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SCOPED MASTER SERVICING STUDY

FOR

STITTSVILLE SOUTH URBAN EXPANSION AREA (W-4)

CAIVAN (STITTSVILLE SOUTH) INC. & CAIVAN (STITTSVILLE WEST) LTD.

CITY OF OTTAWA

PROJECT NO.: 21-1247
DECEMBER 2024
2ND SUBMISSION

EXCUTIVE SUMMARY

This scoped Master Servicing Study (MSS) review has been prepared in support of the Stittsville South Urban Expansion Area (W-4) (SSUEA) development on behalf of Caivan (Stittsville South) Inc. and Caivan (Stittsville West) Ltd. which will collectively be referred to as "Caivan".

The overall MSS study area encompasses approximately 80 ha of land and is bound by Flewellyn Road to the south, Shea Road to the east, an existing urban subdivision development to the north (Stittsville South – Area 6 ("Edenwylde")) and an estate lot subdivision (Woodside Acres) to the west. The SSUEA area includes Caivan's landholdings as well as an additional ~8.82 ha consisting of 5.68 ha residential holdout land parcels and 3.97 ha of Hydro One Networks Inc. (HONI) corridor west of the Faulkner Municipal Drain (FMD). The easternmost parcel of Caivan's lands, referred to henceforth as the Eder parcel, (6030 Fernbank Road, 14.24 ha) has been considered within this scoped MSS given the importance of its inclusion from an infrastructure servicing and development phasing perspective. The Eder parcel is proposed to be brought into the urban boundary through the planning process. The proposed development concept consists of detached single homes, townhomes, stacked townhomes, park blocks, stormwater management blocks, open space and road allowances. The development area is bisected by a Hydro One 500 kV utility corridor.

Following completion of the Terms of Reference, Existing Conditions Report, Public Open House and ongoing consultation with City staff, this MSS represents the next step in the planning process. The purpose of this MSS report is to recommend a feasible servicing strategy for the Stittsville South Urban Expansion Area (SSUEA), with respect to water, wastewater collection and stormwater management. Furthermore, this report includes an MSS level servicing design in support of a future draft plan application for the SSUEA Lands. The report also meets the requirements set out by the City of Ottawa's Serviceability Study Checklist.

The ***SSUEA*** is located within the Jock River Watershed and is subject to the regulations associated with the Rideau Valley Conservation Authority (RVCA). The ultimate storm outlet for the site is the Faulkner Drain at the southeast corner of the site, however, the channel extends from the existing subdivision to the North (at Friendly Crescent) via a storm sewer and concrete headwall structure and continues straight south to meet the existing drain at the Hydro corridor. The existing Faulkner Drain makes a 90-degree bend and flows on the north side of Flewellyn Road to Shea Road. The City of Ottawa have appointed a Drainage Engineer to complete an amendment to the existing Faulkner Drain Engineer's Report for the inclusion of the ***SSUEA*** lands as developed.

The stormwater analysis contained in this report indicates that the existing Davidson SWM facility, located within the ***SSUEA*** lands, can receive peak runoff from 4.13 ha of SSUEA lands. Preliminary analysis has been completed to size the storm trunk sewers for the 1:5-year event (minor system) while accounting for flows in excess of the minor system by providing an overland flow route (major system). Several alternative SWM strategies were evaluated and the preferred option has minor and major system flows directed towards two new stormwater management facilities and the existing Davidson SWM facility for treatment. Trunk storm servicing would be provided by 875 to 1500 mm diameter pipe within the development's Public Right of ways.

The Shea Road Sanitary Pump Station (SRSPS) is expected to service the ***SSUEA*** as contemplated in the ***IMP***. The Fernbank Trunk sewer has been extended within Fernbank Road which provides a gravity outlet to the SRSPS. Currently, significant residual capacity is available within the SRSPS and the Fernbank Road Trunk sewer. The wastewater servicing strategy is to direct all sanitary flows within the Study Area to the SRSPS located on the Davidson property. The existing SRSPS has a current firm capacity of 84 L/s, complete with backup power, emergency overflow and will outlet through dual 200mm forcemains to the Fernbank Trunk Sewer. It is anticipated that the existing SRSPS can accommodate the first phases of SSUEA development. Staged upgrades will be required to increase firm capacity to accommodate the full SSUEA development. Timing and details of these upgrades will be further evaluated as part of the Functional Servicing Report. Trunk wastewater collection will be provided by 200 to 375 mm diameter pipes within the SSUEA public right of ways and include an outlet to the proposed Sanitary Pump Station. The proposed pipe sizes and slopes are to meet the minimum requirements set out by the City of Ottawa Sewer Design Guidelines.

The study area is located at the southern boundary of the 3W pressure zone which is fed by the Glen Cairn and Campeau Drive Pump Stations and the Stittsville Elevated Tank. Line pressure is generally good and is suitable to service the entire study area. The proposed trunk watermain network was analyzed to ensure that City of Ottawa guidelines were met. The potable water network is expected to provide the level of service required for the development of the ***SSUEA*** lands.

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CAIVAN (STITTSVILLE SOUTH) INC. & CAIVAN (STITTSVILE WEST) LTD.

PROJECT NO: 21-1247

1.0 INTRODUCTION

David Schaeffer Engineering Limited (DSEL) was retained to prepare a scoped Master Servicing Study (***MSS***) in support of the Stittsville South Urban Expansion Area (W-4) (***SSUEA***) development on behalf of Caivan (Stittsville South) Inc. and Caivan (Stittsville West) Ltd. which will collectively be referred to as ("Caivan") herein. The W-4 Lands are identified on Schedule 1 of the Infrastructure Master Plan (***IMP***), included in ***Appendix A***.

The study area encompasses approximately 80 ha of land and is bound by Flewellyn Road to the south, Shea Road to the east, an existing urban subdivision development to the north (Stittsville South – Area 6 ("Edenwylde")) and an estate lot subdivision (Woodside Acres) to the west. **Exhibit 1** below illustrates the study area.

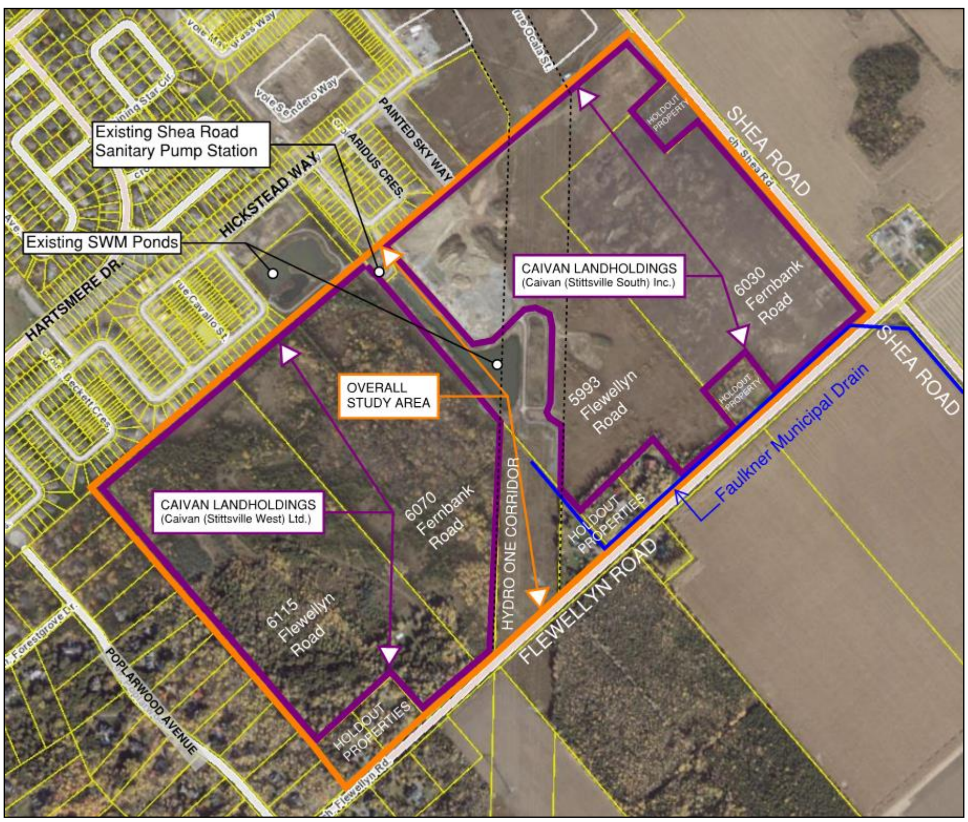

Exhibit 1: Stittsville South Urban Expansion Area

As illustrated on ***Exhibit 1***, the development area has been divided into two distinct land parcels for the purposes of this ***MSS*** on either side of the Faulkner Municipal Drain.

The ***SSUEA*** area includes Caivan's landholdings as well as an additional ~8.82 ha consisting of 5.68ha residential holdout land parcels and 3.97 ha of Hydro One Networks Inc. (HONI) corridor west of the Faulkner Municipal Drain (FMD). The eastern most parcel of Caivan's lands covering 14.24ha (1820 Shea Road) referred to as the Eder parcel herein, and two holdout properties measuring 0.81ha each (1770 Shea Road and 5971 Flewellyn Road), were considered within this scoped MSS.

The proposed future development activities within the ***SSUEA*** are contemplated to include the following land uses:

- Low Density Residential (single detached homes);
- Medium Density Residential (townhomes and stacked townhomes);
- Parkland;
- Woodlot / Open Space;
- Stormwater Management Facilities;
- Hydro Easement / Open Space; and
- Roads (18 m and 24m right-of-ways (ROW)) and Multiuse Pathways.

The preferred Concept Plan for the ***SSUEA*** is presented in ***Figure 1***, prepared by NAK Design Strategies, and illustrates the various components noted above. The preferred concept was prepared and refined in conjunction with the recommended sanitary and storm servicing strategies presented in this ***MSS***.

The preparation of this scoped ***MSS*** is supported by the following subconsultants in their respective fields:

- *Environmental assessment input provided by Morrison Hershfield;*
- *Stormwater management analysis provided by J.F. Sabourin and Associates Inc.;*
- *Watermain analysis provided by GeoAdvice Engineering Inc.;*
- *Geotechnical and hydrogeological investigations completed by Paterson Group Inc.;*
- *Sanitary pumping station analysis completed by Novatech;*
- *Natural environment investigations completed by Kilgour & Associates Ltd.; and.*
- *Transportation analysis completed by CGH Transportation.*

The ***MSS*** supports the Official Plan Amendment for the removal of the Future Neighborhood Overlay on Schedule C17 and for the inclusion of the Eder Lands within the Urban Boundary. The scoped MSS will review and evaluate servicing options to support the subject lands, and will demonstrate that the preferred servicing strategy is in conformance with the Provincial Planning Statement, Official Plan, Infrastructure Master Plan, and Terms of Reference.

1.1 Development Plan

The proposed community concept is shown in ***Figure 1***. The plan was informed by the environmental, site servicing and other studies and guidelines noted in ***Section 2.*** The subdivision is contemplated to consist of a mix of single-family homes, townhomes, stacked townhomes, park blocks, stormwater management blocks, open space and road allowances/widenings. The following table summarizes the land use breakdown and predicted populations associated with the development concept.

Table 1: Development Statistics Projection

Land Use (1,2)	Area (ha)	Projected Residential Units per Area (ha)	Residential Population per Unit	Projected Population
Residential (Low Density)	14.4	33	3.4	1629
Residential (Low Density)	14.8	67	2.7	2677
Residential (Medium Density)	5.5	123	1.8	1214
Holdout Properties	5.7 (Existing Residential)	-	-	-
Streets & Widening	18.3	-	-	-
Parks	3.5	-	-	-
Natural Heritage Site	4.6	-	-	-
Stormwater Facilities	4.4	-	-	-
Hydro Easement	4.0			
Davidson SWM Pond	3.8 (Existing)			
Shea Road Pump Station	0.20 (Existing			
Total	**79.20**	**-**	**-**	**5520**

Notes:
(3) Population density based upon above densities = 33 person/ha (SFH TH), 67 persons/ha (TH), 123 persons/ha (Condo).
(4) Population projections may differ from population estimates used in other background studies. Population projection and residential population per unit values are based on Ministry of Environment, Conservation, and Parks (MECP) guidelines for servicing demand calculations and through consultation with City of Ottawa staff.

The above statistics were used to inform the servicing design for the site.

1.2 Provincial Planning Statement

2024 Provincial Planning Statement vision as it relates to Master Servicing planning is summarized in the following quotations;

- *… the province has set a goal of getting at least 1.5 million homes built by 2031.*
- *Ontario will increase the supply and mix of housing options, addressing the full range of housing affordability needs.*
- *Providing a sufficient supply with the necessary mix of housing options will support a diverse and growing population and workforce, now and for many years to come.*

As such, it is the province's direction to bring to market additional homes in a cost-effective matter.

Chapter 3.1 outlines the General Policies for Infrastructure and Public Service Facilities and Chapter 3.6 provides specific policies related to Sewage, Water, and Stormwater infrastructure.

1.3 Official Plan

Cost-effective civil solutions allow for a more affordable end product. The City of Ottawa Official Plan provides numerous polices to guide growth to provide affordable products to the market.

OP Section 1.1 "We will need to create an affordable supply of options across the city for different household types and income groups."

Big Policy Move 5: "Becoming more liveable and affordable relative to other cities is a key to Ottawa's success."

Chapter 4.7 provides policy direction on Drinking Water, Wastewater and Stormwater Infrastructure.

Annex 4, Local Plan Framework, offers an outline of key points required in a Master Servicing Study.

1.4 Infrastructure Master Plan

The Infrastructure Master Plan establishes growth related polices, objectives, and priorities for municipal infrastructure.

Subject lands are identified as area W-4 and are illustrated on Schedule 1 of the ***IMP***. Schedule 1 extracted and included in ***Appendix A*** for reference. Furthermore, the lands are shown within the Public Service Area, see extracted Schedule 3 in ***Appendix A***, with the exception of the Eter parcel. Except for certain circumstances as defined in the Official Plan, all development inside the Public Service Area is to be serviced by City-operated water and wastewater systems. Consideration of PSA expansion proposals will be governed by the polices outlined in both the IMP and the Official Plan. Each proposal will be evaluated on its own merits, based on local conditions, and without setting a precedent. The direction which follows provides further clarification to the Official Plan policies. This Plan permits service extensions outside of the Public Service Area as shown on Schedule 3 (Appendix A), subject to compliance with Official Plan policies 4.7.2.4 (a), (b), c), or (d), or their successors thereto.

The W-4 lands were considered to add 68 gross ha to the City containing 618 units with a total population of 1,504.

This MSS considered the IMP policies in evaluating water, wastewater, and stormwater infrastructure solutions. Sections 5.3, 6.3, and 7.2 outline the goals for each infrastructure component.

The IMP offered the following for the subject lands:

- *The management of stormwater in both cluster areas in the West Urban Community could prove challenging given the location of urbanization being in the upper watershed* *area of available storm outlets, and the need to manage increased runoff volumes through downstream drainage systems in built-out areas, or across lands not owned by the City.*

- *Servicing in area W-4 is also challenging due to the presence of shallow bedrock, and the proximity of adjacent rural development on private wells.*

The IMP states that completion of an MSS requires fulfilling the following five study steps:

a) Pre-consultation will be conducted with the landowner group or proponent of Municipal Class EA undertakings required in the local plan area;

b) Preparation of a study-specific Terms of Reference consistent with the City's Guidelines for preparing MSS Terms of Reference (Appendix C) and to the satisfaction of the City;

c) Completion of an MSS consistent with the approved study-specific Terms of Reference;

d) Completion of the Municipal Class Environment Assessment process, including the required public consultation; and

e) Approval of the MSS concurrent with approval of the local plan. MSSs supporting local plans identified in IMP policy 4.3.6.1 a) will require Council approval concurrent with approval of a CDP or Concept Plan and EMP.

1.5 Terms of Reference

This section summarizes key items from the terms of reference and where they are addressed in this report. The complete terms of reference are located in ***Appendix A***.

Task 1: Agreement on Terms of Reference

- *Agreed to Terms of Reference are included in **Appendix A.***

Task 2: Internal Concept Plan Review Process (Input Evaluation)

1. Review and Consolidate: As part of the Concept Plan Review Process, a review of background reports that are concerned with the study area will be completed.

- *Completed as part of the Existing Conditions Report included in **Appendix A** and restated in **Section 3.0** of this **MSS**.*

2. Hydrological Modelling: A hydrologic model will be developed to estimate peak flows and hydrographs under for the various outlets from the Study Area.

- *Completed as part of the Existing Conditions Report included in **Appendix A.***

3. Coordination and Liaise with Other Disciplines: The Concept Plan review process will discuss findings from other disciplines including geotechnical, hydrogeology, water budget, hydrology, ecology (aquatic resources and natural areas), etc., which will establish the existing environmental conditions.

    a. Geotechnical Inputs:

i. Review and establish grade raise restrictions.

ii. Review soil characteristics to determine if soils are conducive to infiltration measures.

iii. Review areas of recharge or discharge potential.

b. Hydrologist Inputs:

i. Identify the zones conducive to infiltration measures or other low impact development (LID) strategies.

c. Biologist Inputs:

i. The objectives and targets from a storm discharge perspective will be based on the on-site environmental constraints as well as the limitations of the receiving watercourses.

d. Review Topographical Survey and Complete Inventory of Existing Infrastructure.

➢ ***Sections 2.0 and 3.0*** *summarizes other discipline inputs into the* ***MSS****.*

4. Evaluation and Assessment of Storm Design Criteria, Objectives and Pond Alternatives: Based on the findings of the natural resource inventories, storm criteria for both water quality and quantity will be established from a consensus with other disciplines and based on requirements prevalent in the Study Area.

➢ ***Section 7.0*** *outlines storm design goals and criteria, evaluation, and alternatives.*

5. Coordination with Drainage Engineer for requirements relating to the Faulkner Municipal Drain (FMD).

➢ ***Section 7.1.1.*** *outlines the work completed relating to the Faulkner MD.*

6. Concept Plan Summary Discussions & Preferred Plan Selection.

➢ ***Section 1.1*** *outlines to the Concept Plan whereas the discussion of preferred plan selection is included in this document and others.*

Task 3: Functional Servicing Report and Master Infrastructure Review

1. Evaluation of Municipal Servicing Requirements for the Preferred Concept Plan.

a. Grading: Develop a macro level Grading Plan for the Concept Plans.

➢ *Conceptual grading plan is included in* ***Drawings****.*

b. Review capacity of receiving water course(s).

➢ *As described in* ***Section 7.1.1.*** *this work is underway in coordination with the appointed drainage engineer.*

2. Water Infrastructure: Confirm pressure objectives with the City along feedermains under both domestic and fire flow conditions.

- ***Section 5.0*** *summarizes anticipated pressures along the feedermains.*

3. Wastewater Infrastructure: Based on the sanitary sewer outlets inventoried as part of Task 2, assess residual capacities. Prepare a Sanitary Drainage Area Plan and Design Sheets for the preferred Concept Plan.

- ***Section 6.0*** *of this study completed a sanitary sewer analysis.*

4. Storm Servicing and Stormwater Management: Confirm storm design criteria (quantity and quality) with the RVCA, MECP and the City and discuss potential impacts. Coordinate with the City Drainage Group regarding the Faulkner Drain and any requirements under the Ontario Drainage Act. Prepare Storm Sewer Design Sheets and Drainage Area Plans for the preferred Concept.

- ***Section 7.0*** *details the above objectives.*

5. Water Budget: prepare a pre- and post-development water balance review.

- ***Section 3.0*** *outlines various sources of pre-development water budget, while the* ***Water Budget*** *prepared by Paterson addresses the post development condition. Additional discussion on water budget targets are included in* ***Section 7.4****.*

6. Opinion of Probable Cost and Phasing.

- *Option of Probable Costing and phasing are included in* ***Section 5.0, 6.0, and 7.0****.*

2.0 GUIDELINES, PREVIOUS STUDIES, AND REPORTS

2.1 Existing Studies, Guidelines, and Reports

The following documents were referenced in the preparation of this report:

- **Design Guidelines for Drinking-Water Systems,**
  Ministry of the Environment, Conservation, and Parks, May 11, 2023.

- **Design Guidelines for Sewage Works,**
  Ministry of the Environment, Conservation, and Parks, September 4, 2024.

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

- Low Impact Development Stormwater Management Guidance Manual,
  Draft for Consultation
  Ministry of the Environment, Conservation, and Parks, January 2022.

- **Ontario Building Code Compendium**
  Ministry of Municipal Affairs and Housing Building Development Branch, May 29, 2024.

- **City of Ottawa Official Plan**
  City of Ottawa, November 4, 2022.

- City of Ottawa Infrastructure Master Plan
  City of Ottawa, June 2024.

- Mississippi-Rideau Source Water Protection Plan,
  MVCA & RVCA, April 28, 2022.

- **Ottawa Sewer Design Guidelines**,
  City of Ottawa, *SDG002,* October 2012.

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

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

  - Technical Bulletin ISTB-2018-01, Revisions to Ottawa Design Guidelines – Sewer,
    City of Ottawa, March 21, 2018.

  - Technical Bulletin ISTB-2018-03, Revisions to Ottawa Design Guidelines – Sewer,
    City of Ottawa, June, 2018.

  - Technical Bulletin ISTB-2019-02, Revisions to Ottawa Design Guidelines – Sewer,
    City of Ottawa, July 8, 2019.

  - Technical Bulletin IWSTB-2024-04, Screening Criteria – Infiltration-type LIDs for Development,
    City of Ottawa, September 12, 2024.

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

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

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

  - **Technical Bulletin ISTB-2018-02**
    City of Ottawa, March 21, 2018.

  - **Technical Bulletin ISTB-2021-03**
    City of Ottawa, August 18, 2021.

- Low Impact Development Technical Guidance Report, Implementation in Areas with Potential Hydrogeological Constraints
  Dillon Consulting and Aquafor Beech, February 2021
  *(**LID Report**)*

- Fire Underwriters Survey, 2020 (**FUS**)

- Jock River Reach 2 & Mud Creek Subwatershed Study Existing Conditions Report
  Marshall Macklin Monaghan / WESA, May 2009.
  *(**Jock River Reach 2 SWS**)*

- Engineer's Report for the Flowing Creek Municipal Drain
  A.J. Graham Engineering, December 1973.
  *(**Flowing Creek Engineer's Report**)*

- Amendment to the Engineer's Report for the Faulkner Municipal Drain & Addendum #1
  Robinson, December 2020 and March 2021.
  *(**Faulkner Engineer's Report**)*

- Flowing Creek Flood Risk Mapping from Flewellyn Road to Jock River
  Rideau Valley Conservation Authority, May 2017.
  *(**Flowing Creek Flood Mapping**)*

- Fernbank Community Design Plan, Master Servicing Study
  Novatech, June 2009
  *(**Fernbank MSS**)*

- Stittsville South – Area 6, City of Ottawa, Master Servicing Report & Stormwater Management Design Plan
  Novatech/DSEL, December 2013
  *(**Area 6 MSS**)*

- Stittsville South Subdivision, City of Ottawa – Detailed Servicing & Stormwater Management Report
  Novatech, July 2016
  *(**Stittsville South Servicing Report**)*

- Stittsville South Subdivision, City of Ottawa – Shea Road Sanitary Pump Station Design Brief
  Novatech, May 2016 *(**Shea Road P.S. Design**)*

- Design Brief for the Stormwater Management Pond for the Davidson Lands
  JFSA/DSEL, November 2017 *(**Davidson Pond Brief**)*

- Caivan – Stittsville Lands (5993, 6070 & 6115 Flewellyn Road): Conceptual SWM Ponds Sizing and Preliminary HGL Analysis.
  JFSA (P2267), November 2023. *(**Davidson Pond Brief**)*

- Design Brief, Davidson Lands – OPA 76 Area 6a, Phase 1 (5993 Flewellyn Road)
  IBI Group, February 2018
  *(**IBI Phase 1**)*

- Design Brief, Davidson Lands – OPA 76 Area 6a, Phase 2 (5993 Flewellyn Road)
  IBI Group, July 2020
  *(**IBI Phase 2**)*

- Geotechnical Investigation, Proposed Residential Development, 5993, 6070 & 6115 Flewellyn Road, Ottawa
  Paterson Group (PG5570-2), August 7, 2024
  *(**Geotechnical**)*

- Hydrogeological Existing Conditions Report, Proposed Residential Development, 5993 & 6115 Flewellyn Road & 6030 & 6070 Fernbank Road, Ottawa, Ontario
  Paterson Group (PH4625-REP.01.R2), August 7, 2024.
  (Existing Hydrogeology)

- Hydrogeological Study and Water Budget Assessment, Proposed Residential Development, 5993 & 6115 Flewellyn Road & 6030 & 6070 Fernbank Road, Ottawa, Ontario
  Paterson Group (PH4681-REP.01.R2), August 7, 2024
  *(**Water Budget**)*

- Stittsville South W4 Future Neighborhood Area – Existing Conditions Report
  Kilgour & Associates Ltd., August 13, 2024.
  *(**Kilgour Natural Heritage Conditions**)*

- Hydraulic Capacity and Modeling Analysis – Stittsville South Urban Expansion Area Development (*Final Report*). GeoAdvice Engineering Inc., August 2024.
  *(**GeoAdvice Hydraulic Analysis**)*

- Existing Conditions Report – Servicing for Stittsville South Urban Expansion Area, DSEL, September 2023 (***Existing Conditions Report***)

- Shea Road Pump Station and Fernbank Capacity Review Memorandum, Novatech, May 2023.

- Shea Road Pump Station Upgrade Options, Novatech, December 2024.

- Caivan Lands – Stittsville West Ltd., & Stittsville South Inc.: Conceptual SWM Ponds Sizing and Preliminary HGL Analysis, JFSA, August 9, 2024.

2.2 Report Integration

In support of the Official Plan Amendment application for the ***SSUEA*** study, various studies and plans are required to identify: on-site and off-site municipal infrastructure (e.g. roads, water, and sewers); the natural heritage system; recreational pathways; community facility requirements; on-site and off-site transportation infrastructure; and land use densities and mixes.

The reports and planning for the ***SSUEA*** were undertaken in a similar time frame and in a coordinated manner, resulting in an iterative planning and decision-making process. An inventory of the concurrent and inter-related reports is provided in the following table highlighting how the various components influence this ***MSS***. These reports are referenced throughout the ***MSS*** and are provided for reference in the appendices or as companion documents under separate cover.

Examples of inter-related aspects of the infrastructure and land use planning process include:

- *Analysis of existing conditions, which led to the identification of development constraints that were used as the starting point for the Land Use/Demonstration Plan;*

- *The establishment of trunk watermains, storm collector sewers and sanitary collector sewers along proposed major roads, which is meant to support orderly and cost-effective phasing within **SSUEA**; and,*

- *The integration and design of the pathways system to reflect environmental amenities, transportation networks, and neighborhood requirements.*

Table 2: Summary of Studies and Reports

Report	Relationship to Master Servicing Study
Class Environmental Assessment Requirements Overview (Morrison Hershfield) dated October 2023	Provides overview of infrastructure projects to service the development area and applicability of the *Environmental Assessment* and *Planning Act* process.
Existing Conditions Report - Servicing Infrastructure (DSEL) dated Sept. 2023	Identifies the existing municipal infrastructure within, and surrounding, the ***SSUEA*** and assesses capacity to service the study area.
Stittsville South W4 Future Neighborhood Area – Existing Conditions Report (Kilgour & Associates Ltd.) dated August 13, 2024	Delineates the natural heritage system within the ***SSUEA*** based on field studies performed and identifies opportunities for consideration in the planning process related to development options. Defines drainage features and setbacks within and adjacent to the subject lands, which influences stormwater management recommendations for the development.
Geotechnical Investigation – Proposed Residential Development (Paterson) dated August 7, 2024	Determines general site subsoil and groundwater conditions, provides grade-raise recommendations, and bedrock contours.
Hydrogeological Existing Conditions Report (Paterson) dated August 7, 2024	Assesses the hydrogeological setting of the site with respect to bedrock and surficial geology, aquifers, aquitards, horizontal and vertical flow patterns, existing groundwater recharge/discharge, and aquifer vulnerability.
Hydrogeological Study and Water Budget Assessment (Paterson) dated August 7, 2024	Assesses the hydrogeological setting of the site with respect to aquifer systems, groundwater levels, hydraulic properties and catchment characteristics. Provides pre-development water budget analyses to identify infiltration potential and opportunities for the use of LID measures.
Conceptual SWM Ponds Sizing and Preliminary HGL Analysis – Draft Report (JFSA) dated August 9, 2024	Conceptual sizing of two SWM ponds, impacts of discharging a portion of ***SSUEA*** lands to the Davidson SWM Pond, and preliminary storm and sanitary HGL analysis.
Hydraulic Capacity and Modeling Analysis – Stittsville South Urban Expansion Area Development – Final Report (GeoAdvice Engineering Inc.) dated August 2024	Describes the assumptions and results of the hydraulic modeling and capacity analysis for proposed development within the ***SSUEA*** lands. Includes identification of connections to existing municipal infrastructure and ensuring guideline requirements are satisfied.

3.0 EXISTING CONDITIONS

DSEL prepared and submitted an Existing Conditions Report in September 2023 included in ***Appendix A***.

The following summarizes key items from the existing conditions report that informed the preparation of the MSS along with updated materials.

3.1 Existing and Adjacent Land Uses

The study area encompasses approximately 80 ha of land and is bound by Flewellyn Road to the south, Shea Road to the east, an existing urban subdivision development to the north (Stittsville South – Area 6 ("Edenwylde")) and an estate lot subdivision (Woodside Acres) to the west.

The subject area is currently a mix of active/former agricultural/pasture land in the eastern portions and partial forested areas in the western portion. The overall area is bisected diagonally (north/south) by an existing HONI 500kV utility corridor and an existing stormwater management facility (Davidson Stormwater Pond) is located centrally within the property and manages flows from a portion of the Edenwylde Subdivision to the north.

In addition, a stormwater conveyance ditch originating from the development areas to the north, conveys drainage southward parallel to the east boundary of the current 6070 Fernbank Road property. The ditch officially transitions to being the Faulkner Municipal Drain (FMD) approximately 215 m north of the Flewellyn Road ROW and then flows eastward along the Flewellyn Road corridor and then southward along the west side of Shea Road.

Land use to the southwest of the subject consists of a rural estate lot subdivision (Woodside Acres) while lands to the northwest are comprised of new urban community development areas (Stittsville South – Area 6 ("Edenwylde")) which began construction in ~2016/17.

Along the subject area periphery are six rural residential properties fronting onto Flewellyn Road and one undeveloped rural parcel fronting Shea Road.

3.2 Land Ownership

The ***SSUEA*** subject area is comprised of multiple landowners with lands of varying size. However, the majority of land ownership (approximately 88%) within the development area is under one ownership (Caivan) with the remainder being smaller holdout parcels as indicated in ***Exhibit 1*** in ***Section 1.1*** of this report.

3.3 Jock River Reach 2 and Mud Creek Subwatershed Existing Conditions Report

Marshall, Mackin, Monaghan completed a Subwatershed Existing Conditions Report in May 2009 for the Jock River Reach 2 and Mud Creek subwatershed.

The subject lands are included in the Jock River Reach 2 catchment area, where runoff from the site flow to the Jock River via the Faulkner MD and Flowing Creek. Flowing Creek empties into the Jock River east of the Village of Richmond.

The Subwatershed Existing Conditions Report was prepared to develop integrated subwatershed plans based on eco-system management principles that will guide stakeholders on how to best manage human activities affecting surface/ground water resources and other valued eco-system components in the subject subwatersheds.

Groundwater recharge, to the bedrock aquifers, within the Jock River Reach 2 subwatershed was anticipated to occur where the bedrock is close to the surface, and where the surficial materials have relatively higher permeability. The bedrock is shallowest to the north, west and south of the subwatershed. The study indicated that the subject lands were identified as having shallow overburden.

The study found no evidence of urban impact on flows due to low proportion of urban lands except for Wilson-Cowan Drain.

The estimated water budget within Jock Reach 2 the breakdown was estimated at 358 mm of runoff, 372 mm of evapotranspiration and 213 mm of infiltration (943mm of precipitation).

The study did not present any specific recommendations for development within the watershed.

3.4 Source Protection

The subject lands reside within both the Mississippi-Rideau and Raisin Region-South Nation Source protection areas.

Mapping from the Mississippi-Rideau Source Protection Plan indicates that some portions of the development area may fall under the fringes of the Significant Groundwater Recharge Area (SGRA) mapping and is included with an area identified as Highly Vulnerable Aquifer. See Schedules L and M of the source water protection plan included in ***Appendix A***.

Highly Vulnerable Aquifers receive a vulnerability score of 6. Significant Groundwater Recharge Areas receive a vulnerability score of 2 to 6 depending on the area's vulnerability. Activities can only be considered a "significant" drinking water threat in areas scored 8 to 10.

There were no Wellhead or Intake protection zones identified within the subject lands.

3.5 Road Infrastructure

As discussed above, the subject lands area bounded by the following existing roads:

- Shea Road to the east,
- Flewellyn Road to the south, and
- Existing local roads to the north, Ocala Street and Painted Sky Way.

3.6 Topography and Drainage

For the Caivan landholdings west of the HONI corridor the site topography generally drains east and south (elevations ranging from 109 m to 103 m) with drainage ultimately being conveyed to the north Flewellyn Road right-of-way (ROW) and the FMD which bisects the development area.

Similarly, the development area east of the HONI corridor also drains eastward and southward (elevations ranging from 104 m to 102 m) to the portion of the FMD along the northern Flewellyn Road ROW as well as the western side of the Shea Road ROW.

No flood hazard lands have been identified within or near the subject lands.

3.7 Geotechnical

Paterson Group (Paterson) was commissioned to complete geotechnical investigation for the ***SSUEA*** lands.

Key details are discussed herein, while full details are provided in the above report. The geotechnical investigation indicates that:

- **Surface Conditions:** Western portions of the subject site (west of FMD) are heavily vegetated while eastern areas are generally cleared of trees and vegetation. The site gradually slopes from the northwest to the southeast. The site also gradually slopes downward from the northeast and southwest to the central portion of the site, thereby having a shallow valley bearing northwest to southeast.

- **Soil Profile:** Profile consists of topsoil overlying a loose to compact, brown silty sand to sandy silt deposit, followed by compact to dense glacial till, underlain by bedrock. The glacial till deposit was generally observed to consist of compact to dense brown silty sand with gravel, cobbles and traces of clay.

- **Bedrock:** The bedrock within the subject area consists of limestone, dolostone, shale and sandstone of the Gull River Formation and an overburden drift thickness of 0.3 to 6.1 m depth across the subject site. Borehole investigations into the bedrock surface yielded an average Rock Quality Designation (RQD) value ranging from 57 to 100% indicating a fair to excellent quality bedrock across the site. Proposed development within bedrock may require blasting; specific blasting requirements would apply. See bedrock contour plan extracted from the ***Geotechnical*** report in ***Appendix B***.

- **Preliminary Grade Raise:** From a geotechnical perspective, the subject site has been considered satisfactory for the proposed development. Only two borehole locations observed a discontinuous shallow stiff, brown, silty clay layer which may have isolated specific 2m permissible grade raise restrictions but that would be refined at a site-specific level in future development applications.

- **Groundwater:** A total of 13 groundwater monitoring wells were installed within the development area. The groundwater table will fluctuate seasonally but measured groundwater levels generally ranged from 0 to 3.7 m below existing ground. See bedrock contour plan extracted from the ***Existing Hydrogeological*** report in ***Appendix B***.

3.8 Hydrogeological Conditions

The hydrogeology of the subject area has been analyzed by Paterson Group. The hydrogeological investigations indicates that:

- ***Groundwater Recharge:*** *The field saturated hydraulic conductivity indicates that the overburden soils are considered to have a moderate hydraulic conductivity suggesting that the overburden materials act as a permeable layer to predominantly transmit groundwater in a horizontal direction with insignificant recharge to the bedrock layer below due to the higher RQD values. A portion of the site is mapped as a significant groundwater recharge area (SGRA). The Mississippi- Rideau Source*

Protection Region (MRSPR) SGRA mapping shows that the site area mapped as a recharge area is negligible compared to the overall SGRA zones. It should be noted that site specific testing provides better resolution than the high level SGRA mapping provided by the MRSPR.

- ***Water Budget:*** *It was Paterson's interpretation that saturated conditions in the permeable overburden soils represent the existing water table at the subject site with the potential for minor groundwater lowering due to servicing installation and a typical minor water budget deficit after development. The shallow bedrock, perched groundwater in the shallow overburden, and high RQD values may make it impractical to use infiltrating Low Impact Development (LID) measures on the site. The use of best management practices (BMP) should be used for stormwater quality and quantity control to assist in infiltrating clean water, treating salt impacted water where possible or redirecting salt impacted water away from the SGRA during seasonal periods with expected elevated salt levels.*

- ***Groundwater Flow:*** *The direction of hydraulic gradients shows that groundwater flow travels predominantly from west to east towards the eastern corner of the subject site. The overburden and bedrock groundwater flow in the vicinity of the study area is considered to partially reflect local topography and subwatershed regional boundaries. It is anticipated that the vertical gradient observed in the west portion of the site is due to the higher topography to the west of the subject site providing additional head where groundwater may daylight in areas such as the human-made excavation observed in the west portion of the site. The eastern portion of the site is showing a slight downward gradient which is indicative of the overburden providing insignificant recharge to the underlying bedrock aquifer. It should be noted that groundwater within the shallow overburden aquifer is expected to flow laterally at the bedrock interface until it is discharged at the Faulkner Drain or roadside ditch.*

- ***Aquifers:*** *In general, the overburden soils at the subject site are relatively shallow and consist of moderate hydraulic conductivities with lower value materials on the east side of the development area. With the limited thickness of available quantity of groundwater within the overburden aquifer, it is not considered an adequate source for water supply wells. Surrounding water wells in the vicinity of the site are accessing the bedrock aquifers. Based on a review of the MECP water well record database, Paterson has identified one aquifer system in the vicinity of the study area which consists of the underlying bedrock aquifer. The Gull River Formation aquifer system is located over the entirety of the study area. The majority of water wells are completed at greater depths within the bedrock unit.*

- ***Wells:*** *As noted above, water supply wells are the primary source for drinking water for existing residential properties to the west (Woodside Acres) and adjacent holdout properties.*

3.9 Existing Hydrology

JFSA completed an assessment of the pre-development hydraulic and hydrologic drainage conditions included as part of the ***Existing Conditions Report***, in ***Appendix A***.

A detailed topographic study was completed to identify all major flow paths within the development under existing conditions. From this analysis, it was found that for the eastern lands, the site primarily consists of 2 major drainage areas both of which discharge to the Faulkner Drain on Flewellyn Road. For the western lands, the drainage patterns are slightly more complex but approximately half of the lands discharge to the Faulkner Drain on Flewellyn Road, while the remaining half discharges to the Faulkner Drain where it divides the east and west properties.

Continuous hydrologic modelling has been completed which has made use of soil infiltration testing completed by Paterson Group to determine the site's predevelopment water budget. Based on this analysis it was determined that for the total development site, approximately 17% of the annual rainfall will result in runoff, 63% will evaporate and 20% will infiltrate.

Based on Table 4.2 of the Robinsons report there are three existing culverts that act as residential entrances on Flewellyn Road (Culverts 4+882.90, 5+055.00 & 5+185.40) that are either close to or have slightly less than the required capacity to safely convey the full 100-yearflow. The culverts are likely controlling water levels along this portion of Flewellyn Road, as such these culverts should be revisited in the future to ensure that peak water levels are contained within the Faulkner Municipal drain.

3.10 Municipal Drains

3.10.1 Flowing Creek Municipal Drain

As noted above runoff from the subject site drains to the existing Faulkner Municipal Drain to the Flowing Creek Municipal Drain.

The 1973 Engineers Report indicates that "For most row crops, surface drainage systems should remove excess water from the soil surface within 24 hours after the rainfall ceases, providing there are lateral drains within the basin."

"The flow for excellent farm drainage has been used in our design for the Main Drain. This design will not provide for peak flows during the freshets or the occasional torrential summer storm. Excess run off during these times will be discharged as overland flow and the lands adjacent to the channels may be flooded temporarily, however, not for such a period that excessive crop damage will result."

3.10.2 Faulkner Municipal Drain

Robinson Consultants Inc. was appointed by the City of Ottawa on April 27, 2016 to complete an Engineer's Report to amend the existing Engineer's Report for the Faulkner Municipal Drain.

The engineering consideration of the impact of the land use change included a review of the "Stittsville South Subdivision City of Ottawa, Faulkner Drain Hydrotechnical Update" (SWM Report) as prepared by Novatech Engineering Consultants Ltd., dated "Revised July 15, 2016". The Hydrology in the Novatech Engineering Consultants Ltd., July 2016 report was based on full development in accordance with the approved Community Development Plan, referred to Scenario 3. The hydrology from this report has been reviewed and approved by the City of Ottawa and has been used as the basis for design of the improvements to the Faulkner Municipal Drain included in the current report.

A steady state flow model was produced using HEC-RAS software to review and assess flow impacts on the Faulkner Municipal Drain.

The capacity of existing culverts on the Faulkner Municipal Drain was calculated using MTO nomographs. The modeled flow at these culverts was then used to verify if the culverts had sufficient capacity to convey the design flows.

Robinson Consultants Inc prepared an addendum to the Faulkner Municipal Drain report on March 26, 2021. Modifications to the existing Faulkner Municipal Drain included relocating a portion of the drain, lowering the profile, and modifying the cross-section of the drain to increase the capacity and to reduce the potential for erosion of the steep banks. The proposed modifications were made to accommodate the drainage from the stormwater management systems for the development area and will relocate the drain outside the road allowance for Shea Road where it was very deep and presented a safety hazard.

3.11 Environmental Considerations

Kilgour and Associates was commissioned to complete an Environmental Impact Statement (EIS) for the W-4 lands, assessing the existing natural features, ecological assets, and potential environmental constraints to development.

The subject area is within the Rideau Valley Conservation Authority jurisdiction. During review of the site KAL conducted a headwater drainage feature assessment (HDFA) of the subject area. The review identified six (6) HDF's located both adjacent and within the development. One group of channels (tributaries A, B and D) is associated/located within the western treed area of the site while the second grouping (tributaries C, E and F) is primarily associated with the FMD which bisects the study area and ultimately conveys all flows from the site. The following table describes the various features.

Table 3: HDFA Summary

KAL HDF Identifier(1)	Tributary (HDF) Description
Tributary A	Originates in the northwest region of the site (~150 m offset from west boundary and roughly parallel to Tributary D) and flows southward as a braided channel towards Flewellyn Road. It primarily functions as a drainage feature supporting spring/rainfall run-off.
Tributary B	Originates within the northwest, central region of the site and flows southeast, eventually joining Tributary E. It has a standing water pool present with interstitial flow towards the Flewellyn Drain.
Tributary C	Flewellyn Road ditch feature (north side) originating at the southwestern corner of the Site, at the terminus of Tributary D. Flows eastward, joining the Faulkner Drain. Tributary C is a permanent feature that has water present year-round
Tributary D	Man-made, engineered lot swale feature that originates in the northwestern corner of the Site. It follows the western property boundary and is present within portions of the rear yard allowances of the adjacent Woodside Acres estate lot development. Primarily functions as a drainage feature supporting spring/rainfall run-off.
Tributary E	Constructed, linear channel feature that originates within the west, central portion of the site and flows south eventually turning eastward joining the Faulkner Drain. It has intermittent standing water pools present with intermittent flow towards Faulkner Drain and receives intermittent flow from Tributary B.

Tributary F	Shea Road ditch feature (west side) at the eastern Site boundary. It is located adjacent to an agricultural field and connects downstream to the Faulkner Drain at Flewellyn Road. It primarily functions as a drainage feature supporting spring and rainfall run-off.

HDFs on the site currently exist in primarily forested areas such that they include extensive tree cover along their riparian corridors. The HDFs themselves are hydrologically limited, having insufficient water level though most of the year to support fish or other aquatic wildlife. Based upon site topography and constraints, future site development is anticipated to require the construction of multiple wet stormwater management facilities to support quality/quantity stormwater management for the area. The outlet channels for each feature provide an opportunity to design local watercourses following principles of natural channel design and with increased levels of hydration that would support improved habitat conditions beyond the limited capacity afforded by the current HDFs.

Standard HDFA management directives of "Mitigation" indicate that a feature may be maintained, replicated, or enhanced using natural channel design techniques to maintain or enhance the reach. There is no requirement to retain the feature per se, but on-site flow, outlet flows, and overall water balance for the area must be maintained by providing mitigation measures to infiltrate clean stormwater. Per KAL, this applies to Tributaries A and D.

Standard HDFA management directives of "Protection" indicate that the feature may be maintained and/or enhanced, but typically should not be relocated. The general directive is for the feature to be protected and its riparian zone enhanced where feasible. Notably for Tributaries B and E, however, these tributaries are sourced from the SWCM1-1 community wetland (see *Kilgour Natural Heritage Conditions* report for further details). As the wetland would be unlikely to remain with development occurring on the western half of the site, (i.e. even with standard setbacks) the hydrology of those tributaries is unlikely to remain regardless of protections otherwise applied. Tributaries C and F are also designated as "Protection" but those HDFs are periphery to the site (i.e. roadside ditches) and can be maintained in their respective locations.

Tributary D along the western boundary of the study area, and the Faulkner Drain were identified as requiring development setbacks. Tributary D with a development setback of 5 m is anticipated to protect the limited flows within the feature. KAL has indicated that the existing FMD has variable setback buffers from 0 m through much of its length beyond the site. North of the ***SSUEA*** also has minimal setbacks. KAL concludes that the functionality of any buffer would be limited to providing filtration of overland runoff could be provided by a setback of 15m with simple vegetation buffers, or less provided that overland flows are treated by a stormwater facility prior to release or landscaping with comprehensive plantings.

KAL indicates that, the outlet channels for each feature provide an opportunity to design local watercourses following principals of natural channel design and with increased levels of hydration that would support improved habitat for local biota beyond the limited capacity afforded by the current HDFs. Regarding the previously discussed forest cover on the Site, SWM block planning should include extensive canopy cover that also allows new watercourses to still be situated directly within a forested riparian context.

4.0 NEED AND JUSTIFICATION FOR MUNICIPAL SERVICING

4.1 Vision & Goals for the SSUEA

It is envisioned that the ***SSUEA*** study area will be a residential enclave for the residents in the southern boundary area of Stittsville. The combination of diverse housing options, in addition to the leisure and recreational opportunities, will make it an attractive place to live and play. The integration of various housing options, coupled with leisure and recreational amenities within the development, is anticipated to foster an appealing living and recreational environment.

An offset grid pattern road network, characterized by regularly spaced intersections will optimize transit, cycling, vehicular travel, and pedestrian circulation. The Hydro One Corridor will provide a strong linear corridor for pedestrians and cyclists, which will form part of a Greenspace network that links features such as the Davidson Stormwater Facility, watercourses, parks, and open spaces.

4.2 Servicing Problem Statement

A servicing strategy is needed to support the wastewater collection requirements, water demands, storm drainage requirements, and stormwater management requirements for the proposed land uses within the ***SSUEA***. The servicing strategy must be consistent with the Provincial Policy Statement (PPS), must meet City of Ottawa requirements, must meet the requirements of other approval agencies (e.g. Ontario Ministry of Environment, Conservation, and Parks, Ontario Ministry of Natural Resources and Forestry, Rideau Valley Conservation Authority, etc.), and must demonstrate good engineering practice for the protection of public safety, the environment, and sustainable operation.

5.0 WATER SUPPLY SERVICING

5.1 Existing Water Supply

The ***SSUEA*** study area are expected to be included within the City's Pressure Zone 3W service area of the City of Ottawa water distribution network (see ***Figure 2*** for reference). The pressure zone receives supply from the Campeau Drive and Glen Cairn Pump stations. The Stittsville Elevated Tank provides balanced storage during peak usage and fire flow conditions. The available options for connectivity to the City's water supply network include:

- The major water supply line in the vicinity of the development is a 400mm diameter watermain along Fernbank Road, with a watermain stub approximately 300m southwest of the Fernbank Road and Shea Road intersection;
- An existing 250mm diameter watermain located within the Parade Drive ROW, immediately north of the western portion of the development area. A future southbound ROW block from Parade Drive is located between civic addresses 714 and 720 Parade Drive;
- An existing 250mm diameter watermain is located within the Aridus Crescent ROW which is north of the Davidson Lands parcel. An existing 50mm water service within a servicing block from Aridus Crescent to the SRPS pump station is also installed facilitating water supply to that facility;
- An existing 200mm diameter watermain located within the Painted Sky Way ROW at the northwest portion of the Davidson land parcel; and;
- An existing 200mm diameter watermain location within the Ocala Street ROW north of the northeastern portion of the Davidson land parcel.

5.2 Future Water Infrastructure Improvements

The City of Ottawa's Infrastructure Master Plan (IMP) does not illustrate any planned upgrades to the 3W pressure zone specific to servicing the W-4 lands.

Upgrades to the 3W pressure zone are limited to improvements to support development in the W-2 and W-3 Urban Expansion Areas, where, it is contemplated to create a new Stittsville PS for creation of new Stittsville pressure zone. The creation of the new pressure zone is expected to have an indirect benefit to the existing zone, however City-wide hydraulic modeling will be required to confirm the extent of the benefit.

5.3 Water Supply Goals

The following summarizes goals for the development of a preferred water supply network.

- Per the OP, civil infrastructure will need to be cost effective to support an affordable supply of options across the city for different household types and income groups.
- The subject lands are shown within the PSA, see extracted Schedule 3 in ***Appendix A***, therefore development of water supply options will be restricted to the expansion of the existing municipal system.
- Capable of potable water to the preferred concept plan in a cost-effective manner.

- In conformance with MECP and City of Ottawa design standards.
- Utilize existing infrastructure.
- Minimize disruption to existing community.

5.4 Water Supply Targets

Table 4 summarizes the Water Supply Design Criteria employed in the preparation of the preliminary water demand estimate as provided by the City of Ottawa for expansion areas where the population exceeds 3000 persons. See correspondence with City staff in ***Appendix C.2***.

Table 4: Water Supply Design Criteria

Design Parameter	Value
Extracted from Section 4: Ottawa Design Guidelines, Water Distribution (July 2010)	
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 480 kPa
During normal operating conditions pressure must not drop below	276 kPa
During normal operating conditions pressure must not exceed	552 kPa
During fire flow operating pressure must not drop below	140 kPa
City of Ottawa – Email Correspondence (July 2024)	
Residential - Single Family	3.4 p/unit
Residential – Townhome/ Semi	2.7 p/unit
Residential – MediumDensity	1.8 p/unit
Average Day Demand	
Single Detached	612 L/unit/day
Multifamily	535 L/unit/day
Apartment/Condo	394 L/unit/day
Water Loss per Connection	80 L/unit/day
Parkland	28,000 L/ha/day
Outdoor Water Demand	
Single Detached	700 L/unit/day
Multifamily	350 L/unit/day
Apartment/Condo	0 L/unit/day
Parkland	0 L/unit/day
Maximum Day Demand	
Single Detached	AVDY + OWD L/unit/day
Multifamily	AVDY + OWD L/unit/day
Apartment/Condo	AVDY + OWD L/unit/day

Parkland	1.5 x AVDY
Peak Hour Demand	
Single Detached	2.1 x MXDY L/unit/day
Multifamily	2.1 x MXDY L/unit/day
Apartment/Condo	1.6 x MXDY L/unit/day
Parkland	1.8 x MXDY L/unit/day
[1] Values represent L/cap/day for residential land uses. [2] Occupancy factors chosen according to housing type. The values shown were extracted from Section 4.2.8 of the Ottawa Design Guidelines - Water Distribution (2010) [3] Outdoor water demand is applied to single family, semi-detached and townhome units with rear yards. [4] The 1.5 multiplier represents the additional outdoor water demand associated with employment areas.	

5.5 Required Fire Flow

Fire Flow requirements are to be confirmed in accordance with Local Guidelines (Fire Underwriters Survey, 2020), City of Ottawa Water Supply Guidelines, and the Ontario Building Code, upon development of detailed concepts for the detached single homes, townhouses, stacked townhomes, and the park blocks. For planning purposes, fire flow estimates are provided in the preliminary water demand estimate based on the information available in the preliminary concept plan and comparable recent developments in the City of Ottawa.

Based on the initial boundary conditions provided by the City of Ottawa, the maximum allowable fire flow requirement to ensure the minimum level of service within the distribution network is 217 L/s. As such, a fire flow of 167 L/s and 217 L/s were used for low density residential and medium density residential, respectively, to assess the trunk watermain network capacity and ensure that guideline requirements are met. Based on the analysis provided by GeoAdvice, the distribution network can sufficiently meet the required level of service under normal and emergency operating conditions. Adequate looping, hydrant spacing, and the elimination of dead end watermains will be emphasized within the development as detailed design proceeds to ensure that all guideline requirements are addressed. In addition, detailed fire flow calculations are to be completed for the purpose of sizing local watermains. The trunk watermain network has been designed for the maximum day plus 217 L/s fire flow requirement which will govern the watermain sizing for the ***SSUEA***.

A fire flow requirement of 167 L/s and 217 L/s was assigned to low density and high-density residential areas for the purpose of trunk watermain network design in support of the proposed land uses in the ***SSUEA***. A summary of the minimum available fire flows is shown in ***Table 5.***

Table 5: Summary of Minimum Available Fire Flows (GeoAdvice, 2023)

Required Fire Flow	Minimum Available Fire Flow
167 L/s (10,000 L/min)	273 L/s (16,380 L/min)
217 L/s (13,000 L/min)	254 L/s (15,240 L/min)

The modelling and reporting provided in ***Appendix C.1*** indicates that the proposed watermain network can provide domestic flows to the subject area with service pressures within the acceptable range and can provide the required fire flow at all modelled nodes. This fire flow is considered representative of the maximum allowable flow for residential uses under current City guidelines and is suitable for planning purposes for the residential uses proposed.

5.6 Boundary Conditions

The City of Ottawa provided boundary conditions at the following locations to assess serviceability and recommend a preferred trunk watermain network in support of development within the ***SSUEA***.

- ***Boundary Condition Location 1:*** *Pressure Zone 3W, Parade Drive, Existing 254 mm diameter watermain.*
- ***Boundary Condition Location 2****: Pressure Zone 3W, Hickstead Way via Aridus Crescent, Existing 254 mm diameter PVC watermain.*
- ***Boundary Condition Location 3:*** *Pressure Zone 3W, Hickstead Way via Painted Sky Way, Existing 254 mm diameter PVC watermain.*
- ***Boundary Condition Location 4****: Pressure Zone 3W, Ocaia Street, Existing 203 mm diameter PVC watermain.*

5.7 Water Supply Servicing Design

GeoAdvice Engineering Inc. was retained to perform a preliminary hydraulic assessment for the ***SSUEA*** Lands. The *Hydraulic Capacity and Modeling Analysis – Stittsville South Urban Expansion Area Development* ***(GeoAdvice Hydraulic Analysis)*** prepared by GeoAdvice Engineering Inc. dated August 2024 is enclosed in ***Appendix C.1*** for reference. This report is prepared for the ***SSUEA*** (W-4) and also considered the southeast parcel in the potable water servicing strategy.

The sizing of the trunk watermain infrastructure was considered in the ***GeoAdvice Hydraulic Analysis***. Updated boundary conditions will be provided within the forthcoming Functional Servicing Report and the overall distribution network will be assessed at the detailed design stage.

5.7.1 Water Supply Servicing Alternatives

To supply water to the entirety of the subject property, a local watermain network will follow the road network and ultimately connect to off-site watermains based on the layout presented in *Figure 1.1 of the Hydraulic Capacity and Modelling Analysis Stittsville South Urban Expansion Area Development* (GeoAdvice, August 2024) report. Watermain connections and sizing were reviewed as part of MSS-level design to address City of Ottawa and MECP requirements.

Based on GeoAdvice's review of the background infrastructure in this area, the watermain connections available to the north of the subject property present the only feasible option to service the lands, and no other logical or efficient alternative designs were advanced for additional analysis and evaluation. At this time, no opportunities exist to connect to the existing municipal infrastructure outside of what will be proposed below. Future extension of the 400 mm diameter watermain within Fernbank Road and the 300 mm diameter watermain within Shea Road (Cope Drive-Shea Road Intersection) would provide possible connection opportunities, however, no infrastructure upgrades are currently identified in the *Infrastructure Master Plan* (City of Ottawa, 2023) and adequate supply can be provided to the ***SSUEA*** in the absence of public infrastructure upgrades.

5.7.2 Water Servicing Plan Recommended Alternative

Stittsville West Lands

An existing, single, future north/south roadway connection is depicted within the legal fabric of the subdivision to the north (located between 714 and 720 Parade Drive). This location would provide a future roadway connection and watermain feed location from the existing watermain network for to the West Lands for initial phases of development in this area.

There are no additional future right of way blocks for a second roadway connection to the Parade Drive watermain from the West Lands. In terms of additional watermain feeds (either interim or permanent) a secondary watermain connection for the development area could be implemented via:

- *An interim/permanent loop through the Parade Drive stormwater management pond block at the east end of Parade Drive.*

- *A watermain loop underneath the tributary to the FMD, then north through the walkway block adjacent to the SRSPS and connecting to the Aridus Crescent 250 mm watermain. This would require an upsize of the existing 50mm water service to the sanitary pump station.*

Stittsville South Lands

An existing, single, future north/south roadway connection is depicted within the legal fabric of the subdivision as an extension of Painted Sky Way from the adjacent Stittsville South – Area 6 (Edenwylde) development to the north. This location provides the primary water supply point to the South Lands. Similar to the second feed option for the West Lands, a connection to the Aridus Crescent 250mm watermain could be implemented. For the ultimate development of the South Lands area, east of the HONI corridor, an external connection from Ocala Street will provide additional water supply and looping to the development area.

5.8 Commitments for Functional and Detailed Design

Detailed hydraulic analyses will be prepared for the phases of the proposed water distribution network at the time of their respective detailed designs, to determine that water supply is made available to the ***SSUEA*** as specified in the City of Ottawa Water Supply Guidelines.

The water distribution network will have to be designed to support the phased development of the lands making up the ***SSUEA***. The phased water supply systems will be looped for areas > 50 m^3, per ISTB 2018-02-08, to provide for system security and redundancy.

The proposed trunk watermain network is shown to generally follow the proposed road network. Note that as the road network is conceptual in nature and is subject to change, the watermain network is also subject to change. Easements may be required for local and trunk watermains as detailed design progresses for the development lands, in order to meet City and MECP guidelines.

During detailed design of the developments within the ***SSUEA***:

- *Demands will be updated, and distribution refined, once more detailed development information is available;*
- *Demand factors according to Section 4.2.1 of the City of Ottawa Design Guidelines & subsequent Technical Bulletins will be used (for localized areas with populations less than 3,000 and/or areas less than 50 ha);*
- *Local watermain sizing will need to be evaluated at the subdivision approval stage; and,*
- *Individual residential blocks will be evaluated for required fire flow as detailed plans for these sites are developed.*

5.9 Water Supply Conclusion

The ***SSUEA*** is to be serviced by a proposed network of trunk watermains varying in diameter from 250 mm to 300 mm. At this stage of analysis, only the trunk watermain within the West and South Lands are shown. A network of local watermains is assumed to service developments within the ***SSUEA***.

A preliminary hydraulic analysis, provided in ***Appendix C.1***, has been completed to ensure compliance with City of Ottawa Water Supply Guidelines. The proposed watermain network is expected to deliver all domestic and fire flows as per Ministry of the Environment, Conservation, and Parks (MECP), City of Ottawa and Fire Underwriters Criteria to support development within the ***SSUEA***. Estimated fire flows of 167 L/s and 217 L/s for low density residential and parkland, and medium density residential, respectively, can be achieved for the development and service pressures are expected to fall within the appropriate ranges.

All proposed water infrastructure is to be designed and constructed in accordance with Ministry of the Environment, Conservation, and Parks (MECP) and City of Ottawa guidelines as part of detailed design associated with the ***SSUEA***.

6.0 WASTEWATER SERVICING

6.1 Existing Infrastructure

The adjacent developments to the north of the subject lands are serviced by the existing Shea Road Sanitary Pumping Station (SRSPS) which is located along the north boundary within the ***SSUEA*** lands being assessed and generally located within the ***Stittsville South Lands*** portion of the development area (North of the existing stormwater management pond (Davidson Pond)). As per the Environmental Compliance Approval (*ECA #3415-ADWLJG*) issued September 21, 2016 (see report excerpt in ***Appendix D.1***), the SRSPS, constructed in 2017, was designed with an interim firm capacity of 42 L/s and upgraded to its current firm capacity of 84 L/s (in accordance with its original design) in late 2022. The SRSPS forcemains were also directed to the most recent extension of the Fernbank Sanitary Trunk Sewer (FSTS).

A 450mm diameter sanitary sewer connected to the SRSPS is available to service the ***SSUEA***. The existing 450mm diameter inlet sanitary sewer has a residual capacity of approximately 80% which would allow for an additional ~390 L/s of sanitary.

Per the Master Servicing Report for the *Stittsville South – Area 6* development, there is excess capacity available in the Fernbank Lands trunk sewer (see report excerpt in ***Appendix D.2).*** The *Area 6* study summarized that the Fernbank Trunk was designed for a peak flow of 528 L/s (*Fernbank CDP Lands – New Trunk Sewer* sanitary design sheet provided in ***Appendix D.3*** for reference) and had a capacity of 670 L/s (excess capacity of 142 L/s). The Area 6 report further summarized that the *Area 6* and Liard Street P.S. (monitored) flows to the Fernbank Trunk totaled approximately 85 L/s and 39 L/s respectively and would utilize a portion of this capacity. However, the original design criteria of the Fernbank Trunk system (and Area 6) was based on older City of Ottawa design criteria. When considering the new criteria adopted by the City after those designs the excess capacity available is increased.

Table 6: Sanitary Flow Review

Network Reviewed	Area (ha)	Pop.	PF (7)	Q_{units} (L/s)	$Q_{Com/Inst}$ (L/s)	$Q_{I/I}$ (L/s)	Q_{TOT} (L/s)	Diff. (L/s)
Old City Parameters for Sanitary (1)								
Fernbank CDP Lands (2)	551.8	30,169	2.47	302.5	71.0	154.5	528.0	--
Stittsville Area 6(3)	70.74	4,502	3.29	59.94	2.37	19.81	82.1	--
Liard St P.S. (monitored) (4)	--	--	--	--	--	--	39.0	--
New City Parameters for Sanitary (5)								
Fernbank CDP Lands	551.8	30,169	2.18	213.1	39.76	182.09	435.0	-93.0
Stittsville Area 6	70.74	4,502	2.83	41.2	1.33	23.34	66.0	-16.1
Liard St P.S. (monitored) (6)	--	--	--	--	--	--	39.0	0

(1) Old City Parameters: 350 L/day; 0.28 L/s/ha infiltration; Comm./Inst. Flow = 50,000 l/ha/day
(2) Sanitary design sheet excerpt provided in Appendix B. From "Fernbank Community Design Plan – Master Servicing Study (June 2009)"
(3) Sanitary design sheet excerpt from updated IB design for Edenwylde development. From City submission 2020-04-09"
(4) Liard Street pump station – monitored flow summary from the "*West Urban Community – Wastewater Collection System Master Servicing Plan*" by RV Anderson Associates Ltd., dated July 2012 and as summarized in the Area 6 MSS.
(5) New City Parameters: 280 L/day; 0.33 L/s/ha infiltration; Comm./Inst. Flow = 28,000 l/ha/day; updated Peak Factor correction factor
(6) Same value as prior as it was monitored information.
(7) Peaking Factor

From the table above the flow summarized in the Fernbank Lands trunk is reduced from 528.0 L/s to ~435.0 L/s (-93.0 L/s) based on review with new parameters.

The Area 6 land development flows are reduced from 82.1 L/s to ~66.0 L/s (-16.1 L/s).

The *Area 6 MSS* summarized excess capacity at peak flow in the Fernbank Lands trunk at 142 L/s. With the new parameters this excess capacity increases to 235 L/s based on the above table with 105 L/s of that taken up by the Area 6 and the Liard St. P.S. flows (130 L/s capacity remaining).

6.2 Future Expansion

The ***IMP*** contemplates a required expansion to the existing Shea Road Pump Station to support the ***SSUEA***.

Section 7.8.4.2. of the ***IMP*** indicates that to accommodate growth up to 2046, the capacity of the Shea Road PS will need to be increased to 110 L/s. The project cost was estimated at $7,800,000 and was anticipated to be 100% Development Charge funded.

6.3 Wastewater Collection Goals

The following summarizes goals for the development of a preferred wastewater collection system.

- *Conformance with design standards: Designed and planned in conformance with MECP and City of Ottawa design standards.*

- *Meets Public Service Area requirements: The subject lands are shown within the public service area, see extracted Schedule 3 in* ***Appendix A****, therefore development of wastewater supply options will be restricted conveyance of wastewater to the existing collection system. IE, on-site treatment is not contemplated in the development of collection alternatives.*

- *Level of Service: Per Section 4.3.2. of the IMP, System design criteria established in the IMP is intended to ensure that current City design and level of service guidelines can be met in future neighbourhoods. They are not intended to achieve improvements to levels of service in existing development areas.*

- *Affordable: Civil infrastructure will need to be cost effective to support an affordable supply of options across the city for different household types and income groups.*

- *Operable: Design to consider ease of operation.*

- *Sustainable: Preferred solution will consider future maintenance and operation cost.*

- *Community Impacts: Minimize disruption to existing community.*

6.4 Wastewater Design Targets

The criteria employed in the preliminary design of the proposed wastewater system are summarized in ***Table 7.***

Table 7: 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/per
Peaking Factor	Harmon's Peaking Factor. Max 4.0, Min 1.0
Infiltration and Inflow Allowance	0.33 L/s/ha for all areas
Park Flows	9300 L/ha/d (75 p/acre per Sewer Guidelines Appendix 4-A)
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	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 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	280 L/d/per
Harmon – Correction Factor	0.4 to 0.6
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 City of Ottawa *Sewer Design Guidelines* state that wherever possible, the design of sanitary sewers should be based on the ultimate sewage flows permitted by the land use zoning. The preferred concept plan and associated population projections, detailed in ***Section 1.1*** of this report, represent the best available planning information and thus have been used for the purpose of sizing the proposed trunk sanitary sewer network. A summary of the associated design assumptions is provided below:

- ***Low Density Residential Areas:*** *Based on the unit type areas available from the preferred concept plan, as well as the population densities from the City of Ottawa Sewer Design Guidelines (single family – 3.4p/unit, townhomes – 2.7p/unit, back-to-back townhomes – 2.1 p/unit, apartments 1.8 p/unit), a* *population density of 148 pop/gross ha was assigned to all low-density residential areas.*

- ***Medium Density Residential Areas:*** *Based on the unit type areas available from the preferred concept plan, as well as, the population densities from the City of Ottawa Sewer Design Guidelines (single family – 3.4p/unit, townhomes – 2.7p/unit, back-to-back townhomes – 2.1 p/unit, apartments 1.8 p/unit), a population density of 144 pop/gross ha was assigned to all medium density residential areas. Applying the 221 pop/gross ha density to the medium density areas allows for more flexibility in the future design of the medium density blocks.*

Note that with the use of the population densities reported above, the population may differ from the populations reported in ***Section 1.1.*** The populations used for the wastewater servicing design are conservative in nature to allow for the sanitary sewer networks to accommodate potential changes in population and servicing demand estimates at the detailed design level, as site-specific designs advance.

6.5 SSUEA Wastewater Servicing

Sanitary sewer routing and sizes have been preliminarily proposed as part of MSS-level design, to meet City and MECP guidelines. The preferred trunk wastewater design follows and ultimately connects to the existing 450 mm diameter PVC sanitary sewer which conveys flows to the SRSPS based on the layout presented in ***Drawing No. 4***. The preferred design is a sanitary network that makes efficient use of existing SRSPS pump station and applicable downstream infrastructure.

6.5.1 SSUEA Wastewater Servicing Options

The following options were evaluated for sanitary servicing for the ***West/South Lands***:

Option 1: Gravity sanitary flows for ***Stittsville West/South Land*** areas to the existing SRSS along with:

a. Upgrades to the SRSPS to accommodate new flows (pumps, instrumentation, electrical, generator etc);
b. Utilization of existing forcemains to the FSTS (pending capacity review);
c. Construction of a new emergency overflow to a future stormwater management pond (SWMP) for the ***SSUEA*** to allow for lower underside of footings for the development.

Option 2: Construction of a new sanitary pump station within the southern portion of the ***South Lands*** along with:

a. Forcemains pumping flows to the existing SRSPS;
b. Upgrades to the SRSPS to accommodate new flows (pumps, instrumentation, electrical, generator etc);
c. Utilization of existing forcemains to the Fernbank Sanitary Trunk Sewer (FSTS);
d. Construction of a new emergency overflow to a future stormwater management pond (SWMP) to allow for lower underside of footings for new development.

Option 3: Construction of a new sanitary pump station within the southern portion of the ***South Lands*** which would accept all sanitary flows within the service area along with:

a. Decommissioning of the existing SRSPS;
b. Extension of gravity sewers to the new pump station;

c. Utilization of existing forcemains to the Fernbank Sanitary Trunk Sewer (FSTS);
d. Construction of a new emergency overflow to a future stormwater management pond (SWMP) to allow for lower underside of footings for new development.

Option 4: Similar to Option 3 above with the difference of implementing construction of new, independent, twin forcemains to the FSTS via Shea and Fernbank Roads (i.e. should the existing forcemains be found not suitable due to the additional head required to pump from the southern area).

Option 5: Construction of a new sanitary pump station within the southern portion of the ***South Lands*** which would be independent of the SRSPS:

a. SRSPS is not touched;
b. Construct new, independent, twin forcemains to the FSTS via Shea and Fernbank Roads;
c. Independent emergency overflow to a new SWMP.

6.6 Wastewater Evaluation Matrix

The wastewater servicing options presented in ***Section 6.5*** were brought forward for evaluation through a pair-wise comparison matrix. The evaluation matrix was developed based on the wastewater collection goals which have been assigned weighting to guide the selection of the preferred wastewater servicing solution.

Table 8: Stormwater Management Evaluation Criteria

Evaluation Parameter	Value
Conformance with City Standards/Policies	20%
Affordability	30%
Operation and Maintenance	20%
Sustainability	20%
Community Impacts	10%

The ranking values assigned to the alternatives based on the various criteria are given over a relative range from 1 to 5.

Table 9: Decision Matrix Categories Ranking System

Ranking	Description
5 - Positive or No Impact	The alternative meets all applicable requirements, provides tangible benefits
4 – Minor Impact	The alternative has some minor negative impacts or dis-benefits that may easily be mitigated or compensated for
3- Moderate Impact	The alternative has noticeable negative impacts, however, the severity of the impacts may be reduced or compensated for
2 – Noticeable Negative Impact	The alternative has significant negative impacts which may be mitigated, although these may be costly, time consuming or result in other negative impacts

1 - Negative or Significant Impact	The alternative does not meet applicable requirements, results in significant dis-benefits and/or negative impacts cannot be mitigated

Under this ranking system, each individual criterion is ranked relatively for each alternative.

Table 10: Wastewater Servicing Evaluation

Parameter	Weighting	Option 1 – All flow to existing (upgraded) PS			Option 2 – New PS pumping to existing PS			Option 3/4 – New PS, existing PS decommissioned			Option 3 – New PS, independent of existing		
		Description	Score	Weighting	Description	Score	Weighting	Description	Score	Weighting	Description	Score	Weighting
Conformance with City Standards/ Policies	20%	In conformance with current infrastructure plan for the area	5	1.0	Diverges from infrastructure plan for the area; not standard practice to pump to PS	2	0.4	Diverges from infrastructure plan for the area	3	0.6	Diverges from infrastructure plan for the area	3	0.6
Affordability	30%	Lowest cost option. Consistent DC scope and budget established	5	1.5	High cost, construction of new PS, upgrades to existing	2	0.6	High cost, construction of new PS, deep trunk required to service existing area	2	0.6	Costs for new PS and new forcemain	3	0.9
Operation and Maintenance	20%	Minimal change to current level of maintenance	4	0.8	Operation of two PS facilities	2	0.4	Minimal change to current level of maintenance	4	0.8	Operation of two PS facilities	2	0.4
Sustainability	20%	Consistent with current long-term strategy	4	0.8	Double the amount of infrastructure to maintain	2	0.4	Similar to Option 1 in terms of single PS facility to maintain over long term	4	0.8	Double the amount of infrastructure to maintain	2	0.4
Community Impacts	10%	Some disruption during construction of upgrades adjacent to existing community but long term impacts are unchanged	4	0.4	Similar to Option 1 in terms of construction impacts; having two facilities increases potential odour issues	3	0.3	Increased disruption to existing community during decommissioning of existing PS.	3	0.3	Minimal impacts on existing residential community; traffic disruptions with new forcemain construction; having two facilities increases potential odour issues	3	0.3
Total				**4.5**			**2.1**			**3.1**			**2.6**
Ranking				**1**			**4**			**2**			**3**

6.6.1 Preferred Wastewater Servicing Plan

Based on the above analysis the recommended alternative was found to be **Option 1**, where it scored ***4.1***.

This option mitigates additional costs, utilizes/optimizes existing infrastructure and does not add additional uncertainty into the advancement of development. This is option is also consistent with the City's *Infrastructure Master Plan, Draft Final (July 2024*) which includes costs for the SRSPS and forcemain upgrades as part of its Wastewater Master Plan (Collection) Capital Program. See excerpts from the Draft IMP included ***Appendix D.7***.

See attached ***Drawing No. 4*** for an overview of the proposed trunk sanitary network.

6.6.1.1 West Lands Preferred Wastewater Servicing Plan

Proposed trunk sanitary sewers within the Stittsville West Lands are shown in ***Drawing No. 4***. To demonstrate servicing feasibility, the trunk sewer is carried back at minimum slopes while accounting for drops at manholes, existing infrastructure sizing, and possible conflicts with crossing other sewers. As the design of the ***West Lands*** advance, the sanitary sewer network details are subject to change; for example, to be raised where appropriate to offer construction cost savings, provided that conditions related to minor changes are met.

The peak sanitary flow from the Stittsville ***West Lands*** are expected to be 44.11 L/s. See ***Appendix D*** for detailed calculations.

6.6.1.2 South Lands Preferred Wastewater Servicing Plan

Proposed trunk sanitary sewers within the Stittsville South Lands are shown ***Drawing No. 4***. To demonstrate servicing feasibility, the trunk sewer is carried back at minimum possible slopes while accounting for drops at manholes, existing infrastructure sizing, and possible conflicts with crossing other sewers. As the design of the Stittsville South Lands advance, the sanitary sewer network details are subject to change; for example, to be raised where appropriate to offer construction cost savings, provided that conditions related to minor changes are met.

The peak sanitary flow from the Stittsville ***South Lands*** are expected to be 37.21 L/s. See ***Appendix D.4*** for the sanitary trunk sewer design sheet calculations.

6.6.2 Sanitary Flow Review

As noted in ***Section 8.1***, the SRSPS was recently upgraded to a firm capacity of 84 L/s. Buildout of the tributary areas to the SRSPS is ongoing, however there remains excess capacity available in the facility prior to any further upgrade/expansion being required. Novatech (the original designers of the SRSPS) have reviewed staged flows to the SRSPS with consideration given to inclusion of flows from the ***Stittsville West/South Lands*** development area under various flow conditions. The evaluation of various flow conditions (as often required by the City) considered the following:

a) Condition 1 – Design Flow Parameters for Occupied & Unoccupied
b) Condition 2 – Annual flow Parameters for Occupied & Design Parameters for Unoccupied
c) Condition 3 – Annual flow Parameters for Occupied & Unoccupied

d) Condition 4 – Rare Parameters for Occupied & Unoccupied

(Design Parameters meaning standard design guideline values for design of sewers and pumping stations; Annual Parameters meaning typical flows based on data, and Rare Parameters meaning exceptional events)

Based on proposed conceptual development layout and density, the ***SSUEA*** has a projected population potential and effective extraneous area of ~5,760 persons and 64.2 ha (excluding HONI corridor and ponds), respectively. The theoretical peaked flow for the ***SSUEA***, not considering peaking factors from external areas, is approximately 70 L/s.

With consideration to ongoing development, and existing lands, that are currently allocated as being tributary to the SRSPS (i.e. Area 6 development, redirected flows from the planned decommissioning of the Friendly Street Sanitary Pump Station etc.) the maximum required firm capacity of an updated SRSPS will be approximately 130 L/s.

6.6.3 SRSPS Anticipated Upgrades

In its May 2023 *Shea Road Pump Station & Fernbank Trunk Capacity Review,* Novatech anticipated the following upgrades to accommodate a new firm capacity (See ***Appendix D.6*** for further details):

Certain Upgrades:

- *Higher horsepower pumps;*
- *Starters; and*
- *Power to pumps.*

More than Likely Upgrades:

- *New generator.*

Possible Upgrades:

- *Primary power supply and 600V wiring; and*
- *Upsize 150mm piping between wet well and valve chamber and within basement.*

Current Configuration Likely Sufficient:

- *Controls;*
- *200mm forcemain (need to demonstrate that surge pressures will not be an issue due to higher velocities; the theoretical velocity will be confirmed by a transient analysis as part of the detailed design for the SRSPS upgrades);*
- *Wet well (as long as new pumps fit and operating volumes are adjusted);*
- *Control room; and*
- *Bypass chamber.*

Existing SCADA data for the current wastewater flows to the SRSPS will need to be reviewed further during the Draft Plan stage, prior to detailed design, to determine residual capacity and timing for future upgrades.

Novatech reviewed upgrade options and summarized their finding in the Memorandum "Shea Road Pump Station Upgrade Options" December 20, 2024, included in ***Appendix D***. Novatech concluded that a new 300mm dia. forcemain, discharge chamber and gravity outlet, minor pump station upgrades to mechanical (valve chamber and bypass manhole piping) and electrical. Existing forcemains to be utilized. Similar HP pumps with a firm capacity of 130L/s. Is the most practical, feasible, and cost-effective option.

6.6.4 Consideration of Alternatives for Sanitary Servicing Design

Wastewater sewer sizing and routing were reviewed as part of MSS-level design, to address all City of Ottawa and MECP requirements. Given the background infrastructure planning in this area and the predicted performance, no other logical or efficient alternative designs were advanced for additional analysis and evaluation.

6.7 Commitments for Functional and Detailed Design

The wastewater conveyance systems will be designed to support the phased developments within the ***SSUEA*** lands. All proposed sanitary sewer infrastructure is to be designed in accordance with the City of Ottawa Sewer Design Guidelines and all MECP guidelines.

The proposed gravity sewer conveyance systems are shown to generally follow the proposed road network. Note that as the road network is conceptual in nature, the alignments of the trunk sanitary sewers are also subject to change. Easements may be required in order to provide efficient servicing to address City and MECP guidelines.

During design of the development within the ***SSUEA*** lands:

- *Demands will be updated and distribution refined, once the more detailed development information is available;*
- *Design parameters according to City of Ottawa Sewer Design Guidelines will be used;*
- *Design of the trunk sewers are to be optimized for construction efficiencies, provided that there are no significant negative impacts to affected landowners and that other requirements for minor amendments are met;*
- *Local sanitary sewer sizing will need to be evaluated at the subdivision approval stage; and*
- *Capacity in downstream infrastructure will be confirmed through sanitary sewer network modelling, as-builts, and/or sanitary design sheet information, as required.*
- *Shea Road Sanitary Pump Station upgrade requirements will be reviewed from a timing and cost perspective.*

6.8 Wastewater Servicing Conclusion

The design of the sanitary sewer network is in accordance with the City of Ottawa Sewer Design Guidelines.

The West and South Lands within the ***SSUEA*** are tributary to the Shea Road Sanitary Pump Station (SRSPS) and Fernbank Trunk sanitary sewer. The South and West Lands are to be directed to the Shea Road Sanitary Pump Station via the proposed trunk sanitary infrastructure as outlined in ***Drawing No. 4***. Adequate residual capacity is available within the receiving downstream infrastructure and it can be concluded that the downstream infrastructure can adequately service the ***SSUEA*** lands. To support the full proposed development, the SRSPS will require upgrades to increase the PS firm capacity. There is currently excess capacity to accommodate the first phases of development and the timeline for staged upgrades will be reviewed as part of the FSR and detailed design. Additionally, JFSA has provided PCSWMM modelling to analyze the sanitary HGL elevations within the proposed development lands based on the flow details previously provided. From JFSA's analysis, it was found that the proposed existing sanitary sewer infrastructure is sufficiently sized to convey sanitary flows away from the proposed development under various extreme conditions. Please see the JFSA report in ***Appendix E.1*** for additional details. Note that updated HGL analyses will be provided at the functional and detailed design stage as additional details are established.

All proposed sanitary sewer infrastructure is to be designed and constructed in accordance with the City of Ottawa Sewer Design Guidelines and MECP guidelines as part of detailed design associated with *Planning Act* applications within the ***SSUEA***.

7.0 STORMWATER MANAGEMENT

7.1 Existing Stormwater Drainage

The existing site topography for the subject properties generally drains eastward and southward. As noted previously the site is essentially bisected by an existing drainage watercourse which transitions into the Faulkner Municipal Drain (FMD). See ***Drawing No. 3*** for an overview.

Parade Drive Stormwater Management Facility

The residential development area to the north of the Maguire/Faulkner properties is serviced via an existing 1.9 ha stormwater pond block adjacent to Parade Drive. This stormwater facility has the following characteristics:

Drainage Area = ~33.7ha

Permanent Pool Elevation = 103.50 m

Extended Detention Elevation = 103.70 m

100-Year Elevation = 105.33 m

The facility outlets to an existing ditch located east of the storm outlet approximately 405 m upstream of the commencement of the Faulkner Municipal Drain.

Davidson Stormwater Management Facility

The existing development to the north of the Davidson/Eder properties is serviced by the central "Davidson" stormwater management pond. The existing Davidson stormwater pond occupies approximately 3.2 ha of land and is partially located under the existing Hydro One tower line. The ponds are sized for their respective areas with no specific additional areas considered. This stormwater facility has the following characteristics:

Drainage Area = ~40.6 ha

Permanent Pool Elevation = 101.50 m

Extended Detention Elevation = 102.10 m

100-Year Elevation = 103.17 m

The facility outlets from the south end of its configuration to a ditched outlet that conveys the flows southwest to the Faulkner Municipal Drain.

7.1.1 Faulkner Municipal Drain

Section 4.3.8 of the IMP outlines the requirements for establishing legal stormwater outlets for development. It states:

> *1) Development applications must demonstrate a legal and sufficient outlet exists or that adequate progress has been made towards achieving this requirement.*

2) MSS approval will be contingent on sufficient notification and opportunity for input from affected property owners regarding the need for legal outlets.

The subject lands are entirely tributary to the Faulkner Municipal Drain, where the existing drain bisects the lands.

Caivan petitioned the City to review the existing Faulkner Municipal Drain. A drainage engineer, Robinson Consultants, was appointed by Council on October 16, 2024.

Progress has been made toward confirming the sufficiency of the Faulkner Municipal Drain to accept flows from the subject site in the post development condition. The public will be notified and will have opportunity to comment through the Planning Act and Drainage Act Process.

7.2 Stormwater Management Goals

The following summarizes goals for the development of a preferred stormwater management system.

- *Conformance with design standards: Designed and planned in conformance with MECP and City of Ottawa design standards.*

- Volumetric:

  - The EIS recommends maintaining the existing water budget to support base flow to the receiving water course.

  - Due to the existing geotechnical, hydrogeologic site conditions, and the City of Ottawa Technical Memo **IWSTB-2024-04.** Volumetric controls are not recommended for this development.

- Quality control:

  - Mitigate the release of sediment from the development area to the receiving water course.

- Quantity control:

  - Ensure no increase in water levels in the receiving water course.

- Conveyance:

  - Convey frequent storm events through an underground storm sewer system.

  - Convey major storm events to safe outlets along roadways and servicing corridors.

  - Site grading design to convey stormwater away from properties.

- *Affordable: Civil infrastructure will need to be cost effective to support an affordable supply of options across the city for different household types and income groups.*

- *Operable: Design to consider ease of operation.*
- *Sustainable: Preferred solution will consider future maintenance and operation cost.*
- *Community Impacts: Minimize disruption to existing community.*

7.3 Stormwater Management Targets

7.3.1 Volumetric

As indicated in the Provincial Guidelines, the City of Ottawa OP and IMP, the ***Jock River Reach 2 SWS,*** and the ***EIS***; maintaining the existing pre-development water budget is important for the health of receiving water courses.

However, due to the existing geotechnical, hydrogeologic site conditions, and the City of Ottawa Technical Memo IWSTB-2024-04. Volumetric controls are not recommended for this development.

Therefore, the development of the subject lands are not required to maintain the existing water budget through infiltration style low impact development measures.

As recommended by the ***EIS***, stormwater management ponds shall incorporate baseflow augmentation in their outlet structure to mimic the existing lateral groundwater movement.

7.3.2 Quality control

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 MECP prescribed treatment levels.

7.3.3 Quantity control:

Control post-development runoff to pre-development levels for all rain events up to and including the 100-year storm.

7.3.4 Conveyance:

The following table summarizes the conveyance target to inform design of the storm sewer network.

Table 11: 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	$i = \frac{A}{(t_c + B)^C}$

5-year storm event: A = 998.071 | B = 6.053 | C = 0.814	
Minimum Time of Concentration	10 minutes
Rational Method	$Q = CiA$
Storm sewers are to be sized employing the Manning's Equation	$Q = \frac{1}{n} AR^{2/3} S^{1/2}$
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	Of = 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, based on recent residential subdivisions in City of Ottawa.	

The following key City standards will be required for stormwater management within the subject lands and conveyance to the proposed stormwater management ponds, among other requirements:

- *For less frequent storms (i.e. larger than the minimum level of service), the minor system sewer capture will be restricted with the use of inlet control devices to prevent excessive hydraulic surcharges;*

- *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; and,*

- *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.*

The following additional grading criteria and guidelines will be applied to the detailed grading designs as per City of Ottawa Guidelines:

- *Driveway slopes will have a maximum slope of 6%;*

- *Slope in grassed areas will be between 2% and 5%;*

- *Grades in excess of 7% will require terracing to a maximum of a 3:1 slope;*

- *Swales are to be 0.15 m deep with 3:1 side slopes unless otherwise indicated; and,*

- *Perforated pipe will be required for drainage swales if they are less than 1.5% in slope (preferred to promote infiltration) and will be used to interconnect rear yard catchbasins where possible.*

Conservative average runoff coefficients (C) values have been applied according to the conceptual land uses and the amount of impervious area in each catchment:

- ***Low Density Residential Areas:*** *The Concept Plan designates these areas for detached dwellings, semi-detached dwellings. These areas have been assigned an average runoff coefficient of 0.68 to account for impervious surfaces (driveways, roads, roofs) and pervious areas (backyards). This C value is representative of Caivan's developments in other parts of Ottawa.*

- ***Medium Density Residential Areas:*** *The Concept plan designates these areas rear-lane townhomes, back-to-back townhomes, stacked townhomes, back-to-back stacked townhomes, low-rise and mid-rise apartment buildings. These areas have conservatively been expected to have a small number of pervious surfaces. As such, an average runoff coefficient of 0.7 has been assigned. These C values are representative of recently approved studies of a similar scope to this MSS.*

- ***Park Blocks:*** *These blocks have been assigned an average runoff coefficient of 0.4, associated with maintained grass lawns.*

MECP has indicated a priority to prepare communities for the costs and impacts of climate change, including lowering the risk of basement flooding. As part of this MSS, the City of Ottawa's climate change stress test (100-year 3-hour Chicago storm plus 20%) has been applied in the sections that follow, to confirm that no basement flooding and no unacceptable surface flooding is expected in this test condition.

The preliminary conceptual servicing plan is shown on ***Drawing No.2***. As detailed design progresses, alignment and sizing of local storm sewers will be confirmed and additional servicing easements may be required, guiding the development of the future proposed lot fabric in the concept plan.

7.3.5 End of Pipe Stormwater Alternatives

There are several suitable end-of-pipe options for the treatment of stormwater runoff from urban areas including – Infiltration Basins, Wetlands, Dry Ponds, Wet Ponds, and Hydrodynamic Separation Units. ***Table 12*** presents the four options and their suitability as described in ***SWMPDM*** (MECP, March 2003).

Table 12: End of Pipe Treatment Systems Considered

Stormwater Management Practice	Description
Infiltration Basins	Infiltration basins are above-ground pond systems which are constructed in highly pervious soils. Water infiltrates into the basin and either recharges the groundwater system or is collected by an underground perforated pipe network and is discharged to a downstream outlet.
Wet Ponds	Wet ponds are the most common end-of-pie stormwater facilities in Ontario. The performance does not depend on soil characteristics, permanent pool minimizes re-suspension of captured solids and minimizes blockages at the outlet. Furthermore, the biological removal of pollutants occurs. Wet ponds are suited to drainage areas 5ha and greater
Wetlands	Wetlands are normally more land-intensive than wet ponds because of their shallower permanent pool depth. They provide similar quality benefits as wet ponds, although the biological processes are enhanced.
Dry Ponds	Dry ponds have no permanent pool of water. As such the removal of containments is purely a function of the detention time in the pond.
Hydrodynamic Separation Units	Hydrodynamic Separation Units or Oil / Grit separator are manufactured concrete units for the expressed purpose of trapping sediment and oil. The processes are patented and sizing is dependent on the manufactures specifications and tends to work well with small (less than 5.0ha) catchments. These units tend to occupy less land area.

In developing the various end of pipe stormwater management alternatives, two additional considerations were given priority. First, siting a SWMP at the lowest elevations of the site was considered over higher elevations. Second, the ponds should be situated nearest to their respective outlet locations.

7.3.6 Preliminary Screening of End of Pipe Stormwater Management Alternatives

Infiltration basins require low ground water tables and permeable soils. Based on the findings of the ***Geotechnical Study*** infiltration basins are not suitable in this application.

According to the ***SWMPDM*** wetlands tend to raise the temperature more than wet ponds. End of pipe facilities that minimizes temperature increase was given priority.

Hydrodynamic Separation Units (OGS units) provide only quality control and would require additional facilities, such as dry ponds, to provide the required quantity control. Given the size of the drainage areas, multiple OGS would be required in conjunction with dry ponds making this option cost prohibitive.

Based on the site characteristics, constraints, and requirements; stormwater management solutions incorporating wet ponds will be investigated in additional detail.

7.4 SSUEA Stormwater Management Ponds and Servicing Options

The following options were evaluated for stormwater management and servicing for the ***West/South Lands***.

Conservative average runoff coefficients (C) values were applied according to the conceptual land uses and the amount of impervious area in each catchment:

- ***Low Density Residential Areas:*** *The Concept Plan designates these areas for detached dwellings, semi-detached dwellings. These areas have been assigned an average runoff coefficient of 0.68 to account for impervious surfaces (driveways, roads, roofs) and pervious areas (backyards). This C value is representative of Caivan's developments in other parts of Ottawa.*

- ***Medium Density Residential Areas:*** *The Concept plan designates these areas rear-lane townhomes, back-to-back townhomes, stacked townhomes, back-to-back stacked townhomes, low-rise and mid-rise apartment buildings. These areas have conservatively been expected to have a small number of pervious surfaces. As such, an average runoff coefficient of 0.7 has been assigned. These C values are representative of recently approved studies of a similar scope to this MSS.*

- ***Park Blocks:*** *These blocks have been assigned an average runoff coefficient of 0.4, associated with maintained grass lawns.*

Based on the existing site topography the drainage for the ***West Lands*** trends to the southeast where it is picked up by the FMD. The ***South Lands*** similarly drain to the southeast and are collected in FMD along the north side of Flewellyn Road

The invert of the FMD at the proposed road crossing between the ***West*** and ***South Lands*** is ~101.5m. In order to drain the ***West Lands*** to a pond east of the FMD, DSEL's preliminary analysis found that a storm sewer with a top of pipe elevation of ~102.5m would be required at this crossing which conflicts with the FMD. As such, an independent stormwater solution for quantity and enhanced water quality control will be required for each of the ***West/South Lands*** areas with the most suitable solution being the incorporation of wet stormwater management facilities in the southeast corner of each of each area. This servicing strategy (as outlined in Option 1A) below, was presented to City staff in a February 8, 2024 consultation. While the City agreed this was the most logical servicing strategy, it requested that DSEL assess additional options including the feasibility of combining the proposed facilities and/or decommissioning the City's existing Davidson Pond facility. The results of this analysis are presented below.

A summary of all options evaluated is presented in ***Figure 3***.

7.4.1 Option 1A: Two New SWM Ponds (East Pond on Eder Parcel)

This option consists of maintaining the existing Davidson SWM Pond and constructing two new ponds, one in the southeast corner of the ***West Lands*** and one in the southeast corner of the ***South Lands***. Each pond would outlet to the FMD, with the outlet from for the West facility crossing the HONI corridor. Similar to the existing Davidson Pond it would be proposed to use the Hydro corridor land for 5-year storage.

Under this option, 4.1 Ha of the ***South Lands*** would drain to the existing Davidson Pond.

The unnamed watercourse, upstream of the Faulkner Municipal Drain and downstream of the Area 6 Pond headwall (Inv. 103.20) will be maintained and convey flows through the hydro corridor. This option will provide 56.4 Ha of developable land and have 7.6 Ha of area designated for the SWM ponds, including 2.1 Ha within the Hydro corridor.

Construction of a new emergency overflow to the future stormwater management pond (SWMP) at the south east corner of the development will allow for lower underside of footings for the new development.

This option is shown below in ***Exhibit 2***.

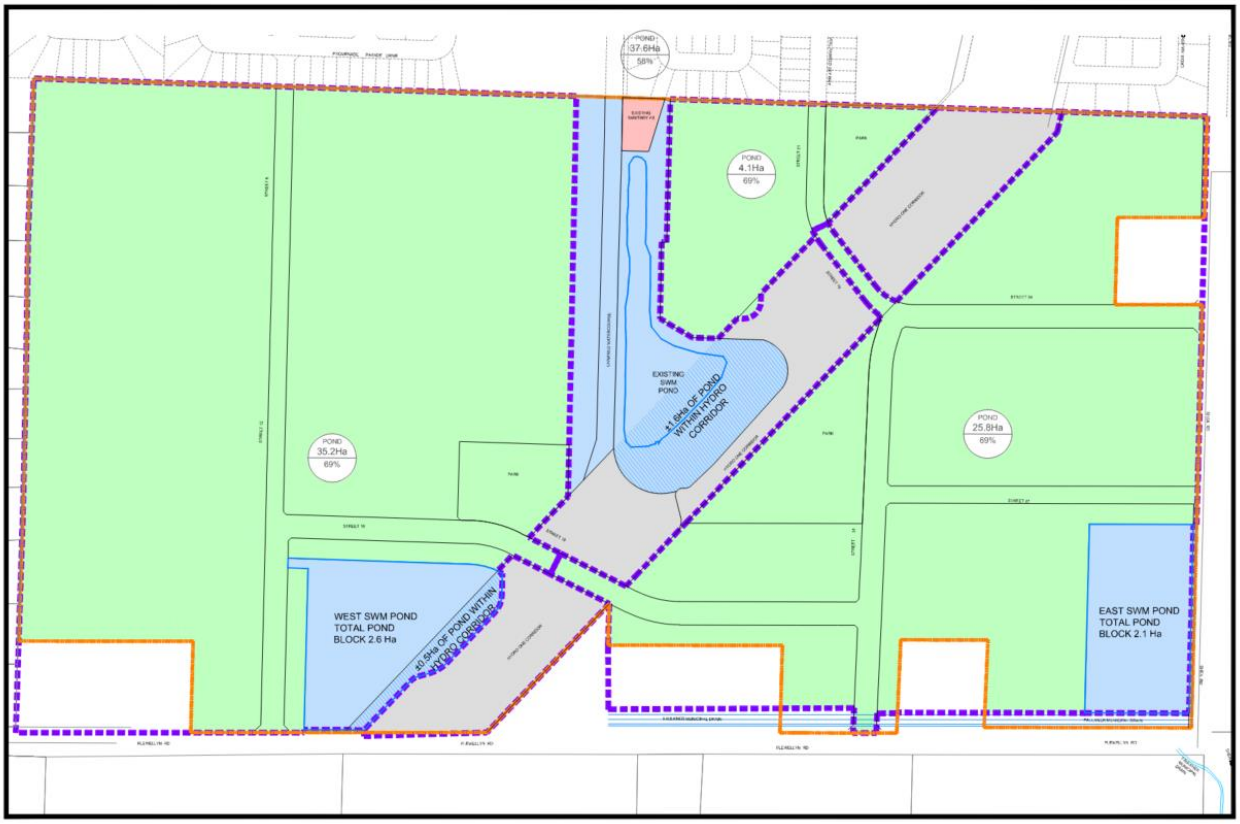

Exhibit 2: Option 1A – Two New SWM Ponds

7.4.2 Option 1B: Two New SWM Ponds (East Pond on Davidson Parcel)

Similar to Option 1A but with the East SWMP constructed within the Davidson Lands. This option presents the following constraints/challenges compared to Option 1A:

1) Construction of the pond within the Davidson Lands would be inconsistent with the natural topography/drainage;
2) Significant cost increase due to:
    a. Approximately 175,000 cu.m of addition fill required on the ***South Lands*** to redirect drainage.
    b. Additional retaining walls required along Flewellyn and Shea Roads.

This option is shown below in ***Exhibit 3***.

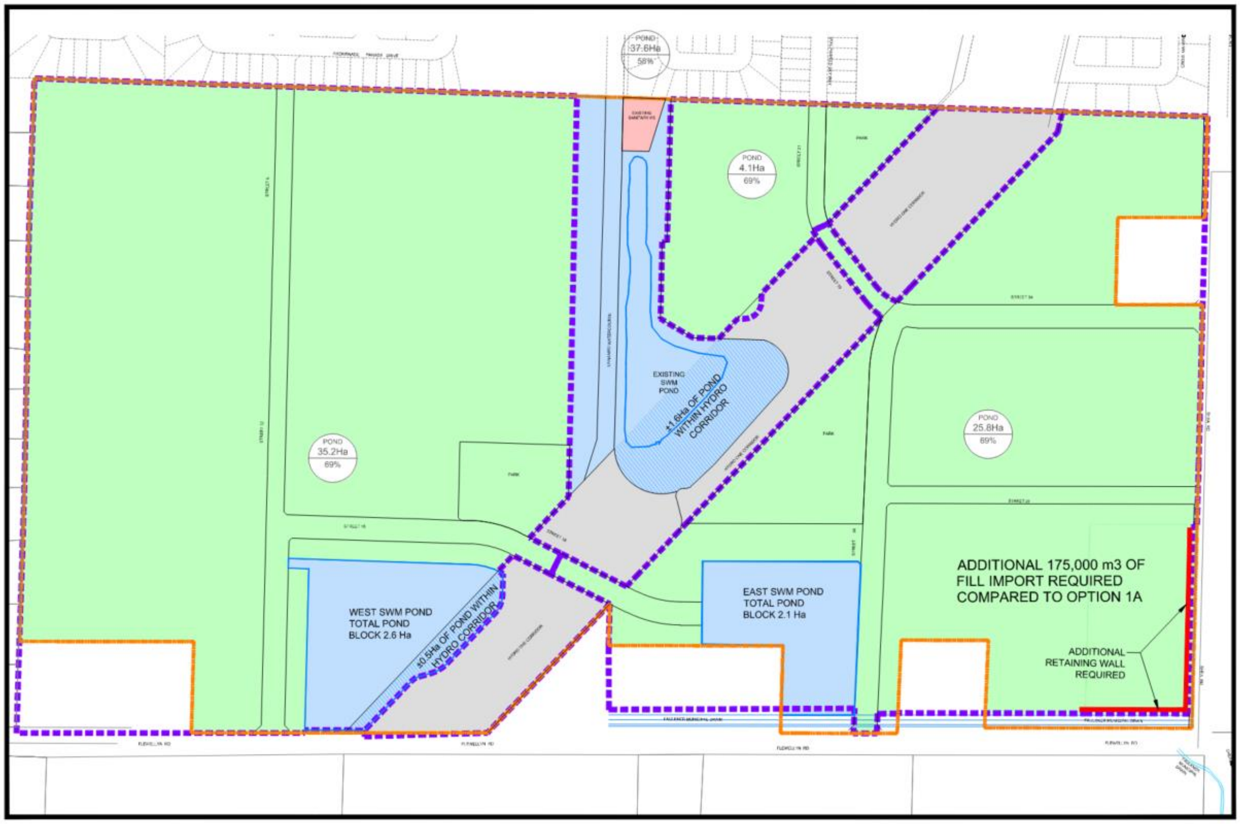

Exhibit 3: Option 1B – Two New SWM Ponds

7.4.3 Option 2A: One SWM Pond and Relocation of Existing Drain (Perimeter Channel)

This option would consist of decommissioning the existing Davidson SWM Pond and constructing one new SWM pond within the ***South Lands***. The unnamed watercourse, upstream of the Faulkner Municipal Drain and downstream of the Area 6 Pond headwall (Inv. 103.20) will be realigned and convey flows along the north and east perimeter of the development. This option will provide 54.9 Ha of developable land and have 6.2 Ha of area designated for the SWM pond.

Construction of a new emergency overflow to the future stormwater management pond (SWMP) at the southeast corner of the development will allow for lower underside of footings for the new development.

The City would decommission its Davidson Pond under this option with its drainage area accommodated by the new pond. In order to remove the constraint caused by the existing FMD, the tributary ditch north of the FMD would be rerouted around the perimeter of the ***South Lands.*** This option presents the following constraints/challenges compared to Option 1A:

1) Rerouted drain requires participation of holdout property;
2) Trunk storm sewer requires non-standard box culvert cross section in order to cross under rerouted drain. Limited cover on storm sewer at crossing (even with box culvert) of ~0.3m;

3) Non-standard pond inlet:
    a. Submerged inlet pipe (invert at pond ~99.5m with PP WL of 100.5m)
    a. Limited cover on sewer (~0.3m)
    b. Inlet pipe invert at ~1.0m above pond bottom;
4) Decrease in net developable area of ~1.5ha when compared to Option 0;
5) Significant cost increase due to:
    a. New channel construction
    b. Davidson Pond decommissioning for future residential development
    c. Additional new pond construction costs to accommodate existing Davidson Pond drainage area.

This option is shown below in ***Exhibit 4***.

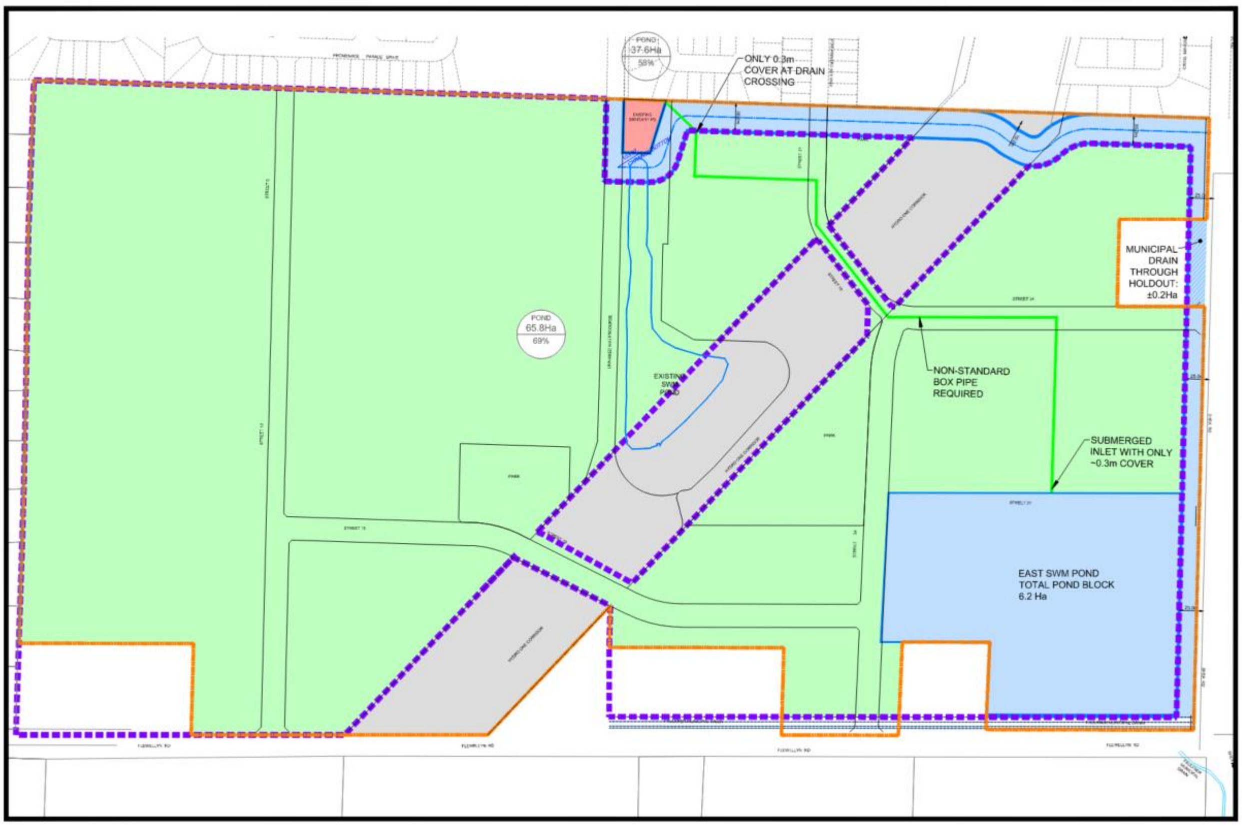

Exhibit 4: Option 2A – One SWM Pond and Relocate Existing Drain

7.4.4 Option 2B One SWM Pond and Relocation of Existing Drain (Central)

Similar to Option 2A, this option would require decommissioning of the existing Davidson SWM Pond and construction of one new SWM pond within the ***South Lands***. In addition, one new dry pond would be proposed within the Hydro corridor. The unnamed watercourse, upstream of the Faulkner Municipal Drain and downstream of the Area 6 Pond headwall (Inv. 103.20) will be maintained until it intersects the Hydro corridor, and a new channel would be constructed to convey flows easterly to the SWMP at the southeast corner of the development before discharging to the Faulkner Municipal Drain. This option would utilize a Dry Pond within the Hydro corridor for volume storage. This option will provide 54.8 Ha of developable land and have 8.4 Ha of area designated for the SWM ponds.

Construction of a new emergency overflow to the future stormwater management pond (SWMP) at the southeast corner of the development will allow for lower underside of footings for the new development.

The City would decommission its Davidson Pond under this option with its drainage area accommodated by the new pond. Under this option, in order to remove the constraint caused by the existing FMD, the tributary ditch north of the FMD would be rerouted through the ***South Lands.*** With this configuration, the Hydro corridor could be used for 5-year storage. This option presents the following constraints/challenges compared to Option 1A:

1) Trunk storm sewer requires non-standard box culvert cross section in order to cross under rerouted drain. Limited cover on storm sewer at crossing (even with box culvert) of ~0.3m;
2) Non-standard pond inlet:
    a. Fully submerged pipe (invert at pond ~99.05m with PP WL of 100.5m)
    b. Limited cover on sewer (~0.3m)
    c. Inlet pipe invert at ~0.5m above pond bottom;
3) Decrease in net developable area of ~1.6ha when compared to Option 0;
4) Significant cost increase due to:
    a. New channel construction
    b. Davidson Pond decommissioning for future residential development
    c. Additional new pond construction costs to accommodate existing Davidson Pond drainage area.

This option is shown below in ***Exhibit 5***.

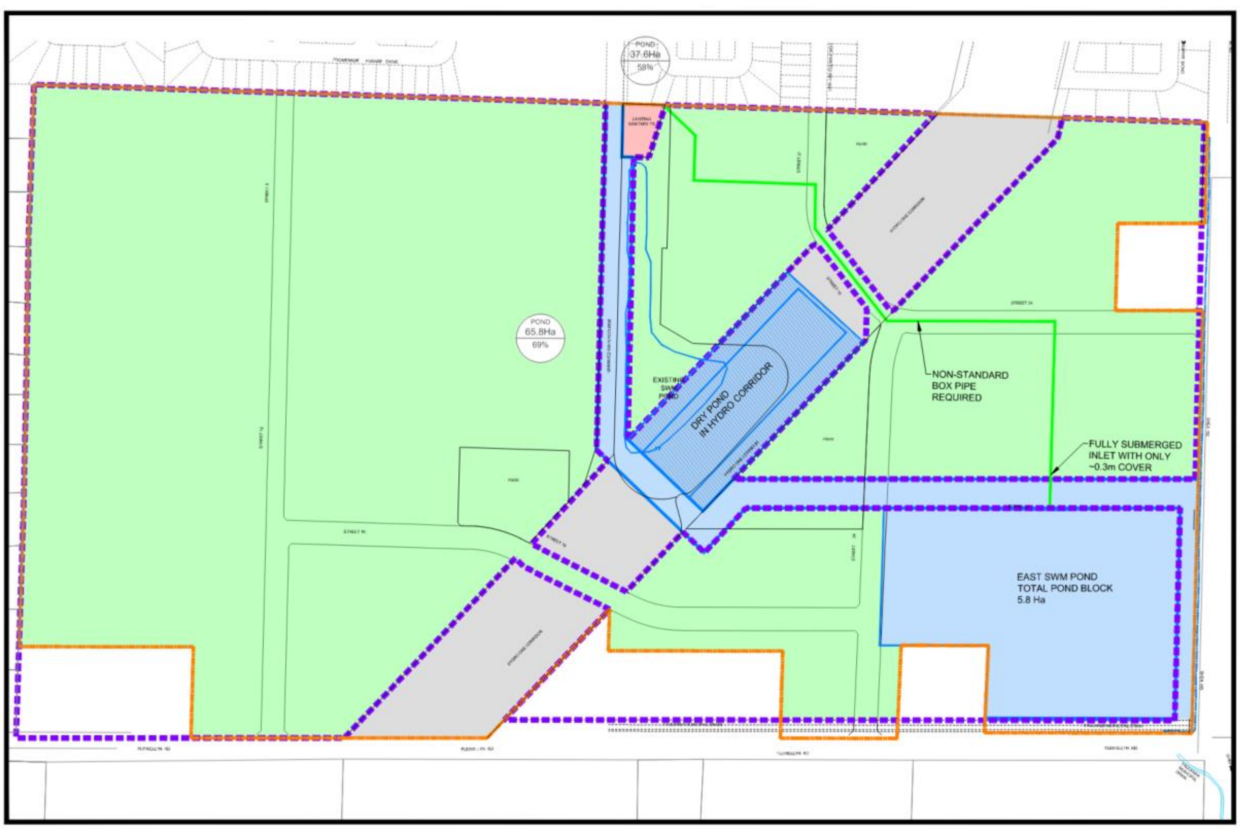

Exhibit 5: Option 2B - One SWM Pond and Relocated Existing Drain

7.4.5 Option 3: Two SWM Ponds and Decommissioning of Davidson Pond

This option would consist of decommissioning the existing Davidson SWM Pond and constructing two new SWM ponds, one in the southeast corner of the ***West Lands*** and one in the southeast corner of the ***South Lands***. The unnamed watercourse, upstream of the Faulkner Municipal Drain and downstream of the Area 6 Pond headwall (Inv. 103.20) will be maintained and convey flows through the hydro corridor to the Faulkner Municipal Drain. This option will provide 55.4 Ha of developable land and have 7.0 Ha of area designated for the SWM ponds, including 0.5 Ha within the Hydro corridor.

Construction of a new emergency overflow to the future stormwater management pond (SWMP) at the southeast corner of the development will allow for lower underside of footings for the new development.

Under this option, the ditch tributary to the FMD would remain in its current location. This option presents the following constraints/challenges compared to Option 1A:

1) Decrease in net developable area of ~1.0ha when compared to Option 1A;
2) Significant cost increase due to:
    a. Davidson Pond decommissioning for future residential development
    b. Additional new pond construction costs to accommodate existing Davidson Pond drainage area.

This option is shown below in ***Exhibit 6***.

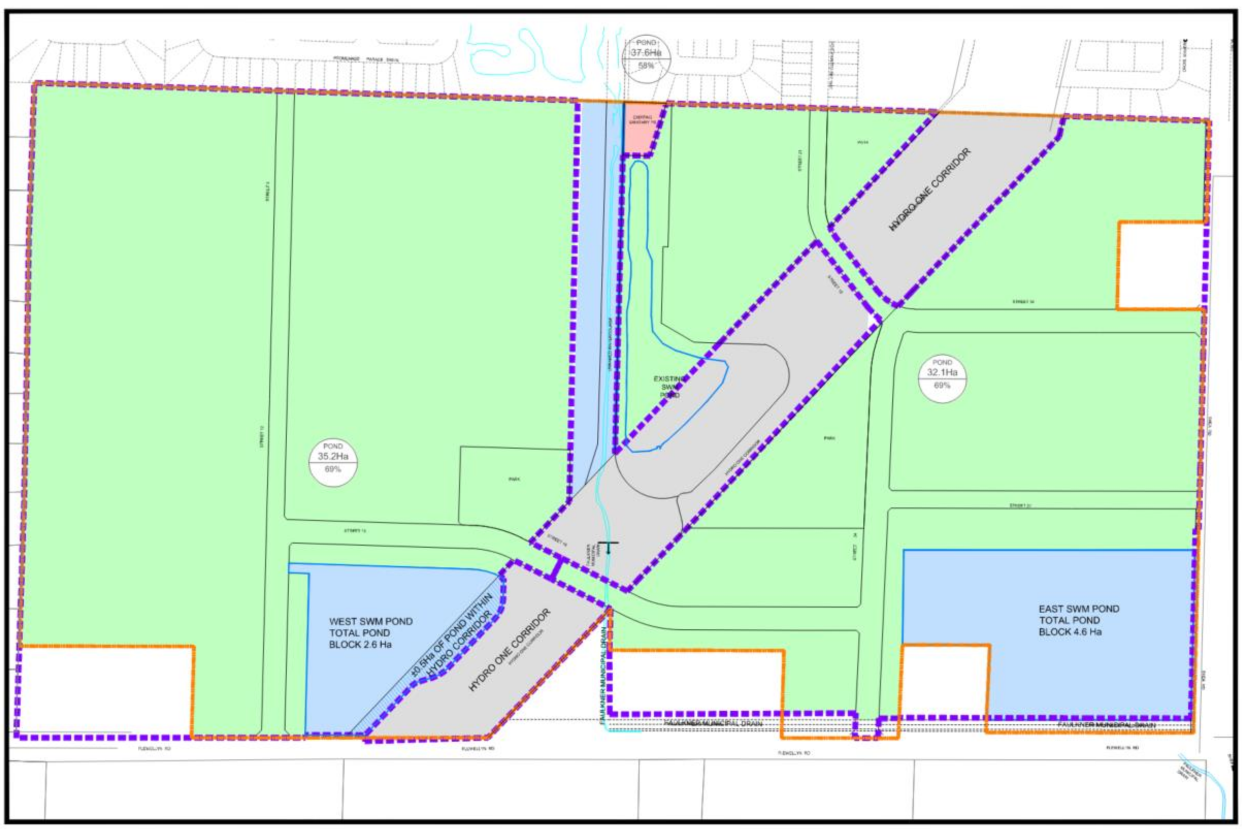

Exhibit 6: Option 3 – Two SWM Ponds and Decommissioning of Davidson Pond

7.4.6 Cost Comparison

A comparison of estimated SWM Pond costs for each option was prepared based on costs for similar work and summarized in the table below.

Table 13: Summary of Estimated SWM Costs

			Option 1A		Option 1B		Option 2A		Option 2B		Option 3	
Estimated SWM Costs	**Unit**	**Unit Cost**	**Quantity**	**Estimated Cost**	**Quantity**	**Estimated Cost**	**Quantity**	**Estimated Cost**	**Quantity**	**Estimated Cost**	**Quantity**	**Estimated Cost**
SWM Pond	ha	$ 1,875,000	5.20	$ 9,750,000	5.20	$ 9,750,000	6.20	$ 11,625,000	8.40	$ 15,750,000	7.00	$ 13,125,000
SWM Pond Channel	m	$ 3,000	-	$ -	-	$ -	1,200	$ 3,600,000	800	$ 2,400,000	-	$ -
SWM Total				*$ 9,750,000*		*$ 9,750,000*		*$ 15,225,000*		*$ 18,150,000*		*$ 13,125,000*
City Costs for Davidson Pond Decommissioning	Allowance	$ 2,100,000	-	$ -	-	$ -	1	$ 2,100,000.00	1	$ 2,100,000.00	1	$ 2,100,000.00
		Total Estimated SWM Costs	**$**	**9,750,000.00**	**$**	**9,750,000.00**	**$**	**17,325,000.00**	**$**	**20,250,000.00**	**$**	**15,225,000.00**

7.5 Stormwater Evaluation Matrix

The stormwater management options presented in ***Section 7.4*** were brought forward for evaluation through a pair-wise comparison matrix. The evaluation matrix was developed based on the stormwater management goals which have been assigned weighting to guide the selection of the preferred wastewater servicing solution.

Table 14: Stormwater Management Evaluation Criteria

Evaluation Parameter	Value
Conformance with City Standards/Policies	20%
Affordability	30%
Operation and Maintenance	20%
Sustainability	20%
Community Impacts	10%

Design alternatives that did not meet design standards for level of service, quality, quantity, or conveyance requirements were not included for analysis. As such, these ranking factors were not included in the evaluation matrix.

The ranking values assigned to the alternatives based on the various criteria are given over a relative range from 1 to 5. The description of these rankings is presented in **Table 15**:

Table 15: Decision Matrix Categories Ranking System

Ranking	Description
5 - Positive or No Impact	The alternative meets all applicable requirements, provides tangible benefits
4 – Minor Impact	The alternative has some minor negative impacts or dis-benefits that may easily be mitigated or compensated for

3- Moderate Impact	The alternative has noticeable negative impacts, however, the severity of the impacts may be reduced or compensated for
2 – Noticeable Negative Impact	The alternative has significant negative impacts which may be mitigated, although these may be costly, time consuming or result in other negative impacts
1 - Negative or Significant Impact	The alternative does not meet applicable requirements, results in significant dis-benefits and/or negative impacts cannot be mitigated

Under this ranking system, each individual criterion is ranked relatively for each alternative.

Table 16: Stormwater Management Evaluation

Parameter	Weighting	Option 1 (A & B)			Option 2 (A& B)			Option 3		
		Description	Score	Weighting	Description	Score	Weighting	Description	Score	Weighting
Conformance with City Standards/ Policies	20%	Ponds conform to City design standards; consistent with SWMP in the area	5	1.0	Submerged inlets; non-standard box culvert with limited cover	2	0.4	Ponds conform to City design standards; consistent with SWMP in the area	5	1.0
Affordability	30%	Lowest cost option. 1B would result in addiotnal costs compared to 1A as the east pond would not be at the lowest point on the site and additional earthworks and retaining walls would be required.	4	1.2	Highest cost option due to channel realignment and Davidson Pond decommissioning costs	2	0.6	Potential for maintenance cost savings by consolidating ponds; construction cost increase due to decommissioning of Davidson Pond	3	0.9
Operation and Maintenance	20%	Highest number of facilities to maintain compared to other options	3	0.6	Single pond; submerged inlets and box pipes increase maintenance requirements	3	0.6	Two ponds to maintain.	4	0.8
Sustainability	20%	Proven technology, long life expectancy standard maintenance	4	0.8	Proven technology, long life expectancy standard maintenance	4	0.8	Proven technology, long life expectancy standard maintenance	4	0.8
Community Impacts	10%	Large separation from new ponds to existing residential areas; minimal disruption during construction	5	0.5	Decommissioning of existing pond would present disruption to existing community; 2A channel construction adjacent to existing community and requires construction on lands owned by others.	1	0.1	Decommissioning of existing pond would present disruption to existing community	3	0.3
Total				**4.1**			**2.5**			**3.8**
Ranking				**1**			**3**			**2**

7.5.1 Preferred SWM Pond Alternative

Based on the above analysis the recommended alternative was found to be **Option 1**, where it scored ***4.1***.

Option 1A – Two New SWM Ponds (East Pond on Eder Parcel) is preferred of *Option 1B* as the preferred stormwater servicing strategy for the Stittsville South Urban Expansion Area. While the estimated stormwater costs for Option 1B are shown as equivalent to Option 1A, this alternative is not consistent with the existing site topography and would require significant additional costs, beyond SWM facility costs, for fill import and retaining walls. The Option 1A alternative minimizes new stormwater facility and channel construction and utilizes capacity in the existing Davidson Pond. As shown in ***Table 16*** above, this option presents the lowest overall SWM servicing cost.

7.5.1.1 South Lands

Stormwater flows from the existing development to the north of the ***South Lands*** is serviced by the existing Davidson SWM Pond. The existing Davidson SWM Pond was sized for its contributing area at the time of its construction and did not specifically account for other development areas.

The facility outlets from the south end of its configuration to a ditched outlet that conveys the flows southwest to the Faulkner Municipal Drain. Preliminary review of the Davidson SWM Pond indicates that it has the potential to accept additional flows from the ***South Lands*** development area.

The full extent of area that can be directed to the Davidson SWM Pond still has to be fully vetted but it is anticipated that a minimum of ~4.0 ha of ***SSUEA South Lands*** could be accommodated (assuming imperviousness of 58%). JFSA reviewed the capacity of of the Davidson Pond in its *Conceptual SWM Ponds and Preliminary HGL Analysis (JFSA, November 2023)* memo and concluded that the pond can accommodate this additional drainage area with minor modifications to the outlet structure. A detailed analysis of the pond operation to assess the release rates, pond water levels and HGL

elevations within the proposed and existing development will be completed as part of the design process.

The remainder of the ***South Lands*** development area will ultimately require the construction of a new stormwater management facility (SWMF) utilizing the FMD as its outlet. The facility will be required to provide an enhanced level of protection as well as providing 2-, 5- and 100-year target release rates and would most appropriately be located in the southeast portion of the property abutting the Flewellyn Road ROW.

7.5.1.2 West Lands

The development of ***West Lands*** will require the construction of a new stormwater management facility utilizing the FMD as its outlet. The facility will be required to provide an enhanced level of protection as well as providing 2-, 5- and 100-year target release rates and would most appropriately be located in the southeast portion of the property abutting the HONI corridor easement. The outlet from the SWMF would preferably cross the HONI corridor in order to outlet to the FMD.

An update to the Drainage Engineer's report for the FMD would be required as part of the proposed new pond outlet to the FMD.

7.6 Commitments for Functional and Detailed Design

The minor and major sewer systems and associated stormwater management facilities will be designed to support phased developments within the SSUAE. All proposed storm sewer infrastructure will be designed in accordance with the *Ottawa Sewer Design Guidelines*. The Stittsville West and South SWM pond designs will be completed according to City guidelines and the *MOE SWMP Design Manual*, further detailing inlet and outlet structures, orifice sizing, and pond block design – including the maintenance of natural heritage lands along the FMD and the implementation of multi-use pathways within the Pond blocks to create connectivity. Pond side slopes design is to be approved by a licensed Geotechnical Engineer prior to construction.

The proposed gravity sewer conveyance systems are shown to generally follow the proposed road network, with the exception of select conceptual servicing easements and a trunk sewer that will connect the West and South Lands through the Hydro Corridor. Note that the road network is conceptual in nature and is subject to change. As such, the trunk storm sewer routing is also subject to change. Easements may be required to provide efficient servicing per City of Ottawa and MECP standards.

During design of the developments within the ***SSUEA*** Lands:

- *Average runoff coefficients will be updated to reflect detailed pervious/impervious surfaces information;*
- *Design parameters factors according to City of Ottawa Sewer Design Guidelines will be used;*
- *Design of the trunk sewers are to be optimized for construction efficiencies, provided that there are no significant impacts to affected landowners and other requirements related to minor amendments are met;*
- *Local storm sewer sizing will need to be evaluated at the subdivision approval stage;*
- *Permissible grade raises will be further analyzed and confirmed by a licensed Geotechnical Engineer;*
- *Detailed storage calculations/modelling will be done to ensure storage targets are being met;*
- *Overland flow routes will be detailed further; and,*
- *Capacity in downstream infrastructure will be confirmed through storm sewer network modelling, as-builts, and rational method design information.*

Of special note is the stormwater management design for the Stittsville South Lands. Decisions related to stormwater management criteria for this area are to be subject to additional City review as part of *Planning Act* approvals for this area, based on the strategy that the lands east and west of the Hydro Corridor outlet to the Faulkner Municipal Drain from the proposed SWM facility.

7.7 Stormwater Servicing Conclusions

Based on the existing site topography and constraints including the FMD and tributary drain, DSEL prepared a stormwater servicing solution consisting of two new SWM ponds, servicing the ***West*** and ***South Lands***, respectively (Option 1A above).

The stormwater runoff is designed to be captured by an internal gravity sewer system that will convey flows to multiple outlet locations

A preliminary assessment was conducted for the conceptual stormwater management (SWM) ponds in a development site, focusing on the Faulkner Municipal Drain. Simulations and sensitivity tests were performed to address erosion concerns. PCSWMM modeling analyzed storm and sanitary water elevations, concluding that gravity storm connections are feasible. Recent downstream upgrades in the FMD, designed by the Drainage Engineer, have been completed to accommodate new and planned development in the area. Coordination with the Drainage Engineer will be completed to verify the recently constructed drain improvements are sufficient to accommodate flows from this development.

8.0 MUNICIPAL CLASS ENVIRONMENTAL ASSESSMENT

This ***MSS*** was prepared in accordance with the Municipal Engineers Association's *Municipal Class Environmental Assessment* (March 2023, as amended in 2000, 2007, 2011 & 2015) to support the Official Plan Amendment.

Caivan is the proponent and the concept plan process followed the Municipal Class EA process as an integrated process with the Planning Act.

Morrison Hershfield were retained by Caivan to an overview of the contemplated civil works and provide advice on required planning for integrating into the EA Process. Their findings are included in ***Appendix A***.

Morrison Hershfield has prepared a Class Environmental Assessment Requirements Overview which summarizes the various infrastructure projects that are anticipated to be associated with the development of the ***SSUEA*** area including:

- *Sanitary pump station upgrades;*
- *New stormwater management facilities for quality/quantity control;*
- *Low Impact Development (LID) systems;*
- *Potable water supply; and,*
- *New local and collector roadways.*

Morrison Hershfield concluded that the projects are exempt from the Class EA process.

The Morrison Hershfield letter was provided to the City of Ottawa on October 17th, 2023.

Appendix A includes the presentation boards from Public Open House #1 (February 29th, 2024) and Public Open House #2 (July 18th, 2024) that outline the integrated Planning Act and MEA Class EA Process.

9.0 CONCLUSIONS

This Master Servicing Study (***MSS***) provides historical background information regarding the servicing in the vicinity of the subject property and presents servicing options explored while determining the recommended servicing strategy. Sufficient detail is provided to demonstrate that the development of the subject property will be adequately supported by municipal services and demonstrate how the municipal services will conform to current guidelines and design criteria. The conclusions from this report are as follows:

- Paterson Group has completed geotechnical investigations of the development areas and has noted that the site has a minor area that may be subject to a grade raise restriction of up to 2 m pending additional investigation. The majority of the site does not have a grade raise restriction.

- The recommended water servicing preferred option of those evaluated is to connect to multiple connection points from the existing development lands to the north. The proposed network has demonstrated a watermain network that could provide RFF of 167 L/s or up to 217 L/s based on the boundary conditions provided by City staff.

- Detailed 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 design supply is to conform to all relevant City and MECP Guidelines and Policies.

- Sanitary service will be provided for the subject property via the upgrading of the adjacent Shea Road Sanitary Pump Station located within the north central portion of the site. Additional analyses and studies will assess the full scope of the upgrades and staging of the improvements.

- Stormwater service is to be provided by capturing stormwater runoff by an internal gravity sewer system that will convey flows to multiple stormwater management facilities:

    1. Existing Davidson SWM Pond – adjustments to the outlet control of the facility will result in minimal variations in water levels to service the northeastern portion of the ***SSUEA***, optimizing existing infrastructure;
    2. A new SWM Pond in the southeast quadrant of the site to service lands east of the FMD as shown in ***Section 9.2.1 Exhibit 2***;
    3. A new SWM Pond along the southwest boundary of the HONI corridor to service the ***SSUEA*** lands west of the FMD. All outletting to the FMD.

- The storm outlets will be set at, or above, the 2-year summer water level of the FMD.

- A preliminary Hydraulic Grade Line (HGL) modelling analysis has been completed and demonstrates that the HGL is maintained below the anticipated future underside of footings for the site.

- Erosion and sediment control measures will be implemented and maintained throughout construction. The FMD and adjacent watercourses will be protected from any negative impacts during construction.

- 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.

Prepared by,
David Schaeffer Engineering Ltd.

Per: Peter Mott, P.Eng.

Reviewed by,
David Schaeffer Engineering Ltd.

Per: Marc Pichette, P.Eng.

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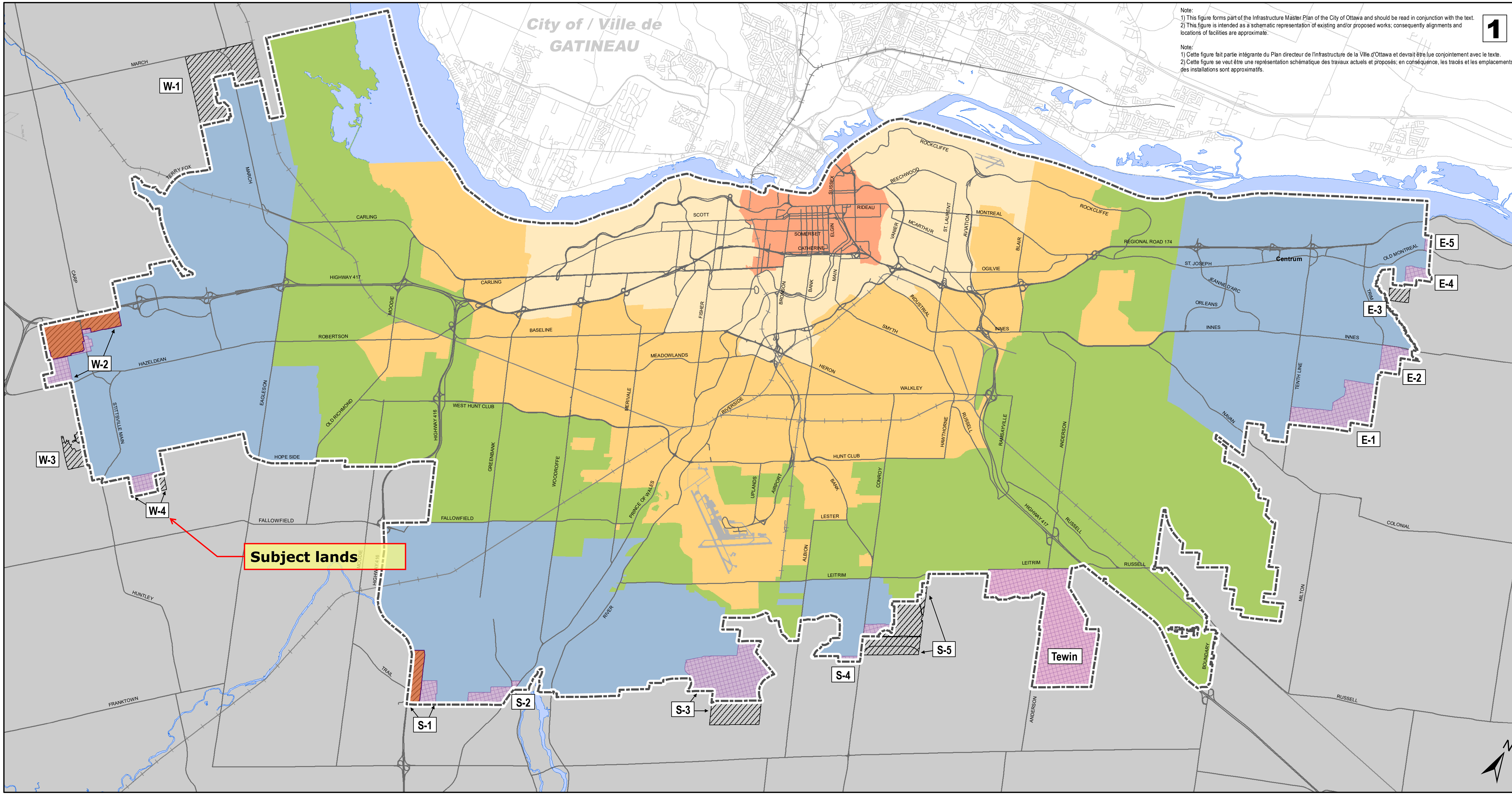
APPENDIX A



URBAN EXPANSION AREAS / ZONES D'EXPANSION URBAINE

- Future Neighbourhood / Futur quartier
- Industrial and Logistics / Industrie et Logistique
- Urban Boundary / Périmètre d'urbanisation
- Expansion Areas added and then rescinded by MMHA / Zones d'expansion ajoutées puis annulées par MMHA

TRANSECT POLICY AREAS / SECTEURS STRATÉGIQUES DU TRANSECT

- Downtown Core / Centre-ville
- Inner Urban / Urbain intérieur
- Outer Urban / Urbain extérieur
- Greenbelt / Ceinture de verdure
- Suburban / Suburbain
- Rural / Rural

Ottawa

INFRASTRUCTURE MASTER PLAN - Schedule 1

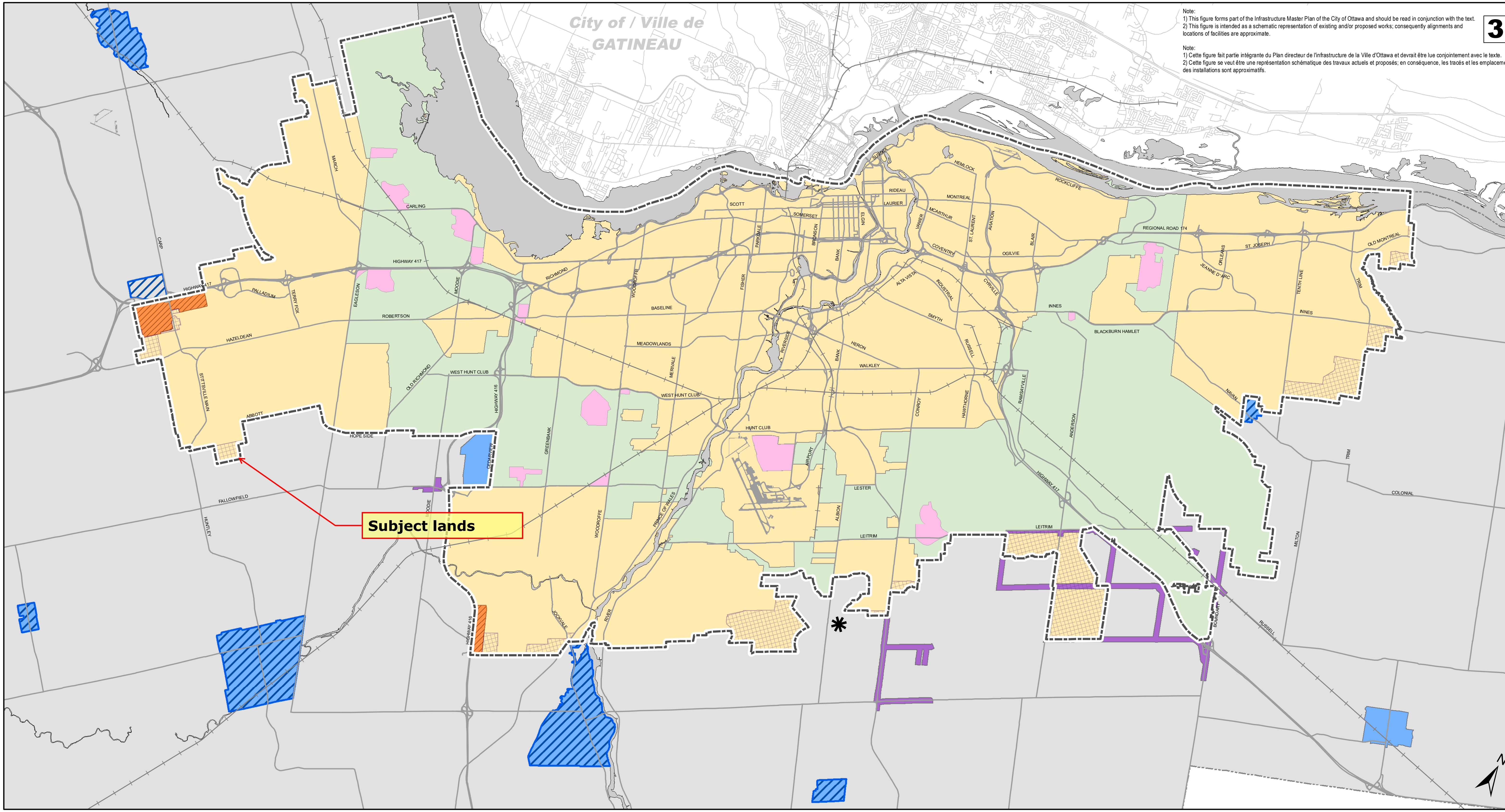
Urban Expansion Areas as defined in the Official Plan

PLAN DIRECTEUR DE L'INFRASTRUCTURE - Annexe 1

Zones d'expansion urbaine comme défini dans le Plan officiel

0 1.25 2.5 5 7.5 10 km

Planning, Development and Building Services, Geospatial Analytics, Technology and Solutions
Direction générale des sevices de planification, de l'aménagement se du bâtiment, Analyse géospatiale, technologie et solutions



URBAN EXPANSION AREAS / ZONES D'EXPANSION URBAINE

- Future Neighbourhood / Futur quartier
- Industrial and Logistics / Industrie et Logistique
- Expansion Areas added and then rescinded by MMHA / Zones d'expansion ajoutées puis annulées par MMHA
- Urban Boundary / Périmètre d'urbanisation
- Greenbelt / Ceinture de verdure
- Other urban area inside the urban boundary / Autre zone urbaine à l'intérieur des limites urbaines

PUBLIC SERVICE AREAS / ZONES DE SERVICES PUBLICS

- Serviced Greenbelt Facilities / Installations de la Ceinture de verdure desservies
- Public Service Area - Water (outside the Urban Boundary) / Zone de services publics – Plans d'eau (hors du périmètre urbain)
- Public Service Area - Water (outside the Urban Boundary - limited connection capacity/availability) / Zone de services publics – Plans d'eau (hors du périmètre urbain – capacité/disponibilité limitée du raccordement)
- Public Service Area - Wastewater (outside the Urban Boundary) / Zone de services publics – Eaux usées (hors du périmètre urbain)
- Public Service Area - Water and Wastewater (outside the Urban Boundary) / Zone de services publics – Aqueduc et égout (hors du périmètre urbain)
- Rideau Carleton Raceway Casino public supplied water and wastewater through private systems / Casino hippodrome Rideau Carleton : alimentation en eau et aqueduc dans le cadre de réseaux privés

Ottawa

INFRASTRUCTURE MASTER PLAN - Schedule 3

Public Service Areas

PLAN DIRECTEUR DE L'INFRASTRUCTURE - Annexe 3

Zones de services publics

0 1.25 2.5 5 7.5 10 km

Planning, Development and Building Services, Geospatial Analytics, Technology and Solutions
Direction générale des services de planification, de l'aménagement et du bâtiment, Analyse géospatiale, technologie et solutions

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613-836-0856
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MEMORANDUM

DATE: March 19, 2024

TO: **Christopher Rogers, P.Eng.**

FROM: Marc Pichette, P. Eng.

SUBJECT: **Caivan – Stittsville Lands (5993, 6070 & 6115 Flewellyn Road)
New Urban Expansion Development – Terms of Reference (REVISED PER CITY COMMENTS DATED MARCH 15, 2024)**

DSEL Job No. 21-1247

ATTACHMENTS:

Chris,

Per comments provided to Caivan on March 15/24, the following is a proposed summary of Terms of Reference (TOR) to document the servicing strategy approach for development of the above noted parcels of land located within Stittsville.

1.0 BACKGROUND

Fotenn Consultants Inc. ("Fotenn") has previously circulated a January 27, 2022 outline for the development of Concept Plans and processes related to the above noted subject lands. Caivan Communities ("Caivan") has ownership of land parcels that are currently located in the rural area and are designated to be brought within the urban boundary through the new Official Plan process.

1.1 Study Area & Objectives

The subject lands are bound by Flewellyn Road to south, Shea Road to the east, an existing urban subdivision development to the north (Stittsville South – Area 6) and an estate lot subdivision to the west. The area is also bisected by the Faulkner Municipal Drain and a Hydro One power transmission corridor.

The main objective of the servicing review is to develop an overall servicing strategy for the Stittsville Lands that will fulfill the requirements of municipal and provincial standards. The review will consider, evaluate and assess the servicing needs of the development area as it relates to geotechnical considerations, availability of service connections and stormwater management objectives. Several development alternatives for road network layouts, parks and unit mixes will be analyzed and assessed with respect to servicing strategies with a preferred overall servicing scheme identified.

The preferred internal servicing plan will be developed to meet regulatory requirements and will be free of conflicts between the various infrastructure components (water, wastewater, storm and stormwater infrastructure). The following sections present the anticipated scope of work to be completed:

- Task 1 (Agreement on Terms of Reference),
- Task 2 (Internal Concept Plan Review Process (Input Evaluation)),
- Task 3 (Functional Servicing Report and Master Infrastructure Review).

2.0 WORK PLAN

Task 1: Agreement on Terms of Reference

Preparation and finalizing of the TOR for the proposed servicing assessment approach guiding the Concept Plan development process. This draft TOR will be circulated to the City for review/comment on the proposed scope and will form the basis of the future servicability review.

Task 2: Internal Concept Plan Review Process (Input Evaluation)

From an Overall Servicing perspective, this task will include a thorough consolidation of the documents listed in Section 2.1, investigate and quantify residual capacities and servicing constraints while keeping in mind the environmental constraints identified as part of the Task 2 process. The scope of work to complete the Concept Plan Review Process will include the following components:

2.1 Review and Consolidate

As part of the Concept Plan Review Process, a review of background reports that are concerned with the study area will be completed. The review will, at minimum, include the following reports and guidelines being considered:

- City of Ottawa Sewer Design Guidelines (City of Ottawa, October 2012) & Technical Bulletins (ISDTB-2014-01, PIEDTB-2016-01, ISTB-2018-01, ISTB-2018-04 & ISTB-2019-02)
- City of Ottawa Water Distribution Guidelines (City of Ottawa, July 2010) & Technical Bulletins (ISD-2010-2, ISDTB-2014-2, ISTB-2018-02, & ISDTB-2021-03)
- Infrastructure Master Plan (City of Ottawa, 2013)
- Low Impact Development Technical Guidance Report, Implementation in Areas with Potential Hydrogeological Constraints (Dillon Consulting and Aquafor Beech, February 2021)
- Stormwater Planning and Design Manual (Ministry of the Environment, March 2003)
- Amendment to the Engineer's Report for the Faulkner Municipal Drain (Robinson, December 2020) & Addendum No. 1 (Robinson, March 2021)
- Stittsville South – Area 6, City of Ottawa, Master Servicing Report & Stormwater Management Design Plan (Novatech/DSEL, December 2013)
- Stittsville South Subdivision, City of Ottawa – Detailed Servicing & Stormwater Management Report (Novatech July 2016)
- Sanitary Pump Station Pre-Design Report, Stittsville South (Novatech, July 2015)
- Stittsville South Subdivision, City of Ottawa – Shea Road Sanitary Pump Station Design Brief (Novatech, May 2016)
- Design Brief, Davidson Lands – OPA 76 Area 6a, Phase 1 (5993 Flewellyn Road) (IBI Group, February 2018)
- Fernbank Community Design Plan, Master Servicing Study (Novatech, June 2009)

- Geotechnical Investigation, Proposed Residential Development 5993, 6070 & 6115 Flewellyn Road – Ottawa (Paterson (PG5570-2) January 2022)
- Low Impact Development Stormwater Management Guidance Manual (Ministry of the Environment, Conservation and Parks, Draft for Consultation – January 2022)

2.2 Hydrological Modelling

Based on a review of background reports and topographic information available, a hydrologic model will be developed to estimate peak flows and hydrographs under for the various outlets from the Study Area. The analysis will be conducted with SWMHYMO under the design storm types, return periods and hydrological parameters described in the Ottawa Sewer Design Guidelines. The analysis will consider the drainage features inventoried as part of the topographical survey (open ditch, culverts, etc.) as well as any drainage divides. Surface flows will be calculated based on the existing flow patterns for the various outlets; drainage ditches, culverts and storm sewers (if applicable).

2.3 Coordination and Liaise with Other Disciplines

The Concept Plan review process will discuss findings from other disciplines including geotechnical, hydrogeology, water budget, hydrology, ecology (aquatic resources and natural areas), etc., which will establish the existing environmental conditions. The coordination will ensure that the hydrologic analysis considers natural environmental inventories and constraints. Where required, drawings prepared will note existing conditions constraints and potential opportunities, which may impact storm and stormwater servicing or other municipal infrastructure.

2.3.1 Coordinate and Liaise with Geotechnical Engineer

In consultation with the geotechnical engineer, DSEL will:

- Review specific grade raise restrictions to better understand the potential grading constraints versus potential land use;
- Review the soil's characteristics to better understand whether they are conducive to infiltration measures;
- Review the soil's structural capabilities from a support/strength perspective;
- Review the areas of either recharge or discharge potential.

2.3.2 Coordinate with the Hydrogeologist

In consultation with the hydrogeologist, the existing conditions water budget analysis will be reviewed to identify the zones conducive to infiltration measures or other low impact development (LID) strategies. These measures could potentially be used to mitigate impacts on the water budget. As part of this task, LID strategies will be reviewed, at a conceptual level, to determine their viability and effectiveness in maintaining the existing conditions water budget and potential benefits to mitigating downstream impacts.

- Prepare a conceptual LID plan which illustrates the zones noted above and how the measures will be integrated into the overall plan(s);
- Evaluate viability and performance of LIDs with respect to soil conditions, groundwater levels and depth of storm sewer infrastructure within the development area. The feasibility of LID performance will be assessed as part of the master planning process;

2.3.3 Coordinate with Biologist

In consultation with the biologist, the environmental constraints will be further reviewed to better understand their sensitivity to various land uses and their proximity to Concept Plan elements. The objectives and targets from a storm discharge perspective will be based on the on-site environmental constraints as well as the limitations of the receiving watercourses.

2.3.4 Review Topographical Survey and Complete Inventory of Existing Infrastructure

Once all constraints have been compiled a further review of topographical surveys will be completed as well as the drainage patterns identified under current conditions. As part of this task, existing services and outlets will be inventoried for wastewater, water and stormwater. The assessment of residual capacities for existing services will also be reviewed. Any additional survey data will be obtained as required to supplement as-built information.

2.4 Evaluation and Assessment of Storm Design Criteria , Objectives and Pond Alternatives

Based on the findings of the natural resource inventories, storm criteria for both water quality and quantity will be established from a consensus with other disciplines and based on requirements prevalent in the Study Area. Once adopted by the consultant team, the storm criteria will be presented and confirmed by regulatory agencies. Review and comment on potential end-of-pipe solutions that would satisfy the storm criteria and the most suitable approach and siting (based on topography, soil type etc) for the Concept Plans. Based on the siting of the facilities, establish footprint of the end-of-pipe facilities in accordance with the guidance described in Section 4 of the MECP SWMPDM. This includes evaluation of potential capacity of the existing Area 6 SWM pond to optimize use of that infrastructure.

Geosynthetic clay liners, or equivalent, will be incorporated into pond design where required based on the recommendations of the geotechnical engineer.

Pond sizing will be established conservatively and not be downsized based on the finding of LID options reviewed to establish water balance.

Several stormwater drainage alternatives will be prepared and evaluated, taking into consideration the following planning constraints:

1) The management of drainage from existing SWM ponds;
2) The development site is bisected by Faulkner Municipal Drain;
3) The lower-lying lands being occupied by non-participating landowners;
4) The seperation of residential developable areas by the Hydro corridor;

2.5 Coordination with Drainage Engineer for requirements relating to the Faulkner Municipal Drain (FMD).

Preliminary consultation with the City's Municipal Drain Group, indicated that the scope of work would fall under Section 65 of the Drainage Act with updates to the change in land use and incorporation of new connections to the FMD. The City would engage with the same Drainage Engineer that completed the design of the recently constructed FMD upgrades to confirm adequate outlet (sufficient capacity) and determine if any further work is required under this project. There are sections of the Faulkner Municipal Drain that currently exist inside the urban boundary and will be abandoned as part of the development approval process. Further consultation will be undertaken with the City's Municipal Drain Group to verify and complete all requirements under the Ontario Drainage Act.

2.6 Concept Plan Summary Discussions & Preferred Plan Selection

The preceding evaluations considered along with the Concept Plans reviewed will determine a preferred plan which will be brought forward for the more detailed review and assessment of servicing in Task 3.

Task 3: Functional Servicing Report and Master Infrastructure Review

After the completion of Task 2, the Consulting Team will have developed several Concept Plans based on the findings and any other discipline inputs compiled to date from the Team with a preferred option selected. This will include environmental, stormwater, geotechnical and transportation. For the preferred Concept Plan the municipal servicing constraints criteria (see Task 3.1) will be investigated for the preparation of the servicing analysis. Review will also include comment on suitable servicing routes via either servicing blocks and/or the establishment of right-of-way corridors that have appropriate cross-sections to accommodate the various elements of servicing infrastructure required.

3.1 Evaluation of Municipal Servicing Requirements for the Preferred Concept Plan

DSEL will evaluate infrastructure servicing alternatives for the Concept Plans prepared by considering each option and providing the Team with inputs using the general criteria outlined below in order to resolve the preferred Concept as described in the Fotenn outline memo previously circulated. The tasks envisioned to be included in a Site Servicing and Stormwater Management Report area as follows:

3.1.1 Grading

1. Develop a macro level Grading Plan for the Concept Plans based on the constraints identified by the geotechnical engineer. Grading will be developed in accordance with the criteria described in the Design Guidelines.

3.1.2 Identify and Assess Capacity of Existing Conveyance Systems

1. Based on topographical maps/surveys and servicing reports of existing developments adjacent to the limits of the Study Area, free flowing capacity of watercourses (i.e. Faulkner Drain), roadside ditches and water crossings (if any) will be reviewed.

3.1.3 Water Infrastructure

1. Confirm pressure objectives with the City along feedermains under both domestic and fire flow conditions. Connections will be to the development areas to the north of the Study Area. Coordination with the Water Master Plan to be undertaken with City staff.

2. Calculate domestic demands (average, maximum day and peak hour) based on “system level parameters” (expectation being there will be in excess of 3,000 persons) under the build-out condition of the proposed land use for the selected Concept Plans. The preferred parameters will be provided by the City.

3. Calculate required design fire flow for concurrence by City staff.

4. Calculate theoretical domestic demands for potential phases of development based on a phasing strategy. Develop and populate a base water model for the preferred Concept Plan.

5. Acquire hydraulic boundary conditions at each of the connection points of the existing water distribution system. Proposed connection locations to be concurred with by City Staff.

6. Evaluate the performance of the distribution system against municipal requirements under domestic demand conditions for the Concept Plan. Assess and identify deficiencies and develop system upgrades, if required, to meet municipal requirements from both pressure and demand criteria.

7. Evaluate the performance of the proposed distribution system under a maximum day plus fire flow conditions for the Concept Plans supply characteristics of the pressure zone in accordance with Technical Bulletins.

8. Prepare a Water Servicing Plan for the preferred Concept Plan.

3.1.4 Wastewater Infrastructure

1. Based on the sanitary sewer outlets inventoried as part of Task 2, assess residual capacities. Coordination Wasterwater Master Plan to be undertaken with City Staff.

2. Develop peak wastewater flows based on the land use and population projections for the different land uses associated with the Concept Plans as per the Sewer Design Guidelines.

3. Prepare a Sanitary Drainage Area Plan and Design Sheets for the preferred Concept Plan.

4. Review trunk sanitary sewer routes, establish preliminary invert elevations based on topography and existing outlets. Prepare Sanitary Servicing Plan and assess impact of phasing on infrastructure. Identify servicing constraints, potential crossing conflicts and adjust, as required once the Storm Servicing Plan has been completed.

5. Assess residual capacities, beyond the Study Area population.

6. Review Shea Road Sanitary Pump Station for capacity and potential upgrades. Coordination with the Wastewater Master Plan Project Manager to be undertaken in order to assess conceptual pumping upgrates that will be required to accommodate the expansion area.:

   a. Summarize the existing pump station parameters.

   b. Review of potential component upgrades as well as overflow requirements.

   c. Review electrical changes needed to accommodate higher HP pumps and high-level electrical overview.

d. Transient analysis review.

7. Summarize findings for Wastewater Component within reporting.

3.1.5 Storm Servicing and Stormwater Management

1. Based on the prior Task findings, confirm storm design criteria (quantity and quality) with the RVCA, MECP and the City and discuss potential impacts.

2. Review topographic survey and maps. Based on the storm sewer outlets inventoried as part of prior tasks, confirm outlet locations and inverts, and assess residual capacities and drainage patterns, etc.

3. Review existing conditions hydrological analysis to establish the baseline condition.

4. Finalize capacity assessment of existing surface outlets using desktop calculations.

5. Determine minor and major system drainage boundaries for the Concept Plans based on residual capacities of the existing outlets.

6. Carry out post-development Water Budget based on the Concept Plan. Identify and assess water budget deficits for the preferred Concept Plan.

7. In consultation with the hydrogeologist:

   - Investigate, at the conceptual level, the integration of low impact development (LID) strategies within the Study Area based on inputs from the hydrogeologist
   - evaluate potential infiltration measures, and
   - assess conceptually the performance of the LID strategies and infiltration measures with respect to the potential water budget deficits.

8. Based on the minor and major system boundaries, prepare post-development Storm Drainage Area Plan and Servicing Layout for the preferred Concept Plan. Identify servicing constraints, potential crossing conflicts and adjust, as required.

9. Coordinate with the City Drainage Group regarding the Faulkner Drain and any requirements under the Ontario Drainage Act.

10. Prepare Storm Sewer Design Sheets and Drainage Area Plans for the preferred Concept Plan with appropriate runoff coefficients, assessment of trunk storm sewer inverts etc as per Sewer Design Guidelines.

11. Review and finalize potential end-of-pipe solutions that would satisfy the storm criteria (water quality and quantity) and the most suitable approach and siting (based on topography, soil type etc) for the preferred Concept Plan. Based on the siting of the facilities, establish footprint of the end-of-pipe facilities in accordance with the guidance described in Section 4 of the MECP SWMPDM.

12. Carry out a hydraulic grade line (HGL) analysis of the proposed storm sewer system to evaluate the freeboard between the potential underside of footings and the 1:100 year storm. The analysis is to include the evaluation under the climate change event in accordance with the OSDG.

13. Assess impact of phasing on proposed storm infrastructure.

14. Summarize findings for Stormwater Management within the reporting

3.1.6 Water Budget

1. In consultation with the hydrogeological/geotechnical engineer, JFSA/DSEL will prepare a pre- and post-development water balance review (infiltration, runoff and evapotranspiration) for the site in accordance with the methodology summarized in Section 3.2 of the MECP's "Stormwater Management Planning & Design Manual, March 2003". This will include consideration of *Table 3.1 – Hydrologic Cycle Component Values* and evaluation of 39 years of historical rainfall data from the Ottawa Airport via continuous hydrologic SWMHYMO model simulations. As per 4.7.1 (3.b) of the draft Official Plan.

2. Findings above will also be correlated to the mitigation of potential downstream impacts of the development.

3.1.7 Opinion of Probable Cost and Phasing

1. Coordination with other disciplines to finalize phasing for the Concept Plan in regard to servicing constraints.
2. Prepare an opinion of probable cost for municipal servicing for the preferred Concept Plan.

Marc Pichette, P.Eng.

DSEL

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EXISTING CONDITIONS REPORT - SERVICING

FOR

STITTSVILLE SOUTH URBAN EXPANSION AREA

CAIVAN (STITTSVILLE SOUTH) INC. & CAIVAN (STITTSVILLE WEST) LTD.

CITY OF OTTAWA

PROJECT NO.: 21-1247

SEPTEMBER 2023 – 1ST SUBMISSION

EXISTING CONDITIONS REPORT - SERVICING
FOR

STITTSVILLE SOUTH URBAN EXPANSION AREA

CAIVAN (STITTSVILLE SOUTH) INC. & CAIVAN (STITTSVILLE WEST) LTD.

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APPENDICES

EXISTING CONDITIONS REPORT - SERVICING
FOR

STITTSVILLE SOUTH URBAN EXPANSION AREA

SEPTEMBER 2023 – 1ST SUBMISSION
CITY OF OTTAWA
PROJECT NO.: 21-1247

1.0 INTRODUCTION

Caivan (Stittsville South) Inc. and Caivan (Stittsville West) Ltd. (Caivan) have retained a Consultant Team to prepare documents to support the Stittsville South Urban Expansion Area (SSUEA)which will be implemented as an Amendment to the City of Ottawa Official Plan (OP) and removal of the Future Neighborhood Overlay on Schedule C17.

Per the City of Ottawa request, a Terms of Reference (TOR) document was prepared and validated by the City (TOR included in Appendix E for reference) to outline the servicing assessment approach for the subject lands. David Schaeffer Engineering Ltd. (DSEL) has been retained to prepare a scoped Master Servicing Study (MSS) to outline water, wastewater, and stormwater management servicing strategies for the SSUEA. In advance of preparing the MSS, an Existing Conditions Report is required to evaluate and assess existing water resources and servicing infrastructure in the vicinity of the SSUEA, and to identify constraints and opportunities that will provide the baseline conditions of an Environmental Management Plan (EMP).

2.0 STUDY AREA

2.1 Location

The properties comprising the Caivan landholdings within the SSUEA are as follows and illustrated in Figure 1:

- ~18.8 ha 6115 Flewellyn Road;
- ~16.1 ha 6070 Fernbank Road;
- ~17.4 ha 5993 Flewellyn Road
- ~12.4 ha (6030 Fernbank Road) parcel and
- ~8.8 ha of holdout land parcels (including Hydro corridor owned lands west of Faulkner Drain) within the SSUEA study area.

The noted land parcels are now designated as Urban Expansion Area in the City of Ottawa Official Plan as of November 2022. As illustrated in the following figure, the overall development area is bound by Flewellyn Road to south, Shea Road to the east, an existing urban subdivision development to the north (Stittsville South – Area 6 ("Edenwylde")) and an estate lot subdivision (Woodside Acres) to the west.

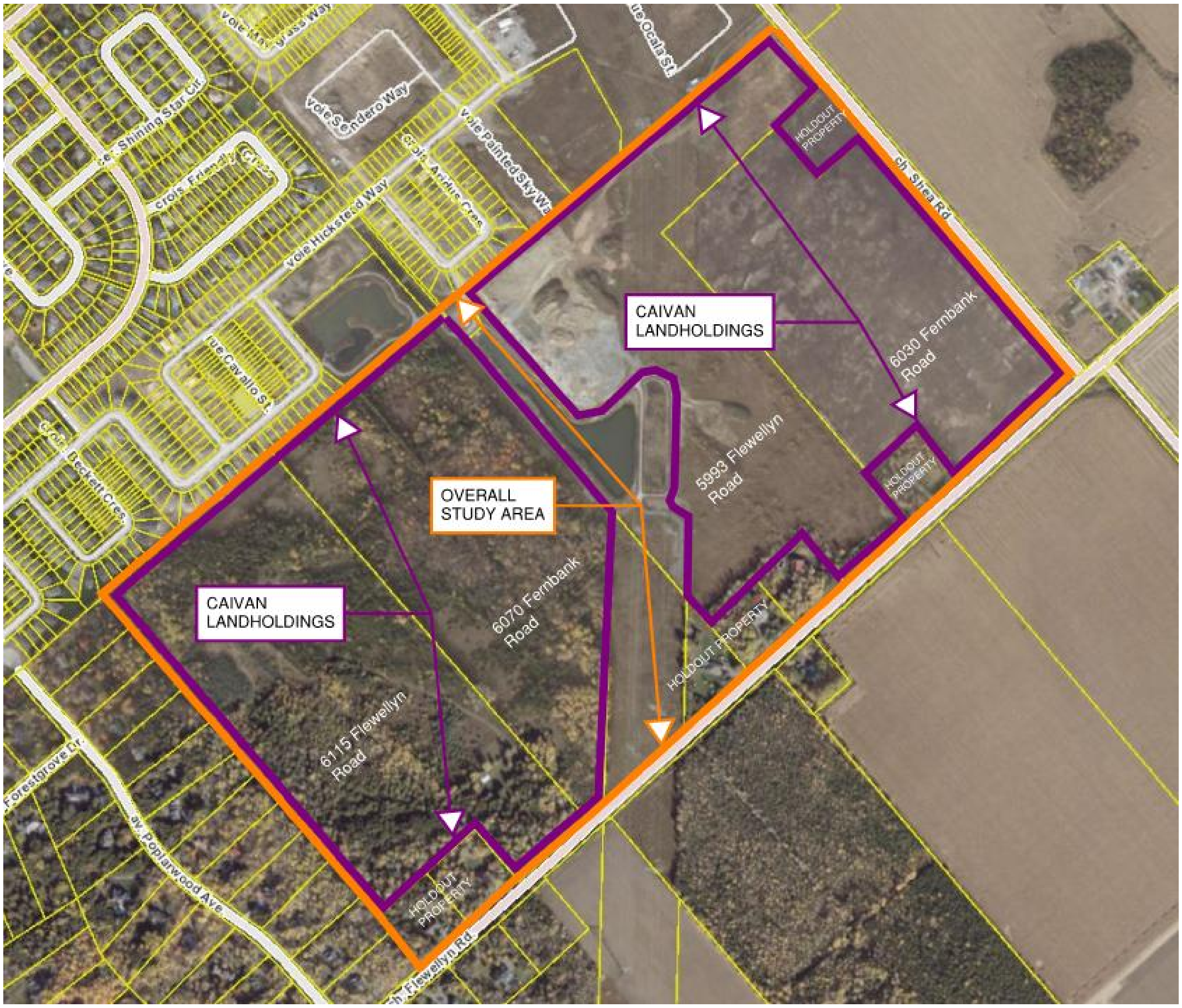


Figure 1: Stittsville South Urban Expansion Area – Location Plan

2.2 Site Characteristics

The subject site is currently undeveloped and is a mix of active/former farmland in the eastern areas and forested areas in the western portion. The overall area is bisected diagonally (north/south) by an existing a Hydro One 500kV utility corridor and an existing stormwater management facility is located centrally within the property and manages flows from a portion of the Edenwylde Subdivision.

In addition, a stormwater conveyance ditch originating from the development areas to the north, runs southward parallel to the east boundary of the Faulkner Property. The ditch officially transitions to being the Faulkner Municipal Drain (FMD) approximately 215 m north of Flewellyn Road and then conveys flows eastward along Flewellyn Road.

For the land parcel west of the Hydro corridor the terrain generally trends lower from northwest to southeast with elevations ranging from 109 m to 103 m. For land area east of the Hydro corridor the same southeast trend existing with elevations ranging from 104 m to 102 m at Flewellyn Road. The various Existing Conditions figures provided in the Appendices demonstrate the SSUEA site contours.

3.0 BACKGROUND DOCUMENTS

There are a variation of documents and reports that have been prepared in relation to lands surrounding the site. The documents include subwatershed studies of the Jock River, covering the areas south of the site, and servicing documents for the urban area north of the site.

- City of Ottawa Sewer Design Guidelines (City of Ottawa, October 2012) & Technical Bulletins (ISDTB-2014-01, PIEDTB-2016-01, ISTB-2018-01, ISTB-2018-04 & ISTB-2019-02).
- City of Ottawa Water Distribution Guidelines (City of Ottawa, July 2010) & Technical Bulletins (ISD-2010-2, ISDTB-2014-2, ISTB-2018-02, & ISDTB-2021-03).
- Infrastructure Master Plan (City of Ottawa, 2013).
- West Urban Community – Wastewater Collection System Master Servicing Plan (RV Anderson Associates Ltd, July 2012).
- Stittsville Master Drainage Plan (A.J. Robinson, 1994).
- Low Impact Development Technical Guidance Report, Implementation in Areas with Potential Hydrogeological Constraints (Dillon Consulting and Aquafor Beech, February 2021).
- Stormwater Planning and Design Manual (Ministry of the Environment, March 2003).
- Low Impact Development Stormwater Management Guidance Manual (Ministry of the Environment, Conservation and Parks, Draft for Consultation – January 2022).
- Jock River Reach 2 & Mud Creek Subwatershed Study Marshall Macklin Monaghan / WESA, May 2009
- Amendment to the Engineer's Report for the Faulkner Municipal Drain (Robinson, December 2020) & Addendum No. 1 (Robinson, March 2021).
- Engineer's Report for the Flowing Creek Municipal Drain (A.J. Graham Engineering, December 1973).
- Flowing Creek Flood Risk Mapping from Flewellyn Road to Jock River (Rideau Valley Conservation Authority, May 8, 2017).
- Stittsville South – Area 6, City of Ottawa, Master Servicing Report & Stormwater Management Design Plan (Novatech/DSEL, December 2013).
- Stittsville South Subdivision, City of Ottawa – Detailed Servicing & Stormwater Management Report (Novatech July 2016).
- Sanitary Pump Station Pre-Design Report, Stittsville South (Novatech, July 2015)
- Stittsville South Subdivision, City of Ottawa – Shea Road Sanitary Pump Station Design Brief (Novatech, May 6, 2016).

- Design Brief, Davidson Lands – OPA 76 Area 6a, Phase 1 (5993 Flewellyn Road) (IBI Group, February 2018).
- Design Brief, Davidson Lands – OPA 76 Area 6a, Phase 2 (5993 Flewellyn Road) (IBI Group, July 2020).
- Design Brief for the Stormwater Management Pond for the Davidson Lands (JFSA/DSEL, November 2017).
- Fernbank Community Design Plan, Master Servicing Study (Novatech, June 2009).
- Geotechnical Investigation, Proposed Residential Development 5993, 6070 & 6115 Flewellyn Road – Ottawa (Paterson (PG5570-2) January 2022).

4.0 EXISTING INFRASTRUCTURE AND SERVICING

4.1 Wastewater Servicing

A recently (2017) constructed sanitary pump station (Stittsville South Area 6 Sanitary Pumping Station – also referred to as the Shea Road Pump Station (SRPS)) associated with the recent new development to the north is located along the north boundary centrally to the land parcels being reviewed (immediately north of an existing stormwater management pond (Davidson Pond)). As per the Environmental Compliance Approval (ECA #3415-ADWLJG issued September 21, 2016. See ***Appendix B***) for the pump station, the initial firm capacity of the station was 42 L/s with recently completed pump expansions to an ultimate firm design capacity of 84 L/s (December 2022).

A 450mm diameter sanitary sewer connects to the existing Shea Road sanitary pump station. The existing 450mm diameter inlet sanitary sewer has an inlet pipe elevation of 98.72 m at the last manhole upstream of the station and wet well invert elevation of 96.50 m. The inlet sewer has a residual capacity of approximately 80% which would allow for an additional ~390 L/s of sanitary flows.

Previously, the SRPS directed forcemain flows northward to the existing Liard Street pumping station. As of December 2022 the SRPS now directs flows directly to the recently completed extension of the Fernbank Lands trunk sanitary sewer. Additionally, there is an existing low lift pumping station located on nearby Friendly Crescent which provides service to 70 dwellings and discharges to the Hartsmere Drive sanitary sewer through a 100mm diameter forcemain. Ultimately this low lift station will be decommissioned and the sanitary flows redirected to the SRPS. Timing for this decommissioning is still pending.

As per the Master Servicing Report for the *Stittsville South – Area 6* development, there is excess capacity available in the Fernbank Lands trunk sewer (see report excerpt in ***Appendix B).*** The *Area 6* study summarized that the Fernbank Trunk was designed for a peak flow of 528 L/s (*Fernbank CDP Lands – New Trunk Sewer* sanitary design sheet provided in ***Appendix B*** for reference) and had a capacity of 670 L/s (excess capacity of 142 L/s). The Area 6 report further summarized that the *Area 6* and Liard Street P.S. (monitored) flows to the Fernbank Trunk totaled approximately 85 L/s and 39 L/s respectively and would utilize a portion of this capacity. However, the original design criteria of the Fernbank Trunk system (and Area 6) was based on older City of Ottawa design criteria. When considering the new criteria adopted by the City after those designs the excess capacity available is increased.

Table 1
Sanitary Flow Review

Network Reviewed	Area (ha)	Pop.	PF (7)	Q_{units} (L/s)	$Q_{Com/Inst}$ (L/s)	$Q_{I/I}$ (L/s)	Q_{TOT} (L/s)	Diff. (L/s)
Old City Parameters for Sanitary (1)								
Fernbank CDP Lands (2)	551.8	30,169	2.47	302.5	71.0	154.5	528.0	--
Stittsville Area 6(3)	70.74	4,502	3.29	59.94	2.37	19.81	82.1	--
Liard St P.S. (monitored) (4)	--	--	--	--	--	--	39.0	--
New City Parameters for Sanitary (5)								
Fernbank CDP Lands	551.8	30,169	2.18	213.1	39.76	182.09	435.0	-93.0
Stittsville Area 6	70.74	4,502	2.83	41.2	1.33	23.34	66.0	-16.1
Liard St P.S. (monitored) (6)	--	--	--	--	--	--	39.0	0

(1) Old City Parameters: 350 L/day; 0.28 L/s/ha infiltration; Comm./Inst. Flow = 50,000 l/ha/day
(2) Sanitary design sheet excerpt provided in Appendix B. From "Fernbank Community Design Plan – Master Servicing Study (June 2009)"
(3) Sanitary design sheet excerpt from updated IB design for Edenwylde development. From City submission 2020-04-09"
(4) Liard Street pump station – monitored flow summary from the "*West Urban Community – Wastewater Collection System Master Servicing Plan*" by RV Anderson Associates Ltd., dated July 2012 and as summarized in the Area 6 MSS.
(5) New City Parameters: 280 L/day; 0.33 L/s/ha infiltration; Comm./Inst. Flow = 28,000 l/ha/day; updated Peak Factor correction factor
(6) Same value as prior as it was monitored information.
(7) Peaking Factor

From the table above the flow summarized in the Fernbank Lands trunk is reduced from 528.0 L/s to ~435.0 L/s (-93.0 L/s) based on review with new parameters.
The Area 6 land development flows are reduced from 82.1 L/s to ~66.0 L/s (-16.1 L/s).

The *Area 6 MSS* summarized excess capacity at peak flow in the Fernbank Lands trunk at 142 L/s. With the new parameters this excess capacity increases to 235 L/s based on the above table with 105 L/s of that taken up by the Area 6 and the Liard St. P.S. flows (130 L/s capacity remaining).

Construction of the Fernbank Lands trunk extension up to the Area 6 development was completed/commissioned in December 2022.

The SRPS details are as follows:

- pump station control building complete with mechanical and electrical systems, process piping, valves, control panels, SCADA system, odour control system, swab launchers and appurtenances;
- one (1) 2400 mm diameter FRP wet well, complete with valves, couplings and appurtenances; with three (3) pumps with each pump capable of delivering 42

liters/second at a TDH of 29 meters for an ultimate firm capacity of 84 liters/second;

- wastewater flows are pumped via dual 200 mm diameter HDPE DR13.5 sanitary forcemains to a to a new discharge chamber on Fernbank Road outletting flows to the newly constructed Fernbank Sanitary Trunk Sewer (completed/commissioned in December 2022);
- one (1) 2400 mm x 1800 mm concrete by-pass chamber, complete with valves, couplings and appurtenances;
- one (1) 1800 mm diameter concrete by-pass manhole, complete with valves, couplings and appurtenances;
- one (1) 1800 mm diameter concrete emergency overflow manhole, complete with one (1) primary measuring device consisting of broad crest weir complete with ultrasonic level recorder (referred to as SAN MH 97);
- one (1) concrete encased underground dedicated commercial hydro service;
- one (1) 170 KW self-enclosed diesel generator on a reinforced concrete pad adjustment to the pump station control building, complete with diesel fuel tank, valves and controls;
- emergency sanitary sewer overflow consisting of a 600 mm diameter sewer to the adjacent Davidson Stormwater Management facility located south of the SRPS (outlet elevation 103.40 m).

4.2 Water Supply Servicing

4.2.1 Existing Water Supply Services

The SSUEL study area will be part of the City's Zone 3W of the City of Ottawa water distribution network (see Drawing 3 for reference). The pressure zone receives supply from the Campeau Drive and Glen Cairn Pump stations. The Stittsville Elevated Tank provides balancing storage during peak usage and fire flow conditions.

Existing watermains to the north of the subject lands represent the only option for water servicing. These include:

- The major water supply line in the vicinity of the development is a 400mm diameter watermain along Fernbank Road;
- An existing 250mm diameter watermain located within the Parade Drive right-of-way (ROW), immediately north of the Maguire and Faulkner land parcels. A future southbound ROW block is located between civic addresses 714 and 720 Parade Drive;
- An existing 250mm diameter watermain is located within the Aridus Crescent ROW which is north of the Davidson Lands parcel. An existing 50mm water service within a servicing block from Aridus Crescent to the SRPS pump station is also installed facilitating water supply to that facility;
- An existing 200mm diameter watermain located within the Painted Sky Way ROW at the northwest portion of the Davidson land parcel; and
- An existing 200mm diameter watermain location within the Ocala Street ROW north of the northeastern portion of the Davidson land parcel.

4.2.2 Existing Watermains and Operating Pressures

In relation to the Stittsville Area 6 development areas to the north, the water supply was reviewed for two separate analyses:

1. Stantec Consulting Ltd. prepared a hydraulic analysis of the proposed western portion of the Area 6 lands in their report titled "Stittsville Area 6 – Phase 1 & 2 – Potable Water Hydraulic Assessment (September 2, 2015). This model was based on the City up to date model that was updated for the 2013 Water Master Plans with current (in 2015) conditions and future conditions (projected 2031 conditions from the 2013 Water Master model) analyzed.
2. IBI Group prepared a hydraulic analysis as part of their "Design Brief – Davidson Lands – OPA 76 Area 6a, Phase 1" (February 2018) servicing reporting for the eastern portion of the Stittsville Area 6 lands. This analysis was based on boundary conditions provided by the City of Ottawa (see report excerpts in ***Appendix C***).

The Stantec analysis above notes that head losses under peak demands could reduce minimum pressure to below guideline requirements at higher elevations (i.e. ground elevations greater than 124m). However, future planned connections within the Fernbank Lands development area will mitigate the issue.
During average day demands ground elevations less than 106m may experience system pressures greater than the upper 80psi limit specified in City guidelines. As noted in Section

2.2, existing site elevations range from 109 m to 103 m (for areas west of the Hydro One corridor) and from 104 m to 102 m in the eastern areas. Should higher pressures be encountered in the southern areas of the development pressure reducing valves would be required.

Water servicing needs in the SSUEA will be evaluated as part of the future MSS review of the development area in consultation with City staff via the generation of hydraulic boundary conditions.

4.3 Stormwater Servicing

4.3.1 Parade Drive Stormwater Management Facility

The residential development area to the north of the Maguire/Faulkner properties is serviced via an existing 1.9 ha stormwater pond block adjacent to Parade Drive. This stormwater facility has the following characteristics:

Drainage Area = ~33.7ha
Permanent Pool Elevation = 103.50 m
Extended Detention Elevation = 103.70 m
100-Year Elevation = 105.33 m

The facility outlets to an existing ditch located east of the storm outlet. The ditch is approximately 405 m upstream of the commencement of the Faulkner Municipal Drain.

4.3.2 Davidson Stormwater Management Facility

The existing development to the north of the Davidson/Eder properties is serviced by the central “Davidson” stormwater management pond. The existing Davidson stormwater pond occupies approximately 3.2 ha of land and is partially located under the existing Hydro One tower line. The ponds are sized for their respective areas with no specific additional areas considered. This stormwater facility has the following characteristics:

Drainage Area = ~40.6 ha
Permanent Pool Elevation = 101.50 m
Extended Detention Elevation = 102.10 m
100-Year Elevation = 103.17 m

The facility outlets from the south end of its configuration to a ditched outlet that conveys the flows southwest to the Faulkner Municipal Drain.

4.3.3 Faulkner Municipal Drain

The Faulkner Municipal Drain (FMD) generally bisects the whole of the development area in half. The FMD conveys flows from north to south to the north side of Flewellyn Road (i.e. roadside ditch) then heads eastward and then southwards along the west side of Shea Road. The FMD drain begins at approximately 215 m north of Flewellyn Road (within the development lands) and ultimately discharges to Flowing Creek Municipal Drain 5.45 km away (approximately 330 m south of the intersection of Shea Road and Brownlee Road). Figure 6.1 (*Maintenance Sections and Section Drainage Areas*) from the Engineer’s Report is provided in **Appendix D** for reference.

The Engineer’s Report for the FMD was recently amended in December 2020 by Robinson Consultants Inc. to accommodate the changes in land use from rural, or agricultural, to urban development. Additionally, some modifications of the main drain were also documented in order to relocate a portion, lower the profile in some locations, and modify the cross-section where required in order to increase capacity and reduce erosion potential. No specific erosion thresholds are noted for the FMD in the Engineer’s Report.
Subsequent to the amended Report, there was a minor addendum in March 2021 to account for an adjustment in the prescribed value for lands utilized for construction of the drain and the resultant modified value of allowances.

The FMD model will be utilized during the design of future stormwater management facilities to confirm that there will be no negative impacts to water levels or capacity of the drain in the post-development condition. JFSA has reviewed the existing conditions as a component of their "*Pre-Development Hydraulic and Hydrologic Study*" (provided in **Appendix D**) and noted some private access culverts along Flewellyn Road are close to or at capacity as summarized in the Engineer's Report Table 4.2. These culverts can be revisited in association with future consultation with the Drainage Engineer is association with the advancement of the development area.

4.3.4 Flowing Creek Municipal Drain

As noted in the prior section, the FMD outlets to the Flowing Creek Municipal Drain (FCMD) south of Brownlee Road. The Engineer's Report for FCMD was prepared by A.J. Graham Engineering Consultants Limited in December 1973 and was constructed in 1974 by the former Township of Goulbourn. There are no known issues with the FCMD.

The Rideau Valley Conservation Authority completed Flood Risk Mapping for Flowing Creek in May 2017 (covering from Flewellyn Road to the confluence with the Jock River). The RVCA report makes reference to some possible shallow field flood areas southwest of Akins/Shea Road, however, it goes on to detail the 'considerable uncertainty' as to how this may occur and whether there would be any material impact to the adjacent FMD (see RVCA report excerpts in ***Appendix D*** for reference). However, it is presumed that the Drainage Engineer for the FMD has considered this potentiality based on their recent FMD improvements and knowledge of the FCMD Flood Risk Mapping results.

4.3.5 Site Drainage

For the Caivan landholdings west of the Hydro one corridor the site topography generally drains eastward and southward with drainage ultimately being conveyed to the FMD which bisects the development area.

Similarly, the development area east of the Hydro One corridor also drains eastward and southward to the portion of the FMD along the northern Flewellyn Road right-of-way.

JFSA has reviewed the development area's existing conditions as a component of their "*Pre-Development Hydraulic and Hydrologic Study*" provided in **Appendix D** for reference.

There are no minor storm sewer systems that the development area is tributary to.

5.0 OPPORTUNITIES AND CONSTRAINTS

5.1 Drainage Network

The review of site topography has generally shown that surface water is conveyed to adjacent perimeter roadside ditches and the Faulkner Municipal Drain.

As a component of the review of storm servicing for the future MSS, any adjustment to drainage boundaries or outlets will require consultation with appropriate agencies. Generally speaking, the development only has one viable stormwater outlet which is the FMD and stormwater management facilities will be located at the southern boundary of study area due to site topography. Therefore any adjustments will need to be coordinated with the Drainage Engineer and any processes completed in accordance with the Drainage Act. This includes consideration of the Flowing Creek Municipal Drain (FCMD) (which the FMD connects to) and ultimately the Jock River.

Lands which comprise the SSUEA are not restricted by floodplain areas from any major watercourses. Preliminary review of the FMD HEC-RAS modelling associated with the recently updated Engineer's Report (see Section 4.3.3) has indicated that there may be private access culverts on the FMD along Flewellyn Road that could constrain flows during the 100-year event and these will be further assessed in future design stages in consultation with the Drainage Engineer.

5.2 Water Quantity Control

Water quantity controls for the development area will be impacted by various site constraints (i.e. infiltration potential, development density, etc) as well as downstream capacities. At minimum, post-development peak flows within the FMD are not to exceed pre-development levels for all storms up to the 100-year event. Generally this will require review of the FMD and FCMD based on the on-site controls implemented and also manage runoff volumes so as not to create downstream impacts. Prior consultation with the RVCA for other development areas tributary to the Jock River has indicated that there are no quantity control required within the Jock River Reach 2 subwatershed. Updated subwatershed reporting is currently a work in progress.

5.3 Water Quality Control

Water quality control for the development area will have to be in accordance with the Jock River Reach 2 & Mud Creek Subwatershed Study. Similar to the adjacent development areas recently advanced, this would mean that the requirement is for an enhanced protection level (80% TSS removal) of water quality treatment.

5.4 Infiltration

The Hydrogeological review completed by Paterson Group characterized the hydrogeological condition of the SSUEA with respect to bedrock and surficial geology, aquifers, aquitards, horizontal and vertical flow patterns, existing groundwater use, and aquifer vulnerability. The report generally summarizes that the overburden and bedrock within the SSUEA have hydraulic conductivity values ranging from 4.2×10^{-6} m/sec to 2.2×10^{-5} m/sec (moderate hydraulic conductivity) and 4.3×10^{-7} m/sec to 1.6×10^{-4}, respectively (refer to the *Table 2* summary from the Paterson report in ***Appendix D***). Field saturated conductivity values from Paterson's *Table 3* are also provided. Highest surficial field saturated values were observed within the southwestern portion of the subject site indicating that this area will have more permeable characteristics than the northeastern areas and as such are more conducive for providing LID measures for water balance and could be considered for optimizing the rate of infiltration via typical lot level and conveyance Best Management Practices (BMPs).

JFSA has reviewed the development area's existing conditions as a component of their "*Pre-Development Hydraulic and Hydrologic Study*" provided in **Appendix D** for reference. JFSA's water budget modelling considered the shallow infiltration results, as reported by Paterson, in their analysis. The JFSA detailed PCSWMM model was run for 39 year, from 1967 to 2007, using hourly rainfall data from Environment Canada's Ottawa International Airport monitoring station. Table 1 from the JFSA report are provided in ***Appendix D*** for reference. The table outlines the water budget breakdown of the development area of the SSUEA. Based on the simulations, JFSA assessed that the eastern portion of the development area (east of the Faulkner Drain) will have 17% of the annual rainfall resulting in runoff with 63% evaporating and 20% infiltrating.

Mapping from the Mississippi-Rideau Source Protection Plan indicates that some portions of the development area may fall under the fringes of the Significant Groundwater Recharge Area (SGRA) mapping. The site review by Paterson has indicated that the high Rock Quality Designation (RQD) of the bedrock within the site area supports an interpretation that the significance of the recharge to the bedrock aquifer is minimal.

5.5 Existing Servicing Infrastructure

The following opportunities and constraints have been identified for the SSUEA and will be reviewed in further detail in a future MSS.

5.5.1 Wastewater Servicing

Wastewater servicing for the SSUEA is governed by the capacity of the SRPS (and its forcemains) and ultimately by the available residual capacity in the existing recently completed Fernbank Lands Sanitary Trunk sewer. As per the Master Servicing Report for the Stittsville South – Area 6 development, there is excess capacity available in the Fernbank Lands trunk sewer. The Area 6 study summarized that the Fernbank Trunk was designed for a peak flow of 528 L/s and had a capacity of 670 L/s (excess capacity of 142 L/s). The prior sanitary system flows were based on older City of Ottawa parameters. When evaluations flows based on updated parameters in Technical Bulletin ISTB-2018-01 the excess capacity is theoretically increased to 235 L/s.

The existing SRPS also has an emergency overflow outlet (internal weir elevation of 103.40m – see Novatech Drawing No. 113004-PS-SVC in ***Appendix B***) to the adjacent "Davidson" stormwater management pond to the south. This overflow will have to be assessed at detailed design to determine if a new overflow is required based on projected underside of footing elevations during the future MSS preparation.

As noted in Section 4.1 the existing sanitary sewer inlet at the SRPS is at an invert elevation of 98.72m. Existing ground elevations in the southeast portion of the SSUEA are as low as ~101.60m which imposes some constraint in terms of fill import required to facilitate a gravity system that would conveys sanitary flows all the way to the SRPS approximately 1km away.

5.5.2 Water Servicing

Based on prior analyses undertaken for development areas within Area 6 to the north of the subject site, lower water pressures are anticipated during peak hours in areas with ground elevations of 124m or higher and high pressures during average day demands for areas with ground elevations lower than 106m. A future detailed analysis to be prepared in conjunction with the MSS will determine where mitigation may be required within the watermain network.

5.5.3 Stormwater Servicing

There are currently no existing or planned stormwater management facilities associated with the SSUEA lands. The overall site currently drains to the Faulkner Municipal Drain via sheet drainage and various periphery roadside drainage ditches. The FMD poses a constraint for the development area given that it bisects the central portion of the development area while topography for the lands areas on either site have the same northwest to southeast drainage pattern. This drainage pattern does provide the opportunity to have a wet pond facility adjacent to the FMD as an outlet(s) at the southern boundary of the development areas but detailed review during MSS preparation will fully assess whether one or two facilities would ultimately be required.

6.0 SUMMARY AND CONCLUSIONS

6.1 Wastewater Servicing

The sanitary flows from the SSUEA will require conveyance by sanitary pumping to convey flows to the Fernbank Lands Trunk sewer. Gravity flows to the existing SSUEA are possible but are likely constrained by the extent of fill importation required to facilitate sufficient sewer cover on a gravity system in the lower (southern) areas of the SSUEA based on site topography. This includes having appropriate freeboard over the sanitary overflow for the SRPS.

The MSS should evaluate proposed servicing alternatives should fill importation be deemed excessive (i.e. new pumping facility, relocation of the SRPS, etc). In addition, the MSS should review the SRPS sanitary overflow condition and assess whether a new overflow elevation to another location (i.e. a new SWM facility) is warranted to further mitigate site grading conditions.

6.2 Water Servicing

At the Master Servicing Study stage the water supply for the SSUEA will be assessed via a hydraulic assessment of the proposed distribution network in order to confirm sufficient water supply is available, and within the required pressure ranges, under future demands during average day, peak hour and fire flow conditions. Watermain boundary conditions will be requested from the City of Ottawa and the analysis will be completed in accordance with the most current design guidelines and technical bulletins.

6.3 Stormwater Servicing

There are currently no planned stormwater management facilities associated within the SSUEA. The local drainage for the subject area is ultimately conveyed by the FMD which bisects the SSSUEA lands.

The site topography has natural gradients from the northwest to the southeast lending to the practical implementation of stormwater management facility/facilities in the southern areas of the site, with an outlet to the FMD. It is anticipated that any proposed facility/facilities could provide both quantity and quality control to meet required targets. Quantity control would be required to maintain the integrity of the FMD and mitigate any increases in water levels within that system. The MSS will detail the target requirements of the facilities.

A review of options for adjustments to the FMD, where it bisects the site, can be reviewed as part of the MSS but there appears to be limited opportunities due to the location of the FMD in relation to holdout properties not under control by the proponent.

Analyses completed by Paterson Group and JFSA have shown areas of moderate hydraulic conductivity. The MSS will quantify the post-development water balance to summarize that a water balance condition is met.

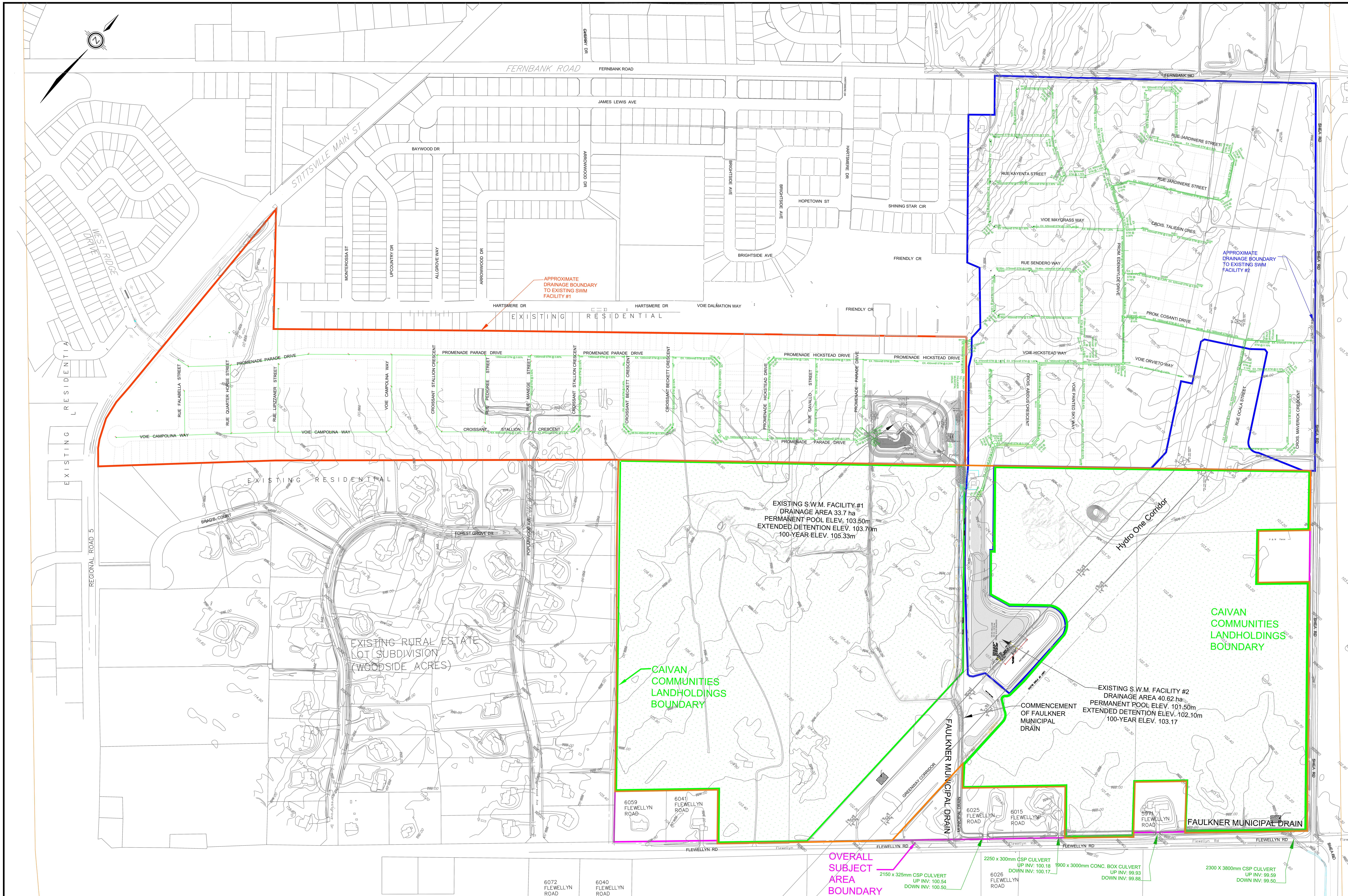
Prepared by,
David Schaeffer Engineering Ltd.

Per: Kevin L. Murphy, P.Eng.

20230912_stittsville_south_exconditions_final.docx

APPENDIX A

DRAWINGS



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STITTSVILLE SOUTH URBAN EXPANSION AREA

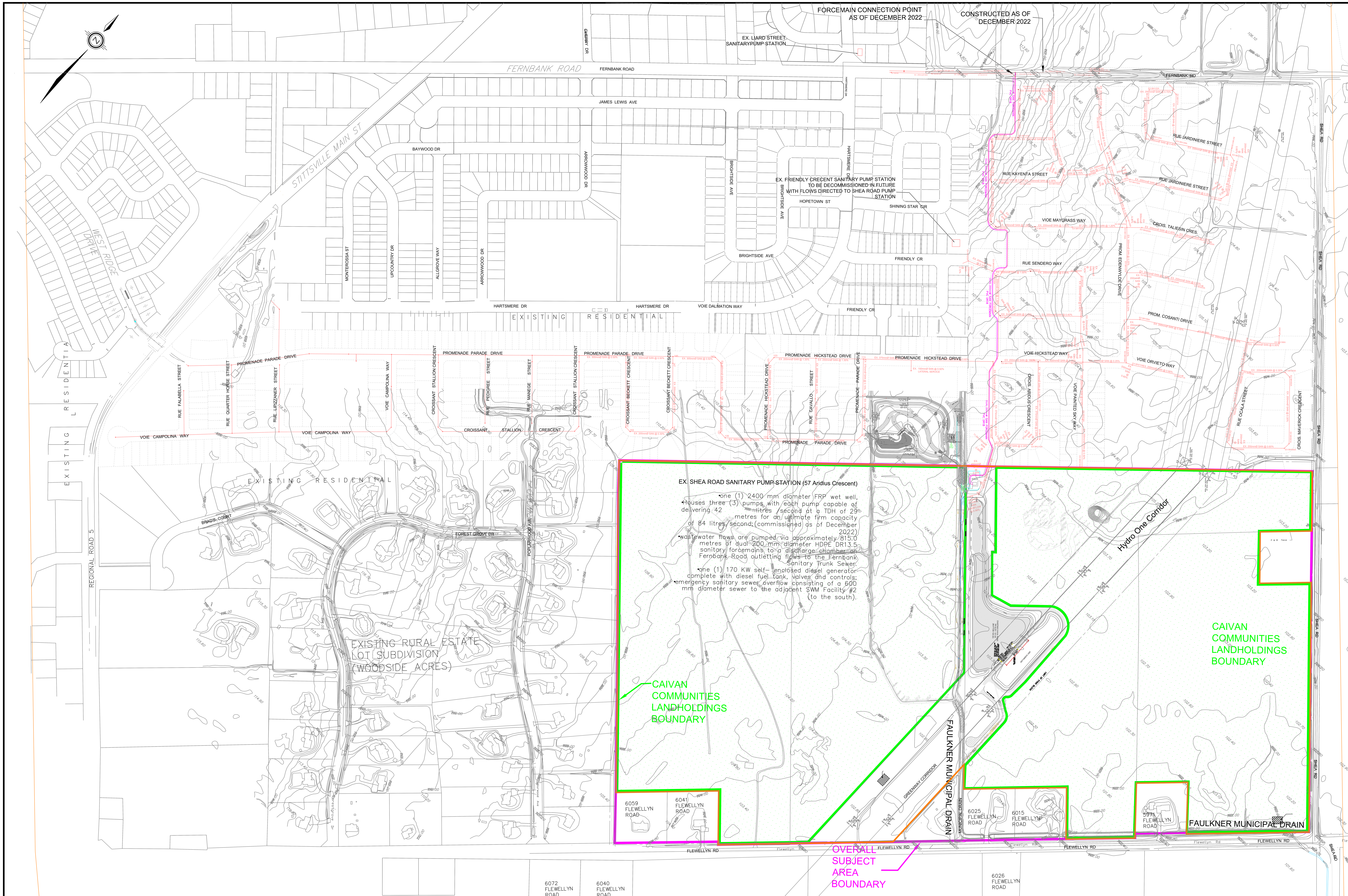
STORM SERVICING EXISTING CONDITIONS

CITY OF OTTAWA

LEGEND

- EXISTING STORM MANHOLE
- EXISTING STORM SEWER
- OVERALL SUBJECT AREA BOUNDARY
- CAIVAN LANDHOLDINGS

PROJECT No.:	21-1247
DATE:	Sep 2023
SCALE:	1:2000
DRAWING:	1



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STITTSVILLE SOUTH URBAN EXPANSION AREA

SANITARY EX. CONDITIONS

CITY OF OTTAWA

LEGEND

- EX. SANITARY MANHOLE
- EX. SANITARY SEWER
- EX. SANITARY FORCEMAIN
- OVERALL SUBJECT AREA BOUNDARY
- CAIVAN LANDHOLDINGS

PROJECT No.:	21-1247
DATE:	Jan 2023
SCALE:	1:2000
DRAWING:	2

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STITTSVILLE SOUTH URBAN EXPANSION AREA

WATERMAIN EXISTING CONDITIONS FIGURE

CITY OF OTTAWA

LEGEND

- EXISTING WATERMAIN
- OVERALL SUBJECT AREA BOUNDARY
- CAIVAN LANDHOLDINGS

PROJECT No.:	21-1247
DATE:	Sep 2023
SCALE:	1:2000
DRAWING:	3

APPENDIX B

WASTEWATER

ENVIRONMENTAL COMPLIANCE APPROVAL

NUMBER 3415-ADQLJG
Issue Date: September 21, 2016

Stittsville South Inc. and 1384341 Ontario Ltd.
1737 Woodward Drive, 2nd Floor
Ottawa, Ontario
K2C 0P9

Site Location: Stittsville South Area 6 Sanitary Pumping Station
5970 Fernbank Road and part of 5993 Flewellyn Road
City of Ottawa, Ontario

You have applied under section 20.2 of Part II.1 of the Environmental Protection Act*, R.S.O. 1990, c. E. 19 (Environmental Protection Act) for approval of:*

Sanitary Pump Station and Forcemain

- one (1) 3000 mm diameter and 8.65 metre deep wet well with provision for three (3) submersible non-clog wastewater pumps, each pump designed for 42 litres/second at a Total Dynamic Head (TDH) of 29 metres, complete with trash basket, pipe rails, level regulation, force air blower unit and appurtenances;

- two (2) pumps will be initially installed with each pump capable of delivering 42 litres/second at a TDH of 29 metres for an initial firm capacity of 42 litres/second;

- the third pump will be added through an amendment to the ECA once development flows approach 42 litres/second to bring the pump station to its ultimate firm capacity of 84 litres/second;

- approximately 870 metres of dual 200 mm diameter HDPE DR13.5 sanitary forcemains originating at the pump station control building and terminating at the existing sanitary sewer on Fernbank Road;

- one (1) 2400 mm x 1800 mm concrete discharge manhole, complete with Swab Catcher, replacing the existing sanitary MH 401 on Fernbank Road. Dual forcemains will discharge to this new manhole;

- pump station control building complete with mechanical and electrical systems, process piping, valves, control panels, SCADA system, odour control system, swab launchers and appurtenances;

- one (1) 170 KW self-enclosed diesel generator (to be registered under Environmental Activity and Sector Registry (EASR)) on a reinforced concrete pad adjustment to the pump station control building complete with diesel fuel tank, valves and controls;

- one (1) 2400 mm x 1800 mm concrete by-pass chamber complete with valves, couplings and appurtenances;

Sanitary Sewers Pump Station

- approximately 4.8 metres of 450 mm diameter sanitary sewer @ 2.55% from Sanitary MH 99 to wet well;

- approximately 18 metres of 200 mm diameter sanitary forcemain HDPE 13.5 from SAN MH 99 to By-pass Chamber;

- approximately 18.7 metres of 600 mm diameter sanitary sewer from SAN MH 99 to SAN MH 97;

Interim Emergency Sanitary Sewer Overflow

approximately 26.6 metres of 250 mm diameter sanitary sewer from sanitary MH 97 to the existing Faulkner Ditch. Elevation of emergency overflow in sanitary MH 97 is 104.27m;

Permanent Emergency Sanitary Sewer Overflow

the permanent Emergency Sanitary Sewer Overflow will discharge to the future Davidson Stormwater Management Facility which is anticipated to be constructed within the next 2-4 years;

- the permanent emergency sanitary sewer overflow will consist of 3 metres of 600 mm diameter sewer from sanitary MH 97 to the future stormwater management facility. The elevation of the emergency overflow in MH 97 is 103.40m;

- provision to adjust the elevation of the permanent emergency sanitary overflow in MH 97 within a range of 102.80m to 103.70m based on the final 100-year water level in the future Davidson Stormwater Management Facility;

- one (1) primary measuring device in MH 97 consisting of a broad crest weir complete with ultrasonic level recorder;

- once permanent emergency sanitary sewer overflow is established, the interim overflow will be abandoned;

including erosion/sedimentation control measures during construction and all other controls and appurtenances essential for the proper operation of the aforementioned Works;

all in accordance with the application from the Stittsville South Inc. and 1384341 Ontario Ltd., dated March 03, 2016, and all other supporting documents, final plans and specifications prepared by Novatech.

For the purpose of this environmental compliance approval, the following definitions apply:

"Approval" means this entire document including the application and any supporting documents listed in any schedules in this Approval;

"BOD5" (also known as TBOD5) means five day biochemical oxygen demand measured in an unfiltered sample and includes carbonaceous and nitrogenous oxygen demand;

"Director" means a person appointed by the Minister pursuant to section 5 of the Environmental Protection Act for the purposes of Part II.1 of the Environmental Protection Act;

"E. Coli" refers to the thermally tolerant forms of Escherichia that can survive at 44.5 degrees Celsius;

"Emergency Situation" means a structural, mechanical or electrical failure that causes a temporary reduction in the capacity of the sanitary sewage pumping station or an unforeseen flow condition that may result in:

a) danger to the health or safety of any person; or
b) injury or damage to any property, or serious risk of injury or damage to any property.

"EPA" means the Environmental Protection Act, R.S.O. 1990, c.E.19, as amended;

"Event" in the context the sanitary sewage pumping station located outside a Sewage Treatment Plant, means an action or occurrence, at the sanitary sewage pumping station that causes a Sewage Pumping Station Overflow. An Event ends when there is no recurrence of a Sewage Pumping Station Overflow in the 12-hour period following the last Sewage Pumping Station Overflow. Two Events are separated by at least 12 hours during which there has been no recurrence of a Sewage Pumping Station Overflow;

"Limited Operational Flexibility" (LOF) means the modifications that the Owner is permitted to make to the Works under this Approval;

"Ministry" means the ministry of the government of Ontario responsible for the Environmental Protection Act and the Ontario Water Resources Act and includes all officials, employees or other persons acting on its behalf;

"Notice of Modifications" means the form entitled “Notice of Modifications to Sewage Works” included in Schedule "A";

"Owner" means the Stittsville South Inc. and 1384341 Ontario Ltd., and includes their successors and assignees;

"Professional Engineer" means a person entitled to practise as a Professional Engineer in the Province of Ontario under a licence issued under the Professional Engineers Act;

"Sewage Pumping Station Overflow" means any discharge from a sanitary sewage pumping station located outside a Sewage Treatment Plant that does not undergo any treatment or only receives partial treatment before it is discharged to the environment;

"Substantial Completion" has the same meaning as “substantial performance” in the Construction Lien Act;

"Water Supervisor" means the person appointed as Water Supervisor of the Ottawa office of the Ministry;

"Works" means the sewage works described in the Owner's application(s) and this Approval.

You are hereby notified that this environmental compliance approval is issued to you subject to the terms and conditions outlined below:

TERMS AND CONDITIONS

1. <u>GENERAL PROVISIONS</u>

(1) The Owner shall ensure that any person authorized to carry out work on or operate any aspect of the Works is notified of this Approval and the Conditions herein and shall take all reasonable measures to ensure any such person complies with the same.

(2) The designation of the The City of Ottawa as the operating authority of the site on the application for approval of the Works does not relieve the Owner from the responsibility of complying with any and all of the Conditions of this Approval.

(3) Except as otherwise provided by these Conditions, the Owner shall design, build, install, operate and maintain the Works in accordance with the description given in this Approval, and the application for approval of the Works.

(4) Where there is a conflict between a provision of any submitted document referred to in this Approval and the Conditions of this Approval, the Conditions in this Approval shall take precedence, and where there is a conflict between the listed submitted documents, the document bearing the most recent date shall prevail.

(5) Where there is a conflict between the listed submitted documents, and the application, the application shall take precedence unless it is clear that the purpose of the document was to amend the application.

(6) The Conditions of this Approval are severable. If any Condition of this Approval, or the application of any requirement of this Approval to any circumstance, is held invalid or unenforceable, the application of such Condition to other circumstances and the remainder of this Approval shall not be affected thereby.

(7) The issuance of, and compliance with the Conditions of this Approval does not:

(a) relieve any person of any obligation to comply with any provision of any applicable statute, regulation or other legal requirement, including, but not limited to, the obligation to obtain approval from the local conservation authority necessary to construct or operate the sewage Works; or

(b) limit in any way the authority of the Ministry to require certain steps be taken to require the

Owner to furnish any further information related to compliance with this Approval.

2. **EXPIRY OF APPROVAL**

(1) This Approval will cease to apply to those parts of the new Works which have not been constructed within **five (5) years** of the date of this Approval.

3. **CHANGE OF OWNER**

(1) The Owner shall notify the Director, in writing, of any of the following changes within **thirty (30) days** of the change occurring:

(a) change of Owner;

(b) change of address of the Owner;

(c) change of partners where the Owner is or at any time becomes a partnership, and a copy of the most recent declaration filed under the Business Names Act, R.S.O. 1990, c. B17 shall be included in the notification to the Director;

(d) change of name of the corporation where the Owner is or at any time becomes a corporation, and a copy of the most current information filed under the Corporations Information Act, R.S.O. 1990, c. C39 shall be included in the notification to the Director.

4. **UPON SUBSTANTIAL COMPLETION OF THE SEWAGE PUMPING STATION**

(1) Upon Substantial Completion of the sewage pumping station, the Owner shall prepare a statement, certified by a Professional Engineer, that the sewage pumping station was constructed in accordance with this Approval, and shall make the written statement available to the Ministry, upon request.

(2) Within **one (1) year** of Substantial Completion of the sewage pumping station, a set of as-built drawings showing the sewage pumping station “as constructed” shall be prepared. These drawings shall be kept up to date through revisions undertaken from time to time and a copy shall be retained at the sewage pumping station for the operational life of the sewage pumping station.

5. **SEWAGE PUMPING STATION OVERFLOW**

(1) Any Sewage Pumping Station Overflow is prohibited, except:

(a) in an Emergency Situation;

(b) where the Sewage Pumping Station Overflow is a direct and unavoidable result of a planned maintenance procedure, the Owner notified the Water Supervisor **fifteen (15) days** prior to the Sewage Pumping Station Overflow and the Water Supervisor has given written consent of the Sewage Pumping Station Overflow; or,

(c) where the Sewage Pumping Station Overflow is planned for research or training purposes, the discharger notified the Water Supervisor **fifteen (15) days** prior to the Sewage Pumping Station Overflow and the Water Supervisor has given written consent of the Sewage Pumping Station Overflow.

(2) The Owner shall forthwith notify the Spills Action Centre (SAC) at 1-800-268-6060 or e-mail at moe.sac.moe@ontario.ca and the Medical Officer of Health of every Sewage Pumping Station Overflow Event. This notice shall include, at a minimum, the following information:

(a) the date and time at which the Event(s) started,

(b) duration of the Event(s);

(c) the location of the Event(s);

(d) the measured or estimated volume of the Event(s) (unless the Event(s) is/are ongoing); and

(e) the reason for the Event (s).

(3) The Owner shall submit Sewage Pumping Station Overflow Event Reports to the Ministry's local office on an Annual basis, no later than forty-five (45) days following the end of the calendar year. Event Reports shall be in an electronic format specified by the Ministry. In each Event Report the Owner shall include, at a minimum, the following information on any Event(s) that occurred during the preceding year:

(a) the date and time at which the Event(s) started,

(b) duration of the Event(s);

(c) the location of the Event(**s**);

(d) the measured or estimated volume of the Event(s) (unless the Event(s) is/are ongoing); and

(e) the reason for the Event(s).

(4) The Owner shall use best efforts to collect a representative sample consisting of a minimum of two (2) grab samples of the Sewage Pumping Station Overflow and have it analysed for parameters outlined in Table 1 of Condition 7 (2) using the protocols specified in Condition 7 (3), one at the beginning of the Event and the second approximately near the end of the Event, to best reflect the effluent quality of such Sewage Pumping Station Overflow.

(5) The Owner shall maintain a record of all Sewage Pumping Station Overflow(s), which shall contain, at a minimum, the types of information set out in Condition 5 (2 (a)) to 5 (2 (e)) in respect of each Sewage Pumping Station Overflow.

6. OPERATION AND MAINTENANCE

(1) The Owner shall exercise due diligence in ensuring that, at all times, the Works and the related equipment and appurtenances used to achieve compliance with this Approval are properly operated and maintained. Proper operation and maintenance shall include effective performance, adequate funding, adequate operator staffing and training, including training in all procedures and other requirements of this Approval and the Act and regulations, adequate laboratory facilities, process controls and alarms and the use of process chemicals and other substances used in the Works.

(2) The Owner shall prepare an operations manual within **six (6) months** of Substantial Completion of the sewage pumping station, that includes, but not necessarily limited to, the following information:

(a) operating procedures for routine operation of the sewage pumping station;

(b) inspection programs, including frequency of inspection, for the sewage pumping station and the methods or tests employed to detect when maintenance is necessary;

(c) repair and maintenance programs, including the frequency of repair and maintenance for the sewage pumping station;

(d) procedures for the inspection and calibration of monitoring equipment;

(e) a spill prevention control and countermeasures plan, consisting of contingency plans and procedures for dealing with equipment breakdowns, potential spills and any other abnormal situations, including notification of the Water Supervisor; and

(f) procedures for receiving, responding and recording public complaints, including recording any follow-up actions taken.

(3) The Owner shall maintain the operations manual current and retain a copy at the location of the sewage pumping station for the operational life of the sewage pumping station. The Owner shall make the manual available to the Ministry, upon request.

(4) The Owner shall make all manuals, plans, records, data, procedures and supporting documentation available to the Ministry, upon request.

7. MONITORING AND RECORDING

The Owner shall, upon the issuance of this Approval, carry out the following monitoring program:

(1) All samples and measurements taken for the purposes of this Approval are to be taken at a time and in a location characteristic of the quality and quantity of the effluent stream over the time period being monitored.

(2) Samples shall be collected at the following sampling points, at the frequency specified, by means of

the specified sample type and analysed for each parameter listed and all results recorded:

Table 1 - Monitoring during a Sewage Pumping Station Overflow Event (Samples to be collected from the Sewage Pumping Station Overflow sewer near the sewage pumping station)	
Sample Type	Grab
Parameters	BOD5, Total Suspended Solids, Total Phosphorus, E. Coli (E. Coli samples may be limited to overflows occurring between Apr 1 and Oct 31)

(3) The methods and protocols for sampling, analysis and recording shall conform, in order of precedence, to the methods and protocols specified in the following:

(a) the Ministry's Procedure F-10-1, “Procedures for Sampling and Analysis Requirements for Municipal and Private Sewage Treatment Works (Liquid Waste Streams Only), as amended from time to time by more recently published editions;

(b) the Ministry's publication "Protocol for the Sampling and Analysis of Industrial/Municipal Wastewater" (January 1999), ISBN 0-7778-1880-9, as amended from time to time by more recently published editions; and

(c) the publication "Standard Methods for the Examination of Water and Wastewater" (21st edition), as amended from time to time by more recently published editions.

8. REPORTING

(1) **Fifteen (15) days** prior to the date of a planned Sewage Pumping Station Overflow being conducted pursuant to Condition 5 and as soon as possible for an unplanned Sewage Pumping Station Overflow, the Owner shall notify the Water Supervisor in writing of the pending start date, in addition to an assessment of the potential adverse effects on the environment and the duration of the Sewage Pumping Station Overflow.

(2) In addition to the obligations under Part X of the Environmental Protection Act, (which includes contacting the Spills Action Centre (SAC) at 1-800-268-6060 or e-mail at moe.sac.moe@ontario.ca), the Owner shall, within **ten (10) working days** of the occurrence of any reportable spill as defined in Ontario Regulation 675/98, Bypass or loss of any product, by-product, intermediate product, oil, solvent, waste material or any other polluting substance into the environment, (with the exception of a sanitary sewage discharged during an Event), submit a full written report of the occurrence to the Water Supervisor describing the cause and discovery of the spill or loss, clean-up and recovery measures taken, preventative measures to be taken and schedule of implementation.

(3) The Owner shall prepare and submit a report to the Water Supervisor on an annual basis. The reports shall contain the following information:

(a) a copy of all Notice of Modifications submitted to the Water Supervisor as a result of Schedule A, Section 1 (Limited Operational Flexibility) with a status report on the implementation of each modification;

(b) a report summarizing all modifications completed as a result of Schedule A, Section 3.

9. LIMITED OPERATIONAL FLEXIBILITY

(1) The Owner may make modifications to the Works in accordance with the Terms and Conditions of this Approval and subject to the Ministry's "Limited Operational Flexibility Criteria for Modifications to Sewage Works", included under Schedule "A" of this Approval, as amended.

(2) The sewage pumping station works proposed under Limited Operational Flexibility shall adhere to the design guidelines contained within the Ministry's publication "Design Guidelines for Sewage Works 2008", as amended.

(3) The Owner shall ensure at all times, that the sewage pumping station works, related equipment and appurtenances which are installed or used to achieve compliance are operated in accordance with all Terms and Conditions of this Approval.

(4) For greater certainty, the following are not permitted as part of Limited Operational Flexibility:

(a) Modifications to the sewage pumping station works that result in an increase of the Rated Capacity of the sewage pumping station works;

(b) Modifications to the sewage pumping station works that may adversely affect the approved effluent quality criteria or the location of the discharge/outfall;

(c) Modifications to the sewage pumping station works approved under s.9 of the EPA, and

(d) Modifications to the sewage pumping station works pursuant to an order issued by the Ministry.

(5) Implementation of Limited Operational Flexibility is not intended to be used for piecemeal measures that result in major alterations or expansions.

(6) If the implementation of Limited Operational Flexibility requires changes to be made to the Emergency Response, Spill Reporting and Contingency Plan, the Owner shall, as deemed necessary in consultation with the Water Supervisor, provide a revised copy of this plan for approval to the local fire services authority prior to implementing Limited Operational Flexibility.

(7) For greater certainty, any alteration made under the Limited Operational Flexibility may only be carried out after other legal obligations have been complied with including those arising from the Environmental Protection Act, Niagara Escarpment Planning and Development Act, Oak Ridges Moraine Conservation Act, Lake Simcoe Protection Act and Greenbelt Act.

(8) Prior to implementing Limited Operational Flexibility, the Owner shall complete a Notice of Modifications describing any proposed modifications to the sewage pumping station works and submit it to the Water Supervisor.

10. TEMPORARY EROSION AND SEDIMENT CONTROL

(1) The Owner shall install and maintain temporary sediment and erosion control measures during construction and conduct inspections once every **two (2) weeks** and after each significant storm event (a significant storm event is defined as a minimum of 25 mm of rain in any 24 hours period). The inspections and maintenance of the temporary sediment and erosion control measures shall continue until they are no longer required and at which time they shall be removed and all disturbed areas reinstated properly.

(2) The Owner shall maintain records of inspections and maintenance which shall be made available for inspection by the Ministry, upon request. The record shall include the name of the inspector, date of inspection, and the remedial measures, if any, undertaken to maintain the temporary sediment and erosion control measures.

11. RECORD KEEPING

The Owner shall retain for a minimum of **five (5) years** from the date of their creation, all records and information related to or resulting from the operation and maintenance activities required by this Approval.

Schedule "A"

Limited Operational Flexibility Criteria for Modifications to Sewage Works

1. The modifications to a sewage pumping station approved under an Environmental Compliance Approval (Approval) that are permitted under the Limited Operational Flexibility (LOF), are outlined below and are subject to the LOF conditions in the Approval, and require the submission of the Notice of Modifications. If there is a conflict between the sewage pumping station works listed below and the Terms and Conditions in the Approval, the Terms and Conditions in the Approval shall take precedence.

1.1 Sewage Pumping Stations

   a. Adding or replacing equipment where new equipment is located within an existing sewage pumping station site, provided that the facility Rated Capacity is not exceeded and the existing flow process and/or treatment train are maintained, as applicable.

1.2 Pilot Systems

   a. Installation of pilot systems for new or existing technologies provided that:

      i. any effluent from the pilot system is discharged to the inlet of the sewage pumping station or hauled off-site for proper disposal,

      ii. any effluent from the pilot system discharged to the inlet of the sewage pumping station or sewage conveyance system does not significantly alter the composition/concentration of the influent sewage to be treated in the downstream process; and that it does not add any inhibiting substances to the downstream process, and

      iii. the pilot system's duration does not exceed a maximum of two years; and a report with results is submitted to the Director and Water Supervisor three months after completion of the pilot project.

2. Sewage works that are exempt from section 53 of the OWRA by O. Reg. 525/98 continue to be exempt and are not required to follow the notification process under this Limited Operational Flexibility.

3. Normal or emergency operational modifications, such as repairs, reconstructions, or other improvements that are part of maintenance activities, including cleaning, renovations to existing approved sewage works equipment, provided that the modification is made with Equivalent Equipment, are considered pre-approved.

4. The modifications noted in section (3) above are not required to follow the notification protocols under Limited Operational Flexibility, provided that the number of pieces and description of the equipment as described in the Approval does not change.

Ontario
Ministry of the Environment

Notice of Modification to Sewage Works

RETAIN COPY OF COMPLETED FORM AS PART OF THE ECA AND SEND A COPY TO THE WATER SUPERVISOR (FOR MUNICIPAL) OR DISTRICT MANAGER (FOR NON-MUNICIPAL SYSTEMS)

Part 1 – Environmental Compliance Approval (ECA) with Limited Operational Flexibility

(Insert the ECA's owner, number, issuance date and notice number, which should start with "01" and consecutive numbers thereafter)

ECA Number	Issuance Date (mm/dd/yy)	Notice number (if applicable)

ECA Owner	Municipality

Part 2: Description of the modifications as part of the Limited Operational Flexibility

(Attach a detailed description of the sewage works)

Description shall include:

1. A detail description of the modifications and/or operations to the sewage works (e.g. sewage work component, location, size, equipment type/model, material, process name, etc.)
2. Confirmation that the anticipated environmental effects are negligible.
3. List of updated versions of, or amendments to, all relevant technical documents that are affected by the modifications as applicable, i.e. submission of documentation is not required, but the listing of updated documents is (design brief, drawings, emergency plan, etc.)

Part 3 – Declaration by Professional Engineer

I hereby declare that I have verified the scope and technical aspects of this modification and confirm that the design:

1. Has been prepared or reviewed by a Professional Engineer who is licensed to practice in the Province of Ontario;
2. Conforms with the Limited Operational Flexibility as per the ECA;
3. Has been designed consistent with Ministry's Design Guidelines, adhering to engineering standards, industry's best management practices, and demonstrating ongoing compliance with s.53 of the Ontario Water Resources Act; and other appropriate regulations.

I hereby declare that to the best of my knowledge, information and belief the information contained in this form is complete and accurate.

Name (Print)	PEO License Number
Signature	Date (mm/dd/yy)
Name of Employer	

Part 4 – Declaration by Owner

I hereby declare that:

1. I am authorized by the Owner to complete this Declaration;

2. The Owner consents to the modification; and
3. These modifications to the sewage works are proposed in accordance with the Limited Operational Flexibility as described in the ECA.
4. The Owner has fulfilled all applicable requirements of the *Environmental Assessment Act*.
I hereby declare that to the best of my knowledge, information and belief the information contained in this form is complete and accurate.

Name of Owner Representative (Print)	Owner representative's title (Print)
Owner Representative's Signature	Date (mm/dd/yy)

The reasons for the imposition of these terms and conditions are as follows:

1. Condition 1 is imposed to ensure that the Works are built and operated in the manner in which they were described for review and upon which approval was granted. This Condition is also included to emphasize the precedence of Conditions in the Approval and the practice that the Approval is based on the most current document, if several conflicting documents are submitted for review.

2. Condition 2 is included to ensure that, when the Works are constructed, the Works will meet the standards that apply at the time of construction to ensure the ongoing protection of the environment.

3. Condition 3 is included to ensure that the Ministry records are kept accurate and current with respect to approved Works and to ensure that any subsequent Owner of the Works is made aware of the Approval and continue to operate the Works in compliance with it.

4. Condition 4 is included to ensure that the sewage pumping station is constructed in accordance with the Approval and that record drawings of the sewage pumping station "as constructed" are maintained for future reference.

5. Conditions 5 and 7 are included to indicate that Sewage Pumping Station Overflow of untreated and/or partially treated sewage to the environment is prohibited, save in certain limited circumstances where the failure to do so could result in greater injury to the public interest than the Sewage Pumping Station Overflow itself, or where the Sewage Pumping Station Overflow can be limited or otherwise mitigated by handling it in accordance with an approved contingency plan. The notification and documentation requirements allow the Ministry to take action in an informed manner and will ensure the Owner is aware of the extent and frequency of Sewage Pumping Station Overflow Event(s).

6. Condition 6 is included to require that the Works be properly operated, maintained, funded, staffed and equipped such that the environment is protected and deterioration, loss, injury or damage to any person or property is prevented. As well, the inclusion of a comprehensive operations manual for the sewage pumping station governing all significant areas of operation, maintenance and repair is prepared, implemented and kept up-to-date by the Owner and made available to the Ministry. Such a manual is an integral part of the operation of the sewage pumping station. Its compilation and use should assist the Owner in staff training, in proper plant operation and in identifying and planning for contingencies during possible abnormal conditions. The manual will also act as a benchmark for Ministry staff when reviewing the Owner's operation of the Works.

7. Condition 8 is included to provide a performance record for future references, to ensure that the Ministry is made aware of problems as they arise, so that the Ministry can work with the Owner in resolving any problems in a timely manner.

8. Condition 9 is included to ensure that the Works are operated in accordance with the application and supporting documentation submitted by the Owner, and not in a manner which the Director has not been asked to consider. These Conditions are also included to ensure that a Professional Engineer has reviewed the proposed Modifications and attests that the Modifications are in line with that of Limited Operational Flexibility, and provide assurance that the proposed Modifications comply with the Ministry's requirements stipulated in the Terms and Conditions of this Approval, Ministry policies, guidelines, and industry engineering standards and best management practices.

9. Condition 10 is included as installation, regular inspection and maintenance of the temporary sediment and erosion control measures is required to mitigate the impact on the downstream receiving watercourse during construction, until they are no longer required.

10. Condition 11 is included to require that all records are retained for a sufficient time period to adequately evaluate the long-term operation and maintenance of the Works.

In accordance with Section 139 of the Environmental Protection Act, you may by written Notice served upon me and the Environmental Review Tribunal within 15 days after receipt of this Notice, require a hearing by the Tribunal. Section 142 of the Environmental Protection Act provides that the Notice requiring the hearing shall state:

1. The portions of the environmental compliance approval or each term or condition in the environmental compliance approval in respect of which the hearing is required, and;
2. The grounds on which you intend to rely at the hearing in relation to each portion appealed.

The Notice should also include:

3. The name of the appellant;
4. The address of the appellant;
5. The environmental compliance approval number;
6. The date of the environmental compliance approval;
7. The name of the Director, and;
8. The municipality or municipalities within which the project is to be engaged in.

And the Notice should be signed and dated by the appellant.

This Notice must be served upon:

The Secretary* Environmental Review Tribunal 655 Bay Street, Suite 1500 Toronto, Ontario M5G 1E5	AND	The Director appointed for the purposes of Part II.1 of the Environmental Protection Act Ministry of the Environment and Climate Change 135 St. Clair Avenue West, 1st Floor Toronto, Ontario M4V 1P5

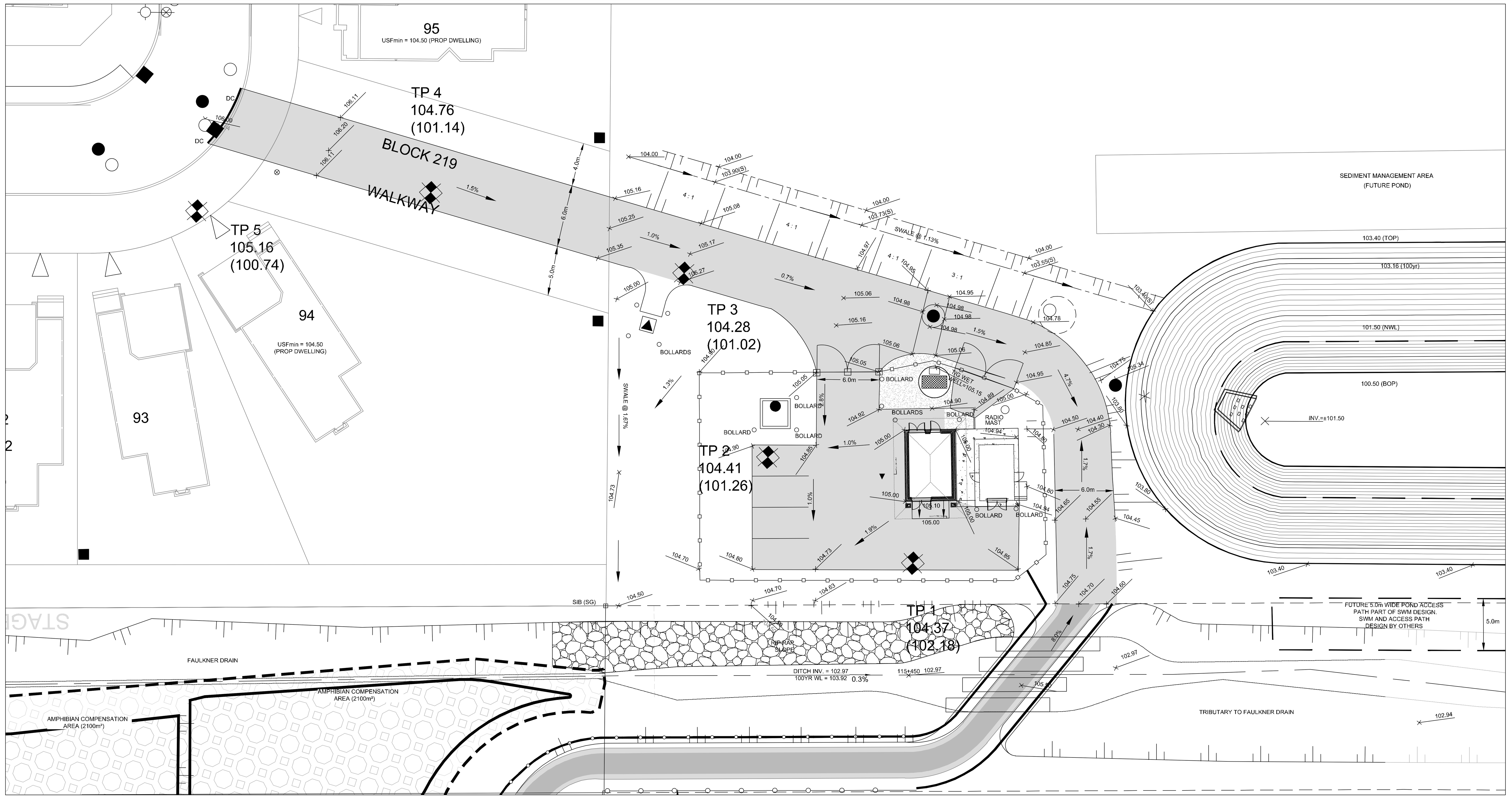
*** Further information on the Environmental Review Tribunal's requirements for an appeal can be obtained directly from the Tribunal at: Tel: (416) 212-6349, Fax: (416) 326-5370 or www.ert.gov.on.ca**

The above noted activity is approved under s.20.3 of Part II.1 of the Environmental Protection Act.

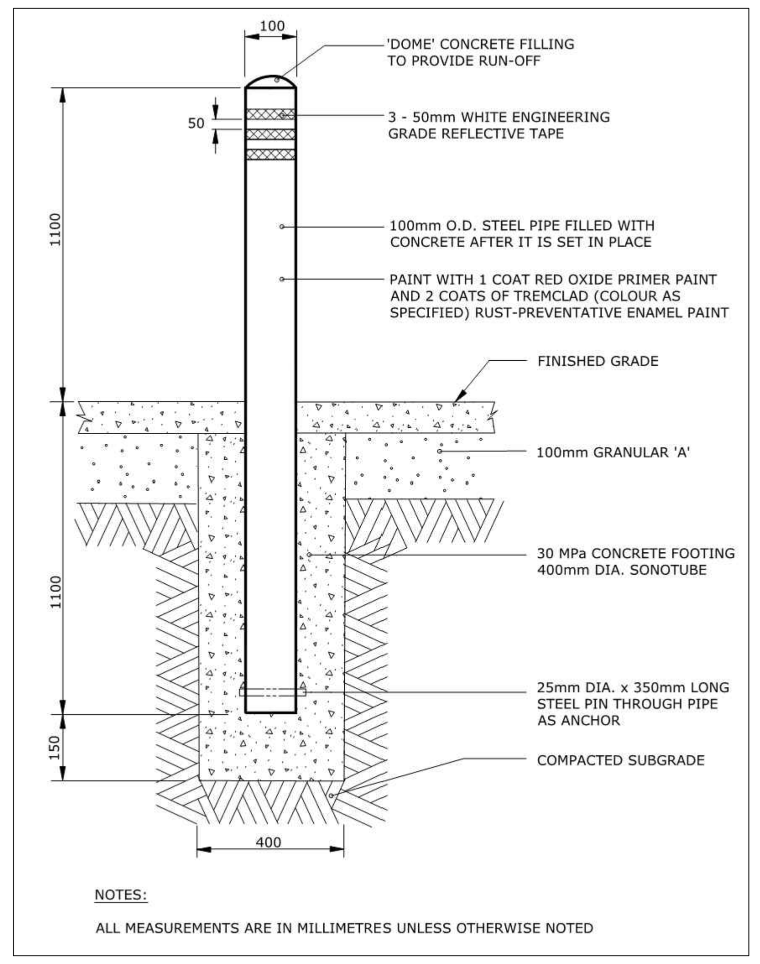
DATED AT TORONTO this 21st day of September, 2016

Gregory Zimmer, P.Eng.
Director
appointed for the purposes of Part II.1 of the
Environmental Protection Act

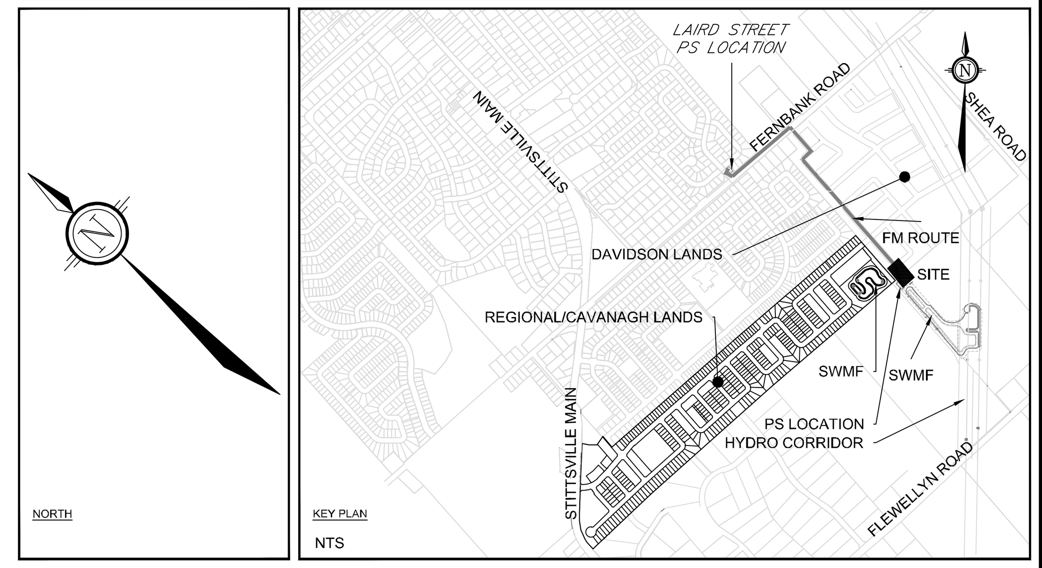
MS/
c: District Manager, MOECC Ottawa office
Greg McDonald, Novatech
Charles Warnock, Program Manager, City of Ottawa, Development Review
Linda Carkner, Program Manager, City of Ottawa, Infrastructure Services

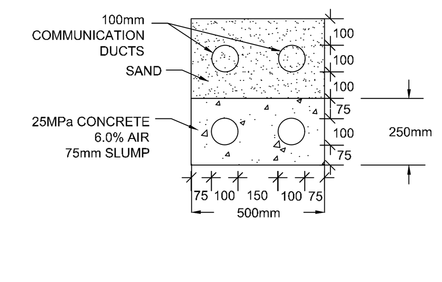


PUMP STATION GRADING



BOLLARD DETAIL



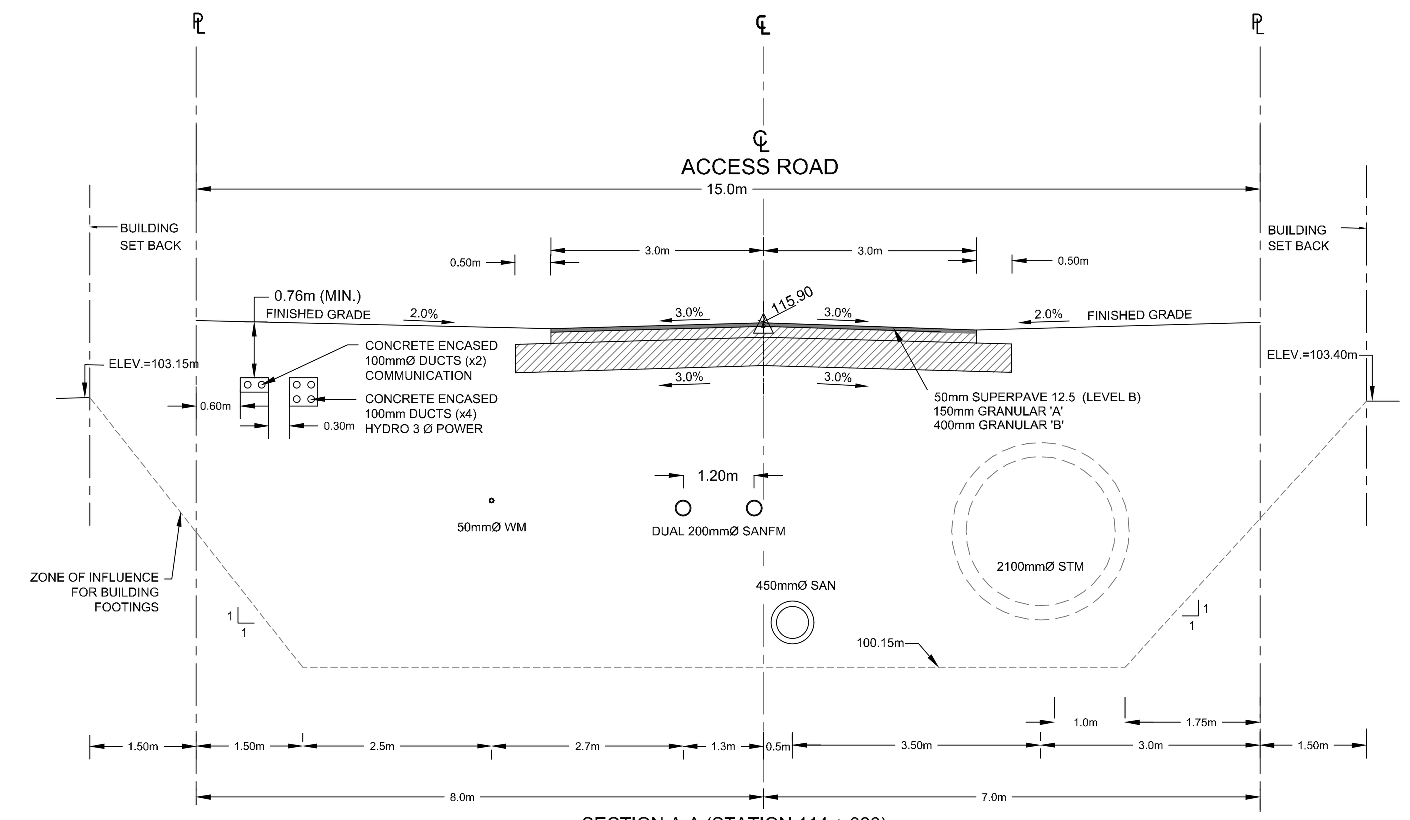


CONCRETE ENCASED HYDRO

SCALE: 1:20

LEGEND

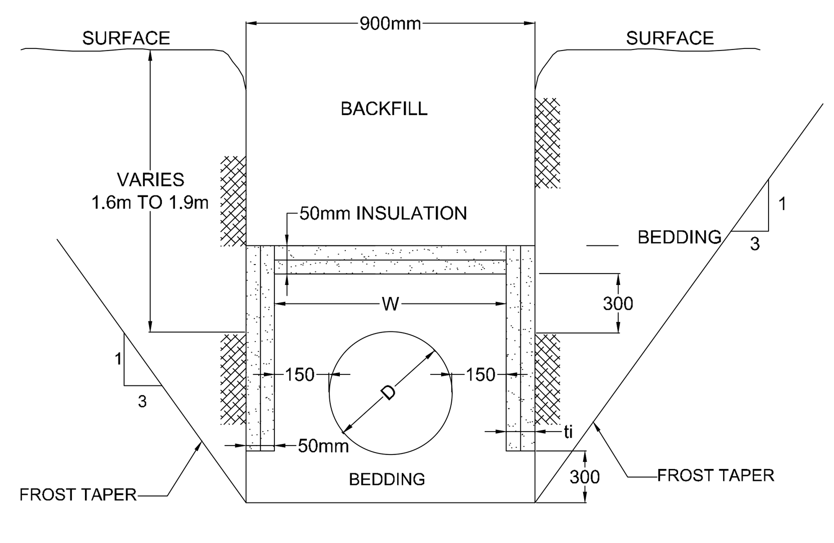
SANMH	PROPOSED SANITARY MH & SEWER
200mmØ	PROPOSED DUAL 200mmØ SANITARY FORCEMAIN
STMMH	PROPOSED STORM MH & SEWER
	DIRECTION OF FLOW
H	PROPOSED CONCRETE ENCASED 3Ø HYDRO SERVICE
	PROPOSED HYDRO TRANSFORMER
	PROPOSED FENCE LINE
GAS	PROPOSED GAS
	TEST PIT (REFER TO HOULE CHEVRIER ENG. LTD. PROJECT No. 12-478 AND 14-420)
	BORE HOLES (REFER TO HOULE CHEVRIER ENG. LTD. PROJECT No. 64153.53)
	TEST PITS DUG OCTOBER 18TH, 2016



SECTION A-A (STATION 114 + 080)

PUMP STATION EASEMENT

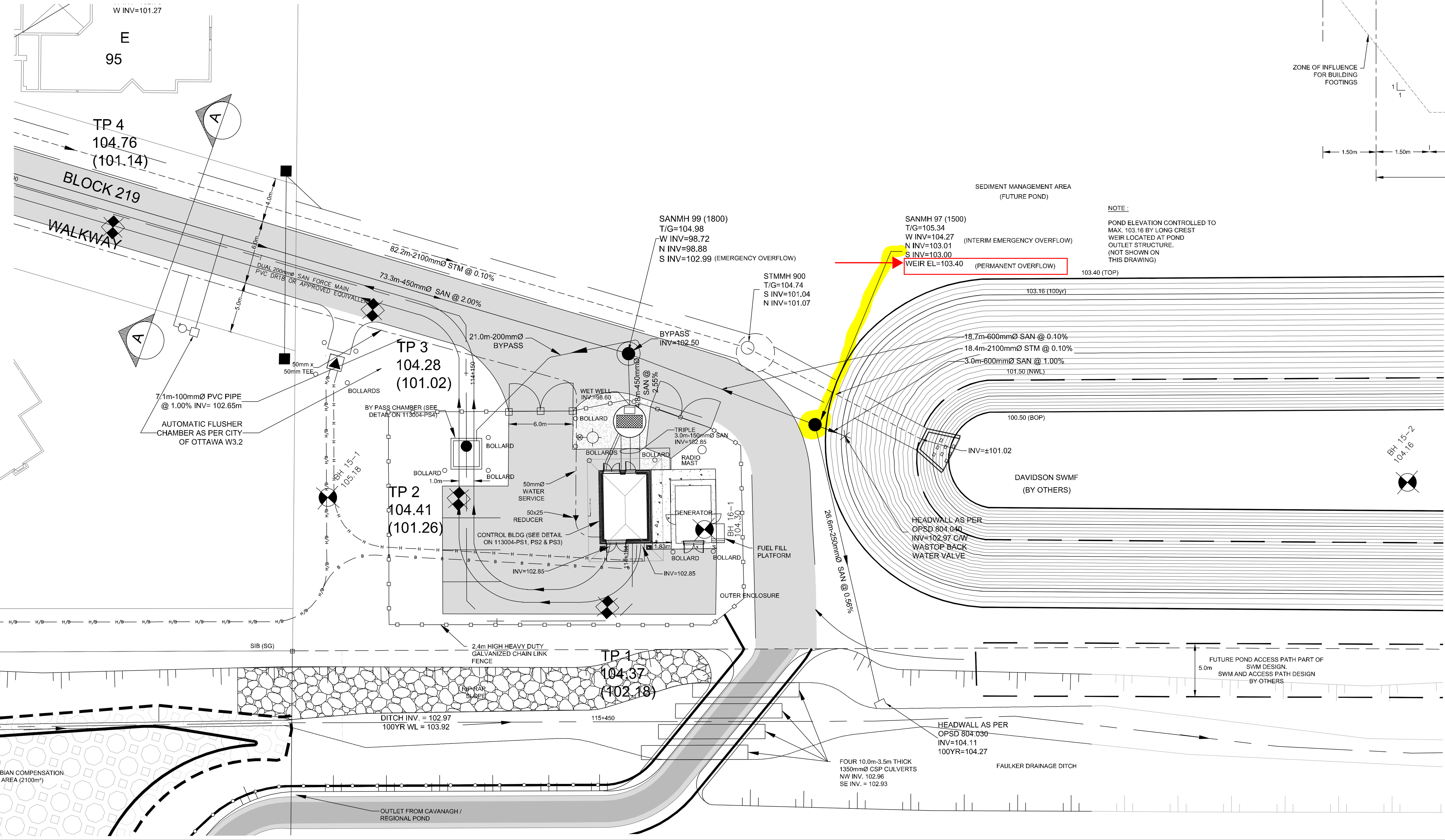
SCALE: 1:75

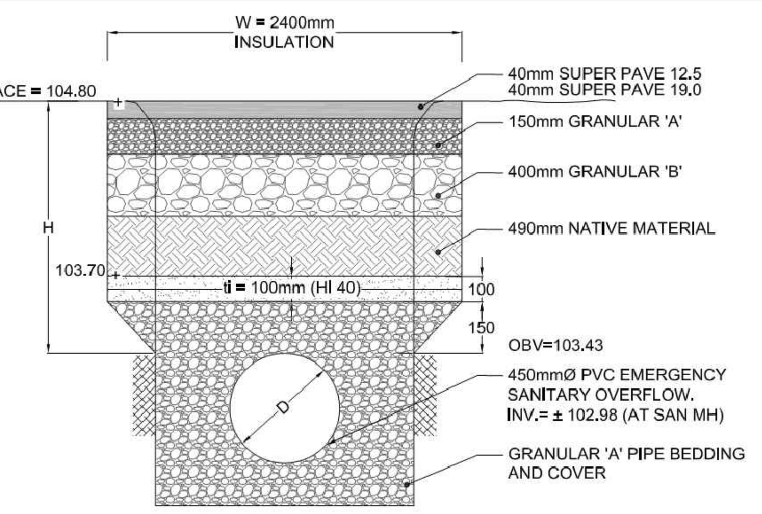


SANITARY FORCEMAIN INSULATION DETAIL

STA 114+110 TO 114+156

N.T.S.





ti = THICKNESS OF INSULATION (mm)
h = DEPTH OF COVER
W = (2.4-H)(2)+D
W = WIDTH OF INSULATION (mm)
D = O.D OF PIPE (mm)

COVER (mm)	INSULATION THICKNESS (mm)
1500-1200 1200-600	50 100

NOTES:

1. INCREMENTS OF THICKNESS SHALL BE ADJUSTABLE TO 50mm
2. THICKNESS OF INSULATION IS 50mm (min.)
3. INSULATE ALL PIPES AS SPECIFIED WITH MIN 50mm (MIN) x 1200mm HI-40 INSULATION. PROVIDE 150mm CLEARANCE BETWEEN PIPE AND INSULATION. (SEE ABOVE DETAIL).
4. THE THICKNESS OF INSULATION SLAB SHALL BE THE EQUIVALENT OF 25mm FOR EVERY 300mm REDUCTION IN THE REQUIRED DEPTH OF COVER (ROUNDED TO THE NEAREST 25mm INCREMENT).

TYPICAL INSULATION DETAIL - SANITARY OVERFLOW

N.T.S.

M:\2013\113004\CAD\Design\113004-PR(FM2).dwg, PS-SVC, Sep 07, 2018 - 11:06am, lbolam

NOTE:
THE POSITION OF ALL POLE LINES, CONDUITS, WATERMAINS, SEWERS AND OTHER UNDERGROUND AND OVERGROUND UTILITIES AND STRUCTURES IS NOT NECESSARILY SHOWN ON THE CONTRACT DRAWINGS, AND WHERE SHOWN, THE ACCURACY OF THE POSITION OF SUCH UTILITIES AND STRUCTURES IS NOT GUARANTEED. BEFORE STARTING WORK, DETERMINE THE EXACT LOCATION OF ALL SUCH UTILITIES AND STRUCTURES AND ASSUME ALL LIABILITY FOR DAMAGE TO THEM.

No.	REVISION	DATE	BY
14.	AS BUILT	SEP 06/18	GJM
13.	REVISED GRADES FROM SANMH 99 TO FAULKNER DRAIN	JUN 23/17	GJM
12.	ISSUED FOR MYLARS	FEB 23/17	GJM
11.	ISSUED FOR LAYOUT	JAN 13/17	GJM
10.	REVISED SANMH 99 AND 101 INVERTS	NOV 17/16	GJM
9.	AUTOMATIC FLUSHER CHAMBER ADDED	SEPT 09/16	BHB
8.	ADDENDUM No. 4	JUL 05/16	GJM
7.	REVISED MANHOLES 97 AND 99. 200mm BYPASS ADDED	JUN 22/16	GJM
6.	ISSUED FOR TENDER	MAY 25/16	GJM
5.	ISSUED FOR ENVIRONMENTAL COMPLIANCE APPROVAL	MAY 04/16	GJM
4.	ISSUED WITH MINOR ADJUSTMENTS	MAR 29/16	GJM
3.	ISSUED FOR 75% DESIGN	MAR 14/16	GJM
2.	50 % DESIGN	DEC 22/15	GJM
1.	ISSUED WITH PUMP STATION PRE-DESIGN REPORT	JUNE 24/15	GJM

SCALE
1 : 250
(UNLESS NOTED)

DESIGN	GJM/BHB
CHECKED	GJM
DRAWN	MWC
CHECKED	GJM
APPROVED	GJM

NOVATECH
Engineers, Planners & Landscape Architects
Suite 200, 240 Michael Cowpland Drive
Ottawa, Ontario, Canada K2M 1P6
Telephone (613) 254-9643
Facsimile (613) 254-5867
Website www.novatech-eng.com

LOCATION
CITY OF OTTAWA
STITTSVILLE SOUTH - AREA 6

DRAWING NAME
SHEA ROAD SANITARY PUMP STATION - SITE SERVICING AND GRADING

PROJECT No. 113004-00
REV: REV # 14
DRAWING No. 113004-PS-SVC

PLANB1.DWG - 1000mmx707mm

TABLE D-1: FERNBANK CDP LANDS - NEW TRUNK SEWER
SANITARY SEWER DESIGN SHEET (2031)

AREA			RESIDENTIAL																COMMERCIAL		INSTITUTIONAL		C+I	INFILTRATION				PIPE					
			LOW DENSITY			MEDIUM DENSITY			HIGH DENSITY			MIXED USE			TOTAL																		
ID	From	To	Area (ha)	Pop.	Accum. Pop.	Area (ha)	Pop.	Accum. Pop.	Area (ha)	Pop.	Accum. Pop.	Area (ha)	Pop.	Accum. Pop.	Pop.	Accum. Pop.	Peak Factor	Peak Flow (l/s)	Area (ha)	Accum. Area (ha)	Area (ha)	Accum. Area (ha)	Peak Flow (l/s)	Total Area (ha)	Accum. Area (ha)	Infilt. Flow (l/s)	Total Flow (l/s)	Size (mm)	Slope (%)	Length (m)	Capacity (l/s)	Full Flow Vel. (m/s)	Q/Q_{full} (%)
1	902	904	9.85	910	910	0.36	54	54	0.00	0	0	0.00	0	0	964	964	3.8	14.9	0.00	0.00	0.78	0.78	0.7	16.07	16.07	4.5	20.1	250	0.24	154	30.4	0.60	66.0%
2	904	908	11.65	1076	1986	3.10	465	519	0.00	0	0	0.00	0	0	1541	2505	3.5	35.6	0.00	0.00	0.91	1.69	1.5	22.29	38.36	10.7	47.8	300	0.24	306	49.4	0.68	96.7%
3	906	908	7.45	688	688	0.00	0	0	0.00	0	0	0.00	0	0	688	688	3.9	10.9	0.00	0.00	2.63	2.63	2.3	14.51	14.51	4.1	17.2	250	1.50	373	76.0	1.50	22.7%
4	908	912	4.45	411	3085	1.67	251	770	0.00	0	0	0.00	0	0	662	3855	3.3	52.3	0.63	0.63	0.00	4.32	4.3	16.43	69.30	19.4	76.0	300	0.61	396	78.8	1.08	96.4%
5	910	912	10.35	956	956	0.00	0	0	0.00	0	0	0.00	0	0	956	956	3.8	14.8	0.00	0.00	0.83	0.83	0.7	19.34	19.34	5.4	20.9	250	0.24	320	30.4	0.60	68.8%
6	912	920	11.15	1030	5071	0.00	0	770	0.00	0	0	0.00	0	0	1030	5841	3.2	75.3	0.00	0.63	2.50	7.65	7.2	18.11	106.75	29.9	112.4	450	0.15	207	115.2	0.70	97.5%
7	914	916	16.35	1511	1511	0.90	135	135	0.00	0	0	0.00	0	0	1646	1646	3.7	24.3	0.00	0.00	0.45	0.45	0.4	25.23	25.23	7.1	31.8	300	0.25	152	50.4	0.69	63.0%
8	916	920	10.45	966	2477	0.00	0	135	0.00	0	0	0.00	0	0	966	2612	3.5	37.0	0.00	0.00	0.85	1.30	1.1	15.69	40.92	11.5	49.5	375	0.20	314	81.8	0.72	60.6%
9	918	920	5.55	513	513	0.49	74	74	0.00	0	0	0.00	0	0	587	587	3.9	9.4	0.00	0.00	6.14	6.14	5.3	16.04	16.04	4.5	19.2	250	0.85	363	57.2	1.13	33.5%
	920	922	0.00	0	8061	0.00	0	979	0.00	0	0	0.00	0	0	0	9040	3.0	109.8	0.00	0.63	0.00	15.09	13.6	0.00	163.71	45.8	169.3	525	0.18	265	190.3	0.85	88.9%
10	922	924	12.20	1127	9188	0.09	14	993	0.00	0	0	0.00	0	0	1141	10181	2.9	121.5	0.00	0.63	1.52	16.61	15.0	27.31	191.02	53.5	190.0	525	0.23	290	215.2	0.96	88.3%
	924	934	0.00	0	9188	0.00	0	993	0.00	0	0	0.00	0	0	0	10181	2.9	121.5	0.00	0.63	0.00	16.61	15.0	0.00	191.02	53.5	190.0	525	0.79	669	398.8	1.78	47.6%
11	926	930	4.95	457	457	8.40	1260	1260	0.00	0	0	3.45	279	279	1996	1996	3.6	29.0	1.99	1.99	0.82	0.82	2.4	26.79	26.79	7.5	38.9	375	0.14	530	68.4	0.60	56.9%
12	928	930	9.35	864	864	3.55	533	533	0.00	0	0	0.00	0	0	1397	1397	3.7	20.9	0.00	0.00	3.85	3.85	3.3	22.72	22.72	6.4	30.7	200	7.00	55	90.5	2.79	33.9%
13	930	932	1.65	152	1473	2.95	443	2236	0.00	0	0	0.00	0	279	595	3988	3.3	53.9	0.34	2.33	0.80	5.47	6.8	10.54	60.05	16.8	77.4	450	0.11	308	99.1	0.60	78.2%
14	932	934	0.00	0	1473	0.00	0	2236	0.00	0	0	7.12	577	856	577	4565	3.3	60.7	3.56	5.89	6.10	11.57	15.2	17.52	77.57	21.7	97.6	525	0.10	455	141.9	0.63	68.8%
15	934	972	2.90	268	10929	1.80	270	3499	0.00	0	0	1.21	98	954	636	15382	2.8	172.4	0.61	7.12	0.40	28.58	31.0	15.08	283.67	79.4	282.8	600	0.26	1007	326.6	1.12	86.6%
16	936	938	7.58	700	700	0.70	105	105	0.00	0	0	0.00	0	0	805	805	3.9	12.6	0.00	0.00	2.17	2.17	1.9	14.42	14.42	4.0	18.5	250	1.00	108	62.0	1.22	29.8%
17	938	940	8.05	744	1444	1.00	150	255	0.00	0	0	4.41	357	357	1251	2056	3.6	29.8	2.21	2.21	0.83	3.00	4.5	25.14	39.56	11.1	45.4	300	0.35	156	59.7	0.82	76.0%
18	940	952	6.35	587	2031	0.99	149	404	0.00	0	0	0.00	0	357	736	2792	3.5	39.2	0.00	2.21	0.00	3.00	4.5	10.51	50.07	14.0	57.8	300	0.75	310	87.4	1.20	66.1%
19	942	944	7.25	670	670	4.70	705	705	0.00	0	0	0.00	0	0	1375	1375	3.7	20.6	0.00	0.00	12.67	12.67	11.0	34.19	34.19	9.6	41.2	250	0.90	516	58.9	1.16	70.0%
20	944	946	12.20	1127	1797	1.00	150	855	0.00	0	0	0.00	0	0	1277	2652	3.5	37.5	0.00	0.00	0.82	13.49	11.7	20.35	54.54	15.3	64.4	375	0.20	511	81.8	0.72	78.8%
21	946	948	4.15	383	2180	4.22	633	1488	0.00	0	0	0.00	0	0	1016	3668	3.4	50.0	0.00	0.00	3.87	17.36	15.1	17.22	71.76	20.1	85.2	375	0.50	243	129.3	1.13	65.9%
	948	950	0.00	0	2180	0.00	0	1488	0.00	0	0	0.00	0	0	0	3668	3.4	50.0	0.00	0.00	0.00	17.36	15.1	0.00	71.76	20.1	85.2	450	0.15	195	115.2	0.70	74.0%
22	950	952	5.05	467	2647	0.30	45	1533	0.00	0	0	0.00	0	0	512	4180	3.3	56.2	0.00	0.00	3.24	20.6	17.9	11.43	83.19	23.3	97.3	450	0.15	221	115.2	0.70	84.5%
23	952	972	4.15	383	5061	5.50	825	2762	0.00	0	0	0.00	0	357	1208	8180	3.0	100.8	0.00	2.21	0.00	23.60	22.4	22.72	155.98	43.7	166.8	450	0.54	282	218.6	1.33	76.3%
24	954	956	7.70	711	711	2.90	435	435	0.00	0	0	6.70	543	543	1689	1689	3.6	24.9	3.35	3.35	0.79	0.79	3.6	22.81	22.81	6.4	34.9	375	0.15	330	70.8	0.62	49.3%
25	956	958	10.70	989	1700	0.00	0	435	0.00	0	0	0.00	0	543	989	2678	3.5	37.8	0.00	3.35	6.27	7.06	9.0	23.45	46.26	13.0	59.8	450	0.20	411	133.0	0.81	44.9%
	958	960	0.00	0	1700	0.00	0	435	0.00	0	0	0.00	0	543	0	2678	3.5	37.8	0.00	3.35	0.00	7.06	9.0	0.00	46.26	13.0	59.8	450	0.15	177	115.2	0.70	51.9%
26	960	966	7.75	716	2416	0.00	0	435	0.00	0	0	0.00	0	543	716	3394	3.4	46.7	0.00	3.35	0.00	7.06	9.0	11.51	57.77	16.2	71.9	450	0.15	82	115.2	0.70	62.4%
27	962	964	2.55	236	236	4.70	705	705	5.04	680	680	0.00	0	0	1621	1621	3.7	24.0	0.00	0.00	0.00	0.00	0.0	20.97	20.97	5.9	29.9	250	0.35	479	36.7	0.72	81.4%
	964	966	0.00	0	236	0.00	0	705	0.00	0	680	0.00	0	0	0	1621	3.7	24.0	0.00	0.00	0.00	0.00	0.0	0.00	20.97	5.9	29.9	250	1.00	298	62.0	1.22	48.2%
28	966	970	1.80	166	2818	5.25	788	1928	0.00	0	680	0.00	0	543	954	5969	3.2	76.7	0.00	3.35	8.89	15.95	16.8	22.38	101.12	28.3	121.8	525	0.15	249	173.8	0.78	70.1%
29	968	970	6.90	638	638	0.00	0	0	0.00	0	0	0.00	0	0	638	638	3.9	10.1	0.00	0.00	0.99	0.99	0.9	11.03	11.03	3.1	14.1	200	0.32	82	19.4	0.60	72.7%
	970	972	0.00	0	3456	0.00	0	1928	0.00	0	680	0.00	0	543	0	6607	3.1	83.8	0.00	3.35	0.00	16.94	17.6	0.00	112.15	31.4	132.8	600	0.15	178	248.1	0.85	53.5%
	972	974	0.00	0	19446	0.00	0	8189	0.00	0	680	0.00	0	1854	0	30169	2.5	302.5	0.00	12.68	0.00	69.12	71.0	0.00	551.8	154.5	528.0	825	0.20	586	669.7	1.21	78.8%
	974	Ex	0.00	0	19446	0.00	0	8189	0.00	0	680	0.00	0	1854	0	30169	2.5	302.5	0.00	12.68	0.00	69.12	71.0	0.00	551.80	154.5	528.0	825	0.20	66	669.7	1.21	78.8%
			210.48			**54.57**			**5.04**			**22.89**																					

Design Parameters:

Avg Flow/Person =	350	l/day	Pipe Friction n = 0.013			
Comm./Inst. Flow =	50,000	l/ha/day	Residential Peaking Factor = Harmon Equation (max 4, min 2)			
Infiltration =	0.28	l/s/ha	Peaking Factor Comm./Inst. = 1.5			

	Units/Net ha	Pop/Unit	
Low Density Residential =	28	3.30	
Medium Density Residential =	60	2.50	(Multi Family Residential)
High Density Residential =	75	1.80	
Mixed Use =	90	1.80	(50% of mixed use area is residential)

Project: Fernbank CDP (101108)
Designed: KJM
Checked: MAB
Dwg. Reference: 101108-SAN
Date: May 8, 2009

IBI GROUP
400-333 Preston Street
Ottawa, Ontario K1S 5N4 Canada
tel 613 225 1311 fax 613 225 9868
ibigroup.com

SANITARY SEWER DESIGN SHEET

Davidson Lands
City of Ottawa
Name of Clien/Developer

LOCATION				RESIDENTIAL										ICI AREAS							INFILTRATION ALLOWANCE			FIXED	TOTAL	PROPOSED SEWER DESIGN						
				AREA	UNIT TYPES				AREA	POPULATION		PEAK	PEAK	AREA (Ha)						PEAK	AREA (Ha)		FLOW	FLOW	FLOW	CAPACITY	LENGTH	DIA	SLOPE	VELOCITY	AVAILABLE CAPACITY	
														INSTITUTIONAL		COMMERCIAL		INDUSTRIAL														
STREET	AREA ID	FROM MH	TO MH	w/ Units (Ha)	SF	SD	TH	APT	w/o Units (Ha)	IND	CUM	FACTOR	FLOW (L/s)	IND	CUM	IND	CUM	IND	CUM	FLOW (L/s)	IND	CUM	(L/s)	(L/s)	(L/s)	(L/s)	(m)	(mm)	(%)	(full) (m/s)	L/s	(%)
PHASE 2																																
Kayenta Street	142A	MH142A	MH143A	0.40	4	4				24.4	24.4	4.00	0.40								0.4	0.40	0.11		0.51	48.39	83.80	200	2.00	1.492	47.88	98.95%
Maygrass Way	146A	MH146A	MH143A	0.29	1	4				14.2	14.2	4.00	0.23								0.29	0.29	0.08		0.31	64.01	39.65	200	3.50	1.974	63.70	99.51%
Maygrass Way	143A	MH143A	MH144A	0.41		6	4			27.0	65.6	4.00	1.06								0.41	1.10	0.31		1.37	60.24	60.76	200	3.10	1.858	58.87	97.72%
Kayenta Street	139A	MH139A	MH140A	0.20		4				10.8	10.8	4.00	0.18								0.2	0.20	0.06		0.23	59.26	40.89	200	3.00	1.827	59.03	99.61%
	140A	MH140A	MH141A	0.07	1					3.4	14.2	4.00	0.23								0.07	0.27	0.08		0.31	51.89	9.57	200	2.30	1.600	51.59	99.41%
	141A	MH141A	MH144A	0.38		6	3			24.3	38.5	4.00	0.62								0.38	0.65	0.18		0.81	51.89	78.46	200	2.30	1.600	51.09	98.45%
Kayenta Street	144A	MH144A	MH145A	0.05			1			2.7	106.8	4.00	1.73								0.05	1.80	0.50		2.23	47.16	13.99	200	1.90	1.454	44.93	95.26%
PHASE 1																																
Kayenta Street	145A	MH145A	MH155A	0.24	1		4			14.2	121.0	4.00	1.96								0.24	2.04	0.57		2.53	47.16	54.00	200	1.90	1.454	44.63	94.63%
Kayenta Street	159A	MH159A	MH153A	0.35	1	2	5			22.3	22.3	4.00	0.36								0.35	0.35	0.10		0.46	51.89	35.93	200	2.30	1.600	51.43	99.11%
	153A	MH153A	MH154A	0.52	2	8	3			36.5	58.8	4.00	0.95								0.52	0.87	0.24		1.20	51.89	69.86	200	2.30	1.600	50.70	97.69%
	154A	MH154A	MH155A	0.25	2					6.8	65.6	4.00	1.06								0.25	1.12	0.31		1.38	54.10	13.93	200	2.50	1.668	52.72	97.46%
Block 159	155A	MH155A	MH156A	0.03						0.0	186.6	4.00	3.02								0.03	3.19	0.89		3.92	45.26	40.50	200	1.75	1.396	41.35	91.35%
	156A	MH156A	MH103A	0.03						0.0	186.6	4.00	3.02								0.03	3.22	0.90		3.93	45.26	41.32	200	1.75	1.396	41.34	91.33%
Edenwylde Drive	100A	MH100A	MH101A	0.63	3		16			53.4	53.4	4.00	0.87								0.63	0.63	0.18		1.04	43.28	68.32	200	1.60	1.335	42.24	97.59%
	101A	MH101A	MH102A	0.23	1		3			11.5	64.9	4.00	1.05								0.23	0.86	0.24		1.29	28.63	29.78	200	0.70	0.883	27.34	95.49%
	102A	MH102A	MH103A	0.34	2		8			28.4	93.3	4.00	1.51								0.34	1.20	0.34		1.85	48.39	43.19	200	2.00	1.492	46.54	96.18%
Edenwylde Drive	103A	MH103A	MH104A	0.23			7			18.9	298.8	4.00	4.84								0.23	4.65	1.30		6.14	45.26	30.98	200	1.75	1.396	39.12	86.43%
Jardiniere Street	122A	MH122A	MH120A	0.21			5			13.5	13.5	4.00	0.22								0.21	0.21	0.06		0.28	28.63	40.37	200	0.70	0.883	28.35	99.03%
	120A	MH120A	MH121A	0.05			1			2.7	16.2	4.00	0.26								0.05	0.26	0.07		0.34	28.63	9.56	200	0.70	0.883	28.29	98.83%
	121A	MH121A	MH126A	0.41			12			32.4	48.6	4.00	0.79								0.41	0.67	0.19		0.98	35.89	86.22	200	1.10	1.107	34.91	97.28%
Jardiniere Street	123A	MH123A	MH124A	0.36			11			29.7	29.7	4.00	0.48								0.36	0.36	0.10		0.58	32.46	67.99	200	0.90	1.001	31.88	98.21%
	124A	MH124A	MH125A	0.17			3			8.1	37.8	4.00	0.61								0.17	0.53	0.15		0.76	21.64	12.58	200	0.40	0.667	20.88	96.48%
	125A	MH125A	MH126A	0.31			10			27.0	64.8	4.00	1.05								0.31	0.84	0.24		1.29	21.64	43.85	200	0.40	0.667	20.36	94.06%
Jardiniere Street	126A	MH126A	MH127A	0.47			14			37.8	151.2	4.00	2.45								0.47	1.98	0.55		3.00	26.50	97.91	200	0.60	0.817	23.50	88.66%
External Commercial	135A	MH135A	MH127A							0.0	0.0	4.00	0.00			2.73	2.73			2.37	2.73	2.73	0.76		3.13	26.50	12.08	200	0.60	0.817	23.37	88.17%
Jardiniere Street	127A	MH127A	MH128A	0.02						0.0	151.2	4.00	2.45				2.73			2.37	0.02	4.73	1.32		6.14	20.24	11.48	200	0.35	0.624	14.10	69.65%
	128A	MH128A	MH129A	0.09						0.0	151.2	4.00	2.45				2.73			2.37	0.09	4.82	1.35		6.17	20.24	61.77	200	0.35	0.624	14.07	69.52%
	129A	MH129A	MH130A	0.03						0.0	151.2	4.00	2.45				2.73			2.37	0.03	4.85	1.36		6.18	20.24	11.48	200	0.35	0.624	14.07	69.48%
	130A	MH130A	MH131A	0.70			26			70.2	221.4	4.00	3.59				2.73			2.37	0.7	5.55	1.55		7.51	20.24	91.95	200	0.35	0.624	12.73	62.89%
	131A	MH131A	MH132A	0.48			15			40.5	261.9	4.00	4.24				2.73			2.37	0.48	6.03	1.69		8.30	20.24	71.17	200	0.35	0.624	11.94	58.99%
	132A	MH132A	MH104A	0.04						0.0	261.9	4.00	4.24				2.73			2.37	0.04	6.07	1.70		8.31	20.24	28.10	200	0.35	0.624	11.93	58.93%
Edenwylde Drive	104A	MH104A	MH105A	0.44			11			29.7	590.4	3.94	9.41				2.73			2.37	0.44	11.16	3.12		14.91	55.26	67.20	300	0.30	0.757	40.35	73.02%
	105A	MH105A	MH106A							0.0	590.4	3.94	9.41				2.73			2.37	0	11.16	3.12		14.91	55.26	11.41	300	0.30	0.757	40.35	73.02%
PHASE 2																																
Maygrass Way	147A	MH147A	CAP	0.43	7					23.8	23.8	4.00	0.39								0.43	0.43	0.12		0.51	56.95	60.75	200	2.77	1.756	56.45	99.11%
PHASE 1																																
Maygrass Way		CAP	MH148A							0.0	23.8	4.00	0.39								0	0.43	0.12		0.51	56.95	12.00	200	2.77	1.756	56.44	99.11%
	148B	MH148A	MH149A	0.40	6					20.4	44.2	4.00	0.72								0.4	0.83	0.23		0.95	50.75	69.93	200	2.20	1.565	49.80	98.13%
	149A	MH149A	MH150A	0.18	2					6.8	51.0	4.00	0.83								0.18	1.01	0.28		1.11	50.75	11.43	200	2.20	1.565	49.64	97.81%
	150A	MH150A	MH151A	0.51	1	1	12			38.5	89.5	4.00	1.45								0.51	1.52	0.43		1.88	41.91	68.53	200	1.50	1.292	40.03	95.52%
	151A	MH151A	MH152A	0.55		9	7			43.2	132.7	4.00	2.15								0.55	2.07	0.58		2.73	41.91	65.09	200	1.50	1.292	39.18	93.49%
	152A	MH152A	MH157A	0.63	1	10	5			43.9	176.6	4.00	2.86								0.63	2.70	0.76		3.62	37.48	87.29	200	1.20	1.156	33.86	90.35%
	---	MH157A	MH106A							0.0	176.6	4.00	2.86								0	2.70	0.76		3.62	100.85	8.35	300	1.00	1.382	97.24	96.41%
PHASE 2																																
Taliesin Crescent	200A	MH200A	MH201A	0.56			18			48.6	48.6	4.00	0.79								0.56	0.56	0.16		0.94	27.59	59.89	200	0.65	0.851	26.64	96.58%
	201A	MH201A	MH202A	0.46			16			43.2	91.8	4.00	1.49								0.46	1.02	0.29		1.77	21.64	63.75	200	0.40	0.667	19.87	91.81%
		MH202A	CAP106AE							0.0	91.8	4.00	1.49								0	1.02	0.29		1.77	21.64	9.65	200	0.40	0.667	19.87	91.81%
	202A	CAP106AE	MH106A	0.08			1			2.7	94.5	4.00	1.53								0.08	1.10	0.31		1.84	21.64	16.50	200	0.40	0.667	19.80	91.50%
PHASE 1																																
Edenwylde Drive	106A	MH106A	MH107A	0.28			6			16.2	877.7	3.84	13.64				2.73			2.37	0.28	15.24	4.27		20.28	50.44	79.17	300	0.25	0.691	30.17	59.80%
PHASE 2																																
Taliesin Crescent	203A	MH203A	MH204A	0.57			18			48.6	48.6	4.00	0.79								0.57	0.57	0.16		0.95	27.59	61.41	200	0.65	0.851	26.64	96.57%
	204A	MH204A	MH205A	0.37			14			37.8	86.4	4.00	1.40								0.37	0.94	0.26		1.66	21.64	50.66	200	0.40	0.667	19.98	92.31%
		MH205A	CAP 107AE							0.0	86.4	4.00	1.40								0	0.94	0.26		1.66	21.64	6.89	200	0.40	0.667	19.98	92.31%
	205A	CAP 107AE	MH107A	0.11			2			5.4	91.8	4.00	1.49								0.11	1.05	0.29		1.78	21.64	16.00	200	0.40	0.667	19.86	91.77%
PHASE 1																																
Edenwylde Drive	107A	MH107A	MH108A	0.39			11			29.7	999.2	3.80	15.38				2.73			2.37	0.39	16.68	4.67		22.42	50.44	81.58	300	0.25	0.691	28.02	55.55%

Design Parameters:

Residential			ICI Areas		Peak Factor
SF	3.4	p/p/u			
TH/SD	2.7	p/p/u	INST	50,000 L/Ha/day	1.5
APT	1.8	p/p/u	COM	50,000 L/Ha/day	1.5
Other	66	p/p/Ha	IND	35,000 L/Ha/day	MOE Chart
				17000 L/Ha/day	

Notes:
1. Mannings coefficient (n) = 0.013
2. Demand (per capita): 350 L/day 300 L/day
3. Infiltration allowance: 0.28 L/s/Ha
4. Residential Peaking Factor:
Harmon Formula = 1+(14/(4+P^0.5))
where P = population in thousands

Designed: LME

Checked:

Dwg. Reference: 37533-501

No.	Revision	Date
1.	City submission No. 1	2019-10-30
2.	City submission No. 2	2020-02-07
3.	City submission No. 3	2020-04-09

File Reference:	Date:	Sheet No:
37533.5.7.1	2020-04-08	1 of 2

IBI GROUP
400-333 Preston Street
Ottawa, Ontario K1S 5N4 Canada
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ibigroup.com

SANITARY SEWER DESIGN SHEET

Davidson Lands
City of Ottawa
Name of Clien/Developer

LOCATION				RESIDENTIAL	UNIT TYPES					POPULATION				ICI AREAS AREA (Ha)							INFILTRATION ALLOWANCE AREA (Ha)			FIXED FLOW	TOTAL FLOW	PROPOSED SEWER DESIGN					AVAILABLE CAPACITY	
STREET	AREA ID	FROM MH	TO MH	AREA w/ Units (Ha)	SF	SD	TH	APT	AREA w/o Units (Ha)	IND	CUM	PEAK FACTOR	PEAK FLOW (L/s)	INSTITUTIONAL IND	INSTITUTIONAL CUM	COMMERCIAL IND	COMMERCIAL CUM	INDUSTRIAL IND	INDUSTRIAL CUM	PEAK FLOW (L/s)	IND	CUM	FLOW (L/s)	(L/s)	(L/s)	CAPACITY (L/s)	LENGTH (m)	DIA (mm)	SLOPE (%)	VELOCITY (full) (m/s)	L/s	(%)
PHASE 2																																
Block 170	320A	MH320A	MH186A						2.08	137.3	137.3	4.00	2.22								2.08	2.08	0.58		2.81	21.64	12.44	200	0.40	0.667	18.83	87.03%
Crosanti Drive	186A	MH186A	MH187A	0.10						0.0	137.3	4.00	2.22								0.1	2.18	0.61		2.83	20.24	45.53	200	0.35	0.624	17.41	86.00%
Maverick Crescent	300A	MH300A	MH301A	0.20			4			10.8	10.8	4.00	0.18								0.2	0.20	0.06		0.23	27.56	11.47	200	0.65	0.850	27.33	99.16%
	301A	MH301A	MH302A	1.01			31			83.7	94.5	4.00	1.53								1.01	1.21	0.34		1.87	20.24	116.48	200	0.35	0.624	18.37	90.76%
	302A	MH302A	MH303A	0.07			2			5.4	99.9	4.00	1.62								0.07	1.28	0.36		1.98	20.24	11.48	200	0.35	0.624	18.27	90.23%
	303A	MH303A	MH304A	0.35			9			24.3	124.2	4.00	2.01								0.35	1.63	0.46		2.47	20.24	61.29	200	0.35	0.624	17.77	87.80%
	304A	MH304A	MH305A	0.01						0.0	124.2	4.00	2.01								0.01	1.64	0.46		2.47	20.24	14.00	200	0.35	0.624	17.77	87.79%
Maverick Crescent	300A1	MH300A	MH306A	0.75			26			70.2	70.2	4.00	1.14								0.75	0.75	0.21		1.35	27.59	92.03	200	0.65	0.851	26.24	95.12%
	306A	MH306A	MH307A	0.08						0.0	70.2	4.00	1.14								0.08	0.83	0.23		1.37	20.24	12.96	200	0.35	0.624	18.87	93.23%
Ocala Street	307A	MH307A	MH308A	0.24			5			13.5	83.7	4.00	1.36								0.24	1.07	0.30		1.66	20.24	68.00	200	0.35	0.624	18.59	91.82%
	308A	MH308A	MH305A	0.26			7			18.9	102.6	4.00	1.66								0.26	1.33	0.37		2.03	20.24	59.95	200	0.35	0.624	18.21	89.95%
Ocala Street	305A	MH305A	MH187A	0.06						0.0	226.8	4.00	3.68								0.06	3.03	0.85		4.52	20.24	50.21	200	0.35	0.624	15.72	77.65%
Crosanti Drive	187A	MH187A	MH188A	0.19						0.0	364.1	4.00	5.90								0.19	5.40	1.51		7.41	20.24	89.74	200	0.35	0.624	12.83	63.39%
	188A	MH188A	MH189A	0.80			27			72.9	437.0	4.00	7.08								0.8	6.20	1.74		8.82	20.24	103.64	200	0.35	0.624	11.43	56.45%
		MH189A	CAP	0.12			2			5.4	442.4	4.00	7.17								0.12	6.32	1.77		8.94	21.64	7.33	200	0.40	0.667	12.70	58.70%
	189A	CAP	MH108A							0.0	442.4	4.00	7.17								0	6.32	1.77		8.94	21.64	16.00	200	0.40	0.667	12.70	58.70%
PHASE 1																																
Edenwylde Drive	108A	MH108A	MH109A	0.26			5			13.5	1455.1	3.69	21.74				2.73			2.37	0.26	23.26	6.51		30.63	50.44	75.91	300	0.25	0.691	19.81	39.28%
PHASE 2																																
Orvieto Way	211A	MH211A	CAP210AE	0.65			13			35.1	35.1	4.00	0.57								0.65	0.65	0.18		0.75	27.59	86.14	200	0.65	0.851	26.84	97.28%
		CAP210AE	MH210A							0.0	35.1	4.00	0.57								0	0.65	0.18		0.75	27.59	4.00	200	0.65	0.851	26.84	97.28%
		MH210A	MH109A							0.0	35.1	4.00	0.57								0	0.65	0.18		0.75	27.59	11.31	200	0.65	0.851	26.84	97.28%
PHASE 1																																
Hickstead Way	109A	MH109A	MH110A	0.32	5					17.0	1507.2	3.68	22.46				2.73			2.37	0.32	24.23	6.78		31.61	50.44	76.01	300	0.25	0.691	18.83	37.33%
PHASE 2																																
FRIENDLY CRESCENT	EXTERNAL	EXMH181	MH230A	4.66	70					238.0	238.0	4.00	3.86								4.66	4.66	1.30		5.16	49.58	10.88	200	2.10	1.529	44.42	89.59%
Block 169		MH230A	MH231A							0.0	238.0	4.00	3.86								0	4.66	1.30		5.16	49.58	45.03	200	2.10	1.529	44.42	89.59%
Sendero Way	231A	MH231A	MH221A	0.59	10					34.0	272.0	4.00	4.41								0.59	5.25	1.47		5.88	34.22	67.09	200	1.00	1.055	28.34	82.82%
	221A	MH221A	MH222A	0.64	15					51.0	323.0	4.00	5.23								0.64	5.89	1.65		6.88	26.50	80.39	200	0.60	0.817	19.62	74.03%
	222A	MH222A	MH223A	0.17	2					6.8	329.8	4.00	5.34								0.17	6.06	1.70		7.04	34.22	11.46	200	1.00	1.055	27.18	79.42%
	223A	MH223A	MH224A	0.40	8					27.2	357.0	4.00	5.78								0.4	6.46	1.81		7.59	21.64	69.88	200	0.40	0.667	14.05	64.91%
Sendero Way	235A	MH235A	MH232A	0.56	8					27.2	27.2	4.00	0.44								0.56	0.56	0.16		0.60	34.22	61.94	200	1.00	1.055	33.62	98.25%
	232A	MH232A	MH233A	0.13	1					3.4	30.6	4.00	0.50								0.13	0.69	0.19		0.69	48.39	11.34	200	2.00	1.492	47.70	98.58%
	233A	MH233A	MH234A	0.45	10					34.0	64.6	4.00	1.05								0.45	1.14	0.32		1.37	21.64	57.60	200	0.40	0.667	20.27	93.69%
	234A	MH234A	MH224A	0.59	13					44.2	108.8	4.00	1.76								0.59	1.73	0.48		2.25	21.64	83.39	200	0.40	0.667	19.39	89.61%
Sendero Way	224A	MH224A	CAP 225AN	0.17	3					10.2	476.0	3.99	7.68								0.17	8.36	2.34		10.03	26.50	37.03	200	0.60	0.817	16.48	62.18%
		CAP 225AN	MH225A							0.0	476.0	3.99	7.68								0	8.36	2.34		10.03	26.50	6.50	200	0.60	0.817	16.48	62.18%
	225A	MH225A	MH226A	0.03						0.0	476.0	3.99	7.68								0.03	8.39	2.35		10.03	26.50	15.56	200	0.60	0.817	16.47	62.14%
	226A	MH226A	MH110A	0.02						0.0	476.0	3.99	7.68								0.02	8.41	2.35		10.04	26.50	21.49	200	0.60	0.817	16.46	62.12%
Painted Sky Way	215A	MH215A	MH216A	0.62	14					47.6	47.6	4.00	0.77								0.62	0.62	0.17		0.94	24.19	83.61	200	0.50	0.746	23.25	96.09%
	216A	MH216A	CAP 110AE	0.75	18					61.2	108.8	4.00	1.76								0.75	1.37	0.38		2.15	49.58	84.93	200	2.10	1.529	47.44	95.67%
		CAP 110AE	MH110A							0.0	108.8	4.00	1.76								0	1.37	0.38		2.15	49.58	15.00	200	2.10	1.529	47.44	95.67%
Hickstead Way	110A	MH110A	MH111A	0.36	6					20.4	2112.4	3.57	30.52				2.73			2.37	0.36	34.37	9.62		42.52	50.44	78.00	300	0.25	0.691	7.92	15.71%
Hickstead Way	176A	MH176A	MH111A	0.36	6					20.4	20.4	4.00	0.33								0.36	0.36	0.10		0.43	34.22	64.00	200	1.00	1.055	33.79	98.74%
Aridus Crescent	111A	MH111A	MH112A	0.47	10					34.0	2166.8	3.56	31.23				2.73			2.37	0.47	35.20	9.86		43.46	91.46	68.97	375	0.25	0.802	48.00	52.48%
	112A	MH112A	MH113A	0.51	10					34.0	2200.8	3.55	31.68				2.73			2.37	0.51	35.71	10.00		44.05	91.46	66.19	375	0.25	0.802	47.41	51.84%
	113A	MH113A	MH114A	0.12	1					3.4	2204.2	3.55	31.72				2.73			2.37	0.12	35.83	10.03		44.12	91.46	13.49	375	0.25	0.802	47.33	51.75%
	114A	MH114A		0.52	9					30.6	2234.8	3.55	32.12				2.73			2.37	0.52	36.35	10.18		44.67	91.46	55.98	375	0.25	0.802	46.79	51.16%
		Structure - (325	MH148A																								12.00	200	2.77			
			EXMH181																								35.00	250	0.54			
		EXMH181																									16.74	250	0.54			
		MH189A	Structure - (328)																								7.33	200	0.40			
WORKS DESIGNED BY NOVATECH																																
STITTSVILLE SOUTH	EXTERNAL			32.94						2182.0	2182.0										32.94	32.94										
	175A	111	109 (0)	0.23	3					10.2	2192.2	3.55	31.57								0.23	33.17	9.29		*40.85*	141.68	*115.7*	*375*	*0.60*	1.243	100.83	71.17%
STREET NO. 11	176B	109 (0)	107 (0)	0.54	11					37.4	2229.6	3.55	32.05								0.54	33.71	9.44		*41.49*	91.46	*71.7*	*375*	*0.25*	0.802	49.97	54.63%
STREET NO. 11	177A	107 (0)	105 (0)	0.49	10					34.0	2263.6	3.54	32.49								0.49	34.20	9.58		*42.07*	91.46	*62.1*	*375*	*0.25*	0.802	49.39	54.00%
STREET NO. 11	178A	105 (0)	MH115A	0.19	1					3.4	2267.0	3.54	32.54								0.19	34.39	9.63		*42.16*	258.68	*11.0*	*375*	*2.00*	2.269	216.51	83.70%
BLOCK 263		MH115A	99 (1800)							0.0	4501.8	3.29	59.94				2.73			2.37	0	70.74	19.81		82.12	320.35	*73.3*	*450*	*1.16*	1.951	238.23	74.37%
BLOCK 263		99 (1800)	PS							0.0	4501.8	3.29	59.94				2.73			2.37	0	70.74	19.81		82.12	474.96	*4.8*	*450*	*2.55*	2.893	392.84	82.71%

Design Parameters:

Residential				ICI Areas		Peak Factor
SF	3.4	p/p/u				
TH/SD	2.7	p/p/u	INST	50,000	L/Ha/day	1.5
APT	1.8	p/p/u	COM	50,000	L/Ha/day	1.5
Other	66	p/p/Ha	IND	35,000	L/Ha/day	MOE Chart
				17000	L/Ha/day	

Notes:
1. Mannings coefficient (n) = 0.013
2. Demand (per capita): 350 L/day 300 L/day
3. Infiltration allowance: 0.28 L/s/Ha
4. Residential Peaking Factor:
Harmon Formula = 1+(14/(4+P^0.5))
where P = population in thousands

Designed: LME

Checked:

Dwg. Reference: 37533-501

No.	Revision	Date
1.	City submission No. 1	2019-10-30
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velocity of approximately 1.4m/s (within MOE recommended forcemain velocities of 0.8 t 2.5m/s).

According to the *West Urban Community – Wastewater Collection System Master Servicing Plan by RV Anderson Associates Ltd., dated July 2012* monitored peak flows entering the Stittsville Pump Station were 39L/s in 2010. With a capacity of 108L/s, the remaining capacity is 69L/s. Based on the aforementioned, the Liard St. Pump Station can handle the majority of the development. It is recommended that the flows at the Liard St. Pump Station continue to be monitored until extension of the Fernbank Trunk is completed (see 6.1.5 for details regarding the Future Fernbank Trunk).

6.1.4 Friendly Crescent Pump Station

The Friendly Crescent Pump Station is a low lift station, which services the properties along Friendly Crescent. The flow is pumped west to the 250mm dia. sewer along Hartsmere Drive and has an overflow that is directed to a storm outlet east of Friendly Crescent.

Novatech Engineering produced the “Design Services and Stormwater Report” in May 2000 with a detailed design of the Friendly Crescent Pump Station. The station was designed to serve 70 dwellings that discharge to the Friendly Crescent Pump Station with a peak flow of 5.77 L/s using twin Flygt effluent pumps CP3085.182 that push 6.0 L/sec at 7.15 meters total dynamic head through a 100mm diameter, 230m long forcemain.

It is proposed that the sanitary sewer-shed of Friendly Crescent Pump Station be accounted for in the servicing alternatives, in order to provide a higher level of service, by providing a gravity outlet to avoid the costs of maintaining and operating the existing pump station.

6.1.5 Future Fernbank Trunk

The Future Fernbank Trunk will be built along the Hydro One easement to accommodate the future development of the Fernbank Community Design Plans as referenced in the Master Servicing Study for the Fernbank lands. Once constructed, the Liard Street Pump Station will be decommissioned, and all flows from the Liard Street Pump Station sewer-shed and the Area 6 lands will be directed to the Fernbank Trunk through a gravity sewer. The Fernbank Trunk will convey flows to the Hazeldean Pump Station. The decommissioning work will be undertaken by the City, based on the time frame provided in Infrastructure Master Plan.

The Fernbank Trunk was designed for a peak flow of 528L/s and has a capacity of 670L/s which leaves an excess capacity of 142L/s. As per section 6.1.3 of this report, the Liard Street Pump Station had a monitored flow of 39L/s in 2010, and proposed Area 6 peak design flows is 85L/s which summates to 124L/s. Based on these flows, there is adequate capacity in the Fernbank Trunk.

Based on coordination with the Landowners within the Fernbank CDP lands, the sewer depth and size will be accounted for at the proposed subdivisions within the Fernbank Lands CDP to provide the required capacity in order to eventually decommission the Liard Street Pump station and accumulate the Area 6 flows. The cost for over-sizing and over –depth of the sewers is discussed in Section 9.2.

Table ES 3: WUC summary of flow generation scenarios

PUMPING STATION OR TRUNK SEWER	FIRM CAPACITY	EXISTING CAPACITY	CURRENT SEWER CONFIGURATION						
			FLOW (1)	Scenario 1		Scenario 2		Scenario 3	
(Year)			2010	2031	2060	2031	2060	2031	2060
	(L/s)	(L/s)	(L/s)	(L/s)	(L/s)	(L/s)	(L/s)	(L/s)	(L/s)
Richmond Pump Station	360		151	340	340	314	314	407	407
Stittsville PS	108		39	106	506	77	300	91	353
Hazeldean Pump Station	1225		832	1537	1937	1373	1596	1741	2003
Kanata West Pump Station (2)	765		152	593	689	462	555	561	678
Signature Ridge Pump Station (3)	360		54	309	423	218	302	256	351
March Pump Station	490		326	771	941	668	814	820	1008
Acres Road Pump Station	4600		2119	4186	4966	3774	4320	4437	5099
Glen Cairn Trunk		2815 to 2988	1139	2512	3008	2192	2508	2758	3137
Stittsville Trunk		519 to 972	358	485	885	444	679	572	732
Main Street Sewer		307 to 739	138	330	444	237	321	342	399
Penfield Sewer		398 to 734	170	360	474	267	351	342	437
March Ridge Trunk (Above March Forcemain)		1223	245	434	548	339	423	428	523
March Ridge Trunk (Below March Forcemain)		1016	571	1205	1489	1007	1237	1248	1531
Watts Creek Siphon		1014	571	1205	1489	1007	1237	1248	1531
Tri-Township Collector		1595 to 1803	1705	3717	4497	3199	3745	4006	4668
March Wood Trunk		1100	230	574	705	502	616	608	752
East March Trunk		550	96	172	211	141	173	187	231
North Kanata Trunk - Phase I		4047 to 4640	1705	3717	4497	3199	3745	4006	4668
Nepean Collector		190	190	197	197	193	193	234	234
Watt's Creek Trunk		5418 to 6640	1891	3914	4694	3392	3938	4240	4902

The coloured cells in the table identify the component of the current sewer system that is under capacity by the time of the projected growth in 2031 or 2060.

(1) – flow results based on the dynamic model calculation;

APPENDIX C

WATER SUPPLY

STITTSVILLE SOUTH SUBDIVISION
CITY OF OTTAWA

DETAILED SERVICING & STORMWATER MANAGEMENT REPORT

Prepared For:

ROSS BRADLEY, CINQUE TERRE HOLDINGS INC. & STITTSVILLE SOUTH INC.

Prepared By:

NOVATECH
Suite 200, 240 Michael Cowpland Drive
Ottawa, Ontario
K2M 1P6

September 21, 2015
Revised July 18, 2016

Novatech File: 113004
Ref: R-2015-072

6.0 WATER SUPPLY SYSTEM

6.1 Background Information

The proposed development is located within the service area of Pressure Zone 3W of the City of Ottawa water distribution system. This zone is fed by the Glen Cairn and Campeau Drive Pump Stations. Balancing storage during peak and fire flow conditions is accomplished with use of the Stittsville Elevated Tank.

The existing water distribution system adjacent to the study area includes;
- 400mm diameter watermain on Fernbank Road
- 300mm diameter watermain on Arrowwood Drive
- 200mm diameter watermain on Hartsmere Drive
- 250mm diameter watermain on West Ridge Drive

The existing ground elevations within Area 6 are between 105m and 124m above sea level.

Novatech has retained Stantec Consulting Ltd.(Stantec) to undertake a hydraulic analysis using the City's most up to date model which had recently been updated for the 2013 Water Master Plan update. The analysis takes into account the future Fernbank CDP Lands. The Stantec findings and recommendations; '*Stittsville Area 6 - Potable Water Hydraulic Assessment Phase 1 &2'* dated September 2nd, 2015 can be found in **Appendix D**.

6.2 Previous Recommendations

As part of the *Area 6 MSR*, it was determined that the preferred water servicing alternative consists of a 250mm watermain spine, and 200mm diameter watermain feeding adjacent local roads. It was also recommended that a 300mm diameter watermain be extended from Arrowwood Drive into the proposed site as 200mm watermain for backbone continuity, and the 400mm diameter watermain on Fernbank Road be extended towards the East in order to meet the proposed 250mm diameter spine. Refer to **Figure 6.1**.

6.3 Overall Water Demand & Criteria

The water demands for Stittsville South would be estimated using the City of Ottawa's Water Distribution Design Guidelines.

6.3.1 Water Demand

The domestic demand design criteria used to determine the size of the watermains required to service the Stittsville South area are as follows:

Domestic Demand

Average Residential Domestic Flow per capita	350 L/cap/day
Capita per dwelling	3.4 persons per single
	2.7 persons per townhouse
	2.3 persons per stacked townhouse
	2.1 persons per apartment
Maximum Day Demand	2.5 x Average Day Demand
Peak Hour Demand	2.2 x Maximum Day Demand

Commercial and Parks Demand

Commercial Capita	50,000 L/ha/day
Maximum Day Demand	1.5 x Average Day Demand
Peak Hour Demand	1.8 x Maximum Day Demand
Park Demand	1000 L/park/day

6.3.2 Fire Flow Demand

The City of Ottawa requires proposed watermain networks meet Fire Underwriters Survey fire flow requirements. However, Technical Bulletin ISDTP-2014-02 specifies that the fire flow requirement can be capped at 10,000 L/min for the following;

- Single detached dwellings, provided that there is a minimum rear yard separation of 10m between adjacent units.
- Town and row homes, provided that firewalls with a minimum of two hour fire-resistance rating that comply with OBC Div. B, Subsection 3.1.10 are used to separate home blocks into fire areas that comprise no more than the lesser of seven units, and 600m² of building area. Furthermore, there must be a minimum rear yard separation of 10m.

Based on the above, the watermain analysis has assessed the ability of the proposed network to attain a fire flow of 10,000 L/min at all locations. Fire Underwriters Survey fire flow calculations have also been included for reference in **Appendix D**.

6.3.3 Design Criteria

The design criteria used to determine the size of the watermains required to service the Stittsville South area are based on a conservative approach that considers three possible scenarios, as follows:

System Pressures

Maximum Allowable Pressure	551.6kPa (80psi)
Minimum Allowable Pressure (excluding fire flow conditions)	275.8kPa (40psi)
Minimum Allowable Pressure (including fire flow conditions)	137.9Kpa (20psi)

6.4 Watermain Analysis

Novatech has retained Stantec Consulting Ltd. to conduct a hydraulic analysis of the proposed development potential, and its effects on the City's water infrastructure. The hydraulic network model and memo 'Stittsville Area 6-Phase 1 & 2 - Potable Water Hydraulic Assessment' dated September 2nd, 2015 is included in **Appendix D**. The hydraulic network simulated average day, peak hour and maximum day plus fire flow conditions.

Stantec used the City's most up to date model that was recently updated for the 2013 Water Master Plan. Both current conditions and future conditions (anticipated 2031 conditions from the 2031 Water Master Plan model) were analyzed.

It is important to note that in the area of the proposed development, head losses under peak demands could reduce minimum pressures to below guideline requirements at higher elevations. Future planned connections as per the Water Master Plan, within the Fernbank lands will mitigate this issue resulting in increased minimum pressures.

6.5 Discussion

6.5.1 Low Pressures

Under peak hour demands, ground elevations greater than 124m are susceptible to minimum pressures marginally below the required 40psi under 2013 existing conditions. In future 2013 conditions, minimum pressures everywhere within the proposed development are not expected to drop below required pressures.

Within the vicinity of the cul-de-sac at the end of Street Five, ground elevations are greater than 124m. In order to mitigate marginally low expected pressures, it is proposed that 25mm services be installed for Lots 23, 24, and 25 to alleviate low pressure concerns. The specifications and details of these mitigations will be provided in the detail design drawings of the Camplina Way, 113004-GP1.

It is also expected that buildings within Block 349 will experience marginally low pressures due to the ground elevations in this area. Within Block 349, jet pumps will be required where buildings are greater than two stories tall. The jet pumps will be owned and maintained by the condominium corporation. Such mitigation measures, including the jet pumps, will be finalized within servicing reports during detailed design in support of the site plan application.

Similarly, at Block 353 contains the potential for a 6 story condominium building that will likely require pressure boosting measures. Such measures include but are not limited to jet pumps within the mechanical room of the apartment block. These measures will be owned and maintained by the condominium corporation and will be finalized within servicing reports during detailed design in support of the site plan application.

Refer to the Legal Plan of Subdivision for the location of the aforementioned blocks.

6.5.2 High Pressures

Under average day demands (also known as basic day demands), ground elevations less than 106m will experience pressures greater than the required limit of 80psi. As Phase 1 and 2 of the Stittsville South subdivision do not have any finished grade elevations around residential units or street below elevation 106.00, high pressures are not a concern.

6.5.3 Fire Flow

As per Appendix B-5 through B-8 of the attached Stantec Potable Water Hydraulic Assessment, a 10,000L/min fire flow is attained in general throughout the proposed development as per ISDB-TB2014-01.However there are a few localized exceptions, where the criteria was not met as discussed below.

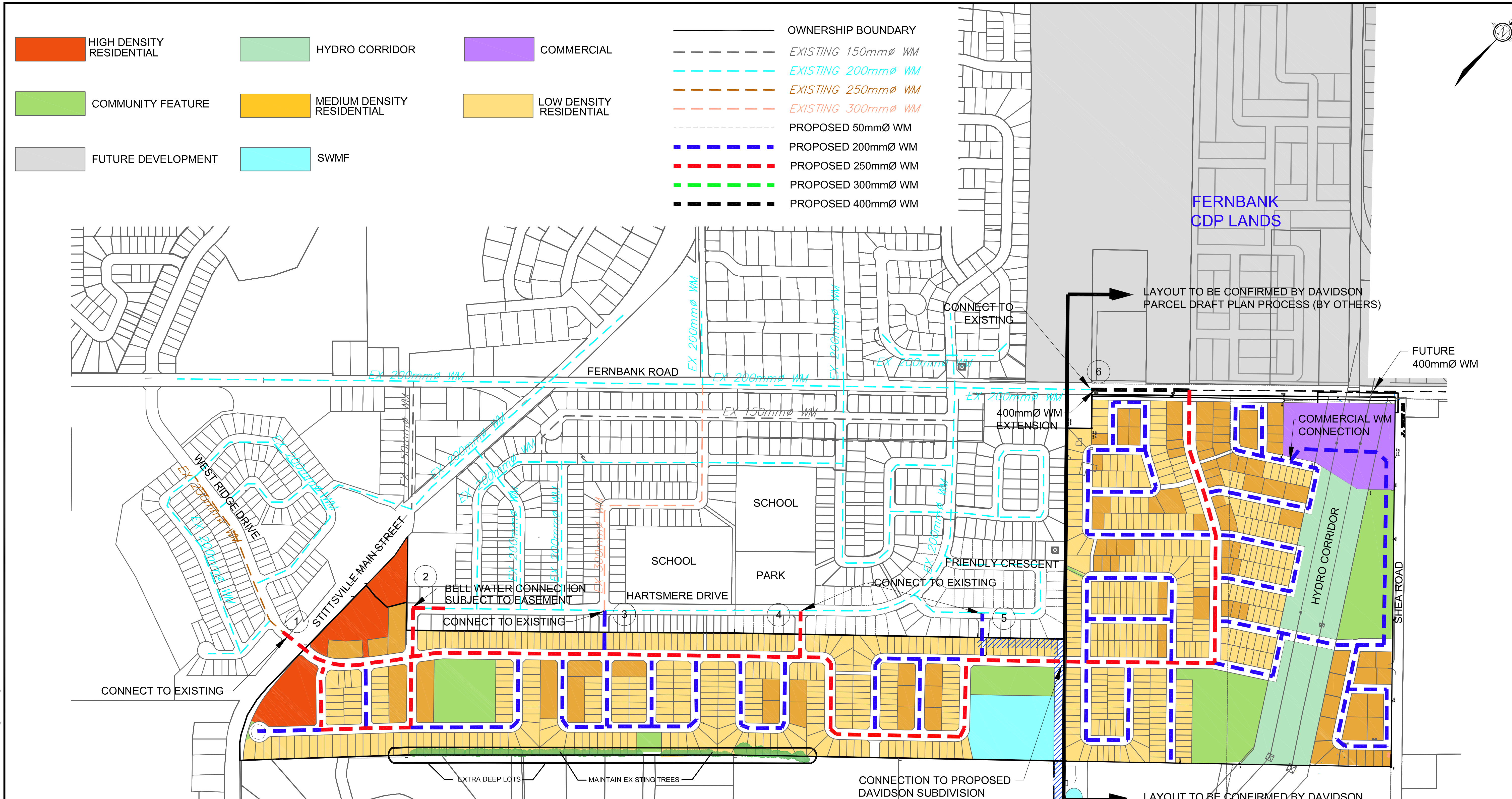
At node A95 (at the dead end of Campolina Way) the available fire flow is 8000L/min. The FUS long calculation for Lot 25 (worst case scenario) was calculated to be 8,000L/min; therefore, the fire demand is met. a second 250mm watermain loop (along Falabella, Campolina, Lipizzaner) was introduced to retain the minimum required fire flows of 8,000L/min.

As per ISD-TB 2014-01, at node 81, the residential configuration does not allow the 10,000 L/min fire demand to be utilized and requires the FUS long method to be utilized. As such, the fire demand at this location is 13,000 L/min. The available fire flow at residual pressure of 20 psi, is 18,000L/min; therefore, the fire demand is met.

6.6 Recommendations & Proposed Water Infrastructure

Based on the findings of 'Stittsville Area 6 - Potable Water Hydraulic Assessment' there is sufficient capacity to provide both the required domestic and emergency fire flows to the service area. In order to accomplish this, it is proposed that the 250mm diameter watermain existing west of the development would be extended through Area 6 and reconnected at Fernbank Road. This 250mm watermain would act as the spine, from which 200mm diameter watermain will feed adjacent roads. It is also recommended that an existing 300mm diameter watermain be extended as a 200mm watermain from Arrowwood Drive into the proposed site for backbone continuity, and the 400mm diameter watermain on Fernbank Road be extended towards the East in order to meet the proposed 250mm diameter spine. Elevations greater than 124m will require additional measures to increase peak hour pressures. Elevations less than 106m will require pressure reduction measures. Refer to **Figure 6.1** for sizing.

It is likely that the eastern portion of Parade (Lots 286 – 295) will be developed in advance of the Davidson Lands; hence the watermain within this portion will be deemed a dead-end. Is it anticipated that the Davidson Lands will advance within the next two years. As there are less than 50 units temporarily connected to this portion of the main, the City's guidelines are met.



NOTE: DAVIDSON LANDS LAYOUT IS SUBJECT TO CHANGE (BY OTHERS). REFER TO CITY OF OTTAWA FILE NO. D07-16-15-0008.

SCALE 1:7000

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STITTSVILLE SOUTH AREA 6

WATERMAIN CONCEPT PLAN

DATE	JOB	FIGURE
JULY 2016	113004	FIGURE 6.1

SHT11X17.DWG - 279mmX432mm

M:\2013\113004\CAD\Design\Figures\Design Brief\May 2015\113005-Demo-figures.dwg, FIG 6.1, Jul 14, 2016 - 11:24am, bsweet

APPENDIX D

Hydraulic Analysis – Stantec (Retained by Novatech)

Stittsville Area 6 - Potable Water Hydraulic Assessment of Phase 1 & 2

Stantec

Prepared for:
Novatech Engineering Consultants Limited

Prepared by:
Stantec Consulting Ltd.

September 2, 2015

Sign-off Sheet

This document entitled Stittsville Area 6 - Potable Water Hydraulic Assessment of Phase 1 & 2 was prepared by Stantec Consulting Ltd. ("Stantec") for the account of Novatech Engineering Consultants Ltd. (the "Client"). Any reliance on this document by any third party is strictly prohibited. The material in it reflects Stantec's professional judgment in light of the scope, schedule and other limitations stated in the document and in the contract between Stantec and the Client. The opinions in the document are based on conditions and information existing at the time the document was published and do not take into account any subsequent changes. In preparing the document, Stantec did not verify information supplied to it by others. Any use which a third party makes of this document is the responsibility of such third party. Such third party agrees that Stantec shall not be responsible for costs or damages of any kind, if any, suffered by it or any other third party as a result of decisions made or actions taken based on this document.

Prepared by ______________________________
(Signature)

Val Hoang, M.A.Sc., Engineering Intern

Reviewed by ______________________________
(Signature)

Kevin Alemany, M.A.Sc., P.Eng.

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Executive Summary

Stantec Consulting Ltd. (Stantec) has carried out a detailed potable water hydraulic analysis for Phases 1 and 2 of the proposed Area 6 service area located in Stittsville on behalf of Novatech Engineering Consultants Ltd. The proposed Area 6 development is located between Stittsville Main Street and Shea Road along Fernbank Road and is adjacent to the boundaries of Pressure Zone 3W of the City of Ottawa water distribution system.

A hydraulic assessment was performed using the City's most up to date model (with permission) for existing conditions to simulate Phase 1 and 2. The spine of the network is proposed to be 250mm diameter piping (which connects to existing watermains) with 200mm diameter piping making up the remainder of the internal network.

The proposed watermain to service the mixed use development has sufficient capacity to provide the required domestic demands while maintaining the City's objective pressure in the development. However, additional consideration should be taken for buildings with more than two storeys in height as they are subject to experiencing low pressures (i.e. below 40 psi) on the higher floors during peak demands. Proposed building heights, ground elevations and minimum pressure constraints need to be considered accordingly.

A fire flow assessment under maximum day demand conditions was carried out and it was determined that fire flows greater than 10,000 L/min can be achieved while maintaining a residual pressure of 20 psi throughout the development except for one dead-end location. According to the latest site plans, this dead-end location is anticipated to service units that require 8,000 L/min of fire flow per the FUS calculation, which is deemed achievable according to model results presented herein.

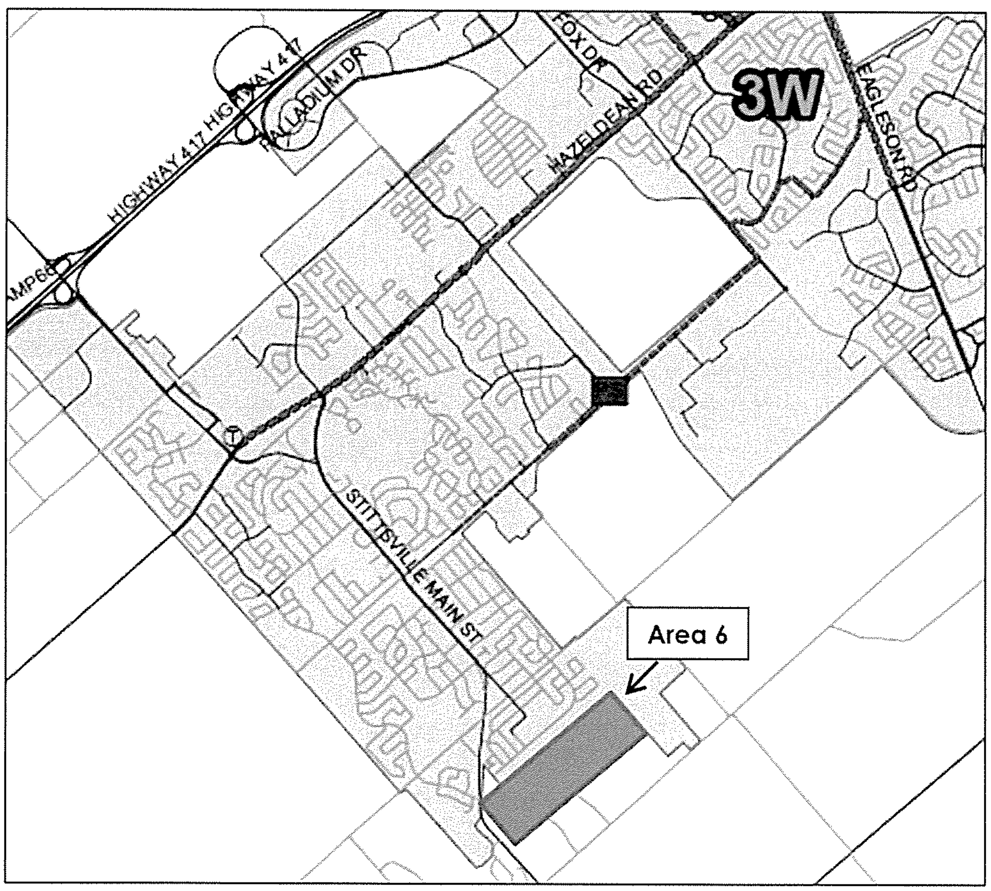
1.0 BACKGROUND

1.1 AREA OF DEVELOPMENT

Stantec Consulting Ltd. (Stantec) has undertaken a hydraulic assessment of the potable water servicing area for the proposed Area 6 Stittsville development on behalf of Novatech Engineering Consultants Ltd. This analysis specifically reviews conditions of Phase 1 and 2_as they are currently in the detailed design stage. Area 6 is a mixed-use development that includes single homes, town houses, apartment buildings and a small commercial area.

The proposed development site is located between Stittsville Main Street and Shea Road along Fernbank Road (**Figure 1-1**). It is located within the service area of Pressure Zone 3W of the City of Ottawa water distribution system. Zone 3W is fed by the Glen Cairn and Campeau Drive Pump Stations with the Stittsville Elevated Tank providing balancing storage for peak flows as well it provides storage to meet emergency and fire flow conditions.

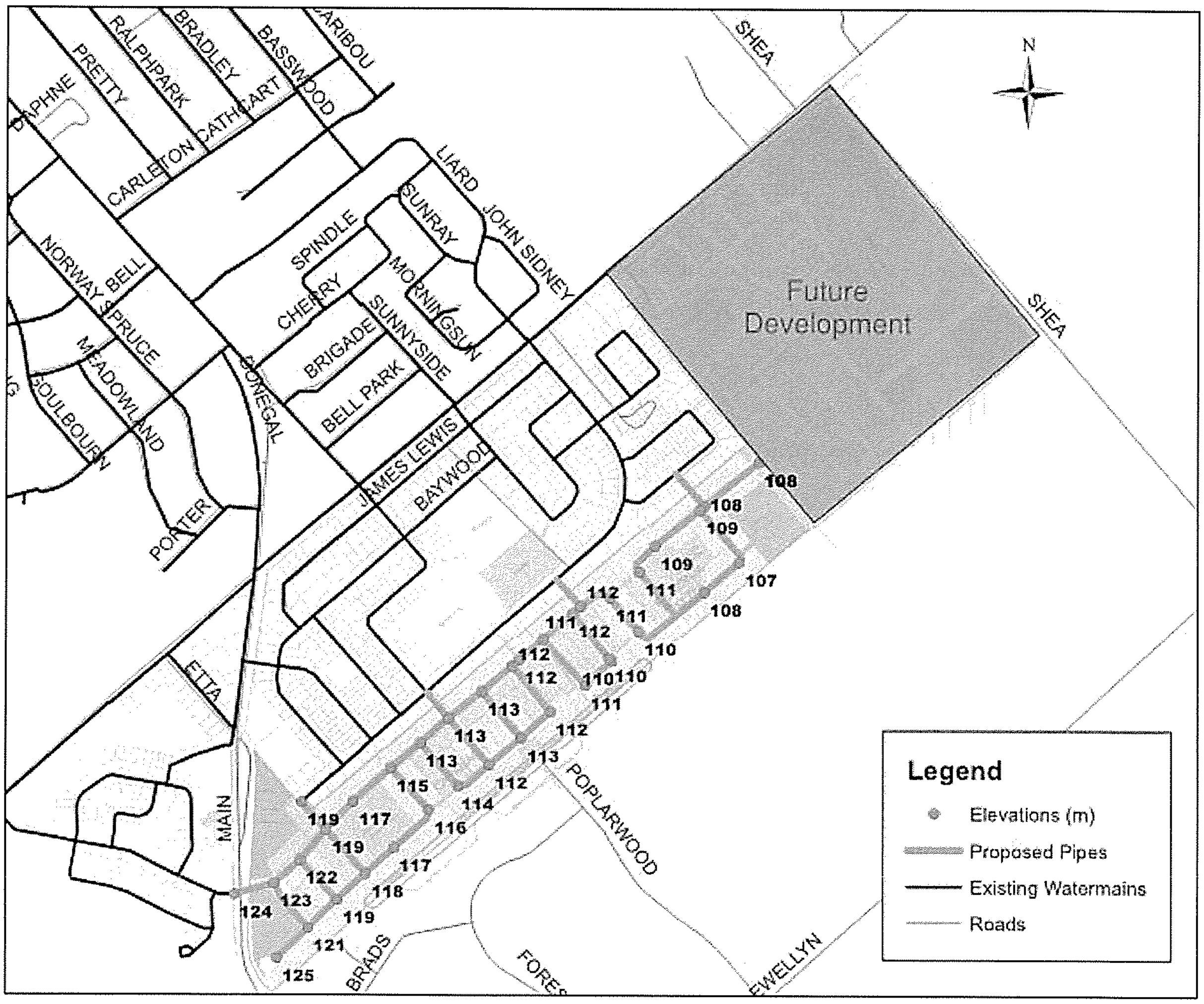
Figure 1-1: Location of Area 6



1.2 GROUND ELEVATIONS

The existing ground elevations of the proposed Area 6 development range from approximately 107m and 125m. The elevations shown on **Figure 1-2** were interpolated from an elevation topography file and assigned to the nodes in the hydraulic model.

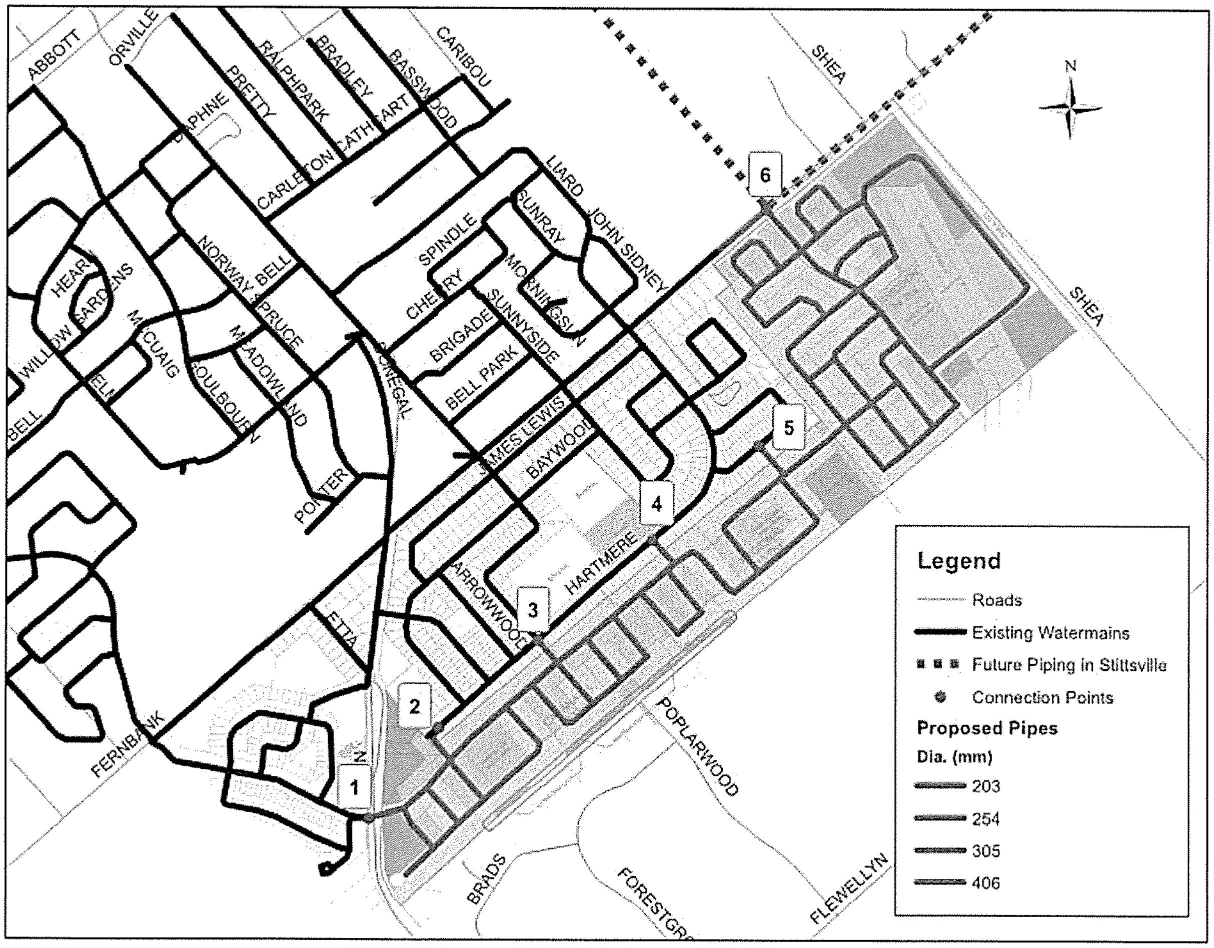
Figure 1-2: Ground Elevations (m) in Area of Proposed Development



1.3 PREVIOUS STUDIES

In 2014, Stantec performed a Zone Level hydraulic analysis for Stittsville Area 6 where the criteria described in the 2013 Water Master Plan (WMP) was used to estimate water demands for the entire development. The resulting proposed watermain network is shown in **Figure 1-3** along with the connection points of Area 6 to the existing water distribution system. Pipes within the proposed network are made up of 305mm, 250mm and 203mm in diameter.

Figure 1-3: Connection Points of Area 6 to Existing Watermains from Stantec 2014 Report



Hydraulic modelling showed that the proposed pipe sizing and alignment was capable of providing domestic demand and the City's Objective fire flow of 10,000 L/min while maintaining pressures in accordance to the City Guidelines except for one location. This location is the dead-end located in the southwest (cul-de-sac) of the development which was capable of achieving 7,000 L/min of flow. Additionally, since this location has a ground elevation greater than 124.5m, it resulted in minimum pressures slightly below the City's objective of 40 psi during peak hour demands. It was recommended that oversized services and plumbing be considered for this location to achieve minimum pressures of 40 psi. Constraints of multi-storey buildings located in areas of high elevations should also be considered accordingly to avoid low pressure on the higher storeys.

During analysis of Phase 3 which was modeled under future 2031 conditions, it was noted that the typical operating pressures are anticipated to exceed the objective limit of 80 psi in the lands with lower elevations. Areas with ground elevations less than 106m are expected to experience pressures greater than 80 psi and require pressure reducing measures to be in accordance with the Ontario Plumbing.

1.4 PHASING & PROPOSED PIPING

Area 6 is currently proposed to be developed in 3 phases (**Figure 1-4**). Phase 1 and 2 are currently in the detailed design stage while Phase 3 is not expected to be developed in the short term and not included in this latest servicing analysis.

Phase 1 - the Cavanagh lands includes

- a connection to the existing 250mm diameter watermain on West Ridge Dr. (point 1);
- a connection the existing 203mm diameter watermain on Hartsmere Dr. (point 2).

Phase 2 - Regional lands and Bell Lands west of Cavanagh Lands includes

- an extension of 300mm diameter watermain along Arrowwood Dr. (point 3);
- a connection to the existing 203mm diameter watermain on Hartsmere Dr. (point 4); and
- a connection to the existing 203mm diameter watermain on Friendly Cres. (point 5).

Phase 3 - Davidson Lands (to be developed in future phases)

- construction of a small section of 400mm diameter pipe to connect point 6 to the existing watermain on Fernbank; this extension would represent a portion of the extended future 400mm diameter watermain along Fernbank Road towards Shea Road.

Figure 1-4: Phasing Plan

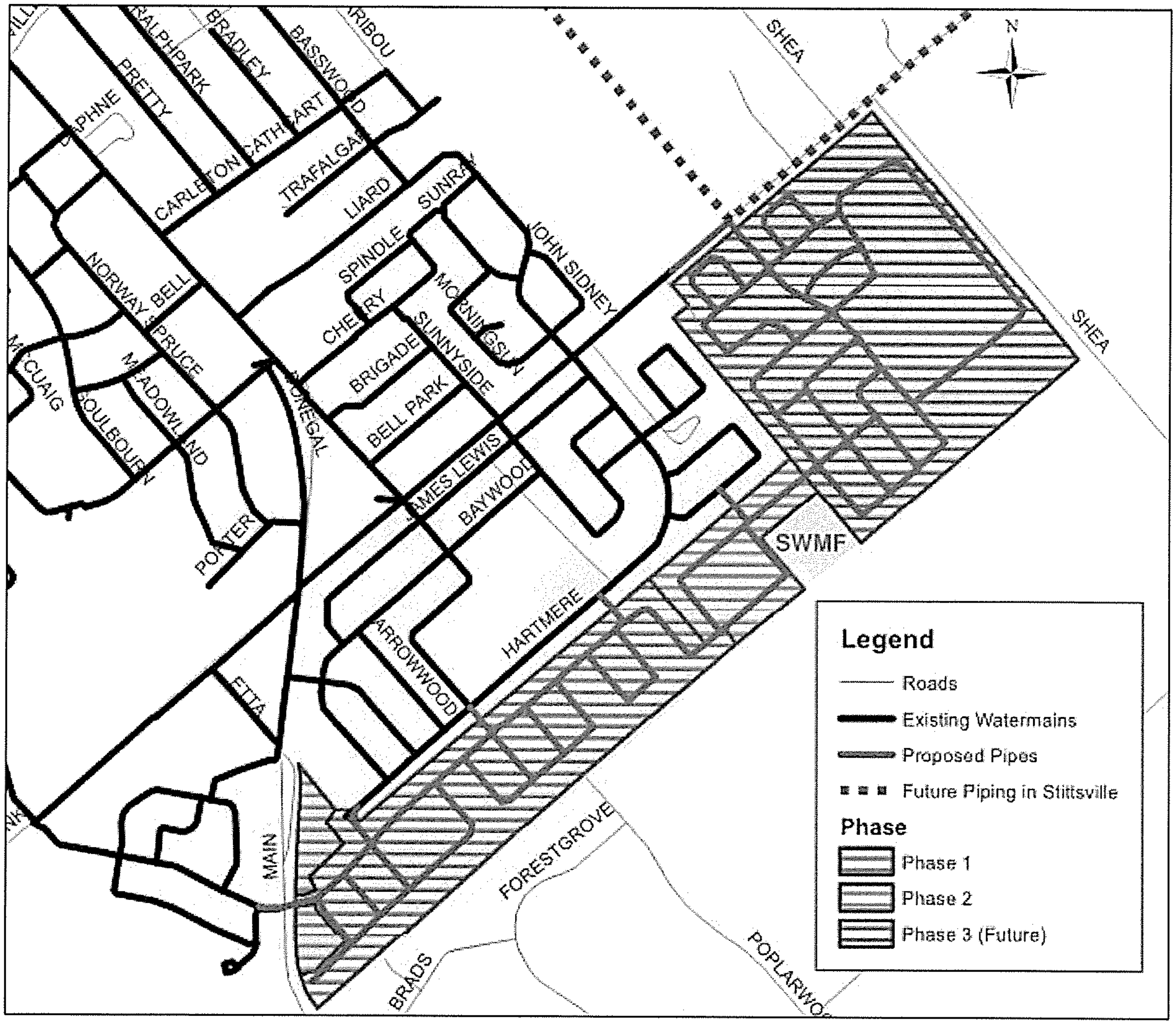


Figure 1-5 shows the connection points of the development to the existing watermain network and the connection from Phase 2 to the future development (Phase 3) on the east side of Area 6 (denoted as connection "F"). It should be noted that the watermain from connection 3 into the development (along Arrowwood Drive) as shown in **Figure 1-6** was previously proposed to be a 305mm diameter pipe (refer to **Figure 1-3**) but has been revised to 250mm and 203mm pipes to avoid oversized piping. Additionally, to increase the and minimum pressures during peak hour and fire flow at the cul-de-sac location, the surrounding pipes are recommended to be upsized from 203mm to 250mm diameter watermains.

Figure 1-5: Connection Points to Existing System and Future Development

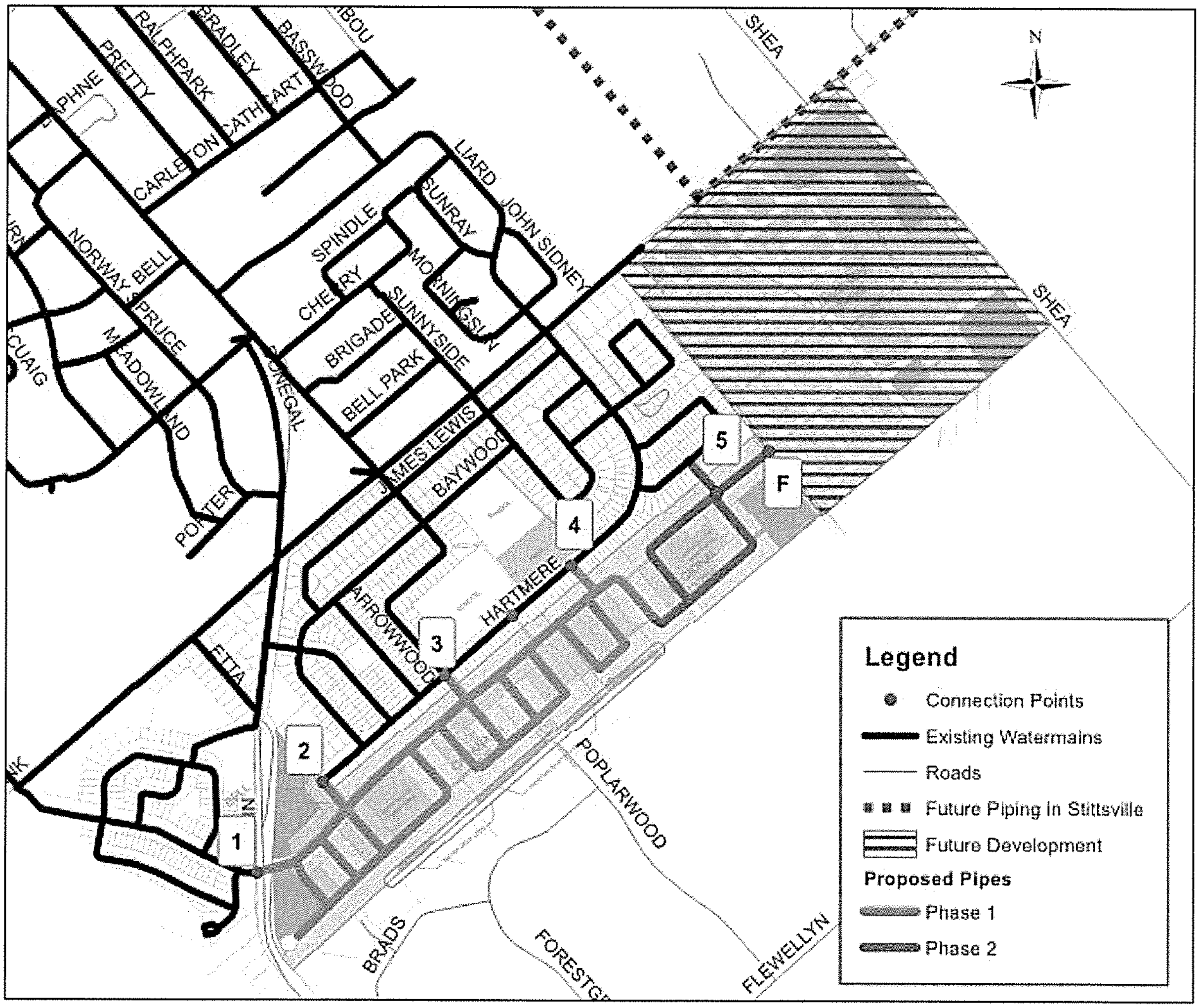
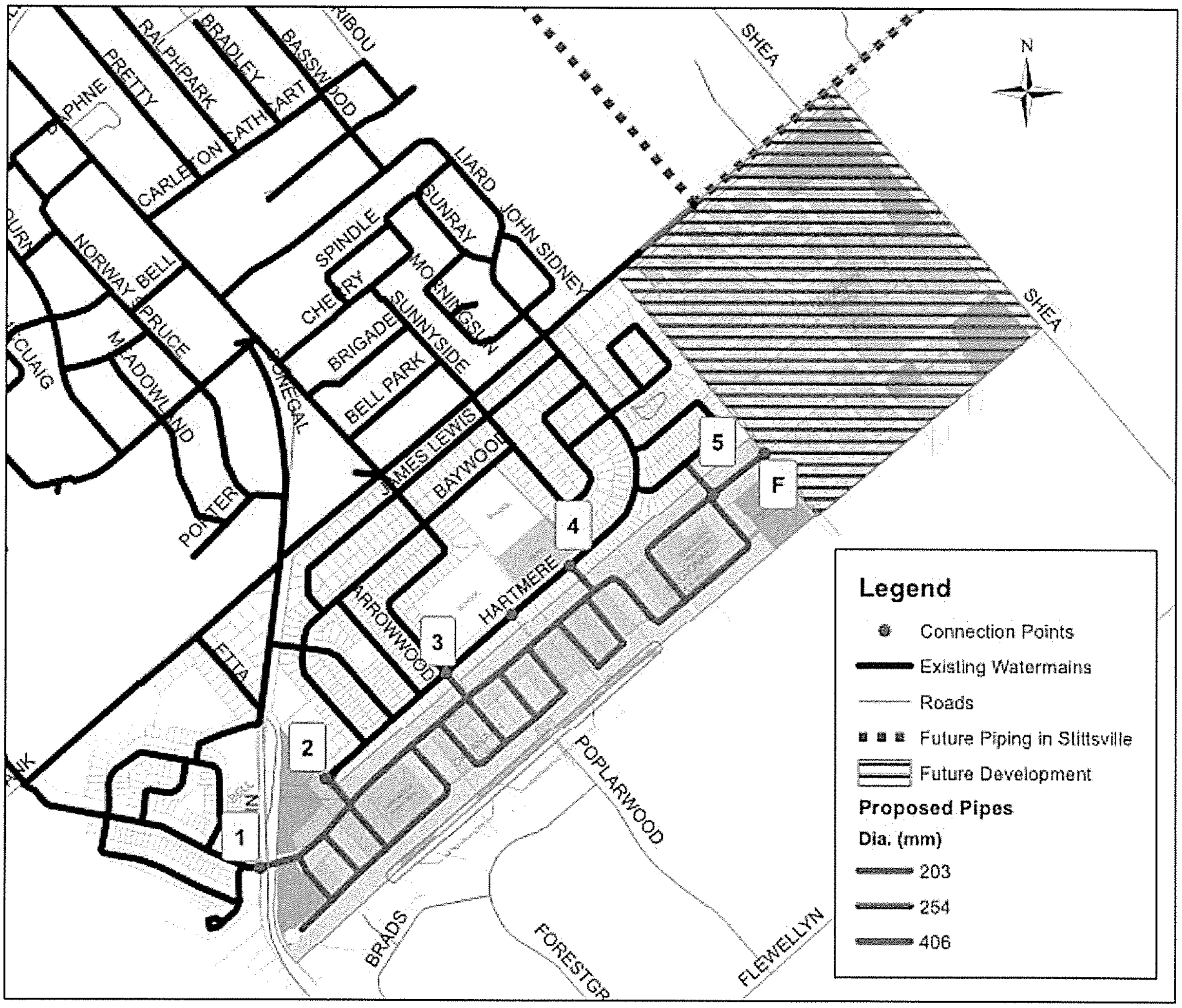


Figure 1-6: Proposed Piping Sizing and Alignment



2.0 SERVICEABILITY

2.1 ALLOWABLE PRESSURES

The City of Ottawa Water Distribution Design Guidelines state that the design objective for system pressures under normal demand conditions (i.e. average day, maximum day and peak hour) is in the range of 40 to 80 psi at the ground elevation in the streets (i.e. at hydrant level). The maximum pressure at any point in the distribution system is 100 psi; however, as per the Ontario Building/Plumbing Code, pressure relief measures are required for services when pressures greater than 80 psi are anticipated. Under emergency fire flow conditions, the minimum pressure in the distribution system is allowed to drop to 20 psi.

Multi-storey residential buildings require an additional 5 psi for every additional storey over two storeys to account for the change in elevation head and some additional headloss. For example, the minimum pressure required for a two-storey building is 40 psi whereas a three-storey building requires at least 45 psi and a four-storey building requires at least 50 psi. This is to account for the difference in elevation and additional pipe headloss.

2.2 FIRE FLOWS

The City of Ottawa requires new developments to demonstrate that the proposed watermain network can achieve the Fire Underwriters Survey (FUS) fire flow objective (using the long form calculation). The City's Technical Bulletin ISDTB-2014-02 specifies the type of development and condition that allow fire flow requirements to be capped at 10,000L/min.

Novatech has confirmed that the maximum fire flow requirement that would be required based on the planned development is 10,000L/min. FUS calculations are presented in **Appendix A**. This report assesses the ability of the network to attain a fire flow of 10,000L/min throughout the network.

3.0 WATER DEMANDS

The City of Ottawa's Water Design Guidelines were used for estimate the water demands of Phase 1 and 2 as they are in the detailed design stage of development. The average day (AVDY) demands were estimated using a residential consumption rate of 350 L/cap/d and population densities based on various unit types. **Table 3-1** shows the unit count and estimated population. For parks, a water consumption rate of 1,000L/d was applied. **Table 3-2** shows the total park area for Phase 1 and 2 and its corresponding water demand.

Maximum day (MXDY) demands were estimated by multiplying AVDY demands by a factor of 2.5 and peak hourly (PKHR) demands were estimated by multiplying MXDY demands by a factor of 2.2. **Table 3-3** shows the estimated water demands for each phase where the latest plans for Phase 1 and 2 calls for a total **650** units and an estimated population of **1,903.**

Table 3-1: Estimated Residential Population based on Unit Types

Phase	Unit Type	Persons/Unit	Units	Population
1	Single Family	3.4	269	914
	Town Houses	2.7	126	341
	Phase 1 Total		***395***	***1,256***
2	Single Family	3.4	69	235
	Town Houses	2.7	34	92
	Apartments	2.1	152	320
	Phase 2 Total		***255***	***647***
			650	***1,903***

Table 3-2: Non-Residential Areas

Phase	Non-Residential	Area (ha)	Demand (L/s)
1	Park	1.33	0.77
2		0.82	0.47

Table 3-3: Estimated Water Demand

Phase	Population	BSDY (L/s)	MXDY (L/s)	PKHR (L/s)
1	1,256	5.08	12.71	27.96
2	1,903	7.70	19.25	42.34

4.0 HYDRAULIC MODELLING RESULTS

4.1 HYDRAULIC MODEL SET-UP

With the permission of the City, Stantec performed the hydraulic analysis using the City's 2013 Water Master Plan (WMP) model. Stantec assessed the anticipated pressures in the Area 6 development and reviewed potential upgrades/upsizing of existing watermains (if any) in order to meet minimum servicing requirements.

The software package used to carry out the analysis was H_2OMAP Water by Innovyze. The model was tested under three different domestic demand conditions: basic day (BSDY), peak hour (PKHR) and one emergency condition: maximum day plus fire (MXDY+FF). For the analysis herein, Stantec adjusted the previous model that was used for the 2014 hydraulic analysis to correspond to the updated changes of Phase 1 and 2.

New watermains were added to the hydraulic model to simulate the proposed distribution system. Hazen-Williams coefficients ("C-Factors") were applied to the new watermain in accordance with the City of Ottawa's Water Distribution Design Guidelines (**Table 4-1**):

Table 4-1: C-Factors Used for Applied Watermain Based on Pipe Diameter

Pipe Diameter (mm)	C-Factor
150	100
200 to 300	110
350 to 600	120
> 600	130

4.2 BASIC DAY AND PEAK HOUR DEMANDS

Steady-state modelling under 2013 (existing) conditions was used to model basic day and peak hour scenarios. **Table 4-2** shows the pressure observed during hydraulic modelling under BSDY and PKHR demands. It can be seen that maximum pressures do not exceed the City's objective of 80 psi in Phase 1 and 2.

During the previous 2014 study, one location within Area 6 with a ground elevation greater than 124m (cul-de-sac) was susceptible to minimum pressure marginally below 40 psi under peak hour. As such for this analysis herein, the pipes surrounding this area were upsized from 200mm to 250mm diameter watermains to increase the minimum pressures to the City's objective. Hydraulic modelling results show that in doing so, the minimum pressure at the cul-de-sac is at 40 psi and satisfies the City's guidelines. It is recommended that pressure testing be performed to confirm that pressures to not drop below 40 psi in this location.

Table 4-2: Residual Pressure during BSDY and PKHR Demands

Phase	BSDY	PKHR
	Max. Pressure (psi)	Min. Pressure (psi)
1	72	40
2	76	40

Multi-storey buildings require an additional 5 psi for every additional storey over two storeys to account for the change in elevation head and additional headloss. Based on a resulting minimum hydraulic gradeline of 153m under peak demand conditions in Area 6, the following are the "cut-off" elevations for various multiple storey buildings, above which, pressures would fall below the minimum pressure guideline objective:

Two storeys: ground elev. greater than 124.5m results in pressures less than 40 psi.
Three storeys: ground elev. greater than 121.0m results in equivalent pressures less than 40 psi.
Four storeys: ground elev. greater than 117.5m results in equivalent pressures less than 40 psi.

4.3 MAXIMUM DAY + FIRE FLOW

The City of Ottawa's design guidelines for water distribution systems require a minimum pressure of 20 psi to be maintained at all points in the distribution system under a condition of maximum day and fire flow demand. A hydraulic analysis was accomplished using a steady-state maximum day demand scenario along with the automated fire flow simulation feature of the software.

During 2013 conditions for Phase 1 and 2, the proposed network was able to supply fire flows greater than 10,000 L/min while maintaining a residual pressure of 20 psi at all locations in Area 6 except one location in the southwest of the development. This location was modelled as a dead-end and the available fire flow was approximately 8,000 L/min at a residual pressure of 20 psi. However, the latest site plan shows this area is anticipated to service single family homes and as per the FUS fire flow calculated for this unit type, the required fire flow is 8,000 L/min (**Appendix A**). See **Appendix B** for available fire flows as each location.

5.0 CONCLUSION

The proposed mixed residential development is located in an area of the City's water distribution system that has sufficient capacity to provide both the required domestic and emergency fire flows to the majority of the service area using the proposed piping alignment and sizing proposed.

During existing conditions, Phases 1 and 2 are expected to operate in objective range of 40 - 80 psi under BSDY and PKHR demands. It is recommended, however, that the dead-end location (cul-de-sac) located in the southwest portion of the development be checked for pressures to confirm minimum pressures do not drop below 40 psi.

A fire flow analysis was performed and it was determined that a fire flow greater than 10,000 L/min is achievable at all locations except for one dead-end located in the southwest portion of the development. Site plans show that location is anticipated to service single family homes and will require an FUS fire flow of 8,000L/min which is achievable.

Appendix A FUS FIRE FLOW CALCULATIONS

NOVATECH ENGINEERING CONSULTANTS LTD. ENGINEERS & PLANNERS

Fire Flow Calculations - Towns (w/o Party Walls) (6 Unit Row)

As per Fire Underwriter's Survey Guidelines

PROJECT: Area 6 Lands **DATE: Aug 2015**
JOB#: 113004

C	**Coefficient related to type of construction**	[yes/no]			
	◆ Wood frame	y	1.5		
	◆ Ordinary construction		1		
	◆ Non-combustible construction		0.8		
	◆ Fire resistive construction (< 2 hrs)		0.7		
	◆ Fire resistive construction (> 2 hrs)		0.6		
	◆ Interpolation (Using FUS Tables)				
A	**Area of structure considered (m^2) ***	***1,200***	<==>	12,917 ft^2	
	(All floors excluding Basement, under 2-Storeys)				
F	**Required fire flow (L/min)**				
	$F = 220\ C\ (A)^{0.5}$			***11,432 L/min***	
	Occupancy hazard reduction of surcharge	[yes/no]			
	◆ Non-combustible	y	-25%		
	◆ Limited combustible		-15%		
	◆ Combustible		0%		
	◆ Free burning		15%		
	◆ Rapid burning		25%		
				8,574 L/min	(1)
	Sprinkler Reduction				
	◆ Non-combustible - Fire Resistive (3	no	50%	***0 L/min***	(2)

Exposure surcharge (cumulative (%), 2 sides)	[yes/no]			
0 - 3 m	yes	25%	2 side	50%
3.1 - 10 m		20%		
10.1 - 20 m	yes	15%	1 side	15%
20.1 - 30 m	yes	10%	1 side	10%
30.1- 45 m		5%		
		Cumulative Total		**75%**
				6,430 L/min

Fire Wall Separation	N/A		
◆ Number of Party Walls * 1000 L/min			
(As per City of Ottawa Standard)		***6,430 L/min***	(3)

REQUIRED FIRE FLOW [(1) - (2) + (3)]		***15,000 L/min***
(2,000 L/min < Fire Flow < 45,000 L/min)	*or*	***250 L/s***
	or	***3,303 IGPM***

BY: *Adam Lambros*

* Largest Block Size

NOVATECH ENGINEERING CONSULTANTS LTD. ENGINEERS & PLANNERS

Fire Flow Calculations - Towns (w/o Party Walls) (Blocks 344&343)

As per Fire Underwriter's Survey Guidelines

PROJECT: Area 6 Lands **DATE: Aug 2015**
JOB#: 113004

C	**Coefficient related to type of construction**	[yes/no]			
	◆ Wood frame	y	1.5		
	◆ Ordinary construction		1		
	◆ Non-combustible construction		0.8		
	◆ Fire resistive construction (< 2 hrs)		0.7		
	◆ Fire resistive construction (> 2 hrs)		0.6		
	◆ Interpolation (Using FUS Tables)				
A	**Area of structure considered (m^2) *** *(All floors excluding Basement, under 2-Storeys)*	***1,000***	<==>	10,764 ft^2	
F	**Required fire flow (L/min)**				
	$F = 220\ C\ (A)^{0.5}$			***10,436 L/min***	
	Occupancy hazard reduction of surcharge	[yes/no]			
	◆ Non-combustible	y	-25%		
	◆ Limited combustible		-15%		
	◆ Combustible		0%		
	◆ Free burning		15%		
	◆ Rapid burning		25%		
				7,827 L/min	(1)
	Sprinkler Reduction				
	◆ Non-combustible - Fire Resistive (3	no	50%	***0 L/min***	(2)
	Exposure surcharge (cumulative (%), 2 sides)	[yes/no]			
	0 - 3 m	yes	25%	1 side 25%	
	3.1 - 10 m	yes	20%	1 side 20%	
	10.1 - 20 m		15%		
	20.1 - 30 m	yes	10%	1 side 10%	
	30.1- 45 m	yes	5%	1 side 5%	
			Cumulative Total	**60%**	
				4,696 L/min	
	Fire Wall Separation	N/A			
	◆ Number of Party Walls * 1000 L/min				
	(As per City of Ottawa Standard)			***4,696 L/min***	(3)

REQUIRED FIRE FLOW [(1) - (2) + (3)]		***13,000 L/min***
(2,000 L/min < Fire Flow < 45,000 L/min)	***or***	***216.67 L/s***
	or	***2,862 IGPM***

BY: *Adam Lambros*

* Largest Block Size

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ENGINEERS & PLANNERS

Fire Flow Calculations - Single Residential Unit (At Cul-De-Sac)

As per Fire Underwriter's Survey Guidelines

PROJECT: Area 6 Lands **DATE: Aug 2015**
JOB#: 113004

C	**Coefficient related to type of construction**	[yes/no]			
	• Wood frame	y	1.5		
	• Ordinary construction		1		
	• Non-combustible construction		0.8		
	• Fire resistive construction (< 2 hrs)		0.7		
	• Fire resistive construction (> 2 hrs)		0.6		
	• Interpolation (Using FUS Tables)				
A	**Area of structure considered (m^2) ***	***360***	<==>	3,875 ft^2	
	(All floors excluding Basement, under 2-Storeys)				
F	**Required fire flow (L/min)**				
	$F = 220\ C\ (A)^{0.5}$			***6,261 L/min***	
	Occupancy hazard reduction of surcharge	[yes/no]			
	• Non-combustible	y	-25%		
	• Limited combustible		-15%		
	• Combustible		0%		
	• Free burning		15%		
	• Rapid burning		25%		
				4,696 L/min	(1)
	Sprinkler Reduction				
	• Non-combustible - Fire Resistive (3	no	50%	***0 L/min***	(2)
	Exposure surcharge (cumulative (%), 2 sides)	[yes/no]			
	0 - 3 m	yes	25%	2 side 50%	
	3.1 - 10 m		20%		
	10.1 - 20 m		15%		
	20.1 - 30 m		10%		
	30.1- 45 m	yes	5%	2 side 10%	
			Cumulative Total	**60%**	
				2,818 L/min	
	Fire Wall Separation	N/A			
	• Number of Party Walls * 1000 L/min				
	(As per City of Ottawa Standard)			***2,818 L/min***	(3)

REQUIRED FIRE FLOW [(1) - (2) + (3)]		***8,000 L/min***
(2,000 L/min < Fire Flow < 45,000 L/min)	***or***	***133.33 L/s***
	or	***1,761 IGPM***

BY: *Adam Lambros*

* Largest Size Unit

NOVATECH ENGINEERING CONSULTANTS LTD. ENGINEERS & PLANNERS

Fire Flow Calculations - Single Residential Unit (3,000sqft +)

As per Fire Underwriter's Survey Guidelines

PROJECT: Area 6 Lands **DATE: Aug 2015**
JOB#: 113004

C	**Coefficient related to type of construction**	[yes/no]			
	• Wood frame	y	1.5		
	• Ordinary construction		1		
	• Non-combustible construction		0.8		
	• Fire resistive construction (< 2 hrs)		0.7		
	• Fire resistive construction (> 2 hrs)		0.6		
	• Interpolation (Using FUS Tables)				
A	**Area of structure considered (m^2) ***	***360***	<==>	3,875 ft^2	
	(All floors excluding Basement, under 2-Storeys)				
F	**Required fire flow (L/min)**				
	F = 220 C $(A)^{0.5}$			***6,261 L/min***	
	Occupancy hazard reduction of surcharge	[yes/no]			
	• Non-combustible	y	-25%		
	• Limited combustible		-15%		
	• Combustible		0%		
	• Free burning		15%		
	• Rapid burning		25%		
				4,696 L/min	(1)
	Sprinkler Reduction				
	• Non-combustible - Fire Resistive (3	no	50%	***0 L/min***	(2)
	Exposure surcharge (cumulative (%), 2 sides)	[yes/no]			
	0 - 3 m	yes	25%	2 side 50%	
	3.1 - 10 m		20%		
	10.1 - 20 m	yes	15%	1 side 15%	
	20.1 - 30 m	yes	10%	1 side 10%	
	30.1- 45 m		5%		
			Cumulative Total	**75%**	
				3,522 L/min	
	Fire Wall Separation	N/A			
	• Number of Party Walls * 1000 L/min				
	(As per City of Ottawa Standard)			***3,522 L/min***	(3)

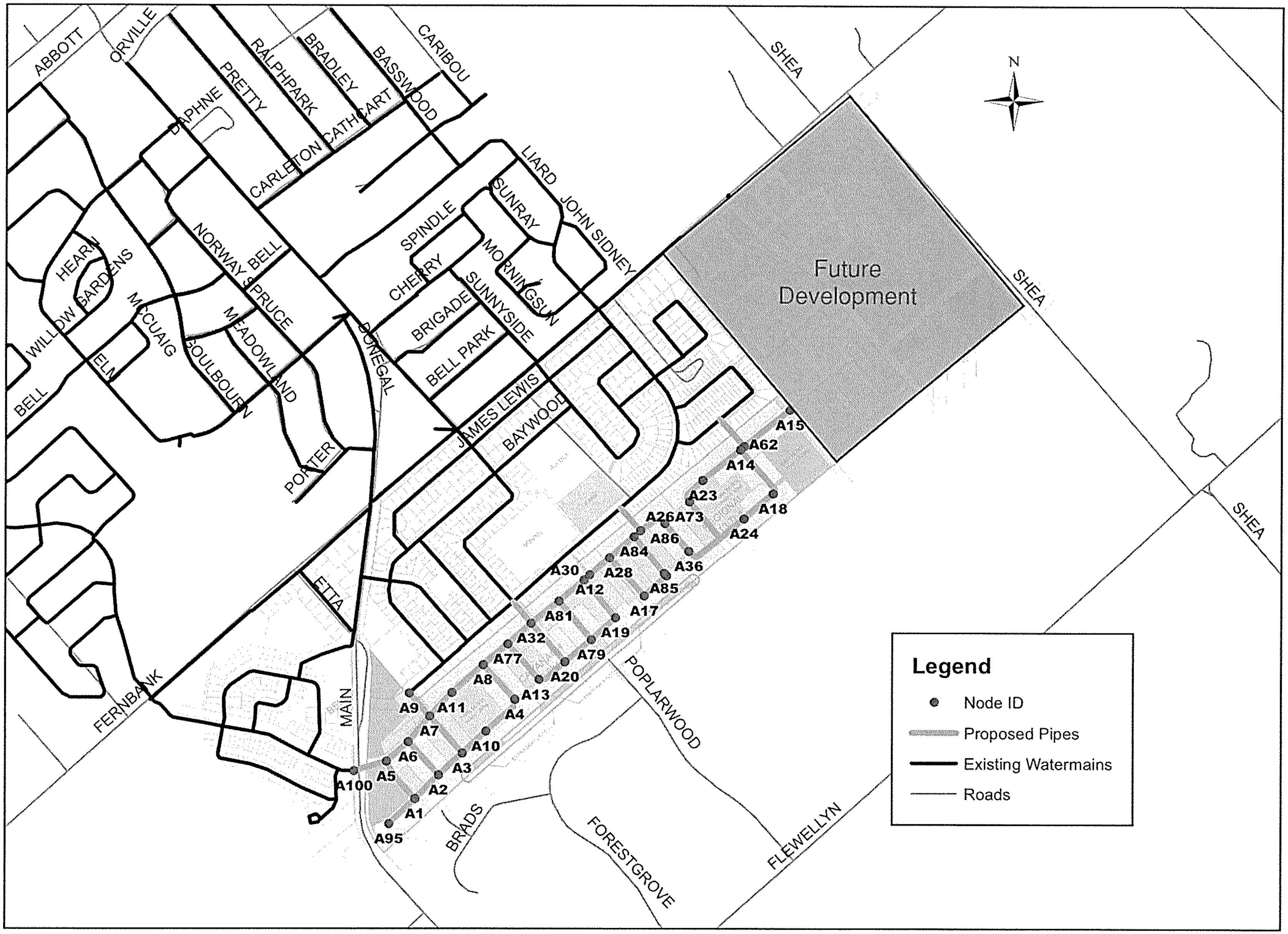
REQUIRED FIRE FLOW [(1) - (2) + (3)]		***8,000 L/min***
(2,000 L/min < Fire Flow < 45,000 L/min)	*or*	***133.33 L/s***
	or	***1,761 IGPM***

BY: *Adam Lambros*

* Largest Unit Size

Appendix B HYDRAULIC MODELLING RESULTS

Figure B-1: Node IDs



PHASE 1

ID	BSDY Demand (L/s)	BSDY Elevation (m)	BSDY Head (m)	BSDY Pressure (psi)	PKHR Demand (L/s)	PKHR Elevation (m)	PKHR Head (m)	PKHR Pressure (psi)
A100	0.195	124.0	160.7	52	1.075	124.0	153.3	42
A6	0.195	122.2	160.7	55	1.075	122.2	153.3	44
A3	0.195	118.3	160.7	60	1.075	118.3	153.3	50
A10	0.385	117.4	160.7	62	0.385	117.4	153.3	51
A7	0.195	119.0	160.7	59	1.075	119.0	153.3	49
A11	0.385	116.8	160.7	62	0.385	116.8	153.3	52
A4	0.195	115.9	160.7	64	1.075	115.9	153.3	53
A13	0.195	113.5	160.7	67	1.075	113.5	153.3	57
A8	0.195	114.6	160.7	66	1.075	114.6	153.3	55
A77	0.195	113.5	160.7	67	1.075	113.5	153.3	57
A20	0.195	112.5	160.7	69	1.075	112.5	153.3	58
A79	0.195	112.6	160.7	68	1.075	112.6	153.3	58
A19	0.195	111.8	160.7	70	1.075	111.8	153.3	59
A32	0.195	112.9	160.7	68	1.075	112.9	153.3	57
A81	0.195	112.7	160.7	68	1.075	112.7	153.3	58
A30	0.195	111.7	160.7	70	1.075	111.7	153.3	59
A28	0.195	110.9	160.7	71	1.075	110.9	153.3	60
A17	0.195	110.5	160.7	71	1.075	110.5	153.3	61
A22	0.195	110.2	160.7	72	1.075	110.2	153.3	61
A26	0.195	111.8	160.7	70	1.075	111.8	153.3	59
A84	0.195	111.8	160.7	70	1.075	111.8	153.3	59
A85	0.195	110.2	160.7	72	1.075	110.2	153.3	61
A86	0.195	111.0	160.7	71	1.075	111.0	153.3	60
A36*	0.195	110.0	160.7	72	1.075	110.0	153.3	62
A12	0.195	111.7	160.7	70	1.075	111.7	153.3	59
A1	0.195	121.0	160.7	56	1.075	121.0	153.3	46
A2	0.195	119.0	160.7	59	1.075	119.0	153.3	49
A95**	0.195	125.0	160.7	51	1.075	125.0	153.3	40
A5	0.055	123.2	160.7	53	0.056	123.2	153.3	43
A9	0.055	119.1	160.7	59	0.056	119.1	153.3	49

*Node A36 is a connection to Phase 2; does remain a dead-end
**Node A95 is a dead-end located southwest of the development

PHASE 1
MXDY+FF

ID	Static Demand (L/s)	Static Pressure (psi)	Static Head (m)	Fire-Flow Demand (Lpm)	Residual Pressure (psi)	Available Flow at Hydrant (Lpm)	Available Flow Pressure (psi)
A1	0.489	49	155.4	10,000	23	13,000	20
A10	0.385	54	155.4	10,000	27	13,000	20
A100	0.489	45	155.4	10,000	24	13,000	20
A11	0.385	55	155.4	10,000	35	16,000	20
A12	0.489	62	155.4	10,000	42	17,000	20
A13	0.489	60	155.4	10,000	35	15,000	20
A17	0.489	64	155.4	10,000	33	13,000	20
A19	0.489	62	155.4	10,000	37	15,000	20
A2	0.489	52	155.4	10,000	29	15,000	20
A20	0.489	61	155.4	10,000	40	16,000	20
A22	0.489	64	155.4	10,000	33	13,000	20
A26	0.489	62	155.4	10,000	40	16,000	20
A28	0.489	63	155.4	10,000	42	17,000	20
A3	0.489	53	155.4	10,000	30	15,000	20
A30	0.489	62	155.4	10,000	42	18,000	20
A32	0.489	60	155.4	10,000	43	19,000	20
A36*	0.489	65	155.4	10,000	17	12,000	20
A4	0.489	56	155.4	10,000	29	13,000	20
A5	0.056	46	155.4	10,000	26	13,000	20
A6	0.489	47	155.4	10,000	27	14,000	20
A7	0.489	52	155.4	10,000	33	16,000	20
A77	0.489	60	155.4	10,000	41	18,000	20
A79	0.489	61	155.4	10,000	39	16,000	20
A8	0.489	58	155.4	10,000	39	17,000	20
A81	0.489	61	155.4	10,000	42	18,000	20
A84	0.489	62	155.4	10,000	40	16,000	20
A85	0.489	64	155.4	10,000	34	13,000	20
A86	0.489	63	155.4	10,000	36	14,000	20
A9	0.056	52	155.4	10,000	31	15,000	20
A95**	0.489	43	155.4	10,000	-2	8,000	20

*Node A36 is a connection to Phase 2; does remain a dead-end
**Node A95 is a dead-end located southwest of the development

PHASE 2

ID	BSDY				PKHR			
	Demand (L/s)	Elevation (m)	Head (m)	Pressure (psi)	Demand (L/s)	Elevation (m)	Head (m)	Pressure (psi)
A100	0.195	124.0	160.7	52	1.075	124.0	152.9	41
A6	0.195	122.2	160.7	55	1.075	122.2	152.9	44
A3	0.195	118.3	160.7	60	1.075	118.3	152.9	49
A10	0.385	117.4	160.7	62	0.385	117.4	152.9	50
A7	0.195	119.0	160.7	59	1.075	119.0	152.9	48
A11	0.385	116.8	160.7	62	0.385	116.8	152.9	51
A4	0.195	115.9	160.7	64	1.075	115.9	152.9	53
A13	0.195	113.5	160.7	67	1.075	113.5	152.9	56
A8	0.195	114.6	160.7	66	1.075	114.6	152.9	54
A77	0.195	113.5	160.7	67	1.075	113.5	152.9	56
A20	0.195	112.5	160.7	69	1.075	112.5	152.9	57
A79	0.195	112.6	160.7	68	1.075	112.6	152.9	57
A19	0.195	111.8	160.7	69	1.075	111.8	152.9	58
A32	0.195	112.9	160.7	68	1.075	112.9	152.9	57
A81	0.195	112.7	160.7	68	1.075	112.7	152.9	57
A30	0.195	111.7	160.7	70	1.075	111.7	152.9	59
A28	0.195	110.9	160.7	71	1.075	110.9	152.9	60
A17	0.195	110.5	160.7	71	1.075	110.5	152.9	60
A22	0.195	110.2	160.7	72	1.075	110.2	152.9	61
A26	0.195	111.8	160.7	69	1.075	111.8	152.9	58
A84	0.195	111.8	160.7	69	1.075	111.8	152.9	58
A85	0.195	110.2	160.7	72	1.075	110.2	152.9	61
A86	0.195	111.0	160.7	71	1.075	111.0	152.9	59
A36	0.195	110.0	160.7	72	1.075	110.0	152.9	61
A12	0.195	111.7	160.7	70	1.075	111.7	152.9	59
A1	0.195	121.0	160.7	56	1.075	121.0	152.9	45
A2	0.195	119.0	160.7	59	1.075	119.0	152.9	48
A95**	0.195	125.0	160.7	51	1.075	125.0	152.9	40
A5	0.647	123.2	160.7	53	3.556	123.2	152.9	42
A9	0.647	119.1	160.7	59	3.556	119.1	152.9	48
A24	0.237	107.7	160.7	75	0.237	107.7	152.8	64
A73	0.264	110.6	160.7	71	1.454	110.6	152.8	60
A23	0.237	109.4	160.7	73	0.237	109.4	152.8	62
A18	0.264	107.0	160.7	76	1.454	107.0	152.8	65
A62	0.264	107.7	160.7	75	1.454	107.7	152.9	64
A14	0.264	108.9	160.7	74	1.454	108.9	152.9	62
A15	0	107.5	160.7	76	0.061	107.5	152.9	64
A21	0.264	109.6	160.7	73	1.454	109.6	152.8	61

**Node A95 is a dead-end located southwest of the development

PHASE 2
MXDY+FF

ID	Static Demand (L/s)	Static Pressure (psi)	Static Head (m)	Fire-Flow Demand (Lpm)	Residual Pressure (psi)	Available Flow at Hydrant (Lpm)	Available Flow Pressure (psi)
A1	0.489	49	155.3	10,000	30	13,000	20
A10	0.385	54	155.3	10,000	31	13,000	20
A100	0.489	44	155.3	10,000	27	12,000	20
A11	0.385	55	155.3	10,000	38	16,000	20
A12	0.489	62	155.2	10,000	45	17,000	20
A13	0.489	59	155.3	10,000	38	15,000	20
A14	0.661	66	155.2	10,000	42	15,000	20
A15	0	68	155.2	10,000	33	12,000	20
A17	0.489	64	155.2	10,000	37	13,000	20
A18	0.661	69	155.2	10,000	43	15,000	20
A19	0.489	62	155.2	10,000	40	15,000	20
A2	0.489	52	155.3	10,000	34	14,000	20
A20	0.489	61	155.3	10,000	43	16,000	20
A21	0.489	65	155.2	10,000	41	15,000	20
A22	0.237	64	155.2	10,000	37	13,000	20
A23	0.237	65	155.2	10,000	34	12,000	20
A24	0.489	68	155.2	10,000	42	15,000	20
A26	0.489	62	155.2	10,000	44	17,000	20
A28	0.489	63	155.2	10,000	45	17,000	20
A3	0.489	52	155.3	10,000	35	15,000	20
A30	0.489	62	155.2	10,000	45	18,000	20
A32	0.489	60	155.3	10,000	46	19,000	20
A36	0.489	64	155.2	10,000	42	15,000	20
A4	1.616	56	155.3	10,000	32	13,000	20
A5	0.489	46	155.3	10,000	29	13,000	20
A6	0.661	47	155.3	10,000	30	13,000	20
A62	0.489	68	155.2	10,000	44	15,000	20
A7	0.661	52	155.3	10,000	36	15,000	20
A73	0.489	63	155.2	10,000	32	12,000	20
A77	0.489	59	155.3	10,000	44	18,000	20
A79	0.489	61	155.3	10,000	42	16,000	20
A8	0.489	58	155.3	10,000	42	17,000	20
A81	0.489	61	155.3	10,000	45	18,000	20
A84	0.489	62	155.2	10,000	44	17,000	20
A85	0.489	64	155.2	10,000	37	13,000	20
A86	1.616	63	155.2	10,000	43	16,000	20
A9	0.489	51	155.3	10,000	34	14,000	20
A95**	0.489	43	155.3	10,000	5.1	8,000	20

**Node A95 is a dead-end located southwest of the development

2 WATER SUPPLY

2.1 Existing Conditions

The proposed development is located within the service area of Pressure Zone 3W of the City of Ottawa water distribution system. The zone is fed by the Glen Cairn and Campeau Drive Pump Stations, both of which are remote from the site. Balancing storage during peak and fire flow conditions is provided by the Stittsville Elevated Tank. There are several existing watermains adjacent to the site including 200 mm diameter watermains on both Fernbank Road and Friendly Crescent and a 200 mm diameter watermain in Fernbank Road, west of the site. As part of the development of the adjacent Stittsville South lands a 250 mm watermain will be extended along Hickstead Drive which extends to Street No. 3 in Phase 1. **Figure 2.1** shows the location of the existing Water Plan adjacent to the site.

2.2 Serviceability Study

A conceptual water plan for the Stittsville South Area 6 area was included in the 2013 MSR study. A copy of the recommended plan, Watermain Concept Plan – Figure 6.1 from that report is included in **Appendix A**. The main elements of the recommended plan for the subject site include an extension of the proposed 250 mm diameter main spine through the subject site from the west (Regional Lands) and connecting to the existing watermain on Fernbank Road to the north.

2.3 Design Criteria

2.3.1 Water Demands

Water demands have been calculated for the full development including Phase 1. Per unit population density and consumption rates are taken from Tables 4.1 and 4.2 at the Ottawa Design Guidelines – Water Distribution and are summarized as follows:

- Single Family 3.4 person per unit
- Townhouse and Semi-Detached 2.7 person per unit
- Average Apartment 1.8 person per unit
- Residential Average Day Demand 350 l/cap/day
- Residential Peak Daily Demand 875 l/cap/day
- Residential Peak Hour Demand 1,925 l/cap/day
- ICI Average Day Demand 50,000 l/gross ha/day
- ICI Peak Daily Demand 75,000 l/gross ha/day
- ICI Peak Hour Demand 135,000 l/gross ha/day

Residential units in Phase 1 consist of single family, semi-detached and street townhouses. A future commercial site which is not part of this development is located at the north corner of the site adjacent to Fernbank and Shea Roads, the water demands for this site is included in the design. A watermain demand calculation sheet is included in **Appendix A** and the total water demands are summarized as follows:

	Full Development	**Phase 1**
• Average Day	10.85 l/s	6.39 l/s
• Maximum Day	25.53 l/s	14.39 l/s
• Peak Hour	55.25 l/s	30.76 l/s

2.3.2 System Pressure

The Ottawa Design Guidelines – Water Distribution (WDG001), July 2010, City of Ottawa, Clause 4.2.2 states that the preferred practice for design of a new distribution system is to have normal operating pressures range between 345 kPa (50 psi) and 552 kPa (80 psi) under maximum daily flow conditions. Other pressure criteria identified in Clause 4.2.2 of the guidelines are as follows:

Minimum Pressure	Minimum system pressure under peak hour demand conditions shall not be less than 276 kPa (40 psi)
Fire Flow	During the period of maximum day demand, the system pressure shall not be less than 140 kPa (20 psi) during a fire flow event.
Maximum Pressure	Maximum pressure at any point in the distribution system shall not exceed 689 kPa (100 psi). In accordance with the Ontario Building/Plumbing Code, the maximum pressure should not exceed 552 kPa (80 psi). Pressure reduction controls will be required for buildings where it is not possible/feasible to maintain the system pressure below 552 kPa.

2.3.3 Fire Flow Rates

The Fire Underwriters Survey (FUS) method of calculating fire flow requirements is to be used in accordance with the Ottawa Design Guidelines – Water Distribution. In the FUS method, wood frame buildings with separations less than three meters are considered one fire area. Buildings in the Davidson Lands Development are wood frame buildings, with separation less than three meters. An example is on Street No. 11 between lots 73 and 81 in which the 9 single family lots all have separations less than three meters thus making one fire area. A FUS calculation for this area is included in **Appendix A.** The calculations predict that the fire flow requirement needs to be 22,000 l/min which is impractical to supply with local watermains.

In the recent Technical Bulletin 'ISDTB-2014-02, Revisions to Ottawa Design Guidelines – Water', the fire flow requirements for single detached dwellings and traditional town and row houses can be capped at 10,000 l/min provided that there is a minimum separation of 10 meters between the backs of adjacent units and that the town and row house blocks are limited to 600 square meters of building areas and seven dwelling units. Since the residential units in the Davidson Lands meet the requirements of ISDTB-2014-02, the fire flow rate of 10,000 l/min (166.7 l/s) is used in the fire flow analysis.

There are no details for the future commercial site at the north of the development. Since the site is bisected by the Hydro One corridor there is a limit on the size of the building that can be placed on the site therefore a fire flow rate of 12,000 l/min (200 l/s) for the external commercial development is used in our fire flow analysis.

2.3.4 Boundary Conditions

The City of Ottawa has provided hydraulic boundary conditions at two locations; one at the existing main on Fernbank Road at Hartsmere Drive and the other at the southwest intersection of Friendly Crescent and Hartsmere Drive. Two separate conditions were given for the max day plus fire scenario, one for the 167 l/s residential fire flow and a separate one for the 200 l/s commercial fire flow. A copy of the boundary conditions is included in **Appendix A** and summarized as follows:

	CONNECTION 1 FERNBANK ROAD	CONNECTION 2 FRIENDLY CRESCENT
Max HGL (Basic Day)	160.4 m	160.4 m
Peak Hour	151.1 m	150.8 m
Max Day + Fire (167 l/s Fire Flow)	142.3 m	135.2 m
Max Day + Fire (200 l/s Fire Flow)	137.5m	127.8 m

2.3.5 Hydraulic Model

A computer model for the overall Davidson Lands along with a separate model 1 containing only Phase 1 has been developed using the H20 MAP Version 6.0 program produced by MWH Soft Inc. The model includes the existing watermains and boundary conditions at Fernbank Road and Friendly Crescent.

2.4 Proposed Water Plan

2.4.1 Modeling Results

The hydraulic model was run under basic day, maximum day with fire flows and under peak hour conditions for the overall development and Phase 1 only. Water pipes are sized to provide sufficient pressure and to deliver the required fire flows. During the design stage all mains are tested at the minimum 150 mm diameter size, while the pressure criteria is met with the minimum sized mains the fire flow requirement is not achieved at all locations. The main sizes are increased in an iterative process until the fire flow results are sufficient for both the overall sub-division and Phase 1.

Results of the hydraulic model are include in **Appendix A** and summarized as follows:

Scenario	Overall	Phase 1 Only
Basic Day (Max HGL) Pressure Range	454.5 to 534.8 kPa	459.5 to 535.9 kPa
Peak Hour Pressure Range	359.6 to 438.4 kPa	367.1 to 440.9 kPa
Max Day + 167 l/s Fire Flow Minimum Flow	163.9 l/s	150.5 l/s
Max Day + 200 l/s Fire Flow Minimum Flow	247.3 l/s	208.8 l/s

A comparison of the results and design criteria is summarized as follows:

Maximum Pressure	All notes in both analysis have basic day pressures under 552 kPa, therefore pressure reducing control is not required for this development.
Minimum Pressure	All nodes in the model exceed the minimum value of 276 kPa (40 psi).

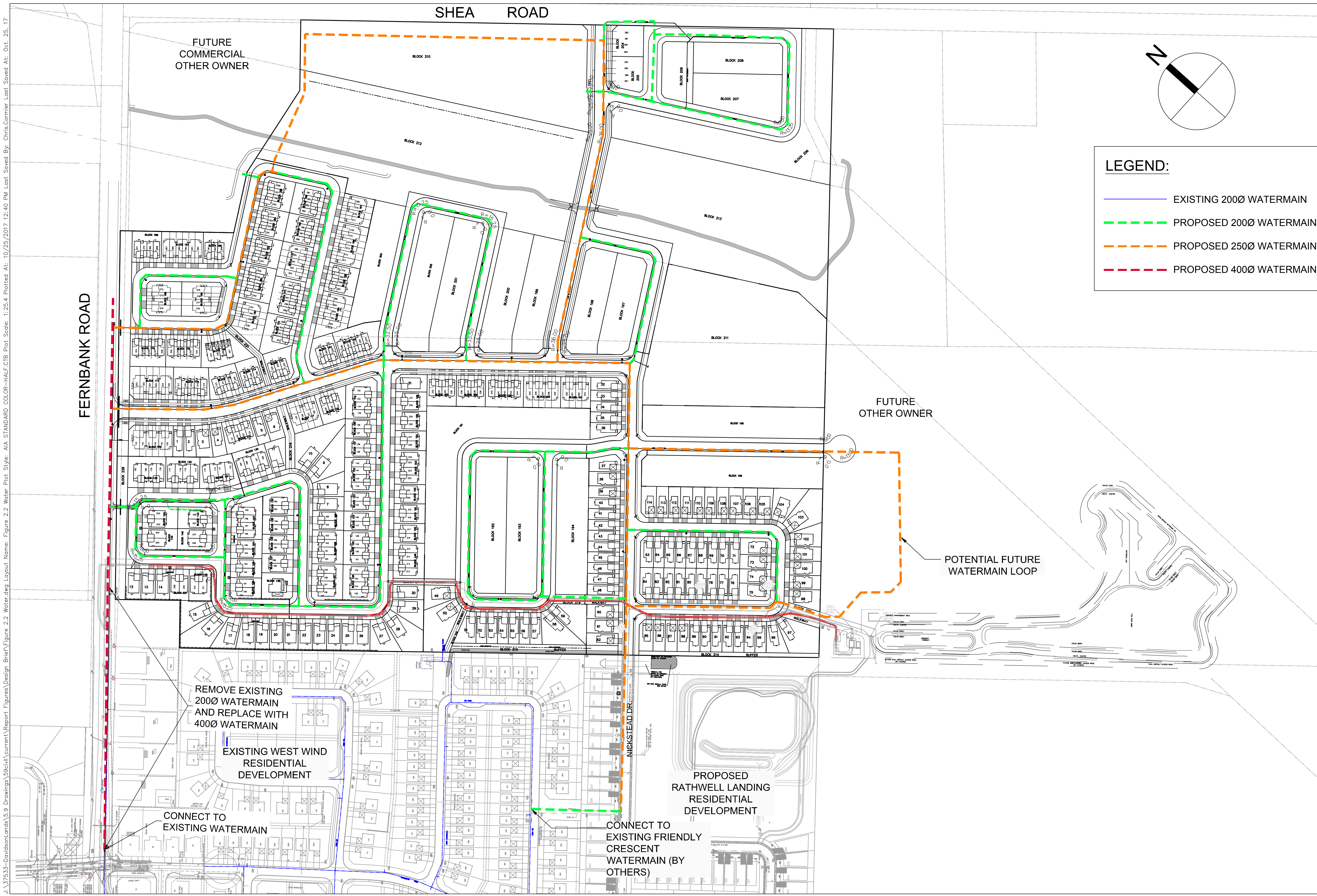
Fire Flow	All residential nodes exceed the fire flow requirement of 166.7 l/s in the overall development. The fire flow for the commercial site exceeds the 200 l/s requirement using the boundary condition for the 200 l/s flow. Under the Phase 1 analysis, there is one location at Node J24 at the south intersection of Maygrass Way and Kayenta Street where the fire flow is less than the requirement. The Phase 1 fire flow at Node 24 is 150.5 l/s which is within 90% of the 166.7 l/s requirement, the fire flow at this node increases to 204.0 l/s when the adjacent Phase 2 is constructed.

2.4.2 Watermain Layout

Figure 2.2 shows the proposed Water Plan for both Phase 1 and the balance of the sub-division.

In the 2013 MSR, a 400 mm watermain is proposed on Fernbank Road along the frontage of the Davidson Lands connecting to an existing 200 mm watermain that is shown on Figure 2.1. With the boundary conditions provided at Fernbank and Hartsmere Drive as shown in Section 2.3.4., the fire flows in the site range from 99.4 l/s to 146.4 l/s, in order to achieve the required fire flows the existing 200 mm watermain is required to be replaced and the 400 mm watermain will be extended to Hartsmere Drive.

A 250 mm watermain will be extended from the adjacent Stittsville South development along Hickstead Way and Edenwylde Drive to connect to the 400 mm main on Fernbank Road. For Phase 1 a second connection is required to the 400 mm main on Fernbank Road that will extend through Kayenta Street which is part of Phase 2. In order to service future Phases 2 and 3, a 250 mm watermain is required to connect to the 400 mm watermain on Fernbank Road at Jardiniere Street, this 250 mm main will, in a future phase cross the hydro corridor and a 250 mm main will be extended along Cosanti Drive connecting to the 250 mm main on Edenwylde Drive.



Scale: N.T.S.

Project Title: DESIGN BRIEF DAVIDSON LANDS-OPA 76 AREA 6a PHASE 1 STITTSVILLE SOUTH

Drawing Title: PROPOSED WATER PLAN

Sheet No. FIGURE 2.2

APPENDIX D

STORMWATER

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January 30, 2023 Project Number: P2267

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

Attention: **Kevin Murphy, P.Eng.**

Subject: **Caivan – Stittsville Lands (5993, 6070 & 6115 Flewellyn Road): Pre-Development Hydraulic and Hydrologic Study**

Introduction

As set out in the Terms of References for the Caivan Stittsville Lands (5993, 6070 & 6115 Flewellyn Road), drafted by David Schaeffer Engineering Ltd (DSEL) on June 9, 2022, the pre-development hydraulic and hydrologic conditions of the proposed development site are required to be assessed. The following memo will assess the existing major flow patterns within and around the site, and outline the findings of a detailed pre-development water budget analysis based on hydrologic modelling using site-based soil data and historical rainfall data.

Site Overview

The subject lands are bound by Flewellyn Road to the south, Shea Road to the east, an existing urban subdivision development to the north (Stittsville South – Area 6) and an estate lot subdivision to the west. The area is also bisected by the Faulkner Municipal Drain and a Hydro One power transmission corridor. For this study, the overall development area has been broken into two sections (referred to as east and west) bisected by the municipal drain and hydro corridor. The property parcel of 5993 Flewellyn Road (east) is cleared of trees and vegetation, while the west parcels (comprising 6070 & 6115 Flewellyn Road) are treed with patches of grassed areas. **Figure 1** provides an overview of the development site relative to the Faulkner drain and major roads.

Pre-Development Drainage

1m LiDAR flown in 2020 by the City of Ottawa has been obtained to determine the existing primary flow patterns within the site. This topographic data was imported into GIS software with watershed delineation tools applied to determine the drainage areas and primary flow paths within the site. **Figure 2** provides an overview of the primary existing subwatersheds and flow paths within the site.

From this analysis, it is seen that for the eastern lands, the site primarily consists of 2 major drainage areas both of which discharge to the Faulkner Drain on Flewellyn Road. For the west property, the drainage patterns are slightly more complex but approximately half of the lands discharge to the Faulkner Drain on Flewellyn road, while the remaining half discharges to the Faulkner drain which divides the east and west properties. Note that there is no external drainage area that flows across either site.

Legend

Development Area

Municipal Drain

SCALE: 1:6000

0 100 200 300 m

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Figure 1: Site Overview

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Figure 2: Existing Drainage Patterns

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Pre-Development Water Budget Analysis

A continuous SWMHYMO model has been developed to assess the site's pre-development water budget. This model makes use of site-based infiltration testing results as well as local climatic conditions, the following sections outline each of these items in detail.

Soil Infiltration / CN

Paterson Group completed Guelph Permeameter testing throughout the site, to determine the site's soil infiltration rates. From this analysis, soils were tested at both shallow depths (approximately 0.3 m - 0.5 m below ground) and deeper depths (0.5 m >). Based on Paterson's site testing the majority of the site consist of Brown Silty Sand to Sandy Silt with some localized pockets of silty clay with sand. Overall the site was found to have soil infiltration rates in the range of **26 mm/hr** to **76 mm/hr.** The localized infiltration results of this testing have been mapped in GIS and an inverse distance weighting algorithm was applied to provide a complete infiltration map of the site, **Figure 3** provides an overview of this mapping. A full summary of Paterson's site infiltration testing can be found in **Attachment A**. Based on Paterson's Site investigation the soils present are considered a "Type C" hydrologic soil group.

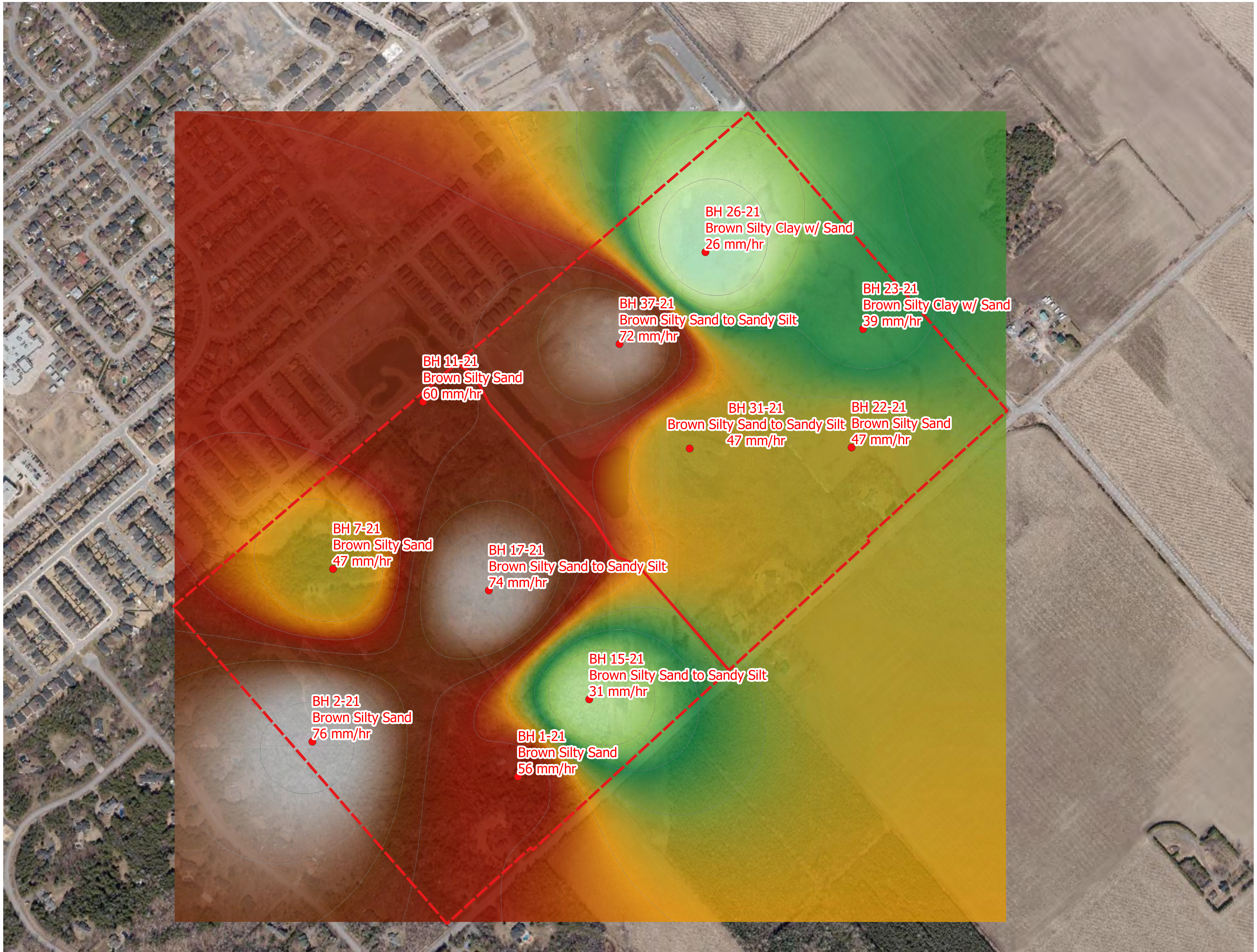
The latest available (2021) aerial mapping for the City of Ottawa was used to discretize the various land use conditions throughout the development site. **Figure B1** in **Attachment B** provides a visual overview of the study area. This land use data was merged with the underlying soil types to derive a Curve Number (CN), based on applicable values outlined in Tables A2 and A3 in the SWMHYMO Manual. Each Curve Number was then weighted based on the total area within a given subcatchment to determine the weighted CN for that subcatchment, see **Table B1** in **Attachment B**. Based on this analysis the site has a CN* of **65** and **61** for the lands East and West of the Faulkner Drain respectively.

Time to Peak

The time-to-peak values have been calculated based on existing topography using the City of Ottawa LiDAR. Flow paths have been discretized based on the topographic data using GIS tools and the longest major flow path was identified; **Figure B2** in **Attachment B** outlines the flow path discretization. The upstream and downstream topographic elevations and flow lengths were identified and used in the calculations. For this natural subcatchment, the Federal Aviation Administration (FFA) method was determined to be the most appropriate method to calculate the Time to Peak. **Table B2 in Attachment B** provides full details of these calculations, along with other time-to-peak values using alternative t_p calculation methods.

Continuous Simulations

A continuous SWMHYMO model was developed to assess the site's water budget under pre-development conditions. 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 evaporation, infiltration and runoff volumes from the subject site were computed and compared. Note that this rain gauge is generally only operational for the months of April-November. Outside of this window precipitation is more likely to be in the form of snowfall and the soils are also more likely to be frozen, making it difficult to simulate such conditions with a hydrologic model using conventional City parameters, as such, this period has not been considered in the analysis.



Legend

N

- Development Area
- Infiltration Locations

Infiltration (mm/hr)

- 25.00
- 30.00
- 35.00
- 40.00
- 45.00
- 50.00
- 55.00
- 60.00
- 65.00
- 70.00
- 75.00
- 80.00

SCALE: 1:6000

0 100 200 300 m

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Figure 3: Infiltration

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Simulation Results

The complete SWMHYMO modelling input and output files have been provided in **Attachment B**. **Table B3** provides the full summary of the SWMHYMO modelling, based on the 39 years of data, and outlines the maximum, minimum and average volumes and percentages of precipitation that evaporate infiltrate and runs off the site, **Table 1** below is an excerpt this summary.

Table 1: Pre-Development Water Budget based on Continuous Simulations

Precipitation (mm)	Evaporation		Infiltration		Runoff	
	(mm)	(%)	(mm)	(%)	(mm)	(%)
589.1	370.7	63%	116.9	20%	101.6	17%

Based on the continuous simulations using 39 years of historical rainfall data it was determined that for the total development site, approximately **17%** of the annual rainfall will result in runoff, **63%** will evaporate and **20%** will infiltrate.

Existing Hydraulic Conditions

Robinson Consulting Inc completed an updated hydraulic model of the Faulkner Drain as a part of their December 2020 *"Amendment to the Engineer's Report for the Faulkner Municipal Drain"*. As a part of this study, modifications were proposed to the existing Faulkner Municipal Drain which included relocating a portion of the drain, lowering the drain profile, and modifying the cross-section of the drain to increase the capacity and reduce the potential for erosion of the steep banks. This study also considered the upgrading/replacement of 3 culverts within the drain. At the time of drafting this memo, these updates are either completed or currently under construction, as such can be reflective of current conditions.

Based on Table 4.2 of the Robinsons report there are three existing culverts that act as residential entrances on Flewellyn Road (Culverts 4+882.90, 5+055.00 & 5+185.40) that are either close to or have slightly less than the required capacity to safely convey the full 100-year flow. The culverts are likely controlling water levels along this portion of Flewellyn Road, as such these culverts should be revisited in the future to ensure that peak water levels are contained within the Faulkner Municipal drain.

Conclusion

In summary, a detailed topographic study has been undertaken on the site to identify all major flow paths within the development under existing conditions. From this analysis, it was found that for the eastern lands, the site primarily consists of 2 major drainage areas both of which discharge to the Faulkner Drain on Flewellyn Road. For the western lands, the drainage patterns are slightly more complex but approximately half of the lands discharge to the Faulkner Drain on Flewellyn Road, while the remaining half discharges to the Faulkner Drain where it divides the east and west properties.

Continuous hydrologic modelling has been completed which has made use of soil infiltration testing completed by Paterson Group to determine the site's predevelopment water budget. Based on this analysis it was determined that for the total development site, approximately **17%** of the annual rainfall will result in runoff, **63%** will evaporate and **20%** will infiltrate.

Based on Table 4.2 of the Robinsons report there are three existing culverts that act as residential entrances on Flewellyn Road (Culverts 4+882.90, 5+055.00 & 5+185.40) that are either close to or have slightly less than the required capacity to safely convey the full 100-year flow. The culverts are likely controlling water levels along this portion of Flewellyn Road, as such these culverts should be revisited in the future to ensure that peak water levels are contained within the Faulkner Municipal drain.

Yours truly,
J.F Sabourin and Associates Inc.

J. Burnett

LICENSED PROFESSIONAL ENGINEER
J. J. BURNETT
100227734
PROVINCE OF ONTARIO

Jonathon Burnett, B.Eng, P.Eng
Water Resources Engineer

cc: J.F Sabourin, M.Eng, P.Eng
Director of Water Resources Projects

Figures

Figure 1: Site Overview
Figure 2: Existing Drainage Patterns
Figure 3: Soil Infiltration Map

Tables

Table 1A: Existing Water Budget Summary

Attachments

Attachment A: Paterson Group Soil Infiltration Testing
Attachment B: Water Budget Analysis

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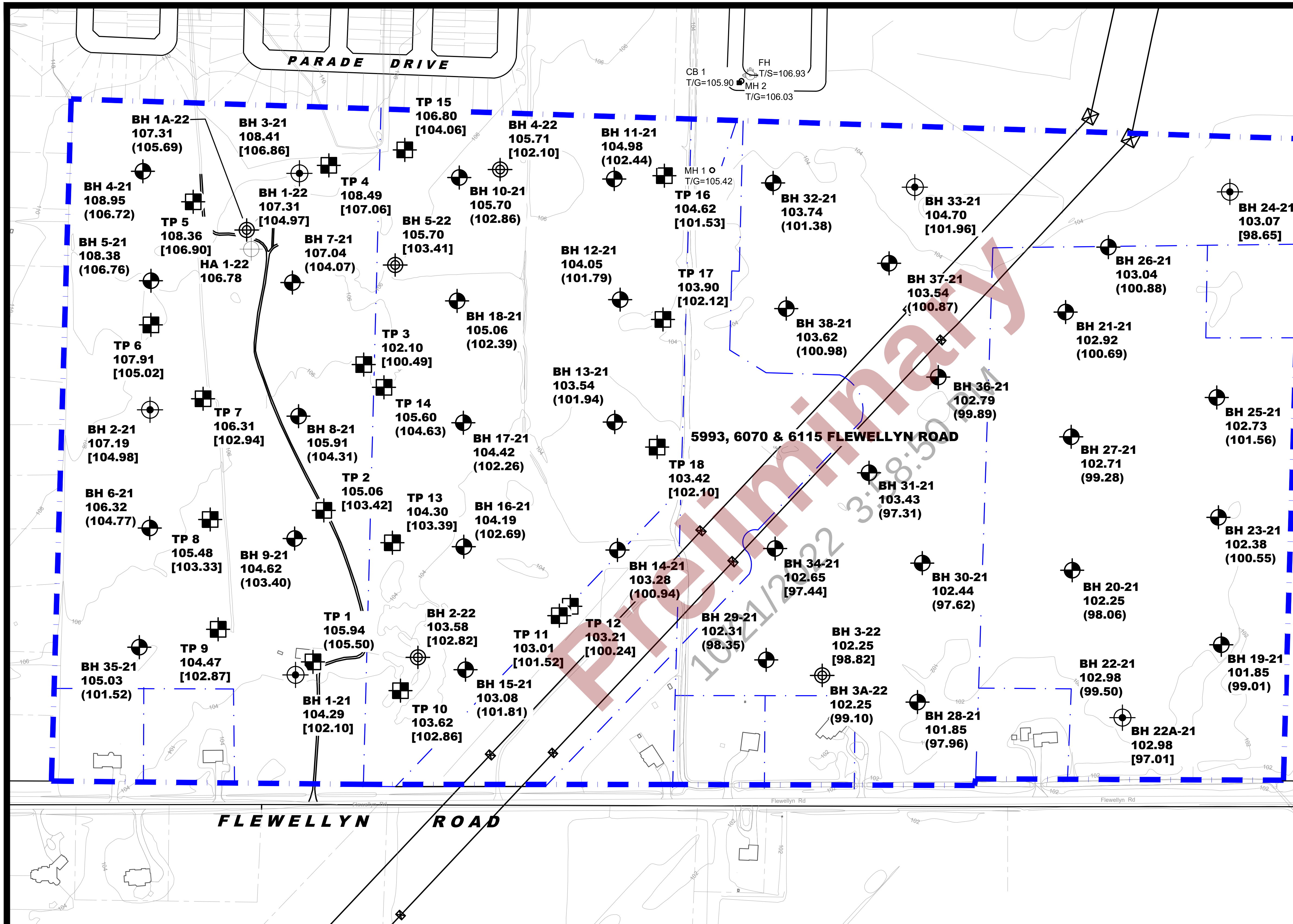
Attachment A

Paterson Group Soil infiltration Testing

Table 1 - Overburden Field Saturated Hydraulic Conductivity Results and Estimated Infiltration Rates				
Test Completed Adjacent to Borehole ID	**Infiltration Testing Elevation (m asl)**	**Material**	**K_{fs} (m/s)**	**Unfactored Infiltration Rate (mm/hr)***
BH1-21	103.90	Brown Silty Sand	2.10E-06	56
	103.63	Brown Silty Sand	1.90E-06	56
BH2-21	106.95	Brown Silty Sand	6.40E-06	76
	106.65	Brown Silty Sand	5.30E-07	39
BH7-21	106.74	Brown Silty Sand	1.10E-06	47
	106.44	Brown Silty Sand	1.60E-06	52
BH11-21	104.68	Brown Silty Sand	2.70E-06	60
	104.38	Brown Silty Sand	1.60E-06	52
BH15-21	102.70	Brown Silty Sand to Sandy Silt	2.10E-07	31
	102.48	Brown Silty Sand to Sandy Silt	≤ 8.1E-09	≤ 13
BH17-21	106.74	Brown Silty Sand to Sandy Silt	5.90E-06	74
	106.44	Brown Silty Sand to Sandy Silt	4.10E-06	67
BH22-21	102.58	Brown Silty Sand	1.10E-06	47
	102.28	Brown Silty Sand	1.60E-06	52
BH23-21	102.33	Brown Silty Clay w/ Sand	5.30E-07	39
	101.70	Brown Silty Clay	≤ 8.1E-09	≤ 13
BH26-21	102.74	Brown Silty Clay w/ Sand	1.10E-07	26
	102.44	Brown Silty Clay w/ Sand	1.10E-07	26
BH29-21	101.87	Brown Silty Sand to Sandy Silt	5.30E-07	39
	101.57	Brown Silty Sand to Sandy Silt	2.70E-07	33
BH31-21	103.19	Brown Silty Sand to Sandy Silt	1.10E-06	47
	102.89	Brown Silty Sand to Sandy Silt	1.35E-07	27
BH37-21	103.21	Brown Silty Sand to Sandy Silt	5.30E-06	72
	102.91	Brown Silty Sand to Sandy Silt	5.90E-06	74

***The infiltration rates do not include a safety correction factor. Based on our testing results, a safety correction factor can range between 2.5 to ≥ 3.5.**

PATERSON GROUP



LEGEND:

	HAND AUGER LOCATION (CURRENT INVESTIGATION)
	BOREHOLE WITH MONITORING WELL LOCATION (CURRENT INVESTIGATION)
	BOREHOLE WITH PIEZOMETER LOCATION (PATERSON GROUP REPORT; PG5570-2, JAN 20, 2022)
	BOREHOLE WITH MONITORING WELL LOCATION (PATERSON GROUP REPORT; PG5570-2, JAN 20, 2022)
	TEST PIT LOCATION\ (PATERSON GROUP REPORT; PG5570-1, JAN 3, 2021)
104.29	GROUND SURFACE ELEVATION (m)
[102.10]	BEDROCK SURFACE ELEVATION (m)
(102.39)	PRACTICAL REFUSAL TO AUGERING / EXCAVATION ELEVATION (m)

BASE PLAN PROVIDED BY KILGOUR & ASSOCIATES.

GROUND SURFACE ELEVATIONS AT BOREHOLE LOCATIONS ARE REFERENCED TO A GEODETIC DATUM.

SCALE: 1:4000

0 50 100 150 200 250m

PATERSON GROUP
9 AURIGA DRIVE
OTTAWA, ON
K2E 7S9
TEL: (613) 226-7381

NO.	REVISIONS	DATE	INITIAL
2	BH 1-22 - BH 5-22 & HA1-22 ADDED TO PLAN	10/03/2022	KP
1	BH 1-21 - BH 38-21 ADDED TO PLAN	01/20/2022	OC

CAIVAN COMMUNITIES
GEOTECHNICAL INVESTIGATION
PROPOSED RESIDENTIAL DEVELOPMENT
5993, 6070 & 6115 FLEWELLYN ROAD

OTTAWA, ONTARIO

Title:

TEST HOLE LOCATION PLAN

Scale: 1:4000	Date: 01/2022
Drawn by: JM	Report No.: PG5570-2, REVISION 1
Checked by: KP	Dwg. No.: PG5570-1
Approved by: DJG	Revision No.: 2

11x17

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Attachment B

Water Budget Analysis

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Figure B1: Land Use

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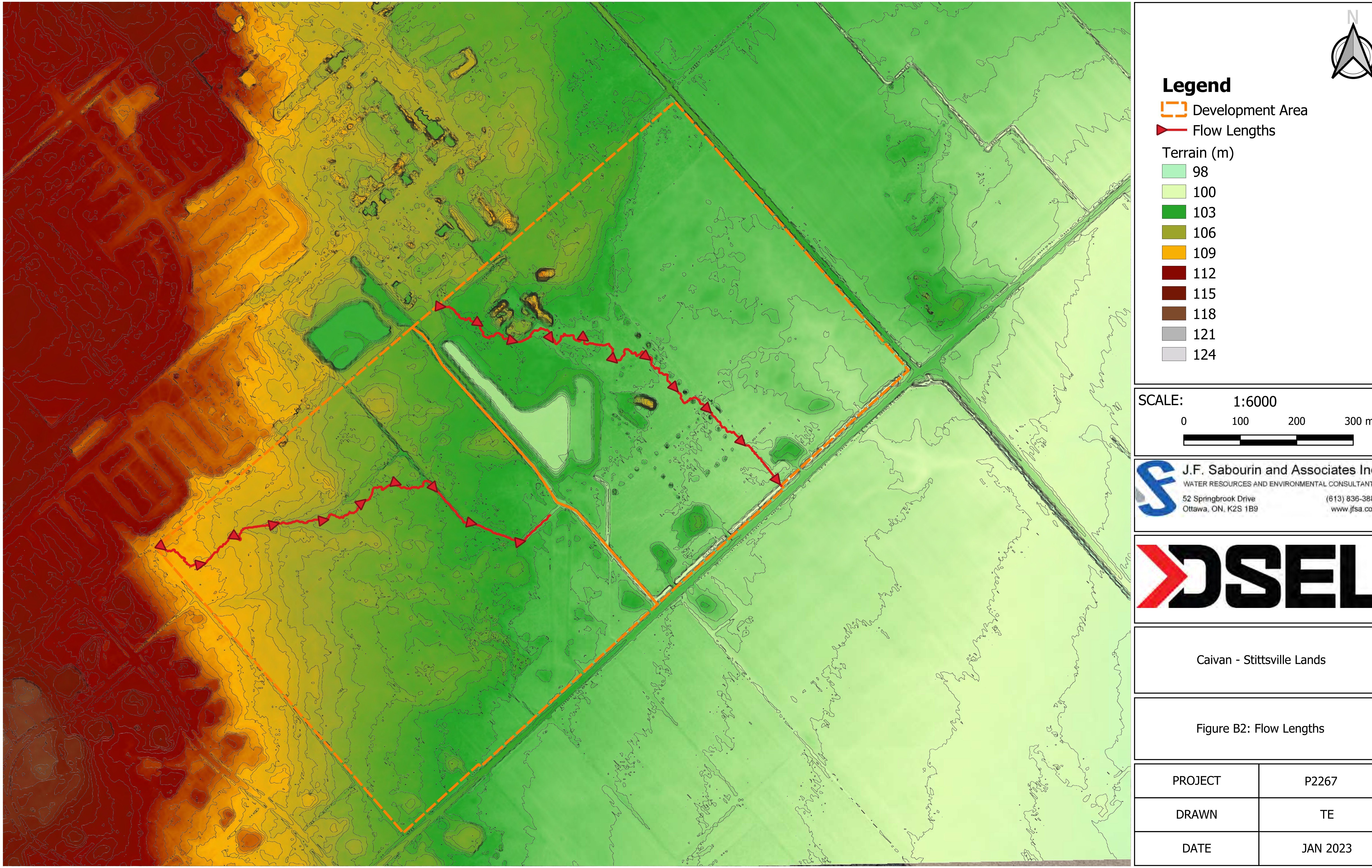

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Figure B2: Flow Lengths

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Table B1: Calculation of SCS Curve Number (CN) and Modified Curve Number (CN*)

EAST (39.345 ha)							
Area (ha)	Land Type	Soil Name	Soil Condition	Soil Group	CN	% of Catchment	Weighted CN
15.625	Urban Lawn/Shallow Rooted Crops	Fine Sandy Loam	C	Fair	79	39.7%	31.4
22.565	Pasture and Shrubs	Fine Sandy Loam	C	Fair	70	57.4%	40.1
1.155	Impervious (SWM)	Fine Sandy Loam	C	Fair	99	2.9%	2.9
						CN	**74.4**
						CN*	**65**

WEST (39.847 ha)							
Area (ha)	Land Type	Soil Name	Soil Condition	Soil Group	CN	% of Catchment	Weighted CN
24.901	Mature Forest	Fine Sandy Loam	C	Fair	73	62.5%	45.6
14.946	Pasture and Shrubs	Fine Sandy Loam	C	Fair	70	37.5%	26.3
						CN	**71.9**
						CN*	**61**

Table B2: Time to Peak Calculations

Parameter	Units	East	West
Area	ha	39.35	39.85
CN*	-	65	61
Ptotal to calc C from CN, use 2 yr 3 hr Chicago stom	P(mm)	33.2	33.2
	Ia(mm)	4.67	4.67
	RV(mm)	4.8	4.3
Ptotal to calc C from CN, use 2 yr 24 hr SCS stom	P(mm)	52.77	52.77
	RV(mm)	12.3	11.0
C (From Chicago storm)	-	0.15	0.13
C (From SCS storm)	-	0.23	0.21
Length of Channel	m	1012	976
	ft	3320	3201
Elevation of Head Water	m	104.35	109.56
	ft	342	359
Elevation of Outlet	m	100.16	102.45
	ft	329	336
Average Slope	m/m	0.41%	0.73%
	ft/ft	0.41%	0.73%
Kirpich			
Time of Concentration	mins	33	26
Time to Peak	min	22	17
Time to Peak	Hours	0.37	0.29
FAA (From Chicago storm)			
Time of Concentration	mins	133	110
Time to Peak	mins	88	73
Time to Peak	Hours	1.47	1.22
FAA (From SCS storm)			
Time of Concentration	mins	121	101
Time to Peak	mins	80	67
Time to Peak	Hours	1.34	1.12
Barnsby Williams			
Time of Concentration	mins	48	41
Time to Peak	mins	32	28
Time to Peak	Hours	0.53	0.46
SCS			
Time of Concentration	mins	199	159
Time to Peak	mins	133	106
Time to Peak	Hours	2.21	1.77
Selected Method			
FAA (From Chicago storm)			
Time to Peak	min	88	73
Time to Peak	Hours	1.47	1.22

Note:

All methods calculated as per Appendix A of the SWMHYMO manual

Time to Peak calculated as 2/3 Time of concentration

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20     Metric units / ID Numbers OFF
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*#  Project Number: [2267]
*#  Date          : [2021/12/14]
*#  Modeller      : [JB]
*#  Company       : J.F. Sabourin and Associates
*#  License #     : 2549237
*#*********************************************************************************
*#*********************************************************************************
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*%                    [""] <--storm filename, one per line for NSTORM time
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*%-----------------|---------------------------------------------------------------|
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                     Baseflow simulation parameters:
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                       SK=[0.025]/(mm), InterEventTime=[ 12 ](hrs)
                     Baseflow simulation parameters:
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                       ](mm/day/mm)
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START               TZERO=[1976.0101],  METOUT=[2],  NSTORM=[0],  NRUN=[76]
*%-----------------|-----------------------------------------------------------|
START               TZERO=[1977.0101],  METOUT=[2],  NSTORM=[0],  NRUN=[77]
*%-----------------|-----------------------------------------------------------|
START               TZERO=[1978.0101],  METOUT=[2],  NSTORM=[0],  NRUN=[78]
*%-----------------|-----------------------------------------------------------|
START               TZERO=[1979.0101],  METOUT=[2],  NSTORM=[0],  NRUN=[79]
*%-----------------|-----------------------------------------------------------|
START               TZERO=[1980.0101],  METOUT=[2],  NSTORM=[0],  NRUN=[80]
*%-----------------|-----------------------------------------------------------|
START               TZERO=[1981.0101],  METOUT=[2],  NSTORM=[0],  NRUN=[81]
*%-----------------|-----------------------------------------------------------|
START               TZERO=[1982.0101],  METOUT=[2],  NSTORM=[0],  NRUN=[82]
*%-----------------|-----------------------------------------------------------|
START               TZERO=[1983.0101],  METOUT=[2],  NSTORM=[0],  NRUN=[83]
*%-----------------|-----------------------------------------------------------|
START               TZERO=[1984.0101],  METOUT=[2],  NSTORM=[0],  NRUN=[84]
*%-----------------|-----------------------------------------------------------|
START               TZERO=[1985.0101],  METOUT=[2],  NSTORM=[0],  NRUN=[85]
*%-----------------|-----------------------------------------------------------|
START               TZERO=[1986.0101],  METOUT=[2],  NSTORM=[0],  NRUN=[86]
*%-----------------|-----------------------------------------------------------|
START               TZERO=[1987.0101],  METOUT=[2],  NSTORM=[0],  NRUN=[87]
*%-----------------|-----------------------------------------------------------|
START               TZERO=[1988.0101],  METOUT=[2],  NSTORM=[0],  NRUN=[88]
*%-----------------|-----------------------------------------------------------|
START               TZERO=[1989.0101],  METOUT=[2],  NSTORM=[0],  NRUN=[89]
*%-----------------|-----------------------------------------------------------|
START               TZERO=[1990.0101],  METOUT=[2],  NSTORM=[0],  NRUN=[90]
*%-----------------|-----------------------------------------------------------|
START               TZERO=[1991.0101],  METOUT=[2],  NSTORM=[0],  NRUN=[91]
*%-----------------|-----------------------------------------------------------|
START               TZERO=[1992.0101],  METOUT=[2],  NSTORM=[0],  NRUN=[92]
*%-----------------|-----------------------------------------------------------|
START               TZERO=[1993.0101],  METOUT=[2],  NSTORM=[0],  NRUN=[93]
*%-----------------|-----------------------------------------------------------|
START               TZERO=[1994.0101],  METOUT=[2],  NSTORM=[0],  NRUN=[94]
*%-----------------|-----------------------------------------------------------|
START               TZERO=[1995.0101],  METOUT=[2],  NSTORM=[0],  NRUN=[95]
*%-----------------|-----------------------------------------------------------|
START               TZERO=[1996.0101],  METOUT=[2],  NSTORM=[0],  NRUN=[96]
*%-----------------|-----------------------------------------------------------|
START               TZERO=[1997.0101],  METOUT=[2],  NSTORM=[0],  NRUN=[97]
*%-----------------|-----------------------------------------------------------|
START               TZERO=[1998.0101],  METOUT=[2],  NSTORM=[0],  NRUN=[98]
*%-----------------|-----------------------------------------------------------|
```

```
START               TZERO=[1999.0101],  METOUT=[2],  NSTORM=[0],  NRUN=[99]
*%-----------------|-----------------------------------------------------------|
START               TZERO=[2000.0101],  METOUT=[2],  NSTORM=[0],  NRUN=[100]
*%-----------------|-----------------------------------------------------------|
*% MISSING FROM AES RAINFALL DATA
*%START               TZERO=[2001.0101],  METOUT=[2],  NSTORM=[0],  NRUN=[101]
*%-----------------|-----------------------------------------------------------|
START               TZERO=[2002.0101],  METOUT=[2],  NSTORM=[0],  NRUN=[102]
*%-----------------|-----------------------------------------------------------|
START               TZERO=[2003.0101],  METOUT=[2],  NSTORM=[0],  NRUN=[103]
*%-----------------|-----------------------------------------------------------|
FINISH
```

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

 SSSSS   W   W   M   M   H   H   Y   Y   M   M    OOO          222     000    11   5555   =========
 S       W W W   MM MM   H   H    Y Y    MM MM   O   O           2    0   0   11   5
 SSSSS   W W W   M M M   HHHHH     Y     M M M   O   O           2    0   0   11   5      Ver 5.500
     S    W W    M   M   H   H     Y     M   M   O   O         222    0   0   11   555    FEB  2015
 SSSSS    W W    M   M   H   H     Y     M   M    OOO          2      0   0   11     5   =========
                                                               2      0   0   11     5   # 2549237
       StormWater Management HYdrologic Model                   222     000    11   555    =========

 ***************************************************************************************************
 **************************************  SWMHYMO Ver 5.500  ****************************************
 ******************  A single event and continuous hydrologic simulation model  ******************
 ******************     based on the principles of HYMO and its successors      ******************
 ******************                 OTTHYMO-83 and OTTHYMO-89.                  ******************
 ***************************************************************************************************
 ****************** Distributed by:  J.F. Sabourin and Associates Inc.          ******************
 ******************                  Ottawa,  Ontario: (613) 836-3884           ******************
 ******************                  Gatineau, Quebec: (819) 243-6858           ******************
 ******************                  E-Mail: swmhymo@jfsa.Com                   ******************
 ***************************************************************************************************

 +++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
 ++++++++++++++++++ Licensed user: JFSAinc.                                     ++++++++++++++++++
 ++++++++++++++++++                Ottawa               SERIAL#:2549237         ++++++++++++++++++
 +++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

 ***************************************************************************************************
 ******************           ++++++ PROGRAM ARRAY DIMENSIONS ++++++            ******************
 ******************           Maximum value for ID numbers  :     11            ******************
 ******************           Max. number of rainfall points: 105408            ******************
 ******************           Max. number of flow points    : 105408            ******************
 ***************************************************************************************************


 ********************************   S U M M A R Y   O U T P U T   ********************************
 ***************************************************************************************************
 *                 RUN DATE: 2023-01-25     TIME: 12:51:43     RUN COUNTER: 000842                *
 ***************************************************************************************************
 * Input   file: C:\Temp\202301-Pre_Dev-WB\STIT-Pre_v01.1-WB.dat                                   *
 * Output  file: C:\Temp\202301-Pre_Dev-WB\STIT-Pre_v01.1-WB.out                                   *
 * Summary file: C:\Temp\202301-Pre_Dev-WB\STIT-Pre_v01.1-WB.sum                                   *
 * User comments:                                                                                  *
 * 1:______________________________________________________________________________________________*
 * 2:______________________________________________________________________________________________*
 * 3:______________________________________________________________________________________________*
 ***************************************************************************************************


#******************************************************************************
#  SWMHYMO Ver:5.02/Jan 2001 <BETA> / INPUT DATA FILE
#******************************************************************************
#  Project Name  : [Caivan Stittsville West properties]
#  Project Number: [2267]
#  Date          : [2021/12/14]
#  Modeller      : [JB]
#  Company       : J.F. Sabourin and Associates
#  License #     : 2549237
#******************************************************************************
#******************************************************************************
  ** END OF RUN :   66

****************************************************************************************************





 RUN#:COMMAND#
R0067:C00001----------------------------------------------------------------------------------------
     START
      [TZERO =    .00 hrs on 19670101]
      [METOUT=   2    (1=imperial, 2=metric output)]
      [NSTORM=   0 ]
      [NRUN  = 0067 ]
#******************************************************************************
#  SWMHYMO Ver:5.02/Jan 2001 <BETA> / INPUT DATA FILE
#******************************************************************************
#  Project Name  : [Caivan Stittsville West properties]
#  Project Number: [2267]
#  Date          : [2021/12/14]
#  Modeller      : [JB]
#  Company       : J.F. Sabourin and Associates
#  License #     : 2549237
#******************************************************************************
#******************************************************************************
# Ottawa International Airport (1967 - 2003)
R0067:C00002----------------------------------------------------------------------------------------
  *  READ AES DATA
      [Filename  = 6106000.123                                                ]
      [Start_date= 1967.0101: End_date= 1967.1231]
      {DT= 60.min: Length= 3984.hrs: WetHrs=  257: DryHrs= 3727: PTOT= 386.90}
      Maximum average rainfall intensities over
        1 hr    2 hrs    3 hrs    6 hrs   12 hrs   24 hrs   36 hrs   48 hrs   72 hrs
       24.60    17.65    13.20     7.25     3.83     2.36     1.73     1.32      .90    mm/hr
       24.60    35.30    39.60    43.50    46.00    56.60    62.30    63.20    64.90    mm
      19670921 19670921 19670921 19670921 19670921 19670922 19670922 19670923 19670924  date
      Number of rainfall events per following interevent time
        1 hr    2 hrs    3 hrs    6 hrs   12 hrs   24 hrs   36 hrs   48 hrs   72 hrs
          80       65       56       40       32       29       24       20       18
      Number of events with at least the following durations
        1 hr    2 hrs    3 hrs    6 hrs   12 hrs   24 hrs   36 hrs   48 hrs   72 hrs
          79       42       29       14        3        0        0        0        0
R0067:C00003----------------------------------------------------------------------------------------
     COMPUTE API
      [APIini= 50.00: APIkdy= .9000: APIkdt= .9956]
      {APImax= 76.77: APIavg= 24.81: APImin=  3.06}
################################################################################
# Pre Development Condition - Using NASHHYD and CN
################################################################################
R0067:C00004------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:EastPre       39.35     .238 1967.0921_19:30   86.42 .223     .000
      [CN= 65.0: N= 3.00: Tp= 1.47]
      [IaREC= 6.00: SMIN= 54.78: SMAX=365.23: SK= .025]
      [InterEventTime=  12.00]
R0067:C00005------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:WestPre       39.85     .231 1967.0921_19:00   84.65 .219     .000
      [CN= 61.0: N= 3.00: Tp= 1.22]
      [IaREC= 6.00: SMIN= 64.50: SMAX=430.01: SK= .025]
      [InterEventTime=  12.00]
R0067:C00006------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ADD HYD              15.0 02:WestPre       39.85     .231 1967.0921_19:00   84.65  n/a     .000
                    +    15.0 02:EastPre       39.35     .238 1967.0921_19:30   86.42  n/a     .000
                 SUM=    15.0 01:Pre           79.20     .468 1967.0921_19:15   85.53  n/a     .000
################################################################################
# Pre Development Condition - Using NASHHYD and CN - No INFILTRATION
################################################################################
R0067:C00007------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:InfEastPre    39.35    1.023 1967.0921_18:45  173.24 .448     .000
      [CN=100.0: N= 3.00: Tp= 1.47]
      [IaREC= 6.00: SMIN=  1.39: SMAX=  9.24: SK= .025]
      [InterEventTime=  12.00]
R0067:C00008------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:InfWestPre    39.85    1.162 1967.0921_18:30  173.24 .448     .000
      [CN=100.0: N= 3.00: Tp= 1.22]
      [IaREC= 6.00: SMIN=  1.39: SMAX=  9.24: SK= .025]
      [InterEventTime=  12.00]
R0067:C00009------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ADD HYD              15.0 02:InfWestPre    39.85    1.162 1967.0921_18:30  173.24  n/a     .000
                    +    15.0 02:InfEastPre    39.35    1.023 1967.0921_18:45  173.24  n/a     .000
                 SUM=    15.0 01:InfPre        79.20    2.176 1967.0921_18:30  173.24  n/a     .000
################################################################################
# STORMS
################################################################################
  ** END OF RUN :   67

****************************************************************************************************





 RUN#:COMMAND#
R0068:C00001----------------------------------------------------------------------------------------
     START
      [TZERO =    .00 hrs on 19680101]
      [METOUT=   2    (1=imperial, 2=metric output)]
      [NSTORM=   0 ]
      [NRUN  = 0068 ]
#******************************************************************************
#  SWMHYMO Ver:5.02/Jan 2001 <BETA> / INPUT DATA FILE
#******************************************************************************
#  Project Name  : [Caivan Stittsville West properties]
#  Project Number: [2267]
#  Date          : [2021/12/14]
#  Modeller      : [JB]
#  Company       : J.F. Sabourin and Associates
#  License #     : 2549237
#******************************************************************************
#******************************************************************************
# Ottawa International Airport (1967 - 2003)
R0068:C00002----------------------------------------------------------------------------------------
  *  READ AES DATA
      [Filename  = 6106000.123                                                ]
      [Start_date= 1968.0101: End_date= 1968.1230]
      {DT= 60.min: Length= 8784.hrs: WetHrs=  413: DryHrs= 8371: PTOT= 592.80}
      Maximum average rainfall intensities over
        1 hr    2 hrs    3 hrs    6 hrs   12 hrs   24 hrs   36 hrs   48 hrs   72 hrs
       33.30    17.05    11.37     6.23     3.74     1.87     1.26      .95      .70    mm/hr
       33.30    34.10    34.10    37.40    44.90    44.90    45.40    45.40    50.20    mm
      19680817 19680817 19680817 19680808 19680817 19680818 19680817 19680808 19680820  date
      Number of rainfall events per following interevent time
        1 hr    2 hrs    3 hrs    6 hrs   12 hrs   24 hrs   36 hrs   48 hrs   72 hrs
         137      105       93       84       72       63       48       43       36
      Number of events with at least the following durations
        1 hr    2 hrs    3 hrs    6 hrs   12 hrs   24 hrs   36 hrs   48 hrs   72 hrs
         136       76       49       18        5        0        0        0        0
R0068:C00003----------------------------------------------------------------------------------------
     COMPUTE API
      [APIini= 50.00: APIkdy= .9000: APIkdt= .9956]
      {APImax= 67.52: APIavg= 16.69: APImin=   .27}
################################################################################
# Pre Development Condition - Using NASHHYD and CN
################################################################################
R0068:C00004------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:EastPre       39.35     .219 1968.0818_ 6:15  109.87 .185     .000
      [CN= 65.0: N= 3.00: Tp= 1.47]
      [IaREC= 6.00: SMIN= 54.78: SMAX=365.23: SK= .025]
      [InterEventTime=  12.00]
R0068:C00005------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:WestPre       39.85     .231 1968.0818_ 6:00  107.93 .182     .000
      [CN= 61.0: N= 3.00: Tp= 1.22]
      [IaREC= 6.00: SMIN= 64.50: SMAX=430.01: SK= .025]
      [InterEventTime=  12.00]
R0068:C00006------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ADD HYD              15.0 02:WestPre       39.85     .231 1968.0818_ 6:00  107.93  n/a     .000
                    +    15.0 02:EastPre       39.35     .219 1968.0818_ 6:15  109.87  n/a     .000
                 SUM=    15.0 01:Pre           79.20     .450 1968.0818_ 6:00  108.89  n/a     .000
################################################################################
# Pre Development Condition - Using NASHHYD and CN - No INFILTRATION
################################################################################
R0068:C00007------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:InfEastPre    39.35    1.014 1968.0818_ 6:00  236.12 .398     .000
      [CN=100.0: N= 3.00: Tp= 1.47]
      [IaREC= 6.00: SMIN=  1.39: SMAX=  9.24: SK= .025]
      [InterEventTime=  12.00]
R0068:C00008------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:InfWestPre    39.85    1.224 1968.0818_ 5:45  236.12 .398     .000
      [CN=100.0: N= 3.00: Tp= 1.22]
      [IaREC= 6.00: SMIN=  1.39: SMAX=  9.24: SK= .025]
      [InterEventTime=  12.00]
R0068:C00009------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ADD HYD              15.0 02:InfWestPre    39.85    1.224 1968.0818_ 5:45  236.12  n/a     .000
                    +    15.0 02:InfEastPre    39.35    1.014 1968.0818_ 6:00  236.12  n/a     .000
                 SUM=    15.0 01:InfPre        79.20    2.205 1968.0818_ 5:45  236.12  n/a     .000
################################################################################
# STORMS
################################################################################
  ** END OF RUN :   68

****************************************************************************************************





 RUN#:COMMAND#
R0069:C00001----------------------------------------------------------------------------------------
     START
      [TZERO =    .00 hrs on 19690101]
      [METOUT=   2    (1=imperial, 2=metric output)]
      [NSTORM=   0 ]
      [NRUN  = 0069 ]
#******************************************************************************
#  SWMHYMO Ver:5.02/Jan 2001 <BETA> / INPUT DATA FILE
#******************************************************************************
#  Project Name  : [Caivan Stittsville West properties]
#  Project Number: [2267]
#  Date          : [2021/12/14]
#  Modeller      : [JB]
#  Company       : J.F. Sabourin and Associates
#  License #     : 2549237
#******************************************************************************
#******************************************************************************
# Ottawa International Airport (1967 - 2003)
R0069:C00002----------------------------------------------------------------------------------------
  *  READ AES DATA
      [Filename  = 6106000.123                                                ]
      [Start_date= 1969.0101: End_date= 1969.1231]
      {DT= 60.min: Length= 8760.hrs: WetHrs=  469: DryHrs= 8291: PTOT= 569.80}
      Maximum average rainfall intensities over
        1 hr    2 hrs    3 hrs    6 hrs   12 hrs   24 hrs   36 hrs   48 hrs   72 hrs
       21.10    16.25    10.83     7.78     3.93     2.10     1.40     1.09      .75    mm/hr
       21.10    32.50    32.50    46.70    47.20    50.30    50.30    52.10    54.00    mm
      19690818 19690818 19690818 19690819 19690819 19690819 19690819 19690819 19690819  date
      Number of rainfall events per following interevent time
        1 hr    2 hrs    3 hrs    6 hrs   12 hrs   24 hrs   36 hrs   48 hrs   72 hrs
         157      119      107       92       72       58       49       43       32
      Number of events with at least the following durations
        1 hr    2 hrs    3 hrs    6 hrs   12 hrs   24 hrs   36 hrs   48 hrs   72 hrs
         156       84       58       21        5        0        0        0        0
R0069:C00003----------------------------------------------------------------------------------------
     COMPUTE API
      [APIini= 50.00: APIkdy= .9000: APIkdt= .9956]
      {APImax= 56.77: APIavg= 16.04: APImin=   .06}
################################################################################
# Pre Development Condition - Using NASHHYD and CN
################################################################################
R0069:C00004------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:EastPre       39.35     .215 1969.0819_ 3:00   90.65 .159     .000
      [CN= 65.0: N= 3.00: Tp= 1.47]
      [IaREC= 6.00: SMIN= 54.78: SMAX=365.23: SK= .025]
      [InterEventTime=  12.00]
R0069:C00005------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:WestPre       39.85     .223 1969.0819_ 2:45   88.71 .156     .000
      [CN= 61.0: N= 3.00: Tp= 1.22]
      [IaREC= 6.00: SMIN= 64.50: SMAX=430.01: SK= .025]
      [InterEventTime=  12.00]
R0069:C00006------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ADD HYD              15.0 02:WestPre       39.85     .223 1969.0819_ 2:45   88.71  n/a     .000
                    +    15.0 02:EastPre       39.35     .215 1969.0819_ 3:00   90.65  n/a     .000
                 SUM=    15.0 01:Pre           79.20     .436 1969.0819_ 3:00   89.68  n/a     .000
################################################################################
# Pre Development Condition - Using NASHHYD and CN - No INFILTRATION
################################################################################
R0069:C00007------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:InfEastPre    39.35     .890 1969.0818_23:00  210.71 .370     .000
      [CN=100.0: N= 3.00: Tp= 1.47]
      [IaREC= 6.00: SMIN=  1.39: SMAX=  9.24: SK= .025]
      [InterEventTime=  12.00]
R0069:C00008------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:InfWestPre    39.85    1.061 1969.0818_22:45  210.72 .370     .000
      [CN=100.0: N= 3.00: Tp= 1.22]
      [IaREC= 6.00: SMIN=  1.39: SMAX=  9.24: SK= .025]
      [InterEventTime=  12.00]
R0069:C00009------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ADD HYD              15.0 02:InfWestPre    39.85    1.061 1969.0818_22:45  210.72  n/a     .000
                    +    15.0 02:InfEastPre    39.35     .890 1969.0818_23:00  210.72  n/a     .000
                 SUM=    15.0 01:InfPre        79.20    1.951 1969.0818_22:45  210.72  n/a     .000
################################################################################
# STORMS
################################################################################
  ** END OF RUN :   69

****************************************************************************************************





 RUN#:COMMAND#
R0070:C00001----------------------------------------------------------------------------------------
     START
      [TZERO =    .00 hrs on 19700101]
      [METOUT=   2    (1=imperial, 2=metric output)]
      [NSTORM=   0 ]
      [NRUN  = 0070 ]
#******************************************************************************
#  SWMHYMO Ver:5.02/Jan 2001 <BETA> / INPUT DATA FILE
#******************************************************************************
#  Project Name  : [Caivan Stittsville West properties]
#  Project Number: [2267]
#  Date          : [2021/12/14]
#  Modeller      : [JB]
#  Company       : J.F. Sabourin and Associates
#  License #     : 2549237
#******************************************************************************
#******************************************************************************
# Ottawa International Airport (1967 - 2003)
R0070:C00002----------------------------------------------------------------------------------------
  *  READ AES DATA
      [Filename  = 6106000.123                                                ]
      [Start_date= 1970.0101: End_date= 1970.1231]
      {DT= 60.min: Length= 8016.hrs: WetHrs=  373: DryHrs= 7643: PTOT= 558.90}
      Maximum average rainfall intensities over
        1 hr    2 hrs    3 hrs    6 hrs   12 hrs   24 hrs   36 hrs   48 hrs   72 hrs
       35.30    18.30    12.20     6.10     3.63     1.81     1.21     1.46      .99    mm/hr
       35.30    36.60    36.60    36.60    43.50    43.50    43.50    69.90    71.20    mm
      19700926 19700926 19700926 19700927 19700817 19700817 19700818 19700926 19700927  date
      Number of rainfall events per following interevent time
        1 hr    2 hrs    3 hrs    6 hrs   12 hrs   24 hrs   36 hrs   48 hrs   72 hrs
         148      127      109       84       72       60       53       40       29
      Number of events with at least the following durations
        1 hr    2 hrs    3 hrs    6 hrs   12 hrs   24 hrs   36 hrs   48 hrs   72 hrs
         147       79       40       15        3        0        0        0        0
R0070:C00003----------------------------------------------------------------------------------------
     COMPUTE API
      [APIini= 50.00: APIkdy= .9000: APIkdt= .9956]
      {APImax= 76.00: APIavg= 17.31: APImin=   .23}
################################################################################
```

```
# Pre Development Condition - Using NASHHYD and CN
##########################################################################
R0070:C00004------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:EastPre       39.35     .295 1970.0926_22:15   89.80 .161     .000
      [CN= 65.0: N= 3.00: Tp= 1.47]
      [IaREC= 6.00: SMIN= 54.78: SMAX=365.23: SK= .025]
      [InterEventTime=  12.00]
R0070:C00005------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:WestPre       39.85     .311 1970.0926_22:00   88.22 .158     .000
      [CN= 61.0: N= 3.00: Tp= 1.22]
      [IaREC= 6.00: SMIN= 64.50: SMAX=430.01: SK= .025]
      [InterEventTime=  12.00]
R0070:C00006------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ADD HYD              15.0 02:WestPre       39.85     .311 1970.0926_22:00   88.22  n/a     .000
                    +    15.0 02:EastPre       39.35     .295 1970.0926_22:15   89.80  n/a     .000
                 SUM=    15.0 01:Pre           79.20     .600 1970.0926_22:00   89.00  n/a     .000
##########################################################################
# Pre Development Condition - Using NASHHYD and CN - No INFILTRATION
##########################################################################
R0070:C00007------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:InfEastPre    39.35    1.108 1970.0926_22:00  200.34 .358     .000
      [CN=100.0: N= 3.00: Tp= 1.47]
      [IaREC= 6.00: SMIN=  1.39: SMAX=  9.24: SK= .025]
      [InterEventTime=  12.00]
R0070:C00008------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:InfWestPre    39.85    1.329 1970.0926_21:45  200.34 .358     .000
      [CN=100.0: N= 3.00: Tp= 1.22]
      [IaREC= 6.00: SMIN=  1.39: SMAX=  9.24: SK= .025]
      [InterEventTime=  12.00]
R0070:C00009------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ADD HYD              15.0 02:InfWestPre    39.85    1.329 1970.0926_21:45  200.34  n/a     .000
                    +    15.0 02:InfEastPre    39.35    1.108 1970.0926_22:00  200.34  n/a     .000
                 SUM=    15.0 01:InfPre        79.20    2.409 1970.0926_22:00  200.34  n/a     .000
##########################################################################
# STORMS
##########################################################################
  ** END OF RUN :   70

*****************************************************************************************

 RUN#:COMMAND#
R0071:C00001-----------------------------------------------------------------------------
     START
      [TZERO =    .00 hrs on 19710101]
      [METOUT=   2    (1=imperial, 2=metric output)]
      [NSTORM=   0 ]
      [NRUN  = 0071 ]
#*************************************************************************
#  SWMHYMO Ver:5.02/Jan 2001 <BETA> / INPUT DATA FILE
#*************************************************************************
#  Project Name  : [Caivan Stittsville West properties]
#  Project Number: [2267]
#  Date          : [2021/12/14]
#  Modeller      : [JB]
#  Company       : J.F. Sabourin and Associates
#  License #     : 2549237
#*************************************************************************
#*************************************************************************
# Ottawa International Airport (1967 - 2003)
R0071:C00002-----------------------------------------------------------------------------
  *  READ AES DATA
      [Filename  = 6106000.123                                               ]
      [Start_date= 1971.0101: End_date= 1971.1231]
      {DT= 60.min: Length= 8760.hrs: WetHrs=  412: DryHrs= 8348: PTOT= 522.10}
      Maximum average rainfall intensities over
        1 hr    2 hrs    3 hrs    6 hrs   12 hrs   24 hrs   36 hrs   48 hrs   72 hrs
       24.60    16.60    11.67     6.13     3.09     1.56     1.06      .79      .54    mm/hr
       24.60    33.20    35.00    36.80    37.10    37.40    38.00    38.00    38.90    mm
      19710810 19710810 19710810 19710810 19710810 19710810 19710811 19710812 19710830  date
      Number of rainfall events per following interevent time
        1 hr    2 hrs    3 hrs    6 hrs   12 hrs   24 hrs   36 hrs   48 hrs   72 hrs
         156      123      113       93       72       61       52       42       33
      Number of events with at least the following durations
        1 hr    2 hrs    3 hrs    6 hrs   12 hrs   24 hrs   36 hrs   48 hrs   72 hrs
         155       81       59       21        2        0        0        0        0
R0071:C00003-----------------------------------------------------------------------------
     COMPUTE API
      [APIini= 50.00: APIkdy= .9000: APIkdt= .9956]
      {APImax= 62.22: APIavg= 14.84: APImin=   .36}
##########################################################################
# Pre Development Condition - Using NASHHYD and CN
##########################################################################
R0071:C00004------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:EastPre       39.35     .216 1971.0810_16:45   68.80 .132     .000
      [CN= 65.0: N= 3.00: Tp= 1.47]
      [IaREC= 6.00: SMIN= 54.78: SMAX=365.23: SK= .025]
      [InterEventTime=  12.00]
R0071:C00005------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:WestPre       39.85     .220 1971.0810_16:30   67.79 .130     .000
      [CN= 61.0: N= 3.00: Tp= 1.22]
      [IaREC= 6.00: SMIN= 64.50: SMAX=430.01: SK= .025]
      [InterEventTime=  12.00]
R0071:C00006------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ADD HYD              15.0 02:WestPre       39.85     .220 1971.0810_16:30   67.79  n/a     .000
                    +    15.0 02:EastPre       39.35     .216 1971.0810_16:45   68.80  n/a     .000
                 SUM=    15.0 01:Pre           79.20     .433 1971.0810_16:30   68.29  n/a     .000
##########################################################################
# Pre Development Condition - Using NASHHYD and CN - No INFILTRATION
##########################################################################
R0071:C00007------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:InfEastPre    39.35    1.003 1971.0810_16:30  160.66 .308     .000
      [CN=100.0: N= 3.00: Tp= 1.47]
      [IaREC= 6.00: SMIN=  1.39: SMAX=  9.24: SK= .025]
      [InterEventTime=  12.00]
R0071:C00008------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:InfWestPre    39.85    1.162 1971.0810_16:15  160.66 .308     .000
      [CN=100.0: N= 3.00: Tp= 1.22]
      [IaREC= 6.00: SMIN=  1.39: SMAX=  9.24: SK= .025]
      [InterEventTime=  12.00]
R0071:C00009------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ADD HYD              15.0 02:InfWestPre    39.85    1.162 1971.0810_16:15  160.66  n/a     .000
                    +    15.0 02:InfEastPre    39.35    1.003 1971.0810_16:30  160.66  n/a     .000
                 SUM=    15.0 01:InfPre        79.20    2.161 1971.0810_16:15  160.66  n/a     .000
##########################################################################
# STORMS
##########################################################################
  ** END OF RUN :   71

*****************************************************************************************

 RUN#:COMMAND#
R0072:C00001-----------------------------------------------------------------------------
     START
      [TZERO =    .00 hrs on 19720101]
      [METOUT=   2    (1=imperial, 2=metric output)]
      [NSTORM=   0 ]
      [NRUN  = 0072 ]
#*************************************************************************
#  SWMHYMO Ver:5.02/Jan 2001 <BETA> / INPUT DATA FILE
#*************************************************************************
#  Project Name  : [Caivan Stittsville West properties]
#  Project Number: [2267]
#  Date          : [2021/12/14]
#  Modeller      : [JB]
#  Company       : J.F. Sabourin and Associates
#  License #     : 2549237
#*************************************************************************
#*************************************************************************
# Ottawa International Airport (1967 - 2003)
R0072:C00002-----------------------------------------------------------------------------
  *  READ AES DATA
      [Filename  = 6106000.123                                               ]
      [Start_date= 1972.0101: End_date= 1972.1230]
      {DT= 60.min: Length= 8760.hrs: WetHrs=  489: DryHrs= 8271: PTOT= 784.30}
      Maximum average rainfall intensities over
        1 hr    2 hrs    3 hrs    6 hrs   12 hrs   24 hrs   36 hrs   48 hrs   72 hrs
       37.30    19.15    12.97     8.15     4.50     2.53     2.00     1.71     1.17    mm/hr
       37.30    38.30    38.90    48.90    54.00    60.70    72.10    82.20    84.20    mm
      19720712 19720712 19720807 19720808 19720808 19720808 19720713 19720714 19720715  date
      Number of rainfall events per following interevent time
        1 hr    2 hrs    3 hrs    6 hrs   12 hrs   24 hrs   36 hrs   48 hrs   72 hrs
         170      133      122       86       76       60       45       41       31
      Number of events with at least the following durations
        1 hr    2 hrs    3 hrs    6 hrs   12 hrs   24 hrs   36 hrs   48 hrs   72 hrs
         169       96       58       21        5        0        0        0        0
R0072:C00003-----------------------------------------------------------------------------
     COMPUTE API
      [APIini= 50.00: APIkdy= .9000: APIkdt= .9956]
      {APImax=108.88: APIavg= 21.70: APImin=   .00}
##########################################################################
# Pre Development Condition - Using NASHHYD and CN
##########################################################################
R0072:C00004------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:EastPre       39.35     .438 1972.0808_ 0:00  191.56 .244     .000
      [CN= 65.0: N= 3.00: Tp= 1.47]
      [IaREC= 6.00: SMIN= 54.78: SMAX=365.23: SK= .025]
      [InterEventTime=  12.00]
R0072:C00005------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:WestPre       39.85     .465 1972.0807_23:45  188.98 .241     .000
      [CN= 61.0: N= 3.00: Tp= 1.22]
      [IaREC= 6.00: SMIN= 64.50: SMAX=430.01: SK= .025]
      [InterEventTime=  12.00]
R0072:C00006------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ADD HYD              15.0 02:WestPre       39.85     .465 1972.0807_23:45  188.98  n/a     .000
                    +    15.0 02:EastPre       39.35     .438 1972.0808_ 0:00  191.56  n/a     .000
                 SUM=    15.0 01:Pre           79.20     .891 1972.0807_23:45  190.26  n/a     .000
##########################################################################
# Pre Development Condition - Using NASHHYD and CN - No INFILTRATION
##########################################################################
R0072:C00007------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:InfEastPre    39.35    1.280 1972.0807_23:45  342.97 .437     .000
      [CN=100.0: N= 3.00: Tp= 1.47]
      [IaREC= 6.00: SMIN=  1.39: SMAX=  9.24: SK= .025]
      [InterEventTime=  12.00]
R0072:C00008------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:InfWestPre    39.85    1.501 1972.0807_23:30  342.97 .437     .000
      [CN=100.0: N= 3.00: Tp= 1.22]
      [IaREC= 6.00: SMIN=  1.39: SMAX=  9.24: SK= .025]
      [InterEventTime=  12.00]
R0072:C00009------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ADD HYD              15.0 02:InfWestPre    39.85    1.501 1972.0807_23:30  342.97  n/a     .000
                    +    15.0 02:InfEastPre    39.35    1.280 1972.0807_23:45  342.97  n/a     .000
                 SUM=    15.0 01:InfPre        79.20    2.755 1972.0807_23:45  342.97  n/a     .000
##########################################################################
# STORMS
##########################################################################
  ** END OF RUN :   72

*****************************************************************************************

 RUN#:COMMAND#
R0073:C00001-----------------------------------------------------------------------------
     START
      [TZERO =    .00 hrs on 19730101]
      [METOUT=   2    (1=imperial, 2=metric output)]
      [NSTORM=   0 ]
      [NRUN  = 0073 ]
#*************************************************************************
#  SWMHYMO Ver:5.02/Jan 2001 <BETA> / INPUT DATA FILE
#*************************************************************************
#  Project Name  : [Caivan Stittsville West properties]
#  Project Number: [2267]
#  Date          : [2021/12/14]
#  Modeller      : [JB]
#  Company       : J.F. Sabourin and Associates
#  License #     : 2549237
#*************************************************************************
#*************************************************************************
# Ottawa International Airport (1967 - 2003)
R0073:C00002-----------------------------------------------------------------------------
  *  READ AES DATA
      [Filename  = 6106000.123                                               ]
      [Start_date= 1973.0101: End_date= 1973.1231]
      {DT= 60.min: Length= 8760.hrs: WetHrs=  549: DryHrs= 8211: PTOT= 744.90}
      Maximum average rainfall intensities over
        1 hr    2 hrs    3 hrs    6 hrs   12 hrs   24 hrs   36 hrs   48 hrs   72 hrs
       30.00    17.25    12.33     7.10     3.63     1.89     1.28      .96      .96    mm/hr
       30.00    34.50    37.00    42.60    43.60    45.40    46.00    46.00    69.20    mm
      19730611 19730808 19730808 19730808 19730808 19730616 19730616 19730616 19731005  date
      Number of rainfall events per following interevent time
        1 hr    2 hrs    3 hrs    6 hrs   12 hrs   24 hrs   36 hrs   48 hrs   72 hrs
         200      164      143      108       79       61       54       43       37
      Number of events with at least the following durations
        1 hr    2 hrs    3 hrs    6 hrs   12 hrs   24 hrs   36 hrs   48 hrs   72 hrs
         200      102       66       20        4        0        0        0        0
R0073:C00003-----------------------------------------------------------------------------
     COMPUTE API
      [APIini= 50.00: APIkdy= .9000: APIkdt= .9956]
      {APImax= 78.26: APIavg= 20.56: APImin=   .06}
##########################################################################
# Pre Development Condition - Using NASHHYD and CN
##########################################################################
R0073:C00004------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:EastPre       39.35     .355 1973.0808_21:00  142.52 .191     .000
      [CN= 65.0: N= 3.00: Tp= 1.47]
      [IaREC= 6.00: SMIN= 54.78: SMAX=365.23: SK= .025]
      [InterEventTime=  12.00]
R0073:C00005------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:WestPre       39.85     .372 1973.0808_20:45  139.70 .188     .000
      [CN= 61.0: N= 3.00: Tp= 1.22]
      [IaREC= 6.00: SMIN= 64.50: SMAX=430.01: SK= .025]
      [InterEventTime=  12.00]
R0073:C00006------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ADD HYD              15.0 02:WestPre       39.85     .372 1973.0808_20:45  139.70  n/a     .000
                    +    15.0 02:EastPre       39.35     .355 1973.0808_21:00  142.52  n/a     .000
                 SUM=    15.0 01:Pre           79.20     .724 1973.0808_21:00  141.10  n/a     .000
##########################################################################
# Pre Development Condition - Using NASHHYD and CN - No INFILTRATION
##########################################################################
R0073:C00007------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:InfEastPre    39.35    1.261 1973.0808_20:45  309.11 .415     .000
      [CN=100.0: N= 3.00: Tp= 1.47]
      [IaREC= 6.00: SMIN=  1.39: SMAX=  9.24: SK= .025]
      [InterEventTime=  12.00]
R0073:C00008------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:InfWestPre    39.85    1.473 1973.0808_20:30  309.11 .415     .000
      [CN=100.0: N= 3.00: Tp= 1.22]
      [IaREC= 6.00: SMIN=  1.39: SMAX=  9.24: SK= .025]
      [InterEventTime=  12.00]
R0073:C00009------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ADD HYD              15.0 02:InfWestPre    39.85    1.473 1973.0808_20:30  309.11  n/a     .000
                    +    15.0 02:InfEastPre    39.35    1.261 1973.0808_20:45  309.11  n/a     .000
                 SUM=    15.0 01:InfPre        79.20    2.726 1973.0808_20:45  309.11  n/a     .000
##########################################################################
# STORMS
##########################################################################
  ** END OF RUN :   73

*****************************************************************************************

 RUN#:COMMAND#
R0074:C00001-----------------------------------------------------------------------------
     START
      [TZERO =    .00 hrs on 19740101]
      [METOUT=   2    (1=imperial, 2=metric output)]
      [NSTORM=   0 ]
      [NRUN  = 0074 ]
#*************************************************************************
#  SWMHYMO Ver:5.02/Jan 2001 <BETA> / INPUT DATA FILE
#*************************************************************************
#  Project Name  : [Caivan Stittsville West properties]
#  Project Number: [2267]
#  Date          : [2021/12/14]
#  Modeller      : [JB]
#  Company       : J.F. Sabourin and Associates
#  License #     : 2549237
#*************************************************************************
#*************************************************************************
# Ottawa International Airport (1967 - 2003)
R0074:C00002-----------------------------------------------------------------------------
  *  READ AES DATA
      [Filename  = 6106000.123                                               ]
      [Start_date= 1974.0101: End_date= 1974.1231]
      {DT= 60.min: Length= 8760.hrs: WetHrs=  320: DryHrs= 8440: PTOT= 386.20}
      Maximum average rainfall intensities over
        1 hr    2 hrs    3 hrs    6 hrs   12 hrs   24 hrs   36 hrs   48 hrs   72 hrs
       20.60    15.40    10.37     5.18     2.98     1.63     1.08      .81      .54    mm/hr
       20.60    30.80    31.10    31.10    35.70    39.00    39.00    39.00    39.00    mm
      19740718 19740719 19740719 19740719 19740305 19740305 19740306 19740306 19740307  date
      Number of rainfall events per following interevent time
        1 hr    2 hrs    3 hrs    6 hrs   12 hrs   24 hrs   36 hrs   48 hrs   72 hrs
         129      105       93       77       63       50       38       33       23
      Number of events with at least the following durations
        1 hr    2 hrs    3 hrs    6 hrs   12 hrs   24 hrs   36 hrs   48 hrs   72 hrs
         128       66       32       10        3        0        0        0        0
R0074:C00003-----------------------------------------------------------------------------
     COMPUTE API
      [APIini= 50.00: APIkdy= .9000: APIkdt= .9956]
      {APImax= 52.93: APIavg= 11.36: APImin=   .00}
##########################################################################
# Pre Development Condition - Using NASHHYD and CN
##########################################################################
R0074:C00004------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:EastPre       39.35     .127 1974.0719_ 1:45   42.84 .111     .000
      [CN= 65.0: N= 3.00: Tp= 1.47]
      [IaREC= 6.00: SMIN= 54.78: SMAX=365.23: SK= .025]
      [InterEventTime=  12.00]
R0074:C00005------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:WestPre       39.85     .129 1974.0719_ 1:30   41.96 .109     .000
      [CN= 61.0: N= 3.00: Tp= 1.22]
      [IaREC= 6.00: SMIN= 64.50: SMAX=430.01: SK= .025]
      [InterEventTime=  12.00]
R0074:C00006------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ADD HYD              15.0 02:WestPre       39.85     .129 1974.0719_ 1:30   41.96  n/a     .000
                    +    15.0 02:EastPre       39.35     .127 1974.0719_ 1:45   42.84  n/a     .000
                 SUM=    15.0 01:Pre           79.20     .255 1974.0719_ 1:45   42.40  n/a     .000
##########################################################################
# Pre Development Condition - Using NASHHYD and CN - No INFILTRATION
##########################################################################
R0074:C00007------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:InfEastPre    39.35     .790 1974.0719_ 1:30  105.03 .272     .000
      [CN=100.0: N= 3.00: Tp= 1.47]
      [IaREC= 6.00: SMIN=  1.39: SMAX=  9.24: SK= .025]
      [InterEventTime=  12.00]
```

```
R0074:C00008------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:InfWestPre    39.85     .916 1974.0719_ 1:15  105.03 .272     .000
      [CN=100.0: N= 3.00: Tp= 1.22]
      [IaREC= 6.00: SMIN=  1.39: SMAX=  9.24: SK= .025]
      [InterEventTime=  12.00]
R0074:C00009------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ADD HYD              15.0 02:InfWestPre    39.85     .916 1974.0719_ 1:15  105.03  n/a     .000
                    +    15.0 02:InfEastPre    39.35     .790 1974.0719_ 1:30  105.03  n/a     .000
                 SUM=    15.0 01:InfPre        79.20    1.704 1974.0719_ 1:30  105.03  n/a     .000
###############################################################################
# STORMS
###############################################################################
  ** END OF RUN :   74

***************************************************************************************************

 RUN#:COMMAND#
R0075:C00001---------------------------------------------------------------------------------------
     START
      [TZERO =    .00 hrs on 19750101]
      [METOUT=   2    (1=imperial, 2=metric output)]
      [NSTORM=   0 ]
      [NRUN  = 0075 ]
#******************************************************************************
#  SWMHYMO Ver:5.02/Jan 2001 <BETA> / INPUT DATA FILE
#******************************************************************************
#  Project Name  : [Caivan Stittsville West properties]
#  Project Number: [2267]
#  Date          : [2021/12/14]
#  Modeller      : [JB]
#  Company       : J.F. Sabourin and Associates
#  License #     : 2549237
#******************************************************************************
#******************************************************************************
# Ottawa International Airport (1967 - 2003)
R0075:C00002---------------------------------------------------------------------------------------
  *  READ AES DATA
      [Filename  = 6106000.123                                                  ]
      [Start_date= 1975.0101: End_date= 1975.1231]
      {DT= 60.min: Length= 8760.hrs: WetHrs=  344: DryHrs= 8416: PTOT= 535.50}
      Maximum average rainfall intensities over
        1 hr    2 hrs    3 hrs    6 hrs   12 hrs   24 hrs   36 hrs   48 hrs   72 hrs
       34.80    18.40    12.53     6.32     3.33     1.73     1.15      .87      .62    mm/hr
       34.80    36.80    37.60    37.90    40.00    41.50    41.50    41.80    44.40    mm
      19750708 19750720 19750720 19750720 19750721 19750721 19750721 19750721 19750928  date
      Number of rainfall events per following interevent time
        1 hr    2 hrs    3 hrs    6 hrs   12 hrs   24 hrs   36 hrs   48 hrs   72 hrs
         136      118       99       78       61       49       40       33       25
      Number of events with at least the following durations
        1 hr    2 hrs    3 hrs    6 hrs   12 hrs   24 hrs   36 hrs   48 hrs   72 hrs
         135       70       40       17        1        0        0        0        0
R0075:C00003---------------------------------------------------------------------------------------
     COMPUTE API
      [APIini= 50.00: APIkdy= .9000: APIkdt= .9956]
      {APImax= 73.23: APIavg= 15.16: APImin=   .00}
###############################################################################
# Pre Development Condition - Using NASHHYD and CN
###############################################################################
R0075:C00004------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:EastPre       39.35     .226 1975.0720_18:00   89.74 .168     .000
      [CN= 65.0: N= 3.00: Tp= 1.47]
      [IaREC= 6.00: SMIN= 54.78: SMAX=365.23: SK= .025]
      [InterEventTime=  12.00]
R0075:C00005------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:WestPre       39.85     .231 1975.0720_17:45   88.19 .165     .000
      [CN= 61.0: N= 3.00: Tp= 1.22]
      [IaREC= 6.00: SMIN= 64.50: SMAX=430.01: SK= .025]
      [InterEventTime=  12.00]
R0075:C00006------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ADD HYD              15.0 02:WestPre       39.85     .231 1975.0720_17:45   88.19  n/a     .000
                    +    15.0 02:EastPre       39.35     .226 1975.0720_18:00   89.74  n/a     .000
                 SUM=    15.0 01:Pre           79.20     .457 1975.0720_17:45   88.96  n/a     .000
###############################################################################
# Pre Development Condition - Using NASHHYD and CN - No INFILTRATION
###############################################################################
R0075:C00007------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:InfEastPre    39.35    1.031 1975.0720_17:30  196.76 .367     .000
      [CN=100.0: N= 3.00: Tp= 1.47]
      [IaREC= 6.00: SMIN=  1.39: SMAX=  9.24: SK= .025]
      [InterEventTime=  12.00]
R0075:C00008------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:InfWestPre    39.85    1.228 1975.0708_17:45  196.76 .367     .000
      [CN=100.0: N= 3.00: Tp= 1.22]
      [IaREC= 6.00: SMIN=  1.39: SMAX=  9.24: SK= .025]
      [InterEventTime=  12.00]
R0075:C00009------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ADD HYD              15.0 02:InfWestPre    39.85    1.228 1975.0708_17:45  196.76  n/a     .000
                    +    15.0 02:InfEastPre    39.35    1.031 1975.0720_17:30  196.76  n/a     .000
                 SUM=    15.0 01:InfPre        79.20    2.218 1975.0708_18:00  196.76  n/a     .000
###############################################################################
# STORMS
###############################################################################
  ** END OF RUN :   75

***************************************************************************************************

 RUN#:COMMAND#
R0076:C00001---------------------------------------------------------------------------------------
     START
      [TZERO =    .00 hrs on 19760101]
      [METOUT=   2    (1=imperial, 2=metric output)]
      [NSTORM=   0 ]
      [NRUN  = 0076 ]
#******************************************************************************
#  SWMHYMO Ver:5.02/Jan 2001 <BETA> / INPUT DATA FILE
#******************************************************************************
#  Project Name  : [Caivan Stittsville West properties]
#  Project Number: [2267]
#  Date          : [2021/12/14]
#  Modeller      : [JB]
#  Company       : J.F. Sabourin and Associates
#  License #     : 2549237
#******************************************************************************
#******************************************************************************
# Ottawa International Airport (1967 - 2003)
R0076:C00002---------------------------------------------------------------------------------------
  *  READ AES DATA
      [Filename  = 6106000.123                                                  ]
      [Start_date= 1976.0101: End_date= 1976.1230]
      {DT= 60.min: Length= 8064.hrs: WetHrs=  389: DryHrs= 7675: PTOT= 492.40}
      Maximum average rainfall intensities over
        1 hr    2 hrs    3 hrs    6 hrs   12 hrs   24 hrs   36 hrs   48 hrs   72 hrs
       14.00     8.90     6.43     4.65     2.35     1.39      .97      .97      .80    mm/hr
       14.00    17.80    19.30    27.90    28.20    33.30    35.10    46.60    57.50    mm
      19760828 19760828 19760828 19760828 19760828 19760920 19760519 19760520 19760921  date
      Number of rainfall events per following interevent time
        1 hr    2 hrs    3 hrs    6 hrs   12 hrs   24 hrs   36 hrs   48 hrs   72 hrs
         173      139      123       96       76       59       44       38       28
      Number of events with at least the following durations
        1 hr    2 hrs    3 hrs    6 hrs   12 hrs   24 hrs   36 hrs   48 hrs   72 hrs
         172       80       46       13        1        0        0        0        0
R0076:C00003---------------------------------------------------------------------------------------
     COMPUTE API
      [APIini= 50.00: APIkdy= .9000: APIkdt= .9956]
      {APImax= 59.67: APIavg= 15.32: APImin=   .02}
###############################################################################
# Pre Development Condition - Using NASHHYD and CN
###############################################################################
R0076:C00004------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:EastPre       39.35     .117 1976.0519_23:15   60.12 .122     .000
      [CN= 65.0: N= 3.00: Tp= 1.47]
      [IaREC= 6.00: SMIN= 54.78: SMAX=365.23: SK= .025]
      [InterEventTime=  12.00]
R0076:C00005------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:WestPre       39.85     .112 1976.0519_23:15   58.79 .119     .000
      [CN= 61.0: N= 3.00: Tp= 1.22]
      [IaREC= 6.00: SMIN= 64.50: SMAX=430.01: SK= .025]
      [InterEventTime=  12.00]
R0076:C00006------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ADD HYD              15.0 02:WestPre       39.85     .112 1976.0519_23:15   58.79  n/a     .000
                    +    15.0 02:EastPre       39.35     .117 1976.0519_23:15   60.12  n/a     .000
                 SUM=    15.0 01:Pre           79.20     .229 1976.0519_23:15   59.45  n/a     .000
###############################################################################
# Pre Development Condition - Using NASHHYD and CN - No INFILTRATION
###############################################################################
R0076:C00007------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:InfEastPre    39.35     .391 1976.0828_23:00  143.78 .292     .000
      [CN=100.0: N= 3.00: Tp= 1.47]
      [IaREC= 6.00: SMIN=  1.39: SMAX=  9.24: SK= .025]
      [InterEventTime=  12.00]
R0076:C00008------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:InfWestPre    39.85     .409 1976.0828_22:45  143.78 .292     .000
      [CN=100.0: N= 3.00: Tp= 1.22]
      [IaREC= 6.00: SMIN=  1.39: SMAX=  9.24: SK= .025]
      [InterEventTime=  12.00]
R0076:C00009------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ADD HYD              15.0 02:InfWestPre    39.85     .409 1976.0828_22:45  143.78  n/a     .000
                    +    15.0 02:InfEastPre    39.35     .391 1976.0828_23:00  143.78  n/a     .000
                 SUM=    15.0 01:InfPre        79.20     .798 1976.0828_22:45  143.78  n/a     .000
###############################################################################
# STORMS
###############################################################################
  ** END OF RUN :   76

***************************************************************************************************

 RUN#:COMMAND#
R0077:C00001---------------------------------------------------------------------------------------
     START
      [TZERO =    .00 hrs on 19770101]
      [METOUT=   2    (1=imperial, 2=metric output)]
      [NSTORM=   0 ]
      [NRUN  = 0077 ]
#******************************************************************************
#  SWMHYMO Ver:5.02/Jan 2001 <BETA> / INPUT DATA FILE
#******************************************************************************
#  Project Name  : [Caivan Stittsville West properties]
#  Project Number: [2267]
#  Date          : [2021/12/14]
#  Modeller      : [JB]
#  Company       : J.F. Sabourin and Associates
#  License #     : 2549237
#******************************************************************************
#******************************************************************************
# Ottawa International Airport (1967 - 2003)
R0077:C00002---------------------------------------------------------------------------------------
  *  READ AES DATA
      [Filename  = 6106000.123                                                  ]
      [Start_date= 1977.0101: End_date= 1977.1231]
      {DT= 60.min: Length= 8016.hrs: WetHrs=  511: DryHrs= 7505: PTOT= 677.60}
      Maximum average rainfall intensities over
        1 hr    2 hrs    3 hrs    6 hrs   12 hrs   24 hrs   36 hrs   48 hrs   72 hrs
       21.30    15.20    10.40     6.53     3.30     1.65     1.38     1.06      .73    mm/hr
       21.30    30.40    31.20    39.20    39.60    39.60    49.60    51.00    52.40    mm
      19770717 19770717 19770717 19770901 19770902 19770902 19770314 19770315 19770718  date
      Number of rainfall events per following interevent time
        1 hr    2 hrs    3 hrs    6 hrs   12 hrs   24 hrs   36 hrs   48 hrs   72 hrs
         188      156      139      107       82       61       52       41       28
      Number of events with at least the following durations
        1 hr    2 hrs    3 hrs    6 hrs   12 hrs   24 hrs   36 hrs   48 hrs   72 hrs
         187       89       58       21        5        1        0        0        0
R0077:C00003---------------------------------------------------------------------------------------
     COMPUTE API
      [APIini= 50.00: APIkdy= .9000: APIkdt= .9956]
      {APImax= 74.28: APIavg= 20.62: APImin=  1.62}
###############################################################################
# Pre Development Condition - Using NASHHYD and CN
###############################################################################
R0077:C00004------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:EastPre       39.35     .224 1977.0902_ 0:00  110.65 .163     .000
      [CN= 65.0: N= 3.00: Tp= 1.47]
      [IaREC= 6.00: SMIN= 54.78: SMAX=365.23: SK= .025]
      [InterEventTime=  12.00]
R0077:C00005------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:WestPre       39.85     .233 1977.0901_23:45  108.42 .160     .000
      [CN= 61.0: N= 3.00: Tp= 1.22]
      [IaREC= 6.00: SMIN= 64.50: SMAX=430.01: SK= .025]
      [InterEventTime=  12.00]
R0077:C00006------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ADD HYD              15.0 02:WestPre       39.85     .233 1977.0901_23:45  108.42  n/a     .000
                    +    15.0 02:EastPre       39.35     .224 1977.0902_ 0:00  110.65  n/a     .000
                 SUM=    15.0 01:Pre           79.20     .451 1977.0901_23:45  109.53  n/a     .000
###############################################################################
# Pre Development Condition - Using NASHHYD and CN - No INFILTRATION
###############################################################################
R0077:C00007------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:InfEastPre    39.35     .943 1977.0901_23:45  247.00 .365     .000
      [CN=100.0: N= 3.00: Tp= 1.47]
      [IaREC= 6.00: SMIN=  1.39: SMAX=  9.24: SK= .025]
      [InterEventTime=  12.00]
R0077:C00008------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:InfWestPre    39.85    1.083 1977.0901_23:30  247.00 .365     .000
      [CN=100.0: N= 3.00: Tp= 1.22]
      [IaREC= 6.00: SMIN=  1.39: SMAX=  9.24: SK= .025]
      [InterEventTime=  12.00]
R0077:C00009------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ADD HYD              15.0 02:InfWestPre    39.85    1.083 1977.0901_23:30  247.00  n/a     .000
                    +    15.0 02:InfEastPre    39.35     .943 1977.0901_23:45  247.00  n/a     .000
                 SUM=    15.0 01:InfPre        79.20    2.008 1977.0901_23:45  247.00  n/a     .000
###############################################################################
# STORMS
###############################################################################
  ** END OF RUN :   77

***************************************************************************************************

 RUN#:COMMAND#
R0078:C00001---------------------------------------------------------------------------------------
     START
      [TZERO =    .00 hrs on 19780101]
      [METOUT=   2    (1=imperial, 2=metric output)]
      [NSTORM=   0 ]
      [NRUN  = 0078 ]
#******************************************************************************
#  SWMHYMO Ver:5.02/Jan 2001 <BETA> / INPUT DATA FILE
#******************************************************************************
#  Project Name  : [Caivan Stittsville West properties]
#  Project Number: [2267]
#  Date          : [2021/12/14]
#  Modeller      : [JB]
#  Company       : J.F. Sabourin and Associates
#  License #     : 2549237
#******************************************************************************
#******************************************************************************
# Ottawa International Airport (1967 - 2003)
R0078:C00002---------------------------------------------------------------------------------------
  *  READ AES DATA
      [Filename  = 6106000.123                                                  ]
      [Start_date= 1978.0101: End_date= 1978.1231]
      {DT= 60.min: Length= 8040.hrs: WetHrs=  407: DryHrs= 7633: PTOT= 638.80}
      Maximum average rainfall intensities over
        1 hr    2 hrs    3 hrs    6 hrs   12 hrs   24 hrs   36 hrs   48 hrs   72 hrs
       36.00    18.15    12.10     6.05     3.04     1.62     1.13      .87      .58    mm/hr
       36.00    36.30    36.30    36.30    36.50    38.80    40.60    41.60    41.60    mm
      19780618 19780618 19780618 19780618 19780619 19780619 19780412 19780620 19780621  date
      Number of rainfall events per following interevent time
        1 hr    2 hrs    3 hrs    6 hrs   12 hrs   24 hrs   36 hrs   48 hrs   72 hrs
         167      135      126      103       76       60       53       45       31
      Number of events with at least the following durations
        1 hr    2 hrs    3 hrs    6 hrs   12 hrs   24 hrs   36 hrs   48 hrs   72 hrs
         166       78       48       17        1        0        0        0        0
R0078:C00003---------------------------------------------------------------------------------------
     COMPUTE API
      [APIini= 50.00: APIkdy= .9000: APIkdt= .9956]
      {APImax= 65.36: APIavg= 19.25: APImin=   .25}
###############################################################################
# Pre Development Condition - Using NASHHYD and CN
###############################################################################
R0078:C00004------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:EastPre       39.35     .263 1978.0618_18:15   87.81 .137     .000
      [CN= 65.0: N= 3.00: Tp= 1.47]
      [IaREC= 6.00: SMIN= 54.78: SMAX=365.23: SK= .025]
      [InterEventTime=  12.00]
R0078:C00005------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:WestPre       39.85     .279 1978.0618_18:00   85.92 .135     .000
      [CN= 61.0: N= 3.00: Tp= 1.22]
      [IaREC= 6.00: SMIN= 64.50: SMAX=430.01: SK= .025]
      [InterEventTime=  12.00]
R0078:C00006------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ADD HYD              15.0 02:WestPre       39.85     .279 1978.0618_18:00   85.92  n/a     .000
                    +    15.0 02:EastPre       39.35     .263 1978.0618_18:15   87.81  n/a     .000
                 SUM=    15.0 01:Pre           79.20     .540 1978.0618_18:00   86.86  n/a     .000
###############################################################################
# Pre Development Condition - Using NASHHYD and CN - No INFILTRATION
###############################################################################
R0078:C00007------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:InfEastPre    39.35    1.103 1978.0618_18:00  230.33 .361     .000
      [CN=100.0: N= 3.00: Tp= 1.47]
      [IaREC= 6.00: SMIN=  1.39: SMAX=  9.24: SK= .025]
      [InterEventTime=  12.00]
R0078:C00008------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:InfWestPre    39.85    1.330 1978.0618_17:45  230.33 .361     .000
      [CN=100.0: N= 3.00: Tp= 1.22]
      [IaREC= 6.00: SMIN=  1.39: SMAX=  9.24: SK= .025]
      [InterEventTime=  12.00]
R0078:C00009------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ADD HYD              15.0 02:InfWestPre    39.85    1.330 1978.0618_17:45  230.33  n/a     .000
                    +    15.0 02:InfEastPre    39.35    1.103 1978.0618_18:00  230.33  n/a     .000
                 SUM=    15.0 01:InfPre        79.20    2.395 1978.0618_18:00  230.33  n/a     .000
###############################################################################
# STORMS
###############################################################################
  ** END OF RUN :   78

***************************************************************************************************

 RUN#:COMMAND#
R0079:C00001---------------------------------------------------------------------------------------
     START
      [TZERO =    .00 hrs on 19790101]
```

```
      [METOUT=   2    (1=imperial, 2=metric output)]
      [NSTORM=   0 ]
      [NRUN  = 0079 ]
#*****************************************************************************
#  SWMHYMO Ver:5.02/Jan 2001 <BETA> / INPUT DATA FILE
#*****************************************************************************
#  Project Name  : [Caivan Stittsville West properties]
#  Project Number: [2267]
#  Date          : [2021/12/14]
#  Modeller      : [JB]
#  Company       : J.F. Sabourin and Associates
#  License #     : 2549237
#*****************************************************************************
#*****************************************************************************
# Ottawa International Airport (1967 - 2003)
R0079:C00002----------------------------------------------------------------------------------------------------
  *  READ AES DATA
      [Filename  = 6106000.123                                                ]
      [Start_date= 1979.0101: End_date= 1979.1231]
      {DT= 60.min: Length= 8760.hrs: WetHrs=  546: DryHrs= 8214: PTOT= 866.50}
      Maximum average rainfall intensities over
        1 hr    2 hrs    3 hrs    6 hrs   12 hrs   24 hrs   36 hrs   48 hrs   72 hrs
       34.90    22.00    14.67     7.33     5.14     2.63     1.75     1.31      .88    mm/hr
       34.90    44.00    44.00    44.00    61.70    63.00    63.00    63.00    63.00    mm
      19790616 19790616 19790616 19790616 19790914 19790915 19790915 19790915 19790917  date
      Number of rainfall events per following interevent time
        1 hr    2 hrs    3 hrs    6 hrs   12 hrs   24 hrs   36 hrs   48 hrs   72 hrs
         205      160      140      114       92       61       52       43       35
      Number of events with at least the following durations
        1 hr    2 hrs    3 hrs    6 hrs   12 hrs   24 hrs   36 hrs   48 hrs   72 hrs
         204       98       68       23        4        0        0        0        0
R0079:C00003----------------------------------------------------------------------------------------------------
     COMPUTE API
      [APIini= 50.00: APIkdy= .9000: APIkdt= .9956]
      {APImax= 78.45: APIavg= 23.13: APImin=   .13}
###############################################################################
# Pre Development Condition - Using NASHHYD and CN
###############################################################################
R0079:C00004------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:EastPre       39.35     .382 1979.0616_15:00  198.36 .229     .000
      [CN= 65.0: N= 3.00: Tp= 1.47]
      [IaREC= 6.00: SMIN= 54.78: SMAX=365.23: SK= .025]
      [InterEventTime=  12.00]
R0079:C00005------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:WestPre       39.85     .406 1979.0616_14:45  194.39 .224     .000
      [CN= 61.0: N= 3.00: Tp= 1.22]
      [IaREC= 6.00: SMIN= 64.50: SMAX=430.01: SK= .025]
      [InterEventTime=  12.00]
R0079:C00006------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ADD HYD              15.0 02:WestPre       39.85     .406 1979.0616_14:45  194.39  n/a     .000
                     +   15.0 02:EastPre       39.35     .382 1979.0616_15:00  198.36  n/a     .000
                  SUM=   15.0 01:Pre           79.20     .785 1979.0616_15:00  196.37  n/a     .000
###############################################################################
# Pre Development Condition - Using NASHHYD and CN - No INFILTRATION
###############################################################################
R0079:C00007------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:InfEastPre    39.35    1.379 1979.0616_15:00  400.19 .462     .000
      [CN=100.0: N= 3.00: Tp= 1.47]
      [IaREC= 6.00: SMIN=  1.39: SMAX=  9.24: SK= .025]
      [InterEventTime=  12.00]
R0079:C00008------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:InfWestPre    39.85    1.653 1979.0616_14:45  400.19 .462     .000
      [CN=100.0: N= 3.00: Tp= 1.22]
      [IaREC= 6.00: SMIN=  1.39: SMAX=  9.24: SK= .025]
      [InterEventTime=  12.00]
R0079:C00009------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ADD HYD              15.0 02:InfWestPre    39.85    1.653 1979.0616_14:45  400.19  n/a     .000
                     +   15.0 02:InfEastPre    39.35    1.379 1979.0616_15:00  400.19  n/a     .000
                  SUM=   15.0 01:InfPre        79.20    3.018 1979.0616_14:45  400.19  n/a     .000
###############################################################################
# STORMS
###############################################################################
  ** END OF RUN :   79

****************************************************************************************************

 RUN#:COMMAND#
R0080:C00001----------------------------------------------------------------------------------------------------
     START
      [TZERO =    .00 hrs on 19800101]
      [METOUT=   2    (1=imperial, 2=metric output)]
      [NSTORM=   0 ]
      [NRUN  = 0080 ]
#*****************************************************************************
#  SWMHYMO Ver:5.02/Jan 2001 <BETA> / INPUT DATA FILE
#*****************************************************************************
#  Project Name  : [Caivan Stittsville West properties]
#  Project Number: [2267]
#  Date          : [2021/12/14]
#  Modeller      : [JB]
#  Company       : J.F. Sabourin and Associates
#  License #     : 2549237
#*****************************************************************************
#*****************************************************************************
# Ottawa International Airport (1967 - 2003)
R0080:C00002----------------------------------------------------------------------------------------------------
  *  READ AES DATA
      [Filename  = 6106000.123                                                ]
      [Start_date= 1980.0101: End_date= 1980.1230]
      {DT= 60.min: Length= 8760.hrs: WetHrs=  427: DryHrs= 8333: PTOT= 622.00}
      Maximum average rainfall intensities over
        1 hr    2 hrs    3 hrs    6 hrs   12 hrs   24 hrs   36 hrs   48 hrs   72 hrs
       15.00     9.20     6.50     4.72     3.23     1.83     1.35     1.01      .86    mm/hr
       15.00    18.40    19.50    28.30    38.80    43.80    48.60    48.60    62.00    mm
      19800830 19800830 19801025 19801025 19800321 19800322 19801026 19801027 19800902  date
      Number of rainfall events per following interevent time
        1 hr    2 hrs    3 hrs    6 hrs   12 hrs   24 hrs   36 hrs   48 hrs   72 hrs
         175      141      129      107       91       64       47       42       25
      Number of events with at least the following durations
        1 hr    2 hrs    3 hrs    6 hrs   12 hrs   24 hrs   36 hrs   48 hrs   72 hrs
         174       88       50       13        3        0        0        0        0
R0080:C00003----------------------------------------------------------------------------------------------------
     COMPUTE API
      [APIini= 50.00: APIkdy= .9000: APIkdt= .9956]
      {APImax= 68.74: APIavg= 17.50: APImin=   .06}
###############################################################################
# Pre Development Condition - Using NASHHYD and CN
###############################################################################
R0080:C00004------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:EastPre       39.35     .113 1980.0901_21:30   88.71 .143     .000
      [CN= 65.0: N= 3.00: Tp= 1.47]
      [IaREC= 6.00: SMIN= 54.78: SMAX=365.23: SK= .025]
      [InterEventTime=  12.00]
R0080:C00005------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:WestPre       39.85     .115 1980.0901_21:15   86.82 .140     .000
      [CN= 61.0: N= 3.00: Tp= 1.22]
      [IaREC= 6.00: SMIN= 64.50: SMAX=430.01: SK= .025]
      [InterEventTime=  12.00]
R0080:C00006------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ADD HYD              15.0 02:WestPre       39.85     .115 1980.0901_21:15   86.82  n/a     .000
                     +   15.0 02:EastPre       39.35     .113 1980.0901_21:30   88.71  n/a     .000
                  SUM=   15.0 01:Pre           79.20     .227 1980.0901_21:30   87.76  n/a     .000
###############################################################################
# Pre Development Condition - Using NASHHYD and CN - No INFILTRATION
###############################################################################
R0080:C00007------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:InfEastPre    39.35     .454 1980.1025_18:15  210.11 .338     .000
      [CN=100.0: N= 3.00: Tp= 1.47]
      [IaREC= 6.00: SMIN=  1.39: SMAX=  9.24: SK= .025]
      [InterEventTime=  12.00]
R0080:C00008------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:InfWestPre    39.85     .494 1980.1025_17:45  210.11 .338     .000
      [CN=100.0: N= 3.00: Tp= 1.22]
      [IaREC= 6.00: SMIN=  1.39: SMAX=  9.24: SK= .025]
      [InterEventTime=  12.00]
R0080:C00009------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ADD HYD              15.0 02:InfWestPre    39.85     .494 1980.1025_17:45  210.11  n/a     .000
                     +   15.0 02:InfEastPre    39.35     .454 1980.1025_18:15  210.11  n/a     .000
                  SUM=   15.0 01:InfPre        79.20     .940 1980.1025_18:00  210.11  n/a     .000
###############################################################################
# STORMS
###############################################################################
  ** END OF RUN :   80

****************************************************************************************************

 RUN#:COMMAND#
R0081:C00001----------------------------------------------------------------------------------------------------
     START
      [TZERO =    .00 hrs on 19810101]
      [METOUT=   2    (1=imperial, 2=metric output)]
      [NSTORM=   0 ]
      [NRUN  = 0081 ]
#*****************************************************************************
#  SWMHYMO Ver:5.02/Jan 2001 <BETA> / INPUT DATA FILE
#*****************************************************************************
#  Project Name  : [Caivan Stittsville West properties]
#  Project Number: [2267]
#  Date          : [2021/12/14]
#  Modeller      : [JB]
#  Company       : J.F. Sabourin and Associates
#  License #     : 2549237
#*****************************************************************************
#*****************************************************************************
# Ottawa International Airport (1967 - 2003)
R0081:C00002----------------------------------------------------------------------------------------------------
  *  READ AES DATA
      [Filename  = 6106000.123                                                ]
      [Start_date= 1981.0101: End_date= 1981.1231]
      {DT= 60.min: Length= 8760.hrs: WetHrs=  641: DryHrs= 8119: PTOT= 936.40}
      Maximum average rainfall intensities over
        1 hr    2 hrs    3 hrs    6 hrs   12 hrs   24 hrs   36 hrs   48 hrs   72 hrs
       35.30    31.85    25.23    15.70     8.03     4.58     3.22     2.41     1.61    mm/hr
       35.30    63.70    75.70    94.20    96.40   110.00   115.90   115.90   115.90    mm
      19810805 19810805 19810805 19810805 19810805 19810805 19810806 19810806 19810807  date
      Number of rainfall events per following interevent time
        1 hr    2 hrs    3 hrs    6 hrs   12 hrs   24 hrs   36 hrs   48 hrs   72 hrs
         242      188      156      122       93       70       57       45       27
      Number of events with at least the following durations
        1 hr    2 hrs    3 hrs    6 hrs   12 hrs   24 hrs   36 hrs   48 hrs   72 hrs
         241      129       79       29        4        0        0        0        0
R0081:C00003----------------------------------------------------------------------------------------------------
     COMPUTE API
      [APIini= 50.00: APIkdy= .9000: APIkdt= .9956]
      {APImax=116.15: APIavg= 25.69: APImin=   .26}
###############################################################################
# Pre Development Condition - Using NASHHYD and CN
###############################################################################
R0081:C00004------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:EastPre       39.35    1.216 1981.0805_ 4:15  226.21 .242     .000
      [CN= 65.0: N= 3.00: Tp= 1.47]
      [IaREC= 6.00: SMIN= 54.78: SMAX=365.23: SK= .025]
      [InterEventTime=  12.00]
R0081:C00005------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:WestPre       39.85    1.206 1981.0805_ 3:30  222.76 .238     .000
      [CN= 61.0: N= 3.00: Tp= 1.22]
      [IaREC= 6.00: SMIN= 64.50: SMAX=430.01: SK= .025]
      [InterEventTime=  12.00]
R0081:C00006------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ADD HYD              15.0 02:WestPre       39.85    1.206 1981.0805_ 3:30  222.76  n/a     .000
                     +   15.0 02:EastPre       39.35    1.216 1981.0805_ 4:15  226.21  n/a     .000
                  SUM=   15.0 01:Pre           79.20    2.402 1981.0805_ 4:15  224.48  n/a     .000
###############################################################################
# Pre Development Condition - Using NASHHYD and CN - No INFILTRATION
###############################################################################
R0081:C00007------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:InfEastPre    39.35    2.274 1981.0805_ 3:00  399.82 .427     .000
      [CN=100.0: N= 3.00: Tp= 1.47]
      [IaREC= 6.00: SMIN=  1.39: SMAX=  9.24: SK= .025]
      [InterEventTime=  12.00]
R0081:C00008------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:InfWestPre    39.85    2.577 1981.0805_ 2:45  399.82 .427     .000
      [CN=100.0: N= 3.00: Tp= 1.22]
      [IaREC= 6.00: SMIN=  1.39: SMAX=  9.24: SK= .025]
      [InterEventTime=  12.00]
R0081:C00009------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ADD HYD              15.0 02:InfWestPre    39.85    2.577 1981.0805_ 2:45  399.82  n/a     .000
                     +   15.0 02:InfEastPre    39.35    2.274 1981.0805_ 3:00  399.82  n/a     .000
                  SUM=   15.0 01:InfPre        79.20    4.809 1981.0805_ 2:45  399.82  n/a     .000
###############################################################################
# STORMS
###############################################################################
  ** END OF RUN :   81

****************************************************************************************************

 RUN#:COMMAND#
R0082:C00001----------------------------------------------------------------------------------------------------
     START
      [TZERO =    .00 hrs on 19820101]
      [METOUT=   2    (1=imperial, 2=metric output)]
      [NSTORM=   0 ]
      [NRUN  = 0082 ]
#*****************************************************************************
#  SWMHYMO Ver:5.02/Jan 2001 <BETA> / INPUT DATA FILE
#*****************************************************************************
#  Project Name  : [Caivan Stittsville West properties]
#  Project Number: [2267]
#  Date          : [2021/12/14]
#  Modeller      : [JB]
#  Company       : J.F. Sabourin and Associates
#  License #     : 2549237
#*****************************************************************************
#*****************************************************************************
# Ottawa International Airport (1967 - 2003)
R0082:C00002----------------------------------------------------------------------------------------------------
  *  READ AES DATA
      [Filename  = 6106000.123                                                ]
      [Start_date= 1982.0101: End_date= 1982.1231]
      {DT= 60.min: Length= 8760.hrs: WetHrs=  436: DryHrs= 8324: PTOT= 596.10}
      Maximum average rainfall intensities over
        1 hr    2 hrs    3 hrs    6 hrs   12 hrs   24 hrs   36 hrs   48 hrs   72 hrs
       19.80    10.75     7.60     5.83     3.36     1.68     1.12     1.01      .80    mm/hr
       19.80    21.50    22.80    35.00    40.30    40.30    40.30    48.70    57.30    mm
      19820801 19820901 19820825 19820825 19820825 19820826 19820826 19820825 19820825  date
      Number of rainfall events per following interevent time
        1 hr    2 hrs    3 hrs    6 hrs   12 hrs   24 hrs   36 hrs   48 hrs   72 hrs
         154      122      112       89       74       58       47       41       32
      Number of events with at least the following durations
        1 hr    2 hrs    3 hrs    6 hrs   12 hrs   24 hrs   36 hrs   48 hrs   72 hrs
         153       84       59       16        4        1        0        0        0
R0082:C00003----------------------------------------------------------------------------------------------------
     COMPUTE API
      [APIini= 50.00: APIkdy= .9000: APIkdt= .9956]
      {APImax= 56.86: APIavg= 16.78: APImin=   .03}
###############################################################################
# Pre Development Condition - Using NASHHYD and CN
###############################################################################
R0082:C00004------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:EastPre       39.35     .173 1982.0825_12:30   74.40 .125     .000
      [CN= 65.0: N= 3.00: Tp= 1.47]
      [IaREC= 6.00: SMIN= 54.78: SMAX=365.23: SK= .025]
      [InterEventTime=  12.00]
R0082:C00005------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:WestPre       39.85     .166 1982.0825_12:15   72.84 .122     .000
      [CN= 61.0: N= 3.00: Tp= 1.22]
      [IaREC= 6.00: SMIN= 64.50: SMAX=430.01: SK= .025]
      [InterEventTime=  12.00]
R0082:C00006------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ADD HYD              15.0 02:WestPre       39.85     .166 1982.0825_12:15   72.84  n/a     .000
                     +   15.0 02:EastPre       39.35     .173 1982.0825_12:30   74.40  n/a     .000
                  SUM=   15.0 01:Pre           79.20     .339 1982.0825_12:30   73.62  n/a     .000
###############################################################################
# Pre Development Condition - Using NASHHYD and CN - No INFILTRATION
###############################################################################
R0082:C00007------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:InfEastPre    39.35     .741 1982.0825_11:45  188.40 .316     .000
      [CN=100.0: N= 3.00: Tp= 1.47]
      [IaREC= 6.00: SMIN=  1.39: SMAX=  9.24: SK= .025]
      [InterEventTime=  12.00]
R0082:C00008------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:InfWestPre    39.85     .817 1982.0825_11:30  188.40 .316     .000
      [CN=100.0: N= 3.00: Tp= 1.22]
      [IaREC= 6.00: SMIN=  1.39: SMAX=  9.24: SK= .025]
      [InterEventTime=  12.00]
R0082:C00009------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ADD HYD              15.0 02:InfWestPre    39.85     .817 1982.0825_11:30  188.40  n/a     .000
                     +   15.0 02:InfEastPre    39.35     .741 1982.0825_11:45  188.40  n/a     .000
                  SUM=   15.0 01:InfPre        79.20    1.550 1982.0825_11:45  188.40  n/a     .000
###############################################################################
# STORMS
###############################################################################
  ** END OF RUN :   82

****************************************************************************************************

 RUN#:COMMAND#
R0083:C00001----------------------------------------------------------------------------------------------------
     START
      [TZERO =    .00 hrs on 19830101]
      [METOUT=   2    (1=imperial, 2=metric output)]
      [NSTORM=   0 ]
      [NRUN  = 0083 ]
#*****************************************************************************
#  SWMHYMO Ver:5.02/Jan 2001 <BETA> / INPUT DATA FILE
#*****************************************************************************
#  Project Name  : [Caivan Stittsville West properties]
#  Project Number: [2267]
#  Date          : [2021/12/14]
#  Modeller      : [JB]
#  Company       : J.F. Sabourin and Associates
#  License #     : 2549237
#*****************************************************************************
#*****************************************************************************
# Ottawa International Airport (1967 - 2003)
R0083:C00002----------------------------------------------------------------------------------------------------
  *  READ AES DATA
      [Filename  = 6106000.123                                                ]
      [Start_date= 1983.0101: End_date= 1983.1231]
      {DT= 60.min: Length= 8760.hrs: WetHrs=  461: DryHrs= 8299: PTOT= 587.30}
      Maximum average rainfall intensities over
        1 hr    2 hrs    3 hrs    6 hrs   12 hrs   24 hrs   36 hrs   48 hrs   72 hrs
       10.40     9.70     7.53     5.43     3.27     2.32     1.67     1.32      .92    mm/hr
       10.40    19.40    22.60    32.60    39.20    55.70    60.00    63.20    66.30    mm
```

```
      19831004 19830921 19830921 19831005 19831005 19831005 19831006 19831006 19831008  date
      Number of rainfall events per following interevent time
        1 hr    2 hrs    3 hrs    6 hrs   12 hrs   24 hrs   36 hrs   48 hrs   72 hrs
         169      130      114       97       78       53       48       44       34
      Number of events with at least the following durations
        1 hr    2 hrs    3 hrs    6 hrs   12 hrs   24 hrs   36 hrs   48 hrs   72 hrs
         168       88       54       24        4        0        0        0        0
R0083:C00003----------------------------------------------------------------------------------
     COMPUTE API
       [APIini= 50.00: APIkdy= .9000: APIkdt= .9956]
       {APImax= 79.30: APIavg= 16.56: APImin=   .05}
################################################################################
# Pre Development Condition - Using NASHHYD and CN
################################################################################
R0083:C00004------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:EastPre       39.35     .215 1983.1005_17:15   78.00 .133     .000
      [CN= 65.0: N= 3.00: Tp= 1.47]
      [IaREC= 6.00: SMIN= 54.78: SMAX=365.23: SK= .025]
      [InterEventTime=  12.00]
R0083:C00005------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:WestPre       39.85     .204 1983.1005_16:30   76.54 .130     .000
      [CN= 61.0: N= 3.00: Tp= 1.22]
      [IaREC= 6.00: SMIN= 64.50: SMAX=430.01: SK= .025]
      [InterEventTime=  12.00]
R0083:C00006------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ADD HYD              15.0 02:WestPre       39.85     .204 1983.1005_16:30   76.54  n/a     .000
                    +    15.0 02:EastPre       39.35     .215 1983.1005_17:15   78.00  n/a     .000
                 SUM=    15.0 01:Pre           79.20     .416 1983.1005_17:00   77.26  n/a     .000
################################################################################
# Pre Development Condition - Using NASHHYD and CN - No INFILTRATION
################################################################################
R0083:C00007------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:InfEastPre    39.35     .663 1983.1005_16:30  174.51 .297     .000
      [CN=100.0: N= 3.00: Tp= 1.47]
      [IaREC= 6.00: SMIN=  1.39: SMAX=  9.24: SK= .025]
      [InterEventTime=  12.00]
R0083:C00008------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:InfWestPre    39.85     .735 1983.1005_16:00  174.51 .297     .000
      [CN=100.0: N= 3.00: Tp= 1.22]
      [IaREC= 6.00: SMIN=  1.39: SMAX=  9.24: SK= .025]
      [InterEventTime=  12.00]
R0083:C00009------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ADD HYD              15.0 02:InfWestPre    39.85     .735 1983.1005_16:00  174.51  n/a     .000
                    +    15.0 02:InfEastPre    39.35     .663 1983.1005_16:30  174.51  n/a     .000
                 SUM=    15.0 01:InfPre        79.20    1.391 1983.1005_16:15  174.51  n/a     .000
################################################################################
# STORMS
################################################################################
  ** END OF RUN :   83

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 RUN#:COMMAND#
R0084:C00001----------------------------------------------------------------------------------
     START
       [TZERO =    .00 hrs on 19840101]
       [METOUT=   2    (1=imperial, 2=metric output)]
       [NSTORM=   0 ]
       [NRUN  = 0084 ]
#*******************************************************************************
#  SWMHYMO Ver:5.02/Jan 2001 <BETA> / INPUT DATA FILE
#*******************************************************************************
#  Project Name  : [Caivan Stittsville West properties]
#  Project Number: [2267]
#  Date          : [2021/12/14]
#  Modeller      : [JB]
#  Company       : J.F. Sabourin and Associates
#  License #     : 2549237
#*******************************************************************************
#*******************************************************************************
# Ottawa International Airport (1967 - 2003)
R0084:C00002----------------------------------------------------------------------------------
   *  READ AES DATA
       [Filename  = 6106000.123                                                  ]
       [Start_date= 1984.0101: End_date= 1984.1230]
       {DT= 60.min: Length= 8760.hrs: WetHrs=  308: DryHrs= 8452: PTOT= 459.40}
      Maximum average rainfall intensities over
        1 hr    2 hrs    3 hrs    6 hrs   12 hrs   24 hrs   36 hrs   48 hrs   72 hrs
       17.80     9.70     7.57     4.33     3.01     1.84     1.58     1.19     1.00    mm/hr
       17.80    19.40    22.70    26.00    36.10    44.10    56.80    57.00    72.00    mm
      19840812 19840812 19840812 19840806 19840812 19840813 19840813 19840814 19840813  date
      Number of rainfall events per following interevent time
        1 hr    2 hrs    3 hrs    6 hrs   12 hrs   24 hrs   36 hrs   48 hrs   72 hrs
         108       87       81       68       59       46       39       34       26
      Number of events with at least the following durations
        1 hr    2 hrs    3 hrs    6 hrs   12 hrs   24 hrs   36 hrs   48 hrs   72 hrs
         107       60       39       11        4        0        0        0        0
R0084:C00003----------------------------------------------------------------------------------
     COMPUTE API
       [APIini= 50.00: APIkdy= .9000: APIkdt= .9956]
       {APImax= 86.65: APIavg= 13.22: APImin=   .00}
################################################################################
# Pre Development Condition - Using NASHHYD and CN
################################################################################
R0084:C00004------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:EastPre       39.35     .173 1984.0813_ 7:45   82.99 .181     .000
      [CN= 65.0: N= 3.00: Tp= 1.47]
      [IaREC= 6.00: SMIN= 54.78: SMAX=365.23: SK= .025]
      [InterEventTime=  12.00]
R0084:C00005------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:WestPre       39.85     .177 1984.0813_ 7:15   81.76 .178     .000
      [CN= 61.0: N= 3.00: Tp= 1.22]
      [IaREC= 6.00: SMIN= 64.50: SMAX=430.01: SK= .025]
      [InterEventTime=  12.00]
R0084:C00006------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ADD HYD              15.0 02:WestPre       39.85     .177 1984.0813_ 7:15   81.76  n/a     .000
                    +    15.0 02:EastPre       39.35     .173 1984.0813_ 7:45   82.99  n/a     .000
                 SUM=    15.0 01:Pre           79.20     .348 1984.0813_ 7:30   82.37  n/a     .000
################################################################################
# Pre Development Condition - Using NASHHYD and CN - No INFILTRATION
################################################################################
R0084:C00007------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:InfEastPre    39.35     .595 1984.0812_ 8:00  178.56 .389     .000
      [CN=100.0: N= 3.00: Tp= 1.47]
      [IaREC= 6.00: SMIN=  1.39: SMAX=  9.24: SK= .025]
      [InterEventTime=  12.00]
R0084:C00008------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:InfWestPre    39.85     .713 1984.0812_ 7:45  178.56 .389     .000
      [CN=100.0: N= 3.00: Tp= 1.22]
      [IaREC= 6.00: SMIN=  1.39: SMAX=  9.24: SK= .025]
      [InterEventTime=  12.00]
R0084:C00009------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ADD HYD              15.0 02:InfWestPre    39.85     .713 1984.0812_ 7:45  178.56  n/a     .000
                    +    15.0 02:InfEastPre    39.35     .595 1984.0812_ 8:00  178.56  n/a     .000
                 SUM=    15.0 01:InfPre        79.20    1.292 1984.0812_ 7:45  178.56  n/a     .000
################################################################################
# STORMS
################################################################################
  ** END OF RUN :   84

*******************************************************************************************





 RUN#:COMMAND#
R0085:C00001----------------------------------------------------------------------------------
     START
       [TZERO =    .00 hrs on 19850101]
       [METOUT=   2    (1=imperial, 2=metric output)]
       [NSTORM=   0 ]
       [NRUN  = 0085 ]
#*******************************************************************************
#  SWMHYMO Ver:5.02/Jan 2001 <BETA> / INPUT DATA FILE
#*******************************************************************************
#  Project Name  : [Caivan Stittsville West properties]
#  Project Number: [2267]
#  Date          : [2021/12/14]
#  Modeller      : [JB]
#  Company       : J.F. Sabourin and Associates
#  License #     : 2549237
#*******************************************************************************
#*******************************************************************************
# Ottawa International Airport (1967 - 2003)
R0085:C00002----------------------------------------------------------------------------------
   *  READ AES DATA
       [Filename  = 6106000.123                                                  ]
       [Start_date= 1985.0101: End_date= 1985.1231]
       {DT= 60.min: Length= 8760.hrs: WetHrs=  354: DryHrs= 8406: PTOT= 559.90}
      Maximum average rainfall intensities over
        1 hr    2 hrs    3 hrs    6 hrs   12 hrs   24 hrs   36 hrs   48 hrs   72 hrs
       19.00    13.60     9.07     5.27     2.63     1.35     1.10      .82      .60    mm/hr
       19.00    27.20    27.20    31.60    31.60    32.30    39.60    39.60    43.10    mm
      19850716 19850617 19850617 19850618 19850618 19850224 19850619 19850619 19850225  date
      Number of rainfall events per following interevent time
        1 hr    2 hrs    3 hrs    6 hrs   12 hrs   24 hrs   36 hrs   48 hrs   72 hrs
         124       99       96       85       77       57       49       41       31
      Number of events with at least the following durations
        1 hr    2 hrs    3 hrs    6 hrs   12 hrs   24 hrs   36 hrs   48 hrs   72 hrs
         123       70       40       14        5        0        0        0        0
R0085:C00003----------------------------------------------------------------------------------
     COMPUTE API
       [APIini= 50.00: APIkdy= .9000: APIkdt= .9956]
       {APImax= 52.83: APIavg= 15.86: APImin=   .20}
################################################################################
# Pre Development Condition - Using NASHHYD and CN
################################################################################
R0085:C00004------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:EastPre       39.35     .109 1985.0618_ 0:00   85.30 .152     .000
      [CN= 65.0: N= 3.00: Tp= 1.47]
      [IaREC= 6.00: SMIN= 54.78: SMAX=365.23: SK= .025]
      [InterEventTime=  12.00]
R0085:C00005------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:WestPre       39.85     .113 1985.0617_23:45   83.69 .149     .000
      [CN= 61.0: N= 3.00: Tp= 1.22]
      [IaREC= 6.00: SMIN= 64.50: SMAX=430.01: SK= .025]
      [InterEventTime=  12.00]
R0085:C00006------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ADD HYD              15.0 02:WestPre       39.85     .113 1985.0617_23:45   83.68  n/a     .000
                    +    15.0 02:EastPre       39.35     .109 1985.0618_ 0:00   85.30  n/a     .000
                 SUM=    15.0 01:Pre           79.20     .218 1985.0617_23:45   84.49  n/a     .000
################################################################################
# Pre Development Condition - Using NASHHYD and CN - No INFILTRATION
################################################################################
R0085:C00007------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:InfEastPre    39.35     .691 1985.0617_23:45  218.00 .389     .000
      [CN=100.0: N= 3.00: Tp= 1.47]
      [IaREC= 6.00: SMIN=  1.39: SMAX=  9.24: SK= .025]
      [InterEventTime=  12.00]
R0085:C00008------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:InfWestPre    39.85     .817 1985.0617_23:30  218.00 .389     .000
      [CN=100.0: N= 3.00: Tp= 1.22]
      [IaREC= 6.00: SMIN=  1.39: SMAX=  9.24: SK= .025]
      [InterEventTime=  12.00]
R0085:C00009------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ADD HYD              15.0 02:InfWestPre    39.85     .817 1985.0617_23:30  218.00  n/a     .000
                    +    15.0 02:InfEastPre    39.35     .691 1985.0617_23:45  218.00  n/a     .000
                 SUM=    15.0 01:InfPre        79.20    1.500 1985.0617_23:45  218.00  n/a     .000
################################################################################
# STORMS
################################################################################
  ** END OF RUN :   85

*******************************************************************************************





 RUN#:COMMAND#
R0086:C00001----------------------------------------------------------------------------------
     START
       [TZERO =    .00 hrs on 19860101]
       [METOUT=   2    (1=imperial, 2=metric output)]
       [NSTORM=   0 ]
       [NRUN  = 0086 ]
#*******************************************************************************
#  SWMHYMO Ver:5.02/Jan 2001 <BETA> / INPUT DATA FILE
#*******************************************************************************
#  Project Name  : [Caivan Stittsville West properties]
#  Project Number: [2267]
#  Date          : [2021/12/14]
#  Modeller      : [JB]
#  Company       : J.F. Sabourin and Associates
#  License #     : 2549237
#*******************************************************************************
#*******************************************************************************
# Ottawa International Airport (1967 - 2003)
R0086:C00002----------------------------------------------------------------------------------
   *  READ AES DATA
       [Filename  = 6106000.123                                                  ]
       [Start_date= 1986.0101: End_date= 1986.1231]
       {DT= 60.min: Length= 8040.hrs: WetHrs=  520: DryHrs= 7520: PTOT= 849.40}
      Maximum average rainfall intensities over
        1 hr    2 hrs    3 hrs    6 hrs   12 hrs   24 hrs   36 hrs   48 hrs   72 hrs
       18.30    17.80    13.57     7.07     4.93     2.93     2.32     1.82     1.31    mm/hr
       18.30    35.60    40.70    42.40    59.20    70.40    83.50    87.20    94.40    mm
      19860729 19860729 19860729 19860729 19860912 19860912 19860912 19860912 19860913  date
      Number of rainfall events per following interevent time
        1 hr    2 hrs    3 hrs    6 hrs   12 hrs   24 hrs   36 hrs   48 hrs   72 hrs
         201      161      149      118       88       61       51       47       30
      Number of events with at least the following durations
        1 hr    2 hrs    3 hrs    6 hrs   12 hrs   24 hrs   36 hrs   48 hrs   72 hrs
         200      107       73       22        1        0        0        0        0
R0086:C00003----------------------------------------------------------------------------------
     COMPUTE API
       [APIini= 50.00: APIkdy= .9000: APIkdt= .9956]
       {APImax= 97.05: APIavg= 25.30: APImin=   .17}
################################################################################
# Pre Development Condition - Using NASHHYD and CN
################################################################################
R0086:C00004------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:EastPre       39.35     .462 1986.0912_ 0:15  187.30 .221     .000
      [CN= 65.0: N= 3.00: Tp= 1.47]
      [IaREC= 6.00: SMIN= 54.78: SMAX=365.23: SK= .025]
      [InterEventTime=  12.00]
R0086:C00005------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:WestPre       39.85     .483 1986.0912_ 6:30  184.33 .217     .000
      [CN= 61.0: N= 3.00: Tp= 1.22]
      [IaREC= 6.00: SMIN= 64.50: SMAX=430.01: SK= .025]
      [InterEventTime=  12.00]
R0086:C00006------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ADD HYD              15.0 02:WestPre       39.85     .483 1986.0912_ 6:30  184.33  n/a     .000
                    +    15.0 02:EastPre       39.35     .462 1986.0912_ 0:15  187.30  n/a     .000
                 SUM=    15.0 01:Pre           79.20     .933 1986.0912_ 6:30  185.80  n/a     .000
################################################################################
# Pre Development Condition - Using NASHHYD and CN - No INFILTRATION
################################################################################
R0086:C00007------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:InfEastPre    39.35    1.126 1986.0729_16:00  349.35 .411     .000
      [CN=100.0: N= 3.00: Tp= 1.47]
      [IaREC= 6.00: SMIN=  1.39: SMAX=  9.24: SK= .025]
      [InterEventTime=  12.00]
R0086:C00008------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:InfWestPre    39.85    1.285 1986.0729_15:45  349.35 .411     .000
      [CN=100.0: N= 3.00: Tp= 1.22]
      [IaREC= 6.00: SMIN=  1.39: SMAX=  9.24: SK= .025]
      [InterEventTime=  12.00]
R0086:C00009------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ADD HYD              15.0 02:InfWestPre    39.85    1.285 1986.0729_15:45  349.35  n/a     .000
                    +    15.0 02:InfEastPre    39.35    1.126 1986.0729_16:00  349.35  n/a     .000
                 SUM=    15.0 01:InfPre        79.20    2.396 1986.0729_15:45  349.35  n/a     .000
################################################################################
# STORMS
################################################################################
  ** END OF RUN :   86

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 RUN#:COMMAND#
R0087:C00001----------------------------------------------------------------------------------
     START
       [TZERO =    .00 hrs on 19870101]
       [METOUT=   2    (1=imperial, 2=metric output)]
       [NSTORM=   0 ]
       [NRUN  = 0087 ]
#*******************************************************************************
#  SWMHYMO Ver:5.02/Jan 2001 <BETA> / INPUT DATA FILE
#*******************************************************************************
#  Project Name  : [Caivan Stittsville West properties]
#  Project Number: [2267]
#  Date          : [2021/12/14]
#  Modeller      : [JB]
#  Company       : J.F. Sabourin and Associates
#  License #     : 2549237
#*******************************************************************************
#*******************************************************************************
# Ottawa International Airport (1967 - 2003)
R0087:C00002----------------------------------------------------------------------------------
   *  READ AES DATA
       [Filename  = 6106000.123                                                  ]
       [Start_date= 1987.0101: End_date= 1987.1231]
       {DT= 60.min: Length= 7344.hrs: WetHrs=  491: DryHrs= 6853: PTOT= 639.90}
      Maximum average rainfall intensities over
        1 hr    2 hrs    3 hrs    6 hrs   12 hrs   24 hrs   36 hrs   48 hrs   72 hrs
       20.00    13.90    14.03     7.05     4.83     2.44     1.77     1.34      .93    mm/hr
       20.00    27.80    42.10    42.30    58.00    58.60    63.60    64.20    67.00    mm
      19870724 19870724 19870724 19870724 19870724 19870725 19870725 19870726 19870727  date
      Number of rainfall events per following interevent time
        1 hr    2 hrs    3 hrs    6 hrs   12 hrs   24 hrs   36 hrs   48 hrs   72 hrs
         207      163      145      107       85       58       46       36       27
      Number of events with at least the following durations
        1 hr    2 hrs    3 hrs    6 hrs   12 hrs   24 hrs   36 hrs   48 hrs   72 hrs
         206      100       59       16        2        0        0        0        0
R0087:C00003----------------------------------------------------------------------------------
     COMPUTE API
       [APIini= 50.00: APIkdy= .9000: APIkdt= .9956]
       {APImax= 75.38: APIavg= 21.40: APImin=  1.18}
################################################################################
# Pre Development Condition - Using NASHHYD and CN
################################################################################
R0087:C00004------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:EastPre       39.35     .298 1987.0724_15:45   92.27 .144     .000
      [CN= 65.0: N= 3.00: Tp= 1.47]
      [IaREC= 6.00: SMIN= 54.78: SMAX=365.23: SK= .025]
      [InterEventTime=  12.00]
R0087:C00005------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:WestPre       39.85     .303 1987.0724_15:45   90.24 .141     .000
      [CN= 61.0: N= 3.00: Tp= 1.22]
      [IaREC= 6.00: SMIN= 64.50: SMAX=430.01: SK= .025]
      [InterEventTime=  12.00]
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R0087:C00006------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ADD HYD              15.0 02:WestPre       39.85      .303 1987.0724_15:45   90.24  n/a     .000
                    +    15.0 02:EastPre       39.35      .298 1987.0724_15:45   92.27  n/a     .000
                 SUM=    15.0 01:Pre           79.20      .601 1987.0724_15:45   91.25  n/a     .000
################################################################################
# Pre Development Condition - Using NASHHYD and CN - No INFILTRATION
################################################################################
R0087:C00007------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:InfEastPre    39.35     1.041 1987.0724_15:30  198.26 .310     .000
      [CN=100.0: N= 3.00: Tp= 1.47]
      [IaREC= 6.00: SMIN=  1.39: SMAX=  9.24: SK= .025]
      [InterEventTime=  12.00]
R0087:C00008------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:InfWestPre    39.85     1.152 1987.0724_15:15  198.26 .310     .000
      [CN=100.0: N= 3.00: Tp= 1.22]
      [IaREC= 6.00: SMIN=  1.39: SMAX=  9.24: SK= .025]
      [InterEventTime=  12.00]
R0087:C00009------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ADD HYD              15.0 02:InfWestPre    39.85     1.152 1987.0724_15:15  198.26  n/a     .000
                    +    15.0 02:InfEastPre    39.35     1.041 1987.0724_15:30  198.26  n/a     .000
                 SUM=    15.0 01:InfPre        79.20     2.181 1987.0724_15:30  198.26  n/a     .000
################################################################################
# STORMS
################################################################################
  ** END OF RUN :   87

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 RUN#:COMMAND#
R0088:C00001----------------------------------------------------------------------------------------
     START
      [TZERO =    .00 hrs on 19880101]
      [METOUT=   2    (1=imperial, 2=metric output)]
      [NSTORM=   0 ]
      [NRUN  = 0088 ]
#*******************************************************************************
#  SWMHYMO Ver:5.02/Jan 2001 <BETA> / INPUT DATA FILE
#*******************************************************************************
#  Project Name  : [Caivan Stittsville West properties]
#  Project Number: [2267]
#  Date          : [2021/12/14]
#  Modeller      : [JB]
#  Company       : J.F. Sabourin and Associates
#  License #     : 2549237
#*******************************************************************************
#*******************************************************************************
# Ottawa International Airport (1967 - 2003)
R0088:C00002----------------------------------------------------------------------------------------
  *  READ AES DATA
      [Filename  = 6106000.123                                                   ]
      [Start_date= 1988.0101: End_date= 1988.1230]
      {DT= 60.min: Length= 8760.hrs: WetHrs=  486: DryHrs= 8274: PTOT= 643.20}
      Maximum average rainfall intensities over
        1 hr    2 hrs    3 hrs    6 hrs   12 hrs   24 hrs   36 hrs   48 hrs   72 hrs
       25.50    18.20    12.77     7.37     3.78     1.91     1.27      .95      .94    mm/hr
       25.50    36.40    38.30    44.20    45.40    45.80    45.80    45.80    67.40    mm
      19880917 19880726 19880625 19880625 19880625 19880625 19880625 19880626 19880625  date
      Number of rainfall events per following interevent time
        1 hr    2 hrs    3 hrs    6 hrs   12 hrs   24 hrs   36 hrs   48 hrs   72 hrs
         183      141      121       85       68       56       48       41       25
      Number of events with at least the following durations
        1 hr    2 hrs    3 hrs    6 hrs   12 hrs   24 hrs   36 hrs   48 hrs   72 hrs
         182      101       70       19        3        0        0        0        0
R0088:C00003----------------------------------------------------------------------------------------
     COMPUTE API
      [APIini= 50.00: APIkdy= .9000: APIkdt= .9956]
      {APImax= 66.19: APIavg= 18.05: APImin=   .03}
################################################################################
# Pre Development Condition - Using NASHHYD and CN
################################################################################
R0088:C00004------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:EastPre       39.35      .366 1988.0625_14:00  106.79 .166     .000
      [CN= 65.0: N= 3.00: Tp= 1.47]
      [IaREC= 6.00: SMIN= 54.78: SMAX=365.23: SK= .025]
      [InterEventTime=  12.00]
R0088:C00005------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:WestPre       39.85      .383 1988.0625_13:45  104.72 .163     .000
      [CN= 61.0: N= 3.00: Tp= 1.22]
      [IaREC= 6.00: SMIN= 64.50: SMAX=430.01: SK= .025]
      [InterEventTime=  12.00]
R0088:C00006------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ADD HYD              15.0 02:WestPre       39.85      .383 1988.0625_13:45  104.72  n/a     .000
                    +    15.0 02:EastPre       39.35      .366 1988.0625_14:00  106.79  n/a     .000
                 SUM=    15.0 01:Pre           79.20      .747 1988.0625_13:45  105.75  n/a     .000
################################################################################
# Pre Development Condition - Using NASHHYD and CN - No INFILTRATION
################################################################################
R0088:C00007------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:InfEastPre    39.35     1.214 1988.0625_13:30  224.71 .349     .000
      [CN=100.0: N= 3.00: Tp= 1.47]
      [IaREC= 6.00: SMIN=  1.39: SMAX=  9.24: SK= .025]
      [InterEventTime=  12.00]
R0088:C00008------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:InfWestPre    39.85     1.397 1988.0625_13:30  224.71 .349     .000
      [CN=100.0: N= 3.00: Tp= 1.22]
      [IaREC= 6.00: SMIN=  1.39: SMAX=  9.24: SK= .025]
      [InterEventTime=  12.00]
R0088:C00009------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ADD HYD              15.0 02:InfWestPre    39.85     1.397 1988.0625_13:30  224.71  n/a     .000
                    +    15.0 02:InfEastPre    39.35     1.214 1988.0625_13:30  224.71  n/a     .000
                 SUM=    15.0 01:InfPre        79.20     2.611 1988.0625_13:30  224.71  n/a     .000
################################################################################
# STORMS
################################################################################
  ** END OF RUN :   88

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 RUN#:COMMAND#
R0089:C00001----------------------------------------------------------------------------------------
     START
      [TZERO =    .00 hrs on 19890101]
      [METOUT=   2    (1=imperial, 2=metric output)]
      [NSTORM=   0 ]
      [NRUN  = 0089 ]
#*******************************************************************************
#  SWMHYMO Ver:5.02/Jan 2001 <BETA> / INPUT DATA FILE
#*******************************************************************************
#  Project Name  : [Caivan Stittsville West properties]
#  Project Number: [2267]
#  Date          : [2021/12/14]
#  Modeller      : [JB]
#  Company       : J.F. Sabourin and Associates
#  License #     : 2549237
#*******************************************************************************
#*******************************************************************************
# Ottawa International Airport (1967 - 2003)
R0089:C00002----------------------------------------------------------------------------------------
  *  READ AES DATA
      [Filename  = 6106000.123                                                   ]
      [Start_date= 1989.0101: End_date= 1989.1231]
      {DT= 60.min: Length= 8040.hrs: WetHrs=  421: DryHrs= 7619: PTOT= 522.50}
      Maximum average rainfall intensities over
        1 hr    2 hrs    3 hrs    6 hrs   12 hrs   24 hrs   36 hrs   48 hrs   72 hrs
       22.70    12.60     8.93     5.75     3.03     1.67     1.14      .86      .59    mm/hr
       22.70    25.20    26.80    34.50    36.30    40.20    40.90    41.50    42.50    mm
      19890727 19890727 19890727 19890727 19890727 19891020 19891021 19891022 19891022  date
      Number of rainfall events per following interevent time
        1 hr    2 hrs    3 hrs    6 hrs   12 hrs   24 hrs   36 hrs   48 hrs   72 hrs
         170      137      120      101       71       52       40       36       29
      Number of events with at least the following durations
        1 hr    2 hrs    3 hrs    6 hrs   12 hrs   24 hrs   36 hrs   48 hrs   72 hrs
         169       81       49       17        4        0        0        0        0
R0089:C00003----------------------------------------------------------------------------------------
     COMPUTE API
      [APIini= 50.00: APIkdy= .9000: APIkdt= .9956]
      {APImax= 54.64: APIavg= 16.01: APImin=   .02}
################################################################################
# Pre Development Condition - Using NASHHYD and CN
################################################################################
R0089:C00004------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:EastPre       39.35      .144 1989.0727_16:30   66.36 .127     .000
      [CN= 65.0: N= 3.00: Tp= 1.47]
      [IaREC= 6.00: SMIN= 54.78: SMAX=365.23: SK= .025]
      [InterEventTime=  12.00]
R0089:C00005------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:WestPre       39.85      .145 1989.0727_16:00   64.85 .124     .000
      [CN= 61.0: N= 3.00: Tp= 1.22]
      [IaREC= 6.00: SMIN= 64.50: SMAX=430.01: SK= .025]
      [InterEventTime=  12.00]
R0089:C00006------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ADD HYD              15.0 02:WestPre       39.85      .145 1989.0727_16:00   64.85  n/a     .000
                    +    15.0 02:EastPre       39.35      .144 1989.0727_16:30   66.36  n/a     .000
                 SUM=    15.0 01:Pre           79.20      .288 1989.0727_16:15   65.60  n/a     .000
################################################################################
# Pre Development Condition - Using NASHHYD and CN - No INFILTRATION
################################################################################
R0089:C00007------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:InfEastPre    39.35      .822 1989.0727_16:15  165.82 .317     .000
      [CN=100.0: N= 3.00: Tp= 1.47]
      [IaREC= 6.00: SMIN=  1.39: SMAX=  9.24: SK= .025]
      [InterEventTime=  12.00]
R0089:C00008------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:InfWestPre    39.85      .969 1989.0727_15:45  165.82 .317     .000
      [CN=100.0: N= 3.00: Tp= 1.22]
      [IaREC= 6.00: SMIN=  1.39: SMAX=  9.24: SK= .025]
      [InterEventTime=  12.00]
R0089:C00009------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ADD HYD              15.0 02:InfWestPre    39.85      .969 1989.0727_15:45  165.82  n/a     .000
                    +    15.0 02:InfEastPre    39.35      .822 1989.0727_16:15  165.82  n/a     .000
                 SUM=    15.0 01:InfPre        79.20     1.784 1989.0727_16:00  165.82  n/a     .000
################################################################################
# STORMS
################################################################################
  ** END OF RUN :   89

****************************************************************************************************





 RUN#:COMMAND#
R0090:C00001----------------------------------------------------------------------------------------
     START
      [TZERO =    .00 hrs on 19900101]
      [METOUT=   2    (1=imperial, 2=metric output)]
      [NSTORM=   0 ]
      [NRUN  = 0090 ]
#*******************************************************************************
#  SWMHYMO Ver:5.02/Jan 2001 <BETA> / INPUT DATA FILE
#*******************************************************************************
#  Project Name  : [Caivan Stittsville West properties]
#  Project Number: [2267]
#  Date          : [2021/12/14]
#  Modeller      : [JB]
#  Company       : J.F. Sabourin and Associates
#  License #     : 2549237
#*******************************************************************************
#*******************************************************************************
# Ottawa International Airport (1967 - 2003)
R0090:C00002----------------------------------------------------------------------------------------
  *  READ AES DATA
      [Filename  = 6106000.123                                                   ]
      [Start_date= 1990.0101: End_date= 1990.1231]
      {DT= 60.min: Length= 7344.hrs: WetHrs=  618: DryHrs= 6726: PTOT= 727.80}
      Maximum average rainfall intensities over
        1 hr    2 hrs    3 hrs    6 hrs   12 hrs   24 hrs   36 hrs   48 hrs   72 hrs
       20.60    12.25     9.60     5.55     4.43     2.25     1.50     1.21     1.06    mm/hr
       20.60    24.50    28.80    33.30    53.20    54.00    54.00    58.30    76.10    mm
      19900720 19900720 19900828 19900828 19900720 19900720 19900720 19900722 19900723  date
      Number of rainfall events per following interevent time
        1 hr    2 hrs    3 hrs    6 hrs   12 hrs   24 hrs   36 hrs   48 hrs   72 hrs
         225      170      153      121       94       68       55       47       33
      Number of events with at least the following durations
        1 hr    2 hrs    3 hrs    6 hrs   12 hrs   24 hrs   36 hrs   48 hrs   72 hrs
         224      116       72       30        6        0        0        0        0
R0090:C00003----------------------------------------------------------------------------------------
     COMPUTE API
      [APIini= 50.00: APIkdy= .9000: APIkdt= .9956]
      {APImax= 74.68: APIavg= 23.47: APImin=  3.11}
################################################################################
# Pre Development Condition - Using NASHHYD and CN
################################################################################
R0090:C00004------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:EastPre       39.35      .335 1990.0720_14:15  128.16 .176     .000
      [CN= 65.0: N= 3.00: Tp= 1.47]
      [IaREC= 6.00: SMIN= 54.78: SMAX=365.23: SK= .025]
      [InterEventTime=  12.00]
R0090:C00005------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:WestPre       39.85      .336 1990.0720_14:00  126.49 .174     .000
      [CN= 61.0: N= 3.00: Tp= 1.22]
      [IaREC= 6.00: SMIN= 64.50: SMAX=430.01: SK= .025]
      [InterEventTime=  12.00]
R0090:C00006------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ADD HYD              15.0 02:WestPre       39.85      .336 1990.0720_14:00  126.49  n/a     .000
                    +    15.0 02:EastPre       39.35      .335 1990.0720_14:15  128.16  n/a     .000
                 SUM=    15.0 01:Pre           79.20      .670 1990.0720_14:15  127.32  n/a     .000
################################################################################
# Pre Development Condition - Using NASHHYD and CN - No INFILTRATION
################################################################################
R0090:C00007------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:InfEastPre    39.35      .726 1990.0720_ 6:15  265.07 .364     .000
      [CN=100.0: N= 3.00: Tp= 1.47]
      [IaREC= 6.00: SMIN=  1.39: SMAX=  9.24: SK= .025]
      [InterEventTime=  12.00]
R0090:C00008------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:InfWestPre    39.85      .851 1990.0720_ 6:00  265.07 .364     .000
      [CN=100.0: N= 3.00: Tp= 1.22]
      [IaREC= 6.00: SMIN=  1.39: SMAX=  9.24: SK= .025]
      [InterEventTime=  12.00]
R0090:C00009------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ADD HYD              15.0 02:InfWestPre    39.85      .851 1990.0720_ 6:00  265.07  n/a     .000
                    +    15.0 02:InfEastPre    39.35      .726 1990.0720_ 6:15  265.07  n/a     .000
                 SUM=    15.0 01:InfPre        79.20     1.573 1990.0720_ 6:00  265.07  n/a     .000
################################################################################
# STORMS
################################################################################
  ** END OF RUN :   90

****************************************************************************************************





 RUN#:COMMAND#
R0091:C00001----------------------------------------------------------------------------------------
     START
      [TZERO =    .00 hrs on 19910101]
      [METOUT=   2    (1=imperial, 2=metric output)]
      [NSTORM=   0 ]
      [NRUN  = 0091 ]
#*******************************************************************************
#  SWMHYMO Ver:5.02/Jan 2001 <BETA> / INPUT DATA FILE
#*******************************************************************************
#  Project Name  : [Caivan Stittsville West properties]
#  Project Number: [2267]
#  Date          : [2021/12/14]
#  Modeller      : [JB]
#  Company       : J.F. Sabourin and Associates
#  License #     : 2549237
#*******************************************************************************
#*******************************************************************************
# Ottawa International Airport (1967 - 2003)
R0091:C00002----------------------------------------------------------------------------------------
  *  READ AES DATA
      [Filename  = 6106000.123                                                   ]
      [Start_date= 1991.0101: End_date= 1991.1231]
      {DT= 60.min: Length= 8040.hrs: WetHrs=  485: DryHrs= 7555: PTOT= 555.80}
      Maximum average rainfall intensities over
        1 hr    2 hrs    3 hrs    6 hrs   12 hrs   24 hrs   36 hrs   48 hrs   72 hrs
       11.30     6.05     4.40     3.77     2.32     1.59     1.28     1.08      .79    mm/hr
       11.30    12.10    13.20    22.60    27.80    38.20    46.00    51.60    56.80    mm
      19910409 19910409 19910409 19910410 19911016 19910422 19910410 19910410 19910423  date
      Number of rainfall events per following interevent time
        1 hr    2 hrs    3 hrs    6 hrs   12 hrs   24 hrs   36 hrs   48 hrs   72 hrs
         192      153      142      113       90       60       51       44       34
      Number of events with at least the following durations
        1 hr    2 hrs    3 hrs    6 hrs   12 hrs   24 hrs   36 hrs   48 hrs   72 hrs
         191       92       57       19        4        0        0        0        0
R0091:C00003----------------------------------------------------------------------------------------
     COMPUTE API
      [APIini= 50.00: APIkdy= .9000: APIkdt= .9956]
      {APImax= 71.51: APIavg= 16.87: APImin=   .26}
################################################################################
# Pre Development Condition - Using NASHHYD and CN
################################################################################
R0091:C00004------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:EastPre       39.35      .154 1991.0410_ 4:00   66.42 .120     .000
      [CN= 65.0: N= 3.00: Tp= 1.47]
      [IaREC= 6.00: SMIN= 54.78: SMAX=365.23: SK= .025]
      [InterEventTime=  12.00]
R0091:C00005------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:WestPre       39.85      .156 1991.0410_ 3:45   65.09 .117     .000
      [CN= 61.0: N= 3.00: Tp= 1.22]
      [IaREC= 6.00: SMIN= 64.50: SMAX=430.01: SK= .025]
      [InterEventTime=  12.00]
R0091:C00006------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ADD HYD              15.0 02:WestPre       39.85      .156 1991.0410_ 3:45   65.09  n/a     .000
                    +    15.0 02:EastPre       39.35      .154 1991.0410_ 4:00   66.42  n/a     .000
                 SUM=    15.0 01:Pre           79.20      .309 1991.0410_ 4:00   65.75  n/a     .000
################################################################################
# Pre Development Condition - Using NASHHYD and CN - No INFILTRATION
################################################################################
R0091:C00007------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:InfEastPre    39.35      .477 1991.0410_ 4:00  157.28 .283     .000
      [CN=100.0: N= 3.00: Tp= 1.47]
      [IaREC= 6.00: SMIN=  1.39: SMAX=  9.24: SK= .025]
      [InterEventTime=  12.00]
R0091:C00008------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:InfWestPre    39.85      .541 1991.0410_ 3:45  157.28 .283     .000
      [CN=100.0: N= 3.00: Tp= 1.22]
      [IaREC= 6.00: SMIN=  1.39: SMAX=  9.24: SK= .025]
      [InterEventTime=  12.00]
R0091:C00009------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ADD HYD              15.0 02:InfWestPre    39.85      .541 1991.0410_ 3:45  157.28  n/a     .000
                    +    15.0 02:InfEastPre    39.35      .477 1991.0410_ 4:00  157.28  n/a     .000
                 SUM=    15.0 01:InfPre        79.20     1.012 1991.0410_ 3:45  157.28  n/a     .000
################################################################################
# STORMS
################################################################################
```

```
  ** END OF RUN :   91
****************************************************************************************************
 RUN#:COMMAND#
R0092:C00001----------------------------------------------------------------------------------------
      START
       [TZERO =    .00 hrs on 19920101]
       [METOUT=   2    (1=imperial, 2=metric output)]
       [NSTORM=   0 ]
       [NRUN  = 0092 ]
#***************************************************************************
#  SWMHYMO Ver:5.02/Jan 2001 <BETA> / INPUT DATA FILE
#***************************************************************************
#  Project Name  : [Caivan Stittsville West properties]
#  Project Number: [2267]
#  Date          : [2021/12/14]
#  Modeller      : [JB]
#  Company       : J.F. Sabourin and Associates
#  License #     : 2549237
#***************************************************************************
#***************************************************************************
# Ottawa International Airport (1967 - 2003)
R0092:C00002----------------------------------------------------------------------------------------
  *  READ AES DATA
       [Filename  = 6106000.123                                              ]
       [Start_date= 1992.0101: End_date= 1992.1230]
       {DT= 60.min: Length= 8760.hrs: WetHrs=  550: DryHrs= 8210: PTOT= 730.20}
       Maximum average rainfall intensities over
         1 hr    2 hrs    3 hrs    6 hrs   12 hrs   24 hrs   36 hrs   48 hrs   72 hrs
        31.50    18.00    13.30     7.22     4.14     2.26     1.51     1.51     1.02    mm/hr
        31.50    36.00    39.90    43.30    49.70    54.20    54.20    72.60    73.60    mm
       19920804 19920804 19920804 19920804 19920717 19920718 19920718 19920719 19920720  date
       Number of rainfall events per following interevent time
         1 hr    2 hrs    3 hrs    6 hrs   12 hrs   24 hrs   36 hrs   48 hrs   72 hrs
          221      171      154      116       95       69       52       45       36
       Number of events with at least the following durations
         1 hr    2 hrs    3 hrs    6 hrs   12 hrs   24 hrs   36 hrs   48 hrs   72 hrs
          220      113       73       18        4        0        0        0        0
R0092:C00003----------------------------------------------------------------------------------------
      COMPUTE API
       [APIini= 50.00: APIkdy= .9000: APIkdt= .9956]
       {APImax= 97.88: APIavg= 20.27: APImin=  1.07}
###########################################################################
# Pre Development Condition - Using NASHHYD and CN
###########################################################################
R0092:C00004------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:EastPre       39.35     .519 1992.0717_19:30  137.55 .188     .000
       [CN= 65.0: N= 3.00: Tp= 1.47]
       [IaREC= 6.00: SMIN= 54.78: SMAX=365.23: SK= .025]
       [InterEventTime=  12.00]
R0092:C00005------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:WestPre       39.85     .528 1992.0717_19:30  135.51 .186     .000
       [CN= 61.0: N= 3.00: Tp= 1.22]
       [IaREC= 6.00: SMIN= 64.50: SMAX=430.01: SK= .025]
       [InterEventTime=  12.00]
R0092:C00006------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ADD HYD              15.0 02:WestPre       39.85     .528 1992.0717_19:30  135.51  n/a     .000
                    +    15.0 02:EastPre       39.35     .519 1992.0717_19:30  137.55  n/a     .000
                 SUM=    15.0 01:Pre           79.20    1.047 1992.0717_19:30  136.52  n/a     .000
###########################################################################
# Pre Development Condition - Using NASHHYD and CN - No INFILTRATION
###########################################################################
R0092:C00007------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:InfEastPre    39.35    1.280 1992.0717_19:15  273.86 .375     .000
       [CN=100.0: N= 3.00: Tp= 1.47]
       [IaREC= 6.00: SMIN=  1.39: SMAX=  9.24: SK= .025]
       [InterEventTime=  12.00]
R0092:C00008------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:InfWestPre    39.85    1.453 1992.0804_14:45  273.86 .375     .000
       [CN=100.0: N= 3.00: Tp= 1.22]
       [IaREC= 6.00: SMIN=  1.39: SMAX=  9.24: SK= .025]
       [InterEventTime=  12.00]
R0092:C00009------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ADD HYD              15.0 02:InfWestPre    39.85    1.453 1992.0804_14:45  273.86  n/a     .000
                    +    15.0 02:InfEastPre    39.35    1.280 1992.0717_19:15  273.86  n/a     .000
                 SUM=    15.0 01:InfPre        79.20    2.699 1992.0717_19:00  273.86  n/a     .000
###########################################################################
# STORMS
###########################################################################
  ** END OF RUN :   92
****************************************************************************************************
 RUN#:COMMAND#
R0093:C00001----------------------------------------------------------------------------------------
      START
       [TZERO =    .00 hrs on 19930101]
       [METOUT=   2    (1=imperial, 2=metric output)]
       [NSTORM=   0 ]
       [NRUN  = 0093 ]
#***************************************************************************
#  SWMHYMO Ver:5.02/Jan 2001 <BETA> / INPUT DATA FILE
#***************************************************************************
#  Project Name  : [Caivan Stittsville West properties]
#  Project Number: [2267]
#  Date          : [2021/12/14]
#  Modeller      : [JB]
#  Company       : J.F. Sabourin and Associates
#  License #     : 2549237
#***************************************************************************
#***************************************************************************
# Ottawa International Airport (1967 - 2003)
R0093:C00002----------------------------------------------------------------------------------------
  *  READ AES DATA
       [Filename  = 6106000.123                                              ]
       [Start_date= 1993.0101: End_date= 1993.1231]
       {DT= 60.min: Length= 8760.hrs: WetHrs=  584: DryHrs= 8176: PTOT= 721.10}
       Maximum average rainfall intensities over
         1 hr    2 hrs    3 hrs    6 hrs   12 hrs   24 hrs   36 hrs   48 hrs   72 hrs
        12.60     6.60     4.83     3.72     3.58     2.31     1.61     1.21      .81    mm/hr
        12.60    13.20    14.50    22.30    43.00    55.50    58.10    58.10    58.10    mm
       19930703 19930703 19931127 19931128 19931128 19931128 19931128 19931128 19931129  date
       Number of rainfall events per following interevent time
         1 hr    2 hrs    3 hrs    6 hrs   12 hrs   24 hrs   36 hrs   48 hrs   72 hrs
          190      154      137      111       91       73       57       48       34
       Number of events with at least the following durations
         1 hr    2 hrs    3 hrs    6 hrs   12 hrs   24 hrs   36 hrs   48 hrs   72 hrs
          189      110       66       27        7        2        0        0        0
R0093:C00003----------------------------------------------------------------------------------------
      COMPUTE API
       [APIini= 50.00: APIkdy= .9000: APIkdt= .9956]
       {APImax= 66.42: APIavg= 20.01: APImin=   .11}
###########################################################################
# Pre Development Condition - Using NASHHYD and CN
###########################################################################
R0093:C00004------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:EastPre       39.35     .194 1993.1128_ 8:45   94.79 .131     .000
       [CN= 65.0: N= 3.00: Tp= 1.47]
       [IaREC= 6.00: SMIN= 54.78: SMAX=365.23: SK= .025]
       [InterEventTime=  12.00]
R0093:C00005------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:WestPre       39.85     .188 1993.1128_ 8:30   92.42 .128     .000
       [CN= 61.0: N= 3.00: Tp= 1.22]
       [IaREC= 6.00: SMIN= 64.50: SMAX=430.01: SK= .025]
       [InterEventTime=  12.00]
R0093:C00006------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ADD HYD              15.0 02:WestPre       39.85     .188 1993.1128_ 8:30   92.42  n/a     .000
                    +    15.0 02:EastPre       39.35     .194 1993.1128_ 8:45   94.79  n/a     .000
                 SUM=    15.0 01:Pre           79.20     .380 1993.1128_ 8:30   93.60  n/a     .000
###########################################################################
# Pre Development Condition - Using NASHHYD and CN - No INFILTRATION
###########################################################################
R0093:C00007------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:InfEastPre    39.35     .458 1993.1128_ 8:30  235.03 .326     .000
       [CN=100.0: N= 3.00: Tp= 1.47]
       [IaREC= 6.00: SMIN=  1.39: SMAX=  9.24: SK= .025]
       [InterEventTime=  12.00]
R0093:C00008------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:InfWestPre    39.85     .485 1993.1128_ 8:15  235.03 .326     .000
       [CN=100.0: N= 3.00: Tp= 1.22]
       [IaREC= 6.00: SMIN=  1.39: SMAX=  9.24: SK= .025]
       [InterEventTime=  12.00]
R0093:C00009------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ADD HYD              15.0 02:InfWestPre    39.85     .485 1993.1128_ 8:15  235.03  n/a     .000
                    +    15.0 02:InfEastPre    39.35     .458 1993.1128_ 8:30  235.03  n/a     .000
                 SUM=    15.0 01:InfPre        79.20     .941 1993.1128_ 8:15  235.03  n/a     .000
###########################################################################
# STORMS
###########################################################################
  ** END OF RUN :   93
****************************************************************************************************
 RUN#:COMMAND#
R0094:C00001----------------------------------------------------------------------------------------
      START
       [TZERO =    .00 hrs on 19940101]
       [METOUT=   2    (1=imperial, 2=metric output)]
       [NSTORM=   0 ]
       [NRUN  = 0094 ]
#***************************************************************************
#  SWMHYMO Ver:5.02/Jan 2001 <BETA> / INPUT DATA FILE
#***************************************************************************
#  Project Name  : [Caivan Stittsville West properties]
#  Project Number: [2267]
#  Date          : [2021/12/14]
#  Modeller      : [JB]
#  Company       : J.F. Sabourin and Associates
#  License #     : 2549237
#***************************************************************************
#***************************************************************************
# Ottawa International Airport (1967 - 2003)
R0094:C00002----------------------------------------------------------------------------------------
  *  READ AES DATA
       [Filename  = 6106000.123                                              ]
       [Start_date= 1994.0101: End_date= 1994.1231]
       {DT= 60.min: Length= 6576.hrs: WetHrs=  328: DryHrs= 6248: PTOT= 527.00}
       Maximum average rainfall intensities over
         1 hr    2 hrs    3 hrs    6 hrs   12 hrs   24 hrs   36 hrs   48 hrs   72 hrs
        22.60    11.90     8.43     5.42     2.92     1.79     1.19      .89     1.15    mm/hr
        22.60    23.80    25.30    32.50    35.00    42.90    42.90    42.90    82.60    mm
       19940629 19940629 19940627 19940625 19940625 19940625 19940626 19940626 19940628  date
       Number of rainfall events per following interevent time
         1 hr    2 hrs    3 hrs    6 hrs   12 hrs   24 hrs   36 hrs   48 hrs   72 hrs
          131      110       96       75       60       46       37       32       23
       Number of events with at least the following durations
         1 hr    2 hrs    3 hrs    6 hrs   12 hrs   24 hrs   36 hrs   48 hrs   72 hrs
          130       70       46       12        1        0        0        0        0
R0094:C00003----------------------------------------------------------------------------------------
      COMPUTE API
       [APIini= 50.00: APIkdy= .9000: APIkdt= .9956]
       {APImax= 97.84: APIavg= 19.15: APImin=   .02}
###########################################################################
# Pre Development Condition - Using NASHHYD and CN
###########################################################################
R0094:C00004------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:EastPre       39.35     .179 1994.0627_13:00  105.31 .200     .000
       [CN= 65.0: N= 3.00: Tp= 1.47]
       [IaREC= 6.00: SMIN= 54.78: SMAX=365.23: SK= .025]
       [InterEventTime=  12.00]
R0094:C00005------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:WestPre       39.85     .173 1994.0627_12:30  103.78 .197     .000
       [CN= 61.0: N= 3.00: Tp= 1.22]
       [IaREC= 6.00: SMIN= 64.50: SMAX=430.01: SK= .025]
       [InterEventTime=  12.00]
R0094:C00006------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ADD HYD              15.0 02:WestPre       39.85     .173 1994.0627_12:30  103.78  n/a     .000
                    +    15.0 02:EastPre       39.35     .179 1994.0627_13:00  105.31  n/a     .000
                 SUM=    15.0 01:Pre           79.20     .349 1994.0627_12:45  104.54  n/a     .000
###########################################################################
# Pre Development Condition - Using NASHHYD and CN - No INFILTRATION
###########################################################################
R0094:C00007------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:InfEastPre    39.35     .696 1994.0627_12:15  204.63 .388     .000
       [CN=100.0: N= 3.00: Tp= 1.47]
       [IaREC= 6.00: SMIN=  1.39: SMAX=  9.24: SK= .025]
       [InterEventTime=  12.00]
R0094:C00008------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:InfWestPre    39.85     .769 1994.0627_12:00  204.63 .388     .000
       [CN=100.0: N= 3.00: Tp= 1.22]
       [IaREC= 6.00: SMIN=  1.39: SMAX=  9.24: SK= .025]
       [InterEventTime=  12.00]
R0094:C00009------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ADD HYD              15.0 02:InfWestPre    39.85     .769 1994.0627_12:00  204.63  n/a     .000
                    +    15.0 02:InfEastPre    39.35     .696 1994.0627_12:15  204.63  n/a     .000
                 SUM=    15.0 01:InfPre        79.20    1.455 1994.0627_12:00  204.63  n/a     .000
###########################################################################
# STORMS
###########################################################################
  ** END OF RUN :   94
****************************************************************************************************
 RUN#:COMMAND#
R0095:C00001----------------------------------------------------------------------------------------
      START
       [TZERO =    .00 hrs on 19950101]
       [METOUT=   2    (1=imperial, 2=metric output)]
       [NSTORM=   0 ]
       [NRUN  = 0095 ]
#***************************************************************************
#  SWMHYMO Ver:5.02/Jan 2001 <BETA> / INPUT DATA FILE
#***************************************************************************
#  Project Name  : [Caivan Stittsville West properties]
#  Project Number: [2267]
#  Date          : [2021/12/14]
#  Modeller      : [JB]
#  Company       : J.F. Sabourin and Associates
#  License #     : 2549237
#***************************************************************************
#***************************************************************************
# Ottawa International Airport (1967 - 2003)
R0095:C00002----------------------------------------------------------------------------------------
  *  READ AES DATA
       [Filename  = 6106000.123                                              ]
       [Start_date= 1995.0101: End_date= 1995.1231]
       {DT= 60.min: Length= 5112.hrs: WetHrs=  228: DryHrs= 4884: PTOT= 321.60}
       Maximum average rainfall intensities over
         1 hr    2 hrs    3 hrs    6 hrs   12 hrs   24 hrs   36 hrs   48 hrs   72 hrs
        16.90    13.25    10.27     7.70     6.32     3.31     2.21     1.65     1.10    mm/hr
        16.90    26.50    30.80    46.20    75.80    79.40    79.40    79.40    79.40    mm
       19950603 19950603 19950603 19950603 19950603 19950603 19950603 19950604 19950604  date
       Number of rainfall events per following interevent time
         1 hr    2 hrs    3 hrs    6 hrs   12 hrs   24 hrs   36 hrs   48 hrs   72 hrs
           67       55       48       38       35       29       24       22       18
       Number of events with at least the following durations
         1 hr    2 hrs    3 hrs    6 hrs   12 hrs   24 hrs   36 hrs   48 hrs   72 hrs
           66       37       23       10        5        1        0        0        0
R0095:C00003----------------------------------------------------------------------------------------
      COMPUTE API
       [APIini= 50.00: APIkdy= .9000: APIkdt= .9956]
       {APImax= 95.54: APIavg= 16.52: APImin=   .49}
###########################################################################
# Pre Development Condition - Using NASHHYD and CN
###########################################################################
R0095:C00004------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:EastPre       39.35     .640 1995.0603_ 9:45   93.16 .290     .000
       [CN= 65.0: N= 3.00: Tp= 1.47]
       [IaREC= 6.00: SMIN= 54.78: SMAX=365.23: SK= .025]
       [InterEventTime=  12.00]
R0095:C00005------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:WestPre       39.85     .660 1995.0603_ 9:30   91.61 .285     .000
       [CN= 61.0: N= 3.00: Tp= 1.22]
       [IaREC= 6.00: SMIN= 64.50: SMAX=430.01: SK= .025]
       [InterEventTime=  12.00]
R0095:C00006------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ADD HYD              15.0 02:WestPre       39.85     .660 1995.0603_ 9:30   91.61  n/a     .000
                    +    15.0 02:EastPre       39.35     .640 1995.0603_ 9:45   93.16  n/a     .000
                 SUM=    15.0 01:Pre           79.20    1.290 1995.0603_ 9:30   92.38  n/a     .000
###########################################################################
# Pre Development Condition - Using NASHHYD and CN - No INFILTRATION
###########################################################################
R0095:C00007------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:InfEastPre    39.35     .898 1995.0603_ 9:30  158.70 .493     .000
       [CN=100.0: N= 3.00: Tp= 1.47]
       [IaREC= 6.00: SMIN=  1.39: SMAX=  9.24: SK= .025]
       [InterEventTime=  12.00]
R0095:C00008------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:InfWestPre    39.85     .988 1995.0603_ 9:15  158.70 .493     .000
       [CN=100.0: N= 3.00: Tp= 1.22]
       [IaREC= 6.00: SMIN=  1.39: SMAX=  9.24: SK= .025]
       [InterEventTime=  12.00]
R0095:C00009------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ADD HYD              15.0 02:InfWestPre    39.85     .988 1995.0603_ 9:15  158.70  n/a     .000
                    +    15.0 02:InfEastPre    39.35     .898 1995.0603_ 9:30  158.70  n/a     .000
                 SUM=    15.0 01:InfPre        79.20    1.879 1995.0603_ 9:30  158.70  n/a     .000
###########################################################################
# STORMS
###########################################################################
  ** END OF RUN :   95
****************************************************************************************************
 RUN#:COMMAND#
R0096:C00001----------------------------------------------------------------------------------------
      START
       [TZERO =    .00 hrs on 19960101]
       [METOUT=   2    (1=imperial, 2=metric output)]
       [NSTORM=   0 ]
       [NRUN  = 0096 ]
#***************************************************************************
#  SWMHYMO Ver:5.02/Jan 2001 <BETA> / INPUT DATA FILE
#***************************************************************************
#  Project Name  : [Caivan Stittsville West properties]
#  Project Number: [2267]
#  Date          : [2021/12/14]
#  Modeller      : [JB]
#  Company       : J.F. Sabourin and Associates
#  License #     : 2549237
```

```
#*****************************************************************************
#*****************************************************************************
# Ottawa International Airport (1967 - 2003)
R0096:C00002----------------------------------------------------------------------------------
  *  READ AES DATA
      [Filename  = 6106000.123                                                  ]
      [Start_date= 1996.0101: End_date= 1996.1230]
      {DT= 60.min: Length= 6552.hrs: WetHrs=  387: DryHrs= 6165: PTOT= 512.20}
      Maximum average rainfall intensities over
        1 hr    2 hrs    3 hrs    6 hrs   12 hrs   24 hrs   36 hrs   48 hrs   72 hrs
       18.50    13.55     9.03     5.42     2.93     1.84     1.32     1.02      .70    mm/hr
       18.50    27.10    27.10    32.50    35.10    44.10    47.50    49.00    50.30    mm
      19960731 19960731 19960731 19960731 19960731 19961109 19961109 19961109 19961109  date
      Number of rainfall events per following interevent time
        1 hr    2 hrs    3 hrs    6 hrs   12 hrs   24 hrs   36 hrs   48 hrs   72 hrs
         132      104       93       71       59       43       36       31       24
      Number of events with at least the following durations
        1 hr    2 hrs    3 hrs    6 hrs   12 hrs   24 hrs   36 hrs   48 hrs   72 hrs
         131       72       50       19        2        1        0        0        0
R0096:C00003----------------------------------------------------------------------------------
     COMPUTE API
      [APIini= 50.00: APIkdy= .9000: APIkdt= .9956]
      {APImax= 63.22: APIavg= 19.39: APImin=   .71}
###############################################################################
# Pre Development Condition - Using NASHHYD and CN
###############################################################################
R0096:C00004------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:EastPre       39.35     .154 1996.0731_16:45   74.44 .145     .000
      [CN= 65.0: N= 3.00: Tp= 1.47]
      [IaREC= 6.00: SMIN= 54.78: SMAX=365.23: SK= .025]
      [InterEventTime=  12.00]
R0096:C00005------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:WestPre       39.85     .157 1996.0731_16:30   72.91 .142     .000
      [CN= 61.0: N= 3.00: Tp= 1.22]
      [IaREC= 6.00: SMIN= 64.50: SMAX=430.01: SK= .025]
      [InterEventTime=  12.00]
R0096:C00006------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ADD HYD              15.0 02:WestPre       39.85     .157 1996.0731_16:30   72.91  n/a     .000
                    +    15.0 02:EastPre       39.35     .154 1996.0731_16:45   74.44  n/a     .000
                 SUM=    15.0 01:Pre           79.20     .307 1996.0731_16:45   73.67  n/a     .000
###############################################################################
# Pre Development Condition - Using NASHHYD and CN - No INFILTRATION
###############################################################################
R0096:C00007------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:InfEastPre    39.35     .751 1996.0731_16:30  172.97 .338     .000
      [CN=100.0: N= 3.00: Tp= 1.47]
      [IaREC= 6.00: SMIN=  1.39: SMAX=  9.24: SK= .025]
      [InterEventTime=  12.00]
R0096:C00008------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:InfWestPre    39.85     .872 1996.0731_16:15  172.97 .338     .000
      [CN=100.0: N= 3.00: Tp= 1.22]
      [IaREC= 6.00: SMIN=  1.39: SMAX=  9.24: SK= .025]
      [InterEventTime=  12.00]
R0096:C00009------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ADD HYD              15.0 02:InfWestPre    39.85     .872 1996.0731_16:15  172.97  n/a     .000
                    +    15.0 02:InfEastPre    39.35     .751 1996.0731_16:30  172.97  n/a     .000
                 SUM=    15.0 01:InfPre        79.20    1.606 1996.0731_16:30  172.97  n/a     .000
###############################################################################
# STORMS
###############################################################################
  ** END OF RUN :   96

*******************************************************************************************






 RUN#:COMMAND#
R0097:C00001----------------------------------------------------------------------------------
     START
      [TZERO =    .00 hrs on 19970101]
      [METOUT=   2    (1=imperial, 2=metric output)]
      [NSTORM=   0 ]
      [NRUN  = 0097 ]
#*****************************************************************************
#  SWMHYMO Ver:5.02/Jan 2001 <BETA> / INPUT DATA FILE
#*****************************************************************************
#  Project Name  : [Caivan Stittsville West properties]
#  Project Number: [2267]
#  Date          : [2021/12/14]
#  Modeller      : [JB]
#  Company       : J.F. Sabourin and Associates
#  License #     : 2549237
#*****************************************************************************
#*****************************************************************************
# Ottawa International Airport (1967 - 2003)
R0097:C00002----------------------------------------------------------------------------------
  *  READ AES DATA
      [Filename  = 6106000.123                                                  ]
      [Start_date= 1997.0101: End_date= 1997.1231]
      {DT= 60.min: Length= 8040.hrs: WetHrs=  379: DryHrs= 7661: PTOT= 433.20}
      Maximum average rainfall intensities over
        1 hr    2 hrs    3 hrs    6 hrs   12 hrs   24 hrs   36 hrs   48 hrs   72 hrs
       12.50     7.60     5.67     4.43     2.91     1.68     1.12      .84      .63    mm/hr
       12.50    15.20    17.00    26.60    34.90    40.40    40.40    40.40    45.30    mm
      19970622 19970622 19970622 19970221 19970222 19970222 19970222 19970222 19970222  date
      Number of rainfall events per following interevent time
        1 hr    2 hrs    3 hrs    6 hrs   12 hrs   24 hrs   36 hrs   48 hrs   72 hrs
         113       92       83       67       61       55       48       43       30
      Number of events with at least the following durations
        1 hr    2 hrs    3 hrs    6 hrs   12 hrs   24 hrs   36 hrs   48 hrs   72 hrs
         112       70       46       20        4        0        0        0        0
R0097:C00003----------------------------------------------------------------------------------
     COMPUTE API
      [APIini= 50.00: APIkdy= .9000: APIkdt= .9956]
      {APImax= 50.00: APIavg= 13.66: APImin=   .27}
###############################################################################
# Pre Development Condition - Using NASHHYD and CN
###############################################################################
R0097:C00004------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:EastPre       39.35     .103 1997.0221_21:45   51.06 .118     .000
      [CN= 65.0: N= 3.00: Tp= 1.47]
      [IaREC= 6.00: SMIN= 54.78: SMAX=365.23: SK= .025]
      [InterEventTime=  12.00]
R0097:C00005------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:WestPre       39.85     .100 1997.0222_ 1:45   49.93 .115     .000
      [CN= 61.0: N= 3.00: Tp= 1.22]
      [IaREC= 6.00: SMIN= 64.50: SMAX=430.01: SK= .025]
      [InterEventTime=  12.00]
R0097:C00006------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ADD HYD              15.0 02:WestPre       39.85     .100 1997.0222_ 1:45   49.93  n/a     .000
                    +    15.0 02:EastPre       39.35     .103 1997.0221_21:45   51.06  n/a     .000
                 SUM=    15.0 01:Pre           79.20     .201 1997.0221_21:45   50.49  n/a     .000
###############################################################################
# Pre Development Condition - Using NASHHYD and CN - No INFILTRATION
###############################################################################
R0097:C00007------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:InfEastPre    39.35     .515 1997.0221_21:30  142.50 .329     .000
      [CN=100.0: N= 3.00: Tp= 1.47]
      [IaREC= 6.00: SMIN=  1.39: SMAX=  9.24: SK= .025]
      [InterEventTime=  12.00]
R0097:C00008------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:InfWestPre    39.85     .549 1997.0221_21:15  142.50 .329     .000
      [CN=100.0: N= 3.00: Tp= 1.22]
      [IaREC= 6.00: SMIN=  1.39: SMAX=  9.24: SK= .025]
      [InterEventTime=  12.00]
R0097:C00009------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ADD HYD              15.0 02:InfWestPre    39.85     .549 1997.0221_21:15  142.50  n/a     .000
                    +    15.0 02:InfEastPre    39.35     .515 1997.0221_21:30  142.50  n/a     .000
                 SUM=    15.0 01:InfPre        79.20    1.064 1997.0221_21:15  142.50  n/a     .000
###############################################################################
# STORMS
###############################################################################
  ** END OF RUN :   97

*******************************************************************************************






 RUN#:COMMAND#
R0098:C00001----------------------------------------------------------------------------------
     START
      [TZERO =    .00 hrs on 19980101]
      [METOUT=   2    (1=imperial, 2=metric output)]
      [NSTORM=   0 ]
      [NRUN  = 0098 ]
#*****************************************************************************
#  SWMHYMO Ver:5.02/Jan 2001 <BETA> / INPUT DATA FILE
#*****************************************************************************
#  Project Name  : [Caivan Stittsville West properties]
#  Project Number: [2267]
#  Date          : [2021/12/14]
#  Modeller      : [JB]
#  Company       : J.F. Sabourin and Associates
#  License #     : 2549237
#*****************************************************************************
#*****************************************************************************
# Ottawa International Airport (1967 - 2003)
R0098:C00002----------------------------------------------------------------------------------
  *  READ AES DATA
      [Filename  = 6106000.123                                                  ]
      [Start_date= 1998.0101: End_date= 1998.1231]
      {DT= 60.min: Length= 5088.hrs: WetHrs=  291: DryHrs= 4797: PTOT= 440.30}
      Maximum average rainfall intensities over
        1 hr    2 hrs    3 hrs    6 hrs   12 hrs   24 hrs   36 hrs   48 hrs   72 hrs
       15.80     8.90     7.60     4.00     2.54     1.82     1.27      .95      .76    mm/hr
       15.80    17.80    22.80    24.00    30.50    43.60    45.80    45.80    54.60    mm
      19980716 19980627 19980927 19980927 19980927 19980927 19980928 19980928 19980615  date
      Number of rainfall events per following interevent time
        1 hr    2 hrs    3 hrs    6 hrs   12 hrs   24 hrs   36 hrs   48 hrs   72 hrs
         126      104       95       78       63       42       37       32       21
      Number of events with at least the following durations
        1 hr    2 hrs    3 hrs    6 hrs   12 hrs   24 hrs   36 hrs   48 hrs   72 hrs
         125       64       43        8        1        0        0        0        0
R0098:C00003----------------------------------------------------------------------------------
     COMPUTE API
      [APIini= 50.00: APIkdy= .9000: APIkdt= .9956]
      {APImax= 57.22: APIavg= 21.28: APImin=  1.69}
###############################################################################
# Pre Development Condition - Using NASHHYD and CN
###############################################################################
R0098:C00004------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:EastPre       39.35     .099 1998.0927_15:15   59.11 .134     .000
      [CN= 65.0: N= 3.00: Tp= 1.47]
      [IaREC= 6.00: SMIN= 54.78: SMAX=365.23: SK= .025]
      [InterEventTime=  12.00]
R0098:C00005------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:WestPre       39.85     .103 1998.0927_15:00   58.17 .132     .000
      [CN= 61.0: N= 3.00: Tp= 1.22]
      [IaREC= 6.00: SMIN= 64.50: SMAX=430.01: SK= .025]
      [InterEventTime=  12.00]
R0098:C00006------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ADD HYD              15.0 02:WestPre       39.85     .103 1998.0927_15:00   58.17  n/a     .000
                    +    15.0 02:EastPre       39.35     .099 1998.0927_15:15   59.11  n/a     .000
                 SUM=    15.0 01:Pre           79.20     .202 1998.0927_15:15   58.64  n/a     .000
###############################################################################
# Pre Development Condition - Using NASHHYD and CN - No INFILTRATION
###############################################################################
R0098:C00007------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:InfEastPre    39.35     .500 1998.0927_ 3:30  142.49 .324     .000
      [CN=100.0: N= 3.00: Tp= 1.47]
      [IaREC= 6.00: SMIN=  1.39: SMAX=  9.24: SK= .025]
      [InterEventTime=  12.00]
R0098:C00008------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:InfWestPre    39.85     .547 1998.0627_ 1:45  142.49 .324     .000
      [CN=100.0: N= 3.00: Tp= 1.22]
      [IaREC= 6.00: SMIN=  1.39: SMAX=  9.24: SK= .025]
      [InterEventTime=  12.00]
R0098:C00009------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ADD HYD              15.0 02:InfWestPre    39.85     .547 1998.0627_ 1:45  142.49  n/a     .000
                    +    15.0 02:InfEastPre    39.35     .500 1998.0927_ 3:30  142.49  n/a     .000
                 SUM=    15.0 01:InfPre        79.20    1.038 1998.0927_ 3:15  142.49  n/a     .000
###############################################################################
# STORMS
###############################################################################
  ** END OF RUN :   98

*******************************************************************************************






 RUN#:COMMAND#
R0099:C00001----------------------------------------------------------------------------------
     START
      [TZERO =    .00 hrs on 19990101]
      [METOUT=   2    (1=imperial, 2=metric output)]
      [NSTORM=   0 ]
      [NRUN  = 0099 ]
#*****************************************************************************
#  SWMHYMO Ver:5.02/Jan 2001 <BETA> / INPUT DATA FILE
#*****************************************************************************
#  Project Name  : [Caivan Stittsville West properties]
#  Project Number: [2267]
#  Date          : [2021/12/14]
#  Modeller      : [JB]
#  Company       : J.F. Sabourin and Associates
#  License #     : 2549237
#*****************************************************************************
#*****************************************************************************
# Ottawa International Airport (1967 - 2003)
R0099:C00002----------------------------------------------------------------------------------
  *  READ AES DATA
      [Filename  = 6106000.123                                                  ]
      [Start_date= 1999.0101: End_date= 1999.1231]
      {DT= 60.min: Length= 4440.hrs: WetHrs=  247: DryHrs= 4193: PTOT= 424.40}
      Maximum average rainfall intensities over
        1 hr    2 hrs    3 hrs    6 hrs   12 hrs   24 hrs   36 hrs   48 hrs   72 hrs
       17.50    10.10     9.03     6.57     3.31     1.65     1.45     1.22      .97    mm/hr
       17.50    20.20    27.10    39.40    39.70    39.70    52.20    58.60    69.50    mm
      19990717 19990717 19990906 19990906 19990906 19990906 19990907 19990908 19990908  date
      Number of rainfall events per following interevent time
        1 hr    2 hrs    3 hrs    6 hrs   12 hrs   24 hrs   36 hrs   48 hrs   72 hrs
         102       80       70       63       56       39       31       28       18
      Number of events with at least the following durations
        1 hr    2 hrs    3 hrs    6 hrs   12 hrs   24 hrs   36 hrs   48 hrs   72 hrs
         101       57       31       10        1        0        0        0        0
R0099:C00003----------------------------------------------------------------------------------
     COMPUTE API
      [APIini= 50.00: APIkdy= .9000: APIkdt= .9956]
      {APImax= 69.51: APIavg= 23.97: APImin=  1.93}
###############################################################################
# Pre Development Condition - Using NASHHYD and CN
###############################################################################
R0099:C00004------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:EastPre       39.35     .160 1999.0906_10:30   66.40 .156     .000
      [CN= 65.0: N= 3.00: Tp= 1.47]
      [IaREC= 6.00: SMIN= 54.78: SMAX=365.23: SK= .025]
      [InterEventTime=  12.00]
R0099:C00005------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:WestPre       39.85     .152 1999.0906_10:15   65.46 .154     .000
      [CN= 61.0: N= 3.00: Tp= 1.22]
      [IaREC= 6.00: SMIN= 64.50: SMAX=430.01: SK= .025]
      [InterEventTime=  12.00]
R0099:C00006------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ADD HYD              15.0 02:WestPre       39.85     .152 1999.0906_10:15   65.46  n/a     .000
                    +    15.0 02:EastPre       39.35     .160 1999.0906_10:30   66.40  n/a     .000
                 SUM=    15.0 01:Pre           79.20     .312 1999.0906_10:15   65.93  n/a     .000
###############################################################################
# Pre Development Condition - Using NASHHYD and CN - No INFILTRATION
###############################################################################
R0099:C00007------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:InfEastPre    39.35     .769 1999.0906_ 9:30  151.02 .356     .000
      [CN=100.0: N= 3.00: Tp= 1.47]
      [IaREC= 6.00: SMIN=  1.39: SMAX=  9.24: SK= .025]
      [InterEventTime=  12.00]
R0099:C00008------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD    15.0 01:InfWestPre    39.85     .839 1999.0906_ 9:15  151.02 .356     .000
      [CN=100.0: N= 3.00: Tp= 1.22]
      [IaREC= 6.00: SMIN=  1.39: SMAX=  9.24: SK= .025]
      [InterEventTime=  12.00]
R0099:C00009------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ADD HYD              15.0 02:InfWestPre    39.85     .839 1999.0906_ 9:15  151.02  n/a     .000
                    +    15.0 02:InfEastPre    39.35     .769 1999.0906_ 9:30  151.02  n/a     .000
                 SUM=    15.0 01:InfPre        79.20    1.602 1999.0906_ 9:15  151.02  n/a     .000
###############################################################################
# STORMS
###############################################################################
  ** END OF RUN :   99

*******************************************************************************************






 RUN#:COMMAND#
R0100:C00001----------------------------------------------------------------------------------
     START
      [TZERO =    .00 hrs on 20000101]
      [METOUT=   2    (1=imperial, 2=metric output)]
      [NSTORM=   0 ]
      [NRUN  = 0100 ]
#*****************************************************************************
#  SWMHYMO Ver:5.02/Jan 2001 <BETA> / INPUT DATA FILE
#*****************************************************************************
#  Project Name  : [Caivan Stittsville West properties]
#  Project Number: [2267]
#  Date          : [2021/12/14]
#  Modeller      : [JB]
#  Company       : J.F. Sabourin and Associates
#  License #     : 2549237
#*****************************************************************************
#*****************************************************************************
# Ottawa International Airport (1967 - 2003)
R0100:C00002----------------------------------------------------------------------------------
  *  READ AES DATA
      [Filename  = 6106000.123                                                  ]
      [Start_date= 2000.0101: End_date= 2000.1230]
      {DT= 60.min: Length= 5160.hrs: WetHrs=  401: DryHrs= 4759: PTOT= 535.90}
      Maximum average rainfall intensities over
        1 hr    2 hrs    3 hrs    6 hrs   12 hrs   24 hrs   36 hrs   48 hrs   72 hrs
       14.70     9.60     8.03     6.43     3.89     1.95     1.30     1.03      .84    mm/hr
       14.70    19.20    24.10    38.60    46.70    46.70    46.80    49.30    60.40    mm
      20000625 20000625 20000625 20000625 20000625 20000625 20000626 20000510 20000511  date
      Number of rainfall events per following interevent time
        1 hr    2 hrs    3 hrs    6 hrs   12 hrs   24 hrs   36 hrs   48 hrs   72 hrs
         156      125      110       86       67       46       34       30       23
      Number of events with at least the following durations
        1 hr    2 hrs    3 hrs    6 hrs   12 hrs   24 hrs   36 hrs   48 hrs   72 hrs
         155       82       49       16        2        0        0        0        0
R0100:C00003----------------------------------------------------------------------------------
     COMPUTE API
      [APIini= 50.00: APIkdy= .9000: APIkdt= .9956]
      {APImax= 76.65: APIavg= 25.66: APImin=  5.70}
###############################################################################
```

```
# Pre Development Condition - Using NASHHYD and CN
################################################################################
R0100:C00004------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD   15.0 01:EastPre       39.35     .359 2000.0625_11:00   85.69 .160     .000
      [CN= 65.0: N= 3.00: Tp= 1.47]
      [IaREC= 6.00: SMIN= 54.78: SMAX=365.23: SK= .025]
      [InterEventTime=  12.00]
R0100:C00005------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD   15.0 01:WestPre       39.85     .369 2000.0625_10:45   84.05 .157     .000
      [CN= 61.0: N= 3.00: Tp= 1.22]
      [IaREC= 6.00: SMIN= 64.50: SMAX=430.01: SK= .025]
      [InterEventTime=  12.00]
R0100:C00006------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ADD HYD             15.0 02:WestPre       39.85     .369 2000.0625_10:45   84.05  n/a     .000
                   +    15.0 02:EastPre       39.35     .359 2000.0625_11:00   85.69  n/a     .000
                SUM=    15.0 01:Pre           79.20     .728 2000.0625_10:45   84.87  n/a     .000
################################################################################
# Pre Development Condition - Using NASHHYD and CN - No INFILTRATION
################################################################################
R0100:C00007------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD   15.0 01:InfEastPre    39.35     .863 2000.0625_10:45  192.84 .360     .000
      [CN=100.0: N= 3.00: Tp= 1.47]
      [IaREC= 6.00: SMIN=  1.39: SMAX=  9.24: SK= .025]
      [InterEventTime=  12.00]
R0100:C00008------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD   15.0 01:InfWestPre    39.85     .960 2000.0625_10:30  192.84 .360     .000
      [CN=100.0: N= 3.00: Tp= 1.22]
      [IaREC= 6.00: SMIN=  1.39: SMAX=  9.24: SK= .025]
      [InterEventTime=  12.00]
R0100:C00009------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ADD HYD             15.0 02:InfWestPre    39.85     .960 2000.0625_10:30  192.84  n/a     .000
                   +    15.0 02:InfEastPre    39.35     .863 2000.0625_10:45  192.84  n/a     .000
                SUM=    15.0 01:InfPre        79.20    1.820 2000.0625_10:30  192.84  n/a     .000
################################################################################
# STORMS
################################################################################
  ** END OF RUN :  101
 
*******************************************************************************************************

 RUN#:COMMAND#
R0102:C00001-------------------------------------------------------------------------------------------
    START
      [TZERO =    .00 hrs on 20020101]
      [METOUT=   2    (1=imperial, 2=metric output)]
      [NSTORM=   0 ]
      [NRUN  = 0102 ]
#******************************************************************************
#  SWMHYMO Ver:5.02/Jan 2001 <BETA> / INPUT DATA FILE
#******************************************************************************
#  Project Name  : [Caivan Stittsville West properties]
#  Project Number: [2267]
#  Date          : [2021/12/14]
#  Modeller      : [JB]
#  Company       : J.F. Sabourin and Associates
#  License #     : 2549237
#******************************************************************************
#******************************************************************************
# Ottawa International Airport (1967 - 2003)
R0102:C00002-------------------------------------------------------------------------------------------
  *  READ AES DATA
      [Filename  = 6106000.123                                          ]
      [Start_date= 2002.0101: End_date= 2002.1231]
      {DT= 60.min: Length= 5088.hrs: WetHrs=  304: DryHrs= 4784: PTOT= 551.50}
      Maximum average rainfall intensities over
        1 hr    2 hrs    3 hrs    6 hrs   12 hrs   24 hrs   36 hrs   48 hrs   72 hrs
       45.00    26.75    18.40     9.48     4.74     2.48     2.08     1.56     1.04    mm/hr
       45.00    53.50    55.20    56.90    56.90    59.50    74.90    74.90    74.90    mm
      20020627 20020627 20020627 20020627 20020627 20020627 20020627 20020628 20020629  date
      Number of rainfall events per following interevent time
        1 hr    2 hrs    3 hrs    6 hrs   12 hrs   24 hrs   36 hrs   48 hrs   72 hrs
         100       83       78       56       47       41       36       34       25
      Number of events with at least the following durations
        1 hr    2 hrs    3 hrs    6 hrs   12 hrs   24 hrs   36 hrs   48 hrs   72 hrs
         100       59       33       13        5        0        0        0        0
R0102:C00003-------------------------------------------------------------------------------------------
    COMPUTE API
      [APIini= 50.00: APIkdy= .9000: APIkdt= .9956]
      {APImax=114.06: APIavg= 26.37: APImin=  4.40}
################################################################################
# Pre Development Condition - Using NASHHYD and CN
################################################################################
R0102:C00004------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD   15.0 01:EastPre       39.35     .783 2002.0627_15:15  159.97 .290     .000
      [CN= 65.0: N= 3.00: Tp= 1.47]
      [IaREC= 6.00: SMIN= 54.78: SMAX=365.23: SK= .025]
      [InterEventTime=  12.00]
R0102:C00005------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD   15.0 01:WestPre       39.85     .844 2002.0627_15:00  158.24 .287     .000
      [CN= 61.0: N= 3.00: Tp= 1.22]
      [IaREC= 6.00: SMIN= 64.50: SMAX=430.01: SK= .025]
      [InterEventTime=  12.00]
R0102:C00006------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ADD HYD             15.0 02:WestPre       39.85     .844 2002.0627_15:00  158.24  n/a     .000
                   +    15.0 02:EastPre       39.35     .783 2002.0627_15:15  159.97  n/a     .000
                SUM=    15.0 01:Pre           79.20    1.625 2002.0627_15:00  159.10  n/a     .000
################################################################################
# Pre Development Condition - Using NASHHYD and CN - No INFILTRATION
################################################################################
R0102:C00007------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD   15.0 01:InfEastPre    39.35    1.819 2002.0627_15:00  273.41 .496     .000
      [CN=100.0: N= 3.00: Tp= 1.47]
      [IaREC= 6.00: SMIN=  1.39: SMAX=  9.24: SK= .025]
      [InterEventTime=  12.00]
R0102:C00008------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD   15.0 01:InfWestPre    39.85    2.169 2002.0627_14:45  273.41 .496     .000
      [CN=100.0: N= 3.00: Tp= 1.22]
      [IaREC= 6.00: SMIN=  1.39: SMAX=  9.24: SK= .025]
      [InterEventTime=  12.00]
R0102:C00009------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ADD HYD             15.0 02:InfWestPre    39.85    2.169 2002.0627_14:45  273.41  n/a     .000
                   +    15.0 02:InfEastPre    39.35    1.819 2002.0627_15:00  273.41  n/a     .000
                SUM=    15.0 01:InfPre        79.20    3.961 2002.0627_14:45  273.41  n/a     .000
################################################################################
# STORMS
################################################################################
  ** END OF RUN :  102
 
*******************************************************************************************************

 RUN#:COMMAND#
R0103:C00001-------------------------------------------------------------------------------------------
    START
      [TZERO =    .00 hrs on 20030101]
      [METOUT=   2    (1=imperial, 2=metric output)]
      [NSTORM=   0 ]
      [NRUN  = 0103 ]
#******************************************************************************
#  SWMHYMO Ver:5.02/Jan 2001 <BETA> / INPUT DATA FILE
#******************************************************************************
#  Project Name  : [Caivan Stittsville West properties]
#  Project Number: [2267]
#  Date          : [2021/12/14]
#  Modeller      : [JB]
#  Company       : J.F. Sabourin and Associates
#  License #     : 2549237
#******************************************************************************
#******************************************************************************
# Ottawa International Airport (1967 - 2003)
R0103:C00002-------------------------------------------------------------------------------------------
  *  READ AES DATA
      [Filename  = 6106000.123                                          ]
      [Start_date= 2003.0101: End_date= 2003.1231]
      {DT= 60.min: Length= 4440.hrs: WetHrs=  406: DryHrs= 4034: PTOT= 554.60}
      Maximum average rainfall intensities over
        1 hr    2 hrs    3 hrs    6 hrs   12 hrs   24 hrs   36 hrs   48 hrs   72 hrs
       15.10    10.00     7.13     4.28     3.18     1.86     1.25      .94      .81    mm/hr
       15.10    20.00    21.40    25.70    38.20    44.60    44.90    45.10    58.30    mm
      20030711 20030711 20030711 20030711 20031021 20031015 20030525 20030526 20030527  date
      Number of rainfall events per following interevent time
        1 hr    2 hrs    3 hrs    6 hrs   12 hrs   24 hrs   36 hrs   48 hrs   72 hrs
         145      127      109       86       64       45       38       25       15
      Number of events with at least the following durations
        1 hr    2 hrs    3 hrs    6 hrs   12 hrs   24 hrs   36 hrs   48 hrs   72 hrs
         144       80       43       13        5        1        0        0        0
R0103:C00003-------------------------------------------------------------------------------------------
    COMPUTE API
      [APIini= 50.00: APIkdy= .9000: APIkdt= .9956]
      {APImax= 72.10: APIavg= 28.54: APImin=  4.70}
################################################################################
# Pre Development Condition - Using NASHHYD and CN
################################################################################
R0103:C00004------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD   15.0 01:EastPre       39.35     .235 2003.0711_18:00  111.68 .201     .000
      [CN= 65.0: N= 3.00: Tp= 1.47]
      [IaREC= 6.00: SMIN= 54.78: SMAX=365.23: SK= .025]
      [InterEventTime=  12.00]
R0103:C00005------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD   15.0 01:WestPre       39.85     .244 2003.0711_17:45  109.00 .197     .000
      [CN= 61.0: N= 3.00: Tp= 1.22]
      [IaREC= 6.00: SMIN= 64.50: SMAX=430.01: SK= .025]
      [InterEventTime=  12.00]
R0103:C00006------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ADD HYD             15.0 02:WestPre       39.85     .244 2003.0711_17:45  109.00  n/a     .000
                   +    15.0 02:EastPre       39.35     .235 2003.0711_18:00  111.68  n/a     .000
                SUM=    15.0 01:Pre           79.20     .476 2003.0711_17:45  110.33  n/a     .000
################################################################################
# Pre Development Condition - Using NASHHYD and CN - No INFILTRATION
################################################################################
R0103:C00007------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD   15.0 01:InfEastPre    39.35     .778 2003.0711_17:45  231.08 .417     .000
      [CN=100.0: N= 3.00: Tp= 1.47]
      [IaREC= 6.00: SMIN=  1.39: SMAX=  9.24: SK= .025]
      [InterEventTime=  12.00]
R0103:C00008------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    CONTINUOUS NASHYD   15.0 01:InfWestPre    39.85     .903 2003.0711_17:30  231.08 .417     .000
      [CN=100.0: N= 3.00: Tp= 1.22]
      [IaREC= 6.00: SMIN=  1.39: SMAX=  9.24: SK= .025]
      [InterEventTime=  12.00]
R0103:C00009------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
    ADD HYD             15.0 02:InfWestPre    39.85     .903 2003.0711_17:30  231.08  n/a     .000
                   +    15.0 02:InfEastPre    39.35     .778 2003.0711_17:45  231.08  n/a     .000
                SUM=    15.0 01:InfPre        79.20    1.663 2003.0711_17:45  231.08  n/a     .000
################################################################################
# STORMS
################################################################################
R0103:C00002-------------------------------------------------------------------------------------------
    FINISH
-------------------------------------------------------------------------------------------------------
*******************************************************************************************************
     WARNINGS / ERRORS / NOTES
     -------------------------
R0067:C00002  READ AES DATA
*** WARNING: Requested start date is less than start date in file.
*** WARNING: Missing rainfall increments were set to 0.
*** WARNING: Missing rainfall increments were set to 0.
*** WARNING: Missing rainfall increments were set to 0.
*** WARNING: Requested start date is less than start date in file.
*** WARNING: Missing rainfall increments were set to 0.
*** WARNING: Missing rainfall increments were set to 0.
*** WARNING: Missing rainfall increments were set to 0.
*** WARNING: Missing rainfall increments were set to 0.
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*** WARNING: Missing rainfall increments were set to 0.
*** WARNING: Requested start date is less than start date in file.
*** WARNING: Missing rainfall increments were set to 0.
*** WARNING: Missing rainfall increments were set to 0.
*** WARNING: Missing rainfall increments were set to 0.
*** WARNING: Requested start date is less than start date in file.
*** WARNING: Missing rainfall increments were set to 0.
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*** WARNING: Requested start date is less than start date in file.
*** WARNING: Missing rainfall increments were set to 0.
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*** WARNING: Requested start date is less than start date in file.
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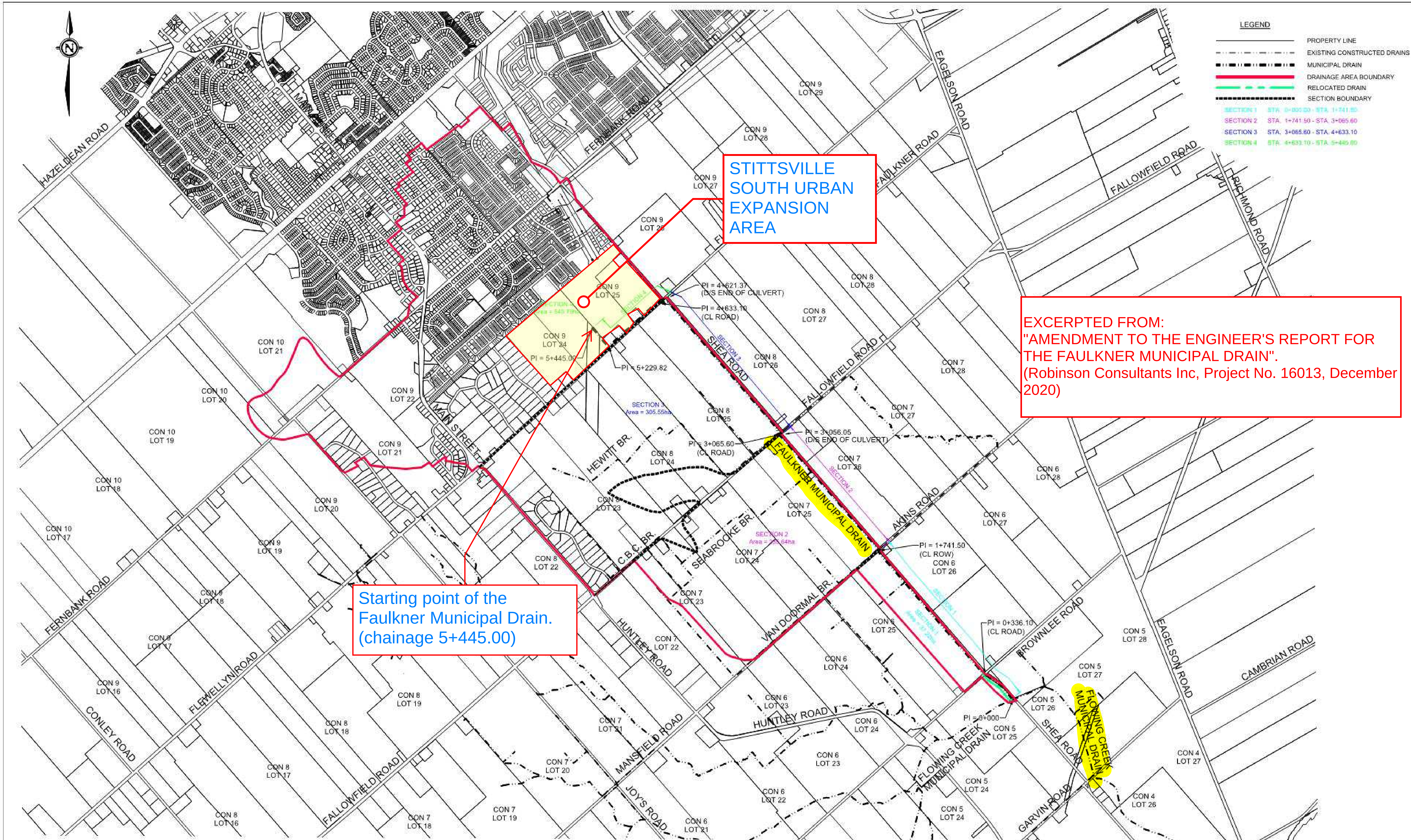
*** WARNING: Missing rainfall increments were set to 0.
*** WARNING: Requested start date is less than start date in file.
*** WARNING: Missing rainfall increments were set to 0.
*** WARNING: Requested start date is less than start date in file.
*** WARNING: Missing rainfall increments were set to 0.
*** WARNING: Requested start date is less than start date in file.
*** WARNING: Specified end date is beyond the end date in file.
*** WARNING: Missing rainfall increments were set to 0.
   Simulation ended on 2023-01-25     at 12:51:51
=======================================================================================================
```

Table B3 - Pre Development Water Budget

Year	Precipitation (mm)	Evaporation (mm)	Evaporation (%)	Infiltration (mm)	Infiltration (%)	Runoff (mm)	Runoff (%)
1967	386.9	213.7	55%	87.7	23%	85.5	22%
1968	592.8	356.7	60%	127.2	21%	108.9	18%
1969	569.8	359.1	63%	121.0	21%	89.7	16%
1970	558.9	358.6	64%	111.3	20%	89.0	16%
1971	522.1	361.4	69%	92.4	18%	68.3	13%
1972	784.3	441.3	56%	152.7	19%	190.3	24%
1973	744.9	435.8	59%	168.0	23%	141.1	19%
1974	386.2	281.2	73%	62.6	16%	42.4	11%
1975	535.5	338.7	63%	107.8	20%	89.0	17%
1976	492.4	348.6	71%	84.3	17%	59.5	12%
1977	677.6	430.6	64%	137.5	20%	109.5	16%
1978	638.8	408.5	64%	143.5	22%	86.9	14%
1979	866.5	466.3	54%	203.8	24%	196.4	23%
1980	622	411.9	66%	122.4	20%	87.8	14%
1981	936.4	536.6	57%	175.3	19%	224.5	24%
1982	596.1	407.7	68%	114.8	19%	73.6	12%
1983	587.3	412.8	70%	97.3	17%	77.3	13%
1984	459.4	280.8	61%	96.2	21%	82.4	18%
1985	559.9	341.9	61%	133.5	24%	84.5	15%
1986	849.4	500.1	59%	163.6	19%	185.8	22%
1987	639.9	441.6	69%	107.0	17%	91.3	14%
1988	643.2	418.5	65%	119.0	18%	105.8	16%
1989	522.5	356.7	68%	100.2	19%	65.6	13%
1990	727.8	462.7	64%	137.8	19%	127.3	17%
1991	555.8	398.5	72%	91.5	16%	65.8	12%
1992	730.2	456.3	62%	137.3	19%	136.5	19%
1993	721.1	486.1	67%	141.4	20%	93.6	13%
1994	527	322.4	61%	100.1	19%	104.5	20%
1995	321.6	162.9	51%	66.3	21%	92.4	29%
1996	512.2	339.2	66%	99.3	19%	73.7	14%
1997	433.2	290.7	67%	92.0	21%	50.5	12%
1998	440.3	297.8	68%	83.9	19%	58.6	13%
1999	424.4	273.4	64%	85.1	20%	65.9	16%
2000	535.9	343.1	64%	108.0	20%	84.9	16%
2002	551.5	278.1	50%	114.3	21%	159.1	29%
2003	554.6	323.5	58%	120.8	22%	110.3	20%
Average	589.1	370.7	63%	116.9	20%	101.6	17%
Min	321.6	162.9	50%	62.6	16%	42.4	11%
Max	936.4	536.6	73%	203.8	24%	224.5	29%



No.	DATE	REVISION	BY
1	15.04.20	ISSUED FOR MUNICIPAL REVIEW	AJR
2	27.05.20	ISSUED FOR AGENCY REVIEW	AJR
3	02.09.20	ISSUED FOR ECA APPLICATION	AJR
4	14.12.20	FINAL - ISSUED FOR DISTRIBUTION	AJR

LICENSED PROFESSIONAL ENGINEER A. J. ROBINSON 20/12/14 PROVINCE OF ONTARIO

SCALES: 150 0 300 HORIZONTAL

Robinson Consultants
350 Palladium Drive
Ottawa, Ontario K2V 1A8
(613) 592-6060 rcii.com

DESIGN LF · CHECKED AJR · DRAWN JHB · CHECKED LF · APPROVED AJR

CITY OF OTTAWA

FAULKNER MUNICIPAL DRAIN

MAINTENANCE SECTIONS and SECTION DRAINAGE AREAS

PROJECT No. 16013
CONTRACT No.
DATED DEC. 2020
DWG. No. FIG 6.1

The record of site-specific information associated with RVCA's regulatory approval process since 2006 was checked. It was found that no site-specific work affects the flood risk lines.

Drawings FL-1 and FL-2 in Appendix F depict the delineated floodplain and areas of shallow flooding.

7.2 Areas of Shallow Flooding

At a few places (Drawing FL-1), it is expected that flood water would go overbank from the channel and identifiable floodplain into the adjacent areas. However, there is considerable uncertainty as to how this would manifest itself and which area would actually be inundated by overbank water under the regulatory flood event. Many factors appear to be in the play: stream hydraulics, volume of flood water, volume of channel and floodplain storage, flood water escaping the stream as spills, amount of flood water available for spilling, local (micro) topography, shallow (sheet) flow with wet/dry fronts, rain water collected in depressions and puddles, soil and vegetation characteristics, etc. etc., and their interaction with each other. Needless to say, this is a very complex phenomenon and does not lend itself to engineering computation. While we can visualize the existence of areas of shallow flooding and can tentatively identify their probable extent, we cannot calculate with any degree of accuracy relevant parameters such as flood elevation, water depth or velocity. We tentatively call them areas of shallow flooding[11]. Such areas of shallow flooding are prone to a lesser (lesser than identifiable floodplains) albeit unspecified degree of flood risk. Even though flood risk parameters cannot be estimated, the areas of shallow flooding are nonetheless hazardous to a certain extent. As such they fall –in our judgment – within the broad category of hazardous lands as defined

[11] Our concept of areas of shallow flooding is somewhat akin to that adopted by Credit Valley Conservation. A recent document (CVC 2010; Section 5.4.3) reads: "**Floodplain Spill Areas** – There are several areas within the CVC's jurisdiction where floodplain spills occur. Spill areas are portions of the floodplain where hydraulic modeling and mapping of the riverine flood hazard indicates that flood waters are not physically contained within the valleyland and may or may not exit the watershed or subwatershed into surrounding lands. It is important to note that floodplain spill areas do not include the flood fringe, regardless of its characteristics such as flood flows and depths. Generally, the depth of flooding in spill areas cannot be readily determined as the flood depths that occur depend on a number of factors such as local and down-gradient topography, storage volume and the amount of spill flow that occurs. In addition, spills typically occur during higher flow rates of the storm event where the volume and depth of flood water is also dependent on the duration of the storm event."


Drawing FL-1 Cross-sections and regulatory flood levels
floodplain-areas of shallow flooding demarcation line
Study Limit
Cross Section
1m LiDAR-derived contours
100yr Floodline / La Crue Regulatrice
areas of shallow flooding
Floodplain
08 MAY 2017
The information in this drawing is for information purposes only. Authoritative information on flood hazard is maintained in RVCA's GIS system and is updated from time to time based on new data.
Shea Road (Faulkner Municipal Drain along western right-of-way)
Potential area of shallow flooding adjacent to Faulkner Municipal Drain
Study Limit
RIDEAU VALLEY CONSERVATION AUTHORITY
Projection note: U.T.M. Zone 18 - NAD 83 Datum
File name: Drawing FL-1
Date Modified: 05/08/2017
N
1:10,000
0
500
1,000
Meters
Base-mapping and GIS services provided courtesy of the Rideau Valley Conservation Authority, under License with the Ontario Ministry of Natural Resources and Forestry © Queen's Printer for Ontario, 2016.
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Table 1 - Groundwater Level Measurement Summary

Well ID		BH1-21	BH2-21	BH3-21	BH22A-21	BH24-21	BH33-21	HA1-22	BH1-22	BH1A-22	BH2-22	BH3-22	BH3A-22	BH4-22	BH5-22
Ground Surface Elevation (m asl)		104.29	107.19	108.41	102.98	103.07	104.7	106.78	107.31	107.31	103.58	102.25	102.25	105.71	105.7
Groundwater (GW) Measurements															
11-Jan-22	GW Level (m bgs)	1.22	0.82	0.89	2.49	0.67	1.84	Wells Were Not Installed At This Time							
	GW Elevation (m asl)	103.07	106.37	107.52	100.49	102.40	102.86								
11-Oct-22	GW Level (m bgs)	1.12	1.16	0.90	2.61	0.60	2.12	0.31	1.33	1.44	1.52	0.84	0.81	3.62	1.62
	GW Elevation (m asl)	103.17	106.03	107.52	100.37	102.47	102.59	106.48	105.99	105.87	102.06	101.42	101.44	102.10	104.09
28-Oct-22	GW Level (m bgs)	1.01	0.95	0.92	N/A	0.46	1.98	0.28	1.35	1.43	1.52	0.61	0.40	3.65	1.64
	GW Elevation (m asl)	103.28	106.25	107.49	N/A	102.61	102.72	106.51	105.97	105.88	102.06	101.64	101.85	102.07	104.06

Table 2 - Single Well Response Test Results Summary

Test Hole ID	Screened Media	Hydraulic Conductivity (m/sec)*
HA1-22	Brown Silty Sand w/ Trace Gravel	1.51E-05
BH1-22	Bedrock	1.53E-05
BH1A-22	Brown Silty Sand/Glacial Till	Insufficient Water Volume to Conduct Test
BH2-22	Bedrock	8.99E-06
BH3-22	Bedrock	6.29E-05
BH3A-22	Brown Silty Sand/Glacial Till	4.48E-06
BH4-22	Bedrock	8.89E-07
BH5-22	Bedrock	1.52E-05
BH1-21	Bedrock	1.23E-04
BH2-21	Bedrock	3.99E-05
BH3-21	Bedrock	2.98E-06
BH22A-21	Bedrock	4.31E-07
BH24-21	Bedrock	6.19E-05
BH33-21	Bedrock	1.60E-04

*Average value from all tests conducted at each test location

Table 3 - Overburden Field Saturated Hydraulic Conductivity Results and Estimated Infiltration Rates				
Test Completed Adjacent to Borehole ID	**Infiltration Testing Elevation (m asl)**	**Material**	**K_{fs} (m/s)***	**Unfactored Infiltration Rate (mm/hr)****
BH1-21	103.90	Brown Silty Sand	2.10E-06	56
	103.63	Brown Silty Sand	1.90E-06	56
BH2-21	106.95	Brown Silty Sand	6.40E-06	76
	106.65	Brown Silty Sand	5.30E-07	39
BH7-21	106.74	Brown Silty Sand	1.10E-06	47
	106.44	Brown Silty Sand	1.60E-06	52
BH11-21	104.68	Brown Silty Sand	2.70E-06	60
	104.38	Brown Silty Sand	1.60E-06	52
BH15-21	102.70	Brown Silty Sand to Sandy Silt	2.10E-07	31
	102.48	Brown Silty Sand to Sandy Silt	≤ 8.1E-09	≤ 13
BH17-21	106.74	Brown Silty Sand to Sandy Silt	5.90E-06	74
	106.44	Brown Silty Sand to Sandy Silt	4.10E-06	67
BH22-21	102.58	Brown Silty Sand	1.10E-06	47
	102.28	Brown Silty Sand	1.60E-06	52
BH23-21	102.33	Brown Silty Clay w/ Sand	5.30E-07	39
	101.70	Brown Silty Clay	≤ 8.1E-09	≤ 13
BH26-21	102.74	Brown Silty Clay w/ Sand	1.10E-07	26
	102.44	Brown Silty Clay w/ Sand	1.10E-07	26
BH29-21	101.87	Brown Silty Sand to Sandy Silt	5.30E-07	39
	101.57	Brown Silty Sand to Sandy Silt	2.70E-07	33
BH31-21	103.19	Brown Silty Sand to Sandy Silt	1.10E-06	47
	102.89	Brown Silty Sand to Sandy Silt	1.35E-07	27
BH37-21	103.21	Brown Silty Sand to Sandy Silt	5.30E-06	72
	102.91	Brown Silty Sand to Sandy Silt	5.90E-06	74

***Field hydrualic conductivity (Kfs)**

****The infiltration rates do not include a safety correction factor. Based on our testing results, a safety correction factor can range between 2.5 to ≥ 3.5.**

Table 4 - Horizontal Hydrualic Gradient Summary

Well 'A'		Well 'B'				
Well ID	GW Elevation (m asl)	Well ID	GW Elevation (m asl)	Distance (m)	Hydrualic Gradient (m/m)*	Date
BH3-21	107.515	BH1-22	105.985	73	0.0208	October 11, 2022
BH3-21	107.515	BH1A-22	105.87	73	0.0224	October 11, 2022
BH3-21	107.515	BH5-22	104.085	131	0.0263	October 11, 2022
BH3-21	107.515	BH4-22	102.095	206	0.0263	October 11, 2022
BH1-22	105.985	BH2-21	106.03	197	-0.0002	October 11, 2022
BH1-22	105.985	BH1-21	103.17	442	0.0064	October 11, 2022
BH1-22	105.985	BH5-22	104.085	148	0.0128	October 11, 2022
BH1-22	105.985	BH2-22	102.06	447	0.0088	October 11, 2022
BH1A-22	105.87	BH2-21	106.03	197	-0.0008	October 11, 2022
BH1A-22	105.87	BH1-21	103.17	442	0.0061	October 11, 2022
BH1A-22	105.87	BH5-22	104.085	148	0.0120	October 11, 2022
BH1A-22	105.87	BH2-22	102.06	447	0.0085	October 11, 2022
BH1A-22	105.87	BH3A-22	101.44	708	0.0063	October 11, 2022
BH2-21	106.03	BH1-21	103.17	296	0.0097	October 11, 2022
BH2-21	106.03	BH2-22	102.06	358	0.0111	October 11, 2022
BH5-22	104.085	BH4-22	102.095	137	0.0145	October 11, 2022
BH5-22	104.085	BH2-22	102.06	330	0.0061	October 11, 2022
BH2-22	102.06	BH3-22	101.415	397	0.0016	October 11, 2022
BH2-22	102.06	BH3A-22	101.44	397	0.0016	October 11, 2022
BH33-21	102.585	BH3-22	101.415	485	0.0024	October 11, 2022
BH33-21	102.585	BH3A-22	101.44	485	0.0024	October 11, 2022
BH33-21	102.585	BH22A-21	100.37	549	0.0040	October 11, 2022
BH33-21	102.585	BH24-21	102.47	307	0.0004	October 11, 2022
BH3-22	101.415	BH22A-21	100.37	296	0.0035	October 11, 2022
BH3A-22	101.44	BH22A-21	100.37	296	0.0036	October 11, 2022
BH24-21	102.47	BH22A-21	100.37	524	0.0040	October 11, 2022
BH4-22	102.095	BH3-22	101.415	584	0.0012	October 11, 2022
BH4-22	102.095	BH3A-22	101.44	584	0.0011	October 11, 2022
BH4-22	102.095	BH33-21	102.585	404	-0.0012	October 11, 2022

**Hydrualic Gradient = (GW Elevation Well 'A' - GW Elevation Well 'B') / Distance

PATERSON GROUP

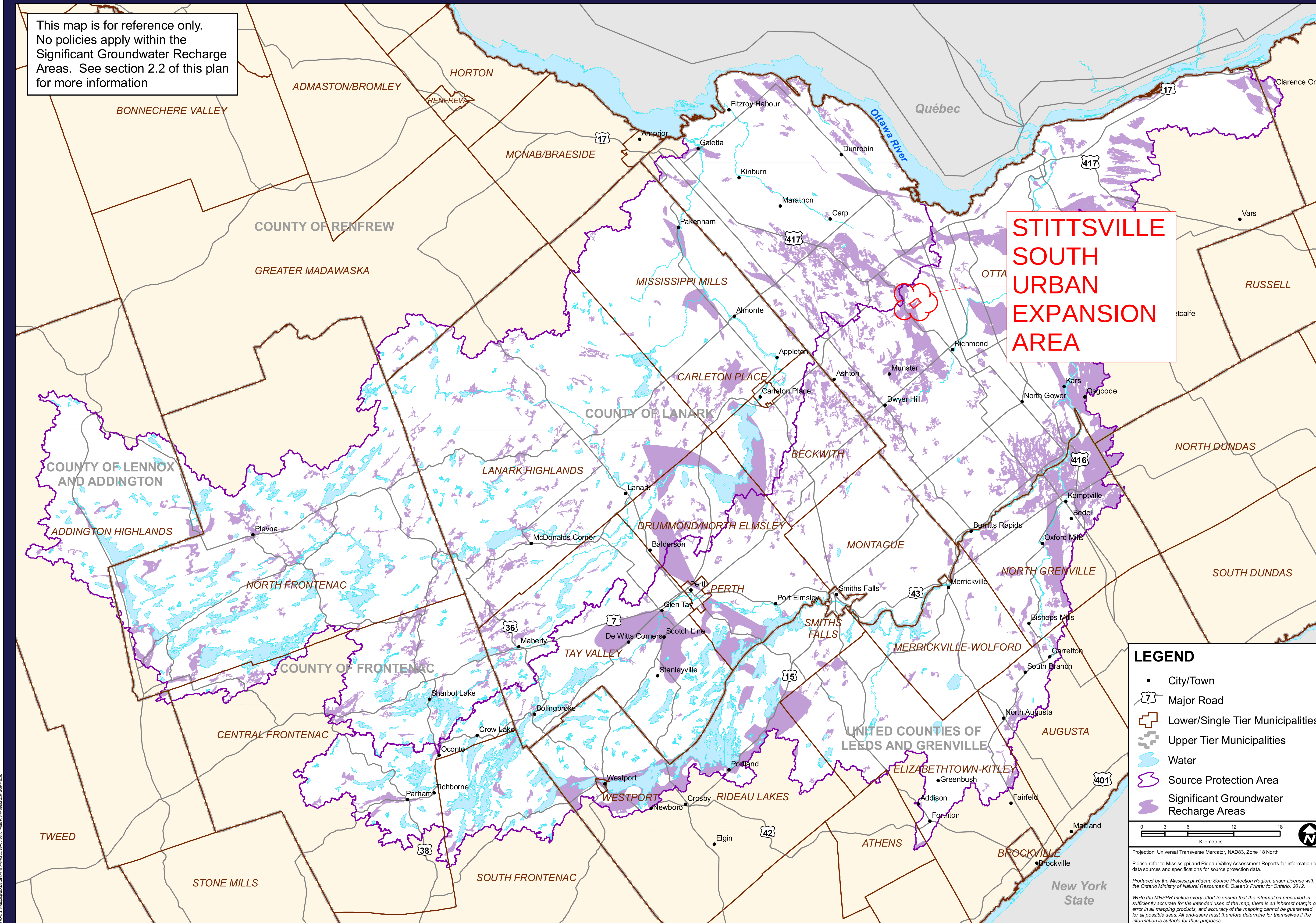
Table 5 - Vertical Hydrualic Gradient Summary

Well 'A'			Well 'B'				
Well ID	GW Elevation (m asl)	Well Depth (m)	Well ID	GW Elevation (m asl)	Well Depth (m)	Hydrualic Gradient (m/m)*	Date
BH1-22	105.985	98.29	BH1A-22	105.87	105.69	-0.0155	October 11, 2022
BH3-22	101.415	93.13	BH3A-22	101.44	99.1	0.0042	October 11, 2022
BH1-22	105.965	98.29	BH1A-22	105.88	105.69	-0.0115	October 28, 2022
BH3-22	101.64	93.13	BH3A-22	101.85	99.1	0.0352	October 28, 2022

*Hydrualic Gradient = (GW Elevation Well 'A' - GW Elevation Well 'B') / (Well Depth Well 'A' - Well Depth Well 'B')

Mississippi-Rideau Source Protection Plan 2013

Mississippi-Rideau Source Protection Region Significant Groundwater Recharge Areas



Schedule M

APPENDIX E

TERMS OF REFERENCE

David Schaeffer Engineering Ltd.
120 Iber Road, Suite 103
Stittsville, ON K2S 1E9
613-836-0856
dsel.ca

MEMORANDUM

DATE:	June 9, 2022
TO:	**Christopher Rogers, P.Eng.**
FROM:	Kevin L. Murphy, P. Eng.
SUBJECT:	**Caivan – Stittsville Lands (5993, 6070 & 6115 Flewellyn Road)** **New Urban Expansion Development – Terms of Reference (REVISED PER CITY COMMENTS DATED MAY 6, 2022)**
DSEL Job No.	21-1247
ATTACHMENTS:	

Chris,
As per your request to Caivan at a pre-consultation meeting held (February 7/22), the following is a proposed summary of Terms of Reference (TOR) to document the servicing strategy approach for development of the above noted parcels of land located within Stittsville.

1.0 BACKGROUND

Fotenn Consultants Inc. ("Fotenn") has previously circulated a January 27, 2022 outline for the development of Concept Plans and processes related to the above noted subject lands. Caivan Communities ("Caivan") has ownership of land parcels that are currently located in the rural area and are designated to be brought within the urban boundary through the new Official Plan process.

1.1 Study Area & Objectives

The subject lands are bound by Flewellyn Road to south, Shea Road to the east, an existing urban subdivision development to the north (Stittsville South – Area 6) and an estate lot subdivision to the west. The area is also bisected by the Faulkner Municipal Drain and a Hydro One power transmission corridor.

The main objective of the servicing review is to develop an overall servicing strategy for the Stittsville Lands that will fulfill the requirements of municipal and provincial standards. The review will consider, evaluate and assess the servicing needs of the development area as it relates to geotechnical considerations, availability of service connections and stormwater management objectives. Several development alternatives for road network layouts, parks and unit mixes will be analyzed and assessed with respect to servicing strategies with a preferred overall servicing scheme identified.

The preferred internal servicing plan will be developed to meet regulatory requirements and will be free of conflicts between the various infrastructure components (water, wastewater, storm and stormwater infrastructure). The following sections present the anticipated scope of work to be completed:

- Task 1 (Agreement on Terms of Reference),
- Task 2 (Internal Concept Plan Review Process (Input Evaluation)),
- Task 3 (Functional Servicing Report and Master Infrastructure Review).

2.0 WORK PLAN

Task 1: Agreement on Terms of Reference

Preparation and finalizing of the TOR for the proposed servicing assessment approach guiding the Concept Plan development process. This draft TOR will be circulated to the City for review/comment on the proposed scope and will form the basis of the future servicability review.

Task 2: Internal Concept Plan Review Process (Input Evaluation)

From an Overall Servicing perspective, this task will include a thorough consolidation of the documents listed in Section 2.1, investigate and quantify residual capacities and servicing constraints while keeping in mind the environmental constraints identified as part of the Task 2 process. The scope of work to complete the Concept Plan Review Process will include the following components:

2.1 Review and Consolidate

As part of the Concept Plan Review Process, a review of background reports that are concerned with the study area will be completed. The review will, at minimum, include the following reports and guidelines being considered:

- City of Ottawa Sewer Design Guidelines (City of Ottawa, October 2012) & Technical Bulletins (ISDTB-2014-01, PIEDTB-2016-01, ISTB-2018-01, ISTB-2018-04 & ISTB-2019-02)
- City of Ottawa Water Distribution Guidelines (City of Ottawa, July 2010) & Technical Bulletins (ISD-2010-2, ISDTB-2014-2, ISTB-2018-02, & ISDTB-2021-03)
- Infrastructure Master Plan (City of Ottawa, 2013)
- Low Impact Development Technical Guidance Report, Implementation in Areas with Potential Hydrogeological Constraints (Dillon Consulting and Aquafor Beech, February 2021)
- Stormwater Planning and Design Manual (Ministry of the Environment, March 2003)
- Amendment to the Engineer's Report for the Faulkner Municipal Drain (Robinson, December 2020) & Addendum No. 1 (Robinson, March 2021)
- Stittsville South – Area 6, City of Ottawa, Master Servicing Report & Stormwater Management Design Plan (Novatech/DSEL, December 2013)
- Stittsville South Subdivision, City of Ottawa – Detailed Servicing & Stormwater Management Report (Novatech July 2016)
- Sanitary Pump Station Pre-Design Report, Stittsville South (Novatech, July 2015)
- Stittsville South Subdivision, City of Ottawa – Shea Road Sanitary Pump Station Design Brief (Novatech, May 2016)
- Design Brief, Davidson Lands – OPA 76 Area 6a, Phase 1 (5993 Flewellyn Road) (IBI Group, February 2018)
- Fernbank Community Design Plan, Master Servicing Study (Novatech, June 2009)

- Geotechnical Investigation, Proposed Residential Development 5993, 6070 & 6115 Flewellyn Road – Ottawa (Paterson (PG5570-2) January 2022)
- Low Impact Development Stormwater Management Guidance Manual (Ministry of the Environment, Conservation and Parks, Draft for Consultation – January 2022)

2.2 Hydrological Modelling

Based on a review of background reports and topographic information available, a hydrologic model will be developed to estimate peak flows and hydrographs under for the various outlets from the Study Area. The analysis will be conducted with SWMHYMO under the design storm types, return periods and hydrological parameters described in the Ottawa Sewer Design Guidelines. The analysis will consider the drainage features inventoried as part of the topographical survey (open ditch, culverts, etc.) as well as any drainage divides. Surface flows will be calculated based on the existing flow patterns for the various outlets; drainage ditches, culverts and storm sewers (if applicable).

2.3 Coordination and Liaise with Other Disciplines

The Concept Plan review process will discuss findings from other disciplines including geotechnical, hydrogeology, water budget, hydrology, ecology (aquatic resources and natural areas), etc., which will establish the existing environmental conditions. The coordination will ensure that the hydrologic analysis considers natural environmental inventories and constraints. Where required, drawings prepared will note existing conditions constraints and potential opportunities, which may impact storm and stormwater servicing or other municipal infrastructure.

2.3.1 Coordinate and Liaise with Geotechnical Engineer

In consultation with the geotechnical engineer, DSEL will:

- Review specific grade raise restrictions to better understand the potential grading constraints versus potential land use;
- Review the soil's characteristics to better understand whether they are conducive to infiltration measures;
- Review the soil's structural capabilities from a support/strength perspective;
- Review the areas of either recharge or discharge potential.

2.3.2 Coordinate with the Hydrogeologist

In consultation with the hydrogeologist, the existing conditions water budget analysis will be reviewed to identify the zones conducive to infiltration measures or other low impact development (LID) strategies. These measures could potentially be used to mitigate impacts on the water budget. As part of this task, LIDAlso strategies will be reviewed, at a conceptual level, to determine their viability and effectiveness in maintaining the existing conditions water budget and potential benefits to mitigating downstream impacts.

- Prepare a conceptual LID plan which illustrates the zones noted above and how the measures will be integrated into the overall plan(s);

2.3.3 Coordinate with Biologist

In consultation with the biologist, the environmental constraints will be further reviewed to better understand their sensitivity to various land uses and their proximity to Concept Plan elements. The objectives and targets from a storm discharge perspective will be based on the on-site environmental constraints as well as the limitations of the receiving watercourses.

2.3.4 Review Topographical Survey and Complete Inventory of Existing Infrastructure

Once all constraints have been compiled a further review of topographical surveys will be completed as well as the drainage patterns identified under current conditions. As part of this task, existing services and outlets will be inventoried for wastewater, water and stormwater. The assessment of residual capacities for existing services will also be reviewed. Any additional survey data will be obtained as required to supplement as-built information.

2.4 Evaluation and Assessment of Storm Design Criteria , Objectives and Pond Alternatives

Based on the findings of the natural resource inventories, storm criteria for both water quality and quantity will be established from a consensus with other disciplines and based on requirements prevalent in the Study Area. Once adopted by the consultant team, the storm criteria will be presented and confirmed by regulatory agencies. Review and comment on potential end-of-pipe solutions that would satisfy the storm criteria and the most suitable approach and siting (based on topography, soil type etc) for the Concept Plans. Based on the siting of the facilities, establish footprint of the end-of-pipe facilities in accordance with the guidance described in Section 4 of the MECP SWMPDM. This includes evaluation of potential capacity of the existing Area 6 SWM pond to optimize use of that infrastructure.

Pond sizing will be established conservatively and not be downsized based on the finding of LID options reviewed to establish water balance.

2.5 Coordination with Drainage Engineer for requirements relating to the Faulkner Municipal Drain.

Consulation will be undertaken with the City's Municipal Drain Group to assess any requirements under the Ontario Drainage Act for the Faulkner Municipal Drain in terms of drainage outlets and land use changes proposed. The consultation will serve as the basis for any amendments to the existing Engineer's Report that may be required.

2.6 Concept Plan Summary Discussions & Preferred Plan Selection

The preceding evaluations considered along with the Concept Plans reviewed will determine a preferred plan which will be brought forward for the more detailed review and assessment of servicing in Task 3.

Task 3: Functional Servicing Report and Master Infrastructure Review

After the completion of Task 2, the Consulting Team will have developed several Concept Plans based on the findings and any other discipline inputs compiled to date from the Team with a preferred option selected. This will include environmental, stormwater, geotechnical and transportation. For the preferred Concept Plan the municipal servicing constraints criteria (see Task 3.1) will be investigated for the preparation of the servicing analysis. Review will also include comment on suitable servicing routes via either servicing blocks and/or the establishment of right-of-way corridors that have appropriate cross-sections to accommodate the various elements of servicing infrastructure required.

3.1 Evaluation of Municipal Servicing Requirements for the Preferred Concept Plan

DSEL will evaluate infrastructure servicing alternatives for the Concept Plans prepared by considering each option and providing the Team with inputs using the general criteria outlined below in order to resolve the preferred Concept as described in the Fotenn outline memo previously circulated. The tasks envisioned to be included in a Site Servicing and Stormwater Management Report area as follows:

3.1.1 Grading

1. Develop a macro level Grading Plan for the Concept Plans based on the constraints identified by the geotechnical engineer. Grading will be developed in accordance with the criteria described in the Design Guidelines.

3.1.2 Identify and Assess Capacity of Existing Conveyance Systems

1. Based on topographical maps/surveys and servicing reports of existing developments adjacent to the limits of the Study Area, free flowing capacity of watercourses (i.e. Faulkner Drain), roadside ditches and water crossings (if any) will be reviewed.

3.1.3 Water Infrastructure

1. Confirm pressure objectives with the City along feedermains under both domestic and fire flow conditions. Connections will be to the development areas to the north of the Study Area. Coordination with the Water Master Plan to be undertaken with City staff.

2. Calculate domestic demands (average, maximum day and peak hour) based on “system level parameters” (expectation being there will be in excess of 3,000 persons) under the build-out condition of the proposed land use for the selected Concept Plans. The preferred parameters will be provided by the City.

3. Calculate required design fire flow for concurrence by City staff.

4. Calculate theoretical domestic demands for potential phases of development based on a phasing strategy. Develop and populate a base water model for the preferred Concept Plan.

5. Acquire hydraulic boundary conditions at each of the connection points of the existing water distribution system. Proposed connection locations to be concurred with by City Staff.

6. Evaluate the performance of the distribution system against municipal requirements under domestic demand conditions for the Concept Plan. Assess and identify deficiencies and develop system upgrades, if required, to meet municipal requirements from both pressure and demand criteria.

7. Evaluate the performance of the proposed distribution system under a maximum day plus fire flow conditions for the Concept Plans supply characteristics of the pressure zone in accordance with Technical Bulletins.

8. Prepare a Water Servicing Plan for the preferred Concept Plan.

3.1.4 Wastewater Infrastructure

1. Based on the sanitary sewer outlets inventoried as part of Task 2, assess residual capacities. Coordination Wasterwater Master Plan to be undertaken with City Staff.

2. Develop peak wastewater flows based on the land use and population projections for the different land uses associated with the Concept Plans as per the Sewer Design Guidelines.

3. Prepare a Sanitary Drainage Area Plan and Design Sheets for the preferred Concept Plan.

4. Review trunk sanitary sewer routes, establish preliminary invert elevations based on topography and existing outlets. Prepare Sanitary Servicing Plan and assess impact of phasing on infrastructure. Identify servicing constraints, potential crossing conflicts and adjust, as required once the Storm Servicing Plan has been completed.

5. Assess residual capacities, beyond the Study Area population.

6. Review Shea Road Sanitary Pump Station for capacity and potential upgrades. Coordination with the Wastewater Master Plan Project Manager to be undertaken in order to assess conceptual pumping upgrates that will be required to accommodate the expansion area.:

   a. Summarize the existing pump station parameters.

   b. Review of potential component upgrades as well as overflow requirements.

   c. Review electrical changes needed to accommodate higher HP pumps and high-level electrical overview.

d. Transient analysis review.

7. Summarize findings for Wastewater Component within reporting.

3.1.5 Storm Servicing and Stormwater Management

1. Based on the prior Task findings, confirm storm design criteria (quantity and quality) with the RVCA, MECP and the City and discuss potential impacts.

2. Review topographic survey and maps. Based on the storm sewer outlets inventoried as part of prior tasks, confirm outlet locations and inverts, and assess residual capacities and drainage patterns, etc.

3. Review existing conditions hydrological analysis to establish the baseline condition.

4. Finalize capacity assessment of existing surface outlets using desktop calculations.

5. Determine minor and major system drainage boundaries for the Concept Plans based on residual capacities of the existing outlets.

6. Carry out post-development Water Budget based on the Concept Plan. Identify and assess water budget deficits for the preferred Concept Plan.

7. In consultation with the hydrogeologist:

- Investigate, at the conceptual level, the integration of low impact development (LID) strategies within the Study Area based on inputs from the hydrogeologist
- evaluate potential infiltration measures, and
- assess conceptually the performance of the LID strategies and infiltration measures with respect to the potential water budget deficits.

8. Based on the minor and major system boundaries, prepare post-development Storm Drainage Area Plan and Servicing Layout for the preferred Concept Plan. Identify servicing constraints, potential crossing conflicts and adjust, as required.

9. Coordinate with the City Drainage Group regarding the Faulkner Drain and any requirements under the Ontario Drainage Act.

10. Prepare Storm Sewer Design Sheets and Drainage Area Plans for the preferred Concept Plan with appropriate runoff coefficients, assessment of trunk storm sewer inverts etc as per Sewer Design Guidelines.

11. Review and finalize potential end-of-pipe solutions that would satisfy the storm criteria (water quality and quantity) and the most suitable approach and siting (based on topography, soil type etc) for the preferred Concept Plan. Based on the siting of the facilities, establish footprint of the end-of-pipe facilities in accordance with the guidance described in Section 4 of the MECP SWMPDM.

12. Carry out a hydraulic grade line (HGL) analysis of the proposed storm sewer system to evaluate the freeboard between the potential underside of footings and the 1:100 year storm. The analysis is to include the evaluation under the climate change event in accordance with the OSDG.

13. Assess impact of phasing on proposed storm infrastructure.

14. Summarize findings for Stormwater Management within the reporting

3.1.6 Water Budget

1. In consultation with the hydrogeological/geotechnical engineer, JFSA/DSEL will prepare a pre- and post-development water balance review (infiltration, runoff and evapotranspiration) for the site in accordance with the methodology summarized in Section 3.2 of the MECP's "Stormwater Management Planning & Design Manual, March 2003". This will include consideration of *Table 3.1 – Hydrologic*

Cycle Component Values and evaluation of 39 years of historical rainfall data from the Ottawa Airport via continuous hydrologic SWMHYMO model simulations. As per 4.7.1 (3.b) of the draft Official Plan.

2. Findings above will also be correlated to the mitigation of potential downstream impacts of the development.

3.1.7 Opinion of Probable Cost and Phasing

1. Coordination with other disciplines to finalize phasing for the Concept Plan in regard to servicing constraints.
2. Prepare an opinion of probable cost for municipal servicing for the prefered Concept Plan.

Kevin L. Murphy, P.Eng.

DSEL

david schaeffer engineering ltd.

MORRISON HERSHFIELD

October 16, 2023

Hugo Lalonde
Director, Land Development
Caivan
3813 Borrisokaen Roade
Ottawa Ontario K2J 4J4

Dear Mr. Lalonde:

Re: Stittsville South W-4 Urban Expansion Area, Class Environmental Assessment Requirements Overview

The new City of Ottawa Official Plan (OP) was approved on November 4, 2022 and added over 1,900 hectares to the urban area including the Stittsville South Urban Expansion Area (SSUEA) and identified by the City as Area W-4. The W-4 lands are shown on Schedule C17 of the Official Plan, excerpt below shown in Figure 1:

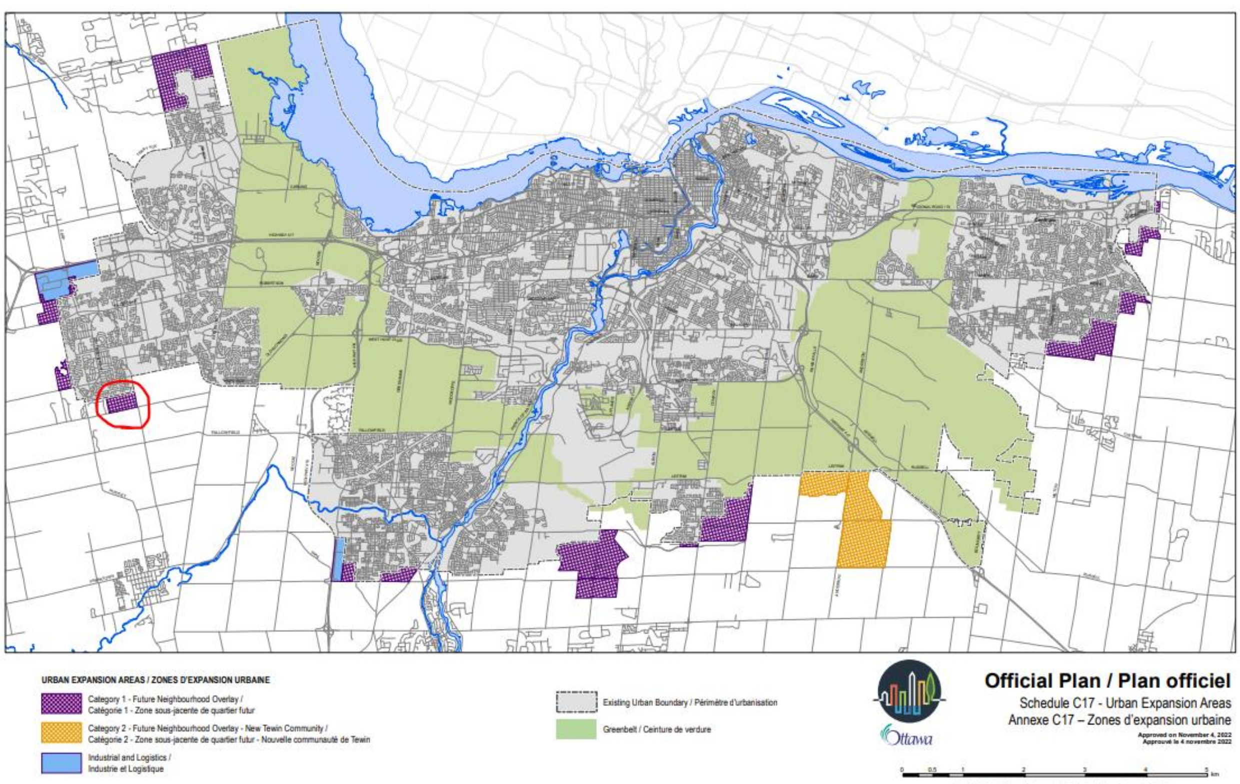


Figure 1: City of Ottawa Official Plan - Schedule C17

The W-4 lands consist of the following parcels and are more accurately shown on Figure 2:

- West Lands (6115 Flewellyn Road and 6070 Fernbank Road under the ownership of Caivan (Stittsville West) Ltd.)
- South Lands (5993 Flewellyn Road and 6030 Fernbank Road under the ownership of Caivan (Stittsville South) Inc.)
- City SWMF lands
- 7 hold out parcels along Shea Road and Flewellyn Road
- Hydro One Network Inc. Corridor

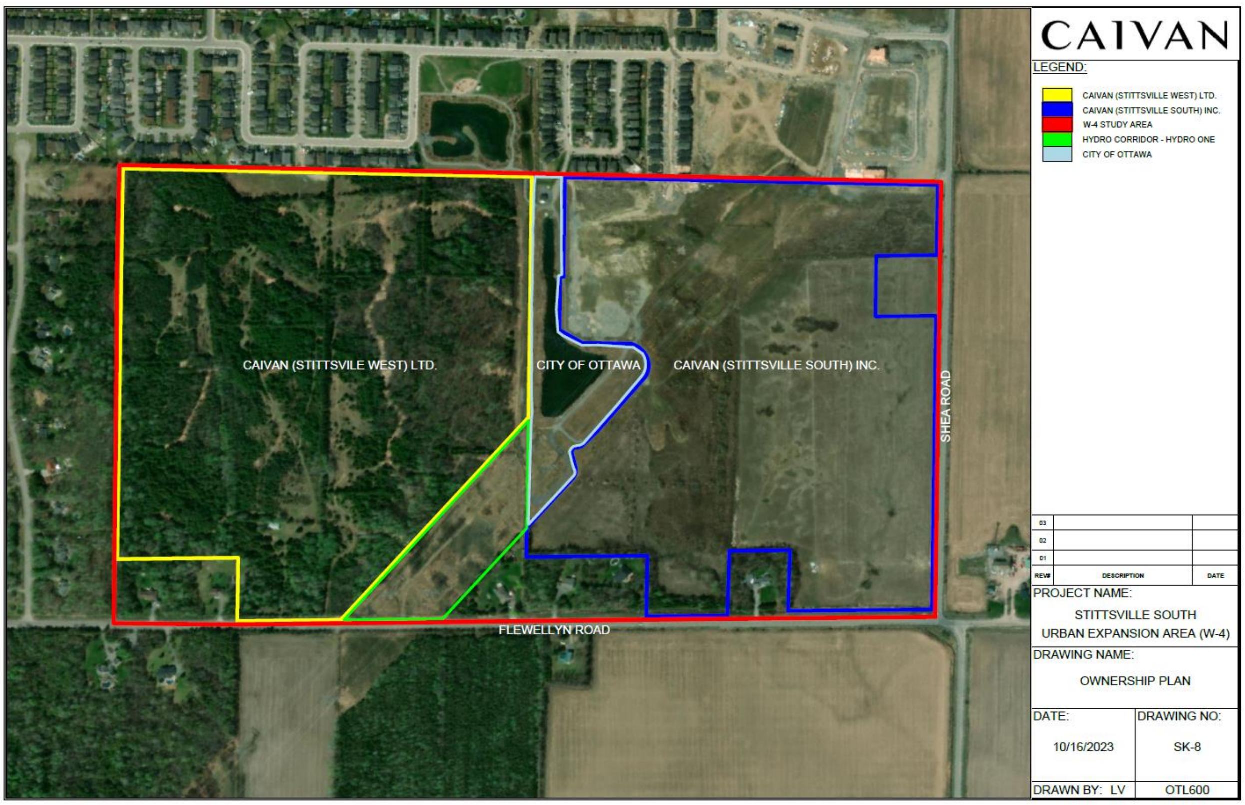


Figure 2: W-4 Study Area

Existing Condition Reports for the W-4 Lands have been completed and submitted to the City of Ottawa for review, including but not limited to:

- Existing Conditions Report – Servicing, DSEL, September 2023
- Stittsville South Expansion Lands Transportation Report, CGH, March 2023

A technical memorandum by DSEL (October 4, 2023), summarizing the findings of the engineering Existing Conditions and advancing preliminary servicing considerations for the future scoped Master Servicing Study for W-4 has also been submitted to the City of Ottawa. This includes the Shea Road PS Capacity upgrade wastewater project as recommended in the draft City of Ottawa Infrastructure Master Plan.

MH has reviewed the above noted documents and the purpose of this memo is to summarize the identified infrastructure projects as they relate to Class EA requirements. The following list identifies infrastructure projects to service the future development area for Caivan's Stittsville South Urban Expansion Area (SSUEA) along with the Class EA requirements as per Appendix 1 of the MCEA (March 2023).

1. Upgrades associated with an existing sanitary pump station (Shea Road Sanitary Pump Station). Upgrades anticipated to consist of:

    a. Potential electrical service to building as well as instrumentation/wiring.
    b. New generator & switchgear.
    c. Potential bigger control building footprint to be assessed at design stage.
    d. New pumps (change all 3 pumps from 30HP to 60HP) and associated variable frequency drives for power supply.
    e. Upsize miscellaneous internal piping.
    f. There is the potential that one of the existing forcemains may have to be upsized. This would also be assessed at the design stage in consultation with City staff.
    g. Provision of a new sanitary emergency overflow pipe to lower sanitary hydraulic grade line constraints for the Caivan landholdings. The new overflow will the overflow from its current location to the existing 'Davidson SWM Pond' to a new SWM Pond associated with development of the Caivan landholdings.

Increase pumping station capacity by adding or replacing equipment and appurtenances, where new equipment is located in an existing building or structure & Extending of existing sewage collection system 'Exempt' from EA process

2. Stormwater management:
    a. Potential to utilize an existing stormwater management pond (the adjacent 'Davidson SWM Pond') for initial phase of development. [Establish new or replace or expand an existing stormwater detention/retention pond where no additional property is required. ***'Exempt' from EA process***
    b. Two new stormwater management facilities that will provide quality and quantity control to the Caivan SSUEA landholdings (a west pond and an east pond). Two facilities are required due to a physical site constraint imposed by the existing Faulkner Municipal Drain which bisects the Caivan landholding. Both new facilities will outlet to the Faulkner Municipal Drain. [Establish new or replace or expand an existing stormwater detention/retention pond where no additional property is required (i.e., owned by Caivan). ***'Exempt' from EA process***
    c. LIDS –strategy/system may be considered. ***'Exempt' from the EA process***

3. Potable water supply will be provided by a southward extension of existing watermains at multiple locations from the development areas to the north of the SSUEA. ***'Exempt' from EA process***

4. Transportation:

a. Local roads which are required as a condition of approval on a site plan, consent, plan of subdivision or plan of condominium which will come into effect under the *Planning Act* prior to the construction of the road. ***'Exempt' from EA process***

b. New collector roads are required as a condition of approval on a plan of subdivision and/or the subdivision agreement which will come into effect under the *Planning Act* prior to the construction of the road.

d. These projects would be 'Exempt' based on the results of the Archaeological Screening Process (Stage 3 AA conducted and no further archaeological assessment or mitigation study is required)

Accordingly, based on our review of the infrastructure requirements for the W-4 Urban Expansion Area, all projects are exempt from the Class EA.

Yours truly,

Kelly Roberts, Principal / Senior Environmental Planner

KRoberts@morrisonhershfield.com
613 739 2910 EXT. 1022303

Bienvenue

Portes ouvertes

Welcome

Open House

Stittsville South (w4) / Stittsville-Sud (quartier 4)

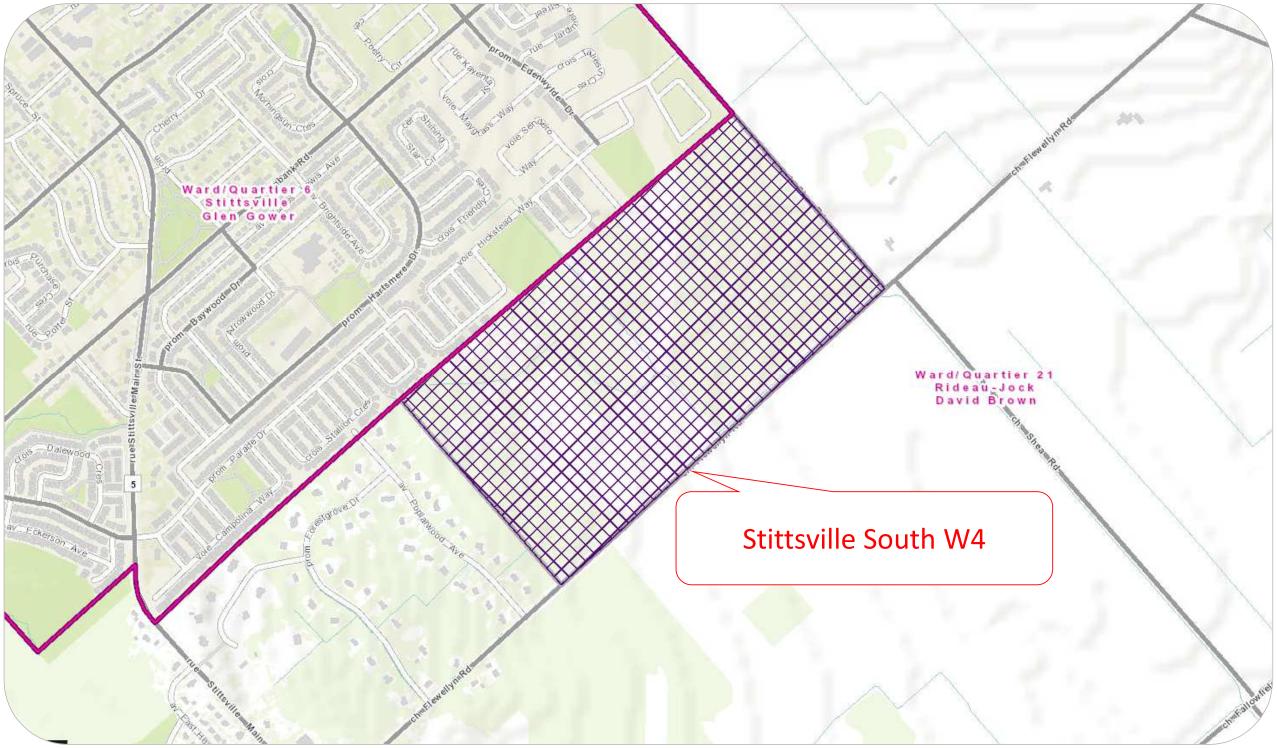
Future Neighbourhood
Quartier projeté

Background

In 2021, Council approved expansion to the urban boundary across the City including the area we are discussing today.

To support development in this area, a secondary planning process must be complete to ensure we meet all applicable legislation, meet the intent of the Official Plan's various policies, and engage meaningfully with stakeholders and the public.

This is the second meeting to as part of this process.

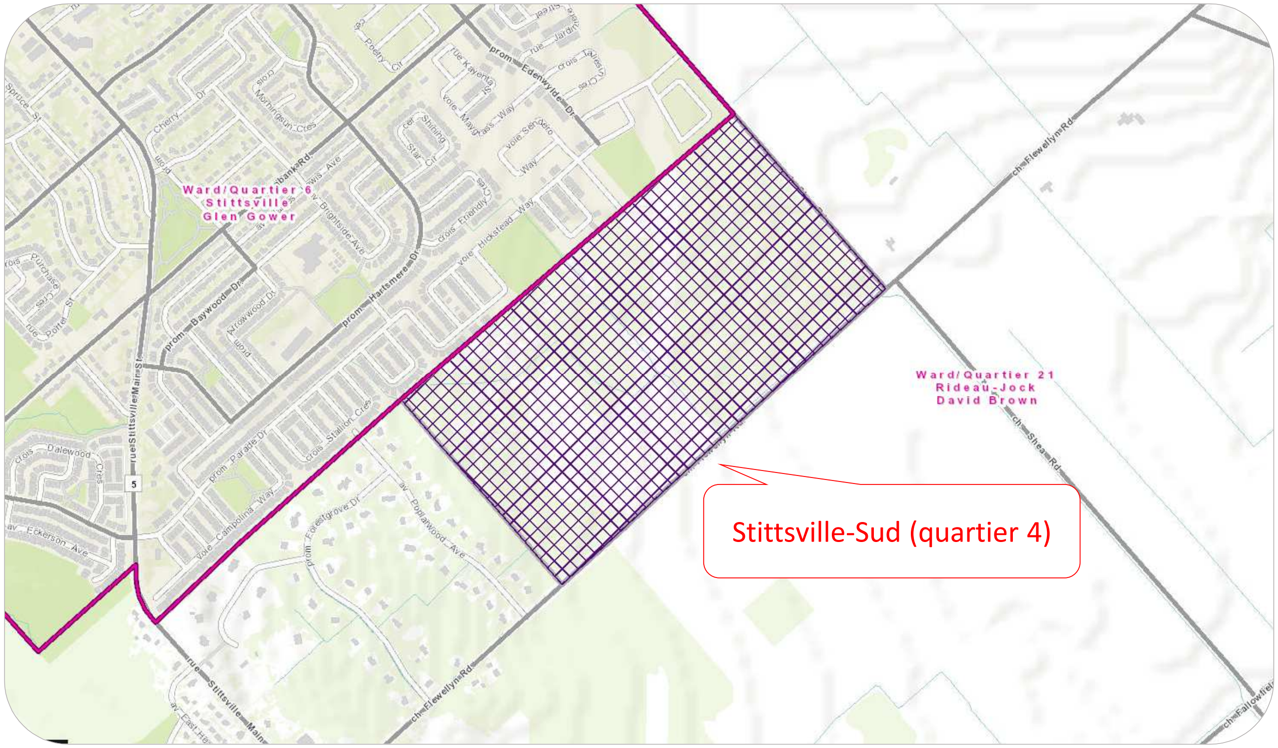


Contexte

En 2021, le Conseil municipal a approuvé l’agrandissement du périmètre urbain de tout le territoire de la Ville, y compris le secteur dont il est question aujourd’hui.

Pour promouvoir l’aménagement de ce secteur, il faut mener à bien un processus de planification secondaire pour veiller à respecter l’ensemble des lois applicables et l’intention des différentes politiques du Plan officiel, ainsi que pour mener une consultation enrichissante auprès des intervenants et du public.

Il s’agit de la première séance organisée pour lancer ce processus.

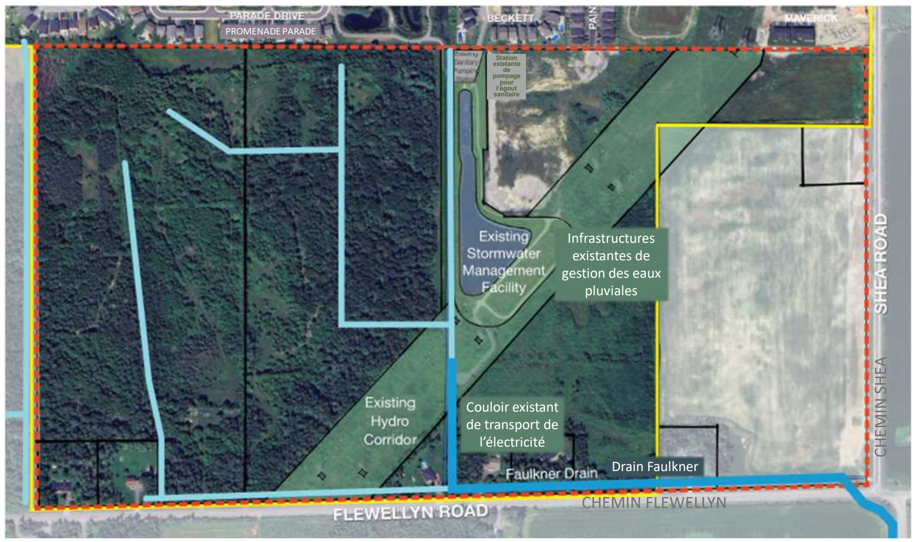


Study Area

L'aire de l'étude

The area in yellow is identified as boundary of the future neighbourhood. The study area, which is larger, is being studied in keeping with the existing natural boundaries of the drainage and transportation.

There is an existing storm water pond, and a Hydro right of way that cross the site.



LEGEND

- Study Area
- Urban Boundary
- Hydro Corridor
- Existing SWM Pond
- Existing Sanitary PS
- Faulkner Drain
- Headwater Drainage Features
- Parcel Lines

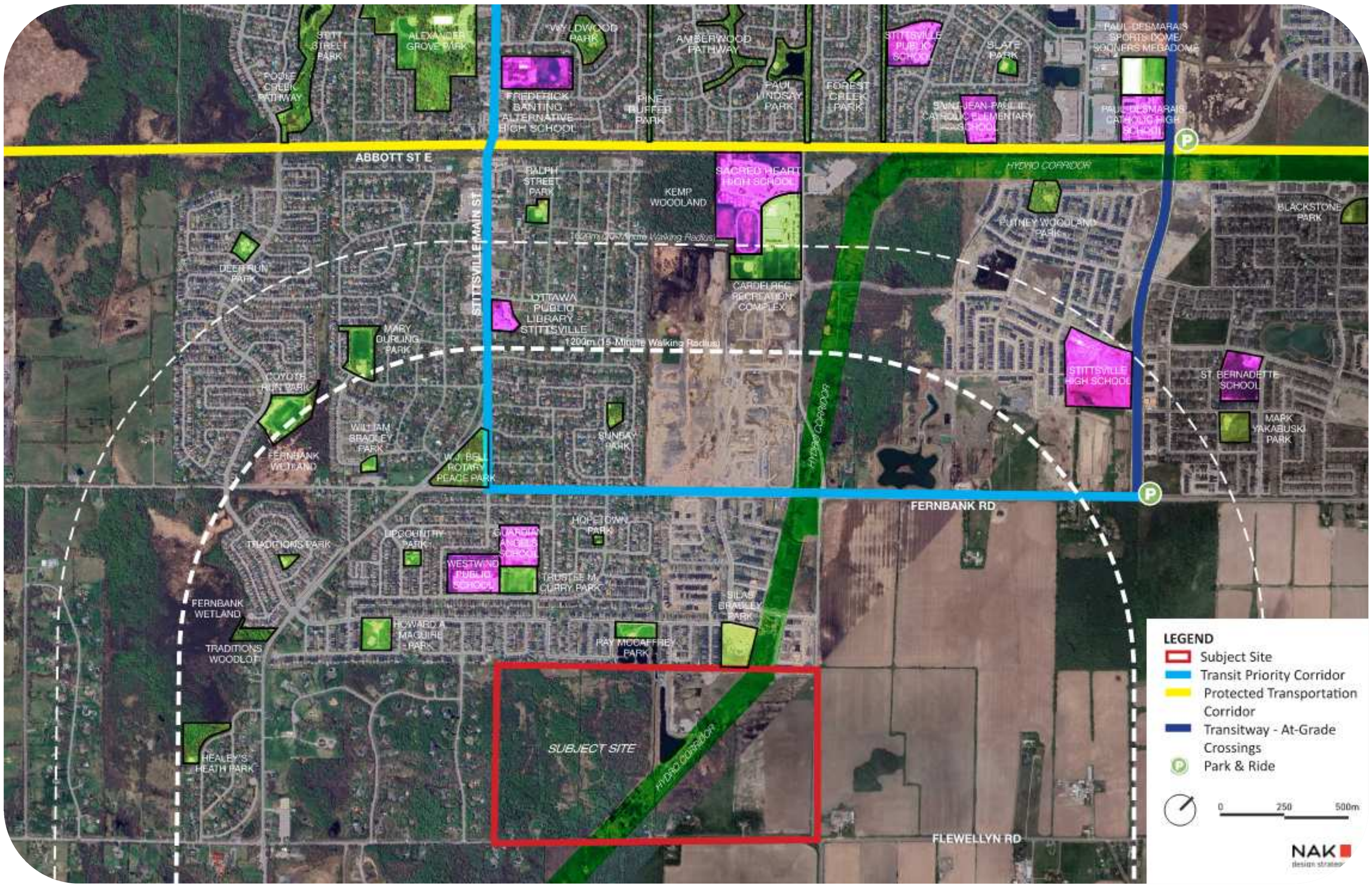
Le secteur dont les contours sont tracés en jaune correspond au périmètre du quartier projeté. L'aire de l'étude, qui est plus vaste, est analysée en fonction du périmètre naturel existant du drainage et du transport.

Il y a déjà un bassin de rétention des eaux pluviales; un couloir de transport de l'électricité traverse le site.

LÉGENDE

- Aire de l'étude
- Périmètre urbain
- Couloir de drainage
- Couloir de transport de l'électricité
- Infrastructures existantes de gestion des eaux pluviales
- Station existante de pompage de l'égout sanitaire
- Drain Faulkner
- Infrastructure de drainage des eaux en amont
- Limites des parcelles

Neighbourhood Context/Le contexte du quartier



LÉGENDE
Site visé
Couloir prioritaire de transport en commun
Couloir protégé de transport
Transitway – Passages au niveau du sol
Parc relais

500 m

Project Timeline (targeted)

At-a-glance

INITIATION

Background study, formation of technical working groups (planning and design, natural heritage, engineering, transportation)

2023

Autumn

MEETING 1

Project kick off, introduction to the project and project team.

2024

Winter

MEETING 2

Presentation of existing conditions and initial planning and engineering, and initial concept plan for new neighbourhood

2024

Summer

We are here

SUBMISSION OF PLAN OF SUBDIVISION

Submission of the plan of subdivision application. Posting on Ottawa.ca

2024

Summer

OFFICIAL PLAN, ZONING AND SUBDIVISION APPLICATIONS

Statutory Open House for Official Plan amendment and other Planning Act applications.

2024-2025

Fall or Winter

Le calendrier du projet (visé)

En bref

LANCEMENT

Étude préliminaire et mise sur pied des groupes de travail techniques (planification et conception, patrimoine naturel, ingénierie et transport)

2023

Automne

ASSEMBLÉE 1

Lancement du projet, présentation du projet et de l'équipe responsable

2024

Hiver

ASSEMBLÉE 2

Présentation des conditions actuelles, de la planification initiale et de l'ingénierie, et plan d'avant-projet initial du nouveau quartier

2024

Été

Voici où nous en sommes.

DÉPÔT DU PLAN DE LOTISSEMENT

Soumission de la demande d'approbation du plan de lotissement
Publication sur ottawa.ca

2024

Été

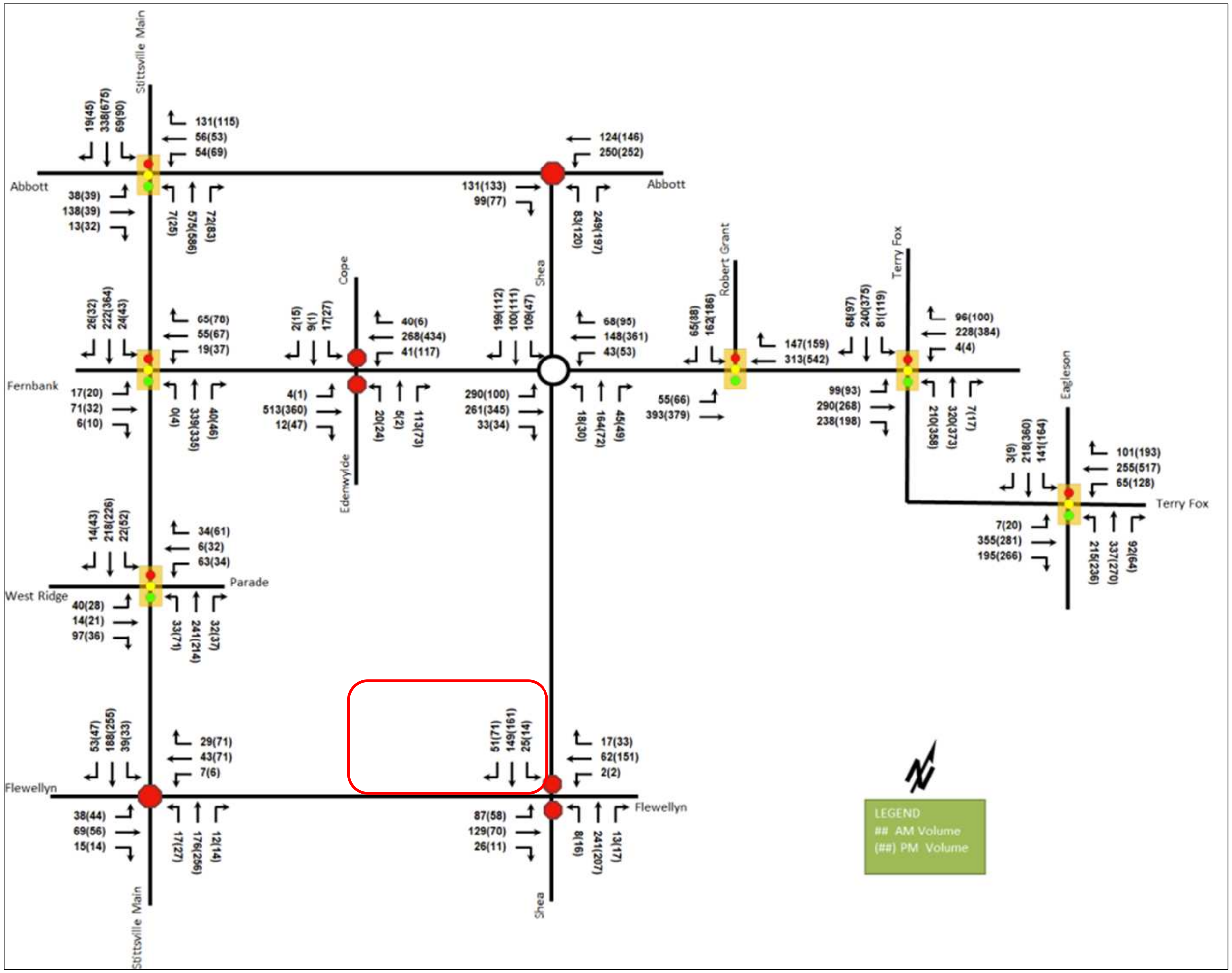
PLAN OFFICIEL, ZONAGE ET DEMANDES DE LOTISSEMENT

Séance portes ouvertes obligatoire pour la modification du Plan officiel et autres demandes liées à la *Loi sur l'aménagement du territoire*

2024-2025

Automne ou hiver

Transportation – Existing Conditions



Study Area

- The volumes illustrate the turning movement counts collected in the study area
- All volumes are 2023 or 2024 counts
- Only capacity constraints were noted during the PM peak for the intersections on Terry Fox Drive
  - at Eagleson Road on the northbound left turn lane and southbound right/right turn lane
  - at Fernbank Road on the northbound left turn lane
- Shea Road at Flewellyn Road met all-way stop control warrants
- No intersections met warrants for signalization

Natural Heritage – Existing Conditions

Caivan Stittsville

LEGEND

- Study Area
- Urban Boundary
- Drainage Corridor
- Hydro Corridor
- Existing Stormwater Management Facility
- Existing Sanitary Pumping Station
- Faulkner Drain
- Minor Feature
- Parcel Lines

Environmental Site Surveys completed

Season	Purpose
Fall 2021	Site recognisance and geotechnical work coordination
Fall 2022	Ecological Land Classification (ELC) surveys
Spring-Summer 2023	Headwater Drainage Feature Assessments, Amphibian, Bird and Bat Surveys & supplemental ELC surveys
Spring 2024	Supplemental ELC surveys

0 100 200

NAK design strategies

Le patrimoine naturel – Conditions existantes

Caivan Stittsville

LÉGENDE

- Aire de l'étude
- Périmètre urbain
- Couloir de drainage
- Couloir de transport de l'électricité
- Infrastructures existantes de gestion des eaux pluviales
- Station existante de pompage de l'égout sanitaire
- Drain Faulkner
- Infrastructures mineures
- Limites des parcelles

Sondages menés sur les sites environnementaux

Saisons	Objectifs
Automne 2021	Reconnaissance du site et coordination des travaux géotechniques
Automne 2022	Relevés de classification des terres écologiques
Printemps-été 2023	Évaluations des infrastructures de drainage en amont, relevés des amphibiens, des oiseaux et des chauves-souris et sondages complémentaires de l'ELC
Printemps 2024	Relevés complémentaires de l'ELC

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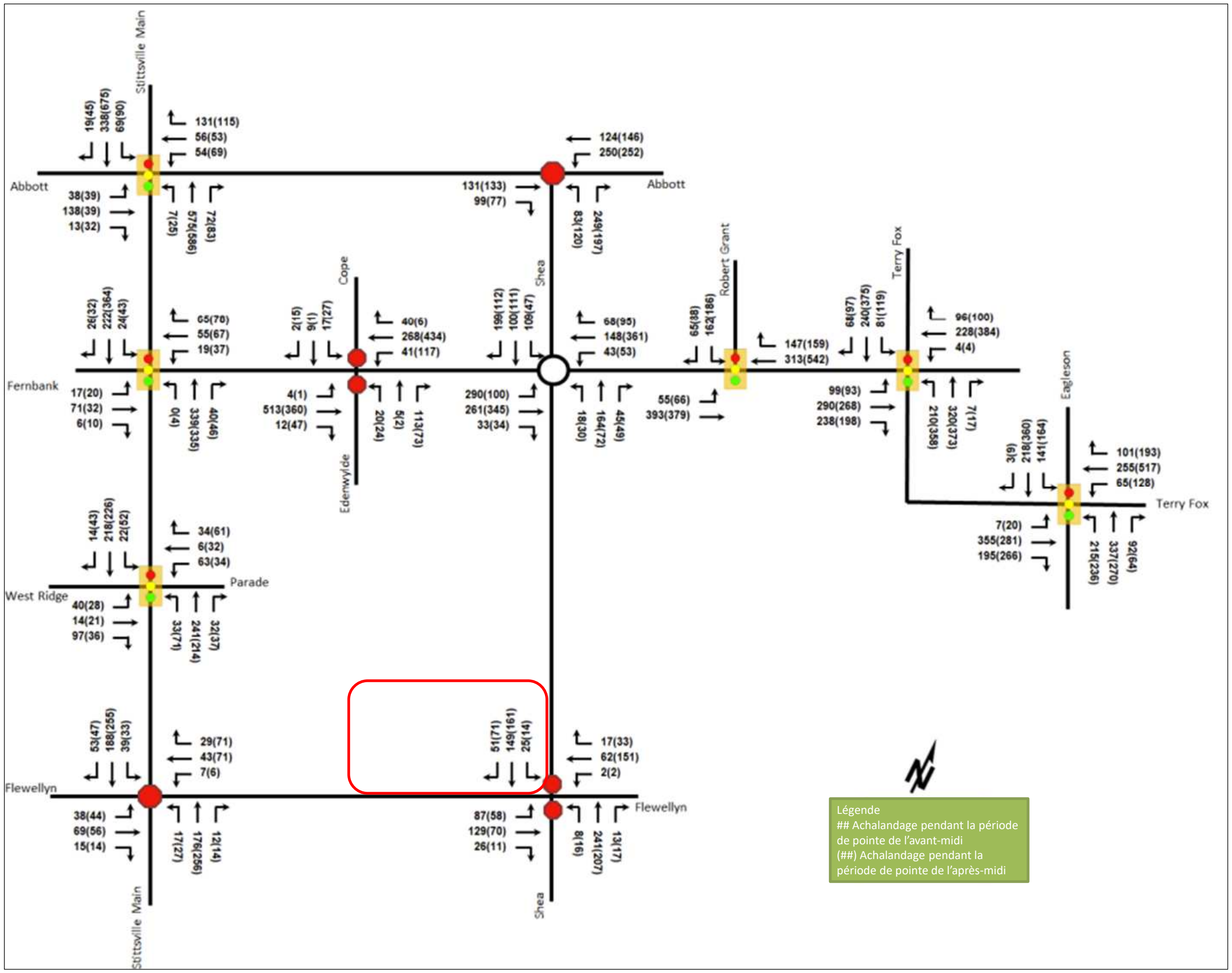
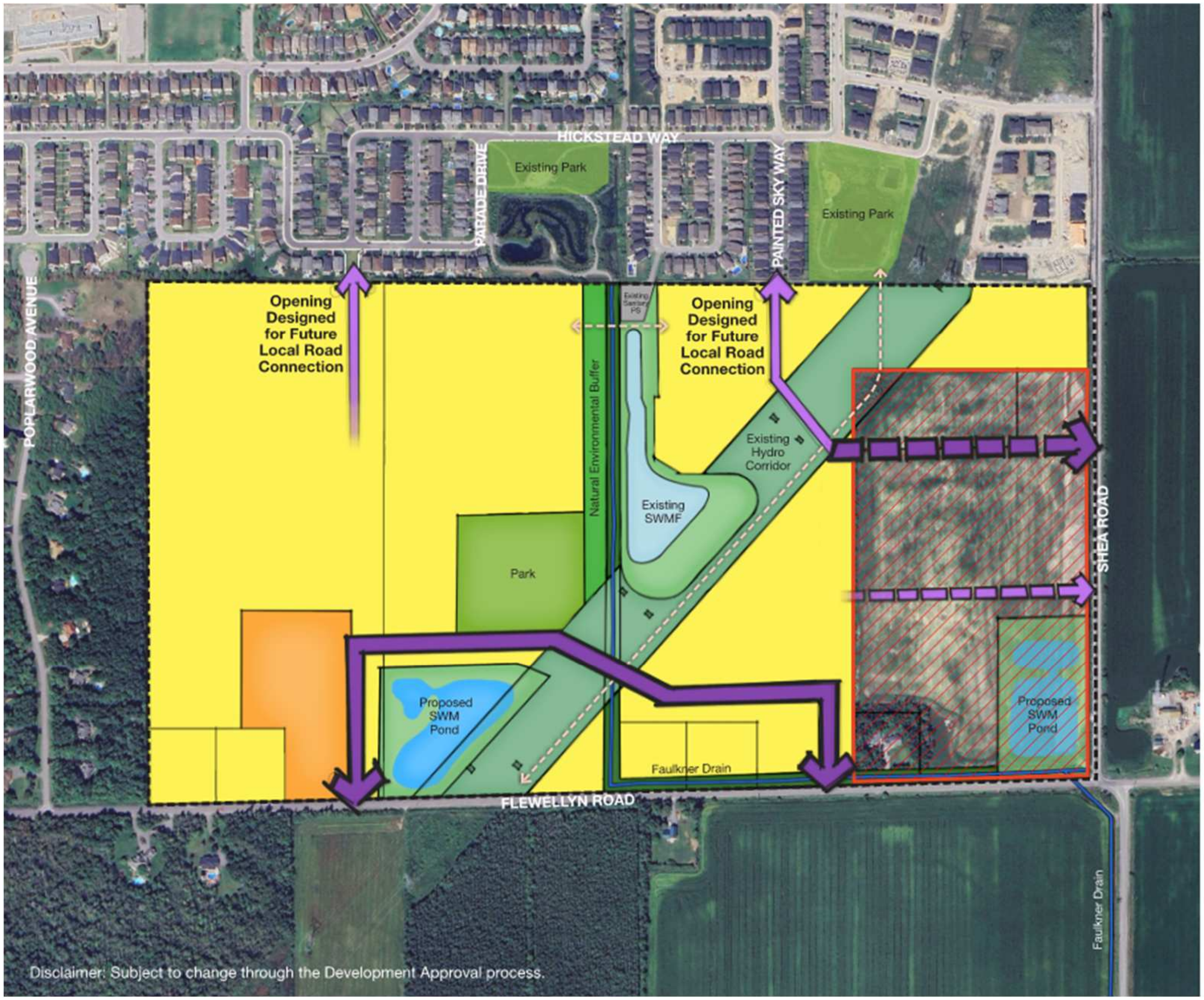
NAK design strategies

Le transport – Conditions existantes



Aire de l'étude

- Les données sur achalandage correspondent aux dénombrements des manœuvres de virage recueillies dans l'aire de l'étude.
- Toutes les données sur l'achalandage correspondent aux dénombrements de 2023 ou de 2024.
- Les seuls épisodes de surachalandage ont été constatés pendant la période de pointe de l'après-midi pour les intersections de la promenade Terry-Fox :
  - et du chemin Eagleson pour la voie de virage à gauche dans le sens nord et pour la voie de virage à droite dans le sens sud;
  - et du chemin Fernbank pour la voie de virage à gauche dans le sens nord.
- Le chemin Shea à la hauteur du chemin Flewellyn respecte toutes les justifications des panneaux d'arrêt dans tous les sens.
- Aucune intersection ne justifie l'installation de panneaux de signalisation.



Stittsville South W-4

CONCEPT PLAN - OPTION 1

LEGEND

- Study Area
- Excluded from Urban Expansion
- Low-Density Residential
- Medium-Density Residential (up to 4 storeys)
- Drainage Corridor
- Hydro Corridor
- Buffer
- Park
- Existing SWM Facility
- Proposed SWM Pond
- Existing Sanitary PS
- Collector Roads
- Local Roads
- Faulkner Drain
- Parcel Lines
- Multi-Use Pathway

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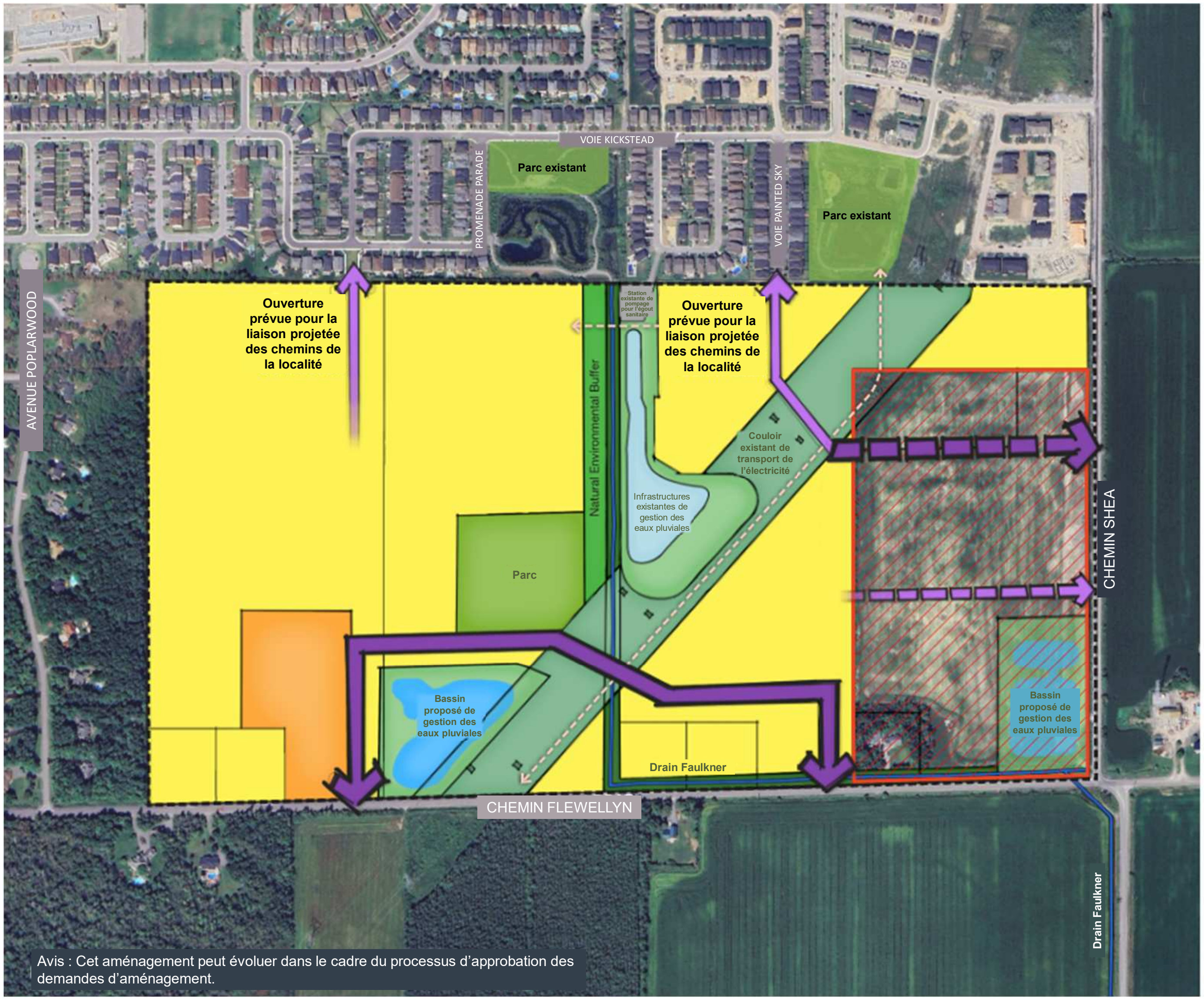
NAK design strategies



Stittsville-Sud – Quartier 4

PLAN D'AVANT-PROJET – OPTION 1

LÉGENDE

- Aire de l'étude
- Exclu de l'expansion urbaine
- Zone résidentielle de faible densité
- Zone résidentielle de densité moyenne (au plus 4 étages)
- Couloir de drainage
- Couloir de transport de l'électricité
- Zone tampon
- Parc
- Infrastructures existantes de gestion des eaux pluviales
- Bassin proposé de gestion des eaux pluviales
- Station existante de pompage pour l'égout sanitaire
- Routes collectrices
- Routes locales
- Drain Faulkner
- Limites des parcelles
- Sentier polyvalent

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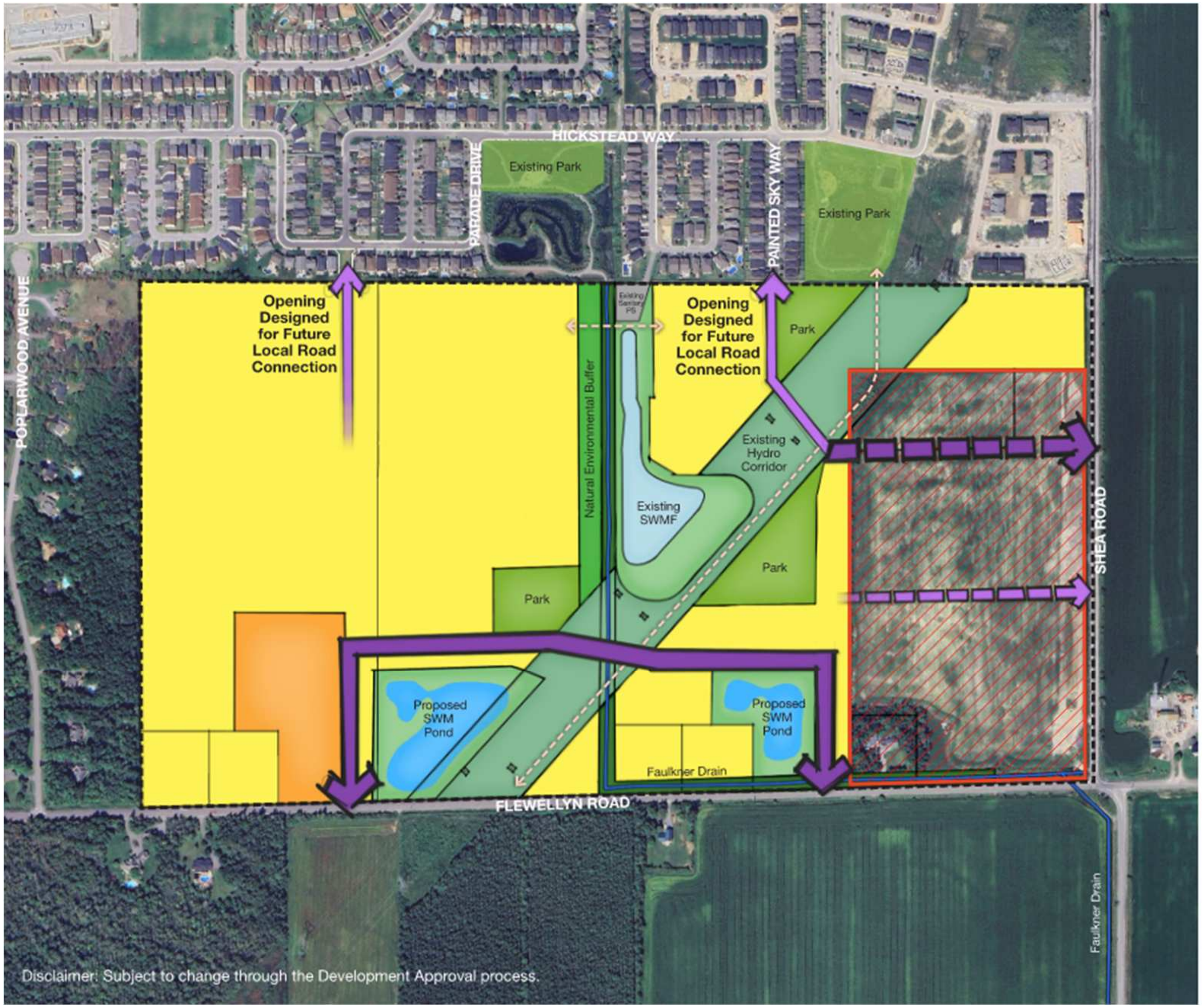
NAK design strategies

Stittsville South W-4
CONCEPT PLAN - OPTION 2



LEGEND

- Study Area
- Excluded from Urban Expansion
- Low-Density Residential
- Medium-Density Residential (up to 4 storeys)
- Drainage Corridor
- Hydro Corridor
- Buffer
- Park
- Existing SWM Facility
- Proposed SWM Pond
- Existing Sanitary PS
- Collector Roads
- Local Roads
- Faulkner Drain
- Parcel Lines
- Multi-Use Pathway

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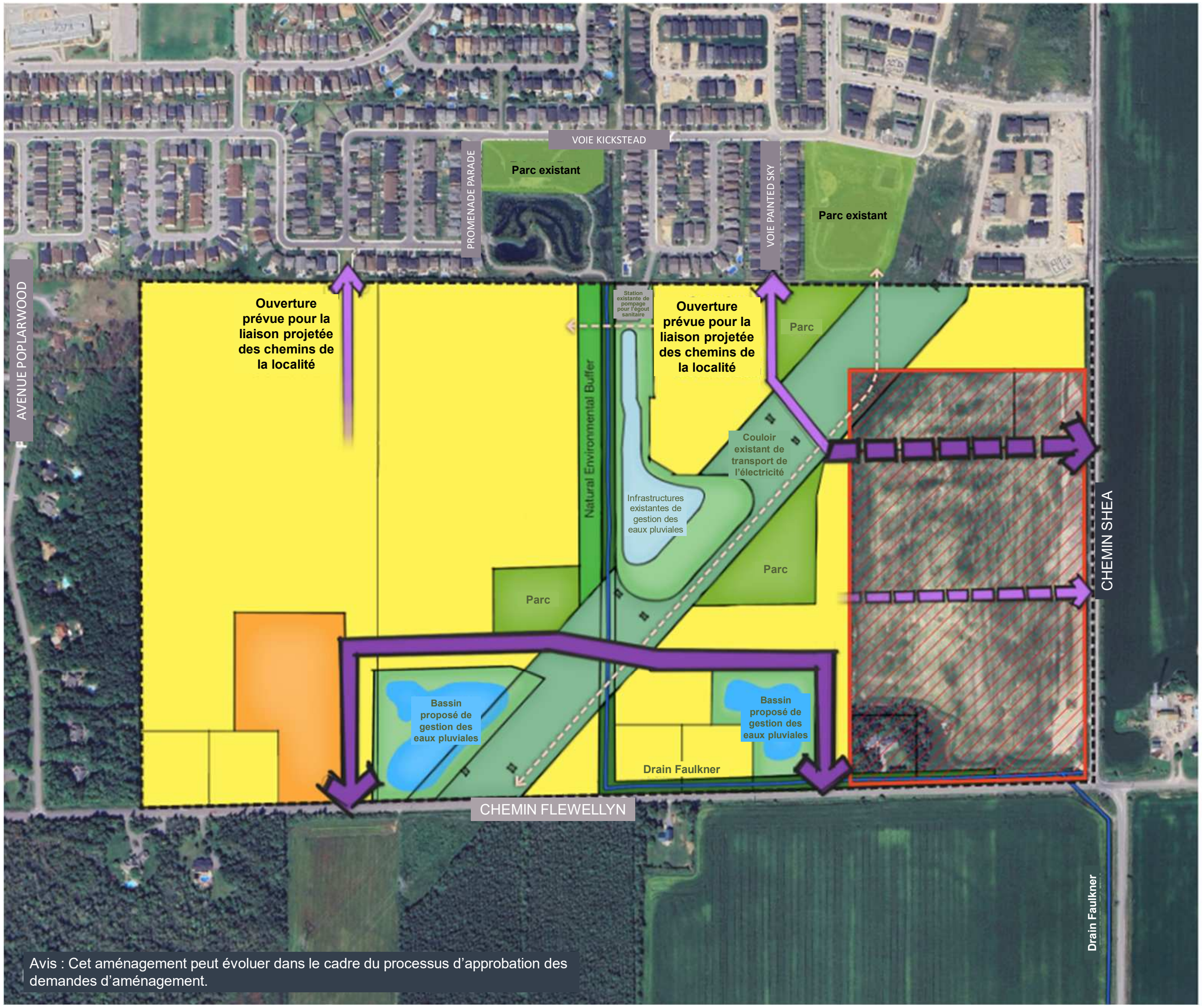
NAK design strategies

Stittsville-Sud – Quartier 4

PLAN D'AVANT-PROJET – OPTION 2



LÉGENDE

- Aire de l'étude
- Exclu de l'expansion urbaine
- Zone résidentielle de faible densité
- Zone résidentielle de densité moyenne (au plus 4 étages)
- Couloir de drainage
- Couloir de transport de l'électricité
- Zone tampon
- Parc
- Infrastructures existantes de gestion des eaux pluviales
- Bassin proposé de gestion des eaux pluviales
- Station existante de pompage de l'égout sanitaire
- Routes collectrices
- Routes locales
- Drain Faulkner
- Limites des parcelles
- Sentier polyvalent

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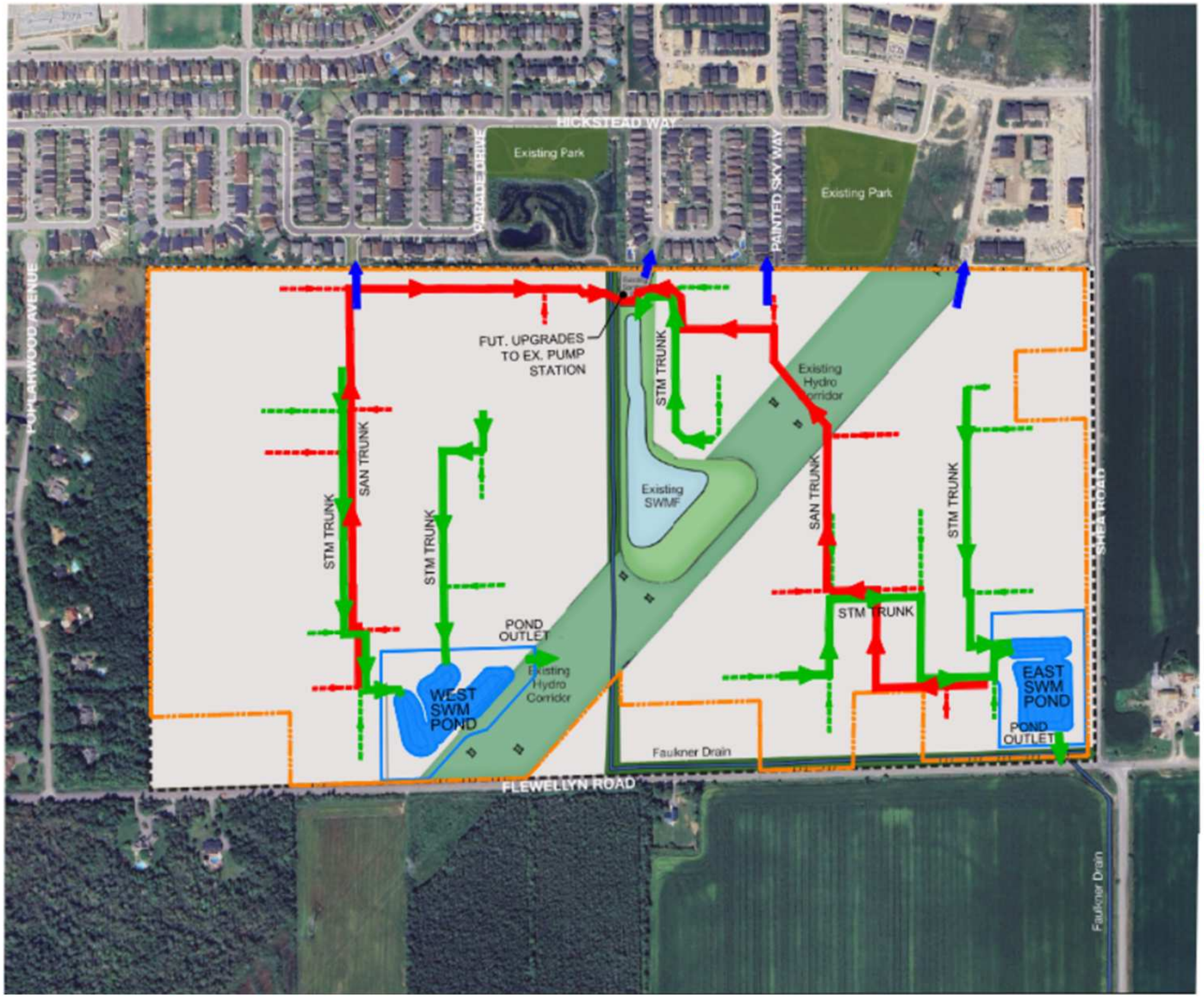
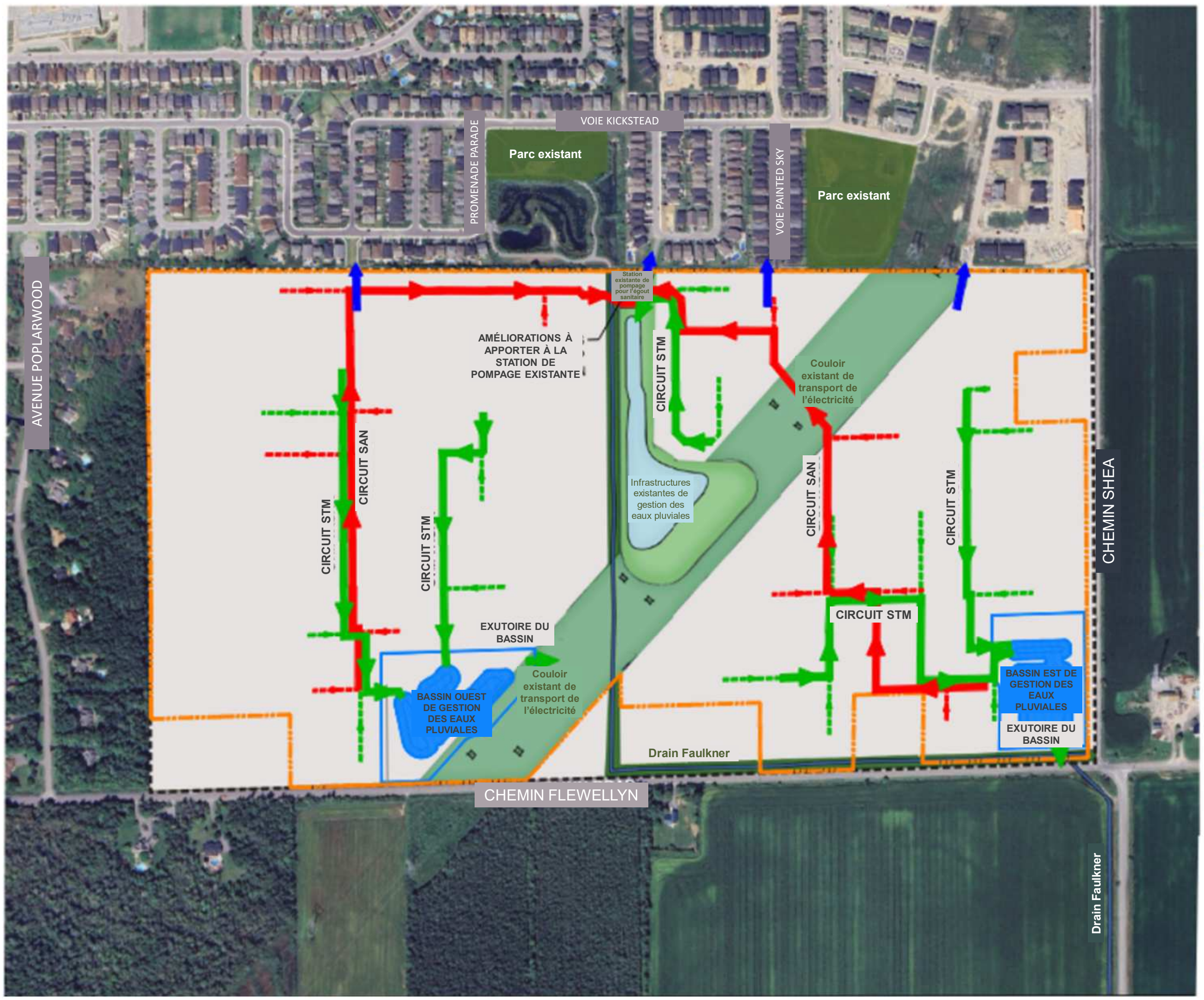
NAK design strategies



Stittsville South W-4
Conceptual Servicing Concept Plan - Option 1

LEGEND

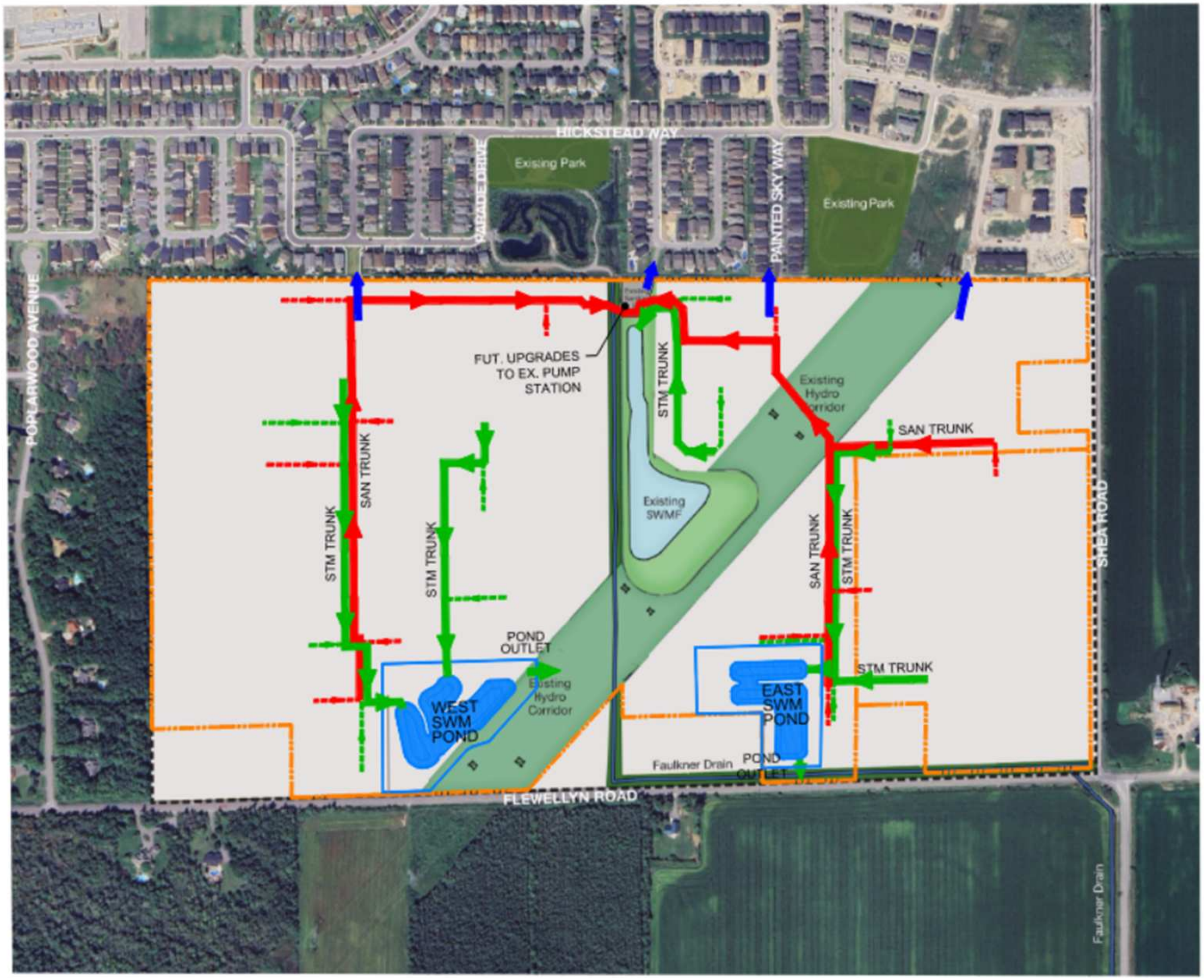
- Study Area
- Developable Area
- Drainage Corridor
- Hydro Corridor
- Existing SWM Facility
- Existing Sanitary PS
- Faulkner Drain
- Parcel Lines
- SANITARY TRUNK SEWER
- STORM TRUNK SEWER
- CONCEPTUAL LOCAL SAN CONNECTION
- CONCEPTUAL LOCAL STM CONNECTION
- WATERMAIN CONNECTION TO EXISTING WATERMAIN



Stittsville-Sud – Quartier 4
Viabilisation conceptuelle
Plan d'avant-projet – Option 1

LÉGENDE

- Aire de l'étude
- Zone aménageable
- Couloir de drainage
- Couloir de transport de l'électricité
- Infrastructures existantes de gestion des eaux pluviales
- Station existante de pompage de l'égout sanitaire
- Drain Faulkner
- Limites des parcelles
- ÉGOUT SANITAIRE COLLECTEUR
- ÉGOUT COLLECTEUR DES EAUX PLUVIALES
- LIAISON CONCEPTUELLE LOCALE SAN
- LIAISON CONCEPTUELLE LOCALE STM
- LIAISON DE LA CONDUITE PRINCIPALE AVEC LA CONDUITE PRINCIPALE EXISTANTE



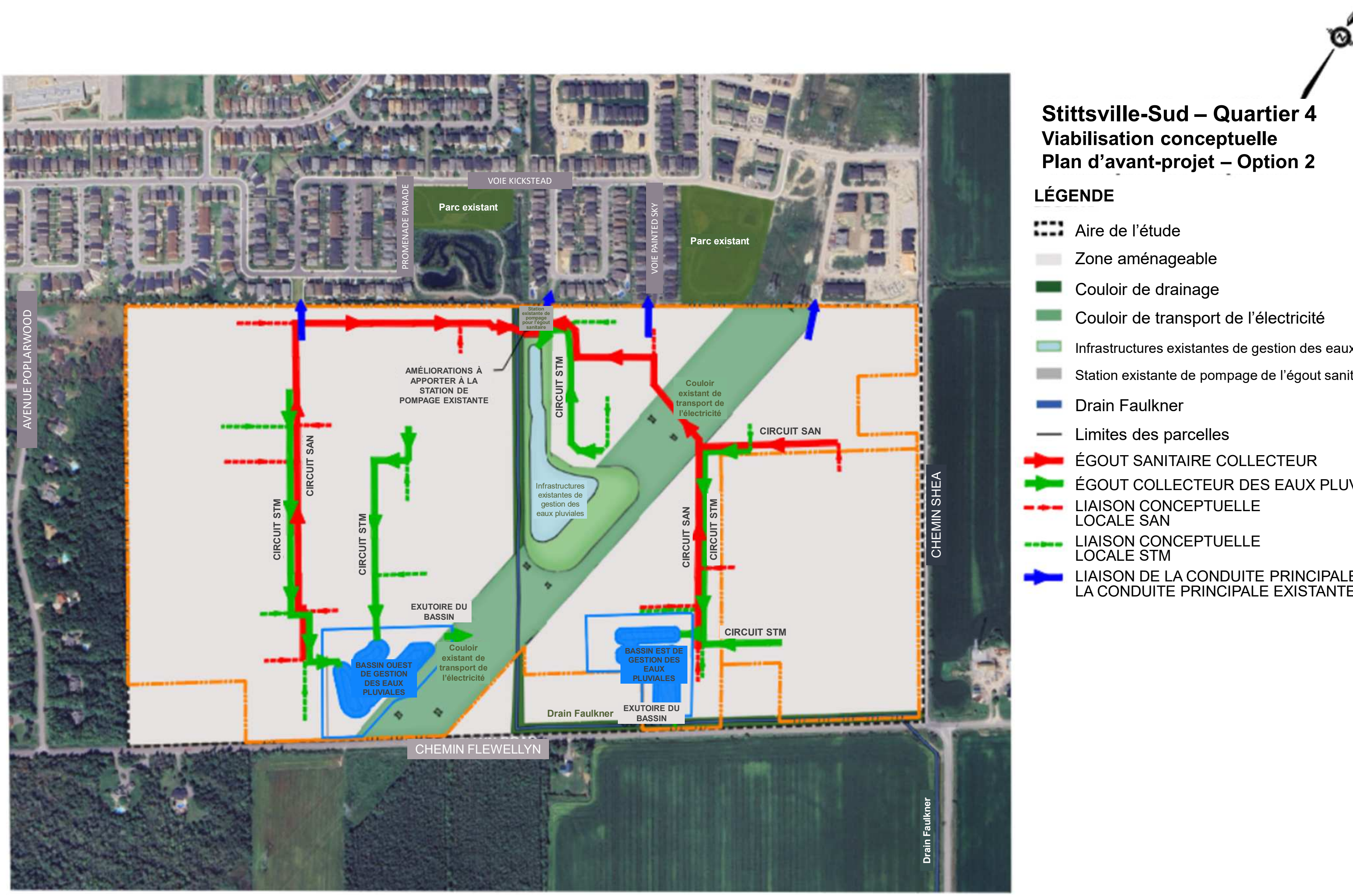
Stittsville South W-4

Conceptual Servicing Concept Plan - Option 2

LEGEND

- Study Area
- Developable Area
- Drainage Corridor
- Hydro Corridor
- Existing SWM Facility
- Existing Sanitary PS
- Faulkner Drain
- Parcel Lines
- SANITARY TRUNK SEWER
- STORM TRUNK SEWER
- CONCEPTUAL LOCAL SAN CONNECTION
- CONCEPTUAL LOCAL STM CONNECTION
- WATERMAIN CONNECTION TO EXISTING WATERMAIN

Stittsville-Sud – Quartier 4
Viabilisation conceptuelle
Plan d'avant-projet – Option 2

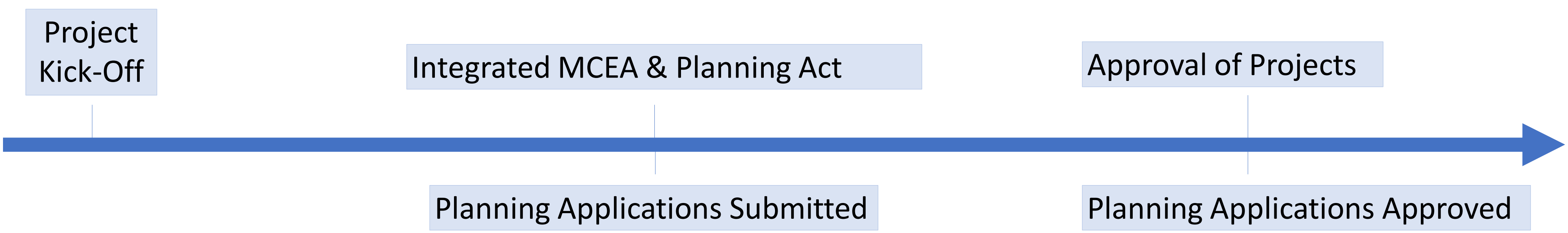


LÉGENDE

- Aire de l'étude
- Zone aménageable
- Couloir de drainage
- Couloir de transport de l'électricité
- Infrastructures existantes de gestion des eaux pluviales
- Station existante de pompage de l'égout sanitaire
- Drain Faulkner
- Limites des parcelles
- ÉGOUT SANITAIRE COLLECTEUR
- ÉGOUT COLLECTEUR DES EAUX PLUVIALES
- LIAISON CONCEPTUELLE LOCALE SAN
- LIAISON CONCEPTUELLE LOCALE STM
- LIAISON DE LA CONDUITE PRINCIPALE AVEC LA CONDUITE PRINCIPALE EXISTANTE

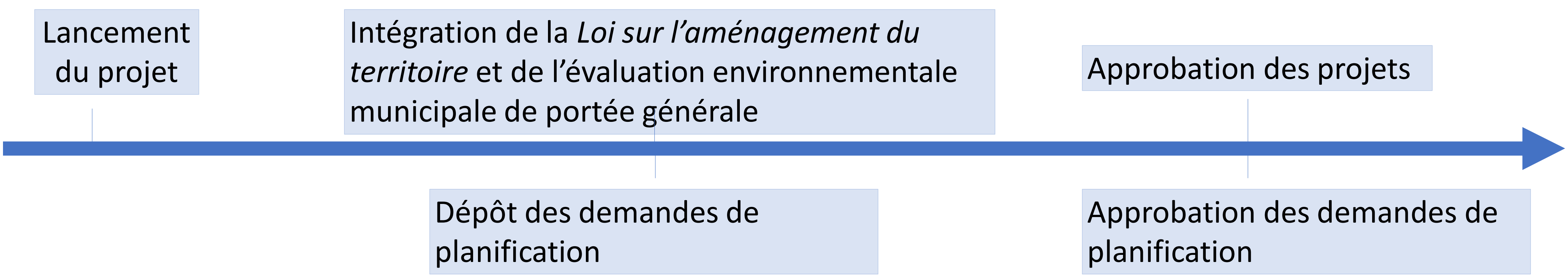
Integrated Municipal Class Environmental Assessment & Planning Act

Infrastructure servicing options are being identified and evaluated following the integrated Planning Act and MEA Class EA process. The identified infrastructure projects will be integrated and approved through the planning approval process under the Planning Act.

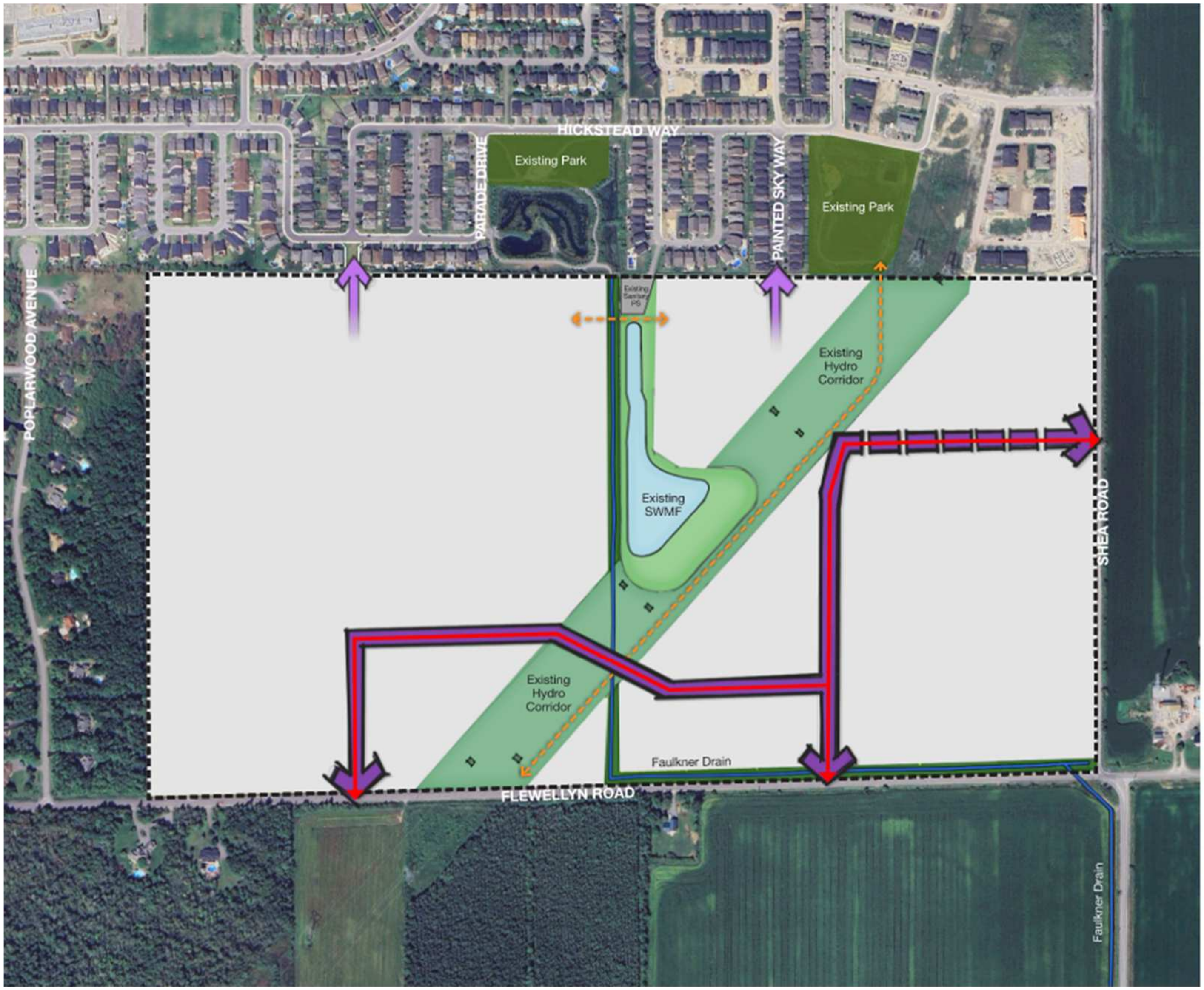


Intégration de la *Loi sur l’aménagement du territoire* et de l’évaluation environnementale municipale de portée générale

Nous sommes en train de recenser et d’évaluer les options de viabilisation des infrastructures conformément au processus intégré de la *Loi sur l’aménagement du territoire* et de l’évaluation environnementale municipale de portée générale. Les projets d’infrastructures recensés seront intégrés et approuvés dans le cadre du processus d’approbation des demandes de planification en vertu de la *Loi sur l’aménagement du territoire*.



Stittsville South W-4
TRANSPORTATION PLANNING



LEGEND

- Study Area
- Developable Area
- Drainage Corridor
- Hydro Corridor
- Existing SWM Facility
- Existing Sanitary PS
- Faulkner Drain
- Parcel Lines
- Multi-Use Pathway
- Potential Transit Routes
- Collector Road Connections*
- Local Road Connections

* Local roads will be shown in development applications

* Sidewalks and multi-use pathways to be provided on collector roads

0 100 200

NAK design strategies

Stittsville-Sud – Quartier 4
PLANIFICATION DU TRANSPORT

LÉGENDE

- Aire de l'étude
- Zone aménageable
- Couloir de drainage
- Couloir de transport de l'électricité
- Infrastructures existantes de gestion des eaux pluviales
- Station existante de pompage de l'égout sanitaire
- Drain Faulkner
- Limites des parcelles
- Sentier polyvalent
- Circuits de transport en commun potentiels
- Liaisons avec les routes collectrices*
- Liaisons avec les routes locales*

* Les routes locales seront représentées dans les demandes d'aménagement.

* Les trottoirs et les sentiers polyvalents seront prévus sur les routes collectrices.

NAK design strategies

Please share your:

Faites-nous parvenir vos :

We want to hear from you!

Dites-nous ce que vous en pensez!

engage.ottawa.ca/w4-south-stittsville

participons.ottawa.ca/w4-stittsville-sud-fr

We would love to hear from you!

Please submit your comments tonight at the meeting, by mail or email in the coming weeks.

After this consultation period we will be reviewing your comments, concerns and questions. It is our intention to present a revised plan as an amendment to the Official Plan to committee and council later in 2024.

Contact:

Robin van de Lande, Urban Planner
Community Planning
110 Laurier Avenue West, 4th Floor
Ottawa, Ontario K1P 1J1
robin.vandelande@ottawa.ca

For more information about the City of Ottawa's future neighbourhoods please go to: engage.ottawa.ca

Nous souhaitons savoir ce que vous en pensez!

Veuillez nous soumettre vos commentaires ce soir même pendant l'assemblée, ou encore par la poste ou par courriel dans les prochaines semaines.
Dans la foulée de cette période de consultation, nous prendrons connaissance de vos commentaires, de vos inquiétudes et de vos questions. Nous avons l'intention de déposer, auprès du comité et du Conseil municipal d'ici la fin de 2024, un plan révisé, qui viendra modifier le Plan officiel.

Personne-ressource :

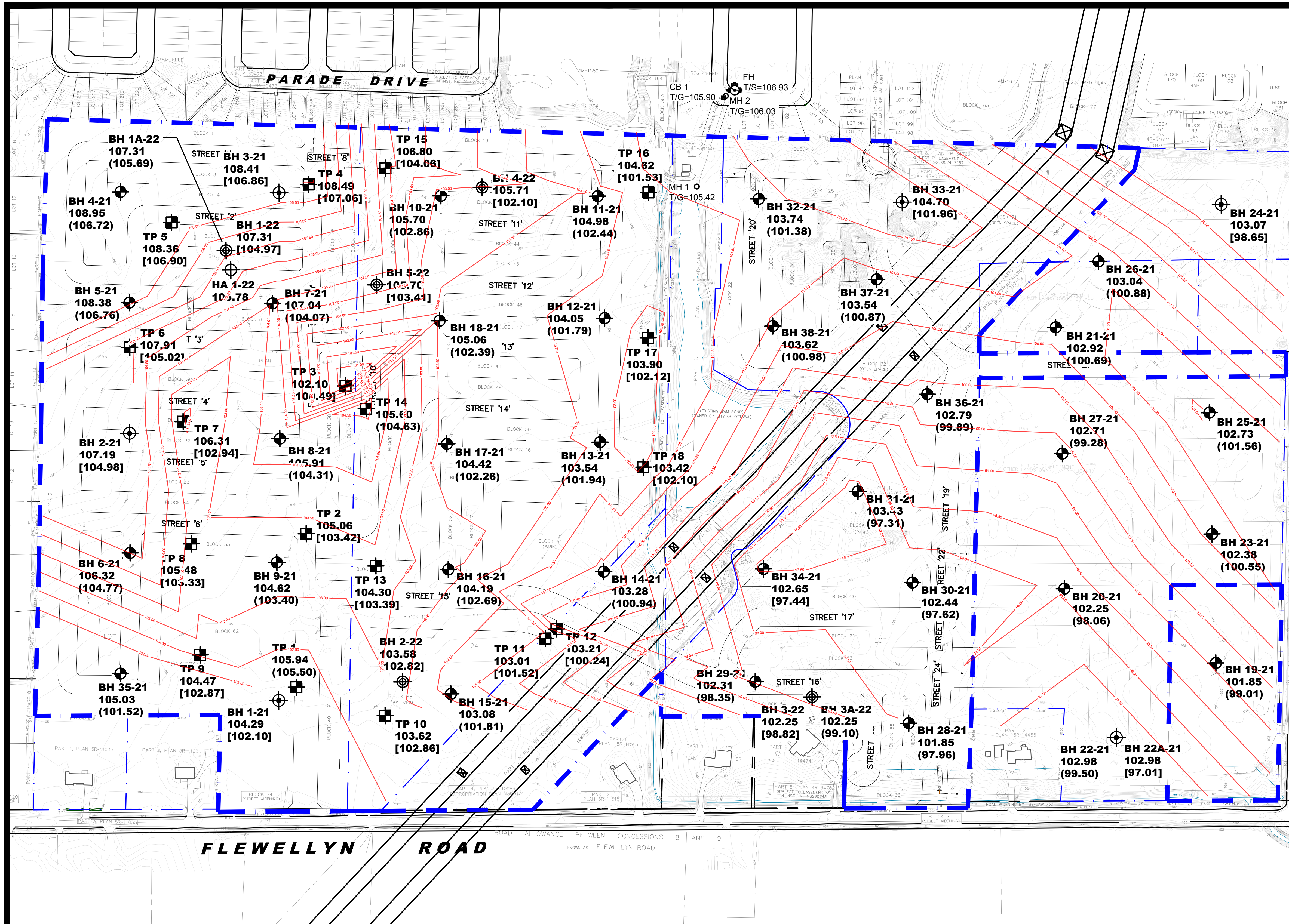
Robin van de Lande, urbaniste
Aménagement et conception communautaires
110, avenue Laurier Ouest, 4e étage
Ottawa (Ontario) K1P 1J1
robin.vandelande@ottawa.ca

Pour en savoir plus sur les quartiers projetés de la Ville d'Ottawa, veuillez nous adresser un courriel (participons.ottawa.ca).

Ottawa

David Schaeffer Engineering Ltd.
120 Iber Road, Suite 103
Stittsville, ON K2S 1E9
613-836-0856
dsel.ca

APPENDIX B



LEGEND:

- HAND AUGER LOCATION (CURRENT INVESTIGATION)
- BOREHOLE WITH MONITORING WELL LOCATION (CURRENT INVESTIGATION)
- BOREHOLE WITH PIEZOMETER LOCATION (PATERSON GROUP REPORT; PG5570-2, JAN 20, 2022)
- BOREHOLE WITH MONITORING WELL LOCATION (PATERSON GROUP REPORT; PG5570-2, JAN 20, 2022)
- TEST PIT LOCATION\ (PATERSON GROUP REPORT; PG5570-1, JAN 3, 2021)
- 97.50 BEDROCK CONTOUR (m)
- 104.29 GROUND SURFACE ELEVATION (m)
- [102.10] BEDROCK SURFACE ELEVATION (m)
- (102.39) PRACTICAL REFUSAL TO AUGERING / EXCAVATION ELEVATION (m)

BASE PLAN PREPARED BY J.D. BARNES LIMITED.

GROUND SURFACE ELEVATIONS AT BOREHOLE LOCATIONS ARE REFERENCED TO A GEODETIC DATUM.

SCALE: 1:4000

0 50 100 150 200 250m

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PATERSON GROUP
9 AURIGA DRIVE
OTTAWA, ON
K2E 7T9
TEL: (613) 226-7381

NO.	REVISIONS	DATE	INITIAL
6	UPDATED TO NEW CONCEPTUAL PLAN	03/07/2024	KP
5	UPDATED TO NEW CONCEPTUAL PLAN	28/08/2023	KP
4	UPDATED CLIENT'S NAME AND SITE ADDRESS	12/06/2023	KP
3	UPDATED SITE BOUNDARY	13/02/2023	KP
2	BH 1-22 - BH 5-22 & HA1-22 ADDED TO PLAN	10/03/2022	KP

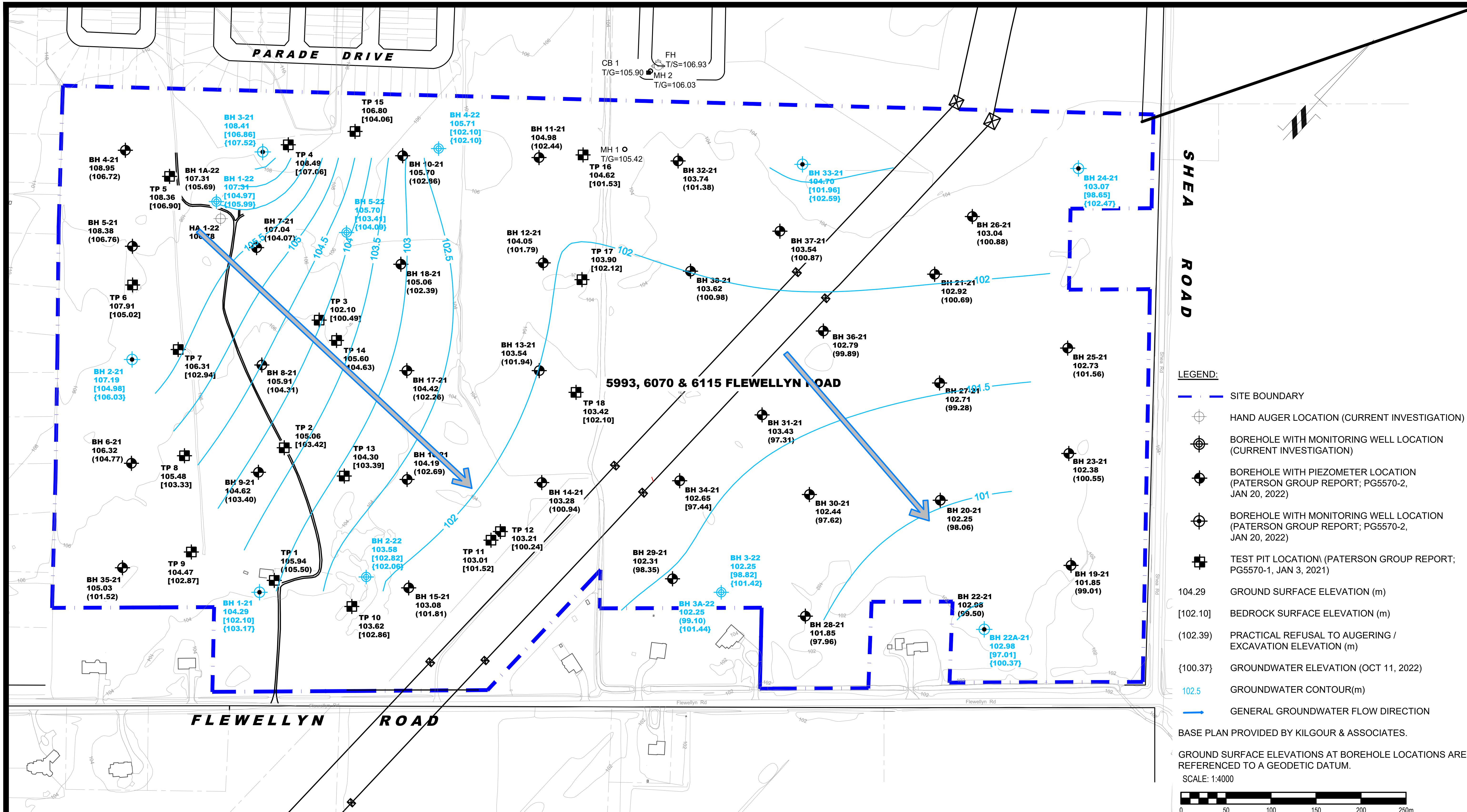
CAIVAN (STITTSVILLE SOUTH) INC. & CAIVAN (STITTSVILLE WEST) LTD.
GEOTECHNICAL INVESTIGATION
PROPOSED RESIDENTIAL DEVELOPMENT
OTTAWA, 5993 & 6115 FLEWELLYN ROAD & 6030 & 6070 FERNBANK ROAD ONTARIO

Title:

BEDROCK CONTOUR PLAN

Scale: 1:4000	Date: 01/2022
Drawn by: YA	Report No.: PG5570-2, REVISION 1
Checked by: KP	Dwg. No.: PG5570-2
Approved by: DJG	Revision No.: 6

11x17



PATERSON GROUP
9 AURIGA DRIVE
OTTAWA, ON
K2E 7S9
TEL: (613) 226-7381

NO.	REVISIONS	DATE	INITIAL
2	REVISED SITE BOUNDARY	04/07/2024	OB
1	UPDATED CLIENT'S NAME AND SITE ADDRESS	12/06/2023	OB

CAIVAN (STITTSVILLE SOUTH) INC. & CAIVAN (STITTSVILLE WEST) LTD.
HYDROGEOLOGICAL EXISTING CONDITIONS
PROPOSED RESIDENTIAL DEVELOPMENT
5993 & 6115 FLEWELLYN ROAD & 6030 & 6070 FERNBANK ROAD

OTTAWA, ONTARIO

Title:
GROUNDWATER CONTOUR PLAN

Scale: 1:4000
Date: 11/2022
Drawn by: RCG
Report No.: PH4625-REP.01
Checked by: OB
Dwg. No.: PH4625-5
Approved by: MK
Revision No.: 2

p:\autocad drawings\hydrogeology\ph46xx\ph4625 - caivan communities - 5993, 6070 & 6115 flewellyn rd\ph4625-gw contour plan (rev.02) aug 2024.dwg

11x17

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APPENDIX C

Hydraulic Capacity and Modeling Analysis Sittsville South Urban Expansion Area Development

Final Report

Prepared for:
David Schaeffer Engineering Ltd.
120 Iber Road, Unit 103
Stittsville, ON K2S 1E9

Prepared by:
GeoAdvice Engineering Inc.
Unit 203, 2502 St. John's Street
Port Moody, BC V3H 2B4

Submission Date: August 8, 2024

Contact: Mr. Werner de Schaetzen, Ph.D., P.Eng.
Project: 2022-018-DSE

Document History and Version Control

Revision No.	Date	Document Description	Revised By	Reviewed By
R0	December 1, 2023	Draft	Ben Loewen	Werner de Schaetzen
R1	December 6, 2023	Updated Draft	Ben Loewen	Werner de Schaetzen
R2	August 8, 2024	Final	Ben Loewen	Werner de Schaetzen

Statement of Qualifications and Limitations

This document represents GeoAdvice Engineering Inc. best professional judgment based on the information available at the time of its completion and as appropriate for the project scope of work. Services performed in developing the content of this document have been conducted in a manner consistent with that level and skill ordinarily exercised by a member of the engineering profession currently practicing under similar conditions. No warranty, express or implied is made.

Contents

1 Introduction

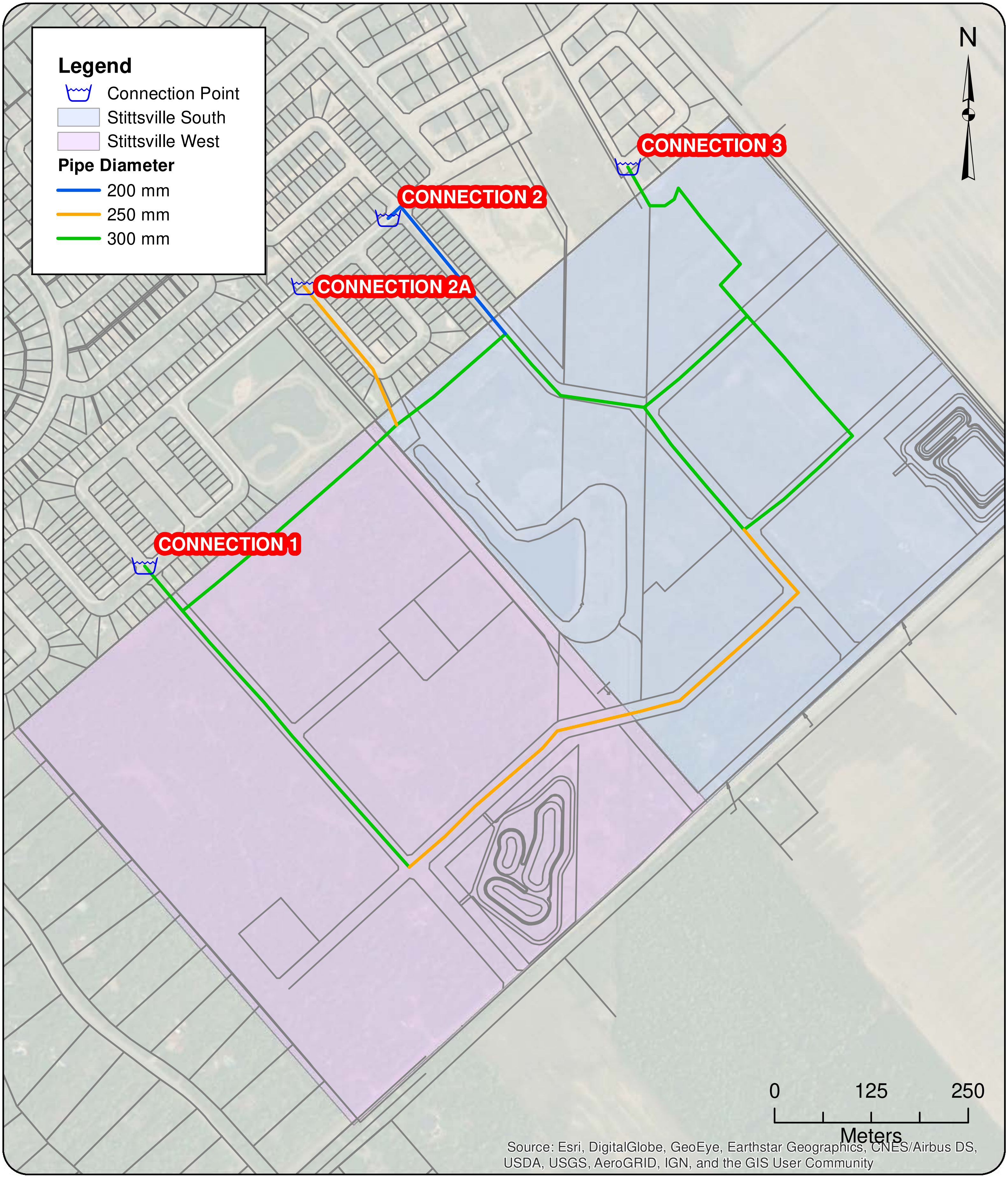
GeoAdvice Engineering Inc. ("GeoAdvice") was retained by David Schaeffer Engineering Ltd. ("DSEL") to size the proposed trunk water main network for the Sittsville South Urban Expansion Area (SSUEA) development ("Development") in the City of Ottawa, ON ("City").

The development will have four (4) connections to the City's water distribution system on Parade Drive, Hickstead Way via Aridius Crescent, Hickstead Way via Painted Sky Way, and Ocaia Street that will feed the proposed development. The connections used for modeling the proposed development were based on the boundary conditions provided by the City on May 30, 2023 (refer to **Appendix C**).

The development site is shown in **Figure 1.1** on the following page, with the recommended trunk main pipe diameters.

This report describes the assumptions and results of the hydraulic modeling and capacity analysis using InfoWater (Innovyze), a GIS water distribution system modeling and management software application.

The results presented in this report are based on the analysis of steady state simulations. The predicted available fire flows, as calculated by the hydraulic model, represent the flow available in the water main while maintaining a residual pressure of 20 psi at the hydrant. No extended period simulations were completed in this analysis to assess the water quality or to assess the hydraulic impact on storage and pumping.



GeoAdvice Engineering Inc.

Project: **Hydraulic Capacity and Modeling Analysis SSUEA 2022-018-DSE**
Client: **David Schaeffer Engineering Ltd.**
Date: **December 2023**
Created by: **BL**
Reviewed by: **WdS**

SSUEA Site Layout and Connection Point

Figure 1.1

2 Modeling Considerations

2.1 Water Main Configuration

The trunk water main network was modeled based on drawings prepared by DSEL and provided to GeoAdvice on September 1, 2023, and November 17, 2023.

2.2 Elevations

Elevations of the modeled junctions were assigned according to a preliminary site grading plan at road level, which was prepared by DSEL and provided to GeoAdvice on September 1, 2023.

2.3 Consumer Demands

The proposed residential demands for the development were based on a demand rate of 280 L/cap/d as per City of Ottawa technical bulletin ISTB 2018-01. Demand factors used for this analysis were taken according to the Ministry of Environment (MOE) Design Guidelines for subdivision populations of 3,001 capita - 10,000 capita. A summary of these tables highlighting relevant data for this development is shown in **Table 2.1**.

Table 2.1: City of Ottawa Demand Factors

Demand Type	Amount	Units
Average Day Demand		
Residential	280	L/c/d
Park	28,000	L/ha/d
Maximum Daily Demand		
Residential	2.0 x avg. day	L/c/d
Park	1.5 x avg. day	L/ha/d
Peak Hour Demand		
Residential	3.0 x avg. day	L/c/d
Park	1.8 x avg. day	L/ha/d

Table 2.2 and **Table 2.3** summarize the water demand calculations for proposed development.

Table 2.2: Development Population and Demand Calculations - Residential

Dwelling Type	Number of Units	Persons Per Unit*	Population	Average Day Demand (L/s)	Maximum Day Demand (L/s)	Peak Hour Demand (L/s)
Single Detached	676	3.4	2,299	7.5	14.9	22.4
Back-to-back Townhome	462	2.3	1,063	3.4	6.9	10.3
Traditional Townhome	679	2.7	1,834	5.9	11.9	17.8
Total	**1,817**		**5,196**	**16.8**	**33.7**	**50.5**

*City of Ottawa Design Guidelines.

Table 2.3: Park Demand Calculations

Dwelling Type	Area (ha)	Average Day Demand (L/s)	Maximum Day Demand (L/s)	Peak Hour Demand (L/s)
Park	0.12	0.04	0.06	0.11

Table 2.4 summarizes the water demand calculations for the hold-out lands adjacent to the development**.**

Table 2.4: Holdout Lands Demand Calculations

Dwelling Type	Area (ha)	Average Day Demand (L/s)	Maximum Day Demand (L/s)	Peak Hour Demand (L/s)
Residential	4.75	1.4	2.8	4.2

Detailed calculations of demands are shown in **Appendix A**.

2.4 Fire Flow Demand

Fire flow demands are typically determined in accordance with the Fire Underwriters Survey's Water Supply for Public fire Protection guideline (2020). FUS calculations are based on the types of building, floor area, number of storeys, construction class, occupancy class and exposure factor. At this time, there is not enough information about the building construction details to complete FUS calculations. As such, the following required fire flow were assumed:

- Park: 167 L/s
- Single family: 167 L/s
- Multi-family/medium density: 217 L/s

FUS calculations should be completed once detailed drawings become available to validate the required fire flow assumption. The FUS fire flows may vary from those assumed in this report.

Fire flow simulations were completed at each model node under the most conservative required fire flow value. The locations of nodes do not necessarily represent hydrant locations. Detailed FUS fire flow calculations as well as the illustrated spatial allocation of the required fire flows are shown in **Appendix B**.

2.5 Boundary Conditions

The boundary conditions were provided by the City of Ottawa in the form of Hydraulic Grade Line (HGL) at the following locations:

- Connection 1: Parade Drive
- Connection 2: Hickstead Way via Painted Sky Way
- Connection 2A: Hickstead Way via Aridius Crescent
    - An additional connection was modeled with the assumption of identical HGL values to Connection 2 based on the location proximity
- Connection 3: Ocaia Street

The four connections to the proposed development are illustrated in **Figure 1.1**.

Boundary conditions were provided for Peak Hour (PHD), Maximum Day plus Fire (MDD+FF) and Average Day (high pressure check, ADD) demand conditions. The City boundary conditions were provided to GeoAdvice on May 30, 2023, and can be found in **Appendix C**.

Table 2.5 summarizes the City of Ottawa boundary conditions ("Scenario 3") used to size the water network.

Table 2.5: Boundary Conditions ("Scenario 3")

Condition	Connection 1 HGL (m)	Connection 2 HGL (m)	Connection 2A HGL (m)	Connection 3 HGL (m)
Average Day (max. pressure)	160.4	160.4	160.4	160.4
Peak Hour (min. pressure)	150.0	149.8	149.8	149.7
Max Day + Fire Flow (167 L/s)	142.8	140.4	140.4	136.1
Max Day + Fire Flow (217 L/s)	134.8	131.0	131.0	124.2

3 Hydraulic Capacity Design Criteria

3.1 Pipe Characteristics

Pipe characteristics of internal diameter (ID) and Hazen-Williams C factors were assigned in the model according to the City of Ottawa Design Guidelines for PVC water main material. Pipe characteristics used for the development are outlined in **Table 3.1** below.

Table 3.1: Model Pipe Characteristics

Nominal Diameter (mm)	ID PVC (mm)	Hazen Williams C-Factor (/)
250	250	110
300	297	120

3.2 Pressure Requirements

As outlined in the City of Ottawa Design Guidelines, the generally accepted best practice is to design new water distribution systems to operate between 350 kPa (50 psi) and 480 kPa (70 psi). The maximum pressure at any point in the distribution system in occupied areas outside of the public right-of-way shall not exceed 552 kPa (80 psi). Pressure requirements are outlined in **Table 3.2.**

Table 3.2: Pressure Requirements

Demand Condition	Minimum Pressure		Maximum Pressure	
	(kPa)	(psi)	(kPa)	(psi)
Normal Operating Pressure (maximum daily flow)	350	50	480	70
Peak Hour Demand (minimum allowable pressure)	276	40	-	-
Maximum Fixture Pressure (Ontario Building Code)	-	-	552	80
Maximum Distribution Pressure (minimum hour check)	-	-	552	80
Maximum Day Plus Fire	140	20	-	-

4 Hydraulic Capacity Analysis

The proposed trunk water mains within the development were sized to the minimum diameter which would satisfy the greater of maximum day plus fire and peak hour demand. Modeling was carried out for average day, peak hour and maximum day plus fire flow using InfoWater.

Detailed pipe and junction model input data can be found in **Appendix D**.

4.1 Development Pressure Analysis

Modeled service pressures for the development is summarized in **Table 4.1**.

Table 4.1: Summary of Available Service Pressures

Average Day Demand Maximum Pressure	Peak Hour Demand Minimum Pressure
78.7 psi (543 kPa)	58.4 psi (402 Pa)

As outlined in the City of Ottawa Design Guidelines, the generally accepted best practice is to design new water distribution systems to operate between 350 kPa (50 psi) and 480 kPa (70 psi). The maximum pressure at any point within the distribution system in occupied areas outside of the public right-of-way shall not exceed 552 kPa (80 psi) and the minimum pressure at any point within the distribution system shall not fall below 270 kPa (40 psi). As such, based on the City boundary conditions, pressure reducing valves are not predicted to be required throughout development.

Detailed result tables and figures can be found in **Appendix E**.

4.2 Development Fire Flow Analysis

Summaries of the minimum available fire flows in the development are shown in **Table 4.2**.

Table 4.2: Summary of the Minimum Available Fire Flows

Required Fire Flow	Minimum Available Flow*	Junction ID
167 L/s	273 L/s	JCT-STV-066
217 L/s	254 L/s	JCT-STV-048

*The predicted available fire flows, as calculated by the hydraulic model, represent the flow available in the water main while maintaining a residual pressure of 20 psi at the hydrant. High available fire flows (>500 L/s) are theoretical values. Actual available fire flow is limited by the hydraulic losses through the hydrant lateral and hydrant port sizes.

As shown in **Table 4.2**, the fire flow requirements can be met at all junctions within the development.

Summaries of the residual pressures in the development are shown in **Table 4.3**. The minimum allowable pressure under fire flow conditions is 140 kPa (20 psi) at the location of the fire.

Table 4.3: Summary of the Residual Pressures (MDD + FF)

Minimum Residual Pressure	Average Residual Pressure	Maximum Residual Pressure
23.8 psi (164 kPa)	40.5 psi (279 kPa)	47.2 psi (325 kPa)

As shown in **Table 4.3**, there is sufficient residual pressure at all the junctions within the development.

Detailed fire flow results and figures illustrating the fire flow results can be found in **Appendix F**.

Additional hydraulic modeling should be conducted once the internal water main network has been designed, in order to validate the proposed trunk main diameters discussed within this report.

5 Other Servicing Considerations

5.1 Water Supply Security

The City of Ottawa Design Guidelines allow single feed systems for developments up to a total average day demand of 50 m^3/day and require two (2) feeds if the development exceeds 50 m^3/day for supply security, according to Technical Bulletin ISDTB-2021-03.

The development services a total average day demand of 1,580 m^3/day; as such, two (2) feeds are required. The development has four (4) feeds, which were modeled as part of this analysis.

5.2 Valves

No comment has been made in this report with respect to exact placement of isolation valves within the distribution network for the development other than to summarize the City of Ottawa Design Guidelines for number, location, and spacing of isolation valves:

- Tee intersection – two (2) valves
- Cross intersection – three (3) valves
- Valves shall be located 2 m away from the intersection
- 300 m spacing for 150 mm to 400 mm diameter valves
- Gate valves for 100 mm to 300 mm diameter mains
- Butterfly valves for 400 mm and larger diameter mains

Drain valves are not strictly required under the City of Ottawa Design Guidelines for water mains under 600 mm in diameter. The Guidelines indicate that “small diameter water mains shall be drained through hydrant via pumping if needed.”

Air valves are not strictly required under the City of Ottawa Design Guidelines for water mains up to and including 400 mm in diameter. The Guidelines indicate that air removal “can be accomplished by the strategic positioning of hydrant at the high points to remove the air or by installing or utilizing available 50 mm chlorination nozzles in 300 mm and 400 mm chambers.”

The detailed engineering drawings for the development are expected to identify valves in accordance with the requirements noted above.

5.3 Hydrants

No additional comment has been made in this report with respect to exact placement of hydrants within the distribution network for the development other than to summarize the City of Ottawa Design Guidelines for maximum hydrant spacing:

- 125 m for single family unit residential areas on lots where frontage at the street line is 15 m or longer
- 110 m for single family unit residential areas on lots where frontage at the street line is less than 15 m and for residential areas zoned for row housing, doubles, or duplexes
- 90 m for institutional, commercial, industrial, apartments and high-density areas

The detailed engineering drawings for the development are expected to identify hydrant locations in accordance with the requirements noted above.

5.4 Water Quality

The turnover rate of the water within the development network only, calculated from the connections to the development is about 3 hours (ADD is 1,580 m^3/day).

The above rate is based on the volume of the development network and the development average day demand.

6 Conclusions

The hydraulic capacity and modeling analysis of the Sittsville South Urban Expansion Area development yielded the following conclusions:

- The proposed water main network can deliver all domestic flows under the ADD and the PHD conditions. Service pressures are expected to range between 58 psi (402 kPa) and 79 psi (543 kPa).
- The proposed trunk water main network is able to deliver fire flows at all junctions.

Submission

Prepared by:

LICENSED PROFESSIONAL ENGINEER
B. J. LOEWEN
100573636
PROVINCE OF ONTARIO

Benjamin Loewen

August 8, 2024

Ben Loewen, P.Eng., GDBA, PMP.
Project Engineer / Project Manager

Approved by:

Werner de Schaetzen

Werner de Schaetzen, Ph.D., P.Eng.
Senior Modeling Review

Appendix A Domestic Water Demand Calculations and Allocation

Consumer Water Demands

Stittsville West - Residential Demands

Dwelling Type	Number of Units	Population		Average Day Demand			Max Day	Peak Hour
		Persons per Unit	Population Per Dwelling Type	(L/c/d)	(L/d)	(L/s)	2.0 x Avg. Day (L/s)	3 x Avg. Day (L/s)
Single Detached	449	3.4	1,527	280	427,560	4.95	9.90	14.85
Back-to-Back Townhome	162	2.3	373		104,440	1.21	2.42	3.63
Traditional Townhome	374	2.7	1,010		282,800	3.27	6.55	9.82
Subtotal	**985**		**2,910**		**814,800**	**9.43**	**18.86**	**28.29**

Stittsville West - Non Residential Demands

Property Type	Area (ha)			Average Day Demand			Max Day	Peak Hour
				(L/ha/d)	(L/d)	(L/s)	1.5 x Avg. Day (L/s)	1.8 x Max Day (L/s)
Park	0.07			28,000	1,963	0.02	0.03	0.06
Subtotal	**0.07**				**1,963**	**0.02**	**0.03**	**0.06**

Future Development & Holdouts 1 - Residential Demands

Dwelling Type	Area (ha)	Population		Average Day Demand			Max Day	Peak Hour
		Persons per Ha	Population Per Dwelling Type	(L/c/d)	(L/d)	(L/s)	2.0 x Avg. Day (L/s)	3 x Avg. Day (L/s)
Residential	2	90.0	150	280	42,000	0.49	0.97	1.46
Subtotal	**2**		**150**		**42,000**	**0.49**	**0.97**	**1.46**

Stittsville South - Residential Demands

Dwelling Type	Number of Units	Population		Average Day Demand			Max Day	Peak Hour
		Persons per Unit	Population Per Dwelling Type	(L/c/d)	(L/d)	(L/s)	2.0 x Avg. Day (L/s)	3 x Avg. Day (L/s)
Single Detached	227	3.4	772	280	216,160	2.50	5.00	7.51
Back-to-Back Townhome	300	2.3	690		193,200	2.24	4.47	6.71
Traditional Townhome	305	2.7	824		230,720	2.67	5.34	8.01
Subtotal	**832**		**2,286**		**640,080**	**7.41**	**14.82**	**22.23**

Stittsville South - Non Residential Demands

Property Type	Area (ha)			Average Day Demand			Max Day	Peak Hour
				(L/ha/d)	(L/d)	(L/s)	1.5 x Avg. Day (L/s)	1.8 x Max Day (L/s)
Park	0.12			28,000	3,405	0.04	0.06	0.11
Subtotal	**0.12**				**3,405**	**0.04**	**0.06**	**0.11**

Future Development & Holdouts 2 - Residential Demands

Dwelling Type	Area (ha)	Population		Average Day Demand			Max Day	Peak Hour
		Persons per Ha	Population Per Dwelling Type	(L/c/d)	(L/d)	(L/s)	2.0 x Avg. Day (L/s)	3 x Avg. Day (L/s)
Residential	1.60	90.0	145	280	40,600	0.47	0.94	1.41
Subtotal			**145**		**40,600**	**0.47**	**0.94**	**1.41**

Future Development & Holdouts 3 - Residential Demands

Dwelling Type	Area (ha)	Population		Average Day Demand			Max Day	Peak Hour
		Persons per Ha	Population Per Dwelling Type	(L/c/d)	(L/d)	(L/s)	2.0 x Avg. Day (L/s)	3 x Avg. Day (L/s)
Residential	0.67	90.0	61	280	17,080	0.20	0.40	0.59
Subtotal			**61**		**17,080**	**0.20**	**0.40**	**0.59**

Future Development & Holdouts 4 - Residential Demands

Dwelling Type	Area (ha)	Population		Average Day Demand			Max Day	Peak Hour
		Persons per Ha	Population Per Dwelling Type	(L/c/d)	(L/d)	(L/s)	2.0 x Avg. Day (L/s)	3 x Avg. Day (L/s)
Residential	0.81	90.0	73	280	20,440	0.24	0.47	0.71
Subtotal			**73**		**20,440**	**0.24**	**0.47**	**0.71**

		Average Day	**Max Day**	**Peak Hour**
Stittsville West		**9.94**	**19.87**	**29.81**
Stittsville South		**8.35**	**16.68**	**25.04**

*Peaking factors based on development population of 3,001-10,000 capita from the MOE Design Guidelines

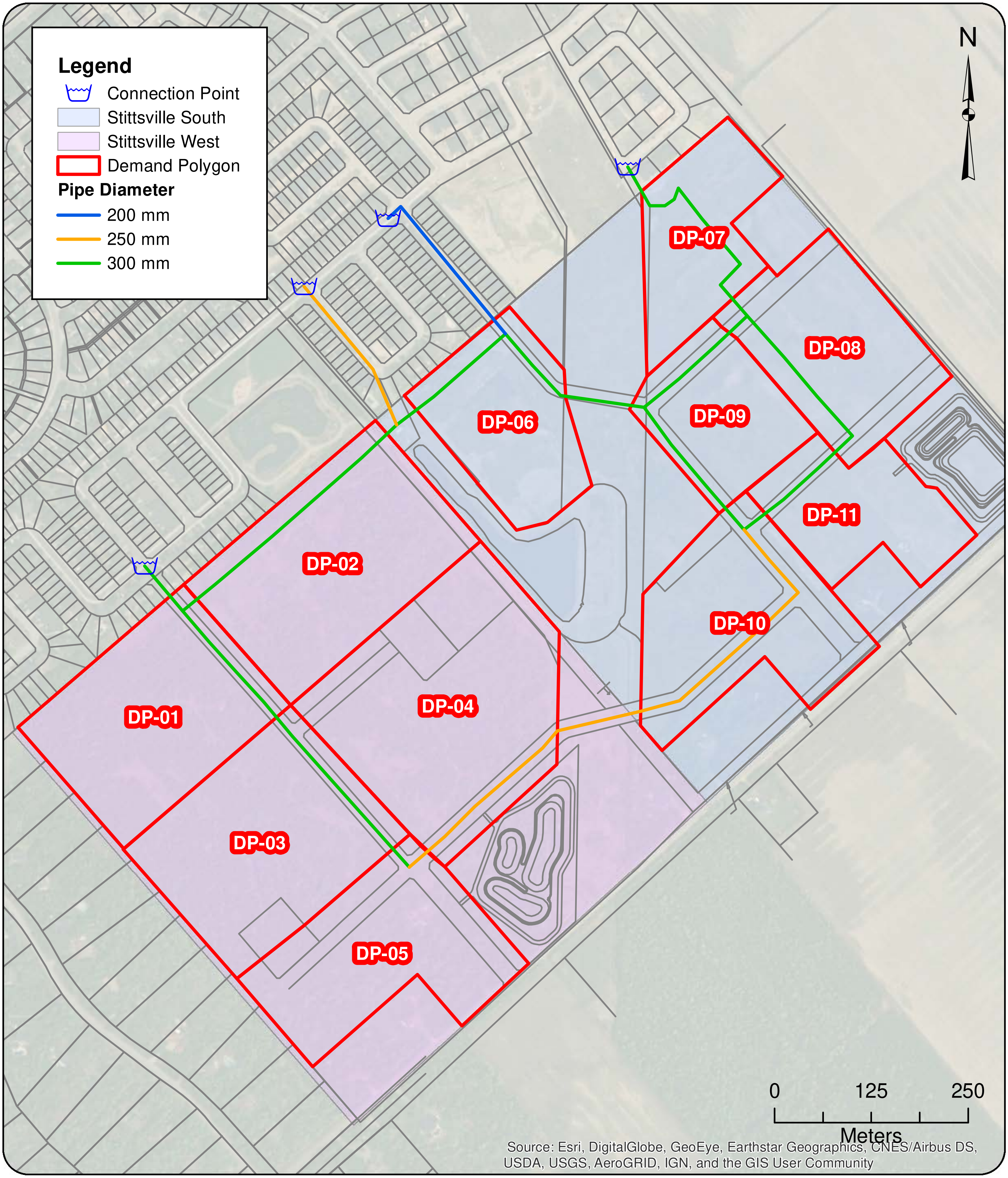
Demand Calculations and Allocation

Drummond Lands Domestic Demands

Demand Polygon	Junction ID	Dwelling Type	Number of Units	Population	Average Day Demand			Max Day 2.0 x Avg. Day (L/s)	Peak Hour 3.0 x Avg. Day (L/s)
					L/c/d	L/d	L/s		
1	JCT-STV-001	Single Detached	148	503	280	140,933	0.41	0.82	1.22
	JCT-STV-008						0.41	0.82	1.22
	JCT-STV-009						0.41	0.82	1.22
	JCT-STV-010						0.41	0.82	1.22
2	JCT-STV-015	Single Detached	165	561	280	157,121	0.45	0.91	1.36
	JCT-STV-019						0.45	0.91	1.36
	JCT-STV-020						0.45	0.91	1.36
	JCT-STV-021						0.45	0.91	1.36
3	JCT-STV-029	Traditional Townhouse	225	608	280	170,134	0.98	1.97	2.95
	JCT-STV-049						0.98	1.97	2.95
4	JCT-STV-053	Single Detached	116	395	280	110,461	0.62	1.24	1.86
	JCT-STV-054						0.62	1.24	1.86
	JCT-STV-066	Traditional Townhouse	66	178	280	49,906	0.62	1.24	1.86
5	JCT-STV-048	Single Detached	20	68	280	19,045	2.16	4.31	6.47
		Traditional Townhouse	83	224	280	62,760			
		Back-to-Back Townhouse	162	373	280	104,440			
6	JCT-STV-068	Single Detached	81	275	280	77,132	0.18	0.36	0.54
	JCT-STV-075						0.18	0.36	0.54
	JCT-STV-076						0.18	0.36	0.54
	JCT-STV-077						0.18	0.36	0.54
	JCT-STV-078						0.18	0.36	0.54
7	JCT-STV-083	Single Detached	66	224	280	62,848	0.18	0.36	0.55
	JCT-STV-086						0.18	0.36	0.55
	JCT-STV-087						0.18	0.36	0.55
	JCT-STV-088						0.18	0.36	0.55
8	JCT-STV-082	Single Detached	5	17	280	4,761	0.67	1.34	2.01
	JCT-STV-093						0.67	1.34	2.01
	JCT-STV-098	Traditional Townhouse	45	122	280	34,041	0.67	1.34	2.01
	JCT-STV-099	Back-to-Back Townhouse	300	690	280	193,200	0.67	1.34	2.01
9	JCT-STV-079	Single Detached	8	27	280	7,618	0.17	0.34	0.52
	JCT-STV-080						0.17	0.34	0.52
	JCT-STV-081						0.17	0.34	0.52
	JCT-STV-108	Traditional Townhouse	88	238	280	66,568	0.17	0.34	0.52
	JCT-STV-109						0.17	0.34	0.52
10	JCT-STV-067	Single Detached	67	228	280	63,801	0.25	0.51	0.76
	JCT-STV-110						0.25	0.51	0.76
	JCT-STV-114						0.25	0.51	0.76
	JCT-STV-115	Traditional Townhouse	61	165	280	46,144	0.25	0.51	0.76
	JCT-STV-117						0.25	0.51	0.76
11	JCT-STV-104	Traditional Townhouse	111	300	280	83,967	0.49	0.97	1.46
	JCT-STV-107						0.49	0.97	1.46
A1	JCT-STV-048	Residential	1.6658	150	280	42,000	0.49	0.97	1.46
A2	JCT-STV-067	Residential	1.6034	145	280	40,600	0.47	0.94	1.41
A3	JCT-STV-107	Residential	0.6690	61	280	17,080	0.20	0.40	0.59
A4	JCT-STV-082	Residential	0.8095	73	280	20,440	0.24	0.47	0.71
	Total:		**1,822**	**5,625**		**1,575,000**	**18.23**	**36.46**	**54.69**

Drummond Lands Non-Domestic Demands

Property Type	Junction ID	Phase	Area (ha)	Average Day Demand			Max Day 1.5 x Avg. Day (L/s)	Peak Hour 1.8 x Max Day (L/s)
				(L/ha/d)	(L/d)	(L/s)		
Park	JCT-STV-048	Stittsville West	0.04	28,000	1,025	0.01	0.02	0.03
Park	JCT-STV-029	Stittsville West	0.03	28,000	938	0.01	0.02	0.03
Park	JCT-STV-110	Stittsville South	0.04	28,000	991	0.01	0.02	0.03
Park	JCT-STV-076	Stittsville South	0.09	28,000	2,414	0.01	0.02	0.04
	JCT-STV-077					0.01	0.02	0.04
	Total:		**0.19**		**5,368**	**0.06**	**0.09**	**0.17**



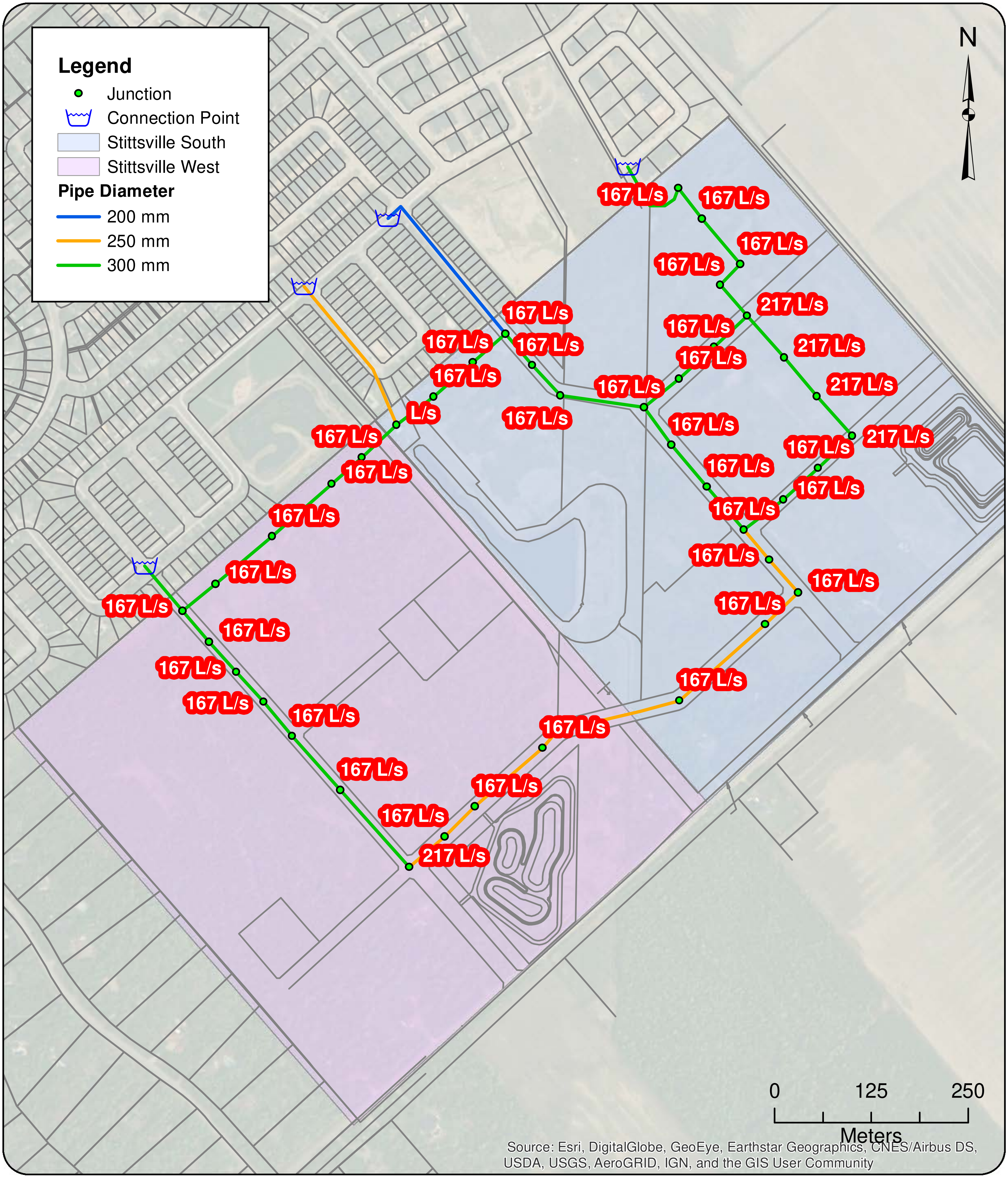
GeoAdvice Engineering Inc.

Project:	Hydraulic Capacity and Modeling Analysis SSUEA 2022-018-DSE
Client:	David Schaeffer Engineering Ltd.
Date:	December 2023
Created by:	BL
Reviewed by:	WdS

Demand Allocation

Figure A.1

Appendix B Required Fire Flow Allocation



GeoAdvice Engineering Inc.

Project: **Hydraulic Capacity and Modeling Analysis SSUEA 2022-018-DSE**
Client: **David Schaeffer Engineering Ltd.**
Date: **December 2023**
Created by: **BL**
Reviewed by: **WdS**

Required Fire Flow

Figure B.1

Appendix C Boundary Conditions

Boundary Conditions
Stittsville South Urban Expansion Area

Provided Information

Scenario	Demand	
	L/min	L/s
Average Daily Demand	1,043	17.39
Maximum Daily Demand	2,059	34.32
Peak Hour	3,114	51.90
Fire Flow Demand #1	10,020	167.00
Fire Flow Demand #2	13,020	217.00
Fire Flow Demand #3	16,980	283.00

Location

Existing Condition Model

Existing Condition with **Conceptual** Looping for Future Servicing Scenario 1

Existing Condition with **Conceptual** Looping for Future Servicing Scenario 2

Results

1. Existing Condition Model (No Future Demand)

Connection 1 - Parade Dr.

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	160.2	72.3
Peak Hour	155.2	65.2
Max Day plus Fire Flow #1	143.5	48.7
Max Day plus Fire Flow #2	135.7	37.7
Max Day plus Fire Flow #3	123.2	19.8
[1] Ground Elevation =	109.2	m

Connection 2 - Hickstead Way

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	160.2	77.9
Peak Hour	155.2	70.8
Max Day plus Fire Flow #1	139.7	48.8
Max Day plus Fire Flow #2	129.6	34.4
Max Day plus Fire Flow #3	113.1	11.0
[1] Ground Elevation =	105.4	m

Connection 3 - Ocaia St.

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	160.2	79.8
Peak Hour	155.2	72.7
Max Day plus Fire Flow #1	127.3	33.0
Max Day plus Fire Flow #2	109.3	7.5
Max Day plus Fire Flow #3	80.0	-34.3
[1] Ground Elevation =	104.1	m

2. Existing Condition Model with Future Demands

Connection 1 – Parade Dr.

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	160.4	72.8
Peak Hour	150.1	58.1
Max Day plus Fire Flow #1	142.3	47.1
Max Day plus Fire Flow #2	134.0	35.2

Max Day plus Fire Flow #3	120.7	16.4

[1] Ground Elevation = 109.2 m

Connection 2 – Hickstead Way

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	160.4	78.1
Peak Hour	149.6	62.8
Max Day plus Fire Flow #1	137.6	45.7
Max Day plus Fire Flow #2	126.7	30.2
Max Day plus Fire Flow #3	109.2	5.3

[1] Ground Elevation = 105.4 m

Connection 3 – Ocaia St.

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	160.4	80.0
Peak Hour	149.2	64.2
Max Day plus Fire Flow #1	123.8	28.0
Max Day plus Fire Flow #2	104.7	0.9
Max Day plus Fire Flow #3	74.0	-42.8

[1] Ground Elevation = 104.1 m

3. Existing Condition with 254 mm Looping for Future Servicing Scenario 1

Connection 1 - Parade Dr.

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	160.4	72.8
Peak Hour	150.0	58.0
Max Day plus Fire Flow #1	142.8	47.7
Max Day plus Fire Flow #2	134.8	36.3
Max Day plus Fire Flow #3	122.0	18.2

[1] Ground Elevation = 109.2 m

Connection 2 - Hickstead Way

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	160.4	78.2
Peak Hour	149.8	63.1
Max Day plus Fire Flow #1	140.4	49.7
Max Day plus Fire Flow #2	131.0	36.4
Max Day plus Fire Flow #3	116.1	15.2

[1] Ground Elevation = 105.4 m

Connection 3 - Ocaia St.

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	160.4	80.1
Peak Hour	149.7	64.9
Max Day plus Fire Flow #1	136.1	45.5
Max Day plus Fire Flow #2	124.2	28.7
Max Day plus Fire Flow #3	105.2	1.7

[1] Ground Elevation = 104.1 m

4. Existing Condition with 254 mm Looping for Future Servicing Scenario 2

Connection 1 - Parade Dr.

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	160.4	72.8
Peak Hour	150.0	58.0
Max Day plus Fire Flow #1	142.8	47.7
Max Day plus Fire Flow #2	134.8	36.3
Max Day plus Fire Flow #3	122.0	18.2

[1] Ground Elevation = 109.2 m

Connection 2 - Hickstead Way

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	160.4	78.2
Peak Hour	149.8	63.1
Max Day plus Fire Flow #1	140.4	49.7
Max Day plus Fire Flow #2	131.0	36.4
Max Day plus Fire Flow #3	116.1	15.3

[1] Ground Elevation = 105.4 m

Connection 3 - Ocaia St.

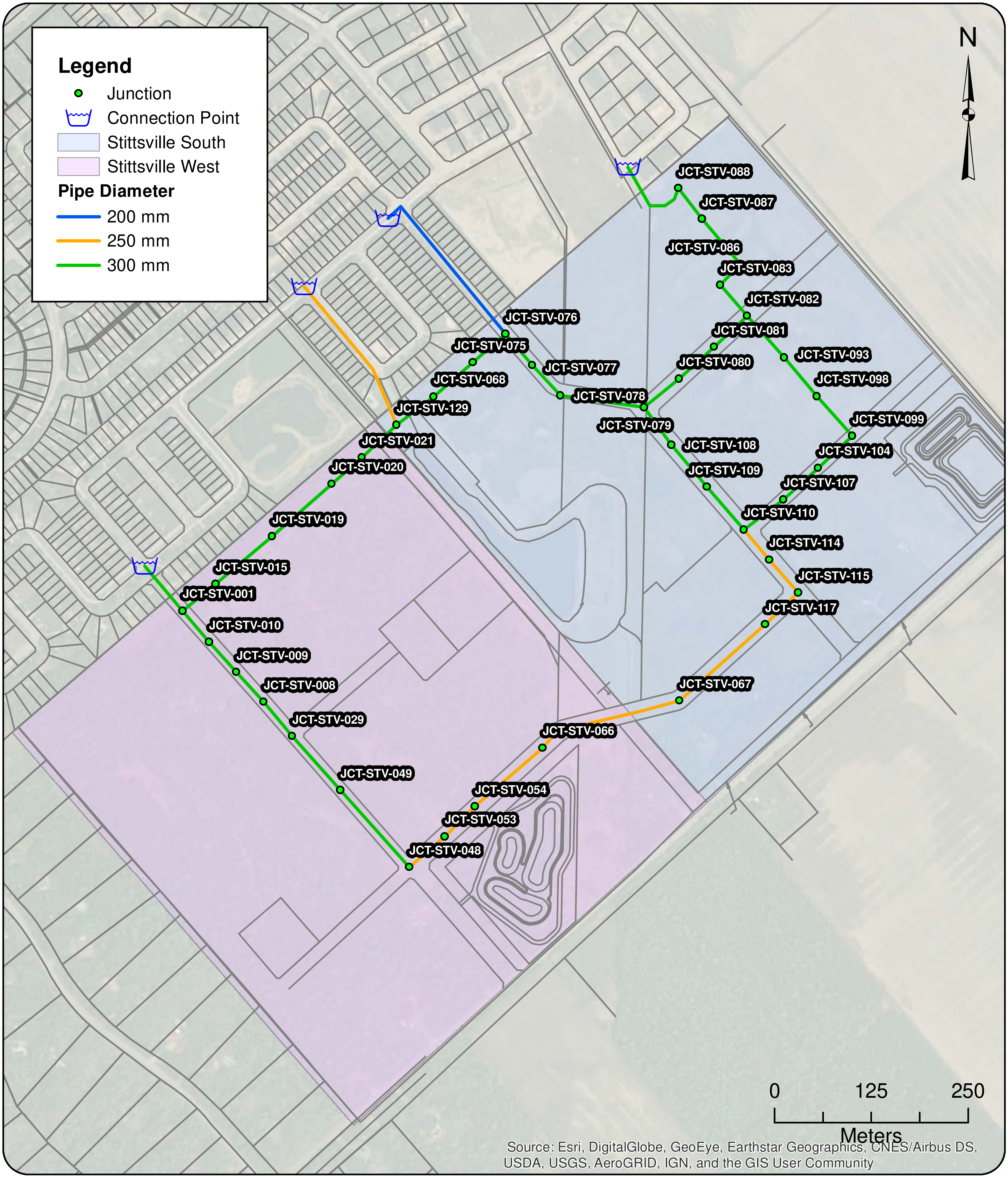
Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	160.4	80.1
Peak Hour	149.7	64.9
Max Day plus Fire Flow #1	136.5	46.1
Max Day plus Fire Flow #2	124.9	29.6
Max Day plus Fire Flow #3	106.3	3.2

[1] Ground Elevation = 104.1 m

Disclaimer

The boundary condition information is based on current operation of the city water distribution system. The computer model simulation is based on the best information available at the time. The operation of the water distribution system can change on a regular basis, resulting in a variation in boundary conditions. The physical properties of watermains deteriorate over time, as such must be assumed in the absence of actual field test data. The variation in physical watermain properties can therefore alter the results of the computer model simulation. Fire Flow analysis is a reflection of available flow in the watermain; there may be additional restrictions that occur between the watermain and the hydrant that the model cannot take into account.

Appendix D Pipe and Junction Model Inputs



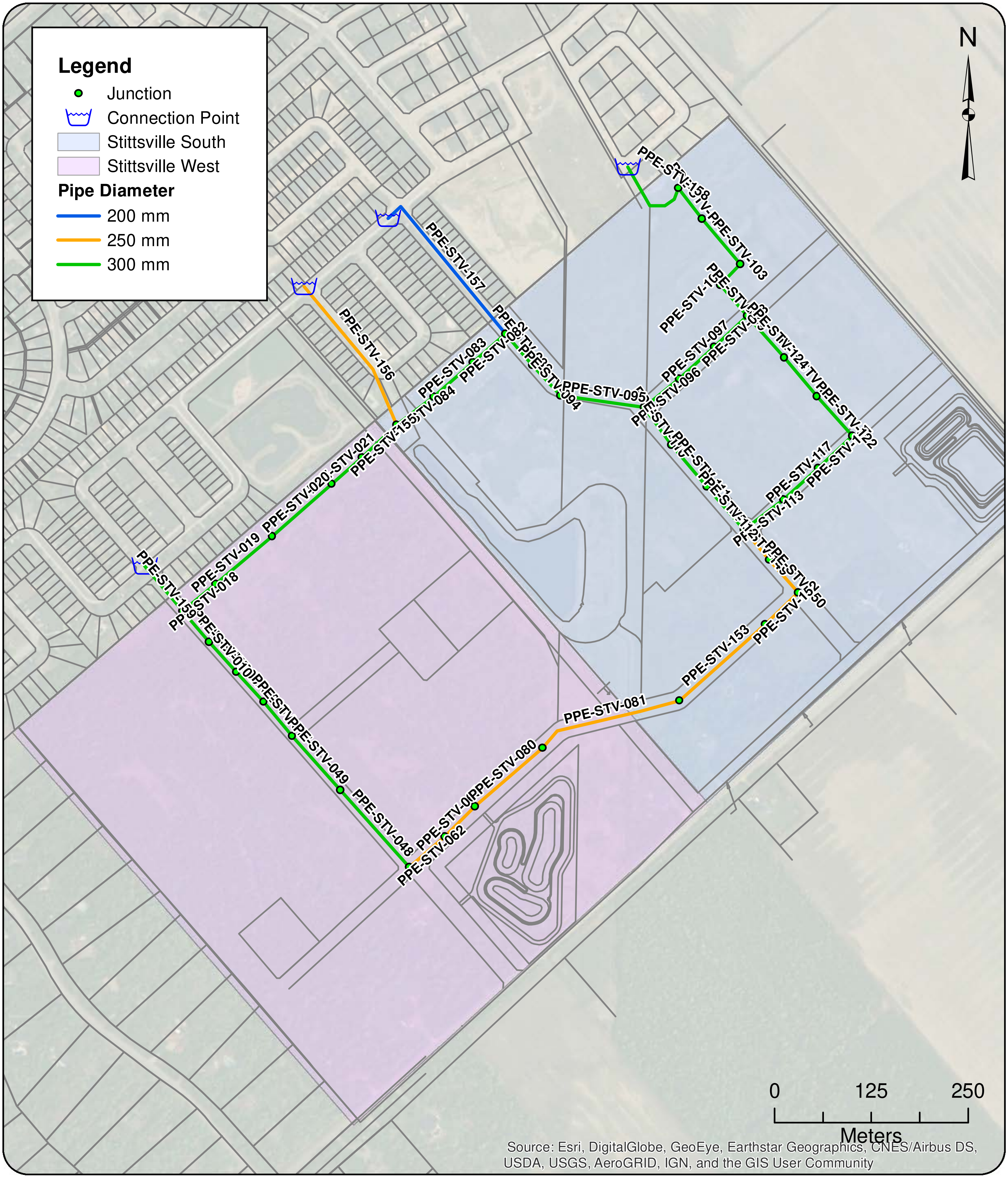
GeoAdvice Engineering Inc.

Project: **Hydraulic Capacity and Modeling Analysis SSUEA**
2022-018-DSE
Client: **David Schaeffer Engineering Ltd.**
Date: **December 2023**
Created by: **BL**
Reviewed by: **WdS**

DISCLAIMER: GeoAdvice does not warrant in any way the accuracy and completeness of the information shown on this map. Field verification of the accuracy and completeness of the information shown on this map is the sole responsibility of the user.

Junction IDs

Figure D.1



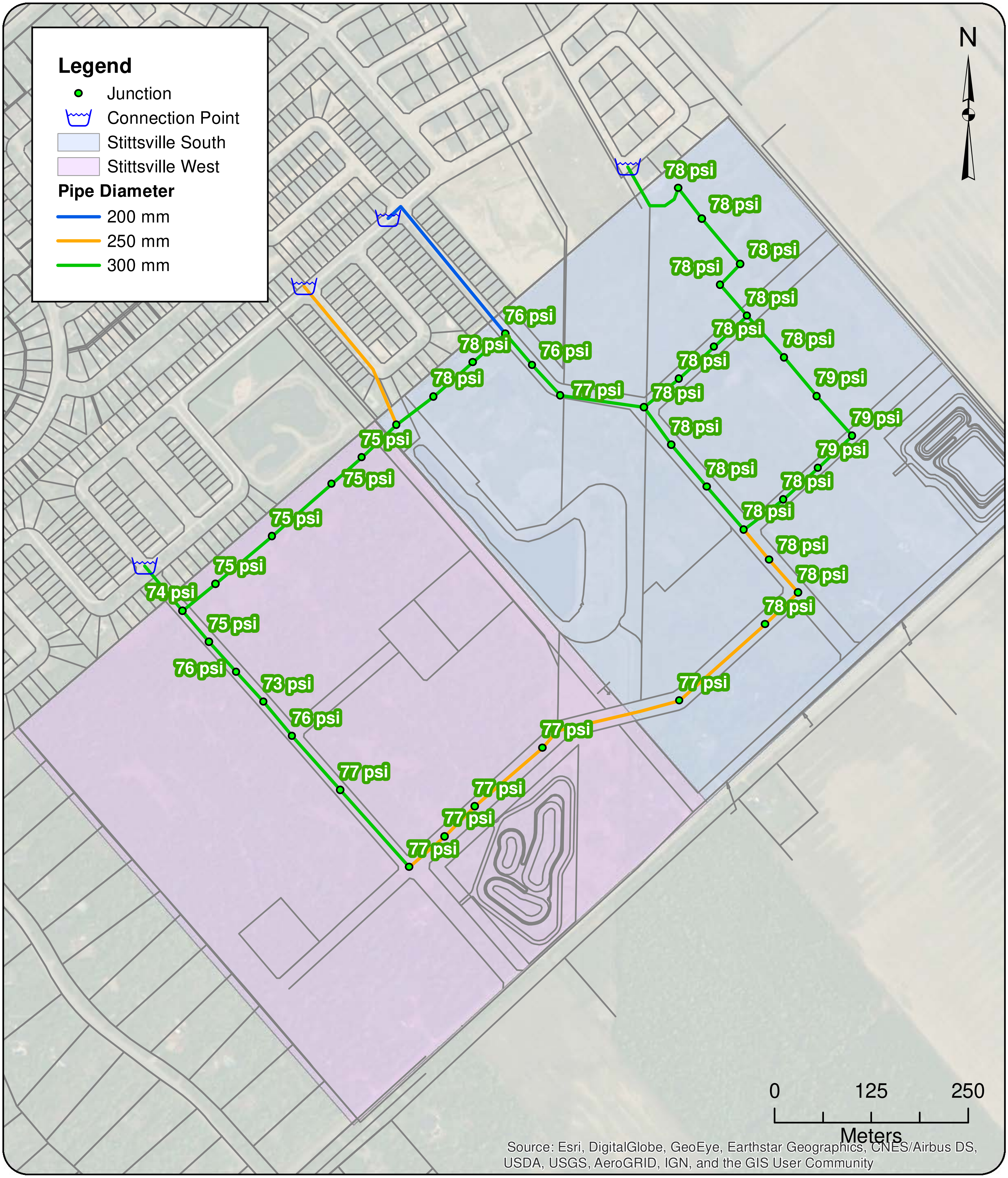
GeoAdvice Engineering Inc.

Project: **Hydraulic Capacity and Modeling Analysis SSUEA 2022-018-DSE**
Client: **David Schaeffer Engineering Ltd.**
Date: **December 2023**
Created by: **BL**
Reviewed by: **WdS**

Pipe IDs

Figure D.2

Appendix E ADD and PHD Model Results

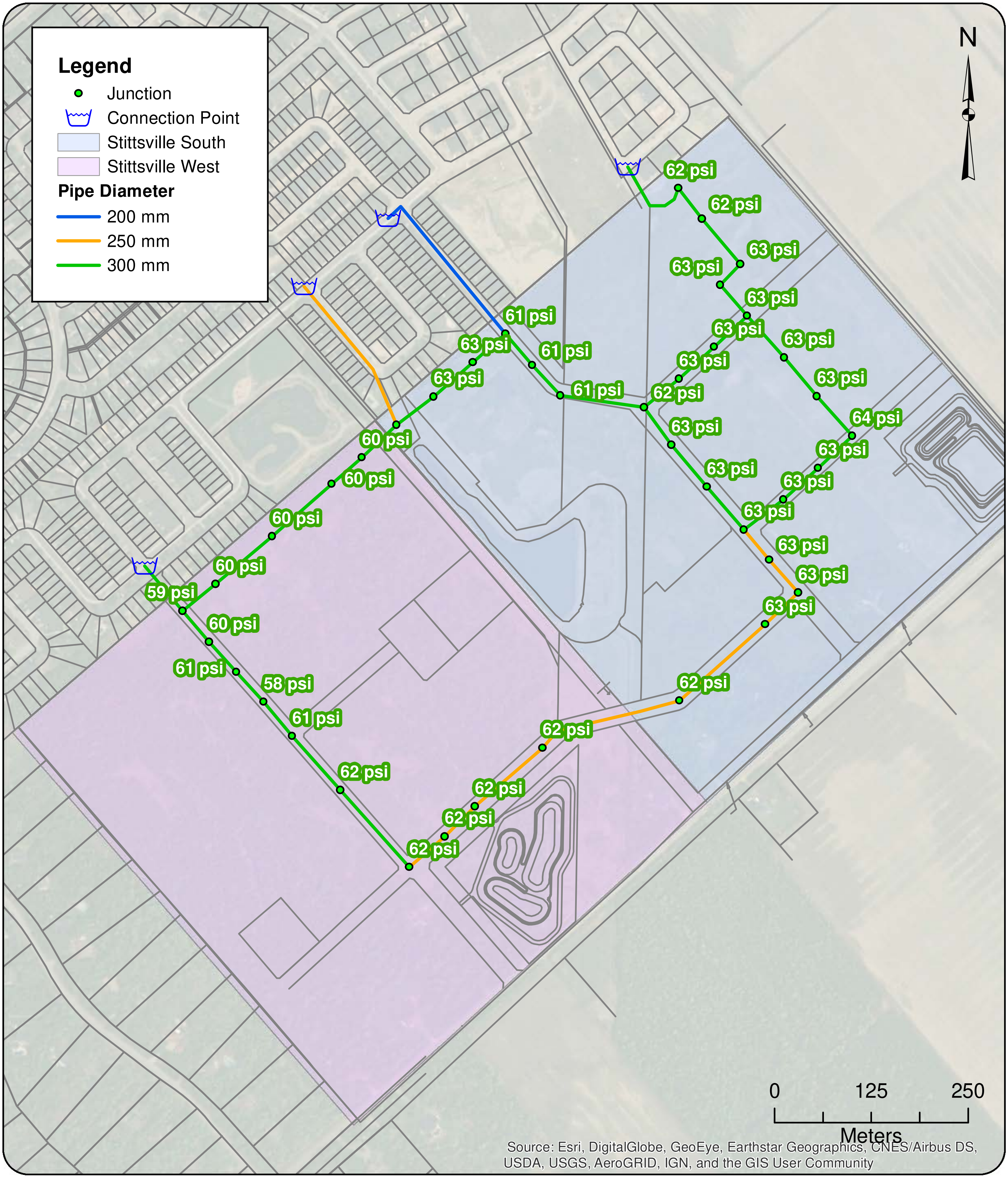


GeoAdvice Engineering Inc.

Project: **Hydraulic Capacity and Modeling Analysis SSUEA**
2022-018-DSE
Client: **David Schaeffer Engineering Ltd.**
Date: **December 2023**
Created by: **BL**
Reviewed by: **WdS**

ADD Pressure Results SSUEA

Figure E.1



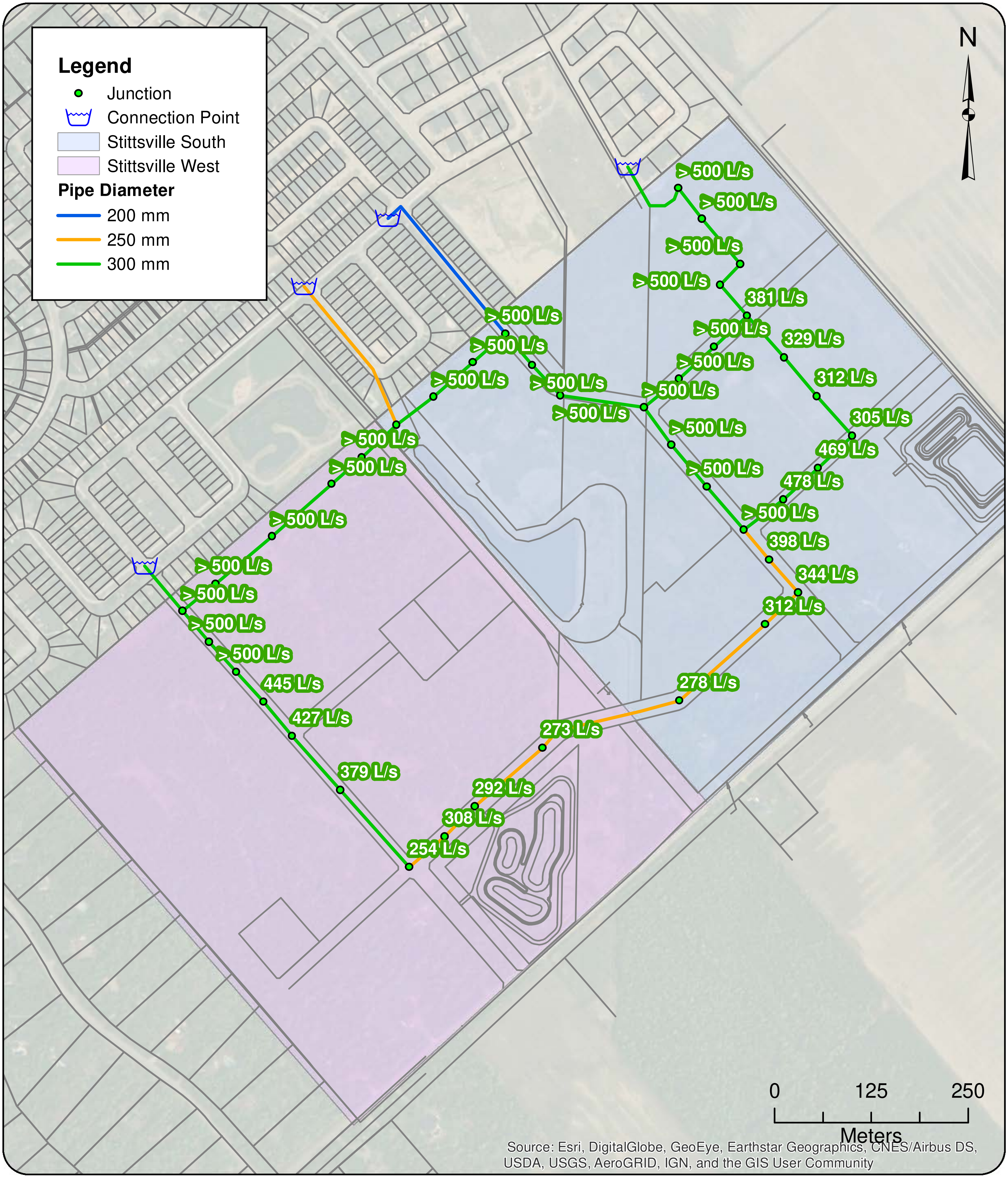
GeoAdvice Engineering Inc.

Project:	**Hydraulic Capacity and Modeling Analysis SSUEA 2022-018-DSE**
Client:	**David Schaeffer Engineering Ltd.**
Date:	**December 2023**
Created by:	**BL**
Reviewed by:	**WdS**

PHD Pressure Results SSUEA

Figure E.2

Appendix F MDD+FF Model Results



GeoAdvice Engineering Inc.

Project: **Hydraulic Capacity and Modeling Analysis SSUEA 2022-018-DSE**
Client: **David Schaeffer Engineering Ltd.**
Date: **December 2023**
Created by: **BL**
Reviewed by: **WdS**

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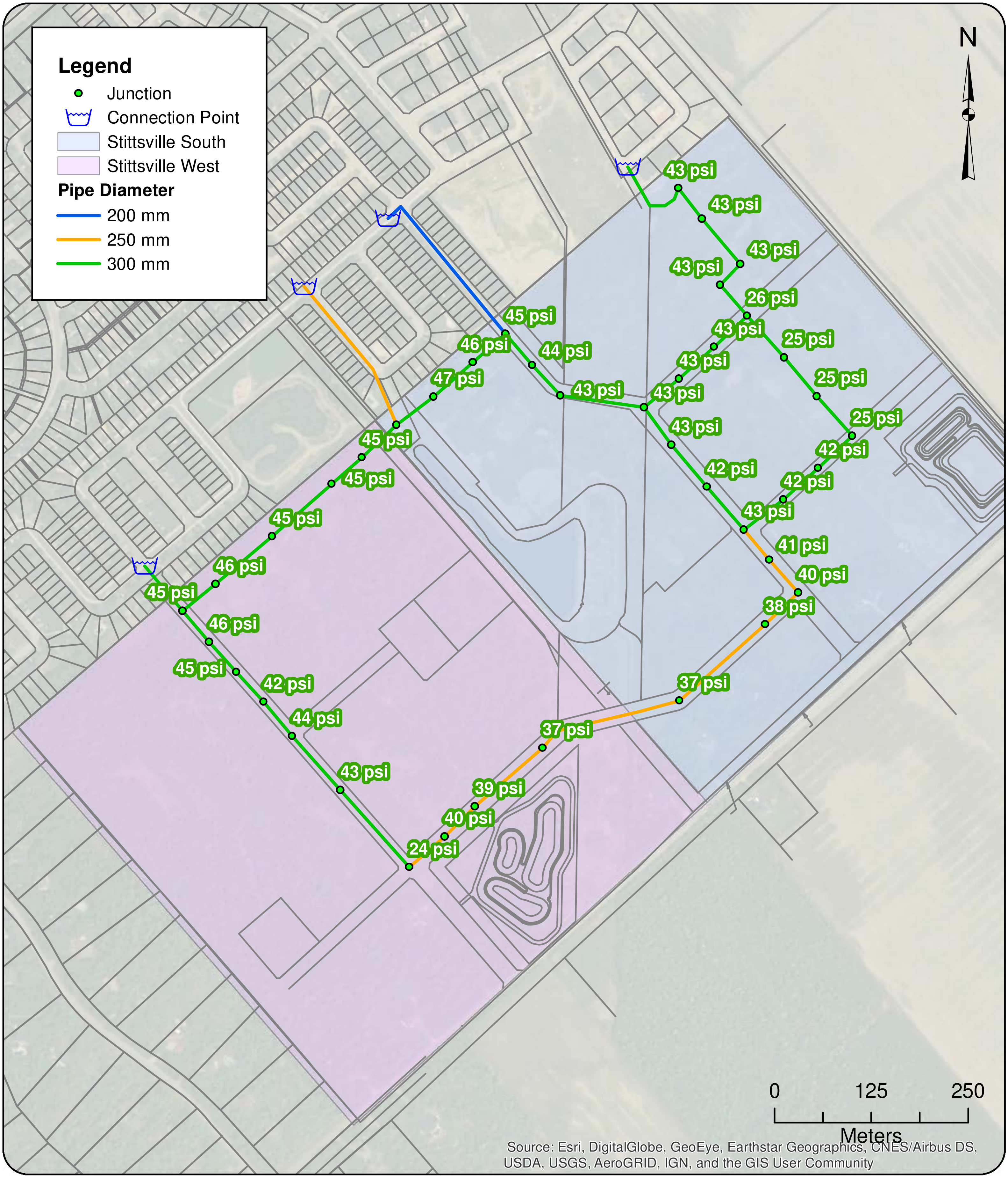
Available Fire Flow SSUEA

Figure F.1



GeoAdvice Engineering Inc.

Project:	**Hydraulic Capacity and Modeling Analysis SSUEA**
	2022-018-DSE
Client:	**David Schaeffer Engineering Ltd.**
Date:	**December 2023**
Created by:	**BL**
Reviewed by:	**WdS**

Residual Pressure @ Required Fire Flow SSUEA

Figure F.2

From: Bougadis, John <John.Bougadis@ottawa.ca>
Sent: July 19, 2024 9:47 AM
To: Peter Mott; van de Lande, Robin
Cc: Marc Pichette; Steve Pichette; Gong, Qiaoqiao
Subject: Re: Stittsville South - Urban Expansion area - Request for hydraulic boundary conditions
Attachments: DraftFinal_SystemLevelDemandParameters_24May2024(JB).xlsx

EXTERNAL E-MAIL - Do not click links or open attachments unless you recognize the sender.

Hi Peter

I have attached the water demand parameters to be used for expansion areas where the population exceeds 3000 persons. Please update the demand calculatioms for Stittsville South and resubmit your boundary conditions request.

Thanks,

John

From: Peter Mott <PMott@dsel.ca>
Sent: Friday, July 12, 2024 2:28 PM
To: van de Lande, Robin <Robin.vandeLande@ottawa.ca>
Cc: Marc Pichette <MPichette@dsel.ca>; Steve Pichette <spichette@dsel.ca>; Bougadis, John <John.Bougadis@ottawa.ca>
Subject: RE: Stittsville South - Urban Expansion area - Request for hydraulic boundary conditions

CAUTION: This email originated from an External Sender. Please do not click links or open attachments unless you recognize the source.
ATTENTION : Ce courriel provient d'un expéditeur externe. Ne cliquez sur aucun lien et n'ouvrez pas de pièce jointe, excepté si vous connaissez l'expéditeur.

Good afternoon Robin **–** In keeping consistent with previous requests, see previous correspondence below, I would like to request the updated hydraulic boundary conditions for the SSUEA. The density estimates for the development have increased which will require remodelling of the proposed supply network.

Could you please have this information provided as soon as possible as it will be used to inform our MSS and FSR design for the area. Please see the, request, attached from GeoAdvice Engineering Inc.

Please let me know if you have any questions or require additional information.

Thanks,

System Level Parameters for MSS (2024)	Consumption Rate[1]	Population Density cap/unit[3]	Average Day Demand (L/unit/day)	Residential Outdoor Water Demand (OWD) (L/unit/day)[4]	Maximum Day Demand (L/unit/day)	Peak Hour Demand
SFH	180	3.4	612	700	Average Day Demand + OWD	2.1 x Maximum Day Demand
MLT	198	2.7	535	350	Average Day Demand + OWD	2.1 x Maximum Day Demand
MLT without rear yards	198	2.7	535	0	Average Day Demand	1.6 x Maximum Day Demand
APT	219	1.8	394	0	Average Day Demand	1.6 x Maximum Day Demand
EMP[2]	138	1	138	N/A	1.5 x Average Day Demand[5]	1.8 x Maximum Day Demand
Water Loss per connection	N/A	N/A	80	N/A	Average Day Demand	Average Day Demand
Total Demand			**Sum above for Total Average Day**		**Sum above for Total Max Day**	**Sum above for Total Peak Hour**

[1] Values represent L/cap/day for residential land uses and L/emp/day for employment areas.

[2] Apply a rate of 17,000 l/h/day if employment totals are unknown. The rate represents the average demand for ICI areas at the 90th percentile.

[3] Occupancy factors should be chosen according to housing type. The values shown were extracted from Section 4.2.8 of the Ottawa Design Guidelines - Water Distribution (2010)

[4] Outdoor water demand is applied to single family, semi-detached and townhome units with rear yards.

[5] The 1.5 multiplier represents the additional outdoor water demand associated with employment areas.

July 24, 2024

Sent by email: PMott@dsel.ca

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

Attention: **Peter Mott, M.Eng., P.Eng.**
Junior Project Manager

Re: Water Distribution Network Boundary Condition Request
Stittsville Properties Development
GeoAdvice Project ID: 2022-018-DSE

Dear Mr. Mott,

In order to carry out the watermain analysis and hydraulic modeling for the Stittsville Properties development in the City of Ottawa, we request the hydraulic boundary conditions (HGL) for the proposed connection points as shown on the attached schematic. Flow conditions are outlined in the attached consumer water demand calculations.

Boundary conditions at **Connections 1, 2, 3 and 4** are required for the following demand conditions:

- Average day demand = 16.72 L/s
- Maximum day demand = 26.21 L/s
- Maximum day demand + fire flow (167 L/s) = 193.21 L/s
- Maximum day demand + fire flow (217 L/s) = 243.21 L/s
- Maximum day demand + fire flow (283 L/s) = 309.21 L/s
- Peak hour demand = 52.24 L/s

NOTE: The above demands and fire flows should be **allocated and split equally to Connections 1, 2, 3 and 4**.

For the maximum day demand plus fire flow scenarios, the HGLs for the lowest (167 L/s) and highest (283 L/s) fire flow requirement scenarios should be provided. The HGLs for any intermediate fire flow scenarios will be interpolated. **Please confirm if any pumps turn on between the lowest (167 L/s) and highest (283 L/s) fire flow requirement scenarios**. If there are any pumps feeding the development area and any additional pumps turning on between the lowest and highest fire flow scenarios, the HGLs **cannot** be interpolated or extrapolated. In this case, boundary conditions should be provided for all fire flow scenarios listed above.

If you have any questions, please do not hesitate to contact me.

Yours truly,

GeoAdvice Engineering Inc.

Werner de Schaetzen

Werner de Schaetzen, Ph.D., P.Eng.
President and Chief Executive Officer
werner@geoadvice.com
GeoAdvice Engineering Inc.

Attachments: Mark up for connection locations and demand calculations

Consumer Water Demands

Stittsville West - Residential Demands***

Dwelling Type	Number of Units	Population		Average Day Demand			OWL		Max Day	Peak Hour 2.1 x Max Day (L/s)
		Persons per Unit	Population Per Dwelling Type	(L/unit/d)	(L/d)	(L/s)	(L/unit/d)	(L/s)		
Single Detached	317	3.4	1,078	612	219,364	2.54	700	2.57	5.11	10.40
Stacked	337	1.8	607	394	159,738	1.85	-	-	1.85	3.54
Traditional Townhome	578	2.7	1,561	535	355,470	4.11	350	2.34	6.46	12.97
Subtotal	**1,232**		**3,246**		**734,572**	**8.50**		**4.91**	**13.41**	**26.91**

Stittsville West - Non Residential Demands

Property Type	Area (ha)			Average Day Demand			OWL		Max Day 1.5 x Avg. Day (L/s)	Peak Hour 1.8 x Max Day (L/s)
				(L/ha/d)	(L/d)	(L/s)	(L/unit/d)	(L/s)		
Park	0.91			28,000	25,480	0.29			0.44	0.80
Subtotal	**0.91**				**25,480**	**0.29**			**0.44**	**0.80**

Future Development & Holdouts 1 - Residential Demands***

Dwelling Type	Area (ha)	Population		Average Day Demand			OWL		Max Day	Peak Hour 2.1 x Max Day (L/s)
		Persons per Ha	Population Per Dwelling Type	(L/unit/d)	(L/d)	(L/s)	(L/unit/d)	(L/s)		
Residential**	1.67	90.0	150	612	30,529	0.35	700	0.36	0.71	1.45
Subtotal	**1.67**		**150**		**30,529**	**0.35**		**0.36**	**0.71**	**1.45**

Stittsville South - Residential Demands***

Dwelling Type	Number of Units	Population		Average Day Demand			OWL		Max Day	Peak Hour 2.1 x Max Day (L/s)
		Persons per Unit	Population Per Dwelling Type	(L/ha/d)	(L/d)	(L/s)	(L/unit/d)	(L/s)		
Single Detached	162	3.4	551	612	112,104	1.30	700	1.31	2.61	5.32
Stacked	337	1.8	607	394	159,738	1.85	-	-	1.85	3.54
Traditional Townhome	413	2.7	1,116	535	253,995	2.94	350	1.67	4.61	9.27
Subtotal	**912**		**2,274**		**525,837**	**6.09**		**2.99**	**9.07**	**18.12**

Stittsville South - Non Residential Demands

Property Type	Area (ha)			Average Day Demand			OWL		Max Day 1.5 x Avg. Day (L/s)	Peak Hour 1.8 x Max Day (L/s)
				(L/ha/d)	(L/d)	(L/s)	(L/unit/d)	(L/s)		
Park	0.75			28,000	21,000	0.24			0.36	0.66
Park	1.85			28,000	51,800	0.60			0.90	1.62
Subtotal	**2.60**				**21,000**	**0.84**			**1.26**	**2.28**

Future Development & Holdouts 2 - Residential Demands***

Dwelling Type	Area (ha)	Population		Average Day Demand			OWL		Max Day	Peak Hour 2.1 x Max Day (L/s)
		Persons per Ha	Population Per Dwelling Type	(L/unit/d)	(L/d)	(L/s)	(L/unit/d)	(L/s)		
Residential**	1.60	90.0	145	612	29,512	0.34	700	0.35	0.69	1.40
Subtotal			**145**		**29,512**	**0.34**		**0.35**	**0.69**	**1.40**

Future Development & Holdouts 3 - Residential Demands***

Dwelling Type	Area (ha)	Population		Average Day Demand			OWL		Max Day	Peak Hour 2.1 x Max Day (L/s)
		Persons per Ha	Population Per Dwelling Type	(L/unit/d)	(L/d)	(L/s)	(L/unit/d)	(L/s)		
Residential**	0.67	90.0	61	612	10,980	0.13	700	0.15	0.27	0.59
Subtotal			**61**		**10,980**	**0.13**		**0.15**	**0.27**	**0.59**

Future Development & Holdouts 4 - Residential Demands***

Dwelling Type	Area (ha)	Population		Average Day Demand			OWL		Max Day	Peak Hour 2.1 x Max Day (L/s)
		Persons per Ha	Population Per Dwelling Type	(L/unit/d)	(L/d)	(L/s)	(L/unit/d)	(L/s)		
Residential**	0.81	90.0	73	612	15,029	0.17	700	0.17	0.35	0.70
Subtotal			**73**		**15,029**	**0.17**		**0.17**	**0.35**	**0.70**

		Average Day	Max Day	Peak Hour
Stittsville West		**9.15**	**14.56**	**29.15**
Stittsville South		**7.57**	**11.64**	**23.09**

*Peaking factors based on the updated City water demand parameters

**Assumed to be single family, to be confirmed in detailed design by DSEL

***As requested by the City, a demand of 80 L/unit was added to each scenario (ADD, MDD, PHD) for residential demands, no peaking factor included

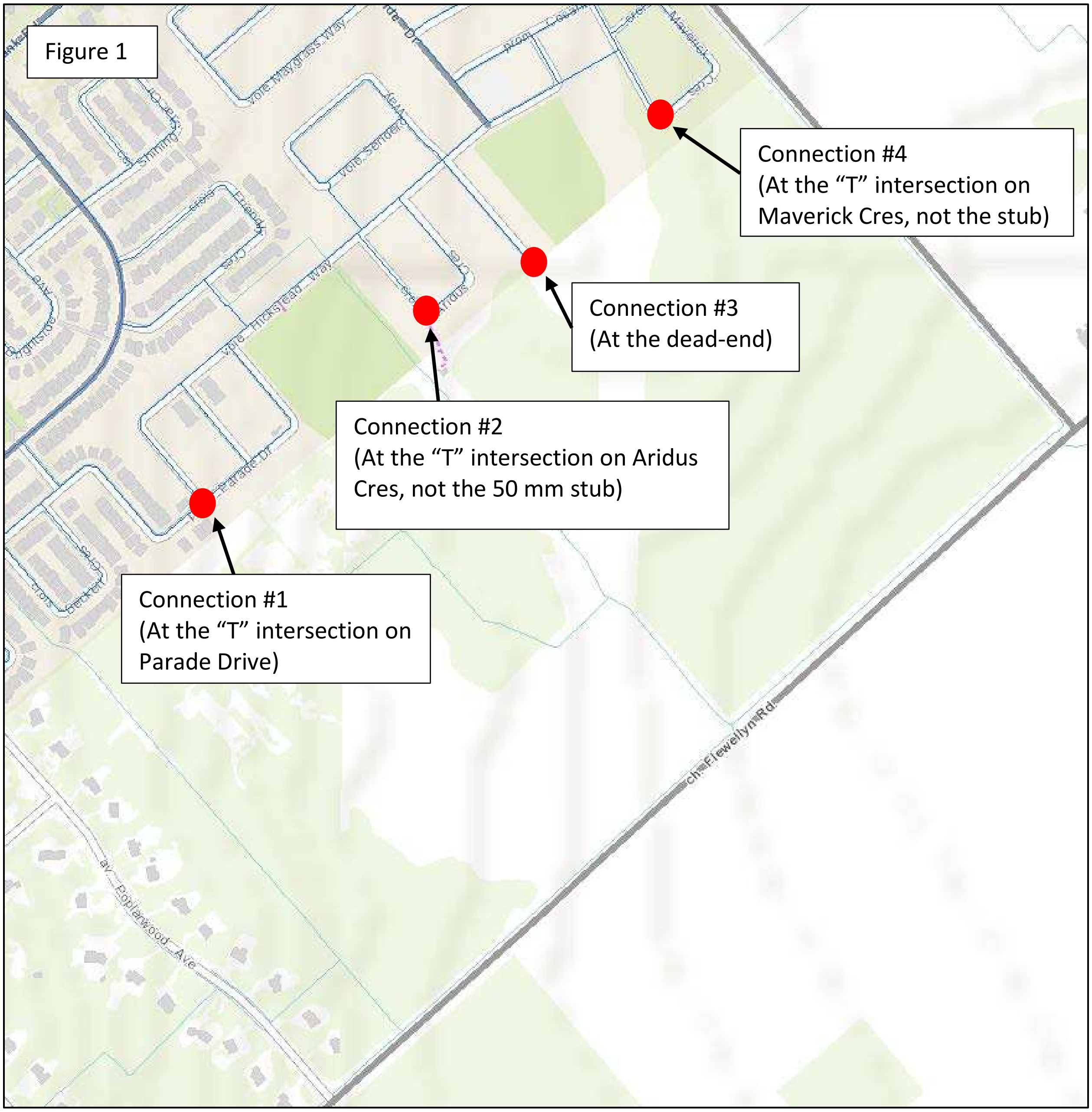
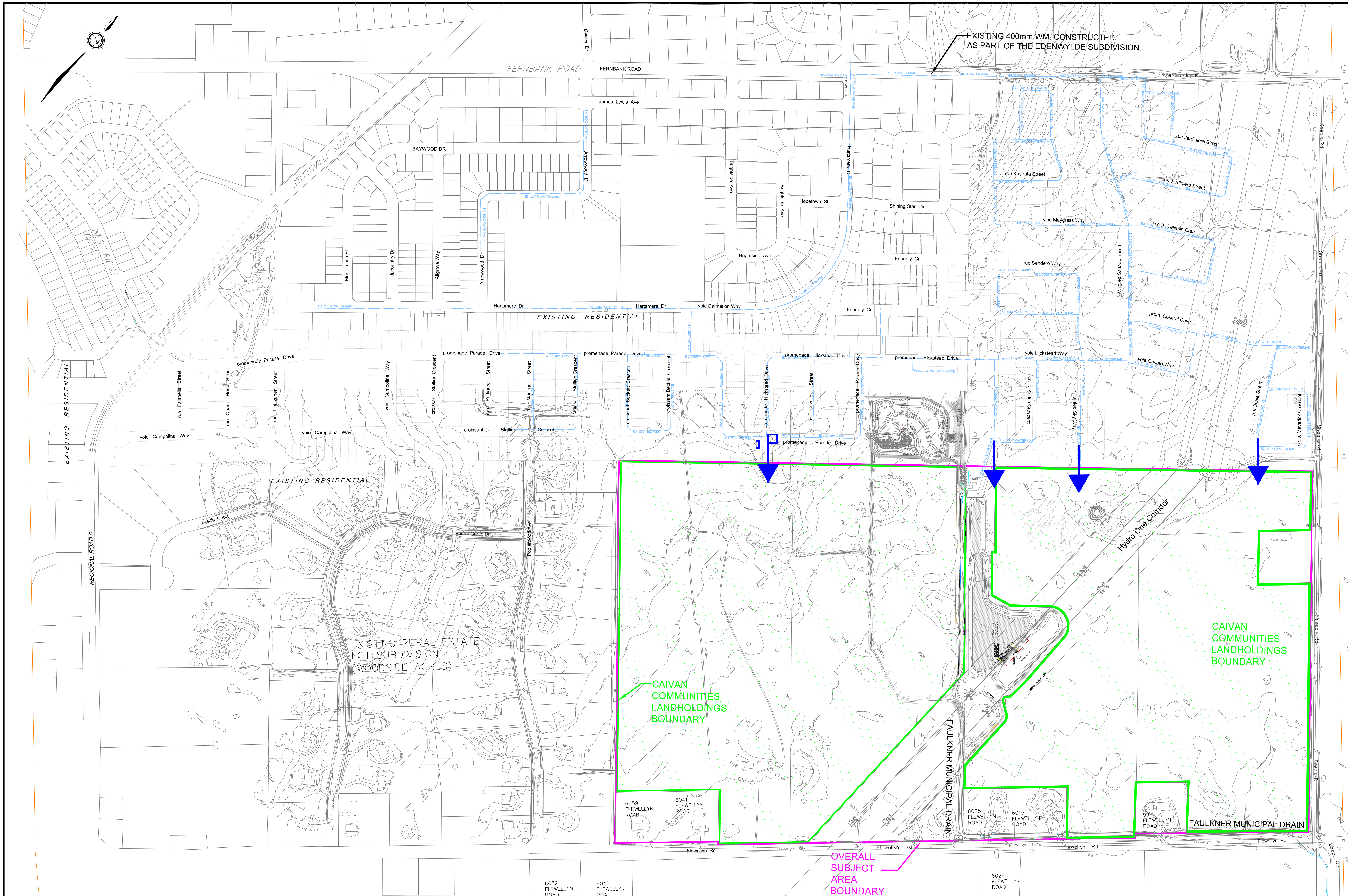


Figure 1
Connection #4
(At the “T” intersection on Maverick Cres, not the stub)
Connection #3
(At the dead-end)
Connection #2
(At the “T” intersection on Aridus Cres, not the 50 mm stub)
Connection #1
(At the “T” intersection on Parade Drive)
Parade Dr
ch. Flewellyn Rd.
Poplarwood Ave



DSEL

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www.DSEL.ca

STITTSVILLE SOUTH URBAN EXPANSION AREA

WATERMAIN EXISTING CONDITIONS FIGURE

CITY OF OTTAWA

LEGEND

- EXISTING WATERMAIN
- OVERALL SUBJECT AREA BOUNDARY
- CAIVAN LANDHOLDINGS

PROJECT No.:	21-1247
DATE:	Jan 2023
SCALE:	1:2000
DRAWING:	3

Boundary Conditions
Stittsville South Urban Expansion Area

Provided Information

Scenario	Demand	
	L/min	L/s
Average Daily Demand	1,043	17.39
Maximum Daily Demand	2,059	34.32
Peak Hour	3,114	51.90
Fire Flow Demand #1	10,020	167.00
Fire Flow Demand #2	13,020	217.00
Fire Flow Demand #3	16,980	283.00

Location

Existing Condition Model

Existing Condition with **Conceptual** Looping for Future Servicing

Results

1. Existing Condition Model (No Future Demand)

Connection 1 - Parade Dr.

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	160.2	72.3
Peak Hour	155.2	65.2
Max Day plus Fire Flow #1	143.5	48.7
Max Day plus Fire Flow #2	135.7	37.7
Max Day plus Fire Flow #3	123.2	19.8

[1] Ground Elevation = 109.2 m

Connection 2 - Hickstead Way

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	160.2	77.9
Peak Hour	155.2	70.8
Max Day plus Fire Flow #1	139.7	48.8
Max Day plus Fire Flow #2	129.6	34.4
Max Day plus Fire Flow #3	113.1	11.0

[1] Ground Elevation = 105.4 m

Connection 3 - Ocaia St.

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	160.2	79.8
Peak Hour	155.2	72.7
Max Day plus Fire Flow #1	127.3	33.0
Max Day plus Fire Flow #2	109.3	7.5
Max Day plus Fire Flow #3	80.0	-34.3
[1] Ground Elevation =	104.1	m

2. Existing Condition Model with Future Demands

Connection 1 – Parade Dr.

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	160.4	72.8
Peak Hour	150.1	58.1
Max Day plus Fire Flow #1	142.3	47.1
Max Day plus Fire Flow #2	134.0	35.2
Max Day plus Fire Flow #3	120.7	16.4
[1] Ground Elevation =	109.2	m

Connection 2 – Hickstead Way

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	160.4	78.1
Peak Hour	149.6	62.8
Max Day plus Fire Flow #1	137.6	45.7
Max Day plus Fire Flow #2	126.7	30.2
Max Day plus Fire Flow #3	109.2	5.3
[1] Ground Elevation =	105.4	m

Connection 3 – Ocaia St.

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	160.4	80.0
Peak Hour	149.2	64.2
Max Day plus Fire Flow #1	123.8	28.0
Max Day plus Fire Flow #2	104.7	0.9
Max Day plus Fire Flow #3	74.0	-42.8
[1] Ground Elevation =	104.1	m

3. Existing Condition with 254 mm Looping for Future Servicing

Connection 1 - Parade Dr.

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	160.4	72.8
Peak Hour	150.0	58.0
Max Day plus Fire Flow #1	142.8	47.7
Max Day plus Fire Flow #2	134.8	36.3
Max Day plus Fire Flow #3	122.0	18.2
[1] Ground Elevation =	109.2	m

Connection 2 - Hickstead Way

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	160.4	78.2
Peak Hour	149.8	63.1
Max Day plus Fire Flow #1	140.4	49.7
Max Day plus Fire Flow #2	131.0	36.4
Max Day plus Fire Flow #3	116.1	15.2
[1] Ground Elevation =	105.4	m

Connection 3 - Ocaia St.

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	160.4	80.1
Peak Hour	149.7	64.9
Max Day plus Fire Flow #1	136.1	45.5
Max Day plus Fire Flow #2	124.2	28.7
Max Day plus Fire Flow #3	105.2	1.7
[1] Ground Elevation =	104.1	m

Disclaimer

The boundary condition information is based on current operation of the city water distribution system. The computer model simulation is based on the best information available at the time. The operation of the water distribution system can change on a regular basis, resulting in a variation in boundary conditions. The physical properties of watermains deteriorate over time, as such must be assumed in the absence of actual field test data. The variation in physical watermain properties can therefore alter the results of the computer model simulation. Fire Flow analysis is a reflection of available flow in the watermain; there may be additional restrictions that occur between the watermain and the hydrant that the model cannot take into account.

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APPENDIX D

Ontario

Ministry of the Environment and Climate Change
Ministère de l'Environnement et de l'Action en matière de changement climatique

ENVIRONMENTAL COMPLIANCE APPROVAL

NUMBER 3415-ADQLJG
Issue Date: September 21, 2016

Stittsville South Inc. and 1384341 Ontario Ltd.
1737 Woodward Drive, 2nd Floor
Ottawa, Ontario
K2C 0P9

Site Location: Stittsville South Area 6 Sanitary Pumping Station
5970 Fernbank Road and part of 5993 Flewellyn Road
City of Ottawa, Ontario

You have applied under section 20.2 of Part II.1 of the Environmental Protection Act, R.S.O. 1990, c. E. 19 (Environmental Protection Act) for approval of:

Sanitary Pump Station and Forcemain

- one (1) 3000 mm diameter and 8.65 metre deep wet well with provision for three (3) submersible non-clog wastewater pumps, each pump designed for 42 litres/second at a Total Dynamic Head (TDH) of 29 metres, complete with trash basket, pipe rails, level regulation, force air blower unit and appurtenances;

- two (2) pumps will be initially installed with each pump capable of delivering 42 litres/second at a TDH of 29 metres for an initial firm capacity of 42 litres/second;

- the third pump will be added through an amendment to the ECA once development flows approach 42 litres/second to bring the pump station to its ultimate firm capacity of 84 litres/second;

- approximately 870 metres of dual 200 mm diameter HDPE DR13.5 sanitary forcemains originating at the pump station control building and terminating at the existing sanitary sewer on Fernbank Road;

- one (1) 2400 mm x 1800 mm concrete discharge manhole, complete with Swab Catcher, replacing the existing sanitary MH 401 on Fernbank Road. Dual forcemains will discharge to this new manhole;

- pump station control building complete with mechanical and electrical systems, process piping, valves, control panels, SCADA system, odour control system, swab launchers and appurtenances;

- one (1) 170 KW self-enclosed diesel generator (to be registered under Environmental Activity and Sector Registry (EASR)) on a reinforced concrete pad adjustment to the pump station control building complete with diesel fuel tank, valves and controls;

- one (1) 2400 mm x 1800 mm concrete by-pass chamber complete with valves, couplings and appurtenances;

Sanitary Sewers Pump Station

- approximately 4.8 metres of 450 mm diameter sanitary sewer @ 2.55% from Sanitary MH 99 to wet well;

- approximately 18 metres of 200 mm diameter sanitary forcemain HDPE 13.5 from SAN MH 99 to By-pass Chamber;

- approximately 18.7 metres of 600 mm diameter sanitary sewer from SAN MH 99 to SAN MH 97;

Interim Emergency Sanitary Sewer Overflow

approximately 26.6 metres of 250 mm diameter sanitary sewer from sanitary MH 97 to the existing Faulkner Ditch. Elevation of emergency overflow in sanitary MH 97 is 104.27m;

Permanent Emergency Sanitary Sewer Overflow

the permanent Emergency Sanitary Sewer Overflow will discharge to the future Davidson Stormwater Management Facility which is anticipated to be constructed within the next 2-4 years;

- the permanent emergency sanitary sewer overflow will consist of 3 metres of 600 mm diameter sewer from sanitary MH 97 to the future stormwater management facility. The elevation of the emergency overflow in MH 97 is 103.40m;

- provision to adjust the elevation of the permanent emergency sanitary overflow in MH 97 within a range of 102.80m to 103.70m based on the final 100-year water level in the future Davidson Stormwater Management Facility;

- one (1) primary measuring device in MH 97 consisting of a broad crest weir complete with ultrasonic level recorder;

- once permanent emergency sanitary sewer overflow is established, the interim overflow will be abandoned;

including erosion/sedimentation control measures during construction and all other controls and appurtenances essential for the proper operation of the aforementioned Works;

all in accordance with the application from the Stittsville South Inc. and 1384341 Ontario Ltd., dated March 03, 2016, and all other supporting documents, final plans and specifications prepared by Novatech.

For the purpose of this environmental compliance approval, the following definitions apply:

"Approval" means this entire document including the application and any supporting documents listed in any schedules in this Approval;

"BOD5" (also known as TBOD5) means five day biochemical oxygen demand measured in an unfiltered sample and includes carbonaceous and nitrogenous oxygen demand;

"Director" means a person appointed by the Minister pursuant to section 5 of the Environmental Protection Act for the purposes of Part II.1 of the Environmental Protection Act;

"E. Coli" refers to the thermally tolerant forms of Escherichia that can survive at 44.5 degrees Celsius;

"Emergency Situation" means a structural, mechanical or electrical failure that causes a temporary reduction in the capacity of the sanitary sewage pumping station or an unforeseen flow condition that may result in:

a) danger to the health or safety of any person; or
b) injury or damage to any property, or serious risk of injury or damage to any property.

"EPA" means the Environmental Protection Act, R.S.O. 1990, c.E.19, as amended;

"Event" in the context the sanitary sewage pumping station located outside a Sewage Treatment Plant, means an action or occurrence, at the sanitary sewage pumping station that causes a Sewage Pumping Station Overflow. An Event ends when there is no recurrence of a Sewage Pumping Station Overflow in the 12-hour period following the last Sewage Pumping Station Overflow. Two Events are separated by at least 12 hours during which there has been no recurrence of a Sewage Pumping Station Overflow;

"Limited Operational Flexibility" (LOF) means the modifications that the Owner is permitted to make to the Works under this Approval;

"Ministry" means the ministry of the government of Ontario responsible for the Environmental Protection Act and the Ontario Water Resources Act and includes all officials, employees or other persons acting on its behalf;

"Notice of Modifications" means the form entitled “Notice of Modifications to Sewage Works” included in Schedule "A";

"Owner" means the Stittsville South Inc. and 1384341 Ontario Ltd., and includes their successors and assignees;

"Professional Engineer" means a person entitled to practise as a Professional Engineer in the Province of Ontario under a licence issued under the Professional Engineers Act;

"Sewage Pumping Station Overflow" means any discharge from a sanitary sewage pumping station located outside a Sewage Treatment Plant that does not undergo any treatment or only receives partial treatment before it is discharged to the environment;

"Substantial Completion" has the same meaning as “substantial performance” in the Construction Lien Act;

"Water Supervisor" means the person appointed as Water Supervisor of the Ottawa office of the Ministry;

"Works" means the sewage works described in the Owner's application(s) and this Approval.

You are hereby notified that this environmental compliance approval is issued to you subject to the terms and conditions outlined below:

TERMS AND CONDITIONS

1. GENERAL PROVISIONS

(1) The Owner shall ensure that any person authorized to carry out work on or operate any aspect of the Works is notified of this Approval and the Conditions herein and shall take all reasonable measures to ensure any such person complies with the same.

(2) The designation of the The City of Ottawa as the operating authority of the site on the application for approval of the Works does not relieve the Owner from the responsibility of complying with any and all of the Conditions of this Approval.

(3) Except as otherwise provided by these Conditions, the Owner shall design, build, install, operate and maintain the Works in accordance with the description given in this Approval, and the application for approval of the Works.

(4) Where there is a conflict between a provision of any submitted document referred to in this Approval and the Conditions of this Approval, the Conditions in this Approval shall take precedence, and where there is a conflict between the listed submitted documents, the document bearing the most recent date shall prevail.

(5) Where there is a conflict between the listed submitted documents, and the application, the application shall take precedence unless it is clear that the purpose of the document was to amend the application.

(6) The Conditions of this Approval are severable. If any Condition of this Approval, or the application of any requirement of this Approval to any circumstance, is held invalid or unenforceable, the application of such Condition to other circumstances and the remainder of this Approval shall not be affected thereby.

(7) The issuance of, and compliance with the Conditions of this Approval does not:

(a) relieve any person of any obligation to comply with any provision of any applicable statute, regulation or other legal requirement, including, but not limited to, the obligation to obtain approval from the local conservation authority necessary to construct or operate the sewage Works; or

(b) limit in any way the authority of the Ministry to require certain steps be taken to require the

Owner to furnish any further information related to compliance with this Approval.

2. **EXPIRY OF APPROVAL**

(1) This Approval will cease to apply to those parts of the new Works which have not been constructed within **five (5) years** of the date of this Approval.

3. **CHANGE OF OWNER**

(1) The Owner shall notify the Director, in writing, of any of the following changes within **thirty (30) days** of the change occurring:

(a) change of Owner;

(b) change of address of the Owner;

(c) change of partners where the Owner is or at any time becomes a partnership, and a copy of the most recent declaration filed under the Business Names Act, R.S.O. 1990, c. B17 shall be included in the notification to the Director;

(d) change of name of the corporation where the Owner is or at any time becomes a corporation, and a copy of the most current information filed under the Corporations Information Act, R.S.O. 1990, c. C39 shall be included in the notification to the Director.

4. **UPON SUBSTANTIAL COMPLETION OF THE SEWAGE PUMPING STATION**

(1) Upon Substantial Completion of the sewage pumping station, the Owner shall prepare a statement, certified by a Professional Engineer, that the sewage pumping station was constructed in accordance with this Approval, and shall make the written statement available to the Ministry, upon request.

(2) Within **one (1) year** of Substantial Completion of the sewage pumping station, a set of as-built drawings showing the sewage pumping station "as constructed" shall be prepared. These drawings shall be kept up to date through revisions undertaken from time to time and a copy shall be retained at the sewage pumping station for the operational life of the sewage pumping station.

5. **SEWAGE PUMPING STATION OVERFLOW**

(1) Any Sewage Pumping Station Overflow is prohibited, except:

(a) in an Emergency Situation;

(b) where the Sewage Pumping Station Overflow is a direct and unavoidable result of a planned maintenance procedure, the Owner notified the Water Supervisor **fifteen (15) days** prior to the Sewage Pumping Station Overflow and the Water Supervisor has given written consent of the Sewage Pumping Station Overflow; or,

(c) where the Sewage Pumping Station Overflow is planned for research or training purposes, the discharger notified the Water Supervisor **fifteen (15) days** prior to the Sewage Pumping Station Overflow and the Water Supervisor has given written consent of the Sewage Pumping Station Overflow.

(2) The Owner shall forthwith notify the Spills Action Centre (SAC) at 1-800-268-6060 or e-mail at moe.sac.moe@ontario.ca and the Medical Officer of Health of every Sewage Pumping Station Overflow Event. This notice shall include, at a minimum, the following information:

(a) the date and time at which the Event(s) started,

(b) duration of the Event(s);

(c) the location of the Event(s);

(d) the measured or estimated volume of the Event(s) (unless the Event(s) is/are ongoing); and

(e) the reason for the Event (s).

(3) The Owner shall submit Sewage Pumping Station Overflow Event Reports to the Ministry's local office on an Annual basis, no later than forty-five (45) days following the end of the calendar year. Event Reports shall be in an electronic format specified by the Ministry. In each Event Report the Owner shall include, at a minimum, the following information on any Event(s) that occurred during the preceding year:

(a) the date and time at which the Event(s) started,

(b) duration of the Event(s);

(c) the location of the Event(**s**);

(d) the measured or estimated volume of the Event(s) (unless the Event(s) is/are ongoing); and

(e) the reason for the Event(s).

(4) The Owner shall use best efforts to collect a representative sample consisting of a minimum of two (2) grab samples of the Sewage Pumping Station Overflow and have it analysed for parameters outlined in Table 1 of Condition 7 (2) using the protocols specified in Condition 7 (3), one at the beginning of the Event and the second approximately near the end of the Event, to best reflect the effluent quality of such Sewage Pumping Station Overflow.

(5) The Owner shall maintain a record of all Sewage Pumping Station Overflow(s), which shall contain, at a minimum, the types of information set out in Condition 5 (2 (a)) to 5 (2 (e)) in respect of each Sewage Pumping Station Overflow.

6. OPERATION AND MAINTENANCE

(1) The Owner shall exercise due diligence in ensuring that, at all times, the Works and the related equipment and appurtenances used to achieve compliance with this Approval are properly operated and maintained. Proper operation and maintenance shall include effective performance, adequate funding, adequate operator staffing and training, including training in all procedures and other requirements of this Approval and the Act and regulations, adequate laboratory facilities, process controls and alarms and the use of process chemicals and other substances used in the Works.

(2) The Owner shall prepare an operations manual within **six (6) months** of Substantial Completion of the sewage pumping station, that includes, but not necessarily limited to, the following information:

(a) operating procedures for routine operation of the sewage pumping station;

(b) inspection programs, including frequency of inspection, for the sewage pumping station and the methods or tests employed to detect when maintenance is necessary;

(c) repair and maintenance programs, including the frequency of repair and maintenance for the sewage pumping station;

(d) procedures for the inspection and calibration of monitoring equipment;

(e) a spill prevention control and countermeasures plan, consisting of contingency plans and procedures for dealing with equipment breakdowns, potential spills and any other abnormal situations, including notification of the Water Supervisor; and

(f) procedures for receiving, responding and recording public complaints, including recording any follow-up actions taken.

(3) The Owner shall maintain the operations manual current and retain a copy at the location of the sewage pumping station for the operational life of the sewage pumping station. The Owner shall make the manual available to the Ministry, upon request.

(4) The Owner shall make all manuals, plans, records, data, procedures and supporting documentation available to the Ministry, upon request.

7. MONITORING AND RECORDING

The Owner shall, upon the issuance of this Approval, carry out the following monitoring program:

(1) All samples and measurements taken for the purposes of this Approval are to be taken at a time and in a location characteristic of the quality and quantity of the effluent stream over the time period being monitored.

(2) Samples shall be collected at the following sampling points, at the frequency specified, by means of

the specified sample type and analysed for each parameter listed and all results recorded:

Table 1 - Monitoring during a Sewage Pumping Station Overflow Event (Samples to be collected from the Sewage Pumping Station Overflow sewer near the sewage pumping station)	
Sample Type	Grab
Parameters	BOD5, Total Suspended Solids, Total Phosphorus, E. Coli (E. Coli samples may be limited to overflows occurring between Apr 1 and Oct 31)

(3) The methods and protocols for sampling, analysis and recording shall conform, in order of precedence, to the methods and protocols specified in the following:

(a) the Ministry's Procedure F-10-1, “Procedures for Sampling and Analysis Requirements for Municipal and Private Sewage Treatment Works (Liquid Waste Streams Only), as amended from time to time by more recently published editions;

(b) the Ministry's publication "Protocol for the Sampling and Analysis of Industrial/Municipal Wastewater" (January 1999), ISBN 0-7778-1880-9, as amended from time to time by more recently published editions; and

(c) the publication "Standard Methods for the Examination of Water and Wastewater" (21st edition), as amended from time to time by more recently published editions.

8. REPORTING

(1) **Fifteen (15) days** prior to the date of a planned Sewage Pumping Station Overflow being conducted pursuant to Condition 5 and as soon as possible for an unplanned Sewage Pumping Station Overflow, the Owner shall notify the Water Supervisor in writing of the pending start date, in addition to an assessment of the potential adverse effects on the environment and the duration of the Sewage Pumping Station Overflow.

(2) In addition to the obligations under Part X of the Environmental Protection Act, (which includes contacting the Spills Action Centre (SAC) at 1-800-268-6060 or e-mail at moe.sac.moe@ontario.ca), the Owner shall, within **ten (10) working days** of the occurrence of any reportable spill as defined in Ontario Regulation 675/98, Bypass or loss of any product, by-product, intermediate product, oil, solvent, waste material or any other polluting substance into the environment, (with the exception of a sanitary sewage discharged during an Event), submit a full written report of the occurrence to the Water Supervisor describing the cause and discovery of the spill or loss, clean-up and recovery measures taken, preventative measures to be taken and schedule of implementation.

(3) The Owner shall prepare and submit a report to the Water Supervisor on an annual basis. The reports shall contain the following information:

(a) a copy of all Notice of Modifications submitted to the Water Supervisor as a result of Schedule A, Section 1 (Limited Operational Flexibility) with a status report on the implementation of each modification;

(b) a report summarizing all modifications completed as a result of Schedule A, Section 3.

9. LIMITED OPERATIONAL FLEXIBILITY

(1) The Owner may make modifications to the Works in accordance with the Terms and Conditions of this Approval and subject to the Ministry's "Limited Operational Flexibility Criteria for Modifications to Sewage Works", included under Schedule "A" of this Approval, as amended.

(2) The sewage pumping station works proposed under Limited Operational Flexibility shall adhere to the design guidelines contained within the Ministry's publication "Design Guidelines for Sewage Works 2008", as amended.

(3) The Owner shall ensure at all times, that the sewage pumping station works, related equipment and appurtenances which are installed or used to achieve compliance are operated in accordance with all Terms and Conditions of this Approval.

(4) For greater certainty, the following are not permitted as part of Limited Operational Flexibility:

(a) Modifications to the sewage pumping station works that result in an increase of the Rated Capacity of the sewage pumping station works;

(b) Modifications to the sewage pumping station works that may adversely affect the approved effluent quality criteria or the location of the discharge/outfall;

(c) Modifications to the sewage pumping station works approved under s.9 of the EPA, and

(d) Modifications to the sewage pumping station works pursuant to an order issued by the Ministry.

(5) Implementation of Limited Operational Flexibility is not intended to be used for piecemeal measures that result in major alterations or expansions.

(6) If the implementation of Limited Operational Flexibility requires changes to be made to the Emergency Response, Spill Reporting and Contingency Plan, the Owner shall, as deemed necessary in consultation with the Water Supervisor, provide a revised copy of this plan for approval to the local fire services authority prior to implementing Limited Operational Flexibility.

(7) For greater certainty, any alteration made under the Limited Operational Flexibility may only be carried out after other legal obligations have been complied with including those arising from the Environmental Protection Act, Niagara Escarpment Planning and Development Act, Oak Ridges Moraine Conservation Act, Lake Simcoe Protection Act and Greenbelt Act.

(8) Prior to implementing Limited Operational Flexibility, the Owner shall complete a Notice of Modifications describing any proposed modifications to the sewage pumping station works and submit it to the Water Supervisor.

10. TEMPORARY EROSION AND SEDIMENT CONTROL

(1) The Owner shall install and maintain temporary sediment and erosion control measures during construction and conduct inspections once every **two (2) weeks** and after each significant storm event (a significant storm event is defined as a minimum of 25 mm of rain in any 24 hours period). The inspections and maintenance of the temporary sediment and erosion control measures shall continue until they are no longer required and at which time they shall be removed and all disturbed areas reinstated properly.

(2) The Owner shall maintain records of inspections and maintenance which shall be made available for inspection by the Ministry, upon request. The record shall include the name of the inspector, date of inspection, and the remedial measures, if any, undertaken to maintain the temporary sediment and erosion control measures.

11. RECORD KEEPING

The Owner shall retain for a minimum of **five (5) years** from the date of their creation, all records and information related to or resulting from the operation and maintenance activities required by this Approval.

Schedule "A"

Limited Operational Flexibility Criteria for Modifications to Sewage Works

1. The modifications to a sewage pumping station approved under an Environmental Compliance Approval (Approval) that are permitted under the Limited Operational Flexibility (LOF), are outlined below and are subject to the LOF conditions in the Approval, and require the submission of the Notice of Modifications. If there is a conflict between the sewage pumping station works listed below and the Terms and Conditions in the Approval, the Terms and Conditions in the Approval shall take precedence.

1.1 Sewage Pumping Stations

a. Adding or replacing equipment where new equipment is located within an existing sewage pumping station site, provided that the facility Rated Capacity is not exceeded and the existing flow process and/or treatment train are maintained, as applicable.

1.2 Pilot Systems

a. Installation of pilot systems for new or existing technologies provided that:

i. any effluent from the pilot system is discharged to the inlet of the sewage pumping station or hauled off-site for proper disposal,

ii. any effluent from the pilot system discharged to the inlet of the sewage pumping station or sewage conveyance system does not significantly alter the composition/concentration of the influent sewage to be treated in the downstream process; and that it does not add any inhibiting substances to the downstream process, and

iii. the pilot system's duration does not exceed a maximum of two years; and a report with results is submitted to the Director and Water Supervisor three months after completion of the pilot project.

2. Sewage works that are exempt from section 53 of the OWRA by O. Reg. 525/98 continue to be exempt and are not required to follow the notification process under this Limited Operational Flexibility.

3. Normal or emergency operational modifications, such as repairs, reconstructions, or other improvements that are part of maintenance activities, including cleaning, renovations to existing approved sewage works equipment, provided that the modification is made with Equivalent Equipment, are considered pre-approved.

4. The modifications noted in section (3) above are not required to follow the notification protocols under Limited Operational Flexibility, provided that the number of pieces and description of the equipment as described in the Approval does not change.

Ontario
Ministry of
the Environment

Notice of Modification to Sewage Works

RETAIN COPY OF COMPLETED FORM AS PART OF THE ECA AND SEND A COPY TO THE WATER SUPERVISOR (FOR MUNICIPAL) OR DISTRICT MANAGER (FOR NON-MUNICIPAL SYSTEMS)

Part 1 – Environmental Compliance Approval (ECA) with Limited Operational Flexibility

(Insert the ECA's owner, number, issuance date and notice number, which should start with "01" and consecutive numbers thereafter)

ECA Number	Issuance Date (mm/dd/yy)	Notice number (if applicable)

ECA Owner	Municipality

Part 2: Description of the modifications as part of the Limited Operational Flexibility

(Attach a detailed description of the sewage works)

Description shall include:

1. A detail description of the modifications and/or operations to the sewage works (e.g. sewage work component, location, size, equipment type/model, material, process name, etc.)
2. Confirmation that the anticipated environmental effects are negligible.
3. List of updated versions of, or amendments to, all relevant technical documents that are affected by the modifications as applicable, i.e. submission of documentation is not required, but the listing of updated documents is (design brief, drawings, emergency plan, etc.)

Part 3 – Declaration by Professional Engineer

I hereby declare that I have verified the scope and technical aspects of this modification and confirm that the design:

1. Has been prepared or reviewed by a Professional Engineer who is licensed to practice in the Province of Ontario;
2. Conforms with the Limited Operational Flexibility as per the ECA;
3. Has been designed consistent with Ministry's Design Guidelines, adhering to engineering standards, industry's best management practices, and demonstrating ongoing compliance with s.53 of the Ontario Water Resources Act; and other appropriate regulations.

I hereby declare that to the best of my knowledge, information and belief the information contained in this form is complete and accurate.

Name (Print)	PEO License Number
Signature	**Date (mm/dd/yy)**

Name of Employer

Part 4 – Declaration by Owner

I hereby declare that:

1. I am authorized by the Owner to complete this Declaration;

2. The Owner consents to the modification; and
3. These modifications to the sewage works are proposed in accordance with the Limited Operational Flexibility as described in the ECA.
4. The Owner has fulfilled all applicable requirements of the *Environmental Assessment Act*.
I hereby declare that to the best of my knowledge, information and belief the information contained in this form is complete and accurate.

Name of Owner Representative (Print)	Owner representative's title (Print)
Owner Representative's Signature	Date (mm/dd/yy)

The reasons for the imposition of these terms and conditions are as follows:

1. Condition 1 is imposed to ensure that the Works are built and operated in the manner in which they were described for review and upon which approval was granted. This Condition is also included to emphasize the precedence of Conditions in the Approval and the practice that the Approval is based on the most current document, if several conflicting documents are submitted for review.

2. Condition 2 is included to ensure that, when the Works are constructed, the Works will meet the standards that apply at the time of construction to ensure the ongoing protection of the environment.

3. Condition 3 is included to ensure that the Ministry records are kept accurate and current with respect to approved Works and to ensure that any subsequent Owner of the Works is made aware of the Approval and continue to operate the Works in compliance with it.

4. Condition 4 is included to ensure that the sewage pumping station is constructed in accordance with the Approval and that record drawings of the sewage pumping station "as constructed" are maintained for future reference.

5. Conditions 5 and 7 are included to indicate that Sewage Pumping Station Overflow of untreated and/or partially treated sewage to the environment is prohibited, save in certain limited circumstances where the failure to do so could result in greater injury to the public interest than the Sewage Pumping Station Overflow itself, or where the Sewage Pumping Station Overflow can be limited or otherwise mitigated by handling it in accordance with an approved contingency plan. The notification and documentation requirements allow the Ministry to take action in an informed manner and will ensure the Owner is aware of the extent and frequency of Sewage Pumping Station Overflow Event(s).

6. Condition 6 is included to require that the Works be properly operated, maintained, funded, staffed and equipped such that the environment is protected and deterioration, loss, injury or damage to any person or property is prevented. As well, the inclusion of a comprehensive operations manual for the sewage pumping station governing all significant areas of operation, maintenance and repair is prepared, implemented and kept up-to-date by the Owner and made available to the Ministry. Such a manual is an integral part of the operation of the sewage pumping station. Its compilation and use should assist the Owner in staff training, in proper plant operation and in identifying and planning for contingencies during possible abnormal conditions. The manual will also act as a benchmark for Ministry staff when reviewing the Owner's operation of the Works.

7. Condition 8 is included to provide a performance record for future references, to ensure that the Ministry is made aware of problems as they arise, so that the Ministry can work with the Owner in resolving any problems in a timely manner.

8. Condition 9 is included to ensure that the Works are operated in accordance with the application and supporting documentation submitted by the Owner, and not in a manner which the Director has not been asked to consider. These Conditions are also included to ensure that a Professional Engineer has reviewed the proposed Modifications and attests that the Modifications are in line with that of Limited Operational Flexibility, and provide assurance that the proposed Modifications comply with the Ministry's requirements stipulated in the Terms and Conditions of this Approval, Ministry policies, guidelines, and industry engineering standards and best management practices.

9. Condition 10 is included as installation, regular inspection and maintenance of the temporary sediment and erosion control measures is required to mitigate the impact on the downstream receiving watercourse during construction, until they are no longer required.

10. Condition 11 is included to require that all records are retained for a sufficient time period to adequately evaluate the long-term operation and maintenance of the Works.

In accordance with Section 139 of the Environmental Protection Act, you may by written Notice served upon me and the Environmental Review Tribunal within 15 days after receipt of this Notice, require a hearing by the Tribunal. Section 142 of the Environmental Protection Act provides that the Notice requiring the hearing shall state:

1. The portions of the environmental compliance approval or each term or condition in the environmental compliance approval in respect of which the hearing is required, and;
2. The grounds on which you intend to rely at the hearing in relation to each portion appealed.

The Notice should also include:

3. The name of the appellant;
4. The address of the appellant;
5. The environmental compliance approval number;
6. The date of the environmental compliance approval;
7. The name of the Director, and;
8. The municipality or municipalities within which the project is to be engaged in.

And the Notice should be signed and dated by the appellant.

This Notice must be served upon:

The Secretary* Environmental Review Tribunal 655 Bay Street, Suite 1500 Toronto, Ontario M5G 1E5	<u>AND</u>	The Director appointed for the purposes of Part II.1 of the Environmental Protection Act Ministry of the Environment and Climate Change 135 St. Clair Avenue West, 1st Floor Toronto, Ontario M4V 1P5

*** Further information on the Environmental Review Tribunal's requirements for an appeal can be obtained directly from the Tribunal at: Tel: (416) 212-6349, Fax: (416) 326-5370 or www.ert.gov.on.ca**

The above noted activity is approved under s.20.3 of Part II.1 of the Environmental Protection Act.

DATED AT TORONTO this 21st day of September, 2016

Gregory Zimmer, P.Eng.
Director
appointed for the purposes of Part II.1 of the
Environmental Protection Act

MS/
c: District Manager, MOECC Ottawa office
Greg McDonald, Novatech
Charles Warnock, Program Manager, City of Ottawa, Development Review
Linda Carkner, Program Manager, City of Ottawa, Infrastructure Services

velocity of approximately 1.4m/s (within MOE recommended forcemain velocities of 0.8 t 2.5m/s).

According to the *West Urban Community – Wastewater Collection System Master Servicing Plan by RV Anderson Associates Ltd., dated July 2012* monitored peak flows entering the Stittsville Pump Station were 39L/s in 2010. With a capacity of 108L/s, the remaining capacity is 69L/s. Based on the aforementioned, the Liard St. Pump Station can handle the majority of the development. It is recommended that the flows at the Liard St. Pump Station continue to be monitored until extension of the Fernbank Trunk is completed (see 6.1.5 for details regarding the Future Fernbank Trunk).

6.1.4 Friendly Crescent Pump Station

The Friendly Crescent Pump Station is a low lift station, which services the properties along Friendly Crescent. The flow is pumped west to the 250mm dia. sewer along Hartsmere Drive and has an overflow that is directed to a storm outlet east of Friendly Crescent.

Novatech Engineering produced the "Design Services and Stormwater Report" in May 2000 with a detailed design of the Friendly Crescent Pump Station. The station was designed to serve 70 dwellings that discharge to the Friendly Crescent Pump Station with a peak flow of 5.77 L/s using twin Flygt effluent pumps CP3085.182 that push 6.0 L/sec at 7.15 meters total dynamic head through a 100mm diameter, 230m long forcemain.

It is proposed that the sanitary sewer-shed of Friendly Crescent Pump Station be accounted for in the servicing alternatives, in order to provide a higher level of service, by providing a gravity outlet to avoid the costs of maintaining and operating the existing pump station.

6.1.5 Future Fernbank Trunk

The Future Fernbank Trunk will be built along the Hydro One easement to accommodate the future development of the Fernbank Community Design Plans as referenced in the Master Servicing Study for the Fernbank lands. Once constructed, the Liard Street Pump Station will be decommissioned, and all flows from the Liard Street Pump Station sewer-shed and the Area 6 lands will be directed to the Fernbank Trunk through a gravity sewer. The Fernbank Trunk will convey flows to the Hazeldean Pump Station. The decommissioning work will be undertaken by the City, based on the time frame provided in Infrastructure Master Plan.

The Fernbank Trunk was designed for a peak flow of 528L/s and has a capacity of 670L/s which leaves an excess capacity of 142L/s. As per section 6.1.3 of this report, the Liard Street Pump Station had a monitored flow of 39L/s in 2010, and proposed Area 6 peak design flows is 85L/s which summates to 124L/s. Based on these flows, there is adequate capacity in the Fernbank Trunk.

Based on coordination with the Landowners within the Fernbank CDP lands, the sewer depth and size will be accounted for at the proposed subdivisions within the Fernbank Lands CDP to provide the required capacity in order to eventually decommission the Liard Street Pump station and accumulate the Area 6 flows. The cost for over-sizing and over –depth of the sewers is discussed in Section 9.2.

TABLE D-1: FERNBANK CDP LANDS - NEW TRUNK SEWER
SANITARY SEWER DESIGN SHEET (2031)

AREA			RESIDENTIAL																COMMERCIAL		INSTITUTIONAL		C+I	INFILTRATION				PIPE					
			LOW DENSITY			MEDIUM DENSITY			HIGH DENSITY			MIXED USE			TOTAL																		
ID	From	To	Area (ha)	Pop.	Accum. Pop.	Area (ha)	Pop.	Accum. Pop.	Area (ha)	Pop.	Accum. Pop.	Area (ha)	Pop.	Accum. Pop.	Pop.	Accum. Pop.	Peak Factor	Peak Flow (l/s)	Area (ha)	Accum. Area (ha)	Area (ha)	Accum. Area (ha)	Peak Flow (l/s)	Total Area (ha)	Accum. Area (ha)	Infilt. Flow (l/s)	Total Flow (l/s)	Size (mm)	Slope (%)	Length (m)	Capacity (l/s)	Full Flow Vel. (m/s)	Q/Q_{full} (%)
1	902	904	9.85	910	910	0.36	54	54	0.00	0	0	0.00	0	0	964	964	3.8	14.9	0.00	0.00	0.78	0.78	0.7	16.07	16.07	4.5	20.1	250	0.24	154	30.4	0.60	66.0%
2	904	908	11.65	1076	1986	3.10	465	519	0.00	0	0	0.00	0	0	1541	2505	3.5	35.6	0.00	0.00	0.91	1.69	1.5	22.29	38.36	10.7	47.8	300	0.24	306	49.4	0.68	96.7%
3	906	908	7.45	688	688	0.00	0	0	0.00	0	0	0.00	0	0	688	688	3.9	10.9	0.00	0.00	2.63	2.63	2.3	14.51	14.51	4.1	17.2	250	1.50	373	76.0	1.50	22.7%
4	908	912	4.45	411	3085	1.67	251	770	0.00	0	0	0.00	0	0	662	3855	3.3	52.3	0.63	0.63	0.00	4.32	4.3	16.43	69.30	19.4	76.0	300	0.61	396	78.8	1.08	96.4%
5	910	912	10.35	956	956	0.00	0	0	0.00	0	0	0.00	0	0	956	956	3.8	14.8	0.00	0.00	0.83	0.83	0.7	19.34	19.34	5.4	20.9	250	0.24	320	30.4	0.60	68.8%
6	912	920	11.15	1030	5071	0.00	0	770	0.00	0	0	0.00	0	0	1030	5841	3.2	75.3	0.00	0.63	2.50	7.65	7.2	18.11	106.75	29.9	112.4	450	0.15	207	115.2	0.70	97.5%
7	914	916	16.35	1511	1511	0.90	135	135	0.00	0	0	0.00	0	0	1646	1646	3.7	24.3	0.00	0.00	0.45	0.45	0.4	25.23	25.23	7.1	31.8	300	0.25	152	50.4	0.69	63.0%
8	916	920	10.45	966	2477	0.00	0	135	0.00	0	0	0.00	0	0	966	2612	3.5	37.0	0.00	0.00	0.85	1.30	1.1	15.69	40.92	11.5	49.5	375	0.20	314	81.8	0.72	60.6%
9	918	920	5.55	513	513	0.49	74	74	0.00	0	0	0.00	0	0	587	587	3.9	9.4	0.00	0.00	6.14	6.14	5.3	16.04	16.04	4.5	19.2	250	0.85	363	57.2	1.13	33.5%
	920	922	0.00	0	8061	0.00	0	979	0.00	0	0	0.00	0	0	0	9040	3.0	109.8	0.00	0.63	0.00	15.09	13.6	0.00	163.71	45.8	169.3	525	0.18	265	190.3	0.85	88.9%
10	922	924	12.20	1127	9188	0.09	14	993	0.00	0	0	0.00	0	0	1141	10181	2.9	121.5	0.00	0.63	1.52	16.61	15.0	27.31	191.02	53.5	190.0	525	0.23	290	215.2	0.96	88.3%
	924	934	0.00	0	9188	0.00	0	993	0.00	0	0	0.00	0	0	0	10181	2.9	121.5	0.00	0.63	0.00	16.61	15.0	0.00	191.02	53.5	190.0	525	0.79	669	398.8	1.78	47.6%
11	926	930	4.95	457	457	8.40	1260	1260	0.00	0	0	3.45	279	279	1996	1996	3.6	29.0	1.99	1.99	0.82	0.82	2.4	26.79	26.79	7.5	38.9	375	0.14	530	68.4	0.60	56.9%
12	928	930	9.35	864	864	3.55	533	533	0.00	0	0	0.00	0	0	1397	1397	3.7	20.9	0.00	0.00	3.85	3.85	3.3	22.72	22.72	6.4	30.7	200	7.00	55	90.5	2.79	33.9%
13	930	932	1.65	152	1473	2.95	443	2236	0.00	0	0	0.00	0	279	595	3988	3.3	53.9	0.34	2.33	0.80	5.47	6.8	10.54	60.05	16.8	77.4	450	0.11	308	99.1	0.60	78.2%
14	932	934	0.00	0	1473	0.00	0	2236	0.00	0	0	7.12	577	856	577	4565	3.3	60.7	3.56	5.89	6.10	11.57	15.2	17.52	77.57	21.7	97.6	525	0.10	455	141.9	0.63	68.8%
15	934	972	2.90	268	10929	1.80	270	3499	0.00	0	0	1.21	98	954	636	15382	2.8	172.4	0.61	7.12	0.40	28.58	31.0	15.08	283.67	79.4	282.8	600	0.26	1007	326.6	1.12	86.6%
16	936	938	7.58	700	700	0.70	105	105	0.00	0	0	0.00	0	0	805	805	3.9	12.6	0.00	0.00	2.17	2.17	1.9	14.42	14.42	4.0	18.5	250	1.00	108	62.0	1.22	29.8%
17	938	940	8.05	744	1444	1.00	150	255	0.00	0	0	4.41	357	357	1251	2056	3.6	29.8	2.21	2.21	0.83	3.00	4.5	25.14	39.56	11.1	45.4	300	0.35	156	59.7	0.82	76.0%
18	940	952	6.35	587	2031	0.99	149	404	0.00	0	0	0.00	0	357	736	2792	3.5	39.2	0.00	2.21	0.00	3.00	4.5	10.51	50.07	14.0	57.8	300	0.75	310	87.4	1.20	66.1%
19	942	944	7.25	670	670	4.70	705	705	0.00	0	0	0.00	0	0	1375	1375	3.7	20.6	0.00	0.00	12.67	12.67	11.0	34.19	34.19	9.6	41.2	250	0.90	516	58.9	1.16	70.0%
20	944	946	12.20	1127	1797	1.00	150	855	0.00	0	0	0.00	0	0	1277	2652	3.5	37.5	0.00	0.00	0.82	13.49	11.7	20.35	54.54	15.3	64.4	375	0.20	511	81.8	0.72	78.8%
21	946	948	4.15	383	2180	4.22	633	1488	0.00	0	0	0.00	0	0	1016	3668	3.4	50.0	0.00	0.00	3.87	17.36	15.1	17.22	71.76	20.1	85.2	375	0.50	243	129.3	1.13	65.9%
	948	950	0.00	0	2180	0.00	0	1488	0.00	0	0	0.00	0	0	0	3668	3.4	50.0	0.00	0.00	0.00	17.36	15.1	0.00	71.76	20.1	85.2	450	0.15	195	115.2	0.70	74.0%
22	950	952	5.05	467	2647	0.30	45	1533	0.00	0	0	0.00	0	0	512	4180	3.3	56.2	0.00	0.00	3.24	20.6	17.9	11.43	83.19	23.3	97.3	450	0.15	221	115.2	0.70	84.5%
23	952	972	4.15	383	5061	5.50	825	2762	0.00	0	0	0.00	0	357	1208	8180	3.0	100.8	0.00	2.21	0.00	23.60	22.4	22.72	155.98	43.7	166.8	450	0.54	282	218.6	1.33	76.3%
24	954	956	7.70	711	711	2.90	435	435	0.00	0	0	6.70	543	543	1689	1689	3.6	24.9	3.35	3.35	0.79	0.79	3.6	22.81	22.81	6.4	34.9	375	0.15	330	70.8	0.62	49.3%
25	956	958	10.70	989	1700	0.00	0	435	0.00	0	0	0.00	0	543	989	2678	3.5	37.8	0.00	3.35	6.27	7.06	9.0	23.45	46.26	13.0	59.8	450	0.20	411	133.0	0.81	44.9%
	958	960	0.00	0	1700	0.00	0	435	0.00	0	0	0.00	0	543	0	2678	3.5	37.8	0.00	3.35	0.00	7.06	9.0	0.00	46.26	13.0	59.8	450	0.15	177	115.2	0.70	51.9%
26	960	966	7.75	716	2416	0.00	0	435	0.00	0	0	0.00	0	543	716	3394	3.4	46.7	0.00	3.35	0.00	7.06	9.0	11.51	57.77	16.2	71.9	450	0.15	82	115.2	0.70	62.4%
27	962	964	2.55	236	236	4.70	705	705	5.04	680	680	0.00	0	0	1621	1621	3.7	24.0	0.00	0.00	0.00	0.00	0.0	20.97	20.97	5.9	29.9	250	0.35	479	36.7	0.72	81.4%
	964	966	0.00	0	236	0.00	0	705	0.00	0	680	0.00	0	0	0	1621	3.7	24.0	0.00	0.00	0.00	0.00	0.0	0.00	20.97	5.9	29.9	250	1.00	298	62.0	1.22	48.2%
28	966	970	1.80	166	2818	5.25	788	1928	0.00	0	680	0.00	0	543	954	5969	3.2	76.7	0.00	3.35	8.89	15.95	16.8	22.38	101.12	28.3	121.8	525	0.15	249	173.8	0.78	70.1%
29	968	970	6.90	638	638	0.00	0	0	0.00	0	0	0.00	0	0	638	638	3.9	10.1	0.00	0.00	0.99	0.99	0.9	11.03	11.03	3.1	14.1	200	0.32	82	19.4	0.60	72.7%
	970	972	0.00	0	3456	0.00	0	1928	0.00	0	680	0.00	0	543	0	6607	3.1	83.8	0.00	3.35	0.00	16.94	17.6	0.00	112.15	31.4	132.8	600	0.15	178	248.1	0.85	53.5%
	972	974	0.00	0	19446	0.00	0	8189	0.00	0	680	0.00	0	1854	0	30169	2.5	302.5	0.00	12.68	0.00	69.12	71.0	0.00	551.8	154.5	528.0	825	0.20	586	669.7	1.21	78.8%
	974	Ex	0.00	0	19446	0.00	0	8189	0.00	0	680	0.00	0	1854	0	30169	2.5	302.5	0.00	12.68	0.00	69.12	71.0	0.00	551.80	154.5	528.0	825	0.20	66	669.7	1.21	78.8%
			210.48			54.57			5.04			22.89																					

Design Parameters:

Avg Flow/Person = 350 l/day
Comm./Inst. Flow = 50,000 l/ha/day
Infiltration = 0.28 l/s/ha

Pipe Friction n = 0.013
Residential Peaking Factor = Harmon Equation (max 4, min 2)
Peaking Factor Comm./Inst. = 1.5

	Units/Net ha	Pop/Unit	
Low Density Residential =	28	3.30	
Medium Density Residential =	60	2.50	(Multi Family Residential)
High Density Residential =	75	1.80	
Mixed Use =	90	1.80	(50% of mixed use area is residential)

Project: Fernbank CDP (101108)
Designed: KJM
Checked: MAB
Dwg. Reference: 101108-SAN
Date: May 8, 2009

M:\2001\101108\DATA\Calculations\Sanitary\2009\20090113 Preferred Internal SAN Design Sheets.xls

SANITARY SEWER CALCULATION SHEET

Manning's n=0.013

LOCATION			RESIDENTIAL AREA AND POPULATION							COMM		INSTIT		PARK		C+I+I	INFILTRATION				PIPE						
STREET	FROM M.H.	TO M.H.	AREA (ha)	UNITS	POP.	CUMULATIVE AREA (ha)	CUMULATIVE POP.	PEAK FACT.	PEAK FLOW (l/s)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	PEAK FLOW (l/s)	TOTAL AREA (ha)	ACCU. AREA (ha)	INFILT. FLOW (l/s)	TOTAL FLOW (l/s)	DIST (m)	DIA (mm)	SLOPE (%)	CAP. (FULL) (l/s)	RATIO Q act/Q cap	VEL. (FULL) (m/s)	VEL. (ACT.) (m/s)
SAN TRUNK 1																											
			0.10		0	0.10	0				0.00		0.00	0.93	0.93		1.03	1.03									
			0.85		98	0.95	98				0.00		0.00		0.93		0.85	1.88									
			1.84		214	2.79	312				0.00		0.00		0.93		1.84	3.72									
			2.68		770	5.47	1082				0.00		0.00		0.93		2.68	6.40									
	120A	135A	2.96		221	8.43	1303	3.2	13.42		0.00		0.00		0.93	0.10	2.96	9.36	3.09	16.61	63.0	300	0.20	43.25	0.38	0.61	0.57
			0.20		23	8.63	1326				0.00		0.00		0.93		0.20	9.56									
			1.10		127	9.73	1453				0.00		0.00		0.93		1.10	10.66									
			1.30		152	11.03	1605				0.00		0.00		0.93		1.30	11.96									
			1.70		196	12.73	1801				0.00		0.00		0.93		1.70	13.66									
	135A	139A	2.43		184	15.16	1985	3.1	19.75		0.00		0.00		0.93	0.10	2.43	16.09	5.31	25.16	60.0	300	0.20	43.25	0.58	0.61	0.63
			0.23		27	15.39	2012				0.00		0.00		0.93		0.23	16.32									
			0.24		18	15.63	2030				0.00		0.00		0.93		0.24	16.56									
	139A	143A	1.28		148	16.91	2178	3.0	21.50		0.00		0.00		0.93	0.10	1.28	17.84	5.89	27.48	60.0	300	0.20	43.25	0.64	0.61	0.65
			0.20		23	17.11	2201				0.00		0.00		0.93		0.20	18.04									
			0.29		22	17.40	2223				0.00		0.00		0.93		0.29	18.33									
	143A	159A	1.28		148	18.68	2371	3.0	23.22		0.00		0.00		0.93	0.10	1.28	19.61	6.47	29.79	60.0	300	0.20	43.25	0.69	0.61	0.66
			0.20		23	18.88	2394				0.00		0.00		0.93		0.20	19.81									
			0.65		51	19.53	2445				0.00		0.00		0.93		0.65	20.46									
			1.36		101	20.89	2546				0.00		0.00		0.93		1.36	21.82									
	159A	166A	4.27		483	25.16	3029	3.0	28.97		0.00		0.00		0.93	0.10	4.27	26.09	8.61	37.68	60.0	300	0.20	43.25	0.87	0.61	0.69
			0.23		27	25.39	3056				0.00		0.00		0.93		0.23	26.32									
	166A	169A	2.26		171	27.65	3227	2.9	30.66		0.00		0.00		0.93	0.10	2.26	28.58	9.43	40.20	60.0	300	0.20	43.25	0.93	0.61	0.69
			0.20		23	27.85	3250				0.00		0.00		0.93		0.20	28.78									
	169A	172A	0.96		73	28.81	3323	2.9	31.48		0.00		0.00		0.93	0.10	0.96	29.74	9.81	41.40	60.0	300	0.20	43.25	0.96	0.61	0.70
			0.05		0	28.86	3323				0.00		0.00		0.93		0.05	29.79									
			0.20		15	29.06	3338				0.00		0.00		0.93		0.20	29.99									
	172A	173A	1.31		99	30.37	3437	2.9	32.45		0.00		0.00		0.93	0.10	1.31	31.30	10.33	42.88	60.0	375	0.20	78.41	0.55	0.71	0.72
	173A	174A	0.37		28	30.74	3465	2.9	32.69		0.00		0.00		0.93	0.10	0.37	31.67	10.45	43.24	72.5	375	0.20	78.41	0.55	0.71	0.73
	174A	175A	0.42		32	31.16	3497	2.9	32.96		0.00		0.00		0.93	0.10	0.42	32.09	10.59	43.65	70.5	375	0.20	78.41	0.56	0.71	0.73
	175A	176A	0.36		27	31.52	3524	2.9	33.18		0.00		0.00		0.93	0.10	0.36	32.45	10.71	43.99	61.0	375	0.20	78.41	0.56	0.71	0.73
	176A	177A	0.12		9	31.64	3533	2.9	33.26		0.00		0.00		0.93	0.10	0.12	32.57	10.75	44.11	9.5	375	0.20	78.41	0.56	0.71	0.73
	177A	178A	0.02		0	31.66	3533	2.9	33.26		0.00		0.00		0.93	0.10	0.02	32.59	10.75	44.11	60.0	375	0.20	78.41	0.56	0.71	0.73
	178A	179A				31.66	3533	2.9	33.26		0.00		0.00		0.93	0.10	0.00	32.59	10.75	44.11	24.5	375	0.20	78.41	0.56	0.71	0.73
	179A	180A				31.66	3533	2.9	33.26		0.00		0.00		0.93	0.10	0.00	32.59	10.75	44.11	16.5	375	0.20	78.41	0.56	0.71	0.73
	180A	283A				31.66	3533	2.9	33.26		0.00		0.00		0.93	0.10	0.00	32.59	10.75	44.11	11.0	375	0.20	78.41	0.56	0.71	0.73
To SAN TRUNK 2, Pipe 283A - 284A						31.66	3533				0.00		0.00		0.93			32.59									
SAN TRUNK 2																											
			0.04		0	0.04	0				0.00		0.00		0.00		0.04	0.04									
			0.28		33	0.32	33				0.00		0.00		0.00		0.28	0.32									
	203A	205A	0.43		50	0.75	83	3.6	0.97		0.00		0.00		0.00	0.00	0.43	0.75	0.25	1.22	60.0	200	0.35	19.40	0.06	0.62	0.34
			0.40		46	1.15	129				0.00		0.00		0.00		0.40	1.15									
	205A	206A	0.70		82	1.85	211	3.5	2.40		0.00		0.00		0.00	0.00	0.70	1.85	0.61	3.01	74.5	200	0.35	19.40	0.16	0.62	0.45
			0.38		44	2.23	255				0.00		0.00		0.00		0.38	2.23									
	206A	217A	0.68		79	2.91	334	3.4	3.73		0.00		0.00		0.00	0.00	0.68	2.91	0.96	4.69	81.0	200	0.35	19.40	0.24	0.62	0.50

DESIGN PARAMETERS

Park Flow =	9300	L/ha/da	0.10764	l/s/Ha			
Average Daily Flow =	280	l/p/day			Industrial Peak Factor = as per MOE Graph		
Comm/Inst Flow =	28000	L/ha/da	0.3241	l/s/Ha	Extraneous Flow =	0.330	L/s/ha
Industrial Flow =	35000	L/ha/da	0.40509	l/s/Ha	Minimum Velocity =	0.600	m/s
Max Res. Peak Factor =	4.00				Manning's n = (Conc)	0.013 (Pvc)	0.013
Commercial/Inst./Park Peak Factor =	1.00				Townhouse coeff=	2.7	
Institutional =	0.32	l/s/Ha			Single house coeff=	3.4	

Designed: V.W.

Checked: W.L.

Dwg. Reference: Sanitary Drainage Plan, Dwgs. No.

PROJECT: **1247- Stittsville South Uban Expansion Area**

LOCATION: **City of Ottawa**

File Ref:

Date: **31 Jul 2024**

Sheet No. 1 of 2

1247_SanTrunk_Designsheets_July3124.xlsx

NOTE:
THE POSITION OF ALL POLE LINES, CONDUITS, WATERMAINS, SEWERS AND OTHER UNDERGROUND AND OVERGROUND UTILITIES AND STRUCTURES IS NOT NECESSARILY SHOWN ON THE CONTRACT DRAWINGS, AND WHERE SHOWN, THE ACCURACY OF THE POSITION OF SUCH UTILITIES AND STRUCTURES IS NOT GUARANTEED. BEFORE STARTING WORK, DETERMINE THE EXACT LOCATION OF ALL SUCH UTILITIES AND STRUCTURES AND ASSUME ALL LIABILITY FOR DAMAGE TO THEM.

No.	REVISION	DATE	BY
14.	AS BUILT	SEP 06/18	GJM
13.	REVISED GRADES FROM SANMH 99 TO FAULKNER DRAIN	JUN 23/17	GJM
12.	ISSUED FOR MYLARS	FEB 23/17	GJM
11.	ISSUED FOR LAYOUT	JAN 13/17	GJM
10.	REVISED SANMH 99 AND 101 INVERTS	NOV 17/16	GJM
9.	AUTOMATIC FLUSHER CHAMBER ADDED	SEPT 09/16	BHB
8.	ADDENDUM No. 4	JUL 05/16	GJM
7.	REVISED MANHOLES 97 AND 99. 200mm BYPASS ADDED	JUN 22/16	GJM
6.	ISSUED FOR TENDER	MAY 25/16	GJM
5.	ISSUED FOR ENVIRONMENTAL COMPLIANCE APPROVAL	MAY 04/16	GJM
4.	ISSUED WITH MINOR ADJUSTMENTS	MAR 29/16	GJM
3.	ISSUED FOR 75% DESIGN	MAR 14/16	GJM
2.	50 % DESIGN	DEC 22/15	GJM
1.	ISSUED WITH PUMP STATION PRE-DESIGN REPORT	JUNE 24/15	GJM

SCALE
1 : 250
(UNLESS NOTED)

DESIGN GJM/BHB
CHECKED GJM
DRAWN MWC
CHECKED GJM
APPROVED GJM

NOVATECH
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Ottawa, Ontario, Canada K2M 1P6
Telephone (613) 254-9643
Facsimile (613) 254-5867
Website www.novatech-eng.com

LOCATION
CITY OF OTTAWA
STITTSVILLE SOUTH - AREA 6

DRAWING NAME
SHEA ROAD SANITARY PUMP STATION - SITE SERVICING AND GRADING

PROJECT No. 113004-00
REV REV # 14
DRAWING No. 113004-PS-SVC

M:\2013\113004\CAD\Design\113004-PR(FM2).dwg, PS-SVC, Sep 07, 2018

PLANB1.DWG - 1000mmx707mm

SANITARY SEWER CALCULATION SHEET

Manning's n=0.013

LOCATION			RESIDENTIAL AREA AND POPULATION							COMM		INSTIT		PARK		C+I+I	INFILTRATION				PIPE						
STREET	FROM M.H.	TO M.H.	AREA (ha)	UNITS	POP.	CUMULATIVE AREA (ha)	CUMULATIVE POP.	PEAK FACT.	PEAK FLOW (l/s)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	PEAK FLOW (l/s)	TOTAL AREA (ha)	ACCU. AREA (ha)	INFILT. FLOW (l/s)	TOTAL FLOW (l/s)	DIST (m)	DIA (mm)	SLOPE (%)	CAP. (FULL) (l/s)	RATIO Q act/Q cap	VEL. (FULL) (m/s)	VEL. (ACT.) (m/s)
			0.12		0	3.03	334				0.00		0.00		0.00		0.12	3.03									
			0.58		67	3.61	401				0.00		0.00		0.00		0.58	3.61									
			1.17		135	4.78	536				0.00		0.00		0.00		1.17	4.78									
	217A	226A	2.13		248	6.91	784	3.3	8.37		0.00		0.00		0.00	0.00	2.13	6.91	2.28	10.65	61.5	250	0.25	29.73	0.36	0.61	0.55
			0.12		0	7.03	784				0.00		0.00		0.00		0.12	7.03									
			0.72		83	7.75	867				0.00		0.00		0.00		0.72	7.75									
			1.15		134	8.90	1001				0.00		0.00		0.00		1.15	8.90									
	226A	228A	1.30		98	10.20	1099	3.2	11.46		0.00		0.00		0.00	0.00	1.30	10.20	3.37	14.83	60.0	250	0.25	29.73	0.50	0.61	0.60
	228A	229A	0.16		0	10.36	1099	3.2	11.46		0.00		0.00	1.85	1.85	0.20	2.01	12.21	4.03	15.69	69.5	250	0.30	32.57	0.48	0.66	0.65
	229A	230A	0.16		0	10.52	1099	3.2	11.46		0.00		0.00		1.85	0.20	0.16	12.37	4.08	15.74	67.5	300	0.20	43.25	0.36	0.61	0.56
	230A	231A	0.04		0	10.56	1099	3.2	11.46		0.00		0.00		1.85	0.20	0.04	12.41	4.10	15.76	15.5	300	0.20	43.25	0.36	0.61	0.56
			0.08		0	10.64	1099				0.00		0.00		1.85		0.08	12.49									
			0.81		61	11.45	1160				0.00		0.00		1.85		0.81	13.30									
			2.74		787	14.19	1947				0.00		0.00		1.85		2.74	16.04									
			3.34		244	17.53	2191				0.00		0.00		1.85		3.34	19.38									
	231A	265A	3.90		452	21.43	2643	3.0	25.62		0.00		0.00		1.85	0.20	3.90	23.28	7.68	33.50	39.0	300	0.20	43.25	0.77	0.61	0.68
	265A	266A	0.06		0	21.49	2643	3.0	25.62		0.00		0.00		1.85	0.20	0.06	23.34	7.70	33.52	34.5	300	0.20	43.25	0.78	0.61	0.68
	266A	267A	0.14		0	21.63	2643	3.0	25.62		0.00		0.00		1.85	0.20	0.14	23.48	7.75	33.57	80.0	300	0.20	43.25	0.78	0.61	0.68
	267A	268A	0.11		9	21.74	2652	3.0	25.70		0.00		0.00		1.85	0.20	0.11	23.59	7.78	33.68	21.0	300	0.20	43.25	0.78	0.61	0.68
			0.05		4	21.79	2656				0.00		0.00	0.73	2.58		0.78	24.37									
			0.06		5	21.85	2661				0.00		0.00		2.58		0.06	24.43									
	268A	269A	0.10		8	21.95	2669	3.0	25.85		0.00		0.00		2.58	0.28	0.10	24.53	8.09	34.22	80.0	300	0.20	43.25	0.79	0.61	0.68
	269A	270A	0.59		45	22.54	2714	3.0	26.24		0.00		0.00		2.58	0.28	0.59	25.12	8.29	34.81	114.0	300	0.20	43.25	0.80	0.61	0.68
	270A	280A	0.12		9	22.66	2723	3.0	26.32		0.00		0.00		2.58	0.28	0.12	25.24	8.33	34.92	14.5	300	0.20	43.25	0.81	0.61	0.68
			0.02		0	22.68	2723				0.00		0.00		2.58		0.02	25.26									
			0.16		12	22.84	2735				0.00		0.00		2.58		0.16	25.42									
	280A	281A	2.15		163	24.99	2898	3.0	27.84		0.00		0.00		2.58	0.28	2.15	27.57	9.10	37.21	37.5	300	0.20	43.25	0.86	0.61	0.69
	281A	282A				24.99	2898	3.0	27.84		0.00		0.00		2.58	0.28	0.00	27.57	9.10	37.21	8.5	300	0.20	43.25	0.86	0.61	0.69
	282A	283A				24.99	2898	3.0	27.84		0.00		0.00		2.58	0.28	0.00	27.57	9.10	37.21	2.5	450	2.50	450.79	0.08	2.83	1.69
Contribution From SAN TRUNK 1, Pipe 180A - 283A						31.66	3533				0.00		0.00		0.93		32.59	60.16									
	283A	284A				56.65	6431	2.7	56.55		0.00		0.00		3.51	0.38	0.00	60.16	19.85	76.79	2.3	450	2.50	450.79	0.17	2.83	2.10
SAN TRUNK 3																											
	6001A	6002A				0.00					0.00		0.00		0.00	0.00	0.00	0.00	0.00	0.00	12.0	375	0.35	103.73	0.00	0.94	0.05
	6002A	6003A				0.00	0				0.00		0.00		0.00	0.00	0.00	0.00	0.00	0.00	44.0	375	0.30	96.03	0.00	0.87	0.05
	6003A	6004A				0.00	0				0.00		0.00		0.00	0.00	0.00	0.00	0.00	0.00	17.0	375	0.35	103.73	0.00	0.94	0.05

DESIGN PARAMETERS

Park Flow =	9300	L/ha/da	0.10764	l/s/Ha					
Average Daily Flow =	280	l/p/day			Industrial Peak Factor = as per MOE Graph				
Comm/Inst Flow =	28000	L/ha/da	0.3241	l/s/Ha	Extraneous Flow =		0.330	L/s/ha	
Industrial Flow =	35000	L/ha/da	0.40509	l/s/Ha	Minimum Velocity =		0.600	m/s	
Max Res. Peak Factor =	4.00				Manning's n =	(Conc)	0.013	(Pvc)	0.013
Commercial/Inst./Park Peak Factor =	1.00				Townhouse coeff=		2.7		
Institutional =	0.32	l/s/Ha			Single house coeff=		3.4		

Designed: V.W.

Checked: W.L.

Dwg. Reference: Sanitary Drainage Plan, Dwgs. No.

PROJECT: **1247- Stittsville South Uban Expansion Area**

LOCATION: **City of Ottawa**

File Ref:

Date: **31 Jul 2024**

Sheet No. 2 of 2

1247_SanTrunk_Designsheets_July3124.xlsx

NOVATECH
Engineers, Planners & Landscape Architects

M E M O R A N D U M

DATE: MAY 30, 2023

TO: KEVIN MURPHY

FROM: SAM BAHIA, BEN SWEET

RE: SHEA ROAD PUMP STATION & FERNBANK TRUNK CAPACITY REVIEW
NOVATECH FILE NO.: 122163

CC: CARL SCIUK

Introduction

Under the New Official Plan two expansion areas were introduced to West Stittsville: W3 and W4 West Stittsville. Wastewater flows from these expansion areas were not previously considered as part of the Shea Road Pump Station (Shea PS) and Fernbank Trunk Sanitary (FTS) Sewer original designs.

As per David Schaeffer Engineering Limited's (DSEL) request, this memorandum summarizes the findings from the Shea PS and FTS Sewer capacity review, for both the current and future wastewater flows within the respective sewer sheds. The capacity review considers the introduction of the New Official Plan expansion areas – W4 West Stittsville (Subject Site), and an allowance for W3 West Stittsville, which would introduce additional flows to the FTS Sewer. Drawing 122163-SAN illustrates W3 and W4 West Stittsville.

The Subject Site is located at the North-West corner of Flewellyn Road and Shea Road, South of the Area 6 lands. As W4 West Stittsville is directly adjacent to the Shea PS, wastewater flows could be directed to the Shea PS through sanitary sewers, and ultimately to the FTS Sewer.

Background and Infrastructure Status

Upgrades to the Shea PS were completed in August 2022, which included the installation of a third pump. These upgrades increased the Shea PS firm capacity from 42 L/s to 84 L/s, accommodating further development of the Area 6 lands as well as the decommissioning of the Friendly Crescent Pump Station (Friendly PS). Currently, it is anticipated that full buildout of the Area 6 lands will be completed within the next five years (assumed to be prior to the development of W3 and W4 West Stittsville) and the decommissioning of the Friendly PS will be completed by July 2023.

Extension of the FTS Sewer from Goldhawk Drive to Edenwylde Drive was completed in December 2022, accommodating the above-mentioned increase in the Shea PS firm capacity as well as further development North of Fernbank Road. In the future, it is planned that the FTS Sewer will be extended to Liard Street to allow for the decommissioning of the Liard Street Pump Station (Liard PS). The future FTS Sewer extension and the Liard PS decommissioning will be completed by others.

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Although this work is being completed by others, it is anticipated that this work will be completed within the next five years.

It is important to note that the decommissioning of the Friendly and Liard PS were both considered as part of the Shea PS and FTS Sewer original designs. The wastewater flows from the Shea PS and FTS Sewer ultimately outlet to the Hazeldean Road Pump Station (Hazeldean PS).

Subject Site Development Potential

High-level development potential of the Subject Site has been provided to Novatech by DSEL, which comprises of a population potential and effective extraneous area of 5,760 persons and 64.2 ha (excluding HONI corridor and ponds), respectively, which would be developed in 2 stages (East and West of the Faulkner Municipal Drain). **The theoretical peaked flow for the Subject Site, not considering peaking factors from external areas, is approximately 70 L/s.**

Shea Road Pump Station Capacity Review

As mentioned previously, the Shea PS current firm capacity is 84 L/s.

For the purposes of the Shea PS capacity review, the development buildout has been broken down into four scenarios for construction staging. The stages are as follows:

- Stage 1 & 2 – Area 6 lands full buildout including MD blocks, Bell lands, and commercial lands
- Stage 3 – Friendly PS decommissioned with flows diverted to the Shea PS
- Stage 4 – W4 West Stittsville partial buildout (Maguire & Faulkner lands only)
- Stage 5 – W4 West Stittsville full buildout (Davidson & Eder lands added)

Tables 1 to 4 have been prepared to compare the Shea PS staged flow under different loading parameters. The different loading parameters are as follows:

- Condition 1 – Design Parameters for Occupied & Unoccupied
- Condition 2 – Annual Parameters for Occupied & Design Parameters for Unoccupied
- Condition 3 – Annual Parameters for Occupied & Unoccupied
- Condition 4 – Rare Parameters for Occupied & Unoccupied

The following table summarizes the Shea PS staged flows under different loading parameters.

Shea PS Staged Flow Summary

Scenario	Condition 1 (Design)	Condition 2 (Annual/Design)	Condition 3 (Annual)	Condition 4 (Rare)
Stage 1 & 2	64.13 L/s	47.48 L/s	44.50 L/s	60.08 L/s
Stage 3	67.45 L/s	49.81 L/s	46.85 L/s	63.60 L/s
Stage 4	101.59 L/s	84.25 L/s	69.38 L/s	94.73 L/s
Stage 5	128.45 L/s	111.46 L/s	87.44 L/s	120.24 L/s

Given the wastewater flows for the Stage 5 (full buildout) under each different loading parameter are all greater than the Shea PS current firm capacity, future upgrades to the pump station will be

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required if these lands are all to be directed to the Shea PS. If the future upgrades are based on the peaked design flows, the Shea PS proposed firm capacity would need to be upgraded to 130 L/s.

Shea Road Pump Station Potential Future Upgrades

Novatech has reviewed potential component upgrades to the Shea PS based on 130 L/s, which should accommodate the above.

The following outlines the potential future upgrades:

Certain Upgrades:
- Higher HP pumps;
- Starters; and
- Power to pumps.

More than Likely Upgrades:
- New generator.

Possible Upgrades:
- Primary power supply and 600V wiring; and
- Upsize 150mm piping between wet well and valve chamber and within basement.

Probably OK:
- Controls;
- 200mm forcemain (as long as it can be demonstrated that surge pressures will not be an issue due to higher velocities; the theoretical velocity will need to be confirmed by a transient analysis as part of the detailed design for the Shea PS future upgrades);
- Wet well (as long as new pumps fit and operating volumes are adjusted);
- Control room; and
- Bypass chamber.

Once DSEL has reviewed the sanitary servicing approach for W4 West Stittsville, the Shea PS future upgrades can be reviewed further.

Monitoring of the existing wastewater flows to the Shea PS will also need to be reviewed further during the Master Servicing Study / Draft Plan stage, prior to detailed design, to determine residual capacity and future upgrades. This will be completed under separate cover.

Fernbank Trunk Sanitary Sewer Capacity Review

For the purposes of the FTS Sewer capacity review, we have updated sanitary sewer design sheets of the downstream trunks which include the anticipated future growth to determine the impacts on the sewer system.

On a reach-by-reach basis, the sanitary sewer design sheets include the relevant population and areas based on the existing and anticipated future growth being directed to the respective sewers as well as the fixed wastewater flow allowances for the Shea PS (Areas 6 lands and W4 West Stittsville) and W3 West Stittsville. The existing and anticipated future growth includes the development lands owned by CRT Developments Inc., 1384341 Ontario Ltd. (Cavanagh-Fernbank), 2087875 Ontario

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Ltd. (Tartan-Fernbank) as well as the Liard PS sewer shed under the assumption that it will be decommissioned.

Sanitary Sewer Design Sheet 1 includes the sewers upstream of EX FT24 (MHSA72815). Sanitary Sewer Design Sheet 2 includes the sewers downstream of EX FT24 (MHSA72815).

The updates are as follows:

- Added fixed wastewater flow allowance to the relevant sections of the downstream trunk for the Shea PS Stage 5 (full buildout) = 130 L/s (as outlined above);
- Added fixed wastewater flow allowance to the relevant sections of the downstream trunk for W3 West Stittsville = 40 L/s (based on 45 ha of developable land at 0.9 L/s/ha); and
- Assumed the Liard PS decommissioning has been completed, thus, the Liard PS sewer shed and W3 West Stittsville are directed to the FTS Sewer.

Based on the foregoing and review of the impacts on the sewer system, it should be noted that there are minor surcharges. However, due to the depth of the trunk sewer and the isolated sections of trunk sewer surcharging under the peaked design flows, impact would be negligible.

Attachments

1. Table 1 – Shea PS Staged Flow Summary (Design Parameters for Occupied & Unoccupied)
2. Table 2 – Shea PS Staged Flow Summary (Annual Parameters for Occupied & Design Parameters for Unoccupied)
3. Table 3 – Shea PS Staged Flow Summary (Annual Parameters for Occupied & Unoccupied)
4. Table 4 – Shea PS Staged Flow Summary (Rare Parameters for Occupied & Unoccupied)
5. Sanitary Sewer Design Sheet 1 - Upstream of EX FT24
6. Sanitary Sewer Design Sheet 2 - Downstream of EX FT24
7. Drawing 122163-SAN
8. Drawing 108180-FT5

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TABLE 1 - SHEA PUMP STATION STAGED FLOW SUMMARY (DESIGN PARAMETERS FOR OCCUPIED AND UNOCCUPIED)

AREA	SCENARIO	TOTAL POPULATION OCCUPIED P	TOTAL POPULATION UNOCCUPIED P	TOTAL POPULATION P	ICI AREA CA (ha)	DRAINAGE AREA BUILT A (ha)	DRAINAGE AREA PROPOSED A (ha)	PRO-RATED POP. FLOW Q(A) (L/s)	PRO-RATED HARMON PEAKING FACTOR HP x k	PEAK POP. FLOW Q(pR) (L/s)	PEAK ICI FLOW Q(pC) (L/s)	EXTRANEOUS FLOW (I/I WET) Q(E) (L/s)	GROUND WATER INFILTRATION (I/I DRY) (L/s)	TOTAL FLOW Q(D) (L/s)	NOTES
Shea Pump Station Sewer Shed	**Stage 1 & 2 Full Buildout Incl. MD, Bell & ICI**	**3583.3**	**820.4**	**4403.7**	**2.6**	**57.73**	**4.60**	**14.27**	**2.64**	**37.63**	**0.73**	**20.05**	**5.72**	**64.13**	**84 L/s SHEA PUMP STATION CURRENT FIRM CAPACITY.**
	Stage 3 Friendly PS Decommissioned	**3821.3**	**820.4**	**4641.7**	**2.6**	**62.39**	**4.60**	**15.04**	**2.62**	**39.41**	**0.73**	**21.36**	**5.95**	**67.45**	
	Stage 4 W4 Partial Buildout (Maguire & Faulkner only)	3821.3	4023.4	7844.7	2.6	62.39	38.99	25.42	2.45	62.21	0.73	30.99	7.67	101.59	**130 L/s SHEA PUMP STATION PROPOSED FIRM CAPACITY**
	Stage 5 W4 Full Buildout (Davidson & Eder added)	3821.3	6580.4	10401.7	2.6	62.39	68.81	33.71	2.35	79.22	0.73	39.34	9.16	128.45	

UNIT	AVG. CAPITA FLOW	HARMON CORRECTION FACTOR	ICI FLOW PARAMETER	I/I WET	I/I DRY	I/I TOTAL
	q (L/person/d)	K	ICI (L/s/ha)	E (L/s/ha)	(L/s/ha)	(L/s/ha)
OCCUPIED (Design)	280	0.8	0.28	0.28	0.05	0.33
UNOCCUPIED (Design)	280	0.8	0.28	0.28	0.05	0.33

EQUATIONs:

1) Q(A) = (P x q /86,400)
2) Q(pR) = Q(A) x HP x K
3) Q(C) = (CA x c /86,400)
4) Q(pC) = Q(C) x CP
5) Q(E) = (A x E)
6) Q(D) = Q(pR) + Q(pC) + Q(E)

DEFINITIONS/NOTES:

Q(A) = Average Residential Flow (L/sec)
Q(pR) = Peak Residential Flow (L/sec)
Q(C) = Average ICI Flow (L/sec)
Q(pC) = Peak ICI Flow (L/sec)
Q(E) = Extraneous Flow (L/sec)
Q(D) = Peak Design Flow (L/sec)

A = Residential Area
CA = ICI Area
P = Population
q = Avg. Residential Capita Flow Parameter
HP = Harmon Residential Peaking Factor
CP = ICI Peaking Factor
K = Harmon Correction Factor
E = Extraneous Flow Parameter

POPULATION:

Singles	**3.4**	
Semis/Towns	**2.7**	
Institutional eq	**14**	persons/ha

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TABLE 2 - SHEA PUMP STATION STAGED FLOW SUMMARY (ANNUAL PARAMETERS FOR OCCUPIED AND DESIGN PARAMETERS FOR UNOCCUPIED)

AREA	SCENARIO	TOTAL POPULATION OCCUPIED P	TOTAL POPULATION UNOCCUPIED P	TOTAL POPULATION P	ICI AREA CA (ha)	DRAINAGE AREA BUILT A (ha)	DRAINAGE AREA PROPOSED A (ha)	PRO-RATED POP. FLOW Q(A) (L/s)	PRO-RATED HARMON PEAKING FACTOR HP x k	PEAK POP. FLOW Q(pR) (L/s)	PEAK ICI FLOW Q(pC) (L/s)	EXTRANEOUS FLOW (I/I WET) Q(E) (L/s)	GROUND WATER INFILTRATION (I/I DRY) (L/s)	TOTAL FLOW Q(D) (L/s)	NOTES
Shea Pump Station Sewer Shed	**Stage 1 & 2 Full Buildout Incl. MD, Bell & ICI**	**3583.3**	**820.4**	**4403.7**	**2.6**	**57.73**	**4.60**	**10.95**	**2.10**	**23.00**	**0.44**	**20.05**	**3.98**	**47.48**	**84 L/s SHEA PUMP STATION CURRENT FIRM CAPACITY.**
	Stage 3 Friendly PS Decommissioned	**3821.3**	**820.4**	**4641.7**	**2.6**	**62.39**	**4.60**	**11.50**	**2.08**	**23.94**	**0.44**	**21.36**	**4.08**	**49.81**	
	Stage 4 W4 Partial Buildout (Maguire & Faulkner only)	3821.3	4023.4	7844.7	2.6	62.39	38.99	21.88	2.15	47.03	0.44	30.99	5.80	84.25	
	Stage 5 W4 Full Buildout (Davidson & Eder added)	3821.3	6580.4	10401.7	2.6	62.39	68.81	30.17	2.13	64.39	0.44	39.34	7.29	111.46	**130 L/s SHEA PUMP STATION PROPOSED FIRM CAPACITY**

UNIT	AVG. CAPITA FLOW q (L/person/d)	HARMON CORRECTION FACTOR K	ICI FLOW PARAMETER ICI (L/s/ha)	I/I WET E (L/s/ha)	I/I DRY (L/s/ha)	I/I TOTAL (L/s/ha)
OCCUPIED (Annual)	200	0.6	0.17	0.28	0.02	0.30
UNOCCUPIED (Design)	280	0.8	0.28	0.28	0.05	0.33

EQUATIONs:
1) Q(A) = (P x q /86,400)
2) Q(pR) = Q(A) x HP x K
3) Q(C) = (CA x c /86,400)
4) Q(pC) = Q(C) x CP
5) Q(E) = (A x E)
6) Q(D) = Q(pR) + Q(pC) + Q(E)

DEFINITIONS/NOTES:
Q(A) = Average Residential Flow (L/sec)
Q(pR) = Peak Residential Flow (L/sec)
Q(C) = Average ICI Flow (L/sec)
Q(pC) = Peak ICI Flow (L/sec)
Q(E) = Extraneous Flow (L/sec)
Q(D) = Peak Design Flow (L/sec)

A = Residential Area
CA = ICI Area
P = Population
q = Avg. Residential Capita Flow Parameter
HP = Harmon Residential Peaking Factor
CP = ICI Peaking Factor
K = Harmon Correction Factor
E = Extraneous Flow Parameter

POPULATION:

Singles	**3.4**	
Semis/Towns	**2.7**	
Institutional eq	**14**	persons/ha

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TABLE 3 - SHEA PUMP STATION STAGED FLOW SUMMARY (ANNUAL PARAMETERS FOR OCCUPIED AND UNOCCUPIED)

AREA	SCENARIO	TOTAL POPULATION OCCUPIED P	TOTAL POPULATION UNOCCUPIED P	TOTAL POPULATION P	ICI AREA CA (ha)	DRAINAGE AREA BUILT A (ha)	DRAINAGE AREA PROPOSED A (ha)	PRO-RATED POP. FLOW Q(A) (L/s)	PRO-RATED HARMON PEAKING FACTOR HP x k	PEAK POP. FLOW Q(pR) (L/s)	PEAK ICI FLOW Q(pC) (L/s)	EXTRANEOUS FLOW (I/I WET) Q(E) (L/s)	GROUND WATER INFILTRATION (I/I DRY) (L/s)	TOTAL FLOW Q(D) (L/s)	NOTES
Shea Pump Station Sewer Shed	**Stage 1 & 2 Full Buildout Incl. MD, Bell & ICI**	**3583.3**	**820.4**	**4403.7**	**2.6**	**57.73**	**4.60**	**10.19**	**1.98**	**20.16**	**0.44**	**20.05**	**3.85**	**44.50**	**84 L/s SHEA PUMP STATION CURRENT FIRM CAPACITY.** **71L/s SHEA PUMP STATION REDUCED OPERATIONAL CAPACITY (15% REDUCTION OF FIRM).**
	Stage 3 Friendly PS Decommissioned	**3821.3**	**820.4**	**4641.7**	**2.6**	**62.39**	**4.60**	**10.74**	**1.96**	**21.11**	**0.44**	**21.36**	**3.94**	**46.85**	
	Stage 4 W4 Partial Buildout (Maguire & Faulkner only)	3821.3	4023.4	7844.7	2.6	62.39	38.99	18.16	1.84	33.32	0.44	30.99	4.63	69.38	
	Stage 5 W4 Full Buildout (Davidson & Eder added)	3821.3	6580.4	10401.7	2.6	62.39	68.81	24.08	1.76	42.44	0.44	39.34	5.22	87.44	**130 L/s SHEA PUMP STATION PROPOSED FIRM CAPACITY**

UNIT	AVG. CAPITA FLOW q (L/person/d)	HARMON CORRECTION FACTOR K	ICI FLOW PARAMETER ICI (L/s/ha)	I/I WET E (L/s/ha)	I/I DRY (L/s/ha)	I/I TOTAL (L/s/ha)
OCCUPIED (Annual)	200	0.6	0.17	0.28	0.02	0.30
UNOCCUPIED (Annual)	200	0.6	0.17	0.28	0.02	0.30

EQUATIONs:

1) Q(A) = (P x q /86,400)
2) Q(pR) = Q(A) x HP x K
3) Q(C) = (CA x c /86,400)
4) Q(pC) = Q(C) x CP
5) Q(E) = (A x E)
6) Q(D) = Q(pR) + Q(pC) + Q(E)

DEFINITIONS/NOTES:

Q(A) = Average Residential Flow (L/sec)
Q(pR) = Peak Residential Flow (L/sec)
Q(C) = Average ICI Flow (L/sec)
Q(pC) = Peak ICI Flow (L/sec)
Q(E) = Extraneous Flow (L/sec)
Q(D) = Peak Design Flow (L/sec)

A = Residential Area
CA = ICI Area
P = Population
q = Avg. Residential Capita Flow Parameter
HP = Harmon Residential Peaking Factor
CP = ICI Peaking Factor
K = Harmon Correction Factor
E = Extraneous Flow Parameter

POPULATION:

Singles	**3.4**	
Semis/Towns	**2.7**	
Institutional eq	**14**	persons/ha

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TABLE 4 - SHEA PUMP STATION STAGED FLOW SUMMARY (RARE PARAMETERS FOR OCCUPIED AND UNOCCUPIED)

AREA	SCENARIO	TOTAL POPULATION OCCUPIED P	TOTAL POPULATION UNOCCUPIED P	TOTAL POPULATION P	ICI AREA CA (ha)	DRAINAGE AREA BUILT A (ha)	DRAINAGE AREA PROPOSED A (ha)	PRO-RATED POP. FLOW Q(A) (L/s)	PRO-RATED HARMON PEAKING FACTOR HP x k	PEAK POP. FLOW Q(pR) (L/s)	PEAK ICI FLOW Q(pC) (L/s)	EXTRANEOUS FLOW (I/I WET) Q(E) (L/s)	GROUND WATER INFILTRATION (I/I DRY) (L/s)	TOTAL FLOW Q(D) (L/s)	NOTES (L/s)
Shea Pump Station Sewer Shed	**Stage 1 & 2 Full Buildout Incl. MD, Bell & ICI**	**3583.3**	**820.4**	**4403.7**	**2.6**	**57.73**	**4.60**	**10.19**	**1.98**	**20.16**	**0.44**	**35.64**	**3.85**	**60.08**	**84 L/s SHEA PUMP STATION CURRENT FIRM CAPACITY.**
	Stage 3 Friendly PS Decommissioned	**3821.3**	**820.4**	**4641.7**	**2.6**	**62.39**	**4.60**	**10.74**	**1.96**	**21.11**	**0.44**	**38.11**	**3.94**	**63.60**	
	Stage 4 W4 Partial Buildout (Maguire & Faulkner only)	3821.3	4023.4	7844.7	2.6	62.39	38.99	18.16	1.84	33.32	0.44	56.33	4.63	94.73	**130 L/s SHEA PUMP STATION PROPOSED FIRM CAPACITY**
	Stage 5 W4 Full Buildout (Davidson & Eder added)	3821.3	6580.4	10401.7	2.6	62.39	68.81	24.08	1.76	42.44	0.44	72.14	5.22	120.24	

UNIT	AVG. CAPITA FLOW q (L/person/d)	HARMON CORRECTION FACTOR K	ICI FLOW PARAMETER ICI (L/s/ha)	I/I WET E (L/s/ha)	I/I DRY (L/s/ha)	I/I TOTAL (L/s/ha)
OCCUPIED (Rare)	200	0.6	0.17	0.53	0.02	0.55
UNOCCUPIED (Rare)	200	0.6	0.17	0.53	0.02	0.55

EQUATIONs:

1) Q(A) = (P x q /86,400)
2) Q(pR) = Q(A) x HP x K
3) Q(C) = (CA x c /86,400)
4) Q(pC) = Q(C) x CP
5) Q(E) = (A x E)
6) Q(D) = Q(pR) + Q(pC) + Q(E)

DEFINITIONS/NOTES:

Q(A) = Average Residential Flow (L/sec)
Q(pR) = Peak Residential Flow (L/sec)
Q(C) = Average ICI Flow (L/sec)
Q(pC) = Peak ICI Flow (L/sec)
Q(E) = Extraneous Flow (L/sec)
Q(D) = Peak Design Flow (L/sec)

A = Residential Area
CA = ICI Area
P = Population
q = Avg. Residential Capita Flow Parameter
HP = Harmon Residential Peaking Factor
CP = ICI Peaking Factor
K = Harmon Correction Factor
E = Extraneous Flow Parameter

POPULATION:

Singles	**3.4**	
Semis/Towns	**2.7**	
Institutional eq	**14**	persons/ha

SANITARY SEWER DESIGN SHEET 1

NOVATECH
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Novatech Project #: 122163
Project Name: Fernbank Trunk Sanitary Sewer
Date Prepared: 5/26/2020
Date Revised: 5/29/2022
Input By: Ben Sweet
Reviewed By: Sam Bahia
Drawing Reference: 122163-SAN

Legend:
PROJECT SPECIFIC INFO
USER DESIGN INPUT
CUMILATIVE CELL
CALCULATED DESIGN CELL OUTPUT
CALCULATED ANNUAL CELL OUTPUT
CALCULATED RARE CELL OUTPUT
USER AS-BUILT INPUT

LOCATION				DEMAND																							AS-BUILT CAPACITY							
				RESIDENTIAL FLOW									INDUSTRIAL / COMMERICAL / INSTITUTIONAL FLOW							EXTRANOUS FLOW (AREA METHOD)				TOTAL DESIGN FLOW			AS-BUILT SEWER PIPE SIZING / DESIGN VERIFICATION							
STREET	AREA	FROM MH	TO MH	POPULATION (in 1000's)	CUMULATIVE POPULATION (in 1000's)	PEAK FACTOR M	AVG POPULATION FLOW Q(q) (L/s)	PEAKED DESIGN POP FLOW Q(p) (L/s)	PEAK ANNUAL/RARE FACTOR M	PEAKED ANNUAL/RARE POP FLOW Q(AR - Res) (L/s)	RESIDENTIAL DRAINAGE AREA (ha.)	CUMULATIVE RES DRAINAGE AREA (ha.)	COMMERICAL / INSTITUTIONAL AREA (ha.)	CUMULATIVE COMMERICAL / INSTITUTIONAL AREA (ha.)	AVG DESIGN COMMERICAL / INSTITUTIONAL FLOW Q (ci) (L/s)	COMMERICAL / INSTITUTIONAL PEAK FACTOR	CUMULATIVE ICI DRAINAGE AREA (ha.)	PEAKED DESIGN ICI FLOW Q (CI) (L/s)	PEAKED ANNUAL/RARE POP FLOW Q(AR - ICI) (L/s)	CUMULATIVE EXTRANOUS DRAINAGE AREA (ha.)	DESIGN EXTRAN. FLOW Q(e) (L/s)	ANNUAL EXTRAN. FLOW Q(e) (L/s)	RARE EXTRAN. FLOW Q(e) (L/s)	TOTAL DESIGN FLOW Q(D) (L/s)	TOTAL ANNUAL FLOW Q(A) (L/s)	TOTAL RARE FLOW Q(R) (L/s)	AS-BUILT LENGTH (m)	AS-BUILT PIPE SIZE (mm) AND MATERIAL	PIPE ID ACTUAL (m)	ROUGH. (n)	AS-BUILT GRADE (%)	CAPACITY (L/s)	FULL FLOW VELOCITY (m/s)	Qpeak Design / Qcap
Future (By Others)																																		
Fernbank Rd	A1 & A2, E1	24	23	4.339	4.339	2.84	14.06	39.95	2.38	23.91	143.270	143.270	5.000	5.000	1.62	1.00	5.000	1.62	0.98	148.270	48.93	44.48	81.55	130.50	97.38	143.446	31.3	450 PVC	0.457	0.013	0.25	148.7	0.91	87.8%
Fernbank Rd		23	22	0.000	4.339	2.84	14.06	39.95	2.38	23.91	0.000	143.270		5.000	1.62	1.00	5.000	1.62	0.98	148.270	48.93	44.48	81.55	130.50	97.38	143.446	97.1	450 PVC	0.457	0.013	0.25	148.7	0.91	87.8%
Fernbank Rd		22	21	0.000	4.339	2.84	14.06	39.95	2.38	23.91	0.000	143.270		5.000	1.62	1.00	5.000	1.62	0.98	148.270	48.93	44.48	81.55	130.50	97.38	143.446	97.1	450 PVC	0.457	0.013	0.25	148.7	0.91	87.8%
Fernbank Rd		21	20	0.000	4.339	2.84	14.06	39.95	2.38	23.91	0.000	143.270		5.000	1.62	1.00	5.000	1.62	0.98	148.270	48.93	44.48	81.55	130.50	97.38	143.446	93.5	450 PVC	0.457	0.013	0.25	148.7	0.91	87.8%
Novatech																																		
Fernbank Rd	A3 & A4, D1-8	20	19	0.000	4.339	2.84	14.06	39.95	2.38	23.91	0.000	143.270		5.000	1.62	1.00	5.000	1.62	0.98	148.270	48.93	44.48	81.55	260.50	185.38	265.446	139.52	600 CONC	0.610	0.013	0.26	326.6	1.12	79.8%
Stantec																																		
Future Cope Dr	B1	19	18	0.000	4.339	2.84	14.06	39.95	2.38	23.91	0.000	143.270		5.000	1.62	1.00	5.000	1.62	0.98	148.270	48.93	44.48	81.55	260.50	185.38	265.446	103.25	600 CONC	0.610	0.013	0.25	320.3	1.10	81.3%
Future Cope Dr		18	17	0.248	4.587	2.82	14.87	41.97	2.37	25.14	3.280	146.550		5.000	1.62	1.00	5.000	1.62	0.98	151.550	50.01	45.47	83.35	263.61	187.59	268.477	79.60	600 CONC	0.610	0.013	0.26	326.6	1.12	80.7%
Future Cope Dr	B2	17	16	0.853	5.440	2.77	17.63	48.81	2.33	29.30	11.320	157.870		5.000	1.62	1.00	5.000	1.62	0.98	162.870	53.75	48.86	89.58	274.18	195.14	278.859	115.78	600 CONC	0.610	0.013	0.25	320.3	1.10	85.6%
Future Cope Dr		16	15	0.000	5.440	2.77	17.63	48.81	2.33	29.30	0.000	157.870		5.000	1.62	1.00	5.000	1.62	0.98	162.870	53.75	48.86	89.58	274.18	195.14	278.859	118.77	600 CONC	0.610	0.013	0.24	313.8	1.08	87.4%
Future Cope Dr	B3	15	14	1.285	6.725	2.70	21.79	58.82	2.27	35.40	18.800	176.670		5.000	1.62	1.00	5.000	1.62	0.98	181.670	59.95	54.50	99.92	290.39	206.88	295.302	94.32	600 CONC	0.610	0.013	0.23	307.2	1.05	94.5%
Future Cope Dr		14	13	0.000	6.725	2.70	21.79	58.82	2.27	35.40	0.000	176.670		5.000	1.62	1.00	5.000	1.62	0.98	181.670	59.95	54.50	99.92	290.39	206.88	295.302	86.87	600 CONC	0.610	0.013	0.25	320.3	1.10	90.7%
Future Cope Dr		13	12	0.000	6.725	2.70	21.79	58.82	2.27	35.40	0.000	176.670		5.000	1.62	1.00	5.000	1.62	0.98	181.670	59.95	54.50	99.92	290.39	206.88	295.302	103.39	600 CONC	0.610	0.013	0.23	307.2	1.05	94.5%
Future Cope Dr		12	11	0.000	6.725	2.70	21.79	58.82	2.27	35.40	0.000	176.670		5.000	1.62	1.00	5.000	1.62	0.98	181.670	59.95	54.50	99.92	290.39	206.88	295.302	36.69	600 CONC	0.610	0.013	0.29	345.0	1.18	84.2%
Future Cope Dr	B4	11	10	0.373	7.098	2.68	23.00	61.66	2.26	37.14	6.020	182.690		5.000	1.62	1.00	5.000	1.62	0.98	187.690	61.94	56.31	103.23	295.22	210.43	300.354	44.62	600 CONC	0.610	0.013	0.22	300.4	1.03	98.3%
Future Cope Dr		10	9	0.000	7.098	2.68	23.00	61.66	2.26	37.14	0.000	182.690		5.000	1.62	1.00	5.000	1.62	0.98	187.690	61.94	56.31	103.23	295.22	210.43	300.354	33.62	600 CONC	0.610	0.013	0.24	313.8	1.08	94.1%
Future Cope Dr		9	8	0.000	7.098	2.68	23.00	61.66	2.26	37.14	0.000	182.690		5.000	1.62	1.00	5.000	1.62	0.98	187.690	61.94	56.31	103.23	295.22	210.43	300.354	41.40	600 CONC	0.610	0.013	0.24	313.8	1.08	94.1%
Future Cope Dr		8	7	0.000	7.098	2.68	23.00	61.66	2.26	37.14	0.000	182.690		5.000	1.62	1.00	5.000	1.62	0.98	187.690	61.94	56.31	103.23	295.22	210.43	300.354	78.56	600 CONC	0.610	0.013	0.25	320.3	1.10	92.2%
Future Cope Dr	B5, B6	7	6	0.265	7.363	2.67	23.86	63.67	2.25	38.37	3.720	186.410	2.950	7.950	2.58	1.00	7.950	2.58	1.56	194.360	64.14	58.31	106.90	300.38	214.24	305.832	139.72	600 CONC	0.610	0.013	0.25	320.3	1.10	93.8%
Novatech																																		
Future Cope Dr		6	5	0.000	7.363	2.67	23.86	63.67	2.25	38.37	0.000	186.410		7.950	2.58	1.00	7.950	2.58	1.56	194.360	64.14	58.31	106.90	300.38	214.24	305.832	102.50	600 CONC	0.610	0.013	0.22	300.4	1.03	100.0%
Future Cope Dr	B7	5	4	0.381	7.744	2.65	25.10	66.54	2.24	40.13	6.950	193.360	0.900	8.850	2.87	1.00	8.850	2.87	1.74	202.210	66.73	60.66	111.22	306.13	218.53	312.083	115.13	600 CONC	0.610	0.013	0.27	332.8	1.14	92.0%
Future Cope Dr		4	3	0.000	7.744	2.65	25.10	66.54	2.24	40.13	0.000	193.360		8.850	2.87	1.00	8.850	2.87	1.74	202.210	66.73	60.66	111.22	306.13	218.53	312.083	118.86	600 CONC	0.610	0.013	0.23	307.2	1.05	99.7%
Future Cope Dr	B10, C2	3	2	1.204	8.948	2.60	29.00	75.45	2.20	45.60	26.340	219.700		8.850	2.87	1.00	8.850	2.87	1.74	228.550	75.42	68.57	125.70	323.74	231.90	332.042	40.06	600 CONC	0.610	0.013	0.37	389.6	1.33	83.1%
Future Cope Dr		2	1	0.000	8.948	2.60	29.00	75.45	2.20	45.60	0.000	219.700		8.850	2.87	1.00	8.850	2.87	1.74	228.550	75.42	68.57	125.70	323.74	231.90	332.042	122.40	600 CONC	0.610	0.013	0.22	300.4	1.03	107.8%
Future Cope Dr		1	EX 110A	0.000	8.948	2.60	29.00	75.45	2.20	45.60	0.000	219.700		8.850	2.87	1.00	8.850	2.87	1.74	228.550	75.42	68.57	125.70	323.74	231.90	332.042	81.40	600 CONC	0.610	0.013	0.29	345.0	1.18	93.9%
IBI																																		
Goldhawk Dr		*EX 110A*	*EX 109A*	*0.000*	*12.330*	*2.49*	*39.96*	*99.54*	*2.12*	*60.46*	*0.000*	*277.420*	*3.130*	*18.260*	*5.92*	*1.00*	*18.260*	*5.92*	*3.59*	*295.680*	*97.57*	*88.70*	*162.62*	*373.03*	*268.75*	*385.675*	*61.28*	*600 CONC*	*0.610*	*0.013*	*0.35*	*379.0*	*1.30*	*98.4%*
Goldhawk Dr		*EX 109A*	*EX 108A*	*0.003*	*12.333*	*2.49*	*39.97*	*99.56*	*2.12*	*60.47*	*0.180*	*277.600*		*18.260*	*5.92*	*1.00*	*18.260*	*5.92*	*3.59*	*295.860*	*97.63*	*88.76*	*162.72*	*373.11*	*268.82*	*385.788*	*57.50*	*600 CONC*	*0.610*	*0.013*	*0.35*	*379.0*	*1.30*	*98.5%*
Goldhawk Dr		*EX 108A*	*EX 107A*	*0.017*	*12.349*	*2.49*	*40.02*	*99.67*	*2.12*	*60.54*	*0.320*	*277.920*		*18.260*	*5.92*	*1.00*	*18.260*	*5.92*	*3.59*	*296.180*	*97.74*	*88.85*	*162.90*	*373.33*	*268.99*	*386.035*	*53.32*	*600 CONC*	*0.610*	*0.013*	*0.35*	*379.0*	*1.30*	*98.5%*
Goldhawk Dr		*EX 107A*	*EX 106A*	*0.013*	*12.363*	*2.49*	*40.06*	*99.77*	*2.12*	*60.60*	*0.300*	*278.220*		*18.260*	*5.92*	*1.00*	*18.260*	*5.92*	*3.59*	*296.480*	*97.84*	*88.94*	*163.06*	*373.52*	*269.14*	*386.257*	*62.94*	*600 CONC*	*0.610*	*0.013*	*0.35*	*379.0*	*1.30*	*98.6%*
Goldhawk Dr		*EX 106A*	*EX 105A*	*0.023*	*12.386*	*2.49*	*40.14*	*99.93*	*2.12*	*60.70*	*0.310*	*278.530*		*18.260*	*5.92*	*1.00*	*18.260*	*5.92*	*3.59*	*296.790*	*97.94*	*89.04*	*163.23*	*373.78*	*269.33*	*386.526*	*60.09*	*600 CONC*	*0.610*	*0.013*	*0.35*	*379.0*	*1.30*	*98.6%*
Goldhawk Dr		*EX 105A*	*EX 104A*	*0.007*	*13.108*	*2.47*	*42.48*	*104.91*	*2.10*	*63.79*	*0.240*	*291.300*		*18.260*	*5.92*	*1.00*	*18.260*	*5.92*	*3.59*	*309.560*	*102.15*	*92.87*	*170.26*	*382.99*	*276.25*	*396.641*	*72.85*	*600 CONC*	*0.610*	*0.013*	*0.37*	*389.6*	*1.33*	*98.3%*
Goldhawk Dr		*EX 104A*	*EX 103A*	*0.023*	*13.131*	*2.47*	*42.56*	*105.07*	*2.10*	*63.89*	*0.450*	*291.750*		*18.260*	*5.92*	*1.00*	*18.260*	*5.92*	*3.59*	*310.010*	*102.30*	*93.00*	*170.51*	*383.29*	*276.48*	*396.987*	*48.77*	*600 CONC*	*0.610*	*0.013*	*0.37*	*389.6*	*1.33*	*98.4%*
Goldhawk Dr		*EX 103A*	*EX 102A*	*0.030*	*13.161*	*2.47*	*42.65*	*105.28*	*2.10*	*64.02*	*0.470*	*292.220*		*18.260*	*5.92*	*1.00*	*18.260*	*5.92*	*3.59*	*310.480*	*102.46*	*93.14*	*170.76*	*383.65*	*276.75*	*397.372*	*45.00*	*600 CONC*	*0.610*	*0.013*	*0.37*	*389.6*	*1.33*	*98.5%*
Goldhawk Dr		*EX 102A*	*EX FT24*	*0.020*	*13.181*	*2.47*	*42.72*	*105.41*	*2.10*	*64.10*	*2.130*	*294.350*		*18.260*	*5.92*	*1.00*	*18.260*	*5.92*	*3.59*	*312.610*	*103.16*	*93.78*	*171.94*	*384.49*	*277.48*	*398.628*	*102.59*	*600 CONC*	*0.610*	*0.013*	*0.37*	*389.6*	*1.33*	*98.7%*

ALLOWANCES (L/S)					
Area E-1	W3 West Stittsville	40	28	37
Areas D1-D8	Shea PS Current Capacity + Upgrade (Area 6 - 84L/s; W4 West Stittsville- 46L/s	130	88	122

DEMAND EQUATION

Design Parameters:
1. Q(D), Q(A), Q(R) = Q(p) + Q(fd) + Q(ici) + Q(e)
2. Q(p) = (P x q x M x K / 86,400)
3. q Avg capita flow (L/per/day)= 280 L/per/day (design); 200 L/per/day (annual and rare)
4. M = Harmon Formula (maximum of 4.0)
5. K = 0.8 (design); 0.6 (annual and rare)
6. Park flow is considered equivalent to a single unit / ha
   Park Demand = 1 Single Unit Equivalent / Park ha
7. Foundation Drains 0.45 L/s/unit
8. Q(ici) = ICI Area x ICI Flow x ICI Peak
9 Q(e) = 0.33 L/sec/ha (design); 0.30 L/sec/ha (annual); 0.55 L/sec/ha (rare)

Definitions:
Q(D) = Peak Design Flow (L/sec)
Q(A) = Peak Annual Flow (L/sec)
Q(e) = Extraneous Flow (L/sec)
Q(R) = Peak Rare Flow (L/sec)
Q(p) = Population Flow (L/sec)
K = Harmon Correction Factor

	Singles	Semis/Towns	Apts (2-BR)
P = Residential Population	3.4	2.7	2.1
Typ Service Diameter (mm)	135		
Typ Service Length (m)	15	15	
I/I Pipe Rate (L/mm dia/m/hr) =	0.007		

Q(fd) = Foundation Flow (L/sec)
Q(ici) = Industrial / Commercial / Institutional Flow (L/sec

Institutional / Commercial / Industria		Industrial	Commercial / Institutional	
	Design =	35000	28000	L/gHa/d
	Annual / Rare =	10000	17000	L/gHa/d
ICI Peak *	Design = Std ICI -->	1.0	1.5	* ICI Peak = 1.0 Default, 1.5 if ICI in contributing area is >20% (design only
	Annual / Rare =	1.0		

CAPACITY EQUATION
Q full= (1/n) A R^(2/3)So^(1/2)
Where : Q full = Capacity (L/s)
n = Manning coefficient of roughness (0.013)
A = Flow area (m^2)
R = Wetter perimenter (m)
So = Pipe Slope/gradient

NOTE(S)
Future (by others) sewer sections included for conceptual design purposes only - design and construction by others
Novatech and Stantec sewer sections based on asbuilts.
IBI sewer sections based on design.
Red text depicts fixed allowances for the above areas within the design sheet.
Residential flows for the sewers downstream of MH6 updated based on the conceptual sanitary servicing approach outlined within CRT Lands Phase 4, Adequacy of Public Servicing Report (May 2022).
Refer to Sanitary Sewer Design Sheet 2, prepared by Novatech, dated May 17, 2023, for analysis of sewers downstream of EX FT24.

SANITARY SEWER DESIGN SHEET 2

AREA			RESIDENTIAL												MIXED USE		COMMERCIAL		INSTITUTIONAL		C+I	INFILTRATION				PIPE							
			LOW DENSITY		MEDIUM DENSITY		HIGH DENSITY		MIXED USE		TOTAL																						
ID	From	To	Area (ha)	Pop.	Area (ha)	Pop.	Area (ha)	Pop.	Area (ha)	Pop.	Pop.	Accum. Pop.	Peak Factor	Peak Flow (l/s)	Area (ha)	Accum. Area (ha)	Area (ha)	Accum. Area (ha)	Area (ha)	Accum. Area (ha)	Peak Flow (l/s)	Total Area (ha)	Accum. Area (ha)	Infilt. Flow (l/s)	Total Flow (l/s)	Size (mm)	Type	Slope (%)	Length (m)	Capacity (l/s)	Full Flow Vel. (m/s)	Q/Q$_{full}$ (%)	Actual Vel. (m/s)
Shea PS Current Capacity + Upgrade (Area 6 - 84 L/s; W 4 West Stittsville - 46 L/s), W3 West Stittsville (40 L/s)																									170.0								
F1											13181	13181	2.5	105.4	0.0	0.00	18.26	18.26		0.00	8.9	312.61	312.61	103.2	217.5								
	FT24	FT23									0	13181	2.5	105.4		0.00		18.26		0.00	8.9		312.61	103.2	387.5	600	C 100-D	0.34	108.9	373.5	1.28	103.7%	1.49
	FT23	FT22									0	13181	2.5	105.4		0.00		18.26		0.00	8.9		312.61	103.2	387.5	600	C 100-D	0.39	106.2	400.0	1.37	96.9%	1.59
	FT22	FT21									0	13181	2.5	105.4		0.00		18.26		0.00	8.9		312.61	103.2	387.5	600	C 100-D	0.36	108.6	384.3	1.32	100.8%	1.53
	FT21	FT20									0	13181	2.5	105.4		0.00		18.26		0.00	8.9		312.61	103.2	387.5	600	C 100-D	0.45	106.3	429.7	1.47	90.2%	1.69
	FT20	FT19									0	13181	2.5	105.4		0.00		18.26		0.00	8.9		312.61	103.2	387.5	600	C 100-D	0.45	103.6	429.7	1.47	90.2%	1.69
	FT19	FT18									0	13181	2.5	105.4		0.00		18.26		0.00	8.9		312.61	103.2	387.5	600	C 100-D	0.91	124.5	611.1	2.09	63.4%	2.22
F2			2.90	268	1.80	270	0.00	0	0.00	0	538	538	3.4	5.9	0.00	0.00	0.00	0.00	0.40	0.40	0.2	13.19	13.19	4.4	10.4								
F3			15.95	1474	14.90	2235	0.00	0	10.57	856	4565	4565	2.8	41.8	10.57	10.57	0.60	0.60	11.57	11.57	8.5	77.57	77.57	25.6	75.9								
	FT18	FT17									0	18284	2.4	139.4		10.57		18.86		11.97	17.6		403.37	133.1	460.1	750	C 100-D	0.20	88.5	519.4	1.14	88.6%	1.30
	FT17	FT16									0	18284	2.4	139.4		10.57		18.86		11.97	17.6		403.37	133.1	460.1	750	C 100-D	0.23	126.4	557.0	1.22	82.6%	1.37
	FT16	FT15									0	18284	2.4	139.4		10.57		18.86		11.97	17.6		403.37	133.1	460.1	750	C 100-D	0.25	110.6	580.7	1.27	79.2%	1.42
	FT15	FT14									0	18284	2.4	139.4		10.57		18.86		11.97	17.6		403.37	133.1	460.1	750	C 100-D	0.18	118.1	492.7	1.08	93.4%	1.24
	FT14	FT13									0	18284	2.4	139.4		10.57		18.86		11.97	17.6		403.37	133.1	460.1	750	C 100-D	0.17	115.3	478.9	1.05	96.1%	1.22
	FT13	FT12									0	18284	2.4	139.4		10.57		18.86		11.97	17.6		403.37	133.1	460.1	750	C 100-D	0.22	129.2	544.8	1.19	84.5%	1.35
	FT12	FT11									0	18284	2.4	139.4		10.57		18.86		11.97	17.6		403.37	133.1	460.1	750	C 100-D	0.18	108.6	492.7	1.08	93.4%	1.24
	FT11	FT10									0	18284	2.4	139.4		10.57		18.86		11.97	17.6		403.37	133.1	460.1	750	C 100-D	0.18	100.8	492.7	1.08	93.4%	1.24
Stittsville Trunk																									379.0								
	FT10	FT09									0	18284	2.4	139.4		10.57		18.86		11.97	17.6		403.37	133.1	839.1	750	C 100-D	0.45	84.1	779.1	1.71	107.7%	1.97
	FT09	FT08									0	18284	2.4	139.4		10.57		18.86		11.97	17.6		403.37	133.1	839.1	750	C 100-D	0.56	40.9	869.1	1.91	96.5%	2.21
F4			60.08	5551	16.71	2506	0.00	0	5.62	455	8512	8512	2.6	72.3	5.62	5.62	0.00	0.00	19.62	19.62	10.9	164.76	164.76	54.4	137.5								
F5			7.70	711	2.90	435	0.00	0	6.70	543	1689	1689	3.1	17.0	6.70	6.70	0.00	0.00	0.79	0.79	2.0	22.81	22.81	7.5	26.6								
F6			29.70	2744	9.95	1493	5.04	680	0.00	0	4917	4917	2.8	44.6	0.00	0.00	0.00	0.00	16.15	16.15	7.9	89.34	89.34	29.5	82.0								
	FT08	FT07									0	33403	2.1	232.2		22.89		18.86		48.53	38.3		680.28	224.5	1044.0	1200	C 100-D	0.22	77.5	1907.7	1.63	54.7%	1.67
	FT07	FT06									0	33403	2.1	232.2		22.89		18.86		48.53	38.3		680.28	224.5	1044.0	1200	C 100-D	0.13	83.5	1466.5	1.26	71.2%	1.37
	FT06	FT05									0	33403	2.1	232.2		22.89		18.86		48.53	38.3		680.28	224.5	1044.0	1200	C 100-D	0.20	24.6	1819.0	1.56	57.4%	1.60
	FT05	FT04									0	33403	2.1	232.2		22.89		18.86		48.53	38.3		680.28	224.5	1044.0	1200	C 100-D	0.16	89.0	1626.9	1.39	64.2%	1.49
	FT04	FT03									0	33403	2.1	232.2		22.89		18.86		48.53	38.3		680.28	224.5	1044.0	1200	C 100-D	0.19	95.0	1772.9	1.52	58.9%	1.58
	FT03	FT02									0	33403	2.1	232.2		22.89		18.86		48.53	38.3		680.28	224.5	1044.0	1200	C 100-D	0.25	107.5	2033.7	1.74	51.3%	1.74
	FT02	FT01									0	33403	2.1	232.2		22.89		18.86		48.53	38.3		680.28	224.5	1044.0	1200	C 100-D	0.17	107.5	1677.0	1.44	62.3%	1.52
	FT01	OTT1									0	33403	2.1	232.2		22.89		18.86		48.53	38.3		680.28	224.5	1044.0	1200	C 100-D	0.22	61.4	1907.7	1.63	54.7%	1.67
	OTT1	GC									0	33403	2.1	232.2		22.89		18.86		48.53	38.3		680.28	224.5	1044.0	1200	C 100-D	0.20	19.1	1819.0	1.56	57.4%	1.60

Design Parameters:

Avg Flow/Person = 280 l/day
Comm./Inst. Flow = 28,000 l/ha/day
Infiltration = 0.33 l/s/ha

Pipe Friction n = 0.013
Residential Peaking Factor = Harmon Equation (max 4, min 2)
Peaking Factor Comm./Inst. = 1.5

	Units/Net ha	Pop/Unit	
Low Density Residential =	28	3.30	
Medium Density Residential =	60	2.50	(Multi Family Residential)
High Density Residential =	75	1.80	
Mixed Use =	90	1.80	(50% of mixed use area is residential)

Project: Fernbank Trunk Sanitary Sewer
Designed: KJM
Checked: MAB
Revised: BCS/BHB
Dwg. Reference: 108180-FT5
Date: February 3, 2015
Revised: May 29, 2023

Note(s):
Sewer sections based on asbuilts.
Red text depicts fixed allowances for the above areas within the design sheet.
Refer to Sanitary Sewer Design Sheet 1, prepared by Novatech, dated May 17, 2023, for analysis of sewers upstream of FT24.

NOTE:
THE POSITION OF ALL POLE LINES, CONDUITS, WATERMAINS, SEWERS AND OTHER UNDERGROUND AND OVERGROUND UTILITIES AND STRUCTURES IS NOT NECESSARILY SHOWN ON THE CONTRACT DRAWINGS, AND WHERE SHOWN, THE ACCURACY OF THE POSITION OF SUCH UTILITIES AND STRUCTURES IS NOT GUARANTEED. BEFORE STARTING WORK, DETERMINE THE EXACT LOCATION OF ALL SUCH UTILITIES AND STRUCTURES AND ASSUME ALL LIABILITY FOR DAMAGE TO THEM.

No.	REVISION	DATE	BY
1.	ISSUED IN SUPPORT OF MEMORANDUM	MAY 11/23	BCS

SCALE 1:5000

1:5000 0 50 100 150 200

DESIGN DJC
CHECKED BCS
DRAWN DJC
CHECKED BCS
APPROVED BHB

FOR REVIEW ONLY

NOVATECH
Engineers, Planners & Landscape Architects
Suite 200, 240 Michael Cowpland Drive
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Telephone (613) 254-9643
Facsimile (613) 254-5867
Website www.novatech-eng.com

LOCATION
CITY OF OTTAWA
SHEA PUMP STATION UPGRADES FOR UEA

DRAWING NAME
SANITARY DRAINAGE AREA PLAN

PROJECT No. 122163
REV REV # 1
DRAWING No. 122163-SAN

PLANB1.DWG - 1000mmx707mm

NOTE:
THE POSITION OF ALL POLE LINES, CONDUITS, WATERMAINS, SEWERS AND OTHER UNDERGROUND AND OVERGROUND UTILITIES AND STRUCTURES IS NOT NECESSARILY SHOWN ON THE CONTRACT DRAWINGS, AND WHERE SHOWN, THE ACCURACY OF THE POSITION OF SUCH UTILITIES AND STRUCTURES IS NOT GUARANTEED. BEFORE STARTING WORK, DETERMINE THE EXACT LOCATION OF ALL SUCH UTILITIES AND STRUCTURES AND ASSUME ALL LIABILITY FOR DAMAGE TO THEM.

No.	REVISION	DATE	BY
5.	ISSUED FOR TENDER	JAN 26/12	MAB
4.	ISSUED FOR MOE APPROVAL	JAN 27/11	MAB
3.	MINOR DESIGN REVISION	NOV 14/11	MAB
2.	REVISED PER CITY AND LANDOWNER COMMENTS	OCT 20/11	MAB
1.	ISSUED WITH SANITARY TRUNK SEWER REPORT	SEPT 16/11	MAB

SCALE 1:6000
0 60 120 180 240

DESIGN KJM
CHECKED MAB
DRAWN KJM
CHECKED MAB
APPROVED JGR

FOR REVIEW ONLY

LICENSED PROFESSIONAL ENGINEER
K. J. MURPHY
100123021
JAN. 26/12
PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER
M.A. BISSETT
JAN. 26/12
PROVINCE OF ONTARIO

NOVATECH
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Email: novainfo@novatech-eng.com

LOCATION
CITY of OTTAWA
FERNBANK COMMUNITY

DRAWING NAME
SANITARY TRUNK SEWER
DRAINAGE AREA PLAN

PROJECT No. 108180-08
REV REV # 5
DRAWING No. 108180-FT5

Project Name	Description	Timing
	new diversion pump station to redirect flow from the Pinecrest area south to the Lynwood Collector	
Merivale North Trunk Diversion Sewer, Replacement, and Oversizing	An opportunity was identified to divert additional flow to the Merivale North Sewer and away from the Cave Creek Collector along Carling Avenue. The diversion would eliminate the need for upgrades along the Cave Creek Collector. The existing Merivale North Sewer is due for renewal. Therefore, the 700 metres of required replacement sewers will be oversized to 750mm on renewal to accommodate upstream intensification growth.	2024-2029

7.8.4.2 Pumping Station Upgrades

Table 7-11 summarizes the upgrades that are proposed for sewage pumping stations.

Table 7-11: New Pumping Station Upgrade Projects

Project Name	Description	Timing
Shea Road PS Capacity Upgrade and Forcemain	To accommodate the projected growth up to 2046, the capacity of Shea Road PS will be increased to 110 L/s.	2029-2034
Tenth Line PS Capacity Upgrade and Forcemain	The capacity of Tenth Line PS will be increased from 422 L/s to 581 L/s, to support 2046 growth demands and existing servicing needs. This project will entail the installation of larger pumps and upsizing the existing 300mm forcemain to 400mm diameter.	2034-2039
Mahogany PS Capacity Upgrade	The capacity of Mahogany PS will be increased by approximately 121 L/s to the facility's ultimate capacity of 166 L/s, to support growth in South Manotick.	2024-2029

7.8.4.3 Major Flow Diversions

As introduced in Section 7.6.3.5, alternative solutions to upsizing and/or twinning of the existing West Nepean Collector have been identified, whereby major flow diversions could be constructed at key locations within the sewer network to divert flow away from the West Nepean Collector. Through these diversions, a large amount of flow would be diverted south toward the Lynwood Collector, which has substantially greater available capacity than the West Nepean Collector and Interceptor Sewer.

The aim of these diversions is to maintain the status quo for flow conditions within the West Nepean Collector in the future. When implemented, the flow diversions would offset the

Engineers, Planners & Landscape Architects

M E M O R A N D U M

DATE: **DECEMBER 19, 2024**

TO: **MARC PICHETTE, PETER MOTT**

FROM: **SAM BAHIA, BEN SWEET**

RE: **SHEA ROAD PUMP STATION UPGRADE OPTIONS**
NOVATECH FILE NO.: 122163

CC: **CARL SCIUK, BRONWYN ANDERSON**

Introduction

This memorandum outlines and evaluates the Shea Road Pump Station (Shea PS) upgrade options that have been considered to accommodate wastewater flows from the Area W4 lands (Subject Site).

This memorandum should be read in conjunction with the *Shea Road Pump Station & Fernbank Capacity Review Memorandum* (Novatech, May 2023). The abovementioned memorandum outlined the following:

- Background and infrastructure status.
- Subject Site development potential.
- Shea PS capacity review.
- Shea PS potential future upgrades.
- Fernbank Trunk Sanitary Sewer capacity review.

The following documents were also utilized in the preparation of this memorandum:

- *Shea Road Sanitary Pump Station Design Brief* (Novatech, May 2016).
- As-builts of Shea PS facility and forcemain (December 2018).
- As-builts of Shea PS third pump upgrade (May 2023).

As outlined in the May 2023 Memorandum, upgrades to the Shea PS were completed in August 2022, which included the installation of a third pump. The existing three 40HP pumps have a firm capacity of 84L/s (42L/s per pump x two pumps in operation).

DSEL and Novatech met with City Staff on May 23, 2024, to discuss additional upgrades that would be required to the Shea PS to accommodate wastewater flows from the Subject Site. The following Operational feedback was provided so that it can be considered within the Shea PS upgrade options during functional design.

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1. Review and add valves on swab launcher.

   Novatech: Acknowledged. Can be reviewed during functional design.

2. Why are check valves noisy after pump runs? Is it a vacuum being created on the flow surge? This issue started after the last upgrade of the outfall chamber. The noisy check valve is from a pounding ball inside the check valve. This will cause premature wear on the check valve. Is the forcemain missing an air reducing valve to break vacuum?

   Novatech: Acknowledged. Please review the transient analysis report for the ramp down period to ensure that Shea PS operation is consistent with the recommendations.

3. Rag basket in the wet well needs to be cleaned every week, creating a labor demand. Should look at a bigger basket or alternate rag removal process.

   Novatech: Acknowledged. Can be reviewed during functional design.

4. Review pump controls with operations. Pump and level controls were designed with outfall limitation. Outfall is no longer restricted, control PCN needs to be changed.

   Novatech: Shea PS operation should be per original design (100% VFD). A revised PCN was provided to City Staff in June 2022 following the Shea PS third pump upgrade.

5. Is the existing chemical large enough? Review chemical demand.

   Novatech: Acknowledged. Can be reviewed during functional design.

6. Many of our stations with >100L/s inflows seem to have a wet well with >100m^3 capacity according to the tables in the combined ECA. Shea PS seems to be a much smaller capacity wet well (49m^3) for that amount of inflow. It would be worthwhile to review the wet well capacity and proposed pump setpoints compared to the sewer design guidelines.

   Novatech: Acknowledged. Can be reviewed during functional design. There is residual storage in the upstream sewers that elevate the storage to approximately 100m^3.

7. Since it is a smaller wet well, how many pump starts per hour would be anticipated with the increased flow? This should be within the sewer design guidelines and the pump manufacturer's recommendations.

   Novatech: The Sewer Design Guidelines only covers basic operation and does not account for two pump operation and VFD pace control. We believe with proper sequencing and pacing the VFD speeds to control wet well levels, the wet well should be adequate to keep the number of starts to an acceptable level. However, the City may object to a strategy that relies on pump sequencing and VFD adjustments to pace with flows. If the City rejects stepped pump operation and pace control, a larger wet well would be required.

8. What would be the retention time of the wet well before an overflow occurred in a worst-case scenario (max inflow, power failure at the pump start elevation)? Is there enough time for the generator to start and for the automatic transfer switch to transfer over?

   Novatech: Acknowledged. Can be reviewed during functional design. Further to the response to comment 6, the residual storage of approximately 100m^3 allows for 1-2 minutes for the genset to turn over prior to an emergency spill.

9. Is the current overflow design sufficient for a higher flow station?

   Novatech: The emergency overflow will have to be relocated to lower ground at a new pond. The emergency overflow will be reviewed and sized at that time.

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10. The Shea PS does not have much available wall space inside, this may be challenging if new equipment is required without first removing the existing.

    Novatech: Acknowledged. Can be reviewed during functional design and is considered for the options below.

Shea Road Pump Station Upgrade Options

Upon further review, the following three options have been considered:

- **Option 1:** Major pump station upgrades to building components, mechanical and electrical. Existing forcemains to be utilized. New 60HP pumps with a firm capacity of 120L/s.
- **Option 2:** Abandon and upsize existing dual 200mm dia. forcemains to dual 300mm dia. forcemains. Minor pump station upgrades to mechanical (valve chamber and bypass manhole piping) and electrical. Similar HP pumps with a firm capacity of 130L/s.
- **Option 3:** New 300mm dia. forcemain, discharge chamber and gravity outlet. Minor pump station upgrades to mechanical (valve chamber and bypass manhole piping) and electrical. Existing forcemains to be utilized. Similar HP pumps with a firm capacity of 130L/s.

Refer to attached Alternative Sanitary Forcemain Option Plan (Drawing 122163-FM1) showing Options 2 and 3.

Shea Road Pump Station Capacity Review

As outlined in the May 2023 Memorandum, high-level development potential of the Subject Site has been provided to Novatech by DSEL. The development potential comprises of a population potential and effective extraneous area of 5,760 persons and 64.2ha (excluding HONI corridor and ponds), which would be developed in two stages, East and West of the Faulkner Municipal Drain. The theoretical peaked flow for the Subject Site, not considering peaking factors from external areas, is approximately 70L/s.

The May 2023 Memorandum also summarized the Shea PS staged flows under different loading parameters. Below is a summary of the ultimate flows for full buildout under the different loading parameters:

- Condition 1 (design parameters for occupied & unoccupied) – 130L/s.
- Condition 2 (annual parameters for occupied & design parameters for unoccupied) – 112L/s.
- Condition 3 (annual parameters for occupied & unoccupied) – 88L/s.
- Condition 4 (rare parameters for occupied & unoccupied) – 121L/s.
- Condition 5 (operational flows, peak domestic flows + GWI) – 50L/s.

It is important to note that for Option 1 the Shea PS ultimate flow would be limited to 120L/s, which would be under the requirements for Condition 1 and Condition 4. For Options 2 and 3 the Shea PS ultimate flow would accommodate 130L/s. Option 2 has significant challenges/impacts which is discussed further in the following sections of this memorandum.

Further, Arcadis was engaged to complete a transient analysis of Options 1 and 3. Refer to attached *Transient Analysis Report* (Arcadis, October 2024) for conclusions and recommendations.

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Description of Criteria

In order to select the preferred upgrade option, a set of criteria were developed to comparatively assess feasibility and impacts of each option. The criteria used to assess the above options are based on the categories listed below:

- **Design and Constructability (30%)**
  - Ease of Design and Approvals (15%)
  - Ease and Flexibility of Construction (15%)
- **Operation and Maintenance (30%)**
  - Ease and Flexibility of Operation and Maintenance (15%)
  - Cost of Operation and Maintenance (15%)
- **Public and Natural Environment Affects (20%)**
  - Impact of Community (10%)
  - Impact of Natural Features, Surface water and Aquatics (5%)
  - Level of Service (5%)
- **Capital Costs (20%)**
  - Capital Costs (20%)

Evaluation of Criteria

As the above categories do not equivalently measure against each other, the rating system for the criterion shall be as tabulated below:

Evaluation Criteria	
Category	Weight (%)
Design and Constructability	30
Operation and Maintenance	30
Natural Environment and Public Affects	20
Capital Costs	20

Each sub-category shall be rated on the following system:

- Major Positive Impact (10)
- Moderate Positive Impact (8)
- Minor Positive Impact (6)
- Minor Negative Impact (4)
- Moderate Negative Impact (2)
- Major Negative Impact (0)

The attached evaluation matrix summarizes a comparison of the options based on the corresponding criteria listed above.

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Preferred Upgrade Option

Based on the evaluation matrix, Option 3 is the most practical, feasible, and cost-effective option to accommodate wastewater flows from the Subject Site.

Option 3 is the best option with respect to ease of design and approvals, ease and flexibility of construction, ease and flexibility of operation and maintenance, level of service, and capital costs. Option 2 is the most undesirable option largely due to the significant challenges related to ease and flexibility of construction, impact to community, and capital costs.

Attachments

1. Alternative Sanitary Forcemain Option Plan (Drawing 122163-FM1).
2. *Transient Analysis Report* (Arcadis, October 2024).
3. Evaluation Matrix.
4. Class ‘C’ Cost Estimate.

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No.	REVISION	DATE	BY
1.	NEW FORCEMAIN POSSIBLE PROFILE	JUNE 17/24	BHB

SCALE 1 : 1000

1:1000 0 10 20 30 40

DESIGN GJM/BHB
CHECKED GJM
DRAWN BSm
CHECKED BRN
APPROVED BHB

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LOCATION
CITY OF OTTAWA
SHEA PUMP STATION UPGRADES FOR UEA

DRAWING NAME
ALTERNATE SANITARY FORCEMAIN OPTION PLAN VIEW

PROJECT No. 122163-00
REV REV # 1
DRAWING No. 122163-FM1

PLANB1.DWG - 1000mmx707mm

Design & Consultancy for natural and built assets

NOVATECH

Click here to enter text.

Transient Analysis Report

Shea Road and Forcemain System Upgrades
City of Ottawa, ON

Prepared for NOVATECH Engineers, Planners & Landscape Architects
by Arcadis Professional Services (Canada) Inc.
8133 Warden Ave, Unit 300 | Markham | ON | L6G 1B3 | Canada | T (905) 763-2322 | F (905) 763-9983
October 2024

Document Control Page

CLIENT:	NOVATECH
PROJECT NAME:	Shea Road and Forcemain System Upgrades
REPORT TITLE:	Transient Analysis Report
ARCADIS REFERENCE:	147554
VERSION:	V2
DIGITAL MASTER:	\147554 Novatech SPS Transient Report_V3.docx
ORIGINATOR:	Shelley Kuan, Associate, Hydraulic & Modelling
REVIEWER:	Phil Gray, Principal - Sr. Practice Lead - Infrastructure Planning
AUTHORIZATION:	Shelley Kuan, Associate, Hydraulic & Modelling
CIRCULATION LIST:	NOVATECH
HISTORY:	
1	August 07, 2024 – Submitted to NOVATECH for Review
2	October 31, 2024 – for submission

Table of Contents

List of Attachments

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Appendices

1 Introduction

Arcadis Professional Services (Canada) Inc (Arcadis) was retained by Novatech Engineers, Planners & Landscape Architects (Novatech, the “Client”) to conduct a hydraulic transient analysis in support of the proposed Shea Road Sanitary Pumping Station (SPS) and the associated proposed forcemain system, in the City of Ottawa (the “City”).

Novatech previously retained Cole Engineering (Arcadis/IBI Group Acquisition) to undertake a transient analysis for the above project in 2016. The analysis was completed in March 2016 based on the maximum design of 84 L/s and a dual 200 mm forcemains (HDPE DR13.5). The existing Shea SPS and the dual forcemains were constructed and have been in service.

The Shea SPS is to be upgraded due the potential increasing ultimate design flow 130 L/s (from the original design flow 84 L/s). An updated transient analysis is to check if additional forcemain is required. **Appendix A** shows the locations of the proposed Shea Road SPS and the associated forcemain alignments.

2 Background

The existing Shea Road SPS is located at the southwest corner of the Davidson property, as shown in **Appendix A**. The proposed SPS will service the Stittsville South Area 6 lands in two phases (Phase 1 and Phase 2). The ultimate condition will consist of the full build-out of the site (Phases 1 and 2). The proposed dual 200 mm diameter forcemains were constructed from the SPS through the Davidson lands along local road northerly to the Fernbank Road.

Currently, the forcemains discharge at the existing sanitary manhole (SANMH 5), and outlets to the existing Fernbank gravity sewer.

The following documents and reports have been reviewed for this study:

- Shea Road SPS and Forcemain System Hydraulic Transient Analysis Prepared by Cole Engineering (now Arcadis Professional Services (Canada) Inc.), dated March 2016; and,
- Proposed Shea Road SPS Manufacturer Pump Performance Curves - See **Appendix B** for details.

3 Methodology

The objective of the transient analysis is to complete an assessment of the SPS and forcemain system and provide recommendations regarding surge protection devices (if required) at the SPS and/or along the forcemain system.

The review of suction system hydraulics, including wet well storage volume and forcemain (including discharge header) design flow velocity and/or pump sizing/selection, was not within the scope of the transient assessment. It has been assumed that flow to be pumped is available in the wet well and the pump selection and forcemain design velocity have been reviewed by others. Additionally, it has been assumed the system is under full flow conditions and outlets at the discharge manhole (SAN MH-5). Only this full flow operational condition is simulated and presented in the report.

Based on the background documents and available design information, the following assumptions for the SPS and forcemain system transient analysis were made:

- There are two (2) pumps (1 duty and 1 standby) each with a rated flow of 65 L/s. Each pump unit is equipped with a Variable Frequency Drive (VFD). Design flow rate is approximately 130 L/s.
- Two pumps are initially in operation.
- The existing dual forcemains are 200 mm (ID=185 mm) diameter HDPE (DR13.5) pipe with a C-factor of 140.
- The proposed forcemain is 300 mm diameter (ID=273 mm) HDPE (DR13.5) pipe with a C-factor of 140.
- There is a 150 mm diameter Stainless Steel (SS) header with a C-factor of 120.
- The pipeline pressure wave speed is 1200 m/s for Stainless Steel (SS), and 350 m/s for HDPE.
- The forcemain high pressure resistance for the SS header include:
  - Working pressure (assumed):110 psi (or 760 kPa); and,
  - Maximum pressure (short-term): 154 psi, or 987 kPa (assumed 140% working pressure).
- The pipe high pressure resistance for the HDPE (DR13.5) forcemain include:
  - Working pressure:110 psi (or 760 kPa);
  - Maximum pressure (short-term): 154 psi or 987 kPa (assumed 140% working pressure);
- Existing dual 200 mm diameter forcemains being discharged into the existing sanitary manhole (SAN MH-5, invert 110.3 m).
- Proposed 300 mm forcemain is to be discharged into an existing sanitary manhole (invert, 106.8 m), which is at a lower elevation and downstream of the discharge manhole (SAN MH-5) for the existing dual forcemains.
- A water level (low water level in wet well) of 97.1 m.
- There is a check valve on each of the pump discharge header.
- There is a 75 mm Surge Relief Valve (SRV) at the pump discharge header to provide surge protection.
- The following scenarios for three (3) proposed pumps under both normal and pump emergency shutdown are performed and presented in the report:
  - Scenario 1 - Pumping Station Upgrades and Two Existing Forcemains
  - Scenario 2 - Existing Pumping Station with Two Existing Forcemains plus One Proposed Forcemain

To complete the transient analysis Bentley HAMMER was used. The approach and findings of the transient analysis for the SPS and forcemain system are presented in the following sections.

4 Transient Analysis

4.1 Scenario 1 – Pumping Station Upgrades with Existing Dual Forcemains

Scenario 1: Larger pumps are proposed at the Shea SPS and the existing dual forcemains will be used. New forcemains will not be proposed. The findings for the transient analysis under Scenario 1 are presented below.

4.1.1 Pump Emergency Shutdown without Surge Protection

Except for check valve protection at each of the pumps, no other surge devices were assumed to be on-line, to provide surge protection at the Shea Road SPS, and/or along the forcemains.

Attachments 1 and **1A** represent the transient HGL profile along the existing dual 200 mm forcemain and the transient histories at the Shea Road SPS, upon pump trip. The plan view of the route is shown in **Appendix A.**

Attachment 1 represents the transient HGL and elevation profile along the forcemain from Shea Road SPS to the existing discharge manhole (SAN MH-5). The steady-state HGL at the discharge side of the SPS is approximately 136 m (corresponding to a pressure of 373 kPa, or 54 psi). The key findings are summarized as follows:

- The maximum transient HGL reaches 165 m (corresponding to a pressure of 656 kPa, or 95 psi) near the discharge side of the SPS and 145 m (corresponding to a pressure of 412 kPa, or 60 psi) along the existing dual forcemains;
- Short-lived full-vacuum or sub-atmospheric pressure occurs along virtually the entire length of the existing dual forcemains; and,
- Up to 5 L vapour pocket was observed at a local high point in the forcemain profile, approximately 600 m from the SPS.

Attachment 1A represents the transient history upon power failure at the discharge header of the Shea Road SPS. Following a power trip at 2 s, the maximum transient HGL after 20 s (18 s after the pump shutdown) reaches 155m, and 50% higher than the steady-state HGL. The existing SRV at the SPS discharge header may trip to open, if the relief pressure set point is set at approximately 20% higher than the steady-state HGL/pressure (or it opens when the pressure at the SPS discharge header reaches 70 psi, or HGL at 147m).

4.1.2 Pump Normal Operation

Attachment 2 shows the transient head profile along the forcemain from the Shea Road SPS to the existing discharge manhole (SAN MH-5) upon normal pump shutdown and restart.

The maximum transient head is slightly higher the steady-state head. The key findings are summarized as follows:

- When comparing **Attachments 1** and **2**, the pressure for the entire forcemain has improved. No significant negative pressure is observed along the entire forcemain system with the proposed VFD pumps in operation; and,
- **Attachment 2A** shows the transient history at the discharge header of the SPS during normal pump shutdown and restart operations. The first pump ramp-down is at 2 s with the pump fully closing at 47 s (pump ramp-down time = 45 s) and the second pump ramp-down is at 47 s with the pump fully closing at 92 s (pump ramp-down time = 45 s). There is a delay for approximately 10 s. The second pump starts to ramp-up

at 102 s and is fully opened at 147 s (pump ramp-up time = 45 s) and the first pump starts to ramp-up at147 s and is fully opened at 192 s (pump ramp-up time = 45 s).

4.2 Scenario 2 – Existing Pumping Station with Existing Dual Forcemains plus One Proposed Forcemain

Scenario 2: A new 300 mm forcemain is proposed and the existing Shea SPS will be used. SPS upgrades will not be proposed. The findings for the transient analysis for Scenario 2 are presented below.

4.2.1 Pump Emergency Shutdown without Surge Protection

Except for check valve protection at each of the pumps, no other surge devices were assumed to be on-line, to provide surge protection at the Shea Road SPS, and/or along the forcemains.

Attachments 3 represents the transient HGL profile along the existing dual 200 mm forcemain and the transient histories at the Shea Road SPS, upon pump trip. The plan view of the route is shown in **Appendix A.**

Attachment 3 represents the transient HGL and elevation profile along the forcemain from the Shea Road SPS to the proposed discharge manhole (SAN MH-5). The steady-state HGL at the discharge side of the SPS is approximately 115 m. The key findings are summarized as follows:

- The maximum transient HGL reaches 130 m (corresponding to a pressure of 332 kPa, or 48 psi) near the discharge side of the SPS and/or along the proposed forcemain;
- Short-lived full-vacuum or sub-atmospheric pressure occurs along virtually the entire length of the forcemain; and,
- Up to 2 L vapour pocket was observed at a local high point, approximately 600 m from the SPS.

Attachment 4 represents the transient HGL and elevation profile along the forcemain from the Shea Road SPS to the existing discharge manhole that is located downstream of SAN MH-5. The steady-state HGL at the discharge side of the SPS is approximately 122 m. The key findings are summarized as follows:

- The maximum transient HGL reaches 130 m (corresponding to a pressure of 332 kPa, or 48 psi) near the discharge side of the SPS and/or along the proposed forcemain;
- Short-lived full-vacuum or sub-atmospheric pressure occurs along virtually the entire length of the new/proposed forcemain; and,
- No signature vapour pocket was observed the new/proposed forcemain.

Attachment 3A represents the transient history upon power failure at the discharge header of the Shea Road SPS. Following a power trip at 2 s, the maximum transient HGL after 65 s (63 s after the pump shutdown) reaches 125 m, slightly higher than the steady-state HGL.

4.2.2 Pump Normal Operation

Attachment 5 shows the transient head profile along the existing dual forcemains from the Shea Road SPS to the existing discharge manhole (SAN MH-5) upon normal pump shutdown and restart.

The maximum transient head is slightly higher the steady-state head. The key findings are summarized as follows:

- When comparing **Attachments 3** and **5**, the pressure for the entire forcemain has improved. No significant negative pressure is observed along the entire forcemain system with the proposed VFD pumps in operation; and,

Attachment 5A shows the transient history at the discharge header of the SPS during normal pump shutdown and restart operations. The first pump ramp-down is at 2 s with the pump fully closing at 32 s (pump ramp-down time = 30 s) and the second pump ramp-down is at 32 s with the pump fully closing at 62 s (pump ramp-down time = 30 s). There is a delay for approximately 10 s. The second pump starts to ramp-up at 72 s and is fully opened at 102 s (pump ramp-up time = 30 s) and the first pump starts to ramp-up at 102 s and is fully opened at 132 s (pump ramp-up time = 30 s).

Attachment 6 shows the transient head profile along the new/proposed forcemain from the Shea Road SPS to the existing discharge manhole upon normal pump shutdown and restart.

The maximum transient head is slightly higher the steady-state head. The key findings are summarized as follows:

- When comparing **Attachments 4** and **6**, the pressure for the entire forcemain has improved. No significant negative pressure is observed along the entire forcemain system with the proposed VFD pumps in operation.

5 Conclusions and Recommendations

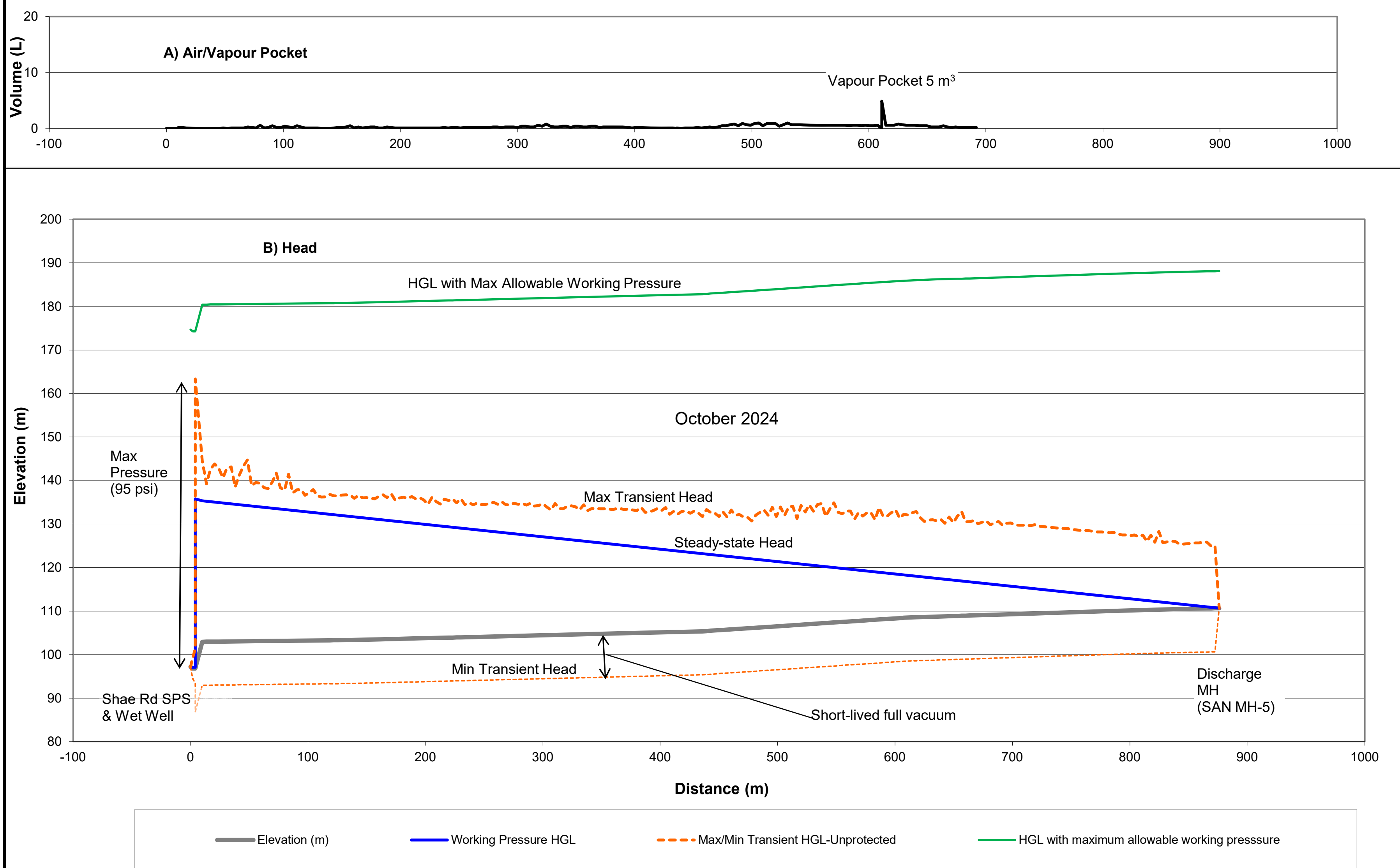
Based on the HAMMER model simulation results, the following conclusions and recommendations can be drawn:

- The Shea Road SPS and forcemain system are capable of withstanding short-lived full vacuum (negative) pressure, and the transient high pressure (working plus surge pressure) of 656 kPa (or 95 psi) upon pump emergency shutdown (or power failure conditions) for the critical Scenario 1 – Shea SPS upgrades and flow via existing dual (200 mm) forcemains.
- Forcemain pressure class HDPE DR13.5, with a pressure rating of greater than 760 kPa (110 psi) was installed for the existing dual 200 mm diameter forcemains and it is recommended for the proposed/new 300 mm forcemain. The anticipated maximum transient pressure of 656 kPa (or 95 psi) is within the working pressure rating of 760 kPa (or 110 psi) without surge protection upon pump emergency shutdown (or power failure conditions). The existing PRV at the SPS may trip to open when the high pressure reaches the pre-set pressure (e.g., pressure reaches 70 psi or 20% higher than the steady-state pressure) at the SPS.
- Based on the model results, short-lived full-vacuum or sub-atmospheric pressure occurs along the existing and proposed forcemains for a duration of 100 seconds per each pump emergency shutdown. The estimated duration of external load (around 22 psi) to the proposed forcemain (with soil cover of approximately 3 m) is around 100 hours assuming one emergency pump shutdown per week for the service life of 70 years. As per the manufactured design information for HDPE DR13.5, the pipeline can withstand external pressure resistance of 27 psi (including a safety factor of 2) for a duration of 100 hours at temperatures of 22^{0}C (73 ^{0}F). Therefore, HDPE DR13.5 is recommended to ensure a sufficient safety factor for long-term resistance to collapse.
- To minimize the negative pressure (or surge pressure) along the forcemain and allow sufficient time for air expulsion from the system, the recommended time for the pump normal operation is as follows:

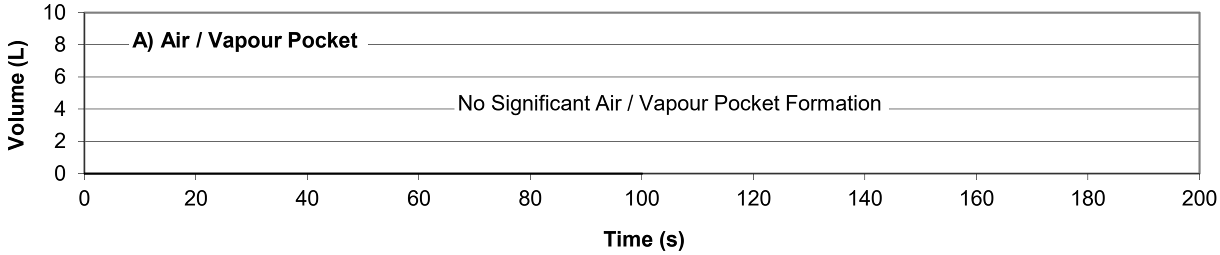
- Scenario 1 (Shea SPS upgrades and flow via existing dual (200 mm) forcemains): Normal pump shutdown and restart is at least 45 s and the time delay between pump operation is at least 10 s; and,
- Scenario 2 (Existing pump units with existing dual forcemains plus one new forcemain): Normal pump shutdown and restart is at least 30 s and the time delay between pump operation is at least 10 s.

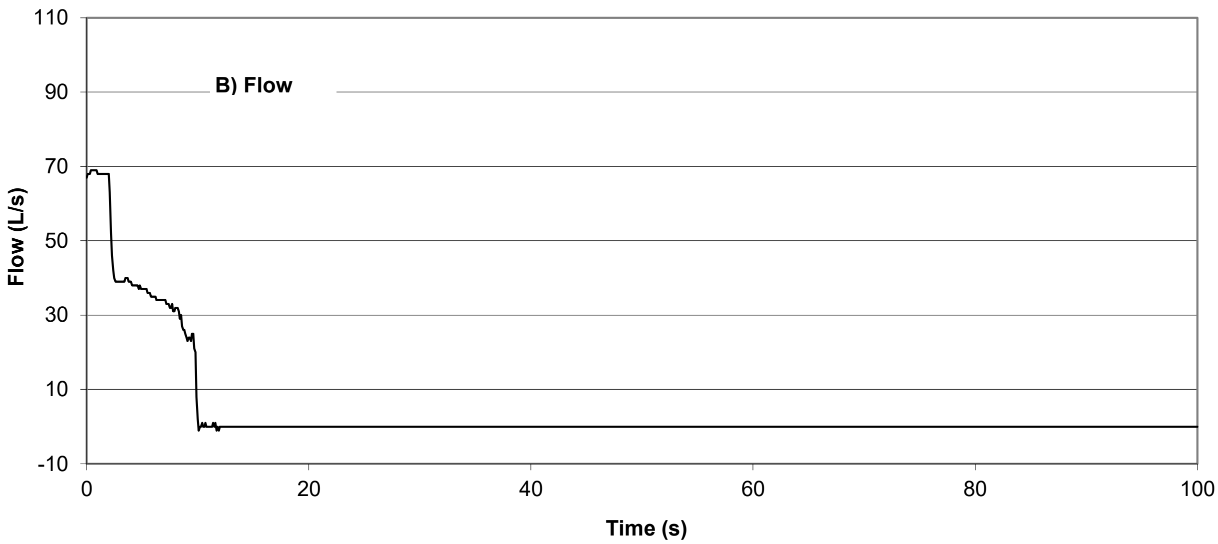
- Other considerations for Scenario 2 conditions (Existing pump units with existing dual forcemains plus one new forcemain): The discharge manhole (SAN MH-5) and a portion of the existing forcemains is located at a higher elevation which is above the invert of the new/proposed forcemain outlet for Scenario 2. As such, reversal flow from the existing dual forcemains will occur and continue discharging at the discharge manhole of the new/proposed 300 mm forcemain after each pump cycle, until the HGL at the dual forcemains approaches 106.8 m (invert elevation of the new/proposed forcemain outlet). Because of this, half of the dual forcemains may be empty. Initially, the flow fills the empty pipe section along the existing dual forcemains during each pump cycle. The pipe filling may be considered for sizing the wet well storage volume and/or pump selection by others.

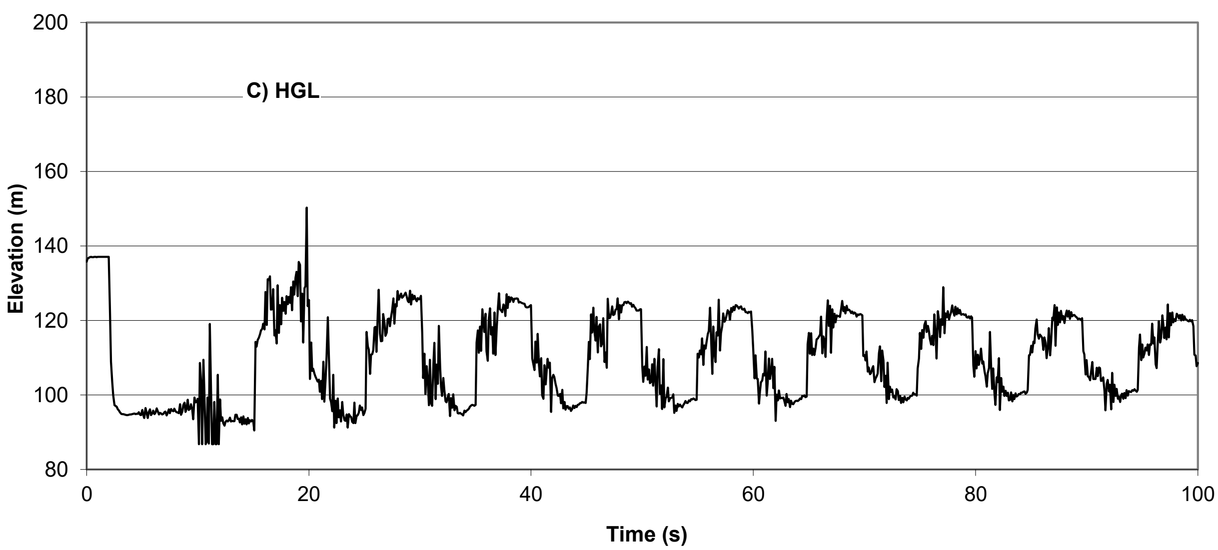
ATTACHMENTS



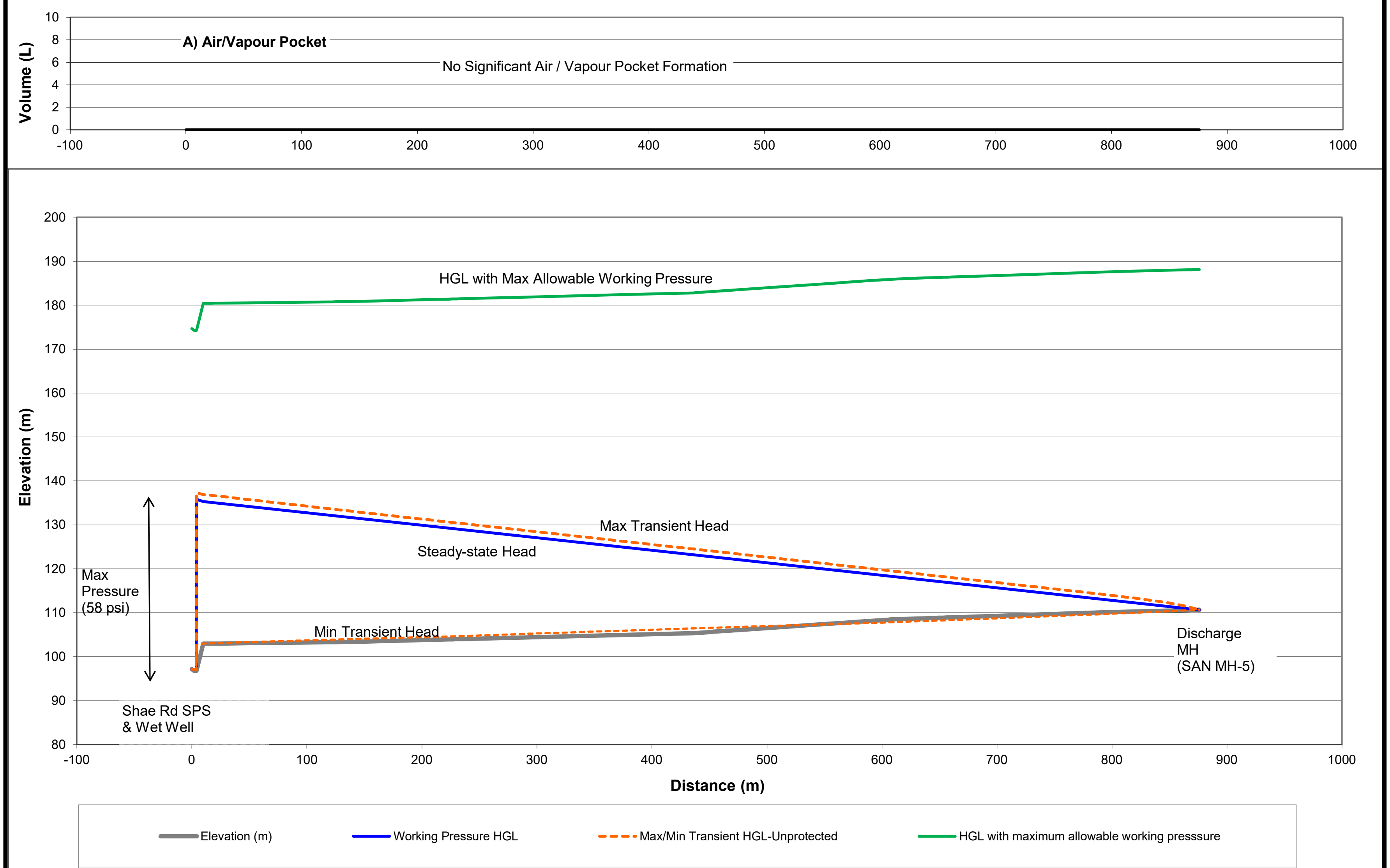
	Project: 147554	October 2024	**Scenario 1 – Pumping Station Upgrades with Existing Dual Forcemains**
	ARCADIS	Attachment 1	Transient Envelopes for Existing Dual Forcemains from Shae Road SPS to Discharge MH (SAN MH-5) upon **Emergency Pump Shutdown** without Surge Protection



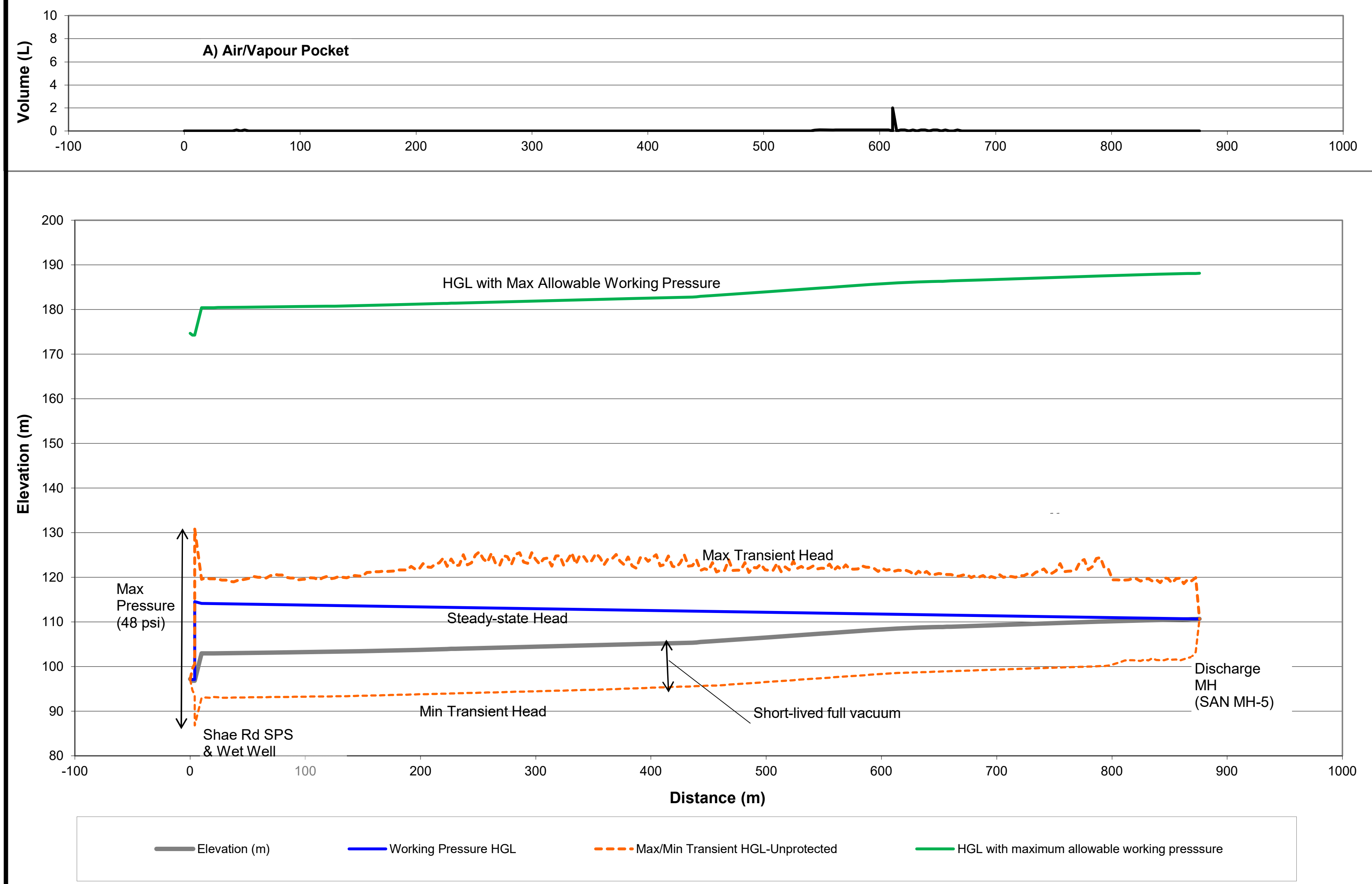




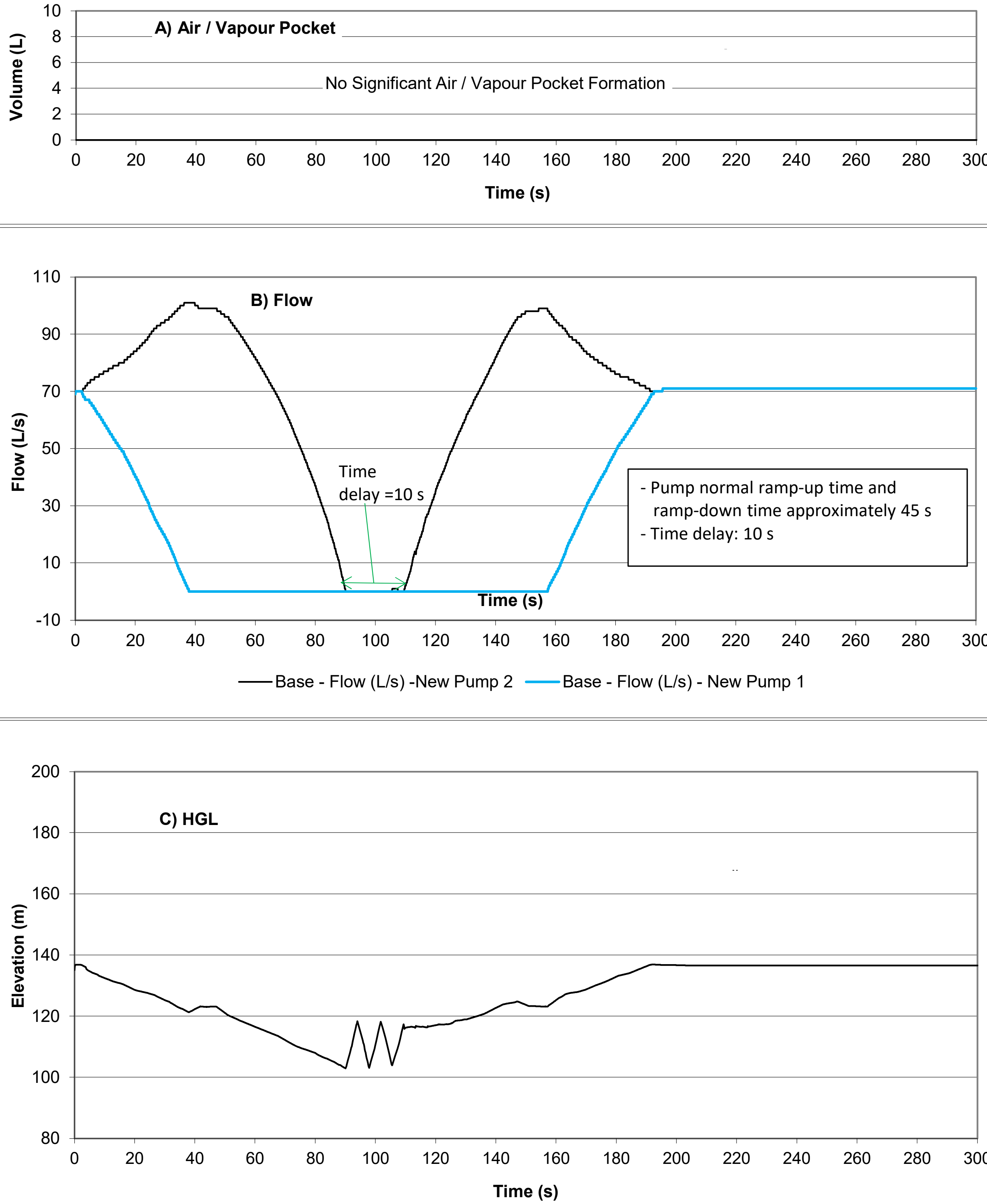
Project: 147554	October 2024	**Scenario 1 – Pumping Station Upgrades with Existing Dual Forcemains**
ARCADIS	Attachment 1A	Transient History at the Proposed Shea SPS upon Emergency Pump Shutdown without Surge Protection



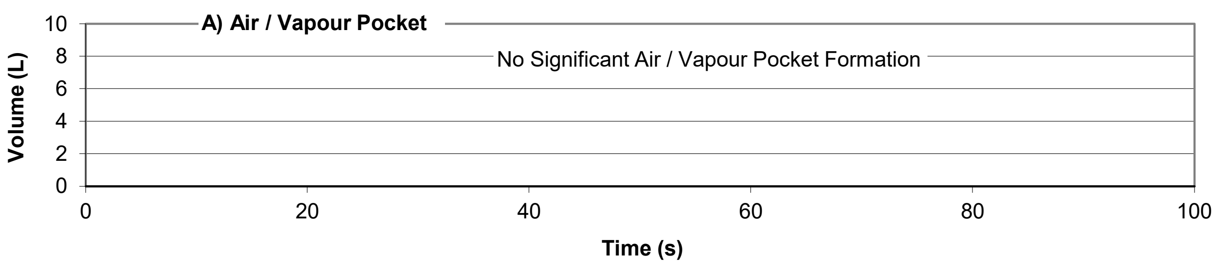
Project: 147554	October 2024	**Scenario 1 – Pumping Station Upgrades with Existing Dual Forcemains**
ARCADIS	Attachment 2	Envelopes for Existing Dual Forcemains from Shae Road SPS to Discharge MH (SAN MH-5) upon **Normal Pump Shutdown and Re-start** without Surge Protection

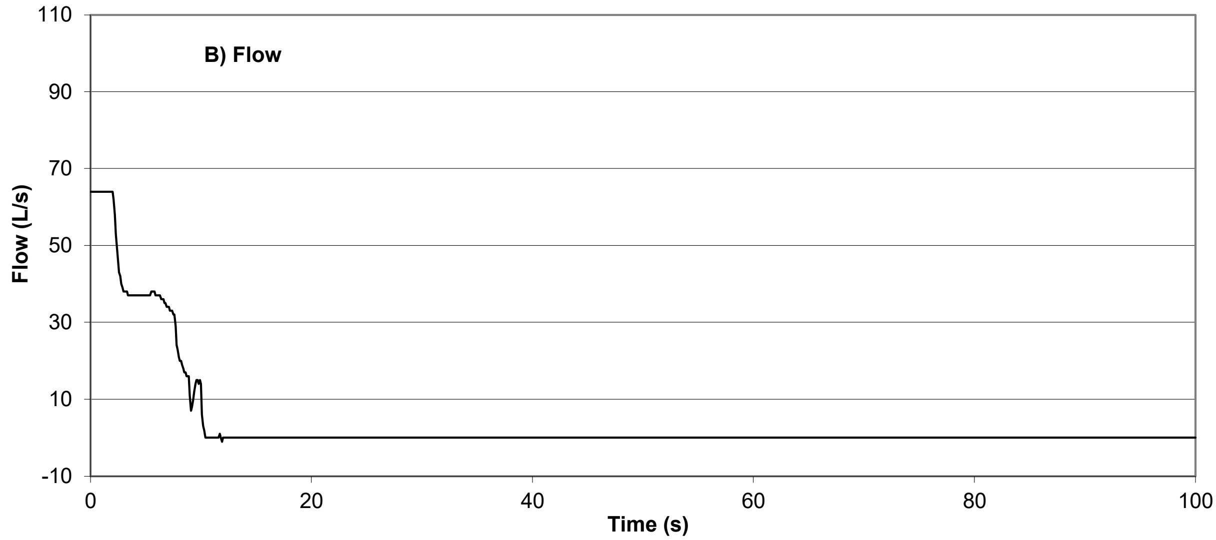


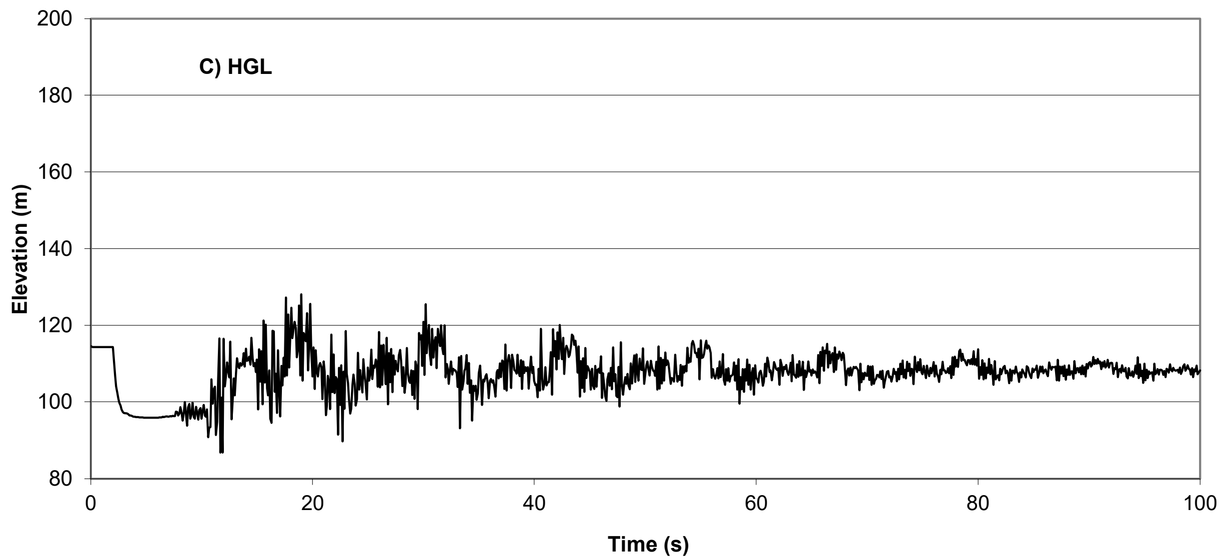
Project: 147554	October 2024	**Scenario 2 – Existing Pumps with Existing Dual Forcemains plus One New Forcemain**
ARCADIS	Attachment 3	Envelopes for Existing Dual Forcemains from Shae Road SPS to Discharge MH (SAN MH-5) upon **Emergency Pump Shutdown** without Surge Protection



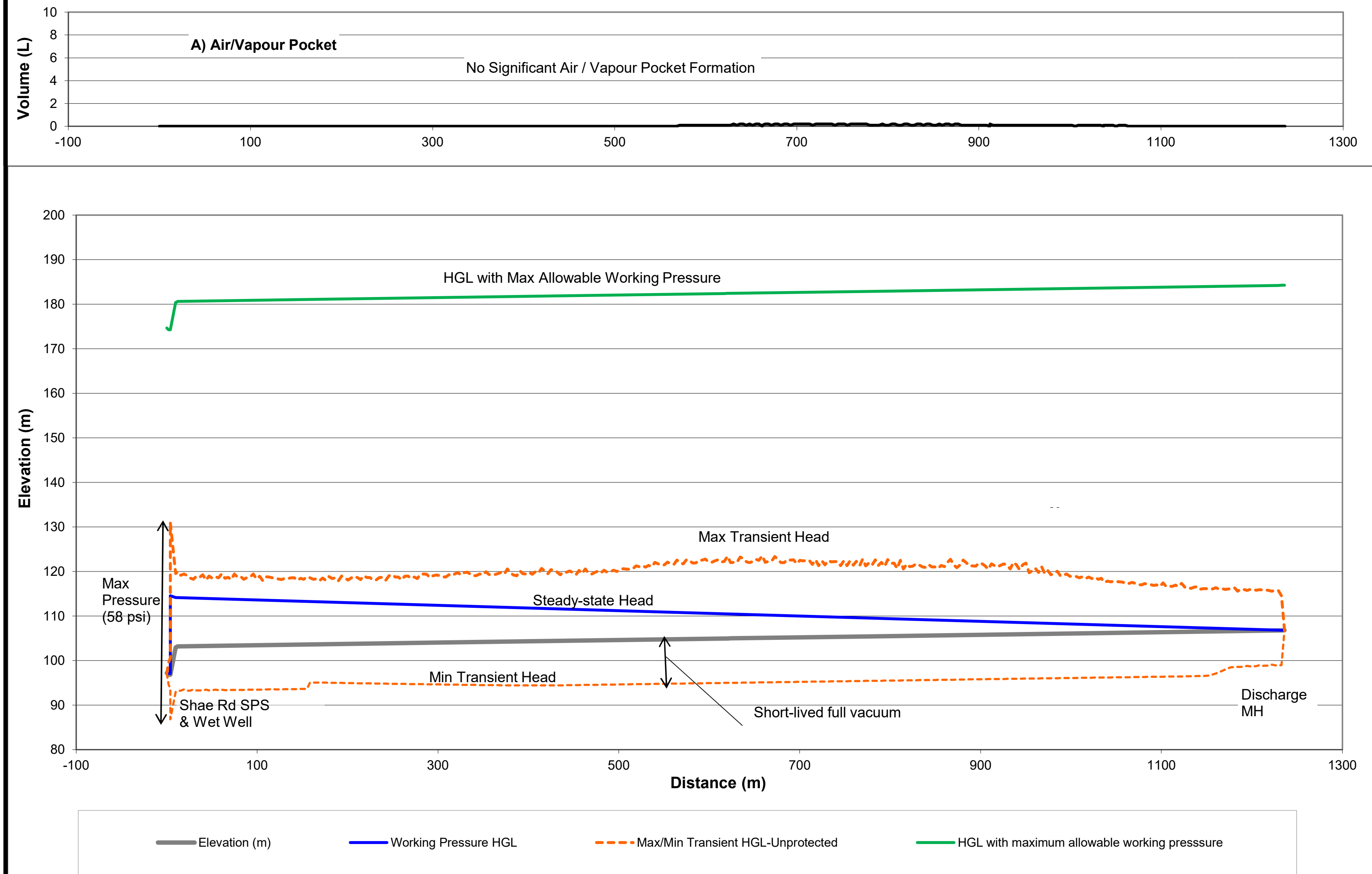
	Project: 147554	October 2024	**Scenario 1 – Pumping Station Upgrades with Existing Dual Forcemains**
	ARCADIS	Attachment 2A	Transient History at the Proposed Shea SPS under Normal Pump Shutdown and Re-start without Surge Protection



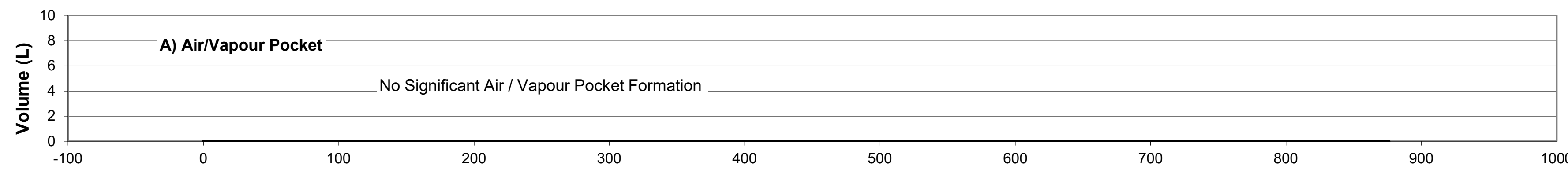


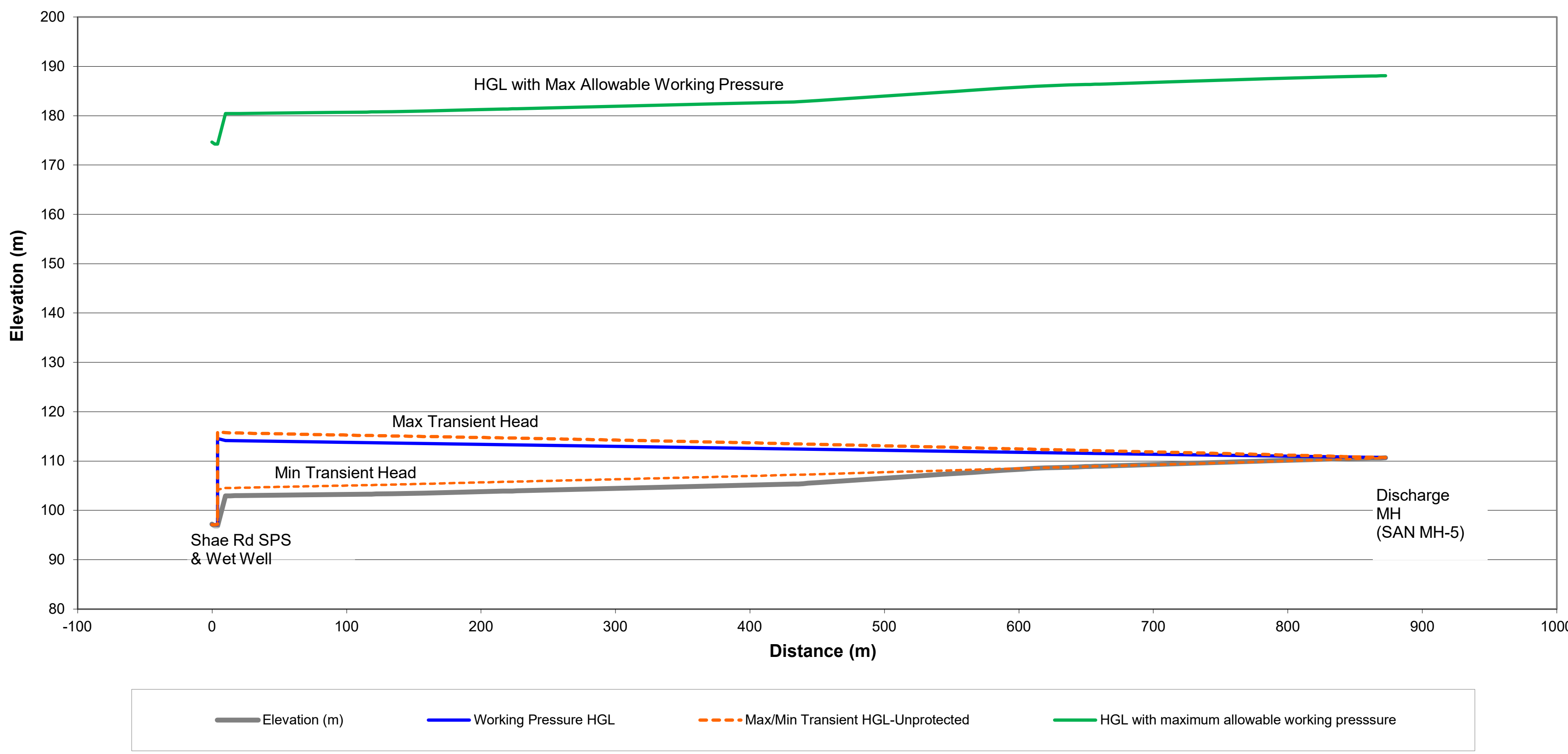


Project: 147554	October 2024	**Scenario 2 – Existing Pumps with Existing Dual Forcemains plus One New Forcemain**
ARCADIS	Attachment 3A	Transient History at the Existing Shea SPS upon Emergency Pump Shutdown without Surge Protection

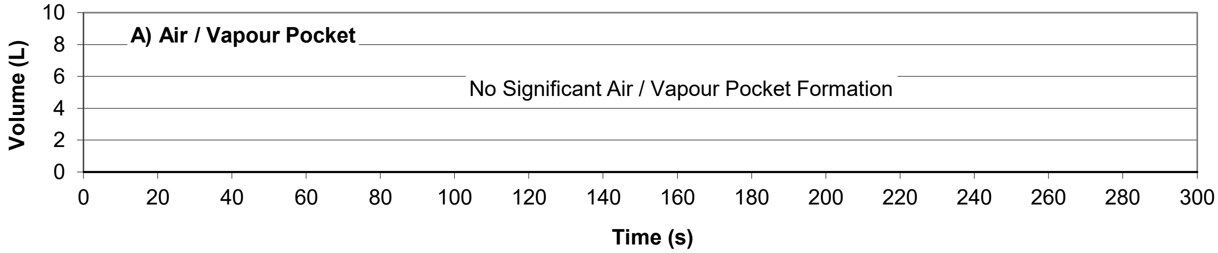


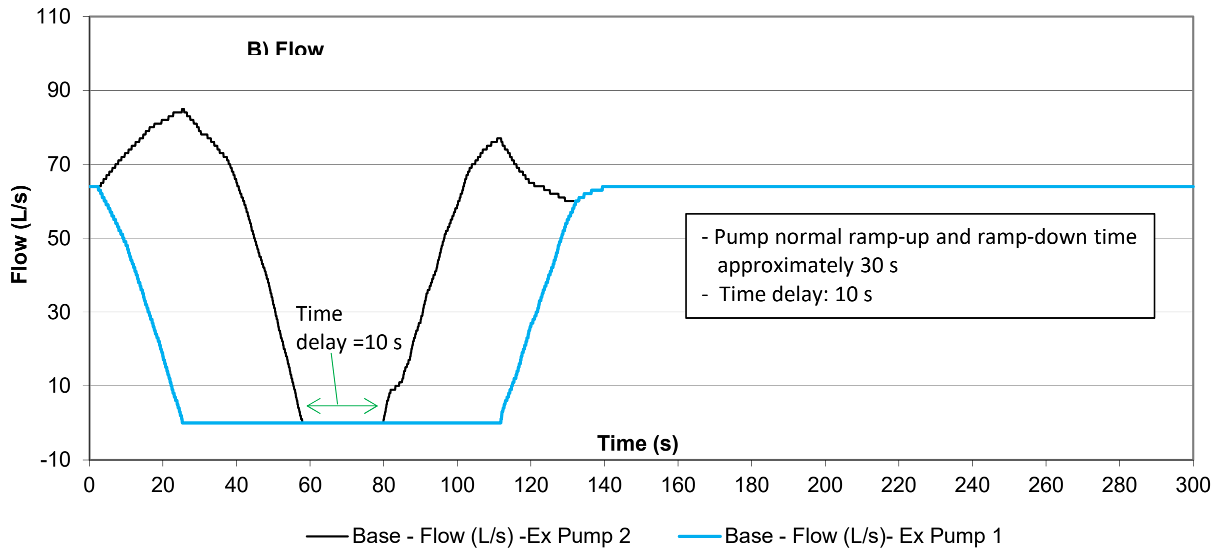
Project : 147554		**Scenario 2 – Existing Pumps with Existing Dual Forcemains plus One New Forcemain**
ARCADIS	Attachment 4	Envelopes for the New Forcemain from Shae Road SPS to Discharge MH upon **Emergency Pump Shutdown** without Surge Protection

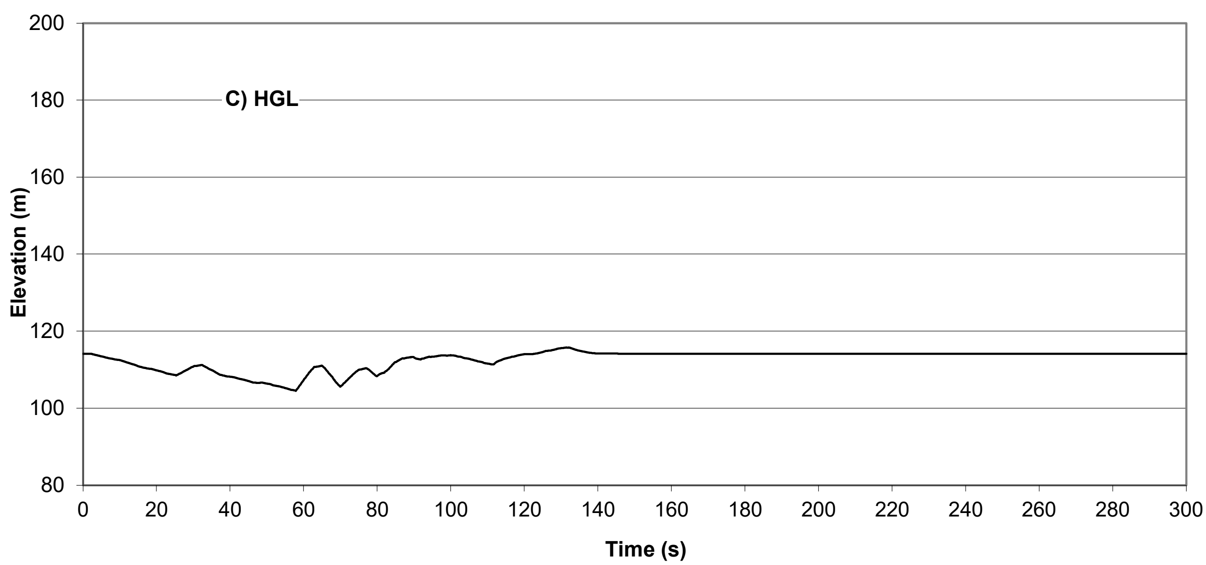




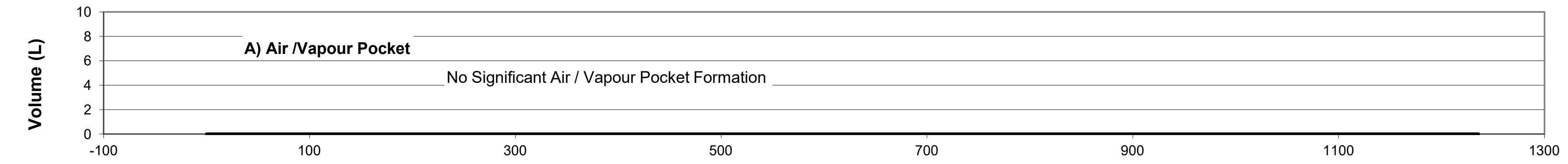
Project: 147554	October 2024	**Scenario 2 – Existing Pumps with Existing Dual Forcemains plus One New Forcemain**
ARCADIS	Attachment 5	Envelopes for the Existing Forcemain from the Existing Shae Road SPS to Discharge MH (SAN MH-5) **under Normal Pump Shutdown and Re-start** without Surge Protection

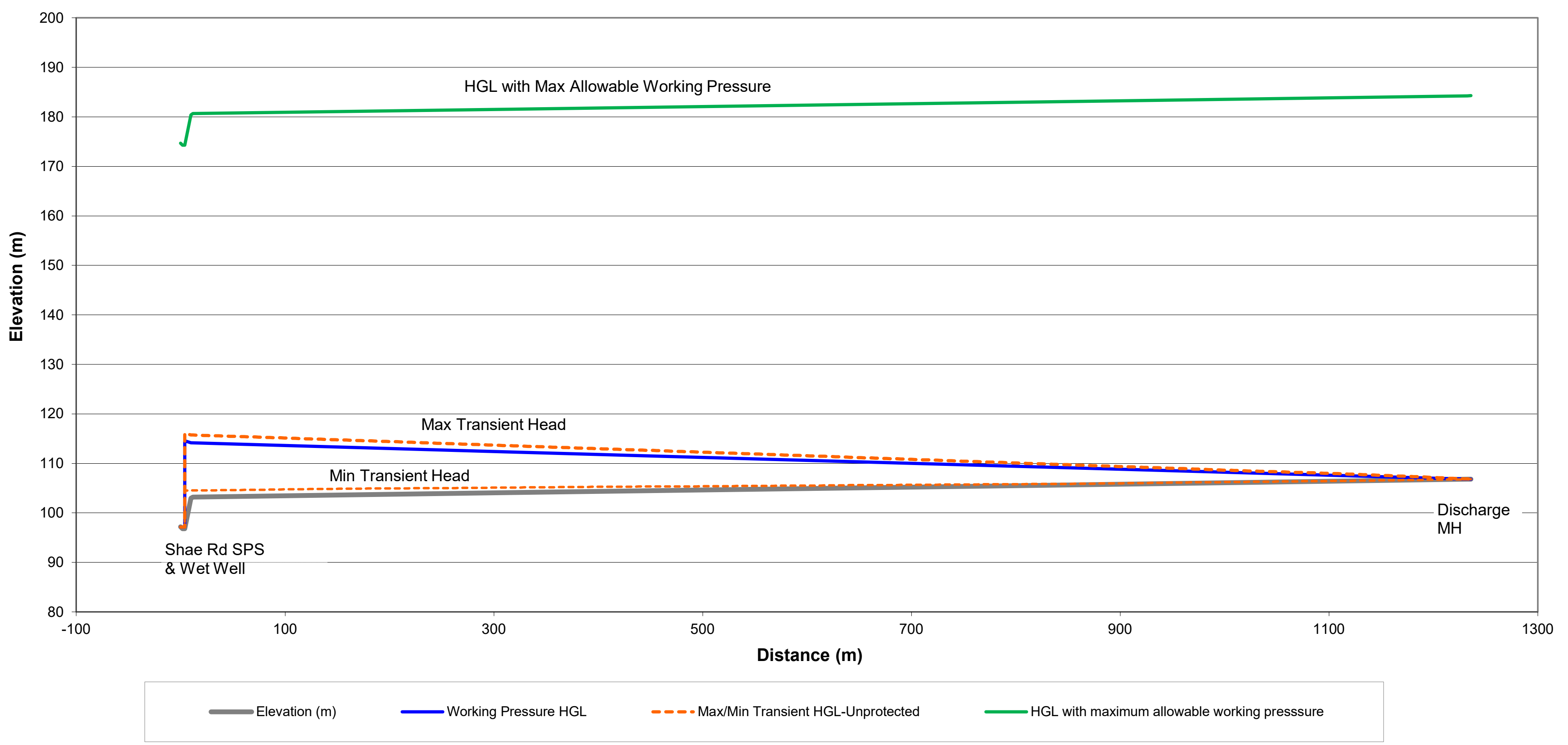






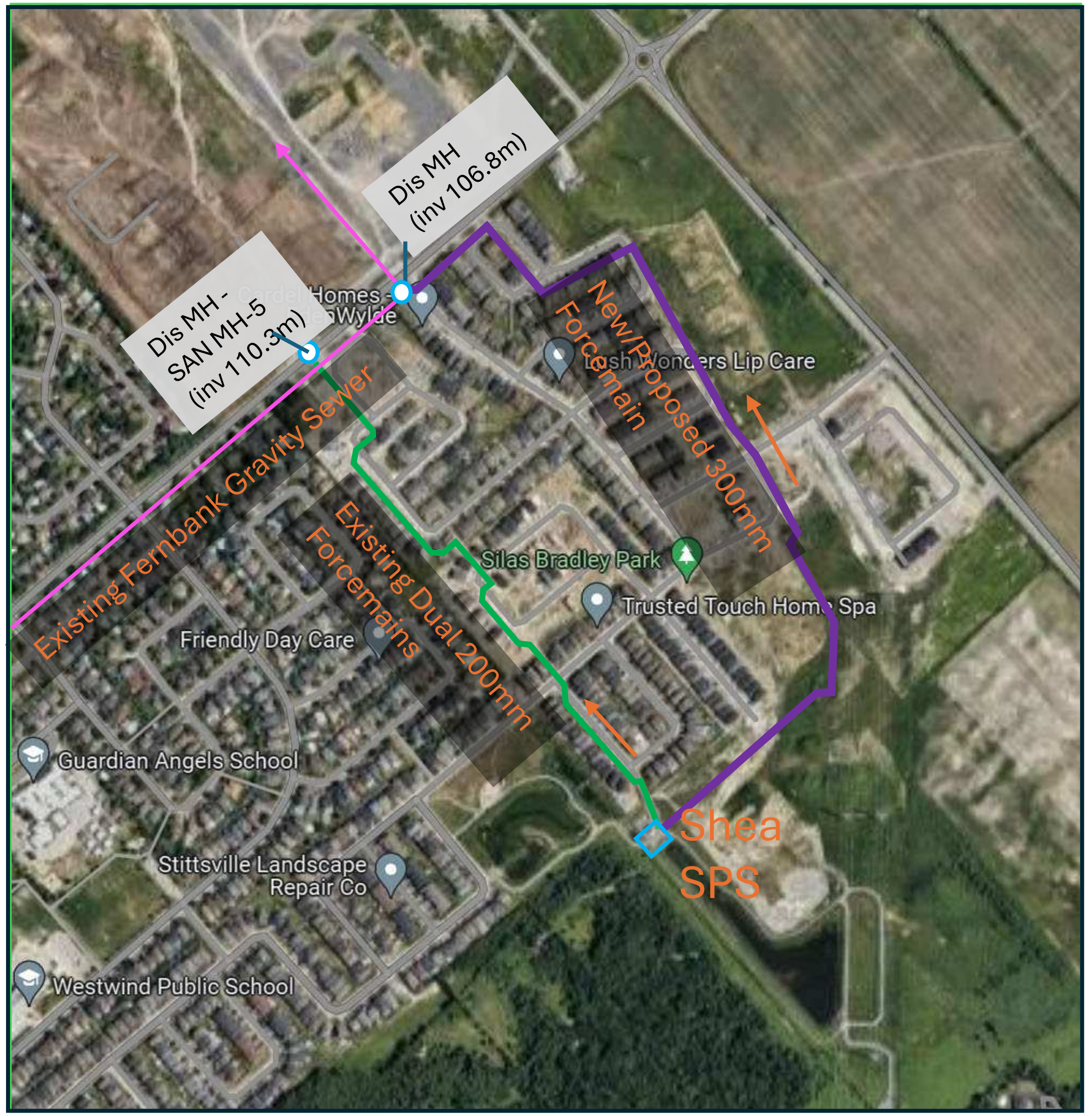
Project:147554	October 2024	**Scenario 2 – Existing Pumps with Existing Dual Forcemains plus One New Forcemain**
ARCADIS	Attachment 5A	Transient History at the Existing Shea SPS under Normal Pump Shutdown and Re-start without Surge Protection



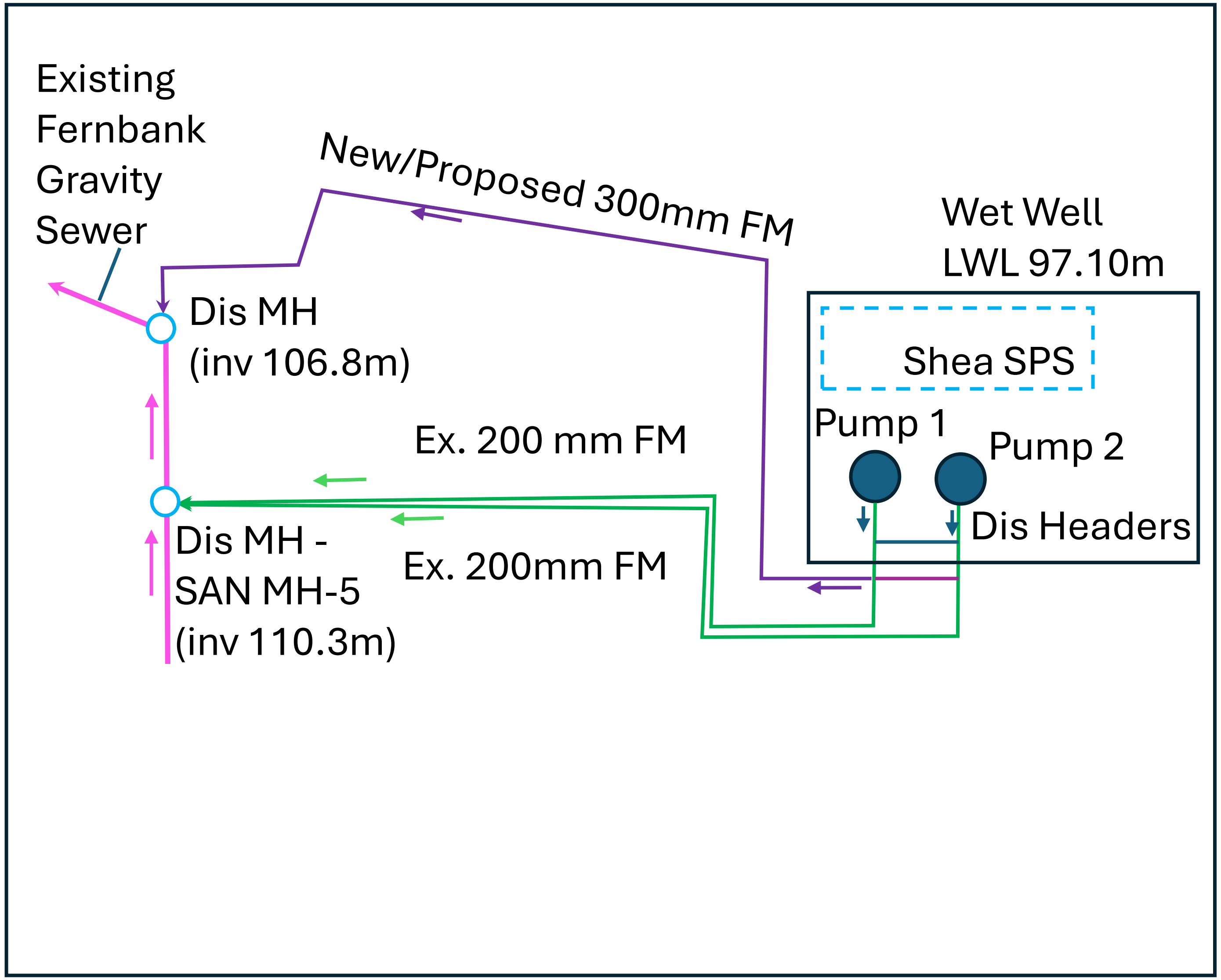


Project: 147554	October 2024	**Scenario 2 – Existing Pumps with Existing Dual Forcemains plus One New Forcemain**
ARCADIS	Attachment 6	Envelopes for the New Forcemain from the Existing Shae Road SPS to Discharge MH under **Normal Pump Shutdown and Re-start** without Surge Protection

APPENDIX A
Location Map



Plan View of Shea SPS and Forcemain System



Schematic of Shea SPS and Forcemain System

APPENDIX B
Background Information

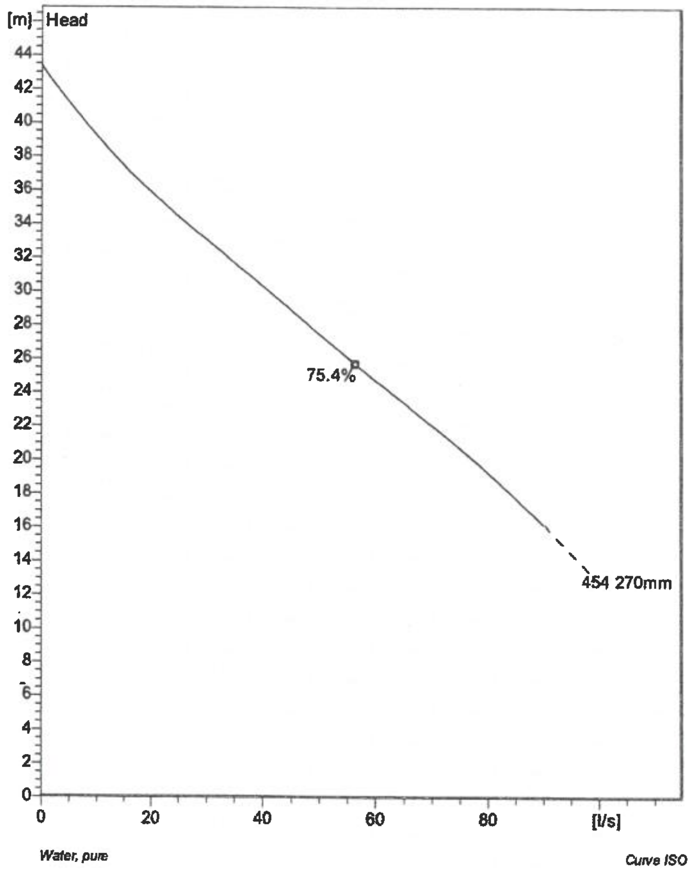
Existing pumps at Shea SPS

xylem

NP 3171 HT 3~ 454

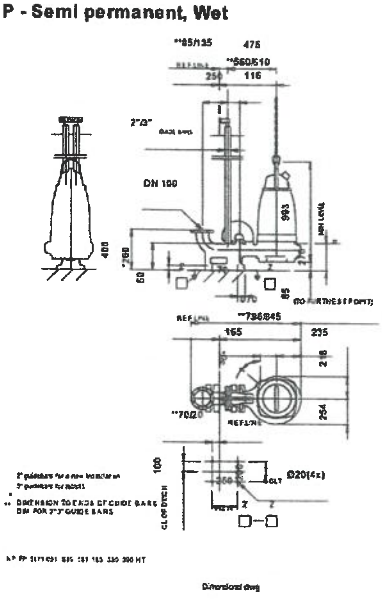
Technical specification

FLYGT



Note: Picture might not correspond to the current configuration.

Installation: **P - Semi permanent, Wet**



General

Patented self cleaning semi-open channel impeller, ideal for pumping in waste water applications. Possible to be upgraded with Guide-pin® for even better clogging resistance. Modular based design with high adaptation grade.

Impeller

Impeller material	Grey cast iron
Discharge Flange Diameter	100 mm
Inlet diameter	100 mm
Impeller diameter	270 mm
Number of blades	2

Motor

Motor #	N3171.181 25-17-4AA-W 30hp
Stator variant	6
Frequency	60 Hz
Rated voltage	600 V
Number of poles	4
Phases	3~
Rated power	30 hp
Rated current	29 A
Starting current	194 A
Rated speed	1760 1/min
Power factor	
1/1 Load	0.84
3/4 Load	0.79
1/2 Load	0.67
Efficiency	
1/1 Load	89.0 %
3/4 Load	90.0 %
1/2 Load	90.0 %

Configuration

FLYGT MODEL NP-3171 SUBMERSIBLE PUMP 600 VOLT 3/60 30HP/22KW 1760 RPM HT IMP 454 VOL 4" 20M 4G10+S(2X0.5) 20M S24X1.5MM2 MAS READY FLUSH VALVE READY EPOXY INT/ EXT

OPTIONS:

- PT-100 IN LOWER BEARING
- PT-100 IN ONE STATOR WINDING
- EXTRA FLS IN JUNCTION BOX
- PUMP MEMORY
- VIBRATION SENSOR VIS-10

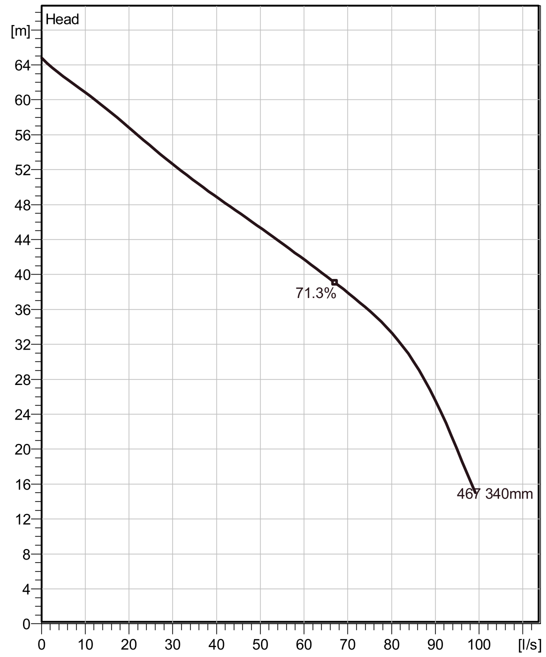
Project	Project ID	Created by	Created on	Last update
			2016-03-10 20:34:53	

NP 3202 HT 3~ 467

Patented self cleaning semi-open channel impeller, ideal for pumping in waste water applications. Modular based design with high adaptation grade.

Technical specification

Curves according to: Water, pure Water, pure [100%],277 K,999.9 kg/m³,1.5692 mm²/s



Curve: ISO 9906

Nominal (mean) data shown. Under- and over-performance from this data should be expected due to standard manufacturing tolerances.
Please consult your local Flygt representative for performance guarantees.

Configuration

Motor number
N3202.185 30-24-4AA-W
60hp

Installation type
P - Semi permanent, Wet

Impeller diameter
340 mm

Discharge diameter
100 mm

Pump information

Impeller diameter
340 mm

Discharge diameter
100 mm

Inlet diameter
200 mm

Maximum operating speed
1775 1/min

Number of blades
2

Max. fluid temperature
40 °C

Material

Impeller
Hard-Iron ™

Project	Xylect-20308627	**Created by**	Eric Mondoux		
Block		**Created on**	7/11/2024	**Last update**	7/11/2024

proposed/New Pumps for Shea SPS

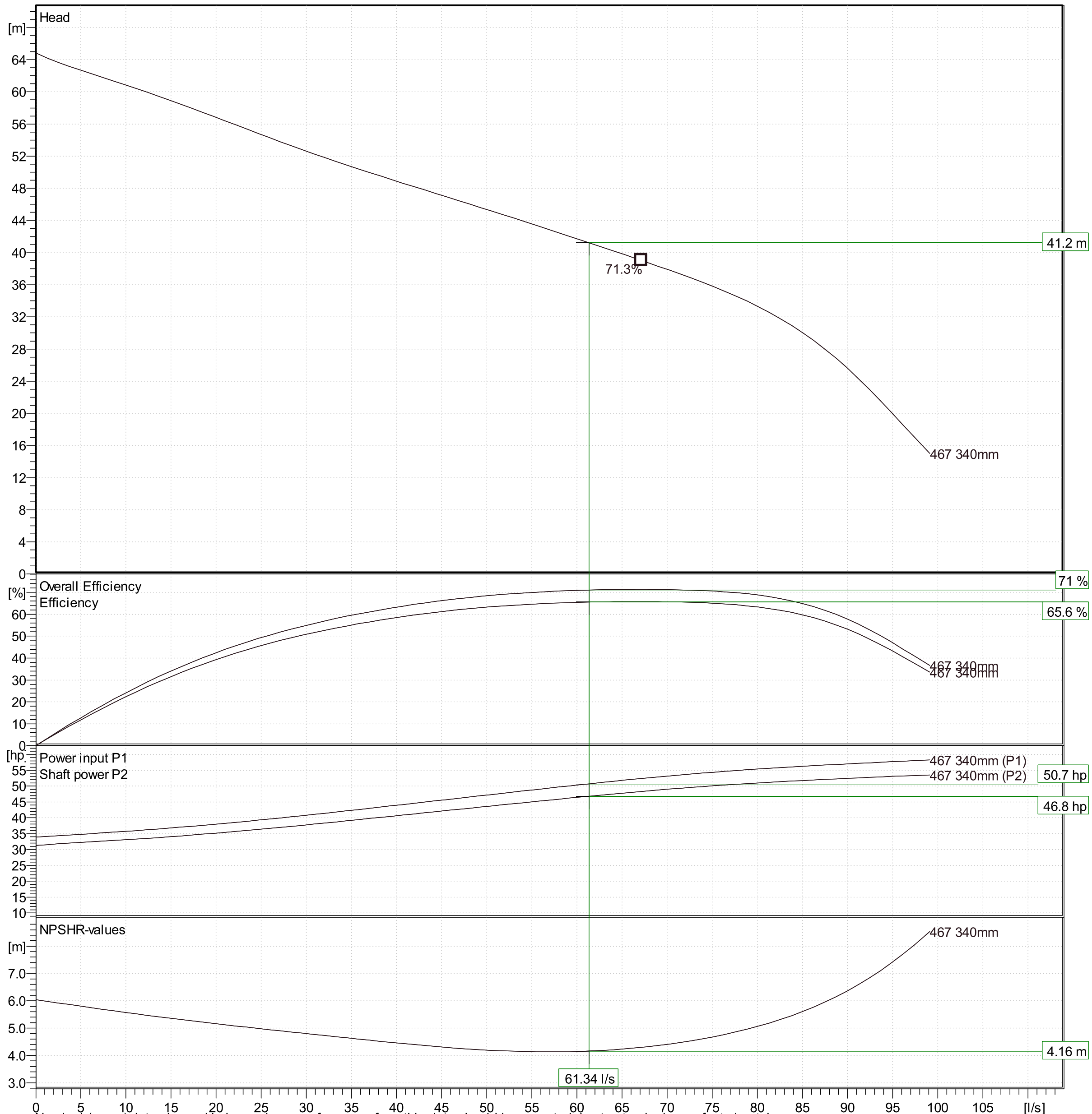
NP 3202 HT 3~ 467

Performance curve

Duty point

Flow	Head
61.3 l/s	41.2 m

Curves according to: Water, pure Water, pure [100%],277 K,999.9 kg/m³,1.5692 mm²/s



Nominal (mean) data shown. Under- and over-performance from this data should be expected due to standard manufacturing tolerances.
Please consult your local Flygt representative for performance guarantees.

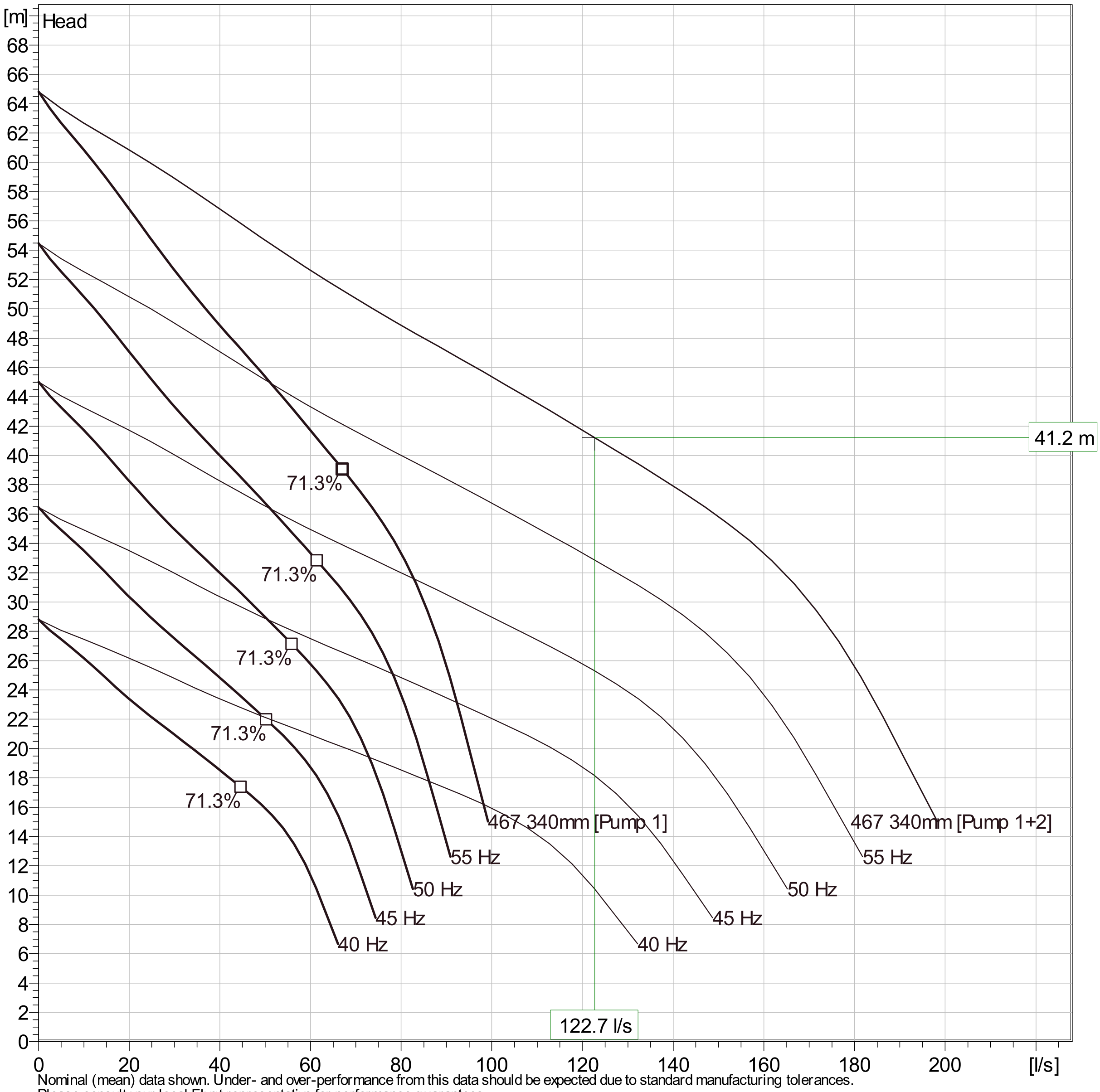
Curve: ISO 9906

Xylect-20308627		Eric Mondoux		
	Created on	7/11/2024	**Last update**	7/11/2024

NP 3202 HT 3~ 467

Duty Analysis

Curves according to: Water, pure [100%] ; 277K; 999.9kg/m³; 1.5692mm²/s



Nominal (mean) data shown. Under- and over-performance from this data should be expected due to standard manufacturing tolerances.
Please consult your local Flygt representative for performance guarantees.

Operating characteristics

Pumps / Systems	Flow	Head	Shaft power	Flow	Head	Shaft power	Hydr.eff.	Spec. Energy	NPSHre
	l/s	m	hp	l/s	m	hp		kWh/m³	m
2 / 1	61.3	41.2	46.8	123	41.2	93.6	71 %	0.171	4.16
1 / 1	88	27.5	52.2	88	27.5	52.2	61.1 %	0.133	6.03

Project		**Created by**	Eric Mondoux		
Block	Xylect-20308627	**Created on**	7/11/2024	**Last update**	7/11/2024

MODERN NIAGARA | *Design. Build. Service.*

09/23/2016 9:00 AM

Submittal

Project: Shea Road Pumping Station

Project #: o-16-2604

Address: Shea Road

Description: Shea Road Pumping Station Install

Reference: 13

Date: September 23rd, 2016

Transmitted to: Mr. Scott Shepard

Transmitted By: Bryce Lemoine

CC:

Distribution List:

SHOP DRAWING REVIEW

This review is for the sole purpose of ascertaining conformance with general design concept. It shall not mean that NOVATECH ENGINEERING CONSULTANTS LTD. approves the detail design inherent in the shop drawings, responsibility for which shall remain with the contractor submitting same, and shall not relieve the contractor of his responsibility for meeting all requirements of the contract documents.

Received

Project No. Drawing No.

[X] Reviewed [ ] Reviewed as Modified

[ ] Revise and Resubmit [ ] Not Reviewed

Reviewed By.... Date OCT 21, 2016

NOVATECH ENGINEERING CONSULTANTS LTD.

Attached Item:

SPEC: Surge Relief Valve

Revision	QTY	Description	Status
0	1	Shop Drawings for Surge Relief Valve	

Remarks:

FLOVAL EQUIPMENT LTD.
250 RAYETTE ROAD UNIT 1, CONCORD, ON, L4K 2G6
TEL. (905)669-4500, 1-800-387-3784,
FAX (905)669-4905,
QMS Registered to ISO 9001-2008

DRAWINGS SUBMITTAL

PROJECT	SHEA RD. SPS
CONTRACTOR	MODERN NIAGARA
P.O.	O-16-2604-009
FLOVAL#	160858
FLOVAL OUTSIDE SALES CONTACT	TODD MCLAREN
FLOVAL INSIDE SALES CONTACT	MARIUS GROZA

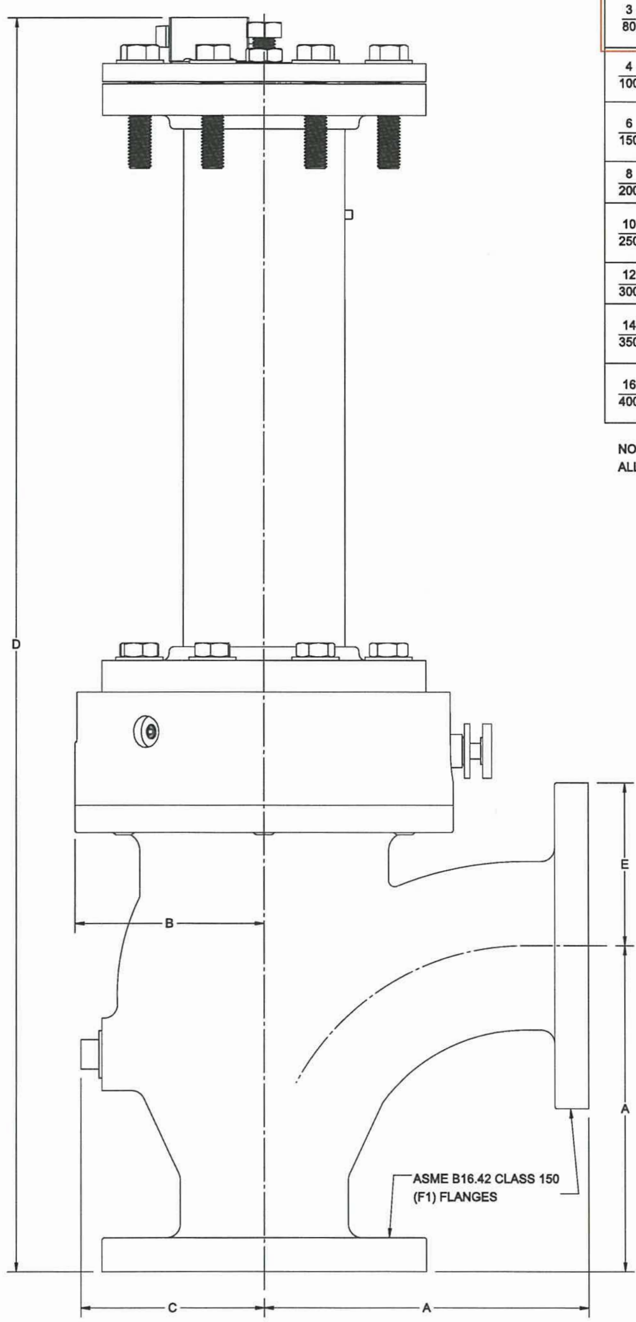
SECTION: 11160 2.11	**DEZURIK SURGE RELIEF VALVE**
VALVE MODEL	SRA,3,3000A,F1,DI,200P,S2,S2,NBR,S40SD0
SRA	APCO SEWAGE SURGE RELIEF VALVE
3	75 MM (3 INCH) SIZE
3000A	VALVE STYLE
F1	ANSI 125# FLANGED END CONNECTIONS
DI	DUCTILE IRON BODY MATERIAL
200P	TO 200 PSI PRESSURE RELIEF RANGE
S2	316 STAINLESS STEEL DISCCOMBINATION
S2	316 STAINLESS STEEL BODY SEAT MATERIAL
NBR	ACRYLONITRILE-BUTADIENE DISC SEAT MATERIAL
S40SD0	12 MILS INT/EXT EPOXY COATING

TAG/ITEM	Qty	Order Code	DRAWINGS
I	1	SRA,3,3000A,F1,DI,200P,S2,S2,NBR,S40SD0	SEE ATTACHED
	SIZE	75 MM (3 INCH) SIZE	

NOTE: SET PRESSURE TO BE ADVISED AT RELEASE TIME

VALVE SIZE	A	B	C	RELIEF PRESSURE SET-POINT (PSI)	D	E
2 / 50	6.50 / 165	4.50 / 114	3.50 / 89	30-135	26.94 / 684	3.00 / 76
				140-200	31.81 / 808	
3 / 80	7.75 / 197	5.25 / 133	4.25 / 108	30-60	29.44 / 748	3.75 / 95
				65-180	34.31 / 872	
				185-200	41.13 / 1045	
4 / 100	9.00 / 229	5.25 / 133	5.13 / 130	30 ONLY	29.81 / 757	4.50 / 114
				35-95	34.69 / 881	
				100-200	41.50 / 1054	
6 / 150	11.50 / 292	6.75 / 171	6.38 / 162	30-35	38.06 / 967	5.50 / 140
				40-110	44.88 / 1140	
				115-200	54.00 / 1372	
8 / 200	14.00 / 356	8.63 / 219	7.63 / 194	30-60	49.13 / 1248	6.75 / 171
				65-200	58.25 / 1480	
10 / 250	16.50 / 419	9.50 / 241	9.94 / 252	30-35	53.38 / 1356	8.00 / 203
				40-120	62.50 / 1588	
				125-200	75.06 / 1907	
12 / 300	19.00 / 483	10.50 / 267	10.94 / 278	30-55, 75-80	66.25 / 1683	9.50 / 241
				60-70, 85-200	78.81 / 2002	
14 / 350	21.50 / 546	11.75 / 298	13.94 / 354	30-50	70.00 / 1778	10.50 / 267
				55-150	82.56 / 2097	
				155-200	83.31 / 2116	
16 / 400	24.00 / 610	11.75 / 298	14.44 / 367	30-40	75.25 / 1911	11.75 / 298
				45-110	87.81 / 2230	
				115-200	88.56 / 2249	

NOTE:
ALL DIMENSIONS ARE SHOWN IN INCHES/MILLIMETERS.

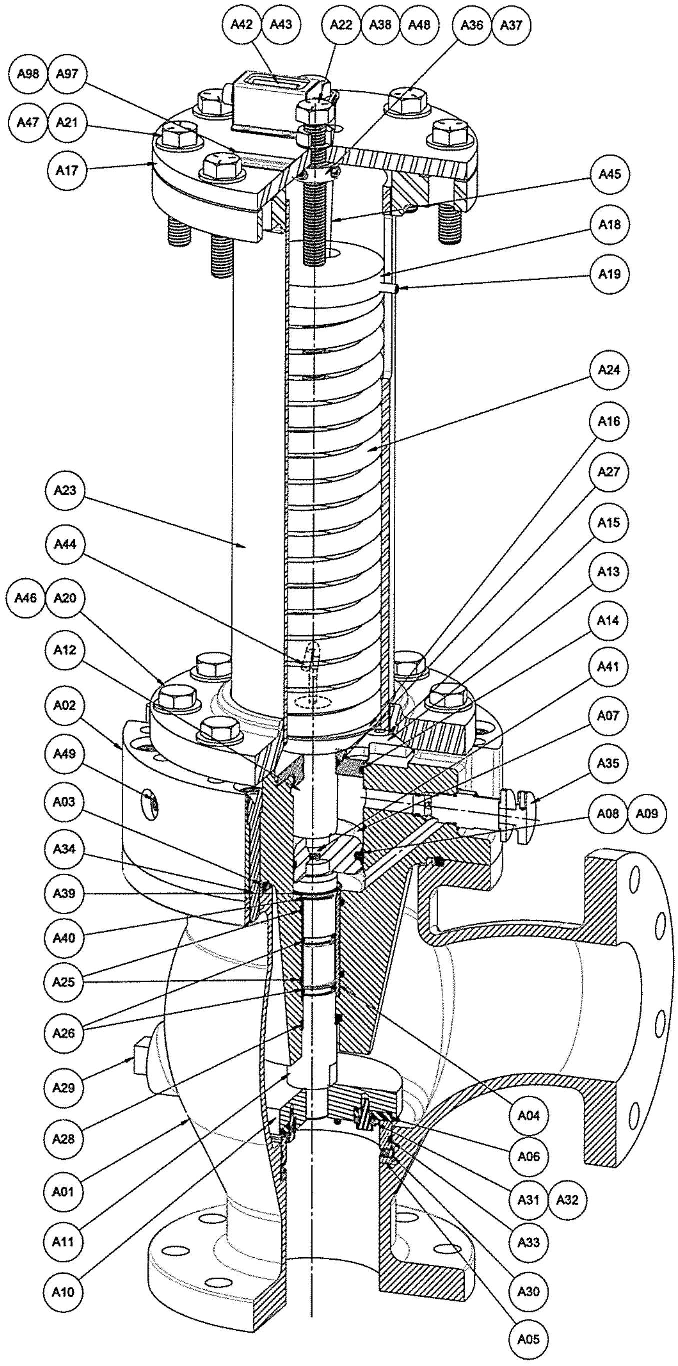


DeZURIK
APCO | HILTON

APCO SRA - SURGE RELIEF ANGLE VALVE, SERIES 3000A,
2-16" INSTALLATION DRAWING

DOC'T CODE	DRAWN	APPROVED	
C1	JPD	TMO	A70148
	CHECKED TMO	DATE 11/05/2015	

G F E D C B 50312 A 3/9/16



DET	DESCRIPTION	QTY
A1	BODY	1
A2	COVER	1
A3	COVER O-RING	1
A4	LOWER SHAFT BUSHING	1
A5	BODY SEAT	1
A6	DISC SEAT	1
A7	PISTON	1
A8	PISTON SEAL	1
A9	PISTON SEAL ENERGIZING O-RING	1
A10	DISC	1
A11	LOWER SHAFT	1
A12	UPPER SHAFT	1
A13	CYLINDER CHAMBER CAP	1
A14	CYLINDER CHAMBER CAP O-RING	1
A15	CYLINDER CHAMBER CAP SCREWS	-
A16	SPRING PRESSURE PLATE GUIDE	1
A17	SPRING COMPRESSION TOP FLANGE	1
A18	SPRING COMPRESSION GUIDE	1
A19	ANTI-ROTATION SET SCREW	1
A20	PIPE ASSEMBLY LOWER SCREWS	-
A21	PIPE ASSEMBLY UPPER SCREWS	-
A22	SPRING COMPRESSION SCREW	1
A23	SPRING COMPRESSION PIPE ASSEMBLY	1
A24	COMPRESSION SPRING[1]	-
A25	BUSHING O-RING	2
A26	LOWER SHAFT O-RING	2
A27	UPPER SHAFT O-RING	1
A28	ROD WIPER	1
A29	INSPECTION HOLE PIPE PLUG	1
A30	BODY SEAT RETAINING SCREW	-
A31	DISC SEAT RETAINING RING[2]	1
A32	DISC SEAT RETAINING SCREW	-
A33	BODY SEAT O-RING	1
A34	COVER SCREWS	-
A35	FLOW CONTROL VALVE	1
A36	SHAFT COLLAR	1
A37	NEEDLE THRUST BEARING (6"-16")[3]	1
A38	LOCK NUT	1
A39	LOWER SHAFT RETAINING RING	1
A40	BUSHING RETAINING RING	1
A41	PISTON ASSEMBLY SCREW	1
A42	MECHANICAL COUNTER	1
A43	MECHANICAL COUNTER MOUNTING SCREWS	4
A44	MECHANICAL COUNTER HOOK (WITH LOCK NUT)	1
A45	MECHANICAL COUNTER WIRE	1
A46	PIPE ASSEMBLY LOWER SCREW WASHER	-
A47	PIPE ASSEMBLY UPPER SCREW WASHER	-
A48	SPRING COMPRESSION SCREW WASHER	-
A49	OIL FILL PIPE PLUG	3
A97	DATA PLATE	1
A98	DRIVE SCREW	2

NOTE:

1. MULTIPLE SPRINGS ARE NESTED INSIDE EACH OTHER FOR CERTAIN RELIEF PRESSURE SET-POINTS FOR SIZES 8"-16".
2. A TWO PIECE DISC SEAT RETAINING RING IS FURNISHED FOR SIZE 3"
3. PART NOT INCLUDED FOR CERTAIN RELIEF PRESSURE SET-POINTS FOR SIZES 6"-10".
4. RECOMMENDED SPARES ARE ITEMS A3, A6, A8, A9, A14, A25, A26, A27, A28, & A33.

G	F	E	D	C	B	A
						50312 3/28/16

DeZURIK
APCO | HILTON

APCO SRA - SURGE RELIEF ANGLE VALVE, SERIES 3000A
BASE VALVE ASSEMBLY

DOC'T. CODE	DRAWN	APPROVED	
C1	JPD	TMO	A70149
	CHECKED TMO	DATE 11/02/2015	

Shea Road Pump Station
Evaluation Matrix of Upgrade Options

Novatech File No.: 122163
Date: 2024/12/19

Evaluation Criteria	Weight	Indicators	Discussion of Options	Score		
				Option 1	**Option 2**	**Option 3**
				Major pump station upgrades to building components, mechanical and electrical. Existing forcemains to be utilized. New 60HP pumps with a firm capacity of 120L/s.	**Abandon and upsize existing dual 200mm dia. forcemains to dual 300mm dia. forcemains. Minor pump station upgrades to mechanical (valve chamber and bypass manhole piping) and electrical. Similar HP pumps with a firm capacity of 130L/s.**	**New 300mm dia. forcemain, discharge chamber and gravity outlet. Minor pump station upgrades to mechanical (valve chamber and bypass manhole piping) and electrical. Existing forcemains to be utilized. Similar HP pumps with a firm capacity of 130L/s.**
Design and Constructability	**30%**					
Ease of Design and Approvals	15%	- Flexibility of design to accommodate wastewater flows, and/or changes to phasing/buildout. - Design reliability (ie. emergency scenarios). - Difficulty of obtaining necessary approvals.	- Option 1 would have limited flexibility for future upgrades. Upgrades would be capped out at 120L/s. Major electrical upgrades would be required. Operations staff would need to accept higher velocities within the existing forcemains. - Option 2 would have flexibility for future upgrades. Upgrades could achieve 130L/s. Designing around existing utilities and service laterals could be challenging. - Option 3 would have flexibility for future upgrades. Upgrades could achieve 130L/s. Designing around existing utilities could be challenging. - All options require similar approvals. However, public consultation will be required for Options 2 and 3 due to impact to community (see below) and coordination with utilities would be required.	6/10	2/10	8/10
Ease and Flexibility of Construction	15%	- Difficulty of construction. - Potential for encountering utility conflict. - Potential for encountering poor soils/rock conditions. - Potential for encountering elevated groundwater conditions.	- Options 1 could present some challenges in the form of sewer flow management as one of the exising forcemains would need to remain operational at all times. The upgrades to Shea PS building components, mechanical, and electrical would need to be staged. An emergency response plan would be needed in the event the Shea PS goes 'down' while upgrades are being completed. - Option 2 would present significant challenges in the form of sewer flow management as one of the existing forcemains would need to remain operational at all times. The abandonment of the existing forcemains and installation of two new forcemains would need to be staged. An emergency response plan would be needed in the event the operational forcemain breaks and neither forcemain can be used. - Option 3 would allow for continued operation of the existing forcemains while the installation of a new forcemain is being completed. - Potential for encountering utility conflicts low risk for Option 1. - Potential for encountering utility conflicts medium risk for Option 2, as new forcemains utilizing existing forcemains routing. - Potential for encountering utility conflicts high risk for Option 3, as new forcemain using new routing. - Based on Geotech, potential for encountering poor soils is not likely. Rock could be encountered. - Based on Geotech, some dewatering may be required due to groundwater conditions, but nothing significant anticipated.	6/10	2/10	8/10
Operation and Maintenance	**30%**					
Ease and Flexibility of Operation and Maintenance	15%	- Ease and flexibility of operation and maintenance. - Amount of maintenance intensive infrastructure required.	- Option 1 and 2 would have similar flexibilty of operation and maintenance due to the two forcemains. - Option 3 would have the best flexibility of operation and maintenance due to the three forcemains. - All options would include the options for swabs to be launched at the City's discretion for maintenance purposes.	6/10	6/10	8/10
Cost of Operation and Maintenance	15%	- Cost of operation and maintenance, upkeep of intended design.	- All options would have similar operational costs in the form of energy consumption costs associated with pumping. Option 1 would likely have marginally higher operational costs due to the higher HP pumps and electrical demand. - Option 1 and 2 would have similar maintenance costs due to the two forcemains. - Option 3 would have marginally higher maintenance costs due to the three forcemains. Although, a second 300mm dia. forcemain could be added to the new routing to abandon the existing forcemains.	4/10	8/10	6/10

Shea Road Pump Station
Evaluation Matrix of Upgrade Options

Novatech File No.: 122163
Date: 2024/12/19

Evaluation Criteria	Weight	Indicators	Discussion of Options	Score		
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				Major pump station upgrades to building components, mechanical and electrical. Existing forcemains to be utilized. New 60HP pumps with a firm capacity of 120L/s.	**Abandon and upsize existing dual 200mm dia. forcemains to dual 300mm dia. forcemains. Minor pump station upgrades to mechanical (valve chamber and bypass manhole piping) and electrical. Similar HP pumps with a firm capacity of 130L/s.**	**New 300mm dia. forcemain, discharge chamber and gravity outlet. Minor pump station upgrades to mechanical (valve chamber and bypass manhole piping) and electrical. Existing forcemains to be utilized. Similar HP pumps with a firm capacity of 130L/s.**
Natural Environment and Public Affects	**15%**					
Impact of Community	10%	- Potential impact on community (i.e. reinstatements).	- Option 1 would have the least impact on the community as the upgrades and reinstatements would be confined to the Shea PS facility. - Option 2 would have the most impact on the community as it would require abandonment of the existing forcemains and installation of two new forcemains. The existing forcemains routing is located within the existing road allowance and would require extensive reinstatements to existing driveways, roadways, and boulevards. - Option 3 would have the second most impact on the community as it would require installation of a new forcemain. The new forcemain routing would be located within undeveloped lands and the existing road allowance. It would require some reinstatements to existing roadways and boulevards, but no driveway reinstatements would be required.	8/10	2/10	6/10
Impact of Natural Features, Surface Water and Acquatics	5%	- Potential impact on fish/wildlife habitat. - Potential of excessive noise, vibration, and air pollution, caused by construction operations.	- All options would have minimal impact on fish/wildlife habitat. - Option 1 would have the least potential of excessive noise, vibration, and air pollution, caused by construction operations as the upgrades and reinstatements would be confined to the Shea PS facility. - Option 2 would have the most potential of excessive noise, vibration, and air pollution, caused by construction operations of the abandonment of the existing forcemains, installation of two new forcemains, and reinstatements. - Option 3 would have the second most potential of excessive noise, vibration, and air pollution, caused by construction operations of the installation of a new forcemain, and reinstatements.	8/10	4/10	6/10
Level of Service	5%	- Impact on existing infrastructure. - Impact on future infrastructure. - Potential for loss of service.	- The existing Fernbank Trunk Sanitary Sewer has capacity to accomodate the Shea PS upgrades ultimate flows. As such, there will be maginal impact to existing infrastructure. - The intent is that the Shea PS upgrades will accomodate future intrastructure and the ultimate buildout of the Subject Site. As such, there will be no impact to future infrastructure. - Option 1 and 2 would have a similar level of service/redundancy as there will be two forcemains. - Option 3 would have the best level of service/redundancy as there will be three forcemains.	6/10	6/10	8/10
Capital Costs	**20%**					
Capital Costs	20%	- Hard costs. - Soft costs. - Potential of unforeseen costs.	- Refer to the Class 'C' Cost Estimate. - Option 1 is marginally above the lowest capital costs of Option 3. - Option 2 has the highest capital costs. - Option 3 has the lowest capital costs.	6/10	2/10	8/10
Total Score	**95%**			**56%**	**36%**	**71%**
Ranking				**2**	**3**	**1**

SHEA ROAD PS CAPACITY UPGRADE
CLASS 'C' COST ESTIMATE
OPTION 1

ITEM NO.	ITEM	UNIT		EST. QUANTITY	UNIT RATE	TOTAL AMOUNT
SECTION A - Site Preparation & General						
1	Mobilization / Demobilization	LS		1.0	$50,000.00	$50,000.00
2	Pre-Construction Inspection / Vibration Monitoring	LS			$25,000.00	$0.00
3	Flow Management	LS		1.0	$505,000.00	$505,000.00
4	Commissioning	LS		1.0	$100,000.00	$100,000.00
				SUBTOTAL - SECTION A		**$655,000.00**
SECTION B - Shea Road PS Siteworks						
1	Building Component Upgrades	LS		1.0	$500,000.00	$500,000.00
2	Process Mechanical Upgrades					
	a) Pumps	ea		3.0	$125,000.00	$375,000.00
	b) Mechanical Upgrades	LS		1.0	$200,000.00	$200,000.00
3	Electrical Upgrades					
	a) 60HP Panel Fabrication	ea		3.0	$60,000.00	$180,000.00
	b) 60 HP Panel Installation	LS		1.0	$85,000.00	$85,000.00
	c) Electrical Integration	LS		1.0	$75,000.00	$75,000.00
4	50mm Water Service Realignment	LS		1.0	$25,000.00	$25,000.00
5	Hydro Ottawa/Electrical Upgrades	LS		1.0	$100,000.00	$100,000.00
				SUBTOTAL - SECTION B		**$1,540,000.00**
SECTION C - Removals & Reinstatement						
1	Pump Station Blk 219 (All Inclusive)	m^2		70.0	$145.00	$10,150.00
2	Yard Reinstatement	LS		1.0	$45,000.00	$45,000.00
				SUBTOTAL - SECTION C		**$10,150.00**
				SUBTOTAL 1A		**$2,205,150.00**
				Engineering Services (20%)		**$441,030.00**
				Property Acquisition (0%)		**$0.00**
				Utilities (15%)		**$330,772.50**
				City Internal Costs (8.5%)		**$187,437.75**
				Miscellaneous (5%)		**$110,257.50**
				Geotech Issues (0%)		**$0.00**
				Change in Design Standards (2%)		**$44,103.00**
				Construction Contract Duration (4%)		**$88,206.00**
				Planning, Design and Land Use Approvals (5%)		**$110,257.50**
				SUBTOTAL 1B		**$3,517,214.25**
				Class 'C' Contingency (40%)		**$1,406,885.70**
				TOTAL OPTION 1		**$4,924,099.95**

SHEA ROAD PS CAPACITY UPGRADE
CLASS 'C' COST ESTIMATE
OPTION 2

ITEM NO.	ITEM	UNIT		EST. QUANTITY	UNIT RATE	TOTAL AMOUNT
SECTION A - Site Preparation & General						
1	Mobilization / Demobilization	LS		1.0	$50,000.00	$50,000.00
2	Traffic Management	LS		1.0	$50,000.00	$50,000.00
3	Erosion and Sediment Control: Implementation, Maintenance and Monitoring	LS		1.0	$10,000.00	$10,000.00
4	Erosion and Sediment Control Items					
	a) Light Duty Silt Fence	m		1000.0	$25.00	$25,000.00
	b) Straw Bales	ea		10.0	$650.00	$6,500.00
5	Pre-Construction Inspection / Vibration Monitoring	LS		1.0	$25,000.00	$25,000.00
6	Flow Management	LS		1.0	$505,000.00	$505,000.00
7	Commissioning	LS		1.0	$50,000.00	$50,000.00
8	Excess Material Offsite Removal	m^3		1200.0	$65.00	$78,000.00
				SUBTOTAL - SECTION A		**$799,500.00**
SECTION B - Sanitary Forcemain						
1	Removal of Existing Sanitary Forcemain					
	a) 200mm dia (HDPE DR 13.5)	m		1677.0	$450.00	$754,650.00
2	Sanitary Forcemain					
	a) 300mm dia (HDPE DR 13.5)	m		1677.0	$900.00	$1,509,300.00
3	Connection to Existing Control Building (at Shea PS)	LS		1.0	$25,000.00	$25,000.00
4	Connection to Existing Discharge Chamber (at Fernbank Road)	LS		1.0	$25,000.00	$25,000.00
				SUBTOTAL - SECTION B		**$2,313,950.00**
SECTION C - Shea Road PS Site Works						
1	Valve Chamber Upgrade	LS		1.0	$70,000.00	$70,000.00
2	Bypass Upgrade	LS		1.0	$50,000.00	$50,000.00
3	Process Mechanical Upgrades	LS		1.0	$100,000.00	$100,000.00
				SUBTOTAL - SECTION C		**$220,000.00**
SECTION D - Removals & Reinstatement						
1	Local Roadway (All Inclusive)	m^2		75.0	$200.00	$15,000.00
2	Collector Roadway (All Inclusive)	m^2		50.0	$240.00	$12,000.00
3	Pathway Blk 216, 218 & 219 (All Inclusive)	m^2		1,300.0	$150.00	$195,000.00
4	Curb Removal and Reinstatement with SOD Stripping	m		527.0	$250.00	$131,750.00
5	Driveway	ea		48.0	$6,500.00	$312,000.00
6	Concrete Sidewalk incl. TWSI	m^2		215.0	$275.00	$59,125.00
7	Shea Road PS Parking Lot (All Inclusive)	m^2		143.0	$165.00	$23,595.00
				SUBTOTAL - SECTION D		**$748,470.00**
SECTION E - Landscaping						
1	Topsoil and Sod Reinstatement	m^2		1434.0	$35.00	$50,190.00
				SUBTOTAL - SECTION E		**$50,190.00**
				SUBTOTAL 2A		**$4,132,110.00**
				Engineering Services (20%)		**$826,422.00**
				Property Acquisition (0%)		**$0.00**
				Utilities (15%)		**$619,816.50**
				City Internal Costs (8.5%)		**$351,229.35**
				Miscellaneous (5%)		**$206,605.50**
				Geotech Issues (5%)		**$206,605.50**
				Change in Design Standards (1%)		**$41,321.10**
				Construction Contract Duration (4%)		**$165,284.40**
				Planning, Design and Land Use Approvals (5%)		**$206,605.50**
				SUBTOTAL 2B		**$6,755,999.85**
				Class 'C' Contingency (40%)		**$2,702,399.94**
				TOTAL OPTION 2		**$9,458,399.79**

SHEA ROAD PS CAPACITY UPGRADE
CLASS 'C' COST ESTIMATE
OPTION 3

ITEM NO.	ITEM	UNIT		EST. QUANTITY	UNIT RATE	TOTAL AMOUNT
SECTION A - Site Preparation & General						
1	Mobilization / Demobilization	LS		1.0	$50,000.00	$50,000.00
2	Traffic Management	LS		1.0	$30,000.00	$30,000.00
3	Erosion and Sediment Control: Implementation, Maintenance and Monitoring	LS		1.0	$10,000.00	$10,000.00
4	Erosion and Sediment Control Items					
	a) Light Duty Silt Fence	m		1000.0	$25.00	$25,000.00
	b) Straw Bales	ea		10.0	$650.00	$6,500.00
5	Pre-Construction Inspection / Vibration Monitoring	LS		1.0	$15,000.00	$15,000.00
6	Flow Management	LS		1.0	$25,000.00	$25,000.00
7	Commissioning	LS		1.0	$15,000.00	$15,000.00
8	Excess Material Offsite Removal	m^3		1200.0	$50.00	$60,000.00
9	Rock Excavation	m^3		1000.0	$125.00	$125,000.00
				SUBTOTAL - SECTION A		**$361,500.00**
SECTION B - Sanitary Forcemain						
1	Removal of Existing Sanitary Forcemain					
	a) 200mm dia (HDPE DR 13.5)	m		60.0	$450.00	$27,000.00
2	Sanitary Forcemain					
	a) 300mm dia (HDPE DR 13.5)	m		1225.0	$750.00	$918,750.00
3	Gravity Outlet Pipe					
	a) 600mm dia (CONC-50)	m		25.0	$1,200.00	$30,000.00
4	1800mmx2400mm Box MH (Discharge Chamber)	ea		1.0	$150,000.00	$150,000.00
5	Connection to Existing Control Building (at Shea PS)	LS		1.0	$25,000.00	$25,000.00
6	Connect to Existing MH 77860 (at Fernbank Road)	LS		1.0	$25,000.00	$25,000.00
7	CCTV Inspection (x2)	m		25.0	$20.00	$500.00
				SUBTOTAL - SECTION B		**$1,176,250.00**
SECTION C - Shea Road PS Site Works						
1	Valve Chamber Replacement	LS		1.0	$100,000.00	$100,000.00
2	Bypass Upgrade	LS		1.0	$50,000.00	$50,000.00
3	Mechanical Upgrades	LS		1.0	$150,000.00	$150,000.00
				SUBTOTAL - SECTION C		**$300,000.00**
SECTION D - Removals & Reinstatement						
1	Local Roadway (All Inclusive)	m^2		115.0	$165.00	$18,975.00
2	Collector Roadway (All Inclusive)	m^2		20.0	$185.00	$3,700.00
3	Pathway Blk 219 (All Inclusive)	m^2		52.0	$145.00	$7,540.00
4	Curb	m		77.0	$225.00	$17,325.00
5	Concrete Sidewalk incl. TWSI	m^2		25.0	$245.00	$6,125.00
6	Shea Road PS Parking Lot (All Inclusive)	m^2		143.0	$165.00	$23,595.00
				SUBTOTAL - SECTION D		**$77,260.00**
SECTION E - Landscaping						
1	Topsoil and Seed Reinstatement	m^2		1850.0	$15.00	$27,750.00
2	Topsoil and Sod Reinstatement	m^2		745.0	$35.00	$26,075.00
				SUBTOTAL - SECTION E		**$53,825.00**
				SUBTOTAL 3A		**$1,968,835.00**
				Engineering Services (20%)		**$393,767.00**
				Property Acquisition (10%)		**$196,883.50**
				Utilities (5%)		**$98,441.75**
				City Internal Costs (8.5%)		**$167,350.98**
				Miscellaneous (5%)		**$98,441.75**
				Geotech Issues (5%)		**$98,441.75**
				Change in Design Standards (1%)		**$19,688.35**
				Construction Contract Duration (4%)		**$78,753.40**
				Planning, Design and Land Use Approvals (5%)		**$98,441.75**
				SUBTOTAL 3B		**$3,219,045.23**
				Class 'C' Contingency (40%)		**$1,287,618.09**
				TOTAL OPTION 3		**$4,506,663.32**

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APPENDIX E

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JFSA MEMO – CONCEPTUAL SWM PONDS SIZING AND PRELIMINARY HGL ANALYSIS (2024-08-09)

(ATTACHED UNDER SEPARATE COVER)

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) 2 YEAR				5 YEAR				10 YEAR				100 YEAR				FLOW Time of Conc.	Intensity 2 Year	Intensity 5 Year	Intensity 10 Year	Intensity 100 Year	Peak Flow	SEWER DATA DIA. (mm)	DIA. (mm)	TYPE	SLOPE	LENGTH	CAPACITY	VELOCITY	TIME OF FLOW	RATIO
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	(min)	(mm/h)	(mm/h)	(mm/h)	(mm/h)	Q (l/s)	(actual)	(nominal)		(%)	(m)	(l/s)	(m/s)	(min)	Q/Q full
STM TRUNK 1																																	
					0.00	0.00	0.00	0.00	0.00	0.00			0.00	0.00			0.00	0.00	15.17														
	112	116	5.24	0.68	9.91	9.91			0.00	0.00			0.00	0.00			0.00	0.00	15.17	61.37	83.01	97.21	141.96	608	825	825	CONC	0.30	56.0	786.2205	1.4708	0.6346	0.773
					0.00	9.91	0.00	0.00	0.00	0.00			0.00	0.00			0.00	0.00	12.91														
	116	120	1.62	0.68	3.06	12.97			0.00	0.00			0.00	0.00			0.00	0.00	15.80	59.93	81.05	94.90	138.56	777	975	975	CONC	0.20	60.0	#######	1.3424	0.7450	0.775
					0.00	12.97	0.00	0.00	0.00	0.00			0.00	0.00			0.00	0.00	14.26														
	120	124	1.80	0.68	3.40	16.37			0.00	0.00			0.00	0.00			0.00	0.00	16.55	58.34	78.87	92.34	134.80	955	1200	1200	CONC	0.15	60.0	#######	1.3351	0.7490	0.632
					0.00	16.37	0.00	0.00	0.00	0.00			0.00	0.00			0.00	0.00	14.23														
	124	139	1.73	0.68	3.27	19.64			0.00	0.00			0.00	0.00			0.00	0.00	17.30	56.83	76.80	89.91	131.24	1116	1200	1200	CONC	0.15	64.0	#######	1.3351	0.7989	0.739
					0.00	19.64	0.00	0.00	0.00	0.00			0.00	0.00			0.00	0.00	16.78														
	139	140	4.93	0.68	9.32	28.96			0.00	0.00			0.00	0.00			0.00	0.00	18.10	55.31	74.73	87.47	127.66	1602	1350	1350	CONC	0.15	59.0	#######	1.4442	0.6809	0.775
	140	143			0.00	28.96	0.08	0.68	0.15	0.15			0.00	0.00			0.00	0.00	18.78	54.08	73.05	85.50	124.78	1577	1500	1500	CONC	0.15	40.0	#######	1.5493	0.4303	0.576
					0.00	28.96	0.00	0.00	0.00	0.15			0.00	0.00			0.00	0.00	12.77														
					0.00	28.96	0.78	0.68	1.47	1.63			0.00	0.00			0.00	0.00															
			1.70	0.68	3.21	32.17			0.00	1.63			0.00	0.00			0.00	0.00															
	143	1002	2.70	0.80	6.00	38.18			0.00	1.63			0.00	0.00			0.00	0.00	19.21	53.34	72.04	84.31	123.03	2154	1500	1500	CONC	0.15	52.0	#######	1.5493	0.5594	0.787
	1002	HW1			0.00	38.18			0.00	1.63			0.00	0.00			0.00	0.00	19.77	52.41	70.77	82.82	120.84	2116	1500	1500	CONC	0.15	17.0	#######	1.5493	0.1829	0.773
STM TRUNK 2																																	
					0.00	0.00	0.00	0.00	0.00	0.00			0.00	0.00			0.00	0.00	14.82														
	231	232	4.38	0.68	8.28	8.28			0.00	0.00			0.00	0.00			0.00	0.00	14.82	62.20	84.15	98.55	143.91	515	975	975	CONC	0.20	54.5	#######	1.3424	0.6767	0.514
	232	235	0.02	0.68	0.04	8.32			0.00	0.00			0.00	0.00			0.00	0.00	15.50	60.62	81.99	96.01	140.19	504	1050	1050	CONC	0.15	15.0	#######	1.2214	0.2047	0.477
					0.00	8.32	0.00	0.00	0.00	0.00			0.00	0.00			0.00	0.00	12.53														
	235	236	0.90	0.68	1.70	10.02			0.00	0.00			0.00	0.00			0.00	0.00	15.70	60.16	81.36	95.27	139.11	603	1050	1050	CONC	0.15	15.5	#######	1.2214	0.2115	0.570
	236	237	0.54	0.68	1.02	11.04			0.00	0.00			0.00	0.00			0.00	0.00	15.91	59.70	80.72	94.52	138.00	659	1050	1050	CONC	0.15	82.0	#######	1.2214	1.1189	0.623
	237	240	0.42	0.68	0.79	11.83			0.00	0.00			0.00	0.00			0.00	0.00	17.03	57.36	77.52	90.76	132.49	679	1050	1050	CONC	0.15	86.0	#######	1.2214	1.1735	0.642
					0.00	11.83	0.00	0.00	0.00	0.00			0.00	0.00			0.00	0.00	23.09														
					0.00	11.83	0.00	0.00	0.00	0.00			0.00	0.00			0.00	0.00															
					0.00	11.83	0.93	0.40	1.03	1.03			0.00	0.00			0.00	0.00															
					0.00	11.83	1.38	0.68	2.61	3.64			0.00	0.00			0.00	0.00															
	240	HW2	3.47	0.68	6.56	18.39			0.00	3.64			0.00	0.00			0.00	0.00	23.09	47.54	64.12	75.01	109.40	1108	1350	1350	CONC	0.25	58.0	#######	1.8644	0.5185	0.415
STM TRUNK 3																																	
					0.00	0.00	0.00	0.00	0.00	0.00			0.00	0.00			0.00	0.00	14.35														
	306	307	1.79	0.68	3.38	3.38			0.00	0.00			0.00	0.00			0.00	0.00	14.35	63.34	85.70	100.38	146.60	214	675	675	CONC	0.15	84.0	325.5584	0.9098	1.5389	0.658
	307	308	0.51	0.68	0.96	4.35			0.00	0.00			0.00	0.00			0.00	0.00	15.89	59.74	80.78	94.59	138.10	260	675	675	CONC	0.20	84.0	375.9224	1.0505	1.3327	0.691
	308	313			0.00	4.35			0.00	0.00			0.00	0.00			0.00	0.00	17.23	56.97	76.99	90.14	131.57	248	750	750	CONC	0.20	5.0	497.8726	1.1270	0.0739	0.498
					0.00	4.35	0.00	0.00	0.00	0.00			0.00	0.00			0.00	0.00	13.71														
					0.00	4.35	0.73	0.40	0.81	0.81			0.00	0.00			0.00	0.00															
	313	314	1.06	0.68	2.00	6.35			0.00	0.81			0.00	0.00			0.00	0.00	17.30	56.82	76.80	89.90	131.23	423	825	825	CONC	0.20	37.5	641.9463	1.2009	0.5205	0.659
	314	HW3			0.00	6.35			0.00	0.81			0.00	0.00			0.00	0.00	17.82	55.82	75.43	88.30	128.88	416	900	900	CONC	0.15	25.0	701.1305	1.1021	0.3781	0.593
STM TRUNK 4																																	
					0.00	0.00	0.00	0.00	0.00	0.00			0.00	0.00			0.00	0.00	13.54														
			0.40	0.68	0.76	0.76			0.00	0.00			0.00	0.00			0.00	0.00															
					0.00	0.76	0.48	0.68	0.91	0.91			0.00	0.00			0.00	0.00															
			1.53	0.80	3.40	4.16			0.00	0.91			0.00	0.00			0.00	0.00															
	405	406			0.00	4.16	1.91	0.40	2.12	3.03			0.00	0.00			0.00	0.00	13.54	65.43	88.58	103.76	151.57	541	825	825	CONC	0.20	39.0	641.9463	1.2009	0.5413	0.842
	406	412			0.00	4.16	0.04	0.68	0.08	3.11			0.00	0.00			0.00	0.00	14.08	64.02	86.64	101.47	148.21	535	825	825	CONC	0.20	21.0	641.9463	1.2009	0.2915	0.834
					0.00	4.16	0.00	0.00	0.00	3.11			0.00	0.00			0.00	0.00	14.34														
					0.00	4.16	0.11	0.68	0.21	3.31			0.00	0.00			0.00	0.00															
	412	413	1.66	0.68	3.14	7.30			0.00	3.31			0.00	0.00			0.00	0.00	14.38	63.28	85.63	100.29	146.47	746	1200	1200	CONC	0.15	73.5	#######	1.3351	0.9175	0.494
	413	414	0.44	0.68	0.83	8.13			0.00	3.31			0.00	0.00			0.00	0.00	15.29	61.08	82.62	96.75	141.28	770	1200	1200	CONC	0.15	74.0	#######	1.3351	0.9238	0.510
	414	415	0.15	0.68	0.28	8.41			0.00	3.31			0.00	0.00			0.00	0.00	16.22	59.04	79.82	93.46	136.45	761	1200	1200	CONC	0.15	9.5	#######	1.3351	0.1186	0.504
	415	430	0.18	0.68	0.34	8.75			0.00	3.31			0.00	0.00			0.00	0.00	16.34	58.78	79.48	93.05	135.85	778	1200	1200	CONC	0.15	48.5	#######	1.3351	0.6054	0.515

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: V.W.	PROJECT: 1247- Stittsville South Uban Expansion Area		
Checked: W.L.	LOCATION: City of Ottawa		
Dwg. Reference:	File Ref:	Date: 31 Jul 2024	Sheet No. SHEET 1 OF 2

1247_StmTrunk_Designsheets_Jul3124.xlsx

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	Intensity	Intensity	Intensity	Intensity	Peak Flow	DIA. (mm)	DIA. (mm)	TYPE	SLOPE	LENGTH	CAPACITY	VELOCITY	TIME OF	RATIO
			AREA	R	Indiv.	Accum.	AREA	R	Indiv.	Accum.	AREA	R	Indiv.	Accum.	AREA	R	Indiv.	Accum.	Conc.	2 Year	5 Year	10 Year	100 Year										
Location	From Node	To Node	(Ha)		2.78 AC	2.78 AC	(Ha)		2.78 AC	2.78 AC	(Ha)		2.78 AC	2.78 AC	(Ha)		2.78 AC	2.78 AC	(min)	(mm/h)	(mm/h)	(mm/h)	(mm/h)	Q (l/s)	(actual)	(nominal)		(%)	(m)	(l/s)	(m/s)	LOW (min	Q/Q full
					0.00	8.75	0.00	0.00	0.00	3.31			0.00	0.00			0.00	0.00	16.48														
					0.00	8.75	0.00	0.00	0.00	3.31			0.00	0.00			0.00	0.00	16.48														
					0.00	8.75	0.00	0.00	0.00	3.31			0.00	0.00			0.00	0.00															
			1.77	0.68	3.35	12.10			0.00	3.31			0.00	0.00			0.00	0.00															
			1.80	0.68	3.40	15.50			0.00	3.31			0.00	0.00			0.00	0.00															
	430	434			0.00	15.50	2.45	0.68	4.63	7.95			0.00	0.00			0.00	0.00	16.94	57.54	77.77	91.05	132.91	1510	1350	1350	CONC	0.15	64.5	#######	1.4442	0.7444	0.730
					0.00	15.50	0.00	0.00	0.00	7.95			0.00	0.00			0.00	0.00	11.45														
	434	435	0.98	0.68	1.85	17.35			0.00	7.95			0.00	0.00			0.00	0.00	17.69	56.08	75.78	88.71	129.47	1575	1350	1350	CONC	0.15	45.0	#######	1.4442	0.5193	0.762
	435	HW4			0.00	17.35			0.00	7.95			0.00	0.00			0.00	0.00	18.20	55.11	74.45	87.15	127.19	1548	1350	1350	CONC	0.15	26.5	#######	1.4442	0.3058	0.749
STM TRUNK 5																																	
					0.00	0.00	0.00	0.00	0.00	0.00			0.00	0.00			0.00	0.00	13.45														
	519	522	1.52	0.68	2.87	2.87			0.00	0.00			0.00	0.00			0.00	0.00	13.45	65.69	88.93	104.17	152.17	189	900	900	CONC	0.15	67.5	701.1305	1.1021	1.0208	0.269
					0.00	2.87	0.00	0.00	0.00	0.00			0.00	0.00			0.00	0.00	12.08														
					0.00	2.87	0.00	0.00	0.00	0.00			0.00	0.00			0.00	0.00	12.08														
					0.00	2.87	0.00	0.00	0.00	0.00			0.00	0.00			0.00	0.00	12.08														
					0.00	2.87	0.00	0.00	0.00	0.00			0.00	0.00			0.00	0.00	12.08														
					0.00	2.87	0.00	0.00	0.00	0.00			0.00	0.00			0.00	0.00	18.32														
					0.00	2.87	0.00	0.00	0.00	0.00			0.00	0.00			0.00	0.00	18.32														
			0.20	0.68	0.38	3.25			0.00	0.00			0.00	0.00			0.00	0.00															
			0.26	0.68	0.49	3.74			0.00	0.00			0.00	0.00			0.00	0.00															
					0.00	3.74	0.50	0.68	0.95	0.95			0.00	0.00			0.00	0.00															
					0.00	3.74	0.74	0.68	1.40	2.34			0.00	0.00			0.00	0.00															
			0.81	0.68	1.53	5.27			0.00	2.34			0.00	0.00			0.00	0.00															
	522	524	1.86	0.68	3.52	8.79			0.00	2.34			0.00	0.00			0.00	0.00	18.32	54.91	74.18	86.83	126.72	657	1200	1200	CONC	0.15	58.5	#######	1.3351	0.7303	0.435
					0.00	8.79	0.00	0.00	0.00	2.34			0.00	0.00			0.00	0.00	11.69														
	524	528	0.74	0.68	1.40	10.19			0.00	2.34			0.00	0.00			0.00	0.00	19.05	53.62	72.42	84.76	123.68	716	1200	1200	CONC	0.15	64.0	#######	1.3351	0.7989	0.474
					0.00	10.19	0.00	0.00	0.00	2.34			0.00	0.00			0.00	0.00	12.84														
	528	5320	0.84	0.68	1.59	11.78			0.00	2.34			0.00	0.00			0.00	0.00	19.84	52.28	70.59	82.61	120.54	781	1200	1200	CONC	0.15	61.0	#######	1.3351	0.7615	0.517
			0.34	0.68	0.64	12.42			0.00	2.34			0.00	0.00			0.00	0.00															
	5320	532	1.21	0.80	2.69	15.11			0.00	2.34			0.00	0.00			0.00	0.00	20.61	51.08	68.95	80.68	117.71	933	1200	1200	CONC	0.15	4.5	#######	1.3351	0.0562	0.618
					0.00	15.11	0.00	0.00	0.00	2.34			0.00	0.00			0.00	0.00	12.13														
	532	533	0.97	0.68	1.83	16.94			0.00	2.34			0.00	0.00			0.00	0.00	20.66	50.99	68.83	80.54	117.50	1025	1350	1350	CONC	0.15	68.5	#######	1.4442	0.7905	0.496
	533	HW5			0.00	16.94			0.00	2.34			0.00	0.00			0.00	0.00	21.45	49.81	67.22	78.64	114.72	1001	1350	1350	CONC	0.15	26.0	#######	1.4442	0.3001	0.484

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: V.W.	PROJECT: 1247- Stittsville South Uban Expansion Area		
Checked: W.L.	LOCATION: City of Ottawa		
Dwg. Reference:	File Ref:	Date: 31 Jul 2024	Sheet No. SHEET 2 OF 2

David Schaeffer Engineering Ltd.
120 Iber Road, Suite 103
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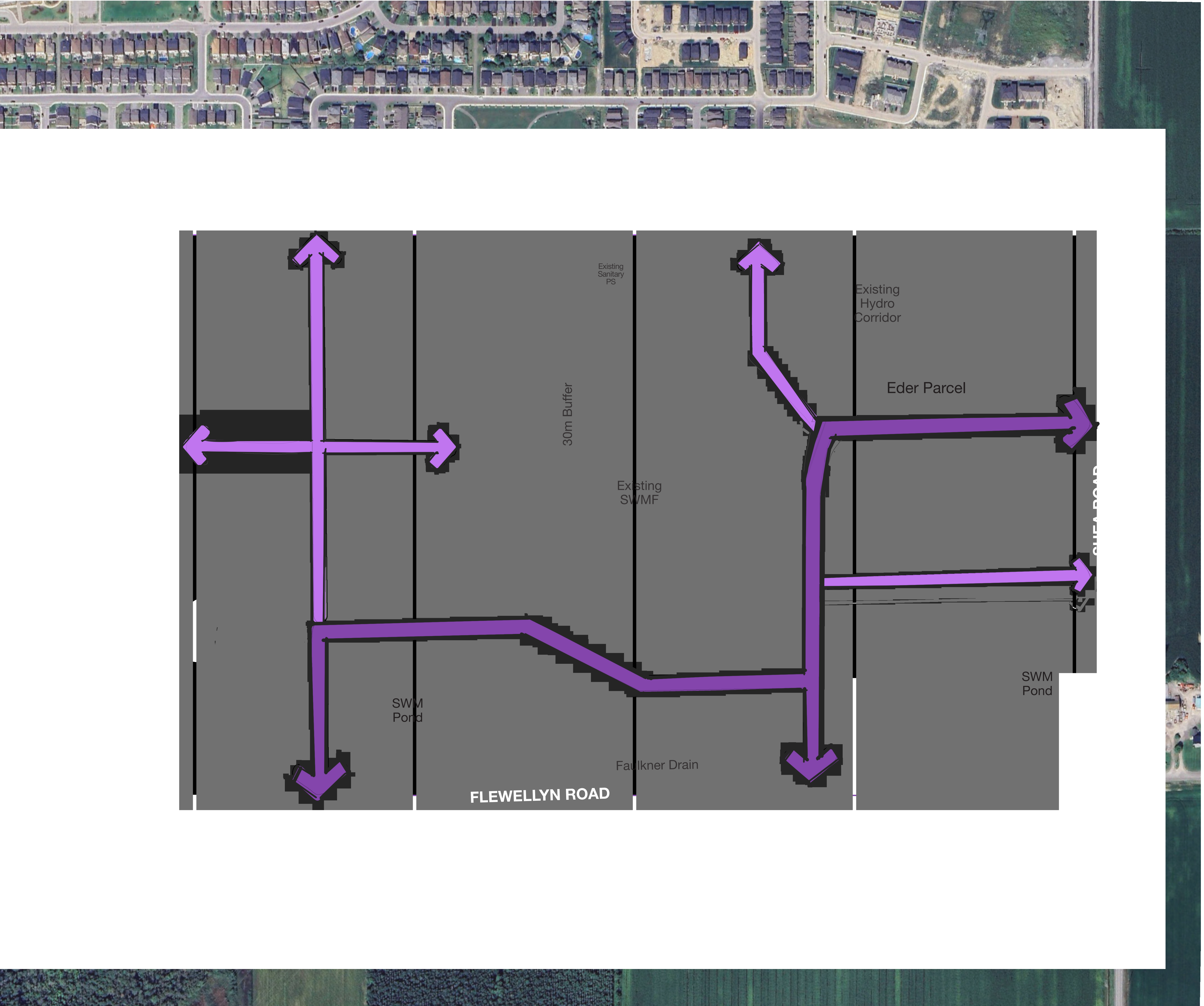
dsel.ca

FIGURES

Caivan Stittsville
CONCEPT PLAN



LEGEND

- Subject Lands
- Eder Parcel
- Low-Density
- Medium-Density
- Drainage Corridor
- Hydro Corridor
- Buffer
- Proposed SWM Pond
- Existing SWM Pond
- Existing Sanitary PS
- Major Roads
- Major Connections
- Faulkner Drain
- Parcel Lines

0 100 200

NAK
design strategies

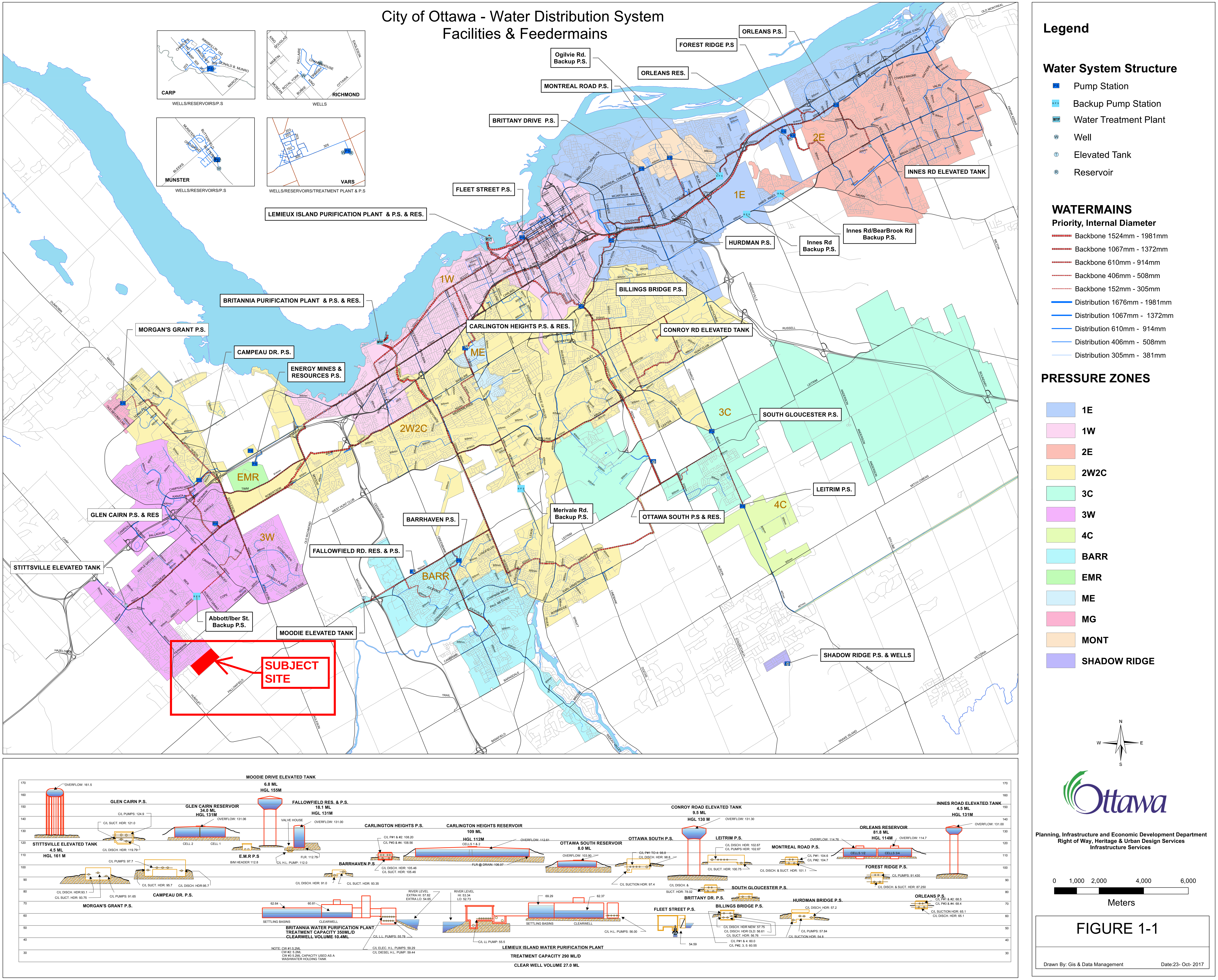
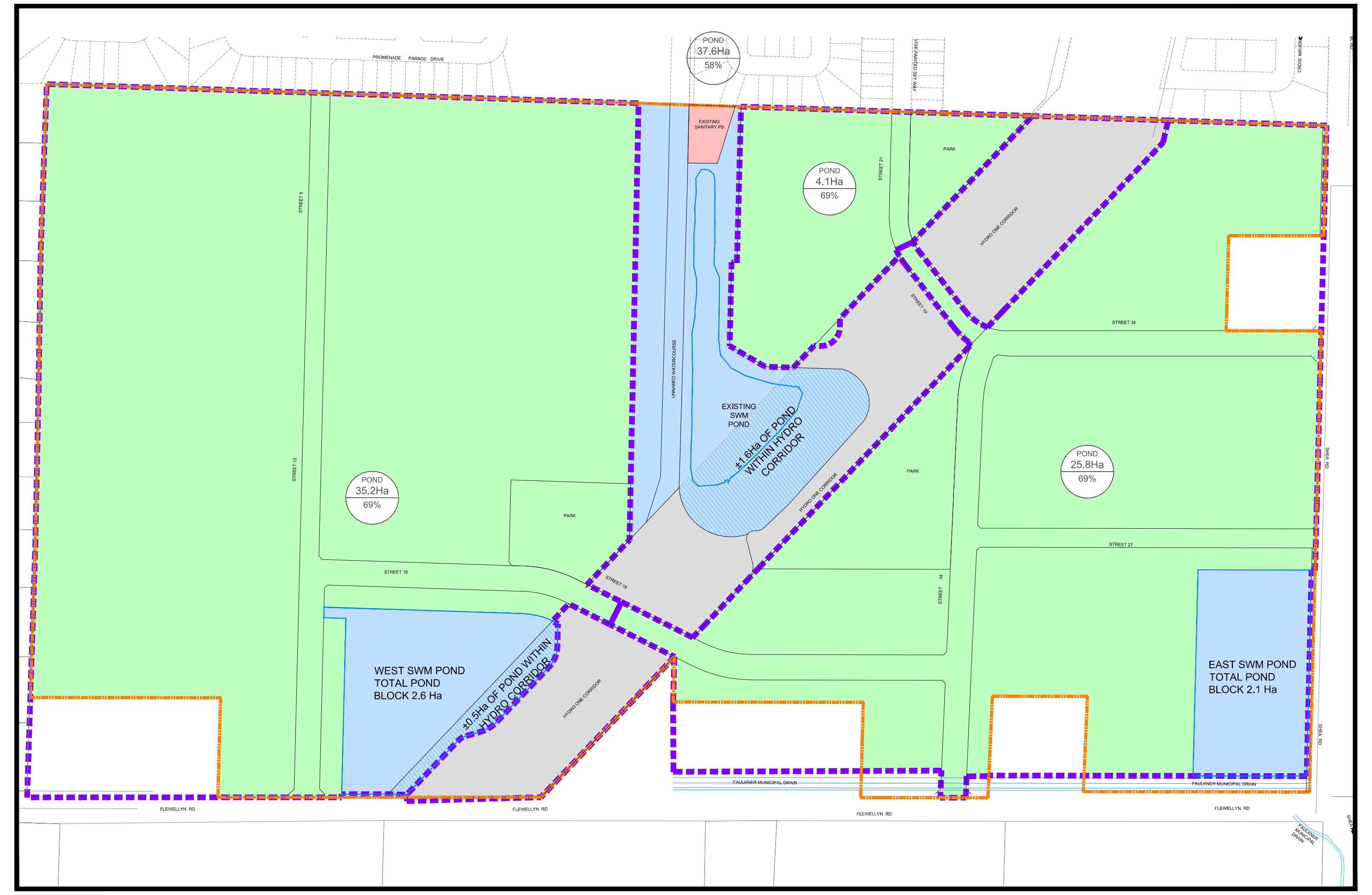
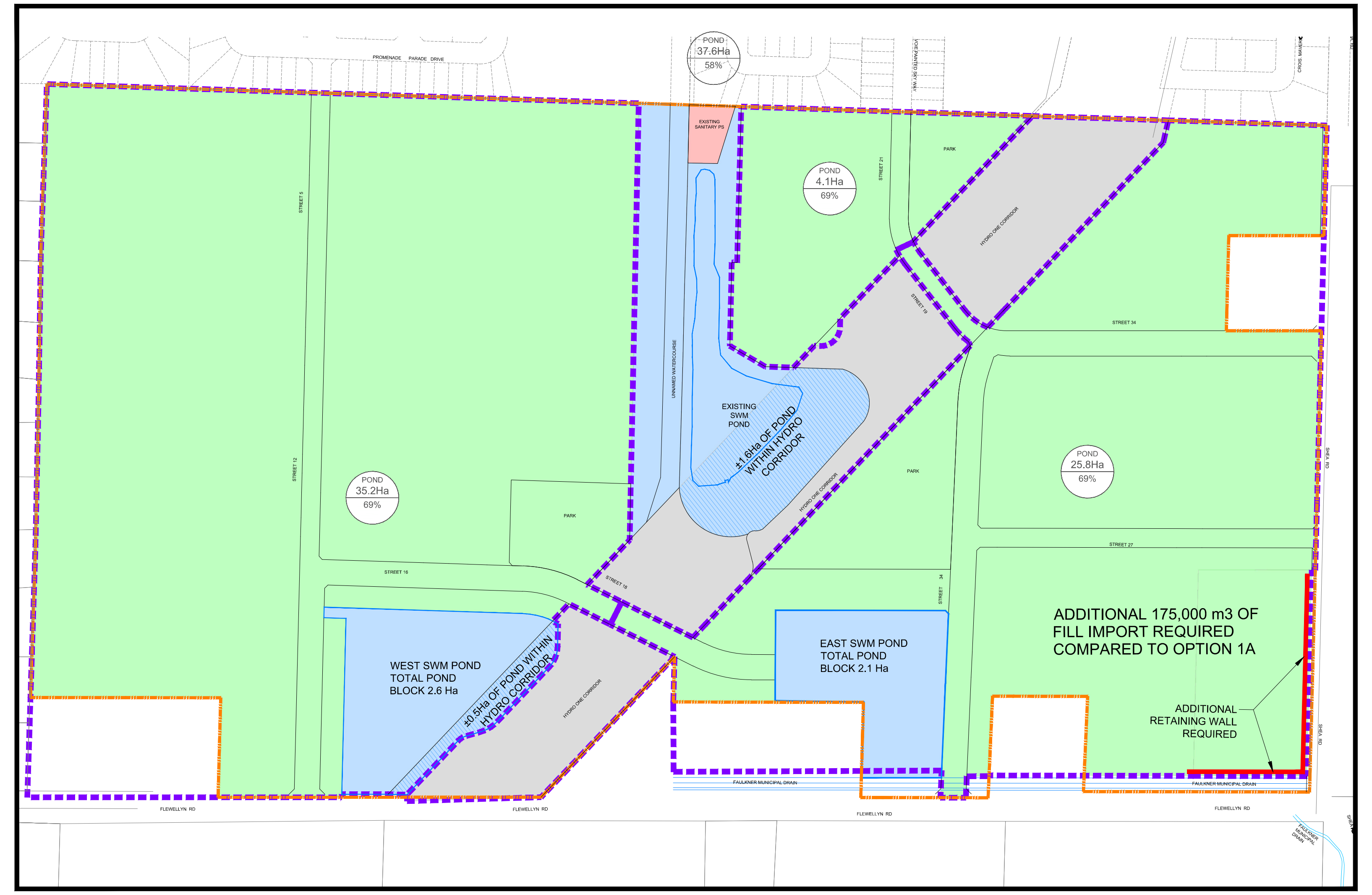

City of Ottawa - Water Distribution System
Facilities & Feedermains
CARP
WELLS/RESERVOIRS/P.S
RICHMOND
WELLS
MUNSTER
WELLS/RESERVOIRS/P.S
VARS
WELLS/RESERVOIRS/TREATMENT PLANT & P.S
ORLEANS P.S.
FOREST RIDGE P.S
Ogilvie Rd. Backup P.S.
ORLEANS RES.
MONTREAL ROAD P.S.
BRITTANY DRIVE P.S.
FLEET STREET P.S.
LEMIEUX ISLAND PURIFICATION PLANT & P.S. & RES.
INNES RD ELEVATED TANK
Innes Rd/BearBrook Rd Backup P.S.
HURDMAN P.S.
Innes Rd Backup P.S.
BRITANNIA PURIFICATION PLANT & P.S. & RES.
BILLINGS BRIDGE P.S.
MORGAN'S GRANT P.S.
CARLINGTON HEIGHTS P.S. & RES.
CONROY RD ELEVATED TANK
CAMPEAU DR. P.S.
ENERGY MINES & RESOURCES P.S.
SOUTH GLOUCESTER P.S.
LEITRIM P.S.
GLEN CAIRN P.S. & RES
Merivale Rd. Backup P.S.
BARRHAVEN P.S.
OTTAWA SOUTH P.S & RES.
FALLOWFIELD RD. RES. & P.S.
STITTSVILLE ELEVATED TANK
Abbott/Iber St. Backup P.S.
MOODIE ELEVATED TANK
SHADOW RIDGE P.S. & WELLS
SUBJECT SITE
1E
1W
2E
2W2C
3C
3W
4C
BARR
EMR
ME
Legend
Water System Structure
Pump Station
Backup Pump Station
Water Treatment Plant
Well
Elevated Tank
Reservoir
WATERMAINS
Priority, Internal Diameter
Backbone 1524mm - 1981mm
Backbone 1067mm - 1372mm
Backbone 610mm - 914mm
Backbone 406mm - 508mm
Backbone 152mm - 305mm
Distribution 1676mm - 1981mm
Distribution 1067mm - 1372mm
Distribution 610mm - 914mm
Distribution 406mm - 508mm
Distribution 305mm - 381mm
PRESSURE ZONES
1E
1W
2E
2W2C
3C
3W
4C
BARR
EMR
ME
MG
MONT
SHADOW RIDGE
MOODIE DRIVE ELEVATED TANK
6.8 ML
HGL 155M
GLEN CAIRN P.S.
GLEN CAIRN RESERVOIR
34.0 ML
HGL 131M
FALLOWFIELD RES. & P.S.
18.1 ML
HGL 131M
STITTSVILLE ELEVATED TANK
4.5 ML
HGL 161 M
CARLINGTON HEIGHTS P.S.
CARLINGTON HEIGHTS RESERVOIR
109 ML
HGL 112M
OTTAWA SOUTH RESERVOIR
8.0 ML
CONROY ROAD ELEVATED TANK
9.5 ML
HGL 130 M
OTTAWA SOUTH P.S.
LEITRIM P.S.
MONTREAL ROAD P.S.
ORLEANS RESERVOIR
81.8 ML
HGL 114M
INNES ROAD ELEVATED TANK
4.5 ML
HGL 131M
FOREST RIDGE P.S.
E.M.R P.S
BARRHAVEN P.S
CAMPEAU DR. P.S.
MORGAN'S GRANT P.S.
SOUTH GLOUCESTER P.S.
BRITTANY DR. P.S.
HURDMAN BRIDGE P.S.
BILLINGS BRIDGE P.S.
FLEET STREET P.S.
ORLEANS P.S.
BRITANNIA WATER PURIFICATION PLANT
TREATMENT CAPACITY 350ML/D
CLEARWELL VOLUME 10.4ML
LEMIEUX ISLAND WATER PURIFICATION PLANT
TREATMENT CAPACITY 290 ML/D
CLEAR WELL VOLUME 27.0 ML
Ottawa
Planning, Infrastructure and Economic Development Department
Right of Way, Heritage & Urban Design Services
Infrastructure Services
0 1,000 2,000 4,000 6,000
Meters
Drawn By: Gis & Data Management
Date:23- Oct- 2017

FIGURE 1-1

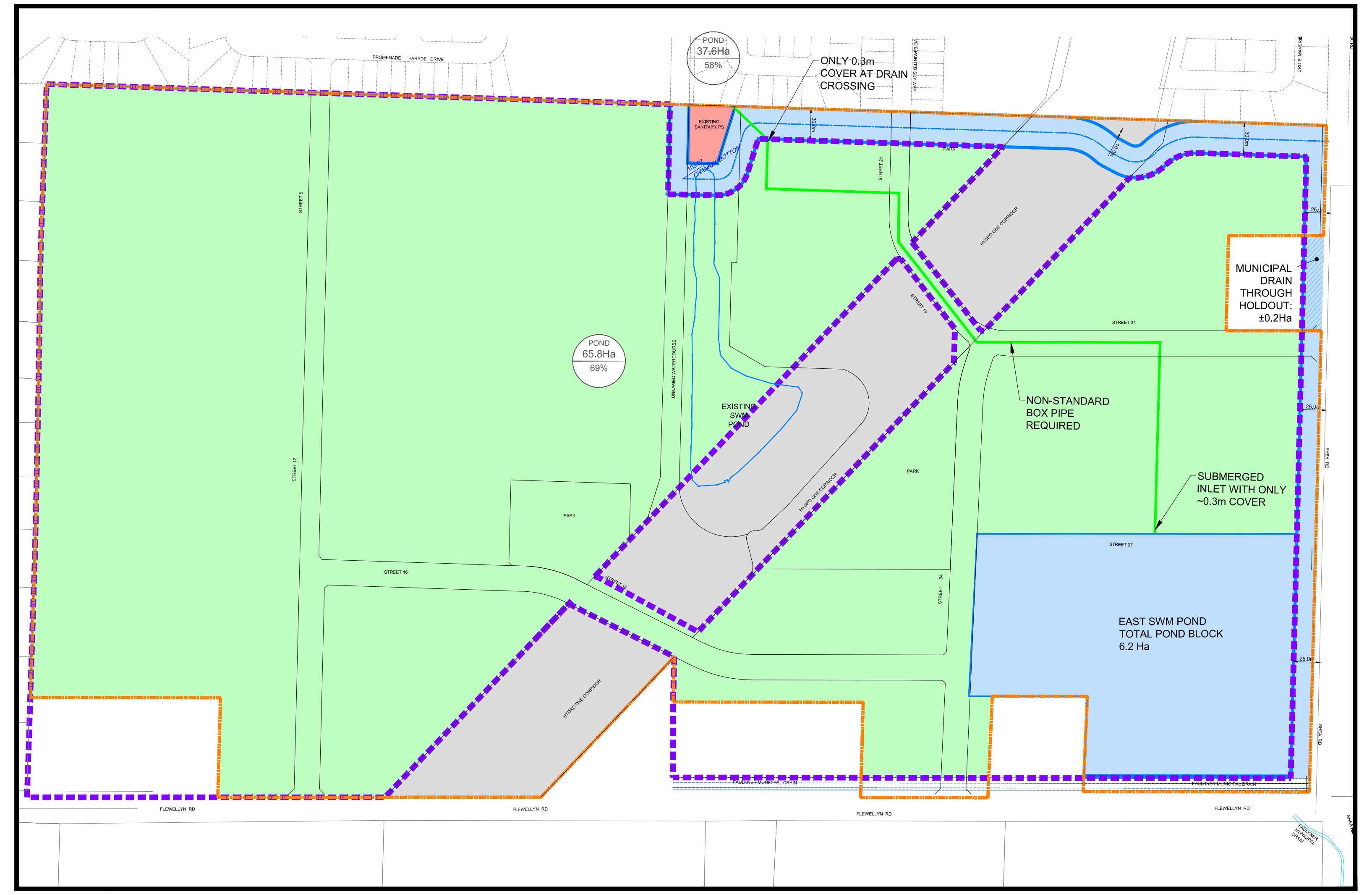
OPTION 1A:
TWO NEW SWM PONDS (EAST SWM POND ON EDER PARCEL)



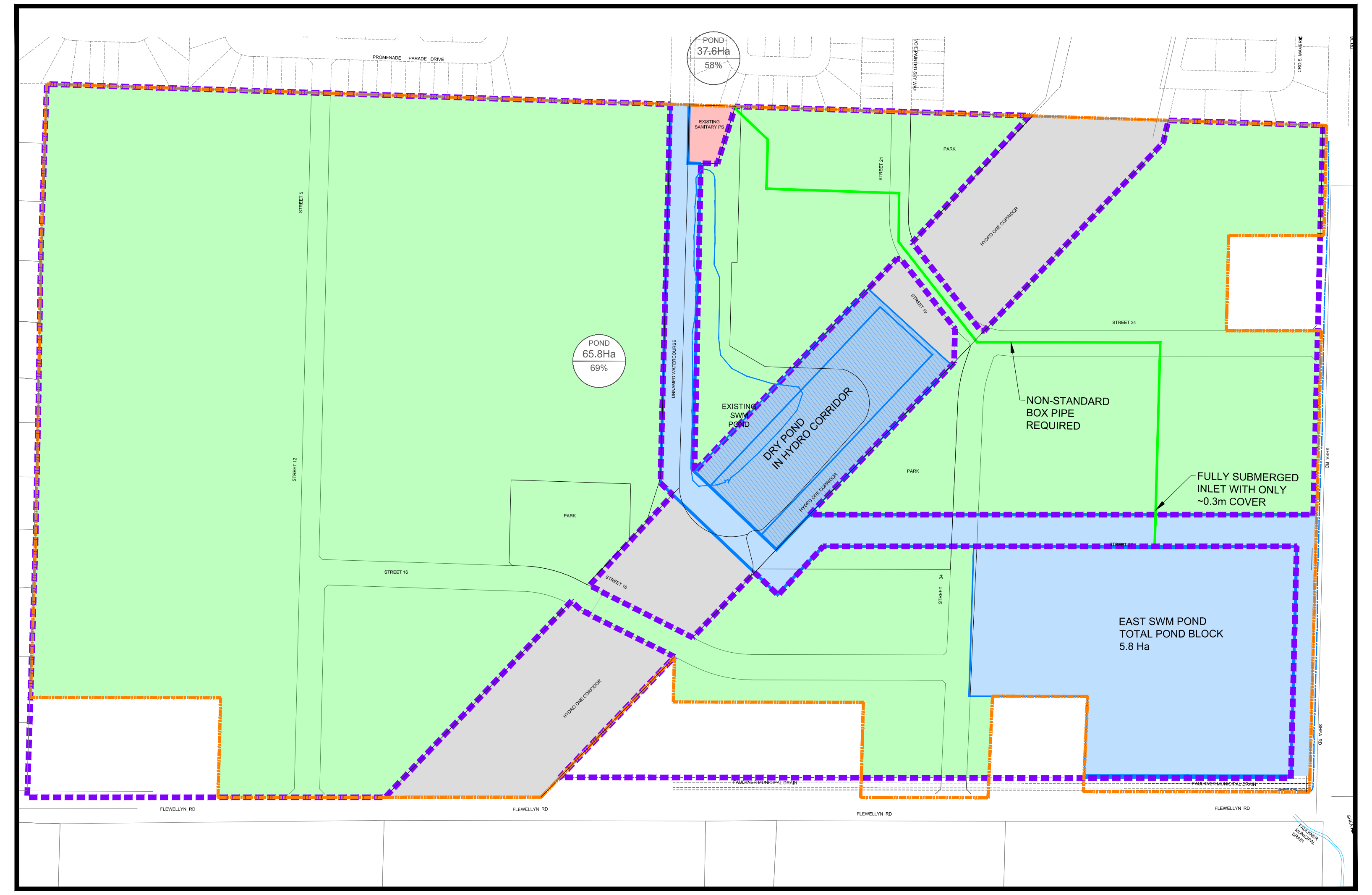
OPTION 1B:
TWO NEW SWM PONDS (EAST SWM POND ON DAVIDSON PARCEL)



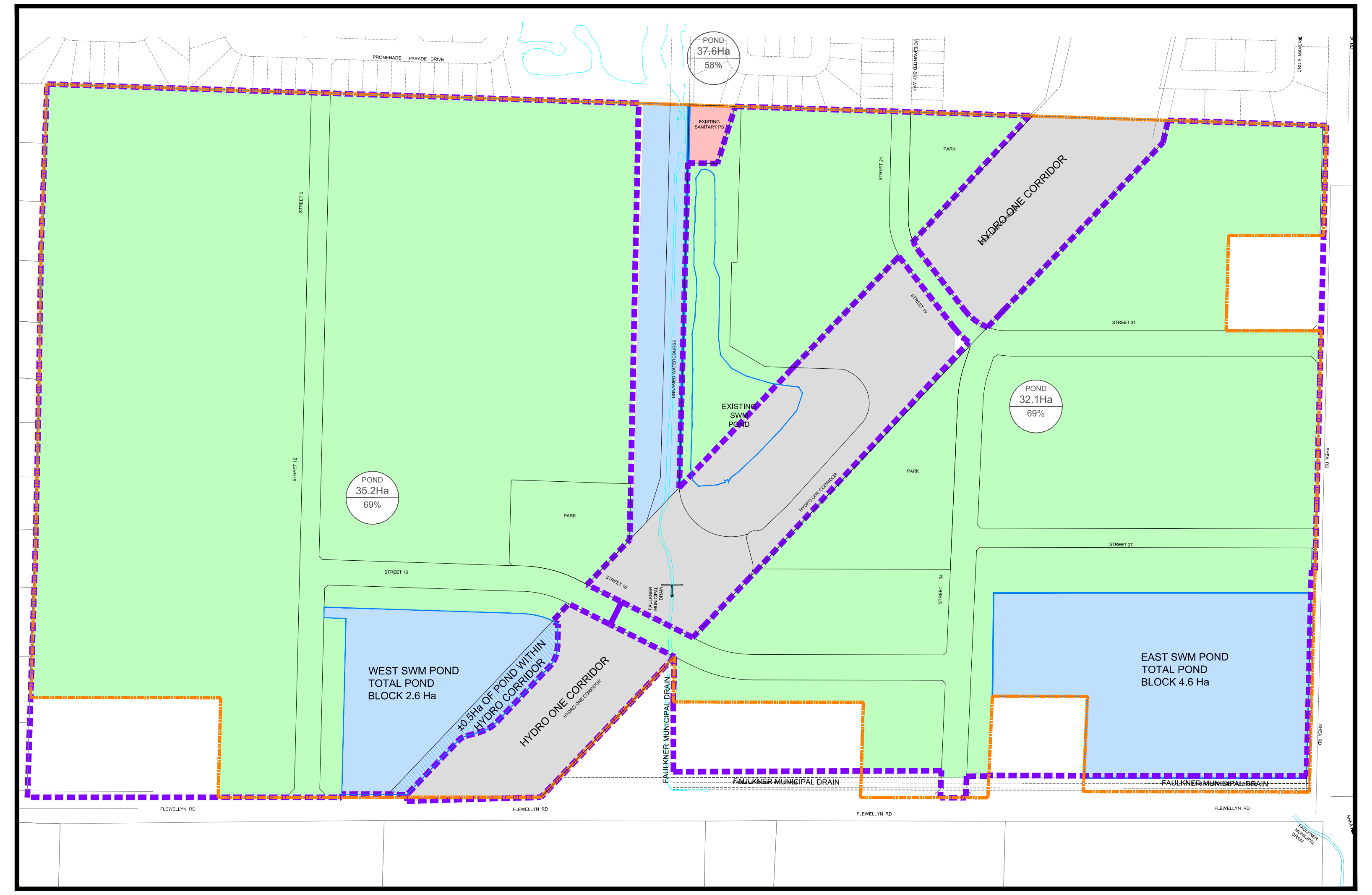
OPTION 2A:
ONE NEW SWM POND, RELOCATE DRAIN (PERIMETER)



OPTION 2B:
ONE NEW SWM POND, RELOCATE DRAIN (CENTRAL)



OPTION 3:
TWO NEW SWM PONDS, DECOMMISSION DAVIDSON SWM POND



Option 1A				
Land Use				
Net Developable Area	ha	56.4		
No. of SWM Ponds (including Davidson)	no.	3		
Total Caivan SWM Pond Area	ha	4.7		
Hydro Corridor SWM Pond - Caivan Built	ha	0.5		
New Pond Channel	m	0		
Estimated SWM Costs	**Unit**	**Unit Cost**	**Quantity**	**Estimated Cost**
SWM Pond	ha	$ 1,875,000	5.20	$ 9,750,000
SWM Pond Channel	m	$ -		$ -
SWM Total				*$ 9,750,000*
City Costs for Davidson Pond Decommissioning	Allowance			$ -
Total Estimated Costs				**$ 9,750,000.00**

Option 1B				
Land Use				
Net Developable Area	ha	56.4		
No. of SWM Ponds (including Davidson)	no.	3		
Total Caivan SWM Pond Area	ha	4.7		
Hydro Corridor SWM Pond - Caivan Built	ha	0.5		
New Pond Channel	m	0		
Estimated SWM Costs	**Unit**	**Unit Cost**	**Quantity**	**Estimated Cost**
SWM Pond	ha	$ 1,875,000	5.20	$ 9,750,000
SWM Pond Channel	m	$ -		$ -
SWM Total				*$ 9,750,000*
City Costs for Davidson Pond Decommissioning	Allowance			$ -
Total Estimated Costs				**$ 9,750,000.00**

*NOTE: ADDITIONAL COSTS, BEYOND THOSE PRESENTED ABOVE FOR SWM PONDS, WOULD BE REQUIRED FOR ADDITIONAL FILL/ENGINEERED FILL AND RETAINING WALLS COMPARED TO OPTION 1A

Option 2A				
Land Use				
Net Developable Area	ha	54.9		
No. of SWM Ponds (including Davidson)	no.	1		
Total Caivan SWM Pond Area	ha	6.2		
Hydro Corridor SWM Pond - Caivan Built	ha	0		
New Pond Channel	m	1200		
Estimated SWM Costs	**Unit**	**Unit Cost**	**Quantity**	**Estimated Cost**
SWM Pond	ha	$ 1,875,000	6.20	$ 11,625,000
SWM Pond Channel	m	$ 3,000	$ 1,200	$ 3,600,000
SWM Total				*$ 15,225,000*
City Costs for Davidson Pond Decommissioning	Allowance			$ 2,100,000.00
Total Estimated Costs				**$ 17,325,000.00**

Option 2B				
Land Use				
Net Developable Area	ha	54.8		
No. of SWM Ponds (including Davidson)	no.	1		
Total Caivan SWM Pond Area	ha	5.8		
Hydro Corridor SWM Pond - Caivan Built	ha	2.6		
New Pond Channel	m	800		
Estimated SWM Costs	**Unit**	**Unit Cost**	**Quantity**	**Estimated Cost**
SWM Pond	ha	$ 1,875,000	8.40	$ 15,750,000
SWM Pond Channel	m	$ 3,000	$ 800	$ 2,400,000
SWM Total				*$ 18,150,000*
City Costs for Davidson Pond Decommissioning	Allowance			$ 2,100,000.00
Total Estimated Costs				**$ 20,250,000.00**

Option 3				
Land Use				
Net Developable Area	ha	55.4		
No. of SWM Ponds (including Davidson)	no.	2		
Total Caivan SWM Pond Area	ha	6.5		
Hydro Corridor SWM Pond - Caivan Built	ha	0.5		
New Pond Channel	m	0		
Estimated SWM Costs	**Unit**	**Unit Cost**	**Quantity**	**Estimated Cost**
SWM Pond	ha	$ 1,875,000	7.00	$ 13,125,000
SWM Pond Channel	m	$ 3,000	$ -	$ -
SWM Total				*$ 13,125,000*
City Costs for Davidson Pond Decommissioning	Allowance			$ 2,100,000.00
Total Estimated Costs				**$ 15,225,000.00**

LEGEND

POND 65.8Ha 71% — DRAINAGE AREA TO POND; IMPERVIOUSNESS (FROM JFSA REPORT)

- DEVELOPABLE LAND
- POND
- MUNICIPAL DRAIN
- SANITARY P.S.
- HYDRO CORRIDOR

DSEL
120 Iber Road, Unit 103
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Fax. (613) 836-7183
www.DSEL.ca

STITTSVILLE SOUTH URBAN EXPANSION AREA
SWM POND AND SERVICING OPTIONS
CITY OF OTTAWA

SCALE:	1:3000	PROJECT No.:	21-1247
DATE:	JULY 2024	DRAWING:	6

David Schaeffer Engineering Ltd.
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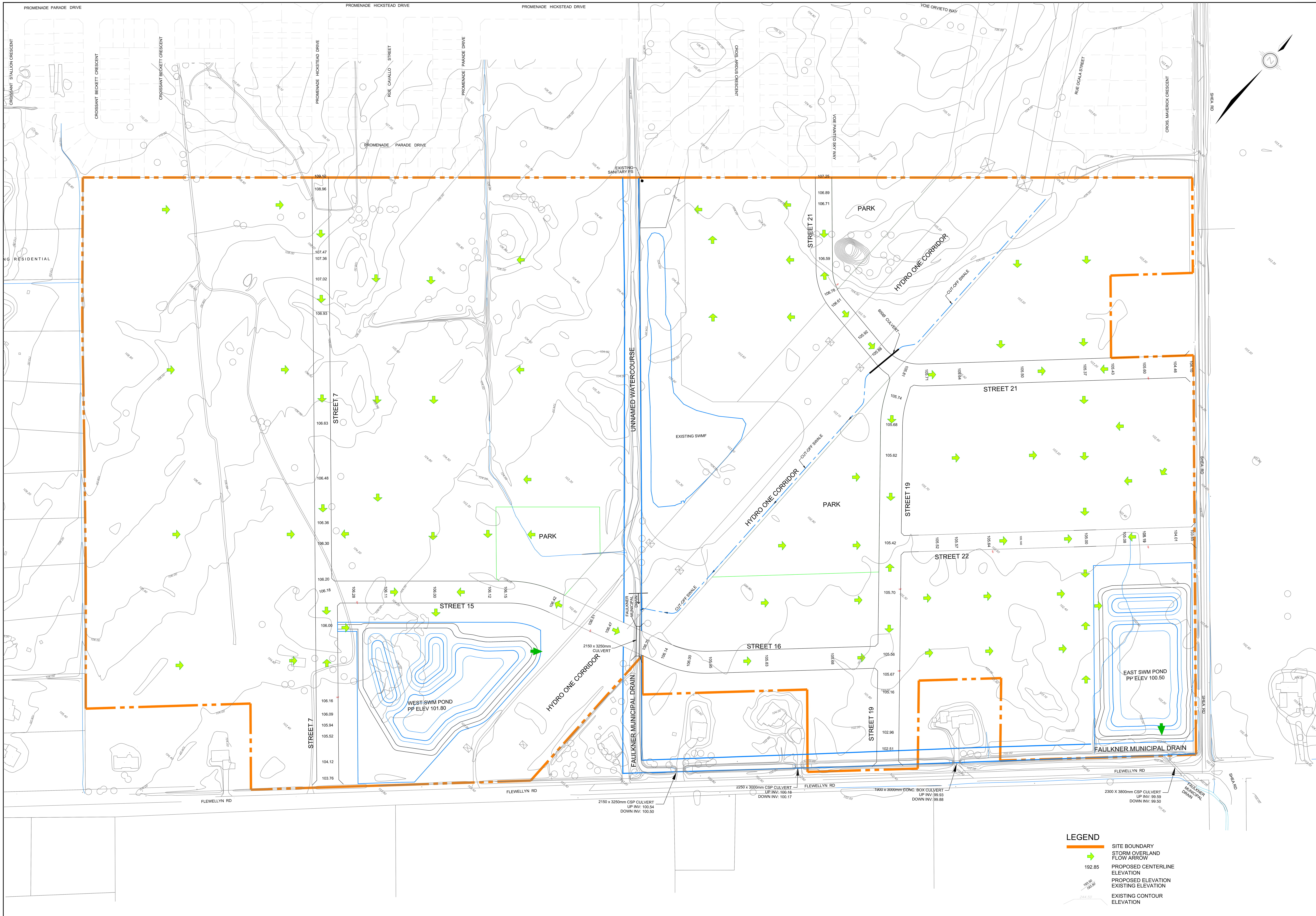
dsel.ca

DRAWINGS



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Fax. (613) 836-7183
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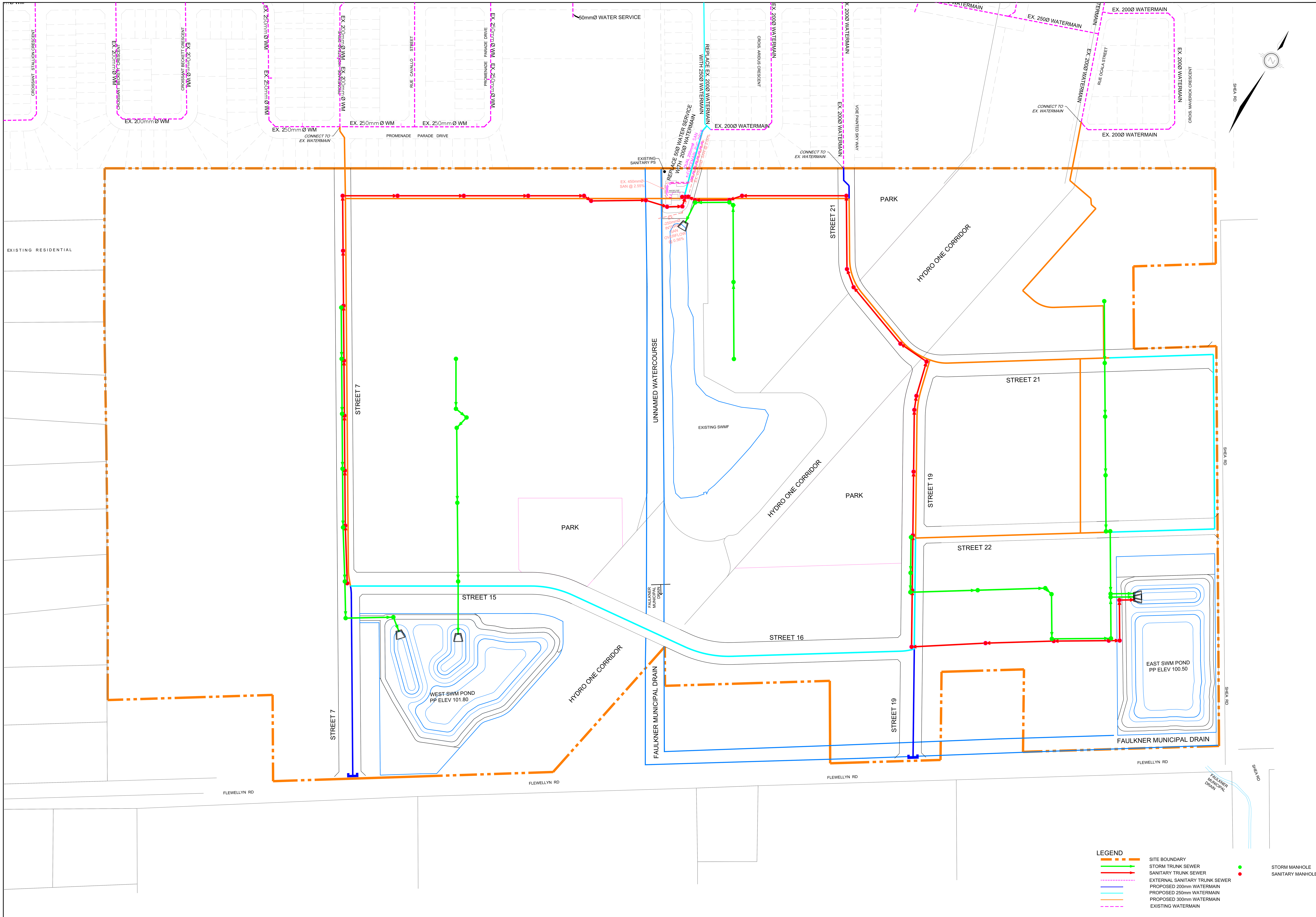
STITTSVILLE SOUTH URBAN EXPANSION AREA
CONCEPTUAL GRADING PLAN
CITY OF OTTAWA

PROJECT No. :	21-1247
SCALE:	1:1250
DATE:	AUG 2024
DRAWING No.	1



DSEL

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Stittsville, ON K2S 1E9
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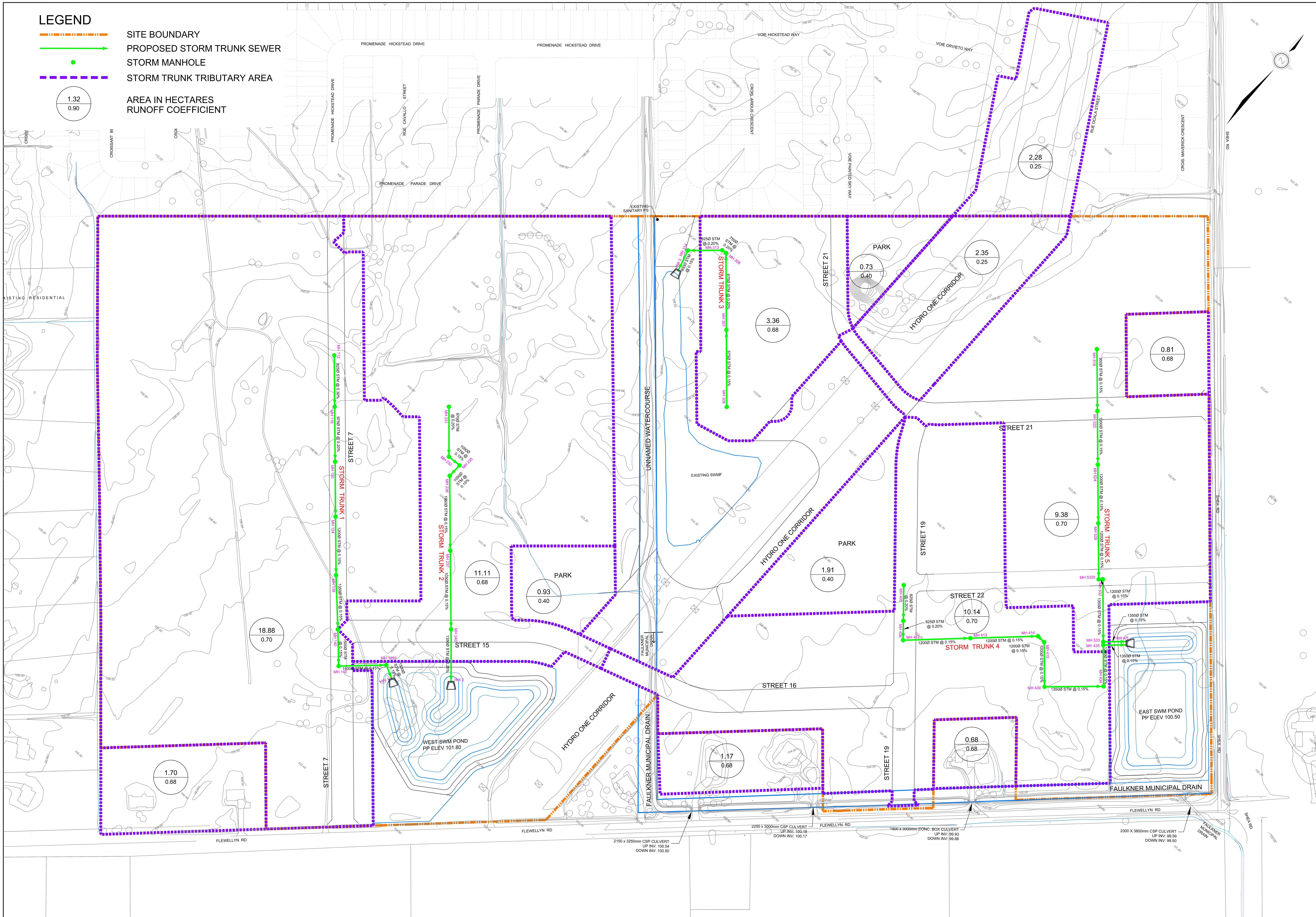
www.DSEL.ca

STITTSVILLE SOUTH URBAN EXPANSION AREA
CONCEPTUAL SERVICING PLAN
CITY OF OTTAWA

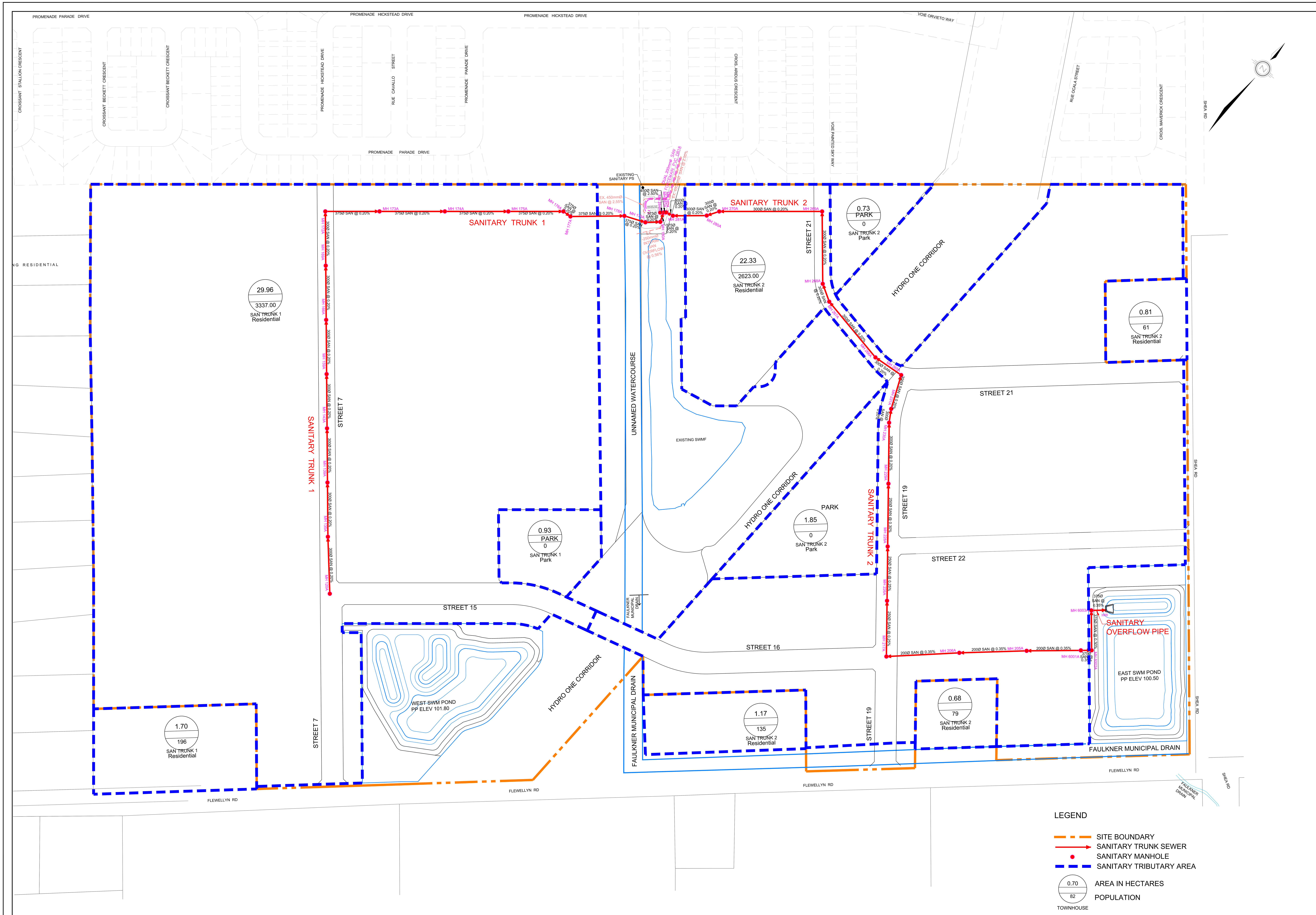
PROJECT No. :	21-1247
SCALE:	1:1250
DATE:	AUG 2024
DRAWING No.	2



120 Iber Road, Unit 103
Stittsville, ON K2S 1E9
Tel. (613) 836-0856
Fax. (613) 836-7183
www.DSEL.ca

STITTSVILLE SOUTH URBAN EXPANSION AREA
STORM SERVICING PLAN
CITY OF OTTAWA

PROJECT No. :	21-1247
SCALE:	1:1250
DATE:	AUG 2024
DRAWING No.	3



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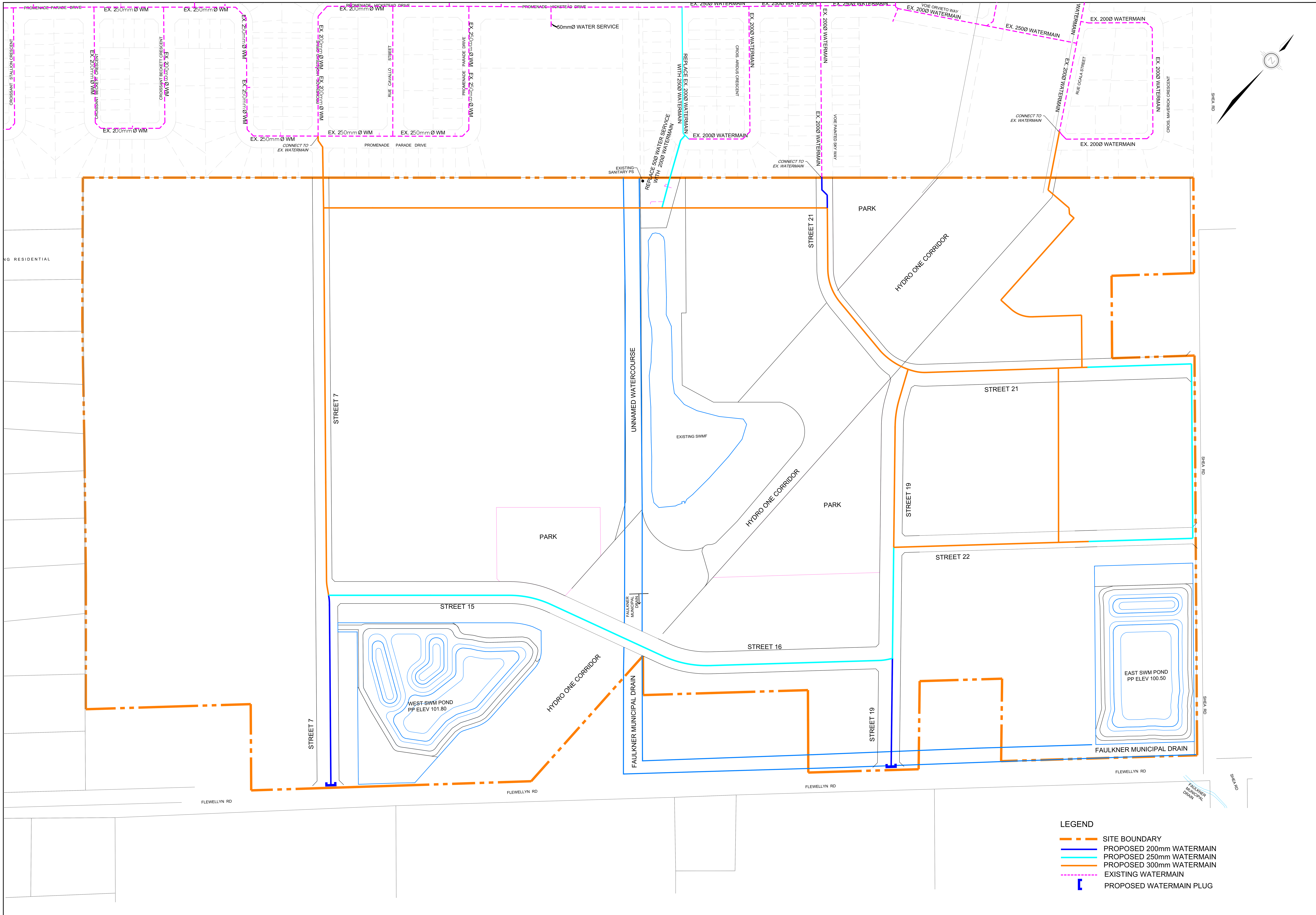
STITTSVILLE SOUTH URBAN EXPANSION AREA
CONCEPTUAL SANITARY SERVICING PLAN
CITY OF OTTAWA

PROJECT No. :	21-1247
SCALE:	1:1250
DATE:	AUG 2024
DRAWING No.	4



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STITTSVILLE SOUTH URBAN EXPANSION AREA
CONCEPTUAL WATERMAIN SERVICING PLAN
CITY OF OTTAWA

PROJECT No. :	21-1247
SCALE:	1:1250
DATE:	AUG 2024
DRAWING No.	5