Robinson
Land Development

Creekside 2 Subdivision
2780 Eagleson Road
Richmond, ON
Serviceability Report

Prepared For:

1470424 Ontario Inc.

Prepared By:

Robinson Land Development

Our Project No. 20002
May 2022
Revised September 2024

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

TABLE OF CONTENTS CONTINUED

LEGAL NOTIFICATION

This report was prepared by Robinson Land Development for the account of **1470424 Ontario Inc.**

Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. **Robinson Land Development** accepts no responsibility for damages, if any, suffered by any third party because of decisions made or actions based on this project

1.0 INTRODUCTION

Robinson Land Development have been retained by 1470424 Ontario Inc. to prepare a Serviceability Report in support of the proposed Creekside 2 Subdivision located at 2780 Eagleson Road in the Village of Richmond. The 24.5 hectare subject site is bounded by Eagleson Road to the east, existing commercial properties to the south, Flowing Creek Municipal Drain to the west, and agricultural land to the north (refer to **Figure 1 – Key Plan** following page 1).

This report will provide details to demonstrate that the site can be adequately serviced with municipal infrastructure and can be designed to achieve the required stormwater management controls. A pre-consultation meeting was held with the City of Ottawa on June 23rd, 2020. Refer to the pre-consultation notes provided in **Appendix A** for more details.

2.0 GUIDELINES, STUDIES AND REPORTS

The servicing and stormwater management designs for the subject site have been prepared in keeping with the following documents:

- **Sewer Design Guidelines**, City of Ottawa, Second Edition, October 2012 (herein referred to as Ottawa Design Guidelines).
  - **Technical Bulletin ISD-2010-1,** City of Ottawa, September 28, 2010.
  - **Technical Bulletin ISD-2011-2,** City of Ottawa, October 6, 2011.
  - **Technical Bulletin ISD-2012-1,** City of Ottawa, January 31, 2012.
  - **Technical Bulletin ISD-2012-4,** City of Ottawa, June 20, 2012.
  - **Technical Bulletin ISD-2012-6,** City of Ottawa, October 31, 2012.
  - **Technical Bulletin ISDTB-2014-01,** City of Ottawa, February 5, 2014.
  - **Technical Bulletin PIEDTB-2016-01,** City of Ottawa, September 6, 2016.
  - **Technical Bulletin ISTB-2018-**01, City of Ottawa, March 21, 2018.
  - **Technical Bulletin ISTB-2018-03,** City of Ottawa, March 21, 2018.
  - **Technical Bulletin ISTB-2018**-04, City of Ottawa, June 27, 2018.
  - **Technical Bulletin ISTB-2019-02,** City of Ottawa, July 08, 2019.

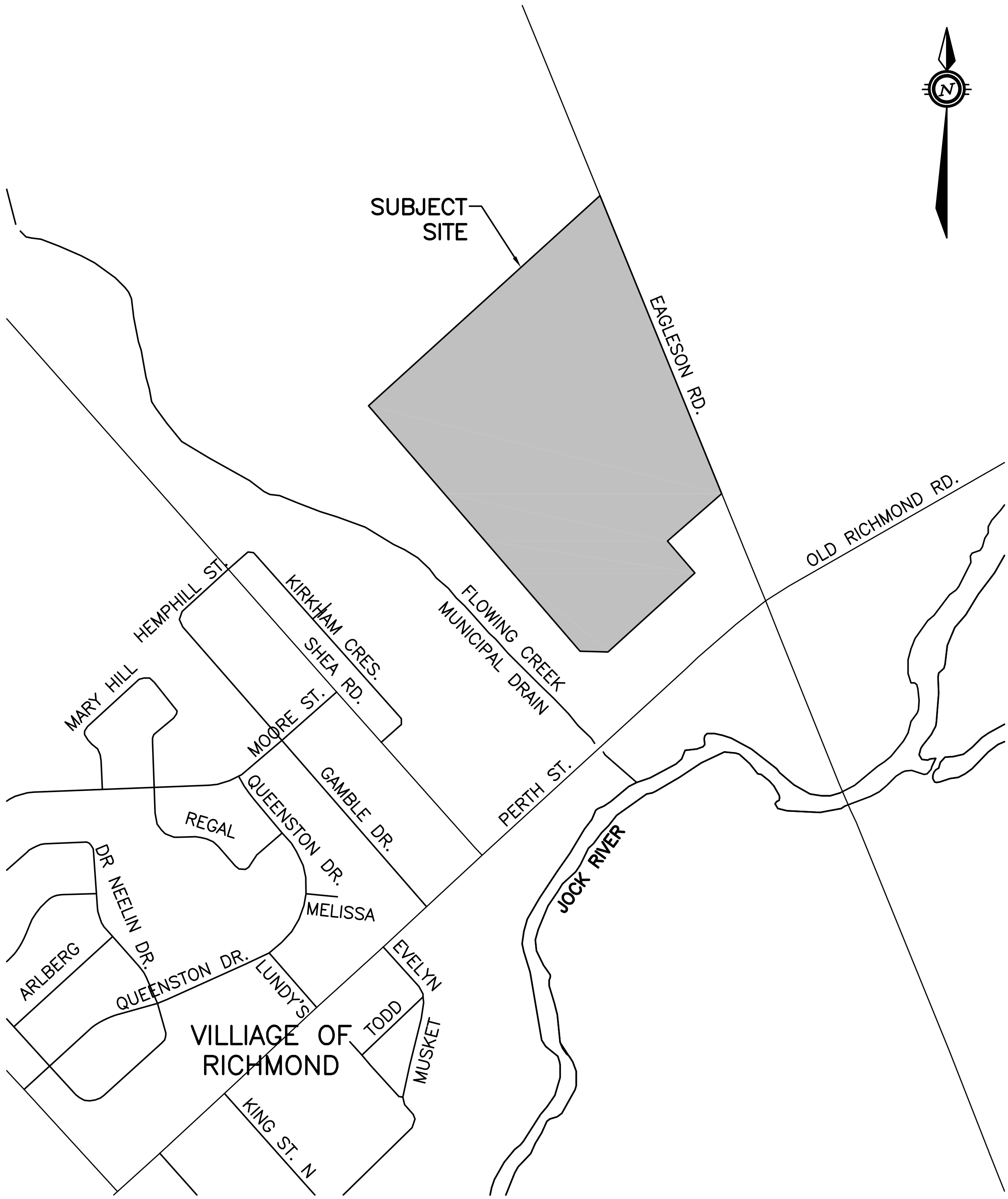
- **Ottawa Design Guidelines**, Water Distribution, City of Ottawa, First Edition, July 2010 (herein referred to as Ottawa Water Design Guidelines).
  - **Technical Bulletin ISD-2010-2,** City of Ottawa, December 15, 2010.
  - **Technical Bulletin ISDTB-2014-02,** City of Ottawa, May 27, 2014.
  - **Technical Bulletin ISTB-2018-02,** City of Ottawa, March 21, 2018.
  - **Technical Bulletin ISTB-2021-03,** City of Ottawa, August 18, 2021.

- **Design Guidelines for Sewage Works**, Ministry of the Environment, 2008 (herein referred to as MECP Design Guidelines).

- **Stormwater Planning and Design Manual**, Ministry of the Environment, March 2003 (herein referred to as MECP SWM Manual).

- **Low Impact Development Stormwater Management Planning and Design Guide**, CVC, TRCA, 2010 (herein referred to as LID Design Guidelines).

- **Water Supply for Public Fire Protection**, Fire Underwriters Survey, 2020 (herein referred to as FUS Guidelines).



Robinson
Land Development

scale N.T.S.	CREEKSIDE 2 SUBDIVISION	project no. 20002
date 18/02/2022		
drawn by LR	KEY PLAN	FIG. 1.0

- **Ontario Building Code Compendium**, Ministry of Municipal Affairs and Housing Building Development Branch, January 1, 2010 (herein referred to as OBC).

- **Village of Richmond Water & Sanitary Master Servicing Study**, Stantec Consulting Ltd., July 22, 2011 (herein referred to as the Stantec MSS).

- **Flowing Creek Catchment Jock River Subwatershed Report 2016**, RVCA, 2016 (herein referred to as the Jock River Subwatershed Report).

- **Design Brief for the Creekside Subdivision Village of Richmond**, David Schaeffer Engineering Ltd., December 2017 (herein referred to as the DSEL Report).

- **Technical Memorandum No. 5 New Gravity Trunk Sewers and Local Pumping Station**, Parsons, August 30, 2019 (herein referred to as the Parsons Memo No. 5).

- **Cut/Fill Analysis Memorandum**, Robinson Land Development, April 3, 2020 (herein referred to as the RLD Cut/Fill Analysis).

- **Cardel Creekside – Flowing Creek: Floodplain Cut Fill Analysis**, J.F. Sabourin and Associates Inc., April 23, 2020 (herein referred to as the JFSA Cut/Fill Analysis).

- **Environmental Impact Statement and Tree Conservation Report**, Muncaster Environmental Planning Inc., April 29, 2020 (herein referred to as the Muncaster Report).

- **Geotechnical and Hydrogeological Investigation**, GEMTEC Consulting Engineers and Scientists Limited, February 1, 2022 (herein referred to as the GEMTEC Geotechnical Report).

- **Village of Richmond Water Supply – Functional Design Study – Fire Flow Requirements**, Stantec Consulting Ltd., September 9, 2021 (herein referred to as the Stantec Fire Flow Study).

- **TW21-1C Water Supply Assessment**, GEMTEC Consulting Engineers and Scientists Limited, December 14, 2021 (herein referred to as the GEMTEC Water Supply Assessment).

- **Agricultural Rehabilitation Plan**, Colville Consulting Inc., November 2, 2021 (herein referred to as the Agrology Report).

- **Conceptual SWM Pond Sizing**, J.F. Sabourin and Associates Inc., September 16, 2024 (herein referred to as the JFSA SWM Memo).

3.0 EXISTING CONDITIONS

The subject site is currently zoned Development Reserve Zone (DR1) and is located within the Jock River watershed. The property is currently undeveloped and consists primarily of agricultural fields. Elevations across the property are generally flat; drainage is conveyed west to the Flowing Creek Municipal Drain or east to the roadside ditch on Eagleson Road. The Flowing Creek Municipal Drain flows north-west to south-east along the western boundary of the property before discharging into the Jock River south of Perth Street. Opposite the Flowing Creek Municipal Drain is the Creekside 1 Subdivision. The 3.8-hectare subdivision received approvals and was constructed to accommodate 51 single-family residential lots.

A portion of the subject site is constrained by the floodplain of the adjacent Flowing Creek Municipal Drain. A cut/fill analysis was prepared by Robinson Land Development in conjunction with J.F. Sabourin and Associates Inc. (JFSA) in support of the proposed development. The cut/fill analysis was submitted for review in April 2020 and is currently pending approval by the Rideau Valley Conservation Authority (RVCA). A cut/fill permit from the RVCA is required to raise the lands subject to development above the 100-year floodplain elevation. In the area of the proposed development, the 100-year floodplain ranges from an elevation of 93.86 metres to an elevation of 94.07 metres, under existing conditions. Following approval and construction of the cut/fill work, the JFSA Cut/Fill Analysis determined that the 100-year floodplain will range from an elevation of 93.87 metres to an elevation of 94.08 metres. Refer to excerpts from the cut/fill analysis provided in **Appendix A**.

Refer to **Figure 2 – Existing Conditions** below for an aerial view of the site in its current development state and the proposed limits of the cut-fill operations.

Figure 2: Existing Conditions

4.0 DEVELOPMENT PROPOSAL

The proposed Creekside 2 Subdivision will incorporate a mix of single family, townhouse and semi-detached residential units. The development will also include a designated park block, a stormwater management (SWM) block, a communal well block, and a wastewater pumping station block. The development will incorporate approximately 3140 metres of municipal roadways with typical 20 metre right-of-ways except for the window streets along Eagleson Road which are proposed to have 14.75 metre right-of-ways. Access to the development will be provided by two new road connections to Eagleson Road. The proposed residential units for the Creekside 2 Subdivision will be as follows:

Single Family:	255 units
Townhouse:	139 units
Semi-Detached:	70 units
Total:	**464 units**

Refer to the Draft Plan of Subdivision, prepared by Annis, O'Sullivan, Vollebekk Ltd. (AOV), in **Appendix A** for more details.

5.0 GRADING DESIGN

The grading for the Creekside 2 Subdivision will be designed to tie into existing elevations along the property boundaries (except for off-site terracing on land by the same Owner) and to minimize cut/fill volumes where possible. Grades within the subject site must be set above the 100-year floodplain of the adjacent Flowing Creek Municipal Drain which ranges from an elevation of 93.87 metres to 94.08 metres adjacent to the site (following the approved cut-fill work; refer to excerpts from the cut/fill analysis in **Appendix A**).

To provide sufficient cover depth over the proposed municipal infrastructure (specifically the storm sewer system), the site will need to be filled above original ground elevations. As a result, retaining walls are anticipated along the interface with Eagleson Road, along the interface with the existing commercial properties to the south, and along the interface with the agricultural land to the north. Typical sections have been prepared to demonstrate how the proposed development will tie into the Eagleson Road right-of-way and abutting properties. Refer to the typical grading sections provided in **Appendix A** for more details.

A geotechnical investigation was prepared by GEMTEC for the subject site. The investigation determined that the development area is underlain by deposits of sensitive silty clay, which has a limited capacity to support loads imposed by grade raise fill material, pavement structures and house foundations. As a result, grade raise restrictions must be implemented for the subject site. GEMTEC has delineated three grade raise restriction zones for the subject site. Area A covers the south-east portion of the site and has a grade raise restriction of 2.7 metres. Area B covers the north-west portion of the site and has a grade raise restriction of 1.7 metres. Area C covers the north-east portion of the site and has a grade raise restriction of 1.9 metres. Refer to excerpts from the GEMTEC Geotechnical Report in **Appendix A** for more details. As noted above, the site will need to be filled to provide sufficient cover depth over the proposed storm sewer system. To accommodate minimum cover depths, the grade raise restrictions will be exceeded in some locations. Further geotechnical investigations will be needed to support the grade raise exceedances. Pre-loading and/or lightweight fill (LWF) are possible solutions, however, the City is not willing to accept LWF within the municipal right-of-ways. Plans have been prepared to demonstrate the estimated fill depth above original ground based on the preliminary grading design and are provided in **Appendix A**.

During detailed design, the following grading criteria will be implemented into the on-site design in accordance with current Ottawa Design Guidelines:

- Maximum slope in grassed areas between 2% and 7%.
- Grades above 7% require terracing.
- Maximum terracing of 3H:1V.
- Driveway grades between 2% and 6%.
- Rear terrace grades to be minimum 0.30 metres above swale spillover elevation.
- Front terrace grades to be minimum 0.30 metres above overland spillover elevation.

- Swales (without perforated subdrain) to have minimum slope of 1.5%.
- Swales with less than 1.5% slope to have perforated subdrain.
- Swales shall have minimum depth of 150 mm and maximum depth of 600 mm.

Refer to the Conceptual Grading Plan (DWG. 20002-GRD) provided in **Appendix A** for more details.

6.0 WATER SERVICING

6.1 Existing Water Supply

No municipal watermains are available in proximity to the subject site to provide water supply for domestic use. The majority of the Village of Richmond is serviced by private wells. The subject site is designated as a Public Service Area (PSA) for water and wastewater (Section 2.3.2 of the Official Plan) and therefore any new developments are to be serviced by municipal services (i.e. no private wells). Domestic water supply for the Creekside 1 Subdivision, located west of the Flowing Creek Municipal Drain, is provided by individual drilled wells. However, the Creekside 1 Subdivision was considered under an exception policy due to the minor residential infill nature of the development (i.e. only 51 single-family units).

The City of Ottawa has retained Stantec Consulting Ltd. to prepare a Functional Design Study for the Village of Richmond Water Supply. The goal of the study is to develop a functional design and phasing plan for the Richmond water supply over the short term, interim and ultimate conditions to allow for the integration of all existing and known future development areas to be ultimately serviced by an integrated communal well system or potential connection to the central system. Based on opinions of probable costs, life cycle costing, evaluation matrix and sensitivity analysis, new communal water systems are the current preferred alternative of water supply for the anticipated growth of the Village of Richmond. Although the study is ongoing, the following scenarios are currently being assessed:

- Expansion of the proposed Tamarack communal well system to include Kings Park.
- Existing Kings Park, proposed Tamarack and Cardel lands to be serviced by a new well and facility located on Tamarack's lands.
- Existing Kings Park, proposed Tamarack and Cardel lands to be serviced by a new well and facility on Cardel's lands (i.e. the Creekside 2 Subdivision).
- Ultimate solution of combining all the systems together (i.e., the Village serviced by Richmond West and a new facility on either the Tamarack or Cardel lands).

Conceptual communal well configurations (prepared by Stantec) for the Village are provided in **Appendix B**. Once the Functional Design Study is finalized (timing expected in the near future) the preferred alternative will need to be reviewed and accepted by the individual land developers. At this time, the development of the Creekside 2 Subdivision will proceed under the assumption that a new communal well system will be required on the Cardel lands. Refer to correspondence from City under **Appendix B**.

GEMTEC Consulting Engineers and Scientists Limited (GEMTEC) were retained to evaluate the use of a communal well system for the proposed Creekside 2 Subdivision. The results of their study were provided in the *GEMTEC Water Supply Assessment* and included the following key conclusions:

"The water quality available from the test well TW21-1C, completed in the Nepean sandstone aquifer is safe for consumption based on the absence of health-related exceedances; however, groundwater treatment for aesthetic parameters will be required."

"The water quality of the upper bedrock water supply aquifer (Oxford/March Formations), with the exception of the localized wells in the southern portion of the Creekside 1 development, meets the ODWQS maximum acceptable concentrations and treatability limits, with aesthetic objective and operational guideline exceedances of colour, total dissolved solids, hardness and the sodium warning level."

"The quantity groundwater available from the proposed water supply aquifer is sufficient for the proposed development and will sustain repeated pumping at the test rate and duration at 24-hour intervals over the long term."

"Interference between neighbouring private drinking water wells is expected to be minimal."

Refer to excerpts from the GEMTEC Water Supply Assessment in **Appendix B**.

6.2 Proposed Water Servicing

The Creekside 2 Subdivision is proposed to be serviced by a new communal well system. The proposed communal well and its appurtenances will be contained within Block 312 of the Draft Plan of Subdivision (provided in **Appendix A**). The communal well block will abut the internal road network (Street No. 4) but will be accessed via a new driveway connection to Eagleson Road as requested by the City during pre-consultation meetings. The communal well design is being prepared by J.L. Richards & Associates (JLR). Refer to the Technical Memorandum and *Communal Well Conceptual Site Plan*, prepared by JLR, in **Appendix B**. The communal well will provide water supply to the proposed watermain network contained within the municipal right-of-ways.

To avoid the creation of a vulnerable service area (VSA), a 6.0 metre watermain block is proposed between Street No. 2 and Street No. 3. During detailed design, a hydraulic water model will be developed to determine minimum pipe sizes and verify that pressures and available flow rates are in accordance with the current Ottawa Water Design Guidelines. Refer to the Conceptual Watermain Design (DWG. 20002-WM) provided in **Appendix B**.

The *GEMTEC Water Supply Assessment* provided the following recommendations regarding the proposed communal well construction and water quality for the Creekside 2 Subdivision:

- *Future production wells should be constructed in accordance with the Drinking Water Facility Design Guidelines and MECP regulations, including, but not limited to, Ontario Reg. 903. The well bore opening should be a minimum of 0.254 metres (10 inches) to reduce well inefficiencies.*
- *Well casings should be extended at least 57.3 metres (188 feet) below ground surface. The entire annular space between the steel casing and the overburden/ bedrock should be filled with a suitable cement or bentonite grout;*
- *A well grouting certification inspection should be conducted during the installation and grouting of the well casing for all future wells installed on the Site. The well grouting certification inspection should be conducted under the supervision of a professional engineer or professional geoscientist.*
- *The future production wells should be located in vicinity of TW21-1C and in accordance with any specific wellhead protection requirements.*
- *It is recommended that a water quality treatment specialist appropriately configure and size the treatment systems.*
- *It is recommended that homeowners and the Local Medical Officer of Health be informed that sodium concentrations exceed 20 mg/L and exceed the warning level for persons on sodium restricted diets.*

Refer to excerpts from the GEMTEC Water Supply Assessment in **Appendix B**.

6.3 Service Connections

All single-family, semi-detached, and townhouse units within the Creekside 2 Subdivision will be serviced with individual 19 mm diameter water service connections to the proposed municipal watermain system in accordance with current Ottawa Water Design Guidelines.

6.4 Water Demands

Water demands for the Creekside 2 Subdivision have been calculated using the following City of Ottawa water design criteria:

- Average Day Demand 280 L/person/day (OWDG; ISTB-2021-03)
- Max. Daily Demand 2.5 x Avg. Day (OWDG; Table 4.2)
- Max. Hourly Demand 2.2 x Max. Day (OWDG; Table 4.2)
- Single-Family 3.4 persons/unit (OWDG; Table 4.1)
- Townhouses 2.7 persons/unit (OWDG; Table 4.1)
- Semi-Detached 2.7 persons/unit (OWDG; Table 4.1)

Based on the proposed unit counts (refer to **Section 4.0**) and the design criteria above, the following water demands have been estimated for the subject site:

- Average Daily Demand: **4.64 L/s**
- Maximum Daily Demand: **11.60 L/s**
- Peak Hourly Demand: **25.51 L/s**

Refer to the watermain design sheet provided in **Appendix B** for more details.

6.5 Fire Protection

Stantec was retained by the City of Ottawa to prepare a water supply functional design study for the Village of Richmond. As part of the study, the current fire flow limitations in the Village were presented and design criteria were established for future fire flow requirements. The results of the study were provided in the *Stantec Fire Flow Assessment* and recommended that the following fire flow design criteria be used within the Village of Richmond:

- *Fire flow is to be supplied solely from the reservoir storage and from high-lift pumps (HLPs). No storage requirement reduction using the groundwater wells' excess capacity (i.e., offsetting) is to be applied.*
- *For new developments, a fire flow of 13,000 L/min for 2.00 hours; developers would ensure that new unit designs meet the requirements for this fire flow, as per the FUS.*
- *For existing developments' future requirements, a fire flow of 10,000 L/min for 2.00 hours, as per the FUS and as per current development designs (mostly SFH on large lots).*
- *A fire flow of 13,000 L/min for a duration of 2.00 hours should be used to size storage in the Village of Richmond, with provision to expand to 3.00 hours.*

Refer to excerpts from the Stantec Fire Flow Assessment in **Appendix B**.

The total required fire flow for the worst-case scenarios within the proposed Creekside 2 Subdivision have been calculated in accordance with the 2020 FUS Guidelines. The FUS calculations have determined that a total required fire flow of 10,000 L/min is achievable if the following conditions are satisfied:

- Firewalls will be required for all 5-unit townhouses in order to reduce the building footprint area (i.e. firewall would provide 40% reduction in area).
- Firewalls will be required for all 6-unit townhouses in order to reduce the building footprint area below 600 m^2 (i.e. firewall would provide 50% reduction in area).

Further, City of Ottawa Technical Bulletin ISDTB-2014-02 states that practitioners may cap FUS calculated fire flows to 10,000 L/min under the following conditions:

- For single detached dwellings, provided that there is a minimum spatial separation of 10 m between the backs of adjacent units;
- For traditional side-by-side town and row houses, provided that:
    - Firewalls with a minimum two-hour fire-resistance rating that comply with OBC Div. B, Subsection 3.1.10, are constructed to separate a row or row house block into fire areas of no more than the lesser of 7 dwellings, or 600 m^2 in building area (building footprint); and
    - There is a minimum separation of 10 m between the backs of adjacent units (the cap is not applicable to back-to-back townhouses).

Given that the above conditions can be achieved with the implementation of firewalls, the cap 10,000 L/min is applicable for this development. The proposed communal well system (to be designed by JLR) will have the ability to be upgraded to accommodate a fire flow of 13,000 L/min in the future, however, the developer does not intend to propose a denser development which would require a higher fire flow. Refer to the supporting FUS calculations provided in **Appendix B**.

In liaison with the City of Ottawa, it has been acknowledged that a fire flow requirement of 10,000 L/min with the ability to expand to 13,000 L/min in the future, if needed, would be appropriate for this development. Refer to the fire flow correspondence with the City in **Appendix B**.

6.6 Water Servicing Conclusion

It has been demonstrated that a communal well system is feasible to provide water supply for domestic use and fire protection for the proposed Creekside 2 Subdivision and can be designed in accordance with the current Ottawa Water Design Guidelines.

7.0 SANITARY SERVICING

7.1 Existing Sanitary Sewer System

During pre-consultation with the City of Ottawa (refer to pre-consultation notes provided in **Appendix A**) it was identified that there is insufficient capacity within the existing Village of Richmond sanitary system to accommodate further development within the Village (which includes the proposed Creekside 2 Subdivision). The City noted that upgrades to the pump station and twinning of the forcemain on Eagleson Road were planned, however, additional capacity for the proposed Creekside 2 Subdivision was not guaranteed. The upgrades were intended to provide additional capacity for the Caivan lands and a significant portion of the Mattamy Subdivision located in Richmond West. The City has noted that additional capacity will be provided on a “first come, first served basis”. At the time of the pre-consultation (June 2020), it was anticipated that the upgrades to the pump station would be completed by 2022 (including partial twinning of the forcemain on Eagleson Road), however, that timing was not met. It is our current understanding that the City has secured the budget to finalize the contract documents and the projected tender date is now in the second or third quarter of 2025.

The proposed Creekside 2 Subdivision will require a front-ending agreement with the City and/or a written agreement with the other local developers for an allocation of their sanitary capacity. At the time of the pre-consultation, the City was in discussions with other developers in the Village (Mattamy and Caivan) regarding front-ending agreements for the proposed upgrades to the existing Village of Richmond sanitary system. Preliminary conversations with the City (refer to pre-consultation for front-ending agreement in **Appendix A**) regarding the front-ending agreement application were held (September 2020) but no application was filed at that time. It is our current understanding that Taggart has submitted a front ending agreement application to the City which Cardel will be party to.

In 2011, Stantec prepared a Master Servicing Study (Stantec MSS) as part of the Class Environmental Assessment (EA) for the water and sanitary servicing in the Village of Richmond. The purpose of the Stantec MSS was to provide recommendations for the long-term servicing requirements for existing and future potential development within the entire Village boundary. The boundary of proposed Creekside 2 Subdivision was noted as a future development area and was assumed (once developed) to convey wastewater flows to the existing sewer system on Moore Street, west of Shea Road, before ultimately being conveyed south to the Richmond Pump Station (PS) on Cockburn Street. The Richmond PS discharges to the Glen Cairn Trunk Sewer just south of Hazeldean/Robertson Road in Kanata through a 500 mm diameter forcemain along Eagleson Road. The Stantec MSS concluded that the existing collection system has sufficient capacity to accommodate existing, infill and future growth potential areas with the exception of nine sewer segments identified as needing upgrades. It should be noted that flows from future development areas (i.e. including the Creekside 2 Subdivision) were estimated using previous City of Ottawa design parameters with higher residential flow values (350 L/person/day compared to current 280 L/person/day). Refer to excerpts from the Stantec MSS in **Appendix C** for more details.

In 2017, Parsons was retained by the City of Ottawa to complete a Functional Design Study for wastewater collection system upgrades identified in the Stantec MSS. The study included a total of five technical memorandums. The Parsons Memo No. 5 details the proposed gravity trunk sewers for the undeveloped parcels south of the Jock River and a local pumping station for a parcel in the northeast quadrant of the village (i.e. the proposed Creekside 2 Subdivision). The Parsons study utilized current City of Ottawa design parameters and assumed a population density of 63 persons per hectare for residential use. The Parsons Memo No. 5 provided the following recommendations/assumptions for the northeast development land:

- *The need for local pumping station has been confirmed, in keeping with the Stantec MSS.*
- *The ultimate arrangement of streets will influence the location of the local sanitary pumping station, forcemain and gravity sewers.*
- *A conceptual location for the pump station has been selected east of Flowing Creek Drain, outside of the regulatory flood limit.*
- *A dual forcemain, per 7.2.1.6.7 of the City of Ottawa Sewer Design Guidelines 2012 and a short segment of sanitary sewer has been indicated discharging to an existing sanitary sewer on Moore Street at the intersection of Shea Road.*
- *The approximate development area includes <u>24.4 ha of residential use</u> and 1.1 ha of commercial use.*
- *For functional design purposes, a three-meter diameter wet-well with duplex submersible pumps (one duty pump, one standby pump) is assumed.*

- *The total peak sanitary design flow is estimated to be 24.6 L/s. At a nominal flowrate of 25 L/s.*
- *A single 150mm diameter forcemain would have a velocity of 1.3 m/s which is within the desired velocity range for forcemains. The nominal characteristics of each pump is estimated to be 25 L/s at 10 m Total Dynamic Head.*
- *The land is only marginally higher than the regulatory flood level of Flowing Creek Drain. As such, the provision of an emergency gravity overflow, in accordance with Technical Bulletin ISTB–2018-01, does not appear to be feasible if dwellings with traditional basements are desired. This issue will need to be analyzed further as development plans for the parcel are initiated.*
- *The Flowing Creek Drain crossing presents a notable forcemain design issue. A bathymetric survey of the Drain will be required during preliminary design to determine elevations and features. Trenchless techniques should be considered for this crossing.*

Refer to excerpts from the Parsons Memo No. 5 in **Appendix C**.

Wastewater flows from the existing Creekside 1 Subdivision are conveyed by 200 mm diameter sewers to the existing sanitary sewer system on Moore Street in accordance with the Stantec MSS. However, the design of the Creekside 1 sanitary sewer system did not allocate additional flows from the proposed Creekside 2 lands (see further discussion in **Section 7.4** below). Refer to excerpts from the DSEL Report in **Appendix C**.

7.2 Design Criteria

A new municipal sanitary sewer system will be required to service the Creekside 2 Subdivision. The proposed sanitary sewer system has been designed in accordance with the current Ottawa Sewer Guidelines using the following design parameters:

- Average Residential Flow: 280 L/person/day
- Peaking Factor: Harmon's Peaking Factor (Max. 4.0, Min. 2.0)
- Harmon Correction Factor: 0.8
- Infiltration Allowance: 0.33 L/s/ha
- Minimum Full Flow Velocity: 0.60 m/s
- Maximum Full Flow Velocity: 3.0 m/s
- Minimum Sewer Diameter: 200 mm
- Manning's 'n' Value: 0.013
- Single Family Homes: 3.4 persons/unit (OSDG; Table 4.2)
- Semi-Detached Units: 2.7 persons/unit (OSDG; Table 4.2)
- Townhouse Units: 2.7 persons/unit (OSDG; Table 4.2)

The proposed communal well system will generate wastewater from its operations (i.e. floor drains, emergency shower/eye wash, washrooms, HVAC, etc.) and therefore must be accounted for in the sanitary sewer design. At this time, JLR has estimated that the communal well system will generate a peak sanitary design flow of 125 L/min (2.08 L/s). This peak flow assumes that only disinfection is required for water treatment. If additional treatment is required (to be determined through detailed design), the peak flow will increase to account for the additional treatment wastewater generated (i.e. filter backwash, softener residuals, etc.).

7.3 Sanitary Design Flows

Using the design criteria provided in **Section 7.2** above, the peak sanitary design flow for the Creekside 2 Subdivision has been calculated as follows:

Population = (255 units x 3.4 persons/unit) + (209 units x 2.7 persons/unit) = 1431.3 persons

Peak Factor = 3.16 (Harmon Equation)

Peak Population Flow = 3.16 x (280 L/person/day) x (1431.3 persons) / (86400 s/day)
Peak Population Flow = **14.64 L/s**

Extraneous Flow = (24.51 ha) x (0.33 L/s/ha) = **8.09 L/s**

Communal Well Peak Flow = **2.08 L/s**

Peak Design Flow = (14.64 L/s) + (8.09 L/s) + (2.08 L/s) = **24.80 L/s**

Note: final values above have been calculated using non-rounded numbers and therefore minor discrepancies may occur in manual computations.

As calculated above, a peak sanitary design flow of 24.8 L/s is expected to be generated from the proposed Creekside 2 Subdivision which is marginally above the allocated flow 24.6 L/s detailed in the Parsons Memo No. 5. The Parson Memo No. 5 assumed the northeast lands would include 24.4 hectares of residential use and 1.1 hectares of commercial use; however, the total area tributary to the existing sewer on Moore Street is only 24.51 hectares and is proposed for residential use only. The calculated population of 1431.3 persons is significantly below the population of 1537.2 persons, estimated using the population density (63 persons/ha) and residential area from the Parsons study.

7.4 Sanitary Sewer Design

Wastewater flows from the Creekside 2 Subdivision will be conveyed by a new sanitary sewer system to the existing sanitary sewer system on Moore Street, in keeping with the Stantec MSS and Parsons Memo No. 5. The development of the Creekside 1 lands impedes a direct connection to the existing sewer system on Moore Street, and therefore a connection to the existing system within the Creekside 1 Subdivision will be required. Wastewater flows from the Creekside 2 Subdivision will discharge to the existing sanitary manhole (denoted as MH 6A) located on Kirkham Crescent, immediately upstream of the existing sanitary manhole (denoted as EX MH 13C) at the intersection of Moore Street and Shea Road (i.e. designated outlet for the subject site). Since the design of the Creekside 1 Subdivision did not allocate flows from the Creekside 2 development, the existing 200 mm diameter sanitary sewer between Kirkham Crescent and Shea Road does not have capacity (approximately 137 percent full) to convey the additional peak design flow from the Creekside 2 development. In order to support the additional flows, the existing 200 mm diameter sewer segment will need to be upgraded to a 250 mm diameter sewer. Refer to the drawing, *Plan and Profile of Sanitary Easement*, prepared by DSEL for the Creekside 1 Subdivision, in **Appendix C**.

Approximately 3255 metres of new gravity sanitary sewers will be required to service the development. The sanitary sewers are all proposed to be 200 mm in diameter except for the last pipe run to the pump station which will require a 250 mm diameter sewer. The proposed sanitary sewers will be designed to have capacity to convey the peak design flows and meet the acceptable full flow velocity range in accordance with the current Ottawa Sewer Guidelines. Refer to the sanitary sewer design sheets and Conceptual Sanitary Design (DWG. 20002-SAN) provided in **Appendix C** for more details.

Due to the lack of vertical separation between the proposed development area and the existing system, a proposed wastewater pumping station will be required to service the development as noted in the Stantec MSS and Parsons Memo No. 5. The proposed wastewater pumping station is to be designed by JLR and will be located within Block 291 of the Draft Plan of Subdivision (provided in **Appendix A**). The JLR scope of work will also include the design of twin sanitary forcemains required to convey wastewater flows from the proposed pumping station, through a designated 9.0 metre Block (i.e. Block 292), under Flowing Creek Municipal Drain, to the existing sanitary sewer in the Creekside 1 Subdivision. Refer to the Sanitary Pumping Station Conceptual Site Plan, prepared by JLR, in **Appendix C** for more details.

7.5 Service Connections

All single-family, semi-detached, and townhouse units within the Creekside 2 Subdivision will be serviced with individual 135 mm diameter sanitary service connections to the proposed municipal sanitary sewer system in accordance with current Ottawa Sewer Guidelines.

7.6 Hydraulic Grade Line (HGL) Analysis

In accordance with City of Ottawa Technical Bulletin ISTB-2018-01, the maximum hydraulic grade line (HGL) in the system shall be assessed using the rare event and assuming normal operating conditions (i.e. pumping stations are operating at their rated capacity). Under this scenario, the maximum HGL shall be no greater than 0.30 metres below the underside of footing (USF). An additional HGL analysis must also be undertaken assuming a catastrophic failure of the pumping station using the annual event and the pumping station is at the overflow level. Under this scenario, the maximum HGL must not touch the USF.

Provision for an emergency conduit connection to an adjacent or downstream sanitary sewer system is preferred; however, a connection of the conduit to a storm sewer system or watercourse is often the only feasible option, as is the case for this development. The emergency overflow for the wastewater pumping station is proposed to be directed to the adjacent stormwater management (SWM) facility. In the event of an overflow, the SWM facility would provide some level of treatment and detention of the wastewater prior to reaching the downstream watercourse. Emergency conduit connections should be above the 25-year stormwater elevation. Preliminary stormwater modelling has determined that the 25-year ponding elevation in the SWM facility will occur at an elevation of 92.95 metres. A preliminary HGL analysis for the catastrophic scenario has been completed, assuming the downstream headwater is at the 25-year ponding elevation. The analysis has been completed for the downstream pipe runs in proximity to the pump station which are most likely to be impacted. The preliminary HGLs have been compared against preliminary USF elevations. The analysis has determined that the HGL within the sanitary sewer system will not touch the USFs under the catastrophic scenario. Refer to supporting sanitary HGL calculations and USF check in **Appendix C**. Further HGL analyses will be required during detailed design as the wastewater pumping station design, sanitary sewer design, and USF elevations are advanced.

Emergency conduit connections shall be provided with suitable protection to prevent backflow from the receptor into the pumping station. This may consist of backwater valves and/or shut off valving. Emergency conduit connections to storm sewers, storage facilities, natural water courses, or surface outfall points will be subject to approval by the MECP.

7.7 Sanitary Servicing Conclusion

It has been demonstrated that the proposed Creekside 2 Subdivision can be adequately serviced with a municipal sanitary sewer system with the provision of a proposed wastewater pumping station and sanitary forcemains (to be designed by JLR). The proposed sanitary sewer network, including the gravity sewers, pumping stations and forcemains, can be designed in accordance with the current Ottawa Sewer Guidelines. The peak sanitary design flow from the ultimate development has been calculated to be in keeping with the peak flow allocated in the Parsons study for the northeast development lands.

Due to capacity constraints within the existing Village of Richmond sanitary system, the proposed Creekside 2 Subdivision will require a front-ending agreement with the City for upgrades (pump station and forcemains) to the existing system.

8.0 STORM SERVICING

8.1 Existing Storm Sewer System

No municipal storm sewers are available in the vicinity of the subject site. Roadside ditches are utilized to convey local drainage along Eagleson Road to the east and Perth Street to the south. Under pre-development conditions, the majority of stormwater runoff from the subject site is conveyed west by overland sheet flow to the Flowing Creek Municipal Drain.

8.2 Storm Sewer Design

A new municipal storm sewer (minor) system will be required to service the subject site. The proposed storm sewer system has been designed in accordance with the current Ottawa Sewer Guidelines using the following parameters:

• Design Return Period	2-Year (Local Roads)
• Rainfall Intensity	City of Ottawa IDF Curve Equations
• Inlet Time of Concentration	10 minutes
• Manning's Roughness Coefficient	0.013
• Minimum Full Flow Velocity	0.80 m/s
• Maximum Full Flow Velocity	3.0 m/s
• Minimum Pipe Diameter	250 mm
• Runoff Coefficients	0.90 for impervious areas (hard surface and roofs) 0.80 for gravel surfaces 0.20 for pervious areas
• Average C-Value	0.70 (for single family lot frontages) 0.74 (for townhouse lot frontages) 0.58 (for rear yards)

Using the runoff coefficients above, weighted c-values have been calculated based on maximum zoning envelopes. The conservative average c-values have been assumed for the proposed storm drainage areas. Sample calculations have been provided under **Appendix D**.

The proposed storm sewer system will consist of gravity storm sewers ranging from 250 mm to 1500 mm in diameter. The proposed storm sewers have been designed to have capacity to convey the full peak 2-year design storm event and to meet the acceptable full flow velocity range in accordance with the current Ottawa Sewer Guidelines. The municipal storm sewer system contained within the proposed right-of-ways will convey stormwater to a proposed stormwater management (SWM) facility, contained within Block 290 (refer to the Draft Plan of Subdivision in **Appendix A**). To reduce pipe sizes and maximize cover depth within the right-of-ways, two storm inlets to the SWM facility will be provided. The SWM facility will outlet flows through a designated 6.0 metre block (i.e. Block 293). The discharged stormwater will outlet to the surface and be conveyed to the Flowing Creek Municipal Drain via an open ditch system. During detailed design, flow velocities at the pipe outlet and within the ditch system will need to be assessed and adequate erosion protection will need to be implemented. Given that a new outlet to Flowing Creek is proposed, a permit from the RVCA under O. Reg. 174/06 will be required. Refer to the storm sewer design sheets, Conceptual Storm Design (DWG. 20002-STM1), and Conceptual SWM Pond and Outlet (DWG. 20002-STM2) in **Appendix D**.

8.3 Service Connections

All single-family, semi-detached, and townhouse units within the Creekside 2 Subdivision will be serviced with individual 150 mm diameter storm service connections to the proposed municipal storm sewer system. Sump pumps for the purpose of foundation drainage will be required for each service as discussed in more detail under **Section 8.4** below.

8.4 Sump Pumps

Sumps pumps for the purpose of foundation drainage will be required for all storm services within the Creekside 2 Subdivision. City of Ottawa Technical Bulletin (ISTB-2018-04) provides a list of conditions which must be satisfied prior to the acceptance and implementation of sump pumps in new developments as follows:

Condition 1: *The area under consideration is on full services.*

Response: Each unit within the Creekside 2 Subdivision will be provided with individual storm, sanitary, and water services via connections to the proposed municipal systems. Therefore, the above condition is satisfied.

Condition 2: *The area under consideration is underlain by clay soils subject to grade raise restrictions.*

Response: The Geotechnical Investigation indicates that native deposits of silty clay were encountered in all boreholes and extends to depths ranging from approximately 2.6 to 8.4 metres below the existing ground surface. Since the development is underlain by deposits of sensitive silty clay, which has a limited capacity to support loads imposed by grade raise fill material, pavement structures and foundations, maximum permissible grade raises are imposed to limit the total settlement of the ground surface (refer to the grade raise excerpts prepared by GEMTEC under **Appendix A**). Therefore, the above condition is satisfied.

Condition 3: *The finished grades that would be required to allow gravity drainage would exceed permissible grade raises, potentially leading to long-term settlements that exceed the Ontario Building Code and City of Ottawa Standards. In making this determination, the proponent must allow for the placement of lightweight fill under the garage and porch. The use of sump pump systems would thus alleviate excessive areas of lightweight fill (beyond the garage and porch), long duration (multi-year) pre-loading, or other such extreme means to prevent long-term settlements. Grade raise restrictions are to be determined by a geotechnical engineer with specific experience in this matter. The analysis and results must be to the satisfaction of the City of Ottawa.*

Response: The finished grades required to allow for gravity drainage throughout the development would exceed the permissible grade raises noted in the Geotechnical Investigation. The implementation of sump pumps will allow the finished grades to be minimized which will help in mitigate the need for lightweight fill (LWF) within the municipal right-of-ways which is undesirable. The finished grades proposed may still require the use of LWF for the building foundations and/or pre-loading in advance of construction. Therefore, the above condition is satisfied.

Condition 4: *Hydraulic grade lines (HGL) cannot reasonably be lowered any further due to outlet restrictions. Outlet restrictions need to be clearly defined and reasonable* *options considered. In addition, increasing the storm sewer pipe size to reduce the HGL should have a higher priority than the implementation of sump pump systems.*

Response: The HGL is influenced by the floodplain elevation of the adjacent Flowing Creek Municipal Drain (i.e. stormwater outlet for the development) and therefore cannot reasonably be lowered. It is not feasible to provide adequate separation between the proposed storm sewer system and USFs due to the grade raise constraints discussed under the responses to conditions 2-3 above. Therefore, the above condition is satisfied.

It has been demonstrated that the conditions provided in ISTB-2018-04 are satisfied and therefore the implementation of sump pump systems for the Creekside 2 Subdivision is warranted. The sump pump system design and construction will need to adhere to the requirements detailed in ISTB-2018-04 (provided in **Appendix D**).

8.5 Storm Servicing Conclusion

It has been demonstrated that the Creekside 2 Subdivision can be adequately serviced with a municipal storm sewer system with the provision of sump pump systems. The proposed storm sewer network, including the gravity sewers, sump pumps, and SWM facility can be designed in accordance with the current Ottawa Sewer Guidelines.

9.0 STORMWATER MANAGEMENT

9.1 Design Criteria

The stormwater management design for the Creekside 2 Subdivision will implement a dual drainage design, consisting of a minor and major system. The minor system (i.e. storm sewer) design is discussed under **Section 8.0**. The major system will be designed in accordance with the current Ottawa Sewer Guidelines using the following parameters:

- Design Return Period 100-Year
- Maximum Road Sag Ponding Depth 0.35 m
- Maximum Rear Yard Ponding Depth 0.30 m

To mitigate impacts to downstream infrastructure and watercourses, stormwater quantity and quality controls will also be implemented into the on-site design. The following stormwater management controls are proposed for the subject site:

Quantity Control

- Provide stormwater attenuation for the erosion control volume during the 2-year Chicago 3-hr design storm at a pro-rated existing release rate.
- Unattenuated flow controls for all events greater than the 2-year design event.

Quality Control

- Provide Enhanced Level (80% TSS removal) quality control of stormwater runoff discharging from the subject site.
- Quality control volume released over 48 hours.

JFSA were retained to assess the impacts of stormwater runoff from the Creekside 2 Subdivision on Flowing Creek and provide recommendations on appropriate stormwater management controls. The quantity and quality control measures proposed above were developed through preliminary modelling completed by JFSA as detailed in the JFSA SWM Memo (excerpts provided in **Appendix E**) and discussed further below.

9.2 Dual Drainage Design

The stormwater management design will include minor system and major system components designed in accordance with the current Ottawa Design Guidelines. The minor (storm sewer) system is designed to collect and convey flows from the more frequent, lower intensity design storm events (2-year for local roads). Inlet control devices (ICDs) are utilized to limit the inflow to the minor system during events exceeding the design level of service. The major (overland) system is designed to convey flows from the less frequent, higher intensity design storm events beyond the capacity of the minor system. The major system utilizes the municipal road network as an overland flow route to convey runoff to a proper outlet without impacting adjacent buildings. The saw-toothed design of the roadways provides areas for surface storage and stormwater detention.

9.3 Inlet Control Devices (ICDs)

The use of inlet control devices (ICDs) within the proposed storm sewer system to prevent the storm sewers from being surcharged during storm events exceeding the 2-year design storm will be reviewed during detailed design. If required, the ICDs will be installed in the outlet pipes of the proposed catch basin structures and will be appropriately sized based on an allowable flow and available head. As per City of Ottawa Technical Bulletin ISTB-2018-04, ICDs may not be required in dual drainage systems where sump pumps are proposed (refer to **Section 8.4**), however, this will be confirmed at detailed design.

9.4 Major System

A major system overland flow route will be incorporated into the overall stormwater management design for the Creekside 2 Subdivision. The major system overland flow route will utilize the internal municipal right-of-ways to convey the major systems flows to the proposed SWM facility contained within Block 286. Major system flows would ultimately be conveyed to Flowing Creek via Block 289, however, the SWM facility will have capacity to contain storm events far exceeding the 100-year design storm before overtopping to the right-of-way occurs. Based on preliminary grading, the SWM facility would overtop into the adjacent right-of-way at an elevation of approximately 95.00 m. Preliminary stage-storage calculations for the SWM facility (refer to **Section 9.5.3**) indicate that the 100-year ponding elevation will occur at an elevation of approximately 93.00 m. Since +/- 2.0 m of freeboard will be provided between the 100-year event and the overtopping spill elevation it is unlikely that Block 289 will be utilized as an overland flow channel.

Ponding within the municipal road sags will be restricted to a maximum depth of 0.35 metres in accordance with the current Ottawa Sewer Guidelines. The major system design will ensure that the proposed houses and adjacent properties are protected for all storm events up to and including the 100-year design event. During detailed design the 100-year and 100-year plus climate change scenarios will be modelled to verify the limits of ponding within the municipal right-of-ways.

9.5 SWM Facility Preliminary Design

Stormwater will be conveyed by the proposed storm sewers (minor system) and road network (major system) to a proposed SWM facility, contained within Block 286. The SWM facility is proposed to be a wet pond designed in accordance with the MECP SWM Manual. The preliminary design of the SWM facility has also incorporated the findings of the JFSA SWM Memo (excerpts provided in **Appendix E**). The design criteria for the SWM facility have been summarized in the table below:

Table 9.1: Wet Pond Design Criteria

Design Criteria	Minimum Criteria as per MECP SWM Manual*2	Proposed Criteria
Drainage Area	>5 hectares	24.6 hectares
Treatment Volume – PP*3	Table 3.2	4,162 m^3
Treatment Vol. – Active Storage*4	40 m^3/ha	985 m^3
Active Storage Detention	24 hours	48 hours
Forebay Depth	Minimum 1m	1.5m
Forebay Volume	Maximum 33% of PP	20% of PP
Length-to-Width Ratio	Overall: Minimum 3:1 Forebay: Minimum 2:1	Overall: 3.8:1 Forebay: 2.8:1 to 5.6:1
Permanent Pool Depth	Max: 3m, Mean: 1m-2m	1.5m
Active Storage Depth	Water Quality & Erosion: Max. 1.5m Total: Max. 2m	Water Quality: 0.25m Erosion: 0.90m Total: 1m
Side Slopes	5:1 for 3m beyond PP Max. 3:1 elsewhere	5:1 for 3m beyond PP 3:1 for PP 4:1 to 5:1 elsewhere

Notes:
1. “PP” denotes permanent pool.
2. Minimum criteria derived from MECP SWM Manual Table 4.6.
3. Required PP volume based on MECP SWM Manual Table 3.2. Refer to JFSA SWM Memo Table B2 in **Appendix E**.
4. Required quality control volume based on 40m^3/ha released over 48 hours. Refer to JFSA SWM Memo Table B2 in **Appendix E**.

As demonstrated in the table above, the SWM facility has been designed in accordance with the criteria outlined in the MECP SWM Manual.

9.5.1 Quantity Control

As detailed in the JFSA SWM Memo, simulations were run using SWMHYMO to verify the impacts of the proposed development on Flowing Creek. The results of the analysis showed that due to the difference in the timing of peaks between the subject site and Flowing Creek, the peak flows in Flowing Creek can be reduced by allowing the runoff from the proposed development out quickly instead of attenuating the flows to existing conditions, which could result in peak flows coinciding with those in Flowing Creek. For this reason, quantity control attenuation to pre-development levels is not warranted. However, to mitigate against downstream erosive impacts an erosion control volume was calculated based on matching the proposed flows during the 2-year Chicago 3-hr design event to a prorated existing release rate. Required storage volumes within the SWM facility based on the preliminary modelling have been summarized in the table below:

Table 9.2: SWM Facility Required Quantity Volumes

Design Event	Pond Release Rate*1 (m^3/s)	Required Storage Volume*2 (m^3)
Quality Event*3	0.011	985
2-Yr CHI 3-hr	0.047	4,338
5-Yr CHI 3-hr	1.393	4,467
25-Yr CHI 3-hr	3.937	4,692
100-Yr CHI 3-hr	5.760	4,849

Notes:

1. Pond release rates as per JFSA SWM Memo Table B3.
2. Pond volumes as per JFSA SWM Memo Table B3.
3. Refer to quality control discussion under **Section 9.5.2**.

An appropriately designed outlet control structure within the SWM facility which can attenuate flows to the release rates noted above will need to be assessed at the detailed design stage.

9.5.2 Quality Control

As detailed in the Jock River Watershed Report, the surface chemistry water quality of Flowing Creek is considered “poor” and has shown persistently elevated nutrient concentrations and E. coli counts as well as high metal concentrations over a 12 year period. Implementation of improved stormwater and agricultural best management practices are recommended to address water quality concerns and retain existing shoreline vegetation. The existing shoreline vegetation of Flowing Creek will remain undisturbed except for a single outlet channel required to convey “treated” stormwater from the Creekside 2 Subdivision to Flowing Creek. The development area for the Creekside 2 Subdivision will be located a minimum of 100 metres from the banks of Flowing Creek which far exceeds the minimum 30 metre development setback for water quality and shoreline protection.

In accordance with the design criteria proposed for the subject site, enhanced level (80% TSS removal) quality control must be achieved for stormwater discharging from the subject site. Quality control will be provided by a proposed SWM facility designed as a wet pond. The JFSA SWM Memo has estimated permanent pool and quality control volumes based on *Table 3.2* from the MECP SWM Manual for enhanced level control. Required quality storage volumes for the SWM facility have been summarized in the table below:

Table 9.3: SWM Facility Required Quality Volumes

Pond Stage	Required Volume (m^3)
Permanent Pool*1	4,162
Quality Control*2	985
Forebay*3	832

Notes:

1. Required PP volume based on MECP SWM Manual Table 3.2. Refer to JFSA SWM Memo Table B2 in **Appendix E**.
2. Required quality control volume based on $40m^3/ha$ released over 48 hours. Refer to JFSA SWM Memo Table B2 in **Appendix E**.

3. Forebay volume based on 20% of PP. Refer to JFSA SWM Memo Table B2 in **Appendix E**.

Additional quality cleansing will be provided by the vegetated outlet channel located between the SWM facility outlet and Flowing Creek.

9.5.3 Stage-Storage

The permanent pool elevation of the SWM facility will be set at an elevation of 92.00 m which is marginally above the 2-year water level in Flowing Creek of 91.98 m (determined by JFSA from RVCA HEC-RAS model). The pond bottom will be set at an elevation of 90.50 m which will provide a permanent pool depth of 1.5 m and a storage volume of approximately 4,575 m^3. Active storage will be provided above the permanent pool for stormwater detention. The ponding elevation for the 25-year design event will occur at an elevation of approximately 92.95 m with an active storage volume of 4,789 m^3. The ponding elevation for the 100-year design event will occur at an elevation of approximately 93.00 m with an active storage volume of 5,081 m^3. The SWM facility has been designed with adequate capacity to detain the required storage volumes for quantity and quality controls. Refer to the SWM facility stage-storage table provided in **Appendix E** for more details.

9.5.4 Forebay Design

The proposed SWM facility will require two forebays to accommodate the two storm sewer inlets. The north forebay will provide pretreatment for stormwater flows conveyed via the Street No. 3 inlet and the south forebay will provide pretreatment for the stormwater flows conveyed via the Street No. 5 inlet. Using equations 4.5, 4.6, and 4.7 from MECP SWM Manual, preliminary forebay sizing calculations have been completed. The results of the calculations have been summarized in the table below:

Table 9.4: SWM Facility Forebay Sizing

Design Criteria	North Forebay		South Forebay	
	Required (m)	Provided (m)	Required (m)	Provided (m)
Settling Length*1	10.1	24.8	14.3	22.4
Dispersion Length*2	11.7	24.8	4.0	22.4
Bottom Width*3	1.45	8.8	0.5	4.0

Notes:
1. Calculated using MECP SWM Manual Equation 4.5.
2. Calculated using MECP SWM Manual Equation 4.6.
3. Calculated using MECP SWM Manual Equation 4.7.

As demonstrated in the table above, the forebays have been designed in accordance with the MECP SWM Manual. Refer to supporting calculations provided in **Appendix E**.

9.5.5 SWM Facility Liner

The GEMTEC Water Supply Assessment provided the following recommendation regarding proposed SWM facilities within the subject site:

"Hydrogeological sensitive areas may exist where the clay is absent or it is removed from the surface by excavation. In general, the groundwater chemistry results, an absence of nitrate compounds and bacteriological parameters, also supports the water level data and suggest that the Site is not hydrogeological sensitive. However, consideration should be given to any

excavations, such as storm water ponds, that could remove protective clays from the near surface at the Site. In these instances where excavation must be made, protective clay liners or geosynthetic liners should be considered."

During detailed design, the proposed bottom of the SWM facility elevation with respect to the existing clay layer will need to reviewed by GEMTEC to determine if a liner is required. Refer to excerpts from the GEMTEC Water Supply Assessment in **Appendix B**.

9.6 Hydraulic Grade Line (HGL) Analysis

As discussed under **Section 8.4**, sump pumps will be required for the proposed development. Since sump pumps are proposed, the freeboard between the 100-year HGL in the storm sewer system and the USFs does not need to be assessed. In accordance with ISTB-2018-04, the 100-year HGL should not exceed the ground surface during the 100-year design event for areas that are designed to use sump pumps. Backwater valves will also provide additional basement protection. An HGL analysis will be completed during detailed design to ensure that the storm system does not surcharge above the ground surface.

As discussed in the JFSA SWM Memo, since there is a significant difference between the timing of peaks between the proposed development and Flowing Creek it can be reasonably assumed that a scenario where there is simultaneously both a 100-year water level in the watercourse and within the SWM facility, would not occur.

9.7 Low Impact Development (LID)

Low Impact Development (LID) is a stormwater management strategy that seeks to mitigate the impacts of increased runoff and stormwater pollution by managing runoff as close to its source as possible. LID comprises a set of site design strategies that minimize runoff through distributed, small scale structural practices that mimic natural or predevelopment hydrology through the processes of infiltration, evapotranspiration, harvesting, filtration and detention of stormwater. These practices can effectively remove nutrients, pathogens and metals from runoff, and they reduce the volume and intensity of stormwater flows. [Low Impact Development Technical Guidance Report, Aquafor Beech, February 2021].

The City of Ottawa will not permit the implementation of infiltration/exfiltration LID systems if site conditions consist of clay soils, bedrock, or engineered fill. The Geotechnical Investigation indicates that native deposits of silty clay were encountered in all boreholes. Further, the development of the site will require fill material throughout, some of which will be engineered fill. Therefore, the proposed development is not considered suitable for infiltration/exfiltration LID systems.

Another site constraint to consider for the implementation of LID measures is the depth of the groundwater table. A minimum separation of 1.0 metre is recommended between the bottom of LID practices and the seasonally high groundwater table. Further geotechnical testing will be required to verify seasonally high groundwater levels across the site.

Based on the constraints noted above, the suitability of LID measures would be limited, however, the following measures may be implemented to promote runoff prevention and treat stormwater as close to the source as possible:

- Discharge roof downspouts to pervious areas for natural infiltration and evaporation.
- Installation of perforated subdrain systems in rear yards to promote filtration and infiltration of stormwater runoff.
- Provide reduced lot grading (where possible) and drainage swales with flattened slopes to promote filtration and infiltration of stormwater runoff.

The proposed location of rear yard subdrain systems are shown on the Conceptual Storm Design (DWG. 20002-STM) in **Appendix D**.

10.0 EROSION AND SEDIMENT CONTROL

In order to protect downstream infrastructure and watercourses, erosion and sediment control measures must be implemented prior to construction and maintained until vegetation has been re-established in disturbed areas. The following erosion and sediment control (ESC) measures have been proposed for the subject site:

- Limiting the extent of exposed soils at any given time.
- Erosion and sediment control measures shall be maintained until vegetation has been re-established in all disturbed areas. Re-vegetate disturbed areas in accordance with approved Landscape Plan as soon as possible.
- Stockpile soil away (15 metres or greater) from watercourses, drainage features and top of steep slopes.
- Installation of silt sacks between frame and cover on all proposed and existing catch basins and open cover storm manholes until construction is completed.
- Silt fence and straw bales to be installed and maintained along the property boundaries where indicated on the erosion and sediment control plans.
- Install mud mats at all construction entrances.
- For dry weather periods (active and/or inactive construction phases) inspections of ESC measures shall be undertaken on a weekly basis.
- Inspection of ESC measures shall be undertaken immediately after major storm events (>25mm of rain in 24 hour period), significant snowmelt events (melting of snow at a rate which adversely affects the performance and function of the system), and extreme weather events.
- Visual inspections shall also be undertaken in anticipation of large storm events (or a series of rainfall and/or snowmelt days) that could potentially yield significant runoff volumes.
- Identify and rectify any deficiencies and undertake necessary maintenance measures as soon as possible.
- Inspections and maintenance of temporary ESC measures shall continue until they are no longer required.
- The Contractor shall ensure that records of inspection are taken, including at a minimum:
  - the inspector’s name;
  - date of inspection;
  - visual observations;
  - any necessary remedial measures taken to maintain the interim ESC measures.
- Care shall be taken to prevent damage to ESC during construction operations.
- In some cases, barriers may be removed temporarily to accommodate construction operations. The affected barriers shall be reinstated immediately after construction operations are completed.
- ESC should be adjusted during construction to adapt to site features as the site becomes developed.
- ESC shall be cleaned of accumulated sedimentation as required and replaced as necessary.
- During the course of construction, if the Engineer believes that additional prevention methods are required to control erosion and sedimentation, the Contractor shall implement additional measures, as required, to the satisfaction of the Engineer.
- Construction and maintenance requirements for erosion and sediment controls are to comply with Ontario Provincial Standard Specification (OPSS) 805.

Detailed erosion and sediment control plans, which indicate the implementation of the above measures, will be prepared during detailed design.

11.0 CONCLUSIONS

It has been demonstrated that the proposed Creekside 2 Subdivision, located in the Village of Richmond, can be adequately serviced with municipal infrastructure and can be designed to meet stormwater management requirements. The proposed servicing and stormwater management designs will be achieved by implementing the following key features:

- Water supply for domestic use and fire protection will be provided by a new communal well and municipal watermains.
- Wastewater flows will be conveyed to the existing sanitary system on Moore Street via new municipal gravity sanitary sewers, a wastewater pumping station and sanitary forcemains.
- Provision of a front-ending agreement with the City for upgrades to the existing sanitary sewer system.
- Stormwater will be collected and conveyed by a new municipal storm sewer system.
- A new SWM facility designed as a wet pond with an outlet to Flowing Creek.
- Provision of stormwater quantity (erosion control) and quality (enhanced level) controls within the SWM facility design.
- Implementation of LID measures to promote groundwater recharge (where possible to do so).
- Erosion and sediment controls will be implemented prior to construction and maintained until vegetation has been re-established in disturbed areas.

Prepared By:

Brandon MacKechnie, P.Eng.
Project Engineer

Reviewed By:

Chris Collins
Manager – Land Development

Appendix A

Pre-Consultation Notes

Pre-Consultation for
Front-Ending Agreement

Draft Plan of Subdivision
(prepared by AOV)

Cut/Fill Analysis Excerpts

Borehole Information
(prepared by GEMTEC)

Grade Raise Excerpts
(prepared by GEMTEC)

Conceptual Grading Plan
(DWG. 20002-GRD)

Conceptual Park Grading Plan
(DWG. 20002-PRK)

Typical Sections
(DWG. 20002-SEC1-SEC3)

ROW Grade Raise Plan
(DWG. 20002-R1)

Lot Grade Raise Plan
(DWG. 20002-R2)

Appendix B

Conceptual Communal
Well Configurations
(prepared by Stantec)

Communal Well Correspondence

GEMTEC Water Supply
Assessment Excerpts

Technical Memorandum
(prepared by JLR)

Communal Well Conceptual Site Plan (prepared by JLR)

Conceptual Watermain Design (DWG. 20002-WM)

Watermain Design Sheet

Stantec Fire Flow
Assessment Excerpts

FUS Calculations

Fire Flow Correspondence with City

Appendix C

Stantec MSS Excerpts

Parsons Memo No. 5 Excerpts

DSEL Report Excerpts

Plan and Profile
of Sanitary Easement
(prepared by DSEL)

Sanitary Sewer Design Sheet

Communal Well
Flow Correspondence

Conceptual Sanitary Design
(DWG. 20002-SAN)

Sanitary Pumping
Station Conceptual Site Plan
(prepared by JLR)

Preliminary Sanitary
HGL Computation Form

Sanitary HGL and USF Check

Appendix D

Runoff Coefficient Calculations

Storm Sewer Design Sheet

Conceptual Storm Design
(DWG. 20002-STM1)

Conceptual SWM Pond and Outlet
(DWG. 20002-STM2)

Sump Pump Technical Bulletins

Appendix E

JFSA SWM Memo Excerpts

SWM Facility Stage-Storage

Preliminary Forebay
Sizing Calculations