW pressure zone. The City has plans to modify the existing pressure zone to SUC anticipated to be completed in Q1 of 2025.

The following watermains are available to support the proposed development:

- 300mm diameter at Dundonald Drive and the Future Greenbank Road alignment extended through the subject lands as part of the Brazeau Lands (The Ridge) development (D07-16-19-0005);
- 200mm diameter on Dundonald constructed as part of Phase 3 servicing.
- 300mm diameter on Expansion Road from Elevation Road extended through the subject lands as part of the Brazeau Lands (The Ridge) development (D07-16-19-0005);
- 200mm diameter on Promotory Place constructed as part of Phase 3 servicing.
- 300mm diameter on Elevation Road.

3.2 Water Supply Servicing Design

The City of Ottawa was contacted on April 24, 2022, to obtain boundary conditions associated with the estimated water demand as indicated in the boundary request correspondence included in ***Appendix B***. The City of Ottawa provided both the anticipated minimum and maximum water pressures, as well as the estimated water pressure during fire flow demand for the demands for the existing and future pressure zone configurations.

Figure 4 shows the proposed configuration of watermains for the subject property.

DSEL retained GeoAdvice to submit proposed domestic and fire flow demands to the City of Ottawa. GeoAdvice utilized the boundary conditions provided by the City to size the internal distribution network.

The proposed water distribution network will include 200mm and 300mm diameter mains.

Geoadvice concluded that:

- The proposed water main network can deliver all domestic flows, with service pressures expected to range between 49 psi (341 kPa) and 80 psi (552 kPa).
- The proposed water main network is able to deliver fire flows at all junctions.
- Pressure reducing valves may be required, since maximum pressures are predicted to exceed the City of Ottawa Design Guidelines (> 80 psi).
- Under the existing pressure zone conditions, any location with elevation lower than 100.4 m may experience high pressures (≥ 80 psi).
- Under the future pressure zone conditions, any location with the elevation lower than 90.4 m may experience high pressures (≥ 80 psi). The minimum development

elevation is about 100.4 m, and as a result, high pressures are not predicted to occur within the Drummond Lands development under the future pressure zone conditions.

Refer to **Appendix B** for the Hydraulic Capacity and Modeling Analysis – Drummond Lands, prepared by GeoAdvice dated May 31, 2023.

3.3 Water Supply Conclusion

The contemplated revision to the existing draft plan approval can be adequately serviced by a network of local watermains that connecting to existing surrounding water supply infrastructure.

The proposed water supply design will conform with all relevant City of Ottawa Guidelines and Policies.

4.0 WASTEWATER SERVICING

4.1 Existing Wastewater Services

Sanitary flows from the ***BSUEA*** were proposed to outlet to the existing 900mm diameter Greenbank Road sanitary trunk sewer. The existing South Nepean Collector (SNC) will provide the sanitary outlet for the entire Barrhaven South Community, which includes the ***BSUEA*** development area.

Sanitary sewers have been extended to the subject lands along Future Greenbank Road and Altitude Avenue to support Phase 3 development.

4.2 Wastewater Design

The subject property is proposed to be serviced by an internal gravity sanitary sewer system that will generally follow the local road network with select servicing easements and land crossing permissions as required to achieve efficiencies in servicing and grading designs. The wastewater layout can be found on the ***Drawing 3***.

Where sanitary sewers are placed below the long term ground water level as determined by Paterson, MH sections are to be sealed tight and have a membrane on the outside plus blue skin wrapping. Watermain grade PVC sewer pipe to be used. Glued pipe sections are not permitted.

The BSUEA MSS Addendum estimated the total contributions at MH 405A, where the Ridge 1, 2, 3, ABIC, Drummond Commercial, and Mattamy Lands converge to be 72.49L/s. Refer to Appendix I of the BSUEA MSS Addendum.

When applying the City of Ottawa wastewater design criteria to the development areas, based on current draft plan layouts, the total estimated peak sanitary flow from the areas assessed is approximately 73.42 L/s (***Appendix C***). This represents an increase of +0.93 L/s over the projected MSS flows. This is within the minimum residual capacity of 52.9 L/s in the downstream limiting pipe reach from MH 13A to MH 15A along Cambrian Road as summarized in Table 6-4 of the BSUEA MSS Addendum (See section 6.4 of the BSUEA MSS Addendum for reference).

The following table summarizes the City design guidelines and criteria applied in the preliminary sanitary design information above and detailed in ***Appendix C***. Sanitary calculation sheet is included in ***Appendix C***.

Table 3: Wastewater Design Criteria

Design Parameter	Value
Residential – Townhome	2.7 P/unit
Residential – Back-To-Back	1.8 P/unit
Average Daily Demand	280 L/d/per
Peaking Factor	Harmon's Peaking Factor. Max 4.0, Min 2.0 Harmon's Corrector Factor 0.8
Infiltration and Inflow Allowance	0.05 L/s/ha (Dry Weather) 0.28 L/s/ha (Wet Weather) 0.33 L/s/ha (Total)
Park Flows	0.33 L/s/ha
Parking Peaking Factor	9300 L/ha/d
Sanitary sewers are to be sized employing the Manning's Equation	$Q = \frac{1}{n} A R^{2/3} S^{1/2}$
Minimum Sewer Size	200 mm diameter
Minimum Manning's 'n'	0.013
Minimum Depth of Cover	2.5 m from crown of sewer to grade
Minimum Full Flowing Velocity	0.6 m/s
Maximum Full Flowing Velocity	3.0 m/s
Extracted from Sections 4 and 6 of the City of Ottawa Sewer Design Guidelines, October 2012, and recent residential subdivisions in City of Ottawa (including revisions per ISTB Sewer-2018-01)	

4.3 Wastewater Servicing Conclusions

The subject property will be serviced by local sanitary sewers which will outlet northward to future sanitary sewers proposed within the Future Greenbank Road right of way. The sewers convey flows to the existing sewers along Cambrian Road as demonstrated in the BSUEA MSS Addendum. There is residual capacity in the downstream sewers providing sufficient capacity for the peak sanitary flows for the subject property.

5.0 STORMWATER MANAGEMENT

5.1 Existing Stormwater Services

The subject lands are within the Jock River Subwatershed. The site is tributary to Borrisokane Road and Future Greenbank Road. Flows directed to Borrisokane are treated and attenuated by an existing dry pond located west of site, previously completed as part of The Ridge Phases 1 and 2 (D07-16-19-0005). Flows directed to Future Greenbank Road are treated by the existing Clarke Pond east and north of the development.

5.2 Proposed Stormwater Management Strategy

The future flows from the land area are planned to meet the following criteria per the ***BSUEA MSS***:

- Not exceed the existing pre-development flows in the downstream roadside ditch system (see below and Section 5.3.2 for details);
- Meet the quality control target of 80% TSS removal as per the Jock River Reach One Subwatershed Study (Stantec, 2007); and,
- Preserve pre-infiltration condition levels (Section 5.3.4 of ***BSUEA MSS***)

In order to provide drainage conveyance to a Borrisokane Road storm outlet, the site grading was adjusted to convey flows westward as much as practicable. The northeast portion of the subject property will drain to Future Greenbank Road given the site topography and the required grading elevation tie-in to the Future Greenbank Road ROW (i.e. to avoid a more significant retaining wall along Greenbank Road).

As noted in the ***BSUEA MSS***, the *Existing Conditions Report* for the BSUEA identified that the culvert downstream of the aggregate properties (on the east side of Borrisokane Road) receives a pre-development flow of 1,300 L/s during the 1:100 year event (see Figure 3-1, and Tables 5-2 and 5-5 in ***Appendix D*** from the ECR noting the constrained culvert CVR-C1). This culvert will not actually be a constraint for the development since the proposed drainage conveyance from the site will be a storm sewer outlet along Borrisokane Road that will outlet to the west side ditch near the Cambrian Road and Borrisokane Road intersection. Regardless, the pre-development flow of 1,300 L/s is the target constraint.

The ***BSUEA MSS*** conceptualized the following requirements for the development area:

- The design of the storm drainage system has been undertaken using the dual-drainage approach. The ***BSUEA MSS*** sets out the design criteria for future draft plan and site plan applications for the BSUEA.
- Two (2) separate storm servicing solutions were developed; one conventional servicing strategy and one that incorporates the Etobicoke Exfiltration System (EES) or alternative, which was recommended (see ***BSUEA MSS*** Drawing MST-2 for details and Section 5.2.1 of this report for discussion).
- The downstream boundary conditions or flow criteria to achieve are developed in the ***BSUEA MSS*** and are used in the design constraints.

- Allowable minor system release rates were set at the required storm event and future design should maintain the same release rate criteria.
- Stormwater management facilities have been identified as the stormwater management solution for the aggregate extraction areas.

The stormwater management design consists of:

- A storm sewer system designed to capture at least the minimum design capture events required under PIETB-2016-01;
- For westerly flows, one dry Stormwater Management (SWM) Pond for quantity control along with Oil Grit Separator (OGS) units designed to provide Enhanced Level of Protection (80% total suspended solids (TSS) removal) per MECP guidelines. The SWM pond will provide controls to levels which respect any downstream pre-development levels. This single pond location was draft approved as part of the advancement of The Ridge (Brazeau) development application;
- For flows from the northeast portion of the site, storm sewers which will convey flows to the previously constructed Clarke Pond within HMB;
- An on-site road network designed to maximize the available storage in the on-site road network for the 100-year design event, where possible, with controlled release of stormwater to the minor storm system; and
- An overland flow route designed to safely convey stormwater runoff flows in excess of the on-site road storage.

5.2.1 Infiltration – Exfiltration System (ES)

Within the ***BSUEA MSS***, Section 5.4.4 discussed the recommendation of distributed infiltration for development areas. An analysis was carried out and summarized in the *Existing Conditions Report* which determined the various contributions of the water budget based on long-term simulation.

The section also notes that the overall pre-development infiltration from the ***BSUEA MSS*** area was determined but that the aggregate extraction areas were excluded in that determination. Ongoing investigations for both the Brazeau (The Ridge Phases 1 and 2) and Drummond (The Ridge phases 3 and 4) properties have been completed and are summarized in the attached "*Groundwater Infiltration Review*" memorandum completed by Paterson Group (see ***Appendix D*** for reference). The memorandum summarizes the estimated infiltration rates that could be anticipated throughout the sites for various soil type conditions that were found during their investigations. These values will be used during the detailed design determinations.

A key point of note, as required by the ***MSS***, is that capture of stormwater by the exfiltration system has strategically located insofar as the system is to be installed on local roads where the surface runoff is less impacted by the City's winter road salting program. Therefore, collector and arterial roads will have conventional storm sewer installations that will convey flows to a proposed downstream oil-grit-separator (OGS) units and end-of-line dry pond facility. A visual representation of the EES system and drainage capture areas can be seen in the Storm Drainage Area plans.

The EES units will be installed underneath storm sewers within the ROW in specific areas determined as being suitable based on-site constraints. Each system will consist of one 250 mm diameter perforated pipes surrounded by a 0.85 m deep by 1.20 m wide clear stone trench. Goss traps will be installed in upstream catch basins in order to prevent/mitigate debris and potential oils from entering the perforated pipe system. Detail drawings of the proposed EES units are provided in Figure 1 of the ***JFSA LID Analysis***.

In addition to the EES system installed below the storm sewers, a series of catch basin infiltration systems have been installed on within the Promotory Place and Expansion Road right of ways. The catch basin system was proposed in these locations since the upstream storm sewers receive drainage from collector roads where salting practices are expected.

For protection measures of the EES system during construction see Section 7.0.

5.2.2 ES Temporary Monitoring

As per Section 5.5.1.8 of the ***BSUEA MSS*** there are requirements for temporary monitoring of the proposed infiltration system in order to assess and confirm that the ES operates as intended. The objectives of the monitoring will be to estimate the drawdown time of the ES (i.e. time for water levels to drop) to see if the infiltration values projected are in line with the results, and to determine the average rate of capture before runoff is conveyed by the traditional storm sewer system.

The final locations and configuration will be coordinated with City staff through the detailed design process.

5.3 Post-Development Stormwater Management Targets

Stormwater management requirements for the proposed alternative Stormwater management scheme have been adopted from the ***Jock River SWS***, ***City Standards***, and the ***MECP SWMP Manual***.

Given the general criteria mentioned above, the following specific standards are expected to be required for stormwater management within the subject property:

- Enhanced quality treatment will be provided for stormwater runoff from the subject property, corresponding to a long-term average TSS removal efficiency of 80%, as defined by the MECP prescribed treatment levels;
- Storm sewers on local roads are to be designed to provide at least a 2-year level of service without any ponding per the City's latest Technical Bulletin PIEDTB-2016-01;
- Storm sewers on collector roads are to be designed to provide at least a 5-year level of service without any ponding per the City's latest Technical Bulletin PIEDTB-2016-01;
- For less frequent storms (i.e. larger than 2-year or 5-year), 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 for all roads, the maximum depth of water (static and/or dynamic) on streets, rear yards, public space 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 right-of-way ROW, or adjacent to the ROW, provided the water level does 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;
- Flow across road intersections shall not be permitted for minor storms (generally 5-year or less);
- 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; and
- The product of the maximum flow depths on streets and maximum flow velocity must be less than 0.60 m^2/s on all roads.

5.3.1 Quality Control

5.3.1.1 Flows to Borrisokane Road ROW

Per the ***Jock River SWS,*** Enhanced quality treatment will be provided for stormwater runoff from the subject property, corresponding to a long-term average TSS removal efficiency of 80%, as described by the MECP prescribed treatment levels. This will be achieved via the proposed ES system installations and the end-of-line OGS units proposed.

Echelon Environmental provided OGS sizing with consideration for future development areas providing on-site controls, the proposed exfiltration system, runoff rates modelled by JFSA, and assumptions for the subject lands as part of the Brazeau Lands (The Ridge Phase 1 and 2) development (D07-16-19-0005). Updated drainage areas, percent impervious, and flow rates were provided to Echelon to confirm OGS sizing. Echelon confirm that the previous units were sized appropriately for the revisions made to the subject lands. Refer to ***Appendix D*** for details.

5.3.1.2 Stormwater Flows to Future Greenbank Road ROW

Stormwater flows to the northeast from the Drummond property will be treated within the existing Clarke Pond in HMB. As per the attached *Half Moon Bay West – Drawing No. 42* (*External Post-Development Storm Drainage Plan*) associated with the ***Clarke SWM PDB,*** a portion of the Brazeau/Drummond properties were previously accounted for in the Clarke Pond design. Given that a portion of the tributary area previously attributed to the Clarke Pond (approximately 7 ha) is now being directed towards the new dry pond associated with the Brazeau/Drummond properties, the approximately 6 ha of minor system flows tributary to the Clarke Pond is readily accommodated. Refer to Section 4.3 of the ***SWM Report*** for additional detail. The 100-year flows will be retained on-site with 100-year capture at the site boundary and will not flow overland to the Green Road ROW.

In the ***Clarke SWM PDB***, a 100-year minor system capture was assumed for this area for two reasons:

1. 100-year capture will be required regardless at the intersection of Greenbank Road and Cambrian Road, to ensure no major system flow crosses an arterial road; and

2. Due to the high HGL in the majority of the Clarke Pond system, it has been assumed that no ICDs are feasible (and sump pumps are installed in lieu of gravity drain connections) for all future development areas. JFSA left the opportunity open to explore the option of ICDs + gravity drains as each phase reaches detailed design, but have generally assumed it is not possible for the purposes of conservatively sizing the storm sewers.

Note that the subject lands are situated such that sump pumps are not required on site.

See the ***Clarke SWM PDB*** by JFSA under separate cover for full details.

5.3.2 Quantity Control

5.3.2.1 Flows to Borrisokane Road ROW

As noted in the ***Jock River SWS***, quantity control is not required for the Jock River; however, based on past reports (***BSUEA MSS*** and Existing Condition Report), some quantity control will be provided to correlate to the quantified pre-development levels noted (i.e. 1,300 L/s) discussed in Section 5.2 of this report. This will assist with minimizing the proposed sizing of storm sewer infrastructure along Borrisokane Road as well as ensure that existing ditch capacities are not impacted. Any infrastructure upgrades or adjustments relating to the Borrisokane Road ROW will require appropriate permits and approvals from the Ministry of Transportation and/or City of Ottawa.

5.3.2.2 Flows to Future Greenbank Road ROW

Flows to the northeast from the Drummond property will be managed within the existing Clarke Pond in HMB. Quantity control is not required in the Clarke Pond; however, some is nonetheless provided by safe conveyance of the 100-year flows through the facility. See the ***Clarke SWM PDB*** by JFSA under separate cover for full SWM facility details. As noted previously, flows within the Drummond Lands will be managed by restriction of the minor system sewer capture with the use of ICDs to prevent hydraulic surcharges.

5.4 Stormwater Management Design

As per The Ridge "*SWM Pond*" ***Drawing No. 77 & 79***, the design consists of OGS units for quality control and an end-of-line dry SWM pond for any required quantity control prior to discharge along Borrisokane Road. The pond is located within the portion of the Drummond quarry land that is between the Drummond residential area to be developed (within the urban boundary) and Borrisokane Road. The facility was sized to meet the required level of quantity control based on a restricted outflow of 1,300 L/s as noted in Section 5.2.

The SWM pond outlets to the Borrisokane Road roadside ditch. The approved design has new 900mm/1200mm storm sewer installations along Borrisokane Road which extends northward to the vicinity of Cambrian Road where it discharges to the western roadside ditch.

5.5 Proposed Minor System

An internal gravity storm sewer system is proposed to conveyed drainage to the proposed dry SWM pond (or future Greenbank Road sewers) with select areas of local streets that will have the ***ES*** installed to achieve infiltration targets.

Street catch basins will collect drainage from the streets and front yards, while rear yard catch basins will capture drainage from backyards. Perforated catch basin leads will be provided in rear yards, except the last segment where it connects to the right-of-way which will be solid pipe, per City standards.

The preliminary rational method design of the minor system captures drainage for storm events up to and including the 2-year (local) and 5-year (collector) event assuming the use of ICDs for all catch basins within the subject property. The peak design flows were estimated based on a calculated runoff coefficient (C-value) according to zoning envelopes and impervious area (roads / sidewalks / driveways) for the development areas and an assumed 0.40 for the park areas. See storm design sheet in ***Appendix D*** for details.

The following table summarizes the standards that will be employed in the detailed design of the storm sewer network. The drainage area information can be found in the *Storm Drainage Plans* and rational method design sheets provided in ***Appendix D***.

Table 3: Storm Sewer Design Criteria

Design Parameter	Value
Minor System Design Return Period	1:2 yr (PIEDTB-2016-01) for local roads, without ponding 1:5 yr for collector roads, without ponding
Major System Design Return Period	1:100 year
Intensity Duration Frequency Curve (IDF) 2-year storm event: A=732.951 | 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	$Q = CiA$
Storm sewers are to be sized employing the Manning's Equation	$Q = \frac{1}{n} AR^{2/3} S^{1/2}$
Runoff coefficient for paved and roof areas	0.9
Runoff coefficient for landscaped areas	0.2
Minimum Sewer Size	250 mm diameter
Minimum Manning's 'n' for pipe flow	0.013
Minimum Depth of Cover	1.5 m from crown of sewer to grade
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	Contained within the ROW, or adjacent to the ROW, provided that the water level not touch any part of the building envelope and remains 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 building envelope (PIEDTB-2016-01)

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. Max. 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, and ISSU,	

5.6 Hydraulic Grade Line Analysis

A detailed hydraulic grade line (HGL) modelling analysis has been completed for the proposed system based on the 100-year 3-hour Chicago, 12-hour SCS, and 24-hour SCS design storms, including historical design storms and climate change stress test as required. The HGL is provided in the plan and profile drawings for the subdivision and details of the modelling can be found in the ***JFSA SWM Report***.

5.7 Proposed Major System

Major system conveyance, or overland flow (OLF), is provided to accommodate flows in excess of the minor system capacity. OLF is accommodated by generally storing stormwater up to the 100-year design event in road sags then routing additional surface flow along the road network and service easements towards the proposed drainage features to the Jock River, as shown in the *Storm Drainage Plans*.

5.8 Stormwater Servicing Conclusions

The stormwater runoff was designed to be captured by an internal gravity sewer system that will convey flows to two outlets:

1. To an end-of-line pair of OGS units for quality control, followed by a dry SWM pond facility for quantity control, at the northwest corner of the property. An Enhanced Level of Protection will be provided for stormwater runoff from the subject property before being discharged to the Jock River. Quantity control is not required for the Jock River. Notwithstanding, some quantity control by on-site and SWM pond storage will be provided due to downstream infrastructure constraints.

2. To the Future Greenbank Road ROW where storm sewers will convey flow to existing storm sewers at Cambrian Road where they will be conveyed to the existing Clarke Pond for quality control treatment.

Infiltration targets noted in the ***MSS*** will be achieved via the installation of the ***ES*** system within local ROWs. The location of the proposed ES system will be finalized at detailed design and will be supported by modelling by JFSA.

6.0 SITE GRADING

The following additional grading criteria and guidelines are applied to detailed design, per City of Ottawa Guidelines:

- Road grades will have a minimum slope of 0.5% measured at the curb line;
- Driveway slopes will have a maximum slope of 6%;
- Slope in grassed areas will be between 2% and 7%;
- 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.

Figure 5 illustrates the conceptual grading for the contemplated development. ***Figure 6*** illustrates conceptual grading for the contemplated park.

Draft 15.0m and 18m cross-sections have been appended to this report.

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

Silt fencing will be installed around the perimeter of the active part of the site (and headwater features) 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. Material stockpiles shall not be permitted near the existing EUC Pond 1.

Catchbasins will have catchbasin inserts installed during construction to protect from silt entering the storm sewer system.

A mud mat will be installed at the construction access to prevent mud tracking onto adjacent roads.

The following additional recommendations to the Contractor will be included in contract documents:

- Limit 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 entering any existing ditches.
- No refueling or cleaning of equipment near existing watercourses.
- Provide sediment traps and basins during dewatering.

The Contractor will be required to complete regular 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 CONCLUSION AND RECOMMENDATIONS

This report provides details on the proposed on-site municipal services for the subject property and demonstrates that adequate municipal infrastructure capacity is expected to be available:

- The City of Ottawa provided updated boundary conditions based on the new demands estimated for the development. GeoAdvice completed detailed hydraulic modeling and confirmed that the water supply system is adequate for the development and offered recommended water main sizes;
- Sanitary service for the site will be provided for the subject property via a new sanitary trunk sewer to be constructed in the Future Greenbank Road ROW as part of the development of The Ridge (Brazeau) development. With the inclusion of the subject property, the existing downstream sewers have sufficient capacity to accommodate the subject property's proposed sanitary flows;
- Stormwater service is to be provided by capturing stormwater runoff via an internal gravity sewer system that will convey flows to:
    - a proposed end-of-line dry SWM pond facility for quantity control while the ES system and OGS units will provide quality control. An Enhanced Level of Protection (80% TSS removal) will be provided for stormwater runoff from the subject property before being discharged to the Borrisokane Road ditch and ultimately to the Jock River. Quantity control is not required for the Jock River, however, some quantity control by on-site and SWM pond storage will be provided to minimize the sizing of offsite infrastructure and ensure that any downstream infrastructure constraints are accommodated, and
    - the Clarke Pond.
- As suggested in the ***BSUEA MSS***, infiltration will be achieved via use of the preferred ***ES*** system approach. The ultimate extents of the system is contingent upon site conditions and the composition of fill material used within the site. Paterson has provided guidance with respect to anticipated infiltration rates (based on site investigations) that will be used for guidance in establishing the system extents;
- Erosion and sediment control measures will be implemented and maintained throughout construction.
- The design of The Ridge Phase 3 was completed in general conformance with the City of Ottawa Design Guidelines and criteria presented in other background study documents.

Prepared by,
David Schaeffer Engineering Ltd.

LICENSED PROFESSIONAL ENGINEER
A.D.FOBERT
100090626
2023-06-14
PROVINCE OF ONTARIO

Job #19-1123

Per: Adam D. Fobert, P.Eng.

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APPENDIX A

Ministry of Natural Resources & Forestry
Kemptville District

10-1 Campus Drive
Kemptville ON K0G 1J0
Tel: 613 258-8204

Ministère des Richesses naturelles et des Forêts
District de Kemptville

10-1 Campus Drive
Kemptville ON K0G 1J0
Tél: 613 258-8204

Ontario

February 12, 2020

George W. Drummond Ltd.
30 Rideau Heights Drive
Nepean, ON K2E 7A6

Via Email: sdrummond@drummonds.com

Attn: Mr. Scott Drummond

Subject: **Surrender of Aggregate Resources Act Licence No. 4074**
'Drummond Costello Pit'
Pt. Lot 9, Concession 3RF
Former Geographic Township of Nepean, City of Ottawa

Dear Mr. Drummond,

Further to your request, a final inspection of this licensed property was completed on January 17, 2020. It was determined during this inspection that the final rehabilitation grades have been achieved for this property.

Further to our discussion, and in consideration of both a conditional sale agreement for the land and the development potential of the property, the requirement to topsoil and seed the site is hereby waived. You hereby accept any and all liability for the site in its current condition.

Due to the fact that the rehabilitation has been ongoing for several years, and that there has been no recent aggregate production, the surrender will be backdated to December 31, 2019 to align with the reporting requirements of The Ontario Aggregate Resources Corporation.

The licence is hereby surrendered, and you have no further obligations under the Aggregate Resources Act for this property. The file for this licence will be closed and archived. Please remove the ARA signage from the entrance to the site.

Thank you for your effort and cooperation in the rehabilitation of this site.

Sincerely,

Christopher M. Bierman

Christopher M. Bierman

Aggregate Resources Technical Specialist
Kemptville District – City of Ottawa & East Lanark Areas
T: 613-258-8264 I E: christopher.bierman@ontario.ca

cc. Sean Moore, Development Review Services - City of Ottawa
John DeRick - The Ontario Aggregate Resources Corporation

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

April 24, 2023

Sent by email: AFobert@dsel.ca

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

Attention: **Mr. Adam Fobert, P.Eng.**
Project Manager

Re: **Water Distribution Network Boundary Condition Request – Version 2**
Drummond Lands (The Ridge Phase 3)
GeoAdvice Project ID: 2021-089-DSE

Dear Mr. Fobert,

In order to carry out the watermain analysis and hydraulic modeling for the Drummond Lands 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.

Boundary conditions at connection points 1, 2, 3, and 4 are required for the demand conditions:

- Average day demand = 6.86 L/s
- Maximum day demand = 16.58 L/s
- Maximum day demand + fire flow (167 L/s) = 183.58 L/s
- Maximum day demand + fire flow (200 L/s) = 216.58 L/s
- Maximum day demand + fire flow (217 L/s) = 233.58 L/s
- Maximum day demand + fire flow (283 L/s) = 299.58 L/s
- Peak hour demand = 36.15 L/s

Please note the following:

- The above demands and fire flows should be applied equally between connection points 1, 2, 3, and 4.
- FUS calculations have been completed for the traditional townhomes not complying with the conditions of City of Ottawa Technical Bulletin ISDTB-2018-02.

For the maximum day demand plus fire flow scenarios, the HGLs for the lowest (167 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 (167 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.

Finally, in previous iterations of boundary conditions provided by the City, HGLs were provided for before and after the proposed pressure zone realignment in the BARR (3SW) and the 3C (SUC) pressure zones. **Please confirm which boundary condition should be used.**

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

Yours truly,

GeoAdvice Engineering Inc.

Werner de Schaetzen

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

Consumer Water Demands

Phase 3 - Residential Demands

Dwelling Type	Number of Units	Population		Average Day Demand			Max Day	Peak Hour	Min Hour
		Persons per Unit	Population Per Dwelling Type	(L/c/d)	(L/d)	(L/s)	2.5 x Avg. Day (L/s)	2.2 x Max Day (L/s)	0.5 x Avg. Day (L/s)
Single Detached	61	3.4	208	280	58,240	0.67	1.69	3.71	0.34
Back-to-Back Townhome	122	2.7	330		92,400	1.07	2.67	5.88	0.53
Traditional Townhome	151	2.7	408		114,240	1.32	3.31	7.27	0.66
Subtotal	**334**		**946**		**264,880**	**3.07**	**7.66**	**16.86**	**1.53**

Phase 3 - Non Residential Demands

Property Type	Area (ha)		Average Day Demand			Max Day	Peak Hour	Min Hour
			(L/ha/d)	(L/d)	(L/s)	1.5 x Avg. Day (L/s)	1.8 x Max Day (L/s)	0.5 x Avg. Day (L/s)
Park	0.07	Phase 3A	28,000	1,960	0.02	0.03	0.06	0.01
Subtotal	**0.07**			**1,960**	**0.02**	**0.03**	**0.06**	**0.01**

Phase 4 - Residential Demands

Dwelling Type	Number of Units	Population		Average Day Demand			Max Day	Peak Hour	Min Hour
		Persons per Unit	Population Per Dwelling Type	(L/c/d)	(L/d)	(L/s)	2.5 x Avg. Day (L/s)	2.2 x Max Day (L/s)	0.5 x Avg. Day (L/s)
Back-to-Back Townhome	88	2.7	238		66,640	0.77	1.93	4.24	0.39
Traditional Townhome	281	2.7	759		212,520	2.46	6.15	13.53	1.23
Subtotal	**369**		**997**		**279,160**	**3.23**	**8.08**	**17.77**	**1.62**

Phase 4 - Non Residential Demands

Property Type	Area (ha)		Average Day Demand			Max Day	Peak Hour	Min Hour
			(L/ha/d)	(L/d)	(L/s)	1.5 x Avg. Day (L/s)	1.8 x Max Day (L/s)	0.5 x Avg. Day (L/s)
Park	1.66	Phase 4	28,000	46,480	0.54	0.81	1.45	0.27
Subtotal	**1.66**			**46,480**	**0.54**	**0.81**	**1.45**	**0.27**

		Average Day	Max Day	Peak Hour	Min Hour
Scenario 1 Total		**6.86**	**16.58**	**36.15**	**3.43**


Proposed Development
Elevation Road
Connection #1
Dundonald Drive
Connection #4
Connection #3
Haiku Street
Connection #2

Hydraulic Capacity and Modeling Analysis Drummond Lands

Final Report

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

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

Submission Date: May 31, 2023

Contact: Mr. Werner de Schaetzen, Ph.D., P.Eng.
Project: 2021-089-DSE

Document History and Version Control

Revision No.	Date	Document Description	Revised By	Reviewed By
R0	January 21, 2022	Draft	Ben Loewen	Werner de Schaetzen
R1	February 11, 2022	Final	Ben Loewen	Werner de Schaetzen
R2	March 16, 2022	Updated Draft	Ben Loewen	Werner de Schaetzen
R3	March 23, 2022	Final	Ben Loewen	Werner de Schaetzen
R4	April 1, 2022	Updated Draft	Ben Loewen	Werner de Schaetzen
R5	April 1, 2022	Final	Ben Loewen	Werner de Schaetzen
R6	April 26, 2022	Updated Draft	Ben Loewen	Werner de Schaetzen
R7	April 27, 2022	Final	Ben Loewen	Werner de Schaetzen
R8	May 25, 2023	Updated Draft	Ben Loewen	Werner de Schaetzen
R9	May 31, 2022	Final	Ben Loewen	Werner de Schaetzen

Statement of Qualifications and Limitations

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

Contents

1 Introduction

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

The development will have four (4) connections to the City water distribution system:

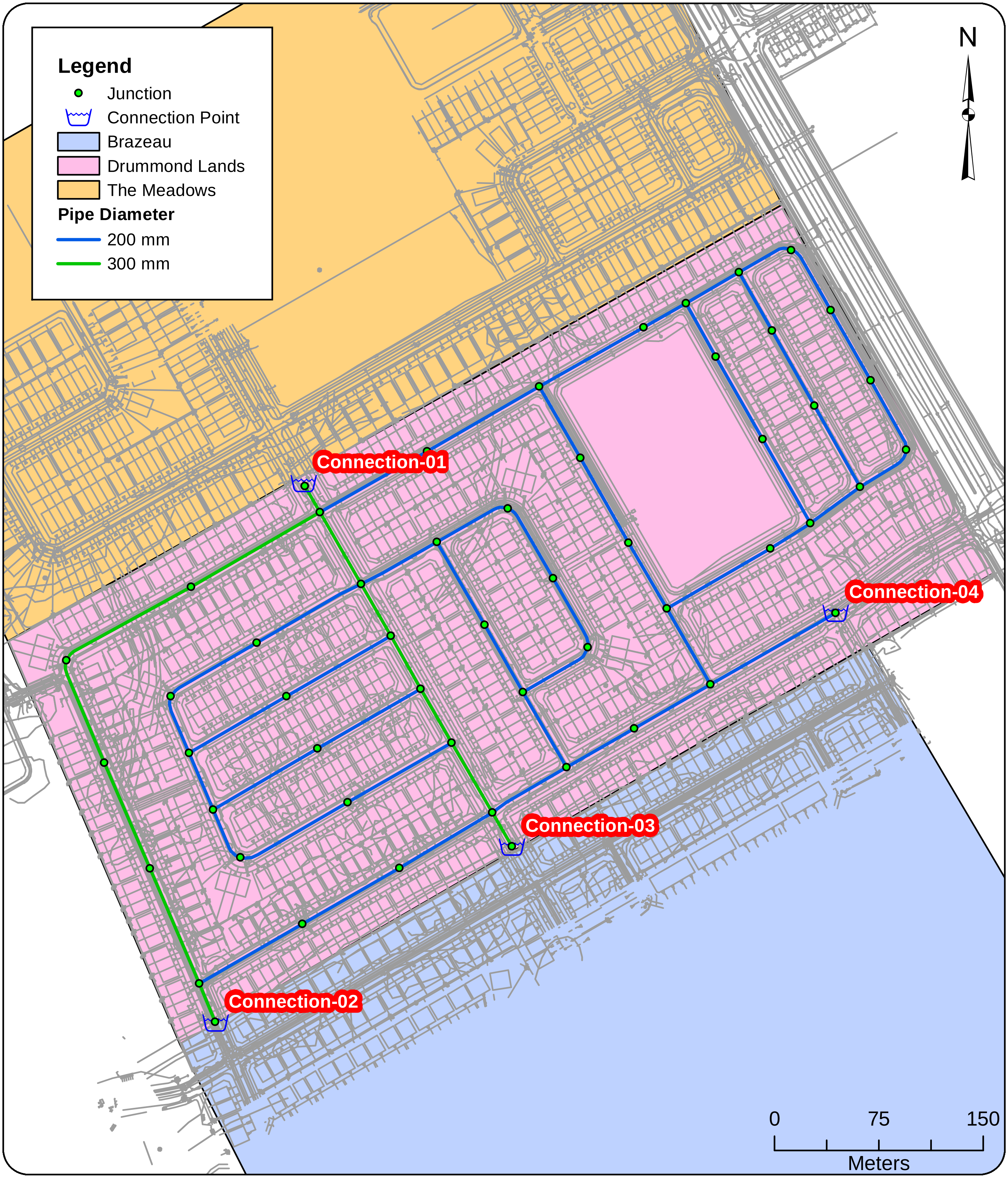
- Connection 1: Elevation Road (North)
- Connection 2: Travertine Way at Haiku Street
- Connection 3: Elevation Road at Haiku Street
- Connection 4: Dundonald Drive

The Drummond Lands development will connect north to the Meadows development and south to the Brazeau development.

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**
Drummond Lands
2021-089-DSE
Client: **David Schaeffer Engineering Ltd.**
Date: **May 2023**
Created by: **BL**
Reviewed by: **WdS**

Drummond Lands Site Layout and Connection Point

Figure 1.1

2 Modeling Considerations

2.1 Water Main Configuration

The water main network was modeled based on drawings prepared by DSEL (1123_Gen_World_Coord_May1223.dwg) and provided to GeoAdvice on May 15th, 2023.

2.2 Elevations

Elevations of the modeled junctions were assigned according to a preliminary site grading plan prepared by DSEL (1123_Grad_World_Coord_May1223.dwg) and provided to GeoAdvice on May 15th, 2023.

2.3 Consumer Demands

The residential demands were based on a demand rate of 280 L/cap/d as per City of Ottawa technical bulletin ISTB 2021-03. The park rate of 28,000 L/ha/d was assumed as per the City of Ottawa design guidelines and is consistent with similar previously completed developments within the City of Ottawa. Demand factors used for this analysis were taken according to the City of Ottawa 2010 Design Guidelines *Table 4.2 Consumption Rate for Subdivisions of 501 to 3,000 Persons*. 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**.

Table 2.1: City of Ottawa Demand Factors

Demand Type	Amount	Units
Average Day Demand		
Residential	280	L/c/d
Park	28,000	L/ha/d
Maximum Daily Demand		
Residential	2.5 x avg. day	L/c/d
Park	1.5 x avg. day	L/ha/d
Peak Hour Demand		
Residential	2.2 x max. day	L/c/d
Park	1.8 x max. day	L/ha/d

Table 2.2 to **Table 2.3** summarize the water demand calculations for the Drummond Lands.

Table 2.2: Development Population and Demand Calculations – Drummond Lands

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	61	3.4	208	0.67	1.69	3.71
Traditional Townhome	210	2.7	568	1.84	4.60	10.12
Back-to-Back Townhouse	432	2.7	1,167	3.78	9.45	20.80
Total	**703**		**1,943**	**6.30**	**15.74**	**34.63**

*City of Ottawa Design Guidelines.

Table 2.3: Non Residential Demand Calculations – Drummond Lands

Land Use Type	Area (ha)	Average Day Demand (L/s)	Maximum Day Demand (L/s)	Peak Hour Demand (L/s)
Park	1.73	0.56	0.84	1.51

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 previously 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. The required fire flow for single detached and traditional townhomes that meet Technical Bulletin ISTB-2018-02 requirements were capped at 10,000 L/min (167 L/s). For the townhouse units where the 10,000 L/min cap could not be applied, the FUS calculations yielded the following required fire flows:

- Block 151: 12,000 L/min (200 L/s)

For the back-to-back townhouse units, the architect provided a section of the back-to-back units that illustrates that the basements are more than 50% below grade. The areas used for the fire flow calculations represent the largest units and total floor areas of the back-to-back product, as confirmed by the architect. Please refer to the correspondence in the **Appendix B** for additional detail. Therefore, only the areas for two (2) floors were used and the FUS calculations for the back-to-back townhouse blocks yielded the following required fire flows:

- 8-unit back-to-back townhouse (middle of development): 13,000 L/min (217 L/s)
- 8-unit back-to-back townhouse (east side of development): 12,000 L/min (200 L/s)
- 10-unit back-to-back townhouse: 10,000 L/min (167 L/s), with one (1) firewall

At this time, there is not enough information available to calculate the required fire flows of the park. As such, the following required fire flow was assumed, based on similar information from previously completed projects:

- Park: 167 L/s

Fire flow simulations were completed at each model node. The locations of nodes do not necessarily represent hydrant locations.

Detailed FUS fire flow calculations as well as the illustrated 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: Elevation Road (North)
- Connection 2: Travertine Way at Haiku Street
- Connection 3: Elevation Road at Haiku Street
- Connection 4: Dundonald Drive

The above connection points 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.

Under existing conditions, the development will be serviced by the 3SW pressure zone; however, in the future, it will be serviced by the South Urban Community (SUC) pressure zone. The future pressure realignment for the SUC pressure zone includes the previous 3C pressure zone, portions of the current adjacent pressure zones, and the portion of the 3SW pressure zone where the development is located. The future SUC pressure zone is expected to be serviced by additional pumps and storage tanks.

Boundary conditions were provided under the existing and future pressure zone configurations. As the timeline for the pressure zone realignment is unconfirmed at this time, the existing conditions were used to ensure that the most conservative option was selected for each of the ADD, PHD, and MDD+FF scenarios.

The City boundary conditions were provided to GeoAdvice on May 16, 2023, and can be found in **Appendix C**.

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

Table 2.4: Boundary Conditions

Condition*	Connection 1 HGL (m)	Connection 2 HGL (m)	Connection 3 HGL (m)	Connection 4 HGL (m)
Average Day (max. pressure)	156.7	156.7	156.7	156.7
Peak Hour (min. pressure)	141.1	141.1	141.1	141.1
Max Day + Fire Flow (167 L/s)	137.5	137.5	137.5	137.5
Max Day + Fire Flow (200 L/s) ǂ	135.8	135.0	135.6	135.9
Max Day + Fire Flow (217 L/s) ǂ	135.0	133.7	134.7	135.0

*Based on the existing boundary conditions provided by the City of Ottawa.
ǂ Interpolated values. The City did not confirm if additional pumps were turned on.

3 Hydraulic Capacity Design Criteria

3.1 Pipe Characteristics

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

Table 3.1: Model Pipe Characteristics

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

3.2 Pressure Requirements

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

Table 3.2: Pressure Requirements

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

4 Hydraulic Capacity Analysis

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

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

4.1 Development Pressure Analysis

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

Table 4.1: Summary of the Drummond Lands Available Service Pressures

Average Day Demand Maximum Pressure	Peak Hour Demand Minimum Pressure
80 psi (552 kPa)	49 psi (341 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 in the distribution system in occupied areas outside of the public right-of-way shall not exceed 552 kPa (80 psi). As such, based on the City boundary conditions for the average day demand scenario, pressure reducing valves may be required throughout the development. In summary:

- Under the existing pressure zone conditions, any location with elevation lower than 100.4 m may experience high pressures (≥ 80 psi). The minimum modeled development elevation is 100.4 m, and as a result, pressure greater than 80 psi are not predicted to occur within the Drummond Lands development under the existing pressure zone conditions.
- Under the future pressure zone conditions, any location with the elevation lower than 90.4 m may experience high pressures (≥ 80 psi). The minimum modeled development elevation is 100.4 m, and as a result, high pressures are not predicted to occur within the Drummond Lands development under the future pressure zone conditions.

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

4.2 Development Fire Flow Analysis

4.2.1 Standard Fire Flow Analysis

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

A different protocol was applied to the design of the water mains adjacent to 8-unit back-to-back townhouse units on the eastern portion of the as per Technical Bulletin *ISTB-2018-02.* The results for these junctions are presented in **Section 4.2.2**.

Table 4.2: Summary of the Drummond Lands Minimum Available Fire Flows

Required Fire Flow	Minimum Available Flow*	Junction ID
167 L/s	186 L/s	JCT-041
200 L/s	206 L/s	JCT-052
217 L/s	291 L/s	JCT-022

*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, except for junctions JCT-039, JCT-040, JCT-043, JCT-044, JCT-045, and JCT-053 (adjacent to 8-unit back-to-back townhouse units), which will use the watermain network sizing protocol referenced in *Appendix I* of City of Ottawa Technical Bulletin *ISTB-2018-02* (refer to **Section 4.2.2**).

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

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

Minimum Residual Pressure	Average Residual Pressure	Maximum Residual Pressure
21 psi (148 kPa)	38 psi (263 kPa)	52 psi (357 kPa)

As shown in **Table 4.3**, there is sufficient residual pressure at all the junctions within the development, except for junctions JCT-039, JCT-040, JCT-043, JCT-044, JCT-045, and JCT-053 (adjacent to 8-unit back-to-back townhouse units), which will use the watermain network sizing protocol referenced in *Appendix I* of City of Ottawa Technical Bulletin *ISTB-2018-02* (refer to **Section 4.2.2**).

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

4.2.2 Fire Flow Analysis using Hydrant Analysis

The watermain network sizing protocol referenced in *Appendix I* of City of Ottawa Technical Bulletin *ISTB-2018-02* ("protocol") was applied to the design of the watermains fronting the most conservative 8-unit back-to-back townhouse Block 171 (expected to have the highest required fire flow), which will be applied to all water mains fronting the 8-unit back-to-back townhouse units corresponding with the following junctions: JCT-039, JCT-040, JCT-043, JCT-044, JCT-045, and JCT-053. This protocol determined the appropriate sizing of these watermains and associated hydrant requirements.

Table 4.4 shows the fire flow simulation results obtained when applying the protocol and **Table 4.5** shows the proposed hydrants spacing. The proposed hydrants placement and the modeling results are shown in **Appendix G**.

Table 4.4: Fire Flow Split and Modeling Results (Back-to-Back Townhouse Block 171)

Hydrant ID	Flow at Hydrant	Residual Pressure
HYD-01	3,780 L/min	23 psi
HYD-02	2,550 L/min	23 psi
HYD-03	5,670 L/min	21 psi
Total	**12,000 L/min (200 L/s)**	**all > 20 psi**

Table 4.5: Hydrant Distances (Back-to-Back Townhouse Block 171)

Location	Distance to Hydrant		
	HYD-01	HYD-02	HYD-03
Block 172	83 m	59 m	19 m

Table 4.4 shows that sufficient fire flow is possible at Block 171 when hydrants HYD-01, HYD-02 and HYD-03 are flowing simultaneously. In addition, all hydrants are within 150 m of Block 171.

It is important to note that all hydrants will need to comply with the City of Ottawa Guidelines (see **Section 5.3**).

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 Drummond Lands development services a total average day demand of 593 m^3/day; as such, two (2) feeds are required. Four (4) feeds to the Drummond Lands development 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 Drummond Lands 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 **Section 4.2.2**. All hydrants will be required to meet 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

The detailed engineering drawings for the Drummond Lands 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 Drummond Lands development network, calculated from the connections to the development is about 6 hours (ADD is 593 m^3/day).

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

6 Conclusions

The hydraulic capacity and modeling analysis of the Drummond Lands development yielded the following conclusions:

- The proposed water main network can deliver all domestic flows, with service pressures expected to range between 49 psi (341 kPa) and 80 psi (552 kPa).
- The proposed water main network is able to deliver fire flows at all junctions using the water main network sizing protocol referenced in the City of Ottawa Technical Bulletin *ISTB-2018-02*, except for junctions JCT-039, JCT-040, JCT-043, JCT-044, JCT-045, and JCT-053 (adjacent to 8-unit back-to-back townhouse units). The watermain network sizing protocol referenced in *Appendix I* of City of Ottawa Technical Bulletin *ISTB-2018-02* was applied to the design of the watermains fronting these buildings. Using the guidelines in *Appendix I*, the proposed water main network is able to deliver fire flows to the 8-unit back-to-back townhouse units.
- Pressure reducing valves may be required, since maximum pressures are predicted to exceed the City of Ottawa Design Guidelines (> 80 psi).
    - Under the existing pressure zone conditions, any location with elevation lower than 100.4 m may experience high pressures (≥ 80 psi). The minimum modeled development elevation is 100.4 m, and as a result, pressure greater than 80 psi are not predicted to occur within the Drummond Lands development under the existing pressure zone conditions.
    - Under the future pressure zone conditions, any location with the elevation lower than 90.4 m may experience high pressures (≥ 80 psi). The minimum modeled development elevation is 100.4 m, and as a result, high pressures are not predicted to occur within the Drummond Lands development under the future pressure zone conditions.
- Hydraulic modeling was completed using the existing scenario boundary conditions provided, to ensure that the most conservative HGLs were used to analyze the ADD, PHD, and MDD+FF scenarios.

Submission

Prepared by:

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May 31, 2023

Ben Loewen, P.Eng., PMP.
Project Engineer / Project Manager

Approved by:

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

Appendix A Domestic Water Demand Calculations and Allocation

Consumer Water Demands

Phase 3 - Residential Demands

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)	2.5 x Avg. Day (L/s)	2.2 x Max Day (L/s)
Single Detached	61	3.4	208	280	58,240	0.67	1.69	3.71
Back-to-Back Townhome	122	2.7	330		92,400	1.07	2.67	5.88
Traditional Townhome	151	2.7	408		114,240	1.32	3.31	7.27
Subtotal	**334**		**946**		**264,880**	**3.07**	**7.66**	**16.86**

Phase 3 - Non Residential Demands

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	0.07	Phase 3A	28,000	1,960	0.02	0.03	0.06
Subtotal	**0.07**			**1,960**	**0.02**	**0.03**	**0.06**

Phase 4 - Residential Demands

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)	2.5 x Avg. Day (L/s)	2.2 x Max Day (L/s)
Back-to-Back Townhome	88	2.7	238		66,640	0.77	1.93	4.24
Traditional Townhome	281	2.7	759		212,520	2.46	6.15	13.53
Subtotal	**369**		**997**		**279,160**	**3.23**	**8.08**	**17.77**

Phase 4 - Non Residential Demands

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	1.66	Phase 4	28,000	46,480	0.54	0.81	1.45
Subtotal	**1.66**			**46,480**	**0.54**	**0.81**	**1.45**

		Average Day	Max Day	Peak Hour
Total		**6.86**	**16.58**	**36.15**

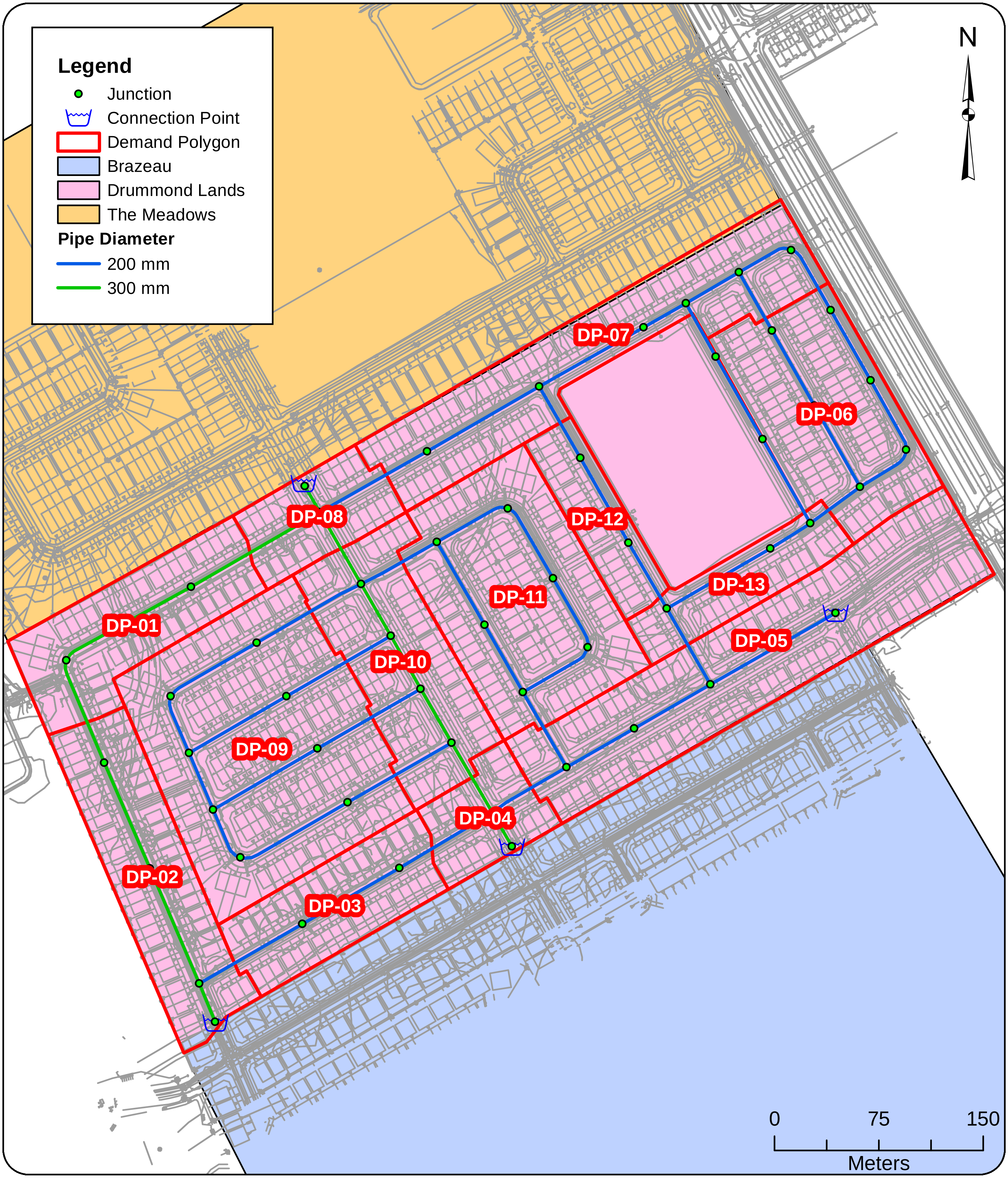
Demand Calculations and Allocation

Drummond Lands Domestic Demands

Demand Polygon	Junction ID	Dwelling Type	Number of Units	Population	Average Day Demand			Max Day 2.5 x Avg. Day (L/s)	Peak Hour 2.2 x Max Day (L/s)
					L/c/d	L/d	L/s		
1	JCT-002	Single Detached	17	58	280	16,231	0.19	0.46	1.02
	JCT-003	Traditional Townhouse	21	57	280	15,888	0.19	0.46	1.02
2	JCT-004	Single Detached	19	65	280	18,140	0.12	0.31	0.67
	JCT-005						0.12	0.31	0.67
	JCT-006	Traditional Townhouse	32	86	280	24,210	0.12	0.31	0.67
	JCT-007						0.12	0.31	0.67
3	JCT-008	Single Detached	17	58	280	16,231	0.18	0.44	0.97
	JCT-009	Traditional Townhouse	19	51	280	14,375	0.18	0.44	0.97
4	JCT-010	Single Detached	3	10	280	2,864	0.06	0.16	0.36
	JCT-050	Traditional Townhouse	11	30	280	8,322	0.06	0.16	0.36
5	JCT-028	Traditional Townhouse	80	216	280	60,525	0.18	0.44	0.96
	JCT-029						0.18	0.44	0.96
	JCT-030						0.18	0.44	0.96
	J-60						0.18	0.44	0.96
6	JCT-040	Traditional Townhouse	9	24	280	6,809	0.09	0.23	0.50
	JCT-041						0.09	0.23	0.50
	JCT-042						0.09	0.23	0.50
	JCT-043	Back-to-Back Townhouse	74	200	280	56,046	0.09	0.23	0.50
	JCT-044						0.09	0.23	0.50
	JCT-045						0.09	0.23	0.50
	JCT-052						0.09	0.23	0.50
	JCT-053						0.09	0.23	0.50
7	JCT-023	Traditional Townhouse	59	159	280	44,637	0.11	0.27	0.59
	JCT-024						0.11	0.27	0.59
	JCT-037	Back-to-Back Townhouse	14	38	280	10,603	0.11	0.27	0.59
	JCT-038						0.11	0.27	0.59
	JCT-039						0.11	0.27	0.59
	JCT-051						0.11	0.27	0.59
8	JCT-001	Single Detached	5	17	280	4,774	0.09	0.22	0.49
	JCT-049	Traditional Townhouse	14	38	280	10,592	0.09	0.22	0.49
9	JCT-015	Traditional Townhouse	47	127	280	35,558	0.16	0.40	0.89
	JCT-016						0.16	0.40	0.89
	JCT-017						0.16	0.40	0.89
	JCT-018						0.16	0.40	0.89
	JCT-019	Back-to-Back Townhouse	100	270	280	75,738	0.16	0.40	0.89
	JCT-020						0.16	0.40	0.89
	JCT-021						0.16	0.40	0.89
	JCT-022						0.16	0.40	0.89
10	JCT-011	Traditional Townhouse	28	76	280	21,184	0.11	0.27	0.60
	JCT-012						0.11	0.27	0.60
	JCT-013	Back-to-Back Townhouse	22	60	280	16,662	0.11	0.27	0.60
	JCT-014						0.11	0.27	0.60
11	JCT-031	Traditional Townhouse	75	203	280	56,742	0.11	0.27	0.60
	JCT-032						0.11	0.27	0.60
	JCT-033						0.11	0.27	0.60
	JCT-034						0.11	0.27	0.60
	JCT-035						0.11	0.27	0.60
	JCT-036						0.11	0.27	0.60
12	JCT-025	Traditional Townhouse	17	46	280	12,861	0.07	0.19	0.41
	JCT-026						0.07	0.19	0.41
13	JCT-027	Traditional Townhouse	20	54	280	15,131	0.06	0.15	0.32
	JCT-046						0.06	0.15	0.32
	JCT-054						0.06	0.15	0.32
	Total:		**703**	**1,943**		**544,121**	**6.30**	**15.74**	**34.64**

Drummond Lands Non-Domestic Demands

Property Type	Junction ID	Phase	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)		
Park (Block 199)	JCT-004		0.07	28,000	1,960	0.02	0.03	0.06
Park (Block 200)	JCT-025		1.66	28,000	46,480	0.13	0.20	0.36
	JCT-026					0.13	0.20	0.36
	JCT-027					0.13	0.20	0.36
	JCT-046					0.13	0.20	0.36
	Total:		**1.73**		**48,440**	**0.56**	**0.84**	**1.51**



GeoAdvice Engineering Inc.

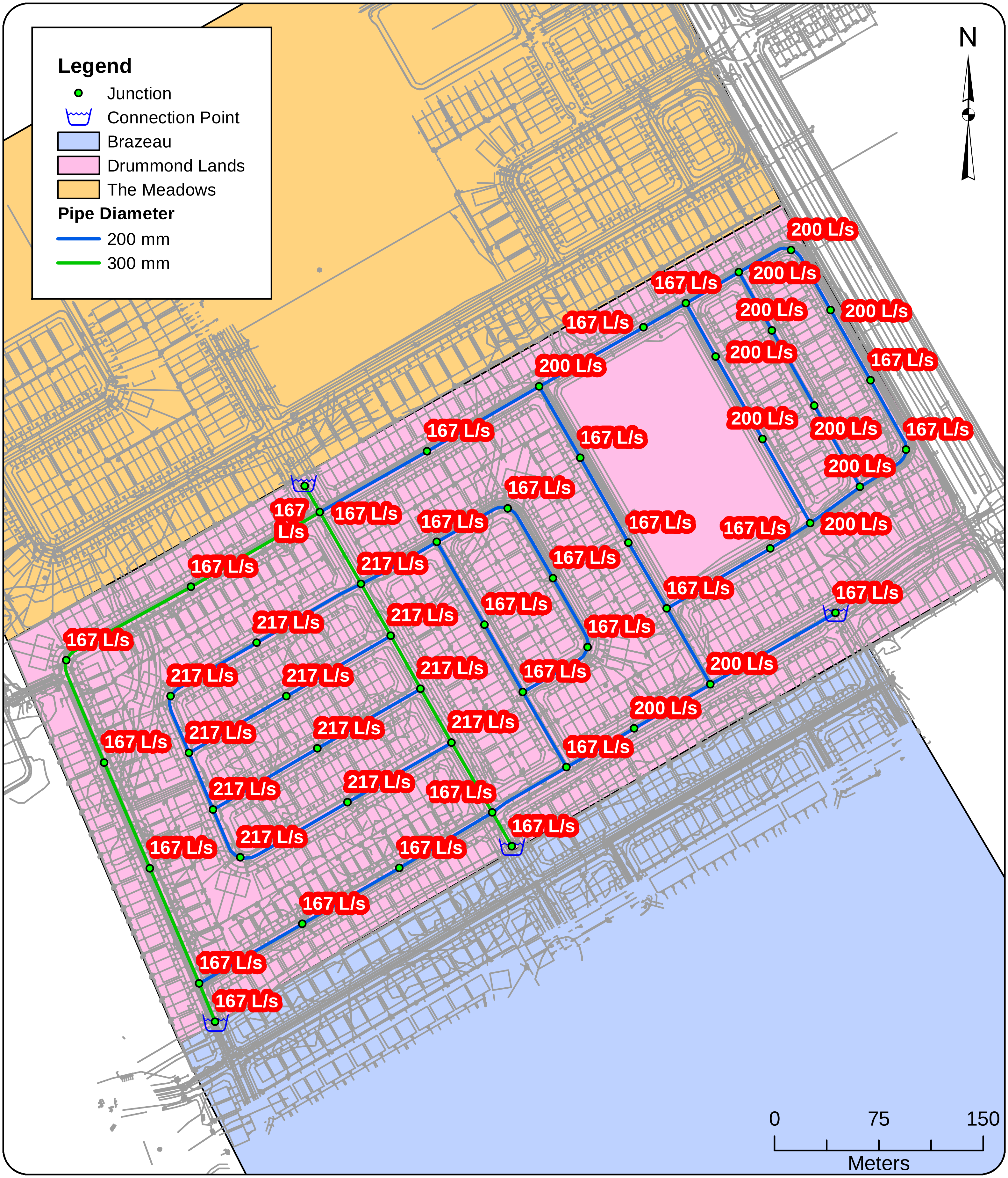
Project: **Hydraulic Capacity and Modeling Analysis**
Drummond Lands
2021-089-DSE
Client: **David Schaeffer Engineering Ltd.**
Date: **May 2023**
Created by: **BL**
Reviewed by: **WdS**

DISCLAIMER: GeoAdvice does not warrant in any way the accuracy and completeness of the information shown on this map. Field verification of the accuracy and completeness of the information shown on this map is the sole responsibility of the user.

Demand Allocation

Figure A.1

Appendix B FUS Fire Flow Calculations and Allocation



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Created by: **BL**
Reviewed by: **WdS**

Required Fire Flow

Figure B.1

FUS Required Fire Flow Calculation

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

Client: David Schaeffer Engineering Ltd.

Project: 2021-089-DSE — Back-to-Back Townhouse Block 173 (10 unit)

Development: Drummond Lands — One (1) firewall splitting block into 6 unit and 4 unit areas

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

Date: April 20, 2022

A. Type of Construction: Wood Frame Construction

B. Ground Floor Area: 332 m^2

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.

C. Number of Storeys: 2

Architect confirmed that the basement will be 50% or more below grade. Therefore, only the areas of 2 floors were used 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 =** 699 m^2 (Combined area of 6 units)

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

F = 8,727 L/min — **D = 9,000 L/min***

E. Occupancy

Occupancy content hazard — Limited Combustible — -15 % of **D** — **-1,350 L/min** — **E = 7,650 L/min**

F. Sprinkler Protection

Automatic sprinkler protection — None — 0 % of **E** — **0 L/min** — **F = 7,650 L/min**

G. Exposures

Side	Separation Distance	Length-Height Factor - Adjacent Structure	Construction Type - Adjacent Structure	Exposure
North	3.1 to 10 m	31-60 m-storeys	Wood Frame or Non-Combustible	18%
East	Beyond 45 m	0-30 m-storeys	Wood Frame or Non-Combustible	0%
South	Fire wall	31-60 m-storeys	Wood Frame or Non-Combustible	10%
West	20.1 to 30 m	31-60 m-storeys	Wood Frame or Non-Combustible	8%
			Total	36%

% of **E** — **+ 2,754 L/min** — **G = 10,404 L/min**

H. Wood Shake Charge — No — **0 L/min** — **H = 10,404 L/min**

For wood shingle or shake roofs

Total Fire Flow Required	**10,000**	**L/min****
	167	**L/s**
Required Duration of Fire Flow	**2**	**Hrs**
Required Volume of Fire Flow	**1,200**	**m^3**

*Rounded to the nearest 1,000 L/min

The Total Required Fire Flow for the Drummond Lands 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

FUS Required Fire Flow Calculation

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

Client: David Schaeffer Engineering Ltd.
Project: 2021-089-DSE
Development: Drummond Lands — Back-to-Back Townhouse Block 172 (8 units)
Zoning: Multi Family Residential — Note: For other 8-unit back-to-back townhouse blocks, a similar fire flow as calculated below will be used.
Date: April 20, 2022

A. Type of Construction: Wood Frame Construction

B. Ground Floor Area: 469 **m²**

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 8 units is considered in this calculation.

C. Number of Storeys: 2

Architect confirmed that the basement will be 50% or more below grade. Therefore, only the areas of 2 floors were used 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 =** 937 **m²** (Combined area of 8 units)

The total floor area in m² in the building being considered

F = 10,104 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	3.1 to 10 m	31-60 m-storeys	Wood Frame or Non-Combustible	18%
East	Beyond 45 m	0-30 m-storeys	Wood Frame or Non-Combustible	0%
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**	**m³**

*Rounded to the nearest 1,000 L/min

The Total Required Fire Flow for the Drummond Lands 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.

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* 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

FUS Required Fire Flow Calculation

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

Client: David Schaeffer Engineering Ltd.
Project: 2021-089-DSE
Development: Drummond Lands — Single Family Lots 42-61
Zoning: Multi Family Residential
Date: March 22, 2022

Note: For other single family lots that do comply with the City of Ottawa Technical Bulletin ISDTB-2018-02 4.1, a similar fire flow as calculated below will be used.

A. Type of Construction: Wood Frame Construction

B. Ground Floor Area: 1836 m^2

C. Number of Storeys: 2

Note: The single detached dwellings are separated by less than 3 m; therefore, they must be considered as one fire area. The combined area of 20 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 =** 3672 m^2 (Combined area of 20 units)

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

F = 19,997 L/min — **D = 20,000 L/min***

E. Occupancy

Occupancy content hazard — Limited Combustible — -15 % of **D** — **-3,000 L/min** — **E = 17,000 L/min**

F. Sprinkler Protection

Automatic sprinkler protection — None — 0 % of **E** — **0 L/min** — **F = 17,000 L/min**

G. Exposures

Side	Separation Distance	Length-Height Factor - Adjacent Structure	Construction Type - Adjacent Structure	Exposure
North	10.1 to 20 m	Over 120 m-storeys	Wood Frame or Non-Combustible	15%
East	30.1 to 45 m	0-30 m-storeys	Wood Frame or Non-Combustible	5%
South	20.1 to 30 m	Over 120 m-storeys	Wood Frame or Non-Combustible	10%
West	10.1 to 20 m	0-30 m-storeys	Wood Frame or Non-Combustible	12%
			Total	**42%**

% of **E** — **+ 7,140 L/min** — **G = 24,140 L/min**

H. Wood Shake Charge — No — **0 L/min** — **H = 24,140 L/min**

For wood shingle or shake roofs

The required fire flow exceeds the cap in the City of Ottawa Technical Bulletin ISDTB-2018-02 4.1. The single family dwellings do comply with the provisions of the Bulletin; therefore, the required fire flow is:

Total Fire Flow Required	**10,000**	**L/min****
	167	**L/s**
Required Duration of Fire Flow	**2**	**Hrs**
Required Volume of Fire Flow	**1,200**	**m^3**

*Rounded to the nearest 1,000 L/min

The Total Required Fire Flow for the Drummond Lands 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

FUS Required Fire Flow Calculation

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

Client: David Schaeffer Engineering Ltd.
Project: 2021-089-DSE
Development: Drummond Lands — Townhouse Block 94
Zoning: Multi Family Residential
Date: March 22, 2022

Note: For other townhouse blocks that do comply with the City of Ottawa Technical Bulletin ISDTB-2018-02 4.2, a similar fire flow as calculated below will be used.

A. Type of Construction: Wood Frame Construction

B. Ground Floor Area: 462 m^2

C. Number of Storeys: 2

Note: The townhouse dwellings are separated by less than 3 m; therefore, they must be considered as one fire area. The combined area of 5 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 =** 924 m^2 (Combined area of 5 units)

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

F = 10,031 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	20.1 to 30 m	91-120 m-storeys	Wood Frame or Non-Combustible	10%
East	3.1 to 10 m	0-30 m-storeys	Wood Frame or Non-Combustible	17%
South	10.1 to 20 m	61-90 m-storeys	Wood Frame or Non-Combustible	14%
West	3.1 to 10 m	0-30 m-storeys	Wood Frame or Non-Combustible	17%
			Total	**58%**

% of **E** — **+ 4,930 L/min** — **G = 13,430 L/min**

H. Wood Shake Charge — No — **0 L/min** — **H = 13,430 L/min**

For wood shingle or shake roofs

The required fire flow exceeds the cap in the City of Ottawa Technical Bulletin ISDTB-2018-02 4.2. The townhouse dwellings do comply with the provisions of the Bulletin; therefore, the required fire flow is:

Total Fire Flow Required	**10,000**	**L/min****
	167	**L/s**
Required Duration of Fire Flow	**2**	**Hrs**
Required Volume of Fire Flow	**1,200**	**m^3**

*Rounded to the nearest 1,000 L/min

The Total Required Fire Flow for the Drummond Lands 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

FUS Required Fire Flow Calculation

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

Client: David Schaeffer Engineering Ltd.
Project: 2021-089-DSE
Development: Drummond Lands — Townhouse Block 151
Zoning: Multi Family Residential
Date: March 22, 2022

Note: For other townhouse blocks that do not comply with the City of Ottawa Technical Bulletin ISDTB-2018-02 4.2, a similar fire flow as calculated below will be used.

A. Type of Construction: Wood Frame Construction

B. Ground Floor Area: 475 m^2

C. Number of Storeys: 2

Note: The townhouse dwellings are separated by less than 3 m; therefore, they must be considered as one fire area. The combined area of 5 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 =** 951 m^2 (Combined area of 5 units)

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

F = 10,176 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	20.1 to 30 m	31-60 m-storeys	Wood Frame or Non-Combustible	8%
East	Beyond 45 m	0-30 m-storeys	Wood Frame or Non-Combustible	0%
South	10.1 to 20 m	0-30 m-storeys	Wood Frame or Non-Combustible	12%
West	3.1 to 10 m	0-30 m-storeys	Wood Frame or Non-Combustible	17%
			Total	**37%**

% of **E** — **+ 3,145 L/min** — **G = 11,645 L/min**

H. Wood Shake Charge — No — **0 L/min** — **H = 11,645 L/min**

For wood shingle or shake roofs

The required fire flow exceeds the cap in the City of Ottawa Technical Bulletin ISDTB-2018-02 4.2. The townhouse dwellings do not comply with the provisions of the Bulletin; therefore, the required fire flow is:

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 Drummond Lands 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

FUS Required Fire Flow Calculation

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

Client: David Schaeffer Engineering Ltd.

Project: 2021-089-DSE

Development: Drummond Lands — Back-to-Back Townhouse Block 104 (8-units)

Zoning: Multi Family Residential — Note: For other back-to-back townhouse blocks, a similar fire flow as calculated below will be used.

Date: March 22, 2022

A. Type of Construction: Wood Frame Construction

B. Ground Floor Area: 443 m^2

C. Number of Storeys: 2

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 8 units is considered in this calculation.

Architect confirmed that the basement will be 50% or more below grade. Therefore, only the areas of 2 floors were used 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 =** 937 m^2 (Combined area of 8 units)

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

F = 10,104 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	20.1 to 30 m	61-90 m-storeys	Wood Frame or Non-Combustible	9%
East	3.1 to 10 m	61-90 m-storeys	Wood Frame or Non-Combustible	19%
South	20.1 to 30 m	61-90 m-storeys	Wood Frame or Non-Combustible	9%
West	3.1 to 10 m	61-90 m-storeys	Wood Frame or Non-Combustible	19%
			Total	**56%**

% of **E** — **+ 4,760 L/min** — **G = 13,260 L/min**

H. Wood Shake Charge — No — **0 L/min** — **H = 13,260 L/min**

For wood shingle or shake roofs

Total Fire Flow Required	**13,000**	**L/min****
	217	**L/s**
Required Duration of Fire Flow	**2.75**	**Hrs**
Required Volume of Fire Flow	**2,145**	**m^3**

*Rounded to the nearest 1,000 L/min

The Total Required Fire Flow for the Drummond Lands 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.

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* 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

FUS Required Fire Flow Calculation

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

Client: David Schaeffer Engineering Ltd.
Project: 2021-089-DSE
Development: Drummond Lands — Back-to-Back Townhouse Block 173 (10 units)
Zoning: Multi Family Residential — Note: For other 10-unit back-to-back townhouse blocks, a similar fire flow as calculated below will be used.
Date: March 22, 2022

A. Type of Construction: Wood Frame Construction

B. Ground Floor Area: 553 **m²**

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 10 units is considered in this calculation.

C. Number of Storeys: 2

Architect confirmed that the basement will be 50% or more below grade. Therefore, only the areas of 2 floors were used 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 =** 1166 **m²** (Combined area of 10 units)

The total floor area in m² in the building being considered

F = 11,266 L/min — **D = 11,000 L/min***

E. Occupancy

Occupancy content hazard — Limited Combustible — -15 % of **D** — **-1,650 L/min** — **E = 9,350 L/min**

F. Sprinkler Protection

Automatic sprinkler protection — None — 0 % of **E** — **0 L/min** — **F = 9,350 L/min**

G. Exposures

Side	Separation Distance	Length-Height Factor - Adjacent Structure	Construction Type - Adjacent Structure	Exposure
North	3.1 to 10 m	61-90 m-storeys	Wood Frame or Non-Combustible	19%
East	Beyond 45 m	0-30 m-storeys	Wood Frame or Non-Combustible	0%
South	3.1 to 10 m	61-90 m-storeys	Wood Frame or Non-Combustible	19%
West	20.1 to 30 m	31-60 m-storeys	Wood Frame or Non-Combustible	8%
			Total	**46%**

% of **E** — **+ 4,301 L/min** — **G = 13,651 L/min**

H. Wood Shake Charge — No — **0 L/min** — **H = 13,651 L/min**

For wood shingle or shake roofs

Total Fire Flow Required	**14,000**	**L/min****
	233	**L/s**
Required Duration of Fire Flow	**3**	**Hrs**
Required Volume of Fire Flow	**2,520**	**m³**

*Rounded to the nearest 1,000 L/min

The Total Required Fire Flow for the Drummond Lands 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

Subject: Caivan - OABB Areas

Reuben Helder <reuben.helder@caivan.com>
to Adam Fobert, Colin Haskin

Tue, Mar 15, 9:14 AM (

You are viewing an attached message. Gmail can't verify the authenticity of attached messages.

EXTERNAL E-MAIL - Do not click links or open attachments unless you recognize the sender.

Adam,

As discussed, here are the areas for the largest End and Internal units in **red**:

Model Number	Bsmnt SQFT	First Flr SQFT	Scnd Flr SQFT	Total SQFT (Exc. OTB & Incl. Bsmnt)	Total SQFT (Excl. OTB & Bsmnt)
OABB2001A	367.95	591.88	610.15	1569.98	1202.03
OABB2001B	367.95	591.88	610.15	1569.98	1202.03
OABB2001EA	378.25	608.06	627.35	1613.66	1235.41
OABB2001EB	378.25	608.06	626.43	1612.74	1234.49
OABB2002A	385.27	591.88	636.44	**1613.59**	**1228.32**
OABB2002B	385.27	591.88	630.33	1607.48	1222.21
OABB2002EA	393.91	609.79	654.53	1658.23	1264.32
OABB2002EB	393.91	609.79	684.42	**1688.12**	**1294.21**
OABB2003CA	428.62	615.23	651.74	**1695.59**	**1266.97**
OABB2003CB	428.62	615.23	634.41	1678.26	1249.64

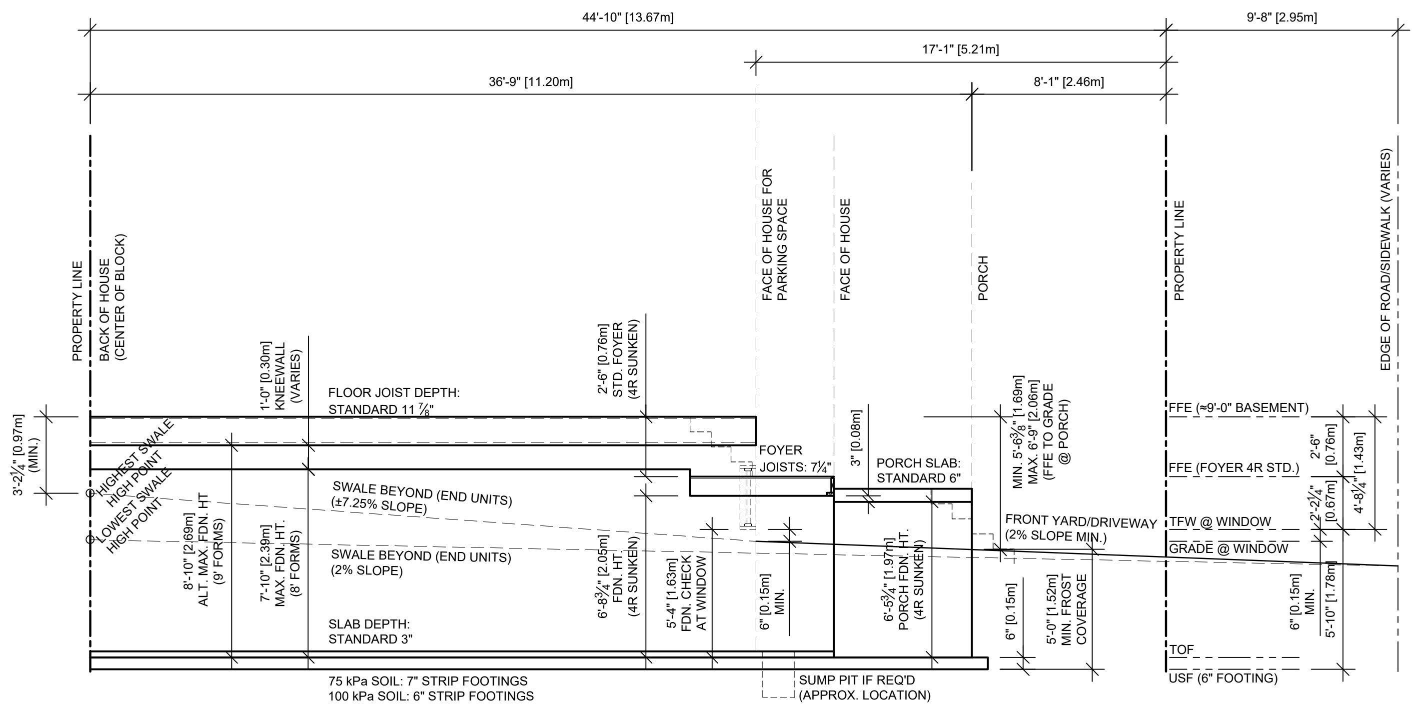
Here are the latest drawings.
Here is the standard grading section.

Was there something else you were looking for?

REUBEN HELDER

Manager, Architecture

C: 613-410-2191



1
GR05a

STANDARD LOT SECTION

SCALE: 1/8"=1'-0"

CAIVAN COMMUNITIES

COMMUNITY NO.:	LOT NO.:	
STANDARD	OABB MODELS	
ISSUED: Oct 05/21	DRAWN BY: RH	CHECKED BY: RH

PRODUCT NO.
STANDARD

SHEET NAME
LOT GRADING
BACK TO BACK TOWNS

SKETCH NO.
SK-GR05a

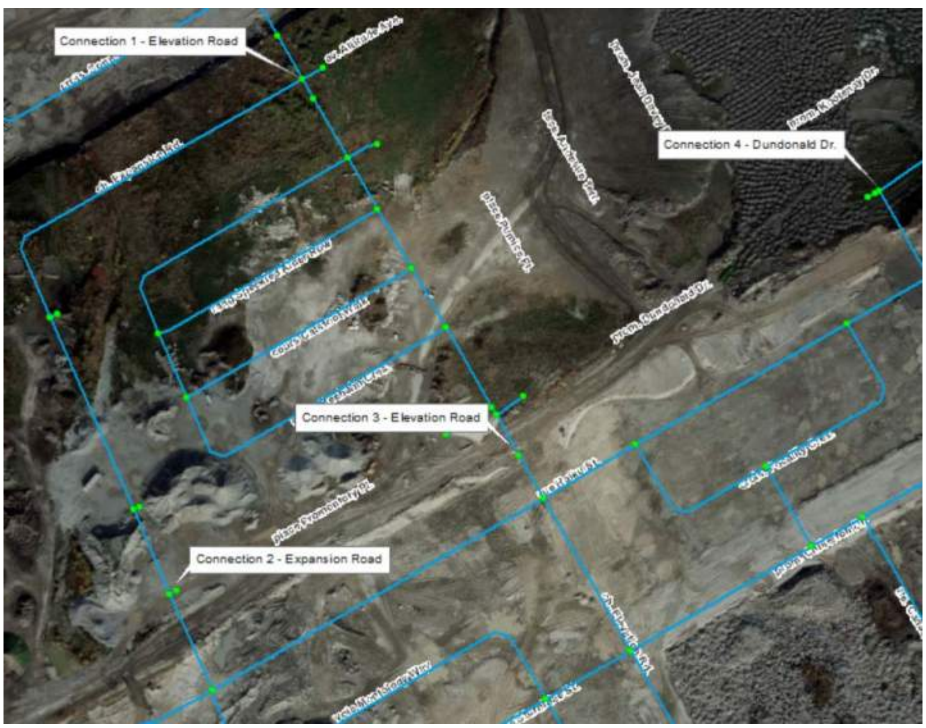
Appendix C Boundary Conditions

Boundary Conditions
Drummond Lands (The Ridge Phase 3)

Provided Information

Scenario	Demand	
	L/min	L/s
Average Daily Demand	412	6.86
Maximum Daily Demand	995	16.58
Peak Hour	2,169	36.15
Fire Flow Demand #1	10,020	167
Fire Flow Demand #2	12,000	200
Fire Flow Demand #3	13,020	217
Fire Flow Demand #4	16,980	283

Location



Results

Existing Condition (Pressure Zone 3SW)

Connection 1 – Elevation Road

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	156.7	74.9
Peak Hour	141.1	52.7
Max Day plus Fire Flow #1	137.5	47.6

Max Day plus Fire Flow #4	131.6	39.3
[1] Ground Elevation =	104.0	m

Connection 2 – Expansion Road

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	156.7	67.3
Peak Hour	141.1	45.1
Max Day plus Fire Flow #1	137.5	40.0
Max Day plus Fire Flow #4	128.8	27.7
[1] Ground Elevation =	109.3	m

Connection 3 – Elevation Road

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	156.7	79.2
Peak Hour	141.1	57.0
Max Day plus Fire Flow #1	137.5	51.9
Max Day plus Fire Flow #4	131.0	42.7
[1] Ground Elevation =	101.0	m

Connection 4 – Dundonald Dr.

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	156.7	81.1
Peak Hour	141.1	59.0
Max Day plus Fire Flow #1	137.5	53.9
Max Day plus Fire Flow #4	131.8	45.7
[1] Ground Elevation =	99.6	m

Future Condition (Pressure Zone SUC)

Connection 1 – Elevation Road

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	146.7	60.7
Peak Hour	141.8	53.7
Max Day plus Fire Flow #1	138.9	49.6
Max Day plus Fire Flow #4	130.4	37.5
[1] Ground Elevation =	104.0	m

Connection 2 – Expansion Road

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	146.7	53.1
Peak Hour	141.7	46.1
Max Day plus Fire Flow #1	137.8	40.4

Max Day plus Fire Flow #4	127.6	25.9
[1] Ground Elevation =	109.3	m

Connection 3 – Elevation Road

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	146.7	65.0
Peak Hour	141.7	58.0
Max Day plus Fire Flow #1	138.6	53.5
Max Day plus Fire Flow #4	129.7	40.9
[1] Ground Elevation =	101.0	m

Connection 4 – Dundonald Dr.

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	146.7	67.0
Peak Hour	141.8	59.9
Max Day plus Fire Flow #1	138.9	55.9
Max Day plus Fire Flow #4	130.5	44.0
[1] Ground Elevation =	99.6	m

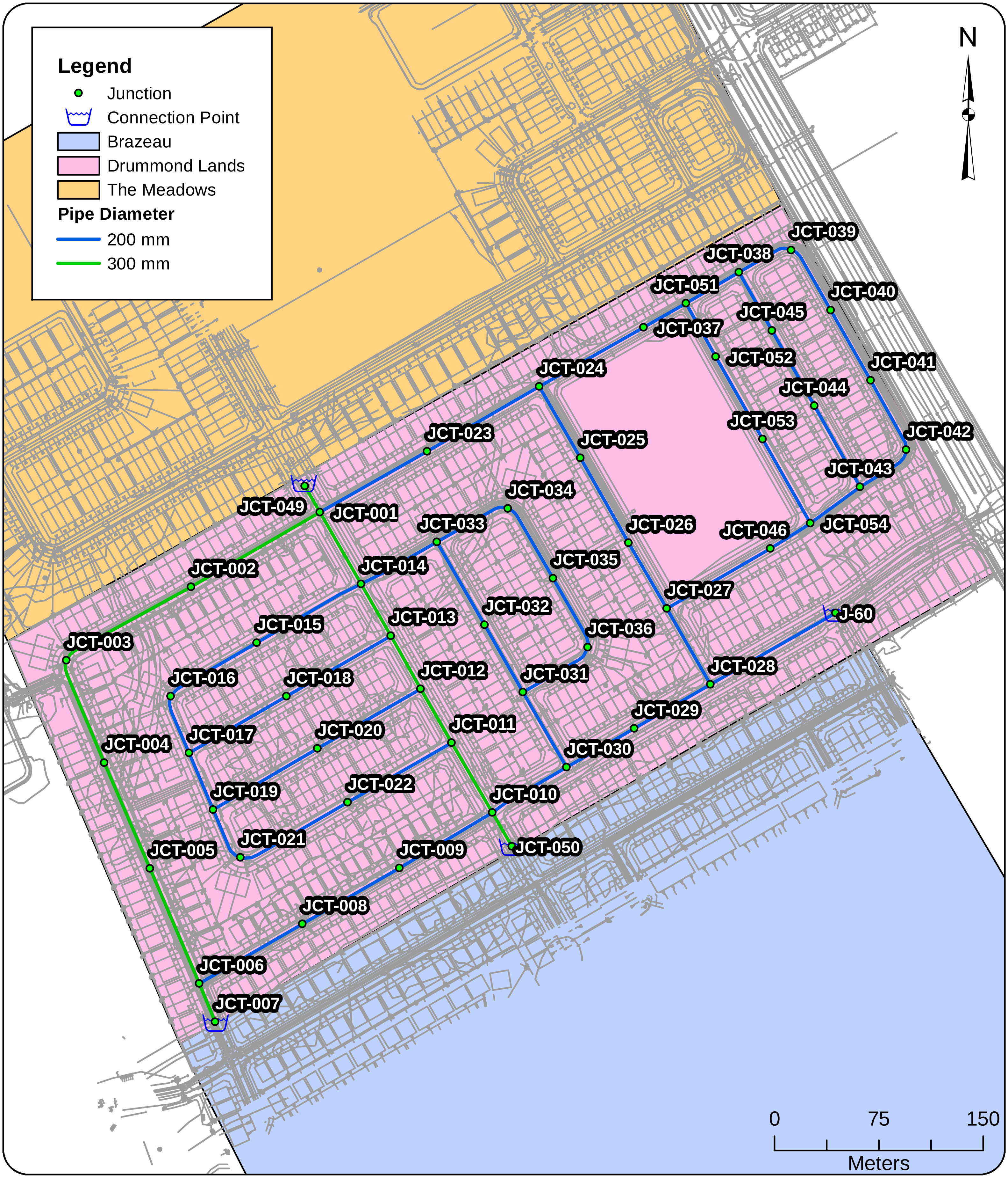
Notes

1. As per the Ontario Building Code in areas that may be occupied, the static pressure at any fixture shall not exceed 552 kPa (80 psi.) Pressure control measures to be considered are as follows, in order of preference:
    a. If possible, systems to be designed to residual pressures of 345 to 552 kPa (50 to 80 psi) in all occupied areas outside of the public right-of-way without special pressure control equipment.
    b. Pressure reducing valves to be installed immediately downstream of the isolation valve in the home/ building, located downstream of the meter so it is owner maintained.

Disclaimer

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

Appendix D Pipe and Junction Model Inputs

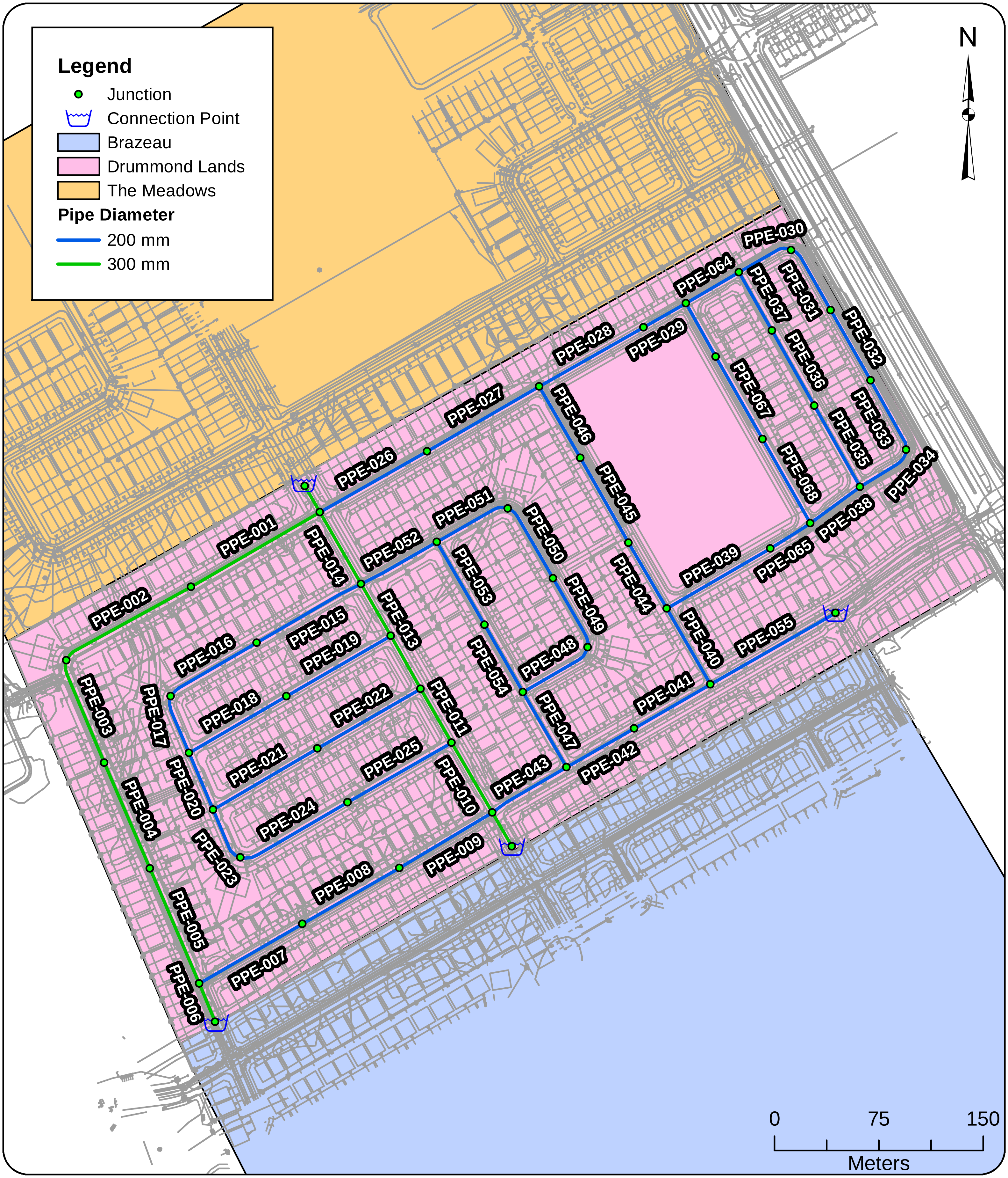


GeoAdvice Engineering Inc.

Project: **Hydraulic Capacity and Modeling Analysis**
Drummond Lands
2021-089-DSE
Client: **David Schaeffer Engineering Ltd.**
Date: **May 2023**
Created by: **BL**
Reviewed by: **WdS**

Junction IDs

Figure D.1



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Reviewed by:	**WdS**

DISCLAIMER: GeoAdvice does not warrant in any way the accuracy and completeness of the information shown on this map. Field verification of the accuracy and completeness of the information shown on this map is the sole responsibility of the user.

Pipe IDs

Figure D.2

Model Inputs - Drummond Lands

ID	From Node	To Node	Length (m)	Diameter (mm)	Roughness
PPE-001	JCT-001	JCT-002	106.97	297	120
PPE-002	JCT-002	JCT-003	104.61	297	120
PPE-003	JCT-003	JCT-004	78.98	297	120
PPE-004	JCT-004	JCT-005	82.72	297	120
PPE-005	JCT-005	JCT-006	89.84	297	120
PPE-006	JCT-006	JCT-007	29.78	297	120
PPE-007	JCT-006	JCT-008	85.50	204	110
PPE-008	JCT-008	JCT-009	80.33	204	110
PPE-009	JCT-009	JCT-010	77.78	204	110
PPE-010	JCT-010	JCT-011	58.09	297	120
PPE-011	JCT-011	JCT-012	44.57	297	120
PPE-012	JCT-012	JCT-013	43.66	297	120
PPE-013	JCT-013	JCT-014	42.83	297	120
PPE-014	JCT-014	JCT-001	59.32	297	120
PPE-015	JCT-015	JCT-014	86.12	204	110
PPE-016	JCT-015	JCT-016	72.93	204	110
PPE-017	JCT-016	JCT-017	43.79	204	110
PPE-018	JCT-017	JCT-018	81.15	204	110
PPE-019	JCT-018	JCT-013	86.67	204	110
PPE-020	JCT-017	JCT-019	44.12	204	110
PPE-021	JCT-019	JCT-020	86.77	204	110
PPE-022	JCT-020	JCT-012	85.59	204	110
PPE-023	JCT-019	JCT-021	40.79	204	110
PPE-024	JCT-021	JCT-022	87.63	204	110
PPE-025	JCT-022	JCT-011	86.05	204	110
PPE-026	JCT-001	JCT-023	88.55	204	110
PPE-027	JCT-023	JCT-024	93.06	204	110
PPE-028	JCT-024	JCT-037	86.02	204	110
PPE-029	JCT-037	JCT-051	34.96	204	110
PPE-030	JCT-038	JCT-039	42.31	204	110
PPE-031	JCT-039	JCT-040	52.42	204	110
PPE-032	JCT-040	JCT-041	58.16	204	110
PPE-033	JCT-041	JCT-042	56.25	204	110

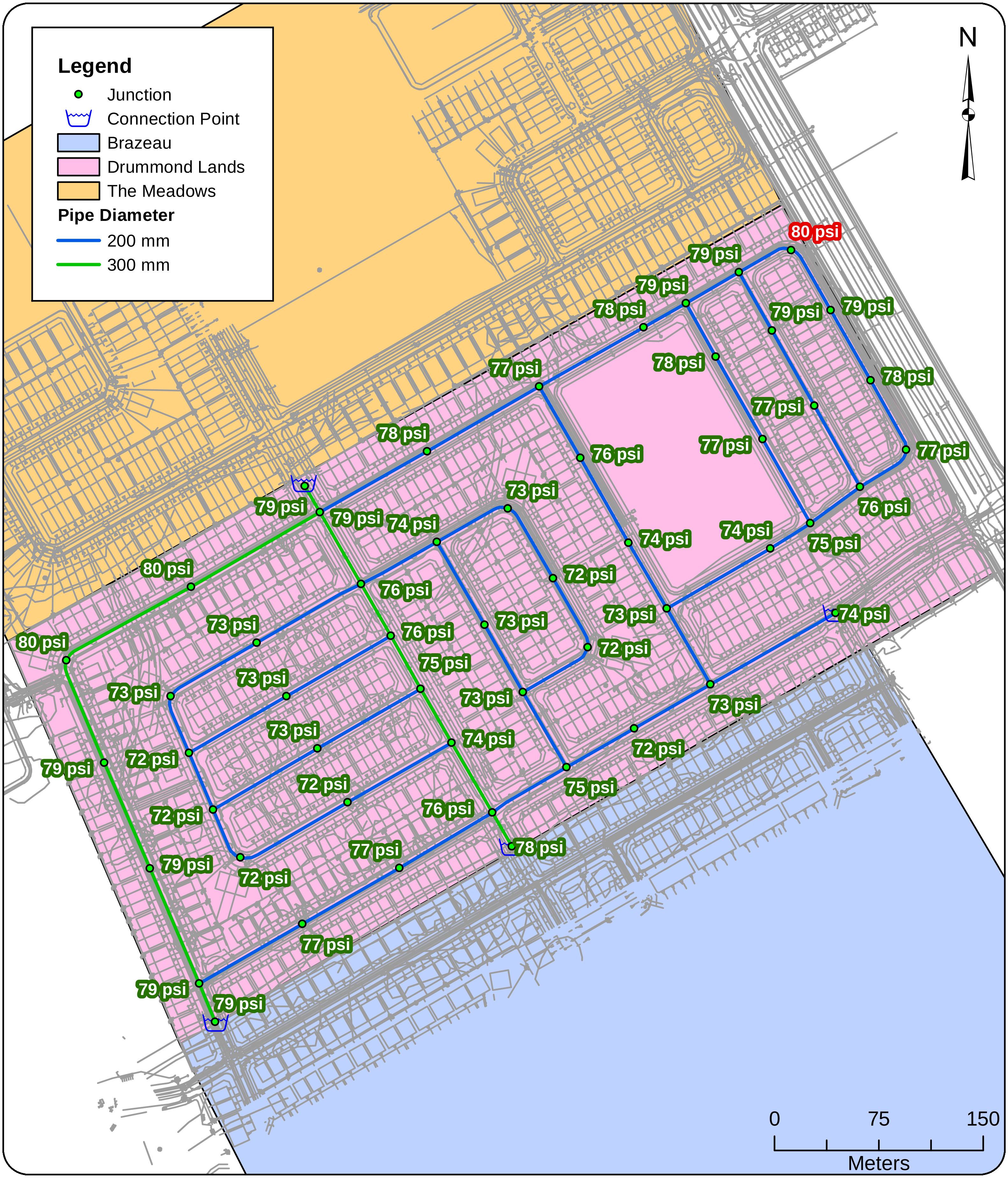
ID	Elevation (m)
J-60	104.4
JCT-001	101.1
JCT-002	100.7
JCT-003	100.5
JCT-004	100.9
JCT-005	100.9
JCT-006	101.2
JCT-007	101.0
JCT-008	102.7
JCT-009	102.8
JCT-010	103.1
JCT-011	104.4
JCT-012	104.0
JCT-013	103.6
JCT-014	103.1
JCT-015	105.2
JCT-016	105.6
JCT-017	105.9
JCT-018	105.4
JCT-019	106.1
JCT-020	105.5
JCT-021	106.3
JCT-022	106.0
JCT-023	101.6
JCT-024	102.4
JCT-025	103.3
JCT-026	104.5
JCT-027	105.0
JCT-028	105.7
JCT-029	106.0
JCT-030	104.3
JCT-031	105.5
JCT-032	105.3

Model Inputs - Drummond Lands

ID	From Node	To Node	Length (m)	Diameter (mm)	Roughness
PPE-034	JCT-042	JCT-043	43.70	204	110
PPE-035	JCT-043	JCT-044	66.75	204	110
PPE-036	JCT-044	JCT-045	62.12	204	110
PPE-037	JCT-045	JCT-038	48.11	204	110
PPE-038	JCT-043	JCT-054	44.36	204	110
PPE-039	JCT-046	JCT-027	86.14	204	110
PPE-040	JCT-027	JCT-028	62.77	204	110
PPE-041	JCT-028	JCT-029	63.20	204	110
PPE-042	JCT-029	JCT-030	56.08	204	110
PPE-043	JCT-030	JCT-010	62.56	204	110
PPE-044	JCT-027	JCT-026	54.68	204	110
PPE-045	JCT-026	JCT-025	69.90	204	110
PPE-046	JCT-025	JCT-024	59.21	204	110
PPE-047	JCT-030	JCT-031	62.35	204	110
PPE-048	JCT-031	JCT-036	57.60	204	110
PPE-049	JCT-036	JCT-035	55.95	204	110
PPE-050	JCT-035	JCT-034	60.42	204	110
PPE-051	JCT-034	JCT-033	57.48	204	110
PPE-052	JCT-033	JCT-014	62.19	204	110
PPE-053	JCT-033	JCT-032	68.55	204	110
PPE-054	JCT-032	JCT-031	55.69	204	110
PPE-055	JCT-028	J-60	103.41	204	110
PPE-056	JCT-001	JCT-049	21.64	297	120
PPE-057	JCT-049	RES-01	2.12	297	120
PPE-058	JCT-007	RES-02	1.01	297	120
PPE-059	JCT-010	JCT-050	28.19	297	120
PPE-060	JCT-050	RES-03	0.64	297	120
PPE-061	J-60	RES-04	0.44	297	120
PPE-064	JCT-051	JCT-038	44.12	204	110
PPE-065	JCT-054	JCT-046	33.86	204	110
PPE-066	JCT-051	JCT-052	43.70	204	110
PPE-067	JCT-052	JCT-053	68.09	204	110
PPE-068	JCT-053	JCT-054	69.37	204	110

ID	Elevation (m)
JCT-033	104.3
JCT-034	105.7
JCT-035	106.0
JCT-036	106.3
JCT-037	101.9
JCT-038	100.8
JCT-039	100.4
JCT-040	101.0
JCT-041	101.9
JCT-042	102.6
JCT-043	103.2
JCT-044	102.3
JCT-045	101.3
JCT-046	104.6
JCT-049	101.0
JCT-050	101.9
JCT-051	101.3
JCT-052	101.5
JCT-053	102.7
JCT-054	103.7

Appendix E ADD and PHD Model Results



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Created by: **BL**
Reviewed by: **WdS**

DISCLAIMER: GeoAdvice does not warrant in any way the accuracy and completeness of the information shown on this map. Field verification of the accuracy and completeness of the information shown on this map is the sole responsibility of the user.

MHD Pressure Results
Drummond Lands

Figure E.1

Average Day Demand Modeling Results - Drummond Lands

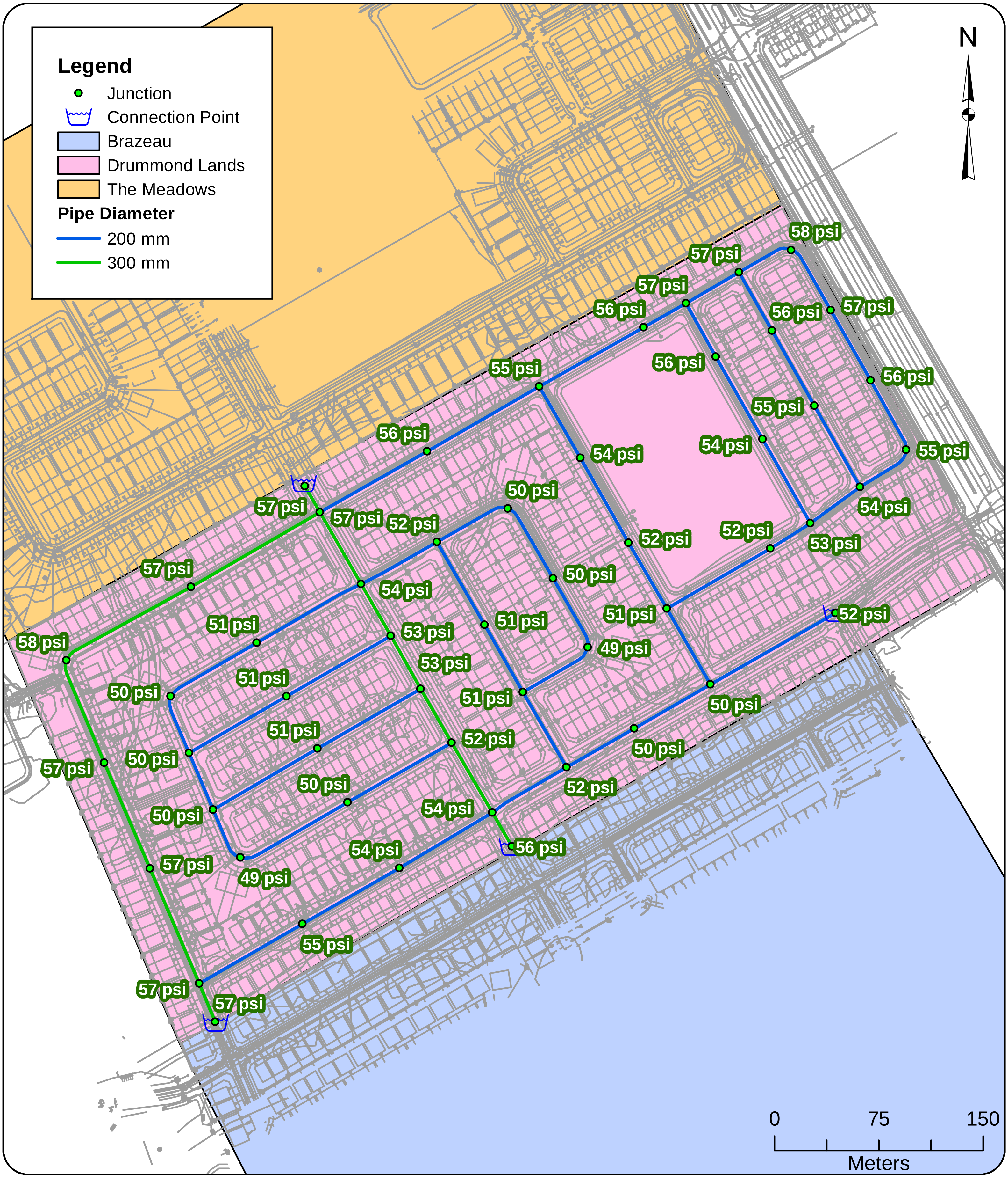
ID	From Node	To Node	Length (m)	Diameter (mm)	Roughness	Flow (L/s)	Velocity (m/s)	Headloss (m)	HL/1000 (m/k-m)
PPE-001	JCT-001	JCT-002	106.97	297	120	0.00	0.00	0.00	0.00
PPE-002	JCT-002	JCT-003	104.61	297	120	-0.19	0.00	0.00	0.00
PPE-003	JCT-003	JCT-004	78.98	297	120	-0.37	0.01	0.00	0.00
PPE-004	JCT-004	JCT-005	82.72	297	120	-0.52	0.01	0.00	0.00
PPE-005	JCT-005	JCT-006	89.84	297	120	-0.64	0.01	0.00	0.00
PPE-006	JCT-006	JCT-007	29.78	297	120	-1.06	0.02	0.00	0.00
PPE-007	JCT-006	JCT-008	85.50	204	110	0.30	0.01	0.00	0.00
PPE-008	JCT-008	JCT-009	80.33	204	110	0.12	0.00	0.00	0.00
PPE-009	JCT-009	JCT-010	77.78	204	110	-0.06	0.00	0.00	0.00
PPE-010	JCT-010	JCT-011	58.09	297	120	1.11	0.02	0.00	0.00
PPE-011	JCT-011	JCT-012	44.57	297	120	0.66	0.01	0.00	0.00
PPE-012	JCT-012	JCT-013	43.66	297	120	0.23	0.00	0.00	0.00
PPE-013	JCT-013	JCT-014	42.83	297	120	-0.19	0.00	0.00	0.00
PPE-014	JCT-014	JCT-001	59.32	297	120	-1.23	0.02	0.00	0.00
PPE-015	JCT-015	JCT-014	86.12	204	110	-0.32	0.01	0.00	0.00
PPE-016	JCT-015	JCT-016	72.93	204	110	0.16	0.00	0.00	0.00
PPE-017	JCT-016	JCT-017	43.79	204	110	0.00	0.00	0.00	0.00
PPE-018	JCT-017	JCT-018	81.15	204	110	-0.15	0.00	0.00	0.00
PPE-019	JCT-018	JCT-013	86.67	204	110	-0.31	0.01	0.00	0.00
PPE-020	JCT-017	JCT-019	44.12	204	110	-0.01	0.00	0.00	0.00
PPE-021	JCT-019	JCT-020	86.77	204	110	-0.15	0.00	0.00	0.00
PPE-022	JCT-020	JCT-012	85.59	204	110	-0.32	0.01	0.00	0.00
PPE-023	JCT-019	JCT-021	40.79	204	110	-0.02	0.00	0.00	0.00
PPE-024	JCT-021	JCT-022	87.63	204	110	-0.18	0.01	0.00	0.00
PPE-025	JCT-022	JCT-011	86.05	204	110	-0.34	0.01	0.00	0.00
PPE-026	JCT-001	JCT-023	88.55	204	110	1.02	0.03	0.00	0.01
PPE-027	JCT-023	JCT-024	93.06	204	110	0.92	0.03	0.00	0.01
PPE-028	JCT-024	JCT-037	86.02	204	110	0.67	0.02	0.00	0.01
PPE-029	JCT-037	JCT-051	34.96	204	110	0.57	0.02	0.00	0.00
PPE-030	JCT-038	JCT-039	42.31	204	110	0.19	0.01	0.00	0.00
PPE-031	JCT-039	JCT-040	52.42	204	110	0.08	0.00	0.00	0.00
PPE-032	JCT-040	JCT-041	58.16	204	110	-0.01	0.00	0.00	0.00
PPE-033	JCT-041	JCT-042	56.25	204	110	-0.10	0.00	0.00	0.00
PPE-034	JCT-042	JCT-043	43.70	204	110	-0.19	0.01	0.00	0.00
PPE-035	JCT-043	JCT-044	66.75	204	110	0.10	0.00	0.00	0.00
PPE-036	JCT-044	JCT-045	62.12	204	110	0.01	0.00	0.00	0.00
PPE-037	JCT-045	JCT-038	48.11	204	110	-0.08	0.00	0.00	0.00
PPE-038	JCT-043	JCT-054	44.36	204	110	-0.38	0.01	0.00	0.00
PPE-039	JCT-046	JCT-027	86.14	204	110	-0.70	0.02	0.00	0.01
PPE-040	JCT-027	JCT-028	62.77	204	110	-1.21	0.04	0.00	0.02
PPE-041	JCT-028	JCT-029	63.20	204	110	-0.43	0.01	0.00	0.00
PPE-042	JCT-029	JCT-030	56.08	204	110	-0.61	0.02	0.00	0.00
PPE-043	JCT-030	JCT-010	62.56	204	110	-0.83	0.03	0.00	0.01
PPE-044	JCT-027	JCT-026	54.68	204	110	0.28	0.01	0.00	0.00
PPE-045	JCT-026	JCT-025	69.90	204	110	0.07	0.00	0.00	0.00
PPE-046	JCT-025	JCT-024	59.21	204	110	-0.14	0.00	0.00	0.00
PPE-047	JCT-030	JCT-031	62.35	204	110	0.04	0.00	0.00	0.00
PPE-048	JCT-031	JCT-036	57.60	204	110	0.07	0.00	0.00	0.00
PPE-049	JCT-036	JCT-035	55.95	204	110	-0.04	0.00	0.00	0.00
PPE-050	JCT-035	JCT-034	60.42	204	110	-0.15	0.00	0.00	0.00

ID	Demand (L/s)	Elevation (m)	Head (m)	Pressure (psi)
J-60	0.18	104.4	157	74
JCT-001	0.09	101.1	157	79
JCT-002	0.19	100.7	157	80
JCT-003	0.19	100.5	157	80
JCT-004	0.15	100.9	157	79
JCT-005	0.12	100.9	157	79
JCT-006	0.12	101.2	157	79
JCT-007	0.12	101.0	157	79
JCT-008	0.18	102.7	157	77
JCT-009	0.18	102.8	157	77
JCT-010	0.06	103.1	157	76
JCT-011	0.11	104.4	157	74
JCT-012	0.11	104.0	157	75
JCT-013	0.11	103.6	157	76
JCT-014	0.11	103.1	157	76
JCT-015	0.16	105.2	157	73
JCT-016	0.16	105.6	157	73
JCT-017	0.16	105.9	157	72
JCT-018	0.16	105.4	157	73
JCT-019	0.16	106.1	157	72
JCT-020	0.16	105.5	157	73
JCT-021	0.16	106.3	157	72
JCT-022	0.16	106.0	157	72
JCT-023	0.11	101.6	157	78
JCT-024	0.11	102.4	157	77
JCT-025	0.21	103.3	157	76
JCT-026	0.21	104.5	157	74
JCT-027	0.22	105.0	157	73
JCT-028	0.18	105.7	157	73
JCT-029	0.18	106.0	157	72
JCT-030	0.18	104.3	157	75
JCT-031	0.11	105.5	157	73
JCT-032	0.11	105.3	157	73
JCT-033	0.11	104.3	157	74
JCT-034	0.11	105.7	157	73
JCT-035	0.11	106.0	157	72
JCT-036	0.11	106.3	157	72
JCT-037	0.11	101.9	157	78
JCT-038	0.11	100.8	157	79
JCT-039	0.11	100.4	157	80
JCT-040	0.09	101.0	157	79
JCT-041	0.09	101.9	157	78
JCT-042	0.09	102.6	157	77
JCT-043	0.09	103.2	157	76
JCT-044	0.09	102.3	157	77
JCT-045	0.09	101.3	157	79
JCT-046	0.13	104.6	157	74
JCT-049	0.09	101.0	157	79
JCT-050	0.06	101.9	157	78
JCT-051	0.11	101.3	157	79

Average Day Demand Modeling Results - Drummond Lands

ID	From Node	To Node	Length (m)	Diameter (mm)	Roughness	Flow (L/s)	Velocity (m/s)	Headloss (m)	HL/1000 (m/k-m)
PPE-051	JCT-034	JCT-033	57.48	204	110	-0.26	0.01	0.00	0.00
PPE-052	JCT-033	JCT-014	62.19	204	110	-0.61	0.02	0.00	0.00
PPE-053	JCT-033	JCT-032	68.55	204	110	0.24	0.01	0.00	0.00
PPE-054	JCT-032	JCT-031	55.69	204	110	0.13	0.00	0.00	0.00
PPE-055	JCT-028	J-60	103.41	204	110	-0.95	0.03	0.00	0.01
PPE-056	JCT-001	JCT-049	21.64	297	120	-2.34	0.03	0.00	0.01
PPE-057	JCT-049	RES-01	2.12	297	120	-2.43	0.04	0.00	0.01
PPE-058	JCT-007	RES-02	1.01	297	120	-1.18	0.02	0.00	0.00
PPE-059	JCT-010	JCT-050	28.19	297	120	-2.06	0.03	0.00	0.01
PPE-060	JCT-050	RES-03	0.64	297	120	-2.12	0.03	0.00	0.00
PPE-061	J-60	RES-04	0.44	297	120	-1.13	0.02	0.00	0.00
PPE-064	JCT-051	JCT-038	44.12	204	110	0.38	0.01	0.00	0.00
PPE-065	JCT-054	JCT-046	33.86	204	110	-0.57	0.02	0.00	0.00
PPE-066	JCT-051	JCT-052	43.70	204	110	0.08	0.00	0.00	0.00
PPE-067	JCT-052	JCT-053	68.09	204	110	-0.01	0.00	0.00	0.00
PPE-068	JCT-053	JCT-054	69.37	204	110	-0.10	0.00	0.00	0.00

ID	Demand (L/s)	Elevation (m)	Head (m)	Pressure (psi)
JCT-052	0.09	101.5	157	78
JCT-053	0.09	102.7	157	77
JCT-054	0.09	103.7	157	75



GeoAdvice Engineering Inc.

Project: **Hydraulic Capacity and Modeling Analysis**
Drummond Lands
2021-089-DSE
Client: **David Schaeffer Engineering Ltd.**
Date: **May 2023**
Created by: **BL**
Reviewed by: **WdS**

DISCLAIMER: GeoAdvice does not warrant in any way the accuracy and completeness of the information shown on this map. Field verification of the accuracy and completeness of the information shown on this map is the sole responsibility of the user.

PHD Pressure Results
Drummond Lands

Figure E.2

Peak Hour Demand Modeling Results - Drummond Lands

ID	From Node	To Node	Length (m)	Diameter (mm)	Roughness	Flow (L/s)	Velocity (m/s)	Headloss (m)	HL/1000 (m/k-m)
PPE-001	JCT-001	JCT-002	106.97	297	120	0.09	0.00	0.00	0.00
PPE-002	JCT-002	JCT-003	104.61	297	120	-0.93	0.01	0.00	0.00
PPE-003	JCT-003	JCT-004	78.98	297	120	-1.95	0.03	0.00	0.01
PPE-004	JCT-004	JCT-005	82.72	297	120	-2.69	0.04	0.00	0.01
PPE-005	JCT-005	JCT-006	89.84	297	120	-3.36	0.05	0.00	0.01
PPE-006	JCT-006	JCT-007	29.78	297	120	-5.64	0.08	0.00	0.04
PPE-007	JCT-006	JCT-008	85.50	204	110	1.60	0.05	0.00	0.03
PPE-008	JCT-008	JCT-009	80.33	204	110	0.63	0.02	0.00	0.00
PPE-009	JCT-009	JCT-010	77.78	204	110	-0.34	0.01	0.00	0.00
PPE-010	JCT-010	JCT-011	58.09	297	120	5.99	0.09	0.00	0.04
PPE-011	JCT-011	JCT-012	44.57	297	120	3.51	0.05	0.00	0.02
PPE-012	JCT-012	JCT-013	43.66	297	120	1.17	0.02	0.00	0.00
PPE-013	JCT-013	JCT-014	42.83	297	120	-1.15	0.02	0.00	0.00
PPE-014	JCT-014	JCT-001	59.32	297	120	-6.69	0.10	0.00	0.05
PPE-015	JCT-015	JCT-014	86.12	204	110	-1.76	0.05	0.00	0.03
PPE-016	JCT-015	JCT-016	72.93	204	110	0.87	0.03	0.00	0.01
PPE-017	JCT-016	JCT-017	43.79	204	110	-0.01	0.00	0.00	0.00
PPE-018	JCT-017	JCT-018	81.15	204	110	-0.83	0.03	0.00	0.01
PPE-019	JCT-018	JCT-013	86.67	204	110	-1.72	0.05	0.00	0.03
PPE-020	JCT-017	JCT-019	44.12	204	110	-0.07	0.00	0.00	0.00
PPE-021	JCT-019	JCT-020	86.77	204	110	-0.85	0.03	0.00	0.01
PPE-022	JCT-020	JCT-012	85.59	204	110	-1.73	0.05	0.00	0.03
PPE-023	JCT-019	JCT-021	40.79	204	110	-0.11	0.00	0.00	0.00
PPE-024	JCT-021	JCT-022	87.63	204	110	-0.99	0.03	0.00	0.01
PPE-025	JCT-022	JCT-011	86.05	204	110	-1.88	0.06	0.00	0.04
PPE-026	JCT-001	JCT-023	88.55	204	110	5.02	0.15	0.02	0.22
PPE-027	JCT-023	JCT-024	93.06	204	110	4.43	0.14	0.02	0.18
PPE-028	JCT-024	JCT-037	86.02	204	110	3.56	0.11	0.01	0.12
PPE-029	JCT-037	JCT-051	34.96	204	110	2.98	0.09	0.00	0.09
PPE-030	JCT-038	JCT-039	42.31	204	110	1.02	0.03	0.00	0.01
PPE-031	JCT-039	JCT-040	52.42	204	110	0.44	0.01	0.00	0.00
PPE-032	JCT-040	JCT-041	58.16	204	110	-0.06	0.00	0.00	0.00
PPE-033	JCT-041	JCT-042	56.25	204	110	-0.56	0.02	0.00	0.00
PPE-034	JCT-042	JCT-043	43.70	204	110	-1.06	0.03	0.00	0.01
PPE-035	JCT-043	JCT-044	66.75	204	110	0.57	0.02	0.00	0.00
PPE-036	JCT-044	JCT-045	62.12	204	110	0.07	0.00	0.00	0.00
PPE-037	JCT-045	JCT-038	48.11	204	110	-0.43	0.01	0.00	0.00
PPE-038	JCT-043	JCT-054	44.36	204	110	-2.13	0.07	0.00	0.05
PPE-039	JCT-046	JCT-027	86.14	204	110	-3.63	0.11	0.01	0.12
PPE-040	JCT-027	JCT-028	62.77	204	110	-5.73	0.18	0.02	0.29
PPE-041	JCT-028	JCT-029	63.20	204	110	-1.93	0.06	0.00	0.04
PPE-042	JCT-029	JCT-030	56.08	204	110	-2.89	0.09	0.00	0.08
PPE-043	JCT-030	JCT-010	62.56	204	110	-4.28	0.13	0.01	0.17
PPE-044	JCT-027	JCT-026	54.68	204	110	1.26	0.04	0.00	0.02
PPE-045	JCT-026	JCT-025	69.90	204	110	0.49	0.02	0.00	0.00
PPE-046	JCT-025	JCT-024	59.21	204	110	-0.28	0.01	0.00	0.00
PPE-047	JCT-030	JCT-031	62.35	204	110	0.43	0.01	0.00	0.00
PPE-048	JCT-031	JCT-036	57.60	204	110	0.45	0.01	0.00	0.00
PPE-049	JCT-036	JCT-035	55.95	204	110	-0.15	0.00	0.00	0.00
PPE-050	JCT-035	JCT-034	60.42	204	110	-0.75	0.02	0.00	0.01

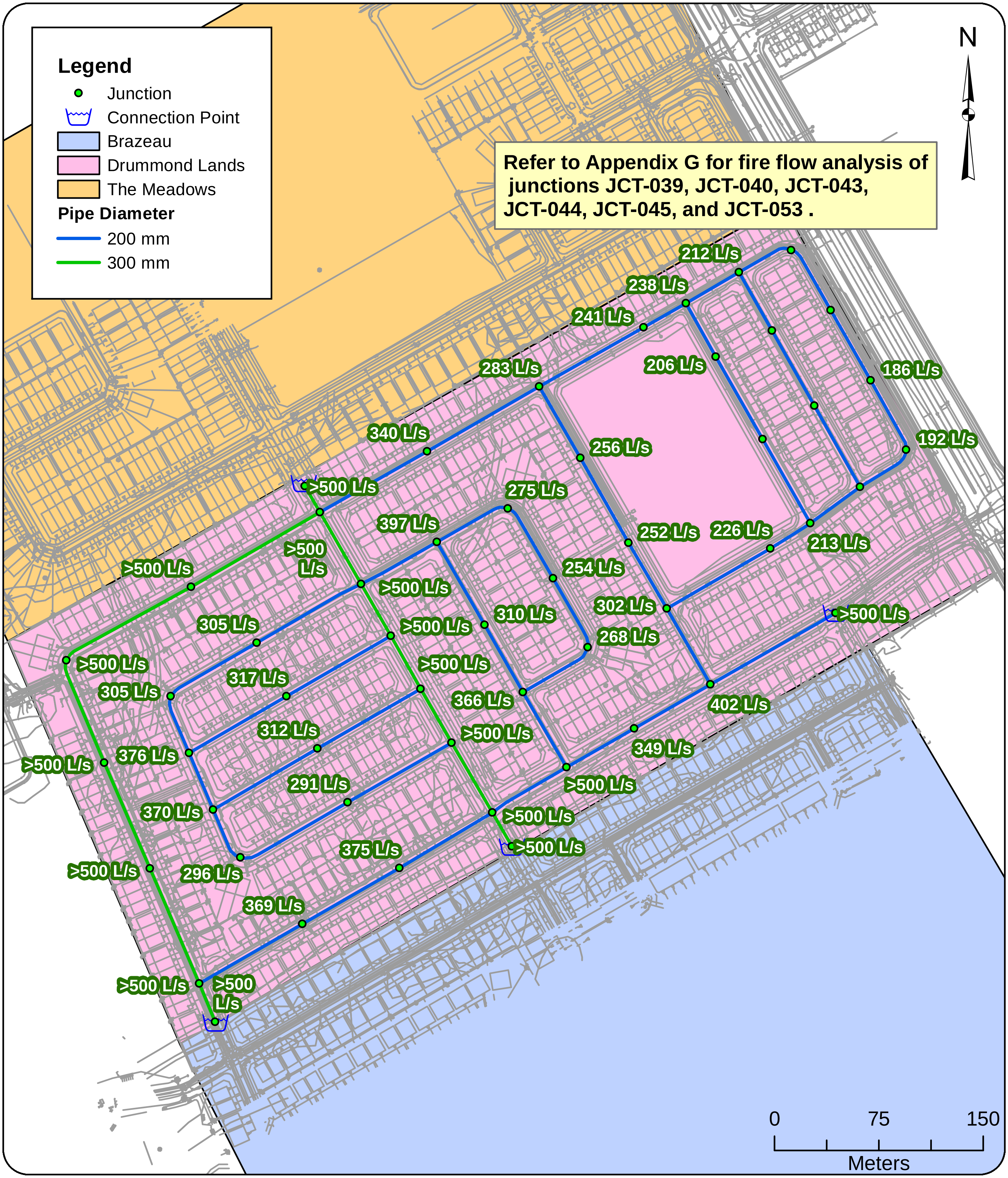
ID	Demand (L/s)	Elevation (m)	Head (m)	Pressure (psi)
J-60	0.96	104.4	141	52
JCT-001	0.49	101.1	141	57
JCT-002	1.02	100.7	141	57
JCT-003	1.02	100.5	141	58
JCT-004	0.74	100.9	141	57
JCT-005	0.67	100.9	141	57
JCT-006	0.67	101.2	141	57
JCT-007	0.67	101.0	141	57
JCT-008	0.97	102.7	141	55
JCT-009	0.97	102.8	141	54
JCT-010	0.36	103.1	141	54
JCT-011	0.60	104.4	141	52
JCT-012	0.60	104.0	141	53
JCT-013	0.60	103.6	141	53
JCT-014	0.60	103.1	141	54
JCT-015	0.89	105.2	141	51
JCT-016	0.89	105.6	141	50
JCT-017	0.89	105.9	141	50
JCT-018	0.89	105.4	141	51
JCT-019	0.89	106.1	141	50
JCT-020	0.89	105.5	141	51
JCT-021	0.89	106.3	141	49
JCT-022	0.89	106.0	141	50
JCT-023	0.59	101.6	141	56
JCT-024	0.59	102.4	141	55
JCT-025	0.77	103.3	141	54
JCT-026	0.77	104.5	141	52
JCT-027	0.84	105.0	141	51
JCT-028	0.96	105.7	141	50
JCT-029	0.96	106.0	141	50
JCT-030	0.96	104.3	141	52
JCT-031	0.60	105.5	141	51
JCT-032	0.60	105.3	141	51
JCT-033	0.60	104.3	141	52
JCT-034	0.60	105.7	141	50
JCT-035	0.60	106.0	141	50
JCT-036	0.60	106.3	141	49
JCT-037	0.59	101.9	141	56
JCT-038	0.59	100.8	141	57
JCT-039	0.59	100.4	141	58
JCT-040	0.50	101.0	141	57
JCT-041	0.50	101.9	141	56
JCT-042	0.50	102.6	141	55
JCT-043	0.50	103.2	141	54
JCT-044	0.50	102.3	141	55
JCT-045	0.50	101.3	141	56
JCT-046	0.36	104.6	141	52
JCT-049	0.49	101.0	141	57
JCT-050	0.36	101.9	141	56
JCT-051	0.59	101.3	141	57

Peak Hour Demand Modeling Results - Drummond Lands

ID	From Node	To Node	Length (m)	Diameter (mm)	Roughness	Flow (L/s)	Velocity (m/s)	Headloss (m)	HL/1000 (m/k-m)
PPE-051	JCT-034	JCT-033	57.48	204	110	-1.35	0.04	0.00	0.02
PPE-052	JCT-033	JCT-014	62.19	204	110	-3.19	0.10	0.01	0.10
PPE-053	JCT-033	JCT-032	68.55	204	110	1.23	0.04	0.00	0.02
PPE-054	JCT-032	JCT-031	55.69	204	110	0.63	0.02	0.00	0.00
PPE-055	JCT-028	J-60	103.41	204	110	-4.77	0.15	0.02	0.20
PPE-056	JCT-001	JCT-049	21.64	297	120	-12.29	0.18	0.00	0.16
PPE-057	JCT-049	RES-01	2.12	297	120	-12.78	0.18	0.00	0.18
PPE-058	JCT-007	RES-02	1.01	297	120	-6.31	0.09	0.00	0.05
PPE-059	JCT-010	JCT-050	28.19	297	120	-10.97	0.16	0.00	0.13
PPE-060	JCT-050	RES-03	0.64	297	120	-11.33	0.16	0.00	0.14
PPE-061	J-60	RES-04	0.44	297	120	-5.73	0.08	0.00	0.04
PPE-064	JCT-051	JCT-038	44.12	204	110	2.04	0.06	0.00	0.04
PPE-065	JCT-054	JCT-046	33.86	204	110	-3.26	0.10	0.00	0.10
PPE-066	JCT-051	JCT-052	43.70	204	110	0.35	0.01	0.00	0.00
PPE-067	JCT-052	JCT-053	68.09	204	110	-0.15	0.00	0.00	0.00
PPE-068	JCT-053	JCT-054	69.37	204	110	-0.65	0.02	0.00	0.01

ID	Demand (L/s)	Elevation (m)	Head (m)	Pressure (psi)
JCT-052	0.50	101.5	141	56
JCT-053	0.50	102.7	141	54
JCT-054	0.48	103.7	141	53

Appendix F MDD+FF Model Results



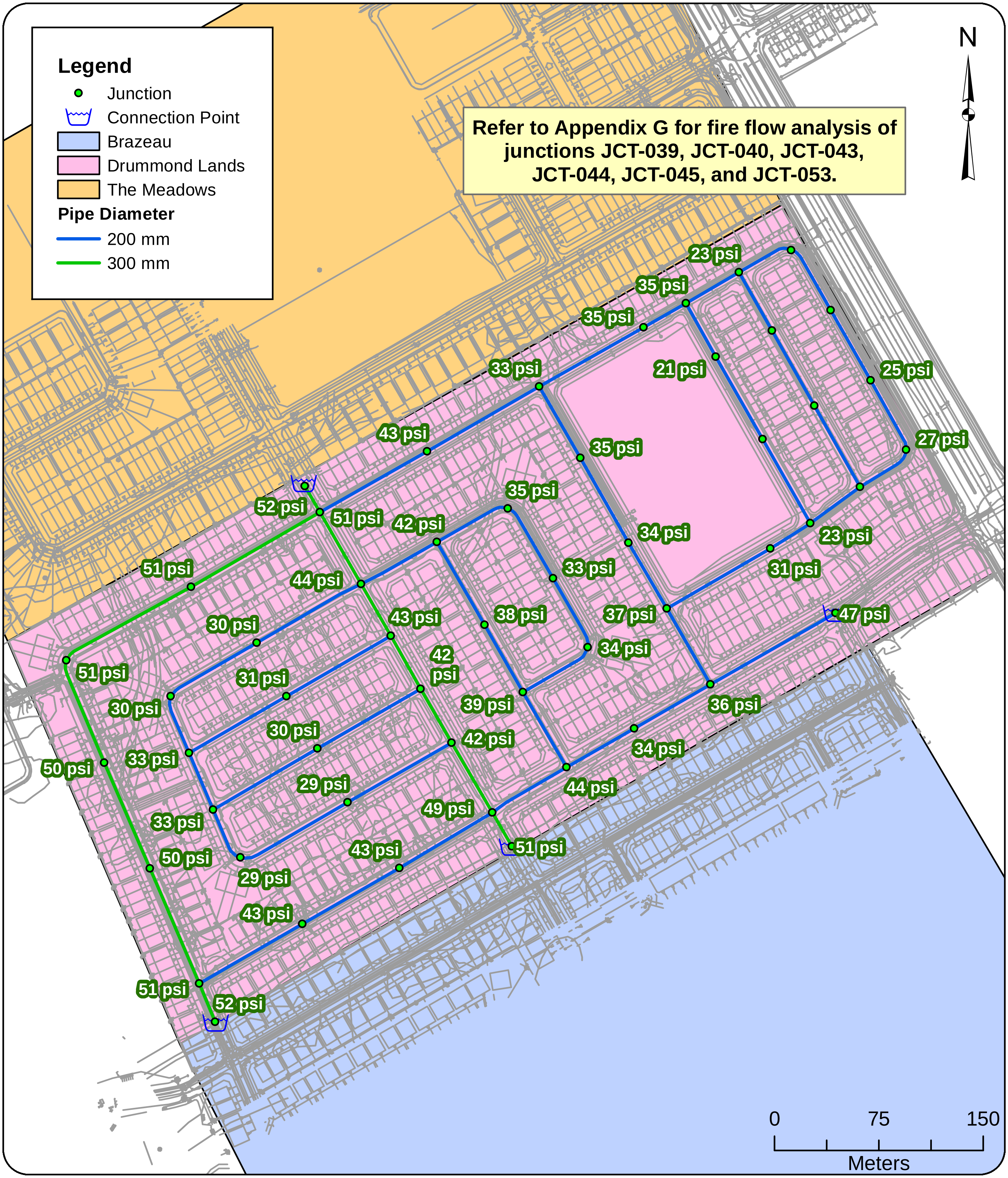
GeoAdvice Engineering Inc.

Project: **Hydraulic Capacity and Modeling Analysis Drummond Lands**
2021-089-DSE
Client: **David Schaeffer Engineering Ltd.**
Date: **May 2023**
Created by: **BL**
Reviewed by: **WdS**

DISCLAIMER: GeoAdvice does not warrant in any way the accuracy and completeness of the information shown on this map. Field verification of the accuracy and completeness of the information shown on this map is the sole responsibility of the user.

Available Fire Flow Drummond Lands

Figure F.1



GeoAdvice Engineering Inc.

Project: Hydraulic Capacity and Modeling Analysis
Drummond Lands
2021-089-DSE
Client: David Schaeffer Engineering Ltd.
Date: May 2023
Created by: BL
Reviewed by: WdS

DISCLAIMER: GeoAdvice does not warrant in any way the accuracy and completeness of the information shown on this map. Field verification of the accuracy and completeness of the information shown on this map is the sole responsibility of the user.

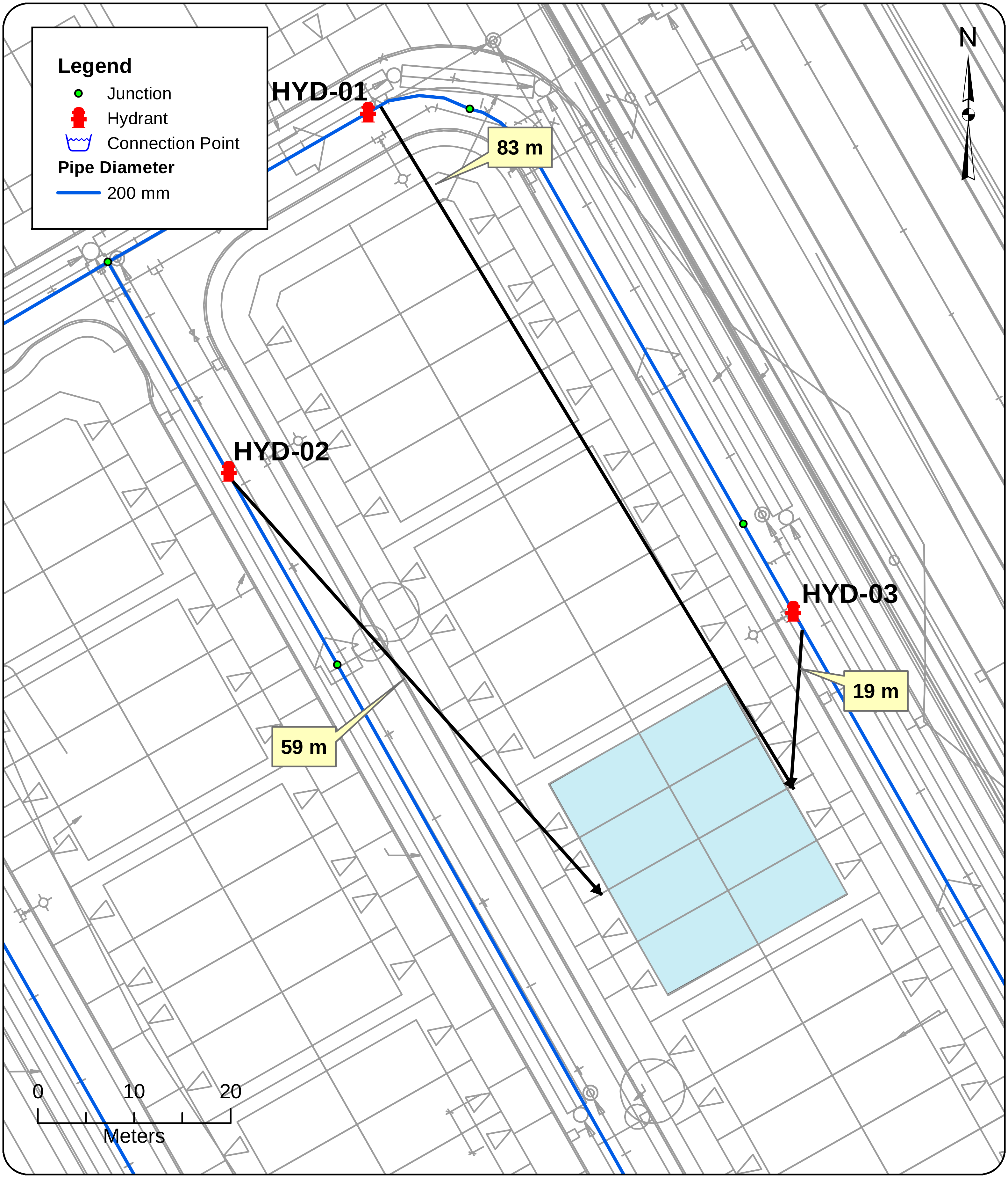
Residual Pressure Drummond Lands

Figure F.2

Fire Flow Modeling Results - Drummond Lands

ID	Static Demand (L/s)	Static Pressure (psi)	Static Head (m)	Fire-Flow Demand (L/s)	Residual Pressure (psi)	Available Flow at Hydrant (L/s)	Available Flow Pressure (psi)
J-60	0.44	47	138	167	47	> 500	20
JCT-001	0.22	52	138	167	51	> 500	20
JCT-002	0.46	52	138	167	51	> 500	20
JCT-003	0.46	53	138	167	51	> 500	20
JCT-004	0.34	52	138	167	50	> 500	20
JCT-005	0.31	52	138	167	50	> 500	20
JCT-006	0.31	52	138	167	51	> 500	20
JCT-007	0.31	52	138	167	52	> 500	20
JCT-008	0.44	50	138	167	43	369	20
JCT-009	0.44	49	138	167	43	375	20
JCT-010	0.16	49	138	167	49	> 500	20
JCT-023	0.27	51	137	167	43	340	20
JCT-025	0.39	49	137	167	35	256	20
JCT-026	0.39	47	137	167	34	252	20
JCT-027	0.42	46	137	167	37	302	20
JCT-030	0.44	47	138	167	44	> 500	20
JCT-031	0.27	45	138	167	39	366	20
JCT-032	0.27	46	138	167	38	310	20
JCT-033	0.27	47	138	167	42	397	20
JCT-034	0.27	45	138	167	35	275	20
JCT-035	0.27	45	138	167	33	254	20
JCT-036	0.27	44	138	167	34	268	20
JCT-037	0.27	51	137	167	35	241	20
JCT-041	0.23	51	137	167	25	186	20
JCT-042	0.23	50	137	167	27	193	20
JCT-046	0.20	47	137	167	31	226	20
JCT-049	0.22	52	138	167	52	> 500	20
JCT-050	0.16	51	138	167	51	> 500	20
JCT-051	0.27	52	137	167	35	238	20
JCT-024	0.27	47	136	200	33	283	20
JCT-028	0.44	43	136	200	36	402	20
JCT-029	0.44	42	136	200	34	349	20
JCT-038	0.27	50	136	200	23	212	20
JCT-039	0.27	50	136	200	18	195	20
JCT-040	0.23	49	136	200	15	183	20
JCT-043	0.23	46	136	200	20	198	20
JCT-044	0.23	48	136	200	16	185	20
JCT-045	0.23	49	136	200	18	192	20
JCT-052	0.23	49	136	200	21	206	20
JCT-053	0.23	47	136	200	19	194	20
JCT-054	0.22	45	136	200	23	213	20
JCT-011	0.27	43	135	217	42	> 500	20
JCT-012	0.27	44	135	217	42	> 500	20
JCT-013	0.27	44	135	217	43	> 500	20
JCT-014	0.27	45	135	217	44	> 500	20
JCT-015	0.40	42	135	217	30	305	20
JCT-016	0.40	41	135	217	30	305	20
JCT-017	0.40	41	135	217	33	376	20
JCT-018	0.40	42	135	217	31	317	20
JCT-019	0.40	41	135	217	33	370	20
JCT-020	0.40	42	135	217	30	312	20
JCT-021	0.40	40	135	217	29	296	20
JCT-022	0.40	41	135	217	29	291	20

Appendix G Hydrant Spacing Analysis

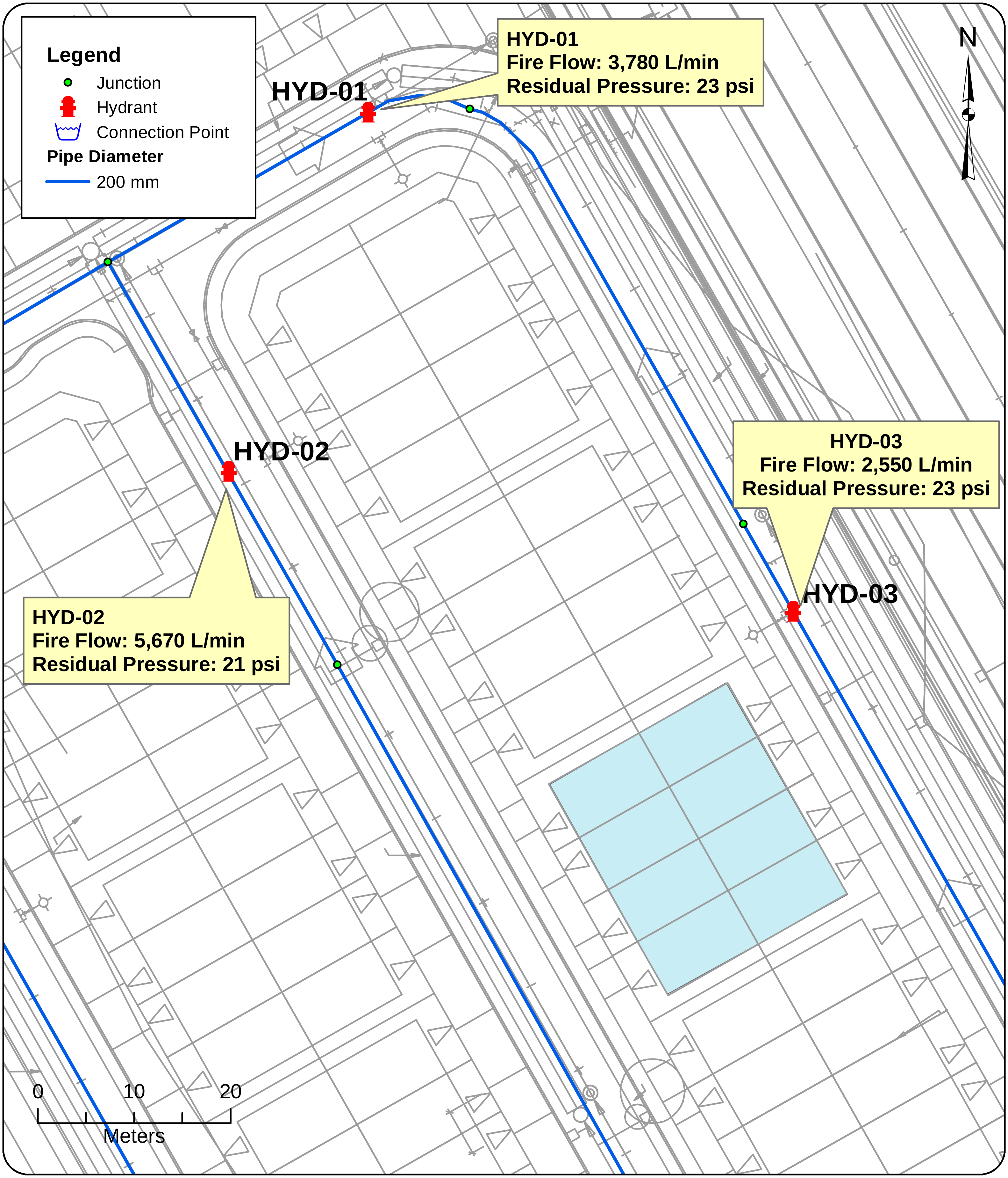


GeoAdvice Engineering Inc.

Project: **Hydraulic Capacity and Modeling Analysis**
Drummond Lands
2021-089-DSE
Client: **David Schaeffer Engineering Ltd.**
Date: **May 2023**
Created by: **BL**
Reviewed by: **WdS**

Hydrant Spacing Summary Block 172

Figure G.1



GeoAdvice Engineering Inc.

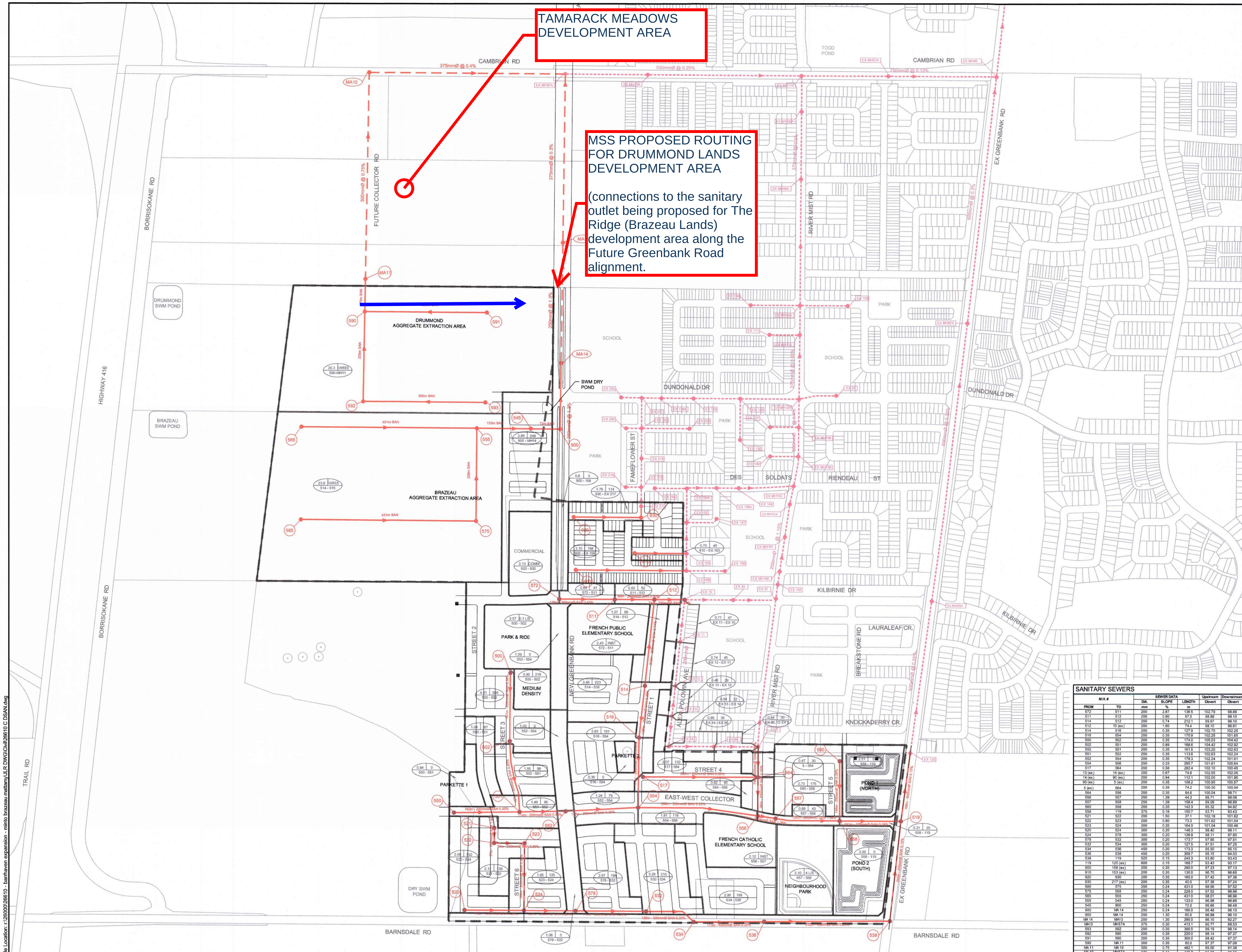
Project:	**Hydraulic Capacity and Modeling Analysis**
	Drummond Lands
	2021-089-DSE
Client:	**David Schaeffer Engineering Ltd.**
Date:	**May 2023**
Created by:	**BL**
Reviewed by:	**WdS**

Fire Flow Results Hydrants Flowing Simultaneously Block 172

Figure G.2

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

APPENDIX C



SANITARY SEWERS

M.H. #		SEWER DATA			Upstream	Downstream
		DIA.	SLOPE	LENGTH	Obvert	Obvert
FROM	TO	mm	%	m		
572	511	200	2.87	136.5	102.79	98.88
511	512	200	0.80	97.5	98.88	98.10
514	512	200	0.74	212.1	99.67	98.10
512	10 (ex.)	200	1.60	74.4	98.10	96.91
514	516	200	0.35	127.9	102.70	102.25
516	554	200	0.35	170.9	102.25	101.65
500	502	200	0.35	174.0	105.03	104.42
502	551	200	0.89	168.6	104.42	102.92
550	551	200	0.35	161.5	103.20	102.63
551	552	200	0.35	113.6	102.63	102.24
552	554	200	0.35	178.3	102.24	101.61
554	556	250	0.33	295.7	101.61	100.64
517	564	200	0.58	282.4	102.10	100.45
13 (ex.)	14 (ex.)	200	0.67	74.6	102.55	102.05
14 (ex.)	90 (ex.)	200	0.94	112.1	102.00	101.95
90 (ex.)	5 (ex.)	200	0.35	108.2	100.95	100.57
5 (ex.)	564	200	0.35	74.2	100.30	100.04
564	556	200	0.35	94.6	100.04	99.71
556	557	250	1.39	44.3	99.71	99.09
557	558	250	1.39	158.4	99.09	96.89
560	558	200	0.35	142.3	95.32	94.82
558	119	375	0.18	150.7	93.71	93.43
521	522	200	1.50	37.1	102.18	101.62
522	523	200	0.80	73.3	101.62	101.04
523	524	200	0.35	164.0	101.04	100.46
520	524	300	0.20	146.3	98.40	98.11
524	578	300	0.20	126.9	98.11	97.85
578	532	300	0.20	173.7	97.85	97.51
532	534	300	0.20	127.5	97.51	97.25
534	536	450	0.20	173.3	95.50	95.15
536	538	450	0.20	309.7	95.15	94.53
538	119	525	0.15	245.3	93.80	93.43
119	120 (ex)	600	0.15	168.7	93.43	93.17
900	158 (ex)	200	0.35	280.0	97.23	97.13
910	153 (ex)	200	0.35	130.0	96.70	96.65
920	930	200	0.35	165.0	97.42	97.36
930	217 (ex)	200	0.35	40.0	97.36	97.24
585	575	250	0.24	431.0	98.56	97.52
575	555	250	0.24	228.0	97.52	96.98
565	555	250	0.24	431.0	98.01	96.98
555	545	250	0.24	133.0	96.98	96.66
545	900	250	0.24	72.0	96.66	96.48
900	MA 14	250	0.24	160.0	96.48	96.10
900	MA 14	250	1.30	60.0	96.88	96.10
MA 14	MA13	250	1.30	295.0	96.10	92.27
MA13	MH57A	375	0.30	413.1	90.77	89.53
593	592	200	0.35	300.0	99.19	98.14
592	590	200	0.35	220.0	98.14	97.37
591	590	200	0.35	300.0	98.42	97.37
590	MA 11	300	0.35	80.0	97.37	97.09
MA 11	MA 10	300	0.75	482.1	95.00	91.38
MA 10	MH57A	375	0.41	449.7	91.38	89.53

LEGEND

PROPOSED SANITARY, PER 2018 BSUEA MSS
FUTURE SANITARY, PER 2014 BS MSS
EXISTING SANITARY
DRAINAGE BOUNDARY
LIMIT OF STUDY AREA FOR BSUEA
AREA IN HECTARES
POPULATION
PIPE REACH UPSTREAM MAINTENANCE HOLE TO DOWNSTREAM MAINTENANCE HOLE
COMM — COMMERCIAL
INST — INSTITUTIONAL
VARIES — SEE DESIGN SHEET FOR CONTRIBUTING FLOWS

No.	ISSUE / REVISION	DD/MM/YY
4	ISSUED FOR PLANNING COMMITTEE APPROVAL	04/05/18
3	ADDRESS COMMENTS, RE-ISSUE BSUEA MSS 2ND SUBMISSION	26/02/18
2	ISSUED AS PART OF DRAFT MSS	20/09/17
1	ISSUED FOR PRE-TAC WORKING MEETING	31/08/17

VERIFY SHEET SIZE AND SCALES. BAR TO THE RIGHT IS 25mm IF THIS IS A FULL SIZE DRAWING. 0 25mm

SCALE: 1:4000

CLIENT:

CONSULTANT: www.jlrichards.ca
J.L.Richards ENGINEERS · ARCHITECTS · PLANNERS

CONSULTANT:

PROFESSIONAL STAMP — LICENSED PROFESSIONAL ENGINEER, M. N. L. DALRYMPLE, May 4/18, PROVINCE OF ONTARIO

PROJECT NORTH

PROJECT:
BARRHAVEN SOUTH URBAN EXPANSION AREA (BSUEA)

DRAWING:
MASTER SANITARY DRAINAGE AREA

DESIGN: JW
DRAWN: CJM
CHECKED: LD
JLR #: 26610
DRAWING #: MSAN

File Location: r:\26000\26610 - barrhaven expansion - minto brazeau mattamy\JLR DWG\Civil\26610 C DSAN.dwg

PLOT DATE: May 3, 2018 4:34:47 PM

was assumed to have 4 washbasins that deliver 375 L/d and four (4) water closets that generate 150 L/hr for 10 hr/day resulting in a total flow of 7500 L/day.

Table 6-3: Land Use and Theoretical Wastewater Flows

Land Use	Flow Rate	Area (ha)	Units	Pop.	Average Flow (L/S)	Peak Factor	Infiltration	Total Flows (L/s)
Minto and Mattamy Lands								
Schools	28,000 L/ha/d	4.55			1.50	1.5	1.50	3.8
Park Block	4 L/s	4.39			4.0	1	1.45	5.5
Commercial	28,000 L/ha/d	2.13			0.70	1.5	0.70	1.8
Low-Medium density Residential	280 l/c/d	35.26	1080	3378	11.0	2.92	11.64	43.6
High Density Residential	280 l/c/d	0.90	120	216	0.7	3.51	0.30	2.8
Roads	-	27.00				1	8.91	8.9
Park and Ride		2.57			0.1	1	0.85	1.0
Total		**76.8**	**1200**	**3594**	**17.95**		**25.35**	**67.4**
Brazeau Aggregate Extraction Area								
Schools	28,000 L/ha/d	1.47			0.48	1.5	0.49	1.2
Commercial	28,000 L/ha/d	0.67			0.22	1.5	0.22	0.6
Low-Medium Density Residential	280 l/c/d	10.27	360	1126	3.65	3.21	3.39	15.1
High Density Residential	280 l/c/d	0.28	38	68	0.22	3.63	0.09	0.9
Roads	-	7.95				1	2.62	2.6
Park Block	-	1.48				1	0.49	0.5
Pond Blocks	-	1.78				1	0.59	0.6
Total		**23.9**		**1194**	**4.57**		**7.89**	**21.5**
Drummond Aggregate Extraction Area								
Schools	28,000 L/ha/d	1.25			0.41	1.5	0.41	1.0
Commercial	28,000 L/ha/d	0.57			0.18	1.5	0.19	0.5
Low-Medium Density Residential	280 l/c/d	8.72	288	900	2.92	3.26	2.88	12.4
High Density Residential	280 l/c/d	0.24	32	58	0.19	3.64	0.08	0.8
Roads	-	6.75				1	2.23	2.2

Land Use	Flow Rate	Area (ha)	Units	Pop.	Average Flow (L/S)	Peak Factor	Infiltration	Total Flows (L/s)
Park Blocks	-	1.26				1	0.42	0.4
Pond Blocks	-	1.51				1	0.50	0.5
Total		**20.3**		**958**	**3.70**		**6.71**	**17.8**
Barrhaven South Urban Expansion Area Totals								
Total		**121.0**		**5746**	**26.22**		**40.0**	**106.7**

Based on the land uses presented on the Demonstration Plan (Figure 4-2), the BSUEA would generate a peak wastewater flow of approximately 106.7 L/s.

6.3 Wastewater Collection System Strategy

6.3.1 Proposed Sewer System Layout and Sizing

A trunk sanitary sewer system layout was developed based on the ROW corridors identified on the BSUEA Demonstration Plan for the purposes of demonstrating the feasibility of providing wastewater servicing for the BSUEA lands, refer to the Key Servicing Plans. Proposed trunk sanitary sewers were sized based on the aforementioned design criteria and the drainage areas depicted on the Master Sanitary Drainage Area Drawing MSAN, refer to the BSUEA Sanitary Sewer Design Sheet (Appendix J) for detailed calculations. Final configuration and sizing of the wastewater collection system will be confirmed at detailed design of each subdivision stage. At such time, refinements may be implemented.

The proposed BSUEA trunk sanitary sewers will discharge to existing/planned sanitary sewers at the following six (6) locations, as shown on Figure 6-2:

1. The Future Collector Road
2. New Greenbank Road
3. Flameflower Street
4. Alex Polowin Avenue
5. Kilbirnie Drive
6. Greenbank Road

It is noted that the residual capacity in the River Mist Road trunk sanitary sewer has in fact increased with the addition of the BSUEA peak flows. This is the result of adding a relatively small tributary area while reducing the average daily residential flow from 350 L/cap to 280 L/cap combined with diverting some existing drainage areas, located in Quinn's Pointe, away from the outlet.

Table 6-4: Residual Capacity Comparison in the BSC Trunk Sanitary Sewers

Existing Trunk Sanitary Sewer	Limiting Pipe reach	Current Minimum Residual Capacity	Proposed BSUEA Tributary Lands	Proposed BSUEA Tributary Area	Revised Minimum Residual Capacity with inclusion of BSUEA Peak Flow
Cambrian Road	MH 13A to MH15A	51.4 L/s	Drummond, Brazeau, Mattamy West (Residential only)	48 ha	52.9 L/s
River Mist Road	MH 102A to MH 17A	14.4 L/s	Mattamy East, Mattamy West (Commercial only), Northwest corner of Minto	12 ha	30.5 L/s
River Mist Road	MH 1 to MH 163	5.58 L/s	Minto	5 ha	4.63 L/s
Greenbank Road	MH 45 to MH 435A	295.4 L/s	Minto	60 ha	283.2 L/s

With the addition of the BSUEA lands, a total theoretical peak wastewater flow of 403.7 L/s was calculated at the most downstream maintenance hole in the BSC (MH 501A on Greenbank Road), as indicated in the Sanitary Sewer Design Sheet in Appendix J. This calculated theoretical peak flow is less than the 590 L/s allocated for all of the BSC in Stantec's City-wide 2013 Wastewater Collection System Assessment. In this assessment, Stantec created a hydrodynamic model of trunk sanitary sewers (450 mm in diameter and greater) which demonstrated that the existing downstream trunk system could accommodate the theoretical flow of 590 L/s generated by the BSC with no risk of surcharging or basement flooding. Consequently, Stantec concluded that system upgrades were not required to accommodate the anticipated growth in the BSC. Since the Stantec assessment considered a peak flow that was 186 L/s greater than that calculated for the BSC and the BSUEA combined, it is understood that the existing trunk sanitary sewers located downstream of the BSC can accommodate the additional flows generated by the BSUEA.

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	UNITS Singles	UNITS Townhouse	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)
Dundonald Drive																													
	555A	556A	0.39	13		13	36	0.39	36	3.67	0.43		0.00		0.00		0.00	0.00	0.39	0.39	0.11	0.54	54.5	200	2.90	55.85	0.01	1.78	0.54
	556A	557A	0.54	17		17	46	0.93	82	3.61	0.96		0.00		0.00		0.00	0.00	0.54	0.93	0.27	1.23	76.0	200	0.35	19.40	0.06	0.62	0.34
	557A	558A	0.26	8		8	22	1.19	104	3.59	1.21		0.00		0.00		0.00	0.00	0.26	1.19	0.34	1.55	59.5	200	1.75	43.39	0.04	1.38	0.64
	558A	Ex 402A						1.19	104	3.59	1.21		0.00		0.00		0.00	0.00	0.00	1.19	0.34	1.55	2.0	200	0.35	19.40	0.08	0.62	0.37
	555A	534A	0.30	10		10	27	0.30	27	3.69	0.32		0.00		0.00		0.00	0.00	0.30	0.30	0.09	0.41	46.0	200	1.05	33.61	0.01	1.07	0.36
	534A	535A	0.40	13		13	36	0.70	63	3.63	0.74		0.00		0.00		0.00	0.00	0.40	0.70	0.20	0.94	61.0	200	0.35	19.40	0.05	0.62	0.31
	535A	536A	0.36	13		13	36	1.06	99	3.60	1.15		0.00		0.00		0.00	0.00	0.36	1.06	0.30	1.46	57.5	200	1.85	44.61	0.03	1.42	0.64
Contribution From Pumice Place, Pipe 517A - 536A								0.21	17				0.00		0.00		0.00		0.21	1.27									
	536A	537A	0.21	6		6	17	1.48	133	3.57	1.54		0.00		0.00		0.00	0.00	0.21	1.48	0.42	1.96	50.0	200	2.10	47.53	0.04	1.51	0.73
	537A	539A						1.48	133	3.57	1.54		0.00		0.00		0.00	0.00	0.00	1.48	0.42	1.96	13.5	200	1.80	44.00	0.04	1.40	0.69
To Expansion Road, Pipe 539A - 540A								1.48	133				0.00		0.00		0.00			1.48									
Pumice Place																													
	517A	536A	0.21	6		6	17	0.21	17	3.71	0.20		0.00		0.00		0.00	0.00	0.21	0.21	0.06	0.26	62.0	200	2.10	47.53	0.01	1.51	0.39
To Dundonald Drive, Pipe 536A - 537A								0.21	17				0.00		0.00		0.00			0.21									
Contribution From Andesite Terrace, Pipe 516A - 517A								0.27	23				0.00		0.00		0.00		0.27	0.27									
	517A	5170A	0.36	15		15	41	0.63	64	3.63	0.75		0.00		0.00		0.00	0.00	0.36	0.63	0.18	0.93	65.0	200	0.35	19.40	0.05	0.62	0.31
	5170A	521A	0.32	12		12	33	0.95	97	3.60	1.13		0.00		0.00		0.00	0.00	0.32	0.95	0.27	1.40	59.5	200	1.55	40.83	0.03	1.30	0.60
To Andesite Terrace, Pipe 521A - 522A								0.95	97				0.00		0.00		0.00			0.95									
Andesite Terrace																													
	515A	516A	0.09	2		2	6	0.09	6	3.75	0.07		0.00		0.00		0.00	0.00	0.09	0.09	0.03	0.10	13.0	200	1.95	45.80	0.00	1.46	0.27
	516A	517A	0.18	6		6	17	0.27	23	3.70	0.28		0.00		0.00		0.00	0.00	0.18	0.27	0.08	0.35	50.5	200	1.80	44.00	0.01	1.40	0.41
To Pumice Place, Pipe 517A - 5170A								0.27	23				0.00		0.00		0.00			0.27									
	515A	518A	0.39	14		14	38	0.39	38	3.67	0.45		0.00		0.00		0.00	0.00	0.39	0.39	0.11	0.56	53.0	200	0.70	27.44	0.02	0.87	0.34
	518A	519A	0.35	13		13	36	0.74	74	3.62	0.87		0.00		0.00		0.00	0.00	0.35	0.74	0.21	1.08	53.0	200	0.50	23.19	0.05	0.74	0.37
	519A	520A	0.09	2		2	6	0.83	80	3.62	0.94		0.00		0.00		0.00	0.00	0.09	0.83	0.24	1.17	13.0	200	0.75	28.40	0.04	0.90	0.44
	520A	521A	0.20	7		7	19	1.03	99	3.60	1.15		0.00		0.00		0.00	0.00	0.20	1.03	0.29	1.45	51.0	200	2.60	52.89	0.03	1.68	0.72
Contribution From Pumice Place, Pipe 5170A - 521A								0.95	97				0.00		0.00		0.00		0.95	1.98									
	521A	522A	0.20	6		6	17	2.18	213	3.51	2.42		0.00		0.00		0.00	0.00	0.20	2.18	0.62	3.05	63.0	200	1.80	44.00	0.07	1.40	0.80
To Elevation Road, Pipe 522A - 526A								2.18	213				0.00		0.00		0.00			2.18									
Kootenay Drive																													
	543A	544A	0.38	12		12	33	0.38	33	3.68	0.39		0.00		0.00		0.00	0.00	0.38	0.38	0.11	0.50	100.0	200	0.90	31.12	0.02	0.99	0.36
	544A	545A	0.23	7		7	19	0.61	52	3.65	0.61		0.00		0.00		0.00	0.00	0.23	0.61	0.17	0.79	58.5	200	1.40	38.81	0.02	1.24	0.48
	545A	546A	0.12	4		4	11	0.73	63	3.63	0.74		0.00		0.00		0.00	0.00	0.12	0.73	0.21	0.95	30.5	200	0.95	31.97	0.03	1.02	0.45
	546A	547A	0.05	1		1	3	0.78	66	3.63	0.78		0.00		0.00		0.00	0.00	0.05	0.78	0.22	1.00	14.0	200	0.75	28.40	0.04	0.90	0.42
	547A	548A	0.33	16		16	44	1.11	110	3.59	1.28		0.00		0.00		0.00	0.00	0.33	1.11	0.32	1.60	110.0	200	0.80	29.34	0.05	0.93	0.49
	548A	553A	0.16	6		6	17	1.27	127	3.57	1.47		0.00		0.00		0.00	0.00	0.16	1.27	0.36	1.83	56.5	200	3.50	61.36	0.03	1.95	0.86
To Greenbank Road, Pipe 553A - 405A								1.27	127				0.00		0.00		0.00			1.27									
Lepsoe Lane																													
	549A	550A	0.32	19		19	52	0.32	52	3.65	0.61		0.00		0.00		0.00	0.00	0.32	0.32	0.09	0.71	64.5	200	1.55	40.83	0.02	1.30	0.49
	550A	552A	0.42	25		25	68	0.74	120	3.58	1.39		0.00		0.00		0.00	0.00	0.42	0.74	0.21	1.60	99.5	200	1.40	38.81	0.04	1.24	0.60
To Altitude Avenue, Pipe 552A - 553A								0.74	120				0.00		0.00		0.00			0.74									

DESIGN PARAMETERS

Park Flow =	9300	L/ha/da	0.10764	l/s/Ha				
Average Daily Flow =	280	l/p/day			Industrial Peak Factor = as per MOE Graph			
Comm/Inst Flow =	28000	L/ha/da	0.3241	l/s/Ha	Extraneous Flow =	0.286	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 =	1.50				Townhouse coeff=	2.7		
Institutional =	0.32	l/s/Ha			Single house coeff=	3.4		

Designed: V.W.	PROJECT: Ridge Phases 3 and 4		
Checked: W.L.	LOCATION: City of Ottawa		
Dwg. Reference: Sanitary Drainage Plan, Dwgs. No.	File Ref: 19-1123	Date: 31 May 2023	Sheet No. 1 of 2

1123_FSR_PH3&4_san.xlsx

SANITARY SEWER CALCULATION SHEET

Manning's n=0.013

Ottawa

LOCATION			RESIDENTIAL AREA AND POPULATION									COMM		INSTIT		PARK		C+I+I	INFILTRATION				PIPE						
STREET	FROM M.H.	TO M.H.	AREA (ha)	UNITS	UNITS Singles	UNITS Townhouse	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)
Glaciation Lane																													
	562A	561A	0.26	10		10	27	0.26	27	3.69	0.32		0.00		0.00		0.00	0.00	0.26	0.26	0.07	0.40	71.5	200	1.70	42.76	0.01	1.36	0.41
	561A	560A	0.28	12		12	33	0.54	60	3.64	0.71		0.00		0.00		0.00	0.00	0.28	0.54	0.15	0.86	93.5	200	1.00	32.80	0.03	1.04	0.44
To Altitude Avenue, Pipe 560A - 552A								0.54	60				0.00		0.00		0.00			0.54									
PARK																													
	5320A	532A						0.00					0.00		0.00	1.66	1.66	0.27	1.66	1.66	0.47	0.74	9.5	200	0.65	26.44	0.03	0.84	0.37
To Jean Davey Drive, Pipe 532A - 533A								0.00	0				0.00		0.00		1.66			1.66									
Jean Davey Drive																													
	530A	532A	0.38	11		11	30	0.38	30	3.68	0.36		0.00		0.00		0.00	0.00	0.38	0.38	0.11	0.47	92.5	200	1.00	32.80	0.01	1.04	0.36
Contribution From PARK, Pipe 5320A - 532A								0.00	0				0.00		0.00		1.66		1.66	2.04									
	532A	533A	0.38	11		11	30	0.76	60	3.64	0.71		0.00		0.00		1.66	0.27	0.38	2.42	0.69	1.67	114.0	200	0.75	28.40	0.06	0.90	0.49
To Altitude Avenue, Pipe 533A - 5330A								0.76	60				0.00		0.00		1.66			2.42									
Altitude Avenue																													
Contribution From Elevation Road, Pipe 522A - 526A								6.40	721				0.00		0.00		0.00		6.07	6.07									
Contribution From Expansion Road, Pipe 525A - 526A								1.79	193				0.00		0.00		0.19		1.98	8.05									
(Local)	527A	526A	0.27	10		10	27	0.27	27	3.69	0.32		0.00		0.00		0.19	0.03	0.27	0.27	0.08	0.43	54.5	200	0.95	31.97	0.01	1.02	0.35
	526A	527A						8.46	941	3.25	9.92		0.00		0.00		0.19	0.03	0.00	8.32	2.38	12.33	54.5	250	0.25	29.73	0.41	0.61	0.58
(Local)	528A	527A	0.50	21		21	57	0.50	57	3.64	0.67		0.00		0.00		0.19	0.03	0.50	0.50	0.14	0.85	82.5	200	0.60	25.41	0.03	0.81	0.37
	527A	528A						8.96	998	3.24	10.48		0.00		0.00		0.19	0.03	0.00	8.82	2.52	13.03	82.5	250	0.25	29.73	0.44	0.61	0.58
(Local)	533A	528A	0.26	11		11	30	0.26	30	3.68	0.36		0.00		0.00		0.19	0.03	0.26	0.26	0.07	0.46	46.0	200	0.65	26.44	0.02	0.84	0.32
	528A	533A						9.22	1028	3.23	10.77		0.00		0.00		0.19	0.03	0.00	9.08	2.60	13.40	46.0	250	0.25	29.73	0.45	0.61	0.59
Contribution From Jean Davey Drive, Pipe 532A - 533A								0.76	60				0.00		0.00		1.66		2.42	11.50									
	533A	5330A						9.98	1088	3.22	11.36		0.00		0.00		1.85	0.30	0.00	11.50	3.29	14.94	11.0	250	0.25	29.73	0.50	0.61	0.61
	5330A	551A						10.74	1148	3.21	11.94		0.00		0.00		1.85	0.30	0.00	11.50	3.29	15.52	83.5	250	0.25	29.73	0.52	0.61	0.61
(Local)	5330A	551A	0.35	11		11	30	0.35	30	3.68	0.36		0.00		0.00		0.00	0.00	0.35	0.35	0.10	0.46	83.5	200	2.45	51.34	0.01	1.63	0.50
	551A	560A						11.09	1178	3.20	12.23		0.00		0.00		1.85	0.30	0.00	11.85	3.39	15.91	24.5	250	0.25	29.73	0.54	0.61	0.62
(Local)	551A	560A	0.09	3		3	9	0.09	9	3.74	0.11		0.00		0.00		0.00	0.00	0.09	0.09	0.03	0.13	24.5	200	1.45	39.49	0.00	1.26	0.28
Contribution From Glaciation Lane, Pipe 561A - 560A								0.54	60				0.00		0.00		0.00		0.54	0.63									
	560A	552A						11.72	1247	3.19	12.89		0.00		0.00		1.85	0.30	0.00	12.48	3.57	16.76	45.5	250	0.25	29.73	0.56	0.61	0.62
(Local)	560A	552A	0.17	6		6	17	0.17	17	3.71	0.20		0.00		0.00		0.00	0.00	0.17	0.17	0.05	0.25	45.5	200	1.45	39.49	0.01	1.26	0.34
Contribution From Lepsoe Lane, Pipe 550A - 552A								0.74	120				0.00		0.00		0.00		0.74	0.91									
	552A	553A						12.63	1384	3.16	14.19		0.00		0.00		1.85	0.30	0.00	13.39	3.83	18.32	45.0	250	0.25	29.73	0.62	0.61	0.64
(Local)	552A	553A	0.15	5		5	14	0.15	14	3.72	0.17		0.00		0.00		0.00	0.00	0.15	1.06	0.30	0.47	45.0	200	0.40	20.74	0.02	0.66	0.26
To Greenbank Road, Pipe 553A - 405A								12.78	1398				0.00		0.00		1.85			13.39									
Greenbank Road																													
Contribution From Kootenay Drive, Pipe 548A - 553A								1.27	127				0.00		0.00		0.00		1.27	1.27									
Contribution From Altitude Avenue, Pipe 552A - 553A								12.78	1398				0.00		0.00		1.85		13.39	14.66									
	553A	405A	0.03	1		1	3	14.08	1528	3.14	15.54		0.00		0.00		1.85	0.30	0.03	15.96	4.56	20.41	27.0	250	0.25	29.73	0.69	0.61	0.65

DESIGN PARAMETERS

Park Flow =	9300	L/ha/da	0.10764	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 =	1.50			
Institutional =	0.32	l/s/Ha		

Industrial Peak Factor = as per MOE Graph
Extraneous Flow = 0.286 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: V.W.

Checked: W.L.

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

PROJECT: **Ridge Phases 3 and 4**

LOCATION: **City of Ottawa**

File Ref: 19-1123

Date: 31 May 2023

Sheet No. 2 of 2

1123_FSR_PH3&4_san.xlsx

Wastewater Design Flows per Unit Count
City of Ottawa Sewer Design Guidelines, 2004

Site Area			63.230	**ha**
Extraneous Flow Allowances				
		Infiltration / Inflow	**20.87**	**L/s**
Domestic Contributions				
Unit Type	**Unit Rate**	**Units**	**Pop**	
Ridge Phase 1/2				
Single Family	3.4	347	1180	
Townhouse	2.7	279	754	
Ridge Phase 3				
Single Family	3.4	61	208	
Townhouse	2.7	273	738	
Ridge Phase 4				
Single Family	3.4		0	
Townhouse	2.7	369	997	
External				
Population			598	
		Total Pop	**4475**	
		Average Domestic Flow	**14.50**	**L/s**
		Peaking Factor	**2.83**	
		Peak Domestic Flow	**41.06**	**L/s**

Institutional / Commercial / Industrial Contributions

Property Type	**Unit Rate**		**No. of Units**	**Avg Wastewater (L/s)**
Commercial floor space	0.3241	L/s/ha	22.45	7.28
Park	0.1076	L/s/ha	3.57	0.38
Institutional	0.4051	L/s/ha	6.06	2.45
			Average I/C/I Flow	**10.11**
			Peak Institutional / Commercial Flow	11.49

Total Estimated Average Dry Weather Flow Rate	**24.62**	**L/s**
Total Estimated Peak Dry Weather Flow Rate	**52.55**	**L/s**
Total Estimated Peak Wet Weather Flow Rate	**73.42**	**L/s**

David Schaeffer Engineering Ltd.
120 Iber Road, Suite 103
Stittsville, ON K2S 1E9
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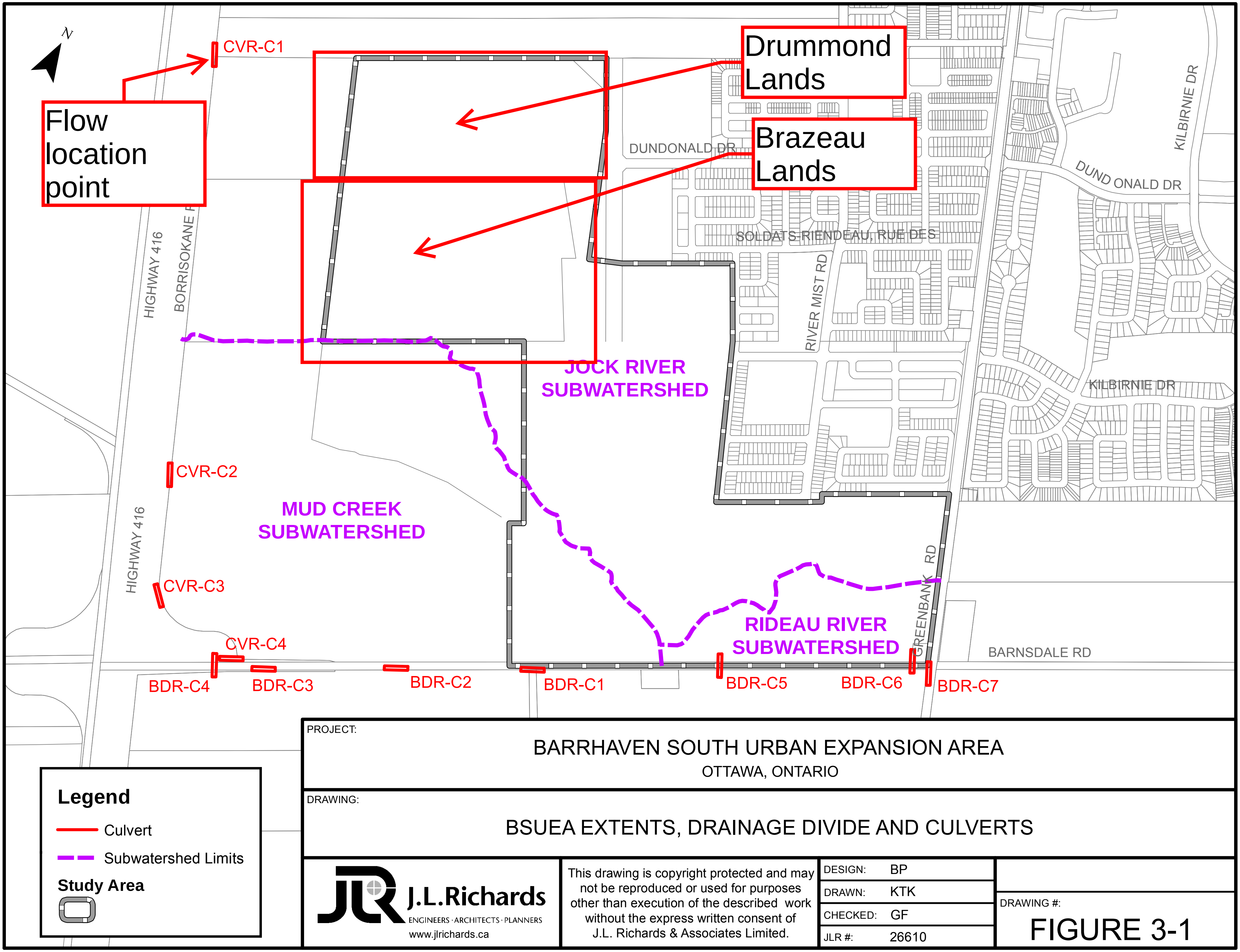
APPENDIX D



PROJECT:

BARRHAVEN SOUTH URBAN EXPANSION AREA

OTTAWA, ONTARIO

DRAWING:

BSUEA EXTENTS, DRAINAGE DIVIDE AND CULVERTS

J.L.Richards
ENGINEERS · ARCHITECTS · PLANNERS
www.jlrichards.ca

DESIGN:	BP
DRAWN:	KTK
CHECKED:	GF
JLR #:	26610

DRAWING #:

FIGURE 3-1

File Location: R:\26000\26610 - Barrhaven Expansion - Minto Brazeau Mattamy\JLR DWG\GIS\26610 C BSUEA EXTENTS.mxd

Plot Date: September 12, 2017 8:45:23 AM

Table 5-1: Inventory of Model Boundary Water Crossings

Culvert ID	Location	Type	Size (mm)
CR-C1	On Cambrian Road, 910 m east of Borrisokane Road, carries Clarke West Municipal Drain	Circ. CSP	1650
CR-C2	On Cambrian Road at Borrisokane Road	Circ. CSP	N/A
BDR-C4	On Barnsdale Road, 50 m west of Borrisokane Road	Circ. CSP	1200
BDR-C5	On Barnsdale Road, 500 m west of the existing Greenbank Road	Circ. CSP	500
BDR-C6	On Barnsdale Road, 60 m west of the existing Greenbank Road	Circ. CSP	400

It should be noted that culvert CR-C2 was not included as part of the topographical survey and size is currently unknown.

The 2014 Barrhaven South Master Servicing Study Draft Addendum (Draft 2014 BSMSSA) prepared by Stantec, notes that water crossing CR-C1 is to be replaced with storm sewers when the Clarke West Municipal Drain is enclosed as part of the adjacent development and the Clarke Stormwater Management Facility is constructed. The Draft 2014 BSMSSA also indicated that culvert CR-C2 is to be maintained, and will accommodate flows from the existing catchment area south of Cambrian Road up to the 1:100 year event. Should future development occur south of the woodlot draining to CR-C2, grading and servicing from the future development area in the vicinity of the woodlot should be developed to maximize overland sheet flow drainage (not channelized) towards the woodlot.

Table 5-2: Inventory of Model Water Crossings (Internal)

Culvert ID	Location	Type	Size (mm)
CVR-C1	East of Borrisokane Road along the north corner of the BSUEA	Circ. CSP	500
CVR-C2	East of Borrisokane Road at Field Entrance	Circ. CSP	450
CVR-C3	East of Borrisokane Road at Field Entrance	Circ. CSP	400
CVR-C4	Borrisokane Road Crossing north of Barnsdale Road	Circ. CSP	1200
BDR-C1	Viewbank Road Crossing	Circ. CSP	400
BDR-C2	Field Entrance Crossing South of Barnsdale Road	Circ. CSP	400
BDR-C3	Field Entrance Crossing South of Barnsdale Road	Circ. CSP	500
BDR-C7	Barnsdale Road Crossing close to the existing Greenbank Road Intersection	Circ. CSP	500

Table 5-2, above, summarizes the various culvert crossings within the BSUEA. As shown above, all the culverts are 500 mm in diameter or less with the exception of CVR-C4, which is 1200 mm in diameter.

B5.5.1 Storm Distribution

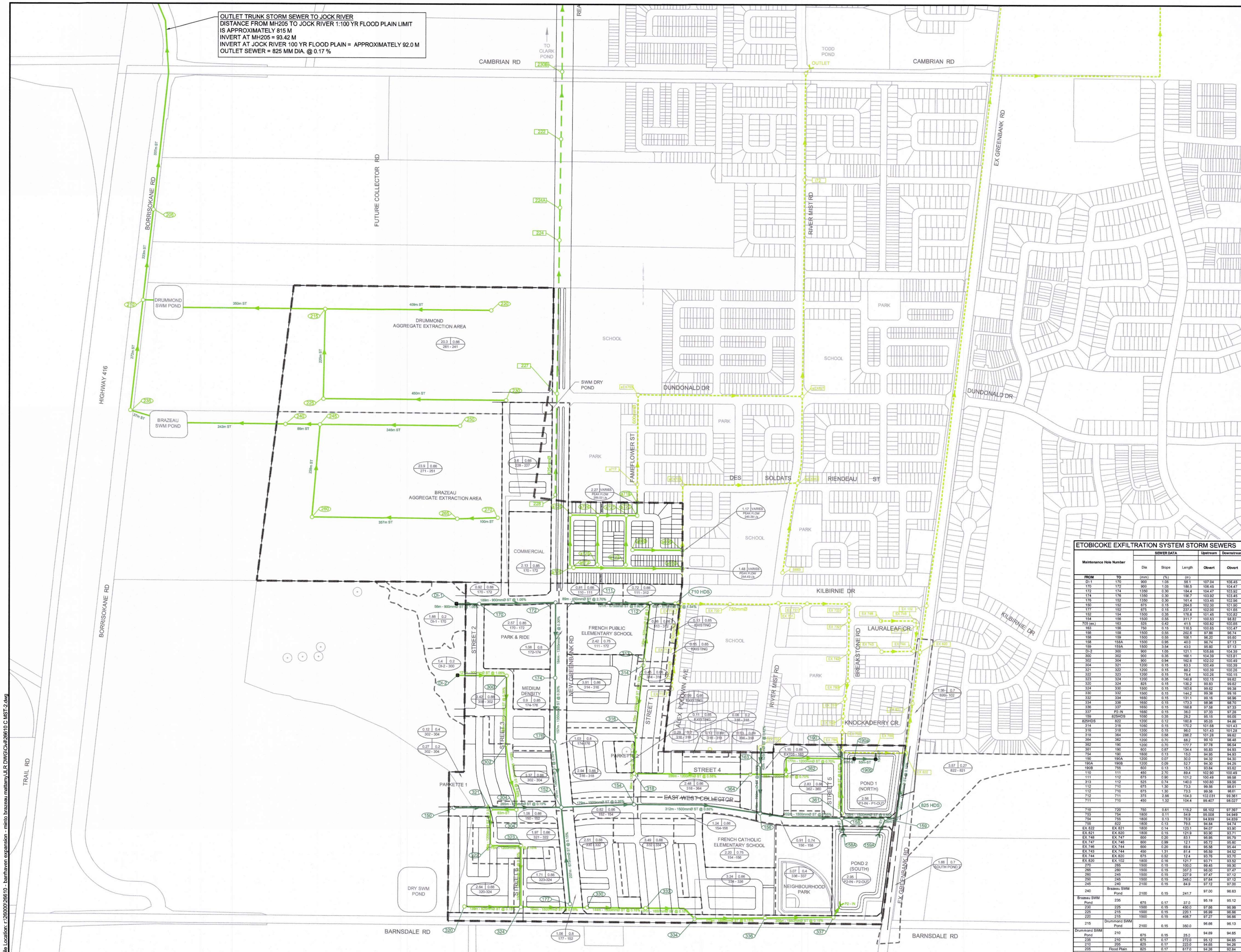
The hydrological response of the BSUEA and abutting lands was simulated under a 6 hour, 12 hour and 24 hour SCS Type II storm distribution. The SCS Type II storm distribution was developed by the American Soil Conservation Service and is generally used for estimating flows in rural areas. The critical storm event under pre-development conditions, with the highest peak runoff, was found to occur under the 12 hour SCS Type II storm distribution.

B5.6 Modeling Results

The pre-development SWMHYMO simulation results, predicting flows at each of the culverts for the critical storm event, are shown in Table 5-5, below. The estimated capacity and level of service of each culvert is also provided. The details of culvert CR-C2, crossing Cambrian Road at Borrisokane Road, could not be obtained in the field due to obstructions and/or structural failure. Hence, the capacity and level of service at this culvert could not be confirmed.

Table 5-5: Hydrological Simulation Results at Culvert Locations (12 hour SCS Type II storm)

Culvert ID	Flow (m³/s) at culvert location for return period (recurrence)						Estimated Culvert Capacity (m³/s)	Estimated Level of Service (years)
	1:2 yr	1:5 yr	1:10 yr	1:25 yr	1:50 yr	1:100 yr		
CR-C1	0.3	0.7	1.0	1.6	2.0	2.5	5.5	1:100
CR-C2	0.2	0.4	0.7	1.0	1.3	1.6	N/A	N/A
CVR-C1	0.1	0.3	0.5	0.8	1.0	1.3	0.4	1:5
CVR-C2	0.0	0.1	0.1	0.2	0.2	0.3	0.2	1:25
CVR-C3	0.0	0.1	0.2	0.2	0.3	0.4	0.3	1:50
CVR-C4	0.2	0.4	0.6	0.9	1.1	1.4	2.6	1:100
BDR-C1	0.0	0.0	0.1	0.1	0.1	0.2	0.2	1:100
BDR-C2	0.0	0.1	0.1	0.1	0.2	0.2	0.2	1:50
BDR-C3	0.1	0.1	0.1	0.2	0.2	0.3	0.5	1:100
BDR-C4	0.2	0.4	0.6	0.9	1.2	1.5	2.6	1:100
BDR-C5	0.0	0.0	0.0	0.0	0.0	0.1	0.3	1:100
BDR-C6	0.0	0.0	0.1	0.1	0.2	0.2	0.2	1:100
BDR-C7	0.1	0.1	0.1	0.2	0.3	0.4	0.3	1:50
Total Flow to Thomas Baxter Municipal Drain	0.2	0.5	0.7	1.1	1.3	1.6	N/A	N/A



ETOBICOKE EXFILTRATION SYSTEM STORM SEWERS

Maintenance Hole Number		SEWER DATA			Upstream	Downstream
		Dia	Slope	Length	Obvert	Obvert
FROM	TO	(mm)	(%)	(m)		
DI-1	170	900	1.05	56.1	107.04	106.45
170	172	900	1.05	188.5	106.45	104.47
172	174	1350	0.30	184.4	104.47	103.92
174	176	1350	0.30	156.7	103.92	103.45
176	152	1350	0.30	161.4	103.45	102.96
150	152	675	0.15	264.6	102.30	101.90
177	152	675	0.15	237.4	102.00	101.65
152	154	1500	0.35	178.8	101.45	100.82
154	156	1500	0.55	311.7	100.53	98.82
705 (ex.)	163	525	0.42	41.5	100.82	100.65
163	156	750	0.15	118.5	100.65	100.47
156	158	1500	0.55	202.6	97.86	96.74
158	159	1500	0.55	108.1	96.20	95.60
158	158A	1500	0.95	40.0	96.74	97.13
159	159A	1500	3.54	43.0	95.60	97.13
DI-2	300	900	1.05	121.1	105.66	104.39
300	302	900	0.35	168.1	104.39	103.81
302	304	900	0.94	162.6	102.02	100.49
304	321	1200	0.15	63.3	100.49	100.39
321	322	1200	0.15	88.2	100.39	100.26
322	323	1200	0.15	75.4	100.26	100.15
323	324	1200	0.35	149.8	100.15	99.62
320	324	825	0.15	139.2	99.83	99.62
324	330	1500	0.15	163.6	99.62	99.38
330	332	1500	0.15	144.2	99.38	99.16
332	334	1650	0.15	131.1	99.16	98.96
334	336	1650	0.15	173.3	98.96	98.70
336	337	1650	0.15	168.8	97.58	97.33
337	P2-IN	1650	0.15	36.0	97.33	97.28
159	825HDS	1050	0.35	26.2	95.15	95.05
825HDS	822	1200	0.12	160.8	95.05	94.86
314	316	1050	0.15	170.2	101.68	101.43
316	318	1200	0.15	96.0	101.43	101.28
318	364	1200	0.58	286.2	101.28	99.62
364	362	1200	0.70	88.2	99.10	98.48
362	190	1200	0.70	177.7	97.78	96.54
361	190	600	0.67	134.4	95.83	94.93
754	190	1800	0.13	15.0	94.95	94.93
190	190A	1200	0.07	30.0	94.32	94.30
190A	190B	1200	0.09	52.7	94.30	94.25
190B	755	600	0.13	15.3	93.64	93.62
110	111	450	2.70	89.4	102.90	100.49
111	112	675	0.90	101.2	100.49	99.58
313	112	525	0.74	140.0	100.60	99.56
112	710	675	1.30	73.3	99.56	98.61
112	710	675	1.30	73.3	99.56	98.61
712	711	375	2.56	104.3	102.031	99.361
711	710	450	1.32	104.4	99.407	98.027
710	720	750	0.61	115.2	98.102	97.397
753	754	1800	0.11	54.9	95.008	94.949
754	755	1800	0.13	76.9	94.939	94.839
755	822	1800	0.13	79.5	94.84	94.74
EX. 822	EX. 821	1800	0.14	123.1	94.07	93.90
EX. 821	EX. 820	1800	0.15	121.9	93.90	93.71
EX. 748	EX. 747	600	0.20	83.1	95.95	95.79
EX. 747	EX. 746	600	0.99	12.1	95.72	95.60
EX. 746	EX. 744	600	0.20	69.4	95.58	95.44
EX. 743	EX. 744	450	1.31	81.4	95.59	94.52
EX. 744	EX. 820	675	0.52	12.4	93.76	93.70
EX. 820	EX. 102	1800	0.16	121.7	93.71	93.52
270	265	1500	0.15	100.0	99.45	99.30
265	260	1500	0.15	357.3	98.00	97.47
260	245	1500	0.15	227.9	97.47	97.12
250	245	1500	0.15	345.0	97.64	97.12
245	240	2100	0.15	84.9	97.12	97.00
240	Brazeau SWM Pond	2100	0.15	241.7	97.00	96.63
Brazeau SWM Pond	235	675	0.17	37.0	95.19	95.12
230	225	1500	0.15	450.0	97.66	96.99
225	215	1500	0.15	220.1	96.99	96.66
220	215	1500	0.15	408.7	97.27	96.66
215	Drummond SWM Pond	2100	0.15	350.0	96.66	96.13
Drummond SWM Pond	210	675	0.15	25.0	94.69	94.65
235	210	675	0.17	272.0	95.12	94.65
210	205	825	0.17	223.0	94.65	94.26
205	Flood Plain	825	0.17	817.0	94.26	92.84
900	227 (ex.)	975	0.15	120.0	97.93	97.75

LEGEND

- PROPOSED STORM (EES SYSTEM), PER 2018 BSUEA MSS
- PROPOSED STORM (CONVENTIONAL), PER 2018 BSUEA MSS
- FUTURE STORM, PER 2014 BS MSS
- EXISTING STORM
- DRAINAGE BOUNDARY
- LIMIT OF STUDY AREA FOR BSUEA
- 710 HDS — HYDROLOGY DYNAMIC SEPARATOR
- AREA IN HECTARES*
- RUNOFF COEFFICIENT*
- PIPE REACH UPSTREAM MAINTENANCE HOLE TO DOWNSTREAM MAINTENANCE HOLE

* IF RED, AREAS DESIGNATED AS COMMERCIAL, SCHOOLS OR PARKS

NOTE:

ROADWAYS WITHIN A DRAINAGE AREA WHICH IS TRIBUTARY TO AN EES SEWER, ARE TO BE DESIGNED WITH EES SEWERS. CONVERSELY, ROADWAYS WITHIN A DRAINAGE AREA WHICH IS TRIBUTARY TO A CONVENTIONAL SEWER, ARE TO BE DESIGNED WITH CONVENTIONAL SEWERS.

No.	ISSUE / REVISION	DD/MM/YY
4	ISSUED FOR PLANNING COMMITTEE APPROVAL	04/05/18
3	ADDRESS COMMENTS, RE-ISSUE BSUEA MSS 2ND SUBMISSION	26/02/18
2	ISSUED AS PART OF DRAFT MSS	20/09/17
1	ISSUED FOR PRE-TAC WORKING MEETING	31/08/17

VERIFY SHEET SIZE AND SCALES. BAR TO THE RIGHT IS 25mm IF THIS IS A FULL SIZE DRAWING. 0 25mm

SCALE: 1:4000

CLIENT:

CONSULTANT: www.jlrichards.ca

J.L.Richards ENGINEERS · ARCHITECTS · PLANNERS

CONSULTANT:

PROFESSIONAL STAMP: LICENSED PROFESSIONAL ENGINEER W. H. L. DALRYMPLE May 4/18 PROVINCE OF ONTARIO

PROJECT NORTH

PROJECT:

BARRHAVEN SOUTH URBAN EXPANSION AREA (BSUEA)

DRAWING:

MASTER STORM DRAINAGE PLAN EES

DESIGN: JW

DRAWN: CJM

CHECKED: LD

JLR #: 26610

DRAWING #: MST-2

PLOT DATE: May 4, 2018 8:44:19 AM

re: **Groundwater Infiltration Review**
Proposed Residential Development
Brazeau Pit and Drummonds Pit- Borrisokane Road - Ottawa

to: Caivan Communities - **Mr. Andrew Finnson** - afinnson@caivan.com

date: August 30, 2019

file: PG4504-MEMO.06 Revision 1

Paterson Group (Paterson) has prepared the current memorandum report to provide a review of the hydrogeological characteristics in support of groundwater infiltration recommendations for the aforementioned site.

Background Information

It is currently understood that the proposed residential development consists of a mixture of single family and townhouse style residential dwellings. It is also understood that the development will be serviced by municipal infrastructure that outlets to a stormwater management pond.

The field program for the geotechnical investigation at the Brazeau Pit was completed between November 16, 2018 and April 10, 2019. At that time, a total of 12 boreholes and 15 test pits were advanced to a maximum depth of 5.9 m below existing grade. The results of the investigation indicated that, in general, the subsurface profile consisted of a thin layer of fill material overlying a deposit of silty sand/sand with varying amounts of gravel and cobbles. A thick layer of fill material was encountered within the southeast portion of the subject site and primarily consisted of silty sand with varying amounts of clay, gravel, cobbles, organics and construction debris. This was typically underlain by a till deposit composed of a silty sand matrix with gravel, cobbles and boulders. A very stiff to stiff silty clay layer was noted between the silty sand/sand and till deposits at select boreholes within the western portion of the property. A DCPT test was completed at one borehole location and encountered practical refusal at a depth of 23.5 m. However, bedrock was not conclusively encountered as part of the geotechnical investigations for the proposed development.

The field program for the geotechnical investigation at the Drummonds Pit was completed between July 22 and July 26, 2019. At that time, a total of 8 boreholes and 14 test pits were advanced to a maximum depth of 11.3 m below existing grade. The results of the investigation indicated that, in general, the subsurface profile consisted of a fill material comprised of silty sand to sand and/or silty clay with varying amounts of gravel, cobbles and boulders. Depending on the depth of excavation during the extraction of the aggregate material, the above noted fill material is underlain by either silty sand/sand with varying amounts of gravel, cobbles and boulders or a glacial till deposit composed of a silty sand to silty clay matrix with varying amounts of gravel, cobbles and boulders. A very stiff to stiff silty clay layer was noted underlying the silty sand/sand or fill material at select test holes. A DCPT test was completed at one borehole location and encountered practical refusal at a depth of 11.6 m.

Bedrock was not conclusively encountered as part of the geotechnical investigations for the proposed development. However, based on available mapping, the site is located in an area where bedrock consists of dolomite of the Oxford formation, with overburden thickness ranging from 15 to 25 m.

Hydrogeological Setting

The subject site is located primarily within the Jock Downstream Reach subwatershed of the Jock watershed, with a negligible percentage of the property being located within the Mud Creek subwatershed of the Lower Rideau watershed.

Hydraulic Conductivity and Infiltration Values

Hydraulic conductivity testing was not completed as part of the geotechnical investigations for the proposed development. However, testing completed directly south of the subject site as part of the Community Development Plan (CDP) determined that the hydraulic conductivity of the silty sand/sand deposit ranged from 3.0×10^{-6} to 4.8×10^{-4} m/sec. The hydraulic conductivity values obtained from within the till deposit were slightly lower, and ranged from 5.0×10^{-7} to 7.6×10^{-5} m/sec. The values obtained from the field testing to the south are consistent with published values, and are considered applicable to the materials encountered at the subject site. With regards to the silty clay layer noted underlying the silty sand/sand deposit, hydraulic conductivity values were anticipated to range from 1.0×10^{-9} to 1.0×10^{-7} m/sec, and were based on published values. Due to the variability in the fill material noted on site, hydraulic conductivity values are anticipated to range from 1.0×10^{-7} to 1.0×10^{-4} m/sec and is dependant on the ratio of silty sand/sand to silty clay within the material. **For infiltration system design purposes, it is recommended to use an infiltration rate of 75 mm/hr for the Brazeau Pit site and an infiltration rate of 50 mm/hr for the Drummond Pit site.**

Based on discussions with David Schaeffer Engineering Ltd., it is understood that a version of the Etobicoke exfiltration system is being proposed for the development in order to ensure infiltration volumes to the underlying aquifer systems be maintained. The exfiltration system is proposed to be installed below the curb lines of the development and placed over native silty sand/sand, free-draining sand material 1.5 m in thickness or a silty sand/sand to silty clay fill material. **It is understood that the subject area is required to meet post-development infiltration levels of 40% of the area precipitation. It is further understood that the annual precipitation for the area is 844 mm, so a post-development infiltration level of 40% would require that a minimum infiltration of 338 mm be achieved for the subject site.**

Water Levels and Flow Directions

Water levels obtained at the time of the geotechnical investigations ranged from 0 to 9.1 m depth below existing grade. Based on the recovered water levels, it is expected that the local groundwater flow direction trends to the north towards the Jock River, located approximately 1.4 km north from the north property boundary of the Drummonds Pit. This is corroborated by the groundwater divide separating the Jock Downstream Reach subwatershed and the Mud Creek subwatershed located at the southern boundary of the Brazeau Pit. Its location at the southern edge of the property would suggest that groundwater flows north, away from the divide.

Groundwater Recharge and Discharge

The presence of overburden soils with moderate to high hydraulic conductivity overlying the bedrock aquifer units are considered to provide the potential for significant groundwater recharge within the study area. The Kars esker is considered to transmit large quantities of water that are recharged through the infiltration of precipitation within the non-cohesive material comprising the original overburden materials in the area. The subject site represents a small portion of the existing zone identified by the Mississippi-Rideau Source Protection Region (MRSPR) as a zone of significant groundwater recharge.

Recommendations

As previously discussed, existing conditions at the subject site currently allow for significant volumes of recharge to occur. As such, it is recommended that measures be taken as part of the proposed development to ensure that infiltration volumes to the underlying aquifer systems be maintained. In accomplishing this, the following are some of the potential measures that could be implemented at the subject site:

- ❏ Transport the water using a modified version of the Etobicoke exfiltration system for the development with a minimum 1 m vertical separation between the base of the system and the seasonally high water table to allow for adequate infiltration.

- ❏ Allocate land for City parks, providing opportunities to allow clean water to infiltrate into the overburden aquifer system.

- ❏ Promote infiltration of clean water from rooftops by directing stormwater to grassed areas as opposed to driveways and/or municipal infrastructure.

- ❏ Implement Low Impact Development (LID) measures in conjunction with BMP for stormwater quality and quantity control to assist in infiltrating clean water, treating salt impacted water where required or redirecting salt impacted water away from infiltration locations.

It is important to note that not all of the above may necessarily need to be employed at the subject site, and that the measures required to maintain existing infiltration will be dependant on the final design of the proposed development.

We trust that this information satisfies your requirements.

Best Regards,

Paterson Group Inc.

LICENSED PROFESSIONAL ENGINEER
Aug.30/2019
D. J. GILBERT
100116130
PROVINCE OF ONTARIO

Mike Killam, P.Eng.

David J. Gilbert, P.Eng.

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5.8 Analysis of EES Results

5.8.1 BSUEA Site Wide Infiltration with EES

A water budget analysis was carried out as part of the Existing Condition Report (Section B6, Appendix B). This analysis revealed that pre-development infiltration across the BSUEA accounted for 40% of the total precipitation based on long-term simulations. Based on the post-development simulation results, the water budget for the overall BSUEA lands is shown in Table 5-8 below and compared in the table with the existing conditions water budget. The use of the EES along the local road network within the BSUEA lands achieves an infiltration of 44% which is greater than under existing conditions, which shows that infiltration within ±10% of existing is achievable. It should be noted that this analysis has excluded the Brazeau and Drummond properties which have been assumed to integrate measures to promote infiltration and preserve pre-infiltration rates along both properties separately from the remaining BSUEA. Further refinements to the high level infiltration concept, including sizing of the EES, can be investigated during detailed design.

Table 5-8: BSUEA EES Water Budget Results

Water Budget Component	Annual Average Depth (mm)	Budget (%)	Existing Condition Budget (%)
Precipitation	844	100%	100%
Evapotranspiration	231	27%	60%
Infiltration	377	44%	40%
Surface Runoff	225	27%	0%

5.8.2 Minto Lands

5.8.2.1 Major System Cascading and Ponding Levels

The simulated elevations along the major overland system nodes are shown in Table 5-9 and Table 5-10. There is no ponding during the 1:5 year event or 1:10 year event for local/collector roads and arterial roads, while the depth of flow along the major system is maintained to or below 350 mm during the 1:100 year event.

Table 5-9: Minto EES Local and Collector Road Major Node Depths

Major System Node	3 hr Chi 1:5 yr Ponding Depth (mm)	24 hr SCS 1:5 yr Ponding Depth (mm)	3 hr Chi 1:100 yr Ponding Depth (mm)	24 hr SCS 1:100 yr Ponding Depth (mm)
S_110-111	10	10	350	210
S_111-112	10	10	250	30
S_150-152	10	10	210	160
S_152-154	10	10	80	70

5.4.3 Stormwater Management Facilities (SWMFs)

The SWMFs, either wet ponds or dry ponds, should be designed in accordance with Section 8 of the OSDG and MOE's publication entitled "SWM Planning and Design Manual, 2003".

The normal water level in the wet ponds should be above the highest elevation of either: (i) the free flowing water level in the downstream storm sewer during the 1:2 year event; or (ii) the elevation of the underlying groundwater table.

For safety reasons, the live storage in dry ponds should be kept to 1.5 m (OSDG) to 2.0 m deep (MOE). A minimum 300 mm freeboard should be provided between the 1:100 year water surface elevation and the overflow elevation.

SWMFs should be integrated into the community through the use of pathways or other linkages.

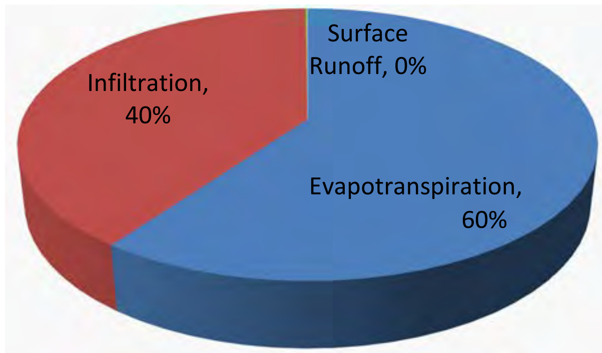
5.4.4 Water Balance

The Hydrogeological Existing Conditions Report (Paterson Group Inc., 2017) recommended that infiltration measures be incorporated into the BSUEA's storm servicing design, as the subject area contributes to groundwater recharge of the esker, which should be preserved. The Paterson Group Inc. (Paterson) Report recommended that:

- Distributed infiltration be achieved to promote recharge of overburden aquifer and preserve the pre-infiltration condition for the three (3) subwatersheds; and,
- Only captured runoff that is relatively free of roadway salts be infiltrated to minimize adverse impacts on the esker.

An analysis (using the PCSWMM software platform) was carried out and is summarized in the Existing Condition Report (Appendix B) to determine the various contributions of the water budget based on long-term simulations. To simulate the infiltration, the analysis utilized measured data compiled as part of Paterson's field program. Infiltration to groundwater recharge zones was simulated based on measured saturated field hydraulic conductivity, which was translated to infiltration rates (refer to Section B6.1.1 of Appendix B). The analysis revealed that overall pre-development infiltration from the subject site (excluding the aggregate extraction areas) accounted for 40% of the overall water budget (Figure 5-2). The City and RVCA have agreed with Paterson's recommendation that pre-development infiltration levels should be maintained and distributed infiltration be achieved across the site, and should not be concentrated at one or two location(s).

Figure 5-2: Existing Water Budget Breakdown



5.5 Storm Servicing Strategy

Based on the storm drainage connections and criteria set out in Sections 5.2 and 5.4 respectively, a stormwater management strategy has been developed. The strategy strives to preserve pre-development infiltration across the BSUEA, which in turn, impacts the individual stormwater management strategies developed for each of the servicing areas depicted in Figure 4-2. Sub-section 5.4 presents the rationale in developing storm servicing strategies, Sub-section 5.5.5 the storm drainage and design methodology, Sub-sections 5.7 5.8, and 5.9 present the analyses carried out for the conventional, EES and infiltration gallery servicing strategies, respectively while Sub-section 5.10.2 summarizes the impact of the strategies on the municipal drains.

5.5.1 EES Infiltration Strategy

5.5.1.1 Background

During the preparation of the Existing Condition Report, it became evident that storm servicing for the BSUEA would need to incorporate measures to recharge the overburden aquifer. As a result of extensive work and consultation with the both the City and RVCA over a nine (9) month period, the preferred infiltration servicing strategy has been identified as the Etobicoke Exfiltration System (EES). During this nine (9) month period, a number of Memoranda were prepared to support the selection process. All documents and work undertaken (Memoranda and Presentation) are described below (Sections 5.5.1.1 to 5.5.1.6) and included in Appendix E.

In September 2016, a Memorandum to the City outlined potential infiltration measures that could be considered for the BSUEA. The Memorandum outlined general considerations related to infiltration and nine (9) specific infiltration measures, which ranged from reduced lot grading to infiltration galleries and bio-retention cells. The advice from the City and RVCA following submission of the Memorandum is that infiltration measures should be spread across the site so as to mimic current infiltration patterns and should not rely on infrastructure on private properties. After further review and discussions, the EES was selected as the preferred measure to preserve the water budget and carried forward for further sizing and analysis.

Table 5-13: Minto EES Pond Parameters and Results

Pond Parameter	Dry Pond 1	Dry Pond 2	Western Spill-over Pond
Water Quality	Not Required	Not Required	Not Required
Simulated Release Rate (m^3/s)	1.7	0.5	0.33
Pond Invert (m)	95	95.6	100
Pond Top of Bank (m)	95.75	96.8	100.7
Active Storage Depth (m)	0.75	1.2	1.1
Freeboard (m)	>0.3	>0.3	>0.3
Outlet Elevation (m)	95	95.6	100
Outlet Diameter (m)	0.675	0.375	0.4
Drawdown Time (hrs)	6	12	6
Surface Area (ha)	1.5	1.7	1.2

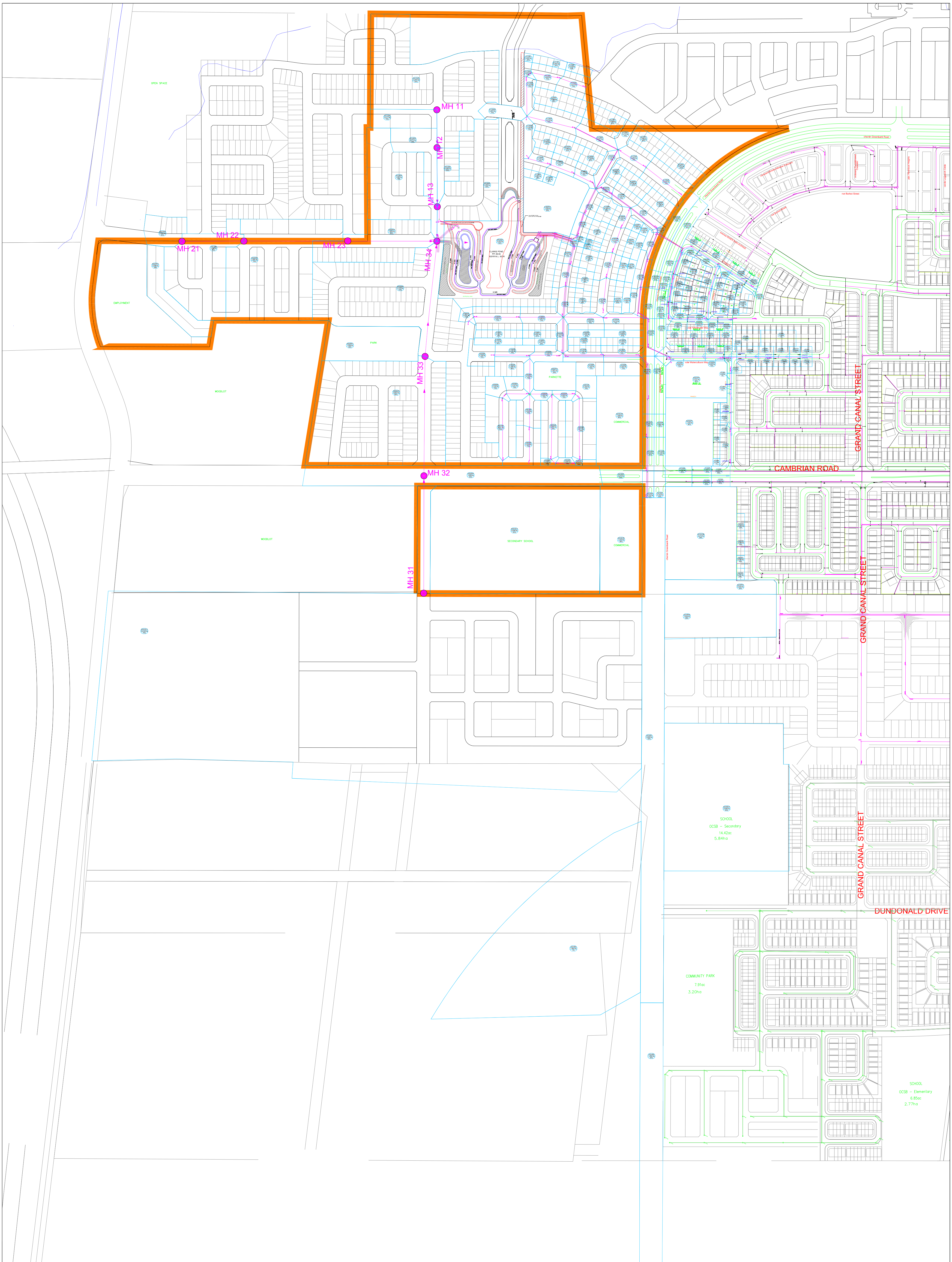
5.8.3 Mattamy Lands East and Mattamy Lands West

The Mattamy Lands East was modelled at the conceptual level as part of the Half Moon Bay South – Phase 4 Stormwater Management Report (Stantec, 2015) while the minor system of Mattamy Lands West was included in the Draft BSMSSA, Stantec, 2014. Neither of these Reports included an assessment of EES within the storm minor system.

Including the EES within these areas would not alter the stormwater management approach as neither of the Mattamy Lands requires additional water quality control and the MSS designs do not affect major system storage requirements. The use of EES in Mattamy Lands East, however, may improve the downstream HGLs in the Half Moon Bay South subdivision and areas draining to the Todd Pond as exfiltration of clean runoff into the underlying groundwater and esker would be promoted resulting in a reduction in the flow and increase in available capacity in the conventional sewers.

5.8.4 Brazeau and Drummond Aggregate Extraction Areas

The EES has been identified as a suitable strategy on urban development in the BSUEA to achieve distributed infiltration as per the recommendations of Paterson's Existing Conditions Report. Assuming that both aggregate extraction areas are developed as residential, infiltrating clean runoff from local roads can achieve the required infiltration. Alternatively, infiltration galleries could also supplement or replace part of an EES. At detailed design of these properties, the strategy to preserve pre-development infiltration rates will need to be reviewed in consultation with the Geotechnical Engineer once it is known what type of fill material was used to meet the minimum rehabilitation elevations.



J.F. Sabourin and Associates Inc.
WATER RESOURCES AND ENVIRONMENTAL CONSULTANTS
GATINEAU (819) 243-6858
OTTAWA (613) 836-3884

CLIENT :
DSEL
david schaeffer engineering ltd
120 IBER ROAD, UNIT 103
STITTSVILLE, ONTARIO., K2S 1E9
(613) 836-0856

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
LP100NW LOW POINT
A100NW SUB-CATCHMENT ID
0,068 ha SUB-CATCHMENT AREA
75% TOTAL IMPERVIOUSNESS

PROJECT : HALF MOON BAY WEST SUBDIVISION

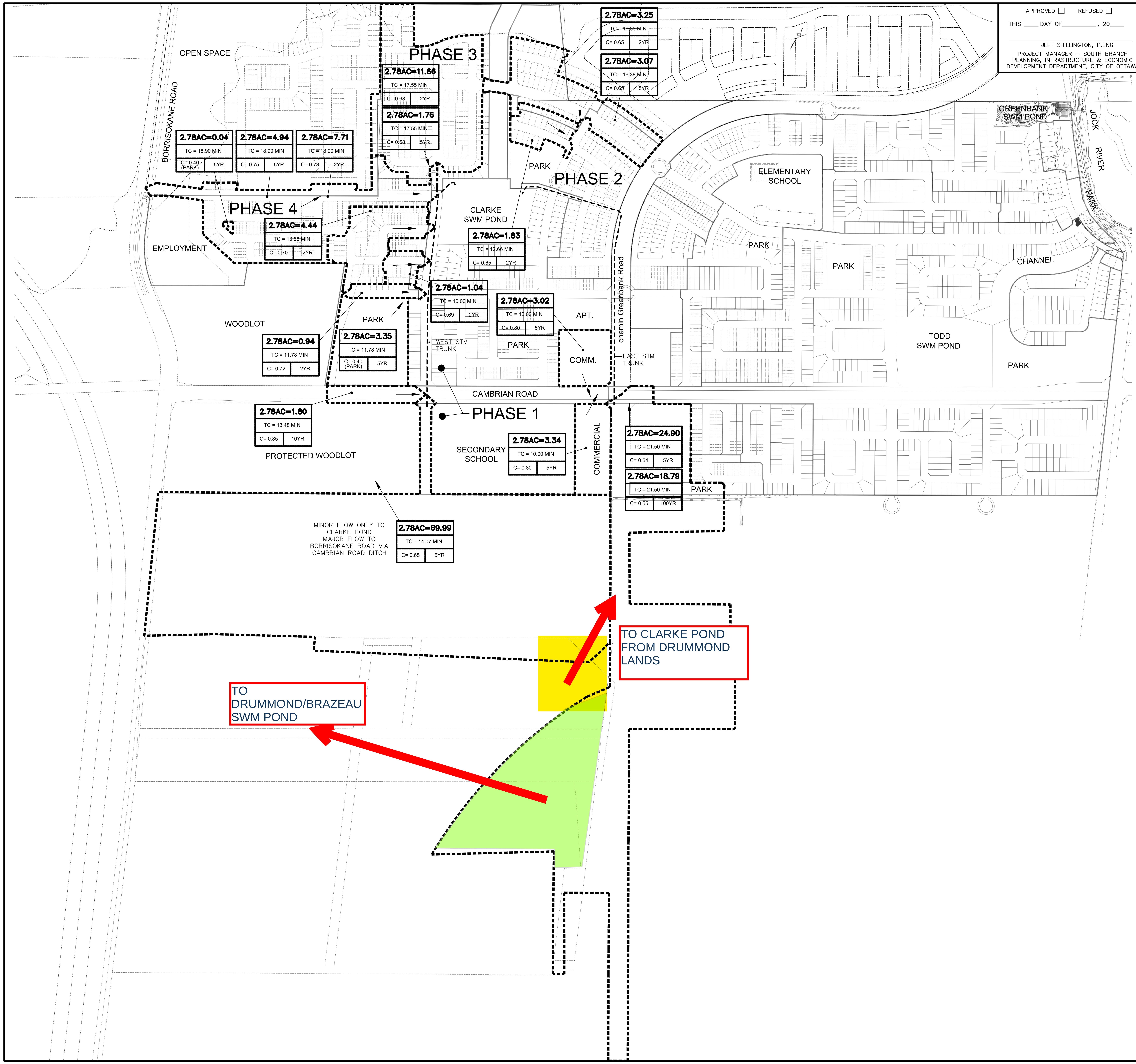
SCALE: 0 75 150 225 300 375m

TITLE : PROPOSED DRAINAGE AREA TO SWM FACILITY

FIGURE 2

No.	BY	DATE	DESCRIPTION	BY

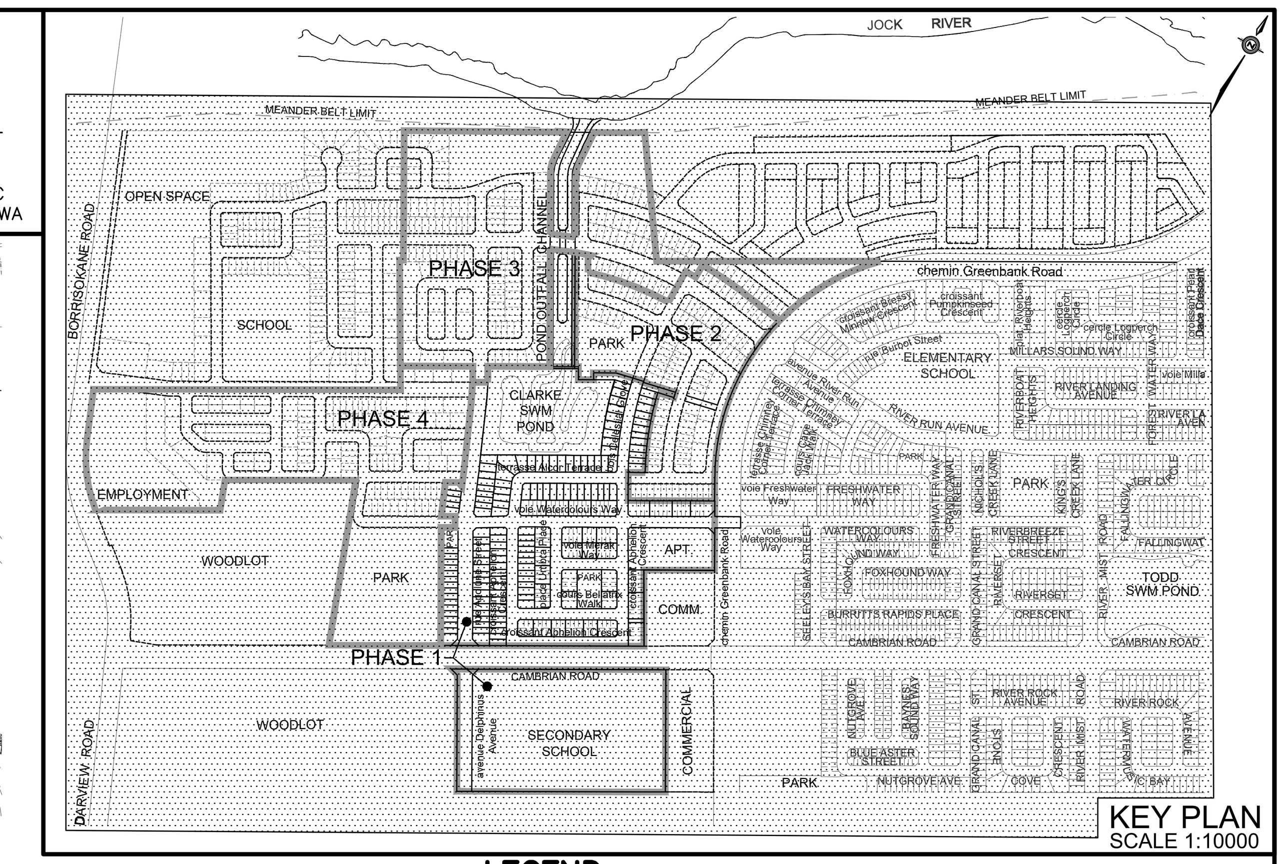
DESIGNED :	
DRAWN :	PW
VERIFIED :	LP
APPROVED :	LP
DATE	PROJECT No.
Oct/17	598(07)-17



APPROVED ☐ REFUSED ☐

THIS ____ DAY OF__________, 20____

JEFF SHILLINGTON, P.ENG
PROJECT MANAGER – SOUTH BRANCH
PLANNING, INFRASTRUCTURE & ECONOMIC DEVELOPMENT DEPARTMENT, CITY OF OTTAWA



LEGEND

- STORM DRAINAGE BOUNDARY
- SUB-DRAINAGE BOUNDARY
- STORM DRAINAGE BOUNDARY (OTHER PHASES)
- STORM FREQUENCY
- UPSTREAM MH TO DOWNSTREAM MH
- AREA IN HECTARES
- RUNOFF COEFFICIENT
- EXTERNAL 2.78AC =
- EXTERNAL TIME OF CONCENTRATION
- EXTERNAL BLENDED RUNOFF COEFFICIENT
- EXTERNAL STORM FREQUENCY
- UPSTREAM MH TO DOWNSTREAM MH
- AREA IN OTHER PHASES IN HECTARES
- RUNOFF COEFFICIENT
- STREET CATCHBASIN & LEAD
- STREET CATCHBASIN WITH CLOSED LID & LEAD
- MAINTENANCE HOLE
- CURB INLET CATCHBASIN & LEAD
- CATCHBASIN/ MAINTENANCE HOLE
- INTERCONNECTED CATCH BASIN & LEADS
- CAP
- OVERLAND FLOW DIRECTION
- EXTERNAL OVERLAND FLOW DIRECTION
- EMERGENCY OVERLAND FLOW DIRECTION

2YR 43-44 0.37 0.51 — 2.78AC=14.40 TC=14.5 MIN C= 0.70 2YR — 21-23 0.28 0.78 — MH202 — CBMH201

TOPOGRAPHIC INFORMATION

TOPOGRAPHIC INFORMATION PROVIDED BY J.D. BARNES LIMITED, PROJECT No. 16-10-100-00. SURVEY DATED FEBRUARY 22, 2017. CITY OF OTTAWA 2K MAPPING, RECEIVED ON JANUARY 18, 2016.

LEGAL INFORMATION

CALCULATED DRAFT PLAN PROVIDED BY J.D. BARNES LIMITED, PROJECT No. 16-10-100-00-ph1 (HALF MOON BAY WEST PHASE 1), RECEIVED ON DECEMBER 04, 2018.

5th SUBMISSION 19-01-29

BENCH MARK No. 00820010126

POINT IS LOCATED 1.65km NORTH OF BARNSDALE ROAD AND 5km SOUTH OF FALLOWFIELD ROAD ON HIGHWAY 416 NORTH OF KEMPTVILLE. THE POINT IS SET EAST OF THE NORTHBOUND LANE IN THE GRASSY SHOULDER.
ELEVATION = 96.923 m

No.	BY	DATE	DESCRIPTION	BY
6	W.L.	19-01-29	5th SUBMISSION	
5	W.L.	18-10-29	4th SUBMISSION	
4	W.L.	18-10-19	ISSUED FOR REVIEW	
3	W.L.	18-09-05	3rd SUBMISSION	
2	W.L.	18-07-13	2nd SUBMISSION	
1	W.L.	18-03-09	1st SUBMISSION	

Ottawa CITY OF OTTAWA

PROJECT No. 16-888

LICENSED PROFESSIONAL ENGINEER W. LIU 100167932 19-01-29 PROVINCE OF ONTARIO

EXTERNAL POST-DEVELOPMENT STORM DRAINAGE PLAN

MATTAMY (HALF MOON BAY) LIMITED

HALF MOON BAY WEST SUBDIVISION
PHASE 1

DSEL david schaeffer engineering ltd
120 Iber Road, Unit 103
Stittsville, ON K2S 1E9
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Fax. (613) 836-7183
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DRAWN BY: V.W./S.L.	CHECKED BY: P.P./C.M.	DRAWING NO.	SHEET NO.	
DESIGNED BY: W.L./C.M.	CHECKED BY: K.M.		42	
SCALE: 1:4000	DATE: MARCH 2018			

CITY PLAN No. 17586

CITY FILE No. D07-16-16-0023 P1

CDS ESTIMATED NET ANNUAL SOLIDS LOAD REDUCTION
BASED ON THE RATIONAL RAINFALL METHOD
BASED ON A FINE PARTICLE SIZE DISTRIBUTION

CONTECH ENGINEERED SOLUTIONS | CDS TECHNOLOGIES

Project Name: Brazeau Subdivision
Location: Ottawa, ON
OGS #: 1

Engineer: DSEL
Contact: A. Fobert, P.Eng.
Report Date: 12-Jun-23

CDS Model 5668 (OFFLINE)
Particle Size Distribution FINE

CDS Treatment Capacity 538 l/s

Rainfall Depth (mm)	Percent Rainfall (%)	Cumulative Rainfall (%)	Total Flowrate (l/s)[1]	Treated Flowrate (l/s)	Operating Rate (%)	Removal Efficiency (%)	Incremental Removal (%)
0.5	10.0%	10.0%	1.1	1.1	0.2	98.8	9.9
1.0	15.0%	25.0%	2.9	2.9	0.5	98.7	14.8
2.0	10.0%	35.0%	4.0	4.0	0.7	98.6	9.9
3.0	10.0%	45.0%	21.0	21.0	3.9	97.7	9.8
4.0	10.0%	55.0%	38.0	38.0	7.1	96.8	9.7
5.0	10.0%	65.0%	55.0	55.0	10.2	95.9	9.6
6.0	4.0%	69.0%	91.4	91.4	17.0	94.0	3.8
7.0	6.0%	75.0%	146.2	146.2	27.2	91.1	5.5
8.0	3.0%	78.0%	173.5	173.5	32.2	89.6	2.7
9.0	2.0%	80.0%	191.8	191.8	35.6	88.6	1.8
10.0	2.0%	82.0%	210.0	210.0	39.0	87.7	1.8
15.0	8.0%	90.0%	385.0	385.0	71.6	78.3	6.3
20.0	4.0%	94.0%	664.2	538.1	100.0	56.9	2.3
22.0	1.0%	95.0%	734.0	538.1	100.0	51.5	0.5
30.0	2.0%	97.0%	1986.8	538.1	100.0	19.0	0.4
40.0	2.0%	99.0%	3239.6	538.1	100.0	11.7	0.2
50.0	1.0%	100.0%	3866.0	538.1	100.0	9.8	0.1
							88.8

Predicted Net Annual Load Removal Efficiency = 88.8%
Predicted Annual Rainfall Treated = 95.0%

1 - Based on flow rates provided by JFSA
2 - CDS Efficiency based on testing conducted at the University of Central Florida
3 - CDS design flowrate and scaling based on standard manufacturer model & product specifications

CDS ESTIMATED NET ANNUAL SOLIDS LOAD REDUCTION
BASED ON THE RATIONAL RAINFALL METHOD
BASED ON A FINE PARTICLE SIZE DISTRIBUTION

Project Name: Brazeau Subdivision
Location: Ottawa, ON
OGS #: 2

Engineer: DSEL
Contact: A. Fobert, P.Eng.
Report Date: 12-Jun-23

CDS Model 5668 (OFFLINE)
Particle Size Distribution FINE

CDS Treatment Capacity 538 l/s

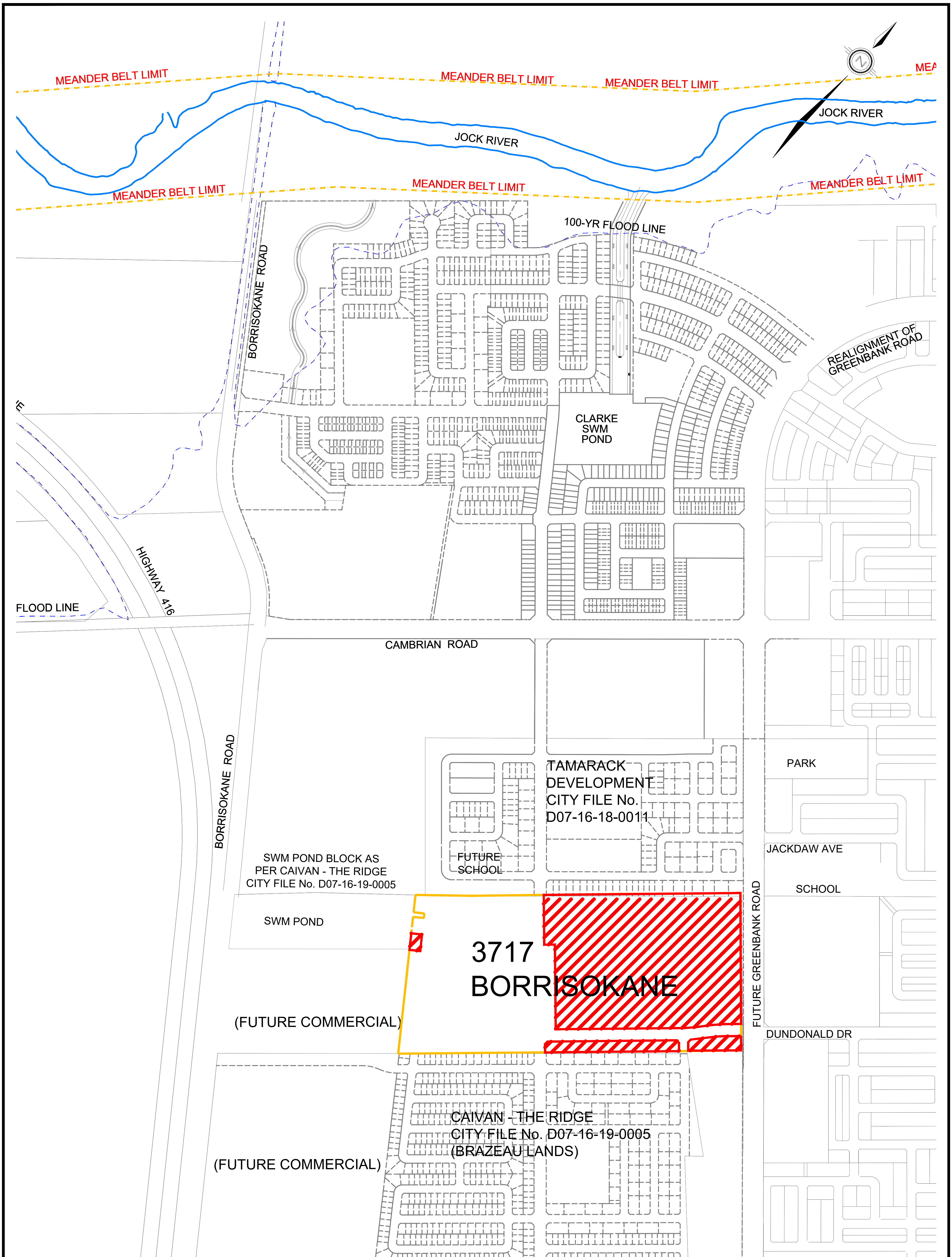
Rainfall Depth (mm)	Percent Rainfall (%)	Cumulative Rainfall (%)	Total Flowrate (l/s)[1]	Treated Flowrate (l/s)	Operating Rate (%)	Removal Efficiency (%)	Incremental Removal (%)
0.5	10.0%	10.0%	0.9	0.9	0.2	98.8	9.9
1.0	15.0%	25.0%	2.1	2.1	0.4	98.7	14.8
2.0	10.0%	35.0%	3.0	3.0	0.6	98.7	9.9
3.0	10.0%	45.0%	18.0	18.0	3.3	97.9	9.8
4.0	10.0%	55.0%	33.0	33.0	6.1	97.1	9.7
5.0	10.0%	65.0%	48.0	48.0	8.9	96.3	9.6
6.0	4.0%	69.0%	82.6	82.6	15.4	94.5	3.8
7.0	6.0%	75.0%	134.5	134.5	25.0	91.7	5.5
8.0	3.0%	78.0%	160.4	160.4	29.8	90.3	2.7
9.0	2.0%	80.0%	177.7	177.7	33.0	89.4	1.8
10.0	2.0%	82.0%	195.0	195.0	36.2	88.5	1.8
15.0	8.0%	90.0%	365.0	365.0	67.8	79.4	6.4
20.0	4.0%	94.0%	660.2	538.1	100.0	57.2	2.3
22.0	1.0%	95.0%	734.0	538.1	100.0	51.5	0.5
30.0	2.0%	97.0%	1632.8	538.1	100.0	23.1	0.5
40.0	2.0%	99.0%	2531.0	538.1	100.0	14.9	0.3
50.0	1.0%	100.0%	2981.0	538.1	100.0	12.7	0.1
							89.3

Predicted Net Annual Load Removal Efficiency = 89.3%
Predicted Annual Rainfall Treated = 95.3%

1 - Based on flow rates provided by JFSA
2 - CDS Efficiency based on testing conducted at the University of Central Florida
3 - CDS design flowrate and scaling based on standard manufacturer model & product specifications

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

DRAWINGS / FIGURES



LEGEND

SITE BOUNDARY

STUDY LIMIT

DSEL

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THE RIDGE

CITY OF OTTAWA

KEY PLAN

SCALE:	1:7000	PROJECT No.:	19-1123
DATE:	MAY 2023	FIGURE:	1

avenue Jackdaw Avenue
croissant Sonmarg Crescent
voie Pine Warbler Way
avenue Delphinus
Altitude Avenue
Elevation Road
Expansion Road
Beebalm Crescent
Speckled Adler Row
Catsfoot Walk
Promontory Place
Pumice Place
Andesite Terrace
Jean Davey Drive
Kootenay Drive
Glaciation Lane
Lepsoe Lane
Dundonald Drive
Obsidian Street
Haiku Street
Montology Way
Focality Crescent
Traverline Way
Sturnidae Street
FUTURE GREENBANK ROAD
CAMBRIAN RO
JACKDAW
REFER TO ADJACENT DWG
PHASE 3
PHASE 4
LEGEND
STORM DRAINAGE BOUNDARY
SUB-DRAINAGE BOUNDARY
STORM DRAINAGE BOUNDARY (OTHER PHASES)
STORM FREQUENCY
UPSTREAM MH TO DOWNSTREAM MH
AREA IN HECTARES
RUNOFF COEFFICIENT
2 YR
43 - 44
0.37 0.51
EXTERNAL 2.78AC =
EXTERNAL TIME OF CONCENTRATION
EXTERNAL BLENDED RUNOFF COEFFICIENT
EXTERNAL STORM FREQUENCY
2.78AC=14.40
TC=14.5 MIN
C=0.70 2YR
UPSTREAM MH TO DOWNSTREAM MH
AREA IN OTHER PHASES IN HECTARES
RUNOFF COEFFICIENT
21-23
0.28 0.78
STREET CATCHBASIN & LEAD
STREET CATCHBASIN WITH CLOSED LID & LEAD
MAINTENANCE HOLE
CURB INLET CATCHBASIN & LEAD
CATCHBASIN/ MAINTENANCE HOLE
INTERCONNECTED CATCH BASIN & LEADS
CAP
SINGLE SERVICE LOCATION (ST, SAN & WM)
SINGLE SERVICE LOCATION (ST, SAN & WM)
SITE BOUNDARY
PROPERTY BOUNDARY
EXISTING STORM MAINTENANCE HOLE
OVERLAND FLOW DIRECTION
EXTERNAL OVERLAND FLOW DIRECTION
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THE RIDGE
PHASES 3 AND 4
CITY OF OTTAWA
STORM SERVICING PLAN
SCALE: 1:1000
PROJECT No.: 19-1123
DATE: MAY 2026
DRAWING: 2

LEGEND

SANITARY DRAINAGE BOUNDARY	
SANITARY SUB-DRAINAGE BOUNDARY	
UPSTREAM MH TO DOWNSTREAM MH	43A - 44A
AREA IN HECTARES	0.78
POPULATION	61
UPSTREAM MH TO DOWNSTREAM MH	43A–44A
AREA IN OTHER PHASES IN HECTARES	0.78
POPULATION	61
EXTERNAL AREA IN HECTARES	A=53.63
EXTERNAL POPULATION	POP=5739
DENSITY (PERSONS/HECTARE)	107
EXTERNAL LAND USE	RESIDENTIAL
SANITARY MAINTENANCE HOLE	MH202A (200mmø SAN)
CAP	
PHASING LIMITS	
SINGLE SERVICE LOCATION (ST, SAN & WM)	
SINGLE SERVICE LOCATION (ST, SAN & WM)	
SITE BOUNDARY	
PROPERTY BOUNDARY	
EXISTING SANITARY MAINTENANCE HOLE	

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THE RIDGE
PHASES 3 AND 4
CITY OF OTTAWA

SANITARY SERVICING PLAN

SCALE:	1:1000	PROJECT No.:	19-1123
DATE:	MAY 2026	DRAWING:	3

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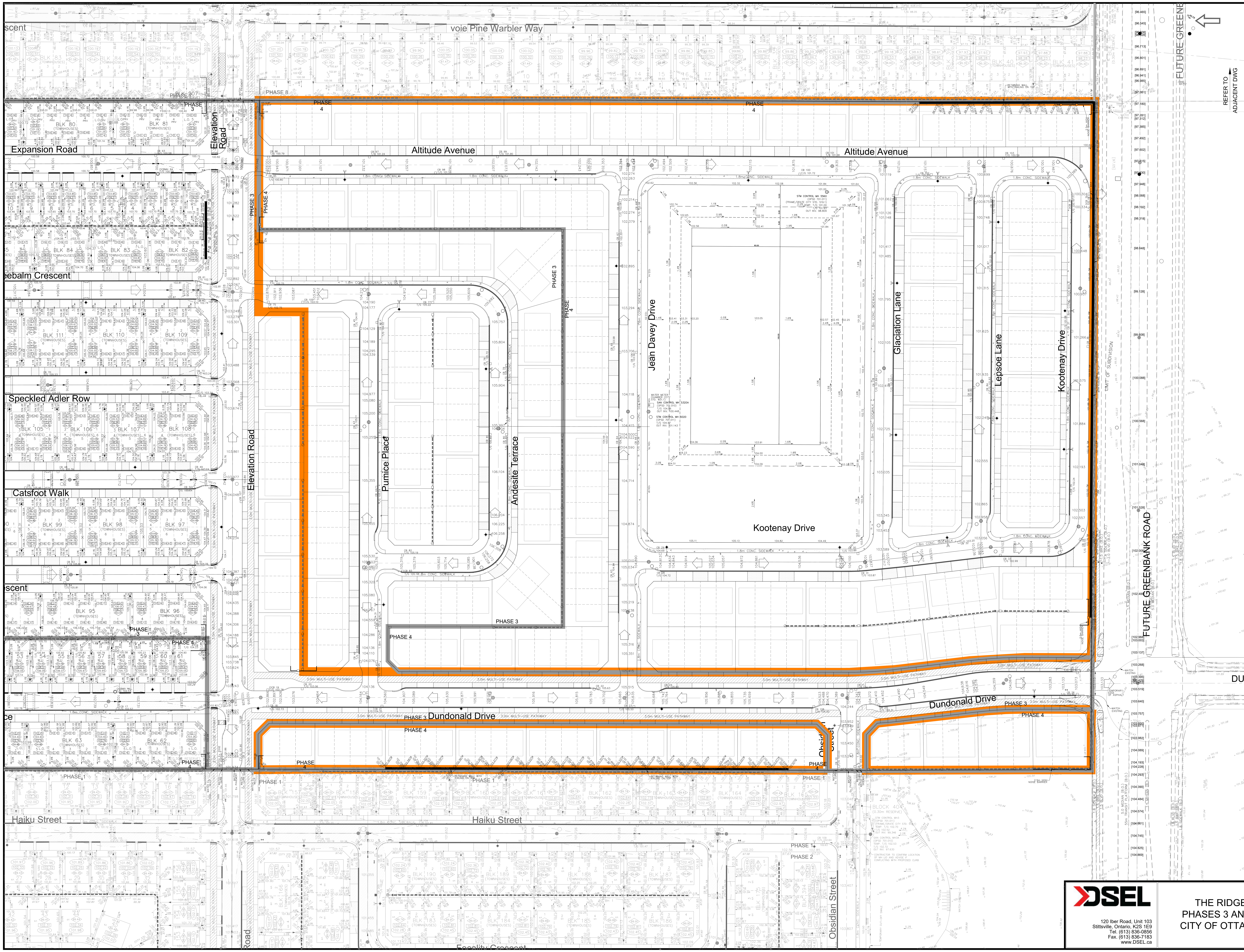
THE RIDGE
PHASES 3 AND 4
CITY OF OTTAWA

WATERMAIN SERVICING PLAN

SCALE:	1:1000	PROJECT No.:	19-1123
DATE:	MAY 2026	DRAWING:	4



LEGEND

PROPOSED ELEVATION	103.45
EXISTING ELEVATION	*102.73*
FUTURE ELEVATION	[93.900]
PROPOSED SWALE GRADE	1.5%
HIGH POINT	102.16
STREET CATCHBASIN	
STREET CATCHBASIN WITH CLOSED LID	
CATCHBASIN MANHOLE	
TEE CATCHBASIN	
ELBOW CATCHBASIN	
HYDRANT, VALVE & VB	
VALVE & VC	
VALVE & VB	
BUILDING ENVELOPE TOP OF FOUNDATION (TOF)	94.70
FINISHED FLOOR ELEVATION (FFE)	95.00
UNDERSIDE OF FOOTING ELEVATION (USF)	92.00
FRONT/REAR ENVELOPE ELEVATION	97.70
WALKOUT UNITS	W.O.
SLAB ON GRADE	SOG
HYDRO SWITCHGEAR	
HYDRO TRANSFORMER	
STREET LIGHT STANDARD	L.S.
TACTILE WALKING SURFACE INDICATOR (AS PER CITY OF OTTAWA STD. SC6)	
100Yr W.L.	
UNITS REQUIRING WATER PRESSURE REDUCING VALVES	PRV
OVERLAND FLOW DIRECTION	
EXTERNAL OVERLAND FLOW DIRECTION	
EMERGENCY OVERLAND FLOW DIRECTION	E
RETAINING WALL AND ELEVATIONS	T/W=103.10 B/W=102.44
CHAINLINK FENCE (1.5m UNLESS OTHERWISE NOTED)	
NOISE BARRIER (2.2m UNLESS OTHERWISE NOTED)	
WOODEN POST AND RAIL FENCE	
CONSTRUCTION FENCE	
PROPERTY BOUNDARY	
3:1 TERRACING MAXIMUM SLOPE	100.20 99.20
PONDING AREA WITH SPILLWAY ELEVATION (MAXIMUM 0.30m)	89.64
250ø PVC PERFORATED PIPE (REFER TO CITY STD S29 FOR REAR YARD TRENCH AND PIPE DETAILS ONLY) (SUBDRAIN APPLIED FOR SLOPE LESS THAN 1.5%)	
EXISTING SANITARY MAINTENANCE HOLE	
EXISTING STORM MAINTENANCE HOLE	
FIREWALL	
PHASING LIMITS	
UNIT TYPE: W.O.=WALK OUT L.O.=LOOK OUT W.U.=WALK UP	
SITE BOUNDARY	

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THE RIDGE
PHASES 3 AND 4
CITY OF OTTAWA

GRADING PLAN

SCALE:	1:750	PROJECT No.:	19-1123
DATE:	MAY 2023	DRAWING:	5

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THE RIDGE PHASES 3 AND 4 PARK GRADING PLAN CITY OF OTTAWA

PROJECT No.:	19-1123
DATE:	MAY 2023
SCALE:	1:500
DRAWING:	6

LEGEND

CROSS
45° BEND
LATERAL
HYDRANT, VALVE & VB
TEE
VALVE & VC
305mmø WM
V&C
VALVE & VB
22.5° BEND
11.25° BEND
REDUCER
CAP
SANITARY MAINTENANCE HOLE
CAP
V&B
200mmø SAN
MH202A
STREET CATCHBASIN & LEAD
STREET CATCHBASIN WITH CLOSED LID & LEAD
STORM MAINTENANCE HOLE
CURB INLET CATCH-BASIN & LEAD
CATCHBASIN/ MAINTENANCE HOLE
INTERCONNECTED CATCH BASIN & LEADS
CAP
TEE CATCHBASIN
PERFORATED PIPE
ELBOW CATCHBASIN
375mmø ST
MH202
CBMH201
SITE BOUNDARY
SINGLE SERVICE LOCATION (ST, SAN & WM)
SINGLE SERVICE LOCATION (ST, SAN & WM)
PHASING LIMITS
PROPERTY BOUNDARY
EXISTING SANITARY MAINTENANCE HOLE
EXISTING STORM MAINTENANCE HOLE

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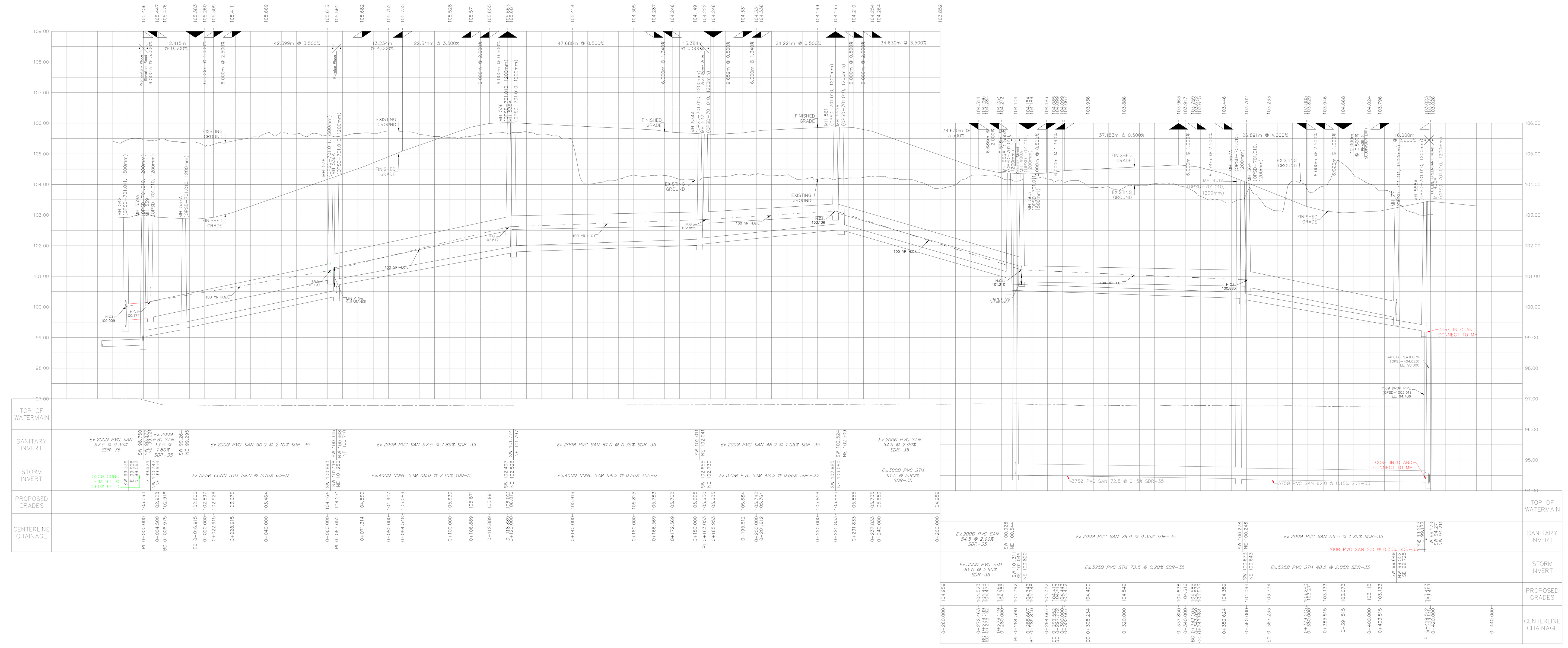
THE RIDGE
PHASES 3 AND 4
CITY OF OTTAWA

OVERALL GENERAL PLAN

SCALE:	1:1000	PROJECT No.:	19-1123
DATE:	MAY 2026	DRAWING:	7

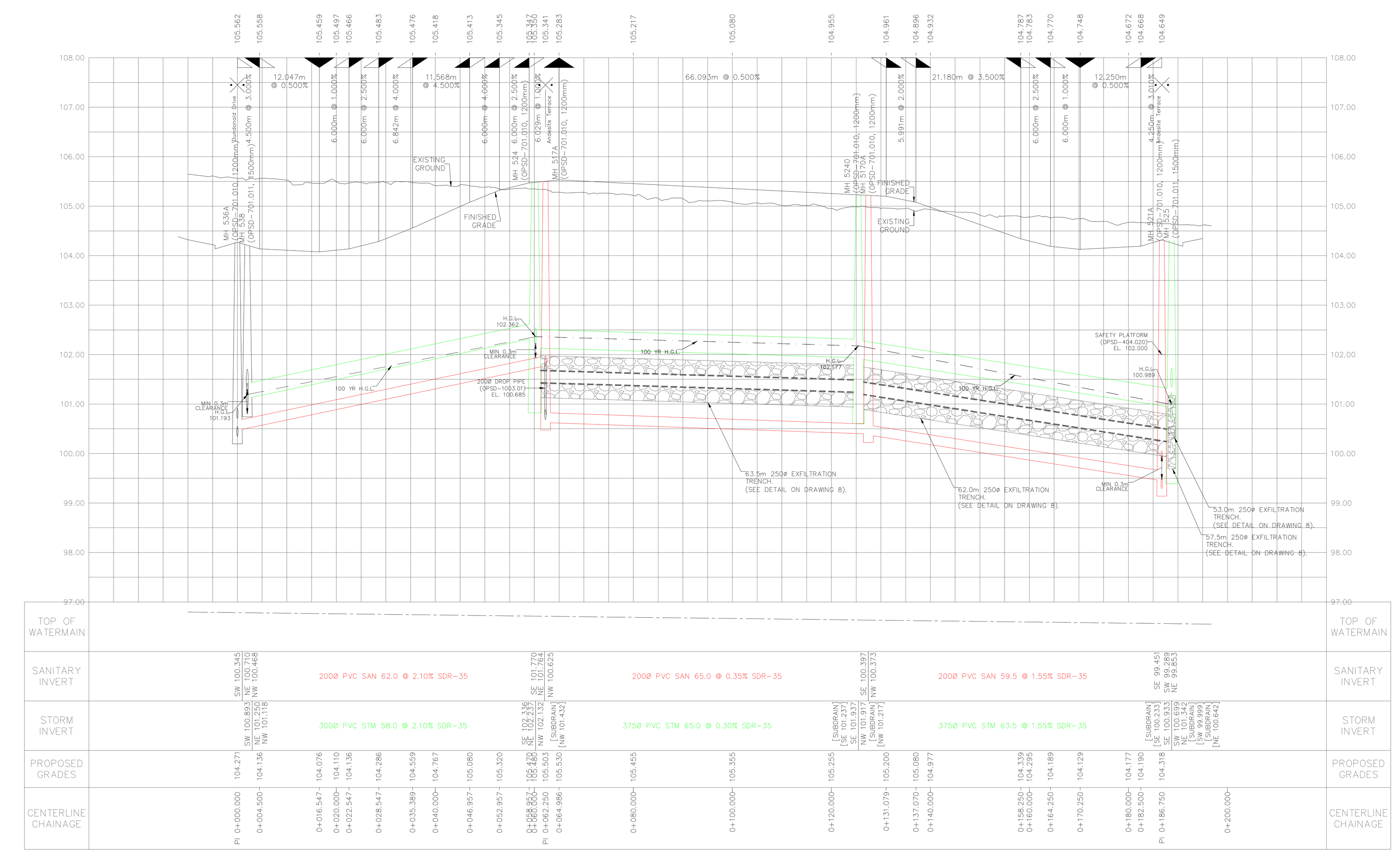
3

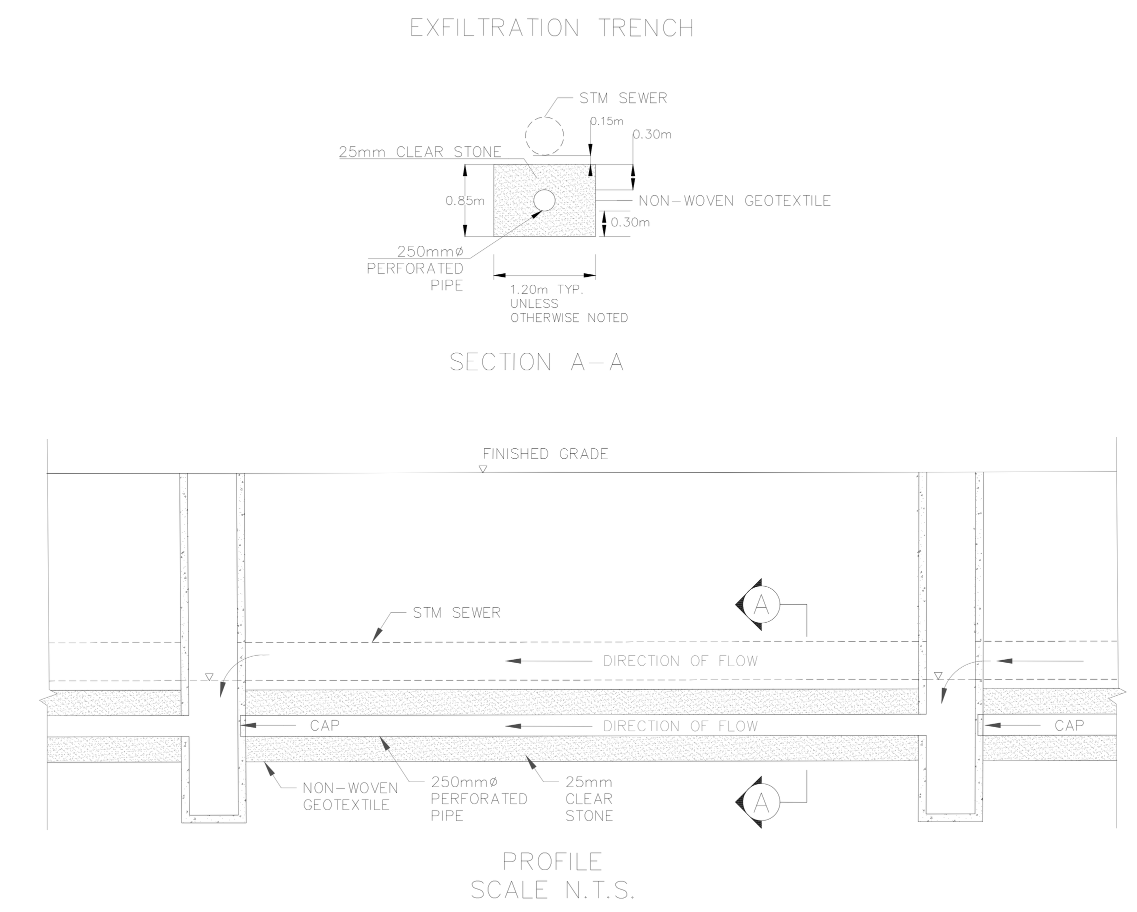
promenade Dundonald Drive



4

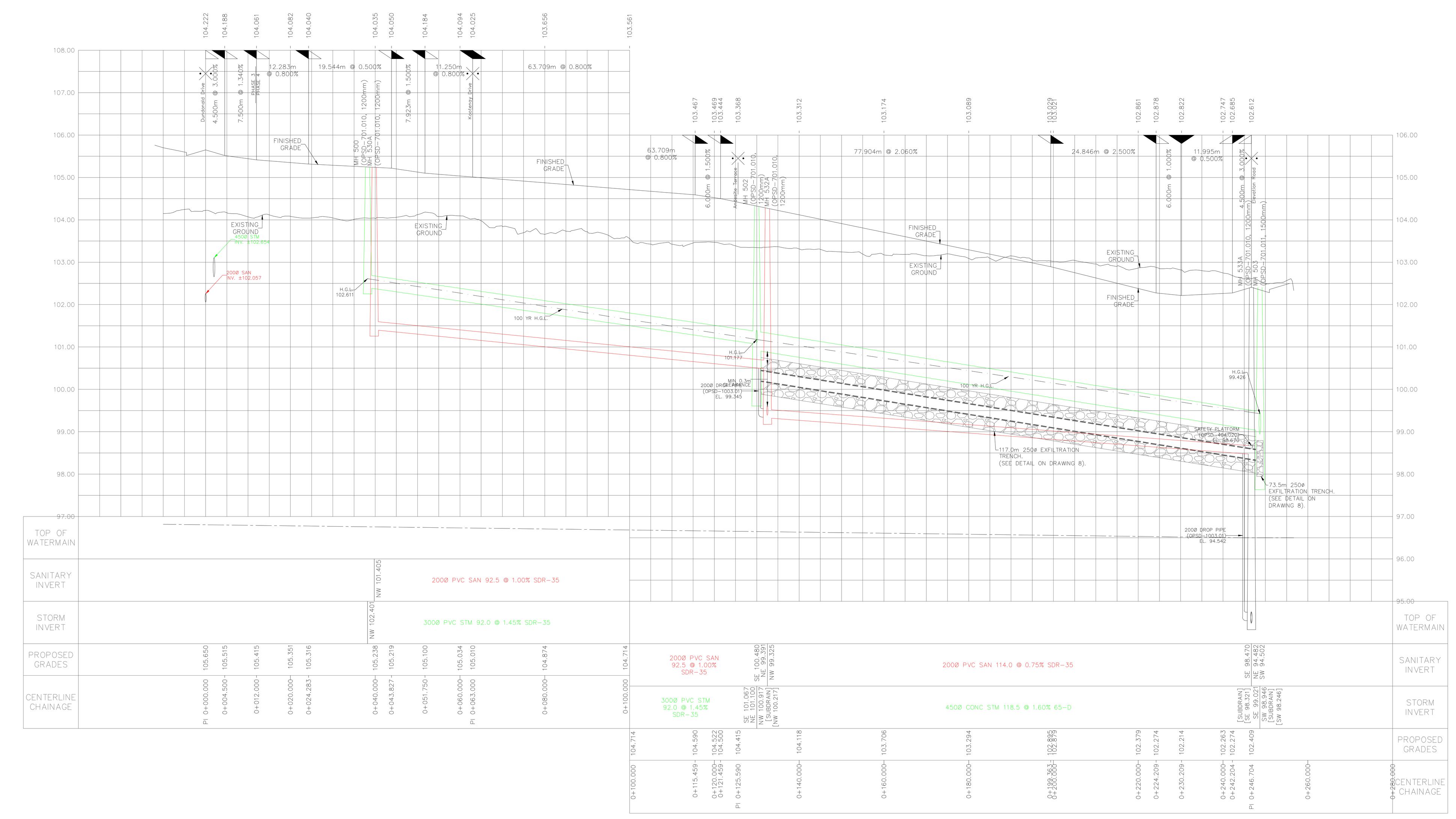
Pumice





5

Jean Davey



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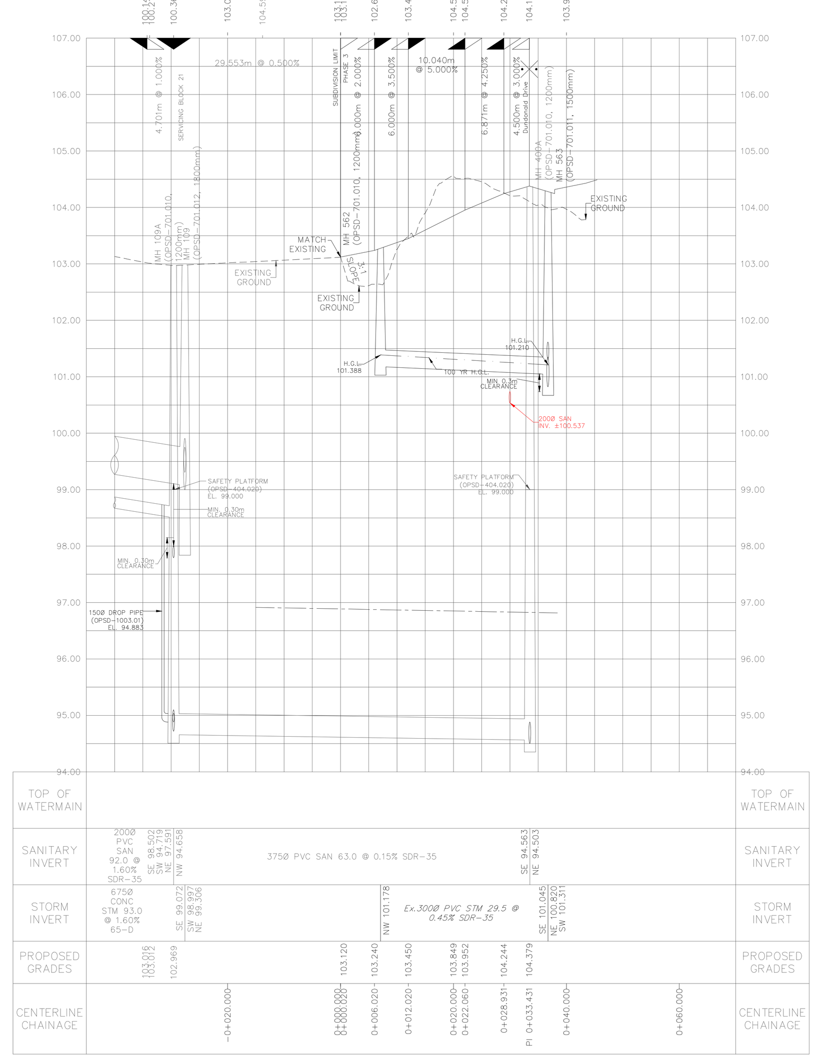
THE RIDGE PHASES 3 AND 4
OVERALL
PROFILES
CITY OF OTTAWA

PROJECT No.:	19-1123
DATE:	MAY 2023
SCALE:	1:750
DRAWING:	8

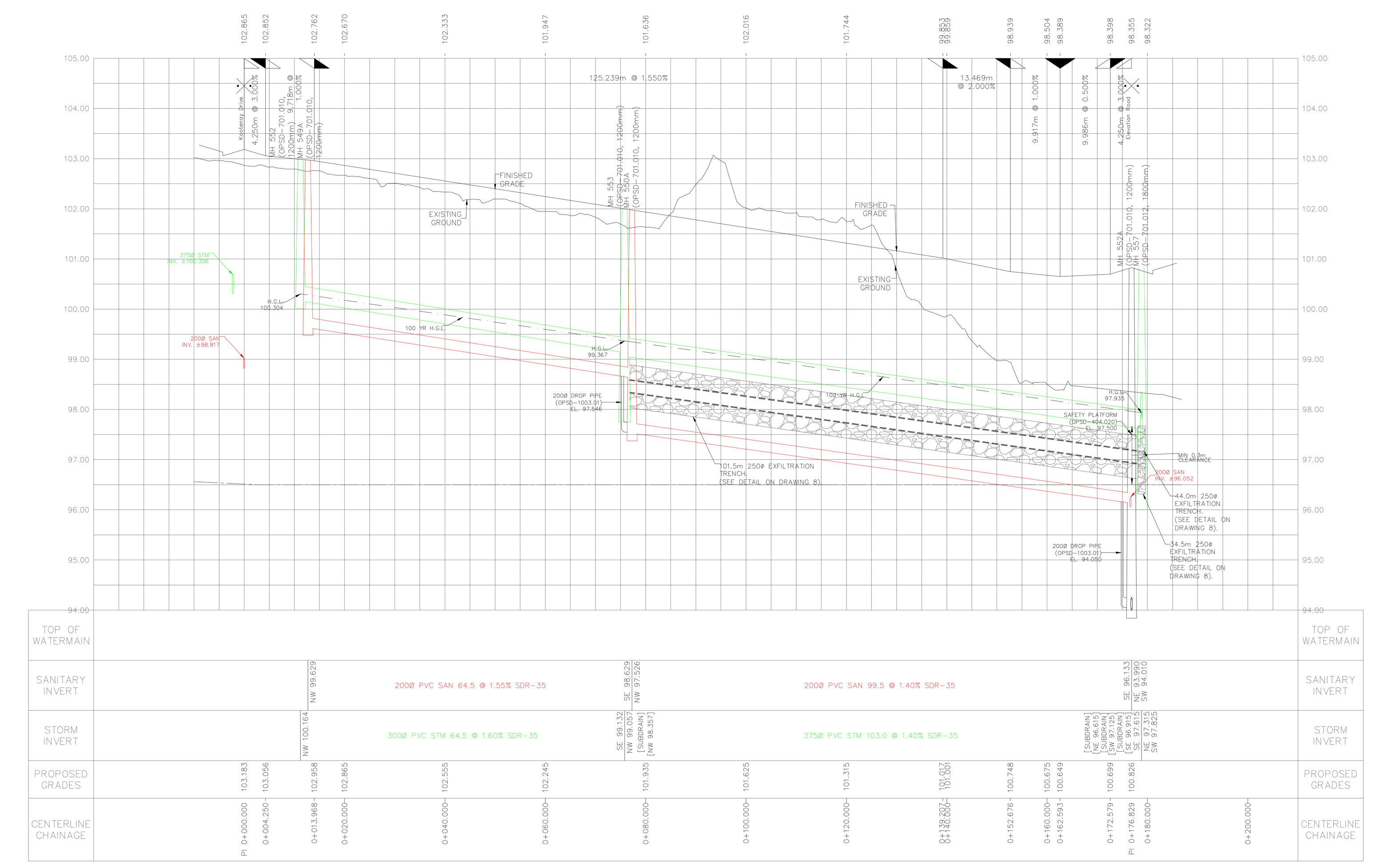
6

rue Obsidian Street



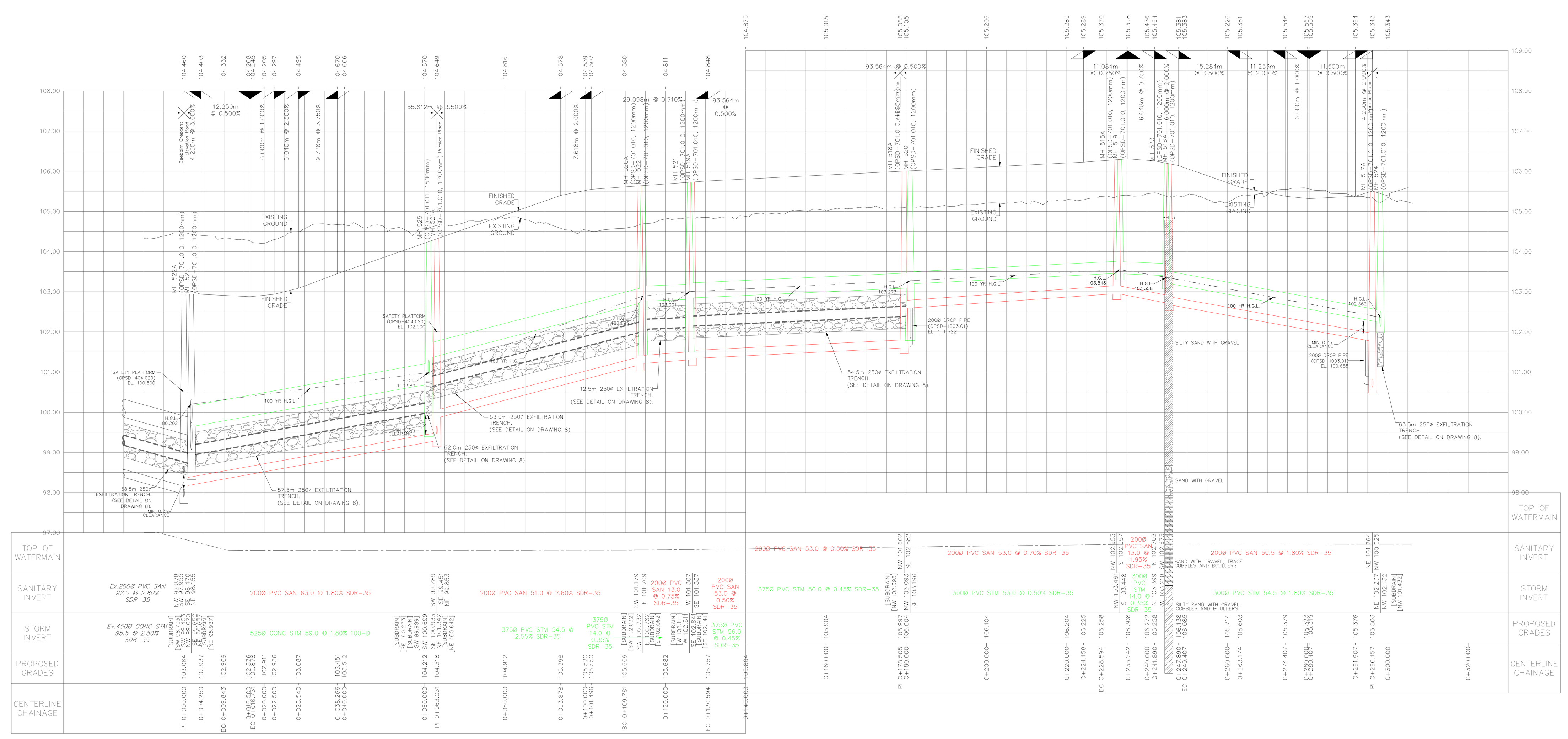
7

Lepsoe



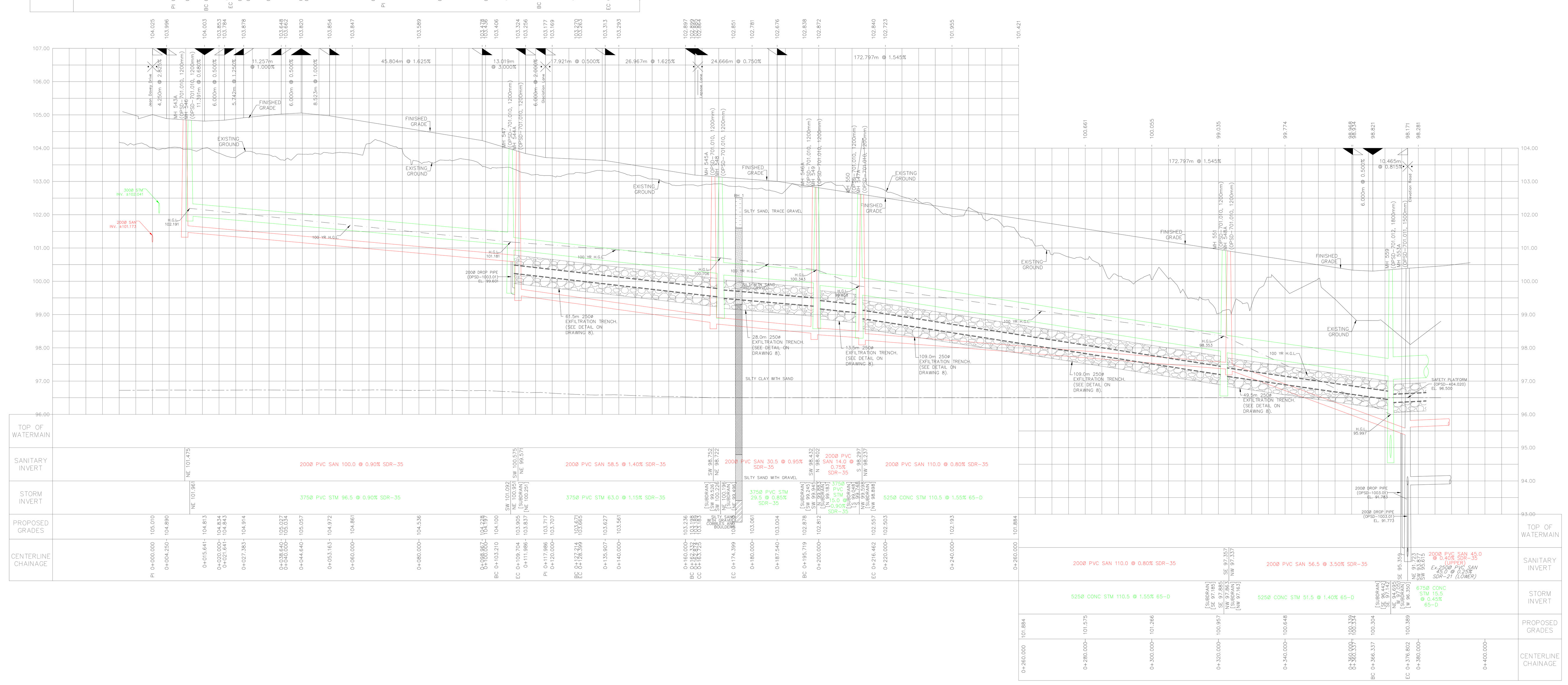
9

Andesite



12

Kootenay



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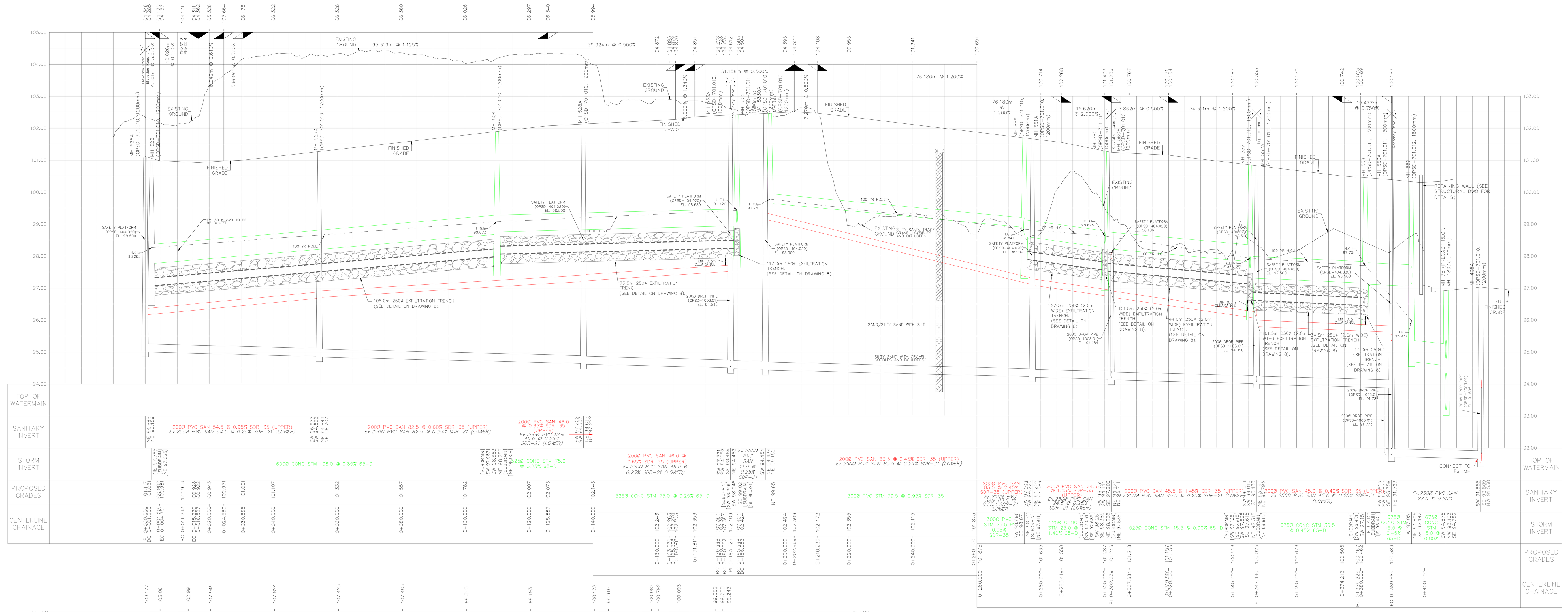
THE RIDGE PHASES 3 AND 4
OVERALL
PROFILES
CITY OF OTTAWA

PROJECT No.:	19-1123
DATE:	MAY 2023
SCALE:	1:750
DRAWING:	9

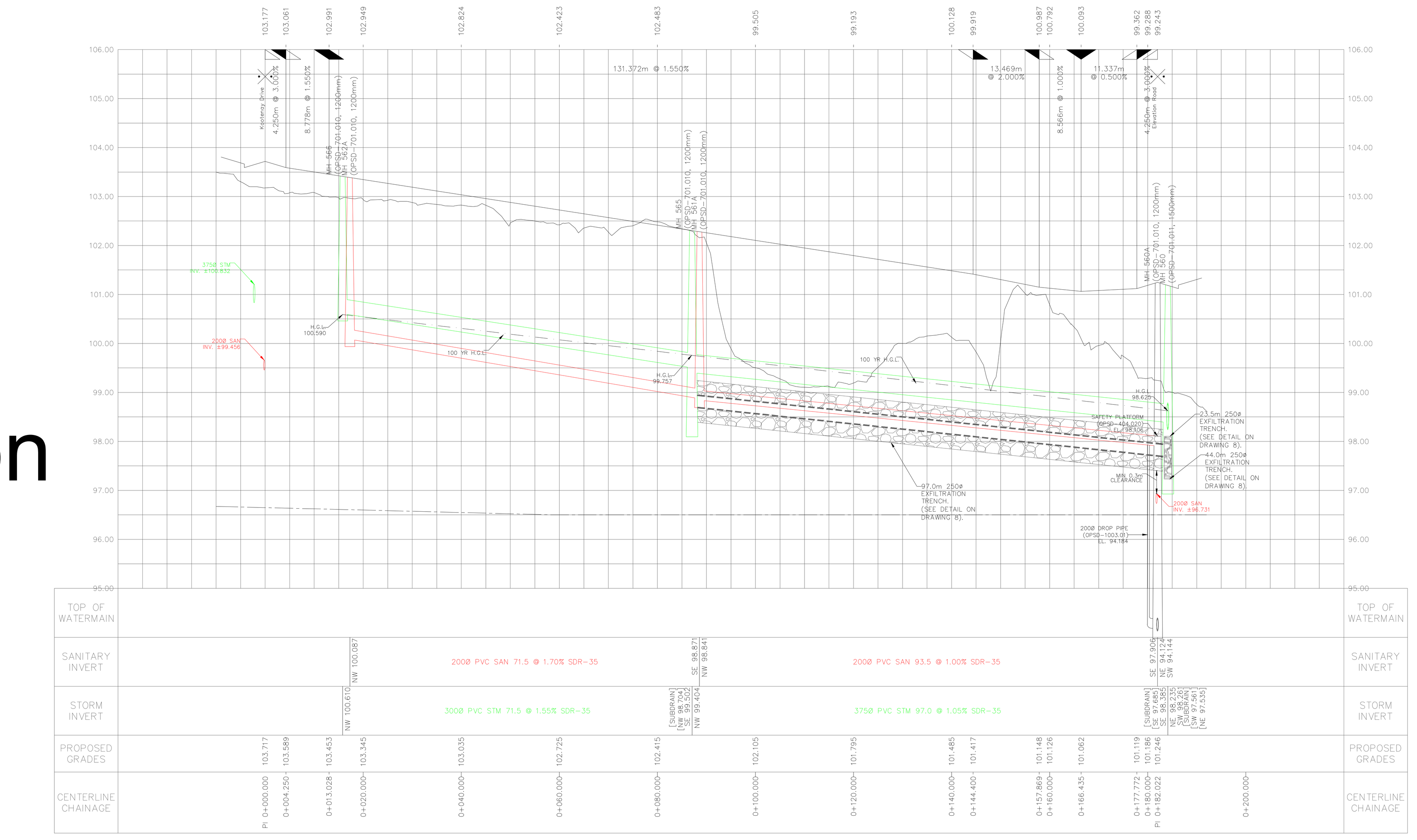
17

Altitude

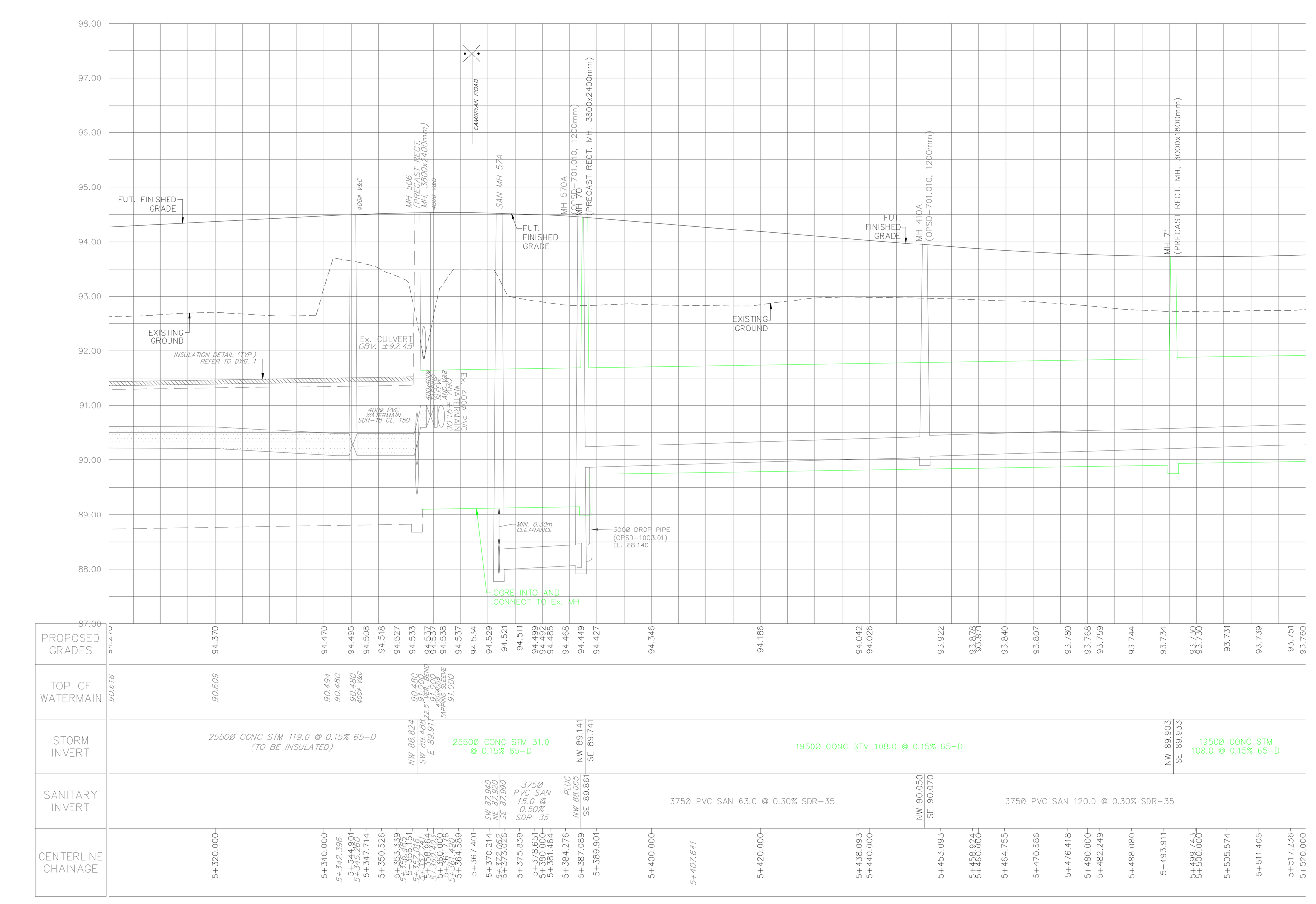


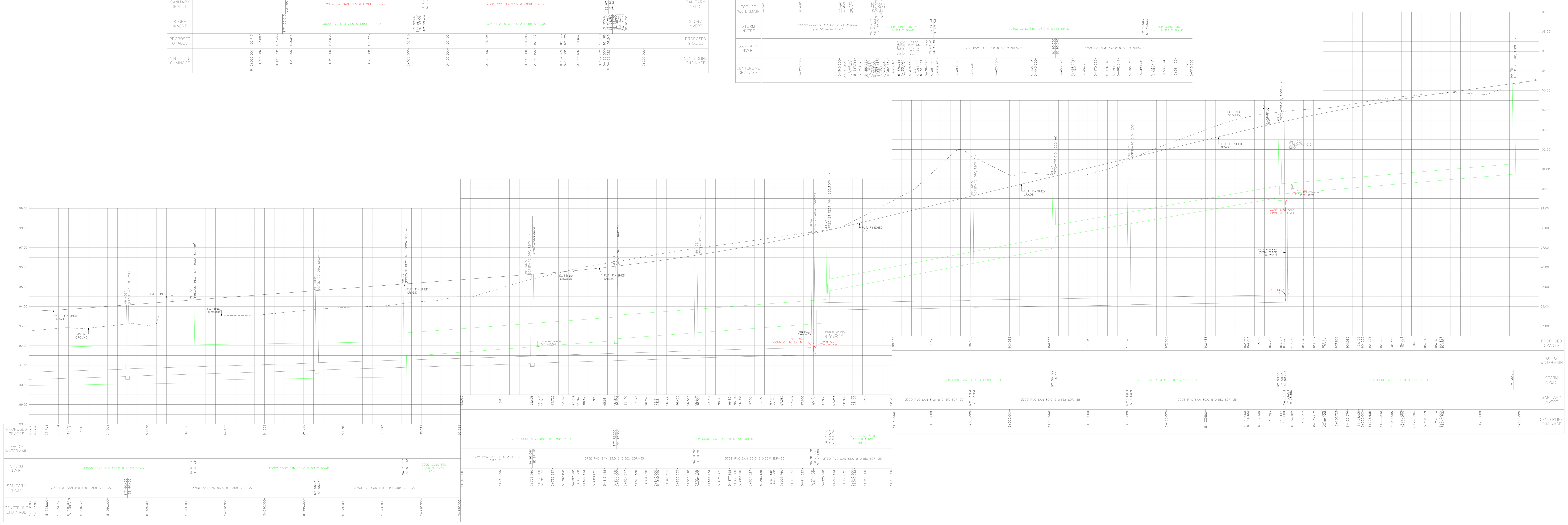
18

Glaciation Lane



Greenbank Road





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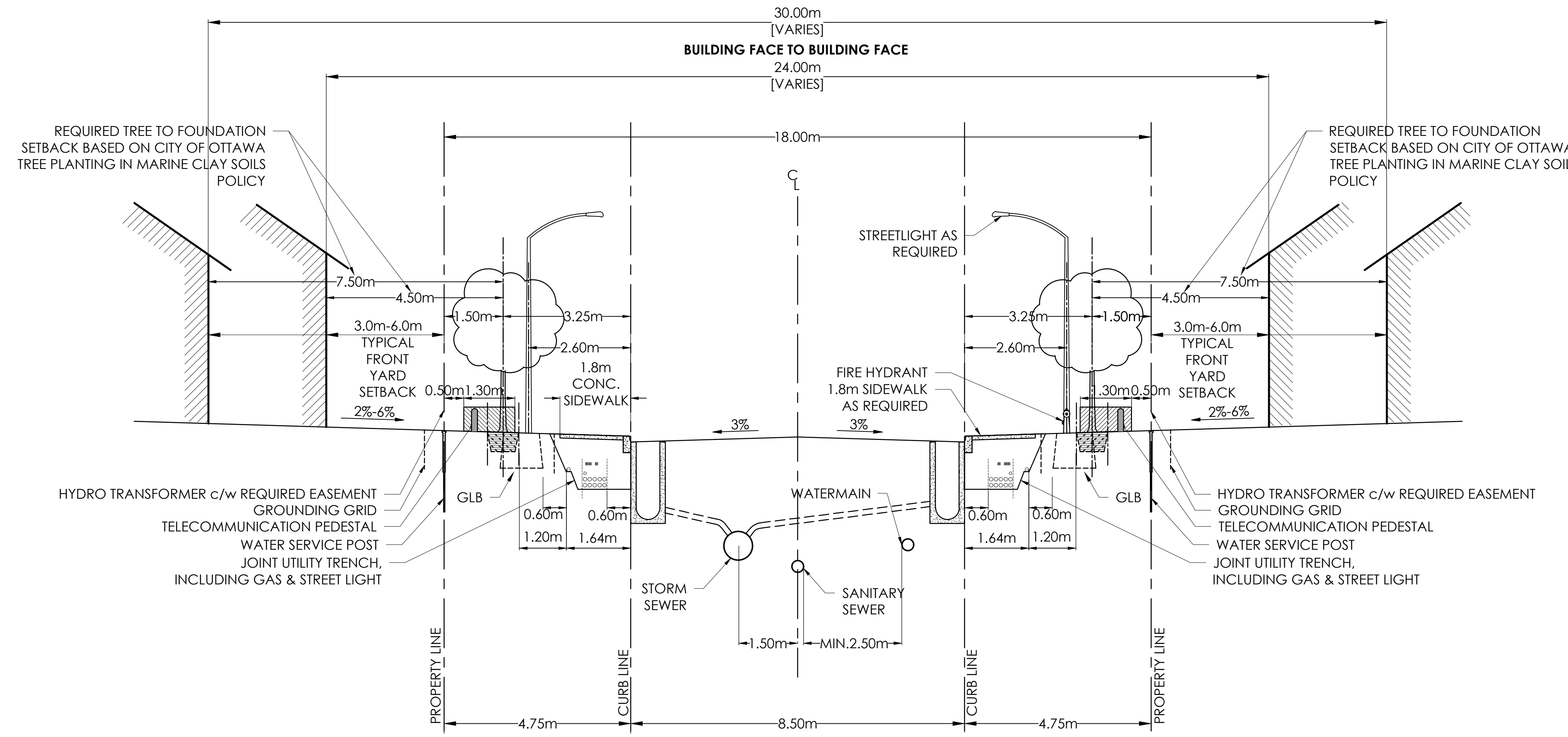
THE RIDGE PHASES 3 AND 4
OVERALL
PROFILES
CITY OF OTTAWA

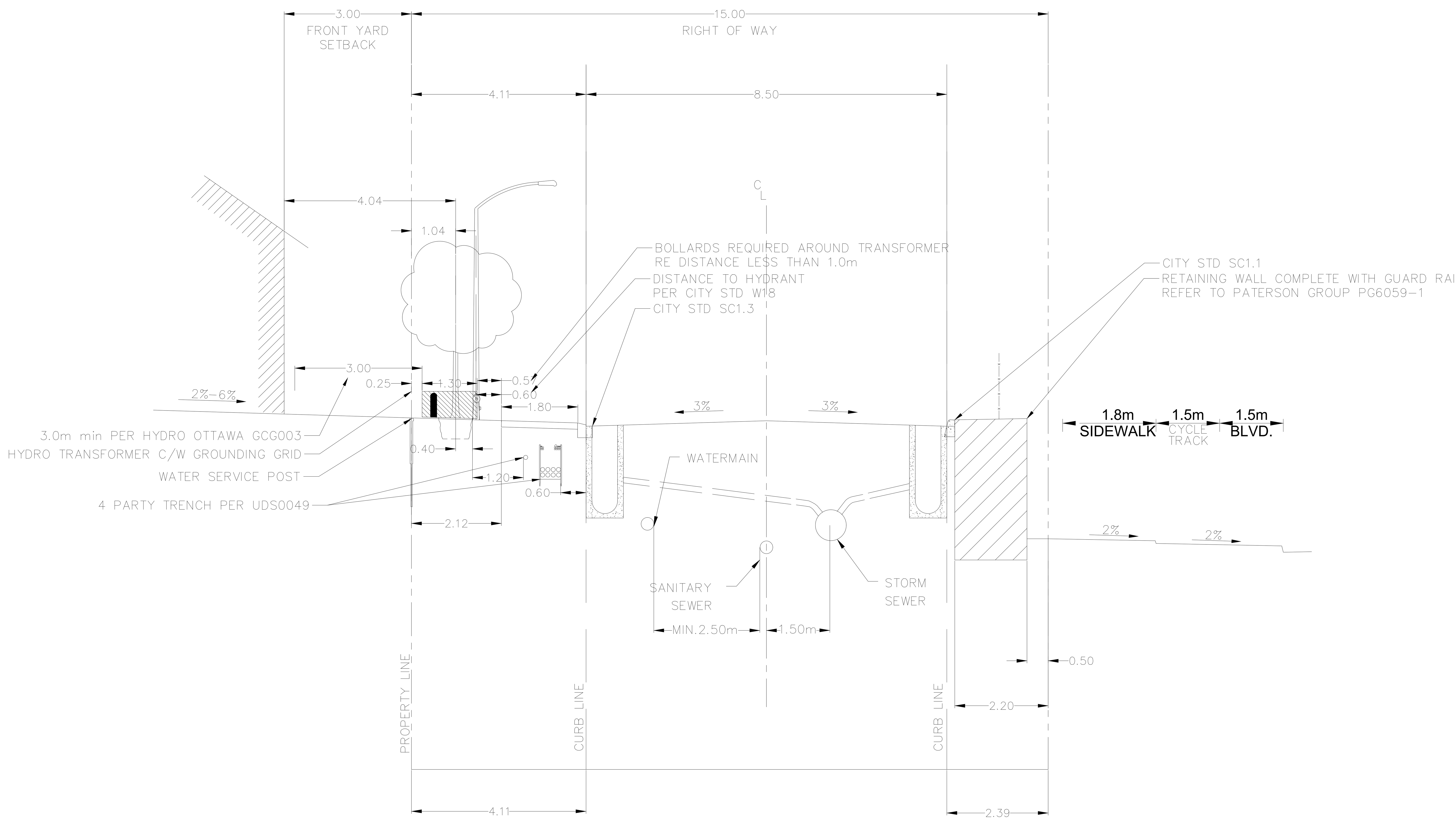
PROJECT No.:	19-1123
DATE:	MAY 2023
SCALE:	1:750
DRAWING:	10

1. STANDARD CROSS-SECTIONS TO BE READ IN CONJUNCTION WITH THE GENERAL STANDARD CROSS-SECTION NOTES AND OTHER APPLICABLE CITY AND UTILITY PLANS AND DETAILS.
2. 18M RIGHT-OF-WAY NOT TO BE USED ON STREETS WITH BUS SERVICE.
3. CONCRETE CURBS TO BE CONSTRUCTED AS PER CITY OF OTTAWA STANDARD DETAILS.
4. TYPICAL FRONT YARD SETBACK IS TO BE CLEAR AND UNENCUMBERED OF ANY SUBSURFACE BUILDING ENCROACHMENTS.
5. FIRE HYDRANTS TO BE LOCATED ON THE WATERMAIN SIDE OF THE STREET.
6. CATCH BASINS TO BE PER CITY OF OTTAWA DETAIL S2.
7. GAS MAIN SHALL HAVE A MINIMUM OF 0.6M CLEARANCE FROM STRUCTURES E.G. CATCH BASINS AND HYDRANTS) AND 1.2 M FROM TREE ROOT BALL.
8. STREETLIGHTS CAN BE LOCATED ON EITHER SIDE OF THE RIGHT-OF-WAY.
9. JOINT-USE UTILITY TRENCH (JUT) UNDER SIDEWALK AS PER DETAIL UDS0049. HELD BY HYDRO OTTAWA.
10. GRADE LEVEL BOX (GLB) AS DRAWN SHOWS GLB3660. EXACT LOCATION TO BE CONFIRMED.
11. THIS CROSS-SECTION CANNOT BE USED WHERE A CONCRETE ENCASED HYDROELECTRIC DUCT OR ANOTHER SEPARATE UTILITY DUCT IS REQUIRED.
12. TREE CLEARANCES TO HYDRO OTTAWA PLANT SHALL FOLLOW GCS0038.
13. CLEARANCES SHOWN ARE MINIMUMS.



18.0m ROW CROSS SECTION	REV.DATE: AUG. 2022
	DWG. No. ROW-18.0

1. STANDARD CROSS-SECTIONS TO BE READ IN CONJUNCTION WITH THE GENERAL STANDARD CROSS-SECTION NOTES AND OTHER APPLICABLE CITY AND UTILITY PLANS AND DETAILS.
2. 15.0m RIGHT-OF-WAY NOT TO BE USED ON STREETS WITH BUS SERVICE.
3. CONCRETE CURBS TO BE CONSTRUCTED AS PER CITY OF OTTAWA STANDARD DETAILS.
4. TYPICAL FRONT YARD SETBACKS ARE TO BE CLEAR AND UNENCUMBERED OF ANY SUBSURFACE BUILDING ENCROACHMENTS.
5. FIRE HYDRANTS SHALL BE LOCATED ON THE WATERMAIN SIDE OF THE STREET.
6. CATCH BASINS TO BE PER CITY OF OTTAWA DETAIL S2.
7. GAS MAIN SHALL HAVE A MINIMUM OF 0.6 M CLEARANCE FROM STRUCTURES (E.G. CATCH BASINS AND HYDRANTS) AND 1.2 M FROM TREE ROOT BALL.
8. JOINT-USE UTILITY TRENCH (JUT) UNDER SIDEWALK AS PER DETAIL UDS0049. HELD BY HYDRO OTTAWA.
9. GRADE LEVEL BOX (GLB) AS DRAWN SHOWS GLB3660. EXACT LOCATION TO BE CONFIRMED.
10. TREE CLEARANCES TO HYDRO OTTAWA PLANT SHALL FOLLOW GCS0038.
11. CLEARANCES SHOWN ARE MINIMUMS.



15.0m ROW CROSS SECTION

REV.DATE: JUNE 2023

DWG. No. ROW-15.0