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FUNCTIONAL SERVICING AND STORMWATER MANAGEMENT

FOR

GREATWISE DEVELOPMENTS MORRISON DRIVE/DRAPER AVENUE

CITY OF OTTAWA

PROJECT NO.: 17-927

JUNE 2017 – REV 1

FUNCTIONAL SERVICING AND STORMWATER MANAGEMENT
FOR
MORRISON DRIVE/DRAPER AVENUE

GREATWISE DEVELOPMENTS

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FUNCTIONAL SERVICING AND STORMWATER MANAGEMENT
FOR
MORRISON DRIVE/DRAPER AVENUE
GREATWISE DEVELOPMENTS
JUNE 2017 – REV 1

CITY OF OTTAWA
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1.0 INTRODUCTION

David Schaeffer Engineering Limited (DSEL) has been retained to prepare a Functional Servicing and Stormwater Management report in support of the application for a Site Plan Control (SPC) for the Phase III development at 2781 Baseline Road.

The subject property is located within the City of Ottawa urban boundary, in the College ward. As illustrated in ***Figure 1***, the site is bound by Morrison Drive to the west, Draper Avenue to the north, Baseline Road to the south, and existing residential development to the east. Comprised of two parcels the subject property measures approximately ***2.1 ha*** and is zoned High Density Residential [R5A]. The Phase III development will occupy ***1.3 ha*** of the property.

Figure 1: Site Location

The approved SPC allowed for the Phase I and Phase II developments, Building E and Building F. Building E consists of 80 residential units and Building F consists of 40 residential units and 598 m^2 of commercial space.

The proposed SPC for Phase III would allow for the development of 13 three-storey townhome units. The full build-out is comprised of approximately 73 units with a communal park space. A copy of the Site Plan is included in ***Drawings/Figures***.

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

1.1 Existing Conditions

The site is currently developed as residential, consisting of 4 townhome buildings and a retail office. The existing buildings are serviced by separate water and sewer services off of municipal mains along Morrison drive and Draper Avenue.

The existing site grades range from approximately 73.13m to 75.31m from the northeast to the southwest corner of the property resulting is a grade change of approximately 2.18m.

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

Draper Avenue

- 200 mm diameter CI watermain
- 450 mm diameter concrete storm sewer tributary to Ottawa Central sub-watershed
- 225 mm diameter concrete sanitary sewer tributary to the Pinecrest Collector

Morrison Drive

- 200mm diameter CI watermain
- 300 mm diameter storm sewer, within Morrison Drive, tributary to Ottawa Central sub-watershed
- 300 mm diameter storm sewer, within the subject site, tributary to Ottawa Central sub-watershed
- 225 mm diameter concrete sanitary sewer, within Morrison Drive, tributary to the Pinecrest Collector
- 200 mm diameter concrete sanitary sewer, within the subject site, tributary to the Pinecrest Collector

1.2 Required Permits / Approvals

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

Ontario Water Resources Act (OWRA)s.53 approval will be required from the Ministry of the Environment and Climate Change (MOECC) for sanitary and stormwater discharge to municipally owned sewers and falls under the Transfer of Review process.

1.3 Pre-consultation

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

2.0 GUIDELINES, PREVIOUS STUDIES, AND REPORTS

2.1 Existing Studies, Guidelines, and Reports

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

- **Ottawa Sewer Design Guidelines**,
  City of Ottawa, *SDG002,* October 2012
  (City Standards)

- **Ottawa Design Guidelines – Water Distribution**
  City of Ottawa, July 2010.
  (Water Supply Guidelines)

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

  - **Technical Bulletin ISDTB-2014-02**
    City of Ottawa, May 27, 2014.
    (*ISDTB-2014-02*)

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

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

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

- **Water Supply for Public Fire Protection**
  Fire Underwriters Survey, 1999.
  (FUS)

- **Morrison Court Development Wastewater Servicing Study**
  Novatech Engineering Consultants Ltd., January 2009
  (Existing Wastewater Study)

- **Geotechnical Investigation, Residential Development, Morrison Drive at Draper Avenue, Ottawa, Ontario**
  Paterson Group, Inc., May 2008
  (Geotechnical Investigation)

3.0 WATER SUPPLY SERVICING

3.1 Existing Water Supply Services

The subject property lies within the City of Ottawa 1W pressure zone, as shown by the Pressure Zone Map in ***Appendix B***. Potable water is available to the Phase III development via an existing 200mm CI watermain on Morrison Drive and an existing 200mm CI watermain on Draper Avenue.

3.2 Water Supply Servicing Design

It is proposed that the development will have an internal watermain network with dual connections to the existing 200 mm diameter watermain within Draper Avenue. Townhomes fronting Draper Avenue, Block 2, 4, 9 and 10, and townhomes fronting Morrison Drive, Block 1 and Block 6, will have independent connections to the existing infrastructure via 19mm diameter service laterals. The remaining Blocks will have connections to the internal watermain via 19mm diameter service laterals.

In accordance with City of Ottawa technical bulletin ISDTB-2014-02, redundant service connections will be required due to an anticipated design flow of greater than 50 m^3/day.

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

Table 1
Water Supply Design Criteria

Design Parameter	Value
Residential Townhome	2.7 P/unit
Residential 1 Bedroom Apartment	1.4 P/unit
Residential 2 Bedroom Apartment	2.1 P/unit
Residential Average Daily Demand	350 L/d/P
Residential Maximum Daily Demand	3.6 x Average Daily *
Residential Maximum Hourly	5.4 x Average Daily *
Commercial Floor Space	2.5 L/m^2/d
Commercial Office Space	75 L/9.3m^2/d
Minimum Watermain Size	150mm diameter
Minimum Depth of Cover	2.4m from top of watermain to finished grade
During normal operating conditions desired operating pressure is within	350kPa and 480kPa
During normal operating conditions pressure must not drop below	275kPa
During normal operating conditions pressure must not exceed	552kPa
During fire flow operating pressure must not drop below	140kPa

Daily average based on Appendix 4-A from **Water Supply Guidelines*
*** Residential Max. Daily and Max. Hourly peaking factors per MOE Guidelines for Drinking-Water Systems Table 3-3 for 0 to 500 persons.*
-Table updated to reflect ISD-2010-2

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

Table 2
Water Demand
Proposed Site Conditions

Design Parameter	Anticipated Demand[1] (L/min)	Boundary Condition[2] (m H_2O / kPa)	Boundary Condition[2] (m H_2O / kPa)
Average Daily Demand	48.1	45.8 / 449.3	45.5 / 446.6
Max Day + Fire Flow	173.3 + 12,000 = 12,173.3	19.1 / 187.4	18.8 / 184.7
Peak Hour	259.9	35.0 / 343.4	34.7 / 340.7

1) Water demand calculation per ***Water Supply Guidelines***. See ***Appendix B*** for detailed calculations.
2) Boundary conditions supplied by the City of Ottawa for the demands indicated in the correspondence; assumed ground elevation 71.9m and 72.17m for Connection 1 and 2, respectively. See ***Appendix B.***

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

Using the ***FUS*** method a conservative estimation of fire flow had been established. The following assumptions were assumed:

- Type of construction - Ordinary Construction
- Occupancy type – Combustible
- Sprinkler Protection – Non-Sprinkler System

The above assumptions result in an estimated fire flow of approximately ***12,000 L/min***, actual building materials selected will affect the estimated flow.

The City of Ottawa was contacted to obtain boundary conditions associated with the estimated water demand as indicated in the boundary request correspondence included in ***Appendix B***.

The City provided both the anticipated minimum and maximum water pressures, as well as the estimated water pressure during fire flow demand for the demands as indicated by the correspondence in ***Appendix B***. The minimum and maximum pressures fall within the required range identified in ***Table 1***.

3.3 Water Supply Conclusion

Anticipated water demand under proposed conditions was submitted to the City of Ottawa for establishing boundary conditions.

The anticipated water demand under proposed conditions was submitted to the City of Ottawa for establishing boundary conditions. As demonstrated by ***Table 2***, based on the

City's model, the municipal system is capable of delivering water within the ***Water Supply Guidelines*** pressure range.

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

4.0 WASTEWATER SERVICING

4.1 Existing Wastewater Services

The subject site lies within the Pinecrest Collector Sewer catchment area, as shown by the City sewer mapping included in ***Appendix C***. An existing 225 mm diameter sanitary sewer within Draper Avenue and a 225mm and 200mm diameter sanitary sewer within Morrison Drive is available to service the proposed development.

The existing site consists of residential units contributing wastewater to the local Draper Avenue and Morrison Drive sewer system. The sanitary sewers are tributary to the Pinecrest Trunk Collector sewer approximately 1.4km downstream of the site.

4.2 Wastewater Design

It is proposed that the development will have an internal sanitary sewer network with a connection to the existing 225 mm diameter sanitary sewer within Draper Avenue. Townhomes fronting Draper Avenue, Block 2, 4, 9 and 10, will have independent connections to the existing 225mm diameter sanitary sewer within Draper Avenue via 135mm diameter service laterals. Townhomes fronting Morrison Drive, Block 1 and Block 6, will have independent connections to the existing 200mm diameter sanitary sewer within the subject site via 135mm diameter service laterals. The remaining Blocks will have connections to the internal network via 135mm diameter service laterals.

Table 3 summarizes the ***City Standards*** employed in the design of the proposed wastewater sewer system.

Table 3
Wastewater Design Criteria

Design Parameter	Value
Residential Townhome	2.7 P/unit
Residential 1 Bedroom Apartment	1.4 P/unit
Residential 2 Bedroom Apartment	2.1 P/unit
Average Daily Demand	350 L/d/per
Peaking Factor	Harmon's Peaking Factor. Max 4.0, Min 2.0
Commercial Floor Space	5 L/m^2/d
Commercial Office Space	75 L/9.3m^2/d
Infiltration and Inflow Allowance	0.28L/s/ha
Sanitary sewers are to be sized employing the Manning's Equation	$Q = \frac{1}{n} AR^{2/3} S^{1/2}$
Minimum Sewer Size	200mm diameter
Minimum Manning's 'n'	0.013
Minimum Depth of Cover	2.5m from crown of sewer to grade
Minimum Full Flowing Velocity	0.6m/s
Maximum Full Flowing Velocity	3.0m/s
Extracted from Sections 4 and 6 of the City of Ottawa Sewer Design Guidelines, October 2012.	

Table 4 and ***5*** demonstrate the anticipated peak flow from the proposed development. See ***Appendix C*** for associated calculations.

Table 4
Summary of Estimated Peak Wastewater Flow – Phase III

Design Parameter	Total Flow (L/s)
Estimated Average Dry Weather Flow	0.80
Estimated Peak Dry Weather Flow	3.21
Estimated Peak Wet Weather Flow	3.58

Table 5
Summary of Estimated Peak Wastewater Flow – Ultimate

Design Parameter	Total Flow (L/s)
Estimated Average Dry Weather Flow	1.89
Estimated Peak Dry Weather Flow	7.40
Estimated Peak Wet Weather Flow	8.00

The estimated sanitary flow based on the Site Plan provide in ***Drawings/Figures*** anticipates a peak wet weather flow of ***3.58 L/s***.

4.3 Morrison Drive Sanitary Sewer HGL Assessment

A preliminary assessment of the existing Morrison drive sanitary sewer capacity was conducted by Novatech. This analysis is provided in ***Appendix C*** in the report *Morrison Court Development Wastewater Servicing* Study dated January 26, 2009. The Novatech study used GIS data provided by the City to model the existing sewer network. Their study found that under existing conditions, the minimum freeboard between the hydraulic grade line (HGL) and the lowest connected underside of footing (USF) elevation was **0.33m**.

To support this study, J.F. Sabourin and Associates (JFSA) was retained by Greatwise to re-create the Novatech model of the Morrison Drive sanitary sewer under both existing and proposed Phase I and Phase II conditions. JFSA recreated the Novatech model using XPSWMM, while Novatech had previously used H2OMAP Sewer/Pro. It was therefore anticipated that JFSA would arrive at slightly different results than Novatech when modelling the same system. In the JFSA model it was found that the minimum freeboard was **0.37m**.

To verify existing sanitary pipe inverts and sizes, Stantec Geomatics Ltd. (Stantec) was retained by Greatwise to conduct a field survey along the Morrison Drive sewer. Several differences were present between the existing conditions data provided by Novatech and the survey performed by Stantec. When the surveyed data was input into the model it was found that the minimum freeboard was **0.48m**.

In proposed Phase I and Phase II scenarios, it was found that the minimum freeboard between the HGL and the lowest connected USF was **0.44m**. This is greater than the City of Ottawa's minimum allowable value of 0.30m. An email report from JFSA as well as detailed modeling information is provided in ***Appendix C***. Wastewater Servicing Conclusions

Based on the previous HGL assessment and the email from JFSA dated January 21, 2013, included in the ***Appendix C***, an available capacity of ***8.0 L/s*** was identified. As a result, no changes to the downstream sanitary network is required at this time. As indicated by Table 5 and the ultimate condition sanitary calculation sheet included in ***Appendix C***, there is sufficient capacity to support the proposed ultimate development.

4.4 Wastewater Servicing Conclusions

The site is tributary to the Pinecrest Trunk Collector sewer; based on the sanitary analysis provided by JFSA, sufficient capacity is available to accommodate the anticipated ***3.58 L/s*** peak wet weather flow from the proposed development.

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

5.0 STORMWATER MANAGEMENT

5.1 Existing Stormwater Services

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

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

The existing site is serviced by existing storm sewers which outlet to Morrison Drive and Draper Avenue. Drainage is routed north along Morrison Drive, then west to the outlet at a tributary to Graham Creek, approximately 1.5km away.

It was determined that the existing development contained no stormwater management controls for flow attenuation. The estimated pre-development peak flows for the 2, 5, and 100-year are summarized in ***Table 6***:

Table 6
Summary of Existing Peak Storm Flow Rates

City of Ottawa Design Storm	Estimated Peak Flow Rate (L/s)
2-year	141.4
5-year	191.6
100-year	409.9

5.2 Post-development Stormwater Management Target

Stormwater management requirements for the proposed development were established using the City of Ottawa standards, where the proposed development is required to:

- Meet an allowable release rate based on a Rational Method Coefficient of 0.50, employing the City of Ottawa IDF parameters for a 5-year storm with a calculated time of concentration greater than or equal to 10 minutes.
- Attenuate all storms up to and including the City of Ottawa 100-year design event are to be attenuated on site.
- The RVCA has been contacted in regards to quality requirements. No response was received at the time of publication.

Based on the above the allowable release rate for the proposed development is ***170.7 L/s***.

5.3 Proposed Stormwater Management System

The proposed stormwater management system will include private catch basin and storm sewer system with an underground storage unit to achieve the target release rates. The stormwater management design is proposed to consist of a private storm sewer system with a connection to the existing 450mm diameter storm sewer within the Draper Avenue right-of-way.

Townhomes fronting Draper Avenue, Block 2, 4, 9 and 10, will have independent connections to the existing 450mm diameter storm sewer within Draper Avenue via 100mm diameter service laterals. Townhomes fronting Morrison Drive, Block 1 and Block 6, will have independent connections to the existing 300mm diameter storm sewer within the subject site via 100mm diameter service laterals. The remaining Blocks will have connections to the internal network via 100mm diameter service laterals.

The hydrology and hydraulics of the proposed stormwater management system were analyzed in EPASWMM using the Dynamic Wave Routing Model. This method best analyzes stormwater systems with respect to pressure flow and backwater impacts, necessary when analyzing a system with ICDs in series. The following was extracted from the EPASWMM manual:

> *Dynamic Wave routing solves the complete one-dimensional Saint Venant flow equations and therefore produces the most theoretically accurate results. These equations consist of the continuity and momentum equations for conduits and a volume continuity equation at nodes.*
>
> *With this form of routing it is possible to represent pressurized flow when a closed conduit becomes full, such that flows can exceed the full normal flow value. Flooding occurs when the water depth at a node exceeds the maximum available depth, and the excess flow is either lost from the system or can pond atop the node and re-enter the drainage system.*
>
> *Dynamic wave routing can account for channel storage, backwater, entrance/exit losses, flow reversal, and pressurized flow. Because it couples together the solution for both water levels at nodes and flow in conduits it can be applied to any general network layout, even those containing multiple downstream diversions and loops. It is the method of choice for systems subjected to significant backwater effects due to downstream flow restrictions and with flow regulation via weirs and orifices. This generality comes at a price of having to use much smaller time steps, on the order of a minute or less (SWMM can automatically reduce the user-defined maximum time step as needed to maintain numerical stability).*
>
> *Each of these routing methods employs the Manning equation to relate flow rate to flow depth and bed (or friction) slope.*

A model schematic and output files are included in ***Appendix D***.

5.3.1 Model Assumptions

The following assumptions were made in the preparation for the EPASWMM model:

- Hydrology

- Initial abstraction parameters per City of Ottawa standards.
- Horton's infiltration for soil loss, per City guidelines.
- Estimated % impervious area assuming limited vegetation / effective perviousness.
- Sub-catchment width measured as perpendicular area to catch basins for longest distance of travel.

- Hydraulics
  - Storage Nodes represent both surface and subsurface components. Each node is assigned an invert elevation that corresponds with the tributary catch basin.
  - "Regular" Node represent either connections to the sewer main or strategic maintenance hole locations. Not all structures have been included in model.
  - All conduits have been assigned a Mannings n = 0.013.
  - Orifices are all side mounted circular and have a 0.61 discharge coefficient.

Table 7 summarizes the storage volumes within each subcatchment.

Table 7: Available Subcatchment Storage Volumes

Catchment ID	Underground Storage (m^3)
X3	193

Table 8 summarizes the assumptions made for the EPASWMM model.

Table 8: Drainage Area Storage Volume Analysis 100-Year 6-Hour Storm

Catchment ID	Outlet	Total Area (ha)	Percent Impervious (%)	Width (m)	Percent Slope (%)
B1	STM102	0.484	53	48	4.0
B2	STM103	0.200	73	76	4.0
B3	STM103B	0.129	66	64	4.0
B4	STM107	0.321	77	77	4.0
U1	-	0.197	75	145	5.0

5.3.2 Quantity Control Requirements

In order to achieve the allowable post-development stormwater runoff release rate identified in Section 5.2 above, the proposed development will utilize subsurface storage.

The private stormwater sewer system has been sized to convey an uncontrolled 5-year storm runoff rate in accordance with the ***City Standards***. Detailed layout and sizing is illustrated by ***SSP-1*** included with this report and the sewer calculation sheet in ***Appendix D***.

Surface runoff from onsite landscaping, sidewalks, access lanes and parking areas will be directed to a catchbasin system. The private storm sewer system and underground storage system will attenuate flow using a ***160mm*** ICD within STM102.

During storms greater than the 100-year event, runoff is directly via overland flow routes to multiple spill points. The overland flow route is designed to provide 0.30m freeboard between the spill point and the first floor elevation of all adjacent buildings.

Table 9 summarizes the storage volume provided per drainage area.

Table 9: Drainage Area Storage Volume Analysis 100-Year 6-Hour Storm

Catchment ID	Structure ID	Average Volume (1000 m^3)	Average Percent Full (%)	Required Volume (1000 m^3)	Available Percent Full (%)	Maximum Outflow (L/s)	Spill-over Elevation (m)
B3	STM103B	0.015	4	0.272	81	51.47	71.86

Table 10 summarizes the results of the EPASWMM model at the outfall.

Table 10: Summary of Storage and Peak Flow Rates for the 6-Hour Chicago Storm Distribution

Outfall Node	Average Flow (L/s)	Maximum Flow (L/s)
1 (Attenuated)	26.83	74.34
2 (Unattenuated)	6.47	94.77
Site (System)[1]	33.29	168.00
1) Please note that the system flow rate is not cumulative as the model accounts for varying time to peaks.		

Based on the EPASWMM analysis, the site is capable of attenuating to the allowable release rate of ***170.7 L/s*** as indicated by consultation with the City of Ottawa. A model schematic and output files are included in ***Appendix D***.

5.4 Stormwater Servicing Conclusions

Based on the EPASWMM analysis, the site is capable of attenuating to the allowable release rate of ***170.7 L/s*** as indicated by consultation with the City of Ottawa. A model schematic and output files are included in ***Appendix D***.

The RVCA has been contacted in regards to quality requirements. No response was received at the time of publication.

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

6.0 UTILITIES

Utility servicing will be coordinated with the individual utility companies prior to site development.

7.0 EROSION AND SEDIMENT CONTROL

Soil erosion occurs naturally and is a function of soil type, climate and topography. The extent of erosion losses is exaggerated during construction where vegetation has been removed and the top layer of soil becomes agitated.

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

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

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

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

Erosion and sediment controls must be in place during construction. The following recommendations to the contractor will be included in contract documents.

- Limit extent of exposed soils at any given time.
- Re-vegetate exposed areas as soon as possible.
- Minimize the area to be cleared and grubbed.
- Protect exposed slopes with plastic or synthetic mulches.
- Install silt fence to prevent sediment from entering existing ditches.
- No refueling or cleaning of equipment near existing watercourses.
- Provide sediment traps and basins during dewatering.
- Install filter cloth between catch basins and frames.
- Plan construction at proper time to avoid flooding.

Establish material stockpiles away from watercourses, so that barriers and filters may be installed.

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

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

8.0 CONCLUSION AND RECOMMENDATIONS

David Schaeffer Engineering Ltd. (DSEL) has been retained to prepare a Functional Servicing and Stormwater Management report in support of the application for a Site Plan Control (SPC) at 2781 Baseline Road. The preceding report outlines the following:

- Based on boundary conditions provided by the City the existing municipal water infrastructure is capable of providing the proposed development with water within the City's required pressure range;
- The FUS method for estimating fire flow indicated ***12,000 L/min*** is required for the proposed development,
- The proposed development is anticipated to have a peak wet weather flow of ***3.58 L/s***; Based on the sanitary analysis prepared by JFSA, the existing municipal sewer infrastructure has sufficient capacity to support the development;
- Based on consultation with the City of Ottawa, the proposed development will be required to attenuate post development flows to an equivalent release rate of ***170.7 L/s*** for all storms up to and including the 100-year storm event;
- It is contemplated that stormwater objectives may be met through storm water retention via subsurface storage, it is anticipated that a ***193 m^3*** underground storage system will be required to attenuate flow to the established release rate above;
- The RVCA has been contacted in regards to quality requirements. No response was received at the time of publication;
- Any development on the subject property may require Ontario Water Resources Act (OWRA) s.53 approval from the Ministry of the Environment (MOE) for sanitary and stormwater discharge.

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APPENDIX A

Pre-Consultation

DEVELOPMENT SERVICING STUDY CHECKLIST

17-927 01/06/2017

4.1 General Content		
☐	Executive Summary (for larger reports only).	N/A
☒	Date and revision number of the report.	Report Cover Sheet
☒	Location map and plan showing municipal address, boundary, and layout of proposed development.	Drawings/Figures
☒	Plan showing the site and location of all existing services.	Figure 1
☒	Development statistics, land use, density, adherence to zoning and official plan, and reference to applicable subwatershed and watershed plans that provide context to applicable subwatershed and watershed plans that provide context to which individual developments must adhere.	Section 1.0
☒	Summary of Pre-consultation Meetings with City and other approval agencies.	Section 1.3
☒	Reference and confirm conformance to higher level studies and reports (Master Servicing Studies, Environmental Assessments, Community Design Plans), or in the case where it is not in conformance, the proponent must provide justification and develop a defendable design criteria.	Section 2.1
☒	Statement of objectives and servicing criteria.	Section 1.0
☒	Identification of existing and proposed infrastructure available in the immediate area.	Sections 3.1, 4.1, 5.1
☐	Identification of Environmentally Significant Areas, watercourses and Municipal Drains potentially impacted by the proposed development (Reference can be made to the Natural Heritage Studies, if available).	N/A
☒	Concept level master grading plan to confirm existing and proposed grades in the development. This is required to confirm the feasibility of proposed stormwater management and drainage, soil removal and fill constraints, and potential impacts to neighbouring properties. This is also required to confirm that the proposed grading will not impede existing major system flow paths.	GP-1
☐	Identification of potential impacts of proposed piped services on private services (such as wells and septic fields on adjacent lands) and mitigation required to address potential impacts.	N/A
☐	Proposed phasing of the development, if applicable.	N/A
☒	Reference to geotechnical studies and recommendations concerning servicing.	Section 1.4
☒	All preliminary and formal site plan submissions should have the following information: -Metric scale -North arrow (including construction North) -Key plan -Name and contact information of applicant and property owner -Property limits including bearings and dimensions -Existing and proposed structures and parking areas -Easements, road widening and rights-of-way -Adjacent street names	SSP-1

4.2 Development Servicing Report: Water		
☐	Confirm consistency with Master Servicing Study, if available	N/A
☒	Availability of public infrastructure to service proposed development	Section 3.1
☒	Identification of system constraints	Section 3.1
☒	Identify boundary conditions	Section 3.1, 3.2
☒	Confirmation of adequate domestic supply and pressure	Section 3.3

*Extracted from the City of Ottawa-Servicing Study Guidelines for Development Applications

☒	Confirmation of adequate fire flow protection and confirmation that fire flow is calculated as per the Fire Underwriter's Survey. Output should show available fire flow at locations throughout the development.	Section 3.2
☐	Provide a check of high pressures. If pressure is found to be high, an assessment is required to confirm the application of pressure reducing valves.	N/A
☐	Definition of phasing constraints. Hydraulic modeling is required to confirm servicing for all defined phases of the project including the ultimate design	N/A
☐	Address reliability requirements such as appropriate location of shut-off valves	N/A
☐	Check on the necessity of a pressure zone boundary modification	N/A
☒	Reference to water supply analysis to show that major infrastructure is capable of delivering sufficient water for the proposed land use. This includes data that shows that the expected demands under average day, peak hour and fire flow conditions provide water within the required pressure range	Section 3.2, 3.3
☐	Description of the proposed water distribution network, including locations of proposed connections to the existing system, provisions for necessary looping, and appurtenances (valves, pressure reducing valves, valve chambers, and fire hydrants) including special metering provisions.	N/A
☐	Description of off-site required feedermains, booster pumping stations, and other water infrastructure that will be ultimately required to service proposed development, including financing, interim facilities, and timing of implementation.	N/A
☒	Confirmation that water demands are calculated based on the City of Ottawa Design Guidelines.	Section 3.2
☐	Provision of a model schematic showing the boundary conditions locations, streets, parcels, and building locations for reference.	N/A

4.3 Development Servicing Report: Wastewater

☒	Summary of proposed design criteria (Note: Wet-weather flow criteria should not deviate from the City of Ottawa Sewer Design Guidelines. Monitored flow data from relatively new infrastructure cannot be used to justify capacity requirements for proposed infrastructure).	Section 4.2
☐	Confirm consistency with Master Servicing Study and/or justifications for deviations.	N/A
☐	Consideration of local conditions that may contribute to extraneous flows that are higher than the recommended flows in the guidelines. This includes groundwater and soil conditions, and age and condition of sewers.	N/A
☒	Description of existing sanitary sewer available for discharge of wastewater from proposed development.	Section 4.1
☒	Verify available capacity in downstream sanitary sewer and/or identification of upgrades necessary to service the proposed development. (Reference can be made to previously completed Master Servicing Study if applicable)	Section 4.2
☒	Calculations related to dry-weather and wet-weather flow rates from the development in standard MOE sanitary sewer design table (Appendix 'C') format.	Section 4.2, Appendix C
☒	Description of proposed sewer network including sewers, pumping stations, and forcemains.	Section 4.2
☐	Discussion of previously identified environmental constraints and impact on servicing (environmental constraints are related to limitations imposed on the development in order to preserve the physical condition of watercourses, vegetation, soil cover, as well as protecting against water quantity and quality).	N/A

*Extracted from the City of Ottawa-Servicing Study Guidelines for Development Applications

☐	Pumping stations: impacts of proposed development on existing pumping stations or requirements for new pumping station to service development.	N/A
☐	Forcemain capacity in terms of operational redundancy, surge pressure and maximum flow velocity.	N/A
☐	Identification and implementation of the emergency overflow from sanitary pumping stations in relation to the hydraulic grade line to protect against basement flooding.	N/A
☐	Special considerations such as contamination, corrosive environment etc.	N/A

4.4 Development Servicing Report: Stormwater Checklist

☒	Description of drainage outlets and downstream constraints including legality of outlets (i.e. municipal drain, right-of-way, watercourse, or private property)	Section 5.1
☒	Analysis of available capacity in existing public infrastructure.	Section 5.1, Appendix D
☒	A drawing showing the subject lands, its surroundings, the receiving watercourse, existing drainage patterns, and proposed drainage pattern.	Drawings/Figures
☒	Water quantity control objective (e.g. controlling post-development peak flows to pre-development level for storm events ranging from the 2 or 5 year event (dependent on the receiving sewer design) to 100 year return period); if other objectives are being applied, a rationale must be included with reference to hydrologic analyses of the potentially affected subwatersheds, taking into account long-term cumulative effects.	Section 5.2
☒	Water Quality control objective (basic, normal or enhanced level of protection based on the sensitivities of the receiving watercourse) and storage requirements.	Section 5.2
☒	Description of the stormwater management concept with facility locations and descriptions with references and supporting information	Section 5.3
☐	Set-back from private sewage disposal systems.	N/A
☐	Watercourse and hazard lands setbacks.	N/A
☒	Record of pre-consultation with the Ontario Ministry of Environment and the Conservation Authority that has jurisdiction on the affected watershed.	Appendix A
☐	Confirm consistency with sub-watershed and Master Servicing Study, if applicable study exists.	N/A
☒	Storage requirements (complete with calculations) and conveyance capacity for minor events (1:5 year return period) and major events (1:100 year return period).	Section 5.3
☐	Identification of watercourses within the proposed development and how watercourses will be protected, or, if necessary, altered by the proposed development with applicable approvals.	N/A
☒	Calculate pre and post development peak flow rates including a description of existing site conditions and proposed impervious areas and drainage catchments in comparison to existing conditions.	Section 5.1, 5.3
☐	Any proposed diversion of drainage catchment areas from one outlet to another.	N/A
☐	Proposed minor and major systems including locations and sizes of stormwater trunk sewers, and stormwater management facilities.	N/A
☐	If quantity control is not proposed, demonstration that downstream system has adequate capacity for the post-development flows up to and including the 100-year return period storm event.	N/A
☐	Identification of potential impacts to receiving watercourses	N/A
☐	Identification of municipal drains and related approval requirements.	N/A

*Extracted from the City of Ottawa-Servicing Study Guidelines for Development Applications

☒	Descriptions of how the conveyance and storage capacity will be achieved for the development.	Section 5.3
☐	100 year flood levels and major flow routing to protect proposed development from flooding for establishing minimum building elevations (MBE) and overall grading.	N/A
☐	Inclusion of hydraulic analysis including hydraulic grade line elevations.	N/A
☒	Description of approach to erosion and sediment control during construction for the protection of receiving watercourse or drainage corridors.	Section 6.0
☐	Identification of floodplains – proponent to obtain relevant floodplain information from the appropriate Conservation Authority. The proponent may be required to delineate floodplain elevations to the satisfaction of the Conservation Authority if such information is not available or if information does not match current conditions.	N/A
☐	Identification of fill constraints related to floodplain and geotechnical investigation.	N/A

4.5 Approval and Permit Requirements: Checklist

☒	Conservation Authority as the designated approval agency for modification of floodplain, potential impact on fish habitat, proposed works in or adjacent to a watercourse, cut/fill permits and Approval under Lakes and Rivers Improvement Act. The Conservation Authority is not the approval authority for the Lakes and Rivers Improvement ct. Where there are Conservation Authority regulations in place, approval under the Lakes and Rivers Improvement Act is not required, except in cases of dams as defined in the Act.	Section 1.2
☐	Application for Certificate of Approval (CofA) under the Ontario Water Resources Act.	N/A
☐	Changes to Municipal Drains.	N/A
☐	Other permits (National Capital Commission, Parks Canada, Public Works and Government Services Canada, Ministry of Transportation etc.)	N/A

4.6 Conclusion Checklist

☒	Clearly stated conclusions and recommendations	Section 8.0
☐	Comments received from review agencies including the City of Ottawa and information on how the comments were addressed. Final sign-off from the responsible reviewing agency.	
☐	All draft and final reports shall be signed and stamped by a professional Engineer registered in Ontario	

*Extracted from the City of Ottawa-Servicing Study Guidelines for Development Applications

APPENDIX B

Water Supply

Greatwise Developments
Morrison Drive/
Draper Avenue
Existing Site Conditions

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

Domestic Demand

Type of Housing	Per / Unit	Units	Pop
Single Family	3.4		0
Semi-detached	2.7		0
Townhouse	2.7	84	227
Apartment			0
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	227	79.5	55.2	286.0	198.6	429.0	297.9

Institutional / Commercial / Industrial Demand

Property Type	Unit Rate	Units	Avg. Daily m^3/d	Avg. Daily L/min	Max Day m^3/d	Max Day L/min	Peak Hour m^3/d	Peak Hour L/min
Commercial floor space	2.5 $L/m^2/d$		0.00	0.0	0.0	0.0	0.0	0.0
Office	75 $L/9.3m^2/d$		0.00	0.0	0.0	0.0	0.0	0.0
Industrial - Light	35,000 L/gross ha/d		0.00	0.0	0.0	0.0	0.0	0.0
Industrial - Heavy	55,000 L/gross ha/d		0.00	0.0	0.0	0.0	0.0	0.0
		Total I/CI Demand	0.0	0.0	0.0	0.0	0.0	0.0
		Total Demand	**79.5**	**55.2**	**286.0**	**198.6**	**429.0**	**297.9**

Greatwise Developments
Morrison Drive/
Draper Avenue
Proposed Site Conditions - Phase II

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

Domestic Demand

Type of Housing	Per / Unit	Units	Pop
Single Family	3.4		0
Semi-detached	2.7		0
Townhouse	2.7	73	198
Apartment			0
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	198	69.3	48.1	249.5	173.3	374.2	259.9

Institutional / Commercial / Industrial Demand

Property Type	Unit Rate	Units	Avg. Daily m^3/d	Avg. Daily L/min	Max Day m^3/d	Max Day L/min	Peak Hour m^3/d	Peak Hour L/min
Commercial floor space	2.5 $L/m^2/d$		0.00	0.0	0.0	0.0	0.0	0.0
Office	75 $L/9.3m^2/d$		0.00	0.0	0.0	0.0	0.0	0.0
Industrial - Light	35,000 L/gross ha/d		0.00	0.0	0.0	0.0	0.0	0.0
Industrial - Heavy	55,000 L/gross ha/d		0.00	0.0	0.0	0.0	0.0	0.0
		Total I/CI Demand	0.0	0.0	0.0	0.0	0.0	0.0
		Total Demand	**69.3**	**48.1**	**249.5**	**173.3**	**374.2**	**259.9**

Greatwise Developments
Morrison Drive/
Draper Avenue
Proposed Site Conditions - Ultimate

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

Domestic Demand

Type of Housing	Per / Unit	Units	Pop	
Single Family	3.4		0	
Semi-detached	2.7		0	
Townhouse	2.7	73	198	*Phase 2 Townhomes*
Apartment			0	
Existing Building E				
1 Bedroom	1.4	56	79	
2 Bedroom	2.1	24	51	
Building F				
1 Bedroom	1.4	34	48	
2 Bedroom	2.1	36	76	

	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	452	158.2	109.9	458.8	318.6	680.3	472.4

Institutional / Commercial / Industrial Demand

			Avg. Daily		Max Day		Peak Hour	
Property Type	**Unit Rate**	**Units**	m^3/d	L/min	m^3/d	L/min	m^3/d	L/min
Commercial floor space	2.5 $L/m^2/d$	225	0.56	0.4	0.8	0.6	1.5	1.1
Office	75 $L/9.3m^2/d$	325	2.62	1.8	3.9	2.7	7.1	4.9
Industrial - Light	35,000 L/gross ha/d		0.00	0.0	0.0	0.0	0.0	0.0
Industrial - Heavy	55,000 L/gross ha/d		0.00	0.0	0.0	0.0	0.0	0.0
		Total I/CI Demand	3.2	2.2	4.8	3.3	8.6	6.0
		Total Demand	**161.4**	**112.1**	**463.6**	**321.9**	**688.9**	**478.4**

Fire Flow Estimation per Fire Underwriters Survey

Water Supply For Public Fire Protection - 1999

Fire Flow Required

1. Base Requirement

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

Type of Construction: Ordinary Construction

C	1		*Type of Construction Coefficient per FUS Part II, Section 1*
A	1026.6	m^2	*Total floor area based on FUS Part II section 1*

Fire Flow	7048.9	L/min	
	7000.0	**L/min**	*rounded to the nearest 1,000 L/min*

Adjustments

2. Reduction for Occupancy Type

Combustible	0%
Fire Flow	**7000.0 L/min**

3. Reduction for Sprinkler Protection

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

4. Increase for Separation Distance

N	0m-3m	25%	
S	3.1m-10m	20%	
E	10.1m-20m	15%	
W	10.1m-20m	15%	
	% Increase	**75%**	*value not to exceed 75% per FUS Part II, Section 4*

Increase	**5250.0 L/min**

Total Fire Flow

Fire Flow	12250.0	L/min	*fire flow not to exceed 45,000 L/min nor be less than 2,000 L/min per FUS Section*
	12000.0	**L/min**	*rounded to the nearest 1,000 L/min*

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

Boundary Conditions Unit Conversion

Connection 1 (WEST)

	Height (m)	Elevation (m	m H_2O	PSI	kPa		L/s	L/min
Avg. DD	117.7	71.9	45.8	65.2	449.3	Fire Flow @ 140kPa	200	12000
Fire Flow	91.0	71.9	19.1	27.2	187.4			
Peak Hour	106.9	71.9	35.0	49.8	343.4			

Connection 2 (EAST)

	Height (m)	Elevation (m	m H_2O	PSI	kPa		L/s	L/min
Avg. DD	117.7	72.17	45.5	64.8	446.6	Fire Flow @ 140kPa	200	12000
Fire Flow	91.0	72.17	18.8	26.8	184.7			
Peak Hour	106.9	72.17	34.7	49.4	340.7			

Alison Gosling

To: Fraser, Mark
Subject: RE: 22781 Baseline Road Phase II - Boundary condition request

From: Fraser, Mark [mailto:Mark.Fraser@ottawa.ca]
Sent: Friday, June 9, 2017 12:00 PM
To: Alison Gosling <AGosling@dsel.ca>
Subject: RE: 22781 Baseline Road Phase II - Boundary condition request

Hi Alison,

Please find below water distribution boundary conditions for hydraulic analysis as requested based on the provided anticipated water demands:

Proposed Development Location: **2781 Baseline Road**
Average Day = 48.1 L/s and 0.80 L.s
Max Day = 173.3 L/s and 2.89 L/s
Peak Hour = 259.9 L/s and 4.33 L/s
Fire Flow = 12,000 L/min

City of Ottawa Boundary Conditions:

The following are boundary conditions, HGL, for hydraulic analysis at 2781 Baseline (zone 1W) assumed to be connected to the 203mm on Draper Ave (see attached PDF for location).

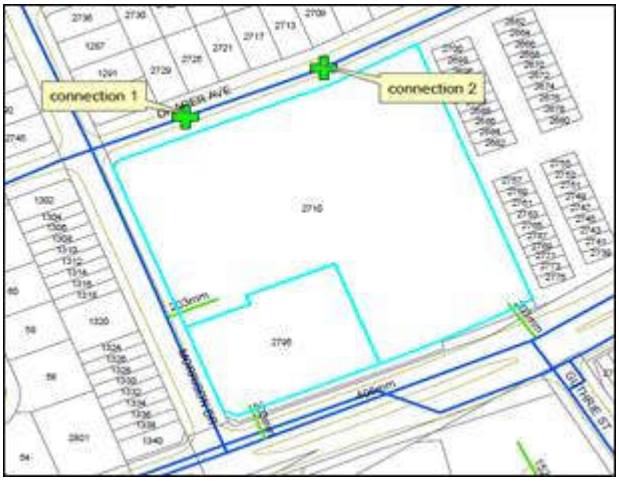
Minimum HGL = **106.9m**

Maximum HGL = **117.7m**

MaxDay (2.9 L/s) + FireFlow (200 L/s) = **91.0m**

Note: HGL is the same at both connections

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



Please refer to City of Ottawa, *Ottawa Design Guidelines – Water Distribution*, First Edition, July 2010, WDG001 Clause 4.2.2 for watermain pressure and demand objectives.

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.

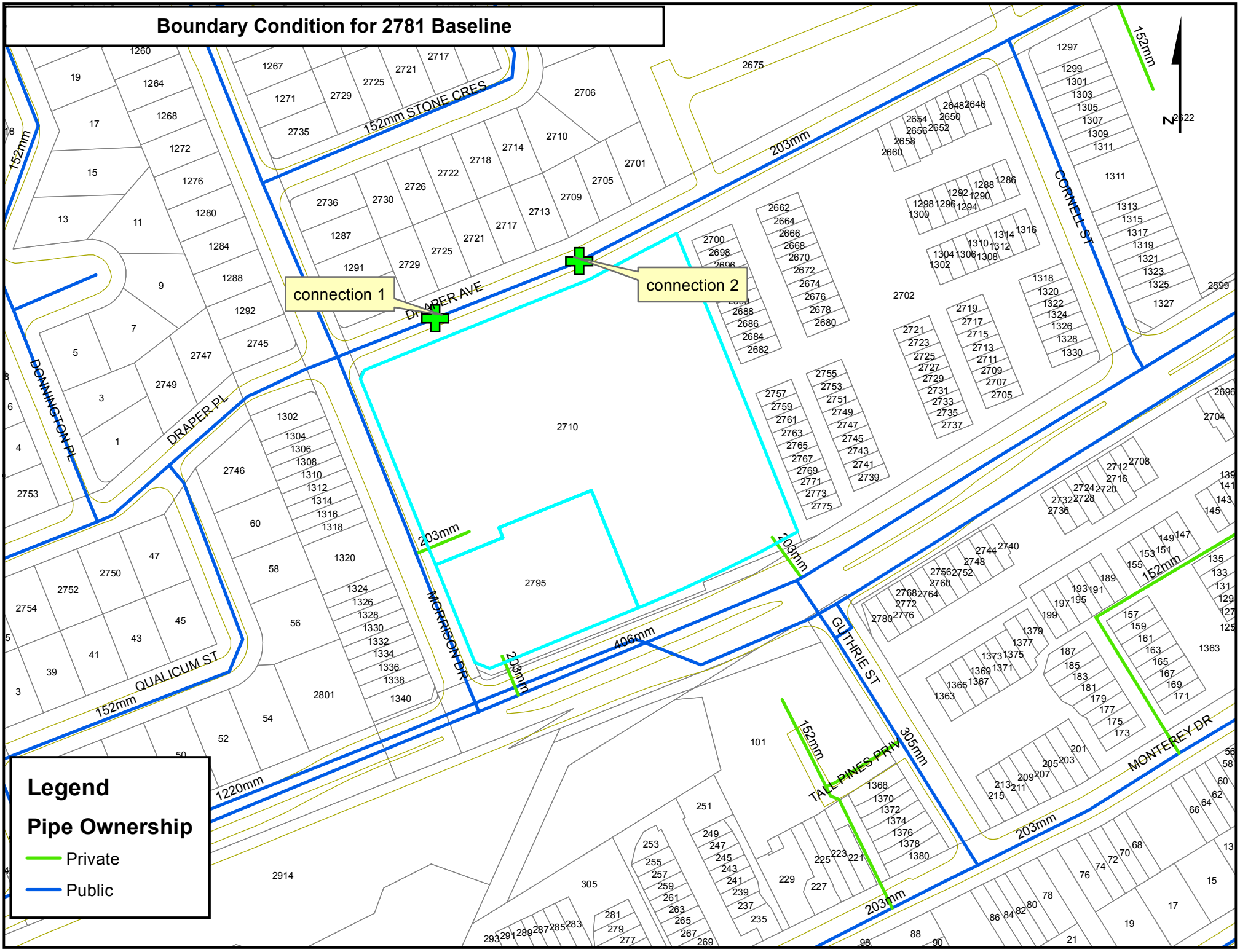
If you have any questions or require any clarification please let me know.

Regards,

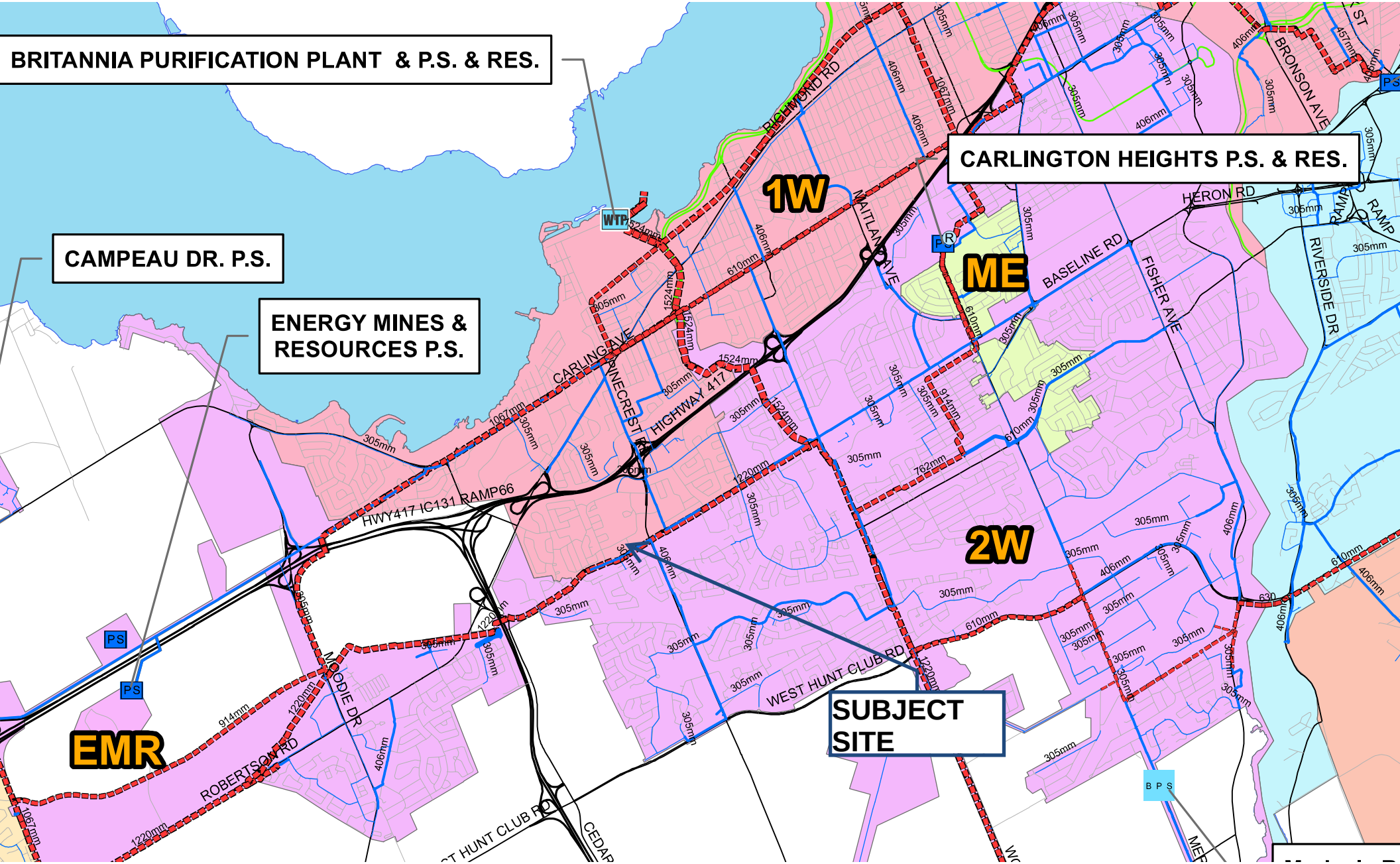
Mark Fraser
Project Manager, Planning Services
Development Review West Branch
City of Ottawa | Ville d'Ottawa
Planning, Infrastructure and Economic Development Department
110 Laurier Avenue West. 4th Floor, Ottawa ON, K1P 1J1
Tel:613.580.2424 ext. 27791
Fax: 613-580-2576
Mail: Code 01-14
Email: Mark.Fraser@ottawa.ca

*Please consider your environmental responsibility before printing this e-mail

Boundary Condition for 2781 Baseline



City of Ottawa - Water Distribution System



APPENDIX C

Wastewater Collection

Greatwise Developments
Morrison Drive/
Draper Avenue
Existing Conditions

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

Site Area 2.130 **ha**

Extraneous Flow Allowances

Infiltration / Inflow **0.60 L/s**

Domestic Contributions

Unit Type	Unit Rate	Units	Pop
Single Family	3.4		0
Semi-detached and duplex	2.7		0
Duplex	2.3		0
Townhouse	2.7	84	227
Apartment			
Bachelor	1.4		0
1 Bedroom	1.4		0
2 Bedroom	2.1		0
3 Bedroom	3.1		0
Average	1.8		0

Total Pop **227**

Average Domestic Flow **0.92 L/s**

Peaking Factor **4**

Peak Domestic Flow **3.68 L/s**

Institutional / Commercial / Industrial Contributions

Property Type	Unit Rate		No. of Units	Avg Wastewater (L/s)
Commercial floor space*	5	$L/m^2/d$		0.00
Office	75	$L/9.3m^2/d$		0.00
Restaurant**	125	L/seat/d		0.00
Industrial - Light***	35,000	L/gross ha/d		0.00
Industrial - Heavy***	55,000	L/gross ha/d		0.00

Average I/C/I Flow **0.00**

Peak Institutional / Commercial Flow 0.00
Peak Industrial Flow** 0.00
Peak I/C/I Flow **0.00**

** assuming a 12 hour commercial operation*
*** Estimated number of seats at 1 seat per 9.3m²*
*** peak industrial flow per City of Ottawa Sewer Design Guidelines Appendix 4B*

Total Estimated Average Dry Weather Flow Rate	**0.92 L/s**
Total Estimated Peak Dry Weather Flow Rate	**3.68 L/s**
Total Estimated Peak Wet Weather Flow Rate	**4.27 L/s**

Greatwise Developments
Morrison Drive/Draper Avenue
Proposed Site Conditions - Phase II

Wastewater Design Flows per Unit Count
City of Ottawa Sewer Design Guidelines, 2012

Site Area 1.33 **ha**

Extraneous Flow Allowances

Infiltration / Inflow **0.37 L/s**

Domestic Contributions

Unit Type	**Unit Rate**	**Units**	**Pop**	
Single Family	3.4		0	
Semi-detached and duplex	2.7		0	
Townhouse	2.7	73	198	*Phase 2 Townhomes*
Stacked Townhouse	2.3		0	
Apartment				
1 Bedroom	1.4		0	
2 Bedroom	2.1		0	

Total Pop **198**

Average Domestic Flow **0.80 L/s**

Peaking Factor **4.00**

Peak Domestic Flow **3.21 L/s**

Institutional / Commercial / Industrial Contributions

Property Type	**Unit Rate**		**No. of Units**	**Avg Wastewater (L/s)**
Commercial floor space*	5	$L/m^2/d$		0.00
Office	75	$L/9.3m^2/d$		0.00
Industrial - Light**	35,000	L/gross ha/d		0.00
Industrial - Heavy**	55,000	L/gross ha/d		0.00

Average I/C/I Flow **0.00**

Peak Institutional / Commercial Flow 0.00
Peak Industrial Flow** 0.00
Peak I/C/I Flow **0.00**

** assuming a 12 hour commercial operation*
*** peak industrial flow per City of Ottawa Sewer Design Guidelines Appendix 4B*

Total Estimated Average Dry Weather Flow Rate	**0.80 L/s**
Total Estimated Peak Dry Weather Flow Rate	**3.21 L/s**
Total Estimated Peak Wet Weather Flow Rate	**3.58 L/s**

Greatwise Developments
Morrison Drive/Draper Avenue
Proposed Site Conditions - Ultimate

Wastewater Design Flows per Unit Count
City of Ottawa Sewer Design Guidelines, 2012

Site Area 2.130 **ha**

Extraneous Flow Allowances

Infiltration / Inflow **0.60 L/s**

Domestic Contributions

Unit Type	**Unit Rate**	**Units**	**Pop**	
Single Family	3.4		0	
Semi-detached and duplex	2.7		0	
Townhouse	2.7	73	198	*Phase 2 Townhomes*
Stacked Townhouse	2.3		0	
Apartment				
Existing Building E				
1 Bedroom	1.4	56	79	
2 Bedroom	2.1	24	51	
Proposed Building F				
1 Bedroom	1.4	34	48	
2 Bedroom	2.1	36	76	*124 pop*

Total Pop **452**

Average Domestic Flow **1.83 L/s**

Peaking Factor **4.00**

Peak Domestic Flow **7.32 L/s**

Institutional / Commercial / Industrial Contributions

Property Type	**Unit Rate**		**No. of Units**	**Avg Wastewater (L/s)**
Commercial floor space*	5	$L/m^2/d$	225	0.03
Office	75	$L/9.3m^2/d$	325	0.03
Industrial - Light**	35,000	L/gross ha/d		0.00
Industrial - Heavy**	55,000	L/gross ha/d		0.00

Average I/C/I Flow **0.06**

Peak Institutional / Commercial Flow 0.08
Peak Industrial Flow** 0.00
Peak I/C/I Flow **0.08**

** assuming a 12 hour commercial operation*
*** peak industrial flow per City of Ottawa Sewer Design Guidelines Appendix 4B*

Total Estimated Average Dry Weather Flow Rate	**1.89 L/s**
Total Estimated Peak Dry Weather Flow Rate	**7.40 L/s**
Total Estimated Peak Wet Weather Flow Rate	**8.00 L/s**

SANITARY SEWER CALCULATION SHEET

CLIENT: **GREATWISE DEVELOPMENTS**
LOCATION: **MORRISON DRIVE/DRAPER AVENUE**
FILE REF: **17-927**
DATE: **14-Jun-17**

DESIGN PARAMETERS

Avg. Daily Flow Res.	350	L/p/d	Peak Fact Res. Per Harmons: Min = 2.0, Max =4.0		Infiltration / Inflow	0.28	L/s/ha
Avg. Daily Flow Comm	50,000	L/ha/d	Peak Fact. Comm.	1.5	Min. Pipe Velocity	0.60	m/s full flowing
Avg. Daily Flow Instit.	50,000	L/ha/d	Peak Fact. Instit.	1.5	Max. Pipe Velocity	3.00	m/s full flowing
Avg. Daily Flow Indust	35,000	L/ha/d	Peak Fact. Indust. per MOE graph		Mannings N	0.013	

Location			Residential Area and Population									Commercial		Institutional		Industrial			Infiltration				Pipe Data							
Area ID	Up	Down	Area	Number of Units				Pop.	Cumulative		Peak.	Q_{res}	Area	Accu.	Area	Accu.	Area	Accu.	Q_{C+I+I}	Total	Accu.	Infiltration	Total	DIA	Slope	Length	$A_{hydraulic}$	R	Velocity	Q_{cap}	Q / Q full
				by type					Area	Pop.	Fact.			Area		Area		Area		Area	Area	Flow	Flow								
			(ha)	Singles	Semi's	Town's	Apt's		(ha)		(-)	(L/s)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(L/s)	(ha)	(ha)	(L/s)	(L/s)	(mm)	(%)	(m)	(m^2)	(m)	(m/s)	(L/s)	(-)
S5	SAN 6	SAN 4	0.280			16		43.0	0.280	43.0	4.00	0.70	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.280	0.280	0.078	0.78	200	0.40	58.4	0.031	0.050	0.66	20.7	0.04
S4	SAN 5	SAN 4	0.070			4		11.0	0.350	54.0	4.00	0.88	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.070	0.350	0.098	0.97	200	0.40	15.3	0.031	0.050	0.66	20.7	0.05
S3	SAN 4	SAN 2	0.220			12		32.0	0.570	129.0	4.00	2.09	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.220	0.850	0.238	2.33	200	0.40	78.3	0.031	0.050	0.66	20.7	0.11
S2	SAN 3	SAN 2	0.070			4		11.0	0.640	140.0	4.00	2.27	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.070	0.920	0.258	2.53	200	0.40	17.8	0.031	0.050	0.66	20.7	0.12
S1	SAN 2	SAN1	0.200			12		32.0	0.840	301.0	4.00	4.88	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.200	1.970	0.552	5.43	200	0.40	72.8	0.031	0.050	0.66	20.7	0.26
EXT			0.490			25		68.0	1.330	369.0	4.00	5.98	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.490	2.460	0.689	6.67	225	0.40		0.040	0.056	0.71	28.4	0.23

Existing Conditions (Reproduction of Novatech Table 2.2)

City MH ID	Pipe ID	Population		Local Area (ha)						Cumulative Area (ha)	Design Flow (L/S)
		Local	Cumulative	Res.	Com.	Com. Cumul.	Inst.	Inst. Cumul.	Total		
Morrison Drive Sewer (Upper Reach)											
25698	1	113	113	1.39		0		0	1.39	1.39	1.8
25699	2	592	705	7.91		0	8.21	8.21	16.12	17.51	16.4
25700	3	71	776	1.55		0		8.21	1.55	19.06	17.8
25701	4	85	861	1.7		0		8.21	1.7	20.76	19.4
25702	5	58	919	1.05		0		8.21	1.05	21.81	20.5
25703	6	27	946	0.59		0		8.21	0.59	22.4	21.0
25704	7	160	1106	3.22		0		8.21	3.22	25.62	24.0
25706	8	43	1149	0.57		0		8.21	0.57	26.19	24.6
43673	9	162	1311	2.17	2.38	2.38		8.21	4.55	30.74	28.8
25709	10		1311	0.76	0.39	2.77		8.21	1.15	31.89	29.4
25710	11		1311	0.71	1.05	3.82		8.21	1.76	33.65	30.5
25711	12		1311	1.29	0.8	4.62		8.21	2.09	35.74	31.7
25713	13	378	1689	3.19		4.62		8.21	3.19	38.93	36.5
25715	14	2294	3983	34.61	6.5	11.12	1.39	9.6	42.5	81.43	77.2
Draper Avenue Sewer System											
	15A	38	38	1.38		0	1.47	1.47	2.85	2.85	2.0
	15B	135	173	2.2		0		1.47	2.2	5.05	4.4
	15C	230	403	0.54		0		1.47	0.54	5.59	6.9
	15D	360	763	0.84		0		1.47	0.84	6.43	10.6
	15E	905	1668	4.13		0		1.47	4.13	10.56	20.4
	15F	251	1919	2.98		0	0.5	1.97	3.48	14.04	24.3
	15G	111	2030	0.94		0	0.25	2.22	1.19	15.23	25.8
Morrison Drive Sewer (Lower Reach)											
25723	15		6013			11.12		11.82	0	96.66	100.4
25722	16		6013	0.38	1.88	13		11.82	2.26	98.92	101.4
25720	17	154	6167	2.07	0.84	13.84		11.82	2.91	101.83	104.2

Domestic Flow	300	(L/per/day)
Correction Factor Dom (Harmon Equation)	0.6	
Extraneous Flow	0.5	L/s/ha
Commercial	17000	L/ha/day
Institutional	10000	
Industrial	10000	
Peaking Factor non-res	1	

Population density	
Single Family	3.4
Townhouse	2.7
Apartment Units	1.4

Phase 1 Conditions as per DSEL 2012

City MH ID	Pipe ID	Population		Local Area (ha)						Cumulative Area (ha)	Design Flow (L/S)
		Local	Cumulative	Res.	Com.	Com. Cumul.	Inst.	Inst. Cumul.	Total		
Morrison Drive Sewer (Upper Reach)											
25698	1	305	305	1.33	0.06	0.06		0	1.39	1.39	4.0
25699	2	592	897	7.91		0.06	8.21	8.21	16.12	17.51	20.3
25700	3	71	968	1.55		0.06		8.21	1.55	19.06	21.7
25701	4	85	1053	1.7		0.06		8.21	1.7	20.76	23.3
25702	5	58	1111	1.05		0.06		8.21	1.05	21.81	24.3
25703	6	27	1138	0.59		0.06		8.21	0.59	22.4	24.8
25704	7	160	1298	3.22		0.06		8.21	3.22	25.62	27.7
25706	8	43	1341	0.57		0.06		8.21	0.57	26.19	28.4
43673	9	162	1503	2.17	2.38	2.44		8.21	4.55	30.74	32.5
25709	10		1503	0.76	0.39	2.83		8.21	1.15	31.89	33.1
25710	11		1503	0.71	1.05	3.88		8.21	1.76	33.65	34.2
25711	12		1503	1.29	0.8	4.68		8.21	2.09	35.74	35.4
25713	13	378	1881	3.19		4.68		8.21	3.19	38.93	40.1
25715	14	2294	4175	34.61	6.5	11.18	1.39	9.6	42.5	81.43	80.5
Draper Avenue Sewer System											
	15A	38	38	1.38		0	1.47	1.47	2.85	2.85	4.5
	15B	135	173	2.2		0		1.47	2.2	5.05	6.9
	15C	230	403	0.54		0		1.47	0.54	5.59	9.2
	15D	360	763	0.84		0		1.47	0.84	6.43	12.8
	15E	905	1668	4.13		0		1.47	4.13	10.56	22.5
	15F	251	1919	2.98		0	0.5	1.97	3.48	14.04	26.3
	15G	111	2030	0.94		0	0.25	2.22	1.19	15.23	27.8
Morrison Drive Sewer (Lower Reach)											
25723	15		6205			11.18		11.82	0	96.66	103.0
25722	16		6205	0.38	1.88	13.06		11.82	2.26	98.92	104.5
25720	17	154	6359	2.07	0.84	13.9		11.82	2.91	101.83	107.2

Population increase based on Phase I proposed development, net population increase of 220.

Domestic Flow - Existing	300	(L/per/day)
Domestic Flow Proposed	350	(L/per/day)
Correction Factor Dom[1] (Harmon Equation)	0.6	
Extraneous Flow	0.5	L/s/ha
Commercial	17000	L/ha/day
Institutional	10000	
Industrial	10000	
Peaking Factor non-res	1	

[1]Correction factor for proposed buildings = 1.0

Population density

Townhouse	2.7
Apartment 1 Bedroom	1.4
Apartment 2 Bedroom	2.1
Apartment 3 Bedroom	3.1

Total Population Increase

Existing Townhouses 5*12 units	162	persons
Proposed	354	persons
Difference	192	
100 % will be added at Link 1	354	persons

Ultimate Proposed Conditions - as per DSEL 2012

City MH ID	Pipe ID	Population		Local Area (ha)						Cumulative Area (ha)	Design Flow (L/S)
		Local	Cumulative	Res.	Com.	Com. Cumul.	Inst.	Inst. Cumul.	Total		
Morrison Drive Sewer (Upper Reach)											
25698	1	347	347	1.33	0.06	0.06		0	1.39	1.39	4.6
25699	2	1060	1407	7.91		0.06	8.21	8.21	16.12	17.51	28.0
25700	3	71	1478	1.55		0.06		8.21	1.55	19.06	29.3
25701	4	85	1563	1.7		0.06		8.21	1.7	20.76	30.9
25702	5	58	1621	1.05		0.06		8.21	1.05	21.81	31.9
25703	6	27	1648	0.59		0.06		8.21	0.59	22.4	32.4
25704	7	160	1808	3.22		0.06		8.21	3.22	25.62	35.2
25706	8	43	1851	0.57		0.06		8.21	0.57	26.19	35.9
43673	9	162	2013	2.17	2.38	2.44		8.21	4.55	30.74	39.9
25709	10		2013	0.76	0.39	2.83		8.21	1.15	31.89	40.5
25710	11		2013	0.71	1.05	3.88		8.21	1.76	33.65	41.6
25711	12		2013	1.29	0.8	4.68		8.21	2.09	35.74	42.8
25713	13	378	2391	3.19		4.68		8.21	3.19	38.93	47.4
25715	14	2294	4685	34.61	6.5	11.18	1.39	9.6	42.5	81.43	87.1
Draper Avenue Sewer System											
	15A	38	38	1.38		0	1.47	1.47	2.85	2.85	8.6
	15B	135	173	2.2		0		1.47	2.2	5.05	10.8
	15C	230	403	0.54		0		1.47	0.54	5.59	13.0
	15D	360	763	0.84		0		1.47	0.84	6.43	16.4
	15E	905	1668	4.13		0		1.47	4.13	10.56	25.8
	15F	251	1919	2.98		0	0.5	1.97	3.48	14.04	29.6
	15G	111	2030	0.94		0	0.25	2.22	1.19	15.23	31.1
Morrison Drive Sewer (Lower Reach)											
25723	15		6715			11.18		11.82	0	96.66	109.3
25722	16		6715	0.38	1.88	13.06		11.82	2.26	98.92	110.8
25720	17	154	6869	2.07	0.84	13.9		11.82	2.91	101.83	113.5

Population increase based on proposed development, net population increase of 702, new pop = 929.

Domestic Flow - Existing	300	(L/per/day)
Domestic Flow Proposed	350	(L/per/day)
Correction Factor Dom[1] (Harmon Equation)	0.6	
Extraneous Flow	0.5	L/s/ha
Commercial	17000	L/ha/day
Institutional	10000	
Industrial	10000	
Peaking Factor non-res	1	

[1]Correction factor for proposed buildings = 1.0

Population density

Townhouse	2.7
Apartment 1 Bedroom	1.4
Apartment 2 Bedroom	2.1
Apartment 3 Bedroom	3.1

Total Population Increase

Existing Townhouses 7*12 units	227	persons
Proposed	929	persons
Difference	702	
1/3 will be added at Link 1	310	persons
2/3 will be added at Link 2	619	L/s

Phase X Conditions - Max Flow increase to not exceed 0.30 m freeboard

City MH ID	Pipe ID	Population		Local Area (ha)						Cumulative Area (ha)	Design Flow (L/S)
		Local	Cumulative	Res.	Com.	Com. Cumul.	Inst.	Inst. Cumul.	Total		
Morrison Drive Sewer (Upper Reach)											
25698	1	276	276	1.33	0.06	0.06		0	1.39	1.39	4.9
25699	2	917	1193	7.91		0.06	8.21	8.21	16.12	17.51	24.6
25700	3	71	1264	1.55		0.06		8.21	1.55	19.06	25.9
25701	4	85	1349	1.7		0.06		8.21	1.7	20.76	27.5
25702	5	58	1407	1.05		0.06		8.21	1.05	21.81	28.5
25703	6	27	1434	0.59		0.06		8.21	0.59	22.4	29.0
25704	7	160	1594	3.22		0.06		8.21	3.22	25.62	31.9
25706	8	43	1637	0.57		0.06		8.21	0.57	26.19	32.6
43673	9	162	1799	2.17	2.38	2.44		8.21	4.55	30.74	36.6
25709	10		1799	0.76	0.39	2.83		8.21	1.15	31.89	37.3
25710	11		1799	0.71	1.05	3.88		8.21	1.76	33.65	38.3
25711	12		1799	1.29	0.8	4.68		8.21	2.09	35.74	39.5
25713	13	378	2177	3.19		4.68		8.21	3.19	38.93	44.1
25715	14	2294	4471	34.61	6.5	11.18	1.39	9.6	42.5	81.43	84.2
Draper Avenue Sewer System											
	15A	38	38	1.38		0	1.47	1.47	2.85	2.85	6.6
	15B	135	173	2.2		0		1.47	2.2	5.05	8.9
	15C	230	403	0.54		0		1.47	0.54	5.59	11.1
	15D	360	763	0.84		0		1.47	0.84	6.43	14.7
	15E	905	1668	4.13		0		1.47	4.13	10.56	24.2
	15F	251	1919	2.98		0	0.5	1.97	3.48	14.04	28.0
	15G	111	2030	0.94		0	0.25	2.22	1.19	15.23	29.5
Morrison Drive Sewer (Lower Reach)											
25723	15		6501			11.18		11.82	0	96.66	106.5
25722	16		6501	0.38	1.88	13.06		11.82	2.26	98.92	108.0
25720	17	154	6655	2.07	0.84	13.9		11.82	2.91	101.83	110.7

Population increase based on JFSA XPSWMM Modelling - max allowable increase for freeboard >= 0.30 m.

Domestic Flow - Existing	300	(L/per/day)
Domestic Flow Proposed	350	(L/per/day)
Correction Factor Dom[1] (Harmon Equation)	0.6	
Extraneous Flow	0.5	L/s/ha
Commercial	17000	L/ha/day
Institutional	10000	
Industrial	10000	
Peaking Factor non-res	1	

[1]Correction factor for proposed buildings = 1.0

Population density

Townhouse	2.7
Apartment 1 Bedroom	1.4
Apartment 2 Bedroom	2.1
Apartment 3 Bedroom	3.1

Total Population Increase

Existing Townhouses 5*12 units	162	persons
Proposed New	650	persons
Difference	488	
1/3 will be added at Link 1	217	persons
2/3 will be added at Link 2	433	L/s

Table 1 - Comparison of Existing Conditions HGL results based on different Sanitary Sewer pipe layouts and Modelling Programs.

City MH ID	Underside of Footing Elevation (m)[1]	Novatech 2009 Existing Conditions[2]		XPSWMM Replica of Novatech 2009 Model[2]		XPSWMM Model with Stantec 2012 Survey data[3]	
		HGL (m)	Freeboard (m)	HGL (m)	Freeboard (m)	HGL (m)	Freeboard (m)
25697	N/A	73.87	N/A	73.77	N/A	N/A	N/A
25698	N/A	71.28	N/A	71.20	N/A	71.30	N/A
25699	N/A	68.75	N/A	68.69	N/A	69.18	N/A
25700	N/A	67.88	N/A	67.81	N/A	68.99	N/A
25701	67.50	66.07	1.43	66.00	1.50	66.07	1.43
25702	66.65	65.68	0.97	65.61	1.04	65.69	0.96
25703	66.25	65.44	0.81	65.38	0.87	65.44	0.81
25704	66.50	65.12	1.38	65.12	1.39	65.20	1.30
25704i[4]	N/A	N/A	N/A	N/A	N/A	64.95	N/A
25705	65.50	65.09	0.41	64.97	0.53	64.93	0.57
25706	65.40	65.07	0.33	64.94	0.46	64.92	0.48
25707	N/A	64.90	N/A	64.90	N/A	64.87	N/A
25708	N/A	64.85	N/A	64.82	N/A	64.74	N/A
43673	65.15	64.82	0.33	64.78	0.37	64.67	0.48
25709	67.08	64.77	2.31	64.74	2.34	64.63	2.45
25710	N/A	64.69	N/A	64.66	N/A	64.55	N/A
25711	N/A	64.59	N/A	64.57	N/A	64.46	N/A
25712	N/A	64.57	N/A	64.55	N/A	64.43	N/A
25713	N/A	64.55	N/A	64.53	N/A	64.41	N/A
25714	N/A	64.54	N/A	64.53	N/A	64.41	N/A
25715	N/A	64.54	N/A	64.52	N/A	64.40	N/A
25723	N/A	64.53	N/A	64.52	N/A	64.39	N/A
25722	N/A	64.51	N/A	64.51	N/A	64.37	N/A
25721	N/A	64.50	N/A	64.51	N/A	64.37	N/A
25720	N/A	64.49	N/A	64.50	N/A	64.36	N/A
25719	N/A	64.48	N/A	64.50	N/A	64.36	N/A

[1]Underside of footing elevation as estimated by Novatech in their January 2009 report titled *Morrison Court Development Wastewater servicing Study* .

[2]Sanitary sewer layout as per Novatech 2009 survey

[3]Sanitary sewer layout as per a survey conducted by Stantec in August 2012.

[4]During the survey conducted by Stantec in August 2012, they identified a maintenance hole between City structures 25704 and 25705. This structure is refered to as 25704i for the purposes of this study.

Note 1: Freeboard distances have only been calculated at maintenance holes where Novatech calculated/reported an underside of footing elevation. N/A in the freeboard column denotes missing USF data.

Note 2: Hydraulic Gradeline elevations have not been calculated at all location in each model due to data gaps. N/A in the HGL column denotes missing pipe data for that particular model.

Table 2 - Existing Conditions, Phase 1 and Phase X Hydraulic Gradeline Results

City MH ID	Underside of Footing Elevation (m)[1]	Novatech 2009 Existing Conditions[2]		XPSWMM Model Existing Condition[3]		XPSWMM Proposed Phase I Condition[3]		XPSWMM Proposed Phase X Condition[4]	
		HGL (m)	Freeboard (m)	HGL (m)	Freeboard (m)	HGL (m)	Freeboard (m)	HGL (m)	Freeboard (m)
25697	N/A	73.87	N/A	N/A	N/A	N/A	N/A	N/A	N/A
25698	N/A	71.28	N/A	71.30	N/A	71.32	N/A	71.32	N/A
25699	N/A	68.75	N/A	69.18	N/A	69.27	N/A	69.38	N/A
25700	N/A	67.88	N/A	68.99	N/A	69.00	N/A	69.00	N/A
25701	67.50	66.07	1.43	66.07	1.43	66.09	1.41	66.11	1.39
25702	66.65	65.68	0.97	65.69	0.96	65.71	0.94	65.73	0.92
25703	66.25	65.44	0.81	65.44	0.81	65.47	0.78	65.49	0.76
25704	66.50	65.12	1.38	65.20	1.30	65.21	1.29	65.23	1.27
25704i[5]	N/A	N/A	N/A	64.95	N/A	64.97	N/A	65.03	N/A
25705	65.50	65.09	0.41	64.93	0.57	64.96	0.54	65.04	0.47
25706	65.40	65.07	0.33	64.92	0.48	64.94	0.46	65.02	0.39
25707	N/A	64.9	N/A	64.87	N/A	64.89	N/A	64.96	N/A
25708	N/A	64.85	N/A	64.74	N/A	64.80	N/A	64.90	N/A
43673	65.15	64.82	0.33	64.67	0.48	64.75	0.40	64.84	0.31
25709	67.08	64.77	2.31	64.63	2.45	64.70	2.38	64.77	2.31
25710	N/A	64.69	N/A	64.55	N/A	64.59	N/A	64.64	N/A
25711	N/A	64.59	N/A	64.46	N/A	64.47	N/A	64.49	N/A
25712	N/A	64.57	N/A	64.43	N/A	64.44	N/A	64.46	N/A
25713	N/A	64.55	N/A	64.41	N/A	64.42	N/A	64.43	N/A
25714	N/A	64.54	N/A	64.41	N/A	64.41	N/A	64.42	N/A
25715	N/A	64.54	N/A	64.40	N/A	64.41	N/A	64.42	N/A
25723	N/A	64.53	N/A	64.39	N/A	64.39	N/A	64.40	N/A
25722	N/A	64.51	N/A	64.37	N/A	64.37	N/A	64.38	N/A
25721	N/A	64.50	N/A	64.37	N/A	64.37	N/A	64.37	N/A
25720	N/A	64.49	N/A	64.36	N/A	64.36	N/A	64.36	N/A
25719	N/A	64.48	N/A	64.36	N/A	64.36	N/A	64.36	N/A

[1]Underside of footing elevation as estimated by Novatech in their January 2009 report titled *Morrison Court Development Wastewater servicing Study* .

[2]Sanitary sewer layout as per Novatech 2009 survey

[3]Sanitary sewer layout as per a survey conducted by Stantec in August 2012.

[4]Phase X condition is a test case to determine the maximum sanitary flow increase from the proposed development that will result in a minimum freeboard of no less than 0.30 m. Modelled flow increase = 8 L/s.

[5]During the survey conducted by Stantec in August 2012, they identified a maintenance hole between City structures 25704 and 25705. This structure is refered to as 25704i for the purposes of this study.

Note 1: Freeboard distances have only been calculated at maintenance holes where Novatech calculated/reported an underside of footing elevation. N/A in the freeboard column denotes missing USF data.

Note 2: Hydraulic Gradeline elevations have not been calculated at all location in each model due to data gaps. N/A in the HGL column denotes missing pipe data for that particular model.

Alison Gosling

From: C. Brennan <cbrennan@jfsa.com>
Sent: January-21-13 2:51 PM
To: 'natan'; 'Andrew Finnson'
Cc: 'J.F. Sabourin'; 'Lloyd Phillips'
Subject: RE: Morrison Drive MH's
Attachments: 20130114 - Hydraulic Gradeline Results + Sanitary Design.pdf

Follow Up Flag: Follow up
Flag Status: Flagged

Hello Andrew,

As requested by your office and Greatwise Developments Corporation (Greatwise), J.F. Sabourin and Associates Inc. (JFSA) have completed our hydraulic analysis of the existing Morrison Drive sanitary sewer system. This analysis is meant to augment the findings that JFSA provided to Greatwise in August 2012. During the previous analysis it was determined that the existing sanitary sewer along Morrison Drive had sufficient capacity to convey the sanitary flow increases from Phase I of the proposed Morrison Court development while maintaining a freeboard of greater than 0.30 m at the critical location, MHSA43673. The current analysis has been undertaken to determine the maximum peak sanitary flow increase from the proposed development that would still result in a freeboard of greater than 0.30 m along the existing Morrison Drive sanitary sewer.

JFSA updated the sanitary sewer design calculations and XPSWMM model of the existing sanitary sewer to determine the maximum flow increase that would meet the 0.30 m freeboard criterion. Based on that analysis it was determined that an overall peak sanitary flow increase of **8 L/s** will result in a freeboard of 0.31 m at the critical location, MHSA43673, along the existing sanitary sewer. Please refer to the Hydraulic Gradeline Results and Sanitary Design sheets attached, these results supersede the tables that were submitted in August 2012. As is illustrated in the sanitary design table for Phase X, the scenario that was used to arrive at the max allowable peak flow increase of 8 L/s is a new development with a population of 650 replacing five (5) of the existing townhouses (population of 162) for a net population increase of 488. Please note that the freeboard calculations are based on the hydraulic gradeline results from JFSA's XPSWMM model and the underside of footing determinations made by Novatech in their January 26, 2009 report titled *Morrison Court Development Wastewater Servicing Study*.

Please contact me if you have any questions or comments,
Kind Regards

Colin Brennan, B.A.Sc.
Water Resources EIT

JFSA Water Resources and Environmental Consultants

J.F. Sabourin and Associates Inc.
52 Springbrook Drive , Ottawa , ON K2S 1B9
tel.: 613.836.3884 ext. 224, fax: 613.836.0332, **www.jfsa.com**

From: natan [mailto:natan@gsregalgroup.com]
Sent: Tuesday, January 08, 2013 3:21 PM
To: 'Andrew Finnson'

Cc: 'J.F. Sabourin'; 'Lloyd Phillips'; cbrennan@jfsa.com
Subject: RE: Morrison Drive MH's

Andrew
Can we start with a conference call on Thursday Jan 10th
I recommend for Colin, you, Lloyd and me to be there.
Do we need James!
If the time is acceptable to all I will send the conference access info to ALL
Regards
Natan

From: Andrew Finnson [mailto:afinnson@dsel.ca]
Sent: January-08-13 1:43 PM
To: cbrennan@jfsa.com; 'natan'
Cc: 'J.F. Sabourin'; 'Lloyd Phillips'
Subject: RE: Morrison Drive MH's

Hi Natan,
Colin's email below states that they would like to have a meeting to discuss the sanitary analysis and make sure that we're all on the same page. Can you suggest a time that would work for you so we can try to set something up?

Thanks,

Andrew Finnson, P.Eng.

DSEL
david schaeffer engineering ltd

phone: (613) 836-0856 ext 229
cell: (613) 222-4957
e-mail: afinnson@DSEL.ca

From: C. Brennan [mailto:cbrennan@jfsa.com]
Sent: Tuesday, December 18, 2012 7:00 PM
To: 'Andrew Finnson'
Cc: 'J.F. Sabourin'; 'natan'; 'Lloyd Phillips'
Subject: RE: Morrison Drive MH's

Hello Andrew,

We can perform such an analysis. It would involve additional work in comparison to the quote provided below and we would like to have a brief meeting with the team to confirm the conclusions that can be drawn from such an analysis and how the project could progress from there. To perform the aforementioned our fee would be $1,250 + tax. A meeting with the City may be required to confirm that our approach will be acceptable to them, which would be charged at our standard hourly rates.

Kind Regards,
Colin

Colin Brennan, B.A.Sc.
Water Resources EIT

JFSA Water Resources and Environmental Consultants

J.F. Sabourin and Associates Inc.
52 Springbrook Drive , Ottawa , ON K2S 1B9
tel.: 613.836.3884 ext. 224, fax: 613.836.0332, **www.jfsa.com**

From: Andrew Finnson [mailto:afinnson@dsel.ca]
Sent: Thursday, December 13, 2012 9:56 AM
To: cbrennan@jfsa.com
Cc: 'J.F. Sabourin'; 'natan'; 'Lloyd Phillips'
Subject: RE: Morrison Drive MH's

Hi Colin,
I've discussed this with Natan at Greatwise and what they'd like to see (since we're looking at this again) is a maximum number of units, or maximum population that could be accommodated without the need for a downstream upgrade. This analysis should show that the additional units can be accommodated, as well as give a bit of a buffer in the event that there are any site plan changes. Are you able to complete this analysis for the fee quoted below or would additional fees be required to complete this type of analysis?

Thanks,

Andrew Finnson, P.Eng.

DSEL
david schaeffer engineering ltd

phone: (613) 836-0856 ext 229
cell: (613) 222-4957
e-mail: afinnson@DSEL.ca

From: C. Brennan [mailto:cbrennan@jfsa.com]
Sent: Wednesday, December 12, 2012 3:14 PM
To: 'Andrew Finnson'
Cc: 'J.F. Sabourin'
Subject: RE: Morrison Drive MH's

Hi Andrew,

I can introduce that flow increase into our hydraulic model and confirm if Phase I can still go ahead without improving the existing sanitary sewer system. It will take about a half day to update everything and respond via email. To perform this check our fee would be $ 500.

Let me know if you would like me to proceed.

Colin

From: Andrew Finnson [mailto:afinnson@dsel.ca]
Sent: Monday, December 10, 2012 11:11 AM

To: cbrennan@jfsa.com
Subject: RE: Morrison Drive MH's

Hi Colin,
I've been told that they are making some minor adjustments to unit counts for the Greatwise - Morrison Drive development. Basically they are converting 5 - 2 bedroom units to 10 – 1 bedroom units. They have asked me to confirm that this will still work without upgrading the downstream sewer. Are you able to confirm that this should still work?

Give me a call if you have any questions.

Thanks,

Andrew Finnson, P.Eng.

DSEL
david schaeffer engineering ltd

phone: (613) 836-0856 ext 229
cell: (613) 222-4957
e-mail: afinnson@DSEL.ca

From: C. Brennan [mailto:cbrennan@jfsa.com]
Sent: Friday, August 24, 2012 11:07 AM
To: 'Andrew Finnson'
Cc: jfsabourin@jfsa.com
Subject: RE: Morrison Drive MH's

Hi Andrew,

As requested, we have assessed the HGL elevations along the Morrison Drive sanitary sewer under ultimate (Phase I and II) flow conditions. Sanitary flows are based on Novatech's 2009 design, with a peak flow of 112.4 L/s at the downstream end of the system. The minimum freeboard for this condition at MHSA43673 is 0.26 m, less than the City's minimum allowable freeboard of 0.30 m.

Regards,

Colin

From: Andrew Finnson [mailto:afinnson@dsel.ca]
Sent: Friday, August 24, 2012 9:19 AM
To: cbrennan@jfsa.com
Subject: RE: Morrison Drive MH's

Colin,
The latest sanitary design sheets are attached. The ultimate flow from the site is 12.08 L/s.

Thanks,
Andrew

From: C. Brennan [mailto:cbrennan@jfsa.com]
Sent: Wednesday, August 22, 2012 2:27 PM
To: 'Andrew Finnson'
Cc: 'J.F. Sabourin'
Subject: RE: Morrison Drive MH's

Hello Andrew,

As requested by your office, on behalf of Greatwise Developments Corporation, J.F. Sabourin and Associates Inc. (JFSA) have completed our modelling exercise along the Morrison Drive sanitary sewer line under both existing and proposed phase I development conditions. A preliminary assessment of the sanitary sewer capacity was previously undertaken by Novatech Engineering Consultants Ltd. (Novatech) as described in their January 26, 2009 report titled *Morrison Court Development Wastewater Servicing Study*. In that study, Novatech found that at the most critical location, MHSA43673, the existing freeboard between the Hydraulic Gradeline (HGL) in the sanitary sewer system and the lowest connected underside of footing (USF) elevation is 0.33 m. Novatech also assessed the HGL within the system under proposed development flows whereby seven (7) 12-unit townhomes (population of 223) would be replaced with a new development having a total population of 929 (representing a population increase of 702 persons). Novatech found that the peak flow at the Pinecrest Trunk confluence would increase from 104.2 L/s under existing conditions to 112.4 L/s under proposed conditions. They found that this flow increase resulted in increased HGL elevations such that, the minimum freeboard at MHSA43673 would be reduced to 0.12 m. Novatech therefore concluded that the existing system does not have adequate capacity for the entire proposed development and recommended increasing the diameter of 423 m of pipe between MHSA25705 and MHSA25711 to 375 mm at 0.14% slope, which would provide a minimum freeboard of 0.41 m.

JFSA conducted our modelling of the sanitary sewer system using XPSWMM version 10.6, while Novatech had previously used H2OMAP Sewer/Pro. It is therefore anticipated that JFSA will arrive at slightly different results than Novatech when modelling the same system. Table 1, attached, indicates that at MHSA43673 where Novatech modelled a freeboard of 0.33 m, the JFSA XPSWMM model indicates that there is a 0.37 m freeboard. Previous modelling was based on a survey conducted by Novatech during the work for their January 2009 report. Pipe lengths and dimensions from the Novatech survey and As Built plans agree with one another and have been taken as correct in JFSA's work. The sanitary pipe inverts were verified/confirmed however, using the results from a field survey conducted by Stantec Consulting Ltd. in August 2012. It is important to note that Stantec located a maintenance hole between MHSA25704 and MHSA25705, this maintenance hole has been included in JFSA's models and labelled as 25704i for the purposes of this work. Furthermore,Stantec's structure SMH2 (correlates to city MHSA25697) was not included in the JFSA modelling as: 1) the measured invert does not agree well with the As Built data and 2) that pipe is upstream of the proposed site and lowest freeboard locations. Similarly, Stantec structures SMH38, SMH39 and SMH40 appear to be a parallel sanitary line to the Morrison sewer and do not appear to have City structure ID's, therefore, JFSA was instructed by DSEL to neglect these three (3) structures as noted in the correspondence below. A graph demonstrating the Morrison Drive sanitary sewer invert elevation as per the: Novatech 2009 survey, Stantec 2012 survey and As Built plans is attached for reference, note that the first node is MHSA25698 and the final node is MHSA25759. The final two columns of attached Table 1 provide JFSA's modelling results under existing flow conditions based on the Stantec surveyed inverts. In updating the XPSWMM model to reflect the Stantec 2012 survey rather than the Novatech 2009 survey the modelled HGL elevations were reduced, such that, the minimum freeboard at MHSA43673 based on JFSA's model is 0.49 m. This freeboard is above the minimum allowable freeboard of 0.30 m as per the *City of Ottawa Sewer Design Guidelines* (November 2004).

JFSA was retained to assess the HGL elevations under the currently proposed Phase I development conditions rather than ultimate development conditions. The proposed Phase I construction will result in the demolition of four (4) existing townhouse buildings and the construction of three (3) 4-storey buildings two of which are for residential use while one is to be mixed use commercial/residential. The net impact of the proposed Phase I development is a population increase of 220 persons (350 - 130) and 600 m^2 of Commercial floor space (equivalent to 10L/s of sanitary flow), which results in a peak flow at the confluence with the Pinecrest trunk sewer of 106.2 L/s. Sanitary flow sheets

are attached for both existing and Phase I development conditions. Table 2, attached, provides a comparison the HGL results from the Novatech 2009 existing modelling, the JFSA XPSWMM existing modelling and the JFSA XPSWMM modelling for proposed Phase I flow conditions. The minimum freeboard calculated along the existing Morrison Drive sanitary sewer under Phase I flows was 0.44 m, which occurs at MHSA43673. Therefore, based on the JFSA XPSWMM model, and the Novatech 2009 USF elevations, the minimum freeboard under Phase I development flows will be 0.44 m, which is greater than the City of Ottawa's minimum allowable value of 0.30 m.

Please contact myself if you have any questions or comments.
Kind Regards,

Colin Brennan, B.A.Sc.
Water Resources EIT

JFSA Water Resources and Environmental Consultants

J.F. Sabourin and Associates Inc.
52 Springbrook Drive , Ottawa , ON K2S 1B9
tel.: 613.836.3884 ext. 224, fax: 613.836.0332, **www.jfsa.com**

From: Andrew Finnson [mailto:afinnson@dsel.ca]
Sent: Wednesday, August 22, 2012 10:13 AM
To: cbrennan@jfsa.com
Subject: RE: Morrison Drive MH's

Colin,
Jamie at Stantec has confirmed that it is in fact a typo. It's 1 metre high. The actual invert is 64.53.

Andrew

From: Andrew Finnson [mailto:afinnson@dsel.ca]
Sent: Wednesday, August 22, 2012 10:02 AM
To: 'cbrennan@jfsa.com'
Subject: RE: Morrison Drive MH's

Colin,
I've left a message with Jamie. Please proceed. I'll make sure we get confirmation from him asap.

Thanks,
Andrew

From: C. Brennan [mailto:cbrennan@jfsa.com]
Sent: Wednesday, August 22, 2012 8:32 AM
To: 'Andrew Finnson'
Subject: RE: Morrison Drive MH's

Thanks Andrew.

Colin

From: Andrew Finnson [mailto:afinnson@dsel.ca]
Sent: Wednesday, August 22, 2012 8:29 AM
To: cbrennan@jfsa.com
Subject: RE: Morrison Drive MH's

Hi Colin,
Your assumptions below are correct. 3 townhouse buildings will remain in Phase I and 4 will be demolished.

Thanks,
Andrew

From: C. Brennan [mailto:cbrennan@jfsa.com]
Sent: Wednesday, August 22, 2012 8:25 AM
To: 'Andrew Finnson'
Subject: RE: Morrison Drive MH's

Hi Andrew,

No problem including the new Phase 1 population numbers. Just to confirm though, from the in-progress base plan I received from you it seems like Phase 1 construction will replace four (4) of the existing Townhouses (4*12units*2.7 = 130 persons). Will the other three (3) existing townhouses remain during Phase 1 (3*12*2.7=97 persons), is this correct?

I am assuming that the proposed Phase 1 buildings will contribute flow from 350 persons which replaces flow from 130 persons, representing a net increase of 220 persons for Phase I.

Colin

From: Andrew Finnson [mailto:afinnson@dsel.ca]
Sent: Tuesday, August 21, 2012 9:29 AM
To: cbrennan@jfsa.com
Subject: RE: Morrison Drive MH's

Hi Colin,
We've just received a new plan with minor revisions to the unit counts for phase 1, and therefore minor revisions to the sanitary flow. If it's possible to revise the flows to match the updated plan without causing you further delay please do so, otherwise please proceed with the previous numbers you have.

Thanks,
Andrew

From: C. Brennan [mailto:cbrennan@jfsa.com]
Sent: Tuesday, August 21, 2012 9:31 AM
To: 'Andrew Finnson'
Cc: jfsabourin@jfsa.com; spichette@dsel.ca
Subject: RE: Morrison Drive MH's

Hi Andrew,

I am currently running various modelling scenarios for Monahan to respond to the RVCA letter from Bruce Reid. Therefore, I will not be able to provide the Sanitary modelling results to you today. Sorry for the delay, I will plan to return to that file first thing tomorrow morning.

Regards,
Colin

From: Andrew Finnson [mailto:afinnson@dsel.ca]
Sent: Tuesday, August 21, 2012 8:17 AM
To: cbrennan@jfsa.com
Subject: RE: Morrison Drive MH's

Hi Colin,
Do you have something you can send me today? I need to get this incorporated into a report which needs to be submitted to the client tomorrow.

Thanks,
Andrew

From: C. Brennan [mailto:cbrennan@jfsa.com]
Sent: Friday, August 17, 2012 1:09 PM
To: 'Andrew Finnson'
Cc: 'J.F. Sabourin'
Subject: RE: Morrison Drive MH's

Hi Andrew,

I've just come across another discrepancy. Where Stantec picks up three (3) sanitary manholes, SMH25, SMH26 and SMH27, the Novatech drawings and model only show two manholes (25705 and 25706). I'm inclined to trust the Stantec survey and add another manhole and pipe (approx. 17 m long) to the model.

Could you please check with Stantec and advise if the above assumption should be used or not.

Regards,
Colin

From: Andrew Finnson [mailto:afinnson@dsel.ca]
Sent: Friday, August 17, 2012 11:20 AM
To: cbrennan@jfsa.com
Cc: 'J.F. Sabourin'
Subject: RE: Morrison Drive MH's

Hi Colin,
I will follow up with Stantec but according to the as-builts the below assumptions are correct. Please proceed on that basis.

Thanks,
Andrew

From: C. Brennan [mailto:cbrennan@jfsa.com]
Sent: Friday, August 17, 2012 11:21 AM
To: 'Andrew Finnson'
Cc: 'J.F. Sabourin'
Subject: RE: Morrison Drive MH's

Hi Andrew,

As a follow-up to our phone conversation I would like to confirm the assumptions that I am to make with respect to the sanitary survey data prepared by Stantec.

1. Due to a discrepancy between the new and old inverts at SMH2 (25697) and the second south invert at SMH4 (25698), JFSA will only model from SMH4 (25698) downstream pending clarification from DSEL/Stantec.
2. The following three (3) manholes seem to be a parallel line which are not noted on the As Built drawings in DSEL's possession, SMH 38, SMH 39 and SMH 40. Therefore these manholes will be neglected in our analysis. We are under the assumption that SMH37 corresponds to the City MH 25711 and SMH41 corresponds to City MH 25712 and that these two manholes are connected by a 63.5 m long 375 mm diameter concrete sanitary pipe.
3. There is a discrepancy from SMH37 to SMH49 with respect to pipe sizes. The sizes recorded by Stantec will be neglected in favour of the sizes included in DSEL's EPA SWMM model, which are based on the As Built Drawings. Pipe diameters to be used are as follows:
   SMH37 (25711) to SMH44 (25715) - 375 mm concrete
   SMH44 (25715) to SMH49 (25719 - 600 mm concrete
4. Except as noted above, the pipe inverts and top of grate elevations recorded by Stantec will be taken as correct and used in all subsequent hydraulic (XPSWMM) modelling.

Please advise if any of the preceding assumptions are incorrect, or if clarification is provided by Stantec.

Regards,
Colin

Colin Brennan, B.A.Sc.
Water Resources EIT

JFSA Water Resources and Environmental Consultants

J.F. Sabourin and Associates Inc.
52 Springbrook Drive , Ottawa , ON K2S 1B9
tel.: 613.836.3884 ext. 224, fax: 613.836.0332, **www.jfsa.com**

From: C. Brennan [mailto:cbrennan@jfsa.com]
Sent: Friday, August 17, 2012 10:05 AM
To: 'Andrew Finnson'
Cc: 'J.F. Sabourin'
Subject: RE: Morrison Drive MH's

Hi Andrew,

I've been reviewing the Stantec Storm and Sanitary manhole survey and would like a few clarifications.

specifically:

1. there two (2) pipes coming into the South side of Structure 4. What is the second pipe, and which one represents the main sewer line.
2. There are more sanitary manholes in the NE portion of Morrison Road than recorded by Novatech. STM 38, 39 and 40 all seem like additions.
3. Several pipe size and invert comments are included on the attached drawing as well.

I have attached a CAD Drawing with City Structure labels included where I believe they may apply, I will call to discuss.

Colin

From: Andrew Finnson [mailto:afinnson@dsel.ca]
Sent: Monday, August 13, 2012 2:30 PM
To: cbrennan@jfsa.com
Subject: FW: Morrison Drive MH's

Colin,
See the attached survey from Stantec.
If anything is unclear let me know.

Thanks,
Andrew

From: Leslie, Jamie [mailto:Jamie.Leslie@stantec.com]
Sent: Monday, August 13, 2012 2:24 PM
To: Andrew Finnson
Subject: RE: Morrison Drive MH's

Hi Andrew,

Sorry for the delay. Here is the CAD file for our MH pickup and invert measurements. Let me know if you have any questions. Thank you.

Jamie Leslie, OLS, OLIP, EIT
Project Manager
Stantec Geomatics Ltd.
1505 Laperriere Avenue
Ottawa ON K1Z 7T1
Ph: (613) 722-4420 Ext. 592
Fx: (613) 722-2799
Jamie.Leslie@stantec.com
stantec.com

From: Andrew Finnson [mailto:afinnson@dsel.ca]
Sent: Friday, August 10, 2012 11:08 AM
To: Leslie, Jamie
Subject: RE: Morrison Drive MH's

Monday morning is fine Jamie. Have a good weekend.

Thanks,
Andrew

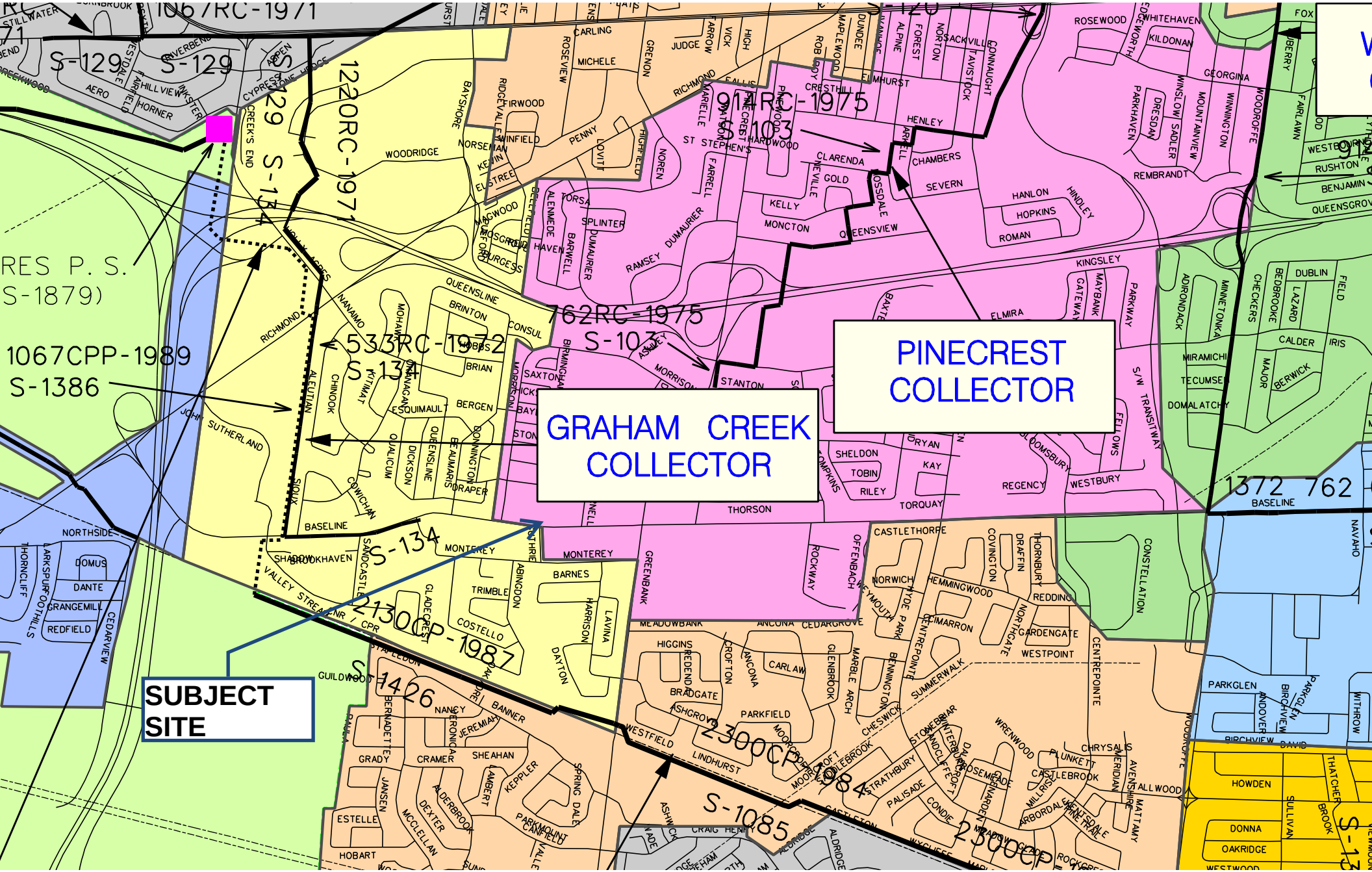
From: Leslie, Jamie [mailto:Jamie.Leslie@stantec.com]
Sent: Friday, August 10, 2012 11:10 AM
To: Andrew Finnson (afinnson@dsel.ca)
Subject: Morrison Drive MH's

Hi Andrew,

I just wanted to update you on the status of the Morrison Drive MH pickup. We are finalizing the CAD file now. I do have to step out shortly for a meeting this afternoon. I'm not sure if I will return to the office this afternoon. Unless you require this information later this afternoon, I will forward you the drawing first thing Monday morning. If you do require it, I will have it sent to you by my CAD person when it is finished. Let me know your thoughts. Thank you.

Jamie Leslie, OLS, OLIP, EIT
Project Manager
Stantec Geomatics Ltd.
1505 Laperriere Avenue
Ottawa ON K1Z 7T1
Ph: (613) 722-4420 Ext. 592
Fx: (613) 722-2799
Jamie.Leslie@stantec.com
stantec.com

TRUNK SANITARY SEWERS & COLLECTION AREAS



APPENDIX D

Stormwater Management

Greatwise Developments
Morrison Drive/Draper Avenue
Storm Sewer Calculation Sheet

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

Existing Drainage Charateristics From Internal Site

Area	1.331	ha
C	0.56	Rational Method runoff coefficient
L	101.6	m
Up Elev	75.85	m
Dn Elev	73	m
Slope	2.8	%
Tc	12.6	min

1) Time of Concentration per Federal Aviation Administration

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

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

Estimated Peak Flow

	2-year	5-year	100-year	
i	68.2	92.4	158.1	mm/hr
Q	141.4	191.6	409.9	L/s

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

										Sewer Data								
Area ID	**Up**	**Down**	**Area**	**C**	**Indiv AxC**	**Acc AxC**	**T_C**	**I**	**Q**	**DIA**	**Slope**	**Length**	**$A_{hydraulic}$**	**R**	**Velocity**	**Qcap**	**Time Flow**	**Q / Q full**
			(ha)	**(-)**			**(min)**	**(mm/hr)**	**(L/s)**	**(mm)**	**(%)**	**(m)**	**(m^2)**	**(m)**	**(m/s)**	**(L/s)**	**(min)**	**(-)**
A1.1	CB'T'1F	CB'T'1E	0.066	0.46	0.03	0.03	10.0	104.2	8.7	250	3.50	22.2	0.049	0.063	2.27	111.3	0.2	0.08
	CB'T'1E	CB'L'1D			0.00	0.03	10.2	103.3	8.6	250	3.20	26.2	0.049	0.063	2.17	106.4	0.2	0.08
	CB'L'1D	CB'T'1C			0.00	0.03	10.2	103.3	8.6	250	0.60	20.5	0.049	0.063	0.94	46.1	0.4	0.19
	CB'T'1C	CICB1B			0.00	0.03	10.5	101.5	8.5	250	1.30	1.1	0.049	0.063	1.38	67.8	0.0	0.13
A1	CICB1A/B	STM107	0.045	0.80	0.04	0.07	10.5	101.4	18.6	250	1.00	2.3	0.049	0.063	1.21	59.5	0.0	0.31
							10.6											
A2	CICB2A/B	STM107	0.080	0.79	0.06	0.06	10.0	104.2	18.3	250	1.00	5.3	0.049	0.063	1.21	59.5	0.1	0.31
							10.1											
A1.2	CB'L'1H	CB'T'1G	0.037	0.47	0.02	0.02	10.0	104.2	5.0	250	3.50	16.0	0.049	0.063	2.27	111.3	0.1	0.04
	CB'T'1G	CB'T'1F			0.00	0.02	10.1	103.6	4.9	250	5.20	17.2	0.049	0.063	2.76	135.6	0.1	0.04
	CB'T'1F	CICB3B			0.00	0.02	10.2	103.0	4.9	250	1.00	20.9	0.049	0.063	1.21	59.5	0.3	0.08
A3	CICB3A/B	STM107	0.066	0.83	0.05	0.07	10.5	101.6	20.3	250	1.00	5.3	0.049	0.063	1.21	59.5	0.1	0.34
							10.6											
	STM107	STM105				0.20	10.6	101.2	56.5	375	0.25	61.7	0.110	0.094	0.79	87.7	1.3	0.64
							11.9											
A4	CICB4A/B	STM106	0.028	0.73	0.02	0.02	10.0	104.2	5.8	250	1.00	5.3	0.049	0.063	1.21	59.5	0.1	0.10
	STM106	STM105			0.00	0.02	10.1	103.8	5.8	250	0.40	16.2	0.049	0.063	0.77	37.6	0.4	0.15
							10.4											
A5	CICB5A/B	STM105	0.070	0.82	0.06	0.06	10.0	104.2	16.5	250	1.00	5.3	0.049	0.063	1.21	59.5	0.1	0.28
							10.1											
	STM105	STM103B				0.28	11.9	95.2	73.6	525	0.16	52.1	0.216	0.131	0.79	172.0	1.1	0.43
							13.0											
A6	CB'L'6D	CB'T'6C	0.059	0.48	0.03	0.03	10.0	104.2	8.2	250	0.50	26.3	0.049	0.063	0.86	42.0	0.5	0.19
	CB'T'6C	CB'T'6B				0.03	10.5	101.6	8.0	250	0.50	18.9	0.049	0.063	0.86	42.0	0.4	0.19
	CB'T'6B	CICB6A				0.03	10.9	99.8	7.8	250	1.00	19.5	0.049	0.063	1.21	59.5	0.3	0.13
	CICB6A	STM103B				0.03	11.1	98.5	7.7	250	1.00	1.0	0.049	0.063	1.21	59.5	0.0	0.13
							11.2											
	STM103B	STM103				0.31	13.0	90.7	77.3	525	0.16	28.0	0.216	0.131	0.79	172.0	0.6	0.45
							13.6											
A7	CICB7A/B	STM104	0.082	0.58	0.05	0.05	10.0	104.2	13.8	250	1.00	8.9	0.049	0.063	1.21	59.5	0.1	0.23
							10.1											
A8	CB'L'8D	CB'T'8C	0.081	0.82	0.07	0.07	10.0	104.2	19.1	250	0.50	15.3	0.049	0.063	0.86	42.0	0.3	0.45
	CB'T'8C	CICB8B				0.07	10.3	102.6	3.4	250	1.00	3.4	0.049	0.063	1.21	59.5	0.0	0.06
	CICB8B	STM104				0.07	10.3	102.4	3.4	250	1.00	5.3	0.049	0.063	1.21	59.5	0.1	0.06
							10.4											
	STM104	STM103				0.11	10.4	102.0	32.2	250	0.40	34.1	0.049	0.063	0.77	37.6	0.7	0.86
							11.2											
A9	CICB9A/B	STM103	0.038	0.78	0.03	0.03	10.0	104.2	8.5	250	1.00	5.0	0.049	0.063	1.21	59.5	0.1	0.14
							10.1											
A10	CB'L'10D	CB'T'10C	0.193	0.63	0.12	0.12	10.0	104.2	35.3	250	0.50	17.6	0.049	0.063	0.86	42.0	0.3	0.84
	CB'T'10C	CB'T'10B				0.12	10.3	102.4	3.4	250	0.50	12	0.049	0.063	0.86	42.0	0.2	0.08
	CB'T'10B	CICB10A				0.12	10.6	101.2	3.4	250	1.00	7.1	0.049	0.063	1.21	59.5	0.1	0.06
	CICB10A	STM103				0.12	10.7	100.8	3.4	250	1.00	1.2	0.049	0.063	1.21	59.5	0.0	0.06
							10.7											
A11	CB'L'11E	CB'T'11D	0.266	0.51	0.14	0.14	10.0	104.2	39.4	250	0.50	20.1	0.049	0.063	0.86	42.0	0.4	0.94
	CB'T'11D	CB'T'11C				0.14	10.4	102.2	38.6	250	0.50	24.5	0.049	0.063	0.86	42.0	0.5	0.92
	CB'T'11C	CB'T'11B				0.14	10.9	99.8	37.7	250	0.50	22.6	0.049	0.063	0.86	42.0	0.4	0.90
	CB'T'11B	CICB11A				0.14	11.3	97.8	36.9	250	1.00	1.2	0.049	0.063	1.21	59.5	0.0	0.62
	CICB11A	STM103				0.14	11.3	97.7	36.9	250	1.00	5.1	0.049	0.063	1.21	59.5	0.1	0.62
							11.4											
A12	CICB12A/B	STM103	0.025	0.81	0.02	0.02	10.0	104.2	5.8	250	1.00	5.0	0.049	0.063	1.21	59.5	0.1	0.10
							10.1											
	STM103	STM102				0.73	13.6	88.5	178.9	600	0.13	61.7	0.283	0.150	0.78	221.4	1.3	0.81
*	STM102	STM101				0.73	14.9	84.0	94.8	450	0.20	15.0	0.159	0.113	0.80	127.5	0.3	0.74
							15.2				.							

* Actual flow rate from EPASWM Model

A1	**Imp.**	**Perv.**	**Total**
Area	0.038	0.006	0.045
C	0.9	0.2	0.80

A1.1	**Imp.**	**Perv.**	**Total**
Area	0.024	0.042	0.066
C	0.9	0.2	0.46

A1.2	**Imp.**	**Perv.**	**Total**
Area	0.014	0.023	0.037
C	0.9	0.2	0.47

A2	**Imp.**	**Perv.**	**Total**
Area	0.067	0.012	0.080
C	0.9	0.2	0.79

A3	**Imp.**	**Perv.**	**Total**
Area	0.059	0.007	0.066
C	0.9	0.2	0.83

A4	**Imp.**	**Perv.**	**Total**
Area	0.021	0.007	0.028
C	0.9	0.2	0.73

A5	**Imp.**	**Perv.**	**Total**
Area	0.062	0.008	0.070
C	0.9	0.2	0.82

A6	**Imp.**	**Perv.**	**Total**
Area	0.024	0.035	0.059
C	0.9	0.2	0.48

A7	**Imp.**	**Perv.**	**Total**
Area	0.045	0.037	0.082
C	0.9	0.2	0.58

A8	**Imp.**	**Perv.**	**Total**
Area	0.071	0.010	0.081
C	0.9	0.2	0.82

A9	**Imp.**	**Perv.**	**Total**
Area	0.031	0.006	0.038
C	0.9	0.2	0.78

A10	**Imp.**	**Perv.**	**Total**
Area	0.119	0.074	0.193
C	0.9	0.2	0.63

A11	**Imp.**	**Perv.**	**Total**
Area	0.118	0.148	0.266
C	0.9	0.2	0.51

A12	**Imp.**	**Perv.**	**Total**
Area	0.022	0.003	0.025
C	0.9	0.2	0.81

U1

U1	Imp.	Perv.	Total	
Area	0.129	0.069	0.197	
C	0.9	0.2	0.66	0.65

B1

A10	Imp.	Perv.	Total
Area	0.119	0.074	0.193
C	0.9	0.2	0.63

A11	Imp.	Perv.	Total
Area	0.118	0.148	0.266
C	0.9	0.2	0.51

A12	Imp.	Perv.	Total
Area	0.022	0.003	0.025
C	0.9	0.2	0.81

B1	Imp.	Perv.	Total	
Area	0.259	0.225	0.484	
C	0.9	0.2	0.57	0.53

B2

A7	Imp.	Perv.	Total
Area	0.045	0.037	0.082
C	0.9	0.2	0.58

A8	Imp.	Perv.	Total
Area	0.071	0.010	0.081
C	0.9	0.2	0.82

A9	Imp.	Perv.	Total
Area	0.031	0.006	0.038
C	0.9	0.2	0.78

B2	Imp.	Perv.	Total	
Area	0.147	0.053	0.200	
C	0.9	0.2	0.71	0.73

B3

A5	Imp.	Perv.	Total
Area	0.062	0.008	0.070
C	0.9	0.2	0.82

A6	Imp.	Perv.	Total
Area	0.024	0.035	0.059
C	0.9	0.2	0.48

B3	Imp.	Perv.	Total	
Area	0.085	0.043	0.129	
C	0.9	0.2	0.66	0.66

B4

A1	Imp.	Perv.	Total
Area	0.038	0.006	0.045
C	0.9	0.2	0.80

A1.1	Imp.	Perv.	Total
Area	0.024	0.042	0.066
C	0.9	0.2	0.46

A1.2	Imp.	Perv.	Total
Area	0.014	0.023	0.037
C	0.9	0.2	0.47

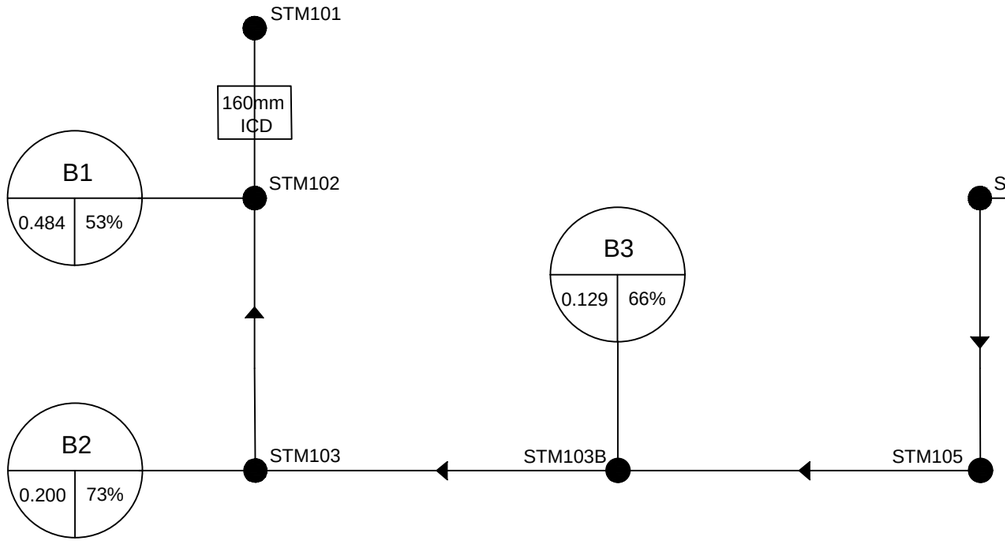
A2	Imp.	Perv.	Total
Area	0.067	0.012	0.080
C	0.9	0.2	0.79

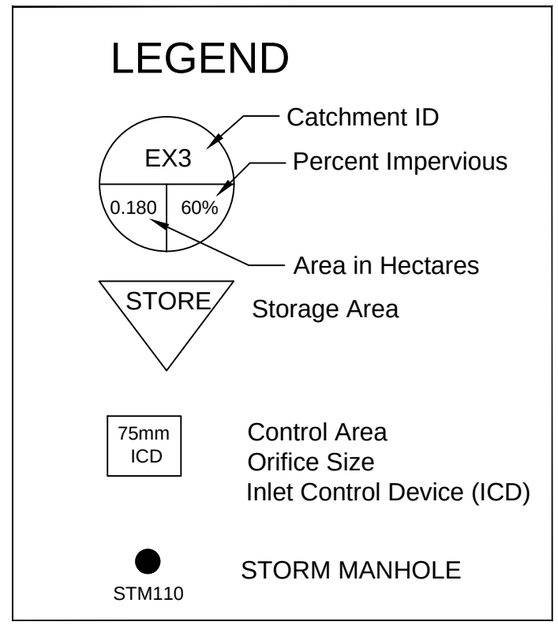
A3	Imp.	Perv.	Total
Area	0.059	0.007	0.066
C	0.9	0.2	0.83

A4	Imp.	Perv.	Total
Area	0.021	0.007	0.028
C	0.9	0.2	0.73

B4	Imp.	Perv.	Total	
Area	0.224	0.097	0.321	
C	0.9	0.2	0.69	0.70

FIGURE 1 - HYDROLOGIC MODEL SCHEMATIC





NOTE: THIS SCHEMATIC IS TO BE VIEWED WITH DRAWING SWM-1 IN THE SERVICING REPORT
NOT ALL STORM MANHOLES SHOWN ON FIGURE

```
[TITLE]
;;Project Title/Notes

[OPTIONS]
;;Option             Value
FLOW_UNITS           LPS
INFILTRATION         HORTON
FLOW_ROUTING         DYNWAVE
LINK_OFFSETS         ELEVATION
MIN_SLOPE            0
ALLOW_PONDING        YES
SKIP_STEADY_STATE    NO

START_DATE           01/01/2000
START_TIME           00:01:00
REPORT_START_DATE    01/01/2000
REPORT_START_TIME    00:01:00
END_DATE             01/02/2000
END_TIME             00:00:00
SWEEP_START          01/01
SWEEP_END            12/31
DRY_DAYS             0
REPORT_STEP          00:01:00
WET_STEP             00:01:00
DRY_STEP             00:01:00
ROUTING_STEP         0:00:02

INERTIAL_DAMPING     PARTIAL
NORMAL_FLOW_LIMITED  BOTH
FORCE_MAIN_EQUATION  H-W
VARIABLE_STEP        0.75
LENGTHENING_STEP     0
MIN_SURFAREA         0
MAX_TRIALS           0
HEAD_TOLERANCE       0
SYS_FLOW_TOL         5
LAT_FLOW_TOL         5
MINIMUM_STEP         0.5
THREADS              1

[EVAPORATION]
;;Data Source    Parameters
;;-------------- ----------------
CONSTANT         0.0
DRY_ONLY         NO

[RAINGAGES]
;;Name           Format    Interval SCF      Source
```

```
;;-------------- --------- ------ ------ ----------
1                INTENSITY 0:10     1.0      TIMESERIES CH6H100

[SUBCATCHMENTS]
;;Name           Rain Gage        Outlet           Area     %Imperv  Width    %Slope
  CurbLen  SnowPack
;;-------------- ---------------- ---------------- -------- -------- --------
-------- --------- ----------------
1                1                U1               0.197    75       145      5.0
  0
B3               1                CB103B           0.129    66       64       4
  0
B4               1                STM107           0.321    70       77       4.0
  0
B2               1                STM103           0.200    73       76       4
  0
B1               1                STM102           0.484    53       48       4
  0

[SUBAREAS]
;;Subcatchment   N-Imperv   N-Perv     S-Imperv   S-Perv     PctZero    RouteTo
PctRouted
;;-------------- ---------- ---------- ---------- ---------- ---------- ----------
----------
1                0.013      0.25       1.57       4.67       0          OUTLET
B3               0.013      0.25       1.57       4.67       0          OUTLET
B4               0.013      0.25       1.57       4.67       0          OUTLET
B2               0.013      0.25       1.57       4.67       0          OUTLET
B1               0.013      0.25       1.57       4.67       0          OUTLET

[INFILTRATION]
;;Subcatchment   MaxRate    MinRate    Decay      DryTime    MaxInfil
;;-------------- ---------- ---------- ---------- ---------- ----------
1                76.2       13.2       4.14       7          0
B3               76.2       13.2       4.14       7          0
B4               76.2       13.2       4.14       7          0
B2               76.2       13.2       4.14       7          0
B1               76.2       13.2       4.14       7          0

[JUNCTIONS]
;;Name           Elevation  MaxDepth   InitDepth  SurDepth   Aponded
;;-------------- ---------- ---------- ---------- ---------- ----------
STM102           69.90      2.18       0          0          0
STM103           69.98      4.85       0          0          0
STM103B          70.09      4.93       0          0          0
STM105           70.18      4.94       0          0          0
STM107           70.39      2.1        0          0          0
```

```
[OUTFALLS]
;;Name           Elevation  Type       Stage Data       Gated    Route To
;;-------------- ---------- ---------- ---------------- -------- ----------------
U1               69.50      FREE                        NO
A1               69.88      FREE                        NO

[STORAGE]
;;Name           Elev.    MaxDepth   InitDepth  Shape      Curve Name/Params
   N/A      Fevap    Psi      Ksat     IMD
;;-------------- -------- ---------- ----------- ----------
---------------------------- -------- --------           -------- --------
CB103B           70.18    1.87       0          TABULAR    UG-A
   0        0

[CONDUITS]
;;Name           From Node        To Node          Length     Roughness  InOffset
OutOffset  InitFlow   MaxFlow
;;-------------- ---------------- ---------------- ---------- ---------- ----------
---------- ---------- ----------
P2               STM102           STM103           61.7       0.013      *
*          0          0
P3               STM103B          STM103           28         0.013      *
*          0          0
P4               STM105           STM103B          52.1       0.013      *
*          0          0
P5               STM107           STM105           61.7       0.013      *
*          0          0
P6               STM103B          CB103B           12.6       0.013      *
*          0          0
4                CB103B           STM103B          13.2       0.013      *
*          0          0

[ORIFICES]
;;Name           From Node        To Node          Type         Offset     Qcoeff
 Gated    CloseTime
;;-------------- ---------------- ---------------- ------------ ----------
---------- -------- ----------
1                STM102           A1               SIDE         *          0.61
 NO       0

[XSECTIONS]
;;Link           Shape        Geom1            Geom2      Geom3      Geom4
Barrels    Culvert
;;-------------- ------------ ---------------- ---------- ---------- ----------
---------- ----------
P2               CIRCULAR     0.600            0          0          0          1

P3               CIRCULAR     0.525            0          0          0          1
```

```
P4               CIRCULAR     0.525           0          0          0          1

P5               CIRCULAR     0.375           0          0          0          1

P6               CIRCULAR     0.45            0          0          0          1

4                CIRCULAR     0.375           0          0          0          1

1                CIRCULAR     0.16            0          0          0

[LOSSES]
;;Link           Kentry     Kexit      Kavg       Flap Gate  Seepage
;;-------------- ---------- ---------- ---------- ---------- ----------
P2               1.3        0          0          NO         0
P3               0          1.3        0          NO         0
P4               1.3        0          0          NO         0
P5               0          1.3        0          NO         0
P6               0          1.3        0          NO         0

[CURVES]
;;Name           Type       X-Value    Y-Value
;;-------------- ---------- ---------- ----------
BLDGD3           Rating     0          0
BLDGD3                      0.025      1.14
BLDGD3                      0.05       2.31
BLDGD3                      0.075      3.42
BLDGD3                      0.10       4.56
BLDGD3                      0.15       6.84
;
BLDGC1           Rating     0          0
BLDGC1                      0.025      0.76
BLDGC1                      0.05       1.54
BLDGC1                      0.075      2.28
BLDGC1                      0.10       3.04
BLDGC1                      0.15       4.56
;
BLDGE2           Rating     0          0
BLDGE2                      0.025      1.90
BLDGE2                      0.05       3.85
BLDGE2                      0.075      5.70
BLDGE2                      0.1        7.60
BLDGE2                      0.15       11.40
;
BLDGD1D2         Rating     0          0
BLDGD1D2                    0.025      7.22
BLDGD1D2                    0.05       14.63
BLDGD1D2                    0.075      21.66
```

```
BLDGD1D2                0.10       28.88
BLDGD1D2                0.15       43.32
;
BLDGB2          Rating  0          0
BLDGB2                  0.025      1.52
BLDGB2                  0.05       3.08
BLDGB2                  0.075      4.56
BLDGB2                  0.10       6.08
BLDGB2                  0.15       9.12
;
BLDGB3          Rating  0          0
BLDGB3                  0.025      0.76
BLDGB3                  0.05       1.54
BLDGB3                  0.075      2.28
BLDGB3                  0.1        3.04
BLDGB3                  0.15       4.56
;
BLDGC2          Rating  0          0
BLDGC2                  0.025      1.14
BLDGC2                  0.05       2.31
BLDGC2                  0.075      3.42
BLDGC2                  0.10       4.56
BLDGC2                  0.15       6.84
;
BLDGC3          Rating  0          0
BLDGC3                  0.025      1.9
BLDGC3                  0.05       3.85
BLDGC3                  0.075      5.70
BLDGC3                  0.1        7.60
BLDGC3                  0.15       11.40
;
BLDGB4          Rating  0          0
BLDGB4                  0.025      0.76
BLDGB4                  0.05       1.54
BLDGB4                  0.075      2.28
BLDGB4                  0.1        3.04
BLDGB4                  0.15       4.56
;
BLDGB1          Rating  0          0
BLDGB1                  0.025      2.66
BLDGB1                  0.05       5.39
BLDGB1                  0.075      7.98
BLDGB1                  0.1        10.64
BLDGB1                  0.15       15.96
;
BLDGA           Rating  0          0
BLDGA                   0.025      19
BLDGA                   0.05       38.5
```

```
BLDGA                    0.075      57
BLDGA                    0.1        76
BLDGA                    0.15       114
;
BLDGE            Rating  0          0
BLDGE                    0.025      3.04
BLDGE                    0.05       6.16
BLDGE                    0.075      9.12
BLDGE                    0.1        12.16
BLDGE                    0.15       18.24
;
UG-A             Storage 0          0.4
UG-A                     0.457      88.201
UG-A                     0.914      176.402
;
100-YEAR         Tidal   0          94.81
100-YEAR                 6          94.81
100-YEAR                 12         0
100-YEAR                 24         0

[TIMESERIES]
;;Name           Date       Time       Value
;;-------------- ---------- ---------- ----------
;2yr12hrS
2yr12hrS         FILE "P:\General Administrative\5 - DSEL Templates\Site
Plan\EPASWMM Template\rainfall\2yr12hrS.dat"
;
;5yr12hrS
5yr12hrS         FILE "P:\General Administrative\5 - DSEL Templates\Site
Plan\EPASWMM Template\rainfall\5yr12hrS.dat"
;
;10yr12hrS
10yr12hrS        FILE "P:\General Administrative\5 - DSEL Templates\Site
Plan\EPASWMM Template\rainfall\10yr12hrS.dat"
;
;25yr12hrS
25yr12hrS        FILE "P:\General Administrative\5 - DSEL Templates\Site
Plan\EPASWMM Template\rainfall\25yr12hrS.dat"
;
;50yr12hrS
50yr12hrS        FILE "P:\General Administrative\5 - DSEL Templates\Site
Plan\EPASWMM Template\rainfall\50yr12hrS.dat"
;
;100yr12hrS
100yr12hrS       FILE "P:\General Administrative\5 - DSEL Templates\Site
Plan\EPASWMM Template\rainfall\100yr12hrS.dat"
;
CH4H005          FILE "P:\General Administrative\5 - DSEL Templates\Site
```

```
Plan\EPASWMM Template\rainfall\CH4H005.dat"
;
;100-year Storm, 4 Hour Chicago Distribution
CH4H100          FILE "P:\General Administrative\5 - DSEL Templates\Site
Plan\EPASWMM Template\rainfall\CH4H100.dat"
;
CH6H100          FILE "P:\General Administrative\5 - DSEL Templates\Site
Plan\EPASWMM Template\rainfall\CH6H100.dat"
;
CH3H100          FILE "P:\General Administrative\5 - DSEL Templates\Site
Plan\EPASWMM Template\rainfall\CH3H100.dat"
;
;3 hour chicago storm + 20%
CH3H100x         FILE "P:\General Administrative\5 - DSEL Templates\Site
Plan\EPASWMM Template\rainfall\CH3H100x.dat"

[REPORT]
;;Reporting Options
INPUT      NO
CONTROLS   NO
SUBCATCHMENTS ALL
NODES ALL
LINKS ALL

[TAGS]

[MAP]
DIMENSIONS -2500.000 0.000 12500.000 10000.000
Units      None

[COORDINATES]
;;Node           X-Coord            Y-Coord
;;-------------- ------------------ ------------------
STM102           2070.358           7047.290
STM103           2093.426           3425.606
STM103B          4746.251           3437.140
STM105           7918.108           3437.140
STM107           7871.972           7231.834
U1               -1043.829          7012.687
A1               2081.892           7993.080
CB103B           4746.251           3979.239

[VERTICES]
;;Link           X-Coord            Y-Coord
;;-------------- ------------------ ------------------
4                4319.493           3679.354

[Polygons]
```

```
;;Subcatchment   X-Coord            Y-Coord
;;-------------- ------------------ ------------------
1                -1066.897          6193.772
1                -1032.295          6182.238
1                -686.275           5478.662
1                -1493.656          5467.128
1                -1032.295          6228.374
B3               5357.555           4971.165
B3               5830.450           4971.165
B3               5622.837           4463.668
B3               5311.419           5017.301
B4               9048.443           6366.782
B4               9613.610           5628.604
B4               9971.165           6401.384
B4               9002.307           6401.384
B2               242.215            3154.556
B2               703.576            2462.514
B2               -184.544           2450.980
B2               230.681            3189.158
B1               397.924            7058.824
B1               836.217            6332.180
B1               74.971             6355.248
B1               409.458            7104.960

[SYMBOLS]
;;Gage           X-Coord            Y-Coord
;;-------------- ------------------ ------------------
1                4711.649           9134.948
```

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.010)

****
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 ..... YES
  Water Quality ..... NO
Infiltration Method ..... HORTON
Flow Routing Method ..... DYNWAVE
Starting Date JAN-01-2000 00:01:00
Ending Date JAN-02-2000 00:00:00
Antecedent Dry Days 0.0
Report Time Step 00:01:00
Wet Time Step 00:01:00
Dry Time Step 00:01:00
Routing Time Step ..... 2.00 sec
Variable Time Step ..... YES
Maximum Trials 8
Number of Threads 1
Head Tolerance ..... 0.001524 m

**********	Volume	Depth
Runoff Quantity Continuity	hectare-m	mm
**********	---------	-------
Total Precipitation	0.110	82.291
Evaporation Loss	0.000	0.000
Infiltration Loss	0.025	18.959
Surface Runoff	0.083	62.401
Final Storage	0.001	1.015
Continuity Error (%)	-0.101	

Flow Routing Continuity	Volume hectare-m	Volume 10^6 ltr
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.083	0.831
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	0.083	0.832
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.000	0.000
Continuity Error (%)	-0.168	

Time-Step Critical Elements

None

Highest Flow Instability Indexes

All links are stable.

Routing Time Step Summary

Minimum Time Step	:	0.90 sec
Average Time Step	:	2.00 sec
Maximum Time Step	:	2.00 sec
Percent in Steady State	:	0.00
Average Iterations per Step	:	2.02
Percent Not Converging	:	0.11

Subcatchment Runoff Summary

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff LPS	Runoff Coeff
1	82.29	0.00	0.00	13.01	68.23	0.13	94.77	0.829
B3	82.29	0.00	0.00	17.79	63.58	0.08	60.63	0.773
B4	82.29	0.00	0.00	15.81	65.47	0.21	147.91	0.796
B2	82.29	0.00	0.00	14.13	67.12	0.13	95.00	0.816
B1	82.29	0.00	0.00	25.78	55.73	0.27	173.38	0.677

****
Node Depth Summary
****

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min	Reported Max Depth Meters
STM102	JUNCTION	0.17	1.95	71.85	0 02:18	0.59
STM103	JUNCTION	0.16	1.88	71.86	0 02:18	0.57
STM103B	JUNCTION	0.14	1.77	71.86	0 02:20	0.54
STM105	JUNCTION	0.13	1.68	71.86	0 02:19	0.51
STM107	JUNCTION	0.11	1.92	72.31	0 01:59	0.58
U1	OUTFALL	0.00	0.00	69.50	0 00:00	0.00
A1	OUTFALL	0.00	0.00	69.88	0 00:00	0.00
CB103B	STORAGE	0.12	1.68	71.86	0 02:19	0.51

****
Node Inflow Summary
****

		Maximum	Maximum		Lateral

Node	Type	Lateral Inflow LPS	Total Inflow LPS	Time of Max Occurrence days hr:min	Inflow Volume 10^6 ltr	Total Inflow Volume 10^6 ltr	Flow Balance Error Percent
STM102	JUNCTION	173.38	173.38	0 01:59	0.27	0.75	-0.028
STM103	JUNCTION	95.00	195.11	0 01:59	0.134	0.599	0.000
STM103B	JUNCTION	0.00	342.51	0 01:59	0	0.635	-0.090
STM105	JUNCTION	0.00	147.84	0 01:59	0	0.21	-0.244
STM107	JUNCTION	147.91	147.91	0 01:59	0.21	0.21	-0.071
U1	OUTFALL	94.77	94.77	0 01:59	0.134	0.134	0.000
A1	OUTFALL	0.00	74.34	0 02:18	0	0.698	0.000
CB103B	STORAGE	60.63	402.96	0 01:59	0.082	0.305	0.119

****
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
STM102	JUNCTION	2.37	1.352	0.228
STM103	JUNCTION	2.25	1.275	2.975
STM103B	JUNCTION	2.21	1.242	3.163
STM105	JUNCTION	2.12	1.154	3.261
STM107	JUNCTION	2.07	1.547	0.178
CB103B	STORAGE	2.19	1.228	0.192

****
Node Flooding Summary

****

No nodes were flooded.

****
Storage Volume Summary
****

Storage Unit	Average Volume 1000 m3	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 m3	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow LPS
CB103B	0.015	4	0	0	0.272	81	0 02:19	51.47

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow LPS	Max Flow LPS	Total Volume 10^6 ltr
U1	24.12	6.47	94.77	0.134
A1	30.14	26.83	74.34	0.698
System	27.13	33.29	168.00	0.832

****
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

P2	CONDUIT	100.11	0	01:59	0.35	0.45	1.00
P3	CONDUIT	194.81	0	01:59	0.90	0.72	1.00
P4	CONDUIT	147.74	0	01:58	0.68	0.83	1.00
P5	CONDUIT	147.84	0	01:59	1.34	1.45	1.00
P6	CONDUIT	172.55	0	01:59	1.08	0.72	1.00
4	CONDUIT	169.78	0	01:59	1.54	1.17	1.00
1	ORIFICE	74.34	0	02:18			1.00

****
Flow Classification Summary
****

Inlet Conduit	Adjusted /Actual Length	Fraction of Time in Flow Class: Dry	Up Dry	Down Dry	Sub Crit	Sup Crit	Up Crit	Down Crit	Norm Ltd	Inlet Ctrl
P2	1.00	0.02	0.00	0.00	0.98	0.00	0.00	0.00	0.32	0.00
P3	1.00	0.02	0.00	0.00	0.98	0.00	0.00	0.00	0.76	0.00
P4	1.00	0.02	0.00	0.00	0.98	0.00	0.00	0.00	0.19	0.00
P5	1.00	0.02	0.00	0.00	0.98	0.00	0.00	0.00	0.48	0.00
P6	1.00	0.02	0.01	0.00	0.97	0.00	0.00	0.00	0.50	0.00
4	1.00	0.02	0.01	0.00	0.97	0.00	0.00	0.00	0.85	0.00

****
Conduit Surcharge Summary
****

Conduit	Hours Full: Both Ends	Hours Full: Upstream	Hours Full: Dnstream	Hours Above Full Normal Flow	Hours Capacity Limited

P2	2.25	2.25	2.37	0.01	0.01
P3	2.21	2.21	2.36	0.01	0.01
P4	2.12	2.12	2.21	0.01	0.02
P5	2.07	2.07	2.29	0.14	0.14
P6	2.19	2.19	2.31	0.01	0.01
4	2.28	2.28	2.42	0.09	0.01

Analysis begun on: Wed Jun 14 10:07:32 2017
Analysis ended on: Wed Jun 14 10:07:33 2017
Total elapsed time: 00:00:01

Site Calculator

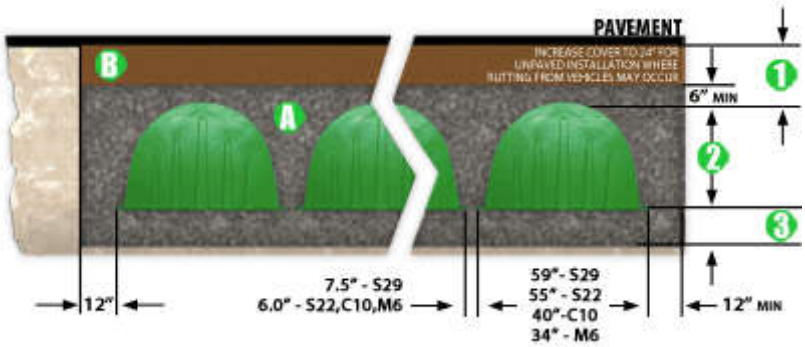
Parameters

Units: Metric ▼
Storage Volume: 193 Cu. M
Chamber Selection: S-29 ▼ [+]
Header Row Position: Left ▼
Fill Over Embedment Stone: 30 cm
Embedment Stone:
Over:
15
Under:
15
Porosity: 0.4
Controlled By (in M):
Width ▼
16
Accessories:
Dumpsters: 0 ▼
Bins: 0 ▼
Floors:
Double Stacked
Double Stacked?:
Lower Chamber: S-29 ▼
Stone Between: 15
Note: After making an input change you must hit recalculate to update the Field Diagram and Project Results.
RECALCULATE SAVE

NOTICE: This calculator works best in when used with Firefox browser. If using Internet Explorer, please be sure to disable Protected Mode. This calculator has shown issues when used in Chrome with AdBlock enabled. If using Chrome, please disable AdBlock.
This calculator is provided for your convenience only and is not meant for final quotation and/or engineering purposes. Please contact Triton for more information. 

Need to model out a full system, or need engineering ready calculations? Triton chambers are available for modeling in HydroCAD by clicking on the HydroCAD banner to the left.

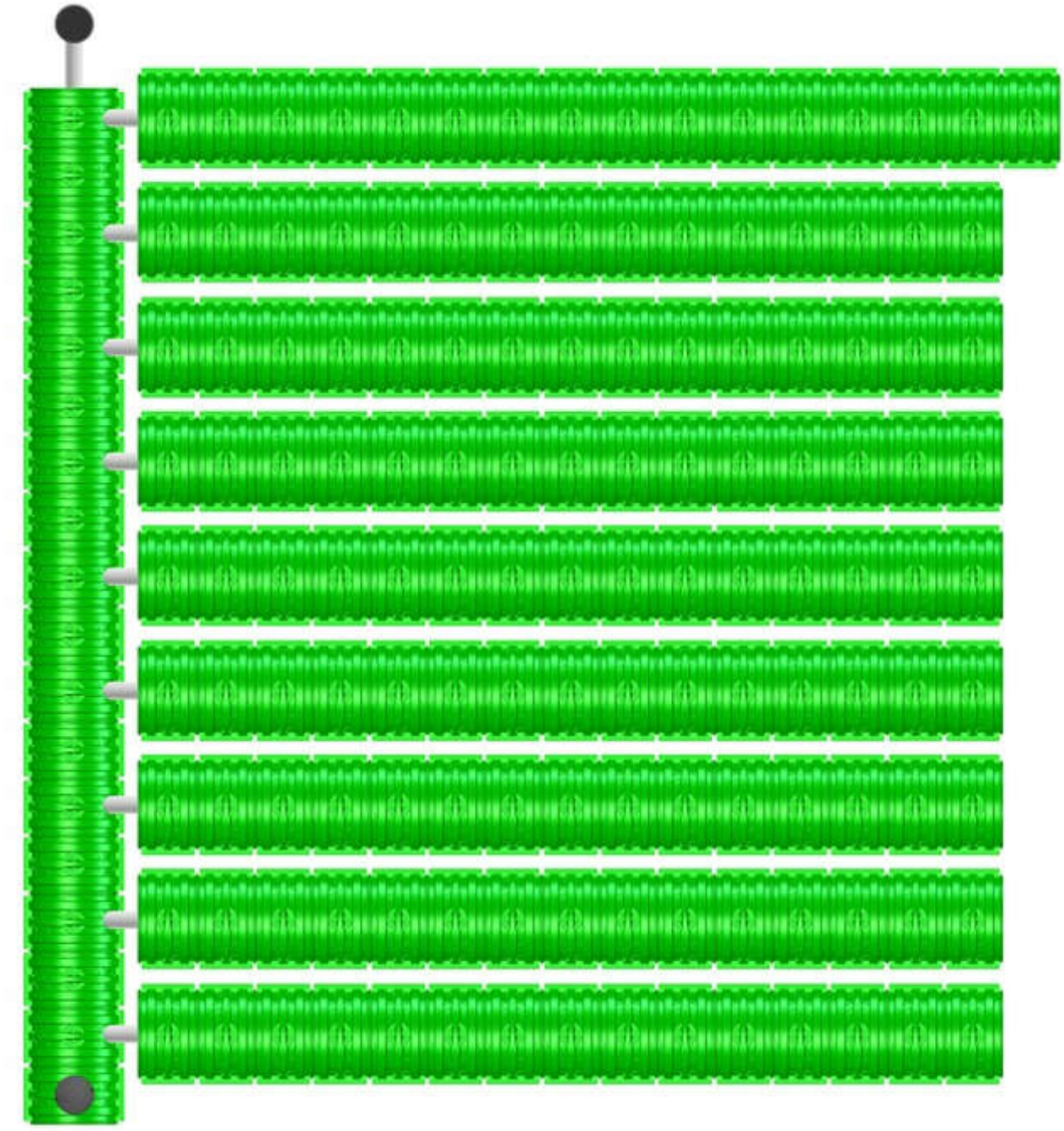
Project Results



- 1 Total Cover Over Chambers: 45.72 cm
- 2 Height of Chamber: 91.44 cm
- 3 Embedment Stone Under Chambers: 15.24 cm
- A Volume of Embedment Stone Required: 183 Cu. M
- B Volume of Fill Material Required: 75 Cu. M

Total Storage Provided:	193.0 Cu. M
Type of Distribution Chambers:	S-29
# of Distribution Chambers Required:	136
# of end caps required:	20
Type of header row chambers required:	S-29
# of header row chambers required:	18
Floors:	0
Bins:	0
Dumpsters:	0
Required Bed Size:	248.42 Sq. M
Volume of Embedment Stone Required:	183.15 Cu. M
Volume of Fill Material Required:	75.72 Cu. M
Volume of Excavation:	378.6 Cu. M
Area of Filter Fabric:	325.29 Sq. M
# of Chambers long:	16
# of rows:	9
Actual Trench Length:	15.903 M
Actual Trench Width:	15.621 M

Field Diagram

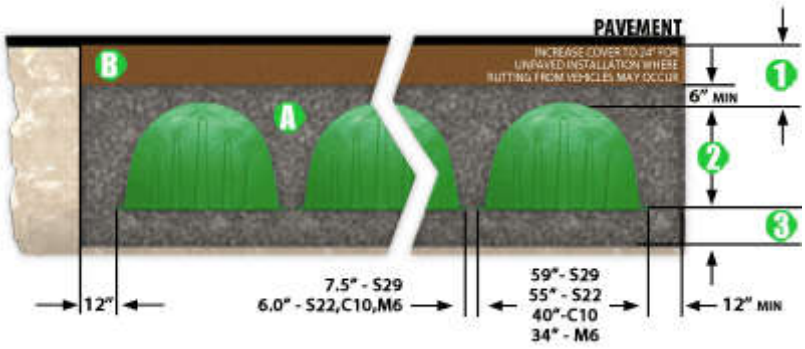


WIRE DIAGRAM

Chamber Type

Dimensions 59" x 36" x 35" (WxHxL)
1498.6mm x 914.4mm x 889mm
Weight 32 lbs / 14.5 kg
Bare Chamber Storage 29 ft³ / 0.82 m³

Project Results



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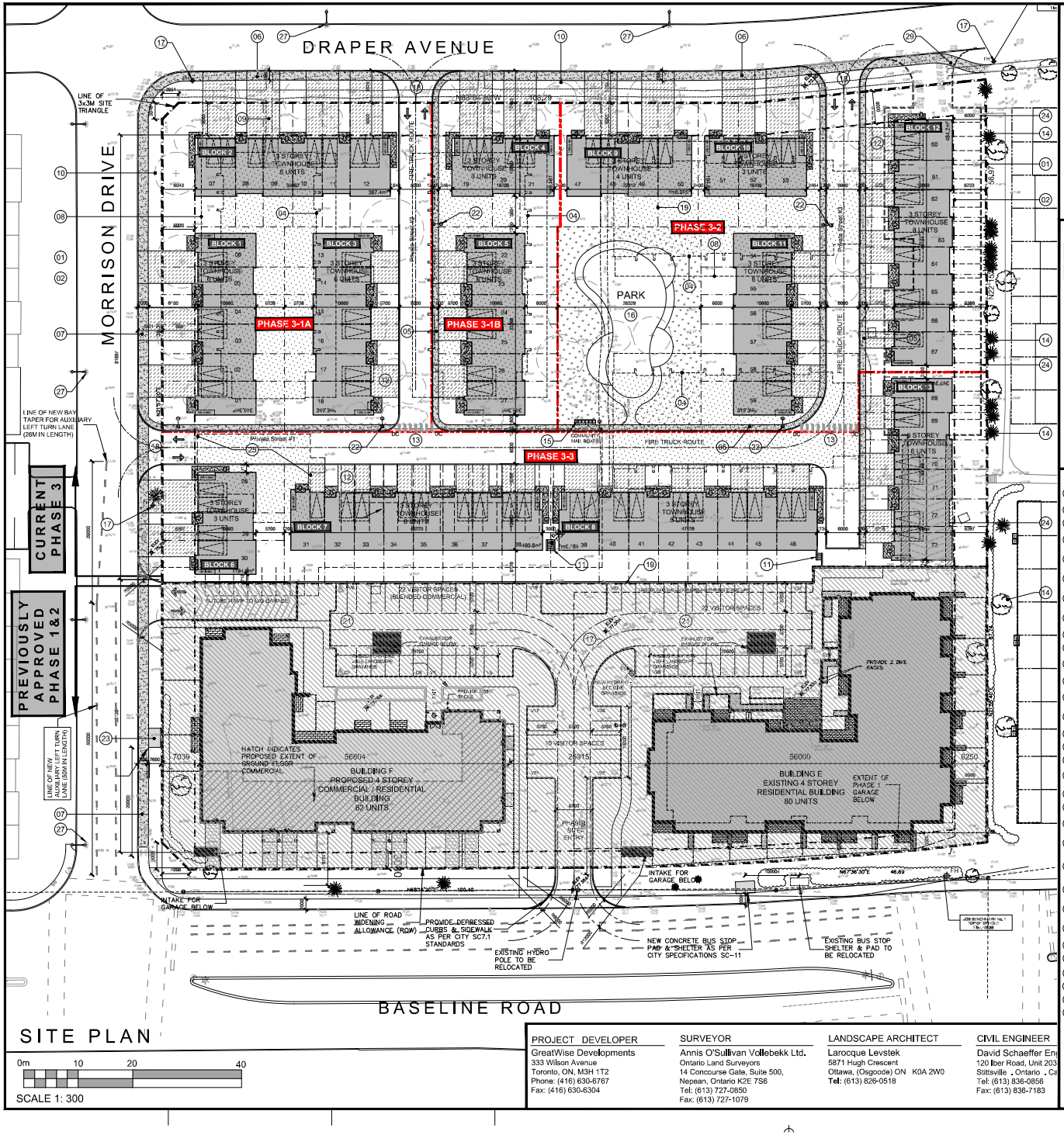
Triton Stormwater Solutions, LLC
7600 Grand River Rd, Suite 195
Brighton, Michigan 48114
Phone: (810) 222-7652 - Fax: (810) 222-1769

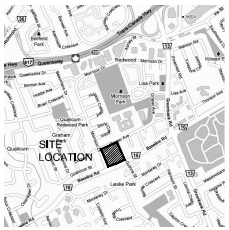
DRAWINGS / FIGURES



SITE PLAN

0m 10 20 40

SCALE 1: 300



LOCATION PLAN- NTS

NOTE:
READ THIS DRAWING IN CONJUNCTION WITH LANDSCAPE PLAN AS PREPARED BY LAROCQUE-LEVSTEK, GRADING PLAN AND SITE SERVICES PLAN AS PREPARED BY DSEL ENGINEERING CONSULTANTS LTD., AND GEOTECHNICAL INVESTIGATION AS PREPARED BY PATERSON GROUP INC..

DRAFT PLAN OF CONDOMINIUM OF

PART OF BLOCK "G"
REGISTERED PLAN 447761
CITY OF OTTAWA

PAUL A. RIDDELL O.L.S., 2005

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

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

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

DO NOT SCALE DRAWINGS.

NOTATION SYMBOLS:

- (N) INDICATES DRAWING NOTES, LISTED ON EACH SHEET.
- (A) INDICATES ASSEMBLIES TYPE, REFER TO TYPICAL ASSEMBLIES SCHEDULE.
- (W) INDICATES WINDOW TYPE, REFER TO WINDOW ELEVATIONS AND DETAILS ON A900 SERIES.
- 500 INDICATES DOOR TYPE, REFER TO DOOR SCHEDULE AND DETAILS ON A900 SERIES.
- DETAIL NUMBER
- TITLE
- DETAIL REFERENCE PAGE
- DETAIL CROSS REFERENCE PAGE

SITE PLAN SYMBOLS

- HARD SURFACE WALKWAY
- NEW CITY CONCRETE SIDEWALK
- EXISTING CITY STREET LIGHT
- LIGHT STANDARD
- TWO WAY VEHICLE CIRCULATION
- ENTRANCE LOCATION
- BOLLARD STYLE BIKE RACK
- EXISTING GRADE
- FH FIRE HYDRANT
- V VISITOR PARKING SPOT
- SMALL CAR PARKING 2400 x 5200
- SMALL CAR PARKING 2400 x 4600
- DC DEPRESSED CURB

DRAWING NOTES

1. PROPERTY LINE (REFER TO SURVEY DRAWING FOR INTERNAL PROPERTY LINES AND PARTS)
2. 6.0M ZONING YARD SETBACK
3. FIRE TRUCK ROUTE
4. EXISTING 2 STOREY APARTMENT BUILDING TO BE REMOVED
5. 1200mm WIDE CONCRETE SIDEWALK AND CURB
6. 1800mm WIDE CITY SIDEWALK, AS PER CITY OF OTTAWA STANDARDS
7. 2000mm WIDE CITY SIDEWALK & CURB, AS PER CITY OF OTTAWA STANDARDS
8. EXISTING WOOD PRIVACY FENCE, TO BE REMOVED
9. EXISTING ASPHALT PATH TO BE REMOVED
10. EXISTING TREES TO BE REMOVED
11. UNIT BLOCK RETAINING WALL WITH STEPS, AS REQUIRED
12. PRIVATE DRIVEWAY
13. PEDESTRIAN CROSS WALK WITH DEPRESSED CURBS
14. EXISTING TREES TO REMAIN, PROTECT AS REQUIRED
15. PROPOSED COMMUNITY MAIL BOX LOCATION
16. PRIVATE PARK WITH SAND FILLED PLAY AREA
17. EXISTING FIRE HYDRANT
18. NEW ENTRY, DEPRESSED CURB AND SIDEWALK TO CITY STANDARDS, SEE CIVIL
19. PROPOSED LOT LINE
20. 1800mm HIGH WOOD PRIVACY FENCE
21. RETAINING WALL / EXPOSED EXTERIOR WALL OF PHASE 1 PARKING GARAGE
22. LIGHT STANDARD, EXACT LOCATION TO BE CONFIRMED BY ELECTRICAL ENGINEER
23. EXISTING BUS STOP AND BENCH TO BE REPLACED WITH CONCRETE BUS STOP PAD & SHELTER AS PER CITY SPECIFICATIONS SC-11
24. EXISTING PARKING LOT, PHASE 1 GARAGE RAMP TO THE REMOVED UNDER THIS PHASE
25. TEMPORARY SALES CENTER AND PARKING AREA TO BE REMOVED UNDER THIS PHASE
26. RELOCATED PHASE 1 PARKING GARAGE ENTRY
27. EXISTING CITY STREET LIGHT
28. METER CLOSETS
29. CONNECT NEW SIDEWALK TO EXISTING
30.
31.
32.

APPROVED PHASE 1 & 2

SITE STATISTICS LOW RISE APARTMENT BUILDING	PROJECT TOTAL	BLDG E	BLDG F
PHASE 1 - SITE AREA m2 =	7,941.5 (100.00%)		
FOOTPRINT m2 =	2,876.4 (36.22%)	1,517.0	1,359.4
PARKING & DRIVEWAYS m2 =	1,779.7 (22.41%)		
OPEN LANDSCAPE m2 =	3,285.4 (41.37%)		
GROSS FLOOR AREA m2 =	9,597.5	5,040.0	4,557.5
BUILDING HEIGHT m =		15.6	15.6
NO. OF STOREYS =		4	4
GROSS COMMERCIAL AREA m2 =	598	0	598
NO OF DWELLING UNITS			
1 BEDROOM =	235	56	43
2 BEDROOM =	149	24	37
3 BEDROOM =	16	0	0
TOTAL =	400	80	80
RESIDENT PARKING			
REQUIRED =	400	80	40
PROVIDED =	400	80	40
VISITOR PARKING			
REQUIRED =	80	16	16
PROVIDED =	80	16	16
COMMERCIAL PARKING REQUIRED:			
RETAIL (1 SPACE / 92.9M2 AREA) =	3		
MEDICAL (4 SPACE/100M2 AREA) =	15	0	3
TOTAL:	3	0	15
TOTAL PARKING REQUIRED:	498		18
PROVIDED =	487		
BICYCLE PARKING			
REQUIRED =	210	40	40
PROVIDED =	212	40	40

PROJECT INFORMATION - PHASE 3 (TOWNHOUSE)

ZONING Zoning By-Law 2008-250 R5A[1700] S247, S282

SITE AREA - PHASE 3 13,363.0 sq. m. (1+3,836) sq. ft.

BUILDING HEIGHT	3 STOREY	12.0 M
BUILDING AREA (73 UNITS)		13,364.1 sq. m. (1+3,800) sq. ft.
FRONT YARD SETBACK (TYPICAL)		5.2 M
CORNER YARD SETBACK (TYPICAL)		1.8 M
INTERIOR YARD SETBACK (TYPICAL)		1.2 M
REAR YARD SETBACK (TYPICAL)		6.0 M

PROJECT STATISTICS - PHASE 3

BUILDING HEIGHT	3 STOREY	12.0 M
BUILDING AREA (73 UNITS)		13,364.1 sq. m. (1+3,800) sq. ft.
FRONT YARD SETBACK (TYPICAL)		5.2 M
CORNER YARD SETBACK (TYPICAL)		1.8 M
INTERIOR YARD SETBACK (TYPICAL)		1.2 M
REAR YARD SETBACK (TYPICAL)		6.0 M

LOT COVERAGE

PAVED SURFACE (ROADS) =	1,885.3 sq. m.	13.7%
PAVED SURFACE (DRIVEWAY) =	1,388.9 sq. m.	10.4%
BUILDING FOOTPRINT =	4,974.1 sq. m.	37.7%
LANDSCAPED OPEN SPACE =	4,948.3 sq. m.	37.0%
LANDSCAPE PARK =	997.3 sq. m.	7.3%
TOTAL =	13,364.1 sq. m.	100.0%

BUILDING STATISTICS	UNIT COUNT	TOTAL UNIT AREA
TOWN-HOUSE TYPE 'A' (WITH GARAGE)	14	26,577 sq. ft.
TOWN-HOUSE TYPE 'B' (WITH GARAGE)	17	28,816 sq. ft.
TOWN-HOUSE TYPE 'C' (WITH GARAGE)	6	14,767 sq. ft.
TOWN-HOUSE TYPE 'D' (WITH GARAGE)	14	31,206 sq. ft.
TOWN-HOUSE TYPE 'E' (WITH GARAGE)	6	9,824 sq. ft.
TOWN-HOUSE TYPE 'F' (WITH GARAGE)	10	15,670 sq. ft.
TOWN-HOUSE TYPE 'G' (WITH GARAGE)	3	5,857 sq. ft.
TOWN-HOUSE TYPE 'H' (WITH GARAGE)	3	6,114 sq. ft.
TOTAL UNITS	73	138,126 sq. ft.

CAR PARKING

REQUIRED

TOWN-HOMES/GARAGE - 1.0 PER UNIT (73 UNITS) 73

GENERAL NOTES:

A. REFER TO TYPICAL ASSEMBLIES SHEET FOR WALL, PARTITION, ROOF CEILING & FLOOR TYPES.
B. FOR DOOR TYPES AND HARDWARE REQUIREMENTS REFER TO DOOR SCHEDULE ON A900 SERIES.
C. ALL INTERIOR DIMENSIONS ARE TAKEN FROM THE FACE OF STUD
D. ALL EXTERIOR DIMENSIONS ARE TAKEN FROM THE FACE OF STUD
E. ALL EXTERIOR WALLS ARE TO BE TYPE 'W' UNLESS NOTED OTHER WISE.
F. ALL INTERIOR PARTITIONS ARE TO BE TYPE 'P1' UNLESS NOTED OTHER WISE.
G. ALL REINFORCED CONCRETE SUSPENDED SLABS, COLUMNS & BEAMS HAVE A MIN. FIR OF 1.0 HRS (AS DETERMINED BY OBC SB-2) UNLESS OTHERWISE STATED.

No.	DESCRIPTION	DATE
REVISIONS:		
A	ISSUED FOR SITE PLAN APPROVAL - PHASE 3	June 12,17
A	ISSUED FOR AS-BUILT DRAWINGS	June 27,16
A	ISSUED FOR CONDOMINIUM REGISTRATION	Apr.27,16
A	CITY COMMENTS - REVISED SPA	Apr.04,16
A	CITY COMMENTS - REVISED SPA	Feb.03,16
A	ISSUED FOR REVISED SPA	Nov.11,15
A	ISSUED FOR TEMP. ENTRY ACCESS PERMIT	Sep.18,15
A	ISSUED FOR CONSTRUCTION	Oct.17,14
A	ISSUED FOR CONSTRUCTION - PARTIAL ONLY	Apr.25,14
A	ISSUED FOR PARTIAL TENDER I	Nov.07,13
A	ISSUED FOR SITE SEVERANCE APPLICATION	Aug.21,13
A	ISSUED FOR FOUNDATION PERMIT	Aug.01,13
A	FINAL SITE PLAN CONTROL	Mar.26,13
A	COMMENTS RE: SITE PLAN CONTROL	Jan.28,13
A	REVISED SITE PLAN CONTROL	Nov.30,12
A	ISSUED FOR DEMOLITION PERMIT	Sept.13,12
A	ISSUED FOR SITE PLAN CONTROL	Sept.04,12

ARCHITECT SEAL: ONTARIO ASSOCIATION OF ARCHITECTS LICENCE 6578 — SEAL DATE: STAMP DATE

NORTH ARROW

CLIENT: Greatwise DEVELOPMENTS

ARCHITECT: RODERICK LAHEY ARCHITECT INC
56 Beech Street, Ottawa, Ontario K1S 3J3
t.613.724.1432 f.613.724.1289 www.roderickLahey.ca

PROJECT TITLE: timber wood towns — trendsettingtowns
2781, 2791 & 2797 BASELINE ROAD
2704, 2706, 2724 & 2764 DRAPER AVENUE
OTTAWA ONTARIO

SHEET TITLE:
SITE PLAN - PROPOSED OVERALL

DRAWN: RV | CHECKED: RL
SCALE: 1:300
PROJECT No.: 1020
SHEET No.: SP-1

PLOT DATE: Friday, June 09, 2017

PROJECT DEVELOPER
GreatWise Developments
333 Wilson Avenue
Toronto, ON, M3H 1T2
Phone: (416) 630-6767
Fax: (416) 630-6304

SURVEYOR
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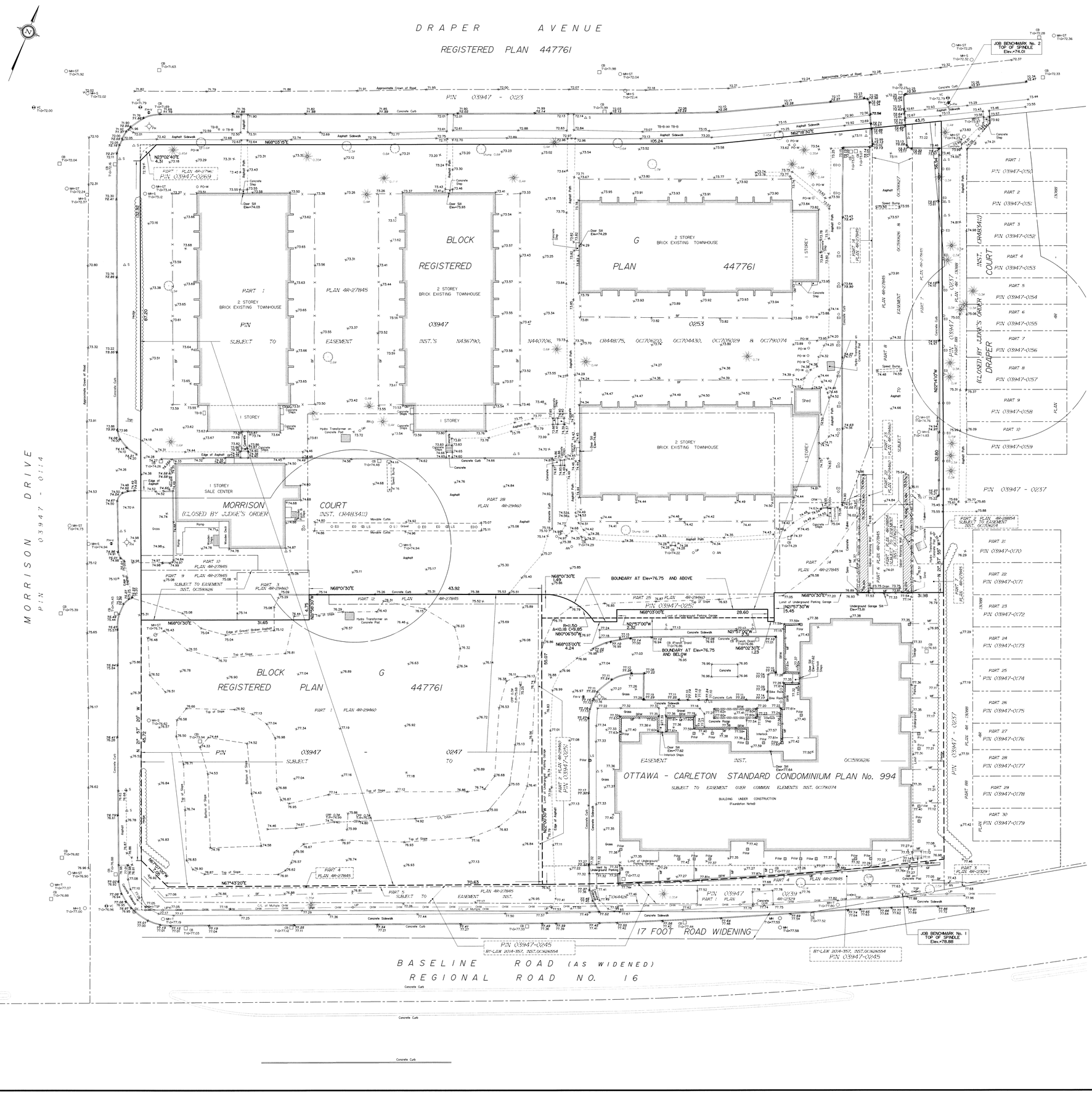
Fax: (613) 727-1079

LANDSCAPE ARCHITECT
Larocque Levstek
5871 Hugh Crescent
Ottawa, (Osgoode) ON K0A 2W0
Tel: (613) 826-0518

CIVIL ENGINEER
David Schaeffer Eng
120 Iber Road, Unit 203
Stittsville , Ontario , Ca
Tel: (613) 836-0856
Fax: (613) 836-7183



TOPOGRAPHICAL SKETCH OF

MORRISON COURT & PART OF DRAPER COURT (Closed by Judge's Order CR483411) PART OF BLOCK G REGISTERED PLAN 447761 AND OTTAWA-CARLETON STANDARD CONDOMINIUM PLAN No. 994 CITY OF OTTAWA

Prepared by Annis, O'Sullivan, Vollebekk Ltd.
Field Work Completed May 4, 2017

Scale 1 : 250

10 7.5 5.0 2.5 0 5 10 Metres

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

Notes & Legend

Denotes		
MH-ST	-	Maintenance Hole (Storm Sewer)
MH-S	-	Maintenance Hole (Sanitary)
MH-T	-	Maintenance Hole (Traffic)
MH	-	Maintenance Hole (Unidentified)
CB	-	Catch Basin
CBI	-	Catch Basin Inlet
VC	-	Valve Chamber (Watermain)
FH	-	Fire Hydrant
WV	-	Water Valve
GV	-	Gas Valve
GM	-	Gas Meter
TSP	-	Traffic Signal Post
S	-	Sign
CPP	-	Corrugated Plastic Pipe
T/P	-	Top of Pipe
T/G	-	Top of Grate
	-	Deciduous Tree
	-	Coniferous Tree
MF	-	Metal Fence
BF	-	Board Fence
UP	-	Utility Pole
AN	-	Anchor
LS	-	Light Standard
PO-W	-	Wood Pole
EO	-	Electrical Outlet
TB-B	-	Bell Terminal Box
Ø	-	Diameter
+68.00	-	Location of Elevations
+68.00	-	Top of Wall Elevations
+68.00	-	Top of Concrete Curb Elevation
C/L	-	Centreline
	-	Property Line
BRW	-	Brick Retaining Wall
CRW	-	Concrete Retaining Wall

BOUNDARY INFORMATION SHOWN HEREON HAS BEEN COMPILED FROM FIELD SURVEY AND EXISTING DOCUMENTS.

ELEVATION NOTES

1. Elevations shown are geodetic and are referred to the CGVD28 geodetic datum.
2. It is the responsibility of the user of this information to verify that the job benchmark has not been altered or disturbed and that it's relative elevation and description agrees with the information shown on this drawing.

UTILITY NOTES

1. This drawing cannot be accepted as acknowledging all of the utilities and it will be the responsibility of the user to contact the respective utility authorities for confirmation.
2. Only visible surface utilities were located.
3. A field location of underground plant by the pertinent utility authority is mandatory before any work involving breaking ground, probing, excavating etc.

ANNIS, O'SULLIVAN, VOLLEBEKK LTD.
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Nepean, Ont. K2E 7S8
Phone: (613) 727-0850 / Fax: (613) 727-1079
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Ontario Land Surveyors

Job No. 19356-17 DWG PREL C PL 447761 T F