J.F. Sabourin and Associates Inc.
52 Springbrook Drive,
Ottawa, ON K2S 1B9
T 613-836-3884 F 613-836-0332

jfsa.com

Ottawa. ON
Paris. ON
Gatineau. QC
Montréal. QC
Québec. QC

January 31, 2023 Project Number: 1474

City of Ottawa
110 Laurier Avenue West
Ottawa, ON K1P 1J1

Attention: **Melanie Gervais, Planner III**

Subject: **Barrhaven Conservancy West - Hydraulic Impact Assessment**

Introduction

A significant portion of the Barrhaven Conservancy Lands were removed from the flood plain by way of physical site alterations in early 2020 in accordance with permits issued by the Rideau Valley Conservation Authority (RVCA). Previous to and since that time, development applications under the Planning Act have been put forth, including:

- Subdivision and associated zoning for Barrhaven Conservancy East Ph1. Now fully registered and built out.
- Subdivision and associated zoning for Barrhaven Conservancy East Ph2. Now draft approved.
- Subdivision and associated zoning for Barrhaven Conservancy West. Currently under review.

This Memo is related to the Barrhaven Conservancy West lands and specifically addresses comments received as part of the Barrhaven Conservancy West Draft Plan circulation, notably, comments 4.5 and 4.6 prepared by the RVCA.

Barrhaven Conservancy West Subdivision Proposal

The subdivision application for Barrhaven Conservancy West was deemed complete on November 2, 2021, by the City of Ottawa Planning staff, and was subsequently circulated for comment. The RVCA staff comments included the following:

4.5. Further, as part of the RVCA letter of permission (RV5-4419) for flood plain modifications, a monitoring program has been initiated as a condition of approval. As part of the monitoring program, it has been anticipated by the Conservation Authority that portions of the proposed subdivision are to be held from development as a potential area for modification should the monitoring program identify a need for additional cut be required. Portions of the lands west of the current O'Keefe alignment were identified as being the optimal location to provide additional cut should it be required. As such, development of these lands should be held in abeyance, until the monitoring program has been completed and that an additional cut is demonstrated to not be required. [emphasis added]

4.6. As such, both concerns related to the extent of the proposed subdivision along with on-going monitoring and potential mitigation needs, the application is considered premature from a natural hazards perspective.

Certain statements provided by RVCA staff in comment 4.5 are incorrect.

1. Neither the subject lands, nor any specific lands west of the O'Keefe Drain, have ever been identified as appropriate to be the subject of additional earth works for mitigation purposes. This is an assumption that has no substance to support it, and has been demonstrated to be technically indefensible, as explained in this memo. The suggestion that these lands are 'optimal' for this purpose is contrary to the modelled hydraulics of the Jock River through this reach.
2. The lands west of the O'Keefe Municipal Drain were removed from the flood plain and are not hazard lands.
3. Revisions to the subdivision draft plan have addressed any remnant flood plain that was previously encroaching on the development lands.

A permit to undertake site alteration in certain areas of the Jock River flood plain within the General Urban Area of the City of Ottawa was approved by the RVCA Executive Committee in November 2019. This approval was based on a detailed, peer-reviewed 2D HEC-RAS model that identified areas where modifications to the grades, both filling and cutting, resulted in no impact on water levels or flows, upstream or downstream.

The RVCA's decision to approve the project was subject to a set of standard and project-specific conditions, including the following relevant conditions:

1. A Monitoring Plan that demonstrates water levels and velocities are verified and within acceptable range. ..by a 3rd party consultant to devise and implement and report.
2. In the event adverse effects from the filling of the flood fringe are identified by the Monitoring Program, the proponent agrees to undertake [additional] earthworks to mitigate the adverse effects to the satisfaction of RVCA.

The monitoring agreement is for a 10-year period (provided certain flow thresholds are achieved).

In direct response to the above comments received from the RVCA for the Barrhaven Conservancy West draft plan, JFSA has demonstrated, with the same modelling exercise accepted to support and approve the original permit, that alterations to the Barrhaven Conservancy West development lands for the purpose of water level mitigation is technically very limited. The reason these lands could be filled is that they have very limited impact on the water levels in the Jock River. For the same reasons, the removal of fill, or cutting of these lands, has very limited effect on the water levels of the Jock River. JFSA has never proposed these lands to be 'held in abeyance' for a potential future cut as that would be contrary to what the engineering models indicate would be useful for that purpose.

The water resource engineering work and discussion documented below in this memo demonstrate:

- The Barrhaven Conservancy West lands proposed to be developed by plan of subdivision could not provide useful benefits to mitigating water levels if they were altered in the future. There is no technical justification to hold them from development, which would result in the sterilization of a large area of serviceable residential lands.

Hydraulic Analysis Overview

A modelling exercise has been undertaken to assess the efficacy of the 'abeyance lands' suggested by the RVCA as a tool for mitigating any future water level impacts in the Jock River, if identified by long-term field monitoring. A 2D hydraulic model of the Jock River was developed as a part of the RVCA-accepted JFSA October 2019 "Barrhaven Conservancy Cut / Fill Hydraulic Impact Assessment" report and subsequent minor boundary reconciliation outlined in the JFSA February 2020 memo "BCDC minor revision to RV5-4419 re: Cut Fill Boundary Reconciliation." This model has been updated to quantify the effect of a potential site alteration option at this location.

RVCA Proposed 'Abeyance' Lands

For this analysis, it is assumed that the westmost parcel of the Barrhaven Conservancy West subdivision lands between Highway 416 and the O'Keefe Drain (**14.18 ha**) is to be utilized to mitigate future water level impacts. To make the most effective use of these lands for mitigation it has been assumed that this parcel would be cut to the 2-Year Spring Water Level on the Jock River (which ranges from **90.92** masl at XS 7657 to **90.87** masl at XS 7441 - per the RVCA 1D Jock River model of record). In completing this potential cut, it was determined that approximately **74,141** m^3 of fill would be removed from predevelopment conditions, with an average cut depth of **0.52 m** and a maximum cut depth of **1.47 m**. Note that the cuts applied in this analysis are simple conceptual designs for modelling purposes, as detailed grading has not been undertaken. The 2D model of the Jock River was run with the described alterations on these lands, and the rest of the Barrhaven Conservancy lands east of the O'Keefe Drain remain as specified in the approved 2019/2020 JFSA study. The resulting peak 100-Year water levels were then compared against the approved conditions model water level results (baseline condition). Comparing these results provides a clear empirical measure of the mitigating benefit potential of the lands west of the O'Keefe Drain.

Figures 1-1 to 1-4 provide flood plain difference maps for the 100-Year flood comparing:

1. the peak water surface elevation under the approved 2019/2020 2D conditions against
2. the peak water surface elevation under the 2D RVCA potential mitigating conditions outlined above.

The difference maps have been produced by subtracting the peak computed water levels of approved 2019/2020 2D conditions from the 2D RVCA potential mitigating conditions. To illustrate the results, increases and decreases in the flood plain peak water level differences have been represented in light red (increases) and light blue (decreases), respectively. Water surface difference contours have been overlaid on this figure at 1 cm increments to provide context to the applied raster palette.

This analysis demonstrates that the lands proposed by the RVCA to be held in abeyance have a very limited impact on the water levels of the Jock River, with a localized **1 cm** decrease upstream of these lands when compared with the approved condition. There is also a localized increase of **2 cm** near the O'Keefe Drain, which is due to flows from the Jock River being able to flow directly to this location (which was previously protected by the filled parcel). As indicated in this figure, the lands proposed by the RVCA to be held in abeyance have a very limited mitigating effect on peak water levels on the Jock River when compared to the expected results presented in the JFSA October 2019 report.

Explanation of the Flood Plain Conveyance Corridor

The reason the lands proposed by the RVCA to be held in abeyance are having negligible impacts on reducing peak flood elevations is due to the fact that the entire flood plain alteration project was designed predicated on flow conveyance, not flood plain storage.

To elaborate on this concept, the 100-Year snow melt + rainfall event assessed in this analysis at Moodie Drive (just upstream of the subject site) has a total runoff volume of **97,623,628 m³** (**52,483 ha** with **186.01 mm** runoff). In contrast, as described above, the proposed cut on the lands between Highway 416 and the O'Keefe Drain would provide only **74,141 m³** of additional flood plain storage, which is insignificant (**0.07%**) when compared to the millions of cubic meters of volume that flows through this section of the watercourse during the 100-Year spring snowmelt event. As the total runoff volume to this reach of the Jock River is so large, changes in available flood plain storage have a negligible impact on peak flood elevations, as the additional storage volume provided in these cut areas would be filled well before the peak of the event.

Alternatively, optimizing how the flows are conveyed through this section of the watercourse can have significant benefits in mitigating peak water levels during extreme events. As outlined above, given the size of this watercourse, improving flow conveyance is a far more effective tool for mitigating peak flood elevations than providing additional flood plain storage volume. **Figure 2** is an excerpt from the JFSA 2019 report [with additional annotations provided for context for this memo] which in essence is a "flow heatmap" under pre-development conditions (Circa 2019). This figure graphically indicates where the majority of the flow during the 100-Year event is located within the greater flood plain area.

As expected, the majority of the flow during the 100-year event is within the channel. Outside of the main channel, there appears green and dark blue shading indicating the major conveyance path when flows are over bank. As seen from this figure, the majority of the lands proposed by the RVCA to be held in abeyance are outside of this conveyance path and primarily contained within the light blue low-flow area. This demonstrates that cutting these lands will not have a significant impact on flow conveyance and, similarly, peak water levels on the Jock River, since the majority of the flows are elsewhere within the floodplain. It is important to emphasize that the approved development boundaries west of Borrisokane Road were specifically located, by design, to avoid impact on the conveyance pathway of the Jock River floodplain. This is why the development boundaries of these three parcels along the southern edge approximately reflect the shape and limit of the conveyance path identified above.

Should adverse impacts from the 2019/2020 site alteration work undertaken be identified, appropriate mitigation works will be identified and deliberately designed based on the specific issue and location identified by the monitoring program. Until such a time, no impacts are anticipated and cannot be devised. The proponent has committed through their acceptance of the permit and conditions to undertake additional earthworks to mitigate the adverse effects to the satisfaction of RVCA. No additional tools or encumbrances are required.

Conclusion

The effectiveness of a potential cut undertaken within the Barrhaven Conservancy West subdivision lands, between Highway 416 and the O'Keefe Drain, as contemplated by the RVCA, has been assessed using detailed 2D hydraulic modelling. The results of this analysis establish that alterations on these lands result in very limited mitigation of peak water levels on the Jock River, with no reduction of significance beyond the subject property. Consequently, there is no technical justification for holding development of these lands in abeyance pending completion of the monitoring program associated with the earlier site alteration approval granted by the RVCA.

Yours truly,
J.F Sabourin and Associates Inc.

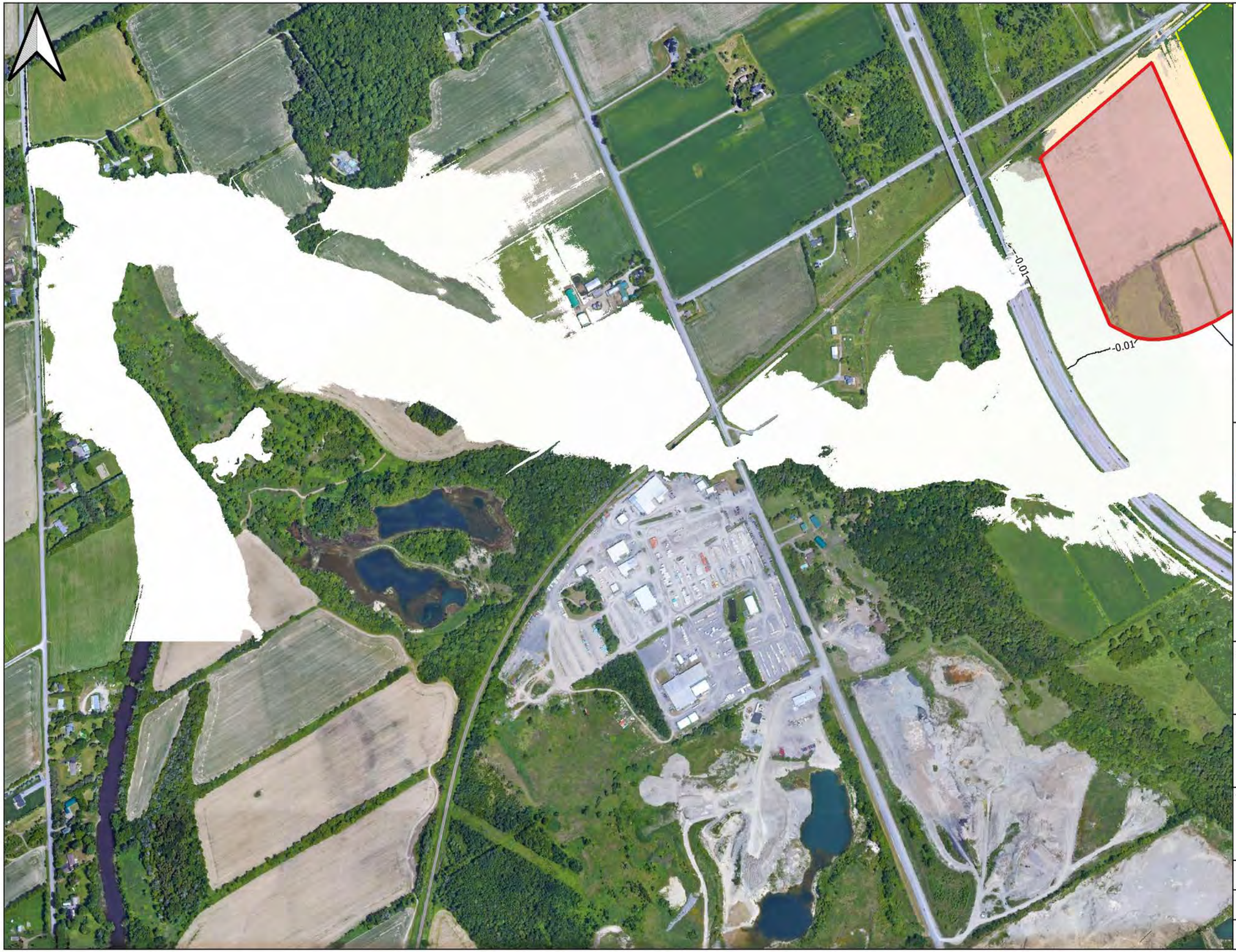
Jonathon Burnett, B.Eng, P.Eng
Water Resources Engineer

Jocelyn Chandler, M.Pl., RPP, MCIP
Land and Water Resource Planner

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

Figures

Figure 1-1 to 1-4	Peak Water Level Difference: 2D RVCA Abeyance Lands (v22.) - 2D 2019 Approved Development (v22.1) (100 Year Flow - 196 cms)
Figure 2	Conveyance Overview



Legend

- RVCA Proposed Abayance Lands
- Development Boundary
- Contours (1cm)
- Added Floodplain
- Removed Floodplain

WSE Difference (m)

- -0.2
- -0.15
- -0.1
- -0.05
- 0
- 0.05
- 0.1
- 0.15
- 0.2

NOTE: Water surface difference calculated as: Abeyance Conditions Model - Approved Conditions Model. This means that a positive value (orange/red) indicates an increase in water levels from the approved conditions.

J.F. Sabourin and Associates Inc.
WATER RESOURCES AND ENVIRONMENTAL CONSULTANTS
52 Springbrook Drive
Ottawa, ON, K2S 1B9
(613) 836-3884
www.jfsa.com

CAIVAN
COMMUNITIES

SCALE : 1:7,500

0 150 300 450 m

PROJECT :

Barrhaven Conservancy Abeyance Land
- Hydraulic Impact Assessment

TITLE : Figure 1-1
Peak Water Level Difference:
2D RVCA Proposed Abeyance Lands (v22.2) - 2D 2019 Approved Development (v22.1)
(100 Year Flow - 196 cms)

PROJECT	1474-17
DRAWN:	JB
DATE:	NOV 2022

Legend

- RVCA Proposed Abayance Lands
- Development Boundary
- Contours (1cm)
- Added Floodplain
- Removed Floodplain

WSE Difference (m)

- -0.2
- -0.15
- -0.1
- -0.05
- 0
- 0.05
- 0.1
- 0.15
- 0.2

NOTE: Water surface difference calculated as: Abeyance Conditions Model - Approved Conditions Model. This means that a positive value (orange/red) indicates an increase in water levels from the approved conditions.

J.F. Sabourin and Associates Inc.
WATER RESOURCES AND ENVIRONMENTAL CONSULTANTS
52 Springbrook Drive
Ottawa, ON, K2S 1B9
(613) 836-3884
www.jfsa.com

CAIVAN
COMMUNITIES

SCALE : 1:7,500

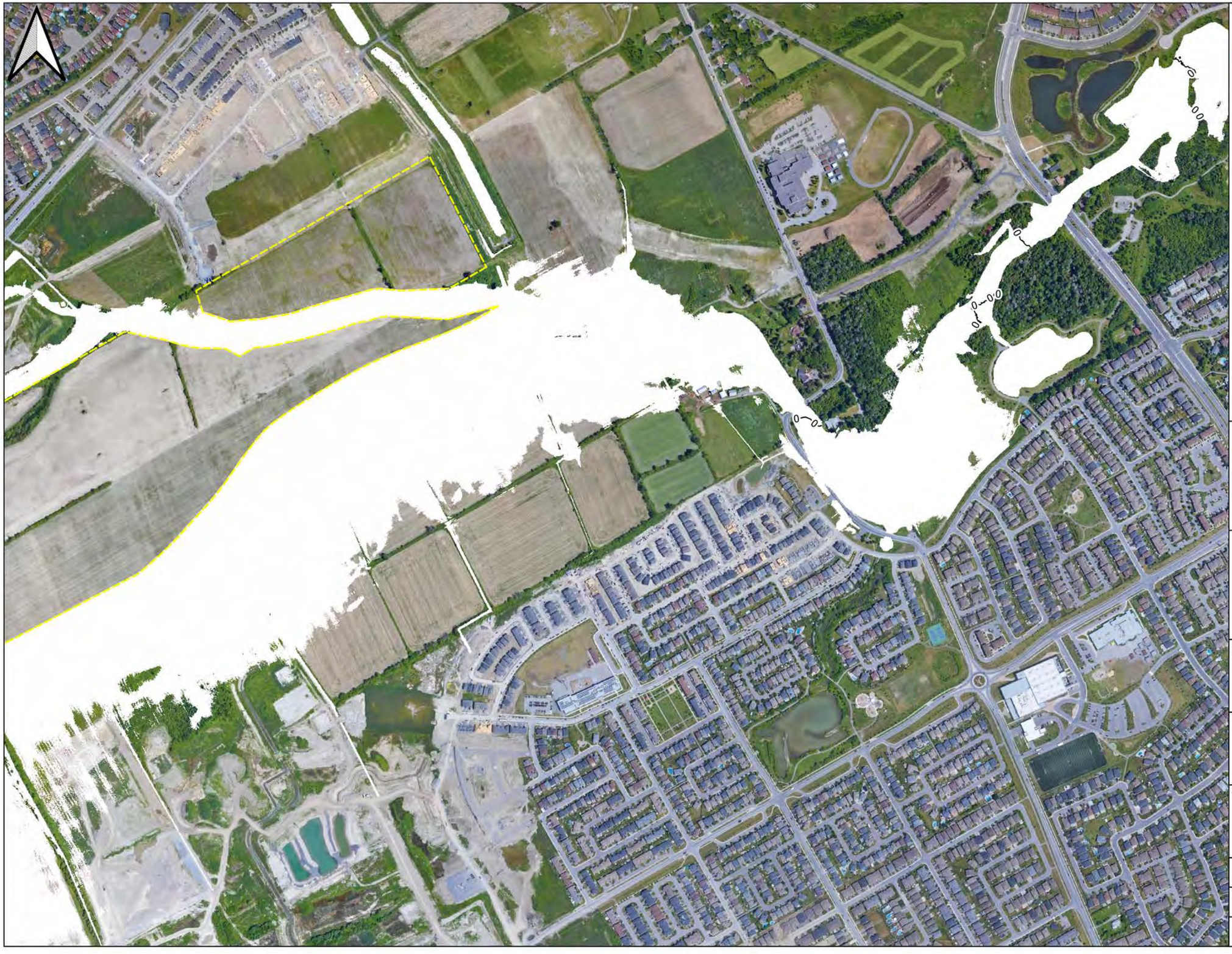
0 150 300 450 m

PROJECT :

Barrhaven Conservancy Abeyance Land
- Hydraulic Impact Assessment

TITLE : Figure 1-2
Peak Water Level Difference:
2D RVCA Proposed Abeyance Lands (v22.2) - 2D 2019 Approved Development (v22.1)
(100 Year Flow - 196 cms)

PROJECT	1474-17
DRAWN:	JB
DATE:	NOV 2022



Legend

- RVCA Proposed Abayance Lands
- Development Boundary
- Contours (1cm)
- Added Floodplain
- Removed Floodplain

WSE Difference (m)

- -0.2
- -0.15
- -0.1
- -0.05
- 0
- 0.05
- 0.1
- 0.15
- 0.2

NOTE: Water surface difference calculated as: Abeyance Conditions Model - Approved Conditions Model. This means that a positive value (orange/red) indicates an increase in water levels from the approved conditions.

J.F. Sabourin and Associates Inc.
WATER RESOURCES AND ENVIRONMENTAL CONSULTANTS
52 Springbrook Drive
Ottawa, ON, K2S 1B9
(613) 836-3884
www.jfsa.com

CAIVAN
COMMUNITIES

SCALE : 1:7,500

0 150 300 450 m

PROJECT :

Barrhaven Conservancy Abeyance Land
- Hydraulic Impact Assessment

TITLE : Figure 1-3
Peak Water Level Difference:
2D RVCA Proposed Abeyance Lands (v22.2) - 2D 2019 Approved Development (v22.1)
(100 Year Flow - 196 cms)

PROJECT	1474-17
DRAWN:	JB
DATE:	NOV 2022

Legend

- RVCA Proposed Abayance Lands
- Development Boundary
- Contours (1cm)
- Added Floodplain
- Removed Floodplain

WSE Difference (m)

- -0.2
- -0.15
- -0.1
- -0.05
- 0
- 0.05
- 0.1
- 0.15
- 0.2

NOTE: Water surface difference calculated as: Abeyance Conditions Model - Approved Conditions Model. This means that a positive value (orange/red) indicates an increase in water levels from the approved conditions.

J.F. Sabourin and Associates Inc.
WATER RESOURCES AND ENVIRONMENTAL CONSULTANTS
52 Springbrook Drive
Ottawa, ON, K2S 1B9
(613) 836-3884
www.jfsa.com

CAIVAN
COMMUNITIES

SCALE : 1:7,500

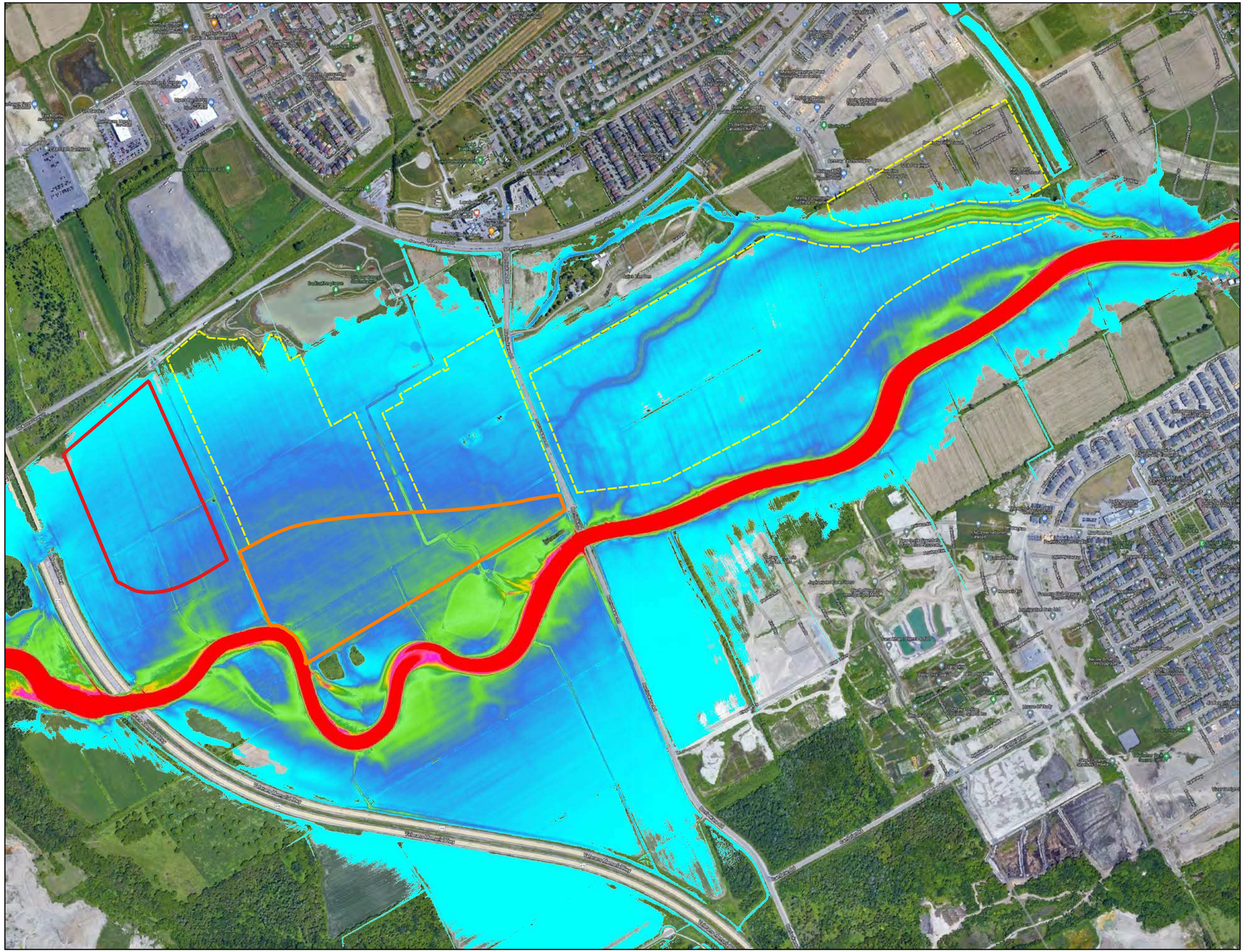
0 150 300 450 m

PROJECT :

Barrhaven Conservancy Abeyance Land
- Hydraulic Impact Assessment

TITLE : Figure 1-4
Peak Water Level Difference:
2D RVCA Proposed Abeyance Lands (v22.2) - 2D 2019 Approved Development (v22.1)
(100 Year Flow - 196 cms)

PROJECT	1474-17
DRAWN:	JB
DATE:	NOV 2022



Legend

- ▭ Approved Development Extents
- ▭ RVCA Proposed Abeyance Lands
- ▭ JFSA Abeyance Solution

Existing Flows:
Depth x Velocity
(m³/s)

- 🟦 0
- 🟦 0.1
- 🟩 0.2
- 🟩 0.3
- 🟩 0.4
- 🟩 0.5
- 🟨 0.6
- 🟧 0.7
- 🟪 0.8
- 🟪 0.9
- 🟥 1>

N

NOTE: Depth x Velocity used as a proxy to represent flow in this figure.

SCALE: 1:10000

0 200 400 600 m

J.F. Sabourin and Associates Inc.
WATER RESOURCES AND ENVIRONMENTAL CONSULTANTS
52 Springbrook Drive
Ottawa, ON, K2S 1B9
(613) 836-3884
www.jfsa.com

CAIVAN
COMMUNITIES

Barrhaven Conservancy Abeyance Land:
Hydraulic Impact Assessment

Figure 2: Conveyance Overview

PROJECT	1474
DRAWN	JB
DATE	Nov 2022

C:\OneDrive\J.F. Sabourin and Associates Inc\JFSA-OTTAWA-SERVER - Documents\PROJ\1474\Design\GIS\20221128-Abeyance Lands