373 PRINCETON AVENUE
OTTAWA, ONTARIO

SERVICING BRIEF AND STORMWATER MANAGEMENT REPORT

Prepared for:

UNIFORM URBAN DEVELOPMENTS
Suite 300, 117 Centrepointe Drive
Ottawa, Ontario
K2G 5X3

&

CORNERSTONE HOUSING FOR WOMEN
c/o Cahdco
Suite 200, 415 Gilmour Street
Ottawa, Ontario
K2P 2M8

Prepared by:

NOVATECH
Suite 200, 240 Michael Cowpland Drive
Ottawa, Ontario
K2M 1P6

May 2017

Novatech File: 116126-00
Ref. No: R-2017-042

May 08, 2017

City of Ottawa
Planning and Growth Management Department
Development Review (Urban) Branch
Infrastructure Approvals Division
110 Laurier Avenue West, 4th Floor
Ottawa, Ontario
K1P 1J1

Attention: **Robert Sandercott and Erin O'Connell**
Planning Services

Dear Sir:

Reference: **373 Princeton Avenue**
Servicing Design Brief
Our File No.: 116126-00

Enclosed herein is the Servicing Brief and Stormwater Management Report for the development at 373 Princeton Avenue. This report is submitted in support of the severance application for the existing Jeanne D'Arc Institute, which is to be converted to the Cornerstone Housing for Women, represented by Cahdco.

This report is also in support of the re-zoning and site plan control applications for the remaining land within the parcel, represented by Uniform Urban Developments. It outlines how the site will be serviced with sanitary sewer, storm sewer and watermain.

Although this report is in support of separate applications that will be reviewed and approved independently, we trust that this report is adequate for your purposes. Should you have any questions, or require additional information, please contact me.

Yours truly,

NOVATECH

Sam Bahia, P. Eng.
Project Manager | Land Development

/bs

Cc Emily Meyers, Uniform Urban Developments
Cynthia Jacques, Cahdco

TABLE OF CONTENTS

LIST OF FIGURES:

LIST OF APPENDICES:

ATTACHED PLANS:

1.0 *INTRODUCTION*

1.1 Background and Development Intent

The development planned at 373 Princeton Avenue is located on the north side of Princeton bounded by Edison and Melbourne Avenues within the City of Ottawa, as shown in Figure 1 - Key Plan. The total area of the existing parcel is approximately 0.586 hectares consisting of the existing Jeanne D'Arc Institute (JDI), miscellaneous buildings, and a parking lot. The existing conditions are shown in Figure 2.

The JDI building, currently residing on the parcel, is to be converted into the Cornerstone Housing for Women (Cornerstone) and will remain on approximately 0.227 hectares of the parcel area, at the south-west corner of the site. The existing building contains forty-eight (48) single-person bedroom suites, and is to be retrofitted to forty-two (42) single-person bedroom suites. FoTenn, as the applicant for both Cornerstone and Uniform, will advance with a severance application to the City of Ottawa to establish the proposed property limits. Figure 3 – Proposed Site Plan, of which Area 1 demonstrates the proposed Cornerstone severance boundary.

Uniform Urban Developments (Uniform) will retain the remaining portion of the parcel surrounding Cornerstone, for proposed low-rise housing, consisting of sixteen (16) unit mix of single, semi-detached and townhome dwellings. Refer to Figure 3, of which Area 2 demonstrates the proposed housing which will connect directly to the existing public right-of-ways (Edison and Melbourne Avenues); while Area 3 demonstrates units that require a private, common element laneway, which is to be directed to Princeton Avenue. Uniform will apply for re-zoning of the remnant parcel, and site plan control through the City of Ottawa. As identified in the City of Ottawa's Zoning By-law (ZBL), the site is currently designated as I1A – minor institutional zone which accommodates the current use of the JDI. A zoning amendment application will seek to revise a portion of the site's current designation to R3N (as provided by Uniform). Specific details are provided in the planning rationale submitted as part of the ZBL amendment application. A site plan control application will be submitted concurrently.

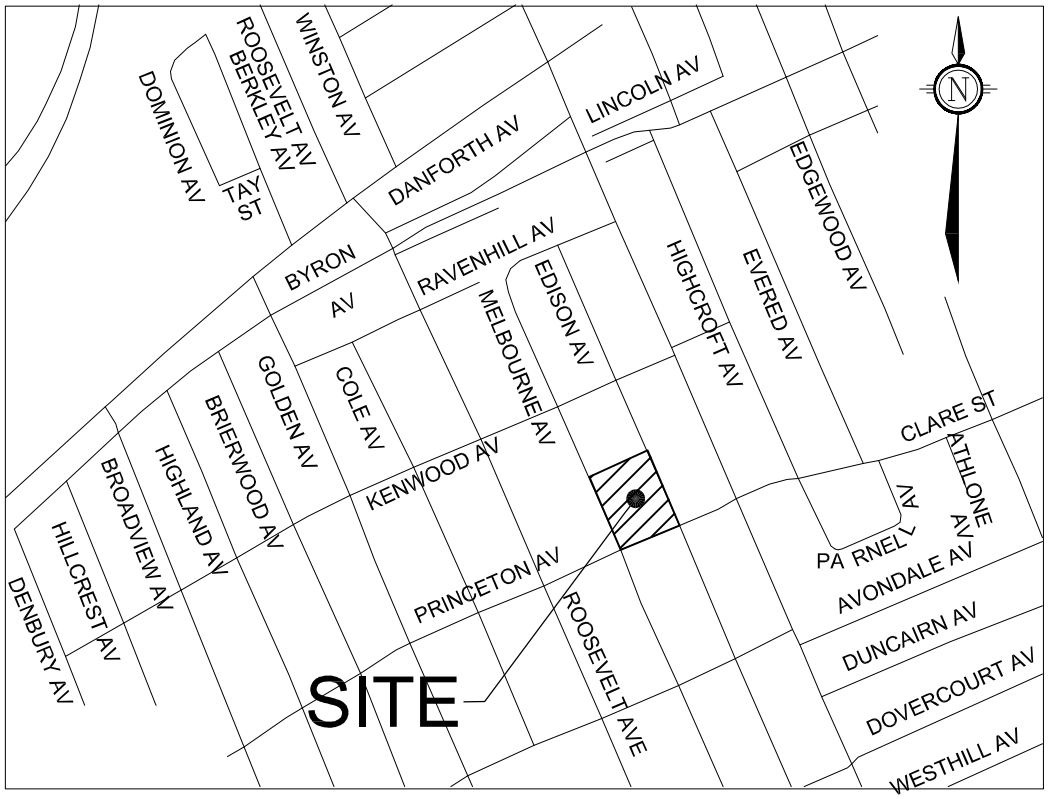
Based on the approval process and development logistics, it is highly likely that the Cornerstone site will proceed in advance of the Uniform housing.

1.2 Report Objective

This report provides servicing and stormwater management details and a functional design in support of the parcel severance, re-zoning, and site plan control applications.

This Servicing Brief and Stormwater Management Report will outline how the site will be serviced with independent sanitary sewer, storm sewer and watermain services; moreover, will illustrate that the severed parcel's grading and drainage are self-contained.

In order to commence with the re-zoning and site plan control applications of the site, this brief demonstrates that the proposed development will have marginal impact upon the existing public services; and outline the proposed development servicing details which will be used in support of any servicing or grading required as part of the building permit application process.



NOVATECH
Engineers, Planners & Landscape Architects
Suite 200, 240 Michael Cowpland Drive
Ottawa, Ontario, Canada K2M 1P6

Telephone (613) 254-9643
Facsimile (613) 254-5867
Website www.novatech-eng.com

KEY PLAN

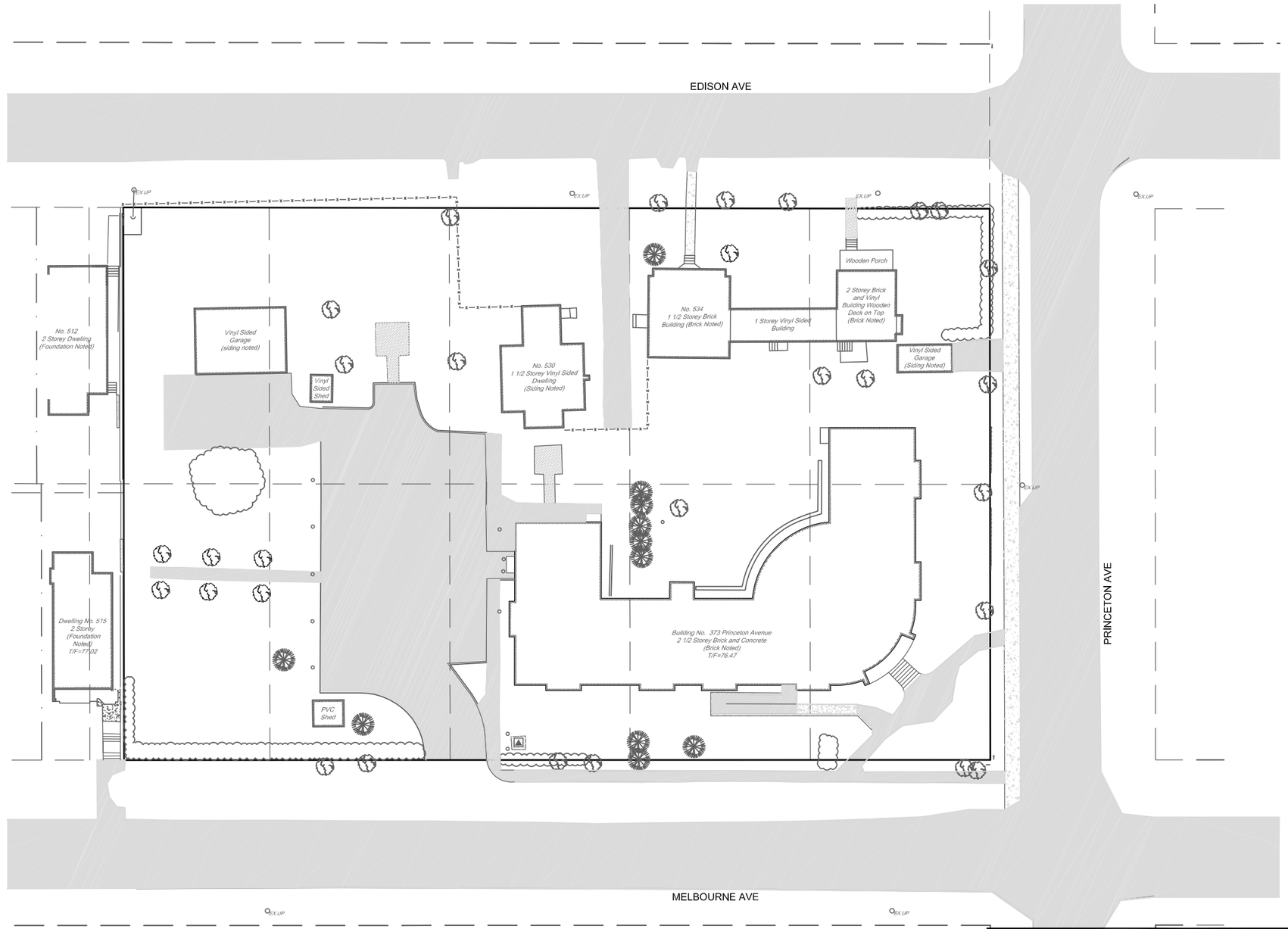
LOTS 23 TO 26 AND PART OF LOT 22
(WEST EDISON AVENUE)
LOTS 23 TO 26 AND PART OF LOT 22
(EAST MELBOURNE AVENUE)
REGISTERED PLAN 204, CITY OF OTTAWA

373 PRINCETON AVENUE

DATE	JOB	FIGURE
FEB 2017	116126	1

M:\2016\116126\CAD\Design\Figures\116126-KP.dwg, FIG1, Feb 09, 2017 - 1:20pm, bsweet

SHT8X11.DWG - 216mmx279mm



M:\2016\116126\CADDesign\116126-ExCons.dwg, FIG2, Jan 06, 2017 - 10:57am, bsweet

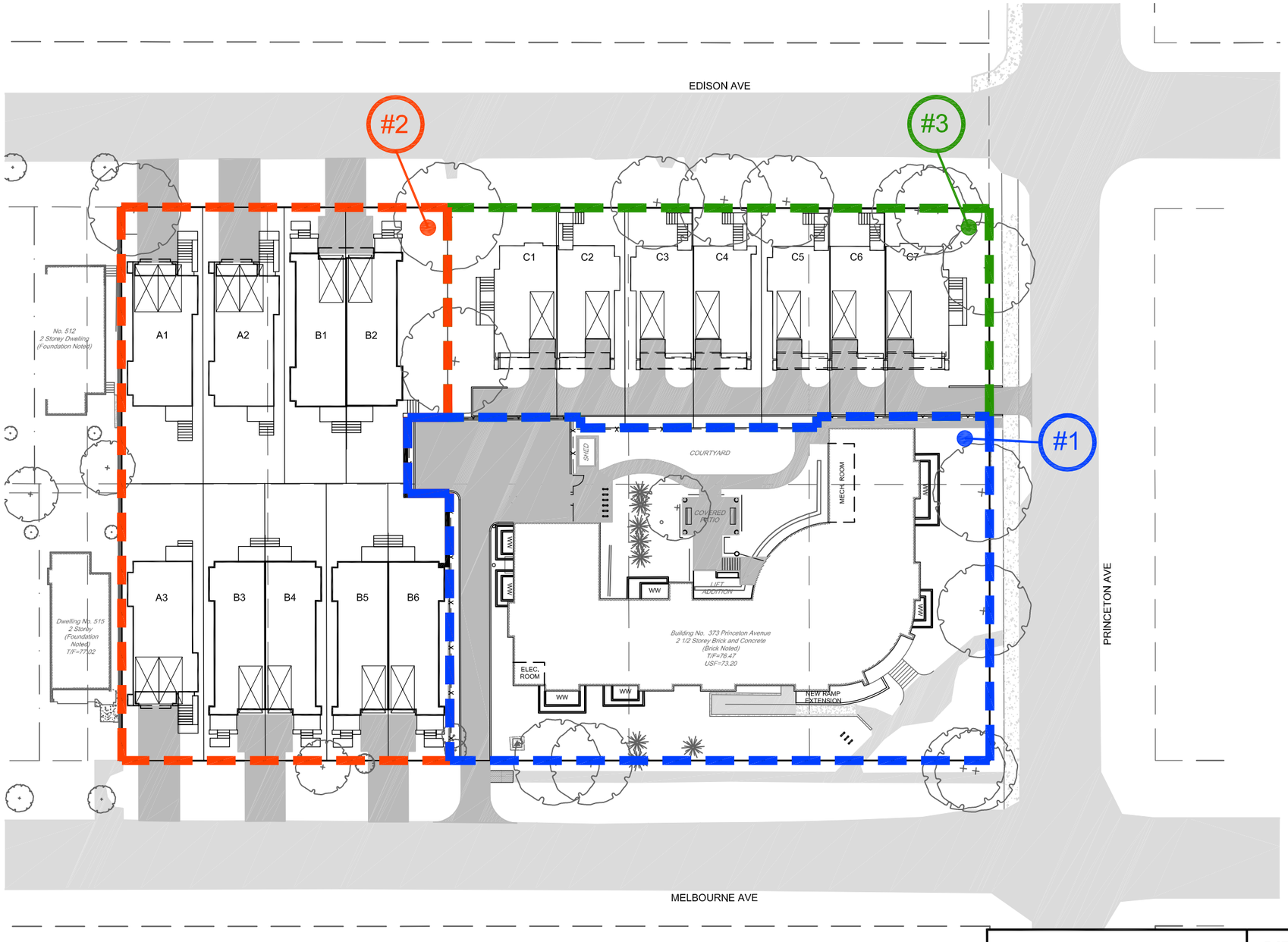
NOVATECH
Engineers, Planners & Landscape Architects
Suite 200, 240 Michael Cowpland Drive
Ottawa, Ontario, Canada K2M 1P6
Telephone (613) 254-9643
Facsimile (613) 254-5867
Website www.novatech-eng.com

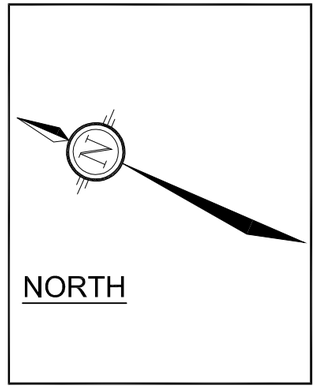
CITY OF OTTAWA
373 PRINCETON AVENUE

EXISTING CONDITIONS PLAN

SCALE 1 : 500 (0 5 10 15 20)

DATE FEB 2017 | JOB 116126 | FIGURE 2





M:\2016\116126\CAD\Design\Figures\Design Brief\116126-SP.dwg, FIG3, Feb 09, 2017 - 11:47pm, bsweet

NOVATECH
Engineers, Planners & Landscape Architects
Suite 200, 240 Michael Cowpland Drive
Ottawa, Ontario, Canada K2M 1P6
Telephone (613) 254-9643
Facsimile (613) 254-5867
Website www.novatech-eng.com

CITY OF OTTAWA
373 PRINCETON AVENUE

PROPOSED SITE PLAN

SCALE 1 : 500 (0 5 10 15 20)

DATE FEB 2017 | JOB 116126 | FIGURE 3

2.0 *REFERENCES AND SUPPORTING DOCUMENTS*

2.1 Guidelines and Supporting Studies

The following guidelines and supporting documents were utilized in the preparation of this report:

- ***City of Ottawa Water Distribution Guidelines***
  City of Ottawa, October 2012.
  (OWDG)
- ***Technical Bulletin ISDTB-2014-02, Revisions to Ottawa Design Guidelines - Water***
  City of Ottawa, May 2014.
- ***City of Ottawa Sewer Design Guidelines***
  City of Ottawa, October 2012.
  (OSDG)
- ***City of Ottawa Technical Bulletin PIEDTB-2016-01 (Stormwater Management)***
  City of Ottawa, October 2016.
  (City Guidelines)
- ***Stormwater Management Guidelines for the Pinecrest Creek/Westboro Area***
  J.F. Sabourin and Associates Inc., October 2012.
  (Westboro SWM Guidelines)
- ***Bay-Kitchissippi Drainage System Assessment – Technical Memo LOS Evaluation***
  Stantec, 2008.
  (Bay - Kitchissippi LOS Drainage System Assessment)
- ***Mississippi-Rideau Source Protection Plan***
  Mississippi Valley C Authority & Rideau Valley Conservation Authority, August 2014.

The City of Ottawa Servicing Study Guidelines for Development Applications checklist has been completed and is attached in **Appendix D**.

2.2 Geotechnical Investigations

Paterson Group (Paterson) has been retained to undertake further investigations. Paterson will also be providing recommendations on the proposed methodology for the installation of the required “amended topsoil” which will be discussed in the following sections of this brief.

The following geotechnical study was prepared in support of the previous development completed by Uniform in 2008, just north of the subject site, referred to as ‘The Avenues’, located at 360 Edison Drive:

- Geotechnical Investigation, Proposed Residential Development, Kenwood Avenue at Edison Avenue Ottawa, Ontario (Paterson Group, March 2, 2007, Report No. PG0949-1)

Based on the above geotechnical study, it is not anticipated that there will be any detrimental geotechnical concerns with respect to servicing the proposed development. However, consideration may be warranted for the servicing of Uniform laneway with respect to impact to the existing JDI building foundation. This consideration will form part of the recommendations of the geotechnical report.

3.0 *SANITARY*

The Cornerstone site's retrofitting and the proposed Uniform housing are to be evaluated independently, under Section 3.1 and 3.2.

The following outlines the proposed post-development wastewater flows to the receiving sanitary sewers:

City of Ottawa Sewer Design Guidelines Criteria (referenced in Section 2.1)
Wastewater Criteria:

- Average Domestic Flow per person = 350 L/day/person
- Population per Unit (Single family) = 3.4 persons/unit
- Population per Unit (Semi-detached) = 2.7 persons/unit
- Population per Unit (Townhouse) = 2.7 persons/unit
- Population per Unit (1 Bedroom Apartment) = 1.4 persons/unit
- Peaking factor = Harmon Formula (maximum of 4.0 for smaller populations)

3.1 Cornerstone Post-Development Sanitary Flows

Cornerstone is to be serviced by the existing 150mm diameter PVC sanitary service lateral that connects to the existing 250mm diameter public sanitary sewer on Princeton Avenue, referred to as connection (1). Given that the sanitary sewer demands from the existing site is to be decreased by 6 one-bedroom apartment units, a comparison of the pre-development to the post-development flows is required in order to ensure that the receiving sewer has adequate capacity.

(1) Princeton Avenue
Proposed change in flows to Princeton Avenue sanitary sewer:

- Number of Existing Bachelor Apartment Units = 48
- Number of Proposed Bachelor Apartment Units = 42
- Total Change in Population = 6 units x 1.4 persons/unit=8.4 people
- Total Change in Average Flows = 350 L/day x 8.4 people = 2,940 L/day = 0.034 L/s
- Total Decrease in Peak Flows = 4.0 x (2,940 L/day / 86,400 s/day) = **0.136 L/s**

The total change in peak sanitary flow outletting into the existing Princeton sanitary sewers, due to the Cornerstone renovation, is a decrease of 0.136 L/s. Given that the site extraneous flow is currently accounted for as a pre-development condition, the flow has been excluded for the purpose of this comparison.

3.2 Uniform Post-Development Sanitary Flows

Each proposed Uniform dwelling will be serviced by a proposed 135mm diameter PVC sanitary service that will connect at one of three locations:

(2a) existing 250mm diameter public sanitary sewer on Edison Avenue;
(2b) existing 225mm diameter public sanitary sewer on Melbourne Avenue; or
(3) proposed 200mm diameter sanitary sewer which will outlet into an existing 250mm diameter public sanitary sewer on Princeton Avenue.

In order to assess the impact on the public sanitary sewers, a comparison of the post-development flows and the receiving sewer capacity is required.

(2a) Edison Avenue
Proposed flows to Edison Avenue sanitary sewer:
Number of Proposed Single Family Units = 2
Number of Proposed Semi-Detached Units = 2
Total Population = (2 units x 3.4 persons/unit)+(2 units x 2.7 persons/unit) = 12.2 people
Total Average Flows = 350 L/day x 12.2 people = 4,270 L/day = 0.0494 L/s
Total Proposed Peak Flows = 4.0 x (4,270 L/day / 86400 s/day) = **0.198 L/s**

(2b) Melbourne Avenue
Proposed flows to Melbourne Avenue sanitary sewer:
Number of Proposed Single Family Units = 1
Number of Proposed Semi-Detached Units = 4
Total Population = (1 units x 3.4 persons/unit)+(4 units x 2.7 persons/unit) = 14.2 people
Total Average Flows = 350 L/day x 14.2 people = 4,970 L/day = 0.0575 L/s
Total Proposed Peak Flows = 4.0 x (4,970 L/day / 86400 s/day) = **0.230 L/s**

(3) Princeton Avenue
Proposed flows to Princeton Avenue sanitary sewer:
Number of Proposed Townhouse Units = 7
Total Population = 7 units x 2.7 persons/unit = 18.9 people
Total Average Flows = 350 L/day x 18.9 people = 6,615 L/day = 0.0766 L/s
Total Proposed Peak Flows = 4.0 x (6,615 L/day / 86400 s/day) = **0.306 L/s**

The total proposed peak sanitary flow at the Edison, Melbourne, and Princeton Avenues' sanitary sewers will be 0.198L/s, 0.230L/s, and 0.306L/s, respectively. Given the site extraneous flow is currently accounted for as a pre-development condition, the flow has been excluded for the purpose of this comparison.

3.3 Receiving Sewer Capacity

The capacity of the Edison, Melbourne, and Princeton Avenues sanitary sewers are 60.5 L/s capacity (250mm diameter at 0.95% slope), 28.5 L/s capacity (225mm diameter at 0.37% slope), and 61.4 L/s capacity (250mm diameter at 0.98% slope), respectively.

3.4 Development Impact and Discussion

Owing to the excess residual sewer capacity available, the additional flows of 0.598 L/s due to the development are marginal, and will have negligible impact on the existing sanitary sewers. Furthermore, for the remaining flows downstream to the trunk (i.e. West Nepean Collector) refer to **Appendix A** which contains a sanitary drainage area analysis complete with sewer design calculations and a reference figure, as well as correspondence with City of Ottawa staff showing the modelling results of the downstream sewers with an additional 1L/s of flow. The existing Edison, Melbourne, and Princeton Avenues' sanitary sewers have adequate capacity to facilitate the proposed development.

The proposed 200mm diameter sanitary sewer, which will outlet into the existing 250mm diameter public sanitary sewer on Princeton Avenue is to service the 7 units of the Uniform housing laneway. This proposed sewer extension will require an Environmental Compliance Approval from the MOECC (Transfer of Review).

4.0 *WATER SUPPLY*

Likewise, the Cornerstone site's retrofitting and the proposed Uniform housing are to be evaluated independently, under Section 4.1 and 4.2.

The following outlines the proposed average, maximum daily and peak hour demands from the existing watermains:

City of Ottawa Water Distribution Design Guidelines Criteria (referenced in Section 2.1)
Consumption Criteria:

- Average Domestic Demand per person = 350 L/day/person
- Population per Unit (Single Family) = 3.4 persons/unit
- Population per Unit (Semi-detached) = 2.7 persons/unit
- Population per Unit (Townhouse) = 2.7 persons/unit
- Population per Unit (Bachelor Apartment) = 1.4 persons/unit
- Maximum Daily and Peak Hour Factors = (2.5 x avg. demand) and (2.2 x max. daily demand)

The design criteria used to determine the adequacy of the watermains required to service the site are based on a conservative approach that considers three possible scenarios, as follows:

<u>System Pressures</u>

Maximum Allowable Pressure	551.6kPa (80psi)
Minimum Allowable Pressure (excluding fire flow conditions)	275.8kPa (40psi)
Minimum Allowable Pressure (including fire flow conditions)	137.9Kpa (20psi)

4.1 Cornerstone Domestic Demand

Cornerstone will be serviced by the existing 100mm diameter PVC water service that connects to the existing 200mm diameter public watermain on Princeton Avenue, referred to as connection (1). Given that the water domestic demands from the existing site is to decrease by 6 units, the impact to the existing water distribution network will be negligible.

4.2 Uniform Domestic Demand

Each lot of the proposed Uniform housing will be serviced by a proposed 19mm diameter Type K soft copper or PEX service with a stand post at the property line, and will connect at one of three connection locations:

(2a) existing 200mm diameter public watermain on Edison Avenue;
(2b) existing 150mm diameter public watermain on Melbourne Avenue; or
(3) proposed 50mm diameter Type K soft copper or PEX watermain extension which will tap into the existing 200mm diameter public watermain on Princeton Avenue.

Estimated domestic water demands for the development have been calculated below, as per Table 4.2 of the OWDG. The domestic flows are calculated below:

(2a) Edison Avenue
Number of Proposed Single Family Units = 2
Number of Proposed Semi-Detached Units = 2
Total Average Demand = 350 L/day x 12.2 people = 4,270 L/day = 0.0494 L/s
Maximum Daily Demand = 0.124 L/s
Peak Hour Demand = 0.272 L/s

(2b) Melbourne Avenue
Proposed flows to Randall Avenue sanitary sewer:
Number of Proposed Single Family Units = 1
Number of Proposed Semi-Detached Units = 4
Total Average Demand = 350 L/day x 14.2 people = 4,970 L/day = 0.0575 L/s
Maximum Daily Demand =0.144 L/s
Peak Hour Demand = 0.316 L/s

(3) Princeton Avenue
Number of Proposed Townhouse Units = 7
Total Average Demand = 350 L/day x 18.9 people = 6,615 L/day = 0.0766 L/s
Maximum Daily Demand = 0.191 L/s
Peak Hour Demand = 0.421 L/s

4.3 Fire Demand

The governing required fire flows for the site were calculated using the Fire Underwriters Survey (FUS), per the OWDG. As outlined in the FUS; wood frame structures separated by less than 3 meters shall be considered as one fire area. Thus, the detailed calculations represent the cumulative floor area of neighbouring residential buildings to adhere to this guideline. It is assumed that no fire walls with a fire resistance rating of 2 or more hours will be implemented in the building construction. Detailed fire flow calculations are provided in **Appendix B.** The required fire flows are summarized below:

(1) Princeton Avenue
2 storey, wood framed, brick cladding residential building = 283 L/s

(2a) Edison Avenue
2 storey, wood framed, detached and semi detached residential buildings = 217 L/s

(2b) Melbourne Avenue
2 storey, wood framed, detached and semi detached residential buildings = 233 L/s

(3) Princeton Avenue
2 storey, wood framed, townhouse residential buildings = 233 L/s

Notwithstanding the above, per the City of Ottawa technical bulletin ISDTB-2014-02 the fire flow requirement may be capped at 10,000 L/min (167 L/s) provided certain site specific conditions are met.

For comparison, the required fire flows for the proposed Uniform housing were also calculated using the Ontario Building Code (OBC). Since the OBC calculation is dependent on a single residential building and not all the neighbouring residential buildings, the calculated fire flow required is achievable. The detailed fire flow calculations are also provided in **Appendix B** and the findings are summarized below:

(1) Princeton Avenue
2 storey, wood framed, brick cladding residential building = 150 L/s

(2a) Edison Avenue
2 storey, wood framed, detached and semi detached residential buildings = 45 L/s

(2b) Melbourne Avenue
2 storey, wood framed, detached and semi detached residential buildings = 45 L/s

(3) Princeton Avenue
2 storey, wood framed, townhouse residential buildings = 45 L/s

There are four existing fire hydrants within proximity to the site, one fronting 517 Edison Avenue, the second in the southeast corner of the Princeton and Edison Avenue intersection, the third in the southwest corner of the Princeton and Melbourne Avenue intersection, and the fourth is fronting the proposed site along Melbourne Avenue. The existing hydrants have a maximum spacing of 110m.

4.4 Watermain Boundary Conditions and Modelling Results

Based on the foregoing domestic and fire demand, boundary condition data was collected from the City. Refer to **Appendix B** for boundary conditions and modelling results.

Owing to the available information and modelling results, the existing Princeton Avenue watermain has adequate capacity to facilitate the Cornerstone building (1). Cornerstone will be serviced by an existing 100mm diameter PVC service which will provide the required system pressures based on the boundary conditions provided by the City. Additionally, Cornerstone is located within the required proximity to the existing hydrant located at the intersection of Princeton and Melbourne Avenue which has the capacity to meet the required fire flows of 283 L/s and 150 L/s as determined by using the FUS and OBC guidelines, respectively.

Furthermore, the existing Edison Avenue watermain also has adequate capacity to facility the proposed Uniform housing (2a) fronting this street. These buildings will again be serviced by individual 19mm diameter service laterals connecting directly to the existing watermain which will provide the required system pressures based on the boundary conditions provided by the City. The existing hydrant fronting these buildings has the capacity to meet the required fire flows of 217 L/s and 45 L/s as determined by using the FUS and OBC guidelines, respectively.

Although the existing Melbourne Avenue watermain has sufficient capacity to facilitate the required domestic demand system pressures for the proposed Uniform housing (2b) along this street, the 150mm diameter watermain and the existing hydrant has adequate capacity to meet the required fire flow as per the OBC guideline, however, it should be noted that the FUS guideline is not being met. Based on the available information and modelling results provided by the City, the existing hydrant fronting these buildings currently only has 60 L/s available at a residual pressure of 20 psi. Thus, only the fire flow demand of 45 L/s as determined by the OBC guideline is being met as the fire flow required per the FUS guideline was calculated to be 233 L/s.

The existing Princeton Avenue watermain has adequate capacity to facilitate the proposed Uniform housing (3) fronting the private laneway. These particular buildings will be serviced by individual 19mm diameter service laterals, connecting to a proposed 50mm diameter Type K soft copper or PEX watermain extension installed within the private laneway and connecting to the existing Princeton Avenue watermain. As per the findings in the hydraulic assessment memorandum provided in **Appendix B**, the proposed 50mm diameter watermain extension should be sufficient to meet the desired system pressures based on the boundary conditions provided by the City. The proposed Uniform housing is located within the required proximity to the existing hydrant located at the intersection of Princeton and Edison Avenue which has the capacity to meet the required fire flows of 233 L/s and 45 L/s as determined by using the FUS and OBC guidelines, respectively.

4.5 Development Impact and Discussion

Based on the minimal domestic demands required by the proposed development, and owing to the available flow at the neighboring hydrants for fire-fighting requirements, the existing Edison, and Princeton Avenues watermain have adequate capacity to facilitate the proposed development.

Currently, the hydrant fronting the proposed Uniform housing on Melbourne Avenue does not have sufficient capacity for the required fire flow demand per the FUS guidelines, but it does meet the OBC requirements.

The water system expansion will need to be approved as part of the MOECC's pre-authorized future alteration program (Form F-1) that accompanies the City of Ottawa's Drinking Water Works Permit.

5.0 *STORM DRAINAGE AND STORMWATER MANAGEMENT*

The Cornerstone site's retrofitting and the proposed Uniform housing are to be evaluated independently, and thus will have separate stormwater management practices implemented in order to achieve the design criteria as per the governing guidelines for the sites location.

Development applications within the Westboro watershed are governed by the Westboro SWM Guidelines (referenced in Section 2.1). These guidelines propose the following requirements for development submissions requiring site plan control approval discharging directly to the Ottawa River (which is the case for this proposal):

- Runoff Volume Reduction - Minimum on-site retention of the 10mm design storm
- Water Quality - Inherent TSS removal due to on-site retention of the first 10mm rainfall
- Water Quantity - As per City's Sewer Design Guideline

The City of Ottawa Sewer Design Guideline (referenced in Section 2.1) requires that on-site stormwater management be implemented to control post-development stormwater discharge for the 100 year storm event to the applicable storm event based on the capacity of the receiving sewer. For this specific site the post-development needs to be designed for a 2-year storm control using a runoff coefficient (C) of 0.50, and a time of concentration (T_c) of 20 minutes.

However, meeting the proposed City requirements is unreasonably onerous for the proposed site works. Novatech proposes the following stormwater management criteria as a reasonable alternative:

- Runoff Volume Reduction - minimum depth of 300mm of "amended topsoil" be placed over all disturbed landscaped areas and that the rooftop downspouts be directed to these areas
- Water Quality - Inherent TSS removal due to the addition of the "amended topsoil"
- Water Quantity - Provide post-to-pre controls for the site

These proposed criteria are very similar, but much more achievable for this site.

The change in the volume reduction criterion from abstracting the 10mm storm to providing the "amended topsoil" is due to the desire to save the existing vegetation on the site as much as is feasible. In order to completely capture the 10mm storm, areas currently proposed to be untouched, such as the area fronting Edison Avenue, would need to be replaced with "amended topsoil". This is likely to cause significant damage to the trees in that area. The amended criterion is in line for proposed residential developments that do not follow a site plan process.

There is no change proposed to the quality control criterion.

The change in the quantity control criterion is not a substantial change. The City's design guidelines specify that release rate assuming the entire 100-year rainfall event is captured on site and is then fed into the storm sewer system, as would be the case for a typical commercial lot. To prevent undue stresses on the sewer, the release rate must be held back to the original design capacity of the sewer. However, capturing the entire 100-year flow on the site is not feasible. Controlling the 100-year runoff from the roof of the Cornerstone building would require a substantial regrading effort along the front of that portion of the property which would cause significant damage to the vegetation in the area and might not be compatible with the foundation of the structure. The situation is similar with the remaining front yard areas. The total 100-year flow for the combined front-yard areas well exceeds the City's proposed allowable release rate which required a 2-year level of control. Instead, a more practical and reasonable criterion has been proposed. Flows into the minor system will be maintained at the capacity of the minor system. Flows off-site will not exceed the existing conditions. In this way, there will be no adverse impact on the surrounding lands or the City's storm sewer.

In regards to the proposed configuration of the 300mm of "amended topsoil", based on discussions with Paterson, a more feasible approach may be to place 100mm of topsoil and sod (as per typical residential landscape specifications) underlain by 200mm of coarse sand to help promote infiltration. The proposed development would utilize this approach.

Stormwater runoff flow from the site will be a combination of uncontrolled direct runoff and controlled flow. Stormwater management will be achieved through the use of on-site storage using both surface and underground storage.

5.1 Cornerstone Stormwater Management

Although the Cornerstone site is undergoing retrofitting, the alterations within the landscaped area fronting the building along Princeton and Melbourne Avenue are to be minimal. As such it has been requested that the proposed works within this area are also minimal to preserve the existing vegetation. Nonetheless, runoff volume reduction measures will be installed to show best efforts in meeting the infiltration requirements as per the Westboro SWM Guidelines. The Cornerstone court yard and the laneway will be utilized for both stormwater infiltration and water quantity. Best efforts have been employed in order to achieve the design criteria as per the governing guidelines.

5.1.1 Runoff Volume Reduction and Water Quality

In order to promote infiltration to capture the 10mm design storm, while trying to preserve the existing conditions within the landscaped area fronting the building, a river stone trench wrapped in geotextile will be constructed. The trench has been sized to capture the 10mm design storm discharge accumulated from the split Cornerstone building rooftop.

To fulfill the infiltration requirements for the court yard, it is recommended that "amended topsoil" be placed where landscaped areas are disturbed. As discussed in the forefront of Section 5.0, the alternative approach of 100mm of top soil and sod underlain by 200mm of sand will be utilized.

Within the Cornerstone laneway a perforated pipe wrapped in clear stone and geotextile will be utilized for both stormwater infiltration and on-site storage. Refer to the Section 5.1.2 below for further insight on the on-site storage system.

Furthermore, refer to the engineered plans for locations of the proposed "amended topsoil" and downspouts.

5.1.2 Water Quantity

As specified in Section 5.0 above, Novatech proposes that stormwater management be applied to control post-development stormwater discharge to match the pre-development conditions. The allowable release rate was determined as follows:

Total Drainage Area (A) = 0.231 ha
Runoff Coefficient (C_{allow}) = 0.49
Intensity (I_{2allow}) = 61.77 mm/hr

$Q_{allow} = 2.78\ CIA$
$Q_{allow} = 2.78 \times 0.49 \times 61.77\ mm/hr \times 0.231ha$
$Q_{allow} = 19.39\ L/s$

Total Drainage Area (A) = 0.231 ha
Runoff Coefficient (C_{allow}) = 0.49
Intensity (I_{5allow}) = 83.56 mm/hr

$Q_{allow} = 2.78\ CIA$
$Q_{allow} = 2.78 \times 0.49 \times 83.56\ mm/hr \times 0.231ha$
$Q_{allow} = 26.23\ L/s$

Total Drainage Area (A) = 0.231 ha
Runoff Coefficient (C_{allow}) = 0.49
Intensity ($I_{100allow}$) = 142.89 mm/hr

$Q_{allow} = 2.78\ CIA$
$Q_{allow} = 2.78 \times 0.49 \times 142.89\ mm/hr \times 0.231ha$
$Q_{allow} = 44.86\ L/s$

The allowable release rate for the Cornerstone 0.231 ha development was calculated using the Rational Method to be 19.39 L/s, 26.23 L/s, and 44.86 L/s for the 2 year, 5 year, and 100 year design storms, respectively. The stormwater runoff flow from the site will be a combination of uncontrolled direct runoff and controlled flow. Stormwater management will be achieved through the use of on-site storage.

The post-development flow from the Cornerstone site consists of controlled flows from the courtyard and laneway coming from the rear and uncontrolled overland flows at the front of the buildings.

To obtain the required on-site storage for the Cornerstone site the proposed storm sewer within the laneway will be increased in size to a 450mm diameter perforated pipe, to act as a superpipe storage system and to help promote infiltration. The pipe will be surrounded with clear

stone and wrapped in a geotextile membrane. The volume obtained from this pipe in conjunction with the volumes within the storm manholes and catch basins will provide the necessary storage. An inlet control device will be placed at the outlet maintenance hole to limit the outflow to the 300mm diameter storm sewer, which will outlet into the existing 300mm diameter public storm sewer on Melbourne Avenue.

Refer to **Appendix C** for the supporting calculations. Table 5.1 below shows the proposed post-development peak flows for the Cornerstone site.

Table 5.1 Proposed Post Development Peak Flows

Area ID	Area (ha)	Runoff		
		2 yr event L/s	5 yr event L/s	100 yr event L/s
Controlled - Surface and Underground Storage				
A-05 & A-06	0.1278	10.78	14.51	19.37
Uncontrolled - Direct Runoff				
A-04	0.1027	8.61	11.72	25.49
Total:	0.2305	19.39	26.23	44.86

The post-development flow from the site will be controlled to 19.39 L/s, 26.23 L/s and 44.86 L/s for the 2 year, 5 year, and 100 year design storms, respectively. Thus, the post-development flow meets the allowable release rates.

5.2 Uniform Stormwater Management

The entirety of the proposed Uniform housing area will be considered to abide by the proposed guidelines. Best efforts have been employed.

5.2.1 Runoff Volume Reduction and Water Quality

In order to fulfill the infiltration requirements for the proposed Uniform housing, it is recommended that “amended topsoil” be placed where landscaped areas are disturbed. As discussed in the forefront of Section 5.0, the alternative approach of 100mm of top soil and sod underlain by 200mm of sand will be utilized.

To help promote additional infiltration there will be a perforated pipe wrapped in clear stone and geotextile constructed in both the Uniform single and semi-detached unit rear yards and in the private laneway fronting the townhouse units. These perforated systems will be utilized for both stormwater infiltration and on-site storage. Refer to Section 5.2.2 below for further insight on the on-site storage system.

Furthermore, refer to the engineered plans for locations of the proposed “amended topsoil” and downspouts.

5.2.2 Water Quantity

As specified in Section 5.0 above, Novatech proposes that stormwater management be applied to control post-development stormwater discharge to match the pre-development conditions. The allowable release rate was determined as follows:

Total Drainage Area (A) = 0.355 ha	Q_{allow} = 2.78 CIA
Runoff Coefficient (C_{allow}) = 0.49	Q_{allow} = 2.78 x 0.49 x 61.77 mm/hr x 0.355ha
Intensity (I_{2allow}) = 61.77 mm/hr	Q_{allow} = 29.89 L/s

Total Drainage Area (A) = 0.355 ha	Q_{allow} = 2.78 CIA
Runoff Coefficient (C_{allow}) = 0.49	Q_{allow} = 2.78 x 0.49 x 83.56 mm/hr x 0.355ha
Intensity (I_{5allow}) = 83.56 mm/hr	Q_{allow} = 40.43 L/s

Total Drainage Area (A) = 0.355 ha	Q_{allow} = 2.78 CIA
Runoff Coefficient (C_{allow}) = 0.49	Q_{allow} = 2.78 x 0.49 x 142.89 mm/hr x 0.355ha
Intensity ($I_{100allow}$) = 142.89 mm/hr	Q_{allow} = 69.15 L/s

The allowable release rate for the Uniform 0.355 ha development was calculated using the Rational Method to be 29.89 L/s, 40.43 L/s, and 69.15 L/s for the 2 year, 5 year, and 100 year design storms, respectively. The stormwater runoff flow from the site will be a combination of uncontrolled direct runoff and controlled flow. Stormwater management will be achieved through the use of on-site storage.

The post-development flow from the Uniform site consists of controlled flows from the proposed Uniform single and semi-detached unit rear yards and from the private laneway fronting the townhouse units. Uncontrolled overland flows at the front of the single and semi-detached units are captured in the proposed catch basins and directed into the existing storm sewers within the ROW. The uncontrolled flows generated from the rear yard of the townhouse units is directed into Edison Avenue which will also make its way into the existing sewers from the roadside catch basins.

To obtain the required on-site storage for the Uniform site two storage systems will be required; 1) for the single and semi-detached unit rear yards, and 2) for the private laneway fronting the townhouse units.

The proposed storm sewer within the single and semi-detached unit rear yards will be a 300mm diameter perforated pipe surrounded by a clear stone deposit wrapped in a geotextile membrane, to act as a superpipe storage system and to help promote infiltration. The volume obtained from this pipe in conjunction with the volume within the voids of the clear stone deposit will provide sufficient storage. An inlet control device will be placed at the outlet catch basin to limit the outflow to the 250mm diameter storm sewer, which will outlet into the existing 300mm diameter public storm sewer on Edison Avenue.

Similar to the Cornerstone site, the proposed storm sewer within the private laneway will be increased in size to a 525mm diameter perforated pipe, to act as a superpipe storage system and to help promote infiltration. The pipe will be surrounded with clear stone and wrapped in a geotextile membrane. The volume obtained from this pipe in conjunction with the volumes within the storm manholes and catch basins will provide the necessary storage. An inlet control device will be placed at the outlet maintenance hole to limit the outflow to the 250mm diameter storm

sewer, which will outlet into the existing 525mm diameter public storm sewer on Princeton Avenue.

Refer to **Appendix C** for the supporting calculations. Table 5.1 below shows the proposed post-development peak flows for the Uniform site.

Table 5.2 Proposed Post Development Peak Flows

Area ID	Area (ha)	Runoff		
		2 yr event L/s	5 yr event L/s	100 yr event L/s
Controlled - Underground Storage				
A-01	0.1654	11.59	15.65	25.20
A-03	0.1059	11.59	15.65	25.20
Uncontrolled - Direct Runoff				
L-01 to L-09	0.0341	1.82	2.48	5.39
D-01 to D-06	0.0176	3.38	4.61	8.90
A-02	0.0322	1.51	2.05	4.46
Total:	0.3552	29.89	40.43	69.15

The post-development flow from the site will be controlled to 29.89 L/s, 40.43 L/s, and 69.15 L/s L/s for the 2 year, 5 year, and 100 year design storms, respectively. Thus, the post-development flow meets the allowable release rates.

5.3 Major Overland Flow Route

A major overland flow route was identified within the site, as part of the Bay - Kitchissippi LOS Drainage System Assessment. The overland flow is directed through the site flowing from Edison Avenue to Melbourne Avenue. The overland flow area was delineated based on the drainage areas established for the Churchill Avenue Reconstruction project as well as on-site observations. **Appendix C** contains excerpts from the Environmental Compliance Approval application submitted to the MOECC in support of the Churchill Avenue Reconstruction project. The excerpts provided outline the determined 100 year major drainage flow coming upstream of the site from Princeton Avenue to be 485.8 L/s. The Environmental Compliance Approval reference number has also been provided.

Minor regrading of Edison Avenue is proposed in order to maximize a flow path along Princeton Avenue, a public ROW, to properly provide an engineered path between the proposed units along Edison Avenue and through the Cornerstone Parking Lot. The area for the external major overland flow (2.53 ha) is shown in **Appendix C**. It was assumed that this area could capture the 2-year flow, based on the results of the Bay-Kitchissippi model. Therefore, the magnitude of the overland flow (370 L/s) was equal to the 100-year flow net of the 2-year capture.

In order to assess the effects of the external overland flow as it relates to the proposed development, a 2D PCSWMM model was assembled to determine the depth of the overland flow through the site under the 100-year flow condition and the stress test flow condition, per City Guidelines. The proposed grading ensures that during the stress test, flows do not encroach on the proposed building envelopes. The calculations and summary figure are

included in **Appendix C**. Refer to the Grading Plans, 113004-GR1 and 113004-GR2, for the engineered overland flow routing and configuration.

In order to ensure that no obstructions inhibit the flow through the major overland flow route, a drainage easement in favour of the City of Ottawa, would protect against any modifications to the engineered flow route. For a preliminary development limit, the easement width are shown in the plans.

6.0 *EROSION AND SEDIMENT CONTROL*

Temporary erosion and sediment control measures will be implemented both prior to commencement and during construction, in accordance with the "Guidelines on Erosion and Sediment Control for Urban Construction Sites", (Government of Ontario, May 1987) and "Construction Specification for Temporary Erosion and Sediment Control Measures" (OPSS 805). Regular inspection and maintenance of the erosion control measures will be undertaken. These measures will include:

- Installment of straw bales at all natural runoff outlets from the property as per OPSD 219.100;
- Placement of filter fabric under all catchbasins and maintenance hatches;
- Silt fences around the area under construction as per OPSD 219.110.

7.0 *MISSISSIPPI-RIDEAU SOURCE PROTECTION PLAN*

The purpose of Ontario's Clean Water Act is to protect our water resources that are being used as a source of drinking water. Since the legislation does not apply, a standard set of policies across Ontario multi-stakeholder Committees are responsible for establishing policies to protect their local sources of drinking water. The Mississippi-Rideau Source Protection Plan has thus been implemented in order to oversee the source protection program in the Mississippi-Rideau Source Protection Region, in which this development is located. Please refer to the Source Protection Figures provided in **Appendix C**. Although the location of the site is within the source protection area as evident by the Figures provided, the impact on this area will be marginal due to the site's minor development potential, and distance to the stormwater outlet.

8.0 *UTILITIES*

The development will be serviced by Hydro Ottawa, Bell Canada, Rogers Communications, and Enbridge Gas Distribution Inc. The utility companies have been contacted and their designs to service the development are underway. The respective designs will be complied to produce a Composite Utility Plan at a later stage.

9.0 *COORDINATION AND APPROVALS*

The proposed municipal infrastructure will be subject to the following:

- Severance Application with a request for a Minor Variance. Submitted to City of Ottawa, proponent FoTenn.
- Re-zoning and Siteplan Control Applications. Submitted to City of Ottawa, proponent Uniform.
- Building Permits. Submitted to City of Ottawa, proponent Uniform.
- Municipal Consent for Regrading of Princeton/Edison Avenue and Utility Relocations. Submitted to City of Ottawa, proponent Cornerstone and Uniform.
- Road Cut Permit. Submitted to City of Ottawa, proponent Cornerstone and Uniform.
- MOECC Environmental Certificates of Approval (ECAs) for the sanitary and storm sewers through the "Transfer of Review" program. Submitted to Ministry of the Environment and Climate Change, proponent Uniform.
- RVCA Approval for the stormwater runoff from this development. In the opinion of Novatech, the distance that the stormwater runoff will travel before outletting into the Ottawa River is sufficiently far such that onsite quality controls would have a negligible impact on surface water improvement. No additional quality control measure required.
- The water system expansion will be approved as part of the MOECC's pre-authorized future alteration program (F-1 Form) that accompanies the City of Ottawa's Drinking Water Works Permit. Submitted to City of Ottawa, proponent Uniform.

10.0 *CONCLUSIONS AND RECOMMENDATIONS*

Based on the foregoing, the development of the site will be supported by the following:

- Due to the excess residual sewer capacity available, the additional flows of 0.598 L/s due to the development are marginal, and will have negligible impact on the existing sanitary sewers.

- Based on the minimal domestic demands required, and owing to the available flow at the neighboring hydrants for fire-fighting requirements, the proposed housing fronting the existing Edison, and Princeton Avenues watermain have adequate capacity to facilitate these particular units. The Fire Underwriters Survey as well as the Ontario Building Code are being met.

- For the proposed housing fronting Melbourne Avenue the minimal domestic demands required are being met. Due to the available flow at the neighboring hydrant for fire-fighting requirements, the existing Melbourne Avenue watermain does not have adequate capacity to meet the Fire Underwriters Survey. This is an existing condition and it should be noted that the criteria as set forth by the Ontario Building Code are indeed being met.

- In order to reduce the runoff volume and promote stormwater infiltration, 100mm of top soil and sod underlain by 200mm of sand will be utilized within all disturbed or proposed landscaped areas within the property limits. Furthermore, in areas that are to be

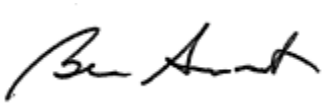
untouched river stone trenches are proposed to help assist in the capturing the 10mm design storm.

- Inherent TSS removal due to the addition of the “amended topsoil”
- Provide post-to-pre controls for the site and limit direct runoff to the storm sewer.
- Minor regrading of Edison Avenue is proposed in order to properly provide an engineered path between the proposed units along Edison Avenue and through the Cornerstone Parking Lot. A drainage easement will be provided in favour of the City of Ottawa, to ensure that the engineered route is not modified.
- Temporary erosion and sediment control measures will be implemented during construction.
- Coordination with the utilities will be required in order to provide each proposed lot with Hydro Ottawa, Bell Canada, Rogers Communications, and Enbridge Gas Distribution Inc. servicing.

It is recommended that the proposed development servicing and grading design be approved for implementation.

NOVATECH

Prepared by:



Ben Sweet, B.A.Sc.
E.I.T.

Reviewed by:

Bassam Bahia, P. Eng.
Project Manager | Land Development

APPENDIX A

EXISTING SANITARY SEWER ANALYSIS, MOE ECA EXCERPT AND CITY CORRESPONDENCE

373 PRINCETON AVENUE
SANITARY DESIGN SHEET (EXISTING SEWERS)

JOB# 116126

NOVATECH
Engineers, Planners & Landscape Architects

LOCATION		FLOW															EXISTING SEWER DATA						
FROM MH	TO MH	POPULATION	PARK	COMMERCIAL	INDIVIDUAL		CUMULATIVE				PEAK FACTOR (M)	POPUL. FLOW	PEAK PARK FLOW	PEAK COMMERCIAL FLOW	PEAK EXTRAN. FLOW	PEAK DESIGN FLOW	LENGTH (m)	PIPE SIZE (mm)	TYPE	SLOPE %	CAPACITY (L/s)	FULL FLOW VELOCITY (m/s)	RATIO (Q/Qfull)
			PARK AREA (ha.)	COMMERCIAL AREA (ha.)	POPUL. (1000's)	AREA (ha.)	POPUL. (1000's)	PARK AREA (ha)	COMMERCIAL AREA (ha)	RESIDENTIAL AREA (ha.)		Q(p) L/s	Q(pk) L/s	Q(c) L/s	Q(e) (L/s)	Q(d) (L/s)							
MH 17 *	MH 9	439.8			0.440	5.54	0.440	0.00	0.00	5.54	4.000	7.126	0.000	0.00	20.520	27.646	-	-	-	-	-	-	-
Upstream	MH 13	118.6			0.119	1.98	0.119	0.00	0.00	1.980	4.000	1.922	0.000	0.00	0.158	2.080	-	-	-	-	-	-	-
MH 13	MH 9	29.2			0.029	0.51	0.148	0.00	0.00	2.49	4.000	2.395	0.000	0.00	0.199	2.594	121.6	250	PVC	0.95	60.468	1.19	4%
Upstream	MH 10	57.8			0.058	1.22	0.058	0.00	0.00	1.220	4.000	0.937	0.000	0.00	0.098	1.034	-	-	-	-	-	-	-
MH 10	MH 9	27.2			0.027	0.62	0.085	0.00	0.00	1.840	4.000	1.377	0.000	0.00	0.147	1.525	-	-	-	-	-	-	-
MH 9	MH 1	77.7			0.078	0.50	0.750	0.00	0.00	10.37	4.000	12.158	0.000	0.00	20.906	33.064	79.2	250	PVC	0.98	61.415	1.21	54%
Upstream	MH 4	116.7			0.117	2.43	0.117	0.00	0.00	2.430	4.000	1.891	0.000	0.00	0.194	2.085	-	-	-	-	-	-	-
MH 4	MH 1	48.2			0.048	0.90	0.165	0.00	0.00	3.330	4.000	2.672	0.000	0.00	0.266	2.938	156.4	225	PVC	0.37	28.493	0.69	10%

* REFER TO PROVIDED MOE CoA # 6507-7VGPZK DOCUMENTATION FOR ACCUMULATIVE FLOWS UPSTREAM OF MH '17' (MH 267B IN APPLICATION)

Design Parameters:

1) Q(e) = 0.08 L/sec/ha	Singles	**3.4**	persons/unit
2) Q(p) = (PxqxM/86,400)	Semis/Towns	**2.7**	persons/unit
3) Q(pk) = 1000 L/d/ha x M	Stacked	**2.3**	persons/unit
4) Q(c) = 50000 L/d/ha x N	Apartements	**2.1**	persons/unit

5) Q(d) = Q(p) + Q(pk) + Q(c)+ Q(e)

Definitions:

P = Population
q = Average per capita flow = 350 L/person/day per Figure 4.4 of Sewer Design Guidelines
M = Residential Peaking Factor (Harmon Formula from Section 4.4.1 of the City Sewer Design Guidelines):
M = 1+[14/(4+Pop/1000)]^1/2*K (Maximum of 4.0) K = 0.4 - 0.6
N =Commercial / Park Peaking Factor (1.5) from City Design Guidelines
Q(d) = Design Flow (L/sec)
Q(p) = Population Flow (L/sec)
Q(pk) = Park Flow (L/sec)
Q(c) = Commercial Flow (L/sec)
Q(e) = Extraneous Flow (L/sec)

SANITARY SEWER DESIGN SHEET (EXISTING SEWERS)

Date	March 29, 2017		
Design			
Job No.	**Dwg. Reference:**	**Checked:**	
116126	116126-SAN	---	

ED.

Ontario

Ministry of the Environment
Ministère de l'Environnement

CERTIFICATE OF APPROVAL
MUNICIPAL AND PRIVATE SEWAGE WORKS
NUMBER 6507-7VGPZK
Issue Date: September 9, 2009

City of Ottawa
100 Constellation Crescent
Nepean, Ontario
K2G 6J8

Site Location: Churchill Avenue, Dovercourt Avenue, Princeton Avenue, and Scott Street
Lot 31 and 32, Concession 1 on Ottawa River, Nepean
City of Ottawa

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

- ***storm sewers*** to be constructed on Churchill Avenue, Dovercourt Avenue, Princeton Avenue, and on Scott Street; and

- ***sanitary sewers*** to be constructed on Churchill Avenue, Princeton Avenue, and Scott Street, in the City of Ottawa ;

all in accordance with the application dated July 27, 2009 and received July 29, 2009, including final plans and specifications prepared by Novatech Engineering Consultants Ltd.

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

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

(2) "*Owner* " means City of Ottawa, and includes its successors and assignees; and

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

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

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

The Notice should also include:

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

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

This Notice must be served upon:

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

AND

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

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

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

DATED AT TORONTO this 9th day of September, 2009

THIS CERTIFICATE WAS MAILED
ON Sept. 14, 2009
SC
(Signed)

Zafar Bhatti

Zafar Bhatti, P.Eng.
Director
Section 53, *Ontario Water Resources Act*

AA/

c: District Manager, MOE Ottawa District Office
Michael J. Petepiece, P.Eng., Novatech Engineering Consultants Ltd. ✓

EXCERPT FROM MOECC ECA APPLICATION FOR THE CHURCHILL SEWER REHABILITATION PROJECT:

A2 - SANITARY SEWER DESIGN SHEET

CHURCHILL AVENUE - RICHMOND, BYRON, & PRINCETON OUTLETS

JOB# 108058

NOVATECH ENGINEERING CONSULTANTS LTD

LOCATION				RESIDENTIAL AREA AND POPULATION						COMMERCIAL/INSTITUTIONAL				INFILTRATION					OTHER EXTRANEOUS FLOWS				FLOW								
	MANHOLES			Area	Pop.	Cumulative		Peak	Peak	Area	Accu.	Peak	Peak	Total	Infiltration	Foundation Drain	Combined	Accumulated	Rev. Slope	Flat	Combined	Accumulated	Total	Type of Pipe	Length	Diameter	Diameter	SLOPE	Velocity	Capacity	Ratio
STREET	FROM	TO	AREA ID	(ha)		Area (ha)	Pop.	Factor	Flow (l/s)	(ha)	Area (ha)	Factor	Flow (l/s)	Area (ha)	Flow (l/s)	allowance (l/s)	additional flow (l/s)	Flow (l/s)	Driveways (l/s)	Roofs (l/s)	Ext Flows (l/s)	Flow (l/s)	Flow (l/s)		(m)	Actual (mm)	Nominal (mm)		(Full) (m/s)	(Full) (l/s)	Q/Qfull (%)
RICHMOND OUTLET																														
Lincoln	*Dead End*	*213*	*Dead End-213 (ROW)*	*0.11*	*0*	*0.11*	*0*	*4.00*	*0.00*	*0*	*0*	*1.5*	*0.00*	*0.11*	*0.03*	*0.00*	*0.03*	*0.03*	*0*	*0*	*0*	*0*	*0.03*	*PVC*	-	*152*	*150*	-	-	-	-
Churchill	213	211	213-211 (A)	0.09	10.2	0.2	10.2			0	0	1.5	0.00	0.09	0.03	0.45	0.48	0.51	0	0	0	0								
			213-211 (B)	0.1	25.5	0.3	35.7			0	0	1.5	0.00	0.1	0.03	0.50	0.53	1.03	0	0	0	0								
			213-211 (ROW A)	0.06	0	0.36	35.7			0	0	1.5	0.00	0.06	0.02	0.00	0.02	1.05	0	0	0	0								
			213-211 (ROW B)	0.28	0	0.64	35.7	4.00	0.58	0	0	1.5	0.00	0.28	0.08	0.00	0.08	1.13	0	0	0	0	1.71	PVC	47.78	254	250	5.99	2.99	151.6	1%
Churchill	211	46990	211-46990 (A)	0.17	35.7	0.81	71.4			0	0	1.5	0.00	0.17	0.05	0.85	0.90	2.03	0	0	0	0								
			211-46990 (B)	0.16	35.7	0.97	107.1			0	0	1.5	0.00	0.16	0.04	0.80	0.84	2.87	0	0	0	0								
			211-46990 (ROW)	0.12	0	1.09	107.1	4.00	1.74	0	0	1.5	0.00	0.12	0.03	0.00	0.03	2.91	0	0	0	0	4.64	PVC	50.2	254	250	2.87	2.07	105.0	4%
Churchill	46990	46989																												
BYRON OUTLET																														
Churchill	217	215	217-215 (A)	0.14	20.4	0.14	20.4			0	0	1.5	0.00	0.14	0.04	0.70	0.74	0.74	0	0	0	0								
			217-215 (B)	0.76	163.2	0.9	183.6			0	0	1.5	0.00	0.76	0.21	3.80	4.01	4.75	0	0	0	0								
			217-215 (ROW)	0.18	0	1.08	183.6	4.00	2.98	0	0	1.5	0.00	0.18	0.05	0.00	0.05	4.80	0	0	0	0	7.78	PVC	75.24	254	250	1.36	1.42	72.2	11%
Churchill	215	27820		0	0	1.08	183.6	4.00	2.98	0	0	1.5	0.00	0	0	0.00	0	4.80	0	0	0	0	7.78	PVC	76.8	229	225	1.22	1.26	51.8	15%
PRINCETON OUTLET																														
Churchill	217	219	217-219 (A)	0.23	30.6	0.23	30.6			0	0	1.5	0.00	0.23	0.06	1.15	1.21	1.21	0	0	0	0								
			217-219 (B)	0.18	21.6	0.41	52.2			0	0	1.5	0.00	0.18	0.05	0.90	0.95	2.16	0	0	0	0								
			217-219 (ROW A)	0.13	0	0.54	52.2			0	0	1.5	0.00	0.13	0.04	0.00	0.04	2.20	0	0	0	0								
			217-219 (ROW B)	0.14	0	0.68	52.2	4.00	0.85	0	0	1.5	0.00	0.14	0.04	0.00	0.04	2.24	0	0	0	0	3.09	PVC	70	254	250	1.03	1.24	62.9	5%
Churchill	219	221	219-221(A)	0.31	40.8	0.99	93			0	0	1.5	0.00	0.31	0.09	1.55	1.64	3.88	0	0	0	0								
			219-221 (B)	0.31	40.8	1.3	133.8			0	0	1.5	0.00	0.31	0.09	1.55	1.64	5.51	0	0	0	0								
			219-221 (ROW)	0.2	0	1.5	133.8	4.00	2.17	0	0	1.5	0.00	0.2	0.06	0.00	0.06	5.57	0	0	0	0	7.74	PVC	98	254	250	0.24	0.61	30.7	25%
Churchill	221	223	221-223 (A)	0.32	30.6	1.82	164.4			0	0	1.5	0.00	0.32	0.09	1.60	1.69	7.26	0	0	0	0								
			221-223 (B)	0.25	30.6	2.07	195			0	0	1.5	0.00	0.25	0.07	1.25	1.32	8.58	0	0	0	0								
			221-223 (ROW)	0.31	0	2.38	195	4.00	3.16	0	0	1.5	0.00	0.31	0.09	0.00	0.09	8.67	0	0	0	0	11.83	PVC	100.5	254	250	0.25	0.61	30.9	38%
Churchill	223	225	223-225 (A)	0.34	51	2.72	246			0	0	1.5	0.00	0.34	0.10	1.70	1.80	10.46	0	0	0	0								
			223-225 (B)	0.3	40.8	3.02	286.8			0	0	1.5	0.00	0.3	0.08	1.50	1.58	12.05	0	0	0	0								
			223-225 (ROW)	0.21	0	3.23	286.8	4.00	4.65	0	0	1.5	0.00	0.21	0.06	0.00	0.06	12.10	0	0	0	0	16.75	PVC	106.83	254	250	0.31	0.68	34.4	49%
Churchill	233	231	233-231 (A)	0.17	15.3	0.17	15.3			0	0	1.5	0.00	0.17	0.05	0.85	0.90	0.90	0	0	0	0								
			233-231 (B)	0.19	15.3	0.36	30.6			0	0	1.5	0.00	0.19	0.05	0.95	1.00	1.90	0	0	0	0								
			233-231 (ROW)	0.25	0	0.61	30.6	4.00	0.50	0	0	1.5	0.00	0.25	0.07	0.00	0.07	1.97	0	0	0	0	2.47	PVC	66.67	254	250	1.18	1.33	67.5	4%
Churchill	231	229	231-229 (A)	0.27	30.6	0.88	61.2			0	0	1.5	0.00	0.27	0.08	1.35	1.43	3.40	0	0	0	0								
			231-229 (B)	0.23	20.4	1.11	81.6			0	0	1.5	0.00	0.23	0.06	1.15	1.21	4.61	0	0	0	0								
			231-229 (ROW)	0.17	0	1.28	81.6	4.00	1.32	0	0	1.5	0.00	0.17	0.05	0.00	0.05	4.66	0	0	0	0	5.98	PVC	86.4	254	250	1.67	1.58	80.0	7%
Churchill	229	227	229-227 (A)	0.27	25.5	1.55	107.1			0	0	1.5	0.00	0.27	0.08	1.35	1.43	6.08	0	0	0	0								
			229-227 (B)	0.26	35.7	1.81	142.8			0	0	1.5	0.00	0.26	0.07	1.30	1.37	7.46	0	0	0	0								
			229-227 (ROW A)	0.07	0	1.88	142.8			0	0	1.5	0.00	0.07	0.02	0.00	0.02	7.48	0	0	0	0								
			229-227 (ROW B)	0.19	0	2.07	142.8	4.00	2.31	0	0	1.5	0.00	0.19	0.05	0.00	0.05	7.53	0	0	0	0	9.84	PVC	85	254	250	2.29	1.85	93.9	10%
Churchill	227	225		0	0	2.07	142.8	4.00	2.31	0	0	1.5	0.00	0	0	0.00	0	7.53	0	0	0	0	9.84	PVC	13	254	250	2.08	1.76	89.3	11%
Princeton	225	267	225-267 (A)	0.05	5.1	5.35	434.7			0	0	1.5	0.00	0.08	0.02	0.40	0.42	20.06	0	0	0	0								
			225-267 (B)	0.05	5.1	5.4	439.8			0	0	1.5	0.00	0.08	0.02	0.40	0.42	20.48	0	0	0	0								
			225-267 (ROW)	0.14	0	5.54	439.8	4.00	7.13	0	0	1.5	0.00	0.14	0.04	0.00	0.04	20.52	0	0	0	0	27.65	PVC	84.17	254	250	0.27	0.64	32.4	85%

Design Flow Rates based on Formulas found in The City of Ottawa Sewer Design Guidelines
Populations Totals based on Anticipated Future Residential Intensification Rates
Areas where population totals are underlined, indicates that the existing conditions produce the most critical sanitary flows (ie. Existing population, infiltration and extraneous flow contributions)
Existing Sanitary Sewers are Indicated in Italics

Extraneous Flow Contricutions from Reverse Sloped Driveways and Flat Roof Buildings contributing to the Churchill Sanitary Sewer have been accounted for as follows:
Flows based on Rational Method (Q=ciA), where
A = Area in hectares (ha)
i = Rainfall intensity (mm/hr)
c = Runoff Coefficient = 0.9 (Impervious Surfaces)

Sanitary Design: Novatech Engineering Consultants Ltd.

PROJECT: Churchill Avenue Reconstruction — Designed: NTQ
CLIENT: City of Ottawa — Checked:
Date: June 8, 2009 — Dwg. Reference:
Revised

Sam Bahia

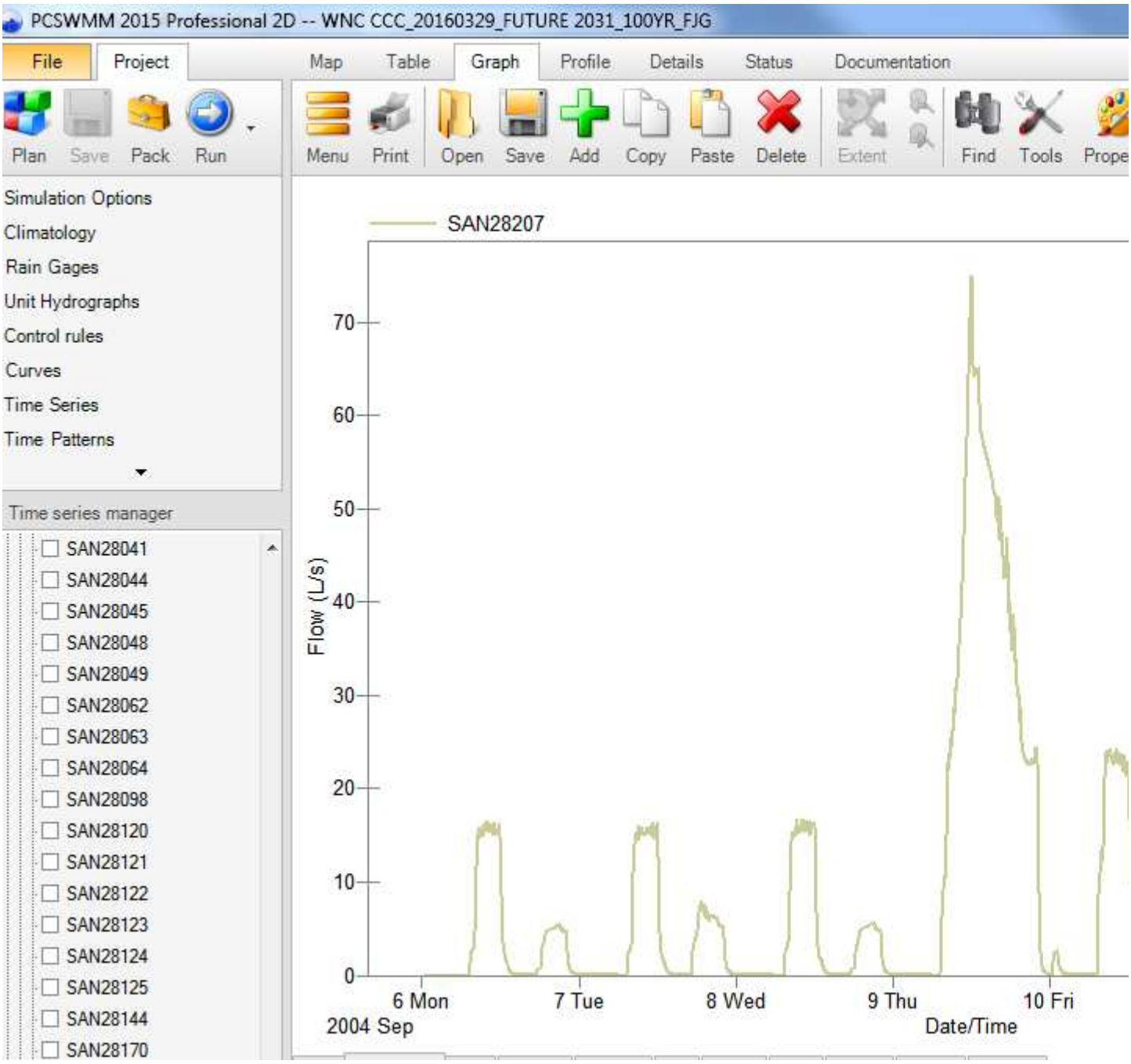
From: Sam Bahia
Sent: Wednesday, September 21, 2016 12:37 PM
To: 'Sandanayake, Hiran'
Subject: RE: 373 Princeton Avenue

Thank you very much Hiran. I will pass this info along to our Client, and inform them that should we wish to pursue it, we will make contact with the Information Center for further information.
Greatly appreciated.
Sam Bahia

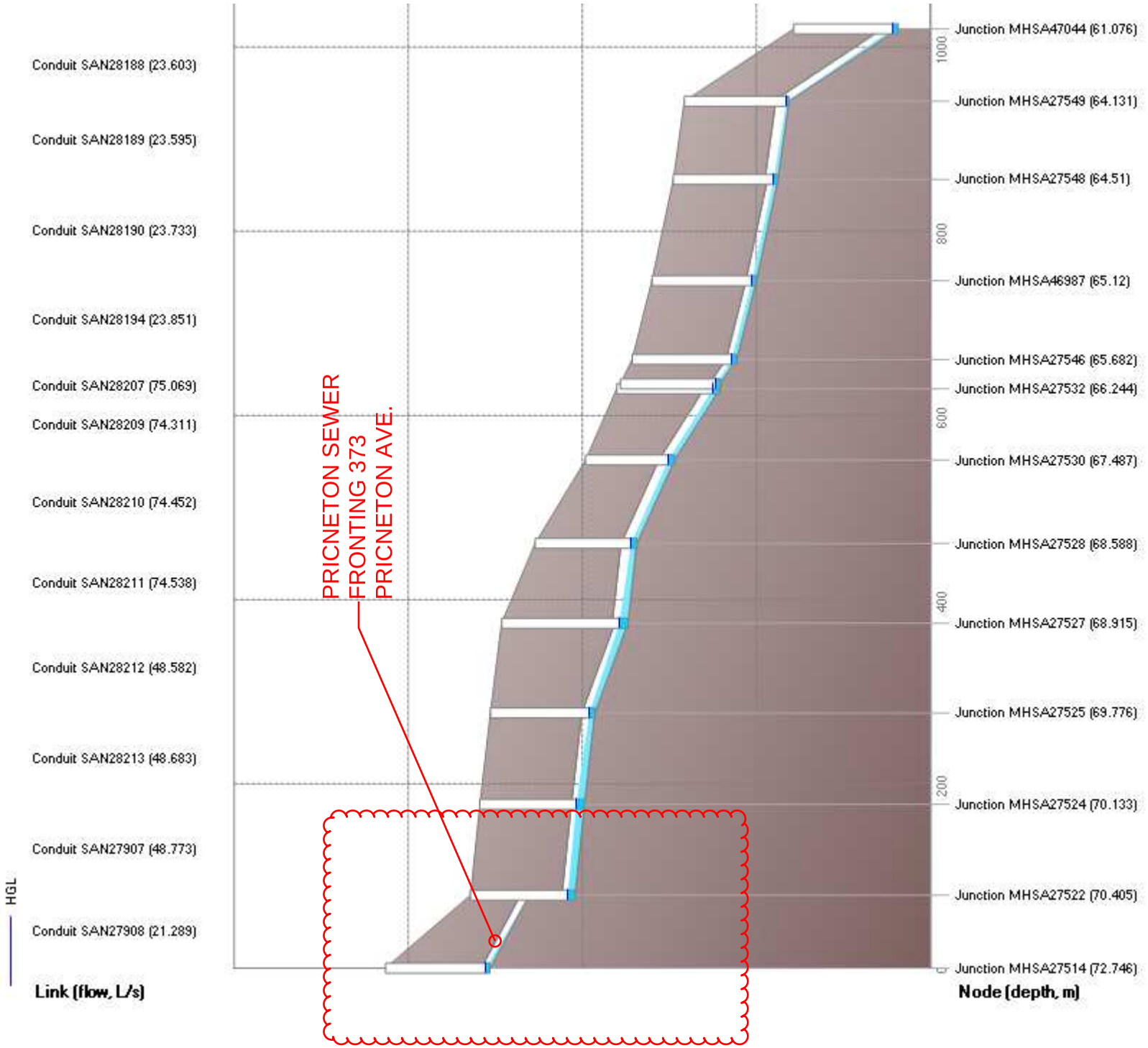
From: Sandanayake, Hiran [mailto:Hiran.Sandanayake@ottawa.ca]
Sent: Wednesday, September 21, 2016 11:41 AM
To: Sam Bahia <s.bahia@novatech-eng.com>
Subject: RE: 373 Princeton Avenue

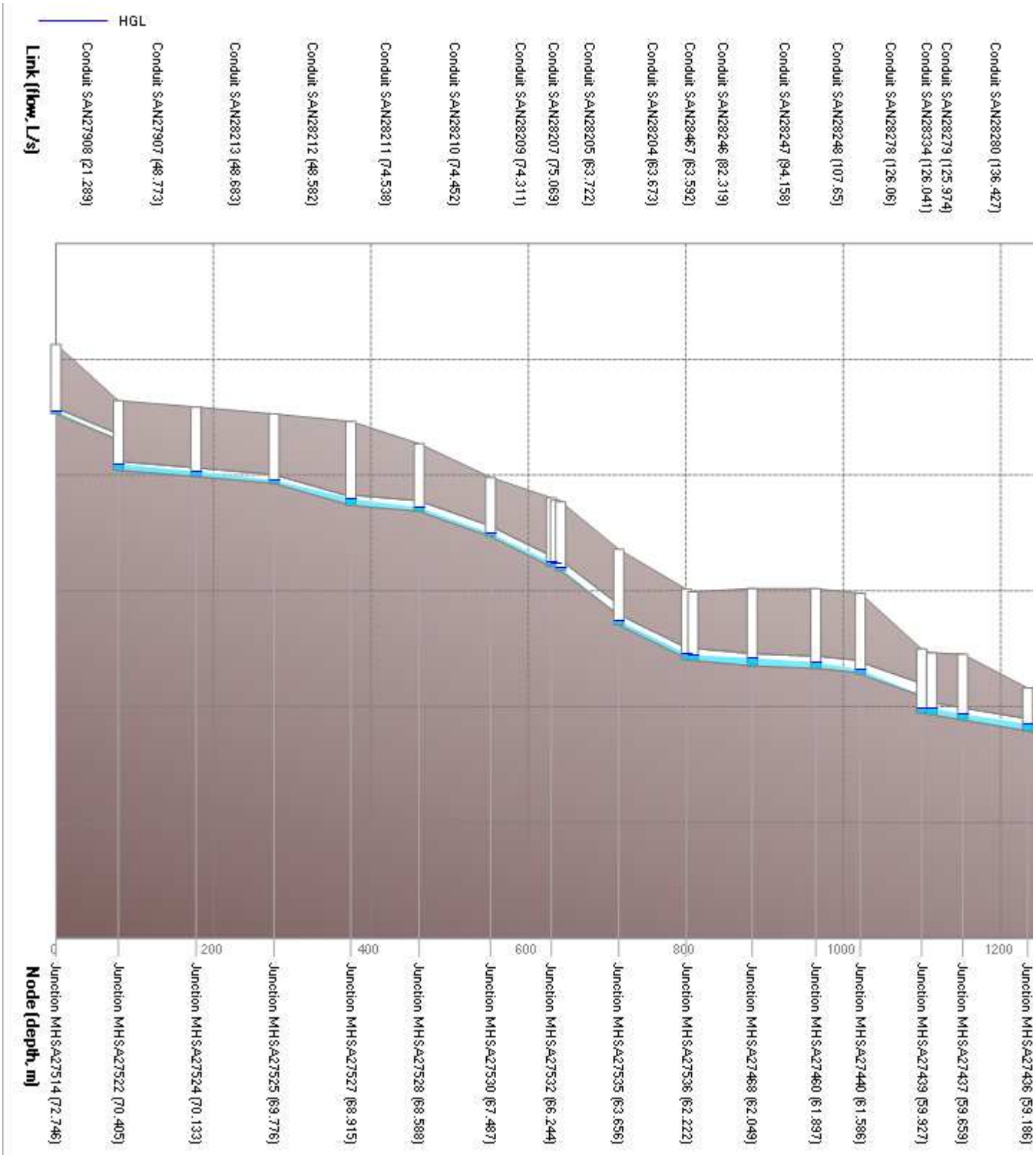
Hi Sam,

This could be of use to you. This is a hydrograph from our 1:100 year model at SAN28207 (the pipe just upstream of the split manhole) with the additional 1 L/s.



Here are the profiles from the subject property to the two connection points at the West Nepean Collector with these assumed flows in the model. If you find very different flows in your analysis, then I can load them into this model and show you the results. As it stands with the current flows in the model, there appears to be plenty of capacity.


Conduit SAN28188 (23.603)
Conduit SAN28189 (23.595)
Conduit SAN28190 (23.733)
Conduit SAN28194 (23.851)
Conduit SAN28207 (75.069)
Conduit SAN28209 (74.311)
Conduit SAN28210 (74.452)
Conduit SAN28211 (74.538)
Conduit SAN28212 (48.582)
Conduit SAN28213 (48.683)
Conduit SAN27907 (48.773)
Conduit SAN27908 (21.289)
HGL
Link (flow, L/s)
PRICNETON SEWER
FRONTING 373
PRICNETON AVE.
1000
800
600
400
200
Junction MHSA47044 (61.076)
Junction MHSA27549 (64.131)
Junction MHSA27548 (64.51)
Junction MHSA46987 (65.12)
Junction MHSA27546 (65.682)
Junction MHSA27532 (66.244)
Junction MHSA27530 (67.487)
Junction MHSA27528 (68.588)
Junction MHSA27527 (68.915)
Junction MHSA27525 (69.776)
Junction MHSA27524 (70.133)
Junction MHSA27522 (70.405)
Junction MHSA27514 (72.746)
Node (depth, m)



Hiran Sandanayake, P.Eng.
Senior Engineer, Water Resources
City of Ottawa
Asset Management Branch, City of Ottawa
100 Constellation Crescent, 6th Floor East
Ottawa, ON K2G 6J8
Mail Code 26-61

613-580-2424 ext. 13848
hiran.sandanayake@ottawa.ca

From: Sam Bahia [mailto:s.bahia@novatech-eng.com]
Sent: Wednesday, September 21, 2016 10:21 AM
To: Sandanayake, Hiran
Subject: 373 Princeton Avenue

Hi Hiran
Below are my coordinates.
Thank you
Sam Bahia, P.Eng, Project Engineer
NOVATECH Engineers, Planners & Landscape Architects
240 Michael Cowpland Drive, Suite 200, Ottawa, ON, K2M 1P6 | Tel: 613.254.9643 x 285 | Fax: 613.254.5867

This e-mail originates from the City of Ottawa e-mail system. Any distribution, use or copying of this e-mail or the information it contains by other than the intended recipient(s) is unauthorized. Thank you.

Le présent courriel a été expédié par le système de courriels de la Ville d'Ottawa. Toute distribution, utilisation ou reproduction du courriel ou des renseignements qui s'y trouvent par une personne autre que son destinataire prévu est interdite. Je vous remercie de votre collaboration.

APPENDIX B

WATERMAIN CORRESPONDENCE, CALCULATIONS AND FIRE INFORMATION

M E M O R A N D U M

DATE: **FEBRUARY 13, 2017**

TO: **JOSHUA WHITE**

FROM: **SAM BAHIA /BS**

RE: **373 PRINCETON AVENUE – WATER SERVICING**

PROJECT NO.: 116126-00

CC:

Overview

In order to service seven (7) units of the development at 373 Princeton Avenue, it is being proposed that a 50mm diameter Type K copper or PEX service be installed within the private laneway which runs along the north east side of the existing Jeanne D'Arc Institute. Refer to **Figure 1** – Request for Residential Water Demand attached. The proposed 50 mm diameter service will connect is an existing 200mm diameter watermain along Princeton Avenue and will feed the seven (7) units by means of a 19mm diameter Type K copper or PEX service lateral complete with service post as per City of Ottawa detail W26. An additional service post will be installed at the property line for the 50mm diameter water service extension as per City of Ottawa detail W35.

System Criteria

The design criteria used to determine the size of the watermains required to service the site are based on a conservative approach that considers three possible scenarios, as follows:

Maximum Allowable Pressure	551.6kPa (80psi)
Minimum Allowable Pressure (excluding fire flow conditions)	275.8kPa (40psi)
Minimum Allowable Pressure (including fire flow conditions)	137.9Kpa (20psi)

Water Demands

The City of Ottawa design criteria for Water Distribution systems were used to calculate the theoretical water demand for the proposed extension of the public watermain. The water demand has been calculated for each semi-detached 2.5-storey townhouse and is as follows:
Domestic Flow Daily = 0.011 L/s
Max. Daily = 0.027 L/s
Peak Hourly = 0.060 L/s

The required fire demand was calculated using the Fire Underwriters Survey (FUS) Guidelines. In the even of a fire the existing Jeanne D'Arc Institute, neighbouring the proposed development, would require the highest fire flow demand. The existing nearby hydrants will provide fire

#2a EDISON AVE DEMAND

EDISON AVE

EX 200mmØ WATERMAIN

EX HYD T/S=76.75

EX 200mmØ WATERMAIN

EX VAVB T/O=75.65

EX HYD T/S=76.85

EX VAVB T/O=75.65

EX 200mmØ WATERMAIN

EX CONCRETE SIDEWALK

No. 512
2 Storey Dwelling
(Foundation Noted)

A1 A2 B1 B2

C1 C2 C3 C4 C5 C6 C7

N7 N6 N5 N4 N3 N2 N1 R1

#3 PRINCETON AVE DEMAND

#1 PRINCETON AVE DEMAND

A3 B3 B4 B5 B6

Dwelling No. 515
2 Storey
(Foundation Noted)
T/F=77.02

EX. 100mmØ WM
COVERED OVER 2.2m

EX VAVB

EX. NON-FREEZE HYDRANT

EX. NON-FREEZE HYDRANT

Building No. 373 Princeton Avenue
2 1/2 Storey Brick and Concrete
(Brick Noted)
T/F=78.47
USF=73.20

PRINCETON AVE

EX 200mmØ WATERMAIN

EX HYD T/S=75.79

MELBOURNE AVE

150mmØ WATERMAIN

EX 150mmØ WATERMAIN

EX 150mmØ WATERMAIN

EX VAVB T/O=74.61

EX VAVB T/O=74.52

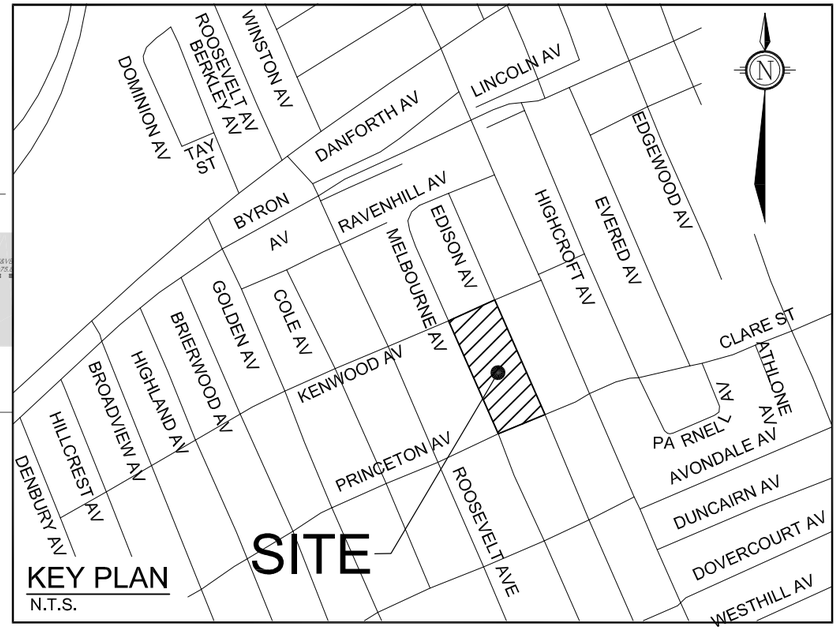
EX VAVB T/O=74.35

EX HYD T/S=74.90

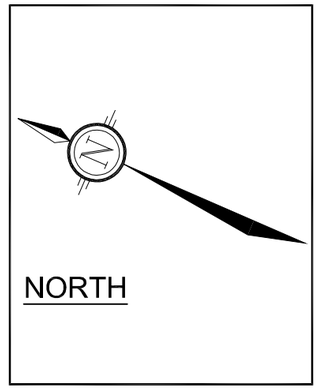
104.7m

68.5m

#2b MELBOURNE AVE DEMAND



KEY PLAN
N.T.S.



NORTH

NOVATECH
Engineers, Planners & Landscape Architects
Suite 200, 240 Michael Cowpland Drive
Ottawa, Ontario, Canada K2M 1P6
Telephone (613) 254-9643
Facsimile (613) 254-5867
Website www.novatech-eng.com

373 PRINCETON AVENUE

REQUEST FOR RESIDENTIAL WATER DEMAND

SCALE 1 : 500 (0 5 10 15 20)

DATE FEB 2017 | JOB 116126 | FIGURE 1

M:\2016\116126\CAD\Design\Figures\WM\FIG1.dwg, FIG1, Feb 13, 2017 - 5:45pm, bsweet

protection for the proposed development. The governing fire demand of this particular building was calculated to be 5,284 USGPM (or 20,000 L/min). Refer to the **Attachments** for a copy of the FUS calculations.

Hydraulic Analysis

This water demand info was submitted to the City and boundary conditions provided from the City's water model. These boundary conditions were input into the hydraulic model EPANET for the purpose of analyzing the performance of the proposed watermain for three theoretical conditions: 1) High Pressure check under Average Day conditions 2) Peak Hour demand 3) Maximum Day + Fire Flow demand. However, the maximum day + fire flow demand was not modelled since a fire flow will not be demanded from the 50mm diameter service. The existing hydrants at both the Princeton and Edison Avenues intersection as well as at the Princeton and Melbourne Avenues intersection are within the required distance to provide the necessary fire flow demands.

The model indicates that the system can provide adequate pressures for domestic use and fire flow demand with a 50mm diameter service connection to Princeton Avenue. The following **Table 1** summarizes the hydraulic water model results.

Table 1: Water Analysis Results Summary

Condition	Individual Building Demand (L/s)	Min/Max Allowable Operating Pressures (psi)	Limits of Design Operating Pressures (psi)
High Pressure	0.011	80psi (Max)	59.57
Maximum Daily Demand and *Fire Flow*	0.027	20psi (Min)	N/A
Peak Hour	0.060	40psi (Min)	47.42

Based on the proceeding analysis it can be concluded that the watermain, as designed, will provide adequate system pressures for the fire flow + maximum day demand and peak hour demand. Refer to **Attachments** for detailed model results, schematics of the model and boundary conditions.

Conclusion

To service the seven (7) units of the development at 373 Princeton Avenue, a 50mm diameter Type K copper or PEX service extension is required within the proposed private laneway. This service will feed all seven (7) units fronting this private laneway from 19mm diameter Type K copper or PEX service laterals, complete with stand posts, and will be connected into the existing 200mm diameter watermain located it Princeton Avenue. An additional service post will be installed at the property line for the 50mm diameter water service extension.

ATTACHMENTS

WATERMAIN CORRESPONDENCE, CALCULATIONS AND FIRE INFORMATION

Ben Sweet

From: Wu, John <John.Wu@ottawa.ca>
Sent: February-07-17 11:30 AM
To: Ben Sweet
Subject: boundary conditions for 373 Princeton Ave.
Attachments: 373 Princeton Feb 2017.pdf

Hello, please find the attached and below:

The following are boundary conditions, HGL, for hydraulic analysis at 373 Princeton (zone 1W) assumed to be connected to the 203mm on Edison, 203mm on Princeton and 152mm on Melbourne (see attached PDF for location).

Minimum HGL = 108.6m (same at all locations)

Maximum HGL = 116.9m (same at all locations)

Edison Ave Fire Flow:

MaxDay (0.12 L/s) + FireFlow (200 L/s) = 97.2m

Princeton Ave Fire Flow:

MaxDay (0.19 L/s) + FireFlow (333 L/s) = 91.7m

Melbourne Ave Fire Flow:

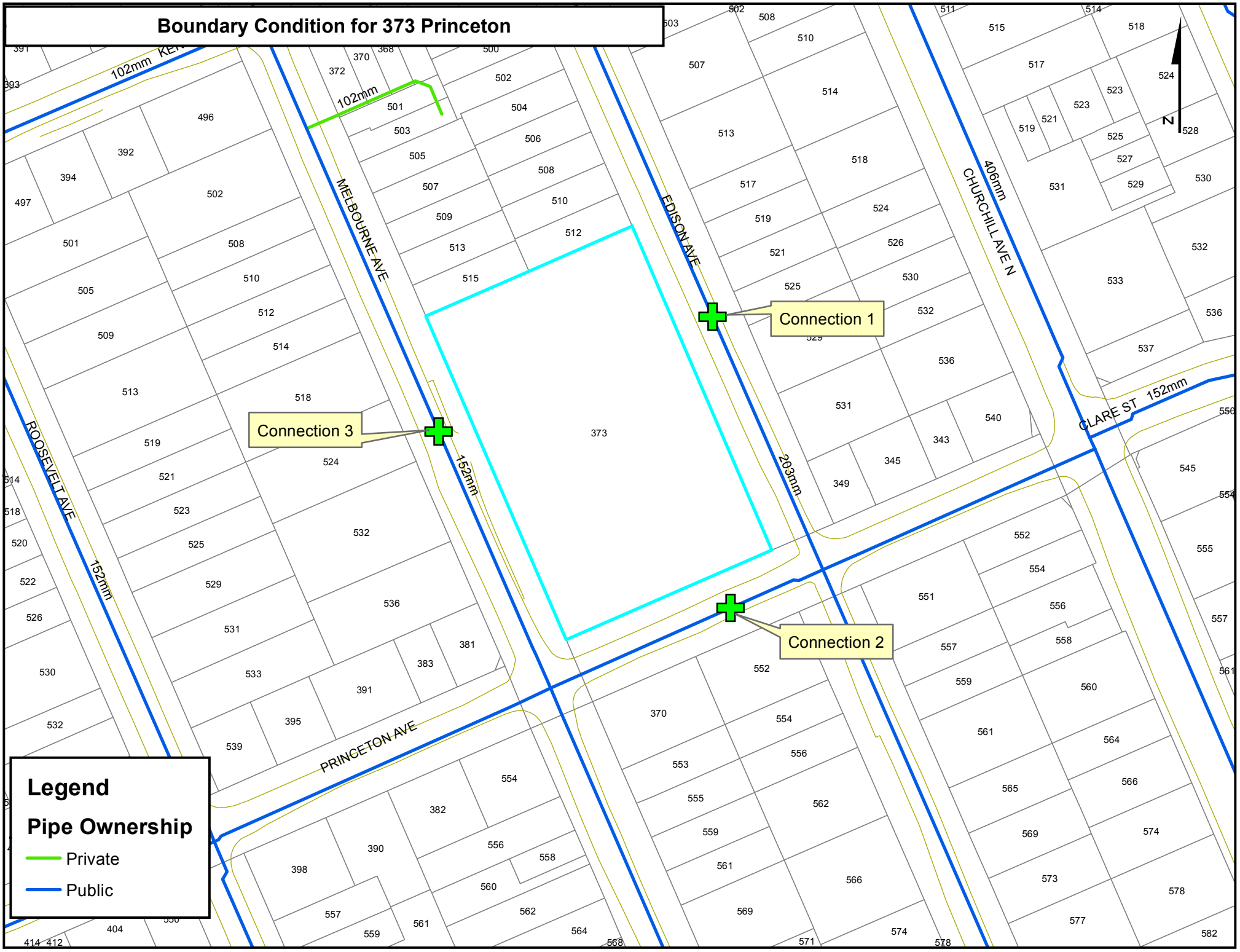
Available Flow = 60 L/s assuming a residual of 20 psi and a ground elevation of 74.8m

These are for current conditions and are based on computer model simulation.

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.

John Wu, P.Eng.
Project Manager, Infrastructure Approval
Development Review (Urban Services)
Gestionnaire de projet, Approbation de L'infrastructure
Examen des projects d'amenagement (Services urbains)
Planning, Infrastructure and Economic Development Department
Services de planification, d'infrastructure et de développement économique
City of Ottawa | Ville d'Ottawa
110 Laurier Avenue West. Ottawa, ON | 110, avenue. Laurier Ouest. Ottawa (Ontario) K1P 1J1
613.580.2424 ext./poste 27734, fax/téléc:613-560-6006, john.wu@ottawa.ca

Boundary Condition for 373 Princeton



NOVATECH
Engineers, Planners & Landscape Architects

Project: 373 Princeton Avenue
Proj. No.: 116126
Design: BCS

Reference: City of Ottawa Water Distribtuion Guidelines
Ontario Building Code 2006
National Fire Protection Association NFPA 13 - 2013 9 (Chapters 5 & 11)

Basic Residential Water Demand (#2a Edison Ave)

Type of Units	=	Single (2), and Semi-detached (2)		
No of. Units	=	4		
Single (2), and Semi-detached (2)	=	3.05	People/unit	
Flow/capita	=	350	L/day/person	
Domestic Flow Daily	=	4270	L/day	(# Units x # People x Residential Flow)
	=	0.049	L/s	Less than 50m³ NO
Max Daily	=	10675	L/day	(2.5 x Domestic)
	=	0.124	L/s	
Max Hour	=	979	L/hour	(2.2 x Max Daily / 24)
	=	0.272	L/s	
Governing FUS	=	12000	L/min	(Unit B3/B4)
	=	3170	USGPM	

Basic Residential Water Demand (#2b Melbourne Ave)

Type of Units	=	Single (1), and Semi-detached (4)		
No of. Units	=	5		
Single (1), and Semi-detached (4)	=	2.84	People/unit	
Flow/capita	=	350	L/day/person	
Domestic Flow Daily	=	4970	L/day	(# Units x # People x Residential Flow)
	=	0.058	L/s	Less than 50m³ NO
Max Daily	=	12425	L/day	(2.5 x Domestic)
	=	0.144	L/s	
Max Hour	=	1139	L/hour	(2.2 x Max Daily / 24)
	=	0.316	L/s	
Governing FUS	=	20000	L/min	(Existing Cornerstone Bldg)
	=	5284	USGPM	

Basic Residential Water Demand (#3 Princeton Ave)

Type of Units	=	Townhouses (7)		
No of. Units	=	7		
Townhouses (7)	=	2.7	People/unit	
Flow/capita	=	350	L/day/person	
Domestic Flow Daily	=	6615	L/day	(# Units x # People x Residential Flow)
	=	0.077	L/s	Less than 50m³ NO
Max Daily	=	16538	L/day	(2.5 x Domestic)
	=	0.191	L/s	
Max Hour	=	1516	L/hour	(2.2 x Max Daily / 24)
	=	0.421	L/s	
Governing FUS	=	20000	L/min	(Existing Cornerstone Bldg)
	=	5284	USGPM	

NOVATECH
Engineers, Planners & Landscape Architects

373 Princeton Avenue High Pressure Check

Node	Elevation (m)	Demand (LPS)	Head (m)	Pressure (m)	Pressure (PSI)
Node 1	75.20	0.011	116.90	41.70	59.30
Node 2	75.16	0.011	116.90	41.74	59.35
Node 3	75.12	0.011	116.90	41.78	59.41
Node 4	75.09	0.011	116.90	41.81	59.45
Node 5	75.06	0.011	116.90	41.84	59.50
Node 6	75.03	0.011	116.90	41.87	59.54
Node 7	75.00	0.011	116.90	41.90	59.58
Resvr 1	116.90	-0.080	116.90	0.00	0.00

373 Princeton Avenue Peak Hour Check					
Node	**Elevation** (m)	**Demand** (LPS)	**Head** (m)	**Pressure** (m)	(PSI)
Node 1	75.20	0.060	108.55	33.35	47.42
Node 2	75.16	0.060	108.54	33.38	47.47
Node 3	75.12	0.060	108.53	33.41	47.51
Node 4	75.09	0.060	108.52	33.43	47.54
Node 5	75.06	0.060	108.52	33.46	47.58
Node 6	75.03	0.060	108.52	33.49	47.62
Node 7	75.00	0.060	108.52	33.52	47.66
Resvr 1	108.60	-0.420	108.60	0.00	0.00

FUS - Fire Flow Calculations

As per 1999 Fire Underwriter's Survey Guidelines

NOVATECH
Engineers, Planners & Landscape Architects

Novatech #: 116126
Project Name: 373 Princeton Avenue
Date: 10-Apr-17
Input By: Ben Sweet
Reviewed By: Sam Bahia

Legend

Building Description: Cornerstone, 2 storey brick and concrete residential building
Wood frame

Step			Choose	Multiplier Options	Value Used	Total Fire Flow (L/min)
	Required Fire Flow					
1	**Construction Material**					
	Coefficient related to type of construction **C**	Wood frame	Yes	1.5	1.5	
		Ordinary construction		1		
		Non-combustible construction		0.8		
		Fire resistive construction (< 3 hrs)		0.7		
		Fire resistive construction (> 3 hrs)		0.6		
2	**Floor Area**					
	A	Building Footprint (m^2)	745			
		Number of Floors/Storeys	2			
		Area of structure considered (m^2)			**1,490**	
	F	**Base fire flow without reductions**				**13,000**
		F = 220 C (A)$^{0.5}$				
	Reductions or Surcharges					
3	**Occupancy hazard reduction or surcharge**					
	(1)	Non-combustible		-25%	-15%	**11,050**
		Limited combustible	Yes	-15%		
		Combustible		0%		
		Free burning		15%		
		Rapid burning		25%		
4	**Sprinkler Reduction**					
	(2)	Adequately Designed System (NFPA 13)	No	-30%		***0***
		Standard Water Supply	No	-10%		
		Fully Supervised System	No	-10%		
				Cumulative Total	**0%**	
5	***Exposure surcharge (cumulative (%))***					
	(3)	North Side	3.1 - 10 m		20%	**5,525**
		East Side	30.1- 45 m		5%	
		South Side	30.1- 45 m		5%	
		West Side	3.1 - 10 m		20%	
				Cumulative Total	**50%**	
	(1) + (2) + (3)	**Total Required Fire Flow, rounded to nearest 1000L/min**			**L/min**	***17,000***
		(2,000 L/min < Fire Flow < 45,000 L/min)		or	L/s	**283**
				or	USGPM	4,491
		Required Duration of Fire Flow (hours)			Hours	3.5
		Required Volume of Fire Flow (m^3)			m^3	3570

FUS - Fire Flow Calculations

As per 1999 Fire Underwriter's Survey Guidelines

NOVATECH
Engineers, Planners & Landscape Architects

Novatech #: 116126
Project Name: 373 Princeton Avenue
Date: 10-Apr-17
Input By: Ben Sweet
Reviewed By: Sam Bahia

Legend

Building Description: Unit A1-A2 and B1-B2, 2 storey detached & semi detached residential buildings
Wood frame

Step			Choose	Multiplier Options	Value Used	Total Fire Flow (L/min)
	Required Fire Flow					
1	**Construction Material**					
	Coefficient related to type of construction **C**	Wood frame	Yes	1.5	1.5	
		Ordinary construction		1		
		Non-combustible construction		0.8		
		Fire resistive construction (< 3 hrs)		0.7		
		Fire resistive construction (> 3 hrs)		0.6		
2	**Floor Area**					
	A	Building Footprint (m^2)	408			
		Number of Floors/Storeys	2			
		Area of structure considered (m^2)			**816**	
	F	**Base fire flow without reductions**				**9,000**
		F = 220 **C** (**A**)$^{0.5}$				
	Reductions or Surcharges					
3	**Occupancy hazard reduction or surcharge**					
	(1)	Non-combustible		-25%	-15%	**7,650**
		Limited combustible	Yes	-15%		
		Combustible		0%		
		Free burning		15%		
		Rapid burning		25%		
4	**Sprinkler Reduction**					
	(2)	Adequately Designed System (NFPA 13)	No	-30%		***0***
		Standard Water Supply	No	-10%		
		Fully Supervised System	No	-10%		
				Cumulative Total	**0%**	
5	***Exposure surcharge (cumulative (%))***					
	(3)	North Side	20.1 - 30 m		10%	**5,355**
		East Side	3.1 - 10 m		20%	
		South Side	10.1 - 20 m		15%	
		West Side	0 - 3 m		25%	
				Cumulative Total	**70%**	
	(1) + (2) + (3)	**Total Required Fire Flow, rounded to nearest 1000L/min**			**L/min**	***13,000***
		(2,000 L/min < Fire Flow < 45,000 L/min)		or	L/s	**217**
				or	USGPM	3,435
		Required Duration of Fire Flow (hours)			Hours	2.5
		Required Volume of Fire Flow (m^3)			m^3	1950

FUS - Fire Flow Calculations

As per 1999 Fire Underwriter's Survey Guidelines

NOVATECH
Engineers, Planners & Landscape Architects

Novatech #: 116126
Project Name: 373 Princeton Avenue
Date: 10-Apr-17
Input By: Ben Sweet
Reviewed By: Sam Bahia

Legend

Building Description: Unit A3 and B3-B6, 2 storey detached and semi detached residential buildings
Wood frame

Step			Choose	Multiplier Options	Value Used	Total Fire Flow (L/min)
	Required Fire Flow					
1	**Construction Material**					
	Coefficient related to type of construction **C**	Wood frame	Yes	1.5	1.5	
		Ordinary construction		1		
		Non-combustible construction		0.8		
		Fire resistive construction (< 3 hrs)		0.7		
		Fire resistive construction (> 3 hrs)		0.6		
2	**Floor Area**					
	A	Building Footprint (m^2)	495			
		Number of Floors/Storeys	2			
		Area of structure considered (m^2)			**990**	
	F	**Base fire flow without reductions**				**10,000**
		F = 220 C (A)$^{0.5}$				
	Reductions or Surcharges					
3	**Occupancy hazard reduction or surcharge**					
	(1)	Non-combustible		-25%	-15%	**8,500**
		Limited combustible	Yes	-15%		
		Combustible		0%		
		Free burning		15%		
		Rapid burning		25%		
4	**Sprinkler Reduction**					
	(2)	Adequately Designed System (NFPA 13)	No	-30%		***0***
		Standard Water Supply	No	-10%		
		Fully Supervised System	No	-10%		
				Cumulative Total	**0%**	
5	***Exposure surcharge (cumulative (%))***					
	(3)	North Side	10.1 - 20 m		15%	**5,950**
		East Side	3.1 - 10 m		20%	
		South Side	20.1 - 30 m		10%	
		West Side	0 - 3 m		25%	
				Cumulative Total	**70%**	
	(1) + (2) + (3)	**Total Required Fire Flow, rounded to nearest 1000L/min**			**L/min**	***14,000***
		(2,000 L/min < Fire Flow < 45,000 L/min)		or	L/s	**233**
				or	USGPM	3,699
		Required Duration of Fire Flow (hours)			Hours	3
		Required Volume of Fire Flow (m^3)			m^3	2520

FUS - Fire Flow Calculations

As per 1999 Fire Underwriter's Survey Guidelines

NOVATECH
Engineers, Planners & Landscape Architects

Novatech #: 116126
Project Name: 373 Princeton Avenue
Date: 10-Apr-17
Input By: Ben Sweet
Reviewed By: Sam Bahia

Legend

Building Description: Units C1-C7, 2.0 storey townhouses
Wood frame

Step			Choose	Multiplier Options	Value Used	Total Fire Flow (L/min)
	Required Fire Flow					
1	**Construction Material**					
	Coefficient related to type of construction **C**	Wood frame	Yes	1.5	1.5	
		Ordinary construction		1		
		Non-combustible construction		0.8		
		Fire resistive construction (< 3 hrs)		0.7		
		Fire resistive construction (> 3 hrs)		0.6		
2	**Floor Area**					
	A	Building Footprint (m^2)	525			
		Number of Floors/Storeys	2			
		Area of structure considered (m^2)			**1,050**	
	F	**Base fire flow without reductions**				**11,000**
		F = 220 C (A)$^{0.5}$				
	Reductions or Surcharges					
3	**Occupancy hazard reduction or surcharge**					
	(1)	Non-combustible		-25%	-15%	**9,350**
		Limited combustible	Yes	-15%		
		Combustible		0%		
		Free burning		15%		
		Rapid burning		25%		
4	**Sprinkler Reduction**					
	(2)	Adequately Designed System (NFPA 13)	No	-30%		***0***
		Standard Water Supply	No	-10%		
		Fully Supervised System	No	-10%		
				Cumulative Total	**0%**	
5	***Exposure surcharge (cumulative (%))***					
	(3)	North Side	20.1 - 30 m		10%	**5,143**
		East Side	20.1 - 30 m		10%	
		South Side	3.1 - 10 m		20%	
		West Side	10.1 - 20 m		15%	
				Cumulative Total	**55%**	
	(1) + (2) + (3)	**Total Required Fire Flow, rounded to nearest 1000L/min**			**L/min**	***14,000***
		(2,000 L/min < Fire Flow < 45,000 L/min)		or	L/s	**233**
				or	USGPM	3,699
		Required Duration of Fire Flow (hours)			Hours	3
		Required Volume of Fire Flow (m^3)			m^3	2520

Fire Water Supply Requirements Based on OBC 2012 (A3.2.5.7)

Project: 373 Princeton Avenue
Proj. No.: 116126
Design: BCS
Checked: BHB

Reference: Ontario Fire Marshal - OBC Fire Fighting Water Supply
Ontario Building Code 2012

Q : Fire Water Supply Volume Required (L)

K : Water Supply Coefficent

V : Building Volume (m^3)

S_{Tot} : Spatial Coefficent

Part 1 Volume

Description: Existing Building (Jeanne D'Arc Institute) is classified as Occupancy C and is of combustible construction.

Building Classification		C		OBC 3.1.2.1		
Water Supply Coefficent K:		23		A3.2.5.7 Table 1		
	W (ft)	N/A	m	m	A = 745	m^2
Original Prop. Add.						
	L (ft)	N/A	m	m	V = 6787	m^3
	H (ft)	9.11	m	m	use average interior height	

Exterior Wall Exposure = Distance between:
(Limiting Distance) Exterior face and Property Line
OBC 3.2.3.1.(3) or Exterior face and Centreline of Street
or Exterior face and line at mid-distance to another building on same lot

North	1.20 m	$S_{side\ 1}$ =	0.50	A3.2.5.7
East	7.60 m	$S_{side\ 2}$ =	0.24	
South	7.60 m	$S_{side\ 3}$ =	0.24	
West	6.40 m	$S_{side\ 4}$ =	0.36	

$S_{Tot} = 1.0 + (S_{side\ 1} + S_{side\ 2} + S_{side\ 3} + S_{side\ 4})$ 2.00

$Q_{REQ} = K\ V\ S_{Tot}$

	Q_{REQ} =	312200	L
Table 2	Flow min =	9000	L/min
	=	150	L/s

Remarks: Refer to drawing 116126-GP1, the Cornerstone building is the existing Jeanne D'Arc Institute.

Fire Water Supply Requirements Based on OBC 2012 (A3.2.5.7)

Project: 373 Princeton Avenue
Proj. No.: 116126
Design: BCS
Checked: BHB

Reference: Ontario Fire Marshal - OBC Fire Fighting Water Supply
Ontario Building Code 2012

Q : Fire Water Supply Volume Required (L)

K : Water Supply Coefficent

V : Building Volume (m^3)

S_{Tot} : Spatial Coefficent

Part 1 Volume

Description: Detached Building is classified as Occupancy C and is of combustible construction.

Building Classification		C		OBC 3.1.2.1		
Water Supply Coefficent K:		23		A3.2.5.7 Table 1		
	W (ft)	6.69	m	m	A = 107	m^2
Original Prop. Add.						
	L (ft)	16.00	m	m	V = 1124	m^3
	H (ft)	10.5	m	m	use average interior height	

Exterior Wall Exposure = Distance between:
(Limiting Distance) Exterior face and Property Line
OBC 3.2.3.1.(3) or Exterior face and Centreline of Street
or Exterior face and line at mid-distance to another building on same lot

North	8.50 m	$S_{side\ 1}$ =	0.15	A3.2.5.7
East	1.20 m	$S_{side\ 2}$ =	0.50	
South	6.00 m	$S_{side\ 3}$ =	0.40	
West	1.20 m	$S_{side\ 4}$ =	0.50	

$S_{Tot} = 1.0 + (S_{side\ 1} + S_{side\ 2} + S_{side\ 3} + S_{side\ 4})$ 2.00

$Q_{REQ} = K\ V\ S_{Tot}$

	Q_{REQ} =	51681	L
Table 2	Flow min =	2700	L/min
	=	45	L/s

Remarks: Refer to drawing 116126-GP2, Detached Buildings are represented with A.

Fire Water Supply Requirements Based on OBC 2012 (A3.2.5.7)

Project: 373 Princeton Avenue
Proj. No.: 116126
Design: BCS
Checked: BHB

Reference: Ontario Fire Marshal - OBC Fire Fighting Water Supply
Ontario Building Code 2012

Q : Fire Water Supply Volume Required (L)

K : Water Supply Coefficent

V : Building Volume (m^3)

S_{Tot} : Spatial Coefficent

Part 1 Volume

Description: Semi-Detached Building is classified as Occupancy C and is of combustible construction.

Building Classification		C		OBC 3.1.2.1		
Water Supply Coefficent K:		23		A3.2.5.7 Table 1		
	W (ft)	11.41	m	m	A = 194	m^2
Original Prop. Add.						
	L (ft)	17.00	m	m	V = 2037	m^3
	H (ft)	10.5	m	m	use average interior height	

Exterior Wall Exposure = Distance between:
(Limiting Distance) Exterior face and Property Line
OBC 3.2.3.1.(3) or Exterior face and Centreline of Street
or Exterior face and line at mid-distance to another building on same lot

North	8.50 m	$S_{side\ 1}$ =	0.15	A3.2.5.7
East	1.20 m	$S_{side\ 2}$ =	0.50	
South	5.00 m	$S_{side\ 3}$ =	0.50	
West	1.20 m	$S_{side\ 4}$ =	0.50	

$S_{Tot} = 1.0 + (S_{side\ 1} + S_{side\ 2} + S_{side\ 3} + S_{side\ 4})$ 2.00

$Q_{REQ} = K\ V\ S_{Tot}$

Q_{REQ} = 93702 L

Table 2 Flow min = 2700 L/min

= 45 L/s

Remarks: Refer to drawing 116126-GP2, Semi-Detached Buildings are represented with B.

Fire Water Supply Requirements Based on OBC 2012 (A3.2.5.7)

Project: 373 Princeton Avenue
Proj. No.: 116126
Design: BCS
Checked: BHB

Reference: Ontario Fire Marshal - OBC Fire Fighting Water Supply
Ontario Building Code 2012

Q : Fire Water Supply Volume Required (L)

K : Water Supply Coefficent

V : Building Volume (m^3)

S_{Tot} : Spatial Coefficent

Part 1 Volume

Description: Townhouse Building (3 Units) is classified as Occupancy C and is of combustible construction.

Building Classification		C		OBC 3.1.2.1		
Water Supply Coefficent K:		23		A3.2.5.7 Table 1		
	W (ft)	18.00	m	m	A = 225	m^2
Original Prop. Add.						
	L (ft)	12.50	m	m	V = 2363	m^3
	H (ft)	10.5	m	m	use average interior height	

Exterior Wall Exposure = Distance between:
(Limiting Distance) Exterior face and Property Line
OBC 3.2.3.1.(3) or Exterior face and Centreline of Street
or Exterior face and line at mid-distance to another building on same lot

North	4.00 m	$S_{side\ 1}$ =	0.50	A3.2.5.7
East	4.50 m	$S_{side\ 2}$ =	0.50	
South	6.50 m	$S_{side\ 3}$ =	0.35	
West	1.20 m	$S_{side\ 4}$ =	0.50	

$S_{Tot} = 1.0 + (S_{side\ 1} + S_{side\ 2} + S_{side\ 3} + S_{side\ 4})$ 2.00

$Q_{REQ} = K\ V\ S_{Tot}$

	Q_{REQ} =	108675	L
Table 2	Flow min =	2700	L/min
	=	45	L/s

Remarks: Refer to drawing 116126-GP2, Townhouse Buildings are represented with C.

Fire Water Supply Requirements Based on OBC 2012 (A3.2.5.7)

Project: 373 Princeton Avenue
Proj. No.: 116126
Design: BCS
Checked: BHB

Reference: Ontario Fire Marshal - OBC Fire Fighting Water Supply
Ontario Building Code 2012

Q : Fire Water Supply Volume Required (L)

K : Water Supply Coefficent

V : Building Volume (m^3)

S_{Tot} : Spatial Coefficent

Part 1 Volume

Description: Townhouse Building (2 Units) is classified as Occupancy C and is of combustible construction.

Building Classification		C		OBC 3.1.2.1		
Water Supply Coefficent K:		23		A3.2.5.7 Table 1		
	W (ft)	11.02	m	m	A = 151	m^2
Original Prop. Add.						
	L (ft)	13.70	m	m	V = 1586	m^3
	H (ft)	10.5	m	m	use average interior height	

Exterior Wall Exposure = Distance between:
(Limiting Distance) Exterior face and Property Line
OBC 3.2.3.1.(3) or Exterior face and Centreline of Street
or Exterior face and line at mid-distance to another building on same lot

North	4.00 m	$S_{side\ 1}$ =	0.50	A3.2.5.7
East	1.20 m	$S_{side\ 2}$ =	0.50	
South	6.60 m	$S_{side\ 3}$ =	0.34	
West	5.10 m	$S_{side\ 4}$ =	0.49	

$S_{Tot} = 1.0 + (S_{side\ 1} + S_{side\ 2} + S_{side\ 3} + S_{side\ 4})$ 2.00

$Q_{REQ} = K\ V\ S_{Tot}$

	Q_{REQ} =	72933	L
Table 2	Flow min =	2700	L/min
	=	45	L/s

Remarks: Refer to drawing 116126-GP2, Townhouse Buildings are represented with C.

A-3.2.5.4.(1) Fire Department Access for Detention Buildings.

Buildings of Group B, Division 1 used for housing persons who are under restraint include security measures that would prevent normal access by local fire departments. These security measures include fencing around the building site, exterior walls without openings or openings which are either very small or fitted with bars, and doors that are equipped with security hardware that would prevent easy entry. These buildings would have firefighting equipment installed and the staff would be trained to handle any small incipient fires. It is expected that appropriate fire safety planning would be undertaken in conjunction with local fire departments in order that special emergencies could be handled in a cooperative manner.

A-3.2.5.6.(1) Fire Department Access Route.

The design and construction of fire department access routes involves the consideration of many variables, some of which are specified in the requirements in the Building Code. All these variables should be considered in relation to the type and size of fire department vehicles available in the municipality or area where the building will be constructed. It is appropriate, therefore, that the local fire department be consulted prior to the design and construction of access routes.

A-3.2.5.7. Water Supply.

This Article requires that an adequate water supply for firefighting is to be provided for every building. However, farm buildings of low human occupancy under the National Farm Building Code of Canada 1995 are exempted. The water supply requirements for interior fire suppression systems such as sprinkler systems and standpipe and hose systems are contained in other standards, for example, NFPA Standard 13, "Installation of Sprinkler Systems", and NFPA Standard 14, "Installation of Standpipe and Hose Systems". This Appendix note focuses only on water supplies that are considered essential to firefighting by fire department or other trained personnel using fire hoses.

Minimum requirements for water supply for firefighting are relevant mainly to building sites not serviced by municipal water supply systems. For building sites serviced by municipal water supply systems where the water supply duration is not a concern, water supply flow rates at minimum pressures would be the main focus of this Appendix note. However, where municipal water supply capacities are limited, it would be necessary for buildings to have on-site supplemental water supply.

An adequate water supply for firefighting should be an immediately available and accessible water supply with sufficient volume and/or flow to enable fire department personnel using fire hoses to control fire growth until the building is safely evacuated, prevent the fire from spreading to adjacent buildings, limit environmental impact of the fire, and provide a limited measure of property protection.

The sources of water supply for firefighting purposes may be natural or man-made. Natural sources may include ponds, lakes, rivers, streams, bays, creeks, springs, artesian wells, and irrigation canals. Man-made sources may include aboveground tanks, elevated gravity tanks, cisterns, swimming pools, wells, reservoirs, aqueducts, tankers, and hydrants served by a public or private water system. It is imperative that such sources of water be accessible to fire department equipment under all climate conditions.

The available water supply would allow arriving fire department personnel to use the water at their discretion when entering a burning building with hose lines. During the search and evacuation operation, hose streams may be needed for fire suppression to limit fire spread. The duration of the water supply should be sufficient to allow complete search and evacuation of the building. Once the search and rescue operations are complete, additional water may be required for exposure protection or fire suppression to limit property damage.

Fire departments serving remote or rural areas often have to respond to a fire with a transportable water supply of sufficient volume for approximately 5 to 10 minutes when using one or two 38 mm hose lines. This would provide minimal hose streams allowing immediate search and rescue operations in small buildings with simple layouts but limited fire suppression capabilities, especially if a fire is already well-established.

For larger more complex buildings, an on-site water supply for firefighting would be needed to provide an extended duration of hose stream use by the fire department to allow search and evacuation of the building, exposure protection and fire suppression. The volume of this on-site water supply would be dependent on the building size, construction, occupancy, exposure and environmental impact potential, and should be sufficient to allow at least 30 minutes of fire department hose stream use.

The recommendations of this Appendix note are predicated on prompt response by a well equipped fire department using modern firefighting techniques, and buildings being evacuated in accordance with established building fire safety plans and fire department pre-fire plans. For buildings constructed in areas where fire department response is not expected at all or in a reasonable time, sprinkler protection should be considered to ensure safe evacuation.

Elementary and secondary schools usually have a record of well established and practiced fire safety plans which would allow complete evacuations within 4 minutes. Because of this and the inherent high level of supervision in these buildings, a reduction of the water supply for firefighting may be considered. It is suggested that the level of reduction should be determined by the local enforcement authority based on the resources and response time of the fire department, and the size and complexity of the buildings.

When designing open, unheated reservoirs as sources of fire protection water, a 600 mm ice depth allowance should be included in the water volume calculations, except where local winter temperature conditions result in a greater ice depth (as typically found on local lakes or ponds). As well, make-up water supplies should be provided to maintain the design volumes, taking into account volume loss due to evaporation during drought periods.

1. Buildings not Requiring an On-Site Water Supply
   (a) A building would not require an on-site water supply for firefighting if the building satisfies the criteria set out in Item 1(b) or Item 1(c) provided that:
      (i) the building is serviced by a municipal water supply system that satisfies Item 3(b), or
      (ii) the fire department can respond with a transportable water supply of sufficient quantity to allow them to conduct an effective search and evacuation of the building, determined on the basis of other guidelines or standards (such as, NFPA 1231, "Standard on Water Supplies for Suburban and Rural Fire Fighting").
   (b) A building would not require an on-site water supply for firefighting where all of the following criteria are met:
      (i) the building area is 200 m^2 or less,
      (ii) the building height is 2 storeys or less,
      (iii) the building does not contain a care or detention occupancy,
      (iv) the building does not require a sprinkler system or a standpipe and hose system,
      (v) the limiting distance from the property line is at least 13 m if the building contains a high hazard industrial occupancy, and
      (vi) the building constitutes no significant environmental contamination potential due to fire.
   (c) A building that exceeds 200 m^2 in building area or 2 storeys in building height and that contains a low hazard industrial occupancy may not require an on-site water supply for firefighting if the combustible loading in the building is insignificant (such as that found in cement plants, steel stock storage sheds, etc.), as determined by the chief building official.

2. Sprinklered Buildings
   For sprinklered buildings, water supply additional to that required by the sprinkler systems should be provided for firefighting using fire hoses in accordance with the hose stream demands and water supply durations for different hazard classifications as specified in NFPA 13, "Installation of Sprinkler Systems".

3. Buildings Requiring On-Site Water Supply
   (a) Except for sprinklered buildings and as required by Items 3(c) and 3(e), buildings should have a supply of water available for firefighting purposes not less than the quantity derived from the following formula:

$$Q = K \cdot V \cdot S_{tot}$$

where

Q = minimum supply of water in litres

K = water supply coefficient from Table 1

V = total building volume in cubic metres

S_{tot} = total of spatial coefficient values from property line exposures on all sides as obtained from the formula:

$$S_{tot} = 1.0 + [S_{side1} + S_{side2} + S_{side3} + \text{... etc.})]$$

where

S_{side} values are established from Figure 1, as modified by Items 3(d) and 3(f), and

S_{tot} need not exceed 2.0.

(b) Water supply flow rates should not be less than that specified in Table 2. Where the water supply is from a municipal or industrial water supply system, the required flow rate should be available at a minimum pressure of 140 kPa.

(c) The water supply as required in Item 3(a) should not be less than that needed to provide the minimum flow rate specified in Table 2 for a minimum duration of 30 minutes.

(d) Where a masonry wall with a minimum fire-resistance rating of 2 h, and no unprotected openings is provided as an exterior wall, the spatial coefficient (S_{side}) for this side of the building may be considered equal to 0. This masonry wall should be provided with a minimum 150 mm parapet. Firewalls that divide a structure into two or more buildings may be given similar consideration when evaluating the exposure of the buildings to each other.

(e) In elementary or secondary schools, the water supply determined in accordance with Items 3(a) and 3(b) may be reduced. The level of reduction to be applied would be at the discretion of the local enforcement authority, and should not exceed 30 percent.

(f) The spatial coefficient S_{side} may be considered equal to 0 when the exposed building is on the same property and is less than 10 m^2 in building area.

4. Additions to Existing Buildings

(a) Except as permitted in Items 4(b) and 4(c), additions to existing buildings should be provided with a water supply for firefighting as required in Items 3(a) to 3(e). Although under Part 11, Renovation, the required water supply is to be based only on the building volume of the addition, it is recommended that the entire building volume of the expanded facility be used to ensure complete evacuation and safety of all the occupants.

(b) Buildings with new additions falling within any one of the following criteria would not require an additional water supply for firefighting where:

(i) the expanded building complies with all the requirements of Item 1(a),

(ii) the new addition does not exceed 100 m^2 in building area, or

(iii) the new addition exceeds 100 m^2 but does not exceed 400 m^2 in building area, contains an assembly, business and personal services, mercantile or low hazard industrial occupancy, is of noncombustible construction, does not result in a significant increase in exposure to other existing buildings, has no combustible storage or process, and is separated from the existing building by a fire separation with a fire-resistance rating of at least 1 h.

(c) Where a firewall is provided between the new addition and the existing building, the water supply for firefighting may be determined in accordance with Items 1(a) and 3(a), using only the building volume of the new addition.

Table 1					
Water Supply Coefficient - K					
Type of Construction	Classification by Group or Division in Accordance with Table 3.1.2.1. of the Building Code				
	A-2 B-1 B-2 B-3 C D	A-4 F-3	A-1 A-3	E F-2	F-1
Building is of noncombustible construction with fire separations and fire-resistance ratings provided in accordance with Subsection 3.2.2., including loadbearing walls, columns and arches.	10	12	14	17	23
Building is of noncombustible construction or of heavy timber construction conforming to Article 3.1.4.6. Floor assemblies are fire separations but with no fire-resistance rating. Roof assemblies, mezzanines, loadbearing walls, columns and arches do not have a fire-resistance rating.	16	19	22	27	37
Building is of combustible construction with fire separations and fire-resistance ratings provided in accordance with Subsection 3.2.2., including loadbearing walls, columns and arches. Noncombustible construction may be used in lieu of fire-resistance rating where permitted in Subsection 3.2.2.	18	22	25	31	41
Building is of combustible construction. Floor assemblies are fire separations but with no fire-resistance rating. Roof assemblies, mezzanines, loadbearing walls, columns and arches do not have a fire-resistance rating.	23	28	32	39	53
Column 1	2	3	4	5	6

Table 2	
Part 3 Buildings under the Building Code	Required Minimum Water Supply Flow Rate, L/min
One-storey building with building area not exceeding 600 m²	1 800
All other buildings	2 700 (if Q ≤ 108 000 L)(1) 3 600 (if Q > 108 000 L and ≤ 135 000 L)(1) 4 500 (if Q > 135 000 L and ≤ 162 000 L)(1) 5 400 (if Q > 162 000 L and ≤ 190 000 L)(1) 6 300 (if Q > 190 000 L and ≤ 270 000 L)(1) 9 000 (if Q > 270 000 L)(1)

Notes to Table 2:
(1) $Q = KVS_{tot}$ as referenced in Paragraph 3(a)

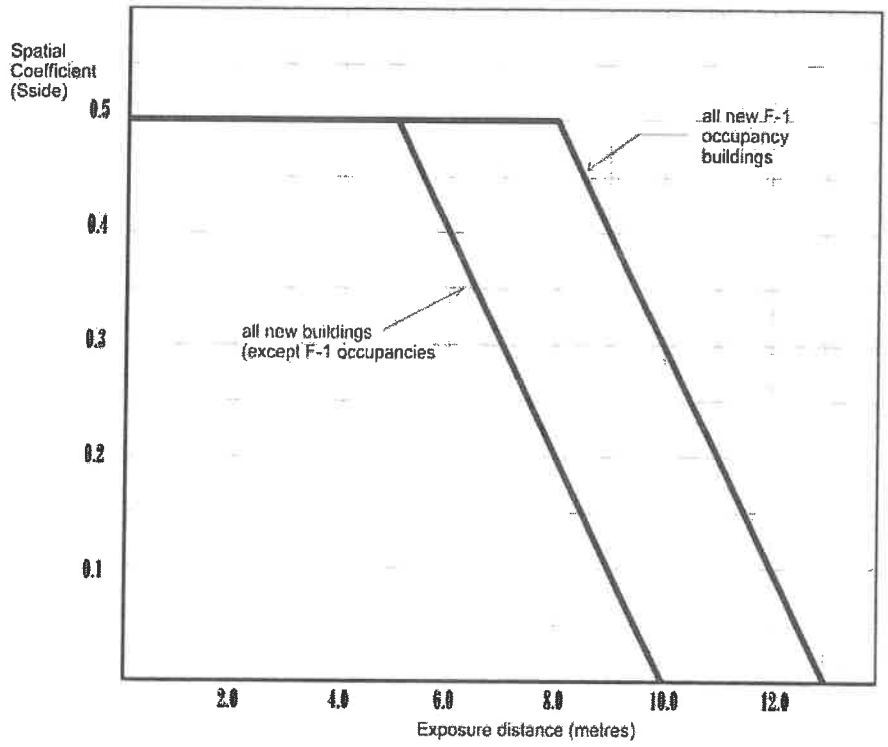


Figure 1
Spatial Coefficient vs Exposure Distance

Further clarification of intent and sample problems and solutions are contained in the "Fire Protection Water Supply Guideline for Part 3 in the Ontario Building Code". This guideline may be obtained through the Office of the Fire Marshal's web site at: "www.ofm.gov.on.ca"

A-3.2.5.13.(1) Sprinkler System Design.

In NFPA 13, "Installation of Sprinkler Systems", reference is made to other NFPA standards which contain additional sprinkler design criteria. These criteria apply to industrial occupancies with high fire loads, including warehouses with high piled storage, and industrial occupancies intended for the use, manufacture or storage of highly flammable materials. Therefore, while only NFPA 13 is called up directly by Sentence 3.2.5.13.(1), the additional criteria in the other NFPA standards are included automatically.

In some NFPA standards, certain aspects of sprinkler protection are dependent on the fire-resistance rating of the vertical structural members. In these cases, the sprinkler system design options can be affected by the fire-resistance rating of these elements. For example, in buildings used for the storage of rubber tires, sprinklers directed at the sides of a column are required if the column does not have the required fire-resistance rating.

Other NFPA standards may require that certain occupancies be sprinklered in conformance with NFPA 13, as in the case of some garages. These requirements do not supersede the requirements in the Building Code. An occupancy is required to be sprinklered only when this is specified in the Building Code, but when it is so required, it must be sprinklered in conformance with NFPA 13 and its referenced standards.

A-3.2.5.13.(6) Sprinklering of Roof Assembly.

Sprinkler protection for roof assemblies in lieu of fire resistance is based on the assumption that the sprinklers will protect the roof assembly from the effects of fire in spaces below the roof. If a ceiling membrane is provided, the sprinklers would have to be located below the membrane in order to react quickly to the fire. In certain instances, however, sprinklers may be required within the concealed spaces as well as below the membrane. NFPA 13, "Installation of Sprinkler Systems", requires sprinklers in certain concealed spaces.

According to NFPA 13 and 13R, rooms and closets within a dwelling unit in a sprinklered building, including those in the storey immediately below the roof assembly do not require sprinklers. However, the Building Code requires sprinkler protection within all rooms and closets immediately below the roof so as to control any fire that might start in that space and thereby limit the probability of the fire spreading into the roof assembly.

Moreover, NFPA 13D, "Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes," also allows the omission of sprinklers in such rooms and closets under certain circumstances, provided the building is sprinklered in conformance with this standard. In this case, the Building Code concurs with the provisions of the NFPA 13D standard.

a_3 A-3.2.5.13.(7) Balconies and Decks.

The intent of this provision is to suppress or control a fire starting on a balcony or deck which could spread to the balcony above, roof assembly or other parts of the building. It is not intended to apply to a roof top deck or uppermost balcony where there are no parts of the building above.

e_3 A-3.2.5.13.(8) Sprinkler Rating.

The requirements of this Sentence can be met by using sprinklers with a rating of 79°C to 107°C.

A-3.2.5.14.(1) Hazard Classification for Sprinkler Selection.

The reference to light hazard occupancies is based on the descriptions of these occupancies given in NFPA 13, "Installation of Sprinkler Systems" and is intended only for use in the design of sprinkler systems. These descriptions should not be confused with the occupancy classifications in the Building Code.

In NFPA 13 a light hazard occupancy is one in which the quantity or combustibility of contents is low and fires with relatively low rates of heat release are expected. Typical buildings or parts of buildings include: churches; clubs; eaves and overhangs, if of combustible construction with no combustibles beneath; educational buildings; hospitals; institutional buildings; libraries, except very large stack rooms; museums; long term care or convalescent homes; offices, including data processing rooms; residential buildings; restaurant seating areas; theatres and auditoria, excluding stages and proscenia; and unused attics.

Although NFPA 13R, "Installation of Sprinkler Systems in Residential Occupancies up to and Including Four Stories in Height", and NFPA 13D, "Installation of Sprinkler Systems in One- and Two-Family Dwellings and Mobile Homes", as referenced by NFPA 13, are concerned with specific types of residential occupancy, namely apartment buildings up to four storeys, one and two family dwellings, and mobile homes, for the purpose of acceptance of combustible sprinkler piping these occupancies are considered to be included in the category of residential buildings under light hazard occupancies.

A-3.2.5.19.(1) Fire Pumps.

In order to ensure an adequate water supply, it may be necessary to install a fire pump for a building that has either a standpipe system or an automatic sprinkler system installed. Reference to NFPA 20, "Installation of Stationary Pumps for Fire Protection", provides the necessary guidance to designers.

A-3.2.6. High Buildings.

It is assumed that buildings regulated by Subsection 3.2.6. will be in an area served by a fire department capable of an early response and that all firefighting and rescue situations will be under the direct control of the officer-in-charge of the fire department responding to the emergency.

Measures that relate to limiting or controlling the movement of smoke caused by a building fire are described in the Supplementary Standard SB-4. Adoption of one of these measures is considered to be an acceptable means of complying with the requirements of this Subsection.

A-3.2.6.4.(6)(a) Elevator Recall.

Automatic emergency recall actuation that is dependent on the operation of 2 smoke detectors in the elevator lobby meets the intent of this requirement. Such an arrangement may reduce the frequency of nuisance recalls.

APPENDIX C

STORMWATER MANAGEMENT CALCULATIONS

PROPOSED POST DEVELOPMENT PEAK FLOWS

NOVATECH
Engineers, Planners & Landscape Architects

Controlled Flow

2 YR

Area No.	Area (ha)	C_{2yr}	Time (min)	Intensity mm/hr	Uncontrolled Runoff L/s	Control System	Controlled Flow (L/s)
Uniform							
L-01	0.0012	0.15	15.00	61.77	0.03	Direct Runoff	0.03
L-02	0.0028	0.34	15.00	61.77	0.16	Direct Runoff	0.16
L-03	0.0036	0.46	15.00	61.77	0.28	Direct Runoff	0.28
L-04	0.0041	0.30	15.00	61.77	0.21	Direct Runoff	0.21
L-05	0.0100	0.18	15.00	61.77	0.31	Direct Runoff	0.31
L-06	0.0011	0.15	15.00	61.77	0.03	Direct Runoff	0.03
L-07	0.0036	0.44	15.00	61.77	0.27	Direct Runoff	0.27
L-08	0.0040	0.46	15.00	61.77	0.32	Direct Runoff	0.32
L-09	0.0038	0.32	15.00	61.77	0.20	Direct Runoff	0.20
D-01	0.0027	0.90	10.00	76.81	0.51	Direct Runoff	0.51
D-02	0.0026	0.90	10.00	76.81	0.51	Direct Runoff	0.51
D-03	0.0032	0.90	10.00	76.81	0.61	Direct Runoff	0.61
D-04	0.0027	0.90	10.00	76.81	0.51	Direct Runoff	0.51
D-05	0.0032	0.90	10.00	76.81	0.62	Direct Runoff	0.62
D-06	0.0032	0.90	10.00	76.81	0.62	Direct Runoff	0.62
A-01	0.1654	0.56	20.00	52.03	13.39	Storage	11.59
A-02	0.0322	0.27	15.00	61.77	1.51	Direct Runoff	1.51
A-03	0.1059	0.69	15.00	61.77	12.61	Storage	11.59
Total:	0.3552				32.71		29.89
Cornerstone							
A-04	0.1027	0.49	15.00	61.77	8.61	Direct Runoff	8.61
A-05	0.0833	0.57	20.00	52.03	6.82	-	-
A-06	0.0445	0.75	10.00	76.81	7.08	Storage	10.78
Total:	0.2305				22.51		19.39

5 YR

Area No.	Area (ha)	C_{2yr}	Time (min)	Intensity mm/hr	Uncontrolled Runoff L/s	Control System	Controlled Flow (L/s)
Uniform							
L-01	0.0012	0.15	15.00	84.11	0.04	Direct Runoff	0.04
L-02	0.0028	0.34	15.00	84.11	0.22	Direct Runoff	0.22
L-03	0.0036	0.46	15.00	84.11	0.38	Direct Runoff	0.38
L-04	0.0041	0.30	15.00	84.11	0.29	Direct Runoff	0.29
L-05	0.0100	0.18	15.00	84.11	0.42	Direct Runoff	0.42
L-06	0.0011	0.15	15.00	84.11	0.04	Direct Runoff	0.04
L-07	0.0036	0.44	15.00	84.11	0.37	Direct Runoff	0.37
L-08	0.0040	0.46	15.00	84.11	0.44	Direct Runoff	0.44
L-09	0.0038	0.32	15.00	84.11	0.28	Direct Runoff	0.28
D-01	0.0027	0.90	10.00	104.59	0.70	Direct Runoff	0.70
D-02	0.0026	0.90	10.00	104.59	0.69	Direct Runoff	0.69
D-03	0.0032	0.90	10.00	104.59	0.84	Direct Runoff	0.84
D-04	0.0027	0.90	10.00	104.59	0.69	Direct Runoff	0.69
D-05	0.0032	0.90	10.00	104.59	0.85	Direct Runoff	0.85
D-06	0.0032	0.90	10.00	104.59	0.84	Direct Runoff	0.84
A-01	0.1654	0.56	20.00	70.85	18.24	Storage	15.65
A-02	0.0322	0.27	15.00	84.11	2.05	Direct Runoff	2.05
A-03	0.1059	0.69	15.00	84.11	17.17	Storage	15.65
Total:	0.3552				44.54		40.43
Cornerstone							
A-04	0.1027	0.49	15.00	84.11	11.72	Direct Runoff	11.72
A-05	0.0833	0.57	20.00	70.85	9.29	Storage	-
A-06	0.0445	0.75	10.00	104.59	9.64	Storage	14.51
Total:	0.2305				30.65		26.23

373 PRINCETON AVENUE

NOVATECH
Engineers, Planners & Landscape Architects

Controlled Flow

100 YR

Area No.	Area (ha)	C_{2yr}	Time (min)	Intensity mm/hr	Uncontrolled Runoff L/s	Control System	Controlled Flow (L/s)
Uniform							
L-01	0.0012	0.19	15.00	146.27	0.09	Direct Runoff	0.09
L-02	0.0028	0.42	15.00	146.27	0.48	Direct Runoff	0.48
L-03	0.0036	0.57	15.00	146.27	0.83	Direct Runoff	0.83
L-04	0.0041	0.37	15.00	146.27	0.62	Direct Runoff	0.62
L-05	0.0100	0.22	15.00	146.27	0.91	Direct Runoff	0.91
L-06	0.0011	0.19	15.00	146.27	0.09	Direct Runoff	0.09
L-07	0.0036	0.55	15.00	146.27	0.81	Direct Runoff	0.81
L-08	0.0040	0.58	15.00	146.27	0.95	Direct Runoff	0.95
L-09	0.0038	0.40	15.00	146.27	0.61	Direct Runoff	0.61
D-01	0.0027	1.00	10.00	181.88	1.34	Direct Runoff	1.34
D-02	0.0026	1.00	10.00	181.88	1.33	Direct Runoff	1.33
D-03	0.0032	1.00	10.00	181.88	1.62	Direct Runoff	1.62
D-04	0.0027	1.00	10.00	181.88	1.34	Direct Runoff	1.34
D-05	0.0032	1.00	10.00	181.88	1.63	Direct Runoff	1.63
D-06	0.0032	1.00	10.00	181.88	1.63	Direct Runoff	1.63
A-01	0.1654	0.70	20.00	123.21	39.65	Storage	25.20
A-02	0.0322	0.34	15.00	146.27	4.46	Direct Runoff	4.46
A-03	0.1059	0.87	15.00	146.27	37.32	Storage	25.20
Total:	0.3552				95.71		69.14
Cornerstone							
A-04	0.1027	0.61	15.00	146.27	25.49	Direct Runoff	25.49
A-05	0.0833	0.71	20.00	123.21	20.20	Storage	-
A-06	0.0445	0.93	10.00	181.88	20.95	Storage	19.37
Total:	0.2305				66.64		44.86

Uniform Allowable Release Rate

Area	0.3552	ha
C	0.49	
tc	15	min
i_2	61.77	mm/hr
i_5	83.56	mm/hr
i_{100}	142.89	mm/hr
$Q_{100\ Allowable}$	2.78 x C x i x A	
	69.15	L/s

Summary Table

Area ID	Area (ha)	Runoff 2 yr event L/s	Runoff 5 yr event L/s	Runoff 100 yr event L/s
Controlled - Surface Storage and Super Pipe				
A-01	0.1654	11.59	15.65	25.20
A-03	0.1059	11.59	15.65	25.20
Uncontrolled - Direct Runoff				
L-01 to L-09	0.0341	1.82	2.48	5.39
D-01 to D-06	0.0176	3.38	4.61	8.90
A-02	0.0322	1.51	2.05	4.46
Total:	0.3552	29.89	40.43	69.14

Cornerstone Allowable Release Rate

Area	0.2305	ha
C	0.49	
tc	15	min
i_2	61.77	mm/hr
i_5	83.56	mm/hr
i_{100}	142.89	mm/hr
$Q_{100\ Allowable}$	2.78 x C x i x A	
	44.86	L/s

Summary Table

Area ID	Area (ha)	Runoff 2 yr event L/s	Runoff 5 yr event L/s	Runoff 100 yr event L/s
Controlled - Surface Storage and Super Pipe				
A-05 & A-06	0.1278	10.78	14.51	19.37
Uncontrolled - Direct Runoff				
A-04	0.1027	8.61	11.72	25.49
Total:	0.2305	19.3903	26.2348	44.8574

NOVATECH
Engineers, Planners & Landscape Architects

Runoff Coefficients

Drainage Area	Total Area (m^2)	Hard Surface Area		Grass Area		5-Year Runoff Coefficient	100-Year Runoff Coefficient
		Area (m^2)	C	Area (m^2)	C		
Uniform							
L-01	11.5	0.0	0.85	11.5	0.15	0.15	0.19
L-02	28.3	7.5	0.85	20.8	0.15	0.34	0.42
L-03	35.7	15.8	0.85	19.9	0.15	0.46	0.57
L-04	40.8	8.7	0.85	32.1	0.15	0.30	0.37
L-05	99.9	4.1	0.85	95.8	0.15	0.18	0.22
L-06	11.3	0.0	0.85	11.3	0.15	0.15	0.19
L-07	36.3	15.1	0.85	21.2	0.15	0.44	0.55
L-08	40.1	18.0	0.85	22.1	0.15	0.46	0.58
L-09	37.5	9.0	0.85	28.5	0.15	0.32	0.40
D-01	26.6	26.6	0.90	0.0	0.15	0.90	1.00
D-02	26.4	26.4	0.90	0.0	0.15	0.90	1.00
D-03	32.0	32.0	0.90	0.0	0.15	0.90	1.00
D-04	26.5	26.5	0.90	0.0	0.15	0.90	1.00
D-05	32.3	32.3	0.90	0.0	0.15	0.90	1.00
D-06	32.2	32.2	0.90	0.0	0.15	0.90	1.00
A-01	1654.3	968.4	0.85	685.9	0.15	0.56	0.70
A-02	321.8	56.3	0.85	265.5	0.15	0.27	0.34
A-03	1058.8	821.9	0.85	236.9	0.15	0.69	0.87
Total:	3552.3	2100.8	0.85	1451.5	0.15	0.57	0.71
Cornerstone							
A-04	1026.8	455.5	0.85	571.3	0.20	0.49	0.61
A-05	833.2	495.4	0.85	337.8	0.15	0.57	0.71
A-06	444.7	353.0	0.90	91.7	0.15	0.75	0.93
Total:	2304.7	1303.9	0.86	1000.8	0.18	0.57	0.71

NOTE: C values have been modified to denote the initial abstraction of the 2-yr storm from the 5 and 100-yr runoff

NOVATECH
Engineers, Planners & Landscape Architects

REQUIRED STORAGE - 2-YEAR EVENT
Uniform Storage (A-01)

OTTAWA IDF CURVE
Area = 0.165 ha Qallow = **11.59**
C = 0.56 Vol(max) = 3.88 m3

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m^3)
5	103.57	26.66	15.07	4.52
10	76.81	19.77	8.18	4.91
15	61.77	15.90	4.31	3.88
20	52.03	13.39	1.80	2.17
25	45.17	11.63	0.04	0.06
30	40.04	10.31	-1.28	-2.31
35	36.06	9.28	-2.31	-4.84
40	32.86	8.46	-3.13	-7.51
45	30.24	7.78	-3.81	-10.27
50	28.04	7.22	-4.37	-13.11
55	26.17	6.74	-4.85	-16.01
60	24.56	6.32	-5.27	-18.96
645	3.85	0.99	-10.60	-410.13

REQUIRED STORAGE - 5-YEAR EVENT
Uniform Storage (A-01)

OTTAWA IDF CURVE
Area = 0.165 ha Qallow = **15.65**
C = 0.56 Vol(max) = 5.26 m3

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m^3)
5	140.99	36.30	20.65	6.19
10	104.10	26.80	11.15	6.69
15	83.50	21.50	5.85	5.26
20	70.21	18.07	2.42	2.91
25	60.87	15.67	0.02	0.03
30	53.91	13.88	-1.77	-3.19
35	48.50	12.49	-3.16	-6.65
40	44.17	11.37	-4.28	-10.27
45	40.62	10.46	-5.19	-14.02
50	37.64	9.69	-5.96	-17.88
55	35.11	9.04	-6.61	-21.81
60	32.94	8.48	-7.17	-25.82
645	5.12	1.32	-14.33	-554.69

REQUIRED STORAGE - 100-YEAR EVENT
Uniform Storage (A-01)

OTTAWA IDF CURVE
Area = 0.165 ha Qallow = **25.20**
C = 0.70 Vol(max) = 18.70 m3

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m^3)
5	242.70	78.10	52.90	15.87
10	178.56	57.46	32.26	19.36
15	142.89	45.98	20.78	18.70
20	119.95	38.60	13.40	16.08
25	103.85	33.42	8.22	12.33
30	91.87	29.56	4.36	7.85
35	82.58	26.57	1.37	2.88
40	75.15	24.18	-1.02	-2.44
45	69.05	22.22	-2.98	-8.05
50	63.95	20.58	-4.62	-13.86
55	59.62	19.19	-6.01	-19.84
60	55.89	17.99	-7.21	-25.97
645	8.56	2.75	-22.45	-868.67

NOVATECH
Engineers, Planners & Landscape Architects

REQUIRED STORAGE - 2-YEAR EVENT
Uniform Storage (A-03)

OTTAWA IDF CURVE
Area = 0.106 ha Qallow = **11.59**
C = 0.69 Vol(max) = 0.91 m3

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m^3)
5	103.57	21.14	9.55	2.86
10	76.81	15.68	4.09	2.45
15	61.77	12.61	1.02	0.91
20	52.03	10.62	-0.97	-1.16
25	45.17	9.22	-2.37	-3.56
30	40.04	8.17	-3.42	-6.15
35	36.06	7.36	-4.23	-8.88
40	32.86	6.71	-4.88	-11.72
45	30.24	6.17	-5.42	-14.63
50	28.04	5.72	-5.87	-17.60
55	26.17	5.34	-6.25	-20.62
60	24.56	5.01	-6.58	-23.68
645	3.85	0.79	-10.80	-418.09

REQUIRED STORAGE - 5-YEAR EVENT
Uniform Storage (A-03)

OTTAWA IDF CURVE
Area = 0.106 ha Qallow = **15.65**
C = 0.69 Vol(max) = 1.25 m3

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m^3)
5	140.99	28.78	13.13	3.94
10	104.10	21.25	5.60	3.36
15	83.50	17.04	1.39	1.25
20	70.21	14.33	-1.32	-1.58
25	60.87	12.42	-3.23	-4.84
30	53.91	11.00	-4.65	-8.37
35	48.50	9.90	-5.75	-12.08
40	44.17	9.01	-6.64	-15.92
45	40.62	8.29	-7.36	-19.87
50	37.64	7.68	-7.97	-23.90
55	35.11	7.17	-8.48	-27.99
60	32.94	6.72	-8.93	-32.14
645	5.12	1.04	-14.61	-565.25

REQUIRED STORAGE - 100-YEAR EVENT
Uniform Storage (A-03)

OTTAWA IDF CURVE
Area = 0.106 ha Qallow = **25.20**
C = 0.87 Vol(max) = 10.13 m3

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m^3)
5	242.70	61.92	36.72	11.02
10	178.56	45.55	20.35	12.21
15	142.89	36.45	11.25	10.13
20	119.95	30.60	5.40	6.48
25	103.85	26.49	1.29	1.94
30	91.87	23.44	-1.76	-3.17
35	82.58	21.07	-4.13	-8.68
40	75.15	19.17	-6.03	-14.47
45	69.05	17.62	-7.58	-20.48
50	63.95	16.32	-8.88	-26.65
55	59.62	15.21	-9.99	-32.96
60	55.89	14.26	-10.94	-39.39
645	8.56	2.18	-23.02	-890.76

NOVATECH
Engineers, Planners & Landscape Architects

REQUIRED STORAGE - 2-YEAR EVENT
Cornerstone Storage (A-05 & A-06)

OTTAWA IDF CURVE

Area =	0.128	ha	Qallow =	**10.78**
C =	0.63		Vol(max) =	2.71 m3

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m^3)
5	103.57	23.13	12.35	3.70
10	76.81	17.15	6.37	3.82
15	61.77	13.79	3.01	2.71
20	52.03	11.62	0.84	1.01
25	45.17	10.09	-0.69	-1.04
30	40.04	8.94	-1.84	-3.31
35	36.06	8.05	-2.73	-5.73
40	32.86	7.34	-3.44	-8.26
45	30.24	6.75	-4.03	-10.87
50	28.04	6.26	-4.52	-13.56
55	26.17	5.84	-4.94	-16.29
60	24.56	5.48	-5.30	-19.07
645	3.85	0.86	-9.92	-383.88

REQUIRED STORAGE - 5-YEAR EVENT
Cornerstone Storage (A-05 & A-06)

OTTAWA IDF CURVE

Area =	0.128	ha	Qallow =	**14.51**
C =	0.63		Vol(max) =	3.72 m3

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m^3)
5	140.99	31.48	16.97	5.09
10	104.10	23.24	8.73	5.24
15	83.50	18.64	4.13	3.72
20	70.21	15.68	1.17	1.40
25	60.87	13.59	-0.92	-1.38
30	53.91	12.04	-2.47	-4.45
35	48.50	10.83	-3.68	-7.73
40	44.17	9.86	-4.65	-11.15
45	40.62	9.07	-5.44	-14.69
50	37.64	8.41	-6.10	-18.31
55	35.11	7.84	-6.67	-22.01
60	32.94	7.35	-7.16	-25.76
645	5.12	1.14	-13.37	-517.33

REQUIRED STORAGE - 100-YEAR EVENT
Cornerstone Storage (A-05 & A-06)

OTTAWA IDF CURVE

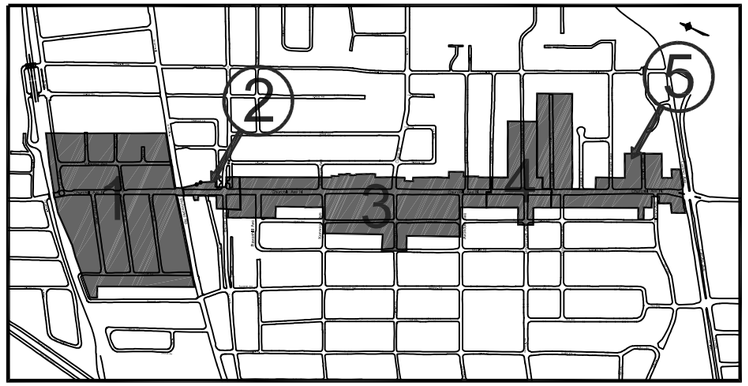
Area =	0.128	ha	Qallow =	**19.37**
C =	0.79		Vol(max) =	18.46 m3

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m^3)
5	242.70	67.74	48.37	14.51
10	178.56	49.84	30.47	18.28
15	142.89	39.88	20.51	18.46
20	119.95	33.48	14.11	16.93
25	103.85	28.99	9.62	14.42
30	91.87	25.64	6.27	11.29
35	82.58	23.05	3.68	7.73
40	75.15	20.97	1.60	3.85
45	69.05	19.27	-0.10	-0.26
50	63.95	17.85	-1.52	-4.56
55	59.62	16.64	-2.73	-9.00
60	55.89	15.60	-3.77	-13.57
645	8.56	2.39	-16.98	-657.19

MAJOR OVERLAND FLOW ROUTE

MAJOR SYSTEM RUNOFF = 100-YEAR FLOW - 2-YEAR FLOW (ASSUMES 2-YEAR INLET CAPACITY)
USING 15 min. Tc:
Q100 = CIA = 1.25(0.45)(142.9mm/hr)(2.53ha) = 565L/s
Q2 = CIA = (0.45)(61.8mm/hr)(2.53ha) = 195L/s

OVERLAND FLOW = 370L/s



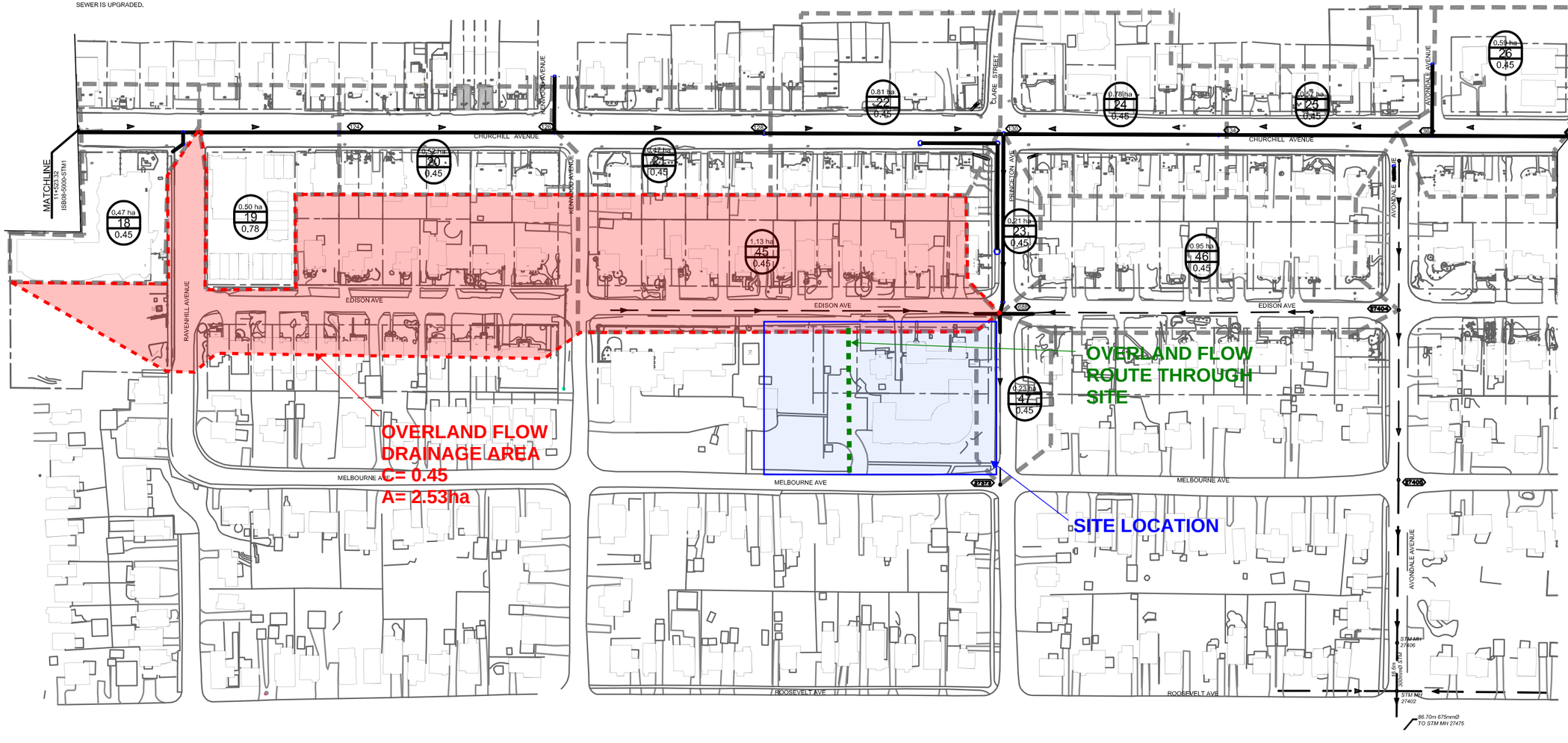
KEY PLAN
N.T.S.

LEGEND

- 0.75 ha / 31 / 0.45 — AREA IN HECTARES; AREA ID; RUNOFF COEFFICIENT
- STORM DRAINAGE AREA BOUNDARY
- DIRECTION OF FLOW
- EXISTING STORM SEWER AND MANHOLE
- PROPOSED STORM SEWER AND MANHOLE
- STM MH 27326 — CITY OF OTTAWA MANHOLE #

AREA 3

- 83mmØ 'PLUG TYPE' INLET CONTROL DEVICES TO BE INSTALLED IN CATCHBASIN LEADS CONNECTIONG TO THE PRINCETON AVENUE STORM OUTLET. ICD'S TO BE REMOVED WHEN PRINCETON AVENUE OUTLET SEWER IS UPGRADED.



CHURCHILL AVE
CARLING TO SCOTT
SCOTT STREET
CHURCHILL TO WINONA

STORM DRAINAGE AREA
STA. 10+523.32 TO 11+209.34

BRUCE MASON, P.Eng. Manager - Division	TODD PENFOUND, CET. Project Manager

LICENSED PROFESSIONAL ENGINEER — M.J. PETEPIECE 100079354 — PROVINCE OF ONTARIO

Ottawa

Contract No.	Dwg. No.
ISB08-5000	STM2

Sheet 06 of 24
Asset No.
Asset Group: ISB
Des: NTO Chk'd:
Dwn: RCH Chk'd:
Utility Circ. No.:
Const. Inspector:
Scale: 0 5 10 20 metres 1 : 1000

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

REVISIONS	No.	Description	By	Date
	1.	ISSUED FOR PRELIMINARY DESIGN CIRCULATION	ERD	07/10/09
	2.	ISSUED FOR MOE APPROVAL	ERD	07/24/09
	3.	RE-ISSUED FOR MOE APPROVAL	ERD	09/04/09

TITLE FRAME: 708mm x 534mm City of Ottawa 2008

Drawing:M:\2008\08058\CAD\design\ISB08-5000-stm-OPT2.dwg Layout:STM2 Updated APR 03, 2009 at 1:52pm by rhillier

Bay-Kitchissippi Drainage System Assessment - Phase I
Technical Memo #1 - Level of Service Evaluation

August 2008

The ponding depths simulated at this location are relatively high and the area could benefit from additional catchbasins. It should be noted that the model is not calibrated and so the results provide an indication of where problem areas are located, but the depths themselves may or may not reflect actual levels.

Furthermore, since the high water levels noted were observed during a spring melt, local measures, such as regarding to further divert overland flow from reaching low level apartments may also be considered.

4.2 MADISON AVENUE CATCHBASINS

The connectivity of the catchbasins along Madison Avenue has been identified as a concern by Novatech in the notes from the Churchill Reconstruction TAC Meeting No. 1 (July 25, 2008). City staff noted that a City of Ottawa maintenance manual indicated the size of the storm sewer along Churchill Avenue from Madison to Whitby as being a 200mm (email August 20, 2008). The City also provided a figure with an assumed connectivity showing this 200mm pipe running along Madison Avenue, and receiving flow from the catchbasins noted above. The model reflects these assumptions.

4.3 OVERLAND FLOW ACROSS PRIVATE PROPERTY

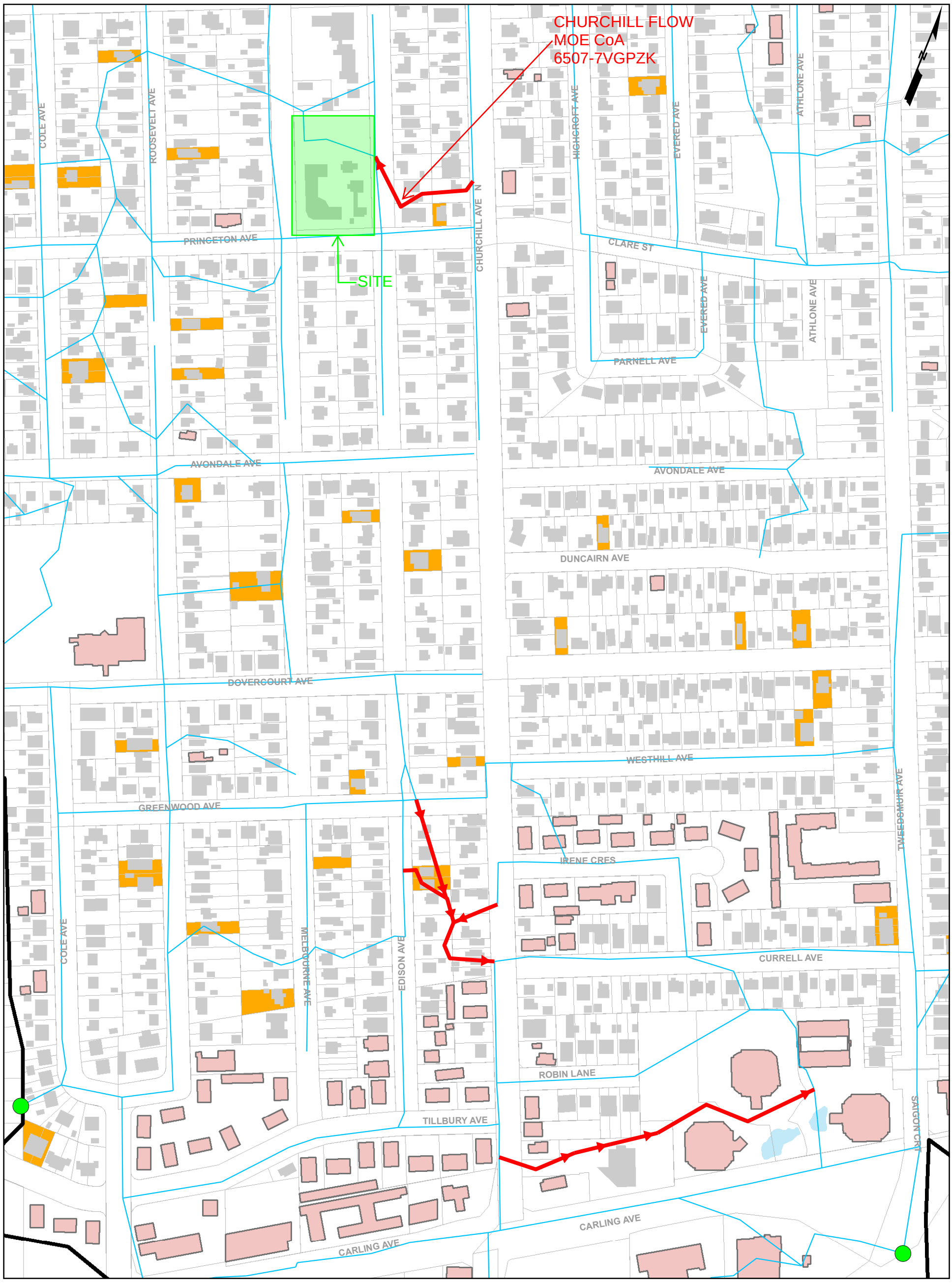
The overland drainage networks for the study area were established based on Streambuilder information provided by the City combined with findings from field investigations. Three (3) locations were noted and modeled as conveying overland flow from Churchill Avenue onto and through adjacent private propriety (see also **Figure 4.1**):

- Churchill Avenue at Princeton Avenue – draining to the west towards Edison Avenue;
- Between Irene Crescent and Currell Avenue – draining to the west towards Edison Avenue; and,
- Between Carling Avenue and Tillbury Avenue – draining to the east towards the adjacent commercial parking lot.

It is good practice to keep overland flows on public right-of-ways, as opposed to crossing private property. The reconstruction of Churchill Avenue provides an opportunity to review the local overland drainage at these locations and potentially regrade to prevent flow from public right-of-ways from crossing onto private property. These opportunities should be reviewed and considered in the design.

4.4 MINOR SYSTEM OUTLETS ALONG CHURCHILL

The capacity of three (3) minor system outlets along Churchill Avenue was identified as a concern by Novatech in the notes from the Churchill Reconstruction TAC Meeting No.1 (July 25, 2008), as well as by City staff. **Figure 4.2** shows the location of the minor system outlets in question.



W:\active\1634_00795_Bay_Kitchissippi_Drainage\planning\drawing\GIS\TM1_Figures_Aug08\BK_TM1_Fig4-1_Churchill OVLND.mxd

Legend

- Flow Path Across Private Proprety

Building Type

- Standard
- Flat Roof

Parcel

- Standard
- Depressed Driveway

0 15 30 60 90 120 Meters

1:3,000

Stantec

Client/Project

CITY OF OTTAWA
BAY-KITCHISSIPPI DRAINAGE SYSTEM ASSESSMENT
TM1 - LEVEL OF SERVICE ASSESSMENT

Figure No.

4.1

Title

Churchill - Overland Flow Across Private Proprety

August 2008
1634-00795

ED.

Ontario

Ministry of the Environment
Ministère de l'Environnement

CERTIFICATE OF APPROVAL
MUNICIPAL AND PRIVATE SEWAGE WORKS
NUMBER 6507-7VGPZK
Issue Date: September 9, 2009

City of Ottawa
100 Constellation Crescent
Nepean, Ontario
K2G 6J8

Site Location: Churchill Avenue, Dovercourt Avenue, Princeton Avenue, and Scott Street
Lot 31 and 32, Concession 1 on Ottawa River, Nepean
City of Ottawa

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

- ***storm sewers*** to be constructed on Churchill Avenue, Dovercourt Avenue, Princeton Avenue, and on Scott Street; and

- ***sanitary sewers*** to be constructed on Churchill Avenue, Princeton Avenue, and Scott Street, in the City of Ottawa ;

all in accordance with the application dated July 27, 2009 and received July 29, 2009, including final plans and specifications prepared by Novatech Engineering Consultants Ltd.

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

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

(2) "*Owner* " means City of Ottawa, and includes its successors and assignees; and

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

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

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

The Notice should also include:

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

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

This Notice must be served upon:

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

AND

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

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

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

DATED AT TORONTO this 9th day of September, 2009

THIS CERTIFICATE WAS MAILED
ON Sept. 14, 2009
SC
(Signed)

Zafar Bhatti

Zafar Bhatti, P.Eng.
Director
Section 53, *Ontario Water Resources Act*

AA/

c: District Manager, MOE Ottawa District Office
Michael J. Petepiece, P.Eng., Novatech Engineering Consultants Ltd. ✓

EXCERPT FROM MOECC ECA APPLICATION FOR THE CHURCHILL SEWER REHABILITATION PROJECT:

B3

Princeton Avenue Major Drainage Outlet Sewer

100 Year Major Drainage Flow at Sag North of Intersection
= **583.4 L/s** (No flow captured by minor system, from design sheet)

Flow Captured by Minor System
= 3 inlets @ (17.6/2)L/s/inlet + 2 inlets @ 17.6L/s/inlet + 2 inlets @ 18.0L/s/inlet = **97.6 L/s**

Total Major Drainage to be conveyed from Road Sag to Princeton Ave Major Drainage Route
= 583.4L/s – 97.6L/s = **485.8L/s = 0.4858m^3/s**

To Determine Required Difference in Elevation of the 2 Catchbasins, Total Head Loss is calculated as follows:

Head Loss (H_L) = $V^2/2g$ (Inlet Loss + Manhole Loss Coefficient + fL/D + Outlet Loss)

Inlet Loss = $0.5*V^2/2g$ Outlet Loss = $1.0* V^2/2g$

Velocity (V) = Flow Rate (Q) / Cross Sectional Area of Sewer (A) = **$(0.4858m^3/s) / ((\pi* 0.675^2)/4)^2$**

Length (L) = Total Length of Sewer between Inlet and Outlet Structures = **69.5m**

Friction Factor (f) = **$8*g / (1/n * (D/4)^{1/6})^2$**

Friction Factor (f) = $8*9.81 / (1/0.013 * (0.675/4)^{1/6})^2$ = **0.024**

Gravitational Constant (g) = **9.81m/s^2**

Roughness Coefficient (n) = **0.013**

Diameter (D) = **675mm or 0.675m**

Manhole Loss Coefficient = [Relative Manhole Size Coefficient (K_o)]*[Correction Factor for Pipe Dia. (C_D)]

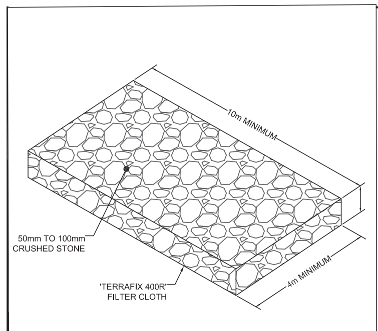
$C_D = (D_o/D_o)^3$
$K_o = 0.1\ (b/D_o)\ (1-\sin\theta) + 1.4\ (b/D_o)^{0.15} \sin\theta$
θ = the angle between the inflow and outflow pipes = **90 degrees**
b = structure diameter, mm = **1800mm**
D_i = inlet pipe diameter, mm = **675mm**
D_o = outlet pipe diameter, mm = **675mm**

Manhole Loss Coefficient = $[0.1\ (1800/675)\ (1-\sin90) + 1.4\ (1800/675)^{0.15} \sin90] * [(675/675)^3]$ = **1.62**

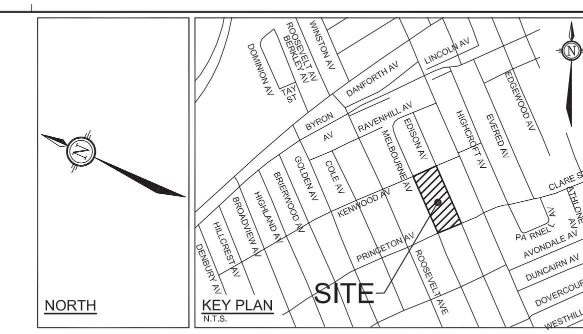
Head Loss (H_L)=$[((0.4858m^3/s) / ((\pi* 0.675^2)/4)^2) / 2*9.81]*[0.5 + 1.62 + 0.024*69.5 / 0.675 + 1.0]$= **0.52m**

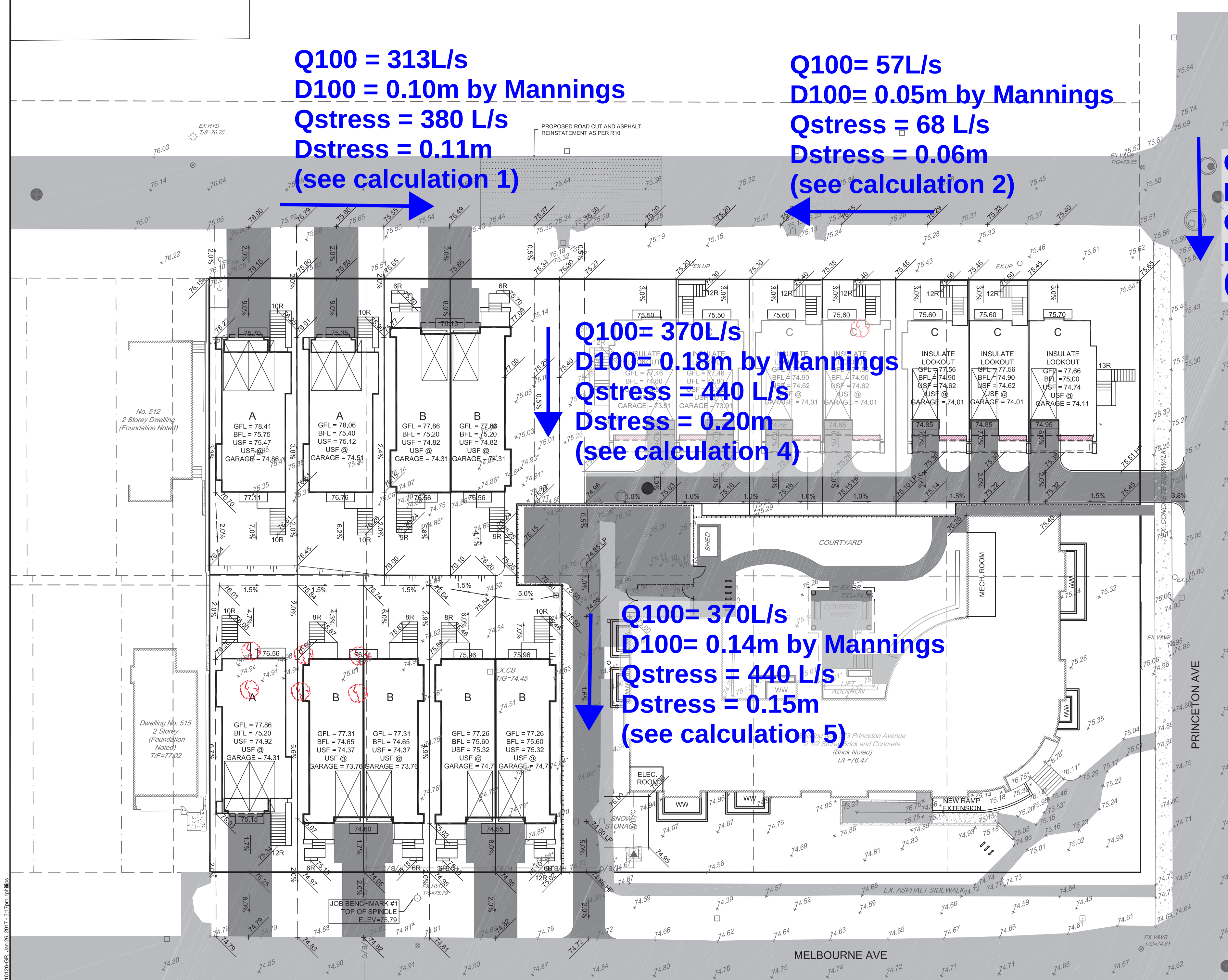
- **Therefore Inlet and Outlet Elevation Difference to be set at 0.52m.**
- **Twin Inlet CB Manhole will Capture this flow provided ponding depth is approximately 0.30m.**

Overland Flows through and around the Site



MUD MAT DETAIL
NTS





LEGEND

- PROPERTY LINE
- PROPOSED CURB
- PROPOSED DEPRESSED CURB
- PROPOSED STANDPOST
- PROPOSED WATER METER
- PROPOSED REMOTE METER
- PROPOSED ELEVATION
- PROPOSED TOP OF CURB ELEVATION
- EXISTING ELEVATION
- PROPOSED TERRACE GRADE
- GRADE AND DIRECTION
- REMOVALS
- DIRECTION OF MAJOR OVERLAND FLOW
- SILT FENCE PER OPSD 219.130
- BIKE RACK
- EXISTING UTILITY POLE C/W GUY WIRES
- EXISTING VALVE & VALVE CHAMBER
- EXISTING HYDRANT C/W VALVE
- EXISTING SANITARY MANHOLE
- EXISTING STORM MANHOLE
- EXISTING CATCHBASIN
- EXISTING TREE TO REMAIN
- EXISTING TREE TO REMOVE
- CB C/W FILTER BAG
- TREE PROTECTION FENCE
- TERRACING (3:1) MAX
- ROOF DOWNSPOUT LOCATION
- PROPOSED ROAD CUT AND ASPHALT REINSTATEMENT AS PER R10.
- TOP LIFT OF ASPHALT BETWEEN ROAD TO BE MILLED AND REINSTATED WITH 40mm HL3 AS PER ROAD ACTIVITY BY-LAW 2003-445 (13) SECTION 12e

GENERAL NOTES:

1) COORDINATE AND SCHEDULE ALL WORK WITH OTHER TRADES AND CONTRACTORS.
2) DETERMINE THE EXACT LOCATION, SIZE, MATERIAL AND ELEVATION OF ALL EXISTING UTILITIES PRIOR TO COMMENCING CONSTRUCTION. PROTECT AND ASSUME RESPONSIBILITY FOR ALL EXISTING UTILITIES WHETHER OR NOT SHOWN ON THIS DRAWING.
3) OBTAIN ALL NECESSARY PERMITS AND APPROVALS FROM THE CITY OF OTTAWA BEFORE COMMENCING CONSTRUCTION.
4) BEFORE COMMENCING CONSTRUCTION OBTAIN AND PROVIDE PROOF OF COMPREHENSIVE, ALL RISK AND OPERATIONAL LIABILITY INSURANCE FOR $2,000,000.00. INSURANCE POLICY TO NAME OWNERS, ENGINEERS AND ARCHITECTS AS CO-INSURED.
5) RESTORE ALL DISTURBED AREAS ON-SITE AND OFF-SITE, INCLUDING TRENCHES AND SURFACES ON PUBLIC ROAD ALLOWANCES TO EXISTING CONDITIONS OR BETTER TO THE SATISFACTION OF THE CITY OF OTTAWA AND ENGINEER.
6) REMOVE FROM SITE ALL EXCESS EXCAVATED MATERIAL, ORGANIC MATERIAL AND DEBRIS UNLESS OTHERWISE INSTRUCTED BY ENGINEER. EXCAVATE AND REMOVE FROM SITE ANY CONTAMINATED MATERIAL. ALL CONTAMINATED MATERIAL SHALL BE DISPOSED OF AT A LICENSED LANDFILL FACILITY.
7) ALL ELEVATIONS ARE GEODETIC.
8) REFER TO ARCHITECT'S AND LANDSCAPE ARCHITECT'S DRAWINGS FOR BUILDING AND HARDSURFACE AREAS AND DIMENSIONS.
9) SAW CUT AND KEY GRIND ASPHALT AT ALL ROAD CUTS AND ASPHALT TIE IN POINTS AS PER CITY OF OTTAWA STANDARDS (R10).
10) CONTRACTOR TO PROVIDE THE CONSULTANT WITH A GENERAL PLAN OF SERVICES INDICATING ALL SERVICING AS-BUILT INFORMATION SHOWN ON THIS PLAN. AS-BUILT INFORMATION MUST INCLUDE: PIPE MATERIAL, SIZES, LENGTHS, SLOPES, INVERT AND T/G ELEVATIONS, STRUCTURE LOCATIONS, VALVE AND HYDRANT LOCATIONS, T/WM ELEVATIONS AND ANY ALIGNMENT CHANGES, ETC.
11) NO EXCESS DRAINAGE SHALL BE DIRECTED ONTO NEIGHBOURING PROPERTY.
12) NO ALTERATIONS TO EXISTING GRADES AS PERMITTED BEYOND THE PROPERTY LINE.

GRADING NOTES:

1) ALL TOPSOIL, ORGANIC OR DELETERIOUS MATERIAL MUST BE ENTIRELY REMOVED FROM BENEATH THE PROPOSED PAVED AREAS.
2) EXPOSED SUBGRADES IN PROPOSED PAVED AREAS SHOULD BE PROOF ROLLED WITH A LARGE STEEL DRUM ROLLER AND INSPECTED BY THE GEOTECHNICAL CONSULTANT.
3) ANY SOFT AREAS EVIDENT FROM THE PROOF ROLLING SHOULD BE SUBEXCAVATED AND REPLACED WITH SUITABLE MATERIAL THAT IS FROST COMPATIBLE WITH THE EXISTING SOILS.
4) THE GRANULAR BASE SHOULD BE COMPACTED TO AT LEAST 100% OF THE STANDARD PROCTOR MAXIMUM DRY DENSITY VALUE. ANY ADDITIONAL GRANULAR FILL USED BELOW THE PROPOSED PAVEMENT SHOULD BE COMPACTED TO AT LEAST 95% OF THE STANDARD PROCTOR MAXIMUM DRY DENSITY VALUE.
5) GRADE AND/OR FILL BEHIND PROPOSED CURB AND BETWEEN BUILDINGS AND CURBS, WHERE REQUIRED TO PROVIDE POSITIVE DRAINAGE.
6) MINIMUM OF 2% GRADE FOR ALL GRASS AREAS UNLESS OTHERWISE NOTED.
7) ALL GRADES BY CURBS ARE EDGE OF PAVEMENT GRADES UNLESS OTHERWISE INDICATED.
8) REFER TO LANDSCAPE PLAN FOR PLANTING AND OTHER LANDSCAPE FEATURE DETAILS.

EROSION AND SEDIMENT CONTROL NOTES:

1) THE OWNER AGREES TO PREPARE AND IMPLEMENT AN EROSION AND SEDIMENT CONTROL PLAN TO THE SATISFACTION OF THE CITY OF OTTAWA, APPROPRIATE TO THE SITE CONDITIONS, PRIOR TO UNDERTAKING ANY SITE ALTERATIONS (FILLING, GRADING, REMOVAL OF VEGETATION, ETC.) AND DURING ALL PHASES OF SITE PREPARATION AND CONSTRUCTION IN ACCORDANCE WITH THE CURRENT BEST MANAGEMENT PRACTICES FOR EROSION AND SEDIMENT CONTROL SUCH AS BUT NOT LIMITED TO INSTALLING FILTER CLOTHS ACROSS MANHOLE/CATCHBASIN LIDS TO PREVENT SEDIMENTS FROM ENTERING STRUCTURES AND INSTALL AND MAINTAIN A LIGHT DUTY SILT FENCE BARRIER AS REQUIRED.
2) THE CONTRACTOR SHALL PLACE FILTER CLOTH UNDER THE CATCHBASIN AND MANHOLE GRATES FOR THE DURATION OF CONSTRUCTION AND WILL REMAIN IN PLACE DURING ALL PHASES OF CONSTRUCTION.
3) SILT FENCING FOR ENTIRE PERIMETER OF SITE, SHALL BE UTILIZED TO CONTROL EROSION FROM THE SITE DURING CONSTRUCTION.
4) THE CONTRACTOR ACKNOWLEDGES THAT FAILURE TO IMPLEMENT EROSION AND SEDIMENT CONTROL MEASURES MAY BE SUBJECT TO PENALTIES IMPOSED BY ANY APPLICABLE REGULATORY AGENCY.
5) TREES TO BE PROTECTED BEFORE AND AFTER CONSTRUCTION.

PRELIMINARY

REFER TO ____________ FOR ADDITIONAL NOTES

NOTE:
THE POSITION OF ALL POLE LINES, CONDUITS, WATERMAINS, SEWERS AND OTHER UNDERGROUND AND OVERGROUND UTILITIES AND STRUCTURES IS NOT NECESSARILY SHOWN ON THE CONTRACT DRAWINGS, AND WHERE SHOWN, THE ACCURACY OF THE POSITION OF SUCH UTILITIES AND STRUCTURES IS NOT GUARANTEED. BEFORE STARTING WORK, DETERMINE THE EXACT LOCATION OF ALL SUCH UTILITIES AND STRUCTURES AND ASSUME ALL LIABILITY FOR DAMAGE TO THEM.

No.	REVISION	DATE	BY
1.	ISSUED FOR DISCUSSION	JAN 26/17	BHB

SCALE 1:200

DESIGN	CHECKED	DRAWN	CHECKED	APPROVED
TGP	BHB	TGP	BHB	GJM

FOR REVIEW ONLY

LICENSED PROFESSIONAL ENGINEER
B. H. BAHIA
100164647
PROVINCE OF ONTARIO

NOVATECH
Engineers, Planners & Landscape Architects
Suite 200, 240 Michael Cowpland Drive
Ottawa, Ontario, Canada K2M 1P6
Telephone (613) 254-9643
Facsimile (613) 254-5867
Website www.novatech-eng.com

LOCATION
CITY OF OTTAWA
373 PRINCETON

DRAWING NAME
GRADING PLAN

PROJECT No. 116126-00
REV # 1
DRAWING No. 116126-GR

PLANB1.DWG - 1000mmx707mm

Manning's Calculations for Flow Depths

Calculation 1: Southbound Edison Ave.

Flow was determined based on an area weighted average using the full overland flow drainage area (2.53ha).
The area from the north is 2.14ha, giving a relative flow of 313L/s. In the stress test (+20%), this flow increases to 380L/s.

The cross-section used is a V-shape to simulate a gutter. The Flows have been cut in half to simulate flow on each side of the road (i.e. two gutters). Slope was determined from the Edison reconstruction contract drawings.

Gutter Flow - 100-year

Depth	m	0.10	Lower than centreline.
Side slope	1 to X	33	(3% crossfall)
Side slope	1 to X	1	(mountable curb)
Top Width	m	3.3	
Top Width	m	0.1	
Area	m^2	0.173	
Perimeter	m	3.48	
R=A/P	m	0.05	
n		0.015	(asphalt)
Slope	m/m	0.01	
Q_{max}	m^3/s	0.157	
V_{max}	m/s	0.903	

Gutter Flow - Stress Test

Depth	m	0.11	At centreline
Side slope	1 to X	33	(3% crossfall)
Side slope	1 to X	1	(mountable curb)
Top Width	m	3.6	
Top Width	m	0.1	
Area	m^2	0.201	
Perimeter	m	3.74	
R=A/P	m	0.05	
n		0.015	(asphalt)
Slope	m/m	0.01	
Q_{max}	m^3/s	0.190	
V_{max}	m/s	0.948	

Calculation 2: Northbound Edison Ave.

Flow was determined based on an area weighted average using the full overland flow drainage area (2.53ha).
The area from the north is 0.39ha, giving a relative flow of 57L/s. In the stress test (+20%), this flow increases to 68L/s.

The cross-section used is a V-shape to simulate a gutter. The Flows have been cut in half to simulate flow on each

side of the road (i.e. two gutters). Slope was determined from the Edison reconstruction contract drawings.

Gutter Flow - 100-year

Depth	m	0.05	Lower than centreline.
Side slope	1 to X	33	(3% crossfall)
Side slope	1 to X	1	(mountable curb)
Top Width	m	1.8	
Top Width	m	0.1	
Area	m^2	0.049	
Perimeter	m	1.85	
R=A/P	m	0.03	
n		0.015	(asphalt)
Slope	m/m	0.01	
Q_{max}	m^3/s	0.029	
V_{max}	m/s	0.593	

Gutter Flow - Stress Test

Depth	m	0.06	Lower than centreline.
Side slope	1 to X	33	(3% crossfall)
Side slope	1 to X	1	(mountable curb)
Top Width	m	1.9	
Top Width	m	0.1	
Area	m^2	0.055	
Perimeter	m	1.96	
R=A/P	m	0.03	
n		0.015	(asphalt)
Slope	m/m	0.01	
Q_{max}	m^3/s	0.034	
V_{max}	m/s	0.617	

Calculation 3: Westbound Princeton Ave.

Flow was determined from the Churchill Reconstruction project. See attached exerpt.

The cross-section used is a V-shape to simulate a gutter. The flows are not reduced because the north gutter was designed to convey the entire flow. Slope determined from the Edison reconstruction contract drawings.

Gutter Flow - 100-year

Depth	m	0.14	Above centreline.
Side slope	1 to X	33	(3% crossfall)
Side slope	1 to X	1	(mountable curb)
Top Width	m	4.5	
Top Width	m	0.1	
Area	m^2	0.315	
Perimeter	m	4.68	
R=A/P	m	0.07	
n		0.015	(asphalt)
Slope	m/m	0.02	

Q_{max}	m^3/s	0.490
V_{max}	m/s	1.558

Gutter Flow - Stress Test

Depth	m	0.15	Above centreline.
Side slope	1 to X	33	(3% crossfall)
Side slope	1 to X	1	(mountable curb)
Top Width	m	4.8	
Top Width	m	0.1	
Area	m^2	0.361	
Perimeter	m	5.02	
R=A/P	m	0.07	
n		0.015	(asphalt)
Slope	m/m	0.02	
Q_{max}	m^3/s	0.590	
V_{max}	m/s	1.632	

Results above centreline indicate that the flow will spill to the other gutter across the street. Assuming this spill will not occur is conservative with respect to determining the maximum depth of flow on the roadways.

Calculation 4: In-site Swale

Flow determined from overland flow drainage analysis.

The cross-section used is trapezoidal to best simulate the W-shape of the cross-section. To compensate, the bottom elevation should be estimated as the difference between the CL swale and the middle high point (e.g. 75.32m at the indicated cross-section)

Swale Flow - 100-year

Depth	m	0.13	
Bottom Wid	m	5.2	
Side slope	1 to X	3.4	(left)
Side slope	1 to X	3.1	(right)
Top Width	m	0.4	
Top Width	m	0.4	
Area	m^2	0.745	
Perimeter	m	6.10	
R=A/P	m	0.12	
n		0.035	(grass channel)
Slope	m/m	0.005	
Q_{max}	m^3/s	0.370	
V_{max}	m/s	0.497	

Swale Flow - Stress Test

Depth	m	0.15	
Bottom Wid	m	5.2	
Side slope	1 to X	3.4	(left)

Side slope	1 to X	3.1	(right)
Top Width	m	0.5	
Top Width	m	0.5	
Area	m^2	0.831	
Perimeter	m	6.20	
R=A/P	m	0.13	
n		0.035	(grass channel)
Slope	m/m	0.005	
Q_{max}	m^3/s	0.440	
V_{max}	m/s	0.529	

Depths on the figure have added 5cm to account for the shape assumption since they will be measured from centreline.

Calculation 5: In-site Roadway

Flow determined from overland flow drainage analysis.

The cross-section used is a recangle section to represent the road. While the road has more of a V shape, the compensation is to split the difference in elevation between the gutter and the opposite EP.

Roadway - 100-year

Depth	m	0.11
Bottom Wid	m	3.2
Area	m^2	0.356
Perimeter	m	3.42
R=A/P	m	0.10
n		0.015
Slope	m/m	0.005
Q_{max}	m^3/s	0.371
V_{max}	m/s	1.042

Roadway - Stress Test

Depth	m	0.12
Bottom Wid	m	3.2
Area	m^2	0.395
Perimeter	m	3.45
R=A/P	m	0.11
n		0.015
Slope	m/m	0.005
Q_{max}	m^3/s	0.440
V_{max}	m/s	1.113

Depths on the figure have added 2cm to account for the shape assumption since they will be measured from centreline.

Modified Rational Method Storage Calculations for Private Lane

REQUIRED STORAGE - 100-YEAR EVENT TO 2-YEAR AREA

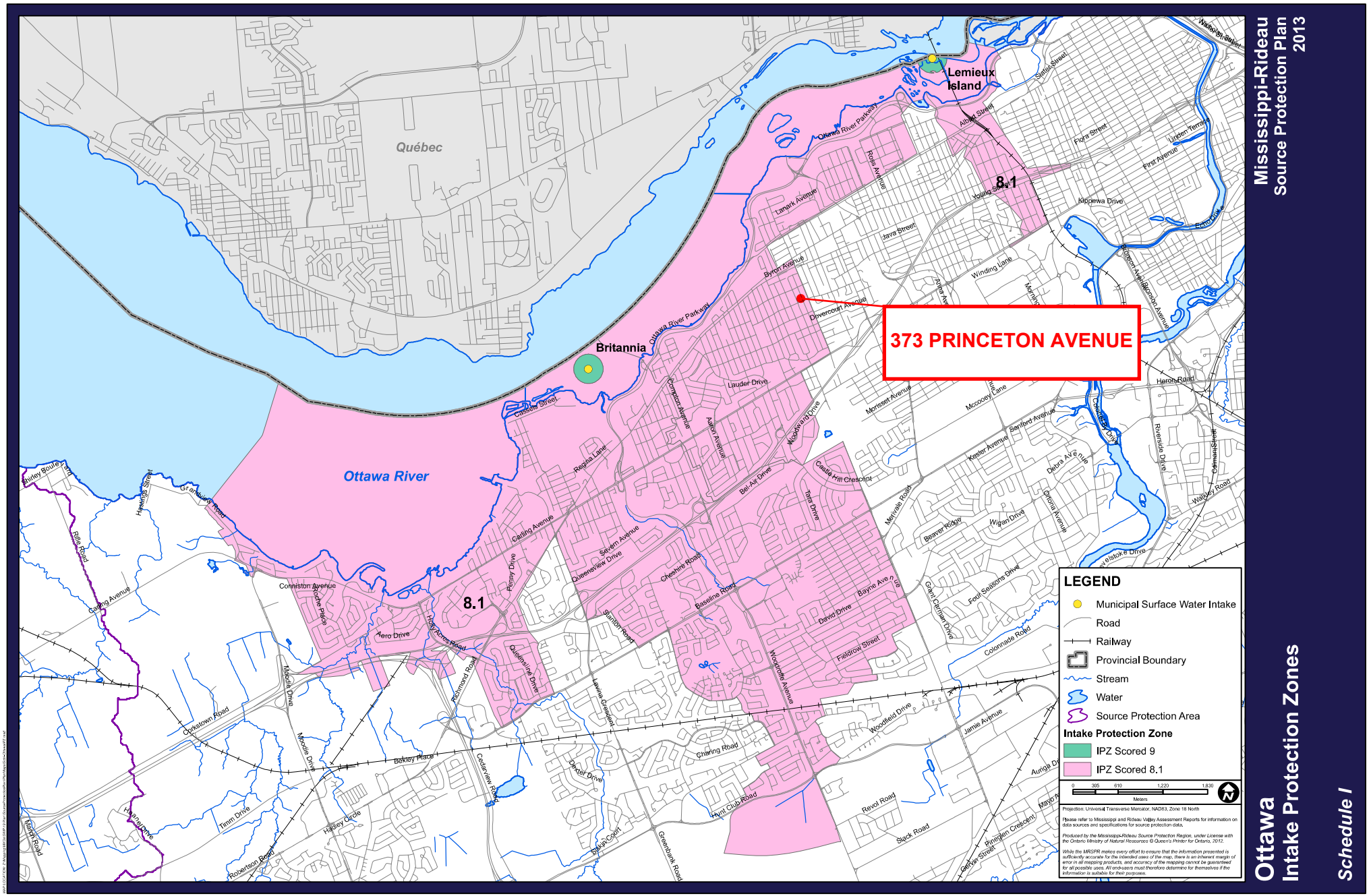
OTTAWA IDF CURVE

Area =	**0.021**	**ha**	**Qallow =**	**2.22**
C =	**1.00**		**Vol(max) =**	**5.85**

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m^3)
10	178.6	10.5	8.3	5.0
15	142.9	8.4	6.2	5.6
20	120.0	7.1	4.8	5.8
25	103.8	6.1	3.9	5.9
30	91.9	5.4	3.2	5.7

2.22L/s is the 2-year flow

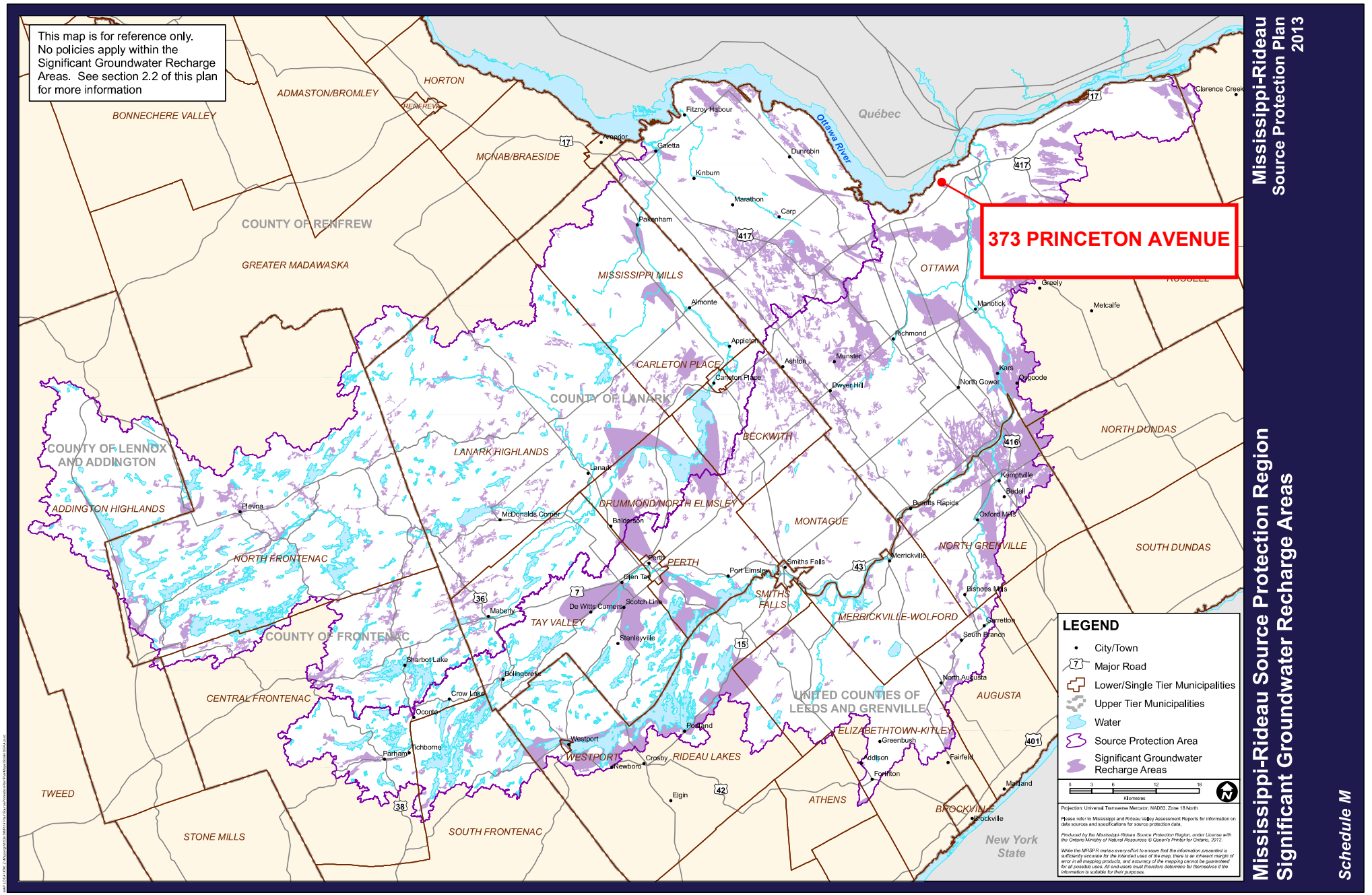
MISSISSIPPI-RIDEAU SOURCE PROTECTION PLAN

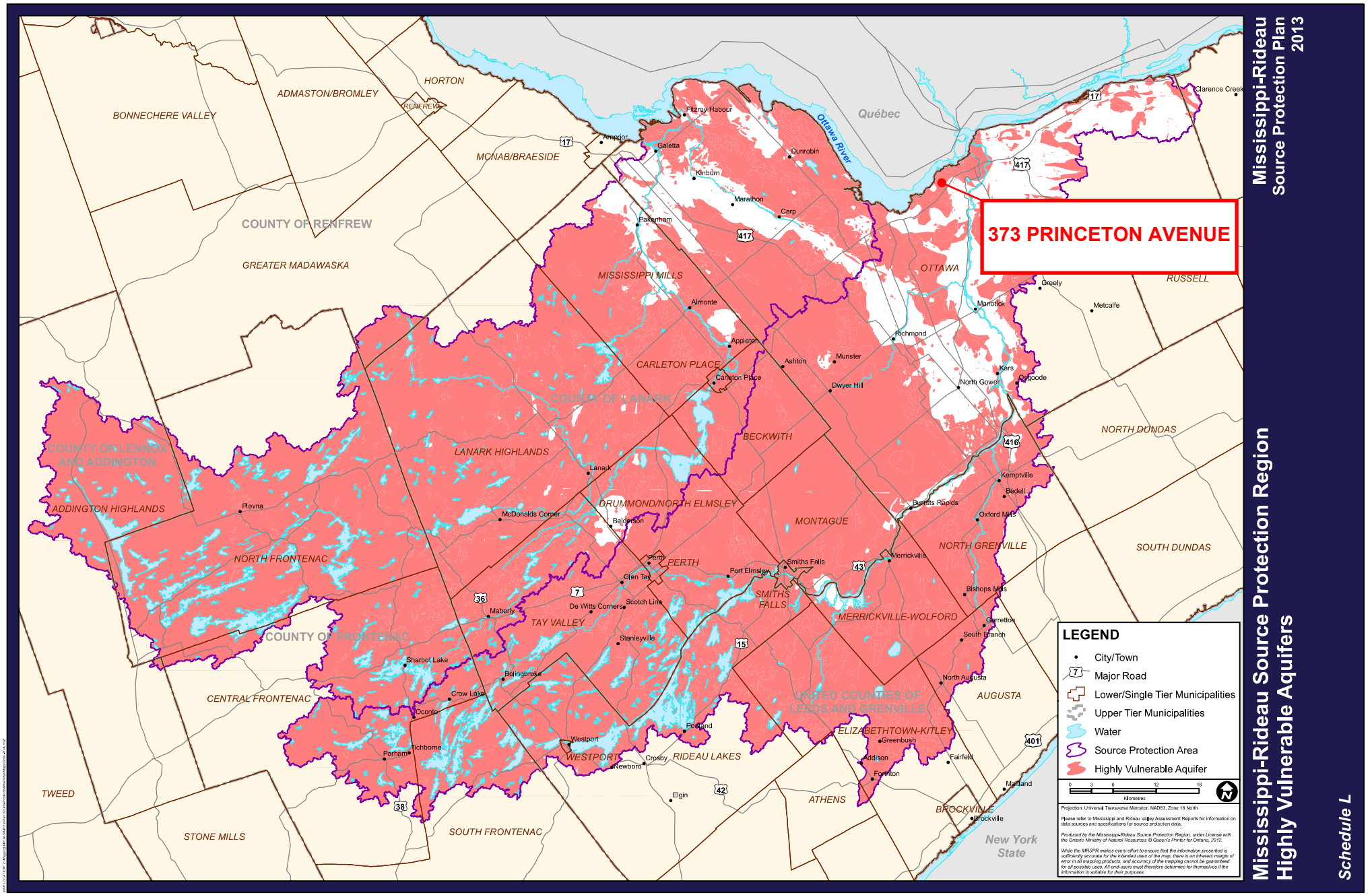


Mississippi-Rideau Source Protection Plan 2013

Ottawa Intake Protection Zones

Schedule I


This map is for reference only.
No policies apply within the Significant Groundwater Recharge Areas. See section 2.2 of this plan for more information
373 PRINCETON AVENUE
Mississippi-Rideau Source Protection Region
Significant Groundwater Recharge Areas
Mississippi-Rideau
Source Protection Plan
2013
Schedule M
LEGEND
City/Town
Major Road
Lower/Single Tier Municipalities
Upper Tier Municipalities
Water
Source Protection Area
Significant Groundwater Recharge Areas
Kilometres
Projection: Universal Transverse Mercator, NAD83, Zone 18 North
Please refer to Mississippi and Rideau Valley Assessment Reports for information on data sources and specifications for source protection data.
Produced by the Mississippi-Rideau Source Protection Region, under License with the Ontario Ministry of Natural Resources. © Queen's Printer for Ontario, 2012.
While the MRSPR makes every effort to ensure that the information presented is sufficiently accurate for the intended uses of the map, there is an inherent margin of error in all mapping products, and accuracy of the mapping cannot be guaranteed for all possible uses. All end-users must therefore determine for themselves if the information is suitable for their purposes.
Québec
Ottawa River
New York State
HORTON
ADMASTON/BROMLEY
RENFREW
BONNECHERE VALLEY
MCNAB/BRAESIDE
COUNTY OF RENFREW
GREATER MADAWASKA
MISSISSIPPI MILLS
OTTAWA
CARLETON PLACE
COUNTY OF LANARK
LANARK HIGHLANDS
BECKWITH
NORTH DUNDAS
COUNTY OF LENNOX AND ADDINGTON
ADDINGTON HIGHLANDS
DRUMMOND/NORTH ELMSLEY
MONTAGUE
NORTH GRENVILLE
SOUTH DUNDAS
NORTH FRONTENAC
PERTH
SMITHS FALLS
MERRICKVILLE-WOLFORD
TAY VALLEY
COUNTY OF FRONTENAC
CENTRAL FRONTENAC
UNITED COUNTIES OF LEEDS AND GRENVILLE
AUGUSTA
ELIZABETHTOWN-KITLEY
WESTPORT
RIDEAU LAKES
ATHENS
BROCKVILLE
TWEED
STONE MILLS
SOUTH FRONTENAC
Fitzroy Harbour
Arnprior
Galetta
Dunrobin
Kinburn
Marathon
Carp
Pakenham
Clarence Creek
Greely
Manotick
Metcalfe
Almonte
Appleton
Richmond
Ashton
Munster
Carleton Place
Dwyer Hill
Kars
Osgoode
North Gower
Lanark
Kemptville
Bedell
Plevna
McDonalds Corner
Balderson
Burritts Rapids
Oxford Mills
Perth
Glen Tay
Port Elmsley
Smiths Falls
Merrickville
Bishops Mills
Maberly
De Witts Corners
Scotch Line
Garretton
South Branch
Stanleyville
Sharbot Lake
Bolingbroke
Crow Lake
Oconto
North Augusta
Portland
Westport
Tichborne
Parham
Newboro
Crosby
Greenbush
Addison
Fairfield
Fornton
Maitland
Elgin
Brockville
17
417
416
43
7
36
15
42
38
401


373 PRINCETON AVENUE
Mississippi-Rideau Source Protection Region
Highly Vulnerable Aquifers
Mississippi-Rideau Source Protection Plan 2013
Schedule L
LEGEND
City/Town
Major Road
Lower/Single Tier Municipalities
Upper Tier Municipalities
Water
Source Protection Area
Highly Vulnerable Aquifer
Kilometres
Projection: Universal Transverse Mercator, NAD83, Zone 18 North
Please refer to Mississippi and Rideau Valley Assessment Reports for information on data sources and specifications for source protection data.
Produced by the Mississippi-Rideau Source Protection Region, under License with the Ontario Ministry of Natural Resources © Queen's Printer for Ontario, 2012.
While the MRSPR makes every effort to ensure that the information presented is sufficiently accurate for the intended uses of the map, there is an inherent margin of error in all mapping products, and accuracy of the mapping cannot be guaranteed for all possible uses. All end-users must therefore determine for themselves if the information is suitable for their purposes.
Québec
Ottawa River
New York State
BONNECHERE VALLEY
ADMASTON/BROMLEY
HORTON
RENFREW
MCNAB/BRAESIDE
COUNTY OF RENFREW
GREATER MADAWASKA
MISSISSIPPI MILLS
CARLETON PLACE
OTTAWA
RUSSELL
NORTH DUNDAS
SOUTH DUNDAS
COUNTY OF LANARK
BECKWITH
LANARK HIGHLANDS
COUNTY OF LENNOX AND ADDINGTON
ADDINGTON HIGHLANDS
DRUMMOND/NORTH ELMSLEY
MONTAGUE
NORTH GRENVILLE
NORTH FRONTENAC
PERTH
SMITHS FALLS
MERRICKVILLE-WOLFORD
TAY VALLEY
COUNTY OF FRONTENAC
UNITED COUNTIES OF LEEDS AND GRENVILLE
AUGUSTA
ELIZABETHTOWN-KITLEY
CENTRAL FRONTENAC
WESTPORT
RIDEAU LAKES
ATHENS
BROCKVILLE
TWEED
STONE MILLS
SOUTH FRONTENAC
Fitzroy Habour
Clarence Creek
Arnprior
Galetta
Dunrobin
Kinburn
Marathon
Carp
Pakenham
Greely
Metcalfe
Almonte
Marlotick
Appleton
Richmond
Ashton
Munster
Kars
Carleton Place
Dwyer Hill
North Gower
Osgoode
Lanark
Kemptville
Bedell
Plevna
McDonalds Corner
Baldwin
Burritts Rapids
Oxford Mills
Perth
Merrickville
Glen Tay
Port Elmsley
Smiths Falls
Bishops Mills
Maberly
De Witts Corners
Scotch Line
Garretton
South Branch
Stanleyville
Sharbot Lake
Boringbroke
North Augusta
Crow Lake
Oconto
Portland
Greenbush
Westport
Addison
Parham
Tichborne
Crosby
Newboro
Fairfield
Forinton
Maitland
Elgin
Brockville
17
417
416
43
7
36
15
42
38
401

APPENDIX D

DEVELOPMENT SERVICING STUDY CHECKLIST

NOVATECH
Engineers, Planners & Landscape Architects

Development Servicing Study Checklist

Project Name: 373 Princeton Avenue
Project Number:116126
Date: Feb 9, 2017

4.1 General Content	**Addressed (Y/N/NA)**	**Section**	**Comments**
Executive Summary (for larger reports only).	**NA**		
Date and revision number of the report.	Y	Cover	
Location map and plan showing municipal address, boundary, and layout of proposed development.	Y	Fig 1, Fig 3, GP	
Plan showing the site and location of all existing services.	Y	Fig 2, GP	
Development statistics, land use, density, adherence to zoning and official plan, and reference to applicable subwatershed and watershed plans that provide context to which individual developments must adhere.	NA		
Summary of Pre-consultation Meetings with City and other approval agencies.	NA		
Reference and confirm conformance to higher level studies and reports (Master Servicing Studies, Environmental Assessments, Community Design Plans), or in the case where it is not in conformance, the proponent must provide justification and develop a defendable design criteria.	Y	2	
Statement of objectives and servicing criteria.	Y	1	
Identification of existing and proposed infrastructure available in the immediate area.	Y	3, 4 ,5	
Identification of Environmentally Significant Areas, watercourses and Municipal Drains potentially impacted by the proposed development (Reference can be made to the Natural Heritage Studies, if available).	Y	7	
Concept level master grading plan to confirm existing and proposed grades in the development. This is required to confirm the feasibility of proposed stormwater management and drainage, soil removal and fill constraints, and potential impacts to neighboring properties. This is also required to confirm that the proposed grading will not impede existing major system flow paths.	Y	GR	

4.1 General Content	**Addressed (Y/N/NA)**	**Section**	**Comments**
Identification of potential impacts of proposed piped services on private services (such as wells and septic fields on adjacent lands) and mitigation required to address potential impacts.	NA		
Proposed phasing of the development, if applicable.	NA		
Reference to geotechnical studies and recommendations concerning servicing.	N		
All preliminary and formal site plan submissions should have the following information:			
Metric scale	Y		
North arrow (including construction North)	Y		
Key plan	Y		
Name and contact information of applicant and property owner	Y		
Property limits including bearings and dimensions	Y		
Existing and proposed structures and parking areas	Y		
Easements, road widening and rights-of-way	Y		
Adjacent street names	Y		

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

4.3 Wastewater	**Addressed (Y/N/NA)**	**Section**	**Comments**
Summary of proposed design criteria (Note: Wet-weather flow criteria should not deviate from the City of Ottawa Sewer Design Guidelines. Monitored flow data from relatively new infrastructure cannot be used to justify capacity requirements for proposed infrastructure).	Y	3	
Confirm consistency with Master Servicing Study and/or justifications for deviations.	N		
Consideration of local conditions that may contribute to extraneous flows that are higher than the recommended flows in the guidelines. This includes groundwater and soil conditions, and age and condition of sewers.	N		
Description of existing sanitary sewer available for discharge of wastewater from proposed development.	Y	3	
Verify available capacity in downstream sanitary sewer and/or identification of upgrades necessary to service the proposed development. (Reference can be made to previously completed Master Servicing Study if applicable)	Y	3	
Calculations related to dry-weather and wet-weather flow rates from the development in standard MOE sanitary sewer design table (Appendix 'C') format.	N		
Description of proposed sewer network including sewers, pumping stations, and forcemains.	Y	2	
Discussion of previously identified environmental constraints and impact on servicing (environmental constraints are related to limitations imposed on the development in order to preserve the physical condition of watercourses, vegetation, soil cover, as well as protecting against water quantity and quality).	NA		
Pumping stations: impacts of proposed development on existing pumping stations or requirements for new pumping station to service development.	NA		
Forcemain capacity in terms of operational redundancy, surge pressure and maximum flow velocity.	NA		
Identification and implementation of the emergency overflow from sanitary pumping stations in relation to the hydraulic grade line to protect against basement flooding.	NA		
Special considerations such as contamination, corrosive environment etc.	NA		

4.4 Stormwater	Addressed (Y/N/NA)	Section	Comments
Description of drainage outlets and downstream constraints including legality of outlet (i.e. municipal drain, right-of-way, watercourse, or private property).	Y	5	
Analysis of the available capacity in existing public infrastructure.	N		
A drawing showing the subject lands, its surroundings, the receiving watercourse, existing drainage patterns and proposed drainage patterns.	Y	AppC, GR	
Water quantity control objective (e.g. controlling post-development peak flows to pre-development level for storm events ranging from the 2 or 5 year event (dependent on the receiving sewer design) to 100 year return period); if other objectives are being applied, a rationale must be included with reference to hydrologic analyses of the potentially affected subwatersheds, taking into account long-term cumulative effects.	Y	5	
Water Quality control objective (basic, normal or enhanced level of protection based on the sensitivities of the receiving watercourse) and storage requirements.	Y	5	
Description of stormwater management concept with facility locations and descriptions with references and supporting information.	Y	5	
Set-back from private sewage disposal systems.	NA		
Watercourse and hazard lands setbacks.	NA		
Record of pre-consultation with the Ontario Ministry of Environment and the Conservation Authority that has jurisdiction on the affected watershed.	NA		
Confirm consistency with sub-watershed and Master Servicing Study, if applicable study exists.	NA		
Storage requirements (complete with calcs) and conveyance capacity for 5 yr and 100 yr events.	Y	5, AppC	
Identification of watercourse within the proposed development and how watercourses will be protected, or, if necessary, altered by the proposed development with applicable approvals.	NA		
Calculate pre and post development peak flow rates including a description of existing site conditions and proposed impervious areas and drainage catchments in comparison to existing conditions.	Y	5	
Any proposed diversion of drainage catchment areas from one outlet to another.	NA		
Proposed minor and major systems including locations and sizes of stormwater trunk sewers, and SWM facilities.	Y	3	
If quantity control is not proposed, demonstration that downstream system has adequate capacity for the post-development flows up to and including the 100-year return period storm event.	NA		

4.4 Stormwater	**Addressed (Y/N/NA)**	**Section**	**Comments**
Identification of municipal drains and related approval requirements.	NA		
Description of how the conveyance and storage capacity will be achieved for the development.	Y	5	
100 year flood levels and major flow routing to protect proposed development from flooding for establishing minimum building elevations (MBE) and overall grading.	Y	5, GR	
Inclusion of hydraulic analysis including HGL elevations.	NA		
Description of approach to erosion and sediment control during construction for the protection of receiving watercourse or drainage corridors.	Y	6	
Identification of floodplains – proponent to obtain relevant floodplain information from the appropriate Conservation Authority. The proponent may be required to delineate floodplain elevations to the satisfaction of the Conservation Authority if such information is not available or if information does not match current conditions.	NA		
Identification of fill constrains related to floodplain and geotechnical investigation.	NA		

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

4.6 Conclusion	Addressed (Y/N/NA)	Section	Comments
Clearly stated conclusions and recommendations.	Y	9	
Comments received from review agencies including the City of Ottawa and information on how the comments were addressed. Final sign-off from the responsible reviewing agency.	NA		
All draft and final reports shall be signed and stamped by a professional Engineer registered in Ontario.	Y	9	

ATTACHED PLANS