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3484 & 3490 Innes Road Functional Servicing Report

Revised May 18th, 2023

Prepared for: Lépine Corporation

**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
Revised December 14th, 2022
Revised May 18th, 2023

Ref: R-2021-129
Novatech File: 121214

May 18th, 2023

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 May 18th, 2023. This report has been revised based on City review comments dated Feb 9th, 2023.

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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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 5.16 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.

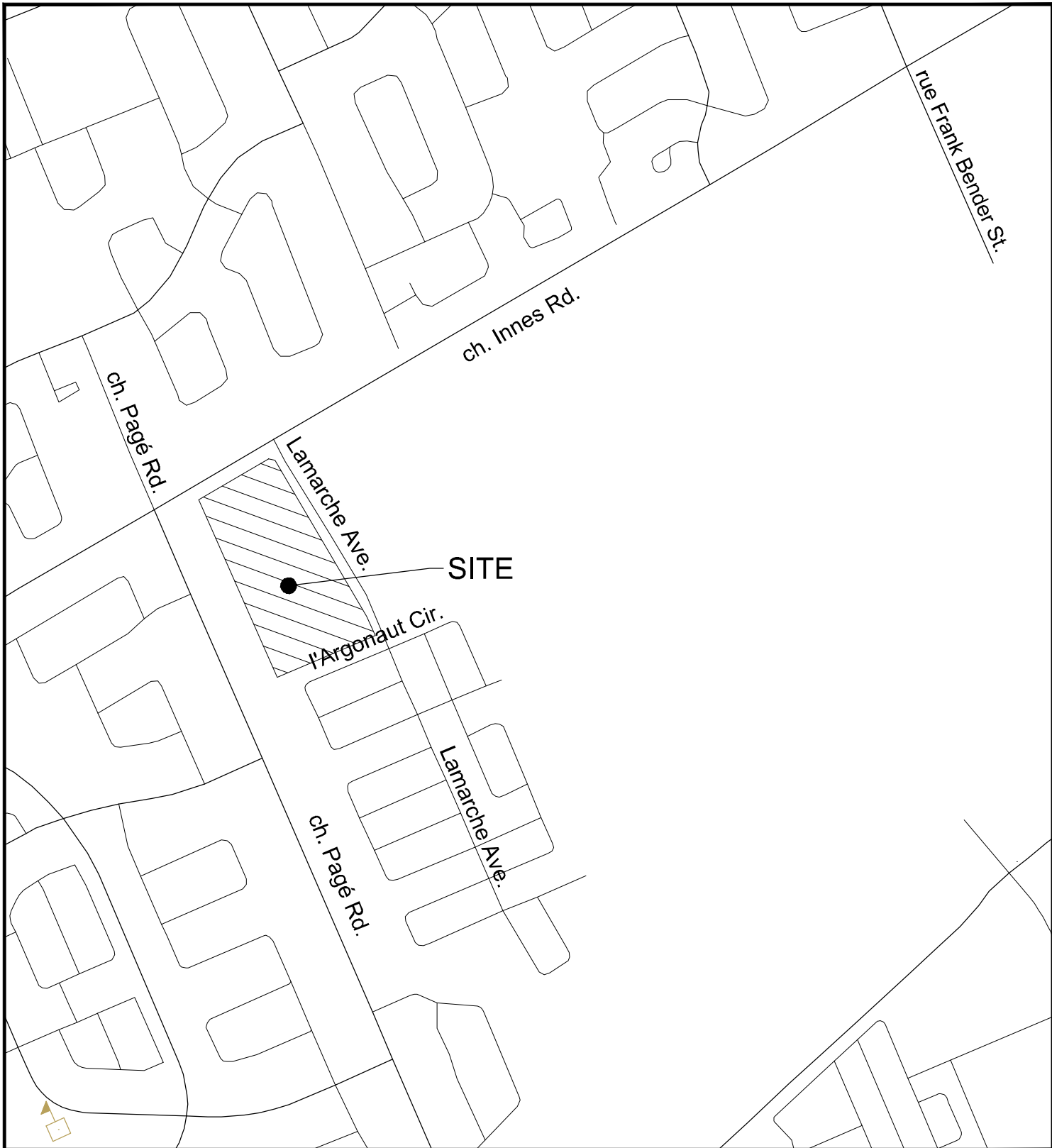
3.0. PROPOSED DEVELOPMENT

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 20m City of Ottawa right-of-way cross-section (**Figure 4**) is included for reference. **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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240-270 LAMARCHE AVENUE &
 3484 INNES ROAD
 CITY OF OTTAWA

KEYPLAN

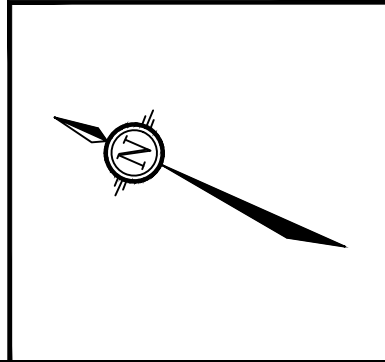
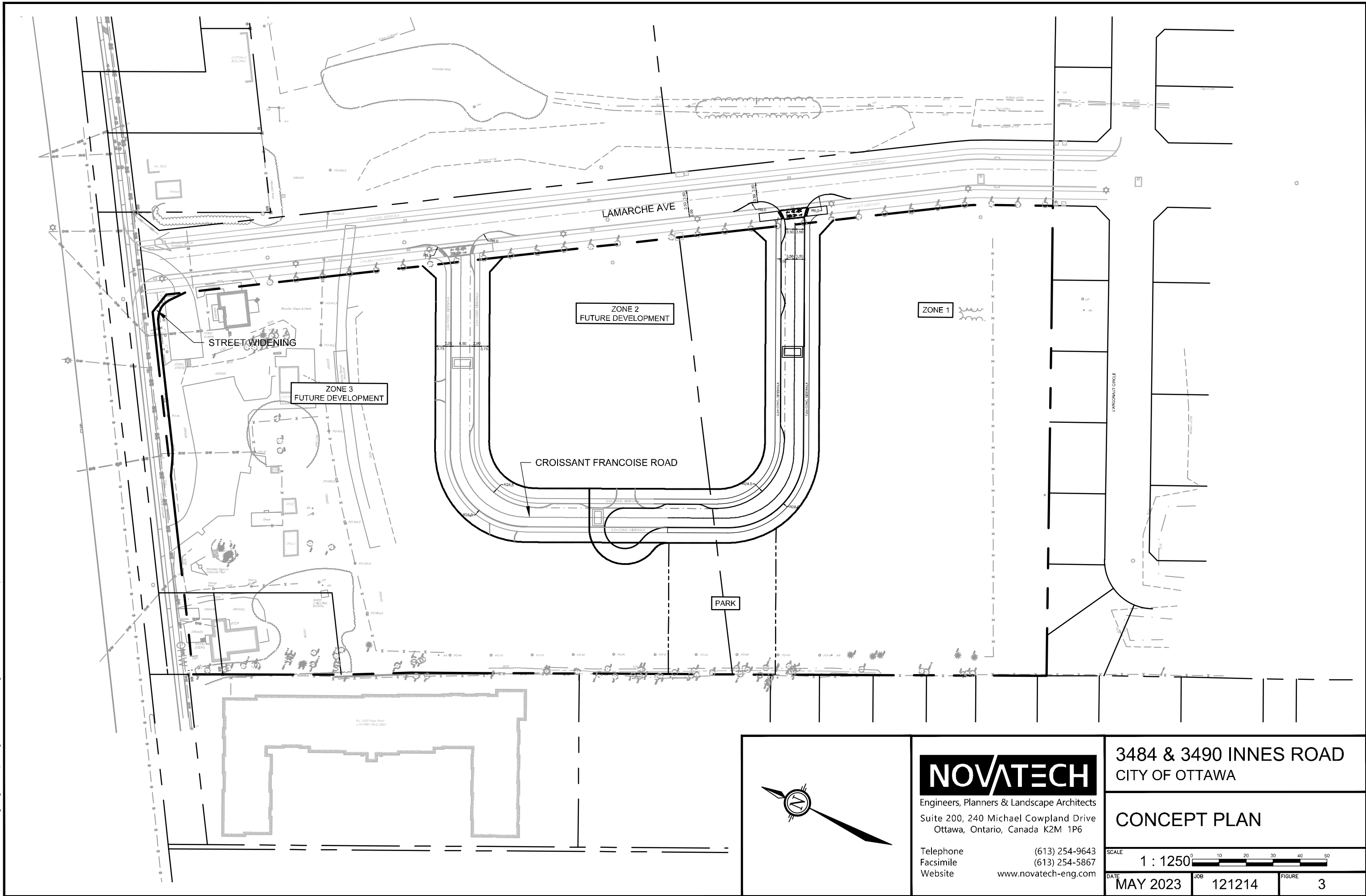
SCALE			N.T.S.		
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	<h1>NOVATECH</h1> <p>Engineers, Planners & Landscape Architects Suite 200, 240 Michael Cowpland Drive Ottawa, Ontario, Canada K2M 1P6</p> <p>Telephone (613) 254-9643 Facsimile (613) 254-5867 Website www.novatech-eng.com</p>	<p>3484 & 3490 INNES ROAD CITY OF OTTAWA</p> <p>EXISTING CONDITIONS PLAN</p>	
	<p>SCALE 1 : 1250</p>		<p>DATE MAY 2023 JOB 121214 FIGURE 2</p>

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3484 & 3490 INNES ROAD
 CITY OF OTTAWA

CONCEPT PLAN

SCALE	1 : 1250	
DATE	MAY 2023	JOB 121214
FIGURE	3	

1. STANDARD CROSS-SECTIONS TO BE READ IN CONJUNCTION WITH THE GENERAL STANDARD CROSS-SECTION NOTES AND OTHER APPLICABLE CITY AND UTILITY PLANS AND DETAILS.
2. CONCRETE CURBS TO BE CONSTRUCTED AS PER CITY OF OTTAWA STANDARD DETAILS.
3. TYPICAL FRONT YARD SETBACK IS TO BE CLEAR AND UNENCUMBERED OF ANY SUBSURFACE BUILDING ENCROACHMENTS.
4. FIRE HYDRANTS TO BE LOCATED ON THE WATERMAIN SIDE OF THE STREET.
5. CATCH BASINS TO BE PER CITY OF OTTAWA DETAIL S2.
6. GAS MAIN SHALL HAVE A MINIMUM OF 0.6M CLEARANCE FROM STRUCTURES E.G. CATCH BASINS AND HYDRANTS) AND 1.2 M FROM TREE ROOT BALL.
7. STREETLIGHTS CAN BE LOCATED ON EITHER SIDE OF THE RIGHT-OF-WAY.
8. GAS MAIN SHALL HAVE A MINIMUM OF 0.6 M CLEARANCE FROM STRUCTURES E.G. CATCH BASINS AND HYDRANTS) AND 1.2 M FROM TREE ROOT BALL.
9. JOINT-USE UTILITY TRENCH (JUT) UNDER SIDEWALK AS PER DETAIL UDS0049 (REV 22) HELD BY OTTAWA HYDRO.
10. GRADE LEVEL BOX (GLB) AS DRAWN SHOWS GLB3660. EXACT LOCATION TO BE CONFIRMED. THIS CROSS SECTION TO BE USED IF CONCRETE ENCASED HYDRO DUCT OR ANOTHER SEPARATE UTILITY DUCT IS REQUIRED. IF CONCRETE ENCASED HYDRO DUCT IS UTILIZED, INSTALLATION AS PER DETAIL UDS0051.
11. WHEN CONCRETE DUCT BANKS ARE REQUIRED, ADDITIONAL CLEARANCE IS REQUIRED FOR THE INSTALLATION OF A 2.2M X 4.0M MAINTENANCE HOLE PER OTTAWA HYDRO DETAIL UCS0014. LOCATIONS TO BE DETERMINED DURING DESIGN PHASE.
12. TREE CLEARANCES TO HYDRO OTTAWA PLANT SHALL FOLLOW GCS0038.
13. CLEARANCES SHOWN ARE MINIMUMS.

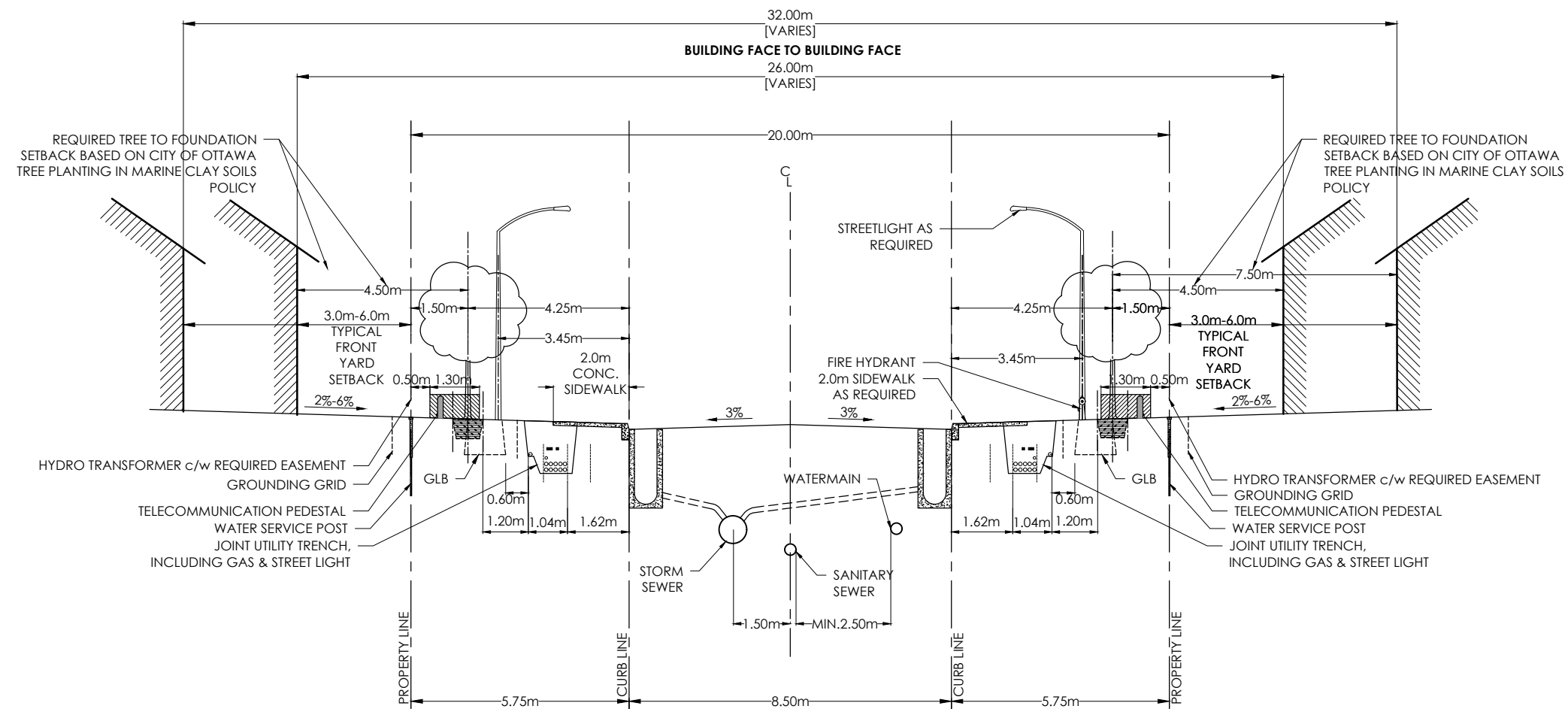


FIGURE 4



20.0m ROW CROSS SECTION

REV. DATE: AUG. 2022

DWG. No. ROW-20.0

- 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. REPORT REFERENCES

The following documents were referenced in preparation of this report:

- Ottawa Sewer Design Guidelines, City of Ottawa, SDG002, October 2012 (*City Sewer Guidelines*)
- Ottawa Design Guidelines – Water Distribution, City of Ottawa, July 2010 (*City Water Guidelines*)
- Design Guidelines for Seage Works, Ministry of Environment, 2008 (*MOE Design Guidelines*)
- Stormwater Planning and Design Manual, Ministry of Environment, March 2003 (*SWMP Design Manual*)
- Stormwater Management Report for the Orleans Village Subdivision, JFSA, July 2018 (*JFSA OV Report*)
- Design Brief for Pond 1 East Urban Community North Main Cell and North Forebay Modifications, DSEL / JFSA, October 2022 (*POND 1 Modifications Report*)
- Design Brief for Caivan (Orleans Village) Limited 3490 Innis Road), DSEL, November 2018 (*DSEL OV Report*)
- Assessment of Adequacy of Public Services for Lepine Corporation 3490 Innis Road, DSEL, July 2018 (*DSEL Adequacy Report*)

6.0. 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 Water 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. To estimate the highest possible flows for the development these calculations were based on the preliminary worst-case scenario of development. 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		Max. Daily Demand		Peak Hour Demand		Fire Flow	
	(L/s)	(L/min)	(L/s)	(L/min)	(L/s)	(L/min)	(L/s)	(L/min)
Zone 1	1.60	96	4.01	240.6	8.82	529.2	117	7,020
Zone 2	1.46	87.6	3.65	219	8.02	481.2		
Zone 3	2.03	121.8	5.08	304.8	11.17	670.2		
Park	0.02	1.2	0.05	3.0	0.12	7.2		
Total	5.11	306.6	12.79	767.4	28.13	1,687.8		

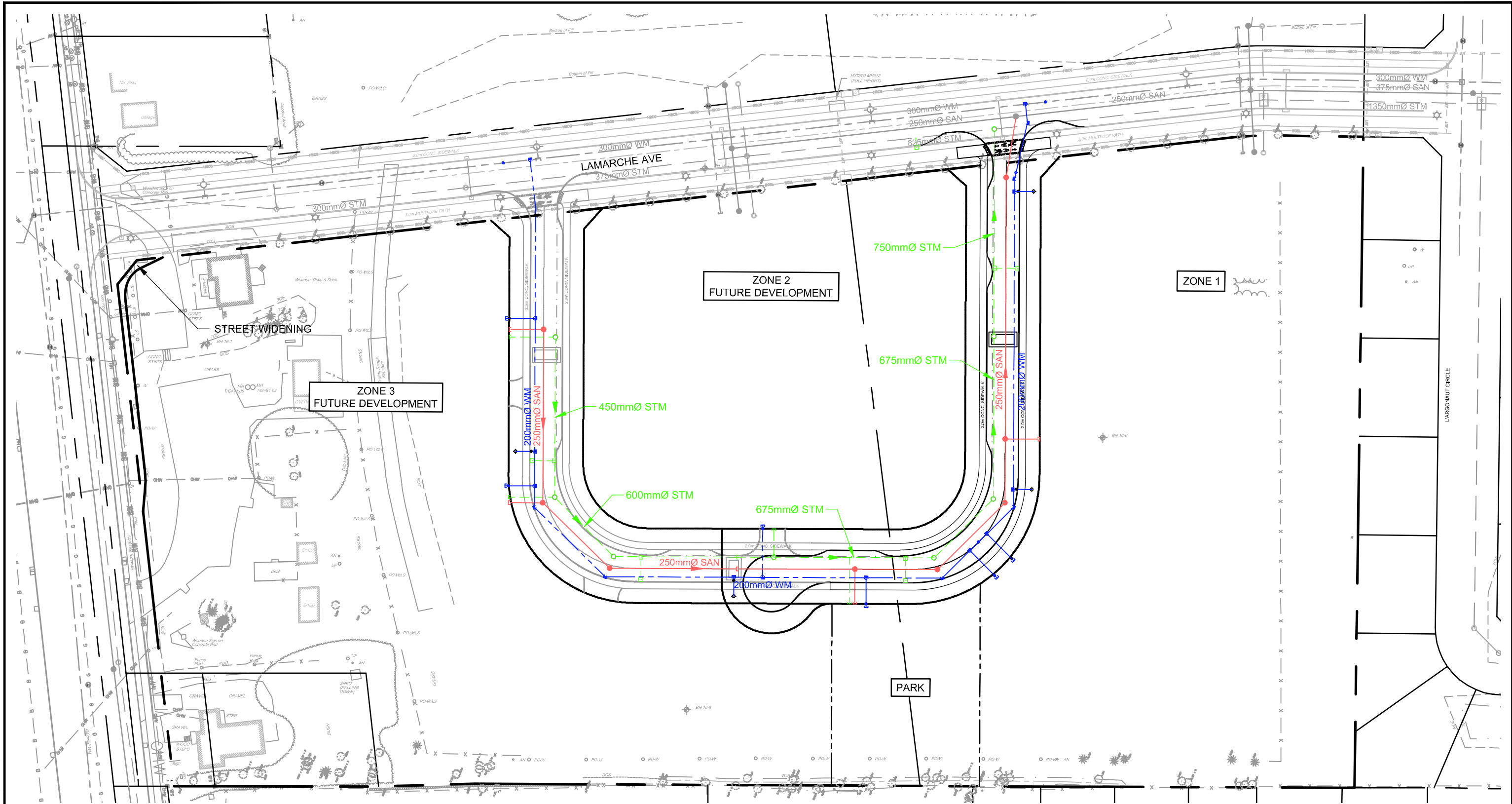
As per the City of Ottawa Technical Bulletin ISDTB-2014-02, the proposed development areas (Zones 1-3) will require two service connections as the average day demands are greater than 50 cubic meters of water. The two services will be separated by an isolation valve within the municipal watermain system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

David Schaeffer Engineering Ltd (DSEL) completed the detailed design for the Orleans Village Subdivision and their findings are detailed within the *DSEL OV Report*. For the subdivision design, Block 149 was assumed to be a commercial development and Block 150 a residential development. The DSEL report included a water model and anticipated demands for development Blocks 149 and 150. The demands from this DSEL model 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)

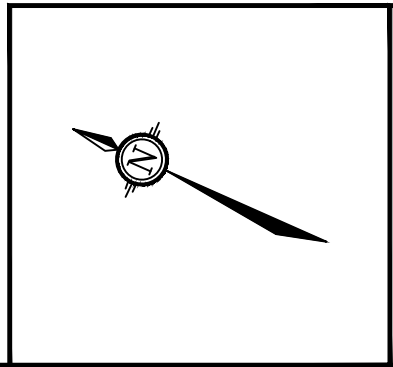
Area	Ave. Daily Demand		Max. Daily Demand		Peak Hour Demand		Fire Flow	
	(L/s)	(L/min)	(L/s)	(L/min)	(L/s)	(L/min)	(L/s)	(L/min)
Block 149 (COM1)	5.38	322.58	12.51	750.85	26.98	1,618.50	217	13,000
Block 150 (RES1)	3.38	202.61	8.44	506.53	18.57	1,114.36		
Total	8.76	525.19	20.95	1,257.38	45.55	2,732.86		

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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	1 : 1000	
DATE	MAY 2023	JOB 121214
FIGURE	5	

As can be noted in the tables above the demands for the proposed development are below the demands assumed within the *DSEL OV 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.

In addition to the DSEL analysis, the anticipated water demands as outlined in Table 5.1 were submitted to the City of Ottawa for boundary conditions provided from the City's water model. These boundary conditions will confirm whether the existing watermain infrastructure surrounding the development has capacity for the proposed development. The boundary conditions are provided in **Table 5.3**.

Table 5.3 Water Boundary Conditions

Criteria	Head (m)	Pressure (psi)
Connection 1 to Existing 300mm Watermain on Ave de Lamarche		
Maximum HGL	130.8	57.6
Peak Hour	127.2	52.6
Max Day + Fire Flow 1	126.5	51.6
Max Day + Fire Flow 2	123.8	47.7
Connection 2 to Existing 300mm Watermain on Ave de Lamarche		
Maximum HGL	130.8	58.7
Peak Hour	127.2	53.6
Max Day + Fire Flow 1	125.8	51.7
Max Day + Fire Flow 2	122.3	46.6

These boundary conditions were used to analyze the performance of the watermain for three theoretical conditions: 1) High Pressure check under Average Day conditions 2) Peak Hour demand 3) Maximum Day + Fire Flow demand. The following **Table 5.4** summarizes the results from the hydraulic water analysis.

Table 5.4 Water Analysis Results Summary

Condition	Demand (L/s)	Min/Max Allowable Operating Pressures (psi)	Limits of Design Operating Pressures (psi)
High Pressure	5.11	80psi (Max)	59.5
Max Day + Fire Flow*	179.79	20psi (Min)	39.7
Peak Hour	28.13	40psi (Min)	53.0

* Fire flow of 10,000 L/min was used for demand scenario

Based on the preceding analysis it can be concluded that the watermain will provide adequate flow, pressures, and stagnation limits for the various conditions outlined in **Table 5.4**. Exact unit

count and water demand for the buildings will be finalized during the site plan process. Calculations will be updated at that time to confirm capacity of the surrounding system. Refer to **Appendix B** for hydraulic calculations and City of Ottawa boundary conditions.

7.0. 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 Sewer 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 17.53 L/s. Detailed sanitary flow calculations and sanitary drainage area plan are provided in **Appendix C** for reference.

As noted previously, the detailed design of the Orleans Village Subdivision was completed by DSEL, and their findings are detailed within the *DSEL OV 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 DSEL 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

Based on this design criteria the following flowrates can be approximated from the DSEL sanitary sewer design sheets.

Table 6.1 Allowable Block 149 and 150 Sanitary Flows (DSEL Report)

Area	Population	Peaking Factor	Approx. Peak Flow (L/s)	Total Area (ha)	Infiltration Flow (L/s)	Approx. Total Design Flow (L/s)
22A-230A (Block 149)	1376	3.0	13.22	2.86	0.94	14.17
23A-24A (Block 150)	1044	3.0	10.25	2.17	0.72	10.97

Based on the preceding analysis it can be concluded that the peak sanitary flow of 17.53 L/s for the proposed development is below the approximated DSEL allocated flow of 25.14 L/s.

Additionally, 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 OV Report*, we do not anticipate any servicing issues in the downstream system.

8.0. 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 (750mm and 675mm diameter) in Lamarche Avenue to service block 149 and 150. These storm sewer stubs will be used where possible to service the proposed development. It is also proposed to construct storm sewers within the proposed public right-of-way. The proposed storm sewers will vary in sizes ranging from 450mm 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 was provided in the *JFSA OV Report* and 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 storm event;

- 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;
- 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 during the 100-year storm event.
- Quality control of 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).

Quantity Control

The proposed site is located within the EUC Pond 1 North Forebay and North Main cell drainage area which was designed to provide quantity control of stormwater for the development. Blocks 149 and 150 were allocated storm water flows to the downstream storm sewer system and EUC Pond 1 based on a runoff coefficient of 0.85 and 0.75 respectively. The 100-year allowable release rate for the site was determined based on the allocated flows for development blocks 149 and 150 which were provided in the *DSEL OV Report*, the *DSEL Adequacy Report* and on the approved subdivision engineering plans. The 100-year allowable release rate for the development is summarized in table 7.1 below:

Table 7.1 Development Block Allowable Release Rates and Required Storage

Block	Area (ha)	% Impervious	Allowable Release Rate (L/s)	Sewer Outlet
Block 149	2.86	93%	501.0	STM MH 13-15
Block 150	2.17	79%	406.0	STM MH 15-21
External Area	0.11	29%	9.4	STM MH 13-15
Total	5.14	86%	916.4	

The development zones, right-of-way, and parkland blocks will be required to control release of stormwater to these flow rates as listed above. The allowable release rates for each development block have been allocated based on the following:

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

Storage of stormwater will be required on site for all storm flows in excess of the allowable release rates provided above. The approximate storage requirements for each development block have been calculated based on an assumed runoff coefficient of 0.85. It is assumed that the stormwater can be stored on building roofs, underground in the storm sewer system/ storage tanks, and on the surface through ponding around catchbasin inlets in the parking lots, roadways, and landscaped areas. The release of storm water to the city system will be controlled by utilizing inlet control devices (ICDs) in catchbasin inlets. The allowable release rates and storage required for each development block are summarized in **Table 7.2** below.

Table 7.2 Allowable Release Rates and Approximate Storage Requirements

Development Zone	Area (ha)	Allowable Release Rate (L/s)	Approx. 100-yr Storage Volumes (m ³)	Approx. 100-yr Storage Volumes (m ³ /ha)
Storm Sewer Outlet MH13 – MH15				
ROW	0.672	146.9	48.5	72.2
Park	0.503	65.1	N/A	N/A
Subtotal	1.175	212.0		
Zone 2	0.919	109.9	215.6	234.6
Zone 3	1.550	186.0	362.2	233.6
Subtotal	2.469	295.9	577.8	
Total	3.644	507.9		
Storm Sewer Outlet MH15 – MH21				
Zone 1	1.535	406.0	127.0	82.7
Total	1.535	406.0		

The allowable release rate to each storm sewer segment in LaMarche avenue will need to be respected as the storm sewer was designed and sized accordingly. The Zone 1 development is proposed to outlet directly to the 1350mm diameter storm sewer in Lamarche Avenue with an allowable release rate of 406 L/s. The proposed storm sewer in Francoise Crescent which includes storm flows from the right-of-way, park, Zone 2 and 3 outlets to the 825mm diameter storm sewer in LaMarche Avenue and must be controlled to 510.4 L/s.

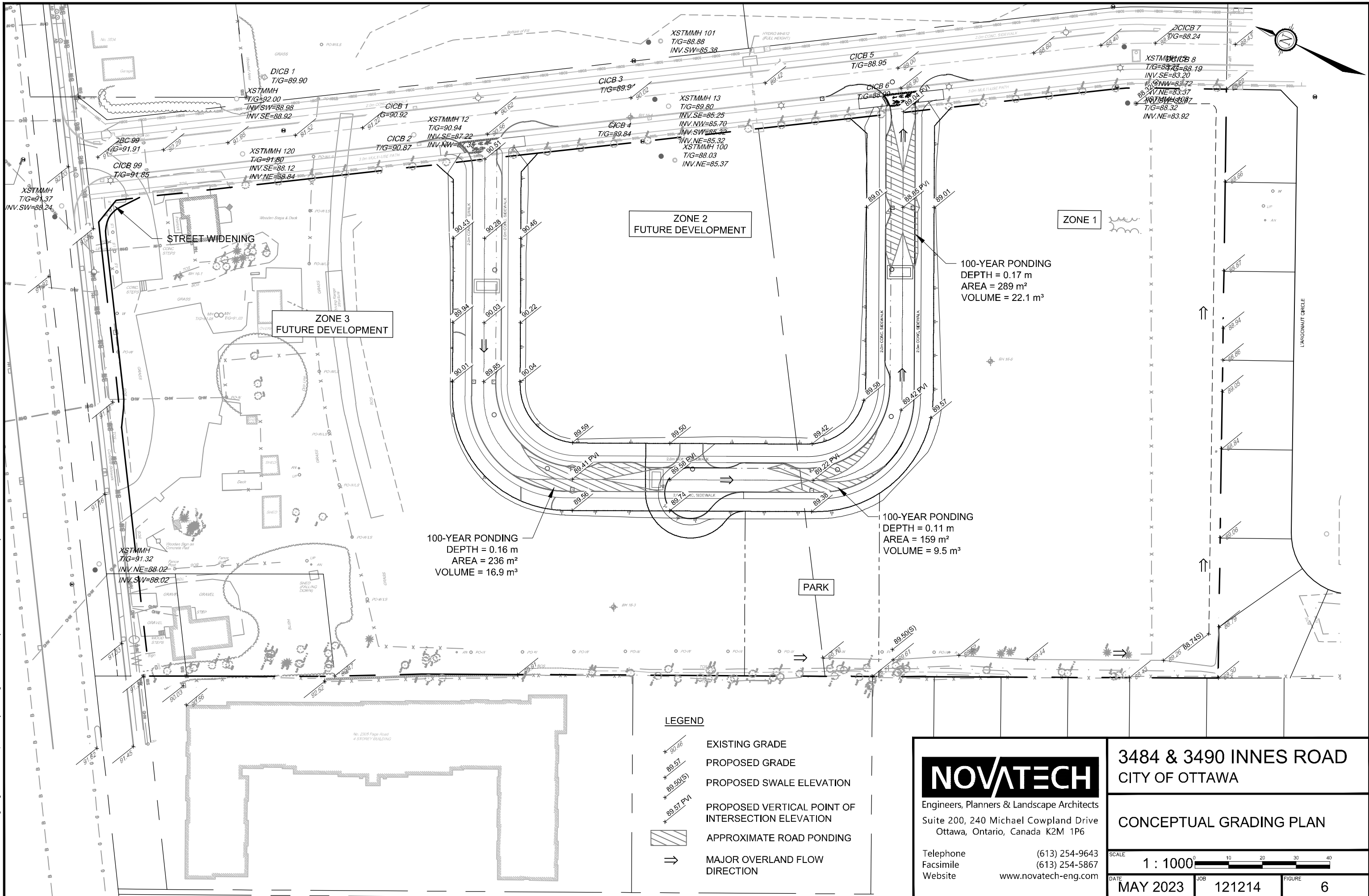
Quality Control

As previously indicated the proposed site is located within the EUC Pond 1 North Forebay and North Main cell drainage area. The EUC Pond 1 was also designed to provide a normal level of quality control with a 70% average long-term removal of total suspended solids therefore, onsite quality control measure will not be required. The EUC Pond 1 design allocated a percent impervious for blocks 149 and 150 to be 93% and 79% respectively which equates to 87% for the total development area. Based on the assumed 93% impervious for each development block, 7% impervious for the park and 73% impervious for the right-of-way the total % impervious was calculated to be 82% therefore, there will be no negative impacts on the downstream EUC Pond and Mud Creek watercourse.







Overland Flow Route

During storm events exceeding the 100-year event, site grading will be designed to 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. The existing swale along the western property limits is to be regraded and maintained as a major overland flow route to Lamarche Road. **Figure 6** Conceptual Grading Plan shows the preliminary conceptual grading design.

M:\2021\1121214\CAD\Design\Figures\121214 - preliminary GR.dwg, FIGURE 6, May 17, 2023 - 10:44am, smanoryk



LEGEND

-  EXISTING GRADE
-  PROPOSED GRADE
-  PROPOSED SWALE ELEVATION
-  PROPOSED VERTICAL POINT OF INTERSECTION ELEVATION
-  APPROXIMATE ROAD PONDING
-  MAJOR OVERLAND FLOW DIRECTION

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 & 3490 INNES ROAD
CITY OF OTTAWA

CONCEPTUAL GRADING PLAN

SCALE 1 : 1000

DATE MAY 2023 JOB 121214 FIGURE 6

EUC Pond 1 Modifications

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 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 OV 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.

A subsequent *POND 1 Modifications Report* was prepared to support the proposed modifications to the EUC Pond 1 North Main Cell and Forebay to allow for continued development in the northwest quadrant of the EUC Phase 3 Community Design Plan area. This report respects the design criteria from the preceding reports for the development area. It is understood that the North Main Cell and North forebay modifications will be required to be constructed prior to any development of the Orleans Village Subdivision including Block 149 and 150.

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 model results and post development drainage area figure.

9.0. 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.

10.0. 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:



Spencer Manoryk
Project Engineer
Land Development Engineering

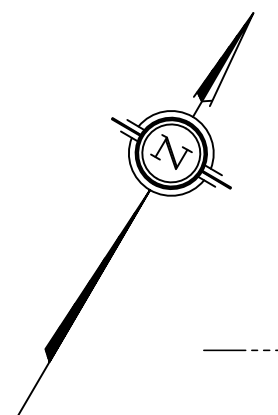
Reviewed by:



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



APPENDIX A
Draft Plan of Subdivision and City Correspondence



INNES ROAD Regional Road No. 30
ROAD ALLOWANCE BETWEEN CONCESSIONS 2 AND 3 (OTTAWA FRONT) (GLOUCESTER)

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

THIS DRAFT PLAN IS APPROVED BY THE CITY OF OTTAWA UNDER SECTION 61 OF THE PLANNING ACT
THIS _____ DAY OF _____, 20__

JEFF McEWEEN, 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, Vollebek Ltd.

Scale 1 : 500
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
adjoning lands have been accurately and correctly shown.
Date _____ E. H. HERVEYER
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



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

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., File No. PC2021-0159
Ward 2 – Innes
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 than 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 than 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.

APPENDIX B
Watermain Information

FUS - Fire Flow Calculations

As per 1999 Fire Underwriter's Survey Guidelines



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 Ruddle

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		2,795		
		Number of Floors/Storeys	6				
		Protected Openings (1 hr)	Yes				
		Area of structure considered (m ²)					
F	Base fire flow without reductions			7,000			
Reductions or Surcharges							
3	Occupancy hazard reduction or surcharge			Reduction/Surcharge			
	(1)	Non-combustible		-25%	-15%		
		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%		
		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%		
		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	

FUS - Fire Flow Calculations - User Guide - Fire Resistive

<p>Novatech Project #: 121214 Project Name: 3484 Innes Road Date: 9/27/2021 Input By: Anthony Mestwarp, P.Eng Reviewed By: Cara Ruddel</p>	<ul style="list-style-type: none"> Please use the notes below as a guide when completing the FUS Fire Flow Calculations When in doubt, confirm construction material, firewalls, etc. with architect/owner When in doubt, err on conservative side
---	---

Note: This form only applies for Fire Resistive

Enter a description of the building or unit being considered, i.e. use/most stringent condition/address

Summary		
Construction Type	Fire Resistive Construction	
Floor Area Considered	2,795	m ²
Occupancy Reduction	-15%	
Sprinkler Reduction	-40%	
Exposure Surcharge	55%	
Total Fire Flow	7,000	L/min

Base Fire Flow

1	<p>Construction Material Does not apply for this form Does not apply for this form Does not apply for this form Only Use if can be confirmed with client/architect (ISO C1 5) Only Use if can be confirmed with client/architect (ISO C1 6)</p>	<p>Project Manager Review Date: _____ Name: _____ Signature: _____</p>
2	<p>Floor Area If considered gross floor area, then enter 1 floor/storey. If Fire wall, then reduce footprint accordingly. Un-Protected <input type="text" value="4"/> = number of floors above first 2, up to max of 10 floors total Do vertical openings have minimum 1 hour rating between floors? Confirm this with the architect. Protected <input type="text" value="2"/> = number of additional immediately adjoining floors to be considered, up to 2 Do vertical openings have minimum 1 hour rating between floors? Confirm this with the architect.</p>	

Reductions or Surcharges

3	<p>Occupancy hazard reduction or surcharge Residential - with no garage Residential - with garage General Commercial - Generally, no reduction Check usage with FUS Check usage with FUS</p>
---	--

4	<p>Sprinkler Reduction Only Use if can be confirmed with client/architect Only Use if can be confirmed with client/architect</p>
---	---

5	<p>Exposure Surcharge (cumulative %) For Fire walls: FUS considers a Fire wall to have a minimum 2 hour rating per NBC.</p>
---	---

Results

6	<p>NOTE: Refer to City Technical Bulletin ISDTB-2014-02 for additional considerations to cap this value at 10,000L/min If IGPM is needed, divide USGPM by 1.20095</p>
7	<p>For Rural areas, or where required</p>

Proposed Development Conditions - Option 1

	Zone 1			Zone 2		Zone 3			Park Land	Totals
	Bldg A	Bldg B	Bldg C	Bldg D	Bldg E	Bldg F	Bldg G	Bldg H		
Number of units	81	96	98	125	125	98	125	125	n/a	873
Population	146	173	176	225	225	176	225	225	n/a	1571
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 (Section 4)
Residential Average Flow	280 L/c/day	City of Ottawa Sewer Design Guidelines (Section 4)
Picnic and Fair Grounds Flush Toilets only	20 L/Person/day Assume 75 Per/acre	City of Ottawa Sewer Design Guidelines (Section 4)

Residential Peaking Factors City of Ottawa Water Distribution Guidelines:

Conditions	Peaking Factor	Units	Source
Maximum Day	2.5 x avg day	L/c/day	City of Ottawa Sewer Design Guidelines (Section 4)
Peak Hour	2.2 x max day	L/c/day	City of Ottawa Sewer Design Guidelines (Section 4)

Boundary Conditions 3484 & 3490 Innes Road

Provided Information

Scenario	Demand	
	L/min	L/s
Average Daily Demand	307	5.11
Maximum Daily Demand	767	12.79
Peak Hour	1,688	28.13
Fire Flow Demand #1	10,000	166.67
Fire Flow Demand #2	15,000	250.00

Location



Results

Connection 1 – Lamarche Ave.

Demand Scenario	Head (m)	Pressure ¹ (psi)
Maximum HGL	130.8	57.6
Peak Hour	127.2	52.6
Max Day plus Fire 1	126.5	51.6
Max Day plus Fire 2	123.8	47.7

Ground Elevation = 90.3 m

Connection 2 – Lamarche Ave.

Demand Scenario	Head (m)	Pressure¹ (psi)
Maximum HGL	130.8	58.7
Peak Hour	127.2	53.6
Max Day plus Fire 1	125.8	51.7
Max Day plus Fire 2	122.3	46.6

Ground Elevation = 89.5 m

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.

```

*****
*                               E P A N E T                               *
*                               Hydraulic and Water Quality                 *
*                               Analysis for Pipe Networks                   *
*                               Version 2.2                                 *
*****
    
```

AVERAGE DAY - HIGH PRESSURE TEST

Input File: HP.net

Link - Node Table:

Link ID	Start Node	End Node	Length m	Diameter mm
1	RES1	1	42.6	200
2	1	2	35.6	200
3	2	3	9.2	200
4	3	4	66.7	200
5	4	5	7.7	200
6	5	6	27.8	200
7	6	7	30.9	200
8	7	8	6.4	200
9	8	9	14.8	200
11	10	RES2	16.8	200
12	9	10	86.7	200

Node Results at 0:00 Hrs:

Node ID	Demand LPS	Head m	Pressure m	Quality hours
3	1.01	130.79	41.08	0.00
1	1.02	130.80	40.64	0.00
2	0.00	130.79	40.98	0.00
4	0.00	130.79	41.30	0.00
5	1.46	130.79	41.31	0.00
6	0.02	130.79	41.54	0.00
7	0.80	130.79	41.47	0.00
8	0.80	130.79	41.44	0.00
9	0.00	130.79	41.45	0.00
10	0.00	130.80	41.86	0.00
RES2	-2.17	130.80	0.00	0.00 Reservoir
RES1	-2.94	130.80	0.00	0.00 Reservoir

Link Results at 0:00 Hrs:

Link ID	Flow LPS	Velocity m/s	Unit Headloss m/km	Status
1	2.94	0.09	0.09	Open
2	1.92	0.06	0.04	Open
3	1.92	0.06	0.04	Open
4	0.91	0.03	0.01	Open
5	0.91	0.03	0.01	Open
6	-0.55	0.02	0.00	Open
7	-0.57	0.02	0.00	Open
8	-1.37	0.04	0.02	Open
9	-2.17	0.07	0.06	Open
11	-2.17	0.07	0.05	Open
12	-2.17	0.07	0.05	Open

Node Results at 24:00 Hrs:

Node ID	Demand LPS	Head m	Pressure m	Quality hours
3	1.01	130.79	41.08	0.33
1	1.02	130.80	40.64	0.13
2	0.00	130.79	40.98	0.29
4	0.00	130.79	41.30	0.97
5	1.46	130.79	41.31	1.19
6	0.02	130.79	41.54	0.99
7	0.80	130.79	41.47	0.52
8	0.80	130.79	41.44	0.48
9	0.00	130.79	41.45	0.42
10	0.00	130.80	41.86	0.07
RES2	-2.17	130.80	0.00	0.00 Reservoir
RES1	-2.94	130.80	0.00	0.00 Reservoir

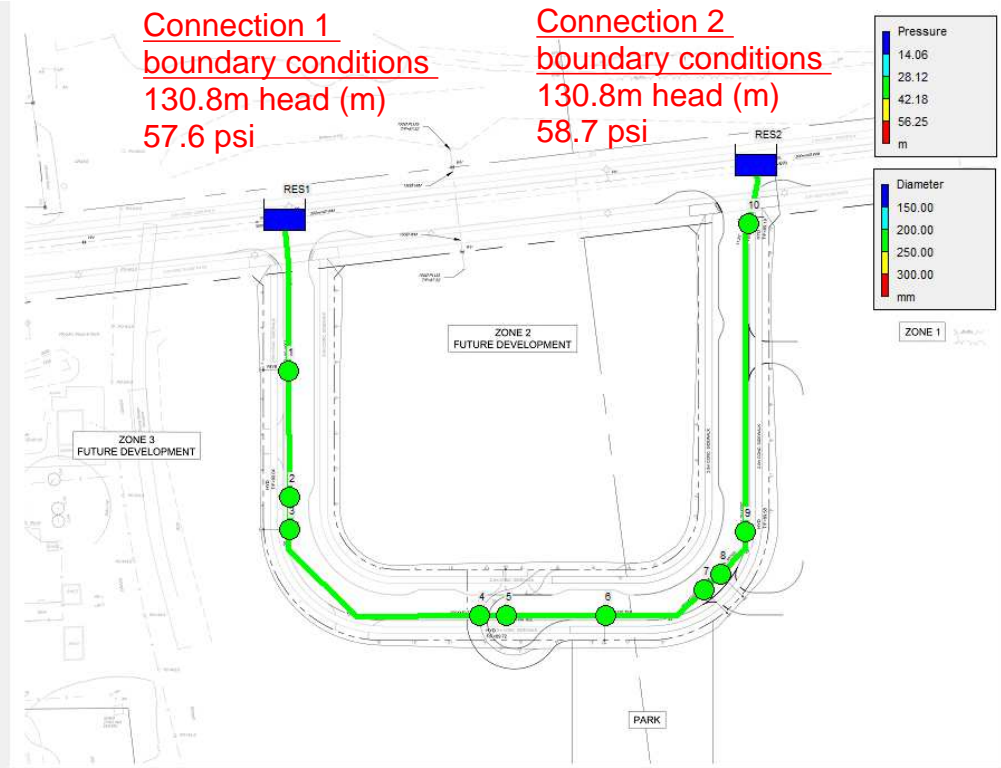


Link Results at 24:00 Hrs:

Link ID	Flow LPS	Velocity m/s	Unit Headloss m/km	Status
1	2.94	0.09	0.09	Open
2	1.92	0.06	0.04	Open
3	1.92	0.06	0.04	Open
4	0.91	0.03	0.01	Open

5	0.91	0.03	0.01	Open
6	-0.55	0.02	0.00	Open
7	-0.57	0.02	0.00	Open
8	-1.37	0.04	0.02	Open
9	-2.17	0.07	0.06	Open
11	-2.17	0.07	0.05	Open
12	-2.17	0.07	0.05	Open

HIGH PRESSURE (AVG. DAY) MAP




```

*****
*                               E P A N E T                               *
*                               Hydraulic and Water Quality                *
*                               Analysis for Pipe Networks                 *
*                               Version 2.2                               *
*****
    
```

Input File: PH.net

Link - Node Table:

Link ID	Start Node	End Node	Length m	Diameter mm
1	RES1	1	42.6	200
2	1	2	35.6	200
3	2	3	9.2	200
4	3	4	66.7	200
5	4	5	7.7	200
6	5	6	27.8	200
7	6	7	30.9	200
8	7	8	6.4	200
9	8	9	14.8	200
11	10	RES2	16.8	200
12	9	10	86.7	200

Node Results at 0:00 Hrs:

Node ID	Demand LPS	Head m	Pressure m	Quality hours	
3	5.58	127.06	37.35	0.00	
1	5.59	127.11	36.95	0.00	
2	0.00	127.07	37.26	0.00	
4	0.00	127.04	37.55	0.00	
5	8.02	127.04	37.56	0.00	
6	0.12	127.04	37.79	0.00	
7	4.41	127.05	37.73	0.00	
8	4.41	127.05	37.70	0.00	
9	0.00	127.07	37.73	0.00	
10	0.00	127.18	38.24	0.00	
RES2	-11.96	127.20	0.00	0.00	Reservoir
RES1	-16.17	127.20	0.00	0.00	Reservoir



Link Results at 0:00 Hrs:

Link ID	Flow LPS	Velocity m/s	Unit Headloss m/km	Status
1	16.17	0.51	2.22	Open
2	10.58	0.34	1.02	Open
3	10.58	0.34	0.98	Open
4	5.00	0.16	0.25	Open
5	5.00	0.16	0.25	Open
6	-3.02	0.10	0.10	Open
7	-3.14	0.10	0.11	Open
8	-7.55	0.24	0.53	Open
9	-11.96	0.38	1.35	Open
11	-11.96	0.38	1.24	Open
12	-11.96	0.38	1.25	Open

Node Results at 24:00 Hrs:

Node ID	Demand LPS	Head m	Pressure m	Quality hours
3	5.58	127.06	37.35	0.06
1	5.59	127.11	36.95	0.02
2	0.00	127.07	37.26	0.05
4	0.00	127.04	37.55	0.18
5	8.02	127.04	37.56	0.22
6	0.12	127.04	37.79	0.18
7	4.41	127.05	37.73	0.09
8	4.41	127.05	37.70	0.09
9	0.00	127.07	37.73	0.08
10	0.00	127.18	38.24	0.01
RES2	-11.96	127.20	0.00	0.00 Reservoir
RES1	-16.17	127.20	0.00	0.00 Reservoir

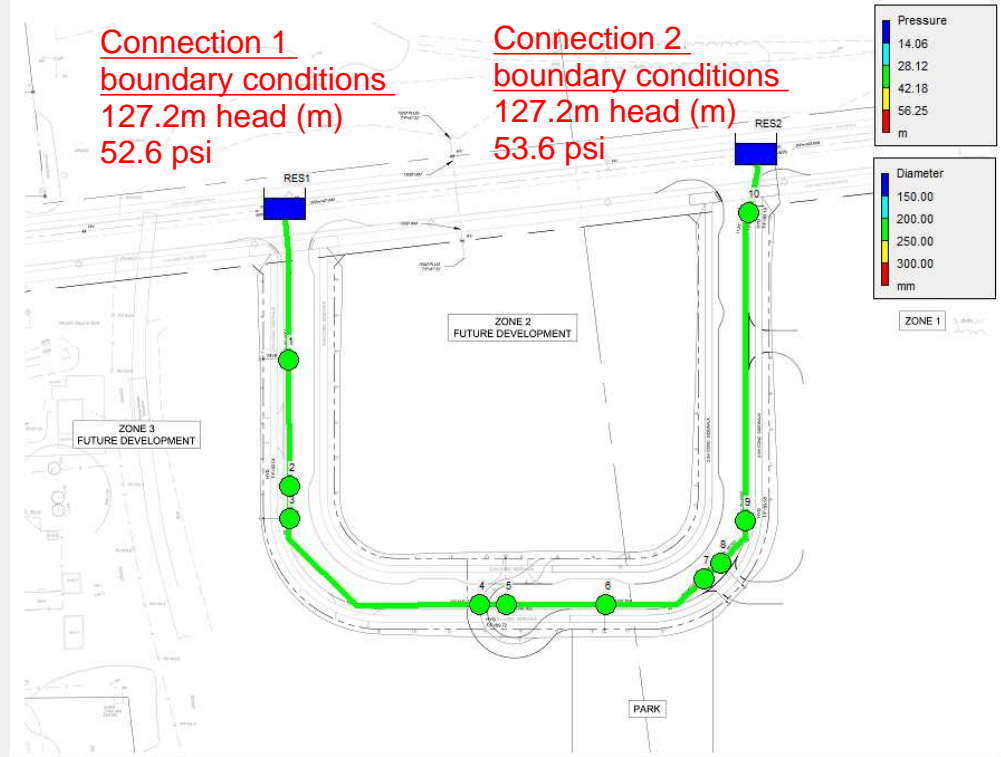


Link Results at 24:00 Hrs:

Link ID	Flow LPS	Velocity m/s	Unit Headloss m/km	Status
1	16.17	0.51	2.22	Open
2	10.58	0.34	1.02	Open
3	10.58	0.34	0.98	Open
4	5.00	0.16	0.25	Open
5	5.00	0.16	0.25	Open

6	-3.02	0.10	0.10	Open
7	-3.14	0.10	0.11	Open
8	-7.55	0.24	0.53	Open
9	-11.96	0.38	1.35	Open
11	-11.96	0.38	1.24	Open
12	-11.96	0.38	1.25	Open

PEAK HOUR MAP



```
*****
*                               E P A N E T                               *
*                               Hydraulic and Water Quality                 *
*                               Analysis for Pipe Networks                   *
*                               Version 2.2                                 *
*****
```

MAX DAY + FIRE FLOW - ZONE 1

Input File: MD+F.net

Link - Node Table:

Link ID	Start Node	End Node	Length m	Diameter mm
1	RES1	1	42.6	200
2	1	2	35.6	200
3	2	3	9.2	200
4	3	4	66.7	200
5	4	5	7.7	200
6	5	6	27.8	200
7	6	7	30.9	200
8	7	8	6.4	200
9	8	9	14.8	200
11	10	RES2	16.8	200
12	9	10	86.7	200

Node Results at 0:00 Hrs:

Node ID	Demand LPS	Head m	Pressure m	Quality hours	
3	2.54	124.95	35.24	0.00	
1	2.54	125.71	35.55	0.00	
2	0.00	125.10	35.29	0.00	
4	0.00	123.92	34.43	0.00	
5	3.65	123.81	34.33	0.00	
6	0.05	123.46	34.21	0.00	
7	2.00	123.05	33.73	0.00	
8	2.01	122.97	33.62	0.00	
9	83.50	122.80	33.46	0.00	
10	83.50	124.10	35.16	0.00	
RES2	-129.08	125.80	0.00	0.00	Reservoir
RES1	-50.71	126.50	0.00	0.00	Reservoir



Link Results at 0:00 Hrs:

Link ID	Flow LPS	Velocity m/s	Unit Headloss m/km	Status
1	50.71	1.61	18.57	Open
2	48.17	1.53	16.99	Open
3	48.17	1.53	16.32	Open
4	45.63	1.45	15.48	Open
5	45.63	1.45	14.76	Open
6	41.98	1.34	12.65	Open
7	41.93	1.33	13.27	Open
8	39.93	1.27	11.53	Open
9	37.92	1.21	11.58	Open
11	-129.08	4.11	101.24	Open
12	-45.58	1.45	14.97	Open

Node Results at 24:00 Hrs:

Node ID	Demand LPS	Head m	Pressure m	Quality hours
3	2.54	124.95	35.24	0.02
1	2.54	125.71	35.55	0.01
2	0.00	125.10	35.29	0.01
4	0.00	123.92	34.43	0.03
5	3.65	123.81	34.33	0.03
6	0.05	123.46	34.21	0.04
7	2.00	123.05	33.73	0.04
8	2.01	122.97	33.62	0.04
9	83.50	122.80	33.46	0.03
10	83.50	124.10	35.16	0.00
RES2	-129.08	125.80	0.00	0.00 Reservoir
RES1	-50.71	126.50	0.00	0.00 Reservoir

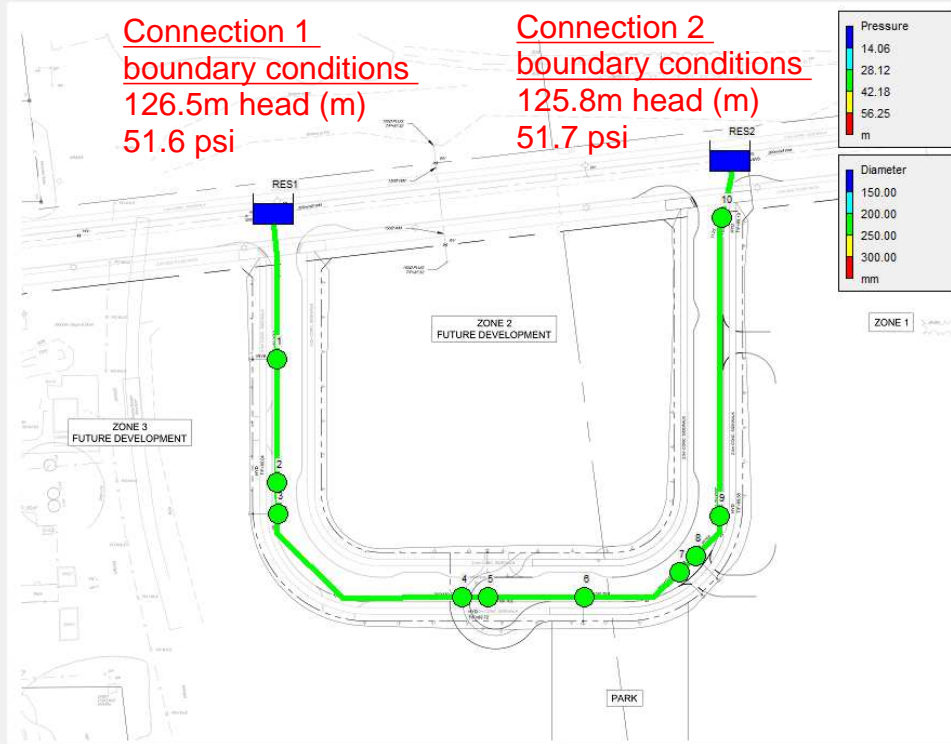


Link Results at 24:00 Hrs:

Link ID	Flow LPS	Velocity m/s	Unit Headloss m/km	Status
1	50.71	1.61	18.57	Open
2	48.17	1.53	16.99	Open
3	48.17	1.53	16.32	Open
4	45.63	1.45	15.48	Open

5	45.63	1.45	14.76	Open
6	41.98	1.34	12.65	Open
7	41.93	1.33	13.27	Open
8	39.93	1.27	11.53	Open
9	37.92	1.21	11.58	Open
11	-129.08	4.11	101.24	Open
12	-45.58	1.45	14.97	Open

MAX DAY + FIRE FLOW ZONE 1 MAP




```

*****
*                               E P A N E T                               *
*                               Hydraulic and Water Quality                 *
*                               Analysis for Pipe Networks                   *
*                               Version 2.2                                 *
*****
    
```

MAX DAY + FIRE FLOW - ZONE 2

Input File: MD+F.net

Link - Node Table:

Link ID	Start Node	End Node	Length m	Diameter mm
1	RES1	1	42.6	200
2	1	2	35.6	200
3	2	3	9.2	200
4	3	4	66.7	200
5	4	5	7.7	200
6	5	6	27.8	200
7	6	7	30.9	200
8	7	8	6.4	200
9	8	9	14.8	200
11	10	RES2	16.8	200
12	9	10	86.7	200

Node Results at 0:00 Hrs:

Node ID	Demand LPS	Head m	Pressure m	Quality hours	
3	2.54	121.21	31.50	0.00	
1	2.54	123.86	33.70	0.00	
2	0.00	121.74	31.93	0.00	
4	167.00	117.41	27.92	0.00	
5	3.65	117.69	28.21	0.00	
6	0.05	118.81	29.56	0.00	
7	2.00	120.13	30.81	0.00	
8	2.01	120.41	31.06	0.00	
9	0.00	121.14	31.80	0.00	
10	0.00	125.05	36.11	0.00	
RES2	-82.66	125.80	0.00	0.00	Reservoir
RES1	-97.13	126.50	0.00	0.00	Reservoir



Link Results at 0:00 Hrs:

Link ID	Flow LPS	Velocity m/s	Unit Headloss m/km	Status
1	97.13	3.09	62.08	Open
2	94.59	3.01	59.52	Open
3	94.59	3.01	56.93	Open
4	92.05	2.93	57.08	Open
5	-74.95	2.39	37.00	Open
6	-78.60	2.50	40.40	Open
7	-78.65	2.50	42.72	Open
8	-80.65	2.57	42.37	Open
9	-82.66	2.63	49.59	Open
11	-82.66	2.63	44.35	Open
12	-82.66	2.63	45.16	Open

Node Results at 24:00 Hrs:

Node ID	Demand LPS	Head m	Pressure m	Quality hours
3	2.54	121.21	31.50	0.01
1	2.54	123.86	33.70	0.00
2	0.00	121.74	31.93	0.01
4	167.00	117.41	27.92	0.02
5	3.65	117.69	28.21	0.02
6	0.05	118.81	29.56	0.02
7	2.00	120.13	30.81	0.01
8	2.01	120.41	31.06	0.01
9	0.00	121.14	31.80	0.01
10	0.00	125.05	36.11	0.00
RES2	-82.66	125.80	0.00	0.00 Reservoir
RES1	-97.13	126.50	0.00	0.00 Reservoir

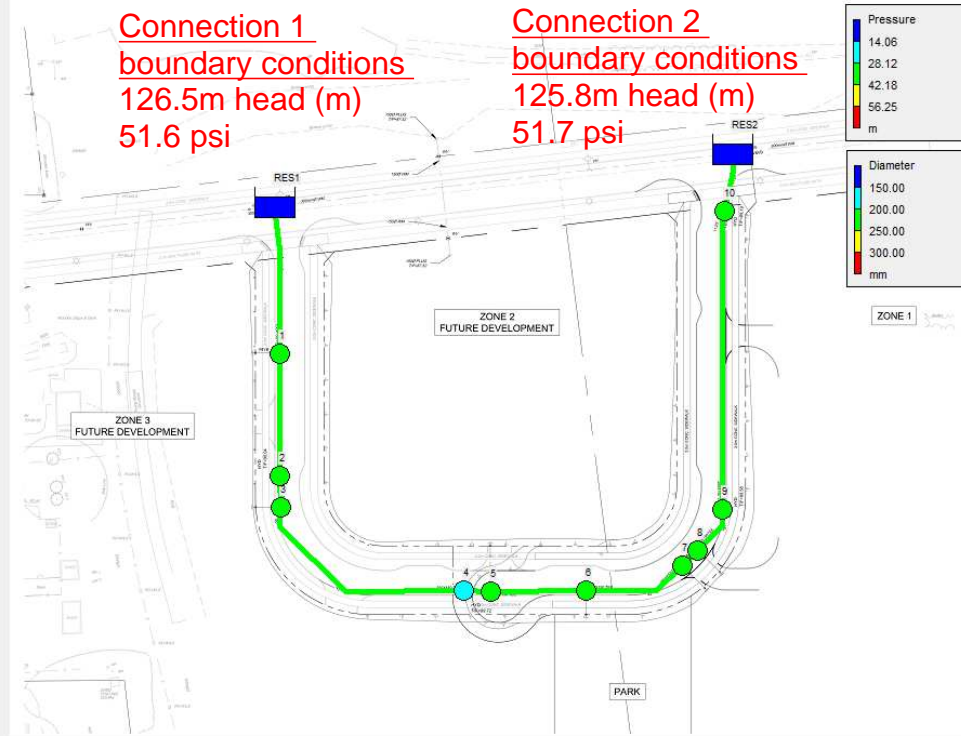


Link Results at 24:00 Hrs:

Link ID	Flow LPS	Velocity m/s	Unit Headloss m/km	Status
1	97.13	3.09	62.08	Open
2	94.59	3.01	59.52	Open
3	94.59	3.01	56.93	Open
4	92.05	2.93	57.08	Open

5	-74.95	2.39	37.00	Open
6	-78.60	2.50	40.40	Open
7	-78.65	2.50	42.72	Open
8	-80.65	2.57	42.37	Open
9	-82.66	2.63	49.59	Open
11	-82.66	2.63	44.35	Open
12	-82.66	2.63	45.16	Open

MAX DAY + FIRE FLOW ZONE 2 MAP



```

*****
*                               E P A N E T                               *
*                               Hydraulic and Water Quality                *
*                               Analysis for Pipe Networks                  *
*                               Version 2.2                                *
*****
    
```

MAX DAY + FIRE FLOW - ZONE 3

Input File: MD+F.net

Link - Node Table:

Link ID	Start Node	End Node	Length m	Diameter mm
1	RES1	1	42.6	200
2	1	2	35.6	200
3	2	3	9.2	200
4	3	4	66.7	200
5	4	5	7.7	200
6	5	6	27.8	200
7	6	7	30.9	200
8	7	8	6.4	200
9	8	9	14.8	200
11	10	RES2	16.8	200
12	9	10	86.7	200

Node Results at 0:00 Hrs:

Node ID	Demand LPS	Head m	Pressure m	Quality hours	
3	2.54	119.71	30.00	0.00	
1	2.54	122.66	32.50	0.00	
2	167.00	119.55	29.74	0.00	
4	0.00	121.09	31.60	0.00	
5	3.65	121.24	31.76	0.00	
6	0.05	121.86	32.61	0.00	
7	2.00	122.58	33.26	0.00	
8	2.01	122.73	33.38	0.00	
9	0.00	123.15	33.81	0.00	
10	0.00	125.38	36.44	0.00	
RES2	-60.98	125.80	0.00	0.00	Reservoir
RES1	-118.81	126.50	0.00	0.00	Reservoir



Link Results at 0:00 Hrs:

Link ID	Flow LPS	Velocity m/s	Unit Headloss m/km	Status
1	118.81	3.78	90.26	Open
2	116.27	3.70	87.35	Open
3	-50.73	1.61	17.95	Open
4	-53.27	1.70	20.64	Open
5	-53.27	1.70	19.65	Open
6	-56.92	1.81	22.22	Open
7	-56.97	1.81	23.45	Open
8	-58.97	1.88	23.73	Open
9	-60.98	1.94	28.10	Open
11	-60.98	1.94	25.24	Open
12	-60.98	1.94	25.69	Open

Node Results at 24:00 Hrs:

Node ID	Demand LPS	Head m	Pressure m	Quality hours
3	2.54	119.71	30.00	0.04
1	2.54	122.66	32.50	0.00
2	167.00	119.55	29.74	0.02
4	0.00	121.09	31.60	0.03
5	3.65	121.24	31.76	0.03
6	0.05	121.86	32.61	0.02
7	2.00	122.58	33.26	0.02
8	2.01	122.73	33.38	0.02
9	0.00	123.15	33.81	0.01
10	0.00	125.38	36.44	0.00
RES2	-60.98	125.80	0.00	0.00 Reservoir
RES1	-118.81	126.50	0.00	0.00 Reservoir

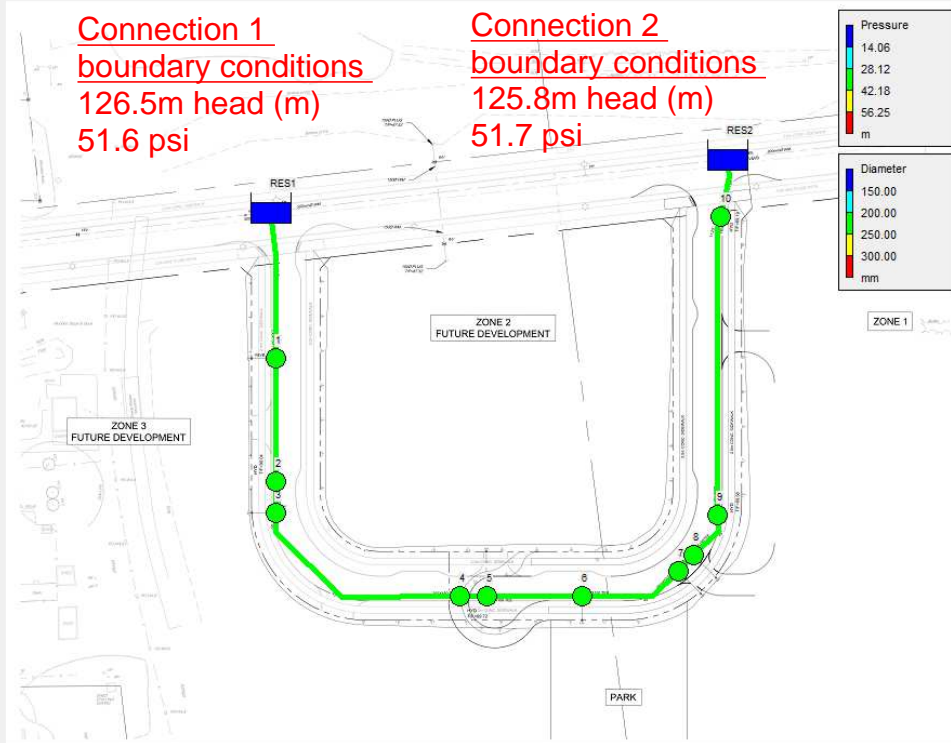


Link Results at 24:00 Hrs:

Link ID	Flow LPS	Velocity m/s	Unit Headloss m/km	Status
1	118.81	3.78	90.26	Open
2	116.27	3.70	87.35	Open
3	-50.73	1.61	17.95	Open
4	-53.27	1.70	20.64	Open

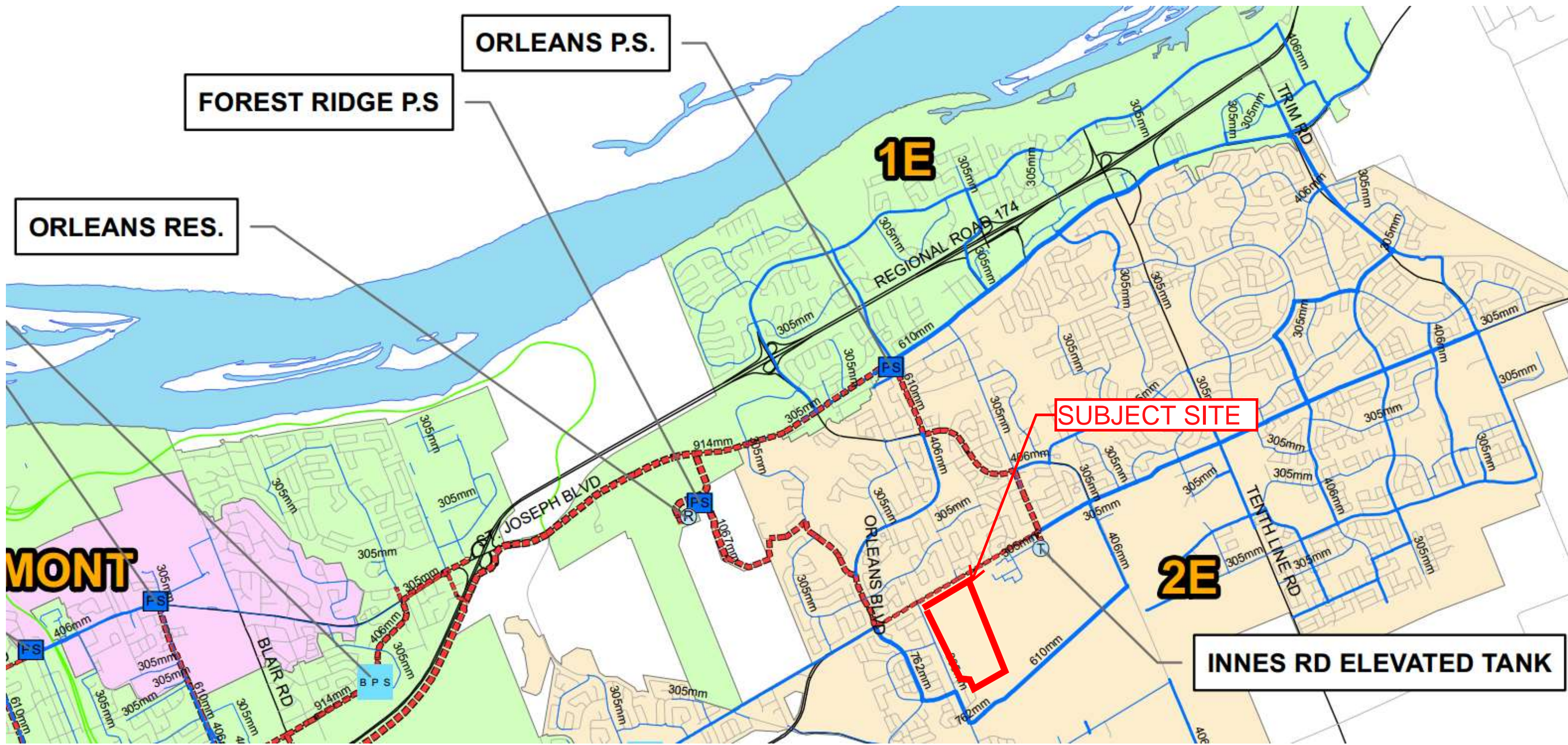
5	-53.27	1.70	19.65	Open
6	-56.92	1.81	22.22	Open
7	-56.97	1.81	23.45	Open
8	-58.97	1.88	23.73	Open
9	-60.98	1.94	28.10	Open
11	-60.98	1.94	25.24	Open
12	-60.98	1.94	25.69	Open

MAX DAY + FIRE FLOW ZONE 3 MAP



APPENDIX C

Water Supply Servicing (DSEL, May 2018)



FOREST RIDGE P.S

ORLEANS P.S.

ORLEANS RES.

1E

SUBJECT SITE

MONT

2E

INNES RD ELEVATED TANK

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



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		Max Day		Peak Hour	
			m ³ /d	L/min	m ³ /d	L/min	m ³ /d	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

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

Type of Construction: **Wood Frame**

C 1.5 *Type of Construction Coefficient per FUS Part II, Section 1*
A 1184.0 m² *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%	<i>value not to exceed 75% per FUS Part II, Section 4</i>

Increase	6545.0 L/min
-----------------	---------------------

Total Fire Flow

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

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

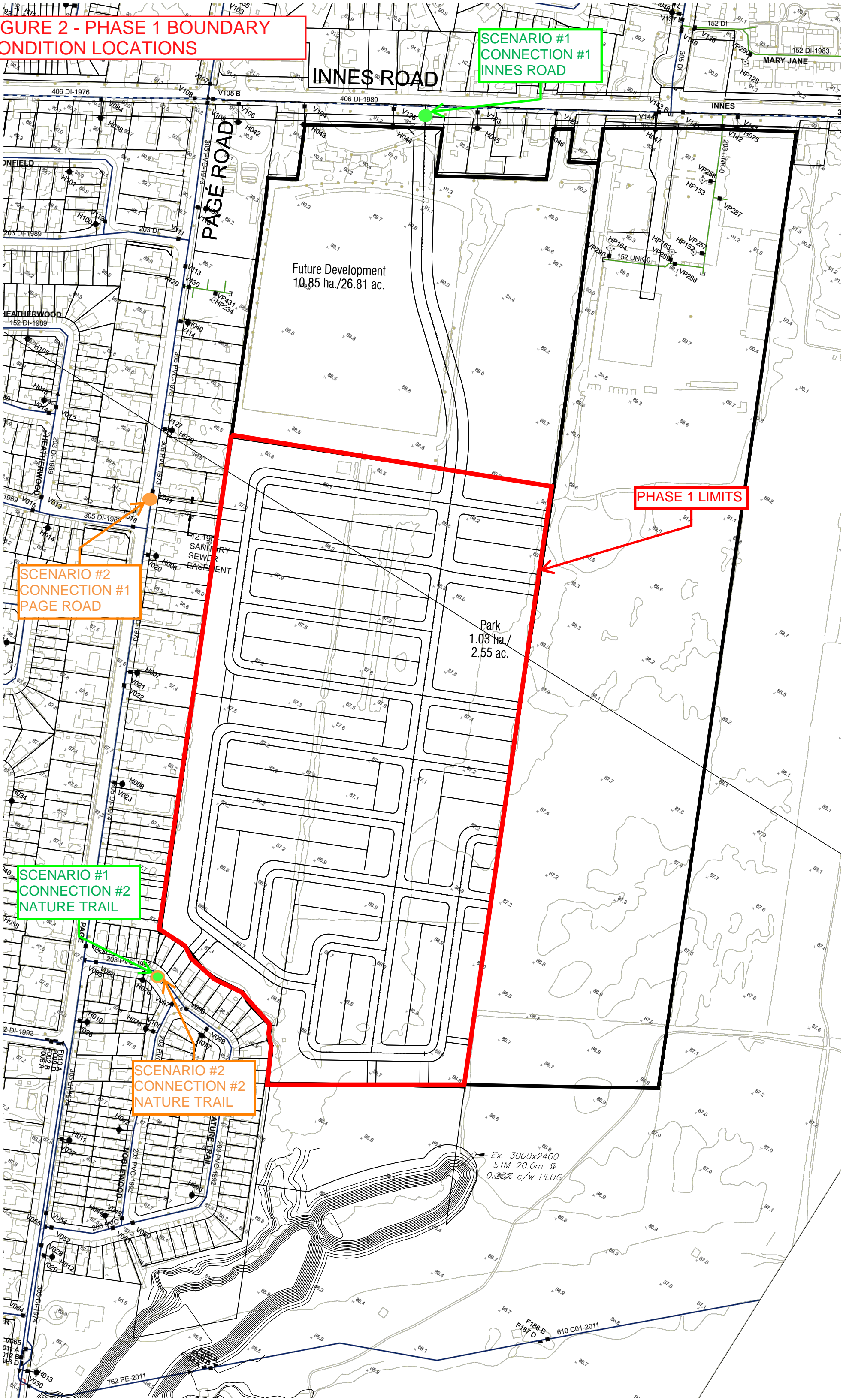
Phase 2 - Scenario 2

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.

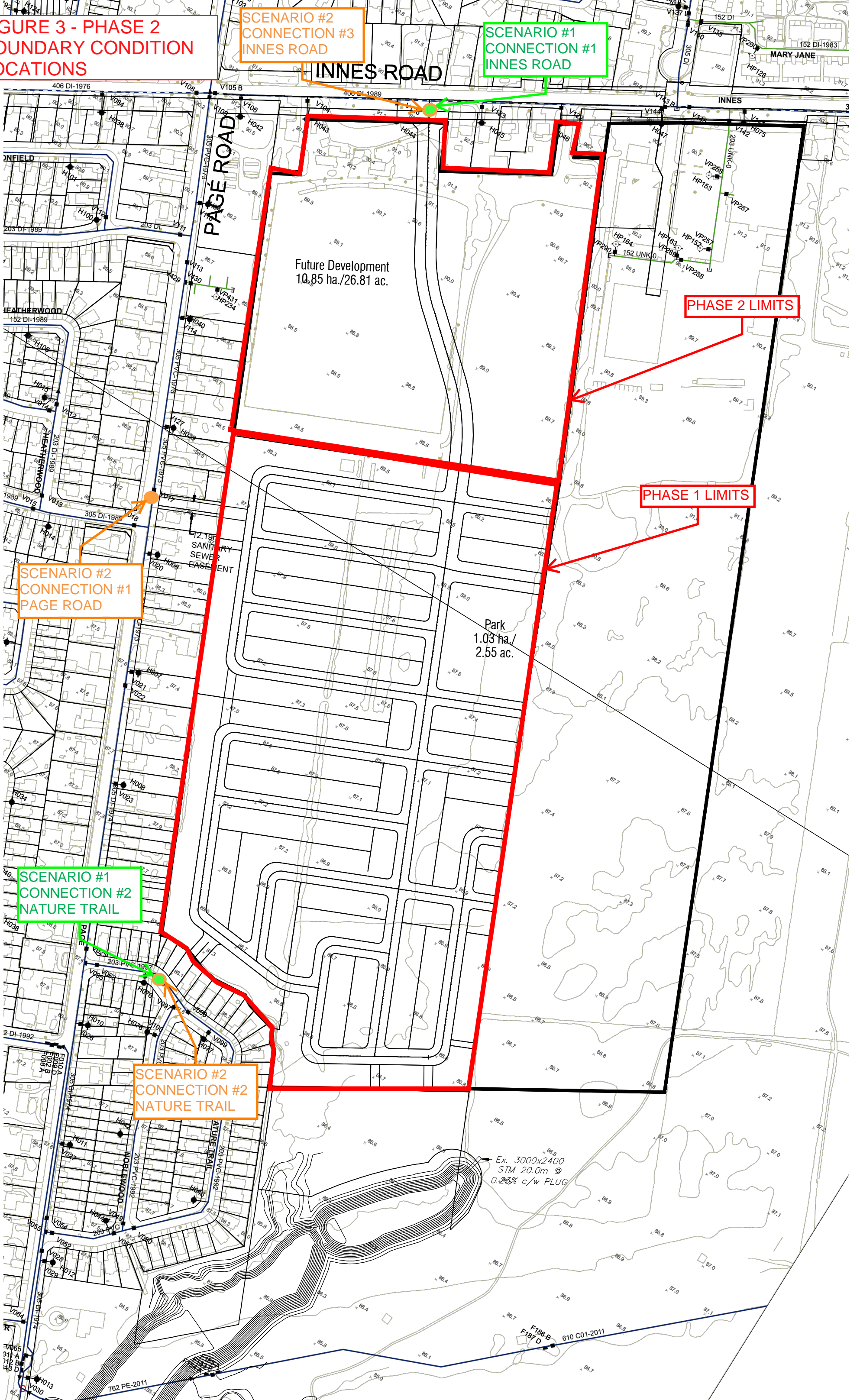
**FIGURE 2 - PHASE 1 BOUNDARY
CONDITION LOCATIONS**



**FIGURE 3 - PHASE 2
BOUNDARY CONDITION
LOCATIONS**

**SCENARIO #2
CONNECTION #3
INNES ROAD**

**SCENARIO #1
CONNECTION #1
INNES ROAD**



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

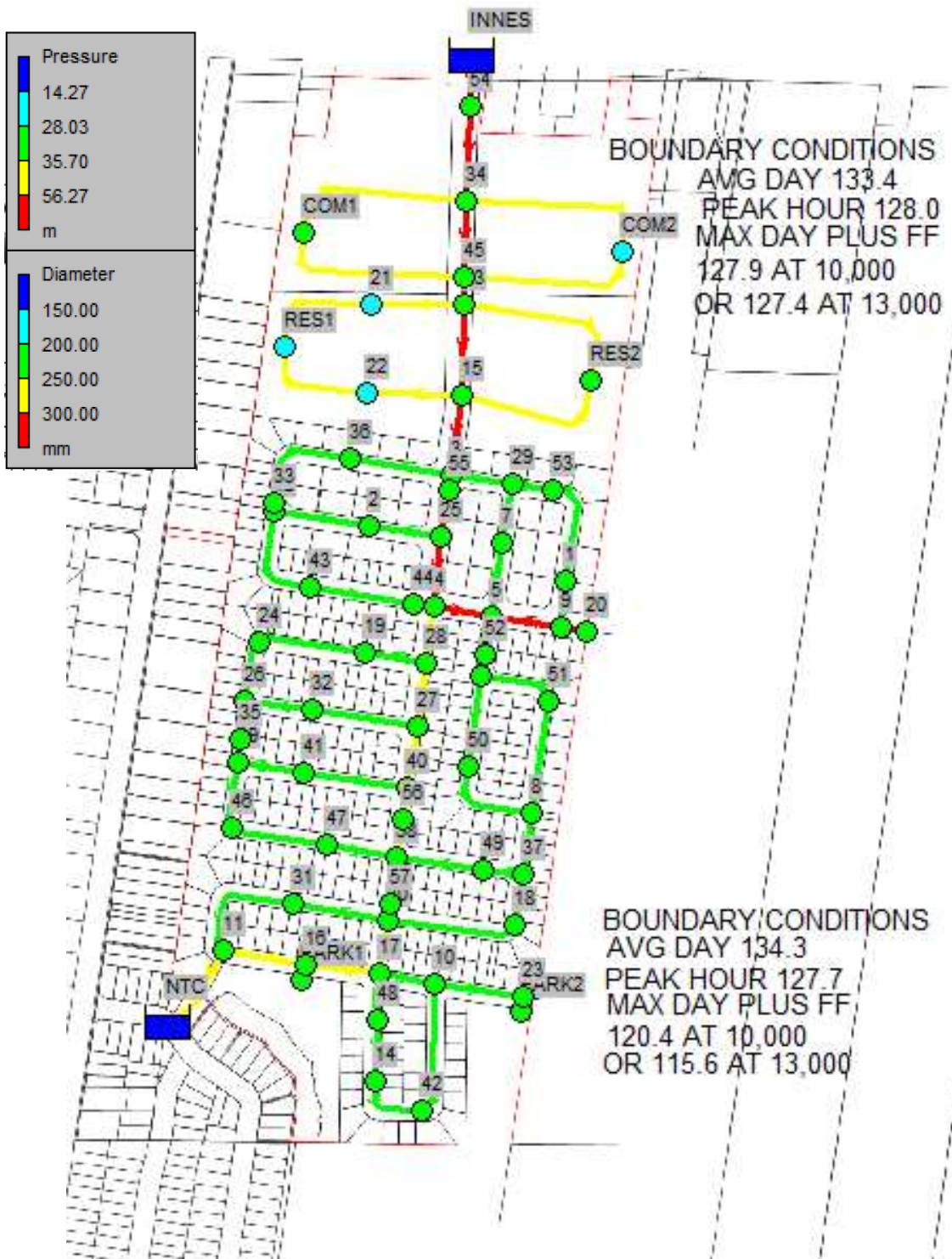
Pipe Diameter vs. "C"

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 H₂O)
Max	552	56.3
Rec Max	480	49.0
Rec Min	350	35.7
Min	275	28.1

AVERAGE DAY SCENARIO



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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



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



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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

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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	Velocity m/s	Unit 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



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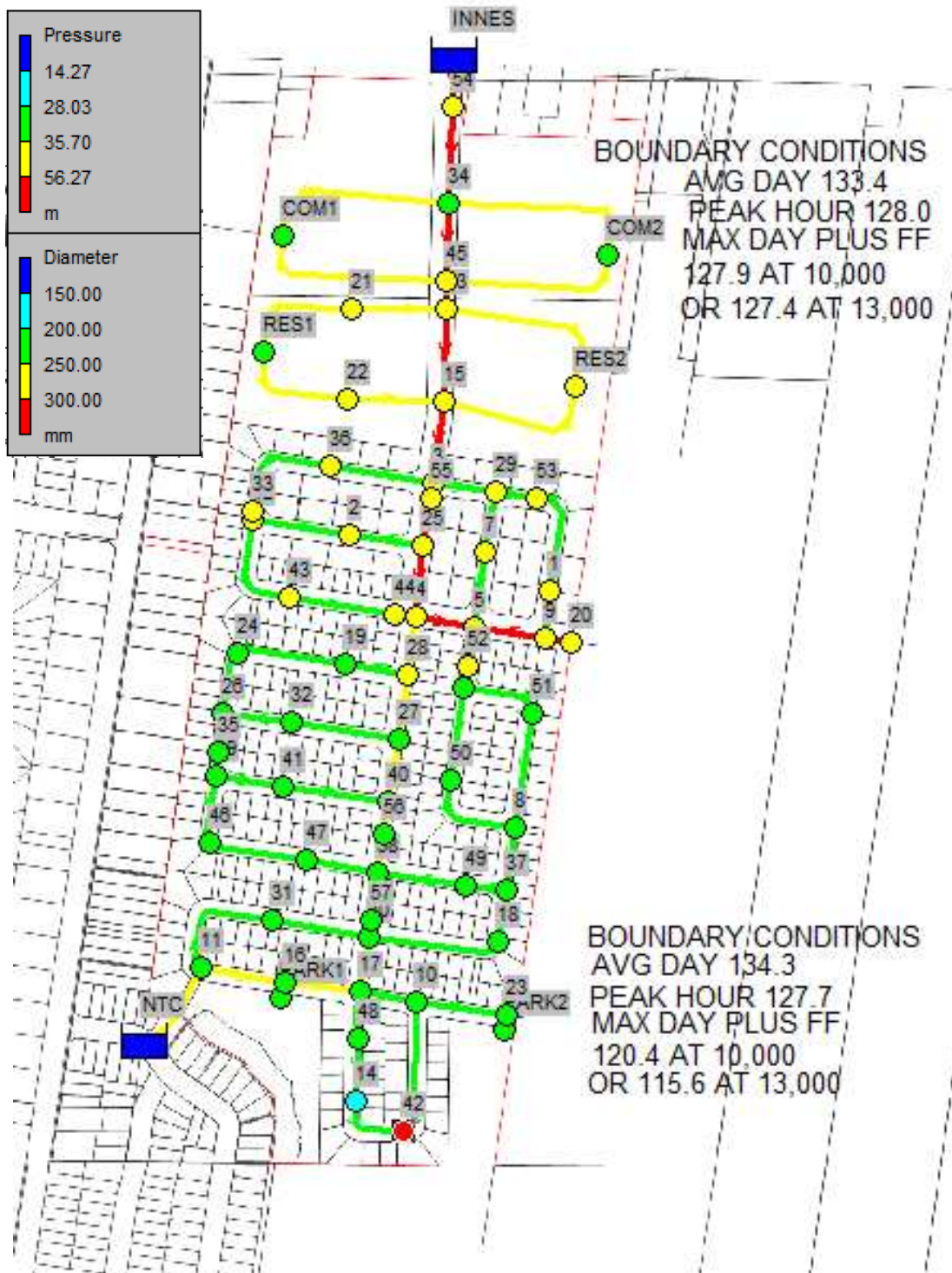
Link Results at 0:00 Hrs: (continued)

Link ID	Flow LPM	Velocity m/s	Unit 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

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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



```
*****
*                               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



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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



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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



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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	Velocity m/s	Unit 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

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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

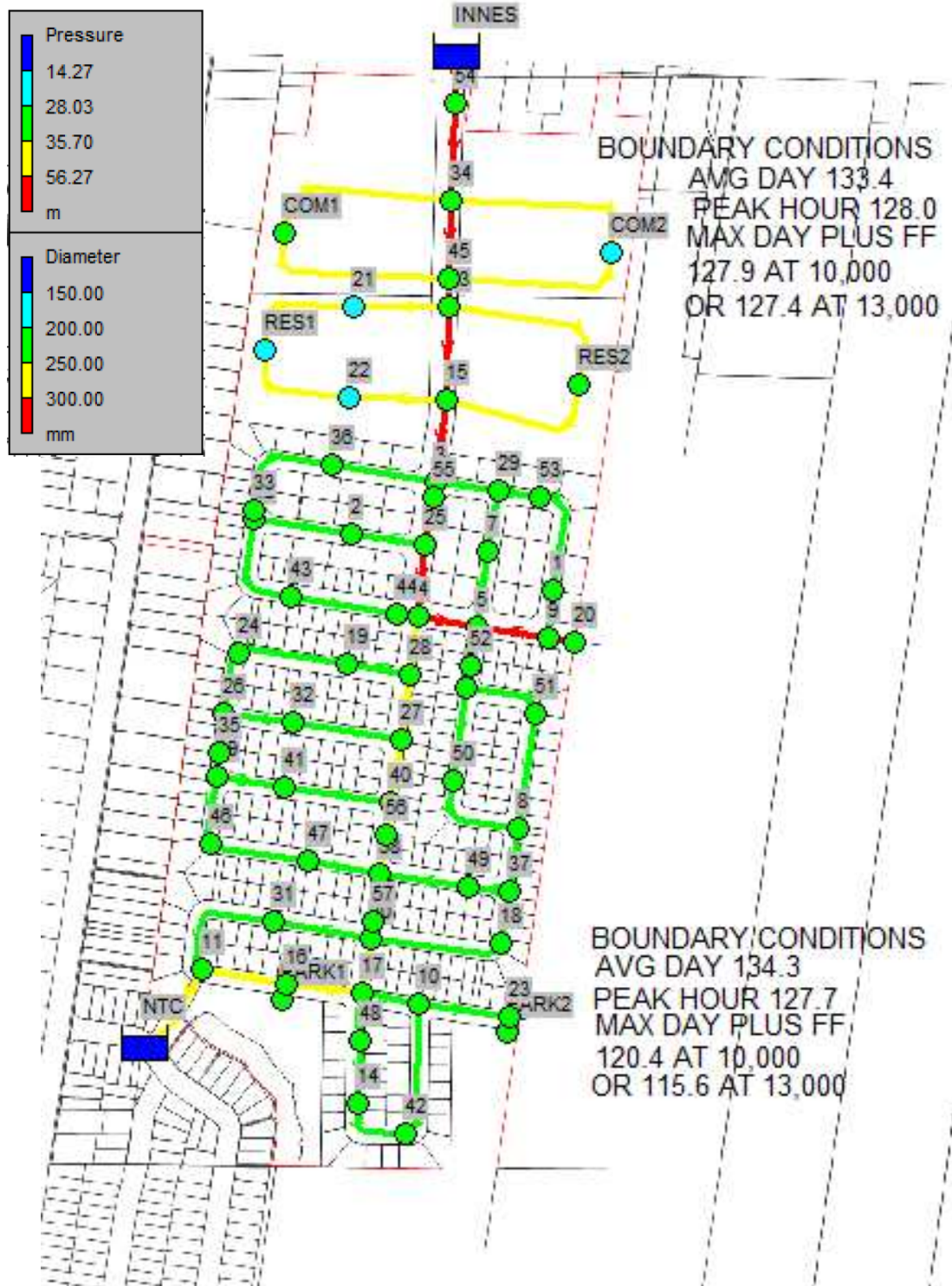


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Link Results at 0:00 Hrs: (continued)

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



```
*****
*                               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



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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



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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

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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



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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	Velocity m/s	Unit 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



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Link Results at 0:00 Hrs: (continued)

Link ID	Flow LPM	Velocity m/s	Unit 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

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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

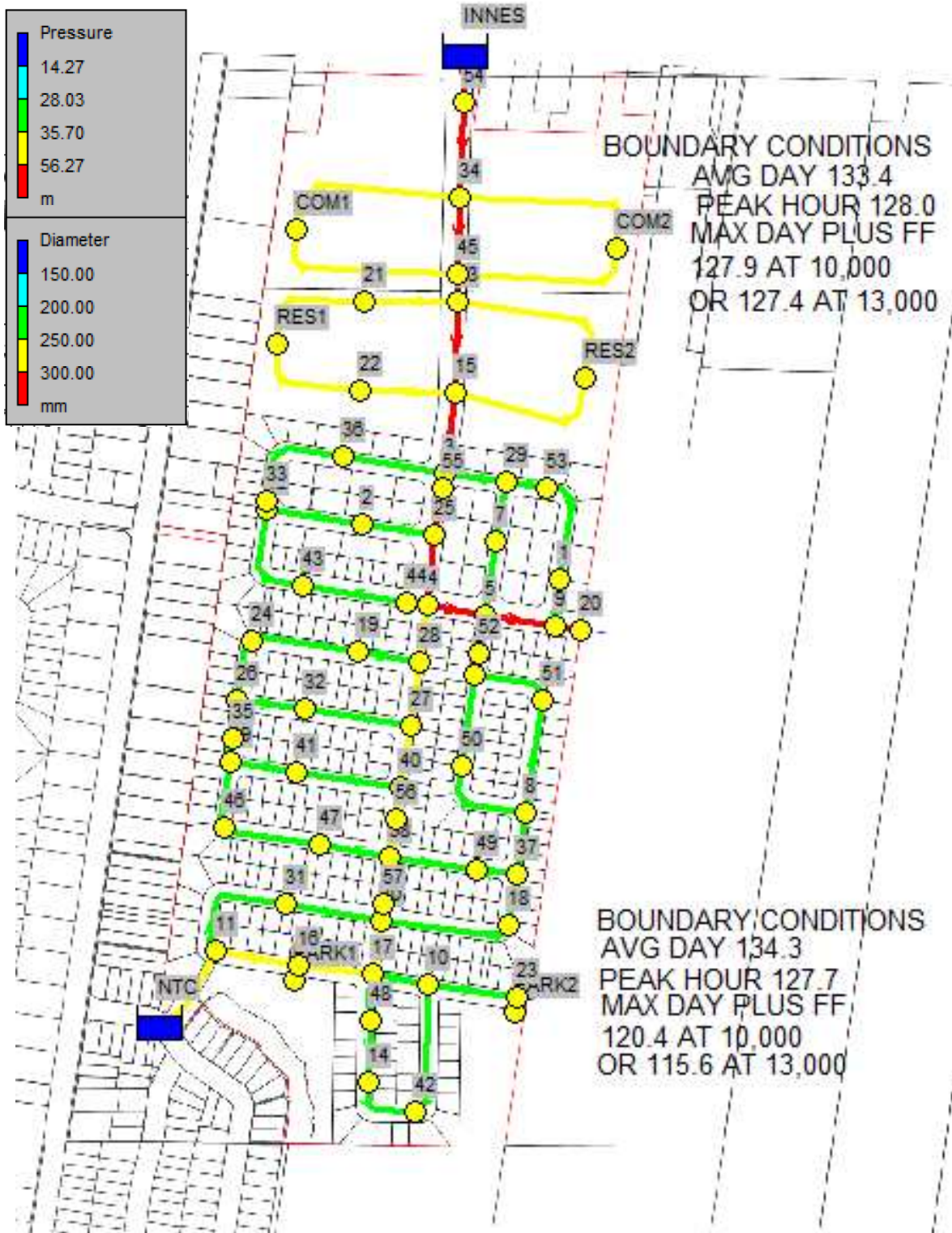


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Link Results at 0:00 Hrs: (continued)

Link ID	Flow LPM	Velocity m/s	Unit 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



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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

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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



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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



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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	Velocity m/s	Unit 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

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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

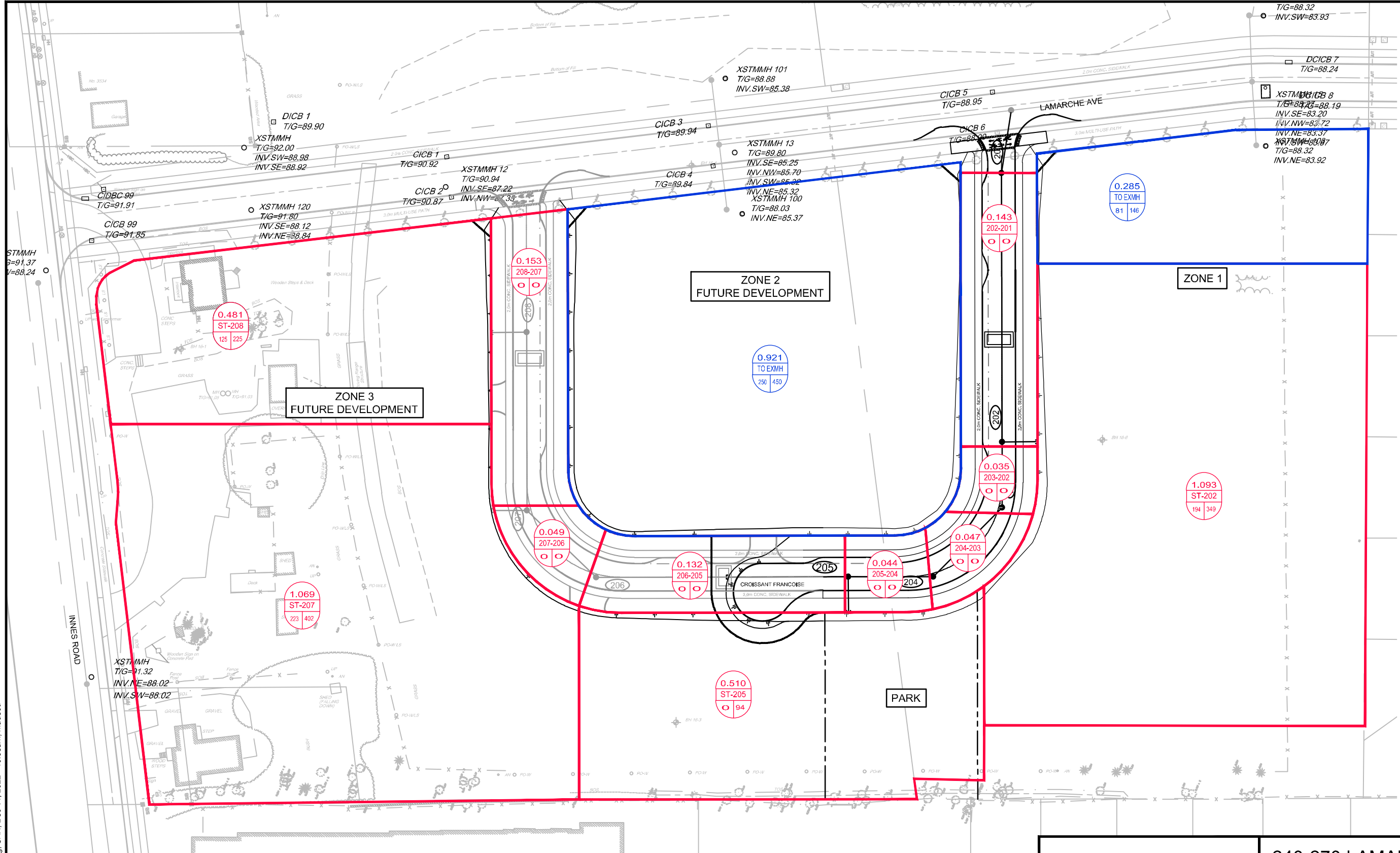
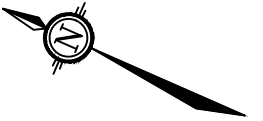
Sanitary Design Sheet - Option 1

LOCATION			RESIDENTIAL FOW					EXTRANEIOUS FLOW			PIPE							
AREA	FROM	TO	No. of Units	Park Area (ha)	TOTAL			Peak Flow (l/s)	Total Area (ha)	Accum. Area (ha)	Infil. Flow (l/s)	Total Design Flow (L/s)	Size (mm)	Slope (%)	Length (m)	Capacity (l/s)	Full Flow Vel. (m/s)	Q/Q _{full} (%)
					Pop.	Accum. Pop.	Peak Factor											
1	STUB	208	125		225	225	3.3	2.41	0.481	0.481	0.16	2.57	200	1.00	9.3	32.8	1.04	7.8%
2	208	207	0		0	225	3.3	2.41	0.153	0.634	0.21	2.62	250	1.38	46.4	69.8	1.42	3.8%
3	STUB	207	223		402	627	3.1	6.37	1.069	1.069	0.35	6.73	200	1.00	9.2	32.8	1.04	20.5%
4	207	206	0		0	627	3.1	6.37	0.049	1.752	0.58	6.95	250	0.50	25.1	42.0	0.86	16.6%
5	206	205	0		0	627	3.1	6.37	0.132	1.884	0.62	7.00	250	0.50	65.7	42.0	0.86	16.7%
6	STUB	205		0.510	94	94	3.4	1.04	0.510	0.510	0.17	1.20	250	1.00	9.2	59.4	1.21	2.0%
7	205	204	0		0	627	3.1	6.37	0.044	2.438	0.80	7.18	250	0.50	22.1	42.0	0.86	17.1%
8	204	203	0		0	627	3.1	6.37	0.047	2.485	0.82	7.19	250	0.50	25.5	42.0	0.86	17.1%
9	203	202	0		0	627	3.1	6.37	0.035	2.520	0.83	7.21	250	0.50	17.1	42.0	0.86	17.2%
10	STUB	202	194		349	976	3.0	9.63	1.093	1.093	0.36	9.99	250	0.50	9.3	42.0	0.86	23.8%
11	202	201	0		0	976	3.0	9.63	0.143	3.756	1.24	10.87	250	0.50	70.1	42.0	0.86	25.9%
12	ZONE 2	EXMH	250		450	450	3.2	4.66	0.921	0.921	0.30	4.97						
13	BLDG A	EXMH	81		146	146	3.4	1.59	0.285	0.285	0.09	1.68						
												17.52						




Design Parameters:

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

- Average Apartment 1.8 Person/unit
- Residential average flow 280 L/person/day
- Extraneous Flows 0.33 L/s/ha
- Parks (Flush Toilet Only) 20 L/ person/day (75 person/acre)




LEGEND

-  DRAINAGE AREA (ha)
DRAINAGE AREA ID
NO. OF UNITS / TOTAL POPULATION
-  SANITARY DRAINAGE AREA BOUNDARY
-  SANITARY DRAINAGE AREA OUTLET TO EXISTING SEWER

NOVATECH
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 Website www.novatech-eng.com

240-270 LAMARCHE AVENUE &
3484 INNES ROAD

SANITARY DRAINAGE AREA

SCALE 1 : 1000 
 DATE MAY 2023 JOB 121214 FIGURE SAN

M:\2021\121214\CAD\Design\121214-SAN.dwg, SAN, Dec 14, 2022 - 10:56am, madeo1

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



Manning's n=0.013

LOCATION		RESIDENTIAL AREA AND POPULATION				COMM		INSTIT		PARK		C+H		INFILTRATION			PIPE										
STREET	FROM M.H.	TO M.H.	AREA (ha)	UNITS	POP.	CUMULATIVE		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	ACCU. AREA	INFILT. FLOW	TOTAL FLOW	DIST (m)	DIA (mm)	SLOPE (%)	CAP. (FULL) (l/s)	RATIO Q act/Q cap	VEL.	
						(ha)	(ha)										(l/s)	(l/s)	(m/s)	(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																											
	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																											
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																											
	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									



DESIGN PARAMETERS Park Flow = 9300 L/ha/da Average Daily Flow = 280 l/p/day Comm/Inst Flow = 28000 L/ha/da Industrial Flow = 35000 L/ha/da 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 Checked: M.Z		PROJECT: ORLEANS VILLAGE LOCATION: City of Ottawa File Ref: 16-881 Date: 2018-05-10 Sheet No. 1 of 4									
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SANITARY SEWER CALCULATION SHEET



Manning's n=0.013

LOCATION			RESIDENTIAL AREA AND POPULATION				COMM		INSTIT		PARK		C+H	INFILTRATION			PIPE										
STREET	FROM M.H.	TO M.H.	AREA (ha)	UNITS	POP.	CUMULATIVE		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.	
						AREA (ha)	POP.																			(FULL) (m/s)	(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 Terrasse de Venneky Terrace, Pipe 45A - 47A																											
						1.10	87											1.10									
Terrasse de Venneky 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									



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

SANITARY SEWER CALCULATION SHEET

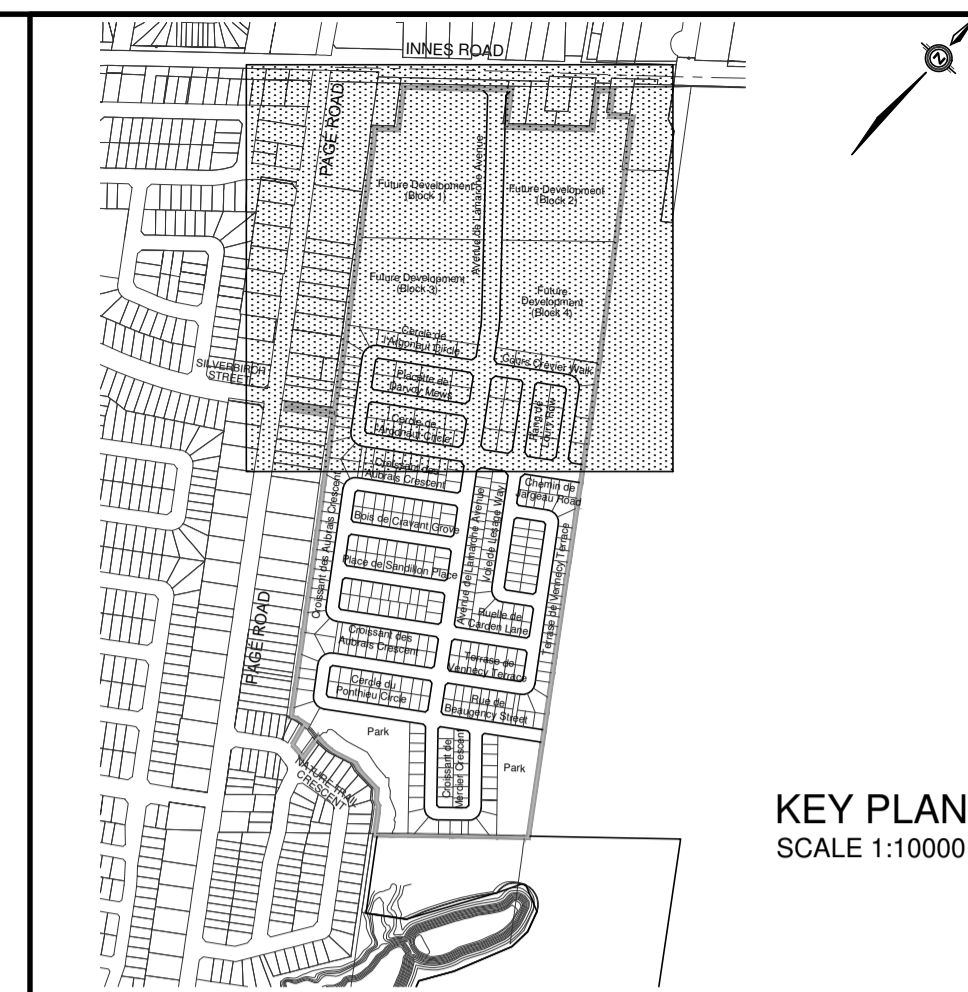
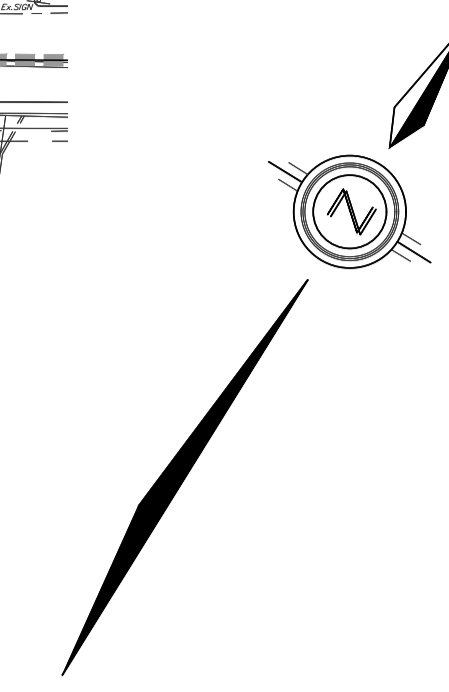


Manning's n=0.013

LOCATION			RESIDENTIAL AREA AND POPULATION				COMM		INSTIT		PARK		C+H	INFILTRATION			PIPE										
STREET	FROM M.H.	TO M.H.	AREA (ha)	UNITS	POP.	CUMULATIVE		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.	
						AREA (ha)	POP.																			(FULL) (m/s)	(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	0.65	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					0.77	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
	504A	505A	0.26		17	0.51	34	3.68	0.41					0.77	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
	505A	58A				0.51	34	3.68	0.41					0.77			1.28										
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	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	



DESIGN PARAMETERS Park Flow = 9300 L/ha/day Average Daily Flow = 280 l/p/day Comm/Inst Flow = 28000 L/ha/day Industrial Flow = 35000 L/ha/day 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 = 0.013 (Pvc) Townhouse coeff = 2.7 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. 4 881 SAN2915x 4	
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LEGEND

- SANITARY DRAINAGE BOUNDARY
- SANITARY SUB-DRAINAGE BOUNDARY
- SANITARY DRAINAGE BOUNDARY (OTHER PHASES)
- UPSTREAM MH TO DOWNSTREAM MH
- AREA IN HECTARES
- POPULATION
- UPSTREAM MH TO DOWNSTREAM MH
- AREA IN OTHER PHASES IN HECTARES
- POPULATION
- EXTERNAL AREA IN HECTARES
- EXTERNAL POPULATION
- DENSITY (PERSONS/HECTARE)
- EXTERNAL LAND USE
- MAINTENANCE HOLE
- CAP

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

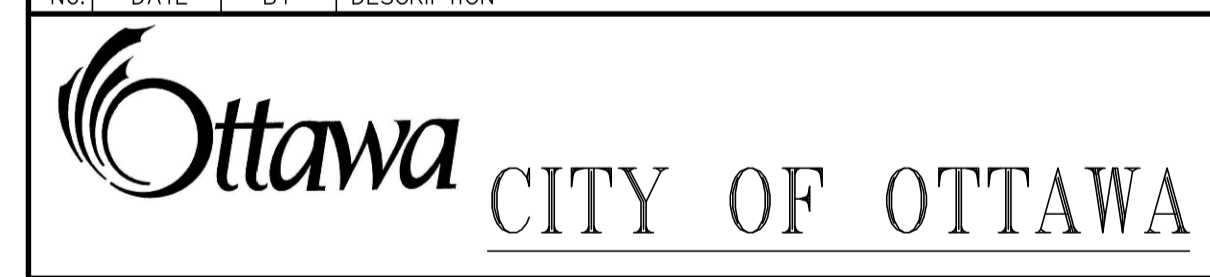
LEGAL INFORMATION
 CALCULATED M-PLAN PROVIDED BY J.D. BARNES LIMITED, PROJECT No. 16-10-116-00 (PHASE 1 & 2) DATED MARCH 09, 2018.

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



PROJECT No. 16-881

SANITARY DRAINAGE PLAN © DSEL

CAIVAN (ORLEANS VILLAGE) LIMITED ORLEANS VILLAGE

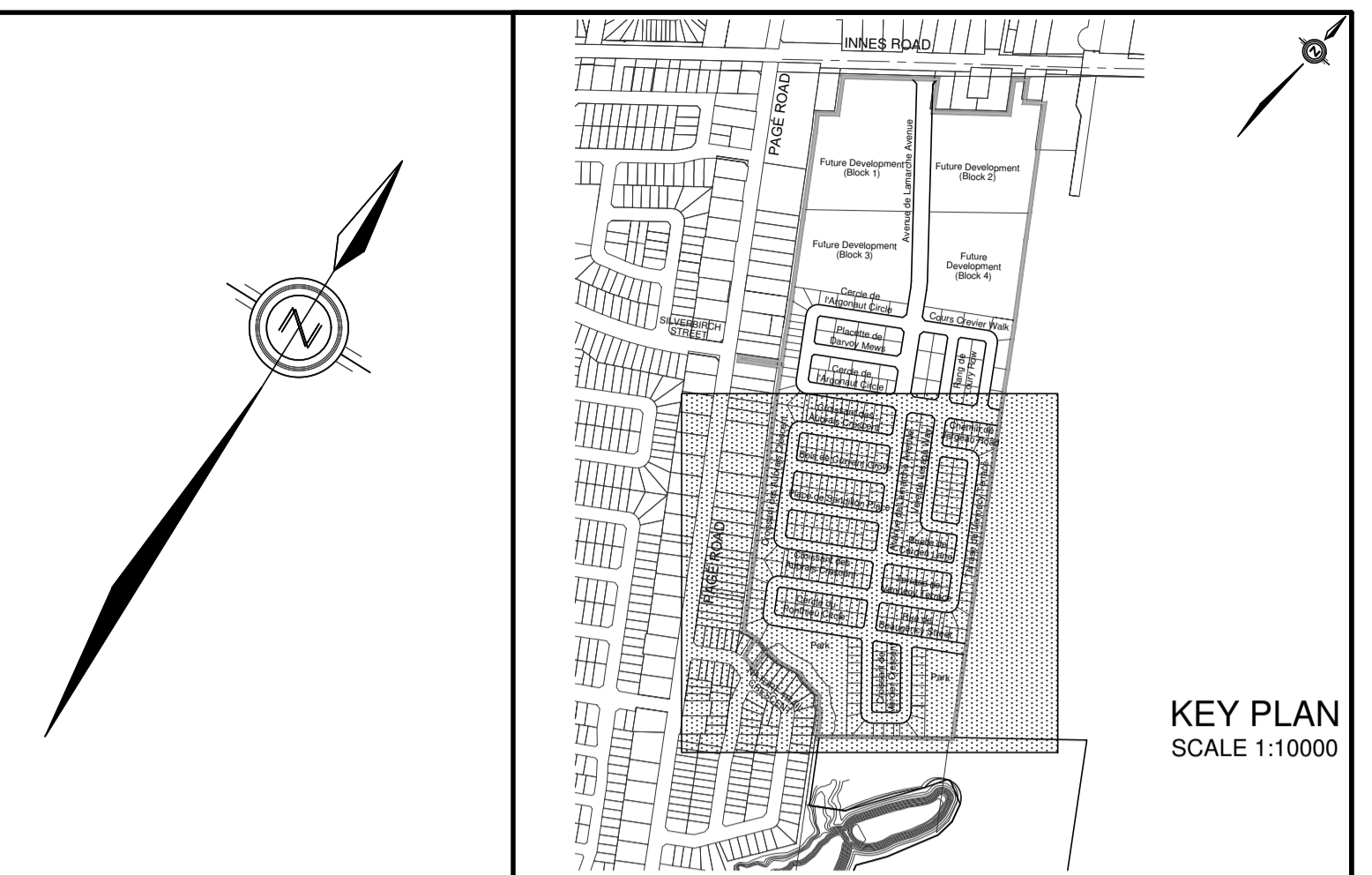
DSEL david schaeffer engineering ltd

120 Iber Road, Unit 103
 Stittsville, ON K2S 1E9
 Tel: (613) 838-8656
 Fax: (613) 838-7183
 www.DSEL.ca

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

EAST URBAN COMMUNITY
 MIXED USE CENTRE
 REFER TO
 DAVID SCHAEFFER ENGINEERING LIMITED
 PROJECT No. 14-723

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



LEGEND

- SANITARY DRAINAGE BOUNDARY
- SANITARY SUB-DRAINAGE BOUNDARY
- SANITARY DRAINAGE BOUNDARY (OTHER PHASES)
- UPSTREAM MH TO DOWNSTREAM MH
- AREA IN HECTARES
- POPULATION
- UPSTREAM MH TO DOWNSTREAM MH
- AREA IN OTHER PHASES IN HECTARES
- POPULATION
- EXTERNAL AREA IN HECTARES
- EXTERNAL POPULATION
- DENSITY (PERSONS/HECTARE)
- EXTERNAL LAND USE
- MAINTENANCE HOLE
- 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
 ELEVATIONS ARE GEODETIC AND ARE DERIVED FROM SITE BENCHMARK NCC CONTROL POINT 001196530229 HAVING A PUBLISHED ELEVATION OF 86.12m

EAST URBAN COMMUNITY
 MIXED USE CENTRE
 REFER TO
 DAVID SCHAEFFER ENGINEERING LIMITED
 PROJECT No. 14-733

A=63.57	POP=6460
RESIDENTIAL	
A=53.65	
COMMERCIAL	
A=10.45	
PARK	

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



PROJECT No. 16-881

SANITARY DRAINAGE PLAN © DSEL

CAIVAN (ORLEANS VILLAGE) LIMITED

ORLEANS VILLAGE

DSEL
 david schaeffer engineering ltd

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 Stittsville, ON K2S 1E9
 Tel: (613) 838-8656
 Fax: (613) 838-7183
 www.DSEL.ca

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

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



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

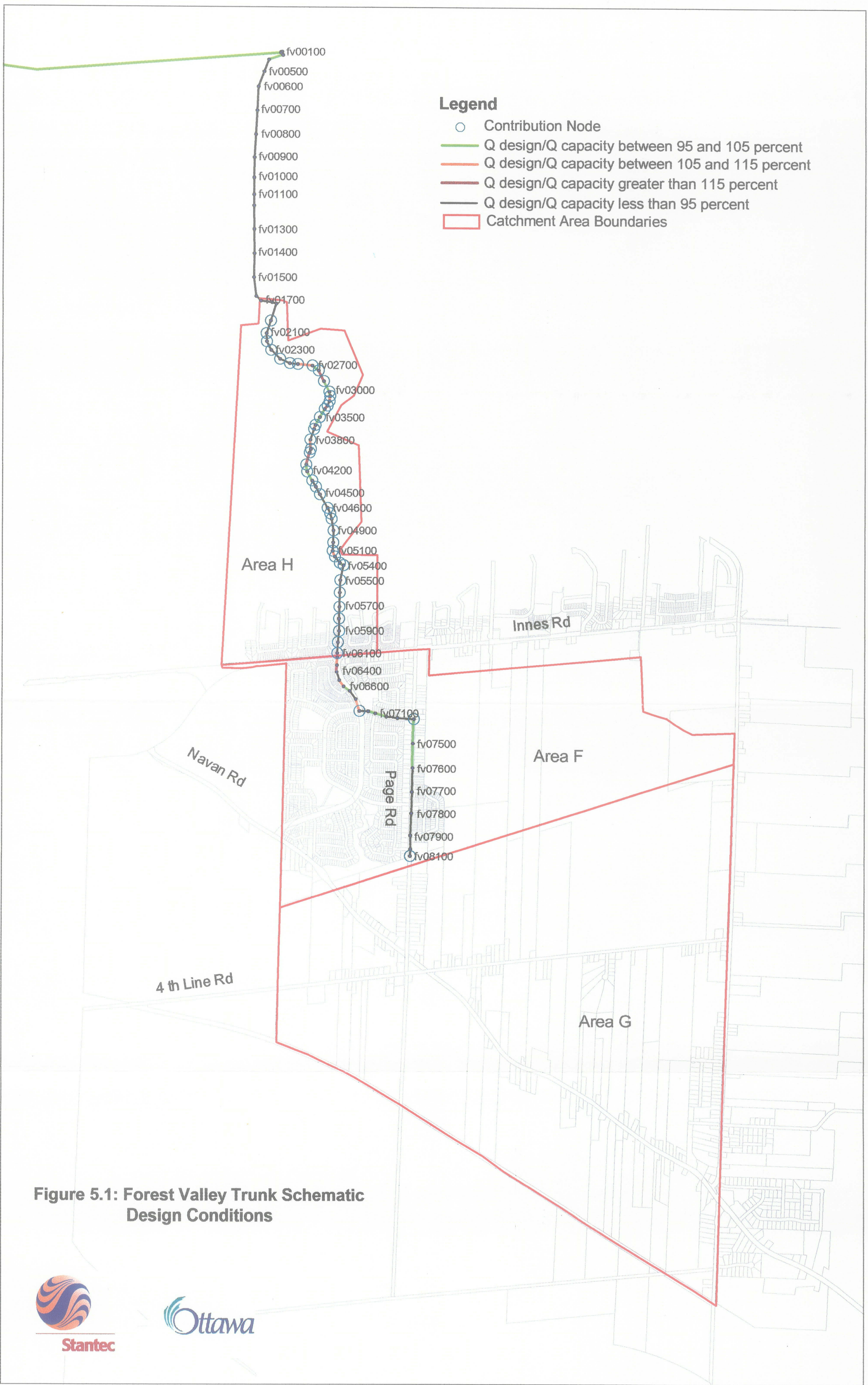
A

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

JFSA

Water Resources and
Environmental Consultants





Legend

- Contribution Node
- Q design/Q capacity between 95 and 105 percent
- Q design/Q capacity between 105 and 115 percent
- Q design/Q capacity greater than 115 percent
- Q design/Q capacity less than 95 percent
- Catchment Area Boundaries

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% and 105%
- Q/Qcap between 105% and 115%
- 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%
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%
fv05000	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%
fv05100	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	113%	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	103%	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

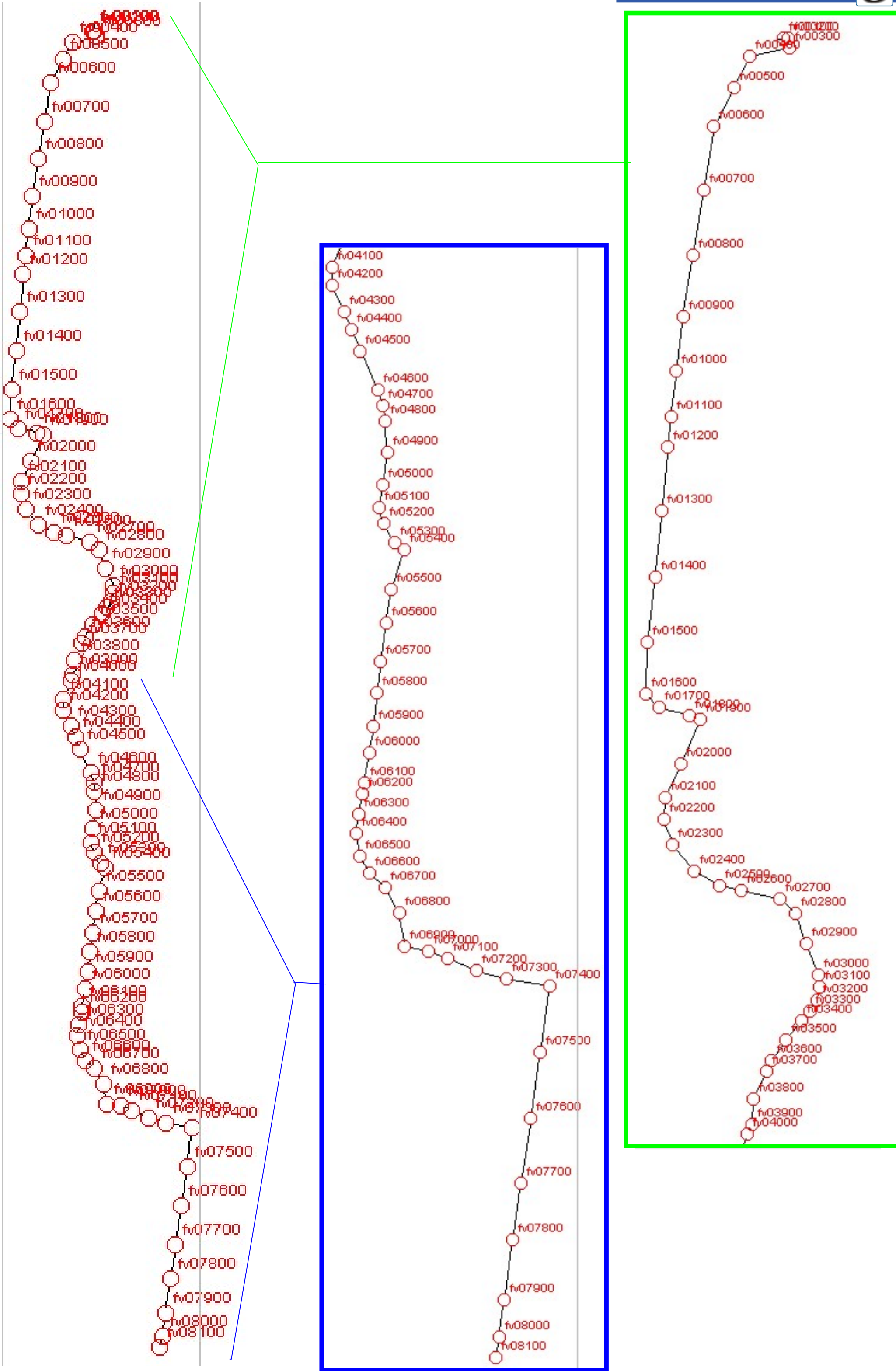


Table B-1: Pipe Data and Hydraulic Simulation Results for the Sanitary Trunk Sewer (Monitored & Design Scenario, Original Flows)

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)
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)
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

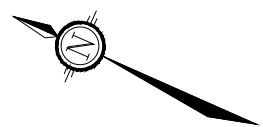
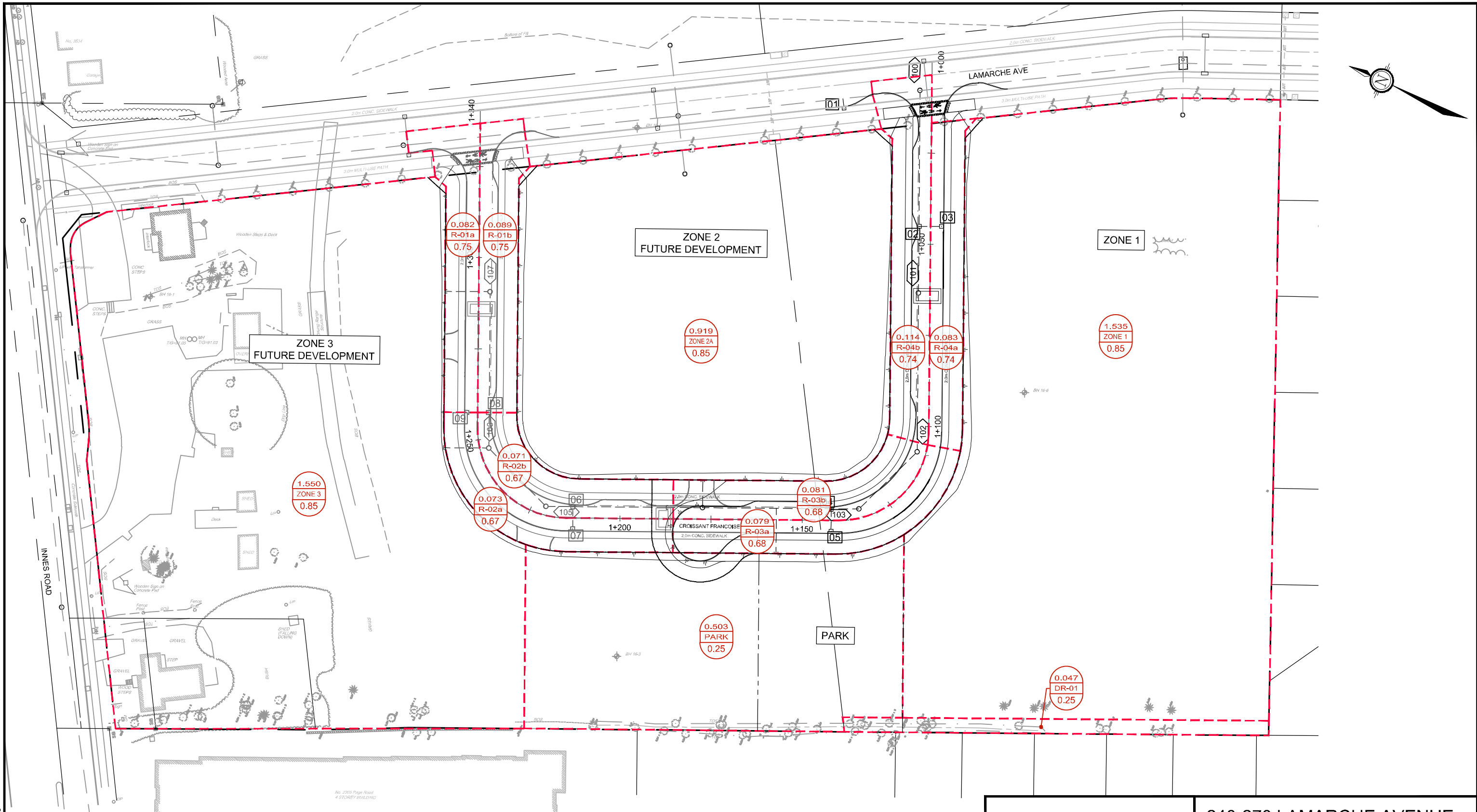
Note: (1) A negative surcharge implies that the pipe is not flowing full.

(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

M:\2021\1121214\CAD\Design\121214-STM.dwg, STM, Dec 14, 2022 - 10:11am, mhrehorjak



LEGEND

- 0.495 DRAINAGE AREA (ha)
- ZONE 3A DRAINAGE AREA ID
- 0.85 RUNOFF COEFFICIENT
- STORM DRAINAGE AREA BOUNDARY

NOVATECH

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

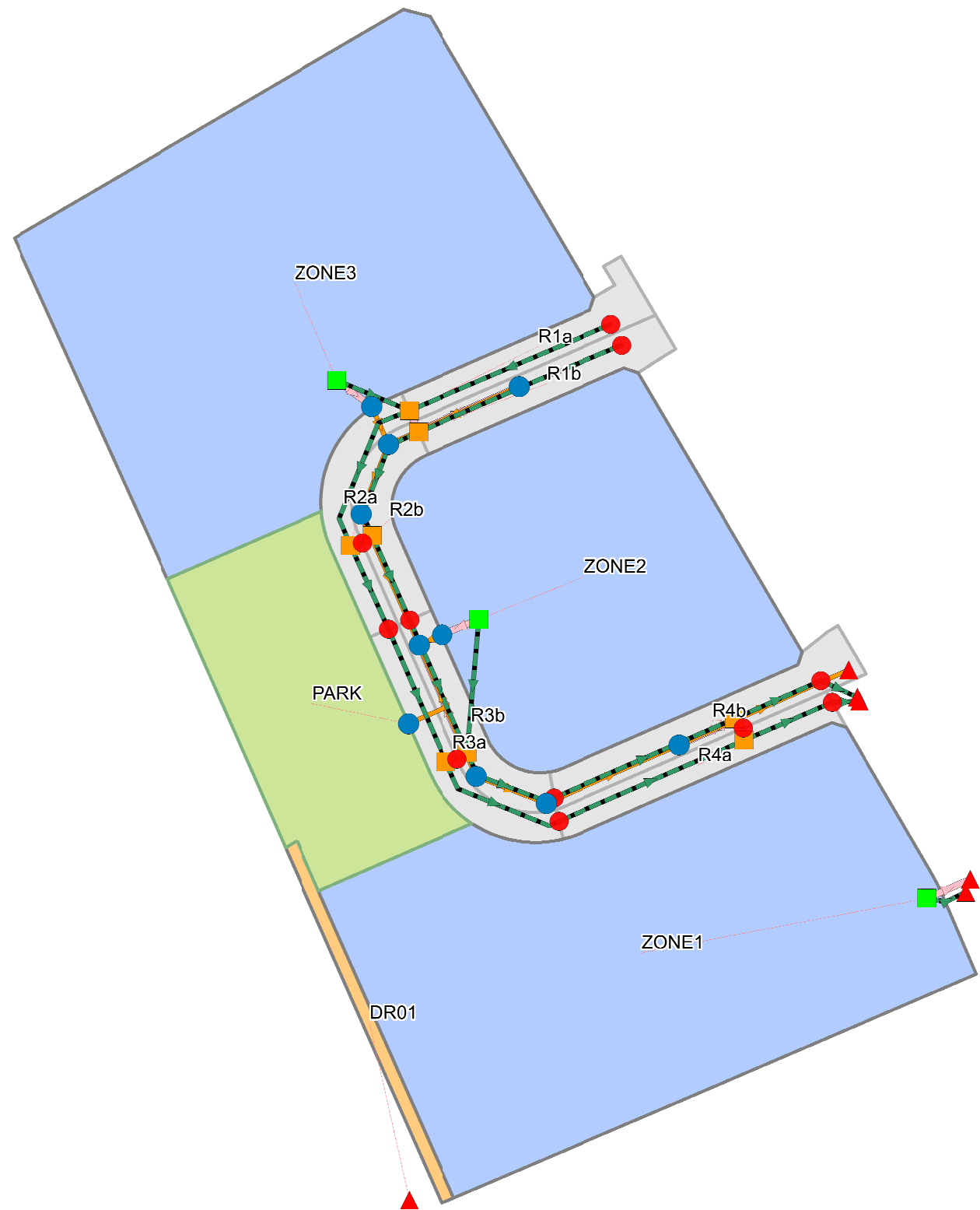
Telephone (613) 254-9643
Facsimile (613) 254-5867
Website www.novatech-eng.com

**240-270 LAMARCHE AVENUE
& 3484 INNES ROAD**

STORM DRAINAGE AREA PLAN

SCALE 1 : 1000

DATE MAY 2023 JOB 121214 FIGURE STM



Legend

● Junctions

▲ Outfalls

Storages

■ Visible

■ CB

● HP

Conduits

— Visible

— Major System

— Free Conveyance STM

— Orifices

Subcatchments

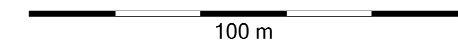
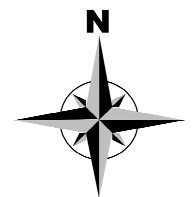
■ Visible

■ ROW

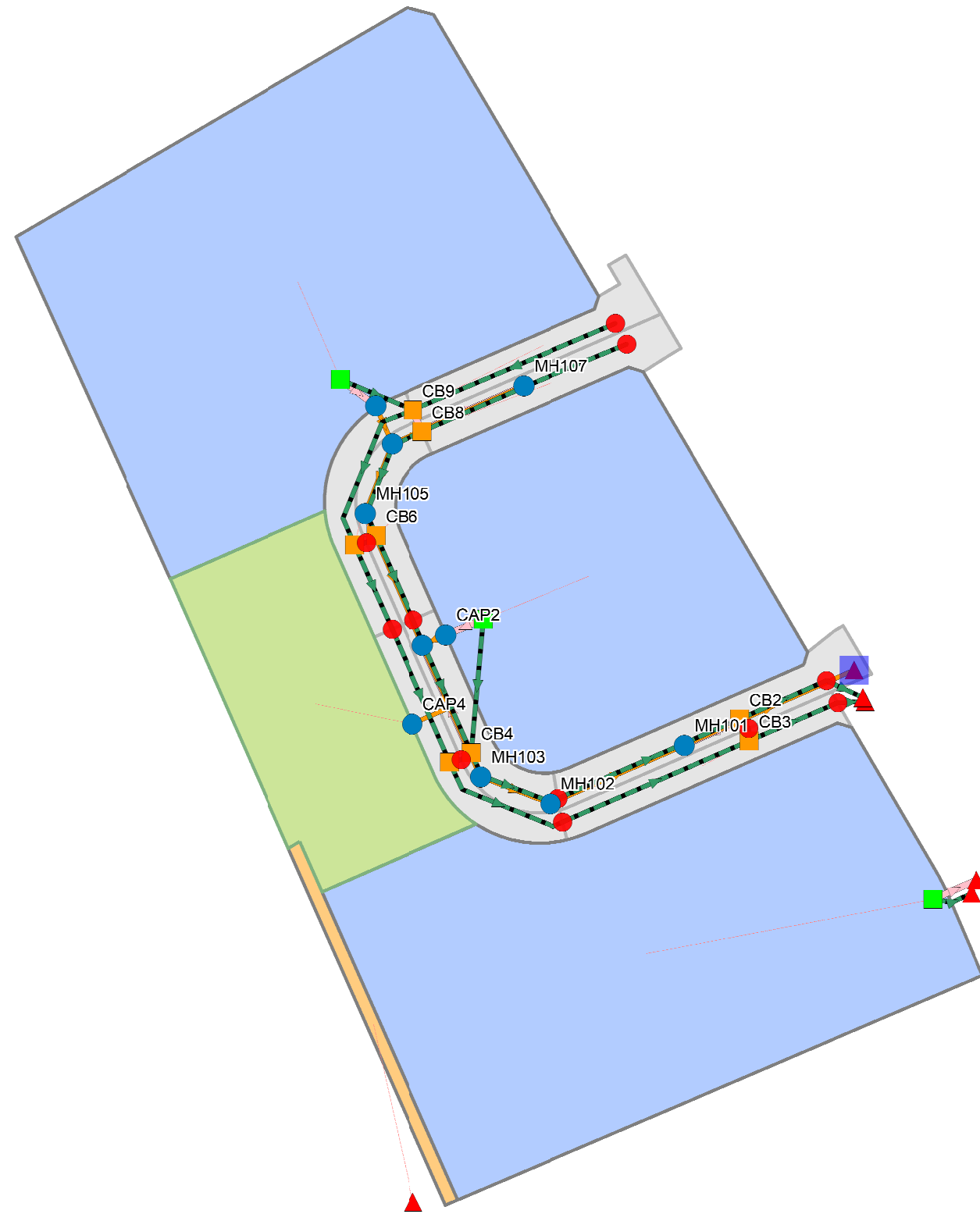
■ Block

■ Park

■ Direct Runoff



100 m



Legend

● Junctions

▲ Outfalls

Storages

■ Visible

■ CB

● HP

Conduits

— Visible

— Major System

— Free Conveyance STM

— Orifices

Subcatchments

■ Visible

■ ROW

■ Block

■ Park

■ Direct Runoff



100 m

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.015)

Element Count

Number of rain gages 1
 Number of subcatchments ... 13
 Number of nodes 38
 Number of links 46
 Number of pollutants 0
 Number of land uses 0

Raingage Summary

Name	Data Source	Data Type	Recording Interval
Raingage1	C3-100	INTENSITY	10 min.

Subcatchment Summary

Name Outlet	Area	Width	%Imperv	%Slope	Rain Gage
DR01	0.05	4.09	5.00	0.5000	Raingage1
RRSW					
PARK	0.50	50.30	7.00	1.5000	Raingage1
CAP4					
R1a	0.08	10.00	79.00	1.0000	Raingage1
CB9					
R1b	0.09	10.00	79.00	1.0000	Raingage1
CB8					
R2a	0.07	14.60	67.00	1.0000	Raingage1
CB7					
R2b	0.07	17.75	67.00	1.0000	Raingage1
CB6					
R3a	0.08	18.81	69.00	0.8500	Raingage1
CB5					
R3b	0.08	19.29	69.00	0.8500	Raingage1
CB4					
R4a	0.08	13.83	77.00	0.9500	Raingage1
CB3					
R4b	0.11	19.00	77.00	0.9500	Raingage1
CB2					
ZONE1	1.53	90.29	93.00	1.5000	Raingage1
STZN1					
ZONE2	0.92	102.11	93.00	1.5000	Raingage1
STZN2					
ZONE3	1.55	155.00	93.00	1.5000	Raingage1
STZN3					

Node Summary

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
CAP2	JUNCTION	85.82	3.96	0.0	
CAP3	JUNCTION	86.31	3.59	0.0	
CAP4	JUNCTION	86.05	3.60	0.0	
MH101	JUNCTION	84.87	4.06	0.0	
MH102	JUNCTION	85.17	4.16	0.0	
MH103	JUNCTION	85.31	3.88	0.0	
MH104	JUNCTION	85.55	3.88	0.0	
MH105	JUNCTION	85.84	3.57	0.0	
MH106	JUNCTION	85.98	3.69	0.0	
MH107	JUNCTION	86.75	3.34	0.0	
LamarcheA	OUTFALL	88.83	1.00	0.0	
LamarcheB	OUTFALL	88.83	1.00	0.0	
LamarcheC	OUTFALL	88.19	1.00	0.0	
MH100	OUTFALL	84.52	0.83	0.0	
RRSW	OUTFALL	0.00	0.00	0.0	
XMH15	OUTFALL	83.20	0.00	0.0	
1+017a	STORAGE	88.93	1.00	0.0	
1+017b	STORAGE	88.93	1.00	0.0	
1+104a	STORAGE	89.31	1.00	0.0	
1+104b	STORAGE	89.31	1.00	0.0	
1+179a	STORAGE	89.47	1.00	0.0	
1+179b	STORAGE	89.47	1.00	0.0	
1+323a	STORAGE	90.38	1.00	0.0	
1+323b	STORAGE	90.38	1.00	0.0	
CB2	STORAGE	87.27	2.50	0.0	
CB3	STORAGE	87.25	2.50	0.0	
CB4	STORAGE	87.62	2.50	0.0	
CB5	STORAGE	87.62	2.50	0.0	
CB6	STORAGE	87.80	2.50	0.0	
CB7	STORAGE	87.80	2.50	0.0	
CB8	STORAGE	88.25	2.50	0.0	
CB9	STORAGE	88.25	2.50	0.0	
HPCB6/7	STORAGE	89.41	1.00	0.0	
STZN1	STORAGE	83.92	5.28	0.0	
STZN2	STORAGE	85.82	4.66	0.0	
STZN3	STORAGE	86.31	4.31	0.0	
SU1	STORAGE	89.22	1.00	0.0	
SU3	STORAGE	88.85	1.00	0.0	

Link Summary

Name	From Node	To Node	Type	Length	%
101-100	MH101	MH100	CONDUIT	55.6	
0.4856 0.0130					
102-101	MH102	MH101	CONDUIT	43.6	
0.5046 0.0130					

103-102		MH103	MH102	CONDUIT	22.4	
0.4911	0.0130					
104-103		MH104	MH103	CONDUIT	42.9	
0.4895	0.0130					
105		MH105	MH104	CONDUIT	42.9	
0.5128	0.0130					
106-105		MH106	MH105	CONDUIT	22.4	
0.4911	0.0130					
107-106		MH107	MH106	CONDUIT	42.9	
1.3984	0.0130					
2-104		CAP2	MH104	CONDUIT	7.6	
0.5263	0.0130					
C11		CB5	SU1	CONDUIT	3.5	-
2.8583	0.0130					
C12		SU1	CB4	CONDUIT	3.5	
2.8583	0.0130					
C13		CB7	HPCB6/7	CONDUIT	3.5	-
3.1444	0.0130					
C14		HPCB6/7	CB6	CONDUIT	3.5	
3.1444	0.0130					
C15		CB3	SU3	CONDUIT	3.8	-
2.6598	0.0150					
C16		SU3	CB2	CONDUIT	3.8	
2.0865	0.0150					
CAP3a-106		CAP3	MH106	CONDUIT	12.4	
0.4839	0.0130					
CAP4-104		CAP4	MH104	CONDUIT	12.4	
0.9678	0.0130					
OVF1		1+017b	LamarcheB	CONDUIT	12.1	
0.8282	0.0150					
OVF2		1+017a	LamarcheA	CONDUIT	8.2	
1.2150	0.0150					
OVFZN1		STZN1	LamarcheC	CONDUIT	1.0	
32.6063	0.0150					
OVFZN2		STZN2	CB4	CONDUIT	1.0	
87.8518	0.0150					
OVFZN3		STZN3	CB9	CONDUIT	1.0	
17.2511	0.0150					
R1aMJR		1+323a	CB9	CONDUIT	66.0	
0.9546	0.0150					
R1bMJR		1+323b	CB8	CONDUIT	66.0	
0.9546	0.0150					
R2aMJR1		CB9	CB7	CONDUIT	50.0	
0.9000	0.0150					
R2aMJR2		CB7	1+179a	CONDUIT	28.0	-
0.6072	0.0150					
R2bMJR1		CB8	CB6	CONDUIT	38.8	
1.1589	0.0150					
R2bMJR2		CB6	1+179b	CONDUIT	28.0	-
0.6072	0.0150					
R3aMJR1		1+179a	CB5	CONDUIT	42.5	
0.8236	0.0150					
R3aMJR2		CB5	1+104a	CONDUIT	42.0	-
0.4524	0.0150					
R3bMJR1		1+179b	CB4	CONDUIT	42.5	
0.8236	0.0150					
R3bMJR2		CB4	1+104b	CONDUIT	31.0	-
0.6129	0.0150					
R4aMJR1		1+104a	CB3	CONDUIT	60.5	
0.9257	0.0150					

R4aMJR2	CB3	1+017a	CONDUIT	28.8	-
0.5550	0.0150				
R4bMJR1	1+104b	CB2	CONDUIT	59.0	
0.9153	0.0150				
R4bMJR2	CB2	1+017b	CONDUIT	28.3	-
0.5655	0.0150				
OR2	CB2	MH101	ORIFICE		
OR3	CB3	MH101	ORIFICE		
OR4	CB4	MH104	ORIFICE		
OR5	CB5	MH104	ORIFICE		
OR6	CB6	MH105	ORIFICE		
OR7	CB7	MH105	ORIFICE		
OR8	CB8	MH107	ORIFICE		
OR9	CB9	MH107	ORIFICE		
ORZN1	STZN1	XMH15	ORIFICE		
ORZN2	STZN2	CAP2	ORIFICE		
ORZN3	STZN3	CAP3	ORIFICE		

Cross Section Summary

Full Conduit Flow	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels
101-100 775.85	CIRCULAR	0.75	0.44	0.19	0.75	1
102-101 597.15	CIRCULAR	0.68	0.36	0.17	0.68	1
103-102 589.09	CIRCULAR	0.68	0.36	0.17	0.68	1
104-103 588.16	CIRCULAR	0.68	0.36	0.17	0.68	1
105 439.73	CIRCULAR	0.60	0.28	0.15	0.60	1
106-105 430.31	CIRCULAR	0.60	0.28	0.15	0.60	1
107-106 337.18	CIRCULAR	0.45	0.16	0.11	0.45	1
2-104 206.85	CIRCULAR	0.45	0.16	0.11	0.45	1
C11 27756.17	RECT_OPEN	1.00	3.00	0.60	3.00	1
C12 27756.17	RECT_OPEN	1.00	3.00	0.60	3.00	1
C13 29112.16	RECT_OPEN	1.00	3.00	0.60	3.00	1
C14 29112.16	RECT_OPEN	1.00	3.00	0.60	3.00	1
C15 3389.04	CIRCULAR	1.00	0.79	0.25	1.00	1
C16 3001.66	CIRCULAR	1.00	0.79	0.25	1.00	1
CAP3a-106 299.17	CIRCULAR	0.53	0.22	0.13	0.53	1
CAP4-104 05 14	CIRCULAR	0.30	0.07	0.07	0.30	1

OVF1	20mROWlaf	1.00	8.41	0.25	10.01	1
20235.73						
OVF2	20mROWlaf	1.00	8.41	0.25	10.01	1
24510.08						
OVFZN1	RECT_OPEN	1.00	3.00	0.60	3.00	1
81247.07						
OVFZN2	RECT_OPEN	1.00	3.00	0.60	3.00	1
133362.03						
OVFZN3	RECT_OPEN	1.00	3.00	0.60	3.00	1
59097.00						
R1aMJR	20mROWlaf	1.00	8.41	0.25	10.01	1
21725.17						
R1bMJR	20mROWlaf	1.00	8.41	0.25	10.01	1
21725.17						
R2aMJR1	20mROWlaf	1.00	8.41	0.25	10.01	1
21095.27						
R2aMJR2	20mROWlaf	1.00	8.41	0.25	10.01	1
17326.24						
R2bMJR1	20mROWlaf	1.00	8.41	0.25	10.01	1
23937.31						
R2bMJR2	20mROWlaf	1.00	8.41	0.25	10.01	1
17326.24						
R3aMJR1	20mROWlaf	1.00	8.41	0.25	10.01	1
20179.11						
R3aMJR2	20mROWlaf	1.00	8.41	0.25	10.01	1
14955.79						
R3bMJR1	20mROWlaf	1.00	8.41	0.25	10.01	1
20179.11						
R3bMJR2	20mROWlaf	1.00	8.41	0.25	10.01	1
17408.25						
R4aMJR1	20mROWlaf	1.00	8.41	0.25	10.01	1
21393.44						
R4aMJR2	20mROWlaf	1.00	8.41	0.25	10.01	1
16565.75						
R4bMJR1	20mROWlaf	1.00	8.41	0.25	10.01	1
21273.30						
R4bMJR2	20mROWlaf	1.00	8.41	0.25	10.01	1
16721.64						

Transect Summary

Transect 20mROWlaf

Area:

0.0008	0.0030	0.0068	0.0121	0.0189
0.0270	0.0354	0.0440	0.0547	0.0677
0.0832	0.1010	0.1212	0.1438	0.1676
0.1913	0.2151	0.2389	0.2626	0.2864
0.3102	0.3339	0.3577	0.3815	0.4052
0.4290	0.4528	0.4766	0.5004	0.5241
0.5479	0.5717	0.5955	0.6193	0.6431
0.6668	0.6906	0.7144	0.7382	0.7620
0.7858	0.8096	0.8334	0.8572	0.8810
0.9048	0.9286	0.9524	0.9762	1.0000

Hrad:

0.0387	0.0774	0.1162	0.1549	0.1936
--------	--------	--------	--------	--------

0.2510	0.3264	0.3981	0.4447	0.4684
0.4771	0.4767	0.4711	0.4627	0.4586
0.4606	0.4665	0.4751	0.4856	0.4976
0.5106	0.5244	0.5389	0.5539	0.5693
0.5851	0.6011	0.6174	0.6339	0.6506
0.6674	0.6844	0.7014	0.7186	0.7358
0.7532	0.7705	0.7880	0.8055	0.8230
0.8406	0.8582	0.8759	0.8935	0.9112
0.9289	0.9467	0.9644	0.9822	1.0000

Width:

0.0635	0.1270	0.1906	0.2541	0.3176
0.3495	0.3496	0.3996	0.4993	0.5991
0.6989	0.7987	0.8984	0.9982	0.9982
0.9983	0.9983	0.9984	0.9984	0.9985
0.9985	0.9986	0.9986	0.9987	0.9987
0.9988	0.9988	0.9989	0.9989	0.9990
0.9990	0.9991	0.9991	0.9992	0.9992
0.9993	0.9993	0.9994	0.9994	0.9995
0.9995	0.9996	0.9996	0.9997	0.9997
0.9998	0.9998	0.9999	0.9999	1.0000

NOTE: The summary statistics displayed in this report are based on results found at every computational time step, not just on results from each reporting time step.

Analysis Options

```
Flow Units ..... LPS
Process Models:
  Rainfall/Runoff ..... YES
  RDII ..... NO
  Snowmelt ..... NO
  Groundwater ..... NO
  Flow Routing ..... YES
  Ponding Allowed ..... NO
  Water Quality ..... NO
Infiltration Method ..... HORTON
Flow Routing Method ..... DYNWAVE
Surcharge Method ..... EXTRAN
Starting Date ..... 11/15/2021 00:00:00
Ending Date ..... 11/16/2021 00:00:00
Antecedent Dry Days ..... 0.0
Report Time Step ..... 00:01:00
Wet Time Step ..... 00:05:00
Dry Time Step ..... 00:05:00
Routing Time Step ..... 5.00 sec
Variable Time Step ..... YES
Maximum Trials ..... 8
Number of Threads ..... 4
Head Tolerance ..... 0.001500 m
```

***** Volume Depth

Runoff Quantity Continuity	hectare-m	mm
Initial LID Storage	0.004	0.722
Total Precipitation	0.375	71.667
Evaporation Loss	0.000	0.000
Infiltration Loss	0.040	7.679
Surface Runoff	0.338	64.615
Final Storage	0.004	0.722
Continuity Error (%)	-0.867	

Flow Routing Continuity	Volume hectare-m	Volume 10 ⁶ ltr
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.338	3.377
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.001	0.012
External Outflow	0.338	3.383
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.004	0.037
Final Stored Volume	0.004	0.037
Continuity Error (%)	0.164	

Highest Continuity Errors

Node CB9 (-1.66%)
Node CB7 (1.34%)

Time-Step Critical Elements

Link 2-104 (19.63%)

Highest Flow Instability Indexes

Link ORZN1 (9)
Link ORZN3 (1)

Routing Time Step Summary

Minimum Time Step : 0.50 sec
Average Time Step : 4.58 sec
Maximum Time Step : 5.00 sec
Percent in Steady State : -0.00
Average Iterations per Step : 6.75
Percent Not Converging : 4.77

```

Time Step Frequencies      :
  5.000 - 3.155 sec      :   87.49 %
  3.155 - 1.991 sec      :   12.38 %
  1.991 - 1.256 sec      :    0.07 %
  1.256 - 0.792 sec      :    0.04 %
  0.792 - 0.500 sec      :    0.02 %

```

```

*****
Subcatchment Runoff Summary
*****

```

Perv	Total	Total	Total	Total	Total	Total	Imperv
Runoff	Runoff	Total	Peak	Runoff	Evap	Infil	Runoff
Subcatchment	Runoff	Precip	Runoff	Runoff	mm	mm	mm
mm	mm	Runoff	Runoff	Coeff	mm	mm	mm
		10^6 ltr	mm	mm			
		LPS					
DR01			71.67	0.00	0.00	46.17	3.59
22.05	25.64	0.01	3.58	0.358			
PARK			71.67	0.00	0.00	41.00	5.02
25.89	30.91	0.16	65.03	0.431			
R1a			71.67	0.00	0.00	8.13	57.10
7.10	64.20	0.05	36.91	0.896			
R1b			71.67	0.00	0.00	8.16	57.11
7.06	64.16	0.06	39.76	0.895			
R2a			71.67	0.00	0.00	12.74	48.33
11.20	59.53	0.04	31.36	0.831			
R2b			71.67	0.00	0.00	12.61	48.28
11.38	59.66	0.04	31.27	0.833			
R3a			71.67	0.00	0.00	11.88	49.76
10.64	60.40	0.05	34.82	0.843			
R3b			71.67	0.00	0.00	11.88	49.76
10.64	60.40	0.05	35.70	0.843			
R4a			71.67	0.00	0.00	8.81	55.61
7.90	63.51	0.05	37.70	0.886			
R4b			71.67	0.00	0.00	8.81	55.61
7.90	63.51	0.07	51.78	0.886			
ZONE1			71.67	0.00	0.00	2.64	67.22
2.46	69.68	1.07	719.67	0.972			
ZONE2			71.67	0.00	0.00	2.60	67.22
2.54	69.76	0.64	448.03	0.973			
ZONE3			71.67	0.00	0.00	2.61	67.23
2.53	69.76	1.08	752.91	0.973			

```

*****
Node Depth Summary
*****

```

Node	Type	Average	Maximum	Maximum	Time of Max	Reported
		Depth	Depth	HGL	Occurrence	Max Depth
		Meters	Meters	Meters	days hr:min	Meters

CAP2	JUNCTION	0.05	0.34	86.16	0	01:12	0.34
CAP3	JUNCTION	0.05	0.33	86.64	0	01:23	0.33
CAP4	JUNCTION	0.02	0.25	86.30	0	01:10	0.24
MH101	JUNCTION	0.62	0.81	85.68	0	01:12	0.81
MH102	JUNCTION	0.33	0.62	85.79	0	01:11	0.62
MH103	JUNCTION	0.21	0.58	85.89	0	01:11	0.58
MH104	JUNCTION	0.07	0.52	86.07	0	01:11	0.52
MH105	JUNCTION	0.05	0.34	86.18	0	01:14	0.34
MH106	JUNCTION	0.05	0.33	86.31	0	01:14	0.33
MH107	JUNCTION	0.01	0.10	86.85	0	01:10	0.10
LamarcheA	OUTFALL	0.00	0.00	88.83	0	00:00	0.00
LamarcheB	OUTFALL	0.00	0.00	88.83	0	00:00	0.00
LamarcheC	OUTFALL	0.00	0.00	88.19	0	00:00	0.00
MH100	OUTFALL	0.96	0.96	85.48	0	00:00	0.96
RRSW	OUTFALL	0.00	0.00	0.00	0	00:00	0.00
XMH15	OUTFALL	1.82	1.82	85.02	0	00:00	1.82
1+017a	STORAGE	0.00	0.00	88.93	0	00:00	0.00
1+017b	STORAGE	0.00	0.00	88.93	0	00:00	0.00
1+104a	STORAGE	0.00	0.00	89.31	0	00:00	0.00
1+104b	STORAGE	0.00	0.00	89.31	0	00:00	0.00
1+179a	STORAGE	0.00	0.00	89.47	0	00:00	0.00
1+179b	STORAGE	0.00	0.00	89.47	0	00:00	0.00
1+323a	STORAGE	0.00	0.00	90.38	0	00:00	0.00
1+323b	STORAGE	0.00	0.00	90.38	0	00:00	0.00
CB2	STORAGE	0.11	1.65	88.92	0	01:12	1.65
CB3	STORAGE	0.10	1.67	88.92	0	01:16	1.67
CB4	STORAGE	0.08	1.61	89.23	0	01:13	1.61
CB5	STORAGE	0.08	1.61	89.23	0	01:14	1.61
CB6	STORAGE	0.08	1.66	89.46	0	01:15	1.66
CB7	STORAGE	0.09	1.66	89.46	0	01:15	1.66
CB8	STORAGE	0.07	1.55	89.80	0	01:10	1.55
CB9	STORAGE	0.06	1.55	89.80	0	01:10	1.55
HPCB6/7	STORAGE	0.00	0.05	89.46	0	01:14	0.05
STZN1	STORAGE	1.24	4.58	88.50	0	01:14	4.58
STZN2	STORAGE	0.47	3.95	89.77	0	01:22	3.95
STZN3	STORAGE	0.43	3.60	89.91	0	01:23	3.60
SU1	STORAGE	0.00	0.01	89.23	0	01:14	0.01
SU3	STORAGE	0.00	0.08	88.93	0	01:15	0.07

Node Inflow Summary

Total Flow		Maximum Lateral Inflow	Maximum Total Inflow	Time of Max Occurrence	Lateral Inflow Volume
Node	Error Percent	Type	LPS	days hr:min	10^6 ltr
CAP2	0.001	JUNCTION	0.00	0 01:26	0
0.641			109.94		

CAP3		JUNCTION	0.00	186.01	0	01:23	0
1.08	0.004						
CAP4		JUNCTION	65.03	65.03	0	01:10	0.156
0.156	0.000						
MH101		JUNCTION	0.00	501.79	0	01:12	0
2.3	-0.003						
MH102		JUNCTION	0.00	464.59	0	01:12	0
2.17	0.002						
MH103		JUNCTION	0.00	465.16	0	01:10	0
2.17	-0.057						
MH104		JUNCTION	0.00	466.53	0	01:10	0
2.17	0.007						
MH105		JUNCTION	0.00	258.52	0	01:16	0
1.28	0.054						
MH106		JUNCTION	0.00	221.37	0	01:18	0
1.18	0.008						
MH107		JUNCTION	0.00	35.87	0	01:10	0
0.0944	0.086						
LamarcheA		OUTFALL	0.00	0.00	0	00:00	0
0	0.000 ltr						
LamarcheB		OUTFALL	0.00	0.00	0	00:00	0
0	0.000 ltr						
LamarcheC		OUTFALL	0.00	0.00	0	00:00	0
0	0.000 ltr						
MH100		OUTFALL	0.00	501.80	0	01:12	0
2.3	0.000						
RRSW		OUTFALL	3.58	3.58	0	01:10	0.0121
0.0121	0.000						
XMH15		OUTFALL	0.00	405.46	0	01:14	0
1.08	0.000						
1+017a		STORAGE	0.00	0.00	0	00:00	0
0	0.000 ltr						
1+017b		STORAGE	0.00	0.00	0	00:00	0
0	0.000 ltr						
1+104a		STORAGE	0.00	0.00	0	00:00	0
0	0.000 ltr						
1+104b		STORAGE	0.00	0.00	0	00:00	0
0	0.000 ltr						
1+179a		STORAGE	0.00	0.00	0	00:00	0
0	0.000 ltr						
1+179b		STORAGE	0.00	0.00	0	00:00	0
0	0.000 ltr						
1+323a		STORAGE	0.00	0.00	0	00:00	0
0	0.000 ltr						
1+323b		STORAGE	0.00	0.00	0	00:00	0
0	0.000 ltr						
CB2		STORAGE	51.78	51.78	0	01:10	0.0724
0.0724	-0.303						
CB3		STORAGE	37.70	48.48	0	01:10	0.0527
0.0599	-0.138						
CB4		STORAGE	35.70	35.70	0	01:10	0.0489
0.0496	0.035						
CB5		STORAGE	34.82	35.20	0	01:11	0.0477
0.0489	-0.010						
CB6		STORAGE	31.27	60.31	0	01:11	0.0424
0.0553	0.899						
CB7		STORAGE	31.36	71.18	0	01:10	0.0435
0.0558	1.358						
CB8		STORAGE	39.76	39.76	0	01:10	0.0571
0.0571	-0.876						

CB9		STORAGE	36.91	36.91	0	01:10	0.0526
0.0526	-1.636						
HPCB6/7		STORAGE	0.00	25.67	0	01:10	0
0.00849	-0.110						
STZN1		STORAGE	719.67	719.67	0	01:10	1.07
1.08	0.518						
STZN2		STORAGE	448.03	448.03	0	01:10	0.641
0.641	0.042						
STZN3		STORAGE	752.91	752.91	0	01:10	1.08
1.08	0.019						
SU1		STORAGE	0.00	8.21	0	01:12	0
0.0018	-0.125						
SU3		STORAGE	0.00	15.41	0	01:12	0
0.00729	0.115						

Node Surcharge Summary

Surcharging occurs when water rises above the top of the highest conduit.

Node	Type	Hours Surcharged	Max. Height Above Crown Meters	Min. Depth Below Rim Meters
MH101	JUNCTION	0.50	0.055	3.250

Node Flooding Summary

No nodes were flooded.

Storage Volume Summary

of Max Occurrence	Maximum Outflow Storage Unit	Average Volume	Avg Full	Evap Loss	Exfil Loss	Maximum Volume	Max Full	Time
hr:min	LPS	1000 m3				1000 m3		days
1+017a 00:00	0.00	0.000	0	0	0	0.000	0	0
1+017b 00:00	0.00	0.000	0	0	0	0.000	0	0
1+104a 00:00	0.00	0.000	0	0	0	0.000	0	0
1+104b 00:00	0.00	0.000	0	0	0	0.000	0	0

1+179a		0.000	0	0	0	0.000	0	0
00:00	0.00							
1+179b		0.000	0	0	0	0.000	0	0
00:00	0.00							
1+323a		0.000	0	0	0	0.000	0	0
00:00	0.00							
1+323b		0.000	0	0	0	0.000	0	0
00:00	0.00							
CB2		0.000	4	0	0	0.002	66	0
01:12	33.98							
CB3		0.000	4	0	0	0.002	67	0
01:16	21.37							
CB4		0.000	3	0	0	0.002	64	0
01:13	26.51							
CB5		0.000	3	0	0	0.002	64	0
01:14	24.80							
CB6		0.000	3	0	0	0.002	66	0
01:15	44.07							
CB7		0.000	3	0	0	0.002	66	0
01:15	35.40							
CB8		0.000	3	0	0	0.002	62	0
01:10	38.53							
CB9		0.000	3	0	0	0.002	62	0
01:10	35.24							
HPCB6/7		0.000	0	0	0	0.000	5	0
01:14	24.86							
STZN1		0.003	2	0	0	0.127	99	0
01:14	405.46							
STZN2		0.014	6	0	0	0.216	96	0
01:22	109.94							
STZN3		0.024	6	0	0	0.362	96	0
01:23	186.01							
SU1		0.000	0	0	0	0.000	1	0
01:14	8.15							
SU3		0.000	0	0	0	0.000	8	0
01:15	16.55							

 Outfall Loading Summary

Outfall Node	Flow Freq Pcnt	Avg Flow LPS	Max Flow LPS	Total Volume 10^6 ltr
LamarcheA	0.00	0.00	0.00	0.000
LamarcheB	0.00	0.00	0.00	0.000
LamarcheC	0.00	0.00	0.00	0.000
MH100	43.02	120.06	501.80	2.298
RRSW	20.42	1.33	3.58	0.012
XMH15	100.00	24.12	405.46	1.084
System	27.24	145.50	910.11	3.395

 Link Flow Summary

Link	Type	Maximum Flow LPS	Time of Max Occurrence days hr:min	Maximum Veloc m/sec	Max/ Full Flow	Max/ Full Depth
101-100	CONDUIT	501.80	0 01:12	1.14	0.65	1.00
102-101	CONDUIT	464.69	0 01:12	1.32	0.78	0.96
103-102	CONDUIT	464.59	0 01:12	1.50	0.79	0.86
104-103	CONDUIT	465.16	0 01:10	1.59	0.79	0.79
105	CONDUIT	258.59	0 01:15	1.44	0.59	0.65
106-105	CONDUIT	221.37	0 01:19	1.45	0.51	0.53
107-106	CONDUIT	35.87	0 01:10	0.96	0.11	0.29
2-104	CONDUIT	110.00	0 01:31	1.06	0.53	0.70
C11	CONDUIT	8.15	0 01:12	0.05	0.00	0.06
C12	CONDUIT	8.21	0 01:12	0.05	0.00	0.06
C13	CONDUIT	24.86	0 01:10	0.12	0.00	0.10
C14	CONDUIT	25.67	0 01:10	0.12	0.00	0.10
C15	CONDUIT	16.55	0 01:14	0.39	0.00	0.12
C16	CONDUIT	15.41	0 01:12	0.37	0.01	0.11
CAP3a-106	CONDUIT	186.01	0 01:23	1.41	0.62	0.59
CAP4-104	CONDUIT	64.68	0 01:10	1.20	0.68	0.71
OVF1	CHANNEL	0.00	0 00:00	0.00	0.00	0.00
OVF2	CHANNEL	0.00	0 00:00	0.00	0.00	0.00
OVFZN1	CONDUIT	0.00	0 00:00	0.00	0.00	0.00
OVFZN2	CONDUIT	0.00	0 00:00	0.00	0.00	0.06
OVFZN3	CONDUIT	0.00	0 00:00	0.00	0.00	0.02
R1aMJR	CHANNEL	0.00	0 00:00	0.00	0.00	0.02
R1bMJR	CHANNEL	0.00	0 00:00	0.00	0.00	0.02
R2aMJR1	CHANNEL	17.31	0 01:10	0.33	0.00	0.10
R2aMJR2	CHANNEL	0.00	0 00:00	0.00	0.00	0.08
R2bMJR1	CHANNEL	20.59	0 01:10	0.40	0.00	0.10
R2bMJR2	CHANNEL	0.00	0 00:00	0.00	0.00	0.08
R3aMJR1	CHANNEL	0.00	0 00:00	0.00	0.00	0.06
R3aMJR2	CHANNEL	0.00	0 00:00	0.00	0.00	0.06
R3bMJR1	CHANNEL	0.00	0 00:00	0.00	0.00	0.06
R3bMJR2	CHANNEL	0.00	0 00:00	0.00	0.00	0.06
R4aMJR1	CHANNEL	0.00	0 00:00	0.00	0.00	0.08
R4aMJR2	CHANNEL	0.00	0 00:00	0.00	0.00	0.07
R4bMJR1	CHANNEL	0.00	0 00:00	0.00	0.00	0.08
R4bMJR2	CHANNEL	0.00	0 00:00	0.00	0.00	0.08
OR2	ORIFICE	18.57	0 01:12			1.00
OR3	ORIFICE	18.65	0 01:16			1.00
OR4	ORIFICE	18.32	0 01:13			1.00
OR5	ORIFICE	18.32	0 01:14			1.00
OR6	ORIFICE	18.59	0 01:15			1.00
OR7	ORIFICE	18.59	0 01:15			1.00
OR8	ORIFICE	17.94	0 01:10			1.00
OR9	ORIFICE	17.93	0 01:10			1.00
ORZN1	ORIFICE	405.46	0 01:14			1.00
ORZN2	ORIFICE	109.94	0 01:26			1.00
ORZN3	ORIFICE	186.01	0 01:23			1.00

Flow Classification Summary

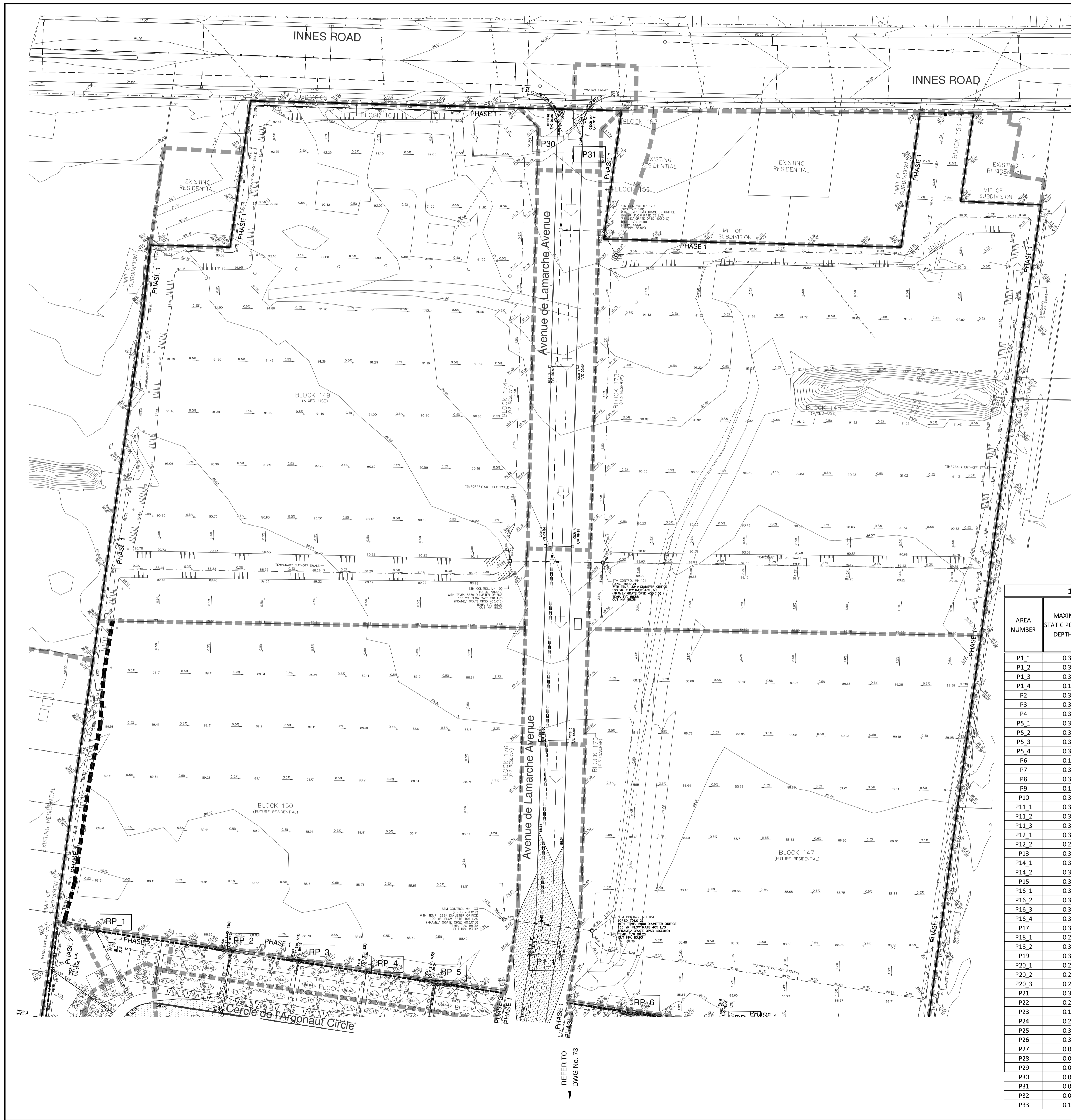
Inlet Conduit Ctrl	Adjusted	Fraction of Time in Flow Class							
	/Actual Length	Up Dry	Down Dry	Sub Dry	Sup Crit	Up Crit	Down Crit	Norm Ltd	
101-100 0.00	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00
102-101 0.00	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00
103-102 0.00	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00
104-103 0.00	1.00	0.00	0.00	0.00	0.97	0.00	0.00	0.02	0.90
105 0.00	1.00	0.00	0.00	0.00	0.11	0.01	0.00	0.88	0.00
106-105 0.00	1.00	0.00	0.00	0.00	0.04	0.00	0.00	0.96	0.00
107-106 0.00	1.00	0.00	0.00	0.00	0.11	0.01	0.00	0.88	0.06
2-104 0.00	1.00	0.00	0.00	0.00	0.04	0.00	0.00	0.96	0.00
C11 0.00	1.00	0.96	0.02	0.00	0.02	0.00	0.00	0.00	0.95
C12 0.00	1.00	0.96	0.02	0.00	0.02	0.00	0.00	0.00	0.95
C13 0.00	1.00	0.96	0.01	0.00	0.03	0.00	0.00	0.00	0.94
C14 0.00	1.00	0.96	0.01	0.00	0.03	0.00	0.00	0.00	0.94
C15 0.00	1.00	0.95	0.01	0.00	0.04	0.00	0.00	0.00	0.94
C16 0.00	1.00	0.95	0.01	0.00	0.05	0.00	0.00	0.00	0.94
CAP3a-106 0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00
CAP4-104 0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00
OVF1 0.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
OVF2 0.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
OVFZN1 0.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
OVFZN2 0.00	1.00	0.96	0.04	0.00	0.00	0.00	0.00	0.00	0.00
OVFZN3 0.00	1.00	0.98	0.02	0.00	0.00	0.00	0.00	0.00	0.00
R1aMJR 0.00	1.00	0.98	0.02	0.00	0.00	0.00	0.00	0.00	0.00
R1bMJR 0.00	1.00	0.97	0.03	0.00	0.00	0.00	0.00	0.00	0.00
R2aMJR1 0.00	1.00	0.96	0.02	0.00	0.02	0.00	0.00	0.00	0.95

R2aMJR2	1.00	0.96	0.04	0.00	0.00	0.00	0.00	0.00	0.00
0.00									
R2bMJR1	1.00	0.96	0.02	0.00	0.02	0.00	0.00	0.00	0.95
0.00									
R2bMJR2	1.00	0.96	0.04	0.00	0.00	0.00	0.00	0.00	0.00
0.00									
R3aMJR1	1.00	0.96	0.04	0.00	0.00	0.00	0.00	0.00	0.00
0.00									
R3aMJR2	1.00	0.96	0.04	0.00	0.00	0.00	0.00	0.00	0.00
0.00									
R3bMJR1	1.00	0.96	0.04	0.00	0.00	0.00	0.00	0.00	0.00
0.00									
R3bMJR2	1.00	0.96	0.04	0.00	0.00	0.00	0.00	0.00	0.00
0.00									
R4aMJR1	1.00	0.95	0.05	0.00	0.00	0.00	0.00	0.00	0.00
0.00									
R4aMJR2	1.00	0.95	0.05	0.00	0.00	0.00	0.00	0.00	0.00
0.00									
R4bMJR1	1.00	0.95	0.05	0.00	0.00	0.00	0.00	0.00	0.00
0.00									
R4bMJR2	1.00	0.95	0.05	0.00	0.00	0.00	0.00	0.00	0.00
0.00									

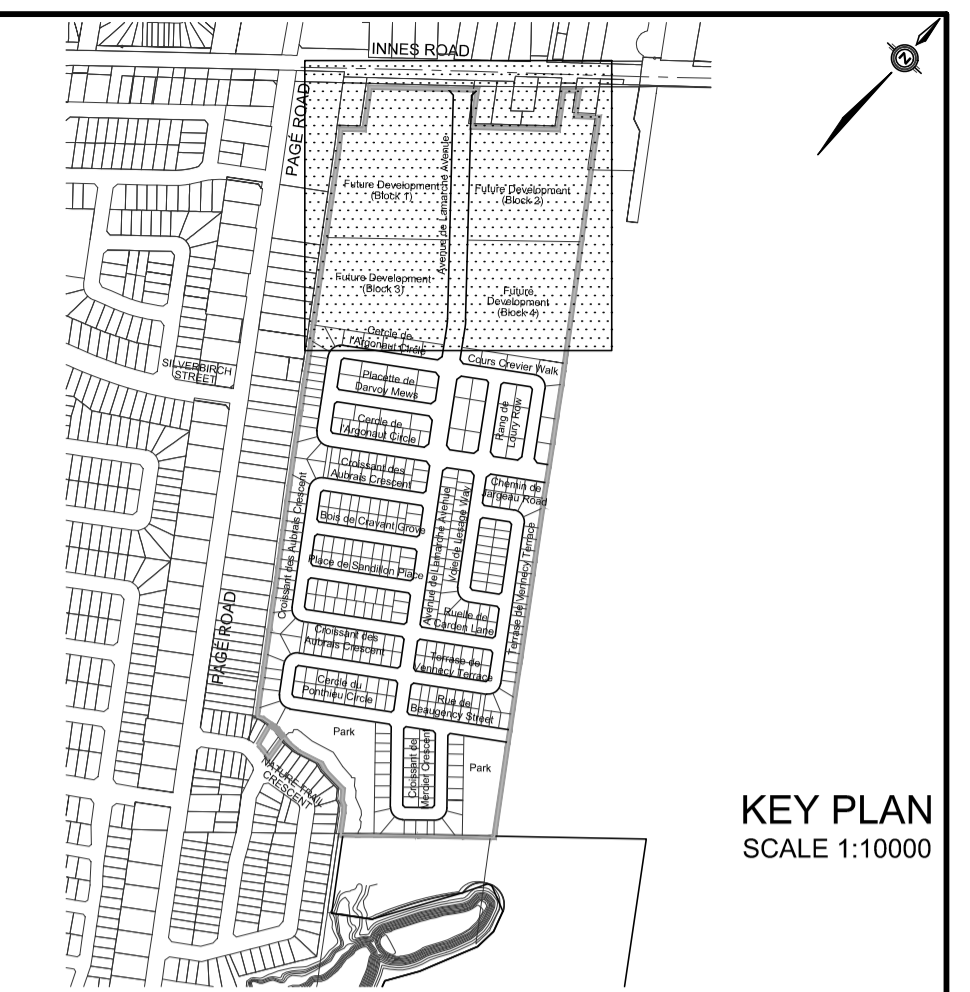
 Conduit Surcharge Summary

Conduit	Hours Full			Hours	
	Both Ends	Upstream	Dnstream	Above Full Normal Flow	Capacity Limited
101-100	0.52	0.52	24.00	0.01	0.01
102-101	0.01	0.01	0.50	0.01	0.01

Analysis begun on: Wed Dec 14 09:56:43 2022
 Analysis ended on: Wed Dec 14 09:56:44 2022
 Total elapsed time: 00:00:01



APPROVED REFUSED
 THIS _____ DAY OF _____, 20____
 JOSHUA WHITE, P.ENG
 PROJECT MANAGER - EAST BRANCH
 PLANNING, INFRASTRUCTURE & ECONOMIC
 DEVELOPMENT DEPARTMENT, CITY OF OTTAWA



LEGEND

- TOP OF FOUNDATION ELEVATION
- FINISHED FLOOR ELEVATION
- UNDERSIDE OF FOOTING ELEVATION
- NUMBER OF RISERS
- UNITS REQUIRING PRESSURE REDUCING VALVES
- WALKOUT UNITS
- SLAB ON GRADE
- PONDING AREA
- PONDING AREA ID
- PHASING LIMITS
- PROPOSED ELEVATION
- EXISTING ELEVATION
- TOP OF GRATE ELEVATION
- MAJOR OVERLAND FLOW DIRECTION

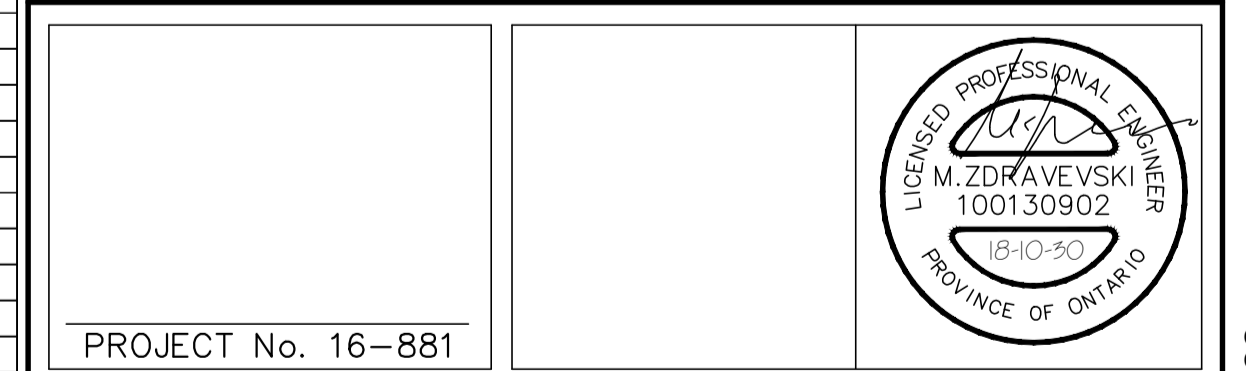
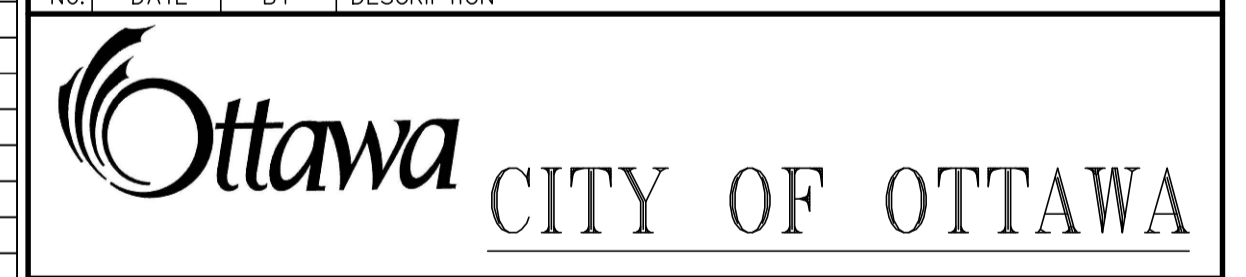
TOPOGRAPHIC INFORMATION
 TOPOGRAPHIC INFORMATION PROVIDED BY J.D. BARNES LIMITED, PROJECT No. 16-10-116-00, SURVEYS DATED NOVEMBER 30, 2017.
LEGAL INFORMATION
 CALCULATED M-PLAN PROVIDED BY J.D. BARNES LIMITED, PROJECT No. 16-10-116-00 (PHASE 1 & 2) DATED SEPTEMBER 14, 2018.

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
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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

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

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



PROJECT No. 16-881

100 YEAR STATIC PONDING AREA AND ICD PLAN
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 ORLEANS VILLAGE



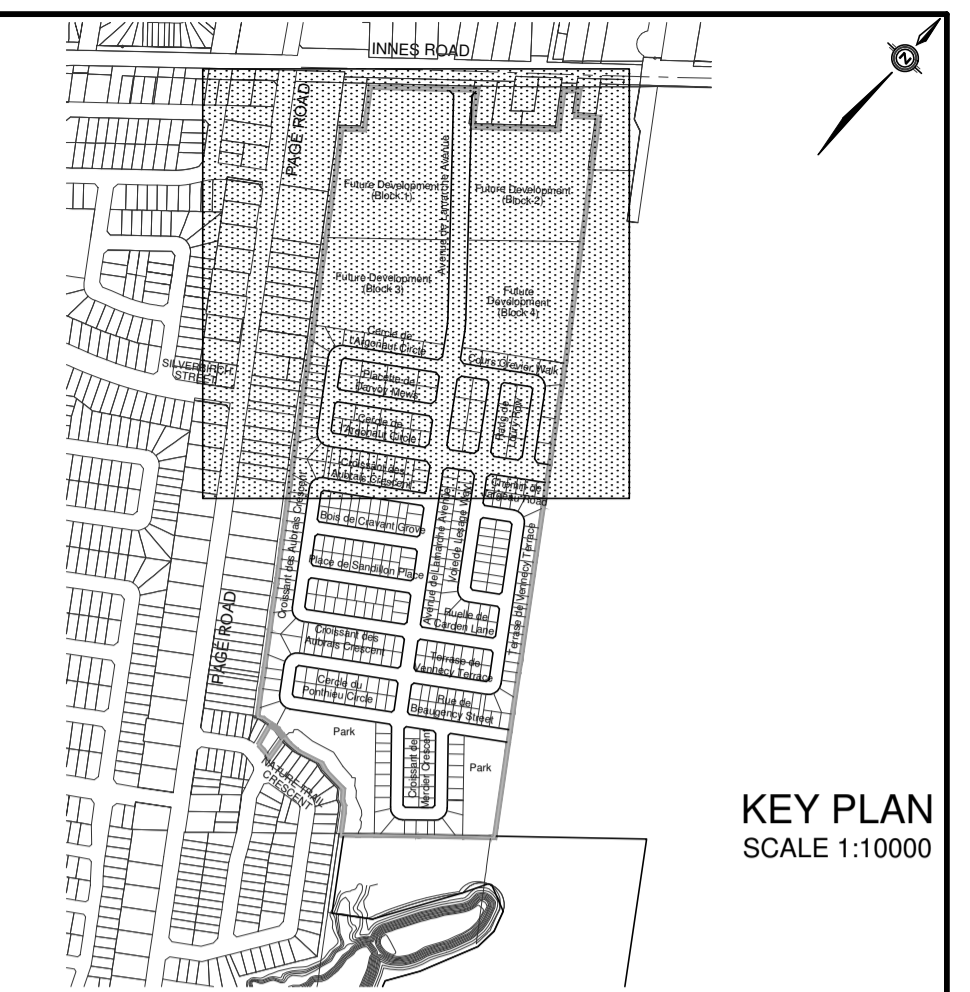
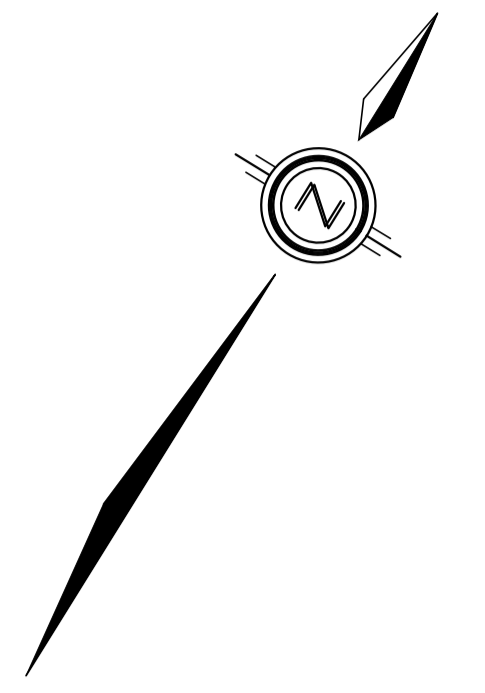
120 Iber Road, Unit 103
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 Tel: (613) 838-8656
 Fax: (613) 838-7183
 www.DSEL.ca

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SCALE: 1:750	DATE: JANUARY 2018		

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



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 0.51

RUNOFF COEFFICIENT

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

CURB INLET CATCHBASIN & LEAD

CATCHBASIN/ MAINTENANCE HOLE

INTERCONNECTED CATCH BASIN & LEADS

CAP

OVERLAND FLOW DIRECTION

EXTERNAL OVERLAND FLOW DIRECTION

EMERGENCY OVERLAND FLOW DIRECTION

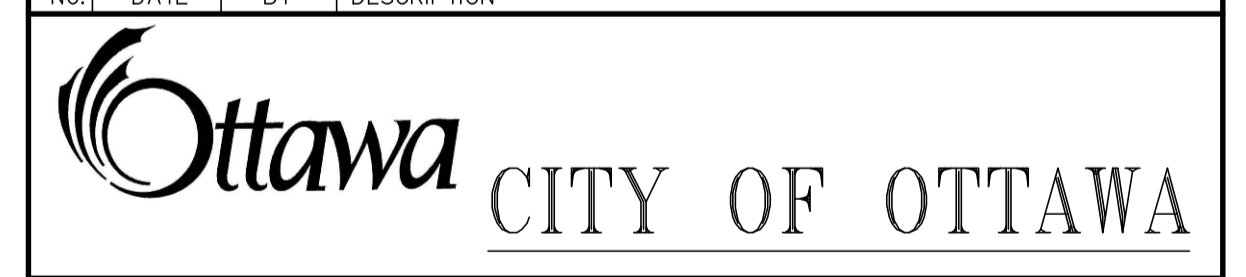
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 TOPOGRAPHIC INFORMATION PROVIDED BY J.D. BARNES LIMITED, PROJECT No. 16-10-116-00, SURVEYS DATED NOVEMBER 30, 2017.

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

EAST URBAN COMMUNITY
 MIXED USE CENTRE
 REFER TO
 DAVID SCHAEFFER ENGINEERING LIMITED
 PROJECT No. 14-733

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



PROJECT No. 16-881

STORM DRAINAGE PLAN © DSEL

CAIVAN (ORLEANS VILLAGE) LIMITED	ORLEANS VILLAGE
DSEL david schaeffer engineering ltd	
120 Iber Road, Unit 103 Stittville, ON K2S 1E9 Tel: (613) 838-8656 Fax: (613) 838-7183 www.DSEL.ca	
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DESIGNED BY: P.P. CHECKED BY: M.Z.	67
SCALE: 1:1000 DATE: JANUARY 2018	

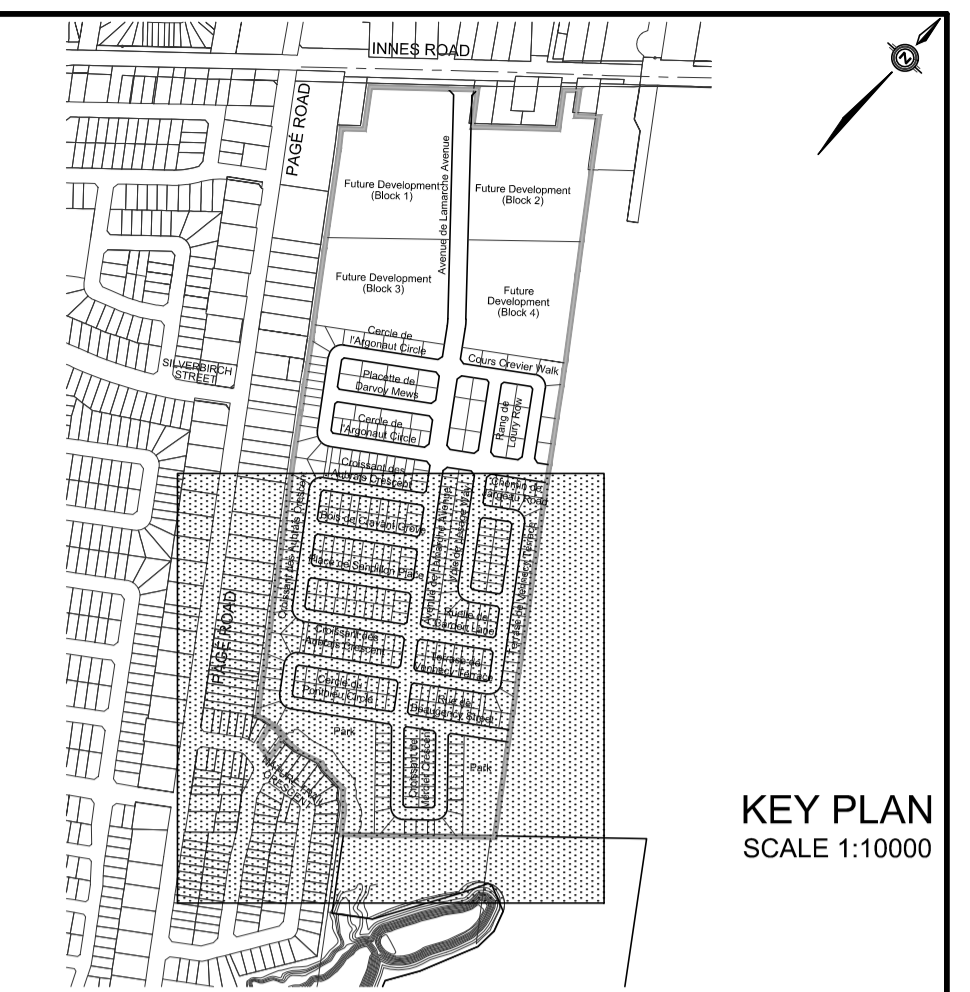
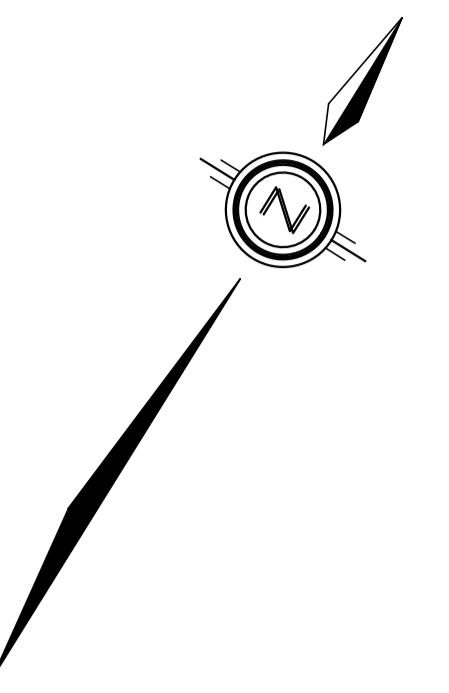
CITY PLAN No. 17675
D07-16-16-0022
CITY FILE No.

REFER TO
 DWG No. 68



REFER TO
DWG No. 67

APPROVED REFUSED
THIS _____ DAY OF _____, 20____
JOSHUA WHITE, P.ENG
PROJECT MANAGER - EAST BRANCH
PLANNING, INFRASTRUCTURE & ECONOMIC
DEVELOPMENT DEPARTMENT, CITY OF OTTAWA



EAST URBAN COMMUNITY
MIXED USE CENTRE
REFER TO
DAVID SCHAEFFER ENGINEERING LIMITED
PROJECT No. 14-733

LEGEND

STORM DRAINAGE BOUNDARY
STORM DRAINAGE BOUNDARY (OTHER PHASES)

UPSTREAM MH TO DOWNSTREAM MH

AREA IN HECTARES

RUNOFF COEFFICIENT

EXTERNAL 2.78AC =

EXTERNAL TIME OF CONCENTRATION

EXTERNAL BLENDED RUNOFF COEFFICIENT

STREET CATCHBASIN & LEAD

STREET CATCHBASIN WITH
CLOSED LID & LEAD
MAINTENANCE HOLE

CURB INLET CATCHBASIN & LEAD

CATCHBASIN/ MAINTENANCE HOLE

INTERCONNECTED CATCH BASIN & LEADS

CAP

OVERLAND FLOW DIRECTION

EXTERNAL OVERLAND FLOW DIRECTION

EMERGENCY OVERLAND FLOW DIRECTION

2.78AC=14.40
TC=14.5 MIN
C=0.70

43-44
0.37 0.51

15' MH202

15' CBM201

TOPOGRAPHIC INFORMATION
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1.	18-01-24	M.Z.	1st SUBMISSION



PROJECT No. 16-881

PROFESSIONAL ENGINEER
M. ZDRAVEVSKI
100130902
18-10-20
PROVINCE OF ONTARIO

STORM DRAINAGE PLAN © DSEL

CAIVAN (ORLEANS VILLAGE) LIMITED

ORLEANS VILLAGE

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D07-16-16-0022
CITY FILE No.



Stormwater Management Report for the Orleans Village Subdivision

City of Ottawa

January 2018
Updated July 2018



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

Prepared for : David Schaeffer Engineering Ltd.

Prepared by :

JFSA

Water Resources and
Environmental Consultants





Stormwater Management Report for the Orleans Village Subdivision

in the City of Ottawa

January 2018
Updated July 2018

Prepared for :

David Schaeffer Engineering Ltd.



Prepared by :

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



Laura Pipkins, P.Eng.

Paul Wilson

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

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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 PI EDTB-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 $0.60 \text{ m}^2/\text{s}$ 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 m³, 395 m³, 451 m³ and 604 m³ for Blocks 147, 148, 149 and 150 (279 m³/ha, 156 m³/ha, 158 m³/ha and 278 m³/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 m³ in single catchbasins, 1.0 m³ in double catchbasins, and 1.9 m³ 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 $C = 0.7 \times \text{imperviousness ratio} + 0.2$.

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 m²/s (refer to Calculation Sheet 1A of Appendix D, where the calculated maximum was 0.068 m²/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 m²/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)	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	DB180N2	0.000	N/A	0.000	0
DB022SW	0.000	N/A	0.000	0	DB180NE	0.000	N/A	0.000	0
DB022W2	0.000	N/A	0.000	0	DB180NW	0.000	N/A	0.000	0
DB024NE	0.000	N/A	0.000	0	DB410NE	0.000	N/A	0.000	0
DB024NW	0.000	N/A	0.000	0	DB410NW	0.000	N/A	0.000	0
DB028N1	0.000	N/A	0.000	0	DB590NE	0.000	N/A	0.000	0
DB028NW	0.000	N/A	0.000	0	DB590NW	0.000	N/A	0.000	0
DB028S1	0.000	N/A	0.000	0	DBOUTNE	0.000	N/A	0.000	0
DB028SW	0.000	N/A	0.000	0	DBOUTNW	0.000	N/A	0.000	0
DB031N1	0.000	N/A	0.000	0	OUT-N	0.000	0.0	0.000	0
DB031NW	0.000	N/A	0.000	0	OUT-S	0.007	0.5	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					

(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 m³/s, 3.830 m³/s and 5.482 m³/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 Chan3a C13 C13b B1 B2 B3 B4	N103	84.758	84.574	IBI (FUT)	N/A	N/A						
	Chan3	83.562	83.403	N/A	N/A	N/A						
	C13b	85.084	83.276	N/A	N/A	N/A						
	MainN	83.276	83.041	N/A	N/A	N/A						
	B2	83.874	83.651	276	85.47	1.596						
	B3	83.651	83.534	275	85.74	2.089						
	B60	83.534	83.090	273	85.68	2.146						
	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)	Dist. From D/S MH (m)	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 m³, 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.

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

The required quality control volume of 14,930 m³ (40 m³/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 m³ exceeds the required volume of 34,724 m³ 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.



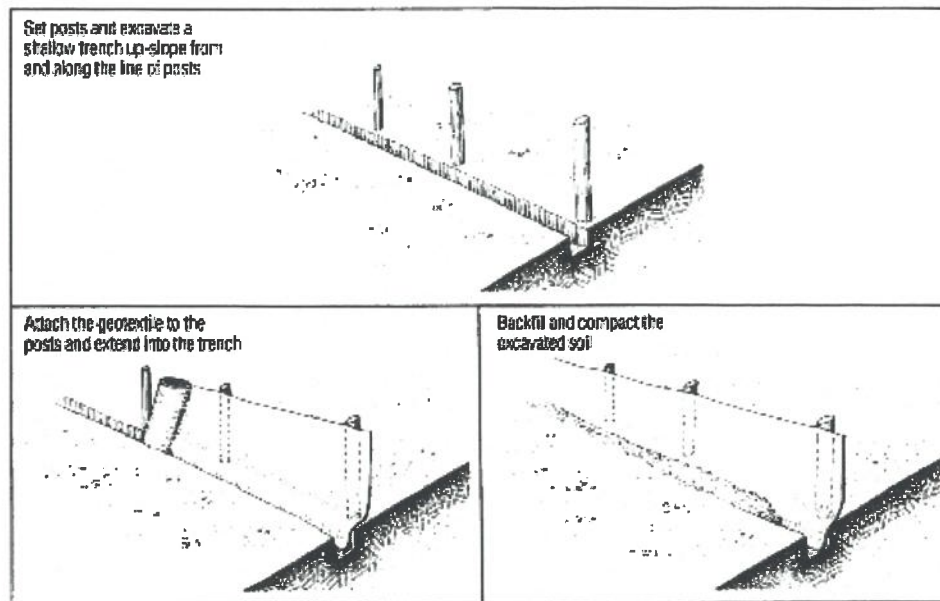


Figure 5: Typical installation of silt fences

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 m³/s, 3.830 m³/s and 5.482 m³/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 m²/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.

