FUNCTIONAL SERVICING AND STORMWATER MANAGEMENT REPORT

FOR

WINDMILL DEVELOPMENT GROUP LTD. DOMTAR LANDS REDEVELOPMENT

CITY OF OTTAWA

PROJECT NO.: 14-717

AUGUST 2015 – REV 1

FUNCTIONAL SERVICING AND STORMWATER MANAGEMENT REPORT
FOR
WINDMILL DEVELOPMENT GROUP LTD.
DOMTAR LANDS REDEVELOPMENT

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1.0 INTRODUCTION

David Schaeffer Engineering Ltd. (DSEL) has been retained to prepare a Functional Servicing and Stormwater Management Report (FSR) for the proposed Domtar Lands Redevelopment in support of Windmill Development Group's application for Site Plan Control (SPC) for Phase 1 of the development.

The subject property consist of lands within the City of Ottawa urban boundary. The applicant also owns lands within Gatineau, Quebec that are planned to be designed and constructed concurrently with the proposed development within Ottawa. The Ontario and Quebec developments will be serviced independently, the following FSR is solely in support of the Phase 1 of the Ontario Site.

As illustrated in ***Figure 1***, the subject property is located on parts of Chaudière and Albert Islands within the Ottawa River, it is accessible via Booth Street and the Chaudière Bridge. The following FSR is to support the development of Phase 1 only, as indicated in ***Figure 1,*** which measures approximately ***1.44 ha.*** Phase 1 is generally bounded by the Booth Stree to the east, Albert Island to the south and Energy Ottawa owned lands on Chaudière Island to the north.

The subject site is currently comprised of thirteen parcels of land with two civic addresses, 3 & 4 Booth Street, herein referred to as the site.

Figure 1: Site Location

The proposed development of Phase 1 involves the construction of approximately ***5,556m²*** of retail, commercial and office space, ***288*** residential units along with associated roadway and parking as outlined by the Phase 1 site plan.

The objective of this report is to support the application for Site Plan Approval by providing sufficient detail to demonstrate that the development is supported by existing municipal servicing infrastructure and that the contemplated site design conforms to current City of Ottawa design standards, in addition to, state of the art design strategies to meet the client's "One Planet" strategy.

Servicing and grading presented in the detailed design of Phase 1 is consistent with the *Master Servicing Plan – Domtar Redevelopment Lands*, prepared by DSEL (July 2015),

1.1 Existing Conditions

A detailed survey was completed by Fairhall Moffat & Woodland Limited on December 11, 2014. As per the topographic survey, elevations vary from ***46.20m*** at the east edge of the Chaudière Island to ***54.85m*** to the west.

The subject site currently consists of several vacant industrial facilities, historically part of a paper mill that was in operation until 2007.

The site is made up of existing building footprint and gravel covered vacant lands. A portion of the Chaudière Island lands west of Booth Street consist of grassed and landscaped area.

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

Booth Street

- 203mm diameter ductile iron watermain (North of Middle Street)
- 305mm diameter PVC watermain (South of Middle Street)
- 250mm diameter sanitary sewer
- 1200mm diameter storm sewer

Middle Street

- 203mm diameter ductile iron watermain
- 250mm diameter sanitary sewer
- 300mm diameter storm sewer
- Sanitary pumping station northwest corner of the Portage Bridge and Middle Street

Portage Bridge

- 100mm diameter sanitary forcemain
- Sanitary pumping station, northwest of the Portage Bridge and Wellington Street intersection
- 450mm diameter storm sewer

1.2 Required Permits / Approvals

Development of the site is subject to the City of Ottawa Planning and Development Approvals process. The City of Ottawa must approve detailed engineering design drawings and reports, prepared to support the proposed development plan.

The existing stormwater outlet proposed to be used in Phase 1 development does have an existing Ministry of the Environment (MOE) Environmental Compliance Approval (ECA). The existing ECA will have to be amended based on the updated land use.

A contemplated purple pipe system capable of supplying non-potable water to the site will require a MOE Permit to Take Water (PTTW).

The subject property contains existing trees. Development, which may require removal of existing trees, may be subject to the City of Ottawa Urban Tree Conservation By-law No. 2009-200.

1.3 Pre-consultation

Pre-Consultation was conducted with the City of Ottawa and Rideau Valley Conservation Authority via email, along with a formal pre-consultation meeting held between the client and City staff on December 20, 2013. Correspondence and a servicing guidelines checklist are included 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, October 2012
  (Water Supply Guidelines)

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

  - **Technical Bulletin ISDTD-2014-2**
    City of Ottawa, May 27, 2014.
    (*ISDTD-2014-2*)

- **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)

- **Low Impact Development Stormwater Management Planning and Design Guide**
  Toronto Region Conservation Authority (TRCA) & Credit Valley Conservation Authority (CVC),
  2010
  (LID Manual)

- **LeBreton Flats Infrastructure and Remediation Project Master Servicing Report**
  Dessau Soprin Inc.,
  February 2004, Revision 5
  (LeBreton MSS)

- **Canadian Guidelines for Domestic Reclaimed Water for Use in Toilet and Urinal Flushing**
  Health Canada,
  January 2010
  (Canada Guidelines for Reclaimed Water)

- **Design and installation of non-potable water systems/Maintenance and field testing of non-potable water systems**
  Canadian Standards Association (CSA),
  2011
  (CSA Design & Installation)

- **Performance of non-potable water reuse systems**
  Canada Standards Association (CSA),
  September 2012
  (CSA Performance)

- **LeBreton Flats Sanitary Pumping Station; Operations and Maintenance Manual**
  City of Ottawa; Public Works and Services Department Utility Services Branch; Wastewater and Drainage Services Division
  March 2010
  (LeBreton PS O&M)

- **Master Servicing Study – Domtar Redevelopment Lands**
  DSEL
  July 2015
  (MSS – Domtar Redevelopment)

3.0 WATER SUPPLY SERVICING

3.1 Existing Water Supply Services

The subject property lies within the City of Ottawa 1W pressure zone. A 203mm and 305mm diameter watermains exist within the Booth Street and a 203mm watermain exists within Middle Street. Both watermains are fed by a 1220mm diameter transmission main within Albert Street. Drawings ***EX-1*** illustrate the existing water distribution network.

Historically, the site would have been serviced via several 203mm diameter service laterals connecting to the 203mm diameter watermain within Booth Street. As discussed previously, the historical conditions of the site up until 2007 was entirely industrial.

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

Table 1
Water Supply Design Criteria

Design Parameter	Value
Industrial – Heavy	55,000 L/gross ha/d
Residential Average Apartment Demand	1.8 person/unit
Residential Daily Average	350 L/person/d
Residential Maximum Daily Demand*	2.25 x Average Daily
Residential Maximum Hourly*	3.38 x Average Daily
Commercial-Floor space	2.5 L/m^2/d
Commercial-Industrial Maximum Daily Demand	1.5 x avg. day L/gross ha/d
Commercial-Industrial Maximum Hour Demand	1.8 x avg. day L/gross ha/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 shall not exceed	552kPa
During fire flow operating pressure must not drop below	140kPa
** Residential Max. Daily and Max. Hourly peaking factors per MOE Guidelines for Drinking-Water Systems Table 3-1 for 2,001 to 3,000 persons.* **** Table updated to reflect ISD-2010-2*	

Table 2 Summarizes the historical water demand based on the current City of Ottawa ***Water Supply Guidelines***.

Table 2
Water Demand - Historical Site Conditions

Design Parameter	Historical Water Demand[1] (L/min)
Average Daily Demand	216.6
Max Day	324.8
Peak Hour	584.7

1) Water demand calculations per ***Water Supply Guidelines***. Refer to ***Appendix B*** for detailed calculations.

3.2 Water Supply Servicing Design

The proposed water servicing is consistent with the ***MSS – Domtar Redevelopment*** proposing a new 200mm watermain crossing the Portage Bridge to connect to the existing 200mm watermain within Middle Street. The proposed watermain will connect to a 200mm private watermain south of the existing Mill Street Restaurant and travel through an existing joint utility cage. A looped connection will be provided from the existing 300mm watermain connecting the Booth Street watermain to the Middle Street watermain underneath the Bronson Channel. The existing watermain connection underneath the Bronson Channel was constructed in 1995 and as per City recommendations a leakage test will not be required, see correspondence in ***Appendix A***.

A 200mm watermain is proposed within the west edge of Booth Street as well as a 300mm watermain is proposed to replace the existing 200mm watermain along the east edge of Booth Street. Both watermains will be connected to internal watermains for Phase 1 to provide adequate servicing in Phase 1 and the ultimate condition as per the ***MSS – Domtar Redevelopment***. Detailed layout and sizing is shown by drawing ***SSP-1*** included with this report.

Each building will be serviced independently via connections to the private watermain network. Fire hydrants will be provided internally to provide adequate fire protection coverage as per the ***Water Supply Guidelines***. Fire flow for the proposed and re-purposed building was estimated with the ***FUS***. Block 206 resulted in the highest fire flow of ***20,000 L/min***, see ***Appendix D*** for detailed calculations. The pipe sizes have been sufficient sized to provide fire flow for all building in the ultimate condition, see ***MSS – Domtar Redevelopment*** for water distribution model of the entire site.

Table 3 summarize the anticipated water demand and boundary conditions for the proposed development, calculated using the ***Water Supply Guidelines***.

Table 3
Water Demand – Proposed Site Conditions

Design Parameter	Anticipated Demand[1] (L/min)	Boundary Condition[2] ($m\ H_2O$ / kPa) Connection @ Booth Street		Boundary Condition[2] ($m\ H_2O$ / kPa) Connection @ Wellington Street	
Average Daily Demand	150.3	61.7	605.3	58.6	574.9
Max Day + Fire Flow	320.1 + 20,000 = 20,320.1	50.3	493.4	52.5	515.0
Peak Hour	491.6	54.7	536.6	51.6	506.2

2) Water demand calculation per ***Water Supply Guidelines***. See ***Appendix B*** for detailed calculations.
3) Boundary conditions supplied by the City of Ottawa for demands as indicated in correspondence. Assumed ground elevation @ Booth Street ***53.4m***, @ Wellington Street ***56.5m***, See ***Appendix B.***

The boundary conditions summarized in ***Table 3*** are based water demands for phase 1 development. After further information was received on commercial, retail, office and community space, the resulting water demands increased, however, with the existing high pressures in the system it is anticipated the increase in water demand will have minimal impact to the boundary conditions.

EPANet was utilized to determine the availability of pressures throughout the system during average day demand, max day plus fire flow, and peak hour demands. Additionally, the model was used to assess maximum pressure for the future conditions. This static model determines pressures based on the available head provided by the City of Ottawa boundary conditions. The model utilizes the Hazen-Williams equation to determine pressure drop, while the pipe properties have been selected in accordance with ***Water Supply Guidelines***. The model was prepared to assess the available pressure at the finished first floor of each building.

To ensure that adequate pressure is available during the fire flow scenario, additional hydrants have been proposed to provide fire protection. Fire protection for Block 205-A will be provided by both hydrant FH 2 & FH 3. Both were modeled assuming a flow of ***8,500 L/min*** totaling ***17,000 L/min*** as per the ***FUS*** estimated fire demand. Fire protection for Block 206 will be provided by FH 3 & FH 4, each modeled assuming a flow rate of ***10,000 L/min***, totaling ***20,000 L/min*** as per the ***FUS***.

Table 4 summarizes the pressures in each scenario including the fire flow scenario yielding the lowest pressure. ***Appendix B*** contains output reports and model schematics for each scenario.

Table 4
Model Simulation Output Summary

Location	Average Day (kPa)	Max Day + Fire Flow (kPa)	Peak Hour (kPa)
Block 205-A	589.1	320.9	520.2
Block 206	590.1	318.1	521.1
Block 207	590.1	333.3	521.2
Block 208	590.1	361.2	521.3
FH 3	585.2	197.6	516.4
FH 4	597.4	216.6	528.7
Note: FH3 & FH4 modelled assuming a fire flow of ***10,000 L/min*** demand at each hydrant to service Block 206			

As demonstrated in ***Table 4***, the anticipated pressures during the average day simulations are higher than allowable pressures in ***Table 1***. Pressure reducing valves are recommended. The recommended pressures from the ***Water Supply Guidelines*** are respected during peak hour and max day + fire flow scenarios.

The model predicted that water will flow in all areas of the system and no ‘dead’ zones were found.

It should be noted that the pressures in ***Table 4*** represent the available pressure at the building meter. The mechanical designer must ensure that the internal distribution system is designed in accordance with the OBC.

3.3 Purple Pipe System

A non-potable purple pipe system will be employed in Phase 1 to service all proposed building. Servicing will be achieved by a central pumping and treatment facility located within the parking garage of Block 205-A. An internal plumbing system will act to convey non-potable through the shared parking garage to each building to service toilets and landscaping needs on-site.

A conceptual design has been provided by Hatch Mott MacDonald (HMM) on the proposed interim non-potable water system. An existing 300mm diameter intake pipe will be re-used to retrieve water from the Ottawa River to the proposed pump and treatment facility located at the west edge of Block 205-A parking garage.

The facility consists of a package filtration system, packaged pumps, sodium hypochlorite system, hydroneumatic tank and a standby generator to treat the water to Ontario Drinking Water Standards – Aesthetic Objectives and convey the non-potable water to the proposed buildings.

Further detail of the proposed purple pipe system can be found in ***Appendix B***.

3.4 Water Supply Conclusion

The site will be serviced by a connection to the Booth Street watermain and a 2nd connection across the Portage Bridge to the private watermain south of the existing Mill Street Brew Pub. Each building will be serviced by an internal network of watermains

An EPANet model was prepared based on boundary conditions received from the City of Ottawa. Pressures in average day and peak hour scenario exceed the recommended pressures as per the ***Water Supply Guidelines,*** pressure reducing valves are recommended.

A purple pipe system will be implemented in Phase 1, including a treatment facility that will provide treatment to Ontario Drinking Water Standards – Aesthetic Objectives.

4.0 WASTEWATER SERVICING

4.1 Existing Wastewater Services

The subject site, based on City of Ottawa's infrastructure maps & utility plans, is connected to the 250mm sanitary sewer within Middle Street. To accomplish this connection, a series of pumps stations direct flow to a single private pump station within the subject lands east of Booth Street. This existing private pump station discharge via a forcemain to the Middle Street sanitary sewer. A figure, prepared by Greenough Environmental Consulting Inc. for Domtar Inc., showing the location of on-site pump stations and forcemains can be found in ***Drawings/Figures*****.** The Middle Street sanitary sewer discharges via gravity flow to an existing pump station northwest of the intersection of Middle Street and The Portage Bridge. A 100mm forcemain directs sanitary flow to a second pump station to the south, across the Bronson Channel. The south pump station discharges via a 100mm forcemain to the 1830mm diameter interceptor sewer (IS) north of Sparks Street. Both pump stations are owned and operated by the NCC and service commercial and recreational development on Victoria Island.

Refer to drawings ***EX-1*** for existing wastewater services.

A field investigation of the existing main pump station on Chaudière Island was completed by DSEL on June 30, 2015. The field investigation was to determine the existing condition of the pump station including wet well size, start and stop elevations, pump type and model and existing pump discharge. A flow rate of ***6.7 L/s*** was observed during operation of the pump through the existing flow meter connected to the forcemain. The pump curve based on the existing pumps was obtained from the manufacturer. The pump curve suggests that the observed flow rate would result in the pump operating in an overloaded condition. See existing pump curve in ***Appendix C*** a technical memo by HMM.

Table 5 summarizes the ***City Standards*** employed in the estimate of available capacity within the municipal wastewater sewer systems, and in the calculation of wastewater flow rates for the historical and proposed development.

Table 5
Wastewater Design Criteria

Design Parameter	Value
Industrial-Heavy	55,000 L/gross ha/d
Industrial Peaking Factor*	4.75
Residential 1 Bedroom Apartment Demand	1.4 person/unit
Residential 2 Bedroom Apartment Demand	2.1 person/unit
Residential Average Apartment Demand	1.8 person/unit
Residential Daily Average	350 L/person/d
Commercial Floor Space	5 L/m²/d
Peaking Factor	Harmon's Peaking Factor. Max 4.0, Min 2.0
Infiltration and Inflow Allowance	0.28L/s/ha
Sanitary sewers are to be sized employing the Manning's Equation	$Q = \frac{1}{n} A R^{2/3} S^{1/2}$
Minimum Sanitary Sewer Lateral	135mm 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

** Industrial Peaking Factor determined as per MOE Guidelines for the Design of Sanitary Sewers, Typical Industrial Sewage Flow Peaking Factors Graph.*
Extracted from Sections 4 and 6 of the City of Ottawa Sewer Design Guidelines, October 2012.

4.2 Wastewater Design

The proposed development will be serviced by a series of internal gravity draining sanitary sewers which connect to the existing pump station within Building 525 on Chaudiere Island. An existing 75mm forcemain is proposed to direct sanitary discharge to the existing gravity sewer within Middle Street. The gravity sewer discharges to a pump station, operated by the NCC, beneath the Portage Bridge. An existing forcemain conveys flow across the portage bridge to another pump station directly east of the existing Mill Street Brew Pub. A forcemain then conveys flow south-east eventually discharging to the Interceptor Sewer north of Sparks Street. See drawing ***SSP-1 & SSP-2*** for sanitary servicing details. Existing peak outflow will be maintained through the redevelopment.

As discussed in ***Section 3.2***, purple pipe flows will be metered to allow the City of Ottawa to properly charge for wastewater discharge.

Individual buildings within the proposed development will be serviced internally via gravity draining sanitary sewer network; detailed layout and sizing is shown by drawing ***SSP-1 & SSP-2*** included with this report.

Table 7 below summarizes the anticipated wastewater discharge from the proposed development based on criteria found in ***Table 5***.

Table 6
Summary of Anticipated Wastewater Discharge

Design Parameter	Subject Properties Flow (L/s)
Average Dry Weather Flow Rate	2.6
Peak Dry Weather Flow Rate	9.1
Peak Wet Weather Flow Rate	9.5

As discussed in ***Section 4.1,*** the existing pump station discharges at an estimated peak rate of ***6.7 L/s***. The proposed development will result in an increase of ***2.8 L/s***. To ensure that the receiving infrastructure, gravity sewers and existing pump stations, has adequate capacity to convey the flow from the proposed development the peak flow is proposed to be detained to the existing flow rate of ***6.7 L/s***.

To determine if the existing wet well has sufficient capacity to detain the proposed sanitary contribution to the existing flow rate of ***6.7 L/s***, a sanitary distribution curve was generated by J.F. Sabourin and Associates Inc. (JFSA) using SWMHYMO. The resulting flow vs time distribution was utilized in the analysis of the existing pumps station, see ***Appendix C*** for details and methodology on generating the sanitary distribution curve.

An analysis of the existing pump station was completed by HMM along with recommendations provided to service the proposed Phase 1 development with the existing infrastructure. The results of the analysis showed that the flow meter will have to be repaired to confirm existing flow rate. Additionally, if the pumps are confirmed to be CP pump models, replacing the pumps will be required to eliminate the operation in an overloaded condition. Refer to the full analysis found in ***Appendix C***.

4.3 Wastewater Servicing Conclusion

Existing sanitary servicing is provided by a centralized pump station located on Chaudière Island, discharging to a series of gravity and pump stations until eventually discharging to the Interceptor Sewer.

Sanitary servicing will be provided by a series of internal gravity sewers, discharging to the existing pump station within Building 525.

To ensure that downstream infrastructure has sufficient capacity to convey the proposed flow from the subject site, sanitary discharge is proposed to be detained to the existing release rate of ***6.7L/s***.

A sanitary distribution for the proposed development was generated using SWMHYMO. An analysis of the existing pump station was conducted to determine if there is sufficient wet well and pump capacity to detain the existing sanitary release rate. Recommendations include confirming the pump models and upgrading pumps to provide adequate servicing to 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 existing subject property is directed uncontrolled to the Ottawa River. The major and minor flow is directed to the Ottawa River overland with a small portion of flow directed by catch basins along Booth Street. The site currently consists of varying sloped topography (0.5% to >5%) and mostly impervious building footprint or associated parking area.

The existing site contains no stormwater management quality controls or controls for flow attenuation.

Runoff from the site is directed to the Ottawa River directly downstream of the Chaudière Falls which has a drop and breadth of 15 and 60m, respectively. The dam is used by Hydro Ottawa and Hydro-Quebec to produce electricity. The dam is also monitored and controlled by the Ottawa River Regulation and Planning Board for flood control.

5.2 Post-development Stormwater Management Targets

Stormwater management requirements for the proposed development are based on relevant ***City Standards*** and pre-consultation with City of Ottawa staff. It has been established that the following criteria apply:

- Increase to flood risk and flood levels in the Ottawa River will not be impacted by the proposed development and therefore stormwater quantity controls are not required
- Based on the consultation with the City & RVCA, stormwater quality controls will be required to achieve an “enhanced” level of quality control as per the ***SWMP Design Manual***, 80% reduction in Total Suspended Solids (TSS) prior to release to the Ottawa River

See correspondence with the City of Ottawa in ***Appendix A***.

5.3 Stormwater Management System

The stormwater management system will consist of a private storm sewer system connecting to an existing 760mm storm sewer east of Booth Street. Stormwater runoff will be conveyed through the existing storm sewer to an outlet north of Chaudiere Island discharging to the Ottawa River.

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*** in included with this report.

The Rational Method was utilized to calculate the runoff from the storm sewer catchment areas; Rational Method “C” values for the catchment areas were derived using “*Table 5.7 Runoff Coefficients for Various Soil Conditions”* from the ***City Standards***.

To meet the specified stormwater quality criteria an end of pipe oil/grit separator (OGS) unit will be designed to provide a TSS reduction of at least 80% achieveing an “enhanced” level of quality control as per the ***SWMP Design Manual***. Building runoff is considered clean, therefore, buildings adjacent to the shoreline will have roof leaders discharge directly the Ottawa River. It is proposed to provide a Stormceptor ***STC4000*** (or approved equivalent) prior to discharge to the Ottawa River.

Buildings adjacent to the Ottawa River will discharge clean roof runoff directly to the River without additional quality control as per pre-consultation with the RVCA.

5.4 Stormwater Servicing Conclusions

Stormwater runoff will be captured by a private storm sewer system conveyed to an existing storm sewer east of Booth Street. Runoff will be directed to an existing outlet along the north edge of Chaudière Island.

Private storm sewer designed to convey the uncontrolled 5-year runoff rate in accordance with the ***City Standards.***

To achieve the runoff quality criteria identified through consultation, an end of pipe oil/grit separator will provide an “enhanced” level of treatment as per the ***SWMP Design Manual***.

The design of the proposed storm sewer system conforms to all relevant ***City Standards***.

6.0 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.

Catchbasins will have a *Siltsack* or approved equivalent installed under the grate during construction to protect silt from entering the storm sewer system. Inlet catchbasins will have *Inletsoxx* or approved equivalent installed during construction to protect silt from 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, See ***EC-1*** for detailed erosion and sediment control measures. 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 during dewatering.
- Install appropriate catch basins inlet protection.
- 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 replace Siltsack as needed at catch basins.

In addition to the above mentioned erosion and sediment controls, a sediment control pond is recommended to provide further control.

The drainage area to the temporary sediment pond is ***1.07 ha*** with a runoff coefficient of 0.25. The temporary sediment pond has been sized using this drainage area to provide an 'Enhanced' level of protection (80% long term total suspended solids removal) – refer to the calculation sheet in ***Appendix D*** for sizing calculations. For the temporary sediment pond, the following volumes are required:

- Required permanent pool volume = 1.07 ha x 185 m^3/ha = 198 m^3
- Required extended detention volume = 1.07 ha x 125 m^3/ha = 134 m^3

Based on the pond design, as shown on drawing ***EC-1,*** the permanent pool provided is ***281.0m^3*** at an elevation of ***49.70m***. The extended detention provided is ***304.9m^3*** at an elevation of ***50.20m***. The available permanent pool and extended detention volume exceeds the required.

Based on the orifice size of ***75mm*** in diameter, the drawdown time for the temporary sediment pond is ***16.4 hours***. Detailed calculations are enclosed on the Sediment Basin Extended Detention Outlet Sizing sheet. A minimum of 12 hours is required for drainage areas less than 8 ha as per the ***SWMP Design Manual***

The temporary sediment pond will be equipped with a sediment forebay in order to improve the pollutant removal by allowing larger particles to settle out prior to entering the main cell of the pond. For further details, refer to the calculation in ***Appendix D***.

The quality control pond should provide over 80% long term removal of total suspended solids (TSS) based on the MOECC's SWM Planning & Design Manual Table 3.2 – Water Quality Storage Requirements based on Receiving Waters (March 2003). Based on our work in Ottawa, this pond should meet 25 mg/L concentration at the outlet as it is designed in accordance with the MOECC guidelines.

Refer to drawing ***EC-1*** for further detail on the proposed sediment control pond.

7.0 UTILITIES

Existing underground hydro ducts within Booth and Middle Street providing connection to hydro powerhouses on Victoria and Chaudière Island.

Existing gas mains are located within Booth Street right-of-way

Existing Bell cable located within Booth Street right-of-way and the Portage Bridge

Utility servicing has been coordinated with the individual utility companies prior to site development.

8.0 CONCLUSION AND RECOMMENDATIONS

David Schaeffer Engineering Ltd. (DSEL) has been retained to prepare a Functional Servicing and Stormwater Management Report to support the proposed development of Domtar Lands Redevelopment in support of Windmill Development Group's application for Site Plan Control (SPC).

- A proposed connection across the Portage Bridge provides a redundant connection to service Phase 1 of the development;
- An internal water distribution model was completed that verified pressures during average day and peak hour scenarios, pressure reducing control are recommended based on the resulting pressures;
- Fire hydrants have are proposed to provide adequate fire protection at each building in Phase 1;
- The existing pump station within Building 525 is proposed to be re-used during Phase 1 to pump at a maximum flow rate of ***6.7 L/s*** to the existing gravity and NCC pump stations downstream
- A minimum TSS removal of 80% will be required for post-development stormwater runoff from the site, provided by an end of pipe oil/grit separator;
- A sediment control pond is proposed to provide quality controls during construction of Phase 1
- Utility services will need to be coordinated with utility companies prior to development;
- Based on the preceding report, adequate servicing capacity exists to support the proposed development

Prepared by,
David Schaeffer Engineering Ltd.

Per: Steven L. Merrick, B.Eng., EIT.

Reviewed by,
David Schaeffer Engineering Ltd.

Per: Adam D. Fobert, P.Eng

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APPENDIX A

Pre-Consultation

DEVELOPMENT SERVICING STUDY CHECKLIST

14-717 17/04/2014

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).	Section 5.0
☒	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.	Section 3.2
☐	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.	Section 3.2
☐	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.	Section 4.0
☐	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.	EX-1
☒	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.	GP-1
☒	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.	Section 5.2
☒	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.	Section 6.0
☒	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.	Appendix D
☐	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

☒	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.	SWM-1
☐	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 7.0
☐	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 9.0
☒	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.	Attached Response Letter
☐	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

Steve Merrick

To: Adam Fobert
Subject: RE: NCC Support for Redundant Water Access

From: Gaspar, Fred
Sent: Wednesday, August 27, 2014 03:43 PM Eastern Standard Time
To: 'Jonathan Westeinde' <JonathanW@windmilldevelopments.com>
Cc: Willis, Stephen; Zanetti, Marco; Miner, Chantal; 'Rodney Wilts' <rodney@windmilldevelopments.com>; Chakraburtty, Bina; Comtois, Jean-Gilles; Barakengera, Martin
Subject: NCC Support for Redundant Water Access

Good afternoon Jonathan.

This email serves to confirm the National Capital Commission's commitment to work with Windmill Development Group Ltd. towards finalizing an agreement for the use of NCC-owned lands primarily along Middle Street on Victoria Island (your option #3 attached) for the purpose of achieving the redundant water servicing requirement being requested by the City of Ottawa as part of its Planning review of your development proposal.

Please understand that NCC staff do not have the authority to bind the organization on these matters at this point. Authority for Federal Land Use & Transaction Approvals rests exclusively with our Board of Directors. Additionally, further authorities may be required for certain commercial terms that may be concluded.

Having reviewed the three options you provided to us earlier, NCC staff have determined that option 3 offers the best opportunity for success insofar as it best supports our common objectives and therefore represents an appropriate use of federal lands, subject to a final design plan to be reviewed and approved by the NCC, as well as the successful conclusion of negotiations on mutually-acceptable commercially fair and reasonable terms. Once that is concluded, NCC staff will positively recommend this option to our Board for Approval.

On this basis, please feel free to share this email with the City of Ottawa as necessary and appropriate to confirm our support for your redundant water servicing requirements.

I trust this meets your immediate requirements. Please let me know if you require further information or clarification.

Best regards,

Fred Gaspar
Director, Planning, Approvals and Environmental Management
202 – 40 rue Elgin Street
OTTAWA ON K1P 1C7
613.239.5678x5776

NCC CCN Canada

APPENDIX B

Water Supply

Ottawa
Proposed Site Conditions

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

Domestic Demand

					Avg. Daily		Max Day		Peak Hour	
Block	**Type of Housing**	**Per / Unit**	**Units***	**Pop**	**m^3/d**	**L/min**	**m^3/d**	**L/min**	**m^3/d**	**L/min**
205-A	Average Appartment	1.8	80	144	50.4	35.0	113.4	78.8	170.4	118.3
206	Average Appartment	1.8	170	306	107.1	74.4	241.0	167.3	362.0	251.4
207	Average Appartment	1.8	38	69	24.2	16.8	54.3	37.7	81.6	56.7
208	Average Appartment	1.8	0	0	0.0	0.0	0.0	0.0	0.0	0.0
Ex. Mill Street		1.8	0	0	0.0	0.0	0.0	0.0	0.0	0.0
Ex. HYDRO		1.8	0	0	0.0	0.0	0.0	0.0	0.0	0.0
		Total Domestic Demand	**288**	**519**	**181.7**	**126.1**	**408.7**	**283.8**	**614.0**	**426.4**

Institutional / Commercial / Industrial Demand

					Avg. Daily		Max Day		Peak Hour	
Block	**Property Type**	**Unit Rate**		**Units**	**m^3/d**	**L/min**	**m^3/d**	**L/min**	**m^3/d**	**L/min**
205-A	Commercial floor space	2.5	$L/m^2/d$	1,087	2.72	1.9	4.1	2.8	7.3	5.1
206	Commercial floor space	2.5	$L/m^2/d$	604	1.51	1.0	2.3	1.6	4.1	2.8
	Community - Hall**	15	L/m2/d	650	9.75	6.8	14.6	10.2	26.3	18.3
207	Office	81	$L/9.3m^2/d$	348	3.03	2.1	4.5	3.2	8.2	5.7
	Commercial floor space	2.5	$L/m^2/d$	348	0.87	0.6	1.3	0.9	2.3	1.6
208	Office	82	$L/9.3m^2/d$	1,680	14.81	10.3	22.2	15.4	40.0	27.8
	Commercial floor space	2.5	$L/m^2/d$	840	2.10	1.5	3.2	2.2	5.7	3.9
Ex. Mill Street	Restaurant	125.0	L/seat/day	100	12.50	8.7	18.8	13.0	33.8	23.4
Ex. HYDRO***	Office	82	$L/9.3m^2/d$	1,067	9.41	6.5	14.1	9.8	25.4	17.6
				Total I/CI Demand	56.7	39.4	85.0	59.1	153.1	106.3
				Total Demand	**238.3**	**165.5**	**493.8**	**342.9**	**767.1**	**532.7**

* Number of residential units estimated using 850 sq.ft per residential unit
**Unit rate for community space from Appendix 4-A.2 for Dance Halls
***Floorspace estimated based on building footprint

Demand by Block

	Avg. Daily		Max Day		Peak Hour	
Block	**m^3/d**	**L/min**	**m^3/d**	**L/min**	**m^3/d**	**L/min**
205-A	53.1	36.9	117.5	81.6	177.7	123.4
206	118.4	82.2	257.9	179.1	392.4	272.5
207	28.1	19.5	60.2	41.8	92.2	64.0
208	16.9	11.7	25.4	17.6	45.7	31.7
Total Domestic Demand	**216.4**	**150.3**	**460.9**	**320.1**	**707.9**	**491.6**

Fire Flow Estimation per Fire Underwriters Survey

Water Supply For Public Fire Protection - 1999

Fire Flow Required - Block 205-A

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: Composite 40% Wood Frame 60% Non-Combustible Construction

C	1.08		*Type of Construction Coefficient per FUS Part II, Section 1*
A	6250.0	m^2	*Total floor area based on FUS Part II section 1*

Fire Flow	18783.9 L/min	
	19000.0 L/min	*rounded to the nearest 1,000 L/min*

Adjustments

2. Reduction for Occupancy Type

Limited Combustible	-15%
Fire Flow	**16150.0 L/min**

3. Reduction for Sprinkler Protection

Sprinklered	-50%
Reduction	**-8075 L/min**

4. Increase for Separation Distance

N	3.1m-10m	20%	
S	3.1m-10m	20%	
E	10.1m-20m	15%	
W	>45m	0%	
	% Increase	**55%**	*value not to exceed 75% per FUS Part II, Section 4*
	Increase	**8882.5 L/min**	

Total Fire Flow

Fire Flow	16957.5 L/min	*fire flow not to exceed 45,000 L/min nor be less than 2,000 L/min per FUS Section 4*
	17000.0 L/min	*rounded to the nearest 1,000 L/min*

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

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

Fire Flow Required - Block 206

1. Base Requirement

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

Type of Construction: Non-Combustible Construction

C 0.8 *Type of Construction Coefficient per FUS Part II, Section 1*
A 14642.0 m^2 *Total floor area based on FUS Part II section 1*

Fire Flow	21296.7 L/min	
	21000.0 L/min	*rounded to the nearest 1,000 L/min*

Adjustments

2. Reduction for Occupancy Type

Limited Combustible -15%

Fire Flow	**17850.0 L/min**

3. Reduction for Sprinkler Protection

Sprinklered -50%

Reduction	**-8925 L/min**

4. Increase for Separation Distance

N	20.1m-30m	10%	
S	10.1m-20m	15%	
E	3.1m-10m	20%	
W	10.1m-20m	15%	
	% Increase	**60%**	*value not to exceed 75% per FUS Part II, Section 4*

Increase	**10710.0 L/min**

Total Fire Flow

Fire Flow	19635.0 L/min	*fire flow not to exceed 45,000 L/min nor be less than 2,000 L/min per FUS Section 4*
	20000.0 L/min	*rounded to the nearest 1,000 L/min*

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

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

Fire Flow Required - Block 207

1. Base Requirement

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

Type of Construction: Non-Combustible Construction

C	0.8		*Type of Construction Coefficient per FUS Part II, Section 1*
A	3709.0	m^2	*Total floor area based on FUS Part II section 1*

Fire Flow	10718.7	L/min	
	11000.0	**L/min**	*rounded to the nearest 1,000 L/min*

Adjustments

2. Reduction for Occupancy Type

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

3. Reduction for Sprinkler Protection

Sprinklered	-50%
Reduction	**-4675 L/min**

4. Increase for Separation Distance

N	20.1m-30m	10%	
S	10.1m-20m	15%	
E	20.1m-30m	10%	
W	3.1m-10m	20%	
	% Increase	**55%**	*value not to exceed 75% per FUS Part II, Section 4*
	Increase	**5142.5 L/min**	

Total Fire Flow

Fire Flow	9817.5	L/min	*fire flow not to exceed 45,000 L/min nor be less than 2,000 L/min per FUS Section 4*
	10000.0	**L/min**	*rounded to the nearest 1,000 L/min*

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

Fire Flow Estimation per Fire Underwriters Survey

Water Supply For Public Fire Protection - 1999

Fire Flow Required - Block 208

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: Composite 40% Wood Frame 60% Non-Combustible Construction

C 1.08 *Type of Construction Coefficient per FUS Part II, Section 1*
A 2533.0 m^2 *Total floor area based on FUS Part II section 1*

Fire Flow	11958.2 L/min	
	12000.0 L/min	*rounded to the nearest 1,000 L/min*

Adjustments

2. Reduction for Occupancy Type

Limited Combustible	-15%
Fire Flow	**10200.0 L/min**

3. Reduction for Sprinkler Protection

Sprinklered	-50%
Reduction	**-5100 L/min**

4. Increase for Separation Distance

N	10.1m-20m	15%	
S	20.1m-30m	10%	
E	10.1m-20m	15%	
W	3.1m-10m	20%	
	% Increase	**60%**	*value not to exceed 75% per FUS Part II, Section 4*
	Increase	**6120.0 L/min**	

Total Fire Flow

Fire Flow	11220.0 L/min	*fire flow not to exceed 45,000 L/min nor be less than 2,000 L/min per FUS Section 4*
	11000.0 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

Steve Merrick

Subject: RE: Chaudiere/Albert Island Development - Water Boundary Condition Request

From: Bazinet, Kristin [mailto:Kristin.Bazinet@ottawa.ca]
Sent: August-04-15 7:30 AM
To: Steve Merrick <smerrick@dsel.ca>; 'Adam Fobert' <afobert@DSEL.ca>
Cc: Buchanan, Richard <Richard.Buchanan@ottawa.ca>; Mottalib, Abdul <Abdul.Mottalib@ottawa.ca>
Subject: FW: Chaudiere/Albert Island Development - Water Boundary Condition Request

Hi Steve – find attached the boundary conditions as requested.

Thanks,
Kristin

Kristin Bazinet. P.Eng
Development Review
Examen des demandes d'aménagement

City of Ottawa | Ville d'Ottawa
613.580.2424 ext./poste 12180
ottawa.ca/planning / ottawa.ca/urbanisme

The following are boundary conditions, HGL, for hydraulic analysis at the Chaudière/Albert Islands Phase 1(Pressure Zone 1W), assumed to be connected to (see attached PDF for location):

1) 406mm on Wellington
2) 305mm on Booth

Minimum HGL = 108.0m (same at both locations)

Maximum HGL = 115.1m (same at both locations), the maximum pressure is estimated to be greater than 80 psi. A pressure check at completion of construction is recommended to determine if pressure control is required.

Fire Flow*	Connection 1 (Wellington)
150 L/s	110.7m
217 L/s	110.1m
250 L/s	109.8m

300 L/s	109.2m
367 L/s	108.3m

*Includes Max Day demands of 2.49 L/s distributed evenly between both connection points (i.e. 1.75L/s at each connection point)

Fire Flow*	Connection 2 (Booth)
150 L/s	109.4m
217 L/s	107.4m
250 L/s	106.3m
300 L/s	104.2m
367 L/s	101.1m

*Includes Max Day demands of 2.49 L/s distributed evenly between both connection points (i.e. 1.75 L/s at each connection point)

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

Disclaimer: The boundary condition information is based on current operation of the city water distribution system. The computer model simulation is based on the best information available at the time. The operation of the water distribution system can change on a regular basis, resulting in a variation in boundary conditions. The physical properties of watermains deteriorate over time, as such must be assumed in the absence of actual field test data. The variation in physical watermain properties can therefore alter the results of the computer model simulation.

From: Buchanan, Richard
Sent: July 28, 2015 2:46 PM
To: Bazinet, Kristin
Subject: FW: Chaudiere/Albert Island Development - Water Boundary Condition Request

Can you send this in for the boundary conditions and forward to DSEL?

Richard Buchanan, CET
Program Manager, Development Review
(Urban Services) Outer
Gestionaire de programme
(Secteur urbain) Exterieur

PLANNING AND GROWTH MANAGEMENT
URBANISME ET GESTION DE LA CROISSANCE

City of Ottawa | Ville d'Ottawa
613.580.2424 ext./poste 27801

ottawa.ca/planning / ottawa.ca/urbanisme

From: Steve Merrick [mailto:smerrick@dsel.ca]
Sent: July-28-15 1:17 PM
To: Abdul <Abdul.Mottalib@ottawa.ca>
Cc: Adam Fobert <afobert@dsel.ca>
Subject: RE: Chaudiere/Albert Island Development - Water Boundary Condition Request

Hi Abdul,

We require updated boundary conditions for Phase 1 of the above noted development. The connection locations are consistent with previous requests. Anticipated demands are as follows:

	L/min	L/s
Avg. Daily	69.6	1.16
Max Day	149.4	2.49
Peak Hour	228.7	3.81

Max Day + Fire Flow = 149.4 + 20,000 L/min

I hope you can expedite this process we are looking to submit as soon as possible.

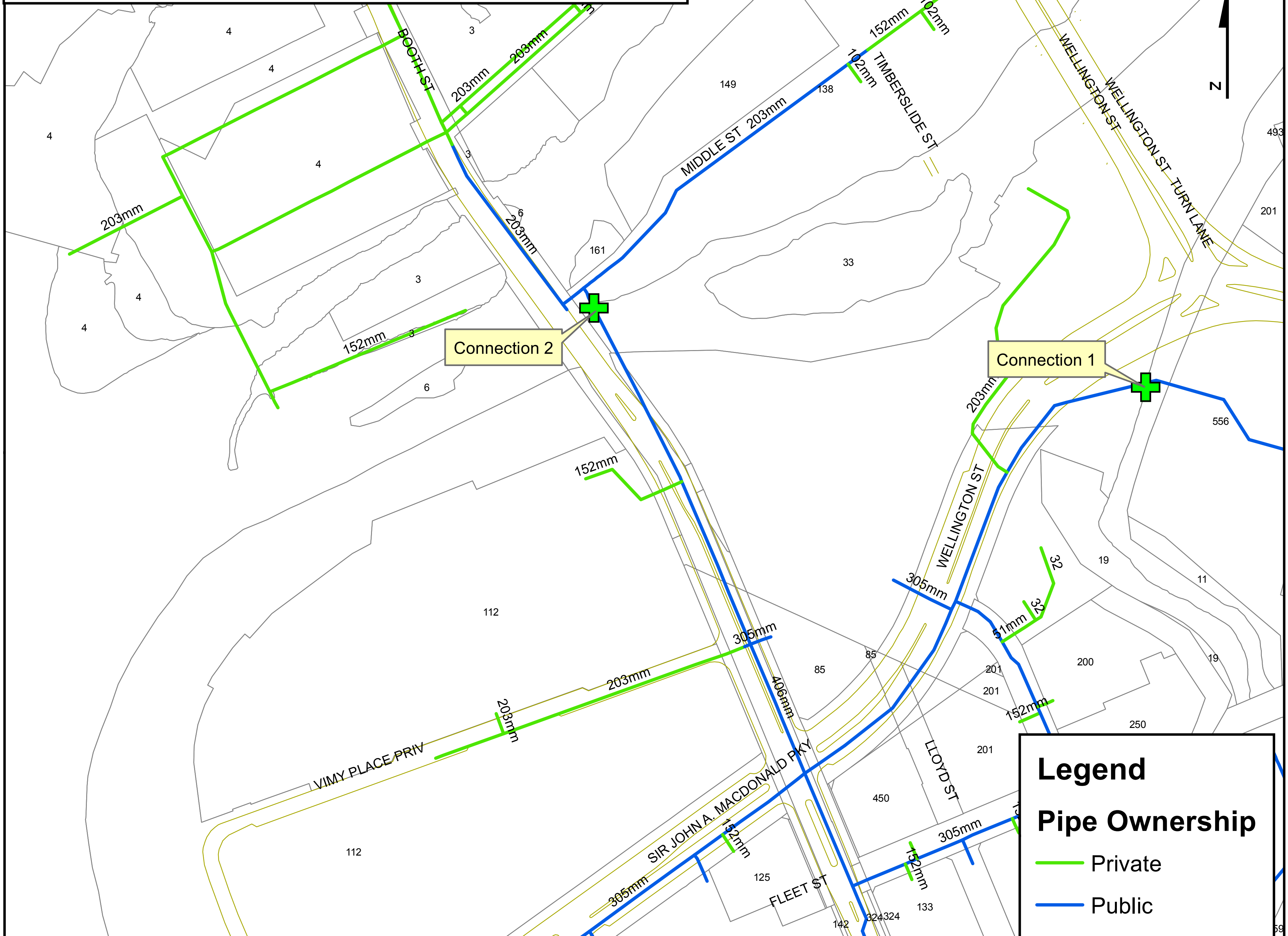
Steve Merrick, EIT.
Project Coordinator / Junior Designer

DSEL
david schaeffer engineering ltd.

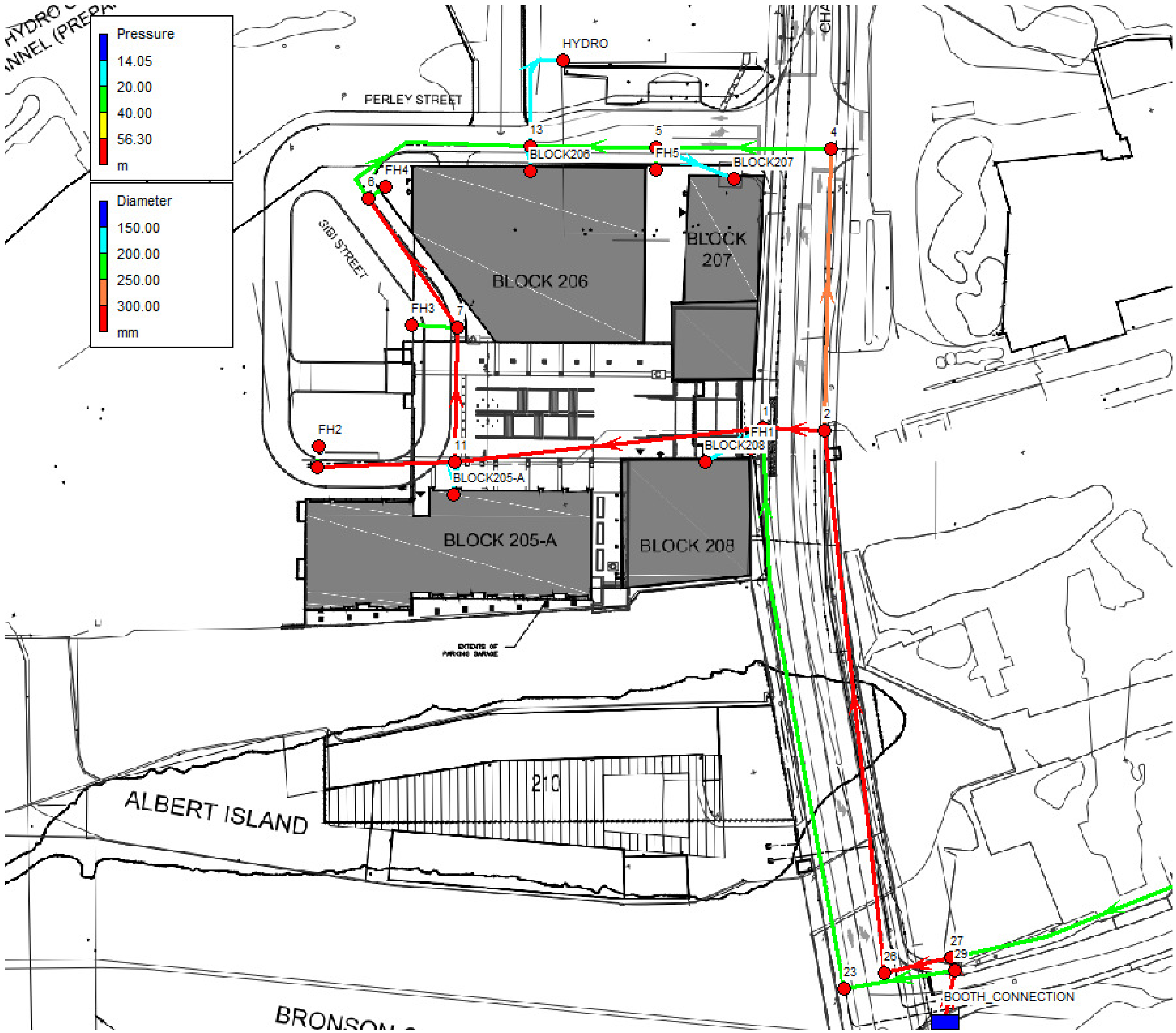
120 Iber Road, Unit 103
Stittsville, ON K2S 1E9

phone: (613) 836-0856 ext. 561
fax: (613) 836-7183
email: smerrick@DSEL.ca

Boundary Condition for Chaudiere/Albert Islands



AVERAGE DAY SCENARIO



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

Input File: 2015-07-28_717_slm.net

Link - Node Table:

Link ID	Start Node	End Node	Length m	Diameter mm
36	26	27	20	300
41	23	29	32	200
42	27	29	3	300
43	29	BOOTH_CONNECTION	3	300
45	30	31	129	200
46	31	32	152	200
47	33	WELLINGTON_CONNECTION	89.23	200
48	33	32	135	200
49	27	30	195	200
1	1	23	140	200
2	2	26	140	300
3	MSBP	33	1000	200
4	2	1	18.2	300
5	2	4	66	250
6	4	5	40	200
9	11	8	35	300
10	11	1	70	300
11	1	FH1	2.2	200
12	FH1	1	1000	200
13	5	FH5	4.5	200
14	6	FH4	1.4	200
15	6	13	50	200
16	13	5	30	200
17	8	FH2	2	200
18	13	HYDRO	26	150
19	11	BLOCK205-A	10	150
20	13	BLOCK206	5	150
21	1	BLOCK208	10	150
22	BLOCK207	5	10	150
7	11	7	40	300
8	7	6	31	300
23	7	FH3	7	200

♀

Node Results:

Node ID	Demand LPM	Head m	Pressure m	Quality hours
23	0.00	115.10	62.10	0.00
26	0.00	115.10	62.10	0.00
27	0.00	115.10	62.35	0.00
29	0.00	115.10	62.35	0.00
30	0.00	115.10	63.35	0.00
31	0.00	115.10	64.10	0.00
32	0.00	115.10	59.10	0.00
33	0.00	115.10	59.10	0.00
1	0.00	115.10	63.99	0.00
2	0.00	115.10	64.18	0.00
MSBP	8.70	115.10	59.10	0.00
4	0.00	115.10	66.00	0.00
5	0.00	115.10	65.30	0.00

6	0.00	115.10	63.90	0.00	
FH4	0.00	115.10	60.90	0.00	
8	0.00	115.10	62.45	0.00	
FH2	0.00	115.10	59.48	0.00	
FH1	0.00	115.10	61.14	0.00	
11	0.00	115.10	62.70	0.00	
FH5	0.00	115.10	62.53	0.00	
13	0.00	115.10	64.70	0.00	
HYDRO	6.50	115.10	65.10	0.00	
BLOCK205-A	36.90	115.10	60.05	0.00	
BLOCK206	82.20	115.10	60.15	0.00	
BLOCK208	11.70	115.10	60.15	0.00	
BLOCK207	19.50	115.10	60.15	0.00	
FH3	0.00	115.10	59.65	0.00	
7	0.00	115.10	62.55	0.00	
BOOTH_CONNECTION	-153.73	115.10	0.00	1.00	Reservoir
WELLINGTON_CONNECTION	-11.77	115.10	0.00	1.00	Reservoir

Link Results:

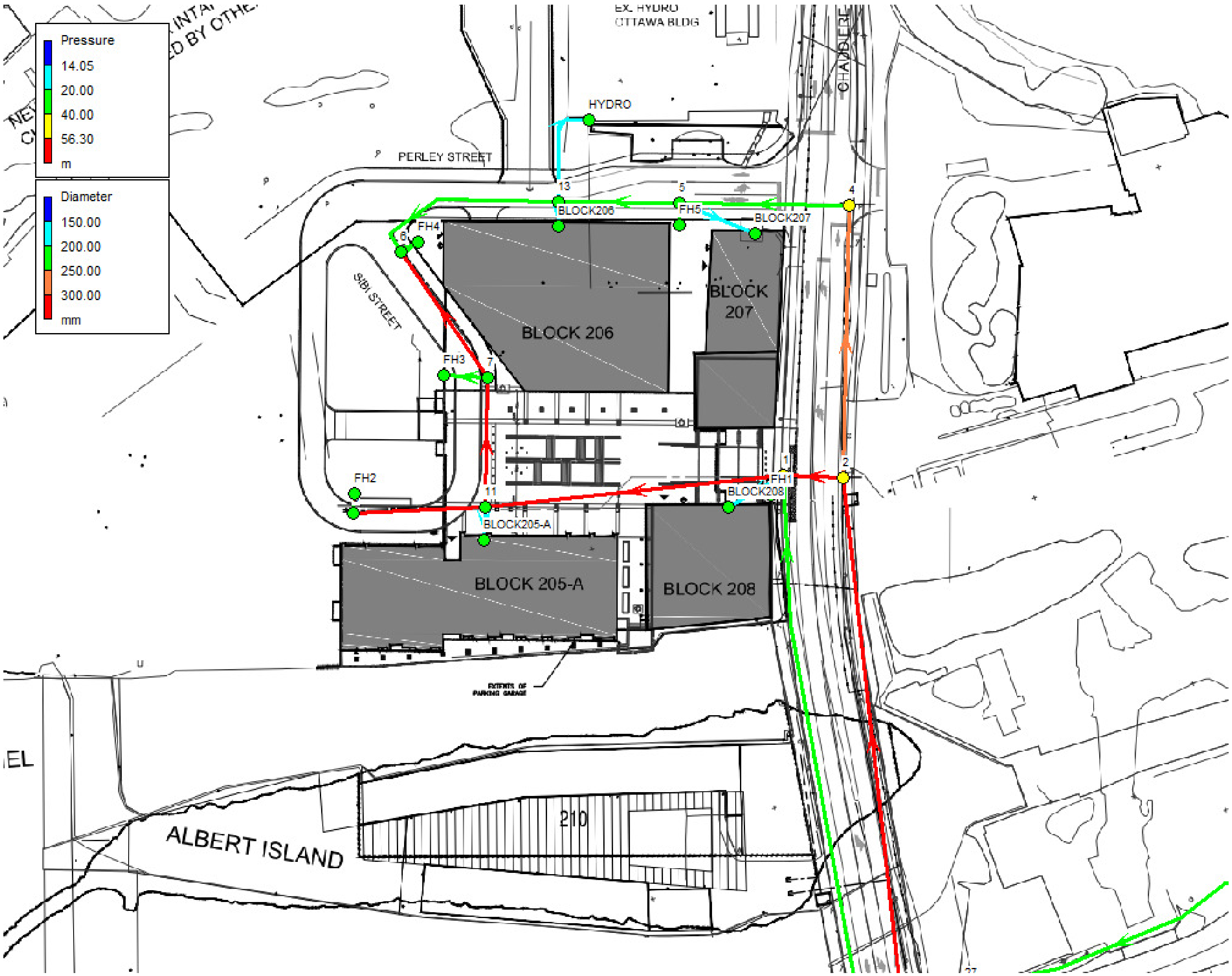
Link ID	Flow LPM	VelocityUnit m/s	Headloss m/km	Status
36	-118.89	0.03	0.01	Open
41	-37.92	0.02	0.01	Open
42	-115.81	0.03	0.02	Open
43	-153.73	0.04	0.01	Open
45	-3.07	0.00	0.00	Open
46	-3.07	0.00	0.00	Open
47	-11.77	0.01	0.00	Open
48	3.07	0.00	0.00	Open
49	-3.07	0.00	0.00	Open
1	-37.92	0.02	0.01	Open
2	-118.89	0.03	0.01	Open

♀

Link Results: (continued)

Link ID	Flow LPM	VelocityUnit m/s	Headloss m/km	Status
3	-8.70	0.00	0.00	Open
4	62.35	0.01	0.00	Open
5	56.53	0.02	0.00	Open
6	56.53	0.03	0.01	Open
9	0.00	0.00	0.00	Open
10	-88.57	0.02	0.00	Open
11	0.00	0.00	0.00	Open
12	0.00	0.00	0.00	Open
13	0.00	0.00	0.00	Open
14	0.00	0.00	0.00	Open
15	51.67	0.03	0.01	Open
16	-37.03	0.02	0.01	Open
17	0.00	0.00	0.00	Open
18	6.50	0.01	0.00	Open
19	36.90	0.03	0.04	Open
20	82.20	0.08	0.23	Open
21	11.70	0.01	0.00	Open
22	-19.50	0.02	0.01	Open
7	51.67	0.01	0.00	Open
8	51.67	0.01	0.00	Open
23	0.00	0.00	0.00	Open

MAX DAY + FIRE FLOW SCENARIO



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**********************************************************************
*                              E P A N E T                           *
*                      Hydraulic and Water Quality                   *
*                      Analysis for Pipe Networks                    *
*                            Version 2.0                             *
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Input File: 2015-07-28_717_slm.net

Link - Node Table:

Link ID	Start Node	End Node	Length m	Diameter mm
36	26	27	20	300
41	23	29	32	200
42	27	29	3	300
43	29	BOOTH_CONNECTION	3	300
45	30	31	129	200
46	31	32	152	200
47	33	WELLINGTON_CONNECTION	89.23	200
48	33	32	135	200
49	27	30	195	200
1	1	23	140	200
2	2	26	140	300
3	MSBP	33	1000	200
4	2	1	18.2	300
5	2	4	66	250
6	4	5	40	200
9	11	8	35	300
10	11	1	70	300
11	1	FH1	2.2	200
12	FH1	1	1000	200
13	5	FH5	4.5	200
14	6	FH4	1.4	200
15	6	13	50	200
16	13	5	30	200
17	8	FH2	2	200
18	13	HYDRO	26	150
19	11	BLOCK205-A	10	150
20	13	BLOCK206	5	150
21	1	BLOCK208	10	150
22	BLOCK207	5	10	150
7	11	7	40	300
8	7	6	31	300
23	7	FH3	7	200

Node Results:

Node ID	Demand LPM	Head m	Pressure m	Quality hours
23	0.00	98.83	45.83	0.00
26	0.00	99.11	46.11	0.00
27	0.00	100.36	47.61	0.00
29	0.00	100.93	48.18	0.00
30	0.00	102.64	50.89	0.00
31	0.00	104.13	53.13	0.00
32	0.00	105.82	49.82	0.00
33	0.00	107.45	51.45	0.00
1	0.00	91.77	40.66	0.00
2	0.00	92.51	41.59	0.00
MSBP	25.40	107.45	51.45	0.00
4	0.00	91.47	42.37	0.00
5	0.00	88.94	39.14	0.00

6	0.00	84.68	33.48	0.00	
FH4	10000.00	76.28	22.08	0.00	
8	0.00	87.76	35.11	0.00	
FH2	0.00	87.76	32.14	0.00	
FH1	0.00	91.77	37.81	0.00	
11	0.00	87.76	35.36	0.00	
FH5	0.00	88.94	36.37	0.00	
13	0.00	87.38	36.98	0.00	
HYDRO	33.80	87.38	37.38	0.00	
BLOCK205-A	81.60	87.76	32.71	0.00	
BLOCK206	179.10	87.38	32.43	0.00	
BLOCK208	17.60	91.77	36.82	0.00	
BLOCK207	41.80	88.93	33.98	0.00	
FH3	10000.00	75.59	20.14	0.00	
7	0.00	84.90	32.35	0.00	
BOOTH_CONNECTION	-18024.60	101.10	0.00	1.00	Reservoir
WELLINGTON_CONNECTION	-2354.70	108.30	0.00	1.00	Reservoir

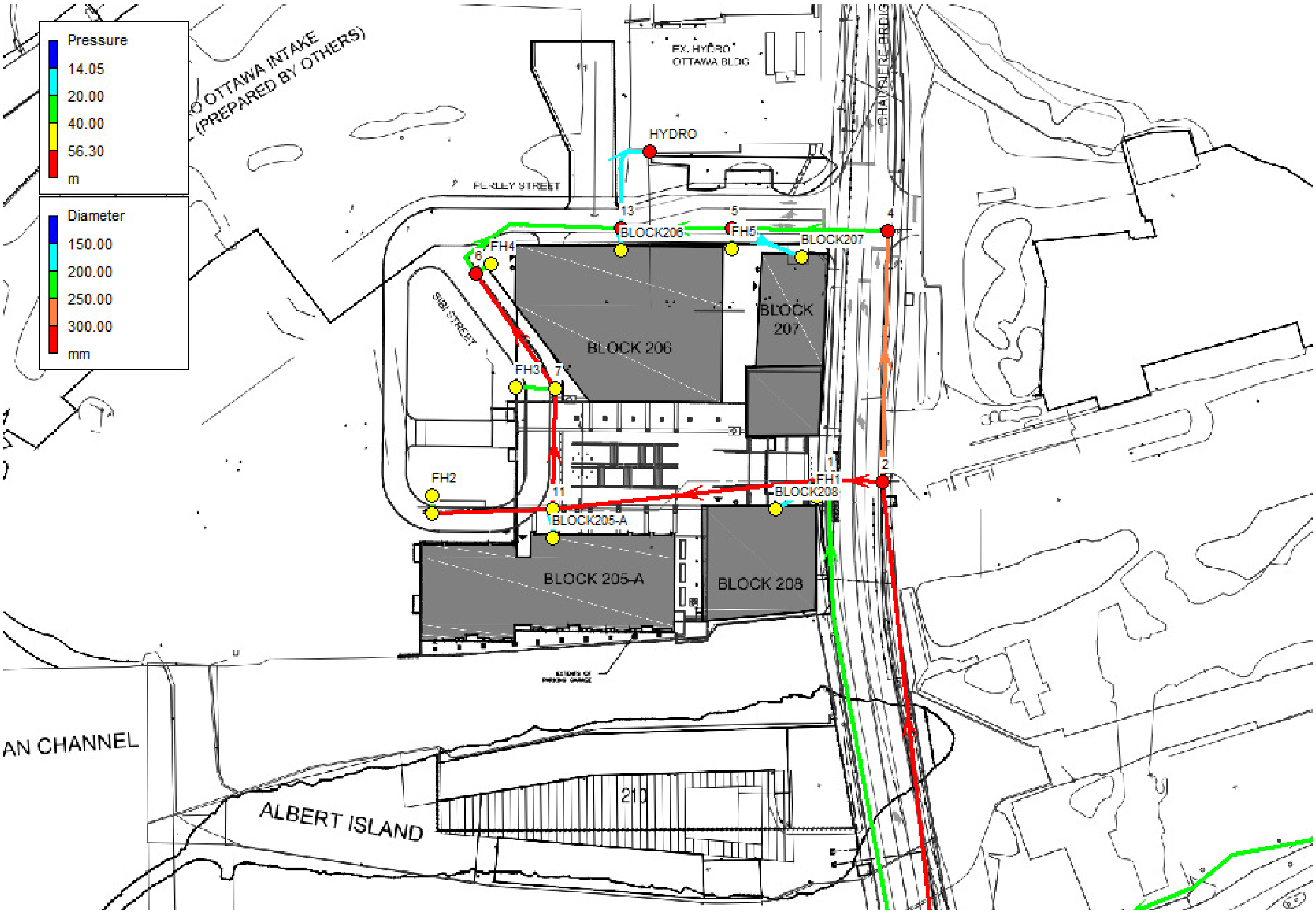
Link Results:

Link ID	Flow LPM	VelocityUnit m/s	Headloss m/km	Status
36	-15339.40	3.62	62.39	Open
41	-5014.50	2.66	65.54	Open
42	-13010.10	3.07	191.03	Open
43	-18024.60	4.25	57.16	Open
45	-2329.30	1.24	11.48	Open
46	-2329.30	1.24	11.15	Open
47	-2354.70	1.25	9.50	Open
48	2329.30	1.24	12.09	Open
49	-2329.30	1.24	11.74	Open
1	-5014.50	2.66	50.41	Open
2	-15339.40	3.62	47.16	Open

Link Results: (continued)

Link ID	Flow LPM	VelocityUnit m/s	Headloss m/km	Status
3	-25.40	0.01	0.00	Open
4	10323.14	2.43	40.26	Open
5	5016.26	1.70	15.72	Open
6	5016.26	2.66	63.33	Open
9	0.00	0.00	0.00	Open
10	-15320.04	3.61	57.29	Open
11	0.54	0.00	0.00	Open
12	0.54	0.00	0.00	Open
13	0.00	0.00	0.00	Open
14	10000.00	5.31	5999.64	Open
15	-4761.56	2.53	54.13	Open
16	-4974.46	2.64	51.69	Open
17	0.00	0.00	0.00	Open
18	33.80	0.03	0.03	Open
19	81.60	0.08	0.17	Open
20	179.10	0.17	1.04	Open
21	17.60	0.02	0.01	Open
22	-41.80	0.04	0.05	Open
7	15238.44	3.59	71.47	Open
8	5238.44	1.24	7.30	Open
23	10000.00	5.31	1329.95	Open

PEAK HOUR SCENARIO



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

Input File: 2015-07-28_717_slm.net

Link - Node Table:

Link ID	Start Node	End Node	Length m	Diameter mm
36	26	27	20	300
41	23	29	32	200
42	27	29	3	300
43	29	BOOTH_CONNECTION	3	300
45	30	31	129	200
46	31	32	152	200
47	33	WELLINGTON_CONNECTION	89.23	200
48	33	32	135	200
49	27	30	195	200
1	1	23	140	200
2	2	26	140	300
3	MSBP	33	1000	200
4	2	1	18.2	300
5	2	4	66	250
6	4	5	40	200
9	11	8	35	300
10	11	1	70	300
11	1	FH1	2.2	200
12	FH1	1	1000	200
13	5	FH5	4.5	200
14	6	FH4	1.4	200
15	6	13	50	200
16	13	5	30	200
17	8	FH2	2	200
18	13	HYDRO	26	150
19	11	BLOCK205-A	10	150
20	13	BLOCK206	5	150
21	1	BLOCK208	10	150
22	BLOCK207	5	10	150
7	11	7	40	300
8	7	6	31	300
23	7	FH3	7	200

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Node Results:

Node ID	Demand LPM	Head m	Pressure m	Quality hours
23	0.00	108.10	55.10	0.00
26	0.00	108.10	55.10	0.00
27	0.00	108.10	55.35	0.00
29	0.00	108.10	55.35	0.00
30	0.00	108.10	56.35	0.00
31	0.00	108.10	57.10	0.00
32	0.00	108.10	52.10	0.00
33	0.00	108.10	52.10	0.00
1	0.00	108.09	56.98	0.00
2	0.00	108.09	57.17	0.00
MSBP	23.40	108.10	52.10	0.00
4	0.00	108.09	58.99	0.00
5	0.00	108.08	58.28	0.00

6	0.00	108.09	56.89	0.00	
FH4	0.00	108.09	53.89	0.00	
8	0.00	108.09	55.44	0.00	
FH2	0.00	108.09	52.47	0.00	
FH1	0.00	108.09	54.13	0.00	
11	0.00	108.09	55.69	0.00	
FH5	0.00	108.08	55.51	0.00	
13	0.00	108.08	57.68	0.00	
HYDRO	17.60	108.08	58.08	0.00	
BLOCK205-A	123.40	108.08	53.03	0.00	
BLOCK206	272.50	108.07	53.12	0.00	
BLOCK208	31.70	108.09	53.14	0.00	
BLOCK207	64.00	108.08	53.13	0.00	
FH3	0.00	108.09	52.64	0.00	
7	0.00	108.09	55.54	0.00	
BOOTH_CONNECTION	-497.27	108.10	0.00	1.00	Reservoir
WELLINGTON_CONNECTION	-35.33	108.10	0.00	1.00	Reservoir

Link Results:

Link ID	Flow LPM	VelocityUnit m/s	Headloss m/km	Status
36	-385.80	0.09	0.06	Open
41	-123.41	0.07	0.06	Open
42	-373.87	0.09	0.17	Open
43	-497.27	0.12	0.07	Open
45	-11.93	0.01	0.00	Open
46	-11.93	0.01	0.00	Open
47	-35.33	0.02	0.00	Open
48	11.93	0.01	0.00	Open
49	-11.93	0.01	0.00	Open
1	-123.41	0.07	0.05	Open
2	-385.80	0.09	0.05	Open

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Link Results: (continued)

Link ID	Flow LPM	VelocityUnit m/s	Headloss m/km	Status
3	-23.40	0.01	0.00	Open
4	200.43	0.05	0.02	Open
5	185.37	0.06	0.03	Open
6	185.37	0.10	0.13	Open
9	0.00	0.00	0.00	Open
10	-292.13	0.07	0.04	Open
11	0.01	0.00	0.00	Open
12	0.01	0.00	0.00	Open
13	0.00	0.00	0.00	Open
14	0.00	0.00	0.00	Open
15	168.73	0.09	0.10	Open
16	-121.37	0.06	0.05	Open
17	0.00	0.00	0.00	Open
18	17.60	0.02	0.01	Open
19	123.40	0.12	0.37	Open
20	272.50	0.26	2.34	Open
21	31.70	0.03	0.03	Open
22	-64.00	0.06	0.11	Open
7	168.73	0.04	0.01	Open
8	168.73	0.04	0.01	Open
23	0.00	0.00	0.00	Open

Hatch Mott MacDonald

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August 13, 2015

Steve Merrick, EIT
David Schaeffer Engineering Ltd.
120 Iber Road, Unit 103
Stittsville, ON K2S 1E9

**RE: Phase 1 of the Chaudiere West Development
Purple Pipe Treatment and Pumping System
Conceptual Level Estimates**

Dear Steve:

As requested, Hatch Mott MacDonald (HMM) have undertaken a conceptual level assessment of the anticipated facility sizing (foot print) and capital cost for providing a Purple Pipe Treatment and Pumping System to service Phase 1 of the Chaudiere West Development (Domtar) that will service Blocks 208, 207, 206 & 205a. It is our understanding that the proposed Purple Pipe System will draw water from the Ottawa River through an existing 300mm diameter intake located adjacent to Block 203.

Based on the available information, the following preliminary design criteria have been assumed for the proposed Purple Pipe System:

- Design Flow Rate (Phase 1): 3.3 L/s
- Raw Water Quality: 1.0 mg/L Iron
  0.15 mg/L Manganese
  100 NTU Turbidity
- Treated Water Quality: 0.3 mg/L Iron
  0.05 mg/L Manganese
  <5 NTU Turbidity

The proposed treated water quality targets are based on Ontario Drinking Water Standards - Aesthetic Objectives for these parameters. This level of treatment is generally required to prevent aesthetic issues with the system including cloudy water and staining of fixtures (i.e., oxidized iron will cause reddish/brown staining, oxidized manganese will cause blackish staining).

Based on the above preliminary design criteria, the proposed Purple Pipe System will be comprised of the following key components:

- **Package Filtration System:**
  - Skid Foot Print ~4.0mWx2.0mLx3.0mH.
  - Two (2) 1,219mmØ Pressure Filters (Expandable to four (4) Filters) with each filter rated for 3.3L/s (Filtration Rate=10.2m/hr) to provide a Duty/Standby configuration.
  - Filter media will be comprised of MD-80 (or equivalent) media for iron and manganese removal; and Anthracite for particulate (turbidity) removal.

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- Filtration System will be fully automated including the following equipment/instrumentation:
  - Control Panel including PLC and Operator Interface Terminal (OIT)
  - One (1) Blower for Backwash Air Scour;
  - One (1) Filter Effluent Magnetic Flow Meter;
  - One (1) Filter Effluent Turbidity Analyzer;
  - Two (2) Pressure Transmitters.

- **Package Pumping System**:
  - Skid Foot Print ~2.0mWx1.2mLx1.5mH.
  - Four (4) booster pumps, each rated for 3.3L/s to supply raw water to the package filtration system and the Purple Pipe System (i.e., water will be pumped to the filtration system at distribution pressures to avoid re-pumping). These pumps will also supply water for backwashing the filters. Note, it is assumed that the proposed system will be located in the basement of the proposed Parking Garage and therefore, raw water can be drawn directly from the existing (extended to the proposed facility) raw water intake without interim (low lift) pumping.
  - Pumping System will be fully automated and integrated with the Filtration System Control Panel and will include Pump Starters/Electrical Panels (Note: VFDs are not anticipated to be required at this time), suction/discharge piping and associated control/isolation valves.

- **Sodium Hypochlorite System:** Panel mounted sodium hypochlorite (liquid chlorine) system equipped with two (2) Metering Pumps (Duty/Standby) and associated control panel. Sodium hypochlorite addition may be utilized for iron oxidation and prevention of microbiological growth in the Purple Pipe System. Sodium Hypochlorite System will be fully automated and integrated with the Filtration System Control Panel.

- **Hydropneumatic Tank:** One (1) 1,800 L (~1,500mmØ x 3,500mm High) capacity to control/maintain Purple Pipe System pressures on the discharge side of the treatment system.

- **System Operation/Control**: System will operate based on system pressure. When the system pressure reaches the Low/Start Pressure Setpoint, the Filtration System and Raw Water Pump(s) will start. The system will continue to supply/treat water until the High/Stop Pressure Setpoint (i.e., Hydropneumatic Tank is full) and the Filtration System and Raw Water Pump(s) will stop. System pressure will be maintained when the system is "Off" by the water in the Hydropneumatic Tank.

- **Standby Generator**: Diesel Standby Generator with base-mounted fuel tank installed in a weather-proof enclosure, adjacent to the facility. The system will be equipped with an Automatic Transfer Switch (ATS) to allow for the system to automatically respond in the event of a power outage. Final sizing of the generator will be determined during the design process.

Based on the keys components identified above and the ancillary systems required for the operation of this system (i.e., Control Panels, Motor Control Centre, etc.) the estimate foot print required to accommodate the proposed Purple Pipe Treatment and Pumping System is as follows:

- Length: 8.5m
- Width: 8.5m
- Height: 4.0m (Required for Filter and Hydropneumatic Tanks)

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It should be noted that the proposed Package Treatment and Pumping Systems could be re-used/relocated to form part of the ultimate Purple Pipe Water Supply System, potentially reducing the cost of the future system significantly.

We trust the above is acceptable. Should you require any additional information, please do not hesitate to contact us.

Yours truly,
Hatch Mott MacDonald

W. Andrews.

William Andrews, P.Eng. BDS, PMP
Principal Project Manager/Associate
T 905.315.3519 F 905.315.3569

cc. G. Harris, HMM

APPENDIX C

Wastewater Collection

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

Domestic Demand

Block	Type of Housing	Per / Unit	Units*	Pop	Average Flow m^3/d	Average Flow L/s	Peak Flow m^3/d	Peak Flow L/s
205-A	Average Appartment	1.8	80	144	50.4	0.6	200.1	2.3
206	Average Appartment	1.8	170	306	107.1	1.2	425.2	4.9
207	Average Appartment	1.8	38	69	24.2	0.3	95.9	1.1
208	Average Appartment	1.8	0	0	0.0	0.0	0.0	0.0
	Total Domestic Demand		**288**	**519**	**181.7**	**2.1**	**646.7**	**7.5**

Institutional / Commercial / Industrial Demand

Block	Property Type	Unit Rate		Units	Avg. Daily m^3/d	Avg. Daily L/s	Peak Flow m^3/d	Peak Flow L/s
205-A	Commercial floor space	5.0	$L/m^2/d$	1,087	5.44	0.1	8.15	0.1
206	Commercial floor space	5.0	$L/m^2/d$	604	3.02	0.0	4.53	0.1
	Community - Hall**	15	L/m2/d	650	9.75	0.1	14.63	0.2
207	Office	81	$L/9.3m^2/d$	348	3.03	0.0	4.55	0.1
	Commercial floor space	5.0	$L/m^2/d$	348	1.74	0.0	2.61	0.0
208	Office	82	$L/9.3m^2/d$	1,680	14.81	0.2	22.22	0.3
	Commercial floor space	5.0	$L/m^2/d$	840	4.20	0.0	6.30	0.1
				Total I/CI Demand	42.0	0.5	63.0	0.7
				Total Demand	**223.6**	**2.6**	**709.7**	**8.2**

* Number of residential units estimated using ratio of total units to respective residential area
**Unit rate for community space from Appendix 4-A.2 for Dance Halls
†Assumed $300ft^2$ per room and double occupancy per room

Demand by Block

Block	Average Flow m^3/d	Average Flow L/s	Peak Flow m^3/d	Peak Flow L/s
205-A	55.8	0.6	208.2	2.4
206	119.9	1.4	444.3	5.1
207	28.9	0.3	103.0	1.2
208	19.0	0.2	28.5	0.3
Total Sanitary Discharge	**223.6**	**2.6**	**784.1**	**9.1**
Total Wet Weather Flow	**224.0**	**3.0**	**784.5**	**9.5**

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

52 Springbrook Drive
Ottawa, Ontario Canada K2S 1B9
TEL: (613) 836-3884
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WEB: www.jfsa.com

August 13, 2015

David Schaeffer Engineering Ltd
120 Iber Road, Unit 103
Stittsville, ON K2S 1E9

Attention: Steve Merrick, EIT., Project Coordinator / Junior Designer

Subject: Windmill Domtar Lands - Diurnal Dry Weather Flow Sanitary Distribution

Dear Sir,

As requested by your office we have simulated a dry weather flow diurnal sanitary flow distribution for the above site and for the data that your office has provided and which is presented below.

*# Population: 287 units x 1.8 person / unit = 517 persons
*# Average daily flow: 350 L/cap/day
*# Commercial space: 5556 sq.m. = .5556 ha
*# Average daily flow for commercial: 10 L/sq.m/day x 1.5 peaking factor
*# Groundwater infiltration: 0.28 L/s/ha x 1.0 ha = 0.28 L/s

To undertake this analysis we made use of SWMHYMO's "COMPUTE DWF+WWF" command with the option to simulate a variable population driven dry weather flow (DWF) with a constant commercially generated flow and groundwater infiltration. The DWF is simulated based on population or area with daily per capita flows or daily per area flows.

In SWMHYMO, variable DWF patterns are available for populations varying from approximately 1500 to 79000 people for weekdays with school, weekdays without school and weekends. The available variable DWF patterns were derived from real flow monitoring data, obtained from a different study, for the City of Edmonton. While this data did not originate in Ottawa, it was successfully used in other studies in Toronto and Gatineau where similar DWF patterns were observed. The most peaky DWF flow pattern is for weekdays with school - this pattern was selected for the current analysis.

Using the above noted information, the simulated and resulting maximum, minimum and average DWF are 5.4 L/s, 1.9 L/s and 3.34 L/s respectively. The Input / Output files are provided in the attached Appendix A with a five (5) day plot of the computed DWF.

Sincerely yours,

J.F. Sabourin and Associates Inc.

J.F. Sabourin, M.Eng., P.Eng.
President and Director of Water Resources Projects

APPENDIX A

SWMHYMO Input File (p.A1)

SWMHYMO Output files (p.A2)

Figure of Simulated DWF Pattern (p.A9)

SWMHYMO Input File:

```
20    Metric units / ID numbers OFF
*#*************************************************************************
*#  SWMHYMO Ver:5.02/Jan 2001 <BETA> / INPUT DATA FILE
*#*************************************************************************
*#  Project Name: [WindMill Sanitary]    Project Number: [1163]
*#  Date        : 07-29-2015
*#  Modeller    : [JFS]
*#  Company     : JFSA inc.
*#  License #   :  2547402
*#*************************************************************************
START                TZERO=[0.0],  METOUT=[2],  NSTORM=[0],  NRUN=[0]
*%                    ["  "] <--storm filename, one per line for NSTORM time
*%-----------------|----------------------------------------------------------|
*#  INFORMATION PROVIDED BY DSEL
*#  -----------------------------------------------------
*#  Population:  287 units x 1.8 person / unit = 517
*#  Average daily flow:  350 L/cap/day
*#  Commerical space:  5556 sq.m. = .5556 ha
*#  Average daily flow for commercial:  10 L/sq.m/day x 1.5 peaking factor
*#  Groundwater infiltration:  0.28 L/s/ha x 1.0 ha = 0.30 L/s
*#
COMPUTE DWF+WWF      NHYD=["DWF"], DT=[5]min, AREA=[1.0](ha),
                     NDays=[5] (must be entered when no rainfall is provided)
                     ========== DRY WEATHER FLOW PARAMETERS ==============
                     --- Residential (or Population) driven flows
                     POP =[517], ADFp=[350](l/cap/day), PKFp=[-111]
                     --- Com / Ind / Inst (or Area) driven flows
                     XAcom=[.5556], ADFa=[100000](l/ha/day), PKFa=[1.5]
                     --- Groundwater baseflow
                     XAgwf=[1], ADFg=[24192](l/ha/day), PKFg=[1.0]
                     ========== WET WEATHER FLOW (I/I) PARAMETERS ========
                     --- Direct connections
                     C_DCON=[0.0], AVGLEN=[0.0](m)
                     --- Weeping tile connections
                     C_WEEP=[0.0], K_WEEP=[0.0](hrs)
                     --- Slow infiltration
                     C_SLOW=[0.0], K_SLOWi=[0.0](hrs), K_SLOWii=[0.0](hrs/ha)
                     END=-1
*%-----------------|----------------------------------------------------------|
PRINT HYD            NHYD=["DWF"], # OF PCYCLES=[1]
*%-----------------|----------------------------------------------------------|
SAVE HYD             NHYD=["DWF"],  # OF PCYCLES=[-1],  ICASEsh=[1]
                     HYD_COMMENT=["WINDMILL Sanitary Flows / Typical day w/School"]
*%-----------------|----------------------------------------------------------|
FINISH
```

SWMHYMO Output File:

```
================================================================================

 SSSSS  W    W  M    M  H    H  Y    Y  M    M    OOO        999     999   =========
 S      W W W   MM MM   H    H   Y Y    MM MM   O    O      9   9   9   9
 SSSSS  W W W   M M M   HHHHH     Y     M M M   O    O  ##  9   9   9   9  Ver5 Beta
     S   W W    M    M  H    H    Y     M    M  O    O       9999    9999  Sept 2000
 SSSSS   W W    M    M  H    H    Y     M    M    OOO           9       9  =========
                                                            9   9   9   9  # 2547402
      StormWater Management HYdrologic Model                 999     999   =========

 ***************************************************************************
 *************************** SWMHYMO Ver/5 Beta ***************************
 *******  A single event and continuous hydrologic simulation model  *******
 *******     based on the principles of HYMO and its successors      *******
 *******                 OTTHYMO-83 and OTTHYMO-89.                  *******
 ***************************************************************************
 ******* Distributed by:  J.F. Sabourin and Associates Inc.           *******
 *******                  Ottawa,  Ontario: (613) 727-5199            *******
 *******                  Gatineau, Quebec: (819) 243-6858            *******
 *******                  E-Mail: swmhymo@jfsa.Com                    *******
 ***************************************************************************

 +++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
 +++++++ Licensed user: JFSA inc.                                   +++++++
 +++++++                Stittsville           SERIAL#:2547402        +++++++
 +++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

 ***************************************************************************
 *******          ++++++ PROGRAM ARRAY DIMENSIONS ++++++             *******
 *******          Maximum value for ID numbers  :     10             *******
 *******          Max. number of rainfall points:  52750             *******
 *******          Max. number of flow points    :  52750             *******
 ***************************************************************************


 ********************   D E T A I L E D   O U T P U T   ********************
 ***************************************************************************
 *      DATE: 2015-08-07     TIME: 12:24:43     RUN COUNTER: 001707        *
 ***************************************************************************
 * Input   filename: Z:\PROJ\1163-13\DESIGN\SANITA~1\DWF.dat               *
 * Output  filename: Z:\PROJ\1163-13\DESIGN\SANITA~1\DWF.out               *
 * Summary filename: Z:\PROJ\1163-13\DESIGN\SANITA~1\DWF.sum               *
 * User comments:                                                          *
 * 1:_______________________________________________________________________*
 * 2:_______________________________________________________________________*
 * 3:_______________________________________________________________________*
 ***************************************************************************

--------------------------------------------------------------------------------
001:0001------------------------------------------------------------------------
*#******************************************************************************
*#  SWMHYMO Ver:5.02/Jan 2001 <BETA> / INPUT DATA FILE
*#******************************************************************************
*#  Project Name: [WindMill Sanitary]    Project Number: [1163]
*#  Date         : 07-29-2015
*#  Modeller     : [JFS]
*#  Company      : JFSA inc.
*#  License #    :  2547402
*#******************************************************************************
--------------------
| START            |  Project  dir.: Z:\PROJ\1163-13\DESIGN\SANITA~1\

--------------------  Rainfall dir.: Z:\PROJ\1163-13\DESIGN\SANITA~1\
```

```
    TZERO =    .00 hrs on        0
    METOUT=    2 (output = METRIC)
    NRUN  = 001
    NSTORM=    0
-------------------------------------------------------------------------------
001:0002-----------------------------------------------------------------------
*#  INFORMATION PROVIDED BY DSEL
*#  --------------------------------------------------
*#  Population:  287 units x 1.8 person / unit = 517
*#  Average daily flow:  350 L/cap/day
*#  Commerical space:  5556 sq.m. = .5556 ha
*#  Average daily flow for commercial:  10 L/sq.m/day x 1.5 peaking factor
*#  Groundwater infiltration:  0.28 L/s/ha x 1.0 ha = 0.30 L/s
*#
----------------------
| COMPUTE DWF+WWF     |   Total Area    (ha)=      1.00
| 01:DWF     DT= 5.00 |   Population        =      517.
----------------------
  DWF PARAMETERS:
    ---- Residential flow data ------------------------------------
    ADFp  = Average Daily Flow (population)      (l/cap/day)=     350.
    PKFp  = Peak Flow Factor (HARMONs= 3.97), user selected=     -111. (curve #)
            Actual Peak Flow Factor from variable DWF curve=     2.006
    ---- Com/Ind/Inst flow data -----------------------------------
    XAcom = .56 (ratio of total area).  Com+Ind+Inst    (ha)=       .56
    ADFa  = Average Daily Flow (com+ind+inst)      (l/ha/day)=  100000.
    PKFa  = Peak Flow Factor for total Com+Ind+Inst area    =    1.500 (const.)
    ---- Groundwater infiltration data ----------------------------
    XAgwf =1.00 (ratio of total), contributing area     (ha)=      1.00
    ADFg  = Average Daily Flow (from groundwater)(l/ha/day)=    24192.
  WWF PARAMETERS:
    ---- Direct connections .................................(N/A)
    ---- Weeping tile connections ...........................(N/A)
    ---- Slow infiltration ..................................(N/A)

  SIMULATION RESULTS OVER      5 DAYS (    120 HOURS):
    Peak DryWeatherFlow (DWF) [includes GWI]          (cms)=      .005
    Total Peak Flow (DWF + WWF)                       (cms)=      .005
    Total Peak Flow occured on            (yyyy.mmdd_hrs)=No_date      7:55
    Ratio of Total Peak Flow to Average Total Peak DWF    =     1.000
    Average flow during simulated period              (cms)=      .003
    Volume of rainfall induced flow                    (mm)=      .000
    Total flow volume simulated                        (mm)=   143.634
    Total rainfall volume                              (mm)=      .000
-------------------------------------------------------------------------------
001:0003-----------------------------------------------------------------------
--------------------
| PRINT HYD          |   AREA       (ha)=     1.000
| ID=01  (DWF    )   |   QPEAK     (cms)=      .005 (i)
| DT= 5.00 PCYC= 1   |   TPEAK     (hrs)=     7.917
--------------------     VOLUME     (mm)=   143.634

      (i)  PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
```

TIME hrs	FLOW cms	TIME hrs	FLOW cms	TIME hrs	FLOW cms	TIME hrs	FLOW cms	TIME hrs	FLOW cms
.00	.003	24.00	.003	48.00	.003	72.00	.003	96.00	.003
.08	.003	24.08	.003	48.08	.003	72.08	.003	96.08	.003
.17	.003	24.17	.003	48.17	.003	72.17	.003	96.17	.003
.25	.003	24.25	.003	48.25	.003	72.25	.003	96.25	.003
.33	.003	24.33	.003	48.33	.003	72.33	.003	96.33	.003
.42	.003	24.42	.003	48.42	.003	72.42	.003	96.42	.003
.50	.003	24.50	.003	48.50	.003	72.50	.003	96.50	.003
.58	.003	24.58	.003	48.58	.003	72.58	.003	96.58	.003
.67	.003	24.67	.003	48.67	.003	72.67	.003	96.67	.003
.75	.003	24.75	.003	48.75	.003	72.75	.003	96.75	.003
.83	.003	24.83	.003	48.83	.003	72.83	.003	96.83	.002
.92	.003	24.92	.003	48.92	.003	72.92	.002	96.92	.002
1.00	.003	25.00	.003	49.00	.002	73.00	.002	97.00	.002
1.08	.003	25.08	.002	49.08	.002	73.08	.002	97.08	.002
1.17	.002	25.17	.002	49.17	.002	73.17	.002	97.17	.002

1.25	.002	25.25	.002	49.25	.002	73.25	.002	97.25	.002
1.33	.002	25.33	.002	49.33	.002	73.33	.002	97.33	.002
1.42	.002	25.42	.002	49.42	.002	73.42	.002	97.42	.002
1.50	.002	25.50	.002	49.50	.002	73.50	.002	97.50	.002
1.58	.002	25.58	.002	49.58	.002	73.58	.002	97.58	.002
1.67	.002	25.67	.002	49.67	.002	73.67	.002	97.67	.002
1.75	.002	25.75	.002	49.75	.002	73.75	.002	97.75	.002
1.83	.002	25.83	.002	49.83	.002	73.83	.002	97.83	.002
1.92	.002	25.92	.002	49.92	.002	73.92	.002	97.92	.002
2.00	.002	26.00	.002	50.00	.002	74.00	.002	98.00	.002
2.08	.002	26.08	.002	50.08	.002	74.08	.002	98.08	.002
2.17	.002	26.17	.002	50.17	.002	74.17	.002	98.17	.002
2.25	.002	26.25	.002	50.25	.002	74.25	.002	98.25	.002
2.33	.002	26.33	.002	50.33	.002	74.33	.002	98.33	.002
2.42	.002	26.42	.002	50.42	.002	74.42	.002	98.42	.002
2.50	.002	26.50	.002	50.50	.002	74.50	.002	98.50	.002
2.58	.002	26.58	.002	50.58	.002	74.58	.002	98.58	.002
2.67	.002	26.67	.002	50.67	.002	74.67	.002	98.67	.002
2.75	.002	26.75	.002	50.75	.002	74.75	.002	98.75	.002
2.83	.002	26.83	.002	50.83	.002	74.83	.002	98.83	.002
2.92	.002	26.92	.002	50.92	.002	74.92	.002	98.92	.002
3.00	.002	27.00	.002	51.00	.002	75.00	.002	99.00	.002
3.08	.002	27.08	.002	51.08	.002	75.08	.002	99.08	.002
3.17	.002	27.17	.002	51.17	.002	75.17	.002	99.17	.002
3.25	.002	27.25	.002	51.25	.002	75.25	.002	99.25	.002
3.33	.002	27.33	.002	51.33	.002	75.33	.002	99.33	.002
3.42	.002	27.42	.002	51.42	.002	75.42	.002	99.42	.002
3.50	.002	27.50	.002	51.50	.002	75.50	.002	99.50	.002
3.58	.002	27.58	.002	51.58	.002	75.58	.002	99.58	.002
3.67	.002	27.67	.002	51.67	.002	75.67	.002	99.67	.002
3.75	.002	27.75	.002	51.75	.002	75.75	.002	99.75	.002
3.83	.002	27.83	.002	51.83	.002	75.83	.002	99.83	.002
3.92	.002	27.92	.002	51.92	.002	75.92	.002	99.92	.002
4.00	.002	28.00	.002	52.00	.002	76.00	.002	100.00	.002
4.08	.002	28.08	.002	52.08	.002	76.08	.002	100.08	.002
4.17	.002	28.17	.002	52.17	.002	76.17	.002	100.17	.002
4.25	.002	28.25	.002	52.25	.002	76.25	.002	100.25	.002
4.33	.002	28.33	.002	52.33	.002	76.33	.002	100.33	.002
4.42	.002	28.42	.002	52.42	.002	76.42	.002	100.42	.002
4.50	.002	28.50	.002	52.50	.002	76.50	.002	100.50	.002
4.58	.002	28.58	.002	52.58	.002	76.58	.002	100.58	.002
4.67	.002	28.67	.002	52.67	.002	76.67	.002	100.67	.002
4.75	.002	28.75	.002	52.75	.002	76.75	.002	100.75	.002
4.83	.002	28.83	.002	52.83	.002	76.83	.002	100.83	.002
4.92	.002	28.92	.002	52.92	.002	76.92	.002	100.92	.002
5.00	.002	29.00	.002	53.00	.002	77.00	.002	101.00	.002
5.08	.002	29.08	.002	53.08	.002	77.08	.002	101.08	.002
5.17	.002	29.17	.002	53.17	.002	77.17	.002	101.17	.002
5.25	.002	29.25	.002	53.25	.002	77.25	.002	101.25	.002
5.33	.002	29.33	.002	53.33	.002	77.33	.002	101.33	.002
5.42	.002	29.42	.002	53.42	.002	77.42	.002	101.42	.002
5.50	.002	29.50	.002	53.50	.002	77.50	.002	101.50	.002
5.58	.002	29.58	.002	53.58	.002	77.58	.002	101.58	.002
5.67	.002	29.67	.002	53.67	.002	77.67	.002	101.67	.002
5.75	.002	29.75	.002	53.75	.002	77.75	.002	101.75	.002
5.83	.002	29.83	.002	53.83	.002	77.83	.002	101.83	.002
5.92	.002	29.92	.002	53.92	.002	77.92	.002	101.92	.002
6.00	.002	30.00	.002	54.00	.002	78.00	.002	102.00	.002
6.08	.002	30.08	.002	54.08	.002	78.08	.002	102.08	.002
6.17	.002	30.17	.002	54.17	.002	78.17	.002	102.17	.002
6.25	.002	30.25	.002	54.25	.002	78.25	.002	102.25	.003
6.33	.002	30.33	.002	54.33	.002	78.33	.003	102.33	.003
6.42	.002	30.42	.002	54.42	.003	78.42	.003	102.42	.003
6.50	.002	30.50	.003	54.50	.003	78.50	.003	102.50	.003
6.58	.003	30.58	.003	54.58	.003	78.58	.003	102.58	.004
6.67	.003	30.67	.003	54.67	.003	78.67	.004	102.67	.004
6.75	.003	30.75	.003	54.75	.004	78.75	.004	102.75	.004
6.83	.003	30.83	.004	54.83	.004	78.83	.004	102.83	.004
6.92	.004	30.92	.004	54.92	.004	78.92	.004	102.92	.004
7.00	.004	31.00	.004	55.00	.004	79.00	.004	103.00	.005

7.08	.004	31.08	.004	55.08	.004	79.08	.005	103.08	.005
7.17	.004	31.17	.004	55.17	.005	79.17	.005	103.17	.005
7.25	.004	31.25	.005	55.25	.005	79.25	.005	103.25	.005
7.33	.005	31.33	.005	55.33	.005	79.33	.005	103.33	.005
7.42	.005	31.42	.005	55.42	.005	79.42	.005	103.42	.005
7.50	.005	31.50	.005	55.50	.005	79.50	.005	103.50	.005
7.58	.005	31.58	.005	55.58	.005	79.58	.005	103.58	.005
7.67	.005	31.67	.005	55.67	.005	79.67	.005	103.67	.005
7.75	.005	31.75	.005	55.75	.005	79.75	.005	103.75	.005
7.83	.005	31.83	.005	55.83	.005	79.83	.005	103.83	.005
7.92	.005	31.92	.005	55.92	.005	79.92	.005	103.92	.005
8.00	.005	32.00	.005	56.00	.005	80.00	.005	104.00	.005
8.08	.005	32.08	.005	56.08	.005	80.08	.005	104.08	.005
8.17	.005	32.17	.005	56.17	.005	80.17	.005	104.17	.005
8.25	.005	32.25	.005	56.25	.005	80.25	.005	104.25	.005
8.33	.005	32.33	.005	56.33	.005	80.33	.005	104.33	.005
8.42	.005	32.42	.005	56.42	.005	80.42	.005	104.42	.005
8.50	.005	32.50	.005	56.50	.005	80.50	.005	104.50	.004
8.58	.005	32.58	.005	56.58	.005	80.58	.004	104.58	.004
8.67	.005	32.67	.005	56.67	.004	80.67	.004	104.67	.004
8.75	.005	32.75	.004	56.75	.004	80.75	.004	104.75	.004
8.83	.004	32.83	.004	56.83	.004	80.83	.004	104.83	.004
8.92	.004	32.92	.004	56.92	.004	80.92	.004	104.92	.004
9.00	.004	33.00	.004	57.00	.004	81.00	.004	105.00	.004
9.08	.004	33.08	.004	57.08	.004	81.08	.004	105.08	.004
9.17	.004	33.17	.004	57.17	.004	81.17	.004	105.17	.004
9.25	.004	33.25	.004	57.25	.004	81.25	.004	105.25	.004
9.33	.004	33.33	.004	57.33	.004	81.33	.004	105.33	.004
9.42	.004	33.42	.004	57.42	.004	81.42	.004	105.42	.004
9.50	.004	33.50	.004	57.50	.004	81.50	.004	105.50	.004
9.58	.004	33.58	.004	57.58	.004	81.58	.004	105.58	.004
9.67	.004	33.67	.004	57.67	.004	81.67	.004	105.67	.004
9.75	.004	33.75	.004	57.75	.004	81.75	.004	105.75	.004
9.83	.004	33.83	.004	57.83	.004	81.83	.004	105.83	.004
9.92	.004	33.92	.004	57.92	.004	81.92	.004	105.92	.004
10.00	.004	34.00	.004	58.00	.004	82.00	.004	106.00	.004
10.08	.004	34.08	.004	58.08	.004	82.08	.004	106.08	.004
10.17	.004	34.17	.004	58.17	.004	82.17	.004	106.17	.004
10.25	.004	34.25	.004	58.25	.004	82.25	.004	106.25	.004
10.33	.004	34.33	.004	58.33	.004	82.33	.004	106.33	.004
10.42	.004	34.42	.004	58.42	.004	82.42	.004	106.42	.004
10.50	.004	34.50	.004	58.50	.004	82.50	.004	106.50	.004
10.58	.004	34.58	.004	58.58	.004	82.58	.004	106.58	.004
10.67	.004	34.67	.004	58.67	.004	82.67	.004	106.67	.004
10.75	.004	34.75	.004	58.75	.004	82.75	.004	106.75	.004
10.83	.004	34.83	.004	58.83	.004	82.83	.004	106.83	.004
10.92	.004	34.92	.004	58.92	.004	82.92	.004	106.92	.004
11.00	.004	35.00	.004	59.00	.004	83.00	.004	107.00	.004
11.08	.004	35.08	.004	59.08	.004	83.08	.004	107.08	.004
11.17	.004	35.17	.004	59.17	.004	83.17	.004	107.17	.004
11.25	.004	35.25	.004	59.25	.004	83.25	.004	107.25	.004
11.33	.004	35.33	.004	59.33	.004	83.33	.004	107.33	.004
11.42	.004	35.42	.004	59.42	.004	83.42	.004	107.42	.004
11.50	.004	35.50	.004	59.50	.004	83.50	.004	107.50	.004
11.58	.004	35.58	.004	59.58	.004	83.58	.004	107.58	.004
11.67	.004	35.67	.004	59.67	.004	83.67	.004	107.67	.004
11.75	.004	35.75	.004	59.75	.004	83.75	.004	107.75	.004
11.83	.004	35.83	.004	59.83	.004	83.83	.004	107.83	.003
11.92	.004	35.92	.004	59.92	.004	83.92	.003	107.92	.003
12.00	.004	36.00	.004	60.00	.003	84.00	.003	108.00	.003
12.08	.004	36.08	.003	60.08	.003	84.08	.003	108.08	.003
12.17	.003	36.17	.003	60.17	.003	84.17	.003	108.17	.003
12.25	.003	36.25	.003	60.25	.003	84.25	.003	108.25	.003
12.33	.003	36.33	.003	60.33	.003	84.33	.003	108.33	.003
12.42	.003	36.42	.003	60.42	.003	84.42	.003	108.42	.003
12.50	.003	36.50	.003	60.50	.003	84.50	.003	108.50	.003
12.58	.003	36.58	.003	60.58	.003	84.58	.003	108.58	.003
12.67	.003	36.67	.003	60.67	.003	84.67	.003	108.67	.003
12.75	.003	36.75	.003	60.75	.003	84.75	.003	108.75	.003
12.83	.003	36.83	.003	60.83	.003	84.83	.003	108.83	.003

12.92	.003	36.92	.003	60.92	.003	84.92	.003	108.92	.003
13.00	.003	37.00	.003	61.00	.003	85.00	.003	109.00	.003
13.08	.003	37.08	.003	61.08	.003	85.08	.003	109.08	.003
13.17	.003	37.17	.003	61.17	.003	85.17	.003	109.17	.003
13.25	.003	37.25	.003	61.25	.003	85.25	.003	109.25	.003
13.33	.003	37.33	.003	61.33	.003	85.33	.003	109.33	.003
13.42	.003	37.42	.003	61.42	.003	85.42	.003	109.42	.003
13.50	.003	37.50	.003	61.50	.003	85.50	.003	109.50	.003
13.58	.003	37.58	.003	61.58	.003	85.58	.003	109.58	.003
13.67	.003	37.67	.003	61.67	.003	85.67	.003	109.67	.003
13.75	.003	37.75	.003	61.75	.003	85.75	.003	109.75	.003
13.83	.003	37.83	.003	61.83	.003	85.83	.003	109.83	.003
13.92	.003	37.92	.003	61.92	.003	85.92	.003	109.92	.003
14.00	.003	38.00	.003	62.00	.003	86.00	.003	110.00	.003
14.08	.003	38.08	.003	62.08	.003	86.08	.003	110.08	.003
14.17	.003	38.17	.003	62.17	.003	86.17	.003	110.17	.003
14.25	.003	38.25	.003	62.25	.003	86.25	.003	110.25	.003
14.33	.003	38.33	.003	62.33	.003	86.33	.003	110.33	.003
14.42	.003	38.42	.003	62.42	.003	86.42	.003	110.42	.003
14.50	.003	38.50	.003	62.50	.003	86.50	.003	110.50	.003
14.58	.003	38.58	.003	62.58	.003	86.58	.003	110.58	.003
14.67	.003	38.67	.003	62.67	.003	86.67	.003	110.67	.003
14.75	.003	38.75	.003	62.75	.003	86.75	.003	110.75	.003
14.83	.003	38.83	.003	62.83	.003	86.83	.003	110.83	.003
14.92	.003	38.92	.003	62.92	.003	86.92	.003	110.92	.003
15.00	.003	39.00	.003	63.00	.003	87.00	.003	111.00	.003
15.08	.003	39.08	.003	63.08	.003	87.08	.003	111.08	.003
15.17	.003	39.17	.003	63.17	.003	87.17	.003	111.17	.003
15.25	.003	39.25	.003	63.25	.003	87.25	.003	111.25	.003
15.33	.003	39.33	.003	63.33	.003	87.33	.003	111.33	.003
15.42	.003	39.42	.003	63.42	.003	87.42	.003	111.42	.003
15.50	.003	39.50	.003	63.50	.003	87.50	.003	111.50	.003
15.58	.003	39.58	.003	63.58	.003	87.58	.003	111.58	.003
15.67	.003	39.67	.003	63.67	.003	87.67	.003	111.67	.003
15.75	.003	39.75	.003	63.75	.003	87.75	.003	111.75	.003
15.83	.003	39.83	.003	63.83	.003	87.83	.003	111.83	.003
15.92	.003	39.92	.003	63.92	.003	87.92	.003	111.92	.003
16.00	.003	40.00	.003	64.00	.003	88.00	.003	112.00	.003
16.08	.003	40.08	.003	64.08	.003	88.08	.003	112.08	.003
16.17	.003	40.17	.003	64.17	.003	88.17	.003	112.17	.003
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16.33	.003	40.33	.003	64.33	.003	88.33	.003	112.33	.003
16.42	.003	40.42	.003	64.42	.003	88.42	.003	112.42	.003
16.50	.003	40.50	.003	64.50	.003	88.50	.003	112.50	.003
16.58	.003	40.58	.003	64.58	.003	88.58	.003	112.58	.003
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17.17	.003	41.17	.004	65.17	.004	89.17	.004	113.17	.004
17.25	.004	41.25	.004	65.25	.004	89.25	.004	113.25	.004
17.33	.004	41.33	.004	65.33	.004	89.33	.004	113.33	.004
17.42	.004	41.42	.004	65.42	.004	89.42	.004	113.42	.004
17.50	.004	41.50	.004	65.50	.004	89.50	.004	113.50	.004
17.58	.004	41.58	.004	65.58	.004	89.58	.004	113.58	.004
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17.75	.004	41.75	.004	65.75	.004	89.75	.004	113.75	.004
17.83	.004	41.83	.004	65.83	.004	89.83	.004	113.83	.004
17.92	.004	41.92	.004	65.92	.004	89.92	.004	113.92	.004
18.00	.004	42.00	.004	66.00	.004	90.00	.004	114.00	.004
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18.42	.004	42.42	.004	66.42	.004	90.42	.004	114.42	.004
18.50	.004	42.50	.004	66.50	.004	90.50	.004	114.50	.004
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19.83	.004	43.83	.004	67.83	.004	91.83	.004	115.83	.004
19.92	.004	43.92	.004	67.92	.004	91.92	.004	115.92	.004
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20.08	.004	44.08	.004	68.08	.004	92.08	.004	116.08	.004
20.17	.004	44.17	.004	68.17	.004	92.17	.004	116.17	.004
20.25	.004	44.25	.004	68.25	.004	92.25	.004	116.25	.004
20.33	.004	44.33	.004	68.33	.004	92.33	.004	116.33	.004
20.42	.004	44.42	.004	68.42	.004	92.42	.004	116.42	.004
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20.67	.004	44.67	.004	68.67	.004	92.67	.004	116.67	.004
20.75	.004	44.75	.004	68.75	.004	92.75	.004	116.75	.004
20.83	.004	44.83	.004	68.83	.004	92.83	.004	116.83	.004
20.92	.004	44.92	.004	68.92	.004	92.92	.004	116.92	.004
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21.17	.004	45.17	.004	69.17	.004	93.17	.004	117.17	.004
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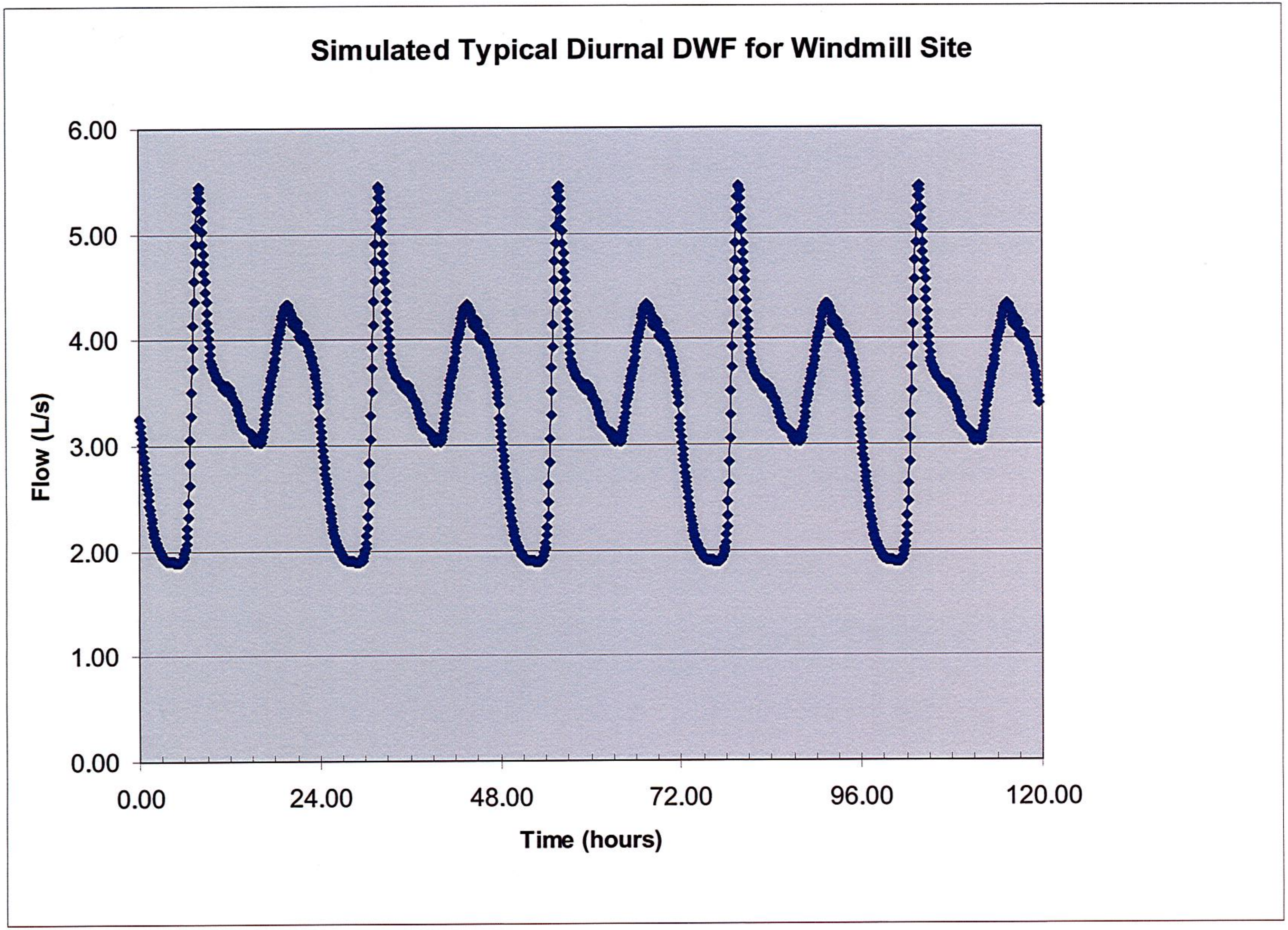
23.50	.004	47.50	.004	71.50	.003	95.50	.003	119.50	.003
23.58	.004	47.58	.003	71.58	.003	95.58	.003		
23.67	.003	47.67	.003	71.67	.003	95.67	.003		
23.75	.003	47.75	.003	71.75	.003	95.75	.003		
23.83	.003	47.83	.003	71.83	.003	95.83	.003		
23.92	.003	47.92	.003	71.92	.003	95.92	.003		

```
-----------------------------------------------------------------------------
001:0004---------------------------------------------------------------------
--------------------
| SAVE HYD           |    AREA       (ha)=      1.000
| ID=01 (DWF    )    |    QPEAK     (cms)=       .005 (i)
| DT= 5.00 PCYC=-1   |    TPEAK     (hrs)=      7.917
--------------------      VOLUME     (mm)=    143.634
```

```
 Filename: Z:\PROJ\1163-13\DESIGN\SANITA~1\H-DWF.001
 Comments: WINDMILL Sanitary Flows / Typical day w/School

     (i)  PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
-----------------------------------------------------------------------------
001:0005---------------------------------------------------------------------
      FINISH
-----------------------------------------------------------------------------
*****************************************************************************
     WARNINGS / ERRORS / NOTES
     -------------------------
   Simulation ended on 2015-08-07     at 12:24:43
=============================================================================
```


Simulated Typical Diurnal DWF for Windmill Site
6.00
5.00
4.00
3.00
2.00
1.00
0.00
Flow (L/s)
0.00
24.00
48.00
72.00
96.00
120.00
Time (hours)

Hatch Mott MacDonald

TECHNICAL MEMO

To:	**David Schaeffer Engineering Limited (DSEL)**
Attn:	Adam Fobert, P.Eng
From:	Peter Rüsch, P.Eng
Date:	August 13, 2015
Project #:	282834
Page(s):	4
CC:	
Subject:	**Windmill Pumping Station Capacity Assessment**

Dear Mr. Fobert:

HMM was retained to evaluate the capacity of an existing pumping station, located in an old paper mill building on Chaudiere Island, in Ottawa, Ontario. HMM staff visited the Pumping Station on June 30, 2015, in the presence of Steve Merrick from DSEL and Kristen Jorgensen from WINDMILL Development Group Ltd. For the purpose of this Technical Memorandum (TM) the pumping station will be called the Windmill Sanitary Pumping Station (WSPS). This analysis is based on the information gathered during the site visit and from additional sources as indicated in this TM. The pumping station is located in an old building, on the south side of Chaudiere Crossing.

In a pumping station evaluation HMM aims to confirm the duty point, and thus capacity, using more than one method, to ensure that errors / inconsistencies in the often unreliable data are discovered and discussed. These methods are:

- Confirming the flow utilizing a flow meter, if installed;
- Confirming the duty point by superimposing the pump curve onto the system curve. In this case the intersection of the pump and system curve defines the duty point and thus flow rate; and
- Confirming the duty point by measuring the power uptake of the electrical motor. It has to be noted that the power uptake of the electric motor in itself does not define the duty, however gives an indication of the duty point as it relates to the original pump curve.

Under ideal conditions, the duty points derived as noted above for the pumping station under consideration should provide for similar or very similar capacities, increasing the overall confidence in the assessment.

For the WSPS, HMM utilized the first two of the three methods noted above, and the purpose of this TM to detail the findings of both of the methods.

Confirming the flow utilizing the flow meter

The WSPS has a Endress and Hauser ProMag F flow meter with a diameter of 50mm. It appears to have been installed a considerable time ago. Photo 1 below shows the flow meter as installed and the corrosion of the flange bolts. The flow meter has more than the required 5 diameters of straight pipe upstream and downstream. The WSPS ran only once during the site

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visit, and during this period a flow rate of ~88 to 90 gpm was indicated by the meter. However, it was also noted that the Flow meter readout showed a "System Error Amplifier". HMM was not able to confirm if the flow rate indicated was measured in US or UK/Canadian gallons.

Photo 1: Flow meter: Endress + Hauser ProMag F

If the flows were measured in US gpm, the flow rate would be 5.55 L/s, however in case the flow rate is measured in UK/ Canadian gallons, the corresponding flow rate would be 6.67 L/s. Assuming that the flow meter measures the flow with reasonable accuracy given it's age it may be concluded that the flow is likely between 5.5 L/s and 6.7 L/s.

Confirming the duty point by superimposing the pump curve onto the system curve

HMM staff obtained a survey (attached to the TM) providing an approximate length of the forcemain, as well as elevation of the wet well (top of lid) and the elevation of the discharge location. From this survey the following core parameters are available for the forcemain:

- Wet Well Top of Lid Elevation – 48.6 m
- Centerline of Discharge Elevation – 51.7 m
- Length of the forcemain ~ 177 m

No material information has been noted on the survey drawing, however HMM staff noted during the site visit that the forcemain material in the building was galvanized steel, diameter 75 mm. HMM has not confirmed the material of the remainder of the forcemain, as it was not accessible. During the site visit the operating levels of the pumps were measured from the PS lid, these were recorded as follows:

- Lead Pump On – 2.6m from Lid, or 46.0 m
- Lead Pump Off – 3.0 m from Lid, or 45.6 m

This would result in a live wet well depth of 0.4 m. HMM notes that the "Lead Pump On" level was recorded based on the concrete being wet at a certain level, and therefore may not be accurate. In the PS electrical panel there are hand written notes referring to the following (see also Photo 2 below):

- Start @ .77
- Stop @ .28

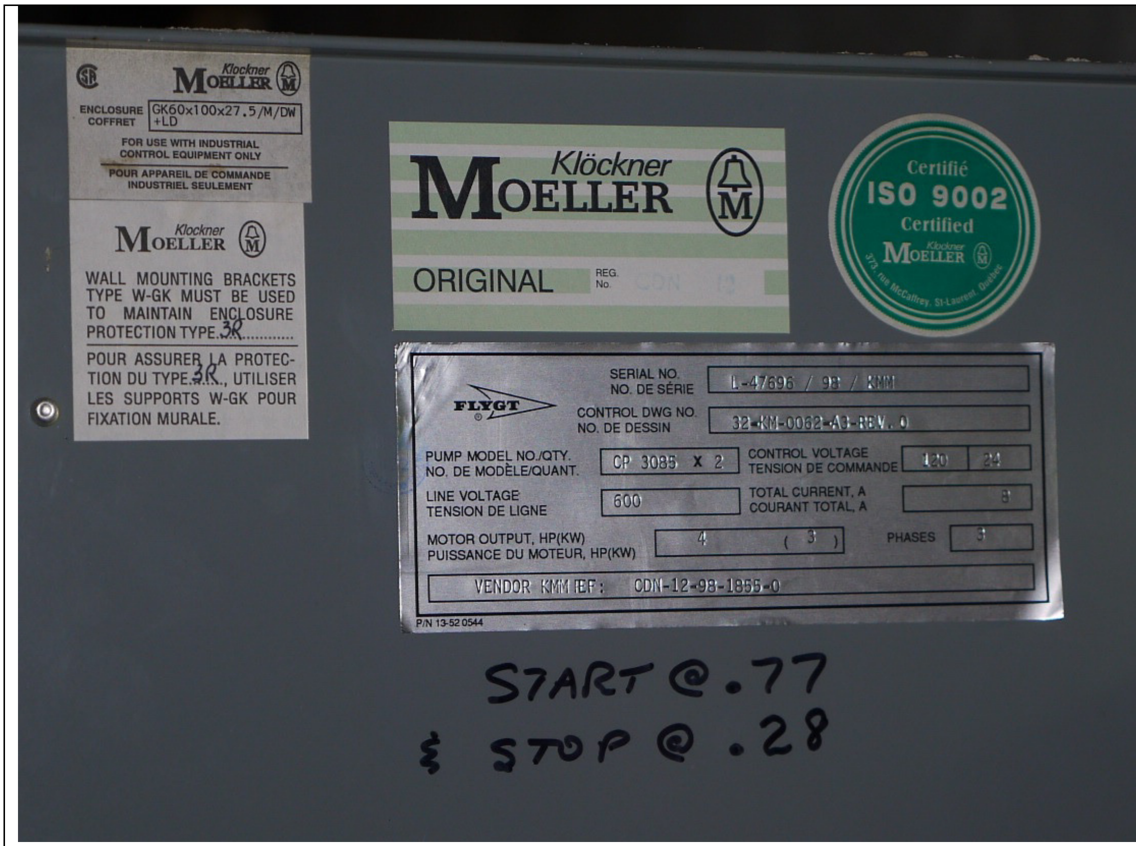


Photo 2: Panel, showing Start/ Stop and pump models

No units are noted. If in m, the resulting live wet well depth would be 0.5 m. HMM calculated the required wet well volume (based on the measured wet well dimensions), and for a flow of 6.7 L/s, this would require a live well depth of 0.5 m, disregarding volume taken by equipment.

As result in the system curve HMM used a "Lead Pump On" elevation of 46.1m.

The following parameters were used in the preparation of the system curve:

- Hazen Williams C (HWC) -factor of 90, 100 and 110: since the HWC is diameter and material dependent, and we expect the material to have some corrosion;

- Local loss factor (k) = 15, to account for fittings;
- Pipe ID is taken as 75 mm.

HMM staff has obtained a pump curve from Flygt for the pump. The pump curve was superimposed on the system curve, and extended past the posted limit. We believe that this may be valid (see also below for additional discussion on the pump) as the hydraulic efficiency was not at its maximum at the cut-off point of the curve.

The system curve with the superimposed pump curve is attached hereto. From the system curve the following observations are made:

- The 2 flow observations based on the flow meter, at 5.5 L/s and 6.7 L/s are marked as a green and black triangle respectively;
- The pump curve intersects the system curve above the black triangle;

In review of the available information, HMM noted that the Flygt panel in the PS (see Photo 2 above) notes that the pump models are CP 3085, these pumps have standard impellors. However Flygt has noted that, based on the data provided from the Flygt Tag that the pumps are DP 3085, with vortex impellors. These are less efficient than standard impellors. Based on the curve provided by Flygt it appears as if the pumps are running well past their power limitation (marked by P on the attached curve). However, in the event that the pumps are actually CP 3085 models as opposed to DP 3085, we would expect the pumps may not be overloaded. In case of the pumps running well past the power limits, HMM notes that the running times appear to be low, and that cool operation may have played a role in keeping the pumps functional.

HMM provides the following recommendations based on the currently available data:

- The flow meter should be repaired / replaced and the units confirmed to confirm the flow rate from the flow meter;
- The pumps should be lifted from the station to confirm if they are CP or DP models;
- If the pumps are CP models it is strongly suggested that the power uptake be measured under various operating condition to confirm if the pump is operating past the power limit if any.

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

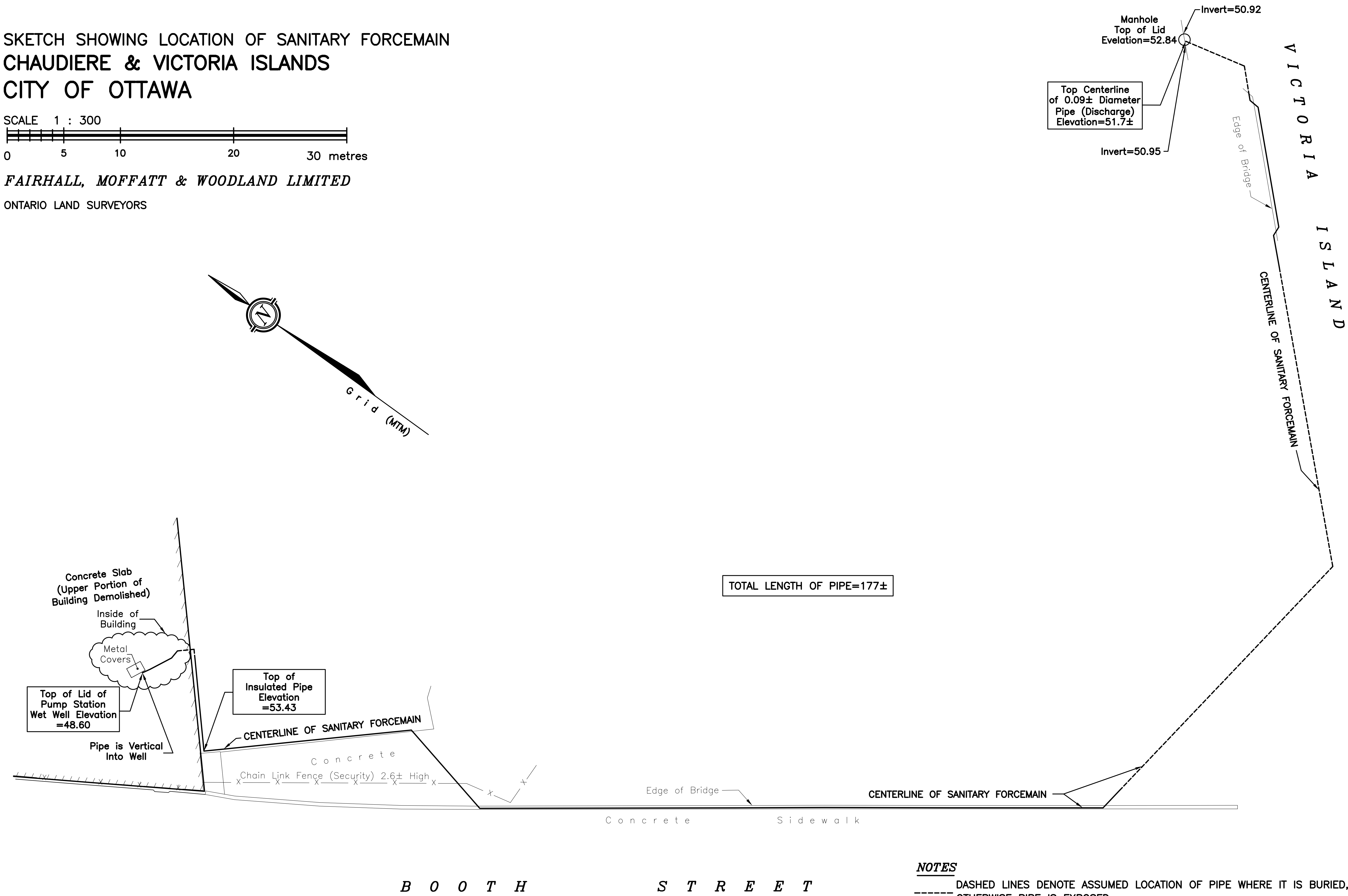
SKETCH SHOWING LOCATION OF SANITARY FORCEMAIN

CHAUDIERE & VICTORIA ISLANDS
CITY OF OTTAWA

SCALE 1 : 300

FAIRHALL, MOFFATT & WOODLAND LIMITED

ONTARIO LAND SURVEYORS



NOTES

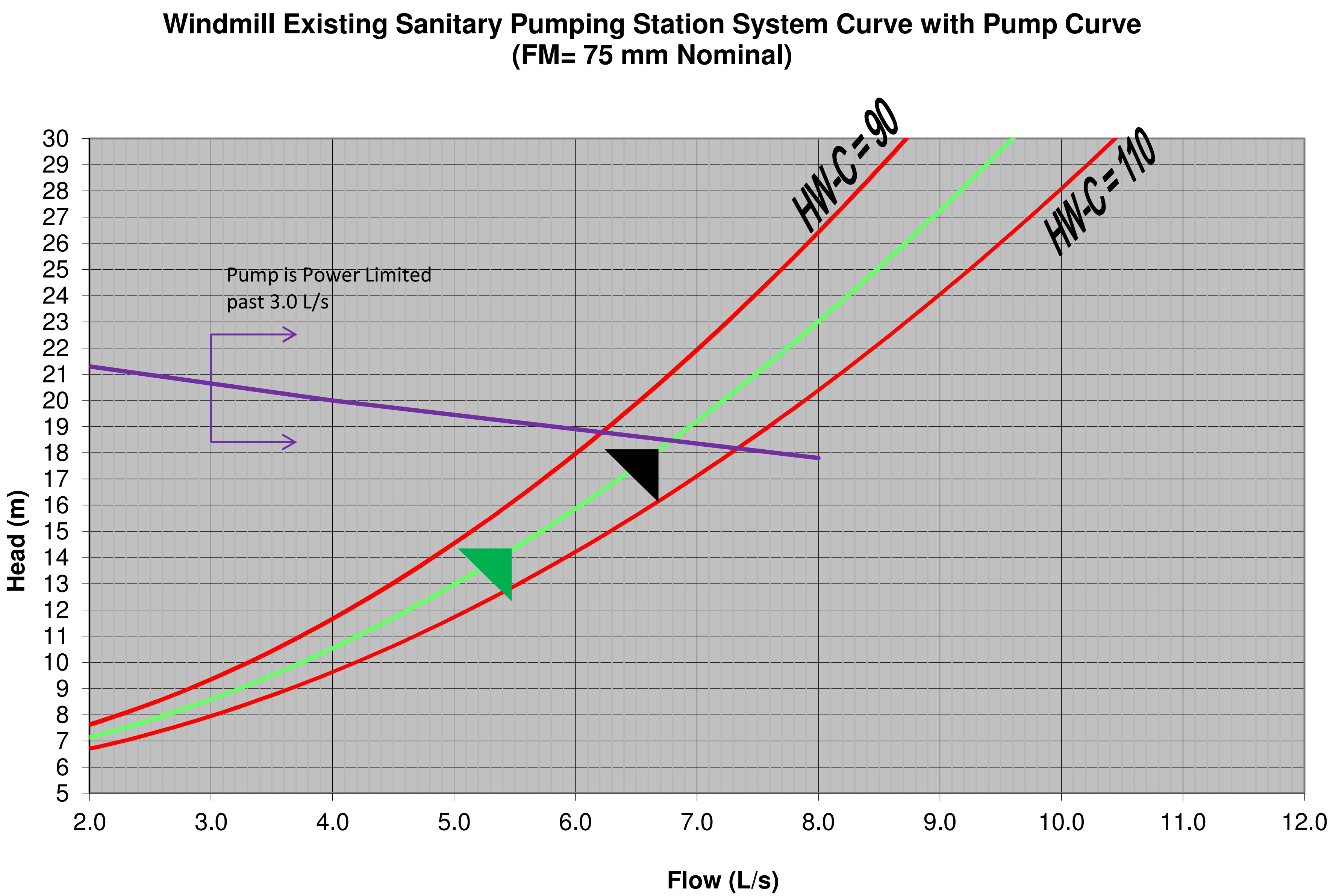
DASHED LINES DENOTE ASSUMED LOCATION OF PIPE WHERE IT IS BURIED, OTHERWISE PIPE IS EXPOSED.

Fairhall Moffatt & Woodland
LIMITED
OTTAWA
ONTARIO LAND SURVEYORS
Surveying and Land Information Services
100-600 TERRY FOX DRIVE, KANATA, ONTARIO K2L 4B6
TEL: (613) 591-2580 FAX: (613) 591-1495
www.fmw.on.ca

JOB No. V 1 8 3 0 0

Date of Survey JULY 21, 2015

S:\JOBS\V18300\DWGS 2015-07-23
sk183v.dwg (kb)



Windmill Existing Sanitary Pumping Station System Curve with Pump Curve
(FM= 75 mm Nominal)
HW-C=90
HW-C=110
Pump is Power Limited
past 3.0 L/s
Head (m)
Flow (L/s)
30
29
28
27
26
25
24
23
22
21
20
19
18
17
16
15
14
13
12
11
10
9
8
7
6
5
2.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
10.0
11.0
12.0

Performance Curve

FLYGT	Performance Curve	Product	Type
		DP3085.182	HT
Date	Project	Curve No	Issue
2015-07-07		63-280-00-1570	3

	1/1-Load	3/4-Load	1/2-Load
Power Factor	0.93	0.91	0.86
Efficiency	80.5 %	82.0 %	81.5 %
Motor Data	---	---	---

Rated Power ...	4 hp (2.98 kW)
Starting Current ...	23 A
Rated Current ...	3.8 A
Rated Speed ...	3415 rpm
Tot. Mom. of Inertia ...	0.0030 kgm2
No. of Blades	1

Impeller Diameter: 114 mm

Motor #	Stator	Rev
15-09-2AL	51Y	11

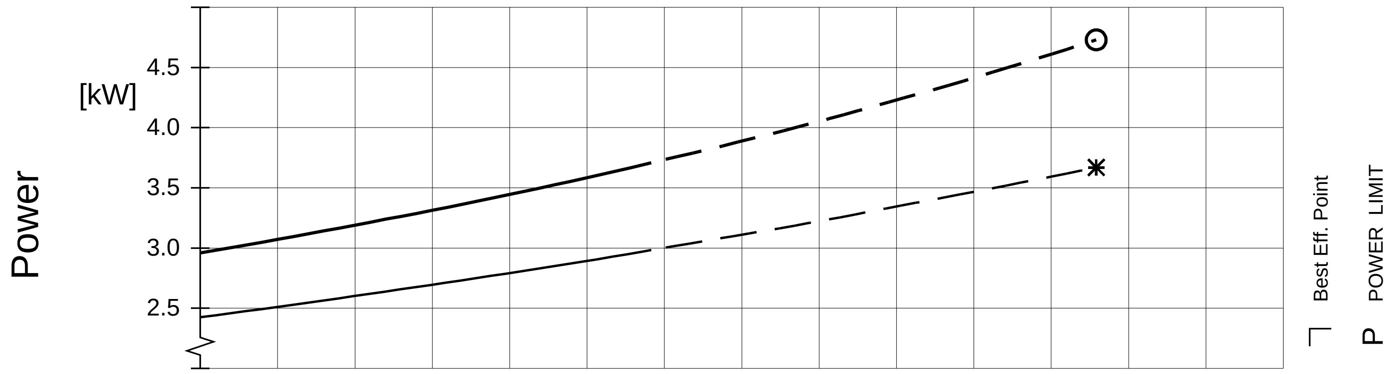
Freq.	Phases	Voltage	Poles
60 Hz	3	600 V	2

Geartype	Ratio
---	---

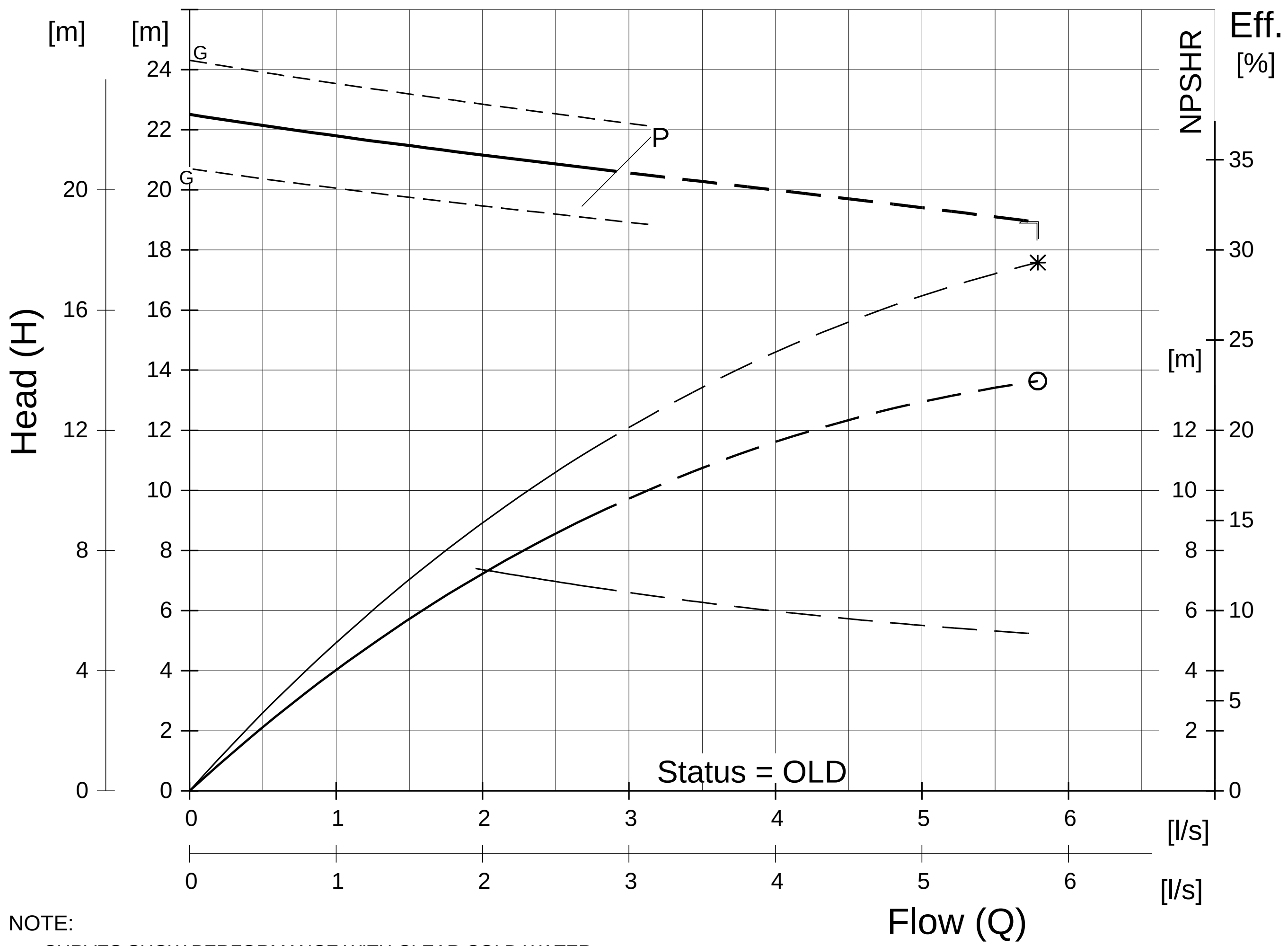
Comments: IMP DIAM 114 MM

Inlet/Outlet: -/ 80 mm

Imp. Throughlet: 52 mm



Duty-Point	Flow [l/s]	Head [m]	Power [kW]	Eff. [%]	NPSHR[m]
B.E.P.	5.79	18.9	4.73 (3.67) *	22.7 (29.3) *	5.3



NOTE:
CURVES SHOW PERFORMANCE WITH CLEAR COLD WATER
* : Pump EFFICIENCY/Shaft POWER
O : Overall EFFICIENCY/Input POWER
NPSHR = NPSH3 + min. operational margin

Guarantee between limits (G) acc. to
ISO 9906:2012 & ANSI/HI 11.6:2012 / <10kW

unix AUTHOR: MAXIMED SACU (rev:8.1)

APPENDIX D

Stormwater Management

										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)**	**(-)**
BLDG 206			0.198	0.90	0.18	0.18												
1111	STM1111	STM111	0.293	0.80	0.23	0.41	10.0	104.2	119.4	375	1.00	44.3	0.110	0.094	1.59	175.3	0.5	0.68
111	CB108A	STM111	0.295	0.50	0.15	0.15	10.0	104.2	42.7	300	1.00	17.5	0.071	0.075	1.37	96.7	0.2	0.44
FUT.			0.265	0.90	0.24	0.24												
	STM111	STM110	0.000	0.00	0.00	0.80	10.7	100.6	223.2	450	1.00	9.7	0.159	0.113	1.79	285.1	0.1	0.78
	STM110	STM109	0.000	0.00	0.00	0.80	10.8	100.2	222.3	450	1.00	53.6	0.159	0.113	1.79	285.1	0.5	0.78
BLDG 207			0.087	0.90	0.08	0.08												
109	STM109	STM108	0.201	0.85	0.17	1.05	11.3	97.8	284.8	450	2.00	95.5	0.159	0.113	2.54	403.2	0.6	0.71
	STM108	STM107	0.000	0.00	0.00	1.05	11.9	95.1	276.6	525	0.50	8.2	0.216	0.131	1.40	304.1	0.1	0.91
Total to Ex. 760mm Storm Sewer			1.339		0.00	1.05	12.0	94.6	275.4									

Stormceptor Sizing Detailed Report

PCSWMM for Stormceptor

Project Information

Date	15/04/2014
Project Name	Les Isles/The Isles
Project Number	14-717
Location	Ottawa, Ontario

Stormwater Quality Objective

This report outlines how Stormceptor System can achieve a defined water quality objective through the removal of total suspended solids (TSS). Attached to this report is the Stormceptor Sizing Summary.

Stormceptor System Recommendation

The Stormceptor System model STC 4000 achieves the water quality objective removing 71% TSS for a City of Toronto (clay, silt and sand) particle size distribution.

The Stormceptor System

The Stormceptor oil and sediment separator is sized to treat stormwater runoff by removing pollutants through gravity separation and flotation. Stormceptor's patented design generates positive TSS removal for all rainfall events, including large storms. Significant levels of pollutants such as heavy metals, free oils and nutrients are prevented from entering natural water resources and the re-suspension of previously captured sediment (scour) does not occur.

Stormceptor provides a high level of TSS removal for small frequent storm events that represent the majority of annual rainfall volume and pollutant load. Positive treatment continues for large infrequent events, however, such events have little impact on the average annual TSS removal as they represent a small percentage of the total runoff volume and pollutant load.

Stormceptor is the only oil and sediment separator on the market sized to remove TSS for a wide range of particle sizes, including fine sediments (clays and silts), that are often overlooked in the design of other stormwater treatment devices.

Small storms dominate hydrologic activity, US EPA reports

"*Early efforts in stormwater management focused on flood events ranging from the 2-yr to the 100-yr storm. Increasingly stormwater professionals have come to realize that small storms (i.e. < 1 in. rainfall) dominate watershed hydrologic parameters typically associated with water quality management issues and BMP design. These small storms are responsible for most annual urban runoff and groundwater recharge. Likewise, with the exception of eroded sediment, they are responsible for most pollutant washoff from urban surfaces. Therefore, the small storms are of most concern for the stormwater management objectives of ground water recharge, water quality resource protection and thermal impacts control.*"

"*Most rainfall events are much smaller than design storms used for urban drainage models. In any given area, most frequently recurrent rainfall events are small (less than 1 in. of daily rainfall).*"

"Continuous simulation offers possibilities for designing and managing BMPs on an individual site-by-site basis that are not provided by other widely used simpler analysis methods. Therefore its application and use should be encouraged."

– US EPA Stormwater Best Management Practice Design Guide, Volume 1 – General Considerations, 2004

Design Methodology

Each Stormceptor system is sized using PCSWMM for Stormceptor, a continuous simulation model based on US EPA SWMM. The program calculates hydrology from up-to-date local historical rainfall data and specified site parameters. With US EPA SWMM's precision, every Stormceptor unit is designed to achieve a defined water quality objective.

The TSS removal data presented follows US EPA guidelines to reduce the average annual TSS load. Stormceptor's unit process for TSS removal is settling. The settling model calculates TSS removal by analyzing (summary of analysis presented in Appendix 2):

- Site parameters
- Continuous historical rainfall, including duration, distribution, peaks (Figure 1)
- Interevent periods
- Particle size distribution
- Particle settling velocities (Stokes Law, corrected for drag)
- TSS load (Figure 2)
- Detention time of the system

The Stormceptor System maintains continuous positive TSS removal for all influent flow rates. Figure 3 illustrates the continuous treatment by Stormceptor throughout the full range of storm events analyzed. It is clear that large events do not significantly impact the average annual TSS removal. There is no decline in cumulative TSS removal, indicating scour does not occur as the flow rate increases.

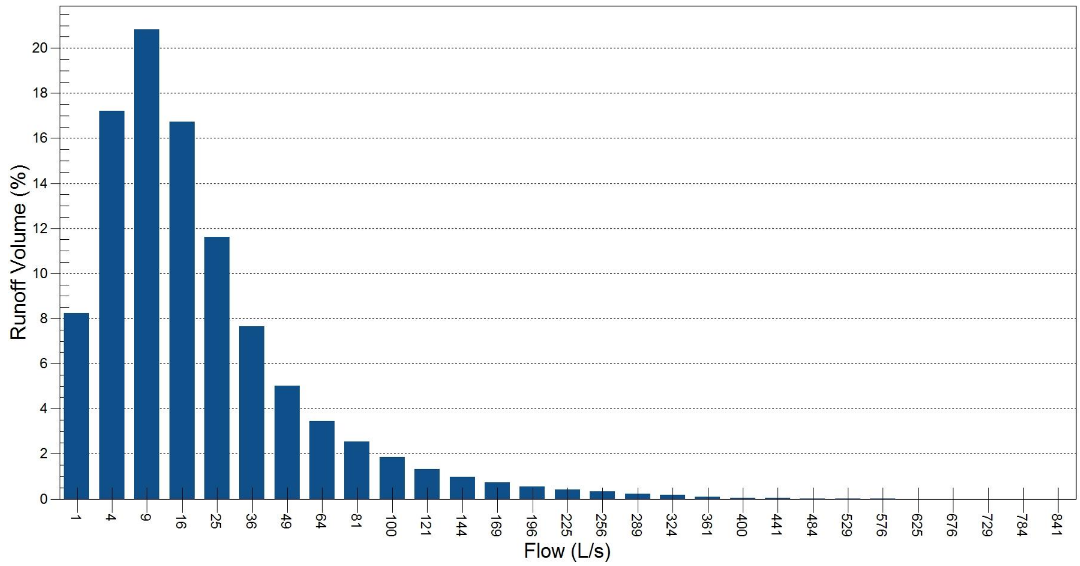


Figure 1. Runoff Volume by Flow Rate for OTTAWA MACDONALD-CARTIER INT'L A – ON 6000, 1967 to 2003 for 3.16 ha, 90% impervious. Small frequent storm events represent the majority of annual rainfall volume. Large infrequent events have little impact on the average annual TSS removal, as they represent a small percentage of the total annual volume of runoff.

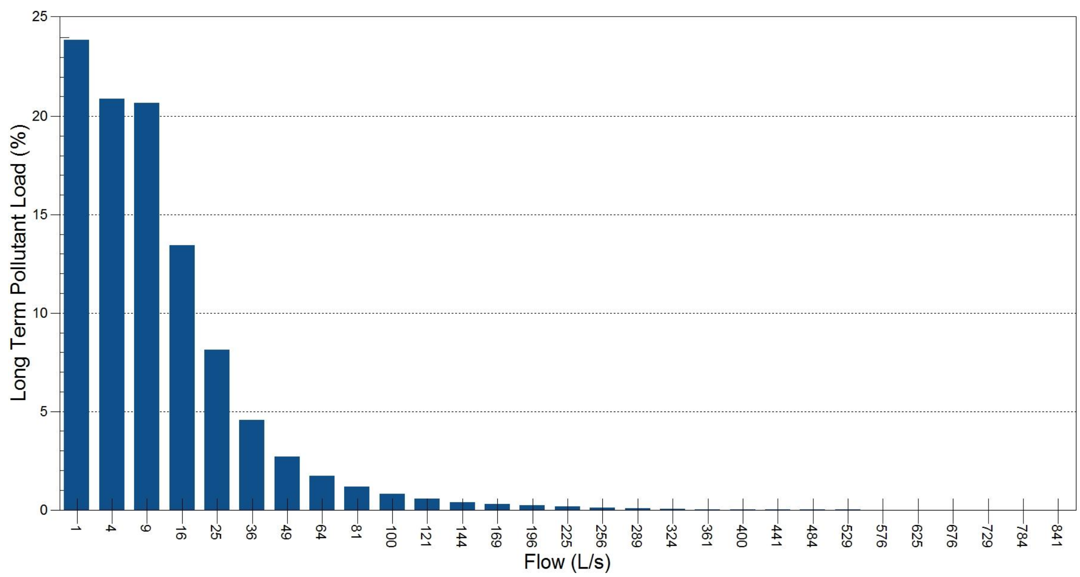
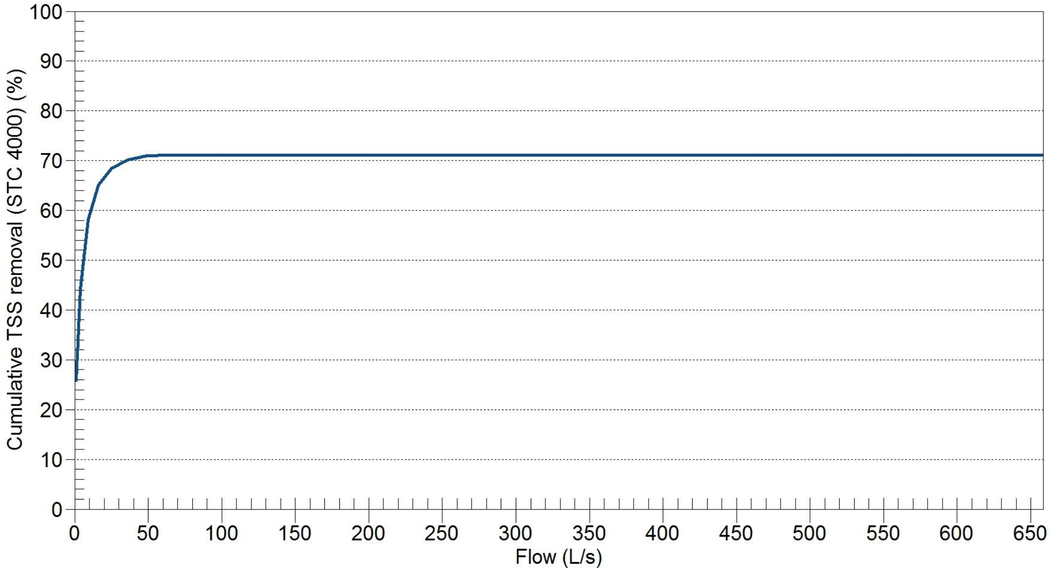


Figure 2. Long Term Pollutant Load by Flow Rate for OTTAWA MACDONALD-CARTIER INT'L A – 6000, 1967 to 2003 for 3.16 ha, 90% impervious. The majority of the annual pollutant load is transported by small frequent storm events. Conversely, large infrequent events carry an insignificant percentage of the total annual pollutant load.



Stormceptor Model	STC 4000	Drainage Area (ha)	3.16
TSS Removal (%)	71	Impervious (%)	90

Figure 3. Cumulative TSS Removal by Flow Rate for OTTAWA MACDONALD-CARTIER INT'L A – 6000, 1967 to 2003. Stormceptor continuously removes TSS throughout the full range of storm events analyzed. Note that large events do not significantly impact the average annual TSS removal. Therefore no decline in cumulative TSS removal indicates scour does not occur as the flow rate increases.

Stormceptor®

Appendix 1
Stormceptor Design Summary

Project Information

Date	15/04/2014
Project Name	Les Isles/The Isles
Project Number	14-717
Location	Ottawa, Ontario

Designer Information

Company	DSEL
Contact	Steve M

Notes

N/A

Drainage Area

Total Area (ha)	3.16
Imperviousness (%)	90

The Stormceptor System model STC 4000 achieves the water quality objective removing 71% TSS for a City of Toronto (clay, silt and sand) particle size distribution.

Rainfall

Name	OTTAWA MACDONALD-CARTIER INT'L A
State	ON
ID	6000
Years of Records	1967 to 2003
Latitude	45°19'N
Longitude	75°40'W

Water Quality Objective

TSS Removal (%)	70

Upstream Storage

Storage (ha-m)	Discharge (L/s)
0	0

Stormceptor Sizing Summary

Stormceptor Model	TSS Removal %
STC 300	45
STC 750	57
STC 1000	57
STC 1500	58
STC 2000	65
STC 3000	66
STC 4000	**71**
STC 5000	72
STC 6000	75
STC 9000	80
STC 10000	79
STC 14000	83

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Particle Size Distribution

Removing silt particles from runoff ensures that the majority of the pollutants, such as hydrocarbons and heavy metals that adhere to fine particles, are not discharged into our natural water courses. The table below lists the particle size distribution used to define the annual TSS removal.

City of Toronto (clay, silt and sand)

Particle Size µm	Distribution %	Specific Gravity	Settling Velocity m/s		Particle Size µm	Distribution %	Specific Gravity	Settling Velocity m/s
10	20	2.65	0.0004					
30	10	2.65	0.0008					
50	10	2.65	0.0022					
95	20	2.65	0.0063					
265	20	2.65	0.0366					
1000	20	2.65	0.1691					

Stormceptor Design Notes

- Stormceptor performance estimates are based on simulations using PCSWMM for Stormceptor version 1.0
- Design estimates listed are only representative of specific project requirements based on total suspended solids (TSS) removal.
- Only the STC 300 is adaptable to function with a catch basin inlet and/or inline pipes.
- Only the Stormceptor models STC 750 to STC 6000 may accommodate multiple inlet pipes.
- Inlet and outlet invert elevation differences are as follows:

Inlet and Outlet Pipe Invert Elevations Differences

Inlet Pipe Configuration	STC 300	STC 750 to STC 6000	STC 9000 to STC 14000
Single inlet pipe	75 mm	25 mm	75 mm
Multiple inlet pipes	75 mm	75 mm	Only one inlet pipe.

- Design estimates are based on stable site conditions only, after construction is completed.
- Design estimates assume that the storm drain is not submerged during zero flows. For submerged applications, please contact your local Stormceptor representative.
- Design estimates may be modified for specific spills controls. Please contact your local Stormceptor representative for further assistance.
- For pricing inquiries or assistance, please contact Imbrium Systems Inc., 1-800-565-4801.

Appendix 2
Summary of Design Assumptions

SITE DETAILS

Site Drainage Area

Total Area (ha)	3.16	Imperviousness (%)	90

Surface Characteristics

Width (m)	356
Slope (%)	2
Impervious Depression Storage (mm)	0.508
Pervious Depression Storage (mm)	5.08
Impervious Manning's n	0.015
Pervious Manning's n	0.25

Infiltration Parameters

Horton's equation is used to estimate infiltration

Max. Infiltration Rate (mm/h)	61.98
Min. Infiltration Rate (mm/h)	10.16
Decay Rate (s^{-1})	0.00055
Regeneration Rate (s^{-1})	0.01

Maintenance Frequency

Sediment build-up reduces the storage volume for sedimentation. Frequency of maintenance is assumed for TSS removal calculations.

Maintenance Frequency (months)	12

Evaporation

Daily Evaporation Rate (mm/day)	2.54

Dry Weather Flow

Dry Weather Flow (L/s)	No

Upstream Attenuation

Stage-storage and stage-discharge relationship used to model attenuation upstream of the Stormceptor System is identified in the table below.

Storage ha-m	Discharge L/s
0	0

PARTICLE SIZE DISTRIBUTION

Particle Size Distribution

Removing fine particles from runoff ensures the majority of pollutants, such as heavy metals, hydrocarbons, free oils and nutrients are not discharged into natural water resources. The table below identifies the particle size distribution selected to define TSS removal for the design of the Stormceptor System.

City of Toronto (clay, silt and sand)

Particle Size µm	Distribution %	Specific Gravity	Settling Velocity m/s		Particle Size µm	Distribution %	Specific Gravity	Settling Velocity m/s
10	20	2.65	0.0004					
30	10	2.65	0.0008					
50	10	2.65	0.0022					
95	20	2.65	0.0063					
265	20	2.65	0.0366					
1000	20	2.65	0.1691					

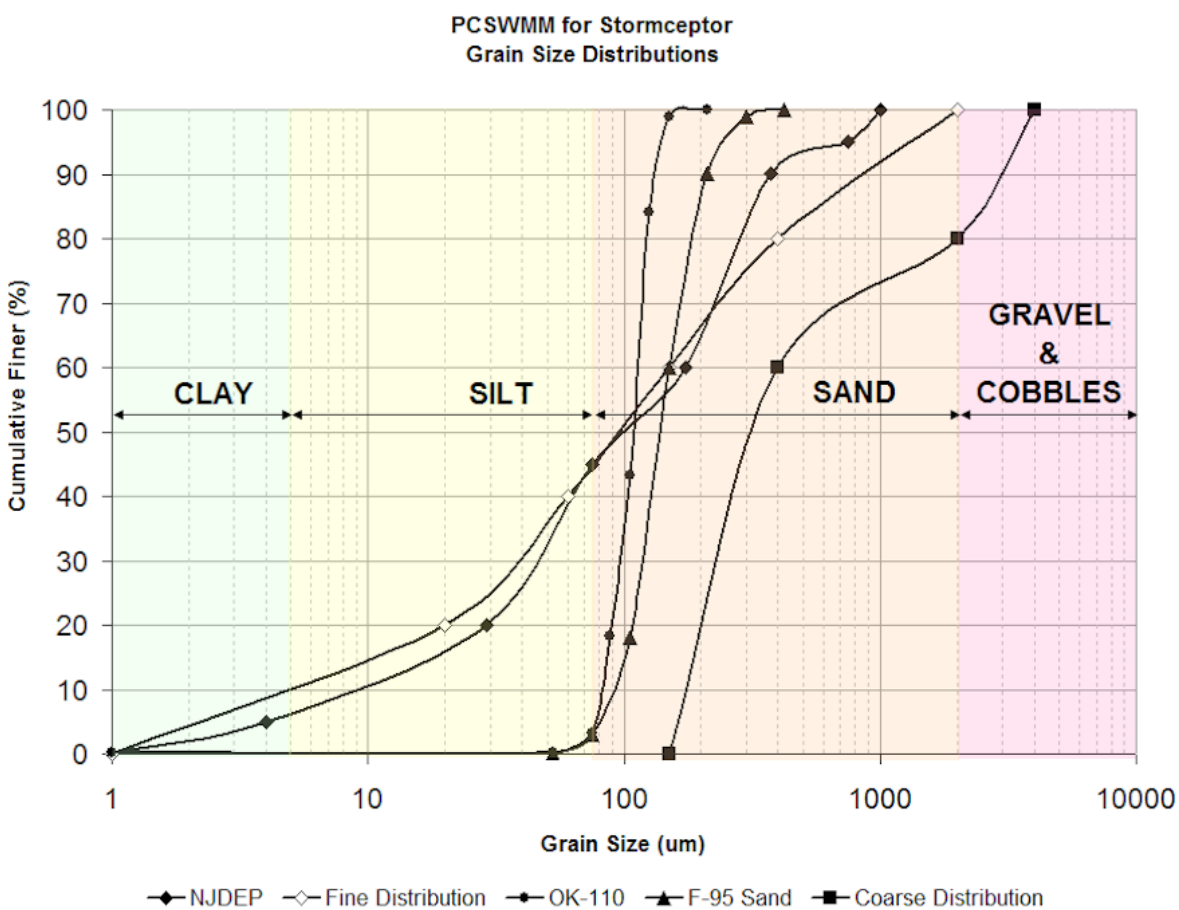

Figure 1. PCSWMM for Stormceptor standard design grain size distributions.

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TSS LOADING

TSS Loading Parameters

TSS Loading Function	Buildup / Washoff

Parameters

Target Event Mean Concentration (EMC) (mg/L)	125
Exponential Buildup Power	0.4
Exponential Washoff Exponential	0.2

HYDROLOGY ANALYSIS

PCSWMM for Stormceptor calculates annual hydrology with the US EPA SWMM and local continuous historical rainfall data. Performance calculations of the Stormceptor System are based on the average annual removal of TSS for the selected site parameters. The Stormceptor System is engineered to capture fine particles (silts and sands) by focusing on average annual runoff volume ensuring positive removal efficiency is maintained during all rainfall events, while preventing the opportunity for negative removal efficiency (scour).

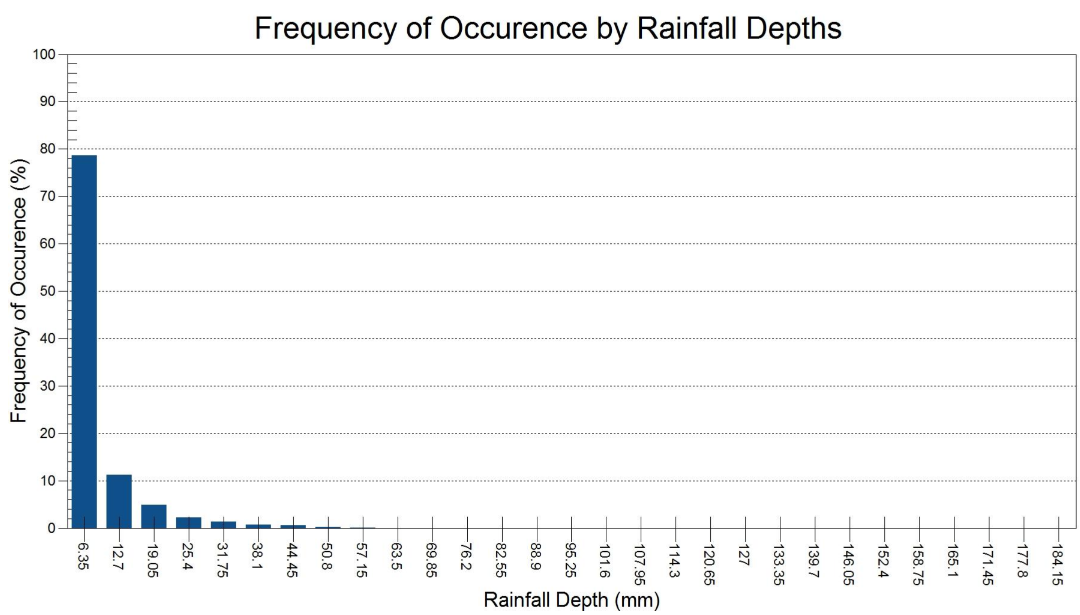
Smaller recurring storms account for the majority of rainfall events and average annual runoff volume, as observed in the historical rainfall data analyses presented in this section.

Rainfall Station

Rainfall Station	OTTAWA MACDONALD-CARTIER INT'L A		
Rainfall File Name	ON6000.NDC	Total Number of Events	4537
Latitude	45°19'N	Total Rainfall (mm)	20978.1
Longitude	75°40'W	Average Annual Rainfall (mm)	567.0
Elevation (m)		Total Evaporation (mm)	1911.4
Rainfall Period of Record (y)	37	Total Infiltration (mm)	2092.2
Total Rainfall Period (y)	37	Percentage of Rainfall that is Runoff (%)	81.3

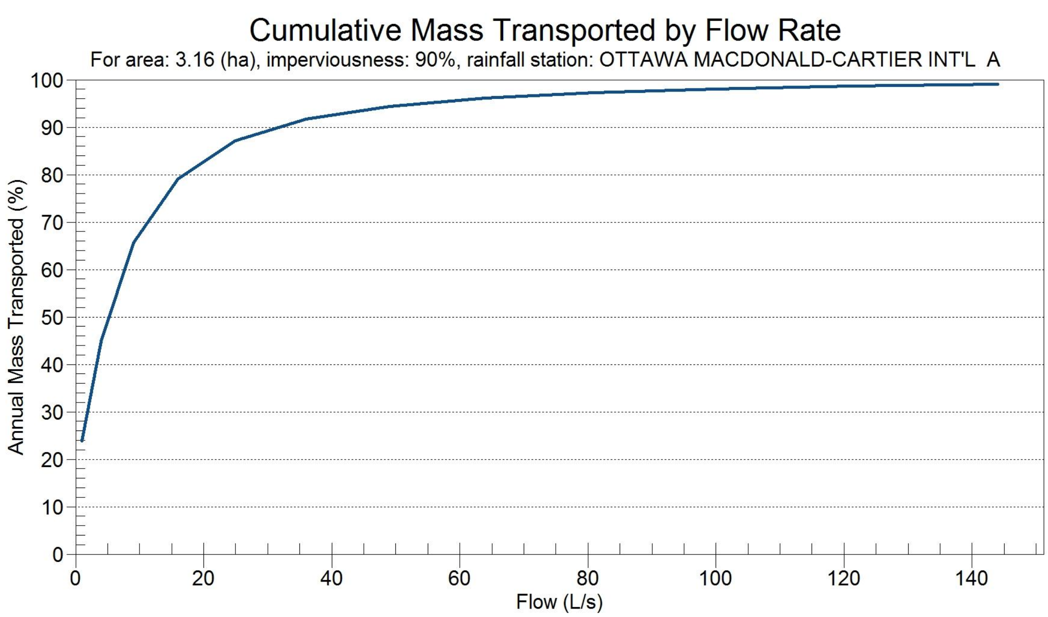
Rainfall Event Analysis

Rainfall Depth mm	No. of Events	Percentage of Total Events %	Total Volume mm	Percentage of Annual Volume %
6.35	3564	78.6	5671	27.0
12.70	508	11.2	4533	21.6
19.05	223	4.9	3434	16.4
25.40	102	2.2	2244	10.7
31.75	60	1.3	1704	8.1
38.10	33	0.7	1145	5.5
44.45	28	0.6	1165	5.6
50.80	9	0.2	416	2.0
57.15	5	0.1	272	1.3
63.50	1	0.0	63	0.3
69.85	1	0.0	64	0.3
76.20	1	0.0	76	0.4
82.55	0	0.0	0	0.0
88.90	1	0.0	84	0.4
95.25	0	0.0	0	0.0
101.60	0	0.0	0	0.0
107.95	0	0.0	0	0.0
114.30	1	0.0	109	0.5
120.65	0	0.0	0	0.0
127.00	0	0.0	0	0.0
133.35	0	0.0	0	0.0
139.70	0	0.0	0	0.0
146.05	0	0.0	0	0.0
152.40	0	0.0	0	0.0
158.75	0	0.0	0	0.0
165.10	0	0.0	0	0.0
171.45	0	0.0	0	0.0
177.80	0	0.0	0	0.0
184.15	0	0.0	0	0.0
190.50	0	0.0	0	0.0
196.85	0	0.0	0	0.0
203.20	0	0.0	0	0.0
209.55	0	0.0	0	0.0
>209.55	0	0.0	0	0.0



Pollutograph

Flow Rate L/s	Cumulative Mass %
1	23.9
4	44.9
9	65.6
16	79.1
25	87.2
36	91.7
49	94.4
64	96.1
81	97.3
100	98.1
121	98.7
144	99.0
169	99.3
196	99.5
225	99.7
256	99.8
289	99.9
324	99.9
361	100.0
400	100.0
441	100.0
484	100.0
529	100.0
576	100.0
625	100.0
676	100.0
729	100.0
784	100.0
841	100.0
900	100.0



SEDIMENT CONTROL POND SIZING

Prepared by: S.Merrick
Prepared on: 29-Jul-15

REFERENCE

Calculations based on Sediment Control Pond Detail from the 'Greater Golden Horseshoe Conservation Authorities - Erosion & Sediment Control Guideline for Urban Construction' (December 2006) - Detail C-58

PERMANENT POOL

Tributary Area	ha	1.07	
Estimated Imperviousness	(%)	0	
Volume Requirements	m^3/ha	185	* For sediment control ponds not meeting the 4:1 length to width ratio requirement
Total Volume Required	m^3	197.95	
Normal Water Level			
Average Pond Depth	m	1	
Side slopes to pond bottom	:1	4	
Length to Width Ratio	:1	2	
Pond Dimensions (Rectangle)			
At Normal Water Level			
Length	m	36.6	
Width	m	14.5	
At Bottom of Pond			
Length	m	28.6	
Width	m	6.5	
Calculated NWL Volume	m^3	358	
Goal Seek Permanent Pond Volume	*m^3*	*(160.1)*	< 0.00 indicates that theoretical perm pool volume satisfied
Approx Forebay Berm Volume	*m^3*	*72.5*	calculated volume reduction from perm pool
	m^3	(87.60)	< 0.00 indicates that perm pool volume requirements satisfied

ACTIVE STORAGE			
Active Storage Depth	m	0.5	
Side slopes to Top of Active	:1	4	
At Active Water Elevation (Max Pond Volume)			
Length	**m**	**40.6**	**Minimum Overall Pond Dimensions**
Width	**m**	**18.5**	
Calculated Active Volume	m^3	320.0	
Active storage provided	m^3/ha	299.10	> 125 m^3/ha indicates that active storage requirements satisfied
DETENTION TIME			
Average head on outlet orifice	m	0.25	= active storage depth / 2
Orifice Size	mm	75	
Q (average outlet flow rate)	m^3/s	0.005	using orifice equation = $0.6*r^2*PI*(2*9.81*\text{avg head})^{1/2}$
Detention time	**hours**	**16.4**	> 12 hrs (As per SWMP and Design Manual for drainage area < 8.0 ha)

FOREBAY

Area	1.07	ha
% Imp	0	
Equiv. C	0.3	
L	9.5	m, length from hydraulically most remote point
t_c	15.1	min, estimated Tc
i_{25mm}	18.8	mm/hr (eq. 4.9 MOE - Estimated 25mm Storm Intensity)
Q_{25mm}	0.017	m^3/s
$i_{100\text{-}year}$	142.2	mm/hr (City of Ottawa IDF)
$Q_{100\text{-}year}$	0.127	m^3/s
Settling Calculation (MOE Equation 4.5)		
r	2	:1, Length to Width Ratio
Vs	0.0003	m/s settling velocity
Dist	10.6	m, forebay length
Dispersion Length (MOE Equation 4.6)		
d	1	m,
Vf	0.5	m/s,
Dist	2.0	m, forebay length
Minimum Forebay Length	10.6	m

SEDIMENT CONTORL POND STORAGE

Increment	0.1
Pond Bottom	48.7
Perm Pool	49.7
Active Storage	50.2

Elevation (m)	Δ Elev (sq.m)	Area (sq.m)
48.7	0	103
49.7	1	457
50.2	1.5	730
52	3.3	1204

Elevation (m)	Depth (m)	Inc. Area (sq.m)	Cuml. Area (sq.m)	Inc. Volume (cu.m)	Cuml. Volume (cu.m)	
48.7	0	103.0	103.0	0.0	0.0	
48.8	0.1	35.4	138.4	12.1	12.1	
48.9	0.2	35.4	173.8	15.6	27.7	
49	0.3	35.4	209.2	19.2	46.8	
49.1	0.4	35.4	244.6	22.7	69.5	
49.2	0.5	35.4	280.0	26.2	95.8	
49.3	0.6	35.4	315.4	29.8	125.5	
49.4	0.7	35.4	350.8	33.3	158.8	
49.5	0.8	35.4	386.2	36.9	195.7	
49.6	0.9	35.4	421.6	40.4	236.1	
49.7	**1**	**54.6**	**476.2**	**44.9**	**281.0**	**Perm Pool Level**
49.8	1.1	54.6	530.8	50.4	331.3	
49.9	1.2	54.6	585.4	55.8	387.1	
50	1.3	54.6	640.0	61.3	448.4	
50.1	1.4	54.6	694.6	66.7	515.1	
50.2	**1.5**	**26.3**	**720.9**	**70.8**	**585.9**	**Maximum Active Storage**
50.3	1.6	26.3	747.3	73.4	659.3	
50.4	1.7	26.3	773.6	76.0	735.4	
50.5	1.8	26.3	799.9	78.7	814.0	
50.6	1.9	26.3	826.3	81.3	895.3	
50.7	2	26.3	852.6	83.9	979.3	
50.8	2.1	26.3	878.9	86.6	1065.9	
50.9	2.2	26.3	905.3	89.2	1155.1	
51	2.3	26.3	931.6	91.8	1246.9	
51.1	2.4	26.3	957.9	94.5	1341.4	
51.2	2.5	26.3	984.3	97.1	1438.5	
51.3	2.6	26.3	1010.6	99.7	1538.2	
51.4	2.7	26.3	1036.9	102.4	1640.6	
51.5	2.8	26.3	1063.3	105.0	1745.6	
51.6	2.9	26.3	1089.6	107.6	1853.3	
51.7	3	26.3	1115.9	110.3	1963.5	
51.8	3.1	26.3	1142.3	112.9	2076.5	
51.9	3.2	26.3	1168.6	115.5	2192.0	
52	3.3	0.0	1168.6	116.9	2308.9	

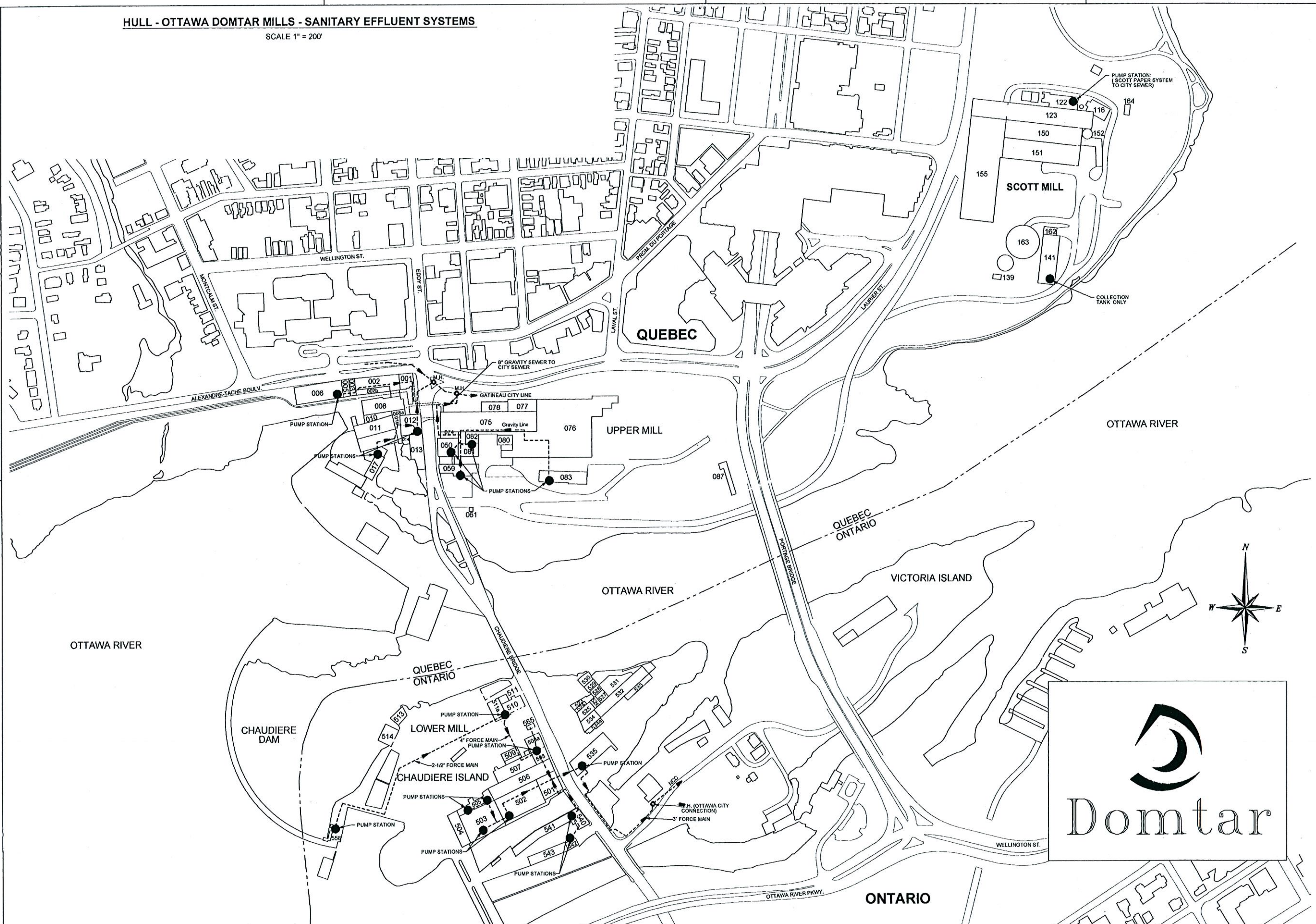
Stormwater - Proposed Development
City of Ottawa Sewer Design Guidelines, 2012

DSEL

Rainfall Details			
Drainage Area	1	ha	
Runoff Coefficient	0.85	RC	
25mm Rainfall Intensity	42.45	mm/hr	**As per Eq. 4.9 of MOE SWMPDM, 2003**
25mm Runoff	100.2	L/s	
5-Year Rainfall Intensity	104.2	mm/hr	**As per City of Ottawa IDF Curve @ 10 minute Tc**
5-Year Runoff	246.0	L/s	
Manhole Details			
Manhole Diameter	1200	mm	
Top of Lid	49.81	m	
East Invert	49.81	m	
West Invert	49.66	m	
South Invert	49.78	m	
Sediment Pond Inlet Diameter	250	mm	
HWL 25mm Event	**0.55**	m	**As per Orifice Equation (h = Q^2 / (Cd x A)^2 x (2 x 9.81)**
Req. Elevation of Internal Wall	**50.33**	m	
Weir Flow Details			
5-Year Runoff - 25mm Runoff	145.8	L/s	
Depth of Flow in 5-Year Storm	0.16	m	
Water Level in 5-Year Storm	**50.49**	m	

DRAWINGS / FIGURES

47856-B



DWG.NO.	REFERENCE

Jan 12/05 1 JFL	Sanitory Lines Revised	
No. DATE	REVISION	

DEPT. | EQ.CLASS | EQ.NO.

DESIGN CODE

DRAWN	RDB	NOV 20/2004
PROJECT		
DES. ENG.		
APPROVAL		

Domtar

gec
greenough environmental consulting inc.
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MILL	ALL
DEPT.	
BLDG	ALL

TITLE

SANITARY EFFLUENT SYSTEMS

DWG TYPE	SITE
PROJECT	SCALE 1" = 200'

47856-B REV. 1

47852.dwg Plot: 03/02/05 12:15 /Logan ver 1018/04