

# **SITE SERVICING AND STORMWATER MANAGEMENT REPORT**

**FOR**

**METRO CANADA INC.  
3831 CAMBRIAN ROAD – PHASE 1**

**CITY OF OTTAWA**

PROJECT NO.: 19-1135  
CITY APPLICATION NO.: D07-12-20-0080

MAY 2021 – REV 3  
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**SITE SERVICING AND STORMWATER MANAGEMENT REPORT  
FOR  
3831 CAMBRIAN ROAD – PHASE 1  
METRO CANADA**

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## **1.0 INTRODUCTION**

David Schaeffer Engineering Limited (DSEL) has been retained by Metro Canada Inc. to prepare a Site Servicing and Stormwater Management report in support of the application for a Site Plan Control (SPC) at 3831 Cambrian Road.

The subject property is located within the City of Ottawa urban boundary, in Barrhaven ward. As illustrated in **Figure 1**, the subject property is located south of the intersection of Cambrian Road and Future Greenbank Road. Comprised of a single parcel the subject property measures approximately **2.2 ha** and is zoned General Mixed Use (GM).



**Figure 1: Site Location**

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The proposed SPC would allow for the development of three commercial buildings fronting onto an internal drive aisle. The proposed development includes approximately **6313 m<sup>2</sup>** of retail area, **530 m<sup>2</sup>** of office area as well as surface parking, with access from Cambrian Drive and Future Greenbank Road. A copy of the Site Plan is included in ***Drawings/Figures***.

The objective of this report is to provide sufficient detail to demonstrate that the proposed development is supported by existing municipal services.

## **1.1 Existing Conditions**

The existing site a vacant lot used for staging of the adjacent subdivision construction consisting of aggregate piles and sandy the elevations range between 94.27 m and 93.00 m with a minimal grade change of approximate 0.45% from the Northeast to the Southwest corner of the property.

The existing soil conditions on the site consist of silty clay with gravel fill with practical refusal occurring between 5.25 m and 13 m in depth per the ***Geotechnical Report***. Due to the existence of underlying silty clay, there are grade raise restrictions applicable to the proposed development. There is on-going surcharge under the proposed metro location and grade raise restrictions of 1.0 m to 1.5 m for the rest of the site. Refer to ***Geotechnical Report*** for grade raise restriction details.

Sewer and watermain mapping collected from the City of Ottawa indicate that the following services exist across the property frontages within the adjacent municipal right-of-ways:

### **Cambrian Road**

- 406 mm diameter PVC watermain;
- 525 mm diameter concrete storm sewer tributary to the Todd Pond;
- 375 mm diameter PVC storm sewer tributary to Todd Pond; and
- 500 mm diameter concrete sanitary sewer tributary to the South Nepean Trunk.

### **Future Greenbank Road**

- 2550 mm diameter concrete storm sewer tributary to Clarke Pond; and
- 375 mm diameter PVC sanitary sewer tributary to the South Nepean Collector.

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## 1.2 Required Permits / Approvals

The proposed development is subject to the site plan control approval process. The City of Ottawa must approve the engineering design drawings and reports prior to the issuance of site plan control.

The proposed development is a single parcel of land that is not industrial and would outlet to a storm sewer. As a result, the stormwater management system is exempt from sections 53(1) and (3) of the Ontario Water Resources Act under Ontario Regulation 525/98, and does not require Environmental Compliance Approval from the Ministry of Environment.

## 1.3 Pre-consultation

Pre-consultation correspondence, along with the servicing guidelines checklist, is located in **Appendix A**.

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## 2.0 GUIDELINES, PREVIOUS STUDIES, AND REPORTS

### 2.1 Existing Studies, Guidelines, and Reports

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

- **Ottawa Sewer Design Guidelines,**  
City of Ottawa, *SDG002*, October 2012.  
**(City Standards)**
  - **Technical Bulletin ISTB-2018-01**  
City of Ottawa, March 21, 2018.  
**(ISTB-2018-01)**
  - **Technical Bulletin ISTB-2018-03**  
City of Ottawa, March 21, 2018.  
**(ISTB-2018-03)**
- **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 ISDTB-2018-02**  
City of Ottawa, March 21, 2018.  
**(ISDTB-2018-02)**
- **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)**

- 
- **Barrhaven South Master Servicing Study Addendum**  
Stantec, October 12, 2017.  
**(BSMSS)**
  - **Design Brief for the Clarke Stormwater Management Pond for the Half Moon Bay West Subdivision**  
J.F. Sabourin and Associates & DSEL  
Revised, October 19, 2017  
**(Clarke Pond Design Brief)**
  - **Half Moon Bay West Subdivision Phase 2A/2B**  
DSEL, November 6, 2019.  
**(HMBW Phase 2 Design Brief)**
  - **City of Ottawa Infrastructure Master Plan**  
City of Ottawa, November 2013.  
**(City of Ottawa IMP)**
  - **Stormwater Management Report for Phase 2 of the Half Moon Bay West Subdivision**  
J.F. Sabourin and Associates  
Updated, October 2019  
**(HMBW Phase 2 SWM Report)**
  - **Geotechnical Investigation Report**  
PG2037-1 Revision 1, Paterson Group  
July 29, 2020  
**(Geotechnical Report)**

## 3.0 WATER SUPPLY SERVICING

### 3.1 Existing Water Supply Services

The subject property lies within the City of Ottawa BARR pressure zone, as shown by the Pressure Zone map in **Appendix B**. A local 406 mm diameter watermain exists within the Cambrian Road right-of-way.

### 3.2 Water Supply Servicing Design

It is proposed to service the development through a 200 mm internal looped watermain with two connections to the existing 406 mm diameter watermain within Cambrian Road.

Based on As-built drawings, there is one fire hydrant fronting the property along Cambrian Road.

**Table 1**, below, summarizes the **Water Supply Guidelines** employed in the preparation of the preliminary water demand estimate.

**Table 1**  
**Water Supply Design Criteria**

Design Parameter	Value
Commercial Retail	2.5 L/m <sup>2</sup> /d
Commercial Maximum Daily Demand	1.5 x avg. day
Commercial Maximum Hour Demand	1.8 x max. day
Minimum Watermain Size	150 mm diameter
Minimum Depth of Cover	2.4 m from top of watermain to finished grade
During normal operating conditions desired operating pressure is within	350 kPa and 480 kPa
During normal operating conditions pressure must not drop below	275 kPa
During normal operating conditions pressure must not exceed	552 kPa
During fire flow operating pressure must not drop below	140 kPa
<small>*Daily average based on Appendix 4-A from <b>Water Supply Guidelines</b> ** Residential Max. Daily and Max. Hourly peaking factors per MOE Guidelines for Drinking-Water Systems Table 3-3 for 0 to 500 persons. -Table updated to reflect ISD-2010-2</small>	

**Table 2**, below, summarizes the estimated water supply demand and boundary conditions for the proposed development based on the **Water Supply Guidelines**.

**Table 2**  
**Water Demands and Boundary Conditions**  
**Proposed Conditions**

Design Parameter	Estimated Demand <sup>1</sup> (L/min)	Boundary Condition <sup>2</sup> (m H <sub>2</sub> O / kPa) Connection 1	Boundary Condition <sup>2</sup> (m H <sub>2</sub> O / kPa) Connection 2
Average Daily Demand	13.9	62.5 / 613.1	62.0 / 608.2
Max Day + Fire Flow	20.9 + 6,000= 6,020.9	42.2 / 414.0	41.7 / 409.1
Peak Hour	37.6	45.6 / 447.3	45.1 / 442.4
1) Water demand calculation per <b>Water Supply Guidelines</b> . See <b>Appendix B</b> for detailed calculations. 2) Boundary conditions supplied by the City of Ottawa for the demands indicated; assumed ground elevation 93.4m at Connection 1 (Cambrian Road) and 93.9m at Connection 2 (Cambrian Road/Greenbank Road). See <b>Appendix B</b> .			

Fire flow requirements are to be determined in accordance with City of Ottawa **Water Supply Guidelines** and the Ontario Building Code.

Fire flow requirements were estimated per City of Ottawa Technical Bulletin **ISTB-2018-02**. The following parameters were assumed for Phase 1:

- Type of construction – Non-Combustible Construction;
- Occupancy type – Limited Combustible; and
- Sprinkler Protection – Fully-Supervised Sprinkled System.

The above assumptions result in an estimated fire flow of approximately **6,000 L/min**, noting that actual building materials selected will affect the estimated flow. A certified fire protection system specialist will need to be employed to design the building fire suppression system and confirm the actual fire flow demand.

The City of Ottawa was contacted to obtain boundary conditions associated with the estimated water demand. The City provided both the anticipated minimum and maximum water pressures, as well as, the estimated water pressure during fire flow demand. Boundary conditions received from the City of Ottawa are included in **Appendix B**. As shown by **Table 2**, above, the minimum and maximum pressures fall within the required range identified in **Table 1**.

Two private hydrants are proposed in order to accommodate the anticipated fire flow demand for the proposed development.

**Table 3**, below, summarizes the maximum available fire flow from the proposed hydrants as per **Table 18.5.4.3** of the **ISTB-2018-02**.

**Table 3**  
**Total Available Fire Flow from Proposed Hydrants**

Number of Hydrants	Distance from Metro & Retail 1 (m)	Available Fire Flow per Table 18.5.4.3 of ISTB-2018-02 (L/min)
2	< 76	5,678 x 2
0	76 < and < 152	3,785 x 0
<b>Total</b>		<b>11,356</b>

The available fire flow from the hydrants is **11,356 L/min** as per *Table 18.5.4.3* of the **ISTB-2018-02**.

### 3.3 Watermain Modelling

EPANet was utilized to determine the availability of pressures throughout the system during average day, max day plus fire flow, and peak hour demands. This static model determines pressures based on the available head obtained from the anticipated maximum and minimum pressures at the connection points. The static model determines pressures based on the available head obtained from the boundary conditions provided by the City of Ottawa.

The model utilizes the Hazen-Williams equation to determine pressure drop, while the pipe properties have been selected in accordance with **Water Supply Guidelines**. The model was prepared to assess the available pressure at each building, as well as, the pressures the watermain provides to fire hydrants during fire flow conditions.

The anticipated fire flow for the ultimate development was modeled through the proposed private hydrants. Please refer to **Appendix B** for a model sketch showing the node locations, fire demands assigned to each hydrant and the resulting pressures. **Table 4** indicates the resulting pressures at each node during the average day, peak hour and maximum day plus fire flow scenarios. **Appendix B** contains output reports and model schematics for each scenario.

**Table 4**  
**Model Simulation Output Summary**

Location	Average Day (kPa)	Max Day + Fire Flow (kPa)	Peak Hour (kPa)
Metro	608.22	386.42	442.43
2	609.69	387.89	443.90
Bldg-A	609.20	382.20	443.41
Hyd1	607.24	378.37	441.45
Bldg-C	610.67	398.97	444.88
Bldg-B	605.77	395.93	439.98
Hyd2	608.71	392.60	442.92

As demonstrated in **Table 4**, the anticipated pressures during the peak hour and max day + fire flow scenarios simulations are within the allowable pressure range described in



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**Table 1** from the *Water Supply Guidelines*. Pressures during average day demand are above the recommended pressures outlined in **Table 1**. A pressure check should be conducted at the time of construction to determine if pressure control is required.

### 3.4 Water Supply Conclusion

It is proposed to service the development through a looped internal watermain network via a 200 mm diameter watermain with two connections to the existing 406 mm watermain within Cambrian Road.

It is proposed that the development will be serviced by the two proposed internal hydrants. Based on **Table 18.5.4.3** of **ISTB-2018-02**, the fire flow demands of the proposed buildings can be supplied through both of the proposed hydrants.

An EPANET model was prepared for the average day, maximum day plus fire flow and peak hour scenarios. The EPANET water distribution model confirmed adequate pressure exists within fire hydrants during fire flow, and within the system for the Average Day, Max Day + Fire Flow and Peak Hour scenarios.

The proposed water supply design conforms to all relevant City Guidelines and Policies.

## 4.0 WASTEWATER SERVICING

### 4.1 Existing Wastewater Services

The subject site lies within the South Nepean Trunk Sewer catchment area, as shown by the City sewer mapping included in **Appendix C**. An existing 500 mm diameter sanitary sewer within Cambrian Road is available to service the proposed development.

### 4.2 Wastewater Design

It is proposed that the development will be serviced via the existing 500 mm sanitary sewer within Cambrian Road via a 250 mm internal sanitary sewer.

A sanitary catch basin is proposed at the rear loading area of the Metro building to capture drainage from the waste bin pad. This area is proposed to be sealed to protect from storm runoff entering the sanitary system.

**Table 5**, below, summarizes the **City Standards** employed in the design of the proposed wastewater sewer system.

**Table 5**  
**Wastewater Design Criteria**

Design Parameter	Value
Peaking Factor	Harmon's Peaking Factor. Max 4.0, Min 2.0 Harmon's Corrector Factor 0.8
Commercial Floor Space	5 L/m <sup>2</sup> /d
Infiltration and Inflow Allowance	0.05 L/s/ha (Dry Weather) 0.28 L/s/ha (Wet Weather) 0.33 L/s/ha (Total)
Sanitary sewers are to be sized employing the Manning's Equation	$Q = \frac{1}{n} AR^{\frac{2}{3}} S^{\frac{1}{2}}$
Minimum Sewer Size (Non-Residential)	250 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.	

**Table 6**, below, demonstrates the estimated peak flow from the proposed development. See **Appendix C** for associated calculations.

**Table 6**  
**Summary of Estimated Peak Wastewater Flow**

Design Parameter	Total Flow (L/s)
Estimated Average Dry Weather Flow	0.94
Estimated Peak Dry Weather Flow	1.59
Estimated Peak Wet Weather Flow	2.21

The estimated sanitary flow based on the **Site Plan**, included in **Drawings/Figures**, results in a peak wet weather flow of **2.21 L/s**.

A sanitary sewer analysis was completed as part of the Barrhaven South Master Servicing Study (**BSMSS**) which included the existing sewers within Cambrian Road and those downstream. The subject property was contemplated as commercial lands in the study. Based on the **BSMSS** Sanitary Sewer Design Sheet, the controlling section of sewer is within Cambrian Road between MH13A and MH15A with an available capacity of **51.5 L/s**, which is sufficient to accommodate the sanitary flow from the proposed development. Extracted sanitary figures and design sheets from **BSMSS** and detailed calculations for the proposed site are included in **Appendix C**.

#### **4.3 Wastewater Servicing Conclusions**

The site is tributary to the South Nepean Trunk It is proposed to discharge wastewater to the existing 500 mm diameter sanitary sewer within Cambrian Road via a 250mm internal sanitary sewer.

Based on the above sanitary analysis, sufficient capacity is available to accommodate the anticipated **2.21 L/s** peak wet weather flow from the contemplated/proposed development.

The proposed wastewater design conforms to all relevant **City Standards**.

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## 5.0 STORMWATER MANAGEMENT

### 5.1 Existing Stormwater Services

Stormwater runoff from the subject property is tributary to the City of Ottawa sewer system located within the Jock River sub-watershed. As such, approvals for proposed development within this area are under the approval authority of the City of Ottawa.

Flows that influence the watershed in which the subject property is located are further reviewed by the principal authority. The subject property is located within the Jock River watershed, and is therefore subject to review by the Rideau Valley Conservation Authority (RVCA). Consultation with the RVCA is located in **Appendix A**.

It was assumed that the existing development contained no stormwater management controls for flow attenuation. The estimated pre-development peak flows for the 2, 5, and 100-year events are summarized in **Table 7**, below:

**Table 7**  
**Summary of Existing Peak Storm Flow Rates**

City of Ottawa Design Storm	Estimated Peak Flow Rate (L/s)
2-year	183.9
5-year	249.5
100-year	534.4

### 5.2 Post-development Stormwater Management Target

Stormwater management requirements for the proposed development were reviewed with the City of Ottawa and summarized in pre-consultation notes in **Appendix A**, where the proposed development is required to:

- Meet an allowable release rate based on a Rational Method Coefficient of 0.64, employing the City of Ottawa IDF parameters for a 5-year storm with a time of concentration equal to or less than 21.5 minutes and greater than or equal to 10 minutes;
- Attenuate all storms up to and including the City of Ottawa 100-year design event on site; and
- Quality controls are to be provided to achieve 80% Total Suspended Solids (TSS) removal as per the recommendation of the Rideau Valley Conservation Authority (RVCA).

Based on the above the allowable release rate for the proposed development is **263.4 L/s**.

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### 5.3 Proposed Stormwater Management System

The subject site was contemplated in the **HMBW Phase 2 Design Brief**, as well as, the **HMBW Phase 2 SWM Report**, to drain to the minor system within future Greenbank Road, eventually draining to the Clarke Pond and ultimately to the Jock River.

It is proposed that the stormwater outlet from the development will be to the existing 2550 mm diameter storm sewer within future Greenbank Road via a 750 mm connection to the existing sewer.

The **Clarke Pond Design Brief** contemplates the area in which the subject property falls within to be a 5-year capture area with onsite 100-year control.

Per the **HMBW Phase 2 SWM Report**, there is a Hydraulic Grade Line (HGL) elevation in the 100-year storm event of approximately **93.023 m** at **MH904** within future Greenbank Road storm sewer, located upstream of the proposed storm connection. Refer to the excerpt of the **HMBW Phase 2 SWM Report**, prepared by JFSA, dated October 2019 in **Appendix D**.

To meet the stormwater quantity control objectives the proposed development will employ rooftop and surface storage. To adhere to the allocated release rate, inlet control devices (ICDs) are proposed at catch basins and manholes to control flow. The 100-year HGL elevation was taken into account in the design of available storage. The downstream condition was set at **93.09 m** to size the ICDs.

Stormwater drainage from parking areas (**A109, A110B, A110A, A114A, A113A, A108, A103B, A106, A107**) will be collected by catch basins and required stormwater storage will be provided via surface ponding. Flow from these areas as indicated on drawing **SWM-1** will be controlled via orifice controls located at the outlet of the catch basins.

Refer to detailed stormwater calculations located in **Appendix D** and drawing **SSP-1** and for ICD locations and sizing.

Building drainage from areas (**METRO, BLDG A, BLDG B, BLDG C**) indicated on drawing **SWM-1**, will be controlled via rooftop controls providing required stormwater storage on the rooftops.

Site grading was designed to ensure a minimum freeboard of 0.30m during the 100 year and climate change storm events between the maximum ponding elevation and the lowest unit opening.

**Table 8** illustrates anticipated release rates and required storage volumes for each drainage area.

**Table 8**, below, estimates post-development flow rates to the storm sewer within Greenbank Road.

**Table 8**  
**Stormwater Flow Rate Summary**

Control Area	5-Year Release Rate  (L/s)	5-Year Required Storage  (m <sup>3</sup> )	100-Year Release Rate  (L/s)	100-Year Required Storage  (m <sup>3</sup> )	100-Year Available Storage  (m <sup>3</sup> )
U1	4.7	0.0	10.1	0.0	0.0
U2	11.4	0.0	21.6	0.0	0.0
U3	13.5	0.0	28.9	0.0	0.0
U4	0.7	0.0	1.4	0.0	0.0
U5	2.5	0.0	5.3	0.0	0.0
METRO	24.2	55.5	31.9	126.8	317.5
BLDG A	7.5	10.7	10.0	25.3	73.6
BLDG B	7.3	9.0	9.8	21.4	65.7
BLDG C	5.1	5.7	6.9	13.7	43.5
A109	9.6	3.2	25.6	3.8	4.2
A110B	9.4	2.7	10.0	12.0	43.0
A110A	9.6	7.3	10.4	25.0	54.7
A114A	16.0	12.2	18.3	40.9	68.7
A113A	8.3	22.3	9.4	63.6	88.3
A108	8.2	23.4	8.9	57.3	114.5
A103B	7.9	8.7	8.4	24.3	76.9
A106 & A107	23.1	60.0	24.5	169.2	51.1
<b>Total</b>	<b>168.9</b>	<b>220.7</b>	<b>241.5</b>	<b>583.3</b>	<b>1001.8</b>

It is anticipated that approximately **583.3 m<sup>3</sup>** of on-site storage will be required to attenuate flow to the established release rate of **263.4 L/s**. Storage calculations are contained within **Appendix D**. Sufficient surface storage is provided to satisfy the 100-year required storage.

“Enhanced” Quality control is provided by the Clarke Pond per the **Clarke Pond Design Brief**. Excerpts and figures extracted from the **Clarke Pond Design Brief** are included in **Appendix D**.

## 5.4 Stormwater Servicing Conclusions

The subject site was contemplated in the **HMBW Phase 2 Design Brief** and **HMBW Phase 2 SWM Report**. An allowable release rate of **263.4 L/s** is to be achieved with attenuation up to the 100-year storm event.

Controls are provided at each catch basin to restrict the total flow from the site to the allowable release rate. To attenuate flow to the allowable release rate, **583.3 m<sup>3</sup>** of surface storage is required.

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Quality control is provided by the Clarke Pond at an enhanced protection level per the ***Clarke Pond Design Brief***.

The proposed stormwater design conforms to all relevant ***City Standards*** and Policies for approval.

## **6.0 UTILITIES**

Gas and Hydro services currently exist within the Cambrian Road right-of-way. Utility servicing will be coordinated with the individual utility companies prior to site development.

The proposed development will be coordinated and approved by the utility company having jurisdiction.

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## 7.0 EROSION AND SEDIMENT CONTROL

Soil erosion occurs naturally and is a function of soil type, climate and topography. During construction the extent of erosion losses is exaggerated due to the removal of vegetation and the top layer of soil becoming agitated.

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

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

Catch basins will have SILTSACKS or an approved equivalent installed under the grate during construction to protect from silt entering the storm sewer system.

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

Erosion and sediment controls must be in place during construction. The following 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 existing ditches;
- No refueling or cleaning of equipment near existing watercourses;
- Provide sediment traps and basins during dewatering;
- Install filter cloth between catch basins and frames;
- Plan construction at proper time to avoid flooding; and
- Establish material stockpiles away from watercourses, so that barriers and filters may be installed.

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

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



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## 8.0 CONCLUSION AND RECOMMENDATIONS

David Schaeffer Engineering Ltd. (DSEL) has been retained by Metro Canada Inc. to prepare a Site Servicing and Stormwater Management report in support of the application for a Site Plan Control (SPC) at 3831 Cambrian Road. The preceding report outlines the following:

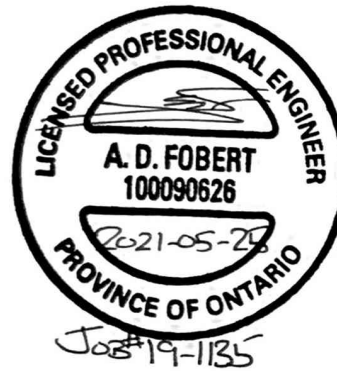
- Based on boundary conditions provided by the City the existing municipal water infrastructure is capable of providing the proposed development with water within the City's required pressure range;
- The FUS method for estimating fire flow indicated **6,000 L/min** is required for proposed development;
- The contemplated development is anticipated to have a peak wet weather flow of **2.21 L/s**; Based the **BSMSS** the existing municipal sewer infrastructure has sufficient capacity to support the development;
- Storm water quantity controls are proposed per the subdivision design, a maximum release rate of **263.4 L/s** is required and provided through the use of ICD's. Flow attenuation to be provided up to the 100-year storm event;
- It is proposed to attenuate flow through rooftop and surface storage. It is anticipated that **583.3 m<sup>3</sup>** of onsite surface storage will be required to attenuate flow to the established release rate above;
- Quality control is provided by the Clarke Pond at an enhanced protection level per the **Clarke Pond Design Brief**.

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Prepared by,  
**David Schaeffer Engineering Ltd.**



Per: Brandon N. Chow



Per: Adam D. Fobert, P.Eng

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## ***APPENDIX A***

### ***Pre-Consultation***

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## Genavieve Greenberg

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**From:** Jaime Posen <posen@fotenn.com>  
**Sent:** Friday, June 5, 2020 5:23 PM  
**To:** Wayne Williams; Antony Cannell  
**Cc:** Bria Aird; Fel Petti; Christopher Gordon  
**Subject:** FW: Metro pre-consult - 3831 Cambrian Rd  
**Attachments:** Pre-con Study and Plan Identification List.pdf; 3831 Cambrian Design Brief.pdf

Hello team,

Please see below and attached for the meeting minutes from the pre-application consultation meeting with the City of Ottawa for 3831 Cambrian Road.

After scanning the comments, I didn't see anything dramatically different than what was shared with us in the meeting, but please let me know if anything stands out as being problematic.

Mélanie also advised that Frank McKinney had shared a link with Chris Gordon to download some material related to the EAs for the surrounding roads.

Hope that's helpful, have a great weekend.

**Jaime Posen, MCIP RPP**

Senior Planner  
T 613.730.5709 ext. 236

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**From:** Gervais, Melanie <Melanie.Gervais@ottawa.ca>  
**Sent:** June 4, 2020 3:48 PM  
**To:** Jaime Posen <posen@fotenn.com>  
**Subject:** Metro pre-consult - 3831 Cambrian Rd

Hi Jaime,

Please find below a recap of our pre-consultation meeting. Please note that during the COVID-19 pandemic the department is accepting electronic applications. Please send pdfs of your submission material (including a scanned copy of the application form) to [planningcirculations@ottawa.ca](mailto:planningcirculations@ottawa.ca) (and cc myself). They will create the file number and upload the files to the proper location. Following the receipt of the electronic submission I will send you an email with your new file number and the new process for submitting payment.

### Planning:

You will need to submit a New - Complex Site Plan application with a fee of \$35,487.53 + engineering review fees + \$1,015 (Conservation Authority fee).

The property is zoned GM[2340]-h which stands for General Mixed Use Zone Exception 2340 with a holding, the zoning provisions for Mixed Use Zone can be found [here](#) and all the provisions for parking lots can be found [here](#). Please note that the holding zone can be lifted given that the Clarke Pond is operational.

The site is also with the Community Core in the Barrhaven South CDP. The CDP speaks to a Community Core Concept Plan and Design Framework which was completed by FoTenn and previously sent to you. Please ensure that the Planning Rationale indicated how the design elements identified in the plan have been met (Built Form, Architecture, and Land Use / Landscape and the Environment / Pedestrians and Cyclists / Vehicles and Parking...).

Proper landscaping will be required on site. This includes the addition of trees along the street edge, within landscape buffers and landscaped islands... Please note that all Landscape Plans need to be stamped by a Landscape Architect.

The Planning Rationale will have to explain the proposal, review the applicable Official Plan and CDP policies, review the applicable Zoning By-law provisions and review the Accessibility Design Standards.

The adjacent property to the south is the Dowitcher Park.

Please see the attached list identifying the submission requirements. Although the list identifies numbers of paper copies these are **not** required at this time.

### **Design:**

More information is necessary to provide design comments and will be detailed in the Design Brief. Some of these will include:

- More details of the surrounding context and how it connects and supports it. (Using page 20 in the Community Design Plan as a guide for the extent of context requested);
- Additional details regarding the landscaping approach (Interim and future);
- How pedestrians will be directed across and through the site;
- How direct adjacency to the park will be considered and any negative impacts from the loading and access road will be mitigated;
- How the buildings will related to the streetscape with active entrances/facades etc. especially when the interim road is removed;

We recommend the site plan illustrate a future design that shows what will replace the interim road. The final design layout should illustrate the mediating solutions to achieve the ten-year plan (especially regarding building placement) when the interim access road that will separate the buildings from the future road is removed;

Please see the Design Brief Terms of Reference provided.

### **Forestry:**

Soil volume is fundamental to the success of newly planted trees. Please ensure newly planted trees have an adequate soil volume for their size at maturity. The following is a table of recommended minimum soil volumes:

Tree Type/Size	Single Tree Soil Volume (m3)	Multiple Tree Soil Volume (m3/tree)
----------------	------------------------------	-------------------------------------

Ornamental	15	9
Columnar	15	9
Small	20	12
Medium	25	15
Large	30	18
Conifer	25	15

Plant for survival to maturity - choose the right species that for the site and one that will contribute to the design and function of the built site, ensure that salt tolerant species are selected for high salt areas.

### **Transportation:**

- Follow Traffic Impact Assessment Guidelines
  - Please begin the TIA report (Steps 1-3 must be submitted and approved prior to application or it will be deemed incomplete).
    - <https://ottawa.ca/en/transportation-impact-assessment-guidelines>
- Noise Impact Studies required for the following:
  - Stationary (any exposed mechanical equipment and loading zone) due to the proximity to neighboring noise sensitive land uses.
- Temporary access road on Greenbank will be permitted.
- Ensure that the Cambrian and Greenbank EAs are followed for right of way requirements and the intersection control at Cambrian and Greenbank temporary road.
- All maintenance of the temporary road will be at the applicant's expense.
- On site plan:
  - Show all details of the roads abutting the site up to and including the opposite curb; include such items as pavement markings, accesses and/or sidewalks.
  - Turning templates will be required for all accesses showing the largest vehicle to access the site; required for internal movements and at all access (entering and exiting and going in both directions).
  - Show all curb radii measurements; ensure that all curb radii are reduced as much as possible
  - Show lane/aisle widths.
  - Ensure pedestrian connections are provided on the site.
  - Grey out any area that will not be impacted by this application.
- AODA legislation ([link](#)) is in effect for all organizations, please ensure that the design conforms to these standards, see attached checklist for guidance.

For any transportation questions, please contact Mike Giampa ([Mike.Giampa@ottawa.ca](mailto:Mike.Giampa@ottawa.ca)).

### **Transportation Planning (Frank McKinney):**

- Although we are not opposed to a complete throw away of the temporary access road, it would be best if we could find a way to prevent this as much as possible.
- Metro will be required to restore the boulevard.
- The timing of realigned Greenbank from Jockvale to Cambrian Rd is 2031 while south of Cambrian Rd is still to be determined through the next TMP.

- Once realigned Greenbank is constructed up to Cambrian Rd, how will the temporary access tie up to the intersection?
- Please hide parking as much as possible

We are having problems locating the microstation files for the Cambrian Road Widening. Frank McKinney will send all information on to Chris Gordon as soon as it is available.

Please note that an email was sent to Patrick Sammon in ISD concerning the design for realigned Greenbank but he is unfortunately away from the office. We will provide you with more information on this as soon as possible and hopefully be able to provide you with more information on how the tie-in to the future intersection should be.

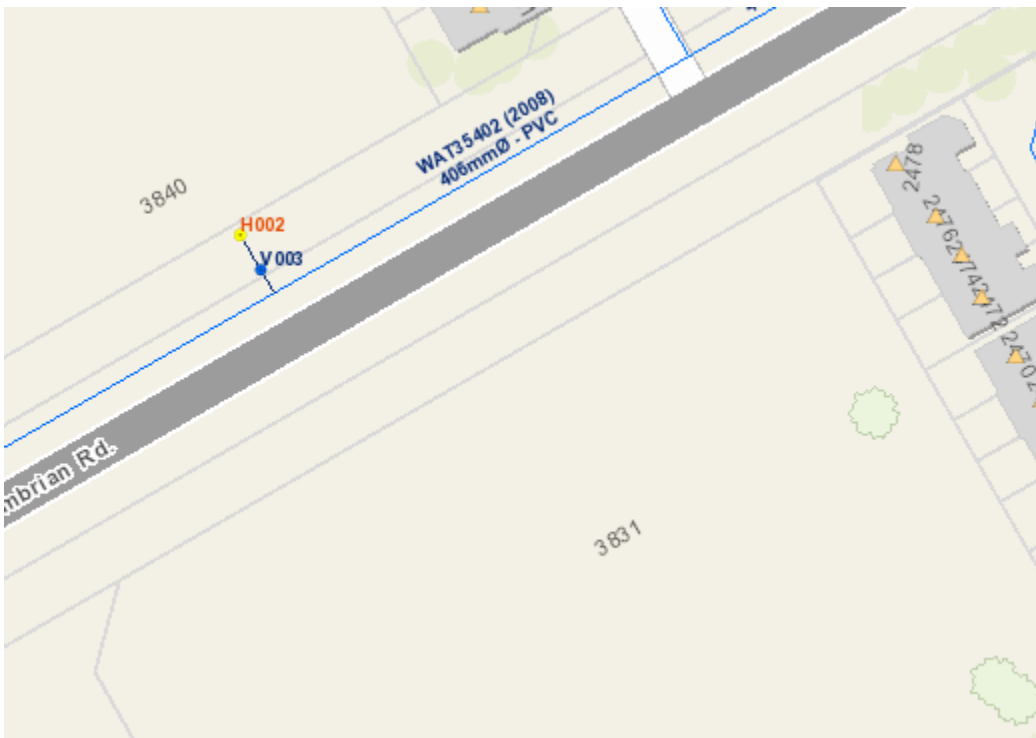
## **Engineering:**

### **Water**

Water District Plan No: 362-012

Existing public services:

- Cambrian Road – 406 mm PVC



- Service areas with a basic demand greater than 50 m<sup>3</sup>/day shall be connected with a minimum of two water services, separated by an isolation valve, to avoid creation of vulnerable service area.
- District Metering Area Chambers are required for services 150mm or greater in diameter.
- A water meter sizing questionnaire [water card] will have to be completed prior to receiving a water permit (water card will be provided post approval)

### **Boundary conditions:**

Civil consultant must request boundary conditions from the City's assigned Project Manager prior to first submission.



- Water boundary condition requests must include the location of the service(s) and the expected loads required by the proposed developments. Please provide all the following information:
  - Location of service(s)
  - Type of development and the amount of fire flow required (as per FUS, 1999).
  - Average daily demand: \_\_\_\_ l/s.
  - Maximum daily demand: \_\_\_\_ l/s.
  - Maximum hourly daily demand: \_\_\_\_ l/s.
- Fire protection (Fire demand, Hydrant Locations)
- A water meter sizing questionnaire [water card] will have to be completed prior to receiving a water permit (water card will be provided post approval)

Existing public services:



## Storm Sewer

- Future Greenbank Road – 2550 mm Conc. Currently this storm sewer has been constructed to just south of Cambrian.
  - The outlet to the Clark Pond and the stormwater network north of Cambrian Road have been constructed by Mattamy as part of the Half Moon Bay West development. The stormwater

network ends just south of Cambrian Road and there are no immediate plans to extend the sewer south of Cambrian Road prior to the construction of the Future Greenbank Road.

- The Zoning Hold can be lifted now that the Clarke Pond is operational.
- Cambrian Road – 375 mm PVC (South) – not designed for drainage from subject site
- Cambrian Road – 525 mm Conc (North) – not designed for drainage from subject site



## Stormwater Management

Quality Control:

- Rideau Valley Conservation Authority to confirm quality control requirements.

Quantity Control:

- Master Servicing Study:
  - Barrhaven South Creek Subwatershed Study (Jock River Reach 1)
  - Barrhaven South Master Servicing Study Oct 2017
  - Half Moon Bay West Subdivision
- Allowable Run-off Coefficient:  $C = 0.64$
- Time of concentration ( $T_c$ ):  $T_c = \text{pre-development}$ ; maximum  $T_c = 21.5 \text{ min}$
- Allowable flowrate: Control the 100-year storm events to the 5-year storm event

## Ministry of Environment, Conservation and Parks (MECP)

All development applications should be considered for an Environmental Compliance Approval, under MECP regulations.

- a. Consultant determines if an approval for sewage works under Section 53 of OWRA is required. Consultant determines what type of application is required and the City's project manager confirms. (If the consultant is not clear if an ECA is required, they will work with the City to determine what is required. If unclear or there is a difference of opinion the City Project Manager will coordinate requirements with MECP).
- b. The project will be either transfer of review (standard), transfer of review (additional), direct submission, or exempt as per O. Reg. 525/98.
- c. Pre-consultation is not required if applying for standard or additional works (Schedule A of the Agreement) under Transfer Review.
- d. Pre-consultation with local District office of MECP is recommended for direct submission.
- e. Consultant completes an MECP request form for a pre-consultation. Sends request to [moeccottawasewage@ontario.ca](mailto:moeccottawasewage@ontario.ca)
- f. ECA applications are required to be submitted online through the MECP portal. A business account required to submit ECA application. For more information visit <https://www.ontario.ca/page/environmental-compliance-approval>

**NOTE: Site Plan Approval is required before any MECP application is signed**

### **General Service Design Comments**

- The City of Ottawa requests that all new services be located within the existing service trench to minimize necessary road cuts.
- Monitoring manholes should be located within the property near the property line in an accessible location to City forces and free from obstruction (i.e. not a parking).
- Where service length is greater than 30 m between the building and the first maintenance hole / connection, a cleanout is required.
- The City of Ottawa Standard Detail Drawings should be referenced where possible for all work within the Public Right-of-Way.
- The upstream and downstream manhole top of grate and invert elevations are required for all new sewer connections.
- Services crossing the existing watermain or sewers need to clearly provide the obvert/invert elevations to demonstrate minimum separation distances. A watermain crossing table may be provided.

### **Other**

Are there are Capital Works Projects scheduled that will impact the application? ☐ Yes ☒ No

### **References**

- As per section 53 of the Professional Engineers Act, O. Reg 941/40, R.S.O. 1990, all documents prepared by engineers must be signed and dated on the seal.

### **CREO (Corporate Real Estate Office)**

Please provide a sketch showing area and dimensions of the portion of future Greenbank Road that want to lease for their access road. CREO will then undertake a circulation to all City departments and utility companies to determine if there are any objections to entering into a license with Metro.

CREO will need to seek Legal advice as to whether a license is appropriate in this case or whether it should be a lease given that it appears that you will be occupying City land for many years.

If you or the Metro consultant should provide some background and anticipated works to be completed on the property.

Once CREO receive the sketch and information, a request for an appraisal will be done.

### **RVCA**

The RVCA would be looking for water quality protection of 80% TSS removal on-site as part of Site Plan.

\*\*\*\*

Please refer to the links to "[Guide to preparing studies and plans](#)" and [fees](#) for general information. Additional information is available related to [building permits](#), [development charges](#), and the [Accessibility Design Standards](#). Be aware that other fees and permits may be required, outside of the

development review process. You may obtain background drawings by contacting [informationcentre@ottawa.ca](mailto:informationcentre@ottawa.ca) (613-580-2424 ext. 44455).

All required plans are to be submitted utilizing a reasonable and appropriate metric scale as per City of Ottawa Servicing and Grading Plan Requirements: title blocks are to be placed on the right of the sheets and not along the bottom. Engineering plans may be combined, but the Site Plans must be provided separately. Plans shall include the survey monument used to confirm datum. Information shall be provided to enable a non-surveyor to locate the survey monument presented by the consultant.

All required plans & reports are to be provided in \*.pdf format (at application submission and for any, and all, re-submissions).

These pre-consultation comments are valid for one year. If you submit a development application(s) after this time, you may be required to meet for another pre-consultation meeting and/or the submission requirements may change.

Please do not hesitate to contact me if you have any questions.

Regards,

***Mélanie Gervais MCIP, RPP***

*Planner / Urbaniste*

*Development Review /*

*Examen des demandes d'aménagement*

*Planning, Infrastructure and Economic Development Department /*

*Services de la planification, de l'infrastructure et du développement économique*

*City of / Ville d'Ottawa*

*110, avenue Laurier Avenue West / Ouest,*

*4th Floor / 4ième étage*

*Ottawa, ON K1P 1J1*

*Tel. : 613-580-2424 ext. 24025*

*Fax / Télécopieur : 613-580-2576*

*E-mail / Courriel : [Melanie.Gervais@ottawa.ca](mailto:Melanie.Gervais@ottawa.ca)*

*Mail Code: 01-14*

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## ***APPENDIX B***

### ***Water Supply***

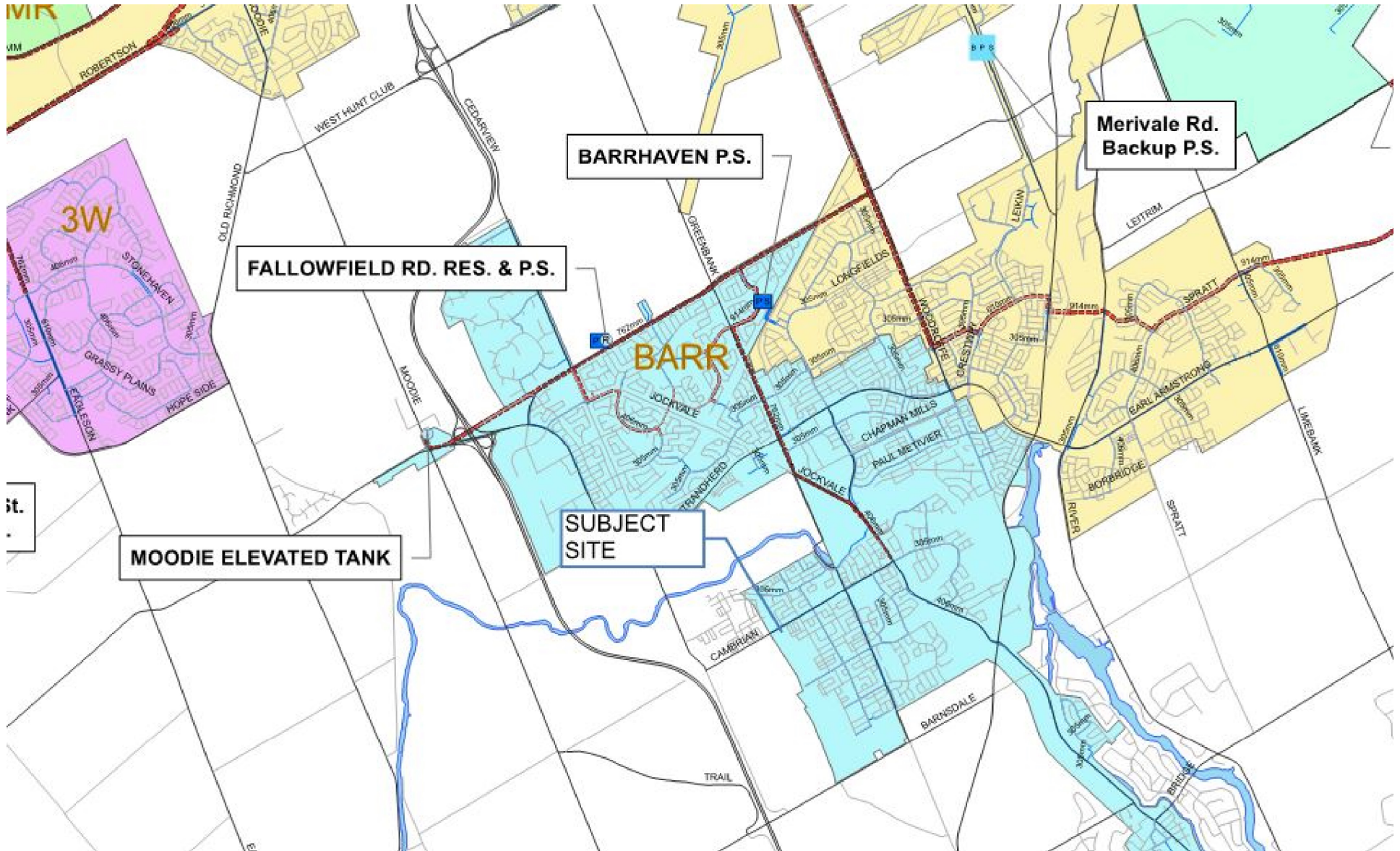
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# Pressure Zone Map



## Boundary Conditions 3831 Cambrian Road

### Provided Information

Scenario	Demand	
	L/min	L/s
Average Daily Demand	12.00	0.2
Maximum Daily Demand	18.00	0.3
Peak Hour	31.80	0.53
Fire Flow Demand 1	7,000.00	116.67

### Location



### Results – Existing Conditions

#### Connection 1 – Cambrian Rd.

Demand Scenario	Head (m)	Pressure <sup>1</sup> (psi)
Maximum HGL	155.9	88.8
Peak Hour	139.0	64.8
Max Day plus Fire 1	135.6	60.0

<sup>1</sup> Ground Elevation = 93.4 m



### Connection 2 – Cambrian Rd. / Greenbank Rd.

Demand Scenario	Head (m)	Pressure <sup>1</sup> (psi)
Maximum HGL	155.9	88.1
Peak Hour	139.0	64.1
Max Day plus Fire 1	135.6	59.3

<sup>1</sup> Ground Elevation = 93.9 m

### Results – SUC Zone Reconfiguration

#### Connection 1 – Cambrian Rd.

Demand Scenario	Head (m)	Pressure <sup>1</sup> (psi)
Maximum HGL	147.5	76.9
Peak Hour	143.4	71.0
Max Day plus Fire 1	143.5	71.2

<sup>1</sup> Ground Elevation = 00.0 m

#### Connection 2 – Cambrian Rd. / Greenbank Rd.

Demand Scenario	Head (m)	Pressure <sup>1</sup> (psi)
Maximum HGL	147.5	76.2
Peak Hour	143.4	70.3
Max Day plus Fire 1	143.5	70.5

<sup>1</sup> Ground Elevation = 00.0 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.*

Water Demand Design Flows per Unit Count  
City of Ottawa - Water Distribution Guidelines, July 2010



Institutional / Commercial / Industrial Demand

Property Type	Unit Rate	Units	Avg. Daily		Max Day		Peak Hour	
			m <sup>3</sup> /d	L/min	m <sup>3</sup> /d	L/min	m <sup>3</sup> /d	L/min
Metro	2.5 L/m <sup>2</sup> /d	4,024	10.06	7.0	15.1	10.5	27.2	18.9
Bldg A	2.5 L/m <sup>2</sup> /d	929	2.32	1.6	3.5	2.4	6.3	4.4
Bldg B	2.5 L/m <sup>2</sup> /d	830	2.08	1.4	3.1	2.2	5.6	3.9
Bldg C (Retail)	2.5 L/m <sup>2</sup> /d	530	1.33	0.9	2.0	1.4	3.6	2.5
Bldg C (Office)	75 L/9.3m <sup>2</sup> /d	530	4.27	3.0	6.4	4.5	11.5	8.0
<b>Total I/CI Demand</b>			<b>20.1</b>	<b>13.9</b>	<b>30.1</b>	<b>20.9</b>	<b>54.2</b>	<b>37.6</b>
<b>Total Demand</b>			<b>20.1</b>	<b>13.9</b>	<b>30.1</b>	<b>20.9</b>	<b>54.2</b>	<b>37.6</b>

## Fire Flow Estimation per Fire Underwriters Survey

Water Supply For Public Fire Protection - 1999



### Fire Flow Required

#### 1. Base Requirement

$$F = 220C\sqrt{A}$$

L/min

Where **F** is the fire flow, **C** is the Type of construction and **A** is the Total floor area

Type of Construction:

Non-Combustible Construction

**C** 0.8 Type of Construction Coefficient per FUS Part II, Section 1  
**A** 4,953 m<sup>2</sup> Total floor area based on FUS Part II section 1

Fire Flow	12386.4 L/min
	<b>12000.0 L/min</b> rounded to the nearest 1,000 L/min

### Adjustments

#### 2. Reduction for Occupancy Type

Limited Combustible -15%

Fire Flow	<b>10200.0 L/min</b>
-----------	----------------------

#### 3. Reduction for Sprinkler Protection

Sprinklered - Supervised -50%

Reduction	<b>-5100 L/min</b>
-----------	--------------------

#### 4. Increase for Separation Distance

Cons. of Exposed Wall	S.D	Lw	Ha	LH	EC	
<b>N</b> Non-Combustible	30.1m-45m	15		2	30	5%
<b>S</b> Non-Combustible	>45m	0		0	0	0%
<b>E</b> Non-Combustible	>45m	0		1	0	0%
<b>W</b> Non-Combustible	>45m	0		1	0	0%
% Increase						<b>5%</b> value not to exceed 75%

Increase	<b>510.0 L/min</b>
----------	--------------------

Lw = Length of the Exposed Wall

Ha = number of storeys of the adjacent structure. Max 5 stories

LH = Length-height factor of exposed wall. Value rounded up.

EC = Exposure Charge

### Total Fire Flow

Fire Flow	5610.0 L/min	fire flow not to exceed 45,000 L/min nor be less than 2,000 L/min per FUS Section 4
	<b>6000.0 L/min</b>	rounded to the nearest 1,000 L/min

#### Notes:

-Type of construction, Occupancy Type and Sprinkler Protection information provided by \_\_\_\_\_.

-Calculations based on Fire Underwriters Survey - Part II

## Fire Flow Estimation per Fire Underwriters Survey

Water Supply For Public Fire Protection - 1999



### Fire Flow Required

#### 1. Base Requirement

$$F = 220C\sqrt{A}$$

L/min

Where **F** is the fire flow, **C** is the Type of construction and **A** is the Total floor area

Type of Construction:

Non-Combustible Construction

**C** 0.8 Type of Construction Coefficient per FUS Part II, Section 1  
**A** 830 m<sup>2</sup> Total floor area based on FUS Part II section 1

**Fire Flow** 5070.5 L/min  
**5000.0 L/min** rounded to the nearest 1,000 L/min

### Adjustments

#### 2. Reduction for Occupancy Type

Limited Combustible -15%

**Fire Flow** 4250.0 L/min

#### 3. Reduction for Sprinkler Protection

Non-Sprinklered 0%

**Reduction** 0 L/min

#### 4. Increase for Separation Distance

Cons. of Exposed Wall	S.D	Lw	Ha	LH	EC
<b>N</b> Non-Combustible	>45m	0	0	0	0%
<b>S</b> Non-Combustible	>45m	0	0	0	0%
<b>E</b> Non-Combustible	>45m	0	0	0	0%
<b>W</b> Non-Combustible	30.1m-45m	30	1	30	5%
<b>% Increase</b>					<b>5%</b> value not to exceed 75%

**Increase** 212.5 L/min

Lw = Length of the Exposed Wall

Ha = number of storeys of the adjacent structure. Max 5 stories

LH = Length-height factor of exposed wall. Value rounded up.

EC = Exposure Charge

### Total Fire Flow

**Fire Flow** 4462.5 L/min fire flow not to exceed 45,000 L/min nor be less than 2,000 L/min per FUS Section 4  
**4000.0 L/min** rounded to the nearest 1,000 L/min

#### Notes:

-Type of construction, Occupancy Type and Sprinkler Protection information provided by \_\_\_\_\_.

-Calculations based on Fire Underwriters Survey - Part II

## Fire Flow Estimation per Fire Underwriters Survey

Water Supply For Public Fire Protection - 1999



### Fire Flow Required

#### 1. Base Requirement

$$F = 220C\sqrt{A}$$

L/min

Where **F** is the fire flow, **C** is the Type of construction and **A** is the Total floor area

Type of Construction:

Non-Combustible Construction

**C** 0.8 Type of Construction Coefficient per FUS Part II, Section 1  
**A** 1,060 m<sup>2</sup> Total floor area based on FUS Part II section 1

Fire Flow	5730.1 L/min
	<b>6000.0 L/min</b> rounded to the nearest 1,000 L/min

### Adjustments

#### 2. Reduction for Occupancy Type

Limited Combustible -15%

Fire Flow	<b>5100.0 L/min</b>
-----------	---------------------

#### 3. Reduction for Sprinkler Protection

Non-Sprinklered 0%

Reduction	<b>0 L/min</b>
-----------	----------------

#### 4. Increase for Separation Distance

Cons. of Exposed Wall	S.D	Lw	Ha	LH	EC	
<b>N</b> Non-Combustible	>45m	0	0	0	0	0%
<b>S</b> Non-Combustible	>45m	0	0	0	0	0%
<b>E</b> Non-Combustible	>45m	0	0	0	0	0%
<b>W</b> Non-Combustible	30.1m-45m	40	1	40	5%	
<b>% Increase</b>					<b>5%</b>	value not to exceed 75%

Increase	<b>255.0 L/min</b>
----------	--------------------

Lw = Length of the Exposed Wall

Ha = number of storeys of the adjacent structure. Max 5 stories

LH = Length-height factor of exposed wall. Value rounded up.

EC = Exposure Charge

### Total Fire Flow

Fire Flow	5355.0 L/min	fire flow not to exceed 45,000 L/min nor be less than 2,000 L/min per FUS Section 4
	<b>5000.0 L/min</b>	rounded to the nearest 1,000 L/min

#### Notes:

-Type of construction, Occupancy Type and Sprinkler Protection information provided by \_\_\_\_\_.

-Calculations based on Fire Underwriters Survey - Part II

[TITLE]

[JUNCTIONS]

;ID	Elev	Demand	Pattern	
Metro	93.90	7.0		;
2	93.75	0		;
Bldg-A	93.80	1.6		;
hyd1	94.00	0		;
Bldg-C	93.65	3.9		;
Bldg-B	94.15	1.4		;
hyd2	93.85	0		;

[RESERVOIRS]

;ID	Head	Pattern	
7	155.9		;
1	155.9		;

[TANKS]

;ID	VolCurve	Elevation	InitLevel	MinLevel	MaxLevel	Diameter	MinVol
-----	----------	-----------	-----------	----------	----------	----------	--------

[PIPES]

;ID	MinorLoss	Node1 Status	Node2	Length	Diameter	Roughness
1	1.4	Bldg-B Open ;	2	64	200	110
2	3.4	2 Open ;	Metro	109	200	110
3	0.6	2 Open ;	Bldg-A	28.5	200	110
4	0.6	Bldg-A Open ;	hyd1	7	200	110
5	1.6	hyd1 Open ;	hyd2	73	200	110
9	2	Bldg-C Open ;	1	53	200	110
10	2.0	Bldg-B Open ;	7	52	200	110
6	0.8	hyd2 Open ;	Bldg-C	18	200	110

[PUMPS]

;ID	Node1	Node2	Parameters
-----	-------	-------	------------

[VALVES]

;ID	Node1	Node2	Diameter	Type	Setting
-----	-------	-------	----------	------	---------

[TAGS]

[DEMANDS]

;Junction	Demand	Pattern	Category
-----------	--------	---------	----------

[STATUS]

;ID	Status/Setting
-----	----------------

[PATTERNS]

;ID	Multipliers
-----	-------------

[CURVES]

;ID	X-Value	Y-Value
-----	---------	---------

[CONTROLS]

[RULES]

[ENERGY]

Global Efficiency	75
-------------------	----

Global Price	0		
Demand Charge	0		

[EMITTERS]			
;Junction	Coefficient		

[QUALITY]			
;Node	InitQual		

[SOURCES]			
;Node	Type	Quality	Pattern

[REACTIONS]			
;Type	Pipe/Tank	Coefficient	

[REACTIONS]			
Order Bulk	1		
Order Tank	1		
Order Wall	1		
Global Bulk	0		
Global Wall	0		
Limiting Potential	0		
Roughness Correlation	0		

[MIXING]			
;Tank	Model		

[TIMES]			
Duration	0		
Hydraulic Timestep	1:00		
Quality Timestep	0:05		
Pattern Timestep	1:00		
Pattern Start	0:00		
Report Timestep	1:00		
Report Start	0:00		
Start ClockTime	12 am		
Statistic	None		

[REPORT]			
Status	No		
Summary	No		
Page	0		

[OPTIONS]			
Units	LPM		
Headloss	H-W		
Specific Gravity	1		
Viscosity	1		
Trials	40		
Accuracy	0.001		
CHECKFREQ	2		
MAXCHECK	10		
DAMPLIMIT	0		
Unbalanced	Continue 10		
Pattern	1		
Demand Multiplier	1		
Emitter Exponent	0.5		
Quality	None mg/L		
Diffusivity	1		
Tolerance	0.01		

[COORDINATES]			
;Node	X-Coord	Y-Coord	
Metro	2805.56	8311.11	
2	1616.67	5644.44	
Bldg-A	2661.11	5655.56	
hyd1	3061.11	5644.44	
Bldg-C	4138.89	3000.00	

Bldg-B	1480.16	2928.57
hyd2	4127.78	3966.67
7	1494.44	1211.11
1	4105.56	1266.67

[VERTICES]

;Link	X-Coord	Y-Coord
1	1483.33	5533.33
2	1627.78	8277.78
2	1716.67	8366.67
2	2816.67	8377.78
5	4105.56	5644.44
5	4161.11	5544.44

[LABELS]

;X-Coord	Y-Coord	Label & Anchor Node
----------	---------	---------------------

[BACKDROP]

DIMENSIONS	0.00	0.00	10000.00	10000.00
UNITS	None			
FILE	Z:\Projects\19-1135_Metro - Greenbank			
Rd\B_Design\B1_Analysis\B1-5_Water\EPANet\Background\2020-07-28_Greenbank-Metro_spa_base-fig-11x17.bmp				
OFFSET	0.00	0.00		

[END]



through pressure control at the PSs. The key characteristics of each pump station in the system are provided in *Table 5.3*.

**Table 5.3: Existing Water Pump Station Characteristics**

Pump Station	Pressure Zone	Zone Type	Nominal Discharge HGL (m)	Total Capacity (MLD) <sup>1</sup>	Firm Capacity (MLD) <sup>2</sup>
<b>Carlington 2W</b>	2W	Open	131	68.0	34.0
<b>Barrhaven Reservoir</b>	BARR	Open	155	7.5	0.0
<b>Ottawa South</b>	3C	Closed	151	39.7	26.2
<b>Billings Bridge</b>	2C	Open	134	177.5	127.0
<b>Britannia 2W</b>	2W	Open	134	302.0	208.0
<b>Glen Cairn</b>	3W	Open	160	87.5	49.5
<b>Forest Ridge</b>	2E	Open	134	91.5	47.0
<b>Lemieux</b>	1W	Open	115	456.0	308.0
<b>Fleet</b>	1W	Open	115	279.0	189.0
<b>Britannia 1W</b>	1W	Open	115	328.0	213.0
<b>Carlington ME</b>	ME	Closed	154	13.5	5.5
<b>Campeau</b>	3W	Open	160	100.0	58.0
<b>Hurdman</b>	1E	Open	115	286.0	204.0
<b>Barrhaven</b>	BARR	Open	155	104.5	57.0
<b>Orléans</b>	2E	Open	134	93.4	64.5
<b>Leitrim</b>	4C	Closed	165	33.3	19.0
<b>Montreal</b>	MONT	Closed	148	39.4	21.9
<b>Brittany</b>	MONT	Closed	148	8.1	2.6
<b>Morgan's Grant</b>	MG	Closed	145	17.7	12.3

Source: Pressure Zone Operation Manuals  
**HGL** = Hydraulic Grade Line (a number that reflects both the elevation of the pump station, and the station discharge pressure)  
**MLD** = Million Litres per Day  
**BARR** = Barrhaven  
**MONT** = Montreal  
**ME** = Meadowlands

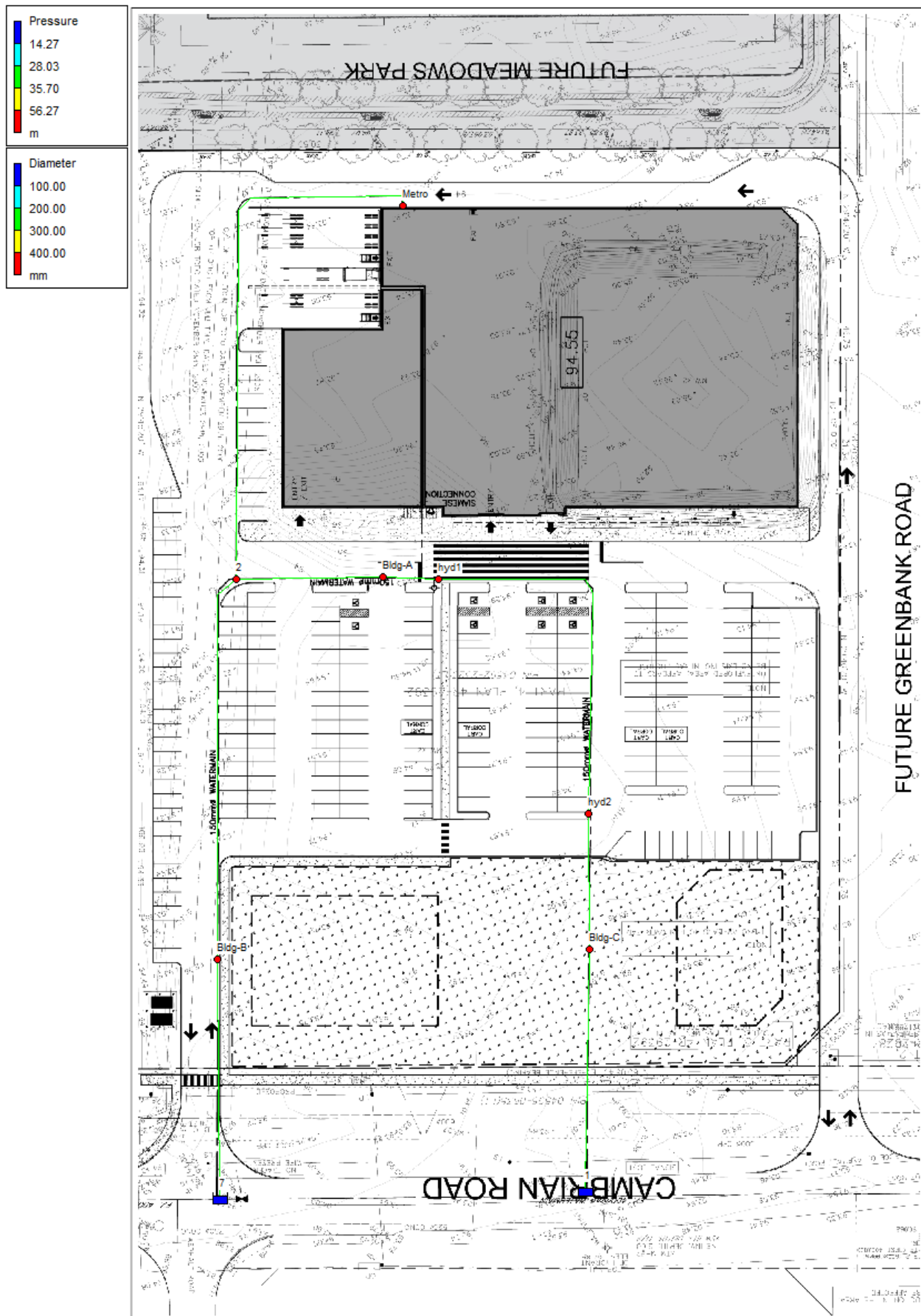
**MG** = Morgan's Grant

1. The nominal capacity of the station with all pumps in operation.
2. Total capacity of the station less the capacity of the largest pump. Typically, pump stations are designed to provide a firm capacity that is at least equal to the expected water system demand at the planning horizon.

## 5.2.1.3 Water Storage Facilities

Water storage facilities are strategically located throughout the distribution system to augment supply during high water demand periods and fire flow conditions, and to increase the reliability of water supply during system outages. During average water demand conditions, pumps are operated to allow frequent turnover of water within each facility to keep the water fresh. The key characteristics of each of the storage facilities are provided in *Table 5.4*.

## Average Day Demand



```

*****
*                               E P A N E T                               *
*                               Hydraulic and Water Quality                 *
*                               Analysis for Pipe Networks                   *
*                               Version 2.0                                 *
*****

```

Input File: 1135\_Avg-Day.net

Link - Node Table:

Link ID	Start Node	End Node	Length m	Diameter mm
1	Bldg-B	2	64	200
2	2	Metro	109	200
3		Bldg-A	28.5	200
4	Bldg-A	hyd1	7	200
5	hyd1	hyd2	73	200
9	Bldg-C	1	53	200
10	Bldg-B	7	52	200
6	hyd2	Bldg-C	18	200

Node Results:

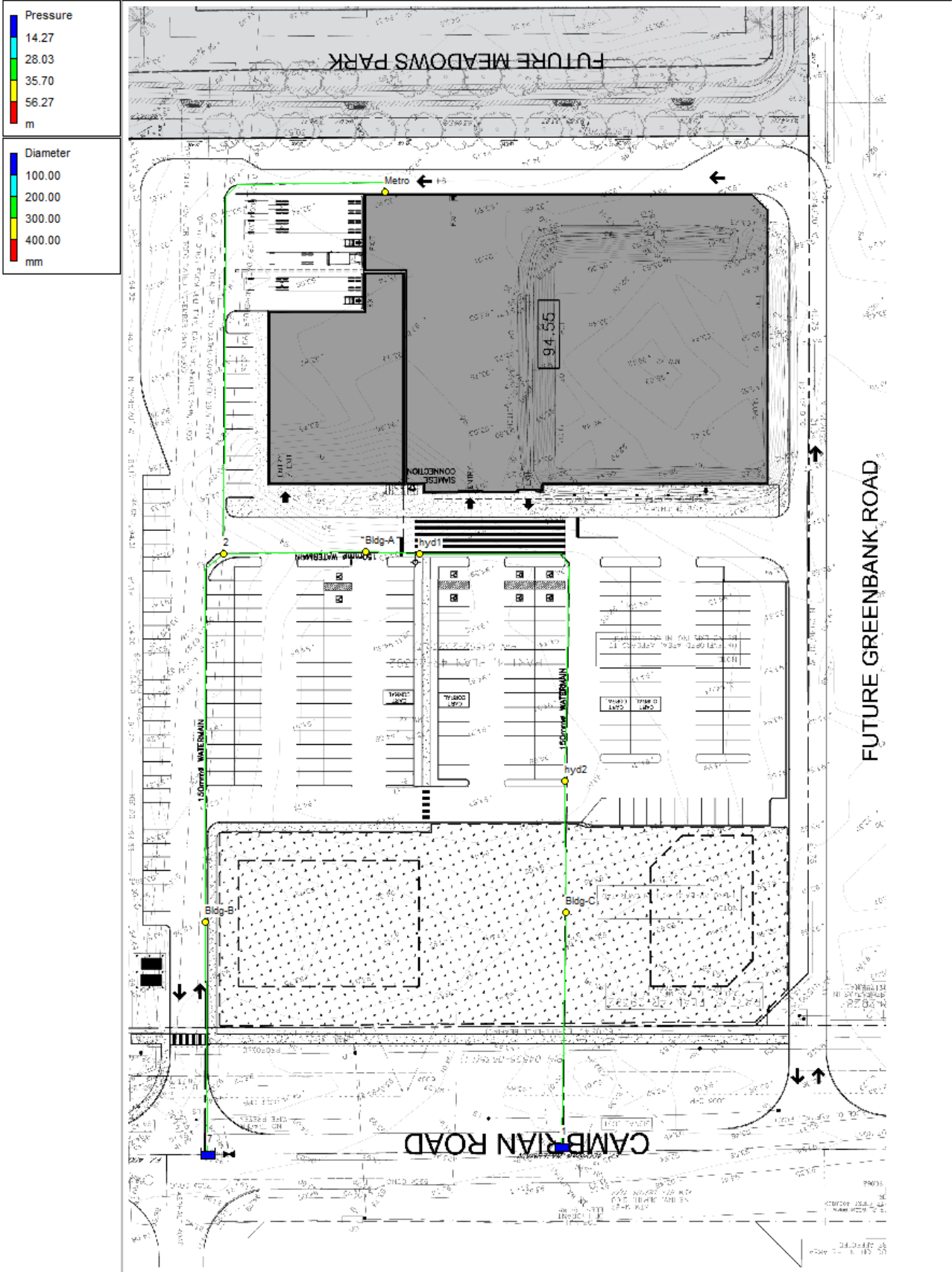
Node ID	Demand LPM	Head m	Pressure m	Quality
Metro	7.00	155.90	62.00	0.00
2	0.00	155.90	62.15	0.00
Bldg-A	1.60	155.90	62.10	0.00
hyd1	0.00	155.90	61.90	0.00
Bldg-C	3.90	155.90	62.25	0.00
Bldg-B	1.40	155.90	61.75	0.00
hyd2	0.00	155.90	62.05	0.00
7	-6.65	155.90	0.00	0.00 Reservoir
1	-7.25	155.90	0.00	0.00 Reservoir

Link Results:

Link ID	Flow LPM	Velocity m/s	Headloss m/km	Status
1	5.25	0.00	0.00	Open
2	7.00	0.00	0.00	Open
3	-1.75	0.00	0.00	Open
4	-3.35	0.00	0.00	Open
5	-3.35	0.00	0.00	Open
9	-7.25	0.00	0.00	Open
10	-6.65	0.00	0.00	Open
6	-3.35	0.00	0.00	Open



# Max Day + Fire Flow



\*\*\*\*\*  
 \* E P A N E T \*  
 \* Hydraulic and Water Quality \*  
 \* Analysis for Pipe Networks \*  
 \* Version 2.0 \*  
 \*\*\*\*\*

Input File: 1135\_Max-Day+FF.net

Link - Node Table:

Link ID	Start Node	End Node	Length m	Diameter mm
1	Bldg-B	2	64	200
2	2	Metro	109	200
3	2	Bldg-A	28.5	200
4	Bldg-A	hyd1	7	200
5	hyd1	hyd2	73	200
9	Bldg-C	1	53	200
10	Bldg-B	7	52	200
6	hyd2	Bldg-C	18	200

Node Results:

Node ID	Demand LPM	Head m	Pressure m	Quality
Metro	10.50	133.29	39.39	0.00
2	0.00	133.29	39.54	0.00
Bldg-A	2.40	132.76	38.96	0.00
hyd1	5678.00	132.57	38.57	0.00
Bldg-C	5.90	134.32	40.67	0.00
Bldg-B	2.20	134.51	40.36	0.00
hyd2	322.00	133.87	40.02	0.00
7	-2896.89	135.60	0.00	0.00 Reservoir
1	-3124.11	135.60	0.00	0.00 Reservoir

Link Results:

Link ID	Flow LPM	Velocity m/s	Headloss m/km	Status
1	2894.69	1.54	18.99	Open
2	10.50	0.01	0.00	Open
3	2884.19	1.53	18.76	Open
4	2881.79	1.53	26.43	Open
5	-2796.21	1.48	17.80	Open
9	-3124.11	1.66	24.12	Open
10	-2896.89	1.54	21.01	Open
6	-3118.21	1.65	24.97	Open





```

*****
*                               E P A N E T                               *
*                               Hydraulic and Water Quality                 *
*                               Analysis for Pipe Networks                   *
*                               Version 2.0                                 *
*****

```

Input File: 1135\_Peak-Hour.net

## Link - Node Table:

Link ID	Start Node	End Node	Length m	Diameter mm
1	Bldg-B	2	64	200
2	2	Metro	109	200
3	2	Bldg-A	28.5	200
4	Bldg-A	hyd1	7	200
5	hyd1	hyd2	73	200
9	Bldg-C	1	53	200
10	Bldg-B	7	52	200
6	hyd2	Bldg-C	18	200

## Node Results:

Node ID	Demand LPM	Head m	Pressure m	Quality
Metro	18.90	139.00	45.10	0.00
2	0.00	139.00	45.25	0.00
Bldg-A	4.40	139.00	45.20	0.00
hyd1	0.00	139.00	45.00	0.00
Bldg-C	10.50	139.00	45.35	0.00
Bldg-B	3.90	139.00	44.85	0.00
hyd2	0.00	139.00	45.15	0.00
7	-18.07	139.00	0.00	0.00 Reservoir
1	-19.63	139.00	0.00	0.00 Reservoir

## Link Results:

Link ID	Flow LPM	Velocity m/s	Headloss m/km	Status
1	14.17	0.01	0.00	Open
2	18.90	0.01	0.00	Open
3	-4.73	0.00	0.00	Open
4	-9.13	0.00	0.00	Open
5	-9.13	0.00	0.00	Open
9	-19.63	0.01	0.00	Open
10	-18.07	0.01	0.00	Open
6	-9.13	0.00	0.00	Open







---

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## ***APPENDIX C***

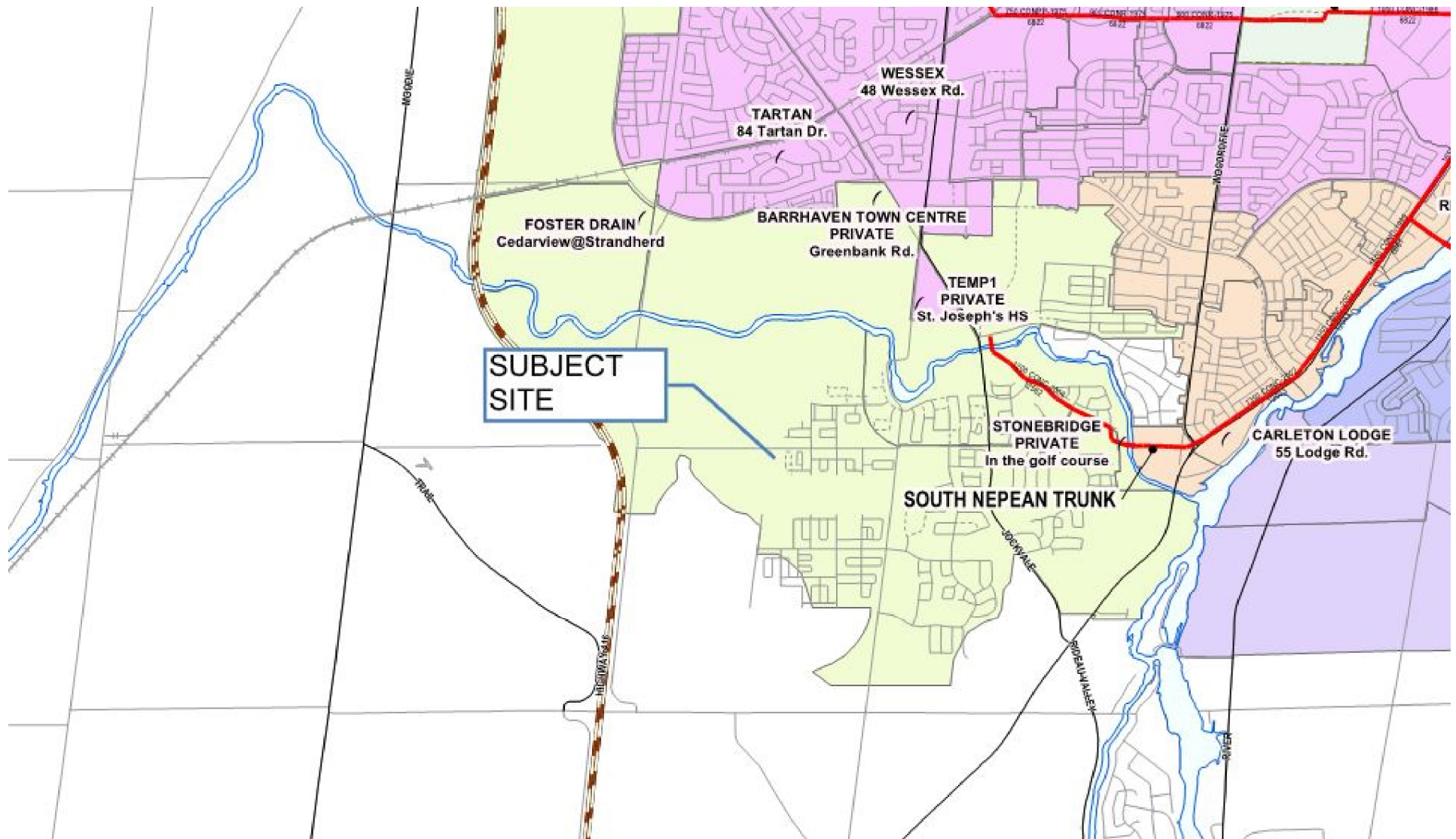
### ***Wastewater Collection***

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# Sanitary Trunk Sewer and Collection Area Map



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



Site Area 2.200 ha

Extraneous Flow Allowances

Infiltration / Inflow (Dry)	0.11 L/s
Infiltration / Inflow (Wet)	0.62 L/s
Infiltration / Inflow (Total)	0.73 L/s

Institutional / Commercial / Industrial Contributions

Property Type	Unit Rate	No. of Units	Avg Wastewater (L/s)
Metro	5 L/m <sup>2</sup> /d	4,024	0.47
Bldg A	5 L/m <sup>2</sup> /d	929	0.11
Bldg B	5 L/m <sup>2</sup> /d	830	0.10
Bldg C (Retail)	5 L/m <sup>2</sup> /d	530	0.06
Bldg C (Office)	75 L/9.3m <sup>2</sup> /d	530	0.10

Average I/C/I Flow 0.83

Peak Institutional / Commercial Flow 1.24

Peak I/C/I Flow 1.48

\* assuming a 12 hour commercial operation

\*\* peak industrial flow per City of Ottawa Sewer Design Guidelines Appendix 4B











Total Estimated Average Dry Weather Flow Rate	0.94 L/s
Total Estimated Peak Dry Weather Flow Rate	1.59 L/s
Total Estimated Peak Wet Weather Flow Rate	2.21 L/s



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Legend

-  BARRHAVEN SOUTH COMMUNITY BOUNDARY
-  EXISTING NODES
-  FUTURE NODES
-  EXISTING SEWER
-  FUTURE SEWER
-  EXISTING SEWER (FROM 2007 MSS)
-  RIVER
-  100 YEAR FLOOD PLAIN
-  SANITARY DRAINAGE CATCHMENTS
-  SANITARY CATCHMENT INFORMATION

Notes

1	ISSUED FOR MSS ADDENDUM	LP	AP	14.11.28
Revision		By	Appd.	YY.MM.DD

File Name:	163400999-SAN-DRAWING4.MXD	LP	AP	LP	14.11.28
		Dwn.	Chkd.	Dsgn.	YY.MM.DD

Permit-Seal

Client/Project

CITY OF OTTAWA

BARRHAVEN SOUTH MASTER  
SERVICING STUDY ADDENDUM

Ottawa, ON

Title

SANITARY SERVICING PLAN

Project No.	163400999	Scale	0 75 150 300 1:5,000
Drawing No.	A-4	Sheet	4 of 9

Revision 1

		Area:		SANITARY SEWER DESIGN SHEET (City of Ottawa)										DESIGN PARAMETERS																As per CDP (units/ha)																																															
BARRHAVEN SOUTH MASTER SERVICING STUDY				FILE NUMBER: 163400999										Colour code: <div>HMB values</div> <div>Hard coded values</div> <div>Most US MH</div> <div>Calculated value</div> <div>Estimated value</div> <div>updated value</div> <div>Value from subdivision design</div> <div>MH receiving flow from 2 or more sewers</div>																MAX PEAK FACTOR (RES.)= 4.0 MIN PEAK FACTOR (RES.)= 2.0 PEAKING FACTOR (INDUSTRIAL): 2.4 PEAKING FACTOR (COMM., INST.): 1.5 PERSONS / SINGLE UNIT 3.4 PERSONS / TOWNHOME 2.7 PERSONS / APARTMENT 1.8																AVG. DAILY FLOW / PERSON 350 L/p/day COMMERCIAL 50,000 L/ha/day INDUSTRIAL (HEAVY) 55,000 L/ha/day INDUSTRIAL (LIGHT) 35,000 L/ha/day INSTITUTIONAL 50,000 L/ha/day INFILTRATION 0.28 L/s/ha																MINIMUM VELOCITY 0.60 m/s MAXIMUM VELOCITY 3.00 m/s MANNINGS n 0.013 BEDDING CLASS B MINIMUM COVER 2.50 m															
DATE: 2017/09/29 REVISION: 2 DESIGNED BY: LP CHECKED BY: /																																																																													
LOCATION				RESIDENTIAL AREA AND POPULATION										COMMERCIAL		INDUSTRIAL (L)		INDUSTRIAL (H)		INSTITUTIONAL		GREEN / UNUSED		C+H	INFILTRATION			TOTAL	PIPE																																																
AREA ID NUMBER	Source	FROM M.H.	TO M.H.	DEV AREA (ha)	DEV POP	ADD'N RES AREA (ha)	ADD'N POP	TOTAL AREA (ha)	TOTAL POP	CUMULATIVE AREA (ha)	POP.	PEAK FACT.	PEAK FLOW (L/s)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	PEAK FLOW (L/s)	TOTAL AREA (ha)	ACCU. AREA (ha)	INFILT. FLOW (L/s)	FLOW (L/s)	LENGTH (m)	DIA (mm)	MATERIAL	SLOPE (%)	CAP. (FULL) (L/s)	CAP. V PEAK FLOW (%)	VEL. (FULL) (m/s)	VEL. (ACT.) (m/s)																																											
MSS-A-23		MA11	MA10	0.00	0	14.2	1,523	14.2	1,523	14.20	1,523	3.67	22.6	0.0	0.0	0.0	0.0	0.0	0.0	2.8	2.8	2.5	2.5	2	19.5	19.5	5.5	30.1	482.1	300	PVC	0.75	87.6	34%	1.20	1.08																																									
MSS-A-22		MA10	MH57A	0.00	0	12.8	1,371	12.8	1,371	27.00	2,894	3.46	40.6	0.0	0.0	0.0	0.0	0.0	0.0	7.2	10.0	14.5	17.0	8.7	34.5	54.0	15.1	64.4	449.7	375	PVC	0.40	115.1	56%	1.01	1.04																																									
Realigned Greenbank Road																																																																													
MSS-A-21		MA14	MA13	0.0	0	4.8	513	4.8	513	4.8	513	3.97	8.3	0.0	0.0	0.0	0.0	0.0	0.0	7.5	7.5	0.0	0.0	6.5	12.3	12.3	3.4	18.2	295.0	250	PVC	1.30	71.4	25%	1.40	1.12																																									
N-4		MA13	MH57A	0.0	0	11.0	1,176	11.0	1,176	15.8	1,689	3.64	24.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.5	0.5	0.5	6.5	11.5	23.8	6.7	38.1	413.1	375	PVC	0.30	100.3	38%	0.88	0.81																																									
Cambrian Road																																																																													
N-5		MH57A	MH13A	0.0	0	4.3	458	4.3	458	47.1	5,041	3.24	66.2	3.4	3.4	0.0	0.0	0.0	0.0	0.0	17.5	0.0	17.5	18.1	7.7	85.5	23.9	108.2	216.5	500	CPP	0.25	188.2	57%	0.96	0.99																																									
N-2		MH13A	MH15A	6.2	631	0.0	3	6.2	634	53.3	5,675	3.19	73.3	0.0	3.4	0.0	0.0	0.0	0.0	0.0	17.5	0.0	17.5	18.1	6.2	91.7	25.7	117.1	165.2	500	CPP	0.20	168.6	69%	0.86	0.93																																									
N-6		MH15A	MH17A	5.6	868	0.0	2	5.6	870	58.9	6,545	3.13	83.0	0.0	3.4	0.0	0.0	0.0	0.0	0.0	17.5	0.0	17.5	18.1	5.6	97.3	27.2	128.3	202.0	600	CPP	0.13	230.7	56%	0.79	0.81																																									
River Mist Road																																																																													
MSS-A-18	Stantec	MH163	162	6.5	543	0.0	0	6.5	543	6.5	543	3.96	8.7	0.0	0.0	0.0	0.0	0.0	0.0	2.8	2.8	0.9	0.9	2.4	10.2	10.2	2.9	14.0	36.3	200	PVC	1.15	35.8	39%	1.12	1.04																																									
	Stantec	162	161	0.0	0	0.0	0	0.0	0	6.5	543	3.96	8.7	0.0	0.0	0.0	0.0	0.0	0.0	2.8	0.9	0.9	2.4	0.0	10.2	2.9	14.0	87.2	250	PVC	1.15	67.3	21%	1.32	1.00																																										
	Stantec	161	EX151	0.0	0	0.0	0	0.0	0	6.5	543	3.96	8.7	0.0	0.0	0.0	0.0	0.0	0.0	2.8	0.9	0.9	2.4	0.0	10.2	2.9	14.0	75.6	250	PVC	1.15	67.3	21%	1.32	1.00																																										
	Stantec	EX151	MH142	0.0	0	0.0	0	0.0	0	6.5	543	3.96	8.7	0.0	0.0	0.0	0.0	0.0	0.0	2.8	0.9	0.9	2.4	0.0	10.2	2.9	14.0	44.4	300	PVC	1.40	119.0	12%	1.63	1.08																																										
N-14	Stantec	MH142	EX139	8.2	825	1.0	102	9.2	927	15.7	1,470	3.69	22.0	0.0	0.0	0.0	0.0	0.0	0.0	2.8	0.9	0.9	2.4	9.2	19.4	5.4	29.8	74.8	300	PVC	0.40	63.5	47%	0.87	0.85																																										
	Stantec	EX139	EX136	0.0	0	0.0	0	0.0	0	15.7	1,470	3.69	22.0	0.0	0.0	0.0	0.0	0.0	0.0	2.8	0.9	0.9	2.4	0.0	19.4	5.4	29.8	64.7	300	PVC	0.40	63.5	47%	0.87	0.85																																										
	Stantec	EX136	MH126	0.0	0	0.0	0	0.0	0	15.7	1,470	3.69	22.0	0.0	0.0	0.0	0.0	0.0	0.0	2.8	0.9	0.9	2.4	0.0	19.4	5.4	29.8	78.9	300	PVC	0.41	64.2	46%	0.88	0.86																																										
N-15	Stantec	MH126	EX123	16.5	954	0.0	0	16.5	954	32.2	2,424	3.52	34.6	0.0	0.0	0.0	0.0	0.0	0.0	4.9	0.0	0.9	4.3	18.6	38.0	10.6	49.5	71.3	375	PVC	0.45	122.0	41%	1.07	1.01																																										
	Stantec	EX123	MH112	0.0	0	0.0	0	0.0	0	32.2	2,424	3.52	34.6	0.0	0.0	0.0	0.0	0.0	0.0	4.9	0.0	0.9	4.3	0.0	38.0	10.6	49.5	90.3	375	PVC	0.42	118.6	42%	1.04	0.99																																										
N-16	Stantec	MH112	EX102	8.3	689	0.0	0	8.3	689	40.5	3,113	3.43	43.3	0.0	0.0	0.0	0.0	0.0	0.0	4.9	0.0	0.9	4.3	8.3	46.3	13.0	60.6	68.0	375	PVC	0.31	101.5	60%	0.89	0.93																																										
	Stantec	EX102	EX101	0.0	0	0.0	0	0.0	0	40.5	3,113	3.43	43.3	0.0	0.0	0.0	0.0	0.0	0.0	4.9	0.0	0.9	4.3	0.0	46.3	13.0	60.6	34.0	375	PVC	0.29	98.0	62%	0.86	0.91																																										
	IBI	EX101	MH43A	0.0	0	0.0	0	0.0	0	40.5	3,113	3.43	43.3	0.0	0.0	0.0	0.0	0.0	0.0	4.9	0.0	0.9	4.3	0.0	46.3	13.0	60.6	38.0	375	PVC	0.30	100.3	60%	0.88	0.92																																										
N-12	IBI	MH43A	MH44A	6.6	352	0.0	0	6.6	352	47.1	3,465	3.39	47.6	0.0	0.0	0.0	0.0	0.0	0.0	4.9	0.0	0.9	4.3	6.6	52.9	14.8	66.7	81.0	375	PVC	0.30	100.3	67%	0.88	0.95																																										
	IBI	MH44A	MH45A	0.0	0	0.0	0	0.0	0	47.1	3,465	3.39	47.6	0.0	0.0	0.0	0.0	0.0	0.0	4.9	0.0	0.9	4.3	0.0	52.9	14.8	66.7	64.0	375	PVC	0.30	100.3	67%	0.88	0.95																																										
	IBI	MH45A	MH46A	0.0	0	0.0	0	0.0	0	47.1	3,465	3.39	47.6	0.0	0.0	0.0	0.0	0.0	0.0	4.9	0.0	0.9	4.3	0.0	52.9	14.8	66.7	85.0	375	PVC	0.30	100.3	67%	0.88	0.95																																										
N-10	IBI	MH46A	MH47A	8.4	562	0.0	0	8.4	562	55.5	4,027	3.33	54.3	0.0	0.0	0.0	0.0	0.0	0.0	4.9	1.6	2.5	4.3	10.0	62.9	17.6	76.2	41.0	375	PVC	0.30	100.3	76%	0.88	0.98																																										
	DSEL	MH47A	MH101A	0.0	0	0.0	0	0.0	0	55.5	4,027	3.33	54.3	0.0	0.0	0.0	0.0	0.0	0.0	4.9	0.0	2.5	4.3	0.0	62.9	17.6	76.2	64.0	375	PVC	0.30	100.3	76%	0.88	0.98																																										
N-7	DSEL	MH101A	MH102A	0.0	0	0.0	0	0.0	0	55.5	4,027	3.33	54.3	0.0	0.0	0.0	0.0	0.0	0.0	4.9	0.0	2.5																																																							



		Area:		BARRHAVEN SOUTH				SANITARY SEWER DESIGN SHEET								
		E		MASTER SERVICING				PIPE DESIGN Colour code: Hard coded values Calculated value Value from subdivision design								
		MAS		STUDY												
		DATE: 2017/09/29														
REVISION: 1		FILE NUMBER: 163400999				Most US MH Estimated value MH receiving flow from 2 or more sewers										
DESIGNED: LP																
CHECKED: /																
LOCATION				CALCULATED VALUES					UPSTREAM				DOWNSTREAM			
AREA ID NUMBER	Source	FROM M.H.	TO M.H.	ACTUAL PIPE SIZE (mm)	AREA (m <sup>2</sup> )	HYDR. RADIUS	SURCHARGE VELOCITY (m/s)	DEPTH OF FLOW (m)	GROUND ELEVATION (m)	OBVERT ELEVATION (m)	INVERT ELEVATION (m)	U/S COVER (m)	GROUND ELEVATION (m)	OBVERT ELEVATION (m)	INVERT ELEVATION (m)	D/S COVER (m)
MSS-A-23		MA11	MA10	305	0.073	0.076			100.00	95.000	94.695	5.00	93.50	91.384	91.079	2.12
MSS-A-22		MA10	MH57A	381	0.114	0.095			93.50	91.324	90.943	2.18	93.60	89.525	89.144	4.07
^ must be above 88.01																
Realigned Greenbank Road		MA14	MA13	254	0.051	0.064			103.00	96.100	95.846	6.90	95.00	92.265	92.011	2.74
MSS-A-21		MA13	MH57A	381	0.114	0.095			95.00	89.800	89.419	5.20	93.60	88.561	88.180	5.04
^ must be above plug @ 88.151																
N-4		MA13	MH57A	381	0.114	0.095			95.00	89.800	89.419	5.20	93.60	88.561	88.180	5.04
Cambrian Road		MH57A	MH13A	500	0.196	0.125			93.60	88.010	87.510	5.59	95.00	87.469	86.969	7.53
N-5		MH13A	MH15A	500	0.196	0.125			95.00	87.469	86.969	7.53	95.00	87.139	86.639	7.86
N-2		MH15A	MH17A	610	0.292	0.152			95.00	87.139	86.529	7.86	97.00	86.876	86.266	10.12
N-6		MH17A	MH19A	610	0.292	0.152			95.00	86.876	86.266	10.12	97.00	86.546	85.936	10.12
River Mist Road		MH19A	MH21A	610	0.292	0.152			95.00	86.546	85.936	10.12	97.00	86.216	85.606	10.12
MSS-A-18	Stantec	MH163	162	203	0.032	0.050	0.333	0.058	100.00	96.000	95.797	4.00	99.55	95.580	95.380	3.97
	Stantec	162	161	254	0.051	0.064	0.284	0.053	99.55	95.580	95.330	3.97	98.55	94.580	94.327	3.97
	Stantec	161	EX151	254	0.051	0.064	0.285	0.053	98.55	94.540	94.292	4.00	97.88	93.670	93.423	4.21
	Stantec	EX151	MH142	305	0.073	0.076	0.201	0.036	97.88	93.670	93.373	4.21	97.48	93.050	92.752	4.42
N-14	Stantec	MH142	EX139	305	0.073	0.076	0.351	0.120	97.48	93.030	92.732	4.44	96.84	92.730	92.433	4.11
	Stantec	EX139	EX136	305	0.073	0.076	0.366	0.126	96.84	92.710	92.411	4.13	96.66	92.450	92.152	4.21
	Stantec	EX136	MH126	305	0.073	0.076	0.383	0.129	96.66	91.650	91.350	5.01	96.85	91.320	91.024	5.53
N-15	Stantec	MH126	EX123	381	0.114	0.095	0.415	0.147	96.85	91.330	90.959	5.52	96.41	91.010	90.639	5.39
	Stantec	EX123	MH112	381	0.114	0.095	0.441	0.161	96.41	90.990	90.616	5.42	96.22	90.610	90.236	5.61
N-16	Stantec	MH112	EX102	381	0.114	0.095	0.497	0.213	96.22	90.590	90.213	5.63	95.71	90.380	90.003	5.33
	Stantec	EX102	EX101	381	0.114	0.095	0.562	0.246	95.71	90.360	89.984	5.35	95.69	90.260	89.884	5.43
	IBI	EX101	MH43A	381	0.114	0.095			95.69	90.265	89.884	5.43	95.60	90.090	89.709	5.51
N-12	IBI	MH43A	MH44A	381	0.114	0.095			95.60	90.070	89.689	5.53	95.50	89.826	89.445	5.67
	IBI	MH44A	MH45A	381	0.114	0.095			95.50	89.806	89.425	5.69	95.00	89.604	89.223	5.40
	IBI	MH45A	MH46A	381	0.114	0.095			95.00	89.594	89.213	5.41	94.20	89.339	88.958	4.86
N-10	IBI	MH46A	MH47A	381	0.114	0.095			94.20	89.319	88.938	4.88	94.20	89.181	88.800	5.02
	DSEL	MH47A	MH101A	381	0.114	0.095			94.20	89.181	88.800	5.02	94.20	88.989	88.608	5.21
	DSEL	MH101A	MH102A	381	0.114	0.095			94.20	88.969	88.588	5.23	93.80	88.777	88.396	5.02
N-7	DSEL	MH102A	MH17A	381	0.114	0.095			93.80	88.693	88.312	5.11	93.40	88.451	88.070	4.95
Cambrian Road		MH17A	MH21A	762	0.456	0.190			97.00	88.876	86.114	10.12	95.00	86.773	86.011	8.23
N-3		MH21A	MH45	762	0.456	0.190			95.00	86.773	86.011	8.23	94.50	86.412	85.650	8.09
N-8		MH45	MH43A	914	0.656	0.228			94.50	86.405	85.491	8.10	92.60	86.108	85.194	6.49
Greenbank Road		MH43A	MH44A	914	0.656	0.228			94.50	86.108	85.194	6.49	92.60	85.882	84.968	6.49
MSS-A-14	IBI	MH205A	MH98A	610	0.292	0.152			97.80	90.780	90.170	7.02	97.40	90.465	89.855	6.94
	IBI	MH98A	MH99A	610	0.292	0.152			97.40	90.443	89.833	6.96	96.90	90.130	89.520	6.77
	IBI	MH99A	MH100A	610	0.292	0.152			96.90	90.105	89.495	6.80	96.60	89.835	89.225	6.77
	IBI	MH100A	MH204A	610	0.292	0.152			96.60	89.803	89.193	6.80	96.20	89.540	88.930	6.66
	IBI	MH204A	MH206A	610	0.292	0.152			96.20	89.517	88.907	6.68	95.80	89.260	88.650	6.54
	IBI	MH206A	MH97A	610	0.292	0.152			95.80	89.260	88.650	6.54	95.40	88.948	88.338	6.45
N-13, N-13-R	IBI	MH97A	MH96A	610	0.292	0.152			95.40	88.938	88.328	6.46	95.20	88.643	88.033	6.56
	IBI	MH96A	MH95A	610	0.292	0.152			95.20	88.643	88.033	6.56	95.00	88.256	87.646	6.74
	IBI	MH95A	MH201A	610	0.292	0.152			95.00	88.256	87.646	6.74	94.50	87.887	87.277	6.61
N-11, N-11-R	IBI	MH201A	MH201B	610	0.292	0.152			94.50	87.887	87.277	6.61	94.70	87.514	86.904	7.19
	IBI	MH201B	MH200A	610	0.292	0.152			94.70	87.510	86.900	7.19	94.40	87.307	86.697	7.09
	IBI	MH200A	MH200C	610	0.292	0.152			94.40	87.241	86.631	7.16	94.80	87.001	86.391	7.80
	IBI	MH200C	MH45	610	0.292	0.152			94.80	87.001	86.391	7.80	94.50	86.405	85.795	8.10
MSS-A-15		MH45	MH435A	914	0.656	0.228			94.50	86.405	85.491	8.10	92.60	86.108	85.194	6.49
North		MH435A	MH501A	914	0.656	0.228			94.50	86.108	85.194	6.49	92.60	85.882	84.968	6.49
MSS-A-9		MA9	MA8	457	0.164	0.114			92.75	89.550	89.093	3.20	92.35	88.992	88.535	3.36
MSS-A-8		MA8	MA7	457	0.164	0.114			92.35	88.932	88.475	3.42	92.90	88.583	88.126	4.32
MSS-A-7		MA7	MA6	457	0.164	0.114			92.90	88.523	88.066	4.38	93.90	87.893	87.436	6.01
MSS-A-6		MA6	MA5	610	0.292	0.152			93.90	87.833	87.223	6.07	93.50	87.359	86.749	6.14
MSS-A-5		MA5	M27A	610	0.292	0.152			93.50	87.299	86.689	6.20	93.00	87.079	86.469	5.92
MSS-A-4		M27A	MH5200A	610	0.292	0.152			93.00	87.019	86.409	5.98	93.00	86.267	85.657	6.73
		MH5200A	MH520A	610	0.292	0.152			93.00	86.231	85.621	6.77	93.80	86.194	85.584	7.61
		MH520A	MH521A	610	0.292	0.152			93.70	86.155	85.545	7.55	93.80	86.111	85.501	7.69
N-1		MH521A	MH522A	610	0.292	0.152			93.80	86.078	85.468	7.72	92.60	86.033	85.423	6.57
		MH522A	MH435A	610	0.292	0.152			92.60	86.005	85.395	6.60	92.60	85.982	85.372	6.62
		MH435A	MH501A	914	0.656	0.228			92.60	85.982	85.068	6.62	92.60	85.967	85.053	6.63





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## ***APPENDIX D***

### ***Stormwater Management***

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Estimated Peak Stormwater Flow Rate  
City of Ottawa Sewer Design Guidelines, 2012



Existing Drainage Charateristics From Internal Site

Area	2.21 ha
C	0.39 Rational Method runoff coefficient
L	152 m
Up Elev	94.71 m
Dn Elev	93.62 m
Slope	0.7 %
Tc	31.9 min

1) Time of Concentration per Federal Aviation Administration

$$t_c = \frac{1.8(1.1 - C)L^{0.5}}{S^{0.333}}$$

tc, in minutes  
C, rational method coefficient, (-)  
L, length in ft  
S, average watershed slope in %

Estimated Peak Flow

	2-year	5-year	100-year
i	76.8	104.2	178.6 mm/hr
Q	183.9	249.5	534.4 L/s

Note:  
C value for the 100-year storm is increased by 25%, to a maximum of 1.0 per Ottawa Sewer Design Guidelines (5.4.5.2.1)

Stormwater - Proposed Development  
City of Ottawa Sewer Design Guidelines, 2012



Target Flow Rate

Area	2.21 ha
C	0.64 Rational Method runoff coefficient
t <sub>c</sub>	21.5 min
5-year	
i	67.1 mm/hr
Q	263.4 L/s

Estimated Post Development Peak Flow from Unattenuated Areas

Area ID	U1
Total Area	0.071 ha
C	0.30 Rational Method runoff coefficient

5-year						100-year				
t <sub>c</sub> (min)	i (mm/hr)	Q <sub>actual</sub> (L/s)	Q <sub>release</sub> (L/s)	Q <sub>stored</sub> (L/s)	V <sub>stored</sub> (m <sup>3</sup> )	i (mm/hr)	Q <sub>actual</sub> (L/s)	Q <sub>release</sub> (L/s)	Q <sub>stored</sub> (L/s)	V <sub>stored</sub> (m <sup>3</sup> )
16.2	79.9	4.7	4.7	0.0	0.0	136.6	10.1	10.1	0.0	0.0

Note:  
C value for the 100-year storm is increased by 25%, to a maximum of 1.0 per Ottawa Sewer Design Guidelines (5.4.5.2.1)

Area ID	U2
Total Area	0.057 ha
C	0.90 Rational Method runoff coefficient

5-Year						100-year				
t <sub>c</sub> (min)	i (mm/hr)	Q <sub>actual</sub> (L/s)	Q <sub>release</sub> (L/s)	Q <sub>stored</sub> (L/s)	V <sub>stored</sub> (m <sup>3</sup> )	i (mm/hr)	Q <sub>actual</sub> (L/s)	Q <sub>release</sub> (L/s)	Q <sub>stored</sub> (L/s)	V <sub>stored</sub> (m <sup>3</sup> )
16.2	79.9	11.4	11.4	0.0	0.0	136.6	21.6	21.6	0.0	0.0

Note:  
C value for the 100-year storm is increased by 25%, to a maximum of 1.0 per Ottawa Sewer Design Guidelines (5.4.5.2.1)

Available Surface Storage							
	Stage (m)	Ponding (m <sup>2</sup> )	100-Year HGL (m)	Head (Stage to 100-year HGL) (m)	delta d (m)	V* (m <sup>3</sup> )	V <sub>acc</sub> ** (m <sup>3</sup> )
TG	93.09	0.36	93.09	0.00	0.00	0.0	0.0
Max Ponding	93.85	528	93.09	0.76	0.76	137.3	137.3

\* V=Incremental storage volume  
\*\*V<sub>acc</sub>=Total surface and sub-surface

Area ID	U3
Total Area	0.122 ha
C	0.50 Rational Method runoff coefficient

5-Year						100-year				
t <sub>c</sub> (min)	i (mm/hr)	Q <sub>actual</sub> (L/s)	Q <sub>release</sub> (L/s)	Q <sub>stored</sub> (L/s)	V <sub>stored</sub> (m <sup>3</sup> )	i (mm/hr)	Q <sub>actual</sub> (L/s)	Q <sub>release</sub> (L/s)	Q <sub>stored</sub> (L/s)	V <sub>stored</sub> (m <sup>3</sup> )
16.2	79.9	13.5	13.5	0.0	0.0	136.6	28.9	28.9	0.0	0.0

Note:  
C value for the 100-year storm is increased by 25%, to a maximum of 1.0 per Ottawa Sewer Design Guidelines (5.4.5.2.1)

Surface Storage							
	Stage (m)	Ponding (m <sup>2</sup> )	100-Year HGL (m)	Head (Stage to 100-year HGL) (m)	delta d (m)	V* (m <sup>3</sup> )	V <sub>acc</sub> ** (m <sup>3</sup> )
TG	93.60	0.72	93.09	0.51	0.00	0.0	0.0
Max Ponding	93.90	479	93.09	0.81	0.30	49.8	49.8

\* V=Incremental storage volume  
\*\*V<sub>acc</sub>=Total surface and sub-surface

Area ID	U4
Total Area	0.015 ha
C	0.20 Rational Method runoff coefficient

5-Year						100-year				
t <sub>c</sub> (min)	i (mm/hr)	Q <sub>actual</sub> (L/s)	Q <sub>release</sub> (L/s)	Q <sub>stored</sub> (L/s)	V <sub>stored</sub> (m <sup>3</sup> )	i (mm/hr)	Q <sub>actual</sub> (L/s)	Q <sub>release</sub> (L/s)	Q <sub>stored</sub> (L/s)	V <sub>stored</sub> (m <sup>3</sup> )
16.2	79.9	0.7	0.7	0.0	0.0	136.6	1.4	1.4	0.0	0.0

Note:  
C value for the 100-year storm is increased by 25%, to a maximum of 1.0 per Ottawa Sewer Design Guidelines (5.4.5.2.1)

Area ID	U5
Total Area	0.028 ha
C	0.40 Rational Method runoff coefficient

5-Year						100-year				
t <sub>c</sub> (min)	i (mm/hr)	Q <sub>actual</sub> (L/s)	Q <sub>release</sub> (L/s)	Q <sub>stored</sub> (L/s)	V <sub>stored</sub> (m <sup>3</sup> )	i (mm/hr)	Q <sub>actual</sub> (L/s)	Q <sub>release</sub> (L/s)	Q <sub>stored</sub> (L/s)	V <sub>stored</sub> (m <sup>3</sup> )
16.2	79.9	2.5	2.5	0.0	0.0	136.6	5.3	5.3	0.0	0.0

Note:  
C value for the 100-year storm is increased by 25%, to a maximum of 1.0 per Ottawa Sewer Design Guidelines (5.4.5.2.1)

Estimated Post Development Peak Flow from Attenuated Areas

Building ID	METRO
Roof Area	0.401 ha
Avail Storage Area	0.381
C	0.90 Rational Method runoff coefficient
t <sub>c</sub>	10 min, t <sub>c</sub> at outlet without restriction

*Note: Rational Method Coefficient "C" increased by 25% for 100-year calculations*

Estimated Number of Roof Drains	
Building Length	69
Building Width	55.6
Number of Drains	21
m <sup>2</sup> / Drain	181.4 max 232.25m <sup>2</sup> /notch as recommended by Zurn for Ottawa

Roof Top Rating Curve per Zurn Model Z-105-5						
d	A	V <sub>acc</sub>	V <sub>avail</sub>	Q <sub>notch</sub>	Q <sub>roof</sub>	V <sub>drawdown</sub>
(m)	(m <sup>2</sup> )	(m <sup>3</sup> )	(m <sup>3</sup> )	(L/s)	(L/s)	(hr)
0.000	0	0.0	0.0	0.00	0.00	0.00
0.025	238.1	2.0	2.0	0.38	7.98	0.07
0.050	952.4	13.9	15.9	0.77	16.17	0.31
0.075	2142.8	37.7	53.6	1.14	23.94	0.75
0.100	3809.5	73.4	127.0	1.52	31.92	1.38
0.125	3809.5	95.2	222.2	1.90	39.90	2.05
0.150	3809.5	95.2	317.5	2.28	47.88	2.60

\* Assumes one notch opening per drain, assumes maximum slope of 10cm

t <sub>c</sub> (min)	5-year					100-year				
	i (mm/hr)	Q <sub>actual</sub> (L/s)	Q <sub>release</sub> (L/s)	Q <sub>stored</sub> (L/s)	V <sub>stored</sub> (m <sup>3</sup> )	i (mm/hr)	Q <sub>actual</sub> (L/s)	Q <sub>release</sub> (L/s)	Q <sub>stored</sub> (L/s)	V <sub>stored</sub> (m <sup>3</sup> )
10	104.2	104.5	24.2	80.3	48.2	178.6	198.9	31.9	167.0	100.2
15	83.6	83.8	24.2	59.6	53.7	142.9	159.2	31.9	127.3	114.5
20	70.3	70.4	24.2	46.3	55.5	120.0	133.6	31.9	101.7	122.1
25	60.9	61.0	24.2	36.9	55.3	103.8	115.7	31.9	83.8	125.7
30	53.9	54.1	24.2	29.9	53.8	91.9	102.3	31.9	70.4	126.8
35	48.5	48.6	24.2	24.5	51.4	82.6	92.0	31.9	60.1	126.2
40	44.2	44.3	24.2	20.1	48.3	75.1	83.7	31.9	51.8	124.3
45	40.6	40.7	24.2	16.6	44.8	69.1	76.9	31.9	45.0	121.5
50	37.7	37.7	24.2	13.6	40.8	64.0	71.2	31.9	39.3	118.0
55	35.1	35.2	24.2	11.1	36.5	59.6	66.4	31.9	34.5	113.9
60	32.9	33.0	24.2	8.9	31.9	55.9	62.3	31.9	30.4	109.3
65	31.0	31.1	24.2	7.0	27.2	52.6	58.6	31.9	26.7	104.3
70	29.4	29.4	24.2	5.3	22.2	49.8	55.5	31.9	23.6	99.0
75	27.9	28.0	24.2	3.8	17.1	47.3	52.6	31.9	20.7	93.3
80	26.6	26.6	24.2	2.5	11.9	45.0	50.1	31.9	18.2	87.4
85	25.4	25.4	24.2	1.3	6.5	43.0	47.8	31.9	15.9	81.3
90	24.3	24.3	24.2	0.2	1.1	41.1	45.8	31.9	13.9	75.0
95	23.3	23.4	23.4	0.0	0.0	39.4	43.9	31.9	12.0	68.6
100	22.4	22.5	22.5	0.0	0.0	37.9	42.2	31.9	10.3	61.9
105	21.6	21.6	21.6	0.0	0.0	36.5	40.7	31.9	8.8	55.2
110	20.8	20.9	20.9	0.0	0.0	35.2	39.2	31.9	7.3	48.3

5-year Q <sub>roof</sub>	24.15 L/s	100-year Q <sub>roof</sub>	31.90 L/s
5-year Max. Storage Required	55.5 m <sup>3</sup>	100-year Max. Storage Required	126.8 m <sup>3</sup>
5-year Storage Depth	0.076 m	100-year Storage Depth	0.100 m
5-year Estimated Drawdown Time	0.76 hr	100-year Estimated Drawdown Time	1.38 hr

Building ID	BLDG A
Roof Area	0.093 ha
Avail Storage Area	0.088
C	0.90 Rational Method runoff coefficient
t <sub>c</sub>	10 min, t <sub>c</sub> at outlet without restriction

*Note: Rational Method Coefficient "C" increased by 25% for 100-year calculations*

Estimated Number of Roof Drains	
Building Length	33
Building Width	26
Number of Drains	7
m <sup>2</sup> / Drain	126.2 max 232.25m <sup>2</sup> /notch as recommended by Zurn for Ottawa

Roof Top Rating Curve per Zurn Model Z-105-5						
d	A	V <sub>acc</sub>	V <sub>avall</sub>	Q <sub>notch</sub>	Q <sub>roof</sub>	V <sub>drawdown</sub>
(m)	(m <sup>2</sup> )	(m <sup>3</sup> )	(m <sup>3</sup> )	(L/s)	(L/s)	(hr)
0.000	0	0.0	0.0	0.00	0.00	0.00
0.025	55.2	0.5	0.5	0.38	2.66	0.05
0.050	220.9	3.2	3.7	0.77	5.39	0.21
0.075	497.0	8.7	12.4	1.14	7.98	0.52
0.100	883.5	17.0	29.5	1.52	10.64	0.96
0.125	883.5	22.1	51.5	1.90	13.30	1.42
0.150	883.5	22.1	73.6	2.28	15.96	1.81

\* Assumes one notch opening per drain, assumes maximum slope of 10cm

t <sub>c</sub> (min)	5-year					100-year				
	i (mm/hr)	Q <sub>actual</sub> (L/s)	Q <sub>release</sub> (L/s)	Q <sub>stored</sub> (L/s)	V <sub>stored</sub> (m <sup>3</sup> )	i (mm/hr)	Q <sub>actual</sub> (L/s)	Q <sub>release</sub> (L/s)	Q <sub>stored</sub> (L/s)	V <sub>stored</sub> (m <sup>3</sup> )
10	104.2	24.2	7.5	16.7	10.0	178.6	46.1	10.0	36.1	21.7
15	83.6	19.4	7.5	11.9	10.7	142.9	36.9	10.0	26.9	24.2
20	70.3	16.3	7.5	8.8	10.6	120.0	31.0	10.0	21.0	25.2
25	60.9	14.2	7.5	6.7	10.0	103.8	26.8	10.0	16.8	25.3
30	53.9	12.5	7.5	5.1	9.1	91.9	23.7	10.0	13.7	24.7
35	48.5	11.3	7.5	3.8	8.0	82.6	21.3	10.0	11.3	23.8
40	44.2	10.3	7.5	2.8	6.7	75.1	19.4	10.0	9.4	22.6
45	40.6	9.4	7.5	2.0	5.3	69.1	17.8	10.0	7.9	21.2
50	37.7	8.8	7.5	1.3	3.8	64.0	16.5	10.0	6.5	19.6
55	35.1	8.2	7.5	0.7	2.3	59.6	15.4	10.0	5.4	17.9
60	32.9	7.7	7.5	0.2	0.6	55.9	14.4	10.0	4.5	16.0
65	31.0	7.2	7.2	0.0	0.0	52.6	13.6	10.0	3.6	14.1
70	29.4	6.8	6.8	0.0	0.0	49.8	12.9	10.0	2.9	12.1
75	27.9	6.5	6.5	0.0	0.0	47.3	12.2	10.0	2.2	10.0
80	26.6	6.2	6.2	0.0	0.0	45.0	11.6	10.0	1.6	7.9
85	25.4	5.9	5.9	0.0	0.0	43.0	11.1	10.0	1.1	5.7
90	24.3	5.6	5.6	0.0	0.0	41.1	10.6	10.0	0.6	3.4
95	23.3	5.4	5.4	0.0	0.0	39.4	10.2	10.0	0.2	1.1
100	22.4	5.2	5.2	0.0	0.0	37.9	9.8	9.8	0.0	0.0
105	21.6	5.0	5.0	0.0	0.0	36.5	9.4	9.4	0.0	0.0
110	20.8	4.8	4.8	0.0	0.0	35.2	9.1	9.1	0.0	0.0

5-year Q <sub>roof</sub>	7.48 L/s	100-year Q <sub>roof</sub>	9.99 L/s
5-year Max. Storage Required	10.7 m <sup>3</sup>	100-year Max. Storage Required	25.3 m <sup>3</sup>
5-year Storage Depth	0.070 m	100-year Storage Depth	0.094 m
5-year Estimated Drawdown Time	0.46 hr	100-year Estimated Drawdown Time	0.85 hr

Building ID

Roof Area

Avail Storage Area

C

t<sub>c</sub>

BLDG B

0.083 ha

0.079

0.90 Rational Method runoff coefficient

10 min, t<sub>c</sub> at outlet without restriction

Note: Rational Method Coefficient "C" increased by 25% for 100-year calculations

Estimated Number of Roof Drains

Building Length

Building Width

Number of Drains

m<sup>2</sup> / Drain

34

23

7

112.6 max 232.25m<sup>2</sup>/notch as recommended by Zurn for Ottawa

Roof Top Rating Curve per Zurn Model Z-105-5						
d	A	V <sub>acc</sub>	V <sub>avall</sub>	Q <sub>notch</sub>	Q <sub>roof</sub>	V <sub>drawdown</sub>
(m)	(m <sup>2</sup> )	(m <sup>3</sup> )	(m <sup>3</sup> )	(L/s)	(L/s)	(hr)
0.000	0	0.0	0.0	0.00	0.00	0.00
0.025	49.3	0.4	0.4	0.38	2.66	0.04
0.050	197.1	2.9	3.3	0.77	5.39	0.19
0.075	443.5	7.8	11.1	1.14	7.98	0.46
0.100	788.5	15.2	26.3	1.52	10.64	0.86
0.125	788.5	19.7	46.0	1.90	13.30	1.27
0.150	788.5	19.7	65.7	2.28	15.96	1.61

\* Assumes one notch opening per drain, assumes maximum slope of 10cm

t <sub>c</sub> (min)	5-year						100-year				
	i (mm/hr)	Q <sub>actual</sub> (L/s)	Q <sub>release</sub> (L/s)	Q <sub>stored</sub> (L/s)	V <sub>stored</sub> (m <sup>3</sup> )		i (mm/hr)	Q <sub>actual</sub> (L/s)	Q <sub>release</sub> (L/s)	Q <sub>stored</sub> (L/s)	V <sub>stored</sub> (m <sup>3</sup> )
10	104.2	21.6	7.3	14.3	8.6		178.6	41.2	9.8	31.4	18.8
15	83.6	17.3	7.3	10.0	9.0		142.9	32.9	9.8	23.2	20.8
20	70.3	14.6	7.3	7.3	8.7		120.0	27.7	9.8	17.9	21.4
25	60.9	12.6	7.3	5.3	8.0		103.8	23.9	9.8	14.2	21.2
30	53.9	11.2	7.3	3.9	7.0		91.9	21.2	9.8	11.4	20.5
35	48.5	10.1	7.3	2.8	5.8		82.6	19.0	9.8	9.2	19.4
40	44.2	9.2	7.3	1.9	4.5		75.1	17.3	9.8	7.5	18.1
45	40.6	8.4	7.3	1.1	3.1		69.1	15.9	9.8	6.1	16.5
50	37.7	7.8	7.3	0.5	1.5		64.0	14.7	9.8	5.0	14.9
55	35.1	7.3	7.3	0.0	0.0		59.6	13.7	9.8	4.0	13.1
60	32.9	6.8	6.8	0.0	0.0		55.9	12.9	9.8	3.1	11.1
65	31.0	6.4	6.4	0.0	0.0		52.6	12.1	9.8	2.3	9.2
70	29.4	6.1	6.1	0.0	0.0		49.8	11.5	9.8	1.7	7.1
75	27.9	5.8	5.8	0.0	0.0		47.3	10.9	9.8	1.1	5.0
80	26.6	5.5	5.5	0.0	0.0		45.0	10.4	9.8	0.6	2.8
85	25.4	5.3	5.3	0.0	0.0		43.0	9.9	9.8	0.1	0.6
90	24.3	5.0	5.0	0.0	0.0		41.1	9.5	9.5	0.0	0.0
95	23.3	4.8	4.8	0.0	0.0		39.4	9.1	9.1	0.0	0.0
100	22.4	4.6	4.6	0.0	0.0		37.9	8.7	8.7	0.0	0.0
105	21.6	4.5	4.5	0.0	0.0		36.5	8.4	8.4	0.0	0.0
110	20.8	4.3	4.3	0.0	0.0		35.2	8.1	8.1	0.0	0.0

5-year Q<sub>roof</sub>

5-year Max. Storage Required

5-year Storage Depth

5-year Estimated Drawdown Time

7.30 L/s

9.0 m<sup>3</sup>

0.068 m

0.39 hr

100-year Q<sub>roof</sub>

100-year Max. Storage Required

100-year Storage Depth

10-year Estimated Drawdown Time

9.79 L/s

21.4 m<sup>3</sup>

0.092 m

0.73 hr

Building ID

Roof Area

Avail Storage Area

C

t<sub>c</sub>

BLDG C

0.055 ha

0.052

0.90 Rational Method runoff coefficient

10 min, t<sub>c</sub> at outlet without restriction

Note: Rational Method Coefficient "C" increased by 25% for 100-year calculations

Estimated Number of Roof Drains

Building Length

Building Width

Number of Drains

m<sup>2</sup> / Drain

29

19

5

104.5 max 232.25m<sup>2</sup>/notch as recommended by Zurn for Ottawa

Roof Top Rating Curve per Zurn Model Z-105-5						
d	A	V <sub>acc</sub>	V <sub>avall</sub>	Q <sub>notch</sub>	Q <sub>roof</sub>	V <sub>drawdown</sub>
(m)	(m <sup>2</sup> )	(m <sup>3</sup> )	(m <sup>3</sup> )	(L/s)	(L/s)	(hr)
0.000	0	0.0	0.0	0.00	0.00	0.00
0.025	32.7	0.3	0.3	0.38	1.90	0.04
0.050	130.6	1.9	2.2	0.77	3.85	0.18
0.075	293.9	5.2	7.3	1.14	5.70	0.43
0.100	522.5	10.1	17.4	1.52	7.60	0.80
0.125	522.5	13.1	30.5	1.90	9.50	1.18
0.150	522.5	13.1	43.5	2.28	11.40	1.50

\* Assumes one notch opening per drain, assumes maximum slope of 10cm

t <sub>c</sub> (min)	5-year						100-year					
	i (mm/hr)	Q <sub>actual</sub> (L/s)	Q <sub>release</sub> (L/s)	Q <sub>stored</sub> (L/s)	V <sub>stored</sub> (m <sup>3</sup> )		i (mm/hr)	Q <sub>actual</sub> (L/s)	Q <sub>release</sub> (L/s)	Q <sub>stored</sub> (L/s)	V <sub>stored</sub> (m <sup>3</sup> )	
10	104.2	14.3	5.1	9.2	5.5		178.6	27.3	6.9	20.4	12.2	
15	83.6	11.5	5.1	6.4	5.7		142.9	21.8	6.9	14.9	13.4	
20	70.3	9.7	5.1	4.5	5.4		120.0	18.3	6.9	11.4	13.7	
25	60.9	8.4	5.1	3.3	4.9		103.8	15.9	6.9	9.0	13.4	
30	53.9	7.4	5.1	2.3	4.1		91.9	14.0	6.9	7.1	12.8	
35	48.5	6.7	5.1	1.5	3.3		82.6	12.6	6.9	5.7	12.0	
40	44.2	6.1	5.1	1.0	2.3		75.1	11.5	6.9	4.6	11.0	
45	40.6	5.6	5.1	0.5	1.3		69.1	10.5	6.9	3.6	9.9	
50	37.7	5.2	5.1	0.1	0.2		64.0	9.8	6.9	2.9	8.6	
55	35.1	4.8	4.8	0.0	0.0		59.6	9.1	6.9	2.2	7.3	
60	32.9	4.5	4.5	0.0	0.0		55.9	8.5	6.9	1.6	5.9	
65	31.0	4.3	4.3	0.0	0.0		52.6	8.0	6.9	1.1	4.5	
70	29.4	4.0	4.0	0.0	0.0		49.8	7.6	6.9	0.7	3.0	
75	27.9	3.8	3.8	0.0	0.0		47.3	7.2	6.9	0.3	1.4	
80	26.6	3.7	3.7	0.0	0.0		45.0	6.9	6.9	0.0	0.0	
85	25.4	3.5	3.5	0.0	0.0		43.0	6.6	6.6	0.0	0.0	
90	24.3	3.3	3.3	0.0	0.0		41.1	6.3	6.3	0.0	0.0	
95	23.3	3.2	3.2	0.0	0.0		39.4	6.0	6.0	0.0	0.0	
100	22.4	3.1	3.1	0.0	0.0		37.9	5.8	5.8	0.0	0.0	
105	21.6	3.0	3.0	0.0	0.0		36.5	5.6	5.6	0.0	0.0	
110	20.8	2.9	2.9	0.0	0.0		35.2	5.4	5.4	0.0	0.0	

5-year Q<sub>roof</sub>

5-year Max. Storage Required

5-year Storage Depth

5-year Estimated Drawdown Time

5.12 L/s

5.7 m<sup>3</sup>

0.067 m

0.35 hr

100-year Q<sub>roof</sub>

100-year Max. Storage Required

100-year Storage Depth

100-year Estimated Drawdown Time

6.90 L/s

13.7 m<sup>3</sup>

0.091 m

0.66 hr



Area ID            A109  
Available Sub-surface Storage  
  
Total Subsurface Storage (m³)            0.0

Stage Attenuated Areas Storage Summary

	Surface Storage					Surface and Subsurface Storage			
	Stage	Ponding	100-Year HGL	Head (Stage to 100-year HGL)	delta d	V*	V <sub>acc</sub> **	Q <sub>release</sub> †	V <sub>drawdown</sub>
	(m)	(m²)	(m)	(m)	(m)	(m³)	(m³)	(L/s)	(hr)
Orifice INV	91.29						0.0	0.0	0.00
TG	93.55	0.4	93.09	0.46	0.46	0.2	0.2	22.6	0.00
0.10m ponding	93.65	43.8	93.09	0.56	0.10	1.6	1.8	24.9	0.02
Max Ponding	93.69	78.0	93.09	0.60	0.04	2.4	4.2	25.8	0.05

\* V=Incremental storage volume  
\*\*V<sub>acc</sub>=Total surface and sub-surface  
† Q<sub>release</sub> = Release rate calculated from orifice equation

Orifice Location            STM109            Dia            125  
Total Area            0.103 ha  
C            0.50 Rational Method runoff coefficient            Note: Rational Method Coefficient "C" increased by 25% for 100-year calculations

t <sub>c</sub> (min)	5-Year						100-year				
	i (mm/hr)	Q <sub>actual</sub> (L/s)	Q <sub>release</sub> (L/s)	Q <sub>stored</sub> (L/s)	V <sub>stored</sub> (m³)		i (mm/hr)	Q <sub>actual</sub> (L/s)	Q <sub>release</sub> (L/s)	Q <sub>stored</sub> (L/s)	V <sub>stored</sub> (m³)
10	104.2	14.9	9.6	5.3	3.2		178.6	31.9	25.6	6.3	3.8
20	70.3	10.0	9.6	0.4	0.5		120.0	21.4	21.4	0.0	0.0
30	53.9	7.7	7.7	0.0	0.0		91.9	16.4	21.4	0.0	0.0
40	44.2	6.3	6.3	0.0	0.0		75.1	13.4	21.4	0.0	0.0
50	37.7	5.4	5.4	0.0	0.0		64.0	11.4	21.4	0.0	0.0
60	32.9	4.7	4.7	0.0	0.0		55.9	10.0	21.4	0.0	0.0
70	29.4	4.2	4.2	0.0	0.0		49.8	8.9	21.4	0.0	0.0
80	26.6	3.8	3.8	0.0	0.0		45.0	8.0	21.4	0.0	0.0
90	24.3	3.5	3.5	0.0	0.0		41.1	7.4	21.4	0.0	0.0
100	22.4	3.2	3.2	0.0	0.0		37.9	6.8	21.4	0.0	0.0
110	20.8	3.0	3.0	0.0	0.0		35.2	6.3	21.4	0.0	0.0
120	19.5	2.8	2.8	0.0	0.0		32.9	5.9	21.4	0.0	0.0
130	18.3	2.6	2.6	0.0	0.0		30.9	5.5	21.4	0.0	0.0
140	17.3	2.5	2.5	0.0	0.0		29.2	5.2	21.4	0.0	0.0
150	16.4	2.3	2.3	0.0	0.0		27.6	4.9	21.4	0.0	0.0
160	15.6	2.2	2.2	0.0	0.0		26.2	4.7	21.4	0.0	0.0
170	14.8	2.1	2.1	0.0	0.0		25.0	4.5	21.4	0.0	0.0
180	14.2	2.0	2.0	0.0	0.0		23.9	4.3	21.4	0.0	0.0
190	13.6	1.9	1.9	0.0	0.0		22.9	4.1	21.4	0.0	0.0
200	13.0	1.9	1.9	0.0	0.0		22.0	3.9	21.4	0.0	0.0
210	12.6	1.8	1.8	0.0	0.0		21.1	3.8	21.4	0.0	0.0
220	12.1	1.7	1.7	0.0	0.0		20.4	3.6	21.4	0.0	0.0
230	11.7	1.7	1.7	0.0	0.0		19.7	3.5	21.4	0.0	0.0
240	11.3	1.6	1.6	0.0	0.0		19.0	3.4	21.4	0.0	0.0
250	10.9	1.6	1.6	0.0	0.0		18.4	3.3	21.4	0.0	0.0
260	10.6	1.5	1.5	0.0	0.0		17.8	3.2	21.4	0.0	0.0

5-Year Q <sub>attenuated</sub>	9.60 L/s	100-year Q <sub>attenuated</sub>	25.63 L/s
5-Year Max. Storage Required	3.2 m³	100-year Max. Storage Required	3.8 m³
Est. 5-Year Storage Elevation	93.67 m	Est. 100-year Storage Elevation	93.68 m

Area ID            A110B  
Available Sub-surface Storage  
  
Total Subsurface Storage (m<sup>3</sup>)            0.0

Stage Attenuated Areas Storage Summary

	Surface Storage					Surface and Subsurface Storage			
	Stage	Ponding	100-Year HGL	Head (Stage to 100-year HGL)	delta d	V*	V <sub>acc</sub> **	Q <sub>release</sub> †	V <sub>drawdown</sub>
	(m)	(m <sup>2</sup> )	(m)	(m)	(m)	(m <sup>3</sup> )	(m <sup>3</sup> )	(L/s)	(hr)
Orifice INV	92.05						0.0	0.0	0.00
TG	93.55	0.36	93.09	0.46	0.46	0.2	0.2	9.3	0.01
Max Ponding	93.85	416	93.09	0.76	0.30	42.9	43.0	11.9	1.01

\* V=Incremental storage volume  
\*\*V<sub>acc</sub>=Total surface and sub-surface  
† Q<sub>release</sub> = Release rate calculated from orifice equation

Orifice Location            CB110B            Dia            80  
Total Area            0.060 ha  
C            0.80 Rational Method runoff coefficient      Note: Rational Method Coefficient "C" increased by 25% for 100-year calculations

t <sub>c</sub> (min)	5-Year						100-year				
	i (mm/hr)	Q <sub>actual</sub> (L/s)	Q <sub>release</sub> (L/s)	Q <sub>stored</sub> (L/s)	V <sub>stored</sub> (m <sup>3</sup> )		i (mm/hr)	Q <sub>actual</sub> (L/s)	Q <sub>release</sub> (L/s)	Q <sub>stored</sub> (L/s)	V <sub>stored</sub> (m <sup>3</sup> )
10	104.2	13.9	9.4	4.5	2.7		178.6	29.8	10.0	19.8	11.9
20	70.3	9.4	9.4	0.0	0.0		120.0	20.0	10.0	10.0	12.0
30	53.9	7.2	7.2	0.0	0.0		91.9	15.3	10.0	5.3	9.6
40	44.2	5.9	5.9	0.0	0.0		75.1	12.5	10.0	2.5	6.1
50	37.7	5.0	5.0	0.0	0.0		64.0	10.7	10.0	0.7	2.0
60	32.9	4.4	4.4	0.0	0.0		55.9	9.3	10.0	0.0	0.0
70	29.4	3.9	3.9	0.0	0.0		49.8	8.3	10.0	0.0	0.0
80	26.6	3.5	3.5	0.0	0.0		45.0	7.5	10.0	0.0	0.0
90	24.3	3.2	3.2	0.0	0.0		41.1	6.9	10.0	0.0	0.0
100	22.4	3.0	3.0	0.0	0.0		37.9	6.3	10.0	0.0	0.0
110	20.8	2.8	2.8	0.0	0.0		35.2	5.9	10.0	0.0	0.0
120	19.5	2.6	2.6	0.0	0.0		32.9	5.5	10.0	0.0	0.0
130	18.3	2.4	2.4	0.0	0.0		30.9	5.1	10.0	0.0	0.0
140	17.3	2.3	2.3	0.0	0.0		29.2	4.9	10.0	0.0	0.0
150	16.4	2.2	2.2	0.0	0.0		27.6	4.6	10.0	0.0	0.0
160	15.6	2.1	2.1	0.0	0.0		26.2	4.4	10.0	0.0	0.0
170	14.8	2.0	2.0	0.0	0.0		25.0	4.2	10.0	0.0	0.0
180	14.2	1.9	1.9	0.0	0.0		23.9	4.0	10.0	0.0	0.0
190	13.6	1.8	1.8	0.0	0.0		22.9	3.8	10.0	0.0	0.0
200	13.0	1.7	1.7	0.0	0.0		22.0	3.7	10.0	0.0	0.0
210	12.6	1.7	1.7	0.0	0.0		21.1	3.5	10.0	0.0	0.0
220	12.1	1.6	1.6	0.0	0.0		20.4	3.4	10.0	0.0	0.0
230	11.7	1.6	1.6	0.0	0.0		19.7	3.3	10.0	0.0	0.0
240	11.3	1.5	1.5	0.0	0.0		19.0	3.2	10.0	0.0	0.0
250	10.9	1.5	1.5	0.0	0.0		18.4	3.1	10.0	0.0	0.0
260	10.6	1.4	1.4	0.0	0.0		17.8	3.0	10.0	0.0	0.0

5-Year Q <sub>attenuated</sub>	9.41 L/s	100-year Q <sub>attenuated</sub>	9.98 L/s
5-Year Max. Storage Required	2.7 m <sup>3</sup>	100-year Max. Storage Required	12.0 m <sup>3</sup>
Est. 5-Year Storage Elevation	93.57 m	Est. 100-year Storage Elevation	93.63 m

Area IDA110A

Available Sub-surface Storage

Total Subsurface Storage (m³)0.0

Stage Attenuated Areas Storage Summary

	Surface Storage					Surface and Subsurface Storage			
	Stage	Ponding	100-Year HGL	Head (Stage to 100-year HGL)	delta d	V*	V <sub>acc</sub> **	Q <sub>release</sub> †	V <sub>drawdown</sub>
	(m)	(m²)	(m)	(m)	(m)	(m³)	(m³)	(L/s)	(hr)
Orifice INV	92.05						0.0	0.0	0.00
TG	93.55	0.36	93.09	0.46	0.46	0.2	0.2	9.3	0.01
Max Ponding	93.85	531	93.09	0.76	0.30	54.5	54.7	11.9	1.28

\* V=Incremental storage volume

\*\*V<sub>acc</sub>=Total surface and sub-surface

† Q<sub>release</sub> = Release rate calculated from orifice equation

Orifice LocationCB110A

Dia80

Total Area0.094 ha

C0.80 Rational Method runoff coefficient

Note: Rational Method Coefficient "C" increased by 25% for 100-year calculations

t <sub>c</sub> (min)	5-Year						100-year				
	i (mm/hr)	Q <sub>actual</sub> (L/s)	Q <sub>release</sub> (L/s)	Q <sub>stored</sub> (L/s)	V <sub>stored</sub> (m³)		i (mm/hr)	Q <sub>actual</sub> (L/s)	Q <sub>release</sub> (L/s)	Q <sub>stored</sub> (L/s)	V <sub>stored</sub> (m³)
10	104.2	21.8	9.6	12.2	7.3		178.6	46.6	10.4	36.2	21.7
20	70.3	14.7	9.6	5.1	6.1		120.0	31.3	10.4	20.9	25.0
30	53.9	11.3	9.6	1.7	3.0		91.9	24.0	10.4	13.5	24.4
40	44.2	9.2	9.2	0.0	0.0		75.1	19.6	10.4	9.2	22.0
50	37.7	7.9	7.9	0.0	0.0		64.0	16.7	10.4	6.3	18.8
60	32.9	6.9	6.9	0.0	0.0		55.9	14.6	10.4	4.1	14.9
70	29.4	6.1	6.1	0.0	0.0		49.8	13.0	10.4	2.6	10.7
80	26.6	5.5	5.5	0.0	0.0		45.0	11.7	10.4	1.3	6.2
90	24.3	5.1	5.1	0.0	0.0		41.1	10.7	10.4	0.3	1.6
100	22.4	4.7	4.7	0.0	0.0		37.9	9.9	10.4	0.0	0.0
110	20.8	4.3	4.3	0.0	0.0		35.2	9.2	10.4	0.0	0.0
120	19.5	4.1	4.1	0.0	0.0		32.9	8.6	10.4	0.0	0.0
130	18.3	3.8	3.8	0.0	0.0		30.9	8.1	10.4	0.0	0.0
140	17.3	3.6	3.6	0.0	0.0		29.2	7.6	10.4	0.0	0.0
150	16.4	3.4	3.4	0.0	0.0		27.6	7.2	10.4	0.0	0.0
160	15.6	3.2	3.2	0.0	0.0		26.2	6.9	10.4	0.0	0.0
170	14.8	3.1	3.1	0.0	0.0		25.0	6.5	10.4	0.0	0.0
180	14.2	3.0	3.0	0.0	0.0		23.9	6.2	10.4	0.0	0.0
190	13.6	2.8	2.8	0.0	0.0		22.9	6.0	10.4	0.0	0.0
200	13.0	2.7	2.7	0.0	0.0		22.0	5.7	10.4	0.0	0.0
210	12.6	2.6	2.6	0.0	0.0		21.1	5.5	10.4	0.0	0.0
220	12.1	2.5	2.5	0.0	0.0		20.4	5.3	10.4	0.0	0.0
230	11.7	2.4	2.4	0.0	0.0		19.7	5.1	10.4	0.0	0.0
240	11.3	2.4	2.4	0.0	0.0		19.0	5.0	10.4	0.0	0.0
250	10.9	2.3	2.3	0.0	0.0		18.4	4.8	10.4	0.0	0.0
260	10.6	2.2	2.2	0.0	0.0		17.8	4.7	10.4	0.0	0.0

5-Year Qattenuated9.59 L/s

5-Year Max. Storage Required7.3 m³

Est. 5-Year Storage Elevation93.59 m

100-year Qattenuated10.45 L/s

100-year Max. Storage Required25.0 m³

Est. 100-year Storage Elevation93.69 m

Area ID            A106 & A107  
Available Sub-surface Storage  
  
Total Subsurface Storage (m<sup>3</sup>)            0.0

Stage Attenuated Areas Storage Summary

	Surface Storage					Surface and Subsurface Storage			
	Stage	Ponding	100-Year HGL	Head (Stage to 100-year HGL)	delta d	V*	V <sub>acc</sub> **	Q <sub>release</sub> †	V <sub>drawdown</sub>
	(m)	(m <sup>2</sup> )	(m)	(m)	(m)	(m <sup>3</sup> )	(m <sup>3</sup> )	(L/s)	(hr)
Orifice INV	91.37						0.0	0.0	0.00
TG	93.50	1.4	93.09	0.41	0.41	0.6	0.6	19.7	0.01
0.15m Ponding	93.65	972.0	93.09	0.56	0.15	50.5	51.1	22.9	0.62
Max Ponding	93.80	2,037.0	93.09	0.71	0.15	220.8	271.9	25.8	2.92

\* V=Incremental storage volume  
\*\*V<sub>acc</sub>=Total surface and sub-surface  
† Q<sub>release</sub> = Release rate calculated from orifice equation

Orifice Location            CBMH106            Dia            120  
Total Area            0.455 ha  
C            0.82 Rational Method runoff coefficient            Note: Rational Method Coefficient "C" increased by 25% for 100-year calculations

t <sub>c</sub> (min)	5-Year						100-year				
	i (mm/hr)	Q <sub>actual</sub> (L/s)	Q <sub>release</sub> (L/s)	Q <sub>stored</sub> (L/s)	V <sub>stored</sub> (m <sup>3</sup> )		i (mm/hr)	Q <sub>actual</sub> (L/s)	Q <sub>release</sub> (L/s)	Q <sub>stored</sub> (L/s)	V <sub>stored</sub> (m <sup>3</sup> )
10	104.2	108.3	23.1	85.3	51.2		178.6	225.7	24.5	201.2	120.7
20	70.3	73.0	23.1	50.0	60.0		120.0	151.6	24.5	127.1	152.5
30	53.9	56.1	23.1	33.0	59.4		91.9	116.1	24.5	91.6	164.9
40	44.2	45.9	23.1	22.9	54.9		75.1	95.0	24.5	70.5	169.2
50	37.7	39.1	23.1	16.1	48.2		64.0	80.8	24.5	56.3	169.0
60	32.9	34.2	23.1	11.2	40.3		55.9	70.6	24.5	46.2	166.2
70	29.4	30.5	23.1	7.5	31.4		49.8	62.9	24.5	38.4	161.5
80	26.6	27.6	23.1	4.5	21.8		45.0	56.9	24.5	32.4	155.4
90	24.3	25.2	23.1	2.2	11.8		41.1	52.0	24.5	27.5	148.4
100	22.4	23.3	23.1	0.2	1.4		37.9	47.9	24.5	23.4	140.5
110	20.8	21.6	21.6	0.0	0.0		35.2	44.5	24.5	20.0	132.0
120	19.5	20.2	20.2	0.0	0.0		32.9	41.6	24.5	17.1	123.0
130	18.3	19.0	19.0	0.0	0.0		30.9	39.1	24.5	14.6	113.6
140	17.3	18.0	18.0	0.0	0.0		29.2	36.8	24.5	12.4	103.8
150	16.4	17.0	17.0	0.0	0.0		27.6	34.9	24.5	10.4	93.7
160	15.6	16.2	16.2	0.0	0.0		26.2	33.2	24.5	8.7	83.3
170	14.8	15.4	15.4	0.0	0.0		25.0	31.6	24.5	7.1	72.7
180	14.2	14.7	14.7	0.0	0.0		23.9	30.2	24.5	5.7	61.8
190	13.6	14.1	14.1	0.0	0.0		22.9	28.9	24.5	4.5	50.8
200	13.0	13.6	13.6	0.0	0.0		22.0	27.8	24.5	3.3	39.6
210	12.6	13.1	13.1	0.0	0.0		21.1	26.7	24.5	2.2	28.2
220	12.1	12.6	12.6	0.0	0.0		20.4	25.8	24.5	1.3	16.7
230	11.7	12.1	12.1	0.0	0.0		19.7	24.9	24.5	0.4	5.1
240	11.3	11.7	11.7	0.0	0.0		19.0	24.0	24.5	0.0	0.0
250	10.9	11.4	11.4	0.0	0.0		18.4	23.2	24.5	0.0	0.0
260	10.6	11.0	11.0	0.0	0.0		17.8	22.5	24.5	0.0	0.0

5-Year Q <sub>attenuated</sub>	23.06 L/s	100-year Q <sub>attenuated</sub>	24.49 L/s
5-Year Max. Storage Required	60.0 m <sup>3</sup>	100-year Max. Storage Required	169.2 m <sup>3</sup>
Est. 5-Year Storage Elevation	93.66 m	Est. 100-year Storage Elevation	93.73 m

Area ID            A114A  
Available Sub-surface Storage  
  
Total Subsurface Storage (m<sup>3</sup>)            0.0

Stage Attenuated Areas Storage Summary

	Surface Storage					Surface and Subsurface Storage			
	Stage	Ponding	100-Year HGL	Head (Stage to 100-year HGL)	delta d	V*	V <sub>acc</sub> **	Q <sub>release</sub> †	V <sub>drawdown</sub>
	(m)	(m <sup>2</sup> )	(m)	(m)	(m)	(m <sup>3</sup> )	(m <sup>3</sup> )	(L/s)	(hr)
Orifice INV	92.00						0.0	0.0	0.00
TG	93.50	0.4	93.09	0.41	0.41	0.1	0.1	15.1	0.00
Max Ponding	93.85	573.0	93.09	0.76	0.35	68.6	68.7	20.5	0.93

\* V=Incremental storage volume  
\*\*V<sub>acc</sub>=Total surface and sub-surface  
† Q<sub>release</sub> = Release rate calculated from orifice equation

Orifice Location            CB114A            Dia            105  
Total Area            0.157 ha  
C            0.80 Rational Method runoff coefficient      Note: Rational Method Coefficient "C" increased by 25% for 100-year calculations

t <sub>c</sub> (min)	5-Year					100-year				
	i (mm/hr)	Q <sub>actual</sub> (L/s)	Q <sub>release</sub> (L/s)	Q <sub>stored</sub> (L/s)	V <sub>stored</sub> (m <sup>3</sup> )	i (mm/hr)	Q <sub>actual</sub> (L/s)	Q <sub>release</sub> (L/s)	Q <sub>stored</sub> (L/s)	V <sub>stored</sub> (m <sup>3</sup> )
10	104.2	36.4	16.0	20.3	12.2	178.6	77.9	18.3	59.6	35.8
20	70.3	24.5	16.0	8.5	10.2	120.0	52.3	18.3	34.1	40.9
30	53.9	18.8	16.0	2.8	5.1	91.9	40.1	18.3	21.8	39.3
40	44.2	15.4	15.4	0.0	0.0	75.1	32.8	18.3	14.5	34.8
50	37.7	13.1	13.1	0.0	0.0	64.0	27.9	18.3	9.6	28.9
60	32.9	11.5	11.5	0.0	0.0	55.9	24.4	18.3	6.1	22.0
70	29.4	10.2	10.2	0.0	0.0	49.8	21.7	18.3	3.5	14.5
80	26.6	9.3	9.3	0.0	0.0	45.0	19.6	18.3	1.4	6.5
90	24.3	8.5	8.5	0.0	0.0	41.1	17.9	18.3	0.0	0.0
100	22.4	7.8	7.8	0.0	0.0	37.9	16.5	18.3	0.0	0.0
110	20.8	7.3	7.3	0.0	0.0	35.2	15.4	18.3	0.0	0.0
120	19.5	6.8	6.8	0.0	0.0	32.9	14.3	18.3	0.0	0.0
130	18.3	6.4	6.4	0.0	0.0	30.9	13.5	18.3	0.0	0.0
140	17.3	6.0	6.0	0.0	0.0	29.2	12.7	18.3	0.0	0.0
150	16.4	5.7	5.7	0.0	0.0	27.6	12.0	18.3	0.0	0.0
160	15.6	5.4	5.4	0.0	0.0	26.2	11.4	18.3	0.0	0.0
170	14.8	5.2	5.2	0.0	0.0	25.0	10.9	18.3	0.0	0.0
180	14.2	4.9	4.9	0.0	0.0	23.9	10.4	18.3	0.0	0.0
190	13.6	4.7	4.7	0.0	0.0	22.9	10.0	18.3	0.0	0.0
200	13.0	4.6	4.6	0.0	0.0	22.0	9.6	18.3	0.0	0.0
210	12.6	4.4	4.4	0.0	0.0	21.1	9.2	18.3	0.0	0.0
220	12.1	4.2	4.2	0.0	0.0	20.4	8.9	18.3	0.0	0.0
230	11.7	4.1	4.1	0.0	0.0	19.7	8.6	18.3	0.0	0.0
240	11.3	3.9	3.9	0.0	0.0	19.0	8.3	18.3	0.0	0.0
250	10.9	3.8	3.8	0.0	0.0	18.4	8.0	18.3	0.0	0.0
260	10.6	3.7	3.7	0.0	0.0	17.8	7.8	18.3	0.0	0.0

5-Year Qattenuated	16.00 L/s	100-year Q <sub>attenuated</sub>	18.26 L/s
5-Year Max. Storage Required	12.2 m <sup>3</sup>	100-year Max. Storage Required	40.9 m <sup>3</sup>
Est. 5-Year Storage Elevation	93.56 m	Est. 100-year Storage Elevation	93.71 m

Area ID            A113A  
Available Sub-surface Storage  
  
Total Subsurface Storage (m<sup>3</sup>)            0.0

Stage Attenuated Areas Storage Summary

	Surface Storage					Surface and Subsurface Storage			
	Stage	Ponding	100-Year HGL	Head (Stage to 100-year HGL)	delta d	V*	V <sub>acc</sub> **	Q <sub>release</sub> †	V <sub>drawdown</sub>
				(m)					
Orifice INV	92.00						0.0	0.0	0.00
TG	93.50	0.36	93.09	0.41	0.41	0.1	0.1	7.7	0.01
Max Ponding	93.80	864	93.09	0.71	0.30	88.2	88.3	10.1	2.43

\* V=Incremental storage volume  
\*\*V<sub>acc</sub>=Total surface and sub-surface  
† Q<sub>release</sub> = Release rate calculated from orifice equation

Orifice Location            CB113A            Dia            75  
Total Area            0.172 ha  
C            0.80 Rational Method runoff coefficient      Note: Rational Method Coefficient "C" increased by 25% for 100-year calculations

t <sub>c</sub> (min)	5-Year						100-year					
	i (mm/hr)	Q <sub>actual</sub> (L/s)	Q <sub>release</sub> (L/s)	Q <sub>stored</sub> (L/s)	V <sub>stored</sub> (m <sup>3</sup> )		i (mm/hr)	Q <sub>actual</sub> (L/s)	Q <sub>release</sub> (L/s)	Q <sub>stored</sub> (L/s)	V <sub>stored</sub> (m <sup>3</sup> )	
10	104.2	39.8	8.3	31.5	18.9		178.6	85.3	9.4	75.9	45.5	
20	70.3	26.9	8.3	18.6	22.3		120.0	57.3	9.4	47.9	57.5	
30	53.9	20.6	8.3	12.3	22.2		91.9	43.9	9.4	34.5	62.1	
40	44.2	16.9	8.3	8.6	20.6		75.1	35.9	9.4	26.5	63.6	
50	37.7	14.4	8.3	6.1	18.3		64.0	30.6	9.4	21.1	63.4	
60	32.9	12.6	8.3	4.3	15.5		55.9	26.7	9.4	17.3	62.3	
70	29.4	11.2	8.3	2.9	12.4		49.8	23.8	9.4	14.4	60.4	
80	26.6	10.2	8.3	1.9	9.0		45.0	21.5	9.4	12.1	58.0	
90	24.3	9.3	8.3	1.0	5.4		41.1	19.6	9.4	10.2	55.2	
100	22.4	8.6	8.3	0.3	1.7		37.9	18.1	9.4	8.7	52.2	
110	20.8	8.0	8.0	0.0	0.0		35.2	16.8	9.4	7.4	48.9	
120	19.5	7.4	7.4	0.0	0.0		32.9	15.7	9.4	6.3	45.4	
130	18.3	7.0	7.0	0.0	0.0		30.9	14.8	9.4	5.4	41.7	
140	17.3	6.6	6.6	0.0	0.0		29.2	13.9	9.4	4.5	37.9	
150	16.4	6.3	6.3	0.0	0.0		27.6	13.2	9.4	3.8	34.0	
160	15.6	5.9	5.9	0.0	0.0		26.2	12.5	9.4	3.1	30.0	
170	14.8	5.7	5.7	0.0	0.0		25.0	11.9	9.4	2.5	25.9	
180	14.2	5.4	5.4	0.0	0.0		23.9	11.4	9.4	2.0	21.7	
190	13.6	5.2	5.2	0.0	0.0		22.9	10.9	9.4	1.5	17.4	
200	13.0	5.0	5.0	0.0	0.0		22.0	10.5	9.4	1.1	13.1	
210	12.6	4.8	4.8	0.0	0.0		21.1	10.1	9.4	0.7	8.7	
220	12.1	4.6	4.6	0.0	0.0		20.4	9.7	9.4	0.3	4.3	
230	11.7	4.5	4.5	0.0	0.0		19.7	9.4	9.4	0.0	0.0	
240	11.3	4.3	4.3	0.0	0.0		19.0	9.1	9.4	0.0	0.0	
250	10.9	4.2	4.2	0.0	0.0		18.4	8.8	9.4	0.0	0.0	
260	10.6	4.1	4.1	0.0	0.0		17.8	8.5	9.4	0.0	0.0	

5-Year Q <sub>attenuated</sub>	8.28 L/s	100-year Q <sub>attenuated</sub>	9.41 L/s
5-Year Max. Storage Required	22.3 m <sup>3</sup>	100-year Max. Storage Required	63.6 m <sup>3</sup>
Est. 5-Year Storage Elevation	93.58 m	Est. 100-year Storage Elevation	93.72 m

Area ID            A108  
Available Sub-surface Storage  
  
Total Subsurface Storage (m³)            0.0

Stage Attenuated Areas Storage Summary

	Surface Storage					Surface and Subsurface Storage			
	Stage	Ponding	100-Year HGL	Head (Stage to 100-year HGL)	delta d	V*	V <sub>acc</sub> **	Q <sub>release</sub> †	V <sub>drawdown</sub>
	(m)	(m²)	(m)	(m)	(m)	(m³)	(m³)	(L/s)	(hr)
Orifice INV	92.00						0.0	0.0	0.00
TG	93.50	0.36	93.09	0.41	0.41	0.1	0.1	7.7	0.01
Max Ponding	93.80	1,123	93.09	0.71	0.30	114.3	114.5	10.1	3.15

\* V=Incremental storage volume  
\*\*V<sub>acc</sub>=Total surface and sub-surface  
† Q<sub>release</sub> = Release rate calculated from orifice equation

Orifice Location            CB108A            Dia            75  
Total Area            0.157 ha  
C            0.90 Rational Method runoff coefficient            Note: Rational Method Coefficient "C" increased by 25% for 100-year calculations

t <sub>c</sub> (min)	5-Year						100-year				
	i (mm/hr)	Q <sub>actual</sub> (L/s)	Q <sub>release</sub> (L/s)	Q <sub>stored</sub> (L/s)	V <sub>stored</sub> (m³)		i (mm/hr)	Q <sub>actual</sub> (L/s)	Q <sub>release</sub> (L/s)	Q <sub>stored</sub> (L/s)	V <sub>stored</sub> (m³)
10	104.2	40.9	8.2	32.7	19.6		178.6	77.9	8.9	69.0	41.4
20	70.3	27.6	8.2	19.4	23.3		120.0	52.3	8.9	43.4	52.1
30	53.9	21.2	8.2	13.0	23.4		91.9	40.1	8.9	31.2	56.1
40	44.2	17.3	8.2	9.2	22.0		75.1	32.8	8.9	23.9	57.3
50	37.7	14.8	8.2	6.6	19.8		64.0	27.9	8.9	19.0	57.0
60	32.9	12.9	8.2	4.8	17.1		55.9	24.4	8.9	15.5	55.8
70	29.4	11.5	8.2	3.4	14.1		49.8	21.7	8.9	12.8	53.9
80	26.6	10.4	8.2	2.3	10.8		45.0	19.6	8.9	10.7	51.5
90	24.3	9.5	8.2	1.4	7.4		41.1	17.9	8.9	9.0	48.8
100	22.4	8.8	8.2	0.6	3.8		37.9	16.5	8.9	7.6	45.9
110	20.8	8.2	8.2	0.0	0.0		35.2	15.4	8.9	6.5	42.7
120	19.5	7.6	7.6	0.0	0.0		32.9	14.3	8.9	5.5	39.3
130	18.3	7.2	7.2	0.0	0.0		30.9	13.5	8.9	4.6	35.8
140	17.3	6.8	6.8	0.0	0.0		29.2	12.7	8.9	3.8	32.2
150	16.4	6.4	6.4	0.0	0.0		27.6	12.0	8.9	3.2	28.4
160	15.6	6.1	6.1	0.0	0.0		26.2	11.4	8.9	2.6	24.6
170	14.8	5.8	5.8	0.0	0.0		25.0	10.9	8.9	2.0	20.6
180	14.2	5.6	5.6	0.0	0.0		23.9	10.4	8.9	1.5	16.6
190	13.6	5.3	5.3	0.0	0.0		22.9	10.0	8.9	1.1	12.6
200	13.0	5.1	5.1	0.0	0.0		22.0	9.6	8.9	0.7	8.4
210	12.6	4.9	4.9	0.0	0.0		21.1	9.2	8.9	0.3	4.3
220	12.1	4.7	4.7	0.0	0.0		20.4	8.9	8.9	0.0	0.0
230	11.7	4.6	4.6	0.0	0.0		19.7	8.6	8.9	0.0	0.0
240	11.3	4.4	4.4	0.0	0.0		19.0	8.3	8.9	0.0	0.0
250	10.9	4.3	4.3	0.0	0.0		18.4	8.0	8.9	0.0	0.0
260	10.6	4.2	4.2	0.0	0.0		17.8	7.8	8.9	0.0	0.0

5-Year Q <sub>attenuated</sub>	8.17 L/s	100-year Q <sub>attenuated</sub>	8.88 L/s
5-Year Max. Storage Required	23.4 m³	100-year Max. Storage Required	57.3 m³
Est. 5-Year Storage Elevation	93.56 m	Est. 100-year Storage Elevation	93.65 m

Area ID            A103B  
Available Sub-surface Storage  
  
Total Subsurface Storage (m³)            0.0

Stage Attenuated Areas Storage Summary

	Surface Storage					Surface and Subsurface Storage			
	Stage	Ponding	100-Year HGL	Head (Stage to 100-year HGL)	delta d	V*	V <sub>acc</sub> **	Q <sub>release</sub> †	V <sub>drawdown</sub>
				(m)					
	(m)	(m²)	(m)	(m)	(m)	(m³)	(m³)	(L/s)	(hr)
Orifice INV	92.00						0.0	0.0	0.00
TG	93.50	0.36	93.09	0.41	0.41	0.1	0.1	7.7	0.01
Max Ponding	93.80	751	93.09	0.71	0.30	76.7	76.9	10.1	2.12

\* V=Incremental storage volume  
\*\*V<sub>acc</sub>=Total surface and sub-surface  
† Q<sub>release</sub> = Release rate calculated from orifice equation

Orifice Location            CB103B            Dia            75  
Total Area            0.086 ha  
C            0.90 Rational Method runoff coefficient      Note: Rational Method Coefficient "C" increased by 25% for 100-year calculations

t <sub>c</sub> (min)	5-Year						100-year				
	i (mm/hr)	Q <sub>actual</sub> (L/s)	Q <sub>release</sub> (L/s)	Q <sub>stored</sub> (L/s)	V <sub>stored</sub> (m³)		i (mm/hr)	Q <sub>actual</sub> (L/s)	Q <sub>release</sub> (L/s)	Q <sub>stored</sub> (L/s)	V <sub>stored</sub> (m³)
10	104.2	22.4	7.9	14.5	8.7		178.6	42.7	8.4	34.2	20.5
20	70.3	15.1	7.9	7.2	8.6		120.0	28.7	8.4	20.2	24.3
30	53.9	11.6	7.9	3.6	6.6		91.9	21.9	8.4	13.5	24.3
40	44.2	9.5	7.9	1.6	3.7		75.1	18.0	8.4	9.5	22.8
50	37.7	8.1	7.9	0.1	0.4		64.0	15.3	8.4	6.8	20.5
60	32.9	7.1	7.1	0.0	0.0		55.9	13.4	8.4	4.9	17.7
70	29.4	6.3	6.3	0.0	0.0		49.8	11.9	8.4	3.5	14.5
80	26.6	5.7	5.7	0.0	0.0		45.0	10.7	8.4	2.3	11.1
90	24.3	5.2	5.2	0.0	0.0		41.1	9.8	8.4	1.4	7.5
100	22.4	4.8	4.8	0.0	0.0		37.9	9.1	8.4	0.6	3.7
110	20.8	4.5	4.5	0.0	0.0		35.2	8.4	8.4	0.0	0.0
120	19.5	4.2	4.2	0.0	0.0		32.9	7.9	8.4	0.0	0.0
130	18.3	3.9	3.9	0.0	0.0		30.9	7.4	8.4	0.0	0.0
140	17.3	3.7	3.7	0.0	0.0		29.2	7.0	8.4	0.0	0.0
150	16.4	3.5	3.5	0.0	0.0		27.6	6.6	8.4	0.0	0.0
160	15.6	3.3	3.3	0.0	0.0		26.2	6.3	8.4	0.0	0.0
170	14.8	3.2	3.2	0.0	0.0		25.0	6.0	8.4	0.0	0.0
180	14.2	3.0	3.0	0.0	0.0		23.9	5.7	8.4	0.0	0.0
190	13.6	2.9	2.9	0.0	0.0		22.9	5.5	8.4	0.0	0.0
200	13.0	2.8	2.8	0.0	0.0		22.0	5.3	8.4	0.0	0.0
210	12.6	2.7	2.7	0.0	0.0		21.1	5.1	8.4	0.0	0.0
220	12.1	2.6	2.6	0.0	0.0		20.4	4.9	8.4	0.0	0.0
230	11.7	2.5	2.5	0.0	0.0		19.7	4.7	8.4	0.0	0.0
240	11.3	2.4	2.4	0.0	0.0		19.0	4.5	8.4	0.0	0.0
250	10.9	2.4	2.4	0.0	0.0		18.4	4.4	8.4	0.0	0.0
260	10.6	2.3	2.3	0.0	0.0		17.8	4.3	8.4	0.0	0.0

5-Year Q <sub>attenuated</sub>	7.95 L/s	100-year Q <sub>attenuated</sub>	8.44 L/s
5-Year Max. Storage Required	8.7 m³	100-year Max. Storage Required	24.3 m³
Est. 5-Year Storage Elevation	93.53 m	Est. 100-year Storage Elevation	93.59 m

Summary of Release Rates and Storage Volumes

Control Area	5-Year Release Rate (L/s)	5-Year Required Storage (m³)	100-Year Release Rate (L/s)	100-Year Required Storage (m³)	100-Year Available Storage (m³)
U1	4.7	0.0	10.1	0.0	0.0
U2	11.4	0.0	21.6	0.0	0.0
U3	13.5	0.0	28.9	0.0	0.0
U4	0.7	0.0	1.4	0.0	0.0
U5	2.5	0.0	5.3	0.0	0.0
METRO	24.2	55.5	31.9	126.8	317.5
BLDG A	7.5	10.7	10.0	25.3	73.6
BLDG B	7.3	9.0	9.8	21.4	65.7
BLDG C	5.1	5.7	6.9	13.7	43.5
A109	9.6	3.2	25.6	3.8	4.2
A110B	9.4	2.7	10.0	12.0	43.0
A110A	9.6	7.3	10.4	25.0	54.7
A114A	16.0	12.2	18.3	40.9	68.7
A113A	8.3	22.3	9.4	63.6	88.3
A108	8.2	23.4	8.9	57.3	114.5
A103B	7.9	8.7	8.4	24.3	76.9
A106 & A107	23.1	60.0	24.5	169.2	51.1
Total	168.9	220.7	241.5	583.3	1001.8



Area ID	Up	Down	Area	C	Indiv AxC	Acc AxC	T <sub>c</sub>	I	Q	Sewer Data								
										DIA	Slope	Length	A <sub>hydraulic</sub>	R	Velocity	Qcap	Time Flow	Q / Q full
			(ha)	(-)			(min)	(mm/hr)	(L/s)	(mm)	(%)	(m)	(m <sup>2</sup> )	(m)	(m/s)	(L/s)	(min)	(-)
U3	STM112	STM111	0.122	0.50	0.06	0.06	10.0	104.2	17.7	300	0.40	75	0.071	0.075	0.87	61.2	1.4	0.29
U2	STM111	STM110	0.211	0.80	0.17	0.23	11.4	97.1	62.0	375	0.40	68.4	0.110	0.094	1.00	110.9	1.1	0.56
BLDG A	STM110	STM108	0.093	0.90	0.08	0.31	12.6	92.3	68.9	375	0.30	76.3	0.110	0.094	0.87	96.0	1.5	0.72
						0.31	14.04											
A107	CBMH107	CBMH106	0.205	0.85	0.17	0.17	10.0	104.2	50.4	300	0.50	20.8	0.071	0.075	0.97	68.4	0.4	0.74
A106	CBMH106	STM104	0.250	0.80	0.20	0.37	10.4	102.3	106.4	375	0.50	12.2	0.110	0.094	1.12	124.0	0.2	0.86
						0.37	10.5											
BLDG B			0.083	0.90	0.07	0.07	10.0	104.2	9.8									
						0.07	10.0											
U4	STM105	STM104	0.015	0.20	0.00	0.08	10.0	104.2	10.7	300	0.50	30.8	0.071	0.075	0.97	68.4	0.5	0.16
						0.08	10.5											
	STM104	STM113			0.00	0.45	10.5	101.4	127.3	450	0.50	22.5	0.159	0.113	1.27	201.6	0.3	0.63
						0.45	10.8											
A114A, U5	STM114	STM113	0.185	0.74	0.14	0.14	10.0	104.2	39.6	300	0.50	35.2	0.071	0.075	0.97	68.4	0.6	0.58
						0.14	10.6											
A113A	STM113	STM103	0.172	0.80	0.14	0.73	10.8	100.0	201.7	525	0.50	16.6	0.216	0.131	1.40	304.1	0.2	0.66
						0.73	11.0											
METRO			0.401	0.90	0.36	0.36	10.0	104.2	31.9									
						0.36	10.0											
A109	STM109	STM108	0.083	0.40	0.03	0.39	10.0	104.2	41.5	375	0.50	39.8	0.110	0.094	1.12	124.0	0.6	0.33
						0.39	10.6											
A108	STM108	STM103	0.157	0.85	0.13	0.84	14.0	86.8	202.7	525	0.28	51.5	0.216	0.131	1.05	227.6	0.8	0.89
						0.84	14.9											
BLDG C			0.055	0.90	0.05	0.05	10.0	104.2	6.9									
						0.05	10.0											
A103B	STM103	STM102	0.086	0.90	0.08	1.69	14.9	84.0	390.8	750	0.30	39.8	0.442	0.188	1.38	609.8	0.5	0.64
A102	STM102	STM101			0.00	1.69	15.3	82.5	388.2	750	0.20	23.0	0.442	0.188	1.13	497.9	0.3	0.78
A101	STM101	Fut. MH 904			0.00	1.69	15.7	81.4	383.2	750	0.20	34.2	0.442	0.188	1.13	497.9	0.5	0.77
						1.69	16.19											
**Controlled 100-year Building Flow																		

**NOTE RE: PROPOSED UNDERGROUND SERVICING IN EXISTING PAVEMENT**

PROPOSED UNDERGROUND SERVICING WITHIN EXISTING PAVEMENT TO BE CONSTRUCTED AS PER THE FOLLOWING:  
1. PROPOSED UNDERGROUND SERVICES TO BE CONSTRUCTED IN VERTICAL TRENCH AND BACKFILLED WITH UNSHRINKABLE FILL  
2. CONTRACTOR TO VERIFY THE PRECISE LOCATIONS AND INVERT ELEVATIONS OF EX. UNDERGROUND SERVICES AND EX. UTILITIES PRIOR TO STARTING CONSTRUCTION  
3. ANY DISTURBED AREAS, INCLUDING CURB, SIDEWALK AND BOULEVARD, TO BE RESTORED TO THE ORIGINAL CONDITION OR BETTER  
4. ALL REMOVED ASPHALT PAVEMENT TO BE DEPOSITED OFF SITE  
5. ALL WORKS INCLUDING REMOVAL AND RESTORATION TO THE SATISFACTION OF CITY OF OTTAWA

**RE: TEST PIT/BOREHOLE EXCAVATIONS**

ANY DISTURBED MATERIAL ENCOUNTERED BELOW THE SUBGRADE LEVEL WITHIN A BUILDING FOOTPRINT TO BE SUB-EXCAVATED AND BACKFILLED WITH COMPACTED ENGINEERED FILL AS PER GEOTECHNICAL ENGINEERS RECOMMENDATION.

**NOTE RE: GREENBANK ROAD FUTURE SERVICING**

THE LOCATION OF DENOTED FUTURE STORM/SANITARY MANHOLES AND STREET CATCHBASINS AS SHOWN ON DRAWINGS, IS FOR ILLUSTRATION PURPOSES ONLY TO IDENTIFY ASSUMED DRAINAGE BOUNDARY AREAS. THE FINAL LOCATION OF SAID SERVICES ARE TO BE FINALIZED AT THE DETAILED DESIGN STAGE.

**NOTE**

FOR WATERMAIN STUBS, 2.4m MIN. COVER TO BE PROVIDED

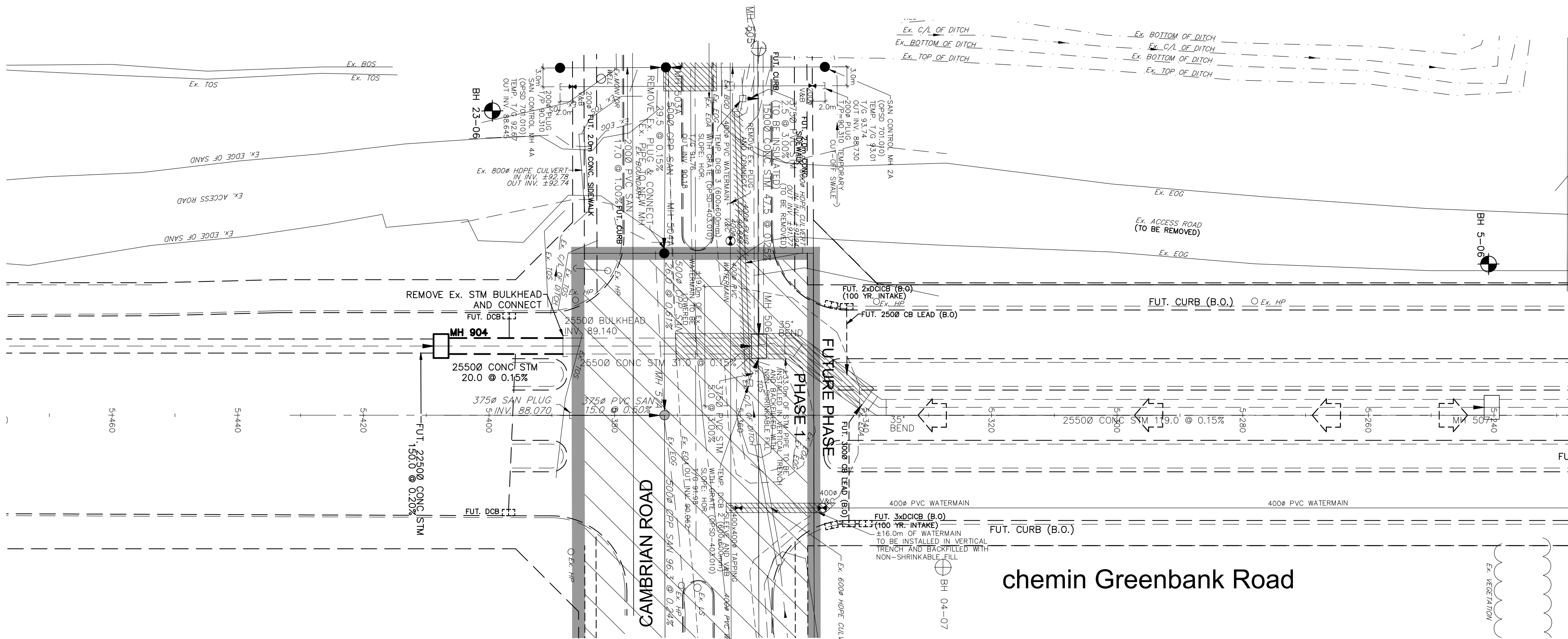
ANY DISTURBED AREA DURING CONSTRUCTION TO BE RESTORED TO THE ORIGINAL CONDITION OR BETTER TO THE SATISFACTION OF THE AUTHORITIES

**NOTE:**

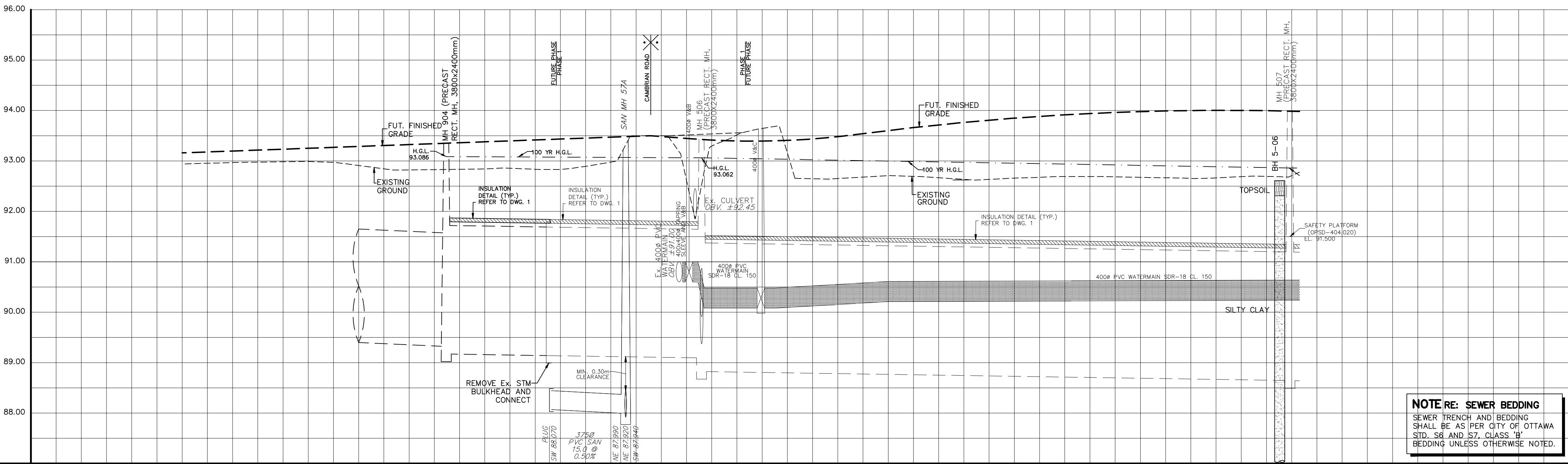
ALL EXISTING POST & WIRE FENCE, CULVERTS, UTILITY WIRE / POLES, TREES, SHRUBS ETC. WITHIN LOTS, BLOCKS AND ROADS TO BE REMOVED, UNLESS OTHERWISE NOTED

PERMISSION REQUIRED FOR WORK ON ADJACENT LANDS

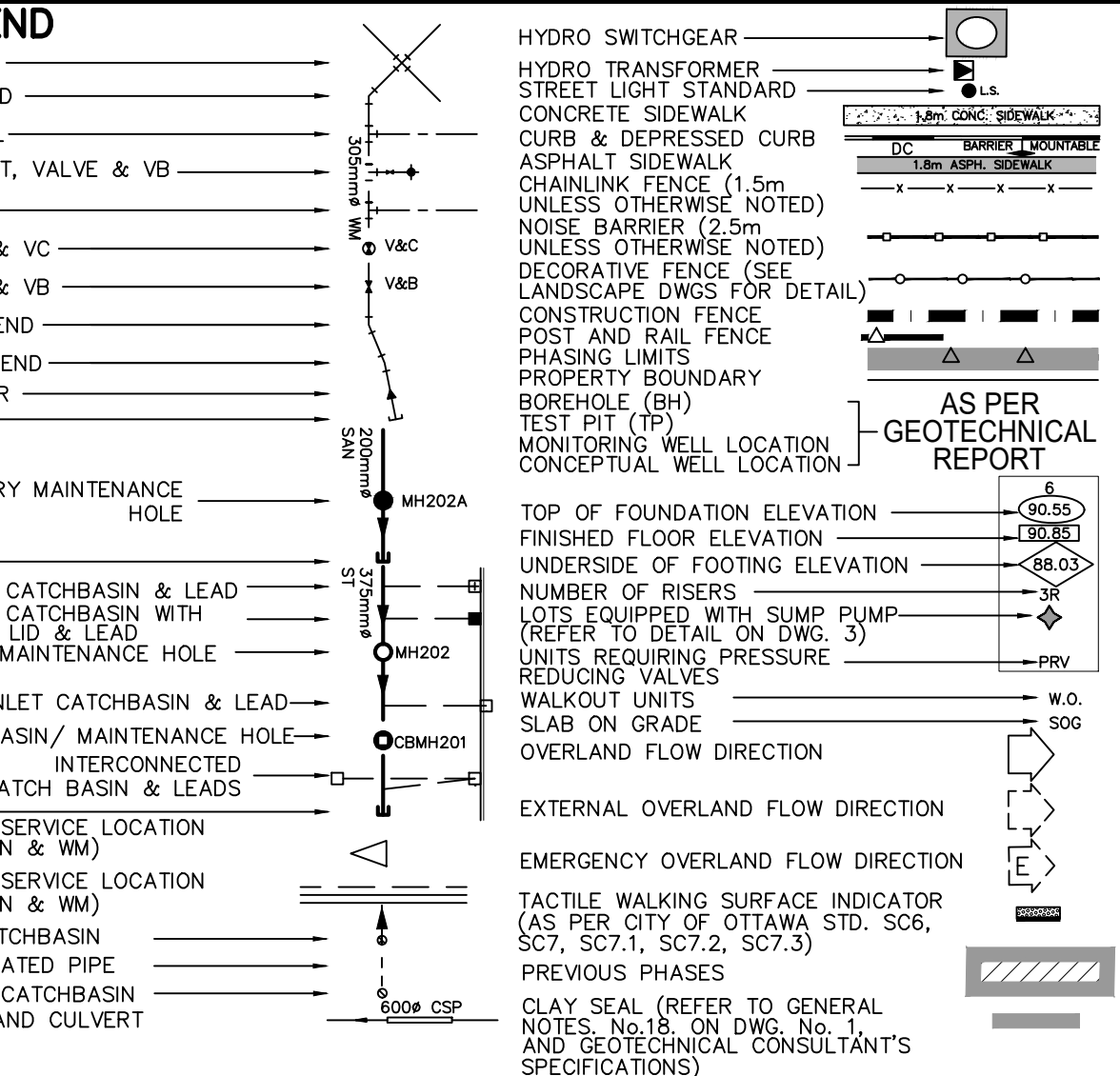
PRELIMINARY DESIGN FOR FUTURE chemin Greenbank Road REFER TO STANTEC PROJECT No. 163600994



chemin Greenbank Road



**NOTE RE: SEWER BEDDING**  
SEWER TRENCH AND BEDDING SHALL BE AS PER CITY OF OTTAWA STD. S6 AND S7, CLASS 'B' BEDDING UNLESS OTHERWISE NOTED.



**TOPOGRAPHIC INFORMATION**  
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 (HALF MOON BAY WEST PHASE 2), RECEIVED ON OCTOBER 11, 2019.

BENCH MARK No. 0011964U3710			
ELEVATIONS ARE GEODETIC AND ARE REFERRED TO THE PUBLISHED BENCHMARK NUMBER 0011965U3710 HAVING AN ELEVATION = 71.724m			
8	P.P.	20-02-25	UPDATED AS PER REVISED CULVERT FOUNDATION DESIGN
7	P.P.	20-01-17	5th SUBMISSION
6	P.P.	19-12-18	CHANNEL CULVERT & SANITARY SEWER CROSSING REVISIONS
5	P.P.	19-11-06	UPDATED AS PER REVISED M-PLAN AND CUP
4	P.P.	19-09-12	4th SUBMISSION
3	P.P.	19-07-05	3rd SUBMISSION
2	P.P.	19-06-12	2nd SUBMISSION
1	P.P.	19-02-22	1st SUBMISSION
No.	BY	DATE	DESCRIPTION

PLAN AND PROFILE OF  
**chemin Greenbank Road**  
(STA. 5+220.000 TO STA. 5+420.000)

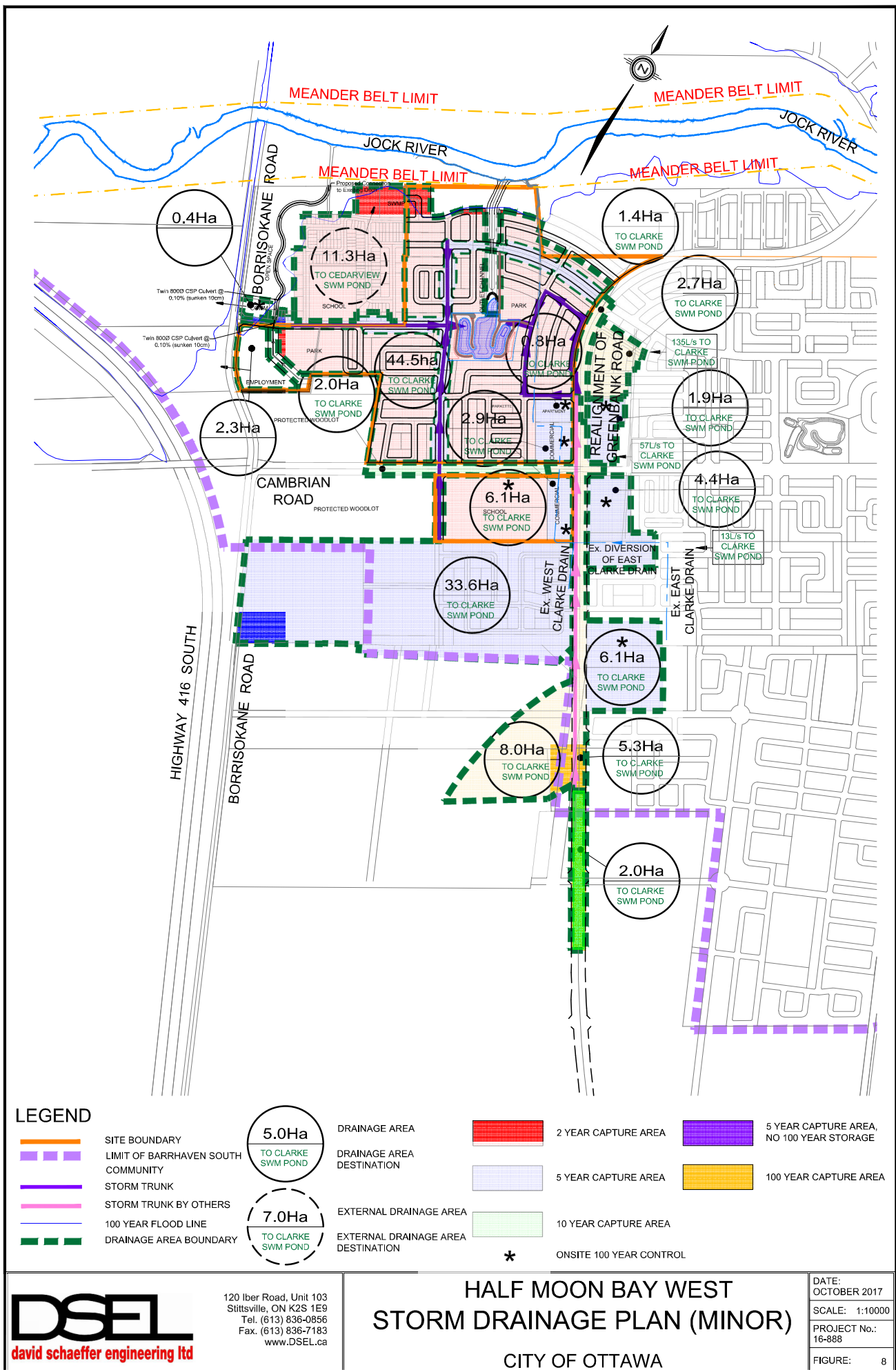
**MATTAMY (HALF MOON BAY) LIMITED**

**DAVID SCHAEFFER ENGINEERING LTD**

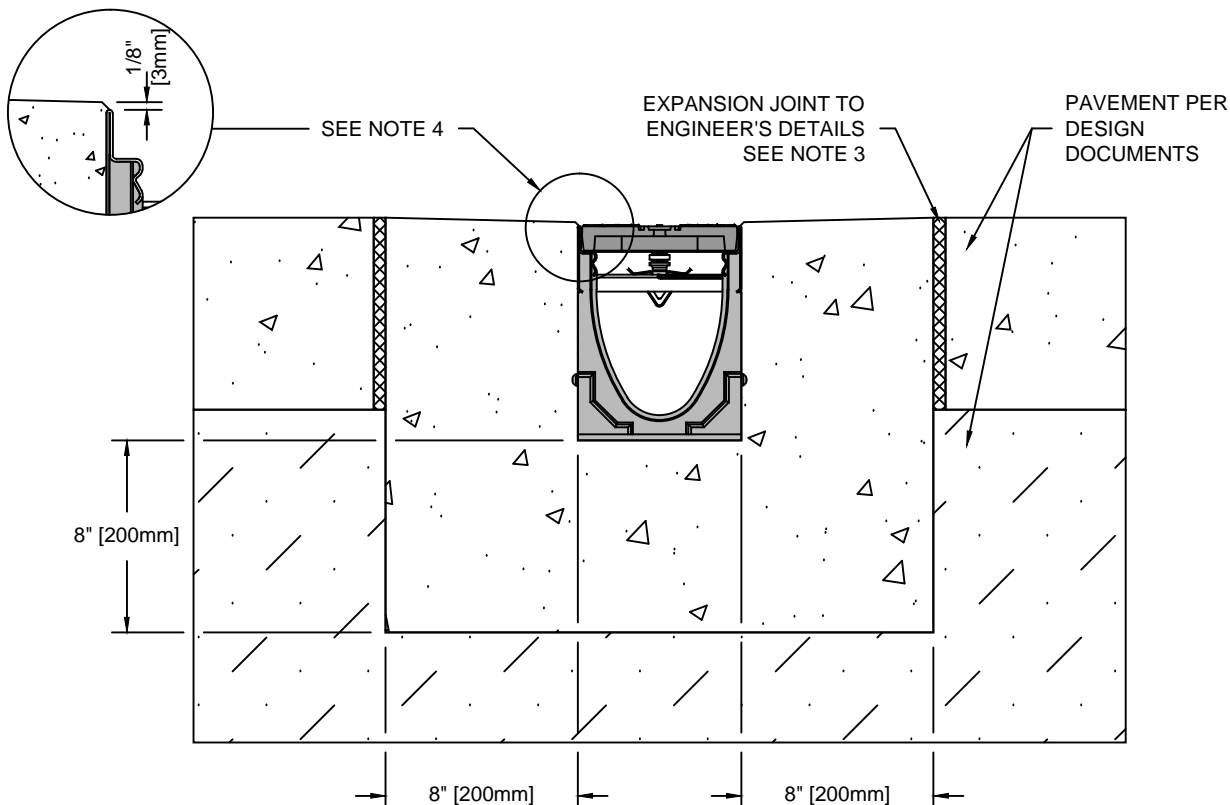
120 Iber Road, Unit 103  
Shelburne, ON K2S 1E9  
Tel. (613) 836-0856  
Fax. (613) 836-7183  
www.DSEL.ca

DESIGNED BY: W.L./C.M. CHECKED BY: K.M.  
SCALE: H1:500, V1:50 DATE: FEB 2019

SHEET No. **32**







#### NOTES:

1. IT IS NECESSARY TO ENSURE MINIMUM DIMENSIONS SHOWN ARE SUITABLE FOR EXISTING GROUND CONDITIONS. *ENGINEERING ADVICE MAY BE REQUIRED.*
2. MINIMUM CONCRETE STRENGTH OF 4,000 PSI IS RECOMMENDED. CONCRETE SHOULD BE VIBRATED TO ELIMINATE AIR POCKETS.
3. EXPANSION AND CONTRACTION CONTROL JOINTS AND REINFORCEMENT ARE RECOMMENDED TO PROTECT CHANNEL AND CONCRETE SURROUND. *ENGINEERING ADVICE MAY BE REQUIRED.*
4. THE FINISHED LEVEL OF THE CONCRETE SURROUND MUST BE APPROX. 1/8" [3mm] ABOVE THE TOP OF THE CHANNEL EDGE.
5. CONCRETE BASE THICKNESS SHOULD MATCH SLAB THICKNESS. *ENGINEERING ADVICE MAY BE REQUIRED TO DETERMINE PROPER LOAD CLASS.*
6. REFER TO ACO'S LATEST INSTALLATION INSTRUCTIONS FOR FURTHER DETAILS.

## SPECIFICATION CLAUSE

### K100 KLASSIKDRAIN - LOAD CLASS E

#### GENERAL

THE SURFACE DRAINAGE SYSTEM SHALL BE POLYMER CONCRETE K100 CHANNEL SYSTEM WITH GALVANIZED STEEL EDGE RAILS AS MANUFACTURED BY ACO POLYMER PRODUCTS, INC.

#### MATERIALS

CHANNELS SHALL BE MANUFACTURED FROM POLYESTER RESIN POLYMER CONCRETE WITH AN INTEGRALLY CAST-IN GALVANIZED STEEL EDGE RAIL. MINIMUM PROPERTIES OF POLYMER CONCRETE WILL BE AS FOLLOWS:

COMPRESSIVE STRENGTH:	14,000 PSI
FLEXURAL STRENGTH:	4,000 PSI
TENSILE STRENGTH:	1,500 PSI
WATER ABSORPTION:	0.07%
FROST PROOF	YES
DILUTE ACID AND ALKALI RESISTANT	YES
B117 SALT SPRAY TEST COMPLIANT	YES

THE SYSTEM SHALL BE 4" (100mm) NOMINAL INTERNAL WIDTH WITH A 5.1" (130mm) OVERALL WIDTH AND A BUILT-IN SLOPE OF 0.5%. CHANNEL INVERT SHALL HAVE DEVELOPED "V" SHAPE. ALL CHANNELS SHALL BE INTERLOCKING WITH A MALE/FEMALE JOINT.

THE COMPLETE DRAINAGE SYSTEM SHALL BE BY ACO POLYMER PRODUCTS, INC. ANY DEVIATION OR PARTIAL SYSTEM DESIGN AND/OR IMPROPER INSTALLATION WILL VOID ANY AND ALL WARRANTIES PROVIDED BY ACO POLYMER PRODUCTS, INC.

CHANNEL SHALL WITHSTAND LOADING TO PROPER LOAD CLASS AS OUTLINED BY EN 1433. GRATE TYPE SHALL BE APPROPRIATE TO MEET THE SYSTEM LOAD CLASS SPECIFIED AND INTENDED APPLICATION. GRATES SHALL BE SECURED USING 'QUICKLOK' BOLTLESS LOCKING SYSTEM. CHANNEL AND GRATE SHALL BE CERTIFIED TO MEET THE SPECIFIED EN 1433 LOAD CLASS. THE SYSTEM SHALL BE INSTALLED IN ACCORDANCE WITH THE MANUFACTURER'S INSTRUCTIONS AND RECOMMENDATIONS.

K1-E-ECP



DATE: 08/24/15

**K100 - KLASSIKDRAIN - LOAD CLASS: E**  
Exposed Concrete Pavement

**INSTALLATION DRAWING - ACO DRAIN**

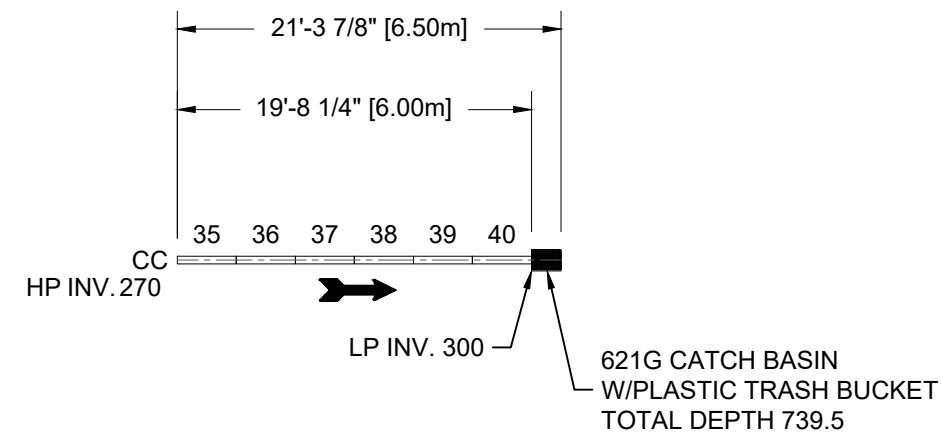
**ACO Polymer Products, Inc.**

825 W. Beechcraft St  
Casa Grande, AZ 85122  
Tel: 520-421-9988  
Fax: 520-421-9899

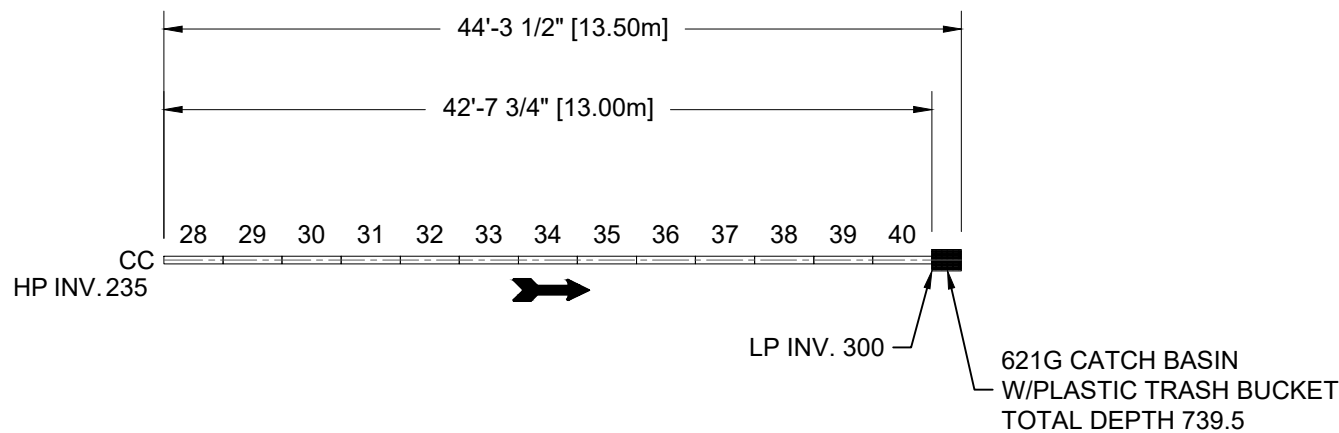
9470 Pinecone Dr.  
Mentor, OH 44060  
Tel: 440-639-7230  
Fax: 440-639-7235

4211 Pleasant Rd.  
Fort Mill, SC 29708  
Tel: 440-639-7230  
Fax: 803-802-1063

TD - 1



TD - 2



**GENERAL NOTES**

1. IT IS CUSTOMERS RESPONSIBILITY TO ENSURE THAT EACH PRODUCT IS FIT FOR IT'S INTENDED PURPOSE AND THAT THE ACTUAL CONDITIONS ARE SUITABLE.
2. IT IS THE CUSTOMERS RESPONSIBILITY TO FOLLOW ACO POLYMER PRODUCTS, INC. INSTALLATION INSTRUCTIONS FOR EACH PRODUCT. SEEK ENGINEERING ADVISE FOR INSTALLATIONS NOT ILLUSTRATED IN THE INSTALLATION GUIDELINES.
3. FOR FURTHER PRODUCT INFORMATION, CUT SHEETS, SPECIFICATIONS AND INSTALLATION INSTRUCTIONS, PLEASE VISIT US AT OUR WEBSITE: [WWW.ACOUSA.COM](http://WWW.ACOUSA.COM).
4. ACO IS NOT RESPONSIBLE TO ENSURE PROPER FLOW TO SYSTEMS OUTLETS OR CATCH BASINS, REFER TO GRADING PLANS. ALL TRENCH DRAIN LAYOUTS ARE DESIGNED AT 0.0% LONGITUDINAL PAVEMENT SLOPE UNLESS OTHERWISE NOTED.

**TRENCH NOTES**

1. ALL FABRICATIONS TO BE COMPLETED BY INSTALLING CONTRACTOR.
2. DIMENSIONS ARE FROM OUTSIDE TO OUTSIDE

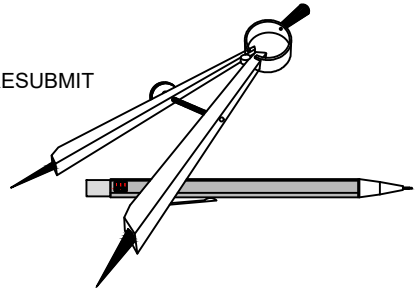
ALL DRAWINGS ARE AS ACCURATE AS THE INFORMATION SUPPLIED. ALL REASONABLE CARE HAS BEEN TAKEN IN COMPILING THE INFORMATION WITHIN. PLEASE REVIEW THIS INFORMATION FOR ACCURACY.

☐ APPROVED ☐ REVISE AND RESUBMIT  
☐ APPROVED AS NOTED ☐ REJECTED

SIGNED: \_\_\_\_\_

DATE: \_\_\_\_\_

COMMENTS:



LEGEND	
	CHANNEL
	CENTER LINE
	INSTALLATION DIRECTION OF CHANNEL
	VOA = VERTICAL OUTLET ADAPTER
	BAU = BRICKSLOT ACCESS UNIT
	CC = CLOSING CAP
	OC = OUTLET CAP
	INV = INVERT
	HP = HIGH POINT
	LP = LOW POINT
	BO = BOTTOM OUTLET

METRO GREENBANK ON		TRENCH DRAIN LAYOUT			
		SYSTEM(S) K100		GRATE(S) 461Q SLOTTED D.I.	
DRAWN BY: KZ	EMAIL: kyle.zheng@aco.com	REVISIONS			
DATE 08-13-2020	CHECKED BY:	NO.	DESCRIPTION	DATE	BY
		A	-	-	-
		B			
SHEET NO. SHEET 1 OF 1	DESIGN SERV. NO. REV. 920-558	C			

CHECKED BY:

DESIGN SERV. NO. REV.

920-558

CANADA

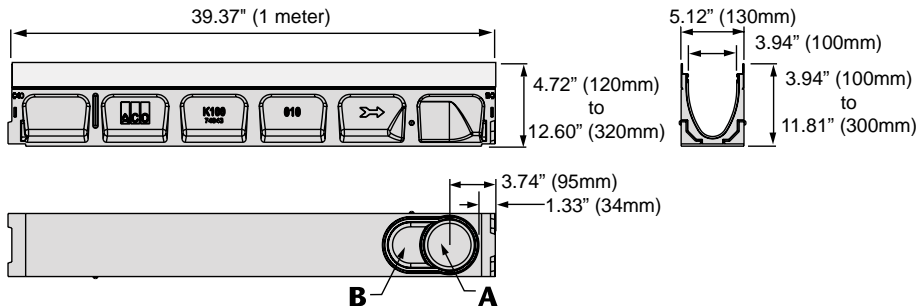


ACO SYSTEMS LTD.  
2910 BRIGHTON RD  
OAKVILLE, ON  
L6H 5S3  
TEL: (905)-829-0665  
FAX: (905)-829-2908  
EMAIL: info@acocan.ca  
WEB: www.acocan.com

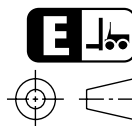


# KlassikDrain - K100 Galvanized steel edge rail channel system

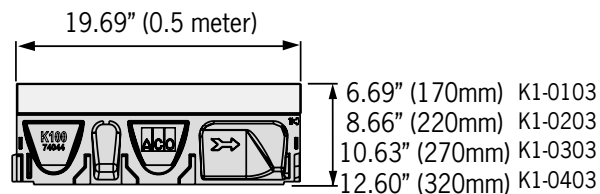
## One meter channel



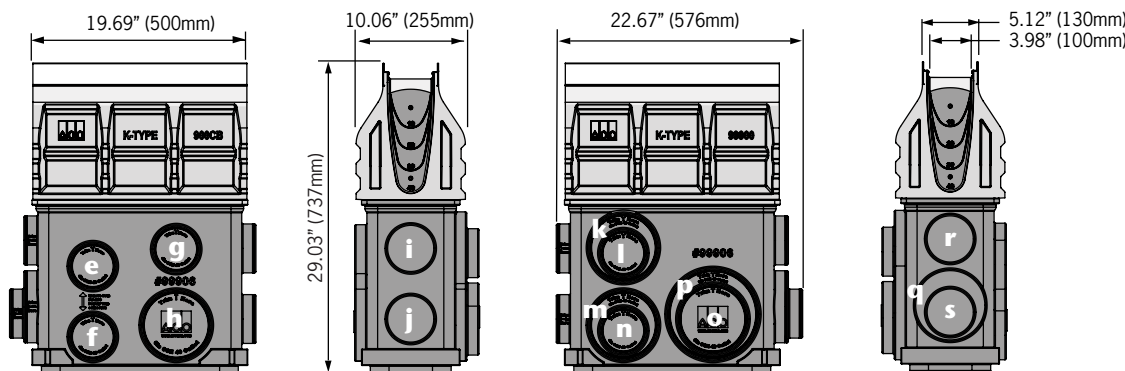
Knock-outs included on every 5th channel



## Half meter channel



## Type K901G In-line catch basin



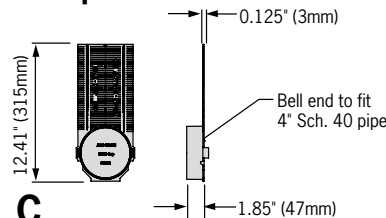
Total capacity = 10.49 gallons

## Outlet flow rates

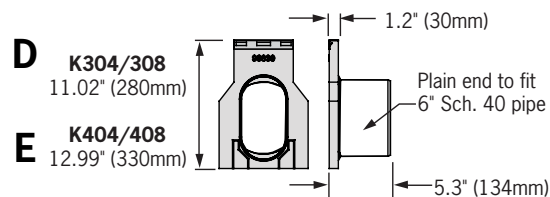
Outlet	Product	Outlet size (Sch. 40)	Invert Depth	GPM	CFS
A	Bottom outlet - K00	4" round	3.94"	108	0.24
A	Bottom outlet - K40	4" round	11.81"	187	0.42
B	Bottom outlet - K00	6" oval	3.94"	177	0.39
B	Bottom outlet - K40	6" oval	11.81"	306	0.68
C	End outlet - K20	4" round	7.87"	132	0.29
C	End outlet - K40	4" round	11.81"	171	0.38
D	K1-308-6 6" outlet cap	6" oval	9.84"	233	0.52
E	K1-408-6 6" outlet cap	6" oval	11.81"	264	0.59
F	Type K1-901G	4" round	19.30"	226	0.50
G	Type K1-901G	4" round	25.67"	265	0.59
H	Type K1-901G	4" round	25.30"	263	0.59
I	Type K1-901G	4" round	18.56"	222	0.49
J	Type K1-901G	6" round	25.85"	586	1.30
K	Type K1-901G	4" round	26.43"	269	0.60
L	Type K1-901G	4" round	19.36"	227	0.51
M	Type K1-901G	6" round	27.30"	604	1.35
N	Type K1-901G	6" round	19.99"	505	1.12
O	Type K1-901G	8" round	27.30"	1051	2.34
P	Type K1-901G	6" round	26.43"	593	1.32
Q	Type K1-901G	4" round	27.17"	273	0.61
R	Type K1-901G	4" round	20.68"	235	0.52
S	Type K1-901G	4" round	18.99"	224	0.50
T	Type K1-901G	6" round	27.17"	6.02	1.34

**Note:** These are the pipe flow rates at the specified outlet, **NOT** channel flow rates. Catch basin flow rates are without trash bucket - using trash bucket reduces flow.

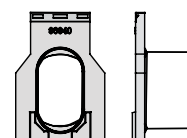
## End Cap



## 6" Oval inlet cap



## 6" Oval outlet cap



## ACO DRAIN

## KlassikDrain - K100 Galvanized steel edge rail channel system



Description	Part No.	Invert Inches <sup>2</sup>	mm <sup>2</sup>	Weight Lbs.	Description	Part No.	Invert Inches <sup>2</sup>	mm <sup>2</sup>	Weight Lbs.
<b>K1-00 Neutral channel - 39.37" (1m)<sup>D</sup></b>	<b>74041</b>	<b>3.94</b>	<b>100</b>	<b>28.1</b>	K1-28 Sloped channel - 39.37" (1m)	<b>74028</b>	9.45	240	49.8
K1-1 Sloped channel - 39.37" (1m)	<b>74001</b>	4.13	105	28.1	K1-29 Sloped channel - 39.37" (1m)	<b>74029</b>	9.65	245	50.6
K1-2 Sloped channel - 39.37" (1m)	<b>74002</b>	4.33	110	28.9	K1-30 Sloped channel - 39.37" (1m) <sup>D</sup>	<b>74030</b>	9.84	250	51.4
K1-3 Sloped channel - 39.37" (1m)	<b>74003</b>	4.53	115	29.7	<b>K1-030 Neutral channel - 39.37" (1m)<sup>D</sup></b>	<b>74047</b>	<b>9.84</b>	<b>250</b>	<b>51.4</b>
K1-4 Sloped channel - 39.37" (1m)	<b>74004</b>	4.72	120	30.5	<b>K1-0303 Neutral channel - 19.69" (0.5m)<sup>D</sup></b>	<b>74048</b>	<b>9.84</b>	<b>250</b>	<b>24.0</b>
K1-5 Sloped channel - 39.37" (1m) <sup>D</sup>	<b>74005</b>	4.92	125	31.3	K1-31 Sloped channel - 39.37" (1m)	<b>74031</b>	10.04	255	52.2
K1-6 Sloped channel - 39.37" (1m)	<b>74006</b>	5.12	130	32.1	K1-32 Sloped channel - 39.37" (1m)	<b>74032</b>	10.24	260	53.0
K1-7 Sloped channel - 39.37" (1m)	<b>74007</b>	5.31	135	32.9	K1-33 Sloped channel - 39.37" (1m)	<b>74033</b>	10.43	265	53.8
K1-8 Sloped channel - 39.37" (1m)	<b>74008</b>	5.51	140	33.7	K1-34 Sloped channel - 39.37" (1m)	<b>74034</b>	10.63	270	54.6
K1-9 Sloped channel - 39.37" (1m)	<b>74009</b>	5.71	145	34.5	K1-35 Sloped channel - 39.37" (1m) <sup>D</sup>	<b>74035</b>	10.83	275	55.4
K1-10 Sloped channel - 39.37" (1m) <sup>D</sup>	<b>74010</b>	5.91	150	35.3	K1-36 Sloped channel - 39.37" (1m)	<b>74036</b>	11.02	280	56.2
<b>K1-010 Neutral channel - 39.37" (1m)<sup>D</sup></b>	<b>74043</b>	<b>5.91</b>	<b>150</b>	<b>35.3</b>	K1-37 Sloped channel - 39.37" (1m)	<b>74037</b>	11.22	285	57.0
<b>K1-0103 Neutral channel - 19.69" (0.5m)<sup>D</sup></b>	<b>74044</b>	<b>5.91</b>	<b>150</b>	<b>17.0</b>	K1-38 Sloped channel - 39.37" (1m)	<b>74038</b>	11.42	290	57.9
K1-11 Sloped channel - 39.37" (1m)	<b>74011</b>	6.10	155	36.1	K1-39 Sloped channel - 39.37" (1m)	<b>74039</b>	11.61	295	58.7
K1-12 Sloped channel - 39.37" (1m)	<b>74012</b>	6.30	160	36.9	K1-40 Sloped channel - 39.37" (1m) <sup>D</sup>	<b>74040</b>	11.81	300	59.5
K1-13 Sloped channel - 39.37" (1m)	<b>74013</b>	6.50	165	37.7	<b>K1-040 Neutral channel - 39.37" (1m)<sup>D</sup></b>	<b>74049</b>	<b>11.81</b>	<b>300</b>	<b>59.5</b>
K1-14 Sloped channel - 39.37" (1m)	<b>74014</b>	6.69	170	38.5	<b>K1-0403 Neutral channel - 19.69" (0.5m)<sup>D</sup></b>	<b>74050</b>	<b>11.81</b>	<b>300</b>	<b>27.5</b>
K1-15 Sloped channel - 39.37" (1m) <sup>D</sup>	<b>74015</b>	6.89	175	39.3	K1-901G In-line catch basin - 19.69" (0.5m) <sup>D</sup>	<b>94608</b>	28.81	701.9	52.6
K1-16 Sloped channel - 39.37" (1m)	<b>74016</b>	7.09	180	40.1	K1-621G catch basin - 19.69" (0.5m) <sup>D</sup>	<b>94617</b>	28.84	732.5	55.8
K1-17 Sloped channel - 39.37" (1m)	<b>74017</b>	7.28	185	40.9	K1-631G catch basin - 19.69" (0.5m) <sup>D</sup>	<b>94631</b>	40.84	1037.4	65.8
K1-18 Sloped channel - 39.37" (1m)	<b>74018</b>	7.48	190	41.7	K1-Series 600 Optional plastic riser	<b>99902</b>	-	-	10.0
K1-19 Sloped channel - 39.37" (1m)	<b>74019</b>	7.68	195	42.5	Foul air trap - fits both 900 & 600 series basins	<b>90854</b>	-	-	1.2
K1-20 Sloped channel - 39.37" (1m) <sup>D</sup>	<b>74020</b>	7.87	200	43.4	K1-304-6 6" Inlet Cap	<b>96839</b>	9.84	250	5.2
<b>K1-020 Neutral channel - 39.37" (1m)<sup>D</sup></b>	<b>74045</b>	<b>7.87</b>	<b>200</b>	<b>43.4</b>	K1-308-6 6" Outlet Cap	<b>96840</b>	9.84	250	5.0
<b>K1-0203 Neutral channel - 19.69" (0.5m)<sup>D</sup></b>	<b>74046</b>	<b>7.87</b>	<b>200</b>	<b>20.5</b>	K1-404-6 6" Inlet Cap	<b>96834</b>	11.81	300	6.0
K1-21 Sloped channel - 39.37" (1m)	<b>74021</b>	8.07	205	44.2	K1-408-6 6" Outlet Cap	<b>96836</b>	11.81	300	5.8
K1-22 Sloped channel - 39.37" (1m)	<b>74022</b>	8.27	210	45.0	Universal end cap	<b>96822</b>	11.81	300	0.4
K1-23 Sloped channel - 39.37" (1m)	<b>74023</b>	8.46	215	45.8	Debris strainer for 4" bottom knockout	<b>93488</b>	-	-	0.2
K1-24 Sloped channel - 39.37" (1m)	<b>74024</b>	8.66	220	46.6	4" Oval to 6" round outlet adapter	<b>95140</b>	-	-	1.1
K1-25 Sloped channel - 39.37" (1m) <sup>D</sup>	<b>74025</b>	8.86	225	47.4	K1-Installation device	<b>97477</b>	-	-	2.8
K1-26 Sloped channel - 39.37" (1m)	<b>74026</b>	9.06	230	48.2	Grate removal tool	<b>01318</b>	-	-	0.3
K1-27 Sloped channel - 39.37" (1m)	<b>74027</b>	9.25	235	49.0	K1-QuickLok locking bar	<b>02899</b>	-	-	0.1

## Notes:

1. This channel offers a bottom knockout feature; 4" round/6" oval.
2. Inverts shown are for the male end; for female invert depth subtract 5mm (=0.2") from the male invert (except for neutral channels, where it will be same as male invert). To calculate the overall channel depth add 20mm (=0.8") to invert depth.
3. This catch basin kit includes a polymer concrete top, removable Quicklok locking bar, trash bucket and plastic base. Select an appropriate grate.
4. This catch basin kit includes a polymer concrete top, removable Quicklok locking bar, deep trash bucket, plastic riser and plastic base. Select an appropriate grate.

Specifications		Water absorption	0.07%	cast in by the manufacturer to ensure maximum homogeneity between polymer concrete body and edge rail. Each edge rail shall be at least 3/32" (2.5mm) thick.
General	The surface drainage system shall be ACO Drain K100 complete with gratings secured with 'QuickLok' locking as manufactured by ACO, Inc. or approved equal.	Frost proof	YES	
		Salt proof	YES	
		Dilute acid and alkali resistant	YES	
Materials		The trench system bodies shall be manufactured from polyester polymer concrete with the minimum properties as follows:	The nominal clear opening shall be 4" (100mm) with overall width of 5.12" (130mm). Pre-cast units shall be manufactured with either an invert slope of 0.5% or with neutral invert and have a wall thickness of at least 0.50" (13mm). Each unit will feature a partial radius in the trench bottom and a male to female interconnecting end profile. Units shall have horizontal cast in anchoring keys on the outside wall to ensure maximum mechanical bond to the surrounding bedding material and pavement surface. The galvanized steel edge rail will be integrally	
Compressive strength:		14,000 psi	<b>Installation</b> The trench drain system shall be installed in accordance with the manufacturer's installation instructions and recommendations.	
Flexural strength:		4,000 psi		

## ACO, Inc.

**Northeast Sales Office**  
9470 Pinecone Drive  
Mentor, OH 44060  
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Toll free: (800) 543-4764  
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**Southeast Sales Office**  
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Fort Mill, SC 29708  
Toll free: (800) 543-4764  
Fax: (803) 802-1063

**Electronic Contact:**  
info@ACODrain.us  
www.ACODrain.us



# Type 461Q Ductile iron slotted grate



## Product Features

- Certified to EN 1433 Load Class E - 135,000 lbs - 2,788 psi
- Uses 'QuickLok' boltless locking system
- Suitable for use with K100, KS100, C100, H100-8, H100-10, H100K-8, H100KS-8, and NW100 channels
- Manufactured from ductile iron to ASTM A 536-84 - Grade 65-45-12
- E- coated for improved resistance against rust
- Bicycle Tire Penetration Resistant to AS 3996 - 2006



## Specifications

### General

The surface drainage system shall be ACO Drain K100, KS100, C100, H100-8, H100-10, H100K-8, H100KS-8, and NW100 channels\* complete with ACO Type 461Q Ductile iron slotted grate with 'QuickLok' locking as manufactured by ACO Polymer Products, Inc. or similar approved.

### Materials

The covers shall be manufactured from ductile iron and have **minimum** properties as follows:

- **Independently certified to meet Load Class E to EN 1433 - 135,000 lbs - 2,788 psi**
- **Ductile iron to ASTM A 536-84 - Grade 65-45-12**
- **Intake area of 46.94 sq. in. (302.84 cm<sup>2</sup>) per half meter of grate**

The overall width of 4.84" (123mm) and overall length of 19.69" (500mm). Slots measure at a maximum of 3.95" (100.2mm).

### Installation

The trench drain system and grates shall be installed in accordance with the manufacturer's installation instructions and recommendations.

\* delete as appropriate

ACO Specification Information

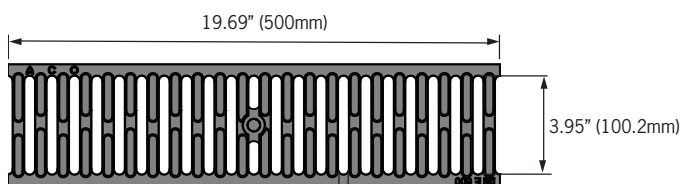


## ACO DRAIN

### Type 461Q Ductile iron slotted grate



**Plan view**

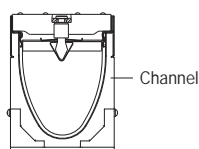


**Side elevation**



Description	Part No.	Length inches (mm)	Width inches (mm)	Weight lbs.
QuickLok grate				
Type 461Q Ductile iron slotted grate	96752	19.69 (500)	4.84 (123)	10.2
QuickLok locking bar	02899	-	-	0.1
QuickLok grate removal tool	01318	-	-	0.3

#### 'QuickLok' locking mechanism



Channel



Grate



'QuickLok' locking  
stud (fixed to grate)



'QuickLok' locking  
spring (fixed to  
locking bar)



'QuickLok' locking  
bar (side and plan  
views)

ACO 'QuickLok' is a patented boltless locking system, grates are removed and replaced with the minimum time and effort for ease of maintenance. The unique design provides a positive 'snap down' fit into the locking bar. A stud is fixed to the grate which 'locks' into the spring clip in the locking bar.

The 'QuickLok' stud is made from stainless steel and high density nylon, the locking bar and clip are stainless steel, for use in both general purpose and corrosive environments.

#### ACO Polymer Products, Inc.

##### Northeast Sales Office

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Chardon, OH 44024  
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##### West Sales Office

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Casa Grande, AZ 85130  
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Toll Free: (888) 490-9552  
Fax: (520) 421-9899

##### Southeast Sales Office

4211 Pleasant Road  
Fort Mill, SC 29708  
Toll free: (800) 543-4764  
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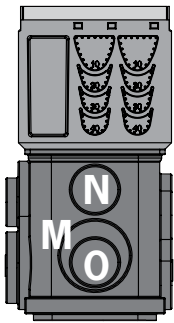
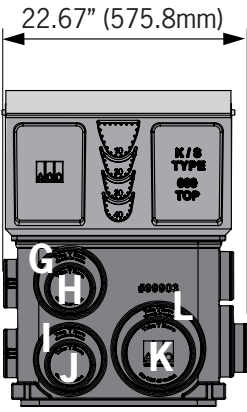
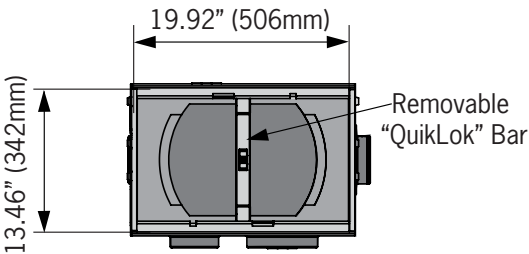
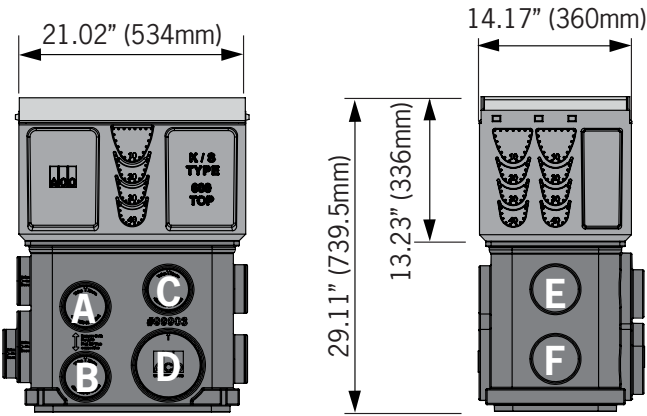
info@ACODrain.us  
www.ACODrain.us

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ACO DRAIN

K1-621G Catch Basin

K1-621G Catch Basin



Outlet flow rates

Outlet	Product	Outlet size (Sch. 40)	Invert Depth	GPM	CFS
A	Type K1-621G	4" round	21.29"	239	0.53
B	Type K1-621G	4" round	27.79"	276	0.62
C	Type K1-621G	4" round	19.72"	229	0.51
D	Type K1-621G	6" round	27.79"	610	1.36
E	Type K1-621G	4" round	19.84"	230	0.51
F	Type K1-621G	4" round	26.34"	269	0.60
G	Type K1-621G	6" round	20.62"	514	1.15
H	Type K1-621G	4" round	20.07"	231	0.52
I	Type K1-621G	6" round	27.76"	609	1.36
J	Type K1-621G	4" round	27.19"	273	0.61
K	Type K1-621G	6" round	27.19"	602	1.34
L	Type K1-621G	8" round	27.76"	1061	2.36
M	Type K1-621G	6" round	26.28"	591	1.32
N	Type K1-621G	4" round	19.15"	225	0.50
O	Type K1-621G	4" round	25.86"	266	0.59

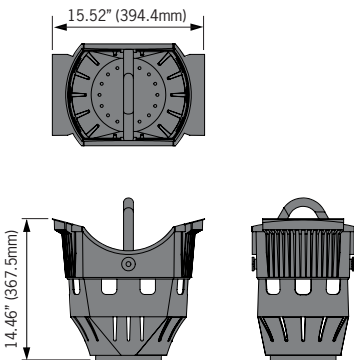
Notes:

1. These are the pipe flow rates at the specified outlet, **NOT** channel flow rates.

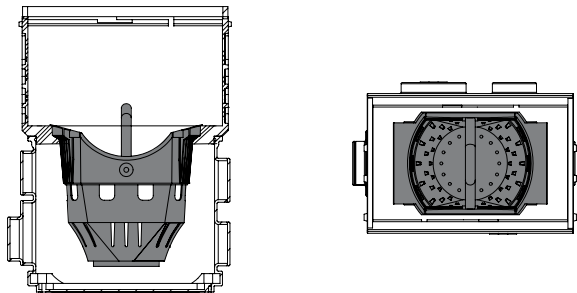
\*Flow rates without trash bucket - using trash bucket or filter bag reduces flow rates.

2. 4" diameter foul air trap, part# 90854, can be fitted to catch basin base at outlet positions A/B and E/F

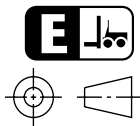
Trash Bucket



Note: Openings in trash bucket are 35.7"² (23,033mm²)



Note: Trash bucket position within K1-621G catch basin body and base



ACO Specification Information

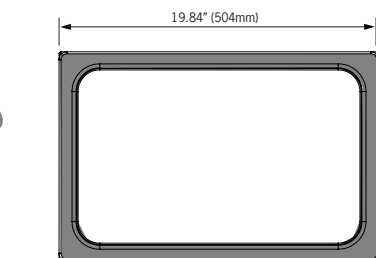
# ACO DRAIN

## K1-621G Catch Basin



Description	Part No.	Invert Depth inches	mm	Weight lbs.
Type K1-621G Catch basin assembly - top, removable "QuikLok" bar, trash bucket & base	<b>94617</b>	28.86	733.2	55.8
<b>Catch Basin Components</b>				
Type 600 optional riser	<b>99902</b>	40.86	1038	10.0
Foul air trap - fits both Type 900 & Type 600 basins	<b>90854</b>	-	-	1.2
QuikLok grate removal tool	<b>01318</b>	-	-	0.3

### Optional riser detail (Part# 99902)



#### Notes:

1. Riser can be cut down in 1" (25mm) increments.
2. Addition of riser will alter the outflow rates of base as shown on table overleaf.

### Specifications

#### General

The catch basin shall be ACO Drain K1-621G Catch Basin - comprising of top section, trash bucket and base as manufactured by ACO, Inc. or similar approved.

#### Materials

The top unit body shall be manufactured from polyester polymer concrete with minimum properties as follows:

Compressive strength:	14,000 psi
Flexural strength:	4,000 psi
Water absorption	0.07%
Frost proof	YES

Salt proof	YES
Dilute acid and alkali resistant	YES

The nominal clear opening shall be 13.46" (342mm) wide by 19.92" (506mm) long. Overall width of 22.70" (575.8mm) by 15.38" (390.6mm) long. Type K1-621G catch basin assembly has overall depth of 29.11" (739.5mm). Polymer concrete top units shall incorporate a cast in galvanized steel frame manufactured with drillouts for channel connection and have a wall thickness of at least 0.59" (15mm). Top units shall have horizontal cast in anchoring key features on the outside to ensure maximum mechanical bond to the surrounding bedding material and pavement surface. The base unit shall be a LLDPE plastic molding and incorporate molded plastic pipe stubbs to facilitate pipe connection.

#### Optional Riser

Optional riser can be useful between polymer concrete top unit and LLDPE base unit. Use of riser is determined by access and local building codes.

#### Grates

Grates shall be specified. See separate ACO Spec Info grate sheets for details. After removal of grates and 'QuickLok' bar there shall be uninterrupted access to the catch basin to aid maintenance. Accepts all half-meter ACO K300 Drainlok grates or K300 Quiklok grates with optional QL bar.

#### Installation

The trench drain/catch basin system shall be installed in accordance with the manufacturer's installation instructions and recommendations.

#### ACO, Inc.

##### Northeast Sales Office

9470 Pinecone Drive  
Mentor, OH 44060  
Tel: (440) 639-7230  
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Fax: (520) 421-9899

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#### Follow us on



#### Electronic Contact:

info@ACODrain.us  
www.ACODrain.us

**SPEC**  
**INFO**  
**ACO**

# Type 861Q Ductile iron slotted grate



## Product Features

- Certified to EN 1433 Load Class E - 135,000 lbs - 2,788 psi
- Uses 'QuickLok' boltless locking system
- Suitable for use with K300, KS300, H300K-13, and H300KS-13 channels and 621G, 621S, 631G, 631S catch basins
- Manufactured from ductile iron to ASTM A 536-84 - Grade 65-45-12
- E- coated for improved resistance against rust
- Bicycle Tire Penetration Resistant to AS 3996 - 2006



## Specifications

### General

The surface drainage system shall be ACO Drain K300, KS300, H300K-13, and H300KS-13, channels\* and 621G, 621S, 631G, and 631S catch basins complete with ACO Type 861Q Ductile iron slotted grate with 'QuickLok' locking as manufactured by ACO Polymer Products, Inc. or similar approved.

### Materials

The covers shall be manufactured from ductile iron and have **minimum** properties as follows:

- **Independently certified to meet Load Class E to EN 1433 - 135,000 lbs - 2,788 psi**
- **Ductile iron to ASTM A 536-84 - Grade 65-45-12**
- **Intake area of 128.71 sq. in. (803.39 cm<sup>2</sup>) per half meter of grate**

The overall width of 13.31" (338mm) and overall length of 19.69" (500mm). Slots measure at a maximum of 5.71" (145mm).

### Installation

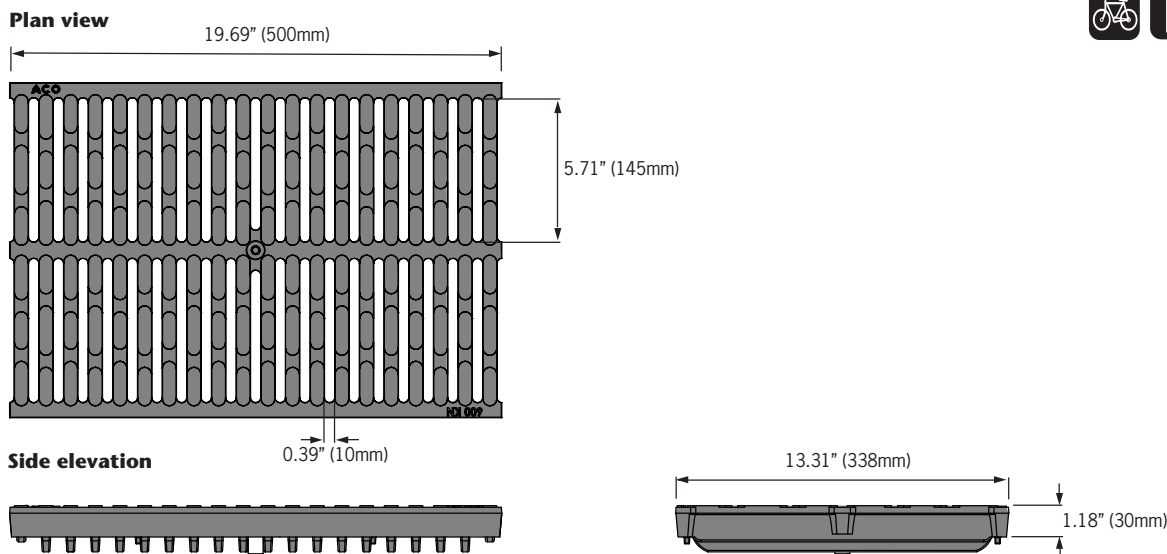
The trench drain system and grates shall be installed in accordance with the manufacturer's installation instructions and recommendations.

\* delete as appropriate

ACO Specification Information

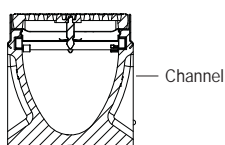
## ACO DRAIN

### Type 861Q Ductile iron slotted grate



Description	Part No.	Length inches (mm)	Width inches (mm)	Weight lbs.
QuickLok grate				
Type 861Q Ductile iron slotted grate	10431	19.69 (500)	13.35 (339)	48.0
QuickLok locking bar	10458	-	-	0.5
QuickLok grate removal tool	01318	-	-	0.3

#### 'QuickLok' locking mechanism



Grate

'QuickLok' locking stud (fixed to grate)

'QuickLok' locking spring (fixed to locking bar)

'QuickLok' locking bar (side and plan views)

ACO 'QuickLok' is a patented boltless locking system, grates are removed and replaced with the minimum time and effort for ease of maintenance. The unique design provides a positive 'snap down' fit into the locking bar. A stud is fixed into the grate which 'locks' into the spring clip in the locking bar.

The 'QuickLok' stud is made from stainless steel and high density nylon, the locking bar and clip are stainless steel, for use in both general purpose and corrosive environments.

#### ACO Polymer Products, Inc.

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Chardon, OH 44024  
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Apr 13/2

www.ACODrain.us

**SPEC**  
**INFO**  
**ACO**

# Trench Hydraulic Calculation for ACO Drainage Systems

## ACO Technical Services



### Project Details

Project Name : METRO GREENBANK  
 Project Number : 920 558  
 Street Address, City :  
 State zip code :

Date: 2020-08-13  
 Page: 1 of 5

### Customer

Company :  
 Contact Name :  
 Street Address, City :  
 State zip code :  
 Phone :  
 Email :

### Input Data

Location :

Number	Catchment Description	Area [m²]	C	D [min]	F [a]	I [mm/hr]	Catchment Surface Type	Installation
1	TD1	168.0	0.90	0	0	150	Asphalt	E600
2	TD2	336.0	0.90	0	0	150	Asphalt	E600

Channel type	Catchment (s)	Catchment Area [m²]	C <sub>m</sub>	Total run length [m]	Application
TD1	1	168.00	0.90	6.50	
TD2	2	336.00	0.90	13.50	

### Notes

# Trench Hydraulic Calculation for ACO Drainage Systems

ACO Technical Services



## Project Details

Project Name : METRO GREENBANK  
 Project Number : 920 558  
 Street Address, City :  
 State zip code :

Date: 2020-08-13

Page: 2 of 5

## Input

Channel type : TD1  
 Trench drain system : K100  
 Sloping, Neutral or Combination layout :  
 Roughness Coefficient (Strickler) inverse Mannings: 95  
 Invert Type : Channel Slope  
 Type of Outlet : sump unit-DN/OD200  
 Run Length [m] : 6.50  
 Catchment Area [m²] : 168  
 Runoff Coefficient [C<sub>m</sub>] : 0.90

Hydraulic run length [m] : 6.50

All run segments combine to give the total run length.

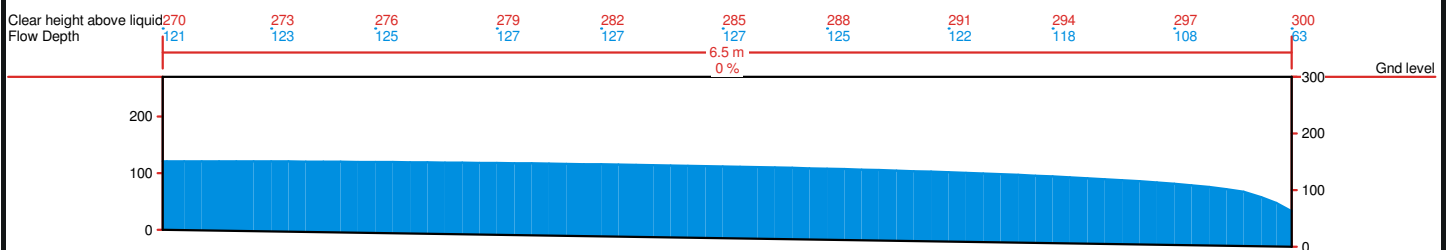
Section		1	2	3	4	5	6	7	8	9	10
Internal Width	[mm]	98									
Upstream Invert	[mm]	270									
Downstream Invert	[mm]	300									
Run Length	[m]	7									
Groundslope	[%]	0.000									

## Results

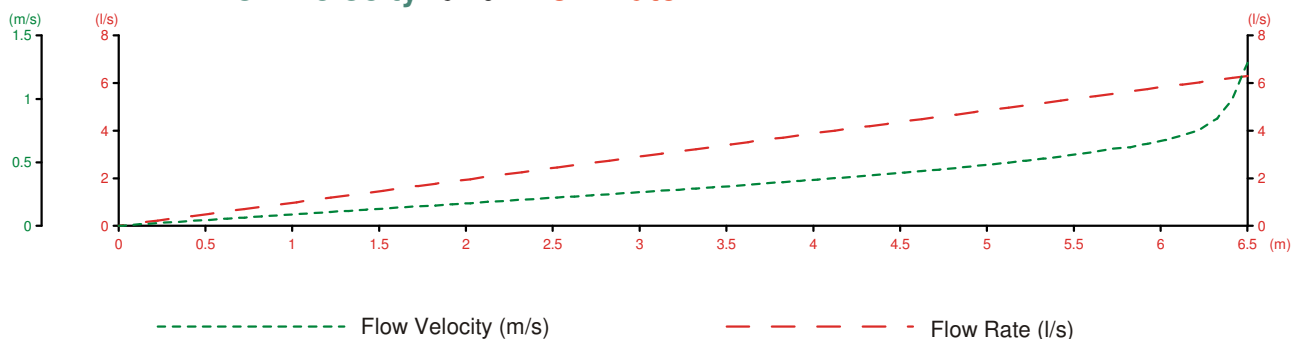
Discharge [l/s] : 6.30  
 Flow Velocity [m/s] : 1.28  
 Minimum Freeboard [mm] : 149.08, X = 0.00 m (Freeboard Depth)  
 Drain Capacity Utilised [%] : 32.21

## Level of liquid

All depths are in mm



## Flow Velocity and Flow Rate



# Trench Hydraulic Calculation for ACO Drainage Systems

## ACO Technical Services



### Project Details

Project Name : METRO GREENBANK  
Project Number : 920 558  
Street Address, City :  
State zip code :

Date: 2020-08-13

Page: 3 of 5

Channel type : TD1  
Trench drain system : K100  
Sloping, Neutral or Combination layout :  
Type of Outlet : sump unit-DN/OD200  
Run Length [m] : 6.50  
Hydraulic run length [m] : 6.50

### Notes

### Installation

#### Legend

LC = Load Class according to EN1433 (A15; B125; C250; D400; E600; F900)

SU = Catch Basin

AU = Access Unit

VO = Vertical Outlet

FO = Free Outflow

EO = End Outlet

LO = Lateral Outlet

A = Adapter

P = Plate



# Trench Hydraulic Calculation for ACO Drainage Systems

ACO Technical Services



## Project Details

Project Name : METRO GREENBANK  
 Project Number : 920 558  
 Street Address, City :  
 State zip code :

Date: 2020-08-13

Page: 4 of 5

## Input

Channel type : TD2  
 Trench drain system : K100  
 Sloping, Neutral or Combination layout :  
 Roughness Coefficient (Strickler) inverse Mannings : 95  
 Invert Type : Channel Slope  
 Type of Outlet : sump unit-DN/OD200  
 Run Length [m] : 13.50  
 Catchment Area [m²] : 336  
 Runoff Coefficient [C<sub>m</sub>] : 0.90

Hydraulic run length [m] : 13.50

All run segments combine to give the total run length.

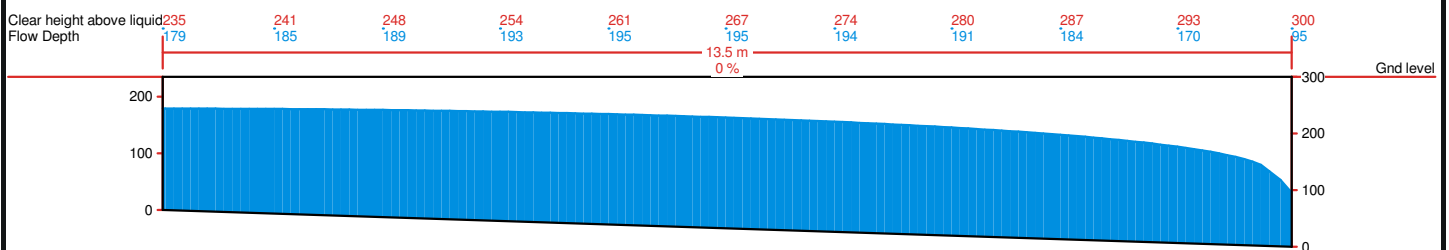
Section		1	2	3	4	5	6	7	8	9	10
Internal Width	[mm]	98									
Upstream Invert	[mm]	235									
Downstream Invert	[mm]	300									
Run Length	[m]	14									
Groundslope	[%]	0.000									

## Results

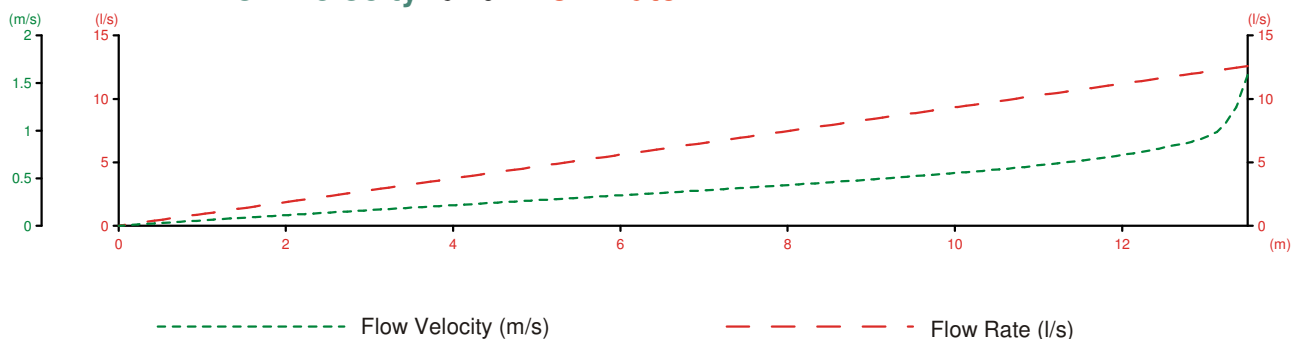
Discharge [l/s] : 12.60  
 Flow Velocity [m/s] : 1.58  
 Minimum Freeboard [mm] : 56.29, X = 0.00 m (Freeboard Depth)  
 Drain Capacity Utilised [%] : 71.30

### Level of liquid

All depths are in mm



### Flow Velocity and Flow Rate



# Trench Hydraulic Calculation for ACO Drainage Systems

## ACO Technical Services



### Project Details

Project Name : METRO GREENBANK  
Project Number : 920 558  
Street Address, City :  
State zip code :

Date: 2020-08-13

Page: 5 of 5

Channel type : TD2  
Trench drain system : K100  
Sloping, Neutral or Combination layout :  
Type of Outlet : sump unit-DN/OD200  
Run Length [m] : 13.50  
Hydraulic run length [m] : 13.50

### Notes

### Installation

#### Legend

LC = Load Class according to EN1433 (A15; B125; C250; D400; E600; F900)

SU = Catch Basin

AU = Access Unit

VO = Vertical Outlet

FO = Free Outflow

EO = End Outlet

LO = Lateral Outlet

A = Adapter

P = Plate

## **ACO KlassikDrain - K100 w/ 461Q – Specifications:**

### **General**

The surface drainage system shall be ACO KlassikDrain K100 complete with Type 461Q class "E" slotted ductile Iron gratings secured with 'QuickLok' boltless locking mechanism as manufactured by ACO Systems Ltd. For technical assistance or supply information, please contact ACO Canada (905)-829-0665 or [info@acocan.ca](mailto:info@acocan.ca).

### **Materials**

The trench system bodies shall be manufactured from polymer concrete with minimum properties as follows:

Compressive strength: 14,000 psi

Flexural strength: 4,000 psi

Water absorption 0.07%

Frost proof

Salt proof

Dilute acid and alkali resistant

The nominal clear opening shall be 4.00" (100mm) with overall width of 5.12" (130mm). Pre-cast units shall be manufactured with either an invert slope of 0.5% or with neutral invert and have a wall thickness of at least 0.50" (13mm). Each unit will feature a partial radius in the trench bottom and a male to female interconnecting end profile. Units shall have horizontal cast in anchoring features on the outside wall to ensure maximum mechanical bond to the surrounding bedding material and pavement surface. The galvanized steel edge rail will be integrally cast in by the manufacturer to ensure maximum homogeneity between polymer concrete body and edge rail. Each edge rail shall be at least 3/32" (2.5mm) thick.

### **Grates**

The grates shall be Type 461 slotted ductile iron with 'QuickLok' boltless locking mechanism as manufactured by ACO Systems Ltd. After removal of the grates and 'QuickLok' bar there shall be uninterrupted access to the trench to aid in maintenance.

### **Materials**

The grates shall be manufactured from ductile iron and have **minimum** properties as follows;

- **Independently certified to meet Load Class E to DIN 19580 - 135,000 lbs - 2,788 psi.**
- **Ductile iron to ASTM A 536-84 - Grade 65-45-12.**
- **Intake area of 20.79 sq. in. (134.13cm<sup>2</sup>) per half meter of grate.**

The overall width of 4.84" (123mm) and overall length of 19.69" (500mm). Slots measure 3.94" (100mm) by 0.39" (10mm) per half meter of grate.

### **Installation**

The trench drain system shall be installed in accordance with the manufacturer's installation instructions and recommendations.

## 2.2 Findings of the Functional Servicing and Stormwater Management Report

The **Functional Servicing and Stormwater Management Report** (DSEL, December 2016) established the stormwater control criteria, the pond location and the general stormwater management scheme.

The proposed stormwater management facility is to be designed with the following characteristics:

- **Water Quality Control:** The permanent pool should be sized for an enhanced level of protection. A 40 m<sup>3</sup>/ha active volume portion for water quality control should be provided in accordance with the **SWMP Design Manual**.
- A sediment forebay shall be provided.
- Emergency overflow conveyance will be provided to safely pass emergency flows.

A summary of the required SWM pond characteristics is provided in Table 1.

## 3.0 DRAINAGE ANALYSIS

The pond design characteristics and requirements, based on a 123.414 ha total drainage area to the pond (121.656 ha contributing minor system flows requiring quality control treatment), as shown in **Figure 2**, are summarized in **Table 1** as follows:

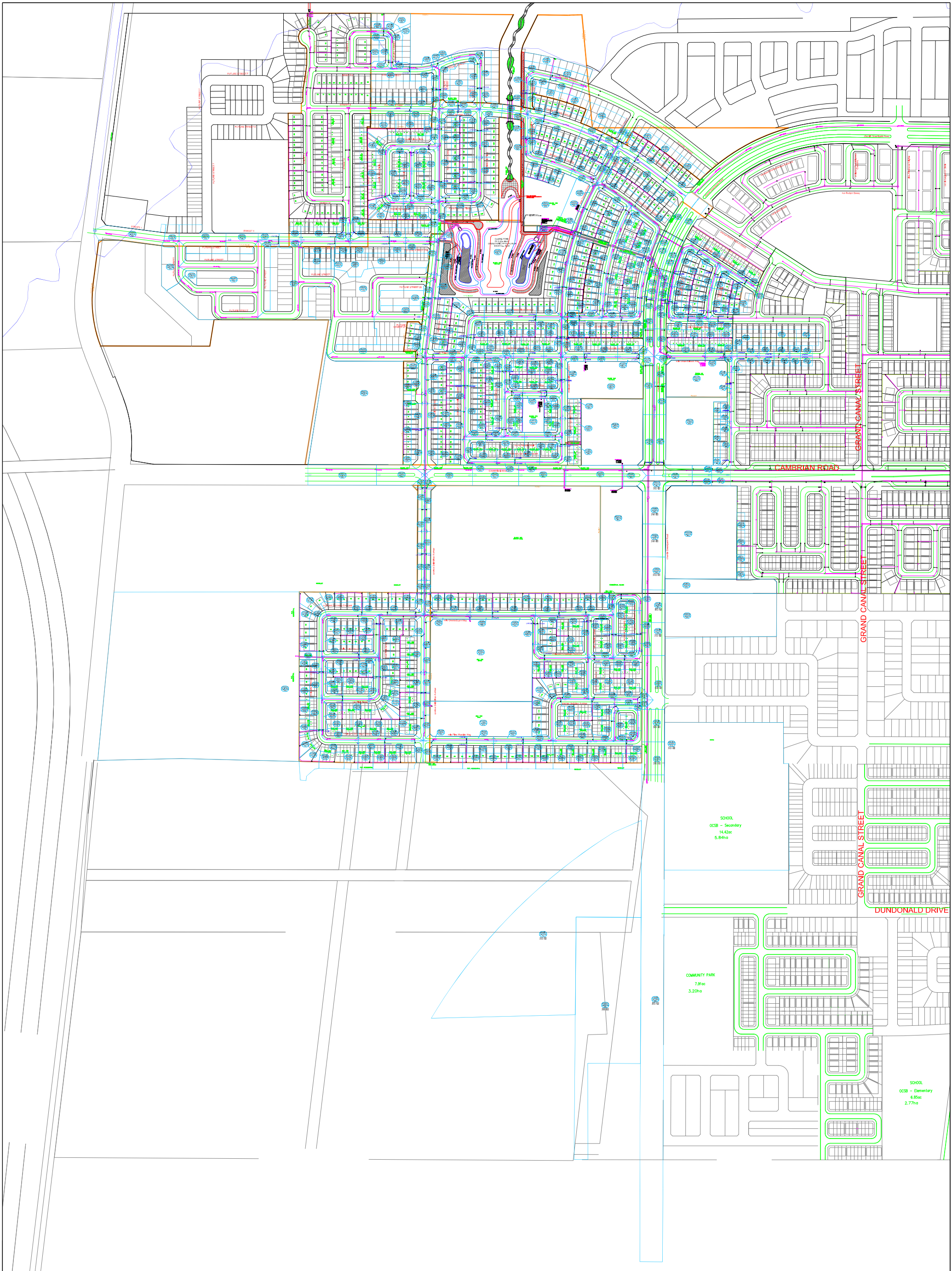
**Table 1**  
**SWM Pond Design Characteristics**


Item	Target	Comments
Drainage Area	123.414 ha total; 121.656 ha minor flows	121.121 ha future development, 0.535 ha existing Half Moon Bay park block, 1.758 ha major flows only from existing Half Moon Bay subdivision
Imperviousness	67%	
Required Permanent Pool Volume	21,655 m <sup>3</sup>	Based on 178.00 m <sup>3</sup> /ha <sup>(1)</sup>
Required Quality Control Volume	4,866 m <sup>3</sup>	40 m <sup>3</sup> /ha
Allowable Release Rate for Quality Control	141 L/s	Minimum extended detention time between 24 to 48 hours <sup>(2)</sup>

<sup>(1)</sup> Note: Interpolated for 67% imperviousness, enhanced protection level for wet pond, as per Table 3.2 of the SWM Planning and Design Manual. Refer to Tables B-1 and B-2 of **Appendix B**.

<sup>(2)</sup> Refer to Tables B-3 and B-4 of **Appendix B**.

Furthermore, the detailed design of the facility has been completed in general conformance with the **SWMP Design Manual**.





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

PROJECT :

PHASES 7 AND 8 OF THE  
MEADOWS IN HALF MOON BAY  
SUBDIVISION

TITLE :

PROPOSED MAJOR SYSTEM

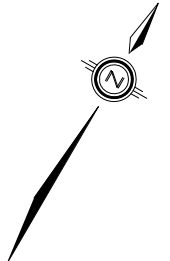
FIGURE 3B

SCALE:

0 75 150 225 300 375m

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
- LP812NW LOW POINT
- A812NW 0.083 ha 74% SUB-CATCHMENT ID SUB-CATCHMENT AREA TOTAL IMPERVIOUSNESS



DESIGNED :	
DRAWN :	LP
VERIFIED :	LP
APPROVED :	JFS
DATE	PROJECT No.
Feb/20	598(07)-17

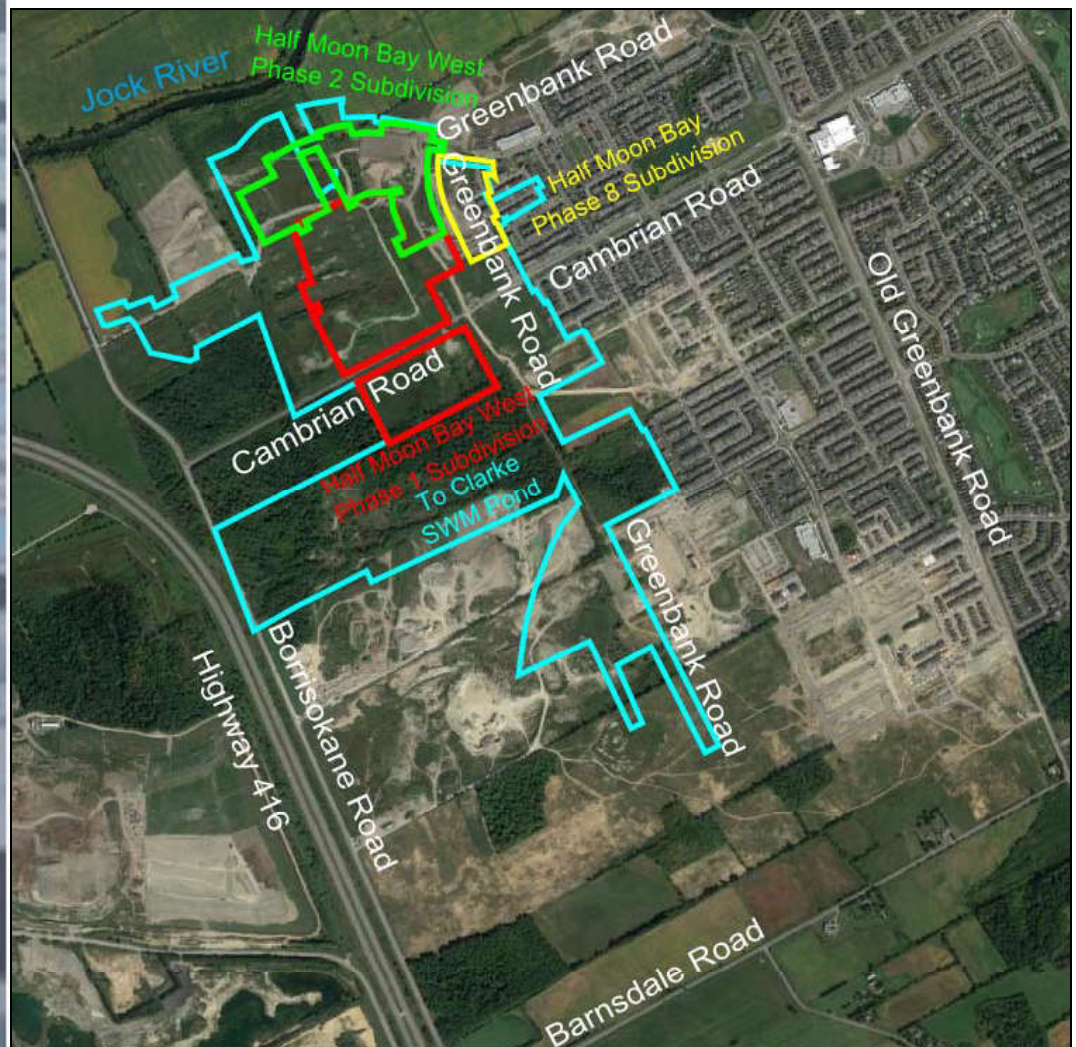




# Stormwater Management Report for Phase 2 of the Half Moon Bay West Subdivision

City of Ottawa

February 2019  
Updated October 2019



JFSA Ref. No.: 598(07)

J.F. Sabourin and Associates Inc.  
www.jfsa.com

Prepared for : David Schaeffer Engineering Ltd.

Prepared by :

**JFSA**

Water Resources and  
Environmental Consultants



**Table 3: Composite Hydraulic Gradeline Results for 100-Year Design Storms**

U/S MH	D/S MH	Max. U/S HGL (m)	Max. D/S HGL (m)	Lot Number	USF / Top of MH Elev (m)	Freeboard  (m)	Interpolated HGL		
							Length HGL (m)	Dist. From D/S MH (m)	HGL (m)
				78	93.38	0.370	45.0	14.0	93.010
				79	93.47	0.448	45.0	25.5	93.022
				80	93.48	0.444	45.0	39.9	93.036
				105	93.54	0.515	45.0	28.6	93.025
				106	93.54	0.530	45.0	14.2	93.010
				104	93.69	0.652	45.0	41.6	93.038
819	820	92.996	92.863	60	93.28	0.284			
				60	93.28	0.357	124.5	56.1	92.923
				61	93.29	0.353	124.5	69.2	92.937
				57	93.30	0.422	124.5	14.3	92.878
				56	93.31	0.441	124.5	5.5	92.869
				58	93.34	0.446	124.5	28.7	92.894
				59	93.34	0.432	124.5	41.7	92.908
				64	93.38	0.403	124.5	106.7	92.977
				62	93.39	0.438	124.5	83.6	92.952
				63	93.39	0.428	124.5	92.3	92.962
				65	93.47	0.479	124.5	119.8	92.991
820	720	92.863	92.750	55	93.32	0.457			
				55	93.32	0.473	66.0	56.9	92.847
				54	93.33	0.502	66.0	45.3	92.828
				52	93.36	0.579	66.0	17.9	92.781
				53	93.36	0.555	66.0	32.3	92.805
900	901	93.629	93.590	Ground (3)	97.30	3.671			
901	902	93.590	93.279	Ground (3)	96.31	2.720			
902	903	93.279	93.313	Ground (3)	95.51	2.231			
903	904	93.313	93.086	Ground (3)	94.14	0.827			
904	5060	93.086	93.078	Ground (3)	93.33	0.244			
400	400a	92.727	92.698	Ground (3)	93.55	0.823			
400a	401	92.698	92.694	N/A	N/A	N/A			
401	402	92.694	92.679	Ground (3)	93.48	0.786			
402	402a	92.679	92.669	Ground (3)	93.49	0.811			
402a	404	92.669	92.649	N/A	N/A	N/A			
403	404	92.670	92.649	Ground (3)	93.46	0.790			
404	404a	92.649	92.630	Ground (3)	93.26	0.611			
404a	405	92.630	92.568	N/A	N/A	N/A			
405	406	92.568	92.422	Ground (3)	93.22	0.652			
406	406a	92.422	92.391	Ground (3)	93.38	0.958			
406a	407	92.391	92.352	N/A	N/A	N/A			
407	407a	92.352	92.350	Ground (3)	93.17	0.818			
407a	410	92.350	92.335	N/A	N/A	N/A			
409	409a	92.359	92.348	Ground (3)	93.21	0.851			
409a	410	92.348	92.335	N/A	N/A	N/A			
410	410a	92.335	92.327	Ground (3)	93.21	0.875			
410a	413	92.327	92.311	N/A	N/A	N/A			
411	411a	92.428	92.424	Ground (3)	93.29	0.862			
411	414	92.428	92.418	Ground (3)	93.29	0.862			
411a	413	92.424	92.311	N/A	N/A	N/A			
412	412a	92.501	92.315	Ground (3)	92.94	0.439			
412a	417	92.315	92.291	N/A	N/A	N/A			
413	413a	92.311	92.268	Ground (3)	93.10	0.789			
413a	425	92.268	92.232	N/A	N/A	N/A			
414	414a	92.418	92.404	Ground (3)	93.31	0.892			
414a	415	92.404	92.391	N/A	N/A	N/A			





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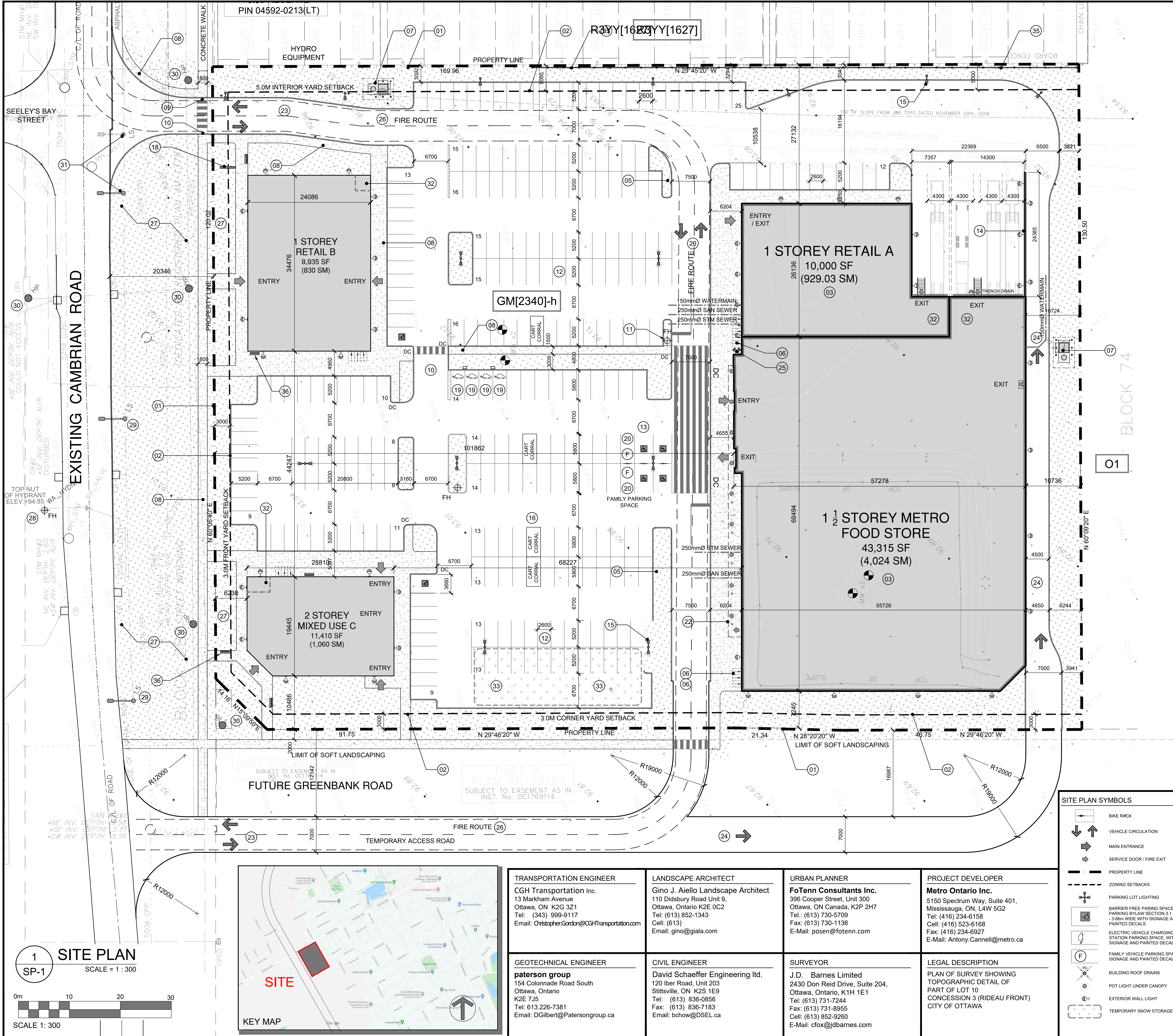
***DRAWINGS / FIGURES***

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### PROJECT INFORMATION

ZONING	GM[2340]-h
SITE AREA	22,063.0 sq. m. (237,484 sq. ft.)
BUILDING HEIGHT	6 Storeys or 24.0 M
FRONT YARD SETBACK	3.0 M
CORNER YARD SETBACK	3.0 M
INTERIOR YARD SETBACK	5.0 M
REAR YARD SETBACK	0.0 M
LANDSCAPE BUFFER AROUND A PARKING LOT	3.0 M
LOADING SPACE - METRO	1
LOADING SPACE - RETAIL 'A'	0
PARKING - FOOD STORE	99
PARKING - RETAIL	24

### GROSS BUILDING - AREAS

GFA - CITY OF OTTAWA'S DEFINITION	2,921.3 sq. m. (31,449 sq. ft.)
RETAIL FOOD - METRO	696.8 sq. m. (7,500 sq. ft.)
RETAIL STORE 'A' (ESTIMATE)	622.5 sq. m. (6,700 sq. ft.)
RETAIL STORE 'B' (ESTIMATE)	786.0 sq. m. (8,557 sq. ft.)
MIXED USE 'C' (ESTIMATE)	2 x 530.0 sq. m. 2 x 5,709 sq. ft.
TOTAL AREA	5,035.1 sq. m. (54,197 sq. ft.)
GFA - BUILDING FOOTPRINT	4,024.0 sq. m. (43,315 sq. ft.)
RETAIL FOOD - METRO	929.0 sq. m. (10,000 sq. ft.)
RETAIL STORE 'A'	830.0 sq. m. (8,935 sq. ft.)
RETAIL STORE 'B'	1,060.0 sq. m. (11,410 sq. ft.)
MIXED USE 'C'	6,845.0 sq. m. (73,653 sq. ft.)
TOTAL AREA	6,845.0 sq. m. (73,653 sq. ft.)

### CAR PARKING

REQUIRED	
METRO - RETAIL FOOD	-3.4 PER 100 m <sup>2</sup> OF GFA 99
RETAIL - BLDG 'A'	-3.4 PER 100 m <sup>2</sup> OF GFA 24
RESTAURANT - BLDG 'B'	-3.4 PER 100 m <sup>2</sup> OF GFA 21
1st FL. RETAIL - BLDG 'C'	-3.4 PER 100 m <sup>2</sup> OF GFA 27
2nd FL. OFFICE - BLDG 'C'	-3.4 PER 100 m <sup>2</sup> OF GFA 27
TOTAL	123
PROVIDED	
METRO - RETAIL FOOD	-4.3 PER 1,000 m <sup>2</sup> OF FOOTPRINT AREA 192
RETAIL - BLDG 'A'	30
RETAIL - BLDG 'B'	25
MIXED USE - BLDG 'C'	29
MIXED USE - BLDG 'C'	29
TOTAL	276
METRO PARKING SPACE	2.74 x 5.75 m 64
STANDARD PARKING SPACE	2.0 x 5.2 m 205
SMALL CAR PARKING SPACE	2.4 x 4.6 m 0
BARRIER FREE SPACE	3.66 x 5.2 m 7

### BICYCLE PARKING

REQUIRED	
COMMERCIAL RETAIL	-1.0 PER 250m <sup>2</sup> OF G.F.A. 20
PROVIDED	24

### LOADING

PROVIDED	
COMMERCIAL RETAIL	-2,000m <sup>2</sup> & OVER OF G.F.A. 2
COMMERCIAL CAFE	-0m <sup>2</sup> TO 350m <sup>2</sup> OF G.F.A. 1
TOTAL	3

### LOT COVERAGE

PAVED SURFACE =	10,464.1 sq. m.	47.4%
BUILDING FOOTPRINT =	6,281.0 sq. m.	28.5%
LANDSCAPE OPEN SPACE =	5,317.9 sq. m.	24.1%
TOTAL =	22,063.0 sq. m.	100.0%

### DRAWING NOTES

- PROPERTY LINE
- BUILDING SETBACK LINE
- PROPOSED COMMERCIAL BUILDING
- FUTURE DEVELOPMENT AREA
- LANDSCAPE ISLAND WITH 150mm BARRIER CURB
- BICYCLE PARKING SPACES (0.6 x 1.8M) WITH RACK
- HYDRO EQUIPMENT
- CONCRETE SIDEWALK, WIDTH AS NOTED
- TWSBI TO BE LOCATED AND INSTALLED AS PER CITY REQUIREMENTS
- PEDESTRIAN CROSS WALK WITH DEPRESSION CURBS
- FIRE HYDRANT
- STANDARD PARKING SPACE (2.6 x 5.2 M)
- BARRIER FREE PARKING SPACE
- DROPPED GARBAGE / LOADING BAYS WITH SCREEN WALL
- LIGHT STANDARD - LOCATION TO BE CONFIRMED
- CART CORRAL
- PAINTED ISLAND AND OR CURBS
- PYLON SIGN
- ELECTRIC VEHICLE SPACE WITH CHARGING STATION AND SIGNAGE
- FAMILY PARKING SPACE WITH SIGNAGE
- WATER STORAGE TANK, SEE CIVIL
- BUILDING CANOPY
- 2 WAY ACCESS DRIVEWAY / ROAD
- 1 WAY ACCESS DRIVEWAY / ROAD
- SIAMSE CONNECTION
- FIRE ROUTE
- SOFT LANDSCAPING
- EXISTING FIRE HYDRANT
- EXISTING LIGHT STANDARD
- EXISTING HYDRO POLE
- RELOCATE EXISTING LIGHT STANDARD
- INTERNAL GARBAGE / RECYCLING AREA
- TEMPORARY SNOW STORAGE AREA
- MOUNTABLE CURB WITH CONCRETE TRUCK APRON
- 3.0m HT. SOUND BARRIER FENCE
- BENCH

### SITE PLAN SYMBOLS

- BIKE RACK
- VEHICLE CIRCULATION
- MAIN ENTRANCE
- SERVICE DOOR / FIRE EXIT
- PROPERTY LINE
- ZONING SETBACKS
- PARKING LOT LIGHTING
- BARRIER FREE PARKING SPACE AS PER PARKING BYLAW SECTION 3.1 - 3.6M WIDE WITH SIGNAGE AND PAINTED DECALS
- ELECTRIC VEHICLE CHARGING STATION PARKING SPACE, WITH SIGNAGE AND PAINTED DECALS
- FAMILY VEHICLE PARKING SPACE, WITH SIGNAGE AND PAINTED DECALS
- BUILDING ROOF DRAINS
- POT LIGHT UNDER CANOPY
- EXTERIOR WALL LIGHT
- TEMPORARY SNOW STORAGE

### NOTATION SYMBOLS:

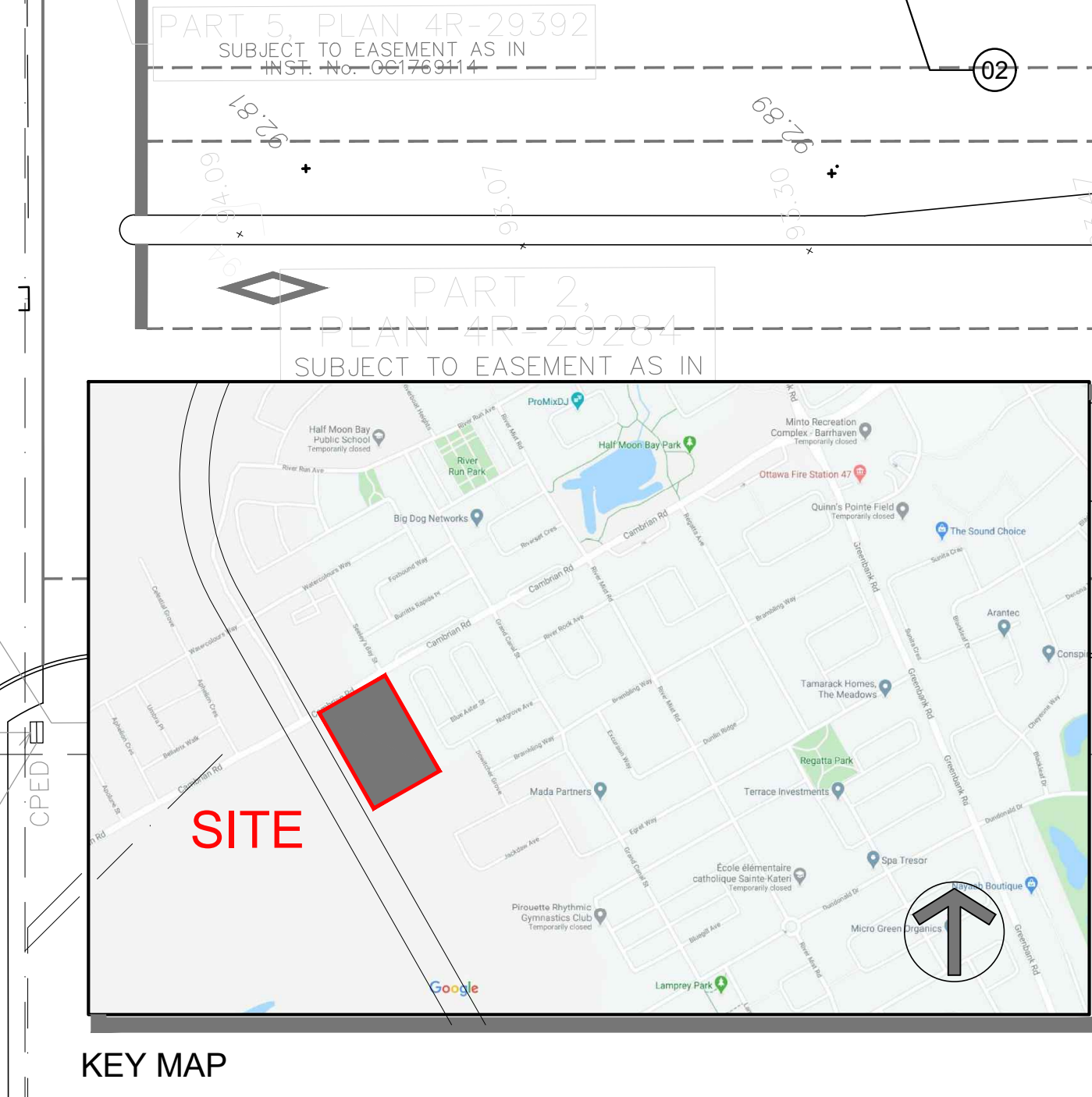
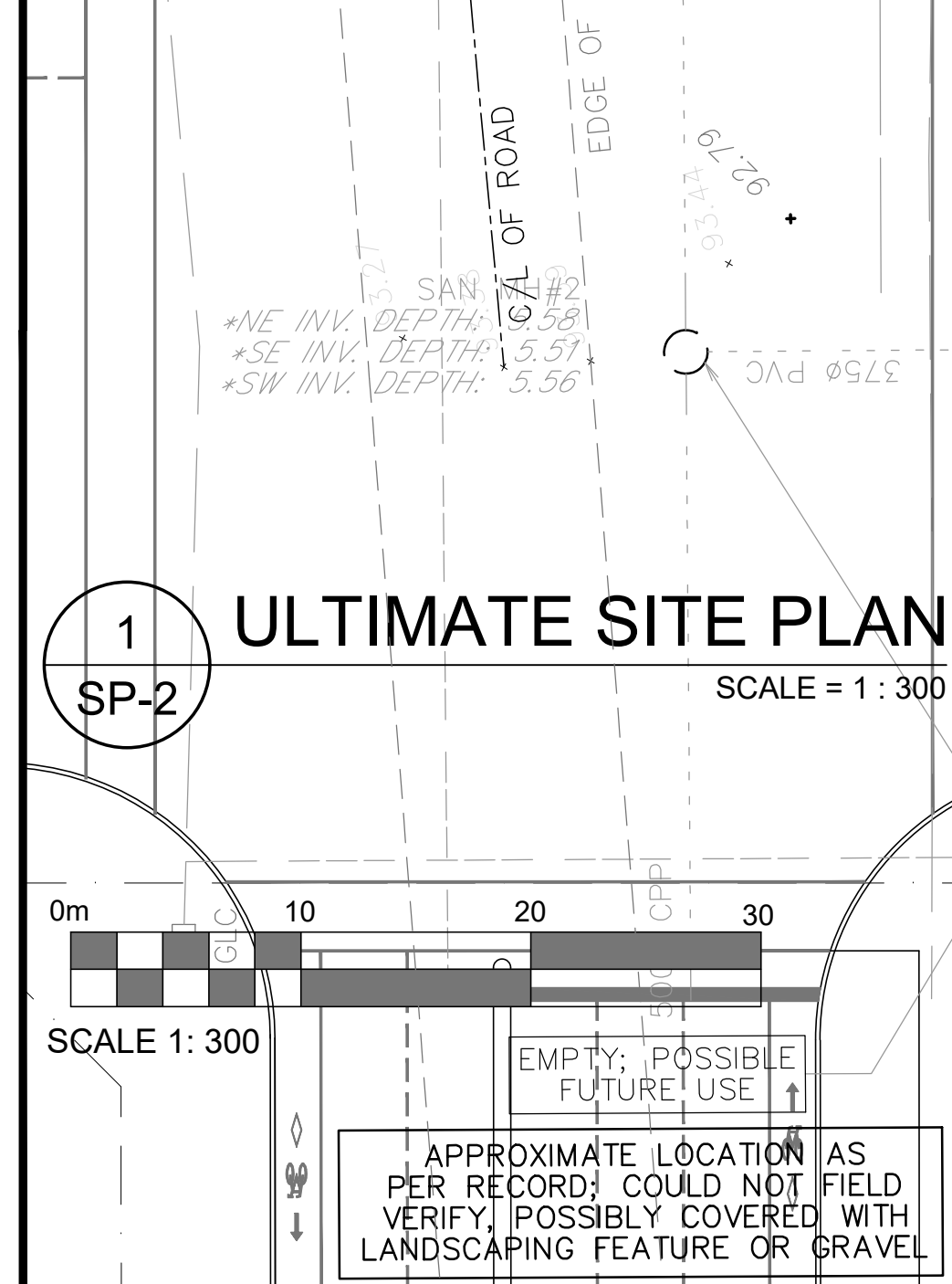
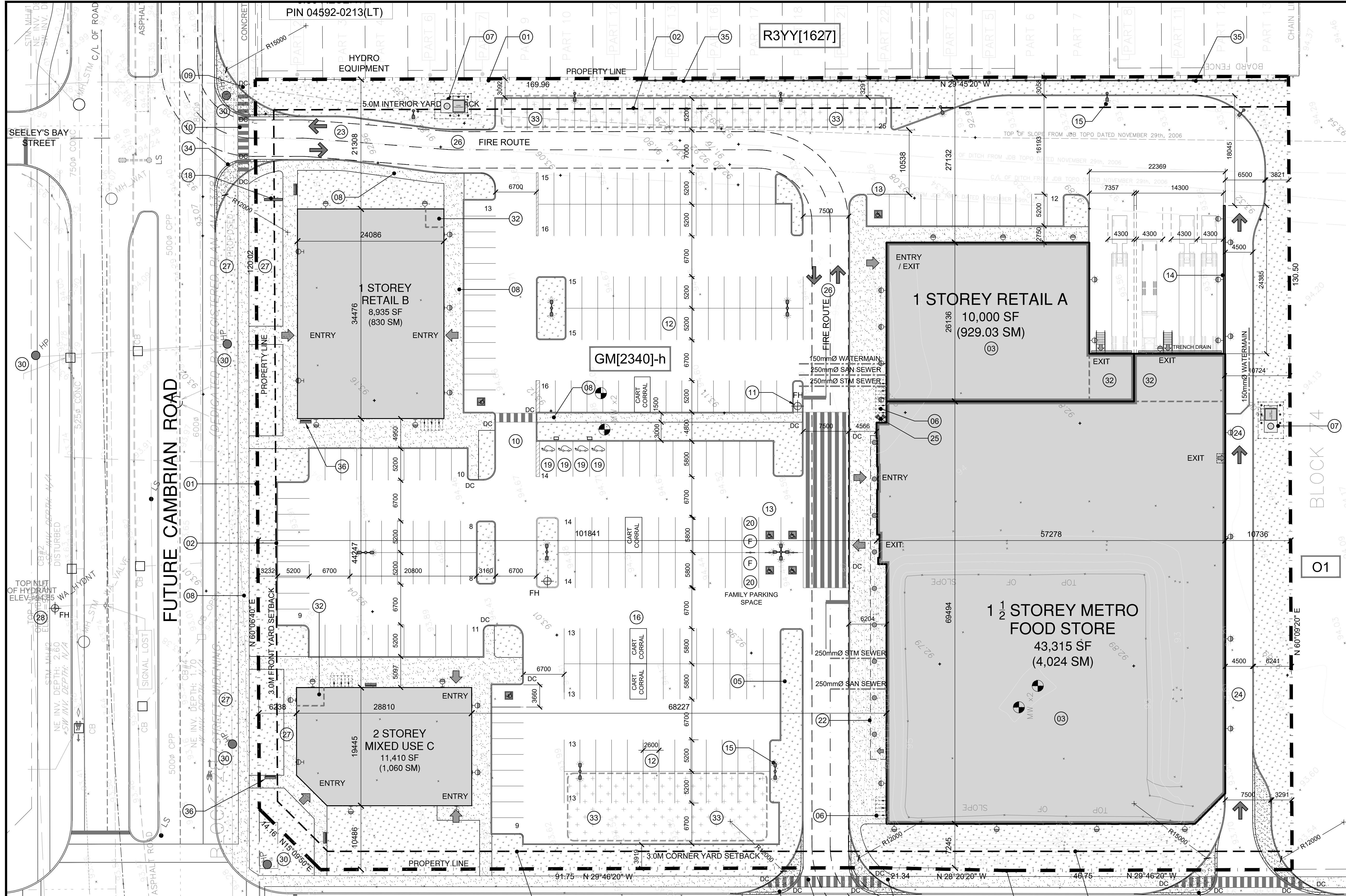
- INDICATES DRAWING NOTES, LISTED ON EACH SHEET.
- INDICATES ASSEMBLY TYPE; REFER TO TYPICAL ASSEMBLIES SCHEDULE.
- INDICATES WINDOW TYPE; REFER TO WINDOW ELEVATIONS AND DETAILS ON A800 SERIES.
- INDICATES DOOR TYPE; REFER TO DOOR SCHEDULE AND DETAILS ON A800 SERIES.
- DETAIL NUMBER
- TITLE
- SCALE
- DETAIL REFERENCE PAGE
- DETAIL CROSS REFERENCE PAGE

REVISED FOR 1st ROUND OF COMMENTS	Mar. 23, 21
ISSUED FOR SITE PLAN CONTROL	Aug. 31, 20
ISSUED FOR CONSULTANT REVIEW	July 9, 20
ISSUED FOR CONSULTANT REVIEW	June 25, 20

### REVISIONS:

ARCHITECT SEAL:	NORTH ARROW:
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25 Vickers Rd Bldg A 2 Floor, Etobicoke Ont M9B 1C1	
Tel: 416-234-6118 Fax: 416-234-6927	
ARCHITECT:	
56 beech street, ottawa, ontario K1S 3J6	
Tel: 613.724.9932 F: 613.724.1209 rlaarchitecture.ca	
PROJECT TITLE:	
<b>METRO - BARRHAVEN</b>	
<b>GREENBANK ROAD @</b>	
<b>CAMBRIAN ROAD</b>	
OTTAWA ONTARIO	
SHEET TITLE:	
<b>SITE PLAN</b>	
DRAWN:	CHECKED:
RV	R.V.
SCALE:	SHEET No.
1:300	
PROJECT No.	
1949	
	<b>SP-1</b>





**TRANSPORTATION ENGINEER**  
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Cell: (613) 836-7183  
Email: gino@giuala.com

**URBAN PLANNER**  
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Cell: (416) 523-6168  
Fax: (416) 234-6927  
E-Mail: posen@fotenn.com

**PROJECT DEVELOPER**  
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K2E 7J5  
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**CIVIL ENGINEER**  
David Schaeffer Engineering Ltd.  
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Stittsville, ON K2S 1E9  
Tel: (613) 836-0856  
Fax: (613) 836-7183  
Email: bchow@DSEL.ca

**SURVEYOR**  
J.D. Barnes Limited  
2430 Don Reid Drive, Suite 204,  
Ottawa, Ontario, K1H 1E1  
Tel: (613) 731-7244  
Fax: (613) 731-8955  
Cell: (613) 852-9260  
E-Mail: cfox@jdbarnes.com

**LEGAL DESCRIPTION**  
PLAN OF SURVEY SHOWING  
TOPOGRAPHIC DETAIL OF  
PART OF LOT 10  
CONCESSION 3 (RIDEAU FRONT)  
CITY OF OTTAWA

SITE PLAN SYMBOLS	
	BIKE RACK
	VEHICLE CIRCULATION
	MAIN ENTRANCE
	SERVICE DOOR / FIRE EXIT
	PROPERTY LINE
	ZONING SETBACKS
	PARKING LOT LIGHTING
	BARRIER FREE PARING SPACE AS PER PARKING BYLAW SECTION 3.1 - 3.16m WIDE WITH SIGNAGE AND PAINTED DECALS
	ELECTRIC VEHICLE CHARGING STATION PARKING SPACE, WITH SIGNAGE AND PAINTED DECALS
	FAMILY VEHICLE PARKING SPACE, WITH SIGNAGE AND PAINTED DECALS
	BUILDING ROOF DRAINS
	POT LIGHT UNDER CANOPY
	EXTERIOR WALL LIGHT
	TEMPORARY SNOW STORAGE

### PROJECT INFORMATION

**ZONING** GM[2340]-h  
**SITE AREA** 22,063.0 sq. m. (237,484 sq. ft.)  
**BUILDING HEIGHT** 6 Storeys or 24.0 M  
**FRONT YARD SETBACK** 3.0 M  
**CORNER YARD SETBACK** 3.0 M  
**INTERIOR YARD SETBACK** 5.0 M  
**REAR YARD SETBACK** 0.0 M  
**LANDSCAPE BUFFER AROUND A PARKING LOT** 3.0 M  
**LOADING SPACE - METRO** 1  
**LOADING SPACE - RETAIL 'A'** 0  
**PARKING - FOOD STORE** 99  
**PARKING - RETAIL** 96

**GROSS BUILDING - AREAS**

GFA - CITY OF OTTAWA'S DEFINITION	2,921.3 sq. m. (31,449 sq. ft.)
RETAIL FOOD - METRO	696.8 sq. m. (7,500 sq. ft.)
RETAIL STORE 'A' (ESTIMATE)	622.5 sq. m. (6,700 sq. ft.)
RETAIL STORE 'B' (ESTIMATE)	766.0 sq. m. (8,300 sq. ft.)
MIXED USE 'C' (ESTIMATE)	2 x 530.0 sq. m. 2 x 5,709 sq. ft.

**TOTAL AREA** 5,035.1 sq. m. (54,197 sq. ft.)

**GFA - BUILDING FOOTPRINT** 4,024.0 sq. m. (43,315 sq. ft.)  
**RETAIL FOOD - METRO** 696.8 sq. m. (7,500 sq. ft.)  
**RETAIL STORE 'A'** 622.5 sq. m. (6,700 sq. ft.)  
**RETAIL STORE 'B'** 766.0 sq. m. (8,300 sq. ft.)  
**MIXED USE 'C'** 2 x 530.0 sq. m. 2 x 5,709 sq. ft.

**TOTAL AREA** 6,843.0 sq. m. (73,650 sq. ft.)

**CAR PARKING**

**REQUIRED**

METRO - RETAIL FOOD	- 3.4 PER 100 m <sup>2</sup> OF G.F.A.	99
RETAIL - BLDG 'A'	- 3.4 PER 100 m <sup>2</sup> OF G.F.A.	24
RESTAURANT - BLDG 'B'	- 3.4 PER 100 m <sup>2</sup> OF G.F.A.	21
1st FL. RETAIL - BLDG 'C'	- 3.4 PER 100 m <sup>2</sup> OF G.F.A.	27
2nd FL. OFFICE - BLDG 'C'	- 3.4 PER 100 m <sup>2</sup> OF G.F.A.	27

**TOTAL** 123

**PROVIDED**

METRO - RETAIL FOOD	- 4.3 PER 1,000 M <sup>2</sup> OF FOOTPRINT AREA	192
RETAIL - BLDG 'A'		30
RETAIL - BLDG 'B'		25
MIXED USE - BLDG 'C'		29
MIXED USE - BLDG 'C'		29

**TOTAL** 276

**METRO PARKING SPACE** 2.74 x 5.75 m 64  
**STANDARD PARKING SPACE** 2.0 x 5.2 m 205  
**SMALL CAR PARKING SPACE** 2.4 x 4.6 m 0  
**BARRIER FREE SPACE** 3.66 x 5.2 m 7

**BICYCLE PARKING**

**REQUIRED**

COMMERCIAL RETAIL	- 1.0 PER 250m <sup>2</sup> OF G.F.A.	20
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**PROVIDED**

COMMERCIAL RETAIL	- 2,000m <sup>2</sup> & OVER OF G.F.A.	2
COMMERCIAL CAFE	- 0m <sup>2</sup> TO 350m <sup>2</sup> OF G.F.A.	1

**TOTAL** 3

**LOT COVERAGE**

PAVED SURFACE =	10,464.1 sq. m.	47.4%
BUILDING FOOTPRINT =	6,281.0 sq. m.	28.5%
LANDSCAPE OPEN SPACE =	5,317.9 sq. m.	24.1%
<b>TOTAL</b>	<b>22,063.0 sq. m.</b>	<b>100.0%</b>

**DRAWING NOTES**

- PROPERTY LINE
- BUILDING SETBACK LINE
- PROPOSED COMMERCIAL BUILDING
- FUTURE DEVELOPMENT AREA
- LANDSCAPE ISLAND WITH 150mm BARRIER CURB
- BICYCLE PARKING SPACES (0.6 x 1.8M) WITH RACK
- HYDRO EQUIPMENT
- CONCRETE SIDEWALK, WIDTH AS NOTED
- TWSI TO BE LOCATED AND INSTALLED AS PER CITY REQUIREMENTS
- PEDESTRIAN CROSS WALK WITH DEPRESSION CURBS
- FIRE HYDRANT
- STANDARD PARKING SPACE (2.0 x 5.2 M)
- BARRIER FREE PARKING SPACE
- DROPPED GARBAGE / LOADING BAYS WITH SCREEN WALL
- LIGHT STANDARD - LOCATION TO BE CONFIRMED
- CART CORRAL
- PAINTED ISLAND AND OR CURBS
- PYLON SIGN
- ELECTRIC VEHICLE SPACE WITH CHARGING STATION AND SIGNAGE
- FAMILY PARKING SPACE WITH SIGNAGE
- WATER STORAGE TANK, SEE CIVIL
- BUILDING CANOPY
- 2 WAY ACCESS DRIVEWAY / ROAD
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- EXISTING FIRE HYDRANT
- EXISTING LIGHT STANDARD
- EXISTING HYDRO POLE
- RELOCATE EXISTING LIGHT STANDARD
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- TEMPORARY SNOW STORAGE AREA
- MOUNTABLE CURB WITH CONCRETE TRUCK APRON
- 3.0m HT. SOUND BARRIER FENCE
- BENCH

**NOTATION SYMBOLS:**

INDICATES DRAWING NOTES, LISTED ON EACH SHEET.

INDICATES ASSEMBLY TYPE; REFER TO TYPICAL ASSEMBLIES SCHEDULE.

INDICATES WINDOW TYPE; REFER TO WINDOW ELEVATIONS AND DETAILS ON A800 SERIES.

INDICATES DOOR TYPE; REFER TO DOOR SCHEDULE AND DETAILS ON A500 SERIES.

DETAIL NUMBER

TITLE

DETAIL REFERENCE PAGE

DETAIL CROSS REFERENCE PAGE

IT IS THE RESPONSIBILITY OF THE APPROPRIATE CONTRACTOR TO CHECK AND VERIFY ALL DIMENSIONS ON SITE AND TO REPORT ALL ERRORS AND/OR OMISSIONS TO THE ARCHITECT.

ALL CONTRACTORS MUST COMPLY WITH ALL PERTINENT CODES AND BY-LAWS.

THIS DRAWING MAY NOT BE USED FOR CONSTRUCTION UNTIL SIGNED BY THE ARCHITECT.

DO NOT SCALE DRAWINGS.

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**PROJECT TITLE:**  
METRO - BARRHAVEN  
GREENBANK ROAD @  
CAMBRIAN ROAD  
OTTAWA ONTARIO

**SHEET TITLE:**  
ULTIMATE  
SITE PLAN  
SP-2

**DRAWN:** RV  
**CHECKED:** R.V.  
**SCALE:** 1:300  
**SHEET No.:**  
**PROJECT No.:** 1949