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

March 15, 2024 Project Number: 1474

David Schaeffer Engineering Ltd
120 Iber Road, Unit 103
Ottawa, Ontario
K2S 1E9

Attention: **Marc Pichette, P.Eng**

Subject: **Barrhaven Conservancy West – Preliminary HGL Analysis**

Introduction

Barrhaven Conservancy West Development is located in Barrhaven, Ontario, north of the Jock River, east of Highway 416 and west of Borrisokane Road. The proposed development is approximately **48.42 ha** that will primarily comprise of single and townhouse residential lots, stacked condos and a park. The following outlines the preliminary hydraulic grade line (HGL) assessment for the site, to ensure that the proposed minor system within the development is adequately sized to safely convey flows to the Jock River under various conditions. As such the following memo outlines the approach taken in assessing the summarises the findings of this analysis.

Analysis Approach

Preliminary hydraulic grade line calculations for the proposed Barrhaven Conservancy West development were completed using PCSWMM modelling software. Pipe data, storm sewer layout and Rational Method flows in the storm sewer are as provided by DSEL. The Rational Method flows were calculated based on the 2-, 5- or 10-year level of service requirements, and the 100-year flows in the hydraulic grade line calculations were estimated as 14% greater than the Rational Method flows, to account for the additional flows captured by catchbasin grates, lead pipes and/or inlet control devices under the higher surface water depths of the 100-year storm.

The 14% increase in flows for the 100-year event is based on the assumption that the head on a lead pipe/ICD will increase by 35 cm (maximum allowable major system ponding depth) during the 100-year event. Taking a typical 250 mm lead pipe and assuming that the head on the pipe is just below the top of the grate (assumed at 1.38 m) results in a peak flow of 209 L/s, then assuming that the head is increased by 35 cm during the 100-Year (head of 1.730 m) the flow through the lead pipe would increase to 234.5 L/s, which results in a 12% increase in peak flows. It is important to note that a 12% increase is observed when the same calculations are applied to the various lead pipe and ICD sizes. An additional 2% is added as a safety factor to allow some flexibility in the design, as it is likely that not all lead pipes will have a head of 1.38 m (just below the top of MH) for the level of service specified.

The proposed storm sewer infrastructure data was extracted from DSEL's detailed drawings and incorporated into a PCSWMM model, and flows derived by DSEL's rational method calculations were then applied to each Maintenance Hole (MH) in the model as steady flows (using the baseflow option). Exit losses were applied to all storm sewer pipes in the system based on the angle of the downstream connection.

Note that the flows applied to each MH in the PCSWMM model are the flow contributions from each respective drainage area to that MH, as such the PCSWMM modelling does not consider the effects of routing and differences in the timing of peaks in the storm sewer network, which results in higher peak flows than indicated in the rational method calc sheets. This ensures a conservative design as the peak storm sewer flows are slightly over-estimated.

As with all other works completed for the Barrhaven Conservancy development phases, the preliminary HGL analysis was completed under two conditions:

- 100-year rainfall event on the development and a 5-year spring water level on the Jock River
- Level of service (2/5/10-year) rainfall event on the development and a 100-year spring water level on the Jock River

Note that the water level along the Jock River through the length of this development varies, and as such the nearest corresponding upstream water surface elevation calculated by RVCA's HEC-RAS floodplain mapping model of the Jock River was applied at each of the respective storm sewer outlets. Also, note that assuming a 5-year spring water level on the Jock River for a 100-year rainfall event on the development is an inherently conservative assumption, as the critical storm for the proposed development is a summer (intense rainfall) event while the critical storm for the Jock River is a spring (snowmelt + rainfall) event. A preliminary Single Station Flood Frequency analysis was completed by JFSA using only summer flows (from May 15 to October 31) based on historical flow data recorded at the Moodie Drive Water Survey Canada gauge. This analysis found that the 100-year summer flow on the Jock River is around **99 m³/s**, while the 5-year spring flow is around **123 m³/s**, therefore the downstream boundary condition applied is conservative.

Within the proposed development, Oil and Grit Separators (OGS) units in conjunction with LID measures will be implemented to ensure the site meets quality control requirements. Preliminary OGS units and associated by-pass weir elevations have also been included in the model, based on similar drainage areas and imperviousness seen in Barrhaven Conservancy Phase 2. Based on previous analysis the majority of the units will have a **750mm** pipe in and out of the OGS unit and a weir height around **0.65m** from the bottom of the OGS. As such this assumption has been applied to all OGS units within this study area. These assumptions will be reassessed at detailed design.

Results

The maximum HGL obtained at each MH has been extracted from the level of service (2/5/10-year) event / 100-year Jock River water level scenario and the 100-year event / 5-year Jock River water level scenario, with the results from this analysis provided in **Tables 1 & 2**, respectively. As all proposed units within this development will have sump pumps, the simulated HGL was compared against the top of MH elevation to ensure that all storm sewers infrastructure is sufficiently sized and is not surcharging to the major system during the assessed events.

From this analysis, it was found that the critical scenario for HGL within the development was the level of service development event and 100-year water level on the Jock River scenario. Based on this scenario, no MHs will have an HGL elevation above the top of MH (minimum freeboard of **0.42 m** at **MH-415**), with an average freeboard of **0.70 m** from the top of MH throughout the proposed development.

For the 100-year event and 5-year water level on the Jock River, no MHs will have HGL elevations above the top of MH (minimum freeboard of **0.95 m** at **MH-313**), with an average freeboard of **1.28 m** from the top of MH throughout the proposed development. As such it can be concluded that the proposed storm sewer infrastructure is sufficiently sized, to safely convey minor system flows from the development under various extreme conditions.

Conclusion

A preliminary HGL analysis for the West Phase of the Barrhaven Conservancy Development was completed using PCSWMM based on storm sewer and flow details provided by DSEL. From this analysis, it was found that the proposed storm sewer infrastructure is sufficiently sized to convey all minor system flows to the Jock River and will not result in any MHs surcharging to the street under extreme events such as 100-year rainfall events on the development and a 5-year spring water level on the Jock River and a level of service (2/5/10 Year) rainfall event on the development and a 100-year spring water level on the Jock River, with the former being the more critical scenario for the HGL within the development.

Yours truly,
J.F Sabourin and Associates Inc.

Jonathon Burnett, P.Eng
Water Resources Engineer

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

Figures
Figure 1: Storm Sewer Overview

Tables
Table 1: HGL Result Tables - Level of service (2/5/10-year) BCDC Development & 100-Year Jock River
Table 2: HGL Result Tables - 100-Year BCDC Development & 5-Year Jock River

Attachments
Attachment A: DSEL Rational Method Calculations

Modelling Files – Provided Electronically
PCSWMM BCDC-West_v03.0-100YrDev5YrJock.inp
BCDC-West_v03.0-LOSDev100YrJock.inp

Legend

- Junctions
- Conduits
- Outfalls
- Development
- Drainage Divide
- Site Plan

SCALE: 1:4500

0 100 200 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

DSEL

Barrhaven Conservancy West – Preliminary HGL Analysis

Figure 1 - Storm Sewer Overview

PROJECT	1474(03)
DRAWN	JB
DATE	MARCH 2024

C:\Users\JonathonBurnett\J.F. Sabourin and Associates Inc\JFSA-OTTAWA-SERVER - Documents\PROJ\1474(03)-21\202403-BCDC West - Prelim Design\Design\GIS\New folder

Table 1: Barrhaven Conservancy West - Preliminary HGL Analysis
LOS (2/5/10 Year) Development & 100-Year Jock River

MH-ID	Invert Elevation (m)	Top of MH (m)	Max HGL (m)	Freeboard (m)
MH-101	91.30	93.70	92.56	1.14
MH-102	91.17	93.67	92.57	1.10
MH-103	91.02	93.53	92.55	0.98
MH-104	90.84	93.35	92.50	0.85
MH-105	90.66	93.16	92.38	0.78
MH-106	90.53	93.10	92.34	0.76
MH-107	90.47	93.06	92.33	0.73
MH-108	90.39	92.99	92.30	0.69
MH-109	90.50	93.05	92.34	0.71
MH-110	90.29	92.96	92.26	0.70
MH-111	90.22	92.94	92.19	0.75
MH-112	90.14	92.92	92.15	0.77
MH-201	91.18	93.58	92.74	0.84
MH-202	90.96	93.44	92.72	0.72
MH-203	90.84	93.57	92.82	0.75
MH-204	90.63	93.42	92.71	0.71
MH-205	90.53	93.33	92.67	0.66
MH-206	90.38	93.23	92.62	0.61
MH-207	90.17	93.08	92.47	0.61
MH-208	90.07	93.00	92.41	0.59
MH-209	89.94	92.92	92.29	0.63
MH-210	89.78	92.79	92.18	0.61
MH-211	89.70	92.78	92.14	0.64
MH-301	91.47	93.91	93.09	0.82
MH-302	91.27	93.86	93.09	0.77
MH-303	91.00	93.70	93.00	0.70
MH-304	90.89	93.61	92.99	0.62
MH-305	91.23	93.82	92.97	0.85
MH-306	91.06	93.75	92.96	0.79
MH-307	90.95	93.64	92.94	0.70
MH-308	90.71	93.49	92.91	0.58
MH-309	90.60	93.49	92.85	0.64
MH-310	90.42	93.46	92.78	0.68
MH-311	90.99	93.39	92.80	0.59
MH-312	90.85	93.27	92.78	0.49
MH-313	90.66	93.19	92.75	0.44
MH-314	90.27	93.34	92.73	0.61
MH-315	90.10	93.14	92.63	0.51
MH-316	89.94	93.13	92.61	0.52

Table 1: Barrhaven Conservancy West - Preliminary HGL Analysis
LOS (2/5/10 Year) Development & 100-Year Jock River

MH-ID	Invert Elevation (m)	Top of MH (m)	Max HGL (m)	Freeboard (m)
MH-317	89.79	92.95	92.49	0.46
MH-318	89.70	92.92	92.41	0.51
MH-319	89.55	92.80	92.32	0.48
MH-320	89.47	92.78	92.28	0.50
MH-321	90.91	93.01	92.35	0.66
MH-322	90.79	92.97	92.34	0.63
MH-323	90.61	92.92	92.29	0.63
MH-324	90.50	92.90	92.28	0.62
MH-325	90.30	92.81	92.24	0.57
MH-326	90.21	92.80	92.22	0.58
MH-327	90.11	92.79	92.22	0.57
MH-328	89.38	92.75	92.20	0.55
MH-401	91.59	93.70	92.76	0.94
MH-402	91.44	93.64	92.75	0.89
MH-403	91.34	93.63	92.75	0.88
MH-404	91.17	93.56	92.73	0.83
MH-405	90.98	93.48	92.62	0.86
MH-406	90.83	93.39	92.55	0.84
MH-407	90.67	93.29	92.50	0.79
MH-408	90.44	93.19	92.45	0.74
MH-409	90.28	93.09	92.41	0.68
MH-410	90.11	92.90	92.31	0.59
MH-411	89.94	92.83	92.22	0.61
MH-412	90.64	93.04	92.47	0.57
MH-413	90.48	92.97	92.44	0.53
MH-414	90.37	92.87	92.39	0.48
MH-415	90.25	92.74	92.32	0.42
MH-416	90.03	92.68	92.19	0.49
MH-417	89.93	92.66	92.14	0.52
MH-418	89.69	92.66	92.10	0.56
MH-501	91.00	93.50	92.43	1.07
MH-502	90.89	93.39	92.42	0.97
MH-503	90.72	93.27	92.39	0.88
MH-504	90.48	93.12	92.28	0.84
MH-505	90.38	93.08	92.26	0.82
MH-506	90.32	93.07	92.25	0.82
MH-507	90.18	92.97	92.19	0.78
MH-508	90.44	92.94	92.20	0.74
MH-509	90.00	92.85	92.13	0.72

Table 1: Barrhaven Conservancy West - Preliminary HGL Analysis
LOS (2/5/10 Year) Development & 100-Year Jock River

MH-ID	Invert Elevation (m)	Top of MH (m)	Max HGL (m)	Freeboard (m)
MH-510	89.81	92.70	92.03	0.67
MH-511	89.74	92.68	92.00	0.68
MH-512	89.65	92.65	91.92	0.73
MH-601	90.78	93.27	92.36	0.91
MH-602	90.63	93.21	92.35	0.86
MH-603	90.25	93.05	92.26	0.79
MH-604	90.13	92.92	92.20	0.72
MH-605	89.99	92.81	92.13	0.68
MH-606	90.66	93.06	92.23	0.83
MH-607	90.41	92.89	92.17	0.72
MH-608	90.28	92.82	92.16	0.66
MH-609	90.20	92.80	92.15	0.65
MH-610	90.12	92.78	92.13	0.65
MH-611	89.86	92.69	92.05	0.64
MH-612	89.75	92.65	91.99	0.66
			Min	0.42
			Max	1.14
			Average	0.70

Table 2: Barrhaven Conservancy West - Preliminary HGL Analysis
100-Year Development & 5-Year Jock River

MH-ID	Invert Elevation (m)	Top of MH (m)	Max HGL (m)	Freeboard (m)
MH-101	91.30	93.70	92.01	1.69
MH-102	91.17	93.67	92.01	1.66
MH-103	91.02	93.53	91.99	1.54
MH-104	90.84	93.35	91.92	1.43
MH-105	90.66	93.16	91.77	1.39
MH-106	90.53	93.10	91.73	1.37
MH-107	90.47	93.06	91.70	1.36
MH-108	90.39	92.99	91.66	1.33
MH-109	90.50	93.05	91.72	1.33
MH-110	90.29	92.96	91.61	1.35
MH-111	90.22	92.94	91.51	1.43
MH-112	90.14	92.92	91.47	1.45
MH-201	91.18	93.58	92.23	1.35
MH-202	90.96	93.44	92.20	1.24
MH-203	90.84	93.57	92.34	1.23
MH-204	90.63	93.42	92.20	1.22
MH-205	90.53	93.33	92.14	1.19
MH-206	90.38	93.23	92.08	1.15
MH-207	90.17	93.08	91.88	1.20
MH-208	90.07	93.00	91.80	1.20
MH-209	89.94	92.92	91.65	1.27
MH-210	89.78	92.79	91.50	1.29
MH-211	89.70	92.78	91.45	1.33
MH-301	91.47	93.91	92.70	1.21
MH-302	91.27	93.86	92.69	1.17
MH-303	91.00	93.70	92.58	1.12
MH-304	90.89	93.61	92.56	1.05
MH-305	91.23	93.82	92.53	1.29
MH-306	91.06	93.75	92.52	1.23
MH-307	90.95	93.64	92.50	1.14
MH-308	90.71	93.49	92.45	1.04
MH-309	90.60	93.49	92.37	1.12
MH-310	90.42	93.46	92.29	1.17
MH-311	90.99	93.39	92.31	1.08
MH-312	90.85	93.27	92.29	0.98
MH-313	90.66	93.19	92.24	0.95
MH-314	90.27	93.34	92.22	1.12
MH-315	90.10	93.14	92.08	1.06
MH-316	89.94	93.13	92.06	1.07

Table 2: Barrhaven Conservancy West - Preliminary HGL Analysis
100-Year Development & 5-Year Jock River

MH-ID	Invert Elevation (m)	Top of MH (m)	Max HGL (m)	Freeboard (m)
MH-317	89.79	92.95	91.91	1.04
MH-318	89.70	92.92	91.81	1.11
MH-319	89.55	92.80	91.69	1.11
MH-320	89.47	92.78	91.64	1.14
MH-321	90.91	93.01	91.73	1.28
MH-322	90.79	92.97	91.71	1.26
MH-323	90.61	92.92	91.65	1.27
MH-324	90.50	92.90	91.63	1.27
MH-325	90.30	92.81	91.58	1.23
MH-326	90.21	92.80	91.57	1.23
MH-327	90.11	92.79	91.55	1.24
MH-328	89.38	92.75	91.53	1.22
MH-401	91.59	93.70	92.29	1.41
MH-402	91.44	93.64	92.28	1.36
MH-403	91.34	93.63	92.28	1.35
MH-404	91.17	93.56	92.25	1.31
MH-405	90.98	93.48	92.10	1.38
MH-406	90.83	93.39	92.02	1.37
MH-407	90.67	93.29	91.95	1.34
MH-408	90.44	93.19	91.89	1.30
MH-409	90.28	93.09	91.82	1.27
MH-410	90.11	92.90	91.70	1.20
MH-411	89.94	92.83	91.59	1.24
MH-412	90.64	93.04	91.90	1.14
MH-413	90.48	92.97	91.87	1.10
MH-414	90.37	92.87	91.81	1.06
MH-415	90.25	92.74	91.72	1.02
MH-416	90.03	92.68	91.55	1.13
MH-417	89.93	92.66	91.49	1.17
MH-418	89.69	92.66	91.43	1.23
MH-501	91.00	93.50	91.87	1.63
MH-502	90.89	93.39	91.87	1.52
MH-503	90.72	93.27	91.81	1.46
MH-504	90.48	93.12	91.68	1.44
MH-505	90.38	93.08	91.65	1.43
MH-506	90.32	93.07	91.64	1.43
MH-507	90.18	92.97	91.57	1.40
MH-508	90.44	92.94	91.58	1.36
MH-509	90.00	92.85	91.48	1.37

Table 2: Barrhaven Conservancy West - Preliminary HGL Analysis
100-Year Development & 5-Year Jock River

MH-ID	Invert Elevation (m)	Top of MH (m)	Max HGL (m)	Freeboard (m)
MH-510	89.81	92.70	91.35	1.35
MH-511	89.74	92.68	91.31	1.37
MH-512	89.65	92.65	91.21	1.44
MH-601	90.78	93.27	91.79	1.48
MH-602	90.63	93.21	91.79	1.42
MH-603	90.25	93.05	91.66	1.39
MH-604	90.13	92.92	91.59	1.33
MH-605	89.99	92.81	91.49	1.32
MH-606	90.66	93.06	91.63	1.43
MH-607	90.41	92.89	91.55	1.34
MH-608	90.28	92.82	91.53	1.29
MH-609	90.20	92.80	91.52	1.28
MH-610	90.12	92.78	91.50	1.28
MH-611	89.86	92.69	91.39	1.30
MH-612	89.75	92.65	91.31	1.34
			Min	0.95
			Max	1.69
			Average	1.28

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

Attachment A

DSEL Rational Method Calculations