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3484 & 3490 Innes Road

Functional Servicing Report

39 Years

Prepared for: Lépine Corporation

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3484 & 3490 INNES ROAD
OTTAWA, ONTARIO

FUNCTIONAL SERVICING REPORT

Prepared by:

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

October 5th, 2021

Ref: R-2021-129
Novatech File: 121214

NOVATECH
Engineers, Planners & Landscape Architects

October 5th, 2021

City of Ottawa
Planning and Growth Management Department
110 Laurier Avenue West, 4th Floor
Ottawa, Ontario
K1P 1J1

Attention: **Michael Boughton RPP/MCIP**

Dear Mr. Boughton:

Re: 3484 & 3490 Innes Road
Functional Servicing Report
Novatech File No.: 121214

Please find enclosed the complete pdf copy of the above noted report dated October 5th, 2021. This report is submitted in support of a Draft Plan of Subdivision Application.

If you have any questions, please contact the undersigned.

Yours truly,

NOVATECH

Cara Ruddle, P.Eng.
Senior Project Manager, Land Development Engineering

cc: Pascale Lépine, Lépine Corporation

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List of Appendices

1.0. INTRODUCTION

Novatech has been retained by Lépine Corporation to review the servicing for a proposed development at 3484 & 3490 Innes Road within the City of Ottawa to support a Draft Plan of Subdivision Application. **Figure 1** is a Key Plan showing the site location. The purpose of this report is to demonstrate that the potential development can be serviced with the existing municipal infrastructure surrounding the property.

2.0. EXISTING DEVELOPMENT

The property is approximately 5.2 hectares in size and consists of two properties. There is an existing single family residence at 3484 Innes Road. The second parcel is 3490 Innes Road which is also identified as Blocks 149 and 150 within the Orleans Village Subdivision. The 3490 Innes Road property was occupied by the Innes Road Golfland Driving range and is currently vacant. The site is bound by Innes Road to the north, Lamarche Avenue to the east, residential buildings to the south, and the Chapel Hill Retirement Residence and residential buildings fronting Page Road to the west. The site is generally flat and slopes towards the southwest corner of the site. **Figure 2** shows the existing site conditions and site topography.

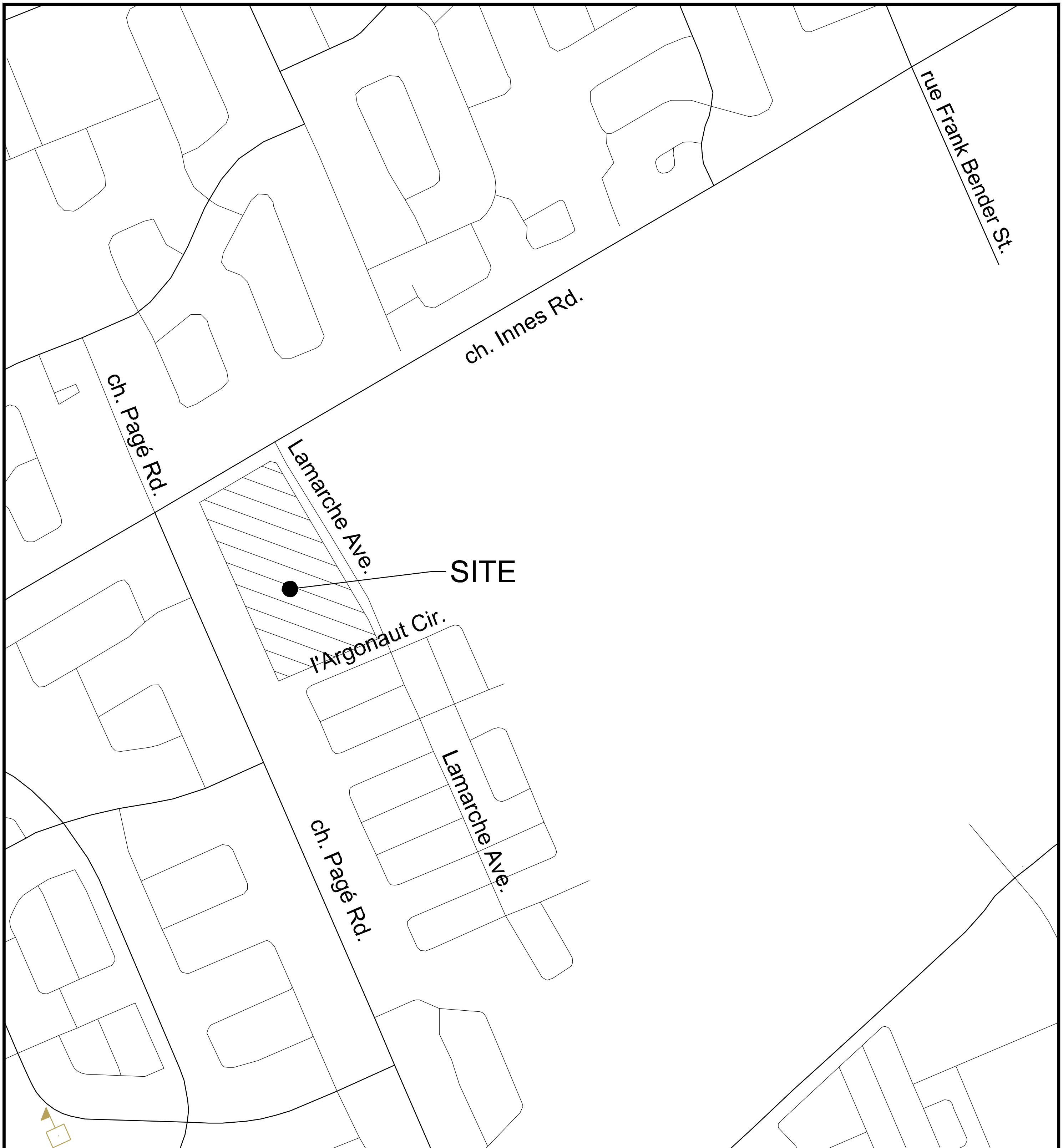
3.0. PROPOSED DEVELOPMENT

It is proposed to construct a mixed-use development with a mix of residential, commercial and office spaces. The proposed development consists of 3 building zones, a proposed parkland block and a proposed right-of-way block. The residential buildings will be a maximum of 7 storeys in height as allowed by the current zoning. A public road is proposed through the property to provide access to the development blocks from Lamarch Avenue at two (2) locations. A proposed right-of-way cross-section (**Figure 4**) is included for referance. **Figure 3** shows the concept plan for the proposed development and the Draft Plan of Subdivision is included in **Appendix A** for reference. Correspondence from the City pre-consultation meeting for the proposed development is also included in **Appendix A** for reference.

4.0. SITE CONSTRAINTS

A geotechnical investigation was completed by Paterson Group Inc. and a report prepared entitled 'Geotechnical Investigation, Proposed Multi-Storey Residential Buildings' dated May 21, 2019. The report included the following recommendations:

- If buildings are founded directly over a clay deposit, a permissible grade raise restriction will be required. A preliminary permissible grade raise restriction of 2 m is recommended for the south portion of the site.
- It should be noted that bedrock was encountered between 0.9 to 5 m below existing grade within the north portion of the site, and between 5.6 to 7 m below existing grade within the south portion of the site.
- To reduce long-term lowering of the groundwater level at this site clay seals should be provided along the sewer trenches.



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3484 & 3490 INNES ROAD
CITY OF OTTAWA

KEYPLAN

SCALE		
N.T.S.		
DATE SEPT 2021	JOB 121214	FIGURE 1

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EXISTING CONDITIONS PLAN

SCALE	DATE	JOB	FIGURE
1 : 1250	SEPT 2021	121214	2

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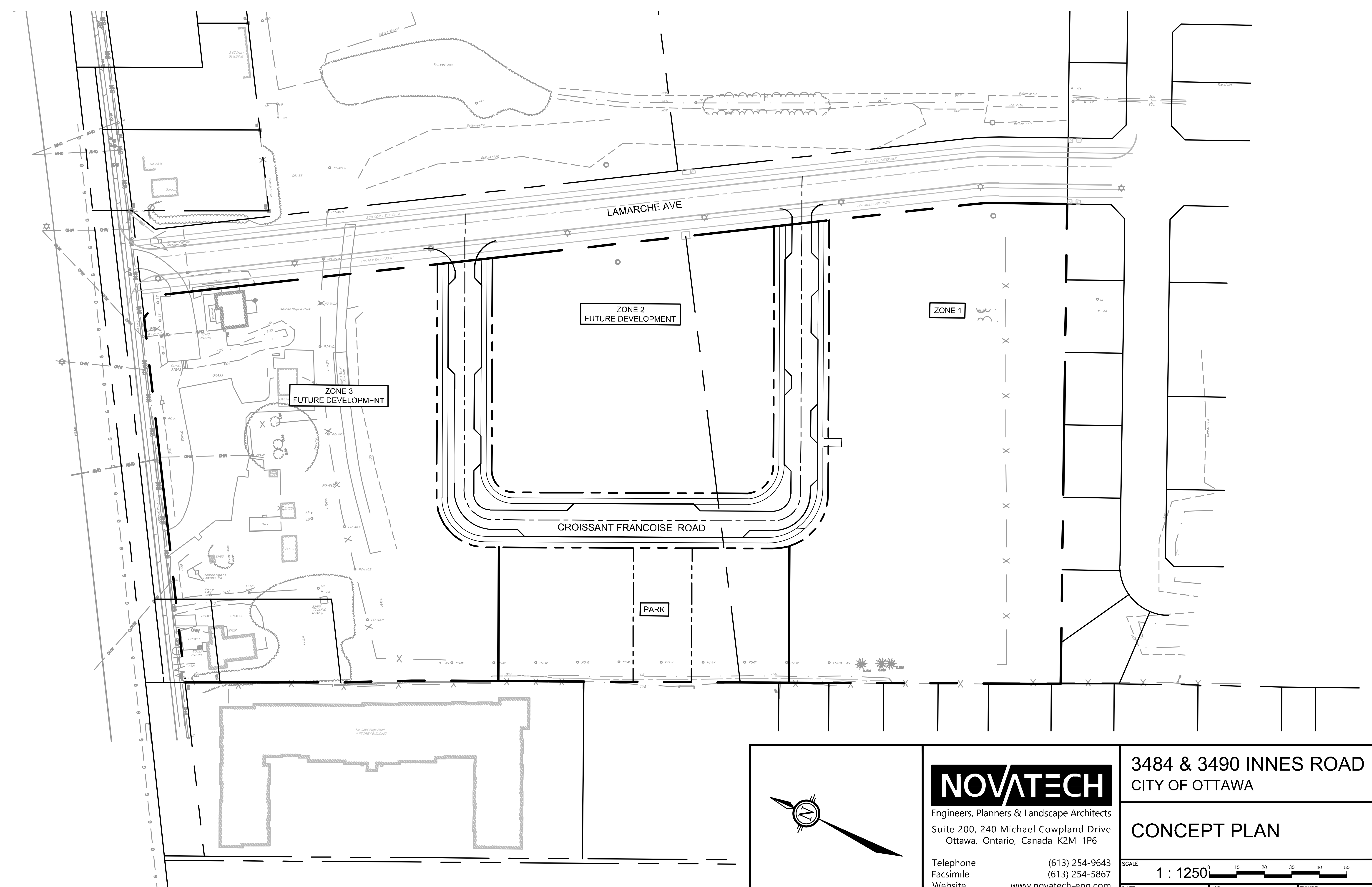

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CONCEPT PLAN

SCALE 1 : 1250 (0, 10, 20, 30, 40, 50)

DATE SEPT 2021 | JOB 121214 | FIGURE 3

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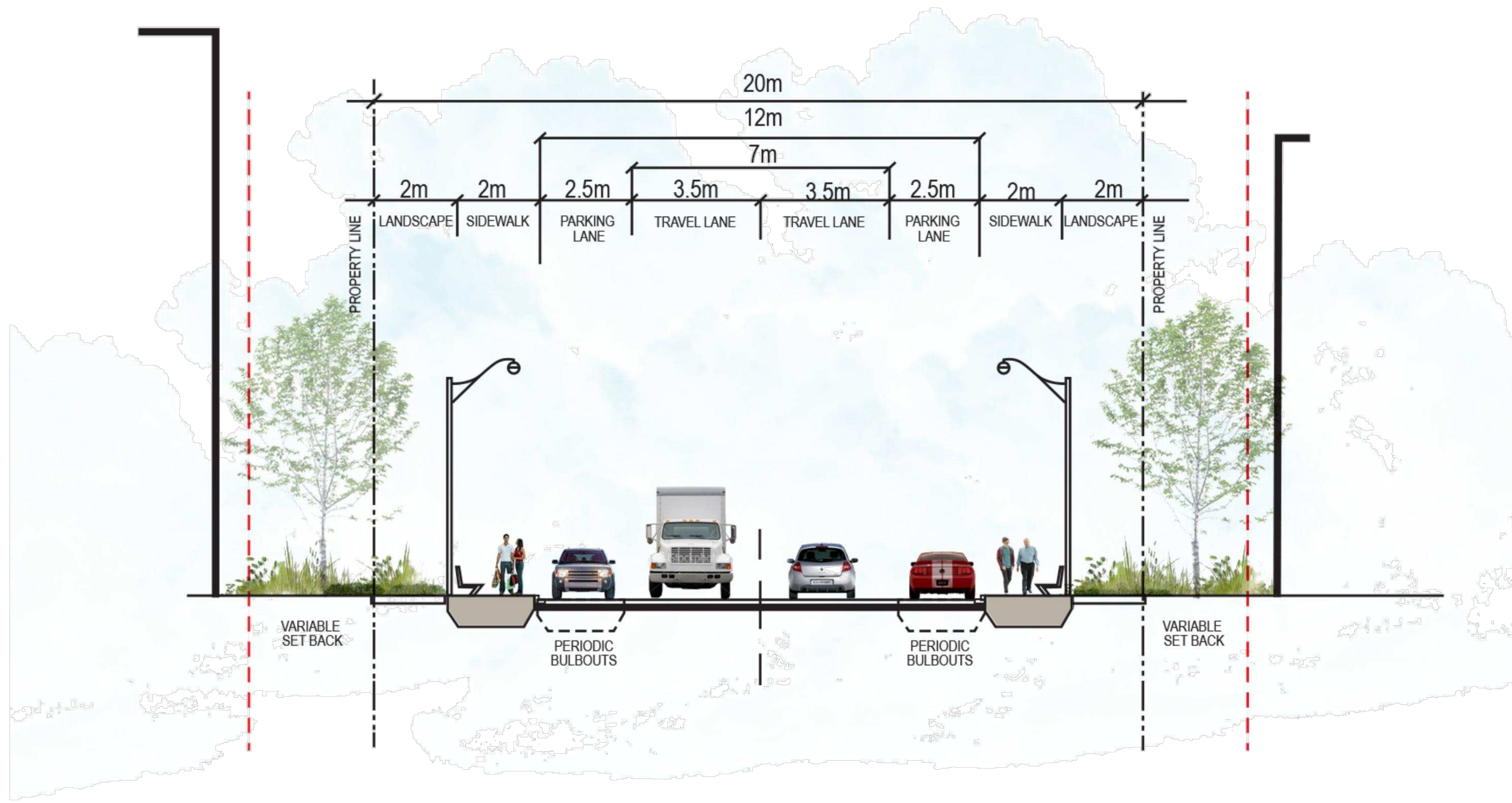

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3484 & 3490 INNES ROAD
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ROW CROSS-SECTION

SCALE	N.T.S		
DATE SEPT 2021	JOB 121214	FIGURE 4	

- During construction, groundwater volumes pumped could be between 50,000 to 400,000 L/day and it would be required to register on the Environmental Activity and Sector Registry (EASR). However, the project is expected to be phased, so each building constructed one at a time. As the phasing of the underground foundation works is planned in stages the groundwater volumes to be pumped are expected to be maintained under the 50,000L/day threshold.

5.0. WATER SERVICING

The subject property is within the City of Ottawa 2E pressure zone. There is an existing 300mm diameter watermain in the Lamarche Avenue right-of-way that was installed as part of the Orleans Village subdivision. The proposed development will include a public right-of-way in which a 200mm watermain is proposed to service the development creating a looped system for redundancy purposes. Hydrants are also proposed within the proposed road allowance to provide fire protection. Two (2) 150mm watermain stubs were installed as part of the Orleans Village subdivision development to provide future services blocks 149 and 150 and can also be utilized to service the proposed development where possible.

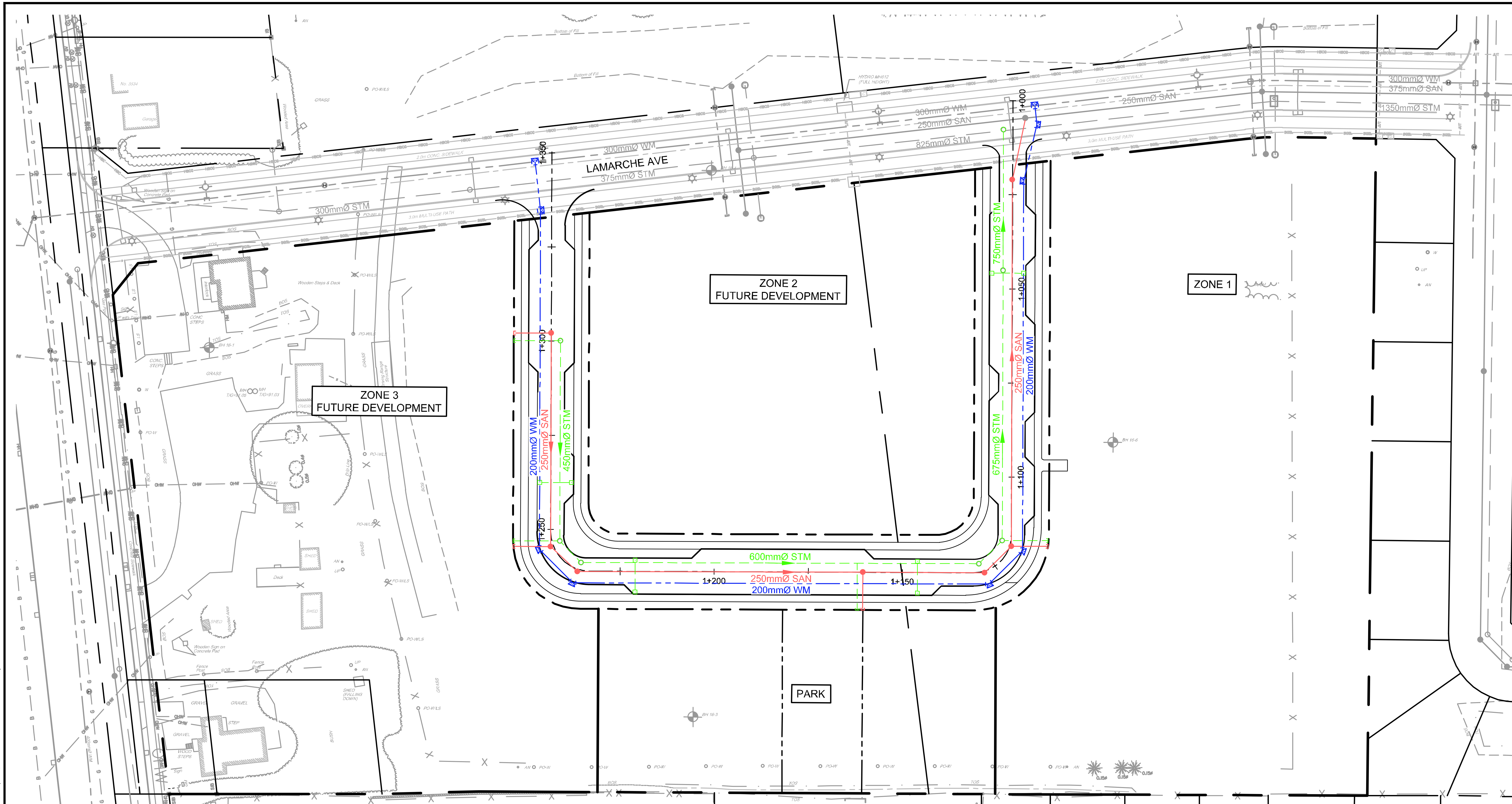
Water demand and fire flow calculations have been calculated using criteria from Section 4 of the City of Ottawa Water Distribution Guidelines. The required fire demand was calculated using the Fire Underwriters Survey (FUS) Guidelines using assumptions on building construction and setback requirements for the worst-case scenario of the potential development options. The water demands were calculated for a population 1571 people from a total of 873 units based on the following criteria:

Water Demands:
- Average Daily Demand = 280 L/capita/day
- Average Apartment Population = 1.8 Person/Unit
- Maximum Daily Demand = 2.5 x Average Daily Demand
- Peak Hour Demand = 2.2 x Maximum Daily Demand
- Fire Flow = Fire Underwriters Survey (FUS)

The preliminary water demand and fire flow calculations are provided in **Appendix B** for reference. A summary of the water demand and fire flows are provided in **Table 5.1** below. Refer to **Figure 5** which shows the existing and proposed servicing for the subject development.

Table 5.1 Water Demand Summary

Area	Ave. Daily Demand (L/s)	Max. Daily Demand (L/s)	Peak Hour Demand (L/s)	Fire Flow (L/s)
Zone 1	1.60	4.01	8.82	**117**
Zone 2	1.46	3.65	8.02	
Zone 3	2.03	5.08	11.17	
Park	0.02	0.05	0.12	
Total	**5.11**	**12.79**	**28.13**	



LEGEND

- PROPOSED STORM SEWER & FLOW DIRECTION ARROW
- PROPOSED SANITARY SEWER & FLOW DIRECTION ARROW
- PROPOSED WATERMAIN
- STORM MANHOLE
- SANITARY MANHOLE
- EXISTING STORM SEWER & FLOW DIRECTION ARROW
- EXISTING SANITARY SEWER & FLOW DIRECTION ARROW
- EXISTING WATERMAIN

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3484 & 3490 INNES ROAD
CITY OF OTTAWA

PRELIMINARY SERVICING

SCALE	DATE	JOB	FIGURE
1 : 1000	SEPT 2021	121214	5

As per the City of Ottawa Technical Bulletin ISDTB-2014-02, the proposed development areas (Zones 1-3) will require two service connections as the average day demands are greater than 50 cubic meters of water. The two services will be separated by an isolation valve within the municipal watermain system in the event maintenance on the system is required.

The detailed design of the Orleans Village Subdivision was performed by David Schaeffer Engineering Ltd (DSEL) and detailed within the report titled “Design Brief, Caivan (Orleans Village) Limited, 3490 Innes Road, City of Ottawa, Dated November 2018 – Ver 3 (DSEL Report). For the subdivision design, block 149 was assumed to be a commercial development and Block 150 a residential development. Based on this a population and flows were allotted for the proposed development area. Excerpts from the report are included within **Appendix B** and are summarized within **Table 5.2** below:

Table 5.2 Allowable Block 149 and 150 Water Demand (DSEL Report)

Area	Ave. Daily Demand (L/s)	Max. Daily Demand (L/s)	Peak Hour Demand (L/s)	Fire Flow (L/s)
Block 149	5.38	12.51	26.98	217
Block 150	3.38	8.44	18.57	
Total	**8.76**	**20.95**	**45.55**	

As can be noted in the tables above the demands for the proposed development are below the demands assumed within the DSEL Report. Thus, it can be concluded that the existing watermain will provide adequate flow and pressures for the fire flow + maximum day demand and peak hour demand. The existing and proposed fire hydrants surrounding the development will provide fire protection for the proposed development.

6.0. SANITARY SERVICING

There are existing 250mm diameter sanitary sewers along Lamarche Avenue and Innes Road. The proposed development will include a public right-of-way in which a 250mm diameter sanitary sewer is proposed within the public right-of-way to service the subject properties. The proposed sanitary sewer will connect to the existing sanitary sewer within the Lamarche Avenue right-of-way. The proposed development is within the Forest Valley Trunk (FVT) catchment area. The conceptual sanitary network is shown in **Figure 5**.

Sanitary flows for the proposed development were calculated using criteria from Section 4 of the City of Ottawa Sewer Design Guidelines. The proposed development is a mixed-use development however, residential units have been used to calculate flows since this gives the highest possible flows for the proposed development blocks. Therefore, the calculations are based on a total population 1571 people from a total of 873 units on the following design criteria:

- Residential Average Flow = 280 L/capita/day
- Average Apartment = 1.8 Person/unit
- Peaking Factor = Harmon Equation (max peaking factor = 4.0)
- Peak Extraneous Flows (Infiltration) = 0.33L/s/ha

The peak sanitary flow including infiltration was calculated to be 17.66 L/s. Detailed sanitary flow calculations are provided in **Appendix C** for reference.

As noted previously, the detailed design of the Orleans Village Subdivision was completed by DSEL with details provided within the aforementioned DSEL Report. The Subdivision design assumed that block 149 was to be a commercial development and Block 150 as residential development. Based on these assumptions, equivalent populations of 1376 and 1044 were assumed for block 149 and block 150 respectively, for a total population of 2420. The design criteria are summarized below, and excerpts from the report are included within **Appendix C** for reference.

- Average Daily Flow = 280 L/capita/day
- Residential Peaking Factor = Harmon Equation (max peaking factor = 4.0)
- Commercial/ Institutional Peaking Factor = 1.0
- Peak Extraneous Flows (Infiltration) = 0.33L/s/ha

The assumed design population was higher than those currently proposed, thus the existing infrastructure within the Orleans Village Subdivision has capacity to service the proposed development.

The outlet for the Orleans Village Subdivision is the FVT sanitary sewer. A Hydraulic grade line (HGL) analysis was performed by JFSA in June 2018, and is included within **Appendix C**. The HGL analysis used design criteria provided by DSEL to analyze the downstream impacts of the Orleans Village Subdivision and the East Urban Community (EUC) developments. This analysis indicated that there were two pipes that were surcharged (by 3-4 cm) otherwise the HGL was contained below the obvert of the trunk sewer. Given that the proposed sanitary flows are less than the assumed flows in the DSEL Report, we do not anticipate any servicing issues in the downstream system.

7.0. STORM SERVICING & STORMWATER MANAGEMENT

The topography of the site is relatively flat and slopes towards the southwest corner of the site. There are storm sewers located within the Larmache Avenue right-of way ranging in size from 300mm to 1350mm in diameter along the frontage of the subject property. The existing storm sewer outlets to the existing EUC pond 1 and ultimately Mud Creek. The existing storm sewers are shown on **Figure 5**.

There are two storm sewer stubs (825mm diameter) along Lamarche Avenue to service each of the 149 and 150 development blocks. These storm sewer stubs will be used where possible to service the proposed development. It is also proposed to provide storm sewers within the proposed public right-of-way. The proposed storm sewers will vary in sizes ranging from 375mm to 750mm in diameter. The conceptual layout of the proposed storm sewer system is shown on **Figure 5**.

Stormwater management design criteria for the proposed development is provided in the DSEL Report and the Stormwater Management Report entitled 'Stormwater Management Report for the Orleans Village Subdivision', prepared by JSFA, dated July 25, 2018 (JFSA Report). The stormwater management criteria provided in the DSEL Report and JFSA Report is as follows:

- Storm sewers on local roads are to be designed to provide a minimum 2-year level of service per the City's latest Technical Bulletin PIEDTB-2016-01;
- Inlet control devices should be sized such that there is no surface ponding on the road during the 2-year design storm;
- Major system flows up to and including the 100-year return period are to be retained on-site
- Roof leaders shall be installed to direct the run-off onto splash pads and on to grassed areas;
- For the 100-year storm and for all roads, the maximum depth of water (static and/or dynamic) on streets, rear yards, public space and parking areas shall not exceed 0.35 m at the gutter;
- Stormwater runoff must be treated to provide a Normal Level of protection, corresponding to a 70% average long-term removal of total suspended solids, as defined in the MOECC Stormwater Management Facility Design Guidelines (MOECC, 2003). The subject property is within the drainage area serviced by the existing EUC Pond 1 facility;

Preliminary stormwater management calculations have been completed for the proposed development based on the information provided within the report titled 'Assessment of Adequacy of Public Services for Lépine Corporation 3490 Innes Road', prepared by DSEL, dated May 2019-REV 1 (DSEL Report 2) and the JFSA Report. The allowable release rates for the site are provided in table 7.1 below:

Table 7.1 Development Block Allowable Release Rates and Required Storage

Block	Area (ha)	Allowable Release Rate (L/s)
Block 149	2.86	501
Block 150	2.17	406
External Area	0.11	9.4
Total	5.14	916.4

The development zones, right-of-way, and parkland blocks will be required to adhere to the same stormwater management criteria as listed above. The allowable release rates have been divided between the development areas based on the following:

- No 2-year storage in the ROW area
- No ponding within the parkland block to maximize the usable area
- The percent area of each zone

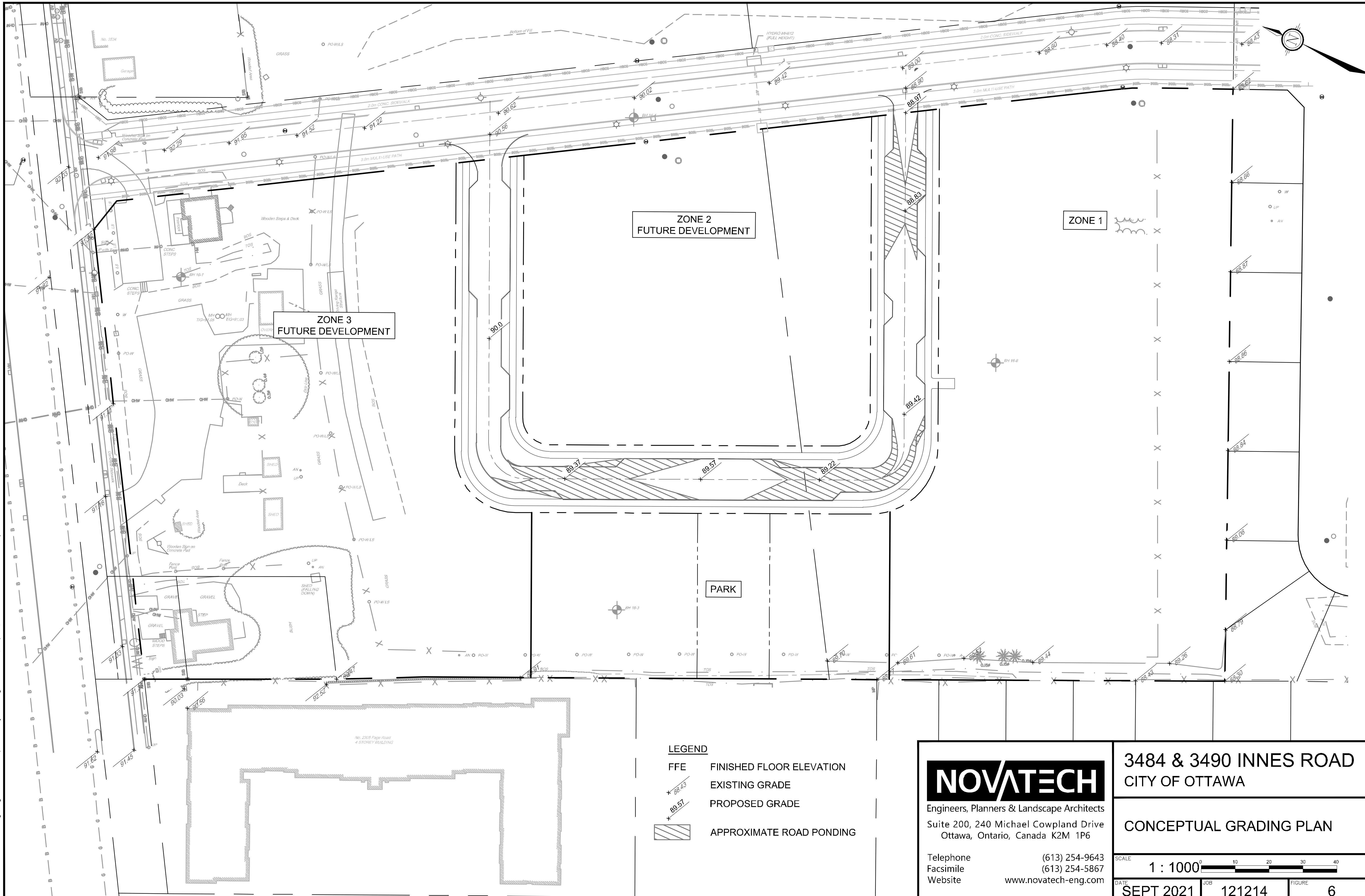
Additionally, the storage required for each block has been calculated assuming a runoff coefficient of 0.85 for the zones, 0.70 for the ROW, and 0.34 for the parkland block. It is assumed that stormwater within each block can be stored on building roofs, within underground storage tanks, and within the proposed parking areas and roadways, utilizing inlet control devices (ICDs) to meet the allowable release rates. The allowable release rates and storage required for the blocks are summarized in **Table 7.2**.

Table 7.2 Proposed Allowable Release Rates and Required Storage

Development Zone	Area (ha)	Allowable Release Rate (L/s)	Required 100-yr Storage (m^3)
Zone 1	1.502	243.5	285.67
Zone 2	0.929	150.6	177.83
Zone 3	1.569	254.3	302.59
ROW	0.638	130	71.33
Park	0.504	138	N/A
Total	5.14	916.4	837.42

During storm events exceeding the 100-year event, site grading will provide an overland flow route to the proposed public right-of-way and to Lamarche Avenue, and ultimately the Existing EUC pond 1 facility, as per existing conditions. **Figure 6** Conceptual Grading Plan shows the preliminary conceptual grading design.

The EUC Pond 1 was constructed in 2008, and modifications have since been undertaken on the South Main Cell and the South Forebay to allow an increase in imperviousness within the area south of the existing Hydro one corridor. The South Cell of the pond was also updated to increase the quality and quantity controls to the City of Ottawa's latest requirements. The Pond


ZONE 1
ZONE 2
FUTURE DEVELOPMENT
ZONE 3
FUTURE DEVELOPMENT
PARK
LEGEND
FFE
FINISHED FLOOR ELEVATION
EXISTING GRADE
PROPOSED GRADE
APPROXIMATE ROAD PONDING
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Website www.novatech-eng.com
3484 & 3490 INNES ROAD
CITY OF OTTAWA
CONCEPTUAL GRADING PLAN
SCALE
1 : 1000
DATE
SEPT 2021
JOB
121214
FIGURE
6
SHT11X17.DWG - 279mmX432mm
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in its current state was designed assuming that the 168ha area (including the Orleans Village Subdivision), tributary to the North Forebay and main cell would remain undeveloped until the completion of the North Cell expansion.

To permit the development of the Orleans Village Subdivision the impacts to the pond if the development were to proceed were explored within the JSFA Report. It was noted within the report that if the complete Orleans Village Subdivision were to be developed with the EUC pond in its present condition the release rates from the pond would not exceed the allowable release rates for the development area. The only impact of note would be that the 100-year water level would increase to 83.047m, which is 0.047m above the maximum allowable elevation of 83.00m. The subject site is a small portion of the overall Orleans Village Subdivision and was accounted for in the above analysis. Therefore, the impact of the subject development would be negligible on the 100-year water level of the pond in its current state.

In summary, the existing storm sewer infrastructure can service the proposed development and appropriate stormwater management methods can be used to meet the allowable release rate. Refer to **Appendix D** for preliminary stormwater management calculations and pre and post development drainage area figures.

8.0. EROSION AND SEDIMENT CONTROL MEASURES

Temporary erosion and sediment control measures will be required on-site during construction in accordance with the Best Management Practices for Erosion and Sediment Control. This includes the following temporary measures:

- Filter socks will be placed in existing catchbasins and manholes, and will remain in place until vegetation has been established and construction is completed;
- Silt fences around the area under construction placed as per OPSS 577 and OPSD 219.110;
- Mud mats will be installed at the site entrances;
- The contractor will be required to perform regular street sweeping and cleaning as required, to suppress dust and to provide safe and clean roadways adjacent to the construction site;

The erosion and sediment control measures are to be installed to the satisfaction of the engineer, and the City of Ottawa prior to construction, and will remain in place during construction until vegetation is established. The erosion and sediment control measure will also be subject to regular inspection to ensure and measures are operational.

9.0. CONCLUSIONS AND RECOMMENDATIONS

The conclusions of this report are as follows:

- Water servicing, including both domestic and fire protection, can be provided by connecting to the existing 300mm diameter watermain within the Lamarche Avenue right-of-way.
- There is adequate capacity within the existing sanitary sewer infrastructure to service the proposed development.
- Quantity control of stormwater will be provided within the proposed public right-of-way using inlet control devices at the roadside catchbasins and ponding stormwater within localized depressions. Quantity control of stormwater will be provided within each individual development block through roof storage, underground storage tanks, and surface storage in parking areas.
- Quality control of stormwater will be provided by the existing EUC pond 1. No on-site quality control is required.
- An overland flow route will be provided along the proposed right-of-way and to Lamarche Avenue. The overland flow will ultimately discharge to the EUC Pond 1 and Mud Creek.
- Erosion and sediment control measures (i.e. filter fabric, catchbasin inserts, silt fences, etc.) will be implemented prior to construction and are to remain in place until vegetation is established.

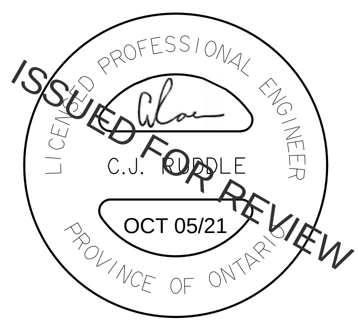
The preceding report is respectfully submitted for review and approval. Please contact the undersigned should you have any questions or require additional information.

NOVATECH

Prepared by:

Anthony Mestwarp, P.Eng
Project Engineer
Land Development Engineering

Reviewed by:



Cara Ruddle, P.Eng.
Senior Project Manager
Land Development Engineering

APPENDIX A
Draft Plan of Subdivision and City Correspondence

From: Mashaie, Sara <sara.mashaie@ottawa.ca>
Sent: Friday, June 11, 2021 11:27 AM
To: Boughton, Michael <Michael.Boughton@ottawa.ca>
Subject: 3484 Innes Rd., 240 & 270 Lamarche Ave. - Pre-Application Consultation Follow-up Notes

Hi Michael,

Further to the pre-application consultation meeting held on June 4, 2021 for the above-noted site, please see my high-level engineering-related notes below, and the attached Servicing Memo. The Servicing Memo reflects the engineering design and submission requirements for the Zoning By-law Amendment application, Site Plan Control application, Plan of Subdivision application, among other relevant information applicable to the said applications. **The Applicant is to consult both the Servicing Memo and the notes listed below.**

Order of comments:

1. Servicing
2. Geotechnical Considerations
3. Permitting and Approvals
4. Background Studies

1. SERVICING

Water Supply Comments

a. The subject property lies within the City of Ottawa 2E pressure zone. There is an existing 406mm dia. ductile iron (DI) watermain on Innes Rd., and an existing 305mm dia. watermain on Pagé Rd.
b. A 305mm dia. watermain on Lamarche Ave. (fronting the subject property) was proposed as part of the Caivan Orléans Village subdivision. Please refer to the 2018 Design Brief for Caivan Orléans Village for further details.
c. Servicing of the development through a looped watermain connection to the 300mm dia. watermain within Lamarche Ave. is preferred.
d. There must also be sufficient pressure available to accommodate the fire flow in addition to the average day and maximum day pressures. Please ensure that boundary conditions are requested from the City accordingly. Please refer to the Servicing Memo for further details.

Wastewater Design Comments (Sanitary and Storm)

a. The subject site lies within the Forest Valley Trunk (FVT) catchment area, and the existing 900mm diameter FVT sanitary sewer is on Silverbirch St. and Pagé Rd. In addition, there are existing 250mm dia. sanitary sewers on Innes Rd. and Pagé Road., accordingly.

b. A 250mm dia. sanitary sewer on Lamarche Ave. was proposed as part of the Caivan Orléans Village subdivision. Please refer to the 2018 Design Brief for Caivan Orléans Village for further details.
c. Based on the wastewater design criteria in relation to the Sewer Design Guidelines and the estimated wastewater flows (average dry weather flow, peak dry weather flow, peak wet weather flow), the City would confirm that the sanitary sewers in Orléans Village have been sized to provide the sufficient capacity to accommodate these development flows. The Consultant is to provide these flow calculations to the City for confirmation, accordingly. Please consider the impacts of the development to the FVT as well.

Stormwater Management Comments

a. The existing site sheet flows from north to south to the existing East Urban Community (EUC) Pond 1, located south of Innes Rd., which then outlets to Mud Creek, a natural watercourse. Please refer to the 2018 Design Brief for Caivan Orléans Village for further details, as well as the background studies listed below concerning EUC Pond 1, Mud Creek, etc.
b. Varying diameter storm sewers along Lamarche Ave. (300mm dia., 375mm dia., 825mm dia.) were proposed as part of the Caivan Orléans Village subdivision, where minor flows are directed to. Please refer to the 2018 Design Brief for Caivan Orléans Village for further details.
a. Quantity control: note that the 100-year storm event is to be accommodated through means of on-site storage.
b. Quality control: note that this is to be provided via EUC Pond 1.

2. GEOTECHNICAL CONSIDERATIONS

a. The sub-surface conditions consist of a stiff silty clay crust overlying a soft to stiff silty clay layer, with a thin layer of silty sand and gravel. With clay present, please note that grade raise restrictions will be required.
b. Note that bedrock is present between approximately 1m to 7m below the existing ground surface across the north and south portions of the site (5m to 7m on the south portion). Should bedrock removal be required, discussion shall be provided in the geotechnical report, accordingly.
c. It is estimated that the long-term groundwater level is between 2.5m to 3.5m below the existing ground surface.

The geotechnical report shall provide recommendations for the development (foundation design) further to the conditions present.

3. PERMITS AND APPROVALS

Please note the following permits and approvals, as required:

a. Rideau Valley Conservation Authority (RVCA) clearance
b. Ministry of the Environment, Conservation and Parks (MECP) Environmental Compliance Approval (ECA)
c. Ministry of the Environment (MOE) Form 1 – Record of Watermains
d. MECP Permit to Take Water (PTTW)

4. BACKGROUND STUDIES

a. In addition to the 2018 Design Brief for Caivan Orléans Village for further details, please note the February 2021 Council approved East Urban Community (EUC) Phase 3 Community Design Plan (CDP), the Master Servicing Study (MSS) for the EUC Phase 3 CDP, and the Mud Creek Cumulative Impact Study (CIS) which provides a plan for mitigating erosion impacts to the Creek. The City advanced the CIS and erosion assessment of Mud Creek outside the boundaries of the CDP, but connected to the Phase 3 CDP in that the existing EUC Pond 1 outlets to the Creek.
b. As stated above, the existing site sheet flows to the EUC Pond 1. That being said, it is anticipated that the EUC Pond 1 will be expanded to provide the capacity to support stormwater flows stemming from development. Please refer to the design details for the expansion provided in the MSS, and associated reference documents which are listed in the MSS. The design of the EUC Pond 1 expansion considers lands within the specific catchment area of the pond, which includes lands inside and outside the CDP boundary.
c. Please consult the documents referenced in the MSS for further detailed information, including calculations. The EUC Pond 1 expansion is described in Section 11.2.5 of the MSS. Further information can be requested from the City regarding the EUC Pond 1 expansion, accordingly.

Should you have any questions, please advise.

Regards,

Sara Mashaie, P.Eng., ing.
Project Manager | Gestionnaire de Projet
Development Review, East Branch | Examen des projets d'aménagement, Secteur est
Planning, Infrastructure and Economic Development Department | Services de la planification, de l'infrastructure et du développement économique
City of Ottawa | Ville d'Ottawa
110 Laurier Avenue West. Ottawa, ON | 110, avenue. Laurier Ouest. Ottawa (Ontario) K1P 1J1
613.580.2424 ext./poste 27885, sara.mashaie@ottawa.ca

Planning, Infrastructure and Economic Development Department
Services de la planification, de l'infrastructure et du développement économique

SERVICING MEMO

Date:	June 11, 2021
To / Destinataire	Michael Boughton, MCIP, RPP Planner, Development Review East
From / Expéditeur	Sara Mashaie, P.Eng. Project Manager, Infrastructure Approvals, Development Review East
Subject / Objet	**Pre-Application Consultation** **3484 Innes Rd., 240 & 270 Lamarche Ave., Ward 2 – Innes** File No. PC2021-0159 *Proposed phased development consisting of residential buildings*

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

****Note:** Some items may not be required as part of your submission and are for informational purposes.

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

2. The following Engineering reports are requested for the **Zoning By-law Amendment** submission:

   a. Site Servicing Report

   b. Stormwater Management Report (can be combined with the Site Servicing Report)

   c. Geotechnical Report

3. The following Engineering plans and reports are requested for the **Site Plan Control** and **Plan of Subdivision** submissions:

   a. Site Servicing Plan

   b. Site Servicing Report

   c. Stormwater Management Report (can be combined with the Site Servicing Report)

   d. Grade Control and Drainage Plan

   e. Erosion and Sediment Control Plan (can be combined with the Grade Control and Drainage Plan)

   f. Geotechnical Report

4. Plans are to be submitted on standard **A1 size** (594mm x 841mm) sheets, utilizing an appropriate Metric scale (1:200, 1:250, 1:300, 1:400, or 1:500). With all submitted plans and reports, please provide an individual PDF format of the files.

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

   ⇨ Ottawa Sewer Design Guidelines (October 2012)

   ⇨ Ottawa Design Guidelines – Water Distribution (2010)

   ⇨ Geotechnical Investigation and Reporting Guidelines for Development Applications in the City of Ottawa (2007)

   ⇨ City of Ottawa Slope Stability Guidelines for Development Applications (revised 2012)

   ⇨ City of Ottawa Environmental Noise Control Guidelines (January 2016)

   ⇨ City of Ottawa Park and Pathway Development Manual (2012)

   ⇨ City of Ottawa Accessibility Design Standards (2012)

   ⇨ Ottawa Standard Tender Documents (latest version)

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

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

7. The Stormwater Management Criteria, for the subject site, is to be based on the following:

   i. The 5-yr storm event using the IDF information derived from the Meteorological Services of Canada rainfall data, taken from the MacDonald Cartier Airport, collected 1966 to 1997.

   ii. For separated sewer system built pre-1970 the design of the storm sewers is based on a 2-year storm.

   iii. The pre-development runoff coefficient or a maximum equivalent 'C' of 0.5, whichever is less (§ 8.3.7.3).

   iv. A calculated time of concentration (Cannot be less than 10 minutes).

   v. Flows to the storm sewer in excess of the 5-year storm release rate, up to and including the 100-year storm event, must be detained on site.

   vi. For a combined sewer system, the maximum C= 0.4 or the pre-development C value, whichever is less. In the absence of other information, the allowable release rate shall be based on a 2-year storm event.

   Note: There may be area specific SWM Criteria that may apply. Check for any related SWM &/or Sub-watershed studies that may have been completed.

8. Deep Services (Storm, Sanitary & Water Supply)

   i. Provide existing servicing information and the recommended location for the proposed connections. Services should ideally be grouped in a common trench to minimize the number of road cuts.

   ii. Connections to trunk sewers and easement sewers are typically not permitted.

   iii. Provide information on the monitoring manhole requirements – should be located in an accessible location on private property near the property line (i.e. Not in a parking area).

iv. Review provision of a high-level sewer.

v. Provide information on the type of connection permitted

Sewer connections to be made above the springline of the sewermain as per:

a. Std Dwg S11.1 for flexible main sewers – *connections made using approved tee or wye fittings.*

b. Std Dwg S11 (For rigid main sewers) – *lateral must be less that 50% the diameter of the sewermain,*

c. Std Dwg S11.2 (for rigid main sewers using bell end insert method) – *for larger diameter laterals where manufactured inserts are not available; lateral must be less that 50% the diameter of the sewermain,*

d. Connections to manholes permitted when the connection is to rigid main sewers where the lateral exceeds 50% the diameter of the sewermain. – Connect obvert to obvert with the outlet pipe unless pipes are a similar size.

e. No submerged outlet connections.

9. Water Boundary condition requests must include the location of the service and the expected loads required by the proposed development. Please provide the following information:

i. Location of service

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

iii. Average daily demand: ___ l/s.

iv. Maximum daily demand: ___l/s.

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

10. All development application should be considered for an ECA by the MOECC.

a. Consultant determines if an approval for sewage works under Section 53 of OWRA is required. Consultant determines what type of application is required and the City's project manager confirms. (If the consultant is not clear if an ECA is required, they will work with the City to determine what is required. If the consultant is still unclear or there is a difference of opinion only then will they approach the MOECC).

b. The project will be either transfer of review (standard), transfer of review (additional), direct submission, or exempt as per O. Reg. 525/98.
c. Pre-consultation is not required if applying for standard works (schedule A of the Agreement) under Transfer Review.
d. Mandatory pre-consultation is required if applying for additional works (schedule A of the Agreement) under Transfer Review.
e. Pre-consultation with local District office of MOECC is recommended for direct submission.
f. Consultant completes an MOECC request form for a pre-consultation. Send request to moeccottawasewage@ontario.ca.

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

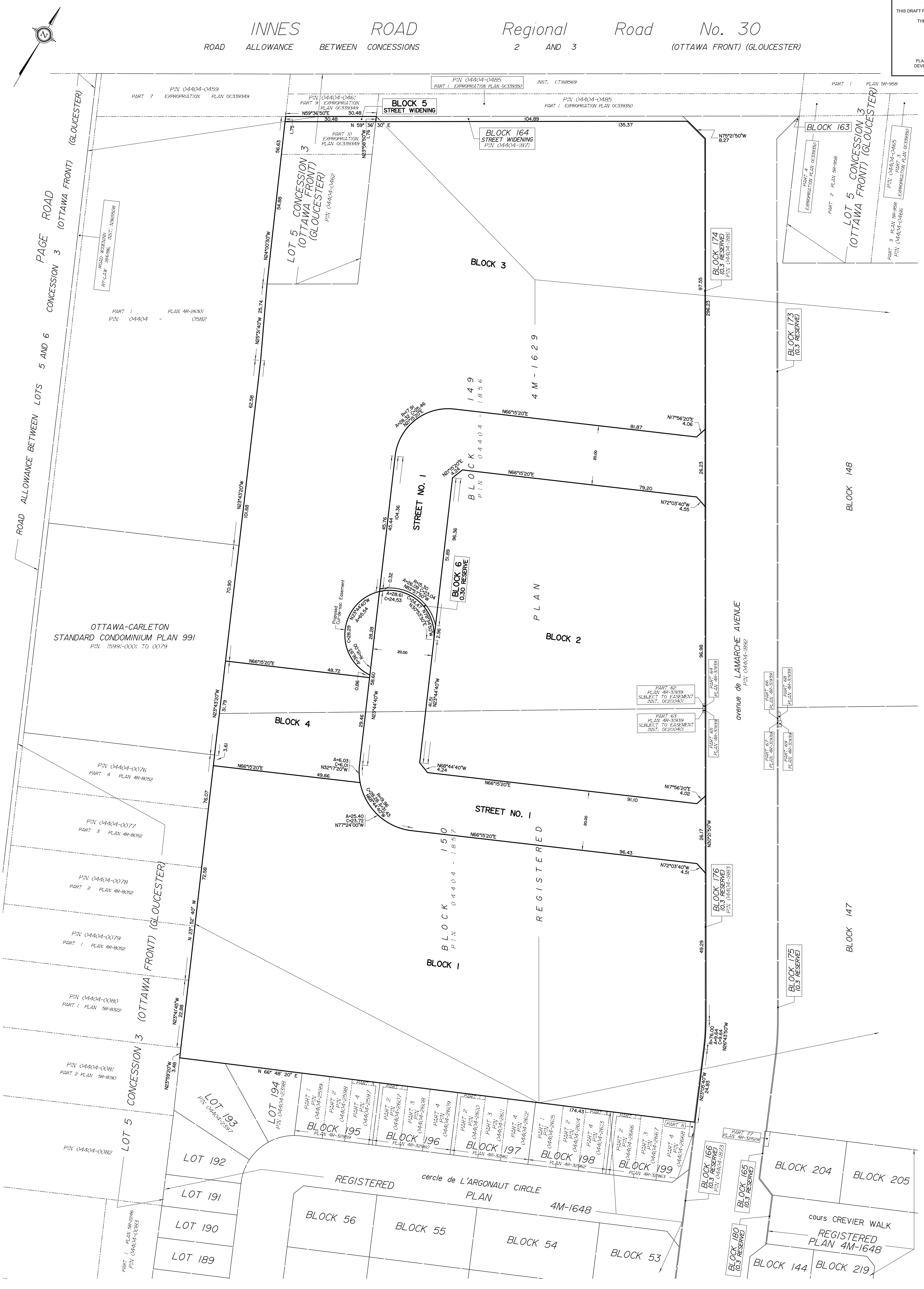
Should you have any questions or require additional information, please contact me directly at (613) 580-2424, ext. 27885 or by email at sara.mashaie@ottawa.ca.

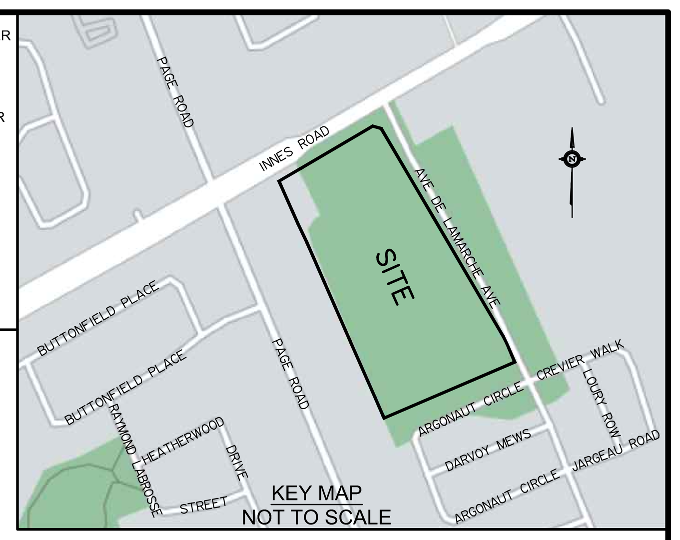
SUBJECT TO THE CONDITIONS, IF ANY, SET FORTH IN OUR LETTER DATED

_ _.

THIS DRAFT PLAN IS APPROVED BY THE CITY OF OTTAWA UNDER SECTION 51 OF THE PLANNING ACT.
THIS _ _ _ _ DAY OF _ _ _ _ _ _ _ _ _ _ _ _, 20_ _ .

_ _
JEFF MCEWEN, P. ENG. MANAGER,
DEVELOPMENT REVIEW-EAST
PLANNING, INFRASTRUCTURE AND ECONOMIC DEVELOPMENT DEPARTMENT, CITY OF OTTAWA





DRAFT PLAN OF SUBDIVISION OF

BLOCKS 149, 150, 174 AND 176 REGISTERED PLAN 4M-1629 AND PART OF LOT 5 CONCESSION 3 (OTTAWA FRONT)

Geographic Township of Gloucester
CITY OF OTTAWA

Prepared by Annis , O'Sullivan , Vollebekk Ltd.

Scale 1 : 500

20 15 10 5 0 10 20 Metres

Metric

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

SURVEYOR'S CERTIFICATE

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

_ _ _ _ _ _ _ _ _ _ _ _ _ Date

_ E. H. HERWEYER
ONTARIO LAND SURVEYOR

Notes & Legend

+ 65.00	Denotes	Location of Elevations
+ 65.00*	"	Top of Curb/ Wall of Elevations
———	"	Property Line

OWNER'S CERTIFICATE

This is to certify that I am the owner / agent of the lands to be subdivided and that this plan was prepared in accordance with my instructions.

_ _ _ _ _ _ _ _ _ _ _ _ _ Date

_ Gibson Patterson

Bearings are grid bearings and are referred to the Central Meridian of MTM Zone 9 (76°30' West Longitude) NAD-83 (original).

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

(a) see plan
(b) see plan
(c) see plan
(d) (purpose for which lots are to be used)
(e) see plan
(f) see plan
(g) see plan
(h) City of Ottawa
(i) see soils report
(j) see plan
(k) (municipal services available or to be available)
(l) see plan

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

Job No. E-8534-18 CRDS PtLt5 C3 OF GL DPS D3 | AP

APPENDIX B
Watermain Information

FUS - Fire Flow Calculations

As per 1999 Fire Underwriter's Survey Guidelines

NOVATECH
Engineers, Planners & Landscape Architects

Novatech Project #:	121214
Project Name:	3484 Innes Road
Date:	9/27/2021
Input By:	Anthony Mestwarp, P.Eng.
Reviewed By:	Cara Ruddel

Legend: Input by User; No Information or Input Required

Building Description: Multi-Storey Apartment

Fire Resistive Construction

Step			Choose		Value Used	Total Fire Flow (L/min)
Base Fire Flow						
1	**Construction Material**			**Multiplier**		
	Coefficient related to type of construction C	Wood frame		1.5	0.6	
		Ordinary construction		1		
		Non-combustible construction		0.8		
		Modified Fire resistive construction (2 hrs)	Yes	0.6		
		Fire resistive construction (> 3 hrs)		0.6		
2	**Floor Area**					
	A	Building Footprint (m^2)	1863			
		Number of Floors/Storeys	6			
		Protected Openings (1 hr)	Yes			
		Area of structure considered (m^2)			**2,795**	
	F	**Base fire flow without reductions**				**7,000**
		$F = 220\ C\ (A)^{0.5}$				
Reductions or Surcharges						
3	**Occupancy hazard reduction or surcharge**			**Reduction/Surcharge**		
	(1)	Non-combustible		-25%	-15%	**5,950**
		Limited combustible	Yes	-15%		
		Combustible		0%		
		Free burning		15%		
		Rapid burning		25%		
4	**Sprinkler Reduction**			**Reduction**		
	(2)	Adequately Designed System (NFPA 13)	Yes	-30%	-30%	**-2,380**
		Standard Water Supply	Yes	-10%	-10%	
		Fully Supervised System	No	-10%		
				Cumulative Total	**-40%**	
5	**Exposure Surcharge (cumulative %)**				**Surcharge**	
	(3)	North Side	20.1 - 30 m		10%	**3,273**
		East Side	10.1 - 20 m		15%	
		South Side	10.1 - 20 m		15%	
		West Side	10.1 - 20 m		15%	
				Cumulative Total	**55%**	
Results						
6	**(1) + (2) + (3)**	**Total Required Fire Flow, rounded to nearest 1000L/min**			**L/min**	**7,000**
		(2,000 L/min < Fire Flow < 45,000 L/min)		or	L/s	**117**
				or	USGPM	1,849
7	**Storage Volume**	Required Duration of Fire Flow (hours)			Hours	2
		Required Volume of Fire Flow (m^3)			m^3	840

M:\2021\121214\DATA\Calculations\Sewer Calcs\Water\FUSv2-0-PRELIM.xlsx

Proposed Development Conditions - Option 1

	Zone 1			Zone 2		Zone 3				
	Bldg A	Bldg B	Bldg C	Bldg D	Bldg E	Bldg F	Bldg G	Bldg H	Park Land	Totals
Number of units	81	96	98	125	125	98	125	125	n/a	873
Area (ha)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0.514	0.514
Total Daily Volume (Liters)	40824.0	48384.0	49392.0	63000.0	63000.0	49392.0	63000.0	63000.0	1904.4	441896.4
Avg Day Demand (L/s)	0.473	0.560	0.572	0.729	0.729	0.572	0.729	0.729	0.022	5.11
Max Day Demand (L/s)	1.181	1.400	1.429	1.823	1.823	1.429	1.823	1.823	0.055	12.79
Peak Hour Demand (L/s)	2.599	3.080	3.144	4.010	4.010	3.144	4.010	4.010	0.121	28.13

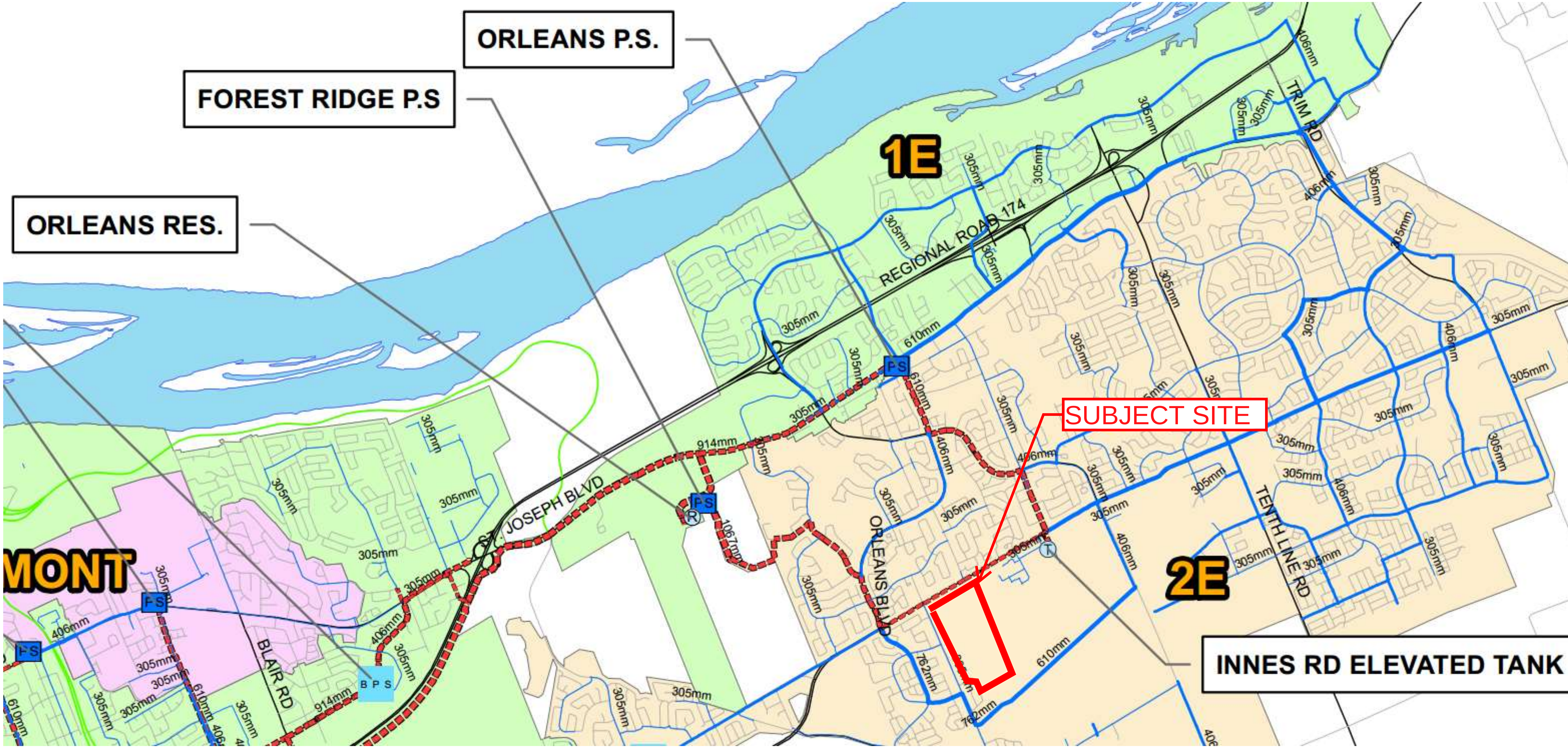
Establishment	Daily Demand Volume		Source
Average Apartment	1.8	Person/unit	City of Ottawa Sewer Design Guidelines
Residential Average Flow	280	L/c/day	City of Ottawa Sewer Design Guidelines
Picnic and Fair Grounds Flush Toilets only	20	L/Person/day Assume 75 Per/acre	City of Ottawa Sewer Design Guidelines

Residential Peaking Factors City of Ottawa Water Distrubution Guidelines:

Conditions	Peaking Factor		Units
Maximum Day	2.5	x avg day	L/c/day
Peak Hour	2.2	x max day	L/c/day

APPENDIX C

Water Supply Servicing (DSEL, May 2018)



ORLEANS P.S.
FOREST RIDGE P.S
ORLEANS RES.
SUBJECT SITE
INNES RD ELEVATED TANK
1E
2E
MONT
REGIONAL ROAD 174
ST. JOSEPH BLVD
ORLEANS BLVD
TENTH LINE RD
TRIM RD
BLAIR RD

Water Demand Design Flows per Unit Count
City of Ottawa - Water Distribution Guidelines, July 2010 (& Bulletin ISTB-2018-02)

DSEL

Domestic Demand

Type of Housing	Per / Unit	Units	Pop
Single Family	3.4	330	1122
Semi-detached	2.7		0
Townhouse / Back-to-Back	2.7	131	354
Condo/Mixed Use Residential			4671
Apartment			
Bachelor	1.4		0
1 Bedroom	1.4		0
2 Bedroom	2.1		0
3 Bedroom	3.1		0
Average	1.8		0

	Pop	Avg. Daily		Max Day		Peak Hour	
		m^3/d	L/min	m^3/d	L/min	m^3/d	L/min
Total Domestic Demand	6147	1721.2	1195.3	4302.9	2988.1	9466.4	6573.9

Institutional / Commercial / Industrial Demand

Property Type	Unit Rate		Units	Avg. Daily m^3/d	Avg. Daily L/min	Max Day m^3/d	Max Day L/min	Peak Hour m^3/d	Peak Hour L/min
Park	9,300.0	L/ha/day	1.43	13.30	9.2	19.9	13.9	35.9	24.9
Commercial Floor Space	28,000.0	L/ha/day	5.40	151.20	105.0	226.8	157.5	408.2	283.5
Residential Commercial Space	28,000.0	L/ha/day	0.00	0.00	0.0	0.0	0.0	0.0	0.0
			Total I/CI Demand	164.5	114.2	246.7	171.4	444.1	308.4
			Total Demand	**1885.7**	**1309.5**	**4549.6**	**3159.5**	**9910.5**	**6882.3**

Page Road
FUS-Fire Flow Demand
Non-Conforming Standard TH

Fire Flow Estimation per Fire Underwriters Survey
Water Supply For Public Fire Protection - 1999

Fire Flow Required

Location Page Road - Non-Conforming TH Blocks

1. Base Requirement

$F = 220C\sqrt{A}$ L/min *Where **F** is the fire flow, **C** is the Type of construction and **A** is the Total floor area*

Type of Construction: Wood Frame

C	1.5		*Type of Construction Coefficient per FUS Part II, Section 1*
A	1184.0	m^2	*Total floor area based on FUS Part II section 1*

Fire Flow	11355.1	L/min	
	11000.0	**L/min**	*rounded to the nearest 1,000 L/min*

Adjustments

2. Reduction for Occupancy Type

Limited Combustible	-15%
Fire Flow	**9350.0 L/min**

3. Reduction for Sprinkler Protection

Non-Sprinklered	0%
Reduction	**0 L/min**

4. Increase for Separation Distance

N	10.1m-20m	15%	
S	10.1m-20m	15%	
E	3.1m-10m	20%	
W	3.1m-10m	20%	
	% Increase	**70%**	*value not to exceed 75% per FUS Part II, Section 4*
	Increase	**6545.0 L/min**	

Total Fire Flow

Fire Flow	15895.0	L/min	*fire flow not to exceed 45,000 L/min nor be less than 2,000 L/min per FUS Section 4*
	16000.0	**L/min**	*rounded to the nearest 1,000 L/min*

266.66667 L/s

Notes:
-Type of construction, Occupancy Type and Sprinkler Protection information provided by Caivan Development Corporation
-Calculations based on Fire Underwriters Survey - Part II

Boundary Conditions at 3490 Innes Rd

Information Provided:

Date provided: Nov 2016

Criteria	Demand (L/s)	
	Phase 1	Phase2
Average Demand (l/min)	438.9	725.6
Maximum Daily Demand (L/min)	1077.3	1641.1
Peak Hourly Demand (L/min)	2358.2	3506.6
Fire Flow Demand (L/s)	167, 216, 266	167, 216, 266

Location:

Results

Phase 1 - Scenario 1

Demand Scenario	Demand (l/min)	Boundary Condition (m)		
		Innes Road	Nature Trail	Page Road
Avg Day	438.9	132.7	133.4	N/A
Max Day + Fire Flow (Single/Town conforming to Technical Bulletin ISTB-2014-02)[1]	11077.3	128.2	121.0	N/A
Max Day + Fire Flow (Back-to-Back)	14077.3	127.4	116.2	N/A
Max Day + Fire Flow (Town not conforming to Technical Bulletin ISTB-2014-02[1])	17077.3	126.6	110.4	N/A
Peak Hour	2358.2	128.1	128.0	N/A

Phase 1 - Scenario 2

Demand Scenario	Demand (l/min)	Boundary Condition (m)		
		Innes Road	Nature Trail	Page Road
Avg Day	438.9	N/A	133.4	133.4
Max Day + Fire Flow (Single/Town conforming to Technical Bulletin ISTB-2014-02[1])	11077.3	N/A	120.9	127.5
Max Day + Fire Flow (Back-to-Back)	14077.3	N/A	116.2	126.4
Max Day + Fire Flow (Town not conforming to Technical Bulletin ISTB-2014-02[1])	17077.3	N/A	110.4	125.3
Peak Hour	2358.2	N/A	127.9	128.1

Phase 2 - Scenario 1

Demand Scenario	Demand (l/min)	Boundary Condition (m) Innes Road	Nature Trail	Page Road
Avg Day	725.6	133.4	134.3	N/A
Max Day + Fire Flow (Single/Town conforming to Technical Bulletin ISTB-2014-02[1])	11641.1	127.9	120.4	N/A
Max Day + Fire Flow (Back-to-Back/Commercial)	14641.1	127.4	115.6	N/A
Max Day + Fire Flow (Town not conforming to Technical Bulletin ISTB-2014-02[1])	17641.1	126.4	109.6	N/A
Peak Hour	3506.6	128.0	127.7	N/A

Phase 2 - Scenario 2

Demand Scenario	Demand (l/min)	Boundary Condition (m) Innes Road	Nature Trail	Page Road
Avg Day	725.6	133.5	134.3	134.2
Max Day + Fire Flow (Single/Town conforming to Technical Bulletin ISTB-2014-02[1])	11641.1	127.9	120.8	127.3
Max Day + Fire Flow (Back-to-Back/Commercial)	14641.1	127.5	116.1	126.5
Max Day + Fire Flow (Town not conforming to Technical Bulletin ISTB-2014-02[1])	17641.1	126.5	110.2	125.1
Peak Hour	3506.6	128.0	127.8	128.0

Disclaimer

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

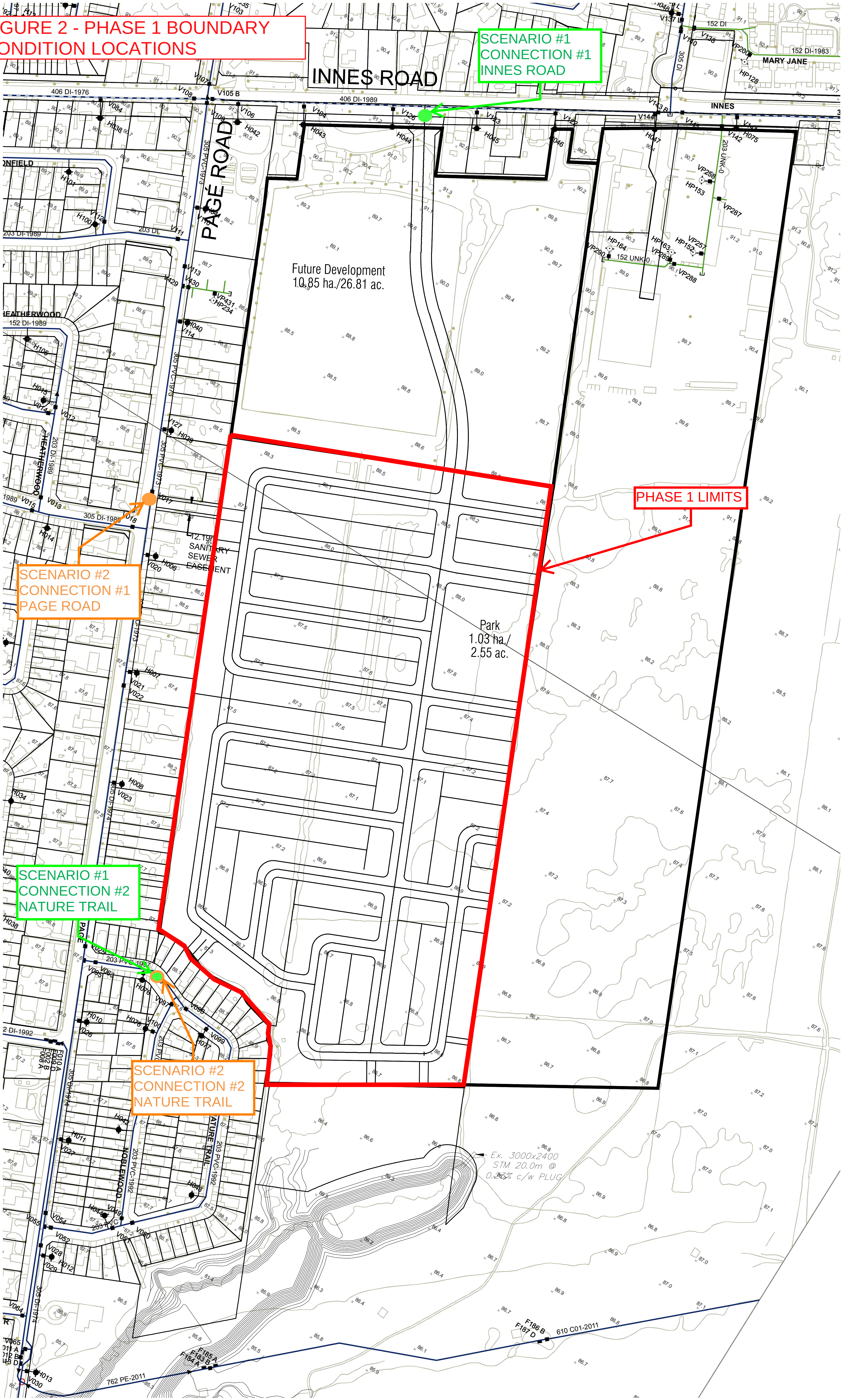


FIGURE 2 - PHASE 1 BOUNDARY CONDITION LOCATIONS

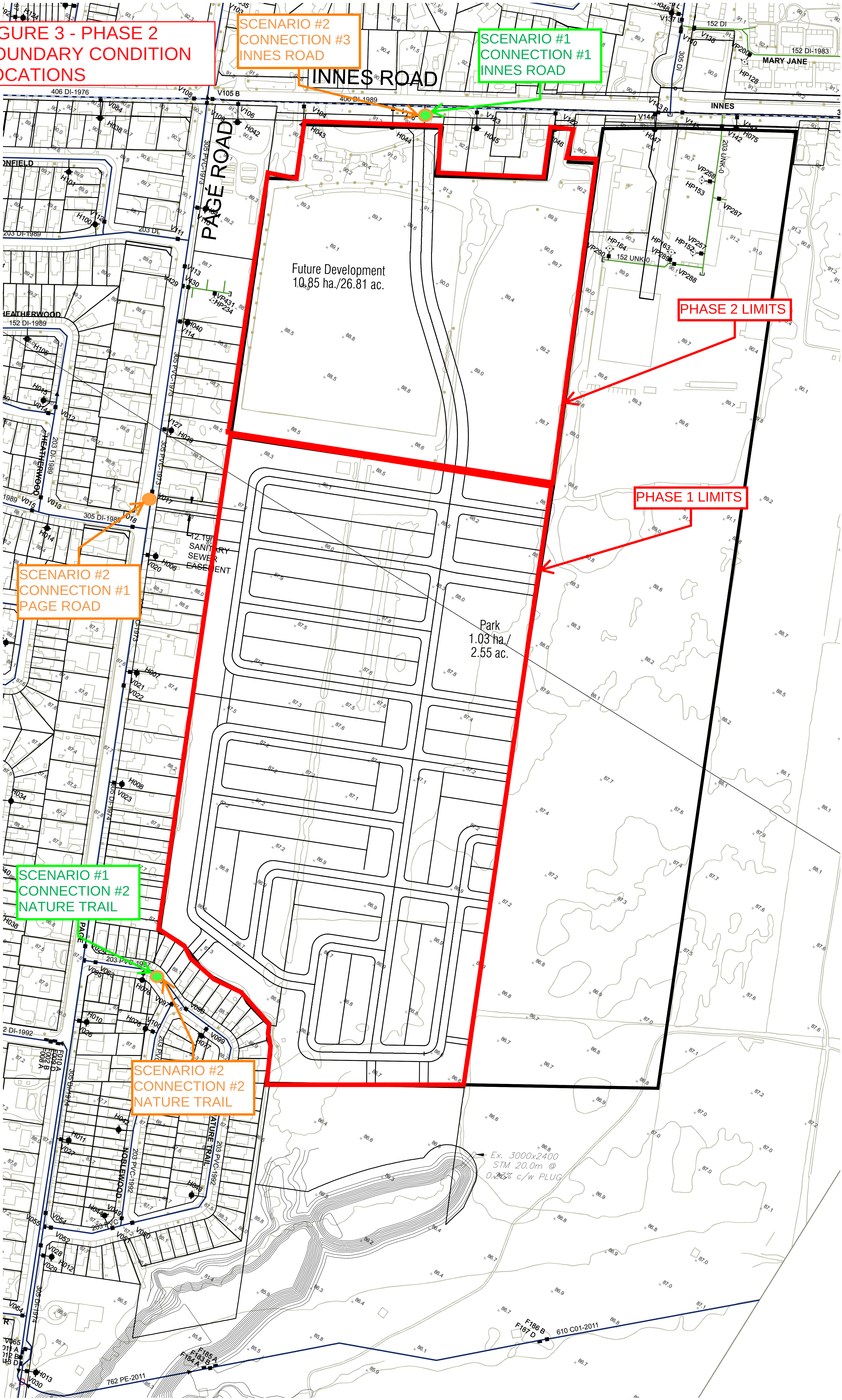


FIGURE 3 - PHASE 2 BOUNDARY CONDITION LOCATIONS
SCENARIO #2 CONNECTION #3 INNES ROAD
SCENARIO #1 CONNECTION #1 INNES ROAD
INNES ROAD
PAGÉ ROAD
Future Development 10.85 ha./26.81 ac.
PHASE 2 LIMITS
PHASE 1 LIMITS
Park 1.03 ha./ 2.55 ac.
12.19m SANITARY SEWER EASEMENT
SCENARIO #2 CONNECTION #1 PAGE ROAD
SCENARIO #1 CONNECTION #2 NATURE TRAIL
SCENARIO #2 CONNECTION #2 NATURE TRAIL
HEATHERWOOD
NOBLEWOOD
NATURE TRAIL
MARY JANE
Ex. 3000x2400 STM 20.0m @ 0.26% c/w PLUG

Minor Loss Coefficients

Fitting	Loss Coefficient
Globe valve, fully open	10
Angle Valve, fully open	5
Swing check valve, fully open	2.5
Gate valve, fully open	0.2
Short-radius elbow	0.9
Medium-radius elbow	0.8
Long-radius elbow	0.6
45 degree elbow	0.4
Closed return bend	2.2
Standard tee-flow through run	0.6
Standard tee- flow through branch	1.8
Square entrance	0.5
Exit	1

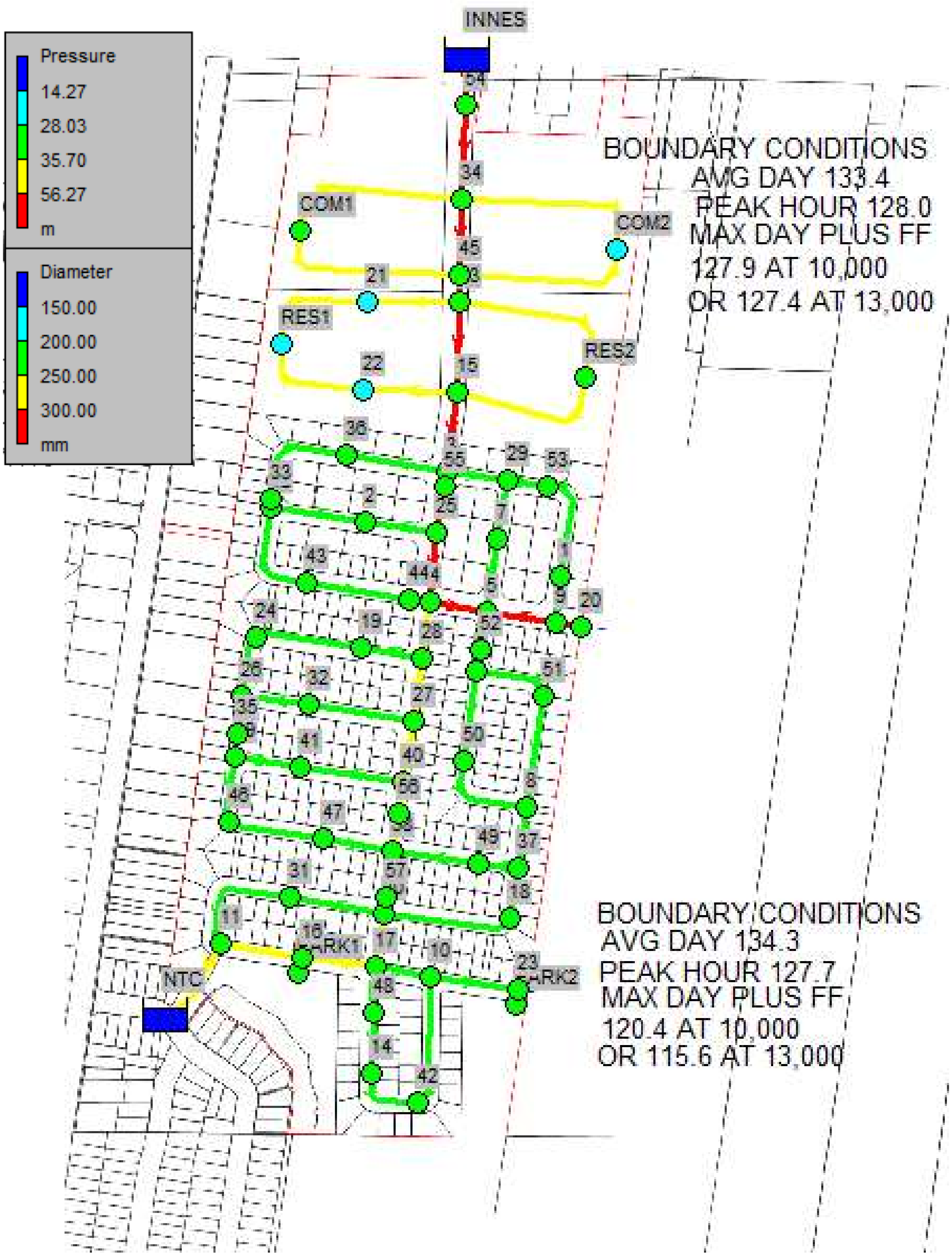
Pipe Diameter vs. "C"

Pipe Diameter (mm)	C-Factor
150	100
200 to 250	110
300 to 600	120
Over 600	130

Node Pressures

Kpa	Pressure (Kpa)	Pressure (mm H_2O)
Max	552	56.3
Rec Max	480	49.0
Rec Min	350	35.7
Min	275	28.1

AVERAGE DAY SCENARIO



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

Input File: 2018-04-05_881_wtr-Alt1ggm.net

Link - Node Table:

Link ID	Start Node	End Node	Length m	Diameter mm
28	31	30	89.2	200
66	30	17	52.5	250
68	30	18	127.8	200
72	18	37	43.5	200
77	8	37	58.5	200
79	5	9	64.5	300
80	9	20	26.3	300
81	3	29	56.3	200
86	25	4	66.1	300
87	4	5	53.6	300
88	40	27	58.5	250
89	27	28	58.5	250
97	21	RES1	97.1	250
98	RES1	22	96.9	250
99	22	15	83.5	250
100	15	3	73.8	300
101	3	36	95.2	200
102	36	33	111.2	200
103	15	RES2	132.6	250
104	RES2	13	139.8	250
106	12	2	90.5	200
107	33	12	3.2	200
108	4	28	52.6	250
109	2	25	67.4	200
111	12	43	103.3	200
112	43	44	97.6	200
113	44	4	19.2	200
114	34	COM2	173.5	250
115	COM2	45	130.1	250
117	45	COM1	130.1	250
118	COM1	34	173.5	250

119	34	45	86.0	300
1	13	15	90	300
2	45	13	4.1	300
3	13	21	77.9	250
12	1	9	42.5	200
13	29	7	56.9	200

Page 2
Link - Node Table: (continued)

Link ID	Start Node	End Node	Length m	Diameter mm
14	7	5	68	200
17	11	31	115.3	200
8	17	10	51.3	200
15	10	23	59.8	200
19	42	10	123.7	200
21	14	42	44.7	200
22	16	17	64.9	250
23	16	PARK1	13.3	200
24	16	11	81.7	250
27	11	NTC	115.6	250
29	23	PARK2	13.3	200
5	26	24	57.5	200
10	24	19	99.2	200
16	19	28	56.6	200
18	26	32	62.5	200
25	32	27	97.7	200
26	26	35	38	200
30	35	39	20.5	200
33	39	46	63.6	200
34	46	47	90.2	200
35	47	38	65.4	200
36	39	41	62.5	200
37	41	40	97.5	200
38	17	48	40.9	200
39	48	14	77.4	200
41	38	49	81	200
42	49	37	36.8	200
43	8	50	93.5	200
44	50	6	85	200
45	6	51	73.3	200
46	51	8	105.2	200
47	6	52	20	200
48	52	5	36.2	200
49	29	53	38.7	200

50	53	1	101.9	200
4	INNES	54	41	300
6	54	34	90	300
7	3	55	16.2	300
9	55	25	42.3	300
11	40	56	30.3	250
20	56	38	34.2	250
31	38	57	42.3	250
32	57	30	16.2	250

Page 3
Node Results at 0:00 Hrs:

Node ID	Demand LPM	Head m	Pressure m	Quality hours
3	5.74	133.49	47.44	0.00
4	5.74	133.53	47.73	0.00
5	5.74	133.53	47.51	0.00
6	5.74	133.58	47.64	0.00
10	5.74	133.83	48.53	0.00
12	5.74	133.50	47.38	0.00
PARK2	4.20	133.83	48.31	0.00
17	5.74	133.83	48.37	0.00
18	5.74	133.70	48.33	0.00
20	5.74	133.53	47.49	0.00
23	5.74	133.83	48.31	0.00
2	5.74	133.51	47.66	0.00
25	5.74	133.51	47.61	0.00
26	5.74	133.62	47.74	0.00
27	5.74	133.62	48.09	0.00
28	5.74	133.58	48.01	0.00
30	5.74	133.77	48.44	0.00
31	5.74	133.86	48.26	0.00
13	0.00	133.42	46.40	0.00
15	0.00	133.44	47.34	0.00
RES2	201.64	133.42	46.26	0.00
RES1	202.61	133.42	44.94	0.00
COM1	322.58	133.41	43.81	0.00
COM2	286.61	133.41	43.58	0.00
34	0.00	133.41	44.04	0.00
21	0.00	133.42	45.42	0.00
22	0.00	133.43	45.43	0.00
33	5.74	133.50	47.32	0.00
36	5.74	133.49	47.24	0.00
37	5.74	133.68	48.16	0.00

38	5.74	133.69	47.93	0.00
39	5.74	133.64	47.81	0.00
40	5.74	133.64	48.21	0.00
42	5.74	133.83	48.70	0.00
44	5.74	133.52	47.84	0.00
8	5.74	133.62	48.02	0.00
9	5.74	133.53	47.59	0.00
29	5.74	133.51	47.40	0.00
43	5.74	133.51	47.77	0.00
45	0.00	133.42	46.40	0.00
PARK1	5.00	133.90	48.42	0.00
1	5.74	133.52	47.29	0.00
7	5.74	133.52	47.32	0.00
11	5.74	134.00	48.48	0.00
14	5.74	133.83	48.92	0.00
16	5.74	133.90	48.42	0.00
19	5.74	133.59	47.81	0.00

Page 4
Node Results at 0:00 Hrs: (continued)

Node ID	Demand LPM	Head m	Pressure m	Quality hours	
24	5.74	133.61	47.86	0.00	
32	5.74	133.62	47.94	0.00	
35	5.74	133.63	47.67	0.00	
41	5.74	133.64	47.96	0.00	
46	5.74	133.65	48.05	0.00	
47	5.74	133.67	48.07	0.00	
48	5.74	133.83	48.57	0.00	
49	5.74	133.68	48.08	0.00	
50	5.74	133.60	47.70	0.00	
51	5.74	133.60	47.82	0.00	
52	5.74	133.56	47.52	0.00	
53	5.74	133.51	47.15	0.00	
54	0.00	133.40	43.52	0.00	
55	5.74	133.49	47.26	0.00	
56	5.74	133.66	48.43	0.00	
57	5.74	133.74	48.28	0.00	
INNES	462.30	133.40	0.00	0.00	Reservoir
NTC	-1771.94	134.30	0.00	0.00	Reservoir

Link Results at 0:00 Hrs:

Link ID	Flow LPM	VelocityUnit m/s	Headloss m/km	Status

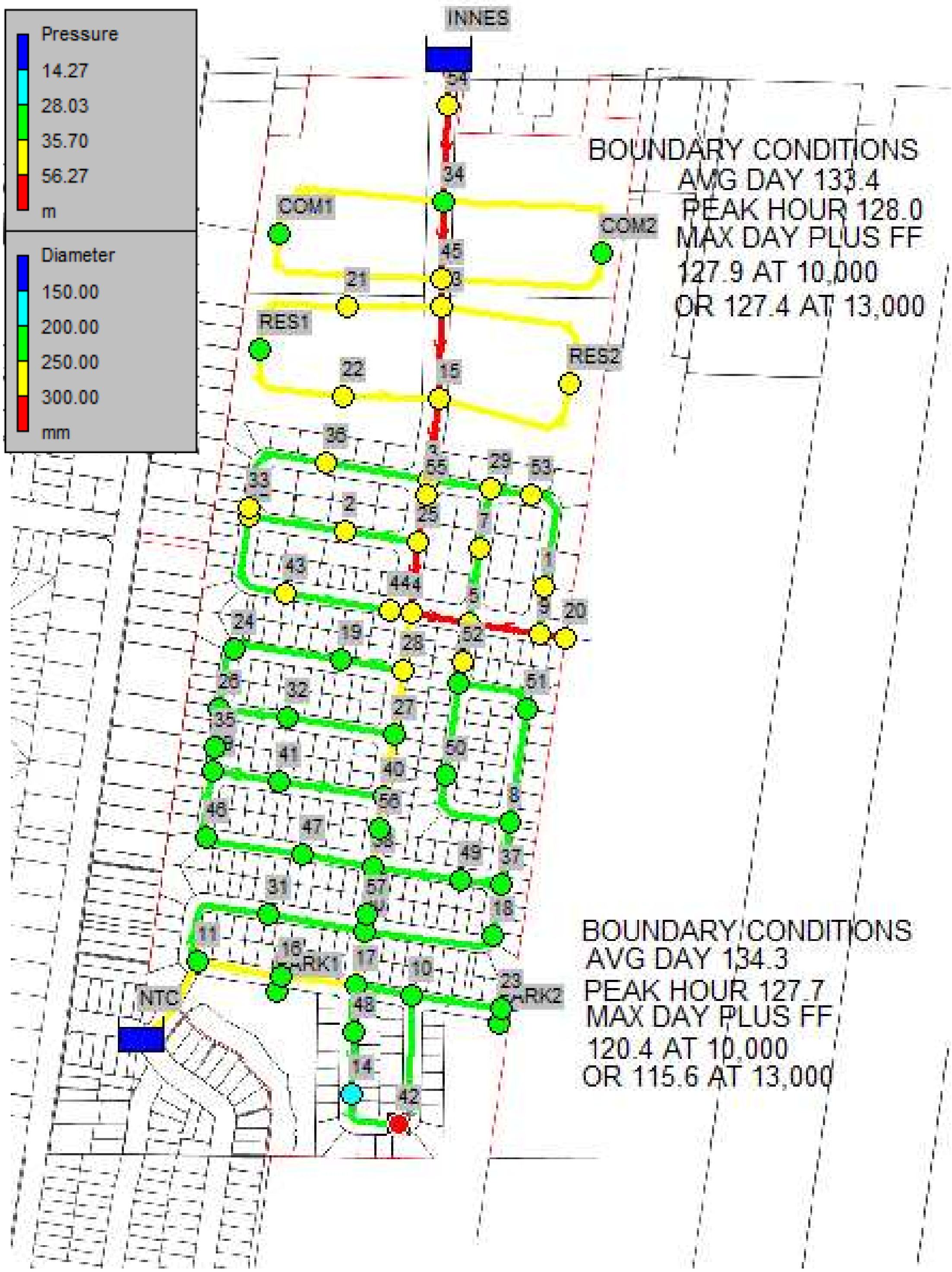
28	645.91	0.34	1.02	Open
66	-1065.17	0.36	1.09	Open
68	427.70	0.23	0.53	Open
72	421.96	0.22	0.57	Open
77	-566.87	0.30	0.94	Open
79	183.95	0.04	0.01	Open
80	5.74	0.00	0.00	Open
81	-363.89	0.19	0.41	Open
86	-981.67	0.23	0.34	Open
87	-134.11	0.03	0.01	Open
88	758.44	0.26	0.50	Open
89	817.23	0.28	0.57	Open
97	-106.78	0.04	0.01	Open
98	-309.39	0.11	0.09	Open
99	-309.39	0.11	0.09	Open
100	-1475.74	0.35	0.64	Open
101	-157.79	0.08	0.08	Open
102	-163.53	0.09	0.08	Open
103	349.33	0.12	0.11	Open
104	147.69	0.05	0.02	Open
106	-4.65	0.00	0.00	Open
107	-169.27	0.09	0.39	Open
108	-1035.14	0.35	1.04	Open

Page 5
Link Results at 0:00 Hrs: (continued)

Link ID	Flow LPM	VelocityUnit m/s	Headloss m/km	Status
109	-10.39	0.01	0.00	Open
111	-170.36	0.09	0.10	Open
112	-176.10	0.09	0.09	Open
113	-181.84	0.10	0.16	Open
114	29.88	0.01	0.00	Open
115	-256.73	0.09	0.06	Open
117	265.04	0.09	0.07	Open
118	-57.54	0.02	0.00	Open
119	-549.71	0.13	0.10	Open
1	-817.01	0.19	0.21	Open
2	-1071.49	0.25	0.78	Open
3	-106.78	0.04	0.01	Open
12	-172.47	0.09	0.09	Open
13	-208.64	0.11	0.15	Open
14	-214.38	0.11	0.13	Open
17	651.65	0.35	1.21	Open

8	18.60	0.01	0.00	Open
15	9.94	0.01	0.00	Open
19	-2.92	0.00	0.00	Open
21	2.82	0.00	0.00	Open
22	1103.81	0.37	1.19	Open
23	5.00	0.00	0.00	Open
24	-1114.55	0.38	1.17	Open
27	-1771.94	0.60	2.61	Open
29	4.20	0.00	0.00	Open
5	235.14	0.12	0.19	Open
10	229.40	0.12	0.16	Open
16	223.66	0.12	0.17	Open
18	70.26	0.04	0.02	Open
25	64.52	0.03	0.02	Open
26	-311.14	0.17	0.35	Open
30	-316.88	0.17	0.44	Open
33	-245.01	0.13	0.21	Open
34	-250.75	0.13	0.20	Open
35	-256.49	0.14	0.22	Open
36	-77.61	0.04	0.02	Open
37	-83.35	0.04	0.03	Open
38	14.30	0.01	0.00	Open
39	8.56	0.00	0.00	Open
41	156.39	0.08	0.08	Open
42	150.65	0.08	0.09	Open
43	282.96	0.15	0.25	Open
44	277.22	0.15	0.22	Open
45	-272.44	0.14	0.24	Open
46	-278.18	0.15	0.23	Open
47	543.91	0.29	0.87	Open
48	538.17	0.29	0.93	Open

MAX DAY + FIRE FLOW 10,000 L/min @ 42



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******************************************************************
*                         E P A N E T                            *
*                 Hydraulic and Water Quality                    *
*                 Analysis for Pipe Networks                     *
*                        Version 2.0                             *
******************************************************************
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Input File: 2018-04-05_881_wtr-Alt1ggm.net

Link - Node Table:

Link ID	Start Node	End Node	Length m	Diameter mm
28	31	30	89.2	200
66	30	17	52.5	250
68	30	18	127.8	200
72	18	37	43.5	200
77	8	37	58.5	200
79	5	9	64.5	300
80	9	20	26.3	300
81	3	29	56.3	200
86	25	4	66.1	300
87	4	5	53.6	300
88	40	27	58.5	250
89	27	28	58.5	250
97	21	RES1	97.1	250
98	RES1	22	96.9	250
99	22	15	83.5	250
100	15	3	73.8	300
101	3	36	95.2	200
102	36	33	111.2	200
103	15	RES2	132.6	250
104	RES2	13	139.8	250
106	12	2	90.5	200
107	33	12	3.2	200
108	4	28	52.6	250
109	2	25	67.4	200
111	12	43	103.3	200
112	43	44	97.6	200
113	44	4	19.2	200
114	34	COM2	173.5	250
115	COM2	45	130.1	250
117	45	COM1	130.1	250
118	COM1	34	173.5	250

119	34	45	86.0	300
1	13	15	90	300
2	45	13	4.1	300
3	13	21	77.9	250
12	1	9	42.5	200
13	29	7	56.9	200

Link - Node Table: (continued)

Link ID	Start Node	End Node	Length m	Diameter mm
14	7	5	68	200
17	11	31	115.3	200
8	17	10	51.3	200
15	10	23	59.8	200
19	42	10	123.7	200
21	14	42	44.7	200
22	16	17	64.9	250
23	16	PARK1	13.3	200
24	16	11	81.7	250
27	11	NTC	115.6	250
29	23	PARK2	13.3	200
5	26	24	57.5	200
10	24	19	99.2	200
16	19	28	56.6	200
18	26	32	62.5	200
25	32	27	97.7	200
26	26	35	38	200
30	35	39	20.5	200
33	39	46	63.6	200
34	46	47	90.2	200
35	47	38	65.4	200
36	39	41	62.5	200
37	41	40	97.5	200
38	17	48	40.9	200
39	48	14	77.4	200
41	38	49	81	200
42	49	37	36.8	200
43	8	50	93.5	200
44	50	6	85	200
45	6	51	73.3	200
46	51	8	105.2	200
47	6	52	20	200
48	52	5	36.2	200
49	29	53	38.7	200

50	53	1	101.9	200
4	INNES	54	41	300
6	54	34	90	300
7	3	55	16.2	300
9	55	25	42.3	300
11	40	56	30.3	250
20	56	38	34.2	250
31	38	57	42.3	250
32	57	30	16.2	250

Page 3
Node Results at 0:00 Hrs:

Node ID	Demand LPM	Head m	Pressure m	Quality hours
3	14.35	122.95	36.90	0.00
4	14.35	122.27	36.47	0.00
5	14.35	122.26	36.24	0.00
6	14.35	121.49	35.55	0.00
10	14.35	114.75	29.45	0.00
12	14.35	122.63	36.51	0.00
PARK2	6.40	114.75	29.23	0.00
17	14.35	117.43	31.97	0.00
18	14.35	119.90	34.53	0.00
20	14.35	122.27	36.23	0.00
23	14.35	114.75	29.23	0.00
2	14.35	122.63	36.78	0.00
25	14.35	122.63	36.73	0.00
26	14.35	120.93	35.05	0.00
27	14.35	120.98	35.45	0.00
28	14.35	121.45	35.88	0.00
30	14.35	119.11	33.78	0.00
31	14.35	119.12	33.52	0.00
13	0.00	124.28	37.26	0.00
15	0.00	123.79	37.69	0.00
RES2	504.10	123.94	36.78	0.00
RES1	506.53	123.94	35.46	0.00
COM1	750.85	124.57	34.97	0.00
COM2	667.14	124.58	34.75	0.00
34	0.00	125.05	35.68	0.00
21	0.00	124.12	36.12	0.00
22	0.00	123.86	35.86	0.00
33	14.35	122.65	36.47	0.00
36	14.35	122.81	36.56	0.00
37	14.35	120.20	34.68	0.00

38	14.35	120.08	34.32	0.00
39	14.35	120.63	34.80	0.00
40	14.35	120.59	35.16	0.00
42	10014.35	107.96	22.83	0.00
44	14.35	122.32	36.64	0.00
8	14.35	120.91	35.31	0.00
9	14.35	122.27	36.33	0.00
29	14.35	122.53	36.42	0.00
43	14.35	122.46	36.72	0.00
45	0.00	124.43	37.41	0.00
PARK1	7.50	118.19	32.71	0.00
1	14.35	122.32	36.09	0.00
7	14.35	122.40	36.20	0.00
11	14.35	119.12	33.60	0.00
14	14.35	110.44	25.53	0.00
16	14.35	118.19	32.71	0.00
19	14.35	121.29	35.51	0.00

Page 4
Node Results at 0:00 Hrs: (continued)

Node ID	Demand LPM	Head m	Pressure m	Quality hours	
24	14.35	121.07	35.32	0.00	
32	14.35	120.95	35.27	0.00	
35	14.35	120.75	34.79	0.00	
41	14.35	120.61	34.93	0.00	
46	14.35	120.46	34.86	0.00	
47	14.35	120.24	34.64	0.00	
48	14.35	114.67	29.41	0.00	
49	14.35	120.16	34.56	0.00	
50	14.35	121.23	35.33	0.00	
51	14.35	121.24	35.46	0.00	
52	14.35	121.74	35.70	0.00	
53	14.35	122.47	36.11	0.00	
54	0.00	126.72	36.84	0.00	
55	14.35	122.85	36.62	0.00	
56	14.35	120.35	35.12	0.00	
57	14.35	119.41	33.95	0.00	
INNES	-9325.16	127.90	0.00	0.00	Reservoir
NTC	-3834.86	120.40	0.00	0.00	Reservoir

Link Results at 0:00 Hrs:

Link ID	Flow LPM	VelocityUnit m/s	Headloss m/km	Status

28	78.98	0.04	0.02	Open
66	6387.17	2.17	32.11	Open
68	-1590.42	0.84	6.13	Open
72	-1604.77	0.85	7.02	Open
77	2218.90	1.18	12.17	Open
79	-689.17	0.16	0.15	Open
80	14.35	0.00	0.00	Open
81	1693.65	0.90	7.38	Open
86	4319.81	1.02	5.49	Open
87	697.45	0.16	0.15	Open
88	-3036.64	1.03	6.58	Open
89	-3377.68	1.15	8.03	Open
97	1532.03	0.52	1.81	Open
98	1025.50	0.35	0.86	Open
99	1025.50	0.35	0.81	Open
100	6896.54	1.63	11.47	Open
101	763.06	0.40	1.46	Open
102	748.71	0.40	1.39	Open
103	-1200.24	0.41	1.13	Open
104	-1704.34	0.58	2.39	Open
106	-62.63	0.03	0.02	Open
107	734.36	0.39	7.09	Open
108	4361.94	1.48	15.61	Open

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Link Results at 0:00 Hrs: (continued)

Link ID	Flow LPM	VelocityUnit m/s	Headloss m/km	Status
109	-76.98	0.04	0.02	Open
111	782.63	0.42	1.67	Open
112	768.28	0.41	1.45	Open
113	753.93	0.40	2.37	Open
114	1853.26	0.63	2.72	Open
115	1186.12	0.40	1.11	Open
117	-1128.87	0.38	1.01	Open
118	-1879.72	0.64	2.79	Open
119	5592.18	1.32	7.16	Open
1	4670.80	1.10	5.37	Open
2	7907.17	1.86	38.34	Open
3	1532.03	0.52	2.02	Open
12	717.87	0.38	1.24	Open
13	932.73	0.49	2.40	Open
14	918.38	0.49	1.95	Open
17	93.33	0.05	0.03	Open

8	5155.12	2.73	52.10	Open
15	20.75	0.01	0.00	Open
19	-5120.02	2.72	54.94	Open
21	4894.33	2.60	55.57	Open
22	3705.33	1.26	11.70	Open
23	7.50	0.00	0.00	Open
24	-3727.18	1.27	11.41	Open
27	-3834.86	1.30	11.08	Open
29	6.40	0.00	0.00	Open
5	-941.21	0.50	2.53	Open
10	-955.56	0.51	2.23	Open
16	-969.91	0.51	2.73	Open
18	-312.35	0.17	0.32	Open
25	-326.70	0.17	0.33	Open
26	1239.21	0.66	4.79	Open
30	1224.86	0.65	5.85	Open
33	955.00	0.51	2.67	Open
34	940.65	0.50	2.43	Open
35	926.30	0.49	2.43	Open
36	255.51	0.14	0.22	Open
37	241.16	0.13	0.18	Open
38	4923.03	2.61	67.48	Open
39	4908.68	2.60	54.59	Open
41	-585.43	0.31	0.99	Open
42	-599.78	0.32	1.22	Open
43	-1127.91	0.60	3.36	Open
44	-1142.26	0.61	3.06	Open
45	1119.68	0.59	3.45	Open
46	1105.33	0.59	3.05	Open
47	-2276.29	1.21	12.71	Open
48	-2290.65	1.22	14.35	Open

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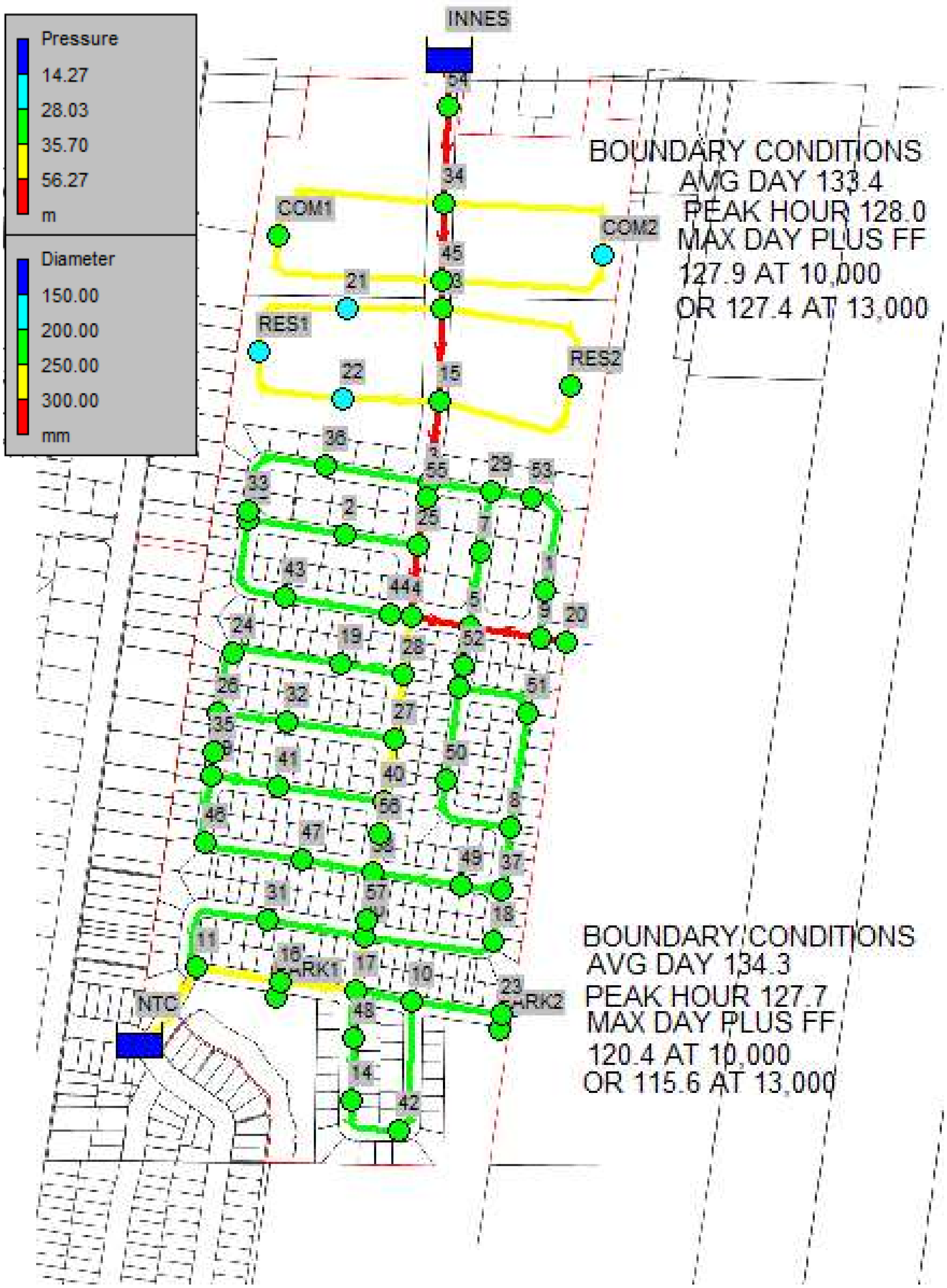
Link Results at 0:00 Hrs: (continued)

Link ID	Flow LPM	VelocityUnit m/s	Headloss m/km	Status
49	746.57	0.40	1.70	Open
50	732.22	0.39	1.39	Open
4	9325.16	2.20	28.88	Open
6	9325.16	2.20	18.51	Open
7	4425.48	1.04	6.30	Open
9	4411.13	1.04	5.00	Open
11	3263.45	1.11	8.13	Open
20	3249.10	1.10	7.92	Open
31	4746.47	1.61	15.66	Open

MAX DAY + FIRE FLOW 13,000 L/min @ RES1



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

Input File: 2018-04-05_881_wtr-Alt1ggm.net

Link - Node Table:

Link ID	Start Node	End Node	Length m	Diameter mm
28	31	30	89.2	200
66	30	17	52.5	250
68	30	18	127.8	200
72	18	37	43.5	200
77	8	37	58.5	200
79	5	9	64.5	300
80	9	20	26.3	300
81	3	29	56.3	200
86	25	4	66.1	300
87	4	5	53.6	300
88	40	27	58.5	250
89	27	28	58.5	250
97	21	RES1	97.1	250
98	RES1	22	96.9	250
99	22	15	83.5	250
100	15	3	73.8	300
101	3	36	95.2	200
102	36	33	111.2	200
103	15	RES2	132.6	250
104	RES2	13	139.8	250
106	12	2	90.5	200
107	33	12	3.2	200
108	4	28	52.6	250
109	2	25	67.4	200
111	12	43	103.3	200
112	43	44	97.6	200
113	44	4	19.2	200
114	34	COM2	173.5	250
115	COM2	45	130.1	250
117	45	COM1	130.1	250
118	COM1	34	173.5	250

119	34	45	86.0	300
1	13	15	90	300
2	45	13	4.1	300
3	13	21	77.9	250
12	1	9	42.5	200
13	29	7	56.9	200

Page 2

Link - Node Table: (continued)

Link ID	Start Node	End Node	Length m	Diameter mm
14	7	5	68	200
17	11	31	115.3	200
8	17	10	51.3	200
15	10	23	59.8	200
19	42	10	123.7	200
21	14	42	44.7	200
22	16	17	64.9	250
23	16	PARK1	13.3	200
24	16	11	81.7	250
27	11	NTC	115.6	250
29	23	PARK2	13.3	200
5	26	24	57.5	200
10	24	19	99.2	200
16	19	28	56.6	200
18	26	32	62.5	200
25	32	27	97.7	200
26	26	35	38	200
30	35	39	20.5	200
33	39	46	63.6	200
34	46	47	90.2	200
35	47	38	65.4	200
36	39	41	62.5	200
37	41	40	97.5	200
38	17	48	40.9	200
39	48	14	77.4	200
41	38	49	81	200
42	49	37	36.8	200
43	8	50	93.5	200
44	50	6	85	200
45	6	51	73.3	200
46	51	8	105.2	200
47	6	52	20	200
48	52	5	36.2	200
49	29	53	38.7	200

50	53	1	101.9	200
4	INNES	54	41	300
6	54	34	90	300
7	3	55	16.2	300
9	55	25	42.3	300
11	40	56	30.3	250
20	56	38	34.2	250
31	38	57	42.3	250
32	57	30	16.2	250

Page 3
Node Results at 0:00 Hrs:

Node ID	Demand LPM	Head m	Pressure m	Quality hours
3	14.35	115.71	29.66	0.00
4	14.35	115.69	29.89	0.00
5	14.35	115.69	29.67	0.00
6	14.35	115.67	29.73	0.00
10	14.35	115.63	30.33	0.00
12	14.35	115.70	29.58	0.00
PARK2	6.40	115.63	30.11	0.00
17	14.35	115.63	30.17	0.00
18	14.35	115.65	30.28	0.00
20	14.35	115.69	29.65	0.00
23	14.35	115.63	30.11	0.00
2	14.35	115.70	29.85	0.00
25	14.35	115.70	29.80	0.00
26	14.35	115.66	29.78	0.00
27	14.35	115.66	30.13	0.00
28	14.35	115.67	30.10	0.00
30	14.35	115.64	30.31	0.00
31	14.35	115.63	30.03	0.00
13	0.00	116.53	29.51	0.00
15	0.00	115.74	29.64	0.00
RES2	504.10	116.01	28.85	0.00
RES1	13506.53	110.96	22.48	0.00
COM1	750.85	117.65	28.05	0.00
COM2	667.14	117.68	27.85	0.00
34	0.00	118.97	29.60	0.00
21	0.00	113.87	25.87	0.00
22	0.00	113.62	25.62	0.00
33	14.35	115.70	29.52	0.00
36	14.35	115.71	29.46	0.00
37	14.35	115.65	30.13	0.00

38	14.35	115.65	29.89	0.00
39	14.35	115.66	29.83	0.00
40	14.35	115.66	30.23	0.00
42	14.35	115.63	30.50	0.00
44	14.35	115.69	30.01	0.00
8	14.35	115.66	30.06	0.00
9	14.35	115.69	29.75	0.00
29	14.35	115.70	29.59	0.00
43	14.35	115.70	29.96	0.00
45	0.00	117.09	30.07	0.00
PARK1	7.50	115.63	30.15	0.00
1	14.35	115.69	29.46	0.00
7	14.35	115.69	29.49	0.00
11	14.35	115.62	30.10	0.00
14	14.35	115.63	30.72	0.00
16	14.35	115.63	30.15	0.00
19	14.35	115.67	29.89	0.00

Page 4
Node Results at 0:00 Hrs: (continued)

Node ID	Demand LPM	Head m	Pressure m	Quality hours	
24	14.35	115.66	29.91	0.00	
32	14.35	115.66	29.98	0.00	
35	14.35	115.66	29.70	0.00	
41	14.35	115.66	29.98	0.00	
46	14.35	115.65	30.05	0.00	
47	14.35	115.65	30.05	0.00	
48	14.35	115.63	30.37	0.00	
49	14.35	115.65	30.05	0.00	
50	14.35	115.67	29.77	0.00	
51	14.35	115.67	29.89	0.00	
52	14.35	115.68	29.64	0.00	
53	14.35	115.70	29.34	0.00	
54	0.00	123.84	33.96	0.00	
55	14.35	115.71	29.48	0.00	
56	14.35	115.65	30.42	0.00	
57	14.35	115.64	30.18	0.00	
INNES	-16568.39	127.40	0.00	0.00	Reservoir
NTC	408.37	115.60	0.00	0.00	Reservoir

Link Results at 0:00 Hrs:

Link ID	Flow LPM	VelocityUnit m/s	Headloss m/km	Status

28	-181.59	0.10	0.10	Open
66	369.83	0.13	0.15	Open
68	-143.27	0.08	0.07	Open
72	-157.62	0.08	0.09	Open
77	242.22	0.13	0.19	Open
79	-61.94	0.01	0.00	Open
80	14.35	0.00	0.00	Open
81	272.62	0.14	0.24	Open
86	648.34	0.15	0.15	Open
87	141.79	0.03	0.01	Open
88	-350.31	0.12	0.12	Open
89	-426.60	0.14	0.17	Open
97	6912.03	2.35	29.97	Open
98	-6594.50	2.24	27.46	Open
99	-6594.50	2.24	25.35	Open
100	1139.77	0.27	0.39	Open
101	132.90	0.07	0.06	Open
102	118.55	0.06	0.05	Open
103	-1654.92	0.56	2.06	Open
104	-2159.02	0.73	3.71	Open
106	-28.51	0.02	0.00	Open
107	104.20	0.06	0.15	Open
108	581.85	0.20	0.35	Open

Page 5
Link Results at 0:00 Hrs: (continued)

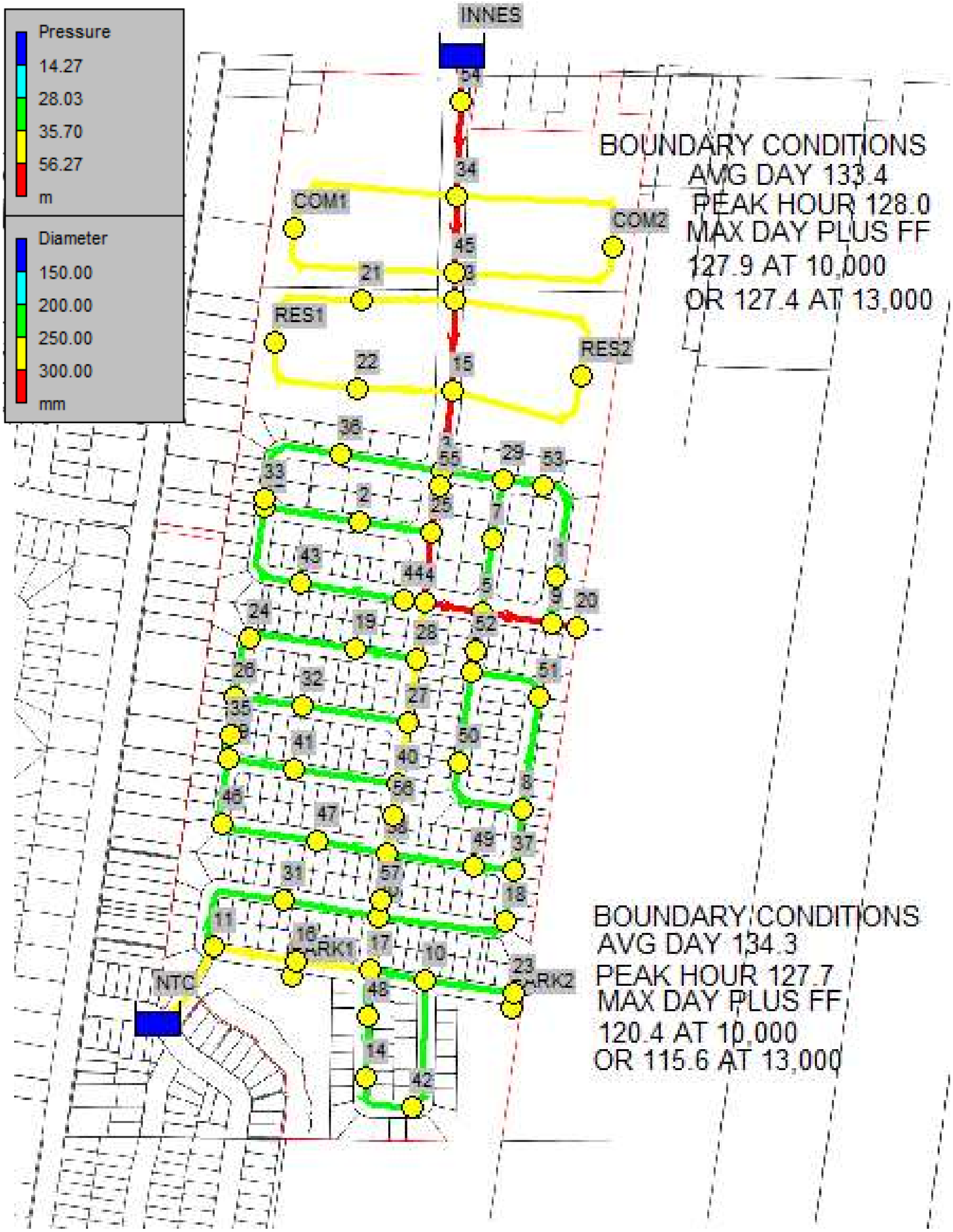
Link ID	Flow LPM	VelocityUnit m/s	Headloss m/km	Status
109	-42.86	0.02	0.01	Open
111	118.36	0.06	0.05	Open
112	104.01	0.06	0.04	Open
113	89.66	0.05	0.04	Open
114	3183.15	1.08	7.47	Open
115	2516.01	0.85	4.48	Open
117	-2462.32	0.84	4.31	Open
118	-3213.17	1.09	7.60	Open
119	10172.07	2.40	21.86	Open
1	6079.35	1.43	8.80	Open
2	15150.40	3.57	136.56	Open
3	6912.03	2.35	34.14	Open
12	90.64	0.05	0.03	Open
13	138.94	0.07	0.07	Open
14	124.59	0.07	0.05	Open
17	-167.24	0.09	0.10	Open

8	43.61	0.02	0.01	Open
15	20.75	0.01	0.00	Open
19	-8.51	0.00	0.00	Open
21	5.84	0.00	0.00	Open
22	-277.33	0.09	0.09	Open
23	7.50	0.00	0.00	Open
24	255.48	0.09	0.07	Open
27	408.37	0.14	0.17	Open
29	6.40	0.00	0.00	Open
5	-112.21	0.06	0.05	Open
10	-126.56	0.07	0.05	Open
16	-140.91	0.07	0.07	Open
18	-47.59	0.03	0.01	Open
25	-61.94	0.03	0.01	Open
26	145.45	0.08	0.08	Open
30	131.10	0.07	0.08	Open
33	105.62	0.06	0.04	Open
34	91.27	0.05	0.03	Open
35	76.92	0.04	0.02	Open
36	11.12	0.01	0.00	Open
37	-3.23	0.00	0.00	Open
38	34.54	0.02	0.01	Open
39	20.19	0.01	0.00	Open
41	-55.90	0.03	0.01	Open
42	-70.25	0.04	0.02	Open
43	-129.16	0.07	0.06	Open
44	-143.51	0.08	0.06	Open
45	141.76	0.08	0.07	Open
46	127.41	0.07	0.05	Open
47	-299.62	0.16	0.28	Open
48	-313.97	0.17	0.34	Open

Page 6
Link Results at 0:00 Hrs: (continued)

Link ID	Flow LPM	VelocityUnit m/s	Headloss m/km	Status
49	119.34	0.06	0.05	Open
50	104.99	0.06	0.04	Open
4	16568.39	3.91	86.82	Open
6	16568.39	3.91	54.08	Open
7	719.90	0.17	0.20	Open
9	705.55	0.17	0.16	Open
11	332.73	0.11	0.11	Open
20	318.38	0.11	0.10	Open
31	436.85	0.15	0.18	Open

PEAK HOUR SCENARIO



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

Input File: 2018-04-05_881_wtr-Alt1ggm.net

Link - Node Table:

Link ID	Start Node	End Node	Length m	Diameter mm
28	31	30	89.2	200
66	30	17	52.5	250
68	30	18	127.8	200
72	18	37	43.5	200
77	8	37	58.5	200
79	5	9	64.5	300
80	9	20	26.3	300
81	3	29	56.3	200
86	25	4	66.1	300
87	4	5	53.6	300
88	40	27	58.5	250
89	27	28	58.5	250
97	21	RES1	97.1	250
98	RES1	22	96.9	250
99	22	15	83.5	250
100	15	3	73.8	300
101	3	36	95.2	200
102	36	33	111.2	200
103	15	RES2	132.6	250
104	RES2	13	139.8	250
106	12	2	90.5	200
107	33	12	3.2	200
108	4	28	52.6	250
109	2	25	67.4	200
111	12	43	103.3	200
112	43	44	97.6	200
113	44	4	19.2	200
114	34	COM2	173.5	250
115	COM2	45	130.1	250
117	45	COM1	130.1	250
118	COM1	34	173.5	250

119	34	45	86.0	300
1	13	15	90	300
2	45	13	4.1	300
3	13	21	77.9	250
12	1	9	42.5	200
13	29	7	56.9	200

Page 2

Link - Node Table: (continued)

Link ID	Start Node	End Node	Length m	Diameter mm
14	7	5	68	200
17	11	31	115.3	200
8	17	10	51.3	200
15	10	23	59.8	200
19	42	10	123.7	200
21	14	42	44.7	200
22	16	17	64.9	250
23	16	PARK1	13.3	200
24	16	11	81.7	250
27	11	NTC	115.6	250
29	23	PARK2	13.3	200
5	26	24	57.5	200
10	24	19	99.2	200
16	19	28	56.6	200
18	26	32	62.5	200
25	32	27	97.7	200
26	26	35	38	200
30	35	39	20.5	200
33	39	46	63.6	200
34	46	47	90.2	200
35	47	38	65.4	200
36	39	41	62.5	200
37	41	40	97.5	200
38	17	48	40.9	200
39	48	14	77.4	200
41	38	49	81	200
42	49	37	36.8	200
43	8	50	93.5	200
44	50	6	85	200
45	6	51	73.3	200
46	51	8	105.2	200
47	6	52	20	200
48	52	5	36.2	200
49	29	53	38.7	200

50	53	1	101.9	200
4	INNES	54	41	300
6	54	34	90	300
7	3	55	16.2	300
9	55	25	42.3	300
11	40	56	30.3	250
20	56	38	34.2	250
31	38	57	42.3	250
32	57	30	16.2	250

Page 3
Node Results at 0:00 Hrs:

Node ID	Demand LPM	Head m	Pressure m	Quality hours
3	31.57	126.95	40.90	0.00
4	31.57	126.96	41.16	0.00
5	31.57	126.96	40.94	0.00
6	31.57	126.97	41.03	0.00
10	31.57	127.15	41.85	0.00
12	31.57	126.95	40.83	0.00
PARK2	11.50	127.15	41.63	0.00
17	31.57	127.15	41.69	0.00
18	31.57	127.05	41.68	0.00
20	31.57	126.95	40.91	0.00
23	31.57	127.15	41.63	0.00
2	31.57	126.95	41.10	0.00
25	31.57	126.95	41.05	0.00
26	31.57	126.99	41.11	0.00
27	31.57	126.99	41.46	0.00
28	31.57	126.97	41.40	0.00
30	31.57	127.10	41.77	0.00
31	31.57	127.20	41.60	0.00
13	0.00	126.96	39.94	0.00
15	0.00	126.95	40.85	0.00
RES2	1109.01	126.92	39.76	0.00
RES1	1114.36	126.90	38.42	0.00
COM1	1618.50	126.94	37.34	0.00
COM2	1438.07	126.96	37.13	0.00
34	0.00	127.13	37.76	0.00
21	0.00	126.93	38.93	0.00
22	0.00	126.93	38.93	0.00
33	31.57	126.95	40.77	0.00
36	31.57	126.95	40.70	0.00
37	31.57	127.03	41.51	0.00

38	31.57	127.03	41.27	0.00
39	31.57	127.00	41.17	0.00
40	31.57	127.00	41.57	0.00
42	31.57	127.15	42.02	0.00
44	31.57	126.95	41.27	0.00
8	31.57	126.99	41.39	0.00
9	31.57	126.95	41.01	0.00
29	31.57	126.95	40.84	0.00
43	31.57	126.95	41.21	0.00
45	0.00	126.97	39.95	0.00
PARK1	13.40	127.24	41.76	0.00
1	31.57	126.95	40.72	0.00
7	31.57	126.95	40.75	0.00
11	31.57	127.35	41.83	0.00
14	31.57	127.15	42.24	0.00
16	31.57	127.24	41.76	0.00
19	31.57	126.98	41.20	0.00

Page 4
Node Results at 0:00 Hrs: (continued)

Node ID	Demand LPM	Head m	Pressure m	Quality hours	
24	31.57	126.98	41.23	0.00	
32	31.57	126.99	41.31	0.00	
35	31.57	126.99	41.03	0.00	
41	31.57	127.00	41.32	0.00	
46	31.57	127.01	41.41	0.00	
47	31.57	127.02	41.42	0.00	
48	31.57	127.15	41.89	0.00	
49	31.57	127.03	41.43	0.00	
50	31.57	126.98	41.08	0.00	
51	31.57	126.98	41.20	0.00	
52	31.57	126.97	40.93	0.00	
53	31.57	126.95	40.59	0.00	
54	0.00	127.65	37.77	0.00	
55	31.57	126.95	40.72	0.00	
56	31.57	127.02	41.79	0.00	
57	31.57	127.08	41.62	0.00	
INNES	-4959.37	128.00	0.00	0.00	Reservoir
NTC	-1923.97	127.70	0.00	0.00	Reservoir

Link Results at 0:00 Hrs:

Link ID	Flow LPM	VelocityUnit m/s	Headloss m/km	Status

28	651.35	0.35	1.03	Open
66	-963.59	0.33	0.91	Open
68	395.22	0.21	0.46	Open
72	363.65	0.19	0.43	Open
77	-440.38	0.23	0.59	Open
79	165.37	0.04	0.01	Open
80	31.57	0.01	0.00	Open
81	-89.07	0.05	0.03	Open
86	-394.04	0.09	0.06	Open
87	27.53	0.01	0.00	Open
88	560.39	0.19	0.28	Open
89	504.84	0.17	0.23	Open
97	595.50	0.20	0.31	Open
98	-518.86	0.18	0.24	Open
99	-518.86	0.18	0.23	Open
100	-320.57	0.08	0.04	Open
101	5.12	0.00	0.00	Open
102	-26.45	0.01	0.00	Open
103	517.94	0.18	0.24	Open
104	-591.07	0.20	0.33	Open
106	-31.14	0.02	0.00	Open
107	-58.02	0.03	0.05	Open
108	-574.73	0.20	0.34	Open

Page 5
Link Results at 0:00 Hrs: (continued)

Link ID	Flow LPM	VelocityUnit m/s	Headloss m/km	Status
109	-62.71	0.03	0.02	Open
111	-58.45	0.03	0.01	Open
112	-90.02	0.05	0.03	Open
113	-121.59	0.06	0.07	Open
114	1094.02	0.37	1.02	Open
115	-344.05	0.12	0.11	Open
117	482.97	0.16	0.21	Open
118	-1135.53	0.39	1.09	Open
119	2729.83	0.64	1.88	Open
1	716.23	0.17	0.16	Open
2	1902.80	0.45	2.39	Open
3	595.50	0.20	0.34	Open
12	-102.23	0.05	0.03	Open
13	-81.54	0.04	0.03	Open
14	-113.11	0.06	0.04	Open
17	682.92	0.36	1.32	Open

8	94.15	0.05	0.03	Open
15	43.07	0.02	0.01	Open
19	-19.51	0.01	0.00	Open
21	12.06	0.01	0.00	Open
22	1164.51	0.40	1.32	Open
23	13.40	0.01	0.00	Open
24	-1209.48	0.41	1.37	Open
27	-1923.97	0.65	3.04	Open
29	11.50	0.01	0.00	Open
5	164.60	0.09	0.10	Open
10	133.03	0.07	0.06	Open
16	101.46	0.05	0.04	Open
18	7.59	0.00	0.00	Open
25	-23.98	0.01	0.00	Open
26	-203.76	0.11	0.16	Open
30	-235.33	0.12	0.25	Open
33	-188.47	0.10	0.13	Open
34	-220.04	0.12	0.16	Open
35	-251.61	0.13	0.21	Open
36	-78.42	0.04	0.02	Open
37	-109.99	0.06	0.04	Open
38	75.20	0.04	0.03	Open
39	43.63	0.02	0.01	Open
41	139.87	0.07	0.07	Open
42	108.30	0.06	0.05	Open
43	206.25	0.11	0.14	Open
44	174.68	0.09	0.09	Open
45	-170.99	0.09	0.10	Open
46	-202.56	0.11	0.13	Open
47	314.10	0.17	0.31	Open
48	282.53	0.15	0.28	Open

Page 6
Link Results at 0:00 Hrs: (continued)

Link ID	Flow LPM	VelocityUnit m/s	Headloss m/km	Status
49	-39.09	0.02	0.01	Open
50	-70.66	0.04	0.02	Open
4	4959.37	1.17	8.64	Open
6	4959.37	1.17	5.70	Open
7	-268.19	0.06	0.03	Open
9	-299.76	0.07	0.03	Open
11	-701.96	0.24	0.46	Open
20	-733.53	0.25	0.49	Open
31	-1156.58	0.39	1.12	Open

APPENDIX C
Sanitary Sewer Information

PROJECT #: 121214
PROJECT NAME: 3484 INNES ROAD
LOCATION: OTTAWA, ONTARIO

NOVATECH
Engineers, Planners & Landscape Architects

DATE PREPARED: September 2021

Sanitary Design Sheet

LOCATION			RESIDENTIAL						INFILTRATION			Total Flow (l/s)	PIPE					
					TOTAL													
AREA	FROM	TO	No. of Units	Pop.	Pop.	Accum. Pop.	Peak Factor	Peak Flow (l/s)	Total Area (ha)	Accum. Area (ha)	Infilt. Flow (l/s)		Size (mm)	Slope (%)	Length (m)	Capacity (l/s)	Full Flow Vel. (m/s)	Q/Q_{full} (%)
1			873	1571	1571	1571	3.1	15.95	5.204	5.204	1.72	**17.66**						

Design Parameters:

City of Ottawa Sewer Design Guidelines (Apendix 4-A)

- Average Appartment 1.8 Person/unit
- Residntial average flow 280 l/ person/day

APPENDIX D

Sanitary Sewer Design Sheet (DSEL, May 2018)

Sanitary Drainage Area Plans (May 2018)

External Sanitary Drainage Plan (DSEL, January 2018)

External Sanitary Drainage Plan (DSEL, January 2018)

EUC MUC CDP Development Statistic Assumptions (DSEL, June 2017)

Comparison of MSU, Servicing Report, and FSR Sanitary Designs (DSEL, August 2017)

SANITARY SEWER CALCULATION SHEET

Ottawa

Manning's n=0.013

LOCATION			RESIDENTIAL AREA AND POPULATION							COMM		INSTIT		PARK		C+I+I	INFILTRATION				PIPE						
STREET	FROM M.H.	TO M.H.	AREA (ha)	UNITS	POP.	CUMULATIVE AREA (ha)	CUMULATIVE POP.	PEAK FACT.	PEAK FLOW (l/s)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	PEAK FLOW (l/s)	TOTAL AREA (ha)	ACCU. AREA (ha)	INFILT. FLOW (l/s)	TOTAL FLOW (l/s)	DIST (m)	DIA (mm)	SLOPE (%)	CAP. (FULL) (l/s)	RATIO Q act/Q cap	VEL. (FULL) (m/s)	VEL. (ACT.) (m/s)
Rang de Loury Row - 03																											
	200A	19A	0.42		44	0.42	44	3.66	0.52								0.42	0.42	0.14	0.66	77.50	200	0.90	31.12	0.02	0.99	0.39
To Chemin de Jargeau Road, Pipe 19A - 34A						0.42	44											0.42									
	200A	20A	0.18		17	0.18	17	3.71	0.20								0.18	0.18	0.06	0.26	40.50	200	0.65	26.44	0.01	0.84	0.27
To Cours Crevier Walk, Pipe 20A - 24A						0.18	17											0.18									
Cercle de l'Argonaut Circle - 12																											
	27A	26A	0.08		4	0.08	4	3.76	0.05								0.08	0.08	0.03	0.08	10.00	200	0.65	26.44	0.00	0.84	0.05
			0.05		4	0.13	8										0.05	0.13									
	26A	25A	0.41		44	0.54	52	3.65	0.62								0.41	0.54	0.18	0.80	71.00	200	0.65	26.44	0.03	0.84	0.37
	25A	24A	0.38		38	0.92	90	3.60	1.05								0.38	0.92	0.30	1.35	74.00	200	0.35	19.40	0.07	0.62	0.35
To Avenue de Lamarche Avenue, Pipe 24A - 21A						0.92	90											0.92									
	27A	29A	0.23		17	0.23	17	3.71	0.20								0.23	0.23	0.08	0.28	51.50	200	0.65	26.44	0.01	0.84	0.27
	29A	30A	0.26		14	0.49	31	3.68	0.37								0.26	0.49	0.16	0.53	51.50	200	0.60	25.41	0.02	0.81	0.32
	30A	31A	0.18		11	0.67	42	3.66	0.50								0.18	0.67	0.22	0.72	11.00	200	0.35	19.40	0.04	0.62	0.30
	31A	32A	0.38		34	1.05	76	3.62	0.89								0.38	1.05	0.35	1.24	65.50	200	0.35	19.40	0.06	0.62	0.34
	32A	34A	0.39		34	1.44	110	3.59	1.28								0.39	1.44	0.48	1.76	81.50	200	0.35	19.40	0.09	0.62	0.38
To Avenue de Lamarche Avenue, Pipe 34A - 35A						1.44	110											1.44									
Placette de Darvoy Mews - 13																											
	29A	28A	0.37		38	0.37	38	3.67	0.45								0.37	0.37	0.12	0.57	71.50	200	0.75	28.40	0.02	0.90	0.35
	28A	21A	0.42		44	0.79	82	3.61	0.96								0.42	0.79	0.26	1.22	80.50	200	0.35	19.40	0.06	0.62	0.34
To Avenue de Lamarche Avenue, Pipe 21A - 33A						0.79	82											0.79									
Croissant des Aubrais Crescent - 10																											
	8A	9A	0.55		41	0.55	41	3.67	0.49								0.55	0.55	0.18	0.67	75.00	200	0.65	26.44	0.03	0.84	0.37
	9A	35A	0.30		24	0.85	65	3.63	0.76								0.30	0.85	0.28	1.04	72.50	200	0.35	19.40	0.05	0.62	0.32
To Avenue de Lamarche Avenue, Pipe 35A - 36A						0.85	65											0.85									
	8A	7A	0.13		7	0.13	7	3.74	0.08								0.13	0.13	0.04	0.12	10.00	200	0.65	26.44	0.00	0.84	0.05
	7A	38A	0.23		14	0.36	21	3.70	0.25								0.23	0.36	0.12	0.37	51.50	200	0.35	19.40	0.02	0.62	0.24
To Bois de Cravant Grove, Pipe 38A - 37A						0.36	21											0.36									
	38A	40A	0.25		17	0.25	17	3.71	0.20								0.25	0.25	0.08	0.28	59.00	200	0.65	26.44	0.01	0.84	0.27
	40A	41A	0.22		14	0.47	31	3.68	0.37								0.22	0.47	0.16	0.53	51.50	200	0.35	19.40	0.03	0.62	0.27
	41A	42A	0.14		7	0.61	38	3.67	0.45								0.14	0.61	0.20	0.65	10.00	200	0.35	19.40	0.03	0.62	0.27
	42A	43A	0.40		34	1.01	72	3.62	0.84								0.40	1.01	0.33	1.17	69.00	200	0.35	19.40	0.06	0.62	0.34
	43A	52A	0.36		31	1.37	103	3.59	1.20								0.36	1.37	0.45	1.65	78.00	200	0.35	19.40	0.09	0.62	0.38
To Avenue de Lamarche Avenue, Pipe 52A - 53A						1.37	103											1.37									
Bois de Cravant Grove - 14																											
Contribution From Croissant des Aubrais Crescent, Pipe 7A - 38A						0.36	21										0.36	0.36									
	38A	37A	0.39		34	0.75	55	3.64	0.65								0.39	0.75	0.25	0.90	69.50	200	0.35	19.40	0.05	0.62	0.32
	37A	36A	0.34		28	1.09	83	3.61	0.97								0.34	1.09	0.36	1.33	85.00	200	0.35	19.40	0.07	0.62	0.35
To Avenue de Lamarche Avenue, Pipe 36A - 44A						1.09	83											1.09									

LICENSED PROFESSIONAL ENGINEER
M. ZURAVEVSKI
100130902
18-05-17
PROVINCE OF ONTARIO

DESIGN PARAMETERS

Park Flow =	9300	L/ha/da	0.10764	l/s/Ha
Average Daily Flow =	280	l/p/day		
Comm/Inst Flow =	28000	L/ha/da	0.5787	l/s/Ha
Industrial Flow =	35000	L/ha/da	0.40509	l/s/Ha
Max Res. Peak Factor =	4.00			
Commercial/Inst./Park Peak Factor =	1.00			
Institutional =	0.32	l/s/Ha		

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

Designed: P.P	PROJECT: ORLEANS VILLAGE		
Checked: M.Z	LOCATION: City of Ottawa		
Dwg. Reference: Sanitary Drainage Plan, Dwgs. No.	File Ref: 16-881	Date: 2018-05-10	Sheet No. 1 of 4

881_SAN2.xlsx

SANITARY SEWER CALCULATION SHEET

Ottawa

Manning's n=0.013

LOCATION			RESIDENTIAL AREA AND POPULATION							COMM		INSTIT		PARK		C+I+I	INFILTRATION				PIPE						
STREET	FROM M.H.	TO M.H.	AREA (ha)	UNITS	POP.	CUMULATIVE AREA (ha)	CUMULATIVE POP.	PEAK FACT.	PEAK FLOW (l/s)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	PEAK FLOW (l/s)	TOTAL AREA (ha)	ACCU. AREA (ha)	INFILT. FLOW (l/s)	TOTAL FLOW (l/s)	DIST (m)	DIA (mm)	SLOPE (%)	CAP. (FULL) (l/s)	RATIO Q act/Q cap	VEL. (FULL) (m/s)	VEL. (ACT.) (m/s)
Place de Sandillon Place - 11																											
	40A	39A	0.38		34	0.38	34	3.68	0.41								0.38	0.38	0.13	0.54	69.50	200	0.65	26.44	0.02	0.84	0.33
	39A	44A	0.34		28	0.72	62	3.64	0.73								0.34	0.72	0.24	0.97	85.00	200	0.40	20.74	0.05	0.66	0.34
To Avenue de Lamarche Avenue, Pipe 44A - 52A						0.72	62											0.72									
Cours Crevier Walk- 02																											
	18A	17A	0.07		6	0.07	6	3.75	0.07								0.07	0.07	0.02	0.09	10.00	200	0.65	26.44	0.00	0.84	0.05
	17A	16A	0.65		65	0.72	71	3.63	0.84								0.65	0.72	0.24	1.08	111.50	200	0.35	19.40	0.06	0.62	0.34
To Chemin de Jargeau Road, Pipe 16A - 19A						0.72	71											0.72									
	18A	20A	0.19		17	0.19	17	3.71	0.20								0.19	0.19	0.06	0.26	51.50	200	0.80	29.34	0.01	0.93	0.30
Contribution From Rang de Loury Row, Pipe 200A - 20A						0.18	17										0.18	0.37									
	20A	24A	0.20		17	0.57	51	3.65	0.60								0.20	0.57	0.19	0.79	62.50	200	0.45	22.00	0.04	0.70	0.34
To Avenue de Lamarche Avenue, Pipe 24A - 21A						0.57	51											0.57									
Chemin de Jargeau Road - 04																											
	10A	16A	0.12		7	0.12	7	3.74	0.08								0.12	0.12	0.04	0.12	26.50	200	0.65	26.44	0.00	0.84	0.05
Contribution From Cours Crevier Walk, Pipe 17A - 16A						0.72	71										0.72	0.84									
	16A	19A	0.23		14	1.07	92	3.60	1.07								0.23	1.07	0.35	1.42	58.50	200	0.35	19.40	0.07	0.62	0.35
Contribution From Rang de Loury Row, Pipe 200A - 19A						0.42	44										0.42	1.49									
	19A	34A	0.11		1	1.60	137	3.56	1.58								0.11	1.60	0.53	2.11	59.00	200	0.35	19.40	0.11	0.62	0.40
To Avenue de Lamarche Avenue, Pipe 34A - 35A						1.60	137											1.60									
Voie de Lesage Way - 05																											
	190A	15A	0.21		14	0.21	14	3.72	0.17								0.21	0.21	0.07	0.24	42.50	200	0.65	26.44	0.01	0.84	0.27
	15A	14A	0.60		55	0.81	69	3.63	0.81								0.60	0.81	0.27	1.08	106.50	200	0.35	19.40	0.06	0.62	0.34
	14A	13A	0.13		7	0.94	76	3.62	0.89								0.13	0.94	0.31	1.20	11.50	200	0.35	19.40	0.06	0.62	0.34
	13A	45A	0.16		11	1.10	87	3.61	1.02								0.16	1.10	0.36	1.38	49.00	200	0.35	19.40	0.07	0.62	0.35
To Terrase de Vennecy Terrace, Pipe 45A - 47A						1.10	87											1.10									
Terrase de Vennecy Terrace - 06																											
	15A	11A	0.15		11	0.15	11	3.73	0.13								0.15	0.15	0.05	0.18	49.00	200	0.65	26.44	0.01	0.84	0.27
	11A	12A	0.11		7	0.26	18	3.71	0.22								0.11	0.26	0.09	0.31	11.50	200	0.35	19.40	0.02	0.62	0.24
	12A	45A	0.64		55	0.90	73	3.62	0.86								0.64	0.90	0.30	1.16	106.50	200	0.35	19.40	0.06	0.62	0.34
Contribution From Voie de Lesage Way, Pipe 13A - 45A						1.10	87										1.10	2.00									
	45A	47A	0.43		31	2.43	191	3.52	2.18								0.43	2.43	0.80	2.98	111.00	250	0.30	32.57	0.09	0.66	0.41
	47A	48A	0.12		7	2.55	198	3.52	2.26								0.12	2.55	0.84	3.10	10.50	250	0.30	32.57	0.10	0.66	0.42
	48A	53A	0.59		55	3.14	253	3.49	2.86								0.59	3.14	1.04	3.90	108.50	250	0.30	32.57	0.12	0.66	0.44
To Avenue de Lamarche Avenue, Pipe 53A - 55A						3.14	253											3.14									
Ruelle de Carden Lane - 07																											
	46A	52A	0.56		48	0.56	48	3.65	0.57								0.56	0.56	0.18	0.75	105.50	200	0.65	26.44	0.03	0.84	0.37
To Avenue de Lamarche Avenue, Pipe 52A - 53A						0.56	48											0.56									

LICENSED PROFESSIONAL ENGINEER
M. ZDRAVEVSKI
100130902
18-05-17
PROVINCE OF ONTARIO

DESIGN PARAMETERS

Park Flow =	9300	L/ha/da	0.10764	l/s/Ha				
Average Daily Flow =	280	l/p/day			Industrial Peak Factor = as per MOE Graph			
Comm/Inst Flow =	28000	L/ha/da	0.5787	l/s/Ha	Extraneous Flow =		0.330	L/s/ha
Industrial Flow =	35000	L/ha/da	0.40509	l/s/Ha	Minimum Velocity =		0.600	m/s
Max Res. Peak Factor =	4.00				Manning's n =	(Conc)	0.013	(Pvc) 0.013
Commercial/Inst./Park Peak Factor =	1.00				Townhouse coeff=		2.7	
Institutional =	0.32	l/s/Ha			Single house coeff=		3.4	

Designed: P.P	PROJECT: ORLEANS VILLAGE			
Checked: M.Z	LOCATION: City of Ottawa			
Dwg. Reference: Sanitary Drainage Plan, Dwgs. No.	File Ref: 16-881	Date: 2018-05-10	Sheet No. 2 of 4	

881_SAN2.xlsx

SANITARY SEWER CALCULATION SHEET

Ottawa

Manning's n=0.013

LOCATION: STREET	FROM M.H.	TO M.H.	RESIDENTIAL AREA AND POPULATION: AREA (ha)	UNITS	POP.	CUMULATIVE AREA (ha)	CUMULATIVE POP.	PEAK FACT.	PEAK FLOW (l/s)	COMM AREA (ha)	COMM ACCU. AREA (ha)	INSTIT AREA (ha)	INSTIT ACCU. AREA (ha)	PARK AREA (ha)	PARK ACCU. AREA (ha)	C+I+I PEAK FLOW (l/s)	INFILTRATION TOTAL AREA (ha)	ACCU. AREA (ha)	INFILT. FLOW (l/s)	TOTAL FLOW (l/s)	PIPE DIST (m)	DIA (mm)	SLOPE (%)	CAP. (FULL) (l/s)	RATIO Q act/Q cap	VEL. (FULL) (m/s)	VEL. (ACT.) (m/s)
Croissant de Mercier Crescent- 09																											
	4A	5A	0.13		7	0.13	7	3.74	0.08								0.13	0.13	0.04	0.12	11.00	200	0.95	31.97	0.00	1.02	0.06
	5A	6A	0.61		48	0.74	55	3.64	0.65								0.61	0.74	0.24	0.89	106.50	200	0.50	23.19	0.04	0.74	0.36
To Cercle du Ponthieu Circle, Pipe 6A - 55A						0.74	55											0.74									
	4A	3A	0.21		11	0.21	11	3.73	0.13								0.21	0.21	0.07	0.20	42.00	200	0.65	26.44	0.01	0.84	0.27
	3A	2A	0.08		4	0.29	15	3.72	0.18								0.08	0.29	0.10	0.28	10.50	200	0.35	19.40	0.01	0.62	0.20
	2A	54A	0.60		51	0.89	66	3.63	0.78								0.60	0.89	0.29	1.07	100.50	200	0.35	19.40	0.06	0.62	0.34
	54A	55A	0.05		4	0.94	70	3.63	0.82								0.05	0.94	0.31	1.13	13.50	200	0.35	19.40	0.06	0.62	0.34
To Cercle du Ponthieu Circle, Pipe 55A - 58A						0.94	70											0.94									
Avenue de Lamarche Avenue - 01																											
			0.60		1	0.60	1			2.54	2.54						3.14	3.14									
			2.54		1222	3.14	1223			2.86	5.40						5.40	8.54									
	22A	230A	2.86		1376	6.00	2599	3.00	25.27		5.40					1.75	2.86	11.40	3.76	30.78	76.50	250	1.20	65.14	0.47	1.33	1.30
	230A	23A	0.15		1	6.15	2600	3.00	25.28		5.40					1.75	0.15	11.55	3.81	30.84	63.50	250	0.85	54.83	0.56	1.12	1.15
			0.13		1	6.28	2601				5.40						0.13	11.68									
			2.16		1039	8.44	3640				5.40						2.16	13.84									
	23A	24A	2.17		1044	10.61	4684	2.82	42.81		5.40					1.75	2.17	16.01	5.28	49.84	59.50	375	0.29	94.42	0.53	0.85	0.86
Contribution From Cours Crevier Walk, Pipe 20A - 24A						0.57	51										0.57	16.58									
Contribution From Cercle de l'Argonaut Circle, Pipe 25A - 24A						0.92	90										0.92	17.50									
	24A	21A	0.23		17	12.33	4842	2.81	44.09		5.40					1.75	0.23	17.73	5.85	51.69	58.50	375	0.30	96.03	0.54	0.87	0.89
Contribution From Placette de Darvoy Mews, Pipe 28A - 21A						0.79	82										0.79	18.52									
	21A	33A	0.19		14	13.31	4938	2.80	44.81		5.40					1.75	0.19	18.71	6.17	52.73	42.50	375	0.20	78.41	0.67	0.71	0.76
	33A	34A	0.03		1	13.34	4939	2.80	44.82		5.40					1.75	0.03	18.74	6.18	52.75	17.00	375	0.42	113.63	0.46	1.03	1.01
Contribution From Chemin de Jargeau Road, Pipe 19A - 34A						1.60	137										1.60	20.34									
Contribution From Cercle de l'Argonaut Circle, Pipe 32A - 34A						1.44	110										1.44	21.78									
	34A	35A	0.29		24	16.67	5210	2.78	46.94		5.40					1.75	0.29	22.07	7.28	55.97	59.00	375	0.20	78.41	0.71	0.71	0.77
Contribution From Croissant des Aubrais Crescent, Pipe 9A - 35A						0.85	65										0.85	22.92									
	35A	36A	0.31		28	17.83	5303	2.78	47.78		5.40					1.75	0.31	23.23	7.67	57.20	58.50	375	0.20	78.41	0.73	0.71	0.77
Contribution From Bois de Cravant Grove, Pipe 37A - 36A						1.09	83										1.09	24.32									
	36A	44A	0.32		28	19.24	5414	2.77	48.60		5.40					1.75	0.32	24.64	8.13	58.48	58.50	375	0.20	78.41	0.75	0.71	0.78
Contribution From Place de Sandillon Place, Pipe 39A - 44A						0.72	62										0.72	25.36									
	44A	52A	0.29		24	20.25	5500	2.77	49.37		5.40					1.75	0.29	25.65	8.46	59.58	58.50	450	0.15	110.42	0.54	0.69	0.70
Contribution From Croissant des Aubrais Crescent, Pipe 43A - 52A						1.37	103										1.37	27.02									
Contribution From Ruelle de Carden Lane, Pipe 46A - 52A						0.56	48										0.56	27.58									
	52A	53A	0.09		1	22.27	5652	2.76	50.55		5.40					1.75	0.09	27.67	9.13	61.43	58.50	450	0.15	110.42	0.56	0.69	0.71
Contribution From Terrase de Vennecy Terrace, Pipe 48A - 53A						3.14	253										3.14	30.81									
Contribution From Cercle du Ponthieu Circle, Pipe 51A - 53A						0.80	69										0.80	31.61									
	53A	55A	0.09		1	26.30	5975	2.74	53.06		5.40					1.75	0.09	31.70	10.46	65.27	61.50	450	0.15	110.42	0.59	0.69	0.72
To Cercle du Ponthieu Circle, Pipe 55A - 58A						26.30	5975				5.40							31.70									

LICENSED PROFESSIONAL ENGINEER
M. ZDRAVEVSKI
100130902
10.05.17
PROVINCE OF ONTARIO

DESIGN PARAMETERS

Park Flow =	9300	L/ha/da	0.10764	l/s/Ha	
Average Daily Flow =	280	l/p/day			Industrial Peak Factor = as per MOE Graph
Comm/Inst Flow =	28000	L/ha/da	0.5787	l/s/Ha	Extraneous Flow = 0.330 L/s/ha
Industrial Flow =	35000	L/ha/da	0.40509	l/s/Ha	Minimum Velocity = 0.600 m/s
Max Res. Peak Factor =	4.00				Manning's n = (Conc) 0.013 (Pvc) 0.013
Commercial/Inst./Park Peak Factor =	1.00				Townhouse coeff= 2.7
Institutional =	0.32	l/s/Ha			Single house coeff= 3.4

Designed: P.P

Checked: M.Z

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

PROJECT: ORLEANS VILLAGE

LOCATION: City of Ottawa

File Ref: 16-881

Date: 2018-05-10

Sheet No. 3 of 4

881_SAN2.xlsx

SANITARY SEWER CALCULATION SHEET

Ottawa

Manning's n=0.013

LOCATION			RESIDENTIAL AREA AND POPULATION							COMM		INSTIT		PARK		C+I+I	INFILTRATION				PIPE						
STREET	FROM M.H.	TO M.H.	AREA (ha)	UNITS	POP.	CUMULATIVE AREA (ha)	CUMULATIVE POP.	PEAK FACT.	PEAK FLOW (l/s)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	PEAK FLOW (l/s)	TOTAL AREA (ha)	ACCU. AREA (ha)	INFILT. FLOW (l/s)	TOTAL FLOW (l/s)	DIST (m)	DIA (mm)	SLOPE (%)	CAP. (FULL) (l/s)	RATIO Q act/Q cap	VEL. (FULL) (m/s)	VEL. (ACT.) (m/s)
Cercle du Ponthieu Circle - 08																											
	50A	51A	0.25		21	0.25	21	3.70	0.25								0.25	0.25	0.08	0.33	41.50	200	0.70	27.44	0.01	0.87	0.28
	51A	53A	0.55		48	0.80	69	3.63	0.81								0.55	0.80	0.26	1.07	98.50	200	0.55	24.32	0.04	0.77	0.37
To Avenue de Lamarche Avenue, Pipe 53A - 55A						0.80	69											0.80									
	490A	49A	0.14		7	0.14	7	3.74	0.08								0.14	0.14	0.05	0.13	11.00	200	0.65	26.44	0.00	0.84	0.05
	49A	57A	0.24		14	0.38	21	3.70	0.25								0.24	0.38	0.13	0.38	50.50	200	0.35	19.40	0.02	0.62	0.24
	57A	58A	0.09		4	0.47	25	3.69	0.30								0.09	0.47	0.16	0.46	14.00	200	0.35	19.40	0.02	0.62	0.24
To Nature Trail Crescent, Pipe 58A - 59A						0.47	25											0.47									
Rue de Beaugency Street - 08																											
	500A	501A	0.33		24	0.33	24	3.70	0.29					0.65	0.65	0.07	0.98	0.98	0.32	0.68	62.50	200	0.65	26.44	0.03	0.84	0.37
	501A	502A	0.19		14	0.52	38	3.67	0.45						0.65	0.07	0.19	1.17	0.39	0.91	78.50	200	0.35	19.40	0.05	0.62	0.32
	502A	55A				0.52	38	3.67	0.45						0.65	0.07	0.00	1.17	0.39	0.91	2.50	200	1.65	42.13	0.02	1.34	0.52
Cercle du Ponthieu Circle - 08																											
	503A	504A	0.25		17	0.25	17	3.71	0.20								0.25	0.25	0.08	0.28	57.50	200	0.65	26.44	0.01	0.84	0.27
	504A	505A	0.26		17	0.51	34	3.68	0.41					0.77	0.77	0.08	1.03	1.28	0.42	0.91	69.50	200	0.50	23.19	0.04	0.74	0.36
	505A	58A				0.51	34	3.68	0.41						0.77	0.08	0.00	1.28	0.42	0.91	3.00	200	1.00	32.80	0.03	1.04	0.46
To Nature Trail Crescent, Pipe 58A - 59A						0.51	34								0.77			1.28									
	1A	6A	63.57		6462	63.57	6462	2.71	56.75	53.65	53.65			10.45	10.45	18.51	127.67	127.67	42.13	117.39	88.50	675	0.11	278.79	0.42	0.78	0.74
Contribution From Croissant de Mercier Crescent, Pipe 5A - 6A						0.74	55										0.74	128.41									
	6A	55A				64.31	6517	2.71	57.23		53.65				10.45	18.51	0.00	128.41	42.38	118.12	57.00	675	0.11	278.79	0.42	0.78	0.74
Contribution From Avenue de Lamarche Avenue, Pipe 53A - 55A						26.30	5975				5.40						31.70	160.11									
Contribution From Croissant de Mercier Crescent, Pipe 54A - 55A						0.94	70										0.94	161.05									
	55A	58A				92.07	12600	2.48	101.27		59.05				11.10	20.33	0.00	161.05	53.15	174.75	143.00	675	0.11	278.79	0.63	0.78	0.83
To Sanitary Easement, Pipe 58A - 59A						92.07	12600				59.05				11.10			161.05									
Sanitary Easement - 20																											
Contribution From Cercle du Ponthieu Circle, Pipe 505A - 58A						0.51	34								0.77		1.28	1.28		0.00							
Contribution From Cercle du Ponthieu Circle, Pipe 55A - 58A						92.07	12600				59.05				11.10		161.05	162.33		0.00							
Contribution From Cercle du Ponthieu Circle, Pipe 57A - 58A						0.47	25										0.47	162.80									
	58A	59A	0.07		1	93.12	12660	2.48	101.75		59.05				11.87	20.41	0.07	162.87	53.75	175.91	48.00	675	0.11	278.79	0.63	0.78	0.83
			0.01		1	93.13	12661				59.05				11.87		0.01	162.88									
	59A	60A	0.05		1	93.18	12662	2.48	101.76		59.05				11.87	20.41	0.05	162.93	53.77	175.94	33.00	675	0.11	278.79	0.63	0.78	0.83
To Nature Trail Crescent, Pipe 60A - 61A						93.18	12662				59.05				11.87			162.93		0.00							
Nature Trail Crescent - 21																											
Contribution From Sanitary Easement, Pipe 59A - 60A						93.18	12662				59.05				11.87		162.93	162.93		0.00							
			0.06		4	93.24	12666				59.05				11.87		0.06	162.99									
	60A	61A	1.47		82	94.71	12748	2.48	102.46		59.05				11.87	20.41	1.47	164.46	54.27	177.14	11.00	675	0.11	278.79	0.64	0.78	0.83
	61A	62A	0.59		47	95.30	12795	2.48	102.83		59.05				11.87	20.41	0.59	165.05	54.47	177.71	73.50	675	0.11	278.79	0.64	0.78	0.83

LICENSED PROFESSIONAL ENGINEER
M. ZDRAVEVSKI
100130902
18-05-17
PROVINCE OF ONTARIO

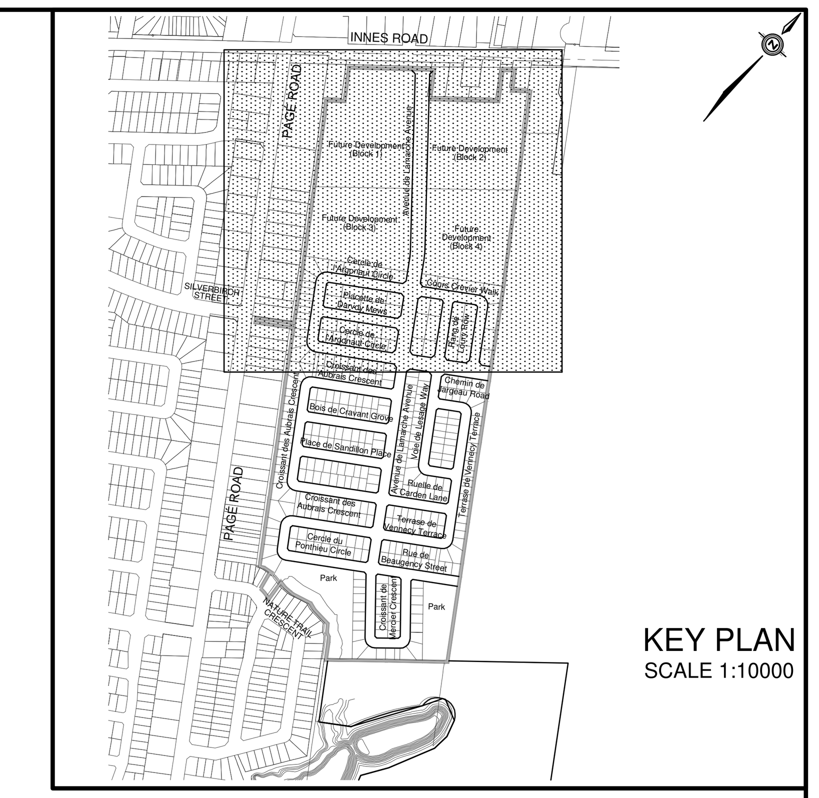
DESIGN PARAMETERS

Park Flow =	9300	L/ha/da	0.10764	l/s/Ha
Average Daily Flow =	280	l/p/day		
Comm/Inst Flow =	28000	L/ha/da	0.5787	l/s/Ha
Industrial Flow =	35000	L/ha/da	0.40509	l/s/Ha
Max Res. Peak Factor =	4.00			
Commercial/Inst./Park Peak Factor =	1.00			
Institutional =	0.32	l/s/Ha		

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

Designed: P.P	PROJECT: ORLEANS VILLAGE
Checked: M.Z	LOCATION: City of Ottawa
Dwg. Reference: Sanitary Drainage Plan, Dwgs. No.	File Ref: 16-881
Date: 2018-05-10	Sheet No. 4 of 4

881 SAN2.xlsx



LEGEND

- SANITARY DRAINAGE BOUNDARY
- SANITARY SUB–DRAINAGE BOUNDARY
- SANITARY DRAINAGE BOUNDARY (OTHER PHASES)
- UPSTREAM MH TO DOWNSTREAM MH / AREA IN HECTARES / POPULATION (43A - 44A, 0.78, 61)
- UPSTREAM MH TO DOWNSTREAM MH / AREA IN OTHER PHASES IN HECTARES / POPULATION (43A–44A, 0.78, 61)
- EXTERNAL AREA IN HECTARES / EXTERNAL POPULATION / DENSITY (PERSONS/HECTARE) / EXTERNAL LAND USE (A=53.63, 107, POP=5739, RESIDENTIAL)
- MAINTENANCE HOLE (200mm SAN, MH202A)
- CAP

TOPOGRAPHIC INFORMATION

TOPOGRAPHIC INFORMATION PROVIDED BY J.D. BARNES LIMITED, PROJECT No. 16–10–116–00. SURVEYS DATED NOVEMBER 30, 2017.

LEGAL INFORMATION

CALCULATED M–PLAN PROVIDED BY J.D. BARNES LIMITED, PROJECT No. 16–10–116–00 (PHASE 1 & 2) DATED MARCH 08, 2018.

ISSUED FOR MOE APPROVAL 18–05–09

NOT FOR CONSTRUCTION

ELEVATION NOTE ELEVATION = 86.12 m

ELEVATIONS ARE GEODETIC AND ARE DERIVED FROM SITE BENCHMARK NCC CONTROL POINT 001196530229 HAVING A PUBLISHED ELEVATION OF 86.12m

No.	DATE	BY	DESCRIPTION
2.	18–05–09	M.Z.	ISSUED FOR MOE APPROVAL
1.	18–01–24	M.Z.	1st SUBMISSION

Ottawa CITY OF OTTAWA

PROJECT No. 16–881

LICENSED PROFESSIONAL ENGINEER M.ZDRAVEVSKI 100130902 18-05-09 PROVINCE OF ONTARIO

SANITARY DRAINAGE PLAN

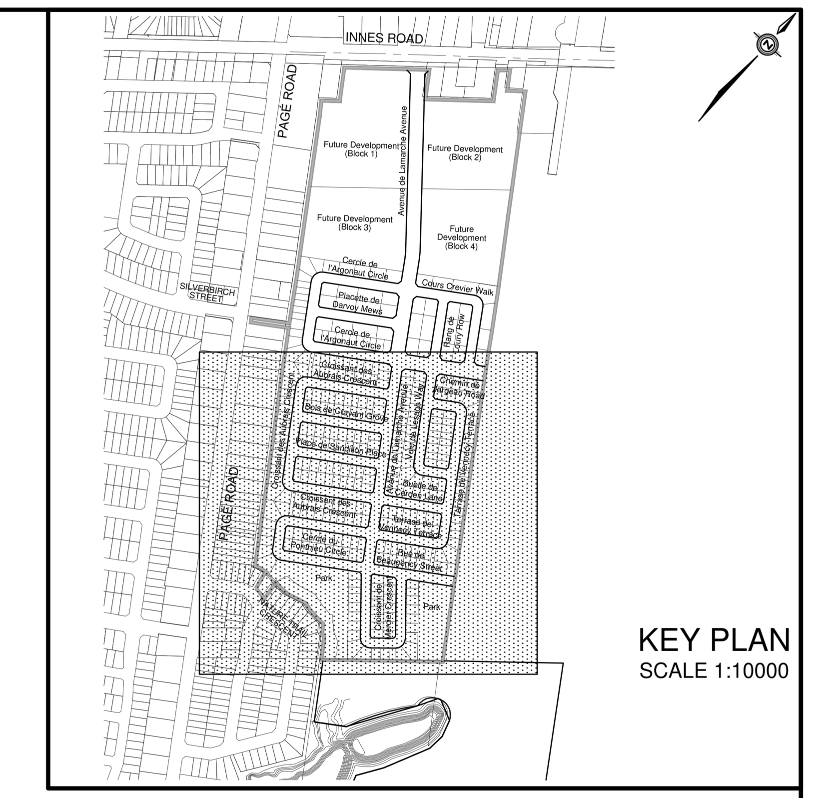
© DSEL

CAIVAN (ORLEANS VILLAGE) LIMITED — ORLEANS VILLAGE

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

DRAWN BY: M.Z./J.Y.	CHECKED BY: P.P.	DRAWING NO.	SHEET NO.
DESIGNED BY: P.P.	CHECKED BY: M.Z.		65
SCALE: 1:1000	DATE: JANUARY 2018		

CITY PLAN No. XXXXX
CITY FILE No. D07-16-16-0022



KEY PLAN
SCALE 1:10000

LEGEND

SANITARY DRAINAGE BOUNDARY
SANITARY SUB-DRAINAGE BOUNDARY
SANITARY DRAINAGE BOUNDARY (OTHER PHASES)
UPSTREAM MH TO DOWNSTREAM MH — 43A - 44A
AREA IN HECTARES — 0.78
POPULATION — 61
UPSTREAM MH TO DOWNSTREAM MH — 43A-44A
AREA IN OTHER PHASES IN HECTARES — 0.78
POPULATION — 61
EXTERNAL AREA IN HECTARES — A=53.63
EXTERNAL POPULATION — POP=5739
DENSITY (PERSONS/HECTARE) — 107
EXTERNAL LAND USE — RESIDENTIAL
MAINTENANCE HOLE — MH202A
200mmø SAN
CAP

TOPOGRAPHIC INFORMATION

TOPOGRAPHIC INFORMATION PROVIDED BY J.D. BARNES LIMITED, PROJECT No. 16–10–116–00. SURVEYS DATED NOVEMBER 30, 2017.

LEGAL INFORMATION

CALCULATED M–PLAN PROVIDED BY J.D. BARNES LIMITED, PROJECT No. 16–10–116–00 (PHASE 1 & 2) DATED MARCH 08, 2018.

ISSUED FOR MOE APPROVAL 18–05–09

NOT FOR CONSTRUCTION

ELEVATION NOTE ELEVATION = 86.12 m

ELEVATIONS ARE GEODETIC AND ARE DERIVED FROM SITE BENCHMARK NCC CONTROL POINT 001196530229 HAVING A PUBLISHED ELEVATION OF 86.12m

No.	DATE	BY	DESCRIPTION
2.	18–05–09	M.Z.	ISSUED FOR MOE APPROVAL
1.	18–01–24	M.Z.	1st SUBMISSION

CITY OF OTTAWA

PROJECT No. 16–881

LICENSED PROFESSIONAL ENGINEER
M.ZDRAVEVSKI
100130902
18-05-09
PROVINCE OF ONTARIO

SANITARY DRAINAGE PLAN

CAIVAN (ORLEANS VILLAGE) LIMITED

ORLEANS VILLAGE

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DRAWN BY: M.Z./J.Y.	CHECKED BY: P.P.	DRAWING NO.	SHEET NO.
DESIGNED BY: P.P.	CHECKED BY: M.Z.		66
SCALE: 1:1000	DATE: JANUARY 2018		

CITY PLAN No. XXXXX

CITY FILE No. D07-16-16-0022

J.F. Sabourin and Associates Inc.
WATER RESOURCES AND ENVIRONMENTAL CONSULTANTS

52 Springbrook Drive
Ottawa (Stittsville), ON K2S 1B9
TEL: (613) 836-3884
FAX: (613) 836-0332
WEB: www.jfsa.com

July 5, 2018

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

Attention: **Laura Maxwell, B.Sc., M.Pl.**

Subject: **Orleans Village Subdivision / Forest Valley Sanitary Trunk Sewer**
Hydraulic Gradeline Analysis Test *our file:883-10*

As requested by your office, based on the provided information as described below, we have evaluated the potential impact of redirecting sanitary flow contributions from the Orleans Village subdivision and East Urban Community (EUC) development to an inflow point approximately 458 m upstream of that previously considered on the existing Forest Valley sanitary trunk sewer.

The impact of these proposed developments on the hydraulic gradeline in the Forest Valley trunk sewer was evaluated based on spreadsheet calculations for a range of scenarios in the October 2003 *Forest Valley Trunk and Orleans Cumberland Collector Capacity Analysis* by Stantec Consulting Ltd.. Refer to Attachment A for key excerpts from the report. We understand from DSEL that the contributions from the Orleans Village and EUC developments make up approximately 165.2 L/s of the inflow to node fv07400 at the intersection of Pagé Road and Silverbirch Street in the “Monitored & Design” flows scenario, with the remaining 15.8 L/s contributed by 1.4 ha of industrial land and 10.3 ha of existing residential land to the east of Pagé Road.

For comparison with the sanitary sewer hydraulic gradeline elevations, the October 2003 report estimated underside of footing elevations for lots connected to the sanitary sewer system as 3.3 m below the trunk sewer top of manhole elevations. Note that this assumption has not been carried forward in the present study, as it is unclear why the estimate is so much more conservative than typical approximations. For example, we understand from DSEL that standard low-rise residential underside of footing elevations are generally shallower than 1.8 m below the road centreline elevation. The impact of relocating sanitary flow contributions from the Orleans Village and EUC developments has instead been evaluated based on differences in hydraulic gradeline elevation and pipe surcharge, with the understanding that a survey may be undertaken if needed to confirm underside of footing elevations in areas where the trunk sewer is surcharged (i.e. the hydraulic gradeline is above the obvert of the pipe).

A model of the Forest Valley sanitary trunk sewer between fv08100 and fv00100 was created in XPSWMM for comparison with the “Monitored & Design” flows scenario from the October 2003 report. Refer to Attachment B for an XPSWMM model schematic. As presented in Table B-1 of Attachment B, the XPSWMM-simulated hydraulic gradeline elevations are between 3 cm and 70 cm lower than those presented in Table 5-1 of the October 2003 report (included in Attachment A), except at fv04200 where the XPSWMM hydraulic gradeline is 4 cm higher. The sanitary trunk sewer is not surcharged based on the XPSWMM analysis, with the exception of two pipes between fv04200 and fv04000, where the hydraulic gradeline is 3-4 cm above the pipe obverts.

The XPSWMM model was then modified based on direction from DSEL, wherein the 165.2 L/s sanitary flow contribution from the Orleans Village and EUC developments was redirected from fv07400 to an upstream inflow point at fv07700, at the north intersection of Nature Trail Crescent and Pagé Road. As a result of this relocation of inflow, the sanitary hydraulic gradeline elevations increase by up to 15.5 cm between fv08100 and fv7500, and are otherwise unaffected. The simulated hydraulic gradeline elevations are still between 3 cm and 70 cm lower than those presented in Table 5-1 of the October 2003 report for this scenario, except at fv04200 where the XPSWMM hydraulic gradeline is 4 cm higher. Similarly, the sanitary trunk sewer pipes are still surcharged by 3-4 cm in two pipes between fv04200 and fv04000 under this scenario, and the hydraulic gradeline is otherwise contained below the obverts of the trunk sewer pipes.

Yours truly,
J.F. Sabourin and Associates Inc.

Laura Pipkins, P.Eng.

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

Attachment A: Excerpts from *Forest Valley Trunk and Orleans Cumberland Collector Capacity Analysis* (Stantec Consulting Ltd., October 2003)
Attachment B: XPSWMM Model Schematic; Pipe Data and Hydraulic Simulation Results

ATTACHMENT

A

Excerpts from Forest Valley Trunk and
Orleans Cumberland Collector Capacity Analysis
(Stantec Consulting Ltd., October 2003)

JFSA Water Resources and Environmental Consultants

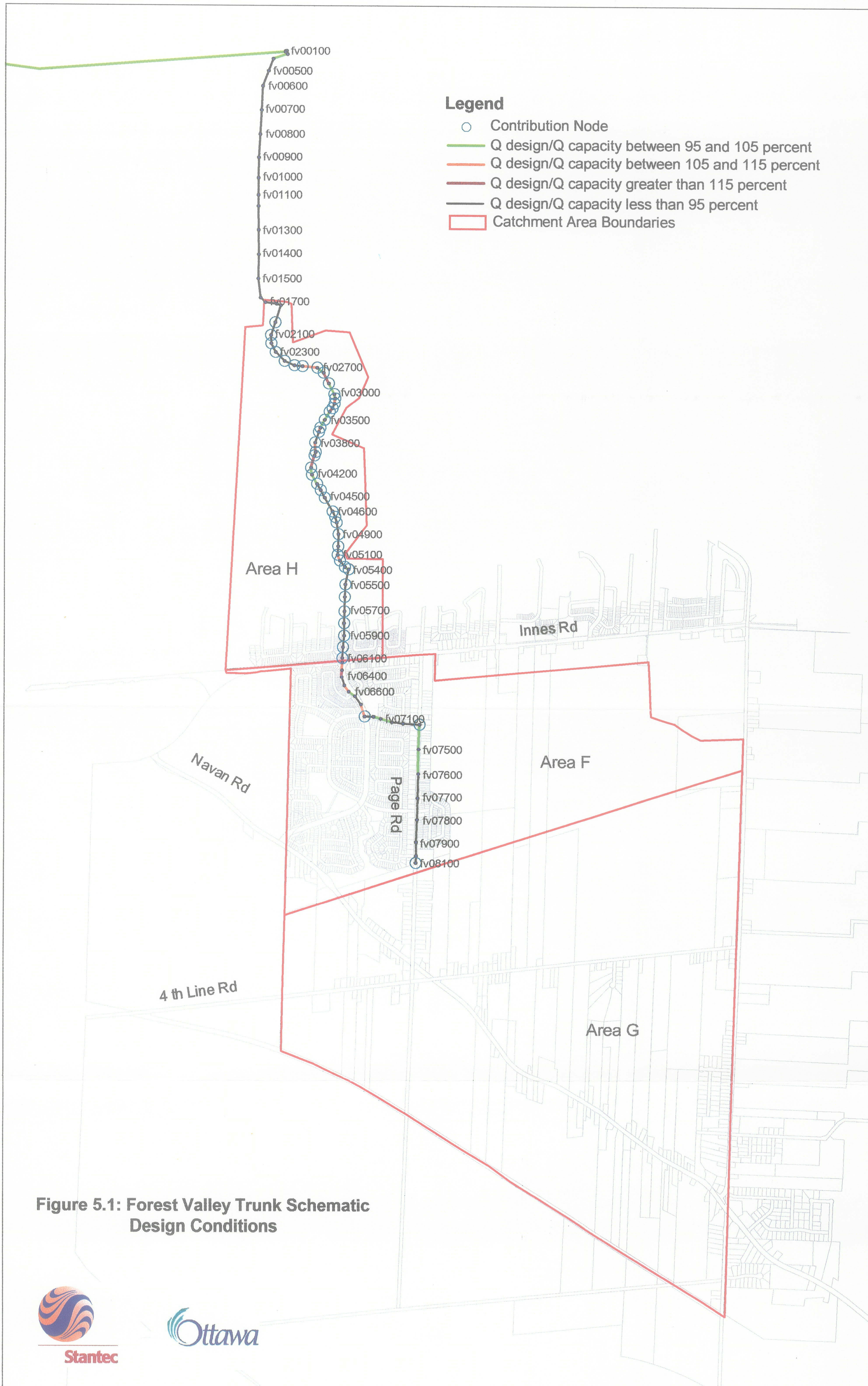


Figure 5.1: Forest Valley Trunk Schematic Design Conditions

TABLE 5-1
Summary of FVT Wastewater Flows and HGL

LEGEND

- Catchment Node
- Q/Qcap between 95% and105%
- Q/Qcap between 105% and115%
- Q/Qcap greater than 115%
- Q/Qcap greater than 95% and HGL is above basement elevation (OG-3.3m)

USMH	DSMH	LENGTH	USINV	USOBV	GROUND	USF Elev. (3.3m below OG)	Qcap Manning's (L/s)	Design				Monitored (300Lpcd, 0.50L/s/ha, K=0.60)				Monitored & Design			
								HGL (m)	Surcharge (m)	Q (L/s)	Q/Qc (%)	HGL (m)	Surcharge (m)	Q (L/s)	Q/Qc (%)	HGL (m)	Surcharge (m)	Q (L/s)	Q/Qc (%)
Forest Valley																			
fv00100	oc00400	-	44.8	45.7	52.0		7843	45.7	0.00	859	11%	45.7	0.00	739	9%	45.7	0.00	904	12%
fv00200	fv00100	8	46.1	47.0	52.0		6005	47.0	0.00	859	14%	47.0	0.00	739	12%	47.0	0.00	904	15%
fv00300	fv00200	30	47.0	47.9	52.2		2831	47.9	0.00	859	30%	47.9	0.00	739	26%	47.9	0.00	904	32%
fv00400	fv00300	123	47.7	48.6	52.5		830	48.6	0.01	859	103%	48.6	0.00	739	89%	48.6	0.03	904	109%
fv00500	fv00400	203	48.1	49.1	53.1		1293	49.1	0.00	859	66%	49.1	0.00	739	57%	49.1	0.00	904	70%
fv00600	fv00500	303	48.6	49.5	53.9		1163	49.5	0.00	859	74%	49.5	0.00	739	64%	49.5	0.00	904	78%
fv00700	fv00600	453	49.0	49.9	54.1		1223	49.9	0.00	859	70%	49.9	0.00	739	60%	49.9	0.00	904	74%
fv00800	fv00700	604	49.7	50.6	54.3		1208	50.6	0.00	859	71%	50.6	0.00	739	61%	50.6	0.00	904	75%
fv00900	fv00800	753	50.3	51.2	54.6		1193	51.2	0.00	859	72%	51.2	0.00	739	62%	51.2	0.00	904	76%
fv01000	fv00900	880	50.9	51.8	55.1		1178	51.8	0.00	859	73%	51.8	0.00	739	63%	51.8	0.00	904	77%
fv01100	fv01000	984	51.4	52.4	56.4		1193	52.4	0.00	859	72%	52.4	0.00	739	62%	52.4	0.00	904	76%
fv01200	fv01100	1,053	51.9	52.8	58.1		1461	52.8	0.00	859	59%	52.8	0.00	739	51%	52.8	0.00	904	62%
fv01300	fv01200	1,202	52.3	53.2	59.5		1208	53.2	0.00	859	71%	53.2	0.00	739	61%	53.2	0.00	904	75%
fv01400	fv01300	1,353	52.9	53.9	63.8		1208	53.9	0.00	859	71%	53.9	0.00	739	61%	53.9	0.00	904	75%
fv01500	fv01400	1,503	53.6	54.5	63.8		1178	54.5	0.00	859	73%	54.5	0.00	739	63%	54.5	0.00	904	77%
fv01600	fv01500	1,624	56.0	56.9	62.0		1178	56.9	0.00	859	73%	56.9	0.00	739	63%	56.9	0.00	904	77%
fv01700	fv01600	1,663	58.1	59.0	63.2		1265	59.0	0.00	859	68%	59.0	0.00	739	58%	59.0	0.00	904	71%
fv01800	fv01700	1,736	58.6	59.6	62.9		1033	59.6	0.00	859	83%	59.6	0.00	739	72%	59.6	0.00	904	88%
fv01900	fv01800	1,764	59.0	60.0	63.2		1193	60.0	0.00	859	72%	60.0	0.00	739	62%	60.0	0.00	904	76%
fv02000	fv01900	1,884	61.7	62.6	66.3	63.0	1987	62.6	0.00	859	43%	62.6	0.00	739	37%	62.6	0.00	904	45%
fv02100	fv02000	1,969	64.7	65.6	70.4	67.1	1969	65.6	0.00	859	44%	65.6	0.00	739	38%	65.6	0.00	904	46%
fv02200	fv02100	2,019	68.6	69.5	71.9	68.6	1951	69.5	0.00	858	44%	69.5	0.00	739	38%	69.5	0.00	904	46%
fv02300	fv02200	2,079	69.8	70.7	73.3	70.0	1886	70.7	0.00	858	46%	70.7	0.00	739	39%	70.7	0.00	903	48%
fv02400	fv02300	2,158	71.6	72.5	76.9	73.6	1951	72.5	0.00	858	44%	72.5	0.00	738	38%	72.5	0.00	903	46%
fv02500	fv02400	2,225	74.6	75.6	80.3	77.0	2151	75.6	0.00	858	40%	75.6	0.00	738	34%	75.6	0.00	903	42%
fv02600	fv02500	2,275	75.7	76.6	82.7	79.4	980	76.6	0.00	858	88%	76.6	0.00	738	75%	76.6	0.00	903	92%
fv02700	fv02600	2,368	75.9	76.8	83.6	80.3	755	76.9	0.04	858	114%	76.8	0.00	738	98%	76.9	0.06	903	120%
fv02800	fv02700	2,418	76.0	76.9	83.8	80.5	844	77.0	0.05	857	102%	76.9	0.00	737	87%	77.0	0.08	902	107%
fv02900	fv02800	2,492	76.2	77.1	83.7	80.4	680	77.1	0.05	855	126%	77.0	0.04	735	108%	77.2	0.10	900	132%
fv03000	fv02900	2,568	76.4	77.3	83.9	80.6	864	77.3	0.00	854	99%	77.3	0.00	733	85%	77.3	0.08	898	104%
fv03100	fv03000	2,596	76.4	77.3	83.8	80.5	885	77.3	0.00	853	96%	77.3	0.00	733	83%	77.4	0.07	897	101%
fv03200	fv03100	2,630	76.5	77.4	84.0	80.7	800	77.4	0.01	853	107%	77.4	0.00	732	91%	77.5	0.04	897	112%
fv03300	fv03200	2,662	76.6	77.5	84.0	80.7	905	77.5	0.00	853	94%	77.5	0.00	732	81%	77.5	0.00	896	99%
fv03400	fv03300	2,690	76.6	77.6	83.8	80.5	597	77.6	0.03	852	143%	77.6	0.01	731	122%	77.6	0.03	895	150%
fv03500	fv03400	2,749	76.8	77.7	84.0	80.7	885	77.7	0.00	852	96%	77.7	0.00	730	83%	77.7	0.04	895	101%
fv03600	fv03500	2,804	76.9	77.8	83.7	80.4	822	77.8	0.01	850	103%	77.8	0.00	728	89%	77.9	0.06	893	109%
fv03700	fv03600	2,831	76.9	77.8	83.6	80.3	755	77.9	0.02	850	113%	77.8	0.00	728	97%	77.9	0.07	892	118%
fv03800	fv03700	2,902	77.1	78.0	83.6	80.3	980	78.0	0.00	849	87%	78.0	0.00	727	74%	78.0	0.00	891	91%
fv03900	fv03800	2,963	77.2	78.1	83.9	80.6	778	78.2	0.02	847	109%	78.1	0.00	725	93%	78.2	0.03	889	114%
fv04000	fv03900	2,984	77.3	78.2	84.1	80.8	844	78.2	0.00	847	100%	78.2	0.00	725	86%	78.2	0.02	889	105%
fv04100	fv04000	3,063	77.4	78.3	84.6	81.3	653	78.4	0.06	843	129%	78.3	0.02	720	110%	78.4	0.09	884	135%
fv04200	fv04100	3,106	77.5	78.4	84.5	81.2	885	78.4	0.00	843	95%	78.4	0.00	720	81%	78.4	0.00	883	100%
fv04300	fv04200	3,161	77.7	78.6	84.0	80.7	838	78.6	0.00	843	101%	78.6	0.00	720	86%	78.6	0.01	883	105%
fv04400	fv04300	3,202	77.8	78.7	84.4	81.1	936	78.7	0.00	800	85%	78.7	0.00	669	71%	78.7	0.00	828	88%
fv04500	fv04400	3,250	77.9	78.8	84.8	81.5	903	78.8	0.00	796	88%	78.8	0.00	664	73%	78.8	0.00	823	91%
fv04600	fv04500	3,331	78.1	79.0	84.4	81.1	899	79.0	0.00	796	89%	79.0	0.00	663	74%	79.0	0.00	823	92%
fv04700	fv04600	3,369	78.2	79.1	84.3	81.0	885	79.1	0.00	795	90%	79.1	0.00	663	75%	79.1	0.00	822	93%
fv04800	fv04700	3,405	78.3	79.2	84.3	81.0	844	79.2	0.00	795	94%	79.2	0.00	663	79%	79.2	0.00	822	97%
fv04900	fv04800	3,479	78.5	79.4	84.8	81.5	864	79.4	0.00	795	92%	79.4	0.00	662	77%	79.4	0.00	822	95%
fv05000	fv04900	3,555	78.7	79.6	84.4	81.1	844	79.6	0.00	794	94%	79.6	0.00	661	78%	79.6	0.00	820	97%

TABLE 5-1
Summary of FVT Wastewater Flows and HGL

LEGEND

- Catchment Node
- Q/Qcap between 95% and105%
- Q/Qcap between 105% and115%
- Q/Qcap greater than 115%
- Q/Qcap greater than 95% and HGL is above basement elevation (OG-3.3m)

USMH	DSMH	LENGTH	USINV	USOBV	GROUND	USF Elev. (3.3m below OG)	Qcap Manning's (L/s)	Design				Monitored (300Lpcd, 0.50L/s/ha, K=0.60)				Monitored & Design			
								HGL (m)	Surcharge (m)	Q (L/s)	Q/Qc (%)	HGL (m)	Surcharge (m)	Q (L/s)	Q/Qc (%)	HGL (m)	Surcharge (m)	Q (L/s)	Q/Qc (%)
fv05100	fv05000	3,608	78.8	79.7	84.0	80.7	924	79.7	0.00	793	86%	79.7	0.00	661	71%	79.7	0.00	820	89%
fv05200	fv05100	3,646	78.9	79.8	84.3	81.0	731	79.8	0.01	793	109%	79.8	0.00	660	90%	79.8	0.02	819	112%
fv05300	fv05200	3,698	79.1	80.0	84.7	81.4	924	80.0	0.00	793	86%	80.0	0.00	660	71%	80.0	0.00	819	89%
fv05400	fv05300	3,724	79.1	80.0	85.5	82.2	822	80.0	0.00	792	96%	80.0	0.00	659	80%	80.0	0.00	819	100%
fv05500	fv05400	3,821	79.4	80.3	86.9	83.6	924	80.3	0.00	783	85%	80.3	0.00	649	70%	80.3	0.00	807	87%
fv05600	fv05500	3,898	79.6	80.5	87.9	84.6	844	80.5	0.00	783	93%	80.5	0.00	648	77%	80.5	0.00	807	96%
fv05700	fv05600	3,989	79.8	80.7	89.1	85.8	962	80.7	0.00	783	81%	80.7	0.00	648	67%	80.7	0.00	806	84%
fv05800	fv05700	4,063	80.0	80.9	89.0	85.7	864	80.9	0.00	773	89%	80.9	0.00	636	74%	80.9	0.00	794	92%
fv05900	fv05800	4,140	80.2	81.1	88.6	85.3	885	81.1	0.00	773	87%	81.1	0.00	636	72%	81.1	0.00	794	90%
fv06000	fv05900	4,210	80.3	81.2	88.6	85.3	885	81.2	0.00	773	87%	81.2	0.00	636	72%	81.2	0.00	793	90%
fv06100	fv06000	4,280	80.5	81.4	88.9	85.6	822	81.4	0.00	772	94%	81.4	0.00	636	77%	81.4	0.00	793	96%
fv06200	fv06100	4,306	80.5	81.4	88.8	85.5	864	81.4	0.00	772	89%	81.4	0.00	635	74%	81.4	0.00	793	92%
fv06300	fv06200	4,354	80.6	81.5	88.6	85.3	731	81.5	0.01	772	106%	81.5	0.00	635	87%	81.5	0.01	793	109%
fv06400	fv06300	4,397	80.6	81.5	88.5	85.2	653	81.6	0.02	772	118%	81.5	0.00	635	97%	81.6	0.02	793	121%
fv06500	fv06400	4,448	80.8	81.7	88.2	84.9	1016	81.7	0.00	772	76%	81.7	0.00	635	63%	81.7	0.00	793	78%
fv06600	fv06500	4,495	80.8	81.8	88.1	84.8	731	81.8	0.01	772	106%	81.8	0.00	635	87%	81.8	0.01	793	109%
fv06700	fv06600	4,544	80.9	81.8	87.8	84.5	778	81.8	0.00	772	99%	81.8	0.00	635	82%	81.9	0.02	793	102%
fv06800	fv06700	4,609	81.1	82.0	87.7	84.4	885	82.0	0.00	772	87%	82.0	0.00	635	72%	82.0	0.00	793	90%
fv06900	fv06800	4,688	81.2	82.1	87.0	83.7	706	82.1	0.02	772	109%	82.1	0.00	635	90%	82.2	0.03	793	112%
fv07000	fv06900	4,744	81.3	82.3	87.3	84.0	800	82.3	0.00	714	89%	82.3	0.00	561	70%	82.3	0.00	714	89%
fv07100	fv07000	4,791	81.4	82.4	87.6	84.3	680	82.4	0.01	714	105%	82.4	0.00	561	83%	82.4	0.01	714	105%
fv07200	fv07100	4,863	81.6	82.5	87.5	84.2	731	82.5	0.00	714	98%	82.5	0.00	561	77%	82.5	0.00	714	98%
fv07300	fv07200	4,934	81.8	82.7	87.8	84.5	1016	82.7	0.00	714	70%	82.7	0.00	561	55%	82.7	0.00	714	70%
fv07400	fv07300	5,037	81.9	82.9	88.0	84.7	1790	82.9	0.00	714	40%	82.9	0.00	561	31%	82.9	0.00	714	40%
fv07500	fv07400	5,189	82.224	83.138	87.8	84.5	706	83.1	0.00	533	76%	83.1	0.00	458	65%	83.1	0.00	533	76%
fv07600	fv07500	5,342	82.450	83.364	87.7	84.4	731	83.4	0.00	533	73%	83.4	0.00	458	63%	83.4	0.00	533	73%
fv07700	fv07600	5,495	82.608	83.522	87.8	84.5	597	83.5	0.00	533	89%	83.5	0.00	458	77%	83.5	0.00	533	89%
fv07800	fv07700	5,627	82.751	83.665	87.6	84.3	626	83.7	0.00	533	85%	83.7	0.00	458	73%	83.7	0.00	533	85%
fv07900	fv07800	5,766	82.877	83.791	87.1	83.8	1790	83.8	0.00	533	30%	83.8	0.00	458	26%	83.8	0.00	533	30%
fv08000	fv07900	5,852	82.965	83.879	86.4	83.1	1790	83.9	0.00	533	30%	83.9	0.00	458	26%	83.9	0.00	533	30%
fv08100	fv08000	5,897	83.011	83.925	86.0	82.7	597	83.9	0.00	533	89%	83.9	0.00	458	77%	83.9	0.00	533	89%

SANITARY SEWER CHARACTERISTICS

Street	Manhole ID		Invert Elevation (m)				Ground Elevation (m)		Length (m)	Diameter (mm)	Slope (%)
	U/S	D/S	U/S		D/S		U/S	D/S			
Vanguard Drive	700	800	81.675	(E)	81.603	(W)	88.38	88.7	36	525	0.20
Tenth Line Road	800	Plug	81.550	(S)	81.51	(N)	88.70	-	20	525	0.20
Page Road	fv08100	fv08000	83.011	(N)	82.965	(N)	86.00	86.40	45	900	0.10
Page Road	fv08000	fv07900	82.965	(N)	82.877	(S)	86.40	87.10	86	900	0.10
Page Road	fv07900	fv07800	82.877	(N)	82.751	(S)	87.10	87.60	139	900	0.09
Page Road	fv07800	fv07700	82.751	(N)	82.608	(S)	87.60	87.80	132	900	0.11
Page Road	fv07700	fv07600	82.608	(N)	82.45	(S)	87.80	87.70	153	900	0.10
Page Road	fv07600	fv07500	82.45	(N)	82.224	(N)	87.70	87.80	153	900	0.15
Page Road	fv07500	fv07400	82.224	(N)	81.9	(S)	87.80	88.00	152	900	0.21
Silverbich	fv07400	fv07300	81.9	(W)	81.8	(E)	88.00	87.80	103	900	0.10
Silverbich	fv07300	fv07200	81.8	(W)	81.6	(E)	87.80	87.50	71	900	0.28
Silverbich	fv07200	fv07100	81.6	(W)	81.4	(E)	87.50	87.60	72	900	0.28
Silverbich	fv07100	fv07000	81.4	(W)	81.3	(E)	87.60	87.30	47	900	0.21
Silverbich	fv07000	fv06900	81.3	(W)	81.2	(E)	87.30	87.00	56	900	0.18
Orleans Blvd.	fv06900	fv06800	81.2	(N)	81.1	(S)	87.00	87.70	79	900	0.12
Orleans Blvd.	fvo6800	fvo6700	81.1	(N)	80.95	(S)	87.7	87.8	65	900	0.31
Orleans Blvd.	fv06700	fv06600	80.9	(N)	80.8	(S)	87.80	88.10	49	900	0.20
Orleans Blvd.	fv06600	fv06500	80.8	(N)	80.8	(S)	88.10	88.2	47	900	0.00
Orleans Blvd.	fv06500	fv06400	80.8	(N)	80.6	(S)	88.20	88.50	51	900	0.39
Orleans Blvd.	fv06400	fv06300	80.6	(N)	80.6	(N)	88.50	88.60	43	900	0.00
Orleans Blvd.	fv06300	fv06200	80.6	(N)	80.5	(S)	88.60	88.80	48	900	0.21
Orleans Blvd.	fv06200	fv06100	80.5	(N)	80.5	(S)	88.8	88.9	26	900	0.00
Orleans Blvd.	fv06100	fv06000	80.5	(N)	80.3	(S)	88.9	88.6	70	900	0.29
	4	5	82.06	(W)	81.62	(E)	87.50	87.60	310	375	0.14
	5	6	81.62	(W)	81.21	(E)	87.60	87.50	295	375	0.14
	6	7	81.13	(W)	81.01	(E)	87.50	87.50	115	450	0.11
	7	8	81.01	(W)	80.75	(E)	87.50	86.90	235	450	0.11
	8	9	80.37	(S)	80.20	(N)	86.90	87.00	170	525	0.10
	9	10	80.20	(S)	79.92	(N)	87.00	87.00	275	525	0.10
	10	11	79.92	(W)	79.52	(E)	87.00	85.50	405	525	0.10
	11	12	79.44	(W)	79.21	(N)	85.50	83.90	230	600	0.100
	LOCAL PS 2	25C					82.00	86.00	300		
	LOCAL PS 1	25C					81.00	86.00	340		
	25B	25A	80.62	(W)	80.21	(E)	86.50	86.50	295	375	0.14

ATTACHMENT

B

XPSWMM Model Schematic

Pipe Data and Hydraulic Simulation Results

JFSA Water Resources and Environmental Consultants

Figure B-1: XPSWMM MODEL SCHEMATIC

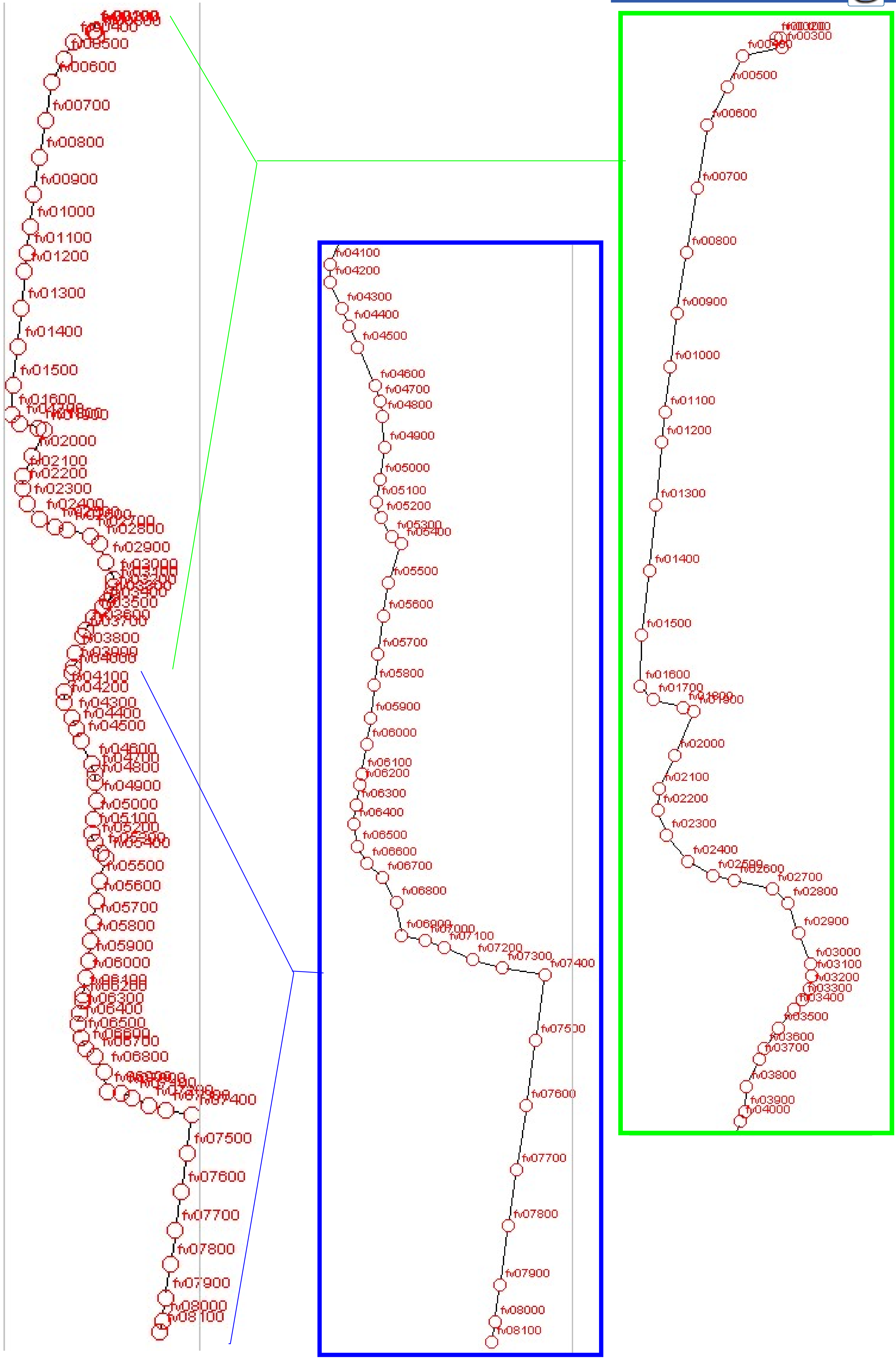


Table B-1: Pipe Data and Hydraulic Simulation Results for the Sanitary Trunk Sewer (Monitored & Design Scenario, Original Flows)

U/S MH	D/S MH	U/S Invert (m)	D/S Invert (m)	Pipe Dia. / Height (mm)	Pipe Length (m)	Pipe Slope (%)	n	U/S MH Cover Elev. (m)	D/S MH Cover Elev. (m)	Design Vel. (m/s)	Design Flow (m^3/s)	Peak Pipe Flow (m^3/s)	Peak / Design Flow	Surcharge U/S [(1)] (m)	Max. U/S HGL (m)	Max. D/S HGL (m)	Freeboard U/S HGL and MH Cover [(2)] (m)	Compare to 2003 HGL Results (m)	
																		U/S HGL [(3)] (m)	Difference (m)
fv08100	fv08000	83.011	82.965	900	45.0	0.1	0.013	86.000	86.400	0.900	0.572	0.533	0.9	-0.217	83.694	83.647	2.306	83.9	-0.206
fv08000	fv07900	82.965	82.877	900	86.0	0.1	0.013	86.400	87.100	0.900	0.572	0.533	0.9	-0.218	83.647	83.558	2.753	83.9	-0.253
fv07900	fv07800	82.877	82.751	900	139.0	0.1	0.013	87.100	87.600	0.854	0.543	0.533	1.0	-0.219	83.558	83.407	3.542	83.8	-0.242
fv07800	fv07700	82.751	82.608	900	132.0	0.1	0.013	87.600	87.800	0.944	0.600	0.533	0.9	-0.244	83.407	83.255	4.193	83.7	-0.293
fv07700	fv07600	82.608	82.450	900	153.0	0.1	0.013	87.800	87.700	0.900	0.572	0.533	0.9	-0.253	83.255	83.063	4.545	83.5	-0.245
fv07600	fv07500	82.450	82.224	900	153.0	0.2	0.013	87.700	87.800	1.102	0.701	0.533	0.8	-0.287	83.063	82.867	4.637	83.4	-0.337
fv07500	fv07400	82.224	81.900	900	152.0	0.2	0.013	87.800	88.000	1.304	0.830	0.533	0.6	-0.257	82.867	82.637	4.933	83.1	-0.233
fv07400	fv07300	81.900	81.800	900	103.0	0.1	0.013	88.000	87.800	0.900	0.572	0.714	1.2	-0.163	82.637	82.442	5.363	82.9	-0.263
fv07300	fv07200	81.800	81.600	900	71.0	0.3	0.013	87.800	87.500	1.506	0.958	0.714	0.7	-0.258	82.442	82.306	5.358	82.7	-0.258
fv07200	fv07100	81.600	81.400	900	72.0	0.3	0.013	87.500	87.600	1.506	0.958	0.714	0.7	-0.194	82.306	82.201	5.194	82.5	-0.194
fv07100	fv07000	81.400	81.300	900	47.0	0.2	0.013	87.600	87.300	1.304	0.830	0.714	0.9	-0.099	82.201	82.133	5.399	82.4	-0.199
fv07000	fv06900	81.300	81.200	900	56.0	0.2	0.013	87.300	87.000	1.207	0.768	0.714	0.9	-0.067	82.133	81.994	5.167	82.3	-0.167
fv06900	fv06800	81.200	81.100	900	79.0	0.1	0.013	87.000	87.700	0.986	0.627	0.793	1.3	-0.106	81.994	81.834	5.006	82.2	-0.206
fv06800	fv06700	81.100	80.900	900	65.0	0.3	0.013	87.700	87.800	1.584	1.008	0.793	0.8	-0.166	81.834	81.713	5.866	82.0	-0.166
fv06700	fv06600	80.900	80.800	900	49.0	0.2	0.013	87.800	88.100	1.273	0.810	0.793	1.0	-0.087	81.713	81.621	6.087	81.9	-0.187
fv06600	fv06500	80.800	80.800	900	47.0	0.0	0.013	88.100	88.200	0.090	0.060	0.793	13.2	-0.079	81.621	81.515	6.479	81.8	-0.179
fv06500	fv06400	80.800	80.600	900	51.0	0.4	0.013	88.200	88.500	1.777	1.131	0.793	0.7	-0.185	81.515	81.422	6.685	81.7	-0.185
fv06400	fv06300	80.600	80.600	900	43.0	0.0	0.013	88.500	88.600	0.090	0.060	0.793	13.2	-0.078	81.422	81.335	7.078	81.6	-0.178
fv06300	fv06200	80.600	80.500	900	48.0	0.2	0.013	88.600	88.800	1.304	0.830	0.793	1.0	-0.165	81.335	81.241	7.265	81.5	-0.165
fv06200	fv06100	80.500	80.500	900	26.0	0.0	0.013	88.800	88.900	0.090	0.060	0.793	13.2	-0.159	81.241	81.174	7.559	81.4	-0.159
fv06100	fv06000	80.500	80.300	900	70.0	0.3	0.013	88.900	88.600	1.520	0.970	0.793	0.8	-0.226	81.174	81.023	7.726	81.4	-0.226
fv06000	fv05900	80.300	80.200	900	70.0	0.1	0.013	88.600	88.600	1.080	0.680	0.793	1.2	-0.177	81.023	80.858	7.577	81.2	-0.177
fv05900	fv05800	80.200	80.000	900	77.0	0.3	0.013	88.600	89.000	1.450	0.920	0.794	0.9	-0.242	80.858	80.669	7.742	81.1	-0.242
fv05800	fv05700	80.000	79.800	900	74.0	0.3	0.013	89.000	89.100	1.480	0.940	0.794	0.8	-0.231	80.669	80.500	8.331	80.9	-0.231
fv05700	fv05600	79.800	79.600	900	91.0	0.2	0.013	89.100	87.900	1.330	0.850	0.806	0.9	-0.200	80.500	80.296	8.600	80.7	-0.200
fv05600	fv05500	79.600	79.400	900	77.0	0.3	0.013	87.900	86.900	1.450	0.920	0.807	0.9	-0.204	80.296	80.126	7.604	80.5	-0.204
fv05500	fv05400	79.400	79.100	900	97.0	0.3	0.013	86.900	85.500	1.580	1.010	0.807	0.8	-0.174	80.126	79.840	6.774	80.3	-0.174
fv05400	fv05300	79.100	79.100	900	26.0	0.0	0.013	85.500	84.700	0.090	0.060	0.819	13.7	-0.160	79.840	79.744	5.660	80.0	-0.160
fv05300	fv05200	79.100	78.900	900	52.0	0.4	0.013	84.700	84.300	1.760	1.120	0.819	0.7	-0.256	79.744	79.615	4.956	80.0	-0.256
fv05200	fv05100	78.900	78.800	900	38.0	0.3	0.013	84.300	84.000	1.460	0.930	0.819	0.9	-0.185	79.615	79.513	4.685	79.8	-0.185
fv05100	fv05000	78.800	78.700	900	53.0	0.2	0.013	84.000	84.400	1.240	0.790	0.820	1.0	-0.187	79.513	79.383	4.487	79.7	-0.187
fv05000	fv04900	78.700	78.500	900	76.0	0.3	0.013	84.400	84.800	1.460	0.930	0.820	0.9	-0.217	79.383	79.198	5.017	79.6	-0.217
fv04900	fv04800	78.500	78.300	900	74.0	0.3	0.013	84.800	84.300	1.480	0.940	0.822	0.9	-0.202	79.198	79.033	5.602	79.4	-0.202
fv04800	fv04700	78.300	78.200	900	36.0	0.3	0.013	84.300	84.300	1.500	0.950	0.822	0.9	-0.167	79.033	78.956	5.267	79.2	-0.167
fv04700	fv04600	78.200	78.100	900	38.0	0.3	0.013	84.300	84.400	1.460	0.930	0.822	0.9	-0.144	78.956	78.882	5.344	79.1	-0.144
fv04600	fv04500	78.100	77.900	900	81.0	0.3	0.013	84.400	84.800	1.410	0.900	0.823	0.9	-0.118	78.882	78.735	5.518	79.0	-0.118
fv04500	fv04400	77.900	77.800	900	48.0	0.2	0.013	84.800	84.400	1.300	0.830	0.823	1.0	-0.065	78.735	78.648	6.065	78.8	-0.065
fv04400	fv04300	77.800	77.700	900	41.0	0.2	0.013	84.400	84.000	1.410	0.890	0.828	0.9	-0.052	78.648	78.572	5.752	78.7	-0.052
fv04300	fv04200	77.700	77.500	900	55.0	0.4	0.013	84.000	84.500	1.720	1.090	0.883	0.8	-0.028	78.572	78.443	5.428	78.6	-0.028
fv04200	fv04100	77.500	77.400	900	43.0	0.2	0.013	84.500	84.600	1.370	0.870	0.883	1.0	0.043	78.443	78.329	6.057	78.4	0.043
fv04100	fv04000	77.400	77.300	900	79.0	0.1	0.013	84.600	84.100	1.010	0.640	0.884	1.4	0.029	78.329	78.140	6.271	78.4	-0.071
fv04000	fv03900	77.300	77.200	900	21.0	0.5	0.013	84.100	83.900	1.960	1.250	0.889	0.7	-0.060	78.140	78.088	5.960	78.2	-0.060
fv03900	fv03800	77.200	77.100	900	61.0	0.2	0.013	83.900	83.600	1.150	0.730	0.889	1.2	-0.012	78.088	77.934	5.812	78.2	-0.112
fv03800	fv03700	77.100	76.900	900	71.0	0.3	0.013	83.600	83.600	1.510	0.960	0.891	0.9	-0.066	77.934	77.781	5.666	78.0	-0.066
fv03700	fv03600	76.900	76.900	900	27.0	0.0	0.013	83.600	83.700	0.090	0.060	0.892	14.9	-0.019	77.781	77.709	5.819	77.9	-0.119
fv03600	fv03500	76.900	76.800	900	55.0	0.2	0.013	83.700	84.000	1.210	0.770	0.893	1.2	-0.091	77.709	77.583	5.991	77.9	-0.191
fv03500	fv03400	76.800	76.600	900	59.0	0.3	0.013	84.000	83.800	1.660	1.050	0.895	0.9	-0.117	77.583	77.458	6.417	77.7	-0.117

Table B-1: Pipe Data and Hydraulic Simulation Results for the Sanitary Trunk Sewer (Monitored & Design Scenario, Original Flows)

U/S MH	D/S MH	U/S Invert (m)	D/S Invert (m)	Pipe Dia. / Height (mm)	Pipe Length (m)	Pipe Slope (%)	n	U/S MH Cover Elev. (m)	D/S MH Cover Elev. (m)	Design Vel. (m/s)	Design Flow (m^3/s)	Peak Pipe Flow (m^3/s)	Peak / Design Flow	Surcharge U/S [1] (m)	Max. U/S HGL (m)	Max. D/S HGL (m)	Freeboard U/S HGL and MH Cover [2] (m)	Compare to 2003 HGL Results (m)	
																		U/S HGL [3] (m)	Difference (m)
fv03400	fv03300	76.600	76.600	900	28.0	0.0	0.013	83.800	84.000	0.090	0.060	0.895	14.9	-0.042	77.458	77.385	6.342	77.6	-0.142
fv03300	fv03200	76.600	76.500	900	32.0	0.3	0.013	84.000	84.000	1.590	1.010	0.896	0.9	-0.115	77.385	77.304	6.615	77.5	-0.115
fv03200	fv03100	76.500	76.400	900	34.0	0.3	0.013	84.000	83.800	1.540	0.980	0.897	0.9	-0.096	77.304	77.219	6.696	77.5	-0.196
fv03100	fv03000	76.400	76.400	900	28.0	0.0	0.013	83.800	83.900	0.090	0.060	0.897	15.0	-0.081	77.219	77.135	6.581	77.4	-0.181
fv03000	fv02900	76.400	76.200	900	76.0	0.3	0.013	83.900	83.700	1.460	0.930	0.898	1.0	-0.165	77.135	76.947	6.765	77.3	-0.165
fv02900	fv02800	76.200	76.000	900	74.0	0.3	0.013	83.700	83.800	1.480	0.940	0.900	1.0	-0.153	76.947	76.747	6.753	77.2	-0.253
fv02800	fv02700	76.000	75.900	900	50.0	0.2	0.013	83.800	83.600	1.270	0.810	0.902	1.1	-0.153	76.747	76.571	7.053	77.0	-0.253
fv02700	fv02600	75.900	75.700	900	93.0	0.2	0.013	83.600	82.700	1.320	0.840	0.903	1.1	-0.229	76.571	76.088	7.029	76.9	-0.329
fv02600	fv02500	75.700	74.600	900	50.0	2.2	0.013	82.700	80.300	4.220	2.690	0.903	0.3	-0.512	76.088	74.897	6.612	76.6	-0.512
fv02500	fv02400	74.600	71.600	900	67.0	4.5	0.013	80.300	76.900	6.020	3.830	0.903	0.2	-0.603	74.897	71.957	5.403	75.6	-0.703
fv02400	fv02300	71.600	69.800	900	79.0	2.3	0.013	76.900	73.300	4.300	2.730	0.903	0.3	-0.543	71.957	70.221	4.943	72.5	-0.543
fv02300	fv02200	69.800	68.600	900	60.0	2.0	0.013	73.300	71.900	4.020	2.560	0.903	0.4	-0.479	70.221	68.858	3.079	70.7	-0.479
fv02200	fv02100	68.600	64.700	900	50.0	7.8	0.013	71.900	70.400	7.950	5.060	0.904	0.2	-0.642	68.858	65.017	3.042	69.5	-0.642
fv02100	fv02000	64.700	61.700	900	85.0	3.5	0.013	70.400	66.300	5.350	3.400	0.904	0.3	-0.583	65.017	62.084	5.383	65.6	-0.583
fv02000	fv01900	61.700	59.000	900	120.0	2.3	0.013	66.300	63.200	4.270	2.720	0.904	0.3	-0.516	62.084	59.445	4.216	62.6	-0.516
fv01900	fv01800	59.000	58.600	900	28.0	1.4	0.013	63.200	62.900	3.400	2.160	0.904	0.4	-0.455	59.445	59.161	3.755	60.0	-0.555
fv01800	fv01700	58.600	58.100	900	73.0	0.7	0.013	62.900	63.200	2.360	1.500	0.904	0.6	-0.339	59.161	58.393	3.739	59.6	-0.439
fv01700	fv01600	58.100	56.000	900	39.0	5.4	0.013	63.200	62.000	6.600	4.200	0.904	0.2	-0.607	58.393	56.370	4.807	59.0	-0.607
fv01600	fv01500	56.000	53.600	900	121.0	2.0	0.013	62.000	63.800	4.010	2.550	0.904	0.4	-0.530	56.370	54.177	5.630	56.9	-0.530
fv01500	fv01400	53.600	52.900	900	150.0	0.5	0.013	63.800	63.800	1.940	1.240	0.904	0.7	-0.323	54.177	53.520	9.623	54.5	-0.323
fv01400	fv01300	52.900	52.300	900	151.0	0.4	0.013	63.800	59.500	1.790	1.140	0.904	0.8	-0.280	53.520	52.995	10.280	53.9	-0.380
fv01300	fv01200	52.300	51.900	900	149.0	0.3	0.013	59.500	58.100	1.470	0.940	0.904	1.0	-0.205	52.995	52.411	6.505	53.2	-0.205
fv01200	fv01100	51.900	51.400	900	69.0	0.7	0.013	58.100	56.400	2.420	1.540	0.904	0.6	-0.389	52.411	51.969	5.689	52.8	-0.389
fv01100	fv01000	51.400	50.900	900	104.0	0.5	0.013	56.400	55.100	1.970	1.260	0.904	0.7	-0.331	51.969	51.476	4.431	52.4	-0.431
fv01000	fv00900	50.900	50.300	900	127.0	0.5	0.013	55.100	54.600	1.960	1.240	0.904	0.7	-0.324	51.476	50.905	3.624	51.8	-0.324
fv00900	fv00800	50.300	49.700	900	149.0	0.4	0.013	54.600	54.300	1.810	1.150	0.904	0.8	-0.295	50.905	50.289	3.695	51.2	-0.295
fv00800	fv00700	49.700	49.000	900	151.0	0.5	0.013	54.300	54.100	1.940	1.230	0.904	0.7	-0.311	50.289	49.705	4.011	50.6	-0.311
fv00700	fv00600	49.000	48.600	900	150.0	0.3	0.013	54.100	53.900	1.470	0.930	0.904	1.0	-0.195	49.705	49.168	4.395	49.9	-0.195
fv00600	fv00500	48.600	48.100	900	100.0	0.5	0.013	53.900	53.100	2.010	1.280	0.904	0.7	-0.332	49.168	48.712	4.732	49.5	-0.332
fv00500	fv00400	48.100	47.700	900	80.0	0.5	0.013	53.100	52.500	2.010	1.280	0.904	0.7	-0.288	48.712	48.270	4.388	49.1	-0.388
fv00400	fv00300	47.700	47.000	900	93.0	0.8	0.013	52.500	52.200	2.470	1.570	0.904	0.6	-0.330	48.270	47.548	4.230	48.6	-0.330
fv00300	fv00200	47.000	46.100	900	22.0	4.1	0.013	52.200	52.000	5.760	3.660	0.904	0.2	-0.352	47.548	46.356	4.652	47.9	-0.352
fv00200	fv00100	46.100	44.800	900	8.0	16.3	0.013	52.000	52.000	11.470	7.300	0.904	0.1	-0.644	46.356	45.700	5.644	47.0	-0.644

Note: [1] A negative surcharge implies that the pipe is not flowing full.

[2] Freeboard between upstream hydraulic gradeline elevation and upstream manhole cover elevation.

[3] HGL elevations at U/S MH for "Monitored & Design" scenario as reported in Table 5-1 of the *Forest Valley Trunk and Orleans Cumberland Collector Capacity Analysis* (Stantec Consulting Ltd., October 2003).

Table B-2: Pipe Data and Hydraulic Simulation Results for the Sanitary Trunk Sewer (Monitored & Design Scenario, 165.2 L/s Redirected from fv07400 to fv07700)

U/S MH	D/S MH	U/S Invert (m)	D/S Invert (m)	Pipe Dia. / Height (mm)	Pipe Length (m)	Pipe Slope (%)	n	U/S MH Cover Elev. (m)	D/S MH Cover Elev. (m)	Design Vel. (m/s)	Design Flow (m^3/s)	Peak Pipe Flow (m^3/s)	Peak / Design Flow	Surcharge U/S [(1)] (m)	Max. U/S HGL (m)	Max. D/S HGL (m)	Freeboard U/S HGL and MH Cover [(2)] (m)	Compare to 2003 HGL Results (m)	
																		U/S HGL [(3)] (m)	Difference (m)
fv08100	fv08000	83.011	82.965	900	45.0	0.1	0.013	86.000	86.400	0.900	0.572	0.533	0.9	-0.166	83.745	83.705	2.255	83.9	-0.155
fv08000	fv07900	82.965	82.877	900	86.0	0.1	0.013	86.400	87.100	0.900	0.572	0.533	0.9	-0.160	83.705	83.631	2.695	83.9	-0.195
fv07900	fv07800	82.877	82.751	900	139.0	0.1	0.013	87.100	87.600	0.854	0.543	0.533	1.0	-0.146	83.631	83.515	3.469	83.8	-0.169
fv07800	fv07700	82.751	82.608	900	132.0	0.1	0.013	87.600	87.800	0.944	0.600	0.533	0.9	-0.136	83.515	83.410	4.085	83.7	-0.185
fv07700	fv07600	82.608	82.450	900	153.0	0.1	0.013	87.800	87.700	0.900	0.572	0.698	1.2	-0.098	83.410	83.194	4.390	83.5	-0.090
fv07600	fv07500	82.450	82.224	900	153.0	0.2	0.013	87.700	87.800	1.102	0.701	0.698	1.0	-0.156	83.194	82.968	4.506	83.4	-0.206
fv07500	fv07400	82.224	81.900	900	152.0	0.2	0.013	87.800	88.000	1.304	0.830	0.698	0.8	-0.156	82.968	82.637	4.832	83.1	-0.132
fv07400	fv07300	81.900	81.800	900	103.0	0.1	0.013	88.000	87.800	0.900	0.572	0.714	1.2	-0.163	82.637	82.442	5.363	82.9	-0.263
fv07300	fv07200	81.800	81.600	900	71.0	0.3	0.013	87.800	87.500	1.506	0.958	0.714	0.7	-0.258	82.442	82.306	5.358	82.7	-0.258
fv07200	fv07100	81.600	81.400	900	72.0	0.3	0.013	87.500	87.600	1.506	0.958	0.714	0.7	-0.194	82.306	82.201	5.194	82.5	-0.194
fv07100	fv07000	81.400	81.300	900	47.0	0.2	0.013	87.600	87.300	1.304	0.830	0.714	0.9	-0.099	82.201	82.133	5.399	82.4	-0.199
fv07000	fv06900	81.300	81.200	900	56.0	0.2	0.013	87.300	87.000	1.207	0.768	0.714	0.9	-0.067	82.133	81.994	5.167	82.3	-0.167
fv06900	fv06800	81.200	81.100	900	79.0	0.1	0.013	87.000	87.700	0.986	0.627	0.793	1.3	-0.106	81.994	81.834	5.006	82.2	-0.206
fv06800	fv06700	81.100	80.900	900	65.0	0.3	0.013	87.700	87.800	1.584	1.008	0.793	0.8	-0.166	81.834	81.713	5.866	82.0	-0.166
fv06700	fv06600	80.900	80.800	900	49.0	0.2	0.013	87.800	88.100	1.273	0.810	0.793	1.0	-0.087	81.713	81.621	6.087	81.9	-0.187
fv06600	fv06500	80.800	80.800	900	47.0	0.0	0.013	88.100	88.200	0.090	0.060	0.793	13.2	-0.079	81.621	81.515	6.479	81.8	-0.179
fv06500	fv06400	80.800	80.600	900	51.0	0.4	0.013	88.200	88.500	1.777	1.131	0.793	0.7	-0.185	81.515	81.422	6.685	81.7	-0.185
fv06400	fv06300	80.600	80.600	900	43.0	0.0	0.013	88.500	88.600	0.090	0.060	0.793	13.2	-0.078	81.422	81.335	7.078	81.6	-0.178
fv06300	fv06200	80.600	80.500	900	48.0	0.2	0.013	88.600	88.800	1.304	0.830	0.793	1.0	-0.165	81.335	81.241	7.265	81.5	-0.165
fv06200	fv06100	80.500	80.500	900	26.0	0.0	0.013	88.800	88.900	0.090	0.060	0.793	13.2	-0.159	81.241	81.174	7.559	81.4	-0.159
fv06100	fv06000	80.500	80.300	900	70.0	0.3	0.013	88.900	88.600	1.520	0.970	0.793	0.8	-0.226	81.174	81.023	7.726	81.4	-0.226
fv06000	fv05900	80.300	80.200	900	70.0	0.1	0.013	88.600	88.600	1.080	0.680	0.793	1.2	-0.177	81.023	80.858	7.577	81.2	-0.177
fv05900	fv05800	80.200	80.000	900	77.0	0.3	0.013	88.600	89.000	1.450	0.920	0.794	0.9	-0.242	80.858	80.669	7.742	81.1	-0.242
fv05800	fv05700	80.000	79.800	900	74.0	0.3	0.013	89.000	89.100	1.480	0.940	0.794	0.8	-0.231	80.669	80.500	8.331	80.9	-0.231
fv05700	fv05600	79.800	79.600	900	91.0	0.2	0.013	89.100	87.900	1.330	0.850	0.806	0.9	-0.200	80.500	80.296	8.600	80.7	-0.200
fv05600	fv05500	79.600	79.400	900	77.0	0.3	0.013	87.900	86.900	1.450	0.920	0.807	0.9	-0.204	80.296	80.126	7.604	80.5	-0.204
fv05500	fv05400	79.400	79.100	900	97.0	0.3	0.013	86.900	85.500	1.580	1.010	0.807	0.8	-0.174	80.126	79.840	6.774	80.3	-0.174
fv05400	fv05300	79.100	79.100	900	26.0	0.0	0.013	85.500	84.700	0.090	0.060	0.819	13.7	-0.160	79.840	79.744	5.660	80.0	-0.160
fv05300	fv05200	79.100	78.900	900	52.0	0.4	0.013	84.700	84.300	1.760	1.120	0.819	0.7	-0.256	79.744	79.615	4.956	80.0	-0.256
fv05200	fv05100	78.900	78.800	900	38.0	0.3	0.013	84.300	84.000	1.460	0.930	0.819	0.9	-0.185	79.615	79.513	4.685	79.8	-0.185
fv05100	fv05000	78.800	78.700	900	53.0	0.2	0.013	84.000	84.400	1.240	0.790	0.820	1.0	-0.187	79.513	79.383	4.487	79.7	-0.187
fv05000	fv04900	78.700	78.500	900	76.0	0.3	0.013	84.400	84.800	1.460	0.930	0.820	0.9	-0.217	79.383	79.198	5.017	79.6	-0.217
fv04900	fv04800	78.500	78.300	900	74.0	0.3	0.013	84.800	84.300	1.480	0.940	0.822	0.9	-0.202	79.198	79.033	5.602	79.4	-0.202
fv04800	fv04700	78.300	78.200	900	36.0	0.3	0.013	84.300	84.300	1.500	0.950	0.822	0.9	-0.167	79.033	78.956	5.267	79.2	-0.167
fv04700	fv04600	78.200	78.100	900	38.0	0.3	0.013	84.300	84.400	1.460	0.930	0.822	0.9	-0.144	78.956	78.882	5.344	79.1	-0.144
fv04600	fv04500	78.100	77.900	900	81.0	0.3	0.013	84.400	84.800	1.410	0.900	0.823	0.9	-0.118	78.882	78.735	5.518	79.0	-0.118
fv04500	fv04400	77.900	77.800	900	48.0	0.2	0.013	84.800	84.400	1.300	0.830	0.823	1.0	-0.065	78.735	78.648	6.065	78.8	-0.065
fv04400	fv04300	77.800	77.700	900	41.0	0.2	0.013	84.400	84.000	1.410	0.890	0.828	0.9	-0.052	78.648	78.572	5.752	78.7	-0.052
fv04300	fv04200	77.700	77.500	900	55.0	0.4	0.013	84.000	84.500	1.720	1.090	0.883	0.8	-0.028	78.572	78.443	5.428	78.6	-0.028
fv04200	fv04100	77.500	77.400	900	43.0	0.2	0.013	84.500	84.600	1.370	0.870	0.883	1.0	0.043	78.443	78.329	6.057	78.4	0.043
fv04100	fv04000	77.400	77.300	900	79.0	0.1	0.013	84.600	84.100	1.010	0.640	0.884	1.4	0.029	78.329	78.140	6.271	78.4	-0.071
fv04000	fv03900	77.300	77.200	900	21.0	0.5	0.013	84.100	83.900	1.960	1.250	0.889	0.7	-0.060	78.140	78.088	5.960	78.2	-0.060
fv03900	fv03800	77.200	77.100	900	61.0	0.2	0.013	83.900	83.600	1.150	0.730	0.889	1.2	-0.012	78.088	77.934	5.812	78.2	-0.112
fv03800	fv03700	77.100	76.900	900	71.0	0.3	0.013	83.600	83.600	1.510	0.960	0.891	0.9	-0.066	77.934	77.781	5.666	78.0	-0.066
fv03700	fv03600	76.900	76.900	900	27.0	0.0	0.013	83.600	83.700	0.090	0.060	0.892	14.9	-0.019	77.781	77.709	5.819	77.9	-0.119
fv03600	fv03500	76.900	76.800	900	55.0	0.2	0.013	83.700	84.000	1.210	0.770	0.893	1.2	-0.091	77.709	77.583	5.991	77.9	-0.191
fv03500	fv03400	76.800	76.600	900	59.0	0.3	0.013	84.000	83.800	1.660	1.050	0.895	0.9	-0.117	77.583	77.458	6.417	77.7	-0.117

Table B-2: Pipe Data and Hydraulic Simulation Results for the Sanitary Trunk Sewer (Monitored & Design Scenario, 165.2 L/s Redirected from fv07400 to fv07700)

U/S MH	D/S MH	U/S Invert (m)	D/S Invert (m)	Pipe Dia. / Height (mm)	Pipe Length (m)	Pipe Slope (%)	n	U/S MH Cover Elev. (m)	D/S MH Cover Elev. (m)	Design Vel. (m/s)	Design Flow (m^3/s)	Peak Pipe Flow (m^3/s)	Peak / Design Flow	Surcharge U/S [1] (m)	Max. U/S HGL (m)	Max. D/S HGL (m)	Freeboard U/S HGL and MH Cover [2] (m)	Compare to 2003 HGL Results (m)	
																		U/S HGL [3] (m)	Difference (m)
fv03400	fv03300	76.600	76.600	900	28.0	0.0	0.013	83.800	84.000	0.090	0.060	0.895	14.9	-0.042	77.458	77.385	6.342	77.6	-0.142
fv03300	fv03200	76.600	76.500	900	32.0	0.3	0.013	84.000	84.000	1.590	1.010	0.896	0.9	-0.115	77.385	77.304	6.615	77.5	-0.115
fv03200	fv03100	76.500	76.400	900	34.0	0.3	0.013	84.000	83.800	1.540	0.980	0.897	0.9	-0.096	77.304	77.219	6.696	77.5	-0.196
fv03100	fv03000	76.400	76.400	900	28.0	0.0	0.013	83.800	83.900	0.090	0.060	0.897	15.0	-0.081	77.219	77.135	6.581	77.4	-0.181
fv03000	fv02900	76.400	76.200	900	76.0	0.3	0.013	83.900	83.700	1.460	0.930	0.898	1.0	-0.165	77.135	76.947	6.765	77.3	-0.165
fv02900	fv02800	76.200	76.000	900	74.0	0.3	0.013	83.700	83.800	1.480	0.940	0.900	1.0	-0.153	76.947	76.747	6.753	77.2	-0.253
fv02800	fv02700	76.000	75.900	900	50.0	0.2	0.013	83.800	83.600	1.270	0.810	0.902	1.1	-0.153	76.747	76.571	7.053	77.0	-0.253
fv02700	fv02600	75.900	75.700	900	93.0	0.2	0.013	83.600	82.700	1.320	0.840	0.903	1.1	-0.229	76.571	76.088	7.029	76.9	-0.329
fv02600	fv02500	75.700	74.600	900	50.0	2.2	0.013	82.700	80.300	4.220	2.690	0.903	0.3	-0.512	76.088	74.897	6.612	76.6	-0.512
fv02500	fv02400	74.600	71.600	900	67.0	4.5	0.013	80.300	76.900	6.020	3.830	0.903	0.2	-0.603	74.897	71.957	5.403	75.6	-0.703
fv02400	fv02300	71.600	69.800	900	79.0	2.3	0.013	76.900	73.300	4.300	2.730	0.903	0.3	-0.543	71.957	70.221	4.943	72.5	-0.543
fv02300	fv02200	69.800	68.600	900	60.0	2.0	0.013	73.300	71.900	4.020	2.560	0.903	0.4	-0.479	70.221	68.858	3.079	70.7	-0.479
fv02200	fv02100	68.600	64.700	900	50.0	7.8	0.013	71.900	70.400	7.950	5.060	0.904	0.2	-0.642	68.858	65.017	3.042	69.5	-0.642
fv02100	fv02000	64.700	61.700	900	85.0	3.5	0.013	70.400	66.300	5.350	3.400	0.904	0.3	-0.583	65.017	62.084	5.383	65.6	-0.583
fv02000	fv01900	61.700	59.000	900	120.0	2.3	0.013	66.300	63.200	4.270	2.720	0.904	0.3	-0.516	62.084	59.445	4.216	62.6	-0.516
fv01900	fv01800	59.000	58.600	900	28.0	1.4	0.013	63.200	62.900	3.400	2.160	0.904	0.4	-0.455	59.445	59.161	3.755	60.0	-0.555
fv01800	fv01700	58.600	58.100	900	73.0	0.7	0.013	62.900	63.200	2.360	1.500	0.904	0.6	-0.339	59.161	58.393	3.739	59.6	-0.439
fv01700	fv01600	58.100	56.000	900	39.0	5.4	0.013	63.200	62.000	6.600	4.200	0.904	0.2	-0.607	58.393	56.370	4.807	59.0	-0.607
fv01600	fv01500	56.000	53.600	900	121.0	2.0	0.013	62.000	63.800	4.010	2.550	0.904	0.4	-0.530	56.370	54.177	5.630	56.9	-0.530
fv01500	fv01400	53.600	52.900	900	150.0	0.5	0.013	63.800	63.800	1.940	1.240	0.904	0.7	-0.323	54.177	53.520	9.623	54.5	-0.323
fv01400	fv01300	52.900	52.300	900	151.0	0.4	0.013	63.800	59.500	1.790	1.140	0.904	0.8	-0.280	53.520	52.995	10.280	53.9	-0.380
fv01300	fv01200	52.300	51.900	900	149.0	0.3	0.013	59.500	58.100	1.470	0.940	0.904	1.0	-0.205	52.995	52.411	6.505	53.2	-0.205
fv01200	fv01100	51.900	51.400	900	69.0	0.7	0.013	58.100	56.400	2.420	1.540	0.904	0.6	-0.389	52.411	51.969	5.689	52.8	-0.389
fv01100	fv01000	51.400	50.900	900	104.0	0.5	0.013	56.400	55.100	1.970	1.260	0.904	0.7	-0.331	51.969	51.476	4.431	52.4	-0.431
fv01000	fv00900	50.900	50.300	900	127.0	0.5	0.013	55.100	54.600	1.960	1.240	0.904	0.7	-0.324	51.476	50.905	3.624	51.8	-0.324
fv00900	fv00800	50.300	49.700	900	149.0	0.4	0.013	54.600	54.300	1.810	1.150	0.904	0.8	-0.295	50.905	50.289	3.695	51.2	-0.295
fv00800	fv00700	49.700	49.000	900	151.0	0.5	0.013	54.300	54.100	1.940	1.230	0.904	0.7	-0.311	50.289	49.705	4.011	50.6	-0.311
fv00700	fv00600	49.000	48.600	900	150.0	0.3	0.013	54.100	53.900	1.470	0.930	0.904	1.0	-0.195	49.705	49.168	4.395	49.9	-0.195
fv00600	fv00500	48.600	48.100	900	100.0	0.5	0.013	53.900	53.100	2.010	1.280	0.904	0.7	-0.332	49.168	48.712	4.732	49.5	-0.332
fv00500	fv00400	48.100	47.700	900	80.0	0.5	0.013	53.100	52.500	2.010	1.280	0.904	0.7	-0.288	48.712	48.270	4.388	49.1	-0.388
fv00400	fv00300	47.700	47.000	900	93.0	0.8	0.013	52.500	52.200	2.470	1.570	0.904	0.6	-0.330	48.270	47.548	4.230	48.6	-0.330
fv00300	fv00200	47.000	46.100	900	22.0	4.1	0.013	52.200	52.000	5.760	3.660	0.904	0.2	-0.352	47.548	46.356	4.652	47.9	-0.352
fv00200	fv00100	46.100	44.800	900	8.0	16.3	0.013	52.000	52.000	11.470	7.300	0.904	0.1	-0.644	46.356	45.700	5.644	47.0	-0.644

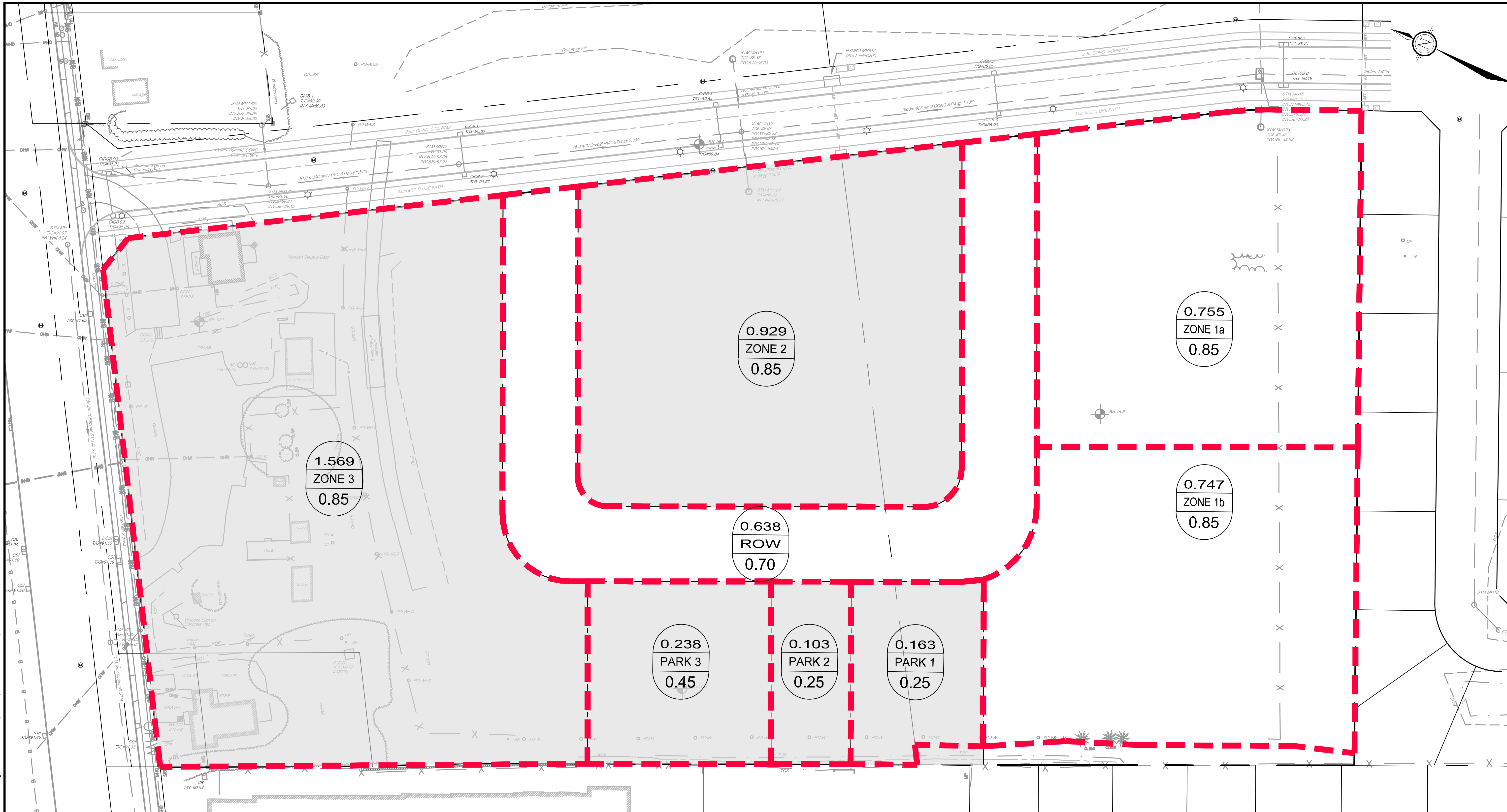
Note:

[1] A negative surcharge implies that the pipe is not flowing full.

[2] Freeboard between upstream hydraulic gradeline elevation and upstream manhole cover elevation.

[3] HGL elevations at U/S MH for "Monitored & Design" scenario as reported in Table 5-1 of the *Forest Valley Trunk and Orleans Cumberland Collector Capacity Analysis* (Stantec Consulting Ltd., October 2003).

APPENDIX D
Storm Sewer and Stormwater Management Information



LEGEND

PROPERTY LINE

STM MH — *EXISTING STORM MANHOLE & SEWER*

CB 1 — *EXISTING CATCHBASIN*

STORM SEWER DRAINAGE AREA BOUNDARY

0.085 / A-16 / 0.78 — DRAINAGE AREA (ha) / DRAINAGE AREA ID / RUNOFF COEFFICIENT

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

3484 INNES ROAD

PRELIMINARY STORMWATER MANAGEMENT AREA PLAN

SCALE	DATE	JOB	FIGURE
1 : 1000	SEPT 2021	121214	SWM

TABLE 1: Allowable Runoff Coefficient "C" - External

Area	"C"
Total	0.40
0.110	

TABLE 1F: Allowable Flows - External

Outlet Options	Area (ha)	"C"	Tc (min)	$Q_{2\ Year}$ (L/s)
	0.110	0.40	10	**9.4**

Time of Concentration	Tc=	10	min
Intensity (2 Year Event)	I_2=	76.81	mm/hr
Intensity (5 Year Event)	I_5=	104.19	mm/hr
Intensity (100 Year Event)	I_{100}=	178.56	mm/hr

100 year Intensity = 1735.688 / (Time in min + 6.014) $^{0.820}$
5 year Intensity = 998.071 / (Time in min + 6.053) $^{0.814}$

Equations:
Flow Equation
Q = 2.78 x C x I x A
Where:
C is the runoff coefficient
I is the rainfall intensity, City of Ottawa IDF
A is the total drainage area

TABLE 2A: Allowable release rate

Area	Allowable Flow	
Block 149	501	(From Assessment of Adequacy of Public Services By DSEI - May 2019)
Block 150	406	(From Assessment of Adequacy of Public Services By DSEI - May 2020)
External	9.4	(Calculated)
Total	**916.4**	**L/s**

TABLE 2B: Release Rate Per Zone

Zone	Area (ha)	% Area	Release Rate By area (L/s)	
ROW	0.638	12.26%	130.00	* ROW release rate set to have no 2-yr storage requirement
Park	0.504	9.69%	138.00	* Park release rate set to prevent ponding for all storms upto and including the 100-yr storm event
Zone 1	1.502	28.87%	243.50	* Release Rate allocated by % area
Zone 2	0.929	17.86%	150.60	* Release Rate allocated by % area
Zone 3	1.569	30.16%	254.30	* Release Rate allocated by % area
Total	**5.142**	**98.83%**	**916.4**	

TABLE 3A: Post-Development Runoff Coefficient "C" - ROW

			5 Year Event		100 Year Event	
Area	0.4	Ha	"C"	C_{avg}	"C" + 25%	*C_{avg}
Total	Hard	0.456	0.90	0.70	1.00	0.79
0.638	Roof	0.000	0.90		1.00	
	Soft	0.182	0.20		0.25	

TABLE 3B: 2 YEAR EVENT QUANTITY STORAGE REQUIREMENT - ROW

0.638 =Area (ha)
0.70 = C

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Allowable Runoff (L/s)	Net Flow to be Stored (L/s)	Storage Req'd (m^3)
2 YEAR	**0**	167.22	**207.65**	**130.0**	**77.65**	**0.00**
	5	103.57	128.61	130.0	-1.39	-0.42
	10	76.81	95.37	130.0	-34.63	-20.78

TABLE 3C: 5 YEAR EVENT QUANTITY STORAGE REQUIREMENT - ROW

0.638 =Area (ha)
0.70 = C

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Allowable Runoff (L/s)	Net Flow to be Stored (L/s)	Storage Req'd (m^3)
5 YEAR	0	230.48	286.20	130.0	156.20	0.00
	5	**141.18**	**175.31**	**130.0**	**45.31**	**13.59**
	10	104.19	129.38	130.0	-0.62	-0.37
	15	83.56	103.76	130.0	-26.24	-23.62

TABLE 3E: 100 YEAR EVENT QUANTITY STORAGE REQUIREMENT - ROW

0.638 =Area (ha)
0.79 = C

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Allowable Runoff (L/s)	Net Flow to be Stored (L/s)	Storage Req'd (m^3)
100 YEAR	0	398.62	555.60	130.0	425.60	0.00
	5	242.70	338.28	130.0	208.28	62.48
	10	**178.56**	**248.88**	**130.0**	**118.88**	**71.33**
	15	142.89	199.17	130.0	69.17	62.25
	20	119.95	167.19	130.0	37.19	44.63

TABLE 3E: 100+20 YEAR EVENT QUANTITY STORAGE REQUIREMENT - ROW

0.638 =Area (ha)
0.79 = C

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Allowable Runoff (L/s)	Net Flow to be Stored (L/s)	Storage Req'd (m^3)
100 YEAR +20%	0	478.34	666.72	130.0	536.72	0.00
	5	291.24	405.94	130.0	275.94	82.78
	10	**214.27**	**298.65**	**130.0**	**168.65**	**101.19**
	15	171.47	239.00	130.0	109.00	98.10
	20	143.94	200.63	130.0	70.63	84.75

Equations:
Flow Equation
$Q = 2.78 \times C \times I \times A$
Where:
C is the runoff coefficient
I is the rainfall intensity, City of Ottawa IDF
A is the total drainage area

Runoff Coefficient Equation
$C_5 = (A_{hard} \times 0.9 + A_{soft} \times 0.2)/A_{Tot}$
$C_{100} = (A_{hard} \times 1.0 + A_{soft} \times 0.25)/A_{Tot}$

TABLE 4A: Post-Development Runoff Coefficient "C" - ZONE 1

			5 Year Event		100 Year Event	
Area	0.4	Ha	"C"	C_{avg}	"C" + 25%	*C_{avg}
Total	Hard	1.382	0.90	0.84	1.00	0.94
1.502	Roof	0.000	0.90		1.00	
	Soft	0.120	0.20		0.25	

TABLE 4B: 2 YEAR EVENT QUANTITY STORAGE REQUIREMENT - ZONE 1

1.502 =Area (ha)
0.84 = C

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Allowable Runoff (L/s)	Net Flow to be Stored (L/s)	Storage Req'd (m^3)
2 YEAR	0	167.22	589.37	243.5	345.87	0.00
	5	103.57	**365.04**	**243.5**	**121.54**	**36.46**
	10	76.81	270.70	243.5	27.20	16.32
	15	61.77	217.70	243.5	-25.80	-23.22

TABLE 4C: 5 YEAR EVENT QUANTITY STORAGE REQUIREMENT - ZONE 1

1.502 =Area (ha)
0.84 = C

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Allowable Runoff (L/s)	Net Flow to be Stored (L/s)	Storage Req'd (m^3)
5 YEAR	0	230.48	812.33	243.5	568.83	0.00
	5	**141.18**	**497.58**	**243.5**	**254.08**	**76.22**
	10	104.19	367.23	243.5	123.73	74.24
	15	83.56	294.50	243.5	51.00	45.90

TABLE 4E: 100 YEAR EVENT QUANTITY STORAGE REQUIREMENT - ZONE 1

1.502 =Area (ha)
0.94 = C

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Allowable Runoff (L/s)	Net Flow to be Stored (L/s)	Storage Req'd (m^3)
100 YEAR	5	242.70	952.70	243.5	709.20	212.76
	10	178.56	700.91	243.5	457.41	274.45
	15	**142.89**	**560.91**	**243.5**	**317.41**	**285.67**
	20	119.95	470.85	243.5	227.35	272.82
	25	103.85	407.64	243.5	164.14	246.21

TABLE 4E: 100+20 YEAR EVENT QUANTITY STORAGE REQUIREMENT - ZONE 1

1.502 =Area (ha)
0.94 = C

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Allowable Runoff (L/s)	Net Flow to be Stored (L/s)	Storage Req'd (m^3)
100 YEAR +20%	10	214.27	841.09	243.5	597.59	358.55
	15	171.47	673.09	243.5	429.59	386.63
	20	**143.94**	**565.02**	**243.5**	**321.52**	**385.82**
	25	124.62	489.16	243.5	245.66	368.50
	30	110.24	432.74	243.5	189.24	340.63

Equations:
Flow Equation
Q = 2.78 x C x I x A
Where:
C is the runoff coefficient
I is the rainfall intensity, City of Ottawa IDF
A is the total drainage area

Runoff Coefficient Equation
$C_5 = (A_{hard} \times 0.9 + A_{soft} \times 0.2)/A_{Tot}$
$C_{100} = (A_{hard} \times 1.0 + A_{soft} \times 0.25)/A_{Tot}$

TABLE 5A: Post-Development Runoff Coefficient "C" - ZONE 2

			5 Year Event		100 Year Event	
Area	0.4	Ha	"C"	C_{avg}	"C" + 25%	*C_{avg}
Total	Hard	0.859	0.90	0.85	1.00	0.94
0.929	Roof	0.000	0.90		1.00	
	Soft	0.070	0.20		0.25	

TABLE 5B: 2 YEAR EVENT QUANTITY STORAGE REQUIREMENT - ZONE 2

0.929 =Area (ha)
0.85 = C

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Allowable Runoff (L/s)	Net Flow to be Stored (L/s)	Storage Req'd (m^3)
2 YEAR	0	167.22	365.91	150.6	215.31	0.00
	5	103.57	**226.63**	**150.6**	**76.03**	**22.81**
	10	76.81	168.06	150.6	17.46	10.48
	15	61.77	135.16	150.6	-15.44	-13.90

TABLE 5C: 5 YEAR EVENT QUANTITY STORAGE REQUIREMENT - ZONE 2

0.929 =Area (ha)
0.85 = C

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Allowable Runoff (L/s)	Net Flow to be Stored (L/s)	Storage Req'd (m^3)
5 YEAR	0	230.48	504.33	150.6	353.73	0.00
	5	**141.18**	**308.92**	**150.6**	**158.32**	**47.50**
	10	104.19	227.99	150.6	77.39	46.43
	15	83.56	182.83	150.6	32.23	29.01

TABLE 5E: 100 YEAR EVENT QUANTITY STORAGE REQUIREMENT - ZONE 2

0.929 =Area (ha)
0.94 = C

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Allowable Runoff (L/s)	Net Flow to be Stored (L/s)	Storage Req'd (m^3)
100 YEAR	5	242.70	591.39	150.6	440.79	132.24
	10	178.56	435.09	150.6	284.49	170.69
	15	**142.89**	**348.19**	**150.6**	**197.59**	**177.83**
	20	119.95	292.28	150.6	141.68	170.02
	25	103.85	253.04	150.6	102.44	153.66

TABLE 5E: 100+20 YEAR EVENT QUANTITY STORAGE REQUIREMENT - ZONE 2

0.929 =Area (ha)
0.94 = C

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Allowable Runoff (L/s)	Net Flow to be Stored (L/s)	Storage Req'd (m^3)
100 YEAR +20%	5	291.24	709.67	150.6	559.07	167.72
	10	214.27	522.11	150.6	371.51	222.90
	15	**171.47**	**417.82**	**150.6**	**267.22**	**240.50**
	20	143.94	350.74	150.6	200.14	240.16
	25	124.62	303.65	150.6	153.05	229.57

Equations:
Flow Equation
$Q = 2.78 \times C \times I \times A$
Where:
C is the runoff coefficient
I is the rainfall intensity, City of Ottawa IDF
A is the total drainage area

Runoff Coefficient Equation
$C_5 = (A_{hard} \times 0.9 + A_{soft} \times 0.2)/A_{Tot}$
$C_{100} = (A_{hard} \times 1.0 + A_{soft} \times 0.25)/A_{Tot}$

TABLE 6A: Post-Development Runoff Coefficient "C" - ZONE 3

			5 Year Event		100 Year Event	
Area	0.4	Ha	"C"	C_{avg}	"C" + 25%	*C_{avg}
Total	Hard	1.459	0.90	0.85	1.00	0.95
1.569	Roof	0.000	0.90		1.00	
	Soft	0.110	0.20		0.25	

TABLE 6B: 2 YEAR EVENT QUANTITY STORAGE REQUIREMENT - ZONE 3

1.569 =Area (ha)
0.85 = C

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Allowable Runoff (L/s)	Net Flow to be Stored (L/s)	Storage Req'd (m^3)
2 YEAR	0	167.22	620.66	254.3	366.36	0.00
	5	103.57	**384.41**	**254.3**	**130.11**	**39.03**
	10	76.81	285.07	254.3	30.77	18.46
	15	61.77	229.25	254.3	-25.05	-22.54

TABLE 6C: 5 YEAR EVENT QUANTITY STORAGE REQUIREMENT - ZONE 3

1.569 =Area (ha)
0.85 = C

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Allowable Runoff (L/s)	Net Flow to be Stored (L/s)	Storage Req'd (m^3)
5 YEAR	0	230.48	855.45	254.3	601.15	0.00
	5	**141.18**	**524.00**	**254.3**	**269.70**	**80.91**
	10	104.19	386.72	254.3	132.42	79.45
	15	83.56	310.13	254.3	55.83	50.25

TABLE 6E: 100 YEAR EVENT QUANTITY STORAGE REQUIREMENT - ZONE 3

1.569 =Area (ha)
0.95 = C

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Allowable Runoff (L/s)	Net Flow to be Stored (L/s)	Storage Req'd (m^3)
100 YEAR	5	242.70	1002.97	254.3	748.67	224.60
	10	178.56	737.89	254.3	483.59	290.15
	15	**142.89**	**590.51**	**254.3**	**336.21**	**302.59**
	20	119.95	495.69	254.3	241.39	289.67
	25	103.85	429.14	254.3	174.84	262.27

TABLE 6E: 100+20 YEAR EVENT QUANTITY STORAGE REQUIREMENT - ZONE 3

1.569 =Area (ha)
0.95 = C

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Allowable Runoff (L/s)	Net Flow to be Stored (L/s)	Storage Req'd (m^3)
100 YEAR +20%	5	291.24	1203.56	254.3	949.26	284.78
	10	214.27	885.47	254.3	631.17	378.70
	15	**171.47**	**708.61**	**254.3**	**454.31**	**408.88**
	20	143.94	594.83	254.3	340.53	408.64
	25	124.62	514.97	254.3	260.67	391.01

Equations:
Flow Equation
$Q = 2.78 \times C \times I \times A$
Where:
C is the runoff coefficient
I is the rainfall intensity, City of Ottawa IDF
A is the total drainage area

Runoff Coefficient Equation
$C_5 = (A_{hard} \times 0.9 + A_{soft} \times 0.2)/A_{Tot}$
$C_{100} = (A_{hard} \times 1.0 + A_{soft} \times 0.25)/A_{Tot}$

TABLE 7A: Post-Development Runoff Coefficient "C" - PARK

			5 Year Event		100 Year Event	
Area	0.4	Ha	"C"	C_{avg}	"C" + 25%	*C_{avg}
Total	Hard	0.104	0.90	0.34	1.00	0.40
0.504	Roof	0.000	0.90		1.00	
	Soft	0.400	0.20		0.25	

TABLE 7B: 2 YEAR EVENT QUANTITY STORAGE REQUIREMENT - PARK

0.504 =Area (ha)
0.34 = C

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Allowable Runoff (L/s)	Net Flow to be Stored (L/s)	Storage Req'd (m^3)
2 YEAR	**0**	167.22	**80.70**	**138.0**	**-57.30**	**0.00**
	5	103.57	49.98	138.0	-88.02	-26.40
	10	76.81	37.07	138.0	-100.93	-60.56

TABLE 7C: 5 YEAR EVENT QUANTITY STORAGE REQUIREMENT - PARK

0.504 =Area (ha)
0.34 = C

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Allowable Runoff (L/s)	Net Flow to be Stored (L/s)	Storage Req'd (m^3)
5 YEAR	**0**	**230.48**	**111.23**	**138.0**	**-26.77**	**0.00**
	5	141.18	68.13	138.0	-69.87	-20.96
	10	104.19	50.28	138.0	-87.72	-52.63

TABLE 7E: 100 YEAR EVENT QUANTITY STORAGE REQUIREMENT - PARK

0.504 =Area (ha)
0.40 = C

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Allowable Runoff (L/s)	Net Flow to be Stored (L/s)	Storage Req'd (m^3)
100 YEAR	**0**	**398.62**	**226.06**	**138.0**	**88.06**	**0.00**
	5	242.70	137.64	138.0	-0.36	-0.11
	10	178.56	101.26	138.0	-36.74	-22.04

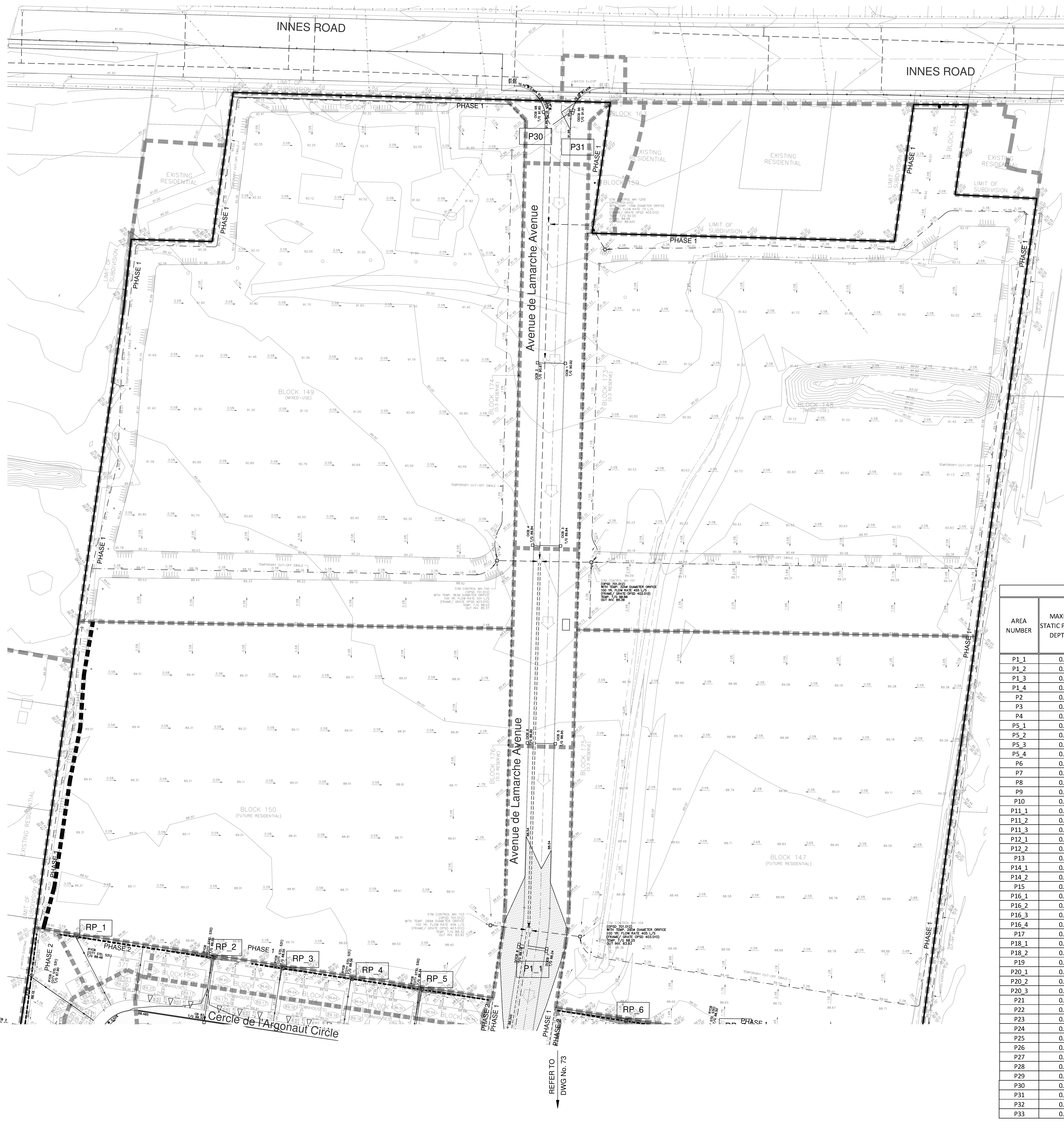
TABLE 7E: 100+20 YEAR EVENT QUANTITY STORAGE REQUIREMENT - PARK

0.504 =Area (ha)
0.40 = C

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Allowable Runoff (L/s)	Net Flow to be Stored (L/s)	Storage Req'd (m^3)
100 YEAR +20%	0	478.34	271.28	144.0	127.28	0.00
	5	**291.24**	**165.17**	**144.0**	**21.17**	**6.35**
	10	214.27	121.52	144.0	-22.48	-13.49
	15	171.47	97.25	144.0	-46.75	-42.08

Equations:
Flow Equation
$Q = 2.78 \times C \times I \times A$
Where:
C is the runoff coefficient
I is the rainfall intensity, City of Ottawa IDF
A is the total drainage area

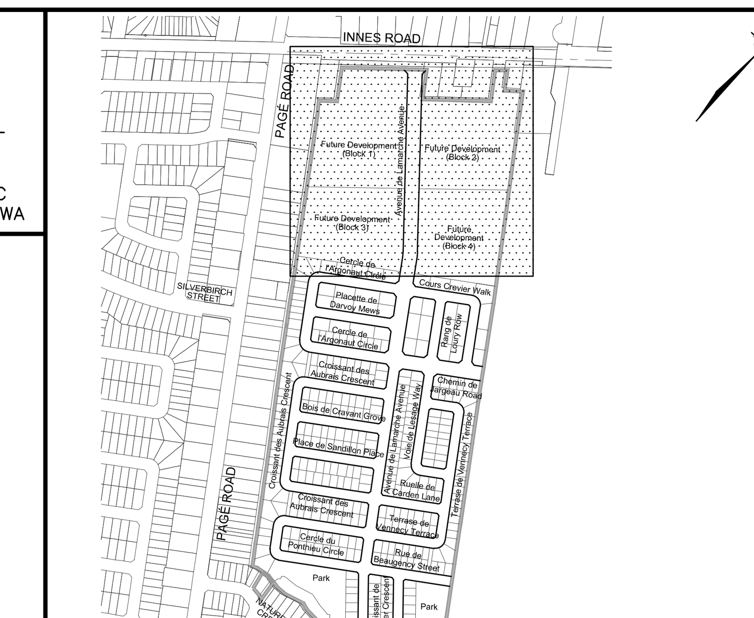
Runoff Coefficient Equation
$C_5 = (A_{hard} \times 0.9 + A_{soft} \times 0.2)/A_{Tot}$
$C_{100} = (A_{hard} \times 1.0 + A_{soft} \times 0.25)/A_{Tot}$



APPROVED ☐ REFUSED ☐

THIS ____ DAY OF_________, 20____

JOSHUA WHITE, P.ENG
PROJECT MANAGER – EAST BRANCH
PLANNING, INFRASTRUCTURE & ECONOMIC DEVELOPMENT DEPARTMENT, CITY OF OTTAWA



KEY PLAN
SCALE 1:10000

LEGEND

TOP OF FOUNDATION ELEVATION
FINISHED FLOOR ELEVATION
UNDERSIDE OF FOOTING ELEVATION
NUMBER OF RISERS
UNITS REQUIRING PRESSURE REDUCING VALVES — PRV
WALKOUT UNITS — W.O.
SLAB ON GRADE — SOG
PONDING AREA
PONDING AREA ID — PA-1
PHASING LIMITS
PROPOSED ELEVATION
EXISTING ELEVATION
TOP OF GRATE ELEVATION — T/G 90.93
MAJOR OVERLAND FLOW DIRECTION

TOPOGRAPHIC INFORMATION

TOPOGRAPHIC INFORMATION PROVIDED BY J.D. BARNES LIMITED, PROJECT No. 16–10–116–00. SURVEYS DATED NOVEMBER 30, 2017.

LEGAL INFORMATION

CALCULATED M–PLAN PROVIDED BY J.D. BARNES LIMITED, PROJECT No. 16–10–116–00 (PHASE 1 & 2) DATED SEPTEMBER 14, 2018.

ELEVATION NOTE

ELEVATION = 86.12 m

ELEVATIONS ARE GEODETIC AND ARE DERIVED FROM SITE BENCHMARK NCC CONTROL POINT 001196530229 HAVING A PUBLISHED ELEVATION OF 86.12m

No.	DATE	BY	DESCRIPTION
6.	18–10–30	M.Z.	REVISED M–PLAN
5.	18–07–27	M.Z.	REVISED WEST BOUNDARY STORM SYSTEM
4.	18–07–10	M.Z.	MYLARS FOR PHASE 1 COMMENCE WORK
3.	18–06–28	M.Z.	REVISED AS PER CITY AND UTILITY COMMENTS
2.	18–05–09	M.Z.	ISSUED FOR MOE APPROVAL
1.	18–01–24	M.Z.	1st SUBMISSION

100 YR/STATIC STREET PONDING AREA TABLE

AREA NUMBER	MAXIMUM STATIC PONDING DEPTH (m)	MAXIMUM STATIC PONDING ELEVATION (m)	MAXIMUM STATIC PONDING VOLUME (m^3)	MAXIMUM STATIC PONDING AREA (m^2)	MAX 100 YEAR PONDING DEPTH (MEASURED ABOVE CB T/G)
P1_1	0.35	88.54	143.2	1292.28	35.00
P1_2	0.35	88.54	108.3	977.91	35.00
P1_3	0.31	88.54	113.1	1050.99	31.00
P1_4	0.19	88.54	20.6	343.94	19.00
P2	0.35	88.67	121.6	1097.62	35.00
P3	0.33	88.58	93.8	898.30	33.00
P4	0.35	88.37	100.9	911.21	35.00
P5_1	0.35	88.20	110.4	996.88	35.00
P5_2	0.35	88.20	79.9	721.74	35.00
P5_3	0.35	88.20	116.3	1050.18	35.00
P5_4	0.35	88.20	79.3	716.38	35.00
P6	0.12	88.23	8.5	225.74	12.00
P7	0.35	88.32	121.7	1098.29	35.00
P8	0.32	88.31	63.7	629.08	32.00
P9	0.18	88.31	13.4	235.51	18.00
P10	0.35	88.14	125.4	1131.86	35.00
P11_1	0.35	87.99	84.3	761.31	35.00
P11_2	0.35	87.99	125.1	1128.87	35.00
P11_3	0.35	87.99	103.1	931.02	35.00
P12_1	0.35	88.17	105.5	952.22	35.00
P12_2	0.27	88.17	56.6	662.09	27.00
P13	0.35	88.09	82.9	727.97	35.00
P14_1	0.35	88.05	130.7	1179.29	35.00
P14_2	0.35	88.05	90.5	816.95	35.00
P15	0.35	88.05	80.6	707.26	35.00
P16_1	0.35	87.87	106.8	963.99	35.00
P16_2	0.35	87.87	106.2	958.57	35.00
P16_3	0.35	87.87	110.0	993.21	35.00
P16_4	0.35	87.87	94.7	854.93	35.00
P17	0.35	87.97	106.0	956.54	35.00
P18_1	0.24	87.94	33.3	438.35	24.00
P18_2	0.33	87.94	110.9	1061.31	33.00
P19	0.35	87.95	119.1	1075.21	35.00
P20_1	0.24	87.67	40.6	534.89	24.00
P20_2	0.25	87.67	36.8	465.29	25.00
P20_3	0.25	87.67	44.4	561.12	25.00
P21	0.35	87.87	95.9	865.76	35.00
P22	0.25	87.67	42.7	540.07	25.00
P23	0.18	87.66	17.2	302.78	18.00
P24	0.24	87.64	44.7	589.18	24.00
P25	0.35	87.54	122.8	1108.11	35.00
P26	0.31	87.49	108.5	1106.13	31.00
P27	0.07	88.50	0.5	23.83	7.00
P28	0.08	88.24	1.0	68.00	8.00
P29	0.08	88.19	1.5	60.73	8.00
P30	0.03	91.88	0.1	10.46	3.00
P31	0.07	91.98	0.4	18.34	7.00
P32	0.04	88.22	0.1	11.05	4.00
P33	0.10	88.27	1.6	51.26	10.00

Ottawa CITY OF OTTAWA

LICENSED PROFESSIONAL ENGINEER
M.ZDRAVEVSKI
100130902
18-10-30
PROVINCE OF ONTARIO

PROJECT No. 16–881

100 YEAR STATIC PONDING AREA AND ICD PLAN

CAIVAN (ORLEANS VILLAGE) LIMITED

ORLEANS VILLAGE

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

DRAWN BY:	M.Z.	CHECKED BY:	P.P.	DRAWING NO.	SHEET NO.
DESIGNED BY:	P.P.	CHECKED BY:	M.Z.		72
SCALE:	1:750	DATE:	JANUARY 2018		

CITY PLAN No. 17675

CITY FILE No. D07-16-16-0022

STORM SEWER CALCULATION SHEET (RATIONAL METHOD)

Manning 0.013

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

Location	LOCATION From Node	LOCATION To Node	AREA (Ha) 2 YEAR AREA (Ha)	2 YEAR R	2 YEAR Indiv. 2.78 AC	2 YEAR Accum. 2.78 AC	5 YEAR AREA (Ha)	5 YEAR R	5 YEAR Indiv. 2.78 AC	5 YEAR Accum. 2.78 AC	10 YEAR AREA (Ha)	10 YEAR R	10 YEAR Indiv. 2.78 AC	10 YEAR Accum. 2.78 AC	100 YEAR AREA (Ha)	100 YEAR R	100 YEAR Indiv. 2.78 AC	100 YEAR Accum. 2.78 AC	FLOW Time of Conc. (min)	Intensity 2 Year (mm/h)	Intensity 5 Year (mm/h)	Intensity 10 Year (mm/h)	Intensity 100 Year (mm/h)	Peak Flow Q (l/s)	SEWER DATA DIA. (mm) (actual)	DIA. (mm) (nominal)	TYPE	SLOPE (%)	LENGTH (m)	CAPACITY (l/s)	VELOCITY (m/s)	TIME OF FLOW (min.)	RATIO Q/Q full
West Boundary STM System																																	
					0.00	0.00			0.00	0.00			0.00	0.00	1.74	0.55	2.66	2.66															
					0.00	0.00			0.00	0.00			0.00	0.00	0.02	0.70	0.04	2.70															
					0.00	0.00			0.00	0.00			0.00	0.00	0.14	0.50	0.19	2.89															
					0.00	0.00			0.00	0.00			0.00	0.00	0.05	0.50	0.07	2.96	Tc=340/(2*60)+10min. (For 340.0m and 2.0m/s)					-59	FLOW TO MH C8 TO 5								
	MH C12 (100yr. Intake	HW C13			0.00	0.00			0.00	0.00			0.00	0.00	0.44	0.50	0.61	3.58	12.80	67.50	91.41	0.00	156.46	500	600	600	CONC	0.90	22.0	583	2.06	0.18	0.86
	.																																

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

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

Designed: P.P./C.M.	PROJECT: Caivan Communities Orleans Village			
Checked: M.Z.	LOCATION: City of Ottawa			
Dwg. Reference:	File Ref:	Date: 30 Oct 2018	Sheet No. SHEET 1 OF 5	

STORM SEWER CALCULATION SHEET (RATIONAL METHOD)

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

Manning 0.013

Ottawa

Location	From Node	To Node	2 YEAR AREA (Ha)	2 YEAR R	2 YEAR Indiv. 2.78 AC	2 YEAR Accum. 2.78 AC	5 YEAR AREA (Ha)	5 YEAR R	5 YEAR Indiv. 2.78 AC	5 YEAR Accum. 2.78 AC	10 YEAR AREA (Ha)	10 YEAR R	10 YEAR Indiv. 2.78 AC	10 YEAR Accum. 2.78 AC	100 YEAR AREA (Ha)	100 YEAR R	100 YEAR Indiv. 2.78 AC	100 YEAR Accum. 2.78 AC	Time of Conc. (min)	Intensity 2 Year (mm/h)	Intensity 5 Year (mm/h)	Intensity 10 Year (mm/h)	Intensity 100 Year (mm/h)	Peak Flow Q (l/s)	DIA. (mm) (actual)	DIA. (mm) (nominal)	TYPE	SLOPE (%)	LENGTH (m)	CAPACITY (l/s)	VELOCITY (m/s)	TIME OF FLOW (min.)	RATIO Q/Q full
Block 155 - 2003																																	
Contribution From Block 155, Pipe C8 - 5																								59	SUBDRAIN FLOW								
	C8	5			0.00	0.00			0.00	0.00			0.00	0.00	0.06	0.50	0.08	0.08	10.00	76.81	104.19	0.00	178.56	74	300	300	PVC	1.00	26.0	97	1.37	0.32	0.76
To Cercle du Ponthieu Circle, Pipe 5 - 56						0.00				0.00				0.00				0.08	10.32					59									
Rue de Beaugency Street-08																																	
	CTRL MH 106	4	0.66	0.40	0.73	0.73			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	0.00	178.56	56	300	300	CONC	0.50	10.5	68	0.97	0.18	0.82
			0.13	0.50	0.18	0.18			0.00	0.00			0.00	0.00			0.00	0.00															
	4	58	0.25	0.70	0.49	1.40			0.00	0.00			0.00	0.00			0.00	0.00	10.18	76.12	103.25	0.00	176.92	107	375	375	PVC	0.70	81.5	147	1.33	1.02	0.73
			0.14	0.70	0.27	1.01			0.00	0.00			0.00	0.00			0.00	0.00															
	58	57	0.22	0.50	0.31	3.45			0.00	0.00			0.00	0.00			0.00	0.00	11.20	72.47	98.24	0.00	168.26	250	450	450	PVC	1.25	61.5	319	2.00	0.51	0.78
To Avenue de Lamarche Avenue, Pipe 57 - 1TEE						3.45				0.00				0.00				0.00	11.72														
Contribution Block 155, Pipe C8 - 5						0.00				0.00				0.00				0.08	10.32					59									
			0.30	0.50	0.42	0.42			0.00	0.00			0.00	0.00			0.00	0.08															
	5	56	0.63	0.70	1.23	1.64			0.00	0.00			0.00	0.00			0.00	0.08	10.32	75.61	102.55	0.00	175.71	198	675	675	CONC	0.95	138.0	819	2.29	1.00	0.24
To Avenue de Lamarche Avenue, Pipe 56 - 57						1.64				0.00				0.00				0.08	11.32					59									
	5	6			0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	0.00	178.56	0	300	300	PVC	1.00	14.5	97	1.37	0.18	0.00
	6	7			0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00	10.18	76.13	103.27	0.00	176.96	0	300	300	PVC	0.65	47.0	78	1.10	0.71	0.00
	7	8			0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00	10.89	73.56	99.73	0.00	170.84	0	300	300	PVC	0.55	12.0	72	1.01	0.20	0.00
			0.13	0.50	0.18	0.18			0.00	0.00			0.00	0.00			0.00	0.00															
	8	9	0.27	0.70	0.53	0.71			0.00	0.00			0.00	0.00			0.00	0.00	11.08	72.88	98.80	0.00	169.22	51	300	300	PVC	0.55	68.0	72	1.01	1.12	0.72
	CTRL MH 105	9	0.71	0.40	0.79	0.79			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	0.00	178.56	61	375	375	PVC	0.40	10.5	111	1.00	0.17	0.55
			0.18	0.50	0.25				0.00	0.00			0.00	0.00			0.00	0.00															
	9	57	0.20	0.70	0.39	2.14			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	0.00	178.56	164	375	375	CONC	1.30	71.5	200	1.81	0.66	0.82
To Avenue de Lamarche Avenue, Pipe 57 - 1TEE						2.14				0.00				0.00				0.00	10.17														
Voie de Lesage Way - 05																																	
	410	42	0.07	0.70	0.14	0.14			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	0.00	178.56	10	300	300	PVC	0.69	51.0	80	1.14	0.75	0.13
			0.17	0.50	0.24	0.37			0.00	0.00			0.00	0.00			0.00	0.00															
	42	45	0.35	0.70	0.68	1.05			0.00	0.00			0.00	0.00			0.00	0.00	10.75	74.05	100.40	0.00	172.00	78	375	375	PVC	0.35	103.0	104	0.94	1.83	0.75
	45	46			0.00	1.05			0.00	0.00			0.00	0.00			0.00	0.00	12.58	68.15	92.31	0.00	158.00	72	375	375	PVC	0.72	10.5	149	1.35	0.13	0.48
			0.05	0.50	0.07	1.12			0.00	0.00			0.00	0.00			0.00	0.00															
	46	47	0.25	0.70	0.49	1.61			0.00	0.00			0.00	0.00			0.00	0.00	12.71	67.77	91.79	0.00	157.10	109	450	450	CONC	0.47	45.5	195	1.23	0.62	0.56
To Terrase de Vennecy Terrace, Pipe 47 - 54						1.61				0.00				0.00				0.00	13.32														
Terrase de Vennecy Terrace - 06																																	
			0.22	0.50	0.31	0.31			0.00	0.00			0.00	0.00			0.00	0.00															
	42	43	0.26	0.70	0.51	0.81			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	0.00	178.56	62	375	375	PVC	0.66	45.5	142	1.29	0.59	0.44
	43	44			0.00	0.81			0.00	0.00			0.00	0.00			0.00	0.00	10.59	74.62	101.19	0.00	173.36	61	375	375	PVC	1.04	10.5	179	1.62	0.11	0.34
			0.13	0.50	0.18	0.99			0.00	0.00			0.00	0.00			0.00	0.00															
	44	47	0.34	0.70	0.66	1.65			0.00	0.00			0.00	0.00			0.00	0.00	10.70	74.23	100.65	0.00	172.44	123	450	450	CONC	0.38	103.0	176	1.11	1.55	0.70
Contribution From Voie de Lesage Way, Pipe 46 - 47						1.61				0.00				0.00				0.00	13.32														
			0.05	0.50	0.07	3.33			0.00	0.00			0.00	0.00			0.00	0.00															
			0.12	0.50	0.17	3.50			0.00	0.00			0.00	0.00			0.00	0.00															
			0.13	0.50	0.18	3.68			0.00	0.00			0.00	0.00			0.00	0.00															
	47	54	0.33	0.70	0.64	4.32			0.00	0.00			0.00	0.00			0.00	0.00	13.32	66.03	89.40	0.00	152.98	285	600	600	CONC	0.39	111.5	383	1.36	1.37	0.74
	54	55			0.00	4.32			0.00	0.00			0.00	0.00			0.00	0.00	14.69	62.50	84.56	0.00	144.63	270	600	600	CONC	0.35	10.0	363	1.28	0.13	0.74
			0.18	0.50	0.25	4.57			0.00	0.00			0.00	0.00			0.00	0.00															
	55	56	0.31	0.70	0.60	5.18			0.00	0.00			0.00	0.00			0.00	0.00	14.82	62.19	84.13	0.00	143.89	322	675	675	CONC	0.52	110.0	606	1.69	1.08	0.53
To Avenue de Lamarche Avenue, Pipe 56 - 57						5.18				0.00				0.00				0.00	15.91														
Ruelle de Carden Lane - 07																																	
			0.28	0.50	0.39	0.39			0.00	0.00			0.00	0.00			0.00	0.00															
	48	52	0.37	0.70	0.72	1.11			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	0.00	178.56	85	375	375	PVC	1.10	110.0	184	1.66	1.10	0.46
To Avenue de Lamarche Avenue, Pipe 52 - 56						1.11				0.00				0.00				0.00	11.10														

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

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

Designed: P.P./C.M.
Checked: M.Z.
Dwg. Reference:

PROJECT: **Caivan Communities** **Orleans Village**
LOCATION: **City of Ottawa**
File Ref:
Date: 30 Oct 2018
Sheet No. SHEET 2 OF 5

881_STM5_Rev.xlsx

STORM SEWER CALCULATION SHEET (RATIONAL METHOD)

Manning 0.013

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

Ottawa

	LOCATION		AREA (Ha)																FLOW						SEWER DATA								
			2 YEAR				5 YEAR				10 YEAR				100 YEAR				Time of	Intensity	Intensity	Intensity	Intensity	Peak Flow	DIA. (mm)	DIA. (mm)	TYPE	SLOPE	LENGTH	CAPACITY	VELOCITY	TIME OF	RATIO
			AREA	R	Indiv.	Accum.	AREA	R	Indiv.	Accum.	AREA	R	Indiv.	Accum.	AREA	R	Indiv.	Accum.	Conc.	2 Year	5 Year	10 Year	100 Year										
Location	From Node	To Node	(Ha)		2.78 AC	2.78 AC	(Ha)		2.78 AC	2.78 AC	(Ha)		2.78 AC	2.78 AC	(Ha)		2.78 AC	2.78 AC	(min)	(mm/h)	(mm/h)	(mm/h)	(mm/h)	Q (l/s)	(actual)	(nominal)		(%)	(m)	(l/s)	(m/s)	FLOW (min.	Q/Q full
Place de Sandillon Place - 11																																	
			0.13	0.50	0.18	0.18			0.00	0.00			0.00	0.00			0.00	0.00															
	36	37	0.26	0.70	0.51	0.69			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	0.00	178.56	53	300	300	PVC	0.68	59.0	80	1.13	0.87	0.66
			0.17	0.50	0.24	0.92			0.00	0.00			0.00	0.00			0.00	0.00															
	37	38	0.26	0.70	0.51	1.43			0.00	0.00			0.00	0.00			0.00	0.00	10.87	73.61	99.80	0.00	170.96	105	375	375	PVC	0.75	80.5	152	1.37	0.98	0.69
To Avenue de Lamarche Avenue, Pipe 38 - 52						1.43				0.00				0.00				0.00	11.85														
Bois de Cravant Grove - 14																																	
Contribution From Croissant des Aubrais Crescent, Pipe 35 - 10						0.00				0.00				0.00				0.00	11.18														
			0.12	0.50	0.17	0.17			0.00	0.00			0.00	0.00			0.00	0.00															
	10	11	0.26	0.70	0.51	0.67			0.00	0.00			0.00	0.00			0.00	0.00	11.18	72.54	98.33	0.00	168.42	49	375	375	PVC	0.38	69.0	108	0.98	1.18	0.45
			0.19	0.50	0.26	0.94			0.00	0.00			0.00	0.00			0.00	0.00															
	11	34	0.29	0.70	0.56	1.50			0.00	0.00			0.00	0.00			0.00	0.00	12.36	68.80	93.19	0.00	159.53	103	375	375	PVC	0.76	80.5	153	1.38	0.97	0.68
To Avenue de Lamarche Avenue, Pipe 34 - 38						1.50				0.00				0.00				0.00	13.33														
Croissant des Aubrais Crescent - 10																																	
			0.05	0.50	0.07	0.07			0.00	0.00			0.00	0.00			0.00	0.00															
			0.29	0.50	0.40	0.47			0.00	0.00			0.00	0.00			0.00	0.00															
	31	33	0.68	0.70	1.32	1.80			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	0.00	178.56	138	450	450	CONC	0.85	143.0	263	1.65	1.44	0.52
To Avenue de Lamarche Avenue, Pipe 33 - 34						1.80				0.00				0.00				0.00	11.44														
	31	35			0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	0.00	178.56	0	300	300	PVC	1.05	9.5	99	1.40	0.11	0.00
	35	10			0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00	10.11	76.37	103.60	0.00	177.53	0	300	300	PVC	0.35	52.0	57	0.81	1.07	0.00
To Bois de Cravant Grove, Pipe 10 - 11						0.00				0.00				0.00				0.00	11.18														
	10	49	0.19	0.70	0.37	0.37			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	0.00	178.56	28	300	300	PVC	0.69	106.5	80	1.14	1.56	0.35
	49	50			0.00	0.37			0.00	0.00			0.00	0.00			0.00	0.00	11.56	71.29	96.61	0.00	165.44	26	300	300	PVC	0.35	9.5	57	0.81	0.20	0.46
			0.13	0.50	0.18	0.55			0.00	0.00			0.00	0.00			0.00	0.00															
			0.17	0.50	0.24	0.79			0.00	0.00			0.00	0.00			0.00	0.00															
	50	52	0.62	0.70	1.21	1.99			0.00	0.00			0.00	0.00			0.00	0.00	11.76	70.66	95.74	0.00	163.94	141	450	450	CONC	0.50	142.5	202	1.27	1.87	0.70
To Avenue de Lamarche Avenue, Pipe 52 - 56						1.99				0.00				0.00				0.00	13.63														
Chemin de Jargeau Road - 04																																	
	39	40	0.04	0.54	0.06	0.06			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	0.00	178.56	5	300	300	PVC	1.60	27.0	122	1.73	0.26	0.04
Contribution From Cours Crevier Walk, Pipe 16 - 40						1.09				0.00				0.00				0.00	11.79														
			0.03	0.54	0.05	1.19			0.00	0.00			0.00	0.00			0.00	0.00															
	40	41	0.24	0.70	0.47	1.66			0.00	0.00			0.00	0.00			0.00	0.00	11.79	70.55	95.60	0.00	163.69	117	525	525	CONC	0.30	54.5	236	1.09	0.83	0.50
Contribution From Rang de Loury Row, Pipe 180 - 41						0.75				0.00				0.00				0.00	10.99														
			0.01	0.70	0.02	2.42			0.00	0.00			0.00	0.00			0.00	0.00															
			0.03	0.54	0.05	2.47			0.00	0.00			0.00	0.00			0.00	0.00															
	41	30	0.13	0.70	0.25	2.72			0.00	0.00			0.00	0.00			0.00	0.00	12.63	68.00	92.10	0.00	157.65	185	525	525	CONC	0.80	64.0	385	1.78	0.60	0.48
To Avenue de Lamarche Avenue, Pipe 30 - 33						2.72				0.00				0.00				0.00	13.23														
Block 158 - 2002																																	
															0.06	0.25	0.04	0.04															
															0.95	0.55	1.45	1.49						-29	SUBDRAIN FLOW								
	C100	C4													0.19	0.50	0.26	1.76	10.00	76.81	104.19	0.00	178.56	285	375	375	PVC	3.40	6.0	323	2.93	0.03	0.88
																			10.03														
															0.25	0.55	0.38	0.38															
	C101	C4													0.11	0.50	0.15	0.54	10.00	76.81	104.19	0.00	178.56	67	300	300	PVC	2.00	4.5	137	1.93	0.04	0.49
																			10.04														
	C4	2200															0.00	2.29	10.00	76.81	104.19	0.00	178.56	381	450	450	CONC	2.40	31.0	442	2.78	0.19	0.86
To Cercle de l'Argonaut Circle, Pipe 2200 - 27						0.00				0.00				0.00				2.29	10.19					-29									
Placette de Darvoy Mews - 13																																	
	22	24	0.50	0.72	1.00	1.00			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	0.00	178.56	77	450	450	CONC	0.75	147.5	247	1.55	1.58	0.31
To Avenue de Lamarche Avenue, Pipe 24 - 25						1.00				0.00				0.00				0.00	11.58														
Cercle de l'Argonaut Circle - 12																																	
			0.02	0.72	0.04	0.04			0.00	0.00			0.00	0.00			0.00	0.00															
			0.05	0.50	0.07	0.11			0.00	0.00			0.00	0.00			0.00	0.00															
			0.12	0.70	0.23	0.34			0.00	0.00			0.00	0.00			0.00	0.00															
			0.15	0.54	0.23	0.57			0.00	0.00			0.00	0.00			0.00	0.00															
	19	21	0.46	0.72	0.92	1.49			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	0.00	178.56	114	450	450	CONC	0.75	141.0	247	1.55	1.51	0.46
To Avenue de Lamarche Avenue, Pipe 21 - 24						1.49				0.00				0.00				0.00	11.51														

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

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

Designed: P.P./C.M.
Checked: M.Z.
Dwg. Reference:

PROJECT: **Caivan Communities**
Orleans Village
LOCATION:
City of Ottawa
File Ref:
Date: 30 Oct 2018
Sheet No. SHEET 3 OF 5

STORM SEWER CALCULATION SHEET (RATIONAL METHOD)

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

Manning 0.013

LOCATION			AREA (Ha)																FLOW						SEWER DATA								
			2 YEAR				5 YEAR				10 YEAR				100 YEAR				Time of	Intensity	Intensity	Intensity	Intensity	Peak Flow	DIA. (mm)	DIA. (mm)	TYPE	SLOPE	LENGTH	CAPACITY	VELOCITY	TIME OF	RATIO
			AREA	R	Indiv.	Accum.	AREA	R	Indiv.	Accum.	AREA	R	Indiv.	Accum.	AREA	R	Indiv.	Accum.	Conc.	2 Year	5 Year	10 Year	100 Year										
Location	From Node	To Node	(Ha)		2.78 AC	2.78 AC	(Ha)		2.78 AC	2.78 AC	(Ha)		2.78 AC	2.78 AC	(Ha)		2.78 AC	2.78 AC	(min)	(mm/h)	(mm/h)	(mm/h)	(mm/h)	Q (l/s)	(actual)	(nominal)		(%)	(m)	(l/s)	(m/s)	FLOW (min.)	Q/Q full
	19	26			0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	0.00	178.56	0	300	300	PVC	0.35	9.5	57	0.81	0.20	0.000
			0.07	0.70	0.14	0.14			0.00	0.00			0.00	0.00			0.00	0.00															
	26	22	0.12	0.54	0.18	0.32			0.00	0.00			0.00	0.00			0.00	0.00	10.20	76.06	103.17	0.00	176.79	24	300	300	PVC	0.40	52.0	61	0.87	1.00	0.393
	22	2200			0.00	0.32			0.00	0.00			0.00	0.00			0.00	0.00	11.20	72.49	98.27	0.00	168.31	23	300	300	PVC	0.41	29.0	62	0.88	0.55	0.370
Contribution From Block 158 Pipe C4 - 2200						0.00				0.00				0.00				2.29	10.19					-29.00									
	2200	27			0.00	0.32			0.00	0.00			0.00	0.00			0.00	2.29	11.75	70.68	95.78	0.00	164.01	399	675	675	CONC	0.50	19.0	594	1.66	0.19	0.670
	27	28			0.00	0.32			0.00	0.00			0.00	0.00			0.00	2.29	11.94	70.08	94.95	0.00	162.58	395	675	675	CONC	1.00	10.5	841	2.35	0.07	0.470
			0.05	0.50	0.07	0.39			0.00	0.00			0.00	0.00			0.00	2.29															
			0.05	0.54	0.08	0.46			0.00	0.00			0.00	0.00			0.00	2.29															
			0.10	0.50	0.14	0.60			0.00	0.00			0.00	0.00			0.00	2.29															
			0.10	0.54	0.15	0.75			0.00	0.00			0.00	0.00			0.00	2.29															
	28	30	0.67	0.70	1.30	2.05			0.00	0.00			0.00	0.00			0.00	2.29	12.01	69.85	94.64	0.00	162.03	515	750	750	CONC	0.50	142.5	787	1.78	1.33	0.654
To Avenue de Lamarche Avenue, Pipe 30 - 33						2.05				0.00				0.00				2.29	13.35					-29									
Rang de Loury Row - 03																																	
	180	18	0.16	0.72	0.32	0.32			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	0.00	178.56	25	300	300	PVC	1.06	38.0	100	1.41	0.45	0.247
To Cours Crevier Walk, Pipe 18 - 21						0.32				0.00				0.00				0.00	10.45														
			0.19	0.54	0.29	0.29			0.00	0.00			0.00	0.00			0.00	0.00															
	180	41	0.23	0.72	0.46	0.75			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	0.00	178.56	57	300	300	PVC	0.88	76.0	91	1.28	0.99	0.631
To Chemin de Jargeau Road, Pipe 41 - 30						0.75				0.00				0.00				0.00	10.99														
Cours Crevier Walk - 02																																	
	17	16			0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	0.00	178.56	0	300	300	PVC	2.00	9.5	137	1.93	0.08	0.000
			0.15	0.54	0.23	0.23			0.00	0.00			0.00	0.00			0.00	0.00															
	16	40	0.43	0.72	0.86	1.09			0.00	0.00			0.00	0.00			0.00	0.00	10.08	76.49	103.76	0.00	177.81	83	375	375	PVC	0.44	108.0	116	1.05	1.71	0.714
To Chemin de Jargeau Road, Pipe 40 - 41						1.09				0.00				0.00				0.00	11.79														
	17	18			0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	0.00	178.56	0	300	300	PVC	1.09	48.0	101	1.43	0.56	0.000
Contribution From Rang de Loury Row, Pipe 180 - 18						0.32				0.00				0.00				0.00	10.45														
			0.02	0.72	0.04	0.36			0.00	0.00			0.00	0.00			0.00	0.00															
			0.15	0.54	0.23	0.59			0.00	0.00			0.00	0.00			0.00	0.00															
	18	21	0.21	0.72	0.42	1.01			0.00	0.00			0.00	0.00			0.00	0.00	10.56	74.72	101.32	0.00	173.60	75	375	375	PVC	0.54	67.0	129	1.17	0.96	0.583
To Avenue de Lamarche Avenue, Pipe 21 - 24						1.01				0.00				0.00				0.00	11.52														
Avenue de Lamarche Avenue - 01																																	
			0.05	0.40	0.06	0.06			0.00	0.00			0.00	0.00			0.00	0.00															
	CTRL MH 1200	120	0.52	0.47	0.68	0.74			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	0.00	178.56	56	300	300	PVC	0.50	16.0	68	0.97	0.28	0.826
			0.04	0.85	0.09	0.83																											
	120	12	0.06	0.85	0.14	0.97			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	0.00	178.56	75	300	300	PVC	1.51	51.0	119	1.68	0.51	0.628
	12	13	0.35	0.85	0.83	1.80			0.00	0.00			0.00	0.00			0.00	0.00	10.51	74.92	101.60	0.00	174.06	135	375	375	PVC	2.00	76.0	248	2.25	0.56	0.543
			2.86	0.85	6.76				0.00	0.00			0.00	0.00			0.00	0.00															
	CTRL MH 100	13	0.11	0.40	0.12	6.88			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	0.00	178.56	528	750	750	CONC	0.35	14.5	659	1.49	0.16	0.802
			0.07	0.56	0.11				0.00	0.00			0.00	0.00			0.00	0.00															
	CTRL MH 101	13	2.54	0.85	6.00	6.11			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	0.00	178.56	469	750	750	CONC	0.30	19.5	610	1.38	0.24	0.770
	13	15	0.18	0.85	0.43	15.22			0.00	0.00			0.00	0.00			0.00	0.00	10.24	75.91	102.97	0.00	176.43	1155	825	825	CONC	1	139	1505	2.82	0.82	0.767
	CTRL MH 103	15	2.17	0.75	4.52	4.52			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	0.00	178.56	348	675	675	CONC	0.30	15.0	460	1.29	0.19	0.755
	CTRL MH 104	15	2.16	0.75	4.50	4.50			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	0.00	178.56	346	675	675	CONC	0.30	19.5	460	1.29	0.25	0.751
	15	21	0.30	0.85	0.71	24.95			0.00	0.00			0.00	0.00			0.00	0.00	10.25	75.85	102.88	0.00	176.28	1893	1350	1350	CONC	0.37	59	3247	2.27	0.43	0.583
Contribution From Cours Crevier Walk, Pipe 18 - 21						1.01				0.00				0.00				0.00	11.52														
Contribution From Cercle de l'Argonaut Circle, Pipe 19 - 21						1.49				0.00				0.00				0.00	11.51														
			0.05	0.72	0.10	27.55			0.00	0.00			0.00	0.00			0.00	0.00															
	21	24	0.18	0.54	0.27	27.82			0.00	0.00			0.00	0.00			0.00	0.00	11.52	71.43	96.81	0.00	165.78	1987	1350	1350	CONC	0.43	58.5	3500	2.45	0.40	0.568
Contribution From Placette de Darvoy Mews, Pipe 220 - 24						1.00				0.00				0.00				0.00	11.58														
			0.19	0.54	0.29	29.10			0.00	0.00			0.00	0.00			0.00	0.00															
	24	25	0.26	0.72	0.52	29.62			0.00	0.00			0.00	0.00			0.00	0.00	11.92	70.16	95.06	0.00	162.75	2078	1350	1350	CONC	0.50	41.5	3774	2.64	0.26	0.551
	25	30			0.00	29.62			0.00	0.00			0.00	0.00			0.00	0.00	12.18	69.34	93.94	0.00	160.83	2054	1350	1350	CONC	0.49	14.0	3736	2.61	0.09	0.550

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

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

Designed: P.P./C.M.
Checked: M.Z.
Dwg. Reference:

PROJECT: Caivan Communities
Orleans Village
LOCATION: City of Ottawa
File Ref:
Date: 30 Oct 2018
Sheet No. SHEET 4 OF 5

881_STM5_Rev.xlsx

STORM SEWER CALCULATION SHEET (RATIONAL METHOD)

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

Manning 0.013

Ottawa

LOCATION			AREA (Ha) 2 YEAR				5 YEAR				10 YEAR				100 YEAR				FLOW						SEWER DATA								
Location	From Node	To Node	AREA (Ha)	R	Indiv. 2.78 AC	Accum. 2.78 AC	AREA (Ha)	R	Indiv. 2.78 AC	Accum. 2.78 AC	AREA (Ha)	R	Indiv. 2.78 AC	Accum. 2.78 AC	AREA (Ha)	R	Indiv. 2.78 AC	Accum. 2.78 AC	Time of Conc. (min)	Intensity 2 Year (mm/h)	Intensity 5 Year (mm/h)	Intensity 10 Year (mm/h)	Intensity 100 Year (mm/h)	Peak Flow Q (l/s)	DIA. (mm) (actual)	DIA. (mm) (nominal)	TYPE	SLOPE (%)	LENGTH (m)	CAPACITY (l/s)	VELOCITY (m/s)	TIME OF FLOW (min.)	RATIO Q/Q full
Contribution From Cercle de l'Argonaut Circle, Pipe 28 - 30						2.05				0.00				0.00				2.29	13.35					-29									
Contribution From Chemin de Jargeau Road, Pipe 41 - 30						2.72				0.00				0.00				0.00	13.23														
	30	33			0.00	34.40			0.00	0.00			0.00	0.00			0.00	2.29	13.35	65.97	89.31	0.00	152.82	2620	1500	1500	CONC	0.20	63.5	3161	1.79	0.59	0.829
Contribution From Croissant des Aubrais Crescent, Pipe 31 - 33						1.80				0.00				0.00				0.00	11.44														
			0.25	0.50	0.35	36.54			0.00	0.00			0.00	0.00			0.00	2.29															
	33	34	0.31	0.70	0.60	37.15			0.00	0.00			0.00	0.00			0.00	2.29	13.94	64.39	87.15	0.00	149.10	2734	1500	1500	CONC	0.23	58.5	3390	1.92	0.51	0.806
Contribution From Bois de Cravant Grove, Pipe 11 - 34						1.50				0.00				0.00				0.00	13.33														
	34	38			0.00	38.65			0.00	0.00			0.00	0.00			0.00	2.29	14.45	63.10	85.39	0.00	146.05	2774	1500	1500	CONC	0.24	58.5	3463	1.96	0.50	0.801
Contribution From Place de Sandillon Place, Pipe 37 - 38						1.43				0.00				0.00				0.00	11.85														
	38	52	0.28	0.70	0.54	40.62			0.00	0.00			0.00	0.00			0.00	2.29	14.94	61.90	83.74	0.00	143.20	2843	1650	1650	CONC	0.16	54.5	3646	1.71	0.53	0.780
Contribution From Ruelle de Carden Lane, Pipe 48 - 52						1.11				0.00				0.00				0.00	11.10														
Contribution From Croissant des Aubrais Crescent, Pipe 50 - 52						1.99				0.00				0.00				0.00	13.63														
	52	56			0.00	43.72			0.00	0.00			0.00	0.00			0.00	2.29	15.48	60.66	82.05	0.00	140.29	2974	1650	1650	CONC	0.18	58.5	3867	1.81	0.54	0.769
Contribution From Cercle du Ponthieu Circle, Pipe 5 - 56						1.64				0.00				0.00				0.08	11.32					59									
Contribution From Terrase de Vennecy Terrace, Pipe 55 - 56						5.18				0.00				0.00				0.00	15.91														
	56	57	0.11	0.70	0.21	50.76			0.00	0.00			0.00	0.00			0.00	2.38	16.02	59.47	80.41	0.00	137.47	3404	1650	1650	CONC	0.23	60.5	4371	2.04	0.49	0.779
Contribution From Cercle du Ponthieu Circle, Pipe 58 - 57						3.45				0.00				0.00				0.00	11.72														
Contribution From Cercle du Ponthieu Circle, Pipe 9 - 57						2.14				0.00				0.00				0.00	10.17														
	57	1TEE			0.00	56.34			0.00	0.00			0.00	0.00			0.00	2.38	16.51	58.42	78.98	0.00	134.99	3671	1800	1800	CONC	0.15	10.5	4452	1.75	0.10	0.825
To Croissant de Mercier Crescent, Pipe 1TEE - 2TEE						56.34				0.00				0.00				2.38	16.61					30									
Croissant de Mercier Crescent - 09																																	
			0.20	0.50	0.28	0.28			0.00	0.00			0.00	0.00			0.00	0.00															
			0.24	0.50	0.33	0.61			0.00	0.00			0.00	0.00			0.00	0.00															
	590	59	0.39	0.70	0.76	1.37			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	0.00	178.56	105	375	375	PVC	0.85	102.0	162	1.46	1.16	0.651
	59	63			0.00	1.37			0.00	0.00			0.00	0.00			0.00	0.00	11.16	72.62	98.43	0.00	168.60	100	375	375	PVC	0.45	8.5	118	1.06	0.13	0.846
	63	60			0.00	1.37			0.00	0.00			0.00	0.00			0.00	0.00	11.29	72.17	97.82	0.00	167.53	99	375	375	PVC	0.60	9.0	136	1.23	0.12	0.728
To Unknown Road5, Pipe 60 - 61TEE						1.37				0.00				0.00				0.00	11.42														
Contribution From Avenue de Lamarche Avenue, Pipe 57 - 1TEE						56.34				0.00				0.00				2.38	16.61					30									
			0.19	0.70	0.37	56.71			0.00	0.00			0.00	0.00			0.00	2.38															
	1TEE	2TEE	0.39	0.70	0.76	57.47			0.00	0.00			0.00	0.00			0.00	2.38	16.61	58.21	78.69	0.00	134.50	3695	1800	1800	CONC	0.15	105.0	4452	1.75	1.00	0.830
	2TEE	3TEE	0.25	0.50	0.35	57.81			0.00	0.00			0.00	0.00			0.00	2.38	17.61	56.22	75.97	0.00	129.81	3589	1800	1800	CONC	0.15	13.5	4452	1.75	0.13	0.806
	3TEE	60			0.00	57.81			0.00	0.00			0.00	0.00			0.00	2.38	17.74	55.98	75.64	0.00	129.24	3574	1800	1800	CONC	0.15	41.5	4452	1.75	0.40	0.803
To Block 382, Pipe 60 - 61TEE						57.81				0.00				0.00				2.38	18.13					30									
Block 382 - 51																																	
Contribution From Croissant de Mercier Crescent, Pipe 3TEE - 60						57.81				0.00				0.00				2.38	18.13					30									
Contribution From Croissant de Mercier Crescent, Pipe 63 - 60						1.37				0.00				0.00				0.00	11.42														
	60	61TEE			0.00	59.19			0.00	0.00			0.00	0.00			0.00	2.38	18.13	55.24	74.63	0.00	127.50	3602	1800	1800	CONC	0.15	30.5	4452	1.75	0.29	0.809
	61TEE	62TEE			0.00	59.19			0.00	0.00			0.00	0.00			0.00	2.38	18.42	54.71	73.91	0.00	126.26	3568	1800	1800	CONC	0.15	73.5	4452	1.75	0.70	0.802
	62TEE	600TEE			0.00	59.19			0.00	0.00			0.00	0.00			0.00	2.38	19.12	53.48	72.23	0.00	123.36	3489	1800	1800	CONC	0.15	48.0	4452	1.75	0.46	0.784
	600TEE	64TEE			0.00	59.19			0.00	0.00			0.00	0.00			0.00	2.38	19.58	52.71	71.18	0.00	121.55	3439	1800	1800	CONC	0.15	23.5	4452	1.75	0.22	0.772
	64TEE	65			0.00	59.19			0.00	0.00			0.00	0.00			0.00	2.38	19.81	52.35	70.68	0.00	120.69	3415	1800	1800	CONC	0.15	3.0	4452	1.75	0.03	0.767

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

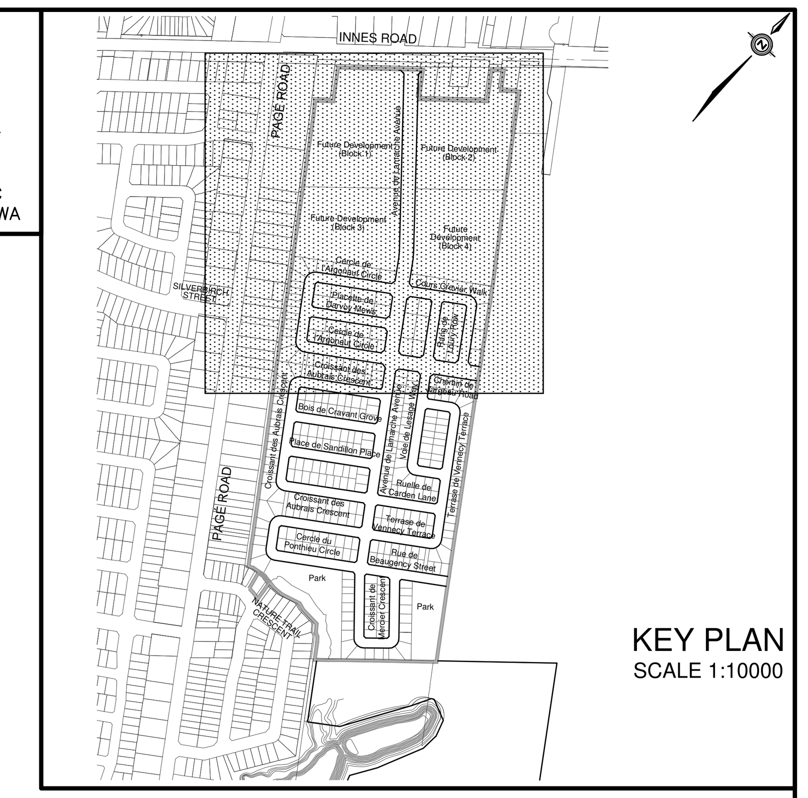
Notes:
1) Ottawa Rainfall-Intensity Curve
2) Min. Velocity = 0.80 m/s

Designed: P.P./C.M.	PROJECT: Caivan Communities Orleans Village	
Checked: M.Z.	LOCATION: City of Ottawa	
Dwg. Reference:	File Ref:	Date: 30 Oct 2018 / Sheet No. SHEET 5 OF 5

APPROVED ☐ REFUSED ☐

THIS ____ DAY OF__________, 20____

JOSHUA WHITE, P.ENG
PROJECT MANAGER – EAST BRANCH
PLANNING, INFRASTRUCTURE & ECONOMIC
DEVELOPMENT DEPARTMENT, CITY OF OTTAWA



LEGEND

- STORM DRAINAGE BOUNDARY
- STORM DRAINAGE BOUNDARY (OTHER PHASES)
- UPSTREAM MH TO DOWNSTREAM MH (43 - 44)
- AREA IN HECTARES (0.37)
- RUNOFF COEFFICIENT (0.51)
- EXTERNAL 2.78AC = (2.78AC=14.40)
- EXTERNAL TIME OF CONCENTRATION (TC=14.5 MIN)
- EXTERNAL BLENDED RUNOFF COEFFICIENT (C= 0.70)
- STREET CATCHBASIN & LEAD
- STREET CATCHBASIN WITH CLOSED LID & LEAD
- MAINTENANCE HOLE (375mmø ST, MH202)
- CURB INLET CATCHBASIN & LEAD
- CATCHBASIN/ MAINTENANCE HOLE (CBMH201)
- INTERCONNECTED CATCH BASIN & LEADS
- CAP
- OVERLAND FLOW DIRECTION
- EXTERNAL OVERLAND FLOW DIRECTION
- EMERGENCY OVERLAND FLOW DIRECTION

TOPOGRAPHIC INFORMATION

TOPOGRAPHIC INFORMATION PROVIDED BY J.D. BARNES LIMITED, PROJECT No. 16–10–116–00. SURVEYS DATED NOVEMBER 30, 2017.

LEGAL INFORMATION

CALCULATED M–PLAN PROVIDED BY J.D. BARNES LIMITED, PROJECT No. 16–10–116–00 (PHASE 1 & 2) DATED SEPTEMBER 14, 2018.

ELEVATION NOTE

ELEVATION = 86.12 m

ELEVATIONS ARE GEODETIC AND ARE DERIVED FROM SITE BENCHMARK NCC CONTROL POINT 001196530229 HAVING A PUBLISHED ELEVATION OF 86.12m

No.	DATE	BY	DESCRIPTION
6.	18–10–30	M.Z.	REVISED M–PLAN
5.	18–07–27	M.Z.	REVISED WEST BOUNDARY STORM SYSTEM
4.	18–07–10	M.Z.	MYLARS FOR PHASE 1 COMMENCE WORK
3.	18–06–28	M.Z.	REVISED AS PER CITY AND UTILITY COMMENTS
2.	18–05–09	M.Z.	ISSUED FOR MOE APPROVAL
1.	18–01–24	M.Z.	1st SUBMISSION

Ottawa CITY OF OTTAWA

PROJECT No. 16–881

LICENSED PROFESSIONAL ENGINEER M.ZDRAVEVSKI 100130902 18-10-30 PROVINCE OF ONTARIO

STORM DRAINAGE PLAN

CAIVAN (ORLEANS VILLAGE) LIMITED

ORLEANS VILLAGE

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

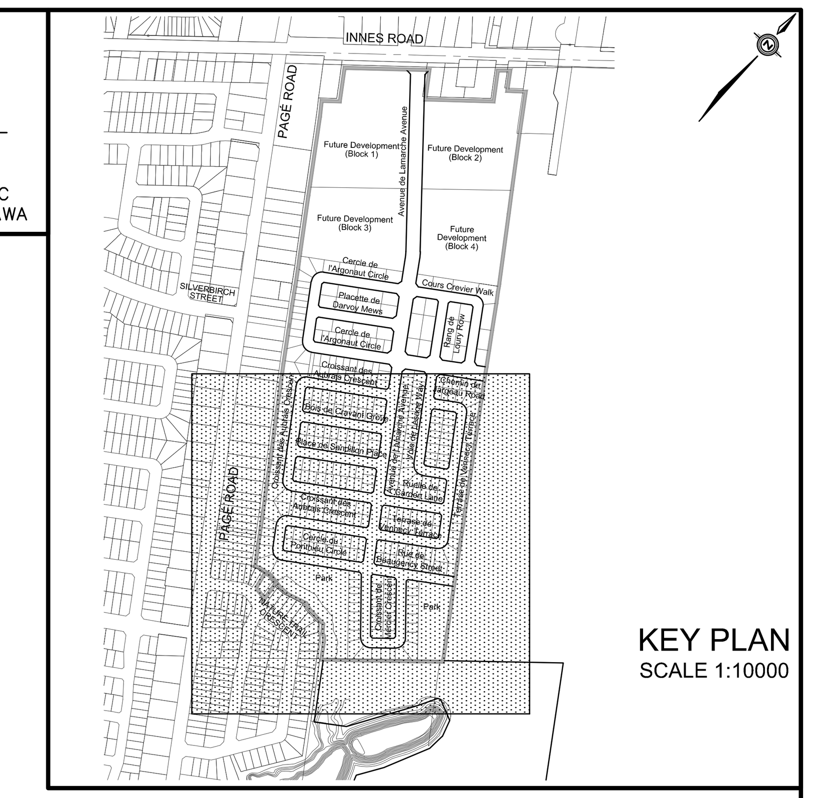
DRAWN BY: M.Z.	CHECKED BY: P.P.	DRAWING NO.	SHEET NO.
DESIGNED BY: P.P.	CHECKED BY: M.Z.		67
SCALE: 1:1000	DATE: JANUARY 2018		

CITY FILE No. D07-16-16-0022 CITY PLAN No. 17675

APPROVED ☐ REFUSED ☐

THIS ____ DAY OF__________, 20____

JOSHUA WHITE, P.ENG
PROJECT MANAGER – EAST BRANCH
PLANNING, INFRASTRUCTURE & ECONOMIC
DEVELOPMENT DEPARTMENT, CITY OF OTTAWA



KEY PLAN
SCALE 1:10000

LEGEND

STORM DRAINAGE BOUNDARY

STORM DRAINAGE BOUNDARY (OTHER PHASES)

UPSTREAM MH TO DOWNSTREAM MH — 43 - 44

AREA IN HECTARES — 0.37

RUNOFF COEFFICIENT — 0.51

EXTERNAL 2.78AC = — **2.78AC=14.40**

EXTERNAL TIME OF CONCENTRATION — TC=14.5 MIN

EXTERNAL BLENDED RUNOFF COEFFICIENT — C= 0.70

STREET CATCHBASIN & LEAD

STREET CATCHBASIN WITH CLOSED LID & LEAD

MAINTENANCE HOLE — MH202

CURB INLET CATCHBASIN & LEAD

CATCHBASIN/ MAINTENANCE HOLE — CBMH201

INTERCONNECTED CATCH BASIN & LEADS

CAP

375mmø ST

OVERLAND FLOW DIRECTION

EXTERNAL OVERLAND FLOW DIRECTION

EMERGENCY OVERLAND FLOW DIRECTION

TOPOGRAPHIC INFORMATION

TOPOGRAPHIC INFORMATION PROVIDED BY J.D. BARNES LIMITED, PROJECT No. 16–10–116–00. SURVEYS DATED NOVEMBER 30, 2017.

LEGAL INFORMATION

CALCULATED M–PLAN PROVIDED BY J.D. BARNES LIMITED, PROJECT No. 16–10–116–00 (PHASE 1 & 2) DATED SEPTEMBER 14, 2018.

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1.	18–01–24	M.Z.	1st SUBMISSION

Ottawa CITY OF OTTAWA

PROJECT No. 16–881

LICENSED PROFESSIONAL ENGINEER
M.ZDRAVEVSKI
100130902
18-10-30
PROVINCE OF ONTARIO

STORM DRAINAGE PLAN

CAIVAN (ORLEANS VILLAGE) LIMITED

ORLEANS VILLAGE

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

DRAWN BY: M.Z.	CHECKED BY: P.P.	DRAWING NO.	SHEET NO.
DESIGNED BY: P.P.	CHECKED BY: M.Z.		68
SCALE: 1:1000	DATE: JANUARY 2018		

CITY PLAN No. 17675

CITY FILE No. D07-16-16-0022

Stormwater Management Report for the Orleans Village Subdivision

City of Ottawa

January 2018
Updated July 2018

Prepared for : David Schaeffer Engineering Ltd.

Prepared by : JFSA Water Resources and Environmental Consultants

JFSA Ref. No.: 883- 10
J.F. Sabourin and Associates Inc.
www.jfsa.com

JFSA Water Resources and Environmental Consultants

J.F. Sabourin and Associates Inc.
52 Springbrook Drive, Ottawa, ON K2S 1B9
tel.: 613.836.3884, fax: 613.836.0332, www.jfsa.com

Stormwater Management Report for the Orleans Village Subdivision

in the City of Ottawa

January 2018
Updated July 2018

Prepared for :

David Schaeffer Engineering Ltd.

LICENSED PROFESSIONAL ENGINEER
M. L. J-F. Sabourin
PROVINCE OF ONTARIO

Prepared by :

J.F. Sabourin, M.Eng., P.Eng.

LICENSED PROFESSIONAL ENGINEER
L. E. PIPKINS
100173786
PROVINCE OF ONTARIO

Laura Pipkins, P.Eng.

Paul Wilson

JFSA Ref. No.: 883- 10

Stormwater Management Report for the Orleans Village Subdivision
in the City of Ottawa

TABLE OF CONTENTS

APPENDICES

LIST OF TABLES

LIST OF FIGURES

Background: Rationale for Report Update

This report is an update of the May 2018 "Stormwater Management Report for the Orleans Village Subdivision". The previous version of this report has been updated to reflect updates to the design of the perforated storm sewer along the west boundary of the subdivision. In the previous version of this report, flows exceeding the capacity of the 250 mm diameter west boundary perforated storm sewer will overflow to the main storm sewer via 250 mm diameter overflow pipes to a parallel non-perforated storm sewer. In the current design, flows exceeding the capacity of the 250 mm diameter west boundary perforated storm sewer will be conveyed by a swale running parallel on the surface. Flows in the perforated storm sewer and swale system will discharge through three outlets – two to the main storm sewer via catchbasins and pipes in Block 158 / Lot 122 and Lots 49/50, and one to an existing ditch - and subsequently to the north main cell of EUC Pond 1 - via a catchbasin and pipe under the access road adjacent to Lot 55.

Stormwater Management Report for the Orleans Village Subdivision
in the City of Ottawa
December 2018
Updated July 2018

1 INTRODUCTION AND OBJECTIVES

J.F. Sabourin and Associates Inc. (JFSA) were retained by David Schaeffer Engineering Ltd. (DSEL) to prepare a Stormwater Management (SWM) Plan for the Orleans Village Subdivision, located within the City of Ottawa. As shown by Figure 1, the proposed subdivision is located south of Innes Road, east of Page Road, north of the East Urban Community (EUC) SWM Pond 1 and a hydro easement, and west of future development in the East Urban Community area. The proposed development is serviced for quality, erosion and quantity control by EUC SWM Pond 1, which discharges to Mud Creek.

The Orleans Village subdivision has a total drainage area of 31.10 ha, 31.04 ha of which is tributary to EUC Pond 1, including 1.80 ha of park blocks, 5.40 ha of medium / high density development blocks, 4.34 ha of future residential development blocks, and 19.50 ha of proposed residential development. The remaining 0.06 ha of proposed residential development will drain overland to Innes Road. Additionally, 4.13 ha of external residential lots will drain through the proposed subdivision to EUC Pond 1.

In addition to 31.04 ha of the Orleans Village site, EUC Pond 1 will also treat flows from 342.21 ha of external lands under "Interim B" conditions, for a total drainage area of 373.25 ha. As detailed in the March 2014 *Design Brief for the Reconstruction of the East Urban Community Stormwater Management Pond 1 for the Trails Edge Subdivision*, existing Pond 1 has been modified for Interim B conditions to support the development of the Trails Edge subdivision south of the hydro easement, and the extension of Brian Coburn Boulevard. Undeveloped area and existing commercial areas north of the hydro easement also drain to Pond 1 under Interim B conditions.

The Orleans Village site was treated as undeveloped under Interim B conditions in the March 2014 *Design Brief*, and lumped in with the development of the East Urban Community lands to the north of the hydro corridor, which will trigger an "Ultimate Conditions" expansion of the north main cell and north forebay in EUC Pond 1. However, it is proposed that the development of the subject site, and particularly Phase 1, be allowed under Interim B conditions with the understanding that 100-year water level in EUC Pond 1 will increase temporarily under these conditions, as discussed in Section 5 of this report.

The purpose of the present study/report is to evaluate the major and minor system flows of the proposed development with respect to new proposed stormwater management guidelines and to check the adequacy of the proposed pipe sizes to convey the 2-year (5-year on collector and 10-year on arterial roads) and the 100-year storm flows from within the development and from external areas.

Background documents that were reviewed in preparing this report include the following:

- *Stormwater Management Planning and Design Manual,* Ministry of the Environment, March 2003.
- *Gloucester East Urban Community Infrastructure Servicing Study Update*, Stantec Consulting Ltd., March 2005.
- *Erosion and Sediment Control Guidelines for Urban Construction,* Conservation Halton et al., December 2006.
- *East Urban Community Pond No. 1 Design Brief*, Stantec Consulting Ltd., April 2008.
- *Trails Edge Phase 1 Design Brief*, IBI Group, April 2010.
- *Trails Edge Phase 1 Stormwater Management Report*, IBI Group, June 2010.
- *EUC Pond No. 1 Page Road Stormwater Management Facility As-Built Drawings*, Stantec Consulting Ltd., January 2012.
- *Draft City of Ottawa Stormwater Management Facility Design Guidelines,* IBI Group, April 2012.
- *City of Ottawa Sewer Design Guidelines*, City of Ottawa, October 2012.
- *Trails Edge Subdivision Stormwater Management Facility 1 Reconstruction and Preliminary Stormwater Management Plan*, J.F. Sabourin and Associates Inc., January 2014.
- *Technical Bulletin ISDTB-2014-01, Revisions to Ottawa Design Guidelines – Sewer,* City of Ottawa, February 2014.
- *Design Brief for the Reconstruction of the East Urban Community Stormwater Management Pond 1 for the Trails Edge Subdivision*, David Schaeffer Engineering Ltd. and J.F. Sabourin and Associates Inc., March 2014.
- *Servicing Report for Trails Edge and Orleans Business Park,* David Schaeffer Engineering Ltd., March 2014.
- *Stormwater Management Report for the Trails Edge West Subdivision*, J.F. Sabourin and Associates Inc., January 2015.
- *Trails Edge Subdivision / Stormwater Management Facility 1 Reconstruction and Preliminary Stormwater Management Plan*, J.F. Sabourin and Associates Inc., April 2015.
- *City of Ottawa Technical Bulletin PIEDTB-2016-01*, City of Ottawa, September 2016.
- *Trails Edge Subdivision Blocks 245 and 248 / Compliance with January 2015 Stormwater Management Report for the Trails Edge West Subdivision*, J.F. Sabourin and Associates Inc., July 2017.
- *Innes Development / Preliminary Hydraulic Gradeline Analysis and Interim Pond Design*, J.F. Sabourin and Associates Inc., August 2017.

- *Edgewater Subdivision / Revisions to M-Plan*, J.F. Sabourin and Associates Inc., April 2018.
- *Orleans Village Subdivision / Phase 1 Interim Conditions*, J.F. Sabourin and Associates Inc., May 2018.

As per the new approach formalized in the September 2016 *City of Ottawa Technical Bulletin PIEDTB-2016-01*, the subdivision has been designed with a 2-year minor system level of service on local roads and a 5-year level of service on collector roads. Where possible with grading limitations, road ponding areas up to 35 cm deep were used to fully contain the 100-year major system flows.

The DDSWMM, SWMHYMO and XPSWMM programs were used to model the major and minor systems, to ensure that all of the new stormwater management requirements are satisfied. The general SWM design criteria and guidelines which are to be met are described in Section 2.

Figure 1: General Site Location

2 DESIGN CRITERIA AND GUIDELINES

The design criteria and guidelines used for the stormwater management of the subject subdivision are those that were developed in the background documents, as well as those provided in the October 2012 *City of Ottawa Sewer Design Guidelines* and subsequent technical memorandums, and generally accepted stormwater management design guidelines.

During the course of the detailed design of the proposed development, it was determined that the proposed 31.10 ha Orleans Village subdivision has an average imperviousness of 60%. The total 373.25 ha drainage area to EUC Pond 1 under Interim B conditions has an average imperviousness of 43%.

A detailed analysis of the proposed dual drainage system was required to confirm that the following general design criteria and guidelines for the minor and major systems would be met.

2.1 Minor System

a) Storm sewers are to be designed to provide a minimum 2-year level of service, plus 5-year inflows on collector roads (Lamarche Avenue and Jargeau Road) and 10-year inflows on arterial roads (not applicable).

b) The 100-year hydraulic grade line (HGL) within the minor system must be maintained at least 0.3 m below the underside of footing elevation where gravity house connections are installed.

c) The 100-year water levels within the swale along the west boundary of the site must not encroach on adjacent existing residential lots.

d) For less frequent storms (i.e. larger than 1:2 year or 1:5 year on collector / 1:10 year on arterial roads), the minor system shall, if required, be limited with the use of inlet control devices to prevent excessive hydraulic surcharges and to maximize the use of surface storage on the road.

e) Catchbasins on the road are to be equipped with City standard type S19 (fish) grates, and grates for catchbasins in rear yards, park and open spaces with pedestrian traffic are to be City standard type S19, S30 and S31. Some road catchbasins on Lamarche Avenue and Jargeau Road are to be equipped with City standard type S22 side inlets.

f) Single catchbasins are to be equipped with 200 mm minimum lead pipes and double catchbasins are to be equipped with 250 mm minimum lead pipes, or two 200 mm minimum lead pipes where two inlet control devices are specified.

g) Rearyard catchbasins are to be equipped with 250 mm minimum lead pipes. Catchbasins installed on the street, where rearyard catchbasins connect to the main storm sewer through the catchbasin, are to be equipped with 250 mm minimum lead pipes for single catchbasins and two 200 mm minimum lead pipes for double catchbasins, unless otherwise noted.

h) Under full flow conditions, the allowable velocity in storm sewers is to be no less than 0.80 m/s and no greater than 6.0 m/s.

2.2 Major System

a) The major system shall be designed with sufficient road surface storage to allow the excess runoff of a 100-year storm to be retained within road ponding areas.

b) Inlet control devices should be sized such that they do not create surface ponding on the road during the 2-year design storm (5-year design storm on collector and 10-year design storm on arterial roads); it should be noted that surface ponding over grates is present during rainfall under any design, as an appropriate depth of water is required for runoff to enter the grate (refer to Tables D-3 and D-5 of Appendix D).

c) Roof leaders shall be installed to direct the runoff to splash pads and on to grassed areas.

d) For the 100-year storm and for all roads, the maximum total depth of water (static + dynamic) shall not exceed 35 cm at the gutter.

e) During the 100-year + 20% stress test, the maximum extent of surface water on streets, rearyards, public space and parking areas shall not touch the building envelope.

f) When catchbasins are installed in rear yards, safe overland flow routes are to be provided to allow the release of excess flows from such areas.

g) The product of the maximum flow depths on streets and maximum flow velocity must be less than 0.60 m^2/s on all roads.

h) Excess major system flows up to the 100-year return period are to be retained on-site in development blocks such as parks, schools, commercial, etc.

i) There must be at least 15 cm of vertical clearance between the spill elevation on the street and the ground elevation at the nearest building envelope that is in the proximity of the flow route or ponding area.

j) There must be at least 30 cm of vertical clearance between the rearyard spill elevation and the ground elevation at the adjacent building envelope.

3 ASSUMPTIONS AND SOURCE OF DATA USED IN THIS STUDY

Sources of information and assumptions made in this study are listed below:

- Stormwater management model: *DDSWMM (release 2.1), SWMHYMO (version 5.59), and XPSWMM (version 10)*
- Minor system design: *1:2 year, plus 1:5 year inflows on collector roads (Lamarche Avenue and Jargeau Road) and 1:10 year on arterial roads (not applicable). See Rational Method in Appendix A.*
- Major system design: *1:100 year*
- Max. 100-yr water depth on roads: *35 cm above gutter*
- Extent of major system: *Shall not touch the building envelope during the 100-year + 20% stress test*
- DDSWMM model parameters: *Fo = 76.2 mm/hr, Fc = 13.2 mm/hr, DCAY = 4.14/hr, D.Stor.Imp. = 1.57 mm, D.Stor.Per. = 4.67 mm (as per 2012 City of Ottawa Sewer Design Guidelines)*
  Detailed Area Imperviousness: based on development layout and taken as fully effective in the front lot portion and half effective in rear lot portion of each house.
  Lumped Area Imperviousness: based on runoff coefficient (C) where C = 0.7 x imperviousness ratio + 0.2.
- Design storms: *2-, 5-, 10- and 100-year 3-hour Chicago and 10- and 100-year 24-hour SCS Type II storms as per 2012 City of Ottawa Sewer Design Guidelines; peak averaged over 10 minutes.*
- Historical Events: *July 1st, 1979; August 4th, 1988; and August 8th, 1996 events as per 2012 City of Ottawa Sewer Design Guidelines.*
- Stress Test: *20% increase in the 100-year 3-hour Chicago storm.*
- Street catchbasin covers: *City Standard Type S19 (fish). Some City Standard Type S22 (side inlets) on Lamarche Avenue and Jargeau Road. Type S19 approach flow-capture curves as per MTO design charts (equivalent to OPSD 400.010). Type S22 approach flow-capture curves as per 2012 City of Ottawa Guidelines.*
- Rearyard catchbasin covers: *City Standard Type S19, S30 and S31*
- Curb and gutter: *City Standard SC1.3 (mountable) and SC1.1 (barrier). In the absence of flow capture curves for these curb and gutters, OPSD 600.010 curb and gutters are assumed.*
- Manning's' roughness coeff.: *0.013 for concrete and PVC pipes (free flow).*
- Minor system losses: *Refer to Appendix C for manhole loss coefficients.*
- Underside of footing elevations: *As provided by DSEL.*

- Freeboard in HGL analysis: *0.3 m between underside of footing elevation and 100-year hydraulic gradeline.*
- Inlet Control Devices: *As required. Refer to Appendix B for Plas-Tech ICD details.*
- Depth of backyard swales: *As per DSEL's Grading Plan*
- Street and pipe dimensions: *As per DSEL's Plan and Profiles*
- Right-of-way characteristics: *As per DSEL's Details of Roads*
- Downstream HGL: *Free outfall conditions at the outlet of EUC Pond 1.*

4 PROPOSED MINOR AND MAJOR SYSTEM DRAINAGE

The proposed minor and major system drainage routes are shown in plan view in Figures 2 and 3, respectively.

In accordance with the new proposed standards, the minor system has been designed to accommodate a minimum of the 2-year post development flows from within the site and from external areas, plus 5-year inflows on collector roads (Lamarche Avenue and Jargeau Road) and 10-year inflows on arterial roads (not applicable). A Rational Method design was conducted by DSEL (refer to Appendix A) in order to estimate minor system flows based on the City of Ottawa IDF relationship and selected runoff coefficients.

Note that the minor system release rates from park blocks 151 and 378 and mixed use blocks 148 and 149 were limited to the 2-year flows, with 100-year on-site storage. For future residential development Blocks 147 and 150, minor system release rates were limited to the 2-year + 20% flows, with 100-year on-site storage, on the understanding that surface storage opportunities may be limited. 100-year + 20% capture and surface storage volumes were estimated for Blocks 147 and 150 based on detailed design results for similar residential developments. Excess flows from park and development blocks will spill overland to the street, and subsequently to the SWM pond.

It was necessary to prepare preliminary modelling prior to detailed design of the mixed use and future residential blocks, in order to simulate hydraulic gradeline results within the subdivision. This preliminary modelling is not intended to be prescriptive, but only to estimate the peak flows entering the proposed Orleans Village system. Nonetheless, to protect the proposed subdivision, minor system peak flows entering the site from the blocks during the 100-year storm and 100-year + 20% stress test should be equal to or less than the estimated peak minor system flow rates modelled, or demonstrate that increased peak minor system flows do not have a negative impact on the hydraulic gradeline results within the Orleans Village subdivision. The maximum storage volumes modelled for the future development blocks are 604 m^3, 395 m^3, 451 m^3 and 604 m^3 for Blocks 147, 148, 149 and 150 (279 m^3/ha, 156 m^3/ha, 158 m^3/ha and 278 m^3/ha), respectively. Note that the volumes modelled do not define surface storage requirements for the blocks, but simply the preliminary modelling approach used to estimate attenuation provided by both surface and sub-surface storage and routing, based on detailed design results for similar developments.

Within the proposed development, circular orifice plate type Inlet Control Devices (ICDs) of City standard diameters 83 mm, 94 mm, 102 mm, 108 mm, 127 mm, 152 mm and 178 mm will be used to limit minor system capture to a minimum of the 2-year flow (refer to Appendix B for Plas-Tech ICD details), allowing for sub-surface storage of 0.5 m^3 in single catchbasins, 1.0 m^3 in double catchbasins, and 1.9 m^3 in catchbasin manholes.

Beyond the 2-year capture requirements, ICDs were selected to maximize the use of available road surface storage during the 100-year storm, while still retaining the excess 100-year runoff within road ponding areas of sufficient volume, where grading allowed. Note that rearyard catchbasins were connected to catchbasin manholes on the road where possible, in order to allow rearyard runoff access to the storage in road ponding areas at regular intervals.

Also note that a perforated 250 mm diameter storm sewer along the west boundary of the site will capture and convey the frequent flows from adjacent proposed and existing residential rearyards to an existing ditch and subsequently to the north main cell of EUC Pond 1. No ICDs are to be installed in the catchbasins along the perforated pipe. Flows exceeding the capacity of the 250 mm diameter west boundary storm sewer will be conveyed by a swale running parallel on the surface. Flows in the perforated storm sewer and swale system will discharge through three outlets – two to the main storm sewer via catchbasins and pipes in Block 158 / Lot 122 and Lots 49/50, and one to the existing ditch via a catchbasin and pipe under the access road adjacent to Lot 55. Calculations for the 100-year intakes at Block 157 and Lot 55 are presented in Calculation Sheet 3 of Appendix D.

The shape of the swale varies between a triangular swale with 3H:1V side slopes to a trapezoidal swale with a 0.6 m bottom width and 3H:1V side slopes. The interaction between the 250 mm diameter perforated storm sewer, the surface swale and the three outlets was modelled dynamically in XPSWMM. Note that the swale was modelled with a Manning's roughness coefficient of 0.04. As simulated in XPSWMM, the 100-year design storm and 100-year + 20% stress test flow depths in the swale do not exceed 35 cm, and do not touch the proposed building envelopes or encroach on the adjacent existing residential lots.

The street segments within the proposed development have been designed using a 'saw tooth' or 'sagged' road profile. The runoff from within these segments will be conveyed to catchbasins located at the lowest point within the street segment. Flows in excess of the catchbasin capture rate will be temporarily stored within the 'sagged' street segments and released slowly to the storm sewers, up to the 100-year design storm. When the storage on a specific street segment is surpassed due to blockage or an event greater than the 100-year storm, the excess water will flow towards the next downstream street sag, and eventually to the pond. It should be noted that the major system would outlet during the 100-year + 20% stress test without flooding any of the properties within the subdivision.

In the event that the drainage system's capacity to capture surface flows is exceeded, Figure 4 presents the maximum extent of static surface ponding and volume on the streets based on grading. Note that the double routing method was used to model the attenuation provided by dynamic storage above static ponding areas, in accordance with the February 2014 *City of Ottawa Technical Bulletin ISDTB-2014-01*. Also note that no surface storage volumes were accounted for in the DDSWMM model in rear lot swales.

Note that as the DDSWMM program is most appropriate for use in modelling urban drainage, the large undeveloped drainage areas and existing commercial areas north of the hydro easement were instead modelled using SWMHYMO, and the generated hydrographs then input to DDSWMM, in accordance with the March 2014 *Design Brief*.

The DDSWMM and XPSWMM analyses, discussed in Sections 4.1 and 4.2, have demonstrated that the proposed drainage system for the subdivision will have sufficient capacity to control the excess flow during a 100-year storm and safely capture and convey the 2-year (plus 5-year on collector roads and 10-year on arterial roads) flow to the pond.

4.1 Major System and DDSWMM Analysis

The DDSWMM computer program was used to model the major and minor system flows within the proposed development and from external areas. As noted above, as the DDSWMM program is most appropriate for use in modelling small urban drainage areas, undeveloped and existing commercial areas north of the hydro easement were instead modelled using SWMHYMO.

The DDSWMM and SWMHYMO models presented in Appendix B were developed based on the information provided in Figures 2 and 3. Fifteen (15) simulations were conducted, one for each of the following rainfall events (as per the October 2012 *City of Ottawa Sewer Design Guidelines*):

i) the 25 mm, 3-hour Chicago storm;
ii) the 2-year, 3-hour Chicago storm;
iii) the 5-year, 3-hour Chicago storm;
iv) the 10-year, 3-hour Chicago storm;
v) the 100-year, 3-hour Chicago storm;
vi) the 2-year, 24-hour SCS Type II storm;
vii) the 5-year, 24-hour SCS Type II storm;
viii) the 10-year, 24-hour SCS Type II storm;
ix) the 25-year, 24-hour SCS Type II storm;
x) the 50-year, 24-hour SCS Type II storm;
xi) the 100-year, 24-hour SCS Type II storm;
xii) the July 1st, 1979 historical event;
xiii) the August 4th, 1988 historical event;
xiv) the August 8th, 1996 historical event; and

xv) the 100-year, 3-hour Chicago storm + 20%.

Note that the purpose of simulating the 100-year, 3-hour Chicago storm with a 20% increase is to stress test the drainage system for potential flooding, as per the October 2012 *City of Ottawa Sewer Design Guidelines.*

The DDSWMM model depression storage and infiltration parameters are as per the October 2012 *City of Ottawa Sewer Design Guidelines*. The percent imperviousness of the detailed drainage areas were measured based on the development layout; impervious areas were taken as fully effective in the front and half effective in the rear of each lot to account for indirectly connected roof drainage. The percent imperviousness of undetailed (lumped/external) drainage areas were calculated based on the runoff coefficient (C), where C = 0.7 x imperviousness ratio + 0.2.

The models use actual catchbasin capture flow curves, and the inflows are limited by circular orifice plate type Inlet Control Devices (ICDs) of City standard diameters 83 mm, 94 mm, 102 mm, 108 mm, 127 mm, 152 mm and 178 mm. Note that 200 mm diameter lead pipes were assumed and are required between single catchbasins and the storm sewers, and 250 mm diameter lead pipes were assumed and are required between rearyard catchbasins or single catchbasin manholes and the storm sewers. Double catchbasins and double catchbasin manholes are to be equipped with 250 mm diameter lead pipes, or two 200 mm diameter lead pipes where two ICDs are specified. Refer to Table D-6 of Appendix D for a summary of inlet controls. As may be seen from Table D-6, the selected controls are sufficient to capture a minimum of the 2-year flows within proposed subdivision.

Within the proposed subdivision, the dynamic flow depth on the road (at the gutter) will be minimal during the 100-year Chicago storm, as the 100-year flows are retained within the road ponding areas and do not accumulate as in a typical subdivision design (refer to Calculation Sheet 1A of Appendix D, where the calculated maximum was 8.6 cm). Furthermore, it was determined that, for the 100-year storm and for all major system segments, the product of the depth of water (m) at the gutter multiplied by the velocity of flow (m/s) will not exceed the maximum allowable 0.60 m^2/s (refer to Calculation Sheet 1A of Appendix D, where the calculated maximum was 0.068 m^2/s). Refer below for an assessment of static ponding depth on the road.

Calculation Sheet 1B of Appendix D presents the stress test results for dynamic flow depth on the road based on a 20% increase in the 100-year storm, as per the October 2012 *City of Ottawa Sewer Design Guidelines.* As shown in Calculation Sheet 1B, the maximum dynamic flow depth under these conditions is calculated as 16.8 cm, and the product of the depth of water at the gutter multiplied by the velocity of flow is 0.212 m^2/s. Refer below for an assessment of static ponding depth on the road.

Details of 100-year street storage results (i.e. actual volume used and depth of water) are provided in Table D-7 of Appendix D. This information, combined with the outflow from road ponding area dummy segments calculated in DDSWMM, demonstrates that total 100-year depth of water on the street at these ponding areas will not exceed the maximum depth of 35 cm.

Table D-7 of Appendix D also presents the street storage stress test results based on a 20% increase in the 100-year storm, as per the October 2012 *City of Ottawa Sewer Design Guidelines*. As shown in Table D-7, the maximum depth of water (static + dynamic overflow) at any ponding area under these conditions is calculated as 52.0 cm. The maximum extent of surface water during the 100-year + 20% stress test will not touch the building envelopes.

An emergency overland flow route has been evaluated in the subdivision to safely convey flows to EUC Pond 1 in the event that the grates at LB002NE and LB002NW are blocked. Refer to Calculation Sheet 2 of Appendix D for the capacity of the overland flow route. The overland flow route will have normal flow depths of 14.3 cm during the 100-year 3-hour Chicago storm and 17.2 cm during the 100-year + 20% stress test, assuming 100% blockage of the adjacent catchbasin grates.

Table 1 presents a summary of the major system results simulated in DDSWMM during the 100-year Chicago storm. Note that the total water depths at low points shown in Table 1 were calculated as dynamic flow depth plus static ponding depth (per grading plan), as per Table D-7 of Appendix D. Dummy segments used in the double routing method for road ponding areas are also included in Table 1 for completeness; however, note that DDSWMM flow depths for dummy segments are not reported as they do not represent actual conditions, as dummy segments are intended for the purpose of replicating dynamic attenuation effects only.

Table 1: Summary of Major System Results for the 100-Year 3-Hour Chicago Storm

DDSWMM Segment ID	Approach Flow (m^3/s)	Flow Depth (cm)	Captured Flow (m^3/s)	Storage Used (m^3)	DDSWMM Segment ID	Approach Flow (m^3/s)	Flow Depth (cm)	Captured Flow (m^3/s)	Storage Used (m^3)
B001N1	0.050	6.6	0.016	0	B009SE	0.015	3.0	0.000	0
B001N2	0.047	6.5	0.015	0	B009SW	0.023	3.5	0.000	0
B002NE	0.076	7.8	0.000	0	LB009SW	0.037	25.0	0.018	6.38
LB002NE	0.096	31.0	0.043	19.52	B010N1	0.021	4.8	0.000	0
B002NW	0.083	8.0	0.000	0	LB010N1	0.046	5.0	0.043	0.89
LB002NW	0.164	31.0	0.097	31.64	B010N2	0.025	5.1	0.000	0
B002R1	0.014	1.0	0.000	0	B010NE	0.027	5.2	0.000	0
B002R2	0.025	1.8	0.000	0	B010NW	0.034	4.0	0.000	0
B002R3	0.061	4.2	0.000	0	LB010NW	0.087	35.0	0.028	35.3
B002R4	0.018	1.2	0.000	0	B010R1	0.038	2.7	0.000	0
B002R5	0.012	0.8	0.000	0	B010S1	0.027	5.2	0.000	0
B002SE	0.021	4.8	0.000	0	LB010S1	0.052	8.0	0.045	1.6
B002SW	0.064	7.3	0.000	0	B010S2	0.025	5.1	0.000	0
B002WK1	0.008	2.0	0.000	0	B010SE	0.029	3.8	0.000	0
B004NE	0.034	4.0	0.000	0	B010SW	0.035	4.1	0.000	0
LB004NE	0.096	24.0	0.051	20.42	LB010SW	0.064	35.0	0.024	17.25
B004NW	0.041	6.2	0.000	0	B010W1	0.009	3.5	0.000	0
B004PK1	0.144	5.9	0.046	73.96	B010W2	0.011	3.7	0.000	0
B004R1	0.017	1.2	0.000	0	B011NE	0.014	4.1	0.000	0
B004R2	0.027	1.9	0.000	0	B011NW	0.049	4.7	0.000	0
B004SE	0.017	3.1	0.000	0	LB011NW	0.096	35.0	0.033	43.89
LB004SE	0.038	24.0	0.019	6.98	B011R1	0.024	1.7	0.000	0
B004SW	0.023	4.9	0.000	0	B011R2	0.055	3.8	0.000	0
B004WK1	0.012	2.5	0.000	0	B011S1	0.019	4.6	0.000	0
B005N1	0.040	4.4	0.000	0	B011SE	0.032	5.6	0.000	0
LB005N1	0.136	24.0	0.099	15.87	B011SW	0.049	4.7	0.000	0
B005N2	0.037	6.0	0.000	0	LB011SW	0.080	35.0	0.031	20.23
B005N3	0.015	4.2	0.000	0	B012EX1	0.161	6.2	0.074	0
B005NE	0.029	3.8	0.000	0	B012EX2	0.146	7.7	0.000	0
B005NW	0.075	5.5	0.000	0	B012NE	0.120	8.1	0.013	0
LB005NW	0.103	35.0	0.048	20.34	B012NW	0.048	5.8	0.006	0
B005R1	0.018	1.2	0.016	0	B012SE	0.134	8.4	0.013	0
B005R2	0.039	3.3	0.000	0	B012SW	0.082	7.0	0.010	0
B005R3	0.055	4.3	0.000	0	B013DV1	1.378	18.1	0.501	451
B005R4	0.088	5.3	0.000	0	B013DV2	1.246	17.4	0.457	395
B005S1	0.040	2.8	0.000	0	B013EX1	0.024	1.7	0.000	0
LB005S1	0.059	24.0	0.025	15.48	B013EX2	0.030	4.2	0.000	0
B005S2	0.023	4.9	0.000	0	B013NE	0.145	8.7	0.014	0
B005SE	0.031	3.9	0.000	0	B013NW	0.115	8.0	0.012	0
B005SW	0.038	4.2	0.000	0	B015NE	0.153	8.9	0.000	0
LB005SW	0.068	35.0	0.028	16.4	LB015NE	0.167	35.0	0.162	1.28
B008NE	0.024	3.5	0.000	0	B015NW	0.142	8.6	0.000	0
B008NW	0.037	4.2	0.000	0	LB015NW	0.168	35.0	0.162	0.8
LB008NW	0.092	35.0	0.028	38.85	B015RE1	0.943	15.6	0.406	270.34
B008R1	0.044	3.0	0.000	0	B015RE2	0.940	15.5	0.405	268.05
B008SE	0.013	2.8	0.000	0	B015SE	0.024	5.0	0.000	0
B008SW	0.054	4.9	0.000	0	B015SW	0.029	5.4	0.000	0
LB008SW	0.066	35.0	0.028	15.54	B016NE	0.064	5.2	0.000	0
B009NE	0.023	3.5	0.000	0	LB016NE	0.102	33.0	0.050	28.19
B009NW	0.046	4.6	0.000	0	B016NW	0.036	4.1	0.000	0
LB009NW	0.105	25.0	0.071	12.48	LB016NW	0.062	33.0	0.024	15.8
B009PK1	0.155	6.1	0.055	68.99	B016R1	0.038	2.6	0.000	0
B009R1	0.019	1.3	0.000	0	B016R2	0.012	0.8	0.000	0
B009R2	0.054	3.8	0.000	0	B016R3	0.016	1.1	0.000	0

Table 1: Summary of Major System Results for the 100-Year 3-Hour Chicago Storm

DDSWMM Segment ID	Approach Flow (m^3/s)	Flow Depth (cm)	Captured Flow (m^3/s)	Storage Used (m^3)	DDSWMM Segment ID	Approach Flow (m^3/s)	Flow Depth (cm)	Captured Flow (m^3/s)	Storage Used (m^3)
B016R4	0.005	0.4	0.000	0	LB024NE	0.130	35.0	0.071	27.02
B016S1	0.030	3.8	0.000	0	B024NW	0.010	3.6	0.000	0
LB016S1	0.030	18.0	0.019	3.64	LB024NW	0.033	35.0	0.018	5.34
B016S2	0.031	3.9	0.000	0	B024R1	0.053	3.7	0.000	0
LB016S2	0.045	18.0	0.026	4	B024R2	0.025	1.7	0.000	0
B016S3	0.014	4.1	0.000	0	B024R3	0.012	0.8	0.000	0
B016SE	0.024	3.5	0.000	0	B024SE	0.029	5.4	0.000	0
B016SW	0.027	3.7	0.000	0	B024SW	0.023	4.9	0.000	0
B018NE	0.053	6.8	0.000	0	B026R1	0.040	2.8	0.021	0
LB018NE	0.091	31.0	0.033	41.66	B028N1	0.041	4.4	0.000	0
B018NW	0.025	5.1	0.000	0	LB028N1	0.128	35.0	0.051	52.25
B018R1	0.034	2.4	0.000	0	B028N2	0.026	5.1	0.000	0
B018R2	0.023	1.6	0.000	0	B028NE	0.031	3.9	0.000	0
B018R3	0.015	1.1	0.000	0	B028NW	0.043	6.3	0.000	0
B018SE	0.010	3.6	0.000	0	LB028NW	0.070	35.0	0.027	20.63
LB018SE	0.032	31.0	0.018	4.97	B028R1	0.035	2.5	0.000	0
B018SW	0.022	4.9	0.000	0	B028R2	0.050	3.5	0.000	0
B019N1	0.033	4.0	0.000	0	B028R3	0.088	5.2	0.000	0
LB019N1	0.068	35.0	0.027	26.58	B028S1	0.043	4.5	0.000	0
B019N2	0.026	5.2	0.000	0	LB028S1	0.069	35.0	0.028	16.88
B019NE	0.033	4.0	0.000	0	B028S2	0.028	5.3	0.000	0
B019NW	0.069	7.6	0.000	0	B028SE	0.029	3.8	0.000	0
LB019NW	0.109	35.0	0.049	27.53	B028SW	0.082	8.0	0.000	0
B019R1	0.012	0.9	0.000	0	LB028SW	0.108	35.0	0.044	29.06
B019R2	0.020	1.4	0.000	0	B031N1	0.031	3.9	0.000	0
B019R3	0.010	0.7	0.000	0	LB031N1	0.098	35.0	0.033	39.07
B019R4	0.014	1.0	0.000	0	B031N2	0.048	6.5	0.000	0
B019R5	0.025	1.7	0.000	0	B031N3	0.038	6.0	0.000	0
B019S1	0.035	4.1	0.000	0	B031NE	0.039	6.1	0.000	0
LB019S1	0.066	35.0	0.028	15.26	B031NW	0.085	8.1	0.000	0
B019S2	0.033	5.7	0.000	0	LB031NW	0.173	35.0	0.073	52.02
B019SE	0.032	3.9	0.000	0	B031R1	0.015	1.1	0.000	0
B019SW	0.036	5.9	0.000	0	B031R2	0.067	4.7	0.000	0
LB019SW	0.064	35.0	0.024	18.62	B031R3	0.020	1.4	0.000	0
B021R1	0.018	1.2	0.000	0	B031R4	0.030	2.1	0.000	0
B021R2	0.054	3.8	0.021	0	B031R5	0.005	0.3	0.000	0
B022N1	0.035	4.1	0.000	0	B031S1	0.031	3.9	0.000	0
LB022N1	0.101	35.0	0.033	38.54	LB031S1	0.045	35.0	0.018	10.89
B022N2	0.049	6.6	0.000	0	B031S2	0.015	4.2	0.000	0
B022N3	0.026	5.2	0.000	0	B031SE	0.039	6.1	0.000	0
B022NE	0.027	3.7	0.000	0	B031SW	0.043	6.3	0.000	0
B022NW	0.038	4.2	0.000	0	LB031SW	0.079	35.0	0.028	24.2
LB022NW	0.071	35.0	0.024	23.78	B033NE	0.065	7.4	0.000	0
B022S1	0.036	4.1	0.000	0	LB033NE	0.164	35.0	0.072	48.44
LB022S1	0.060	35.0	0.023	15.36	B033NW	0.018	3.2	0.000	0
B022S2	0.026	5.1	0.000	0	LB033NW	0.041	35.0	0.023	5.83
B022SE	0.027	3.7	0.000	0	B033R1	0.014	1.0	0.000	0
B022SW	0.031	3.9	0.000	0	B033R2	0.030	2.1	0.000	0
LB022SW	0.058	35.0	0.024	13.72	B033R3	0.067	4.7	0.000	0
B022W1	0.022	3.4	0.000	0	B033SE	0.052	6.7	0.000	0
B022W2	0.012	3.8	0.000	0	B033SW	0.024	5.0	0.000	0
LB022W2	0.034	7.0	0.032	0.83	B036NE	0.030	3.8	0.000	0
B022W3	0.011	2.6	0.000	0	B036NW	0.035	4.1	0.000	0
B024NE	0.062	7.2	0.000	0	LB036NW	0.092	35.0	0.036	28.96

Table 1: Summary of Major System Results for the 100-Year 3-Hour Chicago Storm

DDSWMM Segment ID	Approach Flow (m^3/s)	Flow Depth (cm)	Captured Flow (m^3/s)	Storage Used (m^3)	DDSWMM Segment ID	Approach Flow (m^3/s)	Flow Depth (cm)	Captured Flow (m^3/s)	Storage Used (m^3)
B036R1	0.041	2.8	0.000	0	LB044NE	0.111	35.0	0.036	50.49
B036SE	0.030	3.8	0.000	0	B044NW	0.041	4.4	0.000	0
B036SW	0.036	4.1	0.000	0	LB044NW	0.067	35.0	0.024	19.33
LB036SW	0.065	35.0	0.024	17.75	B044R1	0.014	1.0	0.000	0
B036W1	0.011	3.7	0.000	0	B044R2	0.033	2.3	0.000	0
B036W2	0.012	3.8	0.000	0	B044SE	0.060	7.1	0.000	0
B037N1	0.024	5.0	0.000	0	B044SW	0.027	5.2	0.000	0
B037NE	0.035	5.8	0.000	0	B046NE	0.011	3.6	0.000	0
B037NW	0.048	4.7	0.000	0	B046NW	0.027	3.7	0.000	0
LB037NW	0.114	35.0	0.050	35.34	LB046NW	0.070	35.0	0.021	31.08
B037R1	0.020	1.4	0.000	0	B046R2	0.041	2.9	0.000	0
B037R2	0.050	3.5	0.000	0	B046R3	0.028	1.9	0.000	0
B037R3	0.004	0.3	0.000	0	B046S1	0.010	3.6	0.000	0
B037R4	0.004	0.3	0.000	0	B046SE	0.030	5.4	0.000	0
B037SE	0.012	3.8	0.000	0	B046SW	0.059	5.0	0.000	0
B037SW	0.048	4.7	0.000	0	LB046SW	0.094	35.0	0.044	19.18
LB037SW	0.061	35.0	0.023	16.06	B047NE	0.056	6.9	0.000	0
B038NE	0.051	4.8	0.000	0	LB047NE	0.120	33.0	0.050	37.01
LB038NE	0.076	35.0	0.042	10.24	B047NW	0.012	3.8	0.000	0
B038NW	0.017	3.1	0.000	0	LB047NW	0.065	33.0	0.021	26.95
LB038NW	0.041	35.0	0.023	5.77	B047R1	0.041	2.9	0.021	0
B038SE	0.025	5.0	0.000	0	B047R2	0.019	1.3	0.000	0
B038SW	0.025	5.1	0.000	0	B047R3	0.034	2.3	0.000	0
B040NE	0.016	4.4	0.000	0	B047R4	0.004	0.3	0.000	0
LB040NE	0.036	32.0	0.020	5.85	B047R5	0.017	1.2	0.000	0
B040NW	0.013	4.0	0.000	0	B047R6	0.030	2.1	0.000	0
B040R1	0.011	0.8	0.000	0	B047SE	0.055	6.9	0.000	0
B040SE	0.063	7.2	0.000	0	B047SW	0.028	5.3	0.000	0
LB040SE	0.088	32.0	0.061	7.39	B048N1	0.012	3.9	0.000	0
B040SW	0.027	5.2	0.000	0	B048NE	0.039	4.3	0.000	0
B041NE	0.016	4.4	0.000	0	LB048NE	0.051	24.0	0.019	13.27
LB041NE	0.037	35.0	0.020	6.19	B048NW	0.032	4.3	0.000	0
B041NW	0.014	4.1	0.000	0	LB048NW	0.103	35.0	0.050	33.87
B041R1	0.011	0.7	0.000	0	B048R1	0.020	1.4	0.000	0
B041SE	0.017	4.5	0.000	0	B048R2	0.042	2.9	0.000	0
LB041SE	0.039	35.0	0.023	5.19	B048R3	0.077	5.1	0.000	0
B041SW	0.023	4.9	0.000	0	B048SE	0.040	4.4	0.000	0
B042N1	0.056	6.9	0.000	0	LB048SE	0.040	24.0	0.019	8.24
LB042N1	0.099	27.0	0.045	21.21	B048SW	0.032	4.3	0.000	0
B042N2	0.023	4.9	0.000	0	LB048SW	0.061	35.0	0.024	15.52
LB042N2	0.088	27.0	0.033	27.93	B048W1	0.014	4.1	0.000	0
B042N3	0.012	3.9	0.000	0	B048W2	0.030	5.4	0.000	0
B042NE	0.057	4.9	0.000	0	B048W3	0.011	3.7	0.000	0
B042NW	0.034	4.0	0.000	0	B050N1	0.044	4.6	0.000	0
LB042NW	0.124	35.0	0.051	43.37	LB050N1	0.090	35.0	0.028	45
B042R1	0.029	2.0	0.000	0	B050N2	0.015	4.2	0.000	0
B042R2	0.054	3.7	0.000	0	B050NE	0.033	4.0	0.000	0
B042R3	0.022	1.5	0.000	0	B050NW	0.034	4.1	0.000	0
B042S1	0.047	4.6	0.000	0	LB050NW	0.095	35.0	0.028	42.13
B042S2	0.047	4.6	0.000	0	B050R1	0.041	2.9	0.000	0
B042SE	0.027	3.7	0.000	0	B050R2	0.022	1.5	0.000	0
B042SW	0.012	2.7	0.000	0	B050R3	0.050	3.5	0.000	0
LB042SW	0.039	35.0	0.018	7.29	B050S1	0.044	4.5	0.000	0
B044NE	0.040	4.4	0.000	0	LB050S1	0.075	35.0	0.028	20.34

Table 1: Summary of Major System Results for the 100-Year 3-Hour Chicago Storm

DDSWMM Segment ID	Approach Flow (m^3/s)	Flow Depth (cm)	Captured Flow (m^3/s)	Storage Used (m^3)	DDSWMM Segment ID	Approach Flow (m^3/s)	Flow Depth (cm)	Captured Flow (m^3/s)	Storage Used (m^3)
B050S2	0.032	5.6	0.000	0	BOUTNE	0.036	5.1	0.000	0
B050S3	0.011	3.7	0.000	0	LBOUTNE	0.036	7.0	0.033	0.91
B050SE	0.028	3.7	0.000	0	BOUTNW	0.027	4.6	0.000	0
B050SW	0.074	5.5	0.000	0	LBOUTNW	0.027	3.0	0.026	0.44
LB050SW	0.102	35.0	0.044	23.24	C001R1	0.098	5.3	0.098	0
B055N1	0.013	4.0	0.000	0	C001R2	0.081	5.1	0.000	0
B055NE	0.047	4.6	0.000	0	C003R1	0.026	1.8	0.026	0
LB055NE	0.108	25.0	0.071	12.23	C006R1	0.021	1.5	0.022	0
B055NW	0.036	5.9	0.000	0	C009R1	0.045	3.1	0.045	0
B055R1	0.038	2.7	0.000	0	C011R1	0.038	2.6	0.038	0
B055SE	0.047	4.6	0.000	0	C012R1	0.020	1.4	0.019	0
LB055SE	0.070	25.0	0.029	17.04	C012WK1	0.014	2.7	0.014	0
B055SW	0.024	5.0	0.000	0	C013PK1	0.090	5.2	0.090	0
B056NE	0.013	2.8	0.000	0	C013R1	0.081	5.1	0.081	0
LB056NE	0.024	25.0	0.018	1.66	C013R2	0.045	3.1	0.045	0
B056NW	0.014	2.9	0.000	0	C014R1	0.039	2.7	0.039	0
LB056NW	0.026	25.0	0.018	2.26	C017R1	0.040	2.8	0.040	0
B056SE	0.011	2.6	0.000	0	C021R1	0.047	3.3	0.047	0
B056SW	0.013	2.8	0.000	0	C025R1	0.037	2.6	0.037	0
B058NE	0.020	3.3	0.000	0	C026R1	0.038	2.6	0.038	0
B058NW	0.024	5.0	0.000	0	C028R1	0.042	2.9	0.042	0
LB058NW	0.094	18.0	0.092	0.75	C030R1	0.027	1.9	0.027	0
B058R1	0.065	4.6	0.000	0	DB002NE	0.000	N/A	0.000	0
B058R2	0.033	2.3	0.000	0	DB002NW	0.000	N/A	0.000	0
B058SE	0.010	2.5	0.000	0	DB004NE	0.000	N/A	0.000	0
B058SW	0.015	4.2	0.000	0	DB004SE	0.000	N/A	0.000	0
LB058SW	0.025	18.0	0.018	1.97	DB005N1	0.000	N/A	0.000	0
B180N1	0.030	3.8	0.000	0	DB005NW	0.000	N/A	0.000	0
LB180N1	0.030	19.0	0.019	3.46	DB005S1	0.000	N/A	0.000	0
B180N2	0.030	3.8	0.000	0	DB005SW	0.000	N/A	0.000	0
LB180N2	0.046	19.0	0.028	5.4	DB008NW	0.000	N/A	0.000	0
B180N3	0.017	4.4	0.000	0	DB008SW	0.000	N/A	0.000	0
B180NE	0.032	4.4	0.000	0	DB009NW	0.000	N/A	0.000	0
LB180NE	0.082	12.0	0.071	2.48	DB009SW	0.000	N/A	0.000	0
B180NW	0.033	4.4	0.000	0	DB010N1	0.000	N/A	0.000	0
LB180NW	0.033	12.0	0.024	2.25	DB010NW	0.000	N/A	0.000	0
B180R1	0.039	2.7	0.000	0	DB010S1	0.000	N/A	0.000	0
B180R2	0.059	4.1	0.000	0	DB010SW	0.000	N/A	0.000	0
B180SE	0.026	5.1	0.000	0	DB011NW	0.000	N/A	0.000	0
B180SW	0.024	5.0	0.000	0	DB011SW	0.000	N/A	0.000	0
B410NE	0.012	2.7	0.000	0	DB015NE	0.000	N/A	0.000	0
LB410NE	0.037	10.0	0.037	0.44	DB015NW	0.000	N/A	0.000	0
B410NW	0.020	3.3	0.000	0	DB016NE	0.000	N/A	0.000	0
LB410NW	0.043	4.0	0.042	0.45	DB016NW	0.000	N/A	0.000	0
B590NE	0.053	4.8	0.000	0	DB016S1	0.000	N/A	0.000	0
LB590NE	0.119	35.0	0.046	51.51	DB016S2	0.000	N/A	0.000	0
B590NW	0.055	4.9	0.000	0	DB018NE	0.000	N/A	0.000	0
LB590NW	0.139	35.0	0.051	52.15	DB018SE	0.000	N/A	0.000	0
B590R1	0.022	1.5	0.000	0	DB019N1	0.000	N/A	0.000	0
B590R2	0.070	4.9	0.000	0	DB019NW	0.000	N/A	0.000	0
B590R3	0.047	3.2	0.000	0	DB019S1	0.000	N/A	0.000	0
B590R4	0.022	1.5	0.000	0	DB019SW	0.000	N/A	0.000	0
B590SE	0.052	6.7	0.000	0	DB022N1	0.000	N/A	0.000	0
B590SW	0.036	5.9	0.000	0	DB022NW	0.000	N/A	0.000	0

Table 1: Summary of Major System Results for the 100-Year 3-Hour Chicago Storm

DDSWMM Segment ID	Approach Flow (m^3/s)	Flow Depth (cm)	Captured Flow (m^3/s)	Storage Used (m^3)
DB022S1	0.000	N/A	0.000	0
DB022SW	0.000	N/A	0.000	0
DB022W2	0.000	N/A	0.000	0
DB024NE	0.000	N/A	0.000	0
DB024NW	0.000	N/A	0.000	0
DB028N1	0.000	N/A	0.000	0
DB028NW	0.000	N/A	0.000	0
DB028S1	0.000	N/A	0.000	0
DB028SW	0.000	N/A	0.000	0
DB031N1	0.000	N/A	0.000	0
DB031NW	0.000	N/A	0.000	0
DB031S1	0.000	N/A	0.000	0
DB031SW	0.000	N/A	0.000	0
DB033NE	0.000	N/A	0.000	0
DB033NW	0.000	N/A	0.000	0
DB036NW	0.000	N/A	0.000	0
DB036SW	0.000	N/A	0.000	0
DB037NW	0.000	N/A	0.000	0
DB037SW	0.000	N/A	0.000	0
DB038NE	0.000	N/A	0.000	0
DB038NW	0.000	N/A	0.000	0
DB040NE	0.000	N/A	0.000	0
DB040SE	0.000	N/A	0.000	0
DB041NE	0.000	N/A	0.000	0
DB041SE	0.000	N/A	0.000	0
DB042N1	0.000	N/A	0.000	0
DB042N2	0.000	N/A	0.000	0
DB042NW	0.000	N/A	0.000	0
DB042SW	0.000	N/A	0.000	0
DB044NE	0.000	N/A	0.000	0
DB044NW	0.000	N/A	0.000	0
DB046NW	0.000	N/A	0.000	0
DB046SW	0.000	N/A	0.000	0
DB047NE	0.000	N/A	0.000	0
DB047NW	0.000	N/A	0.000	0
DB048NE	0.000	N/A	0.000	0
DB048NW	0.000	N/A	0.000	0
DB048SE	0.000	N/A	0.000	0
DB048SW	0.000	N/A	0.000	0
DB050N1	0.000	N/A	0.000	0
DB050NW	0.000	N/A	0.000	0
DB050S1	0.000	N/A	0.000	0
DB050SW	0.000	N/A	0.000	0
DB055NE	0.000	N/A	0.000	0
DB055SE	0.000	N/A	0.000	0
DB056NE	0.000	N/A	0.000	0
DB056NW	0.000	N/A	0.000	0
DB058NW	0.000	N/A	0.000	0
DB058SW	0.000	N/A	0.000	0
DB180N1	0.000	N/A	0.000	0
DB180N2	0.000	N/A	0.000	0
DB180NE	0.000	N/A	0.000	0
DB180NW	0.000	N/A	0.000	0
DB410NE	0.000	N/A	0.000	0
DB410NW	0.000	N/A	0.000	0
DB590NE	0.000	N/A	0.000	0
DB590NW	0.000	N/A	0.000	0
DBOUTNE	0.000	N/A	0.000	0
DBOUTNW	0.000	N/A	0.000	0
OUT-N	0.000	0.0	0.000	0
OUT-S	0.007	0.5	0.000	0

[1] Flow depths on major system catchments were estimated using DDSWMM. Total water depths at low points calculated as flow depth plus static ponding depth (per grading plan); refer to Table D-7 of Appendix D for details.

[1] Dummy segments used in the double routing method for road ponding areas; DDSWMM flow depths do not represent actual conditions, as dummy segments are intended to replicate dynamic attenuation effects only.

4.2 Minor System and Hydraulic Gradeline Analysis

The minor system analysis was completed using the XPSWMM program based on the peak flows captured during the rainfall events, as calculated with the DDSWMM and SWMHYMO programs. Note that the storm sewer design is as provided by DSEL, and a Manning's roughness coefficient of 0.013 was used for the concrete and PVC storm sewer pipes. Refer to Appendix C for manhole loss coefficients used in the XPSWMM model.

The minor system performance was analyzed based on free outfall conditions at the outlet of EUC Pond 1 for all storms. Table 2 presents the peak minor system outflows from the Orleans Village subdivision obtained with the above-mentioned simulations, under ultimate development conditions.

Table 2: Comparison of Minor System Flows to the Outlets

Location	DSEL Rational Method Flow (m^3/s)	2-Year DDSWMM/ XPSWMM Flow (m^3/s)	5-Year DDSWMM/ XPSWMM Flow (m^3/s)	100-Year DDSWMM/ XPSWMM Flow (m^3/s)
MH 601 to North Forebay	3.326	3.047	3.781	5.359
MH 12 to HW	0.534	0.035	0.049	0.123
Total (1)	3.860	3.082	3.830	5.482

(1) Total flow taken as summation of peak inflows.

The DDSWMM/XPSWMM simulations have determined that for the selected 2-, 5- and 100-year storms, the total minor system flows would be 3.082 m^3/s, 3.830 m^3/s and 5.482 m^3/s, respectively. Although the 100-year flow will surcharge most parts of the minor system, a freeboard of 0.3 m between the 100-year hydraulic grade line and the underside of footings has been provided throughout the proposed development.

Tables C-1A to C-1E of Appendix C summarizes the pipe data and hydraulic simulation results for the 100-year 3-hour Chicago storm, 100-year 24-hour SCS Type II storm and the three historical events. Note that a minimum freeboard of 0.3 m between the hydraulic grade line and the underside of footings has been provided throughout the proposed development for the 100-year storms, and a minimum freeboard of 0 m has been provided throughout the proposed development for the historical events. Additionally, note that the flowing full pipe velocities are no less than 0.80 m/s and no greater than 6.0 m/s for all proposed pipes.

Table C-1F of Appendix C presents the climate change stress test results for the hydraulic gradeline analysis based on a 20% increase in the 100-year storm, as per the October 2012 *City of Ottawa Sewer Design Guidelines*. Under these conditions, no lots within the proposed development have freeboards of less than 0 m.

Table 3 presents the composite hydraulic gradeline results for the 100-year 3-hour Chicago and 100-year 24-hour SCS Type II design storms.

Table 3: Composite Hydraulic Gradeline Results for 100-Year Design Storms (Int B + Ultimate Orleans Village)

U/S MH	D/S MH	Max. U/S HGL (m)	Max. D/S HGL (m)	Lot Number	USF (m)	Freeboard (m)	Interpolated HGL		
							Length HGL (m)	Dist. From D/S MH (m)	HGL (m)
1	2	85.077	84.774	B91W	85.99	0.913			
2	3	84.774	84.686	N/A	N/A	N/A			
3	4	84.650	84.546	B90N	85.76	1.110			
4	8	84.546	84.513	N/A	N/A	N/A			
5	6	84.960	84.807	B87S	85.67	0.710			
6	12	84.807	84.531	B95SS	85.57	0.763			
7	8	84.953	84.574	B84W	85.52	0.567			
8	14	84.513	84.059	N/A	N/A	N/A			
9	10	85.015	84.883	B94NN	85.78	0.765			
10	11	84.883	84.675	B96SS	85.56	0.677			
11	12	84.675	84.531	B79E	85.53	0.855			
11	18	84.675	84.384	B80E	85.38	0.705			
12	13	84.531	84.280	B77W	85.51	0.979			
13	14	84.264	84.049	B75W	85.37	1.106			
14	140	84.049	83.998	N/A	N/A	N/A			
15	17	84.377	84.360	B97NN	85.85	1.473			
17	170	84.360	84.315	B96NS	85.72	1.360			
18	19	84.286	84.260	N/A	N/A	N/A			
19	19S	84.260	84.258	N/A	N/A	N/A			
19	19W	84.260	84.258	N/A	N/A	N/A			
20	20S	84.223	84.221	N/A	N/A	N/A			
20	20W	85.988	84.396	N/A	N/A	N/A			
21	22	84.176	84.120	68	85.16	0.984			
22	Chan2	84.120	84.107	N/A	N/A	N/A			
23	230	84.055	83.716	B74W	85.14	1.085			
24	25	83.507	83.493	N/A	N/A	N/A			
25	250	83.493	83.467	17	85.09	1.597			
26	27	83.446	83.420	N/A	N/A	N/A			
27	Chan3	83.420	83.403	N/A	N/A	N/A			
28	29	84.361	84.360	52	85.18	0.819			
29	30	84.360	84.070	53	85.16	0.800			
30	31	84.070	83.987	42	85.14	1.070			
31	32	83.987	83.920	41	85.08	1.093			
32	33	83.920	83.753	39	85.01	1.090			
33	34	83.753	83.679	37	85.13	1.377			
34	35	83.679	83.457	22	84.97	1.291			
35	26	83.457	83.446	20	85.01	1.553			
N3900	N54	85.643	85.563	IBI (FUT)	N/A	N/A			
N3900	39	85.643	84.824	N/A	N/A	N/A			
40	41	84.614	84.513	B133W	85.88	1.266			
41	17	84.513	84.360	B132E	85.88	1.367			
43	44	83.940	83.490	B4L120	85.11	1.170			
44	45	83.490	83.378	B6L116	84.63	1.140			
45	46	83.271	82.715	B1B	84.56	1.289			
46	Ex102	82.714	82.590	B15L1	84.44	1.726			
470	460	83.313	83.071	B13L1	84.51	1.197			
48	49	83.543	83.501	N/A	N/A	N/A			
49	50	83.457	83.120	B8L1	84.23	0.773			
50	ExPlug2	83.113	83.091	N/A	N/A	N/A			
N3901	N3900	85.887	85.665	IBI (FUT)	N/A	N/A			
N54	N55	85.563	85.433	IBI (FUT)	N/A	N/A			
N55	N56	85.433	85.271	IBI (FUT)	N/A	N/A			
N56	N57	85.271	85.146	IBI (FUT)	N/A	N/A			

Table 3: Composite Hydraulic Gradeline Results for 100-Year Design Storms (Int B + Ultimate Orleans Village)

U/S MH	D/S MH	Max. U/S HGL (m)	Max. D/S HGL (m)	Lot Number	USF (m)	Freeboard (m)	Interpolated HGL		
							Length HGL (m)	Dist. From D/S MH (m)	HGL (m)
N56	N101	85.271	84.910	IBI (FUT)	N/A	N/A			
N57	Chan1	85.146	84.948	IBI (FUT)	N/A	N/A			
101	102	87.042	87.003	Ground	88.87	1.827			
102	103	87.003	86.823	Ground	89.63	2.630			
103	104	86.823	86.718	Ground	89.50	2.677			
104	105	86.718	86.602	Ground	89.37	2.649			
105	106	86.602	86.489	Ground	89.22	2.619			
106	107	86.489	86.369	Ground	89.10	2.611			
107	108	86.369	86.262	Ground	88.97	2.596			
108	109	86.262	86.173	Ground	88.85	2.588			
109	110	86.173	86.032	Ground	88.75	2.575			
110	111	86.032	85.965	Ground	88.65	2.618			
111	112	85.965	85.892	Ground	88.56	2.596			
112	113	85.892	85.760	Ground	88.44	2.546			
113	N3900	85.760	85.643	Ground	88.30	2.543			
170	18	84.315	84.286	B96SS	85.56	1.245			
201	2001	86.296	86.266	Ground	88.94	2.643			
2002	202	86.253	86.214	Ground	88.81	2.554			
202	203	86.214	86.156	Ground	88.72	2.502			
203	204	86.156	86.088	Ground	88.61	2.451			
204	205	86.088	86.013	Ground	88.51	2.422			
205	206	86.013	85.897	Ground	88.41	2.397			
206	207	85.897	85.814	Ground	88.29	2.389			
207	2070	85.814	85.718	Ground	88.17	2.351			
208	209	85.529	85.450	Ground	87.77	2.236			
209	2090	85.450	85.386	Ground	87.60	2.151			
211	N55	85.508	85.433	Ground	87.68	2.172			
460	46	83.071	82.749	B13L5	84.51	1.439			
1101	1102	86.572	86.552	Ground	89.51	2.936			
1102	1103	86.552	86.419	Ground	89.42	2.864			
1103	1104	86.419	86.298	Ground	89.28	2.859			
1104	1105	86.298	86.217	Ground	89.17	2.869			
1105	1106	86.217	86.164	Ground	89.02	2.801			
1106	1107	86.164	86.104	Ground	88.93	2.765			
1107	110	86.104	86.032	Ground	88.81	2.704			
2001	2002	86.266	86.253	Ground	88.84	2.571			
2070	2071	85.718	85.601	Ground	88.05	2.328			
2071	208	85.601	85.529	Ground	87.92	2.319			
2090	N56	85.386	85.271	Ground	87.48	2.089			
2110	211	85.668	85.508	Ground	87.80	2.132			
19S	20	84.258	84.223	N/A	N/A	N/A			
19W	23	84.258	84.055	B71W	85.25	0.992			
20S	21	84.221	84.176	64	85.23	1.009			
20W	30	84.396	84.149	56	85.28	0.884			
47	48	83.800	83.555	B10L1	84.52	0.720			
Chan1	Chan1a	84.948	84.768	N/A	N/A	N/A			
Chan1a	Chan1b	84.768	84.655	N/A	N/A	N/A			
Chan1b	Chan1c	84.655	84.617	N/A	N/A	N/A			
Chan1c	Chan1d	84.617	84.296	N/A	N/A	N/A			
Chan1d	Chan1e	84.296	84.241	N/A	N/A	N/A			
Chan2	Chan3a	84.107	83.562	N/A	N/A	N/A			
Chan3	Chan4	83.403	83.047	N/A	N/A	N/A			
Chan4	ForeS	83.047	83.047	N/A	N/A	N/A			

Table 3: Composite Hydraulic Gradeline Results for 100-Year Design Storms (Int B + Ultimate Orleans Village)

U/S MH	D/S MH	Max. U/S HGL (m)	Max. D/S HGL (m)	Lot Number	USF (m)	Freeboard (m)	Interpolated HGL		
							Length HGL (m)	Dist. From D/S MH (m)	HGL (m)
DICB	15	84.647	84.377	N/A	N/A	N/A			
Ex100	Ex111	83.048	83.047	IBI (3)	83.47	0.422			
Ex107	Ex100	83.085	83.048	IBI (3)	83.58	0.495			
Ex111	Chan4	83.047	83.047	IBI (3)	83.45	0.403			
ExPlug2	Ex107	83.091	83.085	N/A	N/A	N/A			
ForeN	MainN	83.040	83.040	N/A	N/A	N/A			
ForeS	MainS	83.047	83.046	N/A	N/A	N/A			
MainN	Out	83.041	80.100	N/A	N/A	N/A			
MainS	MainN	83.047	83.041	N/A	N/A	N/A			
140	141	83.998	83.657	N/A	N/A	N/A			
141	24	83.657	83.560	N/A	N/A	N/A			
230	24	83.716	83.592	N/A	N/A	N/A			
250	26	83.467	83.446	N/A	N/A	N/A			
39	40	84.824	84.614	B134W	86.14	1.316			
280	28	84.381	84.361	47	85.21	0.829			
200	41	84.513	84.513	N/A	N/A	N/A			
Chan1e	Chan2	84.241	84.107	N/A	N/A	N/A			
N404	N406	84.352	84.200	IBI (FUT)	N/A	N/A			
N406	N407	84.200	84.171	IBI (FUT)	N/A	N/A			
N407	Chan2	84.171	84.107	IBI (FUT)	N/A	N/A			
N101	N102	84.910	84.758	IBI (FUT)	N/A	N/A			
N104	N105	84.518	84.459	IBI (FUT)	N/A	N/A			
N105	N106	84.459	84.439	IBI (FUT)	N/A	N/A			
N106	19	84.439	84.260	IBI (FUT)	N/A	N/A			
N310	N311	84.580	84.543	IBI (FUT)	N/A	N/A			
N311	N312	84.543	84.472	IBI (FUT)	N/A	N/A			
N312	N313	84.472	84.408	IBI (FUT)	N/A	N/A			
N313	N305	84.408	84.368	IBI (FUT)	N/A	N/A			
N305	N306	84.368	84.275	IBI (FUT)	N/A	N/A			
N306	N406	84.275	84.200	IBI (FUT)	N/A	N/A			
N401	N402	84.739	84.595	IBI (FUT)	N/A	N/A			
N402	N403	84.595	84.445	IBI (FUT)	N/A	N/A			
N403	N404	84.445	84.352	IBI (FUT)	N/A	N/A			
N501	N57	85.128	85.146	IBI (FUT)	N/A	N/A			
N500C	N501	85.197	85.128	IBI (FUT)	N/A	N/A			
N500	N500C	85.336	85.197	IBI (FUT)	N/A	N/A			
N400	N401	84.836	84.739	IBI (FUT)	N/A	N/A			
N399	N400	84.931	84.836	IBI (FUT)	N/A	N/A			
N412	N404	84.365	84.352	IBI (FUT)	N/A	N/A			
N410	N412	84.404	84.365	IBI (FUT)	N/A	N/A			
N410B	N410	84.842	84.404	IBI (FUT)	N/A	N/A			
N309	N310	84.630	84.580	IBI (FUT)	N/A	N/A			
N308	N309	84.593	84.630	IBI (FUT)	N/A	N/A			
N307	N308	84.875	84.593	IBI (FUT)	N/A	N/A			
N304	N305	84.403	84.368	IBI (FUT)	N/A	N/A			
N303	N304	84.404	84.403	IBI (FUT)	N/A	N/A			
N301	N303	84.605	84.404	IBI (FUT)	N/A	N/A			
N314	N304	84.408	84.403	IBI (FUT)	N/A	N/A			
N114	N105	84.808	84.589	IBI (FUT)	N/A	N/A			
N113	N114	85.259	84.855	IBI (FUT)	N/A	N/A			
N112B	N113	85.300	85.259	IBI (FUT)	N/A	N/A			
N112_2	N101	84.985	84.910	IBI (FUT)	N/A	N/A			
N103	N104	84.574	84.518	IBI (FUT)	N/A	N/A			

Table 3: Composite Hydraulic Gradeline Results for 100-Year Design Storms (Int B + Ultimate Orleans Village)

U/S MH	D/S MH	Max. U/S HGL (m)	Max. D/S HGL (m)	Lot Number	USF (m)	Freeboard (m)	Interpolated HGL		
							Length HGL (m)	Dist. From D/S MH (m)	HGL (m)
N102	N103	84.758	84.574	IBI (FUT)	N/A	N/A			
Chan3a	Chan3	83.562	83.403	N/A	N/A	N/A			
C13	C13b	85.084	83.276	N/A	N/A	N/A			
C13b	MainN	83.276	83.041	N/A	N/A	N/A			
B1	B2	83.874	83.651	276	85.47	1.596			
B2	B3	83.651	83.534	275	85.74	2.089			
B3	B60	83.534	83.090	273	85.68	2.146			
B4	B58	84.544	84.198	254	85.75	1.206			
				254	85.75	1.320	81.3	54.5	84.430
				253	85.79	1.314	81.3	65.3	84.476
				252	85.98	1.445	81.3	79.1	84.535
				258	85.68	1.465	81.3	3.9	84.215
				257	85.79	1.532	81.3	14.2	84.258
				256	85.74	1.433	81.3	25.6	84.307
				255	85.78	1.421	81.3	37.8	84.359
B5	B6	84.692	84.917	50	86.01	1.318			
B5	B56	84.300	84.068	40	85.69	1.390			
B6	B7	84.917	84.931	54	86.04	1.123			
B7	B8	84.931	84.934	55	85.97	1.039			
B8	B9	84.934	84.821	27	85.83	0.896			
B9	B57	84.821	83.899	21	85.69	0.869			
B10	B11	84.881	84.820	81	86.04	1.159			
B10	B49	84.881	84.721	311	86.27	1.389			
B11	B34	84.820	84.417	74	85.92	1.100			
B12	B13	87.397	85.877	N/A	N/A	N/A			
B13	B15	85.869	85.015	N/A	N/A	N/A			
B15	B21	85.015	84.927	N/A	N/A	N/A			
B16	B40	85.403	85.109	B370S	86.26	0.857			
				B370S	86.26	1.099	108.2	19.1	85.161
				B370N	86.63	1.433	108.2	32.3	85.197
				B369S	86.63	1.400	108.2	44.6	85.230
				B369N	86.41	1.104	108.2	72.4	85.306
				B368S	86.53	1.188	108.2	85.9	85.342
				B368N	86.63	1.250	108.2	99.7	85.380
				B374S	86.87	1.471	108.2	106.7	85.399
				B373N	86.67	1.289	108.2	100.1	85.381
				B373S	86.55	1.229	108.2	78.1	85.321
				B372N	86.55	1.264	108.2	65.2	85.286
				B372S	86.62	1.393	108.2	43.6	85.227
				B371N	86.62	1.426	108.2	31.4	85.194
				B371S	86.77	1.613	108.2	17.8	85.157
B17	B16	85.392	85.403	B374N	86.75	1.358			
B17	B18	85.392	85.349	B376E	86.59	1.198			
B18	B21	85.349	84.927	B377W	86.51	1.161			
B19	B21	85.202	84.927	B356E	86.51	1.308			
B19	B26	85.202	85.191	351	86.73	1.528			
B21	B24	84.927	84.818	B145N	86.60	1.673			
B22	B24	85.062	84.818	B136E	86.15	1.088			
B22	B2200	85.062	84.985	B158	86.60	1.538			
B24	B25	84.818	84.720	B146S	86.09	1.272			
B25	B30	84.720	84.682	N/A	N/A	N/A			
B26	B22	85.191	85.062	124	86.63	1.439			
B27	B28	84.955	84.934	121	86.38	1.425			

Table 3: Composite Hydraulic Gradeline Results for 100-Year Design Storms (Int B + Ultimate Orleans Village)

U/S MH	D/S MH	Max. U/S HGL (m)	Max. D/S HGL (m)	Lot Number	USF (m)	Freeboard (m)	Interpolated HGL		
							Length HGL (m)	Dist. From D/S MH (m)	HGL (m)
B28	B30	84.934	84.682	126	86.09	1.156			
B30	B33	84.682	84.553	3	85.87	1.188			
B31	B33	84.897	84.553	95	85.99	1.093			
B31	B35	84.897	84.893	104	86.40	1.503			
B33	B34	84.553	84.417	7	85.89	1.337			
B34	B38	84.417	84.272	59	86.06	1.643			
B35	B10	84.893	84.881	105	86.31	1.417			
B36	B37	85.043	84.822	344	86.01	0.967			
B37	B38	84.822	84.272	338	86.00	1.178			
B38	B52	84.272	84.180	18	85.82	1.548			
B39	B40	85.112	85.109	160	86.56	1.448			
B40	B41	85.109	85.034	164	86.37	1.261			
B41	B30	85.034	84.682	N/A	N/A	N/A			
B42	B43	85.483	85.369	167	86.11	0.627			
				167	86.11	0.716	45.7	10.0	85.394
				166	86.14	0.717	45.7	21.6	85.423
				165	86.39	0.936	45.7	34.0	85.454
B42	B45	85.483	85.260	237	86.13	0.647			
				237	86.13	0.699	102.8	78.7	85.431
				236	86.13	0.673	102.8	90.6	85.457
				231	86.36	0.896	102.8	94.0	85.464
				230	86.18	0.742	102.8	82.0	85.438
				229	86.19	0.777	102.8	70.7	85.413
				228	86.29	0.908	102.8	56.2	85.382
				227	86.36	1.008	102.8	42.2	85.352
				226	86.47	1.149	102.8	28.1	85.321
				225	86.47	1.178	102.8	14.8	85.292
				224	86.36	1.098	102.8	0.9	85.262
				243	86.43	1.158	102.8	5.7	85.272
				242	86.47	1.171	102.8	18.2	85.299
				241	86.47	1.141	102.8	31.8	85.329
				240	86.31	0.955	102.8	43.8	85.355
				239	86.30	0.921	102.8	54.9	85.379
				238	86.16	0.754	102.8	67.3	85.406
B43	B44	85.369	85.328	168	86.26	0.891			
				168	86.26	0.897	10.7	9.2	85.363
				169	86.38	1.031	10.7	5.4	85.349
				170	86.38	1.046	10.7	1.5	85.334
B44	B47	85.328	85.064	175	85.95	0.622			
				175	85.95	0.808	103.2	30.3	85.142
				174	86.09	0.906	103.2	47.0	85.184
				173	86.31	1.089	103.2	61.2	85.221
				172	86.32	1.059	103.2	77.2	85.261
				171	86.34	1.041	103.2	91.7	85.299
				251	86.33	1.018	103.2	96.9	85.312
				250	86.33	1.050	103.2	84.5	85.280
				249	86.26	1.008	103.2	73.3	85.252
				248	86.15	0.930	103.2	61.1	85.220
				247	86.07	0.878	103.2	50.0	85.192
				246	86.03	0.876	103.2	35.2	85.154
				245	86.03	0.904	103.2	24.3	85.126
				244	85.96	0.866	103.2	11.8	85.094
				177	86.23	1.156	103.2	4.0	85.074

Table 3: Composite Hydraulic Gradeline Results for 100-Year Design Storms (Int B + Ultimate Orleans Village)

U/S MH	D/S MH	Max. U/S HGL (m)	Max. D/S HGL (m)	Lot Number	USF (m)	Freeboard (m)	Interpolated HGL Length HGL (m)	Interpolated HGL Dist. From D/S MH (m)	Interpolated HGL HGL (m)
				176	86.08	0.973	103.2	16.9	85.107
B45	B46	85.260	85.233	222	86.26	1.000			
B46	B47	85.233	85.064	220	85.95	0.717			
				220	85.95	0.789	45.6	26.2	85.161
				221	86.07	0.858	45.6	39.9	85.212
				219	86.07	0.962	45.6	12.0	85.108
B47	B54	85.064	84.596	185	85.85	0.786			
				185	85.85	1.201	111.4	12.7	84.649
				184	85.85	1.154	111.4	23.8	84.696
				183	85.96	1.212	111.4	36.3	84.748
				182	86.03	1.220	111.4	50.9	84.810
				181	86.13	1.274	111.4	61.8	84.856
				180	86.22	1.313	111.4	74.0	84.907
				179	86.25	1.294	111.4	85.7	84.956
				178	86.26	1.254	111.4	97.6	85.006
B48	B52	84.682	84.180	211	85.83	1.148			
B49	B50	84.721	84.702	309	86.14	1.419			
B50	B52	84.702	84.180	300	85.81	1.108			
B52	B56	84.180	84.068	N/A	N/A	N/A			
B54	B55	84.596	84.535	188	86.02	1.424			
B55	B56	84.535	84.068	199	85.69	1.155			
B56	B57	84.068	83.899	N/A	N/A	N/A			
B57	B1	83.899	83.874	N/A	N/A	N/A			
B58	B57	84.198	83.899	262	85.71	1.512			
				262	85.71	1.722	61.6	18.4	83.988
				261	85.71	1.662	61.6	30.6	84.048
				260	85.73	1.628	61.6	41.9	84.102
				259	85.88	1.717	61.6	54.3	84.163
B59	B63	83.328	83.251	270	85.73	2.402			
B60	B61	83.090	83.081	N/A	N/A	N/A			
B61	B62	83.081	83.064	N/A	N/A	N/A			
B62	B600	83.063	83.054	N/A	N/A	N/A			
B63	B60	83.147	83.090	N/A	N/A	N/A			
B120	B12	88.780	87.397	N/A	N/A	N/A			
B180	B18	85.470	85.349	B367N	86.55	1.080			
				B367N	86.55	1.154	37.9	14.8	85.396
				B367S	86.70	1.262	37.9	28.0	85.438
				B362S	86.72	1.282	37.9	28.0	85.438
				B362N	86.41	1.014	37.9	14.8	85.396
B180	B41	85.470	85.034	B364S	86.21	0.740			
				B364S	86.21	1.074	77.2	18.1	85.136
				B364N	86.22	1.010	77.2	31.1	85.210
				B363S	86.22	0.938	77.2	44.0	85.282
				B363N	86.72	1.277	77.2	72.4	85.443
				B366N	86.72	1.277	77.2	72.4	85.443
				B366S	86.28	0.998	77.2	44.0	85.282
				B365N	86.28	1.070	77.2	31.1	85.210
				B365S	86.26	1.124	77.2	18.1	85.136
B410	B42	85.502	85.483	232	86.45	0.948			
B590	B59	84.170	83.328	294	85.46	1.290			
B2200	B27	84.985	84.955	122	86.48	1.495			
C12	C13	85.105	85.084	N/A	N/A	N/A			
C4MH	B2200	85.529	84.985	N/A	N/A	N/A			

Table 3: Composite Hydraulic Gradeline Results for 100-Year Design Storms (Int B + Ultimate Orleans Village)

U/S MH	D/S MH	Max. U/S HGL (m)	Max. D/S HGL (m)	Lot Number	USF (m)	Freeboard (m)	Interpolated HGL		
							Length HGL (m)	Dist. From D/S MH (m)	HGL (m)
C8MH	B5	85.663	85.200	N/A	N/A	N/A			
B600	B601	83.054	83.041	N/A	N/A	N/A			
B601	ForeN	83.041	83.041	N/A	N/A	N/A			
CB1	CB2	88.105	87.960	N/A	N/A	N/A			
CB2	CB3	87.960	87.861	N/A	N/A	N/A			
CB3	CB4	87.861	87.792	N/A	N/A	N/A			
CB4	CB5	87.792	87.724	N/A	N/A	N/A			
CB5	CB6	87.724	87.660	N/A	N/A	N/A			
CB6	CB7	87.660	87.570	N/A	N/A	N/A			
CB7	CB8	87.570	87.402	N/A	N/A	N/A			
CB8	C100MH	87.402	86.480	N/A	N/A	N/A			
CB9	CB10	86.877	86.975	N/A	N/A	N/A			
CB10	CB10i	86.975	87.063	N/A	N/A	N/A			
CB10i	CB11	87.063	87.162	N/A	N/A	N/A			
CB11	CB12	87.162	87.162	N/A	N/A	N/A			
CB12	CB13	87.162	87.162	N/A	N/A	N/A			
CB13	CB14	87.162	87.162	N/A	N/A	N/A			
CB14	CB15	87.162	87.137	N/A	N/A	N/A			
CB15	CB16	87.137	87.118	N/A	N/A	N/A			
CB16	CB17	87.118	87.105	N/A	N/A	N/A			
CB17	CB18	87.105	87.069	N/A	N/A	N/A			
CB18	CB19	87.069	87.036	N/A	N/A	N/A			
CB19	CB20	87.036	87.006	N/A	N/A	N/A			
CB20	CB21	87.006	86.985	N/A	N/A	N/A			
CB21	CB22	86.985	86.945	N/A	N/A	N/A			
CB22	CB23	86.945	86.906	N/A	N/A	N/A			
CB23	CB24	86.906	86.847	N/A	N/A	N/A			
CB24	CB25	86.847	86.753	N/A	N/A	N/A			
CB25	CB50	86.753	85.856	N/A	N/A	N/A			
CB25	CB25i	86.753	86.738	N/A	N/A	N/A			
CB25i	CB26	86.738	86.667	N/A	N/A	N/A			
CB26	CB27	86.667	86.619	N/A	N/A	N/A			
CB27	CB28	86.619	86.590	N/A	N/A	N/A			
CB28	CB29	86.590	86.536	N/A	N/A	N/A			
CB29	CB30	86.536	86.416	N/A	N/A	N/A			
CB30	C12	86.416	85.430	N/A	N/A	N/A			
CB50	C8MH	85.856	85.663	N/A	N/A	N/A			
CB100	CB1	88.106	88.105	N/A	N/A	N/A			
C100MH	C4MH	86.399	86.148	N/A	N/A	N/A			
C101MH	C4MH	86.455	86.877	N/A	N/A	N/A			
C101MH	CB9	86.449	86.796	N/A	N/A	N/A			

Note: (1) A negative surcharge implies that the pipe is not flowing full

(2) Conservative estimate of freeboard based on U/S HGL and lowest USF connected to pipe. Actual HGL / freeboard at all connecting lots interpolated where conservative estimate does not meet freeboard requirements.

(3) Minimum USF elevation as per June 2010 "Trails Edge Phase 1 SWM Report" by IBI Group.

84.430	Interpolated HGL elevation

An additional sensitivity test was also undertaken to evaluate the hydraulic gradeline results during the 10-year 3-hour Chicago and 10-year 24-hour SCS Type II design storms, with accumulation of sediment in the portions of the proposed storm sewer pipes submerged by the permanent pool of the SWM pond. Storm sewer pipes partially submerged by the permanent pool of the proposed SWM facility were modelled as smaller diameter pipes, in order to replicate the impact of 25% blockage by sediment accumulation in the submerged portions of the pipes (refer to Table E-2 of Appendix E).

Tables E-1A and E-1B of Appendix E summarize the hydraulic simulation results under the sensitivity test for 25% sediment blockage conditions during the 10-year storm. Even under 25% blockage by sediment accumulation, a minimum freeboard of 0 m is provided between the hydraulic gradeline and the underside of footings throughout the subdivision.

5 PERFORMANCE OF INTERIM B EUC POND 1

As noted above, the Orleans Village site was treated as undeveloped under Interim B conditions in the March 2014 *Design Brief for the Reconstruction of the East Urban Community Stormwater Management Pond 1 for the Trails Edge West Subdivision*, and lumped in with the development of the East Urban Community lands to the north of the hydro corridor, which will trigger an "Ultimate Conditions" expansion of the north main cell and north forebay in EUC Pond 1. However, it is proposed that the development of the subject site, and particularly Phase 1, be allowed under Interim B conditions with the understanding that 100-year water level in EUC Pond 1 will increase temporarily under these conditions.

Under full development of the Orleans Village subdivision, the operation of Interim B EUC Pond 1 is summarized in Table 4A below.

Table 4A: Summary of SWM Pond 1 Operating Characteristics Under Interim B Conditions (Ultimate Orleans Village Development)

Pond Component	Water Level (m)				Volume Used (2) (m^3)	Allowable Outflow (3) (m^3/s)	Provided Outflow (m^3/s)
	North Forebay	North Main Cell	South Forebay	South Main Cell			
Permanent Pool (4)	81.600	80.100	81.500	80.100	36400	N/A	N/A
Quality Control	N/A	80.685	N/A	80.685	14930	N/A	0.205
Extended Detention	81.650	81.650	81.650	81.650	43988	N/A	0.383
2-Year, 24-Hour SCS	81.938	81.857	81.946	81.857	54567	1.000	0.575
5-Year, 24-Hour SCS	82.242	82.242	82.243	82.243	71126	2.300	1.183
10-Year, 24-Hour SCS	82.463	82.463	82.463	82.463	81728	3.800	1.799
25-Year, 24-Hour SCS	82.694	82.694	82.695	82.694	93288	5.600	3.519
50-Year, 24-Hour SCS	82.867	82.867	82.869	82.869	102242	6.700	5.241
100-Year, 24-Hour SCS (5)	83.041	83.041	83.047	83.047	111460	8.000	7.223
July 1st, 1979 Event	83.138	83.138	83.143	83.143	115634	N/A	8.419
August 4, 1988 Event	82.934	82.932	82.936	82.936	105700	N/A	5.964
August 8, 1996 Event	82.854	82.852	82.854	82.854	101462	N/A	5.082

(2) Volumes are active storage only for all SWM facility components except the permanent pool.

(3) Refer to the March 2014 Design Brief for target release rates and volumes.

(4) Bottom elevations are 79.00 m in the north main cell, 79.10 m in the south main cell, 79.50 m in the north forebay and 80.00 m in the south forebay.

(5) Maximum allowable 100-year pond level = 83.0 m in the main cell (per the April 2008 "East Urban Community Pond No. 1 Design Brief" by Stantec).

The above results show that the actual provided release rates do not exceed the allowable release rates for SWM Pond 1. Note that the maximum 100-year pond level is 83.047 m; above the maximum allowable 100-year water level of 83.0 m.

Interim B EUC Pond 1 has been equipped with two sediment forebays; the south forebay is not negatively affected by the Orleans Village subdivision, as the proposed development discharges to the north main cell and forebay of SWM Pond 1. Calculations for the minimum dispersion length, settling length and the average velocity in the north forebay under these Interim B conditions have been included in Calculation Sheet F-1 of Attachment F.

EUC SWM Pond 1 has a permanent pool volume of 36,400 m^3, which is more than the minimum permanent pool volume the SWMP Design Manual requires for normal protection for a wet pond for the 373.254 ha drainage area at 43% imperviousness, as calculated below.

$$(98.00 - 40)\ m^3/ha \times 373.254\ ha = 21,649\ m^3$$

The required quality control volume of 14,930 m^3 (40 m^3/ha) for the 373.254 ha drainage area is contained within the extended detention volume at an elevation of 80.685 m. The provided extended detention volume of 43,988 m^3 exceeds the required volume of 34,724 m^3 calculated based on detention of the 25 mm storm runoff.

It may therefore be concluded that the operation of EUC SWM Pond 1 under Interim B conditions, with the Orleans Village subdivision fully developed in place, is in conformance with the requirements presented in the March 2014 *Design Brief for the Reconstruction of the East Urban Community Stormwater Management Pond 1 for the Trails Edge West Subdivision*, with the exception of the 100-year pond level, which exceeds the maximum allowable elevation by 4.6 cm.

It is understood that EUC Pond 1 may be expanded prior to the development of Phase 2 of the Orleans Village subdivision. The DDSWMM / SWMHYMO / XPSWMM models have therefore been modified to reflect the development of Phase 1 only, as an additional scenario for consideration. For the purposes of this analysis, the 1.10 ha and 2.03 ha parcels of Phase 2 on the west side of the site are assumed to be undeveloped with 100-year capture to the proposed storm sewer system. The 8.65 ha parcel of Phase 2 on the east side of the site is assumed to be undeveloped and drain overland to an existing ditch and subsequently to the north main cell of EUC Pond 1. With only Phase 1 of the Orleans Village subdivision in place, the operation of Interim B EUC Pond 1 is summarized in Table 4B below.

Table 4B: Summary of SWM Pond 1 Operating Characteristics Under Interim B Conditions (Orleans Village Phase 1 Only)

Pond Component	Water Level (m)				Volume Used (2) (m^3)	Allowable Outflow (3) (m^3/s)	Provided Outflow (m^3/s)
	North Forebay	North Main Cell	South Forebay	South Main Cell			
Permanent Pool (4)	81.600	80.100	81.500	80.100	36400	N/A	N/A
Quality Control	N/A	80.685	N/A	80.685	14930	N/A	0.205
Extended Detention	81.650	81.650	81.650	81.650	43988	N/A	0.383
2-Year, 24-Hour SCS	81.900	81.821	81.946	81.821	53167	1.000	0.530
5-Year, 24-Hour SCS	82.206	82.206	82.207	82.207	69421	2.300	1.119
10-Year, 24-Hour SCS	82.431	82.431	82.431	82.431	80206	3.800	1.642
25-Year, 24-Hour SCS	82.668	82.667	82.667	82.667	91921	5.600	3.279
50-Year, 24-Hour SCS	82.840	82.840	82.843	82.842	100835	6.700	4.956
100-Year, 24-Hour SCS (5)	83.016	83.016	83.021	83.020	110091	8.000	6.924
July 1st, 1979 Event	83.109	83.108	83.112	83.112	114865	N/A	8.043
August 4, 1988 Event	82.904	82.902	82.906	82.906	104159	N/A	5.627
August 8, 1996 Event	82.815	82.814	82.816	82.815	99465	N/A	4.682

(2) Volumes are active storage only for all SWM facility components except the permanent pool.

(3) Refer to the March 2014 Design Brief for target release rates and volumes.

(4) Bottom elevations are 79.00 m in the north main cell, 79.10 m in the south main cell, 79.50 m in the north forebay and 80.00 m in the south forebay.

(5) Maximum allowable 100-year pond level = 83.0 m in the main cell (per the April 2008 "East Urban Community Pond No. 1 Design Brief" by Stantec).

The above results show that the actual provided release rates do not exceed the allowable release rates for SWM Pond 1. Note that the maximum 100-year pond level is 83.021 m; 2.0 cm above the maximum allowable 100-year water level of 83.0 m.

6 EROSION AND SEDIMENT CONTROL DURING AND AFTER CONSTRUCTION

Silt and erosion control strategies shall be implemented during construction activities in order to minimize the transfer of silt off site. The following measures should be implemented:

i) Silt control fences shall be installed as required in order to prevent the movement of silt off-site during rainfall events.

ii) Construction of a mud mat shall be installed at the site entrance in order to promote self-cleaning of truck tires when leaving the site.

iii) All catchbasins shall be equipped with a crushed stone filter in order to prevent the capture of silt in the storm sewer system.

iv) Regular cleaning of the adjacent roads shall be undertaken during the construction activities.

v) Regular inspection and maintenance of the silt control measures shall be undertaken until the site has been stabilized.

vi) The erosion and sediment control devices shall be removed after the site has been stabilized.

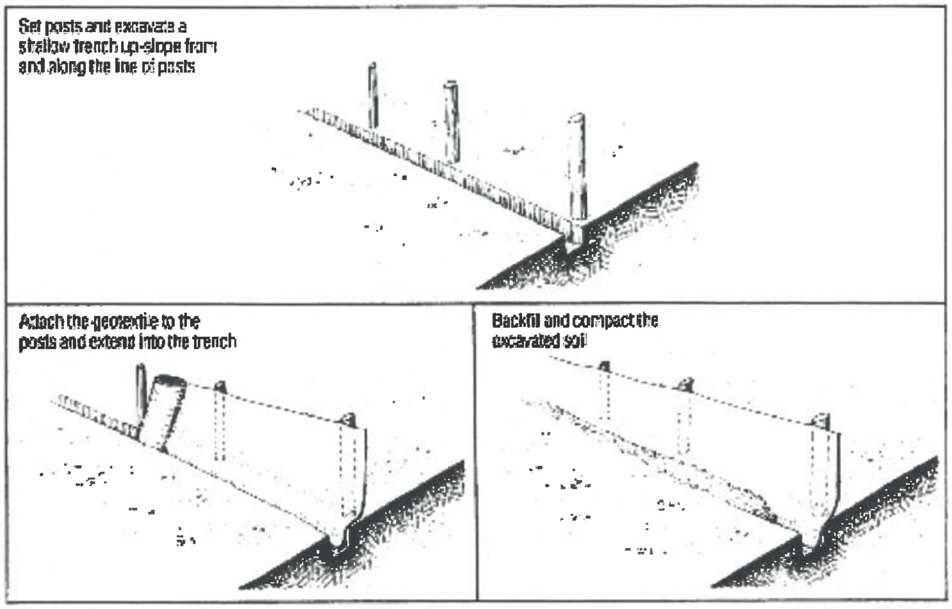

Figure 5: Typical installation of silt fences

Figure 6: Catchbasin with geotextile to protect storm sewer pipes from sediment contamination

7 SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

The Orleans Village subdivision (31.10 ha) is located within the City of Ottawa. The proposed development is located south of Innes Road, east of Page Road, north of the East Urban Community (EUC) SWM Pond 1 and a hydro easement, and west of future development in the East Urban Community area. The proposed development is serviced for quality, erosion and quantity control by EUC SWM Pond 1, which discharges to Mud Creek.

In accordance with the City of Ottawa design guidelines, the minor system has been designed to accommodate a minimum of the 2-year post-development flows from within the site and from external areas (plus 5-year flows on collector and 10-year flows on arterial roads). The combined DDSWMM / SWMHYMO / XPSWMM model analyses have determined that the minor system will surcharge in most parts of the system. However, a freeboard of 0.3 m between the 100-year hydraulic gradeline and the underside of footing elevations has been provided throughout the proposed development with the use of Inlet Control Devices.

The total 2-, 5- and 100-year storm controlled minor system flows from the proposed subdivision and from external areas to the pond will be 3.082 m^3/s, 3.830 m^3/s and 5.482 m^3/s, respectively.

Within the subdivision, the peak water depths do not exceed the maximum allowable 35 cm depth at the gutter for the simulated 100-year storm (refer to Calculation Sheet 1A and Table D-7 of Appendix D). Furthermore, it was determined that for the 100-year event, the product of the velocity and depth of flow does not exceed the maximum allowable 0.60 m^2/s. Also as required, the maximum extent of surface water during the 100-year + 20% stress test will not touch the building envelopes.

Table C-2 of Appendix C summarizes the hydraulic grade line analysis. Note that the full pipe velocities are no less than 0.80 m/s and no greater than 6.0 m/s for all proposed pipes.

Stress test results for the major and minor drainage systems based on a 20% increase in the 100-year storm, as per the October 2012 *City of Ottawa Sewer Design Guidelines*, are summarized in Section 4. A sensitivity test was also undertaken to evaluate the 10-year hydraulic gradeline results under 25% blockage by sediment accumulation in pipes submerged by the permanent pool of the Clarke SWM facility.

Recommendations for silt and erosion control strategies to be implemented during construction are presented in Section 6.

In conclusion, the proposed design satisfies all selected design guidelines and requirements.