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FUNCTIONAL SERVICING REPORT

FOR

BARRHAVEN CONSERVANCY EAST INC.

PHASE 1

CITY OF OTTAWA

PROJECT NO.: 17-891

NOVEMBER 24, 2017
1ST SUBMISSION

FUNCTIONAL SERVICING REPORT
FOR
BARRHAVEN CONSERVANCY EAST INC.
PHASE 1

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1.0 INTRODUCTION

David Schaeffer Engineering Limited (DSEL) has been retained to prepare a Functional Servicing Report (FSR) in support of the Draft Plan of Subdivision application for the Barrhaven Conservancy Phase 1 development on behalf of Barrhaven Conservancy East Inc. (BCE).

Phase 1 is located within the City of Ottawa urban boundary in the Barrhaven ward and is designated as General Urban. As illustrated in ***Figure 1***, the subject property is located north of the Jock River, east of Borrisokane Road, west of Greenbank Road, and south of Strandherd Drive. It is under the jurisdiction of the Rideau Valley Conservation Authority (RVCA). The subject property measures approximately 9.3 ha and is legally described as part of Concession 3, Lot 14.

Phase 1 is currently zoned Development Reserve (DR) Zone. The proposed development concept plan (***Appendix A***) would allow for the development of a mix of detached singles, rear lane townhomes and park blocks. It also includes a road network featuring 16.5 m right-of-way (ROW) local roads and 8.5 m ROW lanes.

The objective of this report is to provide sufficient detail to demonstrate that the development of Phase 1 is supported by municipal services and conforms to applicable standards.

1.1 Existing Conditions

The subject property is relatively flat with the existing elevations ranging from 92 m in the north east to 91 m in the south. The existing topography characterized in the available City of Ottawa base mapping indicates that all flows from the subject property are ultimately conveyed south to the Jock River by way of the Fraser-Clarke Watercourse. The Fraser-Clarke Watercourse runs along the south west of the subject property to the Jock River and the existing Kennedy-Burnett SWM Facility is located to the east of the subject property.

The subject property is within the Jock River watershed and is under the jurisdiction of the RVCA.

A portion of the subject property is currently within the Jock River regulatory flood plain and the boundary will be revised through the placement of fill prior to development. Under separate cover, the ***Hydrodynamic Analysis of Jock River Reach 1 (HWY 416 to Rideau River)*** by J.F. Sabourin and Associates was prepared on June 30, 2017 to support this boundary revision.

1.2 Required Permits / Approvals

The City of Ottawa must approve detailed engineering design drawings and reports prior to construction of the municipal infrastructure identified in this report. This is expected to occur as part of the Plan of Subdivision application process.

The additional approvals and permits listed in ***Table 1*** are expected to be required prior to construction of the municipal infrastructure detailed herein. Please note that other permits and approvals may be required, as detailed in the other studies submitted as part of the Plan of Subdivision application.

Table 1: Required Permits/Approvals

Agency	Permit/Approval Required	Trigger	Remarks
MOECC	Environmental Compliance Approval	Construction of new sanitary and storm sewers throughout the subdivision and new oil and grit separator (OGS).	The MOECC will review the sanitary and storm sewer design through the City of Ottawa transfer of review process.
MOECC	Permit to Take Water	Construction of proposed land uses (e.g. basements for residential homes) and services.	Pumping of groundwater may be required during construction, given groundwater conditions and proposed land uses and on-site/off-site municipal infrastructure.
City of Ottawa	MOE Form 1 – Record of Watermains Authorized as a Future Alteration.	Construction of watermains throughout the subdivision	The City of will review the watermains on behalf of the MOECC through the Form 1 – Record of Watermains Authorized as a Future Alteration.
RVCA	Outlets to Jock River, Alteration to Municipal Drains / Watercourse	Connections to the Jock River and/or modifications to the Fraser-Clarke Watercourse	The RVCA will review applications submitted for new outlets to the Jock River from the proposed OGS. The RVCA will review applications submitted for any modifications to the Fraser-Clarke Watercourse.
RVCA	Floodplain Modifications	Re-designation of development concept boundary	The RVCA will review applications submitted to support the floodplain modifications.

1.3 Pre-Consultation

The following provides a summary of the pre-consultation meetings:

1.3.1 City of Ottawa

Pre-consultation with the City of Ottawa has been on-going and additional meetings will be forthcoming.

1.3.2 Ministry of the Environment and Climate Change (MOECC)

Pre-consultation with the MOECC will be forthcoming, including confirmation of the required approvals.

1.3.3 Rideau Valley Conservation Authority (RVCA)

Pre-consultation with the RVCA have been on-going and will continue, including confirmation of the required approvals.

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)

  - Technical Bulletin ISDTB-2014-01, Revisions to Ottawa Design Guidelines - Sewer
    City of Ottawa, February 5, 2014.
    (ISDTB-2014-01)

  - Technical Bulletin PIEDTB-2016-01, Revisions to Ottawa Design Guidelines – Sewer
    City of Ottawa, September 6, 2016.
    (PIEDTB-2016-01)

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

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

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

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

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

- City of Ottawa Official Plan,
  adopted by Council 2003.
  (Official Plan)

- City of Ottawa Secondary Plan – Former Nepean – South Nepean Urban Area – Areas 9 and 10,
  Adopted by Council 2003.
  (Secondary Plan)
- Erosion & Sediment Control Guidelines for Urban Construction,
  Greater Golden Horseshoe Area Conservation Authorities, December 2006
  (E&S Guidelines)
- South Nepean Collector (SNC) Sewer Phase 2 – Strandherd Drive to Jockvale Road Drawings
  City of Ottawa, December 2016
- South Nepean Collector (SNC) Wastewater Servicing Study and Functional Design Report
  Dillon Consulting, October 2003
  (Dillon SNC Report)
- South Nepean Collector: Phase 2 Hydraulics Review / Assessment Technical Memorandum
  Novatech, August 2015
  (Novatech SNC Memo)
- Infrastructure Master Plan
  City of Ottawa, November 2013
  (IMP)
- Servicing Brief, Minto Communities Inc Clarke Lands
  JL Richards, March 2016
  (Clarke Lands Report)
- Kennedy-Burnett Stormwater Management Facility Project File and Functional Design Report
  CH2M Hill, February 2017
  (CH2M Hill Kennedy-Burnett SWM Facility Report)
- Kennedy-Burnett Potable Water Master Servicing Study
  Stantec, April 2014
- Jock River Flood Risk Map No. *2*
  RVCA, July 2005
- Jock River Reach One Subwatershed Study
  Stantec, 2007
  (Jock River SWS)
- Hydrodynamic Analysis of Jock River Reach 1 (HWY 416 to Rideau River)
  J.F. Sabourin and Associates Inc, June 30, 2017
  (Jock River Flood Plain Report)

3.0 WATER SUPPLY SERVICING

3.1 Existing Water Supply Services

The subject property is located adjacent to the City of Ottawa's Pressure Zone (PZ) 3SW (previously known as PZ BARR). PZ SUC services the land found to the east of the subject property, as well as south of the Jock River.

The City of Ottawa has recently started reconfiguring the pressure zones servicing Barrhaven and the South Urban Community (SUC) in order to improve reliability and efficiency and to increase pumping capacity to accommodate for future growth in the area. There are three pumping stations servicing Zone 3SW and Zone SUC: Fallowfield Road Pumping Station (FRPS), Barrhaven Pumping Station (BPS) and the Ottawa South Pumping Station (OSPS).

Future watermains in the vicinity of the Phase 1 property have been identified at the following locations:

- A 400 mm diameter watermain along Strandherd Drive, which was identified in the City of Ottawa's Infrastructure Master Plan (IMP) dated November 2013 to extend from Fallowfield Road to Greenbank Road. It is anticipated to be constructed by 2018 (refer to extract from the 2013 IMP provided in ***Appendix B***).
- A 300 mm diameter watermain will extend from the Strandherd Drive watermain along the future North-South Chapman Mills Drive extension as shown on Drawing CS1 – Conceptual Site Servicing Drawing for the Minto Clarke Lands by JL Richards. This figure is enclosed in ***Appendix B***.
- 300 mm SUC watermain within a future local road to the east of Greenbank Road.

As noted in the ***Servicing Brief for the Minto Communities Inc Clarke Lands*** by JL Richards in March 2016 ***(Clarke Lands Report)***, in advance of the commissioning of the Strandherd 400 mm diameter watermain, it is anticipated that interim water servicing for the Clarke Lands can be provided by connections to existing local watermains (existing 300 mm on Tartan Drive, existing 250 mm diameter watermain stub on Fraser Fields Way and three connections to the existing 200 mm diameter watermain on Waterlily Way.

3.2 Water Supply Servicing Design

It is proposed that the subject property be connected to the future 300 mm diameter watermain on the future North-South Chapman Mills Extension. In the future, a second connection will be made to a 300 mm diameter watermain within a future local road to the east of Greenbank Road. The proposed water servicing is depicted in ***Figure 3***.

It is anticipated that this feed to Phase 1 will satisfy the City's objective minimum pressure of 40 psi during peak hour demand and achieve a typical planning level fire flow value of 10,000 L/min or greater. At the time of detailed design, detailed hydraulic modelling will be undertaken to verify that the proposed on-site and off-site watermains are in conformance with the City's ***Water Supply Guidelines***.

As detailed designs progress, timing, alignment, and sizing of local watermains will be confirmed. The local watermain network will be sized to meet maximum hour and maximum day plus fire flow demands, with consideration given to proposed phasing plans. ***Table 2*** summarizes the Water Supply Design Criteria to be employed in the design of the watermain network. Fire flow requirements are to be confirmed in accordance with Local Guidelines (Fire Underwriters Survey), City of Ottawa Water Supply Guidelines, and the Ontario Building Code, upon development of detailed concepts for the detached singles, townhomes, and parks.

Table 2: Water Supply Design Criteria

Design Parameter	Value
Extracted from Section 4: Ottawa Design Guidelines, Water Distribution (July 2010)	
Residential – Detached Single	3.4 p/unit
Residential – Townhome/ Semi	2.7 p/unit
Residential – Apartment	1.8 p/unit
Minimum Watermain Size	150 mm diameter
Minimum Depth of Cover	2.4 m from top of watermain to finished grade
During normal operating conditions desired operating pressure is within	350 kPa and 480kPa
During fire flow operating pressure must not drop below	140 kPa
Stantec Hydraulic Analysis, Stantec, July 20, 2017 for Population Exceeding 3000 Persons	
Residential – Detached Single	180 L/cap/day
Residential – Rear Lane Town	198 L/cap/day
Residential – Back-to-Back	198 L/cap/day
Outdoor Water Demand	1049 L/unit/day (single detached)
Basic Day	Population x Demand
Max Day	Basic Day + Outdoor Water Demand

To support the future development of a hydraulic analysis for the subdivision, boundary conditions are expected to be provided by the City of Ottawa for the preliminary water demands.

3.3 Water Supply Conclusion

For Phase 1 servicing, it is proposed that a connection is made to a future 300 mm diameter watermain along the future North-South Chapman Mills Extension. In the future, there is a connection proposed to a future 300 mm diameter watermain to the east. It is anticipated that these feeds will satisfy the City's objective minimum pressure of 40 psi during peak hour demand and achieve a typical planning level fire flow value of 10,000 L/min or greater. At the time of detailed design, detailed hydraulic modelling will be undertaken to verify that the proposed water servicing is in conformance with all relevant City and MOECC Guidelines and Policies.

4.0 WASTEWATER SERVICING

4.1 Existing Wastewater Services

Per the ***South Nepean Collector (SNC) Wastewater Servicing Study and Functional Design Report*** by Dillon in October 2003 ***(Dillon SNC Report)***, the subject lands are tributary to the South Nepean Collector (SNC) sewer as urban development land.

The SNC sewer operates north of the subject property within Strandherd Drive prior to travelling south down a future collector road then travelling east within the future Chapman Mills Drive ROW. The location of the SNC sewer is shown on ***Figure 4***.

The SNC was designed to be constructed in three phases. Phase 1 of the SNC was completed in 2005, terminating at a 2400 mm maintenance hole located east of Longfields Drive, north of Bren-Maur Road. Phase 2 was recently extended to Strandherd Drive via the proposed extension of Chapman Mills Drive from its previous termination. Phase 3 will extend the trunk sewer along Strandherd Drive to the intersection of Maravista Drive. The wastewater is ultimately conveyed to the intersection of Jockvale Road and Longfields Drive where it then passes underneath the Jock River.

The ***South Nepean Collector Phase 2: Hydraulics Review / Assessment*** memo was prepared by Novatech Engineering Consultants on August 20, 2015 ***(Novatech SNC Memo)*** to provide an update to the sanitary design flows for Phase 2 of the South Nepean Collector, as previously documented in the ***South Nepean Collector (SNC) – Functional Design Report and Update*** by Dillon in 2012 ***(Dillon SNC Report and Update)***.

4.2 Wastewater Design

Phase 1 is planned to be serviced by an internal gravity sanitary sewer system that is to generally follow the local road network, with select servicing easements identified to achieve efficiencies in servicing and grading designs. The wastewater servicing plan can be seen in ***Figure 4***. As detailed designs progress, alignment and sizing of local sanitary sewers will be confirmed and additional servicing easements may be required, which may trigger minor amendments to the proposed fabric in the concept plan.

The proposed wastewater servicing design proposes to tie into the adjacent SNC sanitary sewer, located in easements, within the Future Chapman Mills Drive (SANMH 15). The ***Novatech SNC Memo*** notes that a full flow capacity of 900.5 L/s for a 900 mm diameter sewer at 0.10% exists downstream of the proposed tie-in with the SNC trunk. A peak design flow of 634.2 L/s was anticipated, leaving the SNC with 30% (266.3 L/s) residual capacity. The ***Novatech SNC Memo*** is contained in ***Appendix C***.

A total of 8.4 ha is proposed to drain through the subject property into the SNC trunk sewer from the subject property. The sanitary drainage area plan and design sheet are enclosed in ***Appendix D.***

Applying the City of Ottawa's wastewater design criteria to the development concept, the estimated peak sanitary flow from Phase 1 is 13.31 L/s. The sanitary drainage area plan and design sheet are enclosed in ***Appendix D***. The proposed internal gravity sanitary trunk sewer adequately services the subject property and does not exceed 80% capacity throughout the network.

Table 3 summarizes the City design guidelines and criteria applied in the preliminary sanitary design information above and detailed in ***Appendix D***.

Table 3: Wastewater Design Criteria

Design Parameter	Value
Current Design Guidelines	
Residential - Single Family	3.4 p/unit
Residential – Townhome/ Semi	2.7 p/unit
Residential – Apartment	1.8 p/unit
Average Daily Demand	350 L/d/per
Peaking Factor	Harmon's Peaking Factor. Max 4.0, Min 2.0
Commercial / Institutional Flows	50,000 L/ha/day
Commercial / Institutional Peak Factor	1.5
Infiltration and Inflow Allowance	0.28 L/s/ha
Park Flows	28,000 L/ha/d
Park Peaking Factor	1.0
Sanitary sewers are to be sized employing the Manning's Equation	$Q = \frac{1}{n} A R^{2/3} S^{1/2}$
Minimum Sewer Size	200 mm diameter
Minimum Manning's 'n'	0.013
Minimum Depth of Cover	2.5 m from crown of sewer to grade
Minimum Full Flowing Velocity	0.6 m/s
Maximum Full Flowing Velocity	3.0 m/s
Extracted from Sections 4 and 6 of the City of Ottawa Sewer Design Guidelines, October 2012, and recent residential subdivisions in City of Ottawa.	
Operational Parameters on Monitoring Data ***(Example Only, Values to be Reviewed on Case-by-Case Basis with City of Ottawa)***	
Average Daily Demand	300 L/d/per
Harmon – Correction Factor	0.4 to 0.6
Institutional / Industrial Flows	10,000 L/ha/day
Commercial Flows	17,000 L/ha/day
Commercial / Institutional Peak Factor	1 (non-coincident peak)
Extracted from Sections 4 and 6 of the City of Ottawa Sewer Design Guidelines, October 2012, and recent residential subdivisions in City of Ottawa.	

The proposed peak sanitary flow from Phase 1 to the existing SNC sanitary sewer (SANMH 8) is 13.31 L/s. The addition of Phase 1 peak flows to the peak design flows from the ***Novatech SNC Memo*** results in an updated peak flow of 647.51 L/s downstream of SANMH 8 in the SNC sanitary sewer. With the inclusion of the subject property, the SNC sanitary sewer would be at 72% capacity, and can adequately handle the entirety of the Barrhaven Conservancy's proposed sanitary flows.

4.3 Wastewater Servicing Conclusion

The subject property will be serviced by local sanitary sewers and the adjacent SNC sanitary sewer as defined in previous reports. This FSR proposes the expansion of the drainage areas from the ***Novatech SNC Memo*** to include Phase 1. There is significant residual capacity in the downstream SNC, providing sufficient capacity for the peak sanitary flows from Phase 1.

Residual capacity exists downstream in the SNC after the addition of the Phase 1 wastewater flows to the SNC sanitary sewer; therefore, the proposed servicing does not have a negative impact on neighbouring landowners.

5.0 STORMWATER CONVEYANCE

5.1 Existing Stormwater Drainage

The subject property is within the Jock River watershed. Per the existing topography characterized in available City of Ottawa base mapping, all flows from Phase 1 are ultimately conveyed to the Jock River by the Fraser-Clarke Watercourse to the Jock River.

A portion of the subject property is currently within the Jock River regulatory flood plain and the boundary will be revised through the placement of fill prior to development. Under separate cover, the ***Hydrodynamic Analysis of Jock River Reach 1 (HWY 416 to Rideau River)*** by J.F. Sabourin and Associates was prepared on June 30, 2017 to support this boundary revision.

5.2 Proposed Stormwater Management Strategy

This FSR proposes to have stormwater flows conveyed through Phase 1 by way of an underground sewer network. The stormwater runoff will be treated to provide an Enhanced Level of Protection (80% TSS removal) before ultimately being released into the Jock River as per the ***Jock River Reach One Subwatershed Study*** prepared by Stantec in 2007 ***(Jock River SWS)***. The proposed stormwater management design is shown on ***Figure 5***.

The stormwater management designs consists of:

- A storm sewer system designed to capture at least the minimum design capture events required under PIETB-2016-01;
- One (1) on-site oil/grit separator (OGS) designed to provide an Enhanced Level of Protection per MOECC guidelines, via treatment of the stormwater captured by the storm sewer network;
- An on-site road network designed to maximize the available storage in the on-site road network for the 100-year design event, where possible, with controlled release of stormwater to the minor storm system; and,
- An overland flow route designed to safely convey stormwater runoff flows in excess of the on-site road storage.

Quantity control is not required for the Jock River; however, the quantity of stormwater runoff exiting from the subject property is to be minimized by optimizing on-site storage in the sags of the proposed road network, which in turn minimizes the size of downstream storm sewer infrastructure.

Erosion control targets for the Fraser-Clarke Watercourse will be provided by the fluvial engineer and adhered to in the design.

5.3 Post-Development Stormwater Management Targets

Stormwater management requirements for the proposed alternative Stormwater management scheme have been adopted from the ***Jock River SWS***, ***City Standards***, and the ***MOECC SWMP Manual***.

Given the general criteria mentioned above, the following specific standards are expected to be required for stormwater management within the subject property:

- Enhanced quality treatment will be provided for stormwater runoff from the subject property, corresponding to a long-term average Total Suspended Solid removal efficiency of 80%, as defined by the MOECC prescribed treatment levels.
- Downstream receiving watercourses will be assessed for responses to planned stormwater management outflows, and stabilization mitigation measures will be planned as required.
- Downstream receiving drainage features, culverts, and sewers will be assessed for responses to planned stormwater management outflows, and infrastructure rehabilitation or capacity improvement measures will be planned as required.
- Storm sewers on local roads are to be designed to provide at least a 2-year level of service without any ponding per the City's latest Technical Bulletin PIEDTB-2016-01.
- Storm sewers on collector roads are to be designed to provide at least a 5-year level of service without any ponding per the City's latest Technical Bulletin PIEDTB-2016-01.
- For less frequent storms (i.e. larger than 2-year or 5-year), the minor system sewer capture will be restricted with the use of inlet control devices to prevent excessive hydraulic surcharges.
- Under full flow conditions, the allowable velocity in storm sewers is to be no less than 0.80 m/s and no greater than 6.0 m/s.
- For the 100-year storm and for all roads, the maximum depth of water (static and/or dynamic) on streets, rearyards, public space and parking areas shall not exceed 0.35 m at the gutter.
- The major system shall be designed with sufficient capacity to allow the excess runoff of a 100-year storm to be conveyed within the public ROW or adjacent to the right-of-way provided that the water level must not touch any part of the building envelope, must remain below all building openings during the stress test event (100-year + 20%), and must maintain 15 cm vertical clearance between spill elevation on the street and the ground elevation at the nearest building envelope.

- Flow across road intersections shall not be permitted for minor storms (generally 5-year or less).
- When catchbasins are installed in rear yards, safe overland flow routes are to be provided to allow the release of excess flows from such areas. A minimum of 30 cm of vertical clearance is required between the rear yard spill elevation and the ground elevation at the adjacent building envelope.
- The product of the maximum flow depths on streets and maximum flow velocity must be less than 0.60 m^2/s on all roads.

5.3.1 Quality Control

Per the ***MOECC SWMP Design Guidelines***, prior to discharge to the Jock River, quality treatment of stormwater runoff from the subject property is to be provided to meet the MOECC Enhanced Protection criteria by:

- Capturing and treating at least 90% of the runoff volume that occurs for the site on a long-term average basis [treatment volume efficiency must be calculated without bypass – e.g. for 100% of the total runoff volume for all the storm events that occur for the site on a long-term average basis]; and
- Capturing a minimum of 80% of the annual total suspended solids (TSS) load on a long-term average basis [suspended solids removal efficiency must be calculated based on 100% of the total runoff volume for all the storm events that occur for the site on a long-term average basis].

5.3.2 Quantity Control

As noted in the ***Jock River SWS***, quantity control is not required for the Jock River; however, based on past reports, the limited capacity of the tributaries to the north of the Jock River may require that the stormwater management facilities provide a storage volume for quantity control.

Some quantity control will be provided by erosion storage, as erosion thresholds for the Fraser-Clarke Watercourse will be respected.

5.4 Stormwater Management Design

The stormwater runoff from Phase 1 is proposed to be treated by an oil and grit separator (OGS) to meet MOECC Enhanced Level of Protection criteria. The location of the OGS system is shown in ***Figure 5***.

By way of an MOECC Certificate of Technology Assessment and manufacturer's design report, the OGS unit must prove that compliance with Enhanced Level of Protection requirements, given the specific drainage area parameters below:

- Total Drainage Area to be Treated by Oil/Grit Separator east of Fraser-Clarke Watercourse: 10.1 ha;
- Average Imperviousness of Area to be Treated by on-site OGS east of Fraser-Clarke Watercourse: 64%; and,
- Predicted 100-year peak flows through unit east of Fraser-Clarke Watercourse: 0.968 m^3/s (***Section 5.5***).

5.5 Proposed Minor System

Phase 1 is expected to be serviced by an internal gravity storm sewer system that is to generally follow the local road network and proposed servicing easements. The drainage will be conveyed within the underground piped sewer system to an OGS unit.

Street catchbasins will collect drainage from the streets and front yards, while rear yard catchbasins will capture drainage from backyards. Perforated catch basin leads will be provided in rear yards, except the last segment where it connects to the right-of-way which will be solid pipe, per current City standards.

The preliminary rational method design of the minor system captures drainage for storm events up to and including the 2-year (local) and 5-year (collector) event, assuming the use of inlet control devices (ICD) for all catchbasins within the subject property. ***Table*** 4***4*** summarizes the standards that will be employed in the detailed design of the storm sewer network, meeting the requirements in ***Section 5.3***. The drainage area plan and rational method design sheets are provided in ***Appendix E***.

Table 4: Storm Sewer Design Criteria

Design Parameter	Value
Minor System Design Return Period	1:2 year (PIEDTB-2016-01) for local roads, without ponding 1:5 year (PIEDTB-2016-01) for collector roads, without ponding
Major System Design Return Period	1:100 year
Intensity Duration Frequency Curve (IDF) 2-year storm event: A=732.951 | B=6.199 | C=0.810 5-year storm event: A = 998.071 | B = 6.053 | C = 0.814	$i = \frac{A}{(t_c + B)^C}$
Minimum Time of Concentration	10 minutes
Rational Method	$Q = CiA$
Storm sewers are to be sized employing the Manning's Equation	$Q = \frac{1}{n} A R^{2/3} S^{1/2}$
Runoff coefficient for paved and roof areas	0.9
Runoff coefficient for landscaped areas	0.2
Minimum Sewer Size	250 mm diameter
Minimum Manning's 'n' for pipe flow	0.013
Minimum Depth of Cover	1.5 m from crown of sewer to grade
Minimum Full Flowing Velocity	0.8 m/s
Maximum Full Flowing Velocity	6.0 m/s
Clearance from 100-Year Hydraulic Grade Line to Building Opening	0.30 m
Max. Allowable Flow Depth on Municipal Roads	35 cm above gutter (PIEDTB-2016-01)
Extent of Major System	To be contained within the municipal right-of-way or adjacent to the right-of-way provided that the water level must not touch any part of the building envelope and must remain below the lowest building opening during the stress test event (100-year + 20%) and 15cm vertical clearance is maintained between spill elevation on the street and the ground elevation at the nearest building envelope (PIEDTB-2016-01)
Stormwater Management Model	DDSWMM (release 2.1), SWMHYMO (v. 5.02) and XPSWMM (v. 10)
Model Parameters	Fo = 76.2 mm/hr, Fc = 13.2 mm/hr, DCAY = 4.14/hr, D.Stor.Imp. = 1.57 mm, D.Stor.Per. = 4.67 mm
Imperviousness	Based on runoff coefficient (C) where Percent Imperviousness = (C - 0.2) / 0.7 x 100%.
Design Storms	Chicago 3-hour Design Storms and 24-hour SCS Type II Design Storms. Maximum intensity averaged over 10 minutes.
Historical Events	July 1st, 1979, August 4th, 1988 and August 8th, 1996
Climate Change Street Test	20% increase in the 100-year, 3-hour Chicago storm

Extracted from City of Ottawa Sewer Design Guidelines, October 2012, and ISSU, and based on recent residential subdivisions in City of Ottawa.

The peak design flows are calculated based on an average predicted runoff coefficient (C-value) of 0.67 and 0.75 for the development areas and 0.25 for the grassed areas. As detailed design progresses, the runoff coefficients will be refined to reflect the proposed building envelopes, driveways and other details.

As detailed design progresses, alignment and sizing of local storm sewers will be confirmed and additional servicing easements may be required, which may trigger minor amendments to the proposed lot fabric in the concept plan. Specifically, the sizing of storm sewers is subject to change based on the Hydraulic Grade Line (HGL) analysis (***Section 5.6***) and the major system design (***Section 5.7***).

The proposed trunk through Phase 1 varies in size from 750 mm to 1200 mm diameter, discharging to an OGS, which discharges to the Fraser-Clarke Watercourse and the Jock River. The peak flows from Phase 1 to the OGS is 771 L/s as shown on the rational method design sheet, enclosed in ***Appendix E***.

5.6 Hydraulic Grade Line Analysis

A detailed hydraulic gradeline (HGL) modelling analysis will be completed for the proposed system at the detailed design level, based on the 100-year 3-hour Chicago, 12-hour SCS, and 24-hour SCS design storms, including historical design storms and climate change stress test as required. Detailed grading design and storm sewer design will be modified as required to achieve the freeboard requirements set out in ***Section 5.3*** (per PIEDTB-2016-01).

5.7 Proposed Major System

Major system conveyance, or overland flow (OLF), will be provided to accommodate flows in excess of the minor system capacity. OLF is accommodated by generally storing stormwater up to the 100-year design event in road sags then routing additional surface flow along the road network and service easements towards the proposed drainage features to the Jock River, as shown in ***Figure 5***. A composite servicing plan is shown on ***Figure 6***.

The grading design described in ***Section 5.8*** and shown in ***Figure 7*** will include a saw-toothed-road design with 0.10% minimum grade from highpoint to highpoint, in order to maximize available surface storage for management of flows up to the 100-year design event where possible.

The Fraser-Clarke Watercourse, downstream of the OGS unit, will be designed to prevent erosion and sediment transport.

Given the elements above and the minor storm system described in ***Section 5.5***, the proposed drainage systems are expected to safely capture and convey all storms up to and including the 100-year event in accordance with the requirements of the City standards.

The overland flows from Phase 1 are conveyed along the road to the Fraser-Clarke Watercourse.

5.8 Proposed Grading Scheme

A site grading scheme has been developed to optimize earthworks and provide major system conveyance to the receiving outlets, which eventually outlet to the existing Jock River drainage network, while tying into existing roads adjacent to the site. The proposed grading plan can be seen in ***Figure 7***.

The following additional grading criteria and guidelines will be applied to detailed design, per ***City of Ottawa Guidelines***:

- Driveway slopes will have a maximum slope of 6%;
- Grading in grassed/landscaped areas to range from 2% to 3:1, with terracing required for slopes larger than 7%;
- Swales are to be 0.15 m deep with 3:1 side slopes unless otherwise indicated on the drawings; and,
- Perforated pipe will be required for drainage swales if they are less than 1.5% in slope.

The geotechnical analysis of the site, published under separate cover in support of the development applications, provides additional information about the suitability of the site for the proposed services and grading scheme. At the time of detailed design, detailed review and signoff by a licensed Geotechnical Engineer will be required.

5.9 Infiltration

The following Low Impact Development techniques should be considered for implementation, where possible, as part of detailed design:

- Rear-yard swales should be designed with minimum grades where possible, to promote infiltration;
- Rear-yard catchbasin leads should be perforated (except for the last segment connecting to the storm sewer within the right-of-way), to promote infiltration; and,
- Where eavestroughs are provided on residential units, they are to be directed to landscaped surfaces, to promote infiltration.

Furthermore, the following techniques can be examined as part of detailed landscaping design of the park block:

- Amended topsoil (minimum 300 mm thick) can be considered for use; and,

- Micro-grading can be considered to promote infiltration.

5.10 Stormwater Servicing Conclusions

The stormwater runoff is designed to be captured by an internal gravity sewer system that is to convey flows to an OGS unit for quality control treatment prior to release to the Fraser-Clarke Watercourse. An Enhanced Level of Protection will be provided for stormwater runoff from the subject property before being discharged to the Jock River. Quantity control is not required for the Jock River. Notwithstanding, some quantity control by means of erosion storage will be included.

A detailed Hydraulic Grade Line (HGL) modelling analysis will be completed for the proposed system at the detailed design level.

6.0 UTILITIES

Utility services extending to the site may require connections to multiple existing infrastructure points: consultation with Enbridge gas, Hydro Ottawa, Rogers, and Bell is required as part of the development process to confirm the servicing plan for the subject lands.

7.0 EROSION AND SEDIMENT CONTROL

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

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

The following specific 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 leaving the site and entering existing watercourses, and clean and maintain throughout construction.
- Install catchbasin inserts during construction to protect from silt entering the storm sewer system.
- Install mud mat in order to prevent mud tracking onto adjacent roads.
- No refueling or cleaning of equipment near existing watercourses.
- No material stockpiles within 30 m of existing watercourses, unless otherwise permitted by RVCA and City of Ottawa.
- Provide sediment traps and basins during dewatering.
- Plan construction at proper time to avoid flooding.
- The Contractor will, at every rainfall, complete inspections and guarantee proper performance.
- Erosion and sediment control will remain in place until the working areas have been stabilized and re-vegetated.

8.0 CONCLUSION AND RECOMMENDATIONS

This Functional Servicing Study provides details on the planned on-site municipal services for Phase 1 and demonstrates that adequate municipal infrastructure capacity is expected to be available for the planned development of the subject property.

- Phase 1 water servicing is proposed to be to the north and it is anticipated that this feed will satisfy the City's objective minimum pressure of 40 psi during peak hour demand and achieve a typical planning level fire flow value of 10,000 L/min or greater. At the time of detailed design, detailed hydraulic modelling will be undertaken to verify that the proposed on-site and off-site watermains are in conformance with applicable guidelines. A connection to a future watermain in a ROW east of Greenbank Road is proposed in the future.

- Sanitary service is to be provided to the subject property via the adjacent South Nepean Collector (SNC) trunk sanitary sewer. There is sufficient residual capacity in the SNC for the Phase 1 flows, external future residential, commercial and community park flows.

- Stormwater service is to be provided by capturing stormwater runoff by an internal gravity sewer system that is to convey flows to an OGS unit for quality control treatment. An Enhanced Level of Protection will be provided for stormwater runoff from Phase 1 before being discharged to the Jock River via the Fraser-Clarke Watercourse. Quantity control is not required for the Jock River. Notwithstanding, some quantity control by means of erosion storage will be included.

- A portion of the subject property is currently within the Jock River regulatory flood plain and the boundary will be revised through the placement of fill prior to development.

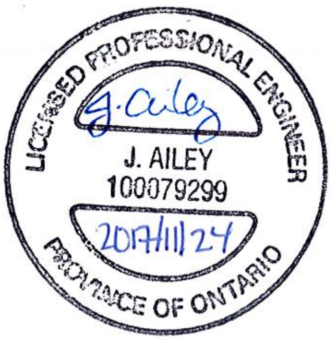
- A detailed Hydraulic Grade Line (HGL) modelling analysis will be completed for the proposed system at the detailed design level.

- Low Impact development techniques will be implemented, to promote infiltration of stormwater.

- Erosion and sediment control measures will be implemented and maintained throughout construction. The Jock River and the Fraser-Clarke Watercourse will be protected from any negative impacts from construction.

- The proposed servicing and grading plans are expected to meet all City, RVCA, and MOECC requirements as set out in background studies and current standards.

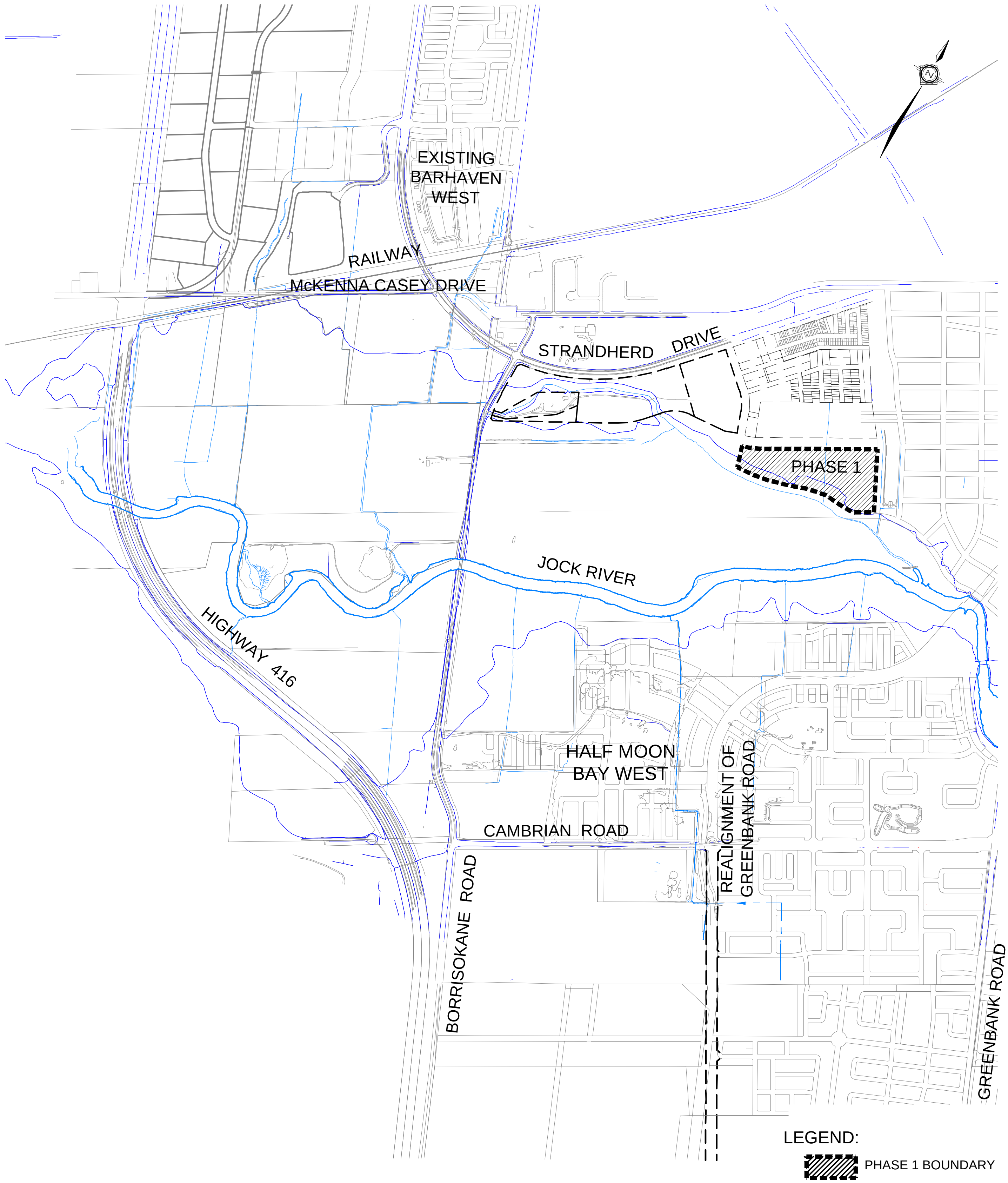
- Prior to detailed design of the infrastructure presented in this report, this FSR will require approval under the Planning Act as supporting information for the Plan of Subdivision application. Project-specific approvals are also expected to be required for the infrastructure presented in this report from the City of Ottawa, Ministry of Environment and Climate Change, and Rideau Valley Conservation Authority, among other agencies.



Prepared by,
David Schaeffer Engineering Ltd.

Per: Jennifer Ailey, P.Eng.

Z:\Projects\16-891_Barrhaven_Conservancy_East_Inc\B_Design\B3_Reports\B3-2_Servicing (DSEL)\2017-11-24_891_Ph1_FSR\2017-11-24-Ph1_FSR_1st_Submission.doc



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Stittsville, ON K2S 1E9
TEL: (613) 836-0856
FAX: (613) 836-7183
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BARRHAVEN CONSERVANCY PHASE 1

KEY PLAN

CITY OF OTTAWA

DATE:	NOV. 2017
SCALE:	1:20000
PROJECT No.:	16-891
FIGURE:	1

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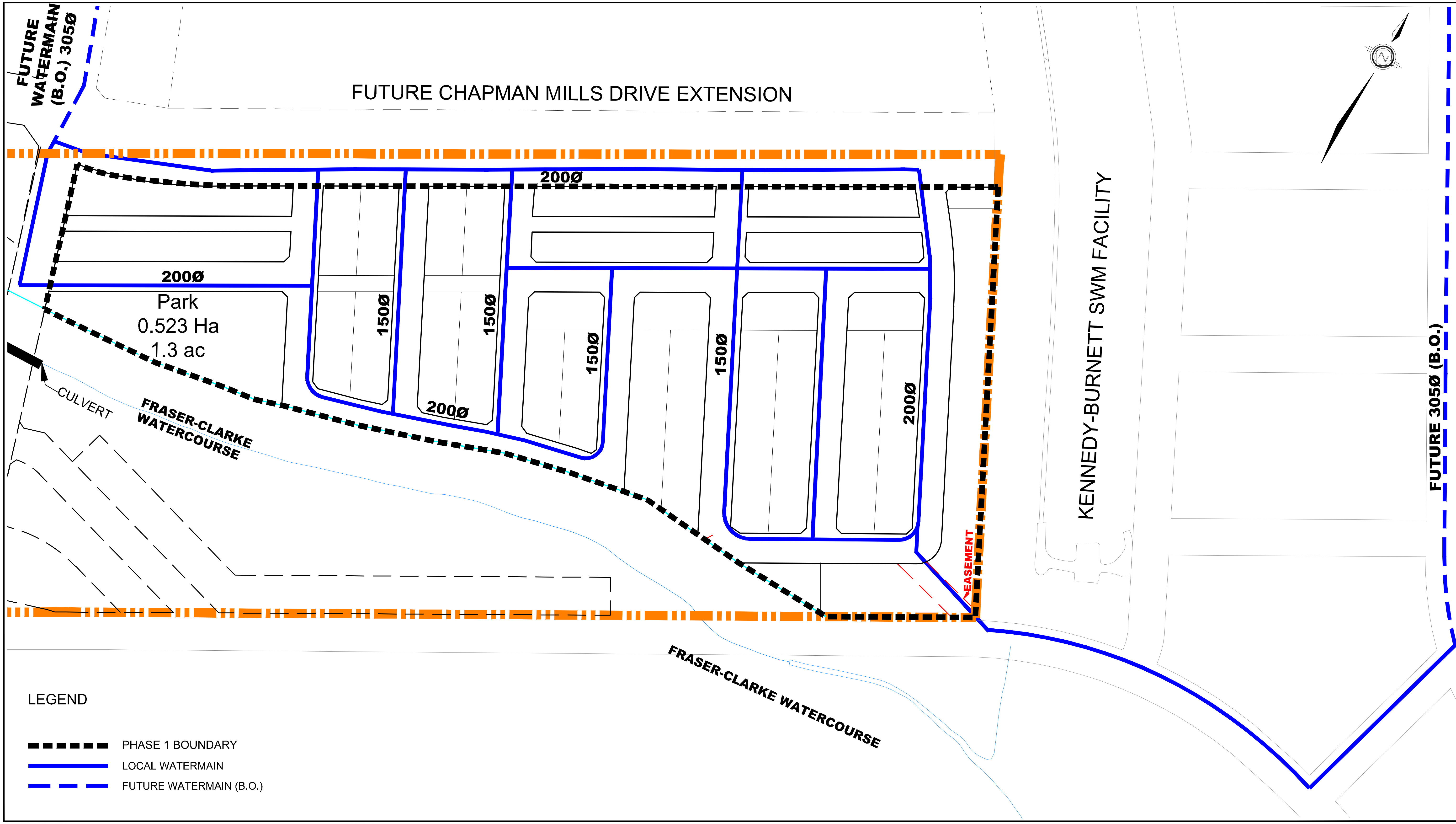
BARRHAVEN CONSERVANCY PHASE 1
SUBDIVISION PLAN
CITY OF OTTAWA

PROJECT No.:	16-891
SCALE:	1:2000
DATE:	NOVEMBER 2017
FIGURE:	2



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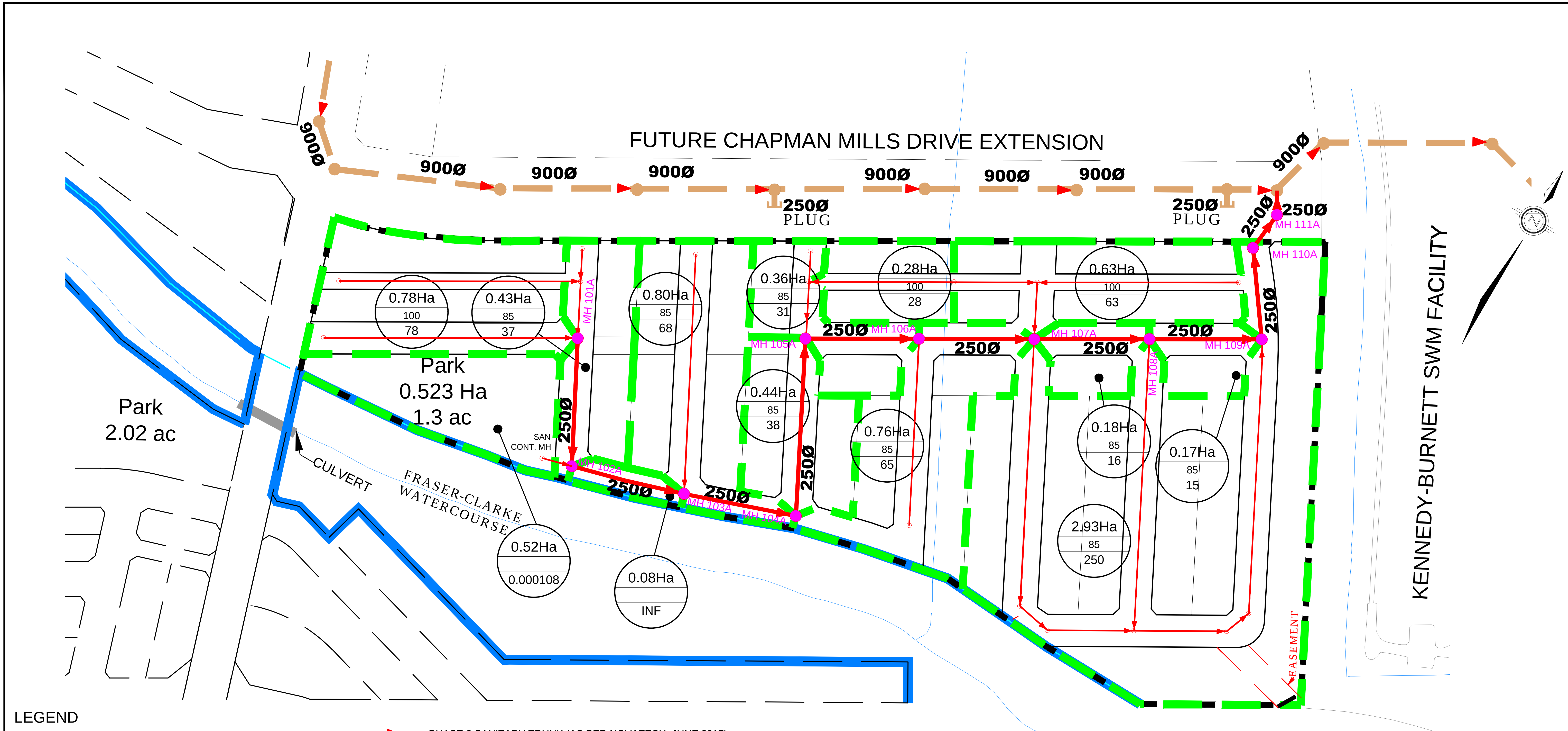
BARRHAVEN CONSERVANCY PHASE 1
WATERMAIN SERVICING PLAN
CITY OF OTTAWA

PROJECT No.:	16-891
SCALE:	1:2000
DATE:	NOVEMBER 2017
FIGURE:	3



LEGEND

PHASE 1 BOUNDARY	PHASE 2 SANITARY TRUNK (AS PER NOVATECH, JUNE 2017)
SANITARY TRIBUTARY BOUNDARY	PROPOSED SANITARY MANHOLE (BY OTHERS)
SANITARY TRUNK	
PROPOSED SANITARY MANHOLE	
LOCAL SANITARY SERVICING	

2.0Ha / 0.000108 — SANITARY DRAINAGE AREA; UNIT FLOW VALUE (m3/s/ha)

8.4Ha / 70 / 588 — SANITARY DRAINAGE AREA; POPULATION PER HECTARE; TOTAL POPULATION

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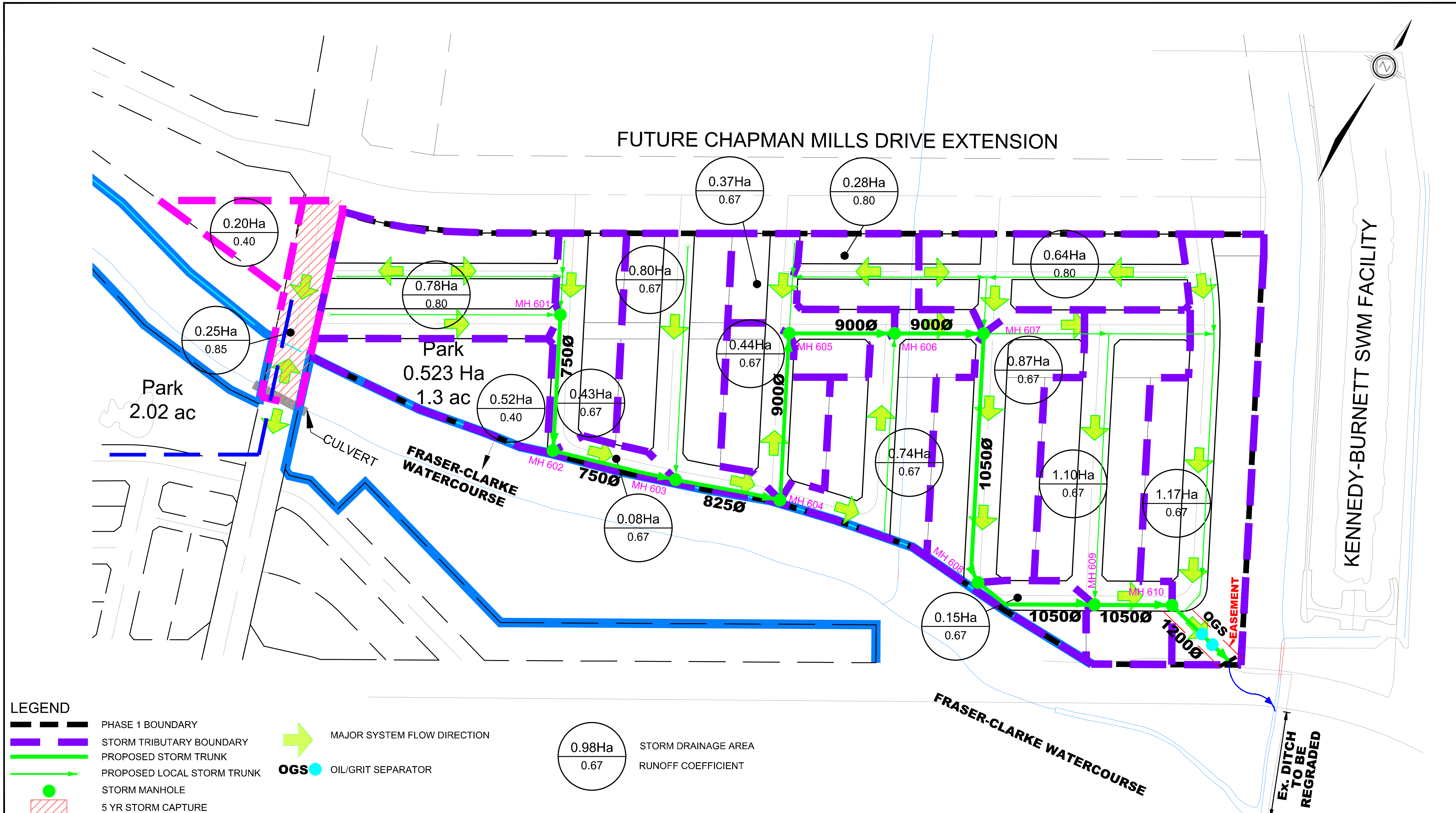
BARRHAVEN CONSERVANCY PHASE 1
SANITARY SERVICING PLAN
CITY OF OTTAWA

PROJECT No.:	16-891
SCALE:	1:2000
DATE:	NOVEMBER 2017
FIGURE:	4



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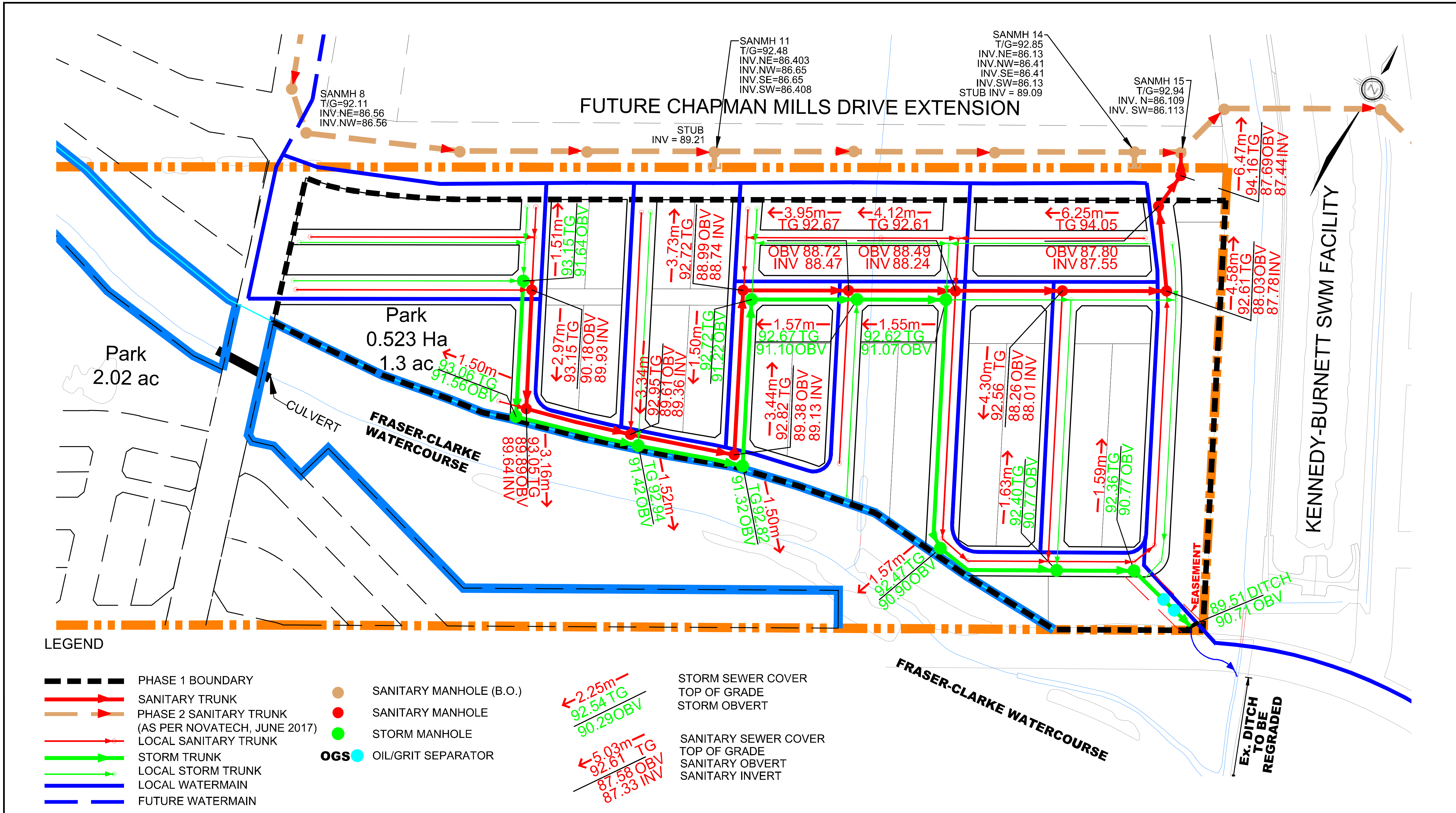
BARRHAVEN CONSERVANCY PHASE 1
STORM SERVICING PLAN
CITY OF OTTAWA

PROJECT No.:	16-891
SCALE:	1:2000
DATE:	NOVEMBER 2017
FIGURE:	5



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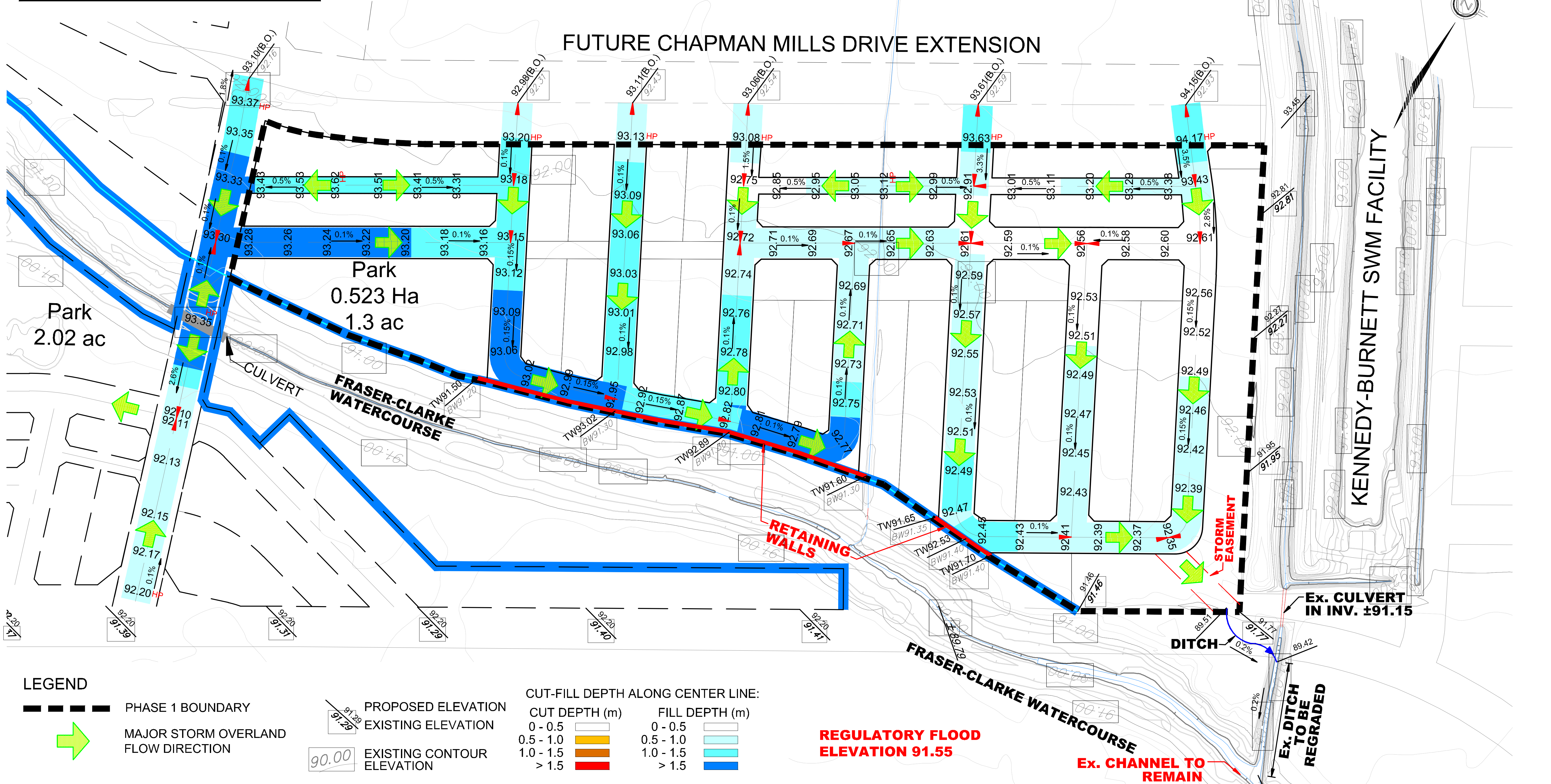
BARRHAVEN CONSERVANCY PHASE 1
COMPOSITE SERVICING PLAN
CITY OF OTTAWA

PROJECT No.:	16-891
SCALE:	1:2000
DATE:	NOVEMBER 2017
FIGURE:	6

ASSUMPTIONS:
- STORM CONNECTIONS WITH SUMP PUMPS
- SAW TOOTH ROAD DESIGN @ 0.10%
- OGS



LEGEND

▬ ▬ ▬	PHASE 1 BOUNDARY
⇨	MAJOR STORM OVERLAND FLOW DIRECTION
91.29 / 91.29	PROPOSED ELEVATION / EXISTING ELEVATION
90.00	EXISTING CONTOUR ELEVATION

CUT-FILL DEPTH ALONG CENTER LINE:

CUT DEPTH (m)	FILL DEPTH (m)
0 - 0.5	0 - 0.5
0.5 - 1.0	0.5 - 1.0
1.0 - 1.5	1.0 - 1.5
> 1.5	> 1.5

REGULATORY FLOOD ELEVATION 91.55

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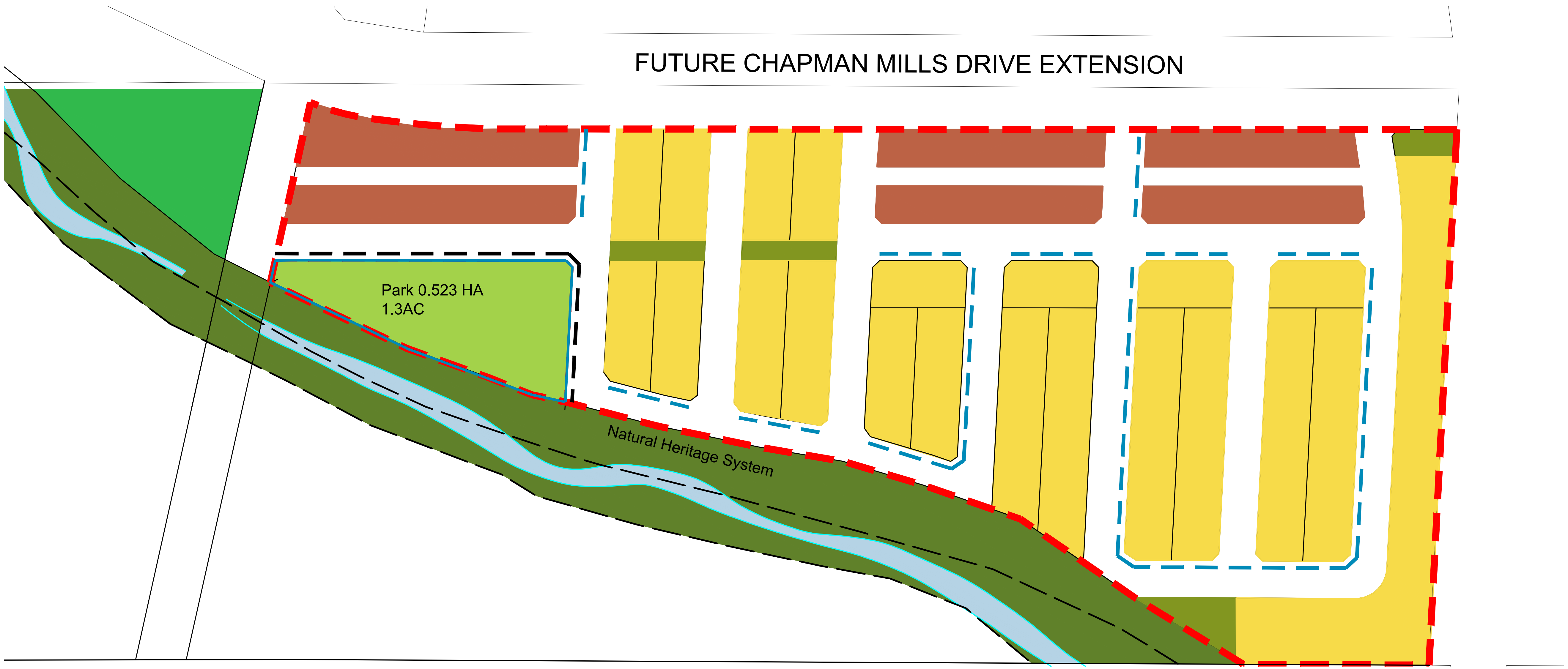
BARRHAVEN CONSERVANCY PHASE 1
PRELIMINARY GRADING PLAN
CITY OF OTTAWA

PROJECT No.:	16-891
SCALE:	1:2000
DATE:	NOVEMBER 2017
FIGURE:	7

APPENDIX A



NORTH

scale | 1: 2000

legend

- Single Detached
- Rear Lane Townhome
- Back to Back Townhome
- Park / Open spaces
- Natural Heritage System
- Phase 1 Boundary
- Site Boundary

summary

AREA
Single Family
3.62 ha
Rear Lane Town
1.11 ha
Park
0.52 ha
Open Spaces
0.17 ha
Road
2.96 ha
Site Area
8.38 ha

FRONTAGE
Single Family
1594.72 m
Rear Lane Town
628.52 m

ROAD
18.0m Local
184.6 m
16.5m Local
1385.3 m
8.50m Lane
323.0 m
Total Road
1892.9 m

CAIVAN COMMUNITIES

NAK design strategies
421 Roncesvalles Avenue | Toronto, Ontario | M6R 2N1
tel: 416.340.8700 | fax: 416.340.7100 | info@nak-design.com

Cavian | Conservancy

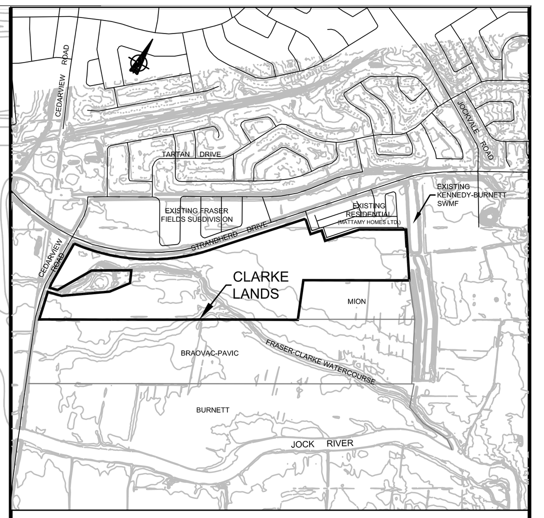
phase 1 concept plan

version 5.2

date | 15 November 2017

Z:\Projects\2016\16-165 Caivan Conservancy\Design\Drawings\Concept\171115 -Caivan Conservancy_Park Fit Plan.dwg

APPENDIX B



KEY PLAN (N.T.S)

LEGEND:

- CONCEPTUAL STORM SEWER
- CONCEPTUAL SANITARY SEWER
- CONCEPTUAL WATERMAIN

No.	ISSUE / REVISION	DD/MM/YY
1	ISSUED FOR SERVICING BRIEF	28/03/16

VERIFY SHEET SIZE AND SCALES. BAR TO THE RIGHT IS 25mm IF THIS IS A FULL SIZE DRAWING. 0 25mm

SCALE: 1:1500

CLIENT:
MINTO COMMUNITIES INC.
200-180 KENT STREET
OTTAWA, ON
K1P 0B6

CONSULTANT:
J.L.Richards
ENGINEERS · ARCHITECTS · PLANNERS
www.jlrichards.ca

CONSULTANT:

PROJECT NORTH

PROFESSIONAL STAMP

PROJECT:
MINTO COMMUNITIES INC.
CLARKE LANDS
4005 STRANDHERD DRIVE

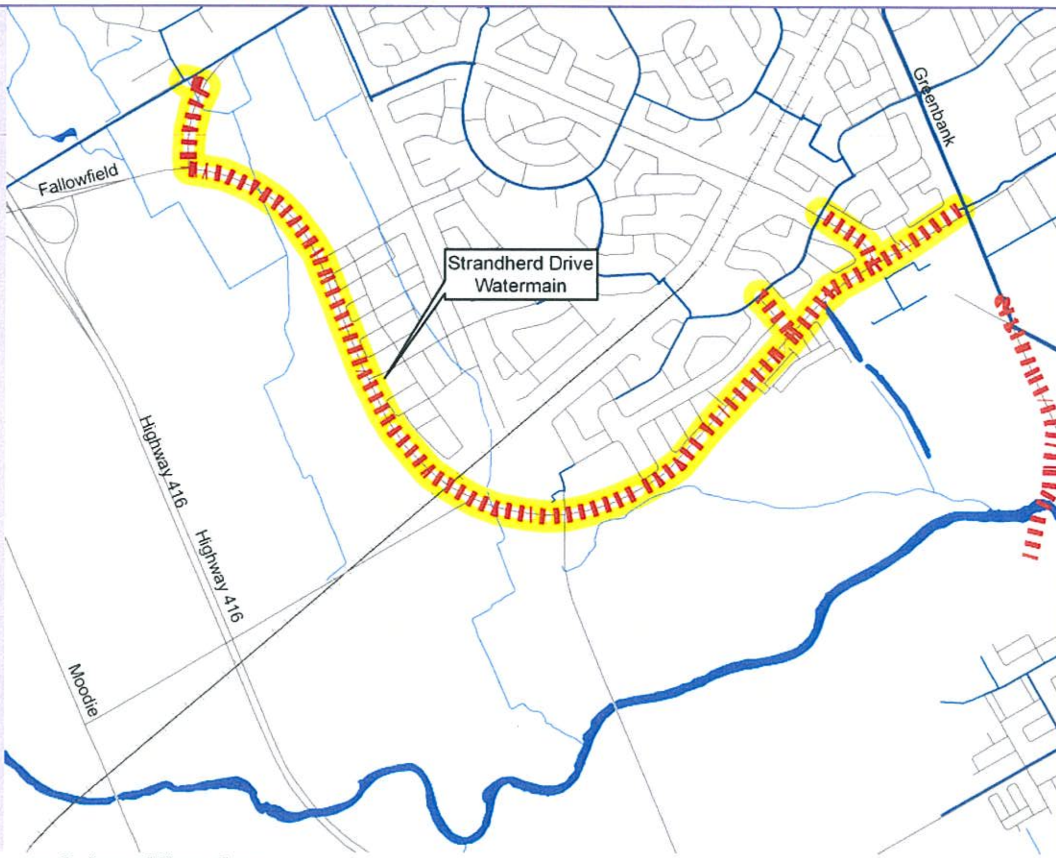
DRAWING:
CONCEPTUAL SITE SERVICING

DESIGN: HM
DRAWN: TB
CHECKED: LD
JLR #: 24051
DRAWING #: CS1

PLOT DATE: March 29, 2016 10:45:05 AM

File Location: P:\24000\24051 LD Minto Clarke\24051 C CONCEPTUAL CS1.dwg

Strandherd Drive Watermain



Scope and Justification

Construct 406 mm watermain along Fallowfield/Strandherd from Fallowfield/O'Keefe to Greenbank, including various connections to existing distribution system. This project is needed to support growth in the Barrhaven area north of the Jock River.

Timing

2013 – 2018: Construct feedermain

Action Item Funding

Construction Cost Estimate = $4.2M
Capital Cost Estimate = $6.6M (90% Development Charges, 10% Rate)
**including construction cost, engineering, city internal costs and contingency allowance.*

EA Requirements and Consultation

This is a Schedule 'A' project – No consultation required prior to implementation.

Follow Up Actions

Coordinate project with development, and South Nepean Collector Sewer where appropriate. Finalize alignment as part of detailed planning and design process.

APPENDIX C

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Engineering

- Land / Site Development
- Municipal Infrastructure
- Environmental / Water Resources
- Traffic/ Transportation
- Structural
- Recreational

Planning

- Land/Site Development
- Planning Application Management
- Municipal Planning Documents & Studies
- Expert Witness (OMB)
- Wireless Industry

Landscape Architecture

- Urban Design & Streetscapes
- Recreation & Parks Planning
- Environmental Restoration
- Sustainable Design

32 Years

South Nepean Collector: Phase 2

Hydraulics Review / Assessment

Technical Memorandum

Prepared for the City of Ottawa

Engineering excellence. Planning precision. Inspired landscapes.

NOVATECH
Engineers, Planners & Landscape Architects

M E M O R A N D U M

DATE:	**AUGUST 20, 2015**
TO:	**JONATHAN KNOYLE – CITY OF OTTAWA**
FROM:	**CONRAD STANG / MIKE PETEPIECE – NOVATECH**
RE:	**SOUTH NEPEAN COLLECTOR PHASE 2: HYDRAULICS REVIEW / ASSESSMENT**
CC:	**EDSON DONNELLY – NOVATECH**

1.0 PURPOSE

This memorandum provides an update to the sanitary design flows for Phase 2 of the South Nepean Collector, as previously documented in the *South Nepean Collector (SNC) – Functional Design Report and Update* (Dillon, 2012).

Sanitary design flows have been estimated for both current-day operational flows and future development peak design flows, based on the latest available planning information for the vacant lands within the SNC sewershed.

2.0 BACKGROUND

In January 1998, the Master Servicing Study for the South Nepean Urban Area provided a conceptual plan for water, wastewater and stormwater infrastructure. The preferred alternative for wastewater servicing was an east/west trunk sewer alignment that was to be completed in several phases. The proposed sanitary trunk sewer was initially called the Jock River Collector, but was renamed the South Nepean Collector during the original functional design study completed in 2003.

Phase 1 of the South Nepean Collector was completed in 2005 and currently terminates at a 2400mm maintenance hole located east of Longfields Drive, north of Bren-Maur Road. Phase 2 will extend the trunk sewer to Strandherd Drive at the intersection of the proposed transitway along the proposed extension to Chapman Mills Drive. Phase 3 will extend the trunk sewer along Strandherd Drive to the intersection of Maravista Drive.

3.0 REVIEW OF FUNCTIONAL DESIGN REPORT HYDRAULIC ASSESSMENT

3.1 Design Parameters

The sanitary design flow were calculated using the parameters from the City of Ottawa Sewer Design Guidelines (October 2012), and are summarized in **Table 1** and **Table 2**. The design parameters are consistent with those used in the Dillon (2012) report.

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Table 1: Peak Design Flow Parameters

Land Use	Average Daily Flow	Peaking Factor	Peak Extraneous Flows
Residential	350 L/cap/day	Harmon Equation, K=1 (2.0 min – 4.0 max)	0.28 L/s/ha
Commercial	50,000 L/ha/day	1.5	
Institutional	50,000 L/ha/day	1.5	
Other*	0 L/ha/day	N/A	

**Open Space, Arterial ROW, SWM Blocks, etc. with no sanitary flow contribution (extraneous flow only)*

Table 2: Operational Design Flow Parameters

Land Use	Average Daily Flow	Peaking Factor	Peak Extraneous Flows
Residential	300 L/cap/day	Harmon Equation, K=0.6 (1.2 min – 2.4 max)	<u>Dry weather</u> 0.05-0.08 L/s/ha <u>Wet Weather</u> 0.15 - 0.20 L/s/ha (typical events) 0.28 L/s/ha (large/annual events) 0.30 - 0.50 L/s/ha (extreme events)
Commercial	17,000 L/ha/day	1.0 (non-coincident peak)	
Institutional	10,000 L/ha/day	1.0 (non-coincident peak)	

**There are no industrial areas identified within the tributary area.*

Harmon Equation $= 1 + \frac{14}{4+\left(\frac{P}{1000}\right)^{\frac{1}{2}}} \times K$

Where:

P = Population

K = Correction Factor:

- Peak Flow = 1
- Operational = between 0.4 to 0.6 (0.6 used)

3.2 Land Use Designations & Population Estimates

The 2012 Functional Design Report (Dillon) used information from the Vacant Urban Residential Lands (VURL) database, provided by the City of Ottawa, with guidance on unit counts and population densities provided by a Technical Advisory Committee (TAC) and information from developers and existing construction projects.

For the updated analysis, population densities and unit counts for future residential development are based on the current concept plans for these areas, and are presented in **Table 3**.

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Table 3: Residential Land Use Population Densities

Residential Land Use	Units per ha	Persons per Unit	Persons per ha
Low Density (singles and semis)	26 – 28 (28 used)	2.7 – 3.4 (3.4 used)	95.2
Medium Density (row/townhouse)	50 – 60 (60 used)	2.7	162.0
High Density (apartments)	60 – 75 (75 used)	1.8	135.0

The land use designations shown in **Table 4** have been applied for the areas within Phases 2 and 3 of the SNC (Node 70 to 130). The sewershed areas and land use designations were delineated using aerial photos (existing development) and conceptual site plans (future development).

Table 4: Land Use Designations

Land Use Designation	
Secondary Plan	**SNC Design**
Residential	Residential (Low / Medium / High Density)
Institutional / Office	Institutional
Commercial	Commercial
Recreational	
Business Park	
Prestige Business Park	
Park/Open Space Area	Other*
Ex. Snow Disposal Facility (future commercial)	
Stormwater Management Facility	
Conservation Lands	
Arterial Right-of-Ways	

** No sanitary flow contribution - extraneous flows (inflow/infiltration) only.*

3.3 Sanitary Flow Allocations & Drainage Area Plans

The updated sanitary flow allocations for Phases 2 and 3 of the SNC are provided in **Table 5**. The corresponding sanitary drainage area plan is provided as **Figure 1**.

The updated Sanitary Drainage Area Plan (Novatech, 2015) includes two areas not included in the Dillon (2012) analysis:

1) The area adjacent to the west side of the existing Kennedy-Burnett Stormwater Management Facility (SWMF) north of the Fraser-Clarke Drain. This area is proposed to be developed with low density residential units unless there is a need to expand the existing Kennedy-Burnett SWMF within these lands.

2) The golf driving range at the current end of Jockvale Road (south) and area adjacent the golf driving range which are proposed to be developed into medium and high residential units, respectively.

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A comparison of the overall residential population estimate and sewershed area for Phases 2 and 3 of the SNC is provided in **Table 6**. For reference, the flow allocations, design sheets, and sanitary drainage area plan from Dillon (2012) are attached.

Table 6: Comparison of Population Estimates and Areas

Existing / Future	Estimated Population / Area	Dillion (2012)	Novatech (2015)
Existing	Estimated Population	3,069 persons	6,944 persons
	Gross Residential Area	125.7 ha	60.09 ha
	Gross Commercial / Institutional Area	62.4 ha	64.37 ha
	Total Sewershed Area	188.1 ha [(1)]	124.5 ha
Future (full service)	Estimated Population	27,137 persons	27,312 persons
	Gross Residential Area	229.4 ha	248.48 ha
	Gross Commercial / Institutional Area	225.3 ha	228.82 ha
	Total Sewershed Area	454.7 ha	477.3 ha

[(1)] The Dillon (2012) report included the snow disposal facility (10C = 16.56 ha), area currently serviced by the Jockvale pumping station (11B = 33.77), and the existing golf driving range (8B = 5.86 ha) as part of the existing SNC sewershed. The Novatech (2015) analysis does not consider these areas to be part of the existing sewershed.

Snow Disposal Facility

In both the Dillon (2012) and Novatech (2015) analysis, it is assumed that the snow dump facility at the Stranderd Drive and McKenna Casey Drive will ultimately be re-zoned for commercial development.

4.0 SANITARY DESIGN FLOWS

The sanitary sewer design sheets from the Dillon (2012) analysis and Novatech (2015) analysis are attached to this technical memorandum. The estimated sanitary design flows from Phases 2 and 3 of the SNC (entering Node 70) are as follows:

Present-Day Operational Design Flows (Theoretical)

- o Dillon (2012) = 56.0 L/s
- o Novatech (2015) = 72.5 L/s

Future Peak Design Flows

- o Dillon (2012) = 603.9 L/s
- o Novatech (2015) = 634.2 L/s

An increase in the serviced area, in addition to changes to the proposed land use and population densities in the sewershed, results in a higher design flow. The updated functional design flows presented in this memorandum are slightly higher than those presented in the Dillon (2012) report. However, they do not exceed the available capacity of the existing downstream sewer (Phase 1).

The outlet for Phase 2 of the SNC is the existing 1050mm outlet pipe at the 2400mm maintenance hole (Node 70) located east of Longfields Drive, north of Bren-Maur Road. Given a minimum design slope of 0.10%, this sanitary trunk sewer would have a full flow capacity of 900.5 L/s.

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Based on the attached sanitary sewer design for Phases 1, 2 and 3 (Dillion, 2003), the estimated total peak flow from Phases 2 and 3 is 631.4 L/s. Therefore, based on the updated future peak design flow being 634.2 L/s (Novatech, 2015), the 1050mm sanitary sewer would be at 70% capacity.

ATTACHMENTS:

- Figure 1: Sanitary Drainage Areas and Land Use – Novatech (2015)
- Sanitary Sewer Design Sheets (Updated) - Novatech (2015)

Excerpts from Dillion (2012)

- Figure 1: Existing Sanitary Network and Collection Areas – Dillion (2012)
- Table 5.1: Allocation of Commercial / Institutional and Residential Demands to SNC by Collection Area – Dillion (2012)
- Sanitary Sewer Design Sheets – Dillon (2012)
- Sanitary Sewer Design Sheets – Dillion (2003)

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Table 5: Updated Allocation of Commercial, Institutional and Residential Demands to Phases 2 & 3 (Nodes 70 – 130) of the SNC by Collection Area (Novatech, 2015)

Collection Area	Upstream Node	Existing / Proposed Development	Existing / Proposed Land Use	Area (ha)	Estimated Number of Residential Units	Population Density (persons / ha)	Comment	Reference
A1	130	Proposed	Commercial	12.80	-	-	O'Keefe Court – Conceptual site plan shows proposed commercial.	Conceptual Plans for O'Keefe Court
A2-A	130	Proposed	Commercial	85.18	-	-	CitiGate – Analysis uses same approach as the design for CitiGate.	Detailed Servicing and SWM Report (Phase 1) (Novatech, 2014)
A2-B	130	Proposed	Commercial	32.46	-	-		
A2-C	120	Proposed	Commercial (ex. Snow dump)	15.25	-	-	Existing snow dump facility assumed to be future commercial.	Functional Design Report and Update – SNC Phase 2 and 3 (Dillon, 2012)
A3-A	130	Proposed	Low Density Residential	16.48	461	95.2	Havencrest – Existing single family units.	Havencrest Design Report (IBI, 2013)
A3-B	130	Existing	Institutional	10.30	-	-	Cedarview Middle School and Cedarview Alliance Church.	Aerial Photos / Site Visits
A3-C	130	Existing	Medium Density Residential	5.19	311	162	Existing townhouse units.	
A3-D	130	Existing	Commercial	0.58	-	-	Existing commercial buildings.	
A3-E	130	Existing	Low Density Residential	35.68	999	95.2	Existing single family units.	
A3-F	130	Existing	Medium Density Residential	8.26	496	162.0	Existing townhouse units.	
A3-G	130	Existing	Institutional	0.90	-	-	Ottawa Torah Centre Chibad.	
A3-H	120	Existing	Low Density Residential	6.09	171	95.2	Existing single family units.	
A4	130	Existing	Low Density Residential	34.44	964	95.2	Existing single family units currently serviced by Jockvale pump station; to be redirected to SNC.	Functional Design Report and Update – SNC Phase 2 and 3 (Dillon, 2012); based on 2011 Census.
A5	110	Proposed	Commercial	17.72	-	-	Proposed commercial south of McKenna Casey Drive.	Site Visits
A6-A	100	Proposed	Institutional	20.70	-	-	Proposed school site on Minto property.	Conceptual Plan for Lands Adjacent the Kennedy-Burnett SWMF provided by Minto (2015)
A6-B	90	Existing	Medium Density Residential	4.87	292	162.0	Existing townhouse units.	Aerial Photos / Site Visits
A6-C	90	Proposed	Low Density Residential	10.11	283	95.2	Proposed single family units on lands owned by Minto.	Conceptual Plans for Lands Adjacent the Kennedy-Burnett SWMF provided by land owners.
A6-D	90	Proposed	Low Density Residential	5.59	157	95.2	Proposed single family units on lands owned by Mion.	
A6-E	90	Proposed	Low Density Residential	7.24	203	95.2	Proposed single family units on lands owned by Pavic / Braovac.	
A7-A	80	Existing	Commercial	13.62	-	-	Existing large retail stores (commercial).	Aerial Photos
A7-B	80	Proposed	High Density Residential	11.01	826	135.0	Proposed high density units on lands owned by Richcraft / Trinity.	Conceptual Plans for Lands Adjacent the Kennedy-Burnett SWMF provided by land owners.
A7-C	80	Proposed	Medium Density Residential	6.97	418	162.0	Proposed Medium density units on lands owned by Mion.	
A7-D	80	Proposed	Medium Density Residential	11.74	704	162.0	Proposed Medium density units on lands owned by Caivan.	
A7-E1/E2	80	Proposed	Medium Density Residential	9.24	554	162.0	Proposed Medium density units on lands owned by Claridge.	
A8-A	80	Existing	Commercial	28.45	-	-	Existing Barrhaven Market Place (commercial).	Aerial Photos / Site Visits
A8-B	80	Proposed	High Density Residential	39.34	2951	135.0	Future development similar to Ampersands development.	Site Visits
A8-C	80	Existing	Institutional	10.52	-	-	Existing St. Joseph High School.	Aerial Photos / Site Visits
A8-D	80	Proposed	Low Density Residential	16.87	1012	162.0	Proposed 600 low density residential units.	Functional Design Report and Update – SNC Phase 2 and 3 (Dillon, 2012)

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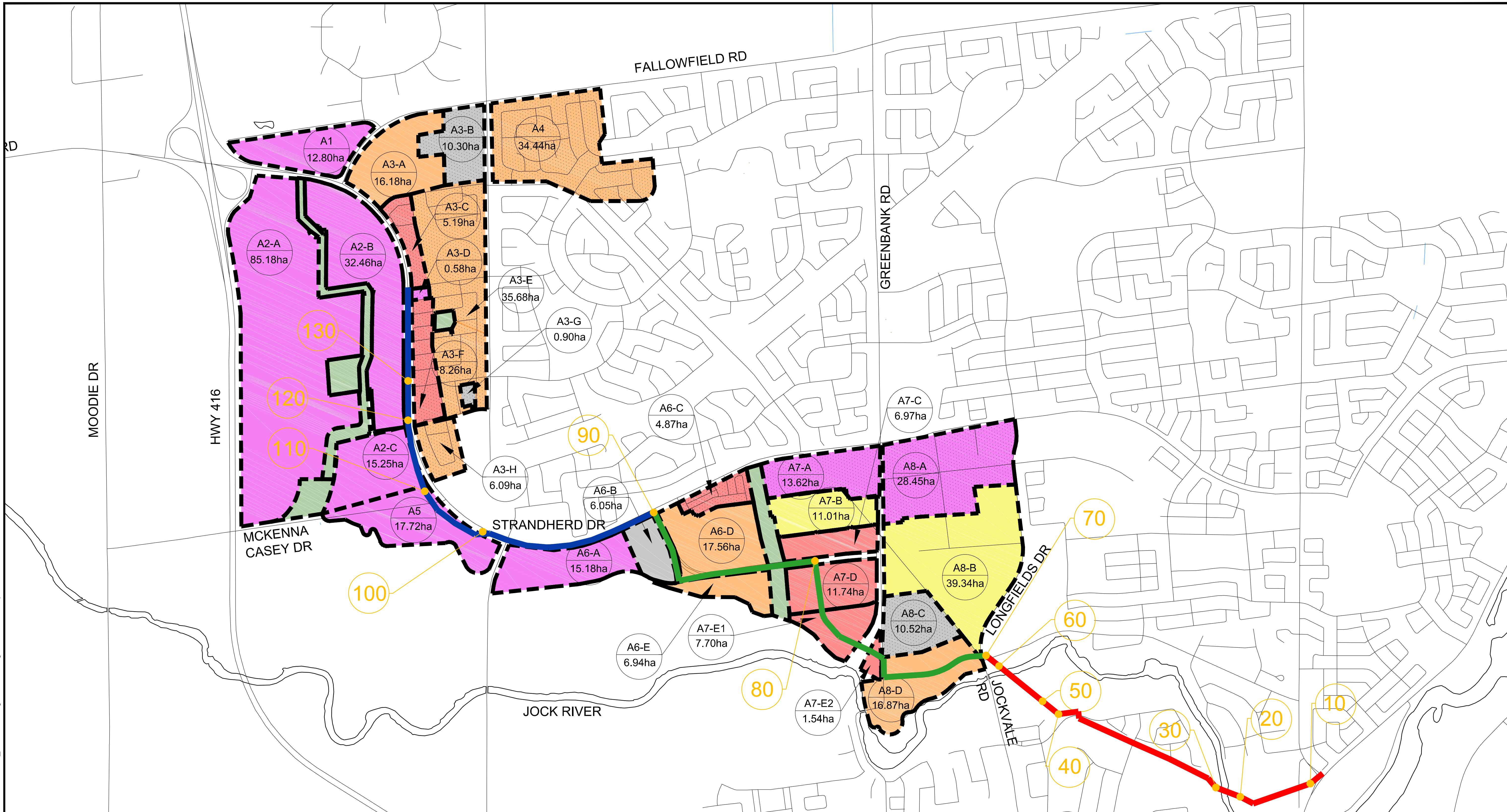

LEGEND

- EXISTING / PROPOSED HIGH DENSITY RESIDENTIAL
- EXISTING / PROPOSED MEDIUM DENSITY RESIDENTIAL
- EXISTING / PROPOSED LOW DENSITY RESIDENTIAL
- EXISTING / PROPOSED COMMERCIAL
- EXISTING / PROPOSED INSTITUTIONAL
- OTHER LANDS (OPEN SPACE, PARKS, AND SWMFS)
- SOUTH NEPEAN COLLECTOR PHASE 1
- SOUTH NEPEAN COLLECTOR PHASE 2
- SOUTH NEPEAN COLLECTOR PHASE 3
- 80 SOUTH NEPEAN COLLECTOR NODE ID

N

NOVATECH

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SOUTH NEPEAN COLLECTOR SEWER

SANITARY DRAINAGE AREAS AND LAND USE

SCALE	JOB	FIGURE
1:20 000		
DATE AUG 2015	115075	FIG. 1

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SHT11X17.DWG - 279mmX432mm

PROJECT #: 115075
DESIGNED BY: CMS
CHECKED BY: MJP
DATE: August 20, 2015

SANITARY SEWER DESIGN SHEET

South Nepean Collector - Phase 2 & 3

Theoretical Current Operational Peak Wastewater Flow

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Location			Areas				Population				Individual Design Flows			Cumulative Design Flows				
Area I.D.	Existing Land Use	Upstream Node	Gross Commercial Area (ha)	Gross Institutional Area (ha)	Gross Residential Area (ha)	Total Gross Area (ha)	Residential Popultation Density (people / ha)	Individual Residential Population	Cumulative Residential Population	Residential Peaking Factor (Harmon Eqn[1])	Commercial Peak Flow Rate[2] (17,000 L/ha/d) (L/s)	Institutional Peak Flow Rate[2] (10,000 L/ha/d) (L/s)	Infiltration / Inflow Rate (0.05 L/s/ha) (L/s)	Commercial (L/s)	Institutional (L/s)	Infiltration / Inflow (L/s)	Residential Peak Flow Rate (300 L/cap/d) (L/s)	Cumulative Peak Design Flow (L/s)
A1	Open Space	130				0.00					0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
A2-A	Open Space	130				0.00					0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
A2-B	Open Space	130				0.00					0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
A3-A	Open Space	130				0.00					0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
A3-B	Institutional	130		10.30		10.30					0.0	1.2	0.5	0.0	1.2	0.5	0.0	1.7
A3-C	Medium Density Residential	130			5.19	5.19	162.0	841	841	2.71	0.0	0.0	0.3	0.0	1.2	0.8	7.9	9.9
A3-D	Commercial	130	0.58			0.58			841	2.71	0.1	0.0	0.0	0.1	1.2	0.8	7.9	10.0
A3-E	Low Density Residential	130			35.68	35.68	95.2	3397	4238	2.39	0.0	0.0	1.8	0.1	1.2	2.6	35.1	39.0
A3-F	Medium Density Residential	130			8.26	8.26	162	1338	5576	2.32	0.0	0.0	0.4	0.1	1.2	3.0	44.9	49.2
A3-G	Institutional	130		0.90		0.90			5576	2.32	0.0	0.1	0.0	0.1	1.3	3.0	44.9	49.4
A4	Low Density Residential*	130				0.00			5576	2.32	0.0	0.0	0.0	0.1	1.3	3.0	44.9	49.4
A2-C	Snow Dump Facility	120				0.00			5576	2.32	0.0	0.0	0.0	0.1	1.3	3.0	44.9	49.4
A3-H	Low Density Residential	120			6.09	6.09	95.2	580	6155	2.30	0.0	0.0	0.3	0.1	1.3	3.4	49.1	53.8
A5	Open Space	110				0.00			6155	2.30	0.0	0.0	0.0	0.1	1.3	3.4	49.1	53.8
A6-A	Open Space	100				0.00			6155	2.30	0.0	0.0	0.0	0.1	1.3	3.4	49.1	53.8
A6-B	Open Space	100				0.00			6155	2.30	0.0	0.0	0.0	0.1	1.3	3.4	49.1	53.8
A6-C	Medium Density Residential	90			4.87	4.87	162.0	789	6944	2.27	0.0	0.0	0.2	0.1	1.3	3.6	54.6	59.6
A6-D	Open Space	90				0.00			6944	2.27	0.0	0.0	0.0	0.1	1.3	3.6	54.6	59.6
A6-E	Open Space	90				0.00			6944	2.27	0.0	0.0	0.0	0.1	1.3	3.6	54.6	59.6
A7-A	Commercial	90	13.62			13.62			6944	2.27	2.7	0.0	0.7	2.8	1.3	4.3	54.6	63.0
A7-B	Open Space	90				0.00			6944	2.27	0.0	0.0	0.0	2.8	1.3	4.3	54.6	63.0
A7-C	Open Space	90				0.00			6944	2.27	0.0	0.0	0.0	2.8	1.3	4.3	54.6	63.0
A7-D	Open Space	90				0.00			6944	2.27	0.0	0.0	0.0	2.8	1.3	4.3	54.6	63.0
A7-E1/E2	Open Space	90				0.00			6944	2.27	0.0	0.0	0.0	2.8	1.3	4.3	54.6	63.0
A8-A	Commercial	80	28.45			28.45			6944	2.27	5.6	0.0	1.4	8.4	1.3	5.7	54.6	70.0
A8-B	Open Space	80				0.00			6944	2.27	0.0	0.0	0.0	8.4	1.3	5.7	54.6	70.0
A8-C	Institutional	80		10.52		10.52			6944	2.27	0.0	1.2	0.5	8.4	2.5	6.2	54.6	71.8
A8-D	Open Space	80				0.00			6944	2.27	0.0	0.0	0.0	8.4	2.5	6.2	54.6	71.8
ROW Along SNC Sewer Alignment	-	80				14.34			6944	2.27	0.0	0.0	0.7	8.4	2.5	6.9	54.6	72.5
TOTAL		***80***	***42.65***	***21.72***	***60.09***	***138.80***	***-***	***6944***	***6944***	***2.27***	***8.4***	***2.5***	***6.9***	***8.4***	***2.5***	***6.9***	***54.6***	***72.5***

Residential Land Use	Population Density (Units / ha)	Persons per Unit	Persons per ha
Low Density (singles and semis)	26 – 28 (28 used)	2.7 – 3.4 (3.4 used)	95.2
Medium Density (row/townhouse)	50 – 60 (60 used)	2.7	162.0
High Density (apartments)	60 – 75 (75 used)	1.8	135.0

Notes:

1. Harmon Equation = 1 + [14 / (4+(P/1000)$^{1/2}$)] x K

Where: P = population; K = correction factor = 0.6

2. Instituional / Commercial Peaking Factor = 1.0

Reported Design Flows / Assumptions:

1. Area A4: Existing single family units currently serviced by Jockvale pump station; currently not directed to SNC

PROJECT #: 115075
DESIGNED BY: CMS
CHECKED BY: MJP
DATE: August 20, 2015

SANITARY SEWER DESIGN SHEET

South Nepean Collector - Phase 2 & 3

Theoretical Future Full Service Peak Wastewater Flow

NOVATECH
Engineers, Planners & Landscape Architects

Location			Areas				Population				Individual Design Flows			Cumulative Design Flows				
Area I.D.	Existing / Proposed Land Use	Upstream Node	Gross Commercial Area (ha)	Gross Institutional Area (ha)	Gross Residential Area (ha)	Total Gross Area (ha)	Residential Popultation Density (people / ha)	Individual Residential Population	Cumulative Residential Population	Residential Peaking Factor (Harmon Eqn[1])	Commercial Peak Flow Rate[2] (50,000 L/ha/d) (L/s)	Institutional Peak Flow Rate[2] (50,000 L/ha/d) (L/s)	Infiltration / Inflow Rate (0.28 L/s/ha) (L/s)	Commercial (L/s)	Institutional (L/s)	Infiltration / Inflow (L/s)	Residential Peak Flow Rate (350 L/cap/d) (L/s)	Cumulative Peak Design Flow (L/s)
A1	Commercial	130	12.80			12.80					11.1	0.0	3.6	11.1	0.0	3.6	0.0	14.7
A2-A	Commercial	130	85.18			85.18					73.9	0.0	23.9	85.1	0.0	27.4	0.0	112.5
A2-B	Commercial	130	32.46			32.46					28.2	0.0	9.1	113.2	0.0	36.5	0.0	149.8
A3-A	Low Density Residential	130			16.18	16.18	95.2	1540	1540	3.67	0.0	0.0	4.5	113.2	0.0	41.1	22.9	177.2
A3-B	Institutional	130		10.30		10.30			1540	3.67	0.0	8.9	2.9	113.2	8.9	43.9	22.9	189.0
A3-C	Medium Density Residential	130			5.19	5.19	162.0	841	2381	3.53	0.0	0.0	1.5	113.2	8.9	45.4	34.0	201.6
A3-D	Commercial	130	0.58			0.58			2381	3.53	0.5	0.0	0.2	113.7	8.9	45.6	34.0	202.2
A3-E	Low Density Residential	130			35.68	35.68	95.2	3397	5778	3.19	0.0	0.0	10.0	113.7	8.9	55.5	74.6	252.8
A3-F	Medium Density Residential	130			8.26	8.26	162	1338	7116	3.10	0.0	0.0	2.3	113.7	8.9	57.9	89.4	269.9
A3-G	Institutional	130		0.90		0.90			7116	3.10	0.0	0.8	0.3	113.7	9.7	58.1	89.4	270.9
A4	Low Density Residential	130			34.44	34.44	95.2	3279	10395	2.94	0.0	0.0	9.6	113.7	9.7	67.8	123.7	314.9
A2-C	Commercial (ex. snow dump)	120	15.25			15.25			10395	2.94	13.2	0.0	4.3	127.0	9.7	72.0	123.7	332.4
A3-H	Low Density Residential	120			6.09	6.09	95.2	580	10974	2.91	0.0	0.0	1.7	127.0	9.7	73.7	129.6	340.0
A5	Commercial	110	17.72			17.72			10974	2.91	15.4	0.0	5.0	142.4	9.7	78.7	129.6	360.3
A6-A	Commercial	100	15.18			15.18			10974	2.91	13.2	0.0	4.3	155.5	9.7	82.9	129.6	377.8
A6-B	Institutional	100		6.05		6.05			10974	2.91	0.0	5.3	1.7	155.5	15.0	84.6	129.6	384.7
A6-C	Medium Density Residential	90			4.87	4.87	162.0	789	11763	2.88	0.0	0.0	1.4	155.5	15.0	86.0	137.4	393.9
A6-D	Low Density Residential	90			17.56	17.56	95.2	1672	13435	2.83	0.0	0.0	4.9	155.5	15.0	90.9	153.8	415.2
A6-E	Low Density Residential	90			6.94	6.94	95.2	661	14096	2.81	0.0	0.0	1.9	155.5	15.0	92.9	160.2	423.6
A7-A	Commercial	90	13.62			13.62			14096	2.81	11.8	0.0	3.8	167.4	15.0	96.7	160.2	439.2
A7-B	High Density Residential	90			11.01	11.01	135.0	1486	15582	2.76	0.0	0.0	3.1	167.4	15.0	99.8	174.3	456.4
A7-C	Medium Density Residential	90			6.97	6.97	162.0	1129	16711	2.73	0.0	0.0	2.0	167.4	15.0	101.7	184.9	468.9
A7-D	Medium Density Residential	90			11.74	11.74	162.0	1902	18613	2.68	0.0	0.0	3.3	167.4	15.0	105.0	202.4	489.7
A7-E1/E2	Medium Density Residential	90			9.24	9.24	162.0	1497	20110	2.65	0.0	0.0	2.6	167.4	15.0	107.6	215.9	505.8
A8-A	Commercial	80	28.45			28.45			20110	2.65	24.7	0.0	8.0	192.0	15.0	115.5	215.9	538.5
A8-B	High Density Residential	80			39.34	39.34	135.0	5311	25421	2.55	0.0	0.0	11.0	192.0	15.0	126.6	262.4	596.0
A8-C	Institutional	80		10.52		10.52			25421	2.55	0.0	9.1	2.9	192.0	24.1	129.5	262.4	608.1
A8-D	Low Density Residential	80			16.87	16.87	120.9	2040	27461	2.52	0.0	0.0	4.7	192.0	24.1	134.2	279.8	630.2
ROW Along SNC Sewer Alignment	-	80				14.34			27461	2.52	0.0	0.0	4.0	192.0	24.1	138.2	279.8	634.2
TOTAL		***80***	***221.24***	***27.77***	***230.38***	***493.73***	***-***	***27461***	***27461***	***2.52***	***192.0***	***24.1***	***134.2***	***192.0***	***24.1***	***138.2***	***279.8***	***634.2***

Residential Land Use	Population Density (Units / ha)	Persons per Unit	Persons per ha
Low Density (singles and semis)	26 – 28 (28 used)	2.7 – 3.4 (3.4 used)	95.2
Medium Density (row/townhouse)	50 – 60 (60 used)	2.7	162.0
High Density (apartments)	60 – 75 (75 used)	1.8	135.0

Notes:

1. Harmon Equation = $1 + [14 / (4+(P/1000)^{1/2})] \times K$

Where: P = population; K = correction factor = 1.0

2. Instituional / Commercial Peaking Factor = 1.5

Reported Design Flows / Assumptions:

1. Area A4: Existing single family units currently serviced by Jockvale pump station to be redirected to SNC

2. Area A8-D: proposed 600 medium density residential units

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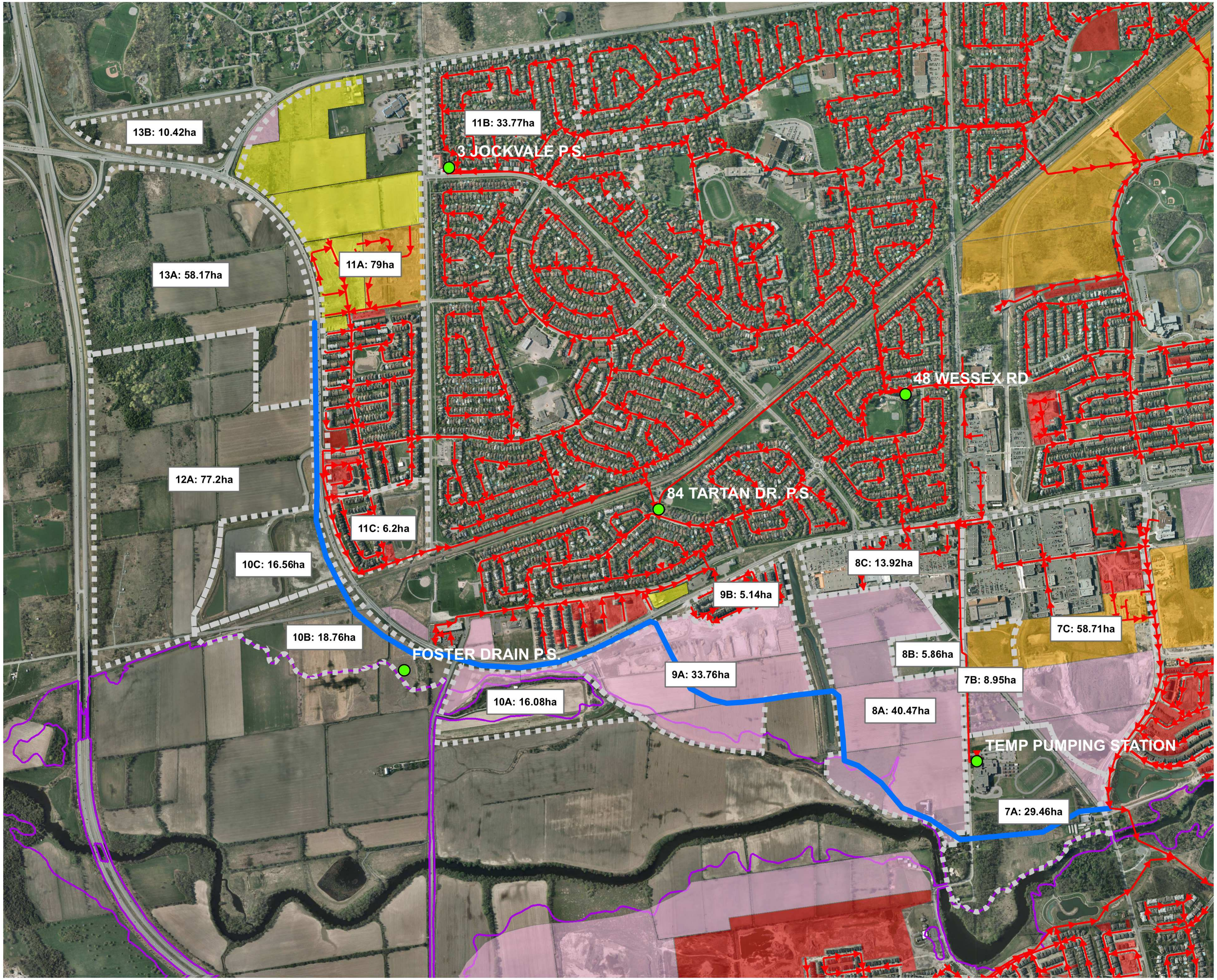
Ottawa

City of Ottawa
South Nepean Collector

Figure 01
Existing Sanitary Network and Collection Areas



- Pump Station
- Existing Sanitary Main (With Flow Direction)
- Proposed Alignment for South Nepean Collector
- Collection Area

DEVELOPMENT STATUS

- Registered
- Draft Approved
- Pending
- No Plan
- Floodplain

NOT TO SCALE

MAP DRAWING INFORMATION:
DATA PROVIDED BY THE CITY OF OTTAWA

MAP CREATED BY: BC
MAP CHECKED BY: MBM
MAP PROJECTION: NO PROJECTION

FILE LOCATION: \\Dillon.ca\dillon_dfs\Ottawa\Ottawa CA\CAD\2011\115681\Design_GIS\MXD\Figure01c_ExistingSanitaryNetwork.mxd

DILLON CONSULTING

PROJECT: 11-5681
STATUS: FINAL
DATE: 18/07/12

Table 5.1: Allocation of Commercial/Institutional and Residential Demands to SNC by Collection Area

Collection Area	Discharging Node	Estimated from GIS			City of Ottawa VURL Data			Other Space [1] (ha)	Population (PE)	Residential Density (PE/net ha)	Comments	Additional Source(s)
		Gross Institutional/Commercial (ha)	Gross Residential (ha)	Gross Area (ha)	Net Residential (ha)	Units (#)	Unit Density (#/ha)					
7A	70	13.5	7.4	29.5	4.0	605	0.3	9.1	1637	4.25	Flow calculations include St Joseph H.S. Pump Station firm capacity of 7.0 L/s Additional 600 units (TAC)	3.4ppu (TAC)
7B		0.0	9.24	9.24	6.23	1474	136.7	3.0	3321	638.8	Population from split VURL allocated by area. VURL parcel id 323 - inconsistency between net and gross reported area.	2.7ppu (TAC)
8A		0.0	40.0	40.0	24.1	4462	185.1	15.9	12047.4	499.9		2.7ppu (TAC)
8B		5.9	0.0	5.9	0.0	0	0	0.0			Future Commercial area	
8C		13.9	0.0	13.9	0.0	0	0	0.0			Commercial area includes Home Depot	
9A	80	0.0	33.8	33.8	18.6	635	34.1	15.2	2210	116.2		3.4ppu (TAC)
10A	90	0.0	16.1	16.1	9.7	451	28.0	6.4	1533.4	158.0	Assume net population = 60% gross.	3.4ppu (TAC)
10B	100	18.8	0.0	35.3	0.0	0	0	16.5			Allocated as potential future I/C use as directed by TAC	
10C	110	16.6	0.0	35.3	0.0	0	0	18.7			Area includes current Municipal Snow Dump. Flow allowance is made for potential future I/C use	
11C		0.0	6.2	6.2	Note 2			2.5	306	82.7	This area is south of '11 block' in the existing development	From IBI Apr 2010 Report Figure 1
11A	120	12.5	66.5	79.0				26.6	3923	98.3	Institutional includes 4.38ha church site and 6.89 ha institution at northeast corner, as well and Claridge Commercial (0.56ha) and DCR/Phoenix Commercial (0.64ha)	From IBI Apr2010 Report Figure 1
11B		0.0	37.0	37.0				14.8	1550	69.8	Presently serviced by Jockvale pump station; to be redirected to SNC.	Estimated from 2011 Census Block data
12A		77.2	0.0	77.2				0.0			Allow sanitary peak flow 79.0 L/s	Novatech, Employment Lands Report, Revised Jan 2012
13A	130	58.5	0.0	58.5				0.0			Allow sanitary peak flow 62.8 L/s plus Collection Area 13B, total 82.2 L/s	
13B		12.5	0.0	12.5				0.0			Allow sanitary peak flow 19.4 L/s; gravity discharge to Collection Area 13A	IBI/Novatech

Notes:
1. Other space includes other residential space accounting for the difference between gross area (measured with GIS) and net area (provided in VURL data), such as sidewalks, roads, greenspace, etc.
2. Collection Area 11A and 11B population and land use as identified under Additional Source(s). Other space reported as 60% of gross residential area, consistent with VURL average.

CITY OF OTTAWA

SOUTH NEPEAN COLLECTOR SEWER

SANITARY SEWER DESIGN SHEET - Operational Service (Average Flow Design Parameters)

TRIBUTARY AREA		LOCATION		AREA (ha)							INDIVIDUAL		CUMULATIVE		RESIDENTIAL		COMMERCIAL & INSTITUTION			INFIL. INFLOW	PEAK DESIGN
	Design Factors	FROM	TO	Gross ICI	Net ICI	Other ICI space (Green, Sidewalks, roads)	Gross RESIDENTIAL Area	Net Residential Area	Other Res (Green, Sidewalks, roads)	TOTAL AREA (Gross ICI plus Gross Residential)	POP	DENSITY (po./ha.)	POP	AREA (ha.)	PEAKING FACTOR	RESIDENT. FLOW (L/s)	PEAKING FACTOR	CUM. AREA	I.C.I. FLOW (l/s)	Q(p) (L/s)	FLOW Q(d) (L/s)
13A	1			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0		0	0.0	4.50	0.00	1.00	0.00	0.00	0.00	0.00
13B	1		Node 130	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0		0	0.0	4.50	0.00	1.00	0.00	0.00	0.00	0.00
12A	1	Node 130		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0		0	0.0	4.50	0.00	1.00	0.00	0.00	0.00	0.00
11A	1			12.5	9.4	3.1	66.5	8.0	58.5	79.0	1196	148.76	1196	79.0	3.75	15.57	1.00	12.50	2.00	3.95	21.52
11B	1		Node 120	0.0	0.0	0.0	37.0	22.2	14.8	37.0	1550	69.82	2746	116.0	3.47	33.13	1.00	12.50	2.00	5.80	40.93
11C	1	Node 120		0.0	0.0	0.0	6.2	3.7	2.5	6.2	306	82.26	3052	122.2	3.44	36.41	1.00	12.50	2.00	6.11	44.52
10C	1		Node 110	16.6	12.5	4.2	0.0	0.0	0.0	16.6	0		3052	138.8	3.44	36.41	1.00	29.10	4.66	6.94	48.01
10B	1	Node 110	Node 100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0		3052	138.8	3.44	36.41	1.00	29.10	4.66	6.94	48.01
10A	1	Node 100	Node 90	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0		3052	138.8	3.44	36.41	1.00	29.10	4.66	6.94	48.01
9A	1	Node 90	Node 80	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0		3052	138.8	3.44	36.41	1.00	29.10	4.66	6.94	48.01
8A	1	Node 80		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0		3052	138.8	3.44	36.41	1.00	29.10	4.66	6.94	48.01
8B	1			5.9	4.4	1.5	0.0	0.0	0.0	5.9	0		3052	144.7	3.44	36.41	1.00	35.00	5.60	7.24	49.25
8C	1			13.9	10.4	3.5	0.0	0.0	0.0	13.9	0		3052	158.6	3.44	36.41	1.00	48.90	7.82	7.93	52.17
7A	1			13.5	10.1	3.4	16.0	1.4	14.6	29.5	17	12.14	3069	188.1	3.43	36.59	1.00	62.40	9.98	9.41	55.93
7B	1		Node 70	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0		3069	188.1	3.43	36.59	1.00	62.40	9.98	9.41	55.93
										188.1											

TRIBUTARY AREA	PROPOSED SEWER											OPERATIONAL DESIGN	
	LENGTH (m)	GROUND ELEVATION (m)	DEPTH OF COVER (m)	PIPE SIZE (m)	INVERT 1 (m)	INVERT 2 (m)	PIPE TYPE	GRADE	CAPACITY (L/s)	Q(d)/Q(c)	VELOCITY at capacity (m/s)	DEPTH (m)	VELOCITY (m/s)
13A													
13B		95.14	5.43	0.750		88.96							
12A													
11A													
11B	531.89	93.60	4.42	0.750	88.96	88.43	Conc.	0.10%	353.24	0.13	0.80	0.20	0.58
11C													
10C	497.82	93.44	4.76	0.750	88.43	87.93	Conc.	0.10%	353.24	0.14	0.80	0.20	0.58
10B	603.17	93.03	4.95	0.750	87.93	87.33	Conc.	0.10%	353.24	0.14	0.80	0.20	0.58
10A	430.49	93.75	6.03	0.825	87.33	86.90	Conc.	0.10%	455.17	0.11	0.85	0.21	0.61
9A	1268.65	92.37	5.84	0.900	86.90	85.63	Conc.	0.10%	573.71	0.08	0.90	0.18	0.56
8A													
8B													
8C													
7A													
7B	1448.98	91.24	6.01	1.050	85.63	84.18	Conc.	0.10%	864.51	0.06	1.00	0.18	0.56

DEFAULTS

q=AVERAGE DAILY FLOW	300	L/CAP.D
I=UNIT OF PEAK EXTR.FLOW	0.050	L/Ha.s
Mannings 'n'	0.013	
q=AVERAGE COMMERCIAL AND INSTITUTIONAL	0.16	L/Ha.s

DESIGN	DJG
CHECKED	
TODAY:	7/18/2012

DILLON CONSULTING

Project 11-5681

CITY OF OTTAWA

SOUTH NEPEAN COLLECTOR SEWER

SANITARY SEWER DESIGN SHEET - Full Service (Peak Flow Design Parameters)

TRIBUTARY AREA		LOCATION		AREA (ha)							INDIVIDUAL		CUMULATIVE		RESIDENTIAL		COMMERCIAL & INSTITUTION			INFIL. INFLOW	PEAK DESIGN
	Design Factors	FROM	TO	Gross ICI	Net ICI	Other ICI space (Green, Sidewalks, roads)	Gross RESIDENTIAL Area	Net Residential Area	Other Res (Sidewalks, roads)	TOTAL AREA (Gross ICI plus Gross Residential)	POP	DENSITY	POP	Total I/C and Res AREA	PEAKING FACTOR	RESIDENT. FLOW	PEAKING FACTOR	I/C CUM. AREA	I/C FLOW (l/s)	Q(p)	FLOW Q(d)
												(pers/net ha.)		(ha.)		(L/s)				(L/s)	(L/s)
13A	1			58.5	43.9	14.6	0.0	0.0	0.0	58.5	0		0	58.5	4.50	0.00	1.50	58.50	50.90	16.38	67.28
13B	1		Node 130	12.5	9.4	3.1	0.0	0.0	0.0	12.5	0		0	71.0	4.50	0.00	1.50	71.00	61.77	19.88	81.65
12A	1	Node 130		77.2	57.9	19.3	0.0	0.0	0.0	77.2	0		0	148.2	4.50	0.00	1.50	148.20	128.93	41.50	170.43
11A	1			12.5	9.4	3.1	66.5	39.9	26.6	79.0	3923	98.32	3923	227.2	3.34	53.09	1.50	160.70	139.81	63.62	256.52
11B	1		Node 120	0.0	0.0	0.0	37.0	22.2	14.8	37.0	1550	69.82	5473	264.2	3.21	71.13	1.50	160.70	139.81	73.98	284.92
11C		Node 120		0.0	0.0	0.0	6.2	3.7	2.5	6.2	306	82.26	5779	270.4	3.19	74.59	1.50	160.70	139.81	75.71	290.11
10C	1		Node 110	16.6	12.5	4.2	0.0	0.0	0.0	16.6	0		5779	287.0	3.19	74.59	1.50	177.30	154.25	80.36	309.20
10B	1	Node 110	Node 100	18.8	14.1	4.7	0.0	0.0	0.0	18.8	0		5779	305.8	3.19	74.59	1.50	196.10	170.61	85.62	330.82
10A	1	Node 100	Node 90	0.0	0.0	0.0	16.1	9.7	6.4	16.1	1533	158.04	7312	321.9	3.09	91.48	1.50	196.10	170.61	90.13	352.22
9A	1	Node 90	Node 80	0.0	0.0	0.0	33.8	18.6	15.2	33.8	2161	116.18	9473	355.7	2.98	114.28	1.50	196.10	170.61	99.60	384.48
8A	1	Node 80		0.0	0.0	0.0	40.0	24.1	15.9	40.0	12047	499.88	21520	395.7	2.62	228.45	1.50	196.10	170.61	110.80	509.85
8B	1			5.9	4.4	1.5	0.0	0.0	0.0	5.9	0		21520	401.6	2.62	228.45	1.50	202.00	175.74	112.45	516.64
8C	1			13.9	10.4	3.5	0.0	0.0	0.0	13.9	0		21520	415.5	2.62	228.45	1.50	215.90	187.83	116.34	532.62
7A	1			13.5	10.1	3.4	16.5	5.2	11.3	30.0	1637	314.81	23157	445.5	2.59	242.84	1.50	229.40	199.58	124.74	567.16
7B	1		Node 70	0.0	0.0	0.0	9.2	6.2	3.0	9.2	3980	638.84	27137	454.7	2.52	277.05	1.50	229.40	199.58	127.32	603.94
							225.3	129.7		454.7	27,137.0										

TRIBUTARY AREA							PROPOSED SEWER					PEAK DESIGN	
	LENGTH	GROUND ELEVATION	DEPTH OF COVER	PIPE SIZE	INVERT 1	INVERT 2	PIPE TYPE	GRADE	CAPACITY	Q(d)/Q(c)	VELOCITY at capacity	DEPTH	VELOCITY
	(m)	(m)	(m)	(m)	(m)	(m)			(L/s)		(m/s)	(m)	(m/s)
13A													
13B		95.14	5.43	0.750		88.96							
12A													
11A													
11B	531.89	93.60	4.42	0.750	88.96	88.43	Conc.	0.10%	353.24	0.81	0.80	0.53	0.90
11C													
10C	497.82	93.44	4.76	0.750	88.43	87.93	Conc.	0.10%	353.24	0.88	0.80	0.55	0.91
10B	603.17	93.03	4.95	0.750	87.93	87.33	Conc.	0.10%	353.24	0.94	0.80	0.58	0.92
10A	430.49	93.75	6.03	0.825	87.33	86.90	Conc.	0.10%	455.17	0.77	0.85	0.55	0.95
9A	1268.65	92.37	5.84	0.900	86.90	85.63	Conc.	0.10%	573.71	0.67	0.90	0.55	0.97
8A													
8B													
8C													
7A													
7B	1448.98	91.24	6.01	1.050	85.63	84.18	Conc.	0.10%	864.51	0.70	1.00	0.64	1.07
	4,781.0												

DEFAULTS

q=AVERAGE DAILY FLOW	350	L/CAP.D
I=UNIT OF PEAK EXTR.FLOW	0.280	L/Ha.s
Mannings 'n'	0.013	
q=AVERAGE COMMERCIAL AND INSTITUTIONAL	0.58	L/Ha.s

DESIGN: DJG
CHECKED:
TODAY: 7/18/2012

DILLON CONSULTING

Project 11-5681

021019-design-v3.xls | Full Service-Manotick

CITY OF OTTAWA
JOCK RIVER COLLECTOR SEWER
SANITARY SEWER DESIGN SHEET - Full Service (Including Manotick)

Sheet 1 of 1

DESCRIPTION	Design Factors	LOCATION FROM	TO	AREA (ha) COM & INSTITUTION	INDUSTRIAL	RESIDENTIAL	GREEN SPACE	TOTAL AREA	INDIVIDUAL POP	DENSITY (po./ha.)	CUMULATIVE RESIDENTIAL POP	AREA (ha.)	PEAKING FACTOR	RESIDENT. FLOW (L/s)	COMMERCIAL & INSTITUTION PEAKING FACTOR	CUM. AREA	I.C.I. FLOW (l/s)	INFIL. INFLOW Q(p) (L/s)	PEAK DESIGN FLOW Q(d) (L/s)
Jockvale PS	1	PS	Node 130	0		36.7		36.7	1530	41.69	1,530.0	36.7	3.673	22.767	1.50	0.00	0	10.276	33.043
Area 1	1	Node 130	Node 120	142.2		65.57		207.8	3430	52.31	4,960.0	244.5	3.248	65.265	1.50	142.20	123.714	68.452	257.431
Area 2	1	Node 120	Node 110	25.4		7.1		32.5	380	53.52	5,340.0	277.0	3.218	69.620	1.50	167.60	145.812	77.552	292.984
Area 3	1	Node 110	Node 100	13.7		0	4.9	18.6			5,340.0	295.6	3.218	69.620	1.50	181.30	157.731	82.760	310.111
Area 4	1	Node 100	Node 90	7.7		21.7	1.4	30.8	980	45.16	6,320.0	326.4	3.149	80.626	1.50	189.00	164.43	91.384	336.440
Area 5	1	Node 90	Node 80	4.5		42.2	9.3	56.0	1800	42.65	8,120.0	382.4	3.044	100.125	1.50	193.50	168.345	107.064	375.534
Area 6	1	Node 80	Node 70	46.8		51	13.1	110.9	4600	90.20	12,720.0	493.3	2.850	146.867	1.50	240.30	209.061	138.116	494.044
Area 7	1	Node 70	Node 60	16		123.9	10.1	150.0	8780	70.86	21,500.0	643.3	2.621	228.273	1.50	256.30	222.981	180.116	631.370
Crossing	1	Node 60	Node 50					0.0			21,500.0	643.3	2.621	228.273	1.50	256.30	222.981	180.116	631.370
Area 8	1	Node 50	Node 40	20		306.0	34	360.0	25000	81.70	46,500.0	1,003.3	2.294	432.118	1.50	276.30	240.381	280.916	953.415
Area 9	1	Node 40	Node 30	12.9		192.4	7.7	213.0	12390	64.40	58,890.0	1,216.3	2.199	524.650	1.50	289.20	251.604	340.556	1,116.810
Manotick	1		Node 30	35.7		571		606.7	8535	14.95	67,425.0	1,823.0	2.146	586.276	1.50	324.90	282.663	510.432	1,379.371
Syphon	1	Node 30	Node 20	0		0	0	0.0	0		67,425.0	1,823.0	2.146	586.276	1.50	324.90	282.663	510.432	1,379.371
Area 10	1	Node 20	Node 10			52.8	14.7	67.5	600	11.36	68,025.0	1,890.5	2.143	590.553	1.50	324.90	282.663	529.332	1,402.548

DESCRIPTION	LENGTH (m)	PIPE SIZE (m)	INVERT 1 (m)	INVERT 2 (m)	PROPOSED SEWER PIPE TYPE	GRADE	CAPACITY (L/s)	Q(p)/Q(c)	VELOCITY (m/s)	PEAK DESIGN DEPTH (m)	VELOCITY (m/s)
Jockvale PS											
Area 1	102.23	0.750	89.000	88.898	Conc.	0.10%	353.24	0.73	0.80	-	0.51
Area 2	246.80	0.750	88.898	88.651	Conc.	0.10%	353.24	0.83	0.80	-	0.56
Area 3	330.40	0.750	88.651	88.321		0.10%	353.24	0.88	0.80		
Area 4	1,022.50	0.750	88.321	87.298	Conc.	0.10%	353.24	0.95	0.80	-	0.80
Area 5	935.59	0.825	87.298	86.362	Conc.	0.10%	455.17	0.83	0.85	-	0.60
Area 6	1,424.25	0.900	86.362	84.938		0.10%	573.71	0.86	0.90		
Area 7	79.41	1.050	84.938	84.859	Conc.	0.10%	864.51	0.73	1.00	-	0.64
Crossing	79.41	1.050	83.400	83.321	Conc.	0.10%	864.51	0.73	1.00	-	0.64
Area 8	152.76	1.200	83.321	83.168	Conc.	0.10%	1,233.19	0.77	1.09	-	0.73
Area 9	978.95	1.200	83.168	82.189	Conc.	0.10%	1,233.19	0.91	1.09	-	0.85
Manotick											
Syphon	978.95	1.350	82.189	81.300	Conc.	0.10%	1,686.93	0.82	1.18	-	0.82
Area 10	482.92	1.350	81.300	80.817	Conc.	0.10%	1,686.93	0.83	1.18	-	0.82

DEFAULTS

q=AVERAGE DAILY FLOW	350	L/CAP.D
I=UNIT OF PEAK EXTR.FLOW	0.280	L/Ha.S
Mannings 'n'	0.013	
q=AVERAGE COMMERCIAL AND INSTITUTIONAL	0.58	L/Ha.S

DESIGN	CJR
CHECKED	21-JAN. 03
TODAY:	10/28/2003

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Project 02-1019

021019-design-v3.xls | operational-Manotick

CITY OF OTTAWA
JOCK RIVER COLLECTOR SEWER
SANITARY SEWER DESIGN SHEET - Full Service Operational Flows

Sheet 1 of 1

DESCRIPTION	Design Factors	LOCATION FROM	TO	AREA (ha) COM & INSTITUTION	INDUSTRIAL	RESIDENTIAL	GREEN SPACE	TOTAL AREA	INDIVIDUAL POP	DENSITY (po./ha.)	CUMULATIVE RESIDENTIAL POP	AREA (ha.)	PEAKING FACTOR	RESIDENT. FLOW (L/s)	COMMERCIAL & INSTITUTION PEAKING FACTOR	CUM. AREA	I.C.I. FLOW (l/s)	INFIL. INFLOW Q(p) (L/s)	PEAK DESIGN FLOW Q(d) (L/s)
Jockvale PS	1	PS	Node 130	0		36.7		36.7	1530	41.69	1,530.0	36.7	2.604	13.834	1.00	0.00	0	1.835	15.669
Area 1	1	Node 130	Node 120	142.2		65.57		207.8	3430	52.31	4,960.0	244.5	2.349	40.454	1.00	142.20	22.21875	12.224	74.896
Area 2	1	Node 120	Node 110	25.4		7.1		32.5	380	53.52	5,340.0	277.0	2.331	43.221	1.00	167.60	26.1875	13.849	83.257
Area 3	1	Node 110	Node 100	13.7		0	4.9	18.6			5,340.0	295.6	2.331	43.221	1.00	181.30	28.32813	14.779	86.328
Area 4	1	Node 100	Node 90	7.7		21.7	1.4	30.8	980	45.16	6,320.0	326.4	2.290	50.243	1.00	189.00	29.53125	16.319	96.092
Area 5	1	Node 90	Node 80	4.5		42.2	9.3	56.0	1800	42.65	8,120.0	382.4	2.226	62.771	1.00	193.50	30.23438	19.119	112.124
Area 6	1	Node 80	Node 70	46.8		51	13.1	110.9	4600	90.20	12,720.0	493.3	2.110	93.199	1.00	240.30	37.54688	24.664	155.409
Area 7	1	Node 70	Node 60	16		123.9	10.1	150.0	8780	70.86	21,500.0	643.3	1.973	147.259	1.00	256.30	40.04688	32.164	219.469
Crossing	1	Node 60	Node 50					0.0			21,500.0	643.3	1.973	147.259	1.00	256.30	40.04688	32.164	219.469
Area 8	1	Node 50	Node 40	20		306.0	34	360.0	25000	81.70	46,500.0	1,003.3	1.776	286.815	1.00	276.30	43.17188	50.164	380.151
Area 9	1	Node 40	Node 30	12.9		192.4	7.7	213.0	12390	64.40	58,890.0	1,216.3	1.720	351.612	1.00	289.20	45.1875	60.814	457.613
Manotick	1		Node 30	35.7		571		606.7	8535	14.95	67,425.0	1,823.0	1.688	395.159	1.00	324.90	50.76563	91.149	537.074
Syphon	1	Node 30	Node 20	0		0	0	0.0	0		67,425.0	1,823.0	1.688	395.159	1.00	324.90	50.76563	91.149	537.074
Area 10	1	Node 20	Node 10			52.8	14.7	67.5	600	11.36	68,025.0	1,890.5	1.686	398.192	1.00	324.90	50.766	94.524	543.481
								1890.5											

DESCRIPTION	LENGTH (m)	PIPE SIZE (m)	INVERT 1 (m)	INVERT 2 (m)	PROPOSED SEWER PIPE TYPE	GRADE	CAPACITY (L/s)	Q(p)/Q(c)	PEAK DESIGN VELOCITY (m/s)	DEPTH (m)	VELOCITY (m/s)
Jockvale PS											
Area 1	102.23	0.750	89.000	88.898	Conc.	0.10%	353.24	0.21	0.80	-	0.27
Area 2	246.80	0.750	88.898	88.651	Conc.	0.10%	353.24	0.24	0.80	-	0.27
Area 3	330.40	0.750	88.651	88.321		0.10%	353.24	0.24	0.80		
Area 4	1,022.50	0.750	88.321	87.298	Conc.	0.10%	353.24	0.27	0.80	-	0.30
Area 5	935.59	0.825	87.298	86.362	Conc.	0.10%	455.17	0.25	0.85	-	0.29
Area 6	1,424.25	0.900	86.362	84.938		0.10%	573.71	0.27	0.90		
Area 7	79.41	1.050	84.938	84.859	Conc.	0.10%	864.51	0.25	1.00	-	0.37
Crossing	79.41	1.050	83.400	83.321	Conc.	0.10%	864.51	0.25	1.00	-	0.37
Area 8	152.76	1.200	83.321	83.168	Conc.	0.10%	1,233.19	0.31	1.09	-	0.45
Area 9	978.95	1.200	83.168	82.189	Conc.	0.10%	1,233.19	0.37	1.09	-	0.48
Manotick											
Syphon	978.95	1.200	82.189	81.300	Conc.	0.10%	1,233.19	0.44	1.09	-	0.51
Area 10	482.92	1.350	81.300	80.817	Conc.	0.10%	1,686.93	0.32	1.18	-	0.48

DEFAULTS

q=AVERAGE DAILY FLOW	300	L/CAP.D
I=UNIT OF PEAK EXTR.FLOW	0.050	L/Ha.S
Mannings 'n'	0.013	
q=AVERAGE COMMERCIAL AND INSTITUTIONAL	0.16	L/Ha.S

DILLON CONSULTING

DESIGN	CJR	
CHECKED	21-JAN. 03	
TODAY:	10/28/2003	

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Project 02-1019

APPENDIX D

SANITARY SEWER CALCULATION SHEET

85 people/Ha

100 people/Ha

Ottawa

Manning's n=0.013

LOCATION: STREET	LOCATION: FROM M.H.	LOCATION: TO M.H.	RESIDENTIAL: AREA (ha)	RESIDENTIAL: POP.	CUMULATIVE AREA (ha)	CUMULATIVE POP.	PEAK FACT.	PEAK FLOW (l/s)	COMM AREA (ha)	COMM ACCU. AREA (ha)	INSTIT AREA (ha)	INSTIT ACCU. AREA (ha)	PARK AREA (ha)	PARK ACCU. AREA (ha)	C+I+I PEAK FLOW (l/s)	INFILTRATION TOTAL AREA (ha)	INFILTRATION ACCU. AREA (ha)	INFILT. FLOW (l/s)	TOTAL FLOW (l/s)	PIPE DIST (m)	PIPE DIA (mm)	PIPE SLOPE (%)	PIPE CAP. (FULL) (l/s)	RATIO Q act/Q cap	VEL. (FULL) (m/s)	VEL. (ACT.) (m/s)
Trunk 1			0.78	78	0.78	78										0.78	0.78									
	101A	102A	0.43	37	1.21	115	4.00	1.86								0.43	1.21	0.339	2.20	66.0	250	0.25	29.73	0.07	0.61	0.35
	102A	103A	0.08		1.29	115	4.00	1.86					0.52	0.52	0.08	0.60	1.81	0.507	2.45	59.5	250	0.25	29.73	0.08	0.61	0.36
	103A	104A	0.80	68	2.09	183	4.00	2.97						0.52	0.08	0.80	2.61	0.731	3.78	58.5	250	0.25	29.73	0.13	0.61	0.42
	104A	105A	0.44	38	2.53	221	4.00	3.58						0.52	0.08	0.44	3.05	0.854	4.51	91.5	250	0.25	29.73	0.15	0.61	0.44
			0.28	28	2.81	249								0.52	0.08	0.28	3.33									
	105A	106A	0.36	31	3.17	280	4.00	4.54						0.52	0.08	0.36	3.69	1.033	5.65	58.5	250	0.25	29.73	0.19	0.61	0.47
	106A	107A	0.76	65	3.93	345	4.00	5.59						0.52	0.08	0.76	4.45	1.246	6.92	59.5	250	0.25	29.73	0.23	0.61	0.49
			0.63	63	4.56	408								0.52	0.08	0.63	5.08									
	107A	108A	0.18	16	4.74	424	4.00	6.87						0.52	0.08	0.18	5.26	1.473	8.42	59.5	250	0.25	29.73	0.28	0.61	0.52
	108A	109A	0.17	15	4.91	439	4.00	7.11						0.52	0.08	0.17	5.43	1.520	8.71	58.0	250	0.25	29.73	0.29	0.61	0.53
	109A	110A	2.93	250	7.84	689	3.90	10.89						0.52	0.08	2.93	8.36	2.341	13.31	47.5	250	0.25	29.73	0.45	0.61	0.59
	110A	111A		0	7.84	689	3.90	10.89						0.52	0.08	0.00	8.36	2.341	13.31	21.0	250	0.25	29.73	0.45	0.61	0.59
	111A	*Ex. MH 15*		0	7.84	689	3.90	10.89						0.52	0.08	0.00	8.36	2.341	13.31	12.5	250	0.25	29.73	0.45	0.61	0.59
To Ex. Sanitary Trunk					7.84	689								0.52			8.36		13.31							

DESIGN PARAMETERS

Park Flow =	9300	L/ha/da			
Average Daily Flow =	350	l/p/day	Industrial Peak Factor = as per MOE Graph		
Comm/Inst Flow =	50000	L/ha/da	Extraneous Flow =	0.280	L/s/ha
Industrial Flow =	35000	L/ha/da	Minimum Velocity =	0.600	m/s
Max Res. Peak Factor =	4.00		Manning's n =	0.000	
Commercial/Inst./Park Peak Factor =	1.50		Townhouse coeff=	2.7	
Institutional	0.58	l/s/Ha	Single house coeff=	3.4	

Designed: A.B.	PROJECT: Barrhaven Conservancy Phase 1		
Checked: P.P.	LOCATION: City of Ottawa		
Dwg. Reference:	File Ref: 16-891	Date: November, 2017	Sheet No. 1 of 1

APPENDIX E

STORM SEWER CALCULATION SHEET (RATIONAL METHOD)

Local Roads Return Frequency = 2 years
Collector Roads Return Frequency = 5 years
Manning 0.013 Arterial Roads Return Frequency = 10 years

LOCATION			AREA (Ha)																FLOW						SEWER DATA								
			2 YEAR				5 YEAR				10 YEAR				100 YEAR				Time of Conc. (min)	Intensity 2 Year (mm/h)	Intensity 5 Year (mm/h)	Intensity 10 Year (mm/h)	Intensity 100 Year (mm/h)	Peak Flow Q (l/s)	DIA. (mm) (actual)	DIA. (mm) (nominal)	TYPE	SLOPE (%)	LENGTH (m)	CAPACITY (l/s)	VELOCITY (m/s)	TIME OF FLOW (min.)	RATIO Q/Q full
Location	From Node	To Node	AREA (Ha)	R	Indiv. 2.78 AC	Accum. 2.78 AC	AREA (Ha)	R	Indiv. 2.78 AC	Accum. 2.78 AC	AREA (Ha)	R	Indiv. 2.78 AC	Accum. 2.78 AC	AREA (Ha)	R	Indiv. 2.78 AC	Accum. 2.78 AC															
			0.20	0.40	0.22	0.22								0.00				0.00															
			0.78	0.80	1.73	1.96								0.00				0.00	127.5	(Estimated length)													
	601	602	0.43	0.67	0.80	2.76	0.25	0.85	0.59	0.59				0.00				0.00	11.06	72.95	98.90			260	750	750	CONC	0.10	75.5	352	0.80	1.58	0.74
	602	603	0.08	0.67	0.15	2.91				0.59				0.00				0.00	12.64	67.96	92.04			252	750	750	CONC	0.10	69.5	352	0.80	1.45	0.72
	603	604	0.80	0.67	1.49	4.40				0.59				0.00				0.00	14.10	63.99	86.60			333	825	825	CONC	0.10	59.0	454	0.85	1.16	0.73
	604	605	0.44	0.67	0.82	5.22				0.59				0.00				0.00	15.25	61.18	82.75			368	900	900	CONC	0.10	92.5	572	0.90	1.71	0.64
			0.28	0.80	0.62	5.84																											
	605	606	0.37	0.67	0.69	6.53				0.59				0.00				0.00	16.97	57.49	77.70			421	900	900	CONC	0.10	58.5	572	0.90	1.08	0.74
	606	607	0.74	0.67	1.38	7.91				0.59				0.00				0.00	18.05	55.40	74.84			482	900	900	CONC	0.10	49.5	572	0.90	0.92	0.84
			0.64	0.80	1.42	9.33				0.59				0.00				0.00															
	607	608	0.87	0.67	1.62	10.95				0.59				0.00				0.00	18.97	53.76	72.60			632	1050	1050	CONC	0.10	139.0	864	1.00	2.32	0.73
	608	609	0.15	0.67	0.28	11.23				0.59				0.00				0.00	21.29	50.04	67.54			602	1050	1050	CONC	0.10	68.5	864	1.00	1.14	0.70
	609	610	1.10	0.67	2.05	13.28				0.59				0.00				0.00	22.43	48.42	65.32			682	1050	1050	CONC	0.10	43.0	864	1.00	0.72	0.79
	610	OGS	1.17	0.67	2.18	15.46				0.59				0.00				0.00	23.15	47.46	64.01			771	1200	1200	CONC	0.10	23.0	1233	1.09	0.35	0.63
TO OGS						**15.46**				**0.59**				**0.00**				**0.00**	**23.50**					**771**									

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

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

Designed: D.A.
Checked: P.P.
Dwg. Reference: Storm Servicing Plan, Figure No. 5

PROJECT: **Barrhaven Conservancy Phase 1**
LOCATION: **City of Ottawa**
File Ref: 16-891
Date: November, 2017
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