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ADEQUACY OF SERVICES REPORT

FOR

BARRHAVEN CONSERVANCY DEVELOPMENT CORPORATION

BARRHAVEN CONSERVANCY WEST

CITY OF OTTAWA

PROJECT NO.: 21-1226

MARCH 2024
3RD SUBMISSION

ADEQUACY OF SERVICES REPORT
FOR
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INTRODUCTION

David Schaeffer Engineering Limited (DSEL) has been retained to prepare an Adequacy of Services Report (AES) in support of the Barrhaven ***Conservancy West*** development area on behalf of Barrhaven Conservancy Development Corporation (BCDC).

The overall Conservancy land area is approximately 139.7 ha (all land use components) and is located within the City of Ottawa urban boundary in the Barrhaven ward. As illustrated in ***Figure 1***, the subject site is located north of the Jock River, east of Highway 416, west of Borrisokane Road and south of McKenna Casey Drive.

The focus of this report is for the ***Conservancy West*** land area that is located west of Borrisokane Road which bisects the overall BCDC landholdings and consists of vacant land. The subject lands are approximately 48.42 ha in area (including all right-of-ways, residential area and park areas) and the proposed development concept plan, ***Figure 2***, is provided for reference. Of this, approximately 13.8 ha in area (including right-of-ways environmental areas and open space) was previously considered in the draft plan application submitted for the BCDC landholdings and in the servicing review of ***Barrhaven Conservancy East Phase 5***. This area is proposed to be updated within the development concept plan as demonstrated in ***Figure 2*** and is included in this review. The development areas are currently zoned Development Reserve (DR) and are planned to be developed with a mix of detached single homes, townhomes, stacked townhomes, park blocks, open spaces and a road network.

A previous draft plan application has been submitted for the BCDC landholdings to the east of this development area.

The Conservancy West development area is outside of the Jock River 100-year limit as confirmed by the Rideau Valley Conservation Authority (RVCA). Refer to the RVCA confirmation letter in ***Appendix D***. The 100-year regulatory flood line is demonstrated in Drawing 1 (Grading) and Drawing 3 (Stormwater) in the ***Appendix***.

The objective of this report is to provide sufficient detail to demonstrate that the proposed development area can be supported by municipal services.

1.1 Existing Conditions

The initial ***Conservancy West*** property topography is relatively flat with the existing ground elevations varying between 91 m and 92 m. All existing flows are either overland to the Jock River or conveyed to the Jock River by way of the O'Keefe Municipal Drain or the Foster Ditch (and their tributaries) which run north to south through the subject property. The property is within the Jock River watershed and is under the jurisdiction of the RVCA.

1.2 Summary of Pre-Consultation

The following provides a summary of the pre-consultation:

Ministry of the Environment, Conservation and Parks (MECP)

Prior consultations associated with the Conservancy East Phase 2-4 development east of Borrisokane Road were previously undertaken for the approval of those phases of the development area.

A pre-consultation with the local MECP office has not yet been completed for the Conservancy West development area until the functional design details and requirements have been established with the City of Ottawa.

Rideau Valley Conservation Authority (RVCA)

Multiple consultations, analysis and submissions were coordinated with the RVCA to establish that the development area is outside of the Jock River 100-year limit. See the RVCA documentation in ***Appendix D*** for reference.

1.3 Existing Permits / Approvals

Key approvals associated with the advancement of development of the Barrhaven Conservancy area, are presented in the following table. The most relevant approval is the Environmental Compliance Approval (ECA) for the South Nepean Collector sanitary trunk sewer as well as the sanitary sewer ECA for the Conservancy East development area east of Borrisokane Road that future Conservancy West phases will be connecting to. The document is provided in ***Appendix A*** for reference.

Table 1A: Existing Permits / Approvals

Agency	Approval Type	Approval Number	Remarks
Ministry of the Environment, Conservation and Parks (MECP)	Environmental Compliance Approval	# 8129-AB7LDF (June 23, 2016)	South Nepean Collector existing approval (sanitary outlet for development area)

MECP	Environmental Compliance Approval	# 4357-CHMQEM (Sept. 1, 2022)	Sanitary and storm sewer approvals for Conservancy lands east of Borrisokane Road
MECP	Permit to take Water	#5633-C2RQPL (May 26, 2021)	Water taking from Building Excavation, Site Servicing, SWMW, In-Water Works, Ponded Surface Water
Rideau Valley Conservation Authority (RVCA)	RVCA Letter of Permission under O.Reg. 174/06	RV5-4419	Letter of permission related to placement of fill within a regulated area.

1.4 Required Permits / Approvals

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

Based on pre-consultation with City staff, the additional approvals and permits listed in the following table 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 to be submitted as part of the Plan of Subdivision application (e.g. *Tree Conservation Report, Environmental Impact Statement, Phase 1 Environmental Site Assessment, Headwater Drainage Feature Assessment, etc.)*

Table 1B: Required Permits/Approvals

Agency	Permit/Approval Required	Trigger	Remarks
MECP	Environmental Compliance Approval	Construction of new storm sewers throughout the subdivision.	The MECP will review the storm sewer design through the City of Ottawa transfer of review process.
MECP	Environmental Compliance Approval	Implementation of oil-grit separator units for quality control.	The MECP will review the stormwater management appurtenance design through the City of Ottawa transfer of review process.
MECP / City of Ottawa	MECP Form SS2 – Record of Future Alteration Authorized for Components of the Municipal Sewage Collection System	Construction of new sanitary sewers	City of Ottawa to review and approve plans prior to the completion of Form SS2.

MECP	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	MECP Form 1 – Record of Watermains Authorized as a Future Alteration.	Construction of watermains throughout the subdivision	The City of Ottawa will review the watermains on behalf of the MECP through the Form 1 – Record of Watermains Authorized as a Future Alteration.
RVCA	Permit under Ontario Regulation 174/06, RVCA's Development, Interference with Wetlands and Alterations to Shorelines and Watercourses Regulation	Grading (proposed development & potential temporary access roads) within the subject lands (i.e. crossing of Foster Ditch)	Supporting applications and documentation as required through consultation with the RVCA.
RVCA	Outlets to Jock River	In conjunction with issuance of MECP applications	Supporting applications and documentation as required through consultation with the RVCA.
RVCA	Alteration to Watercourses (O'Keefe Drain)	As necessary through consultation with the RVCA	Supporting applications and documentation as required through consultation with the RVCA.
City of Ottawa	Commence Work Notification (CWN)	Construction of new sanitary and storm sewers throughout the subdivision	The City of Ottawa will issue a commence work notification for construction of the sanitary and storm sewers once an approval is issued by the MECP.

GUIDELINES, PREVIOUS STUDIES, AND REPORTS

1.5 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
    City of Ottawa, February 5, 2014
    (ITSB-2014-01)

  - Technical Bulletin PIEDTB-2016-01
    City of Ottawa, September 6, 2016
    (PIEDTB-2016-01)

  - Technical Bulletin ISTB-2018-01
    City of Ottawa, March 21, 2018
    (ISTB-2018-01)

  - Technical Bulletin ISTB-2018-04
    City of Ottawa, June 27, 2018
    (ISTB-2018-04)

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

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

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

  - Technical Bulletin ISTB-2018-02 / ISTB-2019-02
    City of Ottawa, March 21, 2018 / July 08, 2019
    (ISTB-2018-02 / ISTB-2019-02)

  - Technical Bulletin ISDTB-2021-03
    City of Ottawa, August 18, 2021
    (ISTB-2021-03)

- Design Guidelines for Sewage Works,
  Ministry of the Environment, Conservation and Parks, 2008. (formerly MOECC)
  (MECP 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)

- South Nepean Collector: Phase 2 Hydraulics Review / Assessment Technical Memorandum
  Novatech, August 2015
  (Novatech SNC Memo)

- South Nepean Collector: Phase 2 Preliminary Design Report,
  Novatech, March 2016
  (Novatech SNC Design Report)

- Strandherd Drive Widening Project, South Nepean Collector: Phase 3 Sanitary Flow Calculations
  Novatech, May 2019
  (2019 Novatech SNC Design Report)

- Hydraulic Potable Water Assessment for Barrhaven Conservancy Development Corporation, March 2021
  (Stantec Hydraulic Analysis)

- Jock River Reach One Subwatershed Study
  Stantec, 2007
  (Jock River SWS)

- Geotechnical Investigation, Proposed Residential Development, Conservancy Lands West, Ottawa, Ontario
  Paterson Group, September 27, 2019 (Project No. PG5036-1)
  (Geotechnical Report)

- Environmental Impact Statement for Barrhaven Conservancy East
  Kilgour & Associates Ltd., July 29, 2020
  (Kilgour EIS)

- Master Infrastructure Review – Barrhaven Conservancy
  David Schaeffer Engineering Ltd., July 2021
  (Conservancy MIR)

- Design Brief for Barrhaven Conservancy East – Phase 2, 3, & Jock River
  David Schaeffer Engineering Ltd., June 2022
  (DSEL East Design Brief)

- Adequacy of Services Report - Barrhaven Conservancy East – Phase 5
  David Schaeffer Engineering Ltd., December 2022
  (DSEL East Ph5 Report)

- Barrhaven Conservancy East (Phases 2, 3, 4 & Jock River): Water Distribution System Analysis, Stantec, June 2, 2022
  (Stantec Hydraulic Analysis - East)

- Barrhaven Conservancy West: Water Distribution System Analysis, Stantec, January 2023
  (Stantec Hydraulic Analysis - West)

WATER SUPPLY SERVICING

1.6 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 lands that are east of the subject property, as well as south of the Jock River.

The City of Ottawa has recently reconfigured 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 as follows: the Fallowfield Road Pumping Station (FRPS), the Barrhaven Pumping Station (BPS) and the Ottawa South Pumping Station (OSPS).

The future watermains to be implemented through the detailed design process for the adjacent Conservancy East lands will facilitate water service to the Conservancy West development area. These services will be further extended to provide the requisite water supply to this development area.

1.7 Water Supply Servicing Design

Stantec Consulting Limited was retained to perform a hydraulic assessment for the Conservancy East Lands. The ***Hydraulic Potable Water Assessment for Barrhaven Conservancy Development Corporation (Stantec Hydraulic Analysis)*** prepared by Stantec (March 2021) previously supported the advancement of the Conservancy East lands east of Borrisokane road. Subsequently, as part of the detailed design for the approved phases east of Borrisokane Road, Stantec prepared an updated study

"***Barrhaven Conservancy East (Phases 2, 3, 4 & Jock River): Water Distribution System Analysis (June 2022 – Stantec Hydraulic Analysis - East***) which contains phasing references that have since changed for the development area. The analysis reviewed the system requirements of the development area on the west and east sides of Borrisokane Road but only the detailed design of particular phases east of Borrisokane Road were advanced to detailed design.

Stantec has since prepared an updated analysis to evaluate the distribution system with the three watermain feeds to the overall development area that were also assessed in the Conservancy East design. Stantec's "***Barrhaven Conservancy West: Water Distribution System Analysis (January 2023)*** is provided in ***Appendix B*** noting that the portion of the Conservancy East Lands west of Borrisokane Road, formerly Conservancy East Phase 5, is considered within the West Conservancy lands subject to this updated draft plan. In addition, the layout of the Conservancy West development analyzed in the Stantec analysis differs slightly but is not expected to impact the overall serviceability.

The proposed water servicing layout is presented in ***Figure 3***.

Fire Flow Demand

Fire Flow requirements are established in the boundary condition request found in ***Appendix B*** as prepared by Stantec. Based on anticipated unit configurations and separations the City's fire flow cap of 10,000 L/min for single dwellings and traditional townhomes as outlined in *ISDTB-2014-02* does not apply and separation of fire areas with units of ordinary construction, as well as architectural elements, will be incorporated to meet target fire flows. The fire flows will be calculated in accordance with the Fire Underwriters Survey's Water Supply for Public Fire Protection Guideline (2020).

Boundary Conditions

To support the preparation of a hydraulic analysis for the subdivision, boundary conditions were provided by the City of Ottawa for the anticipated water demands and are summarized in the following table. See ***Appendix B*** for full details of the boundary condition request submitted.

Table 2B: Boundary Conditions (from *Stantec Hydraulic Analysis – West* report)

HGL (m) - Zone SUC Servicing Conditions			
Demand Scenario	**Three Connections**		
	Connection 1 (1)	**Connection 2 (2)**	**Connection 3 (3)**
AVDY	146.7	146.7	146.6
PKHR	141.4	141.3	141.0
AVDY +FF	139.7	138.1	139.8
MXDY +FF	137.9	136.2	137.9

(1) Ground elevation at Connection 1 (Chapman Mills Drive) = 93.10 m
(2) Ground elevation at Connection 2 (Danson Gardens Grv / Darjeeling Ave) 91.80 m
(3) Ground elevation at Connection 3 (Flagstaff Dr) 92.30 m
As provided by the City of Ottawa via email on December 6, 2022 (J.Bougadis)

Water Demand Calculations

A summary of water demands for the subject site is presented in the following table as derived from the criteria above and the ***Stantec Hydraulic Analysis*** found in ***Appendix B***. As suggested above, the layout of the Conservancy West development analyzed in the Stantec analysis differs slightly from the current concept but is not anticipated to impact the overall serviceability of the development. An updated hydraulic analysis will be provided at detailed design to confirm the proposed design.

Table 2C: Water Demand Estimate

		Unit Count	Pop (1)		AVDY(2) (L/s)	MXDY(3) (L/s)	PKHR(4) (L/s)
East	Single Family	782	2,659		-	-	-
	Townhouse	606	1,636		-	-	-
	Subtotal	***1,388***	***4,295***		***13.92***	***34.80***	***76.55***
West	Single Family	462	1,571		-	-	-
	Townhouse	499	1,347		-	-	-
	Subtotal	***961***	***2,918***		***9.46***	***23.64***	***52.01***
	Totals	***2,349***	***7,213***		***23.38***	***58.44***	***128.57***

(1) Population per unit is 3.4 for Single Family and 2.7 for Townhomes
(2) AVDY = Average Day
(3) MXDY = Maximum Day
(4) PKHR = Peak Hour
(5) See Stantec Hydraulic Analysis in ***Appendix B*** for details.

1.8 Summary of Hydraulic Modeling Analysis

A watermain analysis has been prepared to confirm that the network is sized adequately, which is the greater of maximum day plus fire and maximum hour. City review comments on the prior ***Barrhaven Conservancy East (Phases 2,3,4 & Jock River): Water Distribution System Analysis Hydraulic Analysis*** (Stantec, 2022) noted that the preferred system configuration for the entirety of the Conservancy development area is for three connections to the existing network and those results are presented below.

System Pressures

The modeling indicates that the development can be adequately serviced by the proposed watermain network. Modeled service pressures for the development are summarized in the following table. The detailed pipe and junction tables are contained in the ***Stantec Hydraulic Analysis***, enclosed in ***Appendix B.***

Table 2D: Summary of Available System Pressures

	AVDY Maximum Pressure		Peak Hour Demand Minimum Pressure	
	kPA	psi	kPA	psi
Conservancy West	546	79.23 (J239)	436	63.22 (J297)
*Note: See model results in the Appendix C of the **Stantec Hydraulic Analysis** report.*				

The generally accepted best practice is to design new water distribution systems to operate between 350 kPa (50 psi) and 480 kPa (70 psi) as outlined in the City of Ottawa Design Guidelines. Where pressures exceed 80psi pressure reducing valves (PRV) shall be implemented as per the Ontario Building Code.

Available Fire Flows

The minimum allowable pressure under fire flow conditions is 140 kPa (20 psi) at the location of the fire. A summary of the available fire flows is presented in the following table:

Table 2E: Summary of Available Fire Flows

	Required Fire Flow (L/s)	Minimum Available Flow (L/s)	Junction ID
Conservancy West	217	183.84 177.61 197.95	J363 J365 J369
*Note: See model results in Appendix C of the **Stantec Hydraulic Analysis**.* *It is anticipated that the above minor flow node can be managed by procedures noted in ISDTB-2018-02 (See Section 3.2 of Stantec report)*			

As shown in the above table, the model predicts the majority of the network will be able to provide the required 13,000 L/min (217 L/s) fire flows, per the fire flow requirement established in the ***Barrhaven Conservancy East (Phases 2,3,4 & Jock River): Water Distribution System Analysis Hydraulic Analysis*** (Stantec, 2022)and carried over to the ***Barrhaven Conservancy West: Water Distribution System Analysis Hydraulic Analysis*** (Stantec, 2023) The junctions noted are marginally below this threshold but it is anticipated that at detailed design fire control measures such as ordinary construction units, firewalls and/or using the alternative hydrant spacing procedure outlined in ISDTB-2018-2 can be implemented to mitigate these areas (if fire flow results remain the same at detailed design) and ensure all guideline requirements are satisfied. Detailed results are included in the ***Stantec Hydraulic Analysis***, enclosed in ***Appendix B***.

System Reliability

Various major watermain failure scenarios were reviewed by Stantec. Some scenarios resulted in fire flows that are within the 10,000 L/min range that can be reviewed in more thoroughly at detailed design. See discussion in Section 3.3 of the ***Stantec Hydraulic Analysis*** in ***Appendix B.***

1.9 Water Supply Conclusion

The subject lands have been reviewed by Stantec to confirm the proposed distribution system will meet the required demands and redundancy requirements. While the concept plan reviewed differs slightly from the current concept this is not anticipated to impact the overall serviceability of the development.

The network is proposed to consist of 152 mm, 203 mm, 254 mm and 305 mm watermains with watermain sizing on local streets confirmed at detailed design.

Under AVDY demand conditions the model results indicate that maximum pressures are below the allowable maximum pressure of 80 psi as per the City of Ottawa Design Guidelines. Under PKHR demand conditions the minimum pressures are within the City's system pressure requirements.

Under MXDY+FF demand conditions the assumed required fire flow of 13,000 L/min can be achieved for the majority of the proposed distribution network at full build out conditions. There are several isolated locations where the FF may be slightly less than the 13,000 L/min threshold (i.e. worst-case scenario of 10,657 L/min at Junction 365) but it is assumed that these isolated locations can be managed with fire control measure as required at the detailed design stage.

Reliability assessments indicate that for AVDY+FF conditions there are some locations where system flows are slightly below the fire flow of 13,000 L/min (i.e. in the 10,000 to

11,000 L/min range). At detailed design these areas will be assessed with fire flow measures proposed to mitigate potential shortfalls.

Watermain crossings (300mm diameter) of the O'Keefe Drain and Foster Ditch will be accomplished via the implementation of a 610mm diameter steel casing (gauge 12.7mm – Grade 3) which will have 1m clearance below the culverts and extend up to 5m beyond the edge of the culverts. Pressure grout of 1:5 cement/sand ratio will surround the pipe. Details to be established at future detailed design.

Future modelling at the detailed design stage will confirm phasing of the extensions of trunk watermains and sizing of the local watermain network. The proposed water supply design will conform to all relevant City and MECP Guidelines and Policies.

WASTEWATER SERVICING

1.10 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 property is tributary to the South Nepean Collector (SNC) sewer as urban development land.

The SNC (previously called the Jock River Collector) sewer operates north of the subject property within Strandherd Drive prior to travelling south down Chapman Mills Drive (CMD) and then turns eastward within the future CMD right-of-way (ROW).

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)***. In addition, Novatech is also currently the engineer of record for the design and implementation of the Phase 3 extension of the SNC.

1.11 South Nepean Collector Phase 3 – Preliminary Design

The 2015 ***Novatech SNC Memo*** contemplated that the Conservancy Phase 1 development area (north of the Fraser-Clarke Watercourse) would be serviced by the 900 mm diameter SNC sewer running adjacent to the property within the future extension of CMD. This is represented by area "A6-E" within the "*Sanitary Drainage Areas and Land Use – Fig.1"* plan within the 2015 Novatech memo (note that the actual tributary area and population varied slightly).
For the Phase 3 extension of the SNC, Novatech has prepared another review of sanitary flows within their technical memorandum titled "***Strandherd Drive Widening Project***, ***South Nepean Collector Phase 3: Sanitary Flow Calculations***" May 30,

2019 ***(2019 Novatech SNC Memo).*** The memorandum, along with the design sheet calculations from the Novatech memo, are provided in ***Appendix C*** for reference along with DSEL annotations on key items in the figure and design sheets. The updated "*Sanitary Drainage Areas and Land Use – Fig.1" (May 2019)* plan is essentially reflective of the same tributary information that was provided in the 2015 study (the plan has been marked up to reflect the Conservancy areas as a frame of reference). The associated design sheet also reflects updated City wastewater design criteria that was not accounted for in the 2015 study and is discussed further in the following section.
Report excerpts are provided in ***Appendix C*** for the SNC Phase 2 analysis as well as draft information associated with the Phase 3 extension. The location of the SNC sewer is shown in ***Figure 4***.

1.12 Wastewater Design

The subject property 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 as required to achieve efficiencies in servicing and grading designs. The wastewater servicing plan can be seen in ***Drawing 4***.

Similar to the proposed Conservancy East development, this report proposes that the drainage area of the SNC sanitary sewer be expanded to include the entirety of the Conservancy property. The sewer network will connect to the off-site SNC sanitary sewer within the future CMD at existing manhole 'SANMH8' as identified in the Novatech SNC Phase 2 design Drawing No. 20 provided in ***Appendix C*** for reference (City contract number ISD14-2033). As noted in the prior section, the 2015 ***Novatech SNC Memo*** derived flows based on the City guideline parameters of the time (namely 350 L/capita/day, infiltration allowance of 0.28 L/s/ha and commercial properties at 50,000 L/ha/d). The following table summarizes the City design guidelines and criteria to be applied to the ***Conservancy West*** sewer design as well for the determination of the projected flows to be tributary to the SNC along the frontage of the Conservancy Phase 1 development area.

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	280 L/d/person
Peaking Factor	Harmon's Peaking Factor. Max 4.0, Min 2.0
Commercial / Institutional Flows	28,000 L/ha/day
Commercial / Institutional Peak Factor	1.5
Infiltration and Inflow Allowance	0.33 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	$Q = \frac{1}{n} AR^{2/3} S^{1/2}$
Minimum Sewer Size	200mm diameter
Minimum Manning's 'n'	0.013
Minimum Depth of Cover	2.5m from crown of sewer to grade
Minimum Full Flowing Velocity	0.6m/s
Maximum Full Flowing Velocity	3.0m/s
Extracted from Sections 4 and 6 of the City of Ottawa Sewer Design Guidelines, October 2012, and associated Technical Bulletins.	

Several design sheets are provided in ***Appendix C*** for reference:

- Sanitary design sheet for the lands east of Borrisokane Road;

- Design sheet and drainage plan for Conservancy West (this current application). The Conservancy East Phase 5 development area, bounded by the Foster Ditch to the west and Borrisokane Road to the east, was a part of the previously approved draft plan, but is now considered part of the Conservancy West draft plan area;

Within the Conservancy East design sheet the area and flows from the lands west of Borrisokane Road are highlighted where flows enter the development area at the westward stub from MH10A. That design sheet projected a flow of 77.81 L/s.

Based on the updated concept plans for the Conservancy West development area (west of Borrisokane Road), the flows shown at the eastern limit of Conservancy East (see Conservancy East design sheet in ***Appendix C***) projected ~58.12 L/s at MH 125A where it outlets to the MH10A (re-numbered as MH 126A in Conservancy West design) noted above. As such, downstream systems are sufficient and no negative impacts given that flows are lower than the previously projected 77.81 L/s.

1.13 Sanitary Lift Station

As documented within the ***Conservancy MIR*** the design of the gravity sewers for the Conservancy development areas has been kept the sewer inverts as low as possible from its connection point at the South Nepean Collector. Despite this, the invert of the existing Foster Ditch does impart a constraint for the sanitary sewer crossing. This constraint will necessitate the inclusion of a low lift sanitary pump station, west of the Foster Ditch, in order to provide sanitary service upstream.

Preliminary review of the requirements by Stantec indicates the following pump station characteristics:

The proposed pumping station will be of wet well type, with two submersible sewage pumps (one duty one standby) estimating a required capacity of 60 L/s +/-. The main components will be:

- Precast concrete or fiberglass wet well, 2.4 m in diameter;
- Two submersible sewage pumps with the duty point of 60 L/s at 14.8 m total dynamic head (initial estimate to be finalized at detailed design);
- Approximately 90 m long forcemain (twin), 150 mm dia., PVC SDR 26 or equal;
- Bypass chamber for pumping the sewage during wet well inspections/repairs or emergency situations;
- Precast control building with electrical and SCADA equipment;
- Permanent power supply (transformer);
- Standby Power: Generator (diesel or natural gas);
- SCADA communication tower;
- Approximately 620m^2 block of land for the facility based on past experience on a facility of this nature (Note: final block size may vary slightly based on the detailed design/layout of the facility);
- The proposed facility is adjacent to the Foster Ditch and future residential development. The nearest residential units would be ~35m north, ~30m west, ~12m south or ~75m to the east. Separation distances will ultimately depend on the siting of the station;
- Typical carbon filters would be added to venting to mitigate potential odor issues.

The development area and pumps station location are in close proximity to the Jock River with limited opportunity for discharge to a watercourse or storm sewer. The incoming sanitary sewer invert to the station is ~86.24m. The Foster Ditch immediately adjacent to the facility (to the east) has an invert of 90.20. The 25-year water elevation of the Jock River in this vicinity is ~91.57m and the 100-year water elevation is ~91.89m. An overflow siphon to the sanitary outlet manhole is feasible due to the relatively minor elevation difference between the inlet at the lift station versus the gravity outlet to the east of the Foster Ditch (~ +2.0 to 2.5m).

As an extra level of protection during an overflow situation, along with the gravity outlet option noted above, the sewage would have to be pumped by pumper trucks (or temporary pumps) from the wet well to the adjacent sewers or to the Foster Ditch (depending on the type of emergency). The response time for the Operators would need to be calculated based on the available storage in the wet well and within the incoming sanitary sewer. Wet well and/or sanitary sewers could be oversized to increase the available storage to accommodate the response time so that it would be within acceptable limits based on City experience. This will be discussed and addressed in detail during the preliminary station design.

1.14 Wastewater Servicing Conclusion

The subject property will be serviced by local sanitary sewers, an on-site trunk sanitary sewer, and the off-site SNC sanitary sewer per previous reports. There is residual capacity in the downstream SNC providing sufficient capacity for the peak sanitary flows for the subject property, including external commercial and community park flows. Projected flows from Conservancy West are lower than those previously estimated.

The Conservancy West area will require a low lift sanitary pumping station due to a constraint imposed by the existing Foster ditch watercourse that bisects the property which does not allow for gravity drainage all the way to the SNC connection point. Detailed design for the station will be coordinated with the City during the detailed design stage for the development area.

STORMWATER CONVEYANCE

1.15 Existing Stormwater Drainage

The subject property is within the Jock River watershed. Per the existing topography characterized in available City of Ottawa base mapping, as well as site specific survey, all flows from the subject property are ultimately conveyed to the Jock River by a series of watercourses, sheet flow and minor ditches. The Foster Ditch and the O'Keefe Municipal Drain are the main stormwater conveyances within the Conservancy West property that convey stormwater to the Jock River.

1.16 Proposed Stormwater Management Strategy

Various stormwater strategies were discussed within the Master Infrastructure Review (MIR) prepared previously. Alternatives reviewed were:

Alternative 1 – Oil and Grit Separators & Treatment Train to Naturalized Wetlands*
Alternative 2 – Stormwater Management Wetland Facilities in the Floodplain
Alternative 3 – Stormwater Management Wetland Facilities out of the Floodplain
Alternative 4 – Modified Etobicoke filtration System (MEFS)

For the purposes of this AES update for Conservancy West, Alternative 1 continues to be advanced as per the evaluation provided in the MIR and per discussions with the City of Ottawa on July 20, 2021. This alternative:

> A storm sewer system designed to capture at least the minimum design capture events in accordance with the amendment to the storm sewer and stormwater management elements of the Ottawa Design Guidelines – Sewer (Technical Bulletin PIEDTB-2016-01). The stormwater runoff will be treated before ultimately being released into the natural heritage features and the Jock River as per the

Jock River Reach One Subwatershed Study prepared by Stantec in 2007 ***(Jock River SWS)***.

All proposed units will be equipped with sump pumps due to local constraints;

A treatment train approach to attain an Enhanced Level of Protection (80% total suspended solids (TSS) removal) per MECP guidelines consisting of:

Deep sump catchbasins;

The incorporation of infiltration-type LIDs within the right-of-way extending out from catchbasin locations (see ***Figure 5*** in the ***Figures & Drawings*** section). Future detailed grading will allow for the determination of suitable locations in order to yield optimal benefit from this LID. See Section 5.7 for additional LID discussion.

Multiple oil and grit separators (OGS) units to provide TSS treatment with outlets that are above the 2-year event summer water levels on the Jock River;

The storm systems will discharge the treated stormwater at multiple outlets located along the southern natural heritage corridor, connecting via channels. Discharge locations are demonstrated in the ***Storm Tributary Area*** plan in the ***Figures & Drawings*** section

- An on-site road network designed to maximize the available storage within right-of-ways for the 100-year design event, where possible; and
- An overland flow route designed to safely convey stormwater runoff flows in excess of the on-site road storage.

The design for the site proposes to have stormwater flows conveyed through the development area of the subject property via an underground sewer network. The stormwater runoff will be treated before ultimately being released into the natural heritage features and the Jock River as per the ***Jock River Reach One Subwatershed Study*** prepared by Stantec in 2007 ***(Jock River SWS)***.

The proposed stormwater design layout is shown on ***Drawing 3*** with the stormwater management design consisting of:

A storm sewer system designed to capture at least the minimum design capture events in accordance with the amendment to the storm sewer and stormwater management elements of the Ottawa Design Guidelines – Sewer (Technical Bulletin PIEDTB-2016-01);

Multiple oil and grit separators (OGS) designed to assist with achieving the required Enhanced Level of Protection per MECP guidelines, along with additional treatment train elements, via treatment of the stormwater captured by the storm sewer network;

The storm systems will discharge the treated stormwater at multiple outlets located along the natural heritage corridor, connecting via naturalized channels outletting to the Jock River. Discharge locations are demonstrated in ***Drawing 3***;

Inverts of storm outlets are set at the 2-year summer water levels of the Jock River;

An on-site road network designed to maximize the available storage within right-of-ways 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.

Although quantity control has not typically been required for this reach of the Jock River, as per the ***Jock River SWS***, the quantity of stormwater runoff exiting from the subject property will 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. It is noted that the RVCA is currently reviewing the SWM requirements within the Jock River Reach 1 area. In consideration of this, J.F. Sabourin and Associates (JFSA) has undertaken a review of the existing quantity control recommendations and the existing, and proposed, development conditions for this area. The findings are presented in the JFSA memorandum ***Review of Quantity Control Requirement for Jock River Reach One (March 2021)*** provided in ***Appendix D*** which concludes that quantity controls will still not be required for this reach of the Jock River.

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 ***MECP SWMP Manual***.

Given the general criteria mentioned above, the following specific standards are anticipated 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 TSS removal efficiency of 80%, as defined by the MECP 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;

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, rear yards, 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 ROW, provided the water level does 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.

Quality Control

Per the ***Jock River SWS,*** Enhanced quality treatment will be provided for stormwater runoff from the subject property, corresponding to a long-term average TSS removal efficiency of 80%, as described by the MECP prescribed treatment levels. See Section 5.3 for quality control approach and discussion.

Quantity Control

As noted in the ***Jock River SWS***, quantity control is not anticipated to be required for outlets to the Jock River, however, some quantity control may be provided by erosion storage, as erosion thresholds for any watercourses/outlets will be respected where required. As noted in Section 5.2, JFSA has reviewed the current/future development conditions contributing to this reach of the Jock River and concludes that quantity

control will still not be required. See ***Review of Quantity Control Requirement for Jock River Reach 1 (JFSA March 2021)*** provided in ***Appendix D***.

1.17 Stormwater Management Design

Treatment Train Approach

JFSA previously (June 2021 memo) prepared a review of various potential stormwater quality treatment options that were investigated for the development. These included options, and combinations of options, as summarized in the following updated table. Each of the options has an expected total suspended sediment (TSS) removal capability, varying from 5% to 88%. This review assessed how the required Enhanced Level of Protection (80% TSS removal) could be achieved when the options are used in a treatment train approach, consistent with the expected requirements of the upcoming MECP *Consolidated Linear Infrastructure* policy.

Table 1: Quality Control Alternatives – Treatment Train to achieve 80% TSS Removal

Selection and comparison of alternatives

Method	TSS Removal	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6	Alt. 7	Alt. 8
Street Sweeping (Monthly)	5%								
Street Sweeping (Weekly)	10%								
Street Sweeping (Weekly with Elgin Eagle)*	88%	x							
Curb Cut with Grass Swales	75%			X					
Curb Cut with Infiltration Trenches	80%								
Catchbasin Inserts (CB Shield)*	27%		X		X	X		X	
Deep Sump Catch Basin	25%				X		X		X
Infiltration/ Filtration Trenches**	80%				X	X	X		
Infiltration at CBs, per MOE Table 3.2 (22.5m³/ha)	70%								X
OGS*	50%			X					X
JellyFish*	85%							X	
SWM Pond (Wet Pond)	80%		X						
		=======	=======	=======	=======	=======	=======	=======	=======
Overall Performance		88.0%	85.4%	87.5%	89.1%	85.4%	85.0%	89.1%	**88.8%**

Treatment Train Overall Performance = 1 - (1- TSS Removal Rate Method 1) x (1- TSS Removal Rate Method 2) x (1- TSS Removal Rate Method 3 x ...)

*) TSS Removal as documented by ETV Canada
**) includes the use of Etobicoke infiltration or filtration systems or other permutations of the same

The above table provides a summary of the TSS removal for the various methods that were considered. An option of infiltration LID measures located at catchbasin locations has been added as a method, and to Alternative 8 (see further discussion regarding this method below). The options, and combinations of options, have been assessed and shown to meet or exceed the required 80% TSS target.

For the development area, the updated Alternative 8 option demonstrates an estimated TSS removal of 88.8% for that particular treatment train approach which has been discussed with City staff for the approval of prior phases and will be the design being

advanced. For the determination of the TSS removal of 70% for the infiltration LID at catchbasins, the *Table 3.2* of the MOECC (now MECP) publication entitled "*Stormwater Management Planning and Design Manual, March 2003*" sets the storage volume requirements for infiltration measures to achieve certain TSS removal rates.

Table 3.2 Water Quality Storage Requirements based on Receiving Waters[1, 2]

Protection Level	SWMP Type	Storage Volume (m^3/ha) for Impervious Level			
		35%	55%	70%	85%
Enhanced 80% long-term S.S. removal	Infiltration	25	30	35	40
	Wetlands	80	105	120	140
	Hybrid Wet Pond/Wetland	110	150	175	195
	Wet Pond	140	190	225	250
Normal 70% long-term S.S. removal	Infiltration	20	20	25	30
	Wetlands	60	70	80	90
	Hybrid Wet Pond/Wetland	75	90	105	120
	Wet Pond	90	110	130	150
Basic 60% long-term S.S. removal	Infiltration	20	20	20	20
	Wetlands	60	60	60	60
	Hybrid Wet Pond/Wetland	60	70	75	80
	Wet Pond	60	75	85	95
	Dry Pond (Continuous Flow)	90	150	200	240

[1]Table 3.2 does not include every available SWMP type. Any SWMP type that can be demonstrated to the approval agencies to meet the required long-term suspended solids removal for the selected protection levels under the conditions of the site is acceptable for water quality objectives. The sizing for these SWMP types is to be determined based on performance results that have been peer-reviewed. The designer and those who review the design should be fully aware of the assumptions and sampling methodologies used in formulating performance predictions and their implications for the design.

[2]Hybrid Wet Pond/Wetland systems have 50-60% of their permanent pool volume in deeper portions of the facility (e.g., forebay, wet pond).

The required storage volume of 25.0 m^3/ha is determined for the development area pro-rated from the above table based on an overall imperviousness of ~70%. Similar to prior phases it is anticipated that the extent of the site area for Conservancy West can be managed with the proposed LID and treatment train system. For prior phases it is noted that approximately 140 lineal meters of LID per hectare of area to be treated was required. The overall land area is ~48.42ha as noted in the introduction of this report. The system design would be such that rear yards are not tributary to the LID. Therefore, if we conservatively assume the full 48.42ha being treated this would equate to 140x48.42= 6,779 m extent of LID required. Conservancy West has approximately 8,400 m of roadway available to incorporate the LID infrastructure therefore more than sufficient roadway length is available for use.

Oil-Grit Separator Units (OGS)

As shown on ***Drawing 3***, there will be multiple OGS units at various locations along the southern boundary of the property, discharging to the Jock River via naturalized channels. By way of an MECP Certificate of Technology Assessment and manufacturer's design report, the OGS units will demonstrate compliance with Enhanced Level of Protection requirements, with specific drainage area parameters for each area.

The manufacturer's reported efficiency of TSS removal of the OGS units is expected to be based on a 'fine distribution' particle size distribution in conformance with the following table, unless otherwise approved by the City of Ottawa, RVCA, and MECP. The particle size distribution is the generic particle size distribution accepted by the City of Toronto per the *Wet Weather Flow Management Guidelines* (City of Toronto, 2006) as a typical average stormwater particle size distribution and is an excerpt from Table 3.3 of the *Stormwater Management Practices Planning and Design Manual* (MOECC, 1994).

Table 4: Typical Stormwater Particle Size Distribution & Settling Velocities (Source: *Stormwater Management Practices Planning and Design Manual,* MOECC, 1994)

Particle Size (microns) (NURP 1983)	% of Particle Mass	Average Settling Velocities (m/s)
< 20	0 - 20	0.00000254
20 - 40	20 - 30	0.00001300
40 - 60	30 - 40	0.00002540
60 - 130	40 - 60	0.00012700
130 - 400	60 - 80	0.00059267
400 - 4000	80 - 100	0.00550333

To allow for flexibility as detailed design advances, it is proposed that any OGS unit can be selected, given that it:

- Meets the requirements set out in the preceding sections;
- Ensures no significant negative impact on the upstream storm sewer system – to be determined via hydraulic modelling at detailed design; and
- Demonstrates suitability for meeting Enhanced water quality targets via a MECP Certificate of Technology Assessment.

The preliminary OGS units proposed in the following table have been sized to treat the stormwater runoff for the tributary areas noted in order to meet MECP Enhanced Level

of Protection criteria as part of a treatment train approach prior to discharge to the Jock River via naturalized channels as shown on ***Drawing 3***. The OGS total suspended removal rates and preliminary OGS unit details have been attached for reference in ***Appendix D***.

Table 5: OGS Unit ID and Design Characteristics

Area and Unit ID (1)(2)	Drainage Area Target (ha)	Estimated Weighted C Value	Unit Treatment Capacity (L/s)	Unit Model (1)
OGS 1 (3)	5.45	0.66	170	PMSU4040_8
OGS 2 (3)	8.51	0.62	215	PMSU4045_8
OGS 3	10.03	0.73	396	PMSU5653_10
OGS 4	10.11	0.69	396	PMSU5653_10
OGS 5	6.20	0.67	170	PMSU5640_10
OGS 6	7.81	0.77	255	PMSU4040_8

(1) Providing at minimum 80% TSS removal for a Fine Particle Distribution.
(2) See ***Drawing 3*** for OGS unit locations.
(3) NOTE: The OGS numbering of OGS9 and OGS10 have been changed from previous functional servicing reports circulated in relation to this development area.
(4) Providing at minimum 80% TSS removal (until such time that criteria for the MECP's Consolidated Linear Infrastructure approach is in force at which time only 50% is attributed to OGS units).

The above preliminary OGS unit sizing will achieve required quality controls and, along with other treatment train elements, will have additional beneficial TSS mitigation.

Groundwater

Paterson Group has reviewed the anticipated long term groundwater condition for the development area. Paterson drawing PG5036-10A and PG5036-10B in ***Appendix D*** demonstrates the long-term groundwater elevation across the Conservancy West development area. The elevations range from ~88.5 m in the southern areas up to ~90 m in the northern areas. The lowest storm outlet at the southern boundary is 89.36 m (HW3) and all storm sewers, and any infiltration-type LIDs proposed within the development area, are above the anticipated long term groundwater elevation.

1.18 Proposed Minor System

The subject property will be serviced by an internal gravity storm sewer system that is to generally follow the local road network and proposed servicing blocks as required. The drainage will be conveyed within the underground piped sewer system to headwall

outlets located along the natural heritage corridor, providing hydration to naturalized outlet channels.

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 they connect to the right-of-way which will be solid pipe, per 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). The following table summarizes the standards that will be employed in the detailed design of the storm sewer network. The preliminary drainage area information can be found in ***Drawing 3*** and rational method design sheets are provided in ***Appendix D***.

Table 6: 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 1:100 year (PIEDTB-2016-01) for arterial road, 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
Design Parameter	**Value**
Max. Allowable Flow Depth on Municipal Roads	35 cm above gutter (PIEDTB-2016-01)

Extent of Major System	To be contained within the municipal ROW or adjacent to the ROW 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 0.70 for the development area generally in keeping with the MIR and will require updating, 0.40 for park areas and 0.25 for grassed areas. The runoff coefficients are based on the proposed building envelopes, which have been established based on zoning setbacks and driveway widths and other details (i.e. ROW treatments etc).

There are several trunk sewers proposed and the peak flows are described for the trunk sewers which correspond to the stormwater management design areas as summarized in the following table:

Table 7: Minor System Trunk Sewer Outlets

Area/Outlet # (from west to east)	Trunk Sewer Outlet Headwall	Drainage Area Target (ha)	Peak Flow (L/s) & (L/s/ha)
1 (HW1)	825 mm diameter @ 0.20%	5.75	547 / 95
2 (HW2)	1050 mm diameter @ 0.15%	8.51	873/ 102
3 (HW3)	1200 mm diameter @ 0.12%	10.03	1021/ 102

4 (HW4)	1050 mm diameter @ 0.20%	10.11	992 / 98
5 (HW5)	975 mm diameter @ 0.15%	6.20	644 / 104
6 (HW6)	975 mm diameter @ 0.30%	7.81	1004 / 128
Note: See rational design sheet in ***Appendix D*** for details.			

The storm sewers tributary to the various outlets, and associated peak flows, are detailed in the rational method design sheet, enclosed in ***Appendix D***.

The conceptual servicing layout is shown on ***Drawing 2*** in ***Drawings***. As detailed design progresses, alignment and sizing of local storm sewers will be confirmed and additional servicing blocks may be required, potentially triggering minor amendments to the proposed lot fabric in the concept plan.

Hydraulic Grade Line Analysis

A preliminary hydraulic grade line (HGL) modelling analysis has been completed by JFSA to demonstrate that the HGL will be maintained below the ground surface. See the JFSA memo entitled *Barrhaven Conservancy West– Preliminary HGL Analysis (March 2024)* in ***Appendix D*** for details/results. The analysis has been evaluated for various scenarios for the Jock River in order to assess the appropriate HGL boundary condition:

- 5-year water level in Jock River + 100yr rain event; or
- 100-year water level in Jock River + (2/5/10 yr) rain event (deemed to be the critical event).

The HGL results in JFSA's Table 1 (***Appendix D***) demonstrate that the freeboard to the ground surface ranges from 0.42 m to 1.14 m (Average: 0.70 m) for the Conservancy West area for the critical event noted above.

An updated HGL analysis will be completed for the proposed system at the detailed design stage, based on the above noted events, including historical design storms and climate change stress test as required.

1.19 Proposed Major System

Major system conveyance, or overland flow, will be provided to accommodate flows in excess of the minor system capacity. Overland flow 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 stormwater outlets, discharging to the Jock River through the natural heritage corridors,

as shown on ***Drawing 1***. The grading design includes a saw-toothed-road design with 0.10% minimum grade from high point to high point in order to maximize available surface storage for management of flows up to the 100-year design event where possible.

1.20 Foundation Drainage (Sump Pumps)

Due to the grade raise restrictions and the proposed storm and sanitary drainage schemes, the road centerlines do not allow for standard basements with a gravity connection to the storm sewer system. As such, because of the constraints on the subject property, sump pumps are proposed to be installed for all residential blocks and residential lots.

The City of Ottawa issued Technical Bulletin *ISTB-2018-04* and *2019-02* for the amendment of the *Ottawa Design Guidelines – Sewer, Second Edition,* October 2012 with respect to the screening criteria for the use of sump pump systems for foundation drainage in Greenfield developments on sites with clay soils. Similar to the development of Conservancy Phase 1 and the Conservancy East (Phase 2) site, ***Conservancy West*** has also been assessed as meeting the required criteria for the use of sump pumps.
One of the screening criterion is with respect to the hydraulic grade line (HGL) for the development wherein the system should be reviewed to demonstrate that the HGL cannot reasonably be lowered any further due to outlet restrictions. The site grading is constrained by the close proximity of the Jock River, which is the receiver of stormwater outflows, and is also constrained by grade raise restrictions for the property.

For the Barrhaven ***Conservancy West*** Lands the grade raise restriction varies between 1.4 m and 2.2 m. Paterson's permissible grade raise plan is contained in ***Appendix E*** for reference (See Section 6 for discussion). Further investigations on the property and potential surcharging or lightweight fill (LWF) underneath garages could increase the permissible grade raise and will be investigated further as part of the detailed design.

The functional grading plan for the subdivision has been prepared with the grade raise restrictions in mind with grades being kept as low as possible.

The proposed centerline of road grades, and subsequently the house grades, do not allow for standard basements with a gravity connection to the storm sewer system. As such, the subdivision will be serviced entirely by sump pumps due to site constraints imposed by grade raise restrictions, HGL elevations and the proximity to the Jock River stormwater outlet.

1.21 Low Impact Development (LID) - Infiltration

The following general Low Impact Development (LID) techniques could be considered for implementation, where possible, as part of detailed design (noting that they have to be weighed against the objectives of the City's sump pump technical bulletins):

- 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 ROW), 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; and,
- Micro-grading can be considered to promote infiltration.

The long term groundwater anticipated is demonstrated on Paterson Drawing *PG5036-10A* and Paterson Drawing *PG5036-10B* in ***Appendix D*** as previously noted. The infiltration measure noted in Section 5.2 will contribute some infiltration and quality benefits as first flush stormwater is conveyed into the filtration trench. The amount of infiltration is dependent upon the surrounding soils, but the proposed design will optimize the potential on the site. JFSA has completed a high-level water budget review of the site which is provided in ***Appendix D*** for reference.

To assess the water budget for the site under both pre- and post-development conditions, a SWMHYMO model was developed by JFSA. This model was run using 36 years of hourly rainfall data from the Ottawa International Airport from 1967 to 2003 (excluding missing 2001 rainfall data), the average annual runoff volumes from the subject site were computed and compared. The conceptual LIDs have been included in the model through the use of ROUTE RESERVOIR commands, which represent the storage volume and infiltration rates of each of these proposed LID features. After running each of the models for the 36 years, the annual runoff and infiltration results were extracted and the annual average water budget for each scenario calculated. Full summary tables for each year and scenario have been provided in Table A1 in ***Appendix D***.

The analysis concludes that with the proposed LID the existing annual water infiltration volume can be met and exceeded. The extents of the LID system can be refined at detailed design to optimize LID locations and to minimize the extent of infrastructure to be maintained.

1.22 Existing Watercourses

Foster Ditch

The Foster Ditch bisects a portion of the ***Conservancy West*** development area. It originates south of Fallowfield Road, west of Cedarview Road and flows south until it converges with the Jock River south of McKenna Casey Drive. The ditch is approximately 3,200 m long and has been artificially straightened. This non-municipal drain is a fish bearing tributary of the Jock River with approximately 335 ha of catchment area. The surrounding land use is urban and vacant lands. Riparian vegetation is very sparse consisting of mostly grasses with a few shrubs.

As noted in the ***Jock River SWS***, to ensure protection of the aquatic habitat north of the Jock River, a development setback should be provided for all of the tributaries. Further studies will determine the development setback, which will be the greater of: 1) regulatory floodplain; 2) meander belt width; and 3) aquatic setback, whichever is greater.

Coordination with be undertaken for determinations of the appropriate culvert sizes and configuration for development road crossings of the Foster.

O'Keefe Municipal Drain

The O'Keefe Drain is located east of and runs parallel to Highway 416. The drain extends from south of Fallowfield Road and enters the Jock River south of McKenna Casey Drive. The drain is approximately 3,100 m in length and has been artificially straightened through development areas to the north and to follow the depression between agricultural lands through the subject property. The predominant land use is agricultural. The riparian vegetation consists mainly of grasses and some shrubs with thicker forested patches as the reach approaches the Jock River.

Coordination with be undertaken with the City's Drainage group for determinations of the appropriate culvert sizes and configuration for development road crossings of the OMD. Initial sizing will be as per the Engineer's Report for the O'Keefe Drain.

1.23 Floodplain

On November 8th, 2019 the RCVA gave permission to Barrhaven Conservancy Development Corporation to cut and fill on the subject property under permit RV5 44/19 pursuant to review under Section 28 of the Conservation Authorities Act, regulation 174/06. The application and approval by the RVCA was supported by a 2D HEC-RAS model prepared by JFSA. The JFSA model identified the existing and proposed 100-year water levels and permissible extent of fill placement.

The works pursuant to the above-mentioned permit were completed and accepted by the RVCA on May 31st, 2020. Options to complete the fill area boundary as set by JFSA included building a structural face of fill (retaining wall) to the limits of the 100-year floodplain boundary, or, building a berm with the toe of slope at the 100-year floodplain boundary. As-builts for the fill placement were subsequently provided and approved by the RVCA, resulting in the May 31st approval noted above and the current 100-year floodplain boundary delineation. The toe of any material placed corresponds to the approved 100-year floodplain line.

1.24 Stormwater Servicing Conclusions

The stormwater runoff is designed to be captured by an internal gravity sewer system that will convey flows to multiple outlet locations equipped with end of line OGS units. A proposed treatment train arrangement of 1.0 m deep sump catchbasins to optimize catchbasin sump retention of solids, as well as select catchbasin locations with connected infiltration-type subdrains will provide the required quality control treatment to achieve the Enhanced Level of protection. Downstream of the storm outlets along the southern development boundary will be naturalized channels where treated stormwater will be conveyed through the natural heritage corridor prior to discharge to the Jock River. It is anticipated that quantity control is not required for the Jock River. Notwithstanding, some quantity control by means of erosion storage will be included.

A preliminary Hydraulic Grade Line (HGL) modelling analysis has been completed for the ***Conservancy West*** development area at this time and demonstrates that the HGL is maintained below the ground surface with freeboards ranging from 0.42 m to 1.14 m for critical event conditions. Further detailed HGL review will be completed for the proposed system at the detailed design stage. Due to the grade raise restrictions, and the proposed storm and sanitary drainage layout, the road centerlines do not allow for standard basements with a gravity connection to the storm sewer system. As such, because of the constraints on the subject property, sump pumps are proposed to be installed for all residential blocks and residential lots.

The ***Conservancy West*** development area will be outside of the Jock River's regulatory floodplain area.

Appropriate setbacks from existing watercourse are incorporated into the draft plan based on advancement/finalizing of studies to assess the various determining criteria.

GRADING

A site grading arrangement has been developed to optimize earthworks and provide major system conveyance to the receiving outlets, and naturalized channels, which ultimately outlet to the existing Jock River drainage network. The proposed grading can be found in ***Drawing 1*** in ***Drawings***.

The development area is outside of the Jock River regulatory flood plain limits. The site grading will be a minimum of 0.50m above the 100-year regulatory limit event of the Jock River.

1.25 Geotechnical Conditions

Paterson completed a geotechnical investigation for the Conservancy West lands as follows:

- *Geotechnical Investigation – Proposed Residential Development, Conservancy Lands East* (Paterson Group, September 24, 2019);
- Geotechnical Investigation – Proposed Residential Development, Conservancy Lands West (Paterson Group, October 19, 2021);

The existing ground surface across the site is relatively level with approximate ground surface elevation varying between 91 m and 92 m. The subsurface profile generally consists of an approximate 50 mm to 460 mm thick layer of topsoil underlain by a silty clay deposit.

Due to the presence of a silty clay deposit, permissible grade raise restrictions are recommended for this site. For the Conservancy West area east of the Foster Ditch, the recommended permissible grade raise varies between 1.4 m in the north area of the phase and 1.8 m in the south. See Figure PG5036-2 '*Permissible Grade Raise Plan'* by Paterson. The recommended permissible grade raise for the remainder of the development area varies between 1.9 m to 2.2 m. Figure PG5036-5 '*Permissible Grade Raise Plan'* by Paterson is enclosed in ***Appendix E*** for reference. At the time of detailed design, efforts will be made to mitigate any exceedances and detailed review and signoff by a licensed Geotechnical Engineer will be required. Where grade raises exceed the permissible levels the Engineer will recommend appropriate measures to mitigate where required (i.e. light weight fill or pre-consolidation etc).

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 0.15m 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.

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 are implemented and will be maintained throughout any construction phase.

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 mats in order to prevent mud tracking onto adjacent roadways.
- No refueling or cleaning of equipment near existing watercourses.
- No material stockpiles within 30m 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 to ensure proper performance.
- Erosion and sediment controls will remain in place until the working areas have been stabilized and re-vegetated.

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.

CONCLUSION AND RECOMMENDATIONS

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

- The subject lands have been reviewed by Stantec to confirm that servicing is feasible by City of Ottawa PZ SUC. Several alternatives were presented to confirm that servicing is feasible. The water supply network will be expanded through neighboring properties to meet the water demands of the proposed concept plan, via the trunk watermain network and local watermains identified. Detailed modelling will confirm phasing of the extensions of trunk watermains and sizing of the local watermain network.

- The subject property will be serviced by local sanitary sewers, an on-site trunk sanitary sewer, and the off-site SNC sanitary sewer as defined in previous reports. This AES continues to confirm that the expansion of the drainage areas from the ***2019 Novatech SNC Memo*** to include the entirety of the subject property has no negative impacts. There is residual capacity in the downstream SNC providing sufficient capacity for the peak sanitary flows for the subject property, including external commercial and community park flows. Flows projected for this development area are lower than flows previously projected in the Conservancy East development downstream.

- Stormwater service is to be provided by capturing stormwater runoff by an internal gravity sewer system that will convey flows to various outlets along the southern boundary to proposed naturalized channels. Prior to discharge from the development, any first flush stormwater will have passed through an end of line OGS unit for quality control. The OGS units will provide an Enhanced Level of Protection quality control treatment for stormwater in combination with an upstream treatment train of measures such as 1.0 m deep catchbasin sumps and LID system prior to discharge from the development. It is anticipated that quantity control will not be required for discharges to the Jock River.

- A preliminary Hydraulic Grade Line (HGL) modelling analysis has been completed at this time and demonstrates that the HGL is maintained below the

ground surface. Another detailed HGL review will be completed for the proposed system at the detailed design level.

- A preliminary water budget analysis has been completed by JFSA at this time and indicates that pre-development infiltration levels can be met.
- Sump pumps are proposed to be installed for all units within residential blocks and lots;
- The site will be subject to grade raise restrictions ranging from 1.4 m to 2.2 m;
- The proposed servicing and grading plans are expected to meet all City, RVCA, and MECP requirements as set out in background studies and current standards.
- Prior to detailed design of the infrastructure presented in this report, this AES 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, MECP, and Rideau Valley Conservation Authority, among other agencies.

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FIGURES & DRAWINGS

APPENDIX A

GENERAL

APPENDIX B

WATER SUPPLY

APPENDIX C

SANITARY

APPENDIX D

STORMWATER

APPENDIX E

GEOTECHNICAL