MILL VALLEY ESTATES DEVELOPMENT FUNCTIONAL SERVICING AND STORMWATER MANAGEMENT REPORT

December 11, 2023

Prepared for:
Houchaimi Holdings Inc.

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Project Number:
160401740

Revision	Description	Author	Date	Quality Check	Date	Independent Review	Date
0	Functional Site Servicing and SWM Report	Peter Mott	2022-11-17	Ana Paerez	2022-11-29	Kris Kilborn	2022-12-02
1	Functional Site Servicing and SWM Report	Michael Wu	2023-11-24	Ana Paerez	2023-11-24	Kris Kilborn	2023-11-29

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1 Introduction

The following Servicing and Stormwater Management (SWM) Report has been revised to reflect the revised draft plan and to address comments received from the Municipality of Mississippi Mills (Municipality) and the Mississippi Valley Conservation Authority (MVCA) on the first submission of 2022. A memo summarizing civil-related comments along with Stantec's responses has been provided in **Appendix F**. In addition, a potable water hydraulic analysis has been completed based on available boundary conditions, and an interim condition SWM model has been developed to reflect initial phasing without the existing ditch realignment.

Stantec Consulting Ltd. has been commissioned by Houchaimi Holdings Inc. to prepare the following Functional Site Servicing and Stormwater Management Report for the Mill Valley Estates Development in support of Draft Plan Circulation with the Municipality of Mississippi Mills. The subject property is located within the Ward of Almonte and is bordered by Appleton Side Road to the northeast, Old Almonte Road to the southwest, vacant land to the northwest bound by Industrial Drive, and vacant land to the southeast.

The development lands will conform to the Official Plan by the municipality of Mississippi Mills, and an Official Plan Amendment (OPA 22, 2021) which outlined the subject property as a viable area for urban boundary expansion. The current zoning designates the 'Area 2' lands as Rural Lands. However, based on the OPA, the subject site is zoned for Residential use, and Type I industrial land use.

The proposed overall development comprises approximately 33.6 ha of land consisting of a mixture of townhomes and single-family homes, a stormwater management (SWM) block, a block for a sanitary pump station, a community park block, a parkette, as well as a business park block. The property location is indicated in **Figure 1-1**, and the proposed Draft Plan by Fotenn Planning and Design can be found in **Appendix E**.

Servicing requirements for the Mill Valley Living Retirement Community which will comprise approximately 3.9 ha of land consisting of townhomes, a multi-storey apartment building, and single-family homes were established by McIntosh Perry Consulting Engineers Ltd. in the *Servicing & Stormwater Management Report – Mill Valley Living Community Report (2022)*, which concluded that servicing for the site would be provided through servicing infrastructure within the proposed Mill Valley Estates Development, and as such, the retirement community has been included in this servicing report as an external area.

Figure 1-1: Mill Valley Estates Development – Site Area

1.1 Project Objectives

This Functional Site Servicing and Stormwater Management (SWM) Report has been prepared to present an internal servicing scheme that is free of conflicts and is in accordance with all applicable design guidelines and recommendations included in the various background studies outlined in **Section 2.0**.

Design objectives for the proposed site include:

- Establish an overall grading plan with consideration to grading constraints (i.e., major system relief, sufficient pipe cover, grade raise restrictions), while respecting the natural topography and subsurface soil conditions.

- Define and size the internal water distribution system with connections to the existing water distribution network to service the Mill Valley Estate Development and the Mill Valley Living Retirement Community. The overall development will adhere to the criteria provided in the *Master Plan Update Report – Water and Wastewater Infrastructure (2018)* prepared by J. L. Richards and Associates Limited (JLR).

- Define sizing and internal routing of the sanitary collection system in accordance with coordination with the Municipality and the *Master Plan Update Report – Water and Wastewater Infrastructure (2018)* prepared by JLR.
- Define major and minor storm conveyance systems in conjunction with the grade control plan including overland flow routes to the proposed stormwater management facility, located within the Mill Valley Estates Development, to provide quality treatment, quantity control and ensure any natural features downstream of the proposed storm outlet will not be negatively impacted.

2 Reference Documents

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

- Servicing & Stormwater Management Report– Mill Valley Retirement Community (Project No.: CCO-20-0034), McIntosh Perry Consulting Engineers Ltd., February 11, 2022.
- Environmental Impact Assessment – Old Almonte Road and Appleton Side Road, Southeast Almonte, Muncaster Environmental Planning Inc., July 30,2021.
- Geotechnical Investigation – Proposed Residential Development, Riverfront Estates – Future Expansion Lands (Report: PG5576-1), 1218 Old Almonte Road - Almonte, Paterson Group Inc. Consulting Engineers, December 7, 2020.
- Master Plan Update Report – Final, Municipality of Mississippi Mills Almonte Ward - Water and Wastewater Infrastructure (JLR No.: 27456-01), J.L. Richards and Associates Ltd., February 2018.
- City of Ottawa Sewer Design Guidelines, 2nd Edition, City of Ottawa, October 2012 (and all subsequent technical bulletins).
- City of Ottawa Design Guidelines – Water Distribution, 1st Edition, Infrastructure Services Department, City of Ottawa, July 2010.
- Stormwater Management Planning and Design Manual, Ministry of the Environment, Conservation and Parks, Ontario, March 2003.

3 Potable Water Servicing

The Mill Valley Estates Development project is proposed for mixed land use comprising residential areas and a business park (7.56 ha). The residential area comprises a mix of single-family detached homes (253), back-to-back avenue townhomes (72) and executive townhomes (210).

3.1 Background

Servicing requirements for the Mill Valley Living Retirement Community were established by McIntosh Perry Consulting Engineers Ltd. in the *Servicing & Stormwater Management Report – Mill Valley Living Community Report (2022).* Based on the information provided in McIntosh Perry's report, the community will consist of a mix of single-family homes (2), townhomes (42), and apartments (48). Please refer to **Appendix A.4** for excerpts from McIntosh Perry's Mill Valley Living Servicing and SWM Report for reference.

The drinking water supply system within the Almonte Ward consists of five groundwater wells, an elevated potable water storage tank, and a distribution system owned and operated by the Municipality. The proposed Mill Valley Estates Development is within the vicinity of the existing water distribution system on Industrial Drive which is fed by the Town's main groundwater pump station (Well #7 & 8) and the Town's elevated potable water storage tank.

An existing 250 mm diameter watermain is located northwest of the subject site within Industrial Drive, terminating before Appleton Side Road. Additionally, an existing 200 mm diameter watermain is located southwest of the subject site within Paterson/Robert Street, servicing the existing Old Orchard Retirement site, adjacent to the proposed development lands. **Drawing OSSP-1** in **Appendix G** shows the location of existing watermains and the conceptual watermain network within the proposed development.

At the time of submission of the previous functional servicing report (December 2022), the hydraulic boundary conditions at the connection points to the existing network had not been received from the Municipality of Mississippi Mills and as such, no hydraulic modeling was completed to verify the adequacy of the proposed distribution network. Boundary conditions from the Municipality were subsequently received and the correspondence has been included in **Appendix A.3**.

3.1.1 BOUNDARY CONDITIONS

A boundary condition request was provided to J. L. Richards (the Municipality's consultant) for two connections to the existing water network; a connection to the existing 250 mm diameter watermain on Industrial Drive and a second connection to the 200 mm diameter watermain on Paterson Street. The boundary condition request included Average Day (AVDY), Maximum Day (MXDY), and Peak Hour (PKHR) demands for the Mill Valley Estates Development and the Mill Valley Living site as shown in **Table 3-1**. Boundary conditions were also requested for maximum day plus fire flows of 11,000 L/min (183 L/s) and 15,000 L/min (250 L/s).

Table 3-1 Theoretical Water Demands

Mill Valley Estates	Avg Day (L/s)	Max Day (L/s)	Peak Hour (L/s)
Junction Node J-577 (Elev. 133.20 m)	9.82	21.28	44.86

As shown in correspondence from J. L. Richards included in **Appendix A.3,** it was outlined that the simulated maximum available fire flow for the proposed site is 192 L/s (11,520 L/min), and as such, boundary conditions for MXDY plus fire flows of 183 L/s and 192 L/s were provided. **Table 3-2** shows the boundary conditions obtained from the Municipality's consultant.

Table 3-2 Mill Valley Estates Boundary Conditions (max. available fire flow 192 L/s)

Demand Scenario	Connection 1 - Industrial		Connection 2 – Paterson	
	Junction Node J-3 (Elev. 138.49 m)		Junction Node J-444 (Elev. 132.45 m)	
	Pressure (kPa)	HGL (m)	Pressure (kPa)	HGL (m)
Average Day	413	180.68	471	180.62
Max Day + Fire Flow 11,000 L/min (183 L/s)	346	173.87	368	170.02
Max Day + Fire Flow 11,520 L/min (192 L/s)	341	173.36	360	169.21
Peak Hour	398	179.18	452	178.67

3.2 Proposed Watermain Sizing and Layout

3.2.1 CONNECTIONS TO EXISTING INFRASTRUCTURE

A network of 200 mm and 250 mm diameter watermains is proposed to follow the alignment of the roads within the subject property and extend to the following connection points:

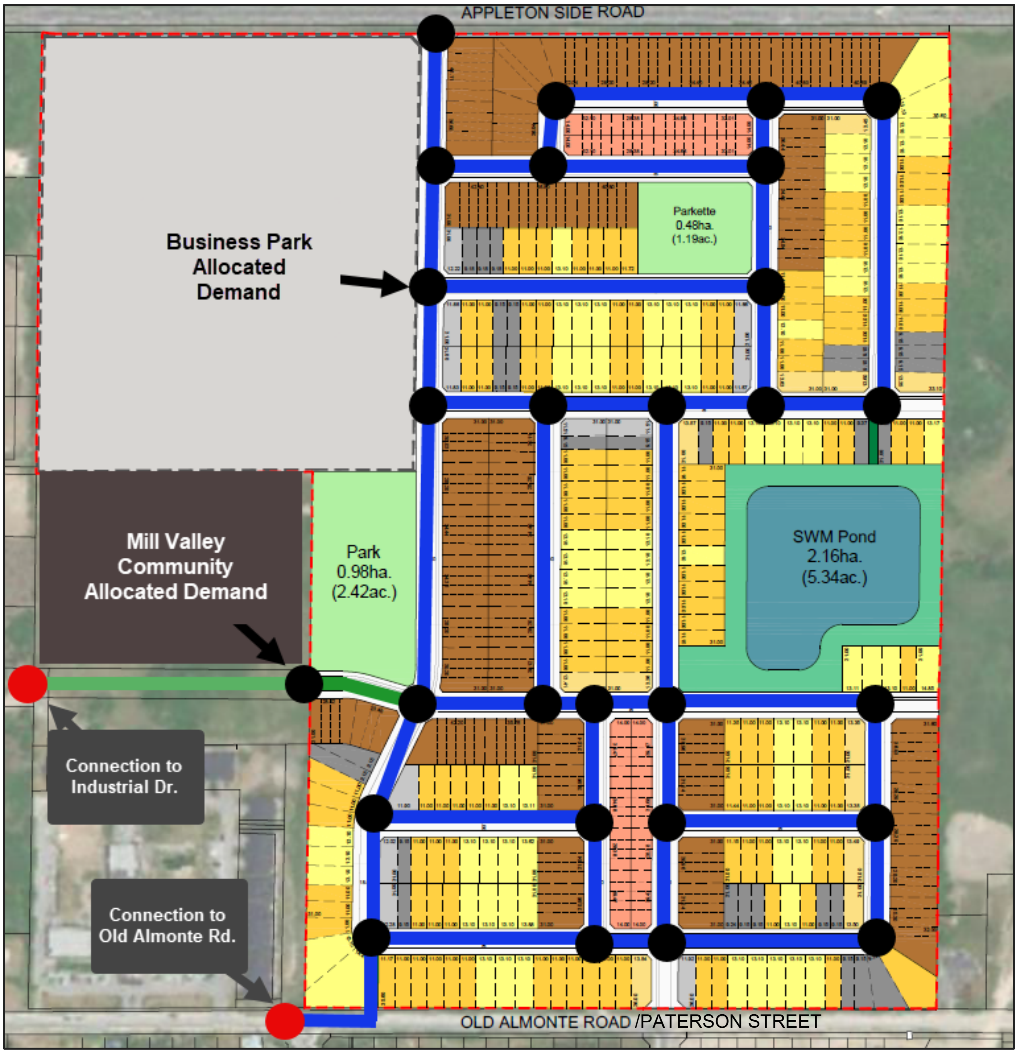
1) At the existing 250 mm diameter watermain to the northwest of the site within Industrial Drive. A 250 mm watermain extension is required fronting the future Mill Valley Living Community and extending down Gerry Emon Road to Industrial Drive.

2) At the existing 200 mm diameter watermain within the intersection of Paterson Street and Robert Street (southwest of the site) via a proposed watermain extension along an easement.

3.2.2 WATERMAIN SIZING AND LAYOUT

Figure 3-1 shows the conceptual potable water network, along with connection points, 200mm watermains shown in blue and 250mm watermains shown in green.

Figure 3-1: Conceptual Water System Layout



3.2.3 DOMESTIC WATER DEMANDS

The proposed Mill Valley Estates Development will comprise of 253 single family homes (SFH), 210 townhomes (TH) and 72 back-to-back units (BTB). The future business park will be serviced with a watermain extension from the proposed Mill Valley Estates Development through an easement block. The future Mill Valley Living Community designed by McIntosh Perry includes 2 SFH, 42 TH, and 48 senior apartment units. A 15% increase in the total number of units has been considered in the overall domestic water demands for the future Mill Valley Living Community to account for potential density increases within that development area at the detailed design stage.

Water demands for the development were estimated using the City of Ottawa's Water Distribution Design Guidelines. For residential areas within the proposed Mill Valley Estates Development, the average water demand per capita of 280 L/p/d was used. For maximum day (MXDY) demand, the average day (AVDY) demand was multiplied by a factor of 2.5 and the peak hour (PKHR) demand was obtained by multiplying the MXDY demand by a factor of 2.2. However, for residential development within the future Mill Valley Living Community, an average water demand per capita of 350 L/p/d was used as per the criteria used in the *Servicing & Stormwater Management Report – Mill Valley Living Community Report (2022)* by McIntosh Perry. For maximum day (MXDY) demand, the average day (AVDY) demand was multiplied by a factor of 2.5 and the peak hour (PKHR) demand was obtained by multiplying the MXDY demand by a factor of 2.2. For the future business park block, light industrial demand rate with an average flow of 28,000 L/ha/d was used, while for maximum day (MXDY) demand, AVDY was multiplied by a factor of 1.5 and for peak hour (PKHR) demand, MXDY was multiplied by a factor of 1.8. For the parkland dedicated areas, commercial demand rates with an average flow of 28,000 L/ha/d was used, while for maximum day (MXDY) demand, AVDY was multiplied by a factor of 1.5 and for peak hour (PKHR) demand, MXDY was multiplied by a factor of 1.8. The calculated water demands for the entire development are tabulated in **Table 3.3** and the domestic water demand calculations are provided in **Appendix A.1**.

Table 3.3: Water Demands for the Mill Valley Estates and Mill Valley Living

Building ID	Area (m^2)	Number of Units	Population[1]	Daily Rate of Demand ($L/m^2/d$ or L/p/d)[5]	AVGD (L/s)	MXDY (L/s)	PKHR (L/s)
Single Family	-	55	187	280	0.61	1.52	3.33
Back-to-Back Townhouse	-	38	103	280	0.33	0.83	1.83
Executive Townhouse	-	49	132	280	0.43	1.07	2.36
Parkland Dedication[2]	9,800	-	-	2.8	0.32	0.48	0.86
Phase 1A Total	**9,800**	**142**	**422**		**1.7**	**3.9**	**8.4**
Single Family	-	51	173	280	0.56	1.40	3.09
Executive Townhouse	-	22	59	280	0.19	0.48	1.06
Phase 1B Total	**-**	**73**	**233**		**0.8**	**1.9**	**4.1**
Single Family	-	147	500	280	1.62	4.05	8.91
Back-to-Back Townhouse	-	34	92	280	0.30	0.74	1.64
Executive Townhouse	-	139	375	280	1.22	3.04	6.69
Parkland Dedication	14,600	-	-	2.8	0.47	0.71	1.28
Business Park (Block 189)	75,600	-	-	2.8	2.45	3.68	6.62
Phase 2-4 Total		**320**	**967**		**6.1**	**12.2**	**25.1**
Mill Valley Estates Total	**-**	**535**	**1,622**		**510**	**1,080**	**2,259**
Single Family		2	7	350	0.03	0.07	0.15
Seniors Apartment		48	110	350	0.45	1.12	2.46
Townhouse		42	113	350	0.46	1.15	2.53
15% Future Buildout Contingency [4]		14	32	350	0.13	0.32	0.71
Mill Valley Living Total[3]		**106**	**263.0**	**-**	**1.06**	**2.66**	**5.84**
Total to Water System		**641**	**1,885**	**-**	**9.6**	**20.7**	**43.5**

1. The residential population is estimated using a persons per unit (PPU) density of 3.4 for single family homes, 2.7 for townhomes, 1.8 for average apartments.

2. The dedicated parkland area is calculated at the end of the Phase1B, based on the recommended guidelines on hectare of parkland is required for every 600 units. The dedicated area of 9,800 m^2 satisfies the required parkland area for Phase 1A and Phase 1B (in total) of around 3,600 m^2.
3. Development statistics for Mill Valley Living taken from McIntosh Perry servicing and SWM Report (February 2022).
4. The population estimate for the Mill Valley Living has been increased due to potential future increases in number of units. A 15%-unit contingency has been provided and has been accounted for in the overall demand.
5. Daily rate of demand for the units within the Mill Valley Living Retirement Community is adopted from the Servicing & Stormwater Management Report - Mill Valley Retirement Community by McIntosh Perry Consulting Engineers Ltd. to ensure consistency with previous studies.

3.2.4 FIRE FLOW REQUIREMENTS

Based on the fire flow limitation of 192 L/s provided by the Municipality's consultant, a series of firewalls are recommended for isolating the proposed townhome and back to back blocks that do not meet the City of Ottawa's conditions to cap the fire flow requirement (FFR) to 10,000 L/min, as shown below.

- For single detached dwellings, the fire flow requirement may be capped at 10,000 L/min, provided there is a minimum separation of 10 metres between the backs of adjacent units.
- For traditional side-by-side town and row houses only, the fire flow requirement may be capped at 10,000 L/min provided that firewalls with a minimum two hour fire-resistance rating are constructed to separate a town or row house block into fire areas that comprise no more than the lesser of seven units, and 600 m^2 of building area, and there is a minimum separation of 10 metres between the backs of adjacent units.

Accordingly, FUS calculations for TH and BTB blocks that do not meet the conditions for the 10.000 L/min FFR cap were completed to establish the number of units per block that will need to be separated by a firewall or a minimum distance of 3m to limit the FFR to the 11,520 L/min (192 L/s) threshold. FUS calculations have been provided in **Appendix A.2**. The conceptual FFR and firewall configuration are shown in **Figure 3-2** and **Table 3.4**. However, it should be noted that firewall configuration and/or TH and BTB block separation requirements will be confirmed at the detailed design stage.

Figure 3-2: Conceptual Firewall Configuration

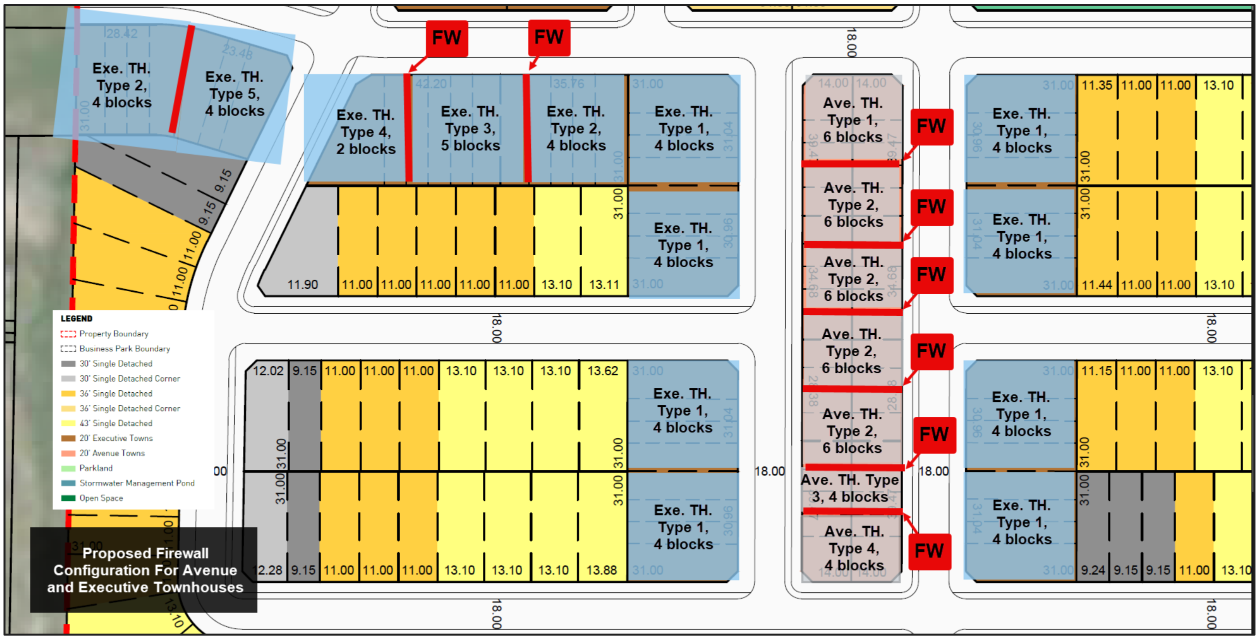


Table 3.4: Fire Flow Requirements and Firewall Configuration

Unit Type	Description	Min. Required Fire Flow (L/min)	Min. Required Fire Flow (L/s)
BTB (Avenue) Type 1	6 three-storey BTB units with an average area of 45 m^2/unit with 1 firewall	11,000	183
BTB (Avenue) Type 2	6 three-storey BTB units with an average area of 45 m^2/unit with 2 firewalls	11,000	183
BTB (Avenue) Type 3	4 three-storey BTB units with an average area of 45 m^2/unit with 2 firewall	10,000	167
BTB (Avenue) Type 4	4 three-storey BTB units with an average area of 45 m^2/unit with 1 firewalls	10,000	167
Exe. TH. Type 1	4 two-storey TH with an average area of 75 m^2/unit with no firewalls (min. 3m separation between blocks)	11,000	183
Exe. TH. Type 2	4 two-storey TH with an average area of 75 m^2/unit with 1 firewall	11,000	183
Exe. TH. Type 3	4 two-storey TH with an average area of 75 m^2/unit with 2 firewalls	11,000	183
Exe. TH. Type 4	2 two-storey TH with an average area of 75 m^2/unit with 1 firewall	8,000	133
Exe. TH. Type 5	3 two-storey TH with an average area of 75 m^2/unit with 1 firewall	8,000	133

3.2.5 LEVEL OF SERVICE

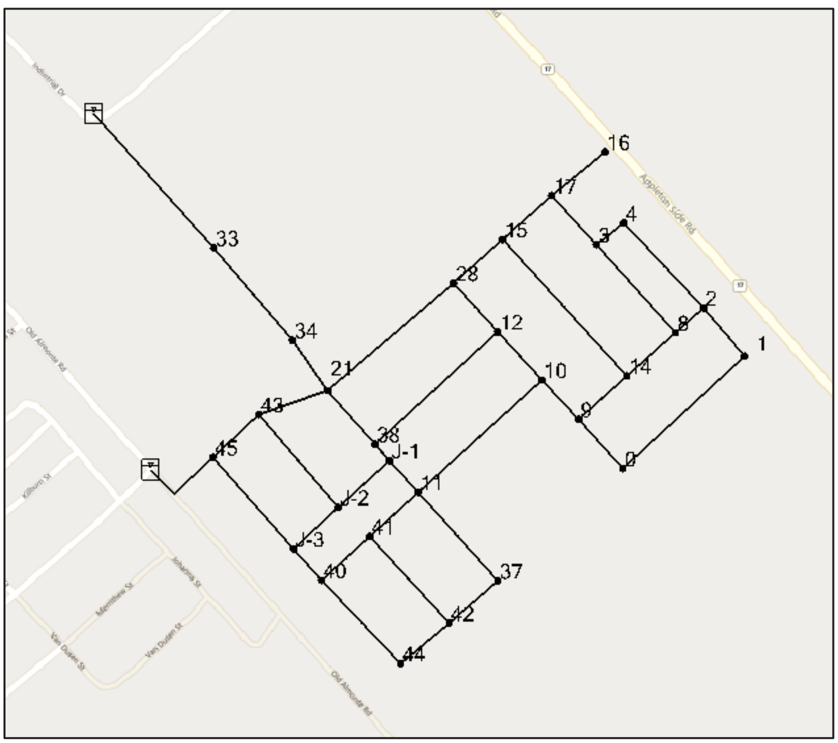
The City of Ottawa's Water Distribution Design Guidelines state that the desired range of system pressures under normal demand conditions (i.e., basic day, maximum day, and peak hour) should be in the range of

350 kPa to 552 kPa (50 to 80 psi) and no less than 275 kPa (40 psi) at ground elevation. The maximum pressure at any point in the distribution system is to be no higher than 552 kPa (80 psi). As per the Ontario Building Code & Guide for Plumbing, if pressures greater than 552 kPa (80 psi) are anticipated, pressure relief measures (such as pressure reducing valves) are required. Under emergency fire flow conditions, the minimum pressure in the distribution system is allowed to drop to 138 kPa (20 psi).

3.3 Hydraulic Model Results

WaterGEMS software was used to create a hydraulic model that reflects the conceptual water network and the water demands from the proposed Mill Valley Estates and the future Mill Valley Living Developments as per ultimate development conditions. **Figure 3-3** shows the hydraulic model network, proposed connections to the existing water system, as well as node IDs for future reference.

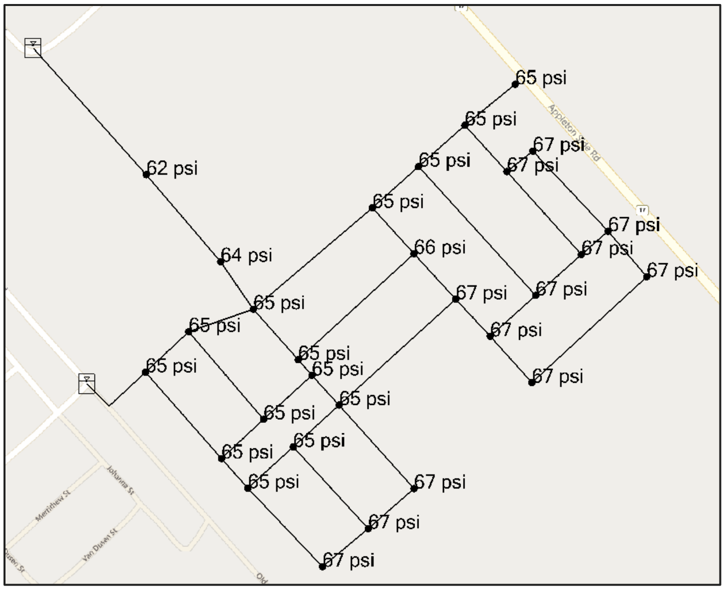
Figure 3-3: Water System Node IDs in WaterGEMS Software



3.3.1 AVERAGE DAY DEMAND

Under the average day demand (AVDY) for ultimate development conditions, model results show that the maximum pressure throughout the water network ranges between 62 psi to 67 psi as shown in **Figure 3-4**.

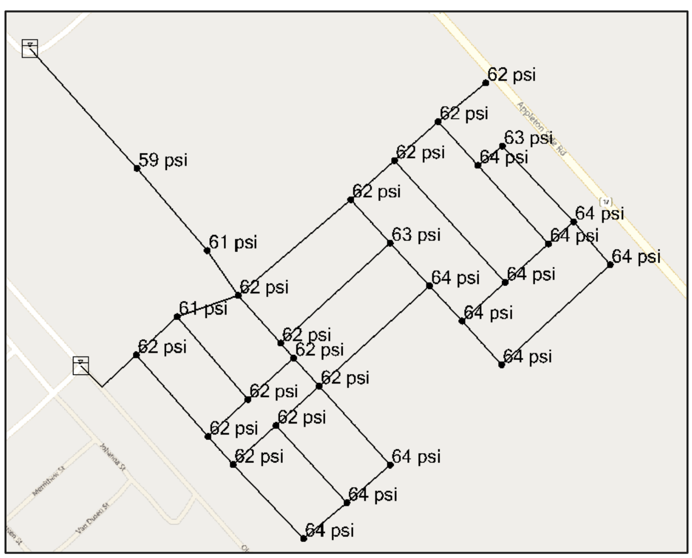
Figure 3-4: AVDY Pressure under Ultimate Development Conditions



3.3.2 PEAK HOUR DEMAND

Under the peak hour demand (PKHR) for ultimate development conditions, model results show that the minimum pressure throughout the water network ranges between 59 psi to 64 psi as shown in **Figure 3-5**.

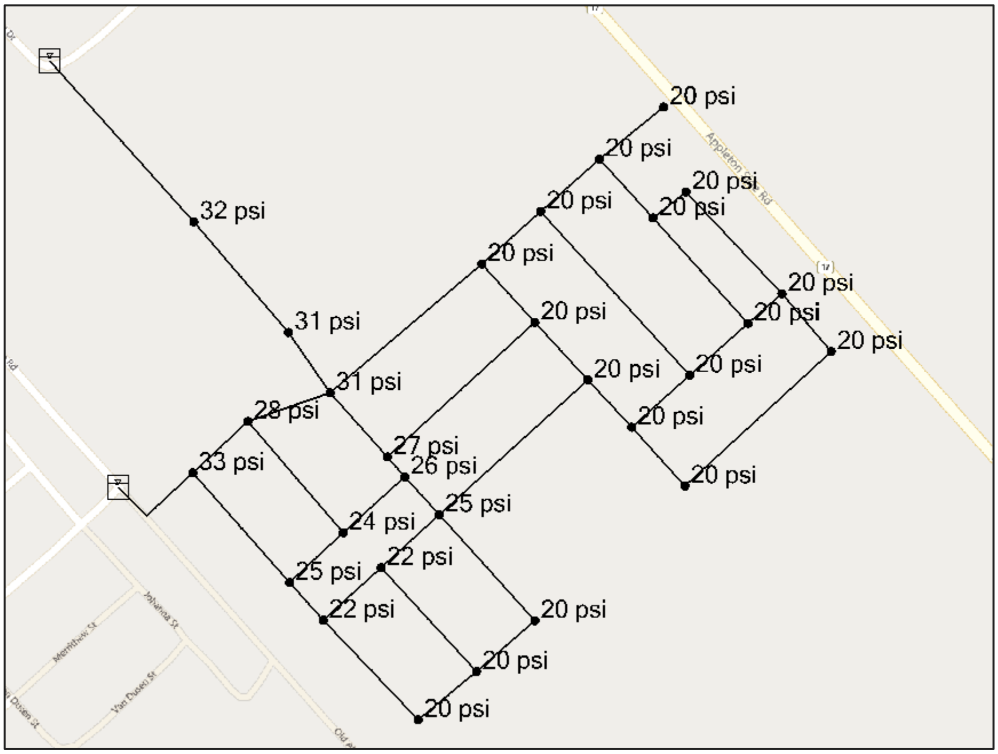
Figure 3-5: AVDY Pressure under Ultimate Development Conditions



3.3.3 MAXIMUM DAY DEMAND+ FIRE FLOW

Available fire flows across the proposed development are limited to 11,520 L/min (192 L/s) as described in **Section 3.1.1**. Under the ultimate development conditions and the maximum day + fire flow (MXDY+FF) scenario (for RFF of 192 L/s), the model results show that fire flows greater than 11,520 L/min are achievable, with a residual pressure of at least 138 kPa (20 psi) at all locations as shown in **Figure 3-6**.

Figure 3-6: MXDY+FF Residual Pressures for Ultimate Development Conditions



4 Wastewater Servicing

The Mill Valley Estates Development will consist of 253 single family homes (SFH), 210 townhome units (TH), 72 back to back avenue townhomes (BTB), a community park, a pump station block, a SWM block, a parkette, and a future business park block. The community park I7B, and the parkette area I12B have been included in the overall wastewater peak flow calculations for the site assuming institutional land use for conservatism. In addition, the future business park (area C26B) has been assessed using commercial sewage generation rates with individual blocks subject to the site plan control process. Please refer to **Drawing OSA-1** for conceptual sanitary sewage network, sanitary drainage areas and pump station location.

The proposed wastewater infrastructure has been sized to service the future Mill Valley Living Community (area R7C). The *Servicing & Stormwater Management Report – Mill Valley Living Community Report (2022)* by McIntosh Perry outlined that the site would consist of a mix of 2 SFH, 42 TH, and 48 apartment units for a population of 229. A 15% increase in the total number of units has been considered for the future Mill Valley Living Community to account for potential density increases within that development area at a population density of 2.3 PPU, which results in a total population of approximately 263 people. Please refer to excerpts from McIntosh Perry's report in **Appendix B.2.**

4.1 Background

The *Master Plan Update Report – Water and Wastewater Infrastructure (2018)* (MPUR-WWI) by J.L Richards and Associates Ltd. for the Municipality of Mississippi Mills, Almonte Ward indicates that wastewater peak flows from the proposed development lands are to be pumped to the gravity sewer located northwest of the subject site within Industrial Drive, and ultimately to the Wastewater Treatment Plant (WWTP).

Per the MPUR-WWI, for 'build out' conditions, new and upgraded sanitary sewers are required to convey wastewater flows to the WWTP. Upgrade requirements were identified for Victoria Street, Menzie Street/Paterson Street, and Houston Drive. Please refer to Error! Reference source not found.**.2** for excerpts from the MPUR-WWI pertaining to the sanitary servicing of the proposed development.

Further coordination with the Municipality and their consultant, J.L Richards and Associates Ltd. (JLR), took place following the first submission of the Mill Valley Estates Functional Servicing and SWM Report of December 2022 to confirm the capacity of downstream trunk and local sewers.

The proposed sanitary peak discharge from the site and the future Mill Valley Living Community was provided to JLR for assessing the downstream sanitary trunk sewer capacity in the Municipality's wastewater model. As shown in Figure 25 of the MPUR-WWI included in Error! Reference source not found.**.2,** sanitary manhole SAMH4-107 on Ottawa Street receives the total peak flows from the proposed site and the future Mill Valley Living Community.

JLR ran the wastewater model under the calibrated dry weather flow (DWF) and the 1:25 year storm events and assessed the future level of service impacts based on two constraints: maintaining free flow capacity in the DWF scenario and maintaining the 1.8 m freeboard to the ground elevation in the 1:25 year return period storm event for basement protection. Where the current sewer is already within the basement elevation the HGL was restricted to 0.3 m above the sewer.

As shown in email correspondence provided to the Town of Mississippi Mills on June 13, 2023 (see **Appendix B.3**), JLR confirmed that there are no HGL level of service issues triggered by the proposed development under 25-year storm event conditions. However, level of service reductions were identified under the DWF event due to the reverse and shallow slope in the short trunk sewer pipe section between SAMH4-101 and SAMH4-004 near the intersection of Florence Street and Ottawa Street.

4.2 Design Criteria

The following criteria as obtained from either the City of Ottawa's Sewer Design Guidelines (2012) and/or the *Master Plan Update Report – Water and Wastewater Infrastructure (2018)* (MPUR-WWI) by J.L Richards and Associates Ltd., were used to estimate wastewater flow rates and to size the sanitary sewers.

- Minimum Velocity – 0.6 m/s (City of Ottawa)
- Maximum Velocity – 3.0 m/s (City of Ottawa)
- Manning roughness coefficient for all smooth wall pipes – 0.013 (City of Ottawa)
- Minimum size – 200mm dia. for residential areas (City of Ottawa)
- Single Family Persons per unit – 3.4 (City of Ottawa)
- Townhouse Persons per unit – 2.7 (City of Ottawa)
- Average Apartment Persons per unit – 1.8 (City of Ottawa)
- Extraneous Flow Allowance – 0.28 L/s/ha (MPUR-WWI)
- Manhole Spacing – 120 m (City of Ottawa)
- Minimum Cover – 2.5 m (City of Ottawa)
- Average Daily Discharge/Person (Residential) – 350 L/cap/day (MPUR-WWI)
- Commercial Daily Discharge/Area (Clubhouse and Future Business Park) – 28,000 L/ha/day (MPUR-WWI)
- Institutional Daily Discharge/Area (Parkland Dedication) – 28,000 L/ha/day (MPUR-WWI)

4.3 Proposed Conceptual Sanitary Servicing

Wastewater from the proposed Mill Valley Estates Development and the future Mill Valley Living Community will be conveyed to a proposed pump station via a gravity sanitary sewer system (see **Drawing OSA-1**). The proposed pump station will be located adjacent to the SWM facility and will direct sewage flows through a proposed forcemain to the existing 300 mm diameter gravity sanitary sewer within Industrial Drive. Sanitary servicing for the future business park block will be provided through the proposed gravity sanitary sewer network via a sanitary sewer connection along an easement block. As outlined in the *Servicing & Stormwater Management Report – Mill Valley Living Community Report (2022)* by McIntosh Perry, the Mill Valley Living Community will be serviced by a 200 mm diameter sewer.

The conceptual sanitary sewer design sheet can be found in **Appendix B.1**. The drainage area plan is shown on **Drawing OSA-1**. Based on the proposed unit count, assumed population densities, as well as the design criteria adopted from the MPUR-WWI, the overall anticipated sanitary peak flows from the development are summarized in **Table 4.1**.

Table 4.1: Overall Wastewater Peak Flows to Existing Industrial Drive Sanitary Sewer

Sewer Outlet	Future Mill Valley Living Community (L/s)	Future Houchaimi Business Park – Commercial Use (L/s)	Mill Valley Estates Subdivision (L/s)	Total Development Peak Flows (L/s)
Industrial Drive EX. SAN MH	4.8	5.8	27.2	37.8

1. The unit estimate for the Mill Valley Living (Sanitary Drainage Area ID# R19C) has been increased by 15%, which results in a population of 263.

4.3.1 LOCAL INDUSTRIAL DRIVE SEWER CAPACITY

The proposed development discharges to the existing sanitary sewer on Industrial Drive, identified as EX SAN-14 in as-builts provided by the Municipality (Refer to figure provided in **Appendix B.3**). Given that local sewers are not included in the Municipality's wastewater model, an initial conceptual assessment has been completed on the conveyance capacity of the existing 300 mm diameter sanitary sewer on Industrial Drive.

Conceptual sanitary sewer design sheets for the Industrial Drive local sewer have been included in **Appendix B.3** for three development scenarios. The first scenario assumes existing development conditions within the Industrial Drive business park, full build-out of the Mill Valley Living community, and the Mill Valley Estates Development without the future business park block (area C26B as shown on **Drawing OSA-1)**. The second scenario is based on existing development conditions within the Industrial Drive business park, and full build-out of the Mill Valley Living community, and the Mill Valley Estates Development (including future business park block). The final scenario assumes full build-out conditions for the entire area tributary to the existing sewer along Industrial Drive. The following assumptions have been made in this analysis.

- Given the lack of as-built information, existing sanitary sewers downstream of the site connection along Industrial Drive to the connection to the trunk sewer on Ottawa Street have been assumed at a 0.2% longitudinal slope.
- The full lot areas of the existing business park developments along Industrial Drive were considered in the sanitary peak flow calculations as shown in the figure provided with the design sheets in **Appendix B.3**.
- Full build out of the Industrial Drive business park as per Figure 25 of the MPUR-WWI results in sanitary peak flows equal to 23.35 L/s.

Results from the first scenario show that the existing sanitary sewer along Industrial Drive has sufficient conveyance capacity, based on the above-mentioned assumptions, to service the existing development conditions within the Industrial Drive business park, full build-out of the Mill Valley Living community, and the Mill Valley Estates Development without the future business park block.

The results of the second scenario shows that the existing local sewer on Industrial Drive will be slightly surcharged once the future business park block within the Mill Valley Estates Development is built, assuming there are no new developments within the Industrial Drive business park.

Furthermore, the results of the final scenario show that the existing sewers on Industrial Drive are over the theoretical capacity to convey sanitary peak flows for full built-out conditions from the Mill Valley Estates and Mill Valley Living Developments, along with full build-out conditions from the Industrial Drive business park. Further coordination with the Municipality will be required at the detailed design stage to confirm the above-stated assumptions and/or to coordinate timing of future developments within the Industrial Drive business park in conjunction with the proposed development.

4.4 Pump Station Design

Proposed road elevations for the site are expected to vary from approximately 135.3 m at the northwestern end of the site to a minimum road grade of approximately 133.2 m at the southeast portion of the site near the SWM facility. Due to the large variance in grade and the higher elevation of the gravity sewer within Industrial Drive, a pumping station will be required to adequately service the proposed development. Design of the pump station is to be finalized during the detailed design stage and will be required to meet a peak inflow rate of 37.8 L/s as generated by an anticipated contributing population of 1,885.

The preferred location of the pumping station is shown on **Drawing OSA-1**. The proposed pump station is located adjacent to the SWM facility and is to discharge to an adequately sized force main running northwest to tie into the existing infrastructure on Industrial Drive. The pump station will include a wet well designed to allow sufficient storage to keep the hydraulic grade line (HGL) at acceptable levels during emergency conditions. The wet well and pumping station design calculations will be provided at the detailed design stage.

The proposed sewage peak flows will be discharged from the proposed pump station through a proposed force main (final alignment and size to be determined at the detailed design stage) to the existing 300 mm diameter sanitary sewer within the Industrial Drive ROW as noted on **Drawing OSA-1**.

5 Storm Drainage

The following sections describe the conceptual stormwater management (SWM) plan for the Mill Valley Estates Development in the context of the governing criteria.

5.1 Existing Conditions

The site is currently undeveloped consisting of agricultural lands areas that sheet flow in a south-east direction towards the Appleton Side Road southern ditch or an existing ditch that crosses the site at the eastern corner and ultimately discharges into the Mississippi River. **Figure 5-1** shows the approximate site location.

Figure 5-1: Approximate Site Location

Appleton Side Road has a rural cross section and as such, runoff from part of the external drainage areas upstream of the site is conveyed through a network of roadside ditches and culverts to an existing 1100 mm diameter CSP that crosses Appleton Side Road and discharges into the exiting ditch crossing the proposed site, which will serve as a storm outlet for the majority of the site. Similarly, there are significant external areas that contribute runoff to the southern Appleton Sideroad roadside ditch through a network of existing grassed swales and culverts, which ultimately drain to the storm outlet ditch. The existing condition storm drainage areas tributary the outlet ditch are shown in **Figure 5-2**.

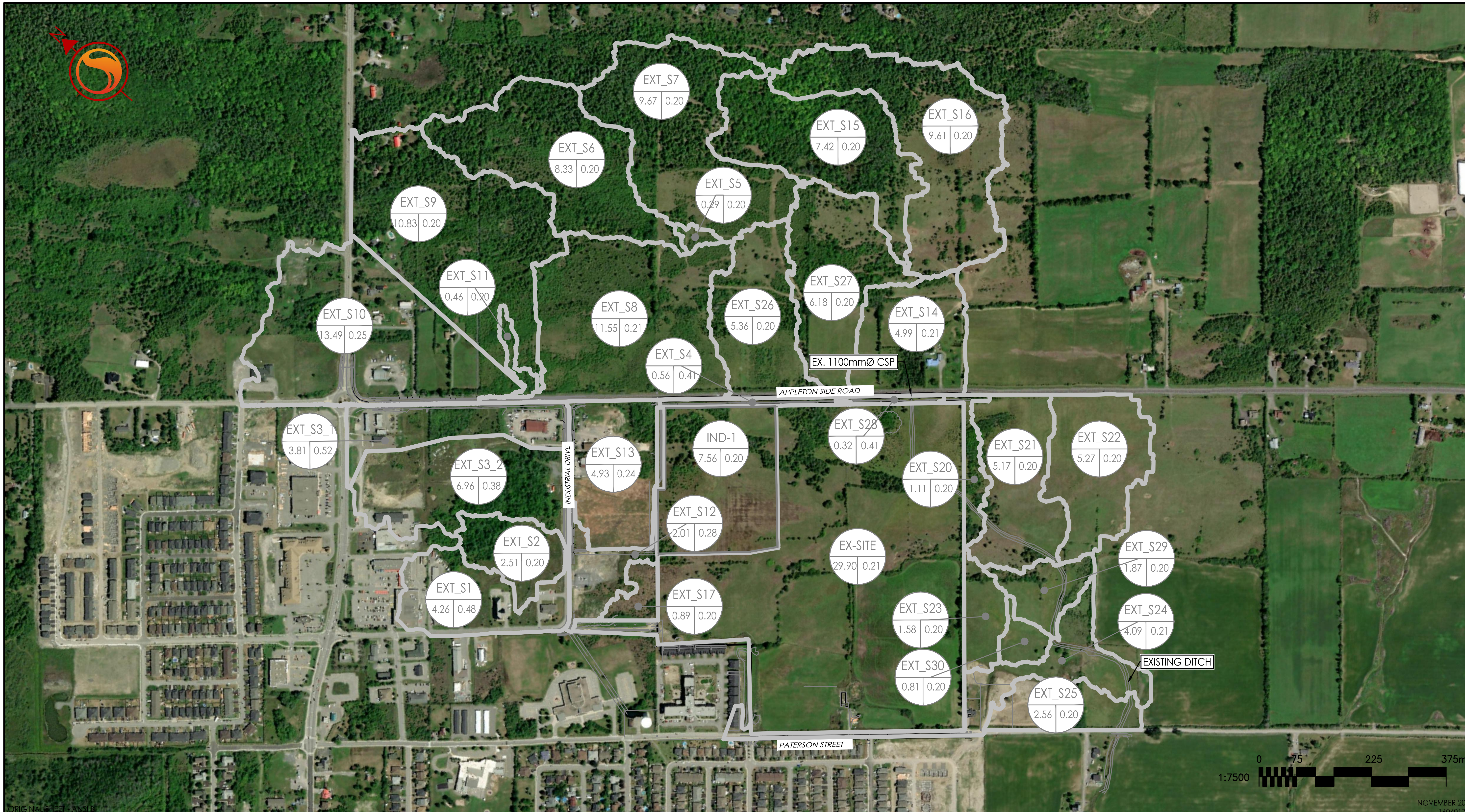
A hydrologic analysis of the existing condition drainage patterns across the site and external areas tributary to the proposed storm outlet has been done using PCSWMM to estimate the existing peak flows from the site and external areas to the proposed outlet location. Input parameter calculations and a PCSWMM input file example have been included in **Appendix C.2**. Modeling files have been included in the digital submission package. The following summarizes the parameters used and assumptions made in the existing conditions model.

- The SCS Dimensionless Unit Hydrograph method was used to generate a runoff response from the undeveloped site and external areas tributary to the proposed outlet ditch.
- Existing soils were assumed to be hydrologic soil group C to represent stiff brown silty clay to clayey silt and/or glacial till as per the Geotechnical Investigation (Paterson Group, December 2020).
- CN values range from 71 to 80 based on the type of land cover.
- Flow length and slope were calculated based on available LIDAR and existing drainage patterns.
- Existing ditch cross sections where estimated based on available LIDAR, and detailed topographical survey.

The PCSWMM model was run using the 24-hour and 12-hour SCS Type II distributions for the 5, and 100-year return periods using City of Ottawa IDF parameters. **Table 5.1** summarizes the existing condition peak flows from site areas to the proposed outlet, as well as existing condition peak flows in the existing ditch downstream of the proposed SWM Pond outlet.

Table 5.1: Existing Condition Peak Flows

Area	Area (ha)	Existing Condition Peak Flow (L/s)			
		5yr - 12hr SCS	100yr - 12hr SCS	5yr - 24hr SCS	100yr - 24hr SCS
Mill Valley Estates and Mill Valley Living	29.90	538.8	1,652.8	509.5	1,305.5
Business Park Block	7.56	216.3	705.8	236.1	637.1
Existing Ditch Downstream of SWM Pond (downstream of J57)	167.73	948.6	3,593.0	868.3	2,733.8



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Legend

- 1-1 — AREA ID
- 0.60 — RUNOFF COEFFICIENT
- 1.13 — STORM DRAINAGE AREA ha.
- EXISTING STORM DRAINAGE BOUNDARY

Notes

Client/Project
HOUCHIAMI HOLDINGS INC.
MILL VALLEY ESTATES

Figure No.
5-2

Title
PRE DEVELOPMENT
STORM DRAINAGE PLAN

5.2 Proposed Storm Drainage Conditions

The proposed development encompasses 33.6 ha of land at 66% imperviousness (runoff coefficient calculations have been provided in Error! Reference source not found.**.3**) and will consist of a mix of townhomes and single family homes, a future business park block (Houchaimi Business Park), a community park block and a parkette, a pump station, a SWM wet pond, and associated transportation and servicing infrastructure. Storm sewers from the site will outlet to a proposed SWM wet pond that will provide quality control and mitigate post development peak flows to pre-development levels up to the 100-year storm. On-site controls (i.e., on-site storage and quality control) will be required within the future Houchaimi Business Park prior to discharging into the Appleton Side Road roadside ditch.

The site storm sewer infrastructure and proposed SWM wet pond have been sized to service the future Mill Valley Living, which encompasses 3.9 ha of land, with an assumed 71% imperviousness. A servicing and SWM report was completed for the Mill Valley Living in support of draft plan approval by McIntosh Perry in February 2022. The SWM approach for the site included an oil grit separator and a temporary dry pond in what is now the proposed park block within the Mill Valley Estates Development. Please refer to excerpts from McIntosh Perry's report in **Appendix C.6.**

Inlet control devices at road low points will be used to restrict inflow rates to the sewer to the 5-year runoff. Major system peak flows from the majority of the site, with the exception of the Houchaimi Business Park, will be directed south towards the SWM wet pond a shown on **Drawing OSD-1**.

5.2.1 PROPOSED DITCH REALIGNMENT

The existing ditch that crosses the eastern corner of the site conveys runoff from the southern Appleton Side roadside ditch, as well as runoff from an existing 1100 mm diameter CSP crossing Appleton Side Road. The existing ditch runs in a south-western direction for approximately 1.1 km and ultimately discharges into the Mississippi River.

Figure 5-3 shows the overall drainage plan which includes proposed site and external areas tributary to the SWM wet pond, the future Houchaimi Business Park block which will provide on-site controls prior to discharging to the Appleton Side roadside ditch, as well as external upstream areas tributary to the existing ditch.

As part of the ultimate condition development, it is proposed to realign a section of the existing ditch that crosses the site as shown on the conceptual grading plan **Drawing GP-1**. However, a stormwater analysis has also been completed for an interim condition assuming Phases 1 and 2 of the development are built out, along with the SWM pond and an outlet channel discharging into the existing ditch. **Figure 5-3** shows the proposed phasing plan.

5.2.2 FUTURE HOUCHAIMI BUSINESS PARK BLOCK

Stormwater management for the future business park block will be provided on-site to provide 'Enhanced' water quality control and to control post development peak flows to pre-development levels up to the 100-year storm prior to discharging into the Appleton Side Road roadside ditch.

Table 5.1 shows the existing condition peak flows from the future business park block. However, as can be seen on **Drawing OG-1** and **Drawing OSD-1**, it is expected that the future business park will include areas that will sheet flow uncontrolled onto adjacent lands due to grading restrictions (i.e., see areas UNC-3, UN-5 and C126B). Area C126B will sheet flow onto the proposed Mill Valley Estates Development and will be captured into the minor system and directed to the proposed SWM Pond, while areas UNC-3 and UNC-5 will sheet flow into the Appleton Side Road southern roadside ditch, and as such these uncontrolled flows will be taken into account to establish the allowable release rate from the future business park (are IND-1).

5.3 SWM Criteria

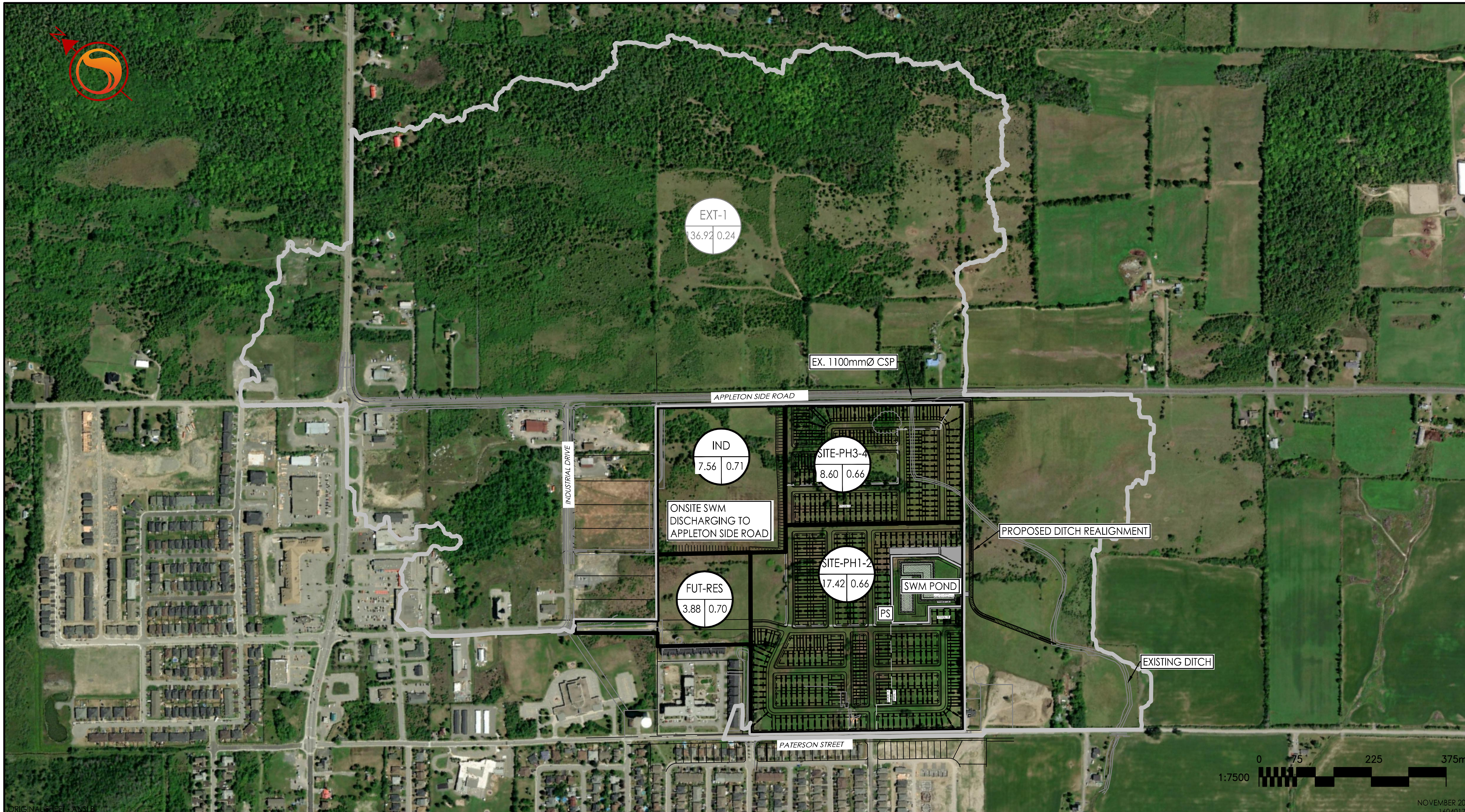
The following summarizes the SWM criteria for the proposed development.

- SWM facility to be designed to provide ‘Enhanced’ level of treatment as per MECP recommendations which represents an equivalent 80% TSS removal.
- Post development peak flows up to the 100-year storm event to be restricted to pre-development levels.
- Provide adequate conveyance of emergency flows off site.
- Provide best management practices to prevent disturbances to the receiving environment.
- Size storm sewers for the 5-year event under free flow conditions.

5.4 Conceptual Design Methodology

The conceptual design methodology for the SWM component of the development is as follows:

- Provide a conceptual pond configuration that meets Ministry of the Environment, Conservation and Parks (MECP) requirements for quality control for the proposed site and external areas.
- Restrict inflows to the sewer to the 5-year rate in all areas.
- Produce a preliminary PCSWMM model that generates major and minor system hydrographs and that routes the hydrographs through a hydraulic model.
- Incorporate the conceptual SWM pond and outlet structure into the model and optimize the proposed SWM pond stage-storage-discharge relationship while assessing the effects of the pond water levels on the hydraulic grade line (HGL) across the site.
- Assess the resulting 100-year hydraulic grade line to provide the lowest underside of footing (USF) allowed for the proposed units to be used during detailed design in order to maintain a minimum clearance of 0.3 m between USF and 100-year HGL.
- Estimate external drainage peak flows tributary to the existing 1100 CSP and the proposed ditch realignment and assess hydraulic performance of the proposed ditch.



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- 1-1 — AREA ID
- 0.60 — RUNOFF COEFFICIENT
- 1.13 — STORM DRAINAGE AREA ha.
- STORM DRAINAGE BOUNDARY
- EXISTING STORM DRAINAGE BOUNDARY

Notes

1. THE PROPOSED INTERIM CONDITIONS WILL INCLUDE THE FUTURE MILL VALLEY LIVING SITE (FUT-RES), PHASES 1 AND 2 OF MILL VALLEY ESTATES (SITE-PH1-2), THE ULTIMATE CONDITION SWM POND (OUTLET STRUCTURE DESIGNED WITH FUTURE RETROFITS), AND THE EXISTING DITCH ALIGNMENT.

Client/Project
HOUCHIAMI HOLDINGS INC.
MILL VALLEY ESTATES

Figure No.
5-3

Title
POST DEVELOPMENT
STORM DRAINAGE PLAN

The site will be designed using the “dual drainage” principle, whereby the minor (pipe) system is designed to convey the peak rate of runoff from the 5-year design storm and runoff from larger events is conveyed by both minor (pipe) and major (overland) channels, such as roadways and walkways, safely off site without impacting proposed or existing downstream properties.

Drawing OSD-1 outlines the conceptual storm sewer alignment, conceptual pond configuration and water levels, and drainage divides and labels.

5.5 Modelling Rationale

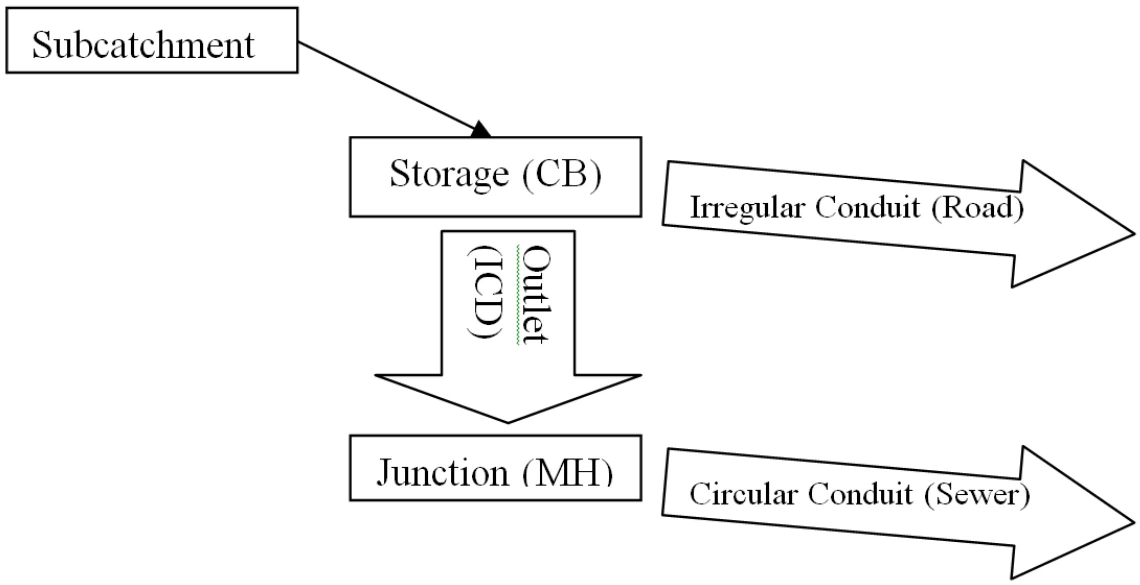
A hydrologic modeling exercise was completed with PCSWMM, accounting for the estimated major and minor systems to evaluate the storm sewer infrastructure, assess the proposed SWM pond hydraulic performance and assess the hydraulic conveyance capacity of the realigned ditch. The use of PCSWMM for modeling of the site hydrology and hydraulics allowed for an analysis of the systems response during various storm events. The following assumptions were applied to the conceptual model:

- Used the 5-year and 100-year, 3-hour Chicago Storm distribution for sewer sizing and HGL analysis, and the 100-year, 12-hour and 24-hour SCS Type II distribution for HGL analysis and pond and ditch realignment hydraulic performance assessment.
- Percent imperviousness calculated based on proposed pervious and impervious areas.
- Subcatchment areas are preliminary lumped areas.
- The width parameter was measured as twice the road/rear yard swale for two-sided catchments and equal to the length of the road/rear yard swale for one-sided catchments. The width parameter for urban external drainage areas and future Mill Valley Living block was defined as 225 m/ha as per the City of Ottawa Sewer Design Guidelines.
- Minor system inflow from each subcatchment was restricted with outlet curves as necessary to maintain 5-year inflow target rates at the assumed catchbasin grate elevation and increased by 10% for a total flow depth of 40 cm.
- No surface ponding has been assumed for conservatism. However, in order to account for surface routing, the major system has been created such that the total street length at 0.5% within each subcatchment is represented in the model.
- Major system conduits defined to represent the proposed right of way (ROW) cross-section.

5.5.1 SWMM DUAL DRAINAGE METHODOLOGY

The proposed development is modeled in one modeling program as a dual conduit system (see **Figure 5-4**), with: 1) circular conduits representing the sewers & junction nodes representing manholes; 2) irregular conduits using street-shaped cross-sections to represent the approximate overland road network and storage nodes representing catchbasins. The dual drainage systems are connected via outlet link objects from storage node (i.e., CB) to junction (i.e., MH), and restrict the minor system capture rate to the 5-year storm. Subcatchments are linked to the storage node on the surface so that generated hydrographs are directed there firstly.

Figure 5-4: Schematic Representing PCSWMM Model Object Roles



Storage nodes are used in the model to represent catchbasins. The invert of the storage node represents the invert of the CB and the rim of the storage node represents the top of the CB plus the allowable flow depth on the segment. For the purpose of this conceptual SWM plan, CB inverts have been assumed to be 2.0 m below the top of the CB and a flow depth of 0.40 m has been assumed to account for 35 cm allowable ponding up to the 100-year storm and an additional 5 cm to account for flow depth during climate change/stress test events.

5.6 Input Parameters

Drawing OSD-1 summarizes the conceptual subcatchments used in the analysis of the proposed development, including external development areas, and outlines the major overland flow path and SWM wet pond location.

Key parameters for the subject area are summarized below; an example input file is provided in **Appendix C.3** for the 100-year, 3hr Chicago storm which indicates all other parameters. For all other input files and results of storm scenarios, please examine the electronic model files included as part of the digital submission. This analysis was performed using PCSWMM, which is a front-end GUI to the EPA-SWMM engine. Model files can be examined in any program which can read EPA-SWMM files version 5.1.015.

5.6.1 HYDROLOGIC PARAMETERS

Table 5.2.2 presents the general subcatchment parameters used for the proposed development (urban catchments):

Table 5.2: General Subcatchment Parameters

Subcatchment Parameter	Value
Infiltration Method	Horton
Max. Infil. Rate (mm/hr)	76.2
Min. Infil. Rate (mm/hr)	13.2
Decay Constant (1/hr)	4.14
N Imperv	0.013
N Perv	0.25
Dstore Imperv (mm)	1.57
Dstore Perv (mm)	4.67

Table 5.3 presents the individual parameters that vary for each of the proposed conceptual subcatchments.

Table 5.3: Conceptual Subcatchment Parameters

Area ID	Area (ha)	Width (m)	Slope (%)	% Impervious	Runoff Coefficient	Subarea Routing	% Routed
C105A	2.10	1020	2.0	60.0%	0.62	OUTLET	100
C107A	0.21	64	2.0	70.0%	0.69	OUTLET	100
C107B	0.98	220	4.5	42.9%	0.50	PERVIOUS	100
C107C	3.88	873	2.0	71.4%	0.70	OUTLET	100
C108A	1.31	624	2.0	60.0%	0.62	OUTLET	100
C111A	1.31	594	2.0	64.3%	0.65	OUTLET	100
C112A	1.29	520	2.0	61.4%	0.63	OUTLET	100
C112B	0.48	108	2.0	42.9%	0.50	OUTLET	100
C113A	1.06	413	2.0	70.0%	0.69	OUTLET	100
C114A	1.33	518	2.0	62.9%	0.64	OUTLET	100
C115A	1.01	332	2.0	71.4%	0.70	OUTLET	100
C116A	1.15	452	2.0	74.3%	0.72	OUTLET	100
C117A	0.91	328	2.0	72.9%	0.71	OUTLET	100
C119A	0.63	181	2.0	72.9%	0.71	OUTLET	100
C121A	1.00	431	2.0	61.4%	0.63	OUTLET	100
C125A	0.33	177	2.0	70.0%	0.69	OUTLET	100
C126A	0.27	77	2.0	74.3%	0.72	OUTLET	100
C126B	0.54	354	2.0	42.9%	0.50	OUTLET	100
C133A	0.91	334	2.0	72.9%	0.71	OUTLET	100
C134A	0.67	206	2.0	67.1%	0.67	OUTLET	100
C136A	0.51	204	2.0	71.4%	0.70	OUTLET	100
C137A	1.27	495	2.0	58.6%	0.61	OUTLET	100
C138A	0.69	228	2.0	68.6%	0.68	OUTLET	100
C141A	0.92	306	2.0	65.7%	0.66	OUTLET	100
C151A	0.65	276	2.0	72.9%	0.71	OUTLET	100
C152A	0.99	481	2.0	61.4%	0.63	OUTLET	100
POND	2.09	471	1.0	57.1%	0.60	OUTLET	100
UNC-1	0.78	164	2.0	58.6%	0.61	PERVIOUS	100
UNC-2	0.29	270	2.0	58.6%	0.61	PERVIOUS	100

Area ID	Area (ha)	Width (m)	Slope (%)	% Impervious	Runoff Coefficient	Subarea Routing	% Routed
UNC-3	0.89	504	2.0	21.4%	0.35	PERVIOUS	100
UNC-4	0.87	195	2.0	57.1%	0.60	PERVIOUS	100
UNC-5	0.35	192	2.0	21.4%	0.35	PERVIOUS	100
IND-1	5.78	1501	2.0	85.7%	0.80	OUTLET	100

Table 5.4 summarizes the storage node parameters used in the conceptual model. All roadway catch basins have been modeled with an outlet invert of 2.0 m below top of grate and total surface flow depths of 0.40 m.

Table 5.4: Storage Node Parameters

Storage Node	Invert Elevation (m)	Rim Elevation (m)	Total Depth (m)
C105A-S	132.96	135.36	2.40
C107A-S	133.21	135.61	2.40
C107B-S	133.60	136.00	2.40
C107C-S	133.60	136.00	2.40
C108A-S	132.93	135.33	2.40
C111A-S	132.74	135.14	2.40
C112A-S	131.44	133.84	2.40
C112B-S	131.50	133.90	2.40
C113A-S	132.59	134.99	2.40
C114A-S	131.20	133.60	2.40
C115A-S	131.41	133.81	2.40
C116A-S	131.64	134.04	2.40
C117A-S	132.99	135.39	2.40
C119A-S	133.06	135.46	2.40
C121A-S	132.66	135.06	2.40
C125A-S	132.82	135.22	2.40
C126A-S	132.86	135.53	2.67
C133A-S	133.17	135.57	2.40
C134A-S	131.32	133.72	2.40
C136A-S	132.90	135.30	2.40
C137A-S	131.47	133.87	2.40
C138A-S	132.96	135.36	2.40
C141A-S	133.25	135.65	2.40
C151A-S	133.01	135.41	2.40
C152A-S	133.25	135.65	2.40
POND-S	127.5	130.75	3.25

5.6.2 HYDRAULIC PARAMETERS

As per the Ottawa Sewer Design Guidelines (OSDG 2012), Manning's roughness values of 0.013 were used for sewer modeling and overland flow corridors representing roadways.

Storm sewers were modeled to confirm flow capacities and to assess the 100-year hydraulic grade lines (HGL) in the development with consideration of the pond backwater acting on the sewers. A conceptual storm sewer design sheet is included in **Appendix C.1**.

5.7 Conceptual Model Results and Discussion

The following section summarizes the key hydrologic and hydraulic conceptual model results. For detailed model results or inputs please refer to the example input file in **Appendix C.3** and the electronic model files included in the digital submission.

5.7.1 HYDROLOGY

Table 5.5 **5.5** summarizes the 100-year, 3hr Chicago storm event minor system capture rates represented in the PCSWMM model through outlet links.

Table 5.5: Conceptual Minor System Capture Rates

Outlet Name	Inlet Node	Outlet Node	Invert Elevation (m)	100-year Flow (L/s)
C105A-IC	C105A-S	105	132.96	477.1
C107A-IC	C107A-S	107	133.21	50.0
C107B-IC	C107B-S	107	133.60	153.5
C107C-IC	C107C-S	107	133.60	915.6
C108A-IC	C108A-S	108	132.93	283.2
C111A-IC	C111A-S	111	132.74	296.4
C112A-IC	C112A-S	112	131.44	279.5
C112B-IC	C112B-S	112	131.50	72.6
C113A-IC	C113A-S	113	132.58	251.3
C114A-IC	C114A-S	114	131.20	295.8
C115A-IC	C115A-S	115	131.41	241.3
C116A-IC	C116A-S	116	131.64	286.9
C117A-IC	C117A-S	117	132.99	220.7
C119A-IC	C119A-S	119	133.06	149.0
C121A-IC	C121A-S	121	132.66	218.8
C125A-IC	C125A-S	125	132.82	82.2
C126A-IC	C126A-S	126	132.86	67.0
C133A-IC	C133A-S	133	133.17	222.1
C134A-IC	C134A-S	134	131.32	153.2
C136A-IC	C136A-S	136	132.90	122.9
C137A-IC	C137A-S	137	131.47	263.6
C138A-IC	C138A-S	138	132.96	157.9
C141A-IC	C141A-S	141	133.25	205.6
C151A-IC	C151A-S	151	133.01	161.6
C152A-IC	C152A-S	152	133.25	218.7
IND-1-IC	IND-1-S	J1	136.00	412.0

As can be seen in the above table, the 100-year minor system capture rate from the future business park block has been set at 412 L/s, so that when including 100-year uncontrolled runoff from areas UNC-3 and

UNC-5, 96 L/s and 127 L/s respectively, the total peak outflows from the business park block into the Appleton Side Road southern road side ditch are les that the 100-year existing peak flow of 637 L/s.

5.7.2 PROPOSED DEVELOPMENT CONCEPTUAL HYDRAULIC GRADE LINE ANALYSIS

Table 5.6 **5.6** summarizes the HGL results within the development for the 100-year, 3-hour Chicago, 12-hour and 24-hour SCS Type II storm events. The City of Ottawa requires that during major storm events up to the 100-year event, the maximum hydraulic grade line be kept at least 0.30 m below the underside-of-footing (USF) of any adjacent units connected to the storm sewer during design storm events. As a result, the HGL values below will be used as a starting point during detailed grading of the development. For the purpose of this conceptual hydraulic analysis, it has been assumed that the future USFs will be approximately 2.1 m below the centreline of the street.

Table 5.6: Conceptual Hydraulic Grade Line Results

STM MH	Prop. Road Grade (m)	Approx USF (m)	100-year HGL (m)			Worst-Case 100-year HGL (m)	Approx. USF-HGL Clearance (m)
			3-hr Chicago	24-hr SCS Type II	12-hr SCS Type II		
100B	132.13	NA	130.14	130.07	130.23	130.23	-
101	132.13	NA	130.14	130.07	130.23	130.23	-
102	133.33	131.23	130.14	130.07	130.23	130.23	1.00
103	134.84	132.74	130.39	130.43	130.46	130.46	2.28
103A	134.88	132.78	131.08	131.07	131.03	131.08	1.69
104	134.90	132.80	131.19	131.18	131.14	131.19	1.61
105	134.97	132.87	131.40	131.39	131.34	131.40	1.47
106	135.24	133.14	131.62	131.61	131.55	131.62	1.52
107	135.35	133.25	131.75	131.74	131.68	131.75	1.50
108	133.74	131.64	130.61	130.62	130.63	130.63	1.01
109	133.33	131.23	131.01	131.00	130.98	131.01	0.22
110	133.37	131.27	131.22	131.20	131.17	131.22	**0.05**
111	134.50	132.40	132.28	132.27	132.24	132.28	**0.12**
112	133.45	131.35	131.29	131.27	131.24	131.29	**0.06**
113	134.60	132.50	132.35	132.35	132.32	132.35	**0.15**
114	133.12	131.02	131.10	131.09	131.07	131.10	**-0.08**
115	133.58	131.48	131.27	131.25	131.22	131.27	0.21
116	133.69	131.59	131.40	131.40	131.36	131.40	**0.19**
117	134.33	132.23	132.27	132.27	132.22	132.27	**-0.05**
118	134.99	132.89	131.54	131.54	131.52	131.54	1.35
119	134.97	132.87	132.37	132.37	132.35	132.37	0.50
121	134.94	132.84	130.90	130.90	130.90	130.90	1.94
123	135.01	132.91	131.28	131.28	131.28	131.28	1.63
125	135.05	132.95	131.50	131.50	131.50	131.50	1.45
126	134.95	132.85	131.67	131.67	131.67	131.67	1.18
130	134.90	132.80	132.13	132.13	132.11	132.13	0.67
132	134.89	132.79	132.40	132.40	132.38	132.40	0.38
133	135.24	133.14	133.17	133.16	133.12	133.17	**-0.03**
134	133.11	131.01	130.86	130.85	130.83	130.86	**0.15**

STM MH	Prop. Road Grade (m)	Approx USF (m)	100-year HGL (m)			Worst-Case 100-year HGL (m)	Approx. USF-HGL Clearance (m)
			3-hr Chicago	24-hr SCS Type II	12-hr SCS Type II		
135	133.45	131.35	131.19	131.18	131.16	131.19	**0.16**
136	134.53	132.43	132.31	132.30	132.29	132.31	**0.12**
137	133.76	131.66	131.32	131.31	131.30	131.32	0.34
138	134.74	132.64	132.47	132.47	132.46	132.47	**0.17**
139	135.22	133.12	132.82	132.81	132.80	132.82	0.30
140	135.32	133.22	132.87	132.87	132.85	132.87	0.35
141	135.25	133.15	133.07	133.07	133.06	133.07	**0.08**
150	134.94	132.84	132.31	132.31	132.29	132.31	0.53
151	135.00	132.90	132.67	132.67	132.65	132.67	0.23
152	135.21	133.11	133.00	133.00	132.99	133.00	**0.11**
200	130.63	NA	128.66	128.62	128.71	128.71	_-

As can be seen in **Table** 5.6 **5.6**, the minimum USF clearance of 0.30 m is not being met at all manholes locations, based on the USF assumptions listed above. However, it is expected that the minimum HGL to USF clearance will be met during detailed design by incorporating multiple risers in the units within these areas.

5.7.3 CONCEPTUAL POND HYDRAULIC MODELING RESULTS

The PCSWMM modeling scenarios were analyzed for the peak pond discharge rate, as well as for peak pond HGL to establish the approximate SWM Pond footprint required to meet the SWM design criteria for the site. Error! Reference source not found. **5.7** below summarizes the pond water levels, peak pond outflow rates, post development peak flows in the receiving section of the existing ditch and compares them to the existing condition peak flows for the 5-year, and 100-year 3-hour Chicago, and 12-hour and 24-hour SCS Type II storm events.

Table 5.7: Conceptual Site Discharges, SWM Pond Peak Outflow Rates and Water Levels

Storm Event	Existing Peak Flows (L/s)			Ultimate Development Conditions		
	Business Park Block	Site Area	Existing Ditch Downstream of SWM Pond	Peak Flows to Existing Ditch Downstream of SWM Pond (L/s)	SWM Pond Outflows (L/s)	SWM Pond Water Level (m)
5yr-12hrSCS	216.3	538.8	948.6	1,063.6	328.9	129.77
100yr-12hrSCS	705.8	1,652.8	3,593.0	3,241.9	1,176.1	130.23
5yr-24hrSCS	236.1	509.5	868.3	943.0	264.4	129.73
100yr-24hrSCS	637.1	1,305.5	2,733.8	2,545.4	829.1	130.07
5yr-3hrChicago	N/A	N/A	N/A	861.5	252.6	129.72

Storm Event	Existing Peak Flows (L/s)			Ultimate Development Conditions		
	Business Park Block	Site Area	Existing Ditch Downstream of SWM Pond	Peak Flows to Existing Ditch Downstream of SWM Pond (L/s)	SWM Pond Outflows (L/s)	SWM Pond Water Level (m)
100yr-3hrChicago	N/A	N/A	N/A	2,741.2	965.6	130.14

The above table shows that the proposed SWM pond configuration and footprint generally provides sufficient storage to restrict post development peak flows to pre-development levels up to the 100-year storm for the proposed Mill Valley Estates Development and the future Mill Valley Living Community. The SWM pond outlet configuration will be optimized at the detailed design stage to ensure post development peak flows are below pre-development levels for all return periods. It should be noted that all uncontrolled peak flows from the site have been allocated to the existing and/or proposed ditch. have been Post development 100-year peak flows (12-hr SCS) at different location along the existing ditch have been shown on **Drawing OSD-1**, while peak hydrographs in the existing ditch downstream of the proposed SWM pond, under existing and ultimate conditions have been included in **Appendix C.2** and **C3** respectively.

5.8 CONCEPTUAL WET POND DESIGN

5.8.1 FACILITY DESIGN CRITERIA

The proposed SWM wet pond will be designed to achieve an ‘enhanced’ level of treatment of urban runoff according to Ministry of the Environment, Conservation and Parks (MECP) criteria – representing an 80% removal of total suspended solids (TSS).

5.8.2 CONCEPTUAL WET POND DESIGN COMPONENTS

The conceptual wet pond has been sized to meet the quality and quantity control requirements outlined above and to achieve all physical design criteria established for wet pond facilities by the MECP. Conceptual pond design calculations have been included in **Appendix C.4**. These physical design criteria are provided in the MECP’s Stormwater Management Design and Planning Manual (March 2003).

The general design approach for the proposed wet pond is as follows:

1. Provide Enhanced water quality treatment, thereby establishing the permanent pool and extended detention volumes.
2. Provide post to pre-development quantity control for up to the 100-year storm event.
3. Size inlet structure and forebay based on generated inflow and MECP guidelines (to be completed at detailed design).

4. Design a bypass structure to convey peak flows from the 25-mm design storm event into the forebay and bypass higher peak flows directly into the main cell (to be completed at detailed design).
5. Consider environmental and operations and maintenance concerns in orientation and design of all pond components.

5.8.2.1 Water Quality Control

The maximum permanent water depth within the facility is 1.5 m. The permanent pool elevation has been set at 129.00 m to provide a gravity outlet to the proposed realigned ditch as seen on **Drawing OSD-1**. This results in a partially submerged inlet pipe. **Table** 5.8 **5.8** shows a comparison of the water quality volume requirements as per MECP guidelines and the volumes provided in the conceptual SWM pond.

Table 5.8: Stormwater Quality Volumetric Requirements

Drainage Area (ha)	Actual % Imp.	MECP Control Level	Water Quality Unit Volume Requirements			Water Quality Volume Requirements		Water Quality Volumes Provided	
			Total Unit Volume (m^3/ha)	Perm. Pool (m^3/ha)	Ext. Detention (m^3/ha)	Perm. Pool (m^3)	Ext. Detention (m^3)	Perm. Pool (m^3)	Ext. Detention (m^3)
28.50	64.4	Enhanced - 80% TSS Removal	212	172	40	4,900	1,140	6,529	4,397

5.8.2.2 Outlet Design

The outlet will be located opposite the inlet and will discharge to the proposed realigned ditch in the ultimate development conditions.

The conceptual design of the outlet structure in the ultimate development condition incorporates a dual control configuration. Firstly, a 220-mm orifice with an invert at the permanent pool elevation (inv=129.00 m) provides an approximate 41-hour extended detention for quality control. The entire extended detention volume is stored between 129.00 m and 129.50 m. Quantity control is provided through a 1m-wide weir opening within the outlet structure at a crest of 129.50 m.

An overflow spillway separate from the outlet control structure is set to 130.45 m and acts as a broad-crested weir, approximately 10.0 m wide. The spillway is design to safely convey runoff to the proposed ditch realignment during storm events higher than the 100-year storm, while maintaining a low water level in the pond.

5.8.3 INTERIM CONDITIONS

An interim condition scenario has also been assessed that will consist of construction of Phases 1 and 2 of the Mill Valley Estates Development, the Mill Valley Living Development, the ultimate condition SWM pond footprint, and the sanitary pump station. The rest of the Mill Valley Estates development (i.e., Phases 3 and

4, and the business park block) will remain undeveloped and as such, this interim condition will not require the existing ditch realignment.

The SWM pond outlet structure will include construction of the most downstream section of the realigned ditch that ultimately discharges into the existing ditch. However, during this interim condition scenario, the upstream section of the ditch, crossing the site in the eastern corner, part of the future Phase 3, will remain as per existing conditions.

The outlet control configuration, along with interim components that can be easily retrofitted for ultimate development conditions (i.e., Phase 3 construction of Mill Valley Estates) will be confirmed at the detailed design stage.

A PCSWMM model has been created to reflect interim development conditions as described above. All PCSWMM modeling files have been included in the digital submission package. The worst-case scenario for hydraulic grade line occurs during the ultimate development conditions (i.e., when the SWM pond water level is higher) and as such, HGL results for interim conditions have not been tabulated in the report. The following table summarizes the interim condition peak flows in the existing ditch downstream of the SWM pond outlet, interim SWM Pond outflows and water levels, along with existing condition peak flow comparison.

Table 5.9: Interim Condition Peak Flow Comparison

Storm Event	Existing Peak Flows at Ditch Downstream of SWM Pond (L/s)	Ultimate Development Conditions		
		Peak Flows to Existing Ditch Downstream of SWM Pond (L/s)	SWM Pond Outflows (L/s)	SWM Pond Water Level (m)
5yr-12hrSCS	948.6	935.1	136.7	129.61
100yr-12hrSCS	3,593.0	3,005.6	646.3	129.97
5yr-24hrSCS	868.3	854.4	104.3	129.57
100yr-24hrSCS	2,733.8	2,339.3	416.5	129.83
5yr-3hrChicago	-	667.7	104.7	129.57
100yr-3hrChicago	-	2,447.0	515.5	129.90

5.9 Conceptual Ditch Realignment

The proposed SWM pond outlet structure and spillway weir will discharge into the proposed ditch realignment as shown on **Drawing SD-1**.

The proposed realigned ditch will convey runoff from upstream drainage areas as shown in

Figure 5-2. The proposed realigned ditch will run east along the Appleton Side Road right of way (ROW) with a longitudinal slope of 0.3% and a V-shaped cross section (2.5:1 side slopes). The realigned ditch will then flow south following the site property line with a trapezoidal cross section at 0.8% longitudinal slope (1m-wide bottom, 1.2m-high, 3:1 side slopes) to ultimately discharge into the existing ditch as shown on **Drawing GP-1**. Detailed channel calculations are provided in **Appendix C.5**, which show that the conceptual ditch realignment configuration provides sufficient hydraulic conveyance capacity for external upstream drainage.

5.10 Future Business Park Block

Stormwater management for the future business park block will be provided on-site to achieve 'Enhanced' water quality control and to control post development peak flows to pre-development levels up to the 100-year storm prior to discharging into the Appleton Side Road roadside ditch.

On-site storage will be provided in the future business park block to restrict 100-year post development peak flows to the 100-year existing condition peak flow of 637 L/s. Uncontrolled peak flows from the future business park block have been assumed from areas UNC-3 and UNC-5 due to grading restrictions. Uncontrolled peak flows from the business park in the 100-year storm are approximately 223 L/s and as such, 100-year peak flows from the future business park into the Appleton Side Road southern roadside ditch should be restricted to 414 L/s.

The following table shows the 100-year flow depth within the southern Appleton Side roadside ditch downstream of the future business park based on the information available.

Table 5.10: Appleton Side Road Southern Ditch Water Levels

Ditch Node ID	Approx. Ditch Cross Section	Node Invert (m)	Maximum Depth (m)	100-year Depth (m)
J1 – Business Park Outlet	V - Shape	134.85	0.65	0.65
J4 – Downstream of 1100 CSP	V - Shape	131.25	0.85	0.72
J5 – Realigned Ditch	Trapezoidal	130.89	1.20	0.60

5.11 Mill Valley Living Community

A servicing and SWM report was completed for the Mill Valley Living in support of draft plan approval by McIntosh Perry in February 2022. Please refer to excerpts from McIntosh Perry's report in **Appendix C.6.**

The proposed storm sewers and SWM pond will be designed to service the Mill Valley Living. As a result, the initial phases of the Mill Valley Estates Development, including the pump station, the SWM pond and associated servicing infrastructure will be required prior to construction of the Mill Valley Living.

Minor system peak flows from the Mill Valley Living Development up to the 100-year storm are to be restricted to 916 L/s, while major system peak overflows should be restricted to 855 L/s.

5.12 Low Impact Development Considerations

Low Impact Development (LID) measures will be implemented across the proposed development to further enhance water quality of runoff, maintain baseflows to nearby watercourses and reduce post development volume of runoff where feasible. **Table 5.11** was taken from the Credit Valley Conservation Low Impact Development Stormwater Management Planning and Design Guide (CVC, 2010, Table 3.4.1) and shows a comparison of site constraints for a range of structural LID SWM practices.

Table 5.11: Comparison of Site Constraints for a Range of Structural LID SWM Practices

LID Stormwater Management Practice	Depth to high water table or bedrock[1] (m)	Typical Ratio of Impervious Drainage Area to Treatment Facility Area	Native Soil Infiltration Rate (mm/hr)[3]	Head[4] (m)	Space[5] %	Slope[6] %	Pollution Hot Spots[7]	Set backs[8]
Rain barrel	Not applicable	[5 to 50 m^2][2]	Not applicable	1	0	NA	Yes	None
Cistern	1	[50 to 3000 m^2][2]	Not applicable	1 to 2	0 to 1	NA	Yes	U, T
Green roof	Not applicable	1:1	Not applicable	0	0	0	Yes	None
Roof downspout disconnection	Not applicable	[5 to 100 m^2][2]	Amend if < 15 mm/hr9	0.5	5 to 20	1 to 5	Yes	B
Soakaway, infiltration trench or chamber	1	5:1 to 20:1	Not a constraint	1 to 2	0 to 1	< 15%	No	B, U, T, W
Bioretention	1	5:1 to 15:1	Underdrain required if < 15 mm/hr	1 to 2	5 to 10	0 to 2	No	B, U, W
Biofilter (filtration only Bioretention design)	Not applicable	5:1	Not applicable	1 to 2	2 to 5	0 to 2	Yes	B, T
Vegetated filter strip	1	5:1	Amend if < 15 mm/hr9	0 to 1	15 to 20	1 to 5	No	None
Permeable pavement	1	1:1 to 1.2:1	Underdrain required if < 15 mm/hr	0.5 to 1	0	1 to 5	No	U, W
Enhanced grass swale	1	5:1 to 10:1	Not applicable	1 to 3	5 to 15	0.5 to 6	No	B, U
Dry swale	1	5:1 to 15:1	Underdrain required if < 15 mm/hr	1 to 3	5 to 10	0.5 to 6	No	B, U, W
Perforated pipe system	1	5:1 to 10:1	Not a constraint	1 to 3	0	< 15%	No	B, U, T, W

LID Stormwater Management Practice	Depth to high water table or bedrock[1] (m)	Typical Ratio of Impervious Drainage Area to Treatment Facility Area	Native Soil Infiltration Rate (mm/hr)[3]	Head[4] (m)	Space[5] %	Slope[6] %	Pollution Hot Spots[7]	Set backs[8]

Notes:

1. Minimum depth between the base of the facility and the elevation of the seasonally high water table or top of bedrock.
2. Values for rain barrels, cisterns and roof downspout disconnection represent typical ranges for impervious drainage area treated.
3. Infiltration rate estimates based on measurements of hydraulic conductivity under field saturated conditions at the proposed location and depth of the practice.
4. Vertical distance between the inlet and outlet of the LID practice.
5. Percent of open pervious land on the site that is required for the LID practice.
6. Slope at the LID practice location.
7. Suitable in pollution hot spots or runoff source areas where land uses or activities have the potential to generate highly contaminated runoff (*e.g.*, vehicle fueling, servicing or demolition areas, outdoor storage or handling areas for hazardous materials and some heavy industry sites).
8. Setback codes: B = Building foundation; U = Underground utilities; T = Trees; W = drinking water wellhead protection areas.
9. Native soils should be tilled and amended with compost to improve infiltration rate, moisture retention capacity and fertility.

The geotechnical investigation prepared by Paterson Group in December 2020 outlined approximate bedrock depth and groundwater levels in test pits across the site. Bedrock and groundwater elevations across the site are shown on **Drawing LID-1**. Based on the information available, and as shown on **Drawing LID-1**, over half of the site has positive conditions to implement rearyard infiltration trenches, where the bottom of the trench will be above 1m from either the groundwater table or bedrock, whichever is higher.

The location of the proposed rearyard infiltration trenches along with detailed design calculations will be provided at the detailed design stage.

6 Geotechnical Considerations and EIA Summary

6.1 Geotechnical Investigation

A geotechnical investigation report for the development was completed by Paterson Group on December 7, 2020. The geotechnical investigation report is included in **Appendix D**.

A geotechnical field investigation was completed by Paterson Group on November 11 and 12, 2020. Forty-two (42) test pits were excavated to a maximum depth of 2.6 m below existing grade throughout the subject site to characterize and delineate the shallow subsurface and groundwater conditions (TP 1-20 to TP 42-20). All test pit locations were used to monitor groundwater infiltration levels at the time of excavation and minor infiltration was observed along the test pit sidewalls within TP 24-20, TP 29-20, TP 30-20, TP 37-20, and TP 39-20. The groundwater levels within these test pits were measured at a depth of 0.5 to 2.1 m below existing ground surface, noting that fluctuations in the groundwater levels due to seasonal variations or in response to precipitation events should be expected. The long-term groundwater table is expected to be near or perched within the bedrock surface based on soil moisture levels and colouring of the recovered samples. For details which are not summarized below, please see Paterson's Geotechnical Investigation Report (2020) in **Appendix D**.

Generally, the subsurface profile encountered at the test hole locations consists of a thin layer of topsoil underlain by stiff brown clay to clayey silt and/or glacial till overlying bedrock. Interbedded dolostone and limestone of the Gull River formation was encountered underlying the overburden soils at all test pit locations with inferred bedrock depths ranging from 0.1 to 2.8 m below existing ground surface. Due to the presence of a silty clay deposit underlying the subject site and undrained shear strength testing results, a permissible grade raise restriction of **2.0 m** is recommended for settlement sensitive structures founded within the clay deposit.

It is anticipated that bedrock removal will be required in areas across the site to complete building construction and service installation. Bedrock removal can be achieved via hoe ramming where small quantities of bedrock removal is required, and line drilling and controlled blasting is recommended where large quantities of bedrock needs to be removed. The blasting operations should be planned and completed under the guidance of a professional engineer with experience in blasting operations.

6.1.1 GROUNDWATER CONTROL

It is anticipated that groundwater infiltration into the excavations should be controllable using open sumps. The contractor should be prepared to direct water away from all bearing surfaces and subgrades, regardless of the source, to prevent disturbance to the founding medium.

A temporary Ministry of the Environment, Conservation, and Parks (MECP) permit to take water (PTTW) may be required for this project if more than 400,000 L/day of ground and/or surface water is to be pumped during the construction phase. A minimum of 4 to 5 months should be allowed for completion of the PTTW application package and issuance of the permit by the MECP.

For typical ground or surface water volumes being pumped during the construction phase, between 50,000 to 400,000 L/day, it is required to register on the Environmental Activity and Sector Registry (EASR). A minimum of two to four weeks should be allotted for completion of the EASR registration and the Water Taking and Discharge Plan to be prepared by a Qualified Person as stipulated under O.Reg. 63/16. If a project qualifies for a PTTW based upon anticipated conditions, an EASR will not be allowed as a temporary dewatering measure while awaiting the MECP review of the PTTW application.

6.1.2 PAVEMENT STRUCTURE

The required pavement structure for car only parking areas, and local roadways and collector roadways without bus traffic are outlined in **Table 6.1** and **Table 6.2**, respectively.

Table 6.1: Recommended Pavement Structure for Car Only Parking Areas

Thickness (mm)	Material Description
50	Wear Course – HL-3 or Superpave SP 12.5 Asphaltic Concrete
150	Base - OPSS Granular 'A' Crushed Stone
300	Subbase - OPSS Granular 'B' Type II
	Subgrade – Either fill, in situ soil, or OPSS Granular 'B' Type I or II material placed over in situ soil or fill

Table 6.2: Recommended Pavement Structure for Local and Collector Roadways without Bus Traffic

Thickness (mm)	Material Description
40	Wear Course – HL-3 or Superpave SP 12.5 Asphaltic Concrete
50	Binder Course – HL-8 or Superpave SP 19 Asphaltic Concrete
150	Base - OPSS Granular 'A' Crushed Stone
400	Subbase - OPSS Granular 'B' Type II
	Subgrade – Either fill, in situ soil, or OPSS Granular 'B' Type I or II material placed over in situ soil or fill

Minimum Performance Grade (PG) 58-34 asphalt cement should be used for this project.

6.2 Environmental Impact Assessment (EIA) Summary

An Environmental Impact Assessment (EIA) was completed by Muncaster Environmental Planning Inc. on July 30th, 2021, in accordance with the Mississippi Mills Community Official Plan. The EIA describes the natural heritage features and functions within the lands and assesses potential Species at Risk within the proposed development area and adjacent to the site.

The drainage channel in the southeast corner and adjacent to the site is considered a potential significant natural heritage feature, however it will be realigned, and the habitat will be maintained and protected in the relocated channel. In addition, the on-site forests do not have the characteristics to be considered significant woodlands and no specimen trees are required to be protected, but tree retention should be maximized as much as possible.

The characteristics of potential Species at Risk, including the eastern meadowlark and bobolink should be discussed with Construction staff and if a Species at Risk is observed, all work that could impact the species is to cease and the Ministry of the Environment, Conservation and Parks and a biological consultant contacted. The EIA notes that the proposed urban residential development and associated infrastructure will not have a significant impact on the local and natural environment. The mitigation measures outlined in the EIA should be properly implemented to ensure the optimal development solution is provided.

7 Grading and Drainage

The proposed development site measures approximately 33.4 ha, and consists primarily of ploughed fields and pasture land, as well as small, forested areas. The topography across the site generally slopes from north to south direction, towards the existing drainage ditch. The existing ground elevations within the development lands varies between 130.11 m to 137.27 m according to the Topographical Plan of Survey provided by Annis, O'Sullivan, Vollebekk Ltd. and slopes downward from the northwest to the southeast.

A detailed grading plan (see **Drawing OGP-1**) has been provided to satisfy the stormwater management requirements, adhere to any geotechnical restrictions (see **Section 6.1**) for the site, and provide for minimum cover requirements for storm and sanitary sewers where possible. Site grading has been established to provide emergency overland flow routes required for stormwater management. The industrial lands, intended as a future business park, will have overland flow directed to Appleton Side Road and conveyed to the realigned channel to the south.

The subject site maintains emergency overland flow routes to the proposed SWM wet pond located at the southwest boundary as depicted in **Drawing OGP-1.**

8 Erosion Control

Erosion and sediment controls must be in place during construction. The following recommendations to the contractor will be included in contract documents.

1. Implement best management practices to provide appropriate protection of the existing and proposed drainage system and the receiving water course(s).
2. Limit extent of exposed soils at any given time.
3. Re-vegetate exposed areas as soon as possible.
4. Minimize the area to be cleared and grubbed.
5. Protect exposed slopes with plastic or synthetic mulches.
6. Provide sediment traps and basins during dewatering.
7. Install sediment traps (such as SiltSack® by Terrafix) between catch basins and frames.
8. Plan construction at proper time to avoid flooding.

The contractor will, at every rainfall, complete inspections and guarantee proper performance. The inspection is to include:

1. Verification that water is not flowing under silt barriers.
2. Clean and change silt traps at catch basins.

Refer to **Drawing EC-1** for the proposed location of silt fences and other erosion control structures.

9 Utilities

As the subject site is bound by existing commercial and residential development to the north and west, Hydro, Internet, Gas and Cable servicing for the proposed development should be readily available through existing infrastructure to the northwest of the proposed subdivision. It is anticipated that existing infrastructure will be sufficient to provide the means of distribution for the proposed site. Exact size, location and routing of utilities, along with determination of any off-site works required for redevelopment, will be finalized after design circulation.

10 Approvals

Ontario Ministry of Environment, Conservation and Parks (MECP) municipal Consolidated Linear Infrastructure (CLI) Environmental Compliance Approval (ECA) will be required for the proposed subdivision works related to stormwater management, inlet control devices, pump station, storm sewers and sanitary sewers.

An MECP Permit to Take Water (PTTW) may be required for the site. The geotechnical consultant shall confirm at the time of application that a PTTW is required.

A permit to alter watercourse will also be required from the Mississippi Valley Conservation Authority (MVCA) to allow for the construction of the wet pond on the southwest boundary and for the realignment of the natural channel to which the SWM facility outlets.

11 Conclusions

11.1 Water Servicing

The proposed Mill Valley Estates Development is within the vicinity of existing water distribution system. The proposed site will be serviced through connections to the existing 250 mm diameter watermain within Industrial Drive and the existing 200 mm diameter watermain within Paterson Street/Robert Hill Street. The maximum available fire flow across the site 11,520 L/min (192 L/s), which will potentially result in firewall requirements to be confirmed at the detailed design stage.

11.2 Sanitary Servicing

Wastewater peak flows from the proposed site and the future Mill Valley Estates Living Community will be conveyed through a gravity sewer system to a proposed pump station located at the southwest end of the site, adjacent to the SWM facility. A forcemain will direct sewage peak flows (approx. 37.8 L/s) from the pump station to the existing 300 mm diameter sanitary sewer within Industrial Drive. The pump station will include a wet well designed to allow sufficient storage to keep the hydraulic grade line (HGL) at acceptable levels during emergency conditions. The wet well and pumping station design calculations will be provided at the detailed design stage.

The trunk sewers downstream of the site have enough capacity to convey ultimate peak flows from the proposed pump station at full build-out conditions. An initial assessment of the conveyance capacity of the existing local sewer along Industrial Drive servicing the site shows that the existing sewer has sufficient capacity for existing development conditions within the Industrial Drive business park, the future Mill Valley Living Community and the proposed Mill Valley Estates Development without the future business park block. However, the existing local sewer will be at capacity during full-build out conditions from the entire future development area (i.e., Industrial Drive Business Park, Mill Valley Living and Mill Valley Estates), and as such, further coordination with the Municipality will be required at the detailed design stage to confirm the analysis assumptions and/or to coordinate timing of future developments within the Industrial Drive business park in conjunction with the proposed development.

11.3 Stormwater Servicing

The conceptual SWM wet pond has been sized to provide ‘Enhanced’ level of treatment equivalent to 80% TSS removal, and to restrict post development peak flows up to the 100-year storm event to pre-development levels for proposed site areas and the future Mill Valley Estates Living Community. Storm sewers will be sized for the 5-year event under free flow conditions.

Post development runoff from the proposed business park block will be treated on-site to provide ‘Enhanced’ level of treatment and to restrict post development peak flows up to the 100-year storm event to pre-development levels prior to discharging into the Appleton Side Road side ditch.

11.4 Grading

A conceptual grading plan has been prepared accounting for required overland flow conveyance, cover over sewers, hydraulic grade line requirements, and recommendations by the geotechnical investigation by Paterson Group. Detailed grading design will be developed at the time of final design.

11.5 Utilities

Utility infrastructure exists within the general area of the subject site. It is anticipated that existing infrastructure will be sufficient to provide a means of distribution for the proposed site. Exact size, location and routing of utilities will be finalized at the detailed design stage.

Appendix A Potable Water Servicing

A.1 Domestic Water Demand Calculations

Mill Valley Estates - Domestic Water Demand Estimates
(Draft Plan of Subdivision)

Last updated on 2023-11-28 based on Concept Plan from 2022-11-14 (Rev 7) prepared by NAK

Population densities as per City of Ottawa Guidelines:

Single Family	3.4	ppu
Townhouse/Back-to-Back	2.7	ppu
Average Apartment	1.8	ppu
Average Apartment (Mill Valley Living)	2.3	ppu

Demand conversion factors as per City of Ottawa Guidelines:

Residential	280	L/p/day
Residential (Mill Valley Retirement)[5]	350	L/p/day
Commercial and Institutional	28000	L/ha/day
Light Industrial	35000	L/ha/day

Building ID	Area (m^2)	Number of Units	Population	Daily Rate of Demand (L/m^2/day or L/p/day)	Avg. Day Demand		Max. Day Demand[1, 2]		Peak Hour Demand[1, 2]	
					(L/min)	(L/s)	(L/min)	(L/s)	(L/min)	(L/s)
Phase 1A										
Single Family	-	55	187	280	36.4	0.61	90.9	1.52	200.0	3.33
Back-to-Back Townhouse	-	38	103	280	20.0	0.33	49.9	0.83	109.7	1.83
Executive Townhouse	-	49	132	280	25.7	0.43	64.3	1.07	141.5	2.36
Parkland Dedication	9,800	-	-	2.8	19.1	0.32	28.6	0.48	51.5	0.86
Phase 1A Total	**9,800**	**142**	**422**		**101.1**	**1.7**	**233.7**	**3.9**	**502.6**	**8.4**
Phase 1B										
Single Family	-	51	173	280	33.7	0.56	84.3	1.40	185.4	3.09
Executive Townhouse	-	22	59	280	11.6	0.19	28.9	0.48	63.5	1.06
Phase 1B Total	**-**	**73**	**233**		**45.3**	**0.8**	**113.2**	**1.9**	**249.0**	**4.1**
Phase 2-4										
Single Family	-	147	500	280	97.2	1.62	243.0	4.05	534.5	8.91
Back-to-Back Townhouse	-	34	92	280	17.9	0.30	44.6	0.74	98.2	1.64
Executive Townhouse	-	139	375	280	73.0	1.22	182.4	3.04	401.4	6.69
Parkland Dedication	14,600	-	-	2.8	28.4	0.47	42.6	0.71	76.7	1.28
Business Park (Block 189)	75,600	-	-	2.8	147.0	2.45	220.5	3.68	396.9	6.62
Phase 2-4 Total		**320**	**967**	**-**	**363.4**	**6.1**	**733.1**	**12.2**	**1507.6**	**25.1**
Ultimate Build-out Total		**535**	**1622**		**510**	**8**	**1080**	**18**	**2259**	**38**
Retirement Community (Mill Valley Living)[3]										
Single Family		2	7	350	1.7	0.03	4.1	0.07	9.1	0.15
Seniors Apartment		48	110	350	26.8	0.45	67.1	1.12	147.6	2.46
Townhouse		42	113	350	27.6	0.46	68.9	1.15	151.6	2.53
15% Future Buildout Contingency[4]		14	32	350	7.7	0.13	19.3	0.32	42.4	0.71
Total Mill Valley Living :		**106**	**263.0**	**-**	**63.8**	**1.06**	**159.4**	**2.66**	**350.7**	**5.84**
Total Mill Valley Development		**641**	**1885**		**573.5**	**9.6**	**1239.4**	**20.7**	**2609.9**	**43.5**

1 Water demand criteria used to estimate peak demand rates for residential areas are as follows:
maximum day demand rate = 2.5 x average day demand rate
peak hour demand rate = 2.2 x maximum day demand rate

2 Water demand criteria used to estimate peak demand rates for commercial/amenity areas are as follows:
maximum day demand rate = 1.5 x average day demand rate
peak hour demand rate = 1.8 x maximum day demand rate

3 Development statistics for Mill Valley Living taken from McIntosh Perry servicing and SWM Report (February 2022)

4 The population estimate for the Mill Valley Living has been increased due to potential future increases in number of units. A 15% unit contingency has been provided and has been accounted for in the overall demand.

5 Daily rate of demand for the units within the Mill Valley Living Retirement Community is adopted from the Servicing & Stormwater Management Report - Mill Valley Retirement Community by McIntosh Perry Consulting Engineers Ltd. to ensure consistency with previous studies.

Mill Valley Estates - Domestic Water Demand Estimates
(Draft Plan of Subdivision)

Population densities as per City of Ottawa Guidelines:

Single Family	3.4	ppu
Townhouse/Back-to-Back	2.7	ppu

Demand conversion factors as per City of Ottawa Guidelines:

Residential	280	L/p/day
Institutional	28000	L/ha/day

Model Node ID	Building ID	Area (m^2)	Number of Units	Population	Daily Rate of Demand	Avg Day Demand		Max Day Demand [1]		Peak Hour Demand [2]	
						(L/min)	(L/s)	(L/min)	(L/s)	(L/min)	(L/s)
Phase 1A											
11	Townhouse/Back-to-Back	-	8	21.6	280	4.2	0.07	10.5	0.18	23.1	0.39
21	Townhouse/Back-to-Back	-	9	24.3	280	4.7	0.08	11.8	0.20	26.0	0.43
21	Parkland Dedication	9,800	-		2.8	19.1	0.32	28.6	0.48	51.5	0.86
33	-	-	0		280	0.0	0.00	0.0	0.00	0.0	0.00
34	Townhouse/Back-to-Back	-	4	10.8	280	2.1	0.04	5.3	0.09	11.6	0.19
38	Townhouse/Back-to-Back		5	13.5	280	2.6	0.04	6.6	0.11	14.4	0.24
40	Townhouse/Back-to-Back	-	8	21.6	280	4.2	0.07	10.5	0.18	23.1	0.39
41	Townhouse/Back-to-Back	-	19	51.3	280	10.0	0.17	24.9	0.42	54.9	0.91
43	Single Family	-	19	64.6	280	12.6	0.21	31.4	0.52	69.1	1.15
45	Single Family	-	17	57.8	280	11.2	0.19	28.1	0.47	61.8	1.03
J-1	Townhouse/Back-to-Back	-	8	21.6	280	4.2	0.07	10.5	0.18	23.1	0.39
J-2	Townhouse/Back-to-Back	-	19	51.3	280	10.0	0.17	24.9	0.42	54.9	0.91
J-2	Single Family	-	6	20.4	280	4.0	0.07	9.9	0.17	21.8	0.36
J-3	Townhouse/Back-to-Back	-	8	21.6	280	4.2	0.07	10.5	0.18	23.1	0.39
J-3	Single Family	-	12	40.8	280	7.9	0.13	19.8	0.33	43.6	0.73
Phase 1A Total	**-**	**9,800**	**142**	**421**		**101.0**	**1.7**	**233.3**	**3.9**	**501.9**	**8.4**
Phase 1B											
37	Single Family	-	15	51.0	280	9.9	0.17	24.8	0.41	54.5	0.91
37	Townhouse/Back-to-Back	-	5	13.5	280	2.6	0.04	6.6	0.11	14.4	0.24
42	Single Family	-	15	51.0	280	9.9	0.17	24.8	0.41	54.5	0.91
42	Townhouse/Back-to-Back	-	11	29.7	280	5.8	0.10	14.4	0.24	31.8	0.53
44	Single Family	-	21	71.4	280	13.9	0.23	34.7	0.58	76.4	1.27
44	Townhouse/Back-to-Back	-	6	16.2	280	3.2	0.05	7.9	0.13	17.3	0.29
Phase 1B Total	**-**	**0**	**73**	**233**		**45.3**	**0.8**	**113.2**	**1.9**	**249.0**	**4.1**
Phase 2 to 4											
0	Single Family	-	25	85.0	280	16.5	0.28	41.3	0.69	90.9	1.52
1	Single Family	-	17	57.8	280	11.2	0.19	28.1	0.47	61.8	1.03
1	Townhouse/Back-to-Back	-	7	18.9	280	3.7	0.06	9.2	0.15	20.2	0.34
2	Townhouse/Back-to-Back	-	27	72.9	280	14.2	0.24	35.4	0.59	78.0	1.30
3	Townhouse/Back-to-Back	-	24	64.8	280	12.6	0.21	31.5	0.53	69.3	1.16
4	Townhouse/Back-to-Back	-	25	67.5	280	13.1	0.22	32.8	0.55	72.2	1.20
8	Townhouse/Back-to-Back		15	40.5	280	7.9	0.13	19.7	0.33	43.3	0.72
8	Parkland Dedication	4800	-	-	3	9.3	0.16	14.0	0.23	25.2	0.42
9	Single Family	-	9	30.6	280	6.0	0.10	14.9	0.25	32.7	0.55
10	Single Family	-	26	88.4	280	17.2	0.29	43.0	0.72	94.5	1.58
11	Single Family	-	14	47.6	280	9.3	0.15	23.1	0.39	50.9	0.85
12	Townhouse/Back-to-Back	-	11	29.7	280	5.8	0.10	14.4	0.24	31.8	0.53
12	Single Family	-	9	30.6	280	6.0	0.10	14.9	0.25	32.7	0.55
14	Single Family		21	71.4	280	13.9	0.23	34.7	0.58	76.4	1.27
14	Townhouse/Back-to-Back		6	16.2	280	3.2	0.05	7.9	0.13	17.3	0.29
15	Single Family	-	14	47.6	280	9.3	0.15	23.1	0.39	50.9	0.85
16	Townhouse/Back-to-Back	-	7	18.9	280	3.7	0.06	9.2	0.15	20.2	0.34
14	Business Park	75600			2.8	147.0	2.45	220.5	3.68	396.9	6.62
17	Townhouse/Back-to-Back	-	12	32.4	280	6.3	0.11	15.8	0.26	34.7	0.58
21	Townhouse/Back-to-Back	-	13	35.1	280	6.8	0.11	17.1	0.28	37.5	0.63
28	Townhouse/Back-to-Back	-	13	35.1	280	6.8	0.11	17.1	0.28	37.5	0.63
28	Single Family	-	4	13.6	280	2.6	0.04	6.6	0.11	14.5	0.24
38	Townhouse/Back-to-Back	-	13	35.1	280	6.8	0.11	17.1	0.28	37.5	0.63
J-1	Single Family	-	8	27.2	280	5.3	0.09	13.2	0.22	29.1	0.48
Phase 2 to 4 Total	**-**	**75,600**	**320**	**967**		**344.3**	**5.7**	**704.5**	**11.7**	**1456.1**	**24.3**
Development Total Site :		**85400**	**535**	**1621**		**490.6**	**8.2**	**1051.0**	**17.5**	**2207.0**	**36.8**

1 Water demand criteria used to estimate peak demand rates for residential areas are as follows:
maximum day demand rate = 2.5 x average day demand rate
peak hour demand rate = 2.2 x maximum day demand rate

2 Water demand criteria used to estimate peak demand rates for commercial areas are as follows:
maximum day demand rate = 1.5 x average day demand rate
peak hour demand rate = 1.8 x maximum day demand rate

A.2 Fire Flow Requirements (2020 FUS Methodology)

FUS Fire Flow Calculation - Long Method

Calculations based on: "*Water Supply for Public Fire Protection*" by Fire Underwriters' Survey, 2020

Stantec Project #: 10601740
Project Name: Mill Valley Estates Developments
Date: November 24, 2023
Data inputted by: Hamidreza Mohabbat MASc.
Data reviewed by: Ana Paerez P.Eng.

Fire Flow Calculation : BTB-TH-6 units-1 firewall
Building Type/Description/Name: Residential
Block Type: 1

Notes: *Based on the comments provided by Houchaimi on the type of the housing and the content combustibility. Three-storey townhouses with an average area of 45 m^2 six of which are assumed to comprise a block. It is also assumed that a firewall would be built between the boundaries of thsese 6-unit blocks.*

Fire Underwriters Survey Determination of Required Fire Flow - Long Method

Step	Task	Term	Options	Multiplier Associated with Option	Choose:	Value Used	Unit	Total Fire Flow (L/min)
		Framing Material						
1	Choose Frame Used for Construction of Unit	Coefficient related to type of construction (C)	Type V - Wood Frame	1.5	Type V - Wood Frame	1.5	m	
			Type IV-A - Mass Timber	0.8				
			Type IV-B - Mass Timber	0.9				
			Type IV-C - Mass Timber	1				
			Type IV-D - Mass Timber	1.5				
			Type III - Ordinary construction	1				
			Type II - Non-combustible construction	0.8				
			Type I - Fire resistive construction	0.6				
		Floor Space Area						
2	Choose Type of Housing (if TH, Enter Number of Units Per TH Block)	Type of Housing	Single Family	1	Townhouse - indicate # of units	6	Units	
			Townhouse - indicate # of units	0				
			Other (Comm, Ind, Apt etc.)	0				
2.2	# of Storeys	Number of Floors/Storeys in the Unit (do not include basement if 50% below grade):			3	3	Storeys	
3	Enter Ground Floor Area of One Unit	Average Floor Area (A) based on total floor area of all floors for one unit (non-fire resistive construction):			45 Square Metres (m2)	45	Area in Square Metres (m^2)	
3.1	Obtain Total Effective Building Area	Total Effective Building Area (# of Storeys x # of Units (if single family or townhouse) x Average Floor Area):			810	810		
4	Obtain Required Fire Flow without Reductions	Required Fire Flow (without reductions or increases per FUS) (F = 220 * C * √A) Round to nearest 1,000 L/min						9,000
5	Apply Factors Affecting Burning	**Reductions/Increases Due to Factors Affecting Burning**						
5.1	Choose Combustibility of Building Contents	Occupancy Content Hazard Reduction or Surcharge	Non-combustible	-0.25	Limited combustible	-0.15	N/A	7,650
			Limited combustible	-0.15				
			Combustible	0				
			Free burning	0.15				
			Rapid burning	0.25				
5.2	Choose Reduction Due to Presence of Sprinklers	Sprinkler Reduction	Adequate Sprinkler conforms to NFPA13	-0.3	None	0	N/A	0
			None	0				
		Water Supply Credit	Water supply is standard for sprinkler and fire dept. hose line	-0.1	Water supply is not standard or N/A	0	N/A	0
			Water supply is not standard or N/A	0				
		Sprinkler Supervision Credit	Sprinkler system is fully supervised	-0.1	Sprinkler not fully supervised or N/A	0	N/A	0
			Sprinkler not fully supervised or N/A	0				
5.3	Choose Presence of Sprinklers for Exposures within 30m	Sprinkler Conforms to NFPA13	Adequate sprinkler for exposures conforms to NFPA13		None for exposures	0	N/A	0
			None for exposures					
		Water Supply	Water supply is standard for sprinkler and fire dept. hose line of exposures		Water supply is not standard or N/A for exposures		N/A	
			Water supply is not standard or N/A for exposures					
		Sprinkler Supervision	Sprinkler system of exposures is fully supervised		Sprinkler not fully supervised or N/A for exposures		N/A	
			Sprinkler not fully supervised or N/A for exposures					
5.4	Choose Separation Distance Between Units	Exposure Distance Between Units	North Side	20.1 to 30.1m	0.1	0.4	m	3,060
			West Side	20.1 to 30.1m	0.1			
			East Side	20.1 to 30.1m	0.1			
			South Side	Fire Wall	0.1			
6	Obtain Required Fire Flow, Duration & Volume	*Total Required Fire Flow, rounded to nearest 1,000 L/min, with max/min limits applied:*						**11,000**
		Total Required Fire Flow (above) in L/s:						**183**
		Required Duration of Fire Flow (hrs)						**2.25**
		Required Volume of Fire Flow (m^3)						**1,485**

FUS Fire Flow Calculation - Long Method

Stantec

Calculations based on: "*Water Supply for Public Fire Protection*" by Fire Underwriters' Survey, 2020

Stantec Project #: 10601740
Project Name: Mill Valley Estates Developments
Date: November 24, 2023
Data inputted by: Hamidreza Mohabbat MASc.
Data reviewed by: Ana Paerez P.Eng.

Fire Flow Calculation : BTB-TH-6 units-two firewalls
Building Type/Description/Name: Residential
Block Type: 2

Notes: *Based on the comments provided by Houchaimi on the type of the housing and the content combustibility.*
Three-storey townhouses with an average area of 45 m^2 six of which are assumed to comprise a block.
It is also assumed that a firewall would be built between the boundaries of thsese 6-unit blocks.

Fire Underwriters Survey Determination of Required Fire Flow - Long Method

Step	Task	Term	Options	Multiplier Associated with Option	Choose:	Value Used	Unit	Total Fire Flow (L/min)
		Framing Material						
1	Choose Frame Used for Construction of Unit	Coefficient related to type of construction (C)	Type V - Wood Frame	1.5	Type V - Wood Frame	1.5	m	
			Type IV-A - Mass Timber	0.8				
			Type IV-B - Mass Timber	0.9				
			Type IV-C - Mass Timber	1				
			Type IV-D - Mass Timber	1.5				
			Type III - Ordinary construction	1				
			Type II - Non-combustible construction	0.8				
			Type I - Fire resistive construction	0.6				
		Floor Space Area						
2	Choose Type of Housing (if TH, Enter Number of Units Per TH Block)	Type of Housing	Single Family	1	Townhouse - indicate # of units	6	Units	
			Townhouse - indicate # of units	0				
			Other (Comm, Ind, Apt etc.)	0				
2.2	# of Storeys	Number of Floors/Storeys in the Unit (do not include basement if 50% below grade):			3	3	Storeys	
3	Enter Ground Floor Area of One Unit	Average Floor Area (A) based on total floor area of all floors for one unit (non-fire resistive construction):			45 / Square Metres (m2)	45	Area in Square Metres (m^2)	
3.1	Obtain Total Effective Building Area	Total Effective Building Area (# of Storeys x # of Units (if single family or townhouse) x Average Floor Area):			810	810		
4	Obtain Required Fire Flow without Reductions	Required Fire Flow (without reductions or increases per FUS) (F = 220 * C * √A) Round to nearest 1,000 L/min						**9,000**
5	Apply Factors Affecting Burning	**Reductions/Increases Due to Factors Affecting Burning**						
5.1	Choose Combustibility of Building Contents	Occupancy Content Hazard Reduction or Surcharge	Non-combustible	-0.25	Limited combustible	-0.15	N/A	**7,650**
			Limited combustible	-0.15				
			Combustible	0				
			Free burning	0.15				
			Rapid burning	0.25				
5.2	Choose Reduction Due to Presence of Sprinklers	Sprinkler Reduction	Adequate Sprinkler conforms to NFPA13	-0.3	None	0	N/A	**0**
			None	0				
		Water Supply Credit	Water supply is standard for sprinkler and fire dept. hose line	-0.1	Water supply is not standard or N/A	0	N/A	**0**
			Water supply is not standard or N/A	0				
		Sprinkler Supervision Credit	Sprinkler system is fully supervised	-0.1	Sprinkler not fully supervised or N/A	0	N/A	**0**
			Sprinkler not fully supervised or N/A	0				
5.3	Choose Presence of Sprinklers for Exposures within 30m	Sprinkler Conforms to NFPA13	Adequate sprinkler for exposures conforms to NFPA13		None for exposures	0	N/A	**0**
			None for exposures					
		Water Supply	Water supply is standard for sprinkler and fire dept. hose line of exposures		Water supply is not standard or N/A for exposures		N/A	
			Water supply is not standard or N/A for exposures					
		Sprinkler Supervision	Sprinkler system of exposures is fully supervised		Sprinkler not fully supervised or N/A for exposures		N/A	
			Sprinkler not fully supervised or N/A for exposures					
5.4	Choose Separation Distance Between Units	Exposure Distance Between Units	North Side	Fire Wall	0.1	0.4	m	**3,060**
			West Side	20.1 to 30.1m	0.1			
			East Side	20.1 to 30.1m	0.1			
			South Side	Fire Wall	0.1			
6	Obtain Required Fire Flow, Duration & Volume	***Total Required Fire Flow, rounded to nearest 1,000 L/min, with max/min limits applied:***						**11,000**
		Total Required Fire Flow (above) in L/s:						**183**
		Required Duration of Fire Flow (hrs)						**2.25**
		Required Volume of Fire Flow (m^3)						**1,485**

FUS Fire Flow Calculation - Long Method

Calculations based on: "*Water Supply for Public Fire Protection*" by Fire Underwriters' Survey, 2020

Stantec Project #: 10601740
Project Name: Mill Valley Estates Developments
Date: November 24, 2023
Data inputted by: Hamidreza Mohabbat MASc.
Data reviewed by: Ana Paerez P.Eng.

Fire Flow Calculation : BTB-TH-4 units-one firewall
Building Type/Description/Name: Residential
Block Type: 1

Notes: *Based on the comments provided by Houchaimi on the type of the housing and the content combustibility.*
Three-storey townhouses with an average area of 45 m^2 six of which are assumed to comprise a block.
It is also assumed that a firewall would be built between the boundaries of thsese 4-unit blocks.

Fire Underwriters Survey Determination of Required Fire Flow - Long Method

Step	Task	Term	Options	Multiplier Associated with Option	Choose:	Value Used	Unit	Total Fire Flow (L/min)
		Framing Material						
1	Choose Frame Used for Construction of Unit	Coefficient related to type of construction (C)	Type V - Wood Frame	1.5	Type V - Wood Frame	1.5	m	
			Type IV-A - Mass Timber	0.8				
			Type IV-B - Mass Timber	0.9				
			Type IV-C - Mass Timber	1				
			Type IV-D - Mass Timber	1.5				
			Type III - Ordinary construction	1				
			Type II - Non-combustible construction	0.8				
			Type I - Fire resistive construction	0.6				
		Floor Space Area						
2	Choose Type of Housing (if TH, Enter Number of Units Per TH Block)	Type of Housing	Single Family	1	Townhouse - indicate # of units	4	Units	
			Townhouse - indicate # of units	0				
			Other (Comm, Ind, Apt etc.)	0				
2.2	# of Storeys	Number of Floors/Storeys in the Unit (do not include basement if 50% below grade):			3	3	Storeys	
3	Enter Ground Floor Area of One Unit	Average Floor Area (A) based on total floor area of all floors for one unit (non-fire resistive construction):			45 Square Metres (m2)	45	Area in Square Metres (m^2)	
3.1	Obtain Total Effective Building Area	Total Effective Building Area (# of Storeys x # of Units (if single family or townhouse) x Average Floor Area):			540	540		
4	Obtain Required Fire Flow without Reductions	Required Fire Flow (without reductions or increases per FUS) (F = 220 * C * √A) Round to nearest 1,000 L/min						**8,000**
5	Apply Factors Affecting Burning	**Reductions/Increases Due to Factors Affecting Burning**						
5.1	Choose Combustibility of Building Contents	Occupancy Content Hazard Reduction or Surcharge	Non-combustible	-0.25	Limited combustible	-0.15	N/A	**6,800**
			Limited combustible	-0.15				
			Combustible	0				
			Free burning	0.15				
			Rapid burning	0.25				
5.2	Choose Reduction Due to Presence of Sprinklers	Sprinkler Reduction	Adequate Sprinkler conforms to NFPA13	-0.3	None	0	N/A	**0**
			None	0				
		Water Supply Credit	Water supply is standard for sprinkler and fire dept. hose line	-0.1	Water supply is not standard or N/A	0	N/A	**0**
			Water supply is not standard or N/A	0				
		Sprinkler Supervision Credit	Sprinkler system is fully supervised	-0.1	Sprinkler not fully supervised or N/A	0	N/A	**0**
			Sprinkler not fully supervised or N/A	0				
5.3	Choose Presence of Sprinklers for Exposures within 30m	Sprinkler Conforms to NFPA13	Adequate sprinkler for exposures conforms to NFPA13		None for exposures	0	N/A	**0**
			None for exposures					
		Water Supply	Water supply is standard for sprinkler and fire dept. hose line of exposures		Water supply is not standard or N/A for exposures		N/A	
			Water supply is not standard or N/A for exposures					
		Sprinkler Supervision	Sprinkler system of exposures is fully supervised		Sprinkler not fully supervised or N/A for exposures		N/A	
			Sprinkler not fully supervised or N/A for exposures					
5.4	Choose Separation Distance Between Units	Exposure Distance Between Units	North Side	20.1 to 30.1m	0.1	0.4	m	**2,720**
			West Side	20.1 to 30.1m	0.1			
			East Side	20.1 to 30.1m	0.1			
			South Side	Fire Wall	0.1			
6	Obtain Required Fire Flow, Duration & Volume	***Total Required Fire Flow, rounded to nearest 1,000 L/min, with max/min limits applied:***						**10,000**
		Total Required Fire Flow (above) in L/s:						**167**
		Required Duration of Fire Flow (hrs)						**2.00**
		Required Volume of Fire Flow (m^3)						**1,200**

FUS Fire Flow Calculation - Long Method

Calculations based on: "*Water Supply for Public Fire Protection*" by Fire Underwriters' Survey, 2020

Stantec Project #: 10601740
Project Name: Mill Valley Estates Developments
Date: November 24, 2023
Data inputted by: Hamidreza Mohabbat MASc.
Data reviewed by: Ana Paerez P.Eng.

Fire Flow Calculation : BTB-TH-4 units-two firewalls
Building Type/Description/Name: Residential
Block Type: 2

Notes: *Based on the comments provided by Houchaimi on the type of the housing and the content combustibility.*
Three-storey townhouses with an average area of 45 m^2 six of which are assumed to comprise a block.
It is also assumed that a firewall would be built between the boundaries of thsese 4-unit blocks.

Fire Underwriters Survey Determination of Required Fire Flow - Long Method

Step	Task	Term	Options	Multiplier Associated with Option	Choose:	Value Used	Unit	Total Fire Flow (L/min)
		Framing Material						
1	Choose Frame Used for Construction of Unit	Coefficient related to type of construction (C)	Type V - Wood Frame	1.5	Type V - Wood Frame	1.5	m	
			Type IV-A - Mass Timber	0.8				
			Type IV-B - Mass Timber	0.9				
			Type IV-C - Mass Timber	1				
			Type IV-D - Mass Timber	1.5				
			Type III - Ordinary construction	1				
			Type II - Non-combustible construction	0.8				
			Type I - Fire resistive construction	0.6				
		Floor Space Area						
2	Choose Type of Housing (if TH, Enter Number of Units Per TH Block)	Type of Housing	Single Family	1	Townhouse - indicate # of units	4	Units	
			Townhouse - indicate # of units	0				
			Other (Comm, Ind, Apt etc.)	0				
2.2	# of Storeys	Number of Floors/Storeys in the Unit (do not include basement if 50% below grade):			3	3	Storeys	
3	Enter Ground Floor Area of One Unit	Average Floor Area (A) based on total floor area of all floors for one unit (non-fire resistive construction):			45 Square Metres (m2)	45	Area in Square Metres (m^2)	
3.1	Obtain Total Effective Building Area	Total Effective Building Area (# of Storeys x # of Units (if single family or townhouse) x Average Floor Area):			540	540		
4	Obtain Required Fire Flow without Reductions	Required Fire Flow (without reductions or increases per FUS) (F = 220 * C * √A) Round to nearest 1,000 L/min						8,000
5	Apply Factors Affecting Burning	**Reductions/Increases Due to Factors Affecting Burning**						
5.1	Choose Combustibility of Building Contents	Occupancy Content Hazard Reduction or Surcharge	Non-combustible	-0.25	Limited combustible	-0.15	N/A	6,800
			Limited combustible	-0.15				
			Combustible	0				
			Free burning	0.15				
			Rapid burning	0.25				
5.2	Choose Reduction Due to Presence of Sprinklers	Sprinkler Reduction	Adequate Sprinkler conforms to NFPA13	-0.3	None	0	N/A	0
			None	0				
		Water Supply Credit	Water supply is standard for sprinkler and fire dept. hose line	-0.1	Water supply is not standard or N/A	0	N/A	0
			Water supply is not standard or N/A	0				
		Sprinkler Supervision Credit	Sprinkler system is fully supervised	-0.1	Sprinkler not fully supervised or N/A	0	N/A	0
			Sprinkler not fully supervised or N/A	0				
5.3	Choose Presence of Sprinklers for Exposures within 30m	Sprinkler Conforms to NFPA13	Adequate sprinkler for exposures conforms to NFPA13		None for exposures	0	N/A	0
			None for exposures					
		Water Supply	Water supply is standard for sprinkler and fire dept. hose line of exposures		Water supply is not standard or N/A for exposures		N/A	
			Water supply is not standard or N/A for exposures					
		Sprinkler Supervision	Sprinkler system of exposures is fully supervised		Sprinkler not fully supervised or N/A for exposures		N/A	
			Sprinkler not fully supervised or N/A for exposures					
5.4	Choose Separation Distance Between Units	Exposure Distance Between Units	North Side	Fire Wall	0.1	0.4	m	2,720
			West Side	20.1 to 30.1m	0.1			
			East Side	20.1 to 30.1m	0.1			
			South Side	Fire Wall	0.1			
6	Obtain Required Fire Flow, Duration & Volume	*Total Required Fire Flow, rounded to nearest 1,000 L/min, with max/min limits applied:*						**10,000**
		Total Required Fire Flow (above) in L/s:						**167**
		Required Duration of Fire Flow (hrs)						**2.00**
		Required Volume of Fire Flow (m^3)						**1,200**

FUS Fire Flow Calculation - Long Method

Calculations based on: "*Water Supply for Public Fire Protection*" by Fire Underwriters' Survey, 2020

Stantec Project #: 10601740
Project Name: Mill Valley Estates Developments
Date: November 24, 2023
Data inputted by: Hamidreza Mohabbat MASc.
Data reviewed by: Ana Paerez P.Eng.

Fire Flow Calculation : Exe-TH-4 units-no firewalls
Building Type/Description/Name: Residential
Block Type: 1

Notes: *Based on the comments provided by Houchaimi on the type of the housing and the content combustibility.*
Two-storey townhouses with an average area of 75 m^2 four of which are assumed to comprise a block.
It is also assumed that a set back of at least six meter is provided to test whether the FUS calculation could be capped.

Fire Underwriters Survey Determination of Required Fire Flow - Long Method

Step	Task	Term	Options	Multiplier Associated with Option	Choose:	Value Used	Unit	Total Fire Flow (L/min)
		Framing Material						
1	Choose Frame Used for Construction of Unit	Coefficient related to type of construction (C)	Type V - Wood Frame	1.5	Type V - Wood Frame	1.5	m	
			Type IV-A - Mass Timber	0.8				
			Type IV-B - Mass Timber	0.9				
			Type IV-C - Mass Timber	1				
			Type IV-D - Mass Timber	1.5				
			Type III - Ordinary construction	1				
			Type II - Non-combustible construction	0.8				
			Type I - Fire resistive construction	0.6				
		Floor Space Area						
2	Choose Type of Housing (if TH, Enter Number of Units Per TH Block)	Type of Housing	Single Family	1	Townhouse - indicate # of units	4	Units	
			Townhouse - indicate # of units	0				
			Other (Comm, Ind, Apt etc.)	0				
2.2	# of Storeys	Number of Floors/Storeys in the Unit (do not include basement if 50% below grade):			2	2	Storeys	
3	Enter Ground Floor Area of One Unit	Average Floor Area (A) based on total floor area of all floors for one unit (non-fire resistive construction):			74 Square Metres (m2)	74	Area in Square Metres (m^2)	
3.1	Obtain Total Effective Building Area	Total Effective Building Area (# of Storeys x # of Units (if single family or townhouse) x Average Floor Area):			590	590		
4	Obtain Required Fire Flow without Reductions	Required Fire Flow (without reductions or increases per FUS) (F = 220 * C * √A) Round to nearest 1,000 L/min						8,000
5	Apply Factors Affecting Burning	**Reductions/Increases Due to Factors Affecting Burning**						
5.1	Choose Combustibility of Building Contents	Occupancy Content Hazard Reduction or Surcharge	Non-combustible	-0.25	Limited combustible	-0.15	N/A	6,800
			Limited combustible	-0.15				
			Combustible	0				
			Free burning	0.15				
			Rapid burning	0.25				
5.2	Choose Reduction Due to Presence of Sprinklers	Sprinkler Reduction	Adequate Sprinkler conforms to NFPA13	-0.3	None	0	N/A	0
			None	0				
		Water Supply Credit	Water supply is standard for sprinkler and fire dept. hose line	-0.1	Water supply is not standard or N/A	0	N/A	0
			Water supply is not standard or N/A	0				
		Sprinkler Supervision Credit	Sprinkler system is fully supervised	-0.1	Sprinkler not fully supervised or N/A	0	N/A	0
			Sprinkler not fully supervised or N/A	0				
5.3	Choose Presence of Sprinklers for Exposures within 30m	Sprinkler Conforms to NFPA13	Adequate sprinkler for exposures conforms to NFPA13		None for exposures	0	N/A	0
			None for exposures					
		Water Supply	Water supply is standard for sprinkler and fire dept. hose line of exposures		Water supply is not standard or N/A for exposures		N/A	
			Water supply is not standard or N/A for exposures					
		Sprinkler Supervision	Sprinkler system of exposures is fully supervised		Sprinkler not fully supervised or N/A for exposures		N/A	
			Sprinkler not fully supervised or N/A for exposures					
5.4	Choose Separation Distance Between Units	Exposure Distance Between Units	North Side	20.1 to 30.1m	0.1	0.6	m	4,080
			West Side	20.1 to 30.1m	0.1			
			East Side	3.1 to 10.0m	0.2			
			South Side	3.1 to 10.0m	0.2			
6	Obtain Required Fire Flow, Duration & Volume	*Total Required Fire Flow, rounded to nearest 1,000 L/min, with max/min limits applied:*						**11,000**
		Total Required Fire Flow (above) in L/s:						**183**
		Required Duration of Fire Flow (hrs)						**2.25**
		Required Volume of Fire Flow (m^3)						**1,485**

FUS Fire Flow Calculation - Long Method

Calculations based on: "*Water Supply for Public Fire Protection*" by Fire Underwriters' Survey, 2020

Stantec Project #: 10601740
Project Name: Mill Valley Estates Developments
Date: November 24, 2023
Data inputted by: Hamidreza Mohabbat MASc.
Data reviewed by: Ana Paerez P.Eng.

Fire Flow Calculation : Exe-TH-4 units-one firewall
Building Type/Description/Name: Residential
Block Type: 2

Notes: *Based on the comments provided by Houchaimi on the type of the housing and the content combustibility.*
Two-storey townhouses with an average area of 75 m^2 four of which are assumed to comprise a block.
It is also assumed that a set back of at least six meter is provided to test whether the FUS calculation could be capped.

Fire Underwriters Survey Determination of Required Fire Flow - Long Method

Step	Task	Term	Options	Multiplier Associated with Option	Choose:	Value Used	Unit	Total Fire Flow (L/min)
		Framing Material						
1	Choose Frame Used for Construction of Unit	Coefficient related to type of construction (C)	Type V - Wood Frame	1.5	Type V - Wood Frame	1.5	m	
			Type IV-A - Mass Timber	0.8				
			Type IV-B - Mass Timber	0.9				
			Type IV-C - Mass Timber	1				
			Type IV-D - Mass Timber	1.5				
			Type III - Ordinary construction	1				
			Type II - Non-combustible construction	0.8				
			Type I - Fire resistive construction	0.6				
		Floor Space Area						
2	Choose Type of Housing (if TH, Enter Number of Units Per TH Block)	Type of Housing	Single Family	1	Townhouse - indicate # of units	4	Units	
			Townhouse - indicate # of units	0				
			Other (Comm, Ind, Apt etc.)	0				
2.2	# of Storeys	Number of Floors/Storeys in the Unit (do not include basement if 50% below grade):			2	2	Storeys	
3	Enter Ground Floor Area of One Unit	Average Floor Area (A) based on total floor area of all floors for one unit (non-fire resistive construction):			74 Square Metres (m2)	74	Area in Square Metres (m^2)	
3.1	Obtain Total Effective Building Area	Total Effective Building Area (# of Storeys x # of Units (if single family or townhouse) x Average Floor Area):			590	590		
4	Obtain Required Fire Flow without Reductions	Required Fire Flow (without reductions or increases per FUS) (F = 220 * C * √A) Round to nearest 1,000 L/min						8,000
5	Apply Factors Affecting Burning	**Reductions/Increases Due to Factors Affecting Burning**						
5.1	Choose Combustibility of Building Contents	Occupancy Content Hazard Reduction or Surcharge	Non-combustible	-0.25	Limited combustible	-0.15	N/A	6,800
			Limited combustible	-0.15				
			Combustible	0				
			Free burning	0.15				
			Rapid burning	0.25				
5.2	Choose Reduction Due to Presence of Sprinklers	Sprinkler Reduction	Adequate Sprinkler conforms to NFPA13	-0.3	None	0	N/A	0
			None	0				
		Water Supply Credit	Water supply is standard for sprinkler and fire dept. hose line	-0.1	Water supply is not standard or N/A	0	N/A	0
			Water supply is not standard or N/A	0				
		Sprinkler Supervision Credit	Sprinkler system is fully supervised	-0.1	Sprinkler not fully supervised or N/A	0	N/A	0
			Sprinkler not fully supervised or N/A	0				
5.3	Choose Presence of Sprinklers for Exposures within 30m	Sprinkler Conforms to NFPA13	Adequate sprinkler for exposures conforms to NFPA13		None for exposures	0	N/A	0
			None for exposures					
		Water Supply	Water supply is standard for sprinkler and fire dept. hose line of exposures		Water supply is not standard or N/A for exposures		N/A	
			Water supply is not standard or N/A for exposures					
		Sprinkler Supervision	Sprinkler system of exposures is fully supervised		Sprinkler not fully supervised or N/A for exposures		N/A	
			Sprinkler not fully supervised or N/A for exposures					
5.4	Choose Separation Distance Between Units	Exposure Distance Between Units	North Side	20.1 to 30.1m	0.1	0.55	m	3,740
			West Side	Fire Wall	0.1			
			East Side	3.1 to 10.0m	0.2			
			South Side	10.1 to 20.0m	0.15			
6	Obtain Required Fire Flow, Duration & Volume	*Total Required Fire Flow, rounded to nearest 1,000 L/min, with max/min limits applied:*						**11,000**
		Total Required Fire Flow (above) in L/s:						**183**
		Required Duration of Fire Flow (hrs)						**2.25**
		Required Volume of Fire Flow (m^3)						**1,485**

FUS Fire Flow Calculation - Long Method

Calculations based on: "*Water Supply for Public Fire Protection*" by Fire Underwriters' Survey, 2020

Stantec Project #: 10601740
Project Name: Mill Valley Estates Developments
Date: November 24, 2023
Data inputted by: Hamidreza Mohabbat MASc.
Data reviewed by: Ana Paerez P.Eng.

Fire Flow Calculation : Exe-TH-5 units-two firewalls
Building Type/Description/Name: Residential
Block Type: 3

Notes: *Based on the comments provided by Houchaimi on the type of the housing and the content combustibility.*
Two-storey townhouses with an average area of 75 m^2 four of which are assumed to comprise a block.
It is also assumed that a set back of at least six meter is provided to test whether the FUS calculation could be capped.

Fire Underwriters Survey Determination of Required Fire Flow - Long Method

Step	Task	Term	Options	Multiplier Associated with Option	Choose:	Value Used	Unit	Total Fire Flow (L/min)
		Framing Material						
1	Choose Frame Used for Construction of Unit	Coefficient related to type of construction (C)	Type V - Wood Frame	1.5	Type V - Wood Frame	1.5	m	
			Type IV-A - Mass Timber	0.8				
			Type IV-B - Mass Timber	0.9				
			Type IV-C - Mass Timber	1				
			Type IV-D - Mass Timber	1.5				
			Type III - Ordinary construction	1				
			Type II - Non-combustible construction	0.8				
			Type I - Fire resistive construction	0.6				
		Floor Space Area						
2	Choose Type of Housing (if TH, Enter Number of Units Per TH Block)	Type of Housing	Single Family	1	Townhouse - indicate # of units	5	Units	
			Townhouse - indicate # of units	0				
			Other (Comm, Ind, Apt etc.)	0				
2.2	# of Storeys	Number of Floors/Storeys in the Unit (do not include basement if 50% below grade):			2	2	Storeys	
3	Enter Ground Floor Area of One Unit	Average Floor Area (A) based on total floor area of all floors for one unit (non-fire resistive construction):			74 Square Metres (m2)	74	Area in Square Metres (m^2)	
3.1	Obtain Total Effective Building Area	Total Effective Building Area (# of Storeys x # of Units (if single family or townhouse) x Average Floor Area):			738	738		
4	Obtain Required Fire Flow without Reductions	Required Fire Flow (without reductions or increases per FUS) (F = 220 * C * √A) Round to nearest 1,000 L/min						**9,000**
5	Apply Factors Affecting Burning	**Reductions/Increases Due to Factors Affecting Burning**						
5.1	Choose Combustibility of Building Contents	Occupancy Content Hazard Reduction or Surcharge	Non-combustible	-0.25	Limited combustible	-0.15	N/A	**7,650**
			Limited combustible	-0.15				
			Combustible	0				
			Free burning	0.15				
			Rapid burning	0.25				
5.2	Choose Reduction Due to Presence of Sprinklers	Sprinkler Reduction	Adequate Sprinkler conforms to NFPA13	-0.3	None	0	N/A	**0**
			None	0				
		Water Supply Credit	Water supply is standard for sprinkler and fire dept. hose line	-0.1	Water supply is not standard or N/A	0	N/A	**0**
			Water supply is not standard or N/A	0				
		Sprinkler Supervision Credit	Sprinkler system is fully supervised	-0.1	Sprinkler not fully supervised or N/A	0	N/A	**0**
			Sprinkler not fully supervised or N/A	0				
5.3	Choose Presence of Sprinklers for Exposures within 30m	Sprinkler Conforms to NFPA13	Adequate sprinkler for exposures conforms to NFPA13		None for exposures	0	N/A	**0**
			None for exposures					
		Water Supply	Water supply is standard for sprinkler and fire dept. hose line of exposures		Water supply is not standard or N/A for exposures		N/A	
			Water supply is not standard or N/A for exposures					
		Sprinkler Supervision	Sprinkler system of exposures is fully supervised		Sprinkler not fully supervised or N/A for exposures		N/A	
			Sprinkler not fully supervised or N/A for exposures					
5.4	Choose Separation Distance Between Units	Exposure Distance Between Units	North Side	20.1 to 30.1m	0.1	0.45	m	**3,443**
			West Side	Fire Wall	0.1			
			East Side	Fire Wall	0.1			
			South Side	10.1 to 20.0m	0.15			
6	Obtain Required Fire Flow, Duration & Volume	*Total Required Fire Flow, rounded to nearest 1,000 L/min, with max/min limits applied:*						**11,000**
		Total Required Fire Flow (above) in L/s:						**183**
		Required Duration of Fire Flow (hrs)						**2.25**
		Required Volume of Fire Flow (m^3)						**1,485**

Stantec

FUS Fire Flow Calculation - Long Method

Calculations based on: "*Water Supply for Public Fire Protection*" by Fire Underwriters' Survey, 2020

Stantec Project #: 10601740
Project Name: Mill Valley Estates Developments
Date: November 24, 2023
Data inputted by: Hamidreza Mohabbat MASc.
Data reviewed by: Ana Paerez P.Eng.

Fire Flow Calculation : Exe-TH-2 units-one firewall
Building Type/Description/Name: Residential
Block Type: 4

Notes: *Based on the comments provided by Houchaimi on the type of the housing and the content combustibility.*
Two-storey townhouses with an average area of 75 m^2 four of which are assumed to comprise a block.
It is also assumed that a set back of at least six meter is provided to test whether the FUS calculation could be capped.

Fire Underwriters Survey Determination of Required Fire Flow - Long Method

Step	Task	Term	Options	Multiplier Associated with Option	Choose:	Value Used	Unit	Total Fire Flow (L/min)
		Framing Material						
1	Choose Frame Used for Construction of Unit	Coefficient related to type of construction (C)	Type V - Wood Frame	1.5	Type V - Wood Frame	1.5	m	
			Type IV-A - Mass Timber	0.8				
			Type IV-B - Mass Timber	0.9				
			Type IV-C - Mass Timber	1				
			Type IV-D - Mass Timber	1.5				
			Type III - Ordinary construction	1				
			Type II - Non-combustible construction	0.8				
			Type I - Fire resistive construction	0.6				
		Floor Space Area						
2	Choose Type of Housing (if TH, Enter Number of Units Per TH Block)	Type of Housing	Single Family	1	Townhouse - indicate # of units	2	Units	
			Townhouse - indicate # of units	0				
			Other (Comm, Ind, Apt etc.)	0				
2.2	# of Storeys	Number of Floors/Storeys in the Unit (do not include basement if 50% below grade):			2	2	Storeys	
3	Enter Ground Floor Area of One Unit	Average Floor Area (A) based on total floor area of all floors for one unit (non-fire resistive construction):			74 Square Metres (m2)	74	Area in Square Metres (m^2)	
3.1	Obtain Total Effective Building Area	Total Effective Building Area (# of Storeys x # of Units (if single family or townhouse) x Average Floor Area):			295	295		
4	Obtain Required Fire Flow without Reductions	Required Fire Flow (without reductions or increases per FUS) (F = 220 * C * √A) Round to nearest 1,000 L/min						6,000
5	Apply Factors Affecting Burning	**Reductions/Increases Due to Factors Affecting Burning**						
5.1	Choose Combustibility of Building Contents	Occupancy Content Hazard Reduction or Surcharge	Non-combustible	-0.25	Limited combustible	-0.15	N/A	5,100
			Limited combustible	-0.15				
			Combustible	0				
			Free burning	0.15				
			Rapid burning	0.25				
5.2	Choose Reduction Due to Presence of Sprinklers	Sprinkler Reduction	Adequate Sprinkler conforms to NFPA13	-0.3	None	0	N/A	0
			None	0				
		Water Supply Credit	Water supply is standard for sprinkler and fire dept. hose line	-0.1	Water supply is not standard or N/A	0	N/A	0
			Water supply is not standard or N/A	0				
		Sprinkler Supervision Credit	Sprinkler system is fully supervised	-0.1	Sprinkler not fully supervised or N/A	0	N/A	0
			Sprinkler not fully supervised or N/A	0				
5.3	Choose Presence of Sprinklers for Exposures within 30m	Sprinkler Conforms to NFPA13	Adequate sprinkler for exposures conforms to NFPA13		None for exposures	0	N/A	0
			None for exposures					
		Water Supply	Water supply is standard for sprinkler and fire dept. hose line of exposures		Water supply is not standard or N/A for exposures		N/A	
			Water supply is not standard or N/A for exposures					
		Sprinkler Supervision	Sprinkler system of exposures is fully supervised		Sprinkler not fully supervised or N/A for exposures		N/A	
			Sprinkler not fully supervised or N/A for exposures					
5.4	Choose Separation Distance Between Units	Exposure Distance Between Units	North Side	20.1 to 30.1m	0.1	0.55	m	2,805
			West Side	10.1 to 20.0m	0.15			
			East Side	Fire Wall	0.1			
			South Side	3.1 to 10.0m	0.2			
6	Obtain Required Fire Flow, Duration & Volume	*Total Required Fire Flow, rounded to nearest 1,000 L/min, with max/min limits applied:*						8,000
		Total Required Fire Flow (above) in L/s:						133
		Required Duration of Fire Flow (hrs)						2.00
		Required Volume of Fire Flow (m^3)						960

FUS Fire Flow Calculation - Long Method

Calculations based on: "*Water Supply for Public Fire Protection*" by Fire Underwriters' Survey, 2020

Stantec Project #: 10601740
Project Name: Mill Valley Estates Developments
Date: November 24, 2023
Data inputted by: Hamidreza Mohabbat MASc.
Data reviewed by: Ana Paerez P.Eng.

Fire Flow Calculation : Exe-TH-3 units-one firewall
Building Type/Description/Name: Residential
Block Type: 5

Notes: *Based on the comments provided by Houchaimi on the type of the housing and the content combustibility.*
Two-storey townhouses with an average area of 75 m^2 four of which are assumed to comprise a block.
It is also assumed that a set back of at least six meter is provided to test whether the FUS calculation could be capped.

Fire Underwriters Survey Determination of Required Fire Flow - Long Method

Step	Task	Term	Options	Multiplier Associated with Option	Choose:	Value Used	Unit	Total Fire Flow (L/min)
		Framing Material						
1	Choose Frame Used for Construction of Unit	Coefficient related to type of construction (C)	Type V - Wood Frame	1.5	Type V - Wood Frame	1.5	m	
			Type IV-A - Mass Timber	0.8				
			Type IV-B - Mass Timber	0.9				
			Type IV-C - Mass Timber	1				
			Type IV-D - Mass Timber	1.5				
			Type III - Ordinary construction	1				
			Type II - Non-combustible construction	0.8				
			Type I - Fire resistive construction	0.6				
		Floor Space Area						
2	Choose Type of Housing (if TH, Enter Number of Units Per TH Block)	Type of Housing	Single Family	1	Townhouse - indicate # of units	3	Units	
			Townhouse - indicate # of units	0				
			Other (Comm, Ind, Apt etc.)	0				
2.2	# of Storeys	Number of Floors/Storeys in the Unit (do not include basement if 50% below grade):			2	2	Storeys	
3	Enter Ground Floor Area of One Unit	Average Floor Area (A) based on total floor area of all floors for one unit (non-fire resistive construction):			74 Square Metres (m2)	74	Area in Square Metres (m^2)	
3.1	Obtain Total Effective Building Area	Total Effective Building Area (# of Storeys x # of Units (if single family or townhouse) x Average Floor Area):			443	443		
4	Obtain Required Fire Flow without Reductions	Required Fire Flow (without reductions or increases per FUS) (F = 220 * C * √A) Round to nearest 1,000 L/min						7,000
5	Apply Factors Affecting Burning	**Reductions/Increases Due to Factors Affecting Burning**						
5.1	Choose Combustibility of Building Contents	Occupancy Content Hazard Reduction or Surcharge	Non-combustible	-0.25	Limited combustible	-0.15	N/A	5,950
			Limited combustible	-0.15				
			Combustible	0				
			Free burning	0.15				
			Rapid burning	0.25				
5.2	Choose Reduction Due to Presence of Sprinklers	Sprinkler Reduction	Adequate Sprinkler conforms to NFPA13	-0.3	None	0	N/A	0
			None	0				
		Water Supply Credit	Water supply is standard for sprinkler and fire dept. hose line	-0.1	Water supply is not standard or N/A	0	N/A	0
			Water supply is not standard or N/A	0				
		Sprinkler Supervision Credit	Sprinkler system is fully supervised	-0.1	Sprinkler not fully supervised or N/A	0	N/A	0
			Sprinkler not fully supervised or N/A	0				
5.3	Choose Presence of Sprinklers for Exposures within 30m	Sprinkler Conforms to NFPA13	Adequate sprinkler for exposures conforms to NFPA13		None for exposures	0	N/A	0
			None for exposures					
		Water Supply	Water supply is standard for sprinkler and fire dept. hose line of exposures		Water supply is not standard or N/A for exposures		N/A	
			Water supply is not standard or N/A for exposures					
		Sprinkler Supervision	Sprinkler system of exposures is fully supervised		Sprinkler not fully supervised or N/A for exposures		N/A	
			Sprinkler not fully supervised or N/A for exposures					
5.4	Choose Separation Distance Between Units	Exposure Distance Between Units	North Side	30.1m or greater	0	0.4	m	2,380
			West Side	Fire Wall	0.1			
			East Side	20.1 to 30.1m	0.1			
			South Side	3.1 to 10.0m	0.2			
6	Obtain Required Fire Flow, Duration & Volume	*Total Required Fire Flow, rounded to nearest 1,000 L/min, with max/min limits applied:*						**8,000**
		Total Required Fire Flow (above) in L/s:						**133**
		Required Duration of Fire Flow (hrs)						**2.00**
		Required Volume of Fire Flow (m^3)						**960**

FUS Fire Flow Calculation - Long Method

Calculations based on: "*Water Supply for Public Fire Protection*" by Fire Underwriters' Survey, 2020

Stantec Project #: 10601740
Project Name: Mill Valley Estates Developments
Date: November 24, 2023
Data inputted by: Hamidreza Mohabbat MASc.
Data reviewed by: Ana Paerez P.Eng.

Fire Flow Calculation : Exe-TH-4 units-one firewall
Building Type/Description/Name: Residential
Block Type: 6

Notes: *Based on the comments provided by Houchaimi on the type of the housing and the content combustibility.*
Two-storey townhouses with an average area of 75 m^2 four of which are assumed to comprise a block.
It is also assumed that a set back of at least six meter is provided to test whether the FUS calculation could be capped.

Fire Underwriters Survey Determination of Required Fire Flow - Long Method

Step	Task	Term	Options	Multiplier Associated with Option	Choose:	Value Used	Unit	Total Fire Flow (L/min)
		Framing Material						
1	Choose Frame Used for Construction of Unit	Coefficient related to type of construction (C)	Type V - Wood Frame	1.5	Type V - Wood Frame	1.5	m	
			Type IV-A - Mass Timber	0.8				
			Type IV-B - Mass Timber	0.9				
			Type IV-C - Mass Timber	1				
			Type IV-D - Mass Timber	1.5				
			Type III - Ordinary construction	1				
			Type II - Non-combustible construction	0.8				
			Type I - Fire resistive construction	0.6				
		Floor Space Area						
2	Choose Type of Housing (if TH, Enter Number of Units Per TH Block)	Type of Housing	Single Family	1	Townhouse - indicate # of units	4	Units	
			Townhouse - indicate # of units	0				
			Other (Comm, Ind, Apt etc.)	0				
2.2	# of Storeys	Number of Floors/Storeys in the Unit (do not include basement if 50% below grade):			2	2	Storeys	
3	Enter Ground Floor Area of One Unit	Average Floor Area (A) based on total floor area of all floors for one unit (non-fire resistive construction):			74 Square Metres (m2)	74	Area in Square Metres (m^2)	
3.1	Obtain Total Effective Building Area	Total Effective Building Area (# of Storeys x # of Units (if single family or townhouse) x Average Floor Area):			590	590		
4	Obtain Required Fire Flow without Reductions	Required Fire Flow (without reductions or increases per FUS) (F = 220 * C * √A) Round to nearest 1,000 L/min						**8,000**
5	Apply Factors Affecting Burning	**Reductions/Increases Due to Factors Affecting Burning**						
5.1	Choose Combustibility of Building Contents	Occupancy Content Hazard Reduction or Surcharge	Non-combustible	-0.25	Limited combustible	-0.15	N/A	**6,800**
			Limited combustible	-0.15				
			Combustible	0				
			Free burning	0.15				
			Rapid burning	0.25				
5.2	Choose Reduction Due to Presence of Sprinklers	Sprinkler Reduction	Adequate Sprinkler conforms to NFPA13	-0.3	None	0	N/A	**0**
			None	0				
		Water Supply Credit	Water supply is standard for sprinkler and fire dept. hose line	-0.1	Water supply is not standard or N/A	0	N/A	**0**
			Water supply is not standard or N/A	0				
		Sprinkler Supervision Credit	Sprinkler system is fully supervised	-0.1	Sprinkler not fully supervised or N/A	0	N/A	**0**
			Sprinkler not fully supervised or N/A	0				
5.3	Choose Presence of Sprinklers for Exposures within 30m	Sprinkler Conforms to NFPA13	Adequate sprinkler for exposures conforms to NFPA13		None for exposures	0	N/A	**0**
			None for exposures					
		Water Supply	Water supply is standard for sprinkler and fire dept. hose line of exposures		Water supply is not standard or N/A for exposures		N/A	
			Water supply is not standard or N/A for exposures					
		Sprinkler Supervision	Sprinkler system of exposures is fully supervised		Sprinkler not fully supervised or N/A for exposures		N/A	
			Sprinkler not fully supervised or N/A for exposures					
5.4	Choose Separation Distance Between Units	Exposure Distance Between Units	North Side	30.1m or greater	0	0.25	m	**1,700**
			West Side	30.1m or greater	0			
			East Side	Fire Wall	0.1			
			South Side	10.1 to 20.0m	0.15			
6	Obtain Required Fire Flow, Duration & Volume	***Total Required Fire Flow, rounded to nearest 1,000 L/min, with max/min limits applied:***						**9,000**
		Total Required Fire Flow (above) in L/s:						**150**
		Required Duration of Fire Flow (hrs)						**2.00**
		Required Volume of Fire Flow (m^3)						**1,080**

A.3 Boundary Conditions Request – Correspondence with the Municipality of Mississippi Mills

Mohabbat, Hamidreza

From: Annie Williams <awilliams@jlrichards.ca>
Sent: Thursday, March 9, 2023 4:01 PM
To: Ryan Kennedy; Mott, Peter
Cc: Kilborn, Kris; Billy Houchaimi; David Shen; Mark Buchanan
Subject: RE: Mill Valley Estates (Houchimi) - Boundary Conditions Request
Attachments: 29920-015 Mill Valley Boundary Condition.pdf

Hello Ryan, Peter,

Please find attached the requested hydraulic boundary conditions for the following two (2) connections as requested by the Developer's Engineer:

- One (1) connection to the existing 250 mm dia. watermain on Industrial Drive.
- One (1) connection to the existing 200 mm dia. watermain stub on Old Almonte Road at Robert Hill Street.

The proposed development ("Mill Valley Estates") located within the Municipality of Mississippi Mills (Municipality), was simulated using the Municipality's existing hydraulic water model (2017) to determine hydraulic boundary conditions based on theoretical water demands and fire flows provided by the Developer's Engineer. Table 1 summarizes the theoretical water demands that were included in the model.

Table 1: Theoretical Water Demands

Mill Valley Estates	Avg Day (L/s)	Max Day (L/s)	Peak Hour (L/s)
Junction Node J-577 (Elev. 133.20 m)	9.82	21.28	44.86

The elevations at the junctions were approximated using the information from the model and the Servicing Plan provided by the Developer's Engineer. The development was modelled with a representative on-site watermain loop consisting of a 250 mm diameter watermain extending from Industrial Drive and a 200 mm diameter watermain extending from Old Almonte Road, per the Servicing Plan provided. **It is noted that the simulated maximum available fire flow is 192 L/s.** The hydraulic boundary conditions have been generated at the requested connection locations labelled as node J-3 and node J-444 in the model and are summarized in Table 2 (refer to attached WaterCAD model outputs).

Table 2: Mill Valley Estates Boundary Conditions (MAX. AVAILABLE FIRE FLOW 192 L/s)

Demand Scenario	Connection 1		Connection 2	
	Junction Node J-3 (Elev. 138.49 m)		Junction Node J-444 (Elev. 132.45 m)	
	Pressure (kPa)	HGL (m)	Pressure (kPa)	HGL (m)
Average Day	413	180.68	471	180.62
Max Day + Fire Flow (183 L/s)	346	173.87	368	170.02
Max Day + Fire Flow (192 L/s)	341	173.36	360	169.21
Peak Hour	398	179.18	452	178.67

Note that the foregoing model results are for current conditions and are based on computer model simulation. We have not reviewed the adequacy of the domestic demand nor the fire flow requirements for the proposed development, which remains the responsibility of the Developer's Engineer.

Disclaimer: The model results are based on current simulated operation of the Municipality's water distribution system. The computer model simulation is based on the best information available at this time. The operation of the water distribution system can change on a regular basis, resulting in a variation in the boundary conditions. It is further noted that the operational characteristics of the water supply system and physical properties of the watermains can change and/or deteriorate over time. These changes may affect the supply characteristics of the system and the assumptions made in developing the model, which in turn could lead to variations in the simulation results. This should be considered by any third party undertaking simulation of system upgrades.

Should you have any questions or require anything further, please do not hesitate to contact us.

Regards,
Annie

Annie Williams, P.Eng.
Civil Engineer

J.L. Richards & Associates Limited
1000-343 Preston Street, Ottawa, ON K1S 1N4
Direct: 343-803-4523

J.L. Richards & Associates Limited
ENGINEERS • ARCHITECTS • PLANNERS

CANADA BEST MANAGED COMPANIES Platinum member

From: Ryan Kennedy <ryan@houchaimi.com>
Sent: February 27, 2023 6:26 PM
To: Annie Williams <awilliams@jlrichards.ca>; Mott, Peter <Peter.Mott@stantec.com>
Cc: Kilborn, Kris <kris.kilborn@stantec.com>; Billy Houchaimi <Billy@houchaimi.com>; David Shen <dshen@mississippimills.ca>; Mark Buchanan <mbuchanan@jlrichards.ca>
Subject: RE: Mill Valley Estates (Houchimi) - Boundary Conditions Request

Hi Annie,

Thank you – please use this as approval to proceed from the developer side.

David – please let us know if you need anything else from us at this time.

Thanks.

RYAN KENNEDY
Manager | Land Development
P 613.255.3850 | **E** ryan@houchaimi.com
HOUCHAIMI HOLDINGS INC.

From: Annie Williams <awilliams@jlrichards.ca>
Sent: Monday, February 27, 2023 10:19 AM
To: Ryan Kennedy <ryan@houchaimi.com>; Mott, Peter <Peter.Mott@stantec.com>
Cc: Kilborn, Kris <kris.kilborn@stantec.com>; Billy Houchaimi <Billy@houchaimi.com>; David Shen <dshen@mississippimills.ca>; Mark Buchanan <mbuchanan@jlrichards.ca>
Subject: RE: Mill Valley Estates (Houchimi) - Boundary Conditions Request

Hello Ryan, Peter,

We would be happy to provide hydraulic boundary conditions for the below request. We will provide the boundary conditions at the two (2) proposed connection locations under the average day, maximum day plus fire flow (183 L/s and 250 L/s), and peak hour demand conditions.

Would you be able to confirm the diameter of the proposed watermain extending from Old Almonte Road through the easement? Is it 200 mm?

We will work for the Municipality and bill by the hour to an upset limit fee of **$2,500** (excl. tax and disbursement).

We can provide these boundary conditions within 10 business days upon receiving your approval to proceed.

Thank you,
Annie

Annie Williams, P.Eng.
Civil Engineer

J.L. Richards & Associates Limited
1000-343 Preston Street, Ottawa, ON K1S 1N4
Direct: 343-803-4523

J.L. Richards & Associates Limited
ENGINEERS • ARCHITECTS • PLANNERS

CANADA BEST MANAGED COMPANIES Platinum member

From: Mott, Peter <Peter.Mott@stantec.com>
Sent: February 21, 2023 11:06 AM
To: Mark Buchanan <mbuchanan@jlrichards.ca>
Cc: Kilborn, Kris <kris.kilborn@stantec.com>; Billy Houchaimi <Billy@houchaimi.com>; David Shen <dshen@mississippimills.ca>; Annie Williams <awilliams@jlrichards.ca>; Ryan Kennedy <ryan@houchaimi.com>
Subject: RE: Mill Valley Estates (Houchimi) - Boundary Conditions Request

Hi Mark – Please see the BC request map showing the proposed connections for the Mill Valley Estates development as well as the site plan and overall site servicing plan. In addition, I've attached the water demand breakdown and fire flow requirement for the subdivision just in case. Please feel free to give me a call if you have any questions.

Best,

Peter Mott EIT
Engineering Intern, Community Development

Mobile: +1 (613) 897-0445
Teams: +1 (613) 724-4370
Peter.Mott@stantec.com
Stantec
300 - 1331 Clyde Avenue
Ottawa ON K2C 3G4

Stantec

From: Mark Buchanan <mbuchanan@jlrichards.ca>
Sent: Friday, February 17, 2023 9:59 AM
To: Ryan Kennedy <ryan@houchaimi.com>
Cc: Mott, Peter <Peter.Mott@stantec.com>; Kilborn, Kris <kris.kilborn@stantec.com>; Billy Houchaimi <Billy@houchaimi.com>; David Shen <dshen@mississippimills.ca>; Annie Williams <awilliams@jlrichards.ca>
Subject: RE: Mill Valley Estates (Houchimi) - Boundary Conditions Request

Hello Ryan

Doing well here, I hope the same for you. Can you arrange for someone on your team to send us the servicing layout showing the proposed connection locations, route and expected diameter.

We'll advise on level of effort for the developer's consideration before we proceed. To be clear, we invoice the Municipality for these assignments and they collect the cost from the developer.

Regards,
Mark

Mark Buchanan, P.Eng.
Associate
Senior Environmental Engineer

J.L. Richards & Associates Limited
1000-343 Preston Street, Ottawa, ON K1S 1N4
Direct: 343-804-5349

J.L. Richards & Associates Limited
ENGINEERS • ARCHITECTS • PLANNERS

CANADA BEST MANAGED COMPANIES Platinum member

From: Ryan Kennedy <ryan@houchaimi.com>
Sent: February 16, 2023 1:25 PM
To: Mark Buchanan <mbuchanan@jlrichards.ca>
Cc: Mott, Peter <peter.mott@stantec.com>; Kilborn, Kris <kris.kilborn@stantec.com>; Billy Houchaimi <Billy@houchaimi.com>; David Shen <dshen@mississippimills.ca>
Subject: FW: Mill Valley Estates (Houchimi) - Boundary Conditions Request

Hi Mark,

Hope you're doing well. See below for a boundary condition request. I will let Stantec provide you with any additional technical information you require, but please send the quote to Houchaimi Holdings for payment when ready.

Thanks.

RYAN KENNEDY
Manager | Land Development
P 613.255.3850 | **E** ryan@houchaimi.com
HOUCHAIMI HOLDINGS INC.

From: David Shen <dshen@mississippimills.ca>
Sent: Thursday, February 16, 2023 11:26 AM

To: Mott, Peter <Peter.Mott@stantec.com>
Cc: Kilborn, Kris <kris.kilborn@stantec.com>; Ryan Kennedy <ryan@houchaimi.com>; Billy Houchaimi <billy@houchaimi.com>
Subject: RE: Mill Valley Estates (Houchimi) - Boundary Conditions Request

Dear all,

I have checked this water calculation and connection request. It has addressed my comments and good to go to J.L.Richards for modelling check.

Use this email to communicate with JL.Richards. They will provide you a fee quote of doing the modelling check. Once you accept, they can start the work.

Thanks!
David Shen

From: Mott, Peter <Peter.Mott@stantec.com>
Sent: February 15, 2023 10:57 AM
To: David Shen <dshen@mississippimills.ca>
Cc: Kilborn, Kris <kris.kilborn@stantec.com>; Ryan Kennedy <ryan@houchaimi.com>; Billy Houchaimi <billy@houchaimi.com>
Subject: RE: Mill Valley Estates (Houchimi) - Boundary Conditions Request

Hello David,

I just wanted to follow up with an updated request for the hydraulic boundary conditions for the Mill Valley Estates Development, including demand estimates from the adjacent Mill Valley Living Senior's Residence. Please find attached the draft plan, the key map showing the location of the proposed development and connection locations, domestic water demand calculations, and fire flow calculations (I've highlighted the blocks within the Subdivision Plan that were used for determining the Fire Flow Requirement). Let me know if you require any additional information to complete this request.

A summary of the proposed site is provided below:

We anticipate a minimum of two (2) connections: one (1) to the existing watermain on Industrial Drive and one (1) within Old Almonte Road at Robert Hill Street. The following connections are expected for servicing:

➢Connection to the existing watermain on Industrial Drive.
➢Connection to the existing watermain stub on Old Almonte Road at Robert Hill Street.

For the purpose of the boundary conditions request, may you please provide us with the boundary conditions for the following servicing options:

i. Watermain connections to the above listed connections; assuming a fire flow requirement of **11,000 L/min (183 L/s)** for the site in addition to the domestic water demands provided below. (Includes the governing Townhouse Blocks with fire separation and the adjacent Retirement Community)
ii. Watermain connections to the above listed connections; assuming a fire flow requirement of **15,000 L/min (250 L/s)** for the site in addition to the domestic water demands provided below.

- The intended land use is a combination of residential, institutional, commercial/mixed use, and park land dedication per the summary provided in the Domestic Demands spreadsheet. (See attached Draft Plan)
- Estimated fire flow demand per the FUS methodology: 15,000 L/min (250 L/s) for the worst-case scenario (6-Unit Townhouse Row)
- Domestic water demands for the entire development:

    - **Average day: 589.3 L/min (9.82 L/s)**
    - **Maximum day: 1276.9 L/min (21.28 L/s)**
    - **Peak hour: 2691.3 L/min (44.86 L/s)**

Thank you.

Best regards,

Peter Mott EIT
Engineering Intern, Community Development

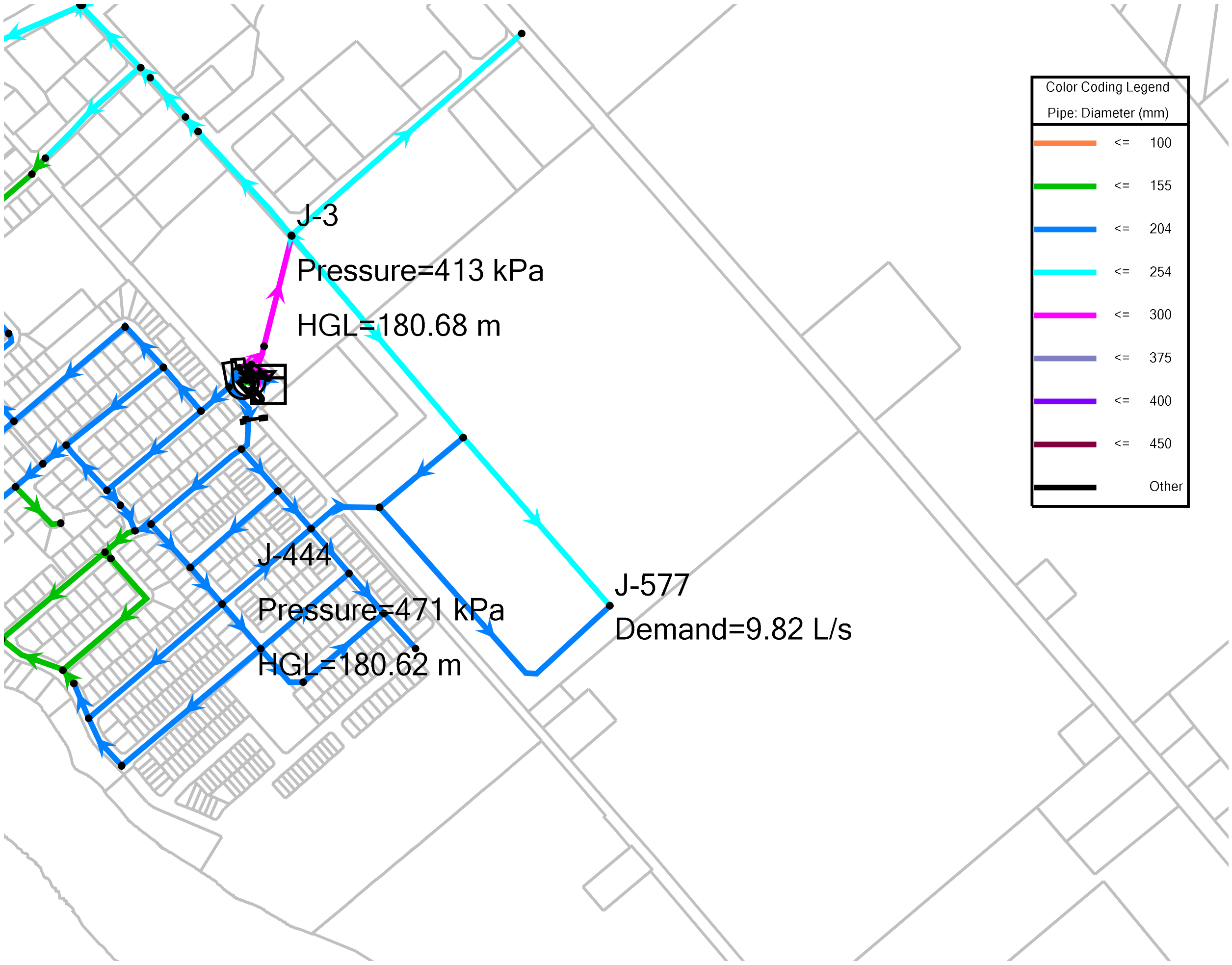
Mobile: +1 (613) 897-0445
Teams: +1 (613) 724-4370
Peter.Mott@stantec.com
Stantec
300 - 1331 Clyde Avenue
Ottawa ON K2C 3G4

Caution: This email originated from outside of Stantec. Please take extra precaution.

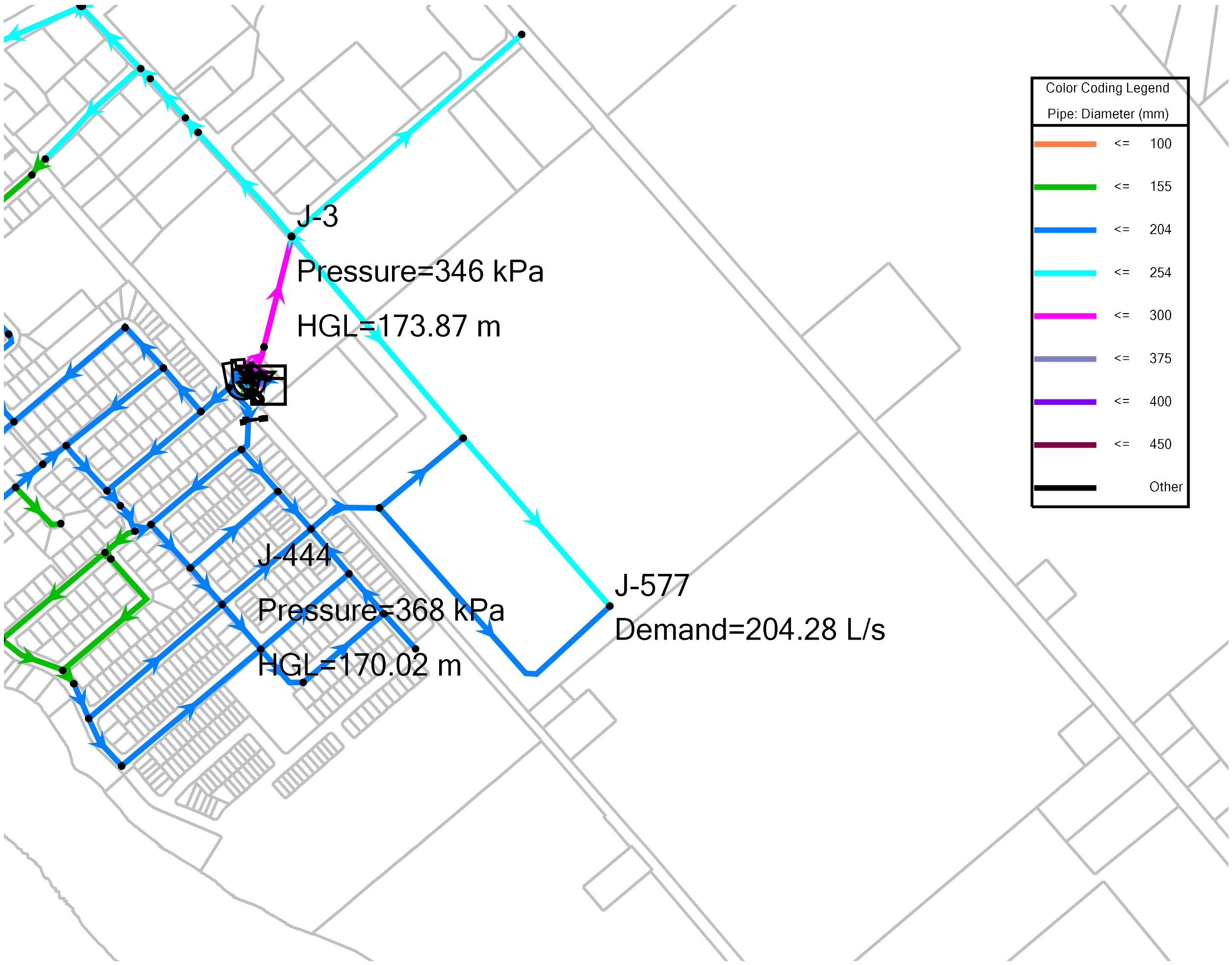
Attention: Ce courriel provient de l'extérieur de Stantec. Veuillez prendre des précautions supplémentaires.

Atención: Este correo electrónico proviene de fuera de Stantec. Por favor, tome precauciones adicionales.

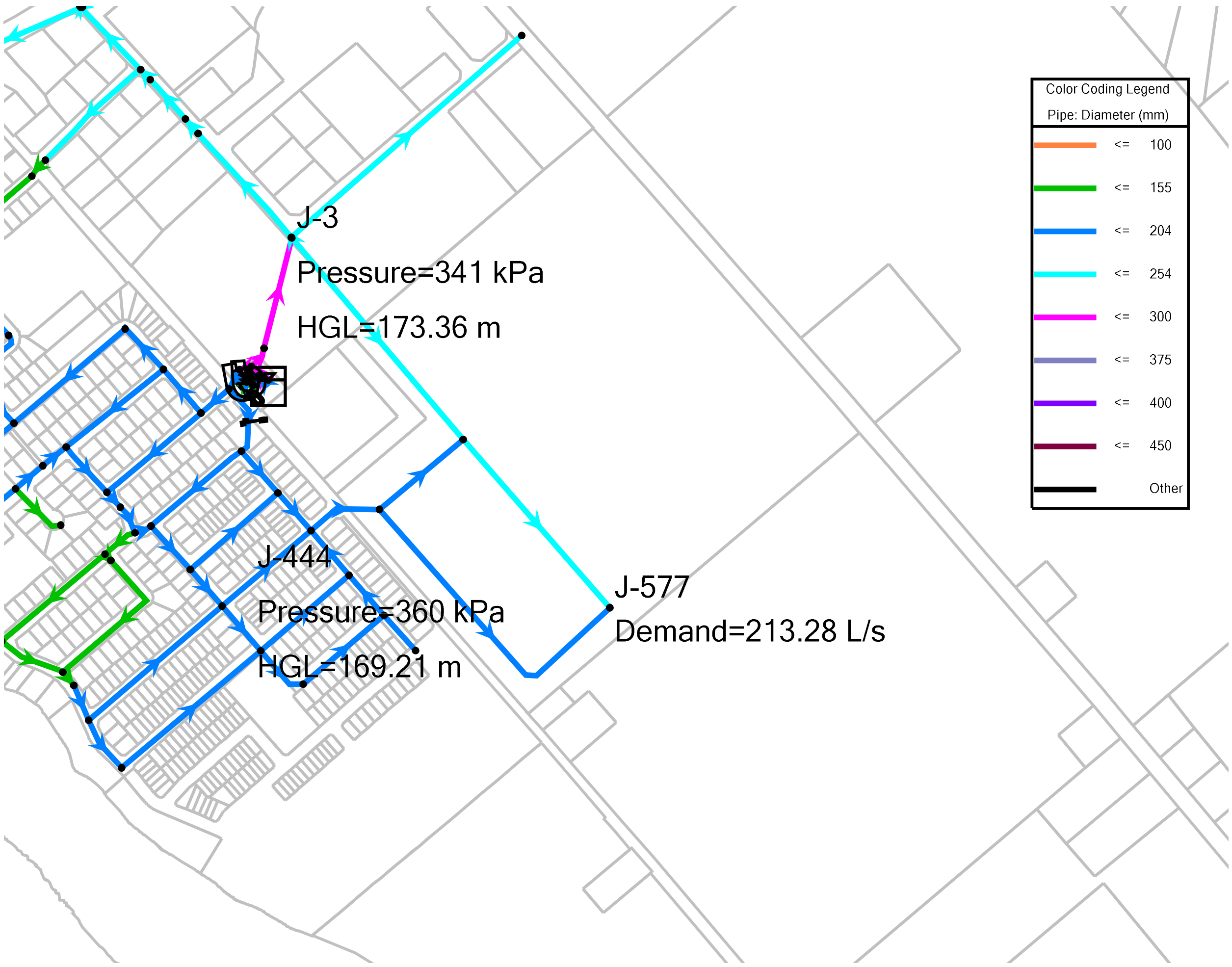
Mill Valley Estates
Average Day



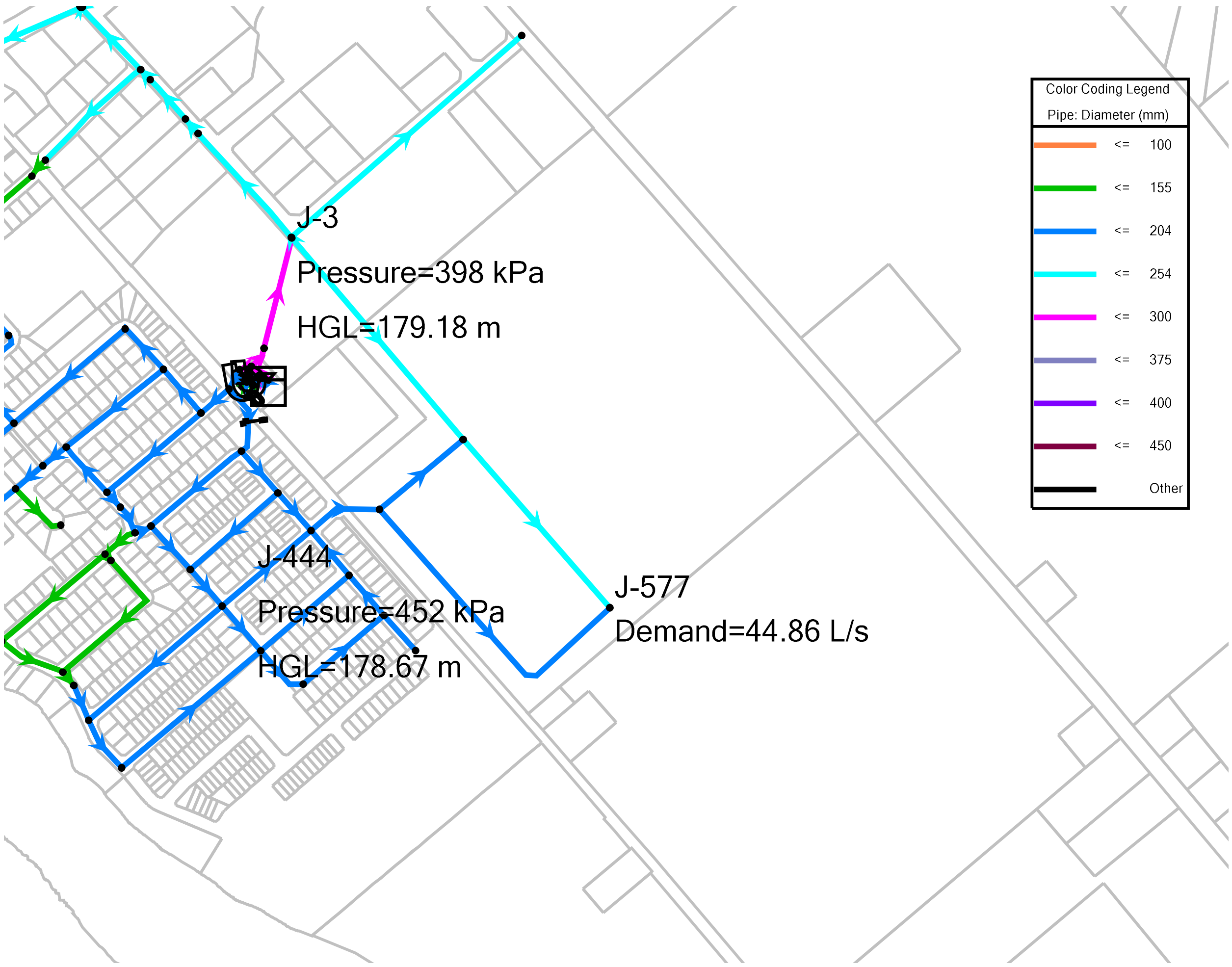
Mill Valley Estates
Maximum Day + Fire Flow (183 L/s)



Mill Valley Estates
Maximum Day + Fire Flow (192 L/s)



Mill Valley Estates
Peak Hour



A.4 Background Report Excerpts – Water

- Updated Modelling: Once all sewage generation parameters were updated, simulations of the wastewater collection system under existing conditions were completed to establish a baseline for comparison with future development scenarios and to ascertain whether there are any existing capacity constraints.

4.0 Potable Water System

The Almonte Ward is the only area in the Municipality that is serviced by a communal water system. The Almonte Ward is generally supplied by five groundwater wells, one elevated potable water storage tank, and approximately 35km of watermains, as illustrated on Figure 6.

4.1 Existing Potable Water System

The communal water system is supplied by five groundwater wells identified as 3, 5, 6, 7, and 8, as shown on Figure 6.

Well 3 is located near Ottawa Street in the northeast end of Municipality. This Well was constructed in 1948 and is a 250mm diameter borehole extending to a depth of 47.5m below the ground surface. The Well is equipped with a vertical turbine pump and enclosed within a vented weather tight masonry block and brick pump house. Well 3 is also equipped with a chlorination system and associated instrumentation.

Well 5 is located in the municipal works yard on the west side of the Mississippi River. This Well was constructed in 1970 and is a 203mm diameter borehole extending to a depth of 38.1m below the ground surface, equipped with a submersible pump and enclosed within a vented weathertight masonry block and aluminum clad pump house. Well 5 is also equipped with a chlorination system and associated instrumentation.

Well 6 is located in Gemmill Park, near Christian Street, on the west side of the Mississippi River. This Well was constructed in 1973 and is a 254mm borehole extending to a depth of 48.8m below the ground surface, with a steel casing to a depth of 10m. It is equipped with a vertical turbine pump and enclosed within a vented weathertight masonry block and wood siding pump house. Well 6 is also equipped with a chlorination system and associated instrumentation.

Wells 7 and 8 are located on Paterson Street on the east edge of Municipality and are approximately 5m apart in the same building. Wells 7 and 8 were constructed in 1990/91, are 254mm boreholes extending to a depth of 79.2m below the ground surface, and have a steel casing to a depth of 13.41m. They are equipped with vertical turbine pumps and enclosed within a vented weathertight masonry block and brick or vinyl siding pump house. The Wells are also equipped with a chlorination system and associated instrumentation.

The water distribution system includes an elevated water storage tank (2,840m^3 nominal capacity) and piping network. The elevated storage tank, constructed in 1992, is located in the northeast quadrant of the Municipality near Wells 7 and 8. The piping network generally consists of polyvinyl chloride, ductile iron and cast iron piping ranging in size from 50mm to 200mm in diameter. It is understood that some of the piping is the original infrastructure dating back to 1930 and earlier.

Table 8: Historic Potable Water Demands (January 2012 to December 2016)

Year	Average Day Demand	Maximum Day Demand
2012	23.4L/s (2,024m^3/d)	43.4L/s (3,754m^3/d)
2013	20.6L/s (1,780m^3/d)	37.8L/s (3,267m^3/d)
2014	19.0L/s (1,641m^3/d)	34.8L/s (3,011m^3/d)
2015	18.4L/s (1,592m^3/d)	37.4L/s (3,228m^3/d)
2016	18.6L/s (1,605m^3/d)	39.1L/s (3,380m^3/d)
Average/Max (2012-2016)	**20.0L/s (1,729m^3/d)**	**43.4L/s (3,754m^3/d)**
Average/Max (2008-2011)	**20.0L/s (1,729m^3/d)**	**38.1L/s (3,893m^3/d)**

Based on the 2016 Almonte Ward design population of 5,039 people and the average day demands, an equivalent per capita average day flow of 343L/c/d is calculated, which is typical for communities of similar size. This is slightly lower than the 352L/c/d calculated in the 2012 Master Plan. Overall, water demands have not changed significantly since the original report.

4.3 Potable Water System Design Criteria

Table 9 provides a summary of the water demand rates used to evaluate the Municipality's water system.

Table 9: Design Criteria - Water Demand Rates

Land Use	Design Criteria	Maximum Day Factor
Existing and Future Residential	350L/cap/day	2.5
Existing and Future Light Industrial	35,000L/ha/day	1.5
Existing and Future Commercial	28,000L/ha/day	1.5

Water pumping stations or wells are rated on their 'firm' pumping capacity. Firm capacity is based on the capacity of the station or system with the largest pump out of service. Pumping stations or well systems are sized based on maximum day flows for areas with sufficient water storage volume, and on peak hour flows for areas without sufficient storage. Storage capacities are based on MOECC Guidelines for Drinking Water Systems (MOECC, 2008). The total storage capacity requirements for a pressure zone are the sum of the equalization storage, fire storage, and emergency storage allowances. These design criteria are summarized in Table 10.

4.8.3 Long-Term (10 to 20 Years): Water Distribution

The long-term water distribution system servicing options identified to address the required fire flow and system pressures include:

- Appleton Side Road Looping: This watermain extension will maintain minimum peak hour pressures in the northeast quadrant. This was envisioned as a long-term need in the 2012 Master Plan.

- Create Pressure Zone 3: This new pressure zone, which was also envisioned as a long-term need in the 2012 Master Plan, will improve pressure management to the island.

It is noted that the 2012 Master Plan also envisioned long-term upgrades on Victoria Street and modifications to PZ-2. The Victoria Street upgrades are currently underway (design ongoing), and now identified in the 0 to 5 year timeframe, and the vision for PZ-2 modifications are now recommended under the 5 to 10 year timeframe.

The opinions of probable costs associated with the long-term water distribution servicing strategies are summarized in Table 19.

Table 19: Opinion of Probable Costs Long-Term Water Distribution

Option	Diameter (mm)	Length (m)	Rate ($/m)(1)	Engineering and Contingency (27%)	Rounded Total(3)
Appleton Side Road Looping	250	435	$1,100	$129,000	$598,000
Create Pressure Zone 3	$100,000(2)			$27,000	$125,000

1. Rates based on City of Ottawa 2015 Unit Rates for watermain, restoration of road (granular, base and wear) and curb, and other past experience.
2. Allowance.
3. Rounded to the nearest $5,000.

4.8.4 Build-Out: Water Distribution System

The build-out water distribution system servicing options identified to address the required fire flow and system pressures are described below. As previously noted, this build-out review offers a broad level overview of potential solutions beyond the 20-year servicing needs.

- Mississippi River Fourth Crossing: This will service build-out Areas 3 and 4.

- County Road 29: This will service build-out Areas 3 and 4.

- Scott Street Looping: This will service build-out Areas 3 and 4.

- Appleton Side Road: This will service build-out Area 1.

- Bridge Street Watermain Extension: This will service build-out Areas 3 and 4, and build-out industrial areas near the Wastewater Treatment Plant.

- Paterson Street Watermain Extension from Tower Street to Ottawa Street: This will service all build-out areas.

- Maude Street to Future Adelaide Street: This will service build-out Area 2.

The opinions of probable costs associated with the build-out water distribution servicing strategies are summarized in Table 20.

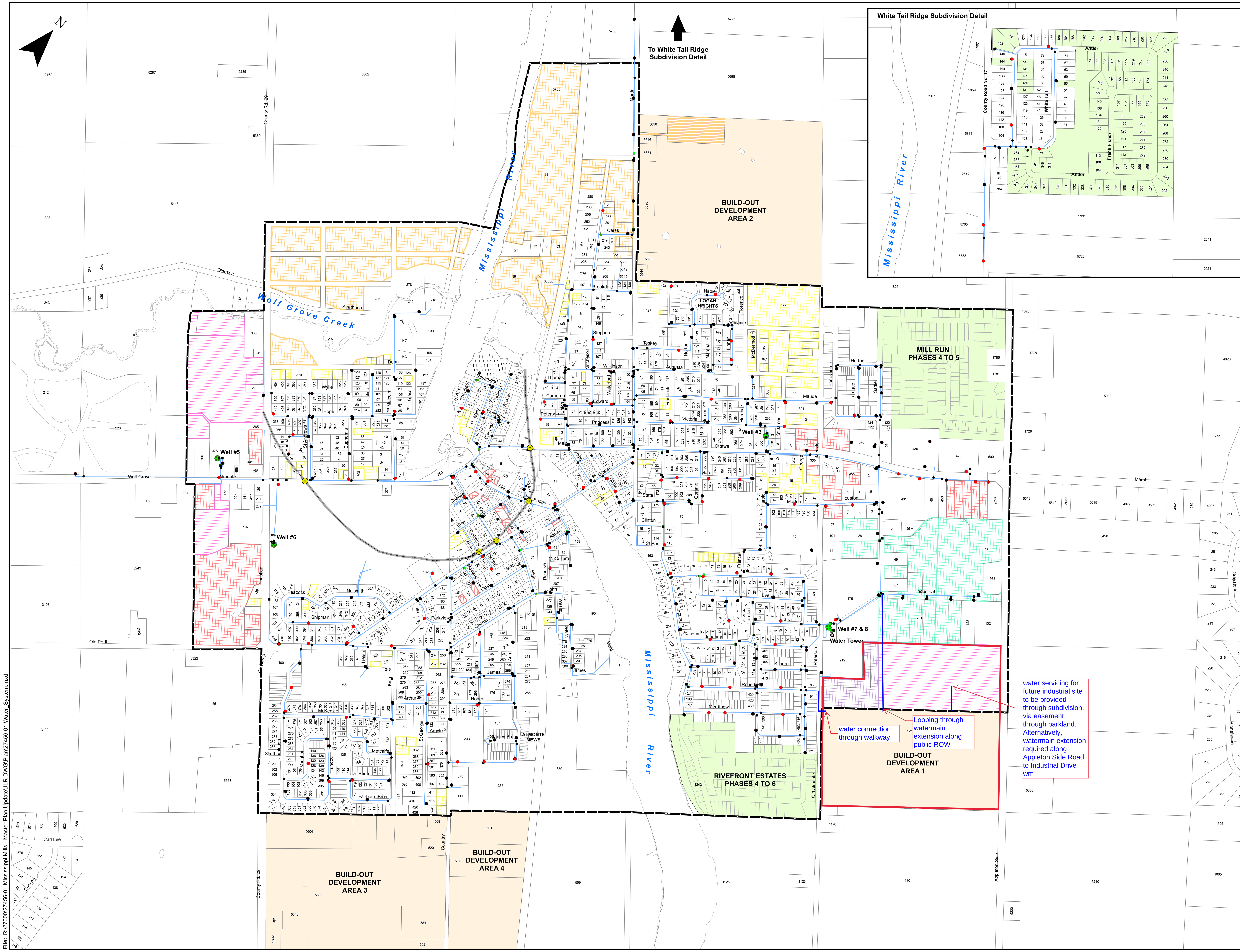
Table 20: Opinion of Probable Costs Build-Out Water Distribution

Option	Diameter (mm)	Length (m)	Rate ($/m)[1]	Engineering and Contingency (27%)	Rounded Total[3]
Mississippi River Fourth Crossing – Riverfront Estates to West Side of River	300	500	$10,000[2]	$1,350,000	$6,350,000
Mississippi River Fourth Crossing – West Side of River to Country Street	300	476	$1,090	$140,000	$660,000
County Road 29	250	711	$1,100	$211,000	$995,000
Scott Street Looping	200	80	$1,030	$22,000	$105,000
Appleton Side Road	250	490	$1,100	$146,000	$685,000
Bridge Street Watermain Extension	300	140	$1,090	$41,000	$195,000
Paterson Street Watermain Extension	300	633	$1,090	$186,000	$875,000
Maude Street to Future Adelaide Street	300	261	$1,090	$77,000	$360,000

1. Rates based on City of Ottawa 2015 Unit Rates for watermain, restoration of road (granulars, base and wear) and curb, and other past experience.
2. High level estimate for rock boring below Mississippi River.
3. Rounded to the nearest $5,000.

4.9 Summary of Potable Water Servicing Strategies

A summary of the water supply and treatment, storage and distribution servicing strategies and opinion of probable costs are presented in Table 21 and Figure 17.



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PROJECT:

MUNICIPALITY OF MISSISSIPPI MILLS ALMONTE WARD WATER AND WASTEWATER INFRASTRUCTURE MASTER PLAN UPDATE

MISSISSIPPI MILLS, ONTARIO

DRAWING:

ALMONTE WARD WATER SYSTEM

DESIGN: MB
DRAWN: KTK
CHECKED: SG
JLR #: 27456-01

DRAWING #: **FIGURE 6**

PLOT DATE: January 5, 2018 8:27:07 AM

File: R:\27000\27456-01 Mississippi Mills - Master Plan Update\JLR DWG\Plan\27456-01 Water System.mxd

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MUNICIPALITY OF MISSISSIPPI MILLS ALMONTE WARD WATER AND WASTEWATER INFRASTRUCTURE MASTER PLAN UPDATE

MISSISSIPPI MILLS, ONTARIO

DRAWING:

ALMONTE WARD WATER SYSTEM SERVICING STRATEGIES SUPPLY STORAGE DISTRIBUTION

DESIGN: MB
DRAWN: KTK
CHECKED: SG
JLR #: 27456-01

DRAWING #: **FIGURE 17**

PLOT DATE: January 26, 2018 11:13:39 AM

File: R:\27000\27456-01 Mississippi Mills - Master Plan Update\JLR DWG\Plan\17_27456-01 AlmonteGrowth BuildOut_WaterUpgrades.mxd

White Tail Ridge Subdivision Detail
To White Tail Ridge Subdivision Detail
Max Day + Fire Flow
< 32 L/s
33 to 50 L/s
51 to 67 L/s
68 to 75 L/s
76 to 100 L/s
100 to 300 L/s
Infrastructure
Pressure Reducing Valve
Well
Water Tower
Pressure Zone
Watermain
Land Use
Almonte Ward Limits
Existing Lots
Future Lots
Closed Waste Disposal Site
Registered Subdivision
Build Out
Business Park (17.0 ha)
Community Facility (3.1 ha)
Commercial (15.6 ha)
Industrial (24.1 ha)
Residential - Geenfield (34.2 ha)
Residential - Infill (16.0 ha)
BUILD-OUT DEVELOPMENT AREA 1
BUILD-OUT DEVELOPMENT AREA 2
BUILD-OUT DEVELOPMENT AREA 3
BUILD-OUT DEVELOPMENT AREA 4
MILL RUN PHASES 4 TO 5
RIVEFRONT ESTATES PHASES 4 TO 6
LOGAN HEIGHTS
ALMONTE MEWS
Well #3
Well #5
Well #6
Well #7 & 8
Water Tower
Mississippi River
Wolf Grove Creek
NEED TO REQUEST BOUNDARY CONDITIONS WITH ADDITIONAL CONNECTION TO INDUSTRIAL TO ASSESS PRESSURES AND FIRE FLOWS
No.
ISSUE / REVISION
DD/MM/YY
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PROJECT:
MUNICIPALITY OF MISSISSIPPI MILLS
ALMONTE WARD WATER AND WASTEWATER INFRASTRUCTURE MASTER PLAN UPDATE
MISSISSIPPI MILLS, ONTARIO
DRAWING:
ALMONTE WARD WATER SYSTEM BUILD-OUT (2037+) MAX DAY DEMAND / FIRE FLOW
DESIGN: MB
DRAWN: KTK
CHECKED: SG
JLR #: 27456-01
DRAWING #:
FIGURE 15
PLOT DATE: January 5, 2018 2:34:35 PM

2.0 BACKROUND STUDIES

Background studies that have been completed for the proposed site include Mississippi Mills as-built drawings, a topographical survey and a geotechnical report.

As-built drawings of existing services within the vicinity of the proposed site were reviewed in order to determine accurate servicing and stormwater management schemes for the site.

A topographic survey of the site was completed by Annis, O'Sullivan Vollebekk.

3.0 WATERMAIN

3.1 Existing Watermain

There is an existing 250mm diameter PVC watermain within Industrial Drive. The watermain services the adjacent properties as well as the fire hydrants along Industrial Drive. Industrial Drive is immediately downstream of the Town's main groundwater pump station and elevated water storage tank.

3.2 Proposed Watermain

A new 250mm diameter PVC watermain is proposed to be extended from Industrial Drive down the Gerry Emon Road right-of-way to service the site. The watermain will also extend to the end of the right-of-way to service future development land. The watermain will loop within the private site with sizes ranging from 150 mm to 200 mm. Four hydrants have been proposed within the ROW. There are also two private hydrants proposed on the site. The watermain is designed to have a minimum of 2.4m cover.

The Fire Underwriters Survey 1999 (FUS) method was utilized to determine the required fire flow for the site. The results of the calculations yielded a total required fire flow of 16,000 L/min. The detailed calculations for the FUS can be found in Appendix 'B'.

The water demands for the proposed development have been calculated to adhere to the Ottawa Design Guidelines – Water Distribution manual and can be found in Appendix 'B'. The results have been summarized below:

Table 1: Water Demands

	Main Building	Blocks
Population	68	130
Residential	350 L/c/day	350 L/c/day
Average Day Demand (L/s)	0.28	0.53
Maximum Daily Demand (L/s)	0.69	1.32

Peak Hourly Demand (L/s)	1.52	2.90
FUS Fire Flow Requirement (L/min)	5,000	11,000

Boundary Conditions have been requested however were not available at the time of submission. Once boundary conditions are obtained, the subject property will be hydraulically modelled using WaterCAD to confirm the system has adequate capacity for the proposed development and the required fire flows can be met.

To confirm the adequacy of fire flow to protect the proposed development, public and private fire hydrants within 150 m of the proposed building were analysed per City of Ottawa ISTB 2018-02 Appendix I Table 1. The results are demonstrated below.

Table 2: Fire Protection Confirmation

Building	Fire Flow Demand (L/min.)	Fire Hydrant(s) within 75m	Fire Hydrant(s) within 150m	Combined Fire Flow (L/min.)
Proposed Site	16,000	3	2	24,700

A.5 Water Modeling Results

Stantec

16040170- Mill Valley Estates Development Project

Phase 1A- Model Results

ADD Scenario				
Node ID	Elevation (m)	Demand (L/s)	Pressure (psi)	Hydraulic Grade (m)
11	134.74	0.07	65	180.63
21	134.97	0.4	65	180.64
33	137.1	0	62	180.66
34	135.36	0.04	64	180.65
38	134.9	0.04	65	180.64
40	134.93	0.08	65	180.63
41	134.87	0.17	65	180.63
43	135.24	0.21	65	180.63
45	135.2	0.19	65	180.63
J-1	134.79	0.07	65	180.64
J-2	134.95	0.24	65	180.63
J-3	134.99	0.2	65	180.63
PHD Scenario				
Node ID	Elevation (m)	Demand (L/s)	Pressure (psi)	Hydraulic Grade (m)
11	134.74	0.39	63	178.76
21	134.97	1.29	62	178.8
33	137.1	0	60	178.99
34	135.36	0.19	62	178.87
38	134.9	0.24	62	178.79
40	134.93	0.45	62	178.75
41	134.87	0.91	62	178.76
43	135.24	1.15	62	178.75
45	135.2	1.03	62	178.73
J-1	134.79	0.39	63	178.76
J-2	134.95	1.27	62	178.75
J-3	134.99	1.12	62	178.75
MDD+FF				
Label	Elevation (m)	Hydraulic Grade (m)	Pressure (Calculated Residual) (psi)	Fire Flow (Needed) (L/s)
11	134.74	170.69	21.5	192
21	134.97	171	32.1	192
33	137.1	172.19	33.4	192
34	135.36	171.4	32	192
38	134.9	170.89	27.5	192
40	134.93	170.61	20	192
41	134.87	170.67	20	192
43	135.24	170.62	29.7	192
45	135.2	170.24	34.2	192
J-1	134.79	170.71	25.8	192
J-2	134.95	170.63	25.1	192
J-3	134.99	170.58	24.5	192

Stantec

16040170- Mill Valley Estates Development Project

Phase 1A+B- Model Results

ADD Scenario				
Node ID	Elevation (m)	Demand (L/s)	Pressure (psi)	Hydraulic Grade (m)
11	134.74	0.07	65.2	180.63
21	134.97	0.4	64.9	180.64
33	137.1	0	61.9	180.66
34	135.36	0.04	64.4	180.64
37	133.32	0.17	67.3	180.63
38	134.9	0.04	65	180.63
40	134.93	0.08	65	180.63
41	134.87	0.17	65.1	180.63
42	133.44	0.27	67.1	180.63
43	135.24	0.21	64.5	180.63
44	133.58	0.29	66.9	180.63
45	135.2	0.19	64.6	180.63
J-1	134.79	0.07	65.2	180.63
J-2	134.95	0.23	64.9	180.63
J-3	134.99	0.2	64.9	180.63

PHD Scenario				
Node ID	Elevation (m)	Demand (L/s)	Pressure (psi)	Hydraulic Grade (m)
11	134.74	0.39	62.5	178.71
21	134.97	1.29	62.3	178.77
33	137.1	0	59.5	178.97
34	135.36	0.19	61.8	178.83
37	133.32	0.91	64.5	178.7
38	134.9	0.24	62.3	178.75
40	134.93	0.45	62.2	178.7
41	134.87	0.91	62.3	178.7
42	133.44	1.5	64.3	178.7
43	135.24	1.15	61.8	178.72
44	133.58	1.62	64.1	178.7
45	135.2	1.03	61.8	178.7
J-1	134.79	0.39	62.4	178.71
J-2	134.95	1.28	62.2	178.71
J-3	134.99	1.11	62.1	178.7

16040170- Mill Valley Estates Development Project

Phase 1A+B- Model Results

MDD+FF				
Label	Elevation (m)	Hydraulic Grade (m)	Pressure (Calculated Residual) (psi)	Fire Flow (Needed) (L/s)
11	134.74	170.6	22.4	192
21	134.97	170.94	31.9	192
33	137.1	172.16	33.3	192
34	135.36	171.34	31.9	192
37	133.32	170.58	20	192
38	134.9	170.82	27.4	192
40	134.93	170.55	20.8	192
41	134.87	170.58	20.2	192
42	133.44	170.58	20	192
43	135.24	170.55	29.5	192
44	133.58	170.56	20	192
45	135.2	170.19	34	192
J-1	134.79	170.63	25.8	192
J-2	134.95	170.56	24.8	192
J-3	134.99	170.52	24.8	192

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16040170- Mill Valley Estates Development Project

Ultimate Build-out- Model Results

ADD Scenario				
Node ID	Elevation (m)	Demand (L/s)	Pressure (psi)	Hydraulic Grade (m)
0	133.21	0.28	67.4	180.6
1	133.44	0.25	67	180.6
2	133.49	0.24	67	180.6
3	133.58	0.21	66.8	180.6
4	133.66	0.22	66.7	180.6
8	133.43	0.31	67.1	180.6
9	133.28	0.1	67.3	180.6
10	133.66	0.29	66.7	180.61
11	134.74	0.22	65.2	180.61
12	134.13	0.2	66.1	180.61
14	133.35	0.28	67.2	180.6
15	134.69	0.15	65.3	180.6
16	134.54	0.06	65.5	180.6
17	134.77	2.55	65.1	180.6
21	134.97	0.51	64.9	180.62
28	134.65	0.16	65.3	180.61
33	137.1	1.06	61.9	180.64
34	135.36	0.03	64.4	180.63
37	133.32	0.17	67.2	180.61
38	134.9	0.04	65	180.61
40	134.93	0.07	64.9	180.61
41	134.87	0.17	65	180.61
42	133.44	0.26	67.1	180.61
43	135.24	0.21	64.5	180.62
44	133.58	0.28	66.9	180.61
45	135.2	0.19	64.6	180.62
J-1	134.79	0.16	65.1	180.61
J-2	134.95	0.23	64.9	180.61
J-3	134.99	0.2	64.9	180.61

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16040170- Mill Valley Estates Development Project

Ultimate Build-out- Model Results

PHD Scenario				
Node ID	Elevation (m)	Demand (L/s)	Pressure (psi)	Hydraulic Grade (m)
0	133.21	0.28	67.4	180.6
1	133.44	0.25	67	180.6
2	133.49	0.24	67	180.6
3	133.58	0.21	66.8	180.6
4	133.66	0.22	66.7	180.6
8	133.43	0.31	67.1	180.6
9	133.28	0.1	67.3	180.6
10	133.66	0.29	66.7	180.61
11	134.74	0.22	65.2	180.61
12	134.13	0.2	66.1	180.61
14	133.35	0.28	67.2	180.6
15	134.69	0.15	65.3	180.6
16	134.54	0.06	65.5	180.6
17	134.77	2.55	65.1	180.6
21	134.97	0.51	64.9	180.62
28	134.65	0.16	65.3	180.61
33	137.1	1.06	61.9	180.64
34	135.36	0.03	64.4	180.63
37	133.32	0.17	67.2	180.61
38	134.9	0.04	65	180.61
40	134.93	0.07	64.9	180.61
41	134.87	0.17	65	180.61
42	133.44	0.26	67.1	180.61
43	135.24	0.21	64.5	180.62
44	133.58	0.28	66.9	180.61
45	135.2	0.19	64.6	180.62
J-1	134.79	0.16	65.1	180.61
J-2	134.95	0.23	64.9	180.61
J-3	134.99	0.2	64.9	180.61

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16040170- Mill Valley Estates Development Project

Ultimate Build-out- Model Results

MDD+FF				
Label	Elevation (m)	Hydraulic Grade (m)	Pressure (Calculated Residual) (psi)	Fire Flow (Needed) (L/s)
0	133.21	170.22	20	192
1	133.44	170.21	20	192
2	133.49	170.21	20	192
3	133.58	170.21	20	192
4	133.66	170.21	20	192
8	133.43	170.21	20	192
9	133.28	170.22	20	192
10	133.66	170.22	20	192
11	134.74	170.19	24.6	192
12	134.13	170.25	20	192
14	133.35	170.22	20	192
15	134.69	170.23	20	192
16	134.54	170.21	20	192
17	134.77	170.21	20	192
21	134.97	170.41	30.6	192
28	134.65	170.26	20	192
33	137.1	171.83	32.3	192
34	135.36	170.88	30.6	192
37	133.32	170.18	20	192
38	134.9	170.3	27	192
40	134.93	170.15	21.5	192
41	134.87	170.18	21.9	192
42	133.44	170.17	20	192
43	135.24	170.15	28	192
44	133.58	170.16	20	192
45	135.2	169.89	33	192
J-1	134.79	170.2	26	192
J-2	134.95	170.15	24.2	192
J-3	134.99	170.13	24.6	192

Appendix B Wastewater Servicing

B.1 Sanitary Sewer Design Sheet

Stantec

SUBDIVISION: **Mill Valley Estates**

DATE: 11/21/2023
REVISION: 3
DESIGNED BY: WAJ
CHECKED BY: MW

FILE NUMBER: 160401740

SANITARY SEWER DESIGN SHEET
(City of Ottawa)

DESIGN PARAMETERS

MAX PEAK FACTOR (RES.)=	4.0	AVG. DAILY FLOW / PERSON	350 l/p/day	MINIMUM VELOCITY	0.60 m/s
MIN PEAK FACTOR (RES.)=	2.0	COMMERCIAL	28,000 l/ha/day	MAXIMUM VELOCITY	3.00 m/s
PEAKING FACTOR (INDUSTRIAL):	2.4	INDUSTRIAL (HEAVY)	55,000 l/ha/day	MANNINGS n	0.013
PEAKING FACTOR (ICI >20%):	1.5	INDUSTRIAL (LIGHT)	35,000 l/ha/day	BEDDING CLASS	B
PERSONS / SINGLE	3.4	INSTITUTIONAL	28,000 l/ha/day	MINIMUM COVER	2.50 m
PERSONS / TOWNHOME	2.7	INFILTRATION	0.28 l/s/Ha	HARMON CORRECTION FACTOR	0.8
PERSONS / APARTMENT	1.8				

LOCATION			RESIDENTIAL AREA AND POPULATION									COMMERCIAL		INDUSTRIAL (L)		INDUSTRIAL (H)		INSTITUTIONAL		GREEN / UNUSED		C+I+I	INFILTRATION			TOTAL	PIPE							
AREA ID NUMBER	FROM M.H.	TO M.H.	AREA (ha)	UNITS SINGLE	UNITS TOWN	UNITS APT	POP.	CUMULATIVE AREA (ha)	CUMULATIVE POP.	PEAK FACT.	PEAK FLOW (l/s)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	PEAK FLOW (l/s)	TOTAL AREA (ha)	ACCU. AREA (ha)	INFILT. FLOW (l/s)	FLOW (l/s)	LENGTH (m)	DIA (mm)	MATERIAL	CLASS	SLOPE (%)	CAP. (FULL) (l/s)	CAP. V PEAK FLOW (%)	VEL. (FULL) (m/s)
R17A	17	4	1.48	16	26	0	125	1.48	125	3.57	1.8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	1.48	1.48	0.4	2.2	184.1	200	PVC	SDR 35	0.32	18.9	**11.73%**	0.60
R41A	41	40	0.84	12	0	0	41	0.84	41	3.67	0.6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.84	0.84	0.2	0.8	73.6	200	PVC	SDR 35	0.32	18.9	**4.44%**	0.60
	40	39	0.00	0	0	0	0	0.84	41	3.67	0.6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.00	0.84	0.2	0.8	25.4	200	PVC	SDR 35	0.32	18.9	**4.44%**	0.60
	39	5	0.00	0	0	0	0	0.84	41	3.67	0.6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.00	0.84	0.2	0.8	63.7	200	PVC	SDR 35	0.32	18.9	**4.44%**	0.60
R7A, R7C, I7B	7	6	4.18	0	7	0	282	4.18	282	3.47	4.0	0.00	0.00	0.00	0.00	0.00	0.00	0.98	0.98	0.00	0.00	0.3	5.16	5.16	1.4	5.7	28.2	200	PVC	SDR 35	0.32	18.9	**30.28%**	0.60
	6	5	0.00	0	0	0	0	4.18	282	3.47	4.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.98	0.00	0.00	0.3	0.00	5.16	1.4	5.7	47.1	200	PVC	SDR 35	0.32	18.9	**30.28%**	0.60
R19A	19	18	0.91	0	26	0	70	0.91	70	3.63	1.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.91	0.91	0.3	1.3	162.6	200	PVC	SDR 35	0.50	23.6	**5.43%**	0.74
	18	5	0.00	0	0	0	0	0.91	70	3.63	1.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.00	0.91	0.3	1.3	26.8	200	PVC	SDR 35	0.50	23.6	**5.43%**	0.74
R5A	5	4	0.56	0	11	0	30	6.48	423	3.41	5.8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.98	0.00	0.00	0.3	0.56	7.46	2.1	8.2	86.0	200	PVC	SDR 35	0.32	18.9	**43.58%**	0.60
	4	3A	0.00	0	0	0	0	7.97	547	3.36	7.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.98	0.00	0.00	0.3	0.00	8.95	2.5	10.3	34.0	200	PVC	SDR 35	0.32	18.9	**54.33%**	0.60
R52A	52	50	1.31	17	18	0	106	1.31	106	3.59	1.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	1.31	1.31	0.4	1.9	141.6	200	PVC	SDR 35	0.50	23.6	**8.10%**	0.74
R51A	51	50	0.40	0	17	0	46	0.40	46	3.66	0.7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.40	0.40	0.1	0.8	69.0	200	PVC	SDR 35	0.50	23.6	**3.35%**	0.74
	50	3A	0.00	0	0	0	0	1.71	152	3.55	2.2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.00	1.71	0.5	2.7	80.0	200	PVC	SDR 35	0.50	23.6	**11.30%**	0.74
	3A	3	0.00	0	0	0	0	9.68	700	3.32	9.4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.98	0.00	0.00	0.3	0.00	10.66	3.0	12.7	46.0	200	PVC	SDR 35	0.32	18.9	**67.13%**	0.60
R38A	38	37	1.19	22	0	0	75	1.19	75	3.62	1.1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	1.19	1.19	0.3	1.4	129.1	200	PVC	SDR 35	0.80	29.9	**4.78%**	0.94
R37A	37	35	0.79	0	22	0	59	1.97	134	3.57	1.9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.79	1.97	0.6	2.5	80.0	200	PVC	SDR 35	0.32	18.9	**13.17%**	0.60
R36A	36	35	0.82	16	0	0	54	0.82	54	3.65	0.8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.82	0.82	0.2	1.0	109.0	200	PVC	SDR 35	1.00	33.4	**3.09%**	1.05
	35	34	0.00	0	0	0	0	2.79	189	3.53	2.7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.00	2.79	0.8	3.5	80.0	200	PVC	SDR 35	0.40	21.1	**16.44%**	0.67
R34A	34	3	0.83	13	0	0	44	3.62	233	3.50	3.3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.83	3.62	1.0	4.3	144.5	200	PVC	SDR 35	0.40	21.1	**20.39%**	0.67
R33A	33	32	1.51	26	0	0	88	1.51	88	3.61	1.3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	1.51	1.51	0.4	1.7	196.0	200	PVC	SDR 35	0.32	18.9	**9.06%**	0.60
R32A	32	30	0.87	0	35	0	95	2.38	183	3.53	2.6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.87	2.38	0.7	3.3	80.0	200	PVC	SDR 35	0.32	18.9	**17.34%**	0.60
	30	3	0.00	0	0	0	0	2.38	183	3.53	2.6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.00	2.38	0.7	3.3	80.0	200	PVC	SDR 35	0.32	18.9	**17.34%**	0.60
	3	2	0.00	0	0	0	0	15.68	1115	3.22	14.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.98	0.00	0.00	0.3	0.00	16.66	4.7	19.5	34.5	250	PVC	SDR 35	0.32	34.3	**56.87%**	0.69
R16A	16	15	1.74	0	58	0	157	1.74	157	3.55	2.3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	1.74	1.74	0.5	2.7	216.4	200	PVC	SDR 35	0.32	18.9	**14.47%**	0.60
R15A	15	14	1.75	34	0	0	116	3.49	272	3.48	3.8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	1.75	3.49	1.0	4.8	206.0	200	PVC	SDR 35	0.32	18.9	**25.43%**	0.60
R14A	14	9	1.08	20	0	0	68	4.56	340	3.44	4.7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	1.08	4.56	1.3	6.0	80.0	200	PVC	SDR 35	0.32	18.9	**31.85%**	0.60
R11A	11	10	1.43	30	0	0	102	1.43	102	3.59	1.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	1.43	1.43	0.4	1.9	209.9	200	PVC	SDR 35	0.50	23.6	**7.97%**	0.74
R13A	13	12	0.96	0	36	0	97	0.96	97	3.60	1.4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.96	0.96	0.3	1.7	209.8	200	PVC	SDR 35	0.50	23.6	**7.13%**	0.74
I12B, R12A	12	10	0.92	7	15	0	64	1.88	162	3.54	2.3	0.00	0.00	0.00	0.00	0.00	0.00	0.48	0.48	0.00	0.00	0.2	1.40	2.36	0.7	3.2	80.0	200	PVC	SDR 35	0.32	18.9	**16.99%**	0.60
	10	9	0.00	0	0	0	0	3.31	264	3.48	3.7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.48	0.00	0.00	0.2	0.00	3.79	1.1	4.9	80.0	200	PVC	SDR 35	0.32	18.9	**26.08%**	0.60
	9	8	0.00	0	0	0	0	7.87	604	3.34	8.2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.48	0.00	0.00	0.2	0.00	8.35	2.3	10.7	66.3	200	PVC	SDR 35	0.32	18.9	**56.43%**	0.60
R26A, C26B	26	25	0.39	0	11	0	30	0.39	30	3.68	0.4	7.56	7.56	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.7	7.95	7.95	2.2	6.3	82.6	200	PVC	SDR 35	0.32	18.9	**33.54%**	0.60
R25A	25	23	0.34	0	0	0	0	0.72	30	3.68	0.4	0.00	7.56	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.7	0.34	8.28	2.3	6.4	80.0	200	PVC	SDR 35	0.32	18.9	**34.03%**	0.60
	23	21	0.00	0	0	0	0	0.72	30	3.68	0.4	0.00	7.56	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.7	0.00	8.28	2.3	6.4	80.0	200	PVC	SDR 35	0.32	18.9	**34.03%**	0.60
R21A	21	8	0.72	13	0	0	44	1.44	74	3.62	1.1	0.00	7.56	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.7	0.72	9.00	2.5	7.3	160.0	200	PVC	SDR 35	0.32	18.9	**38.49%**	0.60
R8A	8	2	1.36	27	0	0	92	10.68	769	3.30	10.3	0.00	7.56	0.00	0.00	0.00	0.00	0.00	0.48	0.00	0.00	3.9	1.36	18.72	5.2	19.4	169.0	300	PVC	SDR 35	0.24	47.0	**41.30%**	0.67
	2	1	0.00	0	0	0	0	26.36	1885	3.08	23.5	0.00	7.56	0.00	0.00	0.00	0.00	0.00	1.46	0.00	0.00	4.4	0.00	35.38	9.9	37.8	19.1	375	PVC	SDR 35	0.20	72.6	**52.13%**	0.69
			26.36	253	282	0	1885					7.56		0.00		0.00		1.46		0.00			35.38					375						

Notes
1. The population estimate for the Mill Valley Living (Sanitary Drainage Area ID# R7C) was obtained from McIntosh Perry Servicing Report as 229 (92 units). The number of units has been increased by 15% which results in 14 additional units at 2.3p/unit which results in total population for Mill Valley Living of 263.

B.2 Background Report Excerpts – Wastewater Servicing

Table 24: Raw Sewage Bypasses at Gemmill's Bay SPS (2012 to Present)

Year	Number of Events	Total Duration (h)
2012	2	7.8
2013	1	3.0
2014	2	23.1
2015	1	1.5
2016	0	0.0
2017 (to Oct. 30)	8	155.3

It is also noted for reference that tertiary filtration bypasses have recently occurred at the WWTP in 2016 and 2017 (since its construction in 2012). The majority of these events were generally noted as being due to heavy precipitation events, mostly during 2017, a particularly wet year.

5.3 Wastewater System Design Criteria

Table 25 provides a summary of the residential wastewater generation rates to be used to assess and size the Municipality's wastewater system. It is noted that the existing residential wastewater flow generation values were determined by a flow monitoring program conducted by the Municipality in the spring of 2011 at seven various locations throughout the wastewater system.

Table 25: Design Criteria - Wastewater Flow Generation

Parameter	Average Day Dry Weather Flow	Dry Weather Peaking Factor	Baseline Infiltration	Wet Weather Extraneous Flow	Wet Weather Peaking Factor
Existing Residential	200L/cap/day	1.5	0.1L/s/ha	0.15L/s/ha	4
Parameter	**Average Day Flow**	**Extraneous Flow**	**Peaking Factor**		
Future Residential	350L/cap/day	0.28L/s/ha	Varies based on Harmon Peaking Factor		
Existing and Future Industrial	35,000L/ha/day	0.28L/s/ha	2.7		
Existing and Future Institutional and Commercial	28,000L/ha/day	0.28L/s/ha	1.5		

The wet weather peaking factor was increased from a factor 3 used in the 2012 Master Plan to a factor of 4 in the Master Plan update, based on the April 2014 wet weather event. Bypass flow was observed at the Gemmill's Bay SPS during the April 2014 event, but no data is available on peak bypass flow rate or volume. The unaccounted for bypass flow could result in a further increase to the wet weather peaking factor. However, any estimated bypass flow rate uniformly attributed to the entire wastewater collection system could generate unrealistic peak flow conditions requiring extensive and potentially unwarranted capacity upgrades. Based on

Table 34: Opinion of Probable Costs Long-Term Wastewater Collection

Option	Diameter (mm)	Length (m)	Rate ($/m)(1)	Engineering and Contingency (27%)	Rounded Total(2)
Union Street (from 225mm to 300mm to match existing)	300	145	$1,060	$41,000	$195,000

1. Rates based on City of Ottawa 2015 Unit Rates for sewers, restoration of road (granulars, base and wear) and curb, and other past experience.
2. Rounded to the nearest $5,000.

5.8.4 Build-Out: Wastewater Collection

Based on a review of development impacts on the wastewater collection system, the following build-out upgrades were identified:

- Martin Street South, from Ottawa Street to Queen Street: This upgrade will service build-out areas 1 and 2.
- Martin Street North, from Victoria Street to Ottawa Street: This upgrade will service build-out areas 1 and 2.

The opinion of probable costs associated with the build-out wastewater collection servicing strategy is summarized in Table 35.

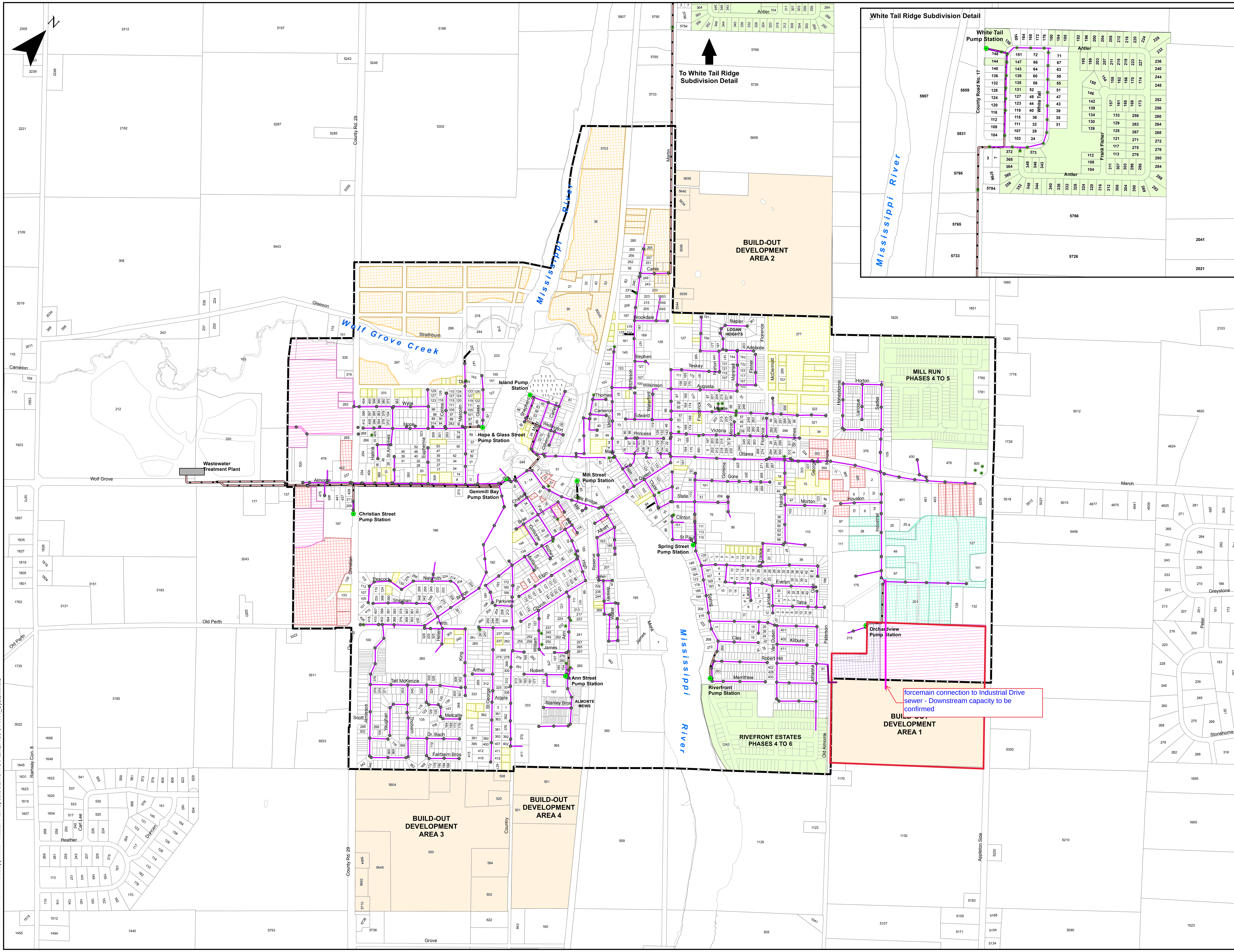
Table 35: Opinion of Probable Costs Build-Out Wastewater Collection

Option	Diameter (mm)	Length (m)	Rate ($/m)(1)	Engineering and Contingency (27%)	Rounded Total(2)
Martin Street South, from Ottawa Street to Queen Street	525	27	$1,660	$12,000	$55,000
Martin Street North, from Victoria Street to Ottawa Street	450	85	$1,630	$37,000	$175,000

1. Rates based on City of Ottawa 2015 Unit Rates for sewers, restoration of road (granulars, base and wear) and curb, estimated traffic control for Ottawa Street and Queen Street detours and other past experience.
2. Rounded to the nearest $5,000.

5.9 Summary of Wastewater Servicing Strategies

A summary of the wastewater treatment, pumping and collection servicing strategies, and opinion of probable costs are presented in Table 36 and Figure 24. Figure 25 was also developed to assist the Municipality in understanding demand allocations for the future servicing strategies and illustrated whether the wastewater flows were modelled under a pumped or gravity scenario.



File: R:\27000\27456-01 Mississippi Mills - Master Plan Update\JLR DWG\Plan\27456-01 WW_System.mxd

Infrastructure

- 4-102 Manhole ID
- Pumping Station
- Cleanout
- Sanitary Manhole
- Saniatry Sewer
- Private Forecmain
- Forcemain

Land Use

- Almonte Ward Limits
- Existing Lots
- Future Lots
- Registered Subdivision
- Build Out
- Business Park (17.0 ha)
- Community Facility (3.1 ha)
- Commercial (15.6 ha)
- Industrial (24.1 ha)
- Residential - Geenfield (34.2 ha)
- Residential - Infill (16.0 ha)

No.	ISSUE / REVISION	DD/MM/YY

VERIFY SHEET SIZE AND SCALES. BAR TO THE RIGHT IS 25mm IF THIS IS A FULL SIZE DRAWING. 0 25mm

SCALE: 0 50 100 200 300 400 Meters

CLIENT:

CONSULTANT: J.L.Richards ENGINEERS · ARCHITECTS · PLANNERS www.jlrichards.ca

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PROFESSIONAL STAMP

PROFESSIONAL STAMP

PROJECT:

MUNICIPALITY OF MISSISSIPPI MILLS ALMONTE WARD WATER AND WASTEWATER INFRASTRUCTURE MASTER PLAN UPDATE

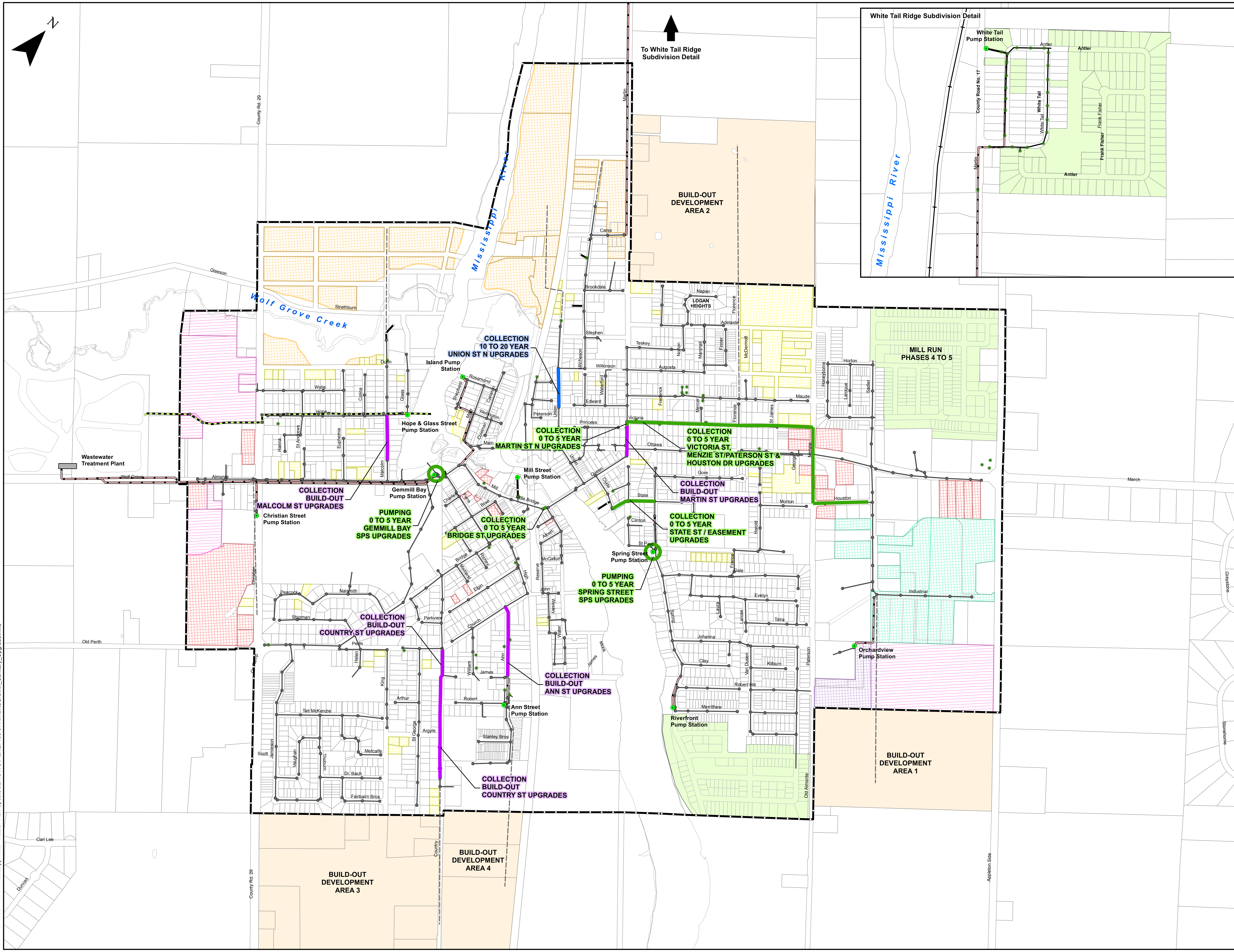
MISSISSIPPI MILLS, ONTARIO

DRAWING:

WASTEWATER SYSTEM

DESIGN: MB	
DRAWN: KTK	DRAWING #:
CHECKED: SG	**FIGURE 18**
JLR #: 27456-01	

PLOT DATE: January 5, 2018 10:04:36 AM



Sanitary Sewer Upgrades
- 0 to 5 Years
- 10 to 20 Years
- Build-out
- Future Servicing

Infrastructure
- Pumping Station
- Cleanout
- Sanitary Manhole
- Lagoon Outfall
- Saniatry Sewer
- Private Forecmain
- Forcemain

Land Use
- Almonte Ward Limits
- Existing Lots
- Future Lots
- Registered Subdivision
- Build Out
- Business Park (17.0 ha)
- Community Facility (3.1 ha)
- Commercial (15.6 ha)
- Industrial (24.1 ha)
- Residential - Geenfield (34.2 ha)
- Residential - Infill (16.0 ha)

No.	ISSUE / REVISION	DD/MM/YY

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SCALE: 0 50 100 200 300 400 Meters

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CONSULTANT:

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PROJECT:
MUNICIPALITY OF MISSISSIPPI MILLS ALMONTE WARD WATER AND WASTEWATER INFRASTRUCTURE MASTER PLAN UPDATE
MISSISSIPPI MILLS, ONTARIO

DRAWING:
ALMONTE WARD WASTEWATER SERVICING STRATEGIES

DESIGN: MB
DRAWN: KTK
CHECKED: SG
JLR #: 27456-01
DRAWING #: **FIGURE 24**

File: R:\27000\27456-01 Mississippi Mills - Master Plan Update\JLR DWG\Plan\27456-01 AlmonteGrowth_Sanitary_Upgrade.mxd

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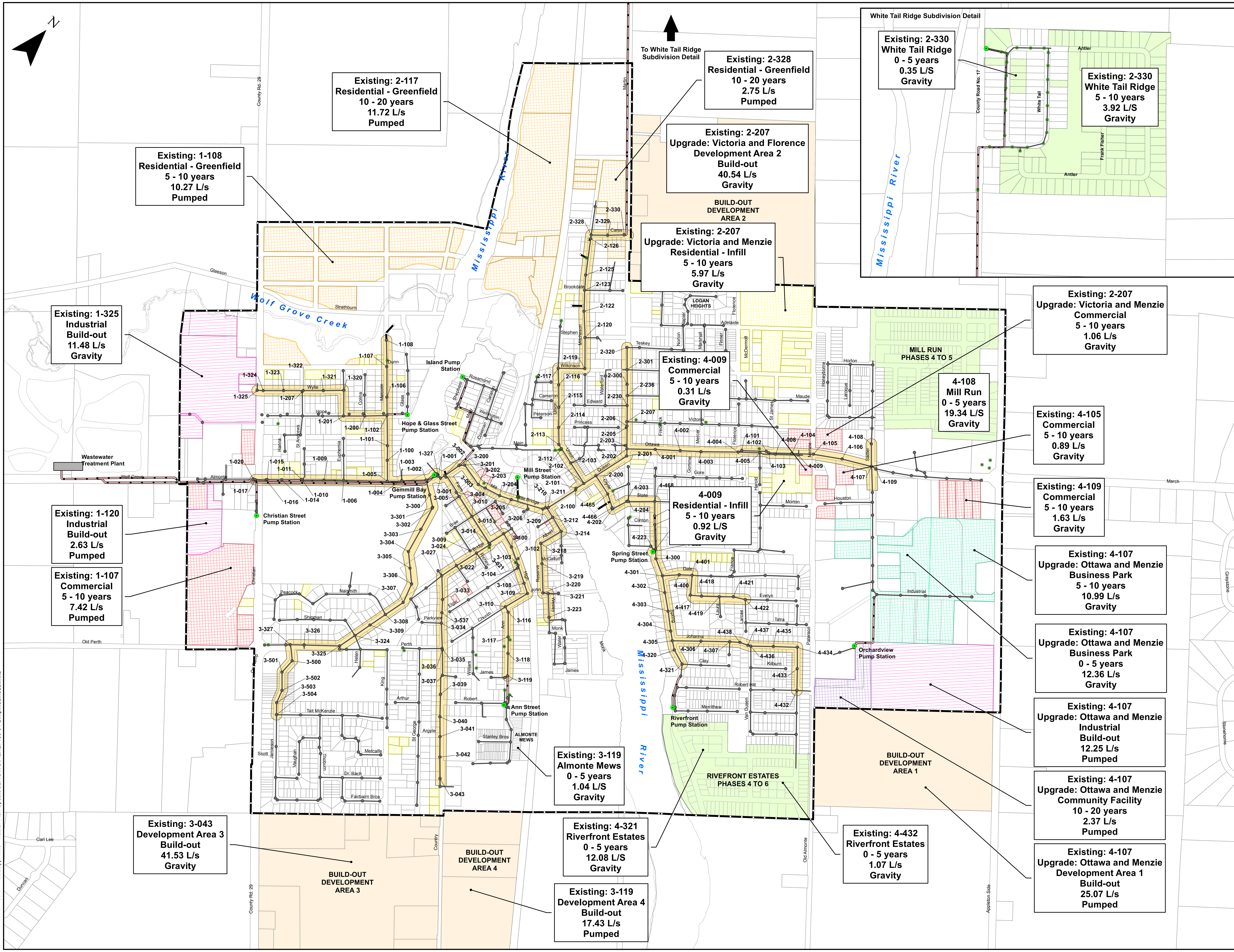

Infrastructure

- 4-102 Manhole ID
- Pumping Station
- Cleanout
- Sanitary Manhole
- Sanitary Sewer
- Private Forecmain
- Forcemain
- Sanitary Trunk Sewers

Land Use

- Almonte Ward Limits
- Existing Lots
- Future Lots
- Registered Subdivision
- Build Out
- Business Park (17.0 ha)
- Community Facility (3.1 ha)
- Commercial (15.6 ha)
- Industrial (24.1 ha)
- Residential - Geenfield (34.2 ha)
- Residential - Infill (16.0 ha)

Existing: 4-109 - Manhole ID
Upgrade : Ottawa and Menzie - Intersection
Commercial - Development Name or Type
5 - 10 years - Development Timeline
1.63 L/s - Estimated Park Flow
Gravity - Anticipated Future Trunk Servicing

No.	ISSUE / REVISION	DD/MM/YY

VERIFY SHEET SIZE AND SCALES. BAR TO THE RIGHT IS 25mm IF THIS IS A FULL SIZE DRAWING. 0 25mm

SCALE: 0 50 100 200 300 400 Meters

CLIENT:

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CONSULTANT:

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PROJECT:
MUNICIPALITY OF MISSISSIPPI MILLS ALMONTE WARD WATER AND WASTEWATER INFRASTRUCTURE MASTER PLAN UPDATE
MISSISSIPPI MILLS, ONTARIO

DRAWING:
WASTEWATER HYDRAULIC MODEL DEMAND ALLOCATION

DESIGN: MB
DRAWN: KTK
CHECKED: SG
JLR #: 27456-01
DRAWING #: **FIGURE 25**

PLOT DATE: January 5, 2018 10:32:24 AM

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Peak Hourly Demand (L/s)	1.52	2.90
FUS Fire Flow Requirement (L/min)	5,000	11,000

Boundary Conditions have been requested however were not available at the time of submission. Once boundary conditions are obtained, the subject property will be hydraulically modelled using WaterCAD to confirm the system has adequate capacity for the proposed development and the required fire flows can be met.

To confirm the adequacy of fire flow to protect the proposed development, public and private fire hydrants within 150 m of the proposed building were analysed per City of Ottawa ISTB 2018-02 Appendix I Table 1. The results are demonstrated below.

Table 2: Fire Protection Confirmation

Building	Fire Flow Demand (L/min.)	Fire Hydrant(s) within 75m	Fire Hydrant(s) within 150m	Combined Fire Flow (L/min.)
Proposed Site	16,000	3	2	24,700

4.0 SANITARY DESIGN

4.1 Existing Sanitary Sewer

There is an existing 300mm diameter PVC sanitary main within Industrial Drive. The 26.0m wide right-of-way section of Gerry Emon Road has an existing 50mm diameter sanitary forcemain within. The forcemain services the existing Orchard View by the Mississippi retirement community.

4.2 Proposed Sanitary Sewer

A new 300 mm diameter gravity sanitary sewer will be connected to the existing 300 mm diameter sanitary sewer within Industrial Drive and will be extended along Gerry Emon Road.

The private road will be serviced by a 200mm diameter sewer, while the proposed apartment building will be services by a 150mm diameter service designed with a minimum full flow target velocity (cleansing velocity) of 0.6 m/s and a full flow velocity of not more than 3.0 m/s. This may not be feasible on every length of pipe, as the capture area for the uppermost mains in the system is relatively small. This issue has been dealt with by increasing the slopes of the sanitary sewers on the uppermost mains. Design parameters for the site include an infiltration rate of 0.33 L/s/Ha.

See the Sanitary Sewer Design Sheet and Sanitary Drainage Area Plan in Appendix 'C' of this report for more details.

SANITARY SEWER DESIGN SHEET

PROJECT: Mill Valley Retirement Community
LOCATION: Almonte, ON
CLIENT: Houchaimi Holdings Inc.

McINTOSH PERRY

LOCATION				RESIDENTIAL									ICI AREAS			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
STREET	AREA ID	FROM MH	TO MH	UNIT TYPES SF	SD	TH	APT	AREA (ha)	POPULATION IND	CUM	PEAK FACTOR	PEAK FLOW (L/s)	AREA (ha) INSTITUTIONAL IND	CUM	COMMERCIAL IND	CUM
GERRY EMON RD.	FUTURE SUBDIVISION		17A						0.0	0.0	4.00	0.00		0.00		0.00
	17	17A	16A		2	1		0.19	8.1	8.1	4.00	0.11		0.00		0.00
BLOCK 1	23a	23A	24A			4		0.25	10.8	10.8	4.00	0.14		0.00		0.00
	24	24A	16A			8		0.37	21.6	32.4	4.00	0.42		0.00		0.00
GERRY EMON RD.	16	16A	15A			9		0.43	24.3	64.8	4.00	0.84		0.00		0.00
	BLD	BUILDING	15A				48	1.26	110.4	110.4	4.00	1.43		0.00		0.00
	15	15A	14A			6		0.30	16.2	191.4	4.00	2.48		0.00		0.00
BLOCK 1	23b	23A	22A			10		0.40	27.0	27.0	4.00	0.35		0.00		0.00
	22	22A	21A			4		0.21	10.8	37.8	4.00	0.49		0.00		0.00
		21A	14A						0.0	37.8	4.00	0.49		0.00		0.00
GERRY EMON RD.	14	14A	13A					0.00	0.0	229.2	4.00	2.97		0.00		0.00
	13	13A	12A					0.00	0.0	229.2	4.00	2.97		0.00		0.00
	12	12A	11A					0.00	0.0	229.2	4.00	2.97		0.00		0.00
	11	11A	10A					0.00	0.0	229.2	4.00	2.97		0.00		0.00

AREA ID	FROM MH	TO MH	ICI AREAS			INFILTRATION ALLOWANCE			FLOW	SEWER DATA								
2	3	4	18	19	20	21	**22**	23	24	25	26	27	28	29	30	31	30	**31**
			INDUSTRIAL IND	CUM	PEAK FLOW (L/s)	AREA (ha) IND	CUM	FLOW (L/s)	DESIGN FLOW (L/s)	CAPACITY (L/s)	LENGTH (m)	DIA (mm)	SLOPE (%)	VELOCITY (full) (m/s)	FLOW DEPTH (mm)	VELOCITY (actual) (m/s)	AVAILABLE CAPACITY L/s	(%)
FUTURE SUBDIVISION		17A		0.00	0.00	0.00	0.00	0.00	0.00									
17	17A	16A		0.00	0.00	0.19	0.19	0.06	0.17	45.12	41.00	300	0.20	0.618	14.3	0.148	44.95	99.63
23a	23A	24A		0.00	0.00	0.25	0.25	0.08	0.22	27.59	12.30	200	0.65	0.851	13.7	0.258	27.36	99.19
24	24A	16A		0.00	0.00	0.37	0.62	0.20	0.62	27.59	95.60	200	0.65	0.851	22.3	0.353	26.96	97.74
16	16A	15A		0.00	0.00	0.43	1.05	0.35	1.19	45.12	82.20	300	0.20	0.618	35.9	0.269	43.93	97.37
BLD	BUILDING	15A		0.00	0.00	1.26	1.26	0.42	1.85	15.89	44.66	150	1.00	0.871	36.1	0.589	14.04	88.38
15	15A	14A		0.00	0.00	0.30	2.61	0.86	3.34	45.12	57.70	300	0.20	0.618	58.3	0.367	41.77	92.59
23b	23A	22A		0.00	0.00	0.40	0.40	0.13	0.48	27.59	88.45	200	0.65	0.851	19.8	0.326	27.10	98.25
22	22A	21A		0.00	0.00	0.21	0.61	0.20	0.69	20.24	42.75	200	0.35	0.624	27.1	0.294	19.55	96.58
	21A	14A		0.00	0.00	0.00	0.61	0.20	0.69	20.24	102.40	200	0.35	0.624	27.1	0.294	19.55	96.58
14	14A	13A		0.00	0.00	0.30	3.52	1.16	4.13	45.12	39.90	300	0.20	0.618	64.4	0.390	40.98	90.84
13	13A	12A		0.00	0.00	0.17	3.69	1.22	4.19	45.12	66.00	300	0.20	0.618	64.8	0.392	40.93	90.72
12	12A	11A		0.00	0.00	0.17	3.86	1.27	4.24	45.12	66.00	300	0.20	0.618	65.2	0.393	40.87	90.59
11	11A	10A		0.00	0.00	0.03	3.89	1.28	4.25	45.12	16.70	300	0.20	0.618	65.3	0.394	40.86	90.57

Design Parameters:

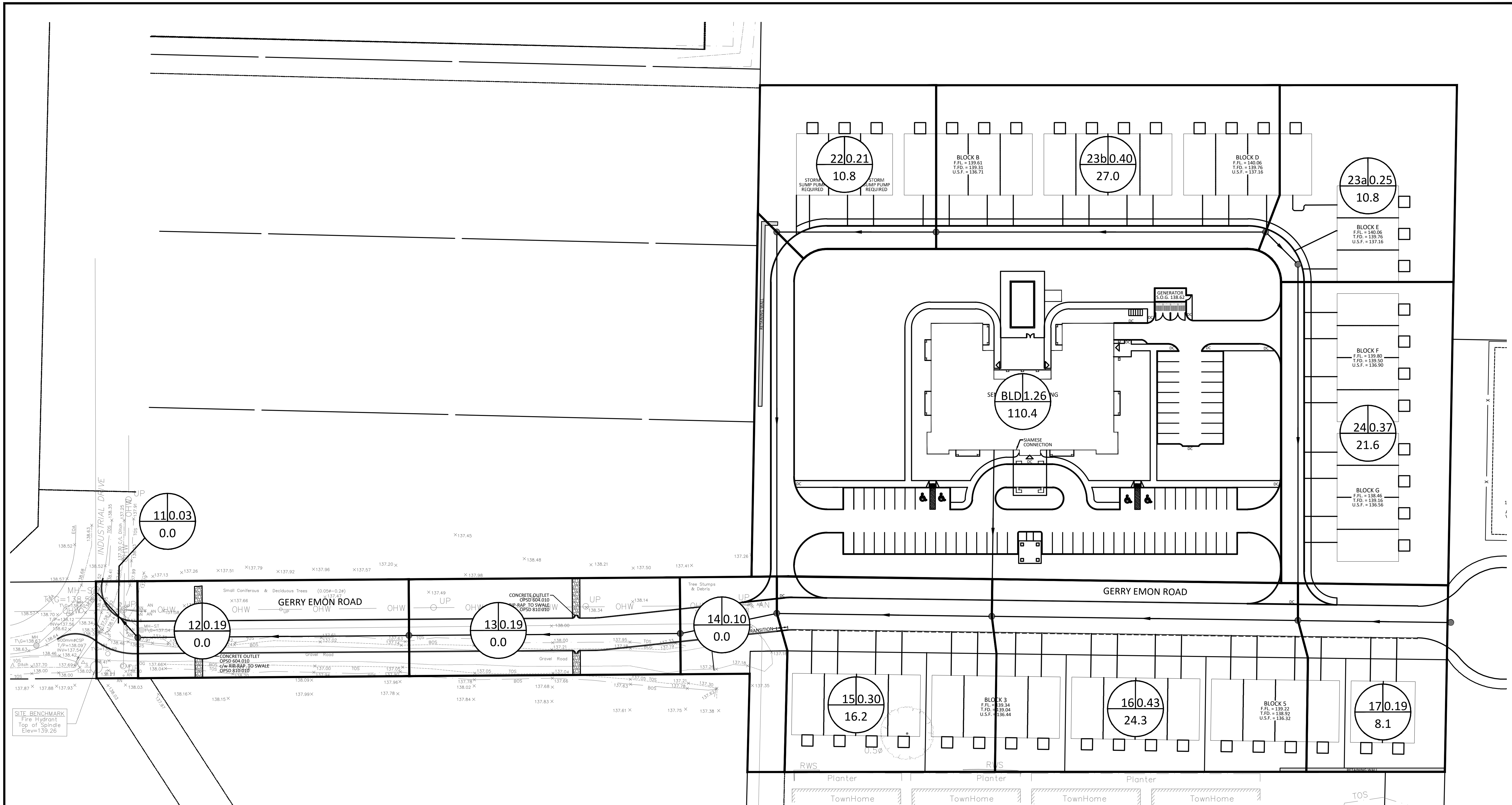
Residential			ICI Areas			Peak Factor
SF	3.4	p/p/u	INST	28,000	L/Ha/day	1.5
TH/SD	2.7	p/p/u	COM	28,000	L/Ha/day	1.5
APT	2.3	p/p/u	IND	35,000	L/Ha/day	MOE Chart
Other	60	p/p/Ha				

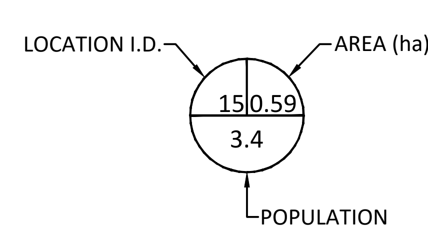
Notes:
1. Mannings coefficient (n) = 0.013
2. Demand (per capita): 280 L/day
3. Infiltration allowance: 0.33 L/s/Ha
4. Residential Peaking Factor:
Harmon Formula = 1+(14/(4+P^0.5)*0.8)
where P = population in thousands

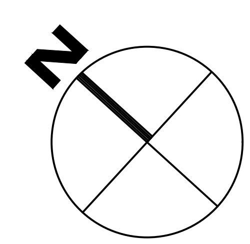
Designed: P.G.K.
Checked: R.P.K.
Project No.: CCO-20-0034

No.	Revision	Date
1.	ISSUED FOR MUNICIPAL REVIEW	JUL. 28, 2021
2.	REVISED PER MUNICIPAL COMMENTS	DEC. 10, 2021
3.	REVISED PER MUNICIPAL COMMENTS	FEB. 11, 2022

Sheet No: 1 of 1







SCALE 1 : 1000

0 25 50 75 100 Metres

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Client:	HOUCHAIMI HOLDINGS INC. 21 HAMPEL CRES. STITTSVILLEM ON K2S 1E4
Project:	MILL VALLEY RETIREMENT COMMUNITY GERRY EMON ROAD
Drawing Title:	SANITARY DRAINAGE AREA PLAN

Drawn by:	Checked By:
P.G.K.	R.P.K.
Scale: 1:1000	Project Number: CCO-20-0034

No.	Revisions	Date

Drawing Number: SAN

FILENAME: U:\Ottawa\01 Project - Proposals\2020 Jobs\CCO\CCO-20-0034 Houchaimi Holdings - Seniors' Residence\Drawings\CCO-20-0034_Presentation.dwg
LAST SAVED: Thursday, December 09, 2021 LAST SAVED BY: p.kirkimtzis
LAST PLOTTED: Friday, December 10, 2021 CTB FILE USED: ----

B.3 Residual Sanitary Sewer Capacity – Correspondence and Calculations

Wu, Michael

From:	Kilborn, Kris
Sent:	June 14, 2023 14:41
To:	Paerez, Ana; Mott, Peter
Cc:	Johnson, Warren
Subject:	FW: Mill Valley Estates - Sanitary Sewer Capacity Assessment

Ana / Peter

Please find below some information from JL Richards on the sanitary discharge for Mill Valley Subdivision
Peter if you could save a copy of this email in your analysis folder as we may require to include in our updated report.

Sincerely

Kris Kilborn
Principal, Community Development
Business Center Practice Leader

Mobile: 613 297-0571
Fax: 613 722-2799
kris.kilborn@stantec.com
Stantec
300 - 1331 Clyde Avenue
Ottawa ON K2C 3G4

Stantec

The Ottawa office is open however many staff are working remotely. To contact me please use email, or my mobile and leave a message.
Please note our reception is on the 3rd floor.

From: Ryan Kennedy <ryan@houchaimi.com>
Sent: Wednesday, June 14, 2023 2:11 PM
To: Kilborn, Kris <kris.kilborn@stantec.com>
Cc: Billy Houchaimi <Billy@houchaimi.com>
Subject: FW: Mill Valley Estates - Sanitary Sewer Capacity Assessment

Hi Kris,

For distribution to your team. Let us know if you have any questions or if you want to clarify anything.

Just a note that we're still holding you up and there will be changes to the plan before you can start again. Happy to discuss any time.

Thanks.

RYAN KENNEDY, P. Eng.
P 613.255.3850 | **E** ryan@houchaimi.com

From: Bobby Pettigrew <bpettigrew@jlrichards.ca>
Sent: Tuesday, June 13, 2023 3:48 PM
To: David Shen <dshen@mississippimills.ca>; Ryan Kennedy <ryan@houchaimi.com>

Cc: Billy Houchaimi <Billy@houchaimi.com>; Mark Buchanan <mbuchanan@jlrichards.ca>; Melanie Knight <mknight@mississippimills.ca>; Annie Williams <awilliams@jlrichards.ca>; Mathieu Lacelle <mlacelle@jlrichards.ca>
Subject: RE: Mill Valley Estates - Sanitary Sewer Capacity Assessment

Hi David / Ryan

We have completed the analysis of the incorporation of the additional loading into the existing conditions sanitary model developed for Mississippi Mills. Based on the email below of May 23, 2023, two scenarios were run in the model:

Location:	SA4MH-107, at the intersection of Industrial Drive and Ottawa Street	SA4MH-432, at the intersection of Robert Hill Street and Johanna Street	Total
Option A	Full buildout population (1584 population, 0.93 ha @28,000 L/ha/day and 7.32ha @35,000 L/ha/day)		Full buildout population (1584 population, 0.93 ha @28,000 L/ha/day and 7.32ha @35,000 L/ha/day)
Option B	Portion of buildout population (1251 population, 0.93 ha @28,000 L/ha/day and 7.32ha @35,000 L/ha/day)	Portion of buildout population (333 population)	Full buildout population (1584 population, 0.93 ha @28,000 L/ha/day and 7.32ha @35,000 L/ha/day)

Residential flow was added at 350 L/cap/day and I&I was added for the total area, 37.22ha, at 0.28 L/s/ha.

The two options were run under the calibrated dry weather flow (DWF) and 1:25 year storm events. In assessing the future level of service impacts from the proposed development two constraints were assessed:

- Maintaining free flow capacity in the dry weather flow scenario; and,
- Maintaining 1.8 metre freeboard to the ground elevation in the 1:25 year return period event storm to protect basements. Where the current sewer is already within the basement elevation the HGL is restricted to 0.3m above the sewer.

In summary,

- There are level of service reductions identified under the DWF events in both options on a short sewer section from SA4MH-101 to SA4MH-004 at the intersection of Florence Street and Ottawa Street. The issue is due to the reverse and shallow slope in the pipe as recorded in the GIS database. It is recommended that the actual configuration of this pipe is confirmed prior to assessing if upgrade work is required. Otherwise there were no issues identified.
- Under 25-year storm event conditions, there are no HGL Level of Service issues triggered by the proposed development.

Any questions on the above let me know

Thanks
Bobby

Bobby Pettigrew, M.Eng., P.Eng.
Associate
Senior Water Resources Engineer

J.L. Richards & Associates Limited
1000-343 Preston Street, Ottawa, ON K1S 1N4
Direct: 343-804-5381

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& Associates Limited
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CANADA BEST MANAGED COMPANIES Platinum member

Stantec

SUBDIVISION:

Industrial Drive & Mill Valley Estates

DATE: 2023-11-23
REVISION: 2
DESIGN BY: MW
CHECKED BY: AMP

SANITARY SEWER DESIGN SHEET

(City of Ottawa)

Industrial Drive Sewer Assessment - Existing Development Plus Mill Valley Estates/Living Communities (w/o Business Park Block)

FILE NUMBER: 160401740

DESIGN PARAMETERS

MAX PEAK FACTOR (RES.)=	4.0	AVG. DAILY FLOW / PERSON	350 l/p/day	MINIMUM VELOCITY	0.60 m/s
MIN PEAK FACTOR (RES.)=	2.0	COMMERCIAL	28,000 l/ha/day	MAXIMUM VELOCITY	3.00 m/s
PEAKING FACTOR (INDUSTRIAL):	2.7	INDUSTRIAL (HEAVY)	55,000 l/ha/day	MANNINGS n	0.013
PEAKING FACTOR (ICI >20%):	1.5	INDUSTRIAL (LIGHT)	35,000 l/ha/day	BEDDING CLASS	B
PERSONS / SINGLE	3.4	INSTITUTIONAL	28,000 l/ha/day	MINIMUM COVER	2.50 m
PERSONS / TOWNHOME	2.7	INFILTRATION	0.28 l/s/Ha	HARMON CORRECTION FACTOR	0.8
PERSONS / APARTMENT	1.8				

LOCATION			RESIDENTIAL AREA AND POPULATION									COMMERCIAL		INDUSTRIAL (L)		INDUSTRIAL (H)		INSTITUTIONAL		GREEN / UNUSED		C+I+I	INFILTRATION			TOTAL	PIPE							
AREA ID NUMBER	FROM M.H.	TO M.H.	AREA (ha)	UNITS SINGLE	UNITS TOWN	UNITS APT	POP.	CUMULATIVE AREA (ha)	CUMULATIVE POP.	PEAK FACT.	PEAK FLOW (l/s)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	PEAK FLOW (l/s)	TOTAL AREA (ha)	ACCU. AREA (ha)	INFILT. FLOW (l/s)	FLOW (l/s)	LENGTH (m)	DIA (mm)	MATERIAL	CLASS	SLOPE (%)	CAP. (FULL) (l/s)	CAP. V PEAK FLOW (%)	VEL. (FULL) (m/s)
Industrial Drive (Upstream)	EX SAN-18	EX SAN-17	0.00	0	0	0	0	0.00	0	3.80	0.0	3.33	3.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.6	3.33	3.33	0.9	2.6	82.5	300	PVC	SDR 35	0.21	44.0	**5.80%**	0.63
	EX SAN-17	EX SAN-16	0.00	0	0	0	0	0.00	0	3.80	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.00	3.33	0.9	0.9	91.5	300	PVC	SDR 35	0.17	39.6	**2.36%**	0.56
	EX SAN-16	EX SAN-15	0.00	0	0	0	0	0.00	0	3.80	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.00	3.33	0.9	0.9	90.9	300	PVC	SDR 35	0.25	48.0	**1.94%**	0.68
	EX SAN-15	EX SAN-14	0.00	0	0	0	0	0.00	0	3.80	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.00	3.33	0.9	0.9	89.4	300	PVC	SDR 35	0.20	42.9	**2.17%**	0.61
Mill Valley Subdivision[1]	2	1	26.36	253	282	0	1885	26.36	1885	3.08	23.6	0.00	0.00	0.00	0.00	0.00	0.00	1.46	1.46	0.00	0.00	0.5	27.82	27.82	7.8	31.8	19.1	375	PVC	SDR 35	0.20	72.6	**43.83%**	0.69
Industrial Drive (Downstream)	SAN FM	EX SAN-14	0.00	0	0	0	0	26.36	1885	3.08	23.6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.46	0.00	0.00	0.5	0.00	31.15	8.7	33.7	617.0	300	PVC	SDR 35	0.20	42.9	**78.43%**	0.61
	EX SAN-14	EX SAN-13	0.00	0	0	0	0	26.36	1885	3.08	23.6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.46	0.00	0.00	0.5	0.00	31.15	8.7	33.7	21.5	300	PVC	SDR 35	0.20	42.9	**78.43%**	0.61
	EX SAN-13	EX SAN-12	0.00	0	0	0	0	26.36	1885	3.08	23.6	6.52	6.52	0.00	0.00	0.00	0.00	0.00	1.46	0.00	0.00	3.9	6.52	37.67	10.5	38.9	93.2	300	PVC	SDR 35	0.20	42.9	**90.62%**	0.61
	EX SAN-12	EX SAN-11	0.00	0	0	0	0	26.36	1885	3.08	23.6	0.99	7.51	0.00	0.00	0.00	0.00	0.00	1.46	0.00	0.00	4.4	0.99	38.66	10.8	39.7	63.9	300	PVC	SDR 35	0.20	42.9	**92.38%**	0.61
	EX SAN-11	EX SAN-10	0.00	0	0	0	0	26.36	1885	3.08	23.6	0.00	7.51	0.00	0.00	0.00	0.00	0.00	1.46	0.00	0.00	4.4	0.00	38.66	10.8	39.7	36.8	300	PVC	SDR 35	0.20	42.9	**92.38%**	0.61
	EX SAN-10	EX SAN-09	0.00	0	0	0	0	26.36	1885	3.08	23.6	5.15	12.66	0.00	0.00	0.00	0.00	0.00	1.46	0.00	0.00	6.9	5.15	43.81	12.3	43.6	84.1	300	PVC	SDR 35	0.20	42.9	**101.58%**	0.61
	EX SAN-09	EX SAN 4-107	0.00	0	0	0	0	26.36	1885	3.08	23.6	0.00	12.66	0.00	0.00	0.00	0.00	0.00	1.46	0.00	0.00	6.9	0.00	43.81	12.3	43.6	179.8	300	PVC	SDR 35	0.20	42.9	**101.58%**	0.61
																										43.6								

Notes

1. See Appendix B.1 for Mill Valley Subdivision Sanitary Design Sheet. For this scenario, the commercial demands for the proposed business park within the Mill Valley Estates, area C26B, are excluded
3. Existing sanitary contributions measured from full lot areas - see attached figure and corresponding colour coding markups

Stantec

SUBDIVISION:

Industrial Drive & Mill Valley Estates

DATE: 11/23/2023
REVISION: 2
DESIGNED BY: MW
CHECKED BY: AMP

SANITARY SEWER DESIGN SHEET

(City of Ottawa)

Industrial Drive Sewer Assessment - Existing Development Plus Mill Valley Estates/Living Communities

FILE NUMBER: 160401740

DESIGN PARAMETERS

MAX PEAK FACTOR (RES.)=	4.0	AVG. DAILY FLOW / PERSON	350 l/p/day	MINIMUM VELOCITY	0.60 m/s
MIN PEAK FACTOR (RES.)=	2.0	COMMERCIAL	28,000 l/ha/day	MAXIMUM VELOCITY	3.00 m/s
PEAKING FACTOR (INDUSTRIAL):	2.7	INDUSTRIAL (HEAVY)	55,000 l/ha/day	MANNINGS n	0.013
PEAKING FACTOR (ICI >20%):	1.5	INDUSTRIAL (LIGHT)	35,000 l/ha/day	BEDDING CLASS	B
PERSONS / SINGLE	3.4	INSTITUTIONAL	28,000 l/ha/day	MINIMUM COVER	2.50 m
PERSONS / TOWNHOME	2.7	INFILTRATION	0.28 l/s/Ha	HARMON CORRECTION FACTOR	0.8
PERSONS / APARTMENT	1.8				

LOCATION			RESIDENTIAL AREA AND POPULATION									COMMERCIAL		INDUSTRIAL (L)	
AREA ID NUMBER	FROM M.H.	TO M.H.	AREA (ha)	UNITS SINGLE	UNITS TOWN	UNITS APT	POP.	CUMULATIVE AREA (ha)	CUMULATIVE POP.	PEAK FACT.	PEAK FLOW (l/s)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)
Industrial Drive (Upstream)	EX SAN-18	EX SAN-17	0.00	0	0	0	0	0.00	0	3.80	0.0	3.33	3.33	0.00	0.00
	EX SAN-17	EX SAN-16	0.00	0	0	0	0	0.00	0	3.80	0.0	0.00	0.00	0.00	0.00
	EX SAN-16	EX SAN-15	0.00	0	0	0	0	0.00	0	3.80	0.0	0.00	0.00	0.00	0.00
	EX SAN-15	EX SAN-14	0.00	0	0	0	0	0.00	0	3.80	0.0	0.00	0.00	0.00	0.00
Mill Valley Subdivision[1]	2	1	26.36	253	282	0	1885	26.36	1885	3.08	23.6	7.56	7.56	0.00	0.00
Industrial Drive (Downstream)	SAN FM	EX SAN-14	0.00	0	0	0	0	26.36	1885	3.08	23.6	0.00	7.56	0.00	0.00
	EX SAN-14	EX SAN-13	0.00	0	0	0	0	26.36	1885	3.08	23.6	0.00	7.56	0.00	0.00
	EX SAN-13	EX SAN-12	0.00	0	0	0	0	26.36	1885	3.08	23.6	6.52	14.08	0.00	0.00
	EX SAN-12	EX SAN-11	0.00	0	0	0	0	26.36	1885	3.08	23.6	0.99	15.07	0.00	0.00
	EX SAN-11	EX SAN-10	0.00	0	0	0	0	26.36	1885	3.08	23.6	0.00	15.07	0.00	0.00
	EX SAN-10	EX SAN-09	0.00	0	0	0	0	26.36	1885	3.08	23.6	5.15	20.22	0.00	0.00
	EX SAN-09	EX SAN 4-107	0.00	0	0	0	0	26.36	1885	3.08	23.6	0.00	20.22	0.00	0.00

FROM M.H.	TO M.H.	INDUSTRIAL (H) AREA (ha)	INDUSTRIAL (H) ACCU. AREA (ha)	INSTITUTIONAL AREA (ha)	INSTITUTIONAL ACCU. AREA (ha)	GREEN / UNUSED AREA (ha)	GREEN / UNUSED ACCU. AREA (ha)	C+I+I PEAK FLOW (l/s)	INFILTRATION TOTAL AREA (ha)	INFILTRATION ACCU. AREA (ha)	INFILT. FLOW (l/s)	TOTAL FLOW (l/s)	PIPE LENGTH (m)	DIA (mm)	MATERIAL	CLASS	SLOPE (%)	CAP. (FULL) (l/s)	CAP. V PEAK FLOW (%)	VEL. (FULL) (m/s)
EX SAN-18	EX SAN-17	0.00	0.00	0.00	0.00	0.00	0.00	1.6	3.33	3.33	0.9	2.6	82.5	300	PVC	SDR 35	0.21	44.0	**5.80%**	0.63
EX SAN-17	EX SAN-16	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.00	3.33	0.9	0.9	91.5	300	PVC	SDR 35	0.17	39.6	**2.36%**	0.56
EX SAN-16	EX SAN-15	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.00	3.33	0.9	0.9	90.9	300	PVC	SDR 35	0.25	48.0	**1.94%**	0.68
EX SAN-15	EX SAN-14	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.00	3.33	0.9	0.9	89.4	300	PVC	SDR 35	0.20	42.9	**2.17%**	0.61
2	1	0.00	0.00	1.46	1.46	0.00	0.00	4.4	35.38	35.38	9.9	37.8	19.1	375	PVC	SDR 35	0.20	72.6	**52.13%**	0.69
SAN FM	EX SAN-14	0.00	0.00	0.00	1.46	0.00	0.00	4.4	0.00	38.71	10.8	39.7	617.0	300	PVC	SDR 35	0.20	42.9	**92.47%**	0.61
EX SAN-14	EX SAN-13	0.00	0.00	0.00	1.46	0.00	0.00	4.4	0.00	38.71	10.8	39.7	21.5	300	PVC	SDR 35	0.20	42.9	**92.47%**	0.61
EX SAN-13	EX SAN-12	0.00	0.00	0.00	1.46	0.00	0.00	7.6	6.52	45.23	12.7	44.7	93.2	300	PVC	SDR 35	0.20	42.9	**104.11%**	0.61
EX SAN-12	EX SAN-11	0.00	0.00	0.00	1.46	0.00	0.00	8.0	0.99	46.22	12.9	45.5	63.9	300	PVC	SDR 35	0.20	42.9	**105.87%**	0.61
EX SAN-11	EX SAN-10	0.00	0.00	0.00	1.46	0.00	0.00	8.0	0.00	46.22	12.9	45.5	36.8	300	PVC	SDR 35	0.20	42.9	**105.87%**	0.61
EX SAN-10	EX SAN-09	0.00	0.00	0.00	1.46	0.00	0.00	10.5	5.15	51.37	14.4	49.4	84.1	300	PVC	SDR 35	0.20	42.9	**115.07%**	0.61
EX SAN-09	EX SAN 4-107	0.00	0.00	0.00	1.46	0.00	0.00	10.5	0.00	51.37	14.4	49.4	179.8	300	PVC	SDR 35	0.20	42.9	**115.07%**	0.61
												49.4								

Notes

1. See Appendix B.1 for Mill Valley Subdivision Sanitary Design Sheet
3. Existing sanitary contributions measured from full lot areas - see attached figure and corresponding colour coding markups

Stantec

SUBDIVISION:
Industrial Drive & Mill Valley Estates

DATE: 11/23/2023
REVISION: 2
DESIGNED BY: MW
CHECKED BY: AMP

SANITARY SEWER DESIGN SHEET
(City of Ottawa)
Industrial Drive Sewer Assessment - Full Build Out

FILE NUMBER: 160401740

DESIGN PARAMETERS

MAX PEAK FACTOR (RES.)=	4.0	AVG. DAILY FLOW / PERSON	350 l/p/day	MINIMUM VELOCITY	0.60 m/s
MIN PEAK FACTOR (RES.)=	2.0	COMMERCIAL	28,000 l/ha/day	MAXIMUM VELOCITY	3.00 m/s
PEAKING FACTOR (INDUSTRIAL):	2.7	INDUSTRIAL (HEAVY)	55,000 l/ha/day	MANNINGS n	0.013
PEAKING FACTOR (ICI >20%):	1.5	INDUSTRIAL (LIGHT)	35,000 l/ha/day	BEDDING CLASS	B
PERSONS / SINGLE	3.4	INSTITUTIONAL	28,000 l/ha/day	MINIMUM COVER	2.50 m
PERSONS / TOWNHOME	2.7	INFILTRATION	0.28 l/s/Ha	HARMON CORRECTION FACTOR	0.8
PERSONS / APARTMENT	1.8				

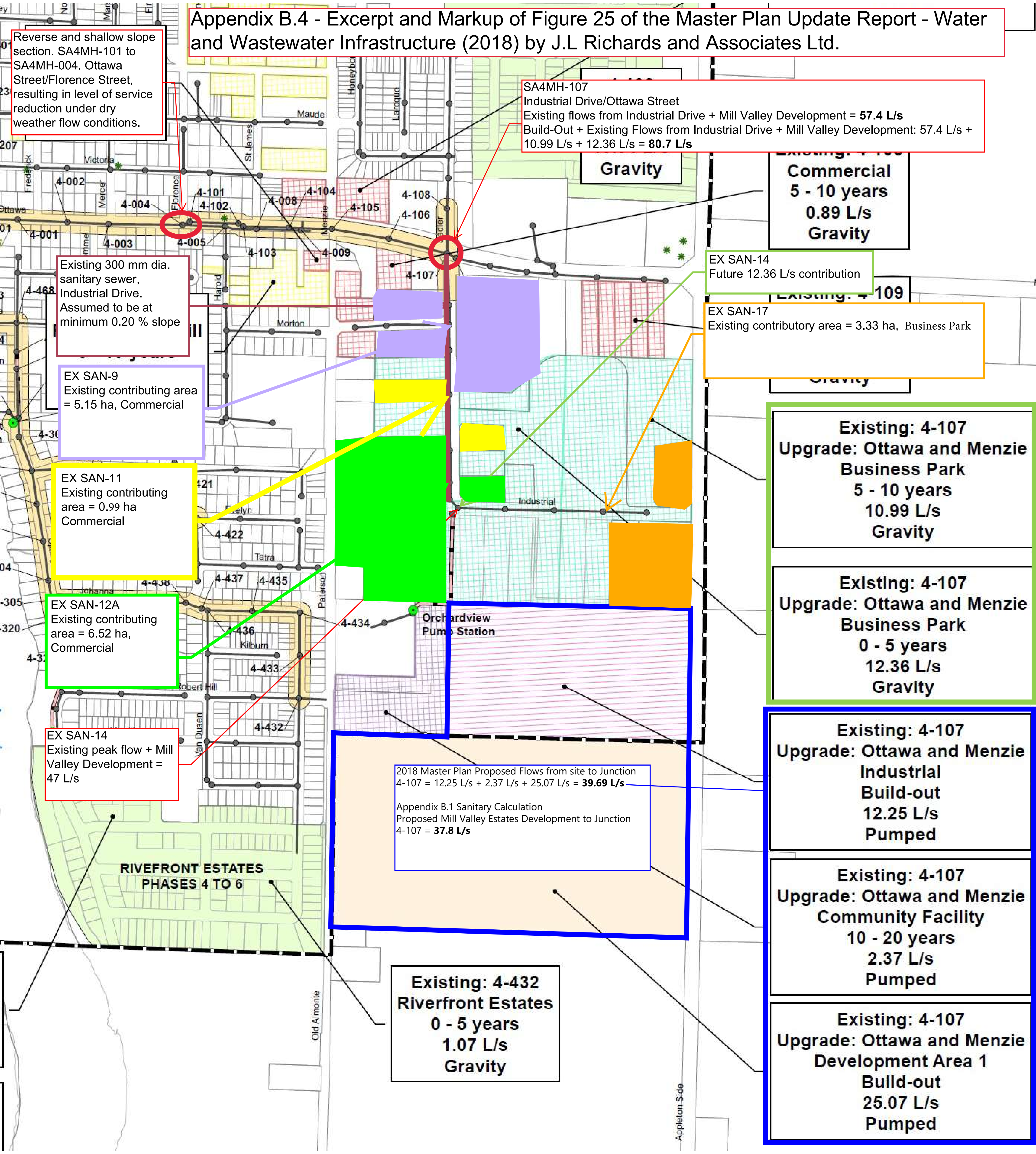
LOCATION			RESIDENTIAL AREA AND POPULATION										COMMERCIAL		INDUSTRIAL (L)	
AREA ID NUMBER	FROM M.H.	TO M.H.	AREA (ha)	UNITS SINGLE	UNITS TOWN	UNITS APT	POP.	CUMULATIVE AREA (ha)	CUMULATIVE POP.	PEAK FACT.	PEAK FLOW (l/s)		AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)
Industrial Drive (Upstream)	EX SAN-18	EX SAN-17	0.00	0	0	0	0	0.00	0	3.80	0.0		3.33	3.33	0.00	0.00
	EX SAN-17	EX SAN-16	0.00	0	0	0	0	0.00	0	3.80	0.0		0.00	3.33	0.00	0.00
	EX SAN-16	EX SAN-15	0.00	0	0	0	0	0.00	0	3.80	0.0		0.00	3.33	0.00	0.00
	EX SAN-15	EX SAN-14	0.00	0	0	0	0	0.00	0	3.80	0.0		0.00	3.33	0.00	0.00
Mill Valley Development[2]	2	1	26.36	253	282	0	1885	26.36	1885	3.08	23.6		7.56	7.56	0.00	0.00
Industrial Drive (Downstream)	SAN FM	EX SAN-14	0.00	0	0	0	0	26.36	1885	3.08	23.6		0.00	10.89	0.00	0.00
	EX SAN-14	EX SAN-13	0.00	0	0	0	0	26.36	1885	3.08	23.6		0.00	10.89	0.00	0.00
	EX SAN-13	EX SAN-12	0.00	0	0	0	0	26.36	1885	3.08	23.6		6.52	17.41	0.00	0.00
	EX SAN-12	EX SAN-11	0.00	0	0	0	0	26.36	1885	3.08	23.6		0.99	18.40	0.00	0.00
	EX SAN-11	EX SAN-10	0.00	0	0	0	0	26.36	1885	3.08	23.6		0.00	18.40	0.00	0.00
	EX SAN-10	EX SAN-09	0.00	0	0	0	0	26.36	1885	3.08	23.6		5.15	23.55	0.00	0.00
	EX SAN-09	EX SAN 4-107	0.00	0	0	0	0	26.36	1885	3.08	23.6		0.00	23.55	0.00	0.00

FROM M.H.	TO M.H.	INDUSTRIAL (H) AREA (ha)	INDUSTRIAL (H) ACCU. AREA (ha)	INSTITUTIONAL AREA (ha)	INSTITUTIONAL ACCU. AREA (ha)	GREEN / UNUSED AREA (ha)	GREEN / UNUSED ACCU. AREA (ha)	C+I+I[1] PEAK FLOW (l/s)	INFILTRATION TOTAL AREA (ha)	INFILTRATION ACCU. AREA (ha)	INFILT. FLOW (l/s)	TOTAL FLOW (l/s)	PIPE LENGTH (m)	DIA (mm)	MATERIAL	CLASS	SLOPE (%)	CAP. (FULL) (l/s)	CAP. V PEAK FLOW (%)	VEL. (FULL) (m/s)
EX SAN-18	EX SAN-17	0.00	0.00	0.00	0.00	0.00	0.00	12.6	3.33	3.33	0.9	13.5	82.5	300	PVC	SDR 35	0.21	44.0	**30.78%**	0.63
EX SAN-17	EX SAN-16	0.00	0.00	0.00	0.00	0.00	0.00	12.6	0.00	3.33	0.9	13.5	91.5	300	PVC	SDR 35	0.17	39.6	**34.21%**	0.56
EX SAN-16	EX SAN-15	0.00	0.00	0.00	0.00	0.00	0.00	12.6	0.00	3.33	0.9	13.5	90.9	300	PVC	SDR 35	0.25	48.0	**28.21%**	0.68
EX SAN-15	EX SAN-14	0.00	0.00	0.00	0.00	0.00	0.00	25.0	0.00	3.33	0.9	25.9	89.4	300	PVC	SDR 35	0.20	42.9	**60.32%**	0.61
2	1	0.00	0.00	1.46	1.46	0.00	0.00	4.4	35.38	35.38	9.9	37.8	19.1	375	PVC	SDR 35	0.20	72.6	**52.13%**	0.69
SAN FM	EX SAN-14	0.00	0.00	0.00	1.46	0.00	0.00	6.0	0.00	38.71	10.8	66.3	617.0	300	PVC	SDR 35	0.20	42.9	**154.39%**	0.61
EX SAN-14	EX SAN-13	0.00	0.00	0.00	1.46	0.00	0.00	6.0	0.00	38.71	10.8	66.3	21.5	300	PVC	SDR 35	0.20	42.9	**154.39%**	0.61
EX SAN-13	EX SAN-12	0.00	0.00	0.00	1.46	0.00	0.00	9.2	6.52	45.23	12.7	71.3	93.2	300	PVC	SDR 35	0.20	42.9	**166.02%**	0.61
EX SAN-12	EX SAN-11	0.00	0.00	0.00	1.46	0.00	0.00	9.7	0.99	46.22	12.9	72.1	63.9	300	PVC	SDR 35	0.20	42.9	**167.79%**	0.61
EX SAN-11	EX SAN-10	0.00	0.00	0.00	1.46	0.00	0.00	9.7	0.00	46.22	12.9	72.1	36.8	300	PVC	SDR 35	0.20	42.9	**167.79%**	0.61
EX SAN-10	EX SAN-09	0.00	0.00	0.00	1.46	0.00	0.00	12.2	5.15	51.37	14.4	76.0	84.1	300	PVC	SDR 35	0.20	42.9	**176.98%**	0.61
EX SAN-09	EX SAN 4-107	0.00	0.00	0.00	1.46	0.00	0.00	12.2	0.00	51.37	14.4	76.0	179.8	300	PVC	SDR 35	0.20	42.9	**176.98%**	0.61
												76.0								

Notes

1. Ultimate Build Out Sanitary Demands taken from contributions to EX SAN 4-107 in Figure 25 of Master Plan Update Report - Water and Wastewater Infrastructure by J.L Richards and Associates Ltd. (2018)
- 10.99 L/s allocated to EX SAN-17
- 12.36 L/s allocated to EX SAN-14
2. Mill Valley Development Demands - Please see Sanitary Design Sheet in Appendix B.1
3. Existing sanitary contributions measured from full lot areas - see attached figure and corresponding colour coding markups

Appendix B.4 - Excerpt and Markup of Figure 25 of the Master Plan Update Report - Water and Wastewater Infrastructure (2018) by J.L Richards and Associates Ltd.



Appendix C Stormwater Management

C.1 Storm Sewer Design Sheet

Stantec

Mill Valley Estates	
DATE:	2023-11-29
REVISION:	3
DESIGNED BY:	WAJ
CHECKED BY:	MN

STORM SEWER DESIGN SHEET
(City of Ottawa)

FILE NUMBER: 160401740

DESIGN PARAMETERS

$I = a / (t+b)^c$ (As per City of Ottawa Guidelines, 2012)

	1:2 yr	1:5 yr	1:10 yr	1:100 yr					
a =	732.951	998.071	1174.184	1735.688	MANNING'S n =	0.013		BEDDING CLASS =	B
b =	6.199	6.053	6.014	6.014	MINIMUM COVER:	2.00	m		
c =	0.810	0.814	0.816	0.820	TIME OF ENTRY	10	min		

LOCATION / DRAINAGE AREA

AREA ID NUMBER	FROM M.H.	TO M.H.	AREA (2-YEAR) (ha)	AREA (5-YEAR) (ha)	AREA (10-YEAR) (ha)	AREA (100-YEAR) (ha)	AREA (ROOF) (ha)	C (2-YEAR) (-)	C (5-YEAR) (-)	C (10-YEAR) (-)	C (100-YEAR) (-)	A x C (2-YEAR) (ha)	ACCUM AxC (2YR) (ha)	A x C (5-YEAR) (ha)	ACCUM. AxC (5YR) (ha)	A x C (10-YEAR) (ha)	ACCUM. AxC (10YR) (ha)	A x C (100-YEAR) (ha)	ACCUM. AxC (100YR) (ha)
Bypass Inlet	101	100B	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.000	0.000	17.297	0.000	0.000	0.000	0.000
	100B	100A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.000	0.000	17.297	0.000	0.000	0.000	0.000
C116A	116	115	0.00	1.15	0.00	0.00	0.00	0.00	0.72	0.00	0.00	0.000	0.000	0.826	0.826	0.000	0.000	0.000	0.000
C115A	115	114	0.00	1.01	0.00	0.00	0.00	0.00	0.70	0.00	0.00	0.000	0.000	0.704	1.531	0.000	0.000	0.000	0.000
C114A	114	109	0.00	1.33	0.00	0.00	0.00	0.00	0.64	0.00	0.00	0.000	0.000	0.851	2.381	0.000	0.000	0.000	0.000
C111A	111	110	0.00	1.31	0.00	0.00	0.00	0.00	0.65	0.00	0.00	0.000	0.000	0.852	0.852	0.000	0.000	0.000	0.000
C113A	113	112	0.00	1.06	0.00	0.00	0.00	0.00	0.69	0.00	0.00	0.000	0.000	0.732	0.732	0.000	0.000	0.000	0.000
C112A, C112B	112	110	0.00	1.77	0.00	0.00	0.00	0.00	0.59	0.00	0.00	0.000	0.000	1.053	1.784	0.000	0.000	0.000	0.000
	110	109	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.000	0.000	2.636	0.000	0.000	0.000	0.000
	109	108	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.000	0.000	5.017	0.000	0.000	0.000	0.000
C126A, C126B	126	125	0.00	0.81	0.00	0.00	0.00	0.00	0.57	0.00	0.00	0.000	0.000	0.467	0.467	0.000	0.000	0.000	0.000
C125A	125	123	0.00	0.33	0.00	0.00	0.00	0.00	0.69	0.00	0.00	0.000	0.000	0.230	0.696	0.000	0.000	0.000	0.000
	123	121	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.000	0.000	0.696	0.000	0.000	0.000	0.000
C121A	121	108	0.00	1.00	0.00	0.00	0.00	0.00	0.63	0.00	0.00	0.000	0.000	0.632	1.328	0.000	0.000	0.000	0.000
C108A	108	103	0.00	1.31	0.00	0.00	0.00	0.00	0.62	0.00	0.00	0.000	0.000	0.815	7.160	0.000	0.000	0.000	0.000
C117A	117	104	0.00	0.91	0.00	0.00	0.00	0.00	0.71	0.00	0.00	0.000	0.000	0.646	0.646	0.000	0.000	0.000	0.000
C141A	141	140	0.00	0.92	0.00	0.00	0.00	0.00	0.66	0.00	0.00	0.000	0.000	0.608	0.608	0.000	0.000	0.000	0.000
	140	139	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.000	0.000	0.608	0.000	0.000	0.000	0.000
	139	105	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.000	0.000	0.608	0.000	0.000	0.000	0.000
C107C, C107A, C107B	107	106	0.00	5.07	0.00	0.00	0.00	0.00	0.66	0.00	0.00	0.000	0.000	3.350	3.350	0.000	0.000	0.000	0.000
	106	105	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.000	0.000	3.350	0.000	0.000	0.000	0.000
C119A	119	118	0.00	0.63	0.00	0.00	0.00	0.00	0.71	0.00	0.00	0.000	0.000	0.444	0.444	0.000	0.000	0.000	0.000
	118	105	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.000	0.000	0.444	0.000	0.000	0.000	0.000

DRAINAGE AREA (cont.) / PIPE SELECTION

AREA ID NUMBER	FROM M.H.	TO M.H.	T of C (min)	I_{2-YEAR} (mm/h)	I_{5-YEAR} (mm/h)	$I_{10-YEAR}$ (mm/h)	$I_{100-YEAR}$ (mm/h)	$Q_{CONTROL}$ (L/s)	ACCUM. $Q_{CONTROL}$ (L/s)	Q_{ACT} (CIA/360) (L/s)	LENGTH (m)	PIPE WIDTH OR DIAMETER (mm)	PIPE HEIGHT (mm)	PIPE SHAPE (-)	MATERIAL (-)	CLASS (-)	SLOPE %	Q_{CAP} (FULL) (L/s)	% FULL (-)	VEL. (FULL) (m/s)	VEL. (ACT) (m/s)	TIME OF FLOW (min)
Bypass Inlet	101	100B	24.53	45.73	61.66	72.12	105.16	0.0	0.0	2962.8	30.7	1950	1950	CIRCULAR	CONCRETE	-	0.10	4694.5	**63.11%**	1.52	1.39	0.37
	100B	100A	24.89	45.29	61.07	71.42	104.14	0.0	0.0	2934.1	37.5	1950	1950	CIRCULAR	CONCRETE	-	0.10	4694.0	**62.51%**	1.52	1.39	0.45
			25.34									1950	1950									
C116A	116	115	10.00	76.81	104.19	122.14	178.56	0.0	0.0	239.2	219.5	750	750	CIRCULAR	CONCRETE	-	0.15	449.8	**53.18%**	0.99	0.86	4.26
C115A	115	114	14.26	63.58	86.03	100.76	147.17	0.0	0.0	365.8	212.0	900	900	CIRCULAR	CONCRETE	-	0.10	597.2	**61.25%**	0.91	0.83	4.28
C114A	114	109	18.54	54.51	73.64	86.19	125.79	0.0	0.0	487.1	86.0	975	975	CIRCULAR	CONCRETE	-	0.10	739.3	**65.88%**	0.96	0.89	1.61
			20.14																			
C111A	111	110	10.00	76.81	104.19	122.14	178.56	0.0	0.0	246.5	207.6	525	525	CIRCULAR	CONCRETE	-	0.50	317.2	**77.70%**	1.42	1.38	2.50
			12.50																			
C113A	113	112	10.00	76.81	104.19	122.14	178.56	0.0	0.0	211.8	206.8	525	525	CIRCULAR	CONCRETE	-	0.50	317.2	**66.75%**	1.42	1.33	2.59
C112A, C112B	112	110	12.59	68.10	92.23	108.06	157.88	0.0	0.0	457.1	80.0	900	900	CIRCULAR	CONCRETE	-	0.20	844.6	**54.12%**	1.29	1.13	1.18
			13.77																			
	110	109	13.77	64.82	87.74	102.77	150.12	0.0	0.0	642.4	86.0	975	975	CIRCULAR	CONCRETE	-	0.30	1280.6	**50.17%**	1.66	1.42	1.01
			14.78																			
	109	108	20.14	51.80	69.94	81.84	119.41	0.0	0.0	974.7	66.3	1200	1200	CIRCULAR	CONCRETE	-	0.10	1286.1	**75.79%**	1.10	1.07	1.04
			21.18																			
C126A, C126B	126	125	10.00	76.81	104.19	122.14	178.56	0.0	0.0	135.0	78.4	975	975	CIRCULAR	CONCRETE	-	0.30	1280.6	**10.54%**	1.66	0.89	1.47
C125A	125	123	11.47	71.58	97.01	113.68	166.13	0.0	0.0	187.6	80.0	975	975	CIRCULAR	CONCRETE	-	0.30	1280.5	**14.65%**	1.66	0.99	1.35
	123	121	12.83	67.43	91.31	106.97	156.28	0.0	0.0	176.6	86.0	975	975	CIRCULAR	CONCRETE	-	0.30	1280.5	**13.79%**	1.66	0.97	1.48
C121A	121	108	14.31	63.45	85.86	100.56	146.87	0.0	0.0	316.7	160.0	1200	1200	CIRCULAR	CONCRETE	-	0.30	2227.7	**14.22%**	1.91	1.11	2.40
			16.71																			
C108A	108	103	21.18	50.21	67.76	79.29	115.67	0.0	0.0	1347.7	197.4	1650	1650	CIRCULAR	CONCRETE	-	0.15	3682.6	**36.60%**	1.67	1.30	2.54
			23.72																			
C117A	117	104	10.00	76.81	104.19	122.14	178.56	0.0	0.0	187.1	182.6	525	525	CIRCULAR	CONCRETE	-	0.30	245.7	**76.14%**	1.10	1.06	2.86
			12.86																			
C141A	141	140	10.00	76.81	104.19	122.14	178.56	0.0	0.0	176.1	75.9	525	525	CIRCULAR	CONCRETE	-	0.30	245.7	**71.66%**	1.10	1.05	1.20
	140	139	11.20	72.47	98.24	115.13	168.26	0.0	0.0	166.0	24.2	525	525	CIRCULAR	CONCRETE	-	0.30	245.7	**67.57%**	1.10	1.03	0.39
	139	105	11.60	71.18	96.46	113.03	165.18	0.0	0.0	163.0	65.6	525	525	CIRCULAR	CONCRETE	-	0.30	245.7	**66.34%**	1.10	1.02	1.07
			12.67																			
C107C, C107A, C107B	107	106	17.24	56.94	76.96	90.09	131.51	0.0	0.0	716.0	27.9	900	900	CIRCULAR	CONCRETE	-	0.30	1034.4	**69.22%**	1.58	1.48	0.31
	106	105	17.55	56.33	76.12	89.11	130.07	0.0	0.0	708.3	44.9	900	900	CIRCULAR	CONCRETE	-	0.30	1034.5	**68.47%**	1.58	1.49	0.50
			18.06																			
C119A	119	118	10.00	76.81	104.19	122.14	178.56	0.0	0.0	128.6	161.8	450	450	CIRCULAR	CONCRETE	-	0.50	210.3	**61.12%**	1.28	1.16	2.32
	118	105	12.32	68.92	93.36	109.39	159.83	0.0	0.0	115.2	23.1	450	450	CIRCULAR	CONCRETE	-	0.50	210.3	**54.77%**	1.28	1.13	0.34
			12.66																			

Stantec

Mill Valley Estates	
DATE:	2023-11-29
REVISION:	3
DESIGNED BY:	WAJ
CHECKED BY:	MN

STORM SEWER DESIGN SHEET (City of Ottawa)

FILE NUMBER: 160401740

DESIGN PARAMETERS

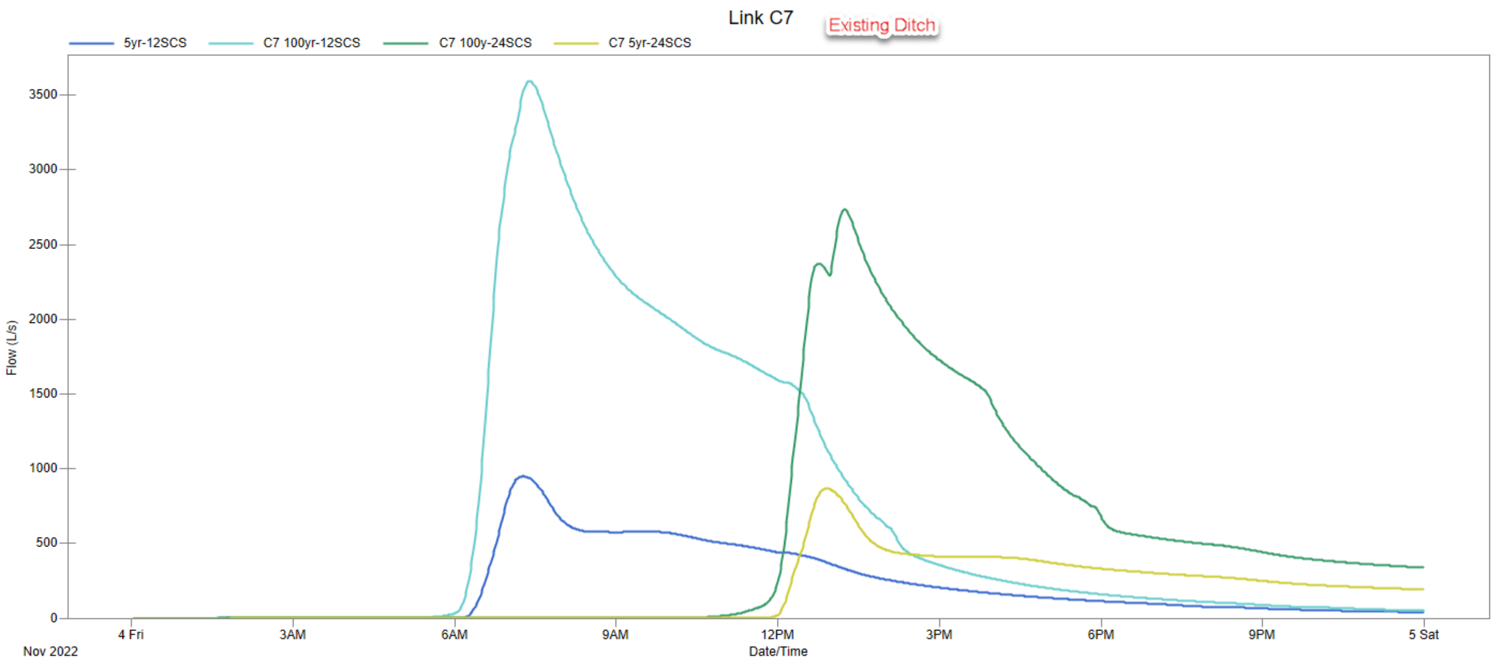
$I = a / (t+b)^c$ (As per City of Ottawa Guidelines, 2012)

	1:2 yr	1:5 yr	1:10 yr	1:100 yr			
a =	732.951	998.071	1174.184	1735.688	MANNING'S n =	0.013	
b =	6.199	6.053	6.014	6.014	MINIMUM COVER:	2.00	m
c =	0.810	0.814	0.816	0.820	TIME OF ENTRY	10	min

BEDDING CLASS = B

LOCATION			DRAINAGE AREA																									PIPE SELECTION											
AREA ID NUMBER	FROM M.H.	TO M.H.	AREA (2-YEAR) (ha)	AREA (5-YEAR) (ha)	AREA (10-YEAR) (ha)	AREA (100-YEAR) (ha)	AREA (ROOF) (ha)	C (2-YEAR) (-)	C (5-YEAR) (-)	C (10-YEAR) (-)	C (100-YEAR) (-)	A x C (2-YEAR) (ha)	ACCUM AxC (2YR) (ha)	A x C (5-YEAR) (ha)	ACCUM. AxC (5YR) (ha)	A x C (10-YEAR) (ha)	ACCUM. AxC (10YR) (ha)	A x C (100-YEAR) (ha)	ACCUM. AxC (100YR) (ha)	T of C (min)	I_{2-YEAR} (mm/h)	I_{5-YEAR} (mm/h)	$I_{10-YEAR}$ (mm/h)	$I_{100-YEAR}$ (mm/h)	$Q_{CONTROL}$ (L/s)	ACCUM. $Q_{CONTROL}$ (L/s)	Q_{ACT} (CIA/360) (L/s)	LENGTH (m)	PIPE WIDTH OR DIAMETER (mm)	PIPE HEIGHT (mm)	PIPE SHAPE (-)	MATERIAL (-)	CLASS (-)	SLOPE %	Q_{CAP} (FULL) (L/s)	% FULL (-)	VEL. (FULL) (m/s)	VEL. (ACT) (m/s)	TIME OF FLOW (min)
C105A	105	104	0.00	2.10	0.00	0.00	0.00	0.00	0.62	0.00	0.00	0.000	0.000	1.305	5.707	0.000	0.000	0.000	0.000	18.06	55.38	74.82	87.58	127.83	0.0	0.0	1186.2	84.7	1200	1200	CIRCULAR	CONCRETE	-	0.25	2033.6	**58.33%**	1.74	1.56	0.91
																				18.96																			
	104	103A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.000	0.000	6.354	0.000	0.000	0.000	0.000	18.96	53.76	72.61	84.98	124.01	0.0	0.0	1281.5	34.0	1200	1200	CIRCULAR	CONCRETE	-	0.25	2033.7	**63.01%**	1.74	1.59	0.36
																				19.32																			
C152A	152	150	0.00	0.99	0.00	0.00	0.00	0.00	0.63	0.00	0.00	0.000	0.000	0.625	0.625	0.000	0.000	0.000	0.000	10.00	76.81	104.19	122.14	178.56	0.0	0.0	180.8	137.6	525	525	CIRCULAR	CONCRETE	-	0.50	317.2	**56.98%**	1.42	1.26	1.82
																				11.82																			
C151A	151	150	0.00	0.65	0.00	0.00	0.00	0.00	0.71	0.00	0.00	0.000	0.000	0.463	0.463	0.000	0.000	0.000	0.000	10.00	76.81	104.19	122.14	178.56	0.0	0.0	133.9	67.5	450	450	CIRCULAR	CONCRETE	-	0.50	210.3	**63.69%**	1.28	1.18	0.95
																				10.95																			
	150	103A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.000	0.000	1.087	0.000	0.000	0.000	0.000	11.82	70.45	95.46	111.86	163.46	0.0	0.0	288.3	80.0	600	600	CIRCULAR	CONCRETE	-	0.50	452.9	**63.66%**	1.55	1.43	0.93
																				12.75																			
	103A	103	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.000	0.000	7.441	0.000	0.000	0.000	0.000	19.32	53.15	71.78	84.01	122.59	0.0	0.0	1483.7	46.0	1200	1200	CIRCULAR	CONCRETE	-	0.25	2033.7	**72.96%**	1.74	1.66	0.46
																				19.78																			
C133A	133	132	0.00	0.91	0.00	0.00	0.00	0.00	0.71	0.00	0.00	0.000	0.000	0.645	0.645	0.000	0.000	0.000	0.000	10.00	76.81	104.19	122.14	178.56	0.0	0.0	186.8	195.5	525	525	CIRCULAR	CONCRETE	-	0.30	245.7	**76.01%**	1.10	1.06	3.06
	132	130	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.000	0.000	0.645	0.000	0.000	0.000	0.000	13.06	66.76	90.40	105.90	154.70	0.0	0.0	162.0	86.0	525	525	CIRCULAR	CONCRETE	-	0.30	245.7	**65.94%**	1.10	1.02	1.40
	130	103	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.000	0.000	0.645	0.000	0.000	0.000	0.000	14.46	63.06	85.33	99.94	145.96	0.0	0.0	153.0	80.0	525	525	CIRCULAR	CONCRETE	-	0.30	245.7	**62.25%**	1.10	1.01	1.32
																				15.79																			
	103	102	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.000	0.000	15.246	0.000	0.000	0.000	0.000	23.72	46.73	63.03	73.73	107.51	0.0	0.0	2669.2	76.1	1950	1950	CIRCULAR	CONCRETE	-	0.15	5749.6	**46.42%**	1.87	1.56	0.81
																				24.53																			
C138A	138	137	0.00	0.69	0.00	0.00	0.00	0.00	0.68	0.00	0.00	0.000	0.000	0.469	0.469	0.000	0.000	0.000	0.000	10.00	76.81	104.19	122.14	178.56	0.0	0.0	135.7	132.1	450	450	CIRCULAR	CONCRETE	-	0.80	266.0	**50.99%**	1.62	1.40	1.57
C137A	137	135	0.00	1.27	0.00	0.00	0.00	0.00	0.61	0.00	0.00	0.000	0.000	0.773	1.241	0.000	0.000	0.000	0.000	11.57	71.24	96.55	113.14	165.34	0.0	0.0	332.9	86.0	750	750	CIRCULAR	CONCRETE	-	0.30	636.1	**52.33%**	1.39	1.20	1.19
																				12.77																			
C136A	136	135	0.00	0.51	0.00	0.00	0.00	0.00	0.70	0.00	0.00	0.000	0.000	0.358	0.358	0.000	0.000	0.000	0.000	10.00	76.81	104.19	122.14	178.56	0.0	0.0	103.6	111.4	375	375	CIRCULAR	PVC	-	1.00	164.8	**62.87%**	1.56	1.43	1.30
																				11.30																			
	135	134	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.000	0.000	1.599	0.000	0.000	0.000	0.000	12.77	67.60	91.55	107.25	156.69	0.0	0.0	406.7	80.0	750	750	CIRCULAR	CONCRETE	-	0.40	734.5	**55.37%**	1.61	1.42	0.94
C134A	134	102	0.00	0.67	0.00	0.00	0.00	0.00	0.67	0.00	0.00	0.000	0.000	0.452	2.051	0.000	0.000	0.000	0.000	13.71	65.00	87.98	103.05	150.53	0.0	0.0	501.3	74.3	825	825	CIRCULAR	CONCRETE	-	0.40	947.1	**52.93%**	1.72	1.49	0.83
																				14.54																			
Forebay Inlet	102	101	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.000	0.000	17.297	0.000	0.000	0.000	0.000	24.53	45.73	61.66	72.12	105.16	0.0	0.0	2962.8	14.1	1950	1950	CIRCULAR	CONCRETE	-	0.10	4694.5	**63.11%**	1.52	1.39	0.17
	101	100	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.000	0.000	17.297	0.000	0.000	0.000	0.000	24.70	45.53	61.39	71.80	104.69	0.0	0.0	2949.5	15.4	1950	1950	CIRCULAR	CONCRETE	-	0.10	4693.3	**62.84%**	1.52	1.39	0.18
																				24.88									1950	1950									
SWM Pond Outlet	200	200A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	10.00	76.81	104.19	122.14	178.56	1673.8	1673.8	1673.8	32.3	1050	1050	CIRCULAR	CONCRETE	-	0.62	2243.2	**74.62%**	2.51	2.43	0.22
																				10.22									1050	1050									

C.2 Pre-development: Input Parameter Calculations/ PCSWMM Input Files



Link C7
Existing Ditch
5yr-12SCS
C7 100yr-12SCS
C7 100y-24SCS
C7 5yr-24SCS
Flow (L/s)
3500
3000
2500
2000
1500
1000
500
0
4 Fri
3AM
6AM
9AM
12PM
3PM
6PM
9PM
5 Sat
Nov 2022
Date/Time

ALTERNATIVE RUNOFF METHOD (ARM) - PCSWMM VERSION 7.5.3406

This is a new version of ARM - your feedback and suggestions are solicited.
Create a ticket, post on the PCSWMM feature request forum, or email us directly!

Simulation start time:	11/04/2022 00:00:00
Simulation end time:	11/05/2022 00:00:00
Runoff wet weather time steps:	300 seconds
Report time steps:	60 seconds
Number of data points:	1441

****
Unit Hydrographs Runoff Method
****

Subcatchment	Runoff Method	Raingage	Area (ha)	Time of Concentration (min)	Time to Peak (min)	Time after Peak (min)	Peak UH Flow (m^3/s/mm)	UH Depth (mm)
IND-1	Dimensionless UH (483.4)	RG1	7.56	27.74	19.15	73.97	0.04929	0.993
EXT_S2	Dimensionless UH (483.4)	RG1	2.513	19.17	14	51.11	0.0224	0.991
EXT_S9	Dimensionless UH (483.4)	RG1	10.83	57.28	36.87	152.7	0.03667	0.995
EXT_S11	Dimensionless UH (483.4)	RG1	0.463	19.05	13.93	50.79	0.00415	0.99
EXT_S6	Dimensionless UH (483.4)	RG1	8.335	57.22	36.83	152.56	0.02825	0.996
EXT_S8	Dimensionless UH (483.4)	RG1	11.551	46.67	30.5	124.42	0.04728	0.993
EXT_S7	Dimensionless UH (483.4)	RG1	9.668	34.8	23.38	92.77	0.05163	0.991
EXT_S5	Dimensionless UH (483.4)	RG1	0.286	8.24	7.44	21.96	0.0048	0.986
EXT_S15	Dimensionless UH (483.4)	RG1	7.42	55.29	35.67	147.39	0.02597	0.996
EXT_S16	Dimensionless UH (483.4)	RG1	9.609	55.58	35.85	148.18	0.03346	0.996
EXT_S27	Dimensionless UH (483.4)	RG1	6.18	29.83	20.4	79.52	0.03783	0.993

EXT_S26	Dimensionless UH (483.4)	RG1	5.36	31.11	21.16	82.93	0.03162	0.992
EXT_S14	Dimensionless UH (483.4)	RG1	4.987	24.51	17.21	65.36	0.03618	0.993
EXT_S20	Dimensionless UH (483.4)	RG1	1.112	45.41	29.74	121.05	0.00467	0.993
EXT_S21	Dimensionless UH (483.4)	RG1	5.168	46.29	30.28	123.41	0.02131	0.993
EXT_S22	Dimensionless UH (483.4)	RG1	5.268	44.52	29.21	118.69	0.02251	0.992
EXT_S29	Dimensionless UH (483.4)	RG1	1.869	19.57	14.24	52.17	0.01639	0.99
EXT_S23	Dimensionless UH (483.4)	RG1	1.597	15.64	11.88	41.69	0.01678	0.989
EXT_S30	Dimensionless UH (483.4)	RG1	0.807	13.48	10.59	35.93	0.00952	0.991
ex-site	Dimensionless UH (483.4)	RG1	29.9	83.93	52.86	223.75	0.07062	1.001

****
ARM Runoff Summary
****

Subcatchment	Total Precip (mm)	Total Losses (mm)	Total Runoff (mm)	Total Runoff 10^6 ltr	Peak Runoff LPS	Runoff Coeff (fraction)
IND-1	96	54.309	41.68	3.151	705.843	0.434
EXT_S2	96	54.309	41.823	1.051	269.676	0.436
EXT_S9	96	61.169	34.857	3.775	568.808	0.363
EXT_S11	96	61.169	34.946	0.162	40.796	0.364
EXT_S6	96	64.364	31.662	2.639	388.57	0.33
EXT_S8	96	51.442	44.559	5.147	903.708	0.464
EXT_S7	96	57.819	38.188	3.692	734.306	0.398

EXT_S5	96	54.309	42.238	0.121	36.781	0.44
EXT_S15	96	64.364	31.671	2.35	352.69	0.33
EXT_S16	96	61.169	34.863	3.35	512.647	0.363
EXT_S27	96	57.819	38.123	2.356	505.757	0.397
EXT_S26	96	57.819	38.19	2.047	430.067	0.398
EXT_S14	96	48.245	47.784	2.383	563.388	0.498
EXT_S20	96	54.309	41.682	0.464	82.218	0.434
EXT_S21	96	56.084	39.919	2.063	359.035	0.416
EXT_S22	96	54.309	41.686	2.196	393.286	0.434
EXT_S29	96	52.492	43.628	0.815	208.755	0.454
EXT_S23	96	52.492	43.131	0.689	183.058	0.449
EXT_S30	96	54.309	41.475	0.335	91.83	0.432
ex-site	96	51.937	44.047	13.17	1652.763	0.459

WARNING ARM01: Computed UH depth for ARM subcatchment EXT_S5 is not unity. Consider reducing wet weather time step.
WARNING ARM01: Computed UH depth for ARM subcatchment EXT_S23 is not unity. Consider reducing wet weather time step.

```
[TITLE]
;;Project Title/Notes

[OPTIONS]
;;Option             Value
FLOW_UNITS           LPS
INFILTRATION         HORTON
FLOW_ROUTING         DYNWAVE
LINK_OFFSETS         ELEVATION
MIN_SLOPE            0
ALLOW_PONDING        NO
SKIP_STEADY_STATE    NO

START_DATE           11/04/2022
START_TIME           00:00:00
REPORT_START_DATE    11/04/2022
REPORT_START_TIME    00:00:00
END_DATE             11/05/2022
END_TIME             00:00:00
SWEEP_START          01/01
SWEEP_END            12/31
DRY_DAYS             0
REPORT_STEP          00:01:00
WET_STEP             00:05:00
DRY_STEP             00:05:00
ROUTING_STEP         5
RULE_STEP            00:00:00

INERTIAL_DAMPING     PARTIAL
NORMAL_FLOW_LIMITED  BOTH
FORCE_MAIN_EQUATION  H-W
VARIABLE_STEP        0
LENGTHENING_STEP     0
MIN_SURFAREA         0
MAX_TRIALS           8
HEAD_TOLERANCE       0.0015
SYS_FLOW_TOL         5
LAT_FLOW_TOL         5
MINIMUM_STEP         0.5
THREADS              2

[FILES]
;;Interfacing Files
USE INFLOWS "C:\Users\apaerez\Documents\ana's\1604\Mill
Valley\Existing\exist_100yr_12SCS_2023-11-20_amp.arm.txt"

[EVAPORATION]
;;Data Source    Parameters
;;-------------- ----------------
CONSTANT         0.0
```

```
DRY_ONLY         NO

[RAINGAGES]
;;Name           Format    Interval SCF      Source
;;-------------- --------- -------- -------- ----------
RG1              INTENSITY 0:30     1.0      TIMESERIES 100yr12hrSCS

[SUBCATCHMENTS]
;;Name           Rain Gage        Outlet           Area     %Imperv  Width
%Slope   CurbLen  SnowPack
;;-------------- ---------------- ---------------- -------- -------- --------
-------- -------- ----------------
EXT_S1           RG1              J10              4.2583   40       958      0.6
   0
EXT_S10          RG1              J23              13.4877  7        3034.8   0.96
   0
EXT_S12          RG1              J13              2.0123   11       452      0.71
   0
EXT_S13          RG1              J26              4.9346   6        1109     0.75
   0
EXT_S17          RG1              J25              0.889    0        200      0.71
   0
EXT_S24          RG1              J50              4.0965   1        920      1.3
   0
EXT_S25          RG1              J50              2.5562   0        574      1.9
   0
EXT_S28          RG1              J4               0.3185   30       218      3
   0
EXT_S3_1         RG1              J2               3.816346 45       857      0.5
   0
EXT_S3_2         RG1              J10              6.967    25       112.371  0.5
   0
EXT_S4           RG1              J18              0.5587   30       374      3
   0

[SUBAREAS]
;;Subcatchment   N-Imperv   N-Perv     S-Imperv   S-Perv     PctZero    RouteTo
PctRouted
;;-------------- ---------- ---------- ---------- ---------- ---------- ----------
----------
EXT_S1           0.013      0.25       1.57       4.67       0          PERVIOUS
100
EXT_S10          0.013      0.25       1.57       4.67       0          PERVIOUS
100
EXT_S12          0.013      0.25       1.57       4.67       0          PERVIOUS
100
EXT_S13          0.013      0.25       1.57       4.67       0          PERVIOUS
100
EXT_S17          0.013      0.25       1.57       4.67       0          PERVIOUS
100
```

```
EXT_S24          0.013      0.25       1.57       4.67       0          PERVIOUS
100
EXT_S25          0.013      0.25       1.57       4.67       0          PERVIOUS
100
EXT_S28          0.013      0.25       1.57       4.67       0          PERVIOUS
100
EXT_S3_1         0.013      0.25       1.57       4.67       0          PERVIOUS
100
EXT_S3_2         0.013      0.25       1.57       4.67       0          PERVIOUS
100
EXT_S4           0.013      0.25       1.57       4.67       0          PERVIOUS
100

[INFILTRATION]
;;Subcatchment   Param1     Param2     Param3     Param4     Param5
;;-------------- ---------- ---------- ---------- ---------- ----------
EXT_S1           76.2       13.2       4.14       7          0
EXT_S10          76.2       13.2       4.14       7          0
EXT_S12          76.2       13.2       4.14       7          0
EXT_S13          76.2       13.2       4.14       7          0
EXT_S17          76.2       13.2       4.14       7          0
EXT_S24          76.2       13.2       4.14       7          0
EXT_S25          76.2       13.2       4.14       7          0
EXT_S28          76.2       13.2       4.14       7          0
EXT_S3_1         76.2       13.2       4.14       7          0
EXT_S3_2         76.2       13.2       4.14       7          0
EXT_S4           76.2       13.2       4.14       7          0

[JUNCTIONS]
;;Name           Elevation  MaxDepth   InitDepth  SurDepth   Aponded
;;-------------- ---------- ---------- ---------- ---------- ----------
J1               123.36     1.94       0          0          0
J13              136.82     1.62       0          0          0
J17              137.25     1.87       0          0          0
J18              135.9      0.878      0          0          0
J19              142.025    1          0          0          0
J2               137.78     1.34       0          0          0
J21              143.605    1          0          0          0
J22              134.865    1.1        0          0          0
J23              139.11     1.4        0          0          0
J25              136.36     1.24       0          0          0
J26              136.25     1.35       0          0          0
J27              136.07     1.53       0          0          0
J31              142.006    1          0          0          0
J4               131.25     2.31       0          0          0
J46              127.668    1          0          0          0
J5               130.89     0.85       0          0          0
J50              123.805    1.995      0          0          0
J57              125.77     1          0          0          0
J6               123.32     1.99       0          0          0
```

```
J7               128.02     1.2        0          0          0

[OUTFALLS]
;;Name           Elevation  Type       Stage Data       Gated    Route To
;;-------------- ---------- ---------- ---------------- -------- ----------------
OF1              123.25     NORMAL                      NO

[STORAGE]
;;Name           Elev.    MaxDepth   InitDepth  Shape      Curve Name/Params
    N/A      Fevap    Psi      Ksat     IMD
;;-------------- -------- ---------- ---------- ----------
-------------------------- -------- --------          -------- --------
J10              136.83   1.61       0          FUNCTIONAL 2000      0         0
    0        0
J3               131.54   2.02       0          FUNCTIONAL 0         0         8000
    0        0
J55              132.51   1          0          FUNCTIONAL 0         0
10000    0        0

[CONDUITS]
;;Name           From Node        To Node          Length     Roughness  InOffset
OutOffset  InitFlow   MaxFlow
;;-------------- ---------------- ---------------- ---------- ---------- ----------
---------- ---------- ----------
C16              J7               J46              242.849    0.035      128.02
127.62     0          0
C17              J31              J55              456.331    0.035      142.006
132.51     0          0
C2               J4               J5               155.141    0.035      131.25
130.89     0          0
C21              J19              J22              336.61     0.035      142.025
134.865    0          0
C22              J21              J19              60.97      0.035      143.605
142.025    0          0
C25              J13              J25              150.821    0.035      136.82
136.36     0          0
C26              J17              J18              181.019    0.035      137.25
135.9      0          0
C27              J18              J4               500.106    0.035      135.9
131.25     0          0
C28              J23              J22              393.336    0.035      139.11
134.865    0          0
C3               J5               J7               106.152    0.035      130.89
128.02     0          0
C30              J25              J26              126.258    0.035      136.36
136.25     0          0
C31              J27              J18              149.093    0.035      136.07
135.9      0          0
C32              J26              J27              21.553     0.035      136.25
136.07     0          0
```

```
C33             J22             J55             235.66     0.035      134.865
132.51     0          0
C34             J55             J3              127.624    0.035      132.51
131.54     0          0
C5              J6              OF1             5          0.035      123.32
123.25     0          0
C6_1            J50             J1              75.404     0.035      123.8
123.36     0          0
C7              J57             J50             215.319    0.035      125.77
123.8      0          0
C8              J46             J57             154.465    0.035      127.668
125.77     0          0
clvt-appleton   J3              J4              22.849     0.025      131.54
131.25     0          0
Clvt-Indust1    J10             J13             12.357     0.024      136.83
136.82     0          0
Clvt-Indust2    J2              J17             15.666     0.024      137.78
137.25     0          0
clvt-oldalmonte1 J1             J6              20.637     0.022      123.53
123.32     0          0
clvt-oldalmonte2 J1             J6              22.693     0.022      123.57
123.32     0          0

[WEIRS]
;;Name           From Node        To Node          Type         CrestHt    Qcoeff
  Gated    EndCon   EndCoeff   Surcharge  RoadWidth  RoadSurf   Coeff. Curve
;;-------------- ---------------- ---------------- ------------ ----------
---------- -------- -------- ---------- ---------- ---------- ----------
----------------
W1               J1               J6               TRANSVERSE   125.15     1.74
  NO       0        0          YES
weir-Apple       J3               J4               TRANSVERSE   133.41     1.74
  NO       0        0          YES
weir-ind1        J10              J13              TRANSVERSE   138.29     1.74
  NO       0        0          YES
weir-ind2        J2               J17              TRANSVERSE   138.97     1.74
  NO       0        0          YES

[XSECTIONS]
;;Link           Shape        Geom1            Geom2      Geom3      Geom4
Barrels    Culvert
;;-------------- ------------ ---------------- ---------- ---------- ----------
---------- ----------
C16              TRAPEZOIDAL  1.2              1          3          3          1

C17              TRAPEZOIDAL  1                1          3          3          1

C2               TRIANGULAR   0.85             3.4        0          0          1

C21              TRAPEZOIDAL  1                1          3          3          1
```

```
C22              TRAPEZOIDAL  1                1         3         3         1

C25              TRAPEZOIDAL  0.65             3         5         5         1

C26              TRIANGULAR   1.2              1.91      0         0         1

C27              TRIANGULAR   0.5              6         0         0         1

C28              TRIANGULAR   1.1              5         0         0         1

C3               TRAPEZOIDAL  1.2              1         3         3         1

C30              TRIANGULAR   0.5              7         0         0         1

C31              TRIANGULAR   0.5              4         0         0         1

C32              TRIANGULAR   0.4              5         0         0         1

C33              TRAPEZOIDAL  1.1              1         3         3         1

C34              TRAPEZOIDAL  1.1              1         3         3         1

C5               TRIANGULAR   0.79             8.7       0         0         1

C6_1             TRIANGULAR   1                8.7       0         0         1

C7               TRIANGULAR   1                10.1      0         0         1

C8               TRIANGULAR   0.84             7.5       0         0         1

clvt-appleton    CIRCULAR     1.1              0         0         0         1
       6
Clvt-Indust1     CIRCULAR     0.75             0         0         0         1
       6
Clvt-Indust2     CIRCULAR     0.6              0         0         0         1
       6
clvt-oldalmonte1 CIRCULAR     0.83             0         0         0         1
       6
clvt-oldalmonte2 CIRCULAR     0.83             0         0         0         1
       6
W1               RECT_OPEN    0.15             10        0         0
weir-Apple       RECT_OPEN    0.15             10        0         0
weir-ind1        RECT_OPEN    0.15             3         0         0
weir-ind2        RECT_OPEN    0.15             6         0         0

[TRANSECTS]
;;Transect Data in HEC-2 format
;
;8.5m asphalt
```

```
;2m sidewalk on each side
NC 0.025    0.025    0.013
X1 ROW               10       7.08     19.58    0.0      0.0      0.0      0.0
0.0
GR 0.35     0        0.3      3.33     0.19     7.08     0.15     9.08     0
9.08
GR 0.128    13.33    0        17.58    0.15     17.58    0.19     19.58    0.35
23.33

[LOSSES]
;;Link           Kentry     Kexit      Kavg       Flap Gate  Seepage
;;-------------- ---------- ---------- ---------- ---------- ----------

[REPORT]
;;Reporting Options
INPUT      YES
CONTROLS   NO
SUBCATCHMENTS ALL
NODES ALL
LINKS ALL

[TAGS]
Subcatch   EXT_S1           EXTERNAL
Subcatch   EXT_S10          EXTERNAL
Subcatch   EXT_S12          EXTERNAL
Subcatch   EXT_S13          EXTERNAL
Subcatch   EXT_S17          EXTERNAL
Subcatch   EXT_S24          EXTERNAL
Subcatch   EXT_S25          EXTERNAL
Subcatch   EXT_S28          EXTERNAL
Subcatch   EXT_S3_1         EXTERNAL
Subcatch   EXT_S3_2         EXTERNAL
Subcatch   EXT_S4           EXTERNAL
Node       J13              EX_DITCH
Node       J17              EX_DITCH
Node       J18              EX_DITCH
Node       J19              WDT
Node       J21              WDT
Node       J22              EX_DITCH
Node       J23              EX_DITCH
Node       J25              EX_DITCH
Node       J26              EX_DITCH
Node       J27              EX_DITCH
Node       J31              WDT
Node       J4               Prop.Ditch
Node       J46              Ex.Ditch
Node       J5               Prop.Ditch
Node       J50              Ex.Ditch
Node       J57              Ex.Ditch
Node       J7               Prop.Ditch
```

Node	J55	EX_DITCH
Link	C16	EX_DITCH
Link	C17	WDT
Link	C2	EX_DITCH
Link	C21	WDT
Link	C22	WDT
Link	C25	EX_DITCH
Link	C26	EX_DITCH
Link	C27	EX_DITCH
Link	C28	EX_DITCH
Link	C3	EX_DITCH
Link	C30	EX_DITCH
Link	C31	EX_DITCH
Link	C32	EX_DITCH
Link	C33	EX_DITCH
Link	C34	EX_DITCH
Link	C5	ex_ditch
Link	C6_1	EX_DITCH
Link	C7	EX_DITCH
Link	C8	EX_DITCH
Link	clvt-appleton	clvt
Link	Clvt-Indust1	clvt
Link	Clvt-Indust2	clvt
Link	clvt-oldalmonte1	clvt

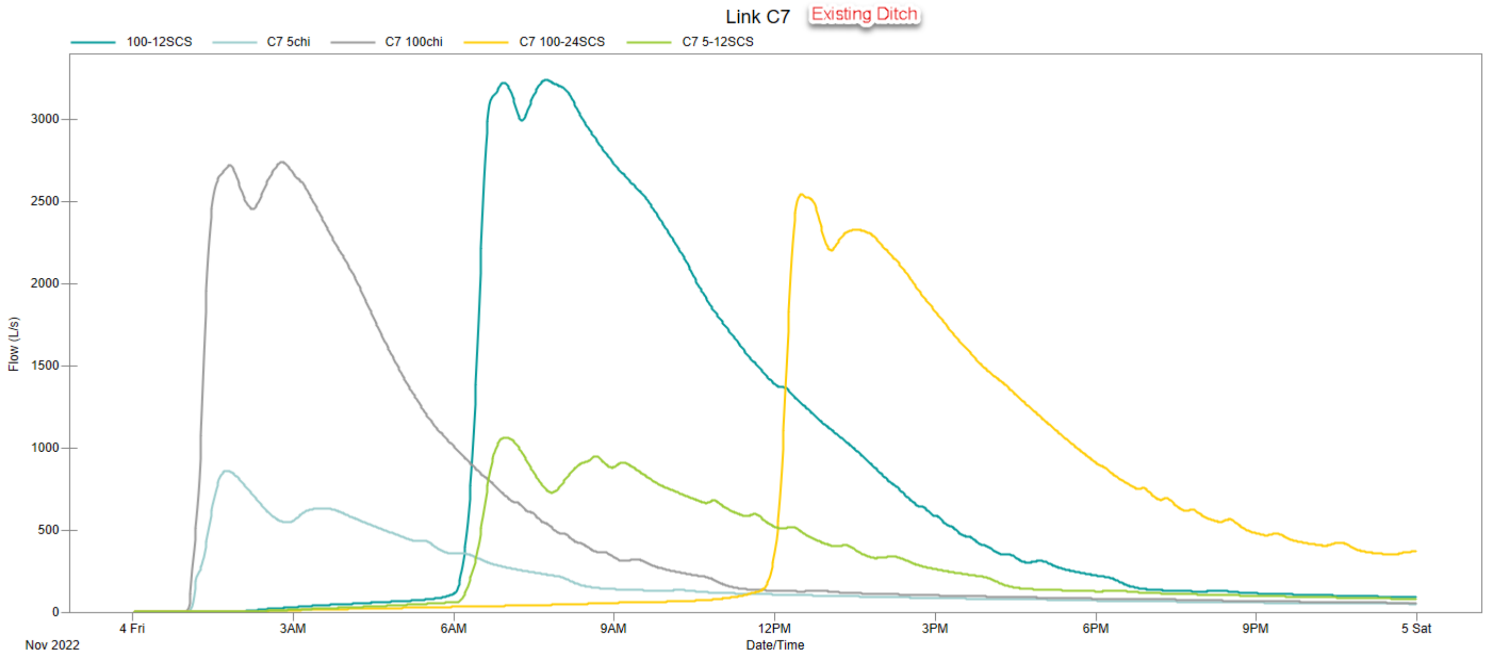
[MAP]

DIMENSIONS	329663.5041	5009128.17	330979.8059	5011249.476
UNITS	Meters			

C.3 Post-Development: Input Parameter Calculations/ PCSWMM Input Files

Runoff Coefficient Calculations

Name	Area (m2)	Hard Surface (m2)	Gravel Surface (m2)	Soft Surface (m2)	C
C105A	21050	12756	0	8294	0.62
C107A	2105	1465	0	640	0.69
C107B	9789	-	-	-	0.50
C108A	13141	7962	0	5179	0.62
C111A	13126	8354	0	4772	0.65
C112A	12897	7961	0	4936	0.63
C112B	4821	-	-	-	0.50
C113A	10623	7421	0	3202	0.69
C114A	13291	8287	0	5004	0.64
C115A	10058	7249	0	2809	0.70
C116A	11479	8527	0	2952	0.72
C117A	9105	6651	0	2454	0.71
C119A	6259	4572	0	1687	0.71
C121A	10025	6089	0	3936	0.63
C125A	3302	2321	0	981	0.69
C126A	2735	2047	0	688	0.72
C152A	9934	6142	0	3792	0.63
C133A	9105	6685	0	2420	0.71
C134A	6747	4538	0	2209	0.67
C136A	5115	3627	0	1488	0.70
C137A	12665	7478	0	5187	0.61
C138A	6893	4710	0	2183	0.68
C141A	9219	6045	0	3174	0.66
C151A	6520	4779	1	1740	0.71
POND	20916	-	-	-	0.60
UNC-1	7764	4562	0	3202	0.61
UNC-2	2934	1710	0	1224	0.61
UNC-3	8875	0	0	8875	0.35
UNC-4	8733	4944	0	3789	0.60
UNC-5	3493	2092	0	1401	0.35



Link C7
Existing Ditch
100-12SCS
C7 5chi
C7 100chi
C7 100-24SCS
C7 5-12SCS
Flow (L/s)
3000
2500
2000
1500
1000
500
0
4 Fri
Nov 2022
3AM
6AM
9AM
12PM
3PM
6PM
9PM
5 Sat
Date/Time

```
[TITLE]
;;Project Title/Notes

[OPTIONS]
;;Option             Value
FLOW_UNITS           LPS
INFILTRATION         HORTON
FLOW_ROUTING         DYNWAVE
LINK_OFFSETS         ELEVATION
MIN_SLOPE            0
ALLOW_PONDING        NO
SKIP_STEADY_STATE    NO

START_DATE           11/04/2022
START_TIME           00:00:00
REPORT_START_DATE    11/04/2022
REPORT_START_TIME    00:00:00
END_DATE             11/05/2022
END_TIME             00:00:00
SWEEP_START          01/01
SWEEP_END            12/31
DRY_DAYS             0
REPORT_STEP          00:01:00
WET_STEP             00:01:00
DRY_STEP             00:01:00
ROUTING_STEP         5
RULE_STEP            00:00:00

INERTIAL_DAMPING     PARTIAL
NORMAL_FLOW_LIMITED  BOTH
FORCE_MAIN_EQUATION  H-W
VARIABLE_STEP        0
LENGTHENING_STEP     0
MIN_SURFAREA         0
MAX_TRIALS           8
HEAD_TOLERANCE       0.0015
SYS_FLOW_TOL         5
LAT_FLOW_TOL         5
MINIMUM_STEP         0.5
THREADS              2

[FILES]
;;Interfacing Files
USE HOTSTART "C:\Users\apaerez\Documents\ana's\1604\Mill
Valley\PCSWMM\nov2023\100chi.HSF"
USE INFLOWS "C:\Users\apaerez\Documents\ana's\1604\Mill
Valley\PCSWMM\nov2023\prop_ult_100y-chi_2023-11-20.arm.txt"

[EVAPORATION]
;;Data Source    Parameters
```

```
;;-------------- ----------------
CONSTANT         0.0
DRY_ONLY         NO

[RAINGAGES]
;;Name           Format    Interval SCF      Source
;;-------------- --------- -------- -------- ----------
RG1              INTENSITY 0:10     1.0      TIMESERIES 100yr3hrChicago

[SUBCATCHMENTS]
;;Name           Rain Gage        Outlet           Area     %Imperv  Width
%Slope   CurbLen  SnowPack
;;-------------- ---------------- ---------------- -------- -------- --------
-------- -------- ----------------
;0.62
C105A            RG1              C105A-S          2.1048   60       1020.33  2
   0
;0.69
C107A            RG1              C107A-S          0.210529 70       63.797   2
   0
;0.50
C107B            RG1              C107B-S          0.97976  42.857   220      4.5
   0
;0.70
C107C            RG1              C107C-S          3.877885 71.429   873      2
   0
;0.62
C108A            RG1              C108A-S          1.314079 60       623.999  2
   0
;0.65
C111A            RG1              C111A-S          1.310237 64.286   594.26   2
   0
;0.63
C112A            RG1              C112A-S          1.289739 61.429   519.993  2
   0
;0.50
C112B            RG1              C112B-S          0.480016 42.857   108.004  2
   0
;0.69
C113A            RG1              C113A-S          1.060386 70       413.31   2
   0
;0.64
C114A            RG1              C114A-S          1.329135 62.857   518      2
   0
;0.70
C115A            RG1              C115A-S          1.005793 71.429   332      2
   0
;0.72
C116A            RG1              C116A-S          1.147892 74.286   451.68   2
   0
```

```
;0.71
C117A           RG1             C117A-S         0.910484 72.857   327.996  2
   0
;0.71
C119A           RG1             C119A-S         0.625452 72.857   181.28   2
   0
;0.63
C121A           RG1             C121A-S         1.002545 61.429   430.998  2
   0
;0.69
C125A           RG1             C125A-S         0.3332   70       176.51   2
   0
;0.72
C126A           RG1             C126A-S         0.274776 74.286   76.93    2
   0
;0.5
C126B           RG1             C126A-S         0.5366   42.857   353.79   2
   0
;0.71
C133A           RG1             C133A-S         0.908952 72.857   333.94   2
   0
;0.67
C134A           RG1             C134A-S         0.674716 67.143   206.001  2
   0
;0.70
C136A           RG1             C136A-S         0.511513 71.429   204.001  2
   0
;0.61
C137A           RG1             C137A-S         1.266486 58.571   494.992  2
   0
;0.68
C138A           RG1             C138A-S         0.689303 68.571   227.997  2
   0
;0.66
C141A           RG1             C141A-S         0.921923 65.714   306      2
   0
;0.71
C151A           RG1             C151A-S         0.651805 72.857   275.7    2
   0
;0.63
C152A           RG1             C152A-S         0.991426 61.429   480.62   2
   0
EXT_S1          RG1             J10             4.2583   40       957.998  0.6
   0
EXT_S10         RG1             J23             13.4877  7        3034.831 0.96
   0
EXT_S12         RG1             J13             2.0123   11       451.999  0.71
   0
EXT_S13         RG1             J26             4.9346   6        1108.999 0.75
   0
```

```
EXT_S17          RG1              J25              0.889    0        200      0.71
   0
EXT_S24          RG1              J50              4.0965   1        920.004  1.3
   0
EXT_S25          RG1              J50              2.5562   0        574.001  1.9
   0
EXT_S28          RG1              J4               0.3185   30       218.001  3
   0
EXT_S3_1         RG1              J2               3.816346 45       857.009  0.5
   0
EXT_S3_2         RG1              J10              6.967    25       112.371  0.5
   0
EXT_S4           RG1              J18              0.5587   30       373.988  3
   0
;0.80
IND-1            RG1              IND-1-S          5.7832   85.714   1501     2
   0
;0.60
POND             RG1              POND-S           2.091604 57.143   471      1
   0
;0.61
UNC-1            RG1              J57              0.776379 58.571   164.003  2
   0
;0.61
UNC-2            RG1              J48              0.293368 58.571   270      2
   0
;0.5
UNC-3            RG1              J26              0.887493 21.43    65       2
   0
;0.60
UNC-4            RG1              J5               0.873272 57.143   194.996  2
   0
;0.50
UNC-5            RG1              J18              0.349297 21.43    191.7    2
   0

[SUBAREAS]
;;Subcatchment   N-Imperv   N-Perv     S-Imperv   S-Perv     PctZero    RouteTo
PctRouted
;;-------------- ---------- ---------- ---------- ---------- ---------- ----------
----------
C105A            0.013      0.25       1.57       4.67       0          OUTLET
C107A            0.013      0.25       1.57       4.67       0          OUTLET
C107B            0.013      0.25       1.57       4.67       0          PERVIOUS
100
C107C            0.013      0.25       1.57       4.67       0          OUTLET
C108A            0.013      0.25       1.57       4.67       0          OUTLET
C111A            0.013      0.25       1.57       4.67       0          OUTLET
C112A            0.013      0.25       1.57       4.67       0          OUTLET
C112B            0.013      0.25       1.57       4.67       0          OUTLET
```

C113A	0.013	0.25	1.57	4.67	0	OUTLET
C114A	0.013	0.25	1.57	4.67	0	OUTLET
C115A	0.013	0.25	1.57	4.67	0	OUTLET
C116A	0.013	0.25	1.57	4.67	0	OUTLET
C117A	0.013	0.25	1.57	4.67	0	OUTLET
C119A	0.013	0.25	1.57	4.67	0	OUTLET
C121A	0.013	0.25	1.57	4.67	0	OUTLET
C125A	0.013	0.25	1.57	4.67	0	OUTLET
C126A	0.013	0.25	1.57	4.67	0	OUTLET
C126B	0.013	0.25	1.57	4.67	0	PERVIOUS
100						
C133A	0.013	0.25	1.57	4.67	0	OUTLET
C134A	0.013	0.25	1.57	4.67	0	OUTLET
C136A	0.013	0.25	1.57	4.67	0	OUTLET
C137A	0.013	0.25	1.57	4.67	0	OUTLET
C138A	0.013	0.25	1.57	4.67	0	OUTLET
C141A	0.013	0.25	1.57	4.67	0	OUTLET
C151A	0.013	0.25	1.57	4.67	0	OUTLET
C152A	0.013	0.25	1.57	4.67	0	OUTLET
EXT_S1	0.013	0.25	1.57	4.67	0	PERVIOUS
100						
EXT_S10	0.013	0.25	1.57	4.67	0	PERVIOUS
100						
EXT_S12	0.013	0.25	1.57	4.67	0	PERVIOUS
100						
EXT_S13	0.013	0.25	1.57	4.67	0	PERVIOUS
100						
EXT_S17	0.013	0.25	1.57	4.67	0	PERVIOUS
100						
EXT_S24	0.013	0.25	1.57	4.67	0	PERVIOUS
100						
EXT_S25	0.013	0.25	1.57	4.67	0	PERVIOUS
100						
EXT_S28	0.013	0.25	1.57	4.67	0	PERVIOUS
100						
EXT_S3_1	0.013	0.25	1.57	4.67	0	PERVIOUS
100						
EXT_S3_2	0.013	0.25	1.57	4.67	0	PERVIOUS
100						
EXT_S4	0.013	0.25	1.57	4.67	0	PERVIOUS
100						
IND-1	0.013	0.25	1.57	4.67	0	OUTLET
POND	0.013	0.25	1.57	4.67	0	OUTLET
UNC-1	0.013	0.25	1.57	4.67	0	PERVIOUS
100						
UNC-2	0.013	0.25	1.57	4.67	0	PERVIOUS
100						
UNC-3	0.013	0.25	1.57	4.67	0	PERVIOUS
100						
UNC-4	0.013	0.25	1.57	4.67	0	PERVIOUS

```
100
UNC-5            0.013      0.25       1.57       4.67       0          PERVIOUS
100

[INFILTRATION]
;;Subcatchment   Param1     Param2     Param3     Param4     Param5
;;-------------- ---------- ---------- ---------- ---------- ----------
C105A            76.2       13.2       4.14       7          0
C107A            76.2       13.2       4.14       7          0
C107B            76.2       13.2       4.14       7          0
C107C            76.2       13.2       4.14       7          0
C108A            76.2       13.2       4.14       7          0
C111A            76.2       13.2       4.14       7          0
C112A            76.2       13.2       4.14       7          0
C112B            76.2       13.2       4.14       7          0
C113A            76.2       13.2       4.14       7          0
C114A            76.2       13.2       4.14       7          0
C115A            76.2       13.2       4.14       7          0
C116A            76.2       13.2       4.14       7          0
C117A            76.2       13.2       4.14       7          0
C119A            76.2       13.2       4.14       7          0
C121A            76.2       13.2       4.14       7          0
C125A            76.2       13.2       4.14       7          0
C126A            76.2       13.2       4.14       7          0
C126B            76.2       13.2       4.14       7          0
C133A            76.2       13.2       4.14       7          0
C134A            76.2       13.2       4.14       7          0
C136A            76.2       13.2       4.14       7          0
C137A            76.2       13.2       4.14       7          0
C138A            76.2       13.2       4.14       7          0
C141A            76.2       13.2       4.14       7          0
C151A            76.2       13.2       4.14       7          0
C152A            76.2       13.2       4.14       7          0
EXT_S1           76.2       13.2       4.14       7          0
EXT_S10          76.2       13.2       4.14       7          0
EXT_S12          76.2       13.2       4.14       7          0
EXT_S13          76.2       13.2       4.14       7          0
EXT_S17          76.2       13.2       4.14       7          0
EXT_S24          76.2       13.2       4.14       7          0
EXT_S25          76.2       13.2       4.14       7          0
EXT_S28          76.2       13.2       4.14       7          0
EXT_S3_1         76.2       13.2       4.14       7          0
EXT_S3_2         76.2       13.2       4.14       7          0
EXT_S4           76.2       13.2       4.14       7          0
IND-1            76.2       13.2       4.14       7          0
POND             76.2       13.2       4.14       7          0
UNC-1            76.2       13.2       4.14       7          0
UNC-2            76.2       13.2       4.14       7          0
UNC-3            76.2       13.2       4.14       7          0
UNC-4            76.2       13.2       4.14       7          0
```

```
UNC-5            76.2       13.2       4.14       7          0

[JUNCTIONS]
;;Name           Elevation  MaxDepth   InitDepth  SurDepth   Aponded
;;-------------- ---------- ---------- ---------- ---------- ----------
J1               134.851    2.349      0          0          0
J100             127.62     1.458      0          0          0
J13              136.82     1.62       0          0          0
J17              137.25     1.87       0          0          0
J18              135.9      1.9        0          0          0
J19              142.025    1          0          0          0
J2               137.78     1.34       0          0          0
J21              143.605    1          0          0          0
J22              134.865    1.1        0          0          0
J25              136.36     1.64       0          0          0
J26              136.25     1.75       0          0          0
J27              136.07     1.93       0          0          0
J31              142.006    1          0          0          0
J4               131.25     2          0          0          0
J46              127.668    1          0          0          0
J48              126.97     1.2        0          0          0
J5               130.89     1.2        0          0          0
J50              123.8      1.7        0          0          0
J57              125.77     1          0          0          0
J6               123.36     1.94       0          0          0
J7               128.02     1.2        0          0          0
J8               123.32     1.99       0          0          0

[OUTFALLS]
;;Name           Elevation  Type       Stage Data       Gated    Route To
;;-------------- ---------- ---------- ---------------- -------- ----------------
OF1              123.25     NORMAL                      NO

[STORAGE]
;;Name           Elev.    MaxDepth   InitDepth  Shape      Curve Name/Params
    N/A      Fevap    Psi      Ksat     IMD
;;-------------- -------- ---------- ---------- ----------
-------------------------- -------- --------          -------- --------
100B             128.544  3.587      0          FUNCTIONAL 0          0          1.13
    0        0
101              128.518  3.616      0          FUNCTIONAL 0          0          1.13
    0        0
102              128.54   4.787      0          FUNCTIONAL 0          0          1.13
    0        0
103              128.714  6.127      0          FUNCTIONAL 0          0          1.13
    0        0
103A             130.079  4.796      0          FUNCTIONAL 0          0          1.13
    0        0
104              130.171  4.73       0          FUNCTIONAL 0          0          1.13
    0        0
```

105	130.39	4.581	0	FUNCTIONAL	0	0	1.13	0	0
106	130.825	4.417	0	FUNCTIONAL	0	0	1.13	0	0
107	130.918	4.436	0	FUNCTIONAL	0	0	1.13	0	0
108	129.31	4.428	0	FUNCTIONAL	0	0	1.13	0	0
109	129.826	3.507	0	FUNCTIONAL	0	0	1.13	0	0
110	130.309	3.061	0	FUNCTIONAL	0	0	1.13	0	0
111	131.797	2.703	0	FUNCTIONAL	0	0	1.13	0	0
112	130.544	2.906	0	FUNCTIONAL	0	0	1.13	0	0
113	131.953	2.649	0	FUNCTIONAL	0	0	1.13	0	0
114	130.137	2.983	0	FUNCTIONAL	0	0	1.13	0	0
115	130.424	3.156	0	FUNCTIONAL	0	0	1.13	0	0
116	130.903	2.787	0	FUNCTIONAL	0	0	1.13	0	0
117	131.794	2.531	0	FUNCTIONAL	0	0	1.13	0	0
118	131.256	3.738	0	FUNCTIONAL	0	0	1.13	0	0
119	132.08	2.892	0	FUNCTIONAL	0	0	1.13	0	0
121	130.54	4.402	0	FUNCTIONAL	0	0	1.13	0	0
123	131.023	3.991	0	FUNCTIONAL	0	0	1.13	0	0
125	131.272	3.78	0	FUNCTIONAL	0	0	1.13	0	0
126	131.516	3.429	0	FUNCTIONAL	0	0	1.13	0	0
130	131.779	3.12	0	FUNCTIONAL	0	0	1.13	0	0
132	132.046	2.839	0	FUNCTIONAL	0	0	1.13	0	0
133	132.692	2.551	0	FUNCTIONAL	0	0	1.13	0	0
134	130.174	2.936	0	FUNCTIONAL	0	0	1.13	0	0
135	130.569	2.881	0	FUNCTIONAL	0	0	1.13	0	0
136	132.058	2.469	0	FUNCTIONAL	0	0	1.13	0	0

137	130.836	2.924	0	FUNCTIONAL	0	0	1.13	0	0
138	132.193	2.545	0	FUNCTIONAL	0	0	1.13	0	0
139	132.362	2.854	0	FUNCTIONAL	0	0	1.13	0	0
140	132.444	2.872	0	FUNCTIONAL	0	0	1.13	0	0
141	132.68	2.573	0	FUNCTIONAL	0	0	1.13	0	0
150	131.879	3.063	0	FUNCTIONAL	0	0	1.13	0	0
151	132.366	2.634	0	FUNCTIONAL	0	0	1.13	0	0
152	132.642	2.568	0	FUNCTIONAL	0	0	1.13	0	0
200	128.23	2.402	0	FUNCTIONAL	0	0	1.13	0	0
C105A-S	132.96	2.4	0	FUNCTIONAL	0	0	0	0	0
C107A-S	133.21	2.4	0	FUNCTIONAL	0	0	0	0	0
C107B-S	133.6	2.4	0	FUNCTIONAL	0	0	0	0	0
C107C-S	133.6	2.4	0	FUNCTIONAL	0	0	0	0	0
C108A-S	132.93	2.4	0	FUNCTIONAL	0	0	0	0	0
C111A-S	132.74	2.4	0	FUNCTIONAL	0	0	0	0	0
C112A-S	131.44	2.4	0	FUNCTIONAL	0	0	0	0	0
C112B-S	131.5	2.4	0	FUNCTIONAL	0	0	0	0	0
C113A-S	132.59	2.4	0	FUNCTIONAL	0	0	0	0	0
C114A-S	131.2	2.4	0	FUNCTIONAL	0	0	0	0	0
C115A-S	131.41	2.4	0	FUNCTIONAL	0	0	0	0	0
C116A-S	131.64	2.4	0	FUNCTIONAL	0	0	0	0	0
C117A-S	132.99	2.4	0	FUNCTIONAL	0	0	0	0	0
C119A-S	133.06	2.4	0	FUNCTIONAL	0	0	0	0	0
C121A-S	132.66	2.4	0	FUNCTIONAL	0	0	0	0	0
C125A-S	132.82	2.4	0	FUNCTIONAL	0	0	0	0	0

```
C126A-S          132.86   2.67       0          FUNCTIONAL 0         0         0
    0        0
C132A-S          134.96   0.4        0          FUNCTIONAL 0         0         0
    0        0
C133A-S          133.17   2.4        0          FUNCTIONAL 0         0         0
    0        0
C134A-S          131.32   2.4        0          FUNCTIONAL 0         0         0
    0        0
C136A-S          132.9    2.4        0          FUNCTIONAL 0         0         0
    0        0
C137A-S          131.47   2.4        0          FUNCTIONAL 0         0         0
    0        0
C138A-S          132.96   2.4        0          FUNCTIONAL 0         0         0
    0        0
C141A-S          133.25   2.4        0          FUNCTIONAL 0         0         0
    0        0
C151A-S          133.01   2.4        0          FUNCTIONAL 0         0         0
    0        0
C152A-S          133.25   2.4        0          FUNCTIONAL 0         0         0
    0        0
IND-1-S          136      2          0          TABULAR    ind-1
    0        0
J10              136.83   1.61       0          FUNCTIONAL 1000      0         0
    0        0
;invert elev. taken from existing 620mm culvert outlet elev on north of road
J23              139.11   1.69       0          FUNCTIONAL 0         0         4000
    0        0
J3               131.54   1.71       0          FUNCTIONAL 0         0         6000
    0        0
J55              132.51   1          0          FUNCTIONAL 0         0
10000    0        0
J9               132.94   2.4        0          FUNCTIONAL 0         0         0
    0        0
;Stage Storage Curve from sept 2023 option 1
POND-S           127.5    3.25       1.5        TABULAR    Pond
    0        0
S10              134.17   0.4        0          FUNCTIONAL 0         0         0
    0        0
S11              134.87   0.4        0          FUNCTIONAL 0         0         0
    0        0
S3               133.36   0.4        0          FUNCTIONAL 0         0         0
    0        0
S4               133.2    0.4        0          FUNCTIONAL 0         0         0
    0        0
S5               134.84   0.4        0          FUNCTIONAL 0         0         0
    0        0
S6               133.68   0.4        0          FUNCTIONAL 0         0         0
    0        0
S7               133.28   0.4        0          FUNCTIONAL 0         0         0
    0        0
```

```
S8               133.4    0.4        0          FUNCTIONAL 0         0         0
    0        0

[CONDUITS]
;;Name           From Node        To Node          Length     Roughness  InOffset
OutOffset  InitFlow   MaxFlow
;;-------------- ---------------- ---------------- ---------- ---------- ----------
---------- ---------- ----------
100B-100A        100B             POND-S           37.498     0.013      128.544
128.506    0          0
101-100          101              POND-S           15.358     0.013      128.518
128.503    0          0
101-100B         101              100B             30.699     0.013      128.634
128.604    0          0
102-101          102              101              14.145     0.013      128.54
128.525    0          0
103-102          103              102              76.148     0.013      128.714
128.6      0          0
103A-103         103A             103              46         0.013      130.079
129.964    0          0
104-103A         104              103A             34         0.013      130.171
130.086    0          0
105-104          105              104              84.651     0.013      130.39
130.179    0          0
106-105          106              105              44.934     0.013      130.825
130.69     0          0
107-106          107              106              27.944     0.013      130.918
130.834    0          0
108-103          108              103              197.419    0.013      129.31
129.014    0          0
109-108          109              108              66.31      0.013      129.826
129.76     0          0
110-109          110              109              85.997     0.013      130.309
130.051    0          0
111-110          111              110              207.568    0.013      131.797
130.759    0          0
112-110          112              110              79.978     0.013      130.544
130.384    0          0
113-112          113              112              206.836    0.013      131.953
130.919    0          0
114-109          114              109              86.003     0.013      130.137
130.051    0          0
115-114          115              114              212.007    0.013      130.424
130.212    0          0
116-115          116              115              219.471    0.013      130.903
130.574    0          0
117-104          117              104              182.62     0.013      131.794
131.246    0          0
118-105          118              105              23.141     0.013      131.256
131.14     0          0
```

```
119-118          119              118              161.8      0.013      132.08
131.271    0          0
121-108          121              108              160        0.013      130.54
130.06     0          0
123-121          123              121              86.003     0.013      131.023
130.765    0          0
125-123          125              123              80.01      0.013      131.272
131.032    0          0
126-125          126              125              78.413     0.013      131.516
131.281    0          0
130-103          130              103              80         0.013      131.779
131.539    0          0
132-130          132              130              86         0.013      132.046
131.788    0          0
133-132          133              132              195.462    0.013      132.692
132.106    0          0
134-102          134              102              74.349     0.013      130.174
129.876    0          0
135-134          135              134              79.986     0.013      130.569
130.249    0          0
136-135          136              135              111.446    0.013      132.058
130.944    0          0
137-135          137              135              86.003     0.013      130.836
130.578    0          0
138-137          138              137              132.144    0.013      132.193
131.136    0          0
139-105          139              105              65.642     0.013      132.362
132.165    0          0
140-139          140              139              24.199     0.013      132.444
132.371    0          0
141-140          141              140              75.883     0.013      132.68
132.453    0          0
150-103A         150              103A             80.006     0.013      131.879
131.479    0          0
151-150          151              150              67.484     0.013      132.366
132.029    0          0
152-150          152              150              137.569    0.013      132.642
131.954    0          0
200-200A         200              J100             32.3       0.01       128.23
128.03     0          0
C1               C107C-S          C107A-S          5          0.013      135.6
135.21     0          0
C11              J48              J57              95.752     0.035      126.97
125.77     0          0
;assumed 0.5% slope
C12              S3               S7               16         0.013      133.36
133.28     0          0
C12_1            C121A-S          S10              82.2       0.013      134.66
134.17     0          0
C12_2            S10              S6               79.5       0.013      134.17
```

```
133.68     0          0
C15                C117A-S            S10                108.8       0.013       134.99
134.17     0          0
C16                J7                 J100               49.839      0.035       128.02
127.62     0          0
C17                J31                J55                456.331     0.035       142.006
132.51     0          0
C18                J100               J48                81.314      0.035       127.62
126.97     0          0
C19                C108A-S            S6                 108.2       0.013       134.93
133.68     0          0
C2                 J4                 J5                 106.625     0.035       131.25
130.89     0          0
C20                S6                 S7                 66.3        0.013       133.68
133.28     0          0
C21                J19                J22                336.61      0.035       142.025
134.865    0          0
C22                J21                J19                60.97       0.035       143.605
142.025    0          0
C23                C112B-S            S3                 5           0.035       133.5
133.36     0          0
;assumed 0.5% slope
C23_1              C125A-S            C121A-S            167         0.013       134.82
134.74     0          0
C25                J13                J25                150.821     0.035       136.82
136.36     0          0
C26                J17                J18                181.019     0.035       137.25
135.9      0          0
C27_1              J18                J1                 112.936     0.035       135.9
134.851    0          0
C27_2              J1                 J4                 387.729     0.035       134.851
131.25     0          0
C28                J23                J22                393.336     0.035       139.11
134.865    0          0
;assumed 0.5% slope
C29                C112A-S            S3                 16          0.013       133.44
133.36     0          0
C3                 J5                 J7                 358.496     0.035       130.89
128.02     0          0
C30                J25                J26                126.258     0.035       136.36
136.25     0          0
C31                J27                J18                149.093     0.035       136.07
135.9      0          0
C32                J26                J27                21.553      0.035       136.25
136.07     0          0
C33                J22                J55                235.66      0.035       134.865
132.51     0          0
C34                J55                J3                 127.624     0.035       132.51
131.54     0          0
C35                S4                 POND-S             5           0.035       133.2
```

```
130.45     0          0
C36              J8               OF1              5          0.035      123.32
123.25     0          0
C36_1            C138A-S          C137A-S          145        0.013      134.96
133.47     0          0
;assumed 0.5% slope
C36_2            C137A-S          S8               14         0.013      133.47
133.4      0          0
;assumed 0.5% slope
C37              C119A-S          C121A-S          80         0.013      135.06
134.66     0          0
C38              C114A-S          POND-S           10         0.035      133.2
130.45     0          0
;assumed 0.5% slope
C39              S7               C114A-S          16         0.013      133.28
133.2      0          0
;assumed 0.5% slope
C39_1            C116A-S          C115A-S          46         0.013      133.64
133.41     0          0
;assumed 0.5% slope
C39_2            C115A-S          C114A-S          42         0.013      133.41
133.2      0          0
C4               C107B-S          C105A-S          20         0.013      135.6
134.96     0          0
;assumed 0.5% slope
C42              C152A-S          J9               149.271    0.013      135.25
134.9      0          0
;assumed 0.5% slope
C43              C111A-S          S3               276        0.013      134.74
133.36     0          0
;assumed 0.5% slope
C44_1            C105A-S          S11              119.583    0.013      134.96
134.863    0          0
;assumed 0.5% slope
C44_2            S11              S5               28.766     0.013      134.863
134.84     0          0
;assumed 0.5% slope
C45_1            C113A-S          C112A-S          228        0.013      134.58
133.44     0          0
;assumed 0.5% slope
C46_1            C133A-S          C132A-S          42         0.013      135.17
134.96     0          0
;assumed 0.5% slope
C46_2            C132A-S          S5               154.123    0.013      134.96
134.9      0          0
;assumed 0.5% slope
C47              C126A-S          C125A-S          8          0.013      134.86
134.82     0          0
C49              C136A-S          S8               141.6      0.013      134.9
133.4      0          0
```

```
;assumed 0.5% slope
C5               C141A-S          C105A-S          58         0.013      135.25
134.96     0          0
;assumed 0.5% slope
C50_1            S8               C134A-S          16         0.013      133.4
133.32     0          0
;assumed 0.5% slope
C50_2            C134A-S          S4               24         0.013      133.32
133.2      0          0
C51              S5               S4               88.6       0.013      134.84
133.2      0          0
;assumed 0.5% slope
C6               C107A-S          C105A-S          50         0.013      135.21
134.96     0          0
C6_1             J50              J6               75.404     0.035      123.8
123.36     0          0
C7               J57              J50              215.319    0.035      125.77
123.8      0          0
C8               J46              J57              154.465    0.035      127.668
125.77     0          0
C9_1             C151A-S          J9               70         0.013      135.01
134.94     0          0
C9_2             J9               S11              78         0.013      134.94
134.87     0          0
clvt-appleton    J3               J4               22.849     0.025      131.54
131.25     0          0
Clvt-Indust1     J10              J13              12.357     0.024      136.83
136.82     0          0
Clvt-Indust2     J2               J17              19.163     0.024      137.78
137.25     0          0
;Information from Oct. 2022 (Annis, Osullivan, Vollebekk Ltd.)
;BASED ON TOP OF PIPE ELEV. PIPE SIZE IS APPROX. 830mm
;CSP (MATERIAL)
clvt-oldalmonte1 J6               J8               20.637     0.022      123.53
123.32     0          0
;Information from Oct. 2022 (Annis, Osullivan, Vollebekk Ltd.)
;BASED ON TOP OF PIPE ELEV. PIPE SIZE IS APPROX. 830mm
;CSP (MATERIAL)
clvt-oldalmonte2 J6               J8               22.693     0.022      123.57
123.32     0          0

[ORIFICES]
;;Name           From Node        To Node          Type         Offset     Qcoeff
  Gated    CloseTime
;;-------------- ---------------- ---------------- ------------ ----------
---------- -------- ----------
Qual-Orf         POND-S           200              SIDE         129        0.61
  NO       0

[WEIRS]
```

```
;;Name           From Node        To Node          Type         CrestHt    Qcoeff
  Gated     EndCon   EndCoeff   Surcharge  RoadWidth  RoadSurf   Coeff. Curve
;;-------------- ---------------- ---------------- ------------ ----------
---------- -------- -------- ---------- ---------- ---------- ----------
----------------
Quant-W          POND-S           200              TRANSVERSE   129.5      1.7
  NO        0        0          YES
Spillway         POND-S           200              TRANSVERSE   130.45     1.74
  NO        0        0          YES
W1               J6               J8               TRANSVERSE   125.15     1.74
  NO        0        0          YES
weir-Apple       J3               J4               TRANSVERSE   133.41     1.74
  NO        0        0          YES
weir-ind1        J10              J13              TRANSVERSE   138.29     1.74
  NO        0        0          YES
weir-ind2        J2               J17              TRANSVERSE   138.97     1.74
  NO        0        0          YES

[OUTLETS]
;;Name           From Node        To Node          Offset     Type
QTable/Qcoeff    Qexpon     Gated
;;-------------- ---------------- ---------------- ---------- ----------------
---------------- ---------- --------
C105A-IC         C105A-S          105              132.96     TABULAR/HEAD
105A-IC                     NO
C107A-IC         C107A-S          107              133.21     TABULAR/HEAD
107A-IC                     NO
C107B-IC         C107B-S          107              133.6      TABULAR/HEAD
107B-IC                     NO
C107C-IC         C107C-S          107              133.6      TABULAR/HEAD
107C-IC                     NO
C108A-IC         C108A-S          108              132.93     TABULAR/HEAD
108A-IC                     NO
C111A-IC         C111A-S          111              132.74     TABULAR/HEAD
111A-IC                     NO
C112A-IC         C112A-S          112              131.44     TABULAR/HEAD
112A-IC                     NO
C112B-IC         C112B-S          112              131.5      TABULAR/HEAD
112B-IC                     NO
C113A-IC         C113A-S          113              132.58     TABULAR/HEAD
113A-IC                     NO
C114A-IC         C114A-S          114              131.2      TABULAR/HEAD
114A-IC                     NO
C115A-IC         C115A-S          115              131.41     TABULAR/HEAD
115A-IC                     NO
C116A-IC         C116A-S          116              131.64     TABULAR/HEAD
116A-IC                     NO
C117A-IC         C117A-S          117              132.99     TABULAR/HEAD
117A-IC                     NO
C119A-IC         C119A-S          119              133.06     TABULAR/HEAD
```

```
119A-IC                          NO
C121A-IC         C121A-S         121              132.66     TABULAR/HEAD
121A-IC                          NO
C125A-IC         C125A-S         125              132.82     TABULAR/HEAD
125A-IC                          NO
C126A-IC         C126A-S         126              132.86     TABULAR/HEAD
126A-IC                          NO
C133A-IC         C133A-S         133              133.17     TABULAR/HEAD
133A-IC                          NO
C134A-IC         C134A-S         134              131.32     TABULAR/HEAD
134A-IC                          NO
C136A-IC         C136A-S         136              132.9      TABULAR/HEAD
136A-IC                          NO
C137A-IC         C137A-S         137              131.47     TABULAR/HEAD
137A-IC                          NO
C138A-IC         C138A-S         138              132.96     TABULAR/HEAD
138A-IC                          NO
C141A-IC         C141A-S         141              133.25     TABULAR/HEAD
141A-IC                          NO
C151A-IC         C151A-S         151              133.01     TABULAR/HEAD
151A-IC                          NO
C152A-IC         C152A-S         152              133.25     TABULAR/HEAD
152A-IC                          NO
IND-1-IC         IND-1-S         J1               136        TABULAR/HEAD
IND-1-IC                         NO

[XSECTIONS]
;;Link           Shape        Geom1            Geom2      Geom3      Geom4
Barrels    Culvert
;;-------------- ------------ ---------------- ---------- ---------- ----------
---------- ----------
100B-100A        CIRCULAR     1.95             0          0          0          1

101-100          CIRCULAR     1.95             0          0          0          1

101-100B         CIRCULAR     1.95             0          0          0          1

102-101          CIRCULAR     1.95             0          0          0          1

103-102          CIRCULAR     1.95             0          0          0          1

103A-103         CIRCULAR     1.2              0          0          0          1

104-103A         CIRCULAR     1.2              0          0          0          1

105-104          CIRCULAR     1.2              0          0          0          1

106-105          CIRCULAR     0.9              0          0          0          1

107-106          CIRCULAR     0.9              0          0          0          1
```

108-103	CIRCULAR	1.65	0	0	0	1
109-108	CIRCULAR	1.2	0	0	0	1
110-109	CIRCULAR	0.975	0	0	0	1
111-110	CIRCULAR	0.525	0	0	0	1
112-110	CIRCULAR	0.9	0	0	0	1
113-112	CIRCULAR	0.525	0	0	0	1
114-109	CIRCULAR	0.975	0	0	0	1
115-114	CIRCULAR	0.9	0	0	0	1
116-115	CIRCULAR	0.75	0	0	0	1
117-104	CIRCULAR	0.525	0	0	0	1
118-105	CIRCULAR	0.45	0	0	0	1
119-118	CIRCULAR	0.45	0	0	0	1
121-108	CIRCULAR	1.2	0	0	0	1
123-121	CIRCULAR	0.975	0	0	0	1
125-123	CIRCULAR	0.975	0	0	0	1
126-125	CIRCULAR	0.975	0	0	0	1
130-103	CIRCULAR	0.75	0	0	0	1
132-130	CIRCULAR	0.6	0	0	0	1
133-132	CIRCULAR	0.525	0	0	0	1
134-102	CIRCULAR	0.825	0	0	0	1
135-134	CIRCULAR	0.75	0	0	0	1
136-135	CIRCULAR	0.375	0	0	0	1
137-135	CIRCULAR	0.75	0	0	0	1
138-137	CIRCULAR	0.45	0	0	0	1
139-105	CIRCULAR	0.525	0	0	0	1

140-139	CIRCULAR	0.525	0	0	0	1
141-140	CIRCULAR	0.525	0	0	0	1
150-103A	CIRCULAR	0.6	0	0	0	1
151-150	CIRCULAR	0.45	0	0	0	1
152-150	CIRCULAR	0.525	0	0	0	1
200-200A	CIRCULAR	1.05	0	0	0	1
C1	IRREGULAR	ROW	0	0	0	1
C11	TRAPEZOIDAL	1	1	3	3	1
C12	IRREGULAR	ROW	0	0	0	1
C12_1	IRREGULAR	ROW	0	0	0	1
C12_2	IRREGULAR	ROW	0	0	0	1
C15	IRREGULAR	ROW	0	0	0	1
C16	TRAPEZOIDAL	1.2	1	3	3	1
C17	TRAPEZOIDAL	1	1	3	3	1
C18	TRAPEZOIDAL	1.2	1	3	3	1
C19	IRREGULAR	ROW	0	0	0	1
C2	TRIANGULAR	0.85	3.4	0	0	1
C20	IRREGULAR	ROW	0	0	0	1
C21	TRAPEZOIDAL	1	1	3	3	1
C22	TRAPEZOIDAL	1	1	3	3	1
C23	TRIANGULAR	0.3	3	0	0	1
C23_1	IRREGULAR	ROW	0	0	0	1
C25	TRAPEZOIDAL	0.8	3	5	5	1
C26	TRIANGULAR	1.2	1.91	0	0	1
C27_1	TRIANGULAR	0.65	2.8	0	0	1

C27_2	TRIANGULAR	0.65	3.5	0	0	1
C28	TRIANGULAR	0.3	3.9	0	0	1
C29	IRREGULAR	ROW	0	0	0	1
C3	TRAPEZOIDAL	1.2	1	3	3	1
C30	TRIANGULAR	0.8	7	0	0	1
C31	TRIANGULAR	0.8	4	0	0	1
C32	TRIANGULAR	0.8	5	0	0	1
C33	TRAPEZOIDAL	1.1	1	3	3	1
C34	TRAPEZOIDAL	1.1	1	3	3	1
C35	TRAPEZOIDAL	0.6	2	5	5	1
C36	TRIANGULAR	0.79	8.7	0	0	1
C36_1	IRREGULAR	ROW	0	0	0	1
C36_2	IRREGULAR	ROW	0	0	0	1
C37	IRREGULAR	ROW	0	0	0	1
C38	TRAPEZOIDAL	0.6	2	5	5	1
C39	IRREGULAR	ROW	0	0	0	1
C39_1	IRREGULAR	ROW	0	0	0	1
C39_2	IRREGULAR	ROW	0	0	0	1
C4	TRIANGULAR	0.6	3.6	0	0	1
C42	IRREGULAR	ROW	0	0	0	1
C43	IRREGULAR	ROW	0	0	0	1
C44_1	IRREGULAR	ROW	0	0	0	1
C44_2	IRREGULAR	ROW	0	0	0	1
C45_1	IRREGULAR	ROW	0	0	0	1
C46_1	IRREGULAR	ROW	0	0	0	1

```
C46_2            IRREGULAR    ROW              0         0         0         1

C47              IRREGULAR    ROW              0         0         0         1

C49              IRREGULAR    ROW              0         0         0         1

C5               IRREGULAR    ROW              0         0         0         1

C50_1            IRREGULAR    ROW              0         0         0         1

C50_2            IRREGULAR    ROW              0         0         0         1

C51              IRREGULAR    ROW              0         0         0         1

C6               IRREGULAR    ROW              0         0         0         1

C6_1             TRIANGULAR   1                10.1      0         0         1

C7               TRIANGULAR   1                10.1      0         0         1

C8               TRIANGULAR   0.84             7.5       0         0         1

C9_1             IRREGULAR    ROW              0         0         0         1

C9_2             IRREGULAR    ROW              0         0         0         1

clvt-appleton    CIRCULAR     1.1              0         0         0         1
       6
Clvt-Indust1     CIRCULAR     0.75             0         0         0         1
       6
Clvt-Indust2     CIRCULAR     0.6              0         0         0         1
       6
clvt-oldalmonte1 CIRCULAR     0.83             0         0         0         1
       6
clvt-oldalmonte2 CIRCULAR     0.83             0         0         0         1
       6
Qual-Orf         CIRCULAR     0.22             0         0         0
Quant-W          RECT_OPEN    0.9              1         0         0
Spillway         RECT_OPEN    0.2              10        0         0
W1               RECT_OPEN    0.15             10        0         0
weir-Apple       RECT_OPEN    0.25             10        0         0
weir-ind1        RECT_OPEN    0.15             3         0         0
weir-ind2        RECT_OPEN    0.15             6         0         0

[TRANSECTS]
;;Transect Data in HEC-2 format
;
;8.5m asphalt
;2m sidewalk on each side
```

```
NC 0.025    0.025    0.013
X1 ROW               10       7.08     19.58    0.0      0.0      0.0      0.0
0.0
GR 0.35     0        0.3      3.33     0.19     7.08     0.15     9.08     0
9.08
GR 0.128    13.33    0        17.58    0.15     17.58    0.19     19.58    0.35
23.33

[LOSSES]
;;Link           Kentry     Kexit      Kavg       Flap Gate  Seepage
;;-------------- ---------- ---------- ---------- ---------- ----------
101-100B         0          1.32       0          NO         0
102-101          0          0.02       0          NO         0
103-102          0          1.32       0          NO         0
103A-103         0          0.02       0          NO         0
104-103A         0          0.02       0          NO         0
105-104          0          0.06       0          NO         0
106-105          0          0.14       0          NO         0
107-106          0          0.14       0          NO         0
108-103          0          1.32       0          NO         0
109-108          0          1.32       0          NO         0
110-109          0          1.32       0          NO         0
111-110          0          1.32       0          NO         0
112-110          0          0.06       0          NO         0
113-112          0          1.32       0          NO         0
114-109          0          0.06       0          NO         0
115-114          0          1.32       0          NO         0
116-115          0          1.32       0          NO         0
117-104          0          1.32       0          NO         0
118-105          0          0.02       0          NO         0
119-118          0          0.14       0          NO         0
121-108          0          1.32       0          NO         0
123-121          0          1.32       0          NO         0
125-123          0          0.06       0          NO         0
126-125          0          0.06       0          NO         0
130-103          0          1.32       0          NO         0
132-130          0          0.02       0          NO         0
133-132          0          1.32       0          NO         0
134-102          0          1.32       0          NO         0
135-134          0          1.32       0          NO         0
136-135          0          1.32       0          NO         0
137-135          0          0.02       0          NO         0
138-137          0          1.32       0          NO         0
139-105          0          1.32       0          NO         0
140-139          0          0.06       0          NO         0
141-140          0          0.14       0          NO         0
151-150          0          0.02       0          NO         0
152-150          0          1.32       0          NO         0

[CURVES]
```

```
;;Name           Type       X-Value    Y-Value   
;;-------------- ---------- ---------- ----------
105A-IC          Rating     0          0         
105A-IC                     2          445       
105A-IC                     2.4        490       

107A-IC          Rating     0          0         
107A-IC                     2          48        
107A-IC                     2.4        53        

107B-IC          Rating     0          0         
107B-IC                     2          147       
107B-IC                     2.4        162       

107C-IC          Rating     0          0         
107C-IC                     2          900       
107C-IC                     2.4        965       

108A-IC          Rating     0          0         
108A-IC                     2          277       
108A-IC                     2.4        304       

111A-IC          Rating     0          0         
111A-IC                     2          289       
111A-IC                     2.4        318       

112A-IC          Rating     0          0         
112A-IC                     2          271       
112A-IC                     2.4        298       

112B-IC          Rating     0          0         
112B-IC                     2          70        
112B-IC                     2.4        77        

113A-IC          Rating     0          0         
113A-IC                     2          246       
113A-IC                     2.4        271       

114A-IC          Rating     0          0         
114A-IC                     2          284       
114A-IC                     2.4        312       

115A-IC          Rating     0          0         
115A-IC                     2          234       
115A-IC                     2.4        257       

116A-IC          Rating     0          0         
116A-IC                     2          279       
116A-IC                     2.4        310       
```

117A-IC	Rating	0	0
117A-IC		2	216
117A-IC		2.4	238
119A-IC	Rating	0	0
119A-IC		2	146
119A-IC		2.4	161
121A-IC	Rating	0	0
121A-IC		2	212
121A-IC		2.4	234
125A-IC	Rating	0	0
125A-IC		2	79
125A-IC		2.4	87
126A-IC	Rating	0	0
126A-IC		2	65
126A-IC		2.4	72
126B-IC	Rating	0	0
126B-IC		2	94
126B-IC		2.4	103
133A-IC	Rating	0	0
133A-IC		2	217
133A-IC		2.4	239
134A-IC	Rating	0	0
134A-IC		2	148
134A-IC		2.4	163
136A-IC	Rating	0	0
136A-IC		2	121
136A-IC		2.4	133
137A-IC	Rating	0	0
137A-IC		2	256
137A-IC		2.4	281
138A-IC	Rating	0	0
138A-IC		2	155
138A-IC		2.4	171
141A-IC	Rating	0	0
141A-IC		2	201
141A-IC		2.4	221
151A-IC	Rating	0	0
151A-IC		2	157

```
151A-IC                   2.4        173

152A-IC         Rating    0          0
152A-IC                   2          213
152A-IC                   2.4        234

DUMMY           Rating    0          0
DUMMY                     2          100
DUMMY                     2.4        110

IND-1-IC        Rating    0          0
IND-1-IC                  0.5        108
IND-1-IC                  1          214
IND-1-IC                  1.5        412
IND-1-IC                  2          412

clvt-up         Storage   0          0
clvt-up                   1.46       4000
clvt-up                   1.61       4000

ind-1           Storage   0          1150
ind-1                     1.5        1450
ind-1                     2          1600

ind-s           Storage   0          0
ind-s                     2          0
ind-s                     2.4        3000

;opt1 pond storage curve from September 2023
Pond            Storage   0          2710
Pond                      0.5        3686
Pond                      1          4662
Pond                      1.2        5411
Pond                      1.5        6730
Pond                      2          10376
Pond                      2.3        11082
Pond                      2.5        11553
Pond                      2.7        12025
Pond                      2.8        12260
Pond                      2.95       12613
Pond                      3.25       13105

store-1         Storage   0          0
store-1                   1          1124

test            Storage   0          1150
test                      2          2957
test                      2.4        3415
```

```
[REPORT]
;;Reporting Options
INPUT      YES
CONTROLS   NO
SUBCATCHMENTS ALL
NODES ALL
LINKS ALL

[TAGS]
Subcatch   C105A            Residential
Subcatch   C107A            Residential
Subcatch   C107B            Park
Subcatch   C107C            Fut-Retirement
Subcatch   C108A            Residential
Subcatch   C111A            Residential
Subcatch   C112A            Residential
Subcatch   C112B            Parkette
Subcatch   C113A            Residential
Subcatch   C114A            Residential
Subcatch   C115A            Residential
Subcatch   C116A            Residential
Subcatch   C117A            Residential
Subcatch   C119A            Residential
Subcatch   C121A            Residential
Subcatch   C125A            Residential
Subcatch   C126A            Residential
Subcatch   C126B            IND-Uncontrolled
Subcatch   C133A            Residential
Subcatch   C134A            Residential
Subcatch   C136A            Residential
Subcatch   C137A            Residential
Subcatch   C138A            Residential
Subcatch   C141A            Residential
Subcatch   C151A            Residential
Subcatch   C152A            Residential
Subcatch   EXT_S1           EXTERNAL
Subcatch   EXT_S10          EXTERNAL
Subcatch   EXT_S12          EXTERNAL
Subcatch   EXT_S13          EXTERNAL
Subcatch   EXT_S17          EXTERNAL
Subcatch   EXT_S24          EXTERNAL
Subcatch   EXT_S25          EXTERNAL
Subcatch   EXT_S28          EXTERNAL
Subcatch   EXT_S3_1         EXTERNAL
Subcatch   EXT_S3_2         EXTERNAL
Subcatch   EXT_S4           EXTERNAL
Subcatch   IND-1            Fut-Industrial
Subcatch   POND             Pond
Subcatch   UNC-1            Ditch
Subcatch   UNC-2            Ditch
```

Subcatch	UNC-3	Ditch
Subcatch	UNC-4	Ditch
Subcatch	UNC-5	Ditch
Node	J100	Prop.Ditch
Node	J13	EX_DITCH
Node	J17	EX_DITCH
Node	J18	EX_DITCH
Node	J19	WDT
Node	J21	WDT
Node	J22	EX_DITCH
Node	J25	EX_DITCH
Node	J26	EX_DITCH
Node	J27	EX_DITCH
Node	J31	WDT
Node	J4	Prop.Ditch
Node	J46	Ex.Ditch
Node	J48	Prop.Ditch
Node	J5	Prop.Ditch
Node	J50	Ex.Ditch
Node	J57	Ex.Ditch
Node	J6	Ex.Ditch
Node	J7	Prop.Ditch
Node	100B	MH
Node	101	MH
Node	102	MH
Node	103	MH
Node	103A	MH
Node	104	MH
Node	105	MH
Node	106	MH
Node	107	MH
Node	108	MH
Node	109	MH
Node	110	MH
Node	111	MH
Node	112	MH
Node	113	MH
Node	114	MH
Node	115	MH
Node	116	MH
Node	117	MH
Node	118	MH
Node	119	MH
Node	121	MH
Node	123	MH
Node	125	MH
Node	126	MH
Node	130	MH
Node	132	MH
Node	133	MH

Node	134	MH
Node	135	MH
Node	136	MH
Node	137	MH
Node	138	MH
Node	139	MH
Node	140	MH
Node	141	MH
Node	150	MH
Node	151	MH
Node	152	MH
Node	200	MH
Node	C107B-S	park
Node	C107C-S	fut-retirement
Node	C112B-S	parkette
Node	J10	Ext_drainage
Node	J23	EX_DITCH
Node	J3	Ext_drainage
Node	J55	Ext_drainage
Node	POND-S	Pond
Link	100B-100A	MINOR
Link	101-100	MINOR
Link	101-100B	MINOR
Link	102-101	MINOR
Link	103-102	MINOR
Link	103A-103	MINOR
Link	104-103A	MINOR
Link	105-104	MINOR
Link	106-105	MINOR
Link	107-106	MINOR
Link	108-103	MINOR
Link	109-108	MINOR
Link	110-109	MINOR
Link	111-110	MINOR
Link	112-110	MINOR
Link	113-112	MINOR
Link	114-109	MINOR
Link	115-114	MINOR
Link	116-115	MINOR
Link	117-104	MINOR
Link	118-105	MINOR
Link	119-118	MINOR
Link	121-108	MINOR
Link	123-121	MINOR
Link	125-123	MINOR
Link	126-125	MINOR
Link	130-103	MINOR
Link	132-130	MINOR
Link	133-132	MINOR
Link	134-102	MINOR

Link	135-134	MINOR
Link	136-135	MINOR
Link	137-135	MINOR
Link	138-137	MINOR
Link	139-105	MINOR
Link	140-139	MINOR
Link	141-140	MINOR
Link	150-103A	MINOR
Link	151-150	MINOR
Link	152-150	MINOR
Link	C1	MJ
Link	C11	Prop-Ditch
Link	C12	MJ
Link	C12_1	MJ
Link	C12_2	MJ
Link	C15	MJ
Link	C16	Prop-Ditch
Link	C17	WDT
Link	C18	Prop-Ditch
Link	C19	MJ
Link	C2	Prop-Ditch
Link	C20	MJ
Link	C21	WDT
Link	C22	WDT
Link	C23	MJ
Link	C23_1	MJ
Link	C25	EX_DITCH
Link	C26	EX_DITCH
Link	C27_1	EX_DITCH
Link	C27_2	EX_DITCH
Link	C28	EX_DITCH
Link	C29	MJ
Link	C3	Prop-Ditch
Link	C30	EX_DITCH
Link	C31	EX_DITCH
Link	C32	EX_DITCH
Link	C33	EX_DITCH
Link	C34	EX_DITCH
Link	C35	MJ
Link	C36	ex_ditch
Link	C36_1	MJ
Link	C36_2	MJ
Link	C37	MJ
Link	C38	MJ
Link	C39	MJ
Link	C39_1	MJ
Link	C39_2	MJ
Link	C4	MJ
Link	C42	MJ
Link	C43	MJ

```
Link       C44_1            MJ
Link       C44_2            MJ
Link       C45_1            MJ
Link       C46_1            MJ
Link       C46_2            MJ
Link       C47              MJ
Link       C49              MJ
Link       C5               MJ
Link       C50_1            MJ
Link       C50_2            MJ
Link       C51              MJ
Link       C6               MJ
Link       C6_1             EX_DITCH
Link       C7               EX_DITCH
Link       C8               EX_DITCH
Link       C9_1             MJ
Link       C9_2             MJ

[MAP]
DIMENSIONS        329663.5041      5009128.17       330979.8059      5011249.476

UNITS             Meters
```

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.015)

WARNING 03: negative offset ignored for Link C44_1
WARNING 03: negative offset ignored for Link C44_2
WARNING 03: negative offset ignored for Link C113A-IC
WARNING 02: maximum depth increased for Node J100

****
Element Count
****
Number of rain gages 1
Number of subcatchments ... 44
Number of nodes 104
Number of links 136
Number of pollutants 0
Number of land uses 0

****
Raingage Summary
****

Name	Data Source	Data Type	Recording Interval
RG1	100yr3hrChicago	INTENSITY	10 min.

****
Subcatchment Summary
****

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
C105A	2.10	1020.33	60.00	2.0000	RG1	C105A-S
C107A	0.21	63.80	70.00	2.0000	RG1	C107A-S
C107B	0.98	220.00	42.86	4.5000	RG1	C107B-S
C107C	3.88	873.00	71.43	2.0000	RG1	C107C-S
C108A	1.31	624.00	60.00	2.0000	RG1	C108A-S
C111A	1.31	594.26	64.29	2.0000	RG1	C111A-S
C112A	1.29	519.99	61.43	2.0000	RG1	

```
C112A-S
 C112B                        0.48    108.00     42.86    2.0000 RG1
C112B-S
 C113A                        1.06    413.31     70.00    2.0000 RG1
C113A-S
 C114A                        1.33    518.00     62.86    2.0000 RG1
C114A-S
 C115A                        1.01    332.00     71.43    2.0000 RG1
C115A-S
 C116A                        1.15    451.68     74.29    2.0000 RG1
C116A-S
 C117A                        0.91    328.00     72.86    2.0000 RG1
C117A-S
 C119A                        0.63    181.28     72.86    2.0000 RG1
C119A-S
 C121A                        1.00    431.00     61.43    2.0000 RG1
C121A-S
 C125A                        0.33    176.51     70.00    2.0000 RG1
C125A-S
 C126A                        0.27     76.93     74.29    2.0000 RG1
C126A-S
 C126B                        0.54    353.79     42.86    2.0000 RG1
C126A-S
 C133A                        0.91    333.94     72.86    2.0000 RG1
C133A-S
 C134A                        0.67    206.00     67.14    2.0000 RG1
C134A-S
 C136A                        0.51    204.00     71.43    2.0000 RG1
C136A-S
 C137A                        1.27    494.99     58.57    2.0000 RG1
C137A-S
 C138A                        0.69    228.00     68.57    2.0000 RG1
C138A-S
 C141A                        0.92    306.00     65.71    2.0000 RG1
C141A-S
 C151A                        0.65    275.70     72.86    2.0000 RG1
C151A-S
 C152A                        0.99    480.62     61.43    2.0000 RG1
C152A-S
 EXT_S1                       4.26    958.00     40.00    0.6000 RG1
J10
 EXT_S10                     13.49   3034.83      7.00    0.9600 RG1
J23
 EXT_S12                      2.01    452.00     11.00    0.7100 RG1
J13
 EXT_S13                      4.93   1109.00      6.00    0.7500 RG1
J26
 EXT_S17                      0.89    200.00      0.00    0.7100 RG1
J25
 EXT_S24                      4.10    920.00      1.00    1.3000 RG1
```

J50					
EXT_S25	2.56	574.00	0.00	1.9000	RG1
J50					
EXT_S28	0.32	218.00	30.00	3.0000	RG1
J4					
EXT_S3_1	3.82	857.01	45.00	0.5000	RG1
J2					
EXT_S3_2	6.97	112.37	25.00	0.5000	RG1
J10					
EXT_S4	0.56	373.99	30.00	3.0000	RG1
J18					
IND-1	5.78	1501.00	85.71	2.0000	RG1
IND-1-S					
POND	2.09	471.00	57.14	1.0000	RG1
POND-S					
UNC-1	0.78	164.00	58.57	2.0000	RG1
J57					
UNC-2	0.29	270.00	58.57	2.0000	RG1
J48					
UNC-3	0.89	65.00	21.43	2.0000	RG1
J26					
UNC-4	0.87	195.00	57.14	2.0000	RG1
J5					
UNC-5	0.35	191.70	21.43	2.0000	RG1
J18					

****
Node Summary
****

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
J1	JUNCTION	134.85	2.35	0.0	
J100	JUNCTION	127.62	1.46	0.0	
J13	JUNCTION	136.82	1.62	0.0	
J17	JUNCTION	137.25	1.87	0.0	
J18	JUNCTION	135.90	1.90	0.0	
J19	JUNCTION	142.03	1.00	0.0	
J2	JUNCTION	137.78	1.34	0.0	
J21	JUNCTION	143.60	1.00	0.0	
J22	JUNCTION	134.87	1.10	0.0	
J25	JUNCTION	136.36	1.64	0.0	
J26	JUNCTION	136.25	1.75	0.0	
J27	JUNCTION	136.07	1.93	0.0	
J31	JUNCTION	142.01	1.00	0.0	
J4	JUNCTION	131.25	2.00	0.0	
J46	JUNCTION	127.67	1.00	0.0	
J48	JUNCTION	126.97	1.20	0.0	
J5	JUNCTION	130.89	1.20	0.0	

J50	JUNCTION	123.80	1.70	0.0
J57	JUNCTION	125.77	1.00	0.0
J6	JUNCTION	123.36	1.94	0.0
J7	JUNCTION	128.02	1.20	0.0
J8	JUNCTION	123.32	1.99	0.0
OF1	OUTFALL	123.25	0.79	0.0
100B	STORAGE	128.54	3.59	0.0
101	STORAGE	128.52	3.62	0.0
102	STORAGE	128.54	4.79	0.0
103	STORAGE	128.71	6.13	0.0
103A	STORAGE	130.08	4.80	0.0
104	STORAGE	130.17	4.73	0.0
105	STORAGE	130.39	4.58	0.0
106	STORAGE	130.82	4.42	0.0
107	STORAGE	130.92	4.44	0.0
108	STORAGE	129.31	4.43	0.0
109	STORAGE	129.83	3.51	0.0
110	STORAGE	130.31	3.06	0.0
111	STORAGE	131.80	2.70	0.0
112	STORAGE	130.54	2.91	0.0
113	STORAGE	131.95	2.65	0.0
114	STORAGE	130.14	2.98	0.0
115	STORAGE	130.42	3.16	0.0
116	STORAGE	130.90	2.79	0.0
117	STORAGE	131.79	2.53	0.0
118	STORAGE	131.26	3.74	0.0
119	STORAGE	132.08	2.89	0.0
121	STORAGE	130.54	4.40	0.0
123	STORAGE	131.02	3.99	0.0
125	STORAGE	131.27	3.78	0.0
126	STORAGE	131.52	3.43	0.0
130	STORAGE	131.78	3.12	0.0
132	STORAGE	132.05	2.84	0.0
133	STORAGE	132.69	2.55	0.0
134	STORAGE	130.17	2.94	0.0
135	STORAGE	130.57	2.88	0.0
136	STORAGE	132.06	2.47	0.0
137	STORAGE	130.84	2.92	0.0
138	STORAGE	132.19	2.54	0.0
139	STORAGE	132.36	2.85	0.0
140	STORAGE	132.44	2.87	0.0
141	STORAGE	132.68	2.57	0.0
150	STORAGE	131.88	3.06	0.0
151	STORAGE	132.37	2.63	0.0
152	STORAGE	132.64	2.57	0.0
200	STORAGE	128.23	2.40	0.0
C105A-S	STORAGE	132.96	2.40	0.0
C107A-S	STORAGE	133.21	2.40	0.0
C107B-S	STORAGE	133.60	2.40	0.0
C107C-S	STORAGE	133.60	2.40	0.0

C108A-S	STORAGE	132.93	2.40	0.0
C111A-S	STORAGE	132.74	2.40	0.0
C112A-S	STORAGE	131.44	2.40	0.0
C112B-S	STORAGE	131.50	2.40	0.0
C113A-S	STORAGE	132.59	2.40	0.0
C114A-S	STORAGE	131.20	2.40	0.0
C115A-S	STORAGE	131.41	2.40	0.0
C116A-S	STORAGE	131.64	2.40	0.0
C117A-S	STORAGE	132.99	2.40	0.0
C119A-S	STORAGE	133.06	2.40	0.0
C121A-S	STORAGE	132.66	2.40	0.0
C125A-S	STORAGE	132.82	2.40	0.0
C126A-S	STORAGE	132.86	2.67	0.0
C132A-S	STORAGE	134.96	0.40	0.0
C133A-S	STORAGE	133.17	2.40	0.0
C134A-S	STORAGE	131.32	2.40	0.0
C136A-S	STORAGE	132.90	2.40	0.0
C137A-S	STORAGE	131.47	2.40	0.0
C138A-S	STORAGE	132.96	2.40	0.0
C141A-S	STORAGE	133.25	2.40	0.0
C151A-S	STORAGE	133.01	2.40	0.0
C152A-S	STORAGE	133.25	2.40	0.0
IND-1-S	STORAGE	136.00	2.00	0.0
J10	STORAGE	136.83	1.61	0.0
J23	STORAGE	139.11	1.69	0.0
J3	STORAGE	131.54	1.71	0.0
J55	STORAGE	132.51	1.00	0.0
J9	STORAGE	132.94	2.40	0.0
POND-S	STORAGE	127.50	3.25	0.0
S10	STORAGE	134.17	0.40	0.0
S11	STORAGE	134.87	0.40	0.0
S3	STORAGE	133.36	0.40	0.0
S4	STORAGE	133.20	0.40	0.0
S5	STORAGE	134.84	0.40	0.0
S6	STORAGE	133.68	0.40	0.0
S7	STORAGE	133.28	0.40	0.0
S8	STORAGE	133.40	0.40	0.0

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Link Summary
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Name	From Node	To Node	Type	Length	%Slope	Roughness
100B-100A	100B	POND-S	CONDUIT	37.5	0.1013	0.0130
101-100	101	POND-S	CONDUIT	15.4		

```
0.0977    0.0130
  101-100B          101               100B              CONDUIT            30.7
0.0977    0.0130
  102-101           102               101               CONDUIT            14.1
0.1060    0.0130
  103-102           103               102               CONDUIT            76.1
0.1497    0.0130
  103A-103          103A              103               CONDUIT            46.0
0.2500    0.0130
  104-103A          104               103A              CONDUIT            34.0
0.2500    0.0130
  105-104           105               104               CONDUIT            84.7
0.2493    0.0130
  106-105           106               105               CONDUIT            44.9
0.3004    0.0130
  107-106           107               106               CONDUIT            27.9
0.3006    0.0130
  108-103           108               103               CONDUIT           197.4
0.1499    0.0130
  109-108           109               108               CONDUIT            66.3
0.0995    0.0130
  110-109           110               109               CONDUIT            86.0
0.3000    0.0130
  111-110           111               110               CONDUIT           207.6
0.5001    0.0130
  112-110           112               110               CONDUIT            80.0
0.2001    0.0130
  113-112           113               112               CONDUIT           206.8
0.4999    0.0130
  114-109           114               109               CONDUIT            86.0
0.1000    0.0130
  115-114           115               114               CONDUIT           212.0
0.1000    0.0130
  116-115           116               115               CONDUIT           219.5
0.1499    0.0130
  117-104           117               104               CONDUIT           182.6
0.3001    0.0130
  118-105           118               105               CONDUIT            23.1
0.5013    0.0130
  119-118           119               118               CONDUIT           161.8
0.5000    0.0130
  121-108           121               108               CONDUIT           160.0
0.3000    0.0130
  123-121           123               121               CONDUIT            86.0
0.3000    0.0130
  125-123           125               123               CONDUIT            80.0
0.3000    0.0130
  126-125           126               125               CONDUIT            78.4
0.2997    0.0130
  130-103           130               103               CONDUIT            80.0
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0.3000    0.0130
  132-130           132               130               CONDUIT              86.0
0.3000    0.0130
  133-132           133               132               CONDUIT             195.5
0.2998    0.0130
  134-102           134               102               CONDUIT              74.3
0.4008    0.0130
  135-134           135               134               CONDUIT              80.0
0.4001    0.0130
  136-135           136               135               CONDUIT             111.4
0.9996    0.0130
  137-135           137               135               CONDUIT              86.0
0.3000    0.0130
  138-137           138               137               CONDUIT             132.1
0.7999    0.0130
  139-105           139               105               CONDUIT              65.6
0.3001    0.0130
  140-139           140               139               CONDUIT              24.2
0.3017    0.0130
  141-140           141               140               CONDUIT              75.9
0.2991    0.0130
  150-103A          150               103A              CONDUIT              80.0
0.5000    0.0130
  151-150           151               150               CONDUIT              67.5
0.4994    0.0130
  152-150           152               150               CONDUIT             137.6
0.5001    0.0130
  200-200A          200               J100              CONDUIT              32.3
0.6192    0.0100
  C1                C107C-S           C107A-S           CONDUIT               5.0
7.8238    0.0130
  C11               J48               J57               CONDUIT              95.8
1.2533    0.0350
  C12               S3                S7                CONDUIT              16.0
0.5000    0.0130
  C12_1             C121A-S           S10               CONDUIT              82.2
0.5961    0.0130
  C12_2             S10               S6                CONDUIT              79.5
0.6164    0.0130
  C15               C117A-S           S10               CONDUIT             108.8
0.7537    0.0130
  C16               J7                J100              CONDUIT              49.8
0.8026    0.0350
  C17               J31               J55               CONDUIT             456.3
2.0814    0.0350
  C18               J100              J48               CONDUIT              81.3
0.7994    0.0350
  C19               C108A-S           S6                CONDUIT             108.2
1.1553    0.0130
  C2                J4                J5                CONDUIT             106.6
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0.3376   0.0350
  C20   S6   S7   CONDUIT   66.3
0.6033   0.0130
  C21   J19   J22   CONDUIT   336.6
2.1276   0.0350
  C22   J21   J19   CONDUIT   61.0
2.5923   0.0350
  C23   C112B-S   S3   CONDUIT   5.0
2.8011   0.0350
  C23_1   C125A-S   C121A-S   CONDUIT   167.0
0.0479   0.0130
  C25   J13   J25   CONDUIT   150.8
0.3050   0.0350
  C26   J17   J18   CONDUIT   181.0
0.7458   0.0350
  C27_1   J18   J1   CONDUIT   112.9
0.9289   0.0350
  C27_2   J1   J4   CONDUIT   387.7
0.9288   0.0350
  C28   J23   J22   CONDUIT   393.3
1.0793   0.0350
  C29   C112A-S   S3   CONDUIT   16.0
0.5000   0.0130
  C3   J5   J7   CONDUIT   358.5
0.8006   0.0350
  C30   J25   J26   CONDUIT   126.3
0.0871   0.0350
  C31   J27   J18   CONDUIT   149.1
0.1140   0.0350
  C32   J26   J27   CONDUIT   21.6
0.8352   0.0350
  C33   J22   J55   CONDUIT   235.7
0.9994   0.0350
  C34   J55   J3   CONDUIT   127.6
0.7601   0.0350
  C35   S4   POND-S   CONDUIT   5.0
65.8553   0.0350
  C36   J8   OF1   CONDUIT   5.0
1.4001   0.0350
  C36_1   C138A-S   C137A-S   CONDUIT   145.0
1.0276   0.0130
  C36_2   C137A-S   S8   CONDUIT   14.0
0.5000   0.0130
  C37   C119A-S   C121A-S   CONDUIT   80.0
0.5000   0.0130
  C38   C114A-S   POND-S   CONDUIT   10.0
28.6028   0.0350
  C39   S7   C114A-S   CONDUIT   16.0
0.5000   0.0130
  C39_1   C116A-S   C115A-S   CONDUIT   46.0

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0.5000    0.0130
  C39_2            C115A-S          C114A-S          CONDUIT              42.0
0.5000    0.0130
  C4               C107B-S          C105A-S          CONDUIT              20.0
3.2016    0.0130
  C42              C152A-S          J9               CONDUIT             149.3
0.2345    0.0130
  C43              C111A-S          S3               CONDUIT             276.0
0.5000    0.0130
  C44_1            C105A-S          S11              CONDUIT             119.6
0.0753    0.0130
  C44_2            S11              S5               CONDUIT              28.8
0.1043    0.0130
  C45_1            C113A-S          C112A-S          CONDUIT             228.0
0.5000    0.0130
  C46_1            C133A-S          C132A-S          CONDUIT              42.0
0.5000    0.0130
  C46_2            C132A-S          S5               CONDUIT             154.1
0.0389    0.0130
  C47              C126A-S          C125A-S          CONDUIT               8.0
0.5000    0.0130
  C49              C136A-S          S8               CONDUIT             141.6
1.0594    0.0130
  C5               C141A-S          C105A-S          CONDUIT              58.0
0.5000    0.0130
  C50_1            S8               C134A-S          CONDUIT              16.0
0.5000    0.0130
  C50_2            C134A-S          S4               CONDUIT              24.0
0.5000    0.0130
  C51              S5               S4               CONDUIT              88.6
1.8513    0.0130
  C6               C107A-S          C105A-S          CONDUIT              50.0
0.5000    0.0130
  C6_1             J50              J6               CONDUIT              75.4
0.5835    0.0350
  C7               J57              J50              CONDUIT             215.3
0.9150    0.0350
  C8               J46              J57              CONDUIT             154.5
1.2289    0.0350
  C9_1             C151A-S          J9               CONDUIT              70.0
0.1000    0.0130
  C9_2             J9               S11              CONDUIT              78.0
0.0897    0.0130
  clvt-appleton    J3               J4               CONDUIT              22.8
1.2693    0.0250
  Clvt-Indust1     J10              J13              CONDUIT              12.4
0.0809    0.0240
  Clvt-Indust2     J2               J17              CONDUIT              19.2
2.7668    0.0240
  clvt-oldalmonte1 J6               J8               CONDUIT              20.6
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1.0176    0.0220
  clvt-oldalmonte2 J6               J8                CONDUIT           22.7
1.1017    0.0220
  Qual-Orf         POND-S           200               ORIFICE
  Quant-W          POND-S           200               WEIR
  Spillway         POND-S           200               WEIR
  W1               J6               J8                WEIR
  weir-Apple       J3               J4                WEIR
  weir-ind1        J10              J13               WEIR
  weir-ind2        J2               J17               WEIR
  C105A-IC         C105A-S          105               OUTLET
  C107A-IC         C107A-S          107               OUTLET
  C107B-IC         C107B-S          107               OUTLET
  C107C-IC         C107C-S          107               OUTLET
  C108A-IC         C108A-S          108               OUTLET
  C111A-IC         C111A-S          111               OUTLET
  C112A-IC         C112A-S          112               OUTLET
  C112B-IC         C112B-S          112               OUTLET
  C113A-IC         C113A-S          113               OUTLET
  C114A-IC         C114A-S          114               OUTLET
  C115A-IC         C115A-S          115               OUTLET
  C116A-IC         C116A-S          116               OUTLET
  C117A-IC         C117A-S          117               OUTLET
  C119A-IC         C119A-S          119               OUTLET
  C121A-IC         C121A-S          121               OUTLET
  C125A-IC         C125A-S          125               OUTLET
  C126A-IC         C126A-S          126               OUTLET
  C133A-IC         C133A-S          133               OUTLET
  C134A-IC         C134A-S          134               OUTLET
  C136A-IC         C136A-S          136               OUTLET
  C137A-IC         C137A-S          137               OUTLET
  C138A-IC         C138A-S          138               OUTLET
  C141A-IC         C141A-S          141               OUTLET
  C151A-IC         C151A-S          151               OUTLET
  C152A-IC         C152A-S          152               OUTLET
  IND-1-IC         IND-1-S          J1                OUTLET


  *********************
  Cross Section Summary
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                                        Full      Full      Hyd.      Max.   No. of
 Full
  Conduit          Shape               Depth      Area      Rad.     Width  Barrels
 Flow

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  100B-100A        CIRCULAR             1.95      2.99      0.49      1.95        1
4530.15
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101-100	CIRCULAR	1.95	2.99	0.49	1.95	1	4447.37
101-100B	CIRCULAR	1.95	2.99	0.49	1.95	1	4448.60
102-101	CIRCULAR	1.95	2.99	0.49	1.95	1	4634.14
103-102	CIRCULAR	1.95	2.99	0.49	1.95	1	5506.15
103A-103	CIRCULAR	1.20	1.13	0.30	1.20	1	1949.49
104-103A	CIRCULAR	1.20	1.13	0.30	1.20	1	1949.49
105-104	CIRCULAR	1.20	1.13	0.30	1.20	1	1946.59
106-105	CIRCULAR	0.90	0.64	0.23	0.90	1	992.34
107-106	CIRCULAR	0.90	0.64	0.23	0.90	1	992.60
108-103	CIRCULAR	1.65	2.14	0.41	1.65	1	3529.46
109-108	CIRCULAR	1.20	1.13	0.30	1.20	1	1230.08
110-109	CIRCULAR	0.97	0.75	0.24	0.97	1	1227.57
111-110	CIRCULAR	0.53	0.22	0.13	0.53	1	304.14
112-110	CIRCULAR	0.90	0.64	0.23	0.90	1	809.76
113-112	CIRCULAR	0.53	0.22	0.13	0.53	1	304.09
114-109	CIRCULAR	0.97	0.75	0.24	0.97	1	708.71
115-114	CIRCULAR	0.90	0.64	0.23	0.90	1	572.50
116-115	CIRCULAR	0.75	0.44	0.19	0.75	1	431.06
117-104	CIRCULAR	0.53	0.22	0.13	0.53	1	235.60
118-105	CIRCULAR	0.45	0.16	0.11	0.45	1	201.87
119-118	CIRCULAR	0.45	0.16	0.11	0.45	1	201.61
121-108	CIRCULAR	1.20	1.13	0.30	1.20	1	2135.56
123-121	CIRCULAR	0.97	0.75	0.24	0.97	1	1227.53
125-123	CIRCULAR	0.97	0.75	0.24	0.97	1	1227.48
126-125	CIRCULAR	0.97	0.75	0.24	0.97	1	1226.93

130-103	CIRCULAR	0.75	0.44	0.19	0.75	1
609.81						
132-130	CIRCULAR	0.60	0.28	0.15	0.60	1
336.33						
133-132	CIRCULAR	0.53	0.22	0.13	0.53	1
235.49						
134-102	CIRCULAR	0.82	0.53	0.21	0.82	1
908.83						
135-134	CIRCULAR	0.75	0.44	0.19	0.75	1
704.21						
136-135	CIRCULAR	0.38	0.11	0.09	0.38	1
175.31						
137-135	CIRCULAR	0.75	0.44	0.19	0.75	1
609.79						
138-137	CIRCULAR	0.45	0.16	0.11	0.45	1
255.01						
139-105	CIRCULAR	0.53	0.22	0.13	0.53	1
235.61						
140-139	CIRCULAR	0.53	0.22	0.13	0.53	1
236.22						
141-140	CIRCULAR	0.53	0.22	0.13	0.53	1
235.23						
150-103A	CIRCULAR	0.60	0.28	0.15	0.60	1
434.18						
151-150	CIRCULAR	0.45	0.16	0.11	0.45	1
201.49						
152-150	CIRCULAR	0.53	0.22	0.13	0.53	1
304.15						
200-200A	CIRCULAR	1.05	0.87	0.26	1.05	1
2793.61						
C1	ROW	0.35	3.93	0.19	23.33	1
28056.18						
C11	TRAPEZOIDAL	1.00	4.00	0.55	7.00	1
8548.78						
C12	ROW	0.35	3.93	0.19	23.33	1
7092.61						
C12_1	ROW	0.35	3.93	0.19	23.33	1
7744.34						
C12_2	ROW	0.35	3.93	0.19	23.33	1
7874.76						
C15	ROW	0.35	3.93	0.19	23.33	1
8707.98						
C16	TRAPEZOIDAL	1.20	5.52	0.64	8.20	1
10522.80						
C17	TRAPEZOIDAL	1.00	4.00	0.55	7.00	1
11016.61						
C18	TRAPEZOIDAL	1.20	5.52	0.64	8.20	1
10501.71						
C19	ROW	0.35	3.93	0.19	23.33	1
10781.38						

C2	TRIANGULAR	0.85	1.44	0.38	3.40	1	1258.94
C20	ROW	0.35	3.93	0.19	23.33	1	7791.05
C21	TRAPEZOIDAL	1.00	4.00	0.55	7.00	1	11138.14
C22	TRAPEZOIDAL	1.00	4.00	0.55	7.00	1	12294.59
C23	TRIANGULAR	0.30	0.45	0.15	3.00	1	599.63
C23_1	ROW	0.35	3.93	0.19	23.33	1	2195.36
C25	TRAPEZOIDAL	0.80	5.60	0.50	11.00	1	5580.65
C26	TRIANGULAR	1.20	1.15	0.37	1.91	1	1466.93
C27_1	TRIANGULAR	0.65	0.91	0.29	2.80	1	1109.97
C27_2	TRIANGULAR	0.65	1.14	0.30	3.50	1	1418.23
C28	TRIANGULAR	0.30	0.58	0.15	3.90	1	486.43
C29	ROW	0.35	3.93	0.19	23.33	1	7092.61
C3	TRAPEZOIDAL	1.20	5.52	0.64	8.20	1	10509.57
C30	TRIANGULAR	0.80	2.80	0.39	7.00	1	1260.43
C31	TRIANGULAR	0.80	1.60	0.37	4.00	1	797.62
C32	TRIANGULAR	0.80	2.00	0.38	5.00	1	2744.55
C33	TRAPEZOIDAL	1.10	4.73	0.59	7.60	1	9551.91
C34	TRAPEZOIDAL	1.10	4.73	0.59	7.60	1	8330.15
C35	TRAPEZOIDAL	0.60	3.00	0.37	8.00	1	35820.10
C36	TRIANGULAR	0.79	3.44	0.39	8.70	1	6187.67
C36_1	ROW	0.35	3.93	0.19	23.33	1	10168.09
C36_2	ROW	0.35	3.93	0.19	23.33	1	7092.61
C37	ROW	0.35	3.93	0.19	23.33	1	7092.61
C38	TRAPEZOIDAL	0.60	3.00	0.37	8.00	1	23606.73
C39	ROW	0.35	3.93	0.19	23.33	1	7092.61

C39_1	ROW	0.35	3.93	0.19	23.33	1	7092.61
C39_2	ROW	0.35	3.93	0.19	23.33	1	7092.61
C4	TRIANGULAR	0.60	1.08	0.28	3.60	1	6432.12
C42	ROW	0.35	3.93	0.19	23.33	1	4856.97
C43	ROW	0.35	3.93	0.19	23.33	1	7092.61
C44_1	ROW	0.35	3.93	0.19	23.33	1	2751.73
C44_2	ROW	0.35	3.93	0.19	23.33	1	3239.21
C45_1	ROW	0.35	3.93	0.19	23.33	1	7092.61
C46_1	ROW	0.35	3.93	0.19	23.33	1	7092.61
C46_2	ROW	0.35	3.93	0.19	23.33	1	1979.07
C47	ROW	0.35	3.93	0.19	23.33	1	7092.61
C49	ROW	0.35	3.93	0.19	23.33	1	10323.92
C5	ROW	0.35	3.93	0.19	23.33	1	7092.61
C50_1	ROW	0.35	3.93	0.19	23.33	1	7092.61
C50_2	ROW	0.35	3.93	0.19	23.33	1	7092.61
C51	ROW	0.35	3.93	0.19	23.33	1	13647.74
C6	ROW	0.35	3.93	0.19	23.33	1	7092.61
C6_1	TRIANGULAR	1.00	5.05	0.49	10.10	1	6855.32
C7	TRIANGULAR	1.00	5.05	0.49	10.10	1	8584.12
C8	TRIANGULAR	0.84	3.15	0.41	7.50	1	5505.08
C9_1	ROW	0.35	3.93	0.19	23.33	1	3171.89
C9_2	ROW	0.35	3.93	0.19	23.33	1	3004.83
clvt-appleton	CIRCULAR	1.10	0.95	0.28	1.10	1	1811.20
Clvt-Indust1	CIRCULAR	0.75	0.44	0.19	0.75	1	171.56
Clvt-Indust2	CIRCULAR	0.60	0.28	0.15	0.60	1	553.25

```
  clvt-oldalmonte1 CIRCULAR             0.83     0.54     0.21     0.83        1
869.61
  clvt-oldalmonte2 CIRCULAR             0.83     0.54     0.21     0.83        1
904.83


  ****************
  Transect Summary
  ****************

  Transect ROW
  Area:
              0.0004     0.0017     0.0037     0.0066     0.0104
              0.0149     0.0203     0.0265     0.0335     0.0414
              0.0501     0.0596     0.0700     0.0812     0.0932
              0.1060     0.1197     0.1342     0.1493     0.1645
              0.1796     0.1950     0.2114     0.2292     0.2482
              0.2684     0.2899     0.3124     0.3356     0.3596
              0.3843     0.4097     0.4358     0.4626     0.4902
              0.5185     0.5475     0.5772     0.6076     0.6387
              0.6706     0.7032     0.7365     0.7708     0.8062
              0.8427     0.8803     0.9191     0.9590     1.0000
  Hrad:
              0.0177     0.0354     0.0531     0.0707     0.0884
              0.1061     0.1238     0.1415     0.1592     0.1769
              0.1946     0.2122     0.2299     0.2476     0.2653
              0.2830     0.3007     0.3184     0.3483     0.3830
              0.4176     0.4333     0.4367     0.4421     0.4491
              0.4573     0.4667     0.4980     0.5315     0.5636
              0.5944     0.6239     0.6524     0.6798     0.7062
              0.7317     0.7563     0.7801     0.8031     0.8255
              0.8471     0.8681     0.8883     0.9069     0.9245
              0.9412     0.9570     0.9721     0.9864     1.0000
  Width:
              0.0199     0.0398     0.0598     0.0797     0.0996
              0.1195     0.1395     0.1594     0.1793     0.1992
              0.2192     0.2391     0.2590     0.2789     0.2989
              0.3188     0.3387     0.3586     0.3643     0.3643
              0.3643     0.3815     0.4115     0.4415     0.4715
              0.5015     0.5315     0.5506     0.5678     0.5851
              0.6024     0.6196     0.6369     0.6542     0.6714
              0.6887     0.7059     0.7232     0.7405     0.7577
              0.7750     0.7922     0.8109     0.8379     0.8649
              0.8919     0.9190     0.9460     0.9730     1.0000


  *********************************************************
  NOTE: The summary statistics displayed in this report are
  based on results found at every computational time step,
```

```
not just on results from each reporting time step.
*********************************************************

****************
Analysis Options
****************
Flow Units ............... LPS
Process Models:
  Rainfall/Runoff ........ YES
  RDII ................... NO
  Snowmelt ............... NO
  Groundwater ............ NO
  Flow Routing ........... YES
  Ponding Allowed ........ NO
  Water Quality .......... NO
Infiltration Method ...... HORTON
Flow Routing Method ...... DYNWAVE
Surcharge Method ......... EXTRAN
Starting Date ............ 11/04/2022 00:00:00
Ending Date .............. 11/05/2022 00:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:01:00
Wet Time Step ............ 00:01:00
Dry Time Step ............ 00:01:00
Routing Time Step ........ 5.00 sec
Variable Time Step ....... NO
Maximum Trials ........... 8
Number of Threads ........ 2
Head Tolerance ........... 0.001500 m


**************************        Volume         Depth
Runoff Quantity Continuity     hectare-m            mm
**************************     ---------       -------
Initial LID Storage ......         0.050         0.611
Total Precipitation ......         5.831        71.665
Evaporation Loss .........         0.000         0.000
Infiltration Loss ........         2.552        31.371
Surface Runoff ...........         3.282        40.344
Final Storage ............         0.050         0.611
Continuity Error (%) .....        -0.070


**************************        Volume        Volume
Flow Routing Continuity        hectare-m      10^6 ltr
**************************     ---------     ---------
Dry Weather Inflow .......         0.000         0.000
Wet Weather Inflow .......         3.282        32.824
Groundwater Inflow .......         0.000         0.000
RDII Inflow ..............         0.000         0.000
```

```
  External Inflow ..........         2.015        20.149
  External Outflow .........         5.000        50.004
  Flooding Loss ............         0.000         0.000
  Evaporation Loss .........         0.000         0.000
  Exfiltration Loss ........         0.000         0.000
  Initial Stored Volume ....         0.682         6.816
  Final Stored Volume ......         0.992         9.921
  Continuity Error (%) .....        -0.226


  *************************
  Highest Continuity Errors
  *************************
  Node C132A-S (6.26%)
  Node S3 (6.22%)
  Node C107A-S (-4.14%)
  Node S10 (3.67%)
  Node S11 (2.52%)


  ********************************
  Highest Flow Instability Indexes
  ********************************
  Link C36 (30)
  Link clvt-oldalmonte1 (28)
  Link clvt-oldalmonte2 (23)
  Link Clvt-Indust2 (3)
  Link C6_1 (1)


  *************************
  Routing Time Step Summary
  *************************
  Minimum Time Step           :     5.00 sec
  Average Time Step           :     5.00 sec
  Maximum Time Step           :     5.00 sec
  Percent in Steady State     :     0.00
  Average Iterations per Step :     2.12
  Percent Not Converging      :     0.73


  ***************************
  Subcatchment Runoff Summary
  ***************************


----------------------------------------------------------------------------------
------------------------------------------
                            Total       Total       Total       Total      Imperv
Perv      Total        Total     Peak  Runoff
```

Subcatchment	Precip mm	Runon mm	Evap mm	Infil mm	Runoff mm	Runoff mm	Runoff mm	Runoff 10^6 ltr	Runoff LPS	Runoff Coeff
C105A	71.66	0.00	0.00	17.64	43.07	11.05	54.11	1.14	935.96	0.755
C107A	71.66	0.00	0.00	13.28	50.23	8.24	58.46	0.12	95.12	0.816
C107B	71.66	0.00	0.00	29.66	30.76	42.10	42.10	0.41	392.77	0.587
C107C	71.66	0.00	0.00	12.72	51.24	7.77	59.01	2.29	1727.14	0.823
C108A	71.66	0.00	0.00	17.65	43.06	11.04	54.10	0.71	583.29	0.755
C111A	71.66	0.00	0.00	15.74	46.14	9.88	56.02	0.73	591.90	0.782
C112A	71.66	0.00	0.00	17.06	44.09	10.60	54.69	0.71	568.34	0.763
C112B	71.66	0.00	0.00	26.08	30.75	14.89	45.64	0.22	163.30	0.637
C113A	71.66	0.00	0.00	13.22	50.23	8.30	58.54	0.62	487.20	0.817
C114A	71.66	0.00	0.00	16.43	45.11	10.21	55.32	0.74	588.62	0.772
C115A	71.66	0.00	0.00	12.61	51.26	7.88	59.13	0.59	460.65	0.825
C116A	71.66	0.00	0.00	11.30	53.31	7.15	60.46	0.69	537.38	0.844
C117A	71.66	0.00	0.00	11.95	52.28	7.52	59.80	0.54	421.96	0.834
C119A	71.66	0.00	0.00	12.00	52.28	7.47	59.74	0.37	286.26	0.834
C121A	71.66	0.00	0.00	17.04	44.09	10.62	54.71	0.55	444.42	0.763
C125A	71.66	0.00	0.00	13.16	50.24	8.36	58.61	0.20	155.42	0.818
C126A	71.66	0.00	0.00	11.37	53.30	7.08	60.38	0.17	126.46	0.842
C126B	71.66	0.00	0.00	29.33	30.76	42.44	42.44	0.23	240.72	0.592
C133A	71.66	0.00	0.00	11.95	52.28	7.52	59.80	0.54	421.67	0.834
C134A	71.66	0.00	0.00	14.57	48.18	8.99	57.17	0.39	299.90	0.798
C136A	71.66	0.00	0.00	12.57	51.26	7.92	59.18	0.30	236.82	0.826
C137A	71.66	0.00	0.00	18.37	42.04					

```
11.34      53.38        0.68   546.83   0.745
  C138A                     71.66       0.00        0.00       13.90       49.21
8.64      57.85        0.40   310.97   0.807
  C141A                     71.66       0.00        0.00       15.19       47.16
9.40      56.55        0.52   409.21   0.789
  C151A                     71.66       0.00        0.00       11.92       52.29
7.55      59.83        0.39   304.37   0.835
  C152A                     71.66       0.00        0.00       17.00       44.09
10.66      54.75        0.54   444.00   0.764
  EXT_S1                    71.66       0.00        0.00       32.03       28.70
39.69      39.69        1.69  1028.47   0.554
  EXT_S10                   71.66       0.00        0.00       45.61        5.02
26.08      26.08        3.52  1805.75   0.364
  EXT_S12                   71.66       0.00        0.00       44.51        7.90
27.18      27.18        0.55   262.75   0.379
  EXT_S13                   71.66       0.00        0.00       46.47        4.31
25.21      25.21        1.24   583.56   0.352
  EXT_S17                   71.66       0.00        0.00       48.98        0.00
22.70      22.70        0.20    89.03   0.317
  EXT_S24                   71.66       0.00        0.00       47.43        0.72
24.25      24.25        0.99   537.13   0.338
  EXT_S25                   71.66       0.00        0.00       47.18        0.00
24.51      24.51        0.63   379.83   0.342
  EXT_S28                   71.66       0.00        0.00       34.14       21.53
37.63      37.63        0.12   136.88   0.525
  EXT_S3_1                  71.66       0.00        0.00       29.90       32.28
41.82      41.82        1.60   972.84   0.584
  EXT_S3_2                  71.66       0.00        0.00       56.11       17.92
15.56      15.56        1.08   159.65   0.217
  EXT_S4                    71.66       0.00        0.00       34.15       21.53
37.62      37.62        0.21   239.43   0.525
  IND-1                     71.66       0.00        0.00        6.26       61.49
3.99      65.48        3.79  2788.35   0.914
  POND                      71.66       0.00        0.00       19.61       40.99
11.11      52.10        1.09   785.80   0.727
  UNC-1                     71.66       0.00        0.00       23.03       42.02
48.72      48.72        0.38   327.75   0.680
  UNC-2                     71.66       0.00        0.00       22.62       42.04
49.18      49.18        0.14   139.31   0.686
  UNC-3                     71.66       0.00        0.00       42.28       15.38
29.41      29.41        0.26    96.09   0.410
  UNC-4                     71.66       0.00        0.00       23.68       41.00
48.08      48.08        0.42   367.83   0.671
  UNC-5                     71.66       0.00        0.00       37.54       15.38
34.19      34.19        0.12   127.15   0.477


  ******************
  Node Depth Summary
  ******************
```

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min	Reported Max Depth Meters
J1	JUNCTION	0.17	1.48	136.33	0 01:28	1.45
J100	JUNCTION	0.25	0.66	128.28	0 02:46	0.66
J13	JUNCTION	0.05	0.91	137.73	0 01:42	0.91
J17	JUNCTION	0.05	1.17	138.42	0 01:11	1.17
J18	JUNCTION	0.15	1.70	137.60	0 01:28	1.58
J19	JUNCTION	0.02	0.30	142.32	0 01:40	0.30
J2	JUNCTION	0.04	1.30	139.08	0 01:11	1.29
J21	JUNCTION	0.02	0.24	143.85	0 01:35	0.24
J22	JUNCTION	0.09	0.54	135.40	0 01:41	0.54
J25	JUNCTION	0.15	1.36	137.72	0 01:41	1.36
J26	JUNCTION	0.13	1.45	137.70	0 01:41	1.45
J27	JUNCTION	0.19	1.61	137.68	0 01:40	1.61
J31	JUNCTION	0.03	0.33	142.34	0 01:37	0.33
J4	JUNCTION	0.52	1.27	132.52	0 02:47	1.27
J46	JUNCTION	0.04	0.36	128.03	0 01:43	0.36
J48	JUNCTION	0.21	0.59	127.56	0 02:47	0.59
J5	JUNCTION	0.19	0.55	131.44	0 02:44	0.55
J50	JUNCTION	0.39	1.48	125.28	0 01:38	1.48
J57	JUNCTION	0.28	0.65	126.42	0 02:47	0.65
J6	JUNCTION	0.61	1.84	125.20	0 01:39	1.84
J7	JUNCTION	0.19	0.55	128.57	0 02:52	0.55
J8	JUNCTION	0.26	0.60	123.92	0 01:39	0.60
OF1	OUTFALL	0.26	0.60	123.85	0 01:39	0.60
100B	STORAGE	0.96	1.59	130.14	0 01:46	1.59
101	STORAGE	0.99	1.62	130.14	0 01:46	1.62
102	STORAGE	0.97	1.60	130.14	0 01:47	1.60
103	STORAGE	0.81	1.68	130.39	0 01:13	1.68
103A	STORAGE	0.05	1.00	131.08	0 01:11	1.00
104	STORAGE	0.05	1.02	131.19	0 01:10	1.02
105	STORAGE	0.04	1.01	131.40	0 01:10	1.01
106	STORAGE	0.03	0.79	131.62	0 01:10	0.79
107	STORAGE	0.04	0.83	131.75	0 01:10	0.83
108	STORAGE	0.23	1.30	130.61	0 01:14	1.30
109	STORAGE	0.06	1.18	131.01	0 01:14	1.18
110	STORAGE	0.04	0.91	131.22	0 01:14	0.91
111	STORAGE	0.02	0.48	132.28	0 01:09	0.48
112	STORAGE	0.03	0.75	131.29	0 01:15	0.75
113	STORAGE	0.02	0.40	132.35	0 01:11	0.40
114	STORAGE	0.05	0.96	131.10	0 01:14	0.96
115	STORAGE	0.04	0.84	131.27	0 01:13	0.84
116	STORAGE	0.03	0.50	131.40	0 01:12	0.50
117	STORAGE	0.02	0.48	132.27	0 01:12	0.48
118	STORAGE	0.01	0.28	131.54	0 01:11	0.28
119	STORAGE	0.01	0.29	132.37	0 01:10	0.29

121	STORAGE	0.02	0.36	130.90	0	01:06	0.36
123	STORAGE	0.02	0.25	131.28	0	01:14	0.25
125	STORAGE	0.01	0.23	131.50	0	01:13	0.23
126	STORAGE	0.01	0.15	131.67	0	01:12	0.15
130	STORAGE	0.02	0.36	132.13	0	01:13	0.36
132	STORAGE	0.02	0.35	132.40	0	01:12	0.35
133	STORAGE	0.02	0.48	133.17	0	01:12	0.48
134	STORAGE	0.03	0.69	130.86	0	01:12	0.69
135	STORAGE	0.03	0.62	131.19	0	01:11	0.62
136	STORAGE	0.01	0.25	132.31	0	01:07	0.25
137	STORAGE	0.02	0.48	131.32	0	01:10	0.48
138	STORAGE	0.01	0.27	132.47	0	01:10	0.27
139	STORAGE	0.02	0.46	132.82	0	01:11	0.46
140	STORAGE	0.02	0.43	132.87	0	01:11	0.43
141	STORAGE	0.02	0.39	133.07	0	01:10	0.39
150	STORAGE	0.02	0.43	132.31	0	01:11	0.43
151	STORAGE	0.01	0.31	132.67	0	01:08	0.31
152	STORAGE	0.02	0.36	133.00	0	01:03	0.36
200	STORAGE	0.15	0.43	128.66	0	01:46	0.43
C105A-S	STORAGE	0.06	2.28	135.24	0	01:10	2.28
C107A-S	STORAGE	0.05	2.16	135.37	0	01:10	2.16
C107B-S	STORAGE	0.05	2.17	135.77	0	01:10	2.17
C107C-S	STORAGE	0.05	2.10	135.70	0	01:09	2.09
C108A-S	STORAGE	0.05	2.09	135.02	0	01:10	2.09
C111A-S	STORAGE	0.05	2.10	134.84	0	01:10	2.10
C112A-S	STORAGE	0.05	2.13	133.57	0	01:10	2.12
C112B-S	STORAGE	0.06	2.15	133.65	0	01:10	2.15
C113A-S	STORAGE	0.05	2.08	134.67	0	01:10	2.08
C114A-S	STORAGE	0.06	2.17	133.37	0	01:10	2.17
C115A-S	STORAGE	0.05	2.13	133.54	0	01:10	2.13
C116A-S	STORAGE	0.05	2.10	133.74	0	01:10	2.10
C117A-S	STORAGE	0.05	2.09	135.08	0	01:10	2.09
C119A-S	STORAGE	0.05	2.08	135.14	0	01:10	2.08
C121A-S	STORAGE	0.06	2.12	134.78	0	01:10	2.12
C125A-S	STORAGE	0.07	2.16	134.98	0	01:11	2.16
C126A-S	STORAGE	0.08	2.12	134.98	0	01:12	2.12
C132A-S	STORAGE	0.01	0.13	135.09	0	01:11	0.13
C133A-S	STORAGE	0.05	2.09	135.26	0	01:10	2.09
C134A-S	STORAGE	0.05	2.14	133.46	0	01:10	2.14
C136A-S	STORAGE	0.05	2.06	134.96	0	01:10	2.06
C137A-S	STORAGE	0.05	2.12	133.59	0	01:10	2.12
C138A-S	STORAGE	0.05	2.07	135.03	0	01:10	2.07
C141A-S	STORAGE	0.05	2.09	135.34	0	01:10	2.09
C151A-S	STORAGE	0.05	2.11	135.12	0	01:08	2.11
C152A-S	STORAGE	0.05	2.11	135.36	0	01:10	2.11
IND-1-S	STORAGE	0.19	1.71	137.71	0	01:30	1.71
J10	STORAGE	0.11	0.98	137.81	0	01:43	0.98
J23	STORAGE	0.20	1.08	140.19	0	02:34	1.08
J3	STORAGE	0.32	1.11	132.65	0	03:18	1.11
J55	STORAGE	0.13	0.53	133.04	0	02:29	0.53

J9	STORAGE	2.01	2.16	135.10	0	01:12	2.16
POND-S	STORAGE	2.01	2.64	130.14	0	01:46	2.64
S10	STORAGE	0.00	0.13	134.30	0	01:10	0.13
S11	STORAGE	0.01	0.22	135.09	0	01:11	0.22
S3	STORAGE	0.00	0.14	133.50	0	01:11	0.14
S4	STORAGE	0.00	0.14	133.34	0	01:11	0.14
S5	STORAGE	0.01	0.15	134.99	0	01:12	0.15
S6	STORAGE	0.00	0.15	133.83	0	01:11	0.15
S7	STORAGE	0.00	0.20	133.48	0	01:11	0.20
S8	STORAGE	0.00	0.13	133.53	0	01:10	0.13

****

Node Inflow Summary

****

Node	Type	Maximum Lateral Inflow LPS	Maximum Total Inflow LPS	Time of Max Occurrence days	Time of Max Occurrence hr:min	Lateral Inflow Volume 10^6 ltr	Total Inflow Volume 10^6 ltr	Flow Balance Error Percent
J1	JUNCTION	0.00	1618.20	0	01:15	0	11.4	-0.370
J100	JUNCTION	178.05	2528.48	0	02:46	0.407	44.8	0.020
J13	JUNCTION	262.75	872.73	0	01:31	0.547	3.91	-0.288
J17	JUNCTION	0.00	974.38	0	01:11	0	1.6	-1.621
J18	JUNCTION	366.58	1531.96	0	01:11	0.33	7.59	-0.124
J19	JUNCTION	284.02	789.58	0	01:38	1.47	3.55	-0.296
J2	JUNCTION	972.84	972.84	0	01:11	1.6	1.6	0.008
J21	JUNCTION	579.25	579.25	0	01:35	2.08	2.08	-0.019
J22	JUNCTION	341.86	1583.81	0	01:38	1.15	13.3	-0.003
J25	JUNCTION	89.03	872.05	0	01:22	0.202	4.17	0.326

J26	JUNCTION	675.03	982.04	0	01:59	1.51	5.66	-0.563
J27	JUNCTION	0.00	984.80	0	01:59	0	5.64	0.130
J31	JUNCTION	893.63	893.63	0	01:45	4.4	4.4	-1.041
J4	JUNCTION	136.88	1820.60	0	02:39	0.12	32	0.434
J46	JUNCTION	594.23	594.23	0	01:42	2.45	2.45	-0.276
J48	JUNCTION	177.19	2538.37	0	02:46	0.339	45.1	0.020
J5	JUNCTION	370.38	1761.55	0	02:49	0.688	30.4	-0.022
J50	JUNCTION	916.96	3017.61	0	01:33	1.62	50	-0.037
J57	JUNCTION	370.91	2744.43	0	02:45	0.855	48.4	0.067
J6	JUNCTION	0.00	3080.87	0	01:30	0	50	0.042
J7	JUNCTION	0.00	1763.27	0	02:48	0	30.5	0.078
J8	JUNCTION	0.00	2992.94	0	01:39	0	50	0.006
OF1	OUTFALL	0.00	2992.95	0	01:39	0	50	0.000
100B	STORAGE	0.00	1195.43	0	01:07	0	2.4	0.631
101	STORAGE	0.00	5637.48	0	01:11	0	12.8	0.071
102	STORAGE	0.00	5677.40	0	01:12	0	12.8	-0.010
103	STORAGE	0.00	4999.18	0	01:12	0	11.3	0.075
103A	STORAGE	0.00	2544.94	0	01:11	0	5.47	-0.070
104	STORAGE	0.00	2165.08	0	01:10	0	4.63	-0.360
105	STORAGE	0.00	1949.01	0	01:10	0	4.17	0.030
106	STORAGE	0.00	1118.75	0	01:10	0	2.37	0.142
107	STORAGE	0.00	1119.11	0	01:10	0	2.37	0.156
108	STORAGE	0.00	2299.05	0	01:14	0	5.34	0.167
109	STORAGE	0.00	1656.39	0	01:14	0	3.8	0.807
110	STORAGE	0.00	894.74	0	01:13	0	1.96	-0.170

111		STORAGE	0.00	296.42	0	01:10	0
0.643	0.946						
112		STORAGE	0.00	601.46	0	01:11	0
1.32	-0.128						
113		STORAGE	0.00	251.28	0	01:10	0
0.538	1.169						
114		STORAGE	0.00	777.81	0	01:13	0
1.83	-0.311						
115		STORAGE	0.00	528.79	0	01:06	0
1.09	-1.029						
116		STORAGE	0.00	286.85	0	01:10	0
0.588	0.272						
117		STORAGE	0.00	220.71	0	01:10	0
0.466	-0.017						
118		STORAGE	0.00	148.84	0	01:11	0
0.32	-0.001						
119		STORAGE	0.00	149.00	0	01:10	0
0.32	-0.006						
121		STORAGE	0.00	367.09	0	01:10	0
0.971	0.242						
123		STORAGE	0.00	149.16	0	01:13	0
0.445	-0.686						
125		STORAGE	0.00	149.18	0	01:12	0
0.448	0.654						
126		STORAGE	0.00	67.04	0	01:12	0
0.214	-0.012						
130		STORAGE	0.00	218.53	0	01:12	0
0.456	-0.720						
132		STORAGE	0.00	218.52	0	01:12	0
0.461	1.065						
133		STORAGE	0.00	222.11	0	01:10	0
0.461	-0.018						
134		STORAGE	0.00	696.40	0	01:11	0
1.52	0.210						
135		STORAGE	0.00	544.19	0	01:10	0
1.17	-0.411						
136		STORAGE	0.00	122.93	0	01:10	0
0.261	0.530						
137		STORAGE	0.00	421.43	0	01:10	0
0.914	0.106						
138		STORAGE	0.00	157.89	0	01:10	0
0.341	-0.005						
139		STORAGE	0.00	205.37	0	01:10	0
0.444	-0.174						
140		STORAGE	0.00	205.79	0	01:02	0
0.443	-0.308						
141		STORAGE	0.00	205.64	0	01:10	0
0.444	0.256						
150		STORAGE	0.00	380.06	0	01:10	0
0.819	-0.478						

151	STORAGE	0.00	161.56	0	01:08	0	0.35	0.255
152	STORAGE	0.00	218.65	0	01:10	0	0.474	0.816
200	STORAGE	0.00	965.62	0	01:46	0	14	0.005
C105A-S	STORAGE	935.96	2211.75	0	01:10	1.14	1.7	-1.475
C107A-S	STORAGE	95.12	949.82	0	01:10	0.123	0.456	-3.980
C107B-S	STORAGE	392.77	392.77	0	01:10	0.412	0.412	0.038
C107C-S	STORAGE	1727.14	1727.14	0	01:10	2.29	2.29	0.011
C108A-S	STORAGE	583.29	583.29	0	01:10	0.711	0.711	-1.761
C111A-S	STORAGE	591.90	591.90	0	01:10	0.734	0.734	-3.864
C112A-S	STORAGE	568.34	773.21	0	01:10	0.705	0.79	0.175
C112B-S	STORAGE	163.30	163.30	0	01:10	0.219	0.219	-0.038
C113A-S	STORAGE	487.20	487.20	0	01:10	0.621	0.621	-0.253
C114A-S	STORAGE	588.62	2137.71	0	01:10	0.735	1.65	-0.498
C115A-S	STORAGE	460.65	708.68	0	01:10	0.595	0.701	0.711
C116A-S	STORAGE	537.38	537.38	0	01:10	0.694	0.694	-0.031
C117A-S	STORAGE	421.96	421.96	0	01:10	0.544	0.544	-1.198
C119A-S	STORAGE	286.26	286.26	0	01:10	0.374	0.374	-0.925
C121A-S	STORAGE	444.42	725.78	0	01:10	0.549	0.747	-0.488
C125A-S	STORAGE	155.42	453.64	0	01:10	0.195	0.377	-0.147
C126A-S	STORAGE	367.18	367.18	0	01:10	0.394	0.396	0.273
C132A-S	STORAGE	0.00	197.33	0	01:10	0	0.0856	6.677
C133A-S	STORAGE	421.67	421.67	0	01:10	0.544	0.544	-0.525
C134A-S	STORAGE	299.90	750.39	0	01:10	0.386	0.594	0.273
C136A-S	STORAGE	236.82	236.82	0	01:10	0.303	0.303	-1.269
C137A-S	STORAGE	546.83	690.53	0	01:10	0.676	0.734	-0.665

C138A-S	STORAGE	310.97	310.97	0	01:10	0.399	0.399	0.088
C141A-S	STORAGE	409.21	409.21	0	01:10	0.521	0.521	-1.081
C151A-S	STORAGE	304.37	304.37	0	01:10	0.39	0.404	0.749
C152A-S	STORAGE	444.00	444.00	0	01:10	0.543	0.543	-3.951
IND-1-S	STORAGE	2788.35	2788.35	0	01:10	3.79	3.79	0.025
J10	STORAGE	1190.65	1190.65	0	01:11	3.38	3.39	0.016
J23	STORAGE	1925.77	1925.77	0	01:20	8.72	8.81	-0.083
J3	STORAGE	0.00	1682.00	0	02:04	0	21	0.133
J55	STORAGE	520.41	2799.50	0	01:43	1.44	19.2	0.339
J9	STORAGE	0.00	447.63	0	01:10	0	0.159	1.049
POND-S	STORAGE	785.80	9581.25	0	01:10	1.09	22.4	0.048
S10	STORAGE	0.00	658.90	0	01:10	0	0.313	3.806
S11	STORAGE	0.00	1542.89	0	01:10	0	0.824	2.590
S3	STORAGE	0.00	769.70	0	01:10	0	0.336	6.627
S4	STORAGE	0.00	1832.99	0	01:11	0	1.11	-0.015
S5	STORAGE	0.00	1438.24	0	01:11	0	0.866	0.906
S6	STORAGE	0.00	848.19	0	01:10	0	0.425	2.144
S7	STORAGE	0.00	1421.00	0	01:11	0	0.731	-0.105
S8	STORAGE	0.00	505.82	0	01:10	0	0.211	1.545

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Node Surcharge Summary
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Surcharging occurs when water rises above the top of the highest conduit.

Node	Type	Hours Surcharged	Max. Height Above Crown Meters	Min. Depth Below Rim Meters

J1	JUNCTION	1.40	0.832	0.867
J18	JUNCTION	0.68	0.496	0.204
J25	JUNCTION	0.91	0.564	0.276
J26	JUNCTION	1.04	0.648	0.302
J27	JUNCTION	1.26	0.809	0.321
J50	JUNCTION	2.51	0.485	0.215

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Node Flooding Summary
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No nodes were flooded.

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Storage Volume Summary
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Storage Unit	Average Volume 1000 m3	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 m3	Max Pcnt Full	Time of Max Occurrence days	hr:min	Maximum Outflow LPS
100B	0.001	27	0	0	0.002	44	0	01:46	1150.99
101	0.001	27	0	0	0.002	45	0	01:46	5606.10
102	0.001	20	0	0	0.002	33	0	01:47	5637.48
103	0.001	13	0	0	0.002	27	0	01:13	4981.50
103A	0.000	1	0	0	0.001	21	0	01:11	2545.16
104	0.000	1	0	0	0.001	22	0	01:10	2164.97
105	0.000	1	0	0	0.001	22	0	01:10	1948.14
106	0.000	1	0	0	0.001	18	0	01:10	1118.37
107	0.000	1	0	0	0.001	19	0	01:10	1118.75
108	0.000	5	0	0	0.001	29	0		

01:14	2304.07							
109		0.000	2	0	0	0.001	34	0
01:14	1655.71							
110		0.000	1	0	0	0.001	30	0
01:14	904.65							
111		0.000	1	0	0	0.001	18	0
01:09	298.70							
112		0.000	1	0	0	0.001	26	0
01:15	597.76							
113		0.000	1	0	0	0.000	15	0
01:11	252.22							
114		0.000	2	0	0	0.001	32	0
01:14	771.41							
115		0.000	1	0	0	0.001	27	0
01:13	484.31							
116		0.000	1	0	0	0.001	18	0
01:12	288.13							
117		0.000	1	0	0	0.001	19	0
01:12	218.21							
118		0.000	0	0	0	0.000	8	0
01:11	148.85							
119		0.000	0	0	0	0.000	10	0
01:10	148.84							
121		0.000	0	0	0	0.000	8	0
01:06	385.10							
123		0.000	0	0	0	0.000	6	0
01:14	149.08							
125		0.000	0	0	0	0.000	6	0
01:13	149.16							
126		0.000	0	0	0	0.000	5	0
01:12	67.03							
130		0.000	1	0	0	0.000	11	0
01:13	218.07							
132		0.000	1	0	0	0.000	12	0
01:12	218.53							
133		0.000	1	0	0	0.001	19	0
01:12	218.52							
134		0.000	1	0	0	0.001	23	0
01:12	695.96							
135		0.000	1	0	0	0.001	21	0
01:11	543.53							
136		0.000	0	0	0	0.000	10	0
01:07	123.06							
137		0.000	1	0	0	0.001	16	0
01:10	421.18							
138		0.000	1	0	0	0.000	11	0
01:10	157.83							
139		0.000	1	0	0	0.001	16	0
01:11	205.20							
140		0.000	1	0	0	0.000	15	0

01:11 205.37							
141	0.000	1	0	0	0.000	15	0
01:10 205.79							
150	0.000	1	0	0	0.000	14	0
01:11 379.98							
151	0.000	1	0	0	0.000	12	0
01:08 161.55							
152	0.000	1	0	0	0.000	14	0
01:03 219.03							
200	0.000	6	0	0	0.000	18	0
01:46 965.63							
C105A-S	0.000	0	0	0	0.000	0	0
00:00 2019.83							
C107A-S	0.000	0	0	0	0.000	0	0
00:00 891.38							
C107B-S	0.000	0	0	0	0.000	0	0
00:00 391.76							
C107C-S	0.000	0	0	0	0.000	0	0
00:00 1770.45							
C108A-S	0.000	0	0	0	0.000	0	0
00:00 573.45							
C111A-S	0.000	0	0	0	0.000	0	0
00:00 551.75							
C112A-S	0.000	0	0	0	0.000	0	0
00:00 714.27							
C112B-S	0.000	0	0	0	0.000	0	0
00:00 163.24							
C113A-S	0.000	0	0	0	0.000	0	0
00:00 457.64							
C114A-S	0.000	0	0	0	0.000	0	0
00:00 2128.19							
C115A-S	0.000	0	0	0	0.000	0	0
00:00 701.16							
C116A-S	0.000	0	0	0	0.000	0	0
00:00 534.87							
C117A-S	0.000	0	0	0	0.000	0	0
00:00 416.01							
C119A-S	0.000	0	0	0	0.000	0	0
00:00 281.86							
C121A-S	0.000	0	0	0	0.000	0	0
00:00 684.42							
C125A-S	0.000	0	0	0	0.000	0	0
00:00 251.86							
C126A-S	0.000	0	0	0	0.000	0	0
00:00 365.22							
C132A-S	0.000	0	0	0	0.000	0	0
00:00 100.74							
C133A-S	0.000	0	0	0	0.000	0	0
00:00 419.44							
C134A-S	0.000	0	0	0	0.000	0	0

								00:00	745.45
C136A-S	0.000	0	0	0	0.000	0	0	00:00	230.78
C137A-S	0.000	0	0	0	0.000	0	0	00:00	662.13
C138A-S	0.000	0	0	0	0.000	0	0	00:00	302.02
C141A-S	0.000	0	0	0	0.000	0	0	00:00	402.23
C151A-S	0.000	0	0	0	0.000	0	0	00:00	313.07
C152A-S	0.000	0	0	0	0.000	0	0	00:00	418.19
IND-1-S	0.240	9	0	0	2.261	83	0	01:30	412.00
J10	0.105	7	0	0	0.980	61	0	01:43	721.80
J23	0.796	12	0	0	4.327	64	0	02:34	524.56
J3	1.921	19	0	0	6.689	65	0	03:18	1359.41
J55	1.347	13	0	0	5.306	53	0	02:29	1588.61
J9	0.000	0	0	0	0.000	0	0	00:00	300.05
POND-S	10.980	43	0	0	17.862	70	0	01:46	965.62
S10	0.000	0	0	0	0.000	0	0	00:00	589.09
S11	0.000	0	0	0	0.000	0	0	00:00	1386.33
S3	0.000	0	0	0	0.000	0	0	00:00	651.43
S4	0.000	0	0	0	0.000	0	0	00:00	1823.11
S5	0.000	0	0	0	0.000	0	0	00:00	1408.92
S6	0.000	0	0	0	0.000	0	0	00:00	769.63
S7	0.000	0	0	0	0.000	0	0	00:00	1409.64
S8	0.000	0	0	0	0.000	0	0	00:00	478.51

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Outfall Loading Summary
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Outfall Node	Flow Freq Pcnt	Avg Flow LPS	Max Flow LPS	Total Volume 10^6 ltr
OF1	100.00	578.75	2992.95	50.004
System	100.00	578.75	2992.95	50.004

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Link Flow Summary
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Link	Type	Maximum |Flow| LPS	Time of Max Occurrence days	hr:min	Maximum |Veloc| m/sec	Max/ Full Flow	Max/ Full Depth
100B-100A	CONDUIT	1150.99	0	01:07	0.88	0.25	0.83
101-100	CONDUIT	4469.99	0	01:12	2.72	1.01	0.83
101-100B	CONDUIT	1195.43	0	01:07	0.98	0.27	0.78
102-101	CONDUIT	5637.48	0	01:11	3.00	1.22	0.82
103-102	CONDUIT	4981.50	0	01:12	2.15	0.90	0.76
103A-103	CONDUIT	2545.16	0	01:11	2.68	1.31	0.78
104-103A	CONDUIT	2164.97	0	01:11	2.14	1.11	0.84
105-104	CONDUIT	1948.14	0	01:10	1.92	1.00	0.84
106-105	CONDUIT	1118.37	0	01:10	2.10	1.13	0.84
107-106	CONDUIT	1118.75	0	01:10	1.95	1.13	0.90
108-103	CONDUIT	2304.07	0	01:14	1.25	0.65	0.81
109-108	CONDUIT	1655.71	0	01:14	1.64	1.35	0.85
110-109	CONDUIT	904.65	0	01:16	1.41	0.74	0.96
111-110	CONDUIT	298.70	0	01:11	1.55	0.98	0.88
112-110	CONDUIT	597.76	0	01:16	1.40	0.74	0.88
113-112	CONDUIT	252.22	0	01:12	1.54	0.83	0.72
114-109	CONDUIT	771.41	0	01:13	1.12	1.09	0.98
115-114	CONDUIT	484.31	0	01:13	0.93	0.85	0.96
116-115	CONDUIT	288.13	0	01:06	0.99	0.67	0.79
117-104	CONDUIT	218.21	0	01:12	1.25	0.93	0.75
118-105	CONDUIT	148.85	0	01:11	1.45	0.74	0.61
119-118	CONDUIT	148.84	0	01:11	1.42	0.74	0.63
121-108	CONDUIT	385.10	0	01:08	1.30	0.18	0.37
123-121	CONDUIT	149.08	0	01:14	1.08	0.12	0.24
125-123	CONDUIT	149.16	0	01:13	1.11	0.12	0.24
126-125	CONDUIT	67.03	0	01:12	0.72	0.05	0.19
130-103	CONDUIT	218.07	0	01:13	1.22	0.36	0.42
132-130	CONDUIT	218.53	0	01:12	1.30	0.65	0.58
133-132	CONDUIT	218.52	0	01:12	1.25	0.93	0.75
134-102	CONDUIT	695.96	0	01:12	1.69	0.77	0.72
135-134	CONDUIT	543.53	0	01:11	1.47	0.77	0.82
136-135	CONDUIT	123.06	0	01:08	1.65	0.70	0.65

137-135	CONDUIT	421.18	0	01:10	1.41	0.69	0.72
138-137	CONDUIT	157.83	0	01:10	1.63	0.62	0.59
139-105	CONDUIT	205.20	0	01:11	1.22	0.87	0.72
140-139	CONDUIT	205.37	0	01:10	1.32	0.87	0.83
141-140	CONDUIT	205.79	0	01:02	1.29	0.87	0.77
150-103A	CONDUIT	379.98	0	01:11	1.81	0.88	0.70
151-150	CONDUIT	161.55	0	01:09	1.48	0.80	0.65
152-150	CONDUIT	219.03	0	01:04	1.42	0.72	0.68
200-200A	CONDUIT	965.63	0	01:46	2.93	0.35	0.41
C1	CHANNEL	854.84	0	01:10	1.62	0.03	0.36
C11	CONDUIT	2537.98	0	02:47	1.44	0.30	0.62
C12	CHANNEL	651.43	0	01:11	0.72	0.09	0.49
C12_1	CHANNEL	465.59	0	01:10	0.86	0.06	0.37
C12_2	CHANNEL	589.09	0	01:11	0.91	0.07	0.40
C15	CHANNEL	195.29	0	01:10	0.87	0.02	0.31
C16	CONDUIT	1762.34	0	02:52	1.06	0.17	0.51
C17	CONDUIT	920.16	0	01:46	1.90	0.08	0.39
C18	CONDUIT	2528.40	0	02:46	1.41	0.24	0.52
C19	CHANNEL	290.25	0	01:10	1.35	0.03	0.33
C2	CONDUIT	1740.56	0	02:50	1.78	1.38	0.82
C20	CHANNEL	769.63	0	01:11	0.83	0.10	0.49
C21	CONDUIT	785.30	0	01:40	0.83	0.07	0.42
C22	CONDUIT	579.10	0	01:35	1.24	0.05	0.27
C23	CONDUIT	90.66	0	01:10	1.43	0.15	0.48
C23_1	CHANNEL	169.69	0	01:11	0.34	0.08	0.35
C25	CONDUIT	837.13	0	02:05	0.38	0.15	1.00
C26	CONDUIT	975.22	0	01:12	1.35	0.66	0.83
C27_1	CONDUIT	1206.20	0	01:15	1.34	1.09	1.00
C27_2	CONDUIT	1541.79	0	01:36	1.36	1.09	1.00
C28	CONDUIT	524.56	0	02:43	1.01	1.08	1.00
C29	CHANNEL	434.82	0	01:10	1.97	0.06	0.38
C3	CONDUIT	1763.27	0	02:48	1.21	0.17	0.46
C30	CONDUIT	854.65	0	02:05	0.35	0.68	1.00
C31	CONDUIT	987.62	0	01:59	0.62	1.24	1.00
C32	CONDUIT	984.80	0	01:59	0.97	0.36	1.00
C33	CONDUIT	1602.48	0	01:45	1.92	0.17	0.43
C34	CONDUIT	1588.61	0	02:29	1.06	0.19	0.73
C35	CONDUIT	1823.11	0	01:12	4.98	0.05	0.23
C36	CONDUIT	2992.95	0	01:39	1.50	0.48	0.76
C36_1	CHANNEL	144.14	0	01:10	0.46	0.01	0.28
C36_2	CHANNEL	398.51	0	01:10	1.02	0.06	0.36
C37	CHANNEL	132.86	0	01:10	0.40	0.02	0.29
C38	CONDUIT	1832.37	0	01:10	3.84	0.08	0.28
C39	CHANNEL	1409.64	0	01:11	1.14	0.20	0.56
C39_1	CHANNEL	248.02	0	01:10	0.59	0.03	0.33
C39_2	CHANNEL	459.83	0	01:10	0.80	0.06	0.42
C4	CONDUIT	238.22	0	01:10	1.51	0.04	0.38
C42	CHANNEL	199.54	0	01:10	0.39	0.04	0.42
C43	CHANNEL	255.33	0	01:10	0.93	0.04	0.35
C44_1	CHANNEL	1542.89	0	01:10	0.87	0.56	0.71

C44_2	CHANNEL	1338.14	0	01:11	1.25	0.41	0.52
C45_1	CHANNEL	206.36	0	01:10	0.51	0.03	0.31
C46_1	CHANNEL	197.33	0	01:10	3.61	0.03	0.31
C46_2	CHANNEL	100.74	0	01:11	0.26	0.05	0.31
C47	CHANNEL	298.22	0	01:10	0.72	0.04	0.39
C49	CHANNEL	107.85	0	01:10	0.48	0.01	0.28
C5	CHANNEL	196.59	0	01:10	0.22	0.03	0.54
C50_1	CHANNEL	478.51	0	01:10	0.84	0.07	0.38
C50_2	CHANNEL	592.26	0	01:10	1.98	0.08	0.39
C51	CHANNEL	1408.92	0	01:12	2.06	0.10	0.42
C6	CHANNEL	841.39	0	01:10	0.75	0.12	0.63
C6_1	CONDUIT	3080.87	0	01:30	0.61	0.45	1.00
C7	CONDUIT	2741.22	0	02:47	0.91	0.32	0.83
C8	CONDUIT	593.33	0	01:43	0.52	0.11	0.60
C9_1	CHANNEL	151.54	0	01:09	0.37	0.05	0.36
C9_2	CHANNEL	243.32	0	01:14	0.28	0.08	0.54
clvt-appleton	CONDUIT	1359.41	0	03:48	2.10	0.75	1.00
Clvt-Indust1	CONDUIT	721.80	0	01:31	1.91	4.21	1.00
Clvt-Indust2	CONDUIT	679.31	0	01:19	2.40	1.23	1.00
clvt-oldalmonte1	CONDUIT	1407.19	0	01:39	2.84	1.62	0.86
clvt-oldalmonte2	CONDUIT	1384.27	0	01:39	2.79	1.53	0.86
Qual-Orf	ORIFICE	104.04	0	01:46			1.00
Quant-W	WEIR	861.57	0	01:46			0.71
Spillway	WEIR	0.00	0	00:00			0.00
W1	WEIR	201.48	0	01:39			0.34
weir-Apple	WEIR	0.00	0	00:00			0.00
weir-ind1	WEIR	0.00	0	00:00			0.00
weir-ind2	WEIR	357.39	0	01:11			0.71
C105A-IC	DUMMY	477.05	0	01:10			
C107A-IC	DUMMY	49.99	0	01:10			
C107B-IC	DUMMY	153.54	0	01:10			
C107C-IC	DUMMY	915.61	0	01:10			
C108A-IC	DUMMY	283.20	0	01:10			
C111A-IC	DUMMY	296.42	0	01:10			
C112A-IC	DUMMY	279.45	0	01:10			
C112B-IC	DUMMY	72.58	0	01:10			
C113A-IC	DUMMY	251.28	0	01:10			
C114A-IC	DUMMY	295.82	0	01:10			
C115A-IC	DUMMY	241.33	0	01:10			
C116A-IC	DUMMY	286.85	0	01:10			
C117A-IC	DUMMY	220.71	0	01:10			
C119A-IC	DUMMY	149.00	0	01:10			
C121A-IC	DUMMY	218.83	0	01:10			
C125A-IC	DUMMY	82.17	0	01:11			
C126A-IC	DUMMY	67.04	0	01:12			
C133A-IC	DUMMY	222.11	0	01:10			
C134A-IC	DUMMY	153.19	0	01:10			
C136A-IC	DUMMY	122.93	0	01:10			
C137A-IC	DUMMY	263.62	0	01:10			
C138A-IC	DUMMY	157.89	0	01:10			

C26	0.01	0.01	0.68	0.01	0.01
C27_1	1.37	1.45	1.40	0.70	0.66
C27_2	1.40	1.40	6.50	1.10	1.10
C28	2.78	4.13	2.78	3.12	2.78
C30	0.91	0.91	1.04	0.01	0.01
C31	1.24	1.26	1.32	1.01	1.00
C32	1.04	1.04	1.26	0.01	0.01
C34	0.01	0.01	0.57	0.01	0.01
C6_1	2.51	2.51	4.11	0.01	0.01
C7	0.01	0.01	2.51	0.01	0.01
clvt-appleton	0.57	0.57	1.88	0.01	0.01
Clvt-Indust1	0.47	0.77	0.47	1.84	0.47
Clvt-Indust2	0.43	0.43	0.64	0.28	0.28
clvt-oldalmonte1	0.01	4.11	0.01	3.47	0.01
clvt-oldalmonte2	0.01	3.93	0.01	3.21	0.01

Analysis begun on: Mon Nov 20 15:54:43 2023
Analysis ended on: Mon Nov 20 15:54:44 2023
Total elapsed time: 00:00:01

C.4 Conceptual Pond Design

160401740 Mill Valley Development - Conceptual SWM Pond Design - Ultimate Development Conditions

Stormwater Quality Volumetric Requirements

Pond	Drainage Area (ha)	Actual % Imp.	MOE Control Level	Water Quality Unit Volume Requirments			Water Quality Volume Requirements			Water Quality Volumes Provided			
				Total Unit Volume (m^3/ha)	Permanent Pool (m^3/ha)	Extended Detention (m^3/ha)	Permanent Pool (m^3)	Extended Detention (m^3)	Total MECP Volume	Permanent Pool (m^3)	Extended Detention (m^3)	Total MECP Volume	Actual Provided Unit Volume (m^3/ha)
Mill Valley SWM Pond	28.50	64.4	Enhanced - 80% TSS Removal	212	171.9	40	4,900	1,140	6,040	6,529	4,397	10,925	383

For use in Interpolation of above formulae

	Wetpond					Wetland			
%	0	35	55	70	85	35	55	70	85
Enhanced - 80% TSS Removal	0	140	190	225	250	80	105	120	140
Normal - 70% TSS Removal	0	90	110	130	150	60	70	80	90
Basic - 60% TSS Removal	0	60	75	85	95	60	60	60	60

160401740 Mill Valley Development - Conceptual SWM Pond Design - Ultimate Development Conditions
Stage-Storage-Discharge Summary

Stage	Discharge	Storage		Depth	Forebay			Main Cell			
		Active	Total*		Area	Incremental Volume	Accumulated Volume	Area	Incremental Volume	Accumulated Volume	
(m)	(m^3/s)	(m^3)	(m^3)	(m)	(m^2)	(m^3)	(m^3)	(m^2)	(m^3)	(m^3)	
127.50		0	0	0.00	624	0	0	2,358	0	0	
128.00		0	1,350	0.50	912	384	384	3,043	1,350	1,350	
128.50		0	3,571	1.00	1,200	528	912	3,729	1,693	3,043	
128.70		0	4,631	1.20	1,432	263	1,175	4,239	797	3,840	
129.00		0	6,529	1.50	2,093	529	1,704	4,884	1,368	5,209	Permanent Pool
129.00		0	6,529	1.50	0	0	1,704	6,978	0	5,209	Permanent Pool
129.50		4,397	10,925	0.50	0	0	1,704	10,610	4,397	9,605	
129.80		7,695	14,224	0.80	0	0	1,704	11,380	3,298	12,904	
130.00		10,022	16,551	1.00	0	0	1,704	11,893	2,327	15,231	
130.20		12,452	18,981	1.20	0	0	1,704	12,406	2,430	17,661	
130.30		13,706	20,234	1.30	0	0	1,704	12,663	1,253	18,914	
130.45		15,634	22,163	1.45	0	0	1,704	13,048	1,928	20,843	
130.75		19,620	26,149	1.75	0	0	1,704	13,526	3,986	24,829	

* Total pond including forebay, excluding sediment storage (assume 0.5m depth in forebay for sediment storage)

160401740 Mill Valley Development - Conceptual SWM Pond Design - l

Conceptual Outlet Structure Discharge Calculations - Ultimate Development Conditions

Elevation	Discharge (m^3/s)								
	Overflow Outlet			Piped Outlet					Total
(m)		Spillway	Total	Orifice 1	Orifice 2		Control	Weir 1	Discharge
127.50									0.000
128.50									0.000
128.70									0.000
129.00									0.000
129.00		0.000	0.000	0.000	0.000		0.000	0.000	0.000
129.50		0.000	0.000	0.071	0.000		0.000	0.000	**0.071**
129.80		0.000	0.000	0.090	0.000		0.000	0.279	**0.370**
130.00		0.000	0.000	0.101	0.000		0.000	0.601	**0.702**
130.20		0.000	0.000	0.111	0.000		0.000	0.996	**1.106**
130.30		0.000	0.000	0.115	0.000		0.000	1.216	**1.332**
130.45		0.000	0.000	0.122	0.000		0.000	1.574	**1.696**
130.75		2.859	2.859	0.134	0.000		0.000	2.376	**5.369**

Parameters

Spillway Weir	Orifice 1	
	Orifice Centre	Perimeter
	129.11 m	0.691 m
	Orifice Invert	Area
	129.00 m	0.0380 m^2
	Orifice Diameter	Orifice Coeff.
	220 mm	0.61
	Orientation	Permanent Pool
Spillway Weir	Vertical	129.00 m
Crest Elevation	**Orifice 2**	
130.45 m		
Crest Width		
10 m*		
Weir Coeff. 1.740		
	Orientation	
	Vertical	
	Weir 1	
	Top of Weir Structure	Max Perimeter
	130.40 m	1.000 m
	Weir Crest Invert	Max Open Area
	129.50 m	0.900 m^2
	Weir Dimensions (Height x Length)	
	0.90 m Height	1.00 m Len
	Side Walls	Weir Coeff.
	Vertical	1.700

1 m long weir at inv = 129.5m
220 mm diameter low flow orifice at inv = 129 m

1. Conceptual outlet structure consists of lowflow pipe connected to orifice #1 (created by equivalent sluice gate orientation)
2. Secondary outlet is Weir#1 in weir wall inside structure
3. Discharge calculations shown above are based on orifice and weir equations shown here, under free flow conditions. Actual SWM Pond outflows are obtained from PCSWMM model.

Water Quality Extended Detention Summary

Required Extended Detention Time	24-48 hrs for water quality drawdown		
Actual Extended Detention Time	41 hrs	Q_{peak}	0.071 m^3/s
Extended Detention Elevation	129.50 m	Q_{avg}	0.036 m^3/s

Watershed Area (ha)	28.50			
Percent Impervious	64.4%			
Water Quality Criteria	Enhanced - 80% TSS Removal			
Req'd Ext. Det. Volume (m^3/ha)	40			
Req'd Ext. Det. Volume (m^3)	1,140			
Provided Ext. Det. (m^3)	4,397			
Req'd Perm. Pool Volume (m^3/ha)	171.9			
Req'd Perm. Pool Volume (m^3)	4,900			
Provided Perm. Pool Volume (m^3)	6,529			

Storm	Discharge Rates from PCSWMM (L/s)				
	Pond Outflow	Existing at Creek	Post at Creek	Active Storage (ha-m)	Water Level
5-yr, 12hr SCS	328.9	948.6	1063.6	7365	129.77
100-yr, 12hr SCS	**1176.1**	3593.0	**3241.9**	12828	**130.23**
5-yr, 24hr SCS	264.4	868.3	943.0	6926	129.73
100-yr, 24hr SCS	829.1	2733.8	2545.4	10873	130.07
5-yr, 3hr Chicago	252.6	-	861.5	6816	129.72
100-yr, 3hr Chicago	965.6	-	2741.2	11723	130.14

Where, $Q = CA\sqrt{2g\left(h_2 - h_1 + \frac{D}{2000}\right)}$

h2 = elevation at stage 2 (m)
h1 = elevation at stage 1 (m)
D = orifice diameter (mm)
C = orifice coefficient
A = orifice open area (m^2)

$Q = CL\,(h_2 - h_1)^{1.5}$

h2 = elevation at stage 2 (m)
h1 = elevation at stage 1 (m)
L = weir crest length (m)
C = weir coefficient

Weir flow calculation for orifice below centreline:

$\theta = 2\cos^{-1}\left(1 - \frac{2h}{D}\right) = 2\,\mathrm{acos}\left(1 - \frac{2h}{D}\right)$

$P_W = \frac{D\theta}{2}$

h = water level stage (m)
D = orifice diameter (m)
θ = angle based on water level (radians)
P_W = Wetted Perimeter = Crest Length (m)

160401740 Mill Valley Development - Conceptual SWM Pond Design - Ultimate Development Conditions

Flow Augmentation Calculation

Falling Head Orifice Equation (used for approximating detention time).
(as per Equation 4.10 in MOE SWMPDM)

a)

$$t = \frac{2 A_p}{C A_0 (2g)^{0.5}} (h_1^{0.5} - h_2^{0.5})$$

where:

- t = drawdown time (seconds)
- A_p = pond surface area (sq.m),
- C = discharge coefficient
- A_0 = area of orifice (sq.m)
- h_1 = starting water elevation above orifice (m)
- h_2 = ending water elevation above orifice (m)

Check for Detention Time

Ap	10609.7	m^2	Approximate pond area
C	0.61		
orifice dia.	0.22	m	
h1	0.50	m	
h2	0.00	m	
Ao =	0.03801	sq.m	
t =	146084.0174	s	
	1.7	days	
	40.6	**hours**	

Equation 4.11

b)

$$t = \frac{0.66 C_2 h^{1.5} + 2 C_3 h^{0.5}}{2.75 A_0}$$

Where:

- t = drawdown time (seconds)
- A_0 = cross sectional area of orifice (sq.m)
- h = maximum water elevation above the orifice (m)
- C_2 = slope coefficient from the area-depth linear regression
- C_3 = intercept form the area-depth linear regression

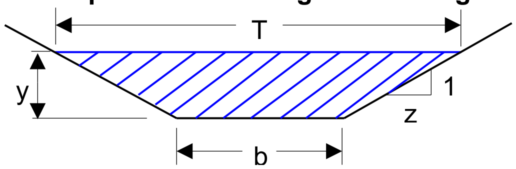
A_0	0.0380	sq.m
h	0.50	m
C_2	2567	
C_3	10609.7	
t=	149261	s
	1.7	days
	41.5	**hours**

C.5 Channel Realignment Calculations

Job # 160401740 Mill Valley Estates

Date: 22-Nov-23

Conceptual Ditch Realignment along Southern Property Line



$$A = (b + z \cdot y)y$$

$$P = b + 2 \cdot y \cdot \sqrt{1 + z^2}$$

$$R = \frac{A}{P}$$

$$T = b + 2zy$$

$$Q = \frac{A}{n} R^{2/3} \sqrt{S}$$

$$V = \frac{Q}{A}$$

$$Fr = \sqrt{\frac{Q^2 T}{g A^3}}$$

	Expected Flow Depth		w Freeboard	
n=	0.035		0.035	
z=	3		3	
b=	1		1	
y=	1.00		1.20	
A=	4		5.52	
P=	7.324555		8.589466	
R=	0.546108		0.642648	
S=	0.008		0.008	
T=	7		8.2	
Q=	**6.830**	m^3/s	10.505	m^3/s
V=	1.71	m/s	1.90	m/s
Fr # =	0.721131		0.740563	

100 Year Flow Generated = 2.090 m^3/s

Full Flow Channel Capacity = 10.505 m^3/s

Channel OK

C.6 SWM Design – Background Information

SERVICING & STORMWATER MANAGEMENT REPORT MILL VALLEY RETIREMENT COMMUNITY

MILL VALLEY LIVING

ACTIVE ADULT COMMUNITY

Project No.: CCO-20-0034

Prepared for:

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21 Hampel Crescent
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Prepared by:

McIntosh Perry Consulting Engineers Ltd.
115 Walgreen Road
Carp, ON
K0A 1L0

Revised February 11, 2022

MCINTOSH PERRY

5.0 STORM SEWER DESIGN

5.1 Existing Storm Sewers

There are no storm sewers available within Industrial Drive. Runoff from the site is currently directed overland to the vacant field at the southeast of the site. Refer to the Pre-Development Drainage Area Plan for further information located within Appendix 'D'.

5.2 Proposed Storm Sewers

A new sewer network will be placed throughout the site and within Gerry Emon Road. The new pipe network will collect storm flows and direct runoff to a temporary storage area which will be constructed offsite. The storage area will be constructed adjacent to the southeast property line and its primary purpose is to provide temporary stormwater management storage for the proposed site until the future development and permanent stormwater management facility is constructed. Runoff collected in the temporary storage area will be restricted prior to discharging to the existing surface via shallow swale and flow level spreader. A 150mm diameter storm service is proposed from the apartment building and will be connected to the proposed on-site storm sewer system.

The storm sewers will range from 200 mm to 825 mm in diameter throughout the proposed works. The minor storm sewers will be sized for the 5-year flow without any restriction. A storm sewer design sheet was created using the rational method and City of Ottawa 5-year storm event.

The storm design sheet calculates the proper sizing of the storm pipes within the development. Drainage area information, along with respective pipe slopes and other necessary information was utilized to evaluate the performance of the storm sewer network. The time of concentration calculated for the storm sewer system is based on a 10-minute inlet time at the uppermost sewer run. Within the design sheet, pipe capacities and associated full flow velocities have been calculated. The design flow (peak flow) was checked against the theoretical capacity to ensure that each storm sewer pipe can convey the 5-year unrestricted flow.

All stormwater runoff from the subject site will be directed to an oil-grit-separator (OGS) unit prior to discharging to the temporary ponding area to achieve a minimum 80% TSS removal rate.

See the Post-Development Drainage Area Plan and Storm Sewer Design Sheet in Appendix 'E' of this report for more details. The Stormwater Management design for the subject property will be outlined in Section 6.0.

6.0 PROPOSED STORMWATER MANAGEMENT

6.1 Design Criteria and Methodology

Stormwater management for the proposed site will be maintained through positive drainage away from the proposed buildings and into a new underground storm sewer system. The storm system will capture the site runoff and direct the flow to a temporary storage pond. The emergency overland flow route for the proposed site will be directed to Gerry Emon Road and to the vacant field to the south-east of the site. The emergency

6.3 Pre-Development Drainage

The existing site drainage limits are demonstrated on the Pre-Development Drainage Area Plan. A summary of the Pre-Development Runoff Calculations can be found below.

Table 3: Pre-Development Runoff Summary

Drainage Area	Area (ha)	Runoff Coefficient (5-Year)	Runoff Coefficient (100-Year)	5-year Peak Flow (L/s)	100-year Peak Flow (L/s)
A1	3.90	0.21	0.26	158.94	339.23

See the Pre-Development Drainage Area Plan in Appendix 'D' and SWM Calculations in Appendix 'F'.

6.4 Post-Development Drainage

The proposed site drainage limits are demonstrated on the Post-Development Drainage Area Plan found in Appendix 'E' of this report. A summary of the Post-Development Runoff Calculations can be found below.

Table 4: Post-Development Runoff Summary

Drainage Area	Area (ha)	Runoff Coefficient (5-Year)	Runoff Coefficient (100-Year)	5-year Peak Flow (L/s)	100-year Peak Flow (L/s)
B1	0.37	0.53	0.61	57.27	111.70
B2	0.25	0.54	0.61	39.08	76.12
B3	0.42	0.62	0.71	76.02	147.11
B4	0.31	0.50	0.57	44.95	88.05
B5	0.34	0.76	0.85	74.58	143.04
B6	0.56	0.59	0.67	96.48	187.10
B7	0.15	0.51	0.58	22.30	43.53
B8	0.13	0.51	0.58	18.83	36.84
B9	0.64	0.40	0.47	74.45	148.02
B10	0.15	0.59	0.67	26.05	50.55
B11	0.24	0.52	0.59	36.44	71.21
B12	0.07	0.20	0.25	4.09	8.75
B13	0.15	0.54	0.61	22.79	44.44
UNCONTROLLED	0.12	0.20	0.25	6.95	14.89
Total	3.90			600.28	1,171.35

See Appendix 'F' for detailed calculations. Runoff for areas B1-B13 will be restricted within the temporary ponding area before being discharging. The required storage will be provided within the temporary ponding area adjacent to the site. The flow will be controlled by an Inlet Control Device (ICD) placed in the outlet pipe from the temporary pond. The restriction device will account for the unrestricted flow leaving the site. This quantity and quality control will be further detailed in Sections 6.5 and 6.6.

6.5 Quantity Control

The total post-development runoff for this site has been restricted to match the 50% of the 5-year pre-development flow rate with a calculated C-value. These values create the following allowable release rate and storage volumes for the development site.

See Appendix 'F' for SWM Calculations.

Reducing site flows will be achieved using flow restrictions and will create the need for onsite storage. Runoff from areas B1 to B13 will be restricted as shown in the table below.

Table 5: Post-Development Restricted Runoff Summary

Drainage Area	Post Development Unrestricted Flow (L/s)		Post Development Restricted Flow (L/s)	
	5-Year	100-Year	5-Year	100-Year
B1	57.27	111.70	45.44	64.55
B2	39.08	76.12		
B3	76.02	147.11		
B4	44.95	88.05		
B5	74.58	143.04		
B6	96.48	187.10		
B7	22.30	43.53		
B8	18.83	36.84		
B9	74.45	148.02		
B10	26.05	50.55		
B11	36.44	71.21		
B12	4.09	8.75		
B13	22.79	44.44		
UNRESTRICTED	6.95	14.89	6.95	14.89
Total	600.28	1,171.35	52.39	79.45

See Appendix 'F' for SWM Calculations.

The total flow leaving Areas B1 to B13 will be 45.44 L/s and 64.55 L/s during the 5 and 100-year storm events, respectively. This will result in ponding depths of 0.44 and 0.79 m for the 5 and 100-year storm events, respectively. The storage required for the site will be contained in the temporary ponding area. The owner will be responsible for all operation and maintenance of the stormwater pond until the new stormwater facility is complete as part of the future subdivision.

See below table for details of the required and provided storage volumes.

Table 6: Storage Summary

Drainage Area	Depth of Ponding (m)	Storage Required (m^3)	Storage Available (m^3)	Depth of Ponding (m)	Storage Required (m^3)	Storage Available (m^3)
	5-Year			100-Year		
B1 – B13	0.44	512.32	527.73	0.79	1,091.10	1,101.73

See Appendix 'F' for SWM Calculations.

In the event that there is a rainfall above the 100-year storm event, or a blockage within the storm sewer system, an emergency overland flow route has been provided so that the storm water runoff will be conveyed towards the southeast to the adjacent property.

6.6 Quality Control

The development of this lot will employ Best Management Practices (BMP's) wherever possible. The intent of implementing stormwater BMP's is to ensure that water quality and quantity concerns are addressed at all stages of development. Lot level BMP's typically include temporary retention of the parking lot runoff, minimizing ground slopes and maximizing landscaped areas. Some of these BMP's cannot be provided for this site due to site constraints and development requirements.

A quality treatment unit has been sized to provide a TSS removal rate of 80% as per MVCA requirements. The treatment unit will provide a water quality of at least 80% TSS. The treatment unit will provide the required water quality treatment for the site runoff before discharging to the temporary stormwater management quantity control and surface discharge following that. Detailed sizing information for the treatment unit have been requested from the manufacturer but are not available at this time.

The flow being discharged from the temporary pond will be directed to a flow level spreader. Flow level spreaders are generally used to convey runoff as sheet flow. The flow level spreader has been designed as a 15m long swale where flow will spill over the length of the swale reducing the effects of a concentrated outlet for the site. The runoff will discharge as sheet flow across undeveloped lands owned by the proponent. Ultimately, it is intended that the temporary storage area and flow level spreader be abandoned upon the development of the future lands. Runoff from the site will then be intercepted by future municipal sewers and

Appendix D External Plans and Reports

D.1 Geotechnical Investigation (Paterson Group, 2020)

Geotechnical Engineering

Environmental Engineering

Hydrogeology

Geological Engineering

Materials Testing

Building Science

Archaeological Services

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Geotechnical Investigation

Proposed Residential Development
Riverfront Estates - Future Expansion Lands
1218 Old Almonte Road - Almonte

Prepared For

Houchaimi Holdings Inc.

December 7, 2020

Report PG5576-1

Table of Contents

Appendices

1.0 Introduction

Paterson Group (Paterson) was commissioned by Houchaimi Holdings Inc. to conduct a geotechnical investigation for the proposed Future Expansion Lands as part of the Riverfront Estates residential development located along Old Almonte Road in the Village of Almonte, Ontario (refer to Figure 1 - Key Plan in Appendix 2).

The objectives of the current investigation were to:

- ❏ Determine the subsoil and groundwater conditions at this site by means of test holes.
- ❏ Provide geotechnical recommendations for the design of the proposed development including construction considerations pertaining to the design which may affect its design.

The following report has been prepared specifically and solely for the aforementioned project. This report contains geotechnical findings and includes recommendations pertaining to the design and construction of the proposed development as understood at the time of writing this report.

2.0 Proposed Development

It is anticipated that the proposed development will consist of single and townhouse style residential dwellings with associated paved parking areas and local roadways. It is further anticipated that the site will be municipally serviced.

3.0 Method of Investigation

3.1 Field Investigation

Field Program

The field program for the investigation was carried out on November 11 and 12, 2020. At that time, a total of forty-two (42) test pits were excavated to a maximum depth of 2.6 m below existing grade using a hydraulic excavator. All fieldwork was conducted under the full-time supervision of Paterson personnel under the direction of a senior engineer. The test pitting procedure consisted of excavating to the required depths at the selected locations and sampling the overburden. The test holes were distributed in a manner to provide general coverage of the subject site taking into consideration site features. The approximate locations of the test holes are shown on Drawing PG5576-1 - Test Hole Location Plan included in Appendix 2.

Sampling and In Situ Testing

Soil samples from the test pits from the current investigation were recovered from the side walls of the open excavation and all soil samples were initially classified on site. All samples were placed in sealed plastic bags and transported to our laboratory for further examination and classification. The depths at which the grab samples were recovered from the test pits are shown as “G” on the Soil Profile and Test Data sheets in Appendix 1.

Undrained shear strength testing was carried out at regular depth intervals in cohesive soils. Undrained shear strength testing in test pits was completed using a handheld, portable vane apparatus (field inspection vane tester Roctest Model H-60).

Subsurface conditions observed in the test holes were recorded in detail in the field. Reference should be made to the Soil Profile and Test Data sheets presented in Appendix 1 for specific details of the soil profile encountered at the test hole location.

Groundwater

Open hole groundwater infiltration levels were observed at the time of excavation at two test pit locations. Our observations are presented in the Soil Profile and Test Data sheets in Appendix 1.

Sample Storage

All samples will be stored in the laboratory for a period of one month after issuance of this report. They will then be discarded unless we are otherwise directed.

3.2 Field Survey

The locations and ground surface elevations at each test hole location were surveyed by Paterson personnel and referenced to a geodetic datum using a Trimble GPS unit. The test hole locations and ground surface elevations at the test hole locations are presented on Drawing PG5576 -1 - Test Hole Location Plan in Appendix 2.

3.3 Laboratory Testing

Soil samples recovered from the subject site were visually examined in our laboratory to review the field logs.

3.4 Analytical Testing

One (1) soil sample was submitted for analytical testing to assess the corrosion potential for exposed ferrous metals and the sulphate potential against subsurface concrete structures. The results are discussed further in Subsection 6.7.

4.0 Observations

4.1 Surface Conditions

The subject site is currently undeveloped agricultural land which is relatively flat and approximately at grade with the surrounding area and Old Almonte Road. Appleton Side Road, to the southeast, by agricultural lands, to the southwest by Old Almonte Road and residential areas, and to the northwest by agricultural lands and Orchard View Long Term Care Home and agricultural land The ground surface across the site is relatively flat and approximately at grade with Old Almonte Road.

4.2 Subsurface Profile

Overburden

Generally, the subsurface profile at the test hole locations completed within the Future Expansion Lands residential development consisted of a thin layer of top soil overlying a stiff brown silty clay to clayey silt and/or glacial till overlying inferred. Practical refusal to excavation on inferred bedrock was encountered at all test pits at depths ranging from 0.1 to 2.8 m below the existing ground surface.

Reference should be made to the Soil Profile and Test Data sheets in Appendix 1 for specific details of the soil profiles encountered at each test hole location.

Bedrock

Based on available geological mapping, the subject site consists of interbedded dolostone and limestone of the Gull River formation with an anticipated drift thickness between 1 to 2 m.

4.3 Groundwater

All test holes were generally observed to be dry upon completion of the sampling program with the exception of minor infiltration noted along the test pit sidewalls these included; TP24-20, TP29-20 , TP30-20, TP37-20, and TP39-20 where the groundwater was measured at a depth of 0.5 to 2.1 m. The measured groundwater level (GWL) readings are presented the Soil Profile and Test Data sheets in Appendix 1. It should be noted that groundwater levels are subject to seasonal fluctuations, therefore, the groundwater level could vary at the time of construction.

Based on the moisture levels and coloring of the recovered soil samples, and our experience with the local area, the long-term groundwater table is expected to be near or perched within the bedrock surface. The recorded groundwater levels are noted on the applicable Soil Profile and Test Data sheet presented in Appendix 1.

5.0 Discussion

5.1 Geotechnical Assessment

From a geotechnical perspective, the subject site is considered satisfactory for the proposed development. It is expected that the proposed residential buildings will be founded on conventional style footing placed on a stiff silty clay, clayey silt, glacial till, and/or bedrock bearing surface.

It is anticipated that some bedrock removal will be required in areas across the site for building construction and service installation. All contractors should be prepared for bedrock removal within the subject site. Additionally, due to the presence of a silty clay deposit underlying the subject site, a permissible grade raise restriction will be required for settlement sensitive structures founded within the clay deposit.

The above and other considerations are discussed in the following sections.

5.2 Site Grading and Preparation

Stripping Depth

Topsoil and deleterious fill, such as those containing organic materials, should be stripped from under any buildings, paved areas, pipe bedding, and other settlement sensitive structures.

Bedrock Removal

Bedrock removal can be accomplished by hoe ramming where only small quantity of the bedrock needs to be removed. Sound bedrock may be removed by line drilling and controlled blasting and/or hoe ramming.

Prior to considering blasting operations, the blasting effects on the existing services, buildings and other structures should be addressed. A pre-blast or pre-construction survey of the existing structures located in proximity of the blasting operations should be completed prior to commencing site activities.

The extent of the survey should be determined by the blasting consultant and should be sufficient to respond to any inquiries/claims related to the blasting operations.

As a general guideline, peak particle velocities (measured at the structures) should not exceed 25 mm/s during the blasting program to reduce the risks of damage to the existing structures.

The blasting operations should be planned and conducted under the supervision of a licensed professional engineer who is also an experienced blasting consultant.

Excavation side slopes in sound bedrock can be excavated using almost vertical side walls. A minimum 1 m horizontal ledge, should remain between the overburden excavation and the bedrock surface to provide an area to allow for potential sloughing. The ledge will provide an area to allow for potential sloughing or a stable base for the overburden shoring system.

Vibration Considerations

Construction operations are the cause of vibrations, and possibly, sources of nuisance to the community. Therefore, means to reduce the vibration levels as much as possible should be incorporated in the construction operations to maintain, as much as possible, a cooperative environment with the residents.

The following construction equipments could be the source of vibrations: hoe ram, compactor, dozer, crane, truck traffic, etc. Vibrations, whether caused by blasting operations or by construction operations, could be the source of detrimental vibrations on the nearby buildings and structures. Therefore, all vibrations are recommended to be limited.

Two parameters are used to determine the permissible vibrations, namely, the maximum peak particle velocity and the frequency. For low frequency vibrations, the maximum allowable peak particle velocity is less than that for high frequency vibrations. As a guideline, the peak particle velocity should be less than 15 mm/s between frequencies of 4 to 12 Hz, and 50 mm/s above a frequency of 40 Hz (interpolate between 12 and 40 Hz). The guidelines are for current construction standards. Considering that these guidelines are above perceptible human level and, in some cases, could be very disturbing to some people, a pre-construction survey is recommended be completed to minimize the risks of claims during or following the construction of the proposed buildings.

Fill Placement

Fill placed for grading beneath the proposed structure(s) or other settlement sensitive areas should consist of clean imported granular fill unless otherwise specified, such as Ontario Provincial Standard Specifications (OPSS) Granular A or Granular B Type II. This material should be tested and approved prior to delivery to the site. The engineered fill should be placed in maximum 300 mm thick lifts and compacted using suitable compaction equipment for the specified lift thickness. Fill placed beneath the building areas should be compacted to at least 98% of the material’s standard Proctor maximum dry density (SPMDD).

To in-fill existing channels/ditches below building areas, roadways or other settlement sensitive structures, it is recommended to place Granular A, Granular B Type I or II, well graded blast rock (maximum 200 mm diameter) or select subgrade material). The backfill material should be placed under dry conditions, in above freezing temperatures and approved by the geotechnical consultant. The backfill should be placed in maximum 300 mm loose lifts and compacted to 98% of its SPMDD.

Non-specified existing fill along with site-excavated soil can be placed as general landscaping fill where surface settlement is a minor concern. The backfill materials should be spread in thin lifts and at a minimum compacted by the tracks of the spreading equipment to minimize voids. If the non-specified backfill is to be placed to increase the subgrade level for areas to be paved, the fill should be compacted in maximum 300 mm lifts and compacted to 98% of the material's SPMDD. Non-specified existing fill and site-excavated soils are not suitable for placement as backfill against foundation walls unless a composite drainage blanket connected to a perimeter drainage system is provided.

If excavated rock is to be used as fill, it should be suitably fragmented to produce a well-graded material with a maximum particle size of 300 mm. This material should be used structurally only to build up the subgrade for roads and paved areas. Where the fill is open-graded, a blinding layer of finer granular fill or a woven geotextile, such as Terratrack 200 or equivalent, may be required to prevent adjacent finer materials from migrating into the voids, with associated loss of ground and settlements. This can be determined at the time of construction

5.3 Foundation Design

Bearing resistance values are provided in Table 1 for footings placed on an undisturbed silty clay, sandy silt, glacial till or clean bedrock bearing surface. Footings designed using the bearing resistance values at SLS provided in Table 1 will be subjected to potential post construction total and differential settlements of 25 and 20 mm, respectively. Footings placed on clean, surface sounded bedrock will be subjected to negligible settlements.

An undisturbed soil bearing surface consists of a surface from which all organic materials and deleterious materials, such as loose, frozen or disturbed soil, whether in situ or not, have been removed, in the dry, prior to the placement of concrete for footings. A clean, surface-sounded bedrock bearing surface should be free of loose materials, and have no near surface seams, voids, fissures or open joints which can be detected from surface sounding with a rock hammer.

Table 1 - Bearing Resistance Values

Bearing Surface	Factored Bearing Resistance Values at ULS (kPa)	Bearing Resistance Values at SLS or Allowable Bearing Pressure (kPa)
Stiff Sandy Silt	200	100
Stiff Silty Clay	250	150
Glacial Till	250	150
Engineered fill (Granular A or Granular B Type II)	250	150
Clean Surface Sounded Bedrock	1000	-

Notes:
- A geotechnical resistance factor of 0.5 was applied to the provided bearing resistance values at ULS

Where a building is founded partly on bedrock and partly on soil, it is recommended to decrease the soil bearing resistance value by 25% for the footings placed on soil bearing media to reduce the potential long term total and differential settlements. Also, at the soil/bedrock and bedrock/soil transitions, it is recommended that the upper 0.5 m of the bedrock be removed for a minimum length of 2 m (on the bedrock side) and replaced with nominally compacted OPSS Granular A or Granular B Type II material. The width of the subexcavation should be at least the proposed footing width plus 0.5 m. Steel reinforcement, extending at least 3 m on both sides of the 2 m long transition, should be placed in the top part of the footings and foundation walls.

Lateral Support

The bearing medium under footing-supported structures is required to be provided with adequate lateral support with respect to excavations and different foundation levels. Adequate lateral support is provided to a stiff silty clay above the groundwater table when a plane extending down and out from the bottom edge of the footing at a minimum of 1.5H:1V passes only through in situ soil of the same or higher capacity as the bearing medium soil. A bedrock bearing medium will require a lateral support zone of 1H:6V.

Bedrock/Soil Transition

Where a building is founded partly on bedrock and partly on soil, it is recommended to decrease the soil bearing resistance value by 25% for the footings placed on soil bearing media to reduce the potential long term total and differential settlements. Also, at the soil/bedrock and bedrock/soil transitions, it is recommended that the upper 0.5 m of the bedrock be removed for a minimum length of 2 m (on the bedrock side) and replaced with nominally compacted OPSS Granular A or Granular B Type II material. The width of the sub-excavation should be at least the proposed footing width plus 0.5 m. Steel reinforcement, extending at least 3 m on both sides of the 2 m long transition, should be placed in the top part of the footings and foundation walls.

Permissible Grade Raise

Based on the undrained shear strength testing results and experience with the local silty clay deposit, a permissible grade raise restriction of **2.0 m** is recommended for settlement sensitive structures founded within the clay deposit.

5.4 Design for Earthquakes

The subject site can be taken as seismic site response **Class C** as defined in Table 4.1.8.4.A of the Ontario Building Code (OBC) 2012 for foundations considered at this site. A higher seismic class may be applicable, such as Class A or B, provided the footings are within 3 m of the bedrock surface. However, this would need to be confirmed by performing a seismic shear wave velocity test at the subject site. The soils underlying the site are not susceptible to liquefaction. Reference should be made to the latest revision of the Ontario Building Code for a full discussion of the earthquake design requirements.

5.5 Basement Slab

With the removal of all topsoil and deleterious fill, such as those containing organic materials, within the footprint of the proposed buildings, the native soil surface will be considered to be an acceptable subgrade on which to commence backfilling for floor slab construction. Provision should be made for proof rolling the soil subgrade using heavy vibratory compaction equipment prior to placing any fill. Any soft areas should be removed and backfilled with appropriate backfill material prior to placing any fill. OPSS Granular A or Granular B Type II, with a maximum particle size of 50 mm, are recommended for backfilling below the floor slab. All backfill material within the footprint of the proposed building(s) should be placed in maximum 300 mm thick loose layers and compacted to a minimum of 98% of the SPMDD.

5.6 Pavement Structure

The subgrade materials for the pavement structure are anticipated to be stiff silty clay, glacial till or compacted engineered fill. Car only parking, local and collector roadways are anticipated at this site. The proposed pavement structures are shown in Tables 2 and 3.

Table 2 - Recommended Pavement Structure - Car Only Parking Areas

Thickness (mm)	Material Description
50	**Wear Course -** HL-3 or Superpave 12.5 Asphaltic Concrete
150	**BASE** - OPSS Granular A Crushed Stone
300	**SUBBASE** - OPSS Granular B Type II
	SUBGRADE - Either fill, in situ soil, or OPSS Granular B Type I or II material placed over in situ soil or fill

Table 4 - Recommended Pavement Structure - Local Roadways and Collector Roadways without Bus Traffic

Thickness (mm)	Material Description
40	**Wear Course -** HL-3 or Superpave 12.5 Asphaltic Concrete
50	**Binder Course -** HL-8 or Superpave 19.0 Asphaltic Concrete
150	**BASE** - OPSS Granular A Crushed Stone
400	**SUBBASE** - OPSS Granular B Type II
	SUBGRADE - Either fill, in situ soil, or OPSS Granular B Type I or II material placed over in situ soil or fill

Minimum Performance Graded (PG) 58-34 asphalt cement should be used for this project.

For residential driveways and car only parking areas, an Ontario Traffic Category A will be used. For local and collector roadways, an Ontario Traffic Category B should be used for design purposes.

If soft spots develop in the subgrade during compaction or due to construction traffic, the affected areas should be excavated and replaced with OPSS Granular B Type I or Type II material.

The pavement granular base and subbase should be placed in maximum 300 mm thick lifts and compacted to a minimum of 99% of the material's SPMDD using suitable compaction equipment.

Pavement Structure Drainage

Satisfactory performance of the pavement structure is largely dependent on keeping the contact zone between the subgrade material and the base stone in a dry condition. Failure to provide adequate drainage under conditions of heavy wheel loading can result in the fine subgrade soil being pumped into the voids in the stone subbase, thereby reducing its load carrying capacity.

Due to the impervious nature of the subgrade materials consideration should be given to installing subdrains during the pavement construction. These drains should extend in four orthogonal directions or longitudinally when placed along a curb. The clear crushed stone surrounding the drainage lines or the pipe, should be wrapped with suitable filter cloth. The subdrain inverts should be approximately 300 mm below subgrade level. The subgrade surface should be shaped to promote water flow to the drainage lines. All subdrains should be provided with a positive outlet to the storm sewer.

6.0 Design and Construction Precautions

6.1 Foundation Drainage and Backfill

Foundation Drainage

A perimeter foundation drainage system is recommended to be provided for the proposed structure. The system should consist of a 100 to 150 mm diameter perforated corrugated plastic pipe, surrounded on all sides by 150 mm of 10 mm clear crushed stone, placed at the footing level around the exterior perimeter of the structure. The pipe should have a positive outlet, such as a gravity connection to the storm sewer.

Foundation Backfill

Backfill against the exterior sides of the foundation walls should consist of free-draining, non frost susceptible granular materials. Imported granular materials, such as clean sand or OPSS Granular B Type I granular material, should be used for this purpose. The greater part of the site excavated materials will be frost susceptible and, as such, are not recommended for re-use as backfill against the foundation walls, unless used in conjunction with a composite drainage blanket, such as Miradrain G100N or Delta Drain 6000.

6.2 Protection of Footings Against Frost Action

Perimeter footings of heated structures are required to be insulated against the deleterious effect of frost action. A minimum of 1.5 m thick soil cover (or equivalent) should be provided in this regard.

Exterior unheated footings, such as those for isolated exterior piers, are more prone to deleterious movement associated with frost action than the exterior walls of the structure proper and require additional protection, such as soil cover of 2.1 m or a combination of soil cover and foundation insulation.

Frost Susceptibility of Bedrock

When bedrock is encountered above the proposed founding depth and soil frost cover is less than 1.5 m, the frost susceptibility of the bedrock should be determined. This can be accomplished as follows:

- ❑ Drill probeholes within the bedrock and assess its frost susceptibility.
- ❑ Examine service trench profiles extending in bedrock in the vicinity of the foundation to determine if weathering is extensive.

If the bedrock is considered to be **non-frost susceptible**, the footings can be poured directly on the bedrock without any further frost protective measures.
If the bedrock is considered to be **frost susceptible**, the following measures should be implemented for frost protection:

- ❑ Option A - Sub-excavate the weathered bedrock to sound bedrock or to the required frost cover depth. Pour footings at the lower level.

- ❑ Option B - Use insulation to protect footings. It is preferable to pour footings on the insulation overlying weathered bedrock. However, due to potential undulating bedrock surface, consideration may have to be given to adopting an insulation detail that allows the footing to be poured directly on the weathered bedrock.

6.3 Excavation Side Slopes

Temporary Side Slopes

The temporary excavation side slopes should be excavated to acceptable slopes from the beginning of the excavation until the structure is backfilled. It is assumed that sufficient room will be available for the greater part of the excavation to be undertaken by open-cut methods (i.e. unsupported excavations). In bedrock, almost vertical side slopes can be used provided that all loose rock and blocks with unfavourable weak planes are removed or stabilized.

The excavation side slopes above the groundwater level extending to a maximum depth of 3 m should be excavated at 1H:1V or shallower. The shallower slope is required for excavation below groundwater level. The subsurface soil is considered to be mainly Type 2 and 3 soil according to the Occupational Health and Safety Act and Regulations for Construction Projects.

Excavated soil should not be stockpiled directly at the top of excavations and heavy equipment should maintain safe working distance from the excavation sides.

Slopes in excess of 3 m in height should be periodically inspected by the geotechnical consultant in order to detect if the slopes are exhibiting signs of distress.

A trench box is recommended to be installed at all times to protect personnel working in trenches with steep or vertical sides. Services are expected to be installed by “cut and cover” methods and excavations should not be remain exposed for extended periods of time.

6.4 Pipe Bedding and Backfill

The pipe bedding for sewer and water pipes should consist of at least 150 mm of OPSS Granular A material for areas over a soil subgrade. However, the bedding thickness should be increased to 300 mm for areas over a bedrock subgrade, if encountered. The material should be placed in maximum 300 mm thick lifts and compacted to a minimum of 99% of its SPMDD. The bedding material should extend at a minimum to the spring line of the pipe.

The cover material, which should consist of OPSS Granular A crushed stone, should extend from the spring line of the pipe to a minimum of 300 mm above the obvert of the pipe. The material should be placed in maximum 300 mm thick lifts and compacted to a minimum of 99% of its SPMDD.

Generally, it should be possible to re-use the moist (not wet) silty sand and glacial till above the cover material if the excavation and filling operations are carried out in dry weather conditions. Wet sub-excavated soil should be given a sufficient drying period to decrease its moisture content to an acceptable level to make compaction possible prior to being re-used. All stones greater than 300 mm in their greatest dimension should be removed prior to reuse of site-generated glacial till.

Where hard surface areas are considered above the trench backfill, the trench backfill material within the frost zone (about 1.8 m below finished grade) should consist of the soils exposed at the trench walls to minimize differential frost heaving. The trench backfill should be placed in maximum 300 mm thick loose lifts and compacted to a minimum of 98% of the SPMDD.

Typically, clay seals are recommended to be placed within service trenches where silty clay is present at invert level. Paterson has reviewed the available service profile drawings for the current phase. Based on our review and existing subsoils information, the silty clay deposit where encountered along proposed service alignment is located above the lowest service pipe invert level. Therefore, clay seals are not required. However, if silty clay is encountered at the lowest service invert level, it is recommended that, clay seals be provided in the service trenches at no more than 60 m intervals in the service trenches.

The seals should be at least 1.5 m long (in the trench direction) and should extend from trench wall to trench wall. The seals should extend from the frost line and fully penetrate the bedding, subbedding and cover material. The barriers should consist of relatively dry and compactable brown silty clay placed in maximum 225 mm thick loose layers and compacted to a minimum of 95% of the SPMDD.

6.5 Groundwater Control

It is anticipated that groundwater infiltration into the excavations should be low and controllable using open sumps. Pumping from open sumps should be sufficient to control the groundwater influx through the sides of shallow excavations. The contractor should be prepared to direct water away from all bearing surfaces and subgrades, regardless of the source, to prevent disturbance to the founding medium.

A temporary Ministry of the Environment, Conservation and Parks (MECP) permit to take water (PTTW) may be required for this project if more than 400,000 L/day of ground and/or surface water is to be pumped during the construction phase. A minimum 4 to 5 months should be allowed for completion of the PTTW application package and issuance of the permit by the MECP.

For typical ground or surface water volumes, being pumped during the construction phase, between 50,000 to 400,000 L/day, it is required to register on the Environmental Activity and Sector Registry (EASR). A minimum of two to four weeks should be allotted for completion of the EASR registration and the Water Taking and Discharge Plan to be prepared by a Qualified Person as stipulated under O.Reg. 63/16.

If a project qualifies for a PTTW based upon anticipated conditions, an EASR will not be allowed as a temporary dewatering measure while awaiting the MECP review of the PTTW application.

6.6 Winter Construction

Precautions must be taken if winter construction is considered for this project. The subsoil conditions at this site consist of frost susceptible materials. In the presence of water and freezing conditions, ice could form within the soil mass. Heaving and settlement upon thawing could occur. Provisions in the contract documents should be provided to protect the excavation walls from freezing, if applicable.

In the event of construction during below zero temperatures, the founding stratum should be protected from freezing temperatures by the installation of straw, propane heaters and tarpaulins or other suitable means. The excavation base should be insulated from sub-zero temperatures immediately upon exposure and until such time as heat is adequately supplied to the building and the footings are protected with sufficient soil cover to prevent freezing at founding level.

Trench excavations and pavement construction are difficult activities to complete during freezing conditions without introducing frost in the subgrade or in the excavation walls and bottoms. Precautions should be considered if such activities are to be completed during freezing conditions. Additional information could be provided, if required.

6.7 Corrosion Potential and Sulphate

The results on analytical testing show that the sulphate content is less than 0.1%. The results are indicative that Type 10 Portland Cement (Type GU) would be appropriate for this site. The chloride content and the pH of the sample indicate that they are not significant factors in creating a corrosive environment for exposed ferrous metals at this site, whereas the resistivity in indicative of a aggressive to very aggressive corrosive environment.

6.8 Landscaping Considerations

Tree Planting Restrictions

The proposed residential dwellings founded over a silty clay deposit are located in a low to moderate sensitivity area with respect to tree planting. It is recommended that trees placed within 5 m of the foundation wall should consist of low water demanding trees with shallow roots systems that extend less than 1.5 m below ground surface for buildings where footings are founded over a silty clay deposit. Trees placed greater than 5 m from the foundation wall may consist of typical street trees, which are typically moderate water demand species with roots extending to a maximum depth of 2 m below ground surface.

It is well documented in the literature, and is our experience, that fast-growing trees located near buildings founded on cohesive soils that shrink on drying can result in long-term differential settlements of the structures. Tree varieties that have the most pronounced effect on foundations are seen to consist of poplars, willows and some maples (i.e. Manitoba Maples) and, as such, they should not be considered in the landscaping design.

7.0 Recommendations

A materials testing and observation services program is a requirement for the provided foundation design data to be applicable. The following aspects of the program should be performed by the geotechnical consultant:

- ❑ Review detailed grading plan(s) from a geotechnical perspective.
- ❑ Review of architectural and structural drawings to ensure adequate frost protection is provided to the subsoil.
- ❑ Observation of all bearing surfaces prior to the placement of concrete.
- ❑ Sampling and testing of the concrete and fill materials used.
- ❑ Periodic observation of the condition of unsupported excavation side slopes in excess of 3 m in height, if applicable.
- ❑ Observation of all subgrades prior to backfilling.
- ❑ Field density tests to determine the level of compaction achieved.
- ❑ Sampling and testing of the bituminous concrete including mix design reviews.

A report confirming that these works have been conducted in general accordance with our recommendations could be issued upon the completion of a satisfactory inspection program by the geotechnical consultant

8.0 Statement of Limitations

The recommendations provided in the report are in accordance with Paterson's present understanding of the project. Paterson request permission to review the recommendations when the drawings and specifications are completed.

A geotechnical investigation is a limited sampling of a site. Should any conditions encountered during construction differ from the test pit locations, Paterson requests immediate notification to permit reassessment of the recommendations provided herein.

The recommendations provided should only be used by the design professionals associated with this project. The recommendations are not intended for contractors bidding on or constructing the project. The latter should evaluate the factual information provided in the report. The contractor should also determine the suitability and completeness for the intended construction schedule and methods. Additional testing may be required for the contractors purpose.

The present report applies only to the project described in this document. Use of this report for purposes other than those described herein or by person(s) other than Houchaimi Holdings Inc. or their agent(s) is not authorized without review by Paterson for the applicability of our recommendations to the altered use of the report.

Paterson Group Inc.

LICENSED PROFESSIONAL ENGINEER
December 7 2020
D. J. GILBERT
100116130
PROVINCE OF ONTARIO

Otillia McLaughlin B.Eng.

David J Gilbert P.Eng.

Report Distribution:

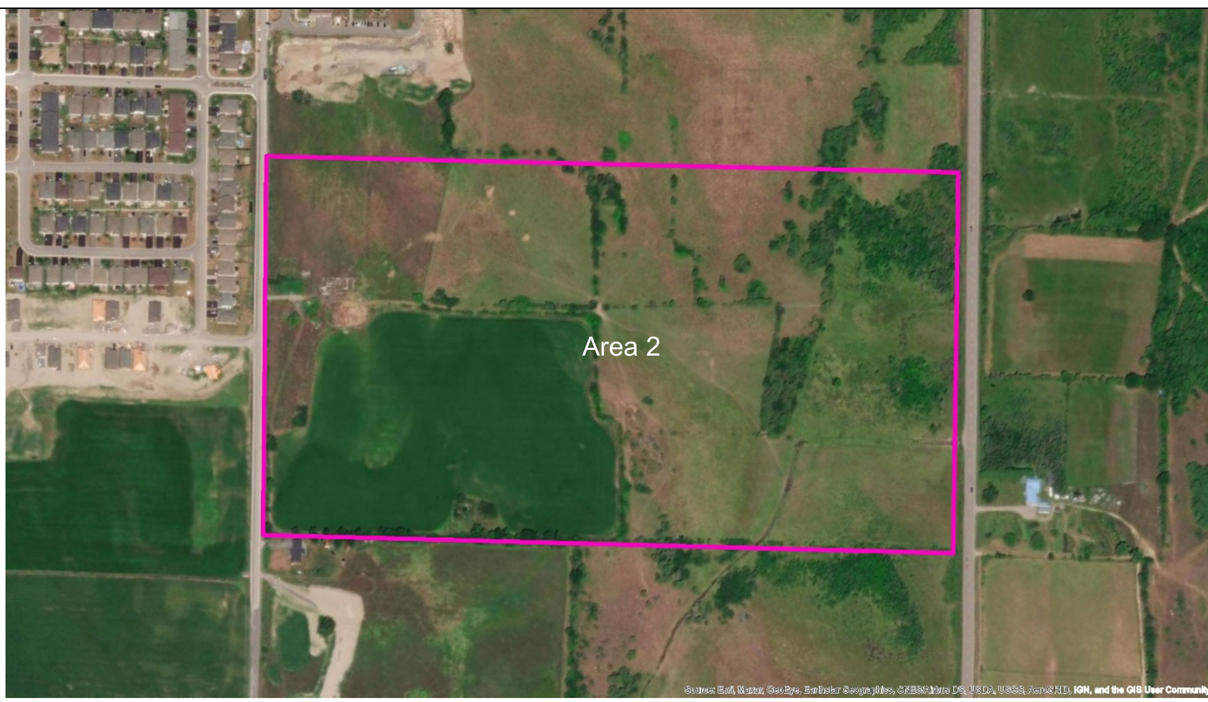
- ❑ Houchaimi Holdings Inc. (1 digital copy)
- ❑ Paterson Group (1 copy)

D.2 Official Plan Amendment No. 22 – Background Excerpts

SITE EVALUATION CRITERIA

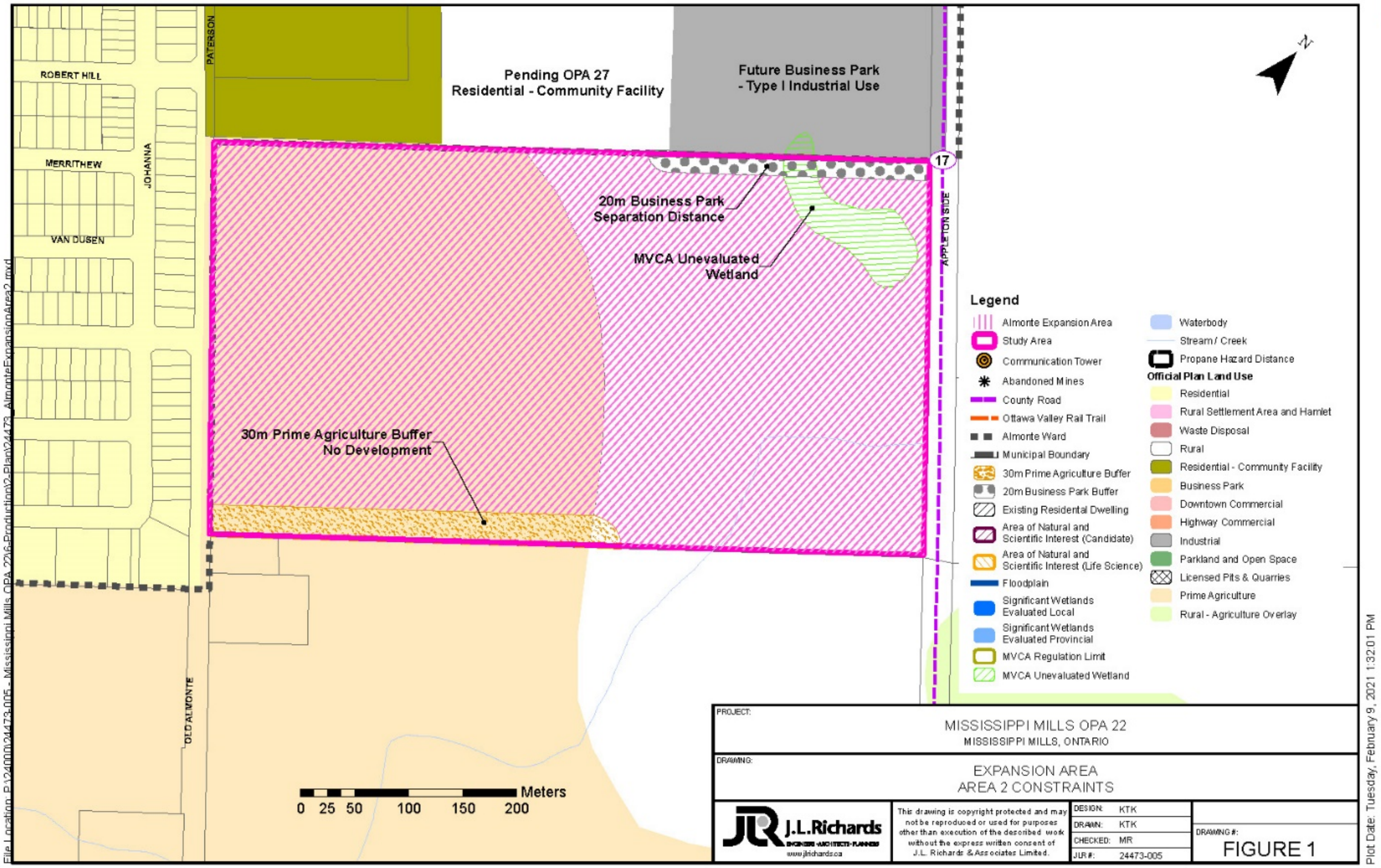
PROFILE SUMMARY
Almonte Potential Expansion Area 2
Location Map

Topographical Map



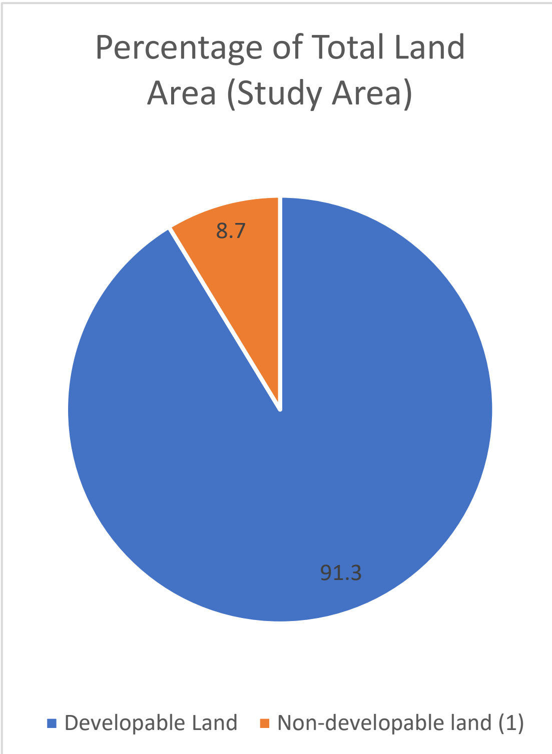
SITE EVALUATION CRITERIA

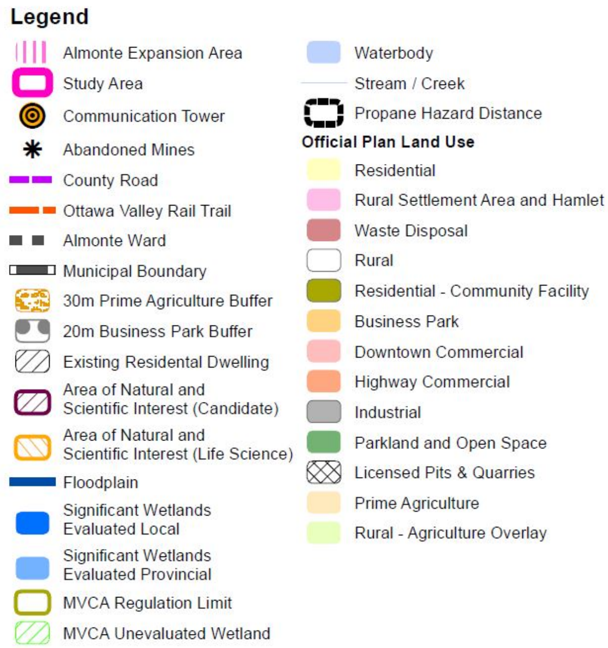
Constraints Map



SITE EVALUATION CRITERIA

Land Area Total





(1) Includes Land Use Constraints and Natural Heritage Features discussed below

Site Location

- Located along the southeastern edge of the settlement area of Almonte, southeast of the Orchard View Retirement Home Phase I and Phase II (pending OPA 27), the Almonte Business Park / Industrial Park and east of an existing residential subdivision.
- The study area consists of 24.01 hectares (ha) of land, including 21.9 ha of developable land and 2.09 ha of undevelopable land, which is constrained by land use constraints and natural heritage features discussed below.
- Land Stakeholders: Area is known as the "Houchaimi Lands".

Servicing

- Included in Master Plan build-out future development areas.
- Water servicing- additional watermain extension along Appleton Side Road.
- Wastewater pumping station and force main required to connect proposed development to gravity sewer system near Patterson and Houston Street. Requires industrial park sewer be routed along Houston Street, under Ottawa Street to the new Victoria Street trunk sewer. These sewer upgrades are required to prevent future sewer surcharging of the existing Ottawa Street sanitary sewer.
- Stormwater: Unknown but anticipate that local water quality and quantity can be managed on site. Outlet location and depth remain unknown and could impact development potential.

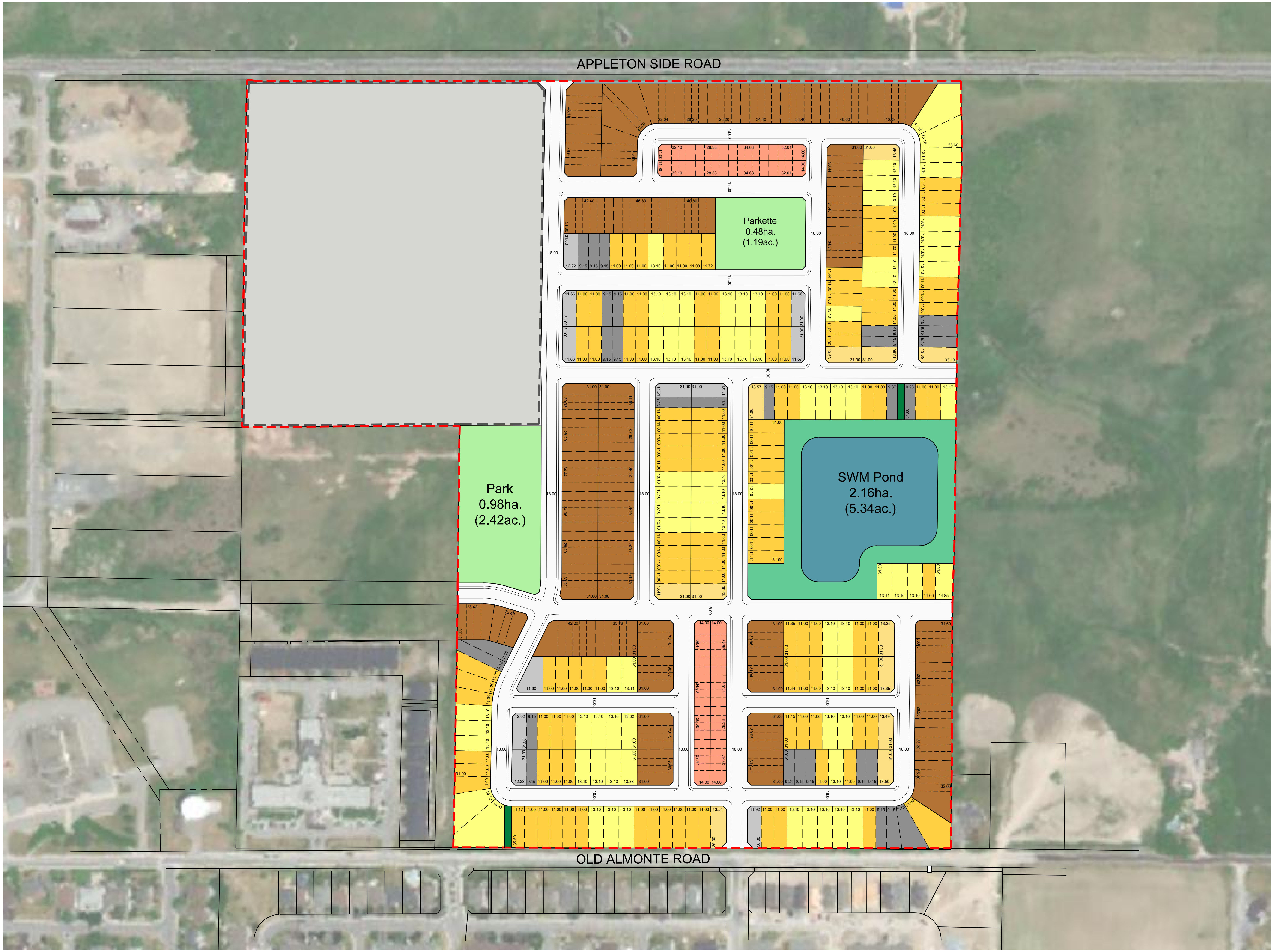
Transportation and Road

- Limited ROW opportunities and nearby road connections.
- Logical sidewalk extensions and planned cycling infrastructure.
- Adjacent to County Road 17 and other major regional roads (County Road 49). Connection to Old Almonte Road and Appleton Side Road possible but will require a Transportation Impact Assessment.

SITE EVALUATION CRITERIA

Land Use Constraints
• 11.4 ha of land currently designated Rural lands. • 12.6 ha of land currently designated Prime Agricultural Land. • 1.12 ha of land is within the 30m Prime Agricultural Buffer. Section 3.6.16 of the Mississippi Mills Community Official Plan (COP) prescribes that residential dwellings be set back 30m when located in a settlement area and abutting agricultural lands. • 0.51 ha of land will be subject to the Ministry of Environment and Climate Change (MOECC) Guideline D-2, D-4 separation distance requirement from Type I industrial land uses which is 20m from the Future Business Park on the lands to the north. Note – might require a greater separation distance should a Type II industrial use be proposed within the Industrial lands. • The Provincial Policy Statement (PPS) 2020, Lanark County Sustainable Communities Official Plan (SCOP) and the Municipality of Mississippi Mills COP all provide policies that limit the range of development opportunities for rural lands and the protection of Prime Agricultural Land, including mitigating the potential loss of agricultural land, potential land use compatibility issues, minimum distance separation formulae requirements, servicing restrictions, etc. The PPS strongly discourages the conversion of prime agricultural land for other land uses.
Natural Heritage Constraints
• 0.63 ha of Rural Land is located within the MVCA Unevaluated Wetland. The MVCA has jurisdiction over these lands and restricts development within wetlands and other natural hazards. A small portion of the site consists of this natural heritage constraint, which will restrict development and include a range of assessments and studies to be completed in advance. • Topography slopes north to south (relatively flat). • Watercourse observed. • There are vacant parcels and lands cleared for agricultural purposes (prime agricultural lands). • Some municipal ditches, scarcely vegetated. • The Provincial Policy Statement (PPS) 2020, Lanark County Sustainable Communities Official Plan (SCOP) and the Municipality of Mississippi Mills Community Official Plan (COP) all provide policies that aim to protect the natural heritage and mitigate potential impacts on wildlife, habitat, species at risk (SAR) and avoid conflicts with natural features, including watercourses. These are all considered potential Natural Heritage Constraints due to the presence of the wetland and watercourse.

Appendix E Draft Plan



minto Communities

MILL VALLEY ESTATES

TOWN OF MISSISSIPPI MILLS

LEGEND

- Property Boundary
- Business Park Boundary
- 30' Single Detached
- 30' Single Detached Corner
- 36' Single Detached
- 36' Single Detached Corner
- 43' Single Detached
- 20' Executive Towns
- 20' Avenue Towns
- Parkland
- Stormwater Management Pond
- Open Space

Site Area: 33.75ha

Density (units/hectare):

Net Residential: 34.90
Net Residential + SWM Pond: 30.59

Unit Count: 535

30' Single Detached: 40
36' Single Detached: 138
43' Single Detached: 75
20' Executive Towns: 210
20' Avenue Towns: 72

Parkland Dedication:
5% of Developable Area + 2% of Business Park Area
Required: 1.31ha + 0.15ha 1.46ha
Provided: 1.46ha

Total Road Length: 3,871.93m

NORTH

NAK design strategies

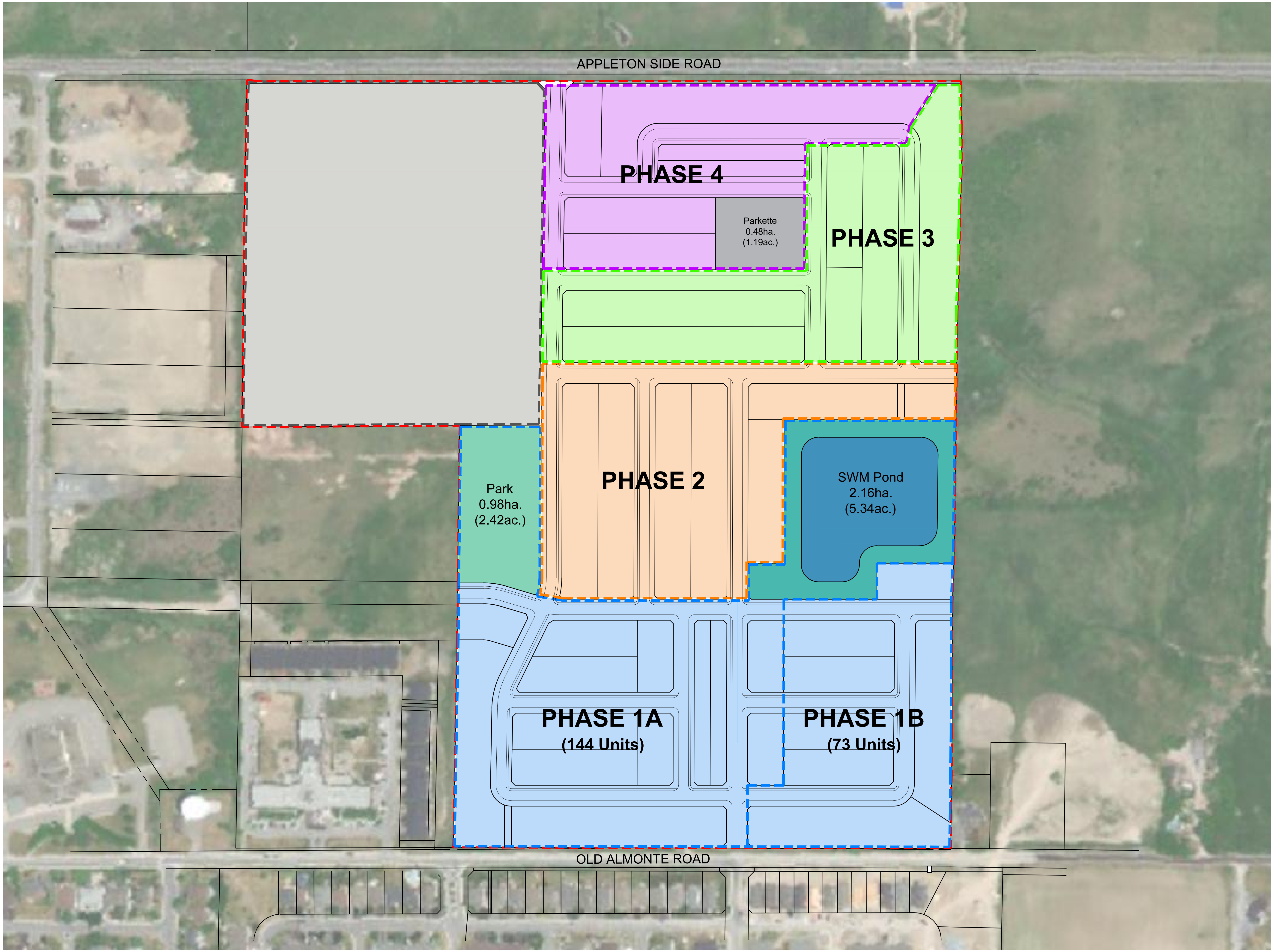
421 RONCESVALLES AVENUE, TORONTO, ON M6R 2N1 CANADA
T 416.340.8700 F 416.340.7100 NAKDESIGNSTRATEGIES.COM

SCALE | 1:3000
0 30m 60m

DATE | 11.08.2023 PROJECT | 23098

LU-5-3

CONCEPT PLAN v5 | LOTTING



CONCEPT PLAN v5 | PHASING

minto Communities

MILL VALLEY ESTATES

TOWN OF MISSISSIPPI MILLS

LEGEND

- Property Boundary
- Business Park Boundary
- Phase 1
- Phase 2
- Phase 3
- Phase 4

NORTH

NAK design strategies

421 RONCESVALLES AVENUE, TORONTO, ON M6R 2N1 CANADA
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SCALE | 1:3000

0 30m 60m

DATE | 11.08.2023

PROJECT | 23098

LU-5-2

Appendix F Civil Comments and Response

Stantec

Memo

To:	Kris Kilborn	From:	Ana Paerez
	Ottawa ON		Moncton NB
File:	160401740	Date:	November 27, 2023

Reference: Mill Valley Estates Draft Plan of Subdivision Submission – First Submission Civil-Related Comments and Response

Below is a summary of the civil-related comments to the first engineering submission for draft plan approval of December 2022, along with our responses.

<u>Servicing Report - Municipality</u>

<u>Stormwater Management</u>

26. Section 5.2, please detail the imperviousness parameters for each type of the surfaces and the calculation to the overall 53% and 71%.
Stantec (November 2023): Runoff coefficient calculations for the proposed site area have been provided as an appendix in the revised report, while overall imperviousness for the Future Mill Valley Living subcatchment was obtained from the approved Servicing and Stormwater Management Report prepared by McIntosh Perry, dated February 11, 2022 as shown in the snip below, which results in a runoff coefficient of 0.61 in the 100-year and was increased to 0.70 for conservatism.

Table 4: Post-Development Runoff Summary

Drainage Area	Area (ha)	Runoff Coefficient (5-Year)	Runoff Coefficient (100-Year)	5-year Peak Flow (L/s)	100-year Peak Flow (L/s)
B1	0.37	0.53	0.61	57.27	111.70
B2	0.25	0.54	0.61	39.08	76.12
B3	0.42	0.62	0.71	76.02	147.11
B4	0.31	0.50	0.57	44.95	88.05
B5	0.34	0.76	0.85	74.58	143.04
B6	0.56	0.59	0.67	96.48	187.10
B7	0.15	0.51	0.58	22.30	43.53
B8	0.13	0.51	0.58	18.83	36.84
B9	0.64	0.40	0.47	74.45	148.02
B10	0.15	0.59	0.67	26.05	50.55
B11	0.24	0.52	0.59	36.44	71.21
B12	0.07	0.20	0.25	4.09	8.75
B13	0.15	0.54	0.61	22.79	44.44
UNCONTROLLED	0.12	0.20	0.25	6.95	14.89
Total	3.90			600.28	1,171.35

27. Section 5.2.2, the business park should be included in the analysis, although it will have a different routing and discharge point. The reviewer is not able to associate modelling input/output with specific modes. Please confirm the model has considered uncontrolled or controlled flow discharge to Appleton Side Road south ditch (by showing flow rates of certain nodes). The Municipality will discuss with the applicant on the stormwater management design for the business park (i.e., individual site actions or a centralized stormwater control).
Stantec (November 2023): The future business park has been included in the post development PCSWMM model with an 86% imperviousness discharging into the Appleton Side Road roadside ditch. The SWM approach for the future block consists of providing on-site controls to achieve 80% TSS removal, and restricting post development peak flows up to the 100-year storm to pre-development levels through on-site storage. In addition, some areas within the future business park block are expected to sheet flow

uncontrolled to adjacent areas due to grading restrictions, and they have been included as uncontrolled areas in the PCSWMM model.

28. The re-aligning of the ditch is subject to MVCA approval, and potential DFO review. Consultation and obtaining approval at detailed design and construction stages from the County is also required.
    Stantec (November 2023): Noted
29. The reviewer is not able to associate modelling input/output with specific modes. Please confirm the model has considered upstream flows from Appleton Side Road (by showing flow rates of certain nodes).
    Stantec (November 2023): The model has considered upstream flows from all external areas as shown in the overall storm drainage plan figure in the report. The overall storm drainage plan figure has been revised to show 100-year peak flows upstream of the Appleton Side road crossing and from areas west of the site discharging to the southern Appleton Side Road ditch.
30. Please consider energy dissipation method in your open channel and inlet/outlet design.
    Stantec (November 2023): energy dissipation measures will be designed at the detailed design stage.
31. The Municipality encourages LID measures to be incorporated into the proposed development.
    Stantec (November 2023): The revised report includes an LID section that discusses the feasibility of implementing LIDs at the detailed design stage based on geotechnical constraints such as groundwater and bedrock elevation.

EC-1:

32. The Municipality requests an Erosion Control Plan by phasing.
    Stantec (November 2023): An erosion control plan has been provided with the report based on the current phasing plan.

Water and Wastewater

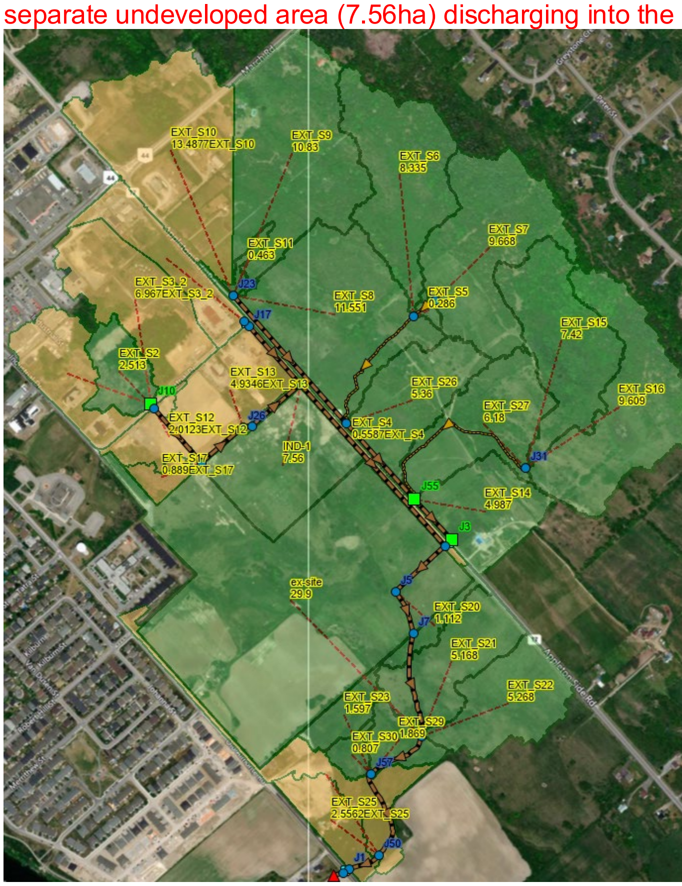
33. The consultant should be aware that a Water/Wastewater Master Plan is being conducted by the Municipality. The applicant should contact the project team (via David Shen dshen@mississippimills.ca) for more information regarding the water wastewater planning in the area.
    Stantec (November 2023): The revised report includes documentation of correspondence with the Municipality regarding wastewater servicing and capacity of the downstream sewers. Similarly, a hydraulic analysis has been included for the potable water network based on boundary conditions received from the Municipality.
34. The Municipality has a separate technical review on water/wastewater servicing plan, connections, and capacity analysis of the existing infrastructure. A phased servicing plan is required.
    Stantec (November 2023): A phasing plan has been included with this submission. Please see response to comment 23 regarding water and wastewater servicing.
35. The Municipality reserves a right to request new/additional watermain looping to limit a satisfactory water age in the area.
    Stantec (November 2023): Noted. A hydraulic analysis has been included for the potable water network based on boundary conditions received from the Municipality.
36. The Municipality intends to have a further discussion with the applicant regarding comprehensive wastewater servicing strategy in the area, including oversizing the area trunk, pumping station and inlet, as well as a forcemain.
    Stantec (November 2023): Noted.
37. Please include the whole development sanitary calculation sheet. Specify the proposed pumping station proposed capacity, show the forcemain calculation in the calculation sheet.
    Stantec (November 2023): Sanitary calculations for the whole development have been provided in the report. Forcemain calculations will be provided at the detailed design stage.

Reference: Mill Valley Estates Draft Plan of Subdivision Submission – First Submission Civil-Related Comments and Response

38. Please be advised due to the size of the proposed pumping station, a direct submission of ECA might be required.
    Stantec (November 2023): Noted

Technical Review PMMSB-30 – MVCA (March 9th, 2023)

1. Please provide a pre-development drainage area plan showing flow paths.
   Stantec (November 2023): An existing condition drainage area figure has been included in the report.
2. The pre and post-development drainage area input to the PCSWMM differs (30.28 ha vs 37.23 ha, Appendix C). The model should update with the correct drainage area in calculating the existing peak flow based on drainage patterns at downstream of the outlet of the pond prior to discharging to an existing ditch.
   Stantec (November 2023): The 37.23ha includes the future business park block and the uncontrolled area UNC-1, which are not directed to the SWM Pond. The future business park will provide on-site treatment to meet post to pre-development peak flow conditions and as such, it is not included in the existing peak flow calculations from site areas directed to the SWM pond.
   a. Pre-development flow should be calculated based on 30.39 ha instead of 30.28 ha.
      Stantec (November 2023): An existing condition PCSWMM model has been created, which includes all areas tributary to the outlet ditch as shown in the existing condition drainage area figure included in the report (see snip below). The model includes the proposed Mill Valley Estates and Mill Valley Living area as one lumped undeveloped area (29.9ha) and the business park block as a separate undeveloped area (7.56ha) discharging into the outlet ditch.



   b. The ultimate allowable release rate should be calculated as the 100-year pre-development flow from 30.39 ha minus post dev flow from UNC-1 (0.11ha). The pond outflow should be less than the ultimate allowable release rate.
   Stantec (November 2023): The report has been revised to show the post development condition peak flow in the ditch downstream of the SWM pond outlet, compared to existing condition peak flows for different storm events. These post development peak flows include all uncontrolled runoff contribution which has also been allocated at different locations along the existing/proposed ditch.

3. The topography across the site slopes from north to south towards the existing drainage ditch (section 7). Per the existing grades shown on the Conceptual Grading Plan, the future industrial block sloped south towards the existing ditch. However, the report indicates that runoff from the future industrial park block will be directed to the existing roadside ditch along Appleton Side Road under the post-development condition. Please demonstrate that the existing roadside ditch can convey the additional flows safely downstream without any negative impacts.
   Stantec (November 2023): A section has been added to the report to outline SWM criteria and approximate storage requirements for the future business park block and to show the resulting 100-year flow depth along the ditch downstream for the site outlet, compared to the maximum depth.
4. With respect to the above comment # 5, is grading work on the future industrial block proposed concurrently with the development on the subject site?
   Stantec (November 2023): The future business park block will be raised and roughly graded to provide positive drainage to the Appleton Side Road southern ditch as shown in the grading plan.
5. Please demonstrate that the flow in the realigned ditch downstream of the outlet of the wet pond does not exceed the pre-development flows/levels in the receiving tributary.
   Stantec (November 2023): The report has been revised to show the post development condition peak flow in the ditch downstream of the SWM pond outlet, compared to existing condition peak flows for different storm events. These post development peak flows include all uncontrolled runoff contribution which has also been allocated at different locations along the existing/proposed ditch.
6. Please include calculations and/or the PCSWMM input/output files showing the 100-year flows along Appleton Side Road ROW and Southern Property Line are 2,295 L/s 2,320 L/s.
   Stantec (November 2023): PCSWMM modeling files have been included with the submission package. In addition, graphs from the PCSWMM model for the worst-case 100-year storm along the Appleton Side Road southern ditch and along the ditch downstream of the proposed SWM pond have been included in the PCSWMM input/output appendix.
7. With the proposed realignments with an approximate 900 bend at the intersection of Appleton Side Road ROW and Southern Property Line, how will the flow from the external drainage area (137.12 ha) through an existing 1100 mm diameter CSP convey to the proposed realigned roadside ditch along Appleton Side Road?
   Stantec (November 2023): A V-shaped cross section, 3.5m wide and 0.85m deep is proposed along Appleton Side Road southern ditch, followed by a trapezoidal cross section with a 1m-wide bottom and 1.2m depth along the southern property line. Given the required 90deg bend at the existing crossing, it is expected that the proposed ditch realignment will include erosion measures such as lining the ditch with rip-rap at the bend location, etc. These measures will be specified at the detailed design stage.
8. The peak discharge from the pond at an elevation of 130.31 m provided in Table 5.7 and calculations in Appendix C are inconsistent. Please review, correct and be consistent in table, report and calculation, as required
   Stantec (November 2023): PCSWMM modeling files have been included with the submission package. The information provided in Table 5.7 of the report corresponds to the water levels and peak flows obtained from the PCSWMM model for the different storm events, which is a dynamic model that takes into account backwater effects on the SWM pond outlet structure. The SWM pond stage-storage-discharge table shown in Appendix C corresponds to hydraulic calculations of the outlet structure based on orifice and weir

equations under free flow conditions and it is used as an approximation to obtain an initial configuration of the outlet structure that is then optimized in PCSWMM.

9. Please provide a stage-storage-discharge table of the wet pond.
   Stantec (November 2023): The approximate stage-storage-discharge table for the SWM pond has been included in Appendix C.
10. Include excerpts from the governing report for Mill Valley Living Community to confirm that minor and major flows identified in the report are consistent with the PCSWMM model output and inflow to the SWM wet pond.
    Stantec (November 2023): Overall imperviousness for the Future Mill Valley Living subcatchment was obtained from the approved Servicing and Stormwater Management Report prepared by McIntosh Perry, dated February 11, 2022, which results in a runoff coefficient of 0.61 in the 100-year and was increased to 0.70 for conservatism. The McIntosh Perry's SWM report for the Mill Valley Living site assumed a dry pond would be located in what is now the proposed park block, to mitigate post development peak flows to pre-development levels. However, the current SWM approach proposes to capture 5-year uncontrolled peak flows from that site into the minor system (878 L/s, increased to 899 L/s in the 100-year) and to route peak flows exceeding the capacity of the minor system overland to the proposed SWM pond during major storm events. Excerpts from McIntosh Perry's report (see snip below) have been included in the revised servicing report for Mill Valley Estates and a sub-section has been added to the report to outline the SWM criteria for that site.

Table 5: Post-Development Restricted Runoff Summary

Drainage Area	Post Development Unrestricted Flow (L/s)		Post Development Restricted Flow (L/s)	
	5-Year	100-Year	5-Year	100-Year
B1	57.27	111.70	45.44	64.55
B2	39.08	76.12		
B3	76.02	147.11		
B4	44.95	88.05		
B5	74.58	143.04		
B6	96.48	187.10		
B7	22.30	43.53		
B8	18.83	36.84		
B9	74.45	148.02		
B10	26.05	50.55		
B11	36.44	71.21		
B12	4.09	8.75		
B13	22.79	44.44		
UNRESTRICTED	6.95	14.89	6.95	14.89
Total	600.28	1,171.35	52.39	79.45

<u>MVCA Review 09-T-23002 dated March 31, 2023</u>

11. With respect to the subject property, the proposed realignment of the tributary, requires written permission from MVCA. As part of the permit application, details will be required to demonstrate the following:

• No loss in channel length;
• Maintenance of hydraulics and base flow/conveyance of similar flows and water volumes as the existing channel.

It is recommended that the Ministry of Natural Resources and the Department of Fisheries and Oceans Canada be contacted to assess any requirements they may have with respect to potential impacts to fish and

Reference: **Mill Valley Estates Draft Plan of Subdivision Submission – First Submission Civil-Related Comments and Response**

fish habitat from the proposed realignment. The inclusion of natural channel habitat characteristics may be required.
Stantec (November 2023): Noted.

Stantec Consulting Ltd.

Ana M. Paerez P. Eng.
Senior Water Resources Engineer
Phone: 506 863 0127
Ana.Paerez@stantec.com

Attachment: Attachment

c. C.C.

Appendix G Drawings