Carleton Place Water & Wastewater Master Plan – Phase 1 Report

Final

April 29, 2022

Prepared for:

Town of Carleton Place

Prepared by:

Stantec Consulting Ltd.

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Executive Summary

Stantec Consulting was retained by the Town of Carleton Place (The Town) to undertake a Municipal Class Environmental Assessment (MCEA, or EA) and prepare a Master Plan for the expansion of the Town's Water Treatment Plant (WTP) and Wastewater Treatment Plant (WWTP) and for the addition of a new water storage reservoir. The Master Planning assignment evaluates the Town's water and wastewater infrastructure needs over 5-year, 10-year and 20-year horizons. The Master Plan also investigates the Town's linear infrastructure through modelling of its sanitary collection system and water distribution system. This report is prepared to document findings of Phase 1 of the EA and identifies the following constraints under existing conditions and system needs under future growth conditions:

Water Treatment Plant

- An expansion to a capacity of approximately 20,700 m^3/d (i.e., 72% increase of current capacity) is needed in the long-term to accommodate population growth over a 20-year planning horizon. This expansion is needed in 2022 to supply maximum day demand without consuming any emergency storage from the facility's clearwells or from the existing water tower.
- The plant's existing low-lift raw water pumps are currently under capacity for the maximum day demand due to operational limitations.
- An expansion of the high-lift pumps' firm capacity to the 20-year maximum day demand of 208.5 L/s (18,000 m^3/d) will be needed by 2037-2038.

Potable Water Distribution System

- Pressures are expected to generally decrease with growth; however, they remain within the pressure objectives.
- Areas north of the Mississippi River are constrained in terms of fire flow, due to constraints in the size of the watermains crossing the river and higher head losses in the watermains, as well as being supplied by dead-end watermains. Under future growth conditions, the existing fire flow deficiencies will persist in the same areas.

Water Storage

- The analysis of the storage capacity using the MECP formula and fire flows shows an existing storage deficit of 373 m^3. For a 20-year planning horizon, an additional storage volume of 4,926 m^3 will be required, to accommodate population growth in the Town.

- Additional storage recommended in previous studies (3,292m^3) can provide sufficient fire flow, maximum day equalization and emergency storage for approximately 11 years, until 2034.
- In comparison, using the FUS fire flow standards (13,000 L/min for 2.75 hours), existing storage would last until 2025. The additional storage recommended in previous studies can supply the required maximum day and fire flow storage needs past the 20-year planning horizon.

<u>Sanitary Collection System</u>

- Sewer capacity constraints were identified along High St and Patterson Crescent in the 20-year planning horizon.
    - The higher extraneous flow rates along High St, however, have not been validated with recent flow monitoring data.
- The degree of surcharge in the sewers cannot be quantified due to the absence of an HGL analysis in the current spreadsheet tool. This tool is intended to be upgraded into a static PCSWMM model in Phase 2 of the EA to complete this analysis.
- Special structures (pumping stations, siphon) cannot be completely assessed using the current spreadsheet tool.
    - Peak inflows to the Mississippi Quays Pumping Station (PS) are projected to exceed the PS's rated capacity of 52.2 L/s (with the largest pump out of service) in the design event (53.0 L/s), which signals a need to consider increasing capacity within the short-term planning horizon. However, this flow can be conveyed when the second pump is also in operation, the PS's ultimate capacity being 104.4 L/s.

<u>Wastewater Treatment Plant</u>

- The wastewater treatment plant will require an expansion of its rated capacity of 2,725 m^3/d (i.e., a 35% increase in capacity) to meet 20-year design average daily flows of 10,625 m^3/d. This expansion would be needed in 2024-2025.
    - Applying the same 35% increase in rated capacity to the wet weather flow capacity and the peak flow capacity results in capacities of 14,040 m^3/d and 29,700 m^3/d, respectively.
- Current effluent concentration and loading limits and objectives under the existing CofA were reviewed.
- Design loads to the plant were determined and will be used in future design stages to size plant processes.

1 Introduction

1.1 Background

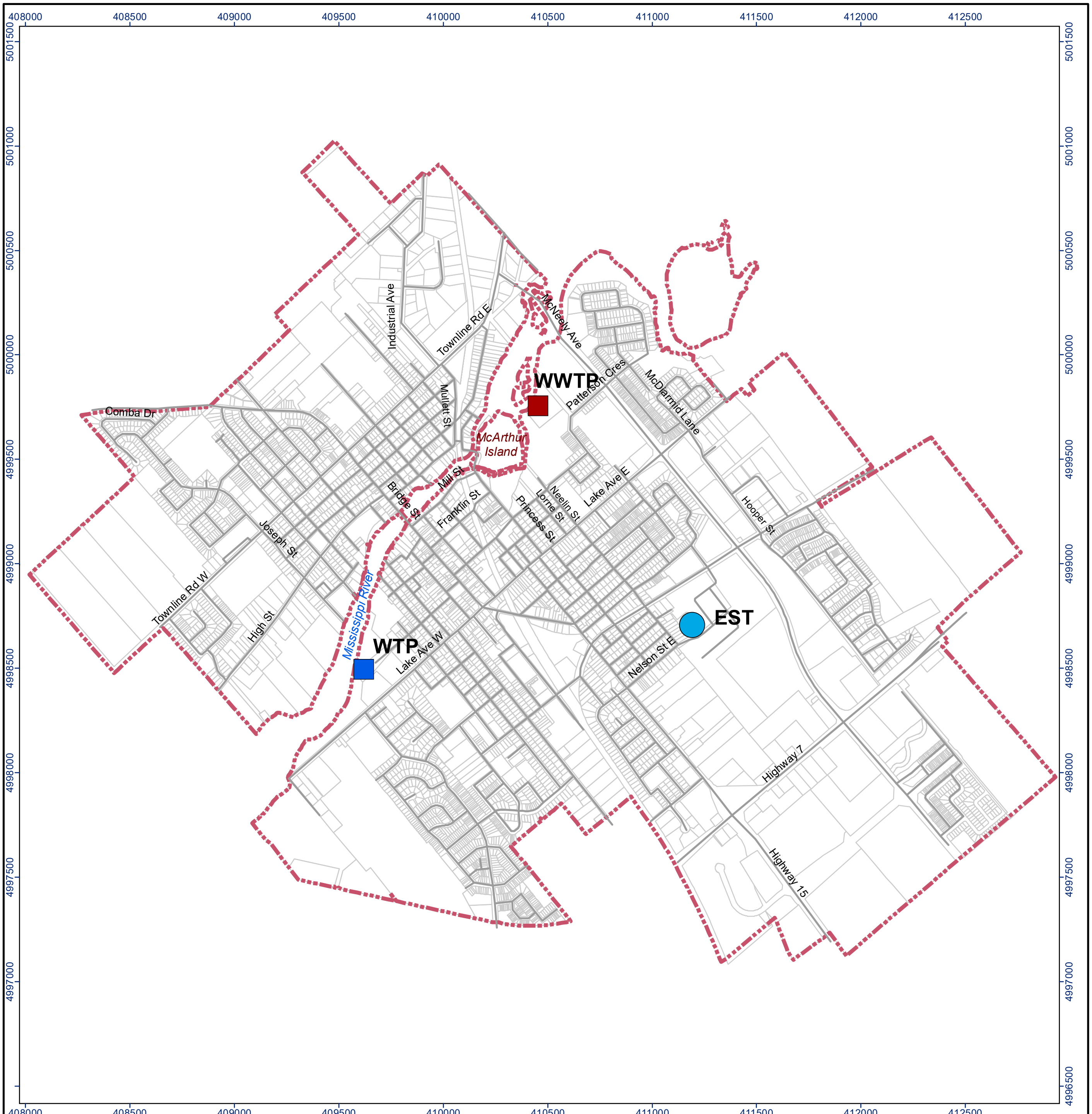
Stantec Consulting was retained by the Town of Carleton Place (The Town) to undertake a Municipal Class Environmental Assessment (MCEA) and prepare a Master Plan for the expansion of the Town's Water Treatment Plant (WTP) and Wastewater Treatment Plant (WWTP) and for the addition of a new water storage reservoir. The Master Planning assignment will evaluate the Town's water and wastewater infrastructure needs over 5-year, 10-year and 20-year horizons. In addition to the treatment facility expansions and the water reservoir, the assessment will investigate current and future needs of the potable water distribution and wastewater collection systems.

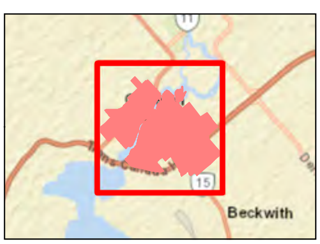
The purpose of this report is to identify constraints under existing conditions and system needs under future growth conditions. The assessment is based on the criteria established in the **Design Basis Memo**, provided in **Appendix A**. Alternative solutions to the constraints identified in this report will be investigated in future reports.

1.2 Study Area

The Town of Carleton Place is situated in Lanark County, west of the City of Ottawa, accessible via Highways 7 and 15. Based on the Census of 2016, the Town had a population of 10,644 inhabitants and occupied an area of 9.049 km^2. The Town has experienced fast population growth and recent population estimates in different studies have ranged from 12,500 to 13,500 persons for 2020.

The Mississippi River runs through the center of the Town and serves as the source of water for the municipal drinking water system and as the receiving stream for treated sewage effluent. The Mississippi River is also used for recreational purposes around the Town. The Town limits and major water & wastewater infrastructure are shown in **Figure 1.1**.





Legend

- Elevated Storage Tank (EST)
- Wastewater Treatment Plant (WWTP)
- Water Treatment Plant (WTP)
- Town Limits

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Carleton PLACE

Project Location

Carleton Place, ON

Client/Project Carleton Place W&WW Master Plan

Town of Carleton Place
Carleton Place W&WW Master Plan
Phase 1 Report

Figure No.

1-1

Title

Town of Carleton Place Limits & Major Water/Wastewater

Notes

1. Coordinate System: NAD 1983 UTM Zone 18N
2. Data Sources: *parcelfabric.shp* and *Road_CL.shp* provided by the Town of Carleton Place *DP_landuse.shp* provided by J.L. Richards
3. Background: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap

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1.3 Background Studies

Stantec reviewed relevant studies, assessments and reports completed in recent years that provide background information on the Town's water and wastewater systems, and on the Town's population growth.

A review of these documents demonstrates that the Town's projected population growth rate continues to increase. The Town's 2011 Master Plans were based on a growth rate of 63 households per year (*Water Treatment Plant Capacity Expansion Master Plan*, Stantec Consulting Ltd. 2011; *Water Pollution Control Plant Capacity Expansion Master Plan*, Stantec Consulting Ltd. 2011). By 2018, that number increased to 150 households per year, as per the Addendums to the Master Plans by J.L. Richards (*Addendum to the August 2011 Water Treatment Plant Capacity Expansion Master Plan*, J.L. Richards. 2018; *Addendum to the August 2011 Water Pollution Control Treatment Plant Capacity Expansion Master Plan* J.L. Richards, 2018). Most recently, the 2020 Development Charges Background Study has further increased that growth projection to 268 households per year (*Development Charges By-law and Background Study,* Watson & Associates, December 2020).

This unprecedented population growth along with increased water demands, increased wastewater generation rates, and the expanding growth areas all underpin the need for infrastructure expansion. The 2018 Addendums to the Master Plans updated the capital costing and projected timing of the future plant expansions. In those reports, it was determined that the Water Treatment Plant (WTP) and Wastewater Treatment Plant (WWTP) should be upgraded in 2028 and 2027, respectively, to service the population. As well, a need for additional distribution system storage was identified and further investigated in a 2018 Water Storage Study (*Potable Water Storage Study,* J.L. Richards, November 2018).

1.4 Class Environmental Assessment Process & Master Planning

The Municipal Class Environment Assessment (EA) process is a process available to municipalities, under which infrastructure projects are evaluated in their planning and implementation, to ensure compliance with the Environmental Assessment Act (EAA). Under the Class EA process, municipal projects are classified in terms of schedules, based on their environmental impact. The Class EA process is composed of the following five phases:

- Phase 1: Identification of problem or opportunity
- Phase 2: Identification of alternative solutions
- Phase 3: Definition of alternative methods to implement the preferred solution
- Phase 4: Publication of an Environmental Study Report

- Phase 5: Implementation of the solution

Consultation is a key element of EA planning, and is required during different phases to ensure public participation. **Figure 1.2** summarizes the different schedules and phases of the Class EA process.

By incorporating the principles of the Class EA, Master Plans can support the requirements of EAs. The Town of Carleton Place will look to satisfy the EA requirements (Schedule B) for a new water reservoir and publish Environmental Study Reports to satisfy the EA requirements (Schedule C) for the water and wastewater treatment plant expansions.

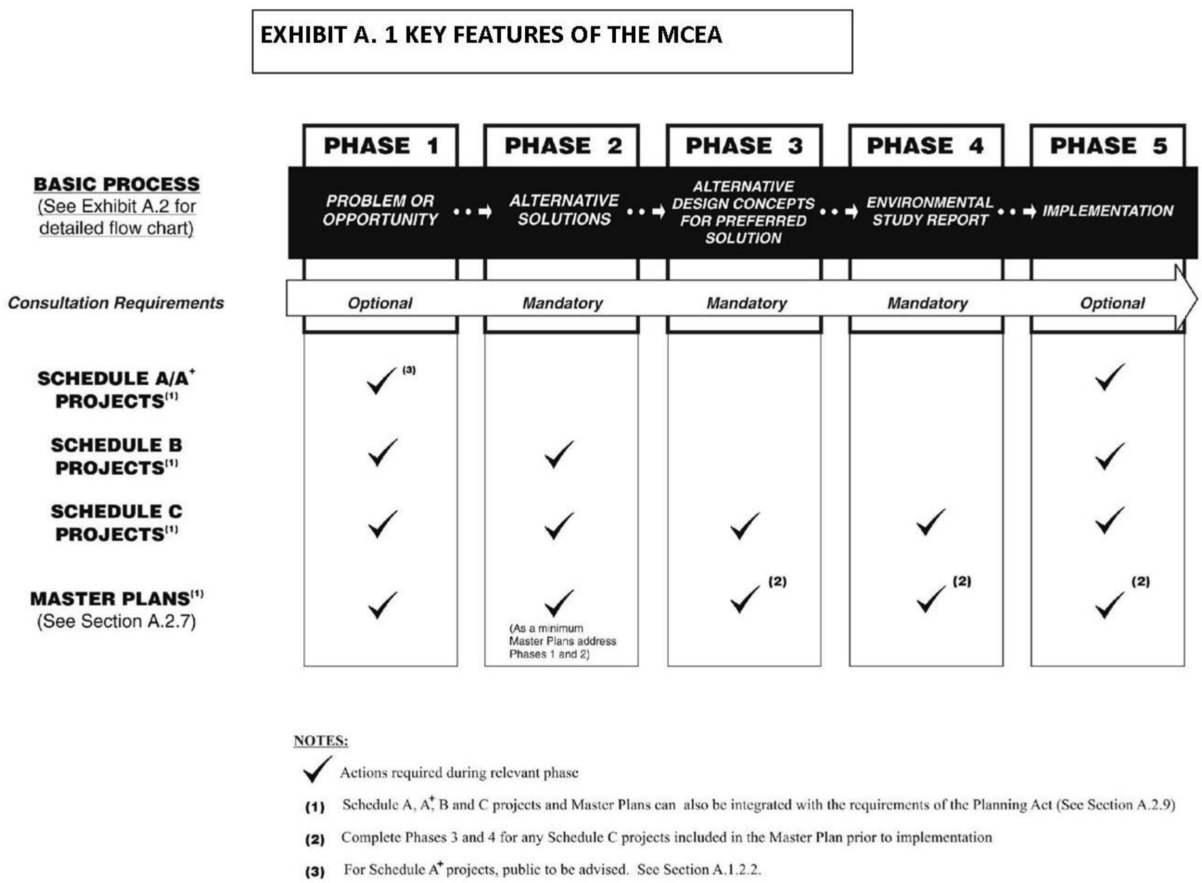

Figure 1.2: Summary of the Municipal Class EA Process (Source: Municipal Engineers Association, 2021)

2 Growth Projections

Growth projections over multiple planning horizons were developed as the basis of the Master Plan. This study addresses the following horizons:

- Baseline year 2021;
- Short term, or 5-year planning horizon, in the year 2026;
- Medium term, or 10-year planning horizon, in the year 2031; and,
- Long term, or 20-year planning horizon, in the year 2041.

The **Design Basis Memo** provides detailed information on how population and area growth projections were developed for this Master Plan. Additionally, for the purpose of estimating I/I flows, the historical area growth rate described in the **Design Basis Memo** of 13 ha/year was used.

The resulting growth projections for the Town of Carleton Place are presented in **Table 2.1**. The detailed geospatial distribution and phasing of development are proposed in the **Design Basis Memo**, and an overview of the growth areas is shown in **Figure 2.1**.

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Table 2.1: Town of Carleton Place Growth Projections (2021-2041)

	Baseline (2021) (1)	2026	2031	2041
Additional Number of Units (2)	-	1,563	2,912	4,958
Total Number of Units	5,623	7,186	8,535	10,581
Population Density (persons per unit, PPU) (3)	2.448	2.448	2.313	2.262
Additional ICI Area (ha) (4)	-	7.2	13.7	22.4
Total ICI Area (ha)	35.0	42.2	48.7	57.4
Additional Total Land Area (5)	-	62.6	124.5	244.2
Total Land Area (ha) (6)	591.0	650.0	700.0	850.0
Additional Population (7)	-	3,500	7,000	11,500
Total Population (8)	13,500	17,000	20,500	25,000

Notes:

(1) 2021 Baseline population and number of units based on *Development Charges By-law and Background Study* (Watson & Associates Economists Ltd, December 2020; 2020 DC Study) population and number of units for 2020, increased using 315 additional housing units, 34 additional institutional units (see Note 2), and 2020 population density of 2.448 PPU. 2021 Baseline ICI area based on review of GIS data.

(2) Housing and institutional units combined. Additional number of housing units based on 2020 DC Study Figure 3-2. Ratio of institutional units / housing units = 245 / 4,330 = 5.7%, based on 2020 DC Study projections for 2038.

(3) Population density as specified in 2020 DC Study. Applicable to year specified, and all following years until next time horizon.

(4) ICI area development rate assumed similar to residential area development rate, see **Design Basis Memo - Appendix B – Table B-1**.

(5) Additional population obtained by subtracting baseline (2021) population from total population; may not correspond to product of additional number of units and population density due to rounding.

(6) Additional total area based on a historical growth rate of 13 ha/year.

(7) Total land area rounded to nearest 50 ha.

(8) Total population rounded to nearest 500.

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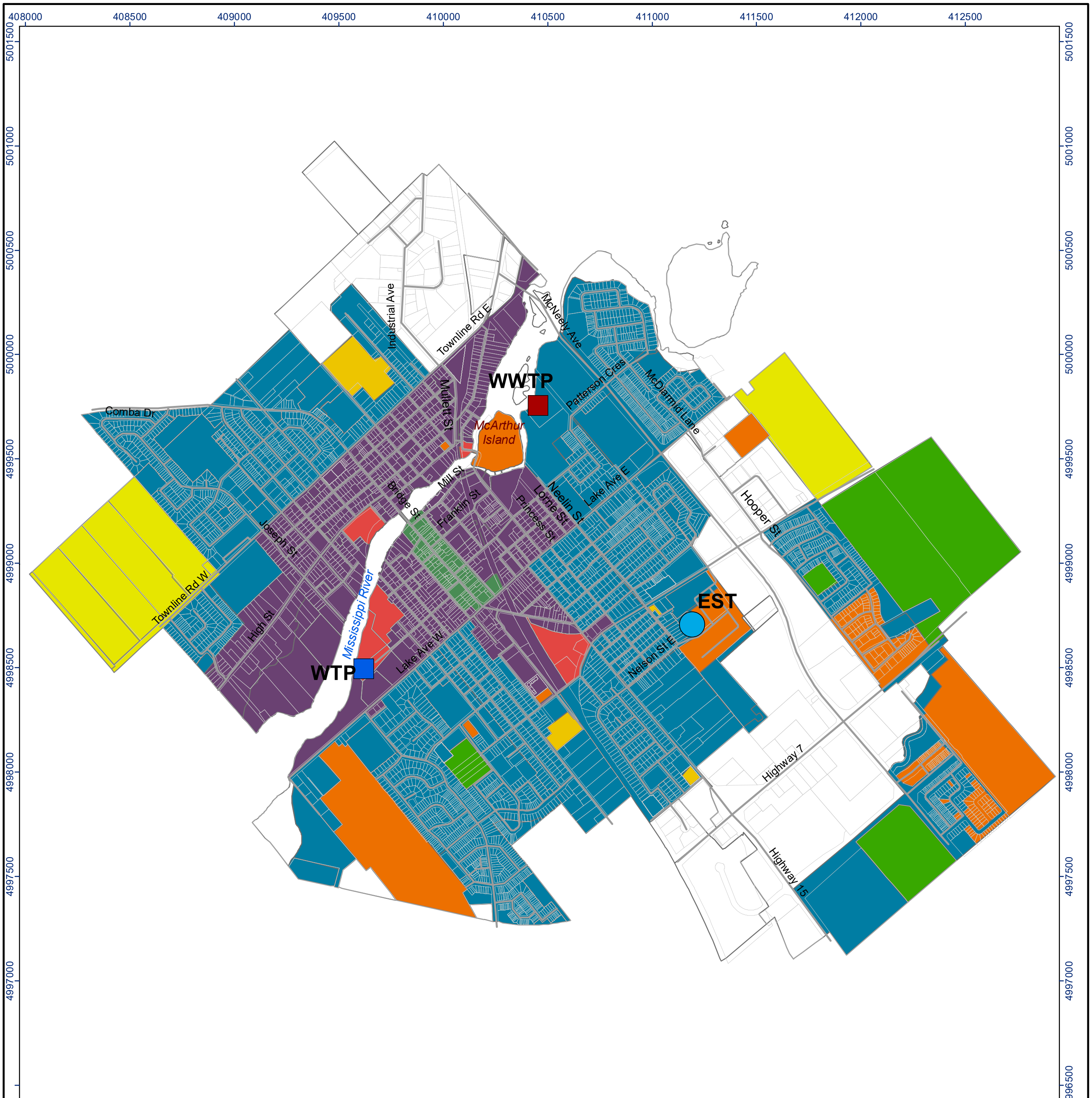

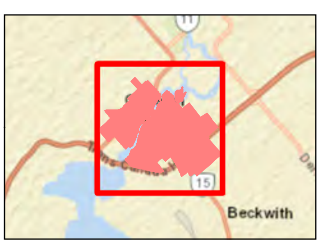

Legend

- Elevated Storage Tank (EST)
- Wastewater Treatment Plant (WWTP)
- Water Treatment Plant (WTP)

Projected Development Areas

- No Projected Development as per Comprehensive Review
- Active Development Applications
- Strategic Properties
- Downtown District
- Intensification Sites
- Mississippi Residential Sector
- Residential District
- Urban Greenfield
- Rural Greenfield

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Notes

1. Coordinate System: NAD 1983 UTM Zone 18N
2. Data Sources: *parcelfabric.shp* and *Road_CL.shp* provided by the Town of Carleton Place, *DP_landuse.shp* provided by J.L. Richards.
3. Projected development areas as defined in J.L. Richards *Council Report for Comprehensive Review* (J.L. Richards, 2021)
34. Background: Sources: Esri, HERE, Garmin,

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Carleton PLACE

Project Location
Carleton Place, ON

Client/Project Carleton Place W&WW Master Plan
Town of Carleton Place
Carleton Place W&WW Master Plan
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2-1

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Future Growth Areas

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3 Preliminary Needs Assessment

3.1 Potable Water System

3.1.1 Potable Water Demands

The potable water demands were based on the demands provided in the latest update of the Town's model (*Town of Carleton Place 2021 WaterCAD Model Update*, J.L. Richards, March 2021). Since the latest update of the model reflects the demands in 2020 (based on WTP records for 2017-2020), the demands were increased to reflect 2021 conditions. The 2021 demands were calculated based on the 2021 population of 13,244 inhabitants and the ICI area of 35 ha. This was used as the baseline for the growth forecasts presented in the **Design Basis Memo**, and the design parameters presented therein. The difference between the total 2021 demand and the total 2020 demand in the model was then distributed to the junctions in the model. The spatial distribution of this growth was based on the *Town of Carleton Place 2021 WaterCAD Model Update* (J.L. Richards, March 2021), which shows areas where recent developments (watermain construction) have occurred. The *Town of Carleton Place 2021 WaterCAD Model Update* (J.L. Richards, March 2021) suggests that the majority of developments have occurred in the Highway District, and the remaining developments are located downtown and in the northern quadrant of Town, north west of Bridge St. **Table 3.1** summarizes the spatial allocation of developments from 2020 to 2021 for the water distribution analysis. The junction allocation is shown in **Appendix B - Figure B-1**.

Table 3.1: Spatial Allocation of Developments from 2020 to 2021 for Potable Water Demand Analysis

Area	Approximated Percentage of Developments in Area	Total Additional (1) Average Day Demand	Total Additional (1) Maximum Day Demand	Total Additional (1) Peak Hour Demand
Highway District	75%	+5.62 L/s (+485 m^3/d)	+0.31 L/s (+26.6 m^3/d)	+4.77 L/s (+412 m^3/d)
Downtown Area	12.5%	+0.94 L/s (+81 m^3/d)	+0.05 L/s (+4.4 m^3/d)	+0.80 L/s (+69 m^3/d)
North of Mississippi River	12.5%	+0.94 L/s (+81 m^3/d)	+0.05 L/s (+4.4 m^3/d)	+0.80 L/s (+69 m^3/d)
Total Growth from 2020 to 2021	***100%***	***+7.49 L/s (+647 m^3/d)***	***+0.41 L/s (+35.5 m^3/d)***	***+6.36 L/s (+550 m^3/d)***

Notes:

Difference between current (2021) and previous (2020) demands in hydraulic model from *Town of Carleton Place 2021 WaterCAD Model Update* (J.L. Richards, March 2021).

The design parameters and level of service requirements presented in the **Design Basis Memo** were used to project water demands in the future planning horizons, and to assess the potable water distribution system's performance under population growth scenarios. Based on the growth projections presented in **Section 1.4** and these design criteria, the water demand in the different development areas for the future planning horizons were calculated. **Table 3.2** summarizes the total demand modelled for each scenario and planning horizon. For future developments, the resulting total water demands per development area are presented in **Appendix B** - **Table B-1** (2026), **Table B-2** (2031) and **Table B-3** (2041). The total demands were then allocated to the model junctions and added to the 2021 demands at these junctions.

Table 3.2: Existing Conditions (2021) and Future Total Potable Water Demands

Scenario	Average Day Demand	Maximum Day Demand	Peak Hour Demand
2021	66.4 L/s (5,700 m^3/d)	113.0 L/s (9,800 m^3/d)	175.3 L/s (15,100 m^3/d)
2026	83.9 L/s (7,200 m^3/d)	143.0 L/s (12,400 m^3/d)	221.4 L/s (19,100 m^3/d)
2031	99.1 L/s (8,600 m^3/d)	169.0 L/s (14,600 m^3/d)	261.6 L/s (22,600 m^3/d)
2041	122.1 L/s (10,600 m^3/d)	208.5 L/s (18,000 m^3/d)	322.2 L/s (27,800 m^3/d)

3.1.2 Water Treatment Plant

3.1.2.1 Existing Conditions

The existing WTP operates under the following permits and approvals (included in Appendices):

- *Certificate of Approval (*CofA*)* No. 1150-69XLVM (April 1, 2005)
- Permit to Take Water No. 1310-9UHPPW (March 13, 2015)
- Drinking Water Works Permit (DWWP) No. 172-201 (February 26, 2021)
- Municipal Drinking Water Licence (MDWL) No. 172-101 (February 26, 2021)

As per these approvals, the WTP has a rated raw water intake capacity of 12,000 m^3/d, including drinking water demand and process wastewater usage. It is understood that the low lift raw water pumps are rated at a capacity of 11,400 m^3/d, however the actual maximum pumping capacity is only approximately 10,000 m^3/d due to operational limitations on the pumps. After process water usage, this correlates to a new drinking water production capacity of approximately 8,500 m^3/d or less. Furthermore, in *Addendum to the August 2011 Water Treatment Plant Capacity Expansion Master Plan* (J.L. Richards. 2018), J.L. Richards observed that the overall treatment capacity is limited by the filtration system to a maximum average daily flow of 11,222 m^3/d (for both drinking water and process wastewater). Currently, an operational benchmark of 7,700 m^3/d has been monitored by Ontario Clean Water Agency (OCWA) to potentially trigger water use by-law actions.

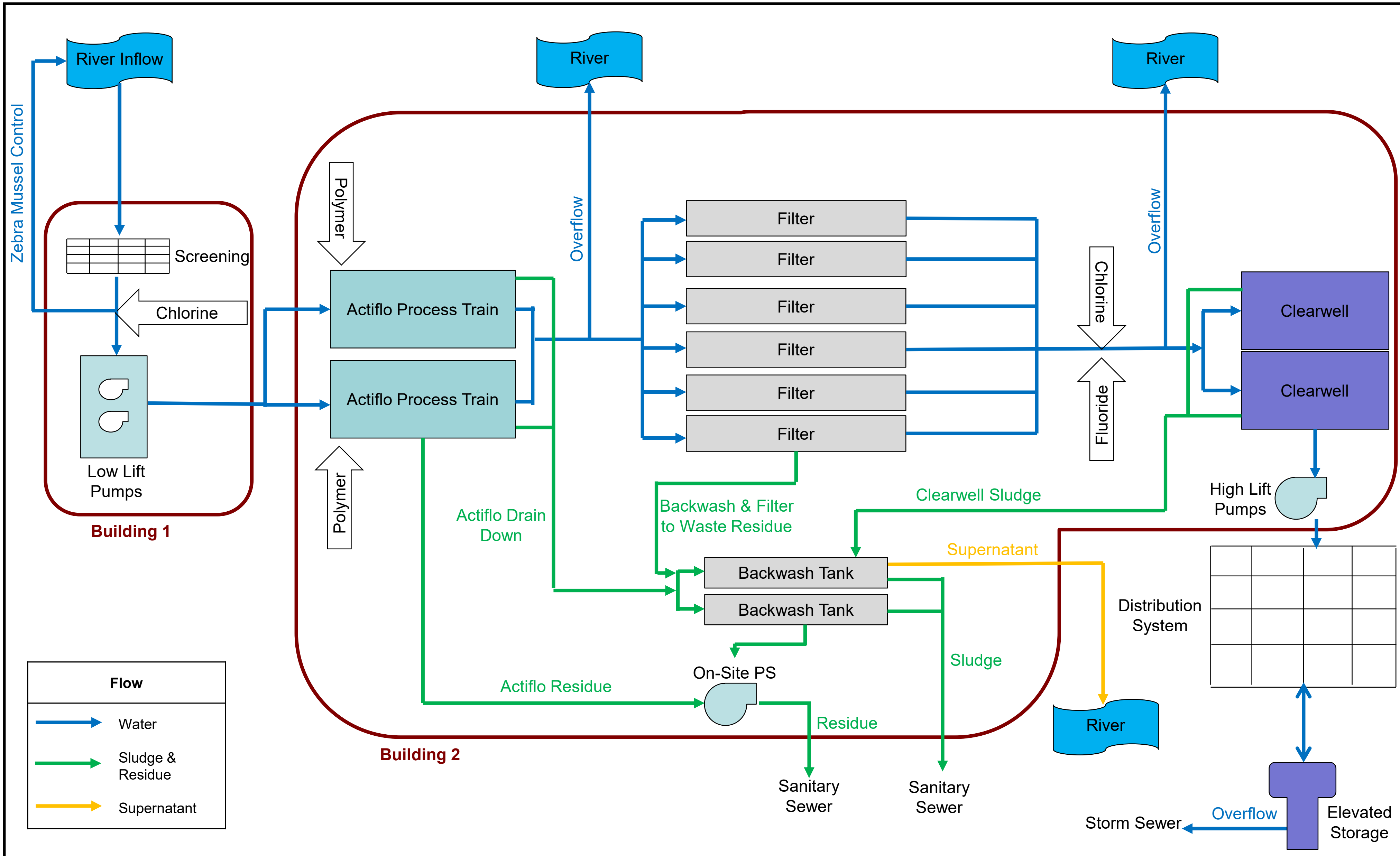
The plant consists of two buildings. The original building, constructed in 1911, has been modified several times and is dedicated to raw water intake, screening, pumping and coagulant storage and injection. It also houses the water-cooled standby diesel generator and a portion of the motor control center. Most of the treatment equipment (ACTIFLO™ clarifiers, filters, chemical feed systems, clearwell, and high lift pumps) is located in a second plant building located adjacent to the first.

The current raw water intake is a 600 mm diameter pipe drawing from the Mississippi River with a coarse screen and a chlorination system for zebra mussel control. The raw water is drawn by four low-lift pumps through an intake well with two coarse mesh screens and a manually-cleaned screening basket in the raw water channel. The vertical turbine pumps discharge into a common 400 mm header pipe with a 1.07 m long in-line static mixer. There is a mag meter on each individual pump discharge, as the one on the common pipe upstream of the clarifiers is reportedly not working properly.

The water is then pumped into two parallel ACTIFLO™ treatment trains including coagulation tank, injection tank, maturation tank and settling tank. Two recirculation pumps (plus one standby) and two hydrocylones are used to separate and recirculate the microsand, a specific component of this process. The water then flows into three cylindrical dual media (sand/anthracite) gravity filters with a common air scour blower for filter backwash operation. Filter backwash water and ACTIFLO™ residuals flow into a settling tank and are pumped into the sanitary sewer system. Although in theory, supernatant could be pumped into the Mississippi River, all process wastewater is discharged to the municipal gravity sewer.

Disinfection is provided through chlorine contact time in two underground clearwell reservoirs, followed by the high lift pump wells. Four vertical turbine high lift pumps force the treated water into the Town's potable water distribution system. These processes are illustrated in **Figure 3.1**.

The Town also completed an assessment of its disinfection process in 2021 to address concerns raised by the MECP during a recent inspection. A memo prepared by JLR reviewed the various operating scenarios for each clearwell and found that clearwell #2 may not meet disinfection requirements under maximum day flow demand at the low level alarm for free chloring residual. The recommendations were to raise the minimum chlorine residual alarm from 0.66mg/L to 1.00mg/L, install free chlorine analyzers at the end of each clearwell, and to modify high light pump configurations as part of the Master Plan. This report is included herein as **Appendix I**.



Stantec	Town of Carleton Place 2021 Water & Wastewater Master Plan	Town of Carleton Place Water Treatment Plant Process Flow Diagram (Adapted from Operational Plans for the Carleton Place Drinking Water System, August 28, 2018)	Date: September 2021	Figure: 3-1

3.1.2.2 Raw Water Intake Projections

Figure 3.2 shows the population and water intake (average and maximum day) projections and calculations are summarized in **Table 3.3.** The existing (2021) maximum day water intake needs of 11,300 m^3/d are near, but within, the WTP's rated capacity of 12,000 m^3/d when maximum day process water is factored into the equation. This is also within the low-lift pumps' rated capacity of 11,400 m^3/d, however, as described previously, these pumps' actual maximum operational capacity is 10,000 m^3/d, in which case the results suggest a deficit of approximately 1,300 m^3/d. OCWA has anecdotally reported that the WTP has at times operated near capacity over multiple days or weeks. As it is expected that the WTP expansion will include upgrades to the low-lift pumps, this study will assume this bottleneck is resolved with expansion and focus on the required WTP expansion to its rated capacity of 12,000 m^3/d.

It should be noted that this assessment is based on a maximum day factor of 1.75, based on the Town's observations and recent historical data provided by OCWA (with maximum rates up to 1.98 in 2018). This does not reflect water conservation measures which may be in place and assumes that process water usage coincides with maximum day demand. The average day water intake needs remain within the WTP's rated capacity until 2040, near the 20-year planning horizon.

Table 3.3: Raw Water Intake

	Average Day Demand (m^3/d) (1)	% Process Water (2)(4)	Average Day Process Water (m^3/d)	Total Average Day Water Intake (Rounded) (m^3/d)	Maximum Day Demand (m^3/d) (1)(3)	Maximum Day Process Water (m^3/d)	Total Maximum Day Water Intake (Rounded) (m^3/d)
2021	5,700	15%	855	6,600	9,800	1,470	11,300
2026	7,200		1,080	8,300	12,400	1,860	14,300
2031	8,600		1,290	9,900	14,600	2,190	16,800
2041	10,600		1,590	12,200	18,000	2,700	20,700

Notes:

(1) Average and maximum day demand as calculated in **Section 3.1.1**
(2) Process water ratio of 15% assumed based on analysis of data provided by OCWA.
(3) Based on maximum day factor of 1.75. This does not reflect conservation from lawn watering bylaw recently put in place.
(4) Assumes coincidental process water usage during maximum day demand.

Based on the population and ICI area projections, the maximum day demand in a 20-year planning horizon is 18,000 m^3/d. Assuming a process water ratio of 15%, which has been observed through testing by OCWA, the total raw water intake would be 20,700 m^3/d. This would therefore require a 73% increase in the WTP's current capacity, and all process equipment will need to be sized to meet the maximum day demand.

The total average day demand in a 20-year planning horizon is projected to reach 10,600 m^3/d in 2041; accounting for process water, total raw water intake in the 20-year planning horizon would be 12,200 m^3/d. This increase in average day raw water intake needs will need to be considered in sizing the chemical storage tanks.

The current projected maximum day raw water intake of 20,700 m^3/d in the 20-year planning horizon will also need to be evaluated in terms of the Mississippi River's capacity to supply these intake needs. River low flows in recent history have decreased to 1.6 m^3/s (*Resiliency Plan – Water Treatment Plant*, J.L. Richards, 2018), which are above the projected maximum day raw water intake (0.28 m^3/s).

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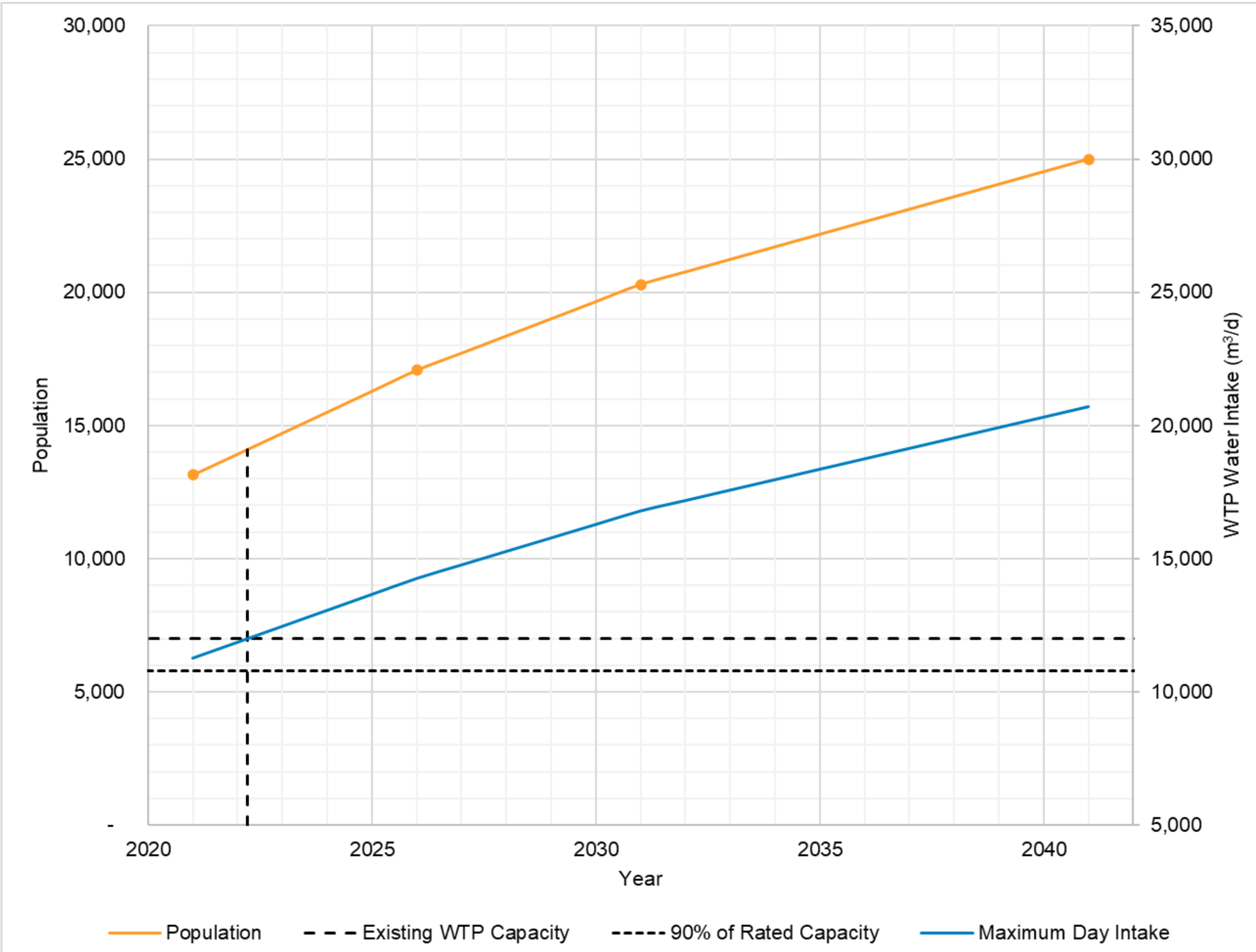

Figure 3.2: WTP Capacity

Table 3.4: Projected 20-Year WTP Capacity

Year	Demand Type	Population	Area	Flow Rate		Average Day Demand	Maximum Day Peaking Factor	Maximum Day Demand
		(ppl)	(ha)	(L/cap/d)	(L/ha/d)	(m^3/d)	(-)	(m^3/d)
2041	Residential	25,000		350		8,750	1.75	15,313
	Light Industrial		29		35,000	1,015	1.5	1,523
	Institutional/ Commercial		29		28,000	812	1.5	1,218
Total Demand (Rounded) (m^3/d)						***10,600***		***18,000***
Process Water Ratio[1] (%)						15%		15%
Process Water Required (m^3/d)						1,590		2,700
Total Raw Water Intake (Rounded) (m^3/d)						***12,200***		***20,700***

Notes:
1) Process water ratio of 15% assumed based on analysis of historical data provided by OCWA.

3.1.2.2.1 Comparison of Future Flow Projections

Comparisons between these future flow projections and those in past Master Planning reports for the Town are summarized in **Table 3.5**. This section compares some of the design values used in these studies and the predicted years that the system demand would reach the existing plant's capacity and 90% of capacity. Each study used a different planning horizon for expansion.

The *Addendum to the August 2011 Water Treatment Plant Capacity Expansion Master Plan* (J.L. Richards, 2018) estimated 90% capacity would be reached during 2025 and the total capacity would be reached 2029 (comparatively, the current study evaluates the plant to be currently under capacity). Although the 2018 study observed several more years of remaining capacity for the plant, the Town's population growth rate has increased in recent years. Also, the 2018 study assumed a lower per capita maximum day demand consumption rate of 1.84 m^3/unit (or 736 L/c/d assuming 2.5 persons per unit) for future projections, which is lower than maximum historical rates and projected rates. This is compared with the current study which identified up to 803 L/c/d for historical consumption and assumed 705 L/c/d for new residential developments (inclusive of process water).

For further comparison, the *Water Treatment Plant Capacity Expansion Master Plan* (Stantec Consulting Ltd., 2011) estimated that 90% of the current capacity would be reached in 2032 with a population of 13,200 and the total rated capacity reached in 2042 at a population of 14,667. These differences illustrate that the growth projections in the 2011 Master Plan were less aggressive than current estimates. Furthermore, the 2011

Master Plan was based on a consumption rate of 767 L/c/d, which is also lower than historical and projected rates in this study. Furthermore, the 2011 Master Plan was based on maximum day peaking factor of 1.65, which is lower than the peaking factors presented in subsequent studies. The peaking factor used in the current study (1.75) is closer to the values observed in the past 4 years.

Table 3.5: Comparison of WTP Expansion Studies

	2021 W&WW Master Plan	2011 Master Plan	2018 Addendum
Existing Plant Rated Capacity (m^3/d)	12,000		
Existing Plant Capacity (m^3/d) (1)	12,000 rated 10,000 actual(13)	11,250 (2)	11,222 (3)
Year Reached	2022	2042	2029 (4)
Population at Capacity	14,104	14,667	- (5)
90% of Plant Capacity (m^3/d)	10,800 rated 9,000 actual(13)	10,125	10,100
Year Reached	passed	2032	2025
Population at 90% of Rated Capacity	exceeded	13,200	- (5)
Average Day Water Consumption Rate (L/c/d)	Residential: 350 ICI: 51-60 (6)	465	410
Maximum Day Demand Peaking Factor	Residential: 1.75 (7) ICI: 1.5	1.65	1.80 (8)
Maximum Day Demand for Existing Developments (L/c/d)	Residential: 705 ICI: 60-70 (6)	767 (9)	736 (5,10)
Maximum Day Demand for Future Developments (L/c/d)	Residential: 705 (11) ICI: 60-70 (12)	767 (8)	736 (5,10)

Notes:

(1) Existing WTP capacity assessed differs between studies.
(2) Expected capacity in in *Water Treatment Plant Capacity Expansion Master Plan* (Stantec Consulting Ltd., 2011) following implementation of WTP upgrades.
(3) Rated capacity of 12,000 m^3/d, but actual capacity evaluated based on filtering capacity.
(4) 2018 Addendum also shows that the rated capacity of 12,000 m3/d would be reached in 2032.
(5) Addendum to the August 2011 Water Treatment Plant Capacity Expansion Master Plan (J.L. Richards, 2018) water demand projections based on number of units, no population specified.
(6) ICI rates as equivalent per capita rates.
(7) Maximum day peaking factor of 1.75.
(8) Maximum day rate of 1.84 m3/unit divided by average day rate of 1.024 m3/d.
(9) Inclusion of process water not specified in Water Treatment Plant Capacity Expansion Master Plan (Stantec Consulting Ltd., 2011).
(10) Treated water per unit rate of 1.84 m3/unit converted to L/c/d using a population density of 2.5 PPU.
(11) Maximum day water intake needs, including process water (15% increase).
(12) ICI rates as equivalent per capita rates, including process water (15% increase).
(13) OCWA advised that current low lift pump restrictions limit the treatment flow to 10,000m^3/d raw water

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3.1.2.2.2 Raw Water Quality

Raw water quality from the Mississippi River and water treatment design criteria are outlined in the **Design Basis Memo**.

3.1.2.3 Other Challenges and Constraints

The following section briefly describes various constraints, challenges and existing issues with the plant based on discussion with OCWA operators and site observation. Some of these will be included in considerations for the conceptual design and evaluation of alternatives, while others will be more appropriately addressed during future design stages.

- The raw water intake structure at river bottom is affected by intense boat traffic in summer, particularly when river water level is the lowest. Water velocity within the raw water intake pipe should also be kept low enough to minimize head loss. Design concepts for the plant expansion should include considerations for twinning or enlarging the existing intake pipe.
- The raw water screen needs to be cleaned manually once a day under extreme conditions in summer (lower river water, higher boat traffic resulting into higher turbulence, higher raw water instantaneous flow rate). Automated screening options could be evaluated during future design stages.
- The raw water building cannot hold more than the current four coagulant solution storage tanks. Storage reserve (in terms of days and receiving capacity at time of delivery) should be revisited.
- The water-cooled standby diesel generator would likely not support future power demand once plant would have been upgraded and should be replaced by a larger unit.
- The current ACTIFLO™ room cannot be extended unless the coagulant sludge pumping basin is relocated. A second separated ACTIFLO™ room could be considered. Sealant coating in the current room concrete basin walls peels off and presents an issue at the clarifier and filter.
- Some operational and health and safety concerns were raised regarding the current chemical feed room, which houses the polymer mixing tank, fluoridation feed system / chemical storage, and ACTISAND™ micro sand storage.
- Clarifier sludge and filter backwash volumes and solids loading should be assessed in relation to impact loading at the wastewater treatment plant and use of the residuals forcemain.

- Current clearwell and high lift pumping basin configuration does not provide optimized contact time for chlorine disinfection process and does not allow isolation of the higher capacity high lift pump and associated clearwell portion for maintenance.
- Configuration of pumps in the clearwells make it difficult to take one out of service for maintenance. The two larger pumps are both on the same clearwell.

3.1.2.3.1 High Lift Pumps

The Carleton Place WTP is equipped with four (4) high lift pumps, comprising one jockey pump, two duty (lead) pumps and one standby (lead) pump. The firm capacity (i.e., with largest pump out) of the high lift pumps at the WTP is 194.7 L/s (16,800 m^3/d). This suffices to supply existing total maximum day demand, as determined by JLR (2021) for the existing conditions model (126.4 L/s; 10,925 m^3/d).
Table 3.6 provides a summary of the high lift pumps at the WTP.

Table 3.6: High Lift Pump Capacities at the WTP

	Rated Flow (m^3/d)	Rated Flow (L/s)	Rated Head (m)
Pump 1 (Jockey Pump)	3,200	36.8	52.5
Pump 2 (Lead Pump)	5,000	57.9	51.2
Pump 3 (Lead Pump)	8,600	100.0	52.5
Pump 4 (Standby Pump)	11,800	136.8	56.0
Total:	28,600	331.5	
Firm (1 pump out)	16,800	194.7	

The system's future pumping capacity requirements were assessed based on projected total maximum day demand, as presented for existing conditions in **Section 3.1.1**. As illustrated in **Figure 3.3**, based on the population projections presented and the equivalent calculated maximum day demand, the high lift pumps are anticipated to reach their firm capacity at a population of 23,236, approximately in 2037-2038. The current firm capacity of the high lift pumps at the WTP (195 L/s; 16,850 m^3/d) will therefore suffice to supply total maximum day demand over a 15-year horizon, past which, an expansion will be required to accommodate future growth. The maximum day demand over a 20-year horizon is expected to reach 208.5 L/s (18,000 m^3/d), which should be considered in the expansion of the high lift pumps' firm capacity.

Detailed calculations are provided in **Appendix C - Table C-1**.

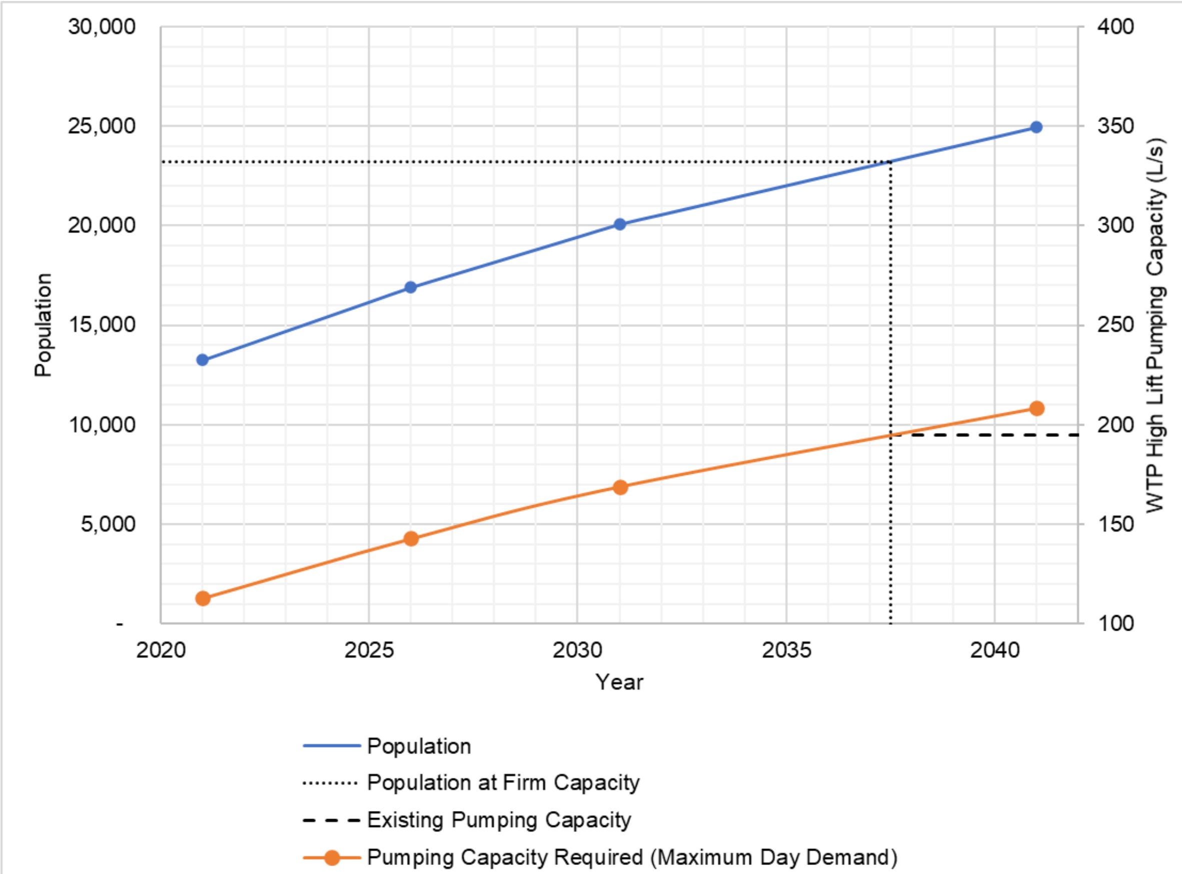


Figure 3.3: Future WTP Pumping Capacity Requirements

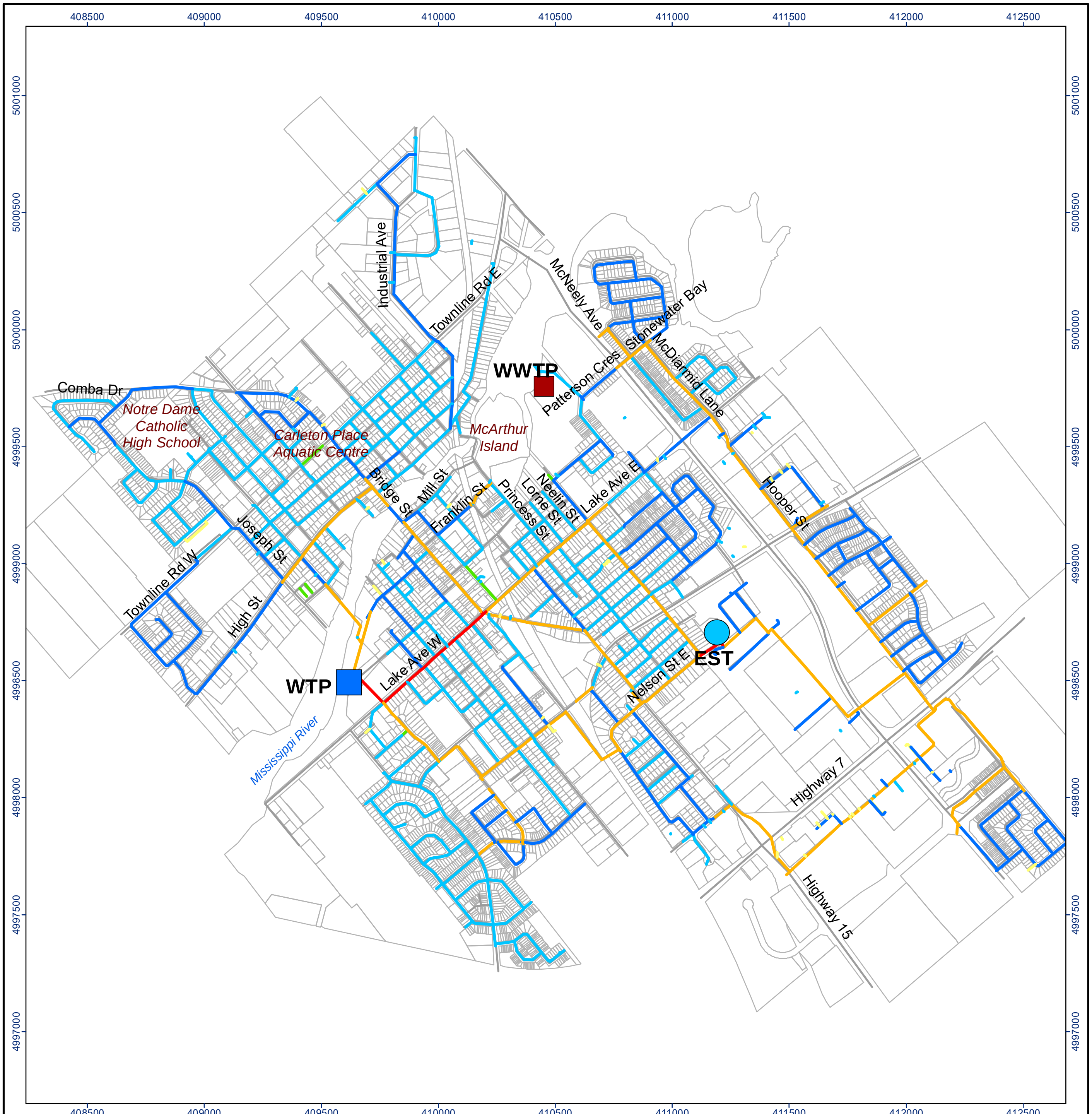
3.1.3 Water Distribution System

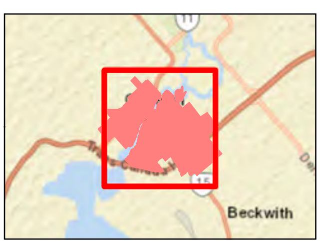
3.1.3.1 Existing Pipe Network

Based on the Town's Geographic Information System (GIS) database and WaterCAD hydraulic model, the Carleton Place Water Distribution System (WDS) is currently comprised of approximately ~76 km of watermain with diameters ranging from 150 to 500 mm. The network, as summarized in **Table 3.7** and shown in **Figure 3.4**, predominantly consists of 150 mm and 200 mm diameter pipes (44% and 29% of total network watermain length, respectively) spread out throughout the network. The larger diameter transmission mains (i.e., > 400 mm) are located along Lake Ave and Nelson St E and transmit flow to/from the water treatment plant (WTP) and elevated storage tank. The network crosses the Mississippi River to service the northern parts of the Town at two locations, along Bridge St (250 mm diameter) and from the WTP to Flora St (285 mm diameter). Watermain age throughout the network ranges up to 105 years, with an average age of ~25 years and consisting of pipe materials such as cast iron, ductile iron, copper, stainless steel and polyvinyl chloride (PVC). As per the *Asset Management Plan 2017 for Carleton Place* (Town of Carleton Place, 2017), the watermain network is mostly in good to excellent condition.

Table 3.7: Existing Watermain Network Breakdown

Watermain Diameter (mm)	Watermain Length (m)	% of Total Length
50 or less	2,036	2.7%
100	720	1.0%
140	212	0.3%
150	33,596	44.4%
200	22,244	29.4%
250	2,428	3.2%
300	12,687	16.8%
350	757	1.0%
400	752	1.0%
450	232	0.3%
500	32	<0.1%
Total	***75,696***	





Legend

Watermain Diameter

- Diameter < 100 mm
- 100 mm ≤ Diameter < 150 mm
- 150 mm ≤ Diameter < 200 mm
- 200 mm ≤ Diameter < 300 mm
- 300 mm ≤ Diameter < 400 mm
- Diameter ≥ 400 mm

- Water Treatment Plant (WTP)
- Elevated Storage Tank (EST)
- Wastewater Treatment Plant (WWTP)

0 400 800 metres

(At original document size of 8.5x11)
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Stantec

Carleton PLACE

Notes

1. Coordinate System: NAD 1983 UTM Zone 18N
2. Data Sources: *wm_mains.shp*, *parcelfabric.shp* and *Road_CL.shp* provided by the Town of Carleton Place
3. Background: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap

Project Location
Carleton Place, ON

Client/Project Carleton Place W&WW Master Plan
Town of Carleton Place
Carleton Place W&WW Master Plan
Phase 1 Report

Figure No.
3-4

Title
Water Distribution System

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3.1.3.2 Service Area Ground Elevations

The existing hydraulic model node elevations and provincial open-source elevation data show that ground elevations within the existing service area range from a low of ~128 m in the residential neighbourhood bound by McNeely Ave, Stonewater Bay and the Mississippi River, to a high of ~146 m along Mississippi Rd north of the Hwy 7. This information will be used in the model to identify the hydraulic gradeline (HGL) throughout the system to help assess system performance and ability to meet level of service requirements (i.e., with respect to pressures).

3.1.3.3 Hydraulic Capacity Assessment

3.1.3.3.1 Hydraulic Model Setup

Appendix B - Table B-1: provides detailed information on the steady-state hydraulic model scenario boundary conditions. No changes to the model network were made for the existing conditions. For future in the Rural and Urban Greenfield development areas east of the Town, the model network was extended to model the additional head losses over the length of the pipes required to supply these areas. The WTP supply is modelled using 2 fixed-head reservoirs. The head at the reservoirs vary based on the scenario.

The WTP is equipped with 4 high-lift pumps. However, in the model simulations, only 2 pumps are active during each scenario. During average day and peak hour conditions, pumps 1 (jockey) and 3 (duty) are active. During maximum day + fire flow conditions, pumps 1 (jockey) and 4 (standby) are active. The pump curves in the model were determined from testing in September 2011 (*Town of Carleton Place 2021 WaterCAD Model Update*, J.L. Richards, March 2021). The modelled rated capacities for pumps 2 (60.6 L/s) and 3 (100.7 L/s) are comparable to the capacities stated in the DWWP, whereas pump 1 is modelled as providing less capacity than stated in the DWWP (30.8 L/s), and pump 4 a higher capacity than stated in the DWWP (150 L/s). The total dynamic heads provided by the pumps in the model range from 41.8 m to 44.9 m, a lower range than specified in the DWWP.

The model also includes the Nelson St EST, which is further discussed and assessed in **Section 3.1.4.**

The capacity assessment is based on the pressure criteria outlined in the **Design Basis Memo**. Additionally, in the maximum day + fire flow scenarios, areas with fire flows of 60 L/s (3,600 L/min) or less were highlighted. In all scenarios, pipes with head loss gradients greater than 5.00 m/km were identified.

3.1.3.3.2 Average Day & Peak Hour Demands

Table 3.8 shows the pressure ranges under average day demand, for all planning horizons. This meets the maximum pressure objective of 80 psi (550 kPa). Results are illustrated in **Appendix B**.- **Figure 2** (2021) **Figure B-5** (2026), **Figure B-8** (2031) and **Figure B-11** (2041).

Table 3.8: Average Day Demand Pressure Ranges

	2021	2026	2031	2041
Minimum	53 psi (365 kPa)	53 psi (365 kPa)	52 (359 kPa)	52 (359 kPa)
Maximum	75 psi (520 kPa)	76 psi (524 kPa)	75 psi (520 kPa)	75 psi (520 kPa)

Table 3.9 shows the pressure ranges under peak hour demand, for all planning horizons. This meets the minimum pressure objective of 40 psi (275 kPa). Results are illustrated in **Appendix B** - **Figure B-3** (2021), **Figure B-6** (2026), **Figure B-9** (2031) and **Figure B-12** (2041).

Table 3.9: Peak Hour Demand Pressure Ranges

	2021	2026	2031	2041
Minimum	49 psi (338 kPa)	48 psi (331 kPa)	47 psi (324 kPa)	43 psi (296 kPa)
Maximum	74 psi (510 kPa)	73 psi (503 kPa)	72 psi (496 kPa)	69 psi (476 kPa)

Head losses under existing conditions (average day & peak hour) remain below 5 m/km. In the short-term (2026), as development occurs on McArthur Island and in the north side of the Mississippi River, head losses during peak hour demands exceed 5 m/km along Mill St, east of Judson St, and along Flora St, past the river crossing. With further developments in the medium-term (2031), head losses in the watermains towards the Bodnar Lands exceed 5 m/km during peak hour demands. In the long-term (2041), additional head loss deficiencies during peak hour demands occur in the river crossing along Bridge St (towards the Mississippi Residential Sector and Residential District infill developments), along Princess St (towards McArthur Island), off Moore St (feeding Strategic Property 25), and in the area of the EST, feeding the Residential District infill developments.

3.1.3.3.3 Maximum Day + Fire Flow

Table 3.10 shows the range of available fire flows at a residual pressure of 20 psi (140 kPa) under a maximum day with fire flow scenario. Results are illustrated in **Appendix B**.- **Figure B-4** (2021), **Figure B-7** (2026), **Figure B-10** (2031) and **Figure B-13** (2041).

The following areas were identified as having fire flows of 60 L/s or less in all planning horizons:

- Residential areas north of Highway 7 and east of Mississippi Rd;
- Light industrial area north of Highway 7 and east of the Ottawa Valley Rail Trail (at the end of Findlay Ave and Bennett St);
- Mill St, east of Judson St and towards McArthur Island;
- At the north end of Francis St, near the wastewater treatment plant;
- Residential areas along the Mississippi River (Rosamond St and William St), and light industrial areas at the intersection of Townline Rd East and McNeely Ave;
- Industrial areas in the north east areas of the Town;
- Near Bridge St, behind the Carleton Place Aquatic Centre; and,
- Notre Dame Catholic High School.

These areas are predominantly areas with dead-end watermains. Looping these watermains may be a solution to evaluate in Phase 2.

Table 3.10: Available Fire Flow Ranges

	2021	2026	2031	2041
Minimum	35 L/s	35 L/s	34 L/s	34 L/s
Maximum	1,957 L/s	1,889 L/s	1,829 L/s	1,726 L/s

Appendix B.- **Figure B-2** to **Figure B-13** also show head losses in the watermains and provide an indication of watermains which could be further evaluated for upsizing and/or relining/replacement to reduce head losses. Reducing the head losses in these watermains could also contribute to enhancing the available fire flows in the areas they feed.

Indeed, the fire flow constraints identified north of the Mississippi River can be associated to constraints in the watermains feeding these areas, crossing the river along Bridge St (250 mm diameter) and from the WTP to Flora St (285 mm diameter). As described previously, these constraints result from future developments (and increased demands) in the areas north of the Mississippi River. The Town has already undertaken the construction of a 3rd watermain crossing across the Mississippi River at McArthur Island, ahead of the planned removal of the Bridge Street crossing during reconstruction in the upcoming year. The new watermain may contribute to solutions to the constraints identified herein and will be analyzed along with other proposed solutions in Phase 2.

3.1.4 Water Storage

3.1.4.1 Fire Flow Storage Volume Assessment

Water storage in the system is currently provided at the WTP clearwell (3,180 m^3) and at the elevated storage tank (EST) on Nelson St E (3,200 m^3), for a total system water storage of 6,380 m^3.

The EST is equipped with an on-site re-chlorination facility, to boost chlorine residual when required. A single pipe interconnects the elevated reservoir to the water distribution system allowing water to circulate in both directions over a 24-hour cycle. Low water levels at this reservoir trigger the high lift pump operation at the WTP.

The system's storage capacity was assessed using the MECP formula, which accounts for fire flow storage requirements, for equalization volume based on maximum day demand, and for emergency storage. The existing storage requirements for existing conditions were assessed, and compared against available combined storage at the WTP and at the EST. For this assessment, the employment density rate of 50 jobs/ha[1] was used to estimate the equivalent population for ICI areas.

The required fire flow rate and duration was obtained by interpolating between values in the 2019 MECP Guidelines Table 8-1. Furthermore, for comparison purposes, a fire flow rate of 13,000 L/min for a duration of 2.75 hours, as per the Fire Underwriters Survey (FUS)'s method and used in the City of Ottawa, was also evaluated.

The total maximum day demand corresponds to the demand as presented in **Section 3.1.1**, whereby a maximum day peaking factor of 1.75 was used. Detailed calculations are presented in **Appendix C- Table C-2** (MECP fire flow) and **Table C-3** (FUS fire flow) and are illustrated in **Figure 3.5**.

The results obtained suggest that there is currently a deficit of 373 m^3 in storage required when using the fire flow rate and duration provided by the MECP. Using the FUS fire flow of 13,000 L/min for a duration of 2.75 hours, there is an existing storage surplus of 650 m^3, and storage expansion would be required in 2025.

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[1] Employment density rate suggested in JLR's Comprehensive Review (2021).

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The system's future storage capacity was also assessed using the MECP formula and recommended fire flow, based on the projected population and ICI growth presented in **Section 1.4**, and compared against proposed storage expansions as described in the *Potable Water Storage Study* (J.L. Richards, November 2018). Assuming that 3,292 m^3 of additional storage is added within the short-term planning horizon (assumed in the year 2023), this volume would meet projected population's maximum day demand and corresponding fire flow requirements for approximately 6 years (until the end of the year 2029), at which point additional storage would be needed. Further, by adding storage through a WTP clearwell expansion of 1,590 m^3 (also as assumed in the *Potable Water Storage Study* (J.L. Richards, November 2018) during WTP expansion in 2024, this storage volume would meet projected fire flow requirements and maximum day demand until the year 2034. In the 20-year planning horizon, it is projected that an additional storage volume of 4,296 m^3 would be required to accommodate population growth in the Town.

In contrast, maintaining the FUS fire flow of 13,000 L/min for a duration of 2.75 hours, the additional 3,292 m^3 of storage would provide for the Town's maximum day and fire flow requirements beyond the 20-year planning horizon. Considering additional storage provided at the WTP (1,590 m^3), an additional storage volume of 340 m^3 would be required in the 20-year planning horizon to accommodate population growth in the Town.

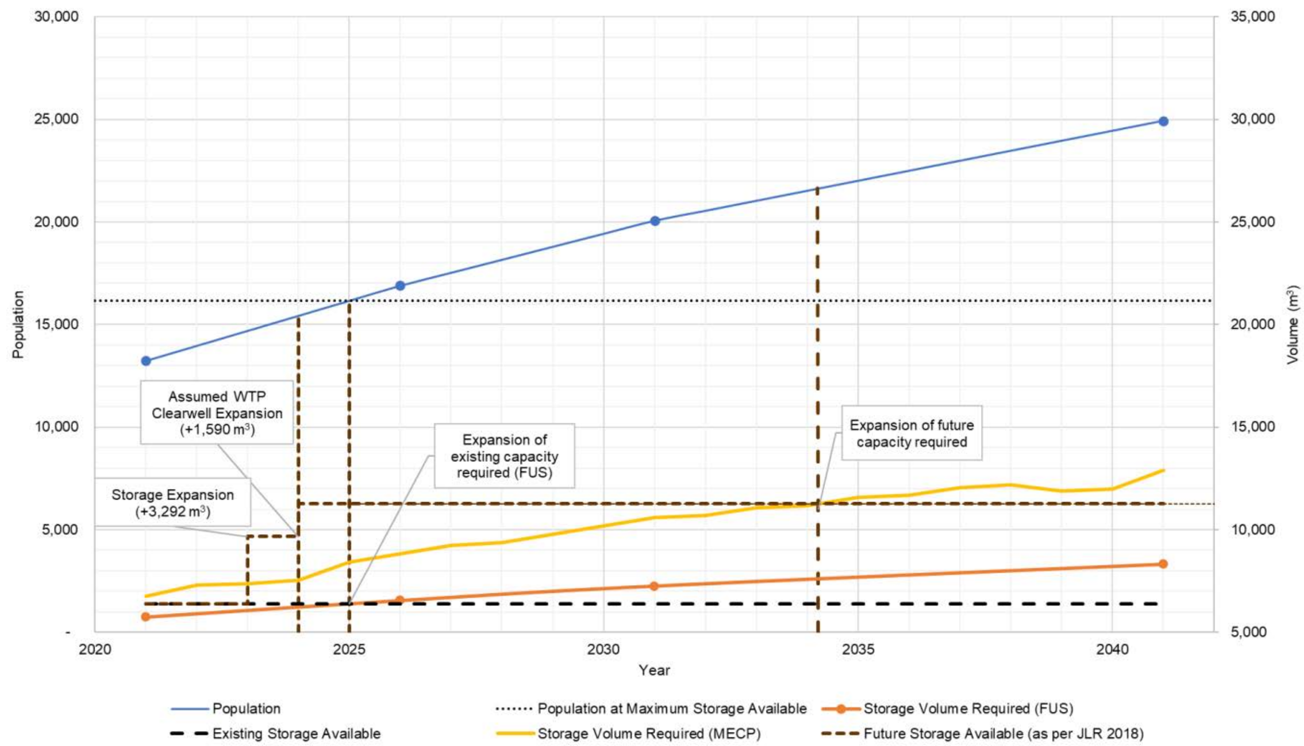

Figure 3.5: Storage Volume Capacity Requirements

3.1.4.2 Comparison of Fire Storage Requirements

Comparisons between these future flow projections and those in past Master Planning reports for the Town are summarized in **Table 3.11**.

The *Potable Water Storage Study* (J.L. Richards, November 2018), also based on the *Addendum to the August 2011 Water Treatment Plant Capacity Expansion Master Plan* (J.L. Richards. 2018), estimated that the total future additional storage required would be 3,292 m^3, implemented in 2023, and assuming expanded storage at the WTP in 2028. As seen previously, in this study, a total future additional storage of 3,292 m^3 would be sufficient until 2029, at which point additional storage (e.g., expanded clearwell storage at the WTP) would be needed. However, additional storage at the WTP would provide further water storage until 2034. The 20-year planning horizon storage requirements could amount to 4,926 m^3/d. This is mainly due to the increased fire flow requirements with increasing population, as provided by the MECP Table 8-1. The MECP guidelines indicate that the rates presented in its Table 8-1 are typically used by small municipalities in Ontario, and also state that:

"Fire protection is a municipal responsibility, and the municipality may elect to provide for higher fire flow requirements or entirely forgo fire protection by way of the drinking-water distribution system."

As shown previously, using a FUS fire flow of 13,000 L/min for 2.75 hours (a rate applied in the City of Ottawa for planning purposes) could extend the availability of storage in the Town. As such, the Town may consider re-evaluating its fire flow requirements, using other standards such as the FUS.

For further comparison, the *Water Treatment Plant Capacity Expansion Master Plan* (Stantec Consulting Ltd., 2011) estimated that additional storage would be needed in 2019, which is consistent with the current study's findings of a deficit in water storage. However, the 2011 Master Plan estimated that the WTP expansion would be required in 2032, at which point the total additional storage provided (2,780 m^3) would service a population of 14,900. The differences in expansion timing and population differences illustrate that the growth projections in the 2011 Master Plan were less aggressive than current estimates. Furthermore, the 2011 Master Plan was based on maximum day peaking factor of 1.65, which is lower than the peaking factors presented in subsequent studies.

It should be noted that the storage volume required is solely based on fire flow and maximum day demand and does not account for any additional storage requirements for chlorine disinfection in the winter (which was assumed in the *Potable Water Storage Study* (J.L. Richards, November 2018) and in *Water Treatment Plant Capacity Expansion Master Plan* (Stantec Consulting Ltd., 2011). This further shows the high impact of the fire flow requirements in the calculation of storage needs and suggests the need to revisit the fire flow established. Additionally, the higher maximum day peaking factors may also contribute to the higher storage requirements. The peaking factor used in the current study (1.75) is within the range of values observed in the past 4 years, peaking in 2018 (1.98).

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Table 3.11: Comparison of Storage Expansion Studies

	2021 W&WW Master Plan	2011 Master Plan	2018 Addendum & Water Storage Study
Storage Available			
Existing WTP Storage Available (m^3)	3,180	3,150	3,180
Additional WTP Storage Available (m^3) (1)	1,590	-	1,590
EST Storage	3,200	3,200	3,200
Maximum Day Demand & Fire Flow			
Population (ppl)	27,800 (2)	14,900	18,400 (2)
Average Day Water Consumption Rate (L/c/d)	Residential: 350 ICI: 51-60 (3)	465	410
Maximum Day Demand Peaking Factor	1.75 (4)	1.65	1.80 (5)
Maximum Day Demand (m^3/d)	18,000	11,430	17,000
Fire Flow (L/s)	323	- (6)	260
Fire Duration (hrs)	5.00	- (6)	4.14
Fire Storage Required (m^3)	5,814	- (6)	3,875
Additional Storage Requirements			
Chlorine Storage Required (m^3)	-	2,514	1,106
Total Future Additional Storage Required (m^3)	4,926	2,780 (7)	3,292
Year of WTP Expansion	2024	2032 (8)	2028
Year of Additional Water Storage	2034 (9)	2019 (8)	2023

Notes:

(1) Additional storage provided within the 20-year planning horizon with WTP clearwell expansion, as identified in the *Addendum to the August 2011 Water Treatment Plant Capacity Expansion Master Plan* (J.L. Richards. 2018).
(2) Total equivalent population, including residential and ICI equivalent, as required for calculation with MECP formula.
(3) Maximum day peaking factor of 1.75 based on recent observations by the Town and OCWA data.
(4) Maximum day rate of 1.84 m^3/unit divided by average day rate of 1.024 m^3/d.
(5) ICI rates as equivalent per capita rates.
(6) Fire flow requirement details unavailable.
(7) Water storage expansion from 6,350 m^3 to 9,130 m^3.
(8) Preferred Alternative Design 2 in 2011 Master Plan entailed dividing the water storage upgrade into two stages, in 2019 and in 2032 (concurrent to WTP upgrade).
(9) Additional storage is needed in 2034 if additional storage at the WTP is provided through clearwell expansion; otherwise, additional storage is needed earlier in 2029.

3.1.4.3 Water Storage Extended Period Assessment

The hydraulic model used for the assessment of the water distribution system (see **Section 3.1.3**) was also used to assess the performance of the EST.

The elevated tank is modelled using a tank curve, which relates the ratio of depth to the range of depths between the minimum and maximum levels (in %) to the ratio of volume to maximum volume (in %), describing the tank's irregular shape. The tank has an initial water elevation of 181.10 m which corresponds to the tank being 37.9% full. In the model's steady-state runs, this initial water elevation (tank HGL) and percentage full is constant over all scenarios and planning horizons.

Extended period simulations (EPS) over a period of 5 days were implemented, in order to assess fluctuations in the tank's levels and volumes, and how projected maximum day demand increases will affect them. A dummy diurnal pattern was implemented evenly across all demands. This approach implies that residential and ICI diurnal demand patterns are similar, however it is likely that the demand peaks in residential and ICI demands do not actually align. Nevertheless, for the purposes of this analysis (assessing the impact of growth on the fluctuations, relative to existing conditions), this approach is deemed acceptable.

The same initial settings as in the steady-state maximum day scenarios were maintained: the WTP's high-lift pumps 1 and 3 are in operation, and the tank has an initial HGL of 181.10 m (is 37.9% full). Controls were added, representing the tank's trigger volumes, which will activate the WTP's high-lift pump 2. The controls were set targeting typical tank operating ranges of 40% to 90% full (with the pump being activated when the tank is 60% full or less), which could be further refined and calibrated in subsequent steps with input from OCWA. Nevertheless, this approach serves the purposes for a comparison of planning horizons.

The results show that, under existing conditions with the aforementioned setpoints, volumes in the tank will fluctuate between 35% full and 96% full, and that the high lift pumps (HLPs) are able to maintain the target operating range. However, in the short-term planning horizon (2026) with the same setpoints, volumes in the tank fluctuate between being fully drained (i.e., 0% full) and 84% full. This highlights a need to adjust HLP operations to meet the target tank operating range. With the projected population and demand growth in the medium- (2031) and long-term (2041) planning horizons, similarly the tank volumes fluctuate between being fully drained and 78% and 71% full, respectively. Besides adjustments in HLP operations, this aligns with the need for increased HLP capacity within the 10 to 20-year planning horizon, as identified in **Section 3.1.2.3.1**.

3.2 Wastewater System

3.2.1 Wastewater Collection System

3.2.1.1 Existing Sewer Network

Based on the Town's GIS database, the Carleton Place sanitary collection system is composed of approximately ~65 km of sewers, 200 mm to 750 mm in diameter. As illustrated in **Figure 3.6** and summarized in **Table 3.12**, the network predominantly consists of 200 mm sewers (55% of total sewer network length) and 250 mm sewers (17% of total sewer network length). Flow in the 600 mm diameter trunks on Franklin St and Lake Ave E discharges into a 750 mm diameter trunk sewer along Neelin St, which conveys flow directly to the WWTP. The majority of the sewers are made of polyvinyl chloride (PVC; 58% of total sewer network length), with other sewers also made of concrete, clay, ductile iron, and Transite. The age of the sewers ranges up to 109 years. As illustrated in **Figure 3.7** and shown in **Figure 3.12**, the average sewer age is ~30 years, with 40.2% of the sewers between 30 and 50 years of age, 29.9% between 10 and 30 years, and 20.8% 10 years of age or less. According to the *Asset Management Plan* (Town of Carleton Place, 2017), the majority of the sewers are mostly in good to excellent condition.

Table 3.12: Existing Sewer Network Breakdown by Sewer Diameter

Sewer Diameter (mm)	Sewer Length (m)	Percent of Total Length
200	36,024	55.3%
250	11,666	17.8%
300	6,373	9.8%
350	2,258	3.5%
375	3,045	4.7%
400	1,331	2.0%
450	1,911	2.9%
500	115	0.2%
525	564	0.9%
600	1,606	2.5%
750	276	0.4%
Total	***65,169***	

Table 3.13: Existing Sewer Network Breakdown by Sewer Age

Sewer Age (years)	Sewer Length (m)	Percent of Total Length
Unknown	4,565	7.0%
90 years and older	374	0.6%
50 to 90 years	964	1.5%
30 to 50 years	26,177	40.2%
10 to 30 years	19,532	29.9%
Less than 10 years	13,556	20.8%
Total	***65,169***	

The Town also owns eleven (11) sewage pumping stations, currently operated by the Ontario Clean Water Agency (OCWA), ranging in age from 40+ years to relatively new (2017) (J.L. Richards 2018). The location of these pumping stations is also shown in **Figure 3.6**. According to the Condition Assessment of Pumping Stations by JLR (2018), the Bridge St Pumping Station (PS), the Industrial PS and the Highway 7 PS are expected to require increased capacity to accommodate future growth. The Bridge St PS is noted to experience high I/I flows in the spring, and the Joseph St PS was said to overflow to an adjacent sanitary sewer on Joseph St during extreme weather events (i.e., sees flows greater than the pump station capacity in extreme weather events). All pumping stations service local sewersheds, with the exception of the Mississippi Quays PS, which is located on a trunk sewer near the McNeely Ave and Patterson Crescent intersection just upstream of the WWTP.

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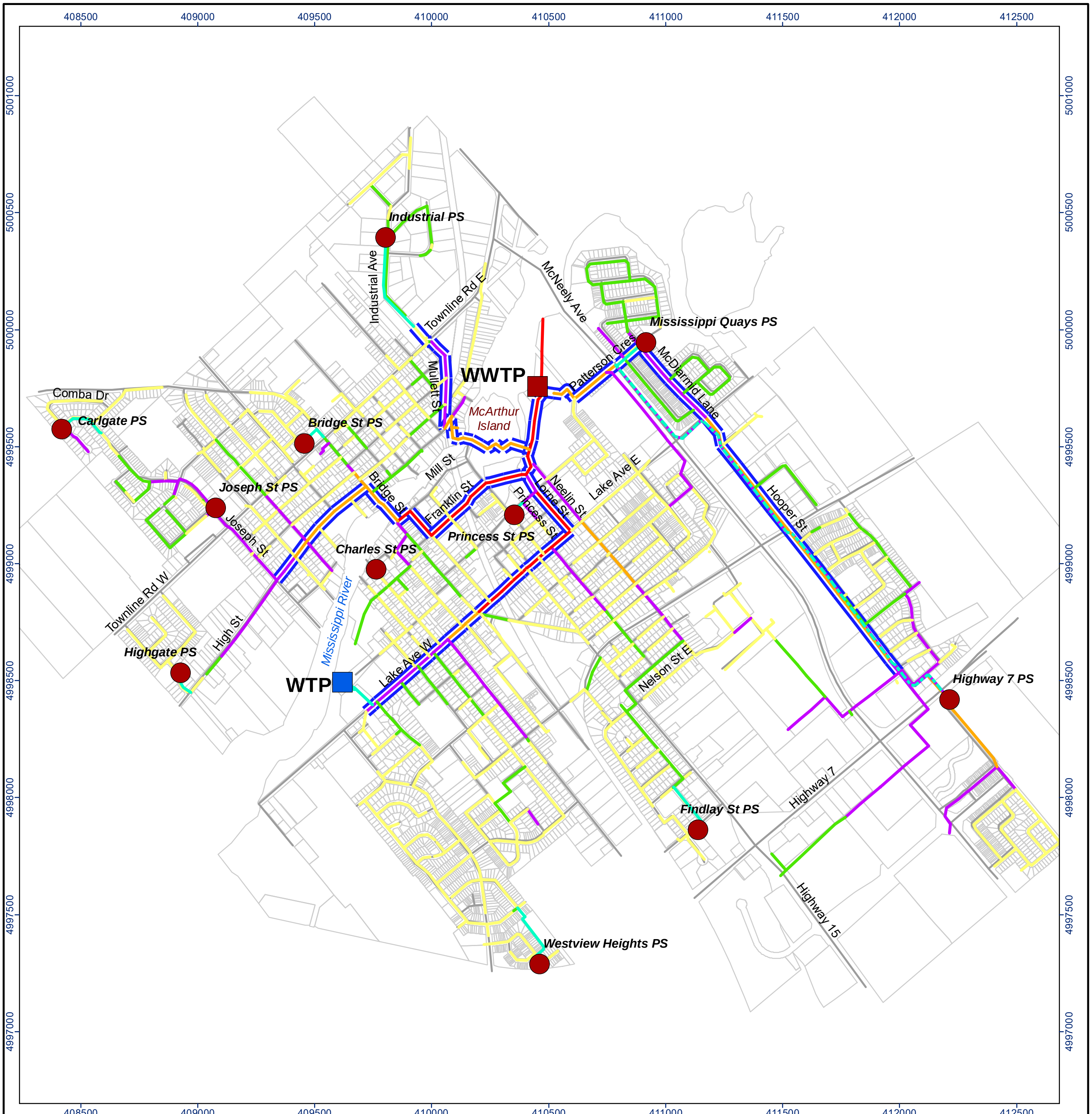

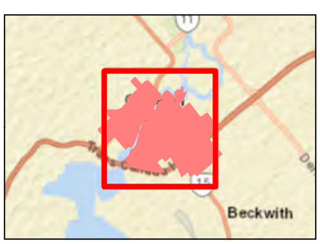

Legend

Sewer Diameter

- 200 mm
- 250 mm ≤ Diameter < 300 mm
- 300 mm ≤ Diameter < 400 mm
- 400 mm ≤ Diameter < 600 mm
- Diameter ≥ 600 mm
- Wastewater Treatment Plant (WWTP)
- Pumping Station (PS)
- Water Treatment Plant (WTP)
- Trunk Sewer (Model)
- Forcemain
- Twin Forcemain

0 400 800 metres

(At original document size of 8.5x11)
1:25,000

N

Notes
1. Coordinate System: NAD 1983 UTM Zone 18N
2. Data Sources: *sanisewer.shp*, *parcelfabric.shp* and *Road_CL.shp* provided by the Town of Carleton Place, *san_trunk_sewer_jlr.shp* provided by J.L. Richards
3. Background: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea,

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Carleton PLACE

Project Location

Carleton Place, ON

Client/Project Carleton Place W&WW Master Plan
Town of Carleton Place
Carleton Place W&WW Master Plan
Phase 1 Report

Figure No.
3-6

Title
Sanitary Sewer System - Sewer Diameters

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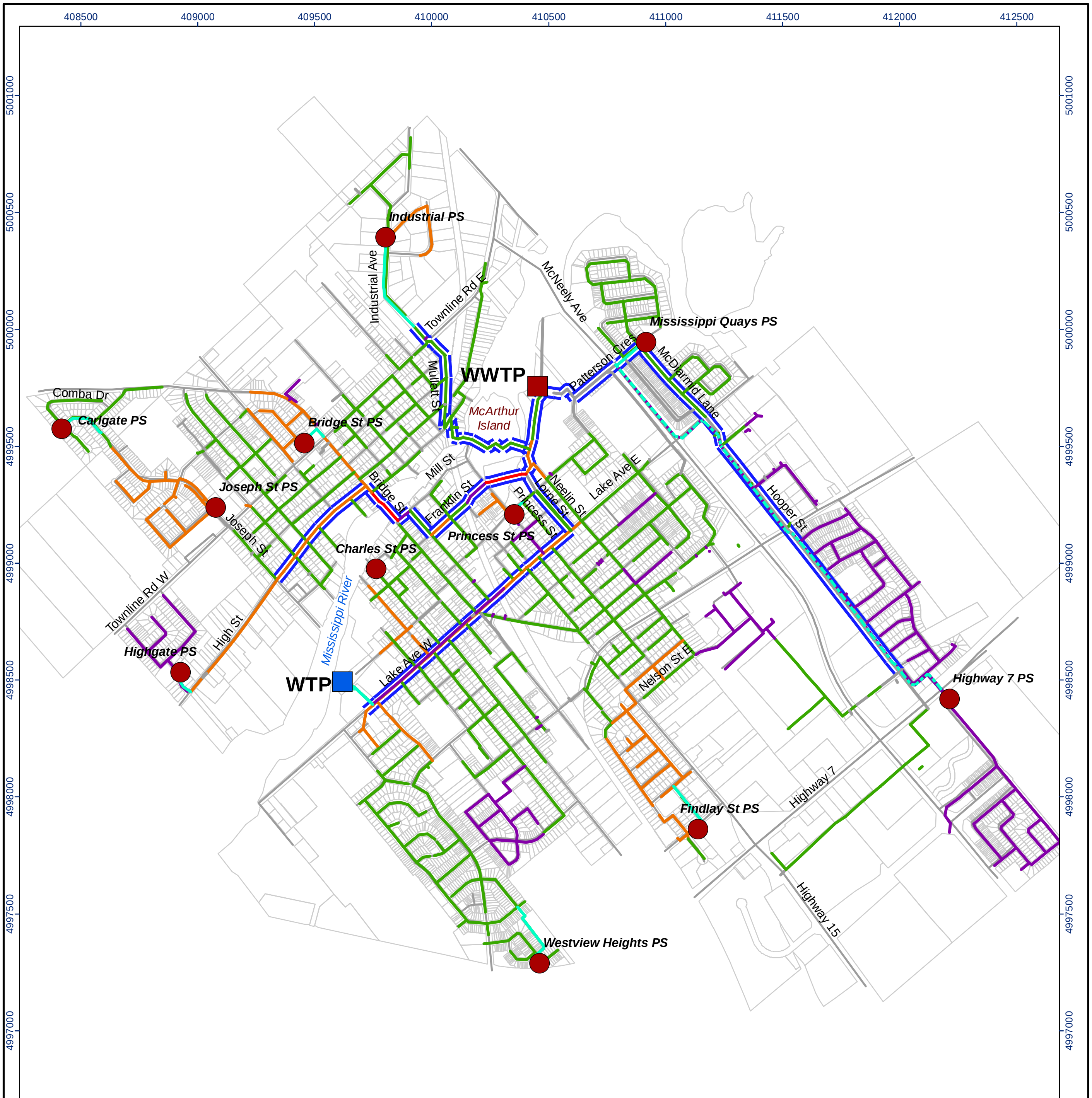

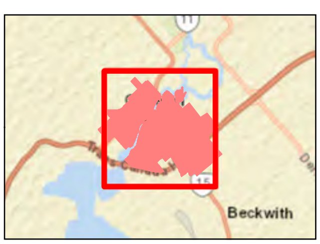

Legend

Sewer Age

- Sewer Age Unknown
- 90 Years and Older
- 50 to 90 Years
- 30 to 50 Years
- 10 to 30 Years
- Less than 10 Years
- Wastewater Treatment Plant (WWTP)
- Pumping Station (PS)
- Water Treatment Plant (WTP)
- Trunk Sewer (Model)
- Forcemain
- Twin Forcemain

0 400 800 metres

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Project Location
Carleton Place, ON

Client/Project
Carleton Place W&WW Master Plan
Town of Carleton Place
Carleton Place W&WW Master Plan
Phase 1 Report

Figure No.
3-7

Title
Sanitary Sewer System - Sewer Age

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3.2.1.2 Existing Hydraulic Capacity Assessment

3.2.1.2.1 Overview of Model Setup & Analysis

The trunk-level sanitary sewer spreadsheet model developed by J.L. Richards, March 2014 (*Trunk Sanitary Sewers – Hydraulic Capacity Investigation* memo) was updated with new parameters to assess the capacity of the wastewater collection system with new growth. The trunk system modelled is illustrated in **Figure 3.6**, and consists of the following alignments:

- Along Lake Ave W, turning northwards at Lorne St;
- Along High St, crossing the Mississippi River at Bridge St, and intersecting with the branch off Lorne St, east of Princess St;
- Along Industrial Ave, north of Townline Rd East, running southwards along Mullet St, and crossing the Mississippi River at McArthur Island to intersect with the two previous alignments near Neelin St. Wastewater is then conveyed to the WWTP; and,
- Along Hooper St (labelled McNeely Ave in the spreadsheet), from Highway 7 northwards to the Mississippi Quay PS. From the PS, a forcemain conveys wastewater to Patterson Crescent, which then flows by gravity to the WWTP.

3.2.1.2.1.1 Sewer and MH Data & Gaps Assessment

The sewers in the spreadsheet model range in diameter from 200 mm to 750 mm. The Town also verified and provided sewer diameters, slopes, lengths, and inverts based on drawings. A comparison of the different sources of information and the diameters and slopes provided is presented in **Appendix D - Table D-1**.The table indicates diameters and slopes that were updated in the spreadsheet model, along with justifications for their selection.

From a cross-verification of the GIS data, the information provided by the Town, and the spreadsheet, it appears that 5 sewer sections were either not modelled separately in the spreadsheet or combined into a single sewer section in the spreadsheet. These sewer sections were added to the spreadsheet, and their characteristics (diameter, slope) assigned based on the data provided by the Town. In a single instance, the slope for a 2.7-meter long sewer section between Princess St and Lorne St was unspecified, and the inverts provided suggested a slope of 0%. Its slope was inferred by assigning the mildest of the upstream or downstream pipe's slope values (to remain conservative in the estimate of capacity). In which case, the upstream slope governed and was applied.

As indicated previously, the Town has provided invert elevations for the sewers and MHs. The spreadsheet model as it currently stands only serves to calculate sanitary sewer dry weather and wet weather flows and the sewers' capacity utilization. However, as recommended in the **Design Basis Memo**, a hydraulic grade line (HGL) analysis is needed to establish the system's level-of-service and determine whether there is a risk of surface or basement flooding. The results presented in this report are based on the existing spreadsheet model, solely assessing the sewers' capacity utilization. However, upcoming upgrades to the sanitary trunk sewer model with the development of a static hydraulic model in PCSWMM will include an analysis of the HGL. **Figure 3.8** illustrates the trunk sewer and MH invert data availability and data gaps. In general, invert data is available for most sections. Information is completely missing for two sewer sections along Patterson Crescent; for which, assumptions will be made. Data gaps or inconsistencies will be addressed as part of the development of the PCSWMM model.

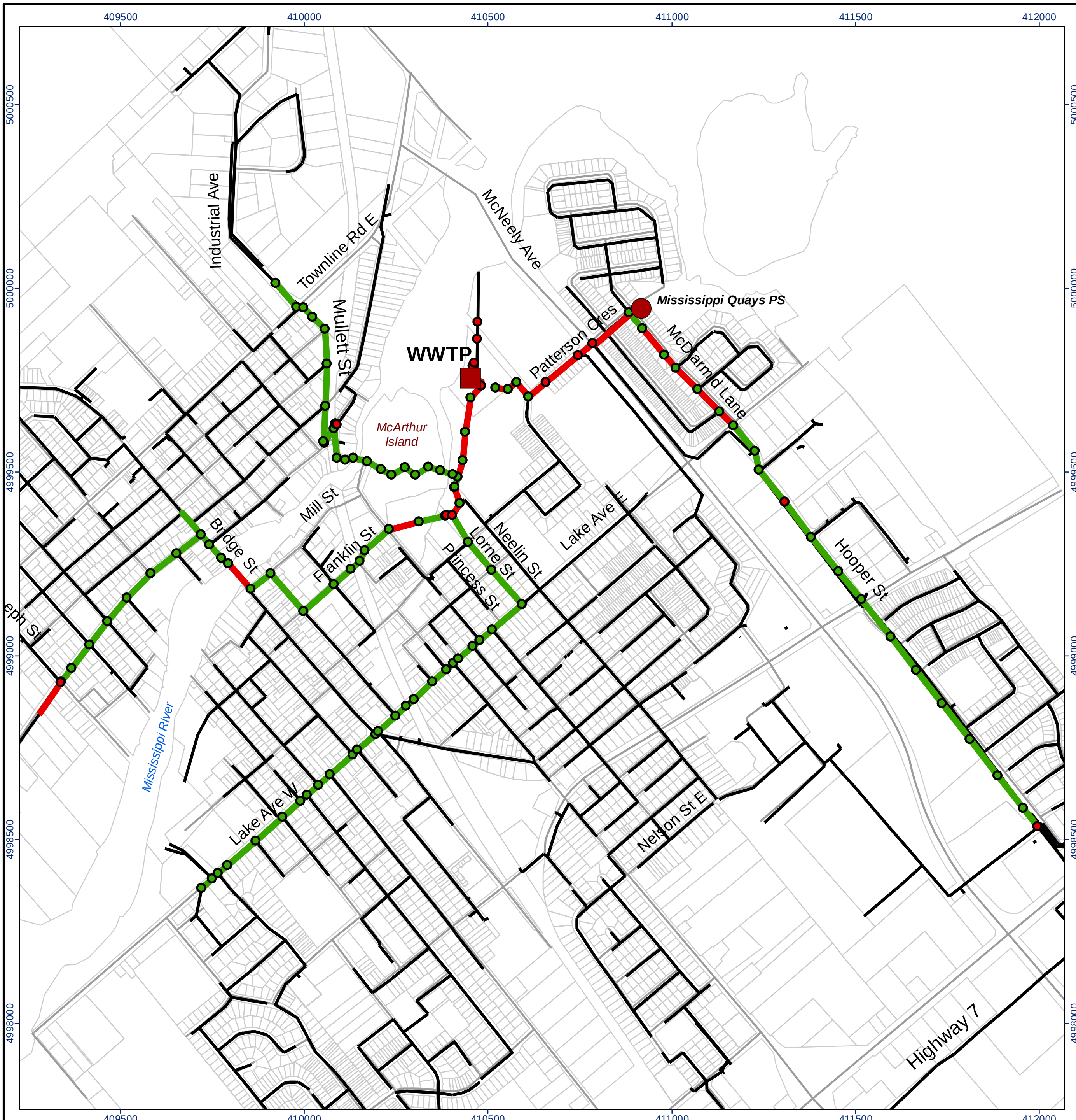
3.2.1.2.1.2 Special Structures

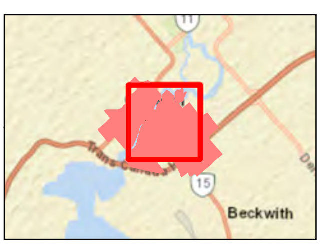
The spreadsheet model includes one of the Town's 11 pump stations; the Mississippi Quays PS, at the corner of Stonewater Bay and McDiarmid Ln (labelled McNeely Ave in the spreadsheet). The PS feeds sewage to a forcemain along Patterson Crescent. This forcemain is included in the spreadsheet, but no calculations are associated to it in the spreadsheet. All sewage received at the PS is assumed to be conveyed to the forcemain's outlet MH without restriction. The peak design inflow to the PS in the sanitary sewer spreadsheet is 49.01 L/s. OCWA has provided PS measurements of inflow volume (in m^3) and wet well levels (in m) for 2017 to 2020 (at a 5-minute time interval for 2017-2019, and 1-minute time interval for 2020). The inflow volume is cumulative, and is reset daily at midnight, such that the total daily volume is equivalent to a flow rate in m^3/d at the PS. Based on this data, peak inflow to the PS has been measured at 3,875.2 m^3/d on February 17th, 2017. This is equivalent to 44.9 L/s, which is below the PS's rated capacity of 52.2 L/s (as per the Certificate of Authorization, dated August 2nd, 1995).

The Town provided drawings for the siphon crossing the Mississippi River, east of McArthur Island. As per the drawings, this siphon consists of two parallel sewers, including a 150 mm diameter ductile iron pipe and a 300 mm diameter ductile iron pipe. It receives flow from a 400 mm diameter pipe on McArthur Island, crosses the river bank at a 41.5% slope (22.5° bend), lies flat underneath the river bed over a 23.6-meter distance, and rises back on the right bank of the Mississippi River at a 41.5% slope (22.5° bend), to discharge into a 400 mm diameter pipe along the Mississippi Riverwalk Trail, conveying flow towards the WWTP . In the model, the section of the siphon is represented by a single 400 mm diameter gravity pipe, with a slope of 0.84%, equivalent to the slope from the upstream MH to the downstream MH across the siphon. As this model represents a free-flowing capacity analysis only, the siphon's pressurized characteristics are excluded from this assessment.

The information provided by the Town also indicates that the 600 mm diameter PVC sewer on Franklin St is divided into twin 450 mm sewers over a length of 52.1 m. Using Manning's equation, the equivalent diameter to the twin sewers is calculated as 584 mm. In the model, these sewers were previously modelled as a single 600 mm diameter sewer. To remain conservative, the diameter of that section was reduced to 584 mm.

With the development of an HGL analysis within a PCSWMM model, it will be possible to improve the representation of these special structures, and better assess how flow is conveyed through them.





Legend

Sewers

- Trunk Sewer Invert Data Missing
- Trunk Sewer Invert Data Available
- Local Collection System

Maintenance Holes

- MH Invert Missing
- MH Invert Available

Sanitary Collection System

- Wastewater Treatment Plant (WWTP)
- Mississippi Quays Pumping Station (PS)

0 200 400 metres
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Notes

1. Coordinate System: NAD 1983 UTM Zone 18N
2. Data Sources: *sanisewer.shp* provided by the Town of Carleton Place, *san_trunk_sewer_jlr.shp* provided by J.L. Richards
3. Background: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap

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Phase 1 Report

Figure No.

3-8

Title

Sanitary Trunk Sewer Data Gaps Assessment

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3.2.1.2.1.3 Sewer Flow Calculations

The population and areas in the original model provided correspond to the 2020 conditions. As presented in the *Update to Wastewater Trunk Sanitary Sewer Model* memo (J.L. Richards, March 2021), the capacity used in each sewer is less than 100%. This update identified critical trunk sections with the highest capacity reductions (compared to the results from the previous model version from the *Trunk Sanitary Sewers – Hydraulic Capacity Investigation* memo (J.L. Richards, March 2014), which have the potential to limit future development in the south-west and in the north-east quadrants of the Town.

In the previous (2020) spreadsheet model (*Update to Wastewater Trunk Sanitary Sewer Model* memo, J.L. Richards, March 2021), ICI areas are modelled as equivalent residential units, i.e., an equivalent population is calculated using a population density of 2.5 PPU. The conversion between ICI areas in hectares and the number of equivalent residential units was not indicated. The equivalent population is added to the residential population. Therefore, the total population comprises both residential and equivalent ICI population. As the total population in each tributary area is used in the calculation of the Harmon Peaking Factor (PF), this approach assumes that sanitary flow rates and patterns in ICI areas are similar to residential flow patterns. This approach is maintained for the existing conditions (2021) assessment completed under this scope of work, implying limited ICI growth in comparison to residential population growth from 2020 to 2021. However, for the future growth areas, the spreadsheet was modified to add residential population and ICI areas separately, and to apply the parameters selected in the **Design Basis Memo**.

Peak flows are calculated per design event and compared to the sewer's full flow capacity. The spreadsheet does not include an HGL analysis, and therefore does not include the components required to calculate the HGL, such as the sewer and MH inverts, the sewer lengths, and boundary conditions (head at the WWTP and at the PS). The Town has provided information on most of the inverts and sewer lengths; however, these were not incorporated at this stage.

3.2.1.2.2 Existing Sanitary Collection System Assessment

As the original sanitary spreadsheet models the 2020 conditions, the population and area were first adjusted in order to reflect existing conditions in 2021, as established in the **Design Basis Memo**.

In the *Update to Wastewater Trunk Sanitary Sewer Model* memo (J.L. Richards, March 2021), the total population of Carleton Place in 2020 is stated to be 13,153. Subtracting the number of residential units privately serviced, a total of 12,990 inhabitants are connected to the Town's sanitary sewer infrastructure. In the original spreadsheet model presented in *Update to Wastewater Trunk Sanitary Sewer Model* memo (J.L. Richards, March 2021), the 2020 total population is similar, at 12,993 inhabitants, including 12,525 residential inhabitants and an ICI equivalent population of 468. The *Development Charges By-law and Background Study* (Watson & Associates Economists Ltd, December 2020) however, states a 2020 population of 12,390 inhabitants (less than both JLR's residential and total populations as noted above). The population as stated by the *Development Charges By-law and Background Study* was used as the basis for developing the 2021 population and the overall planning projections presented in the **Design Basis Memo.**

To be conservative in the estimation of sanitary flow however, the original spreadsheet model's population of 12,993 inhabitants was maintained and increased by the assumed growth rate of approximately ~350 residential units at a population density of 2.5 PPU, as used in the **Design Basis Memo**. For the sanitary collection system assessment, this results in a 2021 total residential population of 13,403 inhabitants (12,525 residential inhabitants from JLR's model with an additional ~350 residential units at 2.5 PPU). The ICI equivalent population was not modified as no known growth has occurred between 2020 and 2021, and thus remains at 468, resulting in a total equivalent population of 13,870 for this assessment.

Using the historical tributary area growth rate of 13 ha/year (presented in the **Design Basis Memo** for the historical extraneous flows analysis), the total area increases from 578 ha in 2020 to 591 ha in 2021. The spatial distribution of this growth was based on *Town of Carleton Place 2021 WaterCAD Model Update* (J.L. Richards, March 2021), which shows areas where recent developments have occurred, and the population and area growth were assigned to the first receiving trunk maintenance hole downstream of these development areas. This 2021 model update suggests that the majority of developments have occurred in the Highway District, and the remaining developments are located downtown and in the northern quadrant of Town, north west of Bridge St. **Table 3.14** summarizes the distribution of growth from 2020 to 2021 in the spreadsheet model.

Table 3.14: Spatial Allocation of Developments from 2020 to 2021 for Sanitary Sewer Analysis

Area	Approximated Percentage of Developments in Area	Unit Growth(1)	Population Growth(2)	Area Growth (ha)	Receiving Trunk MH ID	Receiving Trunk MH Location
Highway District	75%	+263	+658	1.63	321(3)	Patterson Crescent, west of McNeely Ave, to the WWTP
Downtown Area	12.5%	+44(4)	+110	9.75	1	Lake Ave W & Lyndhurst St
North of Mississippi River	12.5%	+44(4)	+110	1.63	101	High St & Joseph St
Total Growth from 2020 to 2021	***100%***	***+351***	***+878***	***13***	**-**	**-**

Notes:

1) Assuming total unit increase of ~350 residential units from 2020 to 2021, as established in the **Design Basis Memo**, based on *Development Charges By-law and Background Study* (Watson & Associates Economists Ltd, December 2020).
2) Assuming a unit density of 2.5 PPU.
3) Assuming flow is first conveyed to the Highway 7 PS, and then to MH321 via a forcemain without restriction.
4) Value rounded up to nearest integer.

The existing conditions were modelled using the parameters established in the **Design Basis Memo**, for the three different scenarios: design, annual and rare.

Table 3.15 presents a summary of the results, illustrated in **Appendix D – Figure D-1** (for the sewer capacity utilization in the design event). Note that only the design event capacity results are presented within the figures in **Appendix D**, as the annual and rare events have not yet been assessed with respect to HGLs under their specific operation conditions. Detailed spreadsheet calculations for all events however, are provided in **Appendix D – Table D-4** (design event), **Table D-5** (annual event), and **Table D-6** (rare event).

Table 3.15: Summary of Sanitary Collection Existing Conditions (2021) Assessment

Parameter	2021		
	Design	Annual	Rare
Residential Population (people)	13,403		
ICI Equivalent Population (people)	468		
Total Population, incl. Equivalent ICI Population (people)	13,870		
Total Area (ha)	591		
Average DWF (m^3/d)	5,437	5,437	5,437
Peak DWF (m^3/d)	13,321	11,350	11,350
Peak Extraneous Flow (m^3/d)	16,847	16,006	45,002
Peak Total Flow (m^3/d)	30,167	27,356	56,352
Number of Sewers Surcharged (-)	0	0	20
Average Sewer Capacity Used (%)	38.1%	34.6%	78.1%
Max Sewer Capacity Used (%)	95.0%	83.3%	337.1%
Mississippi Quays PS Peak Inflow (L/s)	50.7	44.6	69.0

The results suggest that, during the design event, all sewers have sufficient flow capacity in existing (2021) conditions. Only one sewer, on Industrial Ave, has a capacity utilization exceeding 90%.

Under the annual event, all sewers are flowing under capacity in existing conditions. However, as described in the **Design Basis Memo**, the annual event requires an HGL analysis to establish the level-of-service during PS failure. The trunk system only includes one PS; however, HGL calculations have not yet been completed for the system (pending the development of a static hydraulic model in PCSWMM), and it is therefore not currently possible to properly assess the system's level-of-service during the annual event and PS failure conditions.

During the rare event, all the sewers along High St exceed their flow capacity. This area corresponds to the 2013 flow monitoring program FM#6 sub-basin, for which higher extraneous flow rates were used in the rare event, as the flow monitoring information suggests the sewers in this area to be leaky. However, a new flow monitoring program should be conducted to establish more up-to-date representative unit flow rates for this area, as well as the entirety of the system. Furthermore, although the sanitary flow in these sewers exceed their maximum capacity, the rare event also requires an HGL analysis to determine the system's level-of-service, and whether there is a risk of surface or basement flooding. Further downstream, the sewers on Bridge St, Beckwith St and Franklin St, as well as the sewers conveying sewage to the WWTP, are also flowing above their full flow capacity. The sewer on Industrial Ave, which already has a relatively limited capacity under the design event, flows at 128% of its full flow capacity. An HGL analysis should be conducted for both the annual and rare events, as noted in the **Design Basis Memo**.

Based on the model results, the siphon is 15.3% to 22.4% full in existing conditions, depending on the scenario considered. The Town has anecdotally noted that they have recently observed flooding across this siphon (at the upstream MH on McArthur Island, and at the downstream MH on the right bank of the Mississippi River). This, however, is not captured in the modelled scenarios, as the siphon is represented assuming free-flowing gravity conditions only. The HGLs across this siphon should be calculated and assessed with downstream boundary conditions applied to better understand its level-of-service and validate any flooding concerns. If, even with boundary conditions applied, this flooding is not observed within the static hydraulic model, it may be indicative of misrepresented system inflows, which may suggest the need for a new flow monitoring program. Once a static hydraulic model is established and assessed, this can be further explored.

The peak inflow to the Mississippi Quays PS is 50.7 L/s in the design event. This is below, but near, the PS's rated capacity of 52.2 L/s (as per the Certificate of Authorization, dated August 2nd, 1995). Under the annual event, peak inflows to the PS are 44.6 L/s. This flow could theoretically be conveyed by one pump, however, as the annual event seeks to represent a scenario where the PS entirely fails and what the resulting HGL would be, this scenario cannot be fully assessed. Under the rare event, higher I/I leads to peak inflows of 69.0 L/s, which can be conveyed if the PS's 2 pumps are in operation (PS ultimate capacity of 104.4 L/s). Again, this PS is the only PS located along the trunk, and hence is the only one that is assessed within this scope. The performance of other PS's cannot be determined from this trunk-level analysis.

The average dry weather flow to the WWTP is 5,437 m^3/d under the design event. This is within the WWTP dry weather rated capacity of 7,900 m^3/d (as per the Amended Certificate of Approval, issued October 3rd, 2008). The peak wet weather flow is 30,167 m^3/d within the design event, which is similar to historically recorded maximum daily flows of around 30,000 m^3/d, as per the Annual Reports (2017, 2019). The peak wet weather flow to the WWTP of 56,352 m^3/d during the rare event, however, exceeds that of the WWTP's peak wet weather flow capacity of 22,000 m^3/d (as per the Amended Certificate of Approval, issued October 3rd, 2008).

3.2.1.3 Future Sanitary Collection System Assessment

3.2.1.3.1 Future Sanitary Flow Generation

This Master Plan considers 5, 10 and 20-year planning horizons, for which the existing sanitary collection system's capacity was assessed. The design parameters presented in the **Design Basis Memo** were used to project peak sanitary flow in the future planning horizons. The **Design Basis Memo** provides a detailed review of design criteria and level-of-service requirements.

The growth projections were allocated to the downstream receiving trunk MH, based on a visual review of the Town's GIS sewer data with respect to the development areas (illustrated in **Figure 2.1**). The exact location of developments within the major growth areas provided is not known. This would be an important limitation if the local collection system was being analyzed; however, the level of detail suffices for this trunk-level analysis.

Where multiple MH could be receiving flows from a large development area, the most upstream MH along the selected trunk sewer branch was allocated the population and area growth, in order to remain conservative. Exceptions were made if a development area could drain to two different trunk sewer branches. For example, this is the case for Residential District 36, in the northern part of Town, whereby sanitary flow from developments occurring in the western areas would be conveyed to the trunk sewer along High St (i.e., to MH101), whereas flow from developments occurring in the eastern areas would be conveyed to the trunk sewer along Industrial Ave (i.e., to MH205). Since the exact locations of the future developments within these areas are unknown, sanitary flow was equally divided across the selected receiving MH. Furthermore, some development areas near the Highway District (e.g., Rural and Urban Greenfield 50) appeared to be draining to the Highway 7 PS, which conveys flow via a forcemain to Patterson Crescent. In this case, population and area growth was directly allocated to the receiving MH on Patterson Crescent, i.e., MH321. **Table 3.16** provides an overview of the allocation of future developments to the trunk MHs. The detailed resulting population and area growth assigned to each MH, per growth area and per planning horizon is shown in **Appendix D – Table D-3**.

Table 3.16: Allocation of Future Developments to Trunk Maintenance Holes for Sanitary Sewer Analysis

Area	Sub-Neighbourhood	Unit Growth at Buildout	Population Growth at Buildout	Area Growth at Buildout	Receiving Trunk MH ID	Receiving Trunk MH Location
Strategic Properties	Strategic Property-25	108	255	4.20	21	Lake Ave
	Strategic Property-26	100	236	3.80	1	Lake Ave
	Strategic Property-27	55	130	2.10	106	High St
	Strategic Property-29	16	38	0.60	210	Industrial Ave
Residential Districts - Infill	Mississippi Residential Sector-38	17	39	0.73	101	High St
		17	39	0.73	206	Mullett St
	Mississippi Residential Sector-39	10	24	0.45	14	Lake Ave
		10	24	0.45	115	Franklin St
	Mississippi Residential Sector-40	5	11	0.21	112	Bridge St & Franklin St
		5	11	0.21	1	Lake Ave
	Mississippi Residential Sector-44	12	29	0.51	101	High St
	Mississippi Residential Sector-30	9	22	0.38	10	Lake Ave
	Mississippi Residential Sector-31	5	12	0.13	108	High St & Bridge St
	Residential District-35	172	406	7.80	1	Lake Ave
	Residential District-36	61	144	2.76	101	High St
		61	144	2.76	205	Mullett St
	Residential District-41	22	51	0.97	121	Neelin St
		22	51	0.97	316	Hooper St
	Residential District-42	63	149	2.83	21	Lake Ave
	Residential District-43	292	690	13.23	321	Patterson Crescent
	Residential District-45	18	43	0.78	7	Lake Ave
	Residential District-46	81	190	3.64	121	Neelin St

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Area	Sub-Neighbourhood	Unit Growth at Buildout	Population Growth at Buildout	Area Growth at Buildout	Receiving Trunk MH ID	Receiving Trunk MH Location
		81	190	3.64	322	Patterson Crescent
	Residential District-47	13	31	0.56	19	Lake Ave
	Downtown District-33	2	4	0.04	12	Lake Ave
		2	4	0.04	112	Bridge St & Franklin St
Residential Districts - Urban Greenfield	Urban Greenfield-20	176	416	11.70	321	Patterson Crescent
	Urban Greenfield-30	22	52	1.40	321	Patterson Crescent
	Urban Greenfield-40	33	78	2.10	7	Lake Ave
	Urban Greenfield-50	679	1603	45.24	321	Patterson Crescent
Residential Districts - Intensification Sites	Intensification-10	54	127	2.80	205	Mullett St
		54	127	2.80	108	High St & Bridge St
	Intensification-20	8	19	0.40	121	Neelin St
	Intensification-30	33	78	1.70	7	Lake Ave
	Intensification-40	4	10	0.20	121	Neelin St
Settlement Boundary - Rural Greenfield	Rural Greenfield-10	450	1062	39.70	101	High St
	Rural Greenfield-50	219	517	19.30	310	Hooper St
Active Development Applications	Bodnar Lands	582	1374	24.96	1	Lake Ave
	Carmichael Farm Phase 2	323	763	10.28	321	Patterson Crescent
	Carmichael Farm Phase 1	24	57	10.28	321	Patterson Crescent
	NuGlobe Developments	128	303	7.20	321	Patterson Crescent

Area	Sub-Neighbourhood	Unit Growth at Buildout	Population Growth at Buildout	Area Growth at Buildout	Receiving Trunk MH ID	Receiving Trunk MH Location
	Strategic Property (McArthur Island)	595	1405	5.00	214	McArthur Island
	LCHC - 7 Arthur St	20	48	0.30	13	Lake Ave
	119 Bell St	51	121	0.13	208	Mullett St & Rosamond St
	127 Boyd	32	76	0.31	7	Lake Ave
	Millers Crossing (remaining lots)	114	270	5.53	321	Patterson Crescent
	Highway 7 behind Canadian Tire	152	359	9.84	321	Patterson Crescent
	Stoneridge Manor Long-Term Care Home	128	303	2.40	312	Hooper St

The sanitary sewer spreadsheet was updated to include flow calculations for the growth areas at the receiving MHs, in addition to the existing (2021) flow. For each planning horizon and scenario (design, annual, rare), a spreadsheet was produced, and flow was calculated using the corresponding growth projections and design parameters. These can be found in **Appendix D – Table D-7** to **Table D-15**

Appendix D – Table D-2 provides a summary of calculated flows and capacities. **Appendix D – Figure D-2** (2026), **Figure D-3** (2031) and **Figure D-4** (2041) provide an illustration of the sewer capacity utilization for each planning horizon during the design event.

3.2.1.3.2 Short-Term Planning Horizon (2026)

Appendix D - Figure D-2 illustrates the sewer capacity utilization for the short-term planning horizon (2026). The results in the short-term planning horizon are similar to the existing conditions under all three events in terms of sewer capacities. The sewer capacity constraints in the rare event persist, however limited conclusions can be drawn, as the resulting HGLs are unavailable.

Peak WWF inflows to the Mississippi Quays PS are projected to exceed the PS's rated capacity of 52.2 L/s (with the largest pump out of service) in the design event (53.0 L/s), which signals a need to consider increasing capacity within the short-term planning horizon. However, this flow can be conveyed when the second pump is also in operation, the PS's ultimate capacity being 104.4 L/s. In the annual event, peak WWF inflows of 46.1 L/s are within the PS's rated capacity, however noting that the HGLs should rather be assessed for this event under pump station failure conditions. In the rare event, peak WWF inflows increase to 70.8 L/s, which can be conveyed when the second pump is also in operation.

The average dry weather flow to the WWTP is 6,692 m^3/d under the design event. This is within the WWTP dry weather rated capacity of 7,900 m^3/d. Peak total WWF to the WWTP is projected to reach 34,164 m^3/d in the design event, which exceeds the WWTP's peak wet weather flow of 22,000 m^3/d as well as historical maximum daily flows recorded in years with major wet weather events, such as in 2017 and 2019.

3.2.1.3.3 Medium-Term Planning Horizon (2031)

Appendix D - Figure D-3 illustrates the sewer capacity utilization for the medium-term planning horizon (2031). The results in the medium-term planning horizon are similar to existing conditions and the short-term horizon in terms of capacities in the design and annual event. Additional sewer capacity constraints in the rare event start occurring along McNeely Ave (Hooper St), and along Patterson Crescent to the WWTP.

Peak WWF inflows to the Mississippi Quays PS are projected to exceed the PS's rated capacity of 52.2 L/s (with the largest pump out of service) in the design event (57.4 L/s). In the annual event, peak WWF inflows of 49.1 L/s are within the PS's rated capacity, however noting that the HGLs should rather be assessed for this event under pump station failure conditions. In the rare event, peak WWF inflows increase to 75.4 L/s, which can be conveyed when the second pump is also in operation, since the PS's ultimate capacity is 104.4 L/s.

The average dry weather flow to the WWTP is 7,789 m^3/d under the design event. This approaches the WWTP dry weather rated capacity of 7,900 m^3/d, indicating potential constraints in the WWTP's capacity past the medium-term. Peak total WWF to the WWTP is projected to reach 37,797 m^3/d in the design event, which exceeds the WWTP's peak wet weather flow of 22,000 m^3/d as well as historical maximum daily flows recorded in years with major wet weather events, such as in 2017 and 2019.

3.2.1.3.4 Long-Term Planning Horizon (2041)

Appendix D - Figure D-4 illustrates the sewer capacity utilization for the long-term planning horizon (2041). In the long-term, it is expected that sections of the existing trunk sewers will exceed their capacities in the design event. This is the case along High St, where the sewers appear to experience high I/I under existing conditions. As mentioned previously, a new flow monitoring program would help assess the I/I within these sewers (and others throughout the system), to confirm whether they require upsizing to increase their capacity in the long-term. The sewers along Patterson Crescent, and conveying sewage to the WWTP, are also projected to exceed their capacity limits.

Peak WWF inflows to the Mississippi Quays PS are projected to exceed the PS's rated capacity of 52.2 L/s (with the largest pump out of service) in the design event (66.0 L/s). In the annual event, peak WWF inflows of 55.5 L/s also exceed the PS's rated capacity, however noting that the HGLs should rather be assessed for this event under pump station failure conditions. In the rare event, peak WWF inflows increase to 85.2 L/s. Nevertheless, these flows can be conveyed when the second pump is also in operation, since the PS's ultimate capacity is 104.4 L/s.

Average DWF is projected to reach 9,434 m^3/d in the design event, exceeding the WWTP's dry weather rated capacity of 7,900 m^3/d. Peak total WWF to the WWTP is projected to reach 44,016 m^3/d in the design event, which is double the WWTP's peak wet weather flow capacity (22,000 m^3/d).

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Table 3.17: Summary of Calculated Flows and Sewer Capacity Utilization for Future Planning Horizons

	2026			2031			2041		
	Design	**Annual**	**Rare**	**Design**	**Annual**	**Rare**	**Design**	**Annual**	**Rare**
Residential Population (people) (1)	17,061			20,231			25,097		
ICI Equivalent Population (people)	468			468			468		
Total Population + ICI Equivalent Population (people) (1,2)	17,528			20,698			25,564		
Total Additional ICI Area (ha) (1)	7			14			23		
Total Area (ha) (1)	653			715			835		
Average DWF (m^3/d)	6,692	6,268	6,268	7,789	6,991	6,991	9,434	8,085	8,085
Peak DWF (m^3/d) (3)	15,532	12,597	12,597	17,416	13,675	13,675	20,208	15,298	15,298
Peak Extraneous Flow (m^3/d)	18,632	17,640	48,236	20,381	19,245	51,538	23,808	22,696	65,459
Peak Total Flow (m^3/d)	34,164	30,237	60,833	37,797	32,920	65,213	44,016	37,994	80,757
Number of Sewers Surcharged (-)	0	0	20	0	0	31	9	3	43
Average Sewer Capacity Used (%)	42.5%	37.6%	83.0%	46.7%	40.6%	87.9%	55.3%	47.6%	113.6%
Max Sewer Capacity Used (%)	95.0%	83.3%	342.2%	95.0%	83.3%	350.0%	109.7%	107.2%	536.5%
Mississippi Quays PS Peak Inflow (L/s) (4)	53.0	46.1	70.8	57.4	49.1	75.4	66.0	55.5	85.2

Notes:

(1) Residential population, ICI area and total area growths as described in **Design Basis Memo** and summarized in **Section 1.4**.
(2) ICI equivalent population only for existing conditions (2021); ICI growth in future horizons in terms of area (ha), as indicated in Total Additional ICI Area (ha) row.
(3) Harmon peaking factor correction factor of 0.8 in the design event; 0.6 in the annual and rare events. See **Design Basis Memo**.
(4) Mississippi Quays PS rated capacity: 52.2 L/s; ultimate capacity: 104.4 L/s (Certificate of Authorization, dated August 2nd, 1995).

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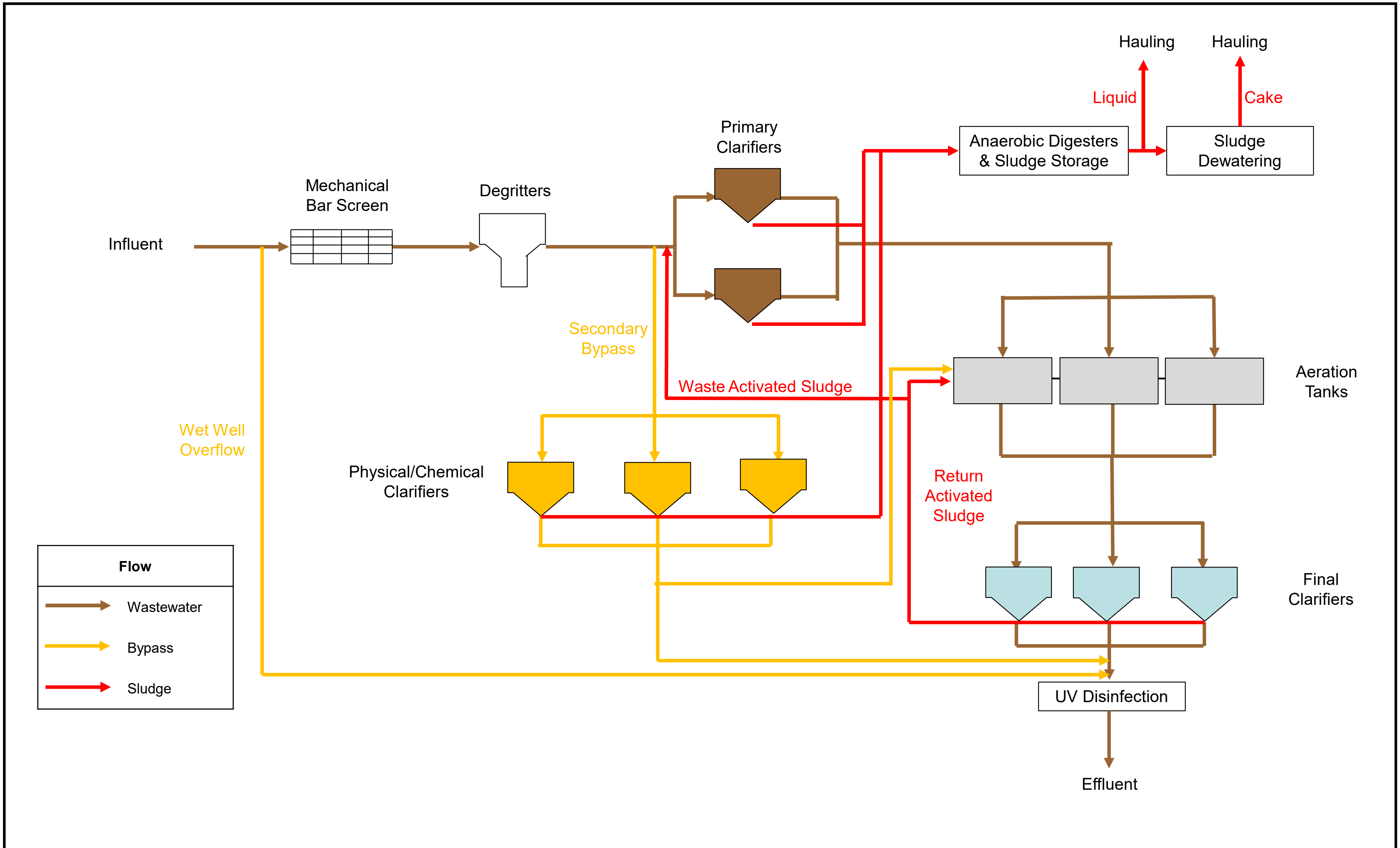
3.2.2 Wastewater Treatment Plant

3.2.2.1 Existing Conditions

The existing WWTP has a rated capacity of 7,900 m^3/d annual average flow and a peak design flow of 22,000 m^3/d. The plant is considered a conventional activated sludge plant with base flow treatment through complete works for flows up to 10,400 m^3/d and excess wet weather flows greater than this passing through physical/chemical clarifiers for enhanced primary treatment. The plant operates under the *Carleton Place Water Pollution Control Plant* CofA (ECA) No. *5001-7FZT4A* (MOE, October 3, 2008), included in **Appendix J**. Refer to **Figure 3.9** for an aerial view of the existing CP WWTP. A process flow diagram description is provided in **Figure 3.10**. The Facility Optimization Report in **Appendix K** provides further details on the plant processes. A review of the existing plant flows and loadings is provided in the **Design Basis Memo**, along with the proposed design parameters for future conditions**.**

Figure 3.9: Carleton Place WWTP Aerial View



Stantec	Town of Carleton Place 2021 Water & Wastewater Master Plan	**Town of Carleton Place Wastewater Treatment Plan Process Flow Diagram (Adapted from OCWA, 2020)**	**Date: October 2021**	**Figure: 3-10**

3.2.2.2 Design Flows

Based on the population projections presented in **Section 2** and the design criteria outlined in the **Design Basis Memo**, the WWTP's future design flows were calculated, as shown in **Table 3.18**. For a 20-year planning horizon, the design average daily flow is 10,625 m^3/d, hence an expansion of the plant's rated capacity of 2,725 m^3/d (i.e., a 35% increase in capacity) would be required.

Table 3.18: WWTP Existing and Future Design Flows

Year	Population	Per Capita Flow (L/cap/d)	Design Flow (m^3/d)
2021	13,500	500	6,750
2026	17,500	480	8,400
2031	20,500	460	9,430
2041	25,000	425	10,625

Figure 3.11 shows the projected population and WWTP flows. It is projected that the WWTP will reach 90% of its rated capacity (7,110 m^3/d) in 2022 with a Town population of ~14,400 and will reach its rated capacity (7,900 m^3/d) in 2024-2025 with a Town population of ~16,300, i.e., within the 5-year planning horizon.

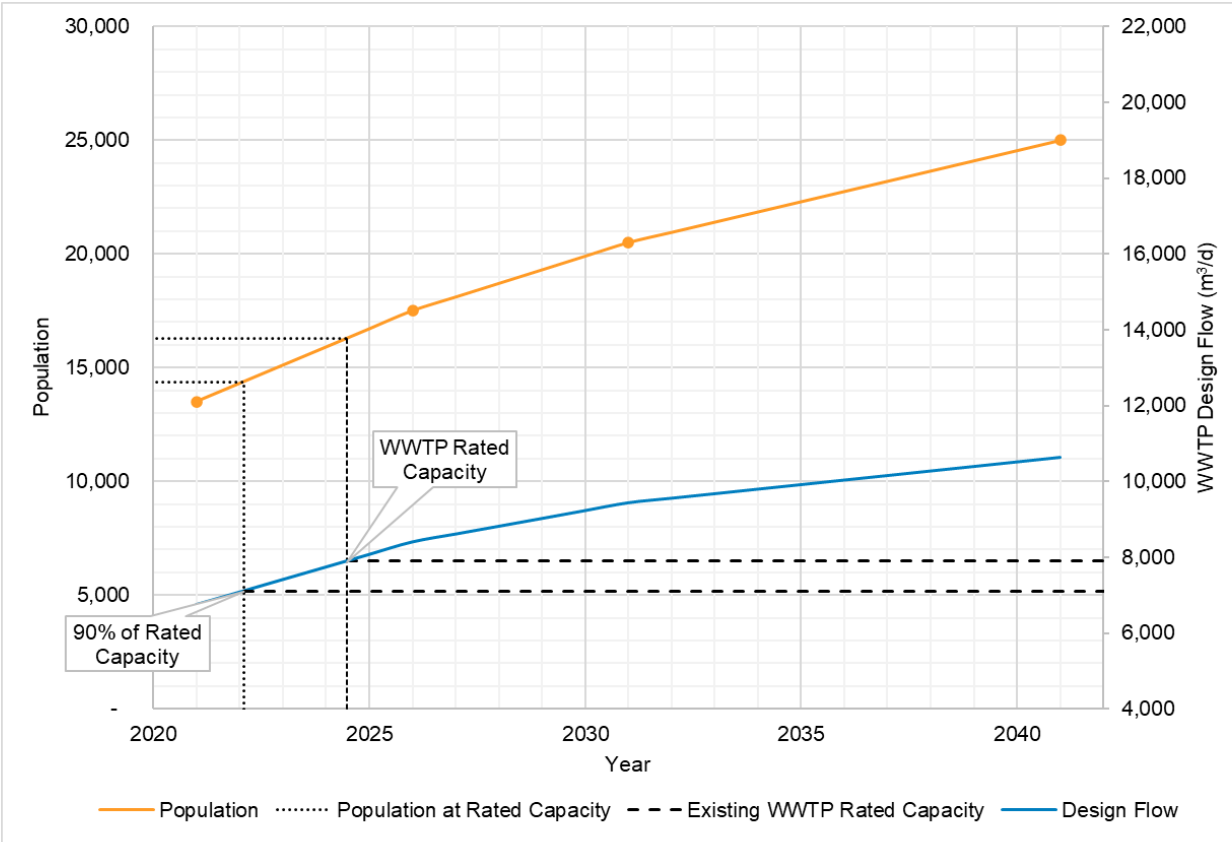


Figure 3.11: WWTP Rated Capacity and Design Flow Projections

3.2.2.2.1 Comparison of Future Flow Projections

Comparisons between these future flow projections and those in past Master Planning reports for the Town are summarized in **Table 3.19**.

The *Addendum to the August 2011 Water Pollution Control Treatment Plant Capacity Expansion Master Plan* (J.L. Richards, 2018) also estimated 90% capacity would be reached during 2022, however, the total capacity would not be reached until 2027. The difference is in the accelerated population growth rate that has been observed in recent years since the 2018 report by JLR. It should be noted that the JLR study assumed a higher per capita waste generation of 1.309 m3/d/unit (or 524 L/c/d assuming 2.5 persons per unit) for future projections. This is compared with the current study which assumed 500L/c/d for existing homes and 350L/c/d for new developments. Per capita waste generation rates have decreased considerably in recent years, as shown in the **Design Basis Memo**, are anticipated to continue declining due to reduced influence from inflow and infiltration (i.e., newer, less leaky sewers with fewer potential inflow points).

For further comparison, the *Water Pollution Control Plant Capacity Expansion Master Plan* (Stantec Consulting Ltd., August 2011) estimated that 90% of the current capacity would be reached in 2020 with a population of 11,472 and the total rated capacity reached in 2029 at a population of 12,746. These differences illustrate that the growth projections in the 2011 Master Plan were less aggressive than current estimates, however the previous studies assumed higher and constant wastewater generation rates (619 L/c/d).

Table 3.19: Comparison of WWTP Expansion Studies

	2021 W&WW Master Plan	2011 Master Plan	2018 Addendum
Existing Plant Rated Capacity (m^3/d)	7,900		
Year Reached	2024-2025	2029	2027
Population at Rated Capacity	16,300	12,746	- (1)
90% of Plant Rated Capacity (m^3/d)	7,110		
Year Reached	2022	2020	2022
Population at 90% of Rated Capacity	14,400	11,472	- (1)
Wastewater Generation Rate for Existing Developments (L/c/d)	500	619	524 (2)
Wastewater Generation Rate for Future Developments (L/c/d)	350	619	524 (2)

Notes:

(1) JLR 2018 wastewater generation projections based on number of units, no population specified.
(2) Rate of 1.309 m3/unit converted to L/c/d using a population density of 2.5 PPU.

3.2.2.2.2 Future Wet Weather Flow Capacities

Given the high wet weather flows experienced at the plant, continuing the current wet weather flow treatment strategy is recommended to maintain stable secondary and tertiary treatment operation and performance. Historical flows for the period of 2017 to 2019 are shown below in **Figure 3.12**.

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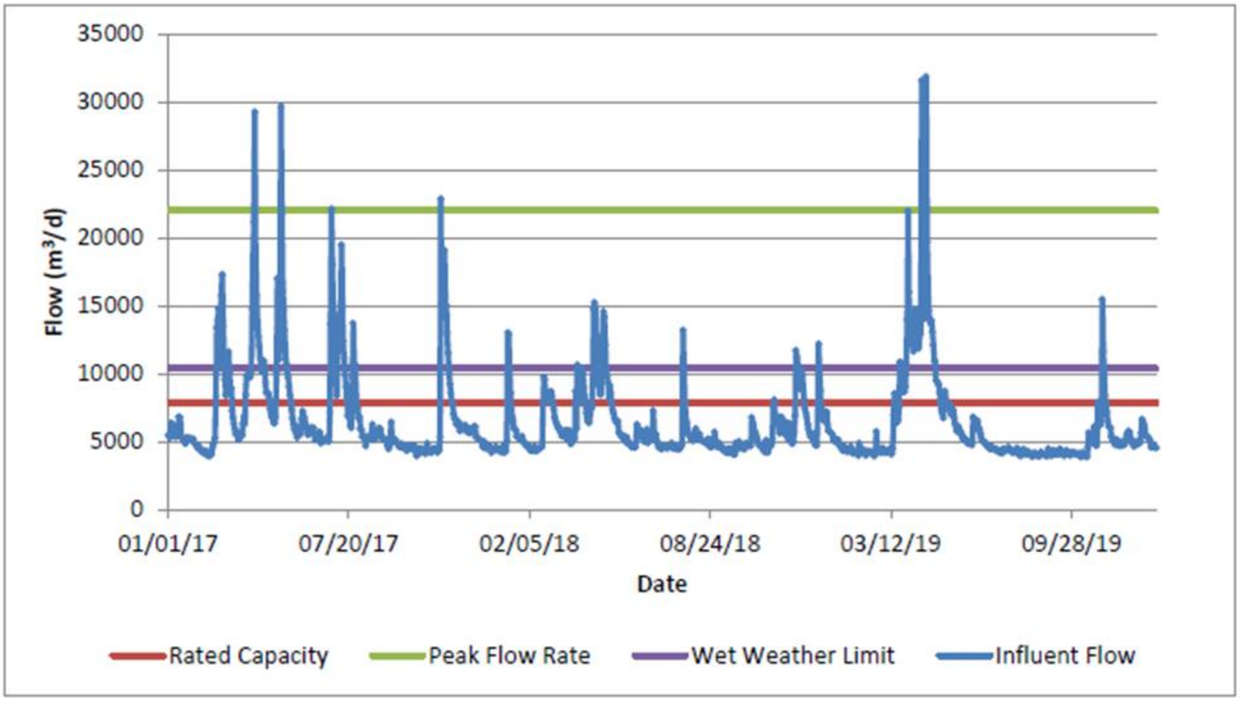


Figure 3.12: Total Daily Influent Flows for the Carleton Place WWTP for 2017-2019 (source: OCWA FOP Report)

The average flow for this period was 6,541 m^3/d with maximum daily flows recorded as high 31,856 m^3/d during wet weather conditions. The data shows that the peak flow capacity of the Phys/Chem system was met or exceeded on seven (7) occasions during this timeframe. The data also reveals extended periods of time of weeks/months duration when the influent flows are consistently higher than the wet weather threshold of 10,400 m^3/d (e.g., March-April 2019, likely related to Spring melt). In addition, the year 2020 Annual Report flow data for the plant is consistent with the year 2017-2019 period with annual average flow of 6,118 m^3/d and a max day flow of 22,111 m^3/d.

Based on the assessment of the sanitary collection system, peak WWF sanitary flows are projected to exceed 34,000 m^3/d under the design event in 2026 and exceed 44,000 m^3/d in 2041. In comparison, a peaking factor of 4.0, as noted in the Design Basis Memo, corresponds to a similar peak hourly flowrate of 42,500 m^3/d. This value will be considered in the evaluation of alternatives and the plant expansion design. In rare events, peak flows are projected to reach 80,757 m^3/d in 2041. This rare event is not a design condition but illustrates potential impacts of climate change on the system.

The plant's wet weather flow treatment capacity of 10,400m^3/d represents the ability to accept flows through the normal treatment train before requiring bypass to the physical/chemical clarifier system, which can accommodate excess peak flows of up to

11,600m^3/d (total plants flows of 22,000m^3/d). At time of writing, we anticipate that these wet weather and peak flow capacities will increase proportionally to the overall plant rated capacity. Applying the same 35% increase in rated capacity to the wet weather flow capacity and the peak flow capacity results in capacities of 14,040 m^3/d and 29,700 m^3/d, respectively. **Table 3.20** shows a comparison of the existing and required plant capacity for the 20-year planning horizon.

Table 3.20: Comparison of Existing and Required Plant Capacity

	Existing Plant Capacity (m^3/d)	Required Plant Capacity (m^3/d)
Rated	7,900	10,625
Wet Weather Flow (1)	10,400	14,040
By-Passed Flow (1)	11,600	15,660
Peak Flow (1)	22,000	29,700

Notes:

(1) Wet weather flow and peak flow (and by-passed flow) assumed to increase proportionally to future rated capacity (increase by 35%).

3.2.2.3 Effluent Limits and Objectives

The current plant effluent limits and objectives are present in **Table 3.21** below and in the existing CofA under **Appendix J**.

Table 3.21: Current Effluent Limits and Objectives

	ECA		ECA Limits					
	CofA Table 4		Table 1		Table 2		Table 3	
	Effluent Limits		Effluent Objectives during Dry Weather Conditions		Effluent Objectives for Physical/Chemical Treatment Process during Wet Weather Conditions		Effluent Objectives at Peak Flow Rate Condition	
	CofA Table 4		CofA Table 1		CofA Table 2		CofA Table 3	
Flow (m^3/d)	22,000		10,400		11,600		22,000	
Parameter Period	**Average Concentration**	**Average Waste Loading**	**Concentration Objective**	**Waste Loading Objective**	**Concentration Objective**	**Waste Loading Objective**	**Concentration Objective**	**Waste Loading Objective**
	(mg/L)	(kg/d)	(mg/L)	(kg/d)	(mg/L)	(kg/d)	(mg/L)	(kg/d)
cBOD5 Year-round	25.0	550	15	156	28	325	21.9	481
TSS Year-round	25.0	550	15	156	28	325	21.9	481
TP Sept 1-May 31	1.0	22	0.75	7.8	1.1	12.8	0.94	20.6
TP June 1-Aug 31	1.0	22	0.75	7.8	1.1	12.8	0.94	20.6
TAN June 1-Aug 31	4.0	88	2	20.8	-	-	-	-
TAN Sept 1-Mar 31	4.0	88	2		-	-	-	-
TAN Apr 1-May 31			2		-	-	-	-
E Coli			200 organisms/ 100 mL		-	-	-	-

Prior to completing the *Water Pollution Control Plant Capacity Expansion Master Plan* (Stantec Consulting Ltd., August 2011), Stantec completed a Receiving Water Assessment (RWA) to determine future effluent loading limits to the Mississippi River (*Receiving Water Assessment Review for Carleton Place Water Pollution Control Plant Discharge to Mississippi River,* Stantec Consulting Ltd., May 2009). The Receiving Water Assessment determined effluent concentration limits for the plant that were reviewed with the MECP and based on a future plant capacity of 10,000 m^3/d. Following pre-consultation discussions with the MECP as part of the current Master Plan, Stantec completed a new Assimilative Capacity Study (ACS) to determine new proposed effluent limits. The new ACS will be appended to the Phase 2 Master Plan Report.

3.2.2.4 Plant Loadings

The design loads to the plant are presented in **Table 3.22** and are based on the future per capita design loading rates that were selected in the **Design Basis Memo**. These values will be used during future design stages to size plant processes.

Table 3.22: WWTP Existing and Future Design Loads

Per Capita Design Loading Rates			
BOD5	TSS	TKN	TP
(g/cap/d)	(g/cap/d)	(g/cap/d)	(g/cap/d)
70	105	18	2.6

Year	Population	WWTP Design Loads			
		BOD5	TSS	TKN	TP
		(kg/d)	(kg/d)	(kg/d)	(kg/d)
2021	13,500	945	1,418	243	35
2026	17,500	1,225	1,838	315	46
2031	20,500	1,435	2,153	369	53
2041	25,000	1,750	2,625	450	65

3.2.2.5 Other Challenges and Constraints

The sections above describe the remaining treatment capacity of the plant and projected future wastewater flows and generation rates, which form the primary need for expansion of the facility or investigating other ways to reduce future contaminant loadings to the Mississippi River. In relation to this, there are several challenges and constraints related to the system that should be considered during the evaluation of alternatives, including:

- Existing space constraints to add new tanks and/or buildings for a process expansion
- Existing floodplain limits that may further limit land available for expansion
- Existing yard piping and utility corridor conflicts
- Managing excess wet weather flows through wet weather treatment, whether continued use of phys/chem clarifiers, or other technology, to operate stable secondary and tertiary treatment processes in future
- New tertiary filtration will be required to meet new monthly non-compliance TP limits < 0.2 mg/L in the summer months. This would include additional processes such as sand filtration, cloth media filter disks or enhanced sedimentation. Finding suitable space and sufficient hydraulic head for the new process may be challenging
- Operators have had difficulty meeting target dissolved oxygen levels
- New nitrification processes may be required to meet stricter TAN effluent concentration limits
- Integrating/adding new primary digester volume to the existing digester complex and adding a new dewatering process may be challenging
- The UV disinfection channel has been identified as a hydraulic bottleneck during high flow period

4 Climate Change Considerations

Climate change can lead to more frequent and/or more intense extreme weather events, which can stress the sanitary and water infrastructure. For the Town of Carleton Place, notable events include the very wet spring of 2017 and 2019 (stressing the WWTP) and the very dry summer of 2016 (stressing the WTP).

With climate change leading to highly variable conditions, adaptation measures may be required in the future to ensure the infrastructure's resiliency and mitigate the impact of extreme weather events. Climate change and the potential impact to infrastructure is highly uncertain. This uncertainty should be considered in engineering planning and design initiatives.

The *Resiliency Plan – Water Treatment Plant* (J.L. Richards, 2018) and the *Resiliency Plan – Wastewater Treatment Plant* (J.L. Richards, 2018) relate to climate change and water infrastructure resiliency for the Town of Carleton Place.

Both studies concluded that some of the infrastructure required to accommodate population growth could also contribute to enhancing the facilities' resiliency to climate change. Measures to enhance the treatment facilities' resiliency were also presented.

4.1 Historical Trends & Projections

Climate can be described by many variables, most often by temperature, precipitation and wind-related parameters. **Table 4.1** shows the historical means, trends and projected trends in average total precipitation and average mean temperature for Pembroke (nearest climate data region in the Climate Atlas of Canada (Prairie Climate Centre, 2019)). The historical and projected timeseries are illustrated in **Figure 4.1** (annual mean temperature) and **Figure 4.2** (annual total precipitation). In general, total precipitation has historically been increasing, and is projected to keep increasing, notably in winter and spring; however, summer precipitations are projected not to vary. Mean temperature has historically been increasing and is projected to continue increasing at a faster rate, with winter and spring temperature showing the largest range of increase.

Table 4.1: Historical Means, Trends and Projected Trends in Total Precipitation and Mean Temperature

	Total Precipitation			Mean Temperature		
	Baseline Average (1976-2005)	**Historical Trend (1950-2013)**	**Projected Trend (1) (2021-2050) (2)**	**Baseline Average (1976-2005)**	**Historical Trend (1950-2013)**	**Projected Trend (2021-2050)**
Annual	838 mm	+120 mm	+60 mm (-90 mm to +210 mm)	5.1°C	+1.1°C	+2°C (+1°C to +4°C)
Spring	195 mm	+30 mm	+20 mm (-50 mm to +100 mm)	4.4°C	+1.6°C	+2°C (-1°C to +5°C)
Summer	225 mm	+32 mm	0 mm (-80 mm to +90 mm)	18.3°C	+1.0°C	+2°C (+1°C to +4°C)
Fall	233 mm	+54 mm	+10 mm (-70 mm to +90 mm)	7.2°C	+0.2°C	+2°C (+1°C to +4°C)
Winter	185 mm	+12 mm	+20 mm (-40 mm to +90 mm)	-9.6°C	+1.5°C	+2°C (-1°C to +6°C)

Source: Prairie Climate Centre (2019). Climate Atlas of Canada, version 2 (July 10, 2019). https://climateatlas.ca

Notes:

(1) Projected trends with respect to the 1976-2005 baseline average. Average trend from multiple climate model projections is shown, with the range of values representing the high (90th percentile) and low (10th percentile) of the projections. Climate projections are based on the representative concentration pathway (RCP) scenario RCP 8.5.

(2) Beyond 2021-2050, trends may vary depending on model projection scenarios, based on GHG emissions and other factors.

Besides trends in total precipitation and mean temperature, trends in extreme precipitation and temperature-related events are also relevant for water infrastructure and should be considered. Additionally, although limited historical information and no projections are available for wind-related variables in the region at this time, their impacts should be considered, as was done in the JLR resiliency studies (e.g., possible power outages at the treatment plants and pumping stations).

Changes in climate are tied to changes in water resources. The resiliency studies by JLR also presented flows recorded in the Mississippi River, at a downstream gauging station in Appleton. They show that, in the period from 1922 to 2017, the very dry summer of 2016 led to the lowest flows recorded in the river. They also present modelled flow projections by the Mississippi Valley Conservation Authority (MVCA). Based on these projections, they predict that river flows below those recorded in 2016 could occur. Peak flows under wet weather conditions should remain below historical peaks and are not expected to require special flood protection measures at the WTP and WWTP.

Figure 4-1: Annual Total Precipitation in the Region of Pembroke - Historical and Projected (Data Source: Prairie Climate Centre, 2019)

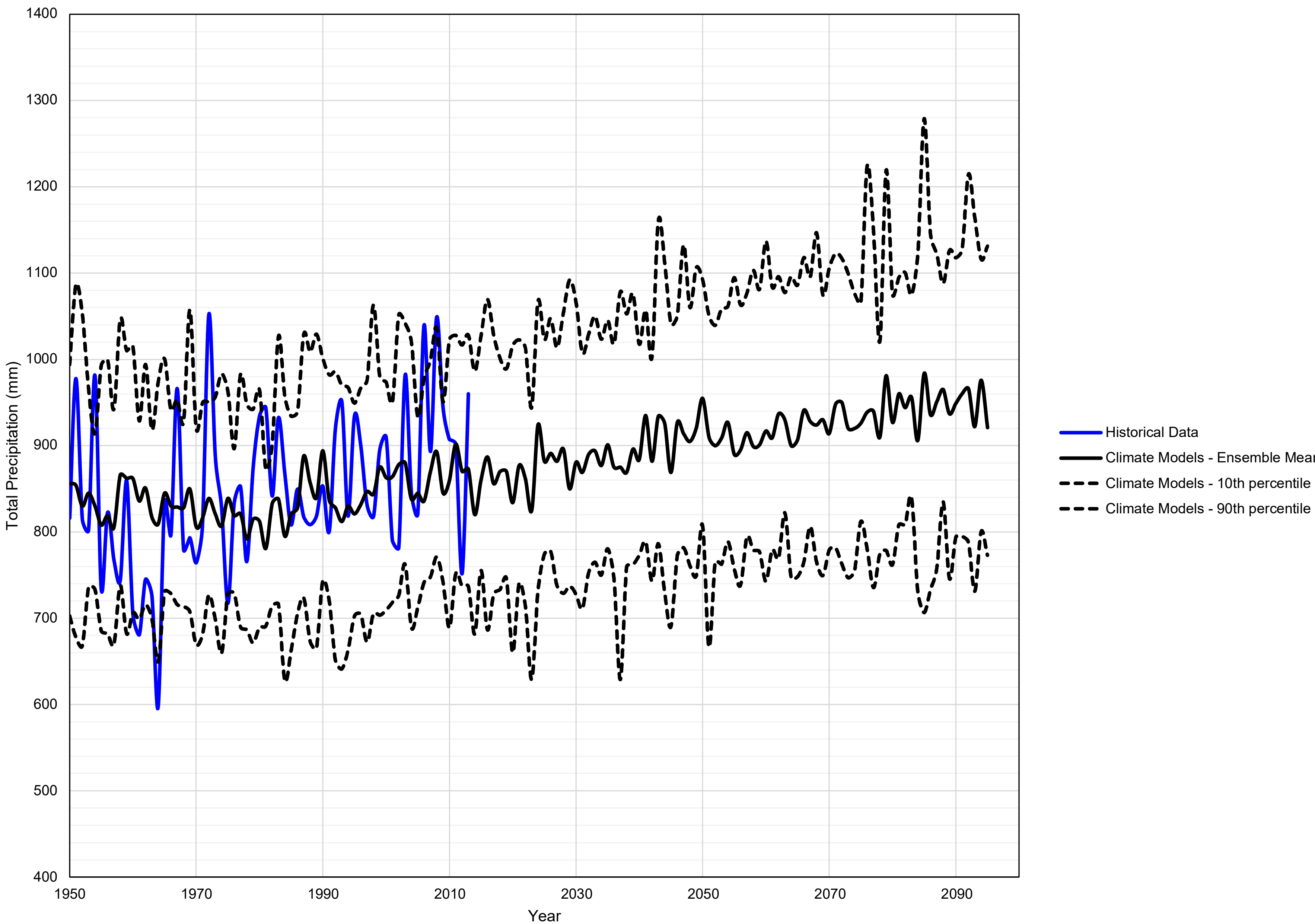
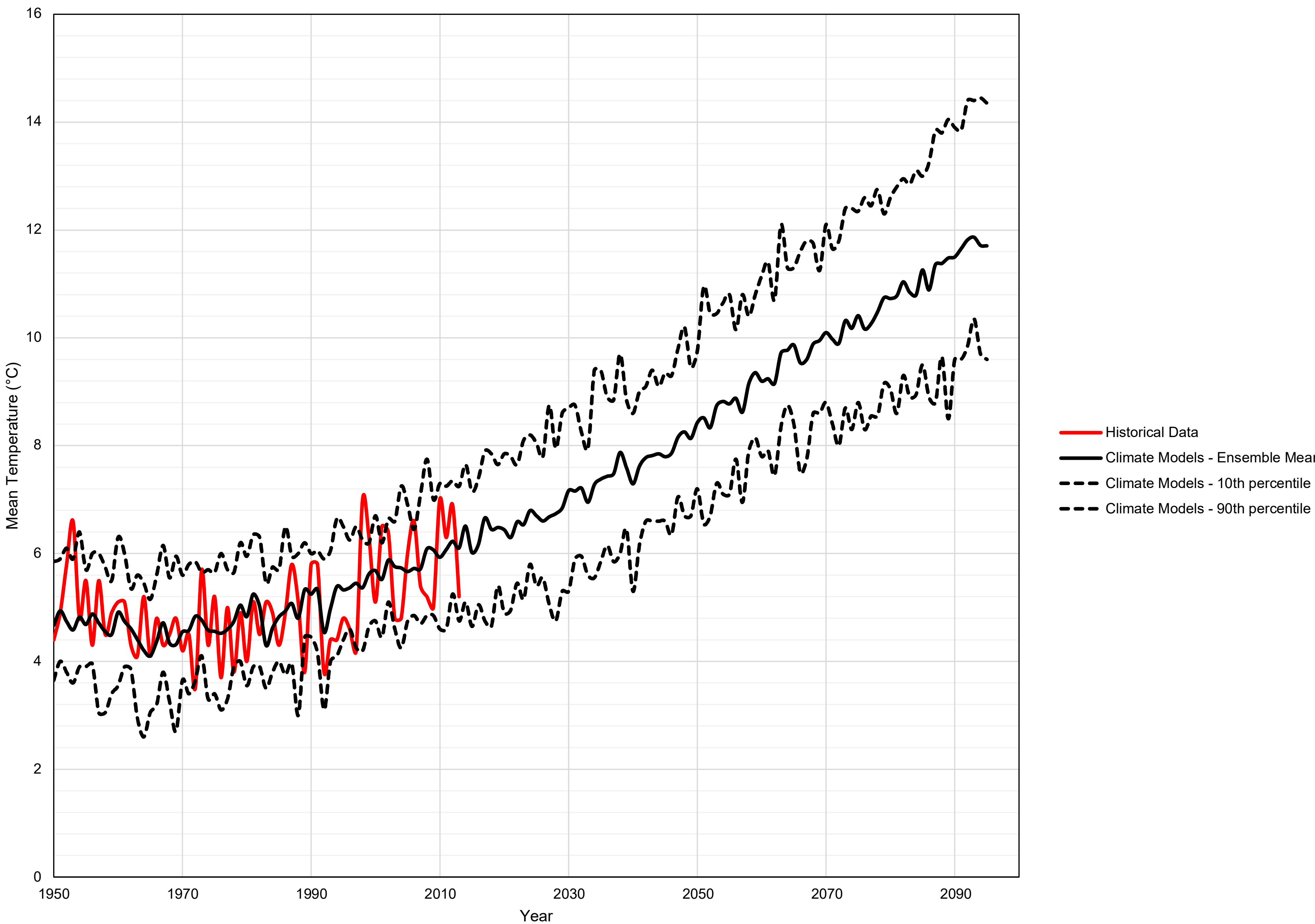


Figure 4-2: Annual Mean Temperature in the Region of Pembroke - Historical and Projected (DataSource: Prairie Climate Centre, 2019)



4.2 Climate Change Impacts

The 2014 Provincial Policy Statement issued under the Planning Act provides Policy 3.1.3, which “Requires consideration of the potential impacts of climate change that may increase the risk associated with natural hazards (e.g., flooding due to severe weather)”. To complement its policy statement, the MECP has issued a guidance on “Considering climate change in the environmental assessment process” (2017). Furthermore, Appendix 2 of the Municipal Class EA Manual (2015) requires that potential adverse environmental effects, including drought, increased flooding, changes in water levels, increases in surface water runoff due to extreme weather events and climate change, be addressed during the planning and design process.

Table 4.2 presents some potential impacts of climate change and extreme weather events on water infrastructure, in part based on the resiliency plans by JLR, with additional considerations. Although this does not constitute a full vulnerability assessment of the Town’s water infrastructure to climate change, planning and design initiatives should include consideration for these elements.

The analysis of the wastewater collection system in **Section 3.2.1** included an assessment of the rare event scenario. This scenario is intended to represent rare wet weather events under extreme precipitation conditions, which may become more frequent (or more intense) with climate change. The results showed capacity constraints in sewer sections, although an HGL analysis was not available to identify potential risks of surface or basement flooding. Furthermore, the increased I/I rates could not be validated with more recent flow monitoring data. Given the influence of climate change on precipitation events, there is a need to understand the wastewater collection system’s I/I, in order to inform the sewer capacity and HGL analyses under extreme events.

Table 4.2: Potential Impacts of Climate Change and Extreme Weather Events on Water and Wastewater Infrastructure

	Precipitation Increase	Precipitation Decrease	Temperature Increase	Other Events
Potential Impacts on WTP	Increased runoff's impact on source water quality Flooding during higher flows	Low flow impact on water intake and water quality Constraints on water intake	Increase in water demand Water quality issues	Formation of frazil ice at intake structure during low water levels Rainstorms impact on water turbidity Severe storms interrupting deliveries Severe storms leading to power outages
Potential Impacts on Water Distribution			Increase in water demand Chlorine depletion	Impact of freeze-thaw cycles on linear infrastructure
Potential Impacts on Sanitary Collection System	Increased peak flow during wet weather events	Insufficient flushing velocity	Potential for odour issues	Impact of freeze-thaw cycles on linear infrastructure Severe storms leading to power outages at pumping stations
Potential Impacts on WWTP	Increased peak inflow during wet weather events Flooding during higher flows	Lower river flows and impact on effluent limits	Impact on aeration system Odour generation Melts requiring wet weather treatment	Severe storms interrupting deliveries Severe storms leading to power outages Severe storms leading to increased inflow during wet weather events

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5 Conclusions and Next Steps

The assessment of the **water treatment plant** (WTP)'s raw water intake capacity shows that current maximum day needs are nearing the WTP's rated capacity. However, average day water intake needs remain within the WTP's rated capacity until 2040, near the 20-year planning horizon. An expansion of approximately 20,700 m^3/d is needed in the long-term to accommodate population growth. Additional constraints in individual treatment steps were identified based on discussion with OCWA operators and site observation.

The current firm capacity of the high lift pumps at the WTP will suffice to supply total maximum day demand over a 15-year horizon, past which expansion will be required to accommodate future growth. The maximum day demand over a 20-year horizon is expected to reach 208.5 L/s (18,000 m^3/d), which should be considered in the expansion of the high lift pumps' firm capacity.

Based on the assessment of the **potable water distribution system**, pressures are expected to generally decrease with growth, however they remain within the pressure objectives. Areas with limited fire flow (< 60 L/s) were identified. Under existing conditions, these areas are mostly located north of the Mississippi River, where the conveyance of fire flow is limited due to constraints in the size of the watermains crossing the river and higher head losses in the watermains, as well as being supplied by dead-end watermains. Assessing the water distribution system under future growth conditions, the existing fire flow deficiencies will persist in the same areas.

The analysis of the storage capacity shows an existing storage deficit of 373 m^3. For a 20-year planning horizon, an additional storage volume of 4,926 m^3 will be required, to accommodate population growth in the Town. Given existing storage volume constraints, which increase in the intermediate planning horizons, additional storage will be required within the short-term (5-year) planning horizon. Additional storage recommended in previous studies can provide sufficient fire flow, maximum day equalization and emergency storage for approximately 11 years, as fire flow requirements significantly increase as population increases, based on the MECP values. In comparison, using fire flow values provided by the FUS method, existing storage will be sufficient until 2025, and future additional storage should provide for the Town's fire flow and maximum day storage needs beyond the 20-year planning horizon. Additionally, given the WTP's high-lift pumps' current capacity, it is possible to maintain the tank's operating ranges between 40% and 90% full. However, along with increasing the pump capacities, future pump setpoints would have to be adjusted to maintain the elevated tank storage volume between within this operating range.

Based on the assessment of the **sanitary collection system** under existing and growth conditions, capacity constraints were identified along High St and Patterson Crescent in the 20-year planning horizon. The sewers along High St were previously identified as experiencing high I/I, hence the use of higher extraneous flow rates as suggested in the City of Ottawa's Technical Bulletins. These higher extraneous flow rates, however, have not been validated with recent flow monitoring data. Other sewer sections also flow above their full flow capacity in the annual and rare events over earlier planning horizons; however, the degree of surcharge cannot be quantified due to the absence of an HGL analysis.

The spreadsheet analysis, as it currently stands, has limited ability to represent special structures. Indeed, the siphon crossing the Mississippi River, east of McArthur Island, is represented by a single continuously downward sloping pipe which flows at less than its full capacity, however this does not capture flooding previously reported by the Town. Pumping stations are assumed to convey flow without restrictions, and hence their failure (e.g., in the annual event scenario) cannot be completely assessed.

The Mississippi Quays PS is the only pumping station along the trunk sewer that was analyzed. Peak WWF inflows to this pumping station are projected to exceed the PS's rated capacity of 52.2 L/s (with the largest pump out of service) in the design event (53.0 L/s), which signals a need to consider increasing capacity within the short-term planning horizon. However, this flow can be conveyed when the second pump is also in operation, the PS's ultimate capacity being 104.4 L/s. In the annual event, peak WWF inflows of 55.5 L/s also exceed the PS's rated capacity in the 20-year planning horizon, however the HGLs should rather be assessed for this event under pump station failure conditions. In the rare event, peak WWF inflows increase to 85.2 L/s in the 20-year planning horizon, which can be conveyed when the second pump is also in operation.

Average DWF to the WWTP under the design event is projected to exceed the WWTP's dry weather rated capacity of 7,900 m^3/d in the 20-year planning horizon. The existing peak wet weather flow is 30,167 m^3/d in the design event, which is similar to historically recorded maximum daily flows of around 30,000 m^3/d, in 2017 and 2019, and already exceeds the WWTP's peak wet weather flow capacity (22,000 m^3/d). Peak WWF are projected to be double the WWTP's peak wet weather flow capacity in the 20-year planning horizon.

The assessment of the **WWTP** under population growth shows that, for a 20-year planning horizon, the design average daily flow is 10,625 m^3/d, hence an expansion of the plant's rated capacity of 2,725 m^3/d (i.e., a 35% increase in capacity) would be required. Applying the same 35% increase in rated capacity to the wet weather flow capacity and the peak flow capacity results in capacities of 14,040 m^3/d and 29,700 m^3/d, respectively.

Based on the Receiving Water Assessment (Stantec, 2009), new effluent concentration limits and loadings were determined for the plant expansion and compared with the current ECA objectives. Design loads to the plant were determined and will be used in future design stages to size plant processes.

Additional constraints were identified, mainly pertaining to space constraints for land expansion, and new treatment processes will be required to meet the new concentration limits established.

Potential impacts of **climate change** and extreme weather events on water and wastewater infrastructure were identified. Projections for these events show that, in general, total precipitation has historically been increasing, and is projected to keep increasing, notably in winter and spring; however, summer precipitations are projected not to vary. Mean temperature has historically been increasing and is projected to continue increasing at a faster rate, with winter and spring temperature showing the largest range of increase. Resiliency measures in planning and operations would be required to mitigate the risks linked to these events.

6 References

Development Planning Studies:

- *Development Charges By-law and Background Study* (Watson & Associates, December 2020).
- *Preliminary Findings on Residential Supply vs Demand and three (3) growth scenarios for the Town of Carleton Place* letter (J.L. Richards, March 2021).
- *Council Report for Comprehensive Review* (Town of Carleton Place / J.L. Richards, March 2021).

Water Treatment Plant:

- *Carleton Place Drinking Water System* (OCWA, 2017).
- *Carleton Place Drinking Water System* (OCWA, 2018).
- *Carleton Place Drinking Water System* (OCWA, 2019).
- *Carleton Place Drinking Water System* (OCWA, 2020).
- *Permit to Take Water No. 1310-9UHPPW* (MECC, March 13, 2015).
- *Drinking Water Works Permit Number 172-201, Issue Number 3* (MECP, February 26, 2021).
- *Drinking Water Works License Number 172-101, Issue Number 3* (MECP, February 26, 2021).
- *Addendum to the August 2011 Water Treatment Plant Capacity Expansion Master Plan* (J.L. Richards. 2018).
- *Resiliency Plan – Water Treatment Plant* (J.L. Richards, 2018).
- *Water Treatment Plant Expansion Master Plan* (J.L. Richards, 2018)
- *Water Treatment Plant Capacity Expansion Master Plan* (Stantec Consulting Ltd., 2011).

Wastewater Treatment Plant:

- *Carleton Place Drinking Water System* (OCWA, 2017).
- *Carleton Place Drinking Water System* (OCWA, 2018).
- *Carleton Place Drinking Water System* (OCWA, 2019).
- *Carleton Place Drinking Water System* (OCWA, 2020).

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- *Receiving Water Assessment Review for Carleton Place Water Pollution Control Plant Discharge to Mississippi River* (Stantec Consulting Ltd., May 2009).
- *Water Pollution Control Plant Capacity Expansion Master Plan* (Stantec Consulting Ltd., August 2011).
- *Facility Optimization Report for the Carleton Place Water Pollution Control Plant* draft memo (OCWA, April 2020).
- *Carleton Place Water Pollution Control Pant Certificate of Approval Number 5001-7FZT4A*, (MOE, October 3, 2008.
- *Addendum to the August 2011 Water Pollution Control Treatment Plant Capacity Expansion Master Plan* (J.L. Richards, 2018).
- *Resiliency Plan* – Wastewater Treatment Plant (J.L. Richards, 2018).
- *Wastewater Treatment Plant Expansion Assessment* (J.L. Richards, 2018).

Sanitary Sewer System:

- *Trunk Sanitary Sewers – Hydraulic Capacity Investigation* memo (J.L. Richards, March 2014).
- *Update to Wastewater Trunk Sanitary Sewer Model* memo (J.L. Richards, March 2021).
- *Condition Assessment of Pumping Stations* (J.L. Richards, 2018).
- *Asset Management Plan* (Town of Carleton Place, 2017).

Water Distribution System:

- *Hydraulic Water Model Investigation Future Development* memo, (J.L. Richards, September 2013).
- *Potable Water Storage Study* (J.L. Richards, November 2018).
- *Town of Carleton Place 2021 WaterCAD Model Update* (J.L. Richards, March 2021).
- *Asset Management Plan*.(Town of Carleton Place, 2017).

APPENDICES

Appendix A Design Basis Memo

Stantec

Memo

To:	Guy Bourgon, P. Eng Town of Carleton Place	From:	Pierre Wilder, P. Eng; Kevin Alemany, P. Eng, M.A.Sc;. Christene Razafimaharo, M. Sc., EIT Stantec Consulting, Ottawa
File:	Water & Wastewater Master Plan	Date:	July 12, 2021

Reference: Design Basis and Existing Conditions Review

INTRODUCTION

Stantec Consulting has been retained by the Town of Carleton Place (the Town) to undertake a Municipal Class Environmental Assessment (MCEA) and prepare a Master Plan for the expansion of the Town's Water Treatment Plant (WTP) and Wastewater Treatment Plant (WWTP) and the addition of a new water storage reservoir. The Master Planning assignment will evaluate the Town's water and wastewater infrastructure needs over 5-year, 10-year and 20-year horizons. In addition to the treatment facility expansions and the water reservoir, the assessment will investigate current and future needs of the potable water distribution and wastewater collection systems.

The purpose of this technical memorandum is to confirm the design bases for the Master Plan for the Town's water and wastewater infrastructure. Recommended values to be used in this Water and Wastewater Master Plan (W&WWMP) are presented. Existing system potable water demand and wastewater generation rates are also calculated and compared to the recommended values and various design guidelines. This memo will be used to evaluate system requirements to meet the forecasted growth.

BACKGROUND

Potable water is provided throughout the Town via a municipal water distribution system. Raw water is drawn from the Mississippi River, treated through a chemically assisted filtration process and discharged to a pipe network through high lift pumps situated at the WTP. Within the distribution network, an existing elevated storage tank situated south of the river assists in providing balancing, fire flow and emergency flows. The existing WTP operates under the following permits and approvals:

- *Certificate of Approval (*CofA*)* No. 1150-69XLVM (April 1, 2005)
- Permit to Take Water No. 1310-9UHPPW (March 13, 2015)
- Drinking Water Works Permit (DWWP) No. 172-201
- Municipal Drinking Water Licence (MDWL) No. 172-101

As per these approvals, the WTP has a rated capacity of 12,000 m^3/day, including drinking water demand and process wastewater. The plant is capable of treating raw water at a rate of 8,400 m^3/d. An operational benchmark of 7,700 m^3/d monitored by Ontario Clean Water Agency (OCWA) for water use by-law considerations.

The Town's wastewater is conveyed to the WWTP via a separated gravity sewer network including eleven (11) pumping stations. The existing WWTP has a rated capacity of 7,900 m^3/d annual average flow and a peak design flow of 22,000 m^3/d. The plant is considered a conventional activated sludge plant with base flow treatment through complete works for flows up to 10,400 m^3/d and excess wet weather flows greater than this passing through physical/chemical clarifiers for enhanced primary treatment. The plant operates under *Carleton Place Water Pollution Control Pant* CofA No. *5001-7FZT4A* (MOE, October 3, 2008).

GROWTH PROJECTIONS

Population growth projections over multiple planning horizons need to be developed as the basis of the Master Plan. This study addresses the following horizons:

- Baseline year 2021;
- Short term, or 5-year planning horizon, in the year 2026;
- Medium term, or 10-year planning horizon, in the year 2031; and,
- Long term, or 20-year planning horizon, in the year 2041;

The following reports were reviewed to inform the population growth projections used in this Master Plan:

- 2020 Development Charges Background Study (Watson & Associates Economists Ltd, 2020). This report developed forecasts for population and housing units within the Town, for 4 different time horizons (early 2020, early 2030, mid 2038 and buildout); employment and non-residential gross floor area estimates were also forecasted. This information is used in the current Design Basis Memo to project the Town's population to the years 2021, 2026, 2031 and 2041.
- Preliminary Findings on Residential Supply vs Demand and three Growth Scenarios for the Town of Carleton Place (J.L. Richards, March 2021) also published as a staff report to Council on the subject of Carleton Place Comprehensive Review (Town of Carleton Place / J.L. Richards, 2021). This report identified different growth scenarios, whereby growth was distributed differently within the Town's boundary; for each scenario, the total number of units that can be built in each area was calculated. This information is used in the current Design Basis Memo to predict ICI (industrial, commercial and institutional) growth and the geospatial distribution of new development for incorporation into the sanitary sewer and water distribution models.

The baseline (2021) population and number of units were determined based on the forecasts for 2020 taken from the *Development Charges By-law and Background Study (DC Study)* (Watson & Associates Economists Ltd, December 2020). The number of housing units was increased by +315 units, as provided in Figure 3-2 in the *DC Study*, and the number of institutional units by +34 units (based on the forecasted ratio of additional institutional units to additional housing units of 5.7% in 2038). The same population density as in 2020 was maintained to estimate the 2021 population.

The same approach was retained for the projections in the different planning horizons, using the number of housing units provided in Figure 3-2 of the DC Study (offset by one year, and maintaining +160 units/year past 2039), and the population densities specified in the study.

The baseline and future ICI areas were estimated by using an employment density of 50 jobs/ha, for an activity rate of 17% of the population (employed and working in the Town), as provided in the *Carleton Place* Comprehensive Review*, Council Report* (Town of Carleton Place / J.L. Richards, March 2021).

The resulting growth projections for the Town of Carleton Place are presented in **Table 1.** The detailed geospatial distribution and phasing of development are illustrated in **Appendix A** - **Figure A-1** (2026), **Figure A-2** (2031) and **Figure A-3** (2041) and proposed in **Appendix B - Table B-1** and **Table B-2**.

Table 1: Town of Carleton Place Growth Projections (2021-2041)

	Baseline (2021) (1)	2026	2031	2041
Additional Number of Units (2)	-	1,563	2,912	4,958
Total Number of Units	5,623	7,186	8,535	10,581
Population Density (persons per unit, PPU) (3)	2.448	2.448	2.313	2.262
Additional ICI Area (ha) (4)	-	7.2	13.7	22.4
Total ICI Area (ha)	35.0	42.2	48.7	57.4
Additional Population (5)	-	3,500	7,000	11,500
Total Population (6)	13,500	17,000	20,500	25,000

Notes:

(1) 2021 Baseline population and number of units based on 2020 DC Study population and number of units for 2020, increased using 315 additional housing units, 34 additional institutional units (see Note 2), and 2020 population density of 2.448 PPU. 2021 Baseline ICI area based on review of GIS data.

(2) Housing and institutional units combined. Additional number of housing units based on *Development Charges By-law and Background Study* (Watson & Associates Economists Ltd, December 2020) Figure 3-2. Ratio of institutional units / housing units = 245 / 4,330 = 5.7%, based on 2020 DC Study projections for 2038.

(3) Population density as specified in 2020 DC Study. Applicable to year specified, and all following years until next time horizon.

(4) ICI area development rate assumed similar to residential area development rate, see **Appendix B – Table B-1**.

(5) Additional population obtained by subtracting baseline (2021) population from total population; may not correspond to product of additional number of units and population density due to rounding.

(6) Total population rounded to nearest 500.

POTABLE WATER DISTRIBUTION

EXISTING SYSTEM DEMANDS

Table 2 summarizes the Town's recent historical average and maximum daily treated water volumes and associated estimated per capita consumption rates and maximum day peak factors. The average daily treated water volumes are taken as the average of the monthly average rated flows reported in the Drinking Water System Annual Reports for the 2017-2020 period. Similarly, the maximum daily treated water volumes are taken as the maximum of the monthly maximum rated flows. Per capita consumption rates were calculated using these treated flows and the estimated populations for years 2017 to 2020 based on growth projection assumptions noted in the **Growth Projections** section of this report.

Table 2: Historical System Water Demands

Parameter	Unit	2017	2018	2019	2020
Estimated Population (1)	persons	11,269	11,894	12,519	13,144
Average Daily Treated Drinking Water Flows	m^3/d	4,348	4,823	4,962	5,488
Maximum Daily Treated Drinking Water Flows	m^3/d	6,556	9,554	8,716	9,730
Average Day Demand (mixed use)	L/c/d	386	405	396	418
Maximum Day Demand (mixed use)	L/c/d	582	803	696	740
Maximum Day Factor (mixed use)	-	1.51	1.98	1.76	1.77

Notes:

(1) Estimated populations based on the 2016 Census population of 10,644 and assumed linear growth of 250 new building permits per year with a population density of 2.5 persons per unit (population density previously used by *Hydraulic Water Model Investigation Future Development* memo, (J.L. Richards, September 2013), *Town of Carleton Place 2021 WaterCAD Model Update* (J.L. Richards, March 2021), *Preliminary Findings on Residential Supply vs Demand and three (3) growth scenarios for the Town of Carleton Place* (J.L. Richards, March 2021), and corresponding to historical densities in the 2020 *DC Study* (Watson & Associates Economists Ltd, December 2020).

During the past four years, the day demand averages at about 401 L/c/d, with the highest consumption rate of 418 L/c/d observed in 2020. For the same four-year period, the average maximum day factor averages at 1.76, with the highest max day factor of 1.98 observed in 2018. A comparison of these values against various design criteria and values used in previous water distribution system analyses completed for the Town is discussed in the following section.

DISTRIBUTION SYSTEM DESIGN CRITERIA

The Town of Carleton Place currently uses a combination of provincial and municipal guidelines, as well as historical data to assess and design water distribution system infrastructure to accommodate future development, both at the neighbourhood level (e.g., sizing of local watermains) and a system-wide level (e.g., transmission mains).

Table 3 summarizes the applicable potable water distribution design criteria specified across various guidelines and other sources and presents Stantec's recommended values to be used in the Water and Wastewater Master Plan (W&WWMP). Based on a comparison of these values, the following notes and recommendations were made for consideration for assessment of future growth:

- For future average day residential demand, it is recommended that a rate of 350 L/c/d be applied. This value has also been used to establish future water demands in previous hydraulic analyses completed for the Town and matches guidelines presented by the City of Ottawa and the Ontario Ministry of Environment, Conservation and Parks (MECP). This value is lower than the total water demand reported in recent WTP Annual Reports; however, this data includes industrial/commercial/institutional (ICI) water demands as well as system leaks, and therefore is expected to be higher than the actual average day residential consumption rate.
- For future average day light industrial and commercial/institutional demands, it is recommended that rates of 35,000 and 28,000 L/gross ha/d be applied, respectively. These rates are both

consistent with values used to establish future water demands in previously completed hydraulic analyses and all applicable design guidelines.

- For peak factors, it is recommended to use 2.0 and 1.5 for future residential and ICI maximum day, respectively, and 3.0 and 2.7 for residential and ICI peak hour, respectively. These factors are consistent with values used in previously completed hydraulic analyses and are similar to those based on recent drinking water system Annual Reports and MECP guidelines.
- For fire demands, the Fire Underwriters Survey (FUS) method of calculating fire flows is appropriate for the sizing of local water distribution mains. Fire flows calculated using the FUS guidelines are specific to actual building developments and are considered appropriate when sizing local distribution watermains in new developments. The Ontario Fire Marshall (OFM) Guidelines for fire flow which form part of Part 3 of the Ontario Building Code (OBC) provides an additional guideline for fire flow and is designed to provide sufficient fire flow for evacuation of persons and is considered a "life protection" fire flow and not a property protection fire flow for which the FUS is designed. The maximum required fire flow specified by the OFM method is 150 L/s (9,000 L/min).

Reference: Design Basis and Existing Conditions Review

Table 3: Comparison of Potable Water Design Criteria & Level of Service Requirements

Design Parameter	Value					Recommended Value for W&WWMP
	Previous Potable Water Hydraulic Analyses (5)	Carleton Place WTP Annual Reports (2017 - 2020)	MECP Design Guidelines	Ottawa Water Design Guidelines & Tech Bulletins	2013 Ottawa Water Master Plan	
Average Day (AVDY)						
AVDY Demand, Residential (L/c/d)	350	386 - 418	270 - 450	350	350 (1)	350
AVDY Demand, Light Industrial (L/gross ha/d)	35,000		35,000	35,000	35,000 (1)	35,000
AVDY Demand, Commercial/Institutional (L/gross ha/d)	28,000		28,000	28,000	28,000 (1)	28,000
Maximum Day (MXDY)						
MXDY Factor, Residential (2)	2.0	1.5 - 2.0	1.8 (3)	2.5	2.5 (1)	2.0
MXDY Factor, ICI (2)	1.5			1.5	1.5 (1)	1.5
Peak Hour (PKHR)						
PKHR Factor, Residential	3.0	-	2.7 (3)	5.5 (2.2*MXDY)	5.5 (1) (2.2*MXDY)	3.0
PKHR Factor, ICI	2.7	-		2.7 (1.8*MXDY)	2.7 (1) (1.8*MXDY)	2.7
Fire Demand						
Fire Flow (L/s)	-	-	311 (3)	167 - 217 (4) or Per FUS (1)	Per FUS	Per FUS (for local watermain sizing)
Duration	-	-	4 (3)	Per FUS (1)	Per FUS	
System Pressures						
Minimum Pressure (psi)	40	-	40	40	40	40
Minimum Pressure, MXDY + Fire Flow (psi)	20	-	20	20	20	20
Maximum Pressure (psi)	80	-	100	80-100	80-100	80-100

*See **Notes** (next page)*

Notes:

(1) Value for subdivision/site level.
(2) MXDY = Max Day Factor * AVDY.
(3) Based on MECP Guidelines, for an ultimate population of 25,000 people in 2041.
(4) For system-level consideration.
(5) Sources:
- Hydraulic Water Model Investigation Future Development memo (J.L. Richards, September 2013).
- Potable Water Storage Study (J.L. Richards, November 2018).
- Town of Carleton Place 2021 WaterCAD Model Update (J.L. Richards, March 2021).

POTABLE WATER TREATMENT

RAW WATER QUALITY

Ontario Clean Water Agency (OCWA) monitors raw water quality quarterly at the WTP. The primary water quality parameters of concern for water treatment are presented in **Table 4** with the range of observed values reported from 2017 to 2020 (OCWA 2017; OCWA 2018; OCWA 2019; OCWA 2020) and the recommended design value for this W&WWMP.

Table 4: Observed Raw Water Quality

Parameter	Unit	Range Observed 2017 – 2020	Associated Challenges	Recommended Design Value
E.Coli	cnt/100mL	0 – 20	Filtration, disinfection	20
Total Coli	cnt/100mL	0 – 124	Filtration, disinfection	150
Turbidity	NTU	0 – 20	Filtration, disinfection	20
Alkalinity	$mgCaCO_3/L$	70 – 112	Coagulation, water corrosiveness	70
Colour	TCU	2 – 39	THM formation	40
DOC	mg/L	5.5 - 8.2	THM formation	10
TOC	mg/L	5.5 - 8.3	THM formation	10
pH	pH unit	7.7 - 8.49	Coagulation, water corrosiveness	7.5

WATER TREATMENT DESIGN CRITERIA

The Carleton Place Water Treatment Plant and elevated water storage tank must conform to the requirements of O.Reg. 169/03 Ontario Drinking Water Quality Standards, January 1st, 2020 version (https://www.ontario.ca/laws/regulation/030169), for drinking water quality standards, and O.Reg, 170/03 Drinking Water Systems April 1st, 2020 version (https://www.ontario.ca/laws/regulation/030170), for water sampling program and disinfection requirement. These also must meet the requirements of Procedure for disinfection of drinking water in Ontario, updated on April 17th, 2021 (https://www.ontario.ca/page/procedure-disinfection-drinking-water-ontario).

WASTEWATER COLLECTION

EXISTING DRY WEATHER FLOWS - APPROXIMATION

In the absence of detailed sanitary flow monitoring data, the dry weather flows in the existing collection system can be approximated by the treated potable water flows from the WTP. **Table 5** summarizes the Town's recent historical average treated potable water volumes from the WTP Annual Reports, which can be correlated with dry weather wastewater flow (DWF) generation, and thus provide an estimate of per capita dry weather wastewater flow rates. This analysis does not take into consideration outdoor water demands, such as watering lawns, or losses in the distribution system due to watermain leaks and breaks.

For the year 2020, an adjusted population (and thus, an adjusted flow rate) was provided based on information from *Update to Wastewater Trunk Sanitary Sewer Model* memo, (J.L. Richards, March 2021) regarding population serviced by private wastewater systems (e.g., septic tanks), and therefore not connected to the Town's sanitary system. A total of 65 units were identified in J.L. Richards 2021 Update as having private wastewater systems, resulting in approximately 163 persons (65 units x 2.5 persons/unit), or ~1.2% of the Town's total 2020 population. This percentage of private systems can be considered negligible at this scale and is therefore not included in the following analyses.

Table 5: Approximation of Sanitary DWF from Historical Water Treatment Plant Flows

Parameter	Unit	2017	2018	2019	2020
Estimated Population (1)	persons	11,269	11,894	12,519	13,144
Average Daily Treated Potable Water Flows	m^3/d	4,348	4,823	4,962	5,488
Average DWF Rate – Based on Total Population	L/c/d	386	405	396	418 (2)
Harmon Peaking Factor (3)	-	2.90	2.88	2.86	2.84
Peak DWF Rate – Based on Total Population	L/c/d	1,119	1,166	1,133	1,187

Notes:

(1) Estimated populations based on the 2016 Census population of 10,644 and assumed linear growth of 250 new building permits per year with a population density of 2.5 persons per unit (population density previously used by *Trunk Sanitary Sewers – Hydraulic Capacity Investigation* memo (J.L. Richards, March 2014), *Update to Wastewater Trunk Sanitary Sewer Model* memo (J.L. Richards, March 2021), *Preliminary Findings on Residential Supply vs Demand and three (3) growth scenarios for the Town of Carleton Place* letter (J.L. Richards, March 2021), and corresponding to historical densities in the *Development Charges By-law and Background Study* (Watson & Associates Economists Ltd, December 2020).

- The average DWF rate for 2020 presented in *Update to Wastewater Trunk Sanitary Sewer Model* memo (J.L. Richards, March 2021).is 392 L/c/d, which differs from the values presented in this table due to the following:
    a. Different total populations in 2020 (13,153 inhabitants in *Update to Wastewater Trunk Sanitary Sewer Model* memo (JL. Richards, March 2021).
    b. The population in *Update to Wastewater Trunk Sanitary Sewer Model* memo (JL. Richards, March 2021) was adjusted by removing the number of inhabitants not connected to the system.
    c. The treated potable water flow in *Update to Wastewater Trunk Sanitary Sewer Model* memo (JL. Richards, March 2021) for 2020 was based on an average of the flows from 2018 to 2020.

(2) Harmon Peaking Factor calculated using a correction factor of K=1, as done in *Update to Wastewater Trunk Sanitary Sewer Model* memo (JL. Richards, March 2021).

Over the past 4 years, the average DWF rate is approximately 400 L/c/d with the highest per capita flow rate of 418 L/c/d in 2020. *Update to Wastewater Trunk Sanitary Sewer Model* memo (JL. Richards, March 2021) uses a per capita rate of 392 L/c/d in the existing conditions model, which aligns with the average DWF per capita rate calculated above. The 392 L/c/d rate will therefore continue to be used in this Master Plan for existing conditions analyses but should be validated through flow monitoring when available. The Harmon Peaking Factor for 2017-2020 varies from 2.84 to 2.90. The decreasing trend for Peaking Factor is expected as variances in flow generation typically decrease with population increases.

EXISTING EXTRANEOUS FLOWS - APPROXIMATION

Extraneous flows, also referred to as inflow and infiltration (I/I), consists of groundwater infiltration (GWI) into sewers through cracks and stormwater flows into the system from surface during wet weather events. The Town has indicated that illegal sump pump connections could also contribute to extraneous flows. These flows are typically quantified using flow monitoring data, however in the absence of recent flow monitoring data, the existing I/I rates can be evaluated using WWTP data.

Table 6 presents the Town's historical average and maximum raw sewage influent, measured at the WWTP. The average and maximum daily sewage influents are reported in the Annual Reports and in the Facility Optimization Report for each year in the 2017-2020 period. Average and peak dry weather flows were obtained from the **Table 5** (approximated based on WTP flows). A tributary area of 578 ha was specified in *Update to Wastewater Trunk Sanitary Sewer Model* memo (JL. Richards, March 2021) for the year 2020. Using the tributary area of 486 ha for the year 2013 (as specified in *Trunk Sanitary Sewers – Hydraulic Capacity Investigation* (J.L. Richards, March 2014), the tributary areas for the years 2017 to 2019 were interpolated.

Table 6: Historical Extraneous Flows

Parameter	Unit	2017	2018	2019	2020
Total Tributary Area (1)	ha	539	552	565	578
WWTP Average Influent (2)	m^3/d	7,340	6,165	6,119	6,132
WWTP Average DWF Generation (3)	m^3/d	4,348	4,823	4,962	5,488
Average I/I (GWI) (4)	m^3/d	2,992	1,342	1,157	644
Equivalent Average I/I (GWI) Rate (5)	L/s/ha	0.06	0.03	0.02	0.01
WWTP Peak Influent (6)	m^3/d	29,690	15,272	31,856	22,111
WWTP Peak DWF (7)	m^3/d	12,610	13,868	14,184	15,602
Peak Total I/I (8)	m^3/d	25,342	10,449	26,894	16,623
Equivalent Peak I/I Rate (9)	L/s/ha	0.54	0.22	0.55	0.33

Notes:

(1) Tributary area for 2020 specified in *Update to Sanitary Wastewater Trunk Sewer Model* memo (J.L. Richards, March 2021,); tributary area for 2013 specified in *Trunk Sanitary Sewers – Hydraulic Capacity Investigation* (J.L. Richards, March 2014). Tributary areas for 2017-2019 obtained from linear interpolation by year.
(2) Average influent values provided in the *Carleton Place Drinking Water System* Annual Reports and the Facility Optimization Report *for the Carleton Place Water Pollution Control Plant* (OCWA 2020).
(3) Taken from **Table 5**: Average Daily Treated Potable Water Flows.
(4) WWTP Average Influent – WWTP Average DWF; An estimation of Groundwater Infiltration (GWI).
(5) Average I/I (GWI) / Total Tributary Area
(6) Maximum influent values provided in the *Carleton Place Drinking Water System* Annual Reports (OCWA 2017; OCWA 2018; OCWA 2019; OCWA 2020) and the Facility Optimization Report *for the Carleton Place Water Pollution Control Plant* (OCWA 2020).
(7) Calculated using the rates in **Table 5**: Total population x Peak DWF Rate; Based on total population.
(8) WWTP Peak Influent – WWTP Average DWF
(9) Peak Total I/I / Total Tributary Area.

Based on the 2017 to 2020 WWTP influent data, the average groundwater infiltration (GWI) flow rates for the Town vary between 0.01 L/s/ha and 0.06 L/s/ha, and the peak extraneous flow rates vary between 0.22 L/s/ha and 0.55 L/s/ha. Based on a previous flow monitoring program in 2013, *Trunk Sanitary Sewers – Hydraulic Capacity Investigation* (J.L. Richards, March 2014), average rates of up to 0.19 L/s/ha in some areas of the Town were reported, with peak rates of up to 0.40 L/s/ha in other areas (Flow Monitor # 6 on High St at Thomas St, comprising the western ~80 ha of the Town, west of the river).

As previously noted, the dry weather and I/I flow rates presented in **Table 6** above are high level approximations based on flows measured at the treatment plants. Flow monitoring programs provide more detailed insights into the collection system's workings on a more localized scale. Further flow monitoring programs can improve the understanding of the Town's collection system under varying precipitation events and provide more up-to-date indications of higher I/I areas within the Town, as well as areas with greater residual capacity that can service additional growth.

WASTEWATER COLLECTION DESIGN CRITERIA

The sanitary flow generation rates summarized in **Table 7** are recommended for use in this W&WWMP. In general, existing residential and ICI sanitary dry weather flows will be based on the rates used in previous modelling studies (392 L/c/d). Previously used rates aligned closely with the 2012 City of Ottawa Sewer Design Guidelines, which have been used by Stantec in studies for nearby municipalities of similar size to the Town of Carleton Place. Recent updates have been made in the 2018 City of Ottawa Technical Bulletin ISTB-2018-01 that account for the transition seen to higher I/I contributions and lower domestic per capita rates, and to conform to climate change consideration requirements. This includes stress-testing the system and assessing the resulting hydraulic gradelines (HGLs) in an "annual" and "rare" event with failed or as-designed pumping station operations (respectively), in addition to assessing capacity during the design event. The annual event represents the highest I/I within a typical year during which critical pump station(s) have failed, and the rare event represents conditions of high extraneous flows with pump stations operating as designed (assumed equivalent to the 1:100-yr I/I).

With the absence of up-to-date flow monitoring data, it is recommended that these Technical Bulletin updates be incorporated in the Town's model while maintaining the model's current residential and ICI distributions, equivalent population calculations, and DWF per capita rate for existing conditions, which can be validated with further flow monitoring programs in the future. In the current model, ICI flows are calculated in the same manner as residential flows, both based on the number of units and average population density of 2.5 persons/unit. It is proposed that parameters for growth be based on the City of Ottawa's guidelines, including the separation between residential and ICI flow generation. The lower residential per capita rates as defined in the guidelines will be applied to account for this. The system will be assessed based on the City of Ottawa's design, annual and rare event I/I rates and Harmon's Correction Factors, as outlined in the 2018 Technical Bulletin and **Table 7** below.

Although there is limited information on the previous flow monitoring programs and observed rainfall events (completed in 2012-2013; 8+ years ago) and with the absence of more up-to-date data, the previously derived peak I/I rate for the area tributary to 2013's flow monitor (FM) #6 (0.40 L/s/ha, *Trunk Sanitary Sewers – Hydraulic Capacity Investigation* (J.L. Richards, March 2014), can be used in the annual event analysis for that area until more recent flow monitoring and rainfall data is obtained. This value falls within the range of peak I/I rates observed more recently at the WWTP (see **Table 6**); however, it should be noted that the WWTP values are representative of the entire Town and are not specific to any one area. The FM #6 sub-basin is comprised of ~80 ha of the western portion of the Town, west of Bridge Street and the river with sewers ranging in age from 30 to 50 years (77% of total sewer lengths in sewershed). Older, leakier sewers contribute to higher I/I rates, which can explain the rate obtained during the previous flow monitoring program for this sewershed.

In the rare event, a peak extraneous I/I rate of 3.0 L/s/ha will be applied for the FM #6 sub-basin only. This rate corresponds to the 2018 Technical Bulletin peak extraneous I/I rate for partially separated areas between 10 and 100 ha in size. Although the Town's sewer system consists of a separated network, the rates observed in the FM #6 sub-basin during the flow monitoring program in 2012-2013 were higher than typical design I/I rates for separated systems, hence the selection of a higher rate in the rare event as well.

Table 7: Recommended Sanitary Flow Generation Parameters

Design Parameter		Existing (2020) Conditions			Future Development (Growth)		
		Design [1]	Annual	Rare	Design	Annual	Rare
Residential	**Average Flow Rate**	392 L/c/d			280 L/c/d	200 L/c/d	200 L/c/d
	Peaking Factor	Harmon Peaking Factor with Correction Factor: 0.8	Harmon Peaking Factor with Correction Factor: 0.6	Harmon Peaking Factor with Correction Factor: 0.6	Harmon Peaking Factor with Correction Factor: 0.8	Harmon Peaking Factor with Correction Factor: 0.6	Harmon Peaking Factor with Correction Factor: 0.6
Extraneous Flows [2]	**Peak Rate**	0.33 L/s /effective gross ha	0.30 L/s /effective gross ha 0.40 L/s /effective gross area for FM#6 sub-basin, taken from J.L. Richards (2014) [3]	0.55 L/s /effective gross ha 3.0 L/s/ha for FM#6 sub-basin (higher rate from 2018 Technical Bulletin)	0.33 L/s /effective gross ha	0.30 L/s /effective gross ha 0.40 L/s /effective gross area for FM#6 sub-basin, taken from J.L. Richards (2014) [3]	0.55 L/s /effective gross ha 3.0 L/s/ha for FM#6 sub-basin (higher rate from 2018 Technical Bulletin)
Institutional/ Commercial	**Average Flow Rate**	-	-	-	28,000 L/gross ha/d	17,000 L/gross ha/d	17,000 L/gross ha/d
	Peaking Factor	-	-	-	ICI contribution > 20% : 1.5 ICI contribution ≤ 20% : 1.0	ICI contribution > 20% : 1.0 ICI contribution ≤ 20% : 1.0	ICI contribution > 20% : 1.0 ICI contribution ≤ 20% : 1.0
Light Industrial	**Average Flow Rate**	-	-	-	35,000 L/gross ha/d	10,000 L/gross ha/d	10,000 L/gross ha/d

<table>
<tr><th colspan="2" rowspan="2">Design Parameter</th><th colspan="3">Existing (2020) Conditions</th><th colspan="3">Future Development (Growth)</th></tr>
<tr><th>Design (1)</th><th>Annual</th><th>Rare</th><th>Design</th><th>Annual</th><th>Rare</th></tr>
<tr><td></td><td>Peaking Factor</td><td>-</td><td>-</td><td>-</td><td>ICI contribution > 20% : 1.5
ICI contribution ≤ 20% : 1.0</td><td>ICI contribution > 20% : 1.0
ICI contribution ≤ 20% : 1.0</td><td>ICI contribution > 20% : 1.0
ICI contribution ≤ 20% : 1.0</td></tr>
</table>

Notes:
(1) Corresponds to 2020 model of existing conditions done by *Update to Wastewater Trunk Sanitary Sewer Model* memo (J.L. Richards, March 2021).
(2) *Update to Wastewater Trunk Sanitary Sewer Model* memo (J.L. Richards, March 2021).
(3) Includes dry weather flow (GWI) & wet weather inflows
(4) Rate taken from *Trunk Sanitary Sewers – Hydraulic Capacity Investigation* memo (J.L. Richards, March 2014).

WASTEWATER TREATMENT

EXISTING RAW SEWAGE FLOWS, CONCENTRATIONS AND LOADINGS

The following **Table 8** presents the annual average raw wastewater flows and concentrations for key parameters as reported in the WWTP Annual Reports from 2017 to 2020 (OCWA 2017; OCWA 2018; OCWA 2019; OCWA 2020):

Table 8: Wastewater Concentration & Per Capita Generation Rates

Year	Pop.	Avg. Flow	Per capita flow	Average WW concentrations (mg/L)				Per Capital Loads (g/cap/d)			
				BOD5[1]	TSS	TP	TKN	BOD5[1]	TSS	TP	TKN
		(m^3/d)	(L/cap/d)								
2017	11,269	7,340	651	147	168	3.9	30.3	96	109	2.5	19.7
2018	11,894	6,165	518	141	208	6.20	33.7	73	108	3.2	17.5
2019	12,519	6,119	489	-	250	5.1	37.2	-	122	2.5	18.2
2020	13,144	6,132	466	88	136	4.24	39.7	41	63	2.0	18.5
Avg.	12,207	6,439	527	125	191	5	35	70	101	2.6	18.5

Notes:
(1) BOD5 influent data not listed in *Carleton Place Water Pollution Control Plant Annual Report* (OCWA, 2019)

Per capita flow generation is higher than normal at >500 L/cap/d. Max day flows regularly occur in the 20,000 – 30,000 m^3/d range, translating into max day peaking factors of 3 to 4.9x annual average, which is also higher than expected. This is likely due to the high influence of groundwater infiltration, wet weather inflow and possible residential sump pump connections. It is reasonable to assume that current generation rates will remain similar for the existing collection system whereas for collection system expansions, the influence of (I/I) will be less and that a lower per capita generation rate can be applied.

The per capita contaminant loadings are also generally higher than MECP typical values. This may be due to a number of raw sewage factors including: 1) influence of biosolids recycle loads, 2) water treatment plant residuals loading, and 3) septage receiving loads. It is reasonable to assume the influence of these recycle streams will continue in future at similar flow pro-rated rates with the exception of septage receiving loads, as discussed below.

WATER PLANT RESIDUALS

The waste residuals from the WTP are currently discharged to the sewer and received and treated at the WWTP. It is understood that a new forcemain between the two plants is partially constructed that may be used in the future to separate the residuals stream from the raw sewage for treatment. This option will be evaluated in the Master Plan and if preferred, the design basis loadings may need to be adjusted accordingly.

Carleton Place Drinking Water System Annual Reports for 2017-2020 were reviewed to estimate the septage receiving at the WWTP. The WWTP is currently permitted to receive a maximum of 4.5 m^3/d septage (or equivalent to 0.057% of the rated plant 7,900 m3/d capacity). It is understood that the facility no longer intends to receive septage or other hauled liquid wastes in the future. This waste stream is mixed into the raw sewage upstream of the plant influent flowmeter and raw sewage sampler, and thus these historical values have been impacted by septage receiving. This makes the design basis values presented herein somewhat conservative in that regard. If further accuracy in loading values is required later in this Master Plan study, this waste stream could be removed from the predicted raw sewage data.

Reference: Design Basis and Existing Conditions Review

PROPOSED DESIGN FLOWS, CONCENTRATIONS AND LOADINGS

The design basis for wastewater flows is listed in **Table 9**. Note that the per capita flow generation rates listed below are different than those recommended in **Table 7** for the sanitary collection system analysis because the per capita flows below are those observed at the plant and include ICI contributions. These design values may be adjusted once sanitary modelling is further developed.

Table 9: Design Basis Flows

Year	Flow Design Assumptions			
	Per capita flow (1) (L/cap/d)	Max Month PF (2) (-)	Max Day PF (3) (-)	Peak Hr PF(4) (-)
2021	500	1.8	4.5	5.0
2026	480	1.7	4.3	4.8
2031	460	1.7	4.0	4.5
2041	425	1.6	3.5	4.0
MECP Typical Values	350 - 500		2.5 - 3.5	
OCWA FOP Report (OCWA 2020)	545		4.9	
2017 – 2020 Data Average	527	1.8	3 - 4.9	

Notes:

(1) Includes inflow and infiltration. Existing per capita flow rates are varying 465-650 L/capita/d according to historical data; therefore 500 L/capita/d applied for year 2021. Future per capita flow generation rates will be affected by degree of water conservation measures applied and the ability of new sanitary collection system to reduce inflow/infiltration. Assuming that the population is doubled by 2041 with all new development at the lower MECP range of 350 L/capita/d, the average in 2041 would be approximately 425 L/cap/d. Values used in 2026 and 2031 are interpolated and rounded.

(2) Existing maximum month flow peaking factor has been estimated at 1.8x annual average flow; therefore 1.8x is applied for year 2021. Future maximum month peaking factor will be affected by the ability of new sanitary collection system to reduce wet season inflow/infiltration and is expected to be as low as 1.3x for new construction, and thus an average of 1.6 by 2041. Values used in 2026 and 2031 are interpolated and rounded.

(3) Existing maximum day flow peaking factor has been estimated at 3-4.9x annual average flow; therefore 4.5x applied for year 2021. Future maximum day peaking factor will be affected by the ability of new sanitary collection system to reduce inflow/infiltration and is expected to be as low as 2.6x for new construction, and thus an average of 3.5 by 2041. Values used in 2026 and 2031 are interpolated and rounded.

(4) Existing peak hour flow peaking factor is unknown but greater than max day peaking factor estimated at 3-4.9x annual average flow; therefore, 5x assumed and applied for year 2021. Future maximum day peaking factor will be affected by the ability of new sanitary collection system to reduce inflow/infiltration and is expected to be as low as 3x for new construction, and thus an average of 4.0 by 2041. Values used in 2026 and 2031 are interpolated and rounded.

The design basis for wastewater loadings is listed in **Table 10**.

Reference: **Design Basis and Existing Conditions Review**

Table 10: Design Basis Loadings

Year	Per Capita Loading Design Assumptions			
	BOD5 (1) (g/cap/d)	**TSS (2) (g/cap/d)**	**TKN (3) (g/cap/d)**	**TP (4) (g/cap/d)**
2021	70	105	18	2.6
2026	70	105	18	2.6
2031	70	105	18	2.6
2041	70	105	18	2.6
MECP Typical Values	35-65	35-75	6-17	1-2
OCWA FOP Report (OCWA 2020)	68	129	16.5	2.7
2017 – 2020 Data Average	70	101	18.5	2.6

Notes:

(1) Current BOD5 generation rates are higher range than typical MECP generation rates of 35-75 g/capita/d, possibly due to influence of biosolids decanting. Future per capita BOD5 loading generation rates may be affected by changes in cBOD5 mass loading from biosolids handling and septage receiving. It is assumed at this time that per capita loadings will continue at these current rates.

(2) Current TSS generation rates are higher range than typical MECP generation rates of 35-75 g/capita/d, likely due to influence of water treatment plant residuals. Future per capita TSS loading generation rates may be affected by changes in TSS mass loading from biosolids handling, septage receiving, and water treatment plant residuals loading. It is assumed at this time that per capita loadings will continue at these current rates.

(3) Current TKN generation rates are higher range than typical MECP generation rates of 35-75 g/capita/d, likely due to influence of biosolids decanting. Future per capita TKN loading generation rates may be affected by changes in TKN mass loading from biosolids handling, and septage receiving. It is assumed at this time that per capita loadings will continue at these current rates.

(4) Current TP generation rates are higher range than typical MECP generation rates of 1-2 g/capita/d. Future per capita TP loading generation rates may be affected by changes in TP mass loading from biosolids handling and septage receiving. It is assumed at this time that per capita loadings will continue at these current rates.

(5) The mass loading changes in recycle loads from biosolids handling and in degree of water conservation measures applied and the ability of new sanitary collection system to reduce inflow/infiltration.

(6) No wastewater temperature information was available to assess seasonal variation. A typical seasonal variation will been assumed for now until temperature data becomes available.

(7) No wastewater alkalinity information was available to assess seasonal variation. A typical seasonal variation will been assumed for now until alkalinity data becomes available.

WASTEWATER EFFLUENT CRITERIA

The current non-compliance monthly effluent limits for the WWTP are shown in **Table 11**.

Table 11: WWTP Non-Compliance Monthly Effluent Limits

Effluent Parameter	Non-compliance Concentration Limits (mg/L unless otherwise stated)	Non-compliance Loading (kg/d unless otherwise stated)
cBOD5	25.0	550
Total Suspended Solids	25.0	550
Total Phosphorus	1.0	22.0
Total Ammonia Nitrogen	4.0 (May 15 to Sept. 30)	88.0 (May 15 to Sept 30)
pH of the effluent maintained between 6.0 to 9.5, inclusive, at all times		

In addition to these non-compliance limits, the minimum effluent standards need to meet federal WSER standards including: cBOD5/TSS = 25 mg/L, total residual chlorine = 0.02 mg/L, and passing acute lethality testing with respect to un-ionized ammonia.

ASSIMILATION CAPACITY AND FUTURE EFFLUENT CRITERIA

Stantec completed a desktop assimilative capacity assessment (ACS) as part of the 2011 Master Plan to expand the Town of Carleton Place WWTP to 10,000 m^3/d average flow [*Receiving Water Assessment Review for Carleton Place Water Pollution Control Plant Discharge to Mississippi River* (Stantec Consulting Ltd., May 2009)]. Key assumptions made in the analysis include:

- WWTP is expanded to 10,000 m^3/d average flow capacity.
- The 7Q20 flow of the Mississippi River is 4.07 m^3/s.
- The water quality data from the closest sampling site (Almonte) is a reasonable estimate of the river water quality conditions at Town of Carleton Place WWTP.

Mass balance calculations were performed to determine non-compliance limits needed to maintain provincial water quality objectives for three seasons: summer (June-August), autumn/winter (Sept-Mar), and spring (April-May). The assimilative capacity assessment derived effluent limits and proposed non-compliance limits are summarized in **Table 12.**

Assuming the allowable discharge loadings remain unchanged and acceptable to the MECP, then revised non-compliance limits will be based on maintaining the mass load to the river. At the time of writing, it is unknown what size of expansion is required at the WWTP; this will be confirmed during the Phase 1 Report. To demonstrate the effect of flow on effluent limits (assuming the current loadings to the River must be maintained), example limits are shown in **Table 12** based on hypothetical plant expansions to 11,000 m^3/d, 12,000 m^3/d, or 13,000 m^3/d.

Reference: Design Basis and Existing Conditions Review

Table 12: Non-compliance Effluent Limits vs Future Treatment Capacity Increases

Parameter/Period	From Stantec ACS Study (10,000 m^3/d Capacity)		For Future Expansion (11,000 / 12,000 / 13,000 m^3/d Capacity)		
	Allowable Concentrations derived from ACS (mg/L)	Proposed Non-compliance Limits (mg/L)	Proposed Non-compliance Limits (mg/L)		
Plant Capacity	10,000 m^3/d	10,000 m^3/d	11,000 m^3/d	12,000 m^3/d	13,000 m^3/d
cBOD5 / year-round	25	25	22.7	20.8	19.2
TSS / year-round	Not modeled	25	22.7	20.8	19.2
TP / Sept1-May31	0.38	0.3	0.27	0.25	0.23
TP / June1-Aug31	0.38	0.2	0.18	0.17	0.15
Total Ammonia N (June1-Aug31)	3.63	3.63	3.30	3.03	2.79
Total Ammonia N (Sept1-Mar31)	25.3	15	13.64	12.50	11.54
Total Ammonia N (April1-May31)	16.2	15	13.64	12.50	11.54

Note that the effluent limits decrease with increasing effluent flow and that a treatment expansion to approximately 13,000 m^3/d will yield summer TP = 0.15 mg/L for non-compliance; meaning the filters will need to operate consistently near 0.1 mg/L, or at the practical limit for standard filtration. Any lower limit will require enhance TP removal technology such as membranes.

WET WEATHER (SECONDARY BYPASS) TREATMENT CRITERIA

In addition, given the high wet weather flows experienced at the plant, continuing the current wet weather flow treatment strategy is recommended to maintain stable secondary and tertiary treatment operation and performance. It's uncertain how the MECP will amend the current ECA limits for wet weather operation but effluent objectives and mass loading targets that are eventually selected will need to reflect the practical treatment removals expected within the phys-chem primary clarifiers.

Reference: Design Basis and Existing Conditions Review

CONCLUSIONS AND NEXT STEPS

This memo presents the parameters that will be used as the basis for the Town of Carleton Place's water and wastewater Master Plan study.

Relevant background studies previously done for the Town of Carleton Place were gathered and reviewed. These documents indicate that the Town has been experiencing accelerated population growth, which has triggered the need for expansions in the water and wastewater systems.

Growth projections in residential population and institutional, commercial and industrial (ICI) areas were developed for the different planning horizons (2026, 2031 and 2041), based on a review of recent planning studies completed for the Town. The phasing and spatial distribution of developments were proposed and will be confirmed with the Town. These will form the basis for the water and wastewater flow projections throughout the collection and distribution networks.

The Town's existing linear and treatment infrastructure and relevant design parameters were analyzed. Applicable guidelines and studies were reviewed and compared, and design criteria and level of service requirements are recommended. These will be used to assess the water and wastewater infrastructure's performance, compliance to regulatory requirements and to identify constraints and develop solutions in subsequent steps.

The next steps of this study will consist of analyzing the different components of the Town's water and wastewater infrastructure system using the future growth projections and with considerations for climate change impacts, where applicable. Based on the design criteria and regulatory requirements outlined in this document, constraints and expansion requirements will be identified, and presented in the Environmental Assessment Phase 1 Report.

REFERENCES

Development Planning Studies:

- *Development Charges By-law and Background Study* (Watson & Associates, December 2020).
- *Preliminary Findings on Residential Supply vs Demand and three (3) growth scenarios for the Town of Carleton Place* letter (J.L. Richards, March 2021).
- *Council Report for Comprehensive Review* (Town of Carleton Place / J.L. Richards, March 2021).

Water Treatment Plant:

- *Carleton Place Drinking Water System* (OCWA, 2017).
- *Carleton Place Drinking Water System* (OCWA, 2018).
- *Carleton Place Drinking Water System* (OCWA, 2019).
- *Carleton Place Drinking Water System* (OCWA, 2020).
- *Permit to Take Water No. 1310-9UHPPW* (MECC, March 13, 2015).
- *Drinking Water Works Permit Number 172-201, Issue Number 3* (MECP, February 26, 2021).
- *Drinking Water Works License Number 172-101, Issue Number 3* (MECP, February 26, 2021).

Wastewater Treatment Plant:

- *Carleton Place Drinking Water System* (OCWA, 2017).
- *Carleton Place Drinking Water System* (OCWA, 2018).
- *Carleton Place Drinking Water System* (OCWA, 2019).
- *Carleton Place Drinking Water System* (OCWA, 2020).
- *Receiving Water Assessment Review for Carleton Place Water Pollution Control Plant Discharge to Mississippi River* (Stantec Consulting Ltd., May 2009).
- *Water Pollution Control Plant Capacity Expansion Master Plan* (Stantec Consulting Ltd., August 2011).
- *Facility Optimization Report for the Carleton Place Water Pollution Control Plant* draft memo (OCWA, April 2020).
- *Carleton Place Water Pollution Control Pant Certificate of Approval Number 5001-7FZT4A*, (MOE, October 3, 2008.

Sanitary Sewer System:

- *Trunk Sanitary Sewers – Hydraulic Capacity Investigation* memo (J.L. Richards, March 2014).
- *Update to Wastewater Trunk Sanitary Sewer Model* memo (J.L. Richards, March 2021).

Water Distribution System:

- *Hydraulic Water Model Investigation Future Development* memo, (J.L. Richards, September 2013).
- *Potable Water Storage Study* (J.L. Richards, November 2018).
- *Town of Carleton Place 2021 WaterCAD Model Update* (J.L. Richards, March 2021).

CLOSURE

We trust this information is satisfactory for your purposes. If you have any questions, please contact the undersigned.

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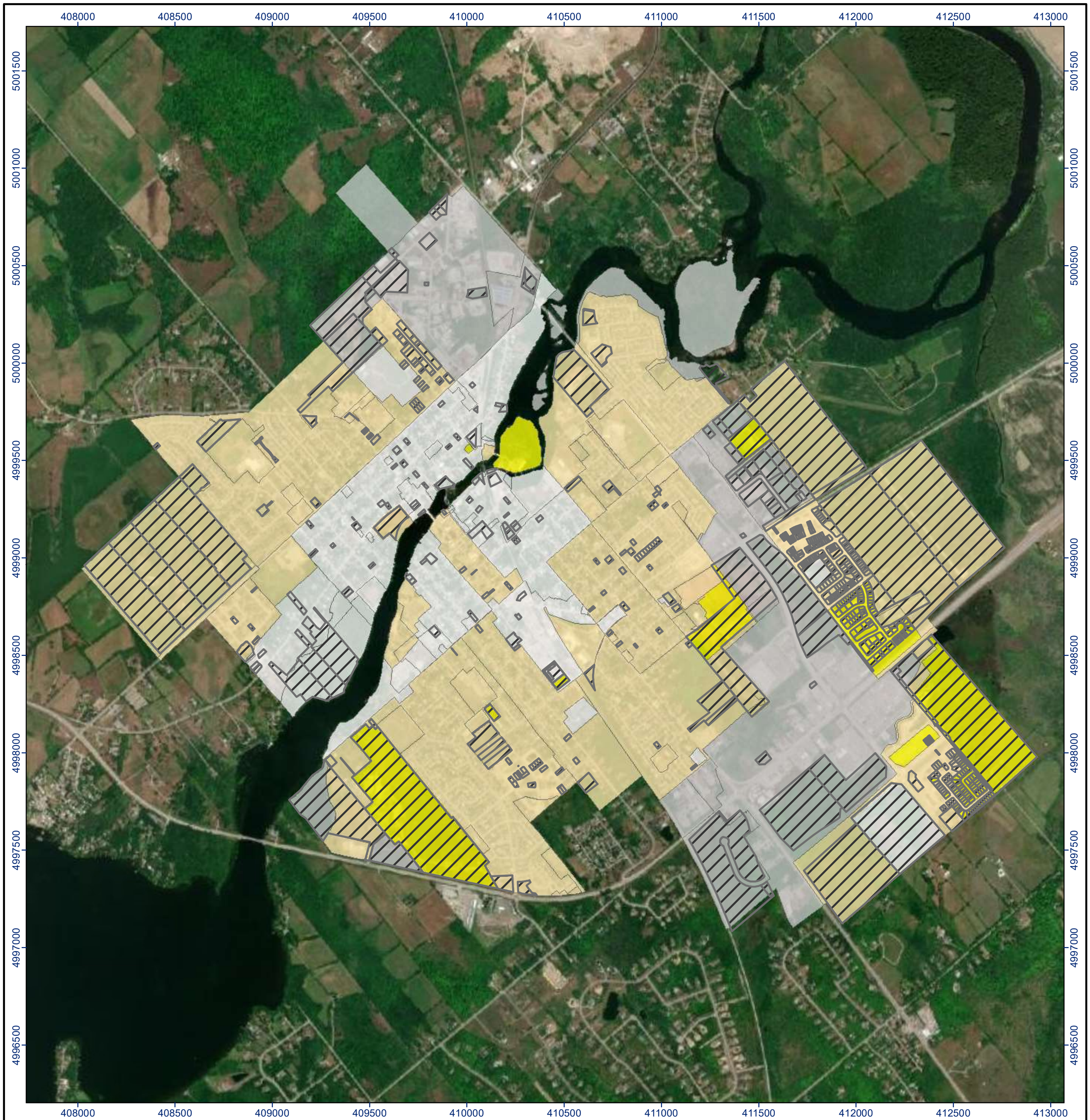
Attachments: Appendix A: Projected Growth Distribution Figures
Appendix B: Projected Development Phasing Tables
Appendix C: Wastewater Collection System Design Parameters and Level of Service Comparison

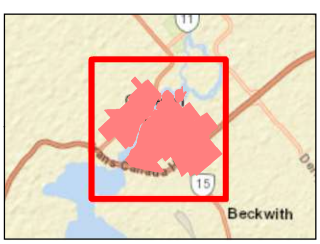
July 12, 2021

Guy Bourgon, P. Eng

Reference: Design Basis and Existing Conditions Review
Appendix A: Projected Growth Distribution Figures

Appendix A PROJECTED GROWTH DISTRIBUTION FIGURES





Legend

- Vacant Land
- No Planned Development
- 0% Developed
- ≥ 25% Developed
- ≥ 50% Developed
- ≥ 80% Developed
- 100% Developed

0 380 760
metres

(At original document size of 8.5x11)
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Stantec

Carleton PLACE

Notes

1. Coordinate System: NAD 1983 UTM Zone 18N
2. Data Sources: *parcelfabric.shp* provided by the Town of Carleton Place and *DP_landuse.shp* provided by J.L. Richards
3. Background: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Project Location
Carleton Place, ON

Client/Project
Carleton Place W&WW Master Plan
Town of Carleton Place
Carleton Place W&WW Master Plan
Design Basis Memo

Figure No.
A-1

Title
Projected Land Development in Carleton Place (2026)

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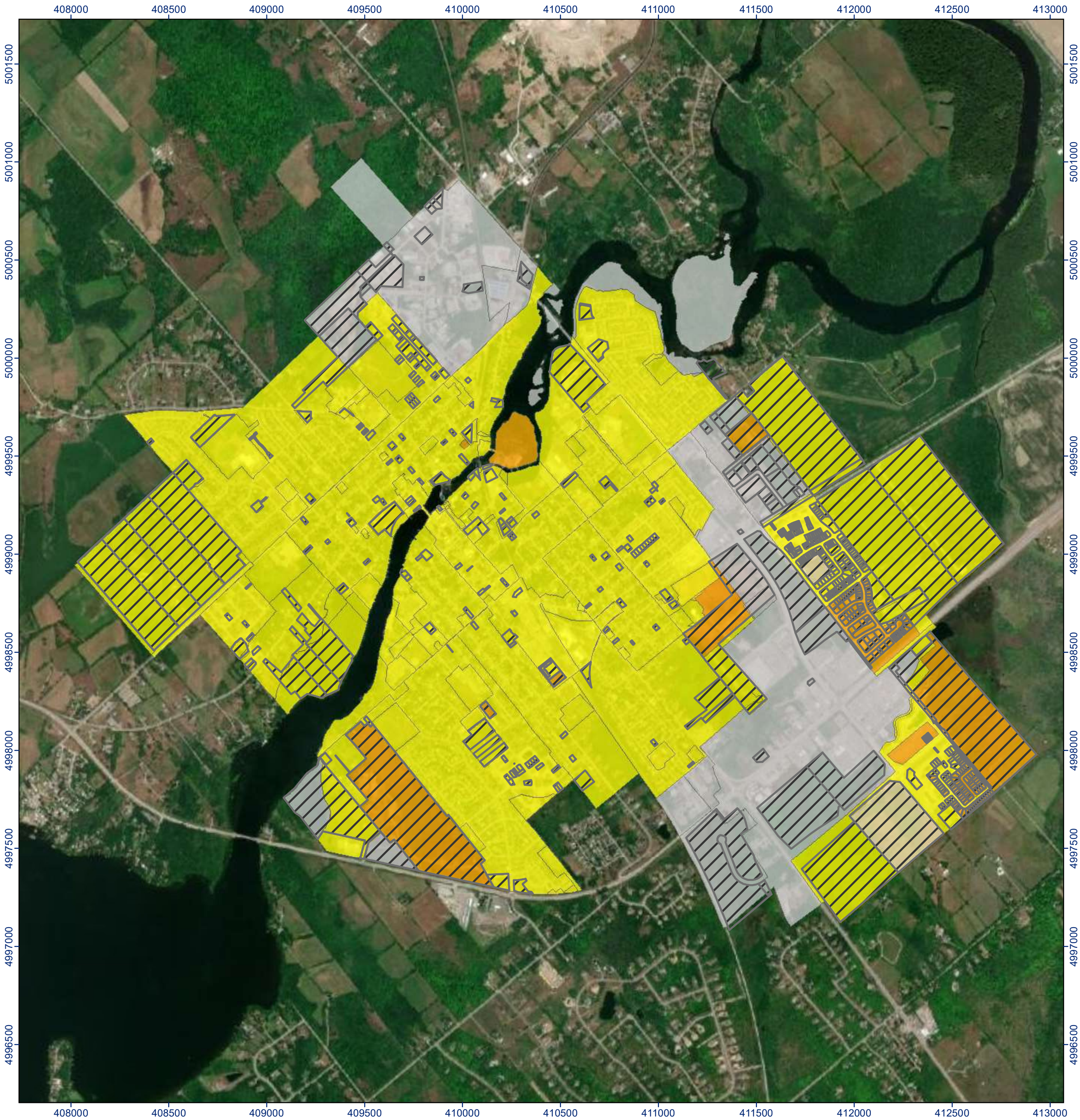

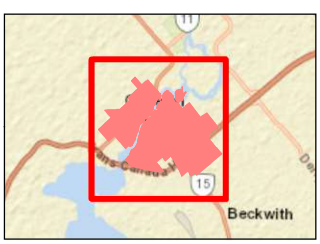

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- 100% Developed

0 380 760 metres

(At original document size of 8.5x11)
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Stantec

Carleton PLACE

Notes
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Project Location
Carleton Place, ON

Client/Project Carleton Place W&WW Master Plan
Town of Carleton Place
Carleton Place W&WW Master Plan
Design Basis Memo

Figure No.
A-2

Title
Projected Land Development in Carleton Place (2031)

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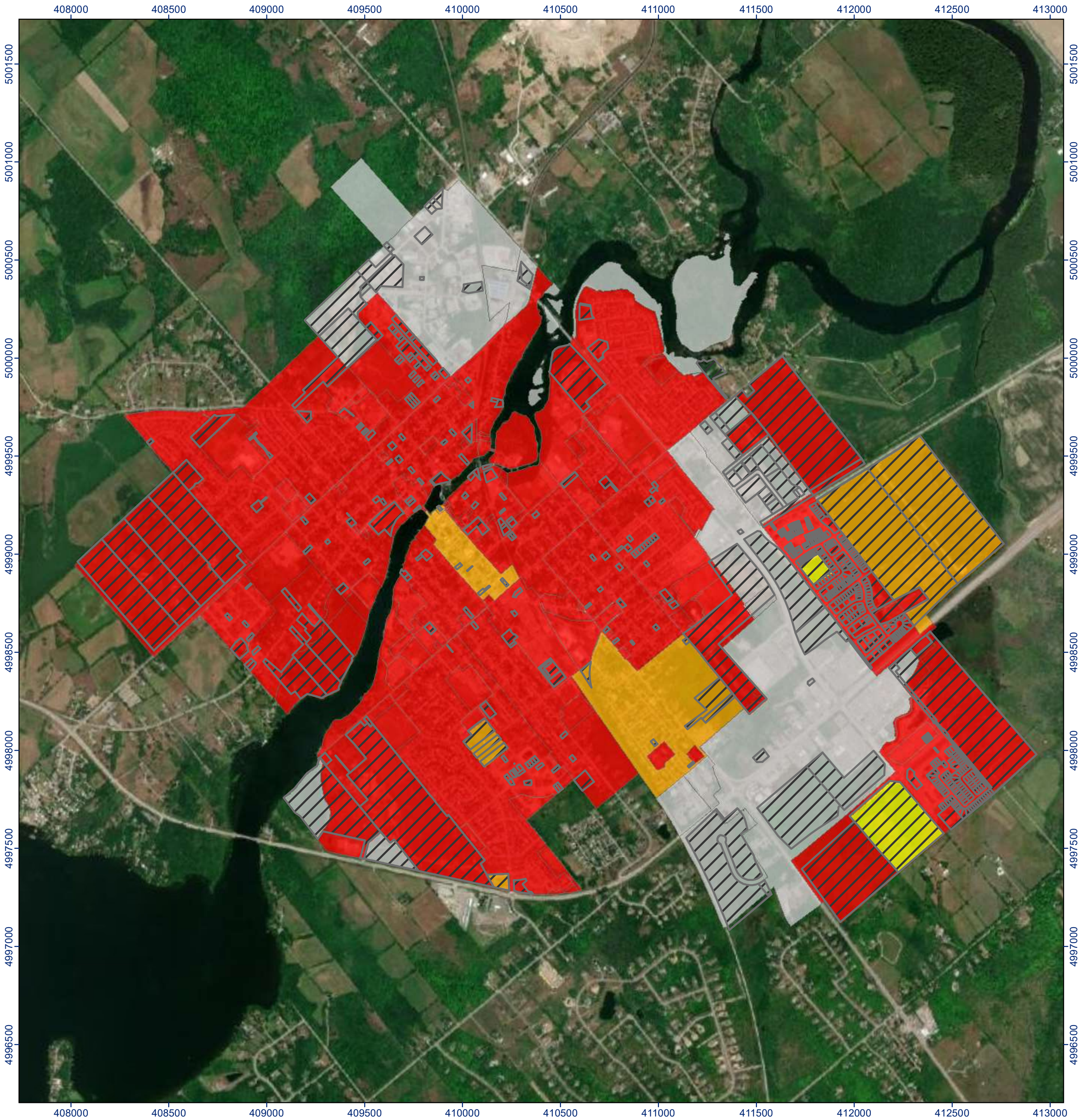

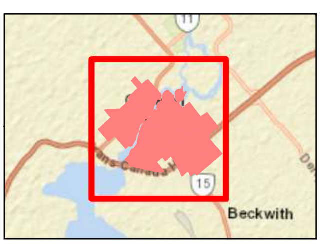

Legend

- Vacant Land
- No Planned Development
- 0% Developed
- ≥ 25% Developed
- ≥ 50% Developed
- ≥ 80% Developed
- 100% Developed

0 380 760
metres

(At original document size of 8.5x11)
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Stantec

Carleton PLACE

Notes
1. Coordinate System: NAD 1983 UTM Zone 18N
2. Data Sources: *parcelfabric.shp* provided by the Town of Carleton Place and *DP_landuse.shp* provided by J.L. Richards
3. Background: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Project Location
Carleton Place, ON

Client/Project
Carleton Place W&WW Master Plan
Town of Carleton Place
Carleton Place W&WW Master Plan
Design Basis Memo

Figure No.
A-3

Title
Projected Land Development in Carleton Place (2041)

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Appendix B PROJECTED DEVELOPMENT PHASING TABLES

163401646 - Town of Carleton Place W/WW Master Plan

Table B-1: Detailed Growth Forecast Phasing (as Percentage of Buildout) & Spatial Distribution (as Total upon Buildout)

Manual Input	
Calculated Value	

Average Population Density from 2021 to Buildout (0)	2.36	PPU
Population 15-64 years old (1)	60%	
Activity Rate (2)	17%	
Employment Density (9)	50	jobs/ha

JLR (2021) Growth Scenario 3 Developments + Active Development Applications		Adjusted Unit Count (3)		Land Use (Buildout)				% Developed - Residential (4)				% Developed - Commercial (4)				% Developed - Light Industrial (4)			
		Unit Count	New Density	Residential	Residential Area	Institutional/Commercial Area (5)	Light Industrial Area (5)	5-year Horizon 2026	10-year Horizon 2031	20-year Horizon 2041	Buildout (6)	5-year Horizon 2026	10-year Horizon 2031	20-year Horizon 2041	Buildout (6)	5-year Horizon 2026	10-year Horizon 2031	20-year Horizon 2041	Buildout (6)
Area	Sub-Neighbourhood	(-)	Units/ha	Population	ha	ha	ha	%	%	%	%	%	%	%	%	%	%	%	%
Strategic Properties	Strategic Property-25	103	35.0	244	2.94	0.25	0.25	25	50	100	100	25	50	100	100	25	50	100	100
Strategic Properties	Strategic Property-26 (7)	94	35.3	222	2.66	0.00	0.00	25	50	100	100	0	0	0	0	0	0	0	0
Strategic Properties	Strategic Property-27	52	35.4	123	1.47	0.13	0.13	25	50	100	100	25	50	100	100	25	50	100	100
Strategic Properties	Strategic Property-29	15	35.7	36	0.42	0.04	0.04	25	50	100	100	25	50	100	100	25	50	100	100
Residential Districts - Infill	Mississippi Residential Sector-38 (8)	31	30.4	74	1.02	0.00	0.00	0	50	100	100	0	0	0	0	0	0	0	0
Residential Districts - Infill	Mississippi Residential Sector-39	19	30.6	45	0.62	0.00	0.00	0	50	100	100	0	0	0	0	0	0	0	0
Residential Districts - Infill	Mississippi Residential Sector-40	9	31.0	22	0.29	0.00	0.00	0	50	100	100	0	0	0	0	0	0	0	0
Residential Districts - Infill	Mississippi Residential Sector-44	11	30.6	26	0.36	0.00	0.00	0	50	100	100	0	0	0	0	0	0	0	0
Residential Districts - Infill	Mississippi Residential Sector-30	9	33.3	22	0.27	0.00	0.00	0	50	100	100	0	0	0	0	0	0	0	0
Residential Districts - Infill	Mississippi Residential Sector-31	5	55.6	12	0.09	0.00	0.00	0	50	100	100	0	0	0	0	0	0	0	0
Residential Districts - Infill	Residential District-35	164	30.0	388	5.46	0.40	0.40	25	50	100	100	25	50	100	100	25	50	100	100
Residential Districts - Infill	Residential District-36	116	30.1	274	3.86	0.28	0.28	25	50	100	100	25	50	100	100	25	50	100	100
Residential Districts - Infill	Residential District-41	41	30.1	97	1.36	0.10	0.10	25	50	100	100	25	50	100	100	25	50	100	100
Residential Districts - Infill	Residential District-42	60	30.3	142	1.98	0.14	0.14	25	50	100	100	25	50	100	100	25	50	100	100
Residential Districts - Infill	Residential District-43	278	30.0	657	9.26	0.67	0.67	25	50	100	100	25	50	100	100	25	50	100	100
Residential Districts - Infill	Residential District-45	17	31.5	41	0.54	0.04	0.04	25	50	100	100	25	50	100	100	25	50	100	100
Residential Districts - Infill	Residential District-46	153	30.1	362	5.09	0.37	0.37	25	50	100	100	25	50	100	100	25	50	100	100
Residential Districts - Infill	Residential District-47	12	30.8	29	0.39	0.03	0.03	25	50	100	100	25	50	100	100	25	50	100	100
Residential Districts - Infill	Downtown District-33	3	50.0	8	0.06	0.01	0.01	25	50	100	100	25	50	100	100	25	50	100	100
Residential Districts - Urban Greenfield	Urban Greenfield-20	168	26.1	397	6.44	0.40	0.40	0	25	75	100	0	25	75	100	0	25	75	100
Residential Districts - Urban Greenfield	Urban Greenfield-30	21	27.3	50	0.77	0.05	0.05	0	25	75	100	0	25	75	100	0	25	75	100
Residential Districts - Urban Greenfield	Urban Greenfield-40	31	26.7	74	1.16	0.08	0.08	25	50	90	100	25	50	90	100	25	50	90	100
Residential Districts - Urban Greenfield	Urban Greenfield-50	647	26.0	1,527	24.88	1.56	1.56	25	50	90	100	25	50	90	100	25	50	90	100
Residential Districts - Intensification Sites	Intensification-10	102	26.0	241	3.92	0.25	0.25	0	50	100	100	0	50	100	100	0	50	100	100
Residential Districts - Intensification Sites	Intensification-20	8	28.6	19	0.28	0.02	0.02	0	50	100	100	0	50	100	100	0	50	100	100
Residential Districts - Intensification Sites	Intensification-30	31	26.1	74	1.19	0.08	0.08	0	50	100	100	0	50	100	100	0	50	100	100
Residential Districts - Intensification Sites	Intensification-40	4	28.6	10	0.14	0.01	0.01	0	50	100	100	0	50	100	100	0	50	100	100
Settlement Boundary - Rural Greenfield	Rural Greenfield-10	429	19.6	1,013	21.84	1.03	1.03	0	0	90	100	0	25	90	100	0	25	90	100
Settlement Boundary - Rural Greenfield	Rural Greenfield-50	209	19.7	494	10.62	0.50	0.50	0	25	90	100	0	25	90	100	0	25	90	100
Additional Residential Units	5% of all units	143	-	338	0	0.00	0.00	25	50	100	100	25	50	100	100	25	50	100	100
Active Development Applications	Bodnar Lands	582	-	1,374	0	0.00	0.00	50	80	100	100	50	80	100	100	50	80	100	100
Active Development Applications	Carmichael Farm Phase 2	323	-	763	0	0.00	0.00	50	80	100	100	50	80	100	100	50	80	100	100
Active Development Applications	Carmichael Farm Phase 1	24	-	57	0	0.00	0.00	50	80	100	100	50	80	100	100	50	80	100	100
Active Development Applications	NuGlobe Developments (Nelson St E, Coleman/McNeely)	128	-	303	0	0.00	0.00	50	80	100	100	50	80	100	100	50	80	100	100
Active Development Applications	Strategic Property (McArthur Island)	595	-	1,405	0	0.00	0.00	50	80	100	100	50	80	100	100	50	80	100	100
Active Development Applications	LCHC - 7 Arthur St	20	-	48	0	0.00	0.00	50	80	100	100	50	80	100	100	50	80	100	100
Active Development Applications	119 Bell St	51	-	121	0	0.00	0.00	50	80	100	100	50	80	100	100	50	80	100	100
Active Development Applications	127 Boyd	32	-	76	0	0.00	0.00	50	80	100	100	50	80	100	100	50	80	100	100
Active Development Applications	Millers Crossing (remaining lots)	114	-	270	0	0.00	0.00	50	80	100	100	50	80	100	100	50	80	100	100
Active Development Applications	Highway 7 behind Canadian Tire	152	-	359	0	0.00	0.00	50	80	100	100	50	80	100	100	50	80	100	100
Active Development Applications	Stoneridge Manor Long-Term Care Home (29 Costello)	128	-	303	0	0.00	0.00	50	80	100	100	50	80	100	100	50	80	100	100

		Unit Count	New Density	Residential Population	Residential Area	Institutional/Commercial Area	Light Industrial Area	Average % Developed											
Subtotal Additional Growth Units		2,842		6,723	109	6	6												
Total (Growth + Additional 5%)		2,985		7,061	109	6	6												
Active Development Applications		2,149		5,079	-	5.18	5.18												
Total Growth (Growth + Additional 5% + Active Development Applications)		5,134		12,140	109	12	12	23	55	98	100	23	47	81	83	23	47	81	83

Baseline (2021) (9)		5,623		13,244	17.5	17.5
Total upon Buildout (Baseline + Growth)		10,757		25,384	29.1	29.1
Total upon Buildout (Baseline + Growth) - Rounded				25,500		

Notes & Assumptions

(0) Average population density based on 2020 DC Study forecasted population densities.
(1) Assume similar age distribution as in 2020 in JLR's Comprehensive Review; proportion of population between 15-64 years of age constant
(2) Activity rate for 2020 from JLR's Comprehensive Review
(3) Adjusted unit count to match projected 20-year additional unit count (+4,958 units in 2041), based on 2020 DC Study additional housing units, while meeting density targets
(4) Assume that ICI develops at the same rate as the residential areas
(5) Assumed 50% of ICI development is institutional/commercial, and 50% is light industrial; ICI area based on activity rate of 17% and employment density of 50 jobs/ha
(6) Buildout provided for reference, but not part of scope
(7) DRS Strategic Property; Official Plan (2013) limits development/redevelopment to residential uses
(8) Official Plan (2013) Section 3.2.2: "[…] it is not the intention of this Plan to permit new local commercial uses in the Mississippi District Residential Policy Area"
(9) 2021 Baseline number of units & population based on Comprehensive Review by JLR (includes active development applications) for 2020 + follow similar approach to expand to 2021

163401646 - Town of Carleton Place W/WW Master Plan

Table B-2: Detailed Growth Forecast Phasing & Spatial Distribution (as Total per Planning Horizon)

Manual Input
Calculated Value

JLR (2021) Growth Scenario 3 Developments + Active Development Applications		# of Units Developed - Residential				Population - Residential			
		5-year Horizon 2026	10-year Horizon 2031	20-year Horizon 2041	Buildout(5)	5-year Horizon 2026	10-year Horizon 2031	20-year Horizon 2041	Buildout(5)
Area	**Sub-Neighbourhood**	(-)	(-)	(-)	(-)	ppl	ppl	ppl	ppl
Strategic Properties	Strategic Property-25	26	52	103	103	61	122	244	244
Strategic Properties	Strategic Property-26(7)	24	47	94	94	56	111	222	222
Strategic Properties	Strategic Property-27	13	26	52	52	31	62	123	123
Strategic Properties	Strategic Property-29	4	8	15	15	9	18	36	36
Residential Districts - Infill	Mississippi Residential Sector-38(8)	0	16	31	31	0	37	74	74
Residential Districts - Infill	Mississippi Residential Sector-39	0	10	19	19	0	23	45	45
Residential Districts - Infill	Mississippi Residential Sector-40	0	5	9	9	0	11	22	22
Residential Districts - Infill	Mississippi Residential Sector-44	0	6	11	11	0	13	26	26
Residential Districts - Infill	Mississippi Residential Sector-30	0	5	9	9	0	11	22	22
Residential Districts - Infill	Mississippi Residential Sector-31	0	3	5	5	0	6	12	12
Residential Districts - Infill	Residential District-35	41	82	164	164	97	194	388	388
Residential Districts - Infill	Residential District-36	29	58	116	116	69	137	274	274
Residential Districts - Infill	Residential District-41	11	21	41	41	25	49	97	97
Residential Districts - Infill	Residential District-42	15	30	60	60	36	71	142	142
Residential Districts - Infill	Residential District-43	70	139	278	278	165	329	657	657
Residential Districts - Infill	Residential District-45	5	9	17	17	11	21	41	41
Residential Districts - Infill	Residential District-46	39	77	153	153	91	181	362	362
Residential Districts - Infill	Residential District-47	3	6	12	12	8	15	29	29
Residential Districts - Infill	Downtown District-33	1	2	3	3	2	4	8	8
Residential Districts - Urban Greenfield	Urban Greenfield-20	0	42	126	168	0	100	298	397
Residential Districts - Urban Greenfield	Urban Greenfield-30	0	6	16	21	0	13	38	50
Residential Districts - Urban Greenfield	Urban Greenfield-40	8	16	28	31	19	37	67	74
Residential Districts - Urban Greenfield	Urban Greenfield-50	162	324	583	647	382	764	1375	1527
Residential Districts - Intensification Sites	Intensification-10	0	51	102	102	0	121	241	241
Residential Districts - Intensification Sites	Intensification-20	0	4	8	8	0	10	19	19
Residential Districts - Intensification Sites	Intensification-30	0	16	31	31	0	37	74	74
Residential Districts - Intensification Sites	Intensification-40	0	2	4	4	0	5	10	10
Settlement Boundary - Rural Greenfield	Rural Greenfield-10	0	0	387	429	0	0	912	1013
Settlement Boundary - Rural Greenfield	Rural Greenfield-50	0	53	189	209	0	124	445	494
Additional Residential Units	5% of all units	36	72	143	143	85	169	338	338
Active Development Applications	Bodnar Lands	291	466	582	582	687	1100	1374	1374
Active Development Applications	Carmichael Farm Phase 2	162	259	323	323	382	611	763	763
Active Development Applications	Carmichael Farm Phase 1	12	20	24	24	29	46	57	57
Active Development Applications	NuGlobe Developments (Nelson St E, Coleman/McNeely)	64	103	128	128	152	243	303	303
Active Development Applications	Strategic Property (McArthur Island)	298	476	595	595	703	1124	1405	1405
Active Development Applications	LCHC - 7 Arthur St	10	16	20	20	24	39	48	48
Active Development Applications	119 Bell St	26	41	51	51	61	97	121	121
Active Development Applications	127 Boyd	16	26	32	32	38	61	76	76
Active Development Applications	Millers Crossing (remaining lots)	57	92	114	114	135	216	270	270
Active Development Applications	Highway 7 behind Canadian Tire	76	122	152	152	180	288	359	359
Active Development Applications	Stoneridge Manor Long-Term Care Home (29 Costello)	64	103	128	128	152	243	303	303
Total Growth (Growth + Additional 5% + Active Development Applications)		1,563	2,912	4,958	5,134	3,690	6,863	11,720	12,140
Baseline (2021)(9)		5,623	5,623	5,623	5,623	13,244	13,244	13,244	13,244
Total upon Buildout (Baseline + Growth)		7,186	8,535	10,581	10,757	16,934	20,107	24,964	25,384
Total upon Buildout (Baseline + Growth) - Rounded									

JLR (2021) Growth Scenario 3 Developments + Active Development Applications		Area Developed - Residential				Area Developed - Commercial				Area Developed - Light Industrial			
		5-year Horizon 2026	10-year Horizon 2031	20-year Horizon 2041	Buildout(5)	5-year Horizon 2026	10-year Horizon 2031	20-year Horizon 2041	Buildout(5)	5-year Horizon 2026	10-year Horizon 2031	20-year Horizon 2041	Buildout(5)
Area	**Sub-Neighbourhood**	ha	ha	ha	ha	ha	ha	ha	ha	ha	ha	ha	ha
Strategic Properties	Strategic Property-25	0.74	1.47	2.94	2.94	0.06	0.12	0.25	0.25	0.06	0.12	0.25	0.25
Strategic Properties	Strategic Property-26(7)	0.67	1.33	2.66	2.66	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Strategic Properties	Strategic Property-27	0.37	0.74	1.47	1.47	0.03	0.06	0.13	0.13	0.03	0.06	0.13	0.13
Strategic Properties	Strategic Property-29	0.11	0.21	0.42	0.42	0.01	0.02	0.04	0.04	0.01	0.02	0.04	0.04
Residential Districts - Infill	Mississippi Residential Sector-38(8)	0.00	0.51	1.02	1.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Residential Districts - Infill	Mississippi Residential Sector-39	0.00	0.31	0.62	0.62	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Residential Districts - Infill	Mississippi Residential Sector-40	0.00	0.15	0.29	0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Residential Districts - Infill	Mississippi Residential Sector-44	0.00	0.18	0.36	0.36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Residential Districts - Infill	Mississippi Residential Sector-30	0.00	0.14	0.27	0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Residential Districts - Infill	Mississippi Residential Sector-31	0.00	0.05	0.09	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Residential Districts - Infill	Residential District-35	1.37	2.73	5.46	5.46	0.10	0.20	0.40	0.40	0.10	0.20	0.40	0.40
Residential Districts - Infill	Residential District-36	0.97	1.93	3.86	3.86	0.07	0.14	0.28	0.28	0.07	0.14	0.28	0.28
Residential Districts - Infill	Residential District-41	0.34	0.68	1.36	1.36	0.02	0.05	0.10	0.10	0.02	0.05	0.10	0.10
Residential Districts - Infill	Residential District-42	0.50	0.99	1.98	1.98	0.04	0.07	0.14	0.14	0.04	0.07	0.14	0.14
Residential Districts - Infill	Residential District-43	2.32	4.63	9.26	9.26	0.17	0.34	0.67	0.67	0.17	0.34	0.67	0.67
Residential Districts - Infill	Residential District-45	0.14	0.27	0.54	0.54	0.01	0.02	0.04	0.04	0.01	0.02	0.04	0.04
Residential Districts - Infill	Residential District-46	1.27	2.55	5.09	5.09	0.09	0.18	0.37	0.37	0.09	0.18	0.37	0.37
Residential Districts - Infill	Residential District-47	0.10	0.20	0.39	0.39	0.01	0.01	0.03	0.03	0.01	0.01	0.03	0.03
Residential Districts - Infill	Downtown District-33	0.02	0.03	0.06	0.06	0.00	0.00	0.01	0.01	0.00	0.00	0.01	0.01
Residential Districts - Urban Greenfield	Urban Greenfield-20	0.00	1.61	4.83	6.44	0.00	0.10	0.30	0.40	0.00	0.10	0.30	0.40
Residential Districts - Urban Greenfield	Urban Greenfield-30	0.00	0.19	0.58	0.77	0.00	0.01	0.04	0.05	0.00	0.01	0.04	0.05
Residential Districts - Urban Greenfield	Urban Greenfield-40	0.29	0.58	1.04	1.16	0.02	0.04	0.07	0.08	0.02	0.04	0.07	0.08
Residential Districts - Urban Greenfield	Urban Greenfield-50	6.22	12.44	22.39	24.88	0.39	0.78	1.40	1.56	0.39	0.78	1.40	1.56
Residential Districts - Intensification Sites	Intensification-10	0.00	1.96	3.92	3.92	0.00	0.12	0.25	0.25	0.00	0.12	0.25	0.25
Residential Districts - Intensification Sites	Intensification-20	0.00	0.14	0.28	0.28	0.00	0.01	0.02	0.02	0.00	0.01	0.02	0.02
Residential Districts - Intensification Sites	Intensification-30	0.00	0.60	1.19	1.19	0.00	0.04	0.08	0.08	0.00	0.04	0.08	0.08
Residential Districts - Intensification Sites	Intensification-40	0.00	0.07	0.14	0.14	0.00	0.01	0.01	0.01	0.00	0.01	0.01	0.01
Settlement Boundary - Rural Greenfield	Rural Greenfield-10	0.00	0.00	19.66	21.84	0.00	0.26	0.93	1.03	0.00	0.26	0.93	1.03
Settlement Boundary - Rural Greenfield	Rural Greenfield-50	0.00	2.66	9.56	10.62	0.00	0.13	0.45	0.50	0.00	0.13	0.45	0.50
Additional Residential Units	5% of all units	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Active Development Applications	Bodnar Lands	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Active Development Applications	Carmichael Farm Phase 2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Active Development Applications	Carmichael Farm Phase 1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Active Development Applications	NuGlobe Developments (Nelson St E, Coleman/McNeely)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Active Development Applications	Strategic Property (McArthur Island)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Active Development Applications	LCHC - 7 Arthur St	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Active Development Applications	119 Bell St	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Active Development Applications	127 Boyd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Active Development Applications	Millers Crossing (remaining lots)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Active Development Applications	Highway 7 behind Canadian Tire	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Active Development Applications	Stoneridge Manor Long-Term Care Home (29 Costello)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Growth (Growth + Additional 5% + Active Development Applications)		15	39	102	109	1.02	2.71	5.99	6.43	1.02	2.71	5.99	6.43
Baseline (2021)(9)						17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5
Total upon Buildout (Baseline + Growth)						21.1	24.4	28.7	29.1	21.1	24.4	28.7	29.1
Total upon Buildout (Baseline + Growth) - Rounded													

Notes & Assumptions

(0) Average population density based on 2020 DC Study forecasted population densities.
(1) Assume similar age distribution as in 2020 in JLR's Comprehensive Review; proportion of population between 15-64 years of age constant
(2) Activity rate for 2020 from JLR's Comprehensive Review
(3) Adjusted unit count to match projected 20-year additional unit count (+4,958 units in 2041), based on 2020 DC Study additional housing units, while meeting density targets
(4) Assume that ICI develops at the same rate as the residential areas
(5) Assumed 50% of ICI development is institutional/commercial, and 50% is light industrial; ICI area based on activity rate of 17% and employment density of 50 jobs/ha
(6) Buildout provided for reference, but not part of scope
(7) DRS Strategic Property; Official Plan (2013) limits development/redevelopment to residential uses
(8) Official Plan (2013) Section 3.2.2: "[…] it is not the intention of this Plan to permit new local commercial uses in the Mississippi District Residential Policy Area"
(9) 2021 Baseline number of units & population based on Comprehensive Review by JLR (includes active development applications) for 2020 + follow similar approach to expand to 2021

Appendix C WASTEWATER COLLECTION SYSTEM DESIGN PARAMETERS AND LEVEL OF SERVICE COMPARISON

Table C- 1: Comparison of Sanitary Flow Generation and Level of Service Parameters

Design Parameter	Previous Modelling Studies (1)			Annual Performance Reports (2017 - 2020)	2019 MECP Guidelines	Ottawa Design Guidelines - Sewer		
	2014 Model (Existing)	2014 Model (Future)	2021 Model (Existing)			Design	Annual (1)	Rare (2)
Population Densities								
Single Family	2.5 persons/unit			2.5 persons/unit	-	3.4 persons/unit		
Semi-Detached					-	2.7 persons/unit		
Duplex					-	2.3 persons/unit		
Townhouse (Row)					-	2.7 persons/unit		
Apartments, Bachelor/1-Bedroom					-	1.4 persons/unit		
Apartments, 2-Bedroom					-	2.1 persons/unit		
Apartments, 3-Bedroom					-	3.1 persons/unit		
Average Apartment					-	1.8 persons/unit		
Average Residential Population per Area	-	20 units/ha	-	-	Min.:25 persons/gross ha	60 persons/gross ha		
Flow Generation								
Average DWF Rate, Residential	430 L/c/d	350 L/c/d	392 L/c/d	386 L/c/d – 423 L/c/d	225 to 450 L/c/d	280 L/c/d	200 L/c/d	
Peaking Factor, Residential	Harmon Peaking Factor (PF) with Correction Factor: 1			2.84 – 2.90	Harmon or Babbitt formula Minimum: 2	Harmon PF with Correction Factor: 0.8	Harmon PF with Correction Factor: 0.6	Harmon PF with Correction Factor: 0.6
Groundwater Infiltration (Dry Weather Extraneous Flows)	0.10 L/s/ha	-	0.10 L/s/ha	0.01 L/s/ha – 0.06 L/s/ha	-	I/I Dry: 0.05 L/s/eff. gross ha	<u>Separated sewers</u>:	<u>Separated sewers</u>:

Design Parameter	Previous Modelling Studies (1)			Annual Performance Reports (2017 - 2020)	2019 MECP Guidelines	Ottawa Design Guidelines - Sewer		
	2014 Model (Existing)	2014 Model (Future)	2021 Model (Existing)			Design	Annual (1)	Rare (2)
Peak Rate, Extraneous Flows	0.28 L/s/ha 0.40 L/s/ha for drainage areas tributary to flow monitor (FM) #6 located on High St at Thomas St, representing the western portion of the Town			0.22 L/s/ha – 0.55 L/s/ha	Peak extraneous flows from applicable references	I/I Wet: 0.28 L/s/eff. gross ha Total I/I: 0.33 L/s/eff. gross ha	I/I Dry: 0.02 L/s/eff. gross ha I/I Wet: 0.28 L/s/eff. gross ha Total I/I 0.3 L/s/eff. gross ha Partially separated sewers (3): Total I/I: to be determined at design	I/I Dry: 0.02 L/s/eff. gross ha I/I Wet: 0.53 L/s/eff. gross ha Total I/I 0.55 L/s/eff. gross ha Partially separated sewers (3): Total I/I: 3.0 L/s/gross ha
Average DWF Rate, Commercial	-	28,000 L/ha/d	-	-	28 m^3/ha/d (4)	28,000 L/gross ha/d	17,000 L/gross ha/d	
Peaking Factor, Commercial	-	2.7	-	-	Similar to relative peak water usage rates	ICI contribution > 20% : 1.5 ICI contribution ≤ 20% : 1.0	ICI contribution > 20% : 1.0 ICI contribution ≤ 20% : 1.0	
Average DWF Rate, Institutional	-	-	-	-	28 m^3/ha/d (4)	28,000 L/gross ha/d	17,000 L/gross ha/d	
Peaking Factor, Institutional	-	-	-	-	Similar to relative peak water usage rates	ICI contribution > 20% : 1.5 ICI contribution ≤ 20% : 1.0	ICI contribution > 20% : 1.0 ICI contribution ≤ 20% : 1.0	

Design Parameter	Previous Modelling Studies [(1)]			Annual Performance Reports (2017 - 2020)	2019 MECP Guidelines	Ottawa Design Guidelines - Sewer		
	2014 Model (Existing)	2014 Model (Future)	2021 Model (Existing)			Design	Annual [(1)]	Rare [(2)]
Average DWF Rate, Light Industrial	-	35,000 L/gross ha/d	-	-	Industry/process-specific rates. Based on monitoring.	35,000 L/gross ha/d	10,000 L/gross ha/d	
Peaking Factor, Light Industrial	-	2.7	-	-		ICI contribution > 20% : 1.5 ICI contribution ≤ 20% : 1.0	ICI contribution > 20% : 1.0 ICI contribution ≤ 20% : 1.0	
Level of Service								
Sewer Capacity	Identified trunk sewers at 90% theoretical conveyance capacity		-	-	Flows from residential, commercial, institutional and industrial establishments, plus extraneous flow (groundwater, surface runoff) Peak sewage flow rates for present and future conditions Design for ultimate tributary population, and for maximum anticipated capacity of institutions, industrial parks and other sewage sources	In existing separated areas: • Peak sewage flow from the ultimate development level expected from the tributary area • Clean sewers not surcharged under peak flow conditions In greenfield areas: • Peak sewage flow from the ultimate development Level expected form the tributary area		

Design Parameter	Previous Modelling Studies [1]			Annual Performance Reports (2017 - 2020)	2019 MECP Guidelines	Ottawa Design Guidelines - Sewer		
	2014 Model (Existing)	2014 Model (Future)	2021 Model (Existing)			Design	Annual [1]	Rare [2]
Hydraulic Grade Line	-	-	-	-	-	-	HGL must be at least 0.3 m below the underside of footing	HGL must not touch the underside of footing

Notes:

(1) Previous modelling studies: JLR (2014) and JLR (2021)
(2) Annual: Assessment of HGL in the sanitary system, assuming pumping station failure
(3) Rare: Assessment of HGL in the sanitary system, under normal pumping station conditions (station operating at its rated capacity)
(4) Rates for a neighbourhood-level analysis
(5) Minimum for commercial tourist areas; should be based on historical records, if available. Also refer to rates in MECP (2019) Table 5-3.

Appendix B Water Distribution System Hydraulic Modelling Results

163401646 - Town of Carleton Place W/WW Master Plan

Table B-1: Future Development Areas Water Demand - 2026

Residential Averaı	350	L/c/d
MXDY Factor, Re:	1.75	
PKHR Factor, Res	1.5	

Commercial Ave	28,000	L/gross ha/d
MXDY Factor, I(	1.5	
PKHR Factor, I(	1.8	

Industrial A\	35,000	L/gross ha/d
MXDY Facto	1.5	
PKHR Facto	1.8	

Manual Input
Calculated Value

JLR (2021) Growth Scenario 3 Developments + Active Development Applications — 2026

Area	Sub-Neighbourhood	GIS ID	Number of Demand Nodes	Residential: Population	AVDY (L/d)	AVDY (L/s)	MXDY (L/d)	MXDY (L/s)	PKHR (L/d)	PKHR (L/s)
Strategic Properties	Strategic Property-25	SP-25	2	64	22,400	0.26	39,200	0.45	58,800	0.68
Strategic Properties	Strategic Property-26(7)	SP-26	7	59	20,650	0.24	36,138	0.42	54,206	0.63
Strategic Properties	Strategic Property-27	SP-27	1	33	11,550	0.13	20,213	0.23	30,319	0.35
Strategic Properties	Strategic Property-29	SP-29	1	10	3,500	0.04	6,125	0.07	9,188	0.11
Residential Districts - Infill	Mississippi Residential Sector-38(8)	MR-38	31	-	-	-	-	-	-	-
Residential Districts - Infill	Mississippi Residential Sector-39	MR-39	19	-	-	-	-	-	-	-
Residential Districts - Infill	Mississippi Residential Sector-40	MR-40	9	-	-	-	-	-	-	-
Residential Districts - Infill	Mississippi Residential Sector-44	MR-44	3	-	-	-	-	-	-	-
Residential Districts - Infill	Mississippi Residential Sector-30	MT-30	9	-	-	-	-	-	-	-
Residential Districts - Infill	Mississippi Residential Sector-31	MT-31	5	-	-	-	-	-	-	-
Residential Districts - Infill	Residential District-35	RD-35	62	102	35,700	0.41	62,475	0.72	93,713	1.08
Residential Districts - Infill	Residential District-36	RD-36	77	72	25,200	0.29	44,100	0.51	66,150	0.77
Residential Districts - Infill	Residential District-41	RD-41	36	26	9,100	0.11	15,925	0.18	23,888	0.28
Residential Districts - Infill	Residential District-42	RD-42	26	38	13,300	0.15	23,275	0.27	34,913	0.40
Residential Districts - Infill	Residential District-43	RD-43	31	173	60,550	0.70	105,963	1.23	158,944	1.84
Residential Districts - Infill	Residential District-45	RD-45	17	11	3,850	0.04	6,738	0.08	10,106	0.12
Residential Districts - Infill	Residential District-46	RD-46	40	95	33,250	0.38	58,188	0.67	87,281	1.01
Residential Districts - Infill	Residential District-47	RD-47	12	8	2,800	0.03	4,900	0.06	7,350	0.09
Residential Districts - Infill	Downtown District-33	DD-33	3	2	700	0.01	1,225	0.01	1,838	0.02
Residential Districts - Urban Greenfield	Urban Greenfield-20	UG-20	1	-	-	-	-	-	-	-
Residential Districts - Urban Greenfield	Urban Greenfield-30	UG-30	2	-	-	-	-	-	-	-
Residential Districts - Urban Greenfield	Urban Greenfield-40	UG-40	1	20	7,000	0.08	12,250	0.14	18,375	0.21
Residential Districts - Urban Greenfield	Urban Greenfield-50	UG-50	2	401	140,350	1.62	245,613	2.84	368,419	4.26
Residential Districts - Intensification Sites	Intensification-10	IS-10	1	-	-	-	-	-	-	-
Residential Districts - Intensification Sites	Intensification-20	IS-20	1	-	-	-	-	-	-	-
Residential Districts - Intensification Sites	Intensification-30	IS-30	1	-	-	-	-	-	-	-
Residential Districts - Intensification Sites	Intensification-40	IS-40	1	-	-	-	-	-	-	-
Settlement Boundary - Rural Greenfield	Rural Greenfield-10	RG-10	2	-	-	-	-	-	-	-
Settlement Boundary - Rural Greenfield	Rural Greenfield-50	RG-50	2	-	-	-	-	-	-	-
Additional Residential Units	5% of all units		0	-	-	-	-	-	-	-
Active Development Applications	Bodnar Lands	BodLands	1	687	240,450	2.78	420,788	4.87	631,181	7.31
Active Development Applications	Carmichael Farm Phase 2	CarmFarm12-2	1	382	133,700	1.55	233,975	2.71	350,963	4.06
Active Development Applications	Carmichael Farm Phase 1	CarmFarm12-1	1	29	10,150	0.12	17,763	0.21	26,644	0.31
Active Development Applications	NuGlobe Developments (Nelson St E, Coleman/McNeely)	NuGlobe	6	152	53,200	0.62	93,100	1.08	139,650	1.62
Active Development Applications	Strategic Property (McArthur Island)	SP-McArt	1	703	246,050	2.85	430,588	4.98	645,881	7.48
Active Development Applications	LCHC - 7 Arthur St	LCHC7Art	1	24	8,400	0.10	14,700	0.17	22,050	0.26
Active Development Applications	119 Bell St	119Bell	1	61	21,350	0.25	37,363	0.43	56,044	0.65
Active Development Applications	127 Boyd	127Boyd	1	38	13,300	0.15	23,275	0.27	34,913	0.40
Active Development Applications	Millers Crossing (remaining lots)	MillCross	2	135	47,250	0.55	82,688	0.96	124,031	1.44
Active Development Applications	Highway 7 behind Canadian Tire	Hwy7CT	9	180	63,000	0.73	110,250	1.28	165,375	1.91
Active Development Applications	Stoneridge Manor Long-Term Care Home (29 Costello)	StoneLTC	1	152	53,200	0.62	93,100	1.08	139,650	1.62
Subtotal Additional Growth Units			Total	1,114	389,900	5	682,325	8	1,023,488	12
Total (Growth + Additional 5%)										
Active Development Applications		Active_Dev	21	2,543	-	-	-	-	-	-
Total Growth (Growth + Additional 5% + Active Development Applications)										

GIS ID	Institutional/Commercial: Area (ha)	AVDY (L/d)	AVDY (L/s)	MXDY (L/d)	MXDY (L/s)	PKHR (L/d)	PKHR (L/s)	Light Industrial: Area (ha)	AVDY (L/d)	AVDY (L/s)	MXDY (L/d)	MXDY (L/s)	PKHR (L/d)	PKHR (L/s)	Demand per Node: AVDY (L/s)	MXDY (L/s)	PKHR (L/s)
SP-25	0.07	1,821	0.02	2,731	0.03	4,916	0.06	0.07	2,276	0.03	3,414	0.04	6,145	0.07	0.15	0.26	0.40
SP-26	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.03	0.06	0.09
SP-27	0.03	928	0.01	1,392	0.02	2,506	0.03	0.03	1,160	0.01	1,740	0.02	3,133	0.04	0.16	0.27	0.42
SP-29	0.01	271	0.00	407	0.00	733	0.01	0.01	339	0.00	509	0.01	916	0.01	0.05	0.08	0.13
MR-38	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MR-39	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MR-40	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MR-44	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MT-30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MT-31	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
RD-35	0.10	2,899	0.03	4,348	0.05	7,827	0.09	0.10	3,624	0.04	5,435	0.06	9,784	0.11	0.01	0.01	0.02
RD-36	0.07	2,056	0.02	3,084	0.04	5,552	0.06	0.07	2,570	0.03	3,856	0.04	6,940	0.08	0.00	0.01	0.01
RD-41	0.03	728	0.01	1,092	0.01	1,966	0.02	0.03	910	0.01	1,366	0.02	2,458	0.03	0.00	0.01	0.01
RD-42	0.04	1,064	0.01	1,596	0.02	2,872	0.03	0.04	1,330	0.02	1,995	0.02	3,591	0.04	0.01	0.01	0.02
RD-43	0.18	4,927	0.06	7,390	0.09	13,302	0.15	0.18	6,158	0.07	9,237	0.11	16,627	0.19	0.03	0.05	0.07
RD-45	0.01	307	0.00	461	0.01	829	0.01	0.01	384	0.00	576	0.01	1,036	0.01	0.00	0.01	0.01
RD-46	0.10	2,713	0.03	4,070	0.05	7,326	0.08	0.10	3,392	0.04	5,087	0.06	9,157	0.11	0.01	0.02	0.03
RD-47	0.01	221	0.00	332	0.00	598	0.01	0.01	277	0.00	415	0.00	747	0.01	0.00	0.01	0.01
DD-33	0.00	57	0.00	86	0.00	154	0.00	0.00	71	0.00	107	0.00	193	0.00	0.00	0.01	0.01
UG-20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UG-30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UG-40	0.02	557	0.01	835	0.01	1,504	0.02	0.02	696	0.01	1,044	0.01	1,880	0.02	0.10	0.16	0.25
UG-50	0.41	11,445	0.13	17,168	0.20	30,903	0.36	0.41	14,307	0.17	21,460	0.25	38,628	0.45	0.96	1.64	2.53
IS-10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
IS-20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
IS-30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
IS-40	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
RG-10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
RG-50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5% of all units	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BodLands	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.78	4.87	7.31
CarmFarm12-2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.55	2.71	4.06
CarmFarm12-1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.12	0.21	0.31
NuGlobe	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.10	0.18	0.27
SP-McArt	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.85	4.98	7.48
LCHC7Art	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.10	0.17	0.26
119Bell	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.25	0.43	0.65
127Boyd	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.15	0.27	0.40
MillCross	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.27	0.48	0.72
Hwy7CT	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.08	0.14	0.21
StoneLTC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.62	1.08	1.62
Subtotal Additional Growth Units (Total)	1	29,995	0	44,993	1	80,987	1	1	37,494	0	56,241	1	101,234	1	2	3	4
Total (Growth + Additional 5%)																	
Active_Dev	2.59	72,528	0.84	108,792	1.26	195,826	2.27	2.59	90,660	1.05	135,990	1.57	244,782	2.83	0.09	0.13	0.24
Total Growth (Growth + Additional 5% + Active Development Applications)																	

163401646 - Town of Carleton Place W/WW Master Plan

Table B-1: Future Development Areas Water Demand - 2031

Residential Averag	350	L/c/d
MXDY Factor, Res	1.75	
PKHR Factor, Res	2.0	

Commercial Ave	28,000	L/gross ha/d
MXDY Factor, IC	1.5	
PKHR Factor, IC	1.8	

Industrial Av	35,000	L/gross ha/d
MXDY Facto	1.5	
PKHR Facto	1.8	

Manual Input
Calculated Value

JLR (2021) Growth Scenario 3 Developments + Active Development Applications — **2031**

Residential

Area	Sub-Neighbourhood	GIS ID	Number of Demand Nodes	Population	AVDY (L/d)	AVDY (L/s)	MXDY (L/d)	MXDY (L/s)	PKHR (L/d)	PKHR (L/s)
Strategic Properties	Strategic Property-25	SP-25	2	128	44,800	0.52	78,400	0.91	156,800	1.81
Strategic Properties	Strategic Property-26[7]	SP-26	7	118	41,300	0.48	72,275	0.84	144,550	1.67
Strategic Properties	Strategic Property-27	SP-27	1	65	22,750	0.26	39,813	0.46	79,625	0.92
Strategic Properties	Strategic Property-29	SP-29	1	19	6,650	0.08	11,638	0.13	23,275	0.27
Residential Districts - Infill	Mississippi Residential Sector-38[8]	MR-38	31	39	13,650	0.16	23,888	0.28	47,775	0.55
Residential Districts - Infill	Mississippi Residential Sector-39	MR-39	19	24	8,400	0.10	14,700	0.17	29,400	0.34
Residential Districts - Infill	Mississippi Residential Sector-40	MR-40	9	11	3,850	0.04	6,738	0.08	13,475	0.16
Residential Districts - Infill	Mississippi Residential Sector-44	MR-44	3	15	5,250	0.06	9,188	0.11	18,375	0.21
Residential Districts - Infill	Mississippi Residential Sector-30	MT-30	9	11	3,850	0.04	6,738	0.08	13,475	0.16
Residential Districts - Infill	Mississippi Residential Sector-31	MT-31	5	6	2,100	0.02	3,675	0.04	7,350	0.09
Residential Districts - Infill	Residential District-35	RD-35	62	203	71,050	0.82	124,338	1.44	248,675	2.88
Residential Districts - Infill	Residential District-36	RD-36	77	144	50,400	0.58	88,200	1.02	176,400	2.04
Residential Districts - Infill	Residential District-41	RD-41	36	51	17,850	0.21	31,238	0.36	62,475	0.72
Residential Districts - Infill	Residential District-42	RD-42	26	75	26,250	0.30	45,938	0.53	91,875	1.06
Residential Districts - Infill	Residential District-43	RD-43	31	345	120,750	1.40	211,313	2.45	422,625	4.89
Residential Districts - Infill	Residential District-45	RD-45	17	22	7,700	0.09	13,475	0.16	26,950	0.31
Residential Districts - Infill	Residential District-46	RD-46	40	190	66,500	0.77	116,375	1.35	232,750	2.69
Residential Districts - Infill	Residential District-47	RD-47	12	16	5,600	0.06	9,800	0.11	19,600	0.23
Residential Districts - Infill	Downtown District-33	DD-33	3	4	1,400	0.02	2,450	0.03	4,900	0.06
Residential Districts - Urban Greenfield	Urban Greenfield-20	UG-20	1	104	36,400	0.42	63,700	0.74	127,400	1.47
Residential Districts - Urban Greenfield	Urban Greenfield-30	UG-30	2	13	4,550	0.05	7,963	0.09	15,925	0.18
Residential Districts - Urban Greenfield	Urban Greenfield-40	UG-40	1	39	13,650	0.16	23,888	0.28	47,775	0.55
Residential Districts - Urban Greenfield	Urban Greenfield-50	UG-50	2	802	280,700	3.25	491,225	5.69	982,450	11.37
Residential Districts - Intensification Sites	Intensification-10	IS-10	1	127	44,450	0.51	77,788	0.90	155,575	1.80
Residential Districts - Intensification Sites	Intensification-20	IS-20	1	10	3,500	0.04	6,125	0.07	12,250	0.14
Residential Districts - Intensification Sites	Intensification-30	IS-30	1	39	13,650	0.16	23,888	0.28	47,775	0.55
Residential Districts - Intensification Sites	Intensification-40	IS-40	1	5	1,750	0.02	3,063	0.04	6,125	0.07
Settlement Boundary - Rural Greenfield	Rural Greenfield-10	RG-10	2	-	-	-	-	-	-	-
Settlement Boundary - Rural Greenfield	Rural Greenfield-50	RG-50	2	130	45,500	0.53	79,625	0.92	159,250	1.84
Additional Residential Units	5% of all units		0	-	-	-	-	-	-	-
Active Development Applications	Bodnar Lands	BodLands	1	1,100	385,000	4.46	673,750	7.80	1,347,500	15.60
Active Development Applications	Carmichael Farm Phase 2	CarmFarm12-2	1	611	213,850	2.48	374,238	4.33	748,475	8.66
Active Development Applications	Carmichael Farm Phase 1	CarmFarm12-1	1	46	16,100	0.19	28,175	0.33	56,350	0.65
Active Development Applications	NuGlobe Developments (Nelson St E, Coleman/McNeely)	NuGlobe	6	243	85,050	0.98	148,838	1.72	297,675	3.45
Active Development Applications	Strategic Property (McArthur Island)	SP-McArt	1	1,124	393,400	4.55	688,450	7.97	1,376,900	15.94
Active Development Applications	LCHC - 7 Arthur St	LCHC7Art	1	39	13,650	0.16	23,888	0.28	47,775	0.55
Active Development Applications	119 Bell St	119Bell	1	97	33,950	0.39	59,413	0.69	118,825	1.38
Active Development Applications	127 Boyd	127Boyd	1	61	21,350	0.25	37,363	0.43	74,725	0.86
Active Development Applications	Millers Crossing (remaining lots)	MillCross	2	216	75,600	0.88	132,300	1.53	264,600	3.06
Active Development Applications	Highway 7 behind Canadian Tire	Hwy7CT	9	288	100,800	1.17	176,400	2.04	352,800	4.08
Active Development Applications	Stoneridge Manor Long-Term Care Home (29 Costello)	StoneLTC	1	243	85,050	0.98	148,838	1.72	297,675	3.45
Subtotal Additional Growth Units			Total #	2,755	964,250	11	1,687,438	20	3,374,875	39
Total (Growth + Additional 5%)										
Active Development Applications		Active_Dev	21	4,068	-	-	-	-	-	-
Total Growth (Growth + Additional 5% + Active Development Applications)										

Institutional/Commercial

GIS ID	Area (ha)	AVDY (L/d)	AVDY (L/s)	MXDY (L/d)	MXDY (L/s)	PKHR (L/d)	PKHR (L/s)
SP-25	0.13	3,641	0.04	5,462	0.06	9,832	0.11
SP-26	-	-	-	-	-	-	-
SP-27	0.07	1,856	0.02	2,785	0.03	5,012	0.06
SP-29	0.02	543	0.01	814	0.01	1,465	0.02
MR-38	-	-	-	-	-	-	-
MR-39	-	-	-	-	-	-	-
MR-40	-	-	-	-	-	-	-
MR-44	-	-	-	-	-	-	-
MT-30	-	-	-	-	-	-	-
MT-31	-	-	-	-	-	-	-
RD-35	0.21	5,798	0.07	8,697	0.10	15,654	0.18
RD-36	0.15	4,113	0.05	6,169	0.07	11,104	0.13
RD-41	0.05	1,457	0.02	2,185	0.03	3,933	0.05
RD-42	0.08	2,128	0.02	3,192	0.04	5,745	0.07
RD-43	0.35	9,853	0.11	14,780	0.17	26,604	0.31
RD-45	0.02	614	0.01	921	0.01	1,658	0.02
RD-46	0.19	5,426	0.06	8,140	0.09	14,651	0.17
RD-47	0.02	443	0.01	664	0.01	1,195	0.01
DD-33	0.00	114	0.00	171	0.00	308	0.00
UG-20	0.11	2,970	0.03	4,455	0.05	8,020	0.09
UG-30	0.01	371	0.00	557	0.01	1,002	0.01
UG-40	0.04	1,114	0.01	1,671	0.02	3,007	0.03
UG-50	0.82	22,891	0.26	34,336	0.40	61,805	0.72
IS-10	0.13	3,613	0.04	5,419	0.06	9,755	0.11
IS-20	0.01	271	0.00	407	0.00	733	0.01
IS-30	0.04	1,114	0.01	1,671	0.02	3,007	0.03
IS-40	0.01	143	0.00	214	0.00	386	0.00
RG-10	0.27	7,583	0.09	11,374	0.13	20,473	0.24
RG-50	0.13	3,691	0.04	5,537	0.06	9,967	0.12
5% of all units	-	-	-	-	-	-	-
BodLands	-	-	-	-	-	-	-
CarmFarm12-2	-	-	-	-	-	-	-
CarmFarm12-1	-	-	-	-	-	-	-
NuGlobe	-	-	-	-	-	-	-
SP-McArt	-	-	-	-	-	-	-
LCHC7Art	-	-	-	-	-	-	-
119Bell	-	-	-	-	-	-	-
127Boyd	-	-	-	-	-	-	-
MillCross	-	-	-	-	-	-	-
Hwy7CT	-	-	-	-	-	-	-
StoneLTC	-	-	-	-	-	-	-
Subtotal Additional Growth Units	3	79,747	1	119,620	1	215,316	2
Total (Growth + Additional 5%)							
Active_Dev	4.14	116,045	1.34	174,067	2.01	313,321	3.63
Total Growth							

Light Industrial / Demand per Node

GIS ID	Area (ha)	AVDY (L/d)	AVDY (L/s)	MXDY (L/d)	MXDY (L/s)	PKHR (L/d)	PKHR (L/s)	Demand per Node AVDY (L/s)	Demand per Node MXDY (L/s)	Demand per Node PKHR (L/s)
SP-25	0.13	4,552	0.05	6,828	0.08	12,290	0.14	0.31	0.52	1.04
SP-26	-	-	-	-	-	-	-	0.07	0.12	0.24
SP-27	0.07	2,321	0.03	3,481	0.04	6,265	0.07	0.31	0.53	1.05
SP-29	0.02	678	0.01	1,017	0.01	1,831	0.02	0.09	0.16	0.31
MR-38	-	-	-	-	-	-	-	0.01	0.01	0.02
MR-39	-	-	-	-	-	-	-	0.01	0.01	0.02
MR-40	-	-	-	-	-	-	-	0.00	0.01	0.02
MR-44	-	-	-	-	-	-	-	0.02	0.04	0.07
MT-30	-	-	-	-	-	-	-	0.00	0.01	0.02
MT-31	-	-	-	-	-	-	-	0.00	0.01	0.02
RD-35	0.21	7,247	0.08	10,871	0.13	19,567	0.23	0.02	0.03	0.05
RD-36	0.15	5,141	0.06	7,711	0.09	13,880	0.16	0.01	0.02	0.03
RD-41	0.05	1,821	0.02	2,731	0.03	4,916	0.06	0.01	0.01	0.02
RD-42	0.08	2,660	0.03	3,989	0.05	7,181	0.08	0.01	0.02	0.05
RD-43	0.35	12,317	0.14	18,475	0.21	33,255	0.38	0.05	0.09	0.18
RD-45	0.02	768	0.01	1,151	0.01	2,072	0.02	0.01	0.01	0.02
RD-46	0.19	6,783	0.08	10,175	0.12	18,314	0.21	0.02	0.04	0.08
RD-47	0.02	553	0.01	830	0.01	1,494	0.02	0.01	0.01	0.02
DD-33	0.00	143	0.00	214	0.00	386	0.00	0.01	0.01	0.02
UG-20	0.11	3,713	0.04	5,569	0.06	10,025	0.12	0.50	0.85	1.68
UG-30	0.01	464	0.01	696	0.01	1,253	0.01	0.03	0.05	0.11
UG-40	0.04	1,392	0.02	2,088	0.02	3,759	0.04	0.19	0.32	0.63
UG-50	0.82	28,614	0.33	42,920	0.50	77,257	0.89	1.92	3.29	6.49
IS-10	0.13	4,516	0.05	6,774	0.08	12,193	0.14	0.61	1.04	2.05
IS-20	0.01	339	0.00	509	0.01	916	0.01	0.05	0.08	0.16
IS-30	0.04	1,392	0.02	2,088	0.02	3,759	0.04	0.19	0.32	0.63
IS-40	0.01	179	0.00	268	0.00	482	0.01	0.02	0.04	0.08
RG-10	0.27	9,478	0.11	14,218	0.16	25,592	0.30	0.10	0.15	0.27
RG-50	0.13	4,614	0.05	6,921	0.08	12,458	0.14	0.31	0.53	1.05
5% of all units	-	-	-	-	-	-	-	-	-	-
BodLands	-	-	-	-	-	-	-	4.46	7.80	15.60
CarmFarm12-2	-	-	-	-	-	-	-	2.48	4.33	8.66
CarmFarm12-1	-	-	-	-	-	-	-	0.19	0.33	0.65
NuGlobe	-	-	-	-	-	-	-	0.16	0.29	0.57
SP-McArt	-	-	-	-	-	-	-	4.55	7.97	15.94
LCHC7Art	-	-	-	-	-	-	-	0.16	0.28	0.55
119Bell	-	-	-	-	-	-	-	0.39	0.69	1.38
127Boyd	-	-	-	-	-	-	-	0.25	0.43	0.86
MillCross	-	-	-	-	-	-	-	0.44	0.77	1.53
Hwy7CT	-	-	-	-	-	-	-	0.13	0.23	0.45
StoneLTC	-	-	-	-	-	-	-	0.98	1.72	3.45
Subtotal Additional Growth Units	3	99,683	1	149,525	2	269,145	3	5	8	16
Total (Growth + Additional 5%)										
Active_Dev	4.14	145,056	1.68	217,584	2.52	391,652	4.53	0.14	0.22	0.39
Total Growth										

163401646 - Town of Carleton Place W/WW Master Plan

Table B-1: Future Development Areas Water Demand - 2041

Manual Input	
Calculated Value	

Parameter	Value	Unit
Residential Averac	350	L/c/d
MXDY Factor, Res	1.75	
PKHR Factor, Res	2.0	
Commercial Ave	28,000	L/gross ha/d
MXDY Factor, IC	1.5	
PKHR Factor, IC	1.8	
Industrial Av	35,000	L/gross ha/d
MXDY Facto	1.5	
PKHR Facto	1.8	

2041

JLR (2021) Growth Scenario 3 Developments + Active Development Applications			Number of Demand Nodes	Residential						
Area	Sub-Neighbourhood	GIS ID		Population	AVDY (L/d)	AVDY (L/s)	MXDY (L/d)	MXDY (L/s)	PKHR (L/d)	PKHR (L/s)
Strategic Properties	Strategic Property-25	SP-25	2	255	89,250	1.03	156,188	1.81	312,375	3.62
Strategic Properties	Strategic Property-26[7]	SP-26	7	236	82,600	0.96	144,550	1.67	289,100	3.35
Strategic Properties	Strategic Property-27	SP-27	1	130	45,500	0.53	79,625	0.92	159,250	1.84
Strategic Properties	Strategic Property-29	SP-29	1	38	13,300	0.15	23,275	0.27	46,550	0.54
Residential Districts - Infill	Mississippi Residential Sector-38[8]	MR-38	31	78	27,300	0.32	47,775	0.55	95,550	1.11
Residential Districts - Infill	Mississippi Residential Sector-39	MR-39	19	48	16,800	0.19	29,400	0.34	58,800	0.68
Residential Districts - Infill	Mississippi Residential Sector-40	MR-40	9	22	7,700	0.09	13,475	0.16	26,950	0.31
Residential Districts - Infill	Mississippi Residential Sector-44	MR-44	3	29	10,150	0.12	17,763	0.21	35,525	0.41
Residential Districts - Infill	Mississippi Residential Sector-30	MT-30	9	22	7,700	0.09	13,475	0.16	26,950	0.31
Residential Districts - Infill	Mississippi Residential Sector-31	MT-31	5	12	4,200	0.05	7,350	0.09	14,700	0.17
Residential Districts - Infill	Residential District-35	RD-35	62	406	142,100	1.64	248,675	2.88	497,350	5.76
Residential Districts - Infill	Residential District-36	RD-36	77	288	100,800	1.17	176,400	2.04	352,800	4.08
Residential Districts - Infill	Residential District-41	RD-41	36	102	35,700	0.41	62,475	0.72	124,950	1.45
Residential Districts - Infill	Residential District-42	RD-42	26	149	52,150	0.60	91,263	1.06	182,525	2.11
Residential Districts - Infill	Residential District-43	RD-43	31	690	241,500	2.80	422,625	4.89	845,250	9.78
Residential Districts - Infill	Residential District-45	RD-45	17	43	15,050	0.17	26,338	0.30	52,675	0.61
Residential Districts - Infill	Residential District-46	RD-46	40	380	133,000	1.54	232,750	2.69	465,500	5.39
Residential Districts - Infill	Residential District-47	RD-47	12	31	10,850	0.13	18,988	0.22	37,975	0.44
Residential Districts - Infill	Downtown District-33	DD-33	3	8	2,800	0.03	4,900	0.06	9,800	0.11
Residential Districts - Urban Greenfield	Urban Greenfield-20	UG-20	1	312	109,200	1.26	191,100	2.21	382,200	4.42
Residential Districts - Urban Greenfield	Urban Greenfield-30	UG-30	2	39	13,650	0.16	23,888	0.28	47,775	0.55
Residential Districts - Urban Greenfield	Urban Greenfield-40	UG-40	1	71	24,850	0.29	43,488	0.50	86,975	1.01
Residential Districts - Urban Greenfield	Urban Greenfield-50	UG-50	2	1,443	505,050	5.85	883,838	10.23	1,767,675	20.46
Residential Districts - Intensification Sites	Intensification-10	IS-10	1	253	88,550	1.02	154,963	1.79	309,925	3.59
Residential Districts - Intensification Sites	Intensification-20	IS-20	1	19	6,650	0.08	11,638	0.13	23,275	0.27
Residential Districts - Intensification Sites	Intensification-30	IS-30	1	78	27,300	0.32	47,775	0.55	95,550	1.11
Residential Districts - Intensification Sites	Intensification-40	IS-40	1	10	3,500	0.04	6,125	0.07	12,250	0.14
Settlement Boundary - Rural Greenfield	Rural Greenfield-10	RG-10	2	956	334,600	3.87	585,550	6.78	1,171,100	13.55
Settlement Boundary - Rural Greenfield	Rural Greenfield-50	RG-50	2	466	163,100	1.89	285,425	3.30	570,850	6.61
Additional Residential Units	5% of all units		0	-	-	-	-	-	-	-
Active Development Applications	Bodnar Lands	BodLands	1	1,374	480,900	5.57	841,575	9.74	1,683,150	19.48
Active Development Applications	Carmichael Farm Phase 2	CarmFarm12-2	1	763	267,050	3.09	467,338	5.41	934,675	10.82
Active Development Applications	Carmichael Farm Phase 1	CarmFarm12-1	1	57	19,950	0.23	34,913	0.40	69,825	0.81
Active Development Applications	NuGlobe Developments (Nelson St E, Coleman/McNeely)	NuGlobe	6	303	106,050	1.23	185,588	2.15	371,175	4.30
Active Development Applications	Strategic Property (McArthur Island)	SP-McArt	1	1,405	491,750	5.69	860,563	9.96	1,721,125	19.92
Active Development Applications	LCHC - 7 Arthur St	LCHC7Art	1	48	16,800	0.19	29,400	0.34	58,800	0.68
Active Development Applications	119 Bell St	119Bell	1	121	42,350	0.49	74,113	0.86	148,225	1.72
Active Development Applications	127 Boyd	127Boyd	1	76	26,600	0.31	46,550	0.54	93,100	1.08
Active Development Applications	Millers Crossing (remaining lots)	MillCross	2	270	94,500	1.09	165,375	1.91	330,750	3.83
Active Development Applications	Highway 7 behind Canadian Tire	Hwy7CT	9	359	125,650	1.45	219,888	2.54	439,775	5.09
Active Development Applications	Stoneridge Manor Long-Term Care Home (29 Costello)	StoneLTC	1	303	106,050	1.23	185,588	2.15	371,175	4.30
Subtotal Additional Growth Units			Total # #	6,614	2,314,900	27	4,051,075	47	8,102,150	94
Total (Growth + Additional 5%)										
Active Development Applications		Active_Dev	21	5,079	-	-	-	-	-	-
Total Growth (Growth + Additional 5% + Active Development Applications)										

GIS ID	Institutional/Commercial							Light Industrial							Demand per Node		
	Area (ha)	AVDY (L/d)	AVDY (L/s)	MXDY (L/d)	MXDY (L/s)	PKHR (L/d)	PKHR (L/s)	Area (ha)	AVDY (L/d)	AVDY (L/s)	MXDY (L/d)	MXDY (L/s)	PKHR (L/d)	PKHR (L/s)	AVDY (L/s)	MXDY (L/s)	PKHR (L/s)
SP-25	0.26	7,283	0.08	10,924	0.13	19,664	0.23	0.26	9,104	0.11	13,655	0.16	24,579	0.28	0.61	1.05	2.06
SP-26	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.14	0.24	0.48
SP-27	0.13	3,713	0.04	5,569	0.06	10,025	0.12	0.13	4,641	0.05	6,962	0.08	12,531	0.15	0.62	1.07	2.10
SP-29	0.04	1,085	0.01	1,628	0.02	2,930	0.03	0.04	1,357	0.02	2,035	0.02	3,663	0.04	0.18	0.31	0.62
MR-38	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.01	0.02	0.04
MR-39	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.01	0.02	0.04
MR-40	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.01	0.02	0.03
MR-44	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.04	0.07	0.14
MT-30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.01	0.02	0.03
MT-31	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.01	0.02	0.03
RD-35	0.41	11,595	0.13	17,393	0.20	31,307	0.36	0.41	14,494	0.17	21,741	0.25	39,134	0.45	0.03	0.05	0.11
RD-36	0.29	8,225	0.10	12,338	0.14	22,208	0.26	0.29	10,282	0.12	15,422	0.18	27,760	0.32	0.02	0.03	0.06
RD-41	0.10	2,913	0.03	4,370	0.05	7,865	0.09	0.10	3,641	0.04	5,462	0.06	9,832	0.11	0.01	0.02	0.05
RD-42	0.15	4,255	0.05	6,383	0.07	11,490	0.13	0.15	5,319	0.06	7,979	0.09	14,362	0.17	0.03	0.05	0.09
RD-43	0.70	19,706	0.23	29,560	0.34	53,207	0.62	0.70	24,633	0.29	36,950	0.43	66,509	0.77	0.11	0.18	0.36
RD-45	0.04	1,228	0.01	1,842	0.02	3,316	0.04	0.04	1,535	0.02	2,303	0.03	4,145	0.05	0.01	0.02	0.04
RD-46	0.39	10,853	0.13	16,279	0.19	29,303	0.34	0.39	13,566	0.16	20,349	0.24	36,628	0.42	0.05	0.08	0.15
RD-47	0.03	885	0.01	1,328	0.02	2,390	0.03	0.03	1,107	0.01	1,660	0.02	2,988	0.03	0.01	0.02	0.04
DD-33	0.01	228	0.00	343	0.00	617	0.01	0.01	286	0.00	428	0.00	771	0.01	0.01	0.02	0.04
UG-20	0.32	8,911	0.10	13,366	0.15	24,059	0.28	0.32	11,138	0.13	16,708	0.19	30,074	0.35	1.50	2.56	5.05
UG-30	0.04	1,114	0.01	1,671	0.02	3,007	0.03	0.04	1,392	0.02	2,088	0.02	3,759	0.04	0.09	0.16	0.32
UG-40	0.07	2,005	0.02	3,007	0.03	5,413	0.06	0.07	2,506	0.03	3,759	0.04	6,767	0.08	0.34	0.58	1.15
UG-50	1.47	41,204	0.48	61,805	0.72	111,249	1.29	1.47	51,504	0.60	77,257	0.89	139,062	1.61	3.46	5.92	11.68
IS-10	0.26	7,226	0.08	10,839	0.13	19,509	0.23	0.26	9,032	0.10	13,548	0.16	24,387	0.28	1.21	2.08	4.10
IS-20	0.02	543	0.01	814	0.01	1,465	0.02	0.02	678	0.01	1,017	0.01	1,831	0.02	0.09	0.16	0.31
IS-30	0.08	2,228	0.03	3,342	0.04	6,015	0.07	0.08	2,785	0.03	4,177	0.05	7,518	0.09	0.37	0.64	1.26
IS-40	0.01	286	0.00	428	0.00	771	0.01	0.01	357	0.00	536	0.01	964	0.01	0.05	0.08	0.16
RG-10	0.97	27,298	0.32	40,946	0.47	73,704	0.85	0.97	34,122	0.39	51,183	0.59	92,130	1.07	2.29	3.92	7.74
RG-50	0.47	13,289	0.15	19,933	0.23	35,880	0.42	0.47	16,611	0.19	24,917	0.29	44,850	0.52	1.12	1.91	3.77
5% of all units	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BodLands	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5.57	9.74	19.48
CarmFarm12-2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.09	5.41	10.82
CarmFarm12-1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.23	0.40	0.81
NuGlobe	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.20	0.36	0.72
SP-McArt	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5.69	9.96	19.92
LCHC7Art	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.19	0.34	0.68
119Bell	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.49	0.86	1.72
127Boyd	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.31	0.54	1.08
MillCross	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.55	0.96	1.91
Hwy7CT	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.16	0.28	0.57
StoneLTC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.23	2.15	4.30
Subtotal Additional Growth Units	6	176,072	2	264,109	3	475,395	6	6	220,091	3	330,136	4	594,244	7	12	21	42
Total (Growth + Additional 5%)																	
Active_Dev	5.18	145,056	1.68	217,584	2.52	391,652	4.53	5.18	181,320	2.10	271,980	3.15	489,565	5.67	0.18	0.27	0.49
Total Growth (Growth + Additional 5% + Active Development Applications)																	

163401646 - Carleton Place Water & Wastewater Master Plan Update

Table B-4: Summary of Model Scenarios Boundary Conditions

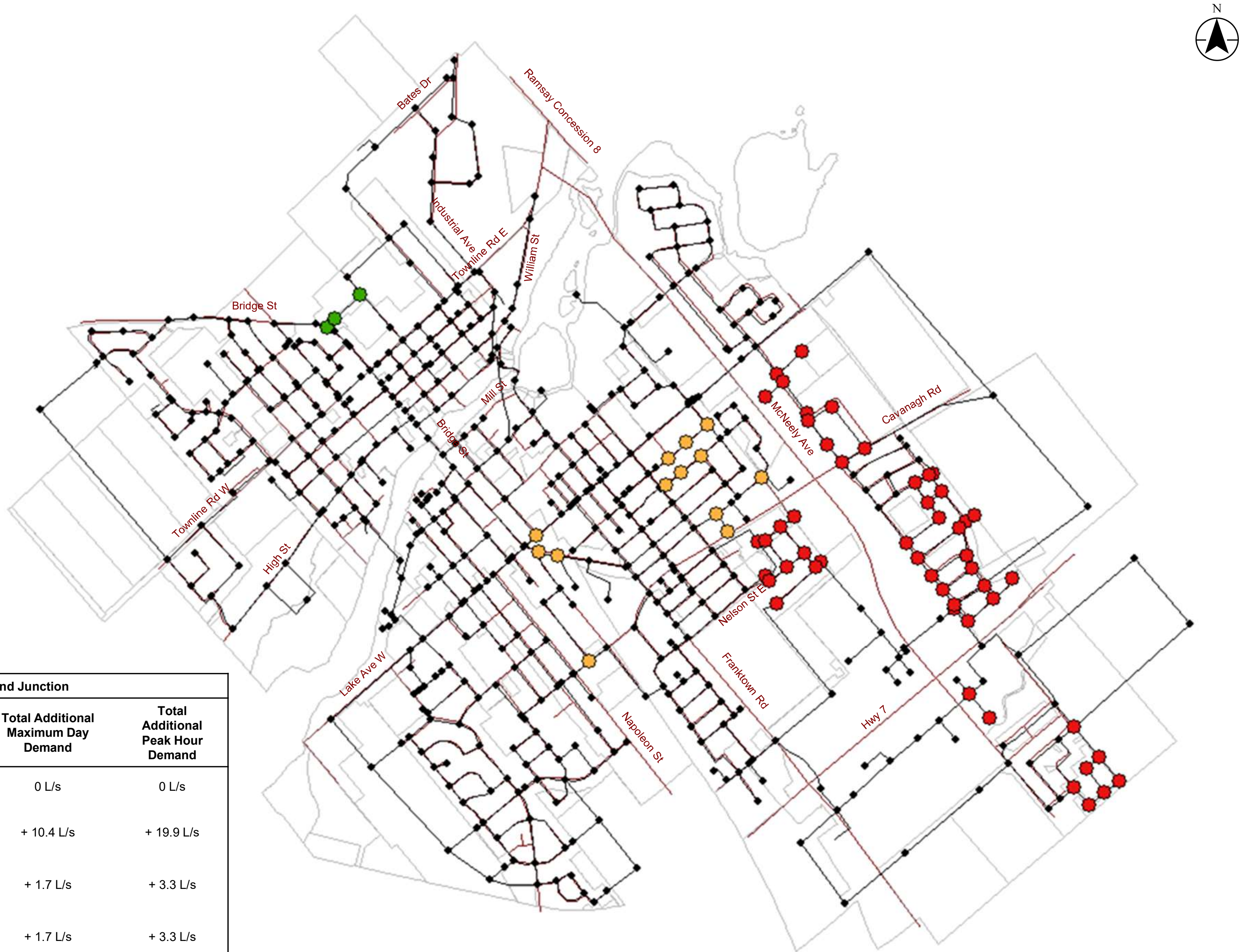
Setting changed from parent scenario

Stantec Additions/Changes

Model Name: 29763_CarletonPlace_Model2021_wmp_stn.wtg

File Path: \\Ca0218-ppfss01\01-634\active\1634_01646\planning\analysis\Water Distribution\model

Network Data Scenario	Model Boundary Conditions															
	WTP Reservoir 1	WTP Reservoir 2	WTP HLP1			WTP HLP2			WTP HLP3			WTP HLP4			All Active Pumps	Elevated Tank	
	Level (m)	Level (m)	Status (1=On; - = Off)	Discharge HGL (m)	Flow (L/s)	Status (1=On; - = Off)	Discharge HGL (m)	Flow (L/s)	Status (1=On; - = Off)	Discharge HGL (m)	Flow (L/s)	Status (1=On; - = Off)	Discharge HGL (m)	Flow (L/s)	Flow (L/s)	HGL (m)	Percent Full (%)
STN_2021_ADD	135.59	135.59	1	185.37	26.60	1	185.77	52.11	1	185.76	82.56	-	-	-	161.27	181.10	37.90
STN_2021_MDDFF	134.75	134.75	1	186.13	25.66	1	186.48	49.45	-	-	-	1	187.21	124.80	199.91	181.10	37.90
STN_2021_PHD	135.00	135.00	1	183.42	27.36	1	183.85	54.31	1	183.86	86.51	-	-	-	168.18	181.10	37.90
STN_2021_MDD	135.25	135.25	1	184.26	27.03	1	184.68	53.35	1	184.68	84.79	-	-	-	165.17	181.10	37.90
STN_2021_MDDEP	135.25	135.25	1	182.45 to 186.21	25.92 to 28.01	On if EST Percent Full ≤ 60%	182.29 to 186.58	0 to 54.99	1	182.92 to 186.57	79.09 to 90.01	-	-	-	110.23 to 170.32	180.95 to 182.77	34.9 to 96.1
STN_2026_ADD	135.59	135.59	1	185.09	26.76	1	185.49	52.57	1	185.49	83.39	-	-	-	162.72	181.10	37.90
STN_2026_MDDFF	134.75	134.75	1	185.65	25.95	1	186.01	50.26	-	-	-	1	186.75	126.34	202.55	181.10	37.90
STN_2026_PHD	135.00	135.00	1	182.97	27.60	1	183.42	55.03	1	183.42	87.79	-	-	-	170.42	181.10	37.90
STN_2026_MDD	135.25	135.25	1	183.87	27.25	1	184.30	53.99	1	184.30	85.93	-	-	-	167.17	181.10	37.90
STN_2026_MDDEP	135.25	135.25	1	169.51 to 186.27	25.88 to 33.75	On if EST Percent Full ≤ 60%	170.4 to 186.64	0 to 75.2	1	170.5 to 186.63	78.89 to 124.77	-	-	-	111.42 to 233.71	179.29 to 182.47	0 to 83.8
STN_2031_ADD	135.59	135.59	1	184.87	26.88	1	185.29	52.91	1	185.28	84.01	-	-	-	163.80	181.10	37.90
STN_2031_MDDFF	134.75	134.75	1	185.25	26.18	1	185.63	50.92	-	-	-	1	186.38	127.58	204.68	181.10	37.90
STN_2031_PHD	135.00	135.00	1	182.40	27.90	1	182.87	55.93	1	182.87	89.42	-	-	-	173.25	181.10	37.90
STN_2031_MDD	135.25	135.25	1	183.59	27.40	1	184.03	54.43	1	184.03	86.72	-	-	-	168.55	181.10	37.90
STN_2031_MDDEP	135.25	135.25	1	135.89 to 186.07	26 to 43.91	On if EST Percent Full ≤ 60%	138.16 to 186.44	0 to 116.25	1	138.72 to 186.43	79.51 to 203.43	-	-	-	112.07 to 363.55	179.29 to 182.33	0 to 78.1
STN_2041_ADD	135.59	135.59	1	184.53	27.07	1	184.95	53.46	1	184.95	84.99	-	-	-	165.52	181.10	37.90
STN_2041_MDDFF	134.75	134.75	1	184.69	26.51	1	185.08	51.84	-	-	-	1	185.85	129.32	207.67	181.10	37.90
STN_2041_PHD	135.00	135.00	1	181.14	28.55	1	181.64	57.91	1	181.66	92.99	-	-	-	179.45	181.10	37.90
STN_2041_MDD	135.25	135.25	1	183.18	27.62	1	183.63	55.09	1	183.63	87.92	-	-	-	170.63	181.10	37.90
STN_2041_MDDEP	135.25	135.25	1	110.53 to 185.89	26.11 to 49.56	On if EST Percent Full ≤ 60%	114.02 to 186.26	0 to 142.91	1	115.1 to 186.25	80.04 to 256.28	-	-	-	112.87 to 448.67	179.29 to 182.15	0 to 71.1



Junction: 2021 Growth Demand Junction

	Growth Area	Total Additional Average Day Demand	Total Additional Maximum Day Demand	Total Additional Peak Hour Demand
● (black)	No Growth from 2020 to 2021	0 L/s	0 L/s	0 L/s
● (red)	Highway District	+ 5.6 L/s	+ 10.4 L/s	+ 19.9 L/s
● (orange)	Downtown Area	+ 0.9 L/s	+ 1.7 L/s	+ 3.3 L/s
● (green)	North of Mississippi River	+ 0.9 L/s	+ 1.7 L/s	+ 3.3 L/s

Stantec

Town of Carleton Place
2021 Water & Wastewater Master Plan
Water Distribution Hydraulic Modelling Results

WaterGEMS [10.03.01.08]
Bentley System, Inc.
Haestad Methods Solution Center
27 Slemon Company Drive Suite 200 W
Watertown, CT 06795 USA

SCENARIO: All
RESULT: Plan View
LOCATION: Town of Carleton Place

29763_CarletonPlace_Model2021_wmp_stn.wtg

Date: August 2021

Figure: B-1

Pipe: Headloss Gradient (m/km)

Black	≤ 0.25
Purple	≤ 0.50
Magenta	≤ 1.00
Orange	≤ 5.00
Red	> 5.00

Junction: Pressure (psi)

Yellow	≤ 40
Blue	≤ 50
Green	≤ 80
Orange	≤ 90
Red	> 90

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Town of Carleton Place
2021 Water & Wastewater Master Plan
Water Distribution Hydraulic Modelling Results

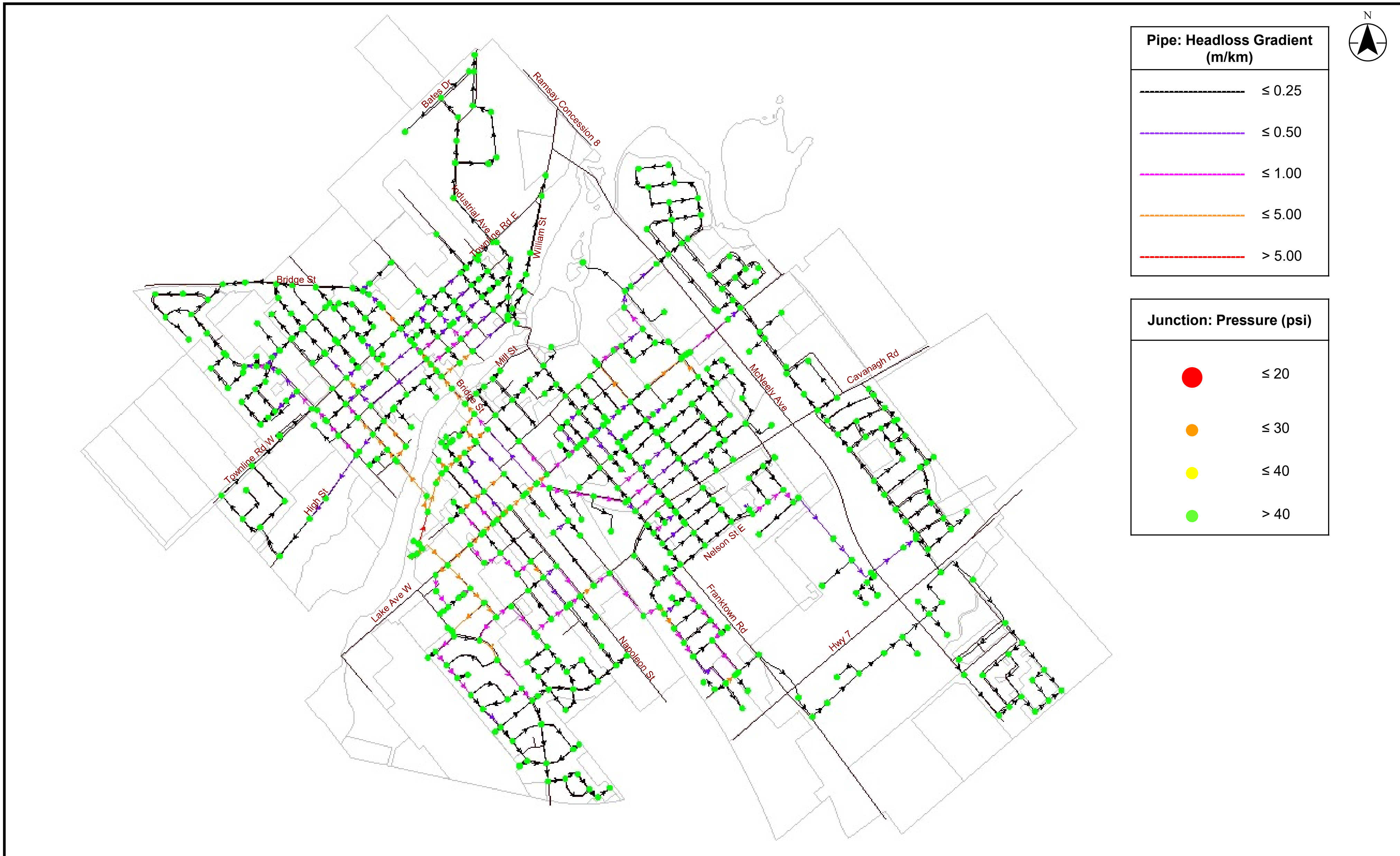
WaterGEMS [10.03.01.08]
Bentley System, Inc.
Haestad Methods Solution Center
27 Slemon Company Drive Suite 200 W
Watertown, CT 06795 USA

SCENARIO: Average Day Demand - 2021
RESULT: Plan View
LOCATION: Town of Carleton Place

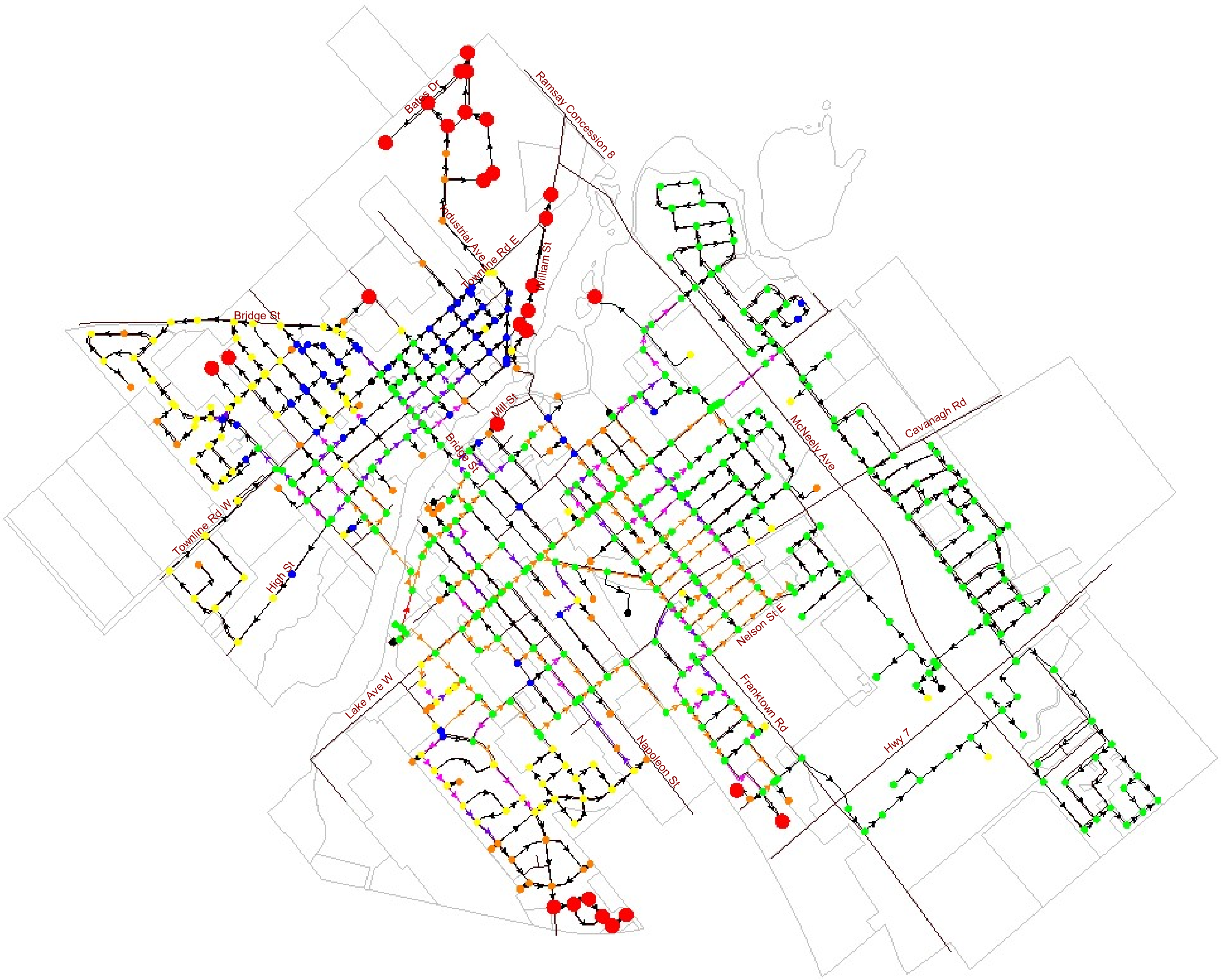
29763_CarletonPlace_Model2021_wmp_stn.wtg

Date: August 2021

Figure: B-2



Stantec	Town of Carleton Place 2021 Water & Wastewater Master Plan Water Distribution Hydraulic Modelling Results	WaterGEMS [10.03.01.08] Bentley System, Inc. Haestad Methods Solution Center 27 Slemon Company Drive Suite 200 W Watertown, CT 06795 USA	SCENARIO: Peak Hour Demand - 2021 RESULT: Plan View LOCATION: Town of Carleton Place	29763_CarletonPlace_Model2021_wmp_stn.wtg Date: August 2021	Figure: B-3



Pipe: Headloss Gradient (m/km)

- ≤ 0.25
- ≤ 0.50
- ≤ 1.00
- ≤ 5.00
- > 5.00

Junction: Fire Flow Available (L/s)

- ≤ 60
- ≤ 90
- ≤ 120
- ≤ 150
- > 150

Stantec	Town of Carleton Place 2021 Water & Wastewater Master Plan Water Distribution Hydraulic Modelling Results	WaterGEMS [10.03.01.08] Bentley System, Inc. Haestad Methods Solution Center 27 Slemon Company Drive Suite 200 W Watertown, CT 06795 USA	SCENARIO: Maximum Day + Fire Flow - 2021 RESULT: Plan View LOCATION: Town of Carleton Place	29763_CarletonPlace_Model2021_wmp_stn.wtg Date: August 2021	Figure: B-4

Stantec

Town of Carleton Place
2021 Water & Wastewater Master Plan
Water Distribution Hydraulic Modelling Results

WaterGEMS [10.03.01.08]
Bentley System, Inc.
Haestad Methods Solution Center
27 Slemon Company Drive Suite 200 W
Watertown, CT 06795 USA

SCENARIO: Average Day Demand - 2026
RESULT: Plan View
LOCATION: Town of Carleton Place

29763_CarletonPlace_Model2021_wmp_stn.wtg

Date: August 2021

Figure: B-5

Stantec

Town of Carleton Place
2021 Water & Wastewater Master Plan
Water Distribution Hydraulic Modelling Results

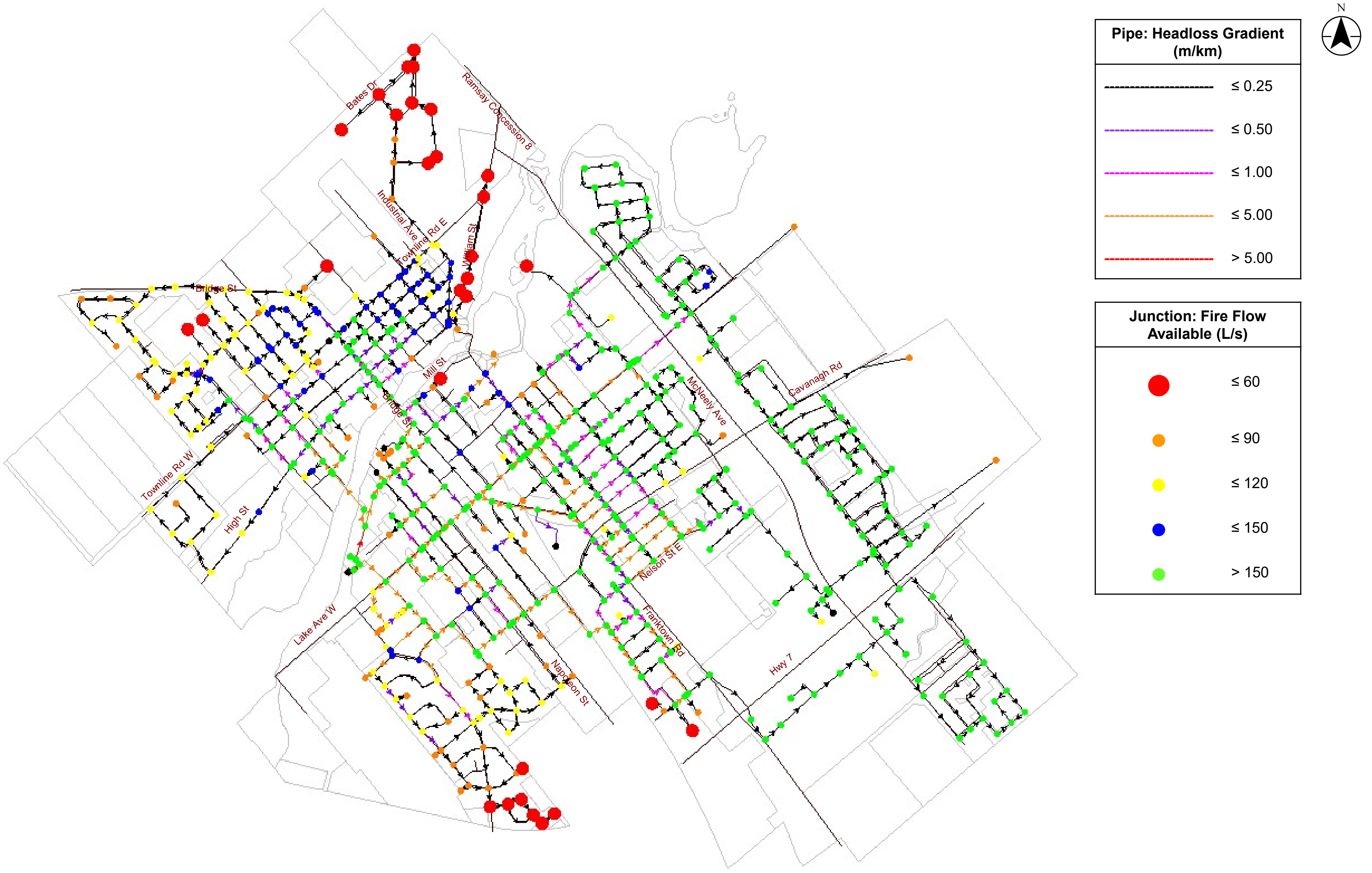
WaterGEMS [10.03.01.08]
Bentley System, Inc.
Haestad Methods Solution Center
27 Slemon Company Drive Suite 200 W
Watertown, CT 06795 USA

SCENARIO: Peak Hour Demand - 2026
RESULT: Plan View
LOCATION: Town of Carleton Place

29763_CarletonPlace_Model2021_wmp_stn.wtg

Date: August 2021

Figure: B-6



Stantec

Town of Carleton Place
2021 Water & Wastewater Master Plan
Water Distribution Hydraulic Modelling Results

WaterGEMS [10.03.01.08]
Bentley System, Inc.
Haestad Methods Solution Center
27 Slemon Company Drive Suite 200 W
Watertown, CT 06795 USA

SCENARIO: Maximum Day + Fire Flow - 2026
RESULT: Plan View
LOCATION: Town of Carleton Place

29763_CarletonPlace_Model2021_wmp_stn.wtg

Date: August 2021

Figure: B-7

Pipe: Headloss Gradient (m/km)
≤ 0.25
≤ 0.50
≤ 1.00
≤ 5.00
> 5.00

Junction: Pressure (psi)
≤ 40
≤ 50
≤ 80
≤ 90
> 90

Stantec	Town of Carleton Place 2021 Water & Wastewater Master Plan Water Distribution Hydraulic Modelling Results	WaterGEMS [10.03.01.08] Bentley System, Inc. Haestad Methods Solution Center 27 Slemon Company Drive Suite 200 W Watertown, CT 06795 USA	SCENARIO: Average Day Demand - 2031 RESULT: Plan View LOCATION: Town of Carleton Place	29763_CarletonPlace_Model2021_wmp_stn.wtg Date: August 2021	Figure: B-8

Stantec

Town of Carleton Place
2021 Water & Wastewater Master Plan
Water Distribution Hydraulic Modelling Results

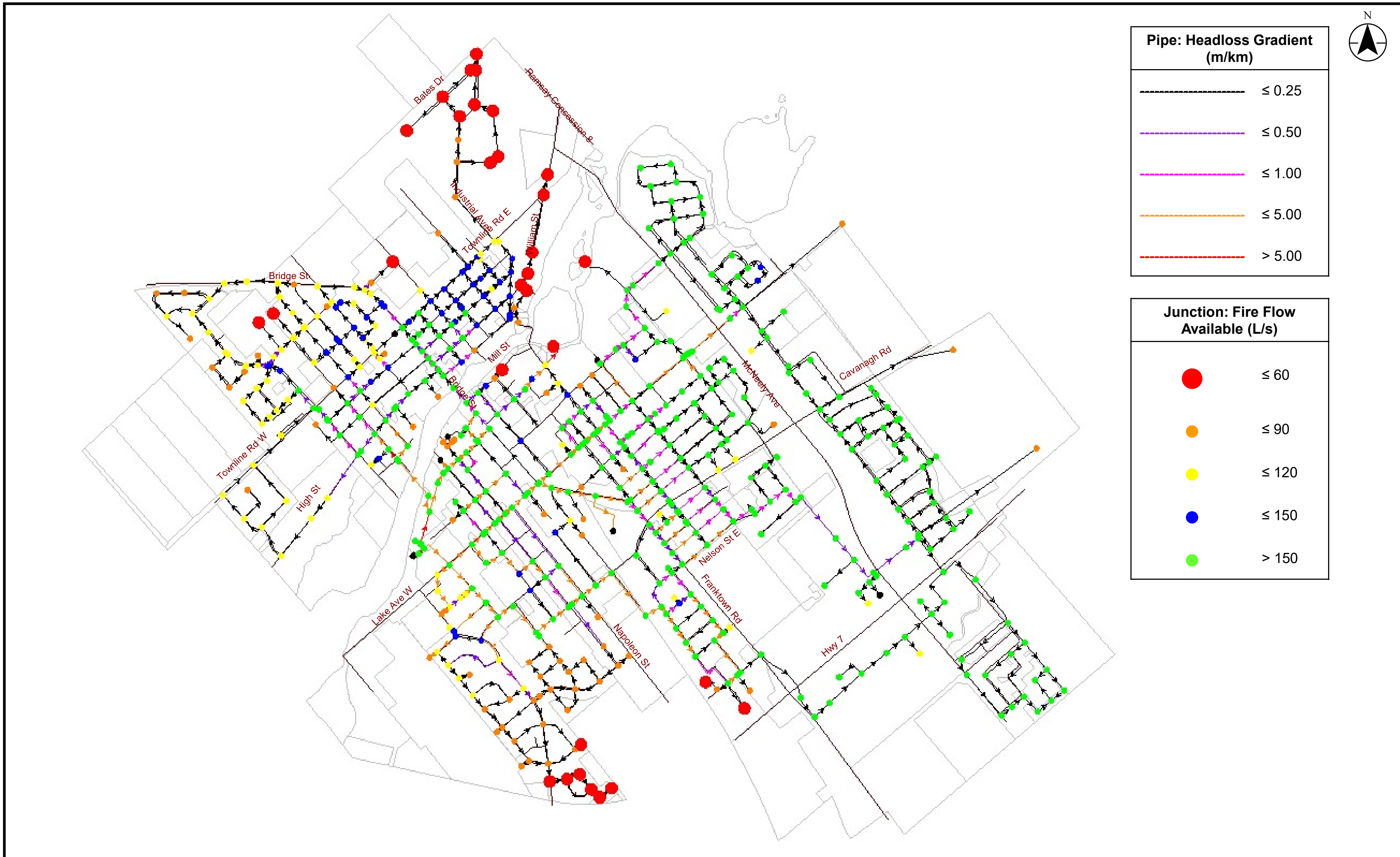
WaterGEMS [10.03.01.08]
Bentley System, Inc.
Haestad Methods Solution Center
27 Slemon Company Drive Suite 200 W
Watertown, CT 06795 USA

SCENARIO: Peak Hour Demand - 2031
RESULT: Plan View
LOCATION: Town of Carleton Place

29763_CarletonPlace_Model2021_wmp_stn.wtg

Date: August 2021

Figure: B-9



Stantec	Town of Carleton Place 2021 Water & Wastewater Master Plan Water Distribution Hydraulic Modelling Results	WaterGEMS [10.03.01.08] Bentley System, Inc. Haestad Methods Solution Center 27 Slemon Company Drive Suite 200 W Watertown, CT 06795 USA	SCENARIO: Maximum Day + Fire Flow - 2031 RESULT: Plan View LOCATION: Town of Carleton Place	29763_CarletonPlace_Model2021_wmp_stn.wtg Date: August 2021	Figure: B-10

Stantec

Town of Carleton Place
2021 Water & Wastewater Master Plan
Water Distribution Hydraulic Modelling Results

WaterGEMS [10.03.01.08]
Bentley System, Inc.
Haestad Methods Solution Center
27 Slemon Company Drive Suite 200 W
Watertown, CT 06795 USA

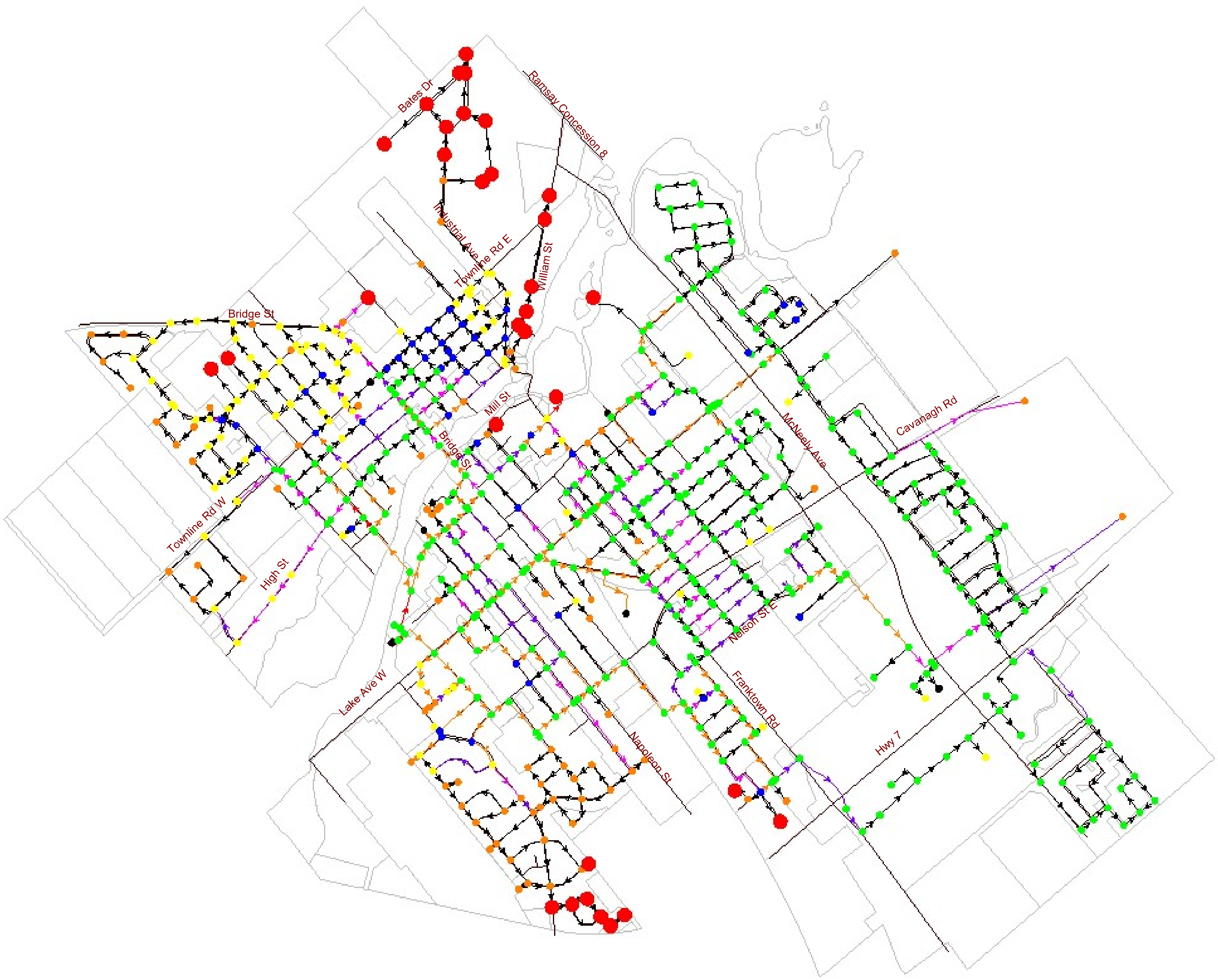
SCENARIO: Average Day Demand - 2041
RESULT: Plan View
LOCATION: Town of Carleton Place

29763_CarletonPlace_Model2021_wmp_stn.wtg

Date: August 2021

Figure: B-11

Stantec	Town of Carleton Place 2021 Water & Wastewater Master Plan Water Distribution Hydraulic Modelling Results	WaterGEMS [10.03.01.08] Bentley System, Inc. Haestad Methods Solution Center 27 Slemon Company Drive Suite 200 W Watertown, CT 06795 USA	SCENARIO: Peak Hour Demand - 2041 RESULT: Plan View LOCATION: Town of Carleton Place	29763_CarletonPlace_Model2021_wmp_stn.wtg Date: August 2021	Figure: B-12



Pipe: Headloss Gradient (m/km)
≤ 0.25
≤ 0.50
≤ 1.00
≤ 5.00
> 5.00

Junction: Fire Flow Available (L/s)
≤ 60
≤ 90
≤ 120
≤ 150
> 150

Stantec	Town of Carleton Place 2021 Water & Wastewater Master Plan Water Distribution Hydraulic Modelling Results	WaterGEMS [10.03.01.08] Bentley System, Inc. Haestad Methods Solution Center 27 Slemon Company Drive Suite 200 W Watertown, CT 06795 USA	SCENARIO: Maximum Day + Fire Flow - 2041 RESULT: Plan View LOCATION: Town of Carleton Place	29763_CarletonPlace_Model2021_wmp_stn.wtg Date: August 2021	Figure: B-13

Appendix C Storage and Pumping Capacity Assessment

163401646 - Carleton Place Water & Wastewater Master Plan Update

Manual Input
Calculated Value

Table C-1: Pumping Capacity Assessment

	2021	2026	2031	2041
Population Projections (ppl)	13,244	16,901	20,067	24,937
Total Maximum Day Demand (L/s)	113.0	143.0	169.0	208.5
Total Maximum Day Demand (m^3/d)	9,800	12,400	14,600	18,000
Pump Rated Capacity at WTP - Pump 1 (L/s)	36.8	36.8	36.8	36.8
Pump Rated Capacity at WTP - Pump 2 (L/s)	57.9	57.9	57.9	57.9
Pump Rated Capacity at WTP - Pump 3 (L/s)	100.0	100.0	100.0	100.0
Pump Rated Capacity at WTP - Pump 4 (L/s)	136.8	136.8	136.8	136.8
Firm Pumping Capacity at WTP (L/s)	194.7	194.7	194.7	194.7
Firm Pumping Capacity at WTP (m^3/d)	16,800	16,800	16,800	16,800
Total Additional Pumping Capacity Required (L/s)	-	-	-	14
Total Additional Pumping Capacity Required (m^3/d)	-	-	-	1,200

Table C-2: Storage Capacity Requirements (MECP Fire Flow)

		2021	2026	2031	2041
	Population Projections (ppl)	13,244	16,901	20,067	24,937
	ICI Area Projections (ha)	35	42	49	58
	Employment Density (jobs/ha)[(1)]	50	50	50	50
	ICI Area Equivalent Population (ppl)	1,750	2,116	2,449	2,897
	Total Equivalent Population (ppl)	14,994	19,017	22,516	27,834
	Total Equivalent Population - Rounded to Nearest 1,000	15,000	19,000	23,000	28,000
	Nearest Low Population Value	13,000	17,000	17,000	27,000
	Nearest High Population Value	17,000	27,000	27,000	33,000
	Total Maximum Day Demand (L/s)	113.0	143.0	169.0	208.5
	Total Maximum Day Demand (m^3)	9,766	12,352	14,606	18,011
	Fire Flow Required (Nearest Low Population) (L/s)	220	250	250	318
	Fire Flow Required (Nearest High Population) (L/s)	250	318	318	348
	Fire Flow Required (Interpolated) (L/s)	235	263.6	290.8	323
	Duration (Nearest Low Population) (hrs)	3	4	4	5
	Duration (Nearest High Population) (hrs)	4	5	5	5
	Duration (Interpolated) (hrs)	3.5	4.2	4.6	5
A	**Fire Storage Required (m^3)**	2,961	3,986	4,816	5,814
B	**Equalization Storage (25% of MXDY) (m^3)**	2,441	3,088	3,651	4,503
C	**Emergency Storage (25% of A+B) (m^3)**	1,351	1,768	2,117	2,579
A+B+C	**Total Storage Volume Required (m^3)**	6,753	8,842	10,584	12,896
	Existing Storage Available - WTP Clearwell (m^3)	3,180	3,180	3,180	3,180
	Existing Storage Available - EST (m^3)	3,200	3,200	3,200	3,200
	Additional Storage (m^3)	-	1,590	1,590	1,590
	Total Storage Volume Available (m^3)	6,380	7,970	7,970	7,970
	Additional Storage Volume Required (m^3)	373	872	2,614	4,926
	Disinfection Storage Volume in Winter (m^3)				
	Total Additional Storage Required (m^3)	373	872	2,614	4,926

Notes

(1) Employment density from JLR's Comprehensive Review (2021)

163401646 - Carleton Place Water & Wastewater Master Plan Update

Table C-3: Storage Capacity Requirements (Fire Underwriters Survey (FUS) Fire Flow)

Manual Input
Calculated Value

		2021	2026	2031	2041
	Population Projections (ppl)	13,244	16,901	20,067	24,937
	Total Maximum Day Demand (L/s)	113.0	143.0	169.0	208.5
	Total Maximum Day Demand (m^3)	9,766	12,352	14,606	18,011
	Fire Flow Required (FUS) (L/s)	13,000	13,000	13,000	13,000
	Fire Flow Required (L/s)	217	217	217	217
	Duration (FUS) (hrs)	2.75	2.75	2.75	2.75
A	**Fire Storage Required (m^3)**	2,145	2,145	2,145	2,145
B	**Equalization Storage (25% of MXDY) (m^3)**	2,441	3,088	3,651	4,503
C	**Emergency Storage (25% of A+B) (m^3)**	1,147	1,308	1,449	1,662
A+B+C	**Total Storage Volume Required (m^3)**	5,733	6,541	7,245	8,310
	Existing Storage Available - WTP Clearwell (m^3)	3,180	3,180	3,180	3,180
	Existing Storage Available - EST (m^3)	3,200	3,200	3,200	3,200
	Additional Storage (m^3)	-	1,590	1,590	1,590
	Total Storage Volume Available (m^3)	6,380	7,970	7,970	7,970
	Additional Storage Volume Required (m^3)	(647)	(1,429)	(725)	340
	Disinfection Storage Volume in Winter (m^3)				
	Total Additional Storage Required (m^3)	(647)	(1,429)	(725)	340

Appendix D Wastewater Collection System Modelling Results

163401646 - Town of Carleton Place 2021 W/WW MP

Table D-1: Comparison of Diameters and Slopes from Different Sources

Street	Maintenance Hole		Sewer Data															
	From	To	Diameter - JLR Sewer Design Spreadsheet	Diameter Data Provided by Town 20210712	Diameter - Original JLR GIS Data	Diameter Data Provided by Town 202105 (Original RFI)	Diameter - Selected Source	Diameter - Selected	Diameter - Comments/Notes	Slope % - JLR Sewer Design Spreadsheet	Slope Data Provided by Town 20210712	Slope Derived from Invert Data Provided by Town 20210712 + GIS Data Lengths	Slope - Original JLR GIS Data	Slope Data Provided by Town 202105 (Original RFI)	Slope - Selected Source	Slope - Selected	Slope - Comments/Notes
Lake Avenue West	001	002A	375	375	375	375	Original JLR Spreadsheet	375	Agreement between all data sources; can retain original spreadsheet data	0.51%	0.44		0.00	0.00	Town	0.44%	Retain value provided by Town
Lake Avenue West	002A	002	N/A	375	375	375	Town	375	Section originally missing from sewer design sheet; data confirmed by Town selected.	N/A	0.42		0.00	0.00	Town	0.42%	Section originally missing from sewer design sheet; data confirmed by Town selected.
Lake Avenue West	002	003	375	375	375	375	Original JLR Spreadsheet	375	Agreement between all data sources; can retain original spreadsheet data	0.47%	0.48		0.00	0.00	Town	0.48%	Retain value provided by Town
Lake Avenue West	003	004	375	375	375	375	Original JLR Spreadsheet	375	Agreement between all data sources; can retain original spreadsheet data	0.47%	0.45		0.00	0.00	Town	0.45%	Retain value provided by Town
Lake Avenue West	004	005	375	375	375	375	Original JLR Spreadsheet	375	Agreement between all data sources; can retain original spreadsheet data	0.50%	0.46		0.00	0.00	Town	0.46%	Retain value provided by Town
Lake Avenue West	005	006	375	375	375	375	Original JLR Spreadsheet	375	Agreement between all data sources; can retain original spreadsheet data	0.44%	0.42		0.00	0.00	Town	0.42%	Retain value provided by Town
Lake Avenue West	006	007	375	375	375	375	Original JLR Spreadsheet	375	Agreement between all data sources; can retain original spreadsheet data	0.26%	0.39		0.00	0.00	Town	0.39%	Retain value provided by Town
Lake Avenue West	007	008	375	375	375	375	Original JLR Spreadsheet	375	Agreement between all data sources; can retain original spreadsheet data	0.51%	0.57		0.00	0.00	Town	0.57%	Retain value provided by Town
Lake Avenue West	008	009	375	375	375	375	Original JLR Spreadsheet	375	Agreement between all data sources; can retain original spreadsheet data	0.82%	0.85		0.00	0.00	Town	0.85%	Retain value provided by Town
Lake Avenue West	009	010	450	450	450	450	Original JLR Spreadsheet	375	Agreement between all data sources; can retain original spreadsheet data	0.60%	0.62		0.00	0.00	Town	0.62%	Retain value provided by Town
Lake Avenue West	010	011	450	450	450	450	Original JLR Spreadsheet	375	Agreement between all data sources; can retain original spreadsheet data	0.54%	0.48		0.00	0.00	Town	0.48%	Retain value provided by Town
Lake Avenue West	011	012	450	450	450	450	Original JLR Spreadsheet	375	Agreement between all data sources; can retain original spreadsheet data	1.82%	1.82		0.00	0.00	Original JLR Spreadsheet	1.82%	Agreement between value recently provided by Town and JLR's original spreadsheet
Lake Avenue West	012	013	525	525	525	525	Original JLR Spreadsheet	525	Agreement between all data sources; can retain original spreadsheet data	5.34%	0.25		0.00	0.00	Town	0.25%	Retain value provided by Town, it is also more conservative
Lake Avenue West	013	014	600	600	600	600	Original JLR Spreadsheet	600	Agreement between all data sources; can retain original spreadsheet data	0.11%	0.12		0.00	0.00	Town	0.12%	Retain value provided by Town
Lake Avenue West	014	15B	600	600	600	600	Original JLR Spreadsheet	600	Agreement between all data sources; can retain original spreadsheet data	0.12%	0.12		0.00	0.00	Original JLR Spreadsheet	0.12%	Agreement between value recently provided by Town and JLR's original spreadsheet
Lake Avenue West	15B	15A	N/A	600	600	600	Town	600	Section originally missing from sewer design sheet; data confirmed by Town selected.	N/A	0.12		0.00	0.00	Town	0.12%	Section originally missing from sewer design sheet; data confirmed by Town selected.
Lake Avenue West	15A	015	600	600	600	600	Original JLR Spreadsheet	600	Agreement between all data sources; can retain original spreadsheet data	0.12%	0.12		0.00	0.00	Original JLR Spreadsheet	0.12%	Agreement between value recently provided by Town and JLR's original spreadsheet
Lake Avenue West	015	016	600	600	600	600	Original JLR Spreadsheet	600	Agreement between all data sources; can retain original spreadsheet data	0.13%	0.12		0.00	0.00	Town	0.12%	Retain value provided by Town, it is also more conservative
Lake Avenue West	016	017	600	600	600	600	Original JLR Spreadsheet	600	Agreement between all data sources; can retain original spreadsheet data	0.10%	0.10		0.00	0.00	Original JLR Spreadsheet	0.10%	Agreement between value recently provided by Town and JLR's original spreadsheet
Lake Avenue West	017	018	600	600	600	600	Original JLR Spreadsheet	600	Agreement between all data sources; can retain original spreadsheet data	0.10%	0.10		0.00	0.00	Original JLR Spreadsheet	0.10%	Agreement between value recently provided by Town and JLR's original spreadsheet
Lake Avenue West	018	019	600	600	600	600	Original JLR Spreadsheet	600	Agreement between all data sources; can retain original spreadsheet data	0.12%	0.12		0.00	0.00	Original JLR Spreadsheet	0.12%	Agreement between value recently provided by Town and JLR's original spreadsheet
Lake Avenue West	019	020	600	600	600	600	Original JLR Spreadsheet	600	Agreement between all data sources; can retain original spreadsheet data	0.12%	0.12		0.00	0.00	Original JLR Spreadsheet	0.12%	Agreement between value recently provided by Town and JLR's original spreadsheet
Lake Avenue West	020	021	600	600	600	600	Original JLR Spreadsheet	600	Agreement between all data sources; can retain original spreadsheet data	0.06%	0.06		0.00	0.00	Town	0.06%	Retain value provided by Town (0.055%), it is slightly more conservative
Lake Avenue West	021	022	600	600	600	600	Original JLR Spreadsheet	600	Agreement between all data sources; can retain original spreadsheet data	0.11%	0.12		0.00	0.00	Town	0.12%	Retain value provided by Town
Lorne Street	022	023	600	600	600	600	Original JLR Spreadsheet	600	Agreement between all data sources; can retain original spreadsheet data	0.20%	0.20		0.00	0.00	Original JLR Spreadsheet	0.20%	Agreement between value recently provided by Town and JLR's original spreadsheet
Lorne Street	023	024	600	600	600	600	Original JLR Spreadsheet	600	Agreement between all data sources; can retain original spreadsheet data	0.20%	0.20		0.00	0.00	Original JLR Spreadsheet	0.20%	Agreement between value recently provided by Town and JLR's original spreadsheet
Ball Park	024	120	600	600	375	375	Original JLR Spreadsheet	600	More recent data provided by Town and JLR's original spreadsheet agree; consistent with upstream diameters	0.49%	0.00	0.47	0.00	0.00	Derived from Town	0.47%	Value derived from Town is close to JLR's original spreadsheet, slightly more conservative
High Street	101	102A	350	350	N/A	300	Original JLR Spreadsheet	350	More recent data provided by Town and JLR's original spreadsheet agree	0.51%	0.51		0.00	0.00	Original JLR Spreadsheet	0.51%	Agreement between value recently provided by Town and JLR's original spreadsheet
High Street	102A	102	350	350	300	300	Original JLR Spreadsheet	350	More recent data provided by Town and JLR's original spreadsheet agree	0.15%	0.15		0.00	0.00	Original JLR Spreadsheet	0.15%	Agreement between value recently provided by Town and JLR's original spreadsheet
High Street	102	103	350	350	300	300	Original JLR Spreadsheet	350	More recent data provided by Town and JLR's original spreadsheet agree	0.17%	0.17		0.00	0.00	Original JLR Spreadsheet	0.17%	Agreement between value recently provided by Town and JLR's original spreadsheet
High Street	103	104	400	400	400	400	Original JLR Spreadsheet	400	Agreement between all data sources; can retain original spreadsheet data	0.14%	0.14		0.00	0.00	Original JLR Spreadsheet	0.14%	Agreement between value recently provided by Town and JLR's original spreadsheet
High Street	104	105	400	400	400	400	Original JLR Spreadsheet	400	Agreement between all data sources; can retain original spreadsheet data	0.14%	0.14		0.00	0.00	Original JLR Spreadsheet	0.14%	Agreement between value recently provided by Town and JLR's original spreadsheet
High Street	105	106	400	400	400	400	Original JLR Spreadsheet	400	Agreement between all data sources; can retain original spreadsheet data	0.14%	0.14		0.00	0.00	Original JLR Spreadsheet	0.14%	Agreement between value recently provided by Town and JLR's original spreadsheet
High Street	106	107	400	400	400	400	Original JLR Spreadsheet	400	Agreement between all data sources; can retain original spreadsheet data	0.13%	0.13		0.00	0.00	Original JLR Spreadsheet	0.13%	Agreement between value recently provided by Town and JLR's original spreadsheet
High Street	107	108	400	400	400	400	Original JLR Spreadsheet	400	Agreement between all data sources; can retain original spreadsheet data	0.15%	0.15		0.00	0.00	Original JLR Spreadsheet	0.15%	Agreement between value recently provided by Town and JLR's original spreadsheet
Bridge Street	108	109	450	450	450	450	Original JLR Spreadsheet	450	Agreement between all data sources; can retain original spreadsheet data	0.36%	0.35		0.00	0.00	Town	0.35%	Retain value provided by Town
Bridge Street	109	110	450	450	450	450	Original JLR Spreadsheet	450	Agreement between all data sources; can retain original spreadsheet data	0.31%	0.31		0.00	0.00	Original JLR Spreadsheet	0.31%	Agreement between value recently provided by Town and JLR's original spreadsheet
Bridge Street	110	111	450	450	450	450	Original JLR Spreadsheet	450	Agreement between all data sources; can retain original spreadsheet data	0.45%	0.45		0.00	0.00	Original JLR Spreadsheet	0.45%	Agreement between value recently provided by Town and JLR's original spreadsheet
Bridge Street	111	112	450	450	450	450	Original JLR Spreadsheet	450	Agreement between all data sources; can retain original spreadsheet data	1.44%	?		0.00	0.00	Original JLR Spreadsheet	1.44%	JLR's original spreadsheet slope is only info available, because Town does not have slope nor does it have DS invert
Mill Street	112	113	600	600	600	600	Original JLR Spreadsheet	600	Agreement between all data sources; can retain original spreadsheet data	0.33%	0.30		0.00	0.00	Town	0.30%	Retain value provided by Town
Beckwith Street	113	114	600	600	600	600	Original JLR Spreadsheet	600	Agreement between all data sources; can retain original spreadsheet data	0.20%	0.20		0.00	0.00	Original JLR Spreadsheet	0.20%	Agreement between value recently provided by Town and JLR's original spreadsheet
Franklin Street	114	115	600	600	600	600	Original JLR Spreadsheet	600	Agreement between all data sources; can retain original spreadsheet data	0.23%	0.23		0.00	0.00	Original JLR Spreadsheet	0.23%	Agreement between value recently provided by Town and JLR's original spreadsheet
Franklin Street	115	115A	600	600	600	600	Original JLR Spreadsheet	600	Agreement between all data sources; can retain original spreadsheet data	0.28%	0.28		0.00	0.00	Original JLR Spreadsheet	0.28%	Agreement between value recently provided by Town and JLR's original spreadsheet
Franklin Street	115A	116	450	600	600	600	Town	600	Original diameter in JLR's spreadsheet does not make sense, smaller than upstream diameters of 600mm; retain Town's corrected value of 600mm	0.31%	0.31		0.00	0.00	Original JLR Spreadsheet	0.31%	Agreement between value recently provided by Town and JLR's original spreadsheet
Franklin Street	116	117	600	600	600	600	Original JLR Spreadsheet	600	Agreement between all data sources; can retain original spreadsheet data	0.18%	0.18		0.00	0.00	Original JLR Spreadsheet	0.18%	Agreement between value recently provided by Town and JLR's original spreadsheet
Franklin Street	117	118	600	450*	600	600	Other	584	Short upstream section is 600mm, but following section (no separate item in this spreadsheet) is Twin 450mm according to Town; 584mm is equivalent diameter calculated by Stantec	0.28%	0.26		0.00	0.00	Town	0.26%	Retain value provided by Town
To WWTP	118	119	600	Not Confirmed	600	600	Original JLR Spreadsheet	600	Recent data from Town did not confirm or correct this, but JLR's spreadsheet is consistent with Town's GIS, and 600mm is consistent with upstream diameters	0.26%	Not Confirmed		0.00	0.00	Original JLR Spreadsheet	0.26%	JLR's original spreadsheet slope is only info available
To WWTP	119	119A	600	600	600	600	Original JLR Spreadsheet	600	Agreement between all data sources; can retain original spreadsheet data	0.27%	0.27		0.00	0.00	Original JLR Spreadsheet	0.27%	Agreement between value recently provided by Town and JLR's original spreadsheet
To WWTP	119A	119B	N/A	600	600	600	Town	600	Section originally missing from sewer design sheet; data confirmed by Town selected.	N/A	0.00		0.00	0.00	Other	0.27%	No value provided other than inverts from Town, which are identical (slope = 0%); use upstream slope.
To WWTP	119B	120	750	750	600	600	Original JLR Spreadsheet	750	More recent data provided by Town and JLR's original spreadsheet agree	1.66%	1.66		0.00	0.00	Original JLR Spreadsheet	1.66%	Agreement between value recently provided by Town and JLR's original spreadsheet
To WWTP	120	121	750	Not Confirmed	600	600	Original JLR Spreadsheet	750	Recent data from Town did not confirm or correct this, but JLR's spreadsheet value is consistent with upstream diameters	0.25%	Not Confirmed		0.00	0.00	Original JLR Spreadsheet	0.25%	JLR's original spreadsheet slope is only info available
To WWTP	121	122	750	Not Confirmed	600	600	Original JLR Spreadsheet	750	Recent data from Town did not confirm or correct this, but JLR's spreadsheet value is consistent with upstream diameters	0.25%	Not Confirmed		0.00	0.00	Original JLR Spreadsheet	0.25%	JLR's original spreadsheet slope is only info available
To WWTP	122	123	750	Not Confirmed	750	750	Original JLR Spreadsheet	750	Recent data from Town did not confirm or correct this, but JLR's spreadsheet is consistent with Town's GIS, and 750mm is consistent with upstream diameters	0.25%	Not Confirmed		0.00	0.00	Original JLR Spreadsheet	0.25%	JLR's original spreadsheet slope is only info available
To WWTP	123	124	750	750	600	600	Original JLR Spreadsheet	750	More recent data provided by Town and JLR's original spreadsheet agree; consistent with upstream diameters	4.08%	3.97		0.00	0.00	Town	3.97%	Retain value provided by Town
Industrial Avenue	200	201	N/A	200	200	200	Town	200	Section originally missing from sewer design sheet; data confirmed by Town selected.	N/A	3.61		0.00	0.00	Town	3.61%	Section originally missing from sewer design sheet; data confirmed by Town selected.
Industrial Avenue	201	202	200	200	250	250	Original JLR Spreadsheet	200	More recent data provided by Town and JLR's original spreadsheet agree; smaller diameter is more conservative	3.01%	0.27		0.00	0.00	Town	0.27%	Retain value provided by Town
Industrial Avenue	202	203	250	300	300	300	Town	300	Retain value provided by Town	0.69%	0.17		0.00	0.00	Town	0.17%	Retain value provided by Town

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Table D-1: Comparison of Diameters and Slopes from Different Sources

Street	Maintenance Hole From	Maintenance Hole To	Sewer Data: Diameter - JLR Sewer Design Spreadsheet	Diameter Data Provided by Town 20210712	Diameter - Original JLR GIS Data	Diameter Data Provided by Town 202105 (Original RFI)	Diameter - Selected Source	Diameter - Selected	Diameter - Comments/Notes	Slope % - JLR Sewer Design Spreadsheet	Slope Data Provided by Town 20210712	Slope Derived from Invert Data Provided by Town 20210712 + GIS Data Lengths	Slope - Original JLR GIS Data	Slope Data Provided by Town 202105 (Original RFI)	Slope - Selected Source	Slope - Selected	Slope - Comments/Notes
Mullett Street	203	204	300	300	300	300	Original JLR Spreadsheet	300	Agreement between all data sources; can retain original spreadsheet data	0.12%	0.22		0.00	0.00	Town	0.22%	Retain value provided by Town
Mullett Street	204	205	300	300	300	300	Original JLR Spreadsheet	300	Agreement between all data sources; can retain original spreadsheet data	0.31%	0.36		0.00	0.00	Town	0.36%	Retain value provided by Town
Mullett Street	205	206	300	300	300	300	Original JLR Spreadsheet	300	Agreement between all data sources; can retain original spreadsheet data	1.08%	0.77		0.00	0.00	Town	0.77%	Retain value provided by Town
Mullett Street	206	207	350	350	350	350	Original JLR Spreadsheet	350	Agreement between all data sources; can retain original spreadsheet data	0.40%	0.32		0.00	0.00	Town	0.32%	Retain value provided by Town
Mullett Street	207	208	350	350	350	350	Original JLR Spreadsheet	350	Agreement between all data sources; can retain original spreadsheet data	3.11%	0.72		0.00	0.00	Town	0.72%	Retain value provided by Town
Mullett Street	208	209	375	600	400	400	Original JLR Spreadsheet	375	Value provided by Town seems inconsistent with upstream and downstream diameters; original GIS data contained 400mm; retain JLR's spreadsheet value of 375mm, smaller diameter is more conservative	0.30%	0.00	0.79	0.00	0.00	Original JLR Spreadsheet	0.30%	JLR's original spreadsheet slope is more conservative than what is derived from Town's invert data + GIS lengths
Mullett Street	209	210	375	375	400	400	Original JLR Spreadsheet	375	More recent data provided by Town and JLR's original spreadsheet agree; smaller diameter is more conservative	0.30%	0.00		0.00	0.00	Original JLR Spreadsheet	0.30%	JLR's original spreadsheet slope is only info available
Mullett Street	210	211A	375	375	400	400	Original JLR Spreadsheet	375	More recent data provided by Town and JLR's original spreadsheet agree; smaller diameter is more conservative	0.24%	0.00		0.00	0.00	Original JLR Spreadsheet	0.24%	JLR's original spreadsheet slope is only info available
Mullett Street	211A	211	N/A	375	400	400	Town	375	Section originally missing from sewer design sheet; data confirmed by Town selected, consistent with other sections upstream and downstream.	N/A	0.26		0.00	0.00	Town	0.26%	Section originally missing from sewer design sheet; data confirmed by Town selected.
Mullett Street	211	212	375	375	400	400	Original JLR Spreadsheet	375	More recent data provided by Town and JLR's original spreadsheet agree; smaller diameter is more conservative	2.82%	2.49		0.00	0.00	Town	2.49%	Retain value provided by Town
To WWTP	212	213	375	400	400	400	Town	400	Retain most recent data provided/corrected by Town	0.20%	0.16		0.00	0.00	Town	0.16%	Retain value provided by Town
To WWTP	213	214	375	400	400	400	Town	400	Retain most recent data provided/corrected by Town	0.21%	0.18		0.00	0.00	Town	0.18%	Retain value provided by Town
To WWTP	214	215	375	400	400	400	Town	400	Retain most recent data provided/corrected by Town	3.25%	3.25		0.00	0.00	Original JLR Spreadsheet	3.25%	Agreement between value recently provided by Town and JLR's original spreadsheet
To WWTP	215	216	400	400	400	400	Original JLR Spreadsheet	400	Agreement between all data sources; can retain original spreadsheet data	0.20%	0.21		0.00	0.00	Town	0.21%	Retain value provided by Town
To WWTP	216	217	400	400	400	400	Original JLR Spreadsheet	400	Agreement between all data sources; can retain original spreadsheet data	0.20%	0.23		0.00	0.00	Town	0.23%	Retain value provided by Town
To WWTP	217	218	400	400	400	400	Original JLR Spreadsheet	400	Agreement between all data sources; can retain original spreadsheet data	0.20%	0.22		0.00	0.00	Town	0.22%	Retain value provided by Town
To WWTP	218	219	400	400	400	400	Original JLR Spreadsheet	400	Agreement between all data sources; can retain original spreadsheet data	0.20%	0.18		0.00	0.00	Town	0.18%	Retain value provided by Town
To WWTP - Siphon	219	220	400	400	400	400	Original JLR Spreadsheet	400	Agreement between all data sources; can retain original spreadsheet data	0.20%	0.22		0.00	0.00	Town	0.22%	Retain value provided by Town
To WWTP - Siphon	220	221	400	400	400	400	Original JLR Spreadsheet	400	As per drawings, siphon consists of two barrels (150mm and 300mm); JLR's original spreadsheet representation as single pipe at a continuous downward slope of 0.84% retained.	0.84%	0.22		0.00	0.00	Original JLR Spreadsheet	0.84%	JLR's original spreadsheet representation as single pipe at a continuous downward slope of 0.84% retained.
To WWTP - Siphon	221	124	400	400	400	400	Original JLR Spreadsheet	400	Agreement between all data sources; can retain original spreadsheet data	0.20%	0.15		0.00	0.00	Town	0.15%	Retain value provided by Town
To WWTP	124	125	750	Not Confirmed	750	750	Original JLR Spreadsheet	750	No recent data/confirmation from Town; JLR's spreadsheet data agrees with GIS, retain this value	0.12%	Not Confirmed		0.00	0.00	Original JLR Spreadsheet	0.12%	JLR's original spreadsheet slope is only info available
To WWTP	125	126	750	Not Confirmed	750	750	Original JLR Spreadsheet	750	No recent data/confirmation from Town; JLR's spreadsheet data agrees with GIS, retain this value	0.12%	Not Confirmed		0.00	0.00	Original JLR Spreadsheet	0.12%	JLR's original spreadsheet slope is only info available
To WWTP	126	127	750	Not Confirmed	750	750	Original JLR Spreadsheet	750	No recent data/confirmation from Town; JLR's spreadsheet data agrees with GIS, retain this value	0.12%	Not Confirmed		0.00	0.00	Original JLR Spreadsheet	0.12%	JLR's original spreadsheet slope is only info available
To WWTP	127	128	750	Not Confirmed	750	750	Original JLR Spreadsheet	750	No recent data/confirmation from Town; JLR's spreadsheet data agrees with GIS, retain this value	0.27%	Not Confirmed		0.00	0.00	Original JLR Spreadsheet	0.27%	JLR's original spreadsheet slope is only info available
To WWTP	128	WWTP	750	Not Confirmed	750	750	Original JLR Spreadsheet	750	No recent data/confirmation from Town; JLR's spreadsheet data agrees with GIS, retain this value	0.27%	Not Confirmed		0.00	0.00	Original JLR Spreadsheet	0.27%	JLR's original spreadsheet slope is only info available
McNeely Avenue	301	302	300	300	300	300	Original JLR Spreadsheet	300	Agreement between all data sources; can retain original spreadsheet data	0.25%	0.25		0.00	0.00	Original JLR Spreadsheet	0.25%	Agreement between value recently provided by Town and JLR's original spreadsheet
McNeely Avenue	302	303	450	450	450	450	Original JLR Spreadsheet	450	Agreement between all data sources; can retain original spreadsheet data	0.14%	0.14		0.00	0.00	Original JLR Spreadsheet	0.14%	Agreement between value recently provided by Town and JLR's original spreadsheet
McNeely Avenue	303	304	450	450	450	450	Original JLR Spreadsheet	450	Agreement between all data sources; can retain original spreadsheet data	0.10%	0.10		0.00	0.00	Original JLR Spreadsheet	0.10%	Agreement between value recently provided by Town and JLR's original spreadsheet
McNeely Avenue	304	305	450	450	450	450	Original JLR Spreadsheet	450	Agreement between all data sources; can retain original spreadsheet data	0.12%	0.12		0.00	0.00	Original JLR Spreadsheet	0.12%	Agreement between value recently provided by Town and JLR's original spreadsheet
McNeely Avenue	305	306	450	450	450	450	Original JLR Spreadsheet	450	Agreement between all data sources; can retain original spreadsheet data	0.05%	0.05		0.00	0.00	Original JLR Spreadsheet	0.05%	Agreement between value recently provided by Town and JLR's original spreadsheet
McNeely Avenue	306	307	450	450	450	450	Original JLR Spreadsheet	450	Agreement between all data sources; can retain original spreadsheet data	0.04%	0.04		0.00	0.00	Original JLR Spreadsheet	0.04%	Agreement between value recently provided by Town and JLR's original spreadsheet
McNeely Avenue	307	308	450	450	450	450	Original JLR Spreadsheet	450	Agreement between all data sources; can retain original spreadsheet data	0.13%	0.13		0.00	0.00	Original JLR Spreadsheet	0.13%	Agreement between value recently provided by Town and JLR's original spreadsheet
McNeely Avenue	308	309	450	450	450	450	Original JLR Spreadsheet	450	Agreement between all data sources; can retain original spreadsheet data	0.11%	0.11		0.00	0.00	Original JLR Spreadsheet	0.11%	Agreement between value recently provided by Town and JLR's original spreadsheet
McNeely Avenue	309	310	450	450	450	450	Original JLR Spreadsheet	450	Agreement between all data sources; can retain original spreadsheet data	0.08%	0.08		0.00	0.00	Original JLR Spreadsheet	0.08%	Agreement between value recently provided by Town and JLR's original spreadsheet
McNeely Avenue	310	311	450	450	450	450	Original JLR Spreadsheet	450	Agreement between all data sources; can retain original spreadsheet data	0.11%	0.10		0.00	0.00	Town	0.10%	Retain value provided by Town
McNeely Avenue	311	312	450	450	450	450	Original JLR Spreadsheet	450	Agreement between all data sources; can retain original spreadsheet data	0.70%	0.06		0.00	0.00	Town	0.06%	Retain value provided by Town
McNeely Avenue	312	313	450	450	450	450	Original JLR Spreadsheet	450	Agreement between all data sources; can retain original spreadsheet data	0.13%	0.13		0.00	0.00	Original JLR Spreadsheet	0.13%	Agreement between value recently provided by Town and JLR's original spreadsheet
McNeely Avenue	313	314	450	450	450	450	Original JLR Spreadsheet	450	Agreement between all data sources; can retain original spreadsheet data	0.12%	0.12		0.00	0.00	Original JLR Spreadsheet	0.12%	Agreement between value recently provided by Town and JLR's original spreadsheet
McNeely Avenue	314	315	300	Not Confirmed	300	300	Original JLR Spreadsheet	300	No recent data/confirmation from Town; JLR's spreadsheet data agrees with GIS, retain this value	0.41%	Not Confirmed		0.00	0.00	Original JLR Spreadsheet	0.41%	JLR's original spreadsheet slope is only info available
McNeely Avenue	315	316	300	Not Confirmed	300	300	Original JLR Spreadsheet	300	No recent data/confirmation from Town; JLR's spreadsheet data agrees with GIS, retain this value	0.41%	Not Confirmed		0.00	0.00	Original JLR Spreadsheet	0.41%	JLR's original spreadsheet slope is only info available
McNeely Avenue	316	317	300	Not Confirmed	300	300	Original JLR Spreadsheet	300	No recent data/confirmation from Town; JLR's spreadsheet data agrees with GIS, retain this value	0.21%	Not Confirmed		0.00	0.00	Original JLR Spreadsheet	0.21%	JLR's original spreadsheet slope is only info available
McNeely Avenue	317	318	300	Not Confirmed	300	300	Original JLR Spreadsheet	300	No recent data/confirmation from Town; JLR's spreadsheet data agrees with GIS, retain this value	0.23%	Not Confirmed		0.00	0.00	Original JLR Spreadsheet	0.23%	JLR's original spreadsheet slope is only info available
McNeely Avenue	318	319	300	Not Confirmed	300	300	Original JLR Spreadsheet	300	No recent data/confirmation from Town; JLR's spreadsheet data agrees with GIS, retain this value	0.27%	Not Confirmed		0.00	0.00	Original JLR Spreadsheet	0.27%	JLR's original spreadsheet slope is only info available
McNeely Avenue	319	320	300	300	300	300	Original JLR Spreadsheet	300	Agreement between all data sources; can retain original spreadsheet data	0.50%	0.00	0.97	0.00	0.00	Original JLR Spreadsheet	0.50%	JLR's original spreadsheet slope is more conservative than what is derived from Town's invert data + GIS lengths
McNeely Avenue	320	Pump Station	300	Not Confirmed	300	300	Original JLR Spreadsheet	300	No recent data/confirmation from Town; JLR's spreadsheet data agrees with GIS, retain this value	0.50%	Not Confirmed		0.00	0.00	Original JLR Spreadsheet	0.50%	JLR's original spreadsheet slope is only info available
Patterson Crescent (Forcemain)	Pump Station	321			200	200	Original JLR Spreadsheet	-	No recent data/confirmation from Town, but this is modelled as a forcemain, so no flow calculations for this section, does not require diameter information		Not Confirmed		0.00	0.00	Original JLR Spreadsheet	-	No recent data/confirmation from Town, but this is modelled as a forcemain, so no flow calculations for this section, does not require slope information
Patterson Crescent	321	322	500	Not Confirmed	525	525	Original JLR Spreadsheet	500	No recent data/confirmation from Town; JLR's spreadsheet data is smaller (more conservative) than GIS, so retain smaller diameter; GIS data is inconsistent with downstream diameters, which are smaller	0.20%	Not Confirmed		0.00	0.00	Original JLR Spreadsheet	0.20%	JLR's original spreadsheet slope is only info available
Patterson Crescent	322	323	500	Not Confirmed	525	525	Original JLR Spreadsheet	500	No recent data/confirmation from Town; JLR's spreadsheet data is smaller (more conservative) than GIS, so retain smaller diameter; GIS data is inconsistent with downstream diameters, which are smaller	0.20%	Not Confirmed		0.00	0.00	Original JLR Spreadsheet	0.20%	JLR's original spreadsheet slope is only info available
Patterson Crescent	323	324	500	Not Confirmed	525	525	Original JLR Spreadsheet	500	No recent data/confirmation from Town; JLR's spreadsheet data is smaller (more conservative) than GIS, so retain smaller diameter; GIS data is inconsistent with downstream diameters, which are smaller	0.20%	Not Confirmed		0.00	0.00	Original JLR Spreadsheet	0.20%	JLR's original spreadsheet slope is only info available
Patterson Crescent	324	325	500	Not Confirmed	500	500	Original JLR Spreadsheet	500	No recent data/confirmation from Town; JLR's spreadsheet data agrees with GIS, retain this value	0.20%	Not Confirmed		0.00	0.00	Original JLR Spreadsheet	0.20%	JLR's original spreadsheet slope is only info available
To WWTP	325	326	500	Not Confirmed	500	500	Original JLR Spreadsheet	500	No recent data/confirmation from Town; JLR's spreadsheet data agrees with GIS, retain this value	0.20%	Not Confirmed		0.00	0.00	Original JLR Spreadsheet	0.20%	JLR's original spreadsheet slope is only info available
To WWTP	326	327	500	Not Confirmed	500	500	Original JLR Spreadsheet	500	No recent data/confirmation from Town; JLR's spreadsheet data agrees with GIS, retain this value	0.20%	Not Confirmed		0.00	0.00	Original JLR Spreadsheet	0.20%	JLR's original spreadsheet slope is only info available
To WWTP	327	128	500	Not Confirmed	N/A	N/A	Original JLR Spreadsheet	500	No recent data/confirmation from Town; JLR's spreadsheet data is only value provided, retain it	0.20%	Not Confirmed		N/A	N/A	Original JLR Spreadsheet	0.20%	JLR's original spreadsheet slope is only info available

163401646 - Town of Carleton Place W/WW Master Plan
Table D-2: Summary of Sewer Capacity Utilization

Manual Input
Calculated Value
Sewer Capacity Used > 100%

Notes

(1) McArthur Island siphon represented by sewer section from MH219 to MH124, as a single 400 mm diameter gravity pipe at 0.84% slope, as per original spreadsheet (JLR, 2021). Based on drawings, siphon consists of two barrels (150 mm and 300 mm); representation of siphon would require adjustments for HGL calculations.

(2) Mississippi Quays PS modelled at the end of McNeely Avenue (from MH320 to Pump Station); no gravity flow calculated through forcemain on Patterson Crescent (from Pump Station to MH321, assumed without restrictions).

(3) Extraneous flows calculated using increased I/I rate for drainage areas tributary to flow monitor No. 6.

(4) Diameters and slopes confirmed or corrected based on comparison of original spreadsheet to information provided by the Town on 20210712; see detailed comparison in Table D-1: Comparison of Diameters and Slopes from Different Sources.

(5) Based on information provided by the Town on 20210712, sewer along Franklin St between MH117 and MH118 appears to first be a ~38-m long 600-mm single sewer, followed by a ~52-m long section of twin 450-mm sewers; equivalent diameter to twin 450-mm retained, as it is more conservative.

(6) Sewer section added to spreadsheet to match Town's GIS data.

Street	Maintenance Hole		2021			2026			2031			2041		
	From	To	Design	Annual	Rare	Design	Annual	Rare	Design	Annual	Rare	Design	Annual	Rare
Lake Avenue West	1	02A	3.4%	2.9%	4.0%	14.8%	11.0%	15.2%	22.3%	16.3%	22.6%	29.9%	21.7%	30.3%
Lake Avenue West(6)	02A	2	3.5%	3.0%	4.0%	15.2%	11.2%	15.5%	22.8%	16.7%	23.2%	30.6%	22.2%	31.0%
Lake Avenue West	2	3	25.4%	21.9%	29.9%	35.5%	29.0%	40.1%	42.2%	33.9%	47.0%	49.2%	38.9%	54.1%
Lake Avenue West	3	4	27.0%	23.3%	31.9%	37.3%	30.6%	42.4%	44.3%	35.6%	49.5%	51.5%	40.7%	56.9%
Lake Avenue West	4	5	27.1%	23.3%	31.9%	37.6%	30.7%	42.4%	44.6%	35.7%	49.5%	51.8%	40.8%	56.9%
Lake Avenue West	5	6	30.6%	26.5%	36.4%	41.6%	34.2%	47.4%	48.9%	39.4%	54.8%	56.4%	44.7%	62.4%
Lake Avenue West	6	7	32.7%	28.3%	38.8%	44.1%	36.2%	50.2%	51.7%	41.6%	57.9%	59.4%	47.2%	65.8%
Lake Avenue West	7	8	42.5%	36.9%	51.6%	52.3%	43.8%	61.4%	59.4%	48.8%	68.7%	66.8%	54.1%	76.4%
Lake Avenue West	8	9	35.8%	31.1%	43.4%	43.8%	36.7%	51.4%	49.6%	40.8%	57.4%	55.7%	45.2%	63.7%
Lake Avenue West	9	10	45.0%	39.1%	54.5%	54.3%	45.6%	63.8%	61.0%	50.4%	70.8%	68.1%	55.5%	78.1%
Lake Avenue West	10	11	53.5%	46.4%	64.7%	64.0%	53.8%	75.3%	71.7%	59.3%	83.2%	79.9%	65.2%	91.7%
Lake Avenue West	11	12	27.9%	24.2%	33.8%	33.3%	28.0%	39.2%	37.3%	30.9%	43.3%	41.5%	33.9%	47.7%
Lake Avenue West	12	13	34.3%	29.9%	42.3%	40.2%	34.0%	48.3%	44.6%	37.1%	52.8%	49.2%	40.4%	57.6%
Lake Avenue West	13	14	34.9%	30.4%	43.1%	41.1%	34.7%	49.3%	45.7%	37.9%	53.9%	50.4%	41.3%	58.8%
Lake Avenue West	14	15B	35.4%	30.9%	43.8%	41.6%	35.2%	50.0%	46.3%	38.5%	54.7%	51.1%	41.9%	59.7%
Lake Avenue West(6)	15B	15A	35.4%	30.9%	43.8%	41.6%	35.2%	50.0%	46.3%	38.5%	54.7%	51.1%	41.9%	59.7%
Lake Avenue West	15A	15	35.5%	30.9%	43.9%	41.7%	35.2%	50.1%	46.3%	38.5%	54.8%	51.2%	42.0%	59.7%
Lake Avenue West	15	16	35.8%	31.2%	44.3%	42.0%	35.5%	50.5%	46.7%	38.8%	55.2%	51.5%	42.3%	60.1%
Lake Avenue West	16	17	39.7%	34.6%	49.1%	46.5%	39.4%	55.9%	51.6%	42.9%	61.0%	56.9%	46.7%	66.5%
Lake Avenue West	17	18	41.2%	35.9%	50.9%	48.0%	40.6%	57.6%	53.0%	44.2%	62.8%	58.3%	48.0%	68.2%
Lake Avenue West	18	19	37.7%	32.8%	46.5%	43.9%	37.1%	52.7%	48.5%	40.4%	57.4%	53.3%	43.8%	62.3%
Lake Avenue West	19	20	38.2%	33.3%	47.2%	44.5%	37.6%	53.4%	49.1%	40.9%	58.1%	54.0%	44.4%	63.2%
Lake Avenue West	20	21	56.6%	49.3%	69.8%	65.8%	55.7%	79.0%	72.7%	60.6%	86.0%	79.9%	65.8%	93.5%
Lake Avenue West	21	22	42.0%	36.6%	51.9%	48.9%	41.4%	58.8%	54.1%	45.1%	64.1%	60.2%	49.5%	70.4%
Lorne Street	22	23	32.7%	28.5%	40.4%	38.0%	32.2%	45.7%	42.1%	35.1%	49.9%	46.8%	38.5%	54.8%
Lorne Street	23	24	32.9%	28.7%	40.7%	38.2%	32.4%	46.0%	42.3%	35.3%	50.1%	47.0%	38.7%	55.0%
Ball Park	24	120	22.4%	19.5%	27.7%	25.8%	21.9%	31.1%	28.5%	23.8%	33.8%	31.6%	26.0%	37.0%
High Street(3)	101	102A	35.2%	35.9%	172.7%	35.8%	36.3%	174.8%	37.0%	37.2%	178.8%	57.6%	56.3%	288.2%
High Street(3)	102A	102	65.0%	66.1%	318.4%	66.0%	66.9%	322.2%	68.2%	68.6%	329.7%	106.2%	103.9%	531.4%
High Street(3)	102	103	71.3%	72.0%	336.6%	72.2%	72.7%	340.2%	74.2%	74.3%	347.2%	109.6%	107.2%	536.5%
High Street(3)	103	104	64.2%	65.2%	310.9%	64.9%	65.8%	313.7%	66.5%	67.0%	319.0%	93.6%	92.3%	465.0%
High Street(3)	104	105	69.7%	70.1%	320.7%	70.4%	70.7%	323.4%	72.0%	71.9%	328.8%	98.9%	97.1%	474.7%
High Street(3)	105	106	70.5%	70.9%	322.9%	71.2%	71.4%	325.7%	72.8%	72.6%	331.1%	99.7%	97.8%	476.9%
High Street(3)	106	107	73.6%	74.0%	337.1%	74.9%	75.0%	342.2%	77.1%	76.8%	350.0%	106.2%	103.8%	505.8%
High Street(3)	107	108	69.1%	69.4%	316.5%	70.3%	70.4%	321.2%	72.4%	72.0%	328.5%	99.4%	97.2%	473.5%
Bridge Street	108	109	46.9%	45.3%	168.5%	47.5%	45.8%	170.7%	49.0%	47.0%	174.9%	62.3%	59.3%	244.7%
Bridge Street	109	110	50.0%	48.3%	179.2%	50.6%	48.8%	181.6%	52.3%	50.1%	186.0%	66.4%	63.2%	260.2%
Bridge Street	110	111	41.6%	40.2%	148.9%	42.1%	40.6%	150.9%	43.5%	41.6%	154.5%	55.2%	52.5%	216.1%
Bridge Street	111	112	23.3%	22.5%	83.2%	23.5%	22.7%	84.3%	24.3%	23.3%	86.4%	30.9%	29.4%	120.8%
Mill Street	112	113	26.8%	25.6%	88.6%	27.0%	25.8%	89.7%	27.9%	26.4%	91.8%	34.5%	32.6%	126.8%
Beckwith Street	113	114	33.0%	31.5%	108.8%	33.4%	31.8%	110.2%	34.3%	32.6%	112.7%	42.5%	40.1%	155.6%
Franklin Street	114	115	31.1%	29.7%	101.9%	31.4%	30.0%	103.2%	32.4%	30.7%	105.5%	39.9%	37.7%	145.5%
Franklin Street	115	115A	29.1%	27.7%	93.4%	29.4%	27.9%	94.6%	30.3%	28.6%	96.8%	37.2%	35.0%	133.1%
Franklin Street	115A	116	27.7%	26.4%	88.9%	28.0%	26.6%	90.0%	28.8%	27.2%	92.1%	35.4%	33.3%	126.6%
Franklin Street	116	117	36.4%	34.6%	116.7%	36.7%	34.9%	118.2%	37.8%	35.7%	120.9%	46.4%	43.7%	166.2%
Franklin Street(5)	117	118	32.7%	31.1%	104.5%	33.0%	31.3%	105.8%	34.0%	32.1%	108.3%	41.7%	39.2%	148.8%
To WWTP	118	119	30.4%	28.9%	97.3%	30.7%	29.2%	98.5%	31.6%	29.9%	100.8%	38.8%	36.5%	138.4%
To WWTP	119	119A	29.8%	28.4%	95.4%	30.1%	28.6%	96.6%	31.0%	29.3%	98.9%	38.0%	35.8%	135.8%
To WWTP(6)	119A	119B	29.8%	28.4%	95.4%	30.1%	28.6%	96.6%	31.0%	29.3%	98.9%	38.0%	35.8%	135.8%
To WWTP	119B	120	6.6%	6.3%	21.2%	6.7%	6.4%	21.5%	6.9%	6.5%	22.0%	8.5%	8.0%	30.2%
To WWTP	120	121	32.6%	30.0%	74.6%	35.2%	31.9%	77.8%	37.6%	33.6%	81.0%	43.7%	38.8%	104.4%
To WWTP	121	122	38.6%	35.3%	82.4%	41.3%	37.3%	85.7%	43.9%	39.1%	89.1%	50.2%	44.5%	112.8%
To WWTP	122	123	38.6%	35.3%	82.4%	41.3%	37.3%	85.7%	43.9%	39.1%	89.1%	50.2%	44.5%	112.8%
To WWTP	123	124	9.7%	8.9%	20.7%	10.4%	9.3%	21.5%	11.0%	9.8%	22.4%	12.6%	11.2%	28.3%
Industrial Avenue(6)	200	201	0.0%	0.2%	6.1%	0.0%	0.2%	4.6%	0.0%	0.5%	11.5%	0.0%	6.4%	157.6%
Industrial Avenue	201	202	95.0%	83.3%	128.0%	95.0%	83.3%	128.0%	95.0%	83.3%	128.0%	95.0%	83.3%	128.0%
Industrial Avenue	202	203	40.6%	35.6%	54.7%	40.6%	35.6%	54.7%	40.6%	35.6%	54.7%	40.6%	35.6%	54.7%
Mullett Street	203	204	37.3%	32.7%	50.1%	37.3%	32.7%	50.1%	37.3%	32.7%	50.1%	37.3%	32.7%	50.1%
Mullett Street	204	205	29.5%	25.8%	39.5%	29.5%	25.8%	39.5%	29.5%	25.8%	39.5%	29.5%	25.8%	39.5%
Mullett Street	205	206	24.6%	21.5%	32.2%	25.3%	21.9%	32.8%	27.2%	23.3%	34.8%	29.9%	25.2%	37.5%
Mullett Street	206	207	30.2%	26.3%	38.7%	30.9%	26.8%	39.4%	33.3%	28.5%	41.8%	36.3%	30.6%	44.8%
Mullett Street	207	208	20.1%	17.5%	25.8%	20.6%	17.9%	26.3%	22.2%	19.0%	27.9%	24.2%	20.4%	29.9%
Mullett Street	208	209	27.5%	24.0%	35.2%	29.0%	24.9%	36.3%	31.6%	26.6%	38.6%	34.5%	28.6%	41.4%
Mullett Street	209	210	27.5%	24.0%	35.2%	29.0%	24.9%	36.3%	31.6%	26.6%	38.6%	34.5%	28.6%	41.4%
Mullett Street	210	211A	38.2%	33.3%	48.8%	40.1%	34.4%	50.1%	43.1%	36.4%	52.9%	46.6%	38.9%	56.3%
Mullett Street(6)	211A	211	36.7%	32.0%	46.9%	38.5%	33.1%	48.2%	41.4%	35.0%	50.8%	44.8%	37.3%	54.1%
Mullett Street	211	212	11.9%	10.4%	15.2%	12.5%	10.7%	15.6%	13.4%	11.4%	16.5%	14.5%	12.1%	17.6%
To WWTP	212	213	39.6%	34.5%	50.5%	41.5%	35.6%	52.0%	44.6%	37.7%	54.8%	48.2%	40.2%	58.3%
To WWTP	213	214	37.3%	32.5%	47.7%	39.1%	33.6%	49.0%	42.0%	35.5%	51.6%	45.5%	37.9%	55.0%
To WWTP	214	215	8.8%	7.7%	11.2%	11.1%	9.1%	12.9%	12.9%	10.2%	14.3%	14.4%	11.2%	15.5%
To WWTP	215	216	34.6%	30.1%	44.1%	43.8%	35.7%	50.6%	50.8%	40.2%	56.1%	56.8%	44.1%	61.2%
To WWTP	216	217	33.3%	29.0%	42.6%	42.1%	34.4%	48.8%	48.8%	38.7%	54.0%	54.5%	42.4%	58.9%
To WWTP	217	218	34.1%	29.7%	43.5%	43.1%	35.2%	49.8%	49.9%	39.5%	55.2%	55.8%	43.4%	60.2%
To WWTP	218	219	37.9%	33.0%	48.4%	47.8%	39.1%	55.4%	55.4%	43.9%	61.3%	61.8%	48.1%	66.8%
To WWTP - Siphon (1)	219	220	34.2%	29.8%	43.8%	43.3%	35.3%	50.1%	50.1%	39.7%	55.5%	55.9%	43.5%	60.4%
To WWTP - Siphon (1)	220	221	17.5%	15.3%	22.4%	22.1%	18.1%	25.6%	25.6%	20.3%	28.4%	28.6%	22.3%	30.9%
To WWTP - Siphon (1)	221	124	41.5%	36.1%	53.0%	52.4%	42.8%	60.7%	60.7%	48.1%	67.2%	67.7%	52.7%	73.2%
To WWTP	124	125	63.2%	57.6%	129.0%	68.8%	61.5%	135.1%	73.8%	65.0%	141.2%	84.0%	73.6%	176.5%
To WWTP	125	126	63.2%	57.6%	129.0%	68.8%	61.5%	135.1%	73.8%	65.0%	141.2%	84.0%	73.6%	176.5%
To WWTP	126	127	63.2%	57.6%	129.0%	68.8%	61.5%	135.1%	73.8%	65.0%	141.2%	84.0%	73.6%	176.5%
To WWTP	127	128	42.1%	38.4%	86.0%	45.9%	41.0%	90.1%	49.2%	43.3%	94.1%	56.0%	49.1%	117.7%
To WWTP	128	WWTP	57.9%	52.5%	108.1%	65.5%	58.0%	116.7%	72.5%	63.1%	125.1%	84.4%	72.9%	154.9%
McNeely Avenue	301	302	35.4%	32.0%	56.9%	35.4%	32.0%	56.9%	35.4%	32.0%	56.9%	35.4%	32.0%	56.9%
McNeely Avenue	302	303	16.4%	14.8%	26.3%	16.4%	14.8%	26.3%	16.4%	14.8%	26.3%	16.4%	14.8%	26.3%
McNeely Avenue	303	304	19.9%	17.9%	31.7%	19.9%	17.9%	31.7%	19.9%	17.9%	31.7%	19.9%	17.9%	31.7%
McNeely Avenue	304	305	18.5%	16.7%	29.5%	18.5%	16.7%	29.5%	18.5%	16.7%	29.5%	18.5%	16.7%	29.5%
McNeely Avenue	305	306	29.3%	26.4%	46.6%	29.3%	26.4%	46.6%	29.3%	26.4%	46.6%	29.3%	26.4%	46.6%
McNeely Avenue	306	307	33.5%	30.1%	53.1%	33.5%	30.1%	53.1%	33.5%	30.1%	53.1%	33.5%	30.1%	53.1%
McNeely Avenue	307	308	19.0%	17.1%	30.1%	19.0%	17.1%	30.1%	19.0%	17.1%	30.1%	19.0%	17.1%	30.1%
McNeely Avenue	308	309	21.3%	19.1%	33.5%	21.3%	19.1%	33.5%	21.3%	19.1%	33.5%	21.3%	19.1%	33.5%
McNeely Avenue	309	310	26.0%	23.3%	40.7%	26.0%	23.3%	40.7%	26.0%	23.3%	40.7%	26.0%	23.3%	40.7%
McNeely Avenue	310	311	24.0%	21.6%	37.6%	24.0%	21.6%	37.6%	27.3%	24.0%	41.3%	35.7%	30.3%	50.9%
McNeely Avenue	311	312	31.7%	28.5%	49.4%	31.7%	28.5%	49.4%	36.0%	31.6%	54.3%	46.7%	39.7%	66.7%
McNeely Avenue	312	313	21.8%	19.6%	33.9%	24.0%	20.9%	35.6%	28.1%	23.9%	39.8%	36.2%	29.8%	48.8%
McNeely Avenue	313	314	23.7%	21.3%	36.7%	26.0%	22.6%	38.4%	30.2%	25.7%	42.7%	38.6%	31.9%	52.1%
McNeely Avenue	314	315	38.2%	34.3%	59.0%	41.8%	36.5%	61.7%	48.6%	41.3%	68.6%	61.9%	51.2%	83.6%
McNeely Avenue	315	316	39.0%	34.9%	59.8%	42.6%	37.1%	62.5%	49.3%	41.9%	69.5%	62.6%	51.8%	84.4%
McNeely Avenue	316	317	61.2%	54.5%	91.2%	66.6%	57.9%	95.3%	76.4%	64.9%	105.5%	95.7%	79.2%	127.1%
McNeely Avenue	317	318	62.7%	55.7%	91.9%	67.8%	58.9%	95.9%	77.1%	65.5%	105.5%	95.5%	79.2%	126.1%
McNeely Avenue	318	319	59.8%	53.1%	86.9%	64.5%	56.0%	90.5%	73.1%	62.1%	99.3%	90.0%	74.6%	118.3%
McNeely Avenue	319	320	44.3%	39.3%	64.3%	47.8%	41.5%	66.9%	54.1%	46.0%	73.4%	66.5%	55.2%	87.4%
McNeely Avenue	320	Pump Station	71.1%	62.6%	96.8%	74.3%	64.6%	99.3%	80.4%	68.9%	105.7%	92.5%	77.9%	119.4%
Patterson Crescent (Forcemain)	Pump Station	321												
Patterson Crescent	321	322	50.9%	44.9%	69.4%	66.2%	56.0%	85.8%	80.1%	66.2%	101.3%	99.4%	80.8%	123.4%
Patterson Crescent	322	323	58.8%	51.7%	78.3%	74.2%	62.9%	94.9%	88.3%	73.4%	110.7%	108.2%	88.3%	133.5%
Patterson Crescent	323	324	58.9%	51.8%	78.3%	74.3%	62.9%	95.0%	88.4%	73.4%	110.8%	108.3%	88.4%	133.6%
Patterson Crescent	324	325	60.4%	53.1%	80.5%	75.7%	64.3%	97.1%	89.8%	74.7%	112.9%	109.7%	89.7%	135.7%
To WWTP	325	326	60.4%	53.1%	80.5%	75.7%	64.3%	97.1%	89.8%	74.7%	112.9%	109.7%	89.7%	135.7%
To WWTP	326	327	60.4%	53.1%	80.5%	75.7%	64.3%	97.1%	89.8%	74.7%	112.9%	109.7%	89.7%	135.7%
To WWTP	327	128	60.4%	53.1%	80.5%	75.7%	64.3%	97.1%	89.8%	74.7%	112.9%	109.7%	89.7%	135.7%

163401646 - Town of Carleton Place W/WW Master Plan
Table D-3: Trunk MH Allocation for Development Lands

Legend
Manual Input
Calculated Value
Original Data
Values to Verify/Confirm

Area	Sub-Neighbourhood	Unit Growth at Buildout	Population Growth at Buildout	Area Growth at Buildout	Receiving Trunk MH ID	Receiving Trunk MH Location	Notes/Comments	Additional at MH – 2021 – ppl – Residential-Pop-2021-per MH	2021 – - – Residential-Units-2021-per MH	2021 – ha – Commercial-Area-2021-per MH	2021 – ha – Light Industrial Area-2021-per MH	2021 – ha – Total-Area-2021-per MH	2026 – ppl – Residential-Pop-2026-per MH	2026 – - – Residential-Units-2026-per MH	2026 – ha – Commercial-Area-2026-per MH	2026 – ha – Light Industrial Area-2026-per MH	2026 – ha – Total-Area-2026-per MH	2031 – ppl – Residential-Pop-2031-per MH	2031 – - – Residential-Units-2031-per MH	2031 – ha – Commercial-Area-2031-per MH	2031 – ha – Light Industrial Area-2031-per MH	2031 – ha – Total-Area-2031-per MH	2041 – ppl – Residential-Pop-2041-per MH	2041 – - – Residential-Units-2041-per MH	2041 – ha – Commercial-Area-2041-per MH	2041 – ha – Light Industrial Area-2041-per MH	2041 – ha – Total-Area-2041-per MH
Strategic Properties	Strategic Property-25	108	255	4.20	21	Lake Ave							64	27	0.07	0.07	1.05	128	54	0.13	0.13	2.10	255	108	0.26	0.26	4.20
Strategic Properties	Strategic Property-26	100	236	3.80	1	Lake Ave	Could also be MH10, but only selecting one (most upstream) MH to be conservative.						59	25	0.00	0.00	0.95	118	50	0.00	0.00	1.90	236	100	0.00	0.00	3.80
Strategic Properties	Strategic Property-27	55	130	2.10	106	High St							33	14	0.03	0.03	0.53	65	28	0.07	0.07	1.05	130	55	0.13	0.13	2.10
Strategic Properties	Strategic Property-29	16	38	0.60	210	Industrial Ave	Could be MH210, MH211, MH212 or MH213. Most upstream MH selected to be conservative.						10	4	0.01	0.01	0.15	19	8	0.02	0.02	0.30	38	16	0.04	0.04	0.60
Residential Districts - Infill	Mississippi Residential Sector-38	17	39	0.73	101	High St	Depends which area is developed. Areas draining to High St. Most upstream MH selected to be conservative.						0	0	0.00	0.00	0.00	20	9	0.00	0.00	0.37	39	17	0.00	0.00	0.73
Residential Districts - Infill	Mississippi Residential Sector-38	17	39	0.73	206	Mullett St	Depends which area is developed. Areas draining to Industrial Ave. Most upstream MH selected to be conservative.						0	0	0.00	0.00	0.00	20	9	0.00	0.00	0.37	39	17	0.00	0.00	0.73
Residential Districts - Infill	Mississippi Residential Sector-39	10	24	0.45	14	Lake Ave	Depends which area is developed. Areas draining to Lake Ave. Most upstream MH selected to be conservative.						0	0	0.00	0.00	0.00	12	5	0.00	0.00	0.22	24	10	0.00	0.00	0.45
Residential Districts - Infill	Mississippi Residential Sector-39	10	24	0.45	115	Franklin St	Depends which area is developed. Areas draining to Franklin St.						0	0	0.00	0.00	0.00	12	5	0.00	0.00	0.22	24	10	0.00	0.00	0.45
Residential Districts - Infill	Mississippi Residential Sector-40	5	11	0.21	112	Bridge St & Franklin St	Depends which area is developed; NE corner near the river, draining to Mill St.						0	0	0.00	0.00	0.00	6	3	0.00	0.00	0.10	11	5	0.00	0.00	0.21
Residential Districts - Infill	Mississippi Residential Sector-40	5	11	0.21	1	Lake Ave	Depends which area is developed. Areas draining to Lake Ave. Most upstream MH selected to be conservative.						0	0	0.00	0.00	0.00	6	3	0.00	0.00	0.10	11	5	0.00	0.00	0.21
Residential Districts - Infill	Mississippi Residential Sector-44	12	29	0.51	101	High St							0	0	0.00	0.00	0.00	15	6	0.00	0.00	0.26	29	12	0.00	0.00	0.51
Residential Districts - Infill	Mississippi Residential Sector-30	9	22	0.38	10	Lake Ave	Areas draining to Lake Ave.						0	0	0.00	0.00	0.00	11	5	0.00	0.00	0.19	22	9	0.00	0.00	0.38
Residential Districts - Infill	Mississippi Residential Sector-31	5	12	0.13	108	High St & Bridge St	One of MH108, MH109, MH110, MH111. Areas draining to Bridge St. Most upstream MH selected to be conservative.						0	0	0.00	0.00	0.00	6	3	0.00	0.00	0.07	12	5	0.00	0.00	0.13
Residential Districts - Infill	Residential District-35	172	406	7.80	1	Lake Ave	Depends which area is developed. Areas draining to Lake Ave. Most upstream MH selected to be conservative.						102	43	0.10	0.10	1.95	203	86	0.21	0.21	3.90	406	172	0.41	0.41	7.80
Residential Districts - Infill	Residential District-36	61	144	2.76	101	High St	Depends which area is developed. Areas draining to High St. Most upstream MH selected to be conservative.						36	16	0.04	0.04	0.69	72	31	0.07	0.07	1.38	144	61	0.15	0.15	2.76
Residential Districts - Infill	Residential District-36	61	144	2.76	205	Mullett St	Depends which area is developed. Areas draining to Industrial Ave.						36	16	0.04	0.04	0.69	72	31	0.07	0.07	1.38	144	61	0.15	0.15	2.76
Residential Districts - Infill	Residential District-41	22	51	0.97	121	Neelin St	Depends which area is developed. Areas draining to Neelin St.						13	6	0.01	0.01	0.24	26	11	0.03	0.03	0.49	51	22	0.05	0.05	0.97
Residential Districts - Infill	Residential District-41	22	51	0.97	316	Hooper St	Depends which area is developed. Areas draining to Hooper St.						13	6	0.01	0.01	0.24	26	11	0.03	0.03	0.49	51	22	0.05	0.05	0.97
Residential Districts - Infill	Residential District-42	63	149	2.83	21	Lake Ave	Depends which area is developed. Areas draining to Lake Ave.						38	16	0.04	0.04	0.71	75	32	0.08	0.08	1.42	149	63	0.15	0.15	2.83
Residential Districts - Infill	Residential District-43	292	690	13.23	321	Patterson Crescent	Received by local sewers, conveyed to Hwy7 PS, then through forcemain to MH321.						173	73	0.18	0.18	3.31	345	146	0.35	0.35	6.62	690	292	0.70	0.70	13.23
Residential Districts - Infill	Residential District-45	18	43	0.78	7	Lake Ave	Areas draining to Lake Ave.						11	5	0.01	0.01	0.20	22	9	0.02	0.02	0.39	43	18	0.04	0.04	0.78
Residential Districts - Infill	Residential District-46	81	190	3.64	121	Neelin St	Depends which area is developed. Areas draining to Neelin St.						48	21	0.05	0.05	0.91	95	41	0.10	0.10	1.82	190	81	0.19	0.19	3.64
Residential Districts - Infill	Residential District-46	81	190	3.64	322	Patterson Crescent	Depends which area is developed. Areas draining to Hooper St.						48	21	0.05	0.05	0.91	95	41	0.10	0.10	1.82	190	81	0.19	0.19	3.64
Residential Districts - Infill	Residential District-47	13	31	0.56	19	Lake Ave	Depends which area is developed. Areas draining to Lake Ave.						8	4	0.01	0.01	0.14	16	7	0.02	0.02	0.28	31	13	0.03	0.03	0.56
Residential Districts - Infill	Downtown District-33	2	4	0.04	12	Lake Ave	Depends which area is developed. Areas draining to Lake Ave.						1	1	0.00	0.00	0.01	2	1	0.00	0.00	0.02	4	2	0.00	0.00	0.04
Residential Districts - Infill	Downtown District-33	2	4	0.04	112	Bridge St & Franklin St	Depends which area is developed. Areas draining to Franklin St.						1	1	0.00	0.00	0.01	2	1	0.00	0.00	0.02	4	2	0.00	0.00	0.04
Residential Districts - Urban Greenfield	Urban Greenfield-20	176	416	11.70	321	Patterson Crescent	Received by local sewers, conveyed to Hwy7 PS, then through forcemain to MH321.						0	0	0.00	0.00	0.00	104	44	0.11	0.11	2.93	312	132	0.32	0.32	8.78
Residential Districts - Urban Greenfield	Urban Greenfield-30	22	52	1.40	321	Patterson Crescent	Received by local sewers, conveyed to Hwy7 PS, then through forcemain to MH321.						0	0	0.00	0.00	0.00	13	6	0.01	0.01	0.35	39	17	0.04	0.04	1.05
Residential Districts - Urban Greenfield	Urban Greenfield-40	33	78	2.10	7	Lake Ave	Areas draining to Lake Ave.						20	9	0.02	0.02	0.53	39	17	0.04	0.04	1.05	71	30	0.07	0.07	1.89
Residential Districts - Urban Greenfield	Urban Greenfield-50	679	1603	45.24	321	Patterson Crescent	Received by local sewers, conveyed to Hwy7 PS, then through forcemain to MH321.						401	170	0.41	0.41	11.31	802	340	0.82	0.82	22.62	1443	612	1.47	1.47	40.72
Residential Districts - Intensification Sites	Intensification-10	54	127	2.80	205	Mullett St	Areas draining to Industrial Ave.						0	0	0.00	0.00	0.00	64	27	0.06	0.06	1.40	127	54	0.13	0.13	2.80
Residential Districts - Intensification Sites	Intensification-10	54	127	2.80	108	High St & Bridge St	Areas draining to High St.						0	0	0.00	0.00	0.00	64	27	0.06	0.06	1.40	127	54	0.13	0.13	2.80
Residential Districts - Intensification Sites	Intensification-20	8	19	0.40	121	Neelin St	Areas draining to Neelin St.						0	0	0.00	0.00	0.00	10	4	0.01	0.01	0.20	19	8	0.02	0.02	0.40
Residential Districts - Intensification Sites	Intensification-30	33	78	1.70	7	Lake Ave	Areas draining to Lake Ave.						0	0	0.00	0.00	0.00	39	17	0.04	0.04	0.85	78	33	0.08	0.08	1.70
Residential Districts - Intensification Sites	Intensification-40	4	10	0.20	121	Neelin St	Areas draining to Neelin St.						0	0	0.00	0.00	0.00	5	2	0.01	0.01	0.10	10	4	0.01	0.01	0.20
Settlement Boundary - Rural Greenfield	Rural Greenfield-10	450	1062	39.70	101	High St	Areas draining to High St.						0	0	0.00	0.00	0.00	0	0	0.27	0.27	0.00	956	405	0.97	0.97	35.73
Settlement Boundary - Rural Greenfield	Rural Greenfield-50	219	517	19.30	310	Hooper St	Areas draining to Hooper St. Either one of MH312 or MH310. Most upstream MH selected to be conservative.						0	0	0.00	0.00	0.00	130	55	0.13	0.13	4.83	466	198	0.47	0.47	17.37
Additional Residential Units	5% of all units				-	-	Additional development has been spread out evenly across other developments lands for water/sanitary modelling																				
Active Development Applications	Bodnar Lands	582	1374	24.96	1	Lake Ave	Areas draining to High St.						687	291	0.00	0.00	12.48	1100	466	0.00	0.00	19.97	1374	582	0.00	0.00	24.96
Active Development Applications	Carmichael Farm Phase 2	323	763	10.28	321	Patterson Crescent	Received by local sewers, conveyed to Hwy7 PS, then through forcemain to MH321.						382	162	0.00	0.00	5.14	611	259	0.00	0.00	8.22	763	323	0.00	0.00	10.28
Active Development Applications	Carmichael Farm Phase 1	24	57	10.28	321	Patterson Crescent	Received by local sewers, conveyed to Hwy7 PS, then through forcemain to MH321.						29	12	0.00	0.00	5.14	46	20	0.00	0.00	8.22	57	24	0.00	0.00	10.28
Active Development Applications	NuGlobe Developments (Nelson St E, Coleman/McNeely)	128	303	7.20	321	Patterson Crescent	Received by local sewers, conveyed to Hwy7 PS, then through forcemain to MH321.						152	64	0.00	0.00	3.60	243	103	0.00	0.00	5.76	303	128	0.00	0.00	7.20
Active Development Applications	Strategic Property (McArthur Island)	595	1405	5.00	214	Arthur's Mill Island	Areas draining to Mullett St. Most upstream MH selected to be conservative.						703	298	0.00	0.00	2.50	1124	476	0.00	0.00	4.00	1405	595	0.00	0.00	5.00
Active Development Applications	LCHC - 7 Arthur St	20	48	0.30	13	Lake Ave							24	10	0.00	0.00	0.15	39	16	0.00	0.00	0.24	48	20	0.00	0.00	0.30
Active Development Applications	119 Bell St	51	121	0.13	208	Mullett St & Rosamond St							61	26	0.00	0.00	0.07	97	41	0.00	0.00	0.10	121	51	0.00	0.00	0.13
Active Development Applications	127 Boyd	32	76	0.31	7	Lake Ave							38	16	0.00	0.00	0.16	61	26	0.00	0.00	0.25	76	32	0.00	0.00	0.31
Active Development Applications	Millers Crossing (remaining lots)	114	270	5.53	321	Patterson Crescent	Received by local sewers, conveyed to Hwy7 PS, then through forcemain to MH321.						135	57	0.00	0.00	2.77	216	92	0.00	0.00	4.42	270	114	0.00	0.00	5.53
Active Development Applications	Highway 7 behind Canadian Tire	152	359	9.84	321	Patterson Crescent	Received by local sewers, conveyed to Hwy7 PS, then through forcemain to MH321.						180	76	0.00	0.00	4.92	288	122	0.00	0.00	7.87	359	152	0.00	0.00	9.84
Active Development Applications	Stoneridge Manor Long-Term Care Home (29 Costello)	128	303	2.40	312	Hooper St							152	64	0.00	0.00	1.20	243	103	0.00	0.00	1.92	303	128	0.00	0.00	2.40
2020-2021 Additional Growth	12.5% of Additional Growth from 2020 to 2021				1	Lake Ave	To account for population growth from 2020 to 2021; based on Water Modelling Update Report (JLR 2021), most developments (assume 3/4) occurred in areas draining to Hwy 7 PS, i.e. flow is conveyed to MH321. A few remaining (assume 1/8 each) would drain to branch where upstream MH is 1, and 101.	110	44	0.00	0.00	1.63															
2020-2021 Additional Growth	75% of Additional Growth from 2020 to 2021				321	Patterson Crescent		658	263	0.00	0.00	9.75															
2020-2021 Additional Growth	12.5% of Additional Growth from 2020 to 2021				101	High St		110	44	0.00	0.00	1.63															
Active Development Applications	ICI spread across MHs associated with Active Development Applications				321	Patterson Crescent							0	0	0.43	0.43	0.00	0	0	0.69	0.69	0.00	0	0	0.86	0.86	0.00
Active Development Applications	ICI spread across MHs associated with Active Development Applications				214	Arthur's Mill Island							0	0	0.43	0.43	0.00	0	0	0.69	0.69	0.00	0	0	0.86	0.86	0.00
Active Development Applications	ICI spread across MHs associated with Active Development Applications				13	Lake Ave							0	0	0.43	0.43	0.00	0	0	0.69	0.69	0.00	0	0	0.86	0.86	0.00
Active Development Applications	ICI spread across MHs associated with Active Development Applications				208	Rosamond St							0	0	0.43	0.43	0.00	0	0	0.69	0.69	0.00	0	0	0.86	0.86	0.00
Active Development Applications	ICI spread across MHs associated with Active Development Applications				4	Lake Ave							0	0	0.43	0.43	0.00	0	0	0.69	0.69	0.00	0	0	0.86	0.86	0.00
Active Development Applications	ICI spread across MHs associated with Active Development Applications				312	Hooper St							0	0	0.43	0.43	0.00	0	0	0.69	0.69	0.00	0	0	0.86	0.86	0.00

163401646 - Town of Carleton Place W/WW Master Plan

Table D-4: Sanitary Sewer Calculation Spreadsheet - 2021 Design Event

Date: 8/19/2021
Prepared by: CR
Checked by: AL

Legend
Manual Input/Modification
Calculated/Extracted Value for Existing + Additional Development
Existing Conditions - 2020 (Original Spreadsheet Data)
Additional Development
Full Flow Velocity < 0.6 m/s
Sewer Capacity Used > 100%; Sewer Velocity > 3 m/s
WWTP Inflow Point

Modelling Parameters - 2021 Design Event		
Horizon:	2021	
Scenario:	Design	
Existing Conditions - 2020		
Average Residential Flow Rate - q =	392	l/cap/day
Peak Extraneous Flow Rate - i =	0.33	l/s/ha
Peak Extraneous Flow Rate (Monitor No. 6)(3) - i =	0.33	l/s/ha
Existing Conditions Population Density =	2.5	PPU
Harmon Peaking Factor Correction Factor - K =	0.80	-
Growth Developments - 2021		
Average Residential Flow Rate - q =	392	l/cap/day
Peak Extraneous Flow Rate - i =	0.33	l/s/ha
Peak Extraneous Flow Rate (Monitor No. 6)(3) - i =	0.33	l/s/ha
Harmon Peaking Factor Correction Factor - K =	0.80	-
Insitutional/Commercial Average Flow Rate - q =	0	l/ha/day
Institutional/Commercial (IC) Peaking Factor (ICI Cont. > 20%) =	0.00	-
Institutional/Commercial (IC) Peaking Factor (ICI Cont. ≤ 20%) =	0.00	-
Light Industrial Average Flow Rate - q =	0	l/ha/day
Light Industrial Peaking Factor (ICI Cont. > 20%) =	0.00	-
Light Industrial Peaking Factor (ICI Cont. ≤ 20%) =	0.00	-
Manning's Coefficient - n =	0.013	

Note: Values as per ***Design Basis Memo*** *(July 12, 2021)*

Summary - 2021 Design Event		
2020 Residential Population	12,525	ppl
2020 ICI Equivalent Population	468	ppl
2020 Total Residential + ICI Equivalent Population	12,993	ppl
2021 Additional Residential Population	878	ppl
2021 Total Residential Population	13,403	ppl
2021 Total Residential + ICI Equivalent Population	13,870	ppl
2021 Additional Residential Area	13	ha
2021 Additional ICI Area	0	ha
2021 Total Area	591	ha
Average DWF (Residential + ICI)	5,437	m^3/d
Peak DWF (Residential + ICI)	13,321	m^3/d
Peak Extraneous Flow	16,847	m^3/d
Peak Total Flow	30,167	m^3/d
Number of Sewers Surcharged	0	
Average Sewer Capacity Used	38.1%	
Max Sewer Capacity Used	95.0%	
Mississippi Quays PS Peak Inflow	50.7	L/s

Notes

(1) McArthur Island siphon represented by sewer section from MH219 to MH124, as a single 400 mm diameter gravity pipe at 0.84% slope, as per original spreadsheet (JLR, 2021). Based on drawings, siphon consists of two barrels (150 mm and 300 mm); representation of siphon would require adjustments for HGL calculations.
(2) Mississippi Quays PS modelled at the end of McNeely Avenue (from MH320 to Pump Station); no gravity flow calculated through forcemain on Patterson Crescent (from Pump Station to MH321, assumed without restrictions).
(3) Extraneous flows calculated using 0.33 L/s/ha for drainage areas tributary to flow monitor No. 6.
(4) Diameters and slopes confirmed or corrected based on comparison of original spreadsheet to information provided by the Town on 20210712; see detailed comparison in Table D-1: Comparison of Diameters and Slopes from Different Sources.
(5) Based on information provided by the Town on 20210712, sewer along Franklin St between MH117 and MH118 appears to first be a ~38 m long 600 mm single sewer, followed by a ~52 m long section of twin 450 mm sewers; equivalent diameter to twin 450 mm retained, as it is more conservative.
(6) Sewer section added to spreadsheet to match Town's GIS data.

Level of Service Limits		
Maximum Velocity	3	m/s
Actual Flow/Full Flow Capacity	100%	

Flow Generation – Residential

Street/Location	Maintenance Hole From	Maintenance Hole To	Previous (2020) Residential Conditions – Number of Units: Residential Units	Commercial Units	Institutional Units	Total Units	Previous Population	Cumulative Previous Population	Previous Residential Sewage Flow (L/s)	Additional (2021) Residential Development: Additional Population	Cumulative Additional Population	Additional Residential Sewage Flow (L/s)	2021 Residential Contributions: Total Cumulative Residential Population	Total Residential Sewage Flow (L/s)	Harmon Peaking Factor	Peak Residential Sewage Flow (L/s)
Lake Avenue West	001	02A	18		1	19	48	48	0.22	110	110	0.50	158	0.71	3.55	2.53
Lake Avenue West(6)	02A	002					0	48	0.22	0	110	0.50	158	0.71	3.55	2.53
Lake Avenue West	002	003	459			459	1,148	1,195	5.42	0	110	0.50	1,305	5.92	3.18	18.82
Lake Avenue West	003	004	9			9	23	1,218	5.52	0	110	0.50	1,328	6.02	3.17	19.12
Lake Avenue West	004	005	11			11	28	1,245	5.65	0	110	0.50	1,355	6.15	3.17	19.48
Lake Avenue West	005	006	37		1	38	95	1,340	6.08	0	110	0.50	1,450	6.58	3.15	20.74
Lake Avenue West	006	007	21			21	53	1,393	6.32	0	110	0.50	1,503	6.82	3.14	21.43
Lake Avenue West	007	008	325			325	813	2,205	10.00	0	110	0.50	2,315	10.50	3.03	31.81
Lake Avenue West	008	009	34			34	85	2,290	10.39	0	110	0.50	2,400	10.89	3.02	32.87
Lake Avenue West	009	010	86			86	215	2,505	11.37	0	110	0.50	2,615	11.86	2.99	35.52
Lake Avenue West	010	011	54	1		55	138	2,643	11.99	0	110	0.50	2,753	12.49	2.98	37.20
Lake Avenue West	011	012	18			18	45	2,688	12.19	0	110	0.50	2,798	12.69	2.97	37.75
Lake Avenue West	012	013	70	4		74	185	2,873	13.03	0	110	0.50	2,983	13.53	2.96	40.00
Lake Avenue West	013	014	7	1		8	20	2,893	13.12	0	110	0.50	3,003	13.62	2.95	40.24
Lake Avenue West	014	15B	15	2		17	43	2,935	13.32	0	110	0.50	3,045	13.82	2.95	40.75
Lake Avenue West(6)	15B	15A					0	2,935	13.32	0	110	0.50	3,045	13.82	2.95	40.75
Lake Avenue West	15A	015	1	1		2	5	2,940	13.34	0	110	0.50	3,050	13.84	2.95	40.81
Lake Avenue West	015	016	15			15	38	2,978	13.51	0	110	0.50	3,088	14.01	2.95	41.26
Lake Avenue West	016	017	12	2		14	35	3,013	13.67	0	110	0.50	3,123	14.17	2.94	41.68
Lake Avenue West	017	018	60			60	150	3,163	14.35	0	110	0.50	3,273	14.85	2.93	43.47
Lake Avenue West	018	019	3			3	8	3,170	14.38	0	110	0.50	3,280	14.88	2.93	43.56
Lake Avenue West	019	020	23			23	58	3,228	14.64	0	110	0.50	3,338	15.14	2.92	44.25
Lake Avenue West	020	021	4			4	10	3,238	14.69	0	110	0.50	3,348	15.19	2.92	44.37
Lake Avenue West	021	022	140		1	141	353	3,590	16.29	0	110	0.50	3,700	16.79	2.89	48.53
Lorne Street	022	023	8			8	20	3,610	16.38	0	110	0.50	3,720	16.88	2.89	48.76
Lorne Street	023	024	12			12	30	3,640	16.51	0	110	0.50	3,750	17.01	2.89	49.11
Ball Park	024	120	77	1		78	195	3,835	17.40	0	110	0.50	3,945	17.90	2.87	51.39
High Street(3)	101	102A	491	4	1	496	1,240	1,240	5.63	110	110	0.50	1,350	6.13	3.17	19.41
High Street(3)	102A	102	0			0	0	1,240	5.63	0	110	0.50	1,350	6.13	3.17	19.41
High Street(3)	102	103	129			129	323	1,563	7.09	0	110	0.50	1,673	7.59	3.12	23.64
High Street(3)	103	104	99			99	248	1,810	8.21	0	110	0.50	1,920	8.71	3.08	26.83
High Street(3)	104	105	125	2		127	318	2,128	9.65	0	110	0.50	2,238	10.15	3.04	30.84
High Street(3)	105	106	16			16	40	2,168	9.83	0	110	0.50	2,278	10.33	3.03	31.34
High Street(3)	106	107	5			5	13	2,180	9.89	0	110	0.50	2,290	10.39	3.03	31.50
High Street(3)	107	108	8			8	20	2,200	9.98	0	110	0.50	2,310	10.48	3.03	31.75
Bridge Street	108	109	415		1	416	1,040	3,240	14.70	0	110	0.50	3,350	15.20	2.92	44.40
Bridge Street	109	110	6	4		10	25	3,265	14.81	0	110	0.50	3,375	15.31	2.92	44.69
Bridge Street	110	111	2			2	5	3,270	14.84	0	110	0.50	3,380	15.34	2.92	44.75
Bridge Street	111	112	0			0	0	3,270	14.84	0	110	0.50	3,380	15.34	2.92	44.75
Mill Street	112	113	158	22	2	182	455	3,725	16.90	0	110	0.50	3,835	17.40	2.88	50.11
Beckwith Street	113	114	12			12	30	3,755	17.04	0	110	0.50	3,865	17.54	2.88	50.46
Franklin Street	114	115	10	5		15	38	3,793	17.21	0	110	0.50	3,903	17.71	2.87	50.89
Franklin Street	115	115A	42	7		49	123	3,915	17.76	0	110	0.50	4,025	18.26	2.86	52.31
Franklin Street	115A	116	2			2	5	3,920	17.79	0	110	0.50	4,030	18.28	2.86	52.37
Franklin Street	116	117	0			0	0	3,920	17.79	0	110	0.50	4,030	18.28	2.86	52.37
Franklin Street(5)	117	118	5	3		8	20	3,940	17.88	0	110	0.50	4,050	18.38	2.86	52.60
To WWTP	118	119	0			0	0	3,940	17.88	0	110	0.50	4,050	18.38	2.86	52.60
To WWTP	119	119A	0			0	0	3,940	17.88	0	110	0.50	4,050	18.38	2.86	52.60
To WWTP(6)	119A	119B					0	3,940	17.88	0	110	0.50	4,050	18.38	2.86	52.60
To WWTP	119B	120	0			0	0	3,940	17.88	0	110	0.50	4,050	18.38	2.86	52.60
To WWTP	120	121	0			0	0	7,775	35.28	0	220	1.00	7,995	36.27	2.64	95.78
To WWTP	121	122	610	12	1	623	1,558	9,333	42.34	0	220	1.00	9,553	43.34	2.58	111.80
To WWTP	122	123	0			0	0	9,333	42.34	0	220	1.00	9,553	43.34	2.58	111.80
To WWTP	123	124	0			0	0	9,333	42.34	0	220	1.00	9,553	43.34	2.58	111.80
Industrial Avenue(6)	200	201					0	0	0.00	0	0	0.00	0	0.00	3.80	0.00
Industrial Avenue	201	202	115	50		165	413	413	1.87	0	0	0.00	413	1.87	3.41	6.39
Industrial Avenue	202	203	0			0	0	413	1.87	0	0	0.00	413	1.87	3.41	6.39
Mullett Street	203	204	7	4		11	28	440	2.00	0	0	0.00	440	2.00	3.40	6.79
Mullett Street	204	205	4			4	10	450	2.04	0	0	0.00	450	2.04	3.40	6.94
Mullett Street	205	206	63	1		64	160	610	2.77	0	0	0.00	610	2.77	3.34	9.25
Mullett Street	206	207	75			75	188	798	3.62	0	0	0.00	798	3.62	3.29	11.90
Mullett Street	207	208	0			0	0	798	3.62	0	0	0.00	798	3.62	3.29	11.90
Mullett Street	208	209	17	5		22	55	853	3.87	0	0	0.00	853	3.87	3.27	12.67
Mullett Street	209	210	0			0	0	853	3.87	0	0	0.00	853	3.87	3.27	12.67
Mullett Street	210	211A	91	5		96	240	1,093	4.96	0	0	0.00	1,093	4.96	3.22	15.96
Mullett Street(6)	211A	211					0	1,093	4.96	0	0	0.00	1,093	4.96	3.22	15.96
Mullett Street	211	212	1			1	3	1,095	4.97	0	0	0.00	1,095	4.97	3.22	15.99
To WWTP	212	213	0			0	0	1,095	4.97	0	0	0.00	1,095	4.97	3.22	15.99
To WWTP	213	214	0			0	0	1,095	4.97	0	0	0.00	1,095	4.97	3.22	15.99
To WWTP	214	215	0			0	0	1,095	4.97	0	0	0.00	1,095	4.97	3.22	15.99
To WWTP	215	216	0			0	0	1,095	4.97	0	0	0.00	1,095	4.97	3.22	15.99
To WWTP	216	217	2		1	3	8	1,103	5.00	0	0	0.00	1,103	5.00	3.22	16.10
To WWTP	217	218	0			0	0	1,103	5.00	0	0	0.00	1,103	5.00	3.22	16.10
To WWTP	218	219	1		1	2	5	1,108	5.02	0	0	0.00	1,108	5.02	3.22	16.16
To WWTP - Siphon (1)	219	220	0			0	0	1,108	5.02	0	0	0.00	1,108	5.02	3.22	16.16
To WWTP - Siphon (1)	220	221	0			0	0	1,108	5.02	0	0	0.00	1,108	5.02	3.22	16.16
To WWTP - Siphon (1)	221	124	0			0	0	1,108	5.02	0	0	0.00	1,108	5.02	3.22	16.16
To WWTP	124	125	0			0	0	10,440	47.37	0	220	1.00	10,660	48.36	2.54	122.93
To WWTP	125	126	0			0	0	10,440	47.37	0	220	1.00	10,660	48.36	2.54	122.93
To WWTP	126	127	0			0	0	10,440	47.37	0	220	1.00	10,660	48.36	2.54	122.93
To WWTP	127	128	0			0	0	10,440	47.37	0	220	1.00	10,660	48.36	2.54	122.93
To WWTP	**128**	**WWTP**	0			0	0	12,993	58.95	0	878	3.98	13,870	62.93	2.45	**154.17**
McNeely Avenue	301	302	0	31		31	78	78	0.35	0	0	0.00	78	0.35	3.62	1.27
McNeely Avenue	302	303	3			3	8	85	0.39	0	0	0.00	85	0.39	3.61	1.39
McNeely Avenue	303	304	3			3	8	93	0.42	0	0	0.00	93	0.42	3.60	1.51
McNeely Avenue	304	305	3			3	8	100	0.45	0	0	0.00	100	0.45	3.59	1.63
McNeely Avenue	305	306	3			3	8	108	0.49	0	0	0.00	108	0.49	3.59	1.75
McNeely Avenue	306	307	3			3	8	115	0.52	0	0	0.00	115	0.52	3.58	1.87
McNeely Avenue	307	308	4			4	10	125	0.57	0	0	0.00	125	0.57	3.57	2.03
McNeely Avenue	308	309	4	2		6	15	140	0.64	0	0	0.00	140	0.64	3.56	2.26
McNeely Avenue	309	310	6	1		7	18	158	0.71	0	0	0.00	158	0.71	3.55	2.53
McNeely Avenue	310	311	6			6	15	173	0.78	0	0	0.00	173	0.78	3.54	2.77
McNeely Avenue	311	312	4	1		5	13	185	0.84	0	0	0.00	185	0.84	3.53	2.96
McNeely Avenue	312	313	4			4	10	195	0.88	0	0	0.00	195	0.88	3.52	3.12
McNeely Avenue	313	314	8	1		9	23	218	0.99	0	0	0.00	218	0.99	3.51	3.46
McNeely Avenue	314	315	4			4	10	228	1.03	0	0	0.00	228	1.03	3.50	3.61
McNeely Avenue	315	316	8			8	20	248	1.12	0	0	0.00	248	1.12	3.49	3.92
McNeely Avenue	316	317	53			53	133	380	1.72	0	0	0.00	380	1.72	3.43	5.91
McNeely Avenue	317	318	36			36	90	470	2.13	0	0	0.00	470	2.13	3.39	7.23
McNeely Avenue	318	319	20			20	50	520	2.36	0	0	0.00	520	2.36	3.37	7.96
McNeely Avenue	319	320	5			5	13	533	2.42	0	0	0.00	533	2.42	3.37	8.14
McNeely Avenue	320	Pump Station	299			299	748	1,280	5.81	0	0	0.00	1,280	5.81	3.18	18.48
Patterson Crescent (Forcemain)	Pump Station	321	0			0	0	1,280	5.81	0	0	0.00	1,280	5.81	3.18	18.48
Patterson Crescent	321	322	179	2		181	453	1,733	7.86	658	658	2.98	2,390	10.84	3.02	32.74
Patterson Crescent	322	323	298	1		299	748	2,480	11.25	0	658	2.98	3,138	14.23	2.94	41.86
Patterson Crescent	323	324	1			1	3	2,483	11.26	0	658	2.98	3,140	14.25	2.94	41.89
Patterson Crescent	324	325	26		2	28	70	2,553	11.58	0	658	2.98	3,210	14.56	2.93	42.73
To WWTP	325	326				0	0	2,553	11.58	0	658	2.98	3,210	14.56	2.93	42.73
To WWTP	326	327				0	0	2,553	11.58	0	658	2.98	3,210	14.56	2.93	42.73
To WWTP	327	128				0	0	2,553	11.58	0	658	2.98	3,210	14.56	2.93	42.73

Flow Generation – ICI

Street/Location	From	To	Previous (2020) ICI Conditions: Previous ICI Sewage (L/s)	Cumulative Previous ICI Sewage (L/s)	Additional (2021) ICI Development: Additional IC Area (ha)	Additional IC Sewage (L/s)	Additional Ind. Area (ha)	Additional Ind. Sewage (L/s)	Total Additional ICI Area (ha)	Total Additional ICI Sewage (L/s)	Cumulative Additional ICI Area (ha)	Cumulative Additional ICI Sewage (L/s)	2021 ICI Contributions: Peaking Factor	Peak ICI Sewage (L/s)
Lake Avenue West	001	02A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lake Avenue West(6)	02A	002	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lake Avenue West	002	003	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lake Avenue West	003	004	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lake Avenue West	004	005	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lake Avenue West	005	006	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lake Avenue West	006	007	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lake Avenue West	007	008	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lake Avenue West	008	009	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lake Avenue West	009	010	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lake Avenue West	010	011	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lake Avenue West	011	012	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lake Avenue West	012	013	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lake Avenue West	013	014	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lake Avenue West	014	15B	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lake Avenue West(6)	15B	15A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lake Avenue West	15A	015	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lake Avenue West	015	016	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lake Avenue West	016	017	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lake Avenue West	017	018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lake Avenue West	018	019	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lake Avenue West	019	020	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lake Avenue West	020	021	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lake Avenue West	021	022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lorne Street	022	023	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lorne Street	023	024	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ball Park	024	120	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
High Street(3)	101	102A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
High Street(3)	102A	102	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
High Street(3)	102	103	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
High Street(3)	103	104	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
High Street(3)	104	105	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
High Street(3)	105	106	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
High Street(3)	106	107	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
High Street(3)	107	108	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bridge Street	108	109	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bridge Street	109	110	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bridge Street	110	111	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bridge Street	111	112	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mill Street	112	113	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Beckwith Street	113	114	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Franklin Street	114	115	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Franklin Street	115	115A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Franklin Street	115A	116	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Franklin Street	116	117	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Franklin Street(5)	117	118	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
To WWTP	118	119	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
To WWTP	119	119A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
To WWTP(6)	119A	119B	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
To WWTP	119B	120	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
To WWTP	120	121	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
To WWTP	121	122	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
To WWTP	122	123	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
To WWTP	123	124	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Industrial Avenue(6)	200	201	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Industrial Avenue	201	202	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Industrial Avenue	202	203	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mullett Street	203	204	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mullett Street	204	205	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mullett Street	205	206	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mullett Street	206	207	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mullett Street	207	208	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mullett Street	208	209	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mullett Street	209	210	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mullett Street	210	211A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mullett Street(6)	211A	211	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mullett Street	211	212	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
To WWTP	212	213	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
To WWTP	213	214	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
To WWTP	214	215	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
To WWTP	215	216	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
To WWTP	216	217	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
To WWTP	217	218	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
To WWTP	218	219	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
To WWTP - Siphon (1)	219	220	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
To WWTP - Siphon (1)	220	221	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
To WWTP - Siphon (1)	221	124	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
To WWTP	124	125	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
To WWTP	125	126	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
To WWTP	126	127	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
To WWTP	127	128	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
To WWTP	**128**	**WWTP**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
McNeely Avenue	301	302	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
McNeely Avenue	302	303	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
McNeely Avenue	303	304	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
McNeely Avenue	304	305	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
McNeely Avenue	305	306	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
McNeely Avenue	306	307	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
McNeely Avenue	307	308	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
McNeely Avenue	308	309	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
McNeely Avenue	309	310	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
McNeely Avenue	310	311	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
McNeely Avenue	311	312	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
McNeely Avenue	312	313	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
McNeely Avenue	313	314	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
McNeely Avenue	314	315	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
McNeely Avenue	315	316	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
McNeely Avenue	316	317	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
McNeely Avenue	317	318	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
McNeely Avenue	318	319	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
McNeely Avenue	319	320	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
McNeely Avenue	320	Pump Station	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Patterson Crescent (Forcemain)	Pump Station	321	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Patterson Crescent	321	322	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Patterson Crescent	322	323	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Patterson Crescent	323	324	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Patterson Crescent	324	325	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
To WWTP	325	326	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
To WWTP	326	327	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
To WWTP	327	128	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Flow Generation – Extraneous Flows; Pipe Conditions – Pipe Capacity Utilization

Street/Location	From	To	Previous (2020) Extraneous Flows: Previous Drainage Area (ha)	Cumulative Previous Drainage Area (ha)	Previous Extraneous Flow (L/s)	Additional (2021) Extraneous Flows: Additional Drainage Area (ha)	Cumulative Additional Drainage Area (ha)	Additional Extraneous Flow (L/s)	2021 Extraneous Flow Contributions: Total Cumulative Drainage Area (ha)	Total Extraneous Flow (L/s)	Total Peak Flow (L/s)	Nominal Pipe Diameter (mm)	Actual Pipe Diameter (mm)	Slope (%)	Full Flow Velocity (m/s)	Full Flow Capacity (L/s)	Capacity Used (%)
Lake Avenue West	001	02A	3.32	3.32	1.10	1.63	1.63	0.54	4.95	1.63	4.17	375	381	0.44%	1.06	121.33	3.4%
Lake Avenue West(6)	02A	002	0.00	3.32	1.10	0.00	1.63	0.54	4.95	1.63	4.17	375	381	0.42%	1.04	118.54	3.5%
Lake Avenue West	002	003	35.59	38.91	12.84	0.00	1.63	0.54	40.54	13.38	32.19	375	381	0.48%	1.11	126.72	25.4%
Lake Avenue West	003	004	1.77	40.68	13.42	0.00	1.63	0.54	42.31	13.96	33.08	375	381	0.45%	1.08	122.70	27.0%
Lake Avenue West	004	005	0.40	41.08	13.56	0.00	1.63	0.54	42.71	14.09	33.57	375	381	0.46%	1.09	124.06	27.1%
Lake Avenue West	005	006	4.51	45.59	15.04	0.00	1.63	0.54	47.22	15.58	36.32	375	381	0.42%	1.04	118.54	30.6%
Lake Avenue West	006	007	1.13	46.72	15.42	0.00	1.63	0.54	48.35	15.95	37.38	375	381	0.39%	1.00	114.23	32.7%
Lake Avenue West	007	008	33.14	79.86	26.35	0.00	1.63	0.54	81.49	26.89	58.70	375	381	0.57%	1.21	138.09	42.5%
Lake Avenue West	008	009	1.84	81.70	26.96	0.00	1.63	0.54	83.33	27.50	60.36	375	381	0.85%	1.48	168.64	35.8%
Lake Avenue West	009	010	5.49	87.19	28.77	0.00	1.63	0.54	88.82	29.31	64.83	375	381	0.62%	1.26	144.02	45.0%
Lake Avenue West	010	011	3.76	90.95	30.01	0.00	1.63	0.54	92.58	30.55	67.75	375	381	0.48%	1.11	126.72	53.5%
Lake Avenue West	011	012	1.69	92.64	30.57	0.00	1.63	0.54	94.27	31.11	68.86	375	381	1.82%	2.16	246.76	27.9%
Lake Avenue West	012	013	17.76	110.40	36.43	0.00	1.63	0.54	112.03	36.97	76.96	525	533	0.25%	1.00	224.33	34.3%
Lake Avenue West	013	014	0.73	111.13	36.67	0.00	1.63	0.54	112.76	37.21	77.45	600	610	0.12%	0.76	221.90	34.9%
Lake Avenue West	014	15B	2.10	113.23	37.37	0.00	1.63	0.54	114.86	37.90	78.65	600	610	0.12%	0.76	221.90	35.4%
Lake Avenue West(6)	15B	15A	0.00	113.23	37.37	0.00	1.63	0.54	114.86	37.90	78.65	600	610	0.12%	0.76	221.90	35.4%
Lake Avenue West	15A	015	0.19	113.42	37.43	0.00	1.63	0.54	115.05	37.97	78.77	600	610	0.12%	0.76	221.90	35.5%
Lake Avenue West	015	016	0.95	114.37	37.74	0.00	1.63	0.54	116.00	38.28	79.54	600	610	0.12%	0.76	221.90	35.8%
Lake Avenue West	016	017	1.67	116.04	38.29	0.00	1.63	0.54	117.67	38.83	80.51	600	610	0.10%	0.69	202.56	39.7%
Lake Avenue West	017	018	3.63	119.67	39.49	0.00	1.63	0.54	121.30	40.03	83.50	600	610	0.10%	0.69	202.56	41.2%
Lake Avenue West	018	019	0.21	119.88	39.56	0.00	1.63	0.54	121.51	40.10	83.66	600	610	0.12%	0.76	221.90	37.7%
Lake Avenue West	019	020	1.57	121.45	40.08	0.00	1.63	0.54	123.08	40.61	84.86	600	610	0.12%	0.76	221.90	38.2%
Lake Avenue West	020	021	0.28	121.73	40.17	0.00	1.63	0.54	123.36	40.71	85.07	600	610	0.06%	*0.51*	150.22	56.6%
Lake Avenue West	021	022	12.30	134.03	44.23	0.00	1.63	0.54	135.66	44.77	93.29	600	610	0.12%	0.76	221.90	42.0%
Lorne Street	022	023	0.84	134.87	44.51	0.00	1.63	0.54	136.50	45.04	93.81	600	610	0.20%	0.98	286.47	32.7%
Lorne Street	023	024	0.65	135.52	44.72	0.00	1.63	0.54	137.15	45.26	94.37	600	610	0.20%	0.98	286.47	32.9%
Ball Park	024	120	5.71	141.23	46.61	0.00	1.63	0.54	142.86	47.14	98.53	600	610	0.47%	1.51	439.42	22.4%
High Street(3)	101	102A	55.56	55.56	18.33	1.63	1.63	0.54	57.19	18.87	38.29	350	356	0.51%	1.09	108.67	35.2%
High Street(3)	102A	102	0.00	55.56	18.33	0.00	1.63	0.54	57.19	18.87	38.29	350	356	0.15%	*0.59*	58.94	65.0%
High Street(3)	102	103	6.67	62.23	20.54	0.00	1.63	0.54	63.86	21.07	44.72	350	356	0.17%	0.63	62.74	71.3%
High Street(3)	103	104	12.95	75.18	24.81	0.00	1.63	0.54	76.81	25.35	52.17	400	406	0.14%	0.63	81.29	64.2%
High Street(3)	104	105	1.53	76.71	25.31	0.00	1.63	0.54	78.34	25.85	56.69	400	406	0.14%	0.63	81.29	69.7%
High Street(3)	105	106	0.47	77.18	25.47	0.00	1.63	0.54	78.81	26.01	57.35	400	406	0.14%	0.63	81.29	70.5%
High Street(3)	106	107	0.48	77.66	25.63	0.00	1.63	0.54	79.29	26.16	57.66	400	406	0.13%	0.60	78.33	73.6%
High Street(3)	107	108	0.67	78.33	25.85	0.00	1.63	0.54	79.95	26.38	58.13	400	406	0.15%	0.65	84.15	69.1%
Bridge Street	108	109	35.48	113.81	37.56	0.00	1.63	0.54	115.44	38.09	82.49	450	457	0.35%	1.07	175.96	46.9%
Bridge Street	109	110	0.18	113.99	37.62	0.00	1.63	0.54	115.62	38.15	82.85	450	457	0.31%	1.01	165.60	50.0%
Bridge Street	110	111	0.26	114.25	37.70	0.00	1.63	0.54	115.88	38.24	82.99	450	457	0.45%	1.22	199.52	41.6%
Bridge Street	111	112	0.00	114.25	37.70	0.00	1.63	0.54	115.88	38.24	82.99	450	457	1.44%	2.17	356.92	23.3%
Mill Street	112	113	16.75	131.00	43.23	0.00	1.63	0.54	132.63	43.77	93.87	600	610	0.30%	1.20	350.85	26.8%
Beckwith Street	113	114	0.98	131.98	43.55	0.00	1.63	0.54	133.61	44.09	94.55	600	610	0.20%	0.98	286.47	33.0%
Franklin Street	114	115	1.72	133.70	44.12	0.00	1.63	0.54	135.33	44.66	95.55	600	610	0.23%	1.05	307.20	31.1%
Franklin Street	115	115A	4.74	138.44	45.69	0.00	1.63	0.54	140.07	46.22	98.54	600	610	0.28%	1.16	338.95	29.1%
Franklin Street	115A	116	0.54	138.98	45.86	0.00	1.63	0.54	140.61	46.40	98.77	600	610	0.31%	1.22	356.65	27.7%
Franklin Street	116	117	0.12	139.10	45.90	0.00	1.63	0.54	140.73	46.44	98.81	600	610	0.18%	0.93	271.77	36.4%
Franklin Street(5)	117	118	0.57	139.67	46.09	0.00	1.63	0.54	141.30	46.63	99.23	584	593	0.26%	1.10	303.91	32.7%
To WWTP	118	119	0.00	139.67	46.09	0.00	1.63	0.54	141.30	46.63	99.23	600	610	0.26%	1.12	326.62	30.4%
To WWTP	119	119A	0.00	139.67	46.09	0.00	1.63	0.54	141.30	46.63	99.23	600	610	0.27%	1.14	332.84	29.8%
To WWTP(6)	119A	119B	0.00	139.67	46.09	0.00	1.63	0.54	141.30	46.63	99.23	600	610	0.27%	1.14	332.84	29.8%
To WWTP	119B	120	0.00	139.67	46.09	0.00	1.63	0.54	141.30	46.63	99.23	750	762	1.66%	***3.28***	1,496.38	6.6%
To WWTP	120	121	0.00	280.90	92.70	0.00	3.25	1.07	284.15	93.77	189.55	750	762	0.25%	1.27	580.71	32.6%
To WWTP	121	122	57.07	337.98	111.53	0.00	3.25	1.07	341.23	112.60	224.40	750	762	0.25%	1.27	580.71	38.6%
To WWTP	122	123	0.00	337.98	111.53	0.00	3.25	1.07	341.23	112.60	224.40	750	762	0.25%	1.27	580.71	38.6%
To WWTP	123	124	0.00	337.98	111.53	0.00	3.25	1.07	341.23	112.60	224.40	750	762	3.97%	***5.07***	2,314.10	9.7%
Industrial Avenue(6)	200	201	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	200	203	3.61%	2.00	65.01	0.0%
Industrial Avenue	201	202	31.82	31.82	10.50	0.00	0.00	0.00	31.82	10.50	16.89	200	203	0.27%	*0.55*	17.78	95.0%
Industrial Avenue	202	203	0.00	31.82	10.50	0.00	0.00	0.00	31.82	10.50	16.89	300	305	0.17%	*0.57*	41.59	40.6%
Mullett Street	203	204	1.14	32.96	10.88	0.00	0.00	0.00	32.96	10.88	17.67	300	305	0.22%	0.65	47.32	37.3%
Mullett Street	204	205	0.14	33.10	10.92	0.00	0.00	0.00	33.10	10.92	17.86	300	305	0.36%	0.83	60.53	29.5%
Mullett Street	205	206	4.80	37.90	12.51	0.00	0.00	0.00	37.90	12.51	21.76	300	305	0.77%	1.21	88.52	24.6%
Mullett Street	206	207	4.84	42.74	14.10	0.00	0.00	0.00	42.74	14.10	26.00	350	356	0.32%	0.87	86.08	30.2%
Mullett Street	207	208	0.00	42.74	14.10	0.00	0.00	0.00	42.74	14.10	26.00	350	356	0.72%	1.30	129.12	20.1%
Mullett Street	208	209	2.37	45.11	14.89	0.00	0.00	0.00	45.11	14.89	27.55	375	381	0.30%	0.88	100.18	27.5%
Mullett Street	209	210	0.00	45.11	14.89	0.00	0.00	0.00	45.11	14.89	27.55	375	381	0.30%	0.88	100.18	27.5%
Mullett Street	210	211A	10.35	55.46	18.30	0.00	0.00	0.00	55.46	18.30	34.26	375	381	0.24%	0.79	89.61	38.2%
Mullett Street(6)	211A	211	0.00	55.46	18.30	0.00	0.00	0.00	55.46	18.30	34.26	375	381	0.26%	0.82	93.27	36.7%
Mullett Street	211	212	0.34	55.80	18.41	0.00	0.00	0.00	55.80	18.41	34.41	375	381	2.49%	2.53	288.63	11.9%
To WWTP	212	213	0.00	55.80	18.41	0.00	0.00	0.00	55.80	18.41	34.41	400	406	0.16%	0.67	86.90	39.6%
To WWTP	213	214	0.00	55.80	18.41	0.00	0.00	0.00	55.80	18.41	34.41	400	406	0.18%	0.71	92.18	37.3%
To WWTP	214	215	0.00	55.80	18.41	0.00	0.00	0.00	55.80	18.41	34.41	400	406	3.25%	***3.02***	391.67	8.8%
To WWTP	215	216	0.00	55.80	18.41	0.00	0.00	0.00	55.80	18.41	34.41	400	406	0.21%	0.77	99.56	34.6%
To WWTP	216	217	0.62	56.42	18.62	0.00	0.00	0.00	56.42	18.62	34.71	400	406	0.23%	0.80	104.20	33.3%
To WWTP	217	218	0.00	56.42	18.62	0.00	0.00	0.00	56.42	18.62	34.71	400	406	0.22%	0.79	101.90	34.1%
To WWTP	218	219	0.35	56.77	18.73	0.00	0.00	0.00	56.77	18.73	34.90	400	406	0.18%	0.71	92.18	37.9%
To WWTP - Siphon (1)	219	220	0.00	56.77	18.73	0.00	0.00	0.00	56.77	18.73	34.90	400	406	0.22%	0.79	101.90	34.2%
To WWTP - Siphon (1)	220	221	0.00	56.77	18.73	0.00	0.00	0.00	56.77	18.73	34.90	400	406	0.84%	1.54	199.12	17.5%
To WWTP - Siphon (1)	221	124	0.00	56.77	18.73	0.00	0.00	0.00	56.77	18.73	34.90	400	406	0.15%	0.65	84.15	41.5%
To WWTP	124	125	0.00	394.75	130.27	0.00	3.25	1.07	398.00	131.34	254.26	750	762	0.12%	0.88	402.33	63.2%
To WWTP	125	126	0.00	394.75	130.27	0.00	3.25	1.07	398.00	131.34	254.26	750	762	0.12%	0.88	402.33	63.2%
To WWTP	126	127	0.00	394.75	130.27	0.00	3.25	1.07	398.00	131.34	254.26	750	762	0.12%	0.88	402.33	63.2%
To WWTP	127	128	0.00	394.75	130.27	0.00	3.25	1.07	398.00	131.34	254.26	750	762	0.27%	1.32	603.49	42.1%
To WWTP	**128**	**WWTP**	0.00	577.87	190.70	0.00	13.00	4.29	590.87	**194.99**	**349.16**	750	762	0.27%	1.32	603.49	57.9%
McNeely Avenue	301	302	50.25	50.25	16.58	0.00	0.00	0.00	50.25	16.58	17.85	300	305	0.25%	0.69	50.44	35.4%
McNeely Avenue	302	303	0.92	51.17	16.89	0.00	0.00	0.00	51.17	16.89	18.28	450	457	0.14%	0.68	111.29	16.4%
McNeely Avenue	303	304	0.87	52.04	17.17	0.00	0.00	0.00	52.04	17.17	18.68	450	457	0.10%	*0.57*	94.06	19.9%
McNeely Avenue	304	305	0.85	52.89	17.45	0.00	0.00	0.00	52.89	17.45	19.08	450	457	0.12%	0.63	103.03	18.5%
McNeely Avenue	305	306	0.88	53.77	17.74	0.00	0.00	0.00	53.77	17.74	19.49	450	457	0.05%	*0.41*	66.51	29.3%
McNeely Avenue	306	307	0.89	54.66	18.04	0.00	0.00	0.00	54.66	18.04	19.91	450	457	0.04%	*0.36*	59.49	33.5%
McNeely Avenue	307	308	1.08	55.74	18.39	0.00	0.00	0.00	55.74	18.39	20.42	450	457	0.13%	0.65	107.24	19.0%
McNeely Avenue	308	309	1.03	56.77	18.73	0.00	0.00	0.00	56.77	18.73	21.00	450	457	0.11%	0.60	98.65	21.3%
McNeely Avenue	309	310	1.77	58.54	19.32	0.00	0.00	0.00	58.54	19.32	21.85	450	457	0.08%	*0.51*	84.13	26.0%
McNeely Avenue	310	311	1.56	60.10	19.83	0.00	0.00	0.00	60.10	19.83	22.60	450	457	0.10%	*0.57*	94.06	24.0%
McNeely Avenue	311	312	0.98	61.08	20.16	0.00	0.00	0.00	61.08	20.16	23.12	450	457	0.06%	*0.44*	72.86	31.7%
McNeely Avenue	312	313	0.46	61.54	20.31	0.00	0.00	0.00	61.54	20.31	23.42	450	457	0.13%	0.65	107.24	21.8%
McNeely Avenue	313	314	2.00	63.54	20.97	0.00	0.00	0.00	63.54	20.97	24.43	450	457	0.12%	0.63	103.03	23.7%
McNeely Avenue	314	315	0.36	63.90	21.09	0.00	0.00	0.00	63.90	21.09	24.70	300	305	0.41%	0.89	64.60	38.2%
McNeely Avenue	315	316	0.51	64.41	21.26	0.00	0.00	0.00	64.41	21.26	25.17	300	305	0.41%	0.89	64.60	39.0%
McNeely Avenue	316	317	3.42	67.83	22.38	0.00	0.00	0.00	67.83	22.38	28.29	300	305	0.21%	0.63	46.23	61.2%
McNeely Avenue	317	318	2.22	70.05	23.12	0.00	0.00	0.00	70.05	23.12	30.35	300	305	0.23%	0.66	48.38	62.7%
McNeely Avenue	318	319	0.82	70.87	23.39	0.00	0.00	0.00	70.87	23.39	31.34	300	305	0.27%	0.72	52.42	59.8%
McNeely Avenue	319	320	0.32	71.19	23.49	0.00	0.00	0.00	71.19	23.49	31.63	300	305	0.50%	0.98	71.33	44.3%
McNeely Avenue	320	Pump Station	26.50	97.69	32.24	0.00	0.00	0.00	97.69	32.24	50.72	300	305	0.50%	0.98	71.33	71.1%
Patterson Crescent (Forcemain)	Pump Station	321	0.00	97.69	32.24	0.00	0.00	0.00	97.69	32.24	50.72						
Patterson Crescent	321	322	65.29	162.99	53.79	9.75	9.75	3.22	172.74	57.00	89.74	500	508	0.20%	0.87	176.17	50.9%
Patterson Crescent	322	323	14.38	177.36	58.53	0.00	9.75	3.22	187.11	61.75	103.61	500	508	0.20%	0.87	176.17	58.8%
Patterson Crescent	323	324	0.23	177.59	58.61	0.00	9.75	3.22	187.34	61.82	103.71	500	508	0.20%	0.87	176.17	58.9%
Patterson Crescent	324	325	5.53	183.12	60.43	0.00	9.75	3.22	192.87	63.65	106.38	500	508	0.20%	0.87	176.17	60.4%
To WWTP	325	326	0.00	183.12	60.43	0.00	9.75	3.22	192.87	63.65	106.38	500	508	0.20%	0.87	176.17	60.4%
To WWTP	326	327	0.00	183.12	60.43	0.00	9.75	3.22	192.87	63.65	106.38	500	508	0.20%	0.87	176.17	60.4%
To WWTP	327	128	0.00	183.12	60.43	0.00	9.75	3.22	192.87	63.65	106.38	500	508	0.20%	0.87	176.17	60.4%

Stantec

163401646 - Town of Carleton Place W/WW Master Plan

Table D-5: Sanitary Sewer Calculation Spreadsheet - 2021 Annual Event

Date: 8/19/2021
Prepared by: CR
Checked by: AL

Legend
Manual Input/Modification
Calculated/Extracted Value for Existing + Additional Development
Existing Conditions - 2020 (Original Spreadsheet Data)
Additional Development
Full Flow Velocity < 0.6 m/s
Sewer Capacity Used > 100%; Sewer Velocity > 3 m/s
WWTP Inflow Point

Modelling Parameters - 2021 Annual Event		
Horizon:	2021	
Scenario:	Annual	
Existing Conditions - 2020		
Average Residential Flow Rate - q =	392	l/cap/day
Peak Extraneous Flow Rate - i =	0.30	l/s/ha
Peak Extraneous Flow Rate (Monitor No. 6)(3) - i =	0.40	l/s/ha
Existing Conditions Population Density =	2.5	PPU
Harmon Peaking Factor Correction Factor - K =	0.60	-
Growth Developments - 2021		
Average Residential Flow Rate - q =	392	l/cap/day
Peak Extraneous Flow Rate - i =	0.30	l/s/ha
Peak Extraneous Flow Rate (Monitor No. 6)(3) - i =	0.40	l/s/ha
Harmon Peaking Factor Correction Factor - K =	0.60	-
Insitutional/Commercial Average Flow Rate - q =	0	l/ha/day
Institutional/Commercial (IC) Peaking Factor (ICI Cont. > 20%) =	0.00	-
Institutional/Commercial (IC) Peaking Factor (ICI Cont. ≤ 20%) =	0.00	-
Light Industrial Average Flow Rate - q =	0	l/ha/day
Light Industrial Peaking Factor (ICI Cont. > 20%) =	0.00	-
Light Industrial Peaking Factor (ICI Cont. ≤ 20%) =	0.00	-
Manning's Coefficient - n =	0.013	

Note: Values as per ***Design Basis Memo*** *(July 12, 2021)*

Summary - 2021 Annual Event		
2020 Residential Population	12,525	ppl
2020 ICI Equivalent Population	468	ppl
2020 Total Residential + ICI Equivalent Population	12,993	ppl
2021 Additional Residential Population	878	ppl
2021 Total Residential Population	13,403	ppl
2021 Total Residential + ICI Equivalent Population	13,870	ppl
2021 Additional Residential Area	13	ha
2021 Additional ICI Area	0	ha
2021 Total Area	591	ha
Average DWF (Residential + ICI)	5,437	m^3/d
Peak DWF (Residential + ICI)	11,350	m^3/d
Peak Extraneous Flow	16,006	m^3/d
Peak Total Flow	27,356	m^3/d
Number of Sewers Surcharged	0	
Average Sewer Capacity Used	34.6%	
Max Sewer Capacity Used	83.3%	
Mississippi Quays PS Peak Inflow	44.6	L/s

Notes

(1) McArthur Island siphon represented by sewer section from MH219 to MH124, as a single 400 mm diameter gravity pipe at 0.84% slope, as per original spreadsheet (JLR, 2021). Based on drawings, siphon consists of two barrels (150 mm and 300 mm); representation of siphon would require adjustments for HGL calculations.
(2) Mississippi Quays PS modelled at the end of McNeely Avenue (from MH320 to Pump Station); no gravity flow calculated through forcemain on Patterson Crescent (from Pump Station to MH321, assumed without restrictions).
(3) Extraneous flows calculated using 0.4 L/s/ha for drainage areas tributary to flow monitor No. 6.
(4) Diameters and slopes confirmed or corrected based on comparison of original spreadsheet to information provided by the Town on 20210712; see detailed comparison in Table D-1: Comparison of Diameters and Slopes from Different Sources.
(5) Based on information provided by the Town on 20210712, sewer along Franklin St between MH117 and MH118 appears to first be a ~38 m long 600 mm single sewer, followed by a ~52 m long section of twin 450 mm sewers; equivalent diameter to twin 450 mm retained, as it is more conservative.
(6) Sewer section added to spreadsheet to match Town's GIS data.

Level of Service Limits		
Maximum Velocity	3	m/s
Actual Flow/Full Flow Capacity	100%	

Flow Generation – Residential (Previous (2020) Residential Conditions; Additional (2021) Residential Development; 2021 Residential Contributions)

Street/Location	Maintenance Hole From	Maintenance Hole To	Residential Units	Commercial Units	Institutional Units	Total Units	Previous Population	Cumulative Previous Population	Previous Residential Sewage Flow (L/s)	Additional Population	Cumulative Additional Population	Additional Residential Sewage Flow (L/s)	Total Cumulative Residential Population	Total Residential Sewage Flow (L/s)	Harmon Peaking Factor	Peak Residential Sewage Flow (L/s)
Lake Avenue West	001	02A	18		1	19	48	48	0.22	110	110	0.50	158	0.71	2.91	2.08
Lake Avenue West[6]	02A	002					0	48	0.22	0	110	0.50	158	0.71	2.91	2.08
Lake Avenue West	002	003	459			459	1,148	1,195	5.42	0	110	0.50	1,305	5.92	2.63	15.59
Lake Avenue West	003	004	9			9	23	1,218	5.52	0	110	0.50	1,328	6.02	2.63	15.84
Lake Avenue West	004	005	11			11	28	1,245	5.65	0	110	0.50	1,355	6.15	2.63	16.15
Lake Avenue West	005	006	37		1	38	95	1,340	6.08	0	110	0.50	1,450	6.58	2.61	17.20
Lake Avenue West	006	007	21			21	53	1,393	6.32	0	110	0.50	1,503	6.82	2.61	17.77
Lake Avenue West	007	008	325			325	813	2,205	10.00	0	110	0.50	2,315	10.50	2.52	26.48
Lake Avenue West	008	009	34			34	85	2,290	10.39	0	110	0.50	2,400	10.89	2.51	27.37
Lake Avenue West	009	010	86			86	215	2,505	11.37	0	110	0.50	2,615	11.86	2.50	29.61
Lake Avenue West	010	011	54	1		55	138	2,643	11.99	0	110	0.50	2,753	12.49	2.48	31.02
Lake Avenue West	011	012	18			18	45	2,688	12.19	0	110	0.50	2,798	12.69	2.48	31.49
Lake Avenue West	012	013	70	4		74	185	2,873	13.03	0	110	0.50	2,983	13.53	2.47	33.38
Lake Avenue West	013	014	7	1		8	20	2,893	13.12	0	110	0.50	3,003	13.62	2.47	33.58
Lake Avenue West	014	15B	15	2		17	43	2,935	13.32	0	110	0.50	3,045	13.82	2.46	34.02
Lake Avenue West[6]	15B	15A					0	2,935	13.32	0	110	0.50	3,045	13.82	2.46	34.02
Lake Avenue West	15A	015	1	1		2	5	2,940	13.34	0	110	0.50	3,050	13.84	2.46	34.07
Lake Avenue West	015	016	15			15	38	2,978	13.51	0	110	0.50	3,088	14.01	2.46	34.45
Lake Avenue West	016	017	12	2		14	35	3,013	13.67	0	110	0.50	3,123	14.17	2.46	34.80
Lake Avenue West	017	018	60			60	150	3,163	14.35	0	110	0.50	3,273	14.85	2.45	36.32
Lake Avenue West	018	019	3			3	8	3,170	14.38	0	110	0.50	3,280	14.88	2.45	36.39
Lake Avenue West	019	020	23			23	58	3,228	14.64	0	110	0.50	3,338	15.14	2.44	36.97
Lake Avenue West	020	021	4			4	10	3,238	14.69	0	110	0.50	3,348	15.19	2.44	37.07
Lake Avenue West	021	022	140		1	141	353	3,590	16.29	0	110	0.50	3,700	16.79	2.42	40.59
Lorne Street	022	023	8			8	20	3,610	16.38	0	110	0.50	3,720	16.88	2.42	40.79
Lorne Street	023	024	12			12	30	3,640	16.51	0	110	0.50	3,750	17.01	2.41	41.09
Ball Park	024	120	77	1		78	195	3,835	17.40	0	110	0.50	3,945	17.90	2.40	43.01
High Street[3]	101	102A	491	4	1	496	1,240	1,240	5.63	110	110	0.50	1,350	6.13	2.63	16.09
High Street[3]	102A	102	0			0	0	1,240	5.63	0	110	0.50	1,350	6.13	2.63	16.09
High Street[3]	102	103	129			129	323	1,563	7.09	0	110	0.50	1,673	7.59	2.59	19.63
High Street[3]	103	104	99			99	248	1,810	8.21	0	110	0.50	1,920	8.71	2.56	22.30
High Street[3]	104	105	125	2		127	318	2,128	9.65	0	110	0.50	2,238	10.15	2.53	25.67
High Street[3]	105	106	16			16	40	2,168	9.83	0	110	0.50	2,278	10.33	2.52	26.09
High Street[3]	106	107	5			5	13	2,180	9.89	0	110	0.50	2,290	10.39	2.52	26.22
High Street[3]	107	108	8			8	20	2,200	9.98	0	110	0.50	2,310	10.48	2.52	26.43
Bridge Street	108	109	415		1	416	1,040	3,240	14.70	0	110	0.50	3,350	15.20	2.44	37.10
Bridge Street	109	110	6	4		10	25	3,265	14.81	0	110	0.50	3,375	15.31	2.44	37.35
Bridge Street	110	111	2			2	5	3,270	14.84	0	110	0.50	3,380	15.34	2.44	37.40
Bridge Street	111	112	0			0	0	3,270	14.84	0	110	0.50	3,380	15.34	2.44	37.40
Mill Street	112	113	158	22	2	182	455	3,725	16.90	0	110	0.50	3,835	17.40	2.41	41.93
Beckwith Street	113	114	12			12	30	3,755	17.04	0	110	0.50	3,865	17.54	2.41	42.23
Franklin Street	114	115	10	5		15	38	3,793	17.21	0	110	0.50	3,903	17.71	2.41	42.60
Franklin Street	115	115A	42	7		49	123	3,915	17.76	0	110	0.50	4,025	18.26	2.40	43.80
Franklin Street	115A	116	2			2	5	3,920	17.79	0	110	0.50	4,030	18.28	2.40	43.85
Franklin Street	116	117	0			0	0	3,920	17.79	0	110	0.50	4,030	18.28	2.40	43.85
Franklin Street[5]	117	118	5	3		8	20	3,940	17.88	0	110	0.50	4,050	18.38	2.40	44.05
To WWTP	118	119	0			0	0	3,940	17.88	0	110	0.50	4,050	18.38	2.40	44.05
To WWTP	119	119A	0			0	0	3,940	17.88	0	110	0.50	4,050	18.38	2.40	44.05
To WWTP[6]	119A	119B					0	3,940	17.88	0	110	0.50	4,050	18.38	2.40	44.05
To WWTP	119B	120	0			0	0	3,940	17.88	0	110	0.50	4,050	18.38	2.40	44.05
To WWTP	120	121	0			0	0	7,775	35.28	0	220	1.00	7,995	36.27	2.23	80.90
To WWTP	121	122	610	12	1	623	1,558	9,333	42.34	0	220	1.00	9,553	43.34	2.18	94.68
To WWTP	122	123	0			0	0	9,333	42.34	0	220	1.00	9,553	43.34	2.18	94.68
To WWTP	123	124	0			0	0	9,333	42.34	0	220	1.00	9,553	43.34	2.18	94.68
Industrial Avenue[6]	200	201					0	0	0.00	0	0	0.00	0	0.00	3.10	0.00
Industrial Avenue	201	202	115	50		165	413	413	1.87	0	0	0.00	413	1.87	2.81	5.26
Industrial Avenue	202	203	0			0	0	413	1.87	0	0	0.00	413	1.87	2.81	5.26
Mullett Street	203	204	7	4		11	28	440	2.00	0	0	0.00	440	2.00	2.80	5.59
Mullett Street	204	205	4			4	10	450	2.04	0	0	0.00	450	2.04	2.80	5.71
Mullett Street	205	206	63	1		64	160	610	2.77	0	0	0.00	610	2.77	2.76	7.63
Mullett Street	206	207	75			75	188	798	3.62	0	0	0.00	798	3.62	2.72	9.83
Mullett Street	207	208	0			0	0	798	3.62	0	0	0.00	798	3.62	2.72	9.83
Mullett Street	208	209	17	5		22	55	853	3.87	0	0	0.00	853	3.87	2.71	10.47
Mullett Street	209	210	0			0	0	853	3.87	0	0	0.00	853	3.87	2.71	10.47
Mullett Street	210	211A	91	5		96	240	1,093	4.96	0	0	0.00	1,093	4.96	2.66	13.21
Mullett Street[6]	211A	211					0	1,093	4.96	0	0	0.00	1,093	4.96	2.66	13.21
Mullett Street	211	212	1			1	3	1,095	4.97	0	0	0.00	1,095	4.97	2.66	13.24
To WWTP	212	213	0			0	0	1,095	4.97	0	0	0.00	1,095	4.97	2.66	13.24
To WWTP	213	214	0			0	0	1,095	4.97	0	0	0.00	1,095	4.97	2.66	13.24
To WWTP	214	215	0			0	0	1,095	4.97	0	0	0.00	1,095	4.97	2.66	13.24
To WWTP	215	216	0			0	0	1,095	4.97	0	0	0.00	1,095	4.97	2.66	13.24
To WWTP	216	217	2		1	3	8	1,103	5.00	0	0	0.00	1,103	5.00	2.66	13.32
To WWTP	217	218	0			0	0	1,103	5.00	0	0	0.00	1,103	5.00	2.66	13.32
To WWTP	218	219	1		1	2	5	1,108	5.02	0	0	0.00	1,108	5.02	2.66	13.38
To WWTP - Siphon [1]	219	220	0			0	0	1,108	5.02	0	0	0.00	1,108	5.02	2.66	13.38
To WWTP - Siphon [1]	220	221	0			0	0	1,108	5.02	0	0	0.00	1,108	5.02	2.66	13.38
To WWTP - Siphon [1]	221	124	0			0	0	1,108	5.02	0	0	0.00	1,108	5.02	2.66	13.38
To WWTP	124	125	0			0	0	10,440	47.37	0	220	1.00	10,660	48.36	2.16	104.29
To WWTP	125	126	0			0	0	10,440	47.37	0	220	1.00	10,660	48.36	2.16	104.29
To WWTP	126	127	0			0	0	10,440	47.37	0	220	1.00	10,660	48.36	2.16	104.29
To WWTP	127	128	0			0	0	10,440	47.37	0	220	1.00	10,660	48.36	2.16	104.29
To WWTP	**128**	**WWTP**	0			0	0	12,993	58.95	0	878	3.98	13,870	62.93	2.09	**131.36**
McNeely Avenue	301	302	0	31		31	78	78	0.35	0	0	0.00	78	0.35	2.96	1.04
McNeely Avenue	302	303	3			3	8	85	0.39	0	0	0.00	85	0.39	2.96	1.14
McNeely Avenue	303	304	3			3	8	93	0.42	0	0	0.00	93	0.42	2.95	1.24
McNeely Avenue	304	305	3			3	8	100	0.45	0	0	0.00	100	0.45	2.95	1.34
McNeely Avenue	305	306	3			3	8	108	0.49	0	0	0.00	108	0.49	2.94	1.43
McNeely Avenue	306	307	3			3	8	115	0.52	0	0	0.00	115	0.52	2.94	1.53
McNeely Avenue	307	308	4			4	10	125	0.57	0	0	0.00	125	0.57	2.93	1.66
McNeely Avenue	308	309	4	2		6	15	140	0.64	0	0	0.00	140	0.64	2.92	1.85
McNeely Avenue	309	310	6	1		7	18	158	0.71	0	0	0.00	158	0.71	2.91	2.08
McNeely Avenue	310	311	6			6	15	173	0.78	0	0	0.00	173	0.78	2.90	2.27
McNeely Avenue	311	312	4	1		5	13	185	0.84	0	0	0.00	185	0.84	2.90	2.43
McNeely Avenue	312	313	4			4	10	195	0.88	0	0	0.00	195	0.88	2.89	2.56
McNeely Avenue	313	314	8	1		9	23	218	0.99	0	0	0.00	218	0.99	2.88	2.84
McNeely Avenue	314	315	4			4	10	228	1.03	0	0	0.00	228	1.03	2.88	2.97
McNeely Avenue	315	316	8			8	20	248	1.12	0	0	0.00	248	1.12	2.87	3.22
McNeely Avenue	316	317	53			53	133	380	1.72	0	0	0.00	380	1.72	2.82	4.86
McNeely Avenue	317	318	36			36	90	470	2.13	0	0	0.00	470	2.13	2.79	5.96
McNeely Avenue	318	319	20			20	50	520	2.36	0	0	0.00	520	2.36	2.78	6.56
McNeely Avenue	319	320	5			5	13	533	2.42	0	0	0.00	533	2.42	2.78	6.71
McNeely Avenue	320	Pump Station	299			299	748	1,280	5.81	0	0	0.00	1,280	5.81	2.64	15.31
Patterson Crescent (Forcemain)	Pump Station	321	0			0	0	1,280	5.81	0	0	0.00	1,280	5.81	2.64	15.31
Patterson Crescent	321	322	179	2		181	453	1,733	7.86	658	658	2.98	2,390	10.84	2.51	27.27
Patterson Crescent	322	323	298	1		299	748	2,480	11.25	0	658	2.98	3,138	14.23	2.46	34.95
Patterson Crescent	323	324	1			1	3	2,483	11.26	0	658	2.98	3,140	14.25	2.46	34.98
Patterson Crescent	324	325	26		2	28	70	2,553	11.58	0	658	2.98	3,210	14.56	2.45	35.69
To WWTP	325	326				0	0	2,553	11.58	0	658	2.98	3,210	14.56	2.45	35.69
To WWTP	326	327				0	0	2,553	11.58	0	658	2.98	3,210	14.56	2.45	35.69
To WWTP	327	128				0	0	2,553	11.58	0	658	2.98	3,210	14.56	2.45	35.69

Flow Generation – ICI (Previous (2020) ICI Conditions; Additional (2021) ICI Development; 2021 ICI Contributions)

Street/Location	From	To	Previous ICI Sewage (L/s)	Cumulative Previous ICI Sewage (L/s)	Additional IC Area (ha)	Additional IC Sewage (L/s)	Additional Ind. Area (ha)	Additional Ind. Sewage (L/s)	Total Additional ICI Area (ha)	Total Additional ICI Sewage (L/s)	Cumulative Additional ICI Area (ha)	Cumulative Additional ICI Sewage (L/s)	Peaking Factor	Peak ICI Sewage (L/s)
Lake Avenue West	001	02A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lake Avenue West[6]	02A	002	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lake Avenue West	002	003	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lake Avenue West	003	004	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lake Avenue West	004	005	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lake Avenue West	005	006	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lake Avenue West	006	007	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lake Avenue West	007	008	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lake Avenue West	008	009	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lake Avenue West	009	010	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lake Avenue West	010	011	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lake Avenue West	011	012	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lake Avenue West	012	013	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lake Avenue West	013	014	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lake Avenue West	014	15B	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lake Avenue West[6]	15B	15A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lake Avenue West	15A	015	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lake Avenue West	015	016	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lake Avenue West	016	017	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lake Avenue West	017	018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lake Avenue West	018	019	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lake Avenue West	019	020	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lake Avenue West	020	021	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lake Avenue West	021	022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lorne Street	022	023	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lorne Street	023	024	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ball Park	024	120	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
High Street[3]	101	102A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
High Street[3]	102A	102	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
High Street[3]	102	103	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
High Street[3]	103	104	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
High Street[3]	104	105	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
High Street[3]	105	106	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
High Street[3]	106	107	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
High Street[3]	107	108	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bridge Street	108	109	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bridge Street	109	110	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bridge Street	110	111	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bridge Street	111	112	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mill Street	112	113	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Beckwith Street	113	114	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Franklin Street	114	115	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Franklin Street	115	115A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Franklin Street	115A	116	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Franklin Street	116	117	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Franklin Street[5]	117	118	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
To WWTP	118	119	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
To WWTP	119	119A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
To WWTP[6]	119A	119B	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
To WWTP	119B	120	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
To WWTP	120	121	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
To WWTP	121	122	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
To WWTP	122	123	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
To WWTP	123	124	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Industrial Avenue[6]	200	201	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Industrial Avenue	201	202	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Industrial Avenue	202	203	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mullett Street	203	204	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mullett Street	204	205	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mullett Street	205	206	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mullett Street	206	207	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mullett Street	207	208	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mullett Street	208	209	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mullett Street	209	210	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mullett Street	210	211A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mullett Street[6]	211A	211	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mullett Street	211	212	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
To WWTP	212	213	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
To WWTP	213	214	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
To WWTP	214	215	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
To WWTP	215	216	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
To WWTP	216	217	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
To WWTP	217	218	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
To WWTP	218	219	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
To WWTP - Siphon [1]	219	220	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
To WWTP - Siphon [1]	220	221	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
To WWTP - Siphon [1]	221	124	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
To WWTP	124	125	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
To WWTP	125	126	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
To WWTP	126	127	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
To WWTP	127	128	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
To WWTP	**128**	**WWTP**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
McNeely Avenue	301	302	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
McNeely Avenue	302	303	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
McNeely Avenue	303	304	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
McNeely Avenue	304	305	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
McNeely Avenue	305	306	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
McNeely Avenue	306	307	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
McNeely Avenue	307	308	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
McNeely Avenue	308	309	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
McNeely Avenue	309	310	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
McNeely Avenue	310	311	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
McNeely Avenue	311	312	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
McNeely Avenue	312	313	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
McNeely Avenue	313	314	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
McNeely Avenue	314	315	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
McNeely Avenue	315	316	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
McNeely Avenue	316	317	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
McNeely Avenue	317	318	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
McNeely Avenue	318	319	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
McNeely Avenue	319	320	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
McNeely Avenue	320	Pump Station	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Patterson Crescent (Forcemain)	Pump Station	321	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Patterson Crescent	321	322	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Patterson Crescent	322	323	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Patterson Crescent	323	324	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Patterson Crescent	324	325	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
To WWTP	325	326	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
To WWTP	326	327	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
To WWTP	327	128	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Extraneous Flows (Previous (2020) Extraneous Flows; Additional (2021) Extraneous Flows; 2021 Extraneous Flow Contributions) **and Pipe Conditions – Pipe Capacity Utilization**

Street/Location	From	To	Previous Drainage Area (ha)	Cumulative Previous Drainage Area (ha)	Previous Extraneous Flow (L/s)	Additional Drainage Area (ha)	Cumulative Additional Drainage Area (ha)	Additional Extraneous Flow (L/s)	Total Cumulative Drainage Area (ha)	Total Extraneous Flow (L/s)	Total Peak Flow (L/s)	Nominal Pipe Diameter (mm)	Actual Pipe Diameter (mm)	Slope (%)	Full Flow Velocity (m/s)	Full Flow Capacity (L/s)	Capacity Used (%)
Lake Avenue West	001	02A	3.32	3.32	1.00	1.63	1.63	0.49	4.95	1.48	3.56	375	381	0.44%	1.06	121.33	2.9%
Lake Avenue West[6]	02A	002	0.00	3.32	1.00	0.00	1.63	0.49	4.95	1.48	3.56	375	381	0.42%	1.04	118.54	3.0%
Lake Avenue West	002	003	35.59	38.91	11.67	0.00	1.63	0.49	40.54	12.16	27.75	375	381	0.48%	1.11	126.72	21.9%
Lake Avenue West	003	004	1.77	40.68	12.20	0.00	1.63	0.49	42.31	12.69	28.53	375	381	0.45%	1.08	122.70	23.3%
Lake Avenue West	004	005	0.40	41.08	12.32	0.00	1.63	0.49	42.71	12.81	28.96	375	381	0.46%	1.09	124.06	23.3%
Lake Avenue West	005	006	4.51	45.59	13.68	0.00	1.63	0.49	47.22	14.16	31.36	375	381	0.42%	1.04	118.54	26.5%
Lake Avenue West	006	007	1.13	46.72	14.02	0.00	1.63	0.49	48.35	14.50	32.28	375	381	0.39%	1.00	114.23	28.3%
Lake Avenue West	007	008	33.14	79.86	23.96	0.00	1.63	0.49	81.49	24.45	50.93	375	381	0.57%	1.21	138.09	36.9%
Lake Avenue West	008	009	1.84	81.70	24.51	0.00	1.63	0.49	83.33	25.00	52.37	375	381	0.85%	1.48	168.64	31.1%
Lake Avenue West	009	010	5.49	87.19	26.16	0.00	1.63	0.49	88.82	26.64	56.25	375	381	0.62%	1.26	144.02	39.1%
Lake Avenue West	010	011	3.76	90.95	27.29	0.00	1.63	0.49	92.58	27.77	58.80	375	381	0.48%	1.11	126.72	46.4%
Lake Avenue West	011	012	1.69	92.64	27.79	0.00	1.63	0.49	94.27	28.28	59.77	375	381	1.82%	2.16	246.76	24.2%
Lake Avenue West	012	013	17.76	110.40	33.12	0.00	1.63	0.49	112.03	33.61	66.99	525	533	0.25%	1.00	224.33	29.9%
Lake Avenue West	013	014	0.73	111.13	33.34	0.00	1.63	0.49	112.76	33.83	67.41	600	610	0.12%	0.76	221.90	30.4%
Lake Avenue West	014	15B	2.10	113.23	33.97	0.00	1.63	0.49	114.86	34.46	68.47	600	610	0.12%	0.76	221.90	30.9%
Lake Avenue West[6]	15B	15A	0.00	113.23	33.97	0.00	1.63	0.49	114.86	34.46	68.47	600	610	0.12%	0.76	221.90	30.9%
Lake Avenue West	15A	015	0.19	113.42	34.03	0.00	1.63	0.49	115.05	34.51	68.58	600	610	0.12%	0.76	221.90	30.9%
Lake Avenue West	015	016	0.95	114.37	34.31	0.00	1.63	0.49	116.00	34.80	69.25	600	610	0.12%	0.76	221.90	31.2%
Lake Avenue West	016	017	1.67	116.04	34.81	0.00	1.63	0.49	117.67	35.30	70.10	600	610	0.10%	0.69	202.56	34.6%
Lake Avenue West	017	018	3.63	119.67	35.90	0.00	1.63	0.49	121.30	36.39	72.71	600	610	0.10%	0.69	202.56	35.9%
Lake Avenue West	018	019	0.21	119.88	35.96	0.00	1.63	0.49	121.51	36.45	72.84	600	610	0.12%	0.76	221.90	32.8%
Lake Avenue West	019	020	1.57	121.45	36.44	0.00	1.63	0.49	123.08	36.92	73.89	600	610	0.12%	0.76	221.90	33.3%
Lake Avenue West	020	021	0.28	121.73	36.52	0.00	1.63	0.49	123.36	37.01	74.08	600	610	0.06%	*0.51*	150.22	49.3%
Lake Avenue West	021	022	12.30	134.03	40.21	0.00	1.63	0.49	135.66	40.70	81.29	600	610	0.12%	0.76	221.90	36.6%
Lorne Street	022	023	0.84	134.87	40.46	0.00	1.63	0.49	136.50	40.95	81.74	600	610	0.20%	0.98	286.47	28.5%
Lorne Street	023	024	0.65	135.52	40.66	0.00	1.63	0.49	137.15	41.14	82.23	600	610	0.20%	0.98	286.47	28.7%
Ball Park	024	120	5.71	141.23	42.37	0.00	1.63	0.49	142.86	42.86	85.87	600	610	0.47%	1.51	439.42	19.5%
High Street[3]	101	102A	55.56	55.56	22.22	1.63	1.63	0.65	57.19	22.87	38.97	350	356	0.51%	1.09	108.67	35.9%
High Street[3]	102A	102	0.00	55.56	22.22	0.00	1.63	0.65	57.19	22.87	38.97	350	356	0.15%	*0.59*	58.94	66.1%
High Street[3]	102	103	6.67	62.23	24.89	0.00	1.63	0.65	63.86	25.54	45.17	350	356	0.17%	0.63	62.74	72.0%
High Street[3]	103	104	12.95	75.18	30.07	0.00	1.63	0.65	76.81	30.72	53.02	400	406	0.14%	0.63	81.29	65.2%
High Street[3]	104	105	1.53	76.71	30.68	0.00	1.63	0.65	78.34	31.33	57.00	400	406	0.14%	0.63	81.29	70.1%
High Street[3]	105	106	0.47	77.18	30.87	0.00	1.63	0.65	78.81	31.52	57.61	400	406	0.14%	0.63	81.29	70.9%
High Street[3]	106	107	0.48	77.66	31.06	0.00	1.63	0.65	79.29	31.71	57.93	400	406	0.13%	0.60	78.33	74.0%
High Street[3]	107	108	0.67	78.33	31.33	0.00	1.63	0.65	79.95	31.98	58.41	400	406	0.15%	0.65	84.15	69.4%
Bridge Street	108	109	35.48	113.81	41.98	0.00	1.63	0.65	115.44	42.63	79.72	450	457	0.35%	1.07	175.96	45.3%
Bridge Street	109	110	0.18	113.99	42.03	0.00	1.63	0.65	115.62	42.68	80.03	450	457	0.31%	1.01	165.60	48.3%
Bridge Street	110	111	0.26	114.25	42.11	0.00	1.63	0.65	115.88	42.76	80.16	450	457	0.45%	1.22	199.52	40.2%
Bridge Street	111	112	0.00	114.25	42.11	0.00	1.63	0.65	115.88	42.76	80.16	450	457	1.44%	2.17	356.92	22.5%
Mill Street	112	113	16.75	131.00	47.13	0.00	1.63	0.65	132.63	47.78	89.71	600	610	0.30%	1.20	350.85	25.6%
Beckwith Street	113	114	0.98	131.98	47.43	0.00	1.63	0.65	133.61	48.08	90.30	600	610	0.20%	0.98	286.47	31.5%
Franklin Street	114	115	1.72	133.70	47.94	0.00	1.63	0.65	135.33	48.59	91.19	600	610	0.23%	1.05	307.20	29.7%
Franklin Street	115	115A	4.74	138.44	49.36	0.00	1.63	0.65	140.07	50.01	93.82	600	610	0.28%	1.16	338.95	27.7%
Franklin Street	115A	116	0.54	138.98	49.53	0.00	1.63	0.65	140.61	50.18	94.03	600	610	0.31%	1.22	356.65	26.4%
Franklin Street	116	117	0.12	139.10	49.56	0.00	1.63	0.65	140.73	50.21	94.06	600	610	0.18%	0.93	271.77	34.6%
Franklin Street[5]	117	118	0.57	139.67	49.73	0.00	1.63	0.65	141.30	50.38	94.43	584	593	0.26%	1.10	303.91	31.1%
To WWTP	118	119	0.00	139.67	49.73	0.00	1.63	0.65	141.30	50.38	94.43	600	610	0.26%	1.12	326.62	28.9%
To WWTP	119	119A	0.00	139.67	49.73	0.00	1.63	0.65	141.30	50.38	94.43	600	610	0.27%	1.14	332.84	28.4%
To WWTP[6]	119A	119B	0.00	139.67	49.73	0.00	1.63	0.65	141.30	50.38	94.43	600	610	0.27%	1.14	332.84	28.4%
To WWTP	119B	120	0.00	139.67	49.73	0.00	1.63	0.65	141.30	50.38	94.43	750	762	1.66%	***3.28***	1,496.38	6.3%
To WWTP	120	121	0.00	280.90	92.10	0.00	3.25	1.14	284.15	93.24	174.14	750	762	0.25%	1.27	580.71	30.0%
To WWTP	121	122	57.07	337.98	109.23	0.00	3.25	1.14	341.23	110.36	205.05	750	762	0.25%	1.27	580.71	35.3%
To WWTP	122	123	0.00	337.98	109.23	0.00	3.25	1.14	341.23	110.36	205.05	750	762	0.25%	1.27	580.71	35.3%
To WWTP	123	124	0.00	337.98	109.23	0.00	3.25	1.14	341.23	110.36	205.05	750	762	3.97%	***5.07***	2,314.10	8.9%
Industrial Avenue[6]	200	201	0.00	0.00	0.00	0.00	0.00	0.16	0.00	0.16	0.16	200	203	3.61%	2.00	65.01	0.2%
Industrial Avenue	201	202	31.82	31.82	9.55	0.00	0.00	0.00	31.82	9.55	14.80	200	203	0.27%	*0.55*	17.78	83.3%
Industrial Avenue	202	203	0.00	31.82	9.55	0.00	0.00	0.00	31.82	9.55	14.80	300	305	0.17%	*0.57*	41.59	35.6%
Mullett Street	203	204	1.14	32.96	9.89	0.00	0.00	0.00	32.96	9.89	15.48	300	305	0.22%	0.65	47.32	32.7%
Mullett Street	204	205	0.14	33.10	9.93	0.00	0.00	0.00	33.10	9.93	15.64	300	305	0.36%	0.83	60.53	25.8%
Mullett Street	205	206	4.80	37.90	11.37	0.00	0.00	0.00	37.90	11.37	19.00	300	305	0.77%	1.21	88.52	21.5%
Mullett Street	206	207	4.84	42.74	12.82	0.00	0.00	0.00	42.74	12.82	22.65	350	356	0.32%	0.87	86.08	26.3%
Mullett Street	207	208	0.00	42.74	12.82	0.00	0.00	0.00	42.74	12.82	22.65	350	356	0.72%	1.30	129.12	17.5%
Mullett Street	208	209	2.37	45.11	13.53	0.00	0.00	0.00	45.11	13.53	24.00	375	381	0.30%	0.88	100.18	24.0%
Mullett Street	209	210	0.00	45.11	13.53	0.00	0.00	0.00	45.11	13.53	24.00	375	381	0.30%	0.88	100.18	24.0%
Mullett Street	210	211A	10.35	55.46	16.64	0.00	0.00	0.00	55.46	16.64	29.85	375	381	0.24%	0.79	89.61	33.3%
Mullett Street[6]	211A	211	0.00	55.46	16.64	0.00	0.00	0.00	55.46	16.64	29.85	375	381	0.26%	0.82	93.27	32.0%
Mullett Street	211	212	0.34	55.80	16.74	0.00	0.00	0.00	55.80	16.74	29.98	375	381	2.49%	2.53	288.63	10.4%
To WWTP	212	213	0.00	55.80	16.74	0.00	0.00	0.00	55.80	16.74	29.98	400	406	0.16%	0.67	86.90	34.5%
To WWTP	213	214	0.00	55.80	16.74	0.00	0.00	0.00	55.80	16.74	29.98	400	406	0.18%	0.71	92.18	32.5%
To WWTP	214	215	0.00	55.80	16.74	0.00	0.00	0.00	55.80	16.74	29.98	400	406	3.25%	***3.02***	391.67	7.7%
To WWTP	215	216	0.00	55.80	16.74	0.00	0.00	0.00	55.80	16.74	29.98	400	406	0.21%	0.77	99.56	30.1%
To WWTP	216	217	0.62	56.42	16.93	0.00	0.00	0.00	56.42	16.93	30.25	400	406	0.23%	0.80	104.20	29.0%
To WWTP	217	218	0.00	56.42	16.93	0.00	0.00	0.00	56.42	16.93	30.25	400	406	0.22%	0.79	101.90	29.7%
To WWTP	218	219	0.35	56.77	17.03	0.00	0.00	0.00	56.77	17.03	30.41	400	406	0.18%	0.71	92.18	33.0%
To WWTP - Siphon [1]	219	220	0.00	56.77	17.03	0.00	0.00	0.00	56.77	17.03	30.41	400	406	0.22%	0.79	101.90	29.8%
To WWTP - Siphon [1]	220	221	0.00	56.77	17.03	0.00	0.00	0.00	56.77	17.03	30.41	400	406	0.84%	1.54	199.12	15.3%
To WWTP - Siphon [1]	221	124	0.00	56.77	17.03	0.00	0.00	0.00	56.77	17.03	30.41	400	406	0.15%	0.65	84.15	36.1%
To WWTP	124	125	0.00	394.75	126.26	0.00	3.25	1.14	398.00	127.39	231.68	750	762	0.12%	0.88	402.33	57.6%
To WWTP	125	126	0.00	394.75	126.26	0.00	3.25	1.14	398.00	127.39	231.68	750	762	0.12%	0.88	402.33	57.6%
To WWTP	126	127	0.00	394.75	126.26	0.00	3.25	1.14	398.00	127.39	231.68	750	762	0.12%	0.88	402.33	57.6%
To WWTP	127	128	0.00	394.75	126.26	0.00	3.25	1.14	398.00	127.39	231.68	750	762	0.27%	1.32	603.49	38.4%
To WWTP	**128**	**WWTP**	0.00	577.87	181.19	0.00	13.00	4.06	590.87	**185.26**	**316.62**	750	762	0.27%	1.32	603.49	52.5%
McNeely Avenue	301	302	50.25	50.25	15.08	0.00	0.00	0.00	50.25	15.08	16.12	300	305	0.25%	0.69	50.44	32.0%
McNeely Avenue	302	303	0.92	51.17	15.35	0.00	0.00	0.00	51.17	15.35	16.49	450	457	0.14%	0.68	111.29	14.8%
McNeely Avenue	303	304	0.87	52.04	15.61	0.00	0.00	0.00	52.04	15.61	16.85	450	457	0.10%	*0.57*	94.06	17.9%
McNeely Avenue	304	305	0.85	52.89	15.87	0.00	0.00	0.00	52.89	15.87	17.20	450	457	0.12%	0.63	103.03	16.7%
McNeely Avenue	305	306	0.88	53.77	16.13	0.00	0.00	0.00	53.77	16.13	17.57	450	457	0.05%	*0.41*	66.51	26.4%
McNeely Avenue	306	307	0.89	54.66	16.40	0.00	0.00	0.00	54.66	16.40	17.93	450	457	0.04%	*0.36*	59.49	30.1%
McNeely Avenue	307	308	1.08	55.74	16.72	0.00	0.00	0.00	55.74	16.72	18.38	450	457	0.13%	0.65	107.24	17.1%
McNeely Avenue	308	309	1.03	56.77	17.03	0.00	0.00	0.00	56.77	17.03	18.89	450	457	0.11%	0.60	98.65	19.1%
McNeely Avenue	309	310	1.77	58.54	17.56	0.00	0.00	0.00	58.54	17.56	19.64	450	457	0.08%	*0.51*	84.13	23.3%
McNeely Avenue	310	311	1.56	60.10	18.03	0.00	0.00	0.00	60.10	18.03	20.30	450	457	0.10%	*0.57*	94.06	21.6%
McNeely Avenue	311	312	0.98	61.08	18.32	0.00	0.00	0.00	61.08	18.32	20.75	450	457	0.06%	*0.44*	72.86	28.5%
McNeely Avenue	312	313	0.46	61.54	18.46	0.00	0.00	0.00	61.54	18.46	21.02	450	457	0.13%	0.65	107.24	19.6%
McNeely Avenue	313	314	2.00	63.54	19.06	0.00	0.00	0.00	63.54	19.06	21.90	450	457	0.12%	0.63	103.03	21.3%
McNeely Avenue	314	315	0.36	63.90	19.17	0.00	0.00	0.00	63.90	19.17	22.14	300	305	0.41%	0.89	64.60	34.3%
McNeely Avenue	315	316	0.51	64.41	19.32	0.00	0.00	0.00	64.41	19.32	22.54	300	305	0.41%	0.89	64.60	34.9%
McNeely Avenue	316	317	3.42	67.83	20.35	0.00	0.00	0.00	67.83	20.35	25.21	300	305	0.21%	0.63	46.23	54.5%
McNeely Avenue	317	318	2.22	70.05	21.02	0.00	0.00	0.00	70.05	21.02	26.97	300	305	0.23%	0.66	48.38	55.7%
McNeely Avenue	318	319	0.82	70.87	21.26	0.00	0.00	0.00	70.87	21.26	27.82	300	305	0.27%	0.72	52.42	53.1%
McNeely Avenue	319	320	0.32	71.19	21.36	0.00	0.00	0.00	71.19	21.36	28.06	300	305	0.50%	0.98	71.33	39.3%
McNeely Avenue	320	Pump Station	26.50	97.69	29.31	0.00	0.00	0.00	97.69	29.31	44.62	300	305	0.50%	0.98	71.33	62.6%
Patterson Crescent (Forcemain)	Pump Station	321	0.00	97.69	29.31	0.00	0.00	0.00	97.69	29.31	44.62						
Patterson Crescent	321	322	65.29	162.99	48.90	9.75	9.75	2.93	172.74	51.82	79.09	500	508	0.20%	0.87	176.17	44.9%
Patterson Crescent	322	323	14.38	177.36	53.21	0.00	9.75	2.93	187.11	56.13	91.09	500	508	0.20%	0.87	176.17	51.7%
Patterson Crescent	323	324	0.23	177.59	53.28	0.00	9.75	2.93	187.34	56.20	91.18	500	508	0.20%	0.87	176.17	51.8%
Patterson Crescent	324	325	5.53	183.12	54.94	0.00	9.75	2.93	192.87	57.86	93.55	500	508	0.20%	0.87	176.17	53.1%
To WWTP	325	326	0.00	183.12	54.94	0.00	9.75	2.93	192.87	57.86	93.55	500	508	0.20%	0.87	176.17	53.1%
To WWTP	326	327	0.00	183.12	54.94	0.00	9.75	2.93	192.87	57.86	93.55	500	508	0.20%	0.87	176.17	53.1%
To WWTP	327	128	0.00	183.12	54.94	0.00	9.75	2.93	192.87	57.86	93.55	500	508	0.20%	0.87	176.17	53.1%

Stantec

163401646 - Town of Carleton Place W/WW Master Plan

Table D-6: Sanitary Sewer Calculation Spreadsheet - 2021 Rare Event

Date: 8/19/2021
Prepared by: CR
Checked by: AL

Legend
Manual Input/Modification
Calculated/Extracted Value for Existing + Additional Development
Existing Conditions - 2020 (Original Spreadsheet Data)
Additional Development
Full Flow Velocity < 0.6 m/s
Sewer Capacity Used > 100%; Sewer Velocity > 3 m/s
WWTP Inflow Point

Modelling Parameters - 2021 Rare Event		
Horizon:	2021	
Scenario:	Rare	
Existing Conditions - 2020		
Average Residential Flow Rate - q =	392	l/cap/day
Peak Extraneous Flow Rate - i =	0.55	l/s/ha
Peak Extraneous Flow Rate (Monitor No. 6)[3] - i =	3.00	l/s/ha
Existing Conditions Population Density =	2.5	PPU
Harmon Peaking Factor Correction Factor - K =	0.60	-
Growth Developments - 2021		
Average Residential Flow Rate - q =	392	l/cap/day
Peak Extraneous Flow Rate - i =	0.55	l/s/ha
Peak Extraneous Flow Rate (Monitor No. 6)[3] - i =	3.00	l/s/ha
Harmon Peaking Factor Correction Factor - K =	0.60	-
Insitutional/Commercial Average Flow Rate - q =	0	l/ha/day
Institutional/Commercial (IC) Peaking Factor (ICI Cont. > 20%) =	0.00	-
Institutional/Commercial (IC) Peaking Factor (ICI Cont. ≤ 20%) =	0.00	-
Light Industrial Average Flow Rate - q =	0	l/ha/day
Light Industrial Peaking Factor (ICI Cont. > 20%) =	0.00	-
Light Industrial Peaking Factor (ICI Cont. ≤ 20%) =	0.00	-
Manning's Coefficient - n =	0.013	

Note: Values as per ***Design Basis Memo*** *(July 12, 2021)*

Summary - 2021 Rare Event		
2020 Residential Population	12,525	ppl
2020 ICI Equivalent Population	468	ppl
2020 Total Residential + ICI Equivalent Population	12,993	ppl
2021 Additional Residential Population	878	ppl
2021 Total Residential Population	13,403	ppl
2021 Total Residential + ICI Equivalent Population	13,870	ppl
2021 Additional Residential Area	13	ha
2021 Additional ICI Area	0	ha
2021 Total Area	591	ha
Average DWF (Residential + ICI)	5,437	m^3/d
Peak DWF (Residential + ICI)	11,350	m^3/d
Peak Extraneous Flow	45,002	m^3/d
Peak Total Flow	56,352	m^3/d
Number of Sewers Surcharged	20	
Average Sewer Capacity Used	78.4%	
Max Sewer Capacity Used	337.1%	
Mississippi Quays PS Peak Inflow	69.0	L/s

Notes

(1) McArthur Island siphon represented by sewer section from MH219 to MH124, as a single 400 mm diameter gravity pipe at 0.84% slope, as per original spreadsheet (JLR, 2021). Based on drawings, siphon consists of two barrels (150 mm and 300 mm); representation of siphon would require adjustments for HGL calculations.
(2) Mississippi Quays PS modelled at the end of McNeely Avenue (from MH320 to Pump Station); no gravity flow calculated through forcemain on Patterson Crescent (from Pump Station to MH321, assumed without restrictions).
(3) Extraneous flows calculated using 3 L/s/ha for drainage areas tributary to flow monitor No. 6.
(4) Diameters and slopes confirmed or corrected based on comparison of original spreadsheet to information provided by the Town on 20210712; see detailed comparison in Table D-1: Comparison of Diameters and Slopes from Different Sources.
(5) Based on information provided by the Town on 20210712, sewer along Franklin St between MH117 and MH118 appears to first be a ~38 m long 600 mm single sewer, followed by a ~52 m long section of twin 450 mm sewers; equivalent diameter to twin 450 mm retained, as it is more conservative.
(6) Sewer section added to spreadsheet to match Town's GIS data.

Level of Service Limits		
Maximum Velocity	3	m/s
Actual Flow/Full Flow Capacity	100%	

Flow Generation – Residential

Street/Location	Maintenance Hole From	Maintenance Hole To	Previous (2020) Residential Conditions: Number of Units – Residential Units	Commercial Units	Institutional Units	Total Units	Previous Population	Cumulative Previous Population	Previous Residential Sewage Flow (L/s)	Additional (2021) Residential Development: Additional Population	Cumulative Additional Population	Additional Residential Sewage Flow (L/s)	2021 Residential Contributions: Total Cumulative Residential Population	Total Residential Sewage Flow (L/s)	Harmon Peaking Factor	Peak Residential Sewage Flow (L/s)
Lake Avenue West	001	02A	18		1	19	48	48	0.22	110	110	0.50	158	0.71	2.91	2.08
Lake Avenue West[6]	02A	002					0	48	0.22	0	110	0.50	158	0.71	2.91	2.08
Lake Avenue West	002	003	459			459	1,148	1,195	5.42	0	110	0.50	1,305	5.92	2.63	15.59
Lake Avenue West	003	004	9			9	23	1,218	5.52	0	110	0.50	1,328	6.02	2.63	15.84
Lake Avenue West	004	005	11			11	28	1,245	5.65	0	110	0.50	1,355	6.15	2.63	16.15
Lake Avenue West	005	006	37		1	38	95	1,340	6.08	0	110	0.50	1,450	6.58	2.61	17.20
Lake Avenue West	006	007	21			21	53	1,393	6.32	0	110	0.50	1,503	6.82	2.61	17.77
Lake Avenue West	007	008	325			325	813	2,205	10.00	0	110	0.50	2,315	10.50	2.52	26.48
Lake Avenue West	008	009	34			34	85	2,290	10.39	0	110	0.50	2,400	10.89	2.51	27.37
Lake Avenue West	009	010	86			86	215	2,505	11.37	0	110	0.50	2,615	11.86	2.50	29.61
Lake Avenue West	010	011	54	1		55	138	2,643	11.99	0	110	0.50	2,753	12.49	2.48	31.02
Lake Avenue West	011	012	18			18	45	2,688	12.19	0	110	0.50	2,798	12.69	2.48	31.49
Lake Avenue West	012	013	70	4		74	185	2,873	13.03	0	110	0.50	2,983	13.53	2.47	33.38
Lake Avenue West	013	014	7	1		8	20	2,893	13.12	0	110	0.50	3,003	13.62	2.47	33.58
Lake Avenue West	014	15B	15	2		17	43	2,935	13.32	0	110	0.50	3,045	13.82	2.46	34.02
Lake Avenue West[6]	15B	15A					0	2,935	13.32	0	110	0.50	3,045	13.82	2.46	34.02
Lake Avenue West	15A	015	1	1		2	5	2,940	13.34	0	110	0.50	3,050	13.84	2.46	34.07
Lake Avenue West	015	016	15			15	38	2,978	13.51	0	110	0.50	3,088	14.01	2.46	34.45
Lake Avenue West	016	017	12	2		14	35	3,013	13.67	0	110	0.50	3,123	14.17	2.46	34.80
Lake Avenue West	017	018	60			60	150	3,163	14.35	0	110	0.50	3,273	14.85	2.45	36.32
Lake Avenue West	018	019	3			3	8	3,170	14.38	0	110	0.50	3,280	14.88	2.45	36.39
Lake Avenue West	019	020	23			23	58	3,228	14.64	0	110	0.50	3,338	15.14	2.44	36.97
Lake Avenue West	020	021	4			4	10	3,238	14.69	0	110	0.50	3,348	15.19	2.44	37.07
Lake Avenue West	021	022	140		1	141	353	3,590	16.29	0	110	0.50	3,700	16.79	2.42	40.59
Lorne Street	022	023	8			8	20	3,610	16.38	0	110	0.50	3,720	16.88	2.42	40.79
Lorne Street	023	024	12			12	30	3,640	16.51	0	110	0.50	3,750	17.01	2.41	41.09
Ball Park	024	120	77	1		78	195	3,835	17.40	0	110	0.50	3,945	17.90	2.40	43.01
High Street[3]	101	102A	491	4	1	496	1,240	1,240	5.63	110	110	0.50	1,350	6.13	2.63	16.09
High Street[3]	102A	102	0			0	0	1,240	5.63	0	110	0.50	1,350	6.13	2.63	16.09
High Street[3]	102	103	129			129	323	1,563	7.09	0	110	0.50	1,673	7.59	2.59	19.63
High Street[3]	103	104	99			99	248	1,810	8.21	0	110	0.50	1,920	8.71	2.56	22.30
High Street[3]	104	105	125	2		127	318	2,128	9.65	0	110	0.50	2,238	10.15	2.53	25.67
High Street[3]	105	106	16			16	40	2,168	9.83	0	110	0.50	2,278	10.33	2.52	26.09
High Street[3]	106	107	5			5	13	2,180	9.89	0	110	0.50	2,290	10.39	2.52	26.22
High Street[3]	107	108	8			8	20	2,200	9.98	0	110	0.50	2,310	10.48	2.52	26.43
Bridge Street	108	109	415		1	416	1,040	3,240	14.70	0	110	0.50	3,350	15.20	2.44	37.10
Bridge Street	109	110	6	4		10	25	3,265	14.81	0	110	0.50	3,375	15.31	2.44	37.35
Bridge Street	110	111	2			2	5	3,270	14.84	0	110	0.50	3,380	15.34	2.44	37.40
Bridge Street	111	112	0			0	0	3,270	14.84	0	110	0.50	3,380	15.34	2.44	37.40
Mill Street	112	113	158	22	2	182	455	3,725	16.90	0	110	0.50	3,835	17.40	2.41	41.93
Beckwith Street	113	114	12			12	30	3,755	17.04	0	110	0.50	3,865	17.54	2.41	42.23
Franklin Street	114	115	10	5		15	38	3,793	17.21	0	110	0.50	3,903	17.71	2.41	42.60
Franklin Street	115	115A	42	7		49	123	3,915	17.76	0	110	0.50	4,025	18.26	2.40	43.80
Franklin Street	115A	116	2			2	5	3,920	17.79	0	110	0.50	4,030	18.28	2.40	43.85
Franklin Street	116	117	0			0	0	3,920	17.79	0	110	0.50	4,030	18.28	2.40	43.85
Franklin Street[5]	117	118	5	3		8	20	3,940	17.88	0	110	0.50	4,050	18.38	2.40	44.05
To WWTP	118	119	0			0	0	3,940	17.88	0	110	0.50	4,050	18.38	2.40	44.05
To WWTP	119	119A	0			0	0	3,940	17.88	0	110	0.50	4,050	18.38	2.40	44.05
To WWTP[6]	119A	119B					0	3,940	17.88	0	110	0.50	4,050	18.38	2.40	44.05
To WWTP	119B	120	0			0	0	3,940	17.88	0	110	0.50	4,050	18.38	2.40	44.05
To WWTP	120	121	0			0	0	7,775	35.28	0	220	1.00	7,995	36.27	2.23	80.90
To WWTP	121	122	610	12	1	623	1,558	9,333	42.34	0	220	1.00	9,553	43.34	2.18	94.68
To WWTP	122	123	0			0	0	9,333	42.34	0	220	1.00	9,553	43.34	2.18	94.68
To WWTP	123	124	0			0	0	9,333	42.34	0	220	1.00	9,553	43.34	2.18	94.68
Industrial Avenue[6]	200	201					0	0	0.00	0	0	0.00	0	0.00	3.10	0.00
Industrial Avenue	201	202	115	50		165	413	413	1.87	0	0	0.00	413	1.87	2.81	5.26
Industrial Avenue	202	203	0			0	0	413	1.87	0	0	0.00	413	1.87	2.81	5.26
Mullett Street	203	204	7	4		11	28	440	2.00	0	0	0.00	440	2.00	2.80	5.59
Mullett Street	204	205	4			4	10	450	2.04	0	0	0.00	450	2.04	2.80	5.71
Mullett Street	205	206	63	1		64	160	610	2.77	0	0	0.00	610	2.77	2.76	7.63
Mullett Street	206	207	75			75	188	798	3.62	0	0	0.00	798	3.62	2.72	9.83
Mullett Street	207	208	0			0	0	798	3.62	0	0	0.00	798	3.62	2.72	9.83
Mullett Street	208	209	17	5		22	55	853	3.87	0	0	0.00	853	3.87	2.71	10.47
Mullett Street	209	210	0			0	0	853	3.87	0	0	0.00	853	3.87	2.71	10.47
Mullett Street	210	211A	91	5		96	240	1,093	4.96	0	0	0.00	1,093	4.96	2.66	13.21
Mullett Street[6]	211A	211					0	1,093	4.96	0	0	0.00	1,093	4.96	2.66	13.21
Mullett Street	211	212	1			1	3	1,095	4.97	0	0	0.00	1,095	4.97	2.66	13.24
To WWTP	212	213	0			0	0	1,095	4.97	0	0	0.00	1,095	4.97	2.66	13.24
To WWTP	213	214	0			0	0	1,095	4.97	0	0	0.00	1,095	4.97	2.66	13.24
To WWTP	214	215	0			0	0	1,095	4.97	0	0	0.00	1,095	4.97	2.66	13.24
To WWTP	215	216	0			0	0	1,095	4.97	0	0	0.00	1,095	4.97	2.66	13.24
To WWTP	216	217	2		1	3	8	1,103	5.00	0	0	0.00	1,103	5.00	2.66	13.32
To WWTP	217	218	0			0	0	1,103	5.00	0	0	0.00	1,103	5.00	2.66	13.32
To WWTP	218	219	1		1	2	5	1,108	5.02	0	0	0.00	1,108	5.02	2.66	13.38
To WWTP - Siphon[1]	219	220	0			0	0	1,108	5.02	0	0	0.00	1,108	5.02	2.66	13.38
To WWTP - Siphon[1]	220	221	0			0	0	1,108	5.02	0	0	0.00	1,108	5.02	2.66	13.38
To WWTP - Siphon[1]	221	124	0			0	0	1,108	5.02	0	0	0.00	1,108	5.02	2.66	13.38
To WWTP	124	125	0			0	0	10,440	47.37	0	220	1.00	10,660	48.36	2.16	104.29
To WWTP	125	126	0			0	0	10,440	47.37	0	220	1.00	10,660	48.36	2.16	104.29
To WWTP	126	127	0			0	0	10,440	47.37	0	220	1.00	10,660	48.36	2.16	104.29
To WWTP	127	128	0			0	0	10,440	47.37	0	220	1.00	10,660	48.36	2.16	104.29
To WWTP	**128**	**WWTP**	0			0	0	12,993	58.95	0	878	3.98	13,870	62.93	2.09	**131.36**
McNeely Avenue	301	302	0	31		31	78	78	0.35	0	0	0.00	78	0.35	2.96	1.04
McNeely Avenue	302	303	3			3	8	85	0.39	0	0	0.00	85	0.39	2.96	1.14
McNeely Avenue	303	304	3			3	8	93	0.42	0	0	0.00	93	0.42	2.95	1.24
McNeely Avenue	304	305	3			3	8	100	0.45	0	0	0.00	100	0.45	2.95	1.34
McNeely Avenue	305	306	3			3	8	108	0.49	0	0	0.00	108	0.49	2.94	1.43
McNeely Avenue	306	307	3			3	8	115	0.52	0	0	0.00	115	0.52	2.94	1.53
McNeely Avenue	307	308	4			4	10	125	0.57	0	0	0.00	125	0.57	2.93	1.66
McNeely Avenue	308	309	4	2		6	15	140	0.64	0	0	0.00	140	0.64	2.92	1.85
McNeely Avenue	309	310	6	1		7	18	158	0.71	0	0	0.00	158	0.71	2.91	2.08
McNeely Avenue	310	311	6			6	15	173	0.78	0	0	0.00	173	0.78	2.90	2.27
McNeely Avenue	311	312	4	1		5	13	185	0.84	0	0	0.00	185	0.84	2.90	2.43
McNeely Avenue	312	313	4			4	10	195	0.88	0	0	0.00	195	0.88	2.89	2.56
McNeely Avenue	313	314	8	1		9	23	218	0.99	0	0	0.00	218	0.99	2.88	2.84
McNeely Avenue	314	315	4			4	10	228	1.03	0	0	0.00	228	1.03	2.88	2.97
McNeely Avenue	315	316	8			8	20	248	1.12	0	0	0.00	248	1.12	2.87	3.22
McNeely Avenue	316	317	53			53	133	380	1.72	0	0	0.00	380	1.72	2.82	4.86
McNeely Avenue	317	318	36			36	90	470	2.13	0	0	0.00	470	2.13	2.79	5.96
McNeely Avenue	318	319	20			20	50	520	2.36	0	0	0.00	520	2.36	2.78	6.56
McNeely Avenue	319	320	5			5	13	533	2.42	0	0	0.00	533	2.42	2.78	6.71
McNeely Avenue	320	Pump Station	299			299	748	1,280	5.81	0	0	0.00	1,280	5.81	2.64	15.31
Patterson Crescent (Forcemain)	Pump Station	321	0			0	0	1,280	5.81	0	0	0.00	1,280	5.81	2.64	15.31
Patterson Crescent	321	322	179	2		181	453	1,733	7.86	658	658	2.98	2,390	10.84	2.51	27.27
Patterson Crescent	322	323	298	1		299	748	2,480	11.25	0	658	2.98	3,138	14.23	2.46	34.95
Patterson Crescent	323	324	1			1	3	2,483	11.26	0	658	2.98	3,140	14.25	2.46	34.98
Patterson Crescent	324	325	26		2	28	70	2,553	11.58	0	658	2.98	3,210	14.56	2.45	35.69
To WWTP	325	326				0	0	2,553	11.58	0	658	2.98	3,210	14.56	2.45	35.69
To WWTP	326	327				0	0	2,553	11.58	0	658	2.98	3,210	14.56	2.45	35.69
To WWTP	327	128				0	0	2,553	11.58	0	658	2.98	3,210	14.56	2.45	35.69

Flow Generation – ICI, Extraneous Flows; Pipe Conditions

Street/Location	From	To	Previous (2020) ICI Conditions: Previous ICI Sewage (L/s)	Cumulative Previous ICI Sewage (L/s)	Additional (2021) ICI Development: Additional IC Area (ha)	Additional IC Sewage (L/s)	Additional Ind. Area (ha)	Additional Ind. Sewage (L/s)	Total Additional ICI Area (ha)	Total Additional ICI Sewage (L/s)	Cumulative Additional ICI Area (ha)	Cumulative Additional ICI Sewage (L/s)	2021 ICI Contributions: Peaking Factor	Peak ICI Sewage (L/s)	Previous (2020) Extraneous Flows: Previous Drainage Area (ha)	Cumulative Previous Drainage Area (ha)	Previous Extraneous Flow (L/s)	Additional (2021) Extraneous Flows: Additional Drainage Area (ha)	Cumulative Additional Drainage Area (ha)	Additional Extraneous Flow (L/s)	2021 Extraneous Flow Contributions: Total Cumulative Drainage Area (ha)	Total Extraneous Flow (L/s)	Total Peak Flow (L/s)	Pipe Conditions – Pipe Capacity Utilization: Nominal Pipe Diameter (mm)	Actual Pipe Diameter (mm)	Slope (%)	Full Flow Velocity (m/s)	Full Flow Capacity (L/s)	Capacity Used (%)
Lake Avenue West	001	02A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.32	3.32	1.83	1.63	1.63	0.89	4.95	2.72	4.80	375	381	0.44%	1.06	121.33	4.0%
Lake Avenue West[6]	02A	002	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.32	1.83	0.00	1.63	0.89	4.95	2.72	4.80	375	381	0.42%	1.04	118.54	4.0%
Lake Avenue West	002	003	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	35.59	38.91	21.40	0.00	1.63	0.89	40.54	22.29	37.89	375	381	0.48%	1.11	126.72	29.9%
Lake Avenue West	003	004	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.77	40.68	22.37	0.00	1.63	0.89	42.31	23.27	39.11	375	381	0.45%	1.08	122.70	31.9%
Lake Avenue West	004	005	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.40	41.08	22.59	0.00	1.63	0.89	42.71	23.49	39.64	375	381	0.46%	1.09	124.06	31.9%
Lake Avenue West	005	006	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.51	45.59	25.07	0.00	1.63	0.89	47.22	25.97	43.17	375	381	0.42%	1.04	118.54	36.4%
Lake Avenue West	006	007	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.13	46.72	25.70	0.00	1.63	0.89	48.35	26.59	44.36	375	381	0.39%	1.00	114.23	38.8%
Lake Avenue West	007	008	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	33.14	79.86	43.92	0.00	1.63	0.89	81.49	44.82	71.30	375	381	0.57%	1.21	138.09	51.6%
Lake Avenue West	008	009	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.84	81.70	44.94	0.00	1.63	0.89	83.33	45.83	73.20	375	381	0.85%	1.48	168.64	43.4%
Lake Avenue West	009	010	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.49	87.19	47.96	0.00	1.63	0.89	88.82	48.85	78.46	375	381	0.62%	1.26	144.02	54.5%
Lake Avenue West	010	011	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.76	90.95	50.02	0.00	1.63	0.89	92.58	50.92	81.94	375	381	0.48%	1.11	126.72	64.7%
Lake Avenue West	011	012	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.69	92.64	50.95	0.00	1.63	0.89	94.27	51.85	83.33	375	381	1.82%	2.16	246.76	33.8%
Lake Avenue West	012	013	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	17.76	110.40	60.72	0.00	1.63	0.89	112.03	61.61	94.99	525	533	0.25%	1.00	224.33	42.3%
Lake Avenue West	013	014	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.73	111.13	61.12	0.00	1.63	0.89	112.76	62.02	95.60	600	610	0.12%	0.76	221.90	43.1%
Lake Avenue West	014	15B	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.10	113.23	62.28	0.00	1.63	0.89	114.86	63.17	97.19	600	610	0.12%	0.76	221.90	43.8%
Lake Avenue West[6]	15B	15A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	113.23	62.28	0.00	1.63	0.89	114.86	63.17	97.19	600	610	0.12%	0.76	221.90	43.8%
Lake Avenue West	15A	015	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.19	113.42	62.38	0.00	1.63	0.89	115.05	63.28	97.34	600	610	0.12%	0.76	221.90	43.9%
Lake Avenue West	015	016	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.95	114.37	62.90	0.00	1.63	0.89	116.00	63.80	98.24	600	610	0.12%	0.76	221.90	44.3%
Lake Avenue West	016	017	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.67	116.04	63.82	0.00	1.63	0.89	117.67	64.72	99.52	600	610	0.10%	0.69	202.56	49.1%
Lake Avenue West	017	018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.63	119.67	65.82	0.00	1.63	0.89	121.30	66.71	103.03	600	610	0.10%	0.69	202.56	50.9%
Lake Avenue West	018	019	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.21	119.88	65.93	0.00	1.63	0.89	121.51	66.83	103.22	600	610	0.12%	0.76	221.90	46.5%
Lake Avenue West	019	020	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.57	121.45	66.80	0.00	1.63	0.89	123.08	67.69	104.66	600	610	0.12%	0.76	221.90	47.2%
Lake Avenue West	020	021	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.28	121.73	66.95	0.00	1.63	0.89	123.36	67.85	104.92	600	610	0.06%	0.51	150.22	69.8%
Lake Avenue West	021	022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	12.30	134.03	73.72	0.00	1.63	0.89	135.66	74.61	115.20	600	610	0.12%	0.76	221.90	51.9%
Lorne Street	022	023	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.84	134.87	74.18	0.00	1.63	0.89	136.50	75.07	115.86	600	610	0.20%	0.98	286.47	40.4%
Lorne Street	023	024	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.65	135.52	74.54	0.00	1.63	0.89	137.15	75.43	116.52	600	610	0.20%	0.98	286.47	40.7%
Ball Park	024	120	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.71	141.23	77.68	0.00	1.63	0.89	142.86	78.57	121.59	600	610	0.47%	1.51	439.42	27.7%
High Street[3]	101	102A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	55.56	55.56	166.68	1.63	1.63	4.88	57.19	171.56	187.65	350	356	0.51%	1.09	108.67	172.7%
High Street[3]	102A	102	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	55.56	166.68	0.00	1.63	4.88	57.19	171.56	187.65	350	356	0.15%	0.59	58.94	318.4%
High Street[3]	102	103	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.67	62.23	186.69	0.00	1.63	4.88	63.86	191.57	211.20	350	356	0.17%	0.63	62.74	336.6%
High Street[3]	103	104	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	12.95	75.18	225.54	0.00	1.63	4.88	76.81	230.42	252.71	400	406	0.14%	0.63	81.29	310.9%
High Street[3]	104	105	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.53	76.71	230.13	0.00	1.63	4.88	78.34	235.01	260.67	400	406	0.14%	0.63	81.29	320.7%
High Street[3]	105	106	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.47	77.18	231.54	0.00	1.63	4.88	78.81	236.42	262.50	400	406	0.14%	0.63	81.29	322.9%
High Street[3]	106	107	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.48	77.66	232.98	0.00	1.63	4.88	79.29	237.86	264.07	400	406	0.13%	0.60	78.33	337.1%
High Street[3]	107	108	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.67	78.33	234.98	0.00	1.63	4.88	79.95	239.86	266.29	400	406	0.15%	0.65	84.15	316.5%
Bridge Street	108	109	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	35.48	113.81	254.50	0.00	1.63	4.88	115.44	259.37	296.47	450	457	0.35%	1.07	175.96	168.5%
Bridge Street	109	110	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.18	113.99	254.60	0.00	1.63	4.88	115.62	259.47	296.82	450	457	0.31%	1.01	165.60	179.2%
Bridge Street	110	111	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.26	114.25	254.74	0.00	1.63	4.88	115.88	259.61	297.01	450	457	0.45%	1.22	199.52	148.9%
Bridge Street	111	112	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	114.25	254.74	0.00	1.63	4.88	115.88	259.61	297.01	450	457	1.44%	2.17	356.92	83.2%
Mill Street	112	113	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	16.75	131.00	263.95	0.00	1.63	4.88	132.63	268.83	310.76	600	610	0.30%	1.20	350.85	88.6%
Beckwith Street	113	114	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.98	131.98	264.49	0.00	1.63	4.88	133.61	269.37	311.59	600	610	0.20%	0.98	286.47	108.8%
Franklin Street	114	115	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.72	133.70	265.44	0.00	1.63	4.88	135.33	270.31	312.91	600	610	0.23%	1.05	307.20	101.9%
Franklin Street	115	115A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.74	138.44	268.04	0.00	1.63	4.88	140.07	272.92	316.72	600	610	0.28%	1.16	338.95	93.4%
Franklin Street	115A	116	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.54	138.98	268.34	0.00	1.63	4.88	140.61	273.22	317.07	600	610	0.31%	1.22	356.65	88.9%
Franklin Street	116	117	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.12	139.10	268.41	0.00	1.63	4.88	140.73	273.28	317.13	600	610	0.18%	0.93	271.77	116.7%
Franklin Street[5]	117	118	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.57	139.67	268.72	0.00	1.63	4.88	141.30	273.60	317.64	584	593	0.26%	1.10	303.91	104.5%
To WWTP	118	119	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	139.67	268.72	0.00	1.63	4.88	141.30	273.60	317.64	600	610	0.26%	1.12	326.62	97.3%
To WWTP	119	119A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	139.67	268.72	0.00	1.63	4.88	141.30	273.60	317.64	600	610	0.27%	1.14	332.84	95.4%
To WWTP[6]	119A	119B	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	139.67	268.72	0.00	1.63	4.88	141.30	273.60	317.64	600	610	0.27%	1.14	332.84	95.4%
To WWTP	119B	120	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	139.67	268.72	0.00	1.63	4.88	141.30	273.60	317.64	750	762	1.66%	3.28	1,496.38	21.2%
To WWTP	120	121	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	280.90	346.40	0.00	3.25	5.77	284.15	352.17	433.07	750	762	0.25%	1.27	580.71	74.6%
To WWTP	121	122	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	57.07	337.98	377.79	0.00	3.25	5.77	341.23	383.56	478.24	750	762	0.25%	1.27	580.71	82.4%
To WWTP	122	123	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	337.98	377.79	0.00	3.25	5.77	341.23	383.56	478.24	750	762	0.25%	1.27	580.71	82.4%
To WWTP	123	124	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	337.98	377.79	0.00	3.25	5.77	341.23	383.56	478.24	750	762	3.97%	5.07	2,314.10	20.7%
Industrial Avenue[6]	200	201	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.98	0.00	3.98	3.98	200	203	3.61%	2.00	65.01	6.1%
Industrial Avenue	201	202	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	31.82	31.82	17.50	0.00	0.00	0.00	31.82	17.50	22.76	200	203	0.27%	0.55	17.78	128.0%
Industrial Avenue	202	203	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	31.82	17.50	0.00	0.00	0.00	31.82	17.50	22.76	300	305	0.17%	0.57	41.59	54.7%
Mullett Street	203	204	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.14	32.96	18.13	0.00	0.00	0.00	32.96	18.13	23.72	300	305	0.22%	0.65	47.32	50.1%
Mullett Street	204	205	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.14	33.10	18.21	0.00	0.00	0.00	33.10	18.21	23.92	300	305	0.36%	0.83	60.53	39.5%
Mullett Street	205	206	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.80	37.90	20.85	0.00	0.00	0.00	37.90	20.85	28.48	300	305	0.77%	1.21	88.52	32.2%
Mullett Street	206	207	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.84	42.74	23.51	0.00	0.00	0.00	42.74	23.51	33.34	350	356	0.32%	0.87	86.08	38.7%
Mullett Street	207	208	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	42.74	23.51	0.00	0.00	0.00	42.74	23.51	33.34	350	356	0.72%	1.30	129.12	25.8%
Mullett Street	208	209	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.37	45.11	24.81	0.00	0.00	0.00	45.11	24.81	35.28	375	381	0.30%	0.88	100.18	35.2%
Mullett Street	209	210	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	45.11	24.81	0.00	0.00	0.00	45.11	24.81	35.28	375	381	0.30%	0.88	100.18	35.2%
Mullett Street	210	211A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.35	55.46	30.50	0.00	0.00	0.00	55.46	30.50	43.71	375	381	0.24%	0.79	89.61	48.8%
Mullett Street[6]	211A	211	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	55.46	30.50	0.00	0.00	0.00	55.46	30.50	43.71	375	381	0.26%	0.82	93.27	46.9%
Mullett Street	211	212	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.34	55.80	30.69	0.00	0.00	0.00	55.80	30.69	43.93	375	381	2.49%	2.53	288.63	15.2%
To WWTP	212	213	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	55.80	30.69	0.00	0.00	0.00	55.80	30.69	43.93	400	406	0.16%	0.67	86.90	50.5%
To WWTP	213	214	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	55.80	30.69	0.00	0.00	0.00	55.80	30.69	43.93	400	406	0.18%	0.71	92.18	47.7%
To WWTP	214	215	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	55.80	30.69	0.00	0.00	0.00	55.80	30.69	43.93	400	406	3.25%	3.02	391.67	11.2%
To WWTP	215	216	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	55.80	30.69	0.00	0.00	0.00	55.80	30.69	43.93	400	406	0.21%	0.77	99.56	44.1%
To WWTP	216	217	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.62	56.42	31.03	0.00	0.00	0.00	56.42	31.03	44.35	400	406	0.23%	0.80	104.20	42.6%
To WWTP	217	218	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	56.42	31.03	0.00	0.00	0.00	56.42	31.03	44.35	400	406	0.22%	0.79	101.90	43.5%
To WWTP	218	219	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.35	56.77	31.22	0.00	0.00	0.00	56.77	31.22	44.60	400	406	0.18%	0.71	92.18	48.4%
To WWTP - Siphon[1]	219	220	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	56.77	31.22	0.00	0.00	0.00	56.77	31.22	44.60	400	406	0.22%	0.79	101.90	43.8%
To WWTP - Siphon[1]	220	221	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	56.77	31.22	0.00	0.00	0.00	56.77	31.22	44.60	400	406	0.84%	1.54	199.12	22.4%
To WWTP - Siphon[1]	221	124	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	56.77	31.22	0.00	0.00	0.00	56.77	31.22	44.60	400	406	0.15%	0.65	84.15	53.0%
To WWTP	124	125	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	394.75	409.01	0.00	3.25	5.77	398.00	414.78	519.07	750	762	0.12%	0.88	402.33	129.0%
To WWTP	125	126	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	394.75	409.01	0.00	3.25	5.77	398.00	414.78	519.07	750	762	0.12%	0.88	402.33	129.0%
To WWTP	126	127	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	394.75	409.01	0.00	3.25	5.77	398.00	414.78	519.07	750	762	0.12%	0.88	402.33	129.0%
To WWTP	127	128	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	394.75	409.01	0.00	3.25	5.77	398.00	414.78	519.07	750	762	0.27%	1.32	603.49	86.0%
To WWTP	**128**	**WWTP**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	577.87	509.73	0.00	13.00	11.13	590.87	**520.86**	**652.22**	750	762	0.27%	1.32	603.49	108.1%
McNeely Avenue	301	302	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	50.25	50.25	27.64	0.00	0.00	0.00	50.25	27.64	28.68	300	305	0.25%	0.69	50.44	56.9%
McNeely Avenue	302	303	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.92	51.17	28.14	0.00	0.00	0.00	51.17	28.14	29.28	450	457	0.14%	0.68	111.29	26.3%
McNeely Avenue	303	304	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.87	52.04	28.62	0.00	0.00	0.00	52.04	28.62	29.86	450	457	0.10%	0.57	94.06	31.7%
McNeely Avenue	304	305	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.85	52.89	29.09	0.00	0.00	0.00	52.89	29.09	30.43	450	457	0.12%	0.63	103.03	29.5%
McNeely Avenue	305	306	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.88	53.77	29.57	0.00	0.00	0.00	53.77	29.57	31.01	450	457	0.05%	0.41	66.51	46.6%
McNeely Avenue	306	307	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.89	54.66	30.06	0.00	0.00	0.00	54.66	30.06	31.59	450	457	0.04%	0.36	59.49	53.1%
McNeely Avenue	307	308	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.08	55.74	30.66	0.00	0.00	0.00	55.74	30.66	32.32	450	457	0.13%	0.65	107.24	30.1%
McNeely Avenue	308	309	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.03	56.77	31.22	0.00	0.00	0.00	56.77	31.22	33.08	450	457	0.11%	0.60	98.65	33.5%
McNeely Avenue	309	310	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.77	58.54	32.20	0.00	0.00	0.00	58.54	32.20	34.28	450	457	0.08%	0.51	84.13	40.7%
McNeely Avenue	310	311	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.56	60.10	33.06	0.00	0.00	0.00	60.10	33.06	35.33	450	457	0.10%	0.57	94.06	37.6%
McNeely Avenue	311	312	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.98	61.08	33.59	0.00	0.00	0.00	61.08	33.59	36.02	450	457	0.06%	0.44	72.86	49.4%
McNeely Avenue	312	313	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.46	61.54	33.85	0.00	0.00	0.00	61.54	33.85	36.40	450	457	0.13%	0.65	107.24	33.9%
McNeely Avenue	313	314	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.00	63.54	34.95	0.00	0.00	0.00	63.54	34.95	37.79	450	457	0.12%	0.63	103.03	36.7%
McNeely Avenue	314	315	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.36	63.90	35.15	0.00	0.00	0.00	63.90	35.15	38.11	300	305	0.41%	0.89	64.60	59.0%
McNeely Avenue	315	316	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.51	64.41	35.43	0.00	0.00	0.00	64.41	35.43	38.65	300	305	0.41%	0.89	64.60	59.8%
McNeely Avenue	316	317	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.42	67.83	37.31	0.00	0.00	0.00	67.83	37.31	42.17	300	305	0.21%	0.63	46.23	91.2%
McNeely Avenue	317	318	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.22	70.05	38.53	0.00	0.00	0.00	70.05	38.53	44.48	300	305	0.23%	0.66	48.38	91.9%
McNeely Avenue	318	319	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.82	70.87	38.98	0.00	0.00	0.00	70.87	38.98	45.54	300	305	0.27%	0.72	52.42	86.9%
McNeely Avenue	319	320	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.32	71.19	39.15	0.00	0.00	0.00	71.19	39.15	45.86	300	305	0.50%	0.98	71.33	64.3%
McNeely Avenue	320	Pump Station	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	26.50	97.69	53.73	0.00	0.00	0.00	97.69	53.73	69.05	300	305	0.50%	0.98	71.33	96.8%
Patterson Crescent (Forcemain)	Pump Station	321	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	97.69	53.73	0.00	0.00	0.00	97.69	53.73	69.05						
Patterson Crescent	321	322	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	65.29	162.99	89.64	9.75	9.75	5.36	172.74	95.01	122.27	500	508	0.20%	0.87	176.17	69.4%
Patterson Crescent	322	323	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	14.38	177.36	97.55	0.00	9.75	5.36	187.11	102.91	137.87	500	508	0.20%	0.87	176.17	78.3%
Patterson Crescent	323	324	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.23	177.59	97.68	0.00	9.75	5.36	187.34	103.04	138.02	500	508	0.20%	0.87	176.17	78.3%
Patterson Crescent	324	325	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.53	183.12	100.72	0.00	9.75	5.36	192.87	106.08	141.77	500	508	0.20%	0.87	176.17	80.5%
To WWTP	325	326	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	183.12	100.72	0.00	9.75	5.36	192.87	106.08	141.77	500	508	0.20%	0.87	176.17	80.5%
To WWTP	326	327	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	183.12	100.72	0.00	9.75	5.36	192.87	106.08	141.77	500	508	0.20%	0.87	176.17	80.5%
To WWTP	327	128	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	183.12	100.72	0.00	9.75	5.36	192.87	106.08	141.77	500	508	0.20%	0.87	176.17	80.5%

Stantec

163401646 - Town of Carleton Place W/WW Master Plan

Table D-7: Sanitary Sewer Calculation Spreadsheet - 2026 Design Event

Date: 8/19/2021
Prepared by: CR
Checked by: AL

Legend
Manual Input/Modification
Calculated/Extracted Value for Existing + Additional Development
Existing Conditions - 2021
Additional Development
Full Flow Velocity < 0.6 m/s
Sewer Capacity Used > 100%; Sewer Velocity > 3 m/s
WWTP Inflow Point

Modelling Parameters - 2026 Design Event		
Horizon:	2026	
Scenario:	Design	
Existing Conditions - 2021		
Average Residential Flow Rate - q =	392	l/cap/day
Peak Extraneous Flow Rate - i =	0.33	l/s/ha
Peak Extraneous Flow Rate (Monitor No. 6)(3) - i =	0.33	l/s/ha
Existing Conditions Population Density =	2.5	PPU
Harmon Peaking Factor Correction Factor - K =	0.80	-
Growth Developments - 2026		
Average Residential Flow Rate - q =	280	l/cap/day
Peak Extraneous Flow Rate - i =	0.33	l/s/ha
Peak Extraneous Flow Rate (Monitor No. 6)(3) - i =	0.33	l/s/ha
Harmon Peaking Factor Correction Factor - K =	0.80	-
Insitutional/Commercial Average Flow Rate - q =	28,000	l/ha/day
Institutional/Commercial (IC) Peaking Factor (ICI Cont. > 20%) =	1.50	-
Institutional/Commercial (IC) Peaking Factor (ICI Cont. ≤ 20%) =	1.00	-
Light Industrial Average Flow Rate - q =	35,000	l/ha/day
Light Industrial Peaking Factor (ICI Cont. > 20%) =	1.50	-
Light Industrial Peaking Factor (ICI Cont. ≤ 20%) =	1.00	-
Manning's Coefficient - n =	0.013	

Note: Values as per ***Design Basis Memo*** *(July 12, 2021)*

Summary - 2026 Design Event		
2021 Residential Population	13,403	ppl
2021 ICI Equivalent Population	468	ppl
2021 Total Residential + ICI Equivalent Population	13,870	ppl
2026 Additional Residential Population	3,658	ppl
2026 Total Residential Population	17,061	ppl
2026 Total Residential + ICI Equivalent Population	17,528	ppl
2026 Additional Residential Area	55	ha
2026 Additional ICI Area	7	ha
2026 Total Area	653	ha
Average DWF (Residential + ICI)	6,692	m^3/d
Peak DWF (Residential + ICI)	15,532	m^3/d
Peak Extraneous Flow	18,632	m^3/d
Peak Total Flow	34,164	m^3/d
Number of Sewers Surcharged	0	
Average Sewer Capacity Used	42.5%	
Max Sewer Capacity Used	95.0%	
Mississippi Quays PS Peak Inflow	53.0	L/s

Notes

(1) McArthur Island siphon represented by sewer section from MH219 to MH124, as a single 400 mm diameter gravity pipe at 0.84% slope, as per original spreadsheet (JLR, 2021). Based on drawings, siphon consists of two barrels (150 mm and 300 mm); representation of siphon would require adjustments for HGL calculations.
(2) Mississippi Quays PS modelled at the end of McNeely Avenue (from MH320 to Pump Station); no gravity flow calculated through forcemain on Patterson Crescent (from Pump Station to MH321, assumed without restrictions).
(3) Extraneous flows calculated using 0.33 L/s/ha for drainage areas tributary to flow monitor No. 6.
(4) Diameters and slopes confirmed or corrected based on comparison of original spreadsheet to information provided by the Town on 20210712; see detailed comparison in Table D-1: Comparison of Diameters and Slopes from Different Sources.
(5) Based on information provided by the Town on 20210712, sewer along Franklin St between MH117 and MH118 appears to first be a ~38 m long 600 mm single sewer, followed by a ~52 m long section of twin 450 mm sewers; equivalent diameter to twin 450 mm retained, as it is more conservative.
(6) Sewer section added to spreadsheet to match Town's GIS data.

Level of Service Limits		
Maximum Velocity	3	m/s
Actual Flow/Full Flow Capacity	100%	

Flow Generation — Residential

Street/Location	Maintenance Hole From	Maintenance Hole To	Existing (2021) Residential Conditions: Number of Units — Residential Units	Commercial Units	Institutional Units	Total Units	Existing Population	Cumulative Existing Population	Existing Residential Sewage Flow (L/s)	Additional (2026) Residential Development: Additional Population	Cumulative Additional Population	Additional Residential Sewage Flow (L/s)	2026 Residential Contributions: Total Cumulative Residential Population	Total Residential Sewage Flow (L/s)	Harmon Peaking Factor	Peak Residential Sewage Flow (L/s)	Existing (2021) ICI Conditions: Existing ICI Sewage (L/s)	Cumulative Existing ICI Sewage (L/s)
Lake Avenue West	001	02A	62		1	63	158	158	0.71	848	848	2.75	1,006	3.46	3.24	11.21	0.00	0.00
Lake Avenue West(6)	02A	002					0	158	0.71	0	848	2.75	1,006	3.46	3.24	11.21	0.00	0.00
Lake Avenue West	002	003	459			459	1,148	1,305	5.92	0	848	2.75	2,153	8.67	3.05	26.43	0.00	0.00
Lake Avenue West	003	004	9			9	23	1,328	6.02	0	848	2.75	2,176	8.77	3.05	26.71	0.00	0.00
Lake Avenue West	004	005	11			11	28	1,355	6.15	0	848	2.75	2,203	8.90	3.04	27.06	0.00	0.00
Lake Avenue West	005	006	37		1	38	95	1,450	6.58	0	848	2.75	2,298	9.33	3.03	28.26	0.00	0.00
Lake Avenue West	006	007	21			21	53	1,503	6.82	0	848	2.75	2,351	9.57	3.02	28.93	0.00	0.00
Lake Avenue West	007	008	325			325	813	2,315	10.50	69	917	2.97	3,232	13.48	2.93	39.51	0.00	0.00
Lake Avenue West	008	009	34			34	85	2,400	10.89	0	917	2.97	3,317	13.86	2.92	40.53	0.00	0.00
Lake Avenue West	009	010	86			86	215	2,615	11.86	0	917	2.97	3,532	14.84	2.90	43.10	0.00	0.00
Lake Avenue West	010	011	54	1		55	138	2,753	12.49	0	917	2.97	3,670	15.46	2.89	44.73	0.00	0.00
Lake Avenue West	011	012	18			18	45	2,798	12.69	0	917	2.97	3,715	15.66	2.89	45.26	0.00	0.00
Lake Avenue West	012	013	70	4		74	185	2,983	13.53	1	918	2.98	3,901	16.51	2.87	47.45	0.00	0.00
Lake Avenue West	013	014	7	1		8	20	3,003	13.62	24	942	3.05	3,945	16.68	2.87	47.87	0.00	0.00
Lake Avenue West	014	15B	15	2		17	43	3,045	13.82	0	942	3.05	3,987	16.87	2.87	48.37	0.00	0.00
Lake Avenue West(6)	15B	15A					0	3,045	13.82	0	942	3.05	3,987	16.87	2.87	48.37	0.00	0.00
Lake Avenue West	15A	015	1	1		2	5	3,050	13.84	0	942	3.05	3,992	16.89	2.87	48.43	0.00	0.00
Lake Avenue West	015	016	15			15	38	3,088	14.01	0	942	3.05	4,030	17.06	2.86	48.87	0.00	0.00
Lake Avenue West	016	017	12	2		14	35	3,123	14.17	0	942	3.05	4,065	17.22	2.86	49.28	0.00	0.00
Lake Avenue West	017	018	60			60	150	3,273	14.85	0	942	3.05	4,215	17.90	2.85	51.02	0.00	0.00
Lake Avenue West	018	019	3			3	8	3,280	14.88	0	942	3.05	4,222	17.93	2.85	51.11	0.00	0.00
Lake Avenue West	019	020	23			23	58	3,338	15.14	8	950	3.08	4,288	18.22	2.84	51.84	0.00	0.00
Lake Avenue West	020	021	4			4	10	3,348	15.19	0	950	3.08	4,298	18.27	2.84	51.95	0.00	0.00
Lake Avenue West	021	022	140		1	141	353	3,700	16.79	102	1,052	3.41	4,752	20.20	2.81	56.80	0.00	0.00
Lorne Street	022	023	8			8	20	3,720	16.88	0	1,052	3.41	4,772	20.29	2.81	57.03	0.00	0.00
Lorne Street	023	024	12			12	30	3,750	17.01	0	1,052	3.41	4,802	20.42	2.81	57.37	0.00	0.00
Ball Park	024	120	77	1		78	195	3,945	17.90	0	1,052	3.41	4,997	21.31	2.80	59.58	0.00	0.00
High Street(3)	101	102A	535	4	1	540	1,350	1,350	6.13	36	36	0.12	1,386	6.24	3.16	19.74	0.00	0.00
High Street(3)	102A	102	0			0	0	1,350	6.13	0	36	0.12	1,386	6.24	3.16	19.74	0.00	0.00
High Street(3)	102	103	129			129	323	1,673	7.59	0	36	0.12	1,709	7.70	3.11	23.97	0.00	0.00
High Street(3)	103	104	99			99	248	1,920	8.71	0	36	0.12	1,956	8.83	3.07	27.14	0.00	0.00
High Street(3)	104	105	125	2		127	318	2,238	10.15	0	36	0.12	2,274	10.27	3.03	31.15	0.00	0.00
High Street(3)	105	106	16			16	40	2,278	10.33	0	36	0.12	2,314	10.45	3.03	31.65	0.00	0.00
High Street(3)	106	107	5			5	13	2,290	10.39	33	69	0.22	2,359	10.61	3.02	32.09	0.00	0.00
High Street(3)	107	108	8			8	20	2,310	10.48	0	69	0.22	2,379	10.70	3.02	32.33	0.00	0.00
Bridge Street	108	109	415		1	416	1,040	3,350	15.20	0	69	0.22	3,419	15.42	2.91	44.95	0.00	0.00
Bridge Street	109	110	6	4		10	25	3,375	15.31	0	69	0.22	3,444	15.54	2.91	45.25	0.00	0.00
Bridge Street	110	111	2			2	5	3,380	15.34	0	69	0.22	3,449	15.56	2.91	45.31	0.00	0.00
Bridge Street	111	112	0			0	0	3,380	15.34	0	69	0.22	3,449	15.56	2.91	45.31	0.00	0.00
Mill Street	112	113	158	22	2	182	455	3,835	17.40	1	70	0.23	3,905	17.63	2.87	50.66	0.00	0.00
Beckwith Street	113	114	12			12	30	3,865	17.54	0	70	0.23	3,935	17.76	2.87	51.01	0.00	0.00
Franklin Street	114	115	10	5		15	38	3,903	17.71	0	70	0.23	3,973	17.93	2.87	51.45	0.00	0.00
Franklin Street	115	115A	42	7		49	123	4,025	18.26	0	70	0.23	4,095	18.49	2.86	52.86	0.00	0.00
Franklin Street	115A	116	2			2	5	4,030	18.28	0	70	0.23	4,100	18.51	2.86	52.92	0.00	0.00
Franklin Street	116	117	0			0	0	4,030	18.28	0	70	0.23	4,100	18.51	2.86	52.92	0.00	0.00
Franklin Street(5)	117	118	5	3		8	20	4,050	18.38	0	70	0.23	4,120	18.60	2.86	53.15	0.00	0.00
To WWTP	118	119	0			0	0	4,050	18.38	0	70	0.23	4,120	18.60	2.86	53.15	0.00	0.00
To WWTP	119	119A	0			0	0	4,050	18.38	0	70	0.23	4,120	18.60	2.86	53.15	0.00	0.00
To WWTP(6)	119A	119B					0	4,050	18.38	0	70	0.23	4,120	18.60	2.86	53.15	0.00	0.00
To WWTP	119B	120	0			0	0	4,050	18.38	0	70	0.23	4,120	18.60	2.86	53.15	0.00	0.00
To WWTP	120	121	0			0	0	7,995	36.27	0	1,122	3.64	9,117	39.91	2.60	103.59	0.00	0.00
To WWTP	121	122	610	12	1	623	1,558	9,553	43.34	61	1,183	3.83	10,736	47.17	2.54	119.78	0.00	0.00
To WWTP	122	123	0			0	0	9,553	43.34	0	1,183	3.83	10,736	47.17	2.54	119.78	0.00	0.00
To WWTP	123	124	0			0	0	9,553	43.34	0	1,183	3.83	10,736	47.17	2.54	119.78	0.00	0.00
Industrial Avenue(6)	200	201					0	0	0.00	0	0	0.00	0	0.00	3.80	0.00	0.00	0.00
Industrial Avenue	201	202	115	50		165	413	413	1.87	0	0	0.00	413	1.87	3.41	6.39	0.00	0.00
Industrial Avenue	202	203	0			0	0	413	1.87	0	0	0.00	413	1.87	3.41	6.39	0.00	0.00
Mullett Street	203	204	7	4		11	28	440	2.00	0	0	0.00	440	2.00	3.40	6.79	0.00	0.00
Mullett Street	204	205	4			4	10	450	2.04	0	0	0.00	450	2.04	3.40	6.94	0.00	0.00
Mullett Street	205	206	63	1		64	160	610	2.77	36	36	0.12	646	2.88	3.33	9.61	0.00	0.00
Mullett Street	206	207	75			75	188	798	3.62	0	36	0.12	834	3.73	3.28	12.25	0.00	0.00
Mullett Street	207	208	0			0	0	798	3.62	0	36	0.12	834	3.73	3.28	12.25	0.00	0.00
Mullett Street	208	209	17	5		22	55	853	3.87	61	97	0.31	950	4.18	3.25	13.60	0.00	0.00
Mullett Street	209	210	0			0	0	853	3.87	0	97	0.31	950	4.18	3.25	13.60	0.00	0.00
Mullett Street	210	211A	91	5		96	240	1,093	4.96	10	107	0.35	1,200	5.30	3.20	16.96	0.00	0.00
Mullett Street(6)	211A	211					0	1,093	4.96	0	107	0.35	1,200	5.30	3.20	16.96	0.00	0.00
Mullett Street	211	212	1			1	3	1,095	4.97	0	107	0.35	1,202	5.31	3.20	16.99	0.00	0.00
To WWTP	212	213	0			0	0	1,095	4.97	0	107	0.35	1,202	5.31	3.20	16.99	0.00	0.00
To WWTP	213	214	0			0	0	1,095	4.97	0	107	0.35	1,202	5.31	3.20	16.99	0.00	0.00
To WWTP	214	215	0			0	0	1,095	4.97	703	810	2.63	1,905	7.59	3.08	23.40	0.00	0.00
To WWTP	215	216	0			0	0	1,095	4.97	0	810	2.63	1,905	7.59	3.08	23.40	0.00	0.00
To WWTP	216	217	2		1	3	8	1,103	5.00	0	810	2.63	1,913	7.63	3.08	23.50	0.00	0.00
To WWTP	217	218	0			0	0	1,103	5.00	0	810	2.63	1,913	7.63	3.08	23.50	0.00	0.00
To WWTP	218	219	1		1	2	5	1,108	5.02	0	810	2.63	1,918	7.65	3.08	23.56	0.00	0.00
To WWTP - Siphon (1)	219	220	0			0	0	1,108	5.02	0	810	2.63	1,918	7.65	3.08	23.56	0.00	0.00
To WWTP - Siphon (1)	220	221	0			0	0	1,108	5.02	0	810	2.63	1,918	7.65	3.08	23.56	0.00	0.00
To WWTP - Siphon (1)	221	124	0			0	0	1,108	5.02	0	810	2.63	1,918	7.65	3.08	23.56	0.00	0.00
To WWTP	124	125	0			0	0	10,660	48.36	0	1,993	6.46	12,653	54.82	2.48	136.07	0.00	0.00
To WWTP	125	126	0			0	0	10,660	48.36	0	1,993	6.46	12,653	54.82	2.48	136.07	0.00	0.00
To WWTP	126	127	0			0	0	10,660	48.36	0	1,993	6.46	12,653	54.82	2.48	136.07	0.00	0.00
To WWTP	127	128	0			0	0	10,660	48.36	0	1,993	6.46	12,653	54.82	2.48	136.07	0.00	0.00
To WWTP	**128**	**WWTP**	0			0	0	13,870	62.93	0	3,658	11.85	17,528	74.78	2.37	**177.09**	0.00	0.00
McNeely Avenue	301	302	0	31		31	78	78	0.35	0	0	0.00	78	0.35	3.62	1.27	0.00	0.00
McNeely Avenue	302	303	3			3	8	85	0.39	0	0	0.00	85	0.39	3.61	1.39	0.00	0.00
McNeely Avenue	303	304	3			3	8	93	0.42	0	0	0.00	93	0.42	3.60	1.51	0.00	0.00
McNeely Avenue	304	305	3			3	8	100	0.45	0	0	0.00	100	0.45	3.59	1.63	0.00	0.00
McNeely Avenue	305	306	3			3	8	108	0.49	0	0	0.00	108	0.49	3.59	1.75	0.00	0.00
McNeely Avenue	306	307	3			3	8	115	0.52	0	0	0.00	115	0.52	3.58	1.87	0.00	0.00
McNeely Avenue	307	308	4			4	10	125	0.57	0	0	0.00	125	0.57	3.57	2.03	0.00	0.00
McNeely Avenue	308	309	4	2		6	15	140	0.64	0	0	0.00	140	0.64	3.56	2.26	0.00	0.00
McNeely Avenue	309	310	6	1		7	18	158	0.71	0	0	0.00	158	0.71	3.55	2.53	0.00	0.00
McNeely Avenue	310	311	6			6	15	173	0.78	0	0	0.00	173	0.78	3.54	2.77	0.00	0.00
McNeely Avenue	311	312	4	1		5	13	185	0.84	0	0	0.00	185	0.84	3.53	2.96	0.00	0.00
McNeely Avenue	312	313	4			4	10	195	0.88	152	152	0.49	347	1.38	3.44	4.74	0.00	0.00
McNeely Avenue	313	314	8	1		9	23	218	0.99	0	152	0.49	370	1.48	3.43	5.08	0.00	0.00
McNeely Avenue	314	315	4			4	10	228	1.03	0	152	0.49	380	1.52	3.43	5.22	0.00	0.00
McNeely Avenue	315	316	8			8	20	248	1.12	0	152	0.49	400	1.62	3.42	5.52	0.00	0.00
McNeely Avenue	316	317	53			53	133	380	1.72	13	165	0.53	545	2.26	3.36	7.60	0.00	0.00
McNeely Avenue	317	318	36			36	90	470	2.13	0	165	0.53	635	2.67	3.33	8.89	0.00	0.00
McNeely Avenue	318	319	20			20	50	520	2.36	0	165	0.53	685	2.89	3.32	9.61	0.00	0.00
McNeely Avenue	319	320	5			5	13	533	2.42	0	165	0.53	698	2.95	3.32	9.79	0.00	0.00
McNeely Avenue	320	Pump Station	299			299	748	1,280	5.81	0	165	0.53	1,445	6.34	3.15	20.00	0.00	0.00
Patterson Crescent (Forcemain)	Pump Station	321	0			0	0	1,280	5.81	0	165	0.53	1,445	6.34	3.15	20.00	0.00	0.00
Patterson Crescent	321	322	442	2		444	1,110	2,390	10.84	1,452	1,617	5.24	4,007	16.08	2.87	46.10	0.00	0.00
Patterson Crescent	322	323	298	1		299	748	3,138	14.23	48	1,665	5.40	4,803	19.63	2.81	55.14	0.00	0.00
Patterson Crescent	323	324	1			1	3	3,140	14.25	0	1,665	5.40	4,805	19.64	2.81	55.17	0.00	0.00
Patterson Crescent	324	325	26		2	28	70	3,210	14.56	0	1,665	5.40	4,875	19.96	2.80	55.97	0.00	0.00
To WWTP	325	326				0	0	3,210	14.56	0	1,665	5.40	4,875	19.96	2.80	55.97	0.00	0.00
To WWTP	326	327				0	0	3,210	14.56	0	1,665	5.40	4,875	19.96	2.80	55.97	0.00	0.00
To WWTP	327	128				0	0	3,210	14.56	0	1,665	5.40	4,875	19.96	2.80	55.97	0.00	0.00

Flow Generation — ICI and Extraneous Flows

Street/Location	From	To	Additional (2026) ICI Development: Additional IC Area (ha)	Additional IC Sewage (L/s)	Additional Ind. Area (ha)	Additional Ind. Sewage (L/s)	Total Additional ICI Area (ha)	Total Additional ICI Sewage (L/s)	Cumulative Additional ICI Area (ha)	Cumulative Additional ICI Sewage (L/s)	2026 ICI Contributions: Peaking Factor	Peak ICI Sewage (L/s)	Existing (2021) Extraneous Flows: Existing Drainage Area (ha)	Cumulative Existing Drainage Area (ha)	Existing Extraneous Flow (L/s)	Additional (2026) Extraneous Flows: Additional Drainage Area (ha)	Cumulative Additional Drainage Area (ha)	Additional Extraneous Flow (L/s)	2026 Extraneous Flow Contributions: Total Cumulative Drainage Area (ha)	Total Extraneous Flow (L/s)	Total Peak Flow (L/s)
Lake Avenue West	001	02A	0.10	0.03	0.10	0.04	0.21	0.08	0.21	0.08	1.00	0.08	4.95	4.95	1.63	15.38	15.38	5.08	20.33	6.71	18.00
Lake Avenue West(6)	02A	002	0.00	0.00	0.00	0.00	0.00	0.00	0.21	0.08	1.00	0.08	0.00	4.95	1.63	0.00	15.38	5.08	20.33	6.71	18.00
Lake Avenue West	002	003	0.00	0.00	0.00	0.00	0.00	0.00	0.21	0.08	1.00	0.08	35.59	40.54	13.38	0.00	15.38	5.08	55.92	18.45	44.96
Lake Avenue West	003	004	0.00	0.00	0.00	0.00	0.00	0.00	0.21	0.08	1.00	0.08	1.77	42.31	13.96	0.00	15.38	5.08	57.69	19.04	45.83
Lake Avenue West	004	005	0.43	0.14	0.43	0.17	0.86	0.31	1.07	0.39	1.00	0.39	0.40	42.71	14.09	0.00	15.38	5.08	58.09	19.17	46.62
Lake Avenue West	005	006	0.00	0.00	0.00	0.00	0.00	0.00	1.07	0.39	1.00	0.39	4.51	47.22	15.58	0.00	15.38	5.08	62.60	20.66	49.31
Lake Avenue West	006	007	0.00	0.00	0.00	0.00	0.00	0.00	1.07	0.39	1.00	0.39	1.13	48.35	15.95	0.00	15.38	5.08	63.73	21.03	50.35
Lake Avenue West	007	008	0.03	0.01	0.03	0.01	0.06	0.02	1.13	0.41	1.00	0.41	33.14	81.49	26.89	0.88	16.26	5.36	97.74	32.25	72.17
Lake Avenue West	008	009	0.00	0.00	0.00	0.00	0.00	0.00	1.13	0.41	1.00	0.41	1.84	83.33	27.50	0.00	16.26	5.36	99.58	32.86	73.80
Lake Avenue West	009	010	0.00	0.00	0.00	0.00	0.00	0.00	1.13	0.41	1.00	0.41	5.49	88.82	29.31	0.00	16.26	5.36	105.07	34.67	78.18
Lake Avenue West	010	011	0.00	0.00	0.00	0.00	0.00	0.00	1.13	0.41	1.00	0.41	3.76	92.58	30.55	0.00	16.26	5.36	108.83	35.91	81.06
Lake Avenue West	011	012	0.00	0.00	0.00	0.00	0.00	0.00	1.13	0.41	1.00	0.41	1.69	94.27	31.11	0.00	16.26	5.36	110.52	36.47	82.15
Lake Avenue West	012	013	0.00	0.00	0.00	0.00	0.00	0.00	1.13	0.41	1.00	0.41	17.76	112.03	36.97	0.01	16.27	5.37	128.29	42.34	90.20
Lake Avenue West	013	014	0.43	0.14	0.43	0.17	0.86	0.31	2.00	0.73	1.00	0.73	0.73	112.76	37.21	0.15	16.42	5.42	129.17	42.63	91.23
Lake Avenue West	014	15B	0.00	0.00	0.00	0.00	0.00	0.00	2.00	0.73	1.00	0.73	2.10	114.86	37.90	0.00	16.42	5.42	131.27	43.32	92.42
Lake Avenue West(6)	15B	15A	0.00	0.00	0.00	0.00	0.00	0.00	2.00	0.73	1.00	0.73	0.00	114.86	37.90	0.00	16.42	5.42	131.27	43.32	92.42
Lake Avenue West	15A	015	0.00	0.00	0.00	0.00	0.00	0.00	2.00	0.73	1.00	0.73	0.19	115.05	37.97	0.00	16.42	5.42	131.46	43.38	92.54
Lake Avenue West	015	016	0.00	0.00	0.00	0.00	0.00	0.00	2.00	0.73	1.00	0.73	0.95	116.00	38.28	0.00	16.42	5.42	132.41	43.70	93.29
Lake Avenue West	016	017	0.00	0.00	0.00	0.00	0.00	0.00	2.00	0.73	1.00	0.73	1.67	117.67	38.83	0.00	16.42	5.42	134.08	44.25	94.25
Lake Avenue West	017	018	0.00	0.00	0.00	0.00	0.00	0.00	2.00	0.73	1.00	0.73	3.63	121.30	40.03	0.00	16.42	5.42	137.71	45.44	97.19
Lake Avenue West	018	019	0.00	0.00	0.00	0.00	0.00	0.00	2.00	0.73	1.00	0.73	0.21	121.51	40.10	0.00	16.42	5.42	137.92	45.51	97.35
Lake Avenue West	019	020	0.01	0.00	0.01	0.00	0.02	0.01	2.01	0.73	1.00	0.73	1.57	123.08	40.61	0.14	16.56	5.46	139.63	46.08	98.65
Lake Avenue West	020	021	0.00	0.00	0.00	0.00	0.00	0.00	2.01	0.73	1.00	0.73	0.28	123.36	40.71	0.00	16.56	5.46	139.91	46.17	98.86
Lake Avenue West	021	022	0.10	0.03	0.10	0.04	0.21	0.08	2.22	0.81	1.00	0.81	12.30	135.66	44.77	1.76	18.31	6.04	153.97	50.81	108.42
Lorne Street	022	023	0.00	0.00	0.00	0.00	0.00	0.00	2.22	0.81	1.00	0.81	0.84	136.50	45.04	0.00	18.31	6.04	154.81	51.09	108.92
Lorne Street	023	024	0.00	0.00	0.00	0.00	0.00	0.00	2.22	0.81	1.00	0.81	0.65	137.15	45.26	0.00	18.31	6.04	155.46	51.30	109.48
Ball Park	024	120	0.00	0.00	0.00	0.00	0.00	0.00	2.22	0.81	1.00	0.81	5.71	142.86	47.14	0.00	18.31	6.04	161.17	53.19	113.58
High Street(3)	101	102A	0.04	0.01	0.04	0.01	0.07	0.03	0.07	0.03	1.00	0.03	57.19	57.19	18.87	0.69	0.69	0.23	57.88	19.10	38.87
High Street(3)	102A	102	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.03	1.00	0.03	0.00	57.19	18.87	0.00	0.69	0.23	57.88	19.10	38.87
High Street(3)	102	103	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.03	1.00	0.03	6.67	63.86	21.07	0.00	0.69	0.23	64.55	21.30	45.29
High Street(3)	103	104	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.03	1.00	0.03	12.95	76.81	25.35	0.00	0.69	0.23	77.50	25.57	52.74
High Street(3)	104	105	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.03	1.00	0.03	1.53	78.34	25.85	0.00	0.69	0.23	79.03	26.08	57.25
High Street(3)	105	106	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.03	1.00	0.03	0.47	78.81	26.01	0.00	0.69	0.23	79.50	26.23	57.91
High Street(3)	106	107	0.03	0.01	0.03	0.01	0.07	0.02	0.14	0.05	1.00	0.05	0.48	79.29	26.16	0.53	1.22	0.40	80.50	26.57	58.70
High Street(3)	107	108	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.05	1.00	0.05	0.67	79.95	26.38	0.00	1.22	0.40	81.17	26.79	59.17
Bridge Street	108	109	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.05	1.00	0.05	35.48	115.44	38.09	0.00	1.22	0.40	116.65	38.49	83.50
Bridge Street	109	110	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.05	1.00	0.05	0.18	115.62	38.15	0.00	1.22	0.40	116.83	38.55	83.86
Bridge Street	110	111	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.05	1.00	0.05	0.26	115.88	38.24	0.00	1.22	0.40	117.09	38.64	84.00
Bridge Street	111	112	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.05	1.00	0.05	0.00	115.88	38.24	0.00	1.22	0.40	117.09	38.64	84.00
Mill Street	112	113	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.05	1.00	0.05	16.75	132.63	43.77	0.01	1.23	0.40	133.85	44.17	94.88
Beckwith Street	113	114	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.05	1.00	0.05	0.98	133.61	44.09	0.00	1.23	0.40	134.83	44.49	95.56
Franklin Street	114	115	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.05	1.00	0.05	1.72	135.33	44.66	0.00	1.23	0.40	136.55	45.06	96.56
Franklin Street	115	115A	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.05	1.00	0.05	4.74	140.07	46.22	0.00	1.23	0.40	141.29	46.63	99.54
Franklin Street	115A	116	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.05	1.00	0.05	0.54	140.61	46.40	0.00	1.23	0.40	141.83	46.80	99.78
Franklin Street	116	117	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.05	1.00	0.05	0.12	140.73	46.44	0.00	1.23	0.40	141.95	46.84	99.82
Franklin Street(5)	117	118	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.05	1.00	0.05	0.57	141.30	46.63	0.00	1.23	0.40	142.52	47.03	100.24
To WWTP	118	119	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.05	1.00	0.05	0.00	141.30	46.63	0.00	1.23	0.40	142.52	47.03	100.24
To WWTP	119	119A	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.05	1.00	0.05	0.00	141.30	46.63	0.00	1.23	0.40	142.52	47.03	100.24
To WWTP(6)	119A	119B	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.05	1.00	0.05	0.00	141.30	46.63	0.00	1.23	0.40	142.52	47.03	100.24
To WWTP	119B	120	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.05	1.00	0.05	0.00	141.30	46.63	0.00	1.23	0.40	142.52	47.03	100.24
To WWTP	120	121	0.00	0.00	0.00	0.00	0.00	0.00	2.36	0.86	1.00	0.86	0.00	284.15	93.77	0.00	19.54	6.45	303.69	100.22	204.67
To WWTP	121	122	0.06	0.02	0.06	0.02	0.12	0.04	2.48	0.91	1.00	0.91	57.07	341.23	112.60	1.15	20.69	6.83	361.91	119.43	240.12
To WWTP	122	123	0.00	0.00	0.00	0.00	0.00	0.00	2.48	0.91	1.00	0.91	0.00	341.23	112.60	0.00	20.69	6.83	361.91	119.43	240.12
To WWTP	123	124	0.00	0.00	0.00	0.00	0.00	0.00	2.48	0.91	1.00	0.91	0.00	341.23	112.60	0.00	20.69	6.83	361.91	119.43	240.12
Industrial Avenue(6)	200	201	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Industrial Avenue	201	202	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	31.82	31.82	10.50	0.00	0.00	0.00	31.82	10.50	16.89
Industrial Avenue	202	203	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	31.82	10.50	0.00	0.00	0.00	31.82	10.50	16.89
Mullett Street	203	204	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	1.14	32.96	10.88	0.00	0.00	0.00	32.96	10.88	17.67
Mullett Street	204	205	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.14	33.10	10.92	0.00	0.00	0.00	33.10	10.92	17.86
Mullett Street	205	206	0.04	0.01	0.04	0.01	0.07	0.03	0.07	0.03	1.00	0.03	4.80	37.90	12.51	0.69	0.69	0.23	38.59	12.73	22.37
Mullett Street	206	207	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.03	1.00	0.03	4.84	42.74	14.10	0.00	0.69	0.23	43.43	14.33	26.61
Mullett Street	207	208	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.03	1.00	0.03	0.00	42.74	14.10	0.00	0.69	0.23	43.43	14.33	26.61
Mullett Street	208	209	0.43	0.14	0.43	0.17	0.86	0.31	0.94	0.34	1.00	0.34	2.37	45.11	14.89	0.07	0.76	0.25	45.87	15.14	29.08
Mullett Street	209	210	0.00	0.00	0.00	0.00	0.00	0.00	0.94	0.34	1.00	0.34	0.00	45.11	14.89	0.00	0.76	0.25	45.87	15.14	29.08
Mullett Street	210	211A	0.01	0.00	0.01	0.00	0.02	0.01	0.96	0.35	1.00	0.35	10.35	55.46	18.30	0.15	0.91	0.30	56.37	18.60	35.91
Mullett Street(6)	211A	211	0.00	0.00	0.00	0.00	0.00	0.00	0.96	0.35	1.00	0.35	0.00	55.46	18.30	0.00	0.91	0.30	56.37	18.60	35.91
Mullett Street	211	212	0.00	0.00	0.00	0.00	0.00	0.00	0.96	0.35	1.00	0.35	0.34	55.80	18.41	0.00	0.91	0.30	56.71	18.71	36.06
To WWTP	212	213	0.00	0.00	0.00	0.00	0.00	0.00	0.96	0.35	1.00	0.35	0.00	55.80	18.41	0.00	0.91	0.30	56.71	18.71	36.06
To WWTP	213	214	0.00	0.00	0.00	0.00	0.00	0.00	0.96	0.35	1.00	0.35	0.00	55.80	18.41	0.00	0.91	0.30	56.71	18.71	36.06
To WWTP	214	215	0.43	0.14	0.43	0.17	0.86	0.31	1.82	0.66	1.00	0.66	0.00	55.80	18.41	2.50	3.41	1.12	59.21	19.54	43.60
To WWTP	215	216	0.00	0.00	0.00	0.00	0.00	0.00	1.82	0.66	1.00	0.66	0.00	55.80	18.41	0.00	3.41	1.12	59.21	19.54	43.60
To WWTP	216	217	0.00	0.00	0.00	0.00	0.00	0.00	1.82	0.66	1.00	0.66	0.62	56.42	18.62	0.00	3.41	1.12	59.83	19.74	43.90
To WWTP	217	218	0.00	0.00	0.00	0.00	0.00	0.00	1.82	0.66	1.00	0.66	0.00	56.42	18.62	0.00	3.41	1.12	59.83	19.74	43.90
To WWTP	218	219	0.00	0.00	0.00	0.00	0.00	0.00	1.82	0.66	1.00	0.66	0.35	56.77	18.73	0.00	3.41	1.12	60.18	19.86	44.08
To WWTP - Siphon (1)	219	220	0.00	0.00	0.00	0.00	0.00	0.00	1.82	0.66	1.00	0.66	0.00	56.77	18.73	0.00	3.41	1.12	60.18	19.86	44.08
To WWTP - Siphon (1)	220	221	0.00	0.00	0.00	0.00	0.00	0.00	1.82	0.66	1.00	0.66	0.00	56.77	18.73	0.00	3.41	1.12	60.18	19.86	44.08
To WWTP - Siphon (1)	221	124	0.00	0.00	0.00	0.00	0.00	0.00	1.82	0.66	1.00	0.66	0.00	56.77	18.73	0.00	3.41	1.12	60.18	19.86	44.08
To WWTP	124	125	0.00	0.00	0.00	0.00	0.00	0.00	4.30	1.57	1.00	1.57	0.00	398.00	131.34	0.00	24.09	7.95	422.09	139.29	276.93
To WWTP	125	126	0.00	0.00	0.00	0.00	0.00	0.00	4.30	1.57	1.00	1.57	0.00	398.00	131.34	0.00	24.09	7.95	422.09	139.29	276.93
To WWTP	126	127	0.00	0.00	0.00	0.00	0.00	0.00	4.30	1.57	1.00	1.57	0.00	398.00	131.34	0.00	24.09	7.95	422.09	139.29	276.93
To WWTP	127	128	0.00	0.00	0.00	0.00	0.00	0.00	4.30	1.57	1.00	1.57	0.00	398.00	131.34	0.00	24.09	7.95	422.09	139.29	276.93
To WWTP	**128**	**WWTP**	0.00	0.00	0.00	0.00	0.00	0.00	7.32	2.67	1.00	2.67	0.00	590.87	194.99	0.00	62.63	20.67	653.50	**215.65**	**395.42**
McNeely Avenue	301	302	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	50.25	50.25	16.58	0.00	0.00	0.00	50.25	16.58	17.85
McNeely Avenue	302	303	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.92	51.17	16.89	0.00	0.00	0.00	51.17	16.89	18.28
McNeely Avenue	303	304	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.87	52.04	17.17	0.00	0.00	0.00	52.04	17.17	18.68
McNeely Avenue	304	305	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.85	52.89	17.45	0.00	0.00	0.00	52.89	17.45	19.08
McNeely Avenue	305	306	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.88	53.77	17.74	0.00	0.00	0.00	53.77	17.74	19.49
McNeely Avenue	306	307	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.89	54.66	18.04	0.00	0.00	0.00	54.66	18.04	19.91
McNeely Avenue	307	308	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	1.08	55.74	18.39	0.00	0.00	0.00	55.74	18.39	20.42
McNeely Avenue	308	309	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	1.03	56.77	18.73	0.00	0.00	0.00	56.77	18.73	21.00
McNeely Avenue	309	310	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	1.77	58.54	19.32	0.00	0.00	0.00	58.54	19.32	21.85
McNeely Avenue	310	311	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	1.56	60.10	19.83	0.00	0.00	0.00	60.10	19.83	22.60
McNeely Avenue	311	312	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.98	61.08	20.16	0.00	0.00	0.00	61.08	20.16	23.12
McNeely Avenue	312	313	0.43	0.14	0.43	0.17	0.86	0.31	0.86	0.31	1.00	0.31	0.46	61.54	20.31	1.20	1.20	0.40	62.74	20.70	25.76
McNeely Avenue	313	314	0.00	0.00	0.00	0.00	0.00	0.00	0.86	0.31	1.00	0.31	2.00	63.54	20.97	0.00	1.20	0.40	64.74	21.36	26.75
McNeely Avenue	314	315	0.00	0.00	0.00	0.00	0.00	0.00	0.86	0.31	1.00	0.31	0.36	63.90	21.09	0.00	1.20	0.40	65.10	21.48	27.02
McNeely Avenue	315	316	0.00	0.00	0.00	0.00	0.00	0.00	0.86	0.31	1.00	0.31	0.51	64.41	21.26	0.00	1.20	0.40	65.61	21.65	27.49
McNeely Avenue	316	317	0.01	0.00	0.01	0.01	0.03	0.01	0.89	0.32	1.00	0.32	3.42	67.83	22.38	0.24	1.44	0.48	69.27	22.86	30.78
McNeely Avenue	317	318	0.00	0.00	0.00	0.00	0.00	0.00	0.89	0.32	1.00	0.32	2.22	70.05	23.12	0.00	1.44	0.48	71.49	23.59	32.81
McNeely Avenue	318	319	0.00	0.00	0.00	0.00	0.00	0.00	0.89	0.32	1.00	0.32	0.82	70.87	23.39	0.00	1.44	0.48	72.31	23.86	33.80
McNeely Avenue	319	320	0.00	0.00	0.00	0.00	0.00	0.00	0.89	0.32	1.00	0.32	0.32	71.19	23.49	0.00	1.44	0.48	72.63	23.97	34.08
McNeely Avenue	320	Pump Station	0.00	0.00	0.00	0.00	0.00	0.00	0.89	0.32	1.00	0.32	26.50	97.69	32.24	0.00	1.44	0.48	99.14	32.71	53.04
Patterson Crescent (Forcemain)	Pump Station	321	0.00	0.00	0.00	0.00	0.00	0.00	0.89	0.32	1.00	0.32	0.00	97.69	32.24	0.00	1.44	0.48	99.14	32.71	53.04
Patterson Crescent	321	322	1.02	0.33	1.02	0.41	2.03	0.74	2.92	1.07	1.00	1.07	75.04	172.74	57.00	36.18	37.63	12.42	210.36	69.42	116.58
Patterson Crescent	322	323	0.05	0.02	0.05	0.02	0.10	0.04	3.02	1.10	1.00	1.10	14.38	187.11	61.75	0.91	38.53	12.72	225.65	74.46	130.71
Patterson Crescent	323	324	0.00	0.00	0.00	0.00	0.00	0.00	3.02	1.10	1.00	1.10	0.23	187.34	61.82	0.00	38.53	12.72	225.88	74.54	130.81
Patterson Crescent	324	325	0.00	0.00	0.00	0.00	0.00	0.00	3.02	1.10	1.00	1.10	5.53	192.87	63.65	0.00	38.53	12.72	231.41	76.36	133.44
To WWTP	325	326	0.00	0.00	0.00	0.00	0.00	0.00	3.02	1.10	1.00	1.10	0.00	192.87	63.65	0.00	38.53	12.72	231.41	76.36	133.44
To WWTP	326	327	0.00	0.00	0.00	0.00	0.00	0.00	3.02	1.10	1.00	1.10	0.00	192.87	63.65	0.00	38.53	12.72	231.41	76.36	133.44
To WWTP	327	128	0.00	0.00	0.00	0.00	0.00	0.00	3.02	1.10	1.00	1.10	0.00	192.87	63.65	0.00	38.53	12.72	231.41	76.36	133.44

Pipe Conditions — Pipe Capacity Utilization

Street/Location	From	To	Nominal Pipe Diameter (mm)	Actual Pipe Diameter (mm)	Slope (%)	Full Flow Velocity (m/s)	Full Flow Capacity (L/s)	Capacity Used (%)
Lake Avenue West	001	02A	375	381	0.44%	1.06	121.33	14.8%
Lake Avenue West(6)	02A	002	375	381	0.42%	1.04	118.54	15.2%
Lake Avenue West	002	003	375	381	0.48%	1.11	126.72	35.5%
Lake Avenue West	003	004	375	381	0.45%	1.08	122.70	37.3%
Lake Avenue West	004	005	375	381	0.46%	1.09	124.06	37.6%
Lake Avenue West	005	006	375	381	0.42%	1.04	118.54	41.6%
Lake Avenue West	006	007	375	381	0.39%	1.00	114.23	44.1%
Lake Avenue West	007	008	375	381	0.57%	1.21	138.09	52.3%
Lake Avenue West	008	009	375	381	0.85%	1.48	168.64	43.8%
Lake Avenue West	009	010	375	381	0.62%	1.26	144.02	54.3%
Lake Avenue West	010	011	375	381	0.48%	1.11	126.72	64.0%
Lake Avenue West	011	012	375	381	1.82%	2.16	246.76	33.3%
Lake Avenue West	012	013	525	533	0.25%	1.00	224.33	40.2%
Lake Avenue West	013	014	600	610	0.12%	0.76	221.90	41.1%
Lake Avenue West	014	15B	600	610	0.12%	0.76	221.90	41.6%
Lake Avenue West(6)	15B	15A	600	610	0.12%	0.76	221.90	41.6%
Lake Avenue West	15A	015	600	610	0.12%	0.76	221.90	41.7%
Lake Avenue West	015	016	600	610	0.12%	0.76	221.90	42.0%
Lake Avenue West	016	017	600	610	0.10%	0.69	202.56	46.5%
Lake Avenue West	017	018	600	610	0.10%	0.69	202.56	48.0%
Lake Avenue West	018	019	600	610	0.12%	0.76	221.90	43.9%
Lake Avenue West	019	020	600	610	0.12%	0.76	221.90	44.5%
Lake Avenue West	020	021	600	610	0.06%	*0.51*	150.22	65.8%
Lake Avenue West	021	022	600	610	0.12%	0.76	221.90	48.9%
Lorne Street	022	023	600	610	0.20%	0.98	286.47	38.0%
Lorne Street	023	024	600	610	0.20%	0.98	286.47	38.2%
Ball Park	024	120	600	610	0.47%	1.51	439.42	25.8%
High Street(3)	101	102A	350	356	0.51%	1.09	108.67	35.8%
High Street(3)	102A	102	350	356	0.15%	*0.59*	58.94	66.0%
High Street(3)	102	103	350	356	0.17%	0.63	62.74	72.2%
High Street(3)	103	104	400	406	0.14%	0.63	81.29	64.9%
High Street(3)	104	105	400	406	0.14%	0.63	81.29	70.4%
High Street(3)	105	106	400	406	0.14%	0.63	81.29	71.2%
High Street(3)	106	107	400	406	0.13%	0.60	78.33	74.9%
High Street(3)	107	108	400	406	0.15%	0.65	84.15	70.3%
Bridge Street	108	109	450	457	0.35%	1.07	175.96	47.5%
Bridge Street	109	110	450	457	0.31%	1.01	165.60	50.6%
Bridge Street	110	111	450	457	0.45%	1.22	199.52	42.1%
Bridge Street	111	112	450	457	1.44%	2.17	356.92	23.5%
Mill Street	112	113	600	610	0.30%	1.20	350.85	27.0%
Beckwith Street	113	114	600	610	0.20%	0.98	286.47	33.4%
Franklin Street	114	115	600	610	0.23%	1.05	307.20	31.4%
Franklin Street	115	115A	600	610	0.28%	1.16	338.95	29.4%
Franklin Street	115A	116	600	610	0.31%	1.22	356.65	28.0%
Franklin Street	116	117	600	610	0.18%	0.93	271.77	36.7%
Franklin Street(5)	117	118	584	593	0.26%	1.10	303.91	33.0%
To WWTP	118	119	600	610	0.26%	1.12	326.62	30.7%
To WWTP	119	119A	600	610	0.27%	1.14	332.84	30.1%
To WWTP(6)	119A	119B	600	610	0.27%	1.14	332.84	30.1%
To WWTP	119B	120	750	762	1.66%	***3.28***	1,496.38	6.7%
To WWTP	120	121	750	762	0.25%	1.27	580.71	35.2%
To WWTP	121	122	750	762	0.25%	1.27	580.71	41.3%
To WWTP	122	123	750	762	0.25%	1.27	580.71	41.3%
To WWTP	123	124	750	762	3.97%	***5.07***	2,314.10	10.4%
Industrial Avenue(6)	200	201	200	203	3.61%	2.00	65.01	0.0%
Industrial Avenue	201	202	200	203	0.27%	*0.55*	17.78	95.0%
Industrial Avenue	202	203	300	305	0.17%	*0.57*	41.59	40.6%
Mullett Street	203	204	300	305	0.22%	0.65	47.32	37.3%
Mullett Street	204	205	300	305	0.36%	0.83	60.53	29.5%
Mullett Street	205	206	300	305	0.77%	1.21	88.52	25.3%
Mullett Street	206	207	350	356	0.32%	0.87	86.08	30.9%
Mullett Street	207	208	350	356	0.72%	1.30	129.12	20.6%
Mullett Street	208	209	375	381	0.30%	0.88	100.18	29.0%
Mullett Street	209	210	375	381	0.30%	0.88	100.18	29.0%
Mullett Street	210	211A	375	381	0.24%	0.79	89.61	40.1%
Mullett Street(6)	211A	211	375	381	0.26%	0.82	93.27	38.5%
Mullett Street	211	212	375	381	2.49%	2.53	288.63	12.5%
To WWTP	212	213	400	406	0.16%	0.67	86.90	41.5%
To WWTP	213	214	400	406	0.18%	0.71	92.18	39.1%
To WWTP	214	215	400	406	3.25%	***3.02***	391.67	11.1%
To WWTP	215	216	400	406	0.21%	0.77	99.56	43.8%
To WWTP	216	217	400	406	0.23%	0.80	104.20	42.1%
To WWTP	217	218	400	406	0.22%	0.79	101.90	43.1%
To WWTP	218	219	400	406	0.18%	0.71	92.18	47.8%
To WWTP - Siphon (1)	219	220	400	406	0.22%	0.79	101.90	43.3%
To WWTP - Siphon (1)	220	221	400	406	0.84%	1.54	199.12	22.1%
To WWTP - Siphon (1)	221	124	400	406	0.15%	0.65	84.15	52.4%
To WWTP	124	125	750	762	0.12%	0.88	402.33	68.8%
To WWTP	125	126	750	762	0.12%	0.88	402.33	68.8%
To WWTP	126	127	750	762	0.12%	0.88	402.33	68.8%
To WWTP	127	128	750	762	0.27%	1.32	603.49	45.9%
To WWTP	**128**	**WWTP**	750	762	0.27%	1.32	603.49	65.5%
McNeely Avenue	301	302	300	305	0.25%	0.69	50.44	35.4%
McNeely Avenue	302	303	450	457	0.14%	0.68	111.29	16.4%
McNeely Avenue	303	304	450	457	0.10%	*0.57*	94.06	19.9%
McNeely Avenue	304	305	450	457	0.12%	0.63	103.03	18.5%
McNeely Avenue	305	306	450	457	0.05%	*0.41*	66.51	29.3%
McNeely Avenue	306	307	450	457	0.04%	*0.36*	59.49	33.5%
McNeely Avenue	307	308	450	457	0.13%	0.65	107.24	19.0%
McNeely Avenue	308	309	450	457	0.11%	0.60	98.65	21.3%
McNeely Avenue	309	310	450	457	0.08%	*0.51*	84.13	26.0%
McNeely Avenue	310	311	450	457	0.10%	*0.57*	94.06	24.0%
McNeely Avenue	311	312	450	457	0.06%	*0.44*	72.86	31.7%
McNeely Avenue	312	313	450	457	0.13%	0.65	107.24	24.0%
McNeely Avenue	313	314	450	457	0.12%	0.63	103.03	26.0%
McNeely Avenue	314	315	300	305	0.41%	0.89	64.60	41.8%
McNeely Avenue	315	316	300	305	0.41%	0.89	64.60	42.6%
McNeely Avenue	316	317	300	305	0.21%	0.63	46.23	66.6%
McNeely Avenue	317	318	300	305	0.23%	0.66	48.38	67.8%
McNeely Avenue	318	319	300	305	0.27%	0.72	52.42	64.5%
McNeely Avenue	319	320	300	305	0.50%	0.98	71.33	47.8%
McNeely Avenue	320	Pump Station	300	305	0.50%	0.98	71.33	74.3%
Patterson Crescent (Forcemain)	Pump Station	321						
Patterson Crescent	321	322	500	508	0.20%	0.87	176.17	66.2%
Patterson Crescent	322	323	500	508	0.20%	0.87	176.17	74.2%
Patterson Crescent	323	324	500	508	0.20%	0.87	176.17	74.3%
Patterson Crescent	324	325	500	508	0.20%	0.87	176.17	75.7%
To WWTP	325	326	500	508	0.20%	0.87	176.17	75.7%
To WWTP	326	327	500	508	0.20%	0.87	176.17	75.7%
To WWTP	327	128	500	508	0.20%	0.87	176.17	75.7%

Stantec

163401646 - Town of Carleton Place W/WW Master Plan

Table D-8: Sanitary Sewer Calculation Spreadsheet - 2026 Annual Event

Date: 8/19/2021
Prepared by: CR
Checked by: AL

Legend
- Manual Input/Modification
- Calculated/Extracted Value for Existing + Additional Development
- Existing Conditions - 2021
- Additional Development
- Full Flow Velocity < 0.6 m/s
- Sewer Capacity Used > 100%; Sewer Velocity > 3 m/s
- WWTP Inflow Point

Modelling Parameters - 2026 Annual Event

Parameter	Value	Unit
Horizon:	2026	
Scenario:	Annual	
Existing Conditions - 2021		
Average Residential Flow Rate - q =	392	l/cap/day
Peak Extraneous Flow Rate - i =	0.30	l/s/ha
Peak Extraneous Flow Rate (Monitor No. 6)[3] - i =	0.40	l/s/ha
Existing Conditions Population Density =	2.5	PPU
Harmon Peaking Factor Correction Factor - K =	0.60	-
Growth Developments - 2026		
Average Residential Flow Rate - q =	200	l/cap/day
Peak Extraneous Flow Rate - i =	0.30	l/s/ha
Peak Extraneous Flow Rate (Monitor No. 6)[3] - i =	0.40	l/s/ha
Harmon Peaking Factor Correction Factor - K =	0.60	-
Institutional/Commercial Average Flow Rate - q =	17,000	l/ha/day
Institutional/Commercial (IC) Peaking Factor (ICI Cont. > 20%) =	1.00	-
Institutional/Commercial (IC) Peaking Factor (ICI Cont. ≤ 20%) =	1.00	-
Light Industrial Average Flow Rate - q =	10,000	l/ha/day
Light Industrial Peaking Factor (ICI Cont. > 20%) =	1.00	-
Light Industrial Peaking Factor (ICI Cont. ≤ 20%) =	1.00	-
Manning's Coefficient - n =	0.013	-

*Note: Values as per **Design Basis Memo** (July 12, 2021)*

Summary - 2026 Annual Event

Item	Value	Unit
2021 Residential Population	13,403	ppl
2021 ICI Equivalent Population	468	ppl
2021 Total Residential + ICI Equivalent Population	13,870	ppl
2026 Additional Residential Population	3,658	ppl
2026 Total Residential Population	17,061	ppl
2026 Total Residential + ICI Equivalent Population	17,528	ppl
2026 Additional Residential Area	55	ha
2026 Additional ICI Area	7	ha
2026 Total Area	653	ha
Average DWF (Residential + ICI)	6,268	m^3/d
Peak DWF (Residential + ICI)	12,597	m^3/d
Peak Extraneous Flow	17,640	m^3/d
Peak Total Flow	30,237	m^3/d
Number of Sewers Surcharged	0	
Average Sewer Capacity Used	37.6%	
Max Sewer Capacity Used	83.3%	
Mississippi Quays PS Peak Inflow	46.1	L/s

Notes

(1) McArthur Island siphon represented by sewer section from MH219 to MH124, as a single 400 mm diameter gravity pipe at 0.84% slope, as per original spreadsheet (JLR, 2021). Based on drawings, siphon consists of two barrels (150 mm and 300 mm); representation of siphon would require adjustments for HGL calculations.
(2) Mississippi Quays PS modelled at the end of McNeely Avenue (from MH320 to Pump Station); no gravity flow calculated through forcemain on Patterson Crescent (from Pump Station to MH321, assumed without restrictions).
(3) Extraneous flows calculated using 0.4 L/s/ha for drainage areas tributary to flow monitor No. 6.
(4) Diameters and slopes confirmed or corrected based on comparison of original spreadsheet to information provided by the Town on 20210712; see detailed comparison in Table D-1: Comparison of Diameters and Slopes from Different Sources.
(5) Based on information provided by the Town on 20210712, sewer along Franklin St between MH117 and MH118 appears to first be a ~38 m long 600 mm single sewer, followed by a ~52 m long section of twin 450 mm sewers; equivalent diameter to twin 450 mm retained, as it is more conservative.
(6) Sewer section added to spreadsheet to match Town's GIS data.

Level of Service Limits

Maximum Velocity	3	m/s
Actual Flow/Full Flow Capacity	100%	

Flow Generation — Residential and Existing ICI

Street/Location	Maintenance Hole From	Maintenance Hole To	Existing (2021) Residential Conditions: Residential Units	Commercial Units	Institutional Units	Total Units	Existing Population	Cumulative Existing Population	Existing Residential Sewage Flow (L/s)	Additional (2026) Residential Development: Additional Population	Cumulative Additional Population	Additional Residential Sewage Flow (L/s)	2026 Residential Contributions: Total Cumulative Residential Population	Total Residential Sewage Flow (L/s)	Harmon Peaking Factor	Peak Residential Sewage Flow (L/s)	Existing (2021) ICI Conditions: Existing ICI Sewage (L/s)	Cumulative Existing ICI Sewage (L/s)
Lake Avenue West	001	02A	62		1	63	158	158	0.71	848	848	1.96	1,006	2.68	2.68	7.17	0.00	0.00
Lake Avenue West[6]	02A	002					0	158	0.71	0	848	1.96	1,006	2.68	2.68	7.17	0.00	0.00
Lake Avenue West	002	003	459			459	1,148	1,305	5.92	0	848	1.96	2,153	7.88	2.54	20.00	0.00	0.00
Lake Avenue West	003	004	9			9	23	1,328	6.02	0	848	1.96	2,176	7.99	2.53	20.24	0.00	0.00
Lake Avenue West	004	005	11			11	28	1,355	6.15	0	848	1.96	2,203	8.11	2.53	20.53	0.00	0.00
Lake Avenue West	005	006	37		1	38	95	1,450	6.58	0	848	1.96	2,298	8.54	2.52	21.55	0.00	0.00
Lake Avenue West	006	007	21			21	53	1,503	6.82	0	848	1.96	2,351	8.78	2.52	22.11	0.00	0.00
Lake Avenue West	007	008	325			325	813	2,315	10.50	69	917	2.12	3,232	12.63	2.45	30.92	0.00	0.00
Lake Avenue West	008	009	34			34	85	2,400	10.89	0	917	2.12	3,317	13.01	2.44	31.79	0.00	0.00
Lake Avenue West	009	010	86			86	215	2,615	11.86	0	917	2.12	3,532	13.99	2.43	33.97	0.00	0.00
Lake Avenue West	010	011	54	1		55	138	2,753	12.49	0	917	2.12	3,670	14.61	2.42	35.36	0.00	0.00
Lake Avenue West	011	012	18			18	45	2,798	12.69	0	917	2.12	3,715	14.82	2.42	35.81	0.00	0.00
Lake Avenue West	012	013	70	4		74	185	2,983	13.53	1	918	2.13	3,901	15.66	2.41	37.67	0.00	0.00
Lake Avenue West	013	014	7	1		8	20	3,003	13.62	24	942	2.18	3,945	15.80	2.40	37.98	0.00	0.00
Lake Avenue West	014	15B	15	2		17	43	3,045	13.82	0	942	2.18	3,987	16.00	2.40	38.40	0.00	0.00
Lake Avenue West[6]	15B	15A					0	3,045	13.82	0	942	2.18	3,987	16.00	2.40	38.40	0.00	0.00
Lake Avenue West	15A	015	1	1		2	5	3,050	13.84	0	942	2.18	3,992	16.02	2.40	38.45	0.00	0.00
Lake Avenue West	015	016	15			15	38	3,088	14.01	0	942	2.18	4,030	16.19	2.40	38.83	0.00	0.00
Lake Avenue West	016	017	12	2		14	35	3,123	14.17	0	942	2.18	4,065	16.35	2.40	39.17	0.00	0.00
Lake Avenue West	017	018	60			60	150	3,273	14.85	0	942	2.18	4,215	17.03	2.39	40.66	0.00	0.00
Lake Avenue West	018	019	3			3	8	3,280	14.88	0	942	2.18	4,222	17.06	2.39	40.73	0.00	0.00
Lake Avenue West	019	020	23			23	58	3,338	15.14	8	950	2.20	4,288	17.34	2.38	41.34	0.00	0.00
Lake Avenue West	020	021	4			4	10	3,348	15.19	0	950	2.20	4,298	17.39	2.38	41.44	0.00	0.00
Lake Avenue West	021	022	140		1	141	353	3,700	16.79	102	1,052	2.44	4,752	19.22	2.36	45.35	0.00	0.00
Lorne Street	022	023	8			8	20	3,720	16.88	0	1,052	2.44	4,772	19.31	2.36	45.54	0.00	0.00
Lorne Street	023	024	12			12	30	3,750	17.01	0	1,052	2.44	4,802	19.45	2.36	45.84	0.00	0.00
Ball Park	024	120	77	1		78	195	3,945	17.90	0	1,052	2.44	4,997	20.33	2.35	47.73	0.00	0.00
High Street[3]	101	102A	535	4	1	540	1,350	1,350	6.13	36	36	0.08	1,386	6.21	2.62	16.28	0.00	0.00
High Street[3]	102A	102	0			0	0	1,350	6.13	0	36	0.08	1,386	6.21	2.62	16.28	0.00	0.00
High Street[3]	102	103	129			129	323	1,673	7.59	0	36	0.08	1,709	7.67	2.58	19.81	0.00	0.00
High Street[3]	103	104	99			99	248	1,920	8.71	0	36	0.08	1,956	8.79	2.56	22.48	0.00	0.00
High Street[3]	104	105	125	2		127	318	2,238	10.15	0	36	0.08	2,274	10.23	2.53	25.84	0.00	0.00
High Street[3]	105	106	16			16	40	2,278	10.33	0	36	0.08	2,314	10.42	2.52	26.26	0.00	0.00
High Street[3]	106	107	5			5	13	2,290	10.39	33	69	0.16	2,359	10.55	2.52	26.56	0.00	0.00
High Street[3]	107	108	8			8	20	2,310	10.48	0	69	0.16	2,379	10.64	2.52	26.77	0.00	0.00
Bridge Street	108	109	415		1	416	1,040	3,350	15.20	0	69	0.16	3,419	15.36	2.44	37.42	0.00	0.00
Bridge Street	109	110	6	4		10	25	3,375	15.31	0	69	0.16	3,444	15.47	2.43	37.67	0.00	0.00
Bridge Street	110	111	2			2	5	3,380	15.34	0	69	0.16	3,449	15.49	2.43	37.72	0.00	0.00
Bridge Street	111	112	0			0	0	3,380	15.34	0	69	0.16	3,449	15.49	2.43	37.72	0.00	0.00
Mill Street	112	113	158	22	2	182	455	3,835	17.40	1	70	0.16	3,905	17.56	2.41	42.25	0.00	0.00
Beckwith Street	113	114	12			12	30	3,865	17.54	0	70	0.16	3,935	17.70	2.40	42.54	0.00	0.00
Franklin Street	114	115	10	5		15	38	3,903	17.71	0	70	0.16	3,973	17.87	2.40	42.91	0.00	0.00
Franklin Street	115	115A	42	7		49	123	4,025	18.26	0	70	0.16	4,095	18.42	2.39	44.12	0.00	0.00
Franklin Street	115A	116	2			2	5	4,030	18.28	0	70	0.16	4,100	18.45	2.39	44.16	0.00	0.00
Franklin Street	116	117	0			0	0	4,030	18.28	0	70	0.16	4,100	18.45	2.39	44.16	0.00	0.00
Franklin Street[5]	117	118	5	3		8	20	4,050	18.38	0	70	0.16	4,120	18.54	2.39	44.36	0.00	0.00
To WWTP	118	119	0			0	0	4,050	18.38	0	70	0.16	4,120	18.54	2.39	44.36	0.00	0.00
To WWTP	119	119A	0			0	0	4,050	18.38	0	70	0.16	4,120	18.54	2.39	44.36	0.00	0.00
To WWTP[6]	119A	119B				0	0	4,050	18.38	0	70	0.16	4,120	18.54	2.39	44.36	0.00	0.00
To WWTP	119B	120	0			0	0	4,050	18.38	0	70	0.16	4,120	18.54	2.39	44.36	0.00	0.00
To WWTP	120	121	0			0	0	7,995	36.27	0	1,122	2.60	9,117	38.87	2.20	85.39	0.00	0.00
To WWTP	121	122	610	12	1	623	1,558	9,553	43.34	61	1,183	2.74	10,736	46.08	2.15	99.27	0.00	0.00
To WWTP	122	123	0			0	0	9,553	43.34	0	1,183	2.74	10,736	46.08	2.15	99.27	0.00	0.00
To WWTP	123	124	0			0	0	9,553	43.34	0	1,183	2.74	10,736	46.08	2.15	99.27	0.00	0.00
Industrial Avenue[6]	200	201					0	0	0.00	0	0	0.00	0	0.00	3.10	0.00	0.00	0.00
Industrial Avenue	201	202	115	50		165	413	413	1.87	0	0	0.00	413	1.87	2.81	5.26	0.00	0.00
Industrial Avenue	202	203	0			0	0	413	1.87	0	0	0.00	413	1.87	2.81	5.26	0.00	0.00
Mullett Street	203	204	7	4		11	28	440	2.00	0	0	0.00	440	2.00	2.80	5.59	0.00	0.00
Mullett Street	204	205	4			4	10	450	2.04	0	0	0.00	450	2.04	2.80	5.71	0.00	0.00
Mullett Street	205	206	63	1		64	160	610	2.77	36	36	0.08	646	2.85	2.75	7.84	0.00	0.00
Mullett Street	206	207	75			75	188	798	3.62	0	36	0.08	834	3.70	2.71	10.03	0.00	0.00
Mullett Street	207	208	0			0	0	798	3.62	0	36	0.08	834	3.70	2.71	10.03	0.00	0.00
Mullett Street	208	209	17	5		22	55	853	3.87	61	97	0.22	950	4.09	2.69	11.00	0.00	0.00
Mullett Street	209	210	0			0	0	853	3.87	0	97	0.22	950	4.09	2.69	11.00	0.00	0.00
Mullett Street	210	211A	91	5		96	240	1,093	4.96	10	107	0.25	1,200	5.20	2.65	13.78	0.00	0.00
Mullett Street[6]	211A	211					0	1,093	4.96	0	107	0.25	1,200	5.20	2.65	13.78	0.00	0.00
Mullett Street	211	212	1			1	3	1,095	4.97	0	107	0.25	1,202	5.22	2.65	13.81	0.00	0.00
To WWTP	212	213	0			0	0	1,095	4.97	0	107	0.25	1,202	5.22	2.65	13.81	0.00	0.00
To WWTP	213	214	0			0	0	1,095	4.97	0	107	0.25	1,202	5.22	2.65	13.81	0.00	0.00
To WWTP	214	215	0			0	0	1,095	4.97	703	810	1.88	1,905	6.84	2.56	17.53	0.00	0.00
To WWTP	215	216	0			0	0	1,095	4.97	0	810	1.88	1,905	6.84	2.56	17.53	0.00	0.00
To WWTP	216	217	2		1	3	8	1,103	5.00	0	810	1.88	1,913	6.88	2.56	17.61	0.00	0.00
To WWTP	217	218	0			0	0	1,103	5.00	0	810	1.88	1,913	6.88	2.56	17.61	0.00	0.00
To WWTP	218	219	1		1	2	5	1,108	5.02	0	810	1.88	1,918	6.90	2.56	17.66	0.00	0.00
To WWTP - Siphon[1]	219	220	0			0	0	1,108	5.02	0	810	1.88	1,918	6.90	2.56	17.66	0.00	0.00
To WWTP - Siphon[1]	220	221	0			0	0	1,108	5.02	0	810	1.88	1,918	6.90	2.56	17.66	0.00	0.00
To WWTP - Siphon[1]	221	124	0			0	0	1,108	5.02	0	810	1.88	1,918	6.90	2.56	17.66	0.00	0.00
To WWTP	124	125	0			0	0	10,660	48.36	0	1,993	4.61	12,653	52.98	2.11	111.87	0.00	0.00
To WWTP	125	126	0			0	0	10,660	48.36	0	1,993	4.61	12,653	52.98	2.11	111.87	0.00	0.00
To WWTP	126	127	0			0	0	10,660	48.36	0	1,993	4.61	12,653	52.98	2.11	111.87	0.00	0.00
To WWTP	127	128	0			0	0	10,660	48.36	0	1,993	4.61	12,653	52.98	2.11	111.87	0.00	0.00
To WWTP	**128**	**WWTP**	0			0	0	13,870	62.93	0	3,658	8.47	17,528	71.40	2.03	**144.65**	0.00	0.00
McNeely Avenue	301	302	0	31		31	78	78	0.35	0	0	0.00	78	0.35	2.96	1.04	0.00	0.00
McNeely Avenue	302	303	3			3	8	85	0.39	0	0	0.00	85	0.39	2.96	1.14	0.00	0.00
McNeely Avenue	303	304	3			3	8	93	0.42	0	0	0.00	93	0.42	2.95	1.24	0.00	0.00
McNeely Avenue	304	305	3			3	8	100	0.45	0	0	0.00	100	0.45	2.95	1.34	0.00	0.00
McNeely Avenue	305	306	3			3	8	108	0.49	0	0	0.00	108	0.49	2.94	1.43	0.00	0.00
McNeely Avenue	306	307	3			3	8	115	0.52	0	0	0.00	115	0.52	2.94	1.53	0.00	0.00
McNeely Avenue	307	308	4			4	10	125	0.57	0	0	0.00	125	0.57	2.93	1.66	0.00	0.00
McNeely Avenue	308	309	4	2		6	15	140	0.64	0	0	0.00	140	0.64	2.92	1.85	0.00	0.00
McNeely Avenue	309	310	6	1		7	18	158	0.71	0	0	0.00	158	0.71	2.91	2.08	0.00	0.00
McNeely Avenue	310	311	6			6	15	173	0.78	0	0	0.00	173	0.78	2.90	2.27	0.00	0.00
McNeely Avenue	311	312	4	1		5	13	185	0.84	0	0	0.00	185	0.84	2.90	2.43	0.00	0.00
McNeely Avenue	312	313	4			4	10	195	0.88	152	152	0.35	347	1.24	2.83	3.50	0.00	0.00
McNeely Avenue	313	314	8	1		9	23	218	0.99	0	152	0.35	370	1.34	2.82	3.78	0.00	0.00
McNeely Avenue	314	315	4			4	10	228	1.03	0	152	0.35	380	1.38	2.82	3.90	0.00	0.00
McNeely Avenue	315	316	8			8	20	248	1.12	0	152	0.35	400	1.47	2.81	4.15	0.00	0.00
McNeely Avenue	316	317	53			53	133	380	1.72	13	165	0.38	545	2.11	2.77	5.84	0.00	0.00
McNeely Avenue	317	318	36			36	90	470	2.13	0	165	0.38	635	2.51	2.75	6.92	0.00	0.00
McNeely Avenue	318	319	20			20	50	520	2.36	0	165	0.38	685	2.74	2.74	7.51	0.00	0.00
McNeely Avenue	319	320	5			5	13	533	2.42	0	165	0.38	698	2.80	2.74	7.66	0.00	0.00
McNeely Avenue	320	Pump Station	299			299	748	1,280	5.81	0	165	0.38	1,445	6.19	2.61	16.18	0.00	0.00
Patterson Crescent (Forcemain)	Pump Station	321	0			0	0	1,280	5.81	0	165	0.38	1,445	6.19	2.61	16.18	0.00	0.00
Patterson Crescent	321	322	442	2		444	1,110	2,390	10.84	1,452	1,617	3.74	4,007	14.59	2.40	35.00	0.00	0.00
Patterson Crescent	322	323	298	1		299	748	3,138	14.23	48	1,665	3.85	4,803	18.09	2.36	42.63	0.00	0.00
Patterson Crescent	323	324	1			1	3	3,140	14.25	0	1,665	3.85	4,805	18.10	2.36	42.66	0.00	0.00
Patterson Crescent	324	325	26		2	28	70	3,210	14.56	0	1,665	3.85	4,875	18.42	2.35	43.34	0.00	0.00
To WWTP	325	326				0	0	3,210	14.56	0	1,665	3.85	4,875	18.42	2.35	43.34	0.00	0.00
To WWTP	326	327				0	0	3,210	14.56	0	1,665	3.85	4,875	18.42	2.35	43.34	0.00	0.00
To WWTP	327	128				0	0	3,210	14.56	0	1,665	3.85	4,875	18.42	2.35	43.34	0.00	0.00

Flow Generation — ICI (Additional (2026) ICI Development and 2026 ICI Contributions)

Street/Location	From	To	Additional IC Area (ha)	Additional IC Sewage (L/s)	Additional Ind. Area (ha)	Additional Ind. Sewage (L/s)	Total Additional ICI Area (ha)	Total Additional ICI Sewage (L/s)	Cumulative Additional ICI Area (ha)	Cumulative Additional ICI Sewage (L/s)	2026 ICI Contributions: Peaking Factor	Peak ICI Sewage (L/s)
Lake Avenue West	001	02A	0.10	0.02	0.10	0.01	0.21	0.03	0.21	0.03	1.00	0.03
Lake Avenue West[6]	02A	002	0.00	0.00	0.00	0.00	0.00	0.00	0.21	0.03	1.00	0.03
Lake Avenue West	002	003	0.00	0.00	0.00	0.00	0.00	0.00	0.21	0.03	1.00	0.03
Lake Avenue West	003	004	0.00	0.00	0.00	0.00	0.00	0.00	0.21	0.03	1.00	0.03
Lake Avenue West	004	005	0.43	0.08	0.43	0.05	0.86	0.13	1.07	0.17	1.00	0.17
Lake Avenue West	005	006	0.00	0.00	0.00	0.00	0.00	0.00	1.07	0.17	1.00	0.17
Lake Avenue West	006	007	0.00	0.00	0.00	0.00	0.00	0.00	1.07	0.17	1.00	0.17
Lake Avenue West	007	008	0.03	0.01	0.03	0.00	0.06	0.01	1.13	0.18	1.00	0.18
Lake Avenue West	008	009	0.00	0.00	0.00	0.00	0.00	0.00	1.13	0.18	1.00	0.18
Lake Avenue West	009	010	0.00	0.00	0.00	0.00	0.00	0.00	1.13	0.18	1.00	0.18
Lake Avenue West	010	011	0.00	0.00	0.00	0.00	0.00	0.00	1.13	0.18	1.00	0.18
Lake Avenue West	011	012	0.00	0.00	0.00	0.00	0.00	0.00	1.13	0.18	1.00	0.18
Lake Avenue West	012	013	0.00	0.00	0.00	0.00	0.00	0.00	1.13	0.18	1.00	0.18
Lake Avenue West	013	014	0.43	0.08	0.43	0.05	0.86	0.13	2.00	0.31	1.00	0.31
Lake Avenue West	014	15B	0.00	0.00	0.00	0.00	0.00	0.00	2.00	0.31	1.00	0.31
Lake Avenue West[6]	15B	15A	0.00	0.00	0.00	0.00	0.00	0.00	2.00	0.31	1.00	0.31
Lake Avenue West	15A	015	0.00	0.00	0.00	0.00	0.00	0.00	2.00	0.31	1.00	0.31
Lake Avenue West	015	016	0.00	0.00	0.00	0.00	0.00	0.00	2.00	0.31	1.00	0.31
Lake Avenue West	016	017	0.00	0.00	0.00	0.00	0.00	0.00	2.00	0.31	1.00	0.31
Lake Avenue West	017	018	0.00	0.00	0.00	0.00	0.00	0.00	2.00	0.31	1.00	0.31
Lake Avenue West	018	019	0.00	0.00	0.00	0.00	0.00	0.00	2.00	0.31	1.00	0.31
Lake Avenue West	019	020	0.01	0.00	0.01	0.00	0.02	0.00	2.01	0.31	1.00	0.31
Lake Avenue West	020	021	0.00	0.00	0.00	0.00	0.00	0.00	2.01	0.31	1.00	0.31
Lake Avenue West	021	022	0.10	0.02	0.10	0.01	0.21	0.03	2.22	0.35	1.00	0.35
Lorne Street	022	023	0.00	0.00	0.00	0.00	0.00	0.00	2.22	0.35	1.00	0.35
Lorne Street	023	024	0.00	0.00	0.00	0.00	0.00	0.00	2.22	0.35	1.00	0.35
Ball Park	024	120	0.00	0.00	0.00	0.00	0.00	0.00	2.22	0.35	1.00	0.35
High Street[3]	101	102A	0.04	0.01	0.04	0.00	0.07	0.01	0.07	0.01	1.00	0.01
High Street[3]	102A	102	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.01	1.00	0.01
High Street[3]	102	103	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.01	1.00	0.01
High Street[3]	103	104	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.01	1.00	0.01
High Street[3]	104	105	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.01	1.00	0.01
High Street[3]	105	106	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.01	1.00	0.01
High Street[3]	106	107	0.03	0.01	0.03	0.00	0.07	0.01	0.14	0.02	1.00	0.02
High Street[3]	107	108	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.02	1.00	0.02
Bridge Street	108	109	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.02	1.00	0.02
Bridge Street	109	110	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.02	1.00	0.02
Bridge Street	110	111	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.02	1.00	0.02
Bridge Street	111	112	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.02	1.00	0.02
Mill Street	112	113	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.02	1.00	0.02
Beckwith Street	113	114	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.02	1.00	0.02
Franklin Street	114	115	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.02	1.00	0.02
Franklin Street	115	115A	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.02	1.00	0.02
Franklin Street	115A	116	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.02	1.00	0.02
Franklin Street	116	117	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.02	1.00	0.02
Franklin Street[5]	117	118	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.02	1.00	0.02
To WWTP	118	119	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.02	1.00	0.02
To WWTP	119	119A	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.02	1.00	0.02
To WWTP[6]	119A	119B	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.02	1.00	0.02
To WWTP	119B	120	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.02	1.00	0.02
To WWTP	120	121	0.00	0.00	0.00	0.00	0.00	0.00	2.36	0.37	1.00	0.37
To WWTP	121	122	0.06	0.01	0.06	0.01	0.12	0.02	2.48	0.39	1.00	0.39
To WWTP	122	123	0.00	0.00	0.00	0.00	0.00	0.00	2.48	0.39	1.00	0.39
To WWTP	123	124	0.00	0.00	0.00	0.00	0.00	0.00	2.48	0.39	1.00	0.39
Industrial Avenue[6]	200	201	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Industrial Avenue	201	202	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00
Industrial Avenue	202	203	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00
Mullett Street	203	204	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00
Mullett Street	204	205	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00
Mullett Street	205	206	0.04	0.01	0.04	0.00	0.07	0.01	0.07	0.01	1.00	0.01
Mullett Street	206	207	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.01	1.00	0.01
Mullett Street	207	208	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.01	1.00	0.01
Mullett Street	208	209	0.43	0.08	0.43	0.05	0.86	0.13	0.94	0.15	1.00	0.15
Mullett Street	209	210	0.00	0.00	0.00	0.00	0.00	0.00	0.94	0.15	1.00	0.15
Mullett Street	210	211A	0.01	0.00	0.01	0.00	0.02	0.00	0.96	0.15	1.00	0.15
Mullett Street[6]	211A	211	0.00	0.00	0.00	0.00	0.00	0.00	0.96	0.15	1.00	0.15
Mullett Street	211	212	0.00	0.00	0.00	0.00	0.00	0.00	0.96	0.15	1.00	0.15
To WWTP	212	213	0.00	0.00	0.00	0.00	0.00	0.00	0.96	0.15	1.00	0.15
To WWTP	213	214	0.00	0.00	0.00	0.00	0.00	0.00	0.96	0.15	1.00	0.15
To WWTP	214	215	0.43	0.08	0.43	0.05	0.86	0.13	1.82	0.28	1.00	0.28
To WWTP	215	216	0.00	0.00	0.00	0.00	0.00	0.00	1.82	0.28	1.00	0.28
To WWTP	216	217	0.00	0.00	0.00	0.00	0.00	0.00	1.82	0.28	1.00	0.28
To WWTP	217	218	0.00	0.00	0.00	0.00	0.00	0.00	1.82	0.28	1.00	0.28
To WWTP	218	219	0.00	0.00	0.00	0.00	0.00	0.00	1.82	0.28	1.00	0.28
To WWTP - Siphon[1]	219	220	0.00	0.00	0.00	0.00	0.00	0.00	1.82	0.28	1.00	0.28
To WWTP - Siphon[1]	220	221	0.00	0.00	0.00	0.00	0.00	0.00	1.82	0.28	1.00	0.28
To WWTP - Siphon[1]	221	124	0.00	0.00	0.00	0.00	0.00	0.00	1.82	0.28	1.00	0.28
To WWTP	124	125	0.00	0.00	0.00	0.00	0.00	0.00	4.30	0.67	1.00	0.67
To WWTP	125	126	0.00	0.00	0.00	0.00	0.00	0.00	4.30	0.67	1.00	0.67
To WWTP	126	127	0.00	0.00	0.00	0.00	0.00	0.00	4.30	0.67	1.00	0.67
To WWTP	127	128	0.00	0.00	0.00	0.00	0.00	0.00	4.30	0.67	1.00	0.67
To WWTP	**128**	**WWTP**	0.00	0.00	0.00	0.00	0.00	0.00	7.32	1.14	1.00	1.14
McNeely Avenue	301	302	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00
McNeely Avenue	302	303	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00
McNeely Avenue	303	304	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00
McNeely Avenue	304	305	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00
McNeely Avenue	305	306	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00
McNeely Avenue	306	307	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00
McNeely Avenue	307	308	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00
McNeely Avenue	308	309	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00
McNeely Avenue	309	310	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00
McNeely Avenue	310	311	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00
McNeely Avenue	311	312	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00
McNeely Avenue	312	313	0.43	0.08	0.43	0.05	0.86	0.13	0.86	0.13	1.00	0.13
McNeely Avenue	313	314	0.00	0.00	0.00	0.00	0.00	0.00	0.86	0.13	1.00	0.13
McNeely Avenue	314	315	0.00	0.00	0.00	0.00	0.00	0.00	0.86	0.13	1.00	0.13
McNeely Avenue	315	316	0.00	0.00	0.00	0.00	0.00	0.00	0.86	0.13	1.00	0.13
McNeely Avenue	316	317	0.01	0.00	0.01	0.00	0.03	0.00	0.89	0.14	1.00	0.14
McNeely Avenue	317	318	0.00	0.00	0.00	0.00	0.00	0.00	0.89	0.14	1.00	0.14
McNeely Avenue	318	319	0.00	0.00	0.00	0.00	0.00	0.00	0.89	0.14	1.00	0.14
McNeely Avenue	319	320	0.00	0.00	0.00	0.00	0.00	0.00	0.89	0.14	1.00	0.14
McNeely Avenue	320	Pump Station	0.00	0.00	0.00	0.00	0.00	0.00	0.89	0.14	1.00	0.14
Patterson Crescent (Forcemain)	Pump Station	321	0.00	0.00	0.00	0.00	0.00	0.00	0.89	0.14	1.00	0.14
Patterson Crescent	321	322	1.02	0.20	1.02	0.12	2.03	0.32	2.92	0.46	1.00	0.46
Patterson Crescent	322	323	0.05	0.01	0.05	0.01	0.10	0.02	3.02	0.47	1.00	0.47
Patterson Crescent	323	324	0.00	0.00	0.00	0.00	0.00	0.00	3.02	0.47	1.00	0.47
Patterson Crescent	324	325	0.00	0.00	0.00	0.00	0.00	0.00	3.02	0.47	1.00	0.47
To WWTP	325	326	0.00	0.00	0.00	0.00	0.00	0.00	3.02	0.47	1.00	0.47
To WWTP	326	327	0.00	0.00	0.00	0.00	0.00	0.00	3.02	0.47	1.00	0.47
To WWTP	327	128	0.00	0.00	0.00	0.00	0.00	0.00	3.02	0.47	1.00	0.47

Extraneous Flows, Total Peak Flow and Pipe Conditions (Pipe Capacity Utilization)

Street/Location	From	To	Existing (2021) Extraneous Flows: Existing Drainage Area (ha)	Cumulative Existing Drainage Area (ha)	Existing Extraneous Flow (L/s)	Additional (2026) Extraneous Flows: Additional Drainage Area (ha)	Cumulative Additional Drainage Area (ha)	Additional Extraneous Flow (L/s)	2026 Extraneous Flow Contributions: Total Cumulative Drainage Area (ha)	Total Extraneous Flow (L/s)	Total Peak Flow (L/s)	Nominal Pipe Diameter (mm)	Actual Pipe Diameter (mm)	Slope (%)	Full Flow Velocity (m/s)	Full Flow Capacity (L/s)	Capacity Used (%)
Lake Avenue West	001	02A	4.95	4.95	1.48	15.38	15.38	4.61	20.33	6.10	13.30	375	381	0.44%	1.06	121.33	11.0%
Lake Avenue West[6]	02A	002	0.00	4.95	1.48	0.00	15.38	4.61	20.33	6.10	13.30	375	381	0.42%	1.04	118.54	11.2%
Lake Avenue West	002	003	35.59	40.54	12.16	0.00	15.38	4.61	55.92	16.77	36.80	375	381	0.48%	1.11	126.72	29.0%
Lake Avenue West	003	004	1.77	42.31	12.69	0.00	15.38	4.61	57.69	17.31	37.58	375	381	0.45%	1.08	122.70	30.6%
Lake Avenue West	004	005	0.40	42.71	12.81	0.00	15.38	4.61	58.09	17.43	38.13	375	381	0.46%	1.09	124.06	30.7%
Lake Avenue West	005	006	4.51	47.22	14.16	0.00	15.38	4.61	62.60	18.78	40.50	375	381	0.42%	1.04	118.54	34.2%
Lake Avenue West	006	007	1.13	48.35	14.50	0.00	15.38	4.61	63.73	19.12	41.39	375	381	0.39%	1.00	114.23	36.2%
Lake Avenue West	007	008	33.14	81.49	24.45	0.88	16.26	4.88	97.74	29.32	60.42	375	381	0.57%	1.21	138.09	43.8%
Lake Avenue West	008	009	1.84	83.33	25.00	0.00	16.26	4.88	99.58	29.87	61.84	375	381	0.85%	1.48	168.64	36.7%
Lake Avenue West	009	010	5.49	88.82	26.64	0.00	16.26	4.88	105.07	31.52	65.67	375	381	0.62%	1.26	144.02	45.6%
Lake Avenue West	010	011	3.76	92.58	27.77	0.00	16.26	4.88	108.83	32.65	68.18	375	381	0.48%	1.11	126.72	53.8%
Lake Avenue West	011	012	1.69	94.27	28.28	0.00	16.26	4.88	110.52	33.16	69.14	375	381	1.82%	2.16	246.76	28.0%
Lake Avenue West	012	013	17.76	112.03	33.61	0.01	16.27	4.88	128.29	38.49	76.33	525	533	0.25%	1.00	224.33	34.0%
Lake Avenue West	013	014	0.73	112.76	33.83	0.15	16.42	4.92	129.17	38.75	77.04	600	610	0.12%	0.76	221.90	34.7%
Lake Avenue West	014	15B	2.10	114.86	34.46	0.00	16.42	4.92	131.27	39.38	78.10	600	610	0.12%	0.76	221.90	35.2%
Lake Avenue West[6]	15B	15A	0.00	114.86	34.46	0.00	16.42	4.92	131.27	39.38	78.10	600	610	0.12%	0.76	221.90	35.2%
Lake Avenue West	15A	015	0.19	115.05	34.51	0.00	16.42	4.92	131.46	39.44	78.20	600	610	0.12%	0.76	221.90	35.2%
Lake Avenue West	015	016	0.95	116.00	34.80	0.00	16.42	4.92	132.41	39.72	78.86	600	610	0.12%	0.76	221.90	35.5%
Lake Avenue West	016	017	1.67	117.67	35.30	0.00	16.42	4.92	134.08	40.22	79.71	600	610	0.10%	0.69	202.56	39.4%
Lake Avenue West	017	018	3.63	121.30	36.39	0.00	16.42	4.92	137.71	41.31	82.28	600	610	0.10%	0.69	202.56	40.6%
Lake Avenue West	018	019	0.21	121.51	36.45	0.00	16.42	4.92	137.92	41.38	82.42	600	610	0.12%	0.76	221.90	37.1%
Lake Avenue West	019	020	1.57	123.08	36.92	0.14	16.56	4.97	139.63	41.89	83.54	600	610	0.12%	0.76	221.90	37.6%
Lake Avenue West	020	021	0.28	123.36	37.01	0.00	16.56	4.97	139.91	41.97	83.72	600	610	0.06%	*0.51*	150.22	55.7%
Lake Avenue West	021	022	12.30	135.66	40.70	1.76	18.31	5.49	153.97	46.19	91.89	600	610	0.12%	0.76	221.90	41.4%
Lorne Street	022	023	0.84	136.50	40.95	0.00	18.31	5.49	154.81	46.44	92.33	600	610	0.20%	0.98	286.47	32.2%
Lorne Street	023	024	0.65	137.15	41.14	0.00	18.31	5.49	155.46	46.64	92.82	600	610	0.20%	0.98	286.47	32.4%
Ball Park	024	120	5.71	142.86	42.86	0.00	18.31	5.49	161.17	48.35	96.42	600	610	0.47%	1.51	439.42	21.9%
High Street[3]	101	102A	57.19	57.19	22.87	0.69	0.69	0.28	57.88	23.15	39.44	350	356	0.51%	1.09	108.67	36.3%
High Street[3]	102A	102	0.00	57.19	22.87	0.00	0.69	0.28	57.88	23.15	39.44	350	356	0.15%	*0.59*	58.94	66.9%
High Street[3]	102	103	6.67	63.86	25.54	0.00	0.69	0.28	64.55	25.82	45.64	350	356	0.17%	0.63	62.74	72.7%
High Street[3]	103	104	12.95	76.81	30.72	0.00	0.69	0.28	77.50	31.00	53.49	400	406	0.14%	0.63	81.29	65.8%
High Street[3]	104	105	1.53	78.34	31.33	0.00	0.69	0.28	79.03	31.61	57.47	400	406	0.14%	0.63	81.29	70.7%
High Street[3]	105	106	0.47	78.81	31.52	0.00	0.69	0.28	79.50	31.80	58.07	400	406	0.14%	0.63	81.29	71.4%
High Street[3]	106	107	0.48	79.29	31.71	0.53	1.22	0.49	80.50	32.20	58.78	400	406	0.13%	0.60	78.33	75.0%
High Street[3]	107	108	0.67	79.95	31.98	0.00	1.22	0.49	81.17	32.47	59.26	400	406	0.15%	0.65	84.15	70.4%
Bridge Street	108	109	35.48	115.44	42.63	0.00	1.22	0.49	116.65	43.11	80.55	450	457	0.35%	1.07	175.96	45.8%
Bridge Street	109	110	0.18	115.62	42.68	0.00	1.22	0.49	116.83	43.17	80.85	450	457	0.31%	1.01	165.60	48.8%
Bridge Street	110	111	0.26	115.88	42.76	0.00	1.22	0.49	117.09	43.24	80.98	450	457	0.45%	1.22	199.52	40.6%
Bridge Street	111	112	0.00	115.88	42.76	0.00	1.22	0.49	117.09	43.24	80.98	450	457	1.44%	2.17	356.92	22.7%
Mill Street	112	113	16.75	132.63	47.78	0.01	1.23	0.49	133.85	48.27	90.54	600	610	0.30%	1.20	350.85	25.8%
Beckwith Street	113	114	0.98	133.61	48.08	0.00	1.23	0.49	134.83	48.57	91.13	600	610	0.20%	0.98	286.47	31.8%
Franklin Street	114	115	1.72	135.33	48.59	0.00	1.23	0.49	136.55	49.08	92.02	600	610	0.23%	1.05	307.20	30.0%
Franklin Street	115	115A	4.74	140.07	50.01	0.00	1.23	0.49	141.29	50.50	94.64	600	610	0.28%	1.16	338.95	27.9%
Franklin Street	115A	116	0.54	140.61	50.18	0.00	1.23	0.49	141.83	50.67	94.85	600	610	0.31%	1.22	356.65	26.6%
Franklin Street	116	117	0.12	140.73	50.21	0.00	1.23	0.49	141.95	50.70	94.89	600	610	0.18%	0.93	271.77	34.9%
Franklin Street[5]	117	118	0.57	141.30	50.38	0.00	1.23	0.49	142.52	50.87	95.26	584	593	0.26%	1.10	303.91	31.3%
To WWTP	118	119	0.00	141.30	50.38	0.00	1.23	0.49	142.52	50.87	95.26	600	610	0.26%	1.12	326.62	29.2%
To WWTP	119	119A	0.00	141.30	50.38	0.00	1.23	0.49	142.52	50.87	95.26	600	610	0.27%	1.14	332.84	28.6%
To WWTP[6]	119A	119B	0.00	141.30	50.38	0.00	1.23	0.49	142.52	50.87	95.26	600	610	0.27%	1.14	332.84	28.6%
To WWTP	119B	120	0.00	141.30	50.38	0.00	1.23	0.49	142.52	50.87	95.26	750	762	1.66%	***3.28***	1,496.38	6.4%
To WWTP	120	121	0.00	284.15	93.24	0.00	19.54	5.98	303.69	99.22	184.98	750	762	0.25%	1.27	580.71	31.9%
To WWTP	121	122	57.07	341.23	110.36	1.15	20.69	6.33	361.91	116.69	216.35	750	762	0.25%	1.27	580.71	37.3%
To WWTP	122	123	0.00	341.23	110.36	0.00	20.69	6.33	361.91	116.69	216.35	750	762	0.25%	1.27	580.71	37.3%
To WWTP	123	124	0.00	341.23	110.36	0.00	20.69	6.33	361.91	116.69	216.35	750	762	3.97%	***5.07***	2,314.10	9.3%
Industrial Avenue[6]	200	201	0.00	0.00	0.00	0.00	0.00	0.12	0.00	0.12	0.12	200	203	3.61%	2.00	65.01	0.2%
Industrial Avenue	201	202	31.82	31.82	9.55	0.00	0.00	0.00	31.82	9.55	14.80	200	203	0.27%	*0.55*	17.78	83.3%
Industrial Avenue	202	203	0.00	31.82	9.55	0.00	0.00	0.00	31.82	9.55	14.80	300	305	0.17%	*0.57*	41.59	35.6%
Mullett Street	203	204	1.14	32.96	9.89	0.00	0.00	0.00	32.96	9.89	15.48	300	305	0.22%	0.65	47.32	32.7%
Mullett Street	204	205	0.14	33.10	9.93	0.00	0.00	0.00	33.10	9.93	15.64	300	305	0.36%	0.83	60.53	25.8%
Mullett Street	205	206	4.80	37.90	11.37	0.69	0.69	0.21	38.59	11.58	19.42	300	305	0.77%	1.21	88.52	21.9%
Mullett Street	206	207	4.84	42.74	12.82	0.00	0.69	0.21	43.43	13.03	23.07	350	356	0.32%	0.87	86.08	26.8%
Mullett Street	207	208	0.00	42.74	12.82	0.00	0.69	0.21	43.43	13.03	23.07	350	356	0.72%	1.30	129.12	17.9%
Mullett Street	208	209	2.37	45.11	13.53	0.07	0.76	0.23	45.87	13.76	24.91	375	381	0.30%	0.88	100.18	24.9%
Mullett Street	209	210	0.00	45.11	13.53	0.00	0.76	0.23	45.87	13.76	24.91	375	381	0.30%	0.88	100.18	24.9%
Mullett Street	210	211A	10.35	55.46	16.64	0.15	0.91	0.27	56.37	16.91	30.84	375	381	0.24%	0.79	89.61	34.4%
Mullett Street[6]	211A	211	0.00	55.46	16.64	0.00	0.91	0.27	56.37	16.91	30.84	375	381	0.26%	0.82	93.27	33.1%
Mullett Street	211	212	0.34	55.80	16.74	0.00	0.91	0.27	56.71	17.01	30.97	375	381	2.49%	2.53	288.63	10.7%
To WWTP	212	213	0.00	55.80	16.74	0.00	0.91	0.27	56.71	17.01	30.97	400	406	0.16%	0.67	86.90	35.6%
To WWTP	213	214	0.00	55.80	16.74	0.00	0.91	0.27	56.71	17.01	30.97	400	406	0.18%	0.71	92.18	33.6%
To WWTP	214	215	0.00	55.80	16.74	2.50	3.41	1.02	59.21	17.76	35.57	400	406	3.25%	***3.02***	391.67	9.1%
To WWTP	215	216	0.00	55.80	16.74	0.00	3.41	1.02	59.21	17.76	35.57	400	406	0.21%	0.77	99.56	35.7%
To WWTP	216	217	0.62	56.42	16.93	0.00	3.41	1.02	59.83	17.95	35.84	400	406	0.23%	0.80	104.20	34.4%
To WWTP	217	218	0.00	56.42	16.93	0.00	3.41	1.02	59.83	17.95	35.84	400	406	0.22%	0.79	101.90	35.2%
To WWTP	218	219	0.35	56.77	17.03	0.00	3.41	1.02	60.18	18.05	36.00	400	406	0.18%	0.71	92.18	39.1%
To WWTP - Siphon[1]	219	220	0.00	56.77	17.03	0.00	3.41	1.02	60.18	18.05	36.00	400	406	0.22%	0.79	101.90	35.3%
To WWTP - Siphon[1]	220	221	0.00	56.77	17.03	0.00	3.41	1.02	60.18	18.05	36.00	400	406	0.84%	1.54	199.12	18.1%
To WWTP - Siphon[1]	221	124	0.00	56.77	17.03	0.00	3.41	1.02	60.18	18.05	36.00	400	406	0.15%	0.65	84.15	42.8%
To WWTP	124	125	0.00	398.00	127.39	0.00	24.09	7.35	422.09	134.74	247.28	750	762	0.12%	0.88	402.33	61.5%
To WWTP	125	126	0.00	398.00	127.39	0.00	24.09	7.35	422.09	134.74	247.28	750	762	0.12%	0.88	402.33	61.5%
To WWTP	126	127	0.00	398.00	127.39	0.00	24.09	7.35	422.09	134.74	247.28	750	762	0.12%	0.88	402.33	61.5%
To WWTP	127	128	0.00	398.00	127.39	0.00	24.09	7.35	422.09	134.74	247.28	750	762	0.27%	1.32	603.49	41.0%
To WWTP	**128**	**WWTP**	0.00	590.87	185.26	0.00	62.63	18.91	653.50	**204.17**	**349.96**	750	762	0.27%	1.32	603.49	58.0%
McNeely Avenue	301	302	50.25	50.25	15.08	0.00	0.00	0.00	50.25	15.08	16.12	300	305	0.25%	0.69	50.44	32.0%
McNeely Avenue	302	303	0.92	51.17	15.35	0.00	0.00	0.00	51.17	15.35	16.49	450	457	0.14%	0.68	111.29	14.8%
McNeely Avenue	303	304	0.87	52.04	15.61	0.00	0.00	0.00	52.04	15.61	16.85	450	457	0.10%	*0.57*	94.06	17.9%
McNeely Avenue	304	305	0.85	52.89	15.87	0.00	0.00	0.00	52.89	15.87	17.20	450	457	0.12%	0.63	103.03	16.7%
McNeely Avenue	305	306	0.88	53.77	16.13	0.00	0.00	0.00	53.77	16.13	17.57	450	457	0.05%	*0.41*	66.51	26.4%
McNeely Avenue	306	307	0.89	54.66	16.40	0.00	0.00	0.00	54.66	16.40	17.93	450	457	0.04%	*0.36*	59.49	30.1%
McNeely Avenue	307	308	1.08	55.74	16.72	0.00	0.00	0.00	55.74	16.72	18.38	450	457	0.13%	0.65	107.24	17.1%
McNeely Avenue	308	309	1.03	56.77	17.03	0.00	0.00	0.00	56.77	17.03	18.89	450	457	0.11%	0.60	98.65	19.1%
McNeely Avenue	309	310	1.77	58.54	17.56	0.00	0.00	0.00	58.54	17.56	19.64	450	457	0.08%	*0.51*	84.13	23.3%
McNeely Avenue	310	311	1.56	60.10	18.03	0.00	0.00	0.00	60.10	18.03	20.30	450	457	0.10%	*0.57*	94.06	21.6%
McNeely Avenue	311	312	0.98	61.08	18.32	0.00	0.00	0.00	61.08	18.32	20.75	450	457	0.06%	*0.44*	72.86	28.5%
McNeely Avenue	312	313	0.46	61.54	18.46	1.20	1.20	0.36	62.74	18.82	22.46	450	457	0.13%	0.65	107.24	20.9%
McNeely Avenue	313	314	2.00	63.54	19.06	0.00	1.20	0.36	64.74	19.42	23.34	450	457	0.12%	0.63	103.03	22.6%
McNeely Avenue	314	315	0.36	63.90	19.17	0.00	1.20	0.36	65.10	19.53	23.57	300	305	0.41%	0.89	64.60	36.5%
McNeely Avenue	315	316	0.51	64.41	19.32	0.00	1.20	0.36	65.61	19.68	23.97	300	305	0.41%	0.89	64.60	37.1%
McNeely Avenue	316	317	3.42	67.83	20.35	0.24	1.44	0.43	69.27	20.78	26.76	300	305	0.21%	0.63	46.23	57.9%
McNeely Avenue	317	318	2.22	70.05	21.02	0.00	1.44	0.43	71.49	21.45	28.50	300	305	0.23%	0.66	48.38	58.9%
McNeely Avenue	318	319	0.82	70.87	21.26	0.00	1.44	0.43	72.31	21.69	29.34	300	305	0.27%	0.72	52.42	56.0%
McNeely Avenue	319	320	0.32	71.19	21.36	0.00	1.44	0.43	72.63	21.79	29.59	300	305	0.50%	0.98	71.33	41.5%
McNeely Avenue	320	Pump Station	26.50	97.69	29.31	0.00	1.44	0.43	99.14	29.74	46.06	300	305	0.50%	0.98	71.33	64.6%
Patterson Crescent (Forcemain)	Pump Station	321	0.00	97.69	29.31	0.00	1.44	0.43	99.14	29.74	46.06						
Patterson Crescent	321	322	75.04	172.74	51.82	36.18	37.63	11.29	210.36	63.11	98.57	500	508	0.20%	0.87	176.17	56.0%
Patterson Crescent	322	323	14.38	187.11	56.13	0.91	38.53	11.56	225.65	67.69	110.80	500	508	0.20%	0.87	176.17	62.9%
Patterson Crescent	323	324	0.23	187.34	56.20	0.00	38.53	11.56	225.88	67.76	110.89	500	508	0.20%	0.87	176.17	62.9%
Patterson Crescent	324	325	5.53	192.87	57.86	0.00	38.53	11.56	231.41	69.42	113.23	500	508	0.20%	0.87	176.17	64.3%
To WWTP	325	326	0.00	192.87	57.86	0.00	38.53	11.56	231.41	69.42	113.23	500	508	0.20%	0.87	176.17	64.3%
To WWTP	326	327	0.00	192.87	57.86	0.00	38.53	11.56	231.41	69.42	113.23	500	508	0.20%	0.87	176.17	64.3%
To WWTP	327	128	0.00	192.87	57.86	0.00	38.53	11.56	231.41	69.42	113.23	500	508	0.20%	0.87	176.17	64.3%

Stantec

163401646 - Town of Carleton Place W/WW Master Plan

Table D-9: Sanitary Sewer Calculation Spreadsheet - 2026 Rare Event

Date: 8/19/2021
Prepared by: CR
Checked by: AL

Legend
Manual Input/Modification
Calculated/Extracted Value for Existing + Additional Development
Existing Conditions - 2021
Additional Development
Full Flow Velocity < 0.6 m/s
Sewer Capacity Used > 100%; Sewer Velocity > 3 m/s
WWTP Inflow Point

Modelling Parameters - 2026 Rare Event		
Horizon:	2026	
Scenario:	Rare	
Existing Conditions - 2021		
Average Residential Flow Rate - q =	392	l/cap/day
Peak Extraneous Flow Rate - i =	0.55	l/s/ha
Peak Extraneous Flow Rate (Monitor No. 6)(3) - i =	3.00	l/s/ha
Existing Conditions Population Density =	2.5	PPU
Harmon Peaking Factor Correction Factor - K =	0.60	-
Growth Developments - 2026		
Average Residential Flow Rate - q =	200	l/cap/day
Peak Extraneous Flow Rate - i =	0.55	l/s/ha
Peak Extraneous Flow Rate (Monitor No. 6)(3) - i =	3.00	l/s/ha
Harmon Peaking Factor Correction Factor - K =	0.60	-
Insitutional/Commercial Average Flow Rate - q =	17,000	l/ha/day
Institutional/Commercial (IC) Peaking Factor (ICI Cont. > 20%) =	1.00	-
Institutional/Commercial (IC) Peaking Factor (ICI Cont. ≤ 20%) =	1.00	-
Light Industrial Average Flow Rate - q =	10,000	l/ha/day
Light Industrial Peaking Factor (ICI Cont. > 20%) =	1.00	-
Light Industrial Peaking Factor (ICI Cont. ≤ 20%) =	1.00	-
Manning's Coefficient - n =	0.013	

Note: Values as per ***Design Basis Memo*** *(July 12, 2021)*

Summary - 2026 Rare Event		
2021 Residential Population	13,403	ppl
2021 ICI Equivalent Population	468	ppl
2021 Total Residential + ICI Equivalent Population	13,870	ppl
2026 Additional Residential Population	3,658	ppl
2026 Total Residential Population	17,061	ppl
2026 Total Residential + ICI Equivalent Population	17,528	ppl
2026 Additional Residential Area	55	ha
2026 Additional ICI Area	7	ha
2026 Total Area	653	ha
Average DWF (Residential + ICI)	6,268	m^3/d
Peak DWF (Residential + ICI)	12,597	m^3/d
Peak Extraneous Flow	48,236	m^3/d
Peak Total Flow	60,833	m^3/d
Number of Sewers Surcharged	20	
Average Sewer Capacity Used	83.0%	
Max Sewer Capacity Used	342.2%	
Mississippi Quays PS Peak Inflow	70.8	L/s

Notes

(1) McArthur Island siphon represented by sewer section from MH219 to MH124, as a single 400 mm diameter gravity pipe at 0.84% slope, as per original spreadsheet (JLR, 2021). Based on drawings, siphon consists of two barrels (150 mm and 300 mm); representation of siphon would require adjustments for HGL calculations.
(2) Mississippi Quays PS modelled at the end of McNeely Avenue (from MH320 to Pump Station); no gravity flow calculated through forcemain on Patterson Crescent (from Pump Station to MH321, assumed without restrictions).
(3) Extraneous flows calculated using 3 L/s/ha for drainage areas tributary to flow monitor No. 6.
(4) Diameters and slopes confirmed or corrected based on comparison of original spreadsheet to information provided by the Town on 20210712; see detailed comparison in Table D-1: Comparison of Diameters and Slopes from Different Sources.
(5) Based on information provided by the Town on 20210712, sewer along Franklin St between MH117 and MH118 appears to first be a ~38 m long 600 mm single sewer, followed by a ~52 m long section of twin 450 mm sewers; equivalent diameter to twin 450 mm retained, as it is more conservative.
(6) Sewer section added to spreadsheet to match Town's GIS data.

Level of Service Limits		
Maximum Velocity	3	m/s
Actual Flow/Full Flow Capacity	100%	

Flow Generation — Residential and ICI

Street/Location	Maintenance Hole From	Maintenance Hole To	Existing (2021) Residential Conditions: Number of Units: Residential Units	Commercial Units	Institutional Units	Total Units	Existing Population	Cumulative Existing Population	Existing Residential Sewage Flow (L/s)	Additional (2026) Residential Development: Additional Population	Cumulative Additional Population	Additional Residential Sewage Flow (L/s)	2026 Residential Contributions: Total Cumulative Residential Population	Total Residential Sewage Flow (L/s)	Harmon Peaking Factor	Peak Residential Sewage Flow (L/s)	Existing (2021) ICI Conditions: Existing ICI Sewage (L/s)	Cumulative Existing ICI Sewage (L/s)	Additional (2026) ICI Development: Additional IC Area (ha)	Additional IC Sewage (L/s)	Additional Ind. Area (ha)	Additional Ind. Sewage (L/s)	Total Additional ICI Area (ha)	Total Additional ICI Sewage (L/s)	Cumulative Additional ICI Area (ha)	Cumulative Additional ICI Sewage (L/s)
Lake Avenue West	001	02A	62		1	63	158	158	0.71	848	848	1.96	1,006	2.68	2.68	7.17	0.00	0.00	0.10	0.02	0.10	0.01	0.21	0.03	0.21	0.03
Lake Avenue West(6)	02A	002					0	158	0.71	0	848	1.96	1,006	2.68	2.68	7.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.21	0.03
Lake Avenue West	002	003	459			459	1,148	1,305	5.92	0	848	1.96	2,153	7.88	2.54	20.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.21	0.03
Lake Avenue West	003	004	9			9	23	1,328	6.02	0	848	1.96	2,176	7.99	2.53	20.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.21	0.03
Lake Avenue West	004	005	11			11	28	1,355	6.15	0	848	1.96	2,203	8.11	2.53	20.53	0.00	0.00	0.43	0.08	0.43	0.05	0.86	0.13	1.07	0.17
Lake Avenue West	005	006	37		1	38	95	1,450	6.58	0	848	1.96	2,298	8.54	2.52	21.55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.07	0.17
Lake Avenue West	006	007	21			21	53	1,503	6.82	0	848	1.96	2,351	8.78	2.52	22.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.07	0.17
Lake Avenue West	007	008	325			325	813	2,315	10.50	69	917	2.12	3,232	12.63	2.45	30.92	0.00	0.00	0.03	0.01	0.03	0.00	0.06	0.01	1.13	0.18
Lake Avenue West	008	009	34			34	85	2,400	10.89	0	917	2.12	3,317	13.01	2.44	31.79	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.13	0.18
Lake Avenue West	009	010	86			86	215	2,615	11.86	0	917	2.12	3,532	13.99	2.43	33.97	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.13	0.18
Lake Avenue West	010	011	54	1		55	138	2,753	12.49	0	917	2.12	3,670	14.61	2.42	35.36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.13	0.18
Lake Avenue West	011	012	18			18	45	2,798	12.69	0	917	2.12	3,715	14.82	2.42	35.81	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.13	0.18
Lake Avenue West	012	013	70	4		74	185	2,983	13.53	1	918	2.13	3,901	15.66	2.41	37.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.13	0.18
Lake Avenue West	013	014	7	1		8	20	3,003	13.62	24	942	2.18	3,945	15.80	2.40	37.98	0.00	0.00	0.43	0.08	0.43	0.05	0.86	0.13	2.00	0.31
Lake Avenue West	014	15B	15	2		17	43	3,045	13.82	0	942	2.18	3,987	16.00	2.40	38.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.00	0.31
Lake Avenue West(6)	15B	15A					0	3,045	13.82	0	942	2.18	3,987	16.00	2.40	38.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.00	0.31
Lake Avenue West	15A	015	1	1		2	5	3,050	13.84	0	942	2.18	3,992	16.02	2.40	38.45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.00	0.31
Lake Avenue West	015	016	15			15	38	3,088	14.01	0	942	2.18	4,030	16.19	2.40	38.83	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.00	0.31
Lake Avenue West	016	017	12	2		14	35	3,123	14.17	0	942	2.18	4,065	16.35	2.40	39.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.00	0.31
Lake Avenue West	017	018	60			60	150	3,273	14.85	0	942	2.18	4,215	17.03	2.39	40.66	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.00	0.31
Lake Avenue West	018	019	3			3	8	3,280	14.88	0	942	2.18	4,222	17.06	2.39	40.73	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.00	0.31
Lake Avenue West	019	020	23			23	58	3,338	15.14	8	950	2.20	4,288	17.34	2.38	41.34	0.00	0.00	0.01	0.00	0.01	0.00	0.02	0.00	2.01	0.31
Lake Avenue West	020	021	4			4	10	3,348	15.19	0	950	2.20	4,298	17.39	2.38	41.44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.01	0.31
Lake Avenue West	021	022	140		1	141	353	3,700	16.79	102	1,052	2.44	4,752	19.22	2.36	45.35	0.00	0.00	0.10	0.02	0.10	0.01	0.21	0.03	2.22	0.35
Lorne Street	022	023	8			8	20	3,720	16.88	0	1,052	2.44	4,772	19.31	2.36	45.54	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.22	0.35
Lorne Street	023	024	12			12	30	3,750	17.01	0	1,052	2.44	4,802	19.45	2.36	45.84	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.22	0.35
Ball Park	024	120	77	1		78	195	3,945	17.90	0	1,052	2.44	4,997	20.33	2.35	47.73	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.22	0.35
High Street(3)	101	102A	535	4	1	540	1,350	1,350	6.13	36	36	0.08	1,386	6.21	2.62	16.28	0.00	0.00	0.04	0.01	0.04	0.00	0.07	0.01	0.07	0.01
High Street(3)	102A	102	0			0	0	1,350	6.13	0	36	0.08	1,386	6.21	2.62	16.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.01
High Street(3)	102	103	129			129	323	1,673	7.59	0	36	0.08	1,709	7.67	2.58	19.81	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.01
High Street(3)	103	104	99			99	248	1,920	8.71	0	36	0.08	1,956	8.79	2.56	22.48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.01
High Street(3)	104	105	125	2		127	318	2,238	10.15	0	36	0.08	2,274	10.23	2.53	25.84	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.01
High Street(3)	105	106	16			16	40	2,278	10.33	0	36	0.08	2,314	10.42	2.52	26.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.01
High Street(3)	106	107	5			5	13	2,290	10.39	33	69	0.16	2,359	10.55	2.52	26.56	0.00	0.00	0.03	0.01	0.03	0.00	0.07	0.01	0.14	0.02
High Street(3)	107	108	8			8	20	2,310	10.48	0	69	0.16	2,379	10.64	2.52	26.77	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.02
Bridge Street	108	109	415		1	416	1,040	3,350	15.20	0	69	0.16	3,419	15.36	2.44	37.42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.02
Bridge Street	109	110	6	4		10	25	3,375	15.31	0	69	0.16	3,444	15.47	2.43	37.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.02
Bridge Street	110	111	2			2	5	3,380	15.34	0	69	0.16	3,449	15.49	2.43	37.72	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.02
Bridge Street	111	112	0			0	0	3,380	15.34	0	69	0.16	3,449	15.49	2.43	37.72	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.02
Mill Street	112	113	158	22	2	182	455	3,835	17.40	1	70	0.16	3,905	17.56	2.41	42.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.02
Beckwith Street	113	114	12			12	30	3,865	17.54	0	70	0.16	3,935	17.70	2.40	42.54	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.02
Franklin Street	114	115	10	5		15	38	3,903	17.71	0	70	0.16	3,973	17.87	2.40	42.91	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.02
Franklin Street	115	115A	42	7		49	123	4,025	18.26	0	70	0.16	4,095	18.42	2.39	44.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.02
Franklin Street	115A	116	2			2	5	4,030	18.28	0	70	0.16	4,100	18.45	2.39	44.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.02
Franklin Street	116	117	0			0	0	4,030	18.28	0	70	0.16	4,100	18.45	2.39	44.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.02
Franklin Street(5)	117	118	5	3		8	20	4,050	18.38	0	70	0.16	4,120	18.54	2.39	44.36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.02
To WWTP	118	119	0			0	0	4,050	18.38	0	70	0.16	4,120	18.54	2.39	44.36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.02
To WWTP	119	119A	0			0	0	4,050	18.38	0	70	0.16	4,120	18.54	2.39	44.36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.02
To WWTP(6)	119A	119B					0	4,050	18.38	0	70	0.16	4,120	18.54	2.39	44.36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.02
To WWTP	119B	120	0			0	0	4,050	18.38	0	70	0.16	4,120	18.54	2.39	44.36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.02
To WWTP	120	121	0			0	0	7,995	36.27	0	1,122	2.60	9,117	38.87	2.20	85.39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.36	0.37
To WWTP	121	122	610	12	1	623	1,558	9,553	43.34	61	1,183	2.74	10,736	46.08	2.15	99.27	0.00	0.00	0.06	0.01	0.06	0.01	0.12	0.02	2.48	0.39
To WWTP	122	123	0			0	0	9,553	43.34	0	1,183	2.74	10,736	46.08	2.15	99.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.48	0.39
To WWTP	123	124	0			0	0	9,553	43.34	0	1,183	2.74	10,736	46.08	2.15	99.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.48	0.39
Industrial Avenue(6)	200	201					0	0	0.00	0	0	0.00	0	0.00	3.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Industrial Avenue	201	202	115	50		165	413	413	1.87	0	0	0.00	413	1.87	2.81	5.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Industrial Avenue	202	203	0			0	0	413	1.87	0	0	0.00	413	1.87	2.81	5.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mullett Street	203	204	7	4		11	28	440	2.00	0	0	0.00	440	2.00	2.80	5.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mullett Street	204	205	4			4	10	450	2.04	0	0	0.00	450	2.04	2.80	5.71	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mullett Street	205	206	63	1		64	160	610	2.77	36	36	0.08	646	2.85	2.75	7.84	0.00	0.00	0.04	0.01	0.04	0.00	0.07	0.01	0.07	0.01
Mullett Street	206	207	75			75	188	798	3.62	0	36	0.08	834	3.70	2.71	10.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.01
Mullett Street	207	208	0			0	0	798	3.62	0	36	0.08	834	3.70	2.71	10.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.01
Mullett Street	208	209	17	5		22	55	853	3.87	61	97	0.22	950	4.09	2.69	11.00	0.00	0.00	0.43	0.08	0.43	0.05	0.86	0.13	0.94	0.15
Mullett Street	209	210	0			0	0	853	3.87	0	97	0.22	950	4.09	2.69	11.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.94	0.15
Mullett Street	210	211A	91	5		96	240	1,093	4.96	10	107	0.25	1,200	5.20	2.65	13.78	0.00	0.00	0.01	0.00	0.01	0.00	0.02	0.00	0.96	0.15
Mullett Street(6)	211A	211					0	1,093	4.96	0	107	0.25	1,200	5.20	2.65	13.78	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.96	0.15
Mullett Street	211	212	1			1	3	1,095	4.97	0	107	0.25	1,202	5.22	2.65	13.81	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.96	0.15
To WWTP	212	213	0			0	0	1,095	4.97	0	107	0.25	1,202	5.22	2.65	13.81	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.96	0.15
To WWTP	213	214	0			0	0	1,095	4.97	0	107	0.25	1,202	5.22	2.65	13.81	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.96	0.15
To WWTP	214	215	0			0	0	1,095	4.97	703	810	1.88	1,905	6.84	2.56	17.53	0.00	0.00	0.43	0.08	0.43	0.05	0.86	0.13	1.82	0.28
To WWTP	215	216	0			0	0	1,095	4.97	0	810	1.88	1,905	6.84	2.56	17.53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.82	0.28
To WWTP	216	217	2		1	3	8	1,103	5.00	0	810	1.88	1,913	6.88	2.56	17.61	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.82	0.28
To WWTP	217	218	0			0	0	1,103	5.00	0	810	1.88	1,913	6.88	2.56	17.61	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.82	0.28
To WWTP	218	219	1		1	2	5	1,108	5.02	0	810	1.88	1,918	6.90	2.56	17.66	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.82	0.28
To WWTP - Siphon (1)	219	220	0			0	0	1,108	5.02	0	810	1.88	1,918	6.90	2.56	17.66	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.82	0.28
To WWTP - Siphon (1)	220	221	0			0	0	1,108	5.02	0	810	1.88	1,918	6.90	2.56	17.66	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.82	0.28
To WWTP - Siphon (1)	221	124	0			0	0	1,108	5.02	0	810	1.88	1,918	6.90	2.56	17.66	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.82	0.28
To WWTP	124	125	0			0	0	10,660	48.36	0	1,993	4.61	12,653	52.98	2.11	111.87	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.30	0.67
To WWTP	125	126	0			0	0	10,660	48.36	0	1,993	4.61	12,653	52.98	2.11	111.87	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.30	0.67
To WWTP	126	127	0			0	0	10,660	48.36	0	1,993	4.61	12,653	52.98	2.11	111.87	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.30	0.67
To WWTP	127	128	0			0	0	10,660	48.36	0	1,993	4.61	12,653	52.98	2.11	111.87	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.30	0.67
To WWTP	**128**	**WWTP**	0			0	0	13,870	62.93	0	3,658	8.47	17,528	71.40	2.03	**144.65**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.32	1.14
McNeely Avenue	301	302	0	31		31	78	78	0.35	0	0	0.00	78	0.35	2.96	1.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
McNeely Avenue	302	303	3			3	8	85	0.39	0	0	0.00	85	0.39	2.96	1.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
McNeely Avenue	303	304	3			3	8	93	0.42	0	0	0.00	93	0.42	2.95	1.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
McNeely Avenue	304	305	3			3	8	100	0.45	0	0	0.00	100	0.45	2.95	1.34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
McNeely Avenue	305	306	3			3	8	108	0.49	0	0	0.00	108	0.49	2.94	1.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
McNeely Avenue	306	307	3			3	8	115	0.52	0	0	0.00	115	0.52	2.94	1.53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
McNeely Avenue	307	308	4			4	10	125	0.57	0	0	0.00	125	0.57	2.93	1.66	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
McNeely Avenue	308	309	4	2		6	15	140	0.64	0	0	0.00	140	0.64	2.92	1.85	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
McNeely Avenue	309	310	6	1		7	18	158	0.71	0	0	0.00	158	0.71	2.91	2.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
McNeely Avenue	310	311	6			6	15	173	0.78	0	0	0.00	173	0.78	2.90	2.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
McNeely Avenue	311	312	4	1		5	13	185	0.84	0	0	0.00	185	0.84	2.90	2.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
McNeely Avenue	312	313	4			4	10	195	0.88	152	152	0.35	347	1.24	2.83	3.50	0.00	0.00	0.43	0.08	0.43	0.05	0.86	0.13	0.86	0.13
McNeely Avenue	313	314	8	1		9	23	218	0.99	0	152	0.35	370	1.34	2.82	3.78	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.86	0.13
McNeely Avenue	314	315	4			4	10	228	1.03	0	152	0.35	380	1.38	2.82	3.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.86	0.13
McNeely Avenue	315	316	8			8	20	248	1.12	0	152	0.35	400	1.47	2.81	4.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.86	0.13
McNeely Avenue	316	317	53			53	133	380	1.72	13	165	0.38	545	2.11	2.77	5.84	0.00	0.00	0.01	0.00	0.01	0.00	0.03	0.00	0.89	0.14
McNeely Avenue	317	318	36			36	90	470	2.13	0	165	0.38	635	2.51	2.75	6.92	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.89	0.14
McNeely Avenue	318	319	20			20	50	520	2.36	0	165	0.38	685	2.74	2.74	7.51	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.89	0.14
McNeely Avenue	319	320	5			5	13	533	2.42	0	165	0.38	698	2.80	2.74	7.66	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.89	0.14
McNeely Avenue	320	Pump Station	299			299	748	1,280	5.81	0	165	0.38	1,445	6.19	2.61	16.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.89	0.14
Patterson Crescent (Forcemain)	Pump Station	321	0			0	0	1,280	5.81	0	165	0.38	1,445	6.19	2.61	16.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.89	0.14
Patterson Crescent	321	322	442	2		444	1,110	2,390	10.84	1,452	1,617	3.74	4,007	14.59	2.40	35.00	0.00	0.00	1.02	0.20	1.02	0.12	2.03	0.32	2.92	0.46
Patterson Crescent	322	323	298	1		299	748	3,138	14.23	48	1,665	3.85	4,803	18.09	2.36	42.63	0.00	0.00	0.05	0.01	0.05	0.01	0.10	0.02	3.02	0.47
Patterson Crescent	323	324	1			1	3	3,140	14.25	0	1,665	3.85	4,805	18.10	2.36	42.66	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.02	0.47
Patterson Crescent	324	325	26		2	28	70	3,210	14.56	0	1,665	3.85	4,875	18.42	2.35	43.34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.02	0.47
To WWTP	325	326				0	0	3,210	14.56	0	1,665	3.85	4,875	18.42	2.35	43.34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.02	0.47
To WWTP	326	327				0	0	3,210	14.56	0	1,665	3.85	4,875	18.42	2.35	43.34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.02	0.47
To WWTP	327	128				0	0	3,210	14.56	0	1,665	3.85	4,875	18.42	2.35	43.34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.02	0.47

Flow Generation — 2026 ICI Contributions, Extraneous Flows; Pipe Conditions — Pipe Capacity Utilization

Street/Location	From	To	2026 ICI Contributions: Peaking Factor	Peak ICI Sewage (L/s)	Existing (2021) Extraneous Flows: Existing Drainage Area (ha)	Cumulative Existing Drainage Area (ha)	Existing Extraneous Flow (L/s)	Additional (2026) Extraneous Flows: Additional Drainage Area (ha)	Cumulative Additional Drainage Area (ha)	Additional Extraneous Flow (L/s)	2026 Extraneous Flow Contributions: Total Cumulative Drainage Area (ha)	Total Extraneous Flow (L/s)	Total Peak Flow (L/s)	Nominal Pipe Diameter (mm)	Actual Pipe Diameter (mm)	Slope (%)	Full Flow Velocity (m/s)	Full Flow Capacity (L/s)	Capacity Used (%)
Lake Avenue West	001	02A	1.00	0.03	4.95	4.95	2.72	15.38	15.38	8.46	20.33	11.18	18.38	375	381	0.44%	1.06	121.33	15.2%
Lake Avenue West(6)	02A	002	1.00	0.03	0.00	4.95	2.72	0.00	15.38	8.46	20.33	11.18	18.38	375	381	0.42%	1.04	118.54	15.5%
Lake Avenue West	002	003	1.00	0.03	35.59	40.54	22.29	0.00	15.38	8.46	55.92	30.75	50.78	375	381	0.48%	1.11	126.72	40.1%
Lake Avenue West	003	004	1.00	0.03	1.77	42.31	23.27	0.00	15.38	8.46	57.69	31.73	52.00	375	381	0.45%	1.08	122.70	42.4%
Lake Avenue West	004	005	1.00	0.17	0.40	42.71	23.49	0.00	15.38	8.46	58.09	31.95	52.65	375	381	0.46%	1.09	124.06	42.4%
Lake Avenue West	005	006	1.00	0.17	4.51	47.22	25.97	0.00	15.38	8.46	62.60	34.43	56.14	375	381	0.42%	1.04	118.54	47.4%
Lake Avenue West	006	007	1.00	0.17	1.13	48.35	26.59	0.00	15.38	8.46	63.73	35.05	57.32	375	381	0.39%	1.00	114.23	50.2%
Lake Avenue West	007	008	1.00	0.18	33.14	81.49	44.82	0.88	16.26	8.94	97.74	53.76	84.85	375	381	0.57%	1.21	138.09	61.4%
Lake Avenue West	008	009	1.00	0.18	1.84	83.33	45.83	0.00	16.26	8.94	99.58	54.77	86.73	375	381	0.85%	1.48	168.64	51.4%
Lake Avenue West	009	010	1.00	0.18	5.49	88.82	48.85	0.00	16.26	8.94	105.07	57.79	91.94	375	381	0.62%	1.26	144.02	63.8%
Lake Avenue West	010	011	1.00	0.18	3.76	92.58	50.92	0.00	16.26	8.94	108.83	59.86	95.39	375	381	0.48%	1.11	126.72	75.3%
Lake Avenue West	011	012	1.00	0.18	1.69	94.27	51.85	0.00	16.26	8.94	110.52	60.79	96.77	375	381	1.82%	2.16	246.76	39.2%
Lake Avenue West	012	013	1.00	0.18	17.76	112.03	61.61	0.01	16.27	8.95	128.29	70.56	108.41	525	533	0.25%	1.00	224.33	48.3%
Lake Avenue West	013	014	1.00	0.31	0.73	112.76	62.02	0.15	16.42	9.03	129.17	71.04	109.33	600	610	0.12%	0.76	221.90	49.3%
Lake Avenue West	014	15B	1.00	0.31	2.10	114.86	63.17	0.00	16.42	9.03	131.27	72.20	110.91	600	610	0.12%	0.76	221.90	50.0%
Lake Avenue West(6)	15B	15A	1.00	0.31	0.00	114.86	63.17	0.00	16.42	9.03	131.27	72.20	110.91	600	610	0.12%	0.76	221.90	50.0%
Lake Avenue West	15A	015	1.00	0.31	0.19	115.05	63.28	0.00	16.42	9.03	131.46	72.30	111.07	600	610	0.12%	0.76	221.90	50.1%
Lake Avenue West	015	016	1.00	0.31	0.95	116.00	63.80	0.00	16.42	9.03	132.41	72.83	111.96	600	610	0.12%	0.76	221.90	50.5%
Lake Avenue West	016	017	1.00	0.31	1.67	117.67	64.72	0.00	16.42	9.03	134.08	73.74	113.23	600	610	0.10%	0.69	202.56	55.9%
Lake Avenue West	017	018	1.00	0.31	3.63	121.30	66.71	0.00	16.42	9.03	137.71	75.74	116.71	600	610	0.10%	0.69	202.56	57.6%
Lake Avenue West	018	019	1.00	0.31	0.21	121.51	66.83	0.00	16.42	9.03	137.92	75.86	116.90	600	610	0.12%	0.76	221.90	52.7%
Lake Avenue West	019	020	1.00	0.31	1.57	123.08	67.69	0.14	16.56	9.11	139.63	76.80	118.45	600	610	0.12%	0.76	221.90	53.4%
Lake Avenue West	020	021	1.00	0.31	0.28	123.36	67.85	0.00	16.56	9.11	139.91	76.95	118.70	600	610	0.06%	*0.51*	150.22	79.0%
Lake Avenue West	021	022	1.00	0.35	12.30	135.66	74.61	1.76	18.31	10.07	153.97	84.68	130.38	600	610	0.12%	0.76	221.90	58.8%
Lorne Street	022	023	1.00	0.35	0.84	136.50	75.07	0.00	18.31	10.07	154.81	85.14	131.04	600	610	0.20%	0.98	286.47	45.7%
Lorne Street	023	024	1.00	0.35	0.65	137.15	75.43	0.00	18.31	10.07	155.46	85.50	131.69	600	610	0.20%	0.98	286.47	46.0%
Ball Park	024	120	1.00	0.35	5.71	142.86	78.57	0.00	18.31	10.07	161.17	88.64	136.72	600	610	0.47%	1.51	439.42	31.1%
High Street(3)	101	102A	1.00	0.01	57.19	57.19	171.56	0.69	0.69	2.07	57.88	173.63	189.92	350	356	0.51%	1.09	108.67	***174.8%***
High Street(3)	102A	102	1.00	0.01	0.00	57.19	171.56	0.00	0.69	2.07	57.88	173.63	189.92	350	356	0.15%	*0.59*	58.94	***322.2%***
High Street(3)	102	103	1.00	0.01	6.67	63.86	191.57	0.00	0.69	2.07	64.55	193.64	213.46	350	356	0.17%	0.63	62.74	***340.2%***
High Street(3)	103	104	1.00	0.01	12.95	76.81	230.42	0.00	0.69	2.07	77.50	232.49	254.97	400	406	0.14%	0.63	81.29	***313.7%***
High Street(3)	104	105	1.00	0.01	1.53	78.34	235.01	0.00	0.69	2.07	79.03	237.08	262.93	400	406	0.14%	0.63	81.29	***323.4%***
High Street(3)	105	106	1.00	0.01	0.47	78.81	236.42	0.00	0.69	2.07	79.50	238.49	264.76	400	406	0.14%	0.63	81.29	***325.7%***
High Street(3)	106	107	1.00	0.02	0.48	79.29	237.86	0.53	1.22	3.65	80.50	241.50	268.08	400	406	0.13%	0.60	78.33	***342.2%***
High Street(3)	107	108	1.00	0.02	0.67	79.95	239.86	0.00	1.22	3.65	81.17	243.50	270.29	400	406	0.15%	0.65	84.15	***321.2%***
Bridge Street	108	109	1.00	0.02	35.48	115.44	259.37	0.00	1.22	3.65	116.65	263.02	300.45	450	457	0.35%	1.07	175.96	***170.7%***
Bridge Street	109	110	1.00	0.02	0.18	115.62	259.47	0.00	1.22	3.65	116.83	263.12	300.80	450	457	0.31%	1.01	165.60	***181.6%***
Bridge Street	110	111	1.00	0.02	0.26	115.88	259.61	0.00	1.22	3.65	117.09	263.26	301.00	450	457	0.45%	1.22	199.52	***150.9%***
Bridge Street	111	112	1.00	0.02	0.00	115.88	259.61	0.00	1.22	3.65	117.09	263.26	301.00	450	457	1.44%	2.17	356.92	84.3%
Mill Street	112	113	1.00	0.02	16.75	132.63	268.83	0.01	1.23	3.65	133.85	272.48	314.74	600	610	0.30%	1.20	350.85	89.7%
Beckwith Street	113	114	1.00	0.02	0.98	133.61	269.37	0.00	1.23	3.65	134.83	273.02	315.58	600	610	0.20%	0.98	286.47	***110.2%***
Franklin Street	114	115	1.00	0.02	1.72	135.33	270.31	0.00	1.23	3.65	136.55	273.96	316.90	600	610	0.23%	1.05	307.20	***103.2%***
Franklin Street	115	115A	1.00	0.02	4.74	140.07	272.92	0.00	1.23	3.65	141.29	276.57	320.71	600	610	0.28%	1.16	338.95	94.6%
Franklin Street	115A	116	1.00	0.02	0.54	140.61	273.22	0.00	1.23	3.65	141.83	276.87	321.05	600	610	0.31%	1.22	356.65	90.0%
Franklin Street	116	117	1.00	0.02	0.12	140.73	273.28	0.00	1.23	3.65	141.95	276.93	321.12	600	610	0.18%	0.93	271.77	***118.2%***
Franklin Street(5)	117	118	1.00	0.02	0.57	141.30	273.60	0.00	1.23	3.65	142.52	277.25	321.63	584	593	0.26%	1.10	303.91	***105.8%***
To WWTP	118	119	1.00	0.02	0.00	141.30	273.60	0.00	1.23	3.65	142.52	277.25	321.63	600	610	0.26%	1.12	326.62	98.5%
To WWTP	119	119A	1.00	0.02	0.00	141.30	273.60	0.00	1.23	3.65	142.52	277.25	321.63	600	610	0.27%	1.14	332.84	96.6%
To WWTP(6)	119A	119B	1.00	0.02	0.00	141.30	273.60	0.00	1.23	3.65	142.52	277.25	321.63	600	610	0.27%	1.14	332.84	96.6%
To WWTP	119B	120	1.00	0.02	0.00	141.30	273.60	0.00	1.23	3.65	142.52	277.25	321.63	750	762	1.66%	***3.28***	1,496.38	21.5%
To WWTP	120	121	1.00	0.37	0.00	284.15	352.17	0.00	19.54	13.72	303.69	365.89	451.65	750	762	0.25%	1.27	580.71	77.8%
To WWTP	121	122	1.00	0.39	57.07	341.23	383.56	1.15	20.69	14.36	361.91	397.91	497.57	750	762	0.25%	1.27	580.71	85.7%
To WWTP	122	123	1.00	0.39	0.00	341.23	383.56	0.00	20.69	14.36	361.91	397.91	497.57	750	762	0.25%	1.27	580.71	85.7%
To WWTP	123	124	1.00	0.39	0.00	341.23	383.56	0.00	20.69	14.36	361.91	397.91	497.57	750	762	3.97%	***5.07***	2,314.10	21.5%
Industrial Avenue(6)	200	201	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.98	0.00	2.98	2.98	200	203	3.61%	2.00	65.01	4.6%
Industrial Avenue	201	202	1.00	0.00	31.82	31.82	17.50	0.00	0.00	0.00	31.82	17.50	22.76	200	203	0.27%	*0.55*	17.78	***128.0%***
Industrial Avenue	202	203	1.00	0.00	0.00	31.82	17.50	0.00	0.00	0.00	31.82	17.50	22.76	300	305	0.17%	*0.57*	41.59	54.7%
Mullett Street	203	204	1.00	0.00	1.14	32.96	18.13	0.00	0.00	0.00	32.96	18.13	23.72	300	305	0.22%	0.65	47.32	50.1%
Mullett Street	204	205	1.00	0.00	0.14	33.10	18.21	0.00	0.00	0.00	33.10	18.21	23.92	300	305	0.36%	0.83	60.53	39.5%
Mullett Street	205	206	1.00	0.01	4.80	37.90	20.85	0.69	0.69	0.38	38.59	21.22	29.07	300	305	0.77%	1.21	88.52	32.8%
Mullett Street	206	207	1.00	0.01	4.84	42.74	23.51	0.00	0.69	0.38	43.43	23.89	33.93	350	356	0.32%	0.87	86.08	39.4%
Mullett Street	207	208	1.00	0.01	0.00	42.74	23.51	0.00	0.69	0.38	43.43	23.89	33.93	350	356	0.72%	1.30	129.12	26.3%
Mullett Street	208	209	1.00	0.15	2.37	45.11	24.81	0.07	0.76	0.42	45.87	25.23	36.38	375	381	0.30%	0.88	100.18	36.3%
Mullett Street	209	210	1.00	0.15	0.00	45.11	24.81	0.00	0.76	0.42	45.87	25.23	36.38	375	381	0.30%	0.88	100.18	36.3%
Mullett Street	210	211A	1.00	0.15	10.35	55.46	30.50	0.15	0.91	0.50	56.37	31.00	44.93	375	381	0.24%	0.79	89.61	50.1%
Mullett Street(6)	211A	211	1.00	0.15	0.00	55.46	30.50	0.00	0.91	0.50	56.37	31.00	44.93	375	381	0.26%	0.82	93.27	48.2%
Mullett Street	211	212	1.00	0.15	0.34	55.80	30.69	0.00	0.91	0.50	56.71	31.19	45.15	375	381	2.49%	2.53	288.63	15.6%
To WWTP	212	213	1.00	0.15	0.00	55.80	30.69	0.00	0.91	0.50	56.71	31.19	45.15	400	406	0.16%	0.67	86.90	52.0%
To WWTP	213	214	1.00	0.15	0.00	55.80	30.69	0.00	0.91	0.50	56.71	31.19	45.15	400	406	0.18%	0.71	92.18	49.0%
To WWTP	214	215	1.00	0.28	0.00	55.80	30.69	2.50	3.41	1.87	59.21	32.56	50.37	400	406	3.25%	***3.02***	391.67	12.9%
To WWTP	215	216	1.00	0.28	0.00	55.80	30.69	0.00	3.41	1.87	59.21	32.56	50.37	400	406	0.21%	0.77	99.56	50.6%
To WWTP	216	217	1.00	0.28	0.62	56.42	31.03	0.00	3.41	1.87	59.83	32.90	50.80	400	406	0.23%	0.80	104.20	48.8%
To WWTP	217	218	1.00	0.28	0.00	56.42	31.03	0.00	3.41	1.87	59.83	32.90	50.80	400	406	0.22%	0.79	101.90	49.8%
To WWTP	218	219	1.00	0.28	0.35	56.77	31.22	0.00	3.41	1.87	60.18	33.10	51.04	400	406	0.18%	0.71	92.18	55.4%
To WWTP - Siphon (1)	219	220	1.00	0.28	0.00	56.77	31.22	0.00	3.41	1.87	60.18	33.10	51.04	400	406	0.22%	0.79	101.90	50.1%
To WWTP - Siphon (1)	220	221	1.00	0.28	0.00	56.77	31.22	0.00	3.41	1.87	60.18	33.10	51.04	400	406	0.84%	1.54	199.12	25.6%
To WWTP - Siphon (1)	221	124	1.00	0.28	0.00	56.77	31.22	0.00	3.41	1.87	60.18	33.10	51.04	400	406	0.15%	0.65	84.15	60.7%
To WWTP	124	125	1.00	0.67	0.00	398.00	414.78	0.00	24.09	16.23	422.09	431.01	543.55	750	762	0.12%	0.88	402.33	***135.1%***
To WWTP	125	126	1.00	0.67	0.00	398.00	414.78	0.00	24.09	16.23	422.09	431.01	543.55	750	762	0.12%	0.88	402.33	***135.1%***
To WWTP	126	127	1.00	0.67	0.00	398.00	414.78	0.00	24.09	16.23	422.09	431.01	543.55	750	762	0.12%	0.88	402.33	***135.1%***
To WWTP	127	128	1.00	0.67	0.00	398.00	414.78	0.00	24.09	16.23	422.09	431.01	543.55	750	762	0.27%	1.32	603.49	90.1%
To WWTP	**128**	**WWTP**	1.00	1.14	0.00	590.87	520.86	0.00	62.63	37.42	653.50	**558.28**	**704.08**	750	762	0.27%	1.32	603.49	***116.7%***
McNeely Avenue	301	302	1.00	0.00	50.25	50.25	27.64	0.00	0.00	0.00	50.25	27.64	28.68	300	305	0.25%	0.69	50.44	56.9%
McNeely Avenue	302	303	1.00	0.00	0.92	51.17	28.14	0.00	0.00	0.00	51.17	28.14	29.28	450	457	0.14%	0.68	111.29	26.3%
McNeely Avenue	303	304	1.00	0.00	0.87	52.04	28.62	0.00	0.00	0.00	52.04	28.62	29.86	450	457	0.10%	*0.57*	94.06	31.7%
McNeely Avenue	304	305	1.00	0.00	0.85	52.89	29.09	0.00	0.00	0.00	52.89	29.09	30.43	450	457	0.12%	0.63	103.03	29.5%
McNeely Avenue	305	306	1.00	0.00	0.88	53.77	29.57	0.00	0.00	0.00	53.77	29.57	31.01	450	457	0.05%	*0.41*	66.51	46.6%
McNeely Avenue	306	307	1.00	0.00	0.89	54.66	30.06	0.00	0.00	0.00	54.66	30.06	31.59	450	457	0.04%	*0.36*	59.49	53.1%
McNeely Avenue	307	308	1.00	0.00	1.08	55.74	30.66	0.00	0.00	0.00	55.74	30.66	32.32	450	457	0.13%	0.65	107.24	30.1%
McNeely Avenue	308	309	1.00	0.00	1.03	56.77	31.22	0.00	0.00	0.00	56.77	31.22	33.08	450	457	0.11%	0.60	98.65	33.5%
McNeely Avenue	309	310	1.00	0.00	1.77	58.54	32.20	0.00	0.00	0.00	58.54	32.20	34.28	450	457	0.08%	*0.51*	84.13	40.7%
McNeely Avenue	310	311	1.00	0.00	1.56	60.10	33.06	0.00	0.00	0.00	60.10	33.06	35.33	450	457	0.10%	*0.57*	94.06	37.6%
McNeely Avenue	311	312	1.00	0.00	0.98	61.08	33.59	0.00	0.00	0.00	61.08	33.59	36.02	450	457	0.06%	*0.44*	72.86	49.4%
McNeely Avenue	312	313	1.00	0.13	0.46	61.54	33.85	1.20	1.20	0.66	62.74	34.51	38.14	450	457	0.13%	0.65	107.24	35.6%
McNeely Avenue	313	314	1.00	0.13	2.00	63.54	34.95	0.00	1.20	0.66	64.74	35.61	39.52	450	457	0.12%	0.63	103.03	38.4%
McNeely Avenue	314	315	1.00	0.13	0.36	63.90	35.15	0.00	1.20	0.66	65.10	35.81	39.84	300	305	0.41%	0.89	64.60	61.7%
McNeely Avenue	315	316	1.00	0.13	0.51	64.41	35.43	0.00	1.20	0.66	65.61	36.09	40.37	300	305	0.41%	0.89	64.60	62.5%
McNeely Avenue	316	317	1.00	0.14	3.42	67.83	37.31	0.24	1.44	0.79	69.27	38.10	44.08	300	305	0.21%	0.63	46.23	95.3%
McNeely Avenue	317	318	1.00	0.14	2.22	70.05	38.53	0.00	1.44	0.79	71.49	39.32	46.38	300	305	0.23%	0.66	48.38	95.9%
McNeely Avenue	318	319	1.00	0.14	0.82	70.87	38.98	0.00	1.44	0.79	72.31	39.77	47.42	300	305	0.27%	0.72	52.42	90.5%
McNeely Avenue	319	320	1.00	0.14	0.32	71.19	39.15	0.00	1.44	0.79	72.63	39.95	47.75	300	305	0.50%	0.98	71.33	66.9%
McNeely Avenue	320	Pump Station	1.00	0.14	26.50	97.69	53.73	0.00	1.44	0.79	99.14	54.52	70.85	300	305	0.50%	0.98	71.33	99.3%
Patterson Crescent (Forcemain)	Pump Station	321	1.00	0.14	0.00	97.69	53.73	0.00	1.44	0.79	99.14	54.52	70.85						
Patterson Crescent	321	322	1.00	0.46	75.04	172.74	95.01	36.18	37.63	20.69	210.36	115.70	151.16	500	508	0.20%	0.87	176.17	85.8%
Patterson Crescent	322	323	1.00	0.47	14.38	187.11	102.91	0.91	38.53	21.19	225.65	124.11	167.21	500	508	0.20%	0.87	176.17	94.9%
Patterson Crescent	323	324	1.00	0.47	0.23	187.34	103.04	0.00	38.53	21.19	225.88	124.23	167.36	500	508	0.20%	0.87	176.17	95.0%
Patterson Crescent	324	325	1.00	0.47	5.53	192.87	106.08	0.00	38.53	21.19	231.41	127.27	171.09	500	508	0.20%	0.87	176.17	97.1%
To WWTP	325	326	1.00	0.47	0.00	192.87	106.08	0.00	38.53	21.19	231.41	127.27	171.09	500	508	0.20%	0.87	176.17	97.1%
To WWTP	326	327	1.00	0.47	0.00	192.87	106.08	0.00	38.53	21.19	231.41	127.27	171.09	500	508	0.20%	0.87	176.17	97.1%
To WWTP	327	128	1.00	0.47	0.00	192.87	106.08	0.00	38.53	21.19	231.41	127.27	171.09	500	508	0.20%	0.87	176.17	97.1%

Stantec

163401646 - Town of Carleton Place W/WW Master Plan

Table D-10: Sanitary Sewer Calculation Spreadsheet - 2031 Design Event

Date: 8/19/2021
Prepared by: CR
Checked by: AL

Legend
Manual Input/Modification
Calculated/Extracted Value for Existing + Additional Development
Existing Conditions - 2021
Additional Development
Full Flow Velocity < 0.6 m/s
Sewer Capacity Used > 100%; Sewer Velocity > 3 m/s
WWTP Inflow Point

Modelling Parameters - 2031 Design Event		
Horizon:	2031	
Scenario:	Design	
Existing Conditions - 2021		
Average Residential Flow Rate - q =	392	l/cap/day
Peak Extraneous Flow Rate - i =	0.33	l/s/ha
Peak Extraneous Flow Rate (Monitor No. 6)[3] - i =	0.33	l/s/ha
Existing Conditions Population Density =	2.5	PPU
Harmon Peaking Factor Correction Factor - K =	0.80	-
Growth Developments - 2031		
Average Residential Flow Rate - q =	280	l/cap/day
Peak Extraneous Flow Rate - i =	0.33	l/s/ha
Peak Extraneous Flow Rate (Monitor No. 6)[3] - i =	0.33	l/s/ha
Harmon Peaking Factor Correction Factor - K =	0.80	-
Insitutional/Commercial Average Flow Rate - q =	28,000	l/ha/day
Institutional/Commercial (IC) Peaking Factor (ICI Cont. > 20%) =	1.50	-
Institutional/Commercial (IC) Peaking Factor (ICI Cont. ≤ 20%) =	1.00	-
Light Industrial Average Flow Rate - q =	35,000	l/ha/day
Light Industrial Peaking Factor (ICI Cont. > 20%) =	1.50	-
Light Industrial Peaking Factor (ICI Cont. ≤ 20%) =	1.00	-
Manning's Coefficient - n =	0.013	

*Note: Values as per **Design Basis Memo** (July 12, 2021)*

Summary - 2031 Design Event		
2021 Residential Population	13,403	ppl
2021 ICI Equivalent Population	468	ppl
2021 Total Residential + ICI Equivalent Population	13,870	ppl
2031 Additional Residential Population	6,827	ppl
2031 Total Residential Population	20,230	ppl
2031 Total Residential + ICI Equivalent Population	20,697	ppl
2031 Additional Residential Area	110	ha
2031 Additional ICI Area	14	ha
2031 Total Area	715	ha
Average DWF (Residential + ICI)	7,789	m^3/d
Peak DWF (Residential + ICI)	17,416	m^3/d
Peak Extraneous Flow	20,381	m^3/d
Peak Total Flow	37,797	m^3/d
Number of Sewers Surcharged	0	
Average Sewer Capacity Used	46.7%	
Max Sewer Capacity Used	95.0%	
Mississippi Quays PS Peak Inflow	57.4	L/s

Notes

(1) McArthur Island siphon represented by sewer section from MH219 to MH124, as a single 400 mm diameter gravity pipe at 0.84% slope, as per original spreadsheet (JLR, 2021). Based on drawings, siphon consists of two barrels (150 mm and 300 mm); representation of siphon would require adjustments for HGL calculations.
(2) Mississippi Quays PS modelled at the end of McNeely Avenue (from MH320 to Pump Station); no gravity flow calculated through forcemain on Patterson Crescent (from Pump Station to MH321, assumed without restrictions).
(3) Extraneous flows calculated using 0.33 L/s/ha for drainage areas tributary to flow monitor No. 6.
(4) Diameters and slopes confirmed or corrected based on comparison of original spreadsheet to information provided by the Town on 20210712; see detailed comparison in Table D-1: Comparison of Diameters and Slopes from Different Sources.
(5) Based on information provided by the Town on 20210712, sewer along Franklin St between MH117 and MH118 appears to first be a ~38 m long 600 mm single sewer, followed by a ~52 m long section of twin 450 mm sewers; equivalent diameter to twin 450 mm retained, as it is more conservative.
(6) Sewer section added to spreadsheet to match Town's GIS data.

Level of Service Limits		
Maximum Velocity	3	m/s
Actual Flow/Full Flow Capacity	100%	

Flow Generation – Residential / Existing (2021) ICI Conditions

Street/Location	Maintenance Hole From	Maintenance Hole To	Existing (2021) Residential Conditions – Number of Units: Residential Units	Commercial Units	Institutional Units	Total Units	Existing Population	Cumulative Existing Population	Existing Residential Sewage Flow (L/s)	Additional (2031) Residential Development: Additional Population	Cumulative Additional Population	Additional Residential Sewage Flow (L/s)	2031 Residential Contributions: Total Cumulative Residential Population	Total Residential Sewage Flow (L/s)	Harmon Peaking Factor	Peak Residential Sewage Flow (L/s)	Existing (2021) ICI Conditions: Existing ICI Sewage (L/s)	Cumulative Existing ICI Sewage (L/s)
Lake Avenue West	001	02A	62		1	63	158	158	0.71	1,427	1,427	4.62	1,585	5.34	3.13	16.71	0.00	0.00
Lake Avenue West[6]	02A	002					0	158	0.71	0	1,427	4.62	1,585	5.34	3.13	16.71	0.00	0.00
Lake Avenue West	002	003	459			459	1,148	1,305	5.92	0	1,427	4.62	2,732	10.55	2.98	31.44	0.00	0.00
Lake Avenue West	003	004	9			9	23	1,328	6.02	0	1,427	4.62	2,755	10.65	2.98	31.72	0.00	0.00
Lake Avenue West	004	005	11			11	28	1,355	6.15	0	1,427	4.62	2,782	10.77	2.98	32.06	0.00	0.00
Lake Avenue West	005	006	37		1	38	95	1,450	6.58	0	1,427	4.62	2,877	11.20	2.97	33.23	0.00	0.00
Lake Avenue West	006	007	21			21	53	1,503	6.82	0	1,427	4.62	2,930	11.44	2.96	33.88	0.00	0.00
Lake Avenue West	007	008	325			325	813	2,315	10.50	161	1,588	5.15	3,903	15.65	2.87	44.98	0.00	0.00
Lake Avenue West	008	009	34			34	85	2,400	10.89	0	1,588	5.15	3,988	16.04	2.87	45.98	0.00	0.00
Lake Avenue West	009	010	86			86	215	2,615	11.86	0	1,588	5.15	4,203	17.01	2.85	48.50	0.00	0.00
Lake Avenue West	010	011	54	1		55	138	2,753	12.49	11	1,599	5.18	4,352	17.67	2.84	50.19	0.00	0.00
Lake Avenue West	011	012	18			18	45	2,798	12.69	0	1,599	5.18	4,397	17.87	2.84	50.71	0.00	0.00
Lake Avenue West	012	013	70	4		74	185	2,983	13.53	2	1,601	5.19	4,584	18.72	2.82	52.86	0.00	0.00
Lake Avenue West	013	014	7	1		8	20	3,003	13.62	39	1,640	5.31	4,643	18.94	2.82	53.40	0.00	0.00
Lake Avenue West	014	15B	15	2		17	43	3,045	13.82	12	1,652	5.35	4,697	19.17	2.82	53.98	0.00	0.00
Lake Avenue West[6]	15B	15A					0	3,045	13.82	0	1,652	5.35	4,697	19.17	2.82	53.98	0.00	0.00
Lake Avenue West	15A	015	1	1		2	5	3,050	13.84	0	1,652	5.35	4,702	19.19	2.82	54.04	0.00	0.00
Lake Avenue West	015	016	15			15	38	3,088	14.01	0	1,652	5.35	4,740	19.36	2.81	54.47	0.00	0.00
Lake Avenue West	016	017	12	2		14	35	3,123	14.17	0	1,652	5.35	4,775	19.52	2.81	54.87	0.00	0.00
Lake Avenue West	017	018	60			60	150	3,273	14.85	0	1,652	5.35	4,925	20.20	2.80	56.58	0.00	0.00
Lake Avenue West	018	019	3			3	8	3,280	14.88	0	1,652	5.35	4,932	20.24	2.80	56.67	0.00	0.00
Lake Avenue West	019	020	23			23	58	3,338	15.14	16	1,668	5.41	5,006	20.55	2.80	57.44	0.00	0.00
Lake Avenue West	020	021	4			4	10	3,348	15.19	0	1,668	5.41	5,016	20.59	2.80	57.56	0.00	0.00
Lake Avenue West	021	022	140		1	141	353	3,700	16.79	203	1,871	6.06	5,571	22.85	2.76	63.09	0.00	0.00
Lorne Street	022	023	8			8	20	3,720	16.88	0	1,871	6.06	5,591	22.94	2.76	63.31	0.00	0.00
Lorne Street	023	024	12			12	30	3,750	17.01	0	1,871	6.06	5,621	23.08	2.76	63.65	0.00	0.00
Ball Park	024	120	77	1		78	195	3,945	17.90	0	1,871	6.06	5,816	23.96	2.75	65.82	0.00	0.00
High Street[3]	101	102A	535	4	1	540	1,350	1,350	6.13	107	107	0.35	1,457	6.47	3.15	20.39	0.00	0.00
High Street[3]	102A	102	0			0	0	1,350	6.13	0	107	0.35	1,457	6.47	3.15	20.39	0.00	0.00
High Street[3]	102	103	129			129	323	1,673	7.59	0	107	0.35	1,780	7.93	3.10	24.60	0.00	0.00
High Street[3]	103	104	99			99	248	1,920	8.71	0	107	0.35	2,027	9.06	3.07	27.76	0.00	0.00
High Street[3]	104	105	125	2		127	318	2,238	10.15	0	107	0.35	2,345	10.50	3.02	31.76	0.00	0.00
High Street[3]	105	106	16			16	40	2,278	10.33	0	107	0.35	2,385	10.68	3.02	32.25	0.00	0.00
High Street[3]	106	107	5			5	13	2,290	10.39	65	172	0.56	2,462	10.95	3.01	32.96	0.00	0.00
High Street[3]	107	108	8			8	20	2,310	10.48	0	172	0.56	2,482	11.04	3.01	33.21	0.00	0.00
Bridge Street	108	109	415		1	416	1,040	3,350	15.20	70	242	0.78	3,592	15.98	2.90	46.35	0.00	0.00
Bridge Street	109	110	6	4		10	25	3,375	15.31	0	242	0.78	3,617	16.10	2.90	46.64	0.00	0.00
Bridge Street	110	111	2			2	5	3,380	15.34	0	242	0.78	3,622	16.12	2.90	46.70	0.00	0.00
Bridge Street	111	112	0			0	0	3,380	15.34	0	242	0.78	3,622	16.12	2.90	46.70	0.00	0.00
Mill Street	112	113	158	22	2	182	455	3,835	17.40	8	250	0.81	4,085	18.21	2.86	52.08	0.00	0.00
Beckwith Street	113	114	12			12	30	3,865	17.54	0	250	0.81	4,115	18.35	2.86	52.43	0.00	0.00
Franklin Street	114	115	10	5		15	38	3,903	17.71	0	250	0.81	4,153	18.52	2.85	52.86	0.00	0.00
Franklin Street	115	115A	42	7		49	123	4,025	18.26	12	262	0.85	4,287	19.11	2.84	54.37	0.00	0.00
Franklin Street	115A	116	2			2	5	4,030	18.28	0	262	0.85	4,292	19.13	2.84	54.43	0.00	0.00
Franklin Street	116	117	0			0	0	4,030	18.28	0	262	0.85	4,292	19.13	2.84	54.43	0.00	0.00
Franklin Street[5]	117	118	5	3		8	20	4,050	18.38	0	262	0.85	4,312	19.22	2.84	54.66	0.00	0.00
To WWTP	118	119	0			0	0	4,050	18.38	0	262	0.85	4,312	19.22	2.84	54.66	0.00	0.00
To WWTP	119	119A	0			0	0	4,050	18.38	0	262	0.85	4,312	19.22	2.84	54.66	0.00	0.00
To WWTP[6]	119A	119B					0	4,050	18.38	0	262	0.85	4,312	19.22	2.84	54.66	0.00	0.00
To WWTP	119B	120	0			0	0	4,050	18.38	0	262	0.85	4,312	19.22	2.84	54.66	0.00	0.00
To WWTP	120	121	0			0	0	7,995	36.27	0	2,133	6.91	10,128	43.19	2.56	110.53	0.00	0.00
To WWTP	121	122	610	12	1	623	1,558	9,553	43.34	136	2,269	7.35	11,822	50.69	2.51	127.02	0.00	0.00
To WWTP	122	123	0			0	0	9,553	43.34	0	2,269	7.35	11,822	50.69	2.51	127.02	0.00	0.00
To WWTP	123	124	0			0	0	9,553	43.34	0	2,269	7.35	11,822	50.69	2.51	127.02	0.00	0.00
Industrial Avenue[6]	200	201					0	0	0.00	0	0	0.00	0	0.00	3.80	0.00	0.00	0.00
Industrial Avenue	201	202	115	50		165	413	413	1.87	0	0	0.00	413	1.87	3.41	6.39	0.00	0.00
Industrial Avenue	202	203	0			0	0	413	1.87	0	0	0.00	413	1.87	3.41	6.39	0.00	0.00
Mullett Street	203	204	7	4		11	28	440	2.00	0	0	0.00	440	2.00	3.40	6.79	0.00	0.00
Mullett Street	204	205	4			4	10	450	2.04	0	0	0.00	450	2.04	3.40	6.94	0.00	0.00
Mullett Street	205	206	63	1		64	160	610	2.77	136	136	0.44	746	3.21	3.30	10.60	0.00	0.00
Mullett Street	206	207	75			75	188	798	3.62	20	156	0.51	954	4.12	3.25	13.40	0.00	0.00
Mullett Street	207	208	0			0	0	798	3.62	0	156	0.51	954	4.12	3.25	13.40	0.00	0.00
Mullett Street	208	209	17	5		22	55	853	3.87	97	253	0.82	1,106	4.69	3.22	15.08	0.00	0.00
Mullett Street	209	210	0			0	0	853	3.87	0	253	0.82	1,106	4.69	3.22	15.08	0.00	0.00
Mullett Street	210	211A	91	5		96	240	1,093	4.96	19	272	0.88	1,365	5.84	3.17	18.49	0.00	0.00
Mullett Street[6]	211A	211					0	1,093	4.96	0	272	0.88	1,365	5.84	3.17	18.49	0.00	0.00
Mullett Street	211	212	1			1	3	1,095	4.97	0	272	0.88	1,367	5.85	3.17	18.52	0.00	0.00
To WWTP	212	213	0			0	0	1,095	4.97	0	272	0.88	1,367	5.85	3.17	18.52	0.00	0.00
To WWTP	213	214	0			0	0	1,095	4.97	0	272	0.88	1,367	5.85	3.17	18.52	0.00	0.00
To WWTP	214	215	0			0	0	1,095	4.97	1,124	1,396	4.52	2,491	9.49	3.01	28.55	0.00	0.00
To WWTP	215	216	0			0	0	1,095	4.97	0	1,396	4.52	2,491	9.49	3.01	28.55	0.00	0.00
To WWTP	216	217	2		1	3	8	1,103	5.00	0	1,396	4.52	2,499	9.53	3.01	28.64	0.00	0.00
To WWTP	217	218	0			0	0	1,103	5.00	0	1,396	4.52	2,499	9.53	3.01	28.64	0.00	0.00
To WWTP	218	219	1		1	2	5	1,108	5.02	0	1,396	4.52	2,504	9.55	3.01	28.71	0.00	0.00
To WWTP - Siphon[1]	219	220	0			0	0	1,108	5.02	0	1,396	4.52	2,504	9.55	3.01	28.71	0.00	0.00
To WWTP - Siphon[1]	220	221	0			0	0	1,108	5.02	0	1,396	4.52	2,504	9.55	3.01	28.71	0.00	0.00
To WWTP - Siphon[1]	221	124	0			0	0	1,108	5.02	0	1,396	4.52	2,504	9.55	3.01	28.71	0.00	0.00
To WWTP	124	125	0			0	0	10,660	48.36	0	3,665	11.88	14,325	60.24	2.44	146.91	0.00	0.00
To WWTP	125	126	0			0	0	10,660	48.36	0	3,665	11.88	14,325	60.24	2.44	146.91	0.00	0.00
To WWTP	126	127	0			0	0	10,660	48.36	0	3,665	11.88	14,325	60.24	2.44	146.91	0.00	0.00
To WWTP	127	128	0			0	0	10,660	48.36	0	3,665	11.88	14,325	60.24	2.44	146.91	0.00	0.00
To WWTP	**128**	**WWTP**	0			0	0	13,870	62.93	0	6,827	22.12	20,697	85.05	2.31	**196.48**	0.00	0.00
McNeely Avenue	301	302	0	31		31	78	78	0.35	0	0	0.00	78	0.35	3.62	1.27	0.00	0.00
McNeely Avenue	302	303	3			3	8	85	0.39	0	0	0.00	85	0.39	3.61	1.39	0.00	0.00
McNeely Avenue	303	304	3			3	8	93	0.42	0	0	0.00	93	0.42	3.60	1.51	0.00	0.00
McNeely Avenue	304	305	3			3	8	100	0.45	0	0	0.00	100	0.45	3.59	1.63	0.00	0.00
McNeely Avenue	305	306	3			3	8	108	0.49	0	0	0.00	108	0.49	3.59	1.75	0.00	0.00
McNeely Avenue	306	307	3			3	8	115	0.52	0	0	0.00	115	0.52	3.58	1.87	0.00	0.00
McNeely Avenue	307	308	4			4	10	125	0.57	0	0	0.00	125	0.57	3.57	2.03	0.00	0.00
McNeely Avenue	308	309	4	2		6	15	140	0.64	0	0	0.00	140	0.64	3.56	2.26	0.00	0.00
McNeely Avenue	309	310	6	1		7	18	158	0.71	0	0	0.00	158	0.71	3.55	2.53	0.00	0.00
McNeely Avenue	310	311	6			6	15	173	0.78	130	130	0.42	303	1.20	3.46	4.17	0.00	0.00
McNeely Avenue	311	312	4	1		5	13	185	0.84	0	130	0.42	315	1.26	3.46	4.36	0.00	0.00
McNeely Avenue	312	313	4			4	10	195	0.88	243	373	1.21	568	2.09	3.36	7.03	0.00	0.00
McNeely Avenue	313	314	8	1		9	23	218	0.99	0	373	1.21	591	2.20	3.35	7.35	0.00	0.00
McNeely Avenue	314	315	4			4	10	228	1.03	0	373	1.21	601	2.24	3.35	7.50	0.00	0.00
McNeely Avenue	315	316	8			8	20	248	1.12	0	373	1.21	621	2.33	3.34	7.79	0.00	0.00
McNeely Avenue	316	317	53			53	133	380	1.72	26	399	1.29	779	3.02	3.29	9.94	0.00	0.00
McNeely Avenue	317	318	36			36	90	470	2.13	0	399	1.29	869	3.43	3.27	11.20	0.00	0.00
McNeely Avenue	318	319	20			20	50	520	2.36	0	399	1.29	919	3.65	3.26	11.90	0.00	0.00
McNeely Avenue	319	320	5			5	13	533	2.42	0	399	1.29	932	3.71	3.26	12.08	0.00	0.00
McNeely Avenue	320	Pump Station	299			299	748	1,280	5.81	0	399	1.29	1,679	7.10	3.11	22.12	0.00	0.00
Patterson Crescent (Forcemain)	Pump Station	321	0			0	0	1,280	5.81	0	399	1.29	1,679	7.10	3.11	22.12	0.00	0.00
Patterson Crescent	321	322	442	2		444	1,110	2,390	10.84	2,668	3,067	9.94	5,457	20.78	2.77	57.52	0.00	0.00
Patterson Crescent	322	323	298	1		299	748	3,138	14.23	95	3,162	10.25	6,300	24.48	2.72	66.60	0.00	0.00
Patterson Crescent	323	324	1			1	3	3,140	14.25	0	3,162	10.25	6,302	24.49	2.72	66.63	0.00	0.00
Patterson Crescent	324	325	26		2	28	70	3,210	14.56	0	3,162	10.25	6,372	24.81	2.72	67.40	0.00	0.00
To WWTP	325	326				0	0	3,210	14.56	0	3,162	10.25	6,372	24.81	2.72	67.40	0.00	0.00
To WWTP	326	327				0	0	3,210	14.56	0	3,162	10.25	6,372	24.81	2.72	67.40	0.00	0.00
To WWTP	327	128				0	0	3,210	14.56	0	3,162	10.25	6,372	24.81	2.72	67.40	0.00	0.00

Flow Generation – ICI / Extraneous Flows / Pipe Conditions

Street/Location	From	To	Additional (2031) ICI Development: Additional IC Area (ha)	Additional IC Sewage (L/s)	Additional Ind. Area (ha)	Additional Ind. Sewage (L/s)	Total Additional ICI Area (ha)	Total Additional ICI Sewage (L/s)	Cumulative Additional ICI Area (ha)	Cumulative Additional ICI Sewage (L/s)	2031 ICI Contributions: Peaking Factor	Peak ICI Sewage (L/s)	Existing (2021) Extraneous Flows: Existing Drainage Area (ha)	Cumulative Existing Drainage Area (ha)	Existing Extraneous Flow (L/s)	Additional (2031) Extraneous Flows: Additional Drainage Area (ha)	Cumulative Additional Drainage Area (ha)	Additional Extraneous Flow (L/s)	2031 Extraneous Flow Contributions: Total Cumulative Drainage Area (ha)	Total Extraneous Flow (L/s)	Total Peak Flow (L/s)	Pipe Capacity Utilization: Nominal Pipe Diameter (mm)	Actual Pipe Diameter (mm)	Slope (%)	Full Flow Velocity (m/s)	Full Flow Capacity (L/s)	Capacity Used (%)
Lake Avenue West	001	02A	0.21	0.07	0.21	0.08	0.41	0.15	0.41	0.15	1.00	0.15	4.95	4.95	1.63	25.87	25.87	8.54	30.82	10.17	27.03	375	381	0.44%	1.06	121.33	22.3%
Lake Avenue West[6]	02A	002	0.00	0.00	0.00	0.00	0.00	0.00	0.41	0.15	1.00	0.15	0.00	4.95	1.63	0.00	25.87	8.54	30.82	10.17	27.03	375	381	0.42%	1.04	118.54	22.8%
Lake Avenue West	002	003	0.00	0.00	0.00	0.00	0.00	0.00	0.41	0.15	1.00	0.15	35.59	40.54	13.38	0.00	25.87	8.54	66.41	21.91	53.50	375	381	0.48%	1.11	126.72	42.2%
Lake Avenue West	003	004	0.00	0.00	0.00	0.00	0.00	0.00	0.41	0.15	1.00	0.15	1.77	42.31	13.96	0.00	25.87	8.54	68.18	22.50	54.37	375	381	0.45%	1.08	122.70	44.3%
Lake Avenue West	004	005	0.69	0.22	0.69	0.28	1.38	0.50	1.80	0.65	1.00	0.65	0.40	42.71	14.09	0.00	25.87	8.54	68.58	22.63	55.34	375	381	0.46%	1.09	124.06	44.6%
Lake Avenue West	005	006	0.00	0.00	0.00	0.00	0.00	0.00	1.80	0.65	1.00	0.65	4.51	47.22	15.58	0.00	25.87	8.54	73.09	24.12	58.00	375	381	0.42%	1.04	118.54	48.9%
Lake Avenue West	006	007	0.00	0.00	0.00	0.00	0.00	0.00	1.80	0.65	1.00	0.65	1.13	48.35	15.95	0.00	25.87	8.54	74.22	24.49	59.02	375	381	0.39%	1.00	114.23	51.7%
Lake Avenue West	007	008	0.10	0.03	0.10	0.04	0.20	0.07	2.00	0.73	1.00	0.73	33.14	81.49	26.89	2.54	28.41	9.37	109.89	36.27	81.98	375	381	0.57%	1.21	138.09	59.4%
Lake Avenue West	008	009	0.00	0.00	0.00	0.00	0.00	0.00	2.00	0.73	1.00	0.73	1.84	83.33	27.50	0.00	28.41	9.37	111.73	36.87	83.58	375	381	0.85%	1.48	168.64	49.6%
Lake Avenue West	009	010	0.00	0.00	0.00	0.00	0.00	0.00	2.00	0.73	1.00	0.73	5.49	88.82	29.31	0.00	28.41	9.37	117.22	38.68	87.91	375	381	0.62%	1.26	144.02	61.0%
Lake Avenue West	010	011	0.00	0.00	0.00	0.00	0.00	0.00	2.00	0.73	1.00	0.73	3.76	92.58	30.55	0.19	28.60	9.44	121.17	39.99	90.90	375	381	0.48%	1.11	126.72	71.7%
Lake Avenue West	011	012	0.00	0.00	0.00	0.00	0.00	0.00	2.00	0.73	1.00	0.73	1.69	94.27	31.11	0.00	28.60	9.44	122.86	40.55	91.98	375	381	1.82%	2.16	246.76	37.3%
Lake Avenue West	012	013	0.00	0.00	0.00	0.00	0.00	0.00	2.00	0.73	1.00	0.73	17.76	112.03	36.97	0.02	28.62	9.44	140.64	46.41	100.01	525	533	0.25%	1.00	224.33	44.6%
Lake Avenue West	013	014	0.69	0.22	0.69	0.28	1.38	0.50	3.38	1.23	1.00	1.23	0.73	112.76	37.21	0.24	28.86	9.52	141.61	46.73	101.37	600	610	0.12%	0.76	221.90	45.7%
Lake Avenue West	014	15B	0.00	0.00	0.00	0.00	0.00	0.00	3.38	1.23	1.00	1.23	2.10	114.86	37.90	0.22	29.08	9.60	143.94	47.50	102.71	600	610	0.12%	0.76	221.90	46.3%
Lake Avenue West[6]	15B	15A	0.00	0.00	0.00	0.00	0.00	0.00	3.38	1.23	1.00	1.23	0.00	114.86	37.90	0.00	29.08	9.60	143.94	47.50	102.71	600	610	0.12%	0.76	221.90	46.3%
Lake Avenue West	15A	015	0.00	0.00	0.00	0.00	0.00	0.00	3.38	1.23	1.00	1.23	0.19	115.05	37.97	0.00	29.08	9.60	144.13	47.56	102.83	600	610	0.12%	0.76	221.90	46.3%
Lake Avenue West	015	016	0.00	0.00	0.00	0.00	0.00	0.00	3.38	1.23	1.00	1.23	0.95	116.00	38.28	0.00	29.08	9.60	145.08	47.88	103.58	600	610	0.12%	0.76	221.90	46.7%
Lake Avenue West	016	017	0.00	0.00	0.00	0.00	0.00	0.00	3.38	1.23	1.00	1.23	1.67	117.67	38.83	0.00	29.08	9.60	146.75	48.43	104.53	600	610	0.10%	0.69	202.56	51.6%
Lake Avenue West	017	018	0.00	0.00	0.00	0.00	0.00	0.00	3.38	1.23	1.00	1.23	3.63	121.30	40.03	0.00	29.08	9.60	150.38	49.62	107.44	600	610	0.10%	0.69	202.56	53.0%
Lake Avenue West	018	019	0.00	0.00	0.00	0.00	0.00	0.00	3.38	1.23	1.00	1.23	0.21	121.51	40.10	0.00	29.08	9.60	150.59	49.69	107.59	600	610	0.12%	0.76	221.90	48.5%
Lake Avenue West	019	020	0.02	0.01	0.02	0.01	0.03	0.01	3.42	1.25	1.00	1.25	1.57	123.08	40.61	0.28	29.36	9.69	152.44	50.30	108.99	600	610	0.12%	0.76	221.90	49.1%
Lake Avenue West	020	021	0.00	0.00	0.00	0.00	0.00	0.00	3.42	1.25	1.00	1.25	0.28	123.36	40.71	0.00	29.36	9.69	152.72	50.40	109.20	600	610	0.06%	*0.51*	150.22	72.7%
Lake Avenue West	021	022	0.21	0.07	0.21	0.08	0.41	0.15	3.83	1.40	1.00	1.40	12.30	135.66	44.77	3.52	32.88	10.85	168.53	55.62	120.10	600	610	0.12%	0.76	221.90	54.1%
Lorne Street	022	023	0.00	0.00	0.00	0.00	0.00	0.00	3.83	1.40	1.00	1.40	0.84	136.50	45.04	0.00	32.88	10.85	169.37	55.89	120.60	600	610	0.20%	0.98	286.47	42.1%
Lorne Street	023	024	0.00	0.00	0.00	0.00	0.00	0.00	3.83	1.40	1.00	1.40	0.65	137.15	45.26	0.00	32.88	10.85	170.02	56.11	121.15	600	610	0.20%	0.98	286.47	42.3%
Ball Park	024	120	0.00	0.00	0.00	0.00	0.00	0.00	3.83	1.40	1.00	1.40	5.71	142.86	47.14	0.00	32.88	10.85	175.73	57.99	125.21	600	610	0.47%	1.51	439.42	28.5%
High Street[3]	101	102A	0.34	0.11	0.34	0.14	0.69	0.25	0.69	0.25	1.00	0.25	57.19	57.19	18.87	2.00	2.00	0.66	59.19	19.53	40.17	350	356	0.51%	1.09	108.67	37.0%
High Street[3]	102A	102	0.00	0.00	0.00	0.00	0.00	0.00	0.69	0.25	1.00	0.25	0.00	57.19	18.87	0.00	2.00	0.66	59.19	19.53	40.17	350	356	0.15%	*0.59*	58.94	68.2%
High Street[3]	102	103	0.00	0.00	0.00	0.00	0.00	0.00	0.69	0.25	1.00	0.25	6.67	63.86	21.07	0.00	2.00	0.66	65.86	21.73	46.58	350	356	0.17%	0.63	62.74	74.2%
High Street[3]	103	104	0.00	0.00	0.00	0.00	0.00	0.00	0.69	0.25	1.00	0.25	12.95	76.81	25.35	0.00	2.00	0.66	78.81	26.01	54.02	400	406	0.14%	0.63	81.29	66.5%
High Street[3]	104	105	0.00	0.00	0.00	0.00	0.00	0.00	0.69	0.25	1.00	0.25	1.53	78.34	25.85	0.00	2.00	0.66	80.34	26.51	58.52	400	406	0.14%	0.63	81.29	72.0%
High Street[3]	105	106	0.00	0.00	0.00	0.00	0.00	0.00	0.69	0.25	1.00	0.25	0.47	78.81	26.01	0.00	2.00	0.66	80.81	26.67	59.17	400	406	0.14%	0.63	81.29	72.8%
High Street[3]	106	107	0.07	0.02	0.07	0.03	0.13	0.05	0.82	0.30	1.00	0.30	0.48	79.29	26.16	1.05	3.05	1.01	82.34	27.17	60.43	400	406	0.13%	0.60	78.33	77.1%
High Street[3]	107	108	0.00	0.00	0.00	0.00	0.00	0.00	0.82	0.30	1.00	0.30	0.67	79.95	26.38	0.00	3.05	1.01	83.00	27.39	60.90	400	406	0.15%	0.65	84.15	72.4%
Bridge Street	108	109	0.06	0.02	0.06	0.03	0.13	0.05	0.95	0.35	1.00	0.35	35.48	115.44	38.09	1.47	4.52	1.49	119.95	39.58	86.28	450	457	0.35%	1.07	175.96	49.0%
Bridge Street	109	110	0.00	0.00	0.00	0.00	0.00	0.00	0.95	0.35	1.00	0.35	0.18	115.62	38.15	0.00	4.52	1.49	120.13	39.64	86.63	450	457	0.31%	1.01	165.60	52.3%
Bridge Street	110	111	0.00	0.00	0.00	0.00	0.00	0.00	0.95	0.35	1.00	0.35	0.26	115.88	38.24	0.00	4.52	1.49	120.39	39.73	86.78	450	457	0.45%	1.22	199.52	43.5%
Bridge Street	111	112	0.00	0.00	0.00	0.00	0.00	0.00	0.95	0.35	1.00	0.35	0.00	115.88	38.24	0.00	4.52	1.49	120.39	39.73	86.78	450	457	1.44%	2.17	356.92	24.3%
Mill Street	112	113	0.00	0.00	0.00	0.00	0.00	0.00	0.95	0.35	1.00	0.35	16.75	132.63	43.77	0.12	4.64	1.53	137.26	45.30	97.73	600	610	0.30%	1.20	350.85	27.9%
Beckwith Street	113	114	0.00	0.00	0.00	0.00	0.00	0.00	0.95	0.35	1.00	0.35	0.98	133.61	44.09	0.00	4.64	1.53	138.24	45.62	98.40	600	610	0.20%	0.98	286.47	34.3%
Franklin Street	114	115	0.00	0.00	0.00	0.00	0.00	0.00	0.95	0.35	1.00	0.35	1.72	135.33	44.66	0.00	4.64	1.53	139.96	46.19	99.40	600	610	0.23%	1.05	307.20	32.4%
Franklin Street	115	115A	0.00	0.00	0.00	0.00	0.00	0.00	0.95	0.35	1.00	0.35	4.74	140.07	46.22	0.22	4.86	1.60	144.93	47.83	102.54	600	610	0.28%	1.16	338.95	30.3%
Franklin Street	115A	116	0.00	0.00	0.00	0.00	0.00	0.00	0.95	0.35	1.00	0.35	0.54	140.61	46.40	0.00	4.86	1.60	145.47	48.00	102.78	600	610	0.31%	1.22	356.65	28.8%
Franklin Street	116	117	0.00	0.00	0.00	0.00	0.00	0.00	0.95	0.35	1.00	0.35	0.12	140.73	46.44	0.00	4.86	1.60	145.59	48.04	102.82	600	610	0.18%	0.93	271.77	37.8%
Franklin Street[5]	117	118	0.00	0.00	0.00	0.00	0.00	0.00	0.95	0.35	1.00	0.35	0.57	141.30	46.63	0.00	4.86	1.60	146.16	48.23	103.24	584	593	0.26%	1.10	303.91	34.0%
To WWTP	118	119	0.00	0.00	0.00	0.00	0.00	0.00	0.95	0.35	1.00	0.35	0.00	141.30	46.63	0.00	4.86	1.60	146.16	48.23	103.24	600	610	0.26%	1.12	326.62	31.6%
To WWTP	119	119A	0.00	0.00	0.00	0.00	0.00	0.00	0.95	0.35	1.00	0.35	0.00	141.30	46.63	0.00	4.86	1.60	146.16	48.23	103.24	600	610	0.27%	1.14	332.84	31.0%
To WWTP[6]	119A	119B	0.00	0.00	0.00	0.00	0.00	0.00	0.95	0.35	1.00	0.35	0.00	141.30	46.63	0.00	4.86	1.60	146.16	48.23	103.24	600	610	0.27%	1.14	332.84	31.0%
To WWTP	119B	120	0.00	0.00	0.00	0.00	0.00	0.00	0.95	0.35	1.00	0.35	0.00	141.30	46.63	0.00	4.86	1.60	146.16	48.23	103.24	750	762	1.66%	***3.28***	1,496.38	6.9%
To WWTP	120	121	0.00	0.00	0.00	0.00	0.00	0.00	4.78	1.74	1.00	1.74	0.00	284.15	93.77	0.00	37.74	12.45	321.89	106.22	218.50	750	762	0.25%	1.27	580.71	37.6%
To WWTP	121	122	0.14	0.04	0.14	0.06	0.28	0.10	5.06	1.84	1.00	1.84	57.07	341.23	112.60	2.60	40.34	13.31	381.56	125.92	254.78	750	762	0.25%	1.27	580.71	43.9%
To WWTP	122	123	0.00	0.00	0.00	0.00	0.00	0.00	5.06	1.84	1.00	1.84	0.00	341.23	112.60	0.00	40.34	13.31	381.56	125.92	254.78	750	762	0.25%	1.27	580.71	43.9%
To WWTP	123	124	0.00	0.00	0.00	0.00	0.00	0.00	5.06	1.84	1.00	1.84	0.00	341.23	112.60	0.00	40.34	13.31	381.56	125.92	254.78	750	762	3.97%	***5.07***	2,314.10	11.0%
Industrial Avenue[6]	200	201	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	200	203	3.61%	2.00	65.01	0.0%
Industrial Avenue	201	202	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	31.82	31.82	10.50	0.00	0.00	0.00	31.82	10.50	16.89	200	203	0.27%	*0.55*	17.78	95.0%
Industrial Avenue	202	203	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	31.82	10.50	0.00	0.00	0.00	31.82	10.50	16.89	300	305	0.17%	*0.57*	41.59	40.6%
Mullett Street	203	204	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	1.14	32.96	10.88	0.00	0.00	0.00	32.96	10.88	17.67	300	305	0.22%	0.65	47.32	37.3%
Mullett Street	204	205	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.14	33.10	10.92	0.00	0.00	0.00	33.10	10.92	17.86	300	305	0.36%	0.83	60.53	29.5%
Mullett Street	205	206	0.14	0.04	0.14	0.06	0.28	0.10	0.28	0.10	1.00	0.10	4.80	37.90	12.51	2.78	2.78	0.92	40.68	13.42	24.12	300	305	0.77%	1.21	88.52	27.2%
Mullett Street	206	207	0.00	0.00	0.00	0.00	0.00	0.00	0.28	0.10	1.00	0.10	4.84	42.74	14.10	0.37	3.15	1.04	45.89	15.14	28.65	350	356	0.32%	0.87	86.08	33.3%
Mullett Street	207	208	0.00	0.00	0.00	0.00	0.00	0.00	0.28	0.10	1.00	0.10	0.00	42.74	14.10	0.00	3.15	1.04	45.89	15.14	28.65	350	356	0.72%	1.30	129.12	22.2%
Mullett Street	208	209	0.69	0.22	0.69	0.28	1.38	0.50	1.66	0.60	1.00	0.60	2.37	45.11	14.89	0.10	3.25	1.07	48.36	15.96	31.64	375	381	0.30%	0.88	100.18	31.6%
Mullett Street	209	210	0.00	0.00	0.00	0.00	0.00	0.00	1.66	0.60	1.00	0.60	0.00	45.11	14.89	0.00	3.25	1.07	48.36	15.96	31.64	375	381	0.30%	0.88	100.18	31.6%
Mullett Street	210	211A	0.02	0.01	0.02	0.01	0.04	0.01	1.70	0.62	1.00	0.62	10.35	55.46	18.30	0.30	3.55	1.17	59.01	19.47	38.58	375	381	0.24%	0.79	89.61	43.1%
Mullett Street[6]	211A	211	0.00	0.00	0.00	0.00	0.00	0.00	1.70	0.62	1.00	0.62	0.00	55.46	18.30	0.00	3.55	1.17	59.01	19.47	38.58	375	381	0.26%	0.82	93.27	41.4%
Mullett Street	211	212	0.00	0.00	0.00	0.00	0.00	0.00	1.70	0.62	1.00	0.62	0.34	55.80	18.41	0.00	3.55	1.17	59.35	19.59	38.73	375	381	2.49%	2.53	288.63	13.4%
To WWTP	212	213	0.00	0.00	0.00	0.00	0.00	0.00	1.70	0.62	1.00	0.62	0.00	55.80	18.41	0.00	3.55	1.17	59.35	19.59	38.73	400	406	0.16%	0.67	86.90	44.6%
To WWTP	213	214	0.00	0.00	0.00	0.00	0.00	0.00	1.70	0.62	1.00	0.62	0.00	55.80	18.41	0.00	3.55	1.17	59.35	19.59	38.73	400	406	0.18%	0.71	92.18	42.0%
To WWTP	214	215	0.69	0.22	0.69	0.28	1.38	0.50	3.08	1.12	1.00	1.12	0.00	55.80	18.41	4.00	7.55	2.49	63.35	20.91	50.58	400	406	3.25%	***3.02***	391.67	12.9%
To WWTP	215	216	0.00	0.00	0.00	0.00	0.00	0.00	3.08	1.12	1.00	1.12	0.00	55.80	18.41	0.00	7.55	2.49	63.35	20.91	50.58	400	406	0.21%	0.77	99.56	50.8%
To WWTP	216	217	0.00	0.00	0.00	0.00	0.00	0.00	3.08	1.12	1.00	1.12	0.62	56.42	18.62	0.00	7.55	2.49	63.97	21.11	50.88	400	406	0.23%	0.80	104.20	48.8%
To WWTP	217	218	0.00	0.00	0.00	0.00	0.00	0.00	3.08	1.12	1.00	1.12	0.00	56.42	18.62	0.00	7.55	2.49	63.97	21.11	50.88	400	406	0.22%	0.79	101.90	49.9%
To WWTP	218	219	0.00	0.00	0.00	0.00	0.00	0.00	3.08	1.12	1.00	1.12	0.35	56.77	18.73	0.00	7.55	2.49	64.32	21.23	51.05	400	406	0.18%	0.71	92.18	55.4%
To WWTP - Siphon[1]	219	220	0.00	0.00	0.00	0.00	0.00	0.00	3.08	1.12	1.00	1.12	0.00	56.77	18.73	0.00	7.55	2.49	64.32	21.23	51.05	400	406	0.22%	0.79	101.90	50.1%
To WWTP - Siphon[1]	220	221	0.00	0.00	0.00	0.00	0.00	0.00	3.08	1.12	1.00	1.12	0.00	56.77	18.73	0.00	7.55	2.49	64.32	21.23	51.05	400	406	0.84%	1.54	199.12	25.6%
To WWTP - Siphon[1]	221	124	0.00	0.00	0.00	0.00	0.00	0.00	3.08	1.12	1.00	1.12	0.00	56.77	18.73	0.00	7.55	2.49	64.32	21.23	51.05	400	406	0.15%	0.65	84.15	60.7%
To WWTP	124	125	0.00	0.00	0.00	0.00	0.00	0.00	8.14	2.97	1.00	2.97	0.00	398.00	131.34	0.00	47.89	15.80	445.88	147.14	297.02	750	762	0.12%	0.88	402.33	73.8%
To WWTP	125	126	0.00	0.00	0.00	0.00	0.00	0.00	8.14	2.97	1.00	2.97	0.00	398.00	131.34	0.00	47.89	15.80	445.88	147.14	297.02	750	762	0.12%	0.88	402.33	73.8%
To WWTP	126	127	0.00	0.00	0.00	0.00	0.00	0.00	8.14	2.97	1.00	2.97	0.00	398.00	131.34	0.00	47.89	15.80	445.88	147.14	297.02	750	762	0.12%	0.88	402.33	73.8%
To WWTP	127	128	0.00	0.00	0.00	0.00	0.00	0.00	8.14	2.97	1.00	2.97	0.00	398.00	131.34	0.00	47.89	15.80	445.88	147.14	297.02	750	762	0.27%	1.32	603.49	49.2%
To WWTP	**128**	**WWTP**	0.00	0.00	0.00	0.00	0.00	0.00	13.99	5.10	1.00	5.10	0.00	590.87	194.99	0.00	123.95	40.90	714.82	**235.89**	**437.46**	750	762	0.27%	1.32	603.49	72.5%
McNeely Avenue	301	302	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	50.25	50.25	16.58	0.00	0.00	0.00	50.25	16.58	17.85	300	305	0.25%	0.69	50.44	35.4%
McNeely Avenue	302	303	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.92	51.17	16.89	0.00	0.00	0.00	51.17	16.89	18.28	450	457	0.14%	0.68	111.29	16.4%
McNeely Avenue	303	304	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.87	52.04	17.17	0.00	0.00	0.00	52.04	17.17	18.68	450	457	0.10%	*0.57*	94.06	19.9%
McNeely Avenue	304	305	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.85	52.89	17.45	0.00	0.00	0.00	52.89	17.45	19.08	450	457	0.12%	0.63	103.03	18.5%
McNeely Avenue	305	306	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.88	53.77	17.74	0.00	0.00	0.00	53.77	17.74	19.49	450	457	0.05%	*0.41*	66.51	29.3%
McNeely Avenue	306	307	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.89	54.66	18.04	0.00	0.00	0.00	54.66	18.04	19.91	450	457	0.04%	*0.36*	59.49	33.5%
McNeely Avenue	307	308	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	1.08	55.74	18.39	0.00	0.00	0.00	55.74	18.39	20.42	450	457	0.13%	0.65	107.24	19.0%
McNeely Avenue	308	309	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	1.03	56.77	18.73	0.00	0.00	0.00	56.77	18.73	21.00	450	457	0.11%	0.60	98.65	21.3%
McNeely Avenue	309	310	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	1.77	58.54	19.32	0.00	0.00	0.00	58.54	19.32	21.85	450	457	0.08%	*0.51*	84.13	26.0%
McNeely Avenue	310	311	0.13	0.04	0.13	0.05	0.26	0.10	0.26	0.10	1.00	0.10	1.56	60.10	19.83	4.83	4.83	1.59	64.93	21.43	25.69	450	457	0.10%	*0.57*	94.06	27.3%
McNeely Avenue	311	312	0.00	0.00	0.00	0.00	0.00	0.00	0.26	0.10	1.00	0.10	0.98	61.08	20.16	0.00	4.83	1.59	65.91	21.75	26.20	450	457	0.06%	*0.44*	72.86	36.0%
McNeely Avenue	312	313	0.69	0.22	0.69	0.28	1.38	0.50	1.65	0.60	1.00	0.60	0.46	61.54	20.31	1.92	6.75	2.23	68.29	22.53	30.16	450	457	0.13%	0.65	107.24	28.1%
McNeely Avenue	313	314	0.00	0.00	0.00	0.00	0.00	0.00	1.65	0.60	1.00	0.60	2.00	63.54	20.97	0.00	6.75	2.23	70.29	23.19	31.15	450	457	0.12%	0.63	103.03	30.2%
McNeely Avenue	314	315	0.00	0.00	0.00	0.00	0.00	0.00	1.65	0.60	1.00	0.60	0.36	63.90	21.09	0.00	6.75	2.23	70.65	23.31	31.41	300	305	0.41%	0.89	64.60	48.6%
McNeely Avenue	315	316	0.00	0.00	0.00	0.00	0.00	0.00	1.65	0.60	1.00	0.60	0.51	64.41	21.26	0.00	6.75	2.23	71.16	23.48	31.87	300	305	0.41%	0.89	64.60	49.3%
McNeely Avenue	316	317	0.03	0.01	0.03	0.01	0.05	0.02	1.70	0.62	1.00	0.62	3.42	67.83	22.38	0.49	7.23	2.39	75.06	24.77	35.33	300	305	0.21%	0.63	46.23	76.4%
McNeely Avenue	317	318	0.00	0.00	0.00	0.00	0.00	0.00	1.70	0.62	1.00	0.62	2.22	70.05	23.12	0.00	7.23	2.39	77.28	25.50	37.33	300	305	0.23%	0.66	48.38	77.1%
McNeely Avenue	318	319	0.00	0.00	0.00	0.00	0.00	0.00	1.70	0.62	1.00	0.62	0.82	70.87	23.39	0.00	7.23	2.39	78.10	25.77	38.29	300	305	0.27%	0.72	52.42	73.1%
McNeely Avenue	319	320	0.00	0.00	0.00	0.00	0.00	0.00	1.70	0.62	1.00	0.62	0.32	71.19	23.49	0.00	7.23	2.39	78.42	25.88	38.57	300	305	0.50%	0.98	71.33	54.1%
McNeely Avenue	320	Pump Station	0.00	0.00	0.00	0.00	0.00	0.00	1.70	0.62	1.00	0.62	26.50	97.69	32.24	0.00	7.23	2.39	104.92	34.62	57.36	300	305	0.50%	0.98	71.33	80.4%
Patterson Crescent (Forcemain)	Pump Station	321	0.00	0.00	0.00	0.00	0.00	0.00	1.70	0.62	1.00	0.62	0.00	97.69	32.24	0.00	7.23	2.39	104.92	34.62	57.36						
Patterson Crescent	321	322	1.98	0.64	1.98	0.80	3.96	1.44	5.66	2.06	1.00	2.06	75.04	172.74	57.00	67.01	74.24	24.50	246.98	81.50	141.09	500	508	0.20%	0.87	176.17	80.1%
Patterson Crescent	322	323	0.10	0.03	0.10	0.04	0.19	0.07	5.85	2.13	1.00	2.13	14.38	187.11	61.75	1.82	76.06	25.10	263.18	86.85	155.58	500	508	0.20%	0.87	176.17	88.3%
Patterson Crescent	323	324	0.00	0.00	0.00	0.00	0.00	0.00	5.85	2.13	1.00	2.13	0.23	187.34	61.82	0.00	76.06	25.10	263.41	86.92	155.69	500	508	0.20%	0.87	176.17	88.4%
Patterson Crescent	324	325	0.00	0.00	0.00	0.00	0.00	0.00	5.85	2.13	1.00	2.13	5.53	192.87	63.65	0.00	76.06	25.10	268.94	88.75	158.28	500	508	0.20%	0.87	176.17	89.8%
To WWTP	325	326	0.00	0.00	0.00	0.00	0.00	0.00	5.85	2.13	1.00	2.13	0.00	192.87	63.65	0.00	76.06	25.10	268.94	88.75	158.28	500	508	0.20%	0.87	176.17	89.8%
To WWTP	326	327	0.00	0.00	0.00	0.00	0.00	0.00	5.85	2.13	1.00	2.13	0.00	192.87	63.65	0.00	76.06	25.10	268.94	88.75	158.28	500	508	0.20%	0.87	176.17	89.8%
To WWTP	327	128	0.00	0.00	0.00	0.00	0.00	0.00	5.85	2.13	1.00	2.13	0.00	192.87	63.65	0.00	76.06	25.10	268.94	88.75	158.28	500	508	0.20%	0.87	176.17	89.8%

![Stantec]

163401646 - Town of Carleton Place W/WW Master Plan

Table D-11: Sanitary Sewer Calculation Spreadsheet - 2031 Annual Event

Date: 8/19/2021
Prepared by: CR
Checked by: AL

Legend
Manual Input/Modification
Calculated/Extracted Value for Existing + Additional Development
Existing Conditions - 2021
Additional Development
Full Flow Velocity < 0.6 m/s
Sewer Capacity Used > 100%; Sewer Velocity > 3 m/s
WWTP Inflow Point

Modelling Parameters - 2031 Annual Event		
Horizon:	2031	
Scenario:	Annual	
Existing Conditions - 2021		
Average Residential Flow Rate - q =	392	l/cap/day
Peak Extraneous Flow Rate - i =	0.30	l/s/ha
Peak Extraneous Flow Rate (Monitor No. 6)[3] - i =	0.40	l/s/ha
Existing Conditions Population Density =	2.5	PPU
Harmon Peaking Factor Correction Factor - K =	0.60	-
Growth Developments - 2031		
Average Residential Flow Rate - q =	200	l/cap/day
Peak Extraneous Flow Rate - i =	0.30	l/s/ha
Peak Extraneous Flow Rate (Monitor No. 6)[3] - i =	0.40	l/s/ha
Harmon Peaking Factor Correction Factor - K =	0.60	-
Insitutional/Commercial Average Flow Rate - q =	17,000	l/ha/day
Institutional/Commercial (IC) Peaking Factor (ICI Cont. > 20%) =	1.00	-
Institutional/Commercial (IC) Peaking Factor (ICI Cont. ≤ 20%) =	1.00	-
Light Industrial Average Flow Rate - q =	10,000	l/ha/day
Light Industrial Peaking Factor (ICI Cont. > 20%) =	1.00	-
Light Industrial Peaking Factor (ICI Cont. ≤ 20%) =	1.00	-
Manning's Coefficient - n =	0.013	

Note: Values as per ***Design Basis Memo*** *(July 12, 2021)*

Summary - 2031 Annual Event		
2021 Residential Population	13,403	ppl
2021 ICI Equivalent Population	468	ppl
2021 Total Residential + ICI Equivalent Population	13,870	ppl
2031 Additional Residential Population	6,827	ppl
2031 Total Residential Population	20,230	ppl
2031 Total Residential + ICI Equivalent Population	20,697	ppl
2031 Additional Residential Area	110	ha
2031 Additional ICI Area	14	ha
2031 Total Area	715	ha
Average DWF (Residential + ICI)	6,991	m^3/d
Peak DWF (Residential + ICI)	13,675	m^3/d
Peak Extraneous Flow	19,245	m^3/d
Peak Total Flow	32,920	m^3/d
Number of Sewers Surcharged	0	
Average Sewer Capacity Used	40.6%	
Max Sewer Capacity Used	83.3%	
Mississippi Quays PS Peak Inflow	49.1	L/s

Notes

(1) McArthur Island siphon represented by sewer section from MH219 to MH124, as a single 400 mm diameter gravity pipe at 0.84% slope, as per original spreadsheet (JLR, 2021). Based on drawings, siphon consists of two barrels (150 mm and 300 mm); representation of siphon would require adjustments for HGL calculations.
(2) Mississippi Quays PS modelled at the end of McNeely Avenue (from MH320 to Pump Station); no gravity flow calculated through forcemain on Patterson Crescent (from Pump Station to MH321, assumed without restrictions).
(3) Extraneous flows calculated using 0.4 L/s/ha for drainage areas tributary to flow monitor No. 6.
(4) Diameters and slopes confirmed or corrected based on comparison of original spreadsheet to information provided by the Town on 20210712; see detailed comparison in Table D-1: Comparison of Diameters and Slopes from Different Sources.
(5) Based on information provided by the Town on 20210712, sewer along Franklin St between MH117 and MH118 appears to first be a ~38 m long 600 mm single sewer, followed by a ~52 m long section of twin 450 mm sewers; equivalent diameter to twin 450 mm retained, as it is more conservative.
(6) Sewer section added to spreadsheet to match Town's GIS data.

Level of Service Limits		
Maximum Velocity	3	m/s
Actual Flow/Full Flow Capacity	100%	

Flow Generation – Residential / Existing (2021) ICI Conditions

Street/Location	Maintenance Hole From	Maintenance Hole To	Existing (2021) Residential Conditions – Number of Units – Residential Units	Commercial Units	Institutional Units	Total Units	Existing Population	Cumulative Existing Population	Existing Residential Sewage Flow (L/s)	Additional (2031) Residential Development – Additional Population	Cumulative Additional Population	Additional Residential Sewage Flow (L/s)	2031 Residential Contributions – Total Cumulative Residential Population	Total Residential Sewage Flow (L/s)	Harmon Peaking Factor	Peak Residential Sewage Flow (L/s)	Existing (2021) ICI Conditions – Existing ICI Sewage (L/s)	Cumulative Existing ICI Sewage (L/s)	Additional (2031) ICI Development – Additional IC Area (ha)	Additional IC Sewage (L/s)
Lake Avenue West	001	02A	62		1	63	158	158	0.71	1,427	1,427	3.30	1,585	4.02	2.60	10.44	0.00	0.00	0.21	0.04
Lake Avenue West[6]	02A	002					0	158	0.71	0	1,427	3.30	1,585	4.02	2.60	10.44	0.00	0.00	0.00	0.00
Lake Avenue West	002	003	459			459	1,148	1,305	5.92	0	1,427	3.30	2,732	9.22	2.49	22.93	0.00	0.00	0.00	0.00
Lake Avenue West	003	004	9			9	23	1,328	6.02	0	1,427	3.30	2,755	9.33	2.48	23.17	0.00	0.00	0.00	0.00
Lake Avenue West	004	005	11			11	28	1,355	6.15	0	1,427	3.30	2,782	9.45	2.48	23.46	0.00	0.00	0.69	0.14
Lake Avenue West	005	006	37		1	38	95	1,450	6.58	0	1,427	3.30	2,877	9.88	2.47	24.45	0.00	0.00	0.00	0.00
Lake Avenue West	006	007	21			21	53	1,503	6.82	0	1,427	3.30	2,930	10.12	2.47	25.00	0.00	0.00	0.00	0.00
Lake Avenue West	007	008	325			325	813	2,315	10.50	161	1,588	3.68	3,903	14.18	2.41	34.11	0.00	0.00	0.10	0.02
Lake Avenue West	008	009	34			34	85	2,400	10.89	0	1,588	3.68	3,988	14.56	2.40	34.97	0.00	0.00	0.00	0.00
Lake Avenue West	009	010	86			86	215	2,615	11.86	0	1,588	3.68	4,203	15.54	2.39	37.12	0.00	0.00	0.00	0.00
Lake Avenue West	010	011	54	1		55	138	2,753	12.49	11	1,599	3.70	4,352	16.19	2.38	38.53	0.00	0.00	0.00	0.00
Lake Avenue West	011	012	18			18	45	2,798	12.69	0	1,599	3.70	4,397	16.39	2.38	38.98	0.00	0.00	0.00	0.00
Lake Avenue West	012	013	70	4		74	185	2,983	13.53	2	1,601	3.71	4,584	17.24	2.37	40.82	0.00	0.00	0.00	0.00
Lake Avenue West	013	014	7	1		8	20	3,003	13.62	39	1,640	3.80	4,643	17.42	2.36	41.19	0.00	0.00	0.69	0.14
Lake Avenue West	014	15B	15	2		17	43	3,045	13.82	12	1,652	3.82	4,697	17.64	2.36	41.66	0.00	0.00	0.00	0.00
Lake Avenue West[6]	15B	15A					0	3,045	13.82	0	1,652	3.82	4,697	17.64	2.36	41.66	0.00	0.00	0.00	0.00
Lake Avenue West	15A	015	1	1		2	5	3,050	13.84	0	1,652	3.82	4,702	17.66	2.36	41.71	0.00	0.00	0.00	0.00
Lake Avenue West	015	016	15			15	38	3,088	14.01	0	1,652	3.82	4,740	17.83	2.36	42.08	0.00	0.00	0.00	0.00
Lake Avenue West	016	017	12	2		14	35	3,123	14.17	0	1,652	3.82	4,775	17.99	2.36	42.42	0.00	0.00	0.00	0.00
Lake Avenue West	017	018	60			60	150	3,273	14.85	0	1,652	3.82	4,925	18.67	2.35	43.89	0.00	0.00	0.00	0.00
Lake Avenue West	018	019	3			3	8	3,280	14.88	0	1,652	3.82	4,932	18.71	2.35	43.96	0.00	0.00	0.00	0.00
Lake Avenue West	019	020	23			23	58	3,338	15.14	16	1,668	3.86	5,006	19.00	2.35	44.60	0.00	0.00	0.02	0.00
Lake Avenue West	020	021	4			4	10	3,348	15.19	0	1,668	3.86	5,016	19.05	2.35	44.69	0.00	0.00	0.00	0.00
Lake Avenue West	021	022	140		1	141	353	3,700	16.79	203	1,871	4.33	5,571	21.12	2.32	49.01	0.00	0.00	0.21	0.04
Lorne Street	022	023	8			8	20	3,720	16.88	0	1,871	4.33	5,591	21.21	2.32	49.20	0.00	0.00	0.00	0.00
Lorne Street	023	024	12			12	30	3,750	17.01	0	1,871	4.33	5,621	21.34	2.32	49.49	0.00	0.00	0.00	0.00
Ball Park	024	120	77	1		78	195	3,945	17.90	0	1,871	4.33	5,816	22.23	2.31	51.35	0.00	0.00	0.00	0.00
High Street[3]	101	102A	535	4	1	540	1,350	1,350	6.13	107	107	0.25	1,457	6.37	2.61	16.65	0.00	0.00	0.34	0.07
High Street[3]	102A	102	0			0	0	1,350	6.13	0	107	0.25	1,457	6.37	2.61	16.65	0.00	0.00	0.00	0.00
High Street[3]	102	103	129			129	323	1,673	7.59	0	107	0.25	1,780	7.84	2.57	20.18	0.00	0.00	0.00	0.00
High Street[3]	103	104	99			99	248	1,920	8.71	0	107	0.25	2,027	8.96	2.55	22.83	0.00	0.00	0.00	0.00
High Street[3]	104	105	125	2		127	318	2,238	10.15	0	107	0.25	2,345	10.40	2.52	26.19	0.00	0.00	0.00	0.00
High Street[3]	105	106	16			16	40	2,278	10.33	0	107	0.25	2,385	10.58	2.52	26.61	0.00	0.00	0.00	0.00
High Street[3]	106	107	5			5	13	2,290	10.39	65	172	0.40	2,462	10.79	2.51	27.06	0.00	0.00	0.07	0.01
High Street[3]	107	108	8			8	20	2,310	10.48	0	172	0.40	2,482	10.88	2.51	27.27	0.00	0.00	0.00	0.00
Bridge Street	108	109	415		1	416	1,040	3,350	15.20	70	242	0.56	3,592	15.76	2.42	38.21	0.00	0.00	0.06	0.01
Bridge Street	109	110	6	4		10	25	3,375	15.31	0	242	0.56	3,617	15.87	2.42	38.46	0.00	0.00	0.00	0.00
Bridge Street	110	111	2			2	5	3,380	15.34	0	242	0.56	3,622	15.90	2.42	38.51	0.00	0.00	0.00	0.00
Bridge Street	111	112	0			0	0	3,380	15.34	0	242	0.56	3,622	15.90	2.42	38.51	0.00	0.00	0.00	0.00
Mill Street	112	113	158	22	2	182	455	3,835	17.40	8	250	0.58	4,085	17.98	2.40	43.06	0.00	0.00	0.00	0.00
Beckwith Street	113	114	12			12	30	3,865	17.54	0	250	0.58	4,115	18.11	2.39	43.35	0.00	0.00	0.00	0.00
Franklin Street	114	115	10	5		15	38	3,903	17.71	0	250	0.58	4,153	18.28	2.39	43.72	0.00	0.00	0.00	0.00
Franklin Street	115	115A	42	7		49	123	4,025	18.26	12	262	0.61	4,287	18.87	2.38	44.98	0.00	0.00	0.00	0.00
Franklin Street	115A	116	2			2	5	4,030	18.28	0	262	0.61	4,292	18.89	2.38	45.03	0.00	0.00	0.00	0.00
Franklin Street	116	117	0			0	0	4,030	18.28	0	262	0.61	4,292	18.89	2.38	45.03	0.00	0.00	0.00	0.00
Franklin Street[5]	117	118	5	3		8	20	4,050	18.38	0	262	0.61	4,312	18.98	2.38	45.22	0.00	0.00	0.00	0.00
To WWTP	118	119	0			0	0	4,050	18.38	0	262	0.61	4,312	18.98	2.38	45.22	0.00	0.00	0.00	0.00
To WWTP	119	119A	0			0	0	4,050	18.38	0	262	0.61	4,312	18.98	2.38	45.22	0.00	0.00	0.00	0.00
To WWTP[6]	119A	119B					0	4,050	18.38	0	262	0.61	4,312	18.98	2.38	45.22	0.00	0.00	0.00	0.00
To WWTP	119B	120	0			0	0	4,050	18.38	0	262	0.61	4,312	18.98	2.38	45.22	0.00	0.00	0.00	0.00
To WWTP	120	121	0			0	0	7,995	36.27	0	2,133	4.94	10,128	41.21	2.17	89.41	0.00	0.00	0.00	0.00
To WWTP	121	122	610	12	1	623	1,558	9,553	43.34	136	2,269	5.25	11,822	48.59	2.13	103.47	0.00	0.00	0.14	0.03
To WWTP	122	123	0			0	0	9,553	43.34	0	2,269	5.25	11,822	48.59	2.13	103.47	0.00	0.00	0.00	0.00
To WWTP	123	124	0			0	0	9,553	43.34	0	2,269	5.25	11,822	48.59	2.13	103.47	0.00	0.00	0.00	0.00
Industrial Avenue[6]	200	201					0	0	0.00	0	0	0.00	0	0.00	3.10	0.00	0.00	0.00	0.00	0.00
Industrial Avenue	201	202	115	50		165	413	413	1.87	0	0	0.00	413	1.87	2.81	5.26	0.00	0.00	0.00	0.00
Industrial Avenue	202	203	0			0	0	413	1.87	0	0	0.00	413	1.87	2.81	5.26	0.00	0.00	0.00	0.00
Mullett Street	203	204	7	4		11	28	440	2.00	0	0	0.00	440	2.00	2.80	5.59	0.00	0.00	0.00	0.00
Mullett Street	204	205	4			4	10	450	2.04	0	0	0.00	450	2.04	2.80	5.71	0.00	0.00	0.00	0.00
Mullett Street	205	206	63	1		64	160	610	2.77	136	136	0.31	746	3.08	2.73	8.41	0.00	0.00	0.14	0.03
Mullett Street	206	207	75			75	188	798	3.62	20	156	0.36	954	3.98	2.69	10.70	0.00	0.00	0.00	0.00
Mullett Street	207	208	0			0	0	798	3.62	0	156	0.36	954	3.98	2.69	10.70	0.00	0.00	0.00	0.00
Mullett Street	208	209	17	5		22	55	853	3.87	97	253	0.59	1,106	4.45	2.66	11.86	0.00	0.00	0.69	0.14
Mullett Street	209	210	0			0	0	853	3.87	0	253	0.59	1,106	4.45	2.66	11.86	0.00	0.00	0.00	0.00
Mullett Street	210	211A	91	5		96	240	1,093	4.96	19	272	0.63	1,365	5.59	2.63	14.67	0.00	0.00	0.02	0.00
Mullett Street[6]	211A	211					0	1,093	4.96	0	272	0.63	1,365	5.59	2.63	14.67	0.00	0.00	0.00	0.00
Mullett Street	211	212	1			1	3	1,095	4.97	0	272	0.63	1,367	5.60	2.63	14.69	0.00	0.00	0.00	0.00
To WWTP	212	213	0			0	0	1,095	4.97	0	272	0.63	1,367	5.60	2.63	14.69	0.00	0.00	0.00	0.00
To WWTP	213	214	0			0	0	1,095	4.97	0	272	0.63	1,367	5.60	2.63	14.69	0.00	0.00	0.00	0.00
To WWTP	214	215	0			0	0	1,095	4.97	1,124	1,396	3.23	2,491	8.20	2.51	20.55	0.00	0.00	0.69	0.14
To WWTP	215	216	0			0	0	1,095	4.97	0	1,396	3.23	2,491	8.20	2.51	20.55	0.00	0.00	0.00	0.00
To WWTP	216	217	2		1	3	8	1,103	5.00	0	1,396	3.23	2,499	8.23	2.51	20.63	0.00	0.00	0.00	0.00
To WWTP	217	218	0			0	0	1,103	5.00	0	1,396	3.23	2,499	8.23	2.51	20.63	0.00	0.00	0.00	0.00
To WWTP	218	219	1		1	2	5	1,108	5.02	0	1,396	3.23	2,504	8.26	2.50	20.68	0.00	0.00	0.00	0.00
To WWTP - Siphon[1]	219	220	0			0	0	1,108	5.02	0	1,396	3.23	2,504	8.26	2.50	20.68	0.00	0.00	0.00	0.00
To WWTP - Siphon[1]	220	221	0			0	0	1,108	5.02	0	1,396	3.23	2,504	8.26	2.50	20.68	0.00	0.00	0.00	0.00
To WWTP - Siphon[1]	221	124	0			0	0	1,108	5.02	0	1,396	3.23	2,504	8.26	2.50	20.68	0.00	0.00	0.00	0.00
To WWTP	124	125	0			0	0	10,660	48.36	0	3,665	8.48	14,325	56.85	2.08	118.19	0.00	0.00	0.00	0.00
To WWTP	125	126	0			0	0	10,660	48.36	0	3,665	8.48	14,325	56.85	2.08	118.19	0.00	0.00	0.00	0.00
To WWTP	126	127	0			0	0	10,660	48.36	0	3,665	8.48	14,325	56.85	2.08	118.19	0.00	0.00	0.00	0.00
To WWTP	127	128	0			0	0	10,660	48.36	0	3,665	8.48	14,325	56.85	2.08	118.19	0.00	0.00	0.00	0.00
To WWTP	**128**	**WWTP**	0			0	0	13,870	62.93	0	6,827	15.80	20,697	78.73	1.98	**156.09**	0.00	0.00	0.00	0.00
McNeely Avenue	301	302	0	31		31	78	78	0.35	0	0	0.00	78	0.35	2.96	1.04	0.00	0.00	0.00	0.00
McNeely Avenue	302	303	3			3	8	85	0.39	0	0	0.00	85	0.39	2.96	1.14	0.00	0.00	0.00	0.00
McNeely Avenue	303	304	3			3	8	93	0.42	0	0	0.00	93	0.42	2.95	1.24	0.00	0.00	0.00	0.00
McNeely Avenue	304	305	3			3	8	100	0.45	0	0	0.00	100	0.45	2.95	1.34	0.00	0.00	0.00	0.00
McNeely Avenue	305	306	3			3	8	108	0.49	0	0	0.00	108	0.49	2.94	1.43	0.00	0.00	0.00	0.00
McNeely Avenue	306	307	3			3	8	115	0.52	0	0	0.00	115	0.52	2.94	1.53	0.00	0.00	0.00	0.00
McNeely Avenue	307	308	4			4	10	125	0.57	0	0	0.00	125	0.57	2.93	1.66	0.00	0.00	0.00	0.00
McNeely Avenue	308	309	4	2		6	15	140	0.64	0	0	0.00	140	0.64	2.92	1.85	0.00	0.00	0.00	0.00
McNeely Avenue	309	310	6	1		7	18	158	0.71	0	0	0.00	158	0.71	2.91	2.08	0.00	0.00	0.00	0.00
McNeely Avenue	310	311	6			6	15	173	0.78	130	130	0.30	303	1.08	2.85	3.08	0.00	0.00	0.13	0.03
McNeely Avenue	311	312	4	1		5	13	185	0.84	0	130	0.30	315	1.14	2.84	3.24	0.00	0.00	0.00	0.00
McNeely Avenue	312	313	4			4	10	195	0.88	243	373	0.86	568	1.75	2.77	4.84	0.00	0.00	0.69	0.14
McNeely Avenue	313	314	8	1		9	23	218	0.99	0	373	0.86	591	1.85	2.76	5.11	0.00	0.00	0.00	0.00
McNeely Avenue	314	315	4			4	10	228	1.03	0	373	0.86	601	1.90	2.76	5.23	0.00	0.00	0.00	0.00
McNeely Avenue	315	316	8			8	20	248	1.12	0	373	0.86	621	1.99	2.75	5.47	0.00	0.00	0.00	0.00
McNeely Avenue	316	317	53			53	133	380	1.72	26	399	0.92	779	2.65	2.72	7.20	0.00	0.00	0.03	0.01
McNeely Avenue	317	318	36			36	90	470	2.13	0	399	0.92	869	3.06	2.70	8.26	0.00	0.00	0.00	0.00
McNeely Avenue	318	319	20			20	50	520	2.36	0	399	0.92	919	3.28	2.69	8.84	0.00	0.00	0.00	0.00
McNeely Avenue	319	320	5			5	13	533	2.42	0	399	0.92	932	3.34	2.69	8.99	0.00	0.00	0.00	0.00
McNeely Avenue	320	Pump Station	299			299	748	1,280	5.81	0	399	0.92	1,679	6.73	2.59	17.41	0.00	0.00	0.00	0.00
Patterson Crescent (Forcemain)	Pump Station	321	0			0	0	1,280	5.81	0	399	0.92	1,679	6.73	2.59	17.41	0.00	0.00	0.00	0.00
Patterson Crescent	321	322	442	2		444	1,110	2,390	10.84	2,668	3,067	7.10	5,457	17.94	2.33	41.73	0.00	0.00	1.98	0.39
Patterson Crescent	322	323	298	1		299	748	3,138	14.23	95	3,162	7.32	6,300	21.55	2.29	49.37	0.00	0.00	0.10	0.02
Patterson Crescent	323	324	1			1	3	3,140	14.25	0	3,162	7.32	6,302	21.57	2.29	49.39	0.00	0.00	0.00	0.00
Patterson Crescent	324	325	26		2	28	70	3,210	14.56	0	3,162	7.32	6,372	21.88	2.29	50.06	0.00	0.00	0.00	0.00
To WWTP	325	326				0	0	3,210	14.56	0	3,162	7.32	6,372	21.88	2.29	50.06	0.00	0.00	0.00	0.00
To WWTP	326	327				0	0	3,210	14.56	0	3,162	7.32	6,372	21.88	2.29	50.06	0.00	0.00	0.00	0.00
To WWTP	327	128				0	0	3,210	14.56	0	3,162	7.32	6,372	21.88	2.29	50.06	0.00	0.00	0.00	0.00

Flow Generation – ICI / Extraneous Flows; Pipe Conditions – Pipe Capacity Utilization

Street/Location	From	To	Additional Ind. Area (ha)	Additional Ind. Sewage (L/s)	Total Additional ICI Area (ha)	Total Additional ICI Sewage (L/s)	Cumulative Additional ICI Area (ha)	Cumulative Additional ICI Sewage (L/s)	2031 ICI Contributions – Peaking Factor	Peak ICI Sewage (L/s)	Existing (2021) Extraneous Flows – Existing Drainage Area (ha)	Cumulative Existing Drainage Area (ha)	Existing Extraneous Flow (L/s)	Additional (2031) Extraneous Flows – Additional Drainage Area (ha)	Cumulative Additional Drainage Area (ha)	Additional Extraneous Flow (L/s)	2031 Extraneous Flow Contributions – Total Cumulative Drainage Area (ha)	Total Extraneous Flow (L/s)	Total Peak Flow (L/s)	Nominal Pipe Diameter (mm)	Actual Pipe Diameter (mm)	Slope (%)	Full Flow Velocity (m/s)	Full Flow Capacity (L/s)	Capacity Used (%)
Lake Avenue West	001	02A	0.21	0.02	0.41	0.06	0.41	0.06	1.00	0.06	4.95	4.95	1.48	25.87	25.87	7.76	30.82	9.24	19.74	375	381	0.44%	1.06	121.33	16.3%
Lake Avenue West[6]	02A	002	0.00	0.00	0.00	0.00	0.41	0.06	1.00	0.06	0.00	4.95	1.48	0.00	25.87	7.76	30.82	9.24	19.74	375	381	0.42%	1.04	118.54	16.7%
Lake Avenue West	002	003	0.00	0.00	0.00	0.00	0.41	0.06	1.00	0.06	35.59	40.54	12.16	0.00	25.87	7.76	66.41	19.92	42.92	375	381	0.48%	1.11	126.72	33.9%
Lake Avenue West	003	004	0.00	0.00	0.00	0.00	0.41	0.06	1.00	0.06	1.77	42.31	12.69	0.00	25.87	7.76	68.18	20.45	43.69	375	381	0.45%	1.08	122.70	35.6%
Lake Avenue West	004	005	0.69	0.08	1.38	0.22	1.80	0.28	1.00	0.28	0.40	42.71	12.81	0.00	25.87	7.76	68.58	20.57	44.31	375	381	0.46%	1.09	124.06	35.7%
Lake Avenue West	005	006	0.00	0.00	0.00	0.00	1.80	0.28	1.00	0.28	4.51	47.22	14.16	0.00	25.87	7.76	73.09	21.93	46.66	375	381	0.42%	1.04	118.54	39.4%
Lake Avenue West	006	007	0.00	0.00	0.00	0.00	1.80	0.28	1.00	0.28	1.13	48.35	14.50	0.00	25.87	7.76	74.22	22.26	47.55	375	381	0.39%	1.00	114.23	41.6%
Lake Avenue West	007	008	0.10	0.01	0.20	0.03	2.00	0.31	1.00	0.31	33.14	81.49	24.45	2.54	28.41	8.52	109.89	32.97	67.39	375	381	0.57%	1.21	138.09	48.8%
Lake Avenue West	008	009	0.00	0.00	0.00	0.00	2.00	0.31	1.00	0.31	1.84	83.33	25.00	0.00	28.41	8.52	111.73	33.52	68.80	375	381	0.85%	1.48	168.64	40.8%
Lake Avenue West	009	010	0.00	0.00	0.00	0.00	2.00	0.31	1.00	0.31	5.49	88.82	26.64	0.00	28.41	8.52	117.22	35.17	72.60	375	381	0.62%	1.26	144.02	50.4%
Lake Avenue West	010	011	0.00	0.00	0.00	0.00	2.00	0.31	1.00	0.31	3.76	92.58	27.77	0.19	28.60	8.58	121.17	36.35	75.20	375	381	0.48%	1.11	126.72	59.3%
Lake Avenue West	011	012	0.00	0.00	0.00	0.00	2.00	0.31	1.00	0.31	1.69	94.27	28.28	0.00	28.60	8.58	122.86	36.86	76.15	375	381	1.82%	2.16	246.76	30.9%
Lake Avenue West	012	013	0.00	0.00	0.00	0.00	2.00	0.31	1.00	0.31	17.76	112.03	33.61	0.02	28.62	8.59	140.64	42.19	83.32	525	533	0.25%	1.00	224.33	37.1%
Lake Avenue West	013	014	0.69	0.08	1.38	0.22	3.38	0.53	1.00	0.53	0.73	112.76	33.83	0.24	28.86	8.66	141.61	42.48	84.21	600	610	0.12%	0.76	221.90	37.9%
Lake Avenue West	014	15B	0.00	0.00	0.00	0.00	3.38	0.53	1.00	0.53	2.10	114.86	34.46	0.22	29.08	8.72	143.94	43.18	85.37	600	610	0.12%	0.76	221.90	38.5%
Lake Avenue West[6]	15B	15A	0.00	0.00	0.00	0.00	3.38	0.53	1.00	0.53	0.00	114.86	34.46	0.00	29.08	8.72	143.94	43.18	85.37	600	610	0.12%	0.76	221.90	38.5%
Lake Avenue West	15A	015	0.00	0.00	0.00	0.00	3.38	0.53	1.00	0.53	0.19	115.05	34.51	0.00	29.08	8.72	144.13	43.24	85.48	600	610	0.12%	0.76	221.90	38.5%
Lake Avenue West	015	016	0.00	0.00	0.00	0.00	3.38	0.53	1.00	0.53	0.95	116.00	34.80	0.00	29.08	8.72	145.08	43.52	86.13	600	610	0.12%	0.76	221.90	38.8%
Lake Avenue West	016	017	0.00	0.00	0.00	0.00	3.38	0.53	1.00	0.53	1.67	117.67	35.30	0.00	29.08	8.72	146.75	44.02	86.98	600	610	0.10%	0.69	202.56	42.9%
Lake Avenue West	017	018	0.00	0.00	0.00	0.00	3.38	0.53	1.00	0.53	3.63	121.30	36.39	0.00	29.08	8.72	150.38	45.11	89.53	600	610	0.10%	0.69	202.56	44.2%
Lake Avenue West	018	019	0.00	0.00	0.00	0.00	3.38	0.53	1.00	0.53	0.21	121.51	36.45	0.00	29.08	8.72	150.59	45.18	89.67	600	610	0.12%	0.76	221.90	40.4%
Lake Avenue West	019	020	0.02	0.00	0.03	0.00	3.42	0.53	1.00	0.53	1.57	123.08	36.92	0.28	29.36	8.81	152.44	45.73	90.86	600	610	0.12%	0.76	221.90	40.9%
Lake Avenue West	020	021	0.00	0.00	0.00	0.00	3.42	0.53	1.00	0.53	0.28	123.36	37.01	0.00	29.36	8.81	152.72	45.81	91.04	600	610	0.06%	*0.51*	150.22	60.6%
Lake Avenue West	021	022	0.21	0.02	0.41	0.06	3.83	0.60	1.00	0.60	12.30	135.66	40.70	3.52	32.88	9.86	168.53	50.56	100.17	600	610	0.12%	0.76	221.90	45.1%
Lorne Street	022	023	0.00	0.00	0.00	0.00	3.83	0.60	1.00	0.60	0.84	136.50	40.95	0.00	32.88	9.86	169.37	50.81	100.61	600	610	0.20%	0.98	286.47	35.1%
Lorne Street	023	024	0.00	0.00	0.00	0.00	3.83	0.60	1.00	0.60	0.65	137.15	41.14	0.00	32.88	9.86	170.02	51.01	101.09	600	610	0.20%	0.98	286.47	35.3%
Ball Park	024	120	0.00	0.00	0.00	0.00	3.83	0.60	1.00	0.60	5.71	142.86	42.86	0.00	32.88	9.86	175.73	52.72	104.67	600	610	0.47%	1.51	439.42	23.8%
High Street[3]	101	102A	0.34	0.04	0.69	0.11	0.69	0.11	1.00	0.11	57.19	57.19	22.87	2.00	2.00	0.80	59.19	23.67	40.43	350	356	0.51%	1.09	108.67	37.2%
High Street[3]	102A	102	0.00	0.00	0.00	0.00	0.69	0.11	1.00	0.11	0.00	57.19	22.87	0.00	2.00	0.80	59.19	23.67	40.43	350	356	0.15%	*0.59*	58.94	68.6%
High Street[3]	102	103	0.00	0.00	0.00	0.00	0.69	0.11	1.00	0.11	6.67	63.86	25.54	0.00	2.00	0.80	65.86	26.34	46.63	350	356	0.17%	0.63	62.74	74.3%
High Street[3]	103	104	0.00	0.00	0.00	0.00	0.69	0.11	1.00	0.11	12.95	76.81	30.72	0.00	2.00	0.80	78.81	31.52	54.46	400	406	0.14%	0.63	81.29	67.0%
High Street[3]	104	105	0.00	0.00	0.00	0.00	0.69	0.11	1.00	0.11	1.53	78.34	31.33	0.00	2.00	0.80	80.34	32.13	58.43	400	406	0.14%	0.63	81.29	71.9%
High Street[3]	105	106	0.00	0.00	0.00	0.00	0.69	0.11	1.00	0.11	0.47	78.81	31.52	0.00	2.00	0.80	80.81	32.32	59.04	400	406	0.14%	0.63	81.29	72.6%
High Street[3]	106	107	0.07	0.01	0.13	0.02	0.82	0.13	1.00	0.13	0.48	79.29	31.71	1.05	3.05	1.22	82.34	32.93	60.12	400	406	0.13%	0.60	78.33	76.8%
High Street[3]	107	108	0.00	0.00	0.00	0.00	0.82	0.13	1.00	0.13	0.67	79.95	31.98	0.00	3.05	1.22	83.00	33.20	60.60	400	406	0.15%	0.65	84.15	72.0%
Bridge Street	108	109	0.06	0.01	0.13	0.02	0.95	0.15	1.00	0.15	35.48	115.44	42.63	1.47	4.52	1.66	119.95	44.29	82.65	450	457	0.35%	1.07	175.96	47.0%
Bridge Street	109	110	0.00	0.00	0.00	0.00	0.95	0.15	1.00	0.15	0.18	115.62	42.68	0.00	4.52	1.66	120.13	44.34	82.95	450	457	0.31%	1.01	165.60	50.1%
Bridge Street	110	111	0.00	0.00	0.00	0.00	0.95	0.15	1.00	0.15	0.26	115.88	42.76	0.00	4.52	1.66	120.39	44.42	83.08	450	457	0.45%	1.22	199.52	41.6%
Bridge Street	111	112	0.00	0.00	0.00	0.00	0.95	0.15	1.00	0.15	0.00	115.88	42.76	0.00	4.52	1.66	120.39	44.42	83.08	450	457	1.44%	2.17	356.92	23.3%
Mill Street	112	113	0.00	0.00	0.00	0.00	0.95	0.15	1.00	0.15	16.75	132.63	47.78	0.12	4.64	1.70	137.26	49.48	92.69	600	610	0.30%	1.20	350.85	26.4%
Beckwith Street	113	114	0.00	0.00	0.00	0.00	0.95	0.15	1.00	0.15	0.98	133.61	48.08	0.00	4.64	1.70	138.24	49.77	93.28	600	610	0.20%	0.98	286.47	32.6%
Franklin Street	114	115	0.00	0.00	0.00	0.00	0.95	0.15	1.00	0.15	1.72	135.33	48.59	0.00	4.64	1.70	139.96	50.29	94.16	600	610	0.23%	1.05	307.20	30.7%
Franklin Street	115	115A	0.00	0.00	0.00	0.00	0.95	0.15	1.00	0.15	4.74	140.07	50.01	0.22	4.86	1.76	144.93	51.78	96.90	600	610	0.28%	1.16	338.95	28.6%
Franklin Street	115A	116	0.00	0.00	0.00	0.00	0.95	0.15	1.00	0.15	0.54	140.61	50.18	0.00	4.86	1.76	145.47	51.94	97.11	600	610	0.31%	1.22	356.65	27.2%
Franklin Street	116	117	0.00	0.00	0.00	0.00	0.95	0.15	1.00	0.15	0.12	140.73	50.21	0.00	4.86	1.76	145.59	51.98	97.15	600	610	0.18%	0.93	271.77	35.7%
Franklin Street[5]	117	118	0.00	0.00	0.00	0.00	0.95	0.15	1.00	0.15	0.57	141.30	50.38	0.00	4.86	1.76	146.16	52.15	97.52	584	593	0.26%	1.10	303.91	32.1%
To WWTP	118	119	0.00	0.00	0.00	0.00	0.95	0.15	1.00	0.15	0.00	141.30	50.38	0.00	4.86	1.76	146.16	52.15	97.52	600	610	0.26%	1.12	326.62	29.9%
To WWTP	119	119A	0.00	0.00	0.00	0.00	0.95	0.15	1.00	0.15	0.00	141.30	50.38	0.00	4.86	1.76	146.16	52.15	97.52	600	610	0.27%	1.14	332.84	29.3%
To WWTP[6]	119A	119B	0.00	0.00	0.00	0.00	0.95	0.15	1.00	0.15	0.00	141.30	50.38	0.00	4.86	1.76	146.16	52.15	97.52	600	610	0.27%	1.14	332.84	29.3%
To WWTP	119B	120	0.00	0.00	0.00	0.00	0.95	0.15	1.00	0.15	0.00	141.30	50.38	0.00	4.86	1.76	146.16	52.15	97.52	750	762	1.66%	***3.28***	1,496.38	6.5%
To WWTP	120	121	0.00	0.00	0.00	0.00	4.78	0.75	1.00	0.75	0.00	284.15	93.24	0.00	37.74	11.63	321.89	104.87	195.02	750	762	0.25%	1.27	580.71	33.6%
To WWTP	121	122	0.14	0.02	0.28	0.04	5.06	0.79	1.00	0.79	57.07	341.23	110.36	2.60	40.34	12.41	381.56	122.77	227.03	750	762	0.25%	1.27	580.71	39.1%
To WWTP	122	123	0.00	0.00	0.00	0.00	5.06	0.79	1.00	0.79	0.00	341.23	110.36	0.00	40.34	12.41	381.56	122.77	227.03	750	762	0.25%	1.27	580.71	39.1%
To WWTP	123	124	0.00	0.00	0.00	0.00	5.06	0.79	1.00	0.79	0.00	341.23	110.36	0.00	40.34	12.41	381.56	122.77	227.03	750	762	3.97%	***5.07***	2,314.10	9.8%
Industrial Avenue[6]	200	201	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.31	0.00	0.31	0.31	200	203	3.61%	2.00	65.01	0.5%
Industrial Avenue	201	202	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	31.82	31.82	9.55	0.00	0.00	0.00	31.82	9.55	14.80	200	203	0.27%	*0.55*	17.78	83.3%
Industrial Avenue	202	203	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	31.82	9.55	0.00	0.00	0.00	31.82	9.55	14.80	300	305	0.17%	*0.57*	41.59	35.6%
Mullett Street	203	204	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	1.14	32.96	9.89	0.00	0.00	0.00	32.96	9.89	15.48	300	305	0.22%	0.65	47.32	32.7%
Mullett Street	204	205	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.14	33.10	9.93	0.00	0.00	0.00	33.10	9.93	15.64	300	305	0.36%	0.83	60.53	25.8%
Mullett Street	205	206	0.14	0.02	0.28	0.04	0.28	0.04	1.00	0.04	4.80	37.90	11.37	2.78	2.78	0.83	40.68	12.20	20.65	300	305	0.77%	1.21	88.52	23.3%
Mullett Street	206	207	0.00	0.00	0.00	0.00	0.28	0.04	1.00	0.04	4.84	42.74	12.82	0.37	3.15	0.94	45.89	13.77	24.51	350	356	0.32%	0.87	86.08	28.5%
Mullett Street	207	208	0.00	0.00	0.00	0.00	0.28	0.04	1.00	0.04	0.00	42.74	12.82	0.00	3.15	0.94	45.89	13.77	24.51	350	356	0.72%	1.30	129.12	19.0%
Mullett Street	208	209	0.69	0.08	1.38	0.22	1.66	0.26	1.00	0.26	2.37	45.11	13.53	0.10	3.25	0.97	48.36	14.51	26.63	375	381	0.30%	0.88	100.18	26.6%
Mullett Street	209	210	0.00	0.00	0.00	0.00	1.66	0.26	1.00	0.26	0.00	45.11	13.53	0.00	3.25	0.97	48.36	14.51	26.63	375	381	0.30%	0.88	100.18	26.6%
Mullett Street	210	211A	0.02	0.00	0.04	0.01	1.70	0.27	1.00	0.27	10.35	55.46	16.64	0.30	3.55	1.06	59.01	17.70	32.63	375	381	0.24%	0.79	89.61	36.4%
Mullett Street[6]	211A	211	0.00	0.00	0.00	0.00	1.70	0.27	1.00	0.27	0.00	55.46	16.64	0.00	3.55	1.06	59.01	17.70	32.63	375	381	0.26%	0.82	93.27	35.0%
Mullett Street	211	212	0.00	0.00	0.00	0.00	1.70	0.27	1.00	0.27	0.34	55.80	16.74	0.00	3.55	1.06	59.35	17.80	32.76	375	381	2.49%	2.53	288.63	11.4%
To WWTP	212	213	0.00	0.00	0.00	0.00	1.70	0.27	1.00	0.27	0.00	55.80	16.74	0.00	3.55	1.06	59.35	17.80	32.76	400	406	0.16%	0.67	86.90	37.7%
To WWTP	213	214	0.00	0.00	0.00	0.00	1.70	0.27	1.00	0.27	0.00	55.80	16.74	0.00	3.55	1.06	59.35	17.80	32.76	400	406	0.18%	0.71	92.18	35.5%
To WWTP	214	215	0.69	0.08	1.38	0.22	3.08	0.48	1.00	0.48	0.00	55.80	16.74	4.00	7.55	2.26	63.35	19.00	40.03	400	406	3.25%	***3.02***	391.67	10.2%
To WWTP	215	216	0.00	0.00	0.00	0.00	3.08	0.48	1.00	0.48	0.00	55.80	16.74	0.00	7.55	2.26	63.35	19.00	40.03	400	406	0.21%	0.77	99.56	40.2%
To WWTP	216	217	0.00	0.00	0.00	0.00	3.08	0.48	1.00	0.48	0.62	56.42	16.93	0.00	7.55	2.26	63.97	19.19	40.30	400	406	0.23%	0.80	104.20	38.7%
To WWTP	217	218	0.00	0.00	0.00	0.00	3.08	0.48	1.00	0.48	0.00	56.42	16.93	0.00	7.55	2.26	63.97	19.19	40.30	400	406	0.22%	0.79	101.90	39.5%
To WWTP	218	219	0.00	0.00	0.00	0.00	3.08	0.48	1.00	0.48	0.35	56.77	17.03	0.00	7.55	2.26	64.32	19.30	40.46	400	406	0.18%	0.71	92.18	43.9%
To WWTP - Siphon[1]	219	220	0.00	0.00	0.00	0.00	3.08	0.48	1.00	0.48	0.00	56.77	17.03	0.00	7.55	2.26	64.32	19.30	40.46	400	406	0.22%	0.79	101.90	39.7%
To WWTP - Siphon[1]	220	221	0.00	0.00	0.00	0.00	3.08	0.48	1.00	0.48	0.00	56.77	17.03	0.00	7.55	2.26	64.32	19.30	40.46	400	406	0.84%	1.54	199.12	20.3%
To WWTP - Siphon[1]	221	124	0.00	0.00	0.00	0.00	3.08	0.48	1.00	0.48	0.00	56.77	17.03	0.00	7.55	2.26	64.32	19.30	40.46	400	406	0.15%	0.65	84.15	48.1%
To WWTP	124	125	0.00	0.00	0.00	0.00	8.14	1.27	1.00	1.27	0.00	398.00	127.39	0.00	47.89	14.67	445.88	142.07	261.53	750	762	0.12%	0.88	402.33	65.0%
To WWTP	125	126	0.00	0.00	0.00	0.00	8.14	1.27	1.00	1.27	0.00	398.00	127.39	0.00	47.89	14.67	445.88	142.07	261.53	750	762	0.12%	0.88	402.33	65.0%
To WWTP	126	127	0.00	0.00	0.00	0.00	8.14	1.27	1.00	1.27	0.00	398.00	127.39	0.00	47.89	14.67	445.88	142.07	261.53	750	762	0.12%	0.88	402.33	65.0%
To WWTP	127	128	0.00	0.00	0.00	0.00	8.14	1.27	1.00	1.27	0.00	398.00	127.39	0.00	47.89	14.67	445.88	142.07	261.53	750	762	0.27%	1.32	603.49	43.3%
To WWTP	**128**	**WWTP**	0.00	0.00	0.00	0.00	13.99	2.19	1.00	2.19	0.00	590.87	185.26	0.00	123.95	37.49	714.82	**222.75**	**381.02**	750	762	0.27%	1.32	603.49	63.1%
McNeely Avenue	301	302	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	50.25	50.25	15.08	0.00	0.00	0.00	50.25	15.08	16.12	300	305	0.25%	0.69	50.44	32.0%
McNeely Avenue	302	303	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.92	51.17	15.35	0.00	0.00	0.00	51.17	15.35	16.49	450	457	0.14%	0.68	111.29	14.8%
McNeely Avenue	303	304	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.87	52.04	15.61	0.00	0.00	0.00	52.04	15.61	16.85	450	457	0.10%	*0.57*	94.06	17.9%
McNeely Avenue	304	305	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.85	52.89	15.87	0.00	0.00	0.00	52.89	15.87	17.20	450	457	0.12%	0.63	103.03	16.7%
McNeely Avenue	305	306	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.88	53.77	16.13	0.00	0.00	0.00	53.77	16.13	17.57	450	457	0.05%	*0.41*	66.51	26.4%
McNeely Avenue	306	307	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.89	54.66	16.40	0.00	0.00	0.00	54.66	16.40	17.93	450	457	0.04%	*0.36*	59.49	30.1%
McNeely Avenue	307	308	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	1.08	55.74	16.72	0.00	0.00	0.00	55.74	16.72	18.38	450	457	0.13%	0.65	107.24	17.1%
McNeely Avenue	308	309	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	1.03	56.77	17.03	0.00	0.00	0.00	56.77	17.03	18.89	450	457	0.11%	0.60	98.65	19.1%
McNeely Avenue	309	310	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	1.77	58.54	17.56	0.00	0.00	0.00	58.54	17.56	19.64	450	457	0.08%	*0.51*	84.13	23.3%
McNeely Avenue	310	311	0.13	0.02	0.26	0.04	0.26	0.04	1.00	0.04	1.56	60.10	18.03	4.83	4.83	1.45	64.93	19.48	22.60	450	457	0.10%	*0.57*	94.06	24.0%
McNeely Avenue	311	312	0.00	0.00	0.00	0.00	0.26	0.04	1.00	0.04	0.98	61.08	18.32	0.00	4.83	1.45	65.91	19.77	23.05	450	457	0.06%	*0.44*	72.86	31.6%
McNeely Avenue	312	313	0.69	0.08	1.38	0.22	1.65	0.26	1.00	0.26	0.46	61.54	18.46	1.92	6.75	2.02	68.29	20.49	25.58	450	457	0.13%	0.65	107.24	23.9%
McNeely Avenue	313	314	0.00	0.00	0.00	0.00	1.65	0.26	1.00	0.26	2.00	63.54	19.06	0.00	6.75	2.02	70.29	21.09	26.45	450	457	0.12%	0.63	103.03	25.7%
McNeely Avenue	314	315	0.00	0.00	0.00	0.00	1.65	0.26	1.00	0.26	0.36	63.90	19.17	0.00	6.75	2.02	70.65	21.19	26.68	300	305	0.41%	0.89	64.60	41.3%
McNeely Avenue	315	316	0.00	0.00	0.00	0.00	1.65	0.26	1.00	0.26	0.51	64.41	19.32	0.00	6.75	2.02	71.16	21.35	27.07	300	305	0.41%	0.89	64.60	41.9%
McNeely Avenue	316	317	0.03	0.00	0.05	0.01	1.70	0.27	1.00	0.27	3.42	67.83	20.35	0.49	7.23	2.17	75.06	22.52	29.99	300	305	0.21%	0.63	46.23	64.9%
McNeely Avenue	317	318	0.00	0.00	0.00	0.00	1.70	0.27	1.00	0.27	2.22	70.05	21.02	0.00	7.23	2.17	77.28	23.18	31.71	300	305	0.23%	0.66	48.38	65.5%
McNeely Avenue	318	319	0.00	0.00	0.00	0.00	1.70	0.27	1.00	0.27	0.82	70.87	21.26	0.00	7.23	2.17	78.10	23.43	32.54	300	305	0.27%	0.72	52.42	62.1%
McNeely Avenue	319	320	0.00	0.00	0.00	0.00	1.70	0.27	1.00	0.27	0.32	71.19	21.36	0.00	7.23	2.17	78.42	23.53	32.78	300	305	0.50%	0.98	71.33	46.0%
McNeely Avenue	320	Pump Station	0.00	0.00	0.00	0.00	1.70	0.27	1.00	0.27	26.50	97.69	29.31	0.00	7.23	2.17	104.92	31.48	49.15	300	305	0.50%	0.98	71.33	68.9%
Patterson Crescent (Forcemain)	Pump Station	321	0.00	0.00	0.00	0.00	1.70	0.27	1.00	0.27	0.00	97.69	29.31	0.00	7.23	2.17	104.92	31.48	49.15						
Patterson Crescent	321	322	1.98	0.23	3.96	0.62	5.66	0.88	1.00	0.88	75.04	172.74	51.82	67.01	74.24	22.27	246.98	74.09	116.71	500	508	0.20%	0.87	176.17	66.2%
Patterson Crescent	322	323	0.10	0.01	0.19	0.03	5.85	0.91	1.00	0.91	14.38	187.11	56.13	1.82	76.06	22.82	263.18	78.95	129.23	500	508	0.20%	0.87	176.17	73.4%
Patterson Crescent	323	324	0.00	0.00	0.00	0.00	5.85	0.91	1.00	0.91	0.23	187.34	56.20	0.00	76.06	22.82	263.41	79.02	129.33	500	508	0.20%	0.87	176.17	73.4%
Patterson Crescent	324	325	0.00	0.00	0.00	0.00	5.85	0.91	1.00	0.91	5.53	192.87	57.86	0.00	76.06	22.82	268.94	80.68	131.65	500	508	0.20%	0.87	176.17	74.7%
To WWTP	325	326	0.00	0.00	0.00	0.00	5.85	0.91	1.00	0.91	0.00	192.87	57.86	0.00	76.06	22.82	268.94	80.68	131.65	500	508	0.20%	0.87	176.17	74.7%
To WWTP	326	327	0.00	0.00	0.00	0.00	5.85	0.91	1.00	0.91	0.00	192.87	57.86	0.00	76.06	22.82	268.94	80.68	131.65	500	508	0.20%	0.87	176.17	74.7%
To WWTP	327	128	0.00	0.00	0.00	0.00	5.85	0.91	1.00	0.91	0.00	192.87	57.86	0.00	76.06	22.82	268.94	80.68	131.65	500	508	0.20%	0.87	176.17	74.7%

Stantec

163401646 - Town of Carleton Place W/WW Master Plan
Table D-12: Sanitary Sewer Calculation Spreadsheet - 2031 Rare Event

Date: 8/19/2021
Prepared by: CR
Checked by: AL

Legend
Manual Input/Modification
Calculated/Extracted Value for Existing + Additional Development
Existing Conditions - 2021
Additional Development
Full Flow Velocity < 0.6 m/s
Sewer Capacity Used > 100%; Sewer Velocity > 3 m/s
WWTP Inflow Point

Modelling Parameters - 2031 Rare Event		
Horizon:	2031	
Scenario:	Rare	
Existing Conditions - 2021		
Average Residential Flow Rate - q =	392	l/cap/day
Peak Extraneous Flow Rate - i =	0.55	l/s/ha
Peak Extraneous Flow Rate (Monitor No. 6)[3] - i =	3.00	l/s/ha
Existing Conditions Population Density =	2.5	PPU
Harmon Peaking Factor Correction Factor - K =	0.60	-
Growth Developments - 2031		
Average Residential Flow Rate - q =	200	l/cap/day
Peak Extraneous Flow Rate - i =	0.55	l/s/ha
Peak Extraneous Flow Rate (Monitor No. 6)[3] - i =	3.00	l/s/ha
Harmon Peaking Factor Correction Factor - K =	0.60	-
Insitutional/Commercial Average Flow Rate - q =	17,000	l/ha/day
Institutional/Commercial (IC) Peaking Factor (ICI Cont. > 20%) =	1.00	-
Institutional/Commercial (IC) Peaking Factor (ICI Cont. ≤ 20%) =	1.00	-
Light Industrial Average Flow Rate - q =	10,000	l/ha/day
Light Industrial Peaking Factor (ICI Cont. > 20%) =	1.00	-
Light Industrial Peaking Factor (ICI Cont. ≤ 20%) =	1.00	-
Manning's Coefficient - n =	0.013	

Note : Values as per ***Design Basis Memo*** *(July 12, 2021)*

Summary - 2031 Rare Event		
2021 Residential Population	13,403	ppl
2021 ICI Equivalent Population	468	ppl
2021 Total Residential + ICI Equivalent Population	13,870	ppl
2031 Additional Residential Population	6,827	ppl
2031 Total Residential Population	20,230	ppl
2031 Total Residential + ICI Equivalent Population	20,697	ppl
2031 Additional Residential Area	110	ha
2031 Additional ICI Area	14	ha
2031 Total Area	715	ha
Average DWF (Residential + ICI)	6,991	m^3/d
Peak DWF (Residential + ICI)	13,675	m^3/d
Peak Extraneous Flow	51,538	m^3/d
Peak Total Flow	65,213	m^3/d
Number of Sewers Surcharged	31	
Average Sewer Capacity Used	87.9%	
Max Sewer Capacity Used	350.0%	
Mississippi Quays PS Peak Inflow	75.4	L/s

Notes

(1) McArthur Island siphon represented by sewer section from MH219 to MH124, as a single 400 mm diameter gravity pipe at 0.84% slope, as per original spreadsheet (JLR, 2021). Based on drawings, siphon consists of two barrels (150 mm and 300 mm); representation of siphon would require adjustments for HGL calculations.
(2) Mississippi Quays PS modelled at the end of McNeely Avenue (from MH320 to Pump Station); no gravity flow calculated through forcemain on Patterson Crescent (from Pump Station to MH321, assumed without restrictions).
(3) Extraneous flows calculated using 3 L/s/ha for drainage areas tributary to flow monitor No. 6.
(4) Diameters and slopes confirmed or corrected based on comparison of original spreadsheet to information provided by the Town on 20210712; see detailed comparison in Table D-1: Comparison of Diameters and Slopes from Different Sources.
(5) Based on information provided by the Town on 20210712, sewer along Franklin St between MH117 and MH118 appears to first be a ~38 m long 600 mm single sewer, followed by a ~52 m long section of twin 450 mm sewers; equivalent diameter to twin 450 mm retained, as it is more conservative.
(6) Sewer section added to spreadsheet to match Town's GIS data.

Level of Service Limits		
Maximum Velocity	3	m/s
Actual Flow/Full Flow Capacity	100%	

Flow Generation – Residential; Existing (2021) ICI Conditions

Street/Location	Maintenance Hole From	Maintenance Hole To	Existing (2021) Residential Conditions: Number of Units: Residential Units	Commercial Units	Institutional Units	Total Units	Existing Population	Cumulative Existing Population	Existing Residential Sewage Flow (L/s)	Additional (2031) Residential Development: Additional Population	Cumulative Additional Population	Additional Residential Sewage Flow (L/s)	2031 Residential Contributions: Total Cumulative Residential Population	Total Residential Sewage Flow (L/s)	Harmon Peaking Factor	Peak Residential Sewage Flow (L/s)	Existing (2021) ICI Conditions: Existing ICI Sewage (L/s)	Cumulative Existing ICI Sewage (L/s)
Lake Avenue West	001	02A	62		1	63	158	158	0.71	1,427	1,427	3.30	1,585	4.02	2.60	10.44	0.00	0.00
Lake Avenue West[6]	02A	002					0	158	0.71	0	1,427	3.30	1,585	4.02	2.60	10.44	0.00	0.00
Lake Avenue West	002	003	459			459	1,148	1,305	5.92	0	1,427	3.30	2,732	9.22	2.49	22.93	0.00	0.00
Lake Avenue West	003	004	9			9	23	1,328	6.02	0	1,427	3.30	2,755	9.33	2.48	23.17	0.00	0.00
Lake Avenue West	004	005	11			11	28	1,355	6.15	0	1,427	3.30	2,782	9.45	2.48	23.46	0.00	0.00
Lake Avenue West	005	006	37		1	38	95	1,450	6.58	0	1,427	3.30	2,877	9.88	2.47	24.45	0.00	0.00
Lake Avenue West	006	007	21			21	53	1,503	6.82	0	1,427	3.30	2,930	10.12	2.47	25.00	0.00	0.00
Lake Avenue West	007	008	325			325	813	2,315	10.50	161	1,588	3.68	3,903	14.18	2.41	34.11	0.00	0.00
Lake Avenue West	008	009	34			34	85	2,400	10.89	0	1,588	3.68	3,988	14.56	2.40	34.97	0.00	0.00
Lake Avenue West	009	010	86			86	215	2,615	11.86	0	1,588	3.68	4,203	15.54	2.39	37.12	0.00	0.00
Lake Avenue West	010	011	54	1		55	138	2,753	12.49	11	1,599	3.70	4,352	16.19	2.38	38.53	0.00	0.00
Lake Avenue West	011	012	18			18	45	2,798	12.69	0	1,599	3.70	4,397	16.39	2.38	38.98	0.00	0.00
Lake Avenue West	012	013	70	4		74	185	2,983	13.53	2	1,601	3.71	4,584	17.24	2.37	40.82	0.00	0.00
Lake Avenue West	013	014	7	1		8	20	3,003	13.62	39	1,640	3.80	4,643	17.42	2.36	41.19	0.00	0.00
Lake Avenue West	014	15B	15	2		17	43	3,045	13.82	12	1,652	3.82	4,697	17.64	2.36	41.66	0.00	0.00
Lake Avenue West[6]	15B	15A					0	3,045	13.82	0	1,652	3.82	4,697	17.64	2.36	41.66	0.00	0.00
Lake Avenue West	15A	015	1	1		2	5	3,050	13.84	0	1,652	3.82	4,702	17.66	2.36	41.71	0.00	0.00
Lake Avenue West	015	016	15			15	38	3,088	14.01	0	1,652	3.82	4,740	17.83	2.36	42.08	0.00	0.00
Lake Avenue West	016	017	12	2		14	35	3,123	14.17	0	1,652	3.82	4,775	17.99	2.36	42.42	0.00	0.00
Lake Avenue West	017	018	60			60	150	3,273	14.85	0	1,652	3.82	4,925	18.67	2.35	43.89	0.00	0.00
Lake Avenue West	018	019	3			3	8	3,280	14.88	0	1,652	3.82	4,932	18.71	2.35	43.96	0.00	0.00
Lake Avenue West	019	020	23			23	58	3,338	15.14	16	1,668	3.86	5,006	19.00	2.35	44.60	0.00	0.00
Lake Avenue West	020	021	4			4	10	3,348	15.19	0	1,668	3.86	5,016	19.05	2.35	44.69	0.00	0.00
Lake Avenue West	021	022	140		1	141	353	3,700	16.79	203	1,871	4.33	5,571	21.12	2.32	49.01	0.00	0.00
Lorne Street	022	023	8			8	20	3,720	16.88	0	1,871	4.33	5,591	21.21	2.32	49.20	0.00	0.00
Lorne Street	023	024	12			12	30	3,750	17.01	0	1,871	4.33	5,621	21.34	2.32	49.49	0.00	0.00
Ball Park	024	120	77	1		78	195	3,945	17.90	0	1,871	4.33	5,816	22.23	2.31	51.35	0.00	0.00
High Street[3]	101	102A	535	4	1	540	1,350	1,350	6.13	107	107	0.25	1,457	6.37	2.61	16.65	0.00	0.00
High Street[3]	102A	102	0			0	0	1,350	6.13	0	107	0.25	1,457	6.37	2.61	16.65	0.00	0.00
High Street[3]	102	103	129			129	323	1,673	7.59	0	107	0.25	1,780	7.84	2.57	20.18	0.00	0.00
High Street[3]	103	104	99			99	248	1,920	8.71	0	107	0.25	2,027	8.96	2.55	22.83	0.00	0.00
High Street[3]	104	105	125	2		127	318	2,238	10.15	0	107	0.25	2,345	10.40	2.52	26.19	0.00	0.00
High Street[3]	105	106	16			16	40	2,278	10.33	0	107	0.25	2,385	10.58	2.52	26.61	0.00	0.00
High Street[3]	106	107	5			5	13	2,290	10.39	65	172	0.40	2,462	10.79	2.51	27.06	0.00	0.00
High Street[3]	107	108	8			8	20	2,310	10.48	0	172	0.40	2,482	10.88	2.51	27.27	0.00	0.00
Bridge Street	108	109	415		1	416	1,040	3,350	15.20	70	242	0.56	3,592	15.76	2.42	38.21	0.00	0.00
Bridge Street	109	110	6	4		10	25	3,375	15.31	0	242	0.56	3,617	15.87	2.42	38.46	0.00	0.00
Bridge Street	110	111	2			2	5	3,380	15.34	0	242	0.56	3,622	15.90	2.42	38.51	0.00	0.00
Bridge Street	111	112	0			0	0	3,380	15.34	0	242	0.56	3,622	15.90	2.42	38.51	0.00	0.00
Mill Street	112	113	158	22	2	182	455	3,835	17.40	8	250	0.58	4,085	17.98	2.40	43.06	0.00	0.00
Beckwith Street	113	114	12			12	30	3,865	17.54	0	250	0.58	4,115	18.11	2.39	43.35	0.00	0.00
Franklin Street	114	115	10	5		15	38	3,903	17.71	0	250	0.58	4,153	18.28	2.39	43.72	0.00	0.00
Franklin Street	115	115A	42	7		49	123	4,025	18.26	12	262	0.61	4,287	18.87	2.38	44.98	0.00	0.00
Franklin Street	115A	116	2			2	5	4,030	18.28	0	262	0.61	4,292	18.89	2.38	45.03	0.00	0.00
Franklin Street	116	117	0			0	0	4,030	18.28	0	262	0.61	4,292	18.89	2.38	45.03	0.00	0.00
Franklin Street[5]	117	118	5	3		8	20	4,050	18.38	0	262	0.61	4,312	18.98	2.38	45.22	0.00	0.00
To WWTP	118	119	0			0	0	4,050	18.38	0	262	0.61	4,312	18.98	2.38	45.22	0.00	0.00
To WWTP	119	119A	0			0	0	4,050	18.38	0	262	0.61	4,312	18.98	2.38	45.22	0.00	0.00
To WWTP[6]	119A	119B					0	4,050	18.38	0	262	0.61	4,312	18.98	2.38	45.22	0.00	0.00
To WWTP	119B	120	0			0	0	4,050	18.38	0	262	0.61	4,312	18.98	2.38	45.22	0.00	0.00
To WWTP	120	121	0			0	0	7,995	36.27	0	2,133	4.94	10,128	41.21	2.17	89.41	0.00	0.00
To WWTP	121	122	610	12	1	623	1,558	9,553	43.34	136	2,269	5.25	11,822	48.59	2.13	103.47	0.00	0.00
To WWTP	122	123	0			0	0	9,553	43.34	0	2,269	5.25	11,822	48.59	2.13	103.47	0.00	0.00
To WWTP	123	124	0			0	0	9,553	43.34	0	2,269	5.25	11,822	48.59	2.13	103.47	0.00	0.00
Industrial Avenue[6]	200	201					0	0	0.00	0	0	0.00	0	0.00	3.10	0.00	0.00	0.00
Industrial Avenue	201	202	115	50		165	413	413	1.87	0	0	0.00	413	1.87	2.81	5.26	0.00	0.00
Industrial Avenue	202	203	0			0	0	413	1.87	0	0	0.00	413	1.87	2.81	5.26	0.00	0.00
Mullett Street	203	204	7	4		11	28	440	2.00	0	0	0.00	440	2.00	2.80	5.59	0.00	0.00
Mullett Street	204	205	4			4	10	450	2.04	0	0	0.00	450	2.04	2.80	5.71	0.00	0.00
Mullett Street	205	206	63	1		64	160	610	2.77	136	136	0.31	746	3.08	2.73	8.41	0.00	0.00
Mullett Street	206	207	75			75	188	798	3.62	20	156	0.36	954	3.98	2.69	10.70	0.00	0.00
Mullett Street	207	208	0			0	0	798	3.62	0	156	0.36	954	3.98	2.69	10.70	0.00	0.00
Mullett Street	208	209	17	5		22	55	853	3.87	97	253	0.59	1,106	4.45	2.66	11.86	0.00	0.00
Mullett Street	209	210	0			0	0	853	3.87	0	253	0.59	1,106	4.45	2.66	11.86	0.00	0.00
Mullett Street	210	211A	91	5		96	240	1,093	4.96	19	272	0.63	1,365	5.59	2.63	14.67	0.00	0.00
Mullett Street[6]	211A	211					0	1,093	4.96	0	272	0.63	1,365	5.59	2.63	14.67	0.00	0.00
Mullett Street	211	212	1			1	3	1,095	4.97	0	272	0.63	1,367	5.60	2.63	14.69	0.00	0.00
To WWTP	212	213	0			0	0	1,095	4.97	0	272	0.63	1,367	5.60	2.63	14.69	0.00	0.00
To WWTP	213	214	0			0	0	1,095	4.97	0	272	0.63	1,367	5.60	2.63	14.69	0.00	0.00
To WWTP	214	215	0			0	0	1,095	4.97	1,124	1,396	3.23	2,491	8.20	2.51	20.55	0.00	0.00
To WWTP	215	216	0			0	0	1,095	4.97	0	1,396	3.23	2,491	8.20	2.51	20.55	0.00	0.00
To WWTP	216	217	2		1	3	8	1,103	5.00	0	1,396	3.23	2,499	8.23	2.51	20.63	0.00	0.00
To WWTP	217	218	0			0	0	1,103	5.00	0	1,396	3.23	2,499	8.23	2.51	20.63	0.00	0.00
To WWTP	218	219	1		1	2	5	1,108	5.02	0	1,396	3.23	2,504	8.26	2.50	20.68	0.00	0.00
To WWTP - Siphon[1]	219	220	0			0	0	1,108	5.02	0	1,396	3.23	2,504	8.26	2.50	20.68	0.00	0.00
To WWTP - Siphon[1]	220	221	0			0	0	1,108	5.02	0	1,396	3.23	2,504	8.26	2.50	20.68	0.00	0.00
To WWTP - Siphon[1]	221	124	0			0	0	1,108	5.02	0	1,396	3.23	2,504	8.26	2.50	20.68	0.00	0.00
To WWTP	124	125	0			0	0	10,660	48.36	0	3,665	8.48	14,325	56.85	2.08	118.19	0.00	0.00
To WWTP	125	126	0			0	0	10,660	48.36	0	3,665	8.48	14,325	56.85	2.08	118.19	0.00	0.00
To WWTP	126	127	0			0	0	10,660	48.36	0	3,665	8.48	14,325	56.85	2.08	118.19	0.00	0.00
To WWTP	127	128	0			0	0	10,660	48.36	0	3,665	8.48	14,325	56.85	2.08	118.19	0.00	0.00
To WWTP	**128**	**WWTP**	0			0	0	13,870	62.93	0	6,827	15.80	20,697	78.73	1.98	**156.09**	0.00	0.00
McNeely Avenue	301	302	0	31		31	78	78	0.35	0	0	0.00	78	0.35	2.96	1.04	0.00	0.00
McNeely Avenue	302	303	3			3	8	85	0.39	0	0	0.00	85	0.39	2.96	1.14	0.00	0.00
McNeely Avenue	303	304	3			3	8	93	0.42	0	0	0.00	93	0.42	2.95	1.24	0.00	0.00
McNeely Avenue	304	305	3			3	8	100	0.45	0	0	0.00	100	0.45	2.95	1.34	0.00	0.00
McNeely Avenue	305	306	3			3	8	108	0.49	0	0	0.00	108	0.49	2.94	1.43	0.00	0.00
McNeely Avenue	306	307	3			3	8	115	0.52	0	0	0.00	115	0.52	2.94	1.53	0.00	0.00
McNeely Avenue	307	308	4			4	10	125	0.57	0	0	0.00	125	0.57	2.93	1.66	0.00	0.00
McNeely Avenue	308	309	4	2		6	15	140	0.64	0	0	0.00	140	0.64	2.92	1.85	0.00	0.00
McNeely Avenue	309	310	6	1		7	18	158	0.71	0	0	0.00	158	0.71	2.91	2.08	0.00	0.00
McNeely Avenue	310	311	6			6	15	173	0.78	130	130	0.30	303	1.08	2.85	3.08	0.00	0.00
McNeely Avenue	311	312	4	1		5	13	185	0.84	0	130	0.30	315	1.14	2.84	3.24	0.00	0.00
McNeely Avenue	312	313	4			4	10	195	0.88	243	373	0.86	568	1.75	2.77	4.84	0.00	0.00
McNeely Avenue	313	314	8	1		9	23	218	0.99	0	373	0.86	591	1.85	2.76	5.11	0.00	0.00
McNeely Avenue	314	315	4			4	10	228	1.03	0	373	0.86	601	1.90	2.76	5.23	0.00	0.00
McNeely Avenue	315	316	8			8	20	248	1.12	0	373	0.86	621	1.99	2.75	5.47	0.00	0.00
McNeely Avenue	316	317	53			53	133	380	1.72	26	399	0.92	779	2.65	2.72	7.20	0.00	0.00
McNeely Avenue	317	318	36			36	90	470	2.13	0	399	0.92	869	3.06	2.70	8.26	0.00	0.00
McNeely Avenue	318	319	20			20	50	520	2.36	0	399	0.92	919	3.28	2.69	8.84	0.00	0.00
McNeely Avenue	319	320	5			5	13	533	2.42	0	399	0.92	932	3.34	2.69	8.99	0.00	0.00
McNeely Avenue	320	Pump Station	299			299	748	1,280	5.81	0	399	0.92	1,679	6.73	2.59	17.41	0.00	0.00
Patterson Crescent (Forcemain)	Pump Station	321	0			0	0	1,280	5.81	0	399	0.92	1,679	6.73	2.59	17.41	0.00	0.00
Patterson Crescent	321	322	442	2		444	1,110	2,390	10.84	2,668	3,067	7.10	5,457	17.94	2.33	41.73	0.00	0.00
Patterson Crescent	322	323	298	1		299	748	3,138	14.23	95	3,162	7.32	6,300	21.55	2.29	49.37	0.00	0.00
Patterson Crescent	323	324	1			1	3	3,140	14.25	0	3,162	7.32	6,302	21.57	2.29	49.39	0.00	0.00
Patterson Crescent	324	325	26		2	28	70	3,210	14.56	0	3,162	7.32	6,372	21.88	2.29	50.06	0.00	0.00
To WWTP	325	326				0	0	3,210	14.56	0	3,162	7.32	6,372	21.88	2.29	50.06	0.00	0.00
To WWTP	326	327				0	0	3,210	14.56	0	3,162	7.32	6,372	21.88	2.29	50.06	0.00	0.00
To WWTP	327	128				0	0	3,210	14.56	0	3,162	7.32	6,372	21.88	2.29	50.06	0.00	0.00

Flow Generation – ICI (Additional (2031) ICI Development, 2031 ICI Contributions); Extraneous Flows; Total Peak Flow; Pipe Conditions – Pipe Capacity Utilization

Street/Location	From	To	Additional IC Area (ha)	Additional IC Sewage (L/s)	Additional Ind. Area (ha)	Additional Ind. Sewage (L/s)	Total Additional ICI Area (ha)	Total Additional ICI Sewage (L/s)	Cumulative Additional ICI Area (ha)	Cumulative Additional ICI Sewage (L/s)	2031 ICI Contributions: Peaking Factor	Peak ICI Sewage (L/s)	Existing (2021) Extraneous Flows: Existing Drainage Area (ha)	Cumulative Existing Drainage Area (ha)	Existing Extraneous Flow (L/s)	Additional (2031) Extraneous Flows: Additional Drainage Area (ha)	Cumulative Additional Drainage Area (ha)	Additional Extraneous Flow (L/s)	2031 Extraneous Flow Contributions: Total Cumulative Drainage Area (ha)	Total Extraneous Flow (L/s)	Total Peak Flow (L/s)	Nominal Pipe Diameter (mm)	Actual Pipe Diameter (mm)	Slope (%)	Full Flow Velocity (m/s)	Full Flow Capacity (L/s)	Capacity Used (%)
Lake Avenue West	001	02A	0.21	0.04	0.21	0.02	0.41	0.06	0.41	0.06	1.00	0.06	4.95	4.95	2.72	25.87	25.87	14.23	30.82	16.95	27.45	375	381	0.44%	1.06	121.33	22.6%
Lake Avenue West[6]	02A	002	0.00	0.00	0.00	0.00	0.00	0.00	0.41	0.06	1.00	0.06	0.00	4.95	2.72	0.00	25.87	14.23	30.82	16.95	27.45	375	381	0.42%	1.04	118.54	23.2%
Lake Avenue West	002	003	0.00	0.00	0.00	0.00	0.00	0.00	0.41	0.06	1.00	0.06	35.59	40.54	22.29	0.00	25.87	14.23	66.41	36.52	59.52	375	381	0.48%	1.11	126.72	47.0%
Lake Avenue West	003	004	0.00	0.00	0.00	0.00	0.00	0.00	0.41	0.06	1.00	0.06	1.77	42.31	23.27	0.00	25.87	14.23	68.18	37.50	60.73	375	381	0.45%	1.08	122.70	49.5%
Lake Avenue West	004	005	0.69	0.14	0.69	0.08	1.38	0.22	1.80	0.28	1.00	0.28	0.40	42.71	23.49	0.00	25.87	14.23	68.58	37.72	61.45	375	381	0.46%	1.09	124.06	49.5%
Lake Avenue West	005	006	0.00	0.00	0.00	0.00	0.00	0.00	1.80	0.28	1.00	0.28	4.51	47.22	25.97	0.00	25.87	14.23	73.09	40.20	64.93	375	381	0.42%	1.04	118.54	54.8%
Lake Avenue West	006	007	0.00	0.00	0.00	0.00	0.00	0.00	1.80	0.28	1.00	0.28	1.13	48.35	26.59	0.00	25.87	14.23	74.22	40.82	66.10	375	381	0.39%	1.00	114.23	57.9%
Lake Avenue West	007	008	0.10	0.02	0.10	0.01	0.20	0.03	2.00	0.31	1.00	0.31	33.14	81.49	44.82	2.54	28.41	15.62	109.89	60.44	94.87	375	381	0.57%	1.21	138.09	68.7%
Lake Avenue West	008	009	0.00	0.00	0.00	0.00	0.00	0.00	2.00	0.31	1.00	0.31	1.84	83.33	45.83	0.00	28.41	15.62	111.73	61.45	96.73	375	381	0.85%	1.48	168.64	57.4%
Lake Avenue West	009	010	0.00	0.00	0.00	0.00	0.00	0.00	2.00	0.31	1.00	0.31	5.49	88.82	48.85	0.00	28.41	15.62	117.22	64.47	101.90	375	381	0.62%	1.26	144.02	70.8%
Lake Avenue West	010	011	0.00	0.00	0.00	0.00	0.00	0.00	2.00	0.31	1.00	0.31	3.76	92.58	50.92	0.19	28.60	15.73	121.17	66.65	105.49	375	381	0.48%	1.11	126.72	83.2%
Lake Avenue West	011	012	0.00	0.00	0.00	0.00	0.00	0.00	2.00	0.31	1.00	0.31	1.69	94.27	51.85	0.00	28.60	15.73	122.86	67.58	106.87	375	381	1.82%	2.16	246.76	43.3%
Lake Avenue West	012	013	0.00	0.00	0.00	0.00	0.00	0.00	2.00	0.31	1.00	0.31	17.76	112.03	61.61	0.02	28.62	15.74	140.64	77.35	118.48	525	533	0.25%	1.00	224.33	52.8%
Lake Avenue West	013	014	0.69	0.14	0.69	0.08	1.38	0.22	3.38	0.53	1.00	0.53	0.73	112.76	62.02	0.24	28.86	15.87	141.61	77.89	119.61	600	610	0.12%	0.76	221.90	53.9%
Lake Avenue West	014	15B	0.00	0.00	0.00	0.00	0.00	0.00	3.38	0.53	1.00	0.53	2.10	114.86	63.17	0.22	29.08	15.99	143.94	79.17	121.36	600	610	0.12%	0.76	221.90	54.7%
Lake Avenue West[6]	15B	15A	0.00	0.00	0.00	0.00	0.00	0.00	3.38	0.53	1.00	0.53	0.00	114.86	63.17	0.00	29.08	15.99	143.94	79.17	121.36	600	610	0.12%	0.76	221.90	54.7%
Lake Avenue West	15A	015	0.00	0.00	0.00	0.00	0.00	0.00	3.38	0.53	1.00	0.53	0.19	115.05	63.28	0.00	29.08	15.99	144.13	79.27	121.51	600	610	0.12%	0.76	221.90	54.8%
Lake Avenue West	015	016	0.00	0.00	0.00	0.00	0.00	0.00	3.38	0.53	1.00	0.53	0.95	116.00	63.80	0.00	29.08	15.99	145.08	79.79	122.40	600	610	0.12%	0.76	221.90	55.2%
Lake Avenue West	016	017	0.00	0.00	0.00	0.00	0.00	0.00	3.38	0.53	1.00	0.53	1.67	117.67	64.72	0.00	29.08	15.99	146.75	80.71	123.66	600	610	0.10%	0.69	202.56	61.0%
Lake Avenue West	017	018	0.00	0.00	0.00	0.00	0.00	0.00	3.38	0.53	1.00	0.53	3.63	121.30	66.71	0.00	29.08	15.99	150.38	82.71	127.13	600	610	0.10%	0.69	202.56	62.8%
Lake Avenue West	018	019	0.00	0.00	0.00	0.00	0.00	0.00	3.38	0.53	1.00	0.53	0.21	121.51	66.83	0.00	29.08	15.99	150.59	82.82	127.32	600	610	0.12%	0.76	221.90	57.4%
Lake Avenue West	019	020	0.02	0.00	0.02	0.00	0.03	0.00	3.42	0.53	1.00	0.53	1.57	123.08	67.69	0.28	29.36	16.15	152.44	83.84	128.97	600	610	0.12%	0.76	221.90	58.1%
Lake Avenue West	020	021	0.00	0.00	0.00	0.00	0.00	0.00	3.42	0.53	1.00	0.53	0.28	123.36	67.85	0.00	29.36	16.15	152.72	83.99	129.22	600	610	0.06%	*0.51*	150.22	86.0%
Lake Avenue West	021	022	0.21	0.04	0.21	0.02	0.41	0.06	3.83	0.60	1.00	0.60	12.30	135.66	74.61	3.52	32.88	18.08	168.53	92.69	142.30	600	610	0.12%	0.76	221.90	64.1%
Lorne Street	022	023	0.00	0.00	0.00	0.00	0.00	0.00	3.83	0.60	1.00	0.60	0.84	136.50	75.07	0.00	32.88	18.08	169.37	93.15	142.95	600	610	0.20%	0.98	286.47	49.9%
Lorne Street	023	024	0.00	0.00	0.00	0.00	0.00	0.00	3.83	0.60	1.00	0.60	0.65	137.15	75.43	0.00	32.88	18.08	170.02	93.51	143.60	600	610	0.20%	0.98	286.47	50.1%
Ball Park	024	120	0.00	0.00	0.00	0.00	0.00	0.00	3.83	0.60	1.00	0.60	5.71	142.86	78.57	0.00	32.88	18.08	175.73	96.65	148.60	600	610	0.47%	1.51	439.42	33.8%
High Street[3]	101	102A	0.34	0.07	0.34	0.04	0.69	0.11	0.69	0.11	1.00	0.11	57.19	57.19	171.56	2.00	2.00	6.00	59.19	177.56	194.32	350	356	0.51%	1.09	108.67	***178.8%***
High Street[3]	102A	102	0.00	0.00	0.00	0.00	0.00	0.00	0.69	0.11	1.00	0.11	0.00	57.19	171.56	0.00	2.00	6.00	59.19	177.56	194.32	350	356	0.15%	*0.59*	58.94	***329.7%***
High Street[3]	102	103	0.00	0.00	0.00	0.00	0.00	0.00	0.69	0.11	1.00	0.11	6.67	63.86	191.57	0.00	2.00	6.00	65.86	197.57	217.85	350	356	0.17%	0.63	62.74	***347.2%***
High Street[3]	103	104	0.00	0.00	0.00	0.00	0.00	0.00	0.69	0.11	1.00	0.11	12.95	76.81	230.42	0.00	2.00	6.00	78.81	236.42	259.36	400	406	0.14%	0.63	81.29	***319.0%***
High Street[3]	104	105	0.00	0.00	0.00	0.00	0.00	0.00	0.69	0.11	1.00	0.11	1.53	78.34	235.01	0.00	2.00	6.00	80.34	241.01	267.30	400	406	0.14%	0.63	81.29	***328.8%***
High Street[3]	105	106	0.00	0.00	0.00	0.00	0.00	0.00	0.69	0.11	1.00	0.11	0.47	78.81	236.42	0.00	2.00	6.00	80.81	242.42	269.13	400	406	0.14%	0.63	81.29	***331.1%***
High Street[3]	106	107	0.07	0.01	0.07	0.01	0.13	0.02	0.82	0.13	1.00	0.13	0.48	79.29	237.86	1.05	3.05	9.15	82.34	247.01	274.19	400	406	0.13%	0.60	78.33	***350.0%***
High Street[3]	107	108	0.00	0.00	0.00	0.00	0.00	0.00	0.82	0.13	1.00	0.13	0.67	79.95	239.86	0.00	3.05	9.15	83.00	249.01	276.40	400	406	0.15%	0.65	84.15	***328.5%***
Bridge Street	108	109	0.06	0.01	0.06	0.01	0.13	0.02	0.95	0.15	1.00	0.15	35.48	115.44	259.37	1.47	4.52	9.96	119.95	269.33	307.69	450	457	0.35%	1.07	175.96	***174.9%***
Bridge Street	109	110	0.00	0.00	0.00	0.00	0.00	0.00	0.95	0.15	1.00	0.15	0.18	115.62	259.47	0.00	4.52	9.96	120.13	269.43	308.04	450	457	0.31%	1.01	165.60	***186.0%***
Bridge Street	110	111	0.00	0.00	0.00	0.00	0.00	0.00	0.95	0.15	1.00	0.15	0.26	115.88	259.61	0.00	4.52	9.96	120.39	269.57	308.23	450	457	0.45%	1.22	199.52	***154.5%***
Bridge Street	111	112	0.00	0.00	0.00	0.00	0.00	0.00	0.95	0.15	1.00	0.15	0.00	115.88	259.61	0.00	4.52	9.96	120.39	269.57	308.23	450	457	1.44%	2.17	356.92	86.4%
Mill Street	112	113	0.00	0.00	0.00	0.00	0.00	0.00	0.95	0.15	1.00	0.15	16.75	132.63	268.83	0.12	4.64	10.02	137.26	278.85	322.06	600	610	0.30%	1.20	350.85	91.8%
Beckwith Street	113	114	0.00	0.00	0.00	0.00	0.00	0.00	0.95	0.15	1.00	0.15	0.98	133.61	269.37	0.00	4.64	10.02	138.24	279.39	322.89	600	610	0.20%	0.98	286.47	***112.7%***
Franklin Street	114	115	0.00	0.00	0.00	0.00	0.00	0.00	0.95	0.15	1.00	0.15	1.72	135.33	270.31	0.00	4.64	10.02	139.96	280.33	324.21	600	610	0.23%	1.05	307.20	***105.5%***
Franklin Street	115	115A	0.00	0.00	0.00	0.00	0.00	0.00	0.95	0.15	1.00	0.15	4.74	140.07	272.92	0.22	4.86	10.15	144.93	283.06	328.19	600	610	0.28%	1.16	338.95	96.8%
Franklin Street	115A	116	0.00	0.00	0.00	0.00	0.00	0.00	0.95	0.15	1.00	0.15	0.54	140.61	273.22	0.00	4.86	10.15	145.47	283.36	328.54	600	610	0.31%	1.22	356.65	92.1%
Franklin Street	116	117	0.00	0.00	0.00	0.00	0.00	0.00	0.95	0.15	1.00	0.15	0.12	140.73	273.28	0.00	4.86	10.15	145.59	283.43	328.60	600	610	0.18%	0.93	271.77	***120.9%***
Franklin Street[5]	117	118	0.00	0.00	0.00	0.00	0.00	0.00	0.95	0.15	1.00	0.15	0.57	141.30	273.60	0.00	4.86	10.15	146.16	283.74	329.11	584	593	0.26%	1.10	303.91	***108.3%***
To WWTP	118	119	0.00	0.00	0.00	0.00	0.00	0.00	0.95	0.15	1.00	0.15	0.00	141.30	273.60	0.00	4.86	10.15	146.16	283.74	329.11	600	610	0.26%	1.12	326.62	***100.8%***
To WWTP	119	119A	0.00	0.00	0.00	0.00	0.00	0.00	0.95	0.15	1.00	0.15	0.00	141.30	273.60	0.00	4.86	10.15	146.16	283.74	329.11	600	610	0.27%	1.14	332.84	98.9%
To WWTP[6]	119A	119B	0.00	0.00	0.00	0.00	0.00	0.00	0.95	0.15	1.00	0.15	0.00	141.30	273.60	0.00	4.86	10.15	146.16	283.74	329.11	600	610	0.27%	1.14	332.84	98.9%
To WWTP	119B	120	0.00	0.00	0.00	0.00	0.00	0.00	0.95	0.15	1.00	0.15	0.00	141.30	273.60	0.00	4.86	10.15	146.16	283.74	329.11	750	762	1.66%	***3.28***	1,496.38	22.0%
To WWTP	120	121	0.00	0.00	0.00	0.00	0.00	0.00	4.78	0.75	1.00	0.75	0.00	284.15	352.17	0.00	37.74	28.23	321.89	380.39	470.55	750	762	0.25%	1.27	580.71	81.0%
To WWTP	121	122	0.14	0.03	0.14	0.02	0.28	0.04	5.06	0.79	1.00	0.79	57.07	341.23	383.56	2.60	40.34	29.66	381.56	413.22	517.47	750	762	0.25%	1.27	580.71	89.1%
To WWTP	122	123	0.00	0.00	0.00	0.00	0.00	0.00	5.06	0.79	1.00	0.79	0.00	341.23	383.56	0.00	40.34	29.66	381.56	413.22	517.47	750	762	0.25%	1.27	580.71	89.1%
To WWTP	123	124	0.00	0.00	0.00	0.00	0.00	0.00	5.06	0.79	1.00	0.79	0.00	341.23	383.56	0.00	40.34	29.66	381.56	413.22	517.47	750	762	3.97%	***5.07***	2,314.10	22.4%
Industrial Avenue[6]	200	201	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.47	0.00	7.47	7.47	200	203	3.61%	2.00	65.01	11.5%
Industrial Avenue	201	202	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	31.82	31.82	17.50	0.00	0.00	0.00	31.82	17.50	22.76	200	203	0.27%	*0.55*	17.78	***128.0%***
Industrial Avenue	202	203	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	31.82	17.50	0.00	0.00	0.00	31.82	17.50	22.76	300	305	0.17%	*0.57*	41.59	54.7%
Mullett Street	203	204	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	1.14	32.96	18.13	0.00	0.00	0.00	32.96	18.13	23.72	300	305	0.22%	0.65	47.32	50.1%
Mullett Street	204	205	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.14	33.10	18.21	0.00	0.00	0.00	33.10	18.21	23.92	300	305	0.36%	0.83	60.53	39.5%
Mullett Street	205	206	0.14	0.03	0.14	0.02	0.28	0.04	0.28	0.04	1.00	0.04	4.80	37.90	20.85	2.78	2.78	1.53	40.68	22.37	30.82	300	305	0.77%	1.21	88.52	34.8%
Mullett Street	206	207	0.00	0.00	0.00	0.00	0.00	0.00	0.28	0.04	1.00	0.04	4.84	42.74	23.51	0.37	3.15	1.73	45.89	25.24	35.98	350	356	0.32%	0.87	86.08	41.8%
Mullett Street	207	208	0.00	0.00	0.00	0.00	0.00	0.00	0.28	0.04	1.00	0.04	0.00	42.74	23.51	0.00	3.15	1.73	45.89	25.24	35.98	350	356	0.72%	1.30	129.12	27.9%
Mullett Street	208	209	0.69	0.14	0.69	0.08	1.38	0.22	1.66	0.26	1.00	0.26	2.37	45.11	24.81	0.10	3.25	1.79	48.36	26.60	38.72	375	381	0.30%	0.88	100.18	38.6%
Mullett Street	209	210	0.00	0.00	0.00	0.00	0.00	0.00	1.66	0.26	1.00	0.26	0.00	45.11	24.81	0.00	3.25	1.79	48.36	26.60	38.72	375	381	0.30%	0.88	100.18	38.6%
Mullett Street	210	211A	0.02	0.00	0.02	0.00	0.04	0.01	1.70	0.27	1.00	0.27	10.35	55.46	30.50	0.30	3.55	1.95	59.01	32.45	47.39	375	381	0.24%	0.79	89.61	52.9%
Mullett Street[6]	211A	211	0.00	0.00	0.00	0.00	0.00	0.00	1.70	0.27	1.00	0.27	0.00	55.46	30.50	0.00	3.55	1.95	59.01	32.45	47.39	375	381	0.26%	0.82	93.27	50.8%
Mullett Street	211	212	0.00	0.00	0.00	0.00	0.00	0.00	1.70	0.27	1.00	0.27	0.34	55.80	30.69	0.00	3.55	1.95	59.35	32.64	47.60	375	381	2.49%	2.53	288.63	16.5%
To WWTP	212	213	0.00	0.00	0.00	0.00	0.00	0.00	1.70	0.27	1.00	0.27	0.00	55.80	30.69	0.00	3.55	1.95	59.35	32.64	47.60	400	406	0.16%	0.67	86.90	54.8%
To WWTP	213	214	0.00	0.00	0.00	0.00	0.00	0.00	1.70	0.27	1.00	0.27	0.00	55.80	30.69	0.00	3.55	1.95	59.35	32.64	47.60	400	406	0.18%	0.71	92.18	51.6%
To WWTP	214	215	0.69	0.14	0.69	0.08	1.38	0.22	3.08	0.48	1.00	0.48	0.00	55.80	30.69	4.00	7.55	4.15	63.35	34.84	55.87	400	406	3.25%	***3.02***	391.67	14.3%
To WWTP	215	216	0.00	0.00	0.00	0.00	0.00	0.00	3.08	0.48	1.00	0.48	0.00	55.80	30.69	0.00	7.55	4.15	63.35	34.84	55.87	400	406	0.21%	0.77	99.56	56.1%
To WWTP	216	217	0.00	0.00	0.00	0.00	0.00	0.00	3.08	0.48	1.00	0.48	0.62	56.42	31.03	0.00	7.55	4.15	63.97	35.18	56.29	400	406	0.23%	0.80	104.20	54.0%
To WWTP	217	218	0.00	0.00	0.00	0.00	0.00	0.00	3.08	0.48	1.00	0.48	0.00	56.42	31.03	0.00	7.55	4.15	63.97	35.18	56.29	400	406	0.22%	0.79	101.90	55.2%
To WWTP	218	219	0.00	0.00	0.00	0.00	0.00	0.00	3.08	0.48	1.00	0.48	0.35	56.77	31.22	0.00	7.55	4.15	64.32	35.38	56.54	400	406	0.18%	0.71	92.18	61.3%
To WWTP - Siphon[1]	219	220	0.00	0.00	0.00	0.00	0.00	0.00	3.08	0.48	1.00	0.48	0.00	56.77	31.22	0.00	7.55	4.15	64.32	35.38	56.54	400	406	0.22%	0.79	101.90	55.5%
To WWTP - Siphon[1]	220	221	0.00	0.00	0.00	0.00	0.00	0.00	3.08	0.48	1.00	0.48	0.00	56.77	31.22	0.00	7.55	4.15	64.32	35.38	56.54	400	406	0.84%	1.54	199.12	28.4%
To WWTP - Siphon[1]	221	124	0.00	0.00	0.00	0.00	0.00	0.00	3.08	0.48	1.00	0.48	0.00	56.77	31.22	0.00	7.55	4.15	64.32	35.38	56.54	400	406	0.15%	0.65	84.15	67.2%
To WWTP	124	125	0.00	0.00	0.00	0.00	0.00	0.00	8.14	1.27	1.00	1.27	0.00	398.00	414.78	0.00	47.89	33.81	445.88	448.59	568.05	750	762	0.12%	0.88	402.33	***141.2%***
To WWTP	125	126	0.00	0.00	0.00	0.00	0.00	0.00	8.14	1.27	1.00	1.27	0.00	398.00	414.78	0.00	47.89	33.81	445.88	448.59	568.05	750	762	0.12%	0.88	402.33	***141.2%***
To WWTP	126	127	0.00	0.00	0.00	0.00	0.00	0.00	8.14	1.27	1.00	1.27	0.00	398.00	414.78	0.00	47.89	33.81	445.88	448.59	568.05	750	762	0.12%	0.88	402.33	***141.2%***
To WWTP	127	128	0.00	0.00	0.00	0.00	0.00	0.00	8.14	1.27	1.00	1.27	0.00	398.00	414.78	0.00	47.89	33.81	445.88	448.59	568.05	750	762	0.27%	1.32	603.49	94.1%
To WWTP	**128**	**WWTP**	0.00	0.00	0.00	0.00	0.00	0.00	13.99	2.19	1.00	2.19	0.00	590.87	520.86	0.00	123.95	75.64	714.82	**596.51**	**754.78**	750	762	0.27%	1.32	603.49	***125.1%***
McNeely Avenue	301	302	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	50.25	50.25	27.64	0.00	0.00	0.00	50.25	27.64	28.68	300	305	0.25%	0.69	50.44	56.9%
McNeely Avenue	302	303	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.92	51.17	28.14	0.00	0.00	0.00	51.17	28.14	29.28	450	457	0.14%	0.68	111.29	26.3%
McNeely Avenue	303	304	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.87	52.04	28.62	0.00	0.00	0.00	52.04	28.62	29.86	450	457	0.10%	*0.57*	94.06	31.7%
McNeely Avenue	304	305	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.85	52.89	29.09	0.00	0.00	0.00	52.89	29.09	30.43	450	457	0.12%	0.63	103.03	29.5%
McNeely Avenue	305	306	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.88	53.77	29.57	0.00	0.00	0.00	53.77	29.57	31.01	450	457	0.05%	*0.41*	66.51	46.6%
McNeely Avenue	306	307	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.89	54.66	30.06	0.00	0.00	0.00	54.66	30.06	31.59	450	457	0.04%	*0.36*	59.49	53.1%
McNeely Avenue	307	308	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	1.08	55.74	30.66	0.00	0.00	0.00	55.74	30.66	32.32	450	457	0.13%	0.65	107.24	30.1%
McNeely Avenue	308	309	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	1.03	56.77	31.22	0.00	0.00	0.00	56.77	31.22	33.08	450	457	0.11%	0.60	98.65	33.5%
McNeely Avenue	309	310	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	1.77	58.54	32.20	0.00	0.00	0.00	58.54	32.20	34.28	450	457	0.08%	*0.51*	84.13	40.7%
McNeely Avenue	310	311	0.13	0.03	0.13	0.02	0.26	0.04	0.26	0.04	1.00	0.04	1.56	60.10	33.06	4.83	4.83	2.65	64.93	35.71	38.83	450	457	0.10%	*0.57*	94.06	41.3%
McNeely Avenue	311	312	0.00	0.00	0.00	0.00	0.00	0.00	0.26	0.04	1.00	0.04	0.98	61.08	33.59	0.00	4.83	2.65	65.91	36.25	39.53	450	457	0.06%	*0.44*	72.86	54.3%
McNeely Avenue	312	313	0.69	0.14	0.69	0.08	1.38	0.22	1.65	0.26	1.00	0.26	0.46	61.54	33.85	1.92	6.75	3.71	68.29	37.56	42.65	450	457	0.13%	0.65	107.24	39.8%
McNeely Avenue	313	314	0.00	0.00	0.00	0.00	0.00	0.00	1.65	0.26	1.00	0.26	2.00	63.54	34.95	0.00	6.75	3.71	70.29	38.66	44.02	450	457	0.12%	0.63	103.03	42.7%
McNeely Avenue	314	315	0.00	0.00	0.00	0.00	0.00	0.00	1.65	0.26	1.00	0.26	0.36	63.90	35.15	0.00	6.75	3.71	70.65	38.85	44.34	300	305	0.41%	0.89	64.60	68.6%
McNeely Avenue	315	316	0.00	0.00	0.00	0.00	0.00	0.00	1.65	0.26	1.00	0.26	0.51	64.41	35.43	0.00	6.75	3.71	71.16	39.14	44.86	300	305	0.41%	0.89	64.60	69.5%
McNeely Avenue	316	317	0.03	0.01	0.03	0.00	0.05	0.01	1.70	0.27	1.00	0.27	3.42	67.83	37.31	0.49	7.23	3.98	75.06	41.28	48.75	300	305	0.21%	0.63	46.23	***105.5%***
McNeely Avenue	317	318	0.00	0.00	0.00	0.00	0.00	0.00	1.70	0.27	1.00	0.27	2.22	70.05	38.53	0.00	7.23	3.98	77.28	42.50	51.03	300	305	0.23%	0.66	48.38	***105.5%***
McNeely Avenue	318	319	0.00	0.00	0.00	0.00	0.00	0.00	1.70	0.27	1.00	0.27	0.82	70.87	38.98	0.00	7.23	3.98	78.10	42.96	52.06	300	305	0.27%	0.72	52.42	99.3%
McNeely Avenue	319	320	0.00	0.00	0.00	0.00	0.00	0.00	1.70	0.27	1.00	0.27	0.32	71.19	39.15	0.00	7.23	3.98	78.42	43.13	52.39	300	305	0.50%	0.98	71.33	73.4%
McNeely Avenue	320	Pump Station	0.00	0.00	0.00	0.00	0.00	0.00	1.70	0.27	1.00	0.27	26.50	97.69	53.73	0.00	7.23	3.98	104.92	57.71	75.38	300	305	0.50%	0.98	71.33	***105.7%***
Patterson Crescent (Forcemain)	Pump Station	321	0.00	0.00	0.00	0.00	0.00	0.00	1.70	0.27	1.00	0.27	0.00	97.69	53.73	0.00	7.23	3.98	104.92	57.71	75.38						
Patterson Crescent	321	322	1.98	0.39	1.98	0.23	3.96	0.62	5.66	0.88	1.00	0.88	75.04	172.74	95.01	67.01	74.24	40.83	246.98	135.84	178.45	500	508	0.20%	0.87	176.17	***101.3%***
Patterson Crescent	322	323	0.10	0.02	0.10	0.01	0.19	0.03	5.85	0.91	1.00	0.91	14.38	187.11	102.91	1.82	76.06	41.83	263.18	144.75	195.03	500	508	0.20%	0.87	176.17	***110.7%***
Patterson Crescent	323	324	0.00	0.00	0.00	0.00	0.00	0.00	5.85	0.91	1.00	0.91	0.23	187.34	103.04	0.00	76.06	41.83	263.41	144.87	195.18	500	508	0.20%	0.87	176.17	***110.8%***
Patterson Crescent	324	325	0.00	0.00	0.00	0.00	0.00	0.00	5.85	0.91	1.00	0.91	5.53	192.87	106.08	0.00	76.06	41.83	268.94	147.91	198.89	500	508	0.20%	0.87	176.17	***112.9%***
To WWTP	325	326	0.00	0.00	0.00	0.00	0.00	0.00	5.85	0.91	1.00	0.91	0.00	192.87	106.08	0.00	76.06	41.83	268.94	147.91	198.89	500	508	0.20%	0.87	176.17	***112.9%***
To WWTP	326	327	0.00	0.00	0.00	0.00	0.00	0.00	5.85	0.91	1.00	0.91	0.00	192.87	106.08	0.00	76.06	41.83	268.94	147.91	198.89	500	508	0.20%	0.87	176.17	***112.9%***
To WWTP	327	128	0.00	0.00	0.00	0.00	0.00	0.00	5.85	0.91	1.00	0.91	0.00	192.87	106.08	0.00	76.06	41.83	268.94	147.91	198.89	500	508	0.20%	0.87	176.17	***112.9%***

Stantec

163401646 - Town of Carleton Place W/WW Master Plan

Table D-13: Sanitary Sewer Calculation Spreadsheet - 2041 Design Event

Date: 8/19/2021
Prepared by: CR
Checked by: AL

Legend
Manual Input/Modification
Calculated/Extracted Value for Existing + Additional Development
Existing Conditions - 2021
Additional Development
Full Flow Velocity < 0.6 m/s
Sewer Capacity Used > 100%; Sewer Velocity > 3 m/s
WWTP Inflow Point

Modelling Parameters - 2041 Design Event		
Horizon:	2041	
Scenario:	Design	
Existing Conditions - 2021		
Average Residential Flow Rate - q =	392	l/cap/day
Peak Extraneous Flow Rate - i =	0.33	l/s/ha
Peak Extraneous Flow Rate (Monitor No. 6)[3] - i =	0.33	l/s/ha
Existing Conditions Population Density =	2.5	PPU
Harmon Peaking Factor Correction Factor - K =	0.80	-
Growth Developments - 2041		
Average Residential Flow Rate - q =	280	l/cap/day
Peak Extraneous Flow Rate - i =	0.33	l/s/ha
Peak Extraneous Flow Rate (Monitor No. 6)[3] - i =	0.33	l/s/ha
Harmon Peaking Factor Correction Factor - K =	0.80	-
Insitutional/Commercial Average Flow Rate - q =	28,000	l/ha/day
Institutional/Commercial (IC) Peaking Factor (ICI Cont. > 20%) =	1.50	-
Institutional/Commercial (IC) Peaking Factor (ICI Cont. ≤ 20%) =	1.00	-
Light Industrial Average Flow Rate - q =	35,000	l/ha/day
Light Industrial Peaking Factor (ICI Cont. > 20%) =	1.50	-
Light Industrial Peaking Factor (ICI Cont. ≤ 20%) =	1.00	-
Manning's Coefficient - n =	0.013	

Note: Values as per ***Design Basis Memo*** *(July 12, 2021)*

Summary - 2041 Design Event		
2021 Residential Population	13,403	ppl
2021 ICI Equivalent Population	468	ppl
2021 Total Residential + ICI Equivalent Population	13,870	ppl
2041 Additional Residential Population	11,694	ppl
2041 Total Residential Population	25,097	ppl
2041 Total Residential + ICI Equivalent Population	25,564	ppl
2041 Additional Residential Area	221	ha
2041 Additional ICI Area	23	ha
2041 Total Area	835	ha
Average DWF (Residential + ICI)	9,434	m^3/d
Peak DWF (Residential + ICI)	20,208	m^3/d
Peak Extraneous Flow	23,808	m^3/d
Peak Total Flow	44,016	m^3/d
Number of Sewers Surcharged	9	
Average Sewer Capacity Used	55.3%	
Max Sewer Capacity Used	109.7%	
Mississippi Quays PS Peak Inflow	66.0	L/s

Notes

(1) McArthur Island siphon represented by sewer section from MH219 to MH124, as a single 400 mm diameter gravity pipe at 0.84% slope, as per original spreadsheet (JLR, 2021). Based on drawings, siphon consists of two barrels (150 mm and 300 mm); representation of siphon would require adjustments for HGL calculations.
(2) Mississippi Quays PS modelled at the end of McNeely Avenue (from MH320 to Pump Station); no gravity flow calculated through forcemain on Patterson Crescent (from Pump Station to MH321, assumed without restrictions).
(3) Extraneous flows calculated using 0.33 L/s/ha for drainage areas tributary to flow monitor No. 6.
(4) Diameters and slopes confirmed or corrected based on comparison of original spreadsheet to information provided by the Town on 20210712; see detailed comparison in Table D-1: Comparison of Diameters and Slopes from Different Sources.
(5) Based on information provided by the Town on 20210712, sewer along Franklin St between MH117 and MH118 appears to first be a ~38 m long 600 mm single sewer, followed by a ~52 m long section of twin 450 mm sewers; equivalent diameter to twin 450 mm retained, as it is more conservative.
(6) Sewer section added to spreadsheet to match Town's GIS data.

Level of Service Limits		
Maximum Velocity	3	m/s
Actual Flow/Full Flow Capacity	100%	

Flow Generation — Residential; Existing (2021) ICI Conditions

Street/Location	Maintenance Hole From	Maintenance Hole To	Existing (2021) Residential Conditions: Number of Units: Residential Units	Commercial Units	Institutional Units	Total Units	Existing Population	Cumulative Existing Population	Existing Residential Sewage Flow (L/s)	Additional (2041) Residential Development: Additional Population	Cumulative Additional Population	Additional Residential Sewage Flow (L/s)	2041 Residential Contributions: Total Cumulative Residential Population	Total Residential Sewage Flow (L/s)	Harmon Peaking Factor	Peak Residential Sewage Flow (L/s)	Existing (2021) ICI Conditions: Existing ICI Sewage (L/s)	Cumulative Existing ICI Sewage (L/s)
Lake Avenue West	001	02A	62		1	63	158	158	0.71	2,027	2,027	6.57	2,185	7.28	3.04	22.18	0.00	0.00
Lake Avenue West[6]	02A	002					0	158	0.71	0	2,027	6.57	2,185	7.28	3.04	22.18	0.00	0.00
Lake Avenue West	002	003	459			459	1,148	1,305	5.92	0	2,027	6.57	3,332	12.49	2.92	36.50	0.00	0.00
Lake Avenue West	003	004	9			9	23	1,328	6.02	0	2,027	6.57	3,355	12.59	2.92	36.78	0.00	0.00
Lake Avenue West	004	005	11			11	28	1,355	6.15	0	2,027	6.57	3,382	12.72	2.92	37.11	0.00	0.00
Lake Avenue West	005	006	37		1	38	95	1,450	6.58	0	2,027	6.57	3,477	13.15	2.91	38.26	0.00	0.00
Lake Avenue West	006	007	21			21	53	1,503	6.82	0	2,027	6.57	3,530	13.39	2.91	38.89	0.00	0.00
Lake Avenue West	007	008	325			325	813	2,315	10.50	268	2,295	7.44	4,610	17.94	2.82	50.63	0.00	0.00
Lake Avenue West	008	009	34			34	85	2,400	10.89	0	2,295	7.44	4,695	18.33	2.82	51.61	0.00	0.00
Lake Avenue West	009	010	86			86	215	2,615	11.86	0	2,295	7.44	4,910	19.30	2.80	54.08	0.00	0.00
Lake Avenue West	010	011	54	1		55	138	2,753	12.49	22	2,317	7.51	5,070	20.00	2.79	55.82	0.00	0.00
Lake Avenue West	011	012	18			18	45	2,798	12.69	0	2,317	7.51	5,115	20.20	2.79	56.33	0.00	0.00
Lake Avenue West	012	013	70	4		74	185	2,983	13.53	4	2,321	7.52	5,304	21.05	2.78	58.46	0.00	0.00
Lake Avenue West	013	014	7	1		8	20	3,003	13.62	48	2,369	7.68	5,372	21.30	2.77	59.06	0.00	0.00
Lake Avenue West	014	15B	15	2		17	43	3,045	13.82	24	2,393	7.76	5,438	21.57	2.77	59.72	0.00	0.00
Lake Avenue West[6]	15B	15A					0	3,045	13.82	0	2,393	7.76	5,438	21.57	2.77	59.72	0.00	0.00
Lake Avenue West	15A	015	1	1		2	5	3,050	13.84	0	2,393	7.76	5,443	21.59	2.77	59.78	0.00	0.00
Lake Avenue West	015	016	15			15	38	3,088	14.01	0	2,393	7.76	5,481	21.76	2.77	60.20	0.00	0.00
Lake Avenue West	016	017	12	2		14	35	3,123	14.17	0	2,393	7.76	5,516	21.92	2.76	60.60	0.00	0.00
Lake Avenue West	017	018	60			60	150	3,273	14.85	0	2,393	7.76	5,666	22.60	2.76	62.28	0.00	0.00
Lake Avenue West	018	019	3			3	8	3,280	14.88	0	2,393	7.76	5,673	22.64	2.75	62.36	0.00	0.00
Lake Avenue West	019	020	23			23	58	3,338	15.14	31	2,424	7.86	5,762	23.00	2.75	63.24	0.00	0.00
Lake Avenue West	020	021	4			4	10	3,348	15.19	0	2,424	7.86	5,772	23.04	2.75	63.35	0.00	0.00
Lake Avenue West	021	022	140		1	141	353	3,700	16.79	404	2,828	9.16	6,528	25.95	2.71	70.29	0.00	0.00
Lorne Street	022	023	8			8	20	3,720	16.88	0	2,828	9.16	6,548	26.04	2.71	70.51	0.00	0.00
Lorne Street	023	024	12			12	30	3,750	17.01	0	2,828	9.16	6,578	26.18	2.71	70.84	0.00	0.00
Ball Park	024	120	77	1		78	195	3,945	17.90	0	2,828	9.16	6,773	27.06	2.70	72.97	0.00	0.00
High Street[3]	101	102A	535	4	1	540	1,350	1,350	6.13	1,168	1,168	3.79	2,518	9.91	3.00	29.78	0.00	0.00
High Street[3]	102A	102	0			0	0	1,350	6.13	0	1,168	3.79	2,518	9.91	3.00	29.78	0.00	0.00
High Street[3]	102	103	129			129	323	1,673	7.59	0	1,168	3.79	2,841	11.37	2.97	33.78	0.00	0.00
High Street[3]	103	104	99			99	248	1,920	8.71	0	1,168	3.79	3,088	12.50	2.95	36.81	0.00	0.00
High Street[3]	104	105	125	2		127	318	2,238	10.15	0	1,168	3.79	3,406	13.94	2.92	40.64	0.00	0.00
High Street[3]	105	106	16			16	40	2,278	10.33	0	1,168	3.79	3,446	14.12	2.91	41.12	0.00	0.00
High Street[3]	106	107	5			5	13	2,290	10.39	130	1,298	4.21	3,588	14.60	2.90	42.33	0.00	0.00
High Street[3]	107	108	8			8	20	2,310	10.48	0	1,298	4.21	3,608	14.69	2.90	42.57	0.00	0.00
Bridge Street	108	109	415		1	416	1,040	3,350	15.20	139	1,437	4.66	4,787	19.86	2.81	55.79	0.00	0.00
Bridge Street	109	110	6	4		10	25	3,375	15.31	0	1,437	4.66	4,812	19.97	2.81	56.08	0.00	0.00
Bridge Street	110	111	2			2	5	3,380	15.34	0	1,437	4.66	4,817	19.99	2.81	56.14	0.00	0.00
Bridge Street	111	112	0			0	0	3,380	15.34	0	1,437	4.66	4,817	19.99	2.81	56.14	0.00	0.00
Mill Street	112	113	158	22	2	182	455	3,835	17.40	15	1,452	4.71	5,287	22.11	2.78	61.41	0.00	0.00
Beckwith Street	113	114	12			12	30	3,865	17.54	0	1,452	4.71	5,317	22.24	2.78	61.74	0.00	0.00
Franklin Street	114	115	10	5		15	38	3,903	17.71	0	1,452	4.71	5,355	22.41	2.77	62.17	0.00	0.00
Franklin Street	115	115A	42	7		49	123	4,025	18.26	24	1,476	4.78	5,501	23.04	2.77	63.72	0.00	0.00
Franklin Street	115A	116	2			2	5	4,030	18.28	0	1,476	4.78	5,506	23.07	2.76	63.78	0.00	0.00
Franklin Street	116	117	0			0	0	4,030	18.28	0	1,476	4.78	5,506	23.07	2.76	63.78	0.00	0.00
Franklin Street[5]	117	118	5	3		8	20	4,050	18.38	0	1,476	4.78	5,526	23.16	2.76	64.00	0.00	0.00
To WWTP	118	119	0			0	0	4,050	18.38	0	1,476	4.78	5,526	23.16	2.76	64.00	0.00	0.00
To WWTP	119	119A	0			0	0	4,050	18.38	0	1,476	4.78	5,526	23.16	2.76	64.00	0.00	0.00
To WWTP[6]	119A	119B					0	4,050	18.38	0	1,476	4.78	5,526	23.16	2.76	64.00	0.00	0.00
To WWTP	119B	120	0			0	0	4,050	18.38	0	1,476	4.78	5,526	23.16	2.76	64.00	0.00	0.00
To WWTP	120	121	0			0	0	7,995	36.27	0	4,304	13.95	12,299	50.22	2.49	125.15	0.00	0.00
To WWTP	121	122	610	12	1	623	1,558	9,553	43.34	270	4,574	14.82	14,127	58.16	2.44	142.13	0.00	0.00
To WWTP	122	123	0			0	0	9,553	43.34	0	4,574	14.82	14,127	58.16	2.44	142.13	0.00	0.00
To WWTP	123	124	0			0	0	9,553	43.34	0	4,574	14.82	14,127	58.16	2.44	142.13	0.00	0.00
Industrial Avenue[6]	200	201					0	0	0.00	0	0	0.00	0	0.00	3.80	0.00	0.00	0.00
Industrial Avenue	201	202	115	50		165	413	413	1.87	0	0	0.00	413	1.87	3.41	6.39	0.00	0.00
Industrial Avenue	202	203	0			0	0	413	1.87	0	0	0.00	413	1.87	3.41	6.39	0.00	0.00
Mullett Street	203	204	7	4		11	28	440	2.00	0	0	0.00	440	2.00	3.40	6.79	0.00	0.00
Mullett Street	204	205	4			4	10	450	2.04	0	0	0.00	450	2.04	3.40	6.94	0.00	0.00
Mullett Street	205	206	63	1		64	160	610	2.77	271	271	0.88	881	3.65	3.27	11.91	0.00	0.00
Mullett Street	206	207	75			75	188	798	3.62	39	310	1.00	1,108	4.62	3.22	14.87	0.00	0.00
Mullett Street	207	208	0			0	0	798	3.62	0	310	1.00	1,108	4.62	3.22	14.87	0.00	0.00
Mullett Street	208	209	17	5		22	55	853	3.87	121	431	1.40	1,284	5.26	3.18	16.75	0.00	0.00
Mullett Street	209	210	0			0	0	853	3.87	0	431	1.40	1,284	5.26	3.18	16.75	0.00	0.00
Mullett Street	210	211A	91	5		96	240	1,093	4.96	38	469	1.52	1,562	6.48	3.13	20.29	0.00	0.00
Mullett Street[6]	211A	211					0	1,093	4.96	0	469	1.52	1,562	6.48	3.13	20.29	0.00	0.00
Mullett Street	211	212	1			1	3	1,095	4.97	0	469	1.52	1,564	6.49	3.13	20.33	0.00	0.00
To WWTP	212	213	0			0	0	1,095	4.97	0	469	1.52	1,564	6.49	3.13	20.33	0.00	0.00
To WWTP	213	214	0			0	0	1,095	4.97	0	469	1.52	1,564	6.49	3.13	20.33	0.00	0.00
To WWTP	214	215	0			0	0	1,095	4.97	1,405	1,874	6.07	2,969	11.04	2.96	32.65	0.00	0.00
To WWTP	215	216	0			0	0	1,095	4.97	0	1,874	6.07	2,969	11.04	2.96	32.65	0.00	0.00
To WWTP	216	217	2		1	3	8	1,103	5.00	0	1,874	6.07	2,977	11.08	2.96	32.74	0.00	0.00
To WWTP	217	218	0			0	0	1,103	5.00	0	1,874	6.07	2,977	11.08	2.96	32.74	0.00	0.00
To WWTP	218	219	1		1	2	5	1,108	5.02	0	1,874	6.07	2,982	11.10	2.96	32.80	0.00	0.00
To WWTP - Siphon[1]	219	220	0			0	0	1,108	5.02	0	1,874	6.07	2,982	11.10	2.96	32.80	0.00	0.00
To WWTP - Siphon[1]	220	221	0			0	0	1,108	5.02	0	1,874	6.07	2,982	11.10	2.96	32.80	0.00	0.00
To WWTP - Siphon[1]	221	124	0			0	0	1,108	5.02	0	1,874	6.07	2,982	11.10	2.96	32.80	0.00	0.00
To WWTP	124	125	0			0	0	10,660	48.36	0	6,448	20.90	17,108	69.26	2.38	164.60	0.00	0.00
To WWTP	125	126	0			0	0	10,660	48.36	0	6,448	20.90	17,108	69.26	2.38	164.60	0.00	0.00
To WWTP	126	127	0			0	0	10,660	48.36	0	6,448	20.90	17,108	69.26	2.38	164.60	0.00	0.00
To WWTP	127	128	0			0	0	10,660	48.36	0	6,448	20.90	17,108	69.26	2.38	164.60	0.00	0.00
To WWTP	**128**	**WWTP**	0			0	0	13,870	62.93	0	11,694	37.90	25,564	100.83	2.24	**225.52**	0.00	0.00
McNeely Avenue	301	302	0	31		31	78	78	0.35	0	0	0.00	78	0.35	3.62	1.27	0.00	0.00
McNeely Avenue	302	303	3			3	8	85	0.39	0	0	0.00	85	0.39	3.61	1.39	0.00	0.00
McNeely Avenue	303	304	3			3	8	93	0.42	0	0	0.00	93	0.42	3.60	1.51	0.00	0.00
McNeely Avenue	304	305	3			3	8	100	0.45	0	0	0.00	100	0.45	3.59	1.63	0.00	0.00
McNeely Avenue	305	306	3			3	8	108	0.49	0	0	0.00	108	0.49	3.59	1.75	0.00	0.00
McNeely Avenue	306	307	3			3	8	115	0.52	0	0	0.00	115	0.52	3.58	1.87	0.00	0.00
McNeely Avenue	307	308	4			4	10	125	0.57	0	0	0.00	125	0.57	3.57	2.03	0.00	0.00
McNeely Avenue	308	309	4	2		6	15	140	0.64	0	0	0.00	140	0.64	3.56	2.26	0.00	0.00
McNeely Avenue	309	310	6	1		7	18	158	0.71	0	0	0.00	158	0.71	3.55	2.53	0.00	0.00
McNeely Avenue	310	311	6			6	15	173	0.78	466	466	1.51	639	2.29	3.33	7.64	0.00	0.00
McNeely Avenue	311	312	4	1		5	13	185	0.84	0	466	1.51	651	2.35	3.33	7.82	0.00	0.00
McNeely Avenue	312	313	4			4	10	195	0.88	303	769	2.49	964	3.38	3.25	10.97	0.00	0.00
McNeely Avenue	313	314	8	1		9	23	218	0.99	0	769	2.49	987	3.48	3.24	11.28	0.00	0.00
McNeely Avenue	314	315	4			4	10	228	1.03	0	769	2.49	997	3.52	3.24	11.42	0.00	0.00
McNeely Avenue	315	316	8			8	20	248	1.12	0	769	2.49	1,017	3.62	3.24	11.70	0.00	0.00
McNeely Avenue	316	317	53			53	133	380	1.72	51	820	2.66	1,200	4.38	3.20	14.01	0.00	0.00
McNeely Avenue	317	318	36			36	90	470	2.13	0	820	2.66	1,290	4.79	3.18	15.24	0.00	0.00
McNeely Avenue	318	319	20			20	50	520	2.36	0	820	2.66	1,340	5.02	3.17	15.91	0.00	0.00
McNeely Avenue	319	320	5			5	13	533	2.42	0	820	2.66	1,353	5.07	3.17	16.08	0.00	0.00
McNeely Avenue	320	Pump Station	299			299	748	1,280	5.81	0	820	2.66	2,100	8.46	3.06	25.86	0.00	0.00
Patterson Crescent (Forcemain)	Pump Station	321	0			0	0	1,280	5.81	0	820	2.66	2,100	8.46	3.06	25.86	0.00	0.00
Patterson Crescent	321	322	442	2		444	1,110	2,390	10.84	4,236	5,056	16.39	7,446	27.23	2.66	72.55	0.00	0.00
Patterson Crescent	322	323	298	1		299	748	3,138	14.23	190	5,246	17.00	8,384	31.24	2.62	81.97	0.00	0.00
Patterson Crescent	323	324	1			1	3	3,140	14.25	0	5,246	17.00	8,386	31.25	2.62	82.00	0.00	0.00
Patterson Crescent	324	325	26		2	28	70	3,210	14.56	0	5,246	17.00	8,456	31.56	2.62	82.74	0.00	0.00
To WWTP	325	326				0	0	3,210	14.56	0	5,246	17.00	8,456	31.56	2.62	82.74	0.00	0.00
To WWTP	326	327				0	0	3,210	14.56	0	5,246	17.00	8,456	31.56	2.62	82.74	0.00	0.00
To WWTP	327	128				0	0	3,210	14.56	0	5,246	17.00	8,456	31.56	2.62	82.74	0.00	0.00

Flow Generation — ICI; Extraneous Flows; Pipe Conditions (Pipe Capacity Utilization)

Street/Location	From	To	Additional (2041) ICI Development: Additional IC Area (ha)	Additional IC Sewage (L/s)	Additional Ind. Area (ha)	Additional Ind. Sewage (L/s)	Total Additional ICI Area (ha)	Total Additional ICI Sewage (L/s)	Cumulative Additional ICI Area (ha)	Cumulative Additional ICI Sewage (L/s)	2041 ICI Contributions: Peaking Factor	Peak ICI Sewage (L/s)	Existing (2021) Extraneous Flows: Existing Drainage Area (ha)	Cumulative Existing Drainage Area (ha)	Existing Extraneous Flow (L/s)	Additional (2041) Extraneous Flows: Additional Drainage Area (ha)	Cumulative Additional Drainage Area (ha)	Additional Extraneous Flow (L/s)	2041 Extraneous Flow Contributions: Total Cumulative Drainage Area (ha)	Total Extraneous Flow (L/s)	Total Peak Flow (L/s)	Nominal Pipe Diameter (mm)	Actual Pipe Diameter (mm)	Slope (%)	Full Flow Velocity (m/s)	Full Flow Capacity (L/s)	Capacity Used (%)
Lake Avenue West	001	02A	0.41	0.13	0.41	0.17	0.83	0.30	0.83	0.30	1.00	0.30	4.95	4.95	1.63	36.77	36.77	12.13	41.71	13.76	36.24	375	381	0.44%	1.06	121.33	29.9%
Lake Avenue West[6]	02A	002	0.00	0.00	0.00	0.00	0.00	0.00	0.83	0.30	1.00	0.30	0.00	4.95	1.63	0.00	36.77	12.13	41.71	13.76	36.24	375	381	0.42%	1.04	118.54	30.6%
Lake Avenue West	002	003	0.00	0.00	0.00	0.00	0.00	0.00	0.83	0.30	1.00	0.30	35.59	40.54	13.38	0.00	36.77	12.13	77.30	25.51	62.31	375	381	0.48%	1.11	126.72	49.2%
Lake Avenue West	003	004	0.00	0.00	0.00	0.00	0.00	0.00	0.83	0.30	1.00	0.30	1.77	42.31	13.96	0.00	36.77	12.13	79.07	26.09	63.17	375	381	0.45%	1.08	122.70	51.5%
Lake Avenue West	004	005	0.86	0.28	0.86	0.35	1.73	0.63	2.56	0.93	1.00	0.93	0.40	42.71	14.09	0.00	36.77	12.13	79.47	26.23	64.27	375	381	0.46%	1.09	124.06	51.8%
Lake Avenue West	005	006	0.00	0.00	0.00	0.00	0.00	0.00	2.56	0.93	1.00	0.93	4.51	47.22	15.58	0.00	36.77	12.13	83.98	27.71	66.90	375	381	0.42%	1.04	118.54	56.4%
Lake Avenue West	006	007	0.00	0.00	0.00	0.00	0.00	0.00	2.56	0.93	1.00	0.93	1.13	48.35	15.95	0.00	36.77	12.13	85.11	28.09	67.91	375	381	0.39%	1.00	114.23	59.4%
Lake Avenue West	007	008	0.20	0.06	0.20	0.08	0.39	0.14	2.95	1.07	1.00	1.07	33.14	81.49	26.89	4.68	41.45	13.68	122.93	40.57	92.27	375	381	0.57%	1.21	138.09	66.8%
Lake Avenue West	008	009	0.00	0.00	0.00	0.00	0.00	0.00	2.95	1.07	1.00	1.07	1.84	83.33	27.50	0.00	41.45	13.68	124.77	41.17	93.86	375	381	0.85%	1.48	168.64	55.7%
Lake Avenue West	009	010	0.00	0.00	0.00	0.00	0.00	0.00	2.95	1.07	1.00	1.07	5.49	88.82	29.31	0.00	41.45	13.68	130.26	42.99	98.14	375	381	0.62%	1.26	144.02	68.1%
Lake Avenue West	010	011	0.00	0.00	0.00	0.00	0.00	0.00	2.95	1.07	1.00	1.07	3.76	92.58	30.55	0.38	41.83	13.80	134.40	44.35	101.25	375	381	0.48%	1.11	126.72	79.9%
Lake Avenue West	011	012	0.00	0.00	0.00	0.00	0.00	0.00	2.95	1.07	1.00	1.07	1.69	94.27	31.11	0.00	41.83	13.80	136.09	44.91	102.32	375	381	1.82%	2.16	246.76	41.5%
Lake Avenue West	012	013	0.00	0.00	0.00	0.00	0.01	0.00	2.95	1.08	1.00	1.08	17.76	112.03	36.97	0.04	41.87	13.82	153.89	50.78	110.33	525	533	0.25%	1.00	224.33	49.2%
Lake Avenue West	013	014	0.86	0.28	0.86	0.35	1.73	0.63	4.68	1.71	1.00	1.71	0.73	112.76	37.21	0.30	42.17	13.91	154.92	51.12	111.89	600	610	0.12%	0.76	221.90	50.4%
Lake Avenue West	014	15B	0.00	0.00	0.00	0.00	0.00	0.00	4.68	1.71	1.00	1.71	2.10	114.86	37.90	0.45	42.61	14.06	157.47	51.96	113.39	600	610	0.12%	0.76	221.90	51.1%
Lake Avenue West[6]	15B	15A	0.00	0.00	0.00	0.00	0.00	0.00	4.68	1.71	1.00	1.71	0.00	114.86	37.90	0.00	42.61	14.06	157.47	51.96	113.39	600	610	0.12%	0.76	221.90	51.1%
Lake Avenue West	15A	015	0.00	0.00	0.00	0.00	0.00	0.00	4.68	1.71	1.00	1.71	0.19	115.05	37.97	0.00	42.61	14.06	157.66	52.03	113.51	600	610	0.12%	0.76	221.90	51.2%
Lake Avenue West	015	016	0.00	0.00	0.00	0.00	0.00	0.00	4.68	1.71	1.00	1.71	0.95	116.00	38.28	0.00	42.61	14.06	158.61	52.34	114.25	600	610	0.12%	0.76	221.90	51.5%
Lake Avenue West	016	017	0.00	0.00	0.00	0.00	0.00	0.00	4.68	1.71	1.00	1.71	1.67	117.67	38.83	0.00	42.61	14.06	160.28	52.89	115.19	600	610	0.10%	0.69	202.56	56.9%
Lake Avenue West	017	018	0.00	0.00	0.00	0.00	0.00	0.00	4.68	1.71	1.00	1.71	3.63	121.30	40.03	0.00	42.61	14.06	163.91	54.09	118.07	600	610	0.10%	0.69	202.56	58.3%
Lake Avenue West	018	019	0.00	0.00	0.00	0.00	0.00	0.00	4.68	1.71	1.00	1.71	0.21	121.51	40.10	0.00	42.61	14.06	164.12	54.16	118.23	600	610	0.12%	0.76	221.90	53.3%
Lake Avenue West	019	020	0.03	0.01	0.03	0.01	0.06	0.02	4.74	1.73	1.00	1.73	1.57	123.08	40.61	0.56	43.17	14.25	166.25	54.86	119.83	600	610	0.12%	0.76	221.90	54.0%
Lake Avenue West	020	021	0.00	0.00	0.00	0.00	0.00	0.00	4.74	1.73	1.00	1.73	0.28	123.36	40.71	0.00	43.17	14.25	166.53	54.95	120.04	600	610	0.06%	*0.51*	150.22	79.9%
Lake Avenue West	021	022	0.41	0.13	0.41	0.17	0.82	0.30	5.57	2.03	1.00	2.03	12.30	135.66	44.77	7.03	50.20	16.57	185.86	61.33	133.66	600	610	0.12%	0.76	221.90	60.2%
Lorne Street	022	023	0.00	0.00	0.00	0.00	0.00	0.00	5.57	2.03	1.00	2.03	0.84	136.50	45.04	0.00	50.20	16.57	186.70	61.61	134.15	600	610	0.20%	0.98	286.47	46.8%
Lorne Street	023	024	0.00	0.00	0.00	0.00	0.00	0.00	5.57	2.03	1.00	2.03	0.65	137.15	45.26	0.00	50.20	16.57	187.35	61.82	134.70	600	610	0.20%	0.98	286.47	47.0%
Ball Park	024	120	0.00	0.00	0.00	0.00	0.00	0.00	5.57	2.03	1.00	2.03	5.71	142.86	47.14	0.00	50.20	16.57	193.06	63.71	138.71	600	610	0.47%	1.51	439.42	31.6%
High Street[3]	101	102A	1.12	0.36	1.12	0.45	2.24	0.82	2.24	0.82	1.00	0.82	57.19	57.19	18.87	39.73	39.73	13.11	96.92	31.98	62.58	350	356	0.51%	1.09	108.67	57.6%
High Street[3]	102A	102	0.00	0.00	0.00	0.00	0.00	0.00	2.24	0.82	1.00	0.82	0.00	57.19	18.87	0.00	39.73	13.11	96.92	31.98	62.58	350	356	0.15%	*0.59*	58.94	*106.2%*
High Street[3]	102	103	0.00	0.00	0.00	0.00	0.00	0.00	2.24	0.82	1.00	0.82	6.67	63.86	21.07	0.00	39.73	13.11	103.59	34.18	68.78	350	356	0.17%	0.63	62.74	*109.6%*
High Street[3]	103	104	0.00	0.00	0.00	0.00	0.00	0.00	2.24	0.82	1.00	0.82	12.95	76.81	25.35	0.00	39.73	13.11	116.54	38.46	76.08	400	406	0.14%	0.63	81.29	93.6%
High Street[3]	104	105	0.00	0.00	0.00	0.00	0.00	0.00	2.24	0.82	1.00	0.82	1.53	78.34	25.85	0.00	39.73	13.11	118.07	38.96	80.42	400	406	0.14%	0.63	81.29	98.9%
High Street[3]	105	106	0.00	0.00	0.00	0.00	0.00	0.00	2.24	0.82	1.00	0.82	0.47	78.81	26.01	0.00	39.73	13.11	118.54	39.12	81.05	400	406	0.14%	0.63	81.29	99.7%
High Street[3]	106	107	0.13	0.04	0.13	0.05	0.27	0.10	2.51	0.91	1.00	0.91	0.48	79.29	26.16	2.10	41.83	13.80	121.12	39.97	83.21	400	406	0.13%	0.60	78.33	*106.2%*
High Street[3]	107	108	0.00	0.00	0.00	0.00	0.00	0.00	2.51	0.91	1.00	0.91	0.67	79.95	26.38	0.00	41.83	13.80	121.78	40.19	83.67	400	406	0.15%	0.65	84.15	99.4%
Bridge Street	108	109	0.13	0.04	0.13	0.05	0.26	0.09	2.77	1.01	1.00	1.01	35.48	115.44	38.09	2.93	44.76	14.77	160.20	52.86	109.67	450	457	0.35%	1.07	175.96	62.3%
Bridge Street	109	110	0.00	0.00	0.00	0.00	0.00	0.00	2.77	1.01	1.00	1.01	0.18	115.62	38.15	0.00	44.76	14.77	160.38	52.92	110.01	450	457	0.31%	1.01	165.60	66.4%
Bridge Street	110	111	0.00	0.00	0.00	0.00	0.00	0.00	2.77	1.01	1.00	1.01	0.26	115.88	38.24	0.00	44.76	14.77	160.64	53.01	110.16	450	457	0.45%	1.22	199.52	55.2%
Bridge Street	111	112	0.00	0.00	0.00	0.00	0.00	0.00	2.77	1.01	1.00	1.01	0.00	115.88	38.24	0.00	44.76	14.77	160.64	53.01	110.16	450	457	1.44%	2.17	356.92	30.9%
Mill Street	112	113	0.00	0.00	0.00	0.00	0.01	0.00	2.78	1.01	1.00	1.01	16.75	132.63	43.77	0.25	45.01	14.85	177.63	58.62	121.04	600	610	0.30%	1.20	350.85	34.5%
Beckwith Street	113	114	0.00	0.00	0.00	0.00	0.00	0.00	2.78	1.01	1.00	1.01	0.98	133.61	44.09	0.00	45.01	14.85	178.61	58.94	121.70	600	610	0.20%	0.98	286.47	42.5%
Franklin Street	114	115	0.00	0.00	0.00	0.00	0.00	0.00	2.78	1.01	1.00	1.01	1.72	135.33	44.66	0.00	45.01	14.85	180.33	59.51	122.69	600	610	0.23%	1.05	307.20	39.9%
Franklin Street	115	115A	0.00	0.00	0.00	0.00	0.00	0.00	2.78	1.01	1.00	1.01	4.74	140.07	46.22	0.45	45.45	15.00	185.52	61.22	125.95	600	610	0.28%	1.16	338.95	37.2%
Franklin Street	115A	116	0.00	0.00	0.00	0.00	0.00	0.00	2.78	1.01	1.00	1.01	0.54	140.61	46.40	0.00	45.45	15.00	186.06	61.40	126.19	600	610	0.31%	1.22	356.65	35.4%
Franklin Street	116	117	0.00	0.00	0.00	0.00	0.00	0.00	2.78	1.01	1.00	1.01	0.12	140.73	46.44	0.00	45.45	15.00	186.18	61.44	126.23	600	610	0.18%	0.93	271.77	46.4%
Franklin Street[5]	117	118	0.00	0.00	0.00	0.00	0.00	0.00	2.78	1.01	1.00	1.01	0.57	141.30	46.63	0.00	45.45	15.00	186.75	61.63	126.64	584	593	0.26%	1.10	303.91	41.7%
To WWTP	118	119	0.00	0.00	0.00	0.00	0.00	0.00	2.78	1.01	1.00	1.01	0.00	141.30	46.63	0.00	45.45	15.00	186.75	61.63	126.64	600	610	0.26%	1.12	326.62	38.8%
To WWTP	119	119A	0.00	0.00	0.00	0.00	0.00	0.00	2.78	1.01	1.00	1.01	0.00	141.30	46.63	0.00	45.45	15.00	186.75	61.63	126.64	600	610	0.27%	1.14	332.84	38.0%
To WWTP[6]	119A	119B	0.00	0.00	0.00	0.00	0.00	0.00	2.78	1.01	1.00	1.01	0.00	141.30	46.63	0.00	45.45	15.00	186.75	61.63	126.64	600	610	0.27%	1.14	332.84	38.0%
To WWTP	119B	120	0.00	0.00	0.00	0.00	0.00	0.00	2.78	1.01	1.00	1.01	0.00	141.30	46.63	0.00	45.45	15.00	186.75	61.63	126.64	750	762	1.66%	*3.28*	1,496.38	8.5%
To WWTP	120	121	0.00	0.00	0.00	0.00	0.00	0.00	8.34	3.04	1.00	3.04	0.00	284.15	93.77	0.00	95.65	31.56	379.80	125.34	253.53	750	762	0.25%	1.27	580.71	43.7%
To WWTP	121	122	0.28	0.09	0.28	0.11	0.55	0.20	8.89	3.24	1.00	3.24	57.07	341.23	112.60	5.21	100.86	33.28	442.08	145.89	291.25	750	762	0.25%	1.27	580.71	50.2%
To WWTP	122	123	0.00	0.00	0.00	0.00	0.00	0.00	8.89	3.24	1.00	3.24	0.00	341.23	112.60	0.00	100.86	33.28	442.08	145.89	291.25	750	762	0.25%	1.27	580.71	50.2%
To WWTP	123	124	0.00	0.00	0.00	0.00	0.00	0.00	8.89	3.24	1.00	3.24	0.00	341.23	112.60	0.00	100.86	33.28	442.08	145.89	291.25	750	762	3.97%	*5.07*	2,314.10	12.6%
Industrial Avenue[6]	200	201	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	200	203	3.61%	2.00	65.01	0.0%
Industrial Avenue	201	202	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	31.82	31.82	10.50	0.00	0.00	0.00	31.82	10.50	16.89	200	203	0.27%	*0.55*	17.78	95.0%
Industrial Avenue	202	203	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	31.82	10.50	0.00	0.00	0.00	31.82	10.50	16.89	300	305	0.17%	*0.57*	41.59	40.6%
Mullett Street	203	204	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	1.14	32.96	10.88	0.00	0.00	0.00	32.96	10.88	17.67	300	305	0.22%	0.65	47.32	37.3%
Mullett Street	204	205	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.14	33.10	10.92	0.00	0.00	0.00	33.10	10.92	17.86	300	305	0.36%	0.83	60.53	29.5%
Mullett Street	205	206	0.28	0.09	0.28	0.11	0.55	0.20	0.55	0.20	1.00	0.20	4.80	37.90	12.51	5.56	5.56	1.83	43.46	14.34	26.46	300	305	0.77%	1.21	88.52	29.9%
Mullett Street	206	207	0.00	0.00	0.00	0.00	0.00	0.00	0.55	0.20	1.00	0.20	4.84	42.74	14.10	0.73	6.29	2.08	49.03	16.18	31.25	350	356	0.32%	0.87	86.08	36.3%
Mullett Street	207	208	0.00	0.00	0.00	0.00	0.00	0.00	0.55	0.20	1.00	0.20	0.00	42.74	14.10	0.00	6.29	2.08	49.03	16.18	31.25	350	356	0.72%	1.30	129.12	24.2%
Mullett Street	208	209	0.86	0.28	0.86	0.35	1.73	0.63	2.28	0.83	1.00	0.83	2.37	45.11	14.89	0.13	6.42	2.12	51.53	17.00	34.59	375	381	0.30%	0.88	100.18	34.5%
Mullett Street	209	210	0.00	0.00	0.00	0.00	0.00	0.00	2.28	0.83	1.00	0.83	0.00	45.11	14.89	0.00	6.42	2.12	51.53	17.00	34.59	375	381	0.30%	0.88	100.18	34.5%
Mullett Street	210	211A	0.04	0.01	0.04	0.02	0.08	0.03	2.36	0.86	1.00	0.86	10.35	55.46	18.30	0.60	7.02	2.32	62.48	20.62	41.77	375	381	0.24%	0.79	89.61	46.6%
Mullett Street[6]	211A	211	0.00	0.00	0.00	0.00	0.00	0.00	2.36	0.86	1.00	0.86	0.00	55.46	18.30	0.00	7.02	2.32	62.48	20.62	41.77	375	381	0.26%	0.82	93.27	44.8%
Mullett Street	211	212	0.00	0.00	0.00	0.00	0.00	0.00	2.36	0.86	1.00	0.86	0.34	55.80	18.41	0.00	7.02	2.32	62.82	20.73	41.92	375	381	2.49%	2.53	288.63	14.5%
To WWTP	212	213	0.00	0.00	0.00	0.00	0.00	0.00	2.36	0.86	1.00	0.86	0.00	55.80	18.41	0.00	7.02	2.32	62.82	20.73	41.92	400	406	0.16%	0.67	86.90	48.2%
To WWTP	213	214	0.00	0.00	0.00	0.00	0.00	0.00	2.36	0.86	1.00	0.86	0.00	55.80	18.41	0.00	7.02	2.32	62.82	20.73	41.92	400	406	0.18%	0.71	92.18	45.5%
To WWTP	214	215	0.86	0.28	0.86	0.35	1.73	0.63	4.08	1.49	1.00	1.49	0.00	55.80	18.41	5.00	12.02	3.97	67.82	22.38	56.52	400	406	3.25%	*3.02*	391.67	14.4%
To WWTP	215	216	0.00	0.00	0.00	0.00	0.00	0.00	4.08	1.49	1.00	1.49	0.00	55.80	18.41	0.00	12.02	3.97	67.82	22.38	56.52	400	406	0.21%	0.77	99.56	56.8%
To WWTP	216	217	0.00	0.00	0.00	0.00	0.00	0.00	4.08	1.49	1.00	1.49	0.62	56.42	18.62	0.00	12.02	3.97	68.44	22.59	56.81	400	406	0.23%	0.80	104.20	54.5%
To WWTP	217	218	0.00	0.00	0.00	0.00	0.00	0.00	4.08	1.49	1.00	1.49	0.00	56.42	18.62	0.00	12.02	3.97	68.44	22.59	56.81	400	406	0.22%	0.79	101.90	55.8%
To WWTP	218	219	0.00	0.00	0.00	0.00	0.00	0.00	4.08	1.49	1.00	1.49	0.35	56.77	18.73	0.00	12.02	3.97	68.79	22.70	56.99	400	406	0.18%	0.71	92.18	61.8%
To WWTP - Siphon[1]	219	220	0.00	0.00	0.00	0.00	0.00	0.00	4.08	1.49	1.00	1.49	0.00	56.77	18.73	0.00	12.02	3.97	68.79	22.70	56.99	400	406	0.22%	0.79	101.90	55.9%
To WWTP - Siphon[1]	220	221	0.00	0.00	0.00	0.00	0.00	0.00	4.08	1.49	1.00	1.49	0.00	56.77	18.73	0.00	12.02	3.97	68.79	22.70	56.99	400	406	0.84%	1.54	199.12	28.6%
To WWTP - Siphon[1]	221	124	0.00	0.00	0.00	0.00	0.00	0.00	4.08	1.49	1.00	1.49	0.00	56.77	18.73	0.00	12.02	3.97	68.79	22.70	56.99	400	406	0.15%	0.65	84.15	67.7%
To WWTP	124	125	0.00	0.00	0.00	0.00	0.00	0.00	12.98	4.73	1.00	4.73	0.00	398.00	131.34	0.00	112.88	37.25	510.87	168.59	337.92	750	762	0.12%	0.88	402.33	84.0%
To WWTP	125	126	0.00	0.00	0.00	0.00	0.00	0.00	12.98	4.73	1.00	4.73	0.00	398.00	131.34	0.00	112.88	37.25	510.87	168.59	337.92	750	762	0.12%	0.88	402.33	84.0%
To WWTP	126	127	0.00	0.00	0.00	0.00	0.00	0.00	12.98	4.73	1.00	4.73	0.00	398.00	131.34	0.00	112.88	37.25	510.87	168.59	337.92	750	762	0.12%	0.88	402.33	84.0%
To WWTP	127	128	0.00	0.00	0.00	0.00	0.00	0.00	12.98	4.73	1.00	4.73	0.00	398.00	131.34	0.00	112.88	37.25	510.87	168.59	337.92	750	762	0.27%	1.32	603.49	56.0%
To WWTP	**128**	**WWTP**	0.00	0.00	0.00	0.00	0.00	0.00	22.94	8.36	1.00	8.36	0.00	590.87	194.99	0.00	244.15	80.57	835.02	**275.56**	**509.44**	750	762	0.27%	1.32	603.49	84.4%
McNeely Avenue	301	302	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	50.25	50.25	16.58	0.00	0.00	0.00	50.25	16.58	17.85	300	305	0.25%	0.69	50.44	35.4%
McNeely Avenue	302	303	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.92	51.17	16.89	0.00	0.00	0.00	51.17	16.89	18.28	450	457	0.14%	0.68	111.29	16.4%
McNeely Avenue	303	304	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.87	52.04	17.17	0.00	0.00	0.00	52.04	17.17	18.68	450	457	0.10%	*0.57*	94.06	19.9%
McNeely Avenue	304	305	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.85	52.89	17.45	0.00	0.00	0.00	52.89	17.45	19.08	450	457	0.12%	0.63	103.03	18.5%
McNeely Avenue	305	306	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.88	53.77	17.74	0.00	0.00	0.00	53.77	17.74	19.49	450	457	0.05%	*0.41*	66.51	29.3%
McNeely Avenue	306	307	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.89	54.66	18.04	0.00	0.00	0.00	54.66	18.04	19.91	450	457	0.04%	*0.36*	59.49	33.5%
McNeely Avenue	307	308	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	1.08	55.74	18.39	0.00	0.00	0.00	55.74	18.39	20.42	450	457	0.13%	0.65	107.24	19.0%
McNeely Avenue	308	309	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	1.03	56.77	18.73	0.00	0.00	0.00	56.77	18.73	21.00	450	457	0.11%	0.60	98.65	21.3%
McNeely Avenue	309	310	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	1.77	58.54	19.32	0.00	0.00	0.00	58.54	19.32	21.85	450	457	0.08%	*0.51*	84.13	26.0%
McNeely Avenue	310	311	0.47	0.15	0.47	0.19	0.95	0.35	0.95	0.35	1.00	0.35	1.56	60.10	19.83	17.37	17.37	5.73	77.47	25.57	33.55	450	457	0.10%	*0.57*	94.06	35.7%
McNeely Avenue	311	312	0.00	0.00	0.00	0.00	0.00	0.00	0.95	0.35	1.00	0.35	0.98	61.08	20.16	0.00	17.37	5.73	78.45	25.89	34.06	450	457	0.06%	*0.44*	72.86	46.7%
McNeely Avenue	312	313	0.86	0.28	0.86	0.35	1.73	0.63	2.68	0.98	1.00	0.98	0.46	61.54	20.31	2.40	19.77	6.52	81.31	26.83	38.78	450	457	0.13%	0.65	107.24	36.2%
McNeely Avenue	313	314	0.00	0.00	0.00	0.00	0.00	0.00	2.68	0.98	1.00	0.98	2.00	63.54	20.97	0.00	19.77	6.52	83.31	27.49	39.75	450	457	0.12%	0.63	103.03	38.6%
McNeely Avenue	314	315	0.00	0.00	0.00	0.00	0.00	0.00	2.68	0.98	1.00	0.98	0.36	63.90	21.09	0.00	19.77	6.52	83.67	27.61	40.01	300	305	0.41%	0.89	64.60	61.9%
McNeely Avenue	315	316	0.00	0.00	0.00	0.00	0.00	0.00	2.68	0.98	1.00	0.98	0.51	64.41	21.26	0.00	19.77	6.52	84.18	27.78	40.45	300	305	0.41%	0.89	64.60	62.6%
McNeely Avenue	316	317	0.05	0.02	0.05	0.02	0.10	0.04	2.78	1.01	1.00	1.01	3.42	67.83	22.38	0.97	20.74	6.84	88.57	29.23	44.25	300	305	0.21%	0.63	46.23	95.7%
McNeely Avenue	317	318	0.00	0.00	0.00	0.00	0.00	0.00	2.78	1.01	1.00	1.01	2.22	70.05	23.12	0.00	20.74	6.84	90.79	29.96	46.21	300	305	0.23%	0.66	48.38	95.5%
McNeely Avenue	318	319	0.00	0.00	0.00	0.00	0.00	0.00	2.78	1.01	1.00	1.01	0.82	70.87	23.39	0.00	20.74	6.84	91.61	30.23	47.16	300	305	0.27%	0.72	52.42	90.0%
McNeely Avenue	319	320	0.00	0.00	0.00	0.00	0.00	0.00	2.78	1.01	1.00	1.01	0.32	71.19	23.49	0.00	20.74	6.84	91.93	30.34	47.43	300	305	0.50%	0.98	71.33	66.5%
McNeely Avenue	320	Pump Station	0.00	0.00	0.00	0.00	0.00	0.00	2.78	1.01	1.00	1.01	26.50	97.69	32.24	0.00	20.74	6.84	118.43	39.08	65.96	300	305	0.50%	0.98	71.33	92.5%
Patterson Crescent (Forcemain)	Pump Station	321	0.00	0.00	0.00	0.00	0.00	0.00	2.78	1.01	1.00	1.01	0.00	97.69	32.24	0.00	20.74	6.84	118.43	39.08	65.96						
Patterson Crescent	321	322	3.40	1.10	3.40	1.38	6.79	2.48	9.57	3.49	1.00	3.49	75.04	172.74	57.00	106.90	127.64	42.12	300.38	99.12	175.17	500	508	0.20%	0.87	176.17	99.4%
Patterson Crescent	322	323	0.19	0.06	0.19	0.08	0.39	0.14	9.96	3.63	1.00	3.63	14.38	187.11	61.75	3.64	131.28	43.32	318.39	105.07	190.67	500	508	0.20%	0.87	176.17	*108.2%*
Patterson Crescent	323	324	0.00	0.00	0.00	0.00	0.00	0.00	9.96	3.63	1.00	3.63	0.23	187.34	61.82	0.00	131.28	43.32	318.62	105.14	190.77	500	508	0.20%	0.87	176.17	*108.3%*
Patterson Crescent	324	325	0.00	0.00	0.00	0.00	0.00	0.00	9.96	3.63	1.00	3.63	5.53	192.87	63.65	0.00	131.28	43.32	324.15	106.97	193.34	500	508	0.20%	0.87	176.17	*109.7%*
To WWTP	325	326	0.00	0.00	0.00	0.00	0.00	0.00	9.96	3.63	1.00	3.63	0.00	192.87	63.65	0.00	131.28	43.32	324.15	106.97	193.34	500	508	0.20%	0.87	176.17	*109.7%*
To WWTP	326	327	0.00	0.00	0.00	0.00	0.00	0.00	9.96	3.63	1.00	3.63	0.00	192.87	63.65	0.00	131.28	43.32	324.15	106.97	193.34	500	508	0.20%	0.87	176.17	*109.7%*
To WWTP	327	128	0.00	0.00	0.00	0.00	0.00	0.00	9.96	3.63	1.00	3.63	0.00	192.87	63.65	0.00	131.28	43.32	324.15	106.97	193.34	500	508	0.20%	0.87	176.17	*109.7%*

Stantec

163401646 - Town of Carleton Place W/WW Master Plan

Table D-14: Sanitary Sewer Calculation Spreadsheet - 2041 Annual Event

Date: 8/19/2021
Prepared by: CR
Checked by: AL

Legend

- Manual Input/Modification
- Calculated/Extracted Value for Existing + Additional Development
- Existing Conditions - 2021
- Additional Development
- Full Flow Velocity < 0.6 m/s
- Sewer Capacity Used > 100%, Sewer Velocity > 3 m/s
- WWTP Inflow Point

Modelling Parameters - 2041 Annual Event		
Horizon:	2041	
Scenario:	Annual	
Existing Conditions - 2021		
Average Residential Flow Rate - q =	392	l/cap/day
Peak Extraneous Flow Rate - i =	0.30	l/s/ha
Peak Extraneous Flow Rate (Monitor No. 6)(3) - i =	0.40	l/s/ha
Existing Conditions Population Density =	2.5	PPU
Harmon Peaking Factor Correction Factor - K =	0.60	-
Growth Developments - 2041		
Average Residential Flow Rate - q =	200	l/cap/day
Peak Extraneous Flow Rate - i =	0.30	l/s/ha
Peak Extraneous Flow Rate (Monitor No. 6)(3) - i =	0.40	l/s/ha
Harmon Peaking Factor Correction Factor - K =	0.60	-
Insitutional/Commercial Average Flow Rate - q =	17,000	l/ha/day
Institutional/Commercial (IC) Peaking Factor (ICI Cont. > 20%) =	1.00	-
Institutional/Commercial (IC) Peaking Factor (ICI Cont. ≤ 20%) =	1.00	-
Light Industrial Average Flow Rate - q =	10,000	l/ha/day
Light Industrial Peaking Factor (ICI Cont. > 20%) =	1.00	-
Light Industrial Peaking Factor (ICI Cont. ≤ 20%) =	1.00	-
Manning's Coefficient - n =	0.013	

*Note: Values as per **Design Basis Memo** (July 12, 2021)*

Summary - 2041 Annual Event		
2021 Residential Population	13,403	ppl
2021 ICI Equivalent Population	468	ppl
2021 Total Residential + ICI Equivalent Population	13,870	ppl
2041 Additional Residential Population	11,694	ppl
2041 Total Residential Population	25,097	ppl
2041 Total Residential + ICI Equivalent Population	25,564	ppl
2041 Additional Residential Area	221	ha
2041 Additional ICI Area	23	ha
2041 Total Area	835	ha
Average DWF (Residential + ICI)	8,085	m^3/d
Peak DWF (Residential + ICI)	15,298	m^3/d
Peak Extraneous Flow	22,696	m^3/d
Peak Total Flow	37,994	m^3/d
Number of Sewers Surcharged	3	
Average Sewer Capacity Used	47.6%	
Max Sewer Capacity Used	107.2%	
Mississippi Quays PS Peak Inflow	55.5	L/s

Notes

(1) McArthur Island siphon represented by sewer section from MH219 to MH124, as a single 400 mm diameter gravity pipe at 0.84% slope, as per original spreadsheet (JLR, 2021). Based on drawings, siphon consists of two barrels (150 mm and 300 mm); representation of siphon would require adjustments for HGL calculations.
(2) Mississippi Quays PS modelled at the end of McNeely Avenue (from MH320 to Pump Station); no gravity flow calculated through forcemain on Patterson Crescent (from Pump Station to MH321, assumed without restrictions).
(3) Extraneous flows calculated using 0.4 L/s/ha for drainage areas tributary to flow monitor No. 6.
(4) Diameters and slopes confirmed or corrected based on comparison of original spreadsheet to information provided by the Town on 20210712; see detailed comparison in Table D-1: Comparison of Diameters and Slopes from Different Sources.
(5) Based on information provided by the Town on 20210712, sewer along Franklin St between MH117 and MH118 appears to first be a ~38 m long 600 mm single sewer, followed by a ~52 m long section of twin 450 mm sewers; equivalent diameter to twin 450 mm retained, as it is more conservative.
(6) Sewer section added to spreadsheet to match Town's GIS data.

Level of Service Limits		
Maximum Velocity	3	m/s
Actual Flow/Full Flow Capacity	100%	

Flow Generation – Residential

Street/Location	MH From	MH To	Existing (2021) Residential Units	Existing Commercial Units	Existing Institutional Units	Existing Total Units	Existing Population	Cumulative Existing Population	Existing Residential Sewage Flow (L/s)	Additional Population	Cumulative Additional Population	Additional Residential Sewage Flow (L/s)	Total Cumulative Residential Population	Total Residential Sewage Flow (L/s)	Harmon Peaking Factor	Peak Residential Sewage Flow (L/s)
Lake Avenue West	001	02A	62		1	63	158	158	0.71	2,027	2,027	4.69	2,185	5.41	2.53	13.70
Lake Avenue West(6)	02A	002					0	158	0.71	0	2,027	4.69	2,185	5.41	2.53	13.70
Lake Avenue West	002	003	459			459	1,148	1,305	5.92	0	2,027	4.69	3,332	10.61	2.44	25.92
Lake Avenue West	003	004	9			9	23	1,328	6.02	0	2,027	4.69	3,355	10.72	2.44	26.15
Lake Avenue West	004	005	11			11	28	1,355	6.15	0	2,027	4.69	3,382	10.84	2.44	26.43
Lake Avenue West	005	006	37		1	38	95	1,450	6.58	0	2,027	4.69	3,477	11.27	2.43	27.41
Lake Avenue West	006	007	21			21	53	1,503	6.82	0	2,027	4.69	3,530	11.51	2.43	27.95
Lake Avenue West	007	008	325			325	813	2,315	10.50	268	2,295	5.31	4,610	15.82	2.37	37.43
Lake Avenue West	008	009	34			34	85	2,400	10.89	0	2,295	5.31	4,695	16.20	2.36	38.27
Lake Avenue West	009	010	86			86	215	2,615	11.86	0	2,295	5.31	4,910	17.18	2.35	40.39
Lake Avenue West	010	011	54	1		55	138	2,753	12.49	22	2,317	5.36	5,070	17.85	2.34	41.84
Lake Avenue West	011	012	18			18	45	2,798	12.69	0	2,317	5.36	5,115	18.06	2.34	42.28
Lake Avenue West	012	013	70	4		74	185	2,983	13.53	4	2,321	5.37	5,304	18.90	2.33	44.10
Lake Avenue West	013	014	7	1		8	20	3,003	13.62	48	2,369	5.48	5,372	19.11	2.33	44.51
Lake Avenue West	014	15B	15	2		17	43	3,045	13.82	24	2,393	5.54	5,438	19.35	2.33	45.03
Lake Avenue West(6)	15B	15A					0	3,045	13.82	0	2,393	5.54	5,438	19.35	2.33	45.03
Lake Avenue West	15A	015	1	1		2	5	3,050	13.84	0	2,393	5.54	5,443	19.38	2.33	45.06
Lake Avenue West	015	016	15			15	38	3,088	14.01	0	2,393	5.54	5,481	19.55	2.32	45.44
Lake Avenue West	016	017	12	2		14	35	3,123	14.17	0	2,393	5.54	5,516	19.71	2.32	45.78
Lake Avenue West	017	018	60			60	150	3,273	14.85	0	2,393	5.54	5,666	20.39	2.32	47.23
Lake Avenue West	018	019	3			3	8	3,280	14.88	0	2,393	5.54	5,673	20.42	2.32	47.30
Lake Avenue West	019	020	23			23	58	3,338	15.14	31	2,424	5.61	5,762	20.75	2.31	47.99
Lake Avenue West	020	021	4			4	10	3,348	15.19	0	2,424	5.61	5,772	20.80	2.31	48.09
Lake Avenue West	021	022	140		1	141	353	3,700	16.79	404	2,828	6.55	6,528	23.33	2.28	53.23
Lorne Street	022	023	8			8	20	3,720	16.88	0	2,828	6.55	6,548	23.42	2.28	53.42
Lorne Street	023	024	12			12	30	3,750	17.01	0	2,828	6.55	6,578	23.56	2.28	53.71
Ball Park	024	120	77	1		78	195	3,945	17.90	0	2,828	6.55	6,773	24.44	2.27	55.54
High Street(3)	101	102A	535	4	1	540	1,350	1,350	6.13	1,168	1,168	2.70	2,518	8.83	2.50	22.10
High Street(3)	102A	102	0			0	0	1,350	6.13	0	1,168	2.70	2,518	8.83	2.50	22.10
High Street(3)	102	103	129			129	323	1,673	7.59	0	1,168	2.70	2,841	10.29	2.48	25.50
High Street(3)	103	104	99			99	248	1,920	8.71	0	1,168	2.70	3,088	11.41	2.46	28.07
High Street(3)	104	105	125	2		127	318	2,238	10.15	0	1,168	2.70	3,406	12.86	2.44	31.33
High Street(3)	105	106	16			16	40	2,278	10.33	0	1,168	2.70	3,446	13.04	2.43	31.74
High Street(3)	106	107	5			5	13	2,290	10.39	130	1,298	3.00	3,588	13.39	2.43	32.49
High Street(3)	107	108	8			8	20	2,310	10.48	0	1,298	3.00	3,608	13.49	2.42	32.69
Bridge Street	108	109	415		1	416	1,040	3,350	15.20	139	1,437	3.33	4,787	18.53	2.36	43.67
Bridge Street	109	110	6	4		10	25	3,375	15.31	0	1,437	3.33	4,812	18.64	2.36	43.92
Bridge Street	110	111	2			2	5	3,380	15.34	0	1,437	3.33	4,817	18.66	2.36	43.97
Bridge Street	111	112	0			0	0	3,380	15.34	0	1,437	3.33	4,817	18.66	2.36	43.97
Mill Street	112	113	158	22	2	182	455	3,835	17.40	15	1,452	3.36	5,287	20.76	2.33	48.44
Beckwith Street	113	114	12			12	30	3,865	17.54	0	1,452	3.36	5,317	20.90	2.33	48.73
Franklin Street	114	115	10	5		15	38	3,903	17.71	0	1,452	3.36	5,355	21.07	2.33	49.09
Franklin Street	115	115A	42	7		49	123	4,025	18.26	24	1,476	3.42	5,501	21.68	2.32	50.38
Franklin Street	115A	116	2			2	5	4,030	18.28	0	1,476	3.42	5,506	21.70	2.32	50.42
Franklin Street	116	117	0			0	0	4,030	18.28	0	1,476	3.42	5,506	21.70	2.32	50.42
Franklin Street(5)	117	118	5	3		8	20	4,050	18.38	0	1,476	3.42	5,526	21.79	2.32	50.62
To WWTP	118	119	0			0	0	4,050	18.38	0	1,476	3.42	5,526	21.79	2.32	50.62
To WWTP	119	119A	0			0	0	4,050	18.38	0	1,476	3.42	5,526	21.79	2.32	50.62
To WWTP(6)	119A	119B					0	4,050	18.38	0	1,476	3.42	5,526	21.79	2.32	50.62
To WWTP	119B	120	0			0	0	4,050	18.38	0	1,476	3.42	5,526	21.79	2.32	50.62
To WWTP	120	121	0			0	0	7,995	36.27	0	4,304	9.96	12,299	46.24	2.12	97.97
To WWTP	121	122	610	12	1	623	1,558	9,553	43.34	270	4,574	10.59	14,127	53.93	2.08	112.31
To WWTP	122	123	0			0	0	9,553	43.34	0	4,574	10.59	14,127	53.93	2.08	112.31
To WWTP	123	124	0			0	0	9,553	43.34	0	4,574	10.59	14,127	53.93	2.08	112.31
Industrial Avenue(6)	200	201					0	0	0.00	0	0	0.00	0	0.00	3.10	0.00
Industrial Avenue	201	202	115	50		165	413	413	1.87	0	0	0.00	413	1.87	2.81	5.26
Industrial Avenue	202	203	0			0	0	413	1.87	0	0	0.00	413	1.87	2.81	5.26
Mullett Street	203	204	7	4		11	28	440	2.00	0	0	0.00	440	2.00	2.80	5.59
Mullett Street	204	205	4			4	10	450	2.04	0	0	0.00	450	2.04	2.80	5.71
Mullett Street	205	206	63	1		64	160	610	2.77	271	271	0.63	881	3.39	2.70	9.17
Mullett Street	206	207	75			75	188	798	3.62	39	310	0.72	1,108	4.34	2.66	11.54
Mullett Street	207	208	0			0	0	798	3.62	0	310	0.72	1,108	4.34	2.66	11.54
Mullett Street	208	209	17	5		22	55	853	3.87	121	431	1.00	1,284	4.87	2.64	12.83
Mullett Street	209	210	0			0	0	853	3.87	0	431	1.00	1,284	4.87	2.64	12.83
Mullett Street	210	211A	91	5		96	240	1,093	4.96	38	469	1.09	1,562	6.04	2.60	15.71
Mullett Street(6)	211A	211					0	1,093	4.96	0	469	1.09	1,562	6.04	2.60	15.71
Mullett Street	211	212	1			1	3	1,095	4.97	0	469	1.09	1,564	6.05	2.60	15.74
To WWTP	212	213	0			0	0	1,095	4.97	0	469	1.09	1,564	6.05	2.60	15.74
To WWTP	213	214	0			0	0	1,095	4.97	0	469	1.09	1,564	6.05	2.60	15.74
To WWTP	214	215	0			0	0	1,095	4.97	1,405	1,874	4.34	2,969	9.31	2.47	22.96
To WWTP	215	216	0			0	0	1,095	4.97	0	1,874	4.34	2,969	9.31	2.47	22.96
To WWTP	216	217	2		1	3	8	1,103	5.00	0	1,874	4.34	2,977	9.34	2.47	23.04
To WWTP	217	218	0			0	0	1,103	5.00	0	1,874	4.34	2,977	9.34	2.47	23.04
To WWTP	218	219	1		1	2	5	1,108	5.02	0	1,874	4.34	2,982	9.36	2.47	23.10
To WWTP - Siphon (1)	219	220	0			0	0	1,108	5.02	0	1,874	4.34	2,982	9.36	2.47	23.10
To WWTP - Siphon (1)	220	221	0			0	0	1,108	5.02	0	1,874	4.34	2,982	9.36	2.47	23.10
To WWTP - Siphon (1)	221	124	0			0	0	1,108	5.02	0	1,874	4.34	2,982	9.36	2.47	23.10
To WWTP	124	125	0			0	0	10,660	48.36	0	6,448	14.93	17,108	63.29	2.03	128.63
To WWTP	125	126	0			0	0	10,660	48.36	0	6,448	14.93	17,108	63.29	2.03	128.63
To WWTP	126	127	0			0	0	10,660	48.36	0	6,448	14.93	17,108	63.29	2.03	128.63
To WWTP	127	128	0			0	0	10,660	48.36	0	6,448	14.93	17,108	63.29	2.03	128.63
To WWTP	**128**	**WWTP**	0			0	0	13,870	62.93	0	11,694	27.07	25,564	90.00	1.93	173.48
McNeely Avenue	301	302	0	31		31	78	78	0.35	0	0	0.00	78	0.35	2.96	1.04
McNeely Avenue	302	303	3			3	8	85	0.39	0	0	0.00	85	0.39	2.96	1.14
McNeely Avenue	303	304	3			3	8	93	0.42	0	0	0.00	93	0.42	2.95	1.25
McNeely Avenue	304	305	3			3	8	100	0.45	0	0	0.00	100	0.45	2.95	1.34
McNeely Avenue	305	306	3			3	8	108	0.49	0	0	0.00	108	0.49	2.94	1.43
McNeely Avenue	306	307	3			3	8	115	0.52	0	0	0.00	115	0.52	2.94	1.53
McNeely Avenue	307	308	4			4	10	125	0.57	0	0	0.00	125	0.57	2.93	1.66
McNeely Avenue	308	309	4	2		6	15	140	0.64	0	0	0.00	140	0.64	2.92	1.85
McNeely Avenue	309	310	6	1		7	18	158	0.71	0	0	0.00	158	0.71	2.91	2.08
McNeely Avenue	310	311	6			6	15	173	0.78	466	466	1.08	639	1.86	2.75	5.12
McNeely Avenue	311	312	4	1		5	13	185	0.84	0	466	1.08	651	1.92	2.75	5.27
McNeely Avenue	312	313	4			4	10	195	0.88	303	769	1.78	964	2.66	2.69	7.16
McNeely Avenue	313	314	8	1		9	23	218	0.99	0	769	1.78	987	2.77	2.68	7.42
McNeely Avenue	314	315	4			4	10	228	1.03	0	769	1.78	997	2.81	2.68	7.54
McNeely Avenue	315	316	8			8	20	248	1.12	0	769	1.78	1,017	2.90	2.68	7.77
McNeely Avenue	316	317	53			53	133	380	1.72	51	820	1.90	1,200	3.62	2.65	9.59
McNeely Avenue	317	318	36			36	90	470	2.13	0	820	1.90	1,290	4.03	2.64	10.62
McNeely Avenue	318	319	20			20	50	520	2.36	0	820	1.90	1,340	4.26	2.63	11.19
McNeely Avenue	319	320	5			5	13	533	2.42	0	820	1.90	1,353	4.31	2.63	11.33
McNeely Avenue	320	Pump Station	299			299	748	1,280	5.81	0	820	1.90	2,100	7.71	2.54	19.58
Patterson Crescent (Forcemain)	Pump Station	321	0			0	0	1,280	5.81	0	820	1.90	2,100	7.71	2.54	19.58
Patterson Crescent	321	322	442	2		444	1,110	2,390	10.84	4,236	5,056	11.70	7,446	22.55	2.25	50.69
Patterson Crescent	322	323	298	1		299	748	3,138	14.23	190	5,246	12.14	8,384	26.38	2.22	58.51
Patterson Crescent	323	324	1			1	3	3,140	14.25	0	5,246	12.14	8,386	26.39	2.22	58.54
Patterson Crescent	324	325	26		2	28	70	3,210	14.56	0	5,246	12.14	8,456	26.71	2.22	59.18
To WWTP	325	326				0	0	3,210	14.56	0	5,246	12.14	8,456	26.71	2.22	59.18
To WWTP	326	327				0	0	3,210	14.56	0	5,246	12.14	8,456	26.71	2.22	59.18
To WWTP	327	128				0	0	3,210	14.56	0	5,246	12.14	8,456	26.71	2.22	59.18

Flow Generation – ICI

Street/Location	MH From	MH To	Existing ICI Sewage (L/s)	Cumulative Existing ICI Sewage (L/s)	Additional IC Area (ha)	Additional IC Sewage (L/s)	Additional Ind. Area (ha)	Additional Ind. Sewage (L/s)	Total Additional ICI Area (ha)	Total Additional ICI Sewage (L/s)	Cumulative Additional ICI Area (ha)	Cumulative Additional ICI Sewage (L/s)	Peaking Factor	Peak ICI Sewage (L/s)
Lake Avenue West	001	02A	0.00	0.00	0.41	0.08	0.41	0.05	0.83	0.13	0.83	0.13	1.00	0.13
Lake Avenue West(6)	02A	002	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.83	0.13	1.00	0.13
Lake Avenue West	002	003	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.83	0.13	1.00	0.13
Lake Avenue West	003	004	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.83	0.13	1.00	0.13
Lake Avenue West	004	005	0.00	0.00	0.86	0.17	0.86	0.10	1.73	0.27	2.56	0.40	1.00	0.40
Lake Avenue West	005	006	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.56	0.40	1.00	0.40
Lake Avenue West	006	007	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.56	0.40	1.00	0.40
Lake Avenue West	007	008	0.00	0.00	0.20	0.04	0.20	0.02	0.39	0.06	2.95	0.46	1.00	0.46
Lake Avenue West	008	009	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.95	0.46	1.00	0.46
Lake Avenue West	009	010	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.95	0.46	1.00	0.46
Lake Avenue West	010	011	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.95	0.46	1.00	0.46
Lake Avenue West	011	012	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.95	0.46	1.00	0.46
Lake Avenue West	012	013	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	2.95	0.46	1.00	0.46
Lake Avenue West	013	014	0.00	0.00	0.86	0.17	0.86	0.10	1.73	0.27	4.68	0.73	1.00	0.73
Lake Avenue West	014	15B	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.68	0.73	1.00	0.73
Lake Avenue West(6)	15B	15A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.68	0.73	1.00	0.73
Lake Avenue West	15A	015	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.68	0.73	1.00	0.73
Lake Avenue West	015	016	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.68	0.73	1.00	0.73
Lake Avenue West	016	017	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.68	0.73	1.00	0.73
Lake Avenue West	017	018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.68	0.73	1.00	0.73
Lake Avenue West	018	019	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.68	0.73	1.00	0.73
Lake Avenue West	019	020	0.00	0.00	0.03	0.01	0.03	0.00	0.06	0.01	4.74	0.74	1.00	0.74
Lake Avenue West	020	021	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.74	0.74	1.00	0.74
Lake Avenue West	021	022	0.00	0.00	0.41	0.08	0.41	0.05	0.82	0.13	5.57	0.87	1.00	0.87
Lorne Street	022	023	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.57	0.87	1.00	0.87
Lorne Street	023	024	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.57	0.87	1.00	0.87
Ball Park	024	120	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.57	0.87	1.00	0.87
High Street(3)	101	102A	0.00	0.00	1.12	0.22	1.12	0.13	2.24	0.35	2.24	0.35	1.00	0.35
High Street(3)	102A	102	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.24	0.35	1.00	0.35
High Street(3)	102	103	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.24	0.35	1.00	0.35
High Street(3)	103	104	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.24	0.35	1.00	0.35
High Street(3)	104	105	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.24	0.35	1.00	0.35
High Street(3)	105	106	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.24	0.35	1.00	0.35
High Street(3)	106	107	0.00	0.00	0.13	0.03	0.13	0.02	0.27	0.04	2.51	0.39	1.00	0.39
High Street(3)	107	108	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.51	0.39	1.00	0.39
Bridge Street	108	109	0.00	0.00	0.13	0.03	0.13	0.01	0.26	0.04	2.77	0.43	1.00	0.43
Bridge Street	109	110	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.77	0.43	1.00	0.43
Bridge Street	110	111	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.77	0.43	1.00	0.43
Bridge Street	111	112	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.77	0.43	1.00	0.43
Mill Street	112	113	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	2.78	0.43	1.00	0.43
Beckwith Street	113	114	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.78	0.43	1.00	0.43
Franklin Street	114	115	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.78	0.43	1.00	0.43
Franklin Street	115	115A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.78	0.43	1.00	0.43
Franklin Street	115A	116	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.78	0.43	1.00	0.43
Franklin Street	116	117	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.78	0.43	1.00	0.43
Franklin Street(5)	117	118	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.78	0.43	1.00	0.43
To WWTP	118	119	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.78	0.43	1.00	0.43
To WWTP	119	119A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.78	0.43	1.00	0.43
To WWTP(6)	119A	119B	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.78	0.43	1.00	0.43
To WWTP	119B	120	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.78	0.43	1.00	0.43
To WWTP	120	121	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.34	1.30	1.00	1.30
To WWTP	121	122	0.00	0.00	0.28	0.05	0.28	0.03	0.55	0.09	8.89	1.39	1.00	1.39
To WWTP	122	123	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.89	1.39	1.00	1.39
To WWTP	123	124	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.89	1.39	1.00	1.39
Industrial Avenue(6)	200	201	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Industrial Avenue	201	202	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00
Industrial Avenue	202	203	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00
Mullett Street	203	204	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00
Mullett Street	204	205	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00
Mullett Street	205	206	0.00	0.00	0.28	0.06	0.28	0.03	0.55	0.09	0.55	0.09	1.00	0.09
Mullett Street	206	207	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.55	0.09	1.00	0.09
Mullett Street	207	208	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.55	0.09	1.00	0.09
Mullett Street	208	209	0.00	0.00	0.86	0.17	0.86	0.10	1.73	0.27	2.28	0.36	1.00	0.36
Mullett Street	209	210	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.28	0.36	1.00	0.36
Mullett Street	210	211A	0.00	0.00	0.04	0.01	0.04	0.00	0.08	0.01	2.36	0.37	1.00	0.37
Mullett Street(6)	211A	211	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.36	0.37	1.00	0.37
Mullett Street	211	212	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.36	0.37	1.00	0.37
To WWTP	212	213	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.36	0.37	1.00	0.37
To WWTP	213	214	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.36	0.37	1.00	0.37
To WWTP	214	215	0.00	0.00	0.86	0.17	0.86	0.10	1.73	0.27	4.08	0.64	1.00	0.64
To WWTP	215	216	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.08	0.64	1.00	0.64
To WWTP	216	217	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.08	0.64	1.00	0.64
To WWTP	217	218	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.08	0.64	1.00	0.64
To WWTP	218	219	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.08	0.64	1.00	0.64
To WWTP - Siphon (1)	219	220	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.08	0.64	1.00	0.64
To WWTP - Siphon (1)	220	221	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.08	0.64	1.00	0.64
To WWTP - Siphon (1)	221	124	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.08	0.64	1.00	0.64
To WWTP	124	125	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	12.98	2.03	1.00	2.03
To WWTP	125	126	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	12.98	2.03	1.00	2.03
To WWTP	126	127	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	12.98	2.03	1.00	2.03
To WWTP	127	128	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	12.98	2.03	1.00	2.03
To WWTP	**128**	**WWTP**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	22.94	3.58	1.00	3.58
McNeely Avenue	301	302	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00
McNeely Avenue	302	303	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00
McNeely Avenue	303	304	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00
McNeely Avenue	304	305	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00
McNeely Avenue	305	306	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00
McNeely Avenue	306	307	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00
McNeely Avenue	307	308	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00
McNeely Avenue	308	309	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00
McNeely Avenue	309	310	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00
McNeely Avenue	310	311	0.00	0.00	0.47	0.09	0.47	0.06	0.95	0.15	0.95	0.15	1.00	0.15
McNeely Avenue	311	312	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.95	0.15	1.00	0.15
McNeely Avenue	312	313	0.00	0.00	0.86	0.17	0.86	0.10	1.73	0.27	2.68	0.42	1.00	0.42
McNeely Avenue	313	314	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.68	0.42	1.00	0.42
McNeely Avenue	314	315	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.68	0.42	1.00	0.42
McNeely Avenue	315	316	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.68	0.42	1.00	0.42
McNeely Avenue	316	317	0.00	0.00	0.05	0.01	0.05	0.01	0.10	0.02	2.78	0.43	1.00	0.43
McNeely Avenue	317	318	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.78	0.43	1.00	0.43
McNeely Avenue	318	319	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.78	0.43	1.00	0.43
McNeely Avenue	319	320	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.78	0.43	1.00	0.43
McNeely Avenue	320	Pump Station	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.78	0.43	1.00	0.43
Patterson Crescent (Forcemain)	Pump Station	321	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.78	0.43	1.00	0.43
Patterson Crescent	321	322	0.00	0.00	3.40	0.67	3.40	0.39	6.79	1.06	9.57	1.50	1.00	1.50
Patterson Crescent	322	323	0.00	0.00	0.19	0.04	0.19	0.02	0.39	0.06	9.96	1.56	1.00	1.56
Patterson Crescent	323	324	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9.96	1.56	1.00	1.56
Patterson Crescent	324	325	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9.96	1.56	1.00	1.56
To WWTP	325	326	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9.96	1.56	1.00	1.56
To WWTP	326	327	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9.96	1.56	1.00	1.56
To WWTP	327	128	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9.96	1.56	1.00	1.56

Extraneous Flows, Total Peak Flow and Pipe Conditions (Pipe Capacity Utilization)

Street/Location	MH From	MH To	Existing Drainage Area (ha)	Cumulative Existing Drainage Area (ha)	Existing Extraneous Flow (L/s)	Additional Drainage Area (ha)	Cumulative Additional Drainage Area (ha)	Additional Extraneous Flow (L/s)	Total Cumulative Drainage Area (ha)	Total Extraneous Flow (L/s)	Total Peak Flow (L/s)	Nominal Pipe Diameter (mm)	Actual Pipe Diameter (mm)	Slope (%)	Full Flow Velocity (m/s)	Full Flow Capacity (L/s)	Capacity Used (%)
Lake Avenue West	001	02A	4.95	4.95	1.48	36.77	36.77	11.03	41.71	12.51	26.34	375	381	0.44%	1.06	121.33	21.7%
Lake Avenue West(6)	02A	002	0.00	4.95	1.48	0.00	36.77	11.03	41.71	12.51	26.34	375	381	0.42%	1.04	118.54	22.2%
Lake Avenue West	002	003	35.59	40.54	12.16	0.00	36.77	11.03	77.30	23.19	49.24	375	381	0.48%	1.11	126.72	38.9%
Lake Avenue West	003	004	1.77	42.31	12.69	0.00	36.77	11.03	79.07	23.72	50.00	375	381	0.45%	1.08	122.70	40.7%
Lake Avenue West	004	005	0.40	42.71	12.81	0.00	36.77	11.03	79.47	23.84	50.67	375	381	0.46%	1.09	124.06	40.8%
Lake Avenue West	005	006	4.51	47.22	14.16	0.00	36.77	11.03	83.98	25.19	53.01	375	381	0.42%	1.04	118.54	44.7%
Lake Avenue West	006	007	1.13	48.35	14.50	0.00	36.77	11.03	85.11	25.53	53.89	375	381	0.39%	1.00	114.23	47.2%
Lake Avenue West	007	008	33.14	81.49	24.45	4.68	41.45	12.43	122.93	36.88	74.77	375	381	0.57%	1.21	138.09	54.1%
Lake Avenue West	008	009	1.84	83.33	25.00	0.00	41.45	12.43	124.77	37.43	76.16	375	381	0.85%	1.48	168.64	45.2%
Lake Avenue West	009	010	5.49	88.82	26.64	0.00	41.45	12.43	130.26	39.08	79.93	375	381	0.62%	1.26	144.02	55.5%
Lake Avenue West	010	011	3.76	92.58	27.77	0.38	41.83	12.55	134.40	40.32	82.62	375	381	0.48%	1.11	126.72	65.2%
Lake Avenue West	011	012	1.69	94.27	28.28	0.00	41.83	12.55	136.09	40.83	83.57	375	381	1.82%	2.16	246.76	33.9%
Lake Avenue West	012	013	17.76	112.03	33.61	0.04	41.87	12.56	153.89	46.17	90.73	525	533	0.25%	1.00	224.33	40.4%
Lake Avenue West	013	014	0.73	112.76	33.83	0.30	42.17	12.65	154.92	46.48	91.72	600	610	0.12%	0.76	221.90	41.3%
Lake Avenue West	014	15B	2.10	114.86	34.46	0.45	42.61	12.78	157.47	47.24	93.00	600	610	0.12%	0.76	221.90	41.9%
Lake Avenue West(6)	15B	15A	0.00	114.86	34.46	0.00	42.61	12.78	157.47	47.24	93.00	600	610	0.12%	0.76	221.90	41.9%
Lake Avenue West	15A	015	0.19	115.05	34.51	0.00	42.61	12.78	157.66	47.30	93.11	600	610	0.12%	0.76	221.90	42.0%
Lake Avenue West	015	016	0.95	116.00	34.80	0.00	42.61	12.78	158.61	47.58	93.75	600	610	0.12%	0.76	221.90	42.3%
Lake Avenue West	016	017	1.67	117.67	35.30	0.00	42.61	12.78	160.28	48.08	94.59	600	610	0.10%	0.69	202.56	46.7%
Lake Avenue West	017	018	3.63	121.30	36.39	0.00	42.61	12.78	163.91	49.17	97.13	600	610	0.10%	0.69	202.56	48.0%
Lake Avenue West	018	019	0.21	121.51	36.45	0.00	42.61	12.78	164.12	49.23	97.27	600	610	0.12%	0.76	221.90	43.8%
Lake Avenue West	019	020	1.57	123.08	36.92	0.56	43.17	12.95	166.25	49.87	98.61	600	610	0.12%	0.76	221.90	44.4%
Lake Avenue West	020	021	0.28	123.36	37.01	0.00	43.17	12.95	166.53	49.96	98.79	600	610	0.06%	0.51	150.22	65.8%
Lake Avenue West	021	022	12.30	135.66	40.70	7.03	50.20	15.06	185.86	55.76	109.86	600	610	0.12%	0.76	221.90	49.5%
Lorne Street	022	023	0.84	136.50	40.95	0.00	50.20	15.06	186.70	56.01	110.30	600	610	0.20%	0.98	286.47	38.5%
Lorne Street	023	024	0.65	137.15	41.14	0.00	50.20	15.06	187.35	56.20	110.78	600	610	0.20%	0.98	286.47	38.7%
Ball Park	024	120	5.71	142.86	42.86	0.00	50.20	15.06	193.06	57.92	114.33	600	610	0.47%	1.51	439.42	26.0%
High Street(3)	101	102A	57.19	57.19	22.87	39.73	39.73	15.89	96.92	38.77	61.22	350	356	0.51%	1.09	108.67	56.3%
High Street(3)	102A	102	0.00	57.19	22.87	0.00	39.73	15.89	96.92	38.77	61.22	350	356	0.15%	0.59	58.94	103.9%
High Street(3)	102	103	6.67	63.86	25.54	0.00	39.73	15.89	103.59	41.43	67.28	350	356	0.17%	0.63	62.74	107.2%
High Street(3)	103	104	12.95	76.81	30.72	0.00	39.73	15.89	116.54	46.61	75.03	400	406	0.14%	0.63	81.29	92.3%
High Street(3)	104	105	1.53	78.34	31.33	0.00	39.73	15.89	118.07	47.23	78.91	400	406	0.14%	0.63	81.29	97.1%
High Street(3)	105	106	0.47	78.81	31.52	0.00	39.73	15.89	118.54	47.41	79.50	400	406	0.14%	0.63	81.29	97.8%
High Street(3)	106	107	0.48	79.29	31.71	2.10	41.83	16.73	121.12	48.45	81.32	400	406	0.13%	0.60	78.33	103.8%
High Street(3)	107	108	0.67	79.95	31.98	0.00	41.83	16.73	121.78	48.71	81.79	400	406	0.15%	0.65	84.15	97.2%
Bridge Street	108	109	35.48	115.44	42.63	2.93	44.76	17.61	160.20	60.24	104.34	450	457	0.35%	1.07	175.96	59.3%
Bridge Street	109	110	0.18	115.62	42.68	0.00	44.76	17.61	160.38	60.29	104.64	450	457	0.31%	1.01	165.60	63.2%
Bridge Street	110	111	0.26	115.88	42.76	0.00	44.76	17.61	160.64	60.37	104.77	450	457	0.45%	1.22	199.52	52.5%
Bridge Street	111	112	0.00	115.88	42.76	0.00	44.76	17.61	160.64	60.37	104.77	450	457	1.44%	2.17	356.92	29.4%
Mill Street	112	113	16.75	132.63	47.78	0.25	45.01	17.68	177.63	65.47	114.35	600	610	0.30%	1.20	350.85	32.6%
Beckwith Street	113	114	0.98	133.61	48.08	0.00	45.01	17.68	178.61	65.76	114.93	600	610	0.20%	0.98	286.47	40.1%
Franklin Street	114	115	1.72	135.33	48.59	0.00	45.01	17.68	180.33	66.28	115.80	600	610	0.23%	1.05	307.20	37.7%
Franklin Street	115	115A	4.74	140.07	50.01	0.45	45.45	17.82	185.52	67.83	118.64	600	610	0.28%	1.16	338.95	35.0%
Franklin Street	115A	116	0.54	140.61	50.18	0.00	45.45	17.82	186.06	67.99	118.85	600	610	0.31%	1.22	356.65	33.3%
Franklin Street	116	117	0.12	140.73	50.21	0.00	45.45	17.82	186.18	68.03	118.89	600	610	0.18%	0.93	271.77	43.7%
Franklin Street(5)	117	118	0.57	141.30	50.38	0.00	45.45	17.82	186.75	68.20	119.25	584	593	0.26%	1.10	303.91	39.2%
To WWTP	118	119	0.00	141.30	50.38	0.00	45.45	17.82	186.75	68.20	119.25	600	610	0.26%	1.12	326.62	36.5%
To WWTP	119	119A	0.00	141.30	50.38	0.00	45.45	17.82	186.75	68.20	119.25	600	610	0.27%	1.14	332.84	35.8%
To WWTP(6)	119A	119B	0.00	141.30	50.38	0.00	45.45	17.82	186.75	68.20	119.25	600	610	0.27%	1.14	332.84	35.8%
To WWTP	119B	120	0.00	141.30	50.38	0.00	45.45	17.82	186.75	68.20	119.25	750	762	1.66%	3.28	1,496.38	8.0%
To WWTP	120	121	0.00	284.15	93.24	0.00	95.65	32.88	379.80	126.12	225.40	750	762	0.25%	1.27	580.71	38.8%
To WWTP	121	122	57.07	341.23	110.36	5.21	100.86	34.44	442.08	144.80	258.51	750	762	0.25%	1.27	580.71	44.5%
To WWTP	122	123	0.00	341.23	110.36	0.00	100.86	34.44	442.08	144.80	258.51	750	762	0.25%	1.27	580.71	44.5%
To WWTP	123	124	0.00	341.23	110.36	0.00	100.86	34.44	442.08	144.80	258.51	750	762	3.97%	5.07	2,314.10	11.2%
Industrial Avenue(6)	200	201	0.00	0.00	0.00	0.00	0.00	4.18	0.00	4.18	4.18	200	203	3.61%	2.00	65.01	6.4%
Industrial Avenue	201	202	31.82	31.82	9.55	0.00	0.00	0.00	31.82	9.55	14.80	200	203	0.27%	0.55	17.78	83.3%
Industrial Avenue	202	203	0.00	31.82	9.55	0.00	0.00	0.00	31.82	9.55	14.80	300	305	0.17%	0.57	41.59	35.6%
Mullett Street	203	204	1.14	32.96	9.89	0.00	0.00	0.00	32.96	9.89	15.48	300	305	0.22%	0.65	47.32	32.7%
Mullett Street	204	205	0.14	33.10	9.93	0.00	0.00	0.00	33.10	9.93	15.64	300	305	0.36%	0.83	60.53	25.8%
Mullett Street	205	206	4.80	37.90	11.37	5.56	5.56	1.67	43.46	13.04	22.29	300	305	0.77%	1.21	88.52	25.2%
Mullett Street	206	207	4.84	42.74	12.82	0.73	6.29	1.89	49.03	14.71	26.34	350	356	0.32%	0.87	86.08	30.6%
Mullett Street	207	208	0.00	42.74	12.82	0.00	6.29	1.89	49.03	14.71	26.34	350	356	0.72%	1.30	129.12	20.4%
Mullett Street	208	209	2.37	45.11	13.53	0.13	6.42	1.93	51.53	15.46	28.64	375	381	0.30%	0.88	100.18	28.6%
Mullett Street	209	210	0.00	45.11	13.53	0.00	6.42	1.93	51.53	15.46	28.64	375	381	0.30%	0.88	100.18	28.6%
Mullett Street	210	211A	10.35	55.46	16.64	0.60	7.02	2.11	62.48	18.74	34.82	375	381	0.24%	0.79	89.61	38.9%
Mullett Street(6)	211A	211	0.00	55.46	16.64	0.00	7.02	2.11	62.48	18.74	34.82	375	381	0.26%	0.82	93.27	37.3%
Mullett Street	211	212	0.34	55.80	16.74	0.00	7.02	2.11	62.82	18.85	34.95	375	381	2.49%	2.53	288.63	12.1%
To WWTP	212	213	0.00	55.80	16.74	0.00	7.02	2.11	62.82	18.85	34.95	400	406	0.16%	0.67	86.90	40.2%
To WWTP	213	214	0.00	55.80	16.74	0.00	7.02	2.11	62.82	18.85	34.95	400	406	0.18%	0.71	92.18	37.9%
To WWTP	214	215	0.00	55.80	16.74	5.00	12.02	3.61	67.82	20.35	43.95	400	406	3.25%	3.02	391.67	11.2%
To WWTP	215	216	0.00	55.80	16.74	0.00	12.02	3.61	67.82	20.35	43.95	400	406	0.21%	0.77	99.56	44.1%
To WWTP	216	217	0.62	56.42	16.93	0.00	12.02	3.61	68.44	20.53	44.21	400	406	0.23%	0.80	104.20	42.4%
To WWTP	217	218	0.00	56.42	16.93	0.00	12.02	3.61	68.44	20.53	44.21	400	406	0.22%	0.79	101.90	43.4%
To WWTP	218	219	0.35	56.77	17.03	0.00	12.02	3.61	68.79	20.64	44.37	400	406	0.18%	0.71	92.18	48.1%
To WWTP - Siphon (1)	219	220	0.00	56.77	17.03	0.00	12.02	3.61	68.79	20.64	44.37	400	406	0.22%	0.79	101.90	43.5%
To WWTP - Siphon (1)	220	221	0.00	56.77	17.03	0.00	12.02	3.61	68.79	20.64	44.37	400	406	0.84%	1.54	199.12	22.3%
To WWTP - Siphon (1)	221	124	0.00	56.77	17.03	0.00	12.02	3.61	68.79	20.64	44.37	400	406	0.15%	0.65	84.15	52.7%
To WWTP	124	125	0.00	398.00	127.39	0.00	112.88	38.05	510.87	165.44	296.10	750	762	0.12%	0.88	402.33	73.6%
To WWTP	125	126	0.00	398.00	127.39	0.00	112.88	38.05	510.87	165.44	296.10	750	762	0.12%	0.88	402.33	73.6%
To WWTP	126	127	0.00	398.00	127.39	0.00	112.88	38.05	510.87	165.44	296.10	750	762	0.12%	0.88	402.33	73.6%
To WWTP	127	128	0.00	398.00	127.39	0.00	112.88	38.05	510.87	165.44	296.10	750	762	0.27%	1.32	603.49	49.1%
To WWTP	**128**	**WWTP**	0.00	590.87	185.26	0.00	244.15	77.43	835.02	**262.68**	**439.74**	750	762	0.27%	1.32	603.49	72.9%
McNeely Avenue	301	302	50.25	50.25	15.08	0.00	0.00	0.00	50.25	15.08	16.12	300	305	0.25%	0.69	50.44	32.0%
McNeely Avenue	302	303	0.92	51.17	15.35	0.00	0.00	0.00	51.17	15.35	16.49	450	457	0.14%	0.68	111.29	14.8%
McNeely Avenue	303	304	0.87	52.04	15.61	0.00	0.00	0.00	52.04	15.61	16.85	450	457	0.10%	0.57	94.06	17.9%
McNeely Avenue	304	305	0.85	52.89	15.87	0.00	0.00	0.00	52.89	15.87	17.20	450	457	0.12%	0.63	103.03	16.7%
McNeely Avenue	305	306	0.88	53.77	16.13	0.00	0.00	0.00	53.77	16.13	17.57	450	457	0.05%	0.41	66.51	26.4%
McNeely Avenue	306	307	0.89	54.66	16.40	0.00	0.00	0.00	54.66	16.40	17.93	450	457	0.04%	0.36	59.49	30.1%
McNeely Avenue	307	308	1.08	55.74	16.72	0.00	0.00	0.00	55.74	16.72	18.38	450	457	0.13%	0.65	107.24	17.1%
McNeely Avenue	308	309	1.03	56.77	17.03	0.00	0.00	0.00	56.77	17.03	18.89	450	457	0.11%	0.60	98.65	19.1%
McNeely Avenue	309	310	1.77	58.54	17.56	0.00	0.00	0.00	58.54	17.56	19.64	450	457	0.08%	0.51	84.13	23.3%
McNeely Avenue	310	311	1.56	60.10	18.03	17.37	17.37	5.21	77.47	23.24	28.51	450	457	0.10%	0.57	94.06	30.3%
McNeely Avenue	311	312	0.98	61.08	18.32	0.00	17.37	5.21	78.45	23.54	28.95	450	457	0.06%	0.44	72.86	39.7%
McNeely Avenue	312	313	0.46	61.54	18.46	2.40	19.77	5.93	81.31	24.39	31.97	450	457	0.13%	0.65	107.24	29.8%
McNeely Avenue	313	314	2.00	63.54	19.06	0.00	19.77	5.93	83.31	24.99	32.83	450	457	0.12%	0.63	103.03	31.9%
McNeely Avenue	314	315	0.36	63.90	19.17	0.00	19.77	5.93	83.67	25.10	33.06	300	305	0.41%	0.89	64.60	51.2%
McNeely Avenue	315	316	0.51	64.41	19.32	0.00	19.77	5.93	84.18	25.25	33.44	300	305	0.41%	0.89	64.60	51.8%
McNeely Avenue	316	317	3.42	67.83	20.35	0.97	20.74	6.22	88.57	26.57	36.60	300	305	0.21%	0.63	46.23	79.2%
McNeely Avenue	317	318	2.22	70.05	21.02	0.00	20.74	6.22	90.79	27.24	38.29	300	305	0.23%	0.66	48.38	79.2%
McNeely Avenue	318	319	0.82	70.87	21.26	0.00	20.74	6.22	91.61	27.48	39.11	300	305	0.27%	0.72	52.42	74.6%
McNeely Avenue	319	320	0.32	71.19	21.36	0.00	20.74	6.22	91.93	27.58	39.35	300	305	0.50%	0.98	71.33	55.2%
McNeely Avenue	320	Pump Station	26.50	97.69	29.31	0.00	20.74	6.22	118.43	35.53	55.55	300	305	0.50%	0.98	71.33	77.9%
Patterson Crescent (Forcemain)	Pump Station	321	0.00	97.69	29.31	0.00	20.74	6.22	118.43	35.53	55.55						
Patterson Crescent	321	322	75.04	172.74	51.82	106.90	127.64	38.29	300.38	90.11	142.30	500	508	0.20%	0.87	176.17	80.8%
Patterson Crescent	322	323	14.38	187.11	56.13	3.64	131.28	39.38	318.39	95.52	155.59	500	508	0.20%	0.87	176.17	88.3%
Patterson Crescent	323	324	0.23	187.34	56.20	0.00	131.28	39.38	318.62	95.59	155.68	500	508	0.20%	0.87	176.17	88.4%
Patterson Crescent	324	325	5.53	192.87	57.86	0.00	131.28	39.38	324.15	97.25	157.98	500	508	0.20%	0.87	176.17	89.7%
To WWTP	325	326	0.00	192.87	57.86	0.00	131.28	39.38	324.15	97.25	157.98	500	508	0.20%	0.87	176.17	89.7%
To WWTP	326	327	0.00	192.87	57.86	0.00	131.28	39.38	324.15	97.25	157.98	500	508	0.20%	0.87	176.17	89.7%
To WWTP	327	128	0.00	192.87	57.86	0.00	131.28	39.38	324.15	97.25	157.98	500	508	0.20%	0.87	176.17	89.7%

Stantec

163401646 - Town of Carleton Place W/WW Master Plan

Table D-15: Sanitary Sewer Calculation Spreadsheet - 2041 Rare Event

Date: 8/19/2021
Prepared by: CR
Checked by: AL

Legend
Manual Input/Modification
Calculated/Extracted Value for Existing + Additional Development
Existing Conditions - 2021
Additional Development
Full Flow Velocity < 0.6 m/s
Sewer Capacity Used > 100%; Sewer Velocity > 3 m/s
WWTP Inflow Point

Modelling Parameters - 2041 Rare Event		
Horizon:	2041	
Scenario:	Rare	
Existing Conditions - 2021		
Average Residential Flow Rate - q =	392	l/cap/day
Peak Extraneous Flow Rate - i =	0.55	l/s/ha
Peak Extraneous Flow Rate (Monitor No. 6)[3] - i =	3.00	l/s/ha
Existing Conditions Population Density =	2.5	PPU
Harmon Peaking Factor Correction Factor - K =	0.60	-
Growth Developments - 2041		
Average Residential Flow Rate - q =	200	l/cap/day
Peak Extraneous Flow Rate - i =	0.55	l/s/ha
Peak Extraneous Flow Rate (Monitor No. 6)[3] - i =	3.00	l/s/ha
Harmon Peaking Factor Correction Factor - K =	0.60	-
Insitutional/Commercial Average Flow Rate - q =	17,000	l/ha/day
Institutional/Commercial (IC) Peaking Factor (ICI Cont. > 20%) =	1.00	-
Institutional/Commercial (IC) Peaking Factor (ICI Cont. ≤ 20%) =	1.00	-
Light Industrial Average Flow Rate - q =	10,000	l/ha/day
Light Industrial Peaking Factor (ICI Cont. > 20%) =	1.00	-
Light Industrial Peaking Factor (ICI Cont. ≤ 20%) =	1.00	-
Manning's Coefficient - n =	0.013	

Note: Values as per ***Design Basis Memo*** *(July 12, 2021)*

Summary - 2041 Rare Event		
2021 Residential Population	13,403	ppl
2021 ICI Equivalent Population	468	ppl
2021 Total Residential + ICI Equivalent Population	13,870	ppl
2041 Additional Residential Population	11,694	ppl
2041 Total Residential Population	25,097	ppl
2041 Total Residential + ICI Equivalent Population	25,564	ppl
2041 Additional Residential Area	221	ha
2041 Additional ICI Area	23	ha
2041 Total Area	835	ha
Average DWF (Residential + ICI)	8,085	m^3/d
Peak DWF (Residential + ICI)	15,298	m^3/d
Peak Extraneous Flow	65,459	m^3/d
Peak Total Flow	80,757	m^3/d
Number of Sewers Surcharged	43	
Average Sewer Capacity Used	113.6%	
Max Sewer Capacity Used	536.5%	
Mississippi Quays PS Peak Inflow	85.2	L/s

Notes

(1) McArthur Island siphon represented by sewer section from MH219 to MH124, as a single 400 mm diameter gravity pipe at 0.84% slope, as per original spreadsheet (JLR, 2021). Based on drawings, siphon consists of two barrels (150 mm and 300 mm); representation of siphon would require adjustments for HGL calculations.
(2) Mississippi Quays PS modelled at the end of McNeely Avenue (from MH320 to Pump Station); no gravity flow calculated through forcemain on Patterson Crescent (from Pump Station to MH321, assumed without restrictions).
(3) Extraneous flows calculated using 3 L/s/ha for drainage areas tributary to flow monitor No. 6.
(4) Diameters and slopes confirmed or corrected based on comparison of original spreadsheet to information provided by the Town on 20210712; see detailed comparison in Table D-1: Comparison of Diameters and Slopes from Different Sources.
(5) Based on information provided by the Town on 20210712, sewer along Franklin St between MH117 and MH118 appears to first be a ~38 m long 600 mm single sewer, followed by a ~52 m long section of twin 450 mm sewers; equivalent diameter to twin 450 mm retained, as it is more conservative.
(6) Sewer section added to spreadsheet to match Town's GIS data.

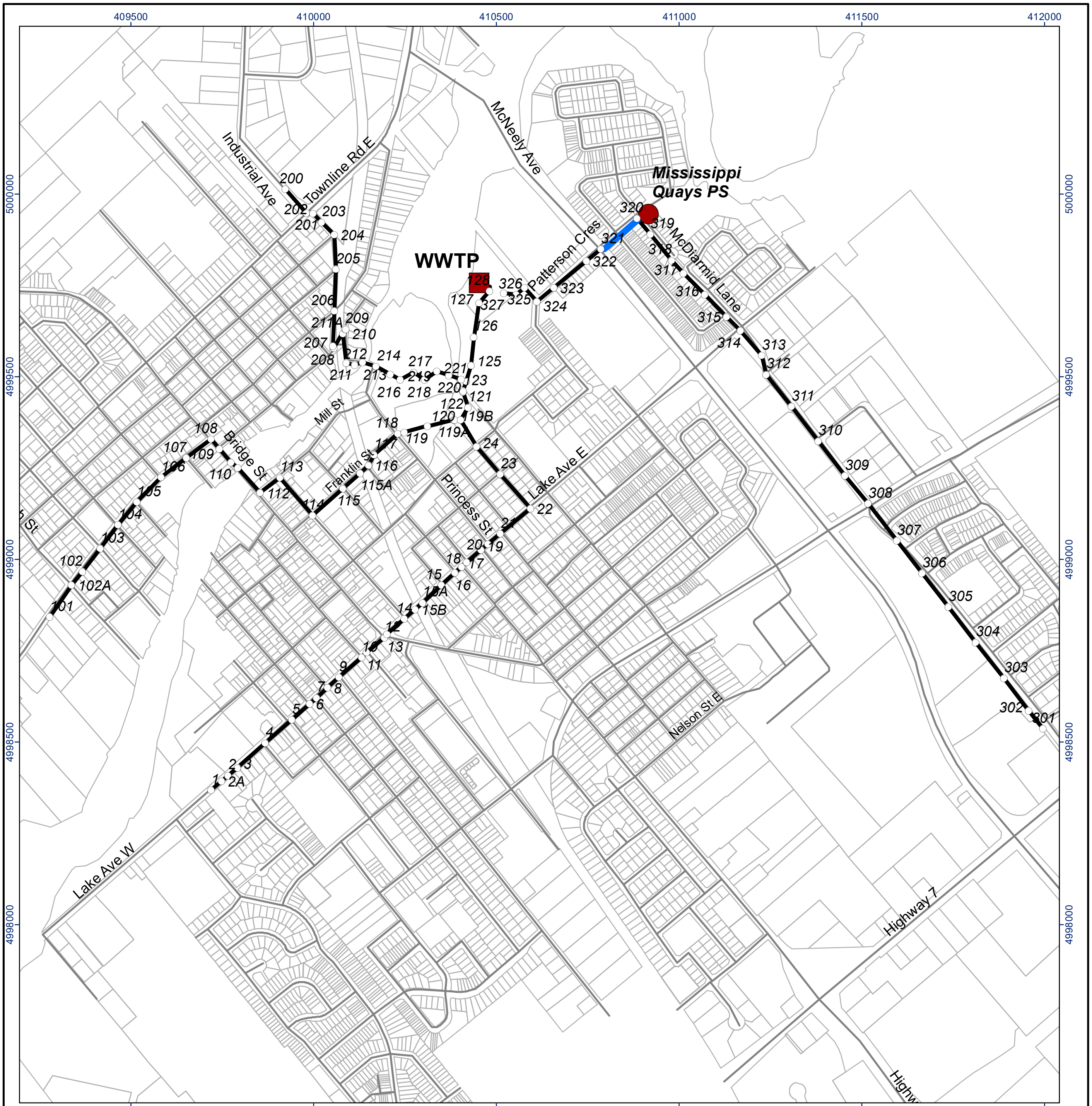
Level of Service Limits		
Maximum Velocity	3	m/s
Actual Flow/Full Flow Capacity	100%	

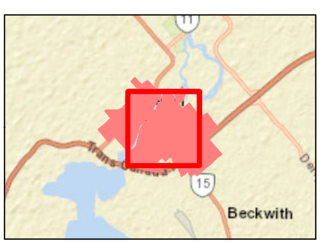
Flow Generation – Residential / Existing (2021) ICI Conditions

Street/Location	Maintenance Hole From	Maintenance Hole To	Existing (2021) Residential Conditions – Number of Units: Residential Units	Commercial Units	Institutional Units	Total Units	Existing Population	Cumulative Existing Population	Existing Residential Sewage Flow (L/s)	Additional (2041) Residential Development: Additional Population	Cumulative Additional Population	Additional Residential Sewage Flow (L/s)	2041 Residential Contributions: Total Cumulative Residential Population	Total Residential Sewage Flow (L/s)	Harmon Peaking Factor	Peak Residential Sewage Flow (L/s)	Existing (2021) ICI Conditions: Existing ICI Sewage (L/s)	Cumulative Existing ICI Sewage (L/s)
Lake Avenue West	001	02A	62		1	63	158	158	0.71	2,027	2,027	4.69	2,185	5.41	2.53	13.70	0.00	0.00
Lake Avenue West[6]	02A	002					0	158	0.71	0	2,027	4.69	2,185	5.41	2.53	13.70	0.00	0.00
Lake Avenue West	002	003	459			459	1,148	1,305	5.92	0	2,027	4.69	3,332	10.61	2.44	25.92	0.00	0.00
Lake Avenue West	003	004	9			9	23	1,328	6.02	0	2,027	4.69	3,355	10.72	2.44	26.15	0.00	0.00
Lake Avenue West	004	005	11			11	28	1,355	6.15	0	2,027	4.69	3,382	10.84	2.44	26.43	0.00	0.00
Lake Avenue West	005	006	37		1	38	95	1,450	6.58	0	2,027	4.69	3,477	11.27	2.43	27.41	0.00	0.00
Lake Avenue West	006	007	21			21	53	1,503	6.82	0	2,027	4.69	3,530	11.51	2.43	27.95	0.00	0.00
Lake Avenue West	007	008	325			325	813	2,315	10.50	268	2,295	5.31	4,610	15.82	2.37	37.43	0.00	0.00
Lake Avenue West	008	009	34			34	85	2,400	10.89	0	2,295	5.31	4,695	16.20	2.36	38.27	0.00	0.00
Lake Avenue West	009	010	86			86	215	2,615	11.86	0	2,295	5.31	4,910	17.18	2.35	40.39	0.00	0.00
Lake Avenue West	010	011	54	1		55	138	2,753	12.49	22	2,317	5.36	5,070	17.85	2.34	41.84	0.00	0.00
Lake Avenue West	011	012	18			18	45	2,798	12.69	0	2,317	5.36	5,115	18.06	2.34	42.28	0.00	0.00
Lake Avenue West	012	013	70	4		74	185	2,983	13.53	4	2,321	5.37	5,304	18.90	2.33	44.10	0.00	0.00
Lake Avenue West	013	014	7	1		8	20	3,003	13.62	48	2,369	5.48	5,372	19.11	2.33	44.51	0.00	0.00
Lake Avenue West	014	15B	15	2		17	43	3,045	13.82	24	2,393	5.54	5,438	19.35	2.33	45.03	0.00	0.00
Lake Avenue West[6]	15B	15A					0	3,045	13.82	0	2,393	5.54	5,438	19.35	2.33	45.03	0.00	0.00
Lake Avenue West	15A	015	1	1		2	5	3,050	13.84	0	2,393	5.54	5,443	19.38	2.33	45.08	0.00	0.00
Lake Avenue West	015	016	15			15	38	3,088	14.01	0	2,393	5.54	5,481	19.55	2.32	45.44	0.00	0.00
Lake Avenue West	016	017	12	2		14	35	3,123	14.17	0	2,393	5.54	5,516	19.71	2.32	45.78	0.00	0.00
Lake Avenue West	017	018	60			60	150	3,273	14.85	0	2,393	5.54	5,666	20.39	2.32	47.23	0.00	0.00
Lake Avenue West	018	019	3			3	8	3,280	14.88	0	2,393	5.54	5,673	20.42	2.32	47.30	0.00	0.00
Lake Avenue West	019	020	23			23	58	3,338	15.14	31	2,424	5.61	5,762	20.75	2.31	47.99	0.00	0.00
Lake Avenue West	020	021	4			4	10	3,348	15.19	0	2,424	5.61	5,772	20.80	2.31	48.09	0.00	0.00
Lake Avenue West	021	022	140		1	141	353	3,700	16.79	404	2,828	6.55	6,528	23.33	2.28	53.23	0.00	0.00
Lorne Street	022	023	8			8	20	3,720	16.88	0	2,828	6.55	6,548	23.42	2.28	53.42	0.00	0.00
Lorne Street	023	024	12			12	30	3,750	17.01	0	2,828	6.55	6,578	23.56	2.28	53.71	0.00	0.00
Ball Park	024	120	77	1		78	195	3,945	17.90	0	2,828	6.55	6,773	24.44	2.27	55.54	0.00	0.00
High Street[3]	101	102A	535	4	1	540	1,350	1,350	6.13	1,168	1,168	2.70	2,518	8.83	2.50	22.10	0.00	0.00
High Street[3]	102A	102	0			0	0	1,350	6.13	0	1,168	2.70	2,518	8.83	2.50	22.10	0.00	0.00
High Street[3]	102	103	129			129	323	1,673	7.59	0	1,168	2.70	2,841	10.29	2.48	25.50	0.00	0.00
High Street[3]	103	104	99			99	248	1,920	8.71	0	1,168	2.70	3,088	11.41	2.46	28.07	0.00	0.00
High Street[3]	104	105	125	2		127	318	2,238	10.15	0	1,168	2.70	3,406	12.86	2.44	31.33	0.00	0.00
High Street[3]	105	106	16			16	40	2,278	10.33	0	1,168	2.70	3,446	13.04	2.43	31.74	0.00	0.00
High Street[3]	106	107	5			5	13	2,290	10.39	130	1,298	3.00	3,588	13.39	2.43	32.48	0.00	0.00
High Street[3]	107	108	8			8	20	2,310	10.48	0	1,298	3.00	3,608	13.49	2.42	32.69	0.00	0.00
Bridge Street	108	109	415		1	416	1,040	3,350	15.20	139	1,437	3.33	4,787	18.53	2.36	43.67	0.00	0.00
Bridge Street	109	110	6	4		10	25	3,375	15.31	0	1,437	3.33	4,812	18.64	2.36	43.92	0.00	0.00
Bridge Street	110	111	2			2	5	3,380	15.34	0	1,437	3.33	4,817	18.66	2.36	43.97	0.00	0.00
Bridge Street	111	112	0			0	0	3,380	15.34	0	1,437	3.33	4,817	18.66	2.36	43.97	0.00	0.00
Mill Street	112	113	158	22	2	182	455	3,835	17.40	15	1,452	3.36	5,287	20.76	2.33	48.44	0.00	0.00
Beckwith Street	113	114	12			12	30	3,865	17.54	0	1,452	3.36	5,317	20.90	2.33	48.73	0.00	0.00
Franklin Street	114	115	10	5		15	38	3,903	17.71	0	1,452	3.36	5,355	21.07	2.33	49.09	0.00	0.00
Franklin Street	115	115A	42	7		49	123	4,025	18.26	24	1,476	3.42	5,501	21.68	2.32	50.38	0.00	0.00
Franklin Street	115A	116	2			2	5	4,030	18.28	0	1,476	3.42	5,506	21.70	2.32	50.42	0.00	0.00
Franklin Street	116	117	0			0	0	4,030	18.28	0	1,476	3.42	5,506	21.70	2.32	50.42	0.00	0.00
Franklin Street[5]	117	118	5	3		8	20	4,050	18.38	0	1,476	3.42	5,526	21.79	2.32	50.62	0.00	0.00
To WWTP	118	119	0			0	0	4,050	18.38	0	1,476	3.42	5,526	21.79	2.32	50.62	0.00	0.00
To WWTP	119	119A	0			0	0	4,050	18.38	0	1,476	3.42	5,526	21.79	2.32	50.62	0.00	0.00
To WWTP[6]	119A	119B					0	4,050	18.38	0	1,476	3.42	5,526	21.79	2.32	50.62	0.00	0.00
To WWTP	119B	120	0			0	0	4,050	18.38	0	1,476	3.42	5,526	21.79	2.32	50.62	0.00	0.00
To WWTP	120	121	0			0	0	7,995	36.27	0	4,304	9.96	12,299	46.24	2.12	97.97	0.00	0.00
To WWTP	121	122	610	12	1	623	1,558	9,553	43.34	270	4,574	10.59	14,127	53.93	2.08	112.31	0.00	0.00
To WWTP	122	123	0			0	0	9,553	43.34	0	4,574	10.59	14,127	53.93	2.08	112.31	0.00	0.00
To WWTP	123	124	0			0	0	9,553	43.34	0	4,574	10.59	14,127	53.93	2.08	112.31	0.00	0.00
Industrial Avenue[6]	200	201					0	0	0.00	0	0	0.00	0	0.00	3.10	0.00	0.00	0.00
Industrial Avenue	201	202	115	50		165	413	413	1.87	0	0	0.00	413	1.87	2.81	5.26	0.00	0.00
Industrial Avenue	202	203	0			0	0	413	1.87	0	0	0.00	413	1.87	2.81	5.26	0.00	0.00
Mullett Street	203	204	7	4		11	28	440	2.00	0	0	0.00	440	2.00	2.80	5.59	0.00	0.00
Mullett Street	204	205	4			4	10	450	2.04	0	0	0.00	450	2.04	2.80	5.71	0.00	0.00
Mullett Street	205	206	63	1		64	160	610	2.77	271	271	0.63	881	3.39	2.70	9.17	0.00	0.00
Mullett Street	206	207	75			75	188	798	3.62	39	310	0.72	1,108	4.34	2.66	11.54	0.00	0.00
Mullett Street	207	208	0			0	0	798	3.62	0	310	0.72	1,108	4.34	2.66	11.54	0.00	0.00
Mullett Street	208	209	17	5		22	55	853	3.87	121	431	1.00	1,284	4.87	2.64	12.83	0.00	0.00
Mullett Street	209	210	0			0	0	853	3.87	0	431	1.00	1,284	4.87	2.64	12.83	0.00	0.00
Mullett Street	210	211A	91	5		96	240	1,093	4.96	38	469	1.09	1,562	6.04	2.60	15.71	0.00	0.00
Mullett Street[6]	211A	211					0	1,093	4.96	0	469	1.09	1,562	6.04	2.60	15.71	0.00	0.00
Mullett Street	211	212	1			1	3	1,095	4.97	0	469	1.09	1,564	6.05	2.60	15.74	0.00	0.00
To WWTP	212	213	0			0	0	1,095	4.97	0	469	1.09	1,564	6.05	2.60	15.74	0.00	0.00
To WWTP	213	214	0			0	0	1,095	4.97	0	469	1.09	1,564	6.05	2.60	15.74	0.00	0.00
To WWTP	214	215	0			0	0	1,095	4.97	1,405	1,874	4.34	2,969	9.31	2.47	22.96	0.00	0.00
To WWTP	215	216	0			0	0	1,095	4.97	0	1,874	4.34	2,969	9.31	2.47	22.96	0.00	0.00
To WWTP	216	217	2		1	3	8	1,103	5.00	0	1,874	4.34	2,977	9.34	2.47	23.04	0.00	0.00
To WWTP	217	218	0			0	0	1,103	5.00	0	1,874	4.34	2,977	9.34	2.47	23.04	0.00	0.00
To WWTP	218	219	1		1	2	5	1,108	5.02	0	1,874	4.34	2,982	9.36	2.47	23.10	0.00	0.00
To WWTP - Siphon [1]	219	220	0			0	0	1,108	5.02	0	1,874	4.34	2,982	9.36	2.47	23.10	0.00	0.00
To WWTP - Siphon [1]	220	221	0			0	0	1,108	5.02	0	1,874	4.34	2,982	9.36	2.47	23.10	0.00	0.00
To WWTP - Siphon [1]	221	124	0			0	0	1,108	5.02	0	1,874	4.34	2,982	9.36	2.47	23.10	0.00	0.00
To WWTP	124	125	0			0	0	10,660	48.36	0	6,448	14.93	17,108	63.29	2.03	128.63	0.00	0.00
To WWTP	125	126	0			0	0	10,660	48.36	0	6,448	14.93	17,108	63.29	2.03	128.63	0.00	0.00
To WWTP	126	127	0			0	0	10,660	48.36	0	6,448	14.93	17,108	63.29	2.03	128.63	0.00	0.00
To WWTP	127	128	0			0	0	10,660	48.36	0	6,448	14.93	17,108	63.29	2.03	128.63	0.00	0.00
To WWTP	**128**	**WWTP**	0			0	0	13,870	62.93	0	11,694	27.07	25,564	90.00	1.93	**173.48**	0.00	0.00
McNeely Avenue	301	302	0	31		31	78	78	0.35	0	0	0.00	78	0.35	2.96	1.04	0.00	0.00
McNeely Avenue	302	303	3			3	8	85	0.39	0	0	0.00	85	0.39	2.96	1.14	0.00	0.00
McNeely Avenue	303	304	3			3	8	93	0.42	0	0	0.00	93	0.42	2.95	1.24	0.00	0.00
McNeely Avenue	304	305	3			3	8	100	0.45	0	0	0.00	100	0.45	2.95	1.34	0.00	0.00
McNeely Avenue	305	306	3			3	8	108	0.49	0	0	0.00	108	0.49	2.94	1.43	0.00	0.00
McNeely Avenue	306	307	3			3	8	115	0.52	0	0	0.00	115	0.52	2.94	1.53	0.00	0.00
McNeely Avenue	307	308	4			4	10	125	0.57	0	0	0.00	125	0.57	2.93	1.66	0.00	0.00
McNeely Avenue	308	309	4	2		6	15	140	0.64	0	0	0.00	140	0.64	2.92	1.85	0.00	0.00
McNeely Avenue	309	310	6	1		7	18	158	0.71	0	0	0.00	158	0.71	2.91	2.08	0.00	0.00
McNeely Avenue	310	311	6			6	15	173	0.78	466	466	1.08	639	1.86	2.75	5.12	0.00	0.00
McNeely Avenue	311	312	4	1		5	13	185	0.84	0	466	1.08	651	1.92	2.75	5.27	0.00	0.00
McNeely Avenue	312	313	4			4	10	195	0.88	303	769	1.78	964	2.66	2.69	7.16	0.00	0.00
McNeely Avenue	313	314	8	1		9	23	218	0.99	0	769	1.78	987	2.77	2.68	7.42	0.00	0.00
McNeely Avenue	314	315	4			4	10	228	1.03	0	769	1.78	997	2.81	2.68	7.54	0.00	0.00
McNeely Avenue	315	316	8			8	20	248	1.12	0	769	1.78	1,017	2.90	2.68	7.77	0.00	0.00
McNeely Avenue	316	317	53			53	133	380	1.72	51	820	1.90	1,200	3.62	2.65	9.59	0.00	0.00
McNeely Avenue	317	318	36			36	90	470	2.13	0	820	1.90	1,290	4.03	2.64	10.62	0.00	0.00
McNeely Avenue	318	319	20			20	50	520	2.36	0	820	1.90	1,340	4.26	2.63	11.19	0.00	0.00
McNeely Avenue	319	320	5			5	13	533	2.42	0	820	1.90	1,353	4.31	2.63	11.33	0.00	0.00
McNeely Avenue	320	Pump Station	299			299	748	1,280	5.81	0	820	1.90	2,100	7.71	2.54	19.58	0.00	0.00
Patterson Crescent (Forcemain)	Pump Station	321	0			0	0	1,280	5.81	0	820	1.90	2,100	7.71	2.54	19.58	0.00	0.00
Patterson Crescent	321	322	442	2		444	1,110	2,390	10.84	4,236	5,056	11.70	7,446	22.55	2.25	50.69	0.00	0.00
Patterson Crescent	322	323	298	1		299	748	3,138	14.23	190	5,246	12.14	8,384	26.38	2.22	58.51	0.00	0.00
Patterson Crescent	323	324	1			1	3	3,140	14.25	0	5,246	12.14	8,386	26.39	2.22	58.54	0.00	0.00
Patterson Crescent	324	325	26		2	28	70	3,210	14.56	0	5,246	12.14	8,456	26.71	2.22	59.18	0.00	0.00
To WWTP	325	326				0	0	3,210	14.56	0	5,246	12.14	8,456	26.71	2.22	59.18	0.00	0.00
To WWTP	326	327				0	0	3,210	14.56	0	5,246	12.14	8,456	26.71	2.22	59.18	0.00	0.00
To WWTP	327	128				0	0	3,210	14.56	0	5,246	12.14	8,456	26.71	2.22	59.18	0.00	0.00

Flow Generation – ICI / Extraneous Flows; Pipe Conditions

Street/Location	From	To	Additional (2041) ICI Development: Additional IC Area (ha)	Additional IC Sewage (L/s)	Additional Ind. Area (ha)	Additional Ind. Sewage (L/s)	Total Additional ICI Area (ha)	Total Additional ICI Sewage (L/s)	Cumulative Additional ICI Area (ha)	Cumulative Additional ICI Sewage (L/s)	2041 ICI Contributions: Peaking Factor	Peak ICI Sewage (L/s)	Existing (2021) Extraneous Flows: Existing Drainage Area (ha)	Cumulative Existing Drainage Area (ha)	Existing Extraneous Flow (L/s)	Additional (2041) Extraneous Flows: Additional Drainage Area (ha)	Cumulative Additional Drainage Area (ha)	Additional Extraneous Flow (L/s)	2041 Extraneous Flow Contributions: Total Cumulative Drainage Area (ha)	Total Extraneous Flow (L/s)	Total Peak Flow (L/s)	Pipe Capacity Utilization: Nominal Pipe Diameter (mm)	Actual Pipe Diameter (mm)	Slope (%)	Full Flow Velocity (m/s)	Full Flow Capacity (L/s)	Capacity Used (%)
Lake Avenue West	001	02A	0.41	0.08	0.41	0.05	0.83	0.13	0.83	0.13	1.00	0.13	4.95	4.95	2.72	36.77	36.77	20.22	41.71	22.94	36.77	375	381	0.44%	1.06	121.33	30.3%
Lake Avenue West[6]	02A	002	0.00	0.00	0.00	0.00	0.00	0.00	0.83	0.13	1.00	0.13	0.00	4.95	2.72	0.00	36.77	20.22	41.71	22.94	36.77	375	381	0.42%	1.04	118.54	31.0%
Lake Avenue West	002	003	0.00	0.00	0.00	0.00	0.00	0.00	0.83	0.13	1.00	0.13	35.59	40.54	22.29	0.00	36.77	20.22	77.30	42.52	68.56	375	381	0.48%	1.11	126.72	54.1%
Lake Avenue West	003	004	0.00	0.00	0.00	0.00	0.00	0.00	0.83	0.13	1.00	0.13	1.77	42.31	23.27	0.00	36.77	20.22	79.07	43.49	69.77	375	381	0.45%	1.08	122.70	56.9%
Lake Avenue West	004	005	0.86	0.17	0.86	0.10	1.73	0.27	2.56	0.40	1.00	0.40	0.40	42.71	23.49	0.00	36.77	20.22	79.47	43.71	70.54	375	381	0.46%	1.09	124.06	56.9%
Lake Avenue West	005	006	0.00	0.00	0.00	0.00	0.00	0.00	2.56	0.40	1.00	0.40	4.51	47.22	25.97	0.00	36.77	20.22	83.98	46.19	74.00	375	381	0.42%	1.04	118.54	62.4%
Lake Avenue West	006	007	0.00	0.00	0.00	0.00	0.00	0.00	2.56	0.40	1.00	0.40	1.13	48.35	26.59	0.00	36.77	20.22	85.11	46.81	75.16	375	381	0.39%	1.00	114.23	65.8%
Lake Avenue West	007	008	0.20	0.04	0.20	0.02	0.39	0.06	2.95	0.46	1.00	0.46	33.14	81.49	44.82	4.68	41.45	22.79	122.93	67.61	105.50	375	381	0.57%	1.21	138.09	76.4%
Lake Avenue West	008	009	0.00	0.00	0.00	0.00	0.00	0.00	2.95	0.46	1.00	0.46	1.84	83.33	45.83	0.00	41.45	22.79	124.77	68.62	107.35	375	381	0.85%	1.48	168.64	63.7%
Lake Avenue West	009	010	0.00	0.00	0.00	0.00	0.00	0.00	2.95	0.46	1.00	0.46	5.49	88.82	48.85	0.00	41.45	22.79	130.26	71.64	112.49	375	381	0.62%	1.26	144.02	78.1%
Lake Avenue West	010	011	0.00	0.00	0.00	0.00	0.00	0.00	2.95	0.46	1.00	0.46	3.76	92.58	50.92	0.38	41.83	23.00	134.40	73.92	116.22	375	381	0.48%	1.11	126.72	91.7%
Lake Avenue West	011	012	0.00	0.00	0.00	0.00	0.00	0.00	2.95	0.46	1.00	0.46	1.69	94.27	51.85	0.00	41.83	23.00	136.09	74.85	117.59	375	381	1.82%	2.16	246.76	47.7%
Lake Avenue West	012	013	0.00	0.00	0.00	0.00	0.01	0.00	2.95	0.46	1.00	0.46	17.76	112.03	61.61	0.04	41.87	23.03	153.89	84.64	129.20	525	533	0.25%	1.00	224.33	57.6%
Lake Avenue West	013	014	0.86	0.17	0.86	0.10	1.73	0.27	4.68	0.73	1.00	0.73	0.73	112.76	62.02	0.30	42.17	23.19	154.92	85.21	130.45	600	610	0.12%	0.76	221.90	58.8%
Lake Avenue West	014	15B	0.00	0.00	0.00	0.00	0.00	0.00	4.68	0.73	1.00	0.73	2.10	114.86	63.17	0.45	42.61	23.44	157.47	86.61	132.37	600	610	0.12%	0.76	221.90	59.7%
Lake Avenue West[6]	15B	15A	0.00	0.00	0.00	0.00	0.00	0.00	4.68	0.73	1.00	0.73	0.00	114.86	63.17	0.00	42.61	23.44	157.47	86.61	132.37	600	610	0.12%	0.76	221.90	59.7%
Lake Avenue West	15A	015	0.00	0.00	0.00	0.00	0.00	0.00	4.68	0.73	1.00	0.73	0.19	115.05	63.28	0.00	42.61	23.44	157.66	86.71	132.52	600	610	0.12%	0.76	221.90	59.7%
Lake Avenue West	015	016	0.00	0.00	0.00	0.00	0.00	0.00	4.68	0.73	1.00	0.73	0.95	116.00	63.80	0.00	42.61	23.44	158.61	87.23	133.41	600	610	0.12%	0.76	221.90	60.1%
Lake Avenue West	016	017	0.00	0.00	0.00	0.00	0.00	0.00	4.68	0.73	1.00	0.73	1.67	117.67	64.72	0.00	42.61	23.44	160.28	88.15	134.66	600	610	0.10%	0.69	202.56	66.5%
Lake Avenue West	017	018	0.00	0.00	0.00	0.00	0.00	0.00	4.68	0.73	1.00	0.73	3.63	121.30	66.71	0.00	42.61	23.44	163.91	90.15	138.11	600	610	0.10%	0.69	202.56	68.2%
Lake Avenue West	018	019	0.00	0.00	0.00	0.00	0.00	0.00	4.68	0.73	1.00	0.73	0.21	121.51	66.83	0.00	42.61	23.44	164.12	90.26	138.29	600	610	0.12%	0.76	221.90	62.3%
Lake Avenue West	019	020	0.03	0.01	0.03	0.00	0.06	0.01	4.74	0.74	1.00	0.74	1.57	123.08	67.69	0.56	43.17	23.74	166.25	91.44	140.17	600	610	0.12%	0.76	221.90	63.2%
Lake Avenue West	020	021	0.00	0.00	0.00	0.00	0.00	0.00	4.74	0.74	1.00	0.74	0.28	123.36	67.85	0.00	43.17	23.74	166.53	91.59	140.42	600	610	0.06%	*0.51*	150.22	93.5%
Lake Avenue West	021	022	0.41	0.08	0.41	0.05	0.82	0.13	5.57	0.87	1.00	0.87	12.30	135.66	74.61	7.03	50.20	27.61	185.86	102.22	156.32	600	610	0.12%	0.76	221.90	70.4%
Lorne Street	022	023	0.00	0.00	0.00	0.00	0.00	0.00	5.57	0.87	1.00	0.87	0.84	136.50	75.07	0.00	50.20	27.61	186.70	102.68	156.98	600	610	0.20%	0.98	286.47	54.8%
Lorne Street	023	024	0.00	0.00	0.00	0.00	0.00	0.00	5.57	0.87	1.00	0.87	0.65	137.15	75.43	0.00	50.20	27.61	187.35	103.04	157.62	600	610	0.20%	0.98	286.47	55.0%
Ball Park	024	120	0.00	0.00	0.00	0.00	0.00	0.00	5.57	0.87	1.00	0.87	5.71	142.86	78.57	0.00	50.20	27.61	193.06	106.18	162.60	600	610	0.47%	1.51	439.42	37.0%
High Street[3]	101	102A	1.12	0.22	1.12	0.13	2.24	0.35	2.24	0.35	1.00	0.35	57.19	57.19	171.56	39.73	39.73	119.19	96.92	290.75	313.20	350	356	0.51%	1.09	108.67	*288.2%*
High Street[3]	102A	102	0.00	0.00	0.00	0.00	0.00	0.00	2.24	0.35	1.00	0.35	0.00	57.19	171.56	0.00	39.73	119.19	96.92	290.75	313.20	350	356	0.15%	*0.59*	58.94	*531.4%*
High Street[3]	102	103	0.00	0.00	0.00	0.00	0.00	0.00	2.24	0.35	1.00	0.35	6.67	63.86	191.57	0.00	39.73	119.19	103.59	310.76	336.60	350	356	0.17%	0.63	62.74	*536.5%*
High Street[3]	103	104	0.00	0.00	0.00	0.00	0.00	0.00	2.24	0.35	1.00	0.35	12.95	76.81	230.42	0.00	39.73	119.19	116.54	349.61	378.02	400	406	0.14%	0.63	81.29	*465.0%*
High Street[3]	104	105	0.00	0.00	0.00	0.00	0.00	0.00	2.24	0.35	1.00	0.35	1.53	78.34	235.01	0.00	39.73	119.19	118.07	354.20	385.87	400	406	0.14%	0.63	81.29	*474.7%*
High Street[3]	105	106	0.00	0.00	0.00	0.00	0.00	0.00	2.24	0.35	1.00	0.35	0.47	78.81	236.42	0.00	39.73	119.19	118.54	355.61	387.69	400	406	0.14%	0.63	81.29	*476.9%*
High Street[3]	106	107	0.13	0.03	0.13	0.02	0.27	0.04	2.51	0.39	1.00	0.39	0.48	79.29	237.86	2.10	41.83	125.49	121.12	363.35	396.22	400	406	0.13%	0.60	78.33	*505.8%*
High Street[3]	107	108	0.00	0.00	0.00	0.00	0.00	0.00	2.51	0.39	1.00	0.39	0.67	79.95	239.86	0.00	41.83	125.49	121.78	365.35	398.42	400	406	0.15%	0.65	84.15	*473.5%*
Bridge Street	108	109	0.13	0.03	0.13	0.01	0.26	0.04	2.77	0.43	1.00	0.43	35.48	115.44	259.37	2.93	44.76	127.10	160.20	386.47	430.58	450	457	0.35%	1.07	175.96	*244.7%*
Bridge Street	109	110	0.00	0.00	0.00	0.00	0.00	0.00	2.77	0.43	1.00	0.43	0.18	115.62	259.47	0.00	44.76	127.10	160.38	386.57	430.92	450	457	0.31%	1.01	165.60	*260.2%*
Bridge Street	110	111	0.00	0.00	0.00	0.00	0.00	0.00	2.77	0.43	1.00	0.43	0.26	115.88	259.61	0.00	44.76	127.10	160.64	386.72	431.11	450	457	0.45%	1.22	199.52	*216.1%*
Bridge Street	111	112	0.00	0.00	0.00	0.00	0.00	0.00	2.77	0.43	1.00	0.43	0.00	115.88	259.61	0.00	44.76	127.10	160.64	386.72	431.11	450	457	1.44%	2.17	356.92	*120.8%*
Mill Street	112	113	0.00	0.00	0.00	0.00	0.01	0.00	2.78	0.43	1.00	0.43	16.75	132.63	268.83	0.25	45.01	127.24	177.63	396.06	444.94	600	610	0.30%	1.20	350.85	*126.8%*
Beckwith Street	113	114	0.00	0.00	0.00	0.00	0.00	0.00	2.78	0.43	1.00	0.43	0.98	133.61	269.37	0.00	45.01	127.24	178.61	396.60	445.77	600	610	0.20%	0.98	286.47	*155.6%*
Franklin Street	114	115	0.00	0.00	0.00	0.00	0.00	0.00	2.78	0.43	1.00	0.43	1.72	135.33	270.31	0.00	45.01	127.24	180.33	397.55	447.08	600	610	0.23%	1.05	307.20	*145.5%*
Franklin Street	115	115A	0.00	0.00	0.00	0.00	0.00	0.00	2.78	0.43	1.00	0.43	4.74	140.07	272.92	0.45	45.45	127.48	185.52	400.40	451.21	600	610	0.28%	1.16	338.95	*133.1%*
Franklin Street	115A	116	0.00	0.00	0.00	0.00	0.00	0.00	2.78	0.43	1.00	0.43	0.54	140.61	273.22	0.00	45.45	127.48	186.06	400.70	451.55	600	610	0.31%	1.22	356.65	*126.6%*
Franklin Street	116	117	0.00	0.00	0.00	0.00	0.00	0.00	2.78	0.43	1.00	0.43	0.12	140.73	273.28	0.00	45.45	127.48	186.18	400.76	451.62	600	610	0.18%	0.93	271.77	*166.2%*
Franklin Street[5]	117	118	0.00	0.00	0.00	0.00	0.00	0.00	2.78	0.43	1.00	0.43	0.57	141.30	273.60	0.00	45.45	127.48	186.75	401.08	452.13	584	593	0.26%	1.10	303.91	*148.8%*
To WWTP	118	119	0.00	0.00	0.00	0.00	0.00	0.00	2.78	0.43	1.00	0.43	0.00	141.30	273.60	0.00	45.45	127.48	186.75	401.08	452.13	600	610	0.26%	1.12	326.62	*138.4%*
To WWTP	119	119A	0.00	0.00	0.00	0.00	0.00	0.00	2.78	0.43	1.00	0.43	0.00	141.30	273.60	0.00	45.45	127.48	186.75	401.08	452.13	600	610	0.27%	1.14	332.84	*135.8%*
To WWTP[6]	119A	119B	0.00	0.00	0.00	0.00	0.00	0.00	2.78	0.43	1.00	0.43	0.00	141.30	273.60	0.00	45.45	127.48	186.75	401.08	452.13	600	610	0.27%	1.14	332.84	*135.8%*
To WWTP	119B	120	0.00	0.00	0.00	0.00	0.00	0.00	2.78	0.43	1.00	0.43	0.00	141.30	273.60	0.00	45.45	127.48	186.75	401.08	452.13	750	762	1.66%	*3.28*	1,496.38	30.2%
To WWTP	120	121	0.00	0.00	0.00	0.00	0.00	0.00	8.34	1.30	1.00	1.30	0.00	284.15	352.17	0.00	95.65	155.09	379.80	507.26	606.53	750	762	0.25%	1.27	580.71	*104.4%*
To WWTP	121	122	0.28	0.05	0.28	0.03	0.55	0.09	8.89	1.39	1.00	1.39	57.07	341.23	383.56	5.21	100.86	157.95	442.08	541.51	655.21	750	762	0.25%	1.27	580.71	*112.8%*
To WWTP	122	123	0.00	0.00	0.00	0.00	0.00	0.00	8.89	1.39	1.00	1.39	0.00	341.23	383.56	0.00	100.86	157.95	442.08	541.51	655.21	750	762	0.25%	1.27	580.71	*112.8%*
To WWTP	123	124	0.00	0.00	0.00	0.00	0.00	0.00	8.89	1.39	1.00	1.39	0.00	341.23	383.56	0.00	100.86	157.95	442.08	541.51	655.21	750	762	3.97%	*5.07*	2,314.10	28.3%
Industrial Avenue[6]	200	201	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	102.48	0.00	102.48	102.48	200	203	3.61%	2.00	65.01	*157.6%*
Industrial Avenue	201	202	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	31.82	31.82	17.50	0.00	0.00	0.00	31.82	17.50	22.76	200	203	0.27%	*0.55*	17.78	*128.0%*
Industrial Avenue	202	203	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	31.82	17.50	0.00	0.00	0.00	31.82	17.50	22.76	300	305	0.17%	*0.57*	41.59	54.7%
Mullett Street	203	204	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	1.14	32.96	18.13	0.00	0.00	0.00	32.96	18.13	23.72	300	305	0.22%	0.65	47.32	50.1%
Mullett Street	204	205	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.14	33.10	18.21	0.00	0.00	0.00	33.10	18.21	23.92	300	305	0.36%	0.83	60.53	39.5%
Mullett Street	205	206	0.28	0.05	0.28	0.03	0.55	0.09	0.55	0.09	1.00	0.09	4.80	37.90	20.85	5.56	5.56	3.06	43.46	23.90	33.16	300	305	0.77%	1.21	88.52	37.5%
Mullett Street	206	207	0.00	0.00	0.00	0.00	0.00	0.00	0.55	0.09	1.00	0.09	4.84	42.74	23.51	0.73	6.29	3.46	49.03	26.97	38.60	350	356	0.32%	0.87	86.08	44.8%
Mullett Street	207	208	0.00	0.00	0.00	0.00	0.00	0.00	0.55	0.09	1.00	0.09	0.00	42.74	23.51	0.00	6.29	3.46	49.03	26.97	38.60	350	356	0.72%	1.30	129.12	29.9%
Mullett Street	208	209	0.86	0.17	0.86	0.10	1.73	0.27	2.28	0.36	1.00	0.36	2.37	45.11	24.81	0.13	6.42	3.53	51.53	28.34	41.53	375	381	0.30%	0.88	100.18	41.4%
Mullett Street	209	210	0.00	0.00	0.00	0.00	0.00	0.00	2.28	0.36	1.00	0.36	0.00	45.11	24.81	0.00	6.42	3.53	51.53	28.34	41.53	375	381	0.30%	0.88	100.18	41.4%
Mullett Street	210	211A	0.04	0.01	0.04	0.00	0.08	0.01	2.36	0.37	1.00	0.37	10.35	55.46	30.50	0.60	7.02	3.86	62.48	34.36	50.44	375	381	0.24%	0.79	89.61	56.3%
Mullett Street[6]	211A	211	0.00	0.00	0.00	0.00	0.00	0.00	2.36	0.37	1.00	0.37	0.00	55.46	30.50	0.00	7.02	3.86	62.48	34.36	50.44	375	381	0.26%	0.82	93.27	54.1%
Mullett Street	211	212	0.00	0.00	0.00	0.00	0.00	0.00	2.36	0.37	1.00	0.37	0.34	55.80	30.69	0.00	7.02	3.86	62.82	34.55	50.66	375	381	2.49%	2.53	288.63	17.6%
To WWTP	212	213	0.00	0.00	0.00	0.00	0.00	0.00	2.36	0.37	1.00	0.37	0.00	55.80	30.69	0.00	7.02	3.86	62.82	34.55	50.66	400	406	0.16%	0.67	86.90	58.3%
To WWTP	213	214	0.00	0.00	0.00	0.00	0.00	0.00	2.36	0.37	1.00	0.37	0.00	55.80	30.69	0.00	7.02	3.86	62.82	34.55	50.66	400	406	0.18%	0.71	92.18	55.0%
To WWTP	214	215	0.86	0.17	0.86	0.10	1.73	0.27	4.08	0.64	1.00	0.64	0.00	55.80	30.69	5.00	12.02	6.61	67.82	37.30	60.90	400	406	3.25%	*3.02*	391.67	15.5%
To WWTP	215	216	0.00	0.00	0.00	0.00	0.00	0.00	4.08	0.64	1.00	0.64	0.00	55.80	30.69	0.00	12.02	6.61	67.82	37.30	60.90	400	406	0.21%	0.77	99.56	61.2%
To WWTP	216	217	0.00	0.00	0.00	0.00	0.00	0.00	4.08	0.64	1.00	0.64	0.62	56.42	31.03	0.00	12.02	6.61	68.44	37.64	61.32	400	406	0.23%	0.80	104.20	58.9%
To WWTP	217	218	0.00	0.00	0.00	0.00	0.00	0.00	4.08	0.64	1.00	0.64	0.00	56.42	31.03	0.00	12.02	6.61	68.44	37.64	61.32	400	406	0.22%	0.79	101.90	60.2%
To WWTP	218	219	0.00	0.00	0.00	0.00	0.00	0.00	4.08	0.64	1.00	0.64	0.35	56.77	31.22	0.00	12.02	6.61	68.79	37.83	61.57	400	406	0.18%	0.71	92.18	66.8%
To WWTP - Siphon [1]	219	220	0.00	0.00	0.00	0.00	0.00	0.00	4.08	0.64	1.00	0.64	0.00	56.77	31.22	0.00	12.02	6.61	68.79	37.83	61.57	400	406	0.22%	0.79	101.90	60.4%
To WWTP - Siphon [1]	220	221	0.00	0.00	0.00	0.00	0.00	0.00	4.08	0.64	1.00	0.64	0.00	56.77	31.22	0.00	12.02	6.61	68.79	37.83	61.57	400	406	0.84%	1.54	199.12	30.9%
To WWTP - Siphon [1]	221	124	0.00	0.00	0.00	0.00	0.00	0.00	4.08	0.64	1.00	0.64	0.00	56.77	31.22	0.00	12.02	6.61	68.79	37.83	61.57	400	406	0.15%	0.65	84.15	73.2%
To WWTP	124	125	0.00	0.00	0.00	0.00	0.00	0.00	12.98	2.03	1.00	2.03	0.00	398.00	414.78	0.00	112.88	164.56	510.87	579.34	710.01	750	762	0.12%	0.88	402.33	*176.5%*
To WWTP	125	126	0.00	0.00	0.00	0.00	0.00	0.00	12.98	2.03	1.00	2.03	0.00	398.00	414.78	0.00	112.88	164.56	510.87	579.34	710.01	750	762	0.12%	0.88	402.33	*176.5%*
To WWTP	126	127	0.00	0.00	0.00	0.00	0.00	0.00	12.98	2.03	1.00	2.03	0.00	398.00	414.78	0.00	112.88	164.56	510.87	579.34	710.01	750	762	0.12%	0.88	402.33	*176.5%*
To WWTP	127	128	0.00	0.00	0.00	0.00	0.00	0.00	12.98	2.03	1.00	2.03	0.00	398.00	414.78	0.00	112.88	164.56	510.87	579.34	710.01	750	762	0.27%	1.32	603.49	*117.7%*
To WWTP	**128**	**WWTP**	0.00	0.00	0.00	0.00	0.00	0.00	22.94	3.58	1.00	3.58	0.00	590.87	520.86	0.00	244.15	236.77	835.02	**757.63**	**934.69**	750	762	0.27%	1.32	603.49	*154.9%*
McNeely Avenue	301	302	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	50.25	50.25	27.64	0.00	0.00	0.00	50.25	27.64	28.68	300	305	0.25%	0.69	50.44	56.9%
McNeely Avenue	302	303	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.92	51.17	28.14	0.00	0.00	0.00	51.17	28.14	29.28	450	457	0.14%	0.68	111.29	26.3%
McNeely Avenue	303	304	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.87	52.04	28.62	0.00	0.00	0.00	52.04	28.62	29.86	450	457	0.10%	*0.57*	94.06	31.7%
McNeely Avenue	304	305	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.85	52.89	29.09	0.00	0.00	0.00	52.89	29.09	30.43	450	457	0.12%	0.63	103.03	29.5%
McNeely Avenue	305	306	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.88	53.77	29.57	0.00	0.00	0.00	53.77	29.57	31.01	450	457	0.05%	*0.41*	66.51	46.6%
McNeely Avenue	306	307	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.89	54.66	30.06	0.00	0.00	0.00	54.66	30.06	31.59	450	457	0.04%	*0.36*	59.49	53.1%
McNeely Avenue	307	308	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	1.08	55.74	30.66	0.00	0.00	0.00	55.74	30.66	32.32	450	457	0.13%	0.65	107.24	30.1%
McNeely Avenue	308	309	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	1.03	56.77	31.22	0.00	0.00	0.00	56.77	31.22	33.08	450	457	0.11%	0.60	98.65	33.5%
McNeely Avenue	309	310	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	1.77	58.54	32.20	0.00	0.00	0.00	58.54	32.20	34.28	450	457	0.08%	*0.51*	84.13	40.7%
McNeely Avenue	310	311	0.47	0.09	0.47	0.05	0.95	0.15	0.95	0.15	1.00	0.15	1.56	60.10	33.06	17.37	17.37	9.55	77.47	42.61	47.88	450	457	0.10%	*0.57*	94.06	50.9%
McNeely Avenue	311	312	0.00	0.00	0.00	0.00	0.00	0.00	0.95	0.15	1.00	0.15	0.98	61.08	33.59	0.00	17.37	9.55	78.45	43.15	48.57	450	457	0.06%	*0.44*	72.86	66.7%
McNeely Avenue	312	313	0.86	0.17	0.86	0.10	1.73	0.27	2.68	0.42	1.00	0.42	0.46	61.54	33.85	2.40	19.77	10.87	81.31	44.72	52.30	450	457	0.13%	0.65	107.24	48.8%
McNeely Avenue	313	314	0.00	0.00	0.00	0.00	0.00	0.00	2.68	0.42	1.00	0.42	2.00	63.54	34.95	0.00	19.77	10.87	83.31	45.82	53.66	450	457	0.12%	0.63	103.03	52.1%
McNeely Avenue	314	315	0.00	0.00	0.00	0.00	0.00	0.00	2.68	0.42	1.00	0.42	0.36	63.90	35.15	0.00	19.77	10.87	83.67	46.02	53.98	300	305	0.41%	0.89	64.60	83.6%
McNeely Avenue	315	316	0.00	0.00	0.00	0.00	0.00	0.00	2.68	0.42	1.00	0.42	0.51	64.41	35.43	0.00	19.77	10.87	84.18	46.30	54.49	300	305	0.41%	0.89	64.60	84.4%
McNeely Avenue	316	317	0.05	0.01	0.05	0.01	0.10	0.02	2.78	0.43	1.00	0.43	3.42	67.83	37.31	0.97	20.74	11.41	88.57	48.71	58.74	300	305	0.21%	0.63	46.23	*127.1%*
McNeely Avenue	317	318	0.00	0.00	0.00	0.00	0.00	0.00	2.78	0.43	1.00	0.43	2.22	70.05	38.53	0.00	20.74	11.41	90.79	49.93	60.99	300	305	0.23%	0.66	48.38	*126.1%*
McNeely Avenue	318	319	0.00	0.00	0.00	0.00	0.00	0.00	2.78	0.43	1.00	0.43	0.82	70.87	38.98	0.00	20.74	11.41	91.61	50.39	62.01	300	305	0.27%	0.72	52.42	*118.3%*
McNeely Avenue	319	320	0.00	0.00	0.00	0.00	0.00	0.00	2.78	0.43	1.00	0.43	0.32	71.19	39.15	0.00	20.74	11.41	91.93	50.56	62.33	300	305	0.50%	0.98	71.33	87.4%
McNeely Avenue	320	Pump Station	0.00	0.00	0.00	0.00	0.00	0.00	2.78	0.43	1.00	0.43	26.50	97.69	53.73	0.00	20.74	11.41	118.43	65.14	85.16	300	305	0.50%	0.98	71.33	*119.4%*
Patterson Crescent (Forcemain)	Pump Station	321	0.00	0.00	0.00	0.00	0.00	0.00	2.78	0.43	1.00	0.43	0.00	97.69	53.73	0.00	20.74	11.41	118.43	65.14	85.16						
Patterson Crescent	321	322	3.40	0.67	3.40	0.39	6.79	1.06	9.57	1.50	1.00	1.50	75.04	172.74	95.01	106.90	127.64	70.20	300.38	165.21	217.40	500	508	0.20%	0.87	176.17	*123.4%*
Patterson Crescent	322	323	0.19	0.04	0.19	0.02	0.39	0.06	9.96	1.56	1.00	1.56	14.38	187.11	102.91	3.64	131.28	72.20	318.39	175.11	235.18	500	508	0.20%	0.87	176.17	*133.5%*
Patterson Crescent	323	324	0.00	0.00	0.00	0.00	0.00	0.00	9.96	1.56	1.00	1.56	0.23	187.34	103.04	0.00	131.28	72.20	318.62	175.24	235.33	500	508	0.20%	0.87	176.17	*133.6%*
Patterson Crescent	324	325	0.00	0.00	0.00	0.00	0.00	0.00	9.96	1.56	1.00	1.56	5.53	192.87	106.08	0.00	131.28	72.20	324.15	178.28	239.02	500	508	0.20%	0.87	176.17	*135.7%*
To WWTP	325	326	0.00	0.00	0.00	0.00	0.00	0.00	9.96	1.56	1.00	1.56	0.00	192.87	106.08	0.00	131.28	72.20	324.15	178.28	239.02	500	508	0.20%	0.87	176.17	*135.7%*
To WWTP	326	327	0.00	0.00	0.00	0.00	0.00	0.00	9.96	1.56	1.00	1.56	0.00	192.87	106.08	0.00	131.28	72.20	324.15	178.28	239.02	500	508	0.20%	0.87	176.17	*135.7%*
To WWTP	327	128	0.00	0.00	0.00	0.00	0.00	0.00	9.96	1.56	1.00	1.56	0.00	192.87	106.08	0.00	131.28	72.20	324.15	178.28	239.02	500	508	0.20%	0.87	176.17	*135.7%*





Legend

Sewer Capacity Utilization (q/Q)

- Forcemain
- q/Q ≤ 75%
- 75% < q/Q ≤ 100%
- 100% < q/Q ≤ 200%
- q/Q > 200%
- Maintenance Hole
- Wastewater Treatment Plant (WWTP)
- Pumping Station (PS)

0 200 400 metres

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Stantec

Carleton PLACE

Project Location

Carleton Place, ON

Client/Project Carleton Place W&WW Master Plan

Town of Carleton Place
Carleton Place W&WW Master Plan
Phase 1 Report

Figure No.

D-1

Title

Sanitary Sewer Capacity Utilization
2021 Design Event

Notes

1. Coordinate System: NAD 1983 UTM Zone 18N
2. Data Sources: *sanisewer.shp* provided by the Town of Carleton Place
3. Background: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

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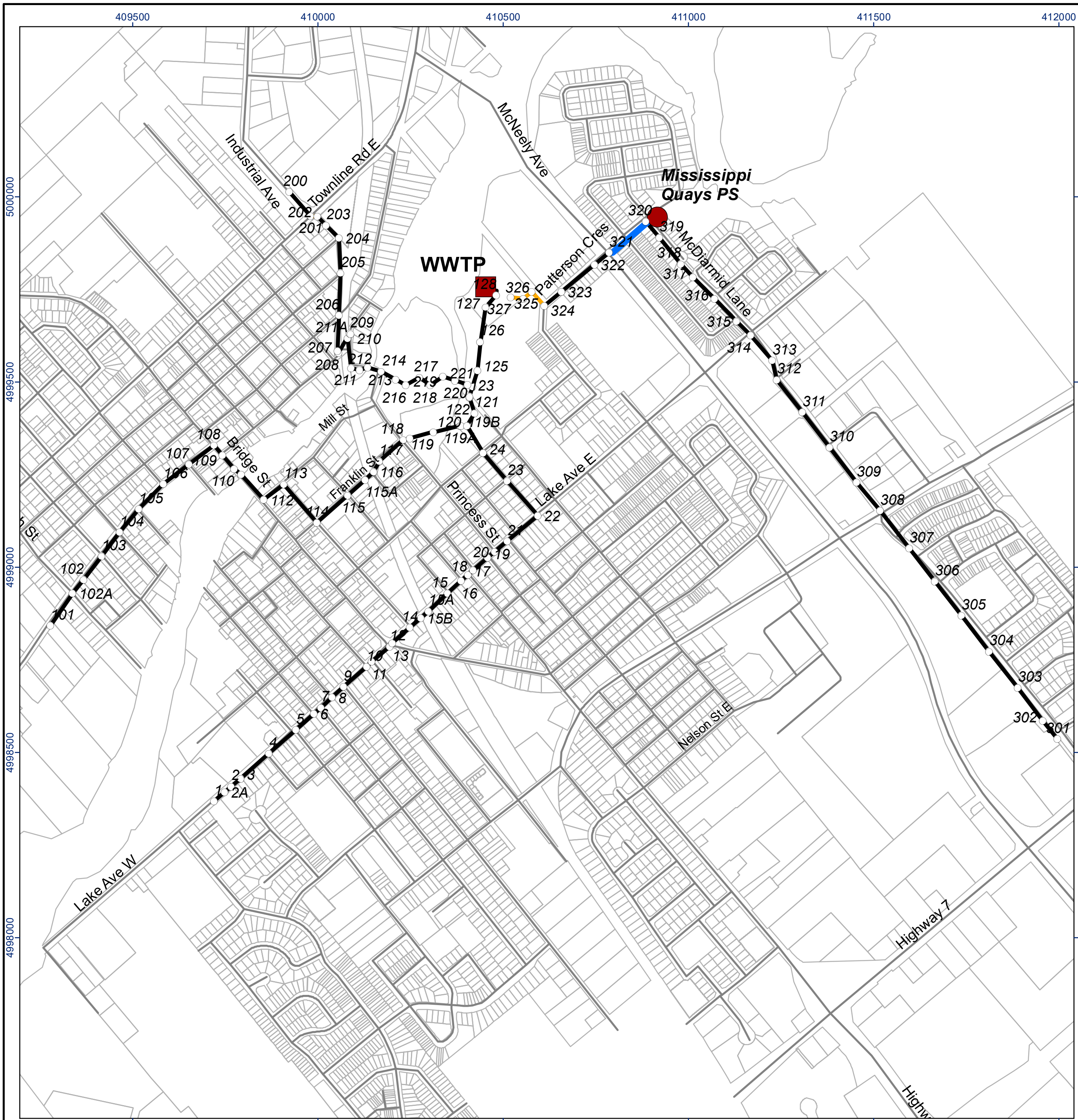

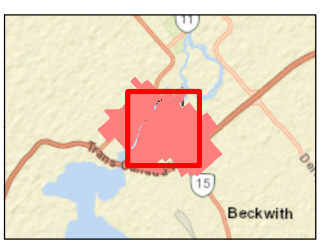

Legend

Sewer Capacity Utilization (q/Q)

- Forcemain
- q/Q ≤ 75%
- 75% < q/Q ≤ 100%
- 100% < q/Q ≤ 200%
- q/Q > 200%
- Maintenance Hole
- Wastewater Treatment Plant (WWTP)
- Pumping Station (PS)

0 200 400 metres

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Carleton PLACE

Notes

1. Coordinate System: NAD 1983 UTM Zone 18N
2. Data Sources: *sanisewer.shp* provided by the Town of Carleton Place
3. Background: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

Project Location

Carleton Place, ON

Client/Project Carleton Place W&WW Master Plan

Town of Carleton Place
Carleton Place W&WW Master Plan
Phase 1 Report

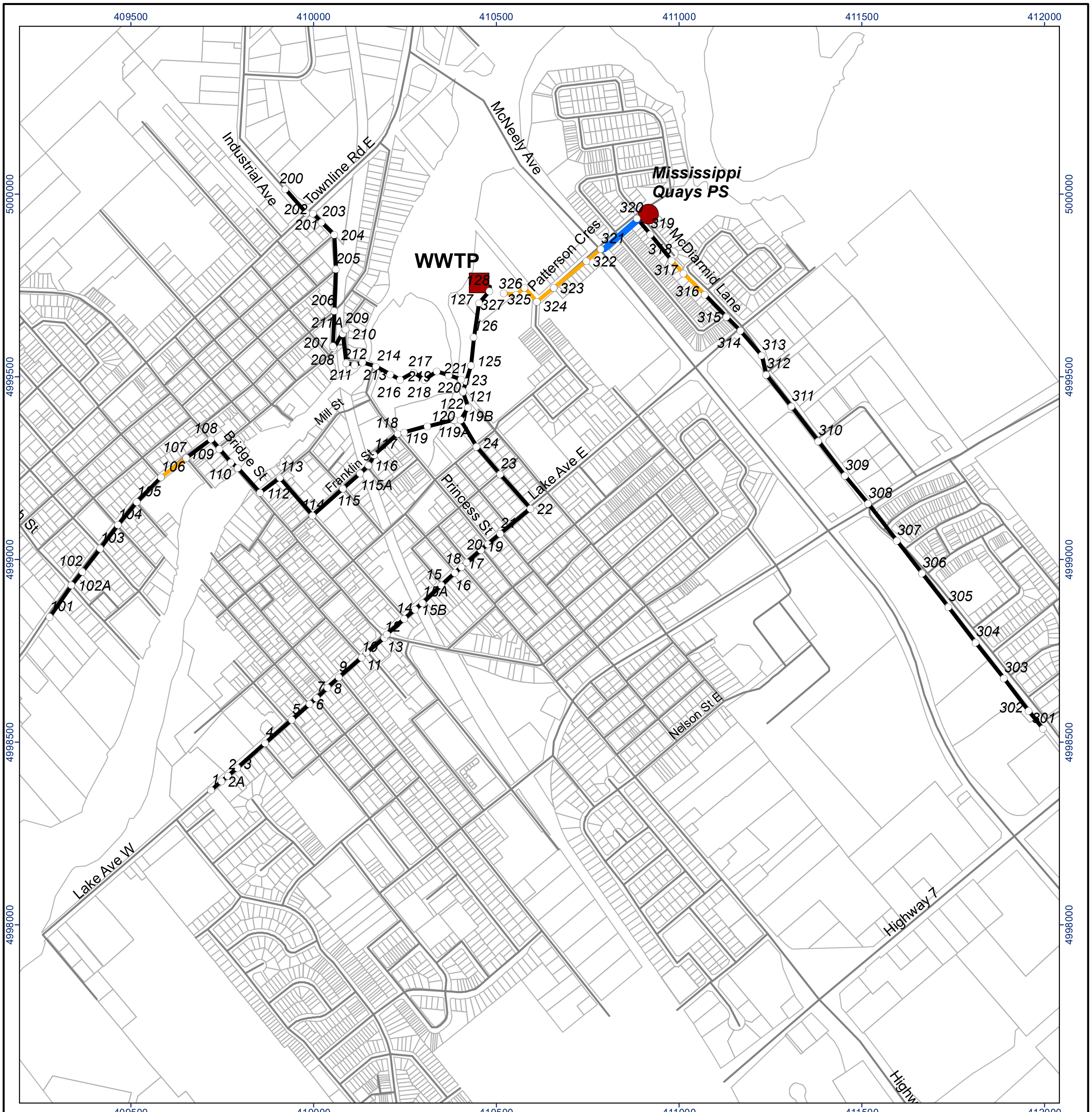
Figure No.

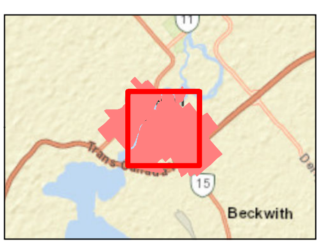
D-2

Title

Sanitary Sewer Capacity Utilization
2026 Design Event

Disclaimer: This document has been prepared based on information provided by others as cited in the Notes section. Stantec has not verified the accuracy and/or completeness of this information and shall not be responsible for any errors or omissions which may be incorporated herein as a result. Stantec assumes no responsibility for data supplied in electronic format, and the recipient accepts full responsibility for verifying the accuracy and completeness of the data.





Legend

Sewer Capacity Utilization (q/Q)

- Forcemain
- q/Q ≤ 75%
- 75% < q/Q ≤ 100%
- 100% < q/Q ≤ 200%
- q/Q > 200%
- Maintenance Hole
- Wastewater Treatment Plant (WWTP)
- Pumping Station (PS)

Notes

1. Coordinate System: NAD 1983 UTM Zone 18N
2. Data Sources: *sanisewer.shp* provided by the Town of Carleton Place
3. Background: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

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Stantec

Carleton PLACE

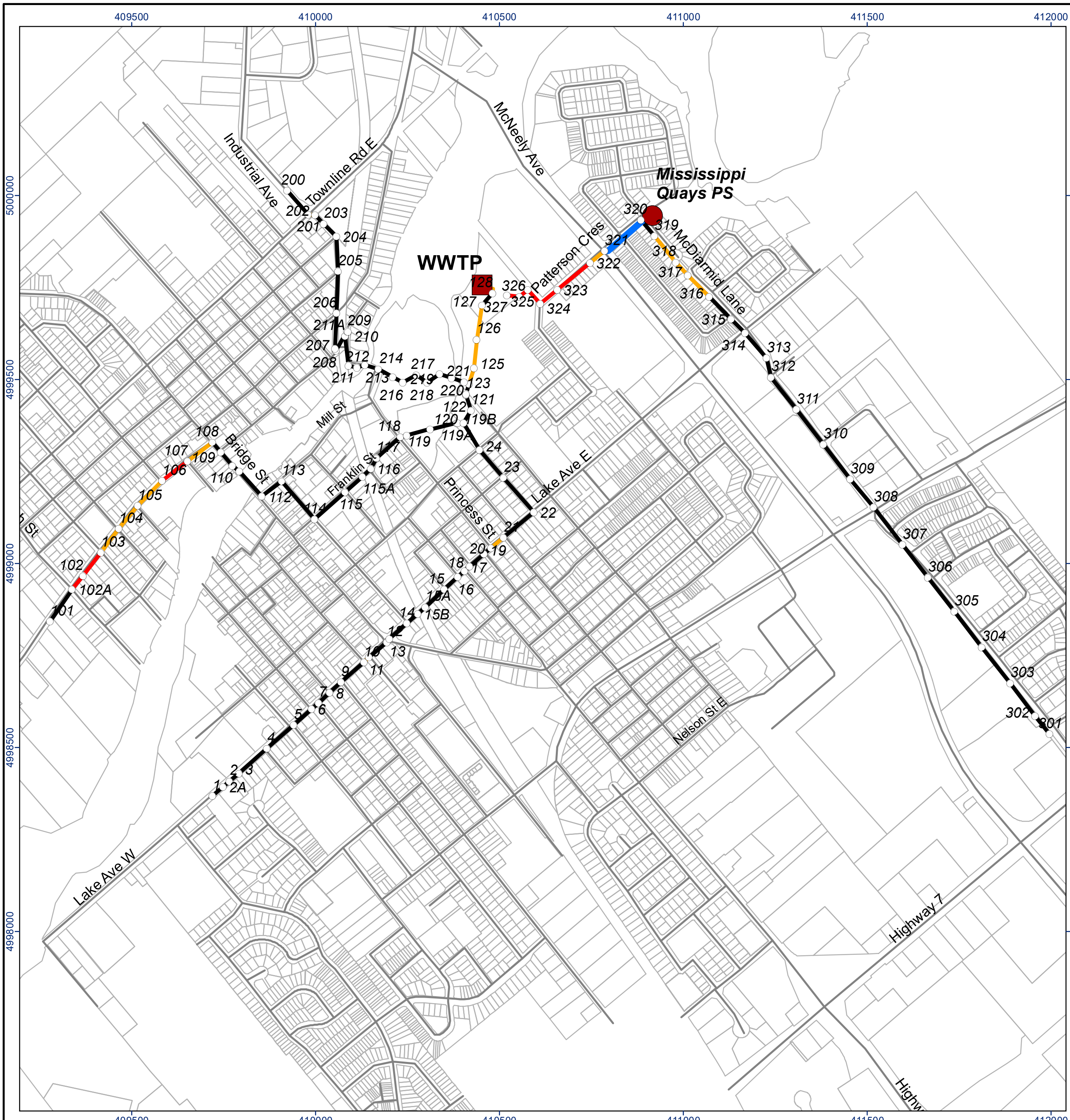
Project Location
Carleton Place, ON

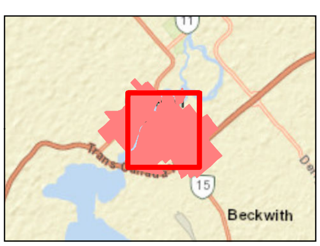
Client/Project
Carleton Place W&WW Master Plan
Town of Carleton Place
Carleton Place W&WW Master Plan
Phase 1 Report

Figure No.
D-3

Title
Sanitary Sewer Capacity Utilization
2031 Design Event

Disclaimer: This document has been prepared based on information provided by others as cited in the Notes section. Stantec has not verified the accuracy and/or completeness of this information and shall not be responsible for any errors or omissions which may be incorporated herein as a result. Stantec assumes no responsibility for data supplied in electronic format, and the recipient accepts full responsibility for verifying the accuracy and completeness of the data.





Legend

Sewer Capacity Utilization (q/Q)

- Forcemain
- q/Q ≤ 75%
- 75% < q/Q ≤ 100%
- 100% < q/Q ≤ 200%
- q/Q > 200%
- Maintenance Hole
- Wastewater Treatment Plant (WWTP)
- Pumping Station (PS)

0 200 400 metres

(At original document size of 8.5x11)
1:16,000

N

Notes

1. Coordinate System: NAD 1983 UTM Zone 18N
2. Data Sources: *sanisewer.shp* provided by the Town of Carleton Place
3. Background: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

Project Location

Carleton Place, ON

Client/Project Carleton Place W&WW Master Plan

Town of Carleton Place
Carleton Place W&WW Master Plan
Phase 1 Report

Figure No.
D-4

Title
Sanitary Sewer Capacity Utilization
2041 Design Event

Disclaimer: This document has been prepared based on information provided by others as cited in the Notes section. Stantec has not verified the accuracy and/or completeness of this information and shall not be responsible for any errors or omissions which may be incorporated herein as a result. Stantec assumes no responsibility for data supplied in electronic format, and the recipient accepts full responsibility for verifying the accuracy and completeness of the data.

Appendix E Water Treatment Plant Certificate of Authorization

CONTENT COPY OF ORIGINAL

Ministry of the Environment

Ministère de l'Environnement

Ontario

AMENDED CERTIFICATE OF APPROVAL
MUNICIPAL DRINKING WATER SYSTEMS
NUMBER 1150-69XLVM

The Corporation of the Town of Carleton Place
175 Bridge Street
Carleton Place, Ontario
K7C 2V8

Site Location: Carleton Place Water Treatment Plant
199 John Street
Carleton Place Town, County of Lanark

Pursuant to the Safe Drinking Water Act, 2002, S.O. 2002, c. 32, and the regulations made thereunder and subject to the limitations thereof, this approval is issued under Part V of the Safe Drinking Water Act, 2002, S.O. 2002, c. 32 to:

The Corporation of the Town of Carleton Place
175 Bridge Street
Carleton Place, Ontario
K7C 2V8

PART 1 - DRINKING-WATER SYSTEM DESCRIPTION

1.1 for a drinking-water system serving the Town of Carleton Place, located on John Street, (NAD83: UTM Zone 18: 409580.00 m E, 4998500.00 m N), rated as set out in Part 4, consisting of the following:

Proposed Water Works
(as per Application for Approval dated December 13, 2004)

Raw Water Intake Modifications

- add a screening basket to the manually cleaned screens in the raw water intake channel.

Filter Modifications

- 200 mm diameter filter-to-waste piping, at each of the six filter compartments, complete with air release valve, automated pneumatic valve and sampling tap;

- one (1) turbidity analyzer, connected to all filter-to-waste lines.

Residue Management System Modifications

- divert ACTIFLO hydrocyclone process sludge from Residue Holding Tanks to Sludge Pumping Station;

- divert flow from Residue Holding Tank residual pumps (progressive cavity type pumps), from 150 mm diameter forcemain to Sludge Pumping Station.

Sludge Pumping Station Construction

- a 1.83 m by 1.83 m wet well, c/w one ultrasonic sensor, one access ladder, one access hatch, two goose necks, and one floor socket for portable lifting davit;

- two submersible non-clog centrifugal type pumps, each having a rated capacity of 9.0 L/s, at a total dynamic head of 5.5 m;

- 100 mm diameter discharge piping and valve assembly;

- 150 mm diameter 190 m long forcemain, from Sludge Pumping Station wet well to Lake Avenue gravity sewer;

- 100 mm diameter overflow drain pipe, connected to plant filter room backwash water trough.

Coagulant Feed System Modifications

- a fourth coagulant storage tank, 1.52 m diameter, 3.4 m high, 6,210 L capacity, double wall configuration, with a leak detector between the two walls;

- a 370 mm high concrete containment curb, at coagulant tanks area;

- one leak detector within the containment area.

Polymer Mixing System Modifications

- a spill channeling wall around the polymer mix tank in the Chemical Room on the ground floor;

- 75 mm diameter drain line from the Chemical Room on the ground floor down to the basement polymer containment area.

Polymer Day Tank System Modifications

- 300 mm high concrete containment curb, at basement polymer day tank area.

Potable Water Supply Modifications

- 75 mm diameter double assembly backflow prevention valve at plant potable water inlet connection.

Standby Power Facility Modifications

- remove and dispose of existing underground diesel fuel tank, transfer pumps, transfer piping, and contaminated soils;

- new diesel fuel tank complete with secondary containment located inside the Water Treatment Plant Generator Room;

- 50 mm diameter fill and vent lines.

Existing Water Works
(as per the Engineer's Report entitled "Engineer's Report for Town of Carleton Place Water Works", dated November 2000, prepared by J. L. Richards and Associates Limited)

Intake

- one (1) 600 mm diameter raw water intake pipe which draws water from the Mississippi River, complete with an upturned elbow at the river end surrounded by a coarse screen.

Screens

- two (2) raw water intake wells located in series in the plant building;

- a two-stage stainless steel coarse mesh screen with 6.35 mm x 6.35 mm openings located in the raw water well closest to the river upstream of the low lift pumps.

Low Lift Pumps

- four (4) vertical turbine low lift pumps located over the second raw water well inside the plant; the pumps consist of a 7.5 hp pump rated to deliver 36.6 L/s against a total dynamic head (TDH) of 7.3 m, a 10 hp pump rated to deliver 57.9 L/s against a TDH of 7.8 m, a 15 hp pump rated to deliver 84.2 L/s against a TDH of 7.8 m, and a 20 hp pump rated to deliver

110.5 L/s against a TDH of 9.1 m; the pump combinations are operator selectable and the operation of the pumps is automatically controlled by the level in the clearwell;

- ultrasonic level sensing device positioned above low lift well, equipped with low and high water level alarm;

- a common 400 mm diameter stainless steel pipe header which extends through the plant terminating in the Actiflo® process treatment area; the pipe includes a 400 mm diameter x 1.7 m long in-line static mixer, valves and coagulant, polymer and chlorine addition points; the pipe also contains a raw water flow meter consisting of a magnetic flow metering device.

Enhanced Coagulation/Flocculation/Sedimentation (as per CofA Amendment No. 7-0127-84-006 dated March 5, 2001)

- two ballasted floc/clarification Actiflo® treatment trains operating in parallel with each train consisting of a coagulation tank, injection tank, maturation tank and settling tank, complete with microsand recirculation pumps, piping and hydrocyclones to separate the microsand and the residuals;

- each coagulation tank to be 1.97 m x 1.346 m x 3.223 m water depth for a working volume of 8.5 m^3 each; one 2 hp mixer per tank;

- each injection tank to be 1.97 m x 1.346 m x 3.223 m water depth for a working volume of 8.5 m^3 one 2 hp mixer per tank along with polymer injection piping;

- each maturation tank to be 2.668 m x 3.0 m x 3.233 m water depth for a working volume of 25.8 m^3; one 3 hp variable speed mixer in each tank, along with polymer injection piping;

- each settling tank, complete with collection hopper, settling module (surface area of 6.25 m^2 per tank), three collection troughs per tank; maximum surface loading rate of 53.3 m/hour.

- three(3) recirculation pumps (two duty and one standby) capable of pumping 8 m3/hour against a TDH of 15 metres, complete with piping, valves and instrumentation and controls.

Filters

- a concrete splitter box located above the filters which receives water from the settling tank effluent troughs and splits the flow to the filter units;

- three (3) cylindrical stainless steel double compartment dual media (sand/anthracite) gravity filters located in the plant building basement; filtration capacity of 27.8 L/s per filter cell (139 L/s total); each filter equipped with underdrains; sand/anthracite filter media; self-contained backwash storage compartments and air scour system, piping and automated control valves for automated backwash operations;

- one (1) air scour blower for filter backwash operation;

- an in-line turbidimeter on the discharge from each cylindrical double compartment dual media filter (3 total).

Clearwell

- a two (2) cell underground storage reservoir which also serves as the high lift pump well, providing a total treated water storage volume of approximately 3,180 m^3; includes isolation gates and piping for flow control and maintenance and provides contact time for disinfection prior to pumping into the distribution system;

- piping and valves to provide operating flexibility to maximize chlorine contact for disinfection purposes while cleaning the clearwell.

High Lift Pumps

- four (4) vertical turbine high lift pumps located in the high lift pump room over the clearwell; the pumps consist of a jockey pump (lag pump) rated to deliver 36.8 L/s against a TDH of 52.5 m, a duty (lead) pump rated to deliver 57.9 L/s against a TDH of 51.2 m, a duty (lead) pump rated to deliver 100 L/s against a TDH of 52.5 m and a standby (lead) pump rated to deliver 136.8 L/s against a TDH of 56 m;

- a common 450 mm diameter discharge header with an in-line flow meter consisting of a universal Venturi insert tube.

Disinfection Facilities (as per CofA Amendment No. 7-0127-84-006 dated March 5, 2001)

- two (2) 227 kg/day vacuum chlorinators, used to draw chlorine gas from two (2) 907 kg cylinders and blend with treated water to create an aqueous chorine solution; one chlorinator designated for post-filtration chlorination; one chlorinator designated for pre-chlorination and application at raw water intake for zebra mussel control and with capabilities for standby post-filtration chlorination;

- one set of 227 kg/day automatic switchover regulators;

- an on-line continuous chlorine analyser for monitoring chlorine residual in the treated water leaving the plant;

- a standby booster chlorination system at the existing water tower located on Nelson Street east of Park Street, consisting of a 100 L capacity sodium hypochlorite solution tank, complete with secondary containment, piping and appurtenances; one chemical metering pump capable of delivering sodium hypochlorite solution at a rate of 3.6 L/h through a feed line discharging into the water tank common fill/draw pipe; and a chlorine analyzer and related instrumentation for operating the pump.

Ammonia Storage and Feed Facilities (as per CofA Amendment No. 7-0127-84-006 dated March 5, 2001)

- equipment and components to allow for the generation of chloramine for disinfection of the distribution system;

- sufficient storage and containment for three (3) 205 litre aqueous ammonia storage containers, including secondary containment and electronic weigh scale for one drum;

- two (2) chemical metering pumps, each capable of pumping coagulant at rates varying between 5 litres/day and 10 litres/day, complete with suction and discharge piping and valves to convey aqueous ammonia to the treated water line;

- instrumentation to control the flow of aqueous ammonia in proportion to chlorine in the treated water.

Coagulant Storage and Feed System

- three (3) 6,950 litre chemical storage tanks, complete with secondary containment and piping for filling tanks;

- two chemical metering pumps each capable of pumping coagulant at rates varying between 120 litres/day and 2,040 litres/day complete with suction and discharge piping to deliver coagulant to the raw water.

Polyelectrolyte Storage and Feed System (as per CofA Amendment No. 7-0127-84-006 dated March 5, 2001)

- one (1) 2,250 litre capacity mixing tank, complete with mixer, water supply system and eductor located in the chemical room;

- two (2) polymer solution storage tanks each with a capacity of 2,270 litres;

- two (2) chemical metering pumps and piping capable of pumping polymer solution at rates varying between 240 litres/day and 1,440 litres/day, complete with suction and discharge piping and valving, transport water system and flow measurement equipment for delivering polymer to the injection tanks and the maturation tanks.

Lime Feed System

- a volumetric feed, slurry tank with mixer and eductor system capable of automatically preparing and feeding lime solution at rates varying from 30 kg/day to 500 kg/day.

Fluoridation System

- a 4,540 litre bulk storage tank for storing hydrofluosilicic (HFS) solution, complete with secondary containment, fill pipe, overflow pipe, vent and ultrasonic level detector;

- a transfer pump with piping to connect the bulk storage tank to a day tank, complete with back pressure valve;

- a day tank, complete with scale and secondary containment;

- two (2) chemical metering pumps (one duty and one standby) used to convey HFS solution into the treated water, complete with piping, valves and instrumentation to control feed rate based on treated water flow;

- an in-line fluoride analyser used to continuously monitor the concentration of fluoride in the treated water pumped into the distribution system.

Backwash Water Treatment System

- a two compartment waste backwash water settling tank with each compartment approximately 9.2 m x 2.65 m x 4.5 m deep providing a total surface area of 48 m^2 complete with high and low level alarm system;

- two (2) progressive cavity type positive displacement sludge pumps, each capable of discharging 7.6 L/s against a total dynamic head of 20 m;

- a 100 mm diameter 190 m long forcemain connecting the sludge pumps to the sanitary sewer on Lake Avenue;

- instrumentation to allow sludge to be removed on a timed cycle;

- two (2) float level controlled self-priming centrifugal supernatant pumps, each capable of discharging 7.6 L/s against a total dynamic head of 8.5 m, complete with piping and valves to convey supernatant to a plant overflow sewer;

- a 600 mm gravity sewer to convey supernatant back to the Mississippi River;

- piping and valves to convey residuals and drainage from the Actiflo® process to one or the other settling tanks.

Water Treatment Plant Building

- a building housing the water treatment process equipment and components including laboratory facilities, staff offices, washrooms and storage facilities.

Instrumentation and Controls

- a Supervisory Control and Data Acquisition (SCADA) system for monitoring and control of various plant process equipment and building systems.

Emergency Power Supply System

- a 375 kW standby Diesel generator set to provide emergency power to essential systems only in the event of a power outage, or for maintenance purposes.

1.2 all in accordance with the applications and plans and other supporting documents listed in Schedule "A", and all other Schedules, which are attached to, and form part of this approval, except as specified in the conditions contained herein.

PART 2 - DEFINITIONS AND INFORMATION

2.1 Words and phrases not defined in this approval shall be given the same meaning as those set out in the *Safe Drinking Water Act, 2002*, S.O. 2002, c. 32 and any regulations made in accordance with that act, unless the context requires otherwise.

2.2 In this approval

"adverse effect", "contaminant", "impairment" and "natural environment" shall have the same meanings as in the *Environmental Protection Act*, R.S.O.1990, c. E.19 and the *Ontario Water Resources Act*, R.S.O.1990, c. O.40;

"approval" means this entire approval document, issued in accordance with section 36 of the *SDWA*, and includes any schedules to it;

"Director" means a Director appointed pursuant to s. 6 of the *SDWA* for the purposes of Part V of the *SDWA*;

"drinking-water system" includes the works set out in Part 1;

"provincial officer" means a provincial officer appointed pursuant to s. 8 of the *SDWA*;

"rated capacity" means the maximum flow rate of water which can be treated when operating the drinking-water system under design conditions;

"*SDWA*" means the *Safe Drinking Water Act, 2002, S.O. 2002, c. 32*, as amended.

2.3 The following information is applicable to this approval

"owner" is The Corporation of the Town of Carleton Place, its successors and assignees;
"operating authority" is Ontario Clean Water Agency (OCWA), its successors and assignees.

PART 3 - GENERAL

Compliance

3.1 The owner and operating authority shall operate the drinking-water system in accordance with the *SDWA*, any applicable regulations made thereunder, and this approval.

3.2 Despite any condition of this approval to the contrary, the owner and operating authority set out in Part 2 are jointly and severally liable to comply with all conditions of this approval.

3.3 The owner and operating authority shall ensure that any person authorized to carry out work on or operate any aspect of the drinking-water system has been informed of the *SDWA*, all applicable regulations made in accordance with that act, and this approval and shall take all reasonable measures to ensure any such person complies with the same.

3.4 A copy of this approval shall be kept in a conspicuous place so that it is available for reference by all persons responsible for all or part of the operation of the drinking-water system.

Build, etc. in Accordance

3.5 Except as otherwise provided by this approval, the drinking-water system shall be designed, developed, built, operated and maintained in accordance with Part 1 above and the documentation listed in Schedule "A".

Interpretation

3.6 Where there is a conflict between the provisions of this approval and any other document, the following hierarchy shall be used to determine the provision that takes precedence:

i. The *SDWA*;

ii. a condition imposed in this approval in accordance with s. 38 of the *SDWA*;

iii. any regulation made under the *SDWA*;

iv. this approval;

v. any application documents listed in Schedule "A" from most recent to earliest; and

vi. all other documents listed in Schedule "A" from most recent to earliest.

3.7 The requirements of this approval are severable. If any requirement of this approval, or the application of any requirement of this approval to any circumstance, is held invalid or unenforceable, the application of such requirement to other circumstances and the remainder of this approval shall not be affected thereby.

3.8 Nothing in this approval shall be read to provide relief from the need for strict compliance with the *Environmental Assessment Act*, R.S.O. 1990, c E.18.

Other Legal Obligations

3.9 The issuance of, and compliance with the conditions of, this approval does not:

i. relieve any person of any obligation to comply with any provision of any applicable statute, regulation or other legal requirement; or

ii. limit in any way the authority of the Ministry to require certain steps be taken or to require the owner to furnish any further information related to compliance with this approval.

3.10 For greater clarity, nothing in this approval shall be read to provide relief from regulatory requirements in accordance with section 38 of the *SDWA*, except as provided in Part 9.

Adverse Effects

3.11 Nothing in this approval shall be read as to permit: i) the discharge of a contaminant into the natural environment that causes or is likely to cause an adverse effect; or ii) the discharge of any material of any kind into or in any waters or on any shore or bank thereof or into or in any place that may impair the quality of the water of any waters.

3.12 All reasonable steps shall be taken to minimize and ameliorate any adverse effect on the natural environment or impairment of the quality of water of any waters resulting from the operation of the drinking-water system including such accelerated or additional monitoring as may be necessary to determine the nature and extent of the effect or impairment.

3.13 Fulfillment of one or more conditions imposed by this approval does not eliminate the requirement to fulfill any other condition of this approval or the requirements of any applicable statute, regulation, or other legal requirement resulting from any act or omission that causes or is likely to cause an adverse effect on the natural environment or the impairment of water quality.

Change of Owner

3.14 The owner or the operating authority, as the case may be, shall notify the Director, in writing, of any of the following changes within 30 days of the change occurring:
i. change of owner or operating authority;

ii. change of address;

iii. change of partners where the owner is or at any time becomes a partnership, and a copy of the most recent declaration filed under the Business Names Act, R.S.O. 1990, c. B17; or

iv. change of name of the corporation where the owner or operating authority is or at any time becomes a corporation, and a copy of the most current information filed under the Corporations Information Act, R.S.O. 1990, c. C.39.

3.15 In the event of any change in ownership of the drinking-water system, other than change to a successor municipality, the owner shall notify the successor of and provide the successor with a copy of this approval, and the owner shall provide a copy of the notification to the district manager of the local office of the Ministry and the Director.

Inspections

3.16 No person shall hinder or obstruct a provincial officer in the performance of his or her duties, including any and all inspections authorized by the *SDWA*.

Information

3.17 Any information requested, by the Ministry, concerning the drinking-water system and its operation under this approval, including but not limited to any records required to be kept by this approval shall be provided to the Ministry, upon request.

3.18 Records required by or created in accordance with this approval, unless specifically referenced in s. 12 of O. Reg. 170/03, shall be retained for at least 5 years in a location where a provincial officer who is inspecting the treatment system can conveniently view them.

PART 4 - PERFORMANCE

Rated Capacity

4.1 The drinking-water system shall not be operated to exceed the rated capacity for the maximum flow rate into the treatment system of 8,333 L/min.

Increase to Rated Capacity

4.2 Despite condition 4.1, the drinking water system may be operated at a rate above the rated capacity set out in condition 4.1 where necessary for:

i. fighting a large fire; or
ii. the maintenance of the drinking-water system.

4.3 Condition 4.2 shall not be construed to allow drinking-water to be supplied that does not meet all other applicable standards and legal requirements.

Management of Residue

4.4 The annual average concentration of suspended solids in the effluent discharged from the backwash wastewater facilities shall not exceed 25 mg/L.

PART 5 - MONITORING AND RECORDING

Flow measuring devices

5.1 Install a sufficient number of flow-measuring devices within the drinking-water system to permit continuous measurement and recording of:

i. the flow rate and daily volume of water conveyed into the treatment system; and

ii. the flow rate and daily volume of water conveyed from the treatment system to the distribution system.

5.2 Records shall be maintained that set out the parameters recorded in accordance with condition 5.1, and where a measured flow rate into a treatment system, train, or stage exceeds the maximum flow rate set out for that treatment system, train, or stage in Part 4, the amount, date, time and duration of the exceedence shall also be recorded.

Calibration of flow measuring devices

5.3 All flow measuring devices must be checked and calibrated in accordance with the manufacturer's instructions.

5.4 If the manufacturer's instructions do not indicate how often to check and calibrate the flow measuring devices, the equipment must be checked and calibrated at least once every year during which the drinking-water system is in operation.

Additional Sampling - Management of Residue

5.6 In addition to any other sampling and analysis that may be required, sampling and analysis shall be undertaken for the parameters listed in **Table 5.1** at the listed frequencies and locations.

Table 5.1 Management of Residue Sampling

Item	Parameter	Frequency	Location
1.	Suspended Solids (composite)	Monthly	Point of discharge to the Mississippi River

5.7 For the purposes of **Table 5.1**, composite means the mean of three samples taken during the discharge event, with at least one sample taken immediately following the commencement of the discharge, one sample taken approximately at the mid-point of the discharge event and one sample taken immediately before the discharge ceases.

PART 6 - OPERATIONS AND MAINTENANCE

Chemical standards

6.1 All chemicals and materials used in the operation of the drinking-water system that come into contact with water within the system shall meet all applicable standards set by both the American Water Works Association ("AWWA") and the American National Standards Institute ("ANSI") safety criteria standards NSF/60 and NSF/61.

6.2 The most current chemical and material product registration documentation from a testing institution accredited by either the Standards Council of Canada or by the American National Standards Institution shall be available at all times for each chemical and material used in the operation of the drinking-water system that comes into contact with water within the system.

6.3 Condition 6.2 does not apply in the context of any particular chemical or material where the Owner has written documentation signed by the Director that indicates that the Ministry is satisfied that the chemical or material is acceptable for use within the drinking-water system and that chemical or material is only used as permitted by the documentation.

Operations manual

6.4 An up-to-date operations manual shall be maintained and available for reference by all persons responsible for all or part of the operation of the drinking-water system.

6.5 The operations manual shall include at a minimum:

i. the requirements of this approval and associated procedures;

ii. the operation and maintenance recommendations from the most recent engineers' report;

iii. procedures for the monitoring and recording of in-process parameters necessary for the control of the treatment system and assessing the performance of the drinking-water system;

iv. procedures for the operation and maintenance of monitoring equipment;

v. contingency plans and procedures for the provision of adequate equipment and material to deal with emergencies, upset and equipment breakdown;

vi. procedures for the dealing with complaints related to the drinking-water system, including the recording of the nature of the complaint and any investigation and corrective action taken in respect of the complaint;

6.6 Procedures necessary to the operation of any physical alterations of the drinking-water system shall be incorporated into the operations manual prior to the alterations coming into operation.

Drawings

6.7 Up-to-date Process Flow Diagrams (PFD) and Process and Instrumentation Diagrams (P&ID) for the treatment system shall be kept on site at the drinking water system.

6.8 All drawings and diagrams in the possession of the owner or operating authority that show the treatment system as constructed shall be retained.

6.9 An alteration to the treatment system shall be incorporated into Process Flow Diagrams (PFD), Process and Instrumentation Diagrams (P&ID), and record drawings and diagrams within one year of the substantial completion of the alteration and shall be retained and shall be made readily available for inspection by Ministry staff.

PART 7 - FUTURE ALTERATIONS

Approved future alterations

7.1 *Not Applicable*

Certificate of compliance

7.2 *Not Applicable*

PART 8 - STUDIES AND UPGRADES REQUIRED

8.1 By **December 31, 2002,** the owner shall implement the following physical improvements to the works:
i. All works necessary to ensure that the effective chlorine contact time downstream of the filters is sufficient to provide 0.5-log inactivation of *Giardia* cysts and 2-log inactivation of viruses.

ii. Install continuous on-line turbidity analyzers on the filter discharges.

iii. Automate switchover of the chlorine contact cylinders to ensure continuous application of chlorine to the treated water.

iv. Implement feedback loops from the chlorine residual analyzer, turbidimeters, and fluoride analyzer to shut down the high lift pumps in the event of low chlorine residual or high turbidity or high fluoride levels.

v. Modify clearwell/reservoir piping to ensure adequate disinfection when either reservoir cell is out of service for maintenance.

vi. Optimize the pre-treatment and filtration processes to reduce the levels of THM precursors remaining in the water prior to the application of chlorine.

8.2 By **December 31, 2004,** the owner shall implement the following physical improvements to the works:

i. Investigate the feasibility of incorporating filter-to-waste capability following filter backwashing and incorporate filter-to-waste or equivalent process modifications as approved by the Director.

Requirement not an approval

8.3 The owner shall not construct any works required by this part until all associated approvals, licenses and permits have been obtained from the Ministry.

PART 9 - RELIEF FROM REGULATORY REQUIREMENTS

Relief from regulatory requirements

9.1 *Not Applicable*

Conditions in exchange for relief from regulatory requirements

9.2 *Not Applicable*

SCHEDULE - A

The following supporting documents form part of this approval.

1. Application dated December 13, 2004
- Final Plans and Specifications dated December, 2004
- Design Brief dated December, 2004
- Correspondence dated March 4, 2005 from Stantec to MOE.

2. The original applications for approval, including design calculations, engineering drawings and reports, and other supporting documents prepared in support of any previous certificate(s) of approval issued for any works now approved and replaced by this approval, unless this approval states otherwise.

This Certificate of Approval revokes and replaces Certificate(s) of Approval No. 0208-5MHLKM issued on May 16, 2003

All or part of this decision may be reviewable in accordance with the provisions of Part X of the SDWA. In accordance with Section 129(1) of the Safe Drinking Water Act, Chapter 32 Statutes of Ontario, 2002, as amended, you may by written notice served upon me and the Environmental Review Tribunal within 15 days after receipt of this notice, require a hearing by the Tribunal. Section 129(2) sets out a procedure upon which the 15 days may be extended by the Tribunal. Section 129(3) of the Safe Drinking Water Act, Chapter 32 Statutes of Ontario, 2002, provides that the Notice requiring the hearing shall state:

1. The aspect of the decision, including the portion of the permit, licence, approval, order or notice of administrative penalty in respect of which the hearing is required; and
2. The grounds for review to be relied on by the person at the hearing.

Except with leave of the Tribunal, a person requiring a hearing in relation to a reviewable decision is not entitled to,
(a) a review of an aspect of the decision other than that stated in the notice requiring the hearing; or
(b) a review of the decision other than on the grounds stated in the notice

CONTENT COPY OF ORIGINAL

The Notice should also include:

3. The name of the appellant;
4. The address of the appellant;
5. The Certificate of Approval number;
6. The date of the Certificate of Approval;
7. The name of the Director;
8. The municipality within which the works are located;

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

This Notice must be served upon:

The Secretary*
Environmental Review Tribunal
2300 Yonge St., 12th Floor
P.O. Box 2382
Toronto, Ontario
M4P 1E4

AND

The Director
Part V, *Safe Drinking Water Act, 2002*
Ministry of Environment
2 St. Clair Avenue West, Floor 12A
Toronto, Ontario
M4V 1L5

*** Further information on the Environmental Review Tribunal's requirements for an appeal can be obtained directly from the Tribunal at: Tel: (416) 314-4600, Fax: (416) 314-4506 or www.ert.gov.on.ca**

The above noted water works are approved under Part V of the Safe Drinking Water Act.

DATED AT TORONTO this 1st day of April, 2005

Pauline Desroches
Director
Part V *of the Safe Drinking Water Act, 2002*

GZ/
c: District Manager, MOE Ottawa
Drinking Water Supervisor, MOE Ottawa
Manager, Drinking Water, Wastewater and Watershed Standards Section, Standards Development Branch
Hebert, Jean, Stantec Consulting Ltd.

Appendix F Water Treatment Plant Permit to Take Water

PERMIT TO TAKE WATER
Surface Water
NUMBER 1310-9UHPPW

Pursuant to Section 34.1 of the Ontario Water Resources Act, R.S.O. 1990 this Permit To Take Water is hereby issued to:

The Corporation of the Town of Carleton Place
175 Bridge Street
Carleton Place, Ontario K7C 2V8
Canada

For the water taking from: Mississippi River

Located at: 199 John St
Carleton Place, County of Lanark

For the purposes of this Permit, and the terms and conditions specified below, the following definitions apply:

DEFINITIONS

(a) "Director" means any person appointed in writing as a Director pursuant to section 5 of the OWRA for the purposes of section 34.1, OWRA.

(b) "Provincial Officer" means any person designated in writing by the Minister as a Provincial Officer pursuant to section 5 of the OWRA.

(c) "Ministry" means Ontario Ministry of the Environment and Climate Change.

(d) "District Office" means the Ottawa District Office.

(e) "Permit" means this Permit to Take Water No. 1310-9UHPPW including its Schedules, if any, issued in accordance with Section 34.1 of the OWRA.

(f) "Permit Holder" means The Corporation of the Town of Carleton Place.

(g) "OWRA " means the *Ontario Water Resources Act*, R.S.O. 1990, c. O. 40, as amended.

You are hereby notified that this Permit is issued subject to the terms and conditions outlined below:

TERMS AND CONDITIONS

1. Compliance with Permit

1.1 Except where modified by this Permit, the water taking shall be in accordance with the application for this Permit To Take Water, dated December 15, 2014 and signed by David Young, and all Schedules included in this Permit.

1.2 The Permit Holder shall ensure that any person authorized by the Permit Holder to take water under this Permit is provided with a copy of this Permit and shall take all reasonable measures to ensure that any such person complies with the conditions of this Permit.

1.3 Any person authorized by the Permit Holder to take water under this Permit shall comply with the conditions of this Permit.

1.4 This Permit is not transferable to another person.

1.5 This Permit provides the Permit Holder with permission to take water in accordance with the conditions of this Permit, up to the date of the expiry of this Permit. This Permit does not constitute a legal right, vested or otherwise, to a water allocation, and the issuance of this Permit does not guarantee that, upon its expiry, it will be renewed.

1.6 The Permit Holder shall keep this Permit available at all times at or near the site of the taking, and shall produce this Permit immediately for inspection by a Provincial Officer upon his or her request.

1.7 The Permit Holder shall report any changes of address to the Director within thirty days of any such change. The Permit Holder shall report any change of ownership of the property for which this Permit is issued within thirty days of any such change. A change in ownership in the property shall cause this Permit to be cancelled.

2. General Conditions and Interpretation

2.1 Inspections
The Permit Holder must forthwith, upon presentation of credentials, permit a Provincial Officer to carry out any and all inspections authorized by the OWRA, the *Environmental Protection Act* , R.S.O. 1990, the *Pesticides Act* , R.S.O. 1990, or the *Safe Drinking Water Act,* S. O. 2002.

2.2 Other Approvals

The issuance of, and compliance with this Permit, does not:

(a) relieve the Permit Holder or any other person from any obligation to comply with any other applicable legal requirements, including the provisions of the *Ontario Water Resources Act* , and the *Environmental Protection Act* , and any regulations made thereunder; or

(b) limit in any way any authority of the Ministry, a Director, or a Provincial Officer, including the authority to require certain steps be taken or to require the Permit Holder to furnish any further information related to this Permit.

2.3 Information

The receipt of any information by the Ministry, the failure of the Ministry to take any action or require any person to take any action in relation to the information, or the failure of a Provincial Officer to prosecute any person in relation to the information, shall not be construed as:

(a) an approval, waiver or justification by the Ministry of any act or omission of any person that contravenes this Permit or other legal requirement; or

(b) acceptance by the Ministry of the information's completeness or accuracy.

2.4 Rights of Action

The issuance of, and compliance with this Permit shall not be construed as precluding or limiting any legal claims or rights of action that any person, including the Crown in right of Ontario or any agency thereof, has or may have against the Permit Holder, its officers, employees, agents, and contractors.

2.5 Severability

The requirements of this Permit are severable. If any requirements of this Permit, or the application of any requirements of this Permit to any circumstance, is held invalid or unenforceable, the application of such requirements to other circumstances and the remainder of this Permit shall not be affected thereby.

2.6 Conflicts

Where there is a conflict between a provision of any submitted document referred to in this Permit, including its Schedules, and the conditions of this Permit, the conditions in this Permit shall take precedence.

3. Water Takings Authorized by This Permit

3.1 **Expiry**

This Permit expires on **March 11, 2025**. No water shall be taken under authority of this Permit after the expiry date.

3.2 Amounts of Taking Permitted

The Permit Holder shall only take water from the source, during the periods and at the rates and amounts of taking specified in Table A. Water takings are authorized only for the purposes specified in Table A.

Table A

	Source Name / Description:	Source: Type:	Taking Specific Purpose:	Taking Major Category:	Max. Taken per Minute (litres):	Max. Num. of Hrs Taken per Day:	Max. Taken per Day (litres):	Max. Num. of Days Taken per Year:	Zone/ Easting/ Northing:
1	Mississippi River	River	Municipal	Water Supply	10,734	24	12,000,000	365	18 409650 4998550
						Total Taking:	12,000,000		

4. Monitoring

4.1 The Permit Holder shall maintain a record of all water takings. This record shall include the dates and times of water takings and the total measured amounts of water taken per day for each day that water is taken under the authorization of this Permit. A separate record shall be maintained for each source. The Permit Holder shall keep all required records up to date and available at or near the site of the taking and shall produce the records immediately for inspection by a Provincial Officer upon his or her request.

5. Impacts of the Water Taking

5.1 Notification

The Permit Holder shall immediately notify the local District Office of any complaint arising from the taking of water authorized under this Permit and shall report any action which has been taken or is proposed with regard to such complaint. The Permit Holder shall immediately notify the local District Office if the taking of water is observed to have any significant impact on the surrounding waters. After hours, calls shall be directed to the Ministry's Spills Action Centre at 1-800-268-6060.

5.2 For Surface-Water Takings

The taking of water (including the taking of water into storage and the subsequent or simultaneous withdrawal from storage) shall be carried out in such a manner that streamflow is not stopped and is not reduced to a rate that will cause interference with downstream uses of water or with the natural functions of the stream.

6. Director May Amend Permit

The Director may amend this Permit by letter requiring the Permit Holder to suspend or reduce the taking to an amount or threshold specified by the Director in the letter. The suspension or reduction in taking shall be effective immediately and may be revoked at any time upon notification by the Director. This condition does not affect your right to appeal the suspension or reduction in taking to the Environmental Review Tribunal under the *Ontario Water Resources Act* , Section 100 (4).

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

1. Condition 1 is included to ensure that the conditions in this Permit are complied with and can be enforced.

2. Condition 2 is included to clarify the legal interpretation of aspects of this Permit.

3. Conditions 3 through 6 are included to protect the quality of the natural environment so as to safeguard the ecosystem and human health and foster efficient use and conservation of waters. These conditions allow for the beneficial use of waters while ensuring the fair sharing, conservation and sustainable use of the waters of Ontario. The conditions also specify the water takings that are authorized by this Permit and the scope of this Permit.

In accordance with Section 100 of the Ontario Water Resources Act, R.S.O. 1990, you may by written notice served upon me, the Environmental Review Tribunal and the Environmental Commissioner, ***Environmental Bill of Rights****, R.S.O. 1993, Chapter 28, within 15 days after receipt of this Notice, require a hearing by the Tribunal. The Environmental Commissioner will place notice of your appeal on the Environmental Registry. Section 101 of the Ontario Water Resources Act, as amended provides that the Notice requiring a hearing shall state:*

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

In addition to these legal requirements, the Notice should also include:

3. The name of the appellant;
4. The address of the appellant;
5. The Permit to Take Water number;
6. The date of the Permit to Take Water;
7. The name of the Director;
8. The municipality within which the works are located;

This notice must be served upon:

The Secretary Environmental Review Tribunal 655 Bay Street, 15th Floor Toronto ON M5G 1E5 Fax: (416) 314-4506 Email: ERTTribunalsecretary@ontario.ca	*AND*	*The Environmental Commissioner 1075 Bay Street 6th Floor, Suite 605 Toronto, Ontario M5S 2W5*	*AND*	*The Director, Section 34.1, Ministry of the Environment and Climate Change 1259 Gardiners Rd, PO Box 22032 Kingston, ON K7P 3J6*

Further information on the Environmental Review Tribunal's requirements for an appeal can be obtained directly from the Tribunal:

by telephone at (416) 314-4600 ***by fax at (416) 314-4506*** ***by e-mail at www.ert.gov.on.ca***

This instrument is subject to Section 38 of the ***Environmental Bill of Rights*** *that allows residents of Ontario to seek leave to appeal the decision on this instrument. Residents of Ontario may seek to appeal for 15 days from the date this decision is placed on the Environmental Registry. By accessing the Environmental Registry, you can determine when the leave to appeal period ends.*

This Permit cancels and replaces Permit Number 6882-686R5M, issued on 2005/01/05.

Dated at Kingston this 13th day of March, 2015.

Greg Faaren
Director, Section 34.1

Ontario Water Resources Act , R.S.O. 1990

Schedule A

This Schedule “A” forms part of Permit To Take Water 1310-9UHPPW, dated March 13, 2015.

Appendix G Water Treatment Plant Drinking Water Works Permit

Ontario

DRINKING WATER WORKS PERMIT

Permit Number: 172-201
Issue Number: 3

Pursuant to the *Safe Drinking Water Act*, 2002, S.O. 2002, c. 32, and the regulations made thereunder and subject to the limitations thereof, I hereby issue this drinking water works permit under Part V of the *Safe Drinking Water Act*, 2002, S.O. 2002, c. 32 to:

The Corporation of the Town of Carleton Place

175 Bridge St.
Carleton Place
ON K7C 2V8

For the following municipal residential drinking water system:

Carleton Place Drinking Water System

This drinking water works permit includes the following:

Schedule	Description
Schedule A	Drinking Water System Description
Schedule B	General
Schedule C	All documents issued as Schedule C to this drinking water works permit which authorize alterations to the drinking water system
Schedule D	Process Flow Diagrams

Upon the effective date of this drinking water works permit # 172-201, all previously issued versions of permit # 172-201 are revoked and replaced by this permit.

DATED at TORONTO this 26th day of February, 2021

Signature

Aziz Ahmed, P.Eng.
Director
Part V, *Safe Drinking Water Act*, 2002

Schedule A: Drinking Water System Description

System Owner	**The Corporation of the Town of Carleton Place**
Permit Number	**172-201**
Drinking Water System Name	**Carleton Place Drinking Water System**
Permit Effective Date	**February 26, 2021**

1.0 System Description

1.1 The following is a summary description of the works comprising the above drinking water system:

Overview

The **Carleton Place Drinking Water System** consists of one drinking water treatment plant, one water tower, and approximately 47 kilometers of watermains ranging from 150 mm to 450 mm in diameter.

Carleton Place Water Treatment Plant

Treatment Plant

Name	Carleton Place Water Treatment Plant
Street Address	199 John Street
UTM Coordinates	NAD83: UTM Zone 18, 409580 m E, 4998500 m N
System Type	Surface Water Treatment Plant
Notes	A building housing the water treatment process equipment and components

Surface Water Supply

Intake Crib and Pipe

Description	One (1) 600 mm diameter raw water intake pipe which draws water from the Mississippi River, complete with an upturned elbow at the river end surrounded by a coarse screen
Notes	

Low Lift Works

Intake Well and Screens

Description	One (1) raw water intake well located in the plant building, a two-stage stainless steel coarse screen in the raw water well closest to the river upstream of the low lift pumps, and a screening basket in the raw water channel
Dimensions	Two-stage stainless steel coarse mesh screen with 6.35 mm x 6.35 mm openings
Notes	

Low Lift Pumps

Description	Four (4) vertical turbine low lift pumps located over the second raw water well inside the plant fed from intake well
Capacity	One (1) pump rated at 36.6 L/s at 7.3 m TDH
	One (1) pump rated at 57.9 L/s at 7.8 m TDH
	One (1) pump rated at 84.2 L/s at 7.8 m TDH
	One (1) pump rated at 110.5 L/s at 9.1 m TDH
Notes	A 400 mm diameter x 1.07 m long in-line static mixer on the low lift pump discharge common header

Coagulation/Flocculation/Sedimentation

Description	Two ballasted floc/clarification Actiflo® treatment trains operating in parallel
Equipment (on each train)	Each coagulation tank 1.97 m x 1.346 m x 3.223 m water depth with a working volume of 8.5 m^3 each; one 2 hp mixer per tank
	Each injection tank 1.97 m x 1.346 m x 3.223 m water depth with a working volume of 8.5 m^3 ; one 2 hp mixer per tank
	Each maturation tank 2.668 m x 3.0 m x 3.233 m water depth with a working volume of 25.8 m^3; one 3 hp variable speed mixer in each tank
	Each settling tank, complete with collection hopper, settling module (surface area of 6.25 m^2 per tank), three collection troughs per tank; maximum surface loading rate of 53.3 m/h
	Three (3) recirculation pumps (two duty and one standby) each capable of pumping 8 m^3/h at 15m TDH
Notes	With each train consisting of a coagulation tank, injection tank, maturation tank and settling tank, complete with microsand recirculation pumps and hydrocyclones to separate the microsand and the residuals

Filtration

Filters

Description	Three (3) cylindrical stainless steel double compartment dual media (sand/anthracite) gravity filters
Capacity	Filtration capacity of 27.8 L/s per filter cell (139 L/s total)
Notes	One (1) air scour blower for filter backwash operation
	Self-contained backwash storage compartments and automated backwash operations
	200 mm diameter filter-to-waste piping

Plant Residuals Management

Backwash Water Treatment System

Description	A two-compartment waste backwash water settling tank
Dimensions	Each compartment approximately 9.2 m x 2.65 m x 4.5 m deep
Equipment	Two (2) self-priming centrifugal sludge pumps, each capable of discharging 7.6 L/s at a TDH of 20 m, to pump sludge directly to the sanitary sewer
	Two (2) self-priming centrifugal supernatant pumps, each capable of discharging 7.6 L/s at a TDH of 8.5 m, to convey supernatant to a 600 mm gravity sewer leading to the Mississippi River via sewer
Notes	Filter backwash water (Actiflo residuals as well) to one or the other settling tank, or both
	Instrumentation to allow sludge to be removed on a timed cycle

Sludge Pumping Station

Description	A residual sludge pumping system
Dimensions	A 1.83 m by 1.83 m sludge wet well
Equipment	Two (2) submersible non-clog centrifugal type pumps, each having a rated capacity of 9.0 L/s at a TDH of 5.5 m, to discharge the sludge to the Lake Avenue gravity sewer
Notes	The sludge wet well receiving sludge streams from the Actiflo hydrocyclone process
	With a 100 mm diameter overflow drain pipe, connected to plant filter room backwash water trough

Clearwell and High Lift Works

Clearwell

Description	A two (2) cell underground storage reservoir which also serves as the high lift pump well, complete with one (1) self-priming centrifugal clearwell drain pump
Dimensions	A total treated water storage volume of approximately 3,180 m^3
Notes	• The clearwell drain pump rated at 7.3 L/s at a TDH of 6.1 m, discharging into the backwash water setting tank. • Providing chlorine disinfection contact time.

High Lift Pumps

Description	Four (4) vertical turbine high lift pumps
Equipment	One (1) pump rated at 36.8 L/s at a TDH of 52.5 m
	One (1) pump rated at 57.9 L/s at a TDH of 51.2 m
	One (1) pump rated at 100 L/s at a TDH of 52.5 m
	One (1) pump rated at 136.8 L/s at a TDH of 56 m
Notes	

Chemical Addition

Coagulant

Description	Coagulant feed system
Feed Point	On the low lift pump discharge common header prior to the in-line static mixer
Equipment	Three (3) 6,950 litre chemical storage tanks complete with secondary containment
	One (1) 6,210 litre coagulant storage tank (1.52 m diameter, 3.4 m high), with double wall configuration and a leak detector between the two walls
	Two (2) chemical metering pumps each capable of pumping coagulant at rates varying between 120 litres/day and 2,040 litres/day
Notes	A 370 mm high concrete containment curb at coagulant tank area; with one leak detector within the containment area

Polyelectrolyte Storage and Feed System

Description	Polyelectrolyte storage and feed system
Feed Point	Injected to the injection tanks and the maturation tanks
Equipment	One (1) 2,250 litre capacity mixing tank, complete with mixer, water supply system and eductor
	Two (2) polymer solution storage tanks each with a capacity of 2,270 litres
	Four (4) chemical metering pumps each capable of pumping polymer solution at rates varying between 240 litres/day and 1,440 litres/day
Notes	A spill channelling wall around the polymer mix tank in the Chemical Room on the ground floor connected through a 75 mm diameter drain line down to the basement polymer containment area
	300 mm high concrete containment curb at basement polymer day tank area

Lime

Description	Lime feed system
Feed Point	Post filter
Equipment	A volumetric feed, slurry tank with mixer and eductor system capable of automatically preparing and feeding lime solution at rates varying from 30 kg/day to 500 kg/day
Notes	Lime feed is brought into service as required

Chlorine

Description	Chlorine disinfection system
Feed Point	One chlorinator designated for post-filtration chlorination
	One chlorinator designated for pre-chlorination and application at raw water intake for zebra mussel control and with capabilities for standby post-filtration chlorination
Equipment	Two (2) 227 kg/day vacuum chlorinators
	Two (2) 907 kg cylinders with one set of 227 kg/day automatic switchover regulators
Notes	

Aqueous Ammonia

Description	Aqueous ammonia feed system
Feed Point	Convey aqueous ammonia to the treated water line
Equipment	Two (2) chemical metering pumps, each capable of pumping aqueous ammonia at rates varying between 5 litres/day and 10 litres/day
	Sufficient storage for three (3) 205 litre containers, including secondary containment and electronic weigh scale for one drum
Notes	This system has never been activated

Hydrofluosilicic Acid

Description	Fluoridation system
Feed Point	Post filter
Equipment	Supplier supplied drums complete with secondary containment
	A transfer pump to connect the bulk storage tank to a day tank
	A day tank, complete with scale and secondary containment
	Two (2) chemical metering pumps (one duty and one standby)
Notes	

Emergency Power

Backup Power Supply

Description	A 375 kW standby Diesel generator set
Notes	Two (2) diesel fuel tanks complete with secondary containment

Elevated Storage Tanks

Carleton Place Water tower

Location	265 Nelson Street, Carleton Place
Dimensions	Total Volume of 3,180 m^3
Equipment	One (1) chemical metering pump capable of delivering sodium hypochlorite solution at a rate of 3.6 L/h
	One (1) 100 L capacity sodium hypochlorite solution tank, complete with secondary containment
Notes	

Instrumentation and Control

Regulatory Monitoring

Description	Process control and monitoring equipment for Carleton Place Drinking Water System
Notes	System control with data acquisition including various in-line analyzers and monitors

Fuel Oil Systems

Carleton Place Water Plant

Location **(UTM Coordinates)**	Carleton Place Water Plant
Description	Two (2) diesel fuel tanks complete with secondary containment
Fuel Type	Diesel
Source Protection Area	Mississippi – Rideau Source Protection Plan
Notes	

Watermains

1.1 Watermains within the distribution system comprise:

1.1.1 Watermains that have been set out in each document or file identified in column 1 of Table 1.

Table 1: Watermains

Column 1 Document or File Name	Column 2 Date
Town of Carleton Place, Water Distribution System	December 16, 2019

1.1.2 Watermains that have been added, modified, replaced or extended further to the provisions of Schedule C of this drinking water works permit on or after the date identified in column 2 of Table 1 for each document or file identified in column 1.

1.1.3 Watermains that have been added, modified, replaced or extended further to an authorization by the Director on or after the date identified in column 2 of Table 1 for each document or file identified in column 1.

Schedule B: General

System Owner	**The Corporation of the Town of Carleton Place**
Permit Number	**172-201**
Drinking Water System Name	**Carleton Place Drinking Water System**
Permit Effective Date	**February 26, 2021**

1.0 Applicability

1.1 In addition to any other applicable legal requirements, the drinking water system identified above shall be altered and operated in accordance with the conditions of this drinking water works permit and the licence #172-101.

1.2 The definitions and conditions of licence #172-101 are incorporated into this permit and also apply to this drinking water system.

2.0 Alterations to the Drinking Water System

2.1 Any document issued by the Director to be incorporated into Schedule C to this drinking water works permit shall provide authority to alter the drinking water system in accordance with the applicable conditions of this drinking water works permit and licence #172-101.

2.2 All documents issued by the Director as described in condition 2.1 shall form part of this drinking water works permit.

2.3 All parts of the drinking water system in contact with drinking water that are added, modified, replaced, extended shall be disinfected in accordance with a procedure approved by the Director or in accordance with the applicable provisions of the following documents:

a) Until July 31, 2021, the ministry's Watermain Disinfection Procedure, dated November 2015, as of August 1, 2021, the ministry's Watermain Disinfection Procedure, dated August 1, 2020;
b) Subject to condition 2.3.2, any updated version of the ministry's Watermain Disinfection Procedure;
c) AWWA C652 – Standard for Disinfection of Water-Storage Facilities;
d) AWWA C653 – Standard for Disinfection of Water Treatment Plants; and
e) AWWA C654 – Standard for Disinfection of Wells.

1.0 For greater clarity, where an activity has occurred that could introduce contamination, including but not limited to repair, maintenance, or physical / video inspection, all equipment that may come in contact with the drinking water system shall be disinfected in accordance with the requirements of condition 2.3. above.

2.3.2 Updated requirements described in condition 2.3 b) are effective six months from the date of publication of the updated Watermain Disinfection Procedure.

2.4 The owner shall notify the Director in writing within thirty (30) days of the placing into service or the completion of any addition, modification, replacement, removal or extension of the drinking water system which had been authorized through:

2.4.1 Schedule B to this drinking water works permit which would require an alteration of the description of a drinking water system component described in Schedule A of this drinking water works permit;

2.4.2 Any document to be incorporated in Schedule C to this drinking water works permit respecting works other than watermains; or

2.4.3 Any approval issued prior to the issue date of the first drinking water works permit respecting works other than watermains which were not in service at the time of the issuance of the first drinking water works permit.

2.5 The notification required in condition 2.4 shall be submitted using the "Director Notification Form" published by the Ministry.

2.6 For greater certainty, the notification requirements set out in condition 2.4 do not apply to any addition, modification, replacement, removal or extension in respect of the drinking water system which:

2.6.1 Is exempt from subsection 31(1) of the SDWA by subsection 9.(2) of O. Reg. 170/03;

2.6.2 Constitutes maintenance or repair of the drinking water system; or

2.6.3 Is a watermain authorized by condition 3.1 of Schedule B of this drinking water works permit.

2.7 The owner shall notify the legal owner of any part of the drinking water system that is prescribed as a municipal drinking water system by section 2 of O. Reg. 172/03 of the requirements of the licence and this drinking water works permit as applicable to the prescribed system.

2.8 For greater certainty, the owner may only carry out alterations to the drinking water system in accordance with this drinking water works permit after having satisfied other applicable legal obligations, including those arising from the *Environmental Assessment Act*, *Niagara Escarpment Planning and Development Act*, *Oak Ridges Moraine Conservation Act, 2001* and *Greenbelt Act, 2005*.

3.0 Watermain Additions, Modifications, Replacements and Extensions

3.1 The owner may alter the drinking water system, or permit it to be altered by a person acting on the owner's behalf, by adding, modifying, replacing or extending a watermain within the distribution system subject to the following conditions:

3.1.1 The design of the watermain addition, modification, replacement or extension:

a) Has been prepared by a licensed engineering practitioner;

b) Has been designed only to transmit water and has not been designed to treat water;

c) Satisfies the design criteria set out in the Ministry publication "Watermain Design Criteria for Future Alterations Authorized under a Drinking Water Works Permit – June 2012", as amended from time to time; and

d) Is consistent with or otherwise addresses the design objectives contained within the Ministry publication "Design Guidelines for Drinking Water Systems, 2008", as amended from time to time.

3.1.2 The maximum demand for water exerted by consumers who are serviced by the addition, modification, replacement or extension of the watermain will not result in an exceedance of the rated capacity of a treatment subsystem or the maximum flow rate for a treatment subsystem component as specified in the licence, or the creation of adverse conditions within the drinking water system.

3.1.3 The watermain addition, modification, replacement or extension will not adversely affect the distribution system's ability to maintain a minimum pressure of 140 kPa at ground level at all points in the distribution system under maximum day demand plus fire flow conditions.

3.1.4 Secondary disinfection will be provided to water within the added, modified, replaced or extended watermain to meet the requirements of O. Reg. 170/03.

3.1.5 The watermain addition, modification, replacement or extension is wholly located within the municipal boundary over which the owner has jurisdiction.

3.1.6 The owner of the drinking water system consents in writing to the watermain addition, modification, replacement or extension.

3.1.7 A licensed engineering practitioner has verified in writing that the watermain addition, modification, replacement or extension meets the requirements of condition 3.1.1.

3.1.8 The owner of the drinking water system has verified in writing that the watermain addition, modification, replacement or extension meets the requirements of conditions 3.1.2 to 3.1.6.

3.2 The authorization for the addition, modification, replacement or extension of a watermain provided for in condition 3.1 does not include the addition, modification, replacement or extension of a watermain that:

3.2.1 Passes under or through a body of surface water, unless trenchless construction methods are used;

3.2.2 Has a nominal diameter greater than 750 mm;

3.2.3 Results in the fragmentation of the drinking water system; or

3.2.4 Connects to another drinking water system, unless:

a) Prior to construction, the owner of the drinking water system seeking the connection obtains written consent from the owner or owner's delegate of the drinking water system being connected to; and

b) The owner of the drinking water system seeking the connection retains a copy of the written consent from the owner or owner's delegate of the drinking water system being connected to as part of the record that is recorded and retained under condition 3.3.

3.3 The verifications required in conditions 3.1.7 and 3.1.8 shall be:

3.3.1 Recorded on "Form 1 – Record of Watermains Authorized as a Future Alteration", as published by the Ministry, prior to the watermain addition, modification, replacement or extension being placed into service; and

3.3.2 Retained for a period of ten (10) years by the owner.

3.4 For greater certainty, the verification requirements set out in condition 3.3 do not apply to any addition, modification, replacement or extension in respect of the drinking water system which:

3.4.1 Is exempt from subsection 31(1) of the SDWA by subsection 9.(2) of O. Reg. 170/03; or

3.4.2 Constitutes maintenance or repair of the drinking water system.

3.5 The document or file referenced in Column 1 of Table 1 of Schedule A of this drinking water works permit that sets out watermains shall be retained by the owner and shall be updated to include watermain additions, modifications, replacements and extensions within 12 months of the addition, modification, replacement or extension.

3.6 The updates required by condition 3.5 shall include watermain location relative to named streets or easements and watermain diameter.

3.7 Despite clause (a) of condition 3.1.1 and condition 3.1.7, with respect to the replacement of an existing watermain or section of watermain that is 6.1 meters in length or less, if a licensed engineering practitioner has:

3.7.1 inspected the replacement prior to it being put into service;

3.7.2 prepared a report confirming that the replacement satisfies clauses (b), (c) and (d) of condition 3.1.1 (i.e. "Form 1 – Record of Watermains Authorized by a Future Alteration" (Form 1), Part 3, items No. 2, 3 and 4); and

3.7.3 appended the report referred to in condition 3.7.2 to the completed Form 1,

the replacement is exempt from the requirements that the design of the replacement be prepared by a licensed engineering practitioner and that a licensed engineering practitioner verify on Form 1, Part 3, item No. 1 that a licensed engineering practitioner prepared the design of the replacement.

3.8 For greater certainty, the exemption in condition 3.7 does not apply to the replacement of an existing watermain or section of watermain if two or more sections of pipe, each of which is 6.1 meters in length or less, are joined together, if the total length of replacement pipes joined together is greater than 6.1 meters.

4.0 Minor Modifications to the Drinking Water System

4.1 The drinking water system may be altered by adding, modifying or replacing the following components in the drinking water system:

4.1.1 Coagulant feed systems in the treatment system, including the location and number of dosing points:

a) Prior to making any alteration to the drinking water system under condition 4.1.1, the owner shall undertake a review of the impacts that the alteration might have on corrosion control or other treatment processes; and

b) The owner shall notify the Director in writing within thirty (30) days of any alteration made under condition 4.1.1 and shall provide the Director with a copy of the review.

c) The notification required in condition 4.1.1 b) shall be submitted using the “Director Notification Form” published by the Ministry

4.1.2 Instrumentation and controls, including new SCADA systems and upgrades to SCADA system hardware;

4.1.3 SCADA system software or programming that:

a) Measures, monitors or reports on a regulated parameter;
b) Measures, monitor or reports on a parameter that is used to calculate CT; or,
c) Calculates CT for the system or is part of the process algorithm that calculates log removal, where the impacts of addition, modification or replacement have been reviewed by a licensed engineering practitioner;

4.1.4 Filter media, backwashing equipment, filter troughs, and under-drains and associated equipment in the treatment system;

4.1.5 Spill containment works; or,

4.1.6 Coarse screens and fine screens

4.2 The drinking water system may be altered by adding, modifying, replacing or removing the following components in the drinking water system:

4.2.1 Treated water pumps, pressure tanks, and associated equipment;

4.2.2 Raw water pumps and process pumps in the treatment system;

4.2.3 Inline booster pumping stations that are not associated with distribution system storage facilities and are on a watermain with a nominal diameter not exceeding 200 mm;

4.2.4 Re-circulation devices within distribution system storage facilities;

4.2.5 In-line mixing equipment;

4.2.6 Chemical metering pumps and chemical handling pumps;

4.2.7 Chemical storage tanks (excluding fuel storage tanks) and associated equipment; or,

4.2.8 Measuring and monitoring devices that are not required by regulation, by a condition in the Drinking Water Works Permit, or by a condition otherwise imposed by the Ministry.

4.2.9 Chemical injection points.

4.2.10 Valves;

4.3 The drinking water system may be altered by replacing the following:

4.3.1 Raw water piping, treatment process piping or treated water piping within the treatment subsystem;

4.3.2 Measuring and monitoring devices that are required by regulation, by a condition in the Drinking Water Works Permit or by a condition otherwise imposed by the Ministry.

4.3.3 Coagulants and pH adjustment chemicals, where the replacement chemicals perform the same function;

a) Prior to making any alteration to the drinking water system under condition 4.3.3, the owner shall undertake a review of the impacts that the alteration might have on corrosion control or other treatment processes; and

b) The owner shall notify the Director in writing within thirty (30) days of any alteration made under condition 4.3.3 and shall provide the Director with a copy of the review.

c) The notification required in condition 4.3.3 b) shall be submitted using the "Director Notification Form" published by the Ministry

4.4 Any alteration of the drinking water system made under conditions 4.1, 4.2 or 4.3 shall not result in:

4.4.1 An exceedance of a treatment subsystem rated capacity or a treatment subsystem component maximum flow rate as specified in the licence;

4.4.2 The bypassing or removal of any unit process within a treatment subsystem;

4.4.3 The addition of any new unit process other than coagulation within a treatment subsystem;

4.4.4 A deterioration in the quality of drinking water provided to consumers;

4.4.5 A reduction in the reliability or redundancy of any component of the drinking water system;

4.4.6 A negative impact on the ability to undertake compliance and other monitoring necessary for the operation of the drinking water system; or

4.4.7 An adverse effect on the environment.

4.5 The owner shall verify in writing that any addition, modification, replacement or removal of drinking water system components in accordance with conditions 4.1, 4.2 or 4.3 has met the requirements of the conditions listed in condition 4.4.

4.6 The verifications and documentation required in condition 4.5 shall be:

4.6.1 Recorded on “Form 2 – Record of Minor Modifications or Replacements to the Drinking Water System” published by the Ministry, prior to the modified or replaced components being placed into service; and

4.6.2 Retained for a period of ten (10) years by the owner.

4.7 For greater certainty, the verification requirements set out in conditions 4.5 and 4.6 do not apply to any addition, modification, replacement or removal in respect of the drinking water system which:

4.7.1 Is exempt from subsection 31(1) of the SDWA by subsection 9.(2) of O. Reg. 170/03; or

4.7.2 Constitutes maintenance or repair of the drinking water system, including software changes to a SCADA system that are not listed in condition 4.1.3

4.8 The owner shall update any drawings maintained for the drinking water system to reflect the modification or replacement of the works, where applicable.

5.0 Equipment with Emissions to the Air

5.1 The drinking water system may be altered by adding, modifying or replacing any of the following drinking water system components that may discharge or alter the rate or manner of a discharge of a compound of concern to the air:

5.1.1 Any equipment, apparatus, mechanism or thing that is used for the transfer of outdoor air into a building or structure that is not a cooling tower;

5.1.2 Any equipment, apparatus, mechanism or thing that is used for the transfer of indoor air out of a space used for the production, processing, repair, maintenance or storage of goods or materials, including chemical storage;

5.1.3 Laboratory fume hoods used for drinking water testing, quality control and quality assurance purposes;

5.1.4 Low temperature handling of compounds with a vapor pressure of less than 1 kilopascal;

5.1.5 Maintenance welding stations;

5.1.6 Minor painting operations used for maintenance purposes;

5.1.7 Parts washers for maintenance shops;

5.1.8 Emergency chlorine and ammonia gas scrubbers and absorbers;

5.1.9 Venting for activated carbon units for drinking water taste and odour control;

5.1.10 Venting for a stripping unit for methane removal from a groundwater supply;

5.1.11 Venting for an ozone treatment unit;

5.1.12 Natural gas or propane fired boilers, water heaters, space heaters and make-up air units with a total facility-wide heat input rating of less than 20 million kilojoules per hour, and with an individual fuel energy input of less than or equal to 10.5 gigajoules per hour; or

5.1.13 Emergency generators that fire No. 2 fuel oil (diesel fuel) with a sulphur content of 0.5 per cent or less measured by weight, natural gas, propane, gasoline or biofuel, and that are used for emergency duty only with periodic testing.

5.2 The owner shall not make an addition, modification, or replacement described in condition 5.1 in relation to an activity that is not related to the treatment and/or distribution of drinking water.

5.3 The emergency generators identified in condition 5.1.13 shall not be used for non-emergency purposes including the generation of electricity for sale or for peak shaving purposes.

5.4 The owner shall prepare an emission summary table for nitrogen oxides emissions only, for each addition, modification or replacement of emergency generators identified in condition 5.1.13.

Performance Limits

5.5 The owner shall ensure that a drinking water system component identified in conditions 5.1.1 to 5.1.13 is operated at all times to comply with the following limits:

5.5.1 For equipment other than emergency generators, the maximum concentration of any compound of concern at a point of impingement shall not exceed the corresponding point of impingement limit;

5.5.2 For emergency generators, the maximum concentration of nitrogen oxides at sensitive receptors shall not exceed the applicable point of impingement limit, and at non-sensitive receptors shall not exceed the Ministry half-hourly screening level of 1880 ug/m^3 as amended; and

5.5.3 The noise emissions comply at all times with the limits set out in publication NPC-300, as applicable.

5.6 The owner shall verify in writing that any addition, modification or replacement of works in accordance with condition 5.1 has met the requirements of the conditions listed in condition 5.5.

5.7 The owner shall document how compliance with the performance limits outlined in condition 5.5.3 is being achieved, through noise abatement equipment and/or operational procedures.

5.8 The verifications and documentation required in conditions 5.6 and 5.7 shall be:

5.8.1 Recorded on "Form 3 – Record of Addition, Modification or Replacement of Equipment Discharging a Contaminant of Concern to the Atmosphere", as published by the Ministry, prior to the additional, modified or replacement equipment being placed into service; and

5.8.2 Retained for a period of ten (10) years by the owner.

5.9 For greater certainty, the verification and documentation requirements set out in conditions 5.6 and 5.8 do not apply to any addition, modification or replacement in respect of the drinking water system which:

5.9.1 Is exempt from subsection 31(1) of the SDWA by subsection 9.(2) of O. Reg. 170/03; or

5.9.2 Constitutes maintenance or repair of the drinking water system.

5.10 The owner shall update any drawings maintained for the works to reflect the addition, modification or replacement of the works, where applicable.

6.0 Previously Approved Works

6.1 The owner may add, modify, replace or extend, and operate part of a municipal drinking water system if:

6.1.1 An approval was issued after January 1, 2004 under section 36 of the SDWA in respect of the addition, modification, replacement or extension and operation of that part of the municipal drinking water system;

6.1.2 The approval expired by virtue of subsection 36(4) of the SDWA; and

6.1.3 The addition, modification, replacement or extension commenced within five years of the date that activity was approved by the expired approval.

7.0 System-Specific Conditions

7.1 Not applicable

8.0 Source Protection

8.1 Not applicable

Schedule C: Authorization to Alter the Drinking Water System

System Owner	**The Corporation of the Town of Carleton Place**
Permit Number	**172-201**
Drinking Water System Name	**Carleton Place Drinking Water System**
Permit Effective Date	**February 26, 2021**

1.0 General

1.1 Table 2 provides a reference list of all documents to be incorporated into Schedule C that have been issued as of the date that this permit was issued.

1.1.1 Table 2 is not intended to be a comprehensive list of all documents that are part of Schedule C. For clarity, any document issued by the Director to be incorporated into Schedule C after this permit has been issued is considered part of this drinking water works permit.

Table 2: Schedule C Documents

Column 1 Issue #	Column 2 Issued Date	Column 3 Description	Column 4 Status	Column 5 DN#
NA	NA	NA	NA	NA

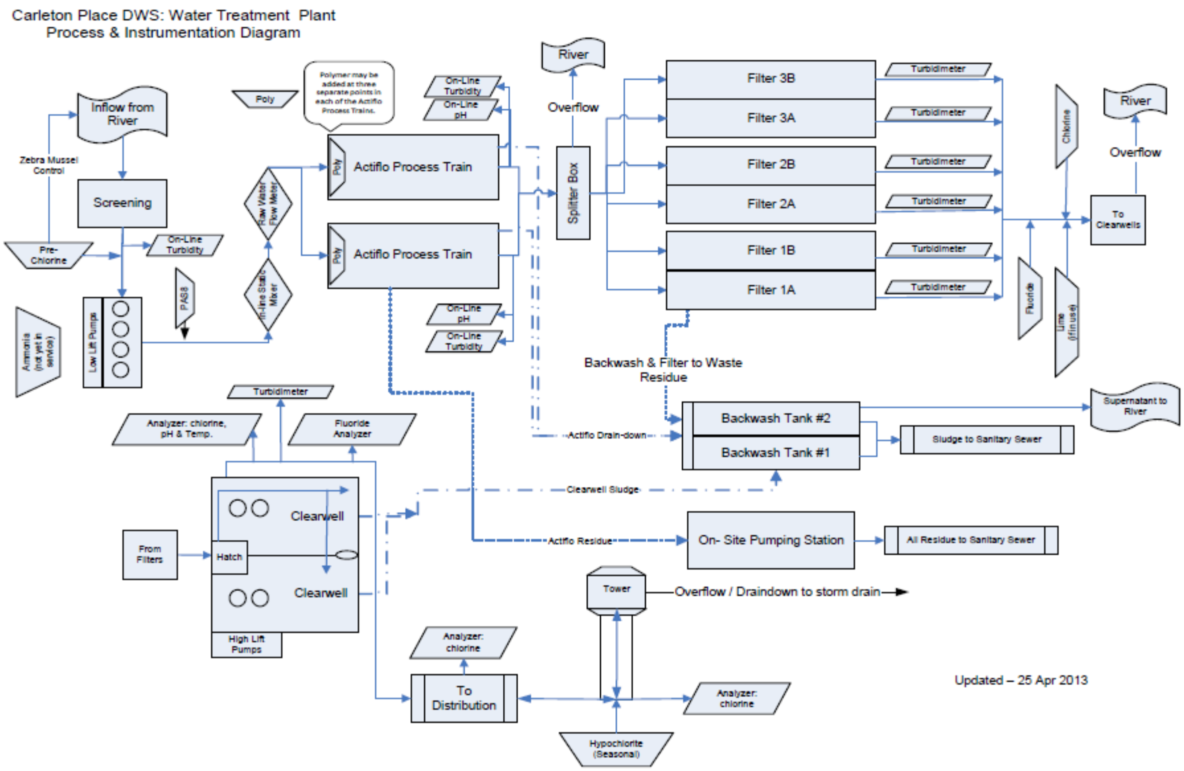
1.2 For each document described in columns 1, 2 and 3 of Table 2, the status of the document is indicated in column 4. Where this status is listed as 'Archived', the approved alterations have been completed and relevant portions of this permit have been updated to reflect the altered works. These 'Archived' Schedule C documents remain as a record of the alterations.

Schedule D: Process Flow Diagrams

System Owner	**The Corporation of the Town of Carleton Place**
Permit Number	**172-201**
Drinking Water System Name	**Carleton Place Drinking Water System**
Permit Effective Date	**February 26, 2021**

2.0 Process Flow Diagrams

Carleton Place Water Treatment Plant



[Source: Operational Plans for the Carleton Place Drinking Water System, August 28, 2018]

Note: this process flow diagram is for reference only, and represents a high level overview of the system as of September 2, 2020.

Appendix H Water Treatment Plant Drinking Water License

Ontario

MUNICIPAL DRINKING WATER LICENCE

Licence Number: 172-101
Issue Number: 3

Pursuant to the *Safe Drinking Water Act*, 2002, S.O. 2002, c. 32, and the regulations made thereunder and subject to the limitations thereof, I hereby issue this municipal drinking water licence under Part V of the *Safe Drinking Water Act*, 2002, S.O. 2002, c. 32 to:

The Corporation of the Town of Carleton Place

175 Bridge St.
Carleton Place
ON K7C 2V8

For the following municipal residential drinking water system:

Carleton Place Drinking Water System

This municipal drinking water licence includes the following:

Schedule	Description
Schedule A	Drinking Water System Information
Schedule B	General Conditions
Schedule C	System-Specific Conditions
Schedule D	Conditions for Relief from Regulatory Requirements
Schedule E	Pathogen Log Removal/Inactivation Credits

Upon the effective date of this drinking water licence # 172-101, all previously issued versions of licence # 172-101 are revoked and replaced by this licence.

DATED at TORONTO this 26th day of February, 2021

Signature

Aziz Ahmed, P.Eng.
Director
Part V, *Safe Drinking Water Act*, 2002

Schedule A: Drinking Water System Information

System Owner	**The Corporation of the Town of Carleton Place**
Licence Number	**172-101**
Drinking Water System Name	**Carleton Place Drinking Water System**
Licence Effective Date	**February 26, 2021**

1.0 Licence Information

Licence Issue Date	2021-02-26
Licence Effective Date	2021-02-26
Licence Expiry Date	2026-02-25
Application for Licence Renewal Date	2025-08-25

2.0 Incorporated Documents

The following documents are applicable to the above drinking water system and form part of this licence:

2.1 Drinking Water Works Permit

Drinking Water System Name	Permit Number	Issue Date
Carleton Place Drinking Water System	172-201	2021-02-26

2.2 Permits to Take Water

Water Taking Location	Permit Number	Issue Date
The Mississippi River	1310-9UHPPW	March 13, 2015

2.3 Other Documents

Document Title	Version Number	Version Date
Not applicable	Not applicable	Not applicable

3.0 Financial Plans

The Financial Plan Number for the Financial Plan required to be developed for this drinking water system in accordance with O. Reg. 453/07 shall be:	172-301
Alternately, if one Financial Plan is developed for all drinking water systems owned by the owner, the Financial Plan Number shall be:	172-301A

4.0 Accredited Operating Authority

Drinking Water System or Operational Subsystems	Accredited Operating Authority	Operational Plan No.	Operating Authority No.
Carleton Place Distribution System	The Corporation of the Town of Carleton Place	172-401A	172-OA1
Carleton Place Water Treatment Plant	Ontario Clean Water Agency	172-401B	172-OA2

Schedule B: General Conditions

System Owner	**The Corporation of the Town of Carleton Place**
Licence Number	**172-101**
Drinking Water System Name	**Carleton Place Drinking Water System**
Licence Effective Date	**February 26, 2021**

1.0 Definitions

1.1 Words and phrases not defined in this licence and the associated drinking water works permit shall be given the same meaning as those set out in the SDWA and any regulations made in accordance with that act, unless the context requires otherwise.

1.2 In this licence and the associated drinking water works permit:

"**adverse effect**", "**contaminant**" and "**natural environment**" shall have the same meanings as in the EPA;

"**alteration**" may include the following in respect of this drinking water system:

(a) An addition to the system,
(b) A modification of the system,
(c) A replacement of part of the system, and
(d) An extension of the system;

"**compound of concern**" means a contaminant described in paragraph 4 subsection 26 (1) of O. Reg. 419/05, namely, a contaminant that is discharged to the air from a component of the drinking water system in an amount that is not negligible;

"CT" means the CT Disinfection Concept, as described in subsection 3.1.1 of the Ministry's Procedure for Disinfection of Drinking Water in Ontario, dated July 29, 2016.

"**Director**" means a Director appointed pursuant to section 6 of the SDWA for the purposes of Part V of the SDWA;

"**drinking water works permit**" means the drinking water works permit for the drinking water system, as identified in Schedule A of this licence and as amended from time to time;

"emission summary table" means a table described in paragraph 14 of subsection 26 (1) of O. Reg. 419/05;

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

"**financial plan**" means the financial plan required by O. Reg. 453/07;

"Harmful Algal Bloom (HAB)" means an overgrowth of aquatic algal bacteria that produce or have the potential to produce toxins in the surrounding water, when the algal cells are damaged or die. Such bacteria are harmful to people and animals and include microcystins produced by cyanobacterial blooms.

"**licence**" means this municipal drinking water licence for the municipal drinking water system identified in Schedule A of this licence;

"Ministry" means the Ontario Ministry of the Environment, Conservation and Parks;

"**operational plan**" means an operational plan developed in accordance with the Director's Directions – Minimum Requirements for Operational Plans made under the authority of subsection 15(1) of the SDWA;

"**owner**" means the owner of the drinking water system as identified in Schedule A of this licence;

"OWRA" means the *Ontario Water Resources Act*, R.S.O. 1990, c. 0.40;

"**permit to take water**" means the permit to take water that is associated with the taking of water for purposes of the operation of the drinking water system, as identified in Schedule A of this licence and as amended from time to time;

"**point of impingement**" has the same meaning as in section 2 of O. Reg. 419/05 under the EPA;

"**point of impingement limit**" means the appropriate standard from Schedule 2 or 3 of O. Reg. 419/05 under the EPA and if a standard is not provided for a compound of concern, the concentration set out for the compound of concern in the document titled "Air Contaminants Benchmarks (ACB) List: Standards, guidelines and screening levels for assessing point of impingement concentrations of air contaminants", as amended from time to time and published by the Ministry and available on a government of Ontario website;

"**licensed engineering practitioner**" means a person who holds a licence, limited licence or temporary licence under the Professional Engineers Act;

"**provincial officer**" means a provincial officer designated pursuant to section 8 of the SDWA;

"**publication NPC-300**" means the Ministry publication titled "Environmental Noise Guideline: Stationary and Transportation Sources – Approval and Planning" dated August 2013, as amended;

"**SCADA system**" means a supervisory control and data acquisition system used for process monitoring, automation, recording and/or reporting within the drinking water system;

"**SDWA**" means the *Safe Drinking Water* Act, 2002, S.O. 2002, c. 32;

“**sensitive receptor**” means any location where routine or normal activities occurring at reasonably expected times would experience adverse effect(s) from a discharge to air from an emergency generator that is a component of the drinking water system, including one or a combination of:

(a) private residences or public facilities where people sleep (e.g.: single and multi-unit dwellings, nursing homes, hospitals, trailer parks, camping grounds, etc.),
(b) institutional facilities (e.g.: schools, churches, community centres, day care centres, recreational centres, etc.),
(c) outdoor public recreational areas (e.g.: trailer parks, play grounds, picnic areas, etc.), and
(d) other outdoor public areas where there are continuous human activities (e.g.: commercial plazas and office buildings).

“**sub-system**” has the same meaning as in Ontario Regulation 128/04 (Certification of Drinking Water System Operators and Water Quality Analysts) under the SDWA;

“**surface water**” means water bodies (lakes, wetlands, ponds - including dug-outs), water courses (rivers, streams, water-filled drainage ditches), infiltration trenches, and areas of seasonal wetlands;

"UV" means ultraviolet, as in ultraviolet light produced from an ultraviolet reactor.

2.0 Applicability

2.1 In addition to any other applicable legal requirements, the drinking water system identified above shall be established, altered and operated in accordance with the conditions of the drinking water works permit and this licence.

3.0 Licence Expiry

3.1 This licence expires on the date identified as the licence expiry date in Schedule A of this licence.

4.0 Licence Renewal

4.1 Any application to renew this licence shall be made on or before the date identified as the application for licence renewal date set out in Schedule A of this licence.

5.0 Compliance

5.1 The owner and operating authority shall ensure that any person authorized to carry out work on or to operate any aspect of the drinking water system has been informed of the SDWA, all applicable regulations made in accordance with that act, the drinking water works permit and this licence and shall take all reasonable measures to ensure any such person complies with the same.

6.0 Licence and Drinking Water Works Permit Availability

6.1 At least one copy of this licence and the drinking water works permit shall be stored in such a manner that they are readily viewable by all persons involved in the operation of the drinking water system.

7.0 Permit to Take Water and Drinking Water Works Permit

7.1 A permit to take water identified in Schedule A of this licence is the applicable permit on the date identified as the Effective Date of this licence.

7.2 A drinking water works permit identified in Schedule A of this licence is the applicable permit on the date identified as the Effective Date of this licence.

8.0 Financial Plan

8.1 For every financial plan prepared in accordance with subsections 2(1) and 3(1) of O. Reg. 453/07, the owner of the drinking water system shall:

8.1.1 Ensure that the financial plan contains on the front page of the financial plan, the appropriate financial plan number as set out in Schedule A of this licence; and

8.1.2 Submit a copy of the financial plan to the Ministry of Municipal Affairs and Housing within three (3) months of receiving approval by a resolution of municipal council or the governing body of the owner.

9.0 Interpretation

9.1 Where there is a conflict between the provisions of this licence and any other document, the following hierarchy shall be used to determine the provision that takes precedence:

9.1.1 The SDWA*;*

9.1.2 A condition imposed in this licence that explicitly overrides a prescribed regulatory requirement;

9.1.3 A condition imposed in the drinking water works permit that explicitly overrides a prescribed regulatory requirement;

9.1.4 Any regulation made under the SDWA;

9.1.5 Any provision of this licence that does not explicitly override a prescribed regulatory requirement;

9.1.6 Any provision of the drinking water works permit that does not explicitly override a prescribed regulatory requirement;

9.1.7 Any application documents listed in this licence, or the drinking water works permit from the most recent to the earliest; and

9.1.8 All other documents listed in this licence, or the drinking water works permit from the most recent to the earliest.

9.1.9 Any other technical bulletin or procedure issued by the Ministry from the most recent to the earliest.

9.2 If any requirement of this licence or the drinking water works permit is found to be invalid by a court of competent jurisdiction, the remaining requirements of this licence and the drinking water works permit shall continue to apply.

9.3 The issuance of and compliance with the conditions of this licence and the drinking water works permit does not:

9.3.1 Relieve any person of any obligation to comply with any provision of any applicable statute, regulation or other legal requirement, including the *Environmental Assessment Act*, R.S.O. 1990, c. E.18; and

9.3.2 Limit in any way the authority of the appointed Directors and provincial officers of the Ministry to require certain steps be taken or to require the owner to furnish any further information related to compliance with the conditions of this licence or the drinking water works permit.

9.4 For greater certainty, nothing in this licence or the drinking water works permit shall be read to provide relief from regulatory requirements in accordance with section 46 of the SDWA, except as expressly provided in the licence or the drinking water works permit.

10.0 Adverse Effects

10.1 Nothing in this licence or the drinking water works permit shall be read as to permit:

10.1.1 The discharge of a contaminant into the natural environment that causes or is likely to cause an adverse effect; or

10.1.2 The discharge of any material of any kind into or in any waters or on any shore or bank thereof or into or in any place that may impair the quality of the water of any waters.

10.2 All reasonable steps shall be taken to minimize and ameliorate any adverse effect on the natural environment or impairment of the quality of water of any waters resulting from the operation of the drinking water system including such accelerated or additional monitoring as may be necessary to determine the nature and extent of the effect or impairment.

10.3 Fulfillment of one or more conditions imposed by this licence or the drinking water works permit does not eliminate the requirement to fulfill any other condition of this licence or the drinking water works permit.

11.0 Change of Owner or Operating Authority

11.1 This licence is not transferable without the prior written consent of the Director.

11.2 The owner shall notify the Director in writing at least 30 days prior to a change of any operating authority identified in Schedule A of this licence.

11.2.1 Where the change of operating authority is the result of an emergency situation, the owner shall notify the Director in writing of the change as soon as practicable.

12.0 Information to be Provided

12.1 Any information requested by a Director or a provincial officer concerning the drinking water system and its operation, including but not limited to any records required to be kept by this licence or the drinking water works permit, shall be provided upon request.

13.0 Records Retention

13.1 Except as otherwise required in this licence or the drinking water works permit, any records required by or created in accordance with this licence or the drinking water works permit, other than the records specifically referenced in section 12 or section 13 of O. Reg. 170/03, shall be retained for at least 5 years and made available for inspection by a provincial officer, upon request.

14.0 Chemicals and Materials

14.1 All chemicals and materials used in the alteration or operation of the drinking water system that come into contact with water within the system shall meet all applicable standards set by both the American Water Works Association ("AWWA") and the American National Standards Institute ("ANSI") safety criteria standards NSF/60, NSF/61 and NSF/372.

14.1.1 In the event that the standards are updated, the owner may request authorization from the Director to use any on hand chemicals and materials that previously met the applicable standards.

14.2 The most current chemical and material product registration documentation from a testing institution accredited by either the Standards Council of Canada or by the American National Standards Institution ("ANSI") shall be available at all times for each chemical and material used in the operation of the drinking water system that comes into contact with water within the system.

14.3 Conditions 14.1 and 14.2 do not apply in the case of the following:

14.3.1 Water pipe and pipe fittings meeting AWWA specifications made from ductile iron, cast iron, PVC, fibre and/or steel wire reinforced cement pipe or high density polyethylene (HDPE);

14.3.2 Articles made from stainless steel, glass, HDPE or Teflon®;

14.3.3 Cement mortar for watermain lining and for water contacting surfaces of concrete structures made from washed aggregates and Portland cement;

14.3.4 Gaskets that are made from NSF approved materials;

14.3.5 Food grade oils and lubricants, food grade anti-freeze, and other food grade chemicals and materials that are compatible for drinking water use that may come into contact with drinking water, but are not added directly to the drinking water; or

14.3.6 Any particular chemical or material where the owner has written documentation signed by the Director that indicates that the Ministry is satisfied that the chemical or material is acceptable for use within the drinking water system and the chemical or material is only used as permitted by the documentation.

15.0 Drawings

15.1 All drawings and diagrams in the possession of the owner that show any treatment subsystem as constructed shall be retained by the owner unless the drawings and diagrams are replaced by a revised or updated version showing the subsystem as constructed subsequent to the alteration.

15.2 Any alteration to any treatment subsystem shall be incorporated into process flow diagrams, process and instrumentation diagrams, and record drawings and diagrams within one year of the alteration being completed or placed into service.

15.3 Process flow diagrams and process and instrumentation diagrams for any treatment subsystem shall be kept in a place, or made available in such a manner, that they may be readily viewed by all persons responsible for all or part of the operation of the drinking water system.

16.0 Operations and Maintenance Manual

16.1 An up-to-date operations and maintenance manual or manuals shall be maintained and applicable parts of the manual or manuals shall be made available for reference to all persons responsible for all or part of the operation or maintenance of the drinking water system.

16.2 The operations and maintenance manual or manuals, shall include at a minimum:

16.2.1 The requirements of this licence and associated procedures;

16.2.2 The requirements of the drinking water works permit for the drinking water system;

16.2.3 A description of the processes used to achieve primary and secondary disinfection within the drinking water system including where applicable:

a) A copy of the CT calculations that were used as the basis for primary disinfection under worst case operating conditions and other operating conditions, if applicable; and

b) The validated operating conditions for UV disinfection equipment, including a copy of the validation certificate;

16.2.4 Procedures for monitoring and recording the in-process parameters necessary for the control of any treatment subsystem and for assessing the performance of the drinking water system;

16.2.5 Procedures for the operation and maintenance of monitoring equipment;

16.2.6 Contingency plans and procedures for the provision of adequate equipment and material to deal with emergencies, upset conditions and equipment breakdown;

16.2.7 Procedures for dealing with complaints related to the drinking water system, including the recording of the nature of the complaint and any investigation and corrective action taken in respect of the complaint;

16.3 Procedures necessary for the operation and maintenance of any alterations to the drinking water system shall be incorporated into the operations and maintenance manual or manuals prior to those alterations coming into operation.

16.4 All of the procedures included or referenced within the operations and maintenance manual must be implemented.

Schedule C: System-Specific Conditions

System Owner	**The Corporation of the Town of Carleton Place**
Licence Number	**172-101**
Drinking Water System Name	**Carleton Place Drinking Water System**
Licence Effective Date	**February 26, 2021**

1.0 System Performance

Rated Capacity

1.1 For each treatment subsystem listed in column 1 of Table 1, the maximum daily volume of treated water that flows from the treatment subsystem to the distribution system shall not exceed the value identified as the rated capacity in column 2 of the same row.

Table 1: Rated Capacity

Column 1 Treatment Subsystem Name	Column 2 Rated Capacity (m^3/day)
Carleton Place Drinking Water System	12,000

Maximum Flow Rates

1.2 For each treatment subsystem listed in column 1 of Table 2, the maximum flow rate of water that flows into a treatment subsystem component listed in column 2 shall not exceed the value listed in column 3 of the same row.

Table 2: Maximum Flow Rates

Column 1 Treatment Subsystem Name	Column 2 Treatment Subsystem Component	Column 3 Maximum Flow Rate (L/s)
Not Applicable	Not Applicable	Not Applicable

1.3 Despite conditions 1.1 and 1.2, a treatment subsystem may be operated temporarily at a maximum daily volume and/or a maximum flow rate above the values set out in column 2 of Table 1 and column 3 of Table 2 respectively for the purposes of fighting a large fire or for the maintenance of the drinking water system.

1.4 Condition 1.3 does not authorize the discharge into the distribution system of any water that does not meet all of the requirements of this licence and all other regulatory requirements, including compliance with the Ontario Drinking Water Quality Standards.

Residuals Management

1.5 In respect of an effluent discharged into the natural environment from a treatment subsystem or treatment subsystem component listed in column 1 of Table 3:

1.5.1 The annual average concentration of a test parameter identified in column 2 shall not exceed the value in column 3 of the same row; and

1.5.2 The maximum concentration of a test parameter identified in column 2 shall not exceed the value in column 4 of the same row.

1.5.3 The test parameters listed in column 2 of Table 3 shall be sampled in accordance with conditions 5.2, 5.3 and 5.4 of this Licence.

Table 3: Residuals Management

Column 1 Treatment Subsystem or Treatment Subsystem Component Name	Column 2 Test Parameter	Column 3 Annual Average Concentration (mg/L)	Column 4 Maximum Concentration (mg/L)
Backwash Water Treatment System	Suspended Solids (Composite)	25 mg/L only when discharging to the River	Not applicable
Backwash Water Treatment System	Total chlorine	0.02 mg/L only when discharging to the River	Not applicable

UV Disinfection Equipment Performance

1.6 For each treatment subsystem or treatment subsystem component listed in column 1 of Table 4, and while directing water to the distribution system and being used to meet pathogen log removal/inactivation credits specified in Schedule E:

1.6.1 The UV disinfection equipment shall be operated within the validated limits for the equipment at all times such that a continuous pass-through UV dose is maintained throughout the life time of the UV lamp(s) that is at least the minimum continuous pass-through UV dose set out in column 2 of the same row

1.6.2 In addition to any other sampling, analysis and recording that may be required, the ultraviolet light disinfection equipment shall test for the test parameters set out in column 4 of the same row at a testing frequency of once every five (5) minutes or less and record the test data at a recording frequency of once every four (4) hours or less;

1.6.3 If there is a UV disinfection equipment alarm signaling that the disinfection equipment is malfunctioning, has lost power, or is not providing the appropriate level of disinfection the test parameters set out in column 4 of the same row shall be recorded at a recording frequency of once every five minutes or less until the alarm condition has been corrected;

1.6.4 A monthly summary report shall be prepared at the end of each calendar month which sets out the time, date and duration of each UV equipment alarm described in condition 1.6.3, the volume of water treated during each alarm period and the actions taken by the operating authority to correct the alarm situation;

Table 4: UV Disinfection Equipment

Column 1 Treatment Subsystem or Treatment Subsystem Component Name	Column 2 Minimum Continuous Pass-Through UV Dose (mJ/cm^2)	Column 3 Control Strategy	Column 4 Test Parameter
Not applicable	Not applicable	Not applicable	Not applicable

2.0 Flow Measurement and Recording Requirements

2.1 For each treatment subsystem identified in column 1 of Table 1 and in addition to any other flow measurement and recording that may be required, continuous flow measurement and recording shall be undertaken for:

2.1.1 The flow rate (L/s) and daily volume (m^3/day) of treated water that flows from the treatment subsystem to the distribution system.

2.1.2 The flow rate (L/s) and daily volume (m^3/day) of water that flows into the treatment subsystem.

2.2 For each treatment subsystem component identified in column 2 of Table 2 and in addition to any other flow measurement and recording that may be required, continuous flow measurement and recording shall be undertaken for the flow rate and daily volume of water that flows into the treatment subsystem component.

2.3 Where a rated capacity from Table 1 or a maximum flow rate from Table 2 is exceeded, the following shall be recorded:

2.3.1 The difference between the measured amount and the applicable rated capacity or maximum flow rate specified in Table 1 or Table 2;

2.3.2 The time and date of the measurement;

2.3.3 The reason for the exceedance; and

2.3.4 The duration of time that lapses between the applicable rated capacity or maximum flow rate first being exceeded and the next measurement where the applicable rated capacity or maximum flow rate is no longer exceeded.

3.0 Calibration of Flow Measuring Devices

3.1 All flow measuring devices that are required by regulation, by a condition in the drinking water works permit 172-201, or by a condition otherwise imposed by the Ministry, shall be checked and where necessary calibrated in accordance with the manufacturer's instructions.

3.2 If the manufacturer's instructions do not indicate how often to check and calibrate a flow measuring device, the equipment shall be checked and where necessary calibrated at least once every 12 months during which the drinking water system is in operation.

3.2.1 For greater certainty, if condition 3.2 applies, the equipment shall be checked and where necessary calibrated not more than 30 days after the first anniversary of the day the equipment was checked and calibrated in the previous 12-month period.

4.0 Calibration of CT Monitoring System

4.1 Any measuring instrumentation that forms part of the monitoring system for CT shall be checked and where necessary calibrated at least once every 12 months during which the drinking water system is in operation, or more frequently in accordance with the manufacturer's instructions.

4.1.1 For greater certainty, if condition 4.1 applies, the instrumentation shall be checked and where necessary calibrated not more than 30 days after the first anniversary of the day the equipment was checked and calibrated in the previous 12-month period.

5.0 Additional Sampling, Testing and Monitoring

Drinking Water Health and Non-Health Related Parameters

5.1 For each treatment subsystem or treatment subsystem component identified in column 1 of Tables 5 and 6 and in addition to any other sampling, testing and monitoring that may be required, sampling, testing and monitoring shall be undertaken for a test parameter listed in column 2 at the sampling frequency listed in column 3 and at the monitoring location listed in column 4 of the same row.

Table 5: Drinking Water Health Related Parameters

Column 1 Treatment Subsystem or Treatment Subsystem Component Name	Column 2 Test Parameter	Column 3 Sampling Frequency	Column 4 Monitoring Location
Not Applicable	Not Applicable	Not Applicable	Not Applicable

Table 6: Drinking Water Non-Health Related Parameters

Column 1 Treatment Subsystem or Treatment Subsystem Component Name	Column 2 Test Parameter	Column 3 Sampling Frequency	Column 4 Monitoring Location
Not Applicable	Not Applicable	Not Applicable	Not Applicable

Environmental Discharge Parameters

5.2 For each treatment subsystem or treatment subsystem component identified in column 1 of Table 7 and in addition to any other sampling, testing and monitoring that may be required, sampling, testing and monitoring shall be undertaken for a test parameter listed in column 2 using the sample type identified in column 3 at the sampling frequency listed in column 4 and at the monitoring location listed in column 5 of the same row.

5.3 For the purposes of Table 7:

5.3.1 Manual Composite means the mean of at least three grab samples taken during a discharge event, with one sample being taken immediately following the commencement of the discharge event, one sample being taken approximately at the mid-point of the discharge event and one sample being taken immediately before the end of the discharge event; and

5.3.2 Automated Composite means samples must be taken during a discharge event by an automated sampler at a minimum sampling frequency of once per hour.

5.4 Any sampling, testing and monitoring for the test parameter Total Suspended Solids shall be performed in accordance with the requirements set out in the publication "Standard Methods for the Examination of Water and Wastewater", 23rd Edition, 2017, or as amended from time to time by more recently published editions.

Table 7: Environmental Discharge Parameters

Column 1 Treatment Subsystem or Treatment Subsystem Component Name	Column 2 Test Parameter	Column 3 Sample Type	Column 4 Sampling Frequency	Column 5 Monitoring Location
Backwash Water Treatment System	Suspended Solids (Composite)	Composite	Monthly only when discharging to the river	Point of discharge to the Mississippi River
Backwash Water Treatment System	Total chlorine	Grab	Monthly only when discharging to the river	Point of discharge to the Mississippi River

5.5 Pursuant to Condition 10 of Schedule B of this licence, the owner may undertake the following environmental discharges associated with the maintenance and/or repair of the drinking water system:

5.5.1 The discharge of potable water from a watermain to a road or storm sewer;

5.5.2 The discharge of potable water from a water storage facility or pumping station:

5.5.2.1 To a road or storm sewer; or

5.5.2.2 To a watercourse where the discharge has been dechlorinated and if necessary, sediment and erosion control measures have been implemented.

5.5.3 The discharge of dechlorinated non-potable water from a watermain, water storage facility or pumping station to a road or storm sewer;

5.5.4 The discharge of raw water from a groundwater well to the environment where if necessary, sediment and erosion control measures have been implemented; and

5.5.5 The discharge of raw water, potable water or non-potable water from a treatment subsystem to the environment where if necessary, the discharge has been dechlorinated and sediment and erosion control measures have been implemented.

5.5.6 The discharge of any excess water to a road, storm sewer or the environment, associated with the management of materials excavated as part of watermain construction or repair, where necessary sediment, erosion and environmental control measures have been implemented.

6.0 Studies Required

Harmful Algal Blooms

6.1 The owner shall develop and keep up to date a Harmful Algal Bloom monitoring, reporting and sampling plan, herein known as the "Plan", to be implemented when a potential harmful algal bloom is suspected or present. The owner shall have the Plan in place on or before September 9, 2021.

6.1.1 The owner must have a copy of the Plan available onsite at the drinking water system, for inspection upon request by Ministry staff.

6.1.2 The owner must implement the Plan annually during the harmful algal bloom season, during but not limited to the warm seasonal period between June 1 and October 31 each year, or as otherwise directed by the Ministry or the Medical Officer of Health.

6.1.3 The owner must train all relevant drinking water system staff on the Plan prior to the beginning of each warm season, as described in Condition 6.1.2.

6.2 For clarity, a Harmful Algal Bloom is considered suspected or occurring when:

6.2.1 the owner or operating authority has observed an algal bloom:

6.2.1.1 near the shoreline at or near the source water intake(s) described in drinking water works permit #172-201, or

6.2.1.2 where the intake has an Intake Protection Zone in a source protection plan, within IPZ-1, or

6.2.1.3 within a circle that has a radius, measured from the intake, equal to the distance from the intake to the farthest edge of IPZ-2.

6.2.2 microcystin has been detected in a raw or treated water sample; and/or,

6.2.3 the owner has received any form of notification related to an algal bloom from the Ministry, a Medical Officer of Health, or the public; or,

6.2.4 the presence of or identification of cyanobacteria has been determined though optical probes or other analytic techniques used by the drinking water system.

6.3 The Plan described in condition 6.1 must include, at a minimum:

6.3.1 details relating to visual monitoring for harmful algal blooms at or near the drinking water system intake(s),

6.3.1.1 as described in drinking water works permit #172-201, or

6.3.1.2 where the intake has an Intake Protection Zone in a source protection plan, within IPZ-1, or

6.3.1.3 within a circle that has a radius, measured from the intake, equal to the distance from the intake to the farthest edge of IPZ-2.

6.3.2 details relating to visual monitoring of shoreline; this is applicable to drinking water systems where the proximity of the intake(s) may be of concern.

6.3.3 details relating to reporting the observed or suspected harmful algal bloom, as described in section 6.2:

6.3.3.1 to the Overall Responsible Operator(s) and/or Operator(s)-in-Charge if the blooms have been observed or suspected by a duty operator; the Plan shall include wording that directs relevant drinking water staff to follow the instructions provided by the Overall Responsible Operator(s) or the Operator(s)-in-Charge;

6.3.3.2 to the medical officer of health; and

6.3.3.3 to the local MECP representative and the Ministry's Spills Action Centre.,

6.3.4 a sampling plan, including the identification of sample location(s) and frequencies that at a minimum match those described in condition 6.4.

6.3.5 triggers that may increase the required sampling frequency;

6.3.6 up-to-date records that document staff training on the harmful algal bloom monitoring, reporting, and sampling procedures.

6.4 Any water samples collected under Condition 6.3.4 must be:

6.4.1 collected, at a minimum, once per week, or as otherwise directed by the Ministry or the medical officer of health;

6.4.2 collected prior to any treatment, if the sample is taken from raw water;

6.4.3 collected at the point of entry into the distribution system, if the sample is taken from treated water;

6.4.4 collected from the shoreline by the drinking water system, if applicable based on Condition 6.3.1;

6.4.5 submitted to a laboratory licensed to perform ELISA testing for total microcystin;

6.4.6 repeatedly collected until 3 consecutive samples have shown non-detection of microcystin and the algal bloom is no longer suspected or visually observed.

7.0 Source Protection

7.1 The owner of the drinking water system shall implement risk management measures, as appropriate, to manage any potential threat to drinking water that results from the operation of the drinking water system.

7.2 The owner of the system shall notify the Director in writing within thirty (30) days of any approved changes to an applicable source protection plan that impact the assessed threat level of a fuel oil system identified in Schedule A of drinking water works permit.

7.3 The notification required in condition 7.2 shall include:

7.3.1 A description of the changes and their impact on the assessed threat level of the fuel oil system(s); and,

7.3.2 A timeline for re-assessing the threat level and providing the results of the assessment to the Director.

Schedule D: Conditions for Relief from Regulatory Requirements

System Owner	**The Corporation of the Town of Carleton Place**
Licence Number	**172-101**
Drinking Water System Name	**Carleton Place Drinking Water System**
Licence Effective Date	**February 26, 2021**

Effective as of the effective date of the MDWL, no relief from regulatory requirements is authorized by the Director under section 46 of the SDWA in respect of the drinking water system.

Schedule E: Pathogen Log Removal/Inactivation Credits

System Owner	**The Corporation of the Town of Carleton Place**
Licence Number	**172-101**
Drinking Water System Name	**Carleton Place Drinking Water System**
Licence Effective Date	**February 26, 2021**

1.0 Primary Disinfection Pathogen Log Removal/Inactivation Credits

Carleton Place Water Treatment Plant

Mississippi River [SURFACE WATER]

Minimum Log Removal/ Inactivation Required	Cryptosporidium Oocysts	Giardia Cysts [a]	Viruses [b]
Carleton Place Water Treatment Plant	2	3	4

[a] At least 0.5 log inactivation of Giardia shall be achieved by the disinfection portion of the overall water treatment process.
[b] At least 2 log inactivation of viruses shall be achieved by disinfection.

Log Removal/Inactivation Credits Assigned [c]	Cryptosporidium Oocysts	Giardia Cysts	Viruses
Conventional Filtration	2	2.5	2
Chlorination [CT:Clearwell]	-	0.5+	2+

[c] Log removal/inactivation credit assignment is based on each treatment process being fully operational and the applicable log removal/inactivation credit assignment criteria being met.

Treatment Component	Log Removal/Inactivation Credit Assignment Criteria
Conventional Filtration	1. A chemical coagulant shall be used at all times when the treatment plant is in operation; 2. Chemical dosages shall be monitored and adjusted in response to variations in raw water quality; 3. Effective backwash procedures shall be maintained including filter-to-waste or an equivalent procedure during filter ripening to ensure that effluent turbidity requirements are met at all times; 4. Filtrate turbidity shall be continuously monitored from each filter; and 5. Performance criterion for filtered water turbidity of less than or equal to 0.3 NTU in 95% of the measurements each month shall be met for each filter.
Chlorination	1. Sampling and testing for free chlorine residual shall be carried out by continuous monitoring equipment in the treatment process at or near a location where the intended contact time has just been completed in accordance with the Ministry's *Procedure for Disinfection of Drinking Water in Ontario*; and, 2. At all times, CT provided shall be greater than or equal to the CT required to achieve the log inactivation credits assigned.

Appendix I Water Treatment Plant Disinfection Review Memo

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J.L.Richards
ENGINEERS · ARCHITECTS · PLANNERS

MEMORANDUM

To: Mr. Guy Bourgon, P.Eng.
Director of Public Works
Town of Carleton Place
175 Bridge Street,
Carleton Place, ON K7C 2V8

From: Matthew Marcuccio, P.Eng.

Re: Carleton Place WTP – CT Review

Date: April 16, 2021

JLR No.: 29995-000.1

CC: Andrew Trader (OCWA)
Brian Hein, P.Eng. (JLR)

1.0 Introduction

The Town of Carleton Place (the Town) retained J.L. Richards & Associates Limited (JLR) to provide professional engineering services relating to the assessment of the primary disinfection process at the Carleton Place Water Treatment Plant (WTP).

During a recent WTP inspection completed by the Ministry of the Environment, Conservation and Parks (MECP), concerns were raised regarding the efficacy of the primary disinfection process in each clearwell. The purpose of this technical memorandum is to assess primary disinfection performance of each clearwell at 'worst-case' conditions in order to determine compliance with the *Procedure for Disinfection of Drinking Water in Ontario* (MECP, 2019)

2.0 Facility Overview

2.1 General

The Carleton Place WTP is classified as a Class 3 facility (MECP, 2016) and is owned by the Town and operated by the Ontario Clean Water Agency (OCWA). The WTP delivers potable water to the Town up to a rated capacity of 12,000 m^3/day. The source of raw water is the Mississippi River.

Raw water from the intake in the Mississippi River flows by gravity through screening into the intake wells consisting of four (4) low lift pumps, which are each rated for 36.6 L/s, 57.9 L/s, 84.2 L/s and 110.5 L/s respectively. The pumps operate in a duty/standby arrangement.

Raw water is pumped by the low lift pumps to two (2) ballasted floc/clarification Actiflo® treatment trains operating in parallel. Each train consists of a coagulation tank, injection tank, maturation tank and settling tank, and are complete with microsand recirculation pumps, piping and hydrocyclones to separate the microsand and residuals.

Water is then directed to three (3) identical cylindrical double compartment dual media (sand/anthracite) gravity filters. Each filter compartment has a filtration capacity of 23.1 L/s (139 L/s total).

Filtered water enters a two (2) cell underground storage reservoir (Clearwell #1 and Clearwell #2), interconnected with isolation valves and piping for flow control and maintenance. The clearwells provide an available storage volume of 1,590 m^3 each (3,180 m^3 total). During normal operating conditions, water enters Clearwell #1, then equalizes with Clearwell #2. The incoming piping and the clearwell interconnection are both located at the farthest point from the high lift pump intakes.

Treated water is conveyed from the clearwells by four (4) high lift pumps (one jockey, two duty and one standby), High Lift Pumps #1 and #2 (HL-1 and HL-2) draw from Clearwell #1, each rated to deliver 36.8 L/s against a TDH (total dynamic head) of 52.5 m and 57.9 L/s against a TDH of 51.2 m respectively. High Lift Pumps #3 and #4

(HL-3 and HL-4) draw from Clearwell #2, each rated to deliver 100 L/s against a TDH (total dynamic head) of 52.5 m and 136.8 L/s against a TDH of 56 m respectively. The high lift pumps discharge into a common header pipe out of the pipe. At peak demand flows, both clearwells are in service, with HL-1 and HL-4 in operation.

2.2 Summary of Disinfection Processes

Disinfection at the WTP is achieved by free chlorination. Chlorinated water is produced by two (2) 227 kg/day vacuum chlorinators, drawing chlorine gas from two (2) 907 kg cylinders. One chlorination injection point has a 90.7 kg/day (200 lb/day) v-notch that doses filtered water entering the clearwells, providing both primary and secondary disinfection. The second injection point has a 9.1 kg/day (20 lb/day) v-notch that doses the raw water wet-well for zebra mussel control. In addition, there is cross over ability to use the second chlorinator as a contingency for chlorination at the clearwells. An on-line continuous chlorine analyzer is located on the common high lift pump discharge header pipe. The analyzer monitors the chlorine residual of the treated water as it leaves the WTP.

A standby booster chlorination system is located at the water tower located on Nelson Street east of Park Street. The system consists of a 100 L sodium hypochlorite solution tank, complete with piping appurtenances, chlorine analyzer and a metered chemical pump rated at 3.6 L/h discharging into the water tank common fill/draw pipe.

The applicable requirements for the primary disinfection system are in accordance with the *Procedure for Disinfection of Drinking Water in Ontario* (MECP, 2019).

3.0 MECP Pathogen Removal or Inactivation Requirements

In accordance with the *Procedure for Disinfection of Drinking Water in Ontario* (MECP, 2019), the treatment process must achieve the following minimum requirements:

Table 1: Minimum Pathogen Removal or Inactivation Requirements

Pathogen	Minimum Removal or Inactivation Requirements
Giardia cysts	3-log (99.9%)
Viruses	4-log (99.99%)
Cryptosporidium oocysts	2-log (99%)

Table 2 identifies the pathogen removal credits associated with the filtration methods relevant to this investigation, per the Town's Municipal Drinking Water License, Schedule E (MECP 2016). The difference between the removal or inactivation requirements (A) and the removal credit (B) indicate the minimum inactivation requirements associated with the disinfection process (C).

Table 2: Pathogen Removal Credits for Relevant Filtration Treatment Methods

		Log Removal or Inactivation: Giardia Cysts	Log Removal or Inactivation: Viruses	Log Removal or Inactivation: Cryptosporidium Oocysts
A	Minimum Requirements	3	4	2
B	Pathogen Removal Credit Conventional Filtration	2.5	2	2
C	Minimum inactivation by disinfection (A – B)	0.5	2	0

The pathogen removal credit for conventional filtration is only valid if the following conditions are met:

- the filtration system design has been approved by the MECP and:
  - chemical coagulant will continue to be added at all times while the WTP is operating;
  - coagulant dosages are adjusted in response to raw water quality;
  - the backwash procedures are effective and effluent turbidity requirements are met at all times; and,
  - the measured filtered water turbidity, from each individual filter, is less than 0.3 NTU in 95% of the measurements recorded during each calendar month (excluding any turbidity measurements taken while the filter corresponding the turbidity meter is undergoing a filter backwash).

OCWA monitors the filtered water turbidity using on-line analyzers. Trends from the analyzers are reviewed for compliance with O.Reg. 170/03 and the filter performance is evaluated monthly. In the 2019 Annual Report (OCWA 2020), recorded spikes in the turbidity reading were reviewed, and were found to be a result of air bubbles or by maintenance/calibration activities, not by a non-compliance issue. Therefore, the pathogen removal credit for conventional filtration is valid for this study.

Therefore, the disinfection process must achieve at least a 0.5-log inactivation of Giardia Cysts and a 2-log inactivation of viruses.

4.0 CT Disinfection Assessment

4.1. Methodology

The CT disinfection concept is a widely used method of quantifying the capabilities of a free chlorine disinfection system. The CT value is calculated by multiplying a disinfectant residual concentration by the contact time between microorganism and the disinfectant.

Contact time (T_{10}) is equivalent to the duration of time that not more than 10% of water passes through the disinfection process. T_{10} can be determined through tracer studies, mathematical modelling, or by multiplying the hydraulic detention time of the process (T) by a typical baffling factor (T_{10}/T) which has been established based on similar arrangements.

For the purposes of this report, the worst-case operating conditions will be considered using the highest minimum required CT value, determined by the water conditions; and the lowest available CT value, determined by the operation conditions in the clearwells. The disinfection system is considered compliant when the available CT is equal or higher than the required minimum CT. It is assumed that, if the available CT value calculated from the worst-case conditions meets the minimum disinfection requirements, any improvement in conditions will also lead to compliant CT values.

The required CT is influenced by the conditions of the water and the required log inactivation requirements for pathogens. The minimum required CT value will be estimated using the following:

- Required log inactivation of the disinfection process for Giardia cysts.
- Maximum pH;
- Minimum water temperature;
- Minimum free chlorine residual concentration

The available CT of the clearwells is determined by the contact time in the tanks and the free chlorine residual. To minimize the CT value, the following operational factors were considered:

- Minimum volume of water in clearwells
  - Each clearwell will be assessed individually (i.e. one clearwell is out of service);
  - Lowest operating water level in each clearwell;
- Maximum flow through each clearwell,
  - Assumed to be the largest pump operating at its rated capacity (HL-2 in Clearwell #1, and HL-4 in Clearwell #2)
- Minimum free chlorine residual concentration;

Table 3 summarizes the variables considered for this analysis:

Table 3: Summary of CT Analysis Variables

Parameter	Value	Reference/Comments
Given		
Maximum flow (m^3/min); Clearwell #1	3.47	Rated capacity of the largest high lift pump (HL-2) per the WTP Drinking Water Works Permit (DWWP) (MECP 2016).
Maximum flow (m^3/min); Clearwell #2	8.21	Rated capacity of the largest high lift pump (HL-4) per the WTP DWWP (MECP 2016).
Maximum pH	7	Maximum pH value per the 2019 Annual Water Report (OCWA 2020).
Primary Chlorination - Free Chlorine Residual (mg/L); Low Level Alarm	0.66	Treated water free chlorine residual low-level alarm, per the Carleton Place WTP QEMS Critical Control Limits/Points document posted at the WTP.
Primary Chlorination - Minimum Free Chlorine Residual (mg/L); recorded operation data	1	Minimum recorded free chlorine residual per the 2019 Annual Water Report (OCWA 2020). Reading taken from the on-line chlorine analyzer located after the clearwells and before leaving the WTP to the distribution system.
Volume (m^3) of each clearwell (Clearwells #1 and #2)	1590	Both clearwell compartments are of equal size. Total combined volume of Clearwells #1 and #2 (3180 m^3) per the WTP DWWP (MECP 2016).
Minimum Percentage of Water Level in clearwells (%)	60	Clearwell Low Level Alarm per the Carleton Place WTP QEMS Critical Control Limits/Points document posted at the WTP.
Assumed		
Minimum temperature (°C)	0.5	Assumed worst case condition.

Parameter	Value	Reference/Comments
Baffling factor – clearwells (Clearwell #1 and Clearwell #2)	0.3	"Poor" baffle condition selected ("Single or multiple unbaffled inlets and outlets, no intra-basin baffles"), as presented in the *Procedure for Disinfection of Drinking Water in Ontario* (MECP 2019).

The minimum CT values for inactivation by disinfection were determined using the tables available in the *Procedure for Disinfection of Drinking Water in Ontario* (MECP, 2019), provided in Attachment 1. Using the given parameters in ***Table 3*** and the minimum log inactivation requirements in ***Table 2***, the minimum required CT values are shown in ***Table 4***.

Table 4: Minimum CT Requirements for Pathogen Inactivation

Pathogen	Minimum Log Removal or Inactivation	Minimum required CT value
Giardia cysts	0.5	33
Viruses	2	6

Using the larger of the two values, the minimum required CT value that the clearwells must meet is 33. At all times, CT provided must be greater than or equal to the CT required to achieve the log inactivation credits assigned

4.2 Results and Discussion

The following operational scenarios were assessed to determine available CTs:

- Scenarios #1 and #2 review the operation of each clearwell at the lowest recorded free chlorine residual (1 mg/L), from the WTP's 2019 annual report (OCWA 2020).
- Scenarios #3 and #4 review the operation of each clearwell at the free chlorine residual low-level alarm (0.66 mg/L).
- Scenarios #5 and #6 indicate the minimum free chlorine residuals needed in each clearwell to meet disinfection requirements (60% Water Level).

Table 5 shows the CT calculations of each scenario reviewed. All calculations that support the results of this assessment are attached to this memorandum (Attachment 2).

Table 5: CT Calculations

Scenario				Assumed Free Chlorine Residual (mg/L)	Available CT value	Meets disinfection requirements (required CT=33) (Y/N)
NO.	Clear Well Operation	High Lift Pumps Operation (at rated pump capacities)	Water Level Percentage (%)			
1	Clearwell #1 only	HL-2	60	1.00	82	Yes
2	Clearwell #2 only	HL-4	60	1.00	35	Yes

Scenario				Assumed Free Chlorine Residual (mg/L)	Available CT value	Meets disinfection requirements (required CT=33) (Y/N)
NO.	Clear Well Operation	High Lift Pumps Operation (at rated pump capacities)	Water Level Percentage (%)			
3	Clearwell #1 only	HL-2	60	0.66	54	Yes
4	Clearwell #2 only	HL-4	60	0.66	23	No
5	Clearwell #1 only	HL-2	60	0.40	33	Yes
6	Clearwell #2 only	HL-4	60	0.95	33	Yes

As seen in Scenario #1 and #2, when the free chlorine residual was at the lowest recorded reading in 2019, the available CT in both clearwells were greater than the required CT threshold. Therefore, during normal operating levels of free chlorine residual in the WTP, disinfection requirements were achieved.

In Scenario #4, Clearwell 2 does not meet minimum disinfection requirements. To address this concern at these worst-case conditions, the minimum free chlorine residual limit should be increased from the current level of 0.66 mg/L to the historical lowest recorded residual of 1.0 mg/L.

It is worth noting that the CT compliance limits are reduced with increasing water temperature and reducing pH. For example, when the water temperature increases to 15°C during the summer, the required CT would be 12 (pH and free chlorine residual remaining the same as noted above), compared to 33 when the water temperature was 0.5°C as a worst-case scenario.

During peak flow demand events, there is a concern that the majority of water will be drawn from Clearwell #2, potentially resulting in degradation of free chlorine residual in Clearwell #1. Scenario #5 results indicate that the free chlorine residual can drop a significant amount below the currently low-level alarm setpoint to meet the CT threshold. However, there is no instrumentation at the WTP to measure free chlorine residuals in each clearwell individually. It is recommended for additional chlorine analyzers be installed near the high lift pump suction intakes in each clearwell. Modelling of the flows in the two clearwells should also be considered, to better understand free chlorine residual interactions with peak demand flows. The MECP also recommends that operation of only Clearwell #2 (Clearwell #1 offline for maintenance) in winter season should be avoided to ensure compliance with CT requirements.

In addition, the WTP expansion will be evaluated as part of a future Master Plan study being undertaken by the Town. As part of this exercise, it is recommended that the current high lift pumping configuration be modified to provide flexibility for all high lift pumps to draw from either clearwell.

Refer to Attachment #3 for a full summary of minimum calculated free chlorine residual required to meet CT requirements at various operating conditions of the clearwells and high lift pumps.

5.0 Summary

The calculations completed as part of this CT Disinfection Assessment predict the following during the previously described worst-case conditions:

- Disinfection requirements can be achieved in each clearwell under normal operating conditions of free chlorine residual, up to maximum day flow demands.
- At the low alarm levels of free chlorine residual, there are concerns that Clearwell #2 may not meet disinfection requirements under maximum day flow demands.

The following recommendations are offered based on this CT disinfection assessment:

1. Consider increasing the treated water free chlorine residual alarm from 0.66 mg/L to 1.00 mg/L.
2. Consider installing free chlorine analyzers at the end of each clearwell, to provide monitoring in each clearwell.
3. Consider modifying the high lift pump configuration in the clearwells as part of the future master planning work.

J.L. RICHARDS & ASSOCIATES LIMITED

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MM:ra

References

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Attachments

Attachment 1 – CT Tables from *Procedure for Disinfection of Drinking Water in Ontario* (MECP, 2019)

Attachment 2 – Carleton Place Water Treatment Plant Chlorination Requirements – Calculations

Attachment 2 – Carleton Place Water Treatment Plant – Minimum Free Chlorine Residuals to meet CT

Attachment #1: CT Tables from *Procedure for Disinfection of Drinking Water in Ontario* (MECP, 2019)

Table 1 – CT values for inactivation of Giardia cysts by free chlorine at 0.5°C or lower (pH = 7)

Free Chlorine Concentration mg/L	0.5 log	1 log	1.5 log	2 log	2.5 log	3 log
≤ 0.4	33	65	98	130	163	195
0.6	33	67	100	133	167	200
0.8	34	68	103	137	171	205
1	35	70	105	140	175	210
1.2	36	72	108	143	179	215
1.4	37	74	111	147	184	201
1.6	38	75	113	151	188	226
1.8	39	77	116	154	193	231
2	39	79	118	157	197	236
2.2	40	81	121	161	202	242
2.4	41	82	124	165	206	247
2.6	42	84	126	168	210	252
2.8	43	86	129	171	214	257
3	44	87	131	174	218	261

Table 7 – CT values for inactivation of viruses by free chlorine

Temperature (°C)	Log Inactivation: 2 (pH: 6 to 9)	Log Inactivation: 2 (pH: 10)	Log Inactivation: 3 (pH: 6 to 9)	Log Inactivation: 3 (pH: 10)	Log Inactivation: 4 (pH: 6 to 9)	Log Inactivation: 4 (pH: 10)
0.5	6	45	9	66	12	90
5	4	30	6	44	8	60
10	3	22	4	33	6	45
15	2	15	3	22	4	30
20	1	11	2	16	3	22
25	1	7	1	11	2	15

Attachment 2 – Carleton Place Water Treatment Plant Chlorination Requirements – Calculations

Scenario			Total Volume (m^3)	% Water in Clear Well	Filled Volume (m^3)	Treated Water Flow (m^3/min)	T (min)	T_{10}/T Factor	T_{10}	Assumed Free Chlorine Residual (mg/L)	CT
No.	Clear Well Operation	High Lift Pumps (at rated pump capacities)									
1	CW-1 only	HL-2	1590	60%	954	3.47	274.9	0.3	82.5	1.00	82
2	CW-2 only	HL-4	1590	60%	954	8.21	116.2	0.3	34.9	1.00	35
3	CW-1 only	HL-2	1590	60%	954	3.47	274.9	0.3	82.5	0.66	54
4	CW-2 only	HL-4	1590	60%	954	8.21	116.2	0.3	34.9	0.66	23
5	CW-1 only	HL-2	1590	60%	954	3.47	274.9	0.3	82.5	0.40	33
6	CW-2 only	HL-4	1590	60%	954	8.21	116.2	0.3	34.9	0.95	33

Attachment 3 – Carleton Place Water Treatment Plant – Minimum Free Chlorine Residuals to meet CT

Scenario			Total Volume (m^3)	% Water in Clear Well	Filled Volume (m^3)	Treated Water Flow (m^3/min)	T (min)	T_{10}/T Factor	T_{10}	Minimum Free Chlorine Residual (mg/L)	CT
No.	Clear Well Operation	High Lift Pumps (at rated pump capacities)									
A	CW #1 only	HL-1 and HL-2	1590	60%	954	5.68	167.9	0.3	50.4	0.66	33
B	CW #2 only	HL-4	1590	60%	954	8.21	116.2	0.3	34.9	0.95	33
C	CW #1 and #2	HL-4 and HL-2	3180	60%	1908	11.68	163.3	0.3	49.0	0.67	33
D	CW #1 only	HL-1 and HL-2	1590	50%	795	5.68	139.9	0.3	42.0	0.79	33
E	CW #2 only	HL-4	1590	50%	795	8.21	96.9	0.3	29.1	1.14	33
F	CW #1 and #2	HL-4 and HL-2	3180	50%	1590	11.68	136.1	0.3	40.8	0.81	33
G	CW #1 only	HL-1 and HL-2	1590	40%	636	5.68	111.9	0.3	33.6	0.98	33
H	CW #2 only	HL-4	1590	40%	636	8.21	77.5	0.3	23.2	1.42	33
I	CW #1 and #2	HL-4 and HL-2	3180	40%	1272	11.68	108.9	0.3	32.7	1.01	33

Appendix J Wastewater Treatment Plant Certificate of Authorization

Ontario

Ministry of the Environment
Ministère de l'Environnement

AMENDED CERTIFICATE OF APPROVAL
MUNICIPAL AND PRIVATE SEWAGE WORKS
NUMBER 5001-7FZT4A
Issue Date: October 3, 2008

The Corporation of the Town of Carleton Place
175 Bridge Street
Carleton Place, Ontario
K7C 2V8

Site Location: Carleton Place Water Pollution Control Plant
122 Patterson Crescent
Carleton Place Town, County of Lanark

You have applied in accordance with Section 53 of the Ontario Water Resources Act for approval of:

modifications to the existing municipal sewage treatment works (NAD83: UTM Zone 18: 410475 m E, 4999750 m N) serving the Town of Carleton Place through the treatment and subsequent disposal of sanitary sewage to the Mississippi River, consisting of the following:

PROPOSED WORKS

- expansion and upgrading of the existing Control Building at the Sewage Treatment Plant (STP):
  - construction of a building addition (Sludge Management Facility) comprising four (4) rooms, including one room to accommodate a new sludge dewatering process, one room to accommodate a future thickening process (subject to future approval), one room for new odour control equipment, and the remaining room for use as a truck bay and storage area;
  - modification of the Control Building ventilation system;
- installation of a new dewatering centrifuge process in the Sludge Management Facility:
  - one (1) new decanter centrifuge located in the Centrifuge Room of the Sludge Management Facility, with a rated capacity of 770 kilograms (dry solids) per hour and 16 cubic metres per hour, equipped with variable frequency drives, automatic hydraulic backdrive, and a programmable logic controller and control panel, intended and approved to process liquid biosolids from the on-site anaerobic digestion system or occasionally raw primary sludge generated at the STP;

- one (1) rectangular knife gate, horizontally mounted below the centrifuge cake discharge chute and controlled directly by the centrifuge control panel;

- installation of sludge transfer equipment:

  - one (1) new positive displacement sludge transfer pump located in the Digester Building, having a rated capacity of 4.44 litres per second at a TDH of 35 metres and equipped with a variable frequency drive (VFD), to pump biosolids from the Biosolids Storage Tank or secondary digester to the dewatering centrifuge;

  - 75 millimetre diameter piping extending from the new sludge transfer pump in the Digester Building to the Centrifuge Room of the Sludge Management Facility, equipped with one (1) 75 millimetre diameter magnetic flow meter;

  - piping extending from the existing liquid biosolids transfer pumps in the Digester Building to the garage bay in the Sludge Management Facility, via the underground service corridor;

  - one (1) positive displacement cake pump located in the Centrifuge Room, having a rated capacity of 1.5 litres per second at a total dynamic head (TDH) of 40 metres, equipped with a variable frequency drive (VFD) motor as well as a cake breaker mechanism operated with an independent constant speed motor, and associated 150 millimetre diameter discharge piping in the garage bay;

  - one (1) horizontal Trough Belt Cake Conveyor located in the Garage Bay, equipped with an explosion-proof constant speed motor, for the purpose of carrying cake into cake trailer bin;

  - one (1) air compressor, developing a pressure of 2.07 megapascals, equipped with a 11.25 kilowatt motor for the purpose of cleaning the cake piping;

- installation of a new polymer system in the Centrifuge Room of the Sludge Management Facility, with a rated capacity of 13.6 kilograms per hour, to supply polymer to the dewatering process:

  - one (1) polymer emulsion feed pump with a rated capacity of 96 litres per hour, controlled by the centrifuge control panel;

  - a polymer dilution system with a capacity of 4.54 cubic metres per hour, controlled by the centrifuge control panel;

  - piping to supply diluted polymer at three points along the centrifuge feed line;

- drum spill containment container, having a capacity to service one 208 litre polymer emulsion drum;

- installation of a Centrate Equalization Tank:

  - one (1) Centrate Equalization Tank located below the garage bay of the Sludge Management Facility, having dimensions of 8.60 metres long by 4.50 metres wide by 3.26 metres average depth with a corresponding liquid storage capacity of 126 cubic metres, equipped with a pressure transducer, a 75 millimetre diameter automated valve and magnetic flow meter on a 75 millimetre diameter centrate return line to the STP headworks, and a 150 millimetre diameter overflow line also leading to the headworks via the main sewer;

- installation of a Septage Receiving Tank:

  - one (1) Septage Receiving Tank located below the garage bay of the Sludge Management Facility, having dimensions of 6.08 metres long by 1.84 metres wide by 3.50 metres maximum depth with a corresponding liquid storage capacity of 28 cubic metres, equipped with a submersible mixer, a pressure transducer, a 150 millimetre diameter automated plug valve on the outlet piping, and a 150 millimetre diameter overflow line;

- installation of a new odour control facility to treat odorous air from the existing headworks and the new dewatering and septage receiving facilities:

  - one (1) granular activated carbon odour control system, comprising a filtration scrubber module containing granular activated carbon media and a filtration scrubber module containing potassium permanganate, and equipped with an upstream mist eliminator/grease filter unit;

- installation of a new alkalinity addition system with a new sodium hydroxide solution feed system to provide supplemental alkalinity to the raw sewage:

  - two (2) solution feed pumps (one duty, one standby), each with a rated capacity of 200 litres per hour at 400 kilopascals back pressure, controlled via SCADA by the existing raw sewage flow meter, to supply solution to the existing manhole upstream of the STP headworks;

  - one (1) solution storage tank with double-wall construction, having a capacity of 13.6 cubic metres, and equipped with a filling line, suction line to the feed pumps, an overflow, vent, ultrasonic sensor, and leak detector;

- increase corner benching for the secondary clarifiers;

- installation of a glycol recirculation pump at the boiler room to transfer heat to the building addition (Sludge Management Facility);

EXISTING WORKS

Control Building

a control building including headworks, generator room, boiler room, compressor room, laboratory, control room and offices:

- headworks:
  - one (1) mechanical bar screen designed for a maximum hourly flow of 26,000 cubic metres per day, complete with electric motor, power supply and controls;
  - two (2) forced vortex degritters designed for a maximum flow of 20,000 cubic metres per day, complete with conveyors, teacups, electric motor and driver, power supply and controls;
  - three (3) sewage lift pumps, each with a capacity of 13,000 cubic metres per day at a total dynamic head (TDH) of 11.5 metres;
- generator room:
  - one (1) diesel generator set including fuel system and exhaust system;
- boiler room:
  - four (4) natural gas boilers with an overall capacity equivalent to a 360 kilowatt input and three (3) digester gas boilers with an overall capacity equivalent to a 25.5 cubic metres per hour gas combustion rate, including standby capacity of no less than 15.6 cubic metres per hour (8 boilers) in the event of failure of any one unit, complete with two (2) primary heating pumps, two (2) secondary heating pumps, and expansion tank;
- compressor room, housing:
  - four (4) positive displacement blowers (three duty, one standby), each with a capacity of 5.7 cubic metres per minute against a backpressure of 41 kilopascals, complete with motors, one of which is driven by a variable frequency drive (VFD) and the other three equipped with constant speed drives;

Primary Clarifiers

a primary treatment system including:

- two (2) main primary clarifiers, each with approximate dimensions of 20.2 metres long by 4.29 metres wide, with a sidewater depth (SWD) of 3.80 metres, complete with longitudinal sludge collectors, scum troughs, and drives;

- maximum design flow rate of 10,400 cubic metres per day to the two clarifiers;

- three (3) physical-chemical clarifiers, each with approximate dimensions of 17.7 metres long by 4.35 metres wide, with 3.80 metres SWD, complete with longitudinal sludge collectors, scum troughs, and drives;

  - maximum design flow rate of 11,600 cubic metres per day to the three clarifiers that are brought on line during wet weather conditions (i.e., for raw sewage flow rates of greater than 10,400 cubic metres per day);

Activated Sludge Plant

a secondary treatment system for biologically treating process effluent from the two main primary clarifiers, including:

- three (3) aeration tanks equipped with a jet mixing system:

  - two (2) tanks, each with approximate dimensions of 23.5 metres long by 8.45 metres wide by 3.20 metres deep and a corresponding volume of approximately 635 cubic metres;

  - one (1) tank with approximate dimensions of 20.7 metres long by 8.50 metres wide by 3.80 metres deep and a corresponding volume of approximately 669 cubic metres;

  - four (4) 15 kilowatt submersible pumps (one duty pump for each aeration tank and one standby pump), each with a rated capacity of 209 litres per second, for jet mixing;

- three (3) final clarifiers, each with approximate dimensions of 16.0 metres long by 16.0 metres wide, with 3.70 metres SWD, complete with rapid sludge collecting and removal systems:

  - maximum design flow rate of 10,400 cubic metres per day to the three clarifiers;

Effluent Disinfection System

- an ultraviolet (UV) irradiation system consisting of two (2) banks of UV lamps in series, complete with lamps, power distribution system, system control centre, level control gate, and UV detection system:

  - maximum design flow rate to the UV disinfection system of 5,500 cubic metres per day for one bank in operation and 11,000 cubic metres per day for two banks in operation;

Chemical Building

a building that houses sludge pumping systems in the basement and chemical feed systems on the main floor:

- sludge pumping systems:
  - two (2) waste activated sludge (WAS) vertical mounted pumps, each with a capacity of 23.15 litres per second against a TDH of 4.0 metres;
  - three (3) return activated sludge (RAS) vertical mounted pumps, each with a capacity of 60.2 litres per second against a TDH of 4.0 metres, and equipped with VFDs;
  - two (2) primary sludge recirculation pumps, each with a capacity of 15.5 litres per second against a TDH of 6.7 metres;
  - two (2) biosolids transfer pumps;
- chemical feed systems for addition of chemicals to various possible application points, including upstream of the primary clarifiers, upstream of the aeration tanks, and primarily to the outlet channel of the aeration tanks:
  - two (2) tanks, each with a capacity of 21 cubic metres for storage of chemical solution (i.e., alum or equivalent coagulant);
  - two (2) coagulant feed pumps (one duty, one standby), each with a capacity of 144 litres per hour at 700 kilopascals, to supply the activated sludge process tanks, normally upstream of the secondary clarifiers, controlled by the existing flowmeter at the main primary clarification process stage;
  - two (2) coagulant feed pumps (one duty, one standby), each with a capacity of 144 litres per hour at 700 kilopascals, to supply the physical/chemical clarification system during wet weather conditions, with chemical addition point at the start of the inlet channel upstream of the clarifiers, controlled by the existing stormwater flowmeter;
  - one (1) lime slurry system with a progressing cavity pump having a capacity of 0.6 litres per second against a TDH of 50 metres, available to provide supplemental alkalinity to the anaerobic digesters, if necessary;
  - four (4) chemical metering pumps for polymer addition to the physical/chemical treatment process, if necessary, with a flow range of 4.2 to 150 litres per hour;

- one (1) liquid polymer make-up system with equivalent capacity of 15 kilograms per day of dry polymer, complete with mixer, dilution water flow rotameter, metering pump, and 190 litre solution tank;

Sludge Digesters

an anaerobic digestion system including:

- one (1) primary digester with a volume of 880 cubic metres;
  - equipped with a mechanical screw type mixer complete with draft tube drive assembly and control panel;
- one (1) secondary digester with a volume of 826 cubic metres:
  - secondary digester has a floating roof;
- one (1) Biosolids Storage Tank with a volume of 1,900 cubic metres:
  - storage tank has a fixed roof;
  - decant piping, complete with isolation valves, to empty into the existing sludge tank overflow line;
- one (1) heat exchanger boiler:
  - 7.5 kilowatt external sludge heat exchanger designed for a minimum sludge flow from the primary digester of 16 litres per second and 1.8 to 3.7 metres sludge head loss;

all other controls, electrical equipment, instrumentation, piping, pumps, valves and appurtenances essential for the proper operation of the aforementioned *Works* ;

all in accordance with the following submitted supporting documents:

1. Application for Approval of Municipal and Private Sewage Works dated January 21, 2008, and accompanying cover letter dated February 1, 2008, from Jean Hebert of Stantec Consulting Ltd., and received on February 4, 2008;
2. Document entitled "Town of Carleton Place Water Pollution Control Plant Application for a Certificate of Approval (Sewage)", including appendices, prepared by Stantec Consulting Ltd. (Stantec), dated January 30, 2008 and received on February 4, 2008;

3. Set of preliminary engineering drawings entitled "Town of Carleton Place Water Pollution Control Plant / Water Treatment Plant Modifications (Project No. 163400782)", prepared by Stantec, dated January, 2008 and received on February 4, 2008;

4. Letter dated April 9, 2008 from Andre Schnell of the Ontario Ministry of the Environment (MOE) to Paul Knowles of The Corporation of the Town of Carleton Place;

5. Letter and attachments dated April 28, 2008 from Jean Hebert of Stantec to Andre Schnell of the MOE;

6. E-mail and attachments dated October 3, 2008 from Jean Hebert of Stantec to Andre Schnell of the MOE;

7. Document entitled "Corporation of the Town of Carleton Place, Water Pollution Control Plant Modifications - Design Brief", prepared by Stantec Consulting Ltd. (Stantec), dated December, 2004;

8. Document entitled "Carleton Place Filter-to-Waste and Actiflo Alum Sludge Management Study", prepared by Stantec, dated September, 2003;

9. Set of Engineering Drawings entitled "Town of Carleton Place, Water Pollution Control Plant / Water Treatment Plant Modifications (Project No. 634-00426)", prepared by Stantec, issued for MOE review, dated December, 2004;

10. Report entitled "Town of Carleton Place Improvements to Sewage Works Detailed Description of Plant Expansion", prepared by J.L. Richards & Associates Limited, Consulting Engineers and Planners, dated January, 1992; and

11. Final plans and specifications prepared by J.L. Richards & Associates Limited, Consulting Engineers and Planners, dated February, 1992.

For the purpose of this Certificate of Approval and the terms and conditions specified below, the following definitions apply:

"*Act* " means the Ontario Water Resources Act, R.S.O. 1990, Chapter 0.40, as amended;

"*Annual Average Concentration* " means the arithmetic mean of the *Monthly Average Concentrations* of a contaminant in the effluent, calculated for any particular calendar year;

"*Annual Average Loading* " means the value obtained by multiplying the *Annual Average Concentration* of a contaminant by the *Average Daily Flow* over the same calendar year;

"*Average Daily Flow* " means the cumulative total sewage flow to the sewage works during a calendar year divided by the number of days during which sewage was flowing to the sewage works that year;

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

"*By-pass* " means any discharge of raw sewage from the *Works* that does not undergo any treatment before it is discharged to the environment;

"*CBOD5* " means five day carbonaceous (nitrification inhibited) biochemical oxygen demand measured in an unfiltered sample;

"*Certificate* " means this entire certificate of approval document, issued in accordance with Section 53 of the *Act* , and includes any schedules;

"*COD* " means chemical oxygen demand measured in an unfiltered sample;

"*Daily Concentration* " means the concentration of a contaminant in the effluent discharged over any single day, as measured by a composite or grab sample, whichever is required;

"*Director* " means any *Ministry* employee appointed by the Minister pursuant to section 5 of the *Act* ;

"*District Manager* " means the District Manager of the Ottawa District Office of the *Ministry* ;

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

"*Existing Works* " means those portions of the sewage works previously constructed and existing on-site on the date of issuance of this *Certificate* ;

"*Geometric Mean Density* " is the nth root of the product of multiplication of the results of n number of samples over the period specified;

"*Ministry* " means the Ontario Ministry of the Environment;

"*Monthly Average Concentration* " means the arithmetic mean of all *Daily Concentrations* of a contaminant in the effluent sampled or measured, or both, during a calendar month;

"*Monthly Average Daily Flow* " means the cumulative total sewage flow to the sewage works during a calendar month divided by the number of days during which sewage was flowing to the sewage works that month;

"*Monthly Average Loading* " means the value obtained by multiplying the *Monthly Average Concentration* of a contaminant by the *Monthly Average Daily Flow* over the same calendar month;

"*Owner* " means The Corporation of the Town of Carleton Place and includes its successors and assignees;

"*Peak Flow Rate* " means the maximum rate of sewage flow for which the plant or process unit was designed;

"*Proposed Works* " means the sewage works described in the *Owner* 's application, this *Certificate* and in the supporting documentation referred to herein, to the extent approved by this *Certificate* ;

"*Rated Capacity* " means the *Average Daily Flow* , during dry weather conditions, for which the *Works* are approved to handle;

"*Regional Director* " means the Regional Director of the Eastern Region of the *Ministry* ;

"*Substantial Completion* " has the same meaning as "*substantial performance* " in the Construction Lien Act; and

"*Works* " means the sewage works described in the *Owner* 's application, this *Certificate* and in the supporting documentation referred to herein, to the extent approved by this *Certificate* and includes both *Existing Works* and *Proposed Works* .

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

TERMS AND CONDITIONS

1. GENERAL PROVISIONS

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

(2) Except as otherwise provided by these Conditions, the *Owner* shall design, build, install, operate and maintain the *Works* in accordance with the description given in this *Certificate* , the application for approval of the works and the submitted supporting documents and plans and specifications as listed in this *Certificate* .

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

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

(5) The requirements of this *Certificate* are severable. If any requirement of this *Certificate* , or the application of any requirement of this *Certificate* to any circumstance, is held invalid or unenforceable, the application of such requirement to other circumstances and the remainder of this Certificate shall not be affected thereby.

2. EXPIRY OF APPROVAL

The approval issued by this *Certificate* will cease to apply to those parts of the *Works* which have not been constructed within five (5) years of the date of this *Certificate* .

3. CHANGE OF OWNER

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

(a) change of *Owner* ;

(b) change of address of the *Owner* ;

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

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

(2) In the event of any change in ownership of the *Works* , other than a change to a successor municipality, the *Owner* shall notify in writing the succeeding owner of the existence of this *Certificate* , and a copy of such notice shall be forwarded to the *District Manager* and the *Director* .

4. UPON THE SUBSTANTIAL COMPLETION OF THE WORKS

(1) Upon the *Substantial Completion* of the *Works* , the *Owner* shall prepare a statement, certified by a Professional Engineer, that the works are constructed in accordance with this *Certificate* , and upon request, shall make the written statement available for inspection by *Ministry* personnel.

(2) Within six (6) months following the *Substantial Completion* of the *Proposed Works* , a set of as-built drawings showing the *Works* "as constructed" shall be prepared. These drawings shall be kept up to date through revisions undertaken from time to time and a copy shall be retained at the *Works* for the operational life of the *Works* .

5. BY-PASSES

(1) Any *By-pass* of sewage from any portion of the *Works* is prohibited, except where:

(a) it is necessary to avoid loss of life, personal injury, danger to public health or severe property damage;

(b) the *District Manager* agrees that it is necessary for the purpose of carrying out essential maintenance and the *District Manager* has given prior written acknowledgment of the *By-pass* ; or

(c) the *Regional Director* has given prior written acknowledgment of the *By-pass* .

(2) The *Owner* shall collect at least one (1) grab sample of the *By-pass* and have it analyzed for the parameters outlined in Table 1 of Condition 6, using the protocols in Condition 9.

(3) The *Owner* shall maintain a logbook of all *By-pass* events which shall include, at a minimum, the time, location, duration, quantity of *By-pass* , the authority for *By-pass* pursuant to subsection (1), and the reasons for the occurrence.

6. EFFLUENT OBJECTIVES

(1) The *Owner* shall use best efforts to design, construct and operate the *Works* with the objective that the concentrations and loadings of the materials named below as effluent parameters are not exceeded in the effluent from the *Works* .

Table 1 - Effluent Objectives during Dry Weather Conditions*

Effluent Parameter	**Concentration Objective** (milligrams per litre unless otherwise indicated)	**Waste Loading Objective** (kilograms per day unless otherwise indicated)
Column 1	Column 2	Column 3
CBOD5	15.0	156
Total Suspended Solids	15.0	156
Total Phosphorus	0.75	7.8
Total Ammonia (Ammonia + Ammonium) Nitrogen	2.0 (May 15 to Sept. 30)	20.8 (May 15 to Sept. 30)
E. Coli	200 organisms per 100 millilitres**	-

* Secondary treated effluent quality.
** *Geometric Mean Density* .

Table 2 - Effluent Objectives for Physical/Chemical Treatment Process during Wet Weather Conditions*		
Effluent Parameter	**Concentration Objective** (milligrams per litre)	**Waste Loading Objective** (kilograms per day)
Column 1	Column 2	Column 3
CBOD5	28.0	325
Total Suspended Solids	28.0	325
Total Phosphorus	1.1	12.8

* Relates to the quality of effluent from the physical/chemical clarifiers that are brought on line during wet weather conditions corresponding to raw sewage flow rates of greater than10.400 cubic metres per day.

Table 3 - Effluent Objectives at *Peak Flow Rate* Condition*		
Effluent Parameter	**Concentration Objective** (milligrams per litre)	**Waste Loading Objective** (kilograms per day)
Column 1	Column 2	Column 3
CBOD5	21.9	481
Total Suspended Solids	21.9	481
Total Phosphorus	0.94	20.6

* Relates to the quality of blended effluent from the secondary treatment and physical/chemical treatment processes during periods of wet weather condition up to the *Peak Flow Rate* , monitored immediately upstream of the outfall sewer.

(2) For the purposes of determining conformance with subsection (1):

(a) The *Annual Average Concentration* of the *CBOD5* and Total Suspended Solids parameters named in Column 1 of subsection (1) should not exceed the corresponding concentration set out in Column 2 of subsection (1) during the respective hydraulic loading conditions.

(b) The *Monthly Average Concentration* of the Total Phosphorus and Total Ammonia Nitrogen parameters named in Column 1 of subsection (1) should not exceed the corresponding concentration set out in Column 2 of subsection (1) during the respective hydraulic loading conditions.

(c) The monthly *Geometric Mean Density* of the *E. Coli* parameter named in Column 1 of subsection (1) should not exceed the corresponding density set out in Column 2 of subsection (1) during dry weather conditions.

(d) The *Annual Average Loading* of the *CBOD5* and Total Suspended Solids parameters named in Column 1 of subsection (1) should not exceed the corresponding waste loading set out in Column 3 of subsection (1) during the respective hydraulic loading conditions.

(c) The *Monthly Average Loading* of the Total Phosphorus and Total Ammonia Nitrogen parameters named in Column 1 of subsection (1) should not exceed the corresponding waste loading set out in Column 3 of subsection (1) during the respective hydraulic loading conditions.

(3) The *Owner* shall use best efforts to:

(a) maintain the pH of the effluent from the *Works* within the range of 6.0 to 9.5, inclusive, at all times;

(b) operate the *Works* within the *Rated Capacity* of the *Works* (7,900 cubic metres per day during dry weather conditions) and within the *Peak Flow Rate* of the Works (22,000 cubic metres per day during wet weather conditions);

(c) operate the *Works* such that the physical/chemical clarifiers are brought on line and operated only when raw sewage flow rates to the *Works* exceed 10,400 cubic metres per day (i.e., during wet weather conditions); and

(d) ensure that the effluent from the *Works* is essentially free of floating and settleable solids and does not contain oil or any other substance in amounts sufficient to create a visible film or sheen or foam or discolouration on the receiving waters.

(4) The *Owner* shall include in all reports submitted in accordance with Conditions 9 and 12 a summary of the efforts made and results achieved under this Condition.

7. <u>EFFLUENT LIMITS</u>

(1) The *Owner* shall operate and maintain the *Works* such that the concentrations and waste loadings of the materials named below as effluent parameters are not exceeded in the effluent from the *Works* .

Table 4 - Effluent Limits*

Effluent Parameter	**Average Concentration** (milligrams per litre unless otherwise indicated)	**Average Waste Loading** (kilograms per day unless otherwise indicated)
Column 1	Column 2	Column 3
CBOD5	25.0	550
Total Suspended Solids	25.0	550
Total Phosphorus	1.0	22.0
Total Ammonia (Ammonia + Ammonium) Nitrogen	4.0 (May 15 to Sept. 30)	88.0 (May 15 to Sept. 30)
pH of the effluent maintained between 6.0 to 9.5, inclusive, at all times		

* Applies to the final effluent discharge from the *Works* , monitored immediately upstream of the outfall sewer

(2) For the purposes of determining compliance with and enforcing subsection (1):

(a) The *Annual Average Concentration* of the *CBOD5* and Total Suspended Solids parameters named in Column 1 of subsection (1) shall not exceed the corresponding maximum concentration set out in Column 2 of subsection (1).

(b) The *Monthly Average Concentration* of the Total Phosphorus and Total Ammonia Nitrogen parameters named in Column 1 of subsection (1) shall not exceed the corresponding maximum concentration set out in Column 2 of subsection (1).

(c) The *Annual Average Loading* of the *CBOD5* and Total Suspended Solids parameters named in Column 1 of subsection (1) shall not exceed the corresponding maximum waste loading set out in Column 3 of subsection (1).

(d) The *Monthly Average Loading* of the Total Phosphorus and Total Ammonia Nitrogen parameters named in Column 1 of subsection (1) shall not exceed the corresponding maximum waste loading set out in Column 3 of subsection (1).

(e) The pH of the effluent shall be maintained within the limits outlined in subsection (1), at all times.

(3) Paragraphs (a), (b), (c), (d), and (e) of subsection (2) shall apply upon the issuance of this *Certificate* .

(4) Only those monitoring results collected during the corresponding time period shall be used in calculating the *Annual Average Concentration* , *Monthly Average Concentration* , *Annual Average Loading* , and *Monthly Average Loading* for this *Certificate* .

8. OPERATION AND MAINTENANCE

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

(2) The *Owner* shall prepare and maintain an operations manual that includes, but is not necessarily limited to, the following information:

(a) operating procedures for routine operation of the *Works* ;

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

(c) maintenance and repair programs, including the frequency of maintenance and repair for the *Works* ;

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

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

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

(3) The *Owner* shall maintain the operations manual current and retain a copy at the location of the *Works* for the operational life of the *Works* . Upon request, the *Owner* shall make the manual available to *Ministry* staff.

(4) The *Owner* shall provide for the overall operation of the *Works* with an operator who holds a licence that is applicable to that type of facility and that is of the same class as or higher than the class of the facility in accordance with Ontario Regulation 129/04.

9. <u>MONITORING AND RECORDING</u>

The *Owner* shall, upon commencement of operation of the *Works* , carry out the following monitoring program:

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

(2) For the purposes of this Condition, the following definitions apply:

(a) Daily means once each day;
(b) Weekly means once each week;
(c) Monthly means once every month; and
(d) Quarterly means once every three months.

(3) Samples shall be collected at the following sampling points, at the frequency specified, by means of the specified sample type and analyzed for each parameter listed and all results recorded:

Table 5 - Raw Sewage Monitoring (Samples to be collected at the treatment plant inlet)	
Frequency	Monthly
Sample Type	Composite
Parameters	*BOD5* , COD, Total Suspended Solids, Total Phosphorus, Total Kjeldahl Nitrogen

Table 6 - Septage Monitoring* (Samples to be collected from the Septage Receiving Tank)	
Frequency	Monthly
Sample Type	Grab
Parameters	*BOD5* , Total Solids, Total Suspended Solids, Total Phosphorus, Total Kjeldahl Nitrogen

* Representative samples of the Septage Receiving Tank contents shall be collected for analysis on a monthly basis, subject to seasonal availability of the septage requiring co-treatment.

Table 7 - Centrate Monitoring (Samples to be collected from the Centrate Equalization Tank)	
Frequency	Quarterly
Sample Type	Grab
Parameters	*BOD5* , COD, Total Suspended Solids, Total Phosphorus, Total Kjeldahl Nitrogen

Table 8 - Physical/Chemical Clarification Effluent Monitoring* (Combined effluent samples to be collected at the physical/chemical clarification stage)	
Frequency	Daily
Sample Type	Grab
Parameters	*CBOD5* , Total Suspended Solids, Total Phosphorus

* Daily sampling whenever the physical/chemical clarifiers are in use.

Table 9 - Final Effluent Monitoring
(Samples to be collected immediately upstream of the outfall sewer)

Parameters	Sample Type	Frequency
CBOD5	Composite	Monthly
Total Suspended Solids	Composite	Monthly
Total Phosphorus	Composite	Weekly
Total Ammonia (Ammonia + Ammonium) Nitrogen	Composite	Weekly
Total Kjeldahl Nitrogen	Composite	Monthly
Nitrite	Composite	Monthly
Nitrate	Composite	Monthly
Faecal Streptococcus	Grab	Monthly
E. Coli	Grab	Weekly
pH	Grab	Weekly

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

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

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

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

(d) for any parameters not mentioned in the documents referenced in (a) and (b), the written approval of the *District Manager* shall be obtained prior to sampling.

(5) The *Owner* shall install and maintain continuous flow measuring devices, to measure the flowrates of sewage into the *Works* and effluent from the *Works* with an accuracy to within plus or minus fifteen per cent (+/- 15%) of the actual flowrate for the entire design range of the flow measuring devices, and record the flowrate at a daily frequency.

(6) The *Owner* shall install and maintain a continuous flow measuring device, to measure the flowrate of storm water flow into the physical/chemical clarification system with an accuracy to within plus or minus fifteen per cent (+/- 15%) of the actual flowrate for the entire design range of the flow measuring device, and record the flowrate at a daily frequency during wet weather conditions.

(7) The *Owner* shall install and maintain a continuous flow measuring device, to measure the flowrate of centrate returned to the STP headworks Centrate Equalization Tank, with an accuracy to within plus or minus fifteen per cent (+/- 15%) of the actual flowrate for the entire design range of the flow measuring device, and record the flowrate at a daily frequency.

(8) The *Owner* shall retain for a minimum of three (3) years from the date of their creation, all records and information related to or resulting from the monitoring activities required by this *Certificate* .

10. SPECIAL CONDITION - SEPTAGE ADDITION FOR CO-TREATMENT

(1) The *Owner* shall measure or calculate the quantity of septage added to the *Works* , and record the quantity at a daily frequency.

(2) The *Owner* shall operate and maintain the *Works* such that the maximum monthly loading of septage to the *Works* for co-treatment does not exceed 4.54 cubic metres per day.

11. SPECIAL CONDITION - CONTINGENCY MEASURES

(1) The *Owner* shall operate the *Works* in a manner such that if the effluent is determined to be non-compliant with respect to the Total Ammonia Nitrogen parameter as stipulated in Condition 7, sludge dewatering operations at the *Works* must be ceased immediately. Sludge dewatering operations may be resumed following a non-compliance situation for the Total Ammonia Nitrogen parameter upon measurement of concentrations at or below the respective effluent limit outlined in Table 4 in any single sample of final effluent monitored in accordance with Condition 9.

(2) Notwithstanding subsection (1) above, if any non-compliance situation is encountered for the Total Ammonia Nitrogen parameter, the *Owner* shall retain an independent consulting engineer to review and determine the cause of the non-compliance situation, including but not limited to an assessment of the potential impacts of centrate return and septage addition to the STP, and to identify appropriate control measures and implementation time lines for ensuring consistent compliance with the effluent limits stipulated in Condition 7. A report of the findings shall be prepared by the independent consulting engineer, and copies of this report shall be submitted by the *Owner* to the *District Manager* and to the *Director* within three (3) months following the effluent non-compliance situation.

(3) The *Owner* shall submit plans for the proposed control measures and implementation time lines in accordance with subsection (2) above for approval to the *District Manager* .

12. REPORTING

(1) One (1) week prior to the start up of the operation of the *Proposed Works* , the *Owner* shall notify the *District Manager* (in writing) of the pending start up date.

(2) Ten (10) days prior to the date of a planned *By-pass* being conducted pursuant to Condition 5, the *Owner* shall notify the *District Manager* (in writing) of the pending start date, and as soon as possible for an unplanned *By-pass* , in addition to an assessment of the potential adverse effects on the environment and the duration of the *By-pass* .

(3) The *Owner* shall report to the *District Manager* or designate, any exceedence of any parameter specified in Condition 7 orally, as soon as reasonably possible, and in writing within seven (7) days of the exceedence.

(4) In addition to the obligations under Part X of the Environmental Protection Act, the *Owner* shall, within ten (10) working days of the occurrence of any reportable spill as defined in Ontario Regulation 675/98, bypass or loss of any product, by-product, intermediate product, oil, solvent, waste material or any other polluting substance into the environment, submit a full written report of the occurrence to the *District Manager* describing the cause and discovery of the spill or loss, clean-up and recovery measures taken, preventative measures to be taken and schedule of implementation.

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

(6) The *Owner* shall prepare and submit to the *District Manager* a performance report, on an annual basis, within ninety (90) days following the end of the period being reported upon. The first such report shall cover the first annual period following the commencement of operation of the *Works* and subsequent reports shall be submitted to cover successive annual periods following thereafter. The reports shall contain, but shall not be limited to, the following information:

(a) a summary and interpretation of all monitoring data and a comparison to the effluent limits outlined in Condition 7, including an overview of the success and adequacy of the *Works* ;

(b) a description of any operating problems encountered and corrective actions taken;

(c) a summary of all maintenance carried out on any major structure, equipment, apparatus, mechanism or thing forming part of the *Works* ;

(d) a summary of any effluent quality assurance or control measures undertaken in the reporting period;

(e) a summary of the calibration and maintenance carried out on all effluent monitoring equipment;

(f) a description of efforts made and results achieved in meeting the Effluent Objectives of Condition 6;

(g) a tabulation of the quantity of centrate returned to the headwork of the *Works* during the reporting period;

(h) a summary of chemical characterization data for samples of centrate collected in accordance with Table 7 of Condition 9 during the reporting period;

(i) a summary of the contaminant mass loadings associated with centrate return during the reporting period, based on the corresponding monitoring results in accordance with Table 7, and an assessment of the impacts on the available treatment capacity and nitrification performance of the STP;

(j) a tabulation of the quantity of septage added to the *Works* for co-treatment during the reporting period;

(k) a summary of chemical characterization data for samples of septage collected in accordance with Table 6 of Condition 9 during the reporting period;

(l) a summary of the contaminant mass loadings associated with septage additions during the reporting period, based on the corresponding monitoring results in accordance with Table 6, and an assessment of the impacts on the available treatment capacity and nitrification performance of the STP;

(m) a tabulation of the volume of sludge generated in the reporting period, an outline of anticipated volumes to be generated in the next reporting period and a summary of the locations to where the sludge was disposed;

(n) a summary of any complaints received during the reporting period and any steps taken to address the complaints;

(o) a summary of all bypass, spill or abnormal discharge events; and

(p) any other information the *District Manager* requires from time to time.

13. REVOCATION OF EXISTING APPROVALS

(1) The descriptions of the approved *Works* and conditions of approval in this *Certificate* apply in place of all existing descriptions and conditions in the Certificates of Approval under the *Ontario Water Resources Act* for sewage works which are part of the *Works* approved by this *Certificate* .

(2) Notwithstanding subsection (1) above, the original applications for approval, including design calculations, engineering drawings and reports prepared in support of the existing Certificate(s) of Approval whose descriptions of the approved *Works* and conditions are now replaced pursuant to subsection (1) above, shall form part of this *Certificate* .

(3) Where an existing Certificate of Approval referred to in subsection (1) above applies to *Works* in addition to the *Works* approved by this *Certificate* , it shall continue to apply to those additional *Works* .

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

1. Condition 1 is imposed to ensure that the *Works* are built and operated in the manner in which they were described for review and upon which approval was granted. This Condition is also included to emphasize the precedence of Conditions in the *Certificate* and the practice that the Approval is based on the most current document, if several conflicting documents are submitted for review. The Condition also advises the *Owner* of their responsibility to notify any person who they authorize to carry out work pursuant to this *Certificate* of the existence of this *Certificate* .

2. Condition 2 is included to ensure that the *Works* are constructed in a timely manner so that standards applicable at the time of Approval of the *Works* are still applicable at the time of construction, to ensure the ongoing protection of the environment.

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

4. Condition 4 is included to ensure that the *Works* are constructed in accordance with the approval and that record drawings of the *Works* "as constructed" are maintained for future references.

5. Condition 5 is included to indicate that by-passes of untreated raw sewage to the receiving watercourse

is prohibited, save in certain limited circumstances where the failure to *By-pass* could result in greater injury to the public interest than the *By-pass* itself where a *By-pass* will not violate the approved effluent requirements, or where the *By-pass* can be limited or otherwise mitigated by handling it in accordance with an approved contingency plan. The notification and documentation requirements allow the *Ministry* to take action in an informed manner and will ensure the *Owner* is aware of the extent and frequency of *By-pass* events.

6. Condition 6 is imposed to establish non-enforceable effluent quality objectives which the *Owner* is obligated to use best efforts to strive towards on an ongoing basis. These objectives are to be used as a mechanism to trigger corrective action proactively and voluntarily before environmental impairment occurs and before the compliance limits of Condition 7 are exceeded.

7. Condition 7 is imposed to ensure that the effluent discharged from the *Works* to the Mississippi River meets the *Ministry* 's effluent quality requirements thus minimizing environmental impact on the receiver and to protect water quality, fish and other aquatic life in the receiving water body.

8. Condition 8 is included to require that the *Works* be properly operated, maintained, funded, staffed and equipped such that the environment is protected and deterioration, loss, injury or damage to any person or property is prevented. As well, inclusion ensures that a comprehensive operations manual governing all significant areas of operation, maintenance and repair is prepared, implemented and kept up-to-date by the *Owner* and made available to the *Ministry* . Such a manual is an integral part of the operation of the *Works* . Its compilation and use should assist the *Owner* in staff training, in proper plant operation and in identifying and planning for contingencies during possible abnormal conditions. The manual will also act as a benchmark for *Ministry* staff when reviewing the *Owner'* s operation of the *Works* .

9. Condition 9 is included to enable the *Owner* to evaluate and demonstrate the performance of the *Works* , on a continual basis, so that the *Works* are properly operated and maintained at a level which is consistent with the design objectives and effluent limits specified in the *Certificate* and that the *Works* does not cause any impairment to the receiving watercourse.

10. Condition 10 is included to ensure that the *Works* are operated within the design capacity, including septage co-treatment capability and capacity.

11. Condition 11 is included owing to the potential impacts of centrate return stream contaminant (Total Kjeldahl Nitrogen, *BOD5* , Total Suspended Solids) loadings on the ability of the STP to nitrify as required and to comply with the effluent Total Ammonia Nitrogen non-compliance limit, thus necessitating the implementation of contingency measures, if necessary, to help ensure consistent compliance by the *Works* with the effluent limits stipulated in Condition 7, within the *Rated Capacity* of the *Works* .

12. Condition 12 is included to provide a performance record for future references, to ensure that the *Ministry* is made aware of problems as they arise, and to provide a compliance record for all the terms and conditions outlined in this *Certificate*, so that the *Ministry* can work with the *Owner* in resolving any problems in a timely manner.

13 Condition 13 is included to stipulate that this *Certificate* replaces all previous approvals for the *Works* being the subject of this *Certificate*, and that the existing approvals remain in force for the purpose of any *Works* which are not subject to this *Certificate*.

This Certificate of Approval revokes and replaces Certificate(s) of Approval No. 4526-6EHHUJ issued on November 25, 2005.

In accordance with Section 100 of the Ontario Water Resources Act, R.S.O. 1990, Chapter 0.40, as amended, you may by written notice served upon me and the Environmental Review Tribunal within 15 days after receipt of this Notice, require a hearing by the Tribunal. Section 101 of the Ontario Water Resources Act, R.S.O. 1990, Chapter 0.40, provides that the Notice requiring the hearing shall state:

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

The Notice should also include:

3. The name of the appellant;
4. The address of the appellant;
5. The Certificate of Approval number;
6. The date of the Certificate of Approval;
7. The name of the Director;
8. The municipality within which the works are located;

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

This Notice must be served upon:

The Secretary Environmental Review Tribunal 655 Bay Street, 15th Floor Toronto, Ontario M5G 1E5	AND	The Director Section 53, *Ontario Water Resources Act* Ministry of the Environment 2 St. Clair Avenue West, Floor 12A Toronto, Ontario M4V 1L5

* **Further information on the Environmental Review Tribunal's requirements for an appeal can be obtained directly from the Tribunal at: Tel: (416) 314-4600, Fax: (416) 314-4506 or www.ert.gov.on.ca**

The above noted sewage works are approved under Section 53 of the Ontario Water Resources Act.

DATED AT TORONTO this 3rd day of October, 2008

[illegible]
ON Oct. 06, 2008
N.P
(Signed)

Mansoor Mahmood, P.Eng.
Director
Section 53, *Ontario Water Resources Act*

AS/

c: District Manager, MOE Ottawa
Jean Hebert, P.Eng., Stantec Consulting Ltd.
Dan Atkinson, VP of Operations, Ontario Clean Water Agency ✓
Water Standards Section, Standards Development Branch, MOE

Appendix K Wastewater Treatment Plant Facility Optimization Report

ONTARIO CLEAN WATER AGENCY
AGENCE ONTARIENNE DES EAUX

MEMORANDUM

TO: Dave Young, Director of Public Works
Town of Carleton Place

FROM: Shane Hogan, Senior Operations Manager
Ontario Clean Water Agency

DATE: April 21, 2020

PROJECT: (DRAFT) Facility Optimization Report for the Carleton Place Water Pollution Control Plant

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Dear Dave,

I am pleased to provide you with a DRAFT copy of OCWA's Facility Optimization Report for the Carleton Place Water Pollution Control Plant.

The Facility Optimization Report was developed to provide the Town of Carleton Place with a general overview of the current status of the facility, and provide recommendations to improve and enhance its current life cycle.

Once you have had a chance to review the draft report, we would like to propose a meeting with the Town in the near future to discuss our findings and recommendations.

Please feel free to contact me should you have any questions or concerns.

Shane Hogan
Senior Operations Manager
Ontario Clean Water Agency

Cc: Andrew Trader, Regional Hub Manager

Hank Andres, Senior Process Engineer
Brad Hoover, Operations Process Specialist
Shelly Bonte-Gelok, Director (A)
Process Optimization and Technical Services

/mb

Encl. (1)

ONTARIO CLEAN WATER AGENCY
AGENCE ONTARIENNE DES EAUX

DRAFT FOR REVIEW

Facility Optimization of the Carleton Place Water Pollution Control Plant

Prepared by

Process Optimization and Technical Services
Ontario Clean Water Agency

Prepared for

OCWA Eastern Regional Office
Town of Carleton Place

April 21, 2020

Facility Optimization Report for the
Carleton Place Water Pollution Control Plant

April 21, 2020

Report Prepared by:

Hank Andres, P.Eng.
Senior Wastewater Process Engineer
Process Optimization and Technical Services

Brad Hoover,
Operations Process Specialist
Process Optimization and Technical Services

Report Reviewed by:

Shelly Bonte-Gelok, M.Sc., P. Eng.
Director (A)
Process Optimization and Technical Services

This *Facility Optimization Report for the Carleton Place Water Pollution Control Plant* (report) was prepared by OCWA for the confidential use of the Town of Carleton Place. The material in this report reflects OCWA's best judgment in light of the information available to OCWA at the time of preparation.

This report shall be used by the Town of Carleton Place for its intended purpose only and not for any other purpose or in relation to any other project. Any use which the Town of Carleton Place makes of the report outside of its intended purpose or in relation to any other project is the responsibility of the Town of Carleton Place. OCWA accepts no responsibility for damages, if any, suffered by the Town of Carleton Place as a result of decisions made or actions based on this report outside of its intended purpose or in relation to any other project.

Furthermore, any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. OCWA accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

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Acknowledgement

On behalf of the Ontario Clean Water Agency's Process Optimization and Technical Services Team, I would like to acknowledge the Town of Carleton Place and the Carleton Place Water Pollution Control Plant Staff for their support and dedication to ensuring that we were able to conduct a detailed review of the facility. This report was made possible with their co-operation in providing administrative, operational and maintenance input. The shared knowledge from the plant staff has enabled us to provide holistic recommendations for improvement that include all of these important elements while taking into consideration the day-to-day and seasonal pressures experienced at this facility.

Thank you for participating in OCWA's 2020 Facility Optimization Study of the Carleton Place Water Pollution Control Plant and we look forward to working with you again.

Shelly Bonte-Gelok, M.Sc., P. Eng.
Director (A), Process Optimization and Technical Services

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SITE VISIT INFORMATION

Site Address	*Carleton Place Water Pollution Control Plant* *122 Patterson Crescent* *Carleton Place, ON K7C 4P3*	
Date of Evaluation	October 21-22, 2019	
Plant Personnel	Shane Hogan	Senior Operations Manager
	Mandi Larose	Operations & Maintenance Team Lead
	Shawn LeBlanc	Operations & Maintenance Team Lead
	Alison O'Connor	Process Compliance Technician
	Vanessa Greatrix	Manager, Safety, Process and Compliance
	Andrew Trader	Regional Hub Manager
OCWA Evaluators	Hank Andres	Team Lead / Process Specialist, Process Optimization & Technical Services
	Brad Hoover	Operations Process Specialist
	Shelly Bonte-Gelok	Director (A), Process Optimization and Technical Services
	Marlene Bergeron	Process Advisor to Director
	William Wang	Process Optimization Assistant

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Executive Summary

The Facility Optimization Program (FOP) was carried out at the Carleton Place Water Pollution Control Plant (WPCP) by OCWA's Process Specialists using the Ministry of Environment, Conservation and Parks (MECP) guideline, "Ontario Composite Correction Program Manual for Optimization of Wastewater Treatment Plants". The key objectives of this study are:

- To review the performance and capacity of the Carleton Place WPCP.
- To identify and prioritize performance limiting factors in the areas of design, operation, maintenance, and administration.
- To develop treatment improvement options to meet the compliance requirements, with a focus on low cost solutions.

<u>Key Findings</u>:

Based on the results of this FOP, the Carleton Place WPCP is rated as a **<u>capable</u>** plant since the performance of the plant met MECP treatment objectives and limits fairly consistently at current flows. Under certain operational conditions there are issues with achieving full nitrification but this can be addressed by implementing a higher level of process control with respect to managing the biosolids supernatant decant volumes, and the SRT/mass inventory and residual alkalinity in the aeration tanks.

A capital project should be initiated to identify and address the current deficiencies with the sludge dewatering system so that the centrifuge can be put into service to help with the current sludge storage limitations at the facility. If the sludge dewatering centrifuge deficiencies cannot be addressed and the centrifuge cannot operate, the sludge storage capacity will need to be expanded to ensure adequate sludge storage capacity over the winter months.

A comprehensive review and analysis of various aspects of the Carleton Place WPCP was completed during this facility optimization study. The main findings are summarized as below:

- The Carleton Place WPCP meets its operating goals and objectives most of the time. The final effluent wastewater quality consistently meets MECP treatment objectives and limits.
- All unit processes can accommodate existing average and peak flows with no issues or relatively minor process upsets.
- The most limiting process at the facility is the biosolids storage capacity as it does not currently meet the MECP design criteria of 180 days.
- With respect to energy consumption, the Carleton Place WPCP is performing relatively well in comparison to the other similar sized facilities. The average volumetric energy intensity of the other similar sized facilities is 0.96 kWh/m^3, while for Carleton Place it is 0.59 kWh/m^3.
- The O&M team is proactive and cooperative; and the plant is well maintained.

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The improvements and upgrades recommended by the FOP team are grouped into four categories; design, operation, maintenance and administration, which are presented in the tables below. Each of recommendation is classified as A, B, or C according to the following guidelines:

A – Recommended for immediate action due to major impact on plant performance and and/or relative low cost involved.

B – Recommended for action within 1-3 years due to significant impact on plant performance.

C – Recommended for future consideration due to the minor or intermittent impact on a periodic basis.

Design

Summary of Design Limiting Factors for the Carleton Place WPCP	
Recommendation	**Factor Classification**
Biosolids Dewatering: • The sludge dewatering centrifuge is currently not in service due to various design and operational issues. A capital project should be initiated to identify and address the current deficiencies with the sludge dewatering system so that the centrifuge can be put into service to help address the current sludge storage limitations at the facility.	**A**
Biosolids Treatment and Storage: • If the sludge dewatering centrifuge deficiencies cannot be addressed and the centrifuge cannot operate, the sludge storage capacity will need to be expanded to ensure adequate sludge storage capacity over the winter months. • Alternatively, the BCR Environmental CleanB sludge treatment technology was recently trialed at the Carleton Place facility with promising results. The CleanB technology may be an economical long-term solution for biosolids treatment and processing at the Carleton Place facility.	**A**
Activated Sludge System Nitrification Capacity: • The aeration tank hydraulic retention time (HRT) and solids retention time (SRT) are both currently above the MECP minimum recommended range (i.e. minimum 6 hour HRT and 10 day SRT), however, they are quite close to the minimum recommended values at current flows, even at the current average MLSS concentration greater than 5,000 mg/L, and this has an impact on the capacity of the plant to achieve consistent nitrification	**Information only**
Final Clarifier Still Wells: • The final clarifier still well center rings are designed to capture the scum and send it to the scum collection manhole. The rings have degraded over the years and reached their end of life, allowing holes to form in them. The holes allow the scum to escape from the rings and make its way into the final effluent. The center rings should be rehabilitated or replaced to prevent scum from escaping. This should also help lower final effluent TSS	**A**

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Summary of Design Limiting Factors for the Carleton Place WPCP	
Recommendation	**Factor Classification**
and the scum build-up that was observed in the UV channel.	
Mechanical WAS Thickening: • A study should be initiated to evaluate mechanical WAS thickening alternatives for the facility. Currently, the WAS is co-thickened in the main plant primary clarifiers. Separate mechanical WAS thickening would decrease the sludge inventory in the system, improve the performance of the primary clarifiers and increase the capacity for nitrification of the existing activated sludge system.	**B**
RAS Control (Pumps/Valves): • The RAS control (i.e. pump size, valves) could be reviewed to improve the design to provide better control of the RAS to the aeration tanks and improve the total mass distribution in the activated sludge system.	**B**
Flow Splitter Chambers: • When reviewing the flow splitter chambers at the plant, the flow entering the aeration tanks and final clarifiers is not being distributed equally. The flow split discrepancy was also confirmed by reviewing the drawings and the in-house lab results. When facility upgrades are required in the future, it is recommended having the splitter boxes reviewed to see if the current design can be improved to allow for more even distribution of flows.	**B**
Aeration Blowers: • At certain times of the year, under higher loading conditions, the 50 HP duty turbo blower cannot provide sufficient oxygen to the three aeration tanks. Under these high oxygen demand conditions, it is recommended to put one of the standby blowers in service to increase the oxygen supply. Consideration should also be given to undertake another turbo blower upgrade to increase the aeration capacity and energy efficiency of the current system.	**B**

Operation

Summary of Operational Limiting Factors for the Carleton Place WPCP	
Recommendation	**Factor Classification**
Biosolids Handling and Storage Capacity Management: • The plant does not achieve adequate nitrification (i.e. ammonia removal) under certain operating conditions. The high TAN in the effluent is most likely due to additional nitrogen loading from the biosolids supernatant sidestreams and a limited capacity for the existing activated sludge system to achieve consistent nitrification under cold weather and/or wet weather flow conditions. Due to this process limitation, a standard operating procedure (SOP) for supernatant management has been developed to limit the supernatant decant volume under certain operating conditions. The detailed SOP can be found in **Appendix D**.	**A**

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Summary of Operational Limiting Factors for the Carleton Place WPCP	
Recommendation	**Factor Classification**
Process Monitoring Spreadsheet: • There is an excellent previously developed process spreadsheet, the "Carleton Place WPCP Formula Sheet" which is currently being utilized to input and review daily lab results. The Formula Sheet is easy to understand, and has pertinent process information and calculations (i.e. SRT, Total Mass etc.) to facilitate process analysis and SRT/mass control. Continue to populate the daily formula sheets and keep them in chronologically organized folders to make it simple and straightforward to access and compare previous labs results and process calculations. • Additionally, a troubleshooting guidance document has been created to assist operators to troubleshoot issues and make appropriate process adjustments based on the observed process symptoms. An overview of Nitrification and Denitrification in Wastewater Treatment Plants can be found in **Appendix E.**	**A** **Information only**
Mechanical Bar Screen: • The mechanical bar screen currently operates on a timer but consideration should be given to run in differential level mode to allow for more efficient operation and improved response to high flows. Bar screens become more efficient at removing debris when rags build up and mat across the bars.	**B**
Primary Clarifier Scum Skimmers: • The manual skimmers in the primary clarifiers are not only difficult to move (they require maintenance – better lubrication) but the east side should have improved access along with platform for smoother operation. Removing scum is necessary for plant operation and may help lessen the scum accumulation in aeration tanks and final clarifiers.	**B**
Physical/Chemical Clarifiers: • The electric actuator is not currently operational and must be turned manually to redirect flow to the physical/chemical clarifiers during wet weather flow events. • Once flow enters the bypass trough the flow is measured using an ultrasonic head to measure the level in the trough. Moving the existing ultrasonic head and installing a V-notch weir upstream of the first influent gate for the physical/chemical clarifiers would provide more accurate wet weather flow measurements. A calculation has also been added to the SCADA PLC to calculate the wet weather flow from the available flow measurements (i.e. raw influent flow minus main primary clarifiers flow). • The current chemical dosing system and flash/floc mixers should be upgraded and overhauled to ensure proper chemical disbursement and mixing. Heat tracing could also be added to the chemical lines to prevent freezing during cold weather conditions. After the chemical dosing and mixing system has been upgraded, the electric actuators should be overhauled or replaced to ensure proper operation and flow distribution into the physical/chemical clarifiers.	**B** **B** **B**

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Summary of Operational Limiting Factors for the Carleton Place WPCP	
Recommendation	**Factor Classification**
Online Analyzers: • Although the plant currently has DO, MLSS, temperature and pH probes, it is recommended that each tank have DO and MLSS probes as there is variability in the DO and MLSS in each tank. Online instrumentation would facilitate manual adjustments to the air distribution to the aeration tanks to ensure the DO concentrations are adequate in each tank. Consideration could also be given to install an ISE ammonia probe in the MLSS effluent channel to monitor the ammonia concentrations online.	**A**
RAS Pump Operation and SCADA Programming: • The difference in solids inventory and suction head are both factors to consider when setting the RAS pump rate for each clarifier to prevent air locks from happening if the RAS pump suction head is too high given the amount of RAS that is collected in the individual sludge center wells of each clarifier. • The VFD speed settings for each RAS pump will be able to be adjusted in the upgraded SCADA system. Consideration should be given to implement programming in the SCADA PLC to set the individual RAS pump flows (i.e. 40%/35%/25%) as a percentage of the overall RAS flow. The overall RAS flow could also be specified as a percentage of the main plant influent flow using the existing main primary clarifier's influent flow meter. • Consideration should also be given to implement programming in the SCADA PLC to ramp up each RAS pump up to full speed for a set period of time (i.e. 60 seconds/day) to flush out the RAS suction lines to prevent solids and rags from building up and impeding the RAS flow.	**Information only** **B** **B**
Sodium Hydroxide Tank: • The influent alkalinity to the plant is lower than typical for municipal wastewater, and is most likely a limiting factor for nitrification as the final effluent alkalinity is periodically below 50 mg/L. The minimum residual alkalinity in the final effluent should ideally be greater than 100 mg/L as CaCO3, and should be greater than 50 mg/L as CaCO3 at an absolute minimum to ensure that an adequate amount of alkalinity is available for full nitrification. Flow-paced sodium hydroxide addition could be implemented to help ensure consistent alkalinity residual for nitrification. • The sodium hydroxide tank is filled in the headworks/loading bay and is susceptible to cold temperatures in the winter. It has been turned off to prevent freezing during the winter, but this could limit the ability to provide sufficient alkalinity to the process for consistent nitrification. A new wall and doorway could be installed to separate it from the loading bay, and the chemical lines could be heat traced to ensure that sodium hydroxide can be added to the process if required during the winter months.	**A** **B**
Final Clarifier Flow Splitter Chamber: • Covering the final clarifier flow splitter chamber with a thick mat (stall mat) should help reduce the scum from potentially rising above the grating.	**C**

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Summary of Operational Limiting Factors for the Carleton Place WPCP	
Recommendation	**Factor Classification**
Anaerobic Digesters Influent Flow Meter: • A flow meter should be installed on the recirculation unit after the heat exchanger to confirm the influent flow to the anaerobic digesters.	**C**
Sampling and Monitoring: • Initiate a special study to quantify the solids, BOD_5, TKN, TAN, TP and Alkalinity loading from the digester supernatant streams to determine the impact on plant performance and capacity.	**B**
PLC, SCADA and Alarm Systems: • Review existing SCADA control systems to ensure that all controls are set up as intended and set points and min/max settings are correct. • Ensure that all critical equipment is alarmed. Ensure all alarm points are confirmed and utilized. Alarm set points should be tested on a regular schedule. • The Carleton Place WPCP SCADA/PLC system is currently undergoing a major upgrade. Operations staff had several suggestions for new functionality, alarms, setpoints and integrating more analyzers and equipment into the SCADA system for enhanced monitoring and optimization of plant operations and process control.	**A** **A** **A**
WISKI/PDM: • Continue efforts to trend and interpret key process/performance data and utilize these trend graphs to improve operational decision making and support daily operational and maintenance activities. • Integrate PDM technology with daily operations to operate the plant within the recommended process parameters; enhance process monitoring and trending system.	**B** **B**

Maintenance

Summary of Maintenance Limiting Factors for Carleton Place WPCP	
Recommendation	**Factor Classification**
Inflow and Infiltration Reduction: • A significant amount of Inflow and infiltration (I&I) was observed in the collection system. Continue ongoing efforts to work in partnership with the Town to reduce I&I into the collection system and to reduce the flows to the WPCP. By isolating and addressing/maintaining the main areas of concern (i.e. infiltration – joints, cracks, manhole covers, sump pumps, storm drain tie-ins, etc.), the number of high flow events and the flow peaking factor to the WPCP will be reduced, which will have a positive impact on the current plant process on and future plant expansion capital costs.	**A**

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Summary of Maintenance Limiting Factors for Carleton Place WPCP	
Recommendation	**Factor Classification**
Vortex Degritters: • Currently, only one of the two vortex degritters can be isolated by the use of a knife valve. It is recommended that the installation of another knife valve be undertaken to allow for isolation of the other vortex degritter during maintenance activities.	**B**
Jet Aeration System: • Continue with the existing jet aeration system inspection frequency to ensure that the aeration equipment remains in proper working order to optimize treatment efficiency.	**B**
Calibration of Analytical Equipment: • Calibrating analyzers and flow meters is critical to the operation and accuracy of the equipment. Annual calibration (i.e. via third party) is common at many facilities across OCWA and is recommended to be continued for the analytical equipment at the Carleton Place WPCP. Calibration of the handheld meters, including DO meter, SS meter, pH meter, and CH4 gas meter are also required based on manufacturer recommendations or OCWA best practices.	**A**

Administration

Summary of Administration Limiting Factors for Carleton Place WPCP	
Recommendation	**Factor Classification**
Standard Operating Procedures (SOPs): • Continue to use all the existing SOPs documents and update as necessary to support/reflect current plant operations. • A standard operating procedure (SOP) for supernatant management has been developed to limit the supernatant decant volume under certain operating conditions. The detailed SOP can be found in **Appendix D**.	**A** **A**
Laboratory Analysis: • A desiccator should be installed in the lab. The desiccant in the desiccator creates low-humidity atmosphere for storing and cooling filter paper to ensure accuracy of in-house labs. • For lab work consistency, samples need to be gathered from the same location, depth and preferably at the same time of day. Labelling sampling locations throughout the plant can remove some confusion when more than one operator is gathering samples to complete lab work.	**C** **C**
Health and Safety: • Hazardous Materials - Some flammable containers should be stored in the fireproof cabinet located in the maintenance area. • Retaining walls are located throughout the facility need to accessed and	**A**

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Summary of Administration Limiting Factors for Carleton Place WPCP	
Recommendation	**Factor Classification**
reconstructed in areas to prevent collapse and further deterioration. • Mechanical Bar Screen Grating - There is a piece of grating missing above the bar screen to allow visual observations to occur; this could be considered a guarding hazard. It would be recommended to replace the panel with a perforated/grating panel to still allow visual observation. The upper section is supported by a come-along and needs to be replaced by a permanent brace. • The Centrifuge Room has many electrical panels that may not be rated for the classification of the room and could be susceptible to hazardous off-gassing from sludge processing when the centrifuge is operating. Relocating the centrifuge to the adjacent room along with upgrading the venting and HVAC system will provide a better physical layout and isolate the off-gassing in an appropriate area. • Currently, the outdoor lights are operated off a timer which should be adjusted based on the season and hours of day light. A motion sensor could be installed to activate the lights to ensure that the outdoor lights are on when lighting conditions are low and operators are present. • Eyewash Stations - Ensure that all eyewash stations located throughout the facility meet the current regulations. There are portable handheld units located in the digester complex but they don't have an eyepiece associated with the bottle to allow for proper flushing procedures.	**B** **B** **A** **B** **A**
Training: • Provide continued support for training programs for the advanced use of WISKI and Maximo for operation and maintenance support. The training program could also include a customized Excel spreadsheet containing typical ranges and targets for key operating parameters.	**B**
WISKI/PDM: • Integrate new WISKI/PDM technology with daily operations to operate the plant within the recommended process parameters.	**B**
Maximo: • Continue to track time on Maximo system to optimize work efficiency and daily time management.	**B**

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Proposed Next Steps

This FOP has resulted in a list of recommendations for discussion, review and prioritization with the Town. The OCWA FOP team will discuss next steps with the Town based on the final prioritized recommendations outlined in this report. Short- and long-term capital plans could be further developed for this facility to address some of the recommendations. OCWA is willing to assist the Town with the pursuit of any of these recommendations at an agreed-upon fee.

Once the Draft FOP report is finalized, a copy will be delivered to the Town for their records. We believe that this FOP document will be a valuable tool to assist OCWA and the Town to make 'best of' operational and capital decisions in the future.

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1. Introduction

The Ontario Clean Water Agency (OCWA) strives to bring value to clients through our commitment to regulatory compliance and the provision of safe and economical wastewater effluent. In support of this goal, OCWA initiated a Facility Optimization Program (FOP) in 2017 at select OCWA-operated water and wastewater treatment facilities. In 2019, the Carleton Place WPCP was selected as one of the facilities for inclusion in the program. Through the FOP, a comprehensive review of plant performance was conducted. This report provides details of the program and key findings through review of background information, plant treatment performance and capacity evaluation to establish opportunities for improved plant operations.

2. Methodology of FOP Study

OCWA's FOP is based on the Composite Correction Program (CCP) developed by the U. S. Environmental Protection Agency (USEPA, 1998). This program is described in detail in the Ontario Ministry of Environment, Conservation and Parks (MECP) guideline entitled, "Guideline Manual for the Optimization of Ontario Water Treatment Plants Using Composite Correction program (CCP) Approach" (MECP, 1998).

The CCP approach consists of two components, a Comprehensive Performance Evaluation (CPE) and Comprehensive Technical Assistance (CTA).

Figure 1 depicts the methodology followed during the CPE phase. During this phase, a comprehensive assessment of the unit process design, administration and maintenance support is performed to establish whether a facility is deemed "capable". This work also includes an assessment of the plant staff's ability to meet the overall objectives to discharge safe and clean final effluent to the surface water receiver. The results of the assessment establish the plant capability and prioritize factors that could be limiting performance.

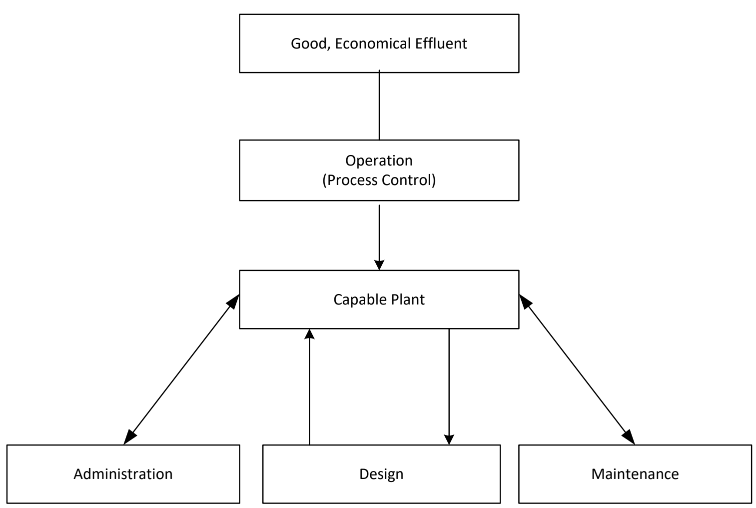

Figure 1 – Comprehensive Performance Evaluation (CPE) Methodology (MECP, 1998)

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A CTA can follow a CPE and help to improve plant performance when it is challenged with issues identified during the CPE. Utility staff can address all or some of the challenges identified to improve the performance and bring the facility within compliance from these efforts.

Based on the above CCP principles, OCWA's FOP is designed to:

- Increase process and facility performance through improved reliability, flexibility and robustness of the system(s)
- Improve and ensure consistent compliance/performance (reduced plant upsets/sampling results)
- Increase efficiencies in the area of energy and chemical consumption
- Improve process control (whether manual or automated)
- Reduce the need for manual process monitoring and control (increase the level of process automation)
- Confirm the efficiency and effectiveness of maintenance programs
- Provide better access to key information
- Identify opportunities to provide additional value to clients
- Reduce operational risks.

3. Facility Description

The Carleton Place WPCP is owned by the Town of Carleton Place and operated by OCWA. The plant treats domestic sewage from the Town of Carleton Place.

The Carleton Place WPCP is a conventional activated sludge treatment plant. Before entering the headworks, sodium hydroxide is added to the influent wastewater for alkalinity addition to promote nitrification in the aeration tanks. The raw influent flows through one (1) mechanical bar screen and splits into two (2) streams entering two (2) forced vortex degritters, it then flows into two (2) primary clarifiers for primary treatment. For secondary treatment, the primary clarifier effluent enters three (3) aeration tanks where Pre-hydroxylated aluminum sulfate 8 (PAS-8) is added for phosphorus removal. After leaving the aeration tanks, the wastewater flows into three (3) final clarifiers before being disinfected by an Ultraviolet (UV) disinfection system. Under wet weather conditions flow above 10,400 m^3/d is diverted after the headworks to three (3) physical/chemical clarifiers for chemically enhanced primary treatment prior to UV disinfection. The combined disinfected final effluent is discharged to the Mississippi River. The return activated sludge (RAS) from the final clarifiers is pumped back to the aeration tanks and the waste activated sludge (WAS) is sent to the anaerobic sludge digestion system followed by centrifuge dewatering.

The Carleton Place WPCP has a rated design capacity of 7,900 m^3/day and a peak design flow of 22,000 m^3/day. The following sections will provide a more detailed facility description. A process flow diagram (PFD) can be seen below in **Figure 2**.

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3.1 Pumping Stations and Force Mains

The Carleton Place collection system consists of a network of 11 sewage pumping stations equipped with high level alarms, nine (9) of which are equipped with backup power. There are 53 km of collection system piping which range in size from 200mm to 750mm in diameter.

3.2 Liquid Train

Figure 2 depicts the process flow diagram (PFD) for the Carleton Place WPCP. The raw wastewater enters the plant via force main and passes through a mechanical bar screen before flowing into two (2) degritters and two (2) primary clarifiers for sediment removal.

The aeration system consists of three (3) aeration tanks equipped with a jet mixing system. The flow from the primary clarifiers mixes with the RAS and enters the aeration tanks where it is aerated with a jet aeration system containing four (4) 15 kW submersible pumps (3 duty, 1 standby) with a rated capacity of 209 L/s, for biological treatment. After the wastewater leaves the aeration tanks, it flows into three (3) final clarifiers equipped with rapid sludge collecting and removal systems. PAS-8 is also dosed into the MLSS effluent upstream of the secondary clarifiers to achieve phosphorus removal.

During wet weather conditions when the influent flow exceeds 10,400 m^3/d, the excessive flow is diverted into the three (3) physical/chemical clarifiers after passing through the headworks. PAS-8 is added at the start of the inlet channel upstream of the clarifiers for chemically enhanced primary treatment. The effluent from these clarifiers is combined with the secondary effluent and flows through the UV disinfection system, which consists of two (2) banks of UV lamps in series. The disinfected final effluent is flows into the outfall sewer and is discharged into the Mississippi River.

3.3 Solids Train

Solids removed in the headworks via the bar screen and the degritters are collected and taken to offsite for disposal. Solids from the primary clarifiers are sent to the anaerobic sludge digesters. Sludge that settles in the final clarifiers is pumped as return activated sludge (RAS) to the three (3) aeration tanks via three (3) vertical mounted pumps, , or pumped as waste activated sludge (WAS) to the primary clarifiers for co-thickening sludge digesters via two (2) vertical mounted pumps. The co-thickened primary and waste activated sludge is pumped to the two-stage anaerobic digestion system for sludge stabilization. The stabilized sludge is pumped to a sludge storage tank prior to centrifuge dewatering. Since the dewatering centrifuge is currently out of service, the sludge is periodically hauled to offsite storage in the winter and hauled for agricultural land application in the spring, summer and fall.

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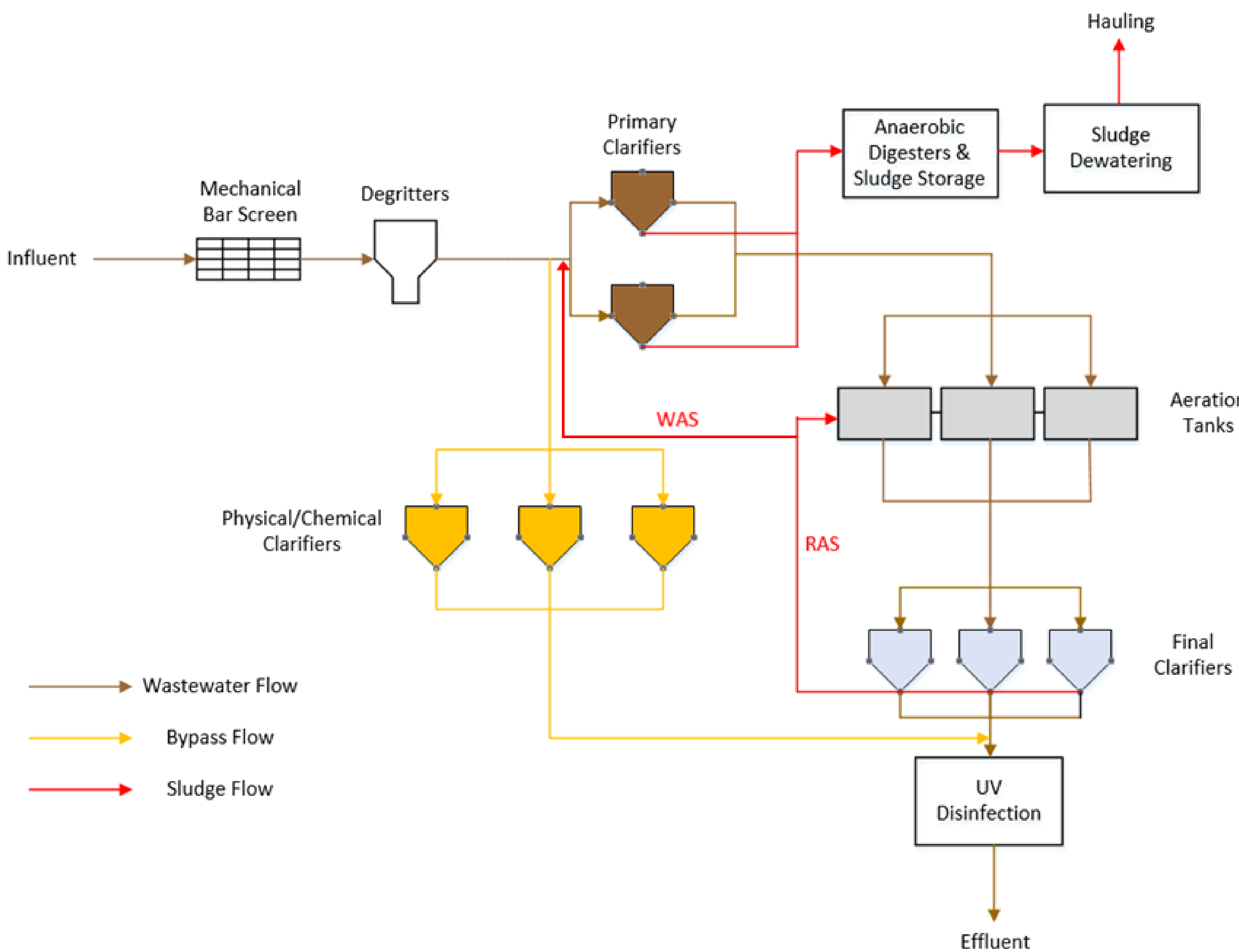

Figure 2 – Process Flow Diagram of the Carleton Place WPCP

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4. Data Analysis and Performance Assessment

The Carleton Place WPCP has a nominal design flow of 7,900 m^3/day and services a population of approximately 12,000 people (2016 Canadian Census). **Table 1**, **Table 2**, **Table 3** and **Table 4** summarize the effluent objectives and limits as outlined in the Certificate of Approval (C of A) No. 5001-7FZT4A dated October 3, 2008.

Table 1 – Carleton Place WPCP Effluent Objectives during Dry Weather Conditions* (MECP, 2008)		
Effluent Parameter	Concentration Objective (mg/L unless otherwise stated)	Waste Loading Objective (kg/day unless otherwise stated)
CBOD5	15.0	156
Total Suspended Solids	15.0	156
Total Phosphorus	0.75	7.8
Total Ammonia Nitrogen	2.0 (May 15 to Sept. 30)	20.8 (May 15 to Sept. 30)
E. Coli	200 organisms per 100 mL	-
****Secondary*** treated effluent only		

Table 2 – Carleton Place WPCP Effluent Objectives during *Wet Weather Conditions** (MECP, 2008)		
Effluent Parameter	Concentration Objective (mg/L unless otherwise stated)	Waste Loading Objective (kg/day unless otherwise stated)
CBOD5	28.0	325
Total Suspended Solids	28.0	325
Total Phosphorus	1.1	12.8
*Relates to effluent quality from the ***physical/chemical clarifiers*** that are brought on line when influent flow exceeds 10,400 m^3/d		

Table 3 – Carleton Place WPCP Effluent Objectives at *Peak Flow Rate Conditions** (MECP, 2008)		
Effluent Parameter	Concentration Objective (mg/L unless otherwise stated)	Waste Loading Objective (kg/day unless otherwise stated)
CBOD5	21.9	481
Total Suspended Solids	21.9	481
Total Phosphorus	0.94	20.6
*Relates to quality of ***blended*** effluent from the secondary treatment and physical/chemical treatment processes during periods of wet weather condition up to the Peak Flow Rate		

Table 4 – Carleton Place WPCP Effluent Limits (MECP, 2008)		
Effluent Parameter	Concentration Limits (mg/L unless otherwise stated)	Waste Loading (kg/day unless otherwise stated)
CBOD5	25.0	550
Total Suspended Solids	25.0	550
Total Phosphorus	1.0	22.0
Total Ammonia Nitrogen	4.0 (May 15 to Sept. 30)	88.0 (May 15 to Sept. 30)

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Table 4 – Carleton Place WPCP Effluent Limits (MECP, 2008)		
Effluent Parameter	Concentration Limits (mg/L unless otherwise stated)	Waste Loading (kg/day unless otherwise stated)
pH of the effluent maintained between 6.0 to 9.5, inclusive, at all times		

In addition to the effluent limits and objectives, the C of A specifies the required sample type and sampling frequency for the raw influent and final effluent monitoring. These raw influent and final effluent monitoring requirements are summarized in **Table 5** and **Table 6**. The C of A also requires daily grab sample monitoring of $CBOD_5$, TSS, and TP in the physical/chemical clarifiers during a bypass event.

Table 5 – Carleton Place WPCP Influent Monitoring (MECP, 2008)		
Influent Parameter	Sample Type	Sampling Frequency
BOD5	Composite	Monthly
COD	Composite	Monthly
TSS	Composite	Monthly
TP	Composite	Monthly
TKN	Composite	Monthly

Table 6 – Carleton Place WPCP Effluent Monitoring (MECP, 2008)		
Effluent Parameter	Sample Type	Sampling Frequency
CBOD5	Composite	Monthly
Total Suspended Solids	Composite	Monthly
Total Phosphorus	Composite	Weekly
Total Ammonia Nitrogen	Composite	Weekly
Total Kjeldahl Nitrogen	Composite	Monthly
Nitrite	Composite	Monthly
Nitrate	Composite	Monthly
Faecal Streptococcus	Grab	Monthly
E. Coli	Grab	Weekly
pH	Grab	Weekly

4.1 Historical Flow Capacity Assessment

Figure 3 below shows the total daily flows for the period from January 1, 2017 to December 31, 2019. This graph shows that the Carleton Palace WPCP has exceeded the rated design capacity of the facility for a significant portion of the analysis period. A more detailed investigation shows that the 95^{th} percentile of the influent flow to the Carleton Place WPCP is approximately 13,650 m^3/day, which is 173% of the facility's rated dry weather capacity.

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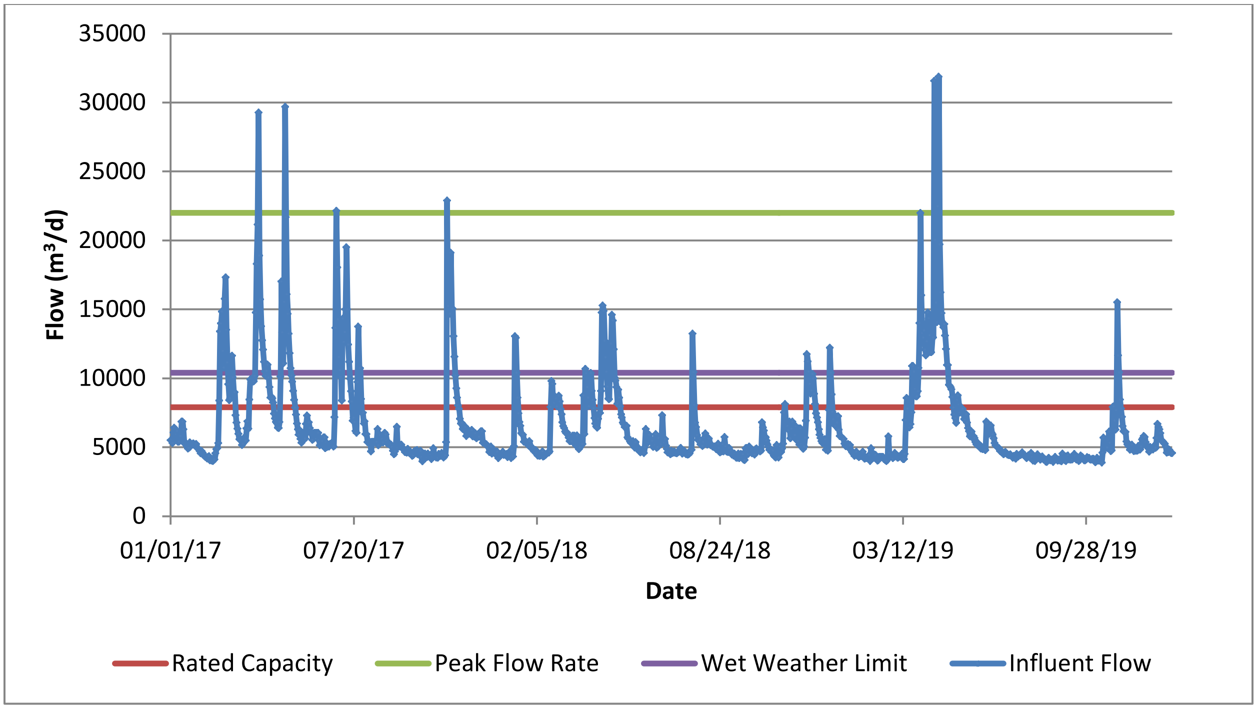

Figure 3 – Total Daily Influent Flows for the Carleton Place WPCP from 2017 to 2019

The average flow during the 3-year period was approximately 6,541 m^3/day, which represents 83% of the plant's rated capacity, meanwhile the maximum daily flow was 31,856 m^3/day during the spring season (i.e. snow melt, run off, etc.). **Table 7** summarizes the influent flows to the facility over the period of analysis.

Table 7 – Flow Capacity Assessment (2017-2019)			
Parameter	2017	2018	2019
Average Daily Flow (m^3/d)	7,340	6,165	6,119
% of Rated Capacity	93%	78%	77%
Maximum daily flow (m^3/d)	29,690	15,272	31,856
% of Rated Capacity	376%	193%	403%

4.2 Historical Influent Wastewater Characteristics

Table 8 summarizes the key raw influent parameters including BOD_5, TSS, TP, and TKN from January 1, 2017 to December 31, 2019 and the typical ranges for domestic raw sewage characteristics. The historical raw influent data plots can be found in **Appendix A**.

Table 8 – Raw Sewage Quality					
Parameter	Raw Water Data (2017-2019)			Typical Values for Influent Wastewater[1]	
	Average	Minimum	Maximum	Medium Strength	Typical Range
BOD_5 (mg/L)	124	34.0	321	190	110 – 350
TSS (mg/L)	236	7.00	1,360	210	120 – 400

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Table 8 – Raw Sewage Quality					
Parameter	Raw Water Data (2017-2019)			Typical Values for Influent Wastewater[1]	
	Average	Minimum	Maximum	Medium Strength	Typical Range
TP (mg/L)	4.96	0.10	28.5	7	4 – 12
TKN (mg/L)	30.3	1.10	103	40	20 – 70
1. Values from Wastewater Engineering Treatment and Reuse 4th Edition (Metcalf & Eddy, 2003)					

The key observations of the raw wastewater quality indicate that:

- The average influent BOD_5 concentration of 124 mg/L is characterized as **low** strength wastewater for BOD_5 (Metcalf & Eddy, 2003).
- The average influent TSS concentration of 236 mg/L is characterized as **medium** strength wastewater for TSS (Metcalf & Eddy, 2003).
- The average influent TP concentration of 4.96 mg/L is characterized as **low** strength wastewater for TP (Metcalf & Eddy, 2003).
- The average influent TKN concentration of 30.3 mg/L is characterized as **low** strength wastewater for TKN (Metcalf & Eddy, 2003).

4.3 Historical Effluent Wastewater Quality

Process data from the Carleton Place WPCP was reviewed for the period of January 1, 2017 to December 31, 2019 and assessed against the plant's C of A effluent objectives and limits. **Table 9** and **Table 10** summarize the annual average effluent concentrations and annual average effluent loadings respectively, for the parameters that are regulated in the C of A.

Based on the analysis of the data over the time period, it was noted that:

- Under dry weather conditions (i.e. flow is less than 10,400 m^3/d); most parameters are within the C of A concentration and loading objectives. The only parameter not in compliance is TAN, which exceeded the dry weather effluent objectives in 2017 and 2019.

- Under wet weather conditions (i.e. flow greater than 10,400 m^3/d is bypassed to the physical/chemical clarifiers), all three regulated parameters ($CBOD_5$, TSS and TP) were above the C of A effluent objectives. However, the combined effluent peak flow effluent was below the effluent objectives, with the exception of the TSS concentration which was slightly above the peak flow effluent objective in 2019 but still below the effluent limit.

The historical final effluent data plots can be found in **Appendix B**.

Table 9 – Average Annual Effluent Concentrations									
Parameter	2017			2018			2019		
	Dry Weather	Wet Weather	Peak Flow	Dry Weather	Wet Weather	Peak Flow	Dry Weather	Wet Weather	Peak Flow
$CBOD_5$	3.2	42.8	10.3	3.1	N/A	N/A	4.2	24.8	11.1

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Table 9 – Average Annual Effluent Concentrations									
Parameter	2017			2018			2019		
	Dry Weather	Wet Weather	Peak Flow	Dry Weather	Wet Weather	Peak Flow	Dry Weather	Wet Weather	Peak Flow
TSS	7.7	65.5	16.9	10.7	N/A	N/A	10.2	43.7	22.4
TP	0.2	1.06	0.4	0.2	N/A	N/A	0.3	2.68	0.7
TAN	2.4[1]	N/A	1.3	1.0	N/A	N/A	3.1[1]	N/A	3.2
E. coli	48.1	N/A	11,779	76.6	N/A	N/A	175.3	N/A	20,984
Values in red indicate exceedances of the C of A objectives. [1]During the period of May 15 to September 30 as indicated in C of A.									

Table 10 – Average Annual Effluent Loadings									
Parameter	2017			2018			2019		
	Dry Weather	Wet Weather	Peak Flow	Dry Weather	Wet Weather	Peak Flow	Dry Weather	Wet Weather	Peak Flow
$CBOD_5$	22.1	331	175	18.5	N/A	N/A	22.7	145	185
TSS	57.2	350	296	64.7	N/A	N/A	54.5	284	379
TP	1.20	6.69	6.7	1.10	N/A	N/A	1.70	9.23	11.0
TAN	14.1[1]	N/A	19.2	5.2	N/A	N/A	14.8[1]	N/A	41.2
Values in red indicate exceedances of the C of A objectives. [1]During the period of May 15 to September 30 as indicated in C of A.									

4.4 Load Evaluation

Two sets of calculations related to process loading were completed using flow and raw influent data for the Carleton Place WPCP for the period of January 1, 2017 to December 31, 2019. Per capita flow and loadings were calculated and compared to typical values of a facility treating domestic sewage. Ratios related to influent flows and concentrations were also calculated and compared to typical values. The detailed calculations for the loading evaluation can be found in **Appendix C** and the results are summarized in **Table 11**.

Table 11 – Flows and Loads Compared to Typical Domestic Sewage			
Parameter	Units	Carleton Place WPCP	Typical Value for Domestic Wastewater (MECP, 2008)
Per Capita Flow	L/capita/day	545	350 – 500
Peak Daily Flow : Average Daily Flow	-	4.9	2.5 – 3.5
Per Capita BOD_5	g/capita/day	67.8	35 – 65

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Table 11 – Flows and Loads Compared to Typical Domestic Sewage			
Parameter	Units	Carleton Place WPCP	Typical Value for Domestic Wastewater (MECP, 2008)
Per Capita TSS	g/capita/day	128.8	35 – 75
Per Capita TKN	g/capita/day	16.5	13
Per Capita TP	g/capita/day	2.7	1 – 2
$TSS:BOD_5$	-	1.9	0.8 – 1.2
$TKN:BOD_5$	-	0.24	0.1 – 0.2

The conclusions from the results in **Table 11** are summarized as follows:

- The per capita flow for the Carleton Place WPCP during this time period was approximately 545 L/capita/day which is higher than the typical range of 350 L/capital/day to 500 L/capita/day. Also, the ratio of the peak day flow to average day flow (i.e. the peaking factor) was 4.9, which is also higher than the typical range of values for domestic sewage.
- The per capita TSS at this facility was 128.8 g/capita/day which is significantly higher than the typical value. The per capita values for BOD_5, TKN and TP were all slightly higher than the typical range. The $TSS:BOD_5$ ratio of 1.9 and $TKN:BOD_5$ ratio of 0.24 are also higher than the typical range indicating that septage and/or internal side stream (i.e. supernatant) contributions could be impacting the measured raw influent concentrations.

4.5 Key Process Parameter Evaluation

Several key process performance parameters for the Carleton Place WPCP were compared to typical values found in various sources from literature for conventional activated sludge facilities. As with the analysis done in preceding sections of the report, the data obtained for the Carleton Place WPCP ranges from 2017 to 2019. Detailed calculations for the values summarized in **Table 12** can be found in **Appendix C**.

Table 12 – Process Evaluation Results for the Carleton Place WPCP (2017 to 2019)			
Parameter	Units	Carleton Place WPCP	Typical (MECP, 2008)
Aeration Tank Organic Loading Rate	kg $BOD_5/m^3/d$	0.33	0.31 – 0.72
MLSS Concentration	mg/L	5,260	3,000 – 5,000
F/M Ratio	kg BOD_5/kg MLVSS	0.086	0.05 – 0.25
Aeration Tank HRT	hours	6.6	> 6
Aeration Tank SRT	days	10.4	> 10
Primary Anaerobic Digester HRT	days	23.3	> 15

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Based on the results in **Table 12**, the operating parameters such as the organic loading rate, mixed liquor suspended solids concentration (MLSS), and Food-to-Microorganism (F:M) ratio are all within or very close to the typical ranges.

The aeration tank hydraulic retention time (HRT) and solids retention time (SRT) are both above the MECP minimum recommended range (i.e. minimum 6 hour HRT and 10 day SRT), however, they are quite close to the minimum recommended values at current flows, even at the current average MLSS concentration greater than 5,000 mg/L, and this has an impact on the capacity of the plant to achieve consistent nitrification.

The primary anaerobic digester HRT is currently above the MECP minimum recommended value of 15 days.

4.6 Sludge Accountability

A sludge accountability analysis is a comparison between the actual reported and theoretical projected sludge production of a facility. It is an essential step in the optimization of the WPCP capacity and performance as well as allows for verification of analytical results and flow data in addition to identifying data gaps related to recycle or waste streams. A sludge accountability analysis was conducted to check reported plant data. The detailed calculations for the sludge accountability analysis can be found in **Appendix C**.

Table 13 summarizes the results of a sludge accountability performed around the primary clarifiers and the biological treatment system. For the Carleton Place WPCP, the difference between the total reported and the projected sludge production is 5.8% which is within the 15% criterion for mass balance.

Table 13 – Sludge Accountability Analysis

Component	Sludge Production (kg/d)
Reported:	
Co-settled primary sludge + Waste sludge	1,247
Unintentional wastage (final effluent TSS)	77.8
Total Reported	**1,325**
Projected:	
TSS removed across primary clarifiers	616
Biological sludge production (BOD_5 removal)	389
Chemical sludge production (coagulant addition)	227
Total Reported	**1,232**
Sludge Accountability (Reported – Projected) / Reported X 100% Criterion (USEPA, 1998)	 + 7.0 % ± 15 %

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The sludge accountability analysis "closed" to 7.0 % around the primary clarifiers and the biological treatment system, which is below the acceptable limit of + 15% CPE criterion established by the USEPA that must be met to consider the result of the mass balance as "closed" (i.e. less than 15% difference between the theoretical sludge production based on plant loading and chemical addition and the actual measured sludge production).

4.7 Facility Energy Performance Analysis

In this section, hydro bills were used to plot the energy usage data at the Carleton Place WPCP. This information was used to calculate several different key performance indicators (KPIs) for the Carleton Place WPCP; these KPIs are summarized in the following section of the report.

According to analysis of the hydro bills at this facility, the average annual monthly energy consumption was approximately 108,265 kWh with minimal variation of the energy consumption on an annual basis. **Figure 4** shows the monthly electrical consumption.

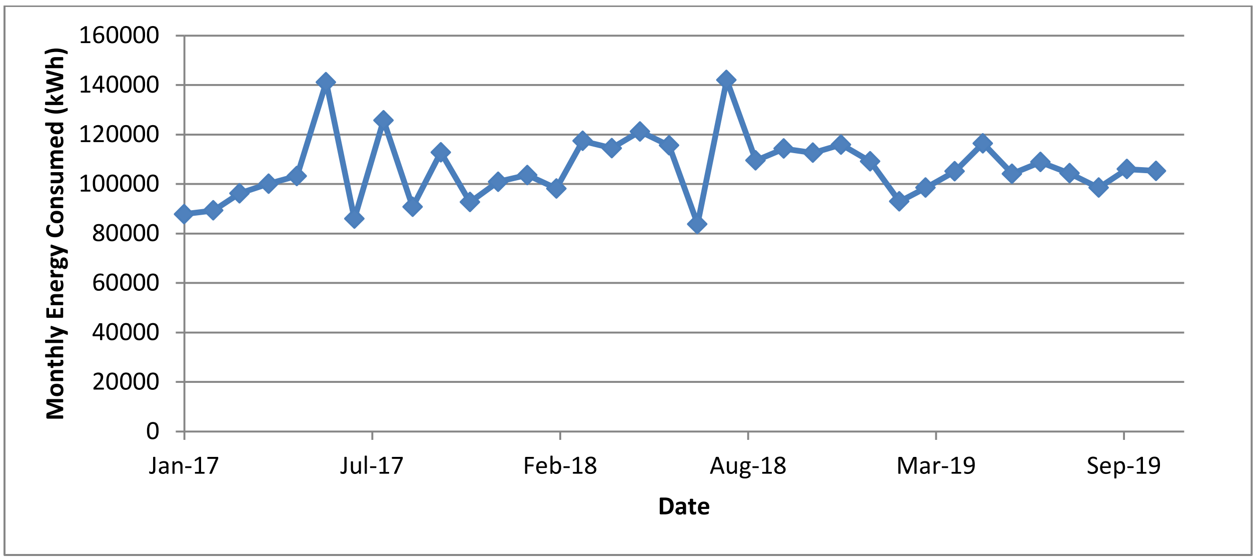

Figure 4 – Monthly Energy Usage based on Hydro Bills from 2017 to 2019

Only the 2019 natural gas data was available for this report. The annual average natural gas consumption at this facility was approximately 3,610 m^3. The 2019 monthly natural gas consumption is shown in **Figure 5**. There is a dramatic difference in natural gas consumption between summer and winter months. This is primarily due to increased natural gas use for facility heating during the winter months.

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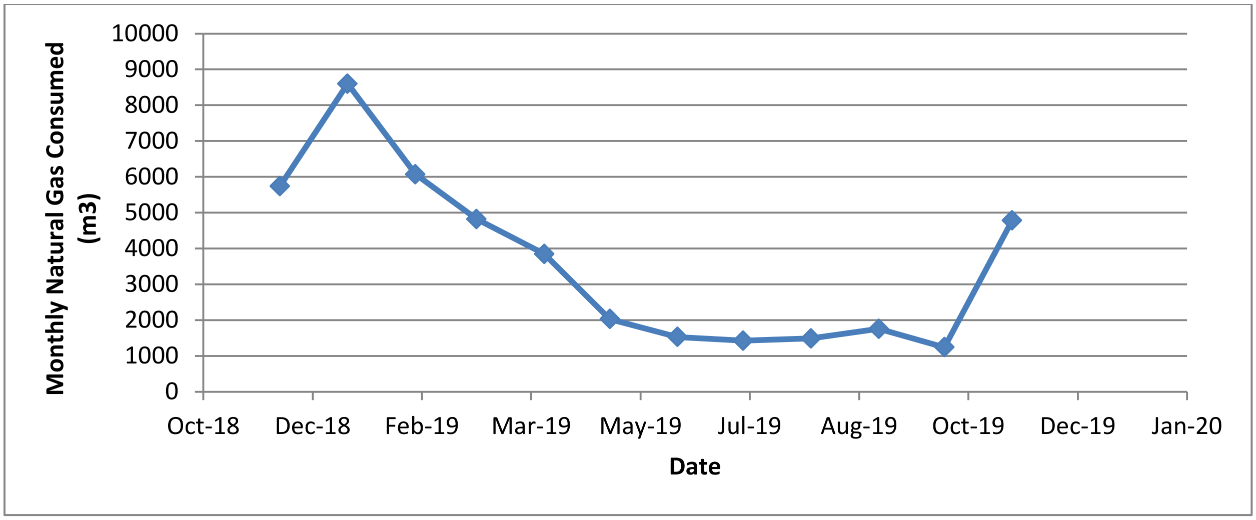

Figure 5 – Monthly Natural Gas Usage based on Gas Bills from 2019

4.7.1 Facility Key Performance Indicators

In order to quantify the energy performance of the Carleton Place WPCP, four (4) KPIs for energy intensity were calculated:

1. Volumetric energy intensity: kWh per volume of raw sewage treated
2. Biological energy intensity: kWh per kilogram of BOD_5 treated
3. Nitrogen energy intensity: kWh per kilogram of TKN treated
4. Phosphorus energy intensity: kWh per kilogram of TP treated

In wastewater treatment plants, the influent wastewater quality, quantity and the treatment requirements for effluent discharge play a large factor in determining the energy intensity of the treatment process. The amount of energy used in a WWTP depends primarily on the equipment installed in the plant and the size (i.e. installed horsepower) of the equipment required to meet the desired level of treatment (i.e. as per the effluent quality parameters outlined in the plant's ECA/C of A).

<u>Volumetric Energy Intensity</u>

For WPCPs, one (1) of the key KPIs is the energy used per volume of sewage treated. The volume of raw sewage received at the plant is derived from historical data and is graphed to show the correlation between monthly treated flow and the volumetric energy intensity in **Figure 6**.

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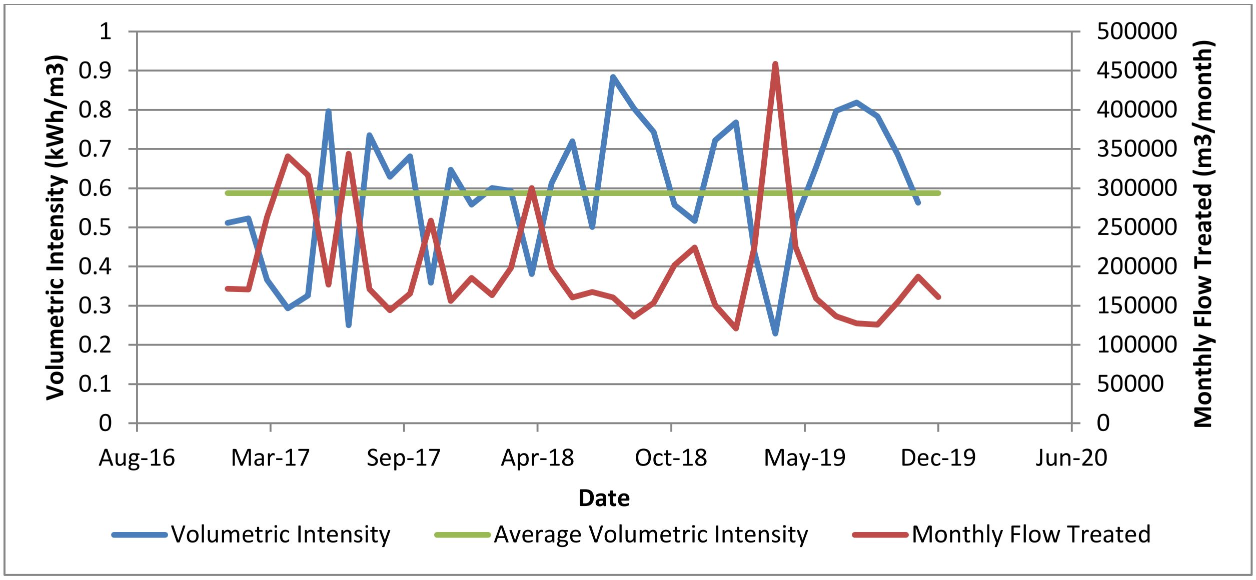

Figure 6 – Monthly Flow Treated (m^3) and Volumetric Energy Intensity (kWh/m^3)

According to the analysis done for **Figure 6**, the average volumetric energy intensity for the Carleton Place WPCP is 0.59 kWh/m^3 and the average monthly treated flow is approximately 198,970 m^3/month.

Biological Energy Intensity

In addition to the volumetric energy intensity, another important KPI analyzed was the biological energy intensity. This KPI is derived from the calculation of the mass of BOD_5 that is removed from the facility and then dividing the energy used for treatment. The BOD_5 removed is calculated by determining the influent and effluent BOD_5 loadings and then calculating the difference between the two (2). The equation used to determine this KPI (and the rest of the KPIs) is shown below.

$$\text{Treated BOD}\left(\frac{kg}{month}\right) = \text{Influent Flow}\left(\frac{m^3}{month}\right) \text{ x Influent BOD}\left(\frac{mg}{L}\right) - \text{Effluent Flow}\left(\frac{m^3}{month}\right) \text{ x Effluent BOD}\left(\frac{mg}{L}\right)$$

$$\text{Biological Energy Intensity}\left(\frac{kWh}{kg}\right) = \frac{Energy\ Used\ (kWh)}{Treated\ BOD\ (kg)}$$

The relationship between the monthly BOD_5 treated and the monthly biological energy intensity is shown in **Figure 7**.

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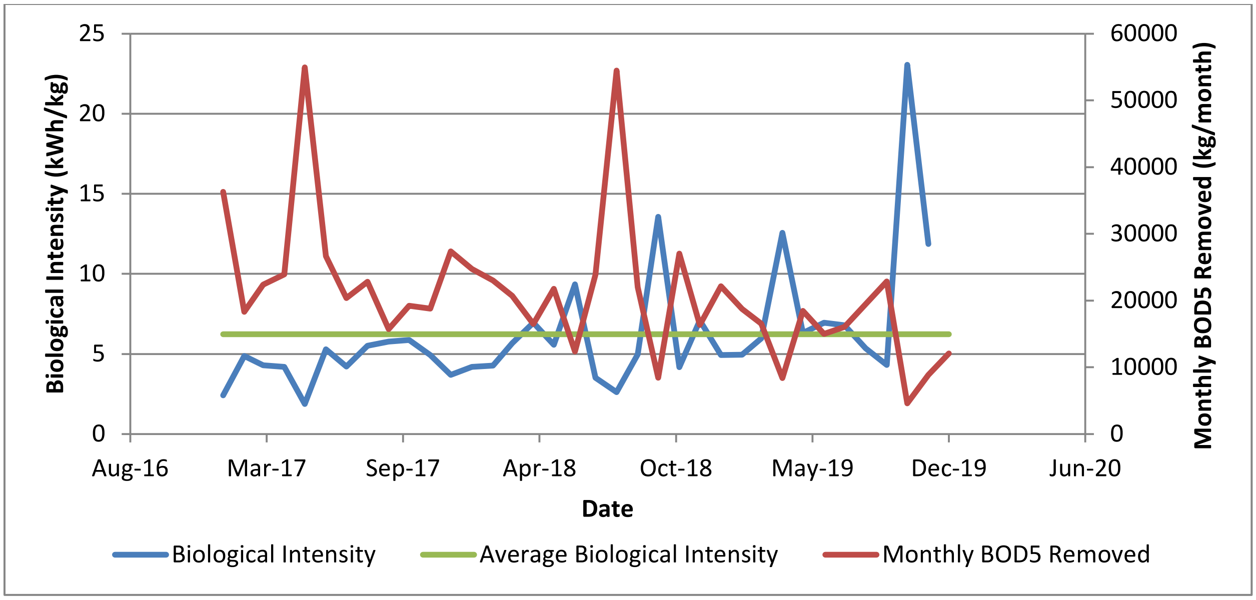

Figure 7 – Monthly BOD_5 Treated (kg) and Biological Energy Intensity (kWh/kg)

As shown in **Figure 7**, the average biological energy intensity for the Carleton Place WPCP is 6.22 kWh/kg of BOD_5 treated. The average total BOD treated per month is approximately 21,143 kg. **Figure 7** shows an inversely proportional relationship between the amount of BOD_5 treated and the biological energy intensity. As the treated BOD_5 increases, the biological energy intensity decreases. (i.e. the process becomes more efficient when more BOD_5 is being treated).

Nitrogen Energy Intensity

Another KPI analyzed was the nitrogen energy intensity. This is the amount of energy required to remove TKN from the influent wastewater. As with the biological energy intensity, this KPI is derived from calculating the difference between the influent TKN and effluent TKN loadings at the facility, and then dividing the energy used for treatment. **Figure 8** shows the relationship between the monthly TKN treated and the monthly nitrogen energy intensity.

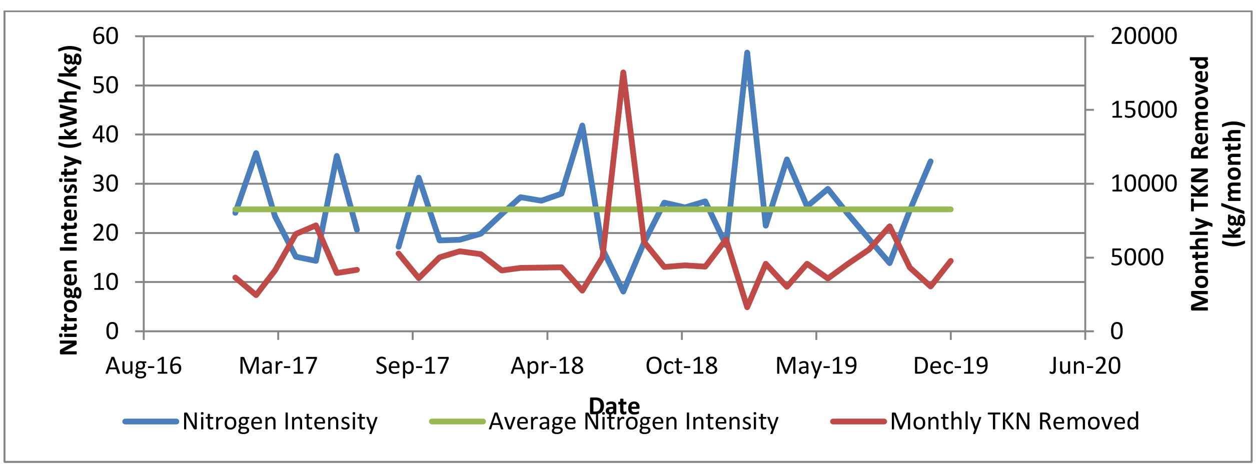

Figure 8 – Monthly TKN Treated (kg) and Nitrogen Energy Intensity (kWh/kg)

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The nitrogen loading (i.e. TKN) to a plant is primarily treated in the aeration process and has the largest impact on the oxygen demand at the facility. Even though the amount of TKN treated on a monthly basis is much lower than BOD_5 at 4,896 kg (approximately one fourth of the mass of BOD_5 treated per month), it has a much higher impact on oxygen demand on a per kg basis, as each kg of TKN has a 4.57 kg oxygen demand, whereas each kg of BOD_5 has a 1.0 kg oxygen demand.

As shown in **Figure 8**, the average nitrogen energy intensity is 24.8 kWh/kg of TKN treated, which is also approximately four times the biological energy intensity. As with the biological energy intensity, there is an inversely proportional relationship between the monthly TKN treated and the monthly nitrogen energy intensity.

4.7.2 Benchmarking Volumetric Energy Intensity to Similar Facilities

Table 14 compares the volumetric energy intensity of the Carleton Place WPCP with other wastewater treatment facilities within Ontario of similar size/capacity. Facilities in this table were selected to match the design flow and type of process of the Carleton Place WPCP as closely as possible, based on information gathered and analyzed by OCWA. Five facilities with similar size and effluent limits to the Carleton Place WPCP were analyzed to compare the treatment performance to the volumetric energy intensity.

The Carleton Place WPCP has a volumetric energy intensity of 0.59 kWh/m^3, which is lower than most the facilities in **Table 14**. The Carleton Place facility is considered to be energy efficient compared to similar sized facilities that are operated by OCWA.

Table 14 – Facility KPI Comparison

Municipality / Facility	Type of Facility	Design Flow (m^3/d)	Volumetric Energy Intensity (kWh/m^3)
Town of Petawawa/Petawawa WWTP	Conventional Activated Sludge	8,730	0.36
Town of Kingsville/Lakeshore West WPCP	Conventional Activated Sludge	5,400	0.97
Town of St. Marys/St. Marys WWTP	Biological Nutrient Removal	5,560	1.1
Region of Waterloo/Hespeler WWTP	Extended Aeration	9,320	0.83
County of Brant/Paris WWTP	Extended Aeration	7,056	1.54
Average	-	-	0.96
Carleton Place WPCP	***Conventional Activated Sludge***	***7,900***	***0.59***

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4.8 Inflow and Infiltration Analysis

To evaluate the impact and extent of inflow and infiltration (I&I) at the Carleton Place WPCP, the historical flow data of the water and wastewater facilities in Carleton Place was analyzed. **Table 15** summarizes the historical flows during the spring wet weather seasons for 2017-2019 at the Carleton Place WPCP and Carleton Place Drinking Water System (DWS).

Table 15 – Historical Comparison of Flows				
DWS Treated Water Flow Summary (March 1 - May 31) for 2017 – 2019				
Year	**2017**	**2018**	**2019**	**Average**
Max Daily Flow (m^3/day)	5,057	6,321	5,699	5,692
Max Monthly Flow (m^3/month)	135,161	141,237	152,266	142,888
Total Wet Season Flow (m^3)	373,463	384,098	443,071	400,211
WPCP Influent Flow Summary (March 1 - May 31) for 2017 – 2019				
Year	**2017**	**2018**	**2019**	**Average**
Max Flow (m^3/day)	29,690	15,271	31,856	25,606
Max Flow (m^3/month)	340,849	300,399	458,705	366,651
Total Wet Season Flow (m^3)	920,409	696,238	909,746	842,131
I&I Summary (March 1 - May 31) for 2017 – 2019				
Year	**2017**	**2018**	**2019**	**Average**
Total Wet Season Flow Discrepancy (%)	147	81	105	111
Average Annual Precipitation (mm)	3.7	2.5	2.6	2.9

A comparison of historical flows at these facilities shows a large discrepancy between the treated flows from the drinking water system and the influent flows to the WPCP. The discrepancy between the flows over the three year period shows fluctuations between 81% and 147%, this indicates I&I in the collection system. In an ideal scenario, if the conveyance network is not a combined sewer system (as is the case in Carleton Place); a typical discrepancy of 15% - 20% is acceptable due to consumer activities (such as watering lawns, etc.). However an average discrepancy of 111% with a maximum of 147% indicates that there is a significant amount of I&I in the collection system, especially during the spring melt seasons. The WPCP influent flows are generally much higher than the treated water flows; except for months of July to October when the treated water flows are slightly higher than the WPCP influent flows.

Total daily flows for the Carleton Place WPCP are shown in **Figure 9**. The figure shows results consistent with **Table 15** confirming discrepancy between the flows at the two (2) facilities during the period of analysis (March 1 to May 31 from 2017 to 2019).

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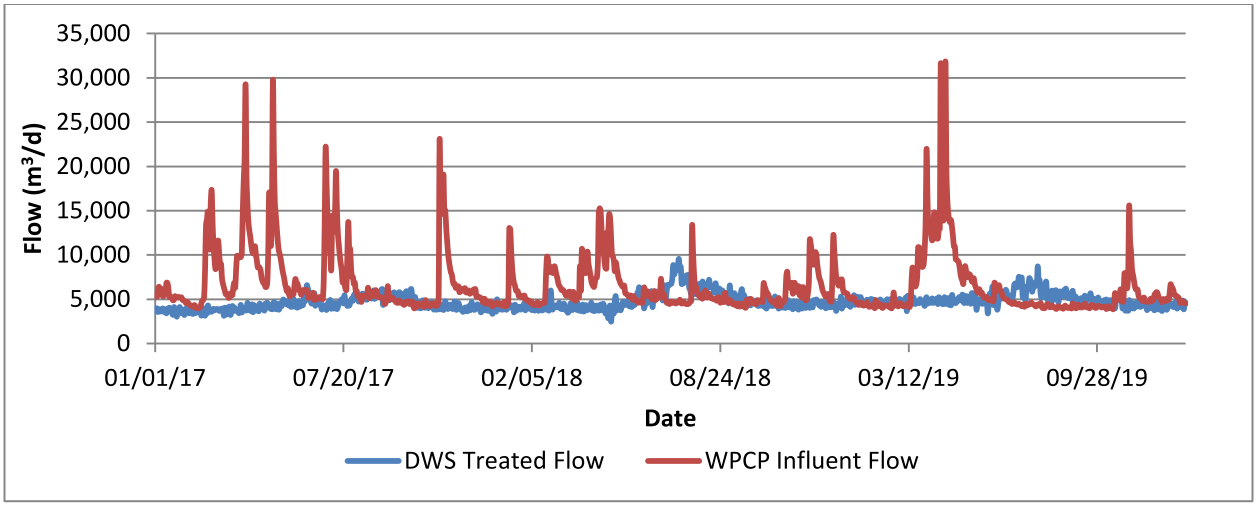

Figure 9 – Comparison of Carleton Place DWS and WPCP Flows for Period of Analysis

Additionally, precipitation data from Environment Canada in Appleton was gathered and plotted against the influent flows at the Carleton Place WPCP in **Figure 10**. There was no up-to-date precipitation data for Carleton Place, thus Appleton was selected because it was the closest weather station with recent precipitation data. The graph shows periods of relatively high precipitation during the wet weather season, which generally correlate to periods of high influent flows. This information further confirms the presence of I&I in the conveyance network that services the Carleton Place WPCP.

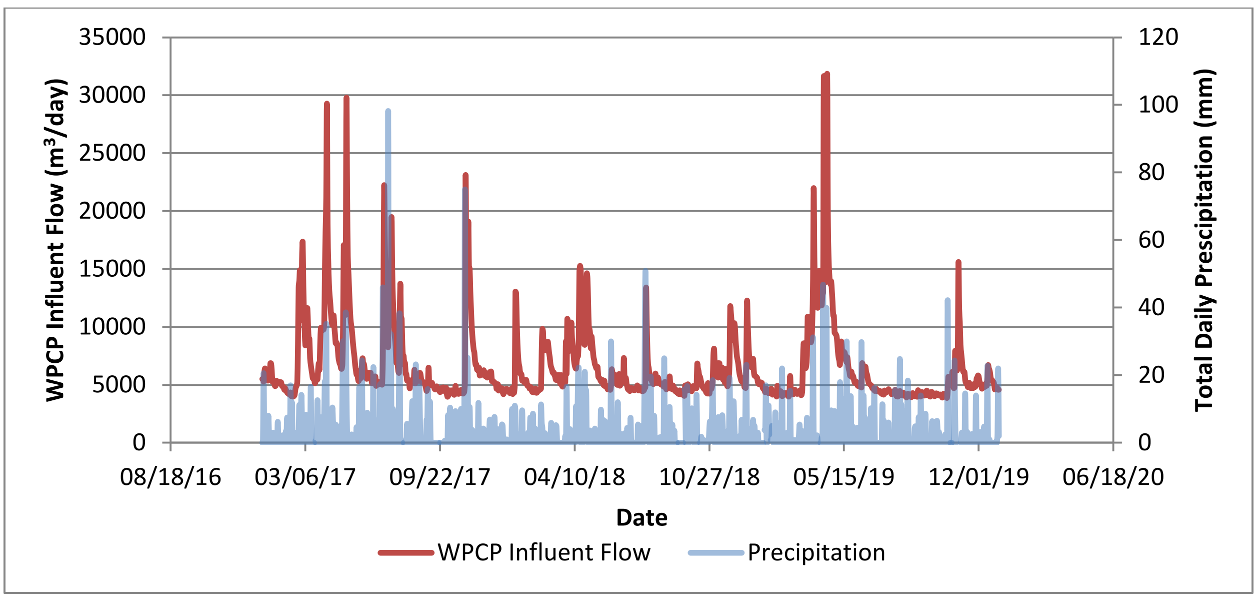

Figure 10 – Comparison of Carleton Place WPCP Influent Flows and Precipitation

5. Major Unit Process Evaluation

The capability of the facility is established through an evaluation of the existing major unit processes and their ability to meet the C of A/ECA effluent requirements. For the Carleton Place WPCP, the criteria in **Table 16** were used to evaluate the performance of each major unit process at the plant. The evaluation

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criteria were developed from best practice information available in the MECP "Design Guidelines for Sewage Works" (2008).

Table 16 – Major Unit Process Evaluation Criteria	
Parameter	**Basis**
Type	A conventional activated sludge plant with a rated capacity of 7,900 m^3/d, with addition of PAS-8 (coagulant) for phosphorus removal, sodium hydroxide for alkalinity addition for nitrification, and UV for disinfection. Sludge is anaerobically digested and dewatered.
Loading	Average annual flow = 6,541 m^3/day (2017 to 2019) Wet season average flow = 15,290 m^3/day (April 2019) Maximum day flow = 31,855 m^3/day (April 20th, 2019) Raw BOD_5 = 124 mg/L Raw TSS = 236 mg/L Raw TKN = 30 mg/L Raw TP = 4.96 mg/L
Effluent Receiver	Mississippi River
Treatment System	
Headworks	• One automatic mechanical bar screen • Two forced vortex degritters • Three sewage lift pumps with one on standby
Primary Clarifiers	• Two main primary clarifiers, each with approximate dimensions of 20.2 m long by 4.29 m wide, with a sidewater depth of 3.80 m • Three physical/chemical clarifiers, each with approximate dimensions of 17.7 m long by 4.35 m wide, with a sidewater depth of 3.80 m, brought on line during wet weather conditions (i.e., for flows greater than 10,400 m^3/d)
Activated Sludge Plant	• Two aeration tanks with a volume of 585 m^3 each, the other aeration tank with a volume of 630 m^3, with a jet aeration system • Three final clarifiers, each with approximate dimensions of 16.0 m long by 16.0 m wide, with a sidewater depth of 3.70 m
UV Disinfection System	• An UV irradiation system consisting of two banks of UV lamps in series, complete with lamps, power distribution system, system control centre, level control gate, and UV detection system
Phosphorus Removal	• Two coagulant feed pumps for PAS-8 addition to the aeration tanks, another two pumps for addition to the physical/chemical clarifiers • Four metering pumps for polymer addition to the physical/chemical clarifiers
Sludge Digesters	• An anaerobic digestion system including one primary digester with a volume of 880 m^3, one secondary digester with a volume of 826 m^3 • One biosolids storage tank with a volume of 1,900 m^3 • One heat exchanger boiler
Sludge Dewatering System	• One decanter centrifuge located in the centrifuge room

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Table 16 – Major Unit Process Evaluation Criteria	
Parameter	**Basis**
	• One polymer dilution system and one emulsion feed pump to supply polymer to the dewatering process • One centrate equalization tank with 126 m^3 of liquid storage capacity

5.1 Process Capacity Evaluation

Figure 11 below displays the results of the major unit process evaluation in the form of a Performance Potential Graph (PPG). A PPG is a tool that is employed to assess the capability of major unit processes at water or wastewater treatment facilities. The major unit processes are shown along the vertical (y-axis) of the PPG. The evaluation criteria used to assess the capability is identified in brackets, below the name of the unit process. For each major unit process, the horizontal bar represents the total estimated capacity of the unit process. The numbers within the rectangular boxes are the flow treatment capacity limits for each of the individual unit processes. For example, under the unit process "Vortex Grit Removal" the 10,000 represents the units having the capacity to treat 10,000 m^3/day each for a total of 20,000 m^3/day. The blue vertical dashed line marks the average influent flow between January 1, 2017 and December 31, 2019 (6,540 m^3/day) and the red vertical solid line marks the nominal design flow (7,900 m^3/day).

The following guidance is applied to establish the "capability" of each process:

- A process is judged "capable" if the projected capacity exceeds the average flow rate (i.e. the associated horizontal bar for that unit process is to the right of the blue dashed vertical line at 6,540 m^3/day).
- A process is "marginal" if the capacity is 80% to 100% of the current flow, (i.e. 5,233 m^3/day to 6,540 m^3/day).
- A process is "not capable" if its capacity is less than 80% of the current flow (i.e. less than 5,233 m^3/day). The shortest bars establish the overall plant rating as "capable", "marginal", or "not capable".

The Carleton Place WPCP is currently operated as a conventional activated sludge plant and major unit processes were rated using appropriate evaluation criteria for this type of operation. The evaluation criteria for the PPG for the Carleton Place WPCP were obtained from the MECP "Design Guidelines for Sewage Works" (2008). Where applicable, the major unit processes were rated separately for the current operation, shown in **yellow** with the capacity of additional units on stand-by in **purple** (refer to **Figure 11**). Detailed calculations for the PPG can be found in **Appendix C.**

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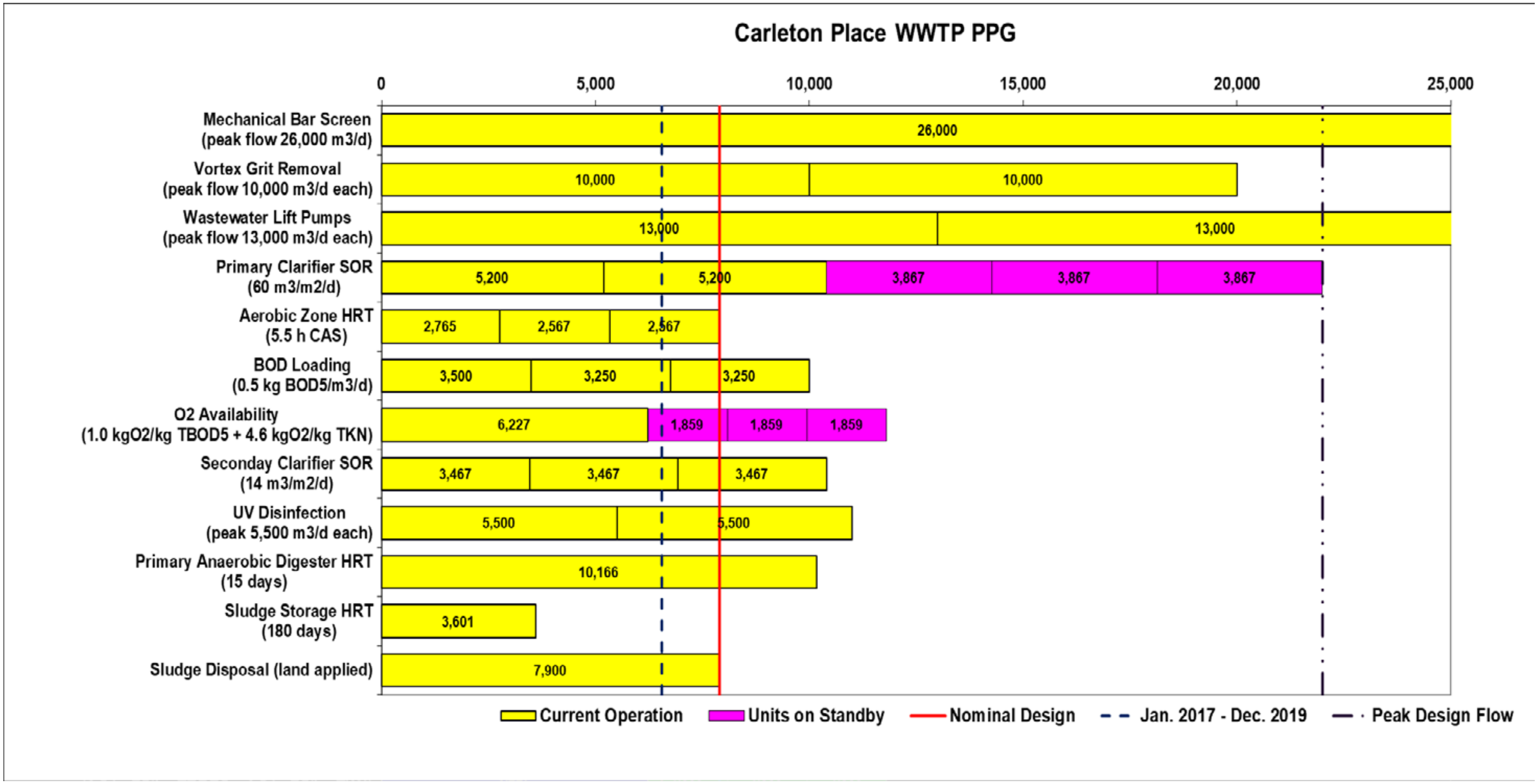

Figure 11 – Performance Potential Graph for the Carleton Place WPCP

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5.2 Unit Process Evaluation

5.2.1 Headworks

5.2.1.1 Mechanical Bar Screen

The mechanical bar screen is primarily designed to protect the downstream processes by removing large debris such as rags, plastic, and metal from the raw wastewater. The pieces of debris are collected off of the bar screen with a mechanical rake and disposed of accordingly. The bar screen at the Carleton Place WPCP can handle 26,000 m^3/day and is rated as **capable** at current flows.

5.2.1.2 Vortex Degritters

A vortex degritter allows the wastewater to flow tangentially into the vessel which then forms a vortex. Grit is forced to the outside perimeter and slowly settles into the bottom where it is collected and disposed of accordingly. The wastewater flow exits the degritter through the top and flows to the wastewater lift pumps. Each vortex degritter has a capacity of 10,000 m^3/day for a total capacity of 20,000 m^3/day. The performance of the vortex degritters is rated as **capable** at current flows.

5.2.1.3 Wastewater Lift Pumps

There are three wastewater lift pumps on site (2 duty, 1 standby). Each lift pump has a capacity of 13,000 m^3/d, the total capacity is 39,000 m^3/d. There were no issues identified with the lift pumps and they are rated as **capable** at current flows. Note that the total capacity is cut off at 25,000 m^3/d in **Figure 11** to display the rest of the graph at a higher resolution.

5.2.2 Primary Clarifiers

5.2.2.1 Main Primary Clarifiers

The purpose of primary clarification is to remove floating and settleable solids through sedimentation to reduce solids and organics loading on downstream treatment processes. During dry weather conditions (flow < 10,400 m^3/d), only two primary clarifiers are in operation. According to the Carleton Place WPCP C of A, the total capacity of the main clarifiers is 10,400 m^3/d which are rated as **capable** at current flows.

Since the adjacent physical/chemical clarifiers have been designed to handle peak flows to the plant above 10,400 m^3/d, a design surface overflow rate (SOR) of 60 m^3/m^2/d was used to design the main primary clarifiers. However, the MECP recommended design value for SOR for average daily flow for tanks that are receiving waste activated sludge is 25-30 m^3/m^2/d. In this case a higher design value was used because the peak flow is treated in the physical/chemical clarifiers.

5.2.2.2 Physical/Chemical Clarifiers

The three physical/chemical clarifiers are brought on-line during wet weather conditions when flow is greater than 10,400 m^3/d. According to the C of A, the capacity of these clarifiers is 11,600 m^3/d. They combine with the two main clarifiers to have a total primary clarifier treatment capacity of 22,000 m^3/d.

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Similarly to the main primary clarifiers, the design SOR for the physical/chemical clarifiers is 50 $m^3/m^2/d$, which is also consistent with the MECP recommended range at peak flows.

5.2.3 Aeration Tanks

The criteria used to evaluate the performance of the aeration tanks are the aerobic zone HRT, BOD_5 loading, and the oxygen availability for BOD removal and nitrification. The criterion with the lowest capacity of the three will limit the overall capacity of the activated sludge system. There are three aeration tanks have approximately the same volume and shape, but are not identical. According to the O&M manual, one tank has a volume of 630 m^3 and the other two tanks have a volume of 585 m^3. Note that these volumes are different from the ones listed in the C of A which do not account for the concrete benching in the tanks to facilitate the air distribution for the jet aeration system.

The rated capacity of the activated sludge system is 7,900 m^3/day based on the original design HRT of 5.5 hours for the aeration tanks. The MECP minimum recommended design HRT is 6 hours; however, a HRT of 5.5 hours was used for this assessment to be consistent with the original design parameters for the facility. This lower HRT design criteria may have an impact on the capacity of the plant to achieve consistent nitrification as influent flows to the facility increase in the future.

The BOD_5 loading rate to the aeration tanks is expressed as kg BOD_5/day per unit of aeration volume. A typical value of 0.5 kg BOD_5/m^3/day was used to determine the capacity of the aeration tanks for BOD_5 loading. The total aeration tank volume of 1,800 m^3 and an average primary effluent BOD_5 concentration of 90 mg/L were used to calculate the total rated capacity of 10,000 m^3/day (one at 3,500 m^3/day and two at 3,250 m^3/day).

There is one 50 HP turbo blower in operation and three 20 HP positive displacement blowers on standby. The 50 HP turbo blower which is currently in service was evaluated for its ability to provide oxygen for the total oxygen demand which was calculated as the sum of the oxygen demand from BOD_5 and TKN in the raw influent. Each kg of total BOD_5 requires 1 kg of dissolved oxygen, whereas each kg of TKN requires 4.6 kg of dissolved oxygen for full oxidation. The rated capacity of the aeration tanks, on an oxygen availability basis with only the 50 HP turbo blower in service, is 6,227 m^3/day, with an additional 5,577 m^3/d on standby (1,859 m^3/d per standby blower).

Currently, the 50 HP turbo blower is limited at certain times of the year under higher loading conditions to provide sufficient oxygen to the three aeration tanks (i.e. residual dissolved oxygen (DO) concentration < 1.0 mg/L). Under these high oxygen demand conditions, it is recommended to put one of the standby blowers in service to increase the oxygen availability. Consideration should also be given to undertake another turbo blower upgrade to increase the aeration capacity and energy efficiency of the current system.

In summary, the aeration tanks are rated as **capable** in terms of aerobic zone HRT, BOD_5 loading, and oxygen availability at the current flows, however the system is near its capacity at current flows so blower upgrades and an additional aeration tank may be required to consistently meet total ammonia nitrogen effluent requirements as influent flows to the facility continue to increase.

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5.2.4 Chemical Addition

5.2.4.1 Sodium Hydroxide Addition for Alkalinity Control

Sodium hydroxide is currently periodically dosed to the headworks for alkalinity addition to promote nitrification in the aeration tanks. During the periods of the year when sodium hydroxide is being added, an average dosage is 22.7 mg/L as sodium hydroxide is being added to maintain an adequate alkalinity residual in the biological process. The influent alkalinity to the plant is lower than typical for municipal wastewater, and is most likely a limiting factor for nitrification as the final effluent alkalinity is periodically below 50 mg/L. The minimum residual alkalinity in the final effluent should ideally be greater than 100 mg/L as $CaCO_3$, and should be greater than 50 mg/L as $CaCO_3$ at an absolute minimum to ensure that an adequate amount of alkalinity is available for full nitrification. Flow-paced sodium hydroxide addition could be implemented to help ensure consistent alkalinity residual for nitrification.

5.2.4.2 PAS-8 Addition for Phosphorus Removal

Pre-hydroxylated aluminum sulfate 8 (i.e. PAS-8) is currently dosed to the mixed liquor effluent upstream of the secondary clarifiers to achieve phosphorus removal at a total average dosage of 75.6 mg/L (range of 17.0 mg/L to 154 mg/L) for phosphorus removal. The PAS-8 dosage is currently flow-paced to main primary tanks influent flow. The overall PAS-8 dosage is adjusted manually as required via the SCADA system to meet the final effluent phosphorus objectives.

For a 75.6 mg/L PAS-8 dosage, the Al dosage is 6.9 mg/L and Al:P mass ratio dosage of approximately 1.5. A typical dosage to achieve the current average phosphorus removal levels of greater than 90% is between 1.4 to 2.0 on an Al:P mass ratio dosage. Based on the Al:P ratio between 2017 and 2019 of 1.5, the alum chemical dosage at this facility is rated **capable** of meeting the required final effluent phosphorus objectives and limits as outlined in the C of A.

5.2.5 Secondary/Final Clarifiers

According to the C of A, the total capacity of the secondary/final clarifiers is 10,400 m^3/day, and based on the total surface area of the three clarifiers the SOR would be approximately 13.5 m^3/m^2/d at the rated capacity of 10,400 m^3/day, which is less than the MECP recommended SOR range of 16-28 m^3/m^2/d at average flow conditions. On an SOR basis, the secondary clarifier is rated as **capable** at the current flows.

However, during the site visit it was noted that the significant amounts of scum was present on the surface of the clarifiers due to deterioration of the clarifier still well center rings. Consideration should be given to initiate a capital project to rehabilitate or replace the center rings to limit the amount of scum floating on the surface of the clarifiers.

5.2.6 Ultraviolet (UV) Disinfection

A UV disinfection system is used at the Carleton Place WPCP to deactivate pathogens to prevent waterborne disease. There are two UV banks in the system. According to the C of A, the total capacity of

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the UV system is 11,000 m^3/d with 5,500 m^3/d each bank. Based on the hydraulic capacity of each bank, the UV system is rated as **capable**.

However, during the site visit it was noted that the significant amounts of scum was present in the UV disinfection channel which may be inhibiting the performance of the UV system under certain conditions. As per the previous section, consideration should be given to initiate a capital project to rehabilitate or replace the center rings to limit the amount of scum floating on the surface of the clarifiers.

5.2.7 Anaerobic Digesters

A two-stage anaerobic digester system is used to stabilize the sludge before disposal. The capacity of the system was evaluated based on the MECP guideline of a minimum of 15 days of HRT for the primary digester (MECP, 2008). With the primary digester volume of 880 m^3/d, the capacity of the system is 10,166 m^3/d at the current plant sludge production; therefore the anaerobic digesters are rated as **capable** from a hydraulic perspective at the current flows.

5.2.8 Sludge Storage Tank and Disposal

A minimum of 180 days of sludge storage should be provided by the sludge storage tank. The biosolids storage tank has a volume of 1,900 m^3. At the current average co-thickened sludge production rate of 37.8 m^3/day, and an average digester/holding tank supernatant decant volume of 18.6 m^3/day and using the MECP guideline of 180 days of storage, the capacity of the biosolids storage tank has a rated capacity of 3,601 m^3/day and is rated as **not capable** at the current flows.

As for sludge disposal, since there were no issues identified with the current process of land application for disposal, the process is rated at the design capacity of 7,900 m^3/day and was determined to be **capable** at the current flows.

5.2.9 Sludge Dewatering System/WAS Thickening

The sludge dewatering centrifuge is currently not in service due to various design and operational issues (i.e. frequent clogging of sludge/cake due to centrifuge layout and piping restrictions, issues with cake conveyer system for truck loading). Hence, the centrifuge was not included in the PPG unit process capacity analysis at this time. A capital project should be initiated to identify and address the current deficiencies with the sludge dewatering system so that the centrifuge can be put into service to help address the current sludge storage limitations at the facility.

Also, a study should be initiated to evaluate mechanical WAS thickening alternatives for the facility. Currently the WAS is co-thickened in the main plant primary clarifiers. Separate mechanical WAS thickening would decrease the sludge inventory in the system, improve the performance of the primary clarifiers and increase the capacity for nitrification of the existing activated sludge system.

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5.2.10 Plant SCADA Control, Monitoring and Alarms

The Carleton Place WPCP SCADA/PLC system is currently undergoing a major upgrade. The SCADA system has data logging and trending capabilities, and monitors and records alarms. The operations staff manually record the daily operational data when they are doing their doing their rounds at present and it is then inputted it into WISKI, OCWA's process data management system. Consideration should be given to expand the capabilities of the plant SCADA system to capture and trend key process data parameters and automatically upload the data from the SCADA historian to WISKI. All of the alarms should be tested on a regular basis and the thresholds/setpoints should be adjusted as required.

6. Operations and Maintenance

In order to get a better understanding of the day-to-day operations that take place at the Carleton Place WPCP, information was gathered to assess the application and implication of employing corporate tools by operations' staff. These corporate tools are used to gather information and ensure maintenance is being tracked and monitored. Daily activities were reviewed to assess how operations are spending time and explore any opportunities for improved efficiency.

6.1 Plant Staffing and Operation

The Carleton Place WPCP is operated by OCWA. Operators at the plant are responsible for performing lab work, making process control decisions, and reporting to the Senior Operations Manager at OCWA's Eastern Hub. The operations staff often works on independent tasks, so time should be allocated to continuously train/update operators on activities taking place at the facility. Staff at the Carleton Place WPCP input process and performance data in WISKI (OCWA's internal database for operational data). OCWA's process specialists serve as internal consultants. Meetings are held by OCWA and the Town of Carleton Place on a quarterly basis to discuss various issues at the town's facilities, which include the Carleton Place WPCP. There are quarterly compliance meetings with operations staff to discuss challenges being encountered.

6.2 O & M Tool Application

In the past few years, OCWA has spent significant effort to develop and apply advanced software tools, such as WISKI and Maximo, to improve operational efficiencies at OCWA-operated facilities. These tools effectively collect, input, manage, analyze, and report the operating data. The introduction of these tools has shown to be valuable for optimizing plant operation and maintenance. The operational software tools used in Carleton Place WPCP were reviewed and summarized below.

6.2.1 WISKI

WISKI is customized software developed by Kisters and OCWA to replace OCWA's older PDC software. This upgrade of software has required significant time and effort to import data from a number of sources and programs, scale corrections, store, retrieve, edit and modify data, and generate custom reports. Due to the complexity of the software, some areas have been overlooked in the process and it is not until specific data is being searched that a problem is identified.

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A review of the WISKI application at Carleton Place WPCP identified the following areas for additional improvement:

Data Mapping from SCADA/PLC to WISKI: Currently the plant SCADA system is undergoing a major upgrade but it hasn't been integrated with WISKI yet. For all process data, the operators manually record the daily operational data when they are doing their doing their rounds and it is periodically inputted it into WISKI. Consideration should be given to expand the capabilities of the plant SCADA system to allow data to be automatically uploaded from the SCADA historian to WISKI.

Use of WISKI to Support Daily Operations: It is recommended to integrate WISKI with daily operations to ensure that the plant is operated within the recommended process parameters and enhance process monitoring. Utilizing WISKI as a tool to review influent, activated sludge and final effluent data trends (i.e. final effluent ammonia concentrations) would support operational decision-making and help prioritize maintenance activities. If required, customized charts or tables for each process unit can be created with assistance from the OCWA WISKI team to facilitate routine data review. Currently accredited laboratory reports are imported directly into WISKI and can be used to generate standard and customized reports.

6.2.2 Maximo

Maximo has been developed by IBM and replaces the previous Hanson software that was utilized by OCWA for maintenance management. The Maximo system is seamless and work orders arrive at the mainframe computer station at the beginning of each month. This advanced work order and asset management software tracks the operations, maintenance and removal of equipment. The assigned personnel for the Carleton Place WPCP has access to all work order flow with a customized dashboard that directs them to outstanding / overdue work or incomplete work orders. This ensures that the facility's work orders are completed at the right time while monitoring the maximum efficient life cycle of each piece of equipment. The OCWA Maximo and Carleton Place WPCP staff members are working to complete the internal data mapping and to fully implement the Maximo Infrastructure Management System, which will optimize work efficiency, equipment maintenance and asset management for the Carleton Place WPCP. Staff training continues to be provided as the Maximo system is fully implemented at the facility.

A review of the work orders (WOs) completed at the Carleton Place WPCP shows that most of the time spent at the facility is on the operational WOs. A breakdown of the work order allocation of hours is shown in **Figure 12.** A review of the WO data over the past 3 years shows a significant shift in how time is being spent at the facility. Prior to 2017, most of the time was split between preventative maintenance and operations, but there has been a greater shift to operations in more recent years.

Additional WOs are being generated to capture items that were missed during the Hanson transition to ensure that required maintenance work is being completed and tracked. Overall, the current WO management at the Carleton Place WPCP is quite good.

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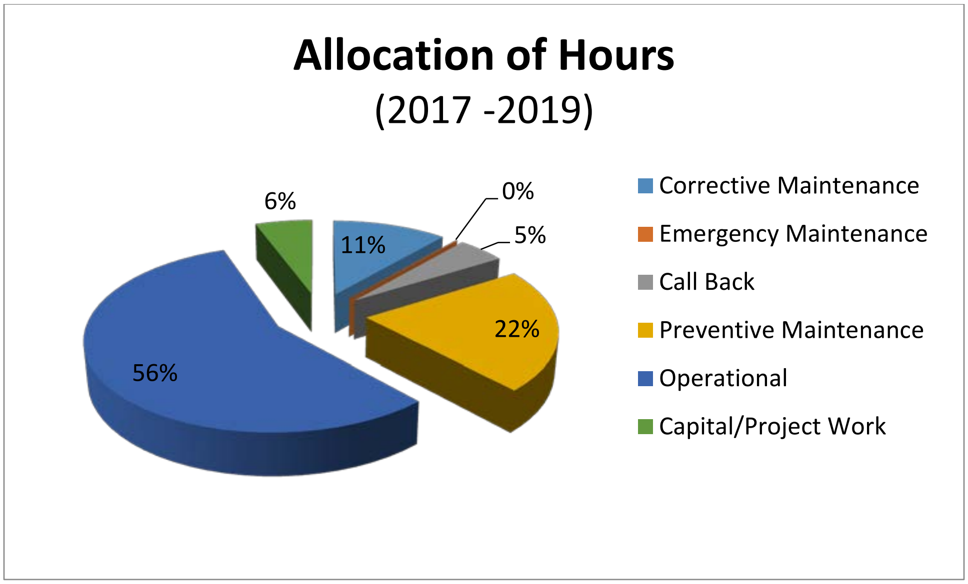

Figure 12 – Allocation of Work Order Hours – 2017 to 2019

6.3 Operational Improvements and Efficiencies

The following improvements could increase operational efficiencies at Carleton Place WPCP:

Mechanical Bar Screen

The mechanical bar screen currently operates on a timer but consideration should be given to run in differential level mode to allow for more efficient operation and improved response to high flows. Bar screens become more efficient at removing debris when rags buildup and mat across the bars.

Vortex Degritters

Currently, only one of the two vortex degritters can be isolated by the use of a knife valve. It is recommended that the installation of another knife valve be undertaken to allow for isolation of the other vortex degritter during maintenance activities.

Physical/Chemical Clarifiers

When the flow is greater than 10,400 m^3/d, the physical/chemical clarifiers are put into service. However, the electric actuator is not currently operational and must be turned manually to redirect flow to the physical/chemical clarifiers. Once flow enters the bypass trough; the flow is measured using an ultrasonic head to measure the level in the trough. The current setup provides less accurate flow measurements. Moving the existing ultrasonic head and installing a V-notch weir upstream of the first influent gate for the physical/chemical clarifiers would provide more accurate wet weather flow measurements. A calculation has also been added to the SCADA PLC to calculate the wet weather flow from the available flow measurements (i.e. raw influent flow minus main primary clarifiers flow).

The current chemical dosing system and flash/floc mixers should be upgraded and overhauled to ensure proper chemical disbursement and mixing. Heat tracing could also be added to the chemical lines to prevent freezing during cold weather conditions. After the chemical dosing and mixing system has been

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upgraded, the electric actuators should be overhauled or replaced to ensure proper operation and flow distribution into the physical/chemical clarifiers.

Flow Splitters

When reviewing the flow splitter chambers at the plant, the flow entering the aeration tanks and final clarifiers is not being distributed equally. The flow split discrepancy was also confirmed by reviewing the drawings and the in-house lab results. When facility upgrades are required in the future, a review of the splitter boxes is recommended to see if the current design can be improved to allow for more even distribution of flows. Currently, the aeration tanks and final clarifiers are operating at different loading rates, which add to operational complexity of the facility.

Covering the final clarifier flow splitter chamber with a thick mat (stall mat) should help reduce the scum from potentially rising above the grating.

Final Clarifier Still Wells

The final clarifiers still well center rings are designed to capture the scum and send it to the scum collection manhole. The rings have degraded over the years and reached their end of life, allowing holes to form in them. The holes allow the scum to escape from the rings and make its way into the final effluent. It is recommended to rehabilitate or replace the center rings to prevent the scum from escaping. This should also help lower final effluent TSS and the scum build up that was observed in the UV channel.

RAS Pumps

The RAS pumps are in a good state of repair. The current RAS operational setup draws sludge from each of the three clarifiers and using a duty pump for each clarifier, utilizing all three pumps to recycle RAS to the aeration tanks. The individual pumps are being controlled by manually adjusting the variable frequency drives (VFDs). Each pump is currently set to pump at a different rate, since the clarifiers are receiving different amounts of solids due to unequal flow distribution to the clarifiers (see Flow Splitters section above) and therefore the sludge blankets and solids concentrations differ considerably. Also, the suction side of each RAS pump has a different head due to the different lengths of RAS piping for each clarifier. The difference in solids inventory and suction head are both factors to consider when setting the RAS pump rate for each clarifier to prevent air locks from happening if the RAS pump suction head is too high given the amount of RAS that is collected in the individual sludge center wells of each clarifier.

The VFD speed settings for each RAS pump will be able to be adjusted in the upgraded SCADA system. Consideration should be given to implement programming in the SCADA PLC to set the individual RAS pump flows (i.e. 40%/35%/25%) as a percentage of the overall RAS flow. The overall RAS flow could also be specified as a percentage of the main plant influent flow using the existing main primary clarifiers influent flow meter.

Consideration should also be given to implement programming in the SCADA PLC to ramp up each RAS pump up to full speed for a set period of time (i.e. 60 seconds/day) to flush out the RAS suction lines to prevent solids and rags from building up and impeding the RAS flow.

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Flow Meter Recirculation Unit

A flow meter should be installed on the recirculation unit after the heat exchanger to confirm the influent flow to the anaerobic digesters.

Secondary Digester/Sludge Storage Tank Decanting

When supernatant has been returned to the main process from the secondary digester and/or sludge storage tank, the final effluent total ammonia nitrogen limits have been exceeded periodically due to the increased loading to the facility and a limited capacity for the existing activated sludge system to achieve consistent nitrification under cold weather and/or wet weather flow conditions. Due to this process limitation, a standard operating procedure (SOP) for supernatant management has been developed to limit the supernatant decant volume under certain operating conditions. The detailed SOP can be found in **Appendix D**.

Sodium Hydroxide Tank

The sodium hydroxide tank is filled in the headworks/loading bay and is susceptible to cold temperatures in the winter. It has been turned off to prevent freezing during the winter, but this could limit the ability to provide sufficient alkalinity to the process for consistent nitrification. A new wall and doorway could be installed to separate it from the loading bay, and the chemical lines could be heat traced to ensure that sodium hydroxide can be added to the process if required during the winter months.

Online Analyzers

The current online monitoring equipment and instrumentation at the facility was reviewed. Many similar facilities monitor DO, pH, temperature and MLSS concentration in each tank of the activated sludge system. Some plants are now monitoring ammonia online as well now that ion selective electrode (ISE) ammonia sensor technology has become more reliable. Changes in wireless technology have simplified the installation of online analyzers, which also reduces the installation effort and cost. Although the plant currently has DO, MLSS, temperature and pH probes, it is recommended for each tank to have a DO and MLSS probes as there is variability in the DO and MLSS in each tank. Online instrumentation would facilitate manual adjustments to the air distribution to the aeration tanks to ensure the DO concentrations are adequate in each tank. Consideration could also be given to install to install an ISE ammonia probe in the MLSS effluent channel to monitor the ammonia concentrations online.

SCADA System

The Carleton Place WPCP SCADA/PLC system is currently undergoing a major upgrade. Operations staff had several suggestions for new functionality, alarms, setpoints and integrating more analyzers and equipment into the SCADA system for enhanced monitoring and optimization of plant operations and process control.

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6.4 Standard Operating Procedures (SOPs)

The facility has Standard Operating Procedures (SOPs) on general and site-specific tasks. A review of these SOPs was completed and they were found to be very well organized with updated versions for the facility.

The Biosolids Handing SOP has been revised to deal with the periodic final effluent total ammonia nitrogen limit exceedances that have been experienced at the facility in the past. The modified SOP can be found in **Appendix D**.

If routine operational procedures change in the future, the SOPs need to be updated to ensure that the tasks are completed correctly and efficiently.

6.5 Overview of Nitrification and Denitrification in Wastewater Treatment Plants

The process optimization team has created a troubleshooting guidance document to assist operators to troubleshoot issues and make appropriate process adjustments based on the observed process symptoms. An overview of Nitrification and Denitrification in Wastewater Treatment Plants is shown in **Appendix E**.

6.6 Calibration of Meters and Sensors

Calibrating analyzers and flow meters is critical to the operation and accuracy of the equipment. Annual calibration (i.e. via third party) is common at many facilities across OCWA and is recommended to be continued for the analytical equipment at the Carleton Place WPCP.

Calibration of the handheld meters, including DO meter, SS meter, pH meter, and CH_4 gas meter are also required based on manufacturer recommendations or OCWA best practices.

6.7 Laboratory Procedures and Equipment

The laboratory at the Carleton Place WPCP is well equipped to allow for the required laboratory tests to be completed efficiently and effectively. There are some items that could be considered to improve analytical capabilities. There is an excellent previously developed process spreadsheet, the ***"Carleton Place WPCP Formula Sheet"*** which is being utilized to input and review daily lab results. The Formula Sheet is easy to understand, and has pertinent process information and calculations to facilitate process analysis and SRT/mass control. Keeping the daily formula sheets in chronologically organized folders makes it simple and straightforward to access and compare previous labs results and process calculations.

Daily In-House Labs

The ***"Carleton Place WPCP Formula Sheet"*** is an in-house lab sheet and is shown in **Figure 12**. This sheet is updated when labs are completed and then entered into WISKI for trending purposes.

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QEMS
Ontario Clean Water Agency

Carleton Place WPCP
Formula Sheet

Issued: 12-Mar-2020
Revision: 9
1 of 1
Reviewed: Alison O'Connor (PCT)
Approved: Shane Hogan (Senior Ops. Manager)

Date:	Aeration			Clarifier			WAS	Final
Tank # / Vol(m³)	1 - 669	2 - 635	3 - 635	1 - 947.2	2 - 947.2	3 - 947.2		
Vol. Filtered (ml)	100	100	100	100	100	100	25	250
Weight after drying (g)								
Weight of filter (g)								
Difference (g)	0	0	0	0	0	0	0	0
Suspended Solids (mg/l)	0	0	0	0	0	0	0	0
Mass (kg)	0	0	0	0	0	0	0	0
Dissolved Oxygen								
Average SS (mg/l)	0			0				
Total Mass (kg)	0			0				
Clarifiers	Primary			Secondary				
Sludge Depth (ft)								

30 min settling			
Average 30 min settling	0		
Total Mass (Kg)	0		
Total Wasted (Kg)	0		
SRT (d)	#DIV/0!		
SRT Target (d)	7.5	10	15
KG to waste	0	0	0
Volume to waste (m³)	0	0	0
SDR	#DIV/0!		
Effluent pH			
Effluent Temperature (°C)			
Phosphorus Indicator			
SVI	#DIV/0!	#DIV/0!	#DIV/0!

Process Data	
Methane (m³/d)	
Primary Sludge (m³)	
Sludge Transfer (m³/d)	
RAS Flow	
PAS/08 Dosage (mg/L)	0.0
DO Average (mg/L)	
Effluent Alkalinity (mg/L)	
Raw Flow (m³/d)	
WAS Flow (m³/d)	
Effluent Ammonia (mg/L)	
Sodium Hydroxide Dose (mg/L)	

SRT = Sludge Retention Time (20C - 7.5 d, 15C - 10 d, 10C - 15 d)
SDR = Sludge Distribution Ratio (>10 very good, 6.5 - 10 good, 5.0 - 6.5 OK, 3.0 - 5.0 potential problems, < 3.0 immediate/pending problems)
SVI = Sludge Volume Index (80 - 150) good settling, (0 - 70) old sludge/pin floc, (150 - 200) potential bulking, (200 - 300) bulking/poor settling

Figure 13 – Carleton Place WPCP Formula Sheet

On days where there is not enough time for labs, test strips could be used for alkalinity and ammonia, to give the operator a quick snapshot of the current process conditions. Test strips take less than 1 minute to complete. If possible, an MLVSS measurement could be added to the spreadsheet to be completed periodically.

By filling out the lab sheet, a comprehensive history of the plant's performance can be collected. This history gives the operators a good overview of how the facility has performed in the past under different flow conditions and changing seasons. It is recommended to complete microscope analysis when doing labs to confirm the microorganisms that are presently in the activated sludge.

The following recommendations might improve the accuracy of the lab tests to provide more precise results.

Relative Humidity

When working in the lab, relative humidity can alter specific test results. Any tests that involve filter paper and weight can be affected by relative humidity. This normally occurs during the summer months when hot humid conditions occur. When samples are taken out of a drying oven, furnace or microwave; they can absorb moisture and increase the weight of the sample. When samples are removed from the microwave, they should be placed in the desiccator to create a low-humidity and cool atmosphere to

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ensure that the measurements are accurate. Ideally relative humidity should be kept between 30 to 55% and temperature should range from 20 to 23 °C.

<u>Sample Locations</u>

In order to achieve acceptable consistency for lab work, samples need to be taken from the same location, depth and preferably at the same time of day. Labelling sampling locations throughout the plant can remove some confusion when more than one operator is gathering samples to complete lab work.

6.8 Health and Safety

When it comes to Health and Safety (H&S), OCWA takes a proactive, preventative approach. We continue to expand, enhance and promote our safe and healthy work practices through partnerships and collaborations to help ensure compliance with the *Occupational Health and Safety Act*. OCWA is fully committed to the H&S of workers. It is our highest priority.

Over the past several years, we have made significant investment in technologies that have improved our H&S reporting capabilities. Our reports are structured to provide basic template information for a myriad of parameters. Since the Town is responsible to the public for the safe and efficient operation of their facilities, it is important to have timely reporting. This is achieved through regular dialogue with our operations staff, compliance, health and safety team, and business managers. **Table 17** highlights the reports that OCWA provides to the Town in order to maintain accountability and compliance with the Carleton Place WPCP.

Table 17 – Reports Generated for the Town of Carleton Place

Report	Frequency	Submission
Compliance (MECP) Sewage	Annually	By April 21
Operations	Quarterly	30 days after quarter end
Maintenance	Quarterly	30 days after quarter end
Yearly Summary	Annually	60 days after year end
Condition Survey	Annually	60 days after year end
Capital Improvements	Annually	30 days prior to annual capital budget meeting
Contingency and Emergency Preparedness Plans		Within 30 days of the start
OCWA's Health and Safety Procedures		Within 20 days of the start

Table 18 provides some Health and Safety highlights that have been achieved through our partnership with the Town of Carleton Place.

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Table 18 – Health and Safety Achievements	
Zero lost-time incidents (due to occupational injuries and illness)	●
OCWA's Near Misses Reporting	●
Successful completion of safety training for each member of staff satisfying regulatory requirements	●

● (green)	Results are positive and on target	● (yellow)	Results in range but not yet achieved	● (red)	Results are of target and action is needed

6.8.1 Health and Safety Inspections

OCWA's FOP team, working with plant operations, have reviewed key health and safety issues related to individual processes and workplace areas. Based on this review, included below are health and safety items requiring further improvement for your consideration (see **Appendix F** for a detailed Health and Safety checklist):

Laboratory Labels

The microwaves and fridge should be labeled "No Food" "Samples Only" to ensure that equipment used for samples are not accidently mixed with food for human consumption.

Signage

Some of the chemical lines could be labeled better in the Chemical Feed Building to remove any confusion on what chemical is flowing through each chemical line.

General Housekeeping and Physical Layout

There could be some better organization in the garage/shop areas. These areas house many different materials and tools, which could be organized more efficiently.

Centrifuge Room - The layout of this room is cramped and difficult to move around in and has the potential to experience hazardous off-gassing from sludge processing.

Headworks/Truck Loading Bay - This room is too small to accommodate trucks for liquid hauling and therefore cannot be utilized as intended, which could release odours into the existing area. Temporary sludge lines must be laid out across the floor to hookup and load the liquid hauling trucks. These lines must also be moved and dried/emptied by hand which is a dirty and physically demanding job.

Hazardous Materials

Some flammable containers should be stored in the fireproof cabinet located in the maintenance area.

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Ladders/Scaffolding/Platforms

Retaining walls are located throughout the facility need to accessed and reconstructed in areas to prevent collapse and further deterioration.

Machinery and Hand Tools

Mechanical Bar Screen - There is a piece of grating missing above the bar screen to allow visual observations to occur; this could be considered a guarding hazard. It would be recommended to replace the panel with a perforated/grating panel to still allow visual observation.

The upper section is supported by a come-along and needs to be replaced by a permanent brace.

The manual skimmers in the primary clarifiers are not only difficult to move (they require maintenance – better lubrication), but the east side should have improved access along with platform for smoother operation. Removing scum is necessary for plant operation and may help lessen the scum accumulation in aeration tanks and final clarifiers.

Electrical Concerns

The Centrifuge Room has many electrical panels that may not be rated for the classification of the room and could be susceptible to hazardous off-gassing from sludge processing when the centrifuge is operating. Relocating the centrifuge to the adjacent room along with upgrading the venting and HVAC system will provide a better physical layout and isolate the off-gassing in an appropriate area.

Currently, the outdoor lights are operated by a timer which should be adjusted based on the season and hours of day light. A motion sensor could be installed to activate the lights to ensure that the outdoor lights are on when lighting conditions are low and operators are present.

Slip and Trip Hazards

The temporary piping being utilized to load the tanker trucks in the Headworks/Truck Loading Bay is a potential tripping hazard. An addition to the building is required as it is not currently large enough to properly house the tanker trucks and the building cannot be effectively used with how the current sludge piping has been installed.

Personal Protective Equipment (PPE)

Additional Safety Rings (floating) at the final clarifiers and aeration tanks are recommended.

Safety Equipment – Eyewash Stations and Showers

The existing few eyewash stations with showers may require a large hot water tank, as they may not meet the current ANSI Z358.1-2004 requirement or the manufacturer safety data sheet (SDS) requirements. The eyewash stations need 15 minutes of flush time with tepid water but the safety shower requires 30 minutes. The portable handheld units located in the digester complex require eyepieces associated with the bottle to allow for proper flushing procedures.

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7. Performance Limiting Factors and Recommendations

The areas of design, operation, maintenance, and administration were evaluated in order to identify factors which limit performance. These evaluations were based on information obtained from the plant tour, interviews, performance and design assessments, special studies, and the judgment of the evaluation team.

Each of the factors was classified as A, B, or C according to the following guidelines:

A. Recommended for immediate action due to major impact on plant performance and and/or relative low cost involved.

B. Recommended for action within 1-3 years due to significant impact on plant performance.

C. Recommended for future consideration due to the minor or intermittent impact on a periodic basis.

7.1 Design

Table 19 - Summary of Design Limiting Factors for the Carleton Place WPCP

Recommendation	Factor Classification
Biosolids Dewatering: • The sludge dewatering centrifuge is currently not in service due to various design and operational issues. A capital project should be initiated to identify and address the current deficiencies with the sludge dewatering system so that the centrifuge can be put into service to help address the current sludge storage limitations at the facility.	**A**
Biosolids Treatment and Storage: • If the sludge dewatering centrifuge deficiencies cannot be addressed and the centrifuge cannot operate, the sludge storage capacity will need to be expanded to ensure adequate sludge storage capacity over the winter months. • Alternatively, the BCR Environmental CleanB sludge treatment technology was recently trialed at the Carleton Place facility with promising results. The CleanB technology may be an economical long term solution for biosolids treatment and processing at the Carleton Place facility.	**A**
Activated Sludge System Nitrification Capacity: • The aeration tank hydraulic retention time (HRT) and solids retention time (SRT) are both currently above the MECP minimum recommended range (i.e. minimum 6 hour HRT and 10 day SRT), however they are quite close to the minimum recommended values at current flows, even at the current average MLSS concentration greater than 5,000 mg/L, and this has an impact on the capacity of the plant to achieve consistent nitrification.	**Information only**

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Table 19 - Summary of Design Limiting Factors for the Carleton Place WPCP	
Recommendation	**Factor Classification**
Final Clarifier Still Wells: • The final clarifier still well center rings are designed to capture the scum and send it to the scum collection manhole. The rings have degraded over the years and reached their end of life, allowing holes to form in them. The holes allow the scum to escape from the rings and make its way into the final effluent. The center rings should be rehabilitated or replaced to prevent scum from escaping. This should also help lower final effluent TSS and the scum build up that was observed in the UV channel.	**A**
Mechanical WAS Thickening: • A study should be initiated to evaluate mechanical WAS thickening alternatives for the facility. Currently the WAS is co-thickened in the main plant primary clarifiers. Separate mechanical WAS thickening would decrease the sludge inventory in the system, improve the performance of the primary clarifiers and increase the capacity for nitrification of the existing activated sludge system.	**B**
RAS Control (Pumps/Valves): • The RAS control (i.e. pump size, valves) could be reviewed to improve the design to provide better control of the RAS to the aeration tanks and improve the total mass distribution in the activated sludge system.	**B**
Flow Splitter Chambers: • When reviewing the flow splitter chambers at the plant, the flow entering the aeration tanks and final clarifiers is not being distributed equally. The flow split discrepancy was also confirmed by reviewing the drawings and the in-house lab results. When facility upgrades are required in the future, it is recommend having the splitter boxes reviewed to see if the current design can be improved to allow for more even distribution of flows.	**B**
Aeration Blowers: • At certain times of the year, under higher loading conditions, the 50 HP duty turbo blower cannot provide sufficient oxygen to the three aeration tanks. Under these high oxygen demand conditions, it is recommended to put one of the standby blowers in service to increase the oxygen supply. Consideration should also be given to undertake another turbo blower upgrade to increase the aeration capacity and energy efficiency of the current system.	**B**

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7.2 Operation

Table 20 - Summary of Operational Limiting Factors for the Carleton Place WPCP	
Recommendation	**Factor Classification**
Biosolids Handling and Storage Capacity Management:	
• The plant does not achieve adequate nitrification (i.e. ammonia removal) under certain operating conditions. The high TAN in the effluent is most likely due to additional nitrogen loading from the biosolids supernatant sidestreams and a limited capacity for the existing activated sludge system to achieve consistent nitrification under cold weather and/or wet weather flow conditions. Due to this process limitation, a standard operating procedure (SOP) for supernatant management has been developed to limit the supernatant decant volume under certain operating conditions. The detailed SOP can be found in **Appendix D**.	**A**
Process Monitoring Spreadsheet:	
• There is an excellent previously developed process spreadsheet, the "Carleton Place WPCP Formula Sheet" which is currently being utilized to input and review daily lab results. The Formula Sheet is easy to understand, and has pertinent process information and calculations (i.e. SRT, Total Mass etc.) to facilitate process analysis and SRT/mass control. Continue to populate the daily formula sheets and keep them in chronologically organized folders to make it simple and straightforward to access and compare previous labs results and process calculations.	**A**
• Additionally, a troubleshooting guidance document has been created to assist operators to troubleshoot issues and make appropriate process adjustments based on the observed process symptoms. An overview of Nitrification and Denitrification in Wastewater Treatment Plants can be found in Appendix E.	**Information only**
Mechanical Bar Screen:	
• The mechanical bar screen currently operates on a timer but consideration should be given to run in differential level mode to allow for more efficient operation and improved response to high flows. Bar screens become more efficient at removing debris when rags buildup and mat across the bars.	**B**
Primary Clarifier Scum Skimmers:	
• The manual skimmers in the primary clarifiers are not only difficult to move (they require maintenance – better lubrication), but the east side should have improved access along with platform for smoother operation. Removing scum is necessary for plant operation and may help lessen the scum accumulation in aeration tanks and final clarifiers.	**B**
Physical/Chemical Clarifiers:	
• The electric actuator is not currently operational and must be turned manually to redirect flow to the physical/chemical clarifiers during wet weather flow events.	**B**
• Once flow enters the bypass trough; the flow is measured using an ultrasonic head to measure the level in the trough. Moving the existing	**B**

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Table 20 - Summary of Operational Limiting Factors for the Carleton Place WPCP	
Recommendation	**Factor Classification**
ultrasonic head and installing a V-notch weir upstream of the first influent gate for the physical/chemical clarifiers would provide more accurate wet weather flow measurements. A calculation has also been added to the SCADA PLC to calculate the wet weather flow from the available flow measurements (i.e. raw influent flow minus main primary clarifiers flow). • The current chemical dosing system and flash/floc mixers should be upgraded and overhauled to ensure proper chemical disbursement and mixing. Heat tracing could also be added to the chemical lines to prevent freezing during cold weather conditions. After the chemical dosing and mixing system has been upgraded, the electric actuators should be overhauled or replaced to ensure proper operation and flow distribution into the physical/chemical clarifiers.	**B**
Online Analyzers: • Although the plant currently has DO, MLSS, temperature and pH probes, it is recommended for each tank to have a DO and MLSS probes as there is variability in the DO and MLSS in each tank. Online instrumentation would facilitate manual adjustments to the air distribution to the aeration tanks to ensure the DO concentrations are adequate in each tank. Consideration could also be given to install to install an ISE ammonia probe in the MLSS effluent channel to monitor the ammonia concentrations online.	**A**
RAS Pump Operation and SCADA Programming: • The difference in solids inventory and suction head are both factors to consider when setting the RAS pump rate for each clarifier to prevent air locks from happening if the RAS pump suction head is too high given the amount of RAS that is collected in the individual sludge center wells of each clarifier. • The VFD speed settings for each RAS pump will be able to be adjusted in the upgraded SCADA system. Consideration should be given to implement programming in the SCADA PLC to set the individual RAS pump flows (i.e. 40%/35%/25%) as a percentage of the overall RAS flow. The overall RAS flow could also be specified as a percentage of the main plant influent flow using the existing main primary clarifier's influent flow meter. • Consideration should also be given to implement programming in the SCADA PLC to ramp up each RAS pump up to full speed for a set period of time (i.e. 60 seconds/day) to flush out the RAS suction lines to prevent solids and rags from building up and impeding the RAS flow.	**Information only** **B** **B**
Sodium Hydroxide Tank: • The influent alkalinity to the plant is lower than typical for municipal wastewater, and is most likely a limiting factor for nitrification as the final effluent alkalinity is periodically below 50 mg/L. The minimum residual alkalinity in the final effluent should ideally be greater than 100 mg/L as CaCO3, and should be greater than 50 mg/L as CaCO3 at an absolute minimum to ensure that an adequate amount of alkalinity is available for full nitrification. Flow-paced sodium hydroxide addition could be	**A**

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Table 20 - Summary of Operational Limiting Factors for the Carleton Place WPCP	
Recommendation	**Factor Classification**
implemented to help ensure consistent alkalinity residual for nitrification. • The sodium hydroxide tank is filled in the headworks/loading bay and is susceptible to cold temperatures in the winter. It has been turned off to prevent freezing during the winter, but this could limit the ability to provide sufficient alkalinity to the process for consistent nitrification. A new wall and doorway could be installed to separate it from the loading bay, and the chemical lines could be heat traced to ensure that sodium hydroxide can be added to the process if required during the winter months.	**B**
Final Clarifier Flow Splitter Chamber: • Covering the final clarifier flow splitter chamber with a thick mat (stall mat) should help reduce the scum from potentially rising above the grating.	**C**
Anaerobic Digesters Influent Flow Meter: • A flow meter should be installed on the recirculation unit after the heat exchanger to confirm the influent flow to the anaerobic digesters.	**C**
Sampling and Monitoring: • Initiate a special study to quantify the solids, BOD_5, TKN, TAN, TP and Alkalinity loading from the digester supernatant streams to determine the impact on plant performance and capacity.	**B**
PLC, SCADA and Alarm Systems: • Review existing SCADA control systems to ensure that all controls are set up as intended and set points and min/max settings are correct. • Ensure that all critical equipment is alarmed. Ensure all alarm points are confirmed and utilized. Alarm set points should be tested on a regular schedule. • The Carleton Place WPCP SCADA/PLC system is currently undergoing a major upgrade. Operations staff had several suggestions for new functionality, alarms, setpoints and integrating more analyzers and equipment into the SCADA system for enhanced monitoring and optimization of plant operations and process control.	**A** **A** **A**
WISKI/PDM: • Continue efforts to trend and interpret key process/performance data and utilize these trend graphs to improve operational decision making and support daily operational and maintenance activities. • Integrate PDM technology with daily operations to operate the plant within the recommended process parameters; enhance process monitoring and trending system.	**B** **B**

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7.3 Maintenance

Table 21 - Summary of Maintenance Limiting Factors for Carleton Place WPCP	
Recommendation	**Factor Classification**
Inflow and Infiltration Reduction: • A significant amount of Inflow and infiltration (I&I) was observed in the collection system. Continue ongoing efforts to work in partnership with the Town to reduce I&I into the collection system and to reduce the flows to the WPCP. By isolating and addressing/maintaining the main areas of concern (i.e. infiltration – joints, cracks, manhole covers, etc., sump pumps, storm drain tie-ins, etc.), the number of high flow events and the flow peaking factor to the WPCP will be reduced, which will have a positive impact on the current plant process on and future plant expansion capital costs.	**A**
Vortex Degritters: • Currently, only one of the two vortex degritters can be isolated by the use of a knife valve. It is recommended that the installation of another knife valve be undertaken to allow for isolation of the other vortex degritter during maintenance activities.	**B**
Jet Aeration System: • Continue the existing jet aeration system inspection frequency to ensure that the aeration equipment remains in proper working order to optimize treatment efficiency.	**B**
Calibration of Analytical Equipment: • Calibrating analyzers and flow meters is critical to the operation and accuracy of the equipment. Annual calibration (i.e. via third party) is common at many facilities across OCWA and is recommended to be continued for the analytical equipment at the Carleton Place WPCP. Calibration of the handheld meters, including DO meter, SS meter, pH meter, and CH4 gas meter are also required based on manufacturer recommendations or OCWA best practices.	**A**

7.4 Administration

Table 22 - Summary of Administration Limiting Factors for Carleton Place WPCP	
Recommendation	**Factor Classification**
Standard Operating Procedures (SOPs): • Continue to use all the existing SOPs documents and update as necessary to support/reflect current plant operations. • A standard operating procedure (SOP) for supernatant management has been developed to limit the supernatant decant volume under certain operating conditions. The detailed SOP can be found in **Appendix D**.	**A** **A**

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Table 22 - Summary of Administration Limiting Factors for Carleton Place WPCP	
Recommendation	**Factor Classification**
Laboratory Analysis:	
• A desiccator should be installed in the lab. The desiccant in the desiccator creates low-humidity atmosphere for storing and cooling filter paper to ensure accuracy of in-house labs.	**C**
• For lab work consistency, samples need to be gathered from the same location, depth and preferably at the same time of day. Labelling sampling locations throughout the plant can remove some confusion when more than one operator is gathering samples to complete lab work.	**C**
Health and Safety:	
• Hazardous Materials - Some flammable containers should be stored in the fireproof cabinet located in the maintenance area.	**A**
• Retaining walls are located throughout the facility need to accessed and reconstructed in areas to prevent collapse and further deterioration.	**B**
• Mechanical Bar Screen Grating - There is a piece of grating missing above the bar screen to allow visual observations to occur; this could be considered a guarding hazard. It would be recommended to replace the panel with a perforated/grating panel to still allow visual observation. The upper section is supported by a come-along and needs to be replaced by a permanent brace.	**B**
• The Centrifuge Room has many electrical panels that may not be rated for the classification of the room and could be susceptible to hazardous off-gassing from sludge processing when the centrifuge is operating. Relocating the centrifuge to the adjacent room along with upgrading the venting and HVAC system will provide a better physical layout and isolate the off-gassing in an appropriate area.	**A**
• Currently the outdoor lights are operated off a timer which should be adjusted based on the season and hours of day light. A motion sensor could be installed to activate the lights to ensure that the outdoor lights are on when lighting conditions are low and operators are present.	**B**
• Eyewash Stations - Ensure that all eyewash stations located throughout the facility meet the current regulations. There are portable handheld units located in the digester complex but they don't have an eyepiece associated with the bottle to allow for proper flushing procedures.	**A**
Training:	
• Provide continued support for training programs for the advanced use of WISKI and Maximo for operation and maintenance support. The training program could also include a customized Excel spreadsheet containing typical ranges and targets for key operating parameters.	**B**
WISKI/PDM:	
• Integrate new WISKI/PDM technology with daily operations to operate the plant within the recommended process parameters.	**B**

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Table 22 - Summary of Administration Limiting Factors for Carleton Place WPCP	
Recommendation	**Factor Classification**
Maximo: • Continue to track time on Maximo system to optimize work efficiency and daily time management.	**B**

8. Summary of Findings

The Carleton Place WPCP FOP study is based on U.S EPA's Composite Correction Program (CCP). The CCP approach consists of two components, a Comprehensive Performance Evaluation (CPE) and Comprehensive Technical Assistance (CTA). The FOP study described in this report has a focus on the first step: CPE study.

Based on the results of this FOP, the Carleton Place WPCP is rated as a **capable** plant since the performance of the plant met MECP treatment objectives and limits fairly consistently. Under certain operational conditions there are issues with achieving full nitrification but this can be addressed by implementing a higher level of process control with respect to managing the biosolids supernatant decant volumes, and the SRT/mass inventory and residual alkalinity in the aeration tanks.

The performance of the plant met the ECA objectives and limits for most of the months reviewed and the plant was capable at current flows. A capital project should be initiated to identify and address the current deficiencies with the sludge dewatering system so that the centrifuge can be put into service to help with the current sludge storage limitations at the facility. If the sludge dewatering centrifuge deficiencies cannot be addressed and the centrifuge cannot operate, the sludge storage capacity will need to be expanded to ensure adequate sludge storage capacity over the winter months.

A comprehensive review and analysis of various aspects of the Carleton Place WPCP was completed during this facility optimization study, the main findings are summarized as below:

- The Carleton Place WPCP meets its operating goals and objectives most of the time. The final effluent wastewater quality consistently meets MECP treatment objectives and limits.
- All unit processes can accommodate existing average and peak flows with no issues or relatively minor process upsets.
- The most limiting process at the facility is the biosolids storage capacity as it does not currently meet the MECP design criteria of 180 days.
- With respect to energy consumption, the Carleton Place WPCP is performing relatively well in comparison to the other similar sized facilities. The average volumetric energy intensity of the other similar sized facilities is 0.96 kWh/m^3, while for Carleton Place it is 0.59 kWh/m^3.
- The O&M team is proactive and cooperative; and the plant is well maintained.

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- As part of OCWA's continuous improvement mandate, the FOP team recommends further improvements and upgrades, grouped in four categories – design, operation, maintenance and administration as summarized in **Section 7.0**.

9. Evaluation Follow-Up

This FOP has resulted in a list of recommendations for discussion, review and prioritization with the Town of Carleton Place. The OCWA FOP team will discuss next steps with the Town based on the final prioritized recommendations outlined in this report. Short- and long-term capital plans could be further developed for this facility to address some of the recommendations. OCWA is willing to assist the Town with the pursuit of any of these recommendations for an agreed-upon fee.

Once the Draft FOP report is finalized, a copy will be delivered to the Town for their records. We believe that this FOP document will be a valuable tool to assist OCWA and the Town to make 'best of' operational and capital decisions in the future.

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Appendix A

Raw Influent Wastewater Historical Data

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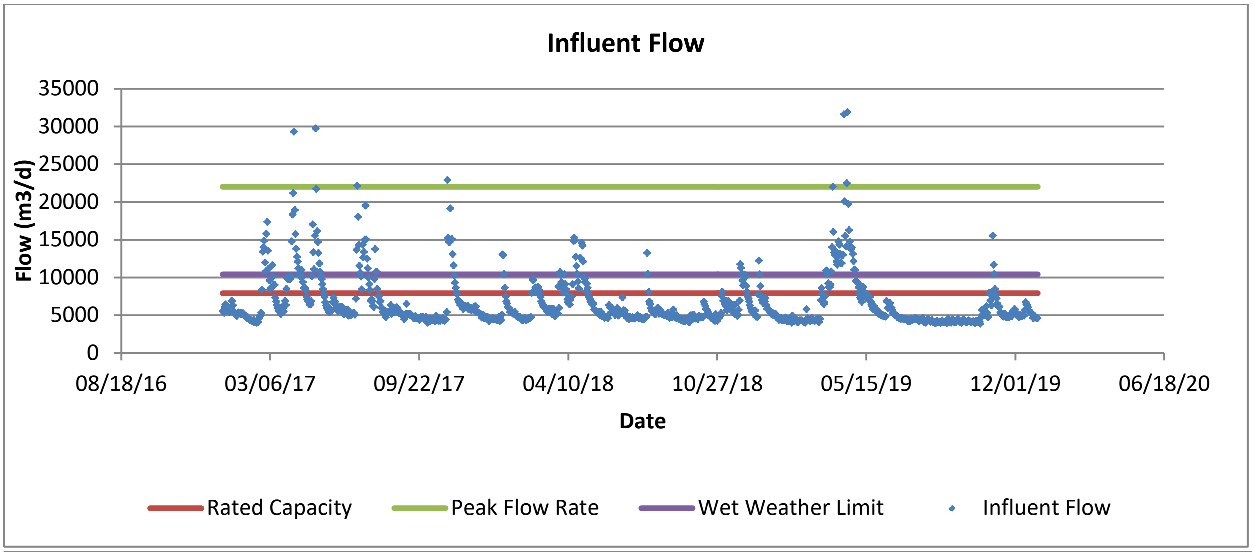

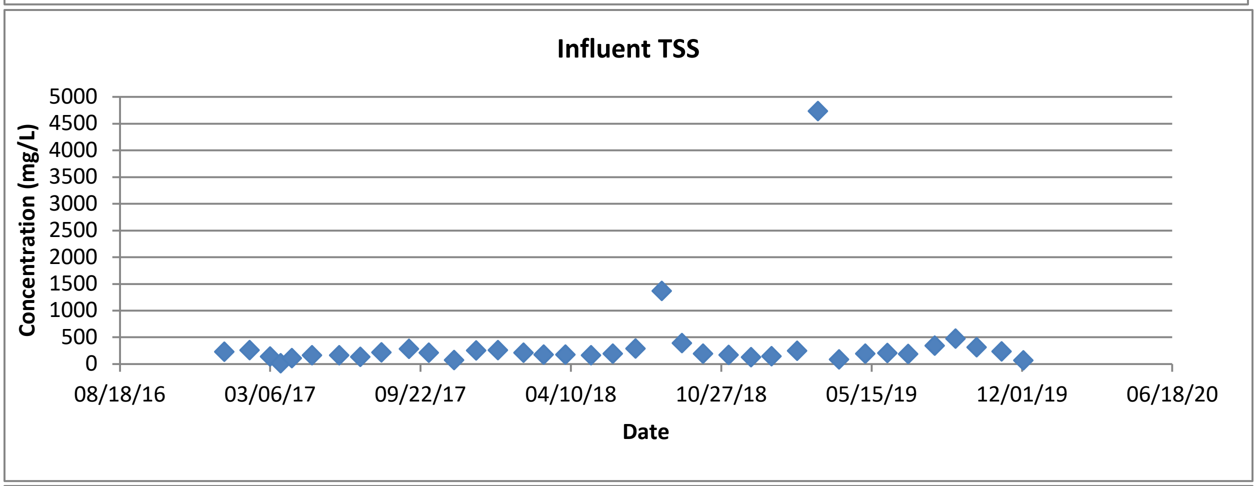

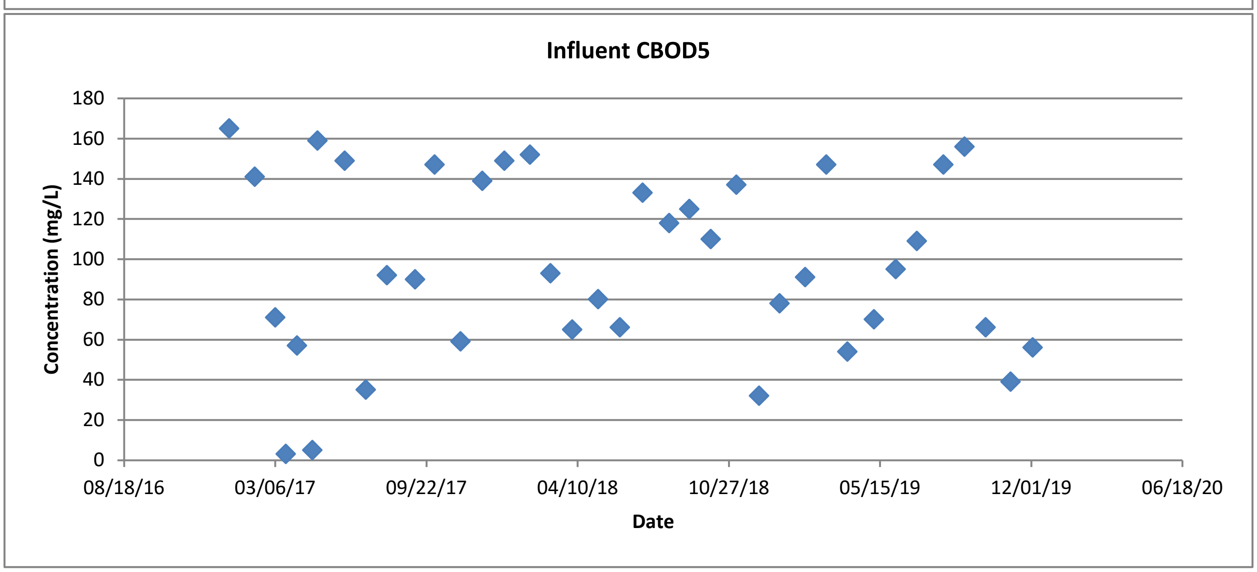

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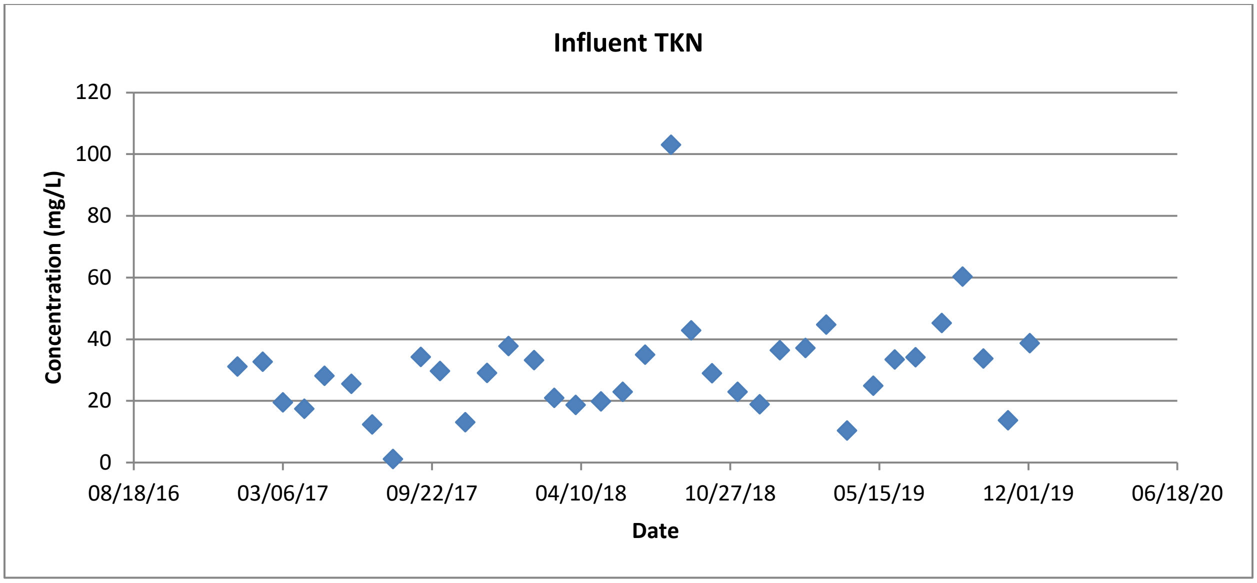

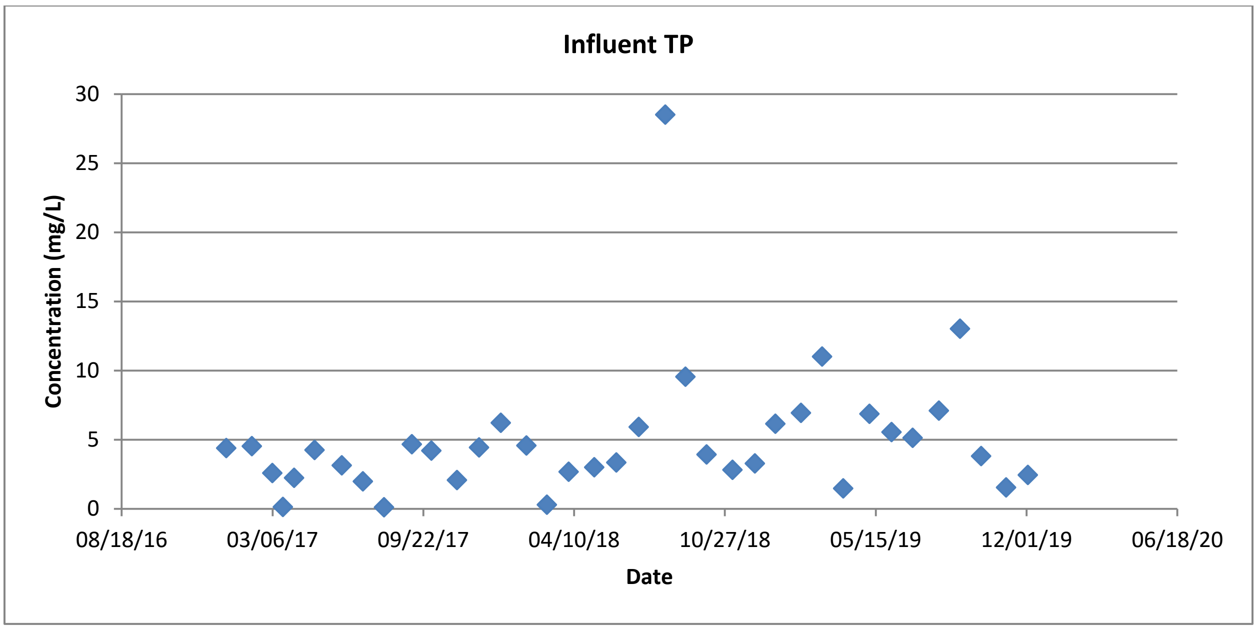

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Appendix B

Final Effluent Wastewater Historical Data

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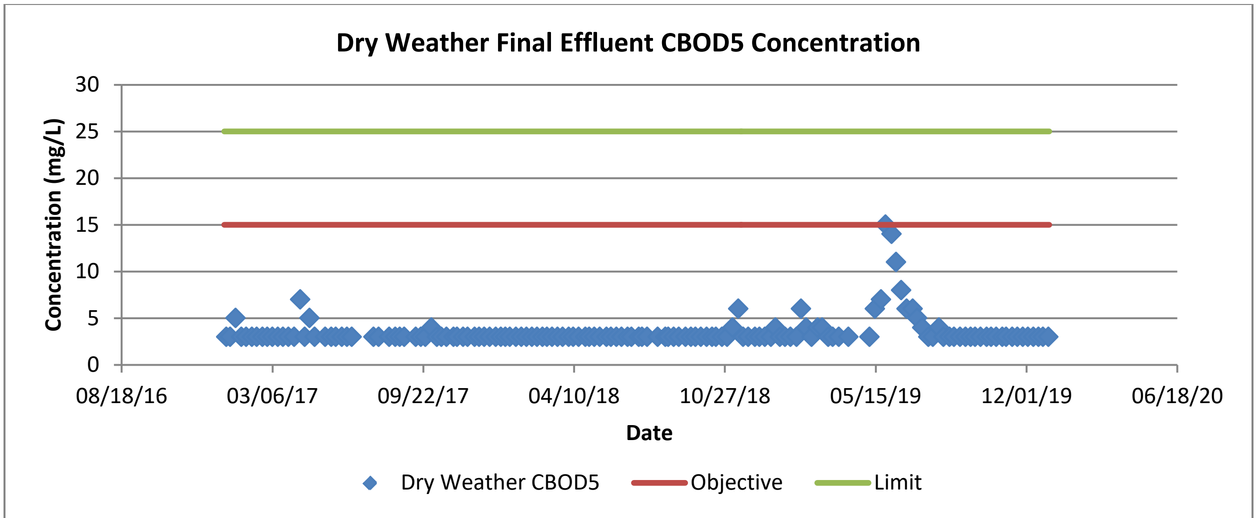

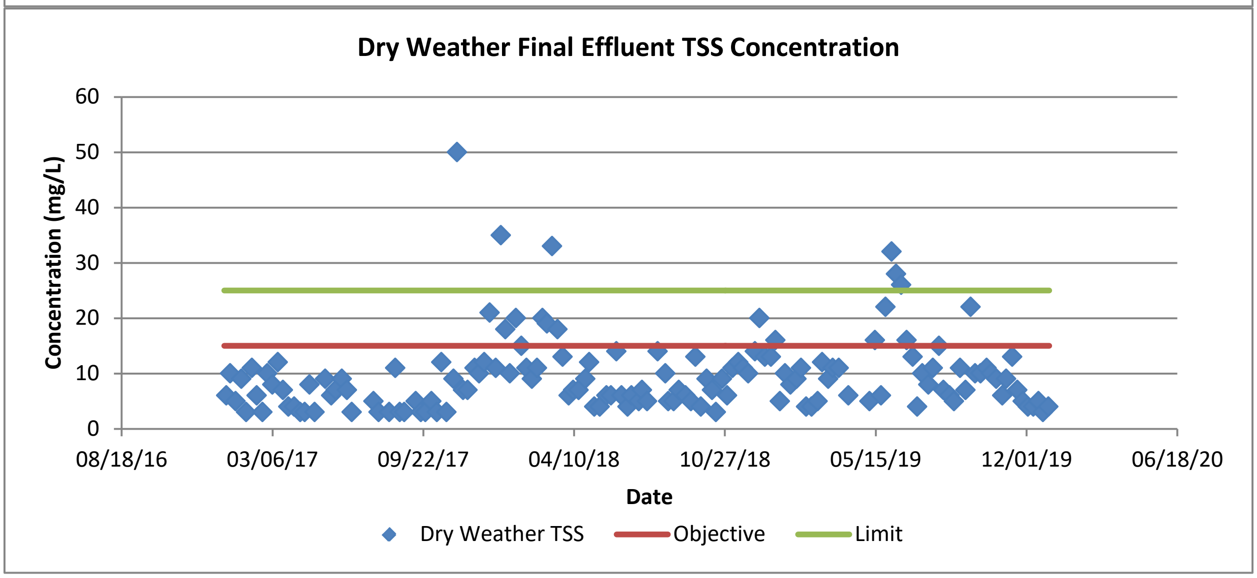

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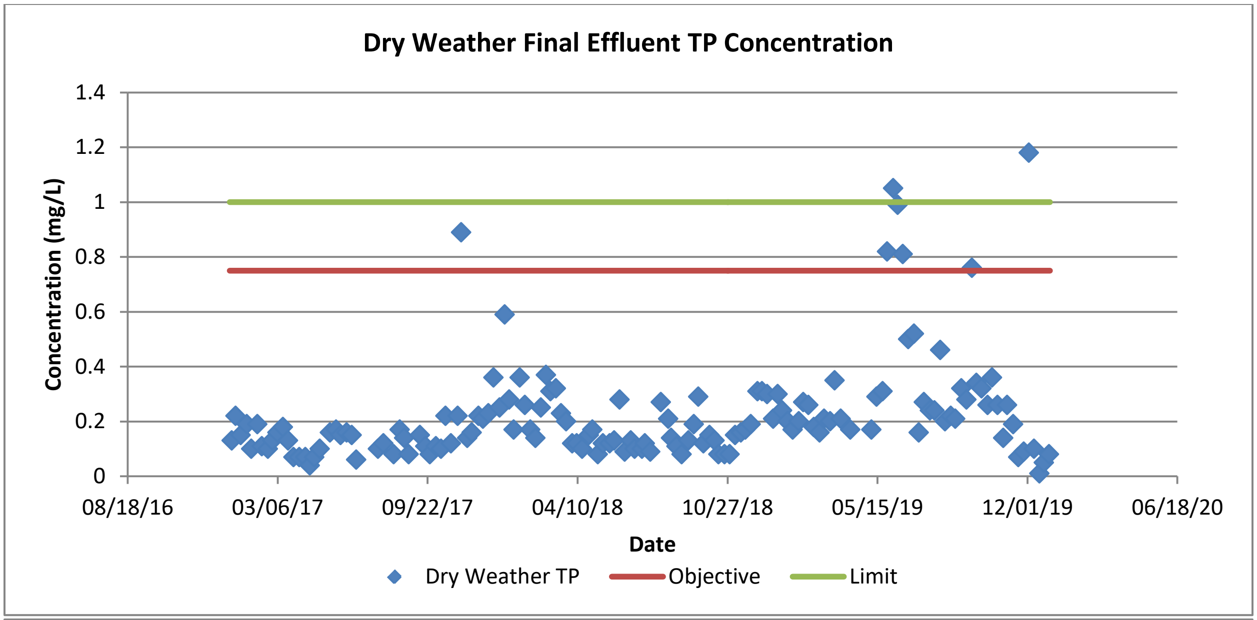

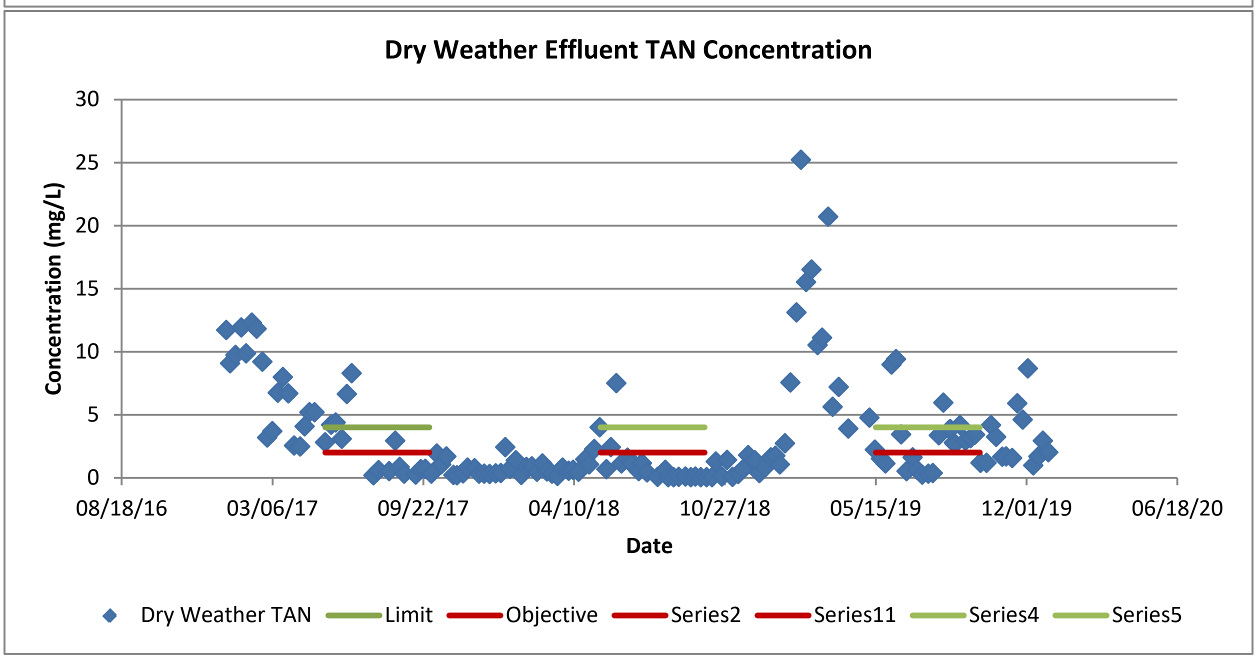

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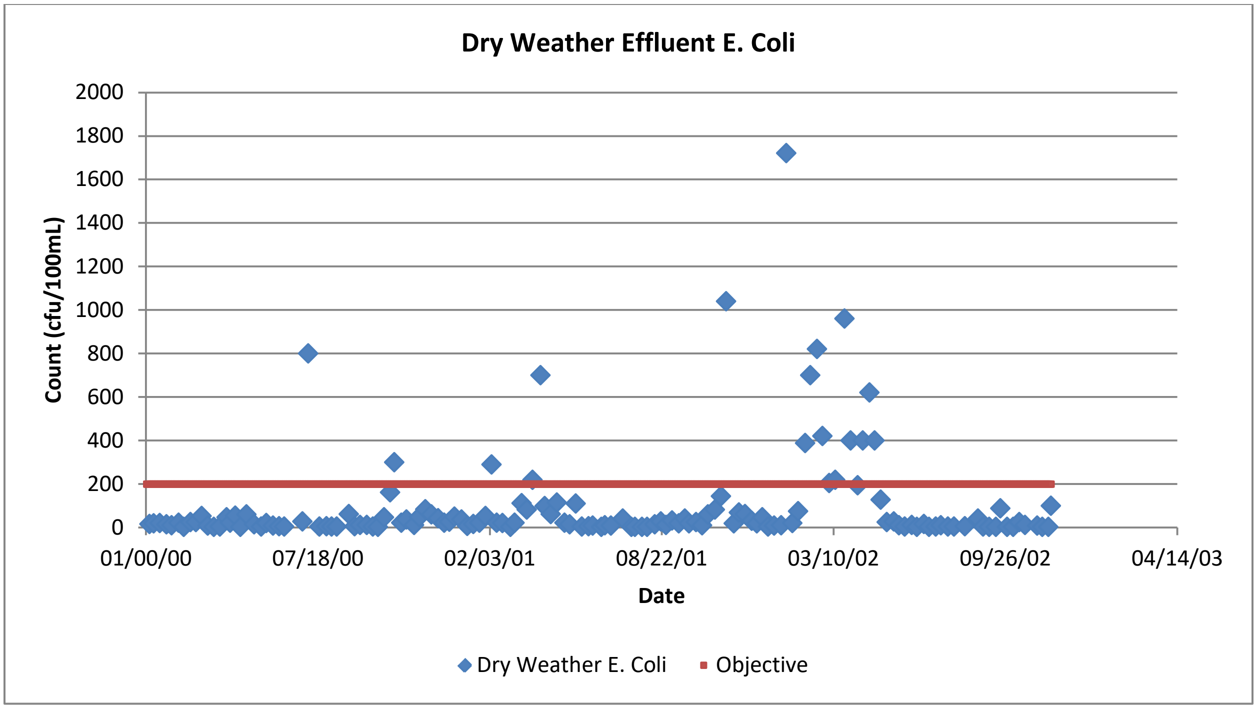

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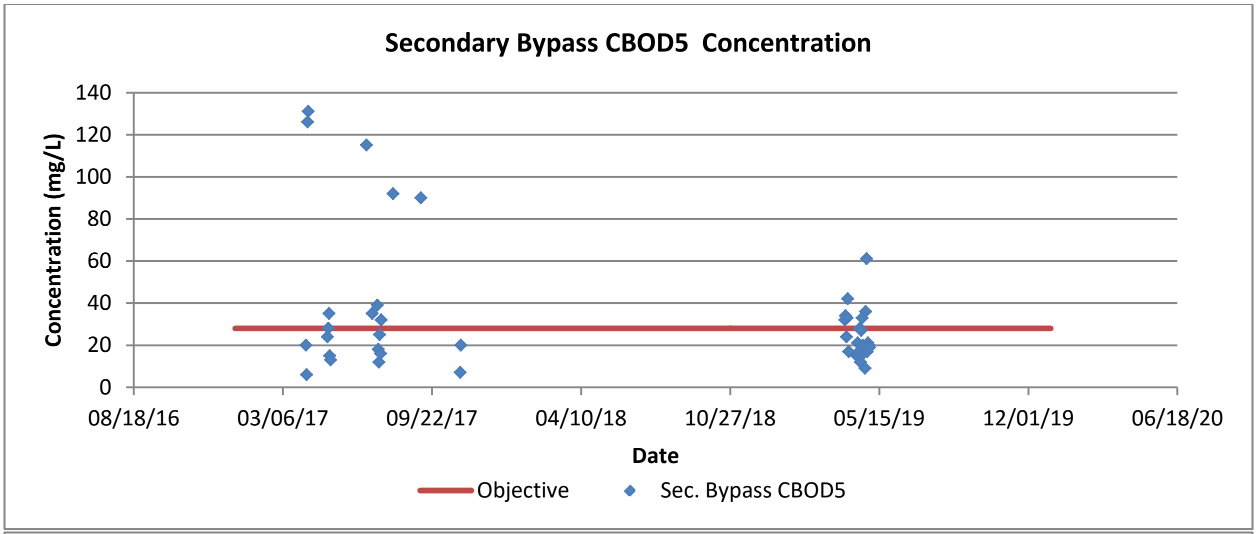

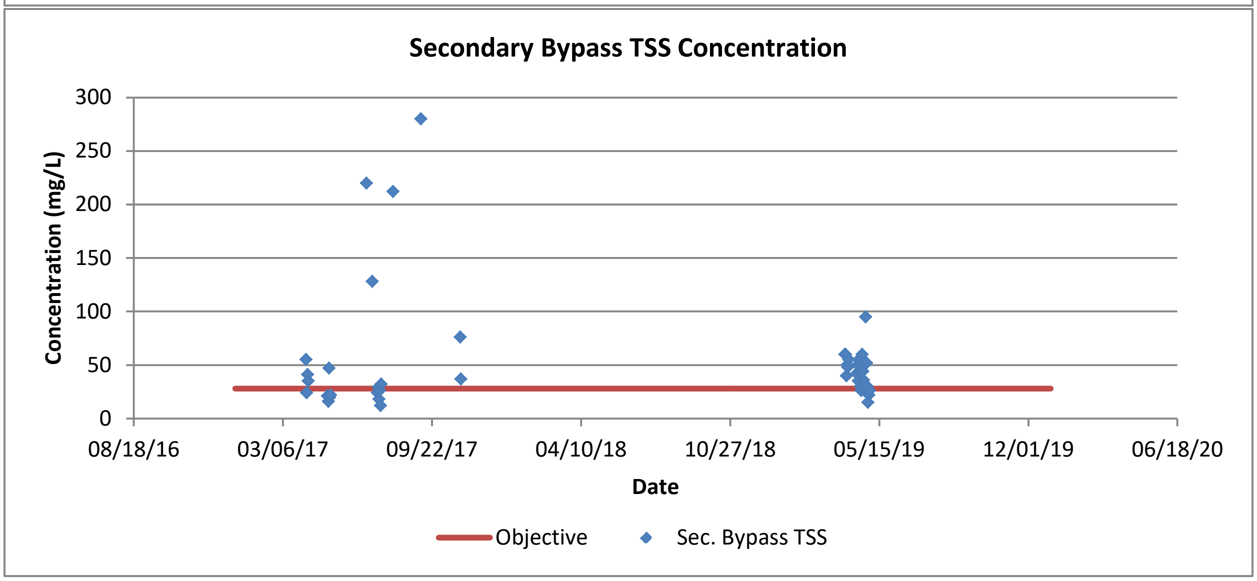

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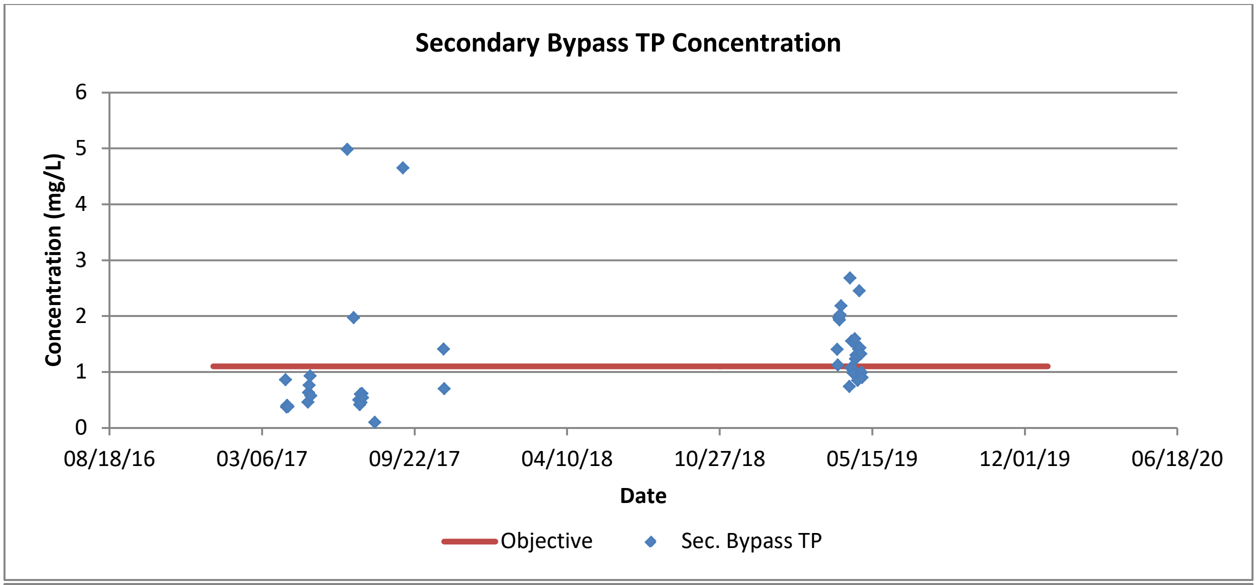

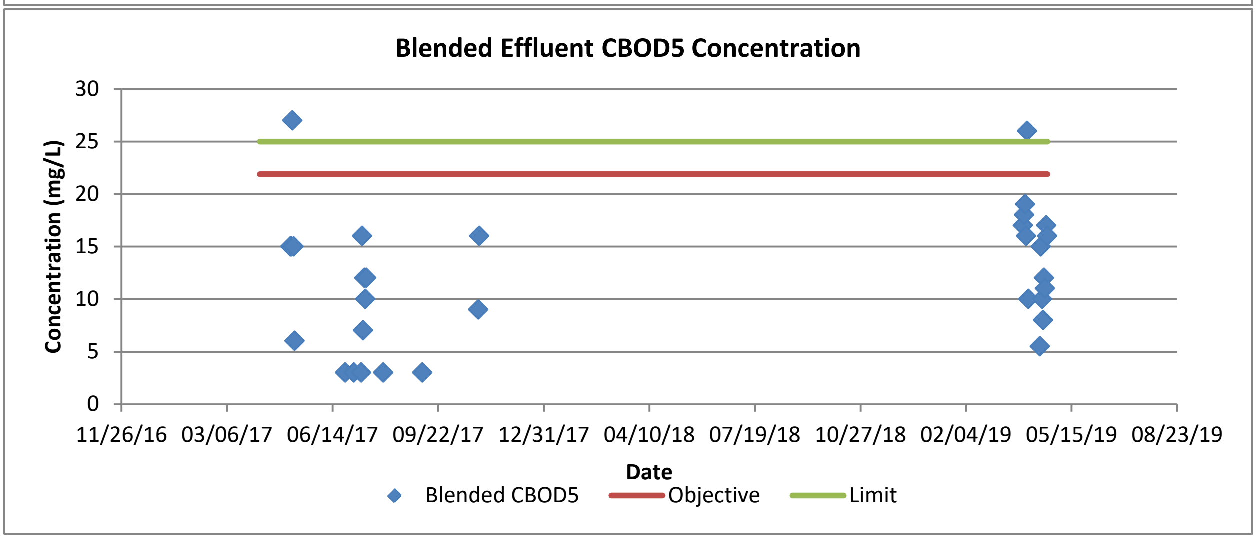

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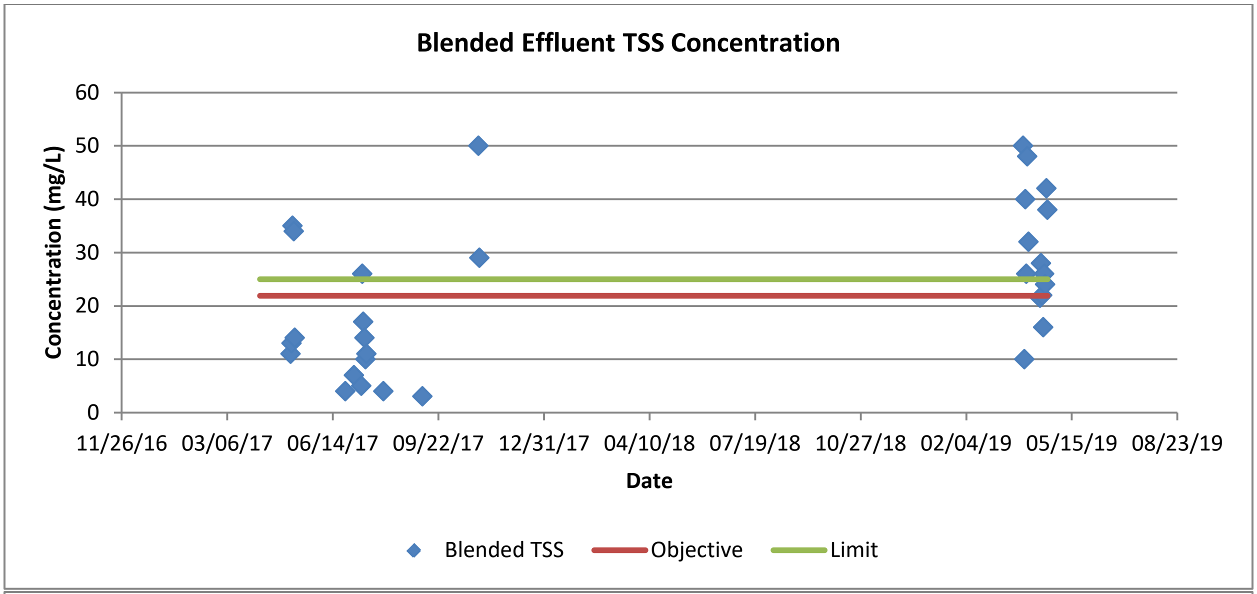

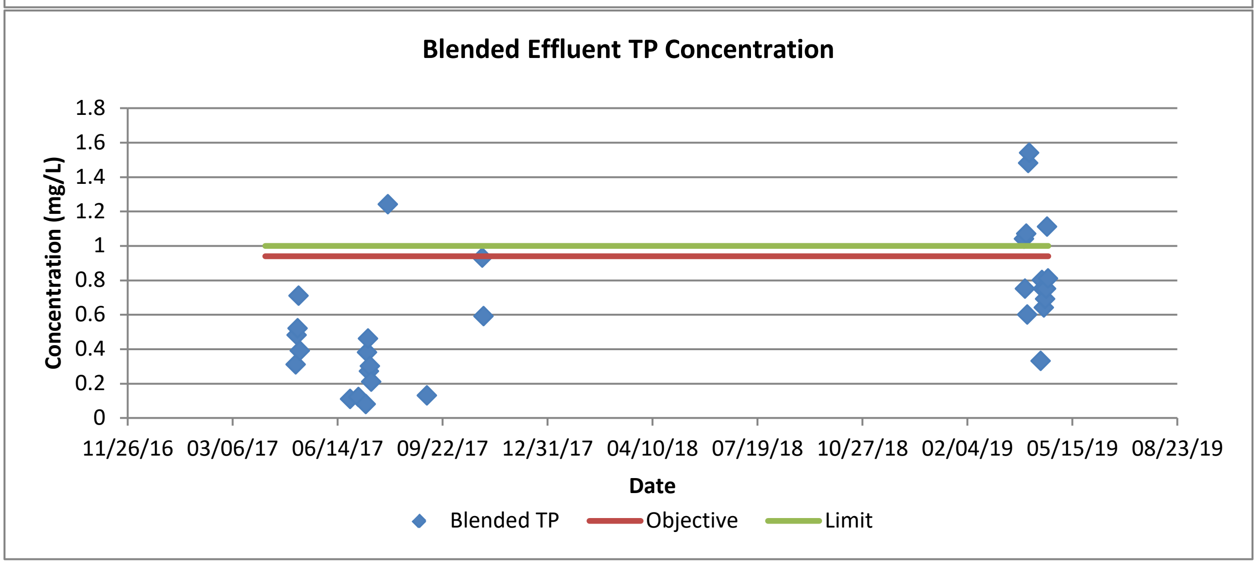

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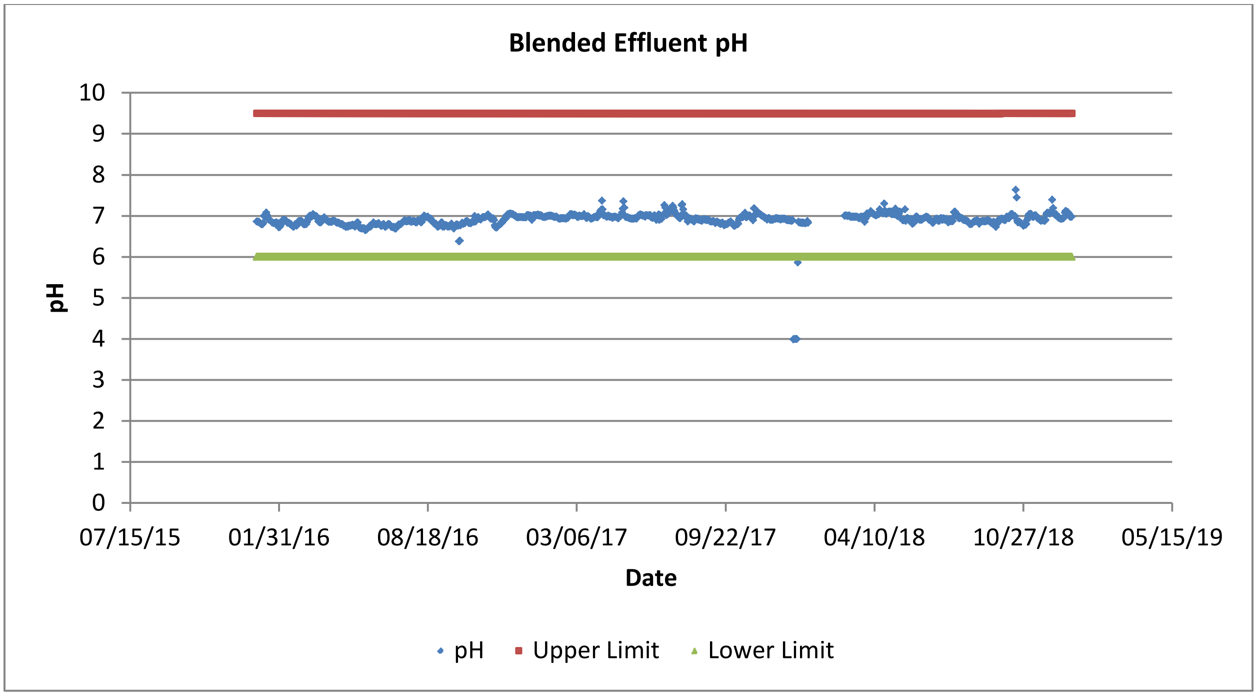

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Appendix C

Process Capacity Evaluation Calculations

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1. Loading Evaluation Calculations

All of the calculations related to process loading, process evaluation and the PPG formulation are presented in the following section.

The facility loading numbers were prepared using flows and raw sewage data for the Carleton Place WPCP for the period of January 1, 2017 to December 31, 2019. Per capita flows and loads were calculated and compared to values typical of a facility treating domestic sewage. Ratios related to influent flows and concentrations were also calculated and compared to typical values.

Summary of Key Information for Loading Evaluation Calculations (Jan. 2017 to Dec. 2019)	
Parameter (Units)	**Value**
Serviced Population	12,000
Nominal Design Flow (m^3/day)	7,900
Average Daily Flow (m^3/day)	6,541
Max Day Flow (m^3/day)	31,855
Influent BOD_5 (mg/L)	124.3
Influent TSS (mg/L)	236.3
Influent TKN (mg/L)	30.3
Influent TP (mg/L)	5.0

<u>Per Capita Flows:</u>

= (Average Daily Flow)/(Population)

= (6,541 m^3/day)(1000 L/m^3)/(12,000 Persons)

= **545 L/capita/day** *(typical 350 to 500 L/capita/day)*

<u>Max Day Flow: Annual Average Flow:</u>

= (Max Day Flow)/(Average Daily Flow)

= (31,855 m^3/day)/(6,541 m^3/day)

= **4.87** *(typical 2.5 to 3.5)*

<u>Per Capita BOD_5 Load:</u>

= (Raw BOD_5)(Average Daily Flow)/(Population)

= (124.3 mg/L)(6,541 m^3/day)/(12,000 Persons)

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= **67.8 g/capita/day** *(typical 35 to 65 g/capita/day)*

Per Capita TSS Load:

= (Raw TSS)(Average Daily Flow)/(Population)

= (236.3 mg/L)(6,541 m^3/day)/(12,000 Persons)

= **128.8 g/capita/day** *(typical 35 to 75 g/capita/day)*

Per Capita TKN Load:

= (Raw TKN)(Average Daily Flow)/(Population)

= (30.3 mg/L)(6,541 m^3/day)/(12,000 Persons)

= **16.5 g/capita/day** *(typical 13 g/capita/day)*

Per Capita TP Load:

= (Raw TP)(Average Daily Flow)/(Population)

= (5.0 mg/L)(6,541 m^3/day)/(12,000 Persons)

= **2.73 g/capita/day** *(typical 1 to 2 g/capita/day)*

TSS:BOD_5 Ratio:

= (Raw TSS)/(Raw BOD_5)

= (236.3 mg/L)/(124.3 mg/L)

= **1.9** *(typical 0.8 to 1.2)*

TKN:BOD_5 Ratio:

= (Raw TKN)/(Raw BOD_5)

= (30.3 mg/L)/(124.3 mg/L)

= **0.24** *(typical 0.1 to 0.2)*

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2. Process Evaluation Calculations

Summary of Key Information for Process Evaluation Calculations	
Parameter (Units)	**Value**
Flow (m^3/day)	6,541
WAS Flow (m^3/day)	34.0
Influent BOD_5 (mg/L)	124.3
Influent TSS (mg/L) Effluent TSS (mg/L)	236.3 11.9
Aeration Volume (m^3)	585 + 585 + 630 = 1,800
Aeration Train #1 MLSS (mg/L) Aeration Train #2 MLSS (mg/L) Aeration Train #3 MLSS (mg/L) **Average**	5,850 5,378 4,551 **5,260**
WAS TSS (mg/L)	24,596

Assumptions:

- 30% BOD_5 reduction in the primary clarifiers (i.e. primary effluent BOD_5 ~ 90 mg/L)
- 0.72 MLVSS/MLSS ratio

<u>**MLSS Concentration**</u>

= **5,260 mg/L** *(typical value for a conventional activated sludge plant: 3,000 – 5,000 mg/L)*

<u>**Average Aeration Tank Solids Retention Time (SRT)**</u>

= (Avg. Annual MLSS Conc. x Aeration Vol.) / [(Avg. WAS Flow x Avg. WAS TSS Conc.) + (Influent Flow x Effluent TSS)]

= (5,260 mg/L x 1,800 m^3) / [(34.0 m^3/day x 24,596 mg/L) + (6,541 m^3/day x 11.9 mg/L)]

= **10.4 Days** *(typical value for a conventional activated sludge plant: 4 – 12 days)*

<u>**Average Aeration Tank F/M Ratio**</u>

= (mass of BOD_5 applied to aeration tanks) / (mass of MLVSS in Aerobic Zone)

= (90 mg/L x 6,541 m^3/day) / (5,260 mg/L x 0.72 $\text{Ratio}_{MLVSS:MLSS}$ x 1,800 m^3)

= **0.086** *(typical value for a conventional activated sludge plant: 0.05 – 0.25)*

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Average Aeration Tank Organic Loading Rate

= (Influent Flow x Influent BOD_5 x 70%) / (Aeration Tank Volume)

= [(6,541 m^3/day x 90 mg/L / 1,800 m^3] / 1000

= **0.33 kg/m^3/day** *(typical value for a conventional activated sludge plant: 0.31 – 0.72)*

Aeration Hydraulic Retention Time (HRT)

= (Aeration Zone Vol.)/(Annual Avg. Flow)

= [(1,800 m^3)/(6,541 m^3/day)] x (24 hrs./day)

= **6.6 hours** *(typical value for a conventional activated sludge plant: >6 hrs.)*

Primary Anaerobic Digester Hydraulic Retention Time (HRT)

= (Primary Digester Vol.) / (Co-thickened Primary Sludge/WAS Flow)

= 880 m^3 / (37.8 m^3/d)

= **23.3 days**

3. Sludge Accountability Calculations

Sludge Accountability Analysis for the Carleton Place WPCP (2017 to 2019)	
Component	**Sludge Production (kg/d)**
Reported:	
Co-settled Primary sludge + WAS sludge	1,247
Unintentional wastage (final effluent TSS)	77.8
Total Reported	**1,325**
Projected:	
TSS removed across primaries	616
Biological sludge production (BOD_5 removal)	389
Chemical sludge production (coagulant addition)	227
Total Reported	**1,232**
Sludge Accountability (Reported – Projected) / Reported X 100% Criterion	**+ 7.0 %** ± 15 %

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Around Primary Settler

Reported primary sludge production = PS Flow X PS Concentration

= 37.8 m^3/d X 33 kg/m^3

= 1,247 kg/d

Projected primary sludge production = TSS removed X Flow + WAS to Primaries

= (0.236 – 0.142) kg TSS/m^3 X 6,541 m^3/d + (24.6 kg TSS/m3 X 34.0 m3/d)

= **1,451 kg/d**

<u>Sludge accountability (1)</u>

= (Projected – Reported) / Projected X 100%

= (1,451 – 1,247) / 1,451 X 100%

= 14.1 % *(Range for Closing $\pm$ 15%)*

Therefore, the sludge accountability around primary clarifiers closes.

Around Bioreactor

Reported Sludge Production

<u>Unintentional wastage</u>

= Effluent TSS X Flow

= 0.0119 kg/m^3 X 6,541 m^3/d

= **77.8 kg/d** discharged in the final effluent

<u>Intentional wastage</u>

WAS to Primaries

= WAS Concentration X WAS Flow

= 24.6 kg TSS/m3 X 34.0 m3/d

= **836 kg/d**

Total Reported sludge – unintentional wastage + intentional wastage = (77.8 + 836) kg/d = **913.8 kg/d**

<u>Projected Sludge Production</u>

Biological sludge production = Sludge production ratio X kg BOD removed

Note: SPR_{bio} for CAS w/ primary settler = 0.70

= 0.70 X (0.090 kg BOD_5/m^3 – 0.0051 kg BOD_5/m^3) X 6,550 m^3/d

= **389.3 kg/d**

<u>Chemical Sludge Production</u>

Carleton Place WWTP uses Pre-hydroxylated Aluminum sulphate (PAS-8) for phosphorus removal.

Chemical sludge production ratio for Al = 4.79 kg TSS/kg Al

Chemical addition rate (PAS-8)

= 835.6 L PAS-8/d X 1.29 kg PAS-8 /L

= 1,078 kg/d PAS-8

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Chemical addition rate (Al)
= 1,078 kg PAS-8 kg/d X (0.044 kg Al/kg PAS-8)
= **47.4 kg Al/d**

Chemical sludge production = (47.4 kg Al/d) X (4.79 kg TSS/kg Al)

= 227.1 kg/d

PAS-8 Dosage

= (1,078 kg/d PAS-8) / (6,550 m^3/d)

= 0.1646 kg/m^3

= 164.6 mg/L

Total projected sludge production = biological sludge + chemical sludge

= 389.3 kg/d + 227.1 kg/d
= 616.4 kg/d

<u>Sludge Accountability (2)</u>
= (Reported – Projected) / Reported X 100%
= (913.8 – 616.4) / 913.8 X 100%
= 32.5 % *(Range for Closing + 15%)*

Therefore, sludge accountability (around biological treatment system) does not close.

Around Primary Settler and Bioreactor

Reported Sludge Production (Co-settled Primary sludge + WAS sludge) + (Effluent TSS X Flow)
= (37.8 m^3/d X 33 kg/m^3) + (0.0119 kg/m^3 X 6,541 m^3/d)
= 1,325 kg/d

<u>Projected Sludge Production</u>
= Primary sludge + Biological sludge + Chemical sludge
= ((0.236 – 0.142) kg TSS/m^3 X 6,550 m^3/d + 389.3 kg/d + 227.1 kg/d
= 1,232 kg/d

<u>Sludge Accountability (3)</u>
= (Reported – Projected) / Reported X 100%
= (1,325 – 1,232) / 1,325 X 100%
= 7.0 % *(Range for Closing $\pm$ 15%)*

Therefore, sludge accountability for the Carleton Place wastewater treatment facility (primary + bioreactor) closes.

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4. Performance Potential Graph Calculations

Mechanical Bar Screen:

Rated Capacity = **26,000 m^3/day**

(Based on peak flow from C of A)

Vortex Degritters:

Rated Capacity = (10,000 m^3/day) x 2 = **20,000 m^3/day**

(Based on peak flow from C of A)

Wastewater Lift Pumps:

Rated Capacity = (13,000 m^3/day) x 3 = **39,000 m^3/day**

(Based on peak flow from C of A)

Main Primary Clarifiers SOR:

Rated Capacity = (5,200 m^3/day) x 2 = **10,400 m^3/day**

(Based on peak flow from C of A)

Surface Area = 20.2 m * 4.29 m = 86.66 m^2

Associated Design SOR = (5,200 m^3/day) / 86.66 m^2) = 60 $m^3/m^2/d$

Note that the MECP recommended SOR for primary clarifiers is 50-60 at design peak flow

Physical/Chemical Clarifiers SOR:

Rated Capacity = (3,867 m^3/day) x 3 = **11,600 m^3/day**

(Based on peak flow from C of A)

Surface Area = 17.7 m * 4.35 m = 77 m^2

Associated Design SOR = (3,867 m^3/day) / 77 m^2) = 50.2 $m^3/m^2/d$

Note that the MECP recommended SOR for primary clarifiers is 50-60 at design peak flow

Aeration Tank HRT:

Rate Capacity = 2765 + 2567 + 2567 = **7,900 m^3/d**

(Based on peak flow from C of A and O&M Manual)

Volume of aeration tanks = 630 + 585 + 585 = 1,800 m^3

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Associated Design HRT = 1800 / 7900 * 24 = 5.47 hr

Note that the MECP requires a minimum of 6 hrs HRT for conventional activated sludge plants

Aeration Tank BOD_5 Loading:

Recommended Loading = 0.5 kg $BOD_5/m^3/d$ (MECP)

Assuming 30% BOD removal in the primary clarifiers

BOD_5 concentration at the aeration tank = 124.3 mg/L * 70% ≈ 90 mg/L

Rated Capacity = 630 * 0.5 / (90/1000) + 585 * 0.5 / (90/1000) * 2 = 3,500 + 2 * 3,250 = **10,000 m^3/d**

Aeration Tank O_2 Availability:

1) Determining Total Oxygen Demand:

Oxygen Transfer Requirement = 1.0 kg O_2/kg BOD + 4.6 kg O_2/kg TKN

= 1 * (7900 * (90 - 5)/1000 + 4.6 *(7900 * 30)/1000 = 1765 kg O_2/d

2) Determining Standard Oxygen Transfer Rate:

Constants	Value
α	0.85
β	0.95
C_L	2.0
θ	1.024
C_S	9.17

Constants	Value
T	25˚C
Dd	2.9 m (9.5 feet)
Elev	134 m
$C_{14.7}$	8.38 mg/L
Output	**Value**
P_{atm}	99.73 kPa
C_{SW}	8.13 mg/L
SOTR	2930 kg O_2/d (270 lb O_2/hr)

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Where:

- α is the relative rate of oxygen transfer in wastewater relative to water.
- β is the relative oxygen saturation value in wastewater relative to water.
- C_L is the mixed liquor D.O. level.
- θ is the temperature correction constant.
- C_S is the oxygen saturation value of clean water at standard conditions.
- T is the temperature of the wastewater.
- D_d is the diffuser depth.
- Elev is the plant's elevation.
- $C_{14.7}$ is the oxygen saturation value of clean water at standard pressures of 14.7 psi and actual water temperature.
- P_{atm} is the atmospheric pressure at the site, at the given elevation.
- C_{SW} is the oxygen saturation value of clean water at site conditions.

3) Determining Standard Cubic Feet Minute Requirement (SCFM)
Standard Oxygen Transfer Efficiency in Clean Water = 15%

SCFM = 270 lb/hr / [0.0765 lb/ft^3 *(0.23 lb O^2/lb air) * (60 min/hr) * 0.15) = 1695

4) Determining Capacity
Current air flow at plant = 1340 SCFM (one 50 hp blower)

Standby air flow at plant = 400 SCFM * 3 blowers = 1200 SCFM (three 20 hp blowers)

Note that the 400 SCFM capacity is from O&M Manual, actual operating range is 200-400 SCFM

Rated Capacity = (1340/1695) * 7900 + (400/1695) * 7900 *3 = 6277 + 1859 * 3 = **11,804 m^3/d**

Secondary Clarifiers SOR:
Rated Capacity = (3467 m^3/day) x 3 = **10,400 m^3/day**

(Based on peak flow from C of A)

Surface Area = 16 m * 16 m = 256 m^2

Associated Design SOR = (3467 m^3/day) / 256 m^2) = 13.5 m^3/m^2/d

Note that the MECP recommended SOR for final clarifiers with P-removal is 37 at design peak flow.

UV Disinfection System:
Rated Capacity = (5500 m^3/day) x 2 banks = **11,000 m^3/day**

(Based on peak flow from C of A)

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Primary Anaerobic Digester HRT:

Volume of primary digester = 880 m^3

WAS flow = 37.8 m^3/d

Recommended HRT for anaerobic digester = 15 days (MECP)

Rated Capacity = 880 m^3/ (37.8 m^3/d) / 15 days * 6550 m^3/d = **10166 m^3/d**

Sludge Storage HRT:

Volume of storage tank = 1900 m^3

Supernatant Withdrawal Flow = 18.6 m^3/d (estimated)

Storage Time = 180 days

Rated Capacity = 1900 m^3/ [(37.8 – 18.6) m^3/d] / 180 d * 6550 m^3/d = **3601 m^3/d**

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Appendix D

Biosolids Handling/Biosolids Storage Capacity Standard Operating Procedure (SOP)

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Biosolids Handling

1. BIOSOLIDS STORAGE CAPACITY

To ensure that adequate on site sludge storage, it has been a common practice to decant the biosolids storage tank to make more volume available for sludge storage. The decant volumes are typically small and could be the equivalent of two or three truckloads of sludge. However, when the supernatant is returned to the facility it can often have very high ammonia, TKN, TSS and BOD concentrations, and the plant may not have adequate capacity for nitrification. In the past this has led to exceedances in the final effluent ammonia in the winter and spring seasons.

In the winter/spring season (i.e. Oct 1 to May 14) when there is not a C of A final effluent ammonia objective/limit, the WSER acute lethality un-ionized ammonia limits must still be met. It is recommended that if supernatant is being returned to the main plant process during this period, the final effluent ammonia should be monitored using in-house labs on a daily basis. Where ammonia levels exceed 10 mg/L ALL SUPERNATANT needs to STOP and not returned to the plant. Biosolids will then need to be HAULED OFF-SITE in order to make more room for incoming solids. This will help minimize possible final effluent ammonia exceedances, and should minimize effluent non-compliances.

During the summer/fall season (i.e. May 15 to Sept 30) when there is a C of A final effluent ammonia objective/limit the final effluent ammonia should be reviewed on a semi-regular basis with in-house labs and if ammonia levels exceed the C of A final effluent ammonia objective, ALL SUPERNATANT needs to STOP and not returned to the plant. Biosolids will then need to be HAULED OFF-SITE in order to make more room for incoming solids. This will help minimize possible final effluent ammonia exceedances, and should minimize effluent non-compliances.

In order to determine if hauling needs to occur, effective monitoring of the biosolids storage capacity is required. There is a calculator located in the Excel file **Carleton Place WWT – In-House Sheets** under **Biosolids Volume** tab, which completes the calculations and only requires two values “Actual Tank Level” and “Average Daily Transfer”.

Calculate total estimated days of storage remaining.

Holding tank volume = 1900 m^3
Approximate volume per meter of level = 200 m^3
Top of Tank Level (TTL) = 9.7 m
Average Daily Transfer (ADT)

Remaining Volume Available (RVA) m^3 = (TTL – Actual Level) x 200
Days of Capacity Remaining (DCR) days = RAV / ADT

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Adjustment for Supernatant (AFS) = DCR x 0.2
Total Estimated Capacity Remaining (TCR) days = DRC + AFS

Note: If decanting has been stopped, DCR is equal to TCR and AFS is equal to zero.

Record TCR on weekly operation summary and communicate results at weekly meeting.

2. REMOVAL OF BIOSOLIDS

Wastewater treatment facilities generate sewage sludge which must be removed from the treatment plant. Where sewage biosolids are going to be beneficially used in agriculture, the quality of the biosolids must be verified prior hauling to farmland. The disposal of sewage sludge and the agricultural utilization of sewage biosolids are regulated provincially. It is the responsibility of the facility owner and operating authority to make certain that regardless of the option chosen, final disposal or agricultural utilization is done safely and effectively.

2.1 Agricultural Land Application

The Nutrient Management Act regulates the application of biosolids to agricultural land. Where the biosolids are used in agriculture, the site must have a NASM Plan approved by the Ontario Ministry Agriculture, Food and Rural Affairs. Where biosolids are sent to landfill for disposal, are land applied for beneficial use or disposal at a non-agricultural site the receiving site must have an Environmental Compliance Approval (ECA) that allows receipt or land application of this material. The hauler must have an Environmental Activity and Sector Registry (EASR) or ECA for the specific waste materials before they can be moved to the land application or disposal site.

OCWA has entered into an agreement with Terrapure (the hauler) to manage the biosolids land application duties for the Carleton Place WPCP.

Based on the contract with Terrapure they are responsible for the following:

- Ensuring enough sites are available
- Provide Monthly Biosolids Haulage Records
- Spill Reporting and clean-up while biosolids are in their care including roads, ditches and at the spreading site.
- To be available within 24 hours' notice to remove biosolids from the site.
    - There are clauses within the contract in the event Terrapure can't haul.
- Provide contingency plans for biosolids within their care.

Commence in three stages: Planning and Preparation, Application and Follow-up

2.2 Planning and Preparation:

1. Review the biosolids sampling to ensure that at least two (2) samples were collected and tested during the two (2) month period prior to the transfer date. At least one of the samples must be taken during the one-month period before the transfer date

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2. Contact the hauler at least two (2) weeks in advance of the desired transfer date.
3. Contact PCT to submit results to hauler for application loading calculations.

2.3 Application

1. Co-ordinate sewage biosolids loading with the hauler.
2. Haulers are to complete the Biosolids Hauling Tracking Sheet. One sheet per day. Scan copies to the PCT at the end of the day.
3. Enter day totals into PDM.

2.4 Follow-up

1. Contact the hauler and request a copy of the “Post Application Report”.
2. Provide the report to the PCT.
3. File a copy of the Post Application Report in the corresponding sludge hauling file.

3. SLUDGE HAULING: MORNING AND EVENING PROCEDURES

3.1 Morning

1. Open both gates to town yard
2. SCADA:
    a) ENABLE the Outdoor Sludge Transfer Panel Permission. This permission is found on the SCADA screen entitled: Digester Sludge Transfer.
    b) Record current sludge transfer cycle rates then change the sludge transfer cycle to: 1 cycle/day at 1 sec cycles.
    c) Verify the Auto Stop volume. This volume should be set to correspond to the volume of the smallest capacity truck in use for the day.
3. Turn all five (5) Primary Tank Sludge Transfer pumps to “Off” position. This is done at the SPCP panel located in the basement of the chemical building.
4. Open disconnects for the sludge transfer pumps (two locations). Opening these disconnects will ensure there is no electrical power to the pumps. These disconnects are located in the basement level of the digester building.
5. Set Valves IN ORDER:
    a) Close all Secondary Digester Valve (Bottom of sec. digester) – all five (5) valves

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b) Open one Holding Tank valve (Bottom of Sludge Storage Tank) – there are two valves at this location (identified on brass tag as #131 and #132). Switch the valves back and forth approximately every hour throughout the day.

c) Close transfer valve to Holding Tank (Top)

d) Open Transfer valve to head-works loading area. (Top – identified by new stainless steel piping)

6. Close disconnects for the sludge transfer pumps (Two Locations)
7. Record the sludge transfer meter flow volume reading
8. Verify both Transfer Pumps are in Auto. (panel located on ground floor digester building)
9. Holding Tank Mixer

a) **Ensure power cable is always tight**. Any loose cable may tangle in the mixer impeller.

b) Ensure mixer is running and is submersed in sludge.

c) Monitor the sludge levels throughout the day to ensure the mixer remains submersed.

d) Adjust mixer height as necessary to ensure mixer remains submersed.

10. Note the sludge storage tank sludge levels.
11. In head-works, assemble the sludge delivery hoses and valves.

Head-works ¼ turn valve	Piping	Knife-edge Valve	Piping	Connection to truck made by driver.	Truck valve	Tank

12. Open truck loading Panel (locate by truck bay door). This panel has the sludge transfer pump control and a counter.

a) Start one pump then verify counter movement.

b) If two pumps are to be used, delay starting the second pump by at least 10 sec.

c) When the pumps are stopped, reset the counter. Otherwise the volume pumped will be limited to volume that was entered into SCADA Auto Stop.

13. Setup Load sheet, record date, field and COA info. ONE sheet PER FIELD please.
14. Visit field and observe transfer location and procedure.

3.2 Days' End

1. Turn off Transfer pumps at Sludge Haul Panel
2. Review the load sheet and ensure the record is complete and accurate. Drivers may ask for a copy of the Sludge sheets – copy and file sheet appropriately.
3. Close ¼ turn head-works valve. If hauling is complete then clean and store all apparatus.

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4. Hose-down loading area if necessary.
5. Record Transfer meter reading
6. Set Valves **IN ORDER**:
    a) Close Transfer valve to head-works loading area. (Top – identified by new stainless steel piping)
    b) Open transfer valve to Holding Tank (Top)
    c) Close both Holding Tank valves (Bottom of Sludge Storage Tank) – there are two valves at this location (identified on brass tag as #131 and #132).
    d) Open one Secondary Digester Valve (Bottom of sec. digester)

7. Re-enable Primary Sludge cycles at the SPCP for tanks 4 and 5
8. DISSABLE the Outdoor Sludge Transfer Panel Permission. This permission is found on the SCADA screen entitled: Digester Sludge Transfer.
9. Restore Sludge Transfer cycles to pervious settings.
10. Log volumes and field info in facility log book
11. Close town yard gates when leaving

    NOTE: No composite sample required.

4. ALTERNATE DISPOSAL METHOD

ROPEC (Robert O. Pickard Environmental Centre) commonly known as the Green's Creek WWTF serves as a backup liquid sludge/biosolids disposal site for Carleton Place, Waste Management, and Renfrew WPCP's.

Alternatively sewage biosolids can be dewatered at the Carleton Place WPCP and brought to landfill.

Note: Since centrate will be generated from dewatering process; there is a high probability that this will reintroduce high levels of ammonia back into the process and may lead to exceedances at the plant effluent.

Contracts have been established with the City for each of the facilities listed above. Sample results and the City of Ottawa ratios spreadsheet is submitted monthly.
The City of Ottawa has its own procedure for accepting sludge discharges – see the following SOP.

4.1 City of Ottawa: Sludge Discharge

1) The Hauling Company must have specific approval to discharge sludge at The Pickard Centre.
2) The sludge must have been scheduled in advance with Sewer Use Program staff, with at least seven (7) days' notice. Unscheduled loads will be turned away.

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3) Sludge will only be accepted from Monday to Friday, excluding statutory holidays, between the hours of 8:00 a.m. and 3:00 p.m.

4) A City of Ottawa designate must be notified 2 hours in advance of the arrival of the load of sludge as The Pickard Centre.

5) The Hauling Company must sign in at the Guard Hut upon arrival and follow all on site procedures as stipulated by Sewer Use Program staff. Please note that the Northeast Discharge location and Septage Receiving Facility are not to be used for the discharge of any sludge.

6) An accurately completed City of Ottawa waste manifest must be submitted by the Hauling Company for each load of sludge, prior to discharge. The manifest shall identify the source and the volume of waste. The waste is to be listed as “Approved Waste Sludge”.

7) Sludge may only be discharged with the accompaniment of City of Ottawa staff at the discharge location they indicate is appropriate.

Failure to follow any of these procedures will result in enforcement action.

Sewer Use Program Contact Number: 613-580-2424

5. REVISION HISTORY

Date	Revision #	Reason for Revision	Revision By
2019-Feb-05	0	SOP Manual re-format	Alison O’Connor, PCT
2020-Mar-06	1	FOP Recommendations	Brad Hoover, Hank Andres, Process Specialists

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Example of a Calculation for Biosolids Storage Volume Remaining

Calculate total estimated days of storage remaining

	Holding Tank Volume	1900 m^3	
	Approximate volume per meter of level	200 m^3	
TTL	Top of Tank Level	9.7 m	
	Actual Tank Level	8.0 m	Input readings
ADT	Average Daily Transfer	15 m^3	Input readings
RVA	Remaining Voulme Available	333 m^3	
DCR	Days of Capacity Remaining	22 d	

Note: If supernatant is being sent back, enter **1**, if not enter **0**

	Supernatant being returned to process	1	Input value 1 or 0
AFS	Adjustment for Supernatant	4.4 m^3	
TCR	Total Estimated Capacity Remaining	26.6 d	

Note: Record TCR on weekly operation summary and communicate results at weekly meeting.

Note: Refer to **Biosolids Handing SOP** if there are concerns about the TCR.

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Appendix E

Nitrification and Denitrification in Wastewater Treatment Plants

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Nitrification and Denitrification in Wastewater Treatment Plants

What are Nitrification and Denitrification?

Nitrification is an aerobic process that transforms ammonia/ ammonium nitrogen (NH_3/NH_4^+) to its oxidized form (NO_2/ NO_3).

Reaction No.1: Nitrosomonas
$2\ NH_4^+ + 3O_2 \rightarrow 2NO_2^- + 2H_2O + 4H^+$ + New Cells

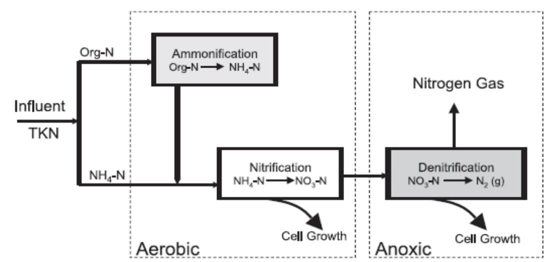
Reaction No.2: Nitrobacter
$2NO_2^- + O_2 \rightarrow 2NO_3^-$ + New Cells

De-nitrification is the biological process that occurs in an anoxic environment (void of oxygen) following nitrification. During denitrification, heterotrophic microorganisms reduce nitrates to nitrogen gas for release to the atmosphere.

Reaction No.1:
NO_3^- + Rapidly Biodegradable Organic Matter -> N_2 (gas) + CO_2 + H_2O + OH^- + New Cells

All plants in Ontario are required to nitrify under the Wastewater Systems Effluent Regulations, subsection (34)([1]) - (SOR\2012-139 – Fisheries Act).

Figure 1: Biological Nitrogen Removal



Monitoring Nitrification and Denitrification in a Wastewater Treatment Plant

Recommended Sampling	Performance Rules of Thumb
Raw Sewage: TKN/NH_3 – Once per week pH, Alkalinity – 2 to 3 times per week	Solids Retention Time (SRT): Conventional Activated Sludge: > 4 days > 15 °C > 10 days < 15 °C Extended Aeration: > 15 days
Secondary Effluent: NO_2, NO_3, NH_3, TKN - 2 to 3 times per week	F/M Ratio: Conventional Activated Sludge: 0.05 – 0.25 Extended Aeration: 0.05 – 0.15
	Return Rates: Conventional Activated Sludge: 25 – 100% of influent flow Extended Aeration: 25 – 100% of influent flow Based on Surface Overflow Rate (SOR), 40 – 60% of influent flow

Nitrification Versus Denitrification Conditions

Factor	Nitrification	Denitrification
Environment	Aerobic	Anoxic
Oxygen Source (Electron acceptor)	Dissolved Oxygen (DO)	Combined Oxygen (NO_3)
Type of Organism	Autotrophs	Heterotrophs
Energy source (Electron Donor)	Ammonia – N	Organic Matter
Carbon Source	Organic Matter	Inorganics (CO_2)
Oxygen	Demand: 4.6 kg O2/kg NH4 oxidized	Credit: 2.9 kg O_2/kg NO_3 reduced
Alkalinity (as CaCO3)	Consumed: 7.2 kg/kg NH4 oxidized (plus a 50 mg buffer). Alkalinity needed in the influent to facilitate nitrification.	Produced: **3.6 kg/kg NO_3 reduced** *Denitrification recovers some alkalinity as $CaCO_3$.*
pH	Should be maintained between 7.2 – 7.8.	

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Nitrification

How to start-up nitrification in a WWTP?

1. Run plant normally under required nitrification conditions. These organisms grow slowly (several weeks) before nitrification can begin.
2. Seed Plant – Bring in a few truckloads of waste activated sludge (WAS) from a nearby Nitrifying plant to kick-start nitrification in an aeration system operating under correct conditions.

Since nitrifying bacteria are very sensitive, the time between loading and unloading should be < 2 hours.

Troubleshooting Nitrification Plant Recovery

The following conditions should be verified if nitrification is not being met:

Adequate Dissolved Oxygen (DO) – Effluent DO is between 2.0 - 3.0 mg/L.

- Inadequate DO can result in partial nitrification (i.e. the formation of Nitrites).
- Higher DO concentrations are inhibitory.

Alkalinity – in conjunction with pH, the alkalinity must be maintained to provide adequate buffering capacity for the Nitrification reaction.

- Example – Raw Sewage TKN is 43 mg/L . The minimum alkalinity required in the Raw Sewage is: 43 X 7.2 + 50 mg/L = 360 mg/L.

Temperature – Lower temperatures results in lower nitrifier growth rates and require longer solids retention time to complete the reactions. Every 10 degree drop in temperature drops the growth rate by half.

- Winter: Nitrification recovery takes much longer; ensure that the SRT is at least > 10 days (when temperature is < 15 °C).
- Summer: When temperature is >15 °C, a 5-day SRT is adequate.

Inhibitory Substances – Sulfides are the most common inhibitory substance to Nitrification recovery. Sulfides are present in septic conditions, incoming wastewater or generated in the plant from anaerobic processes. Other inhibitory substances are referenced in **Design of Municipal Wastewater Treatment Plants: WEF Manual of Practice No.8**.

To ensure timely recovery, septic conditions can be dealt with by: a) additional aeration to the plant inlet headers to avoid sludge settling in the inlet channels and becoming septic, and, b) diverting/halting return supernatant from anaerobic processes until Nitrification is recovered.

Process Limitations

Technology available	Typical effluent performance
One anoxic zone/ oxidation ditch	8 – 10 mg/L TN
Two anoxic zones/ denitrification filter	3 mg/L TN
Tertiary treatment for DON	<3.0 mg/L TN

Denitrification

How to start-up denitrfication in a WWTP?

Once the organisms are in place, the necessary conditions need to be created in order to facilitate adequate denitrification. These conditions are:

1. Deplete oxygen levels to at least < 0.5 mg/L.
2. Ensure that the organisms have a soluble carbon source of at least 5 mg/L soluble BOD for every mg of NO_3 that is to be reduced.

Troubleshooting Denitrification Plant Recovery

The following conditions should be verified if denitrification is not being met:

Influent Characteristics – Denitrification is sensitive to influent characteristics. Dilute influent, excessive BOD removal in the primary clarifier, or high nitrogen loads from return side streams may cause BOD limited conditions. Ideal influent conditions are:

- BOD:TKN ratio 20:1 to 25:1
- BOD:TKN ratio 2:1 to 3:1

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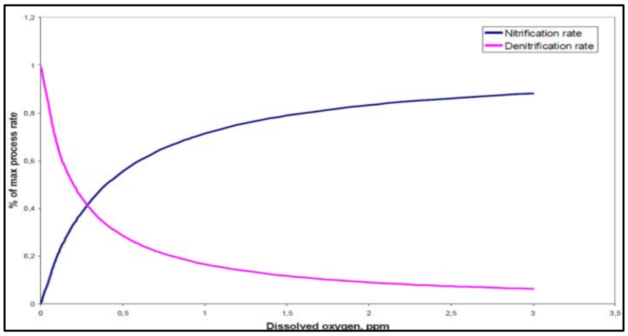
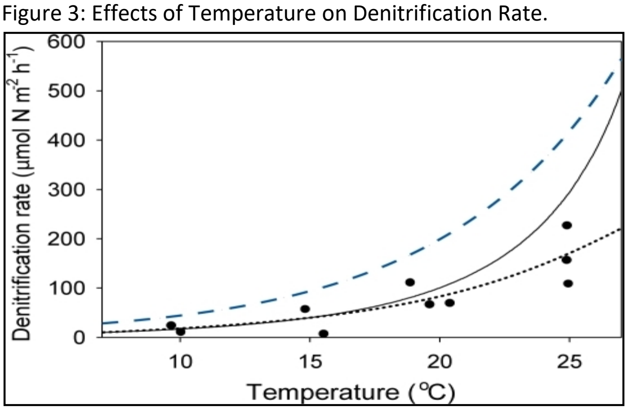
Dissolved Oxygen – Minimize dissolved oxygen so that the bacteria use nitrate as the electron acceptor. If oxygen is available at sufficient enough concentrations, the bacteria will use oxygen instead. Specific concentrations will vary depending on the kind of bacteria but literature suggests denitrification is noticeably decreased at DO concentrations of >0.2 mg/L and once the DO exceeds 0.5 mg/L the denitrification process will be significantly limited [1] (refer to figure 2).

Figure 2: D.O. Versus Nitrification and Denitrification Efficiency.



Temperature – Higher wastewater temperatures result in increased microbial activity, which lead to higher denitrification rates. For a given substrate concentration, a temperature change from 20 °C to 10 °C decreases the denitrification rate by approximately 75% (refer to figure 3).

Figure 3: Effects of Temperature on Denitrification Rate.



Contact Time & Mixing – A minimum of 20 minutes contact time (DO at least <0.5 mg/L) is required with suitable ***mechanical*** mixing to ensure adequate denitrification. The mixing should not be facilitated by air or via the introduction of oxygen into the system.

Readily Biodegradable Organic Matter (RBOM) (Carbon Source) Availability – Denitrifying bacteria use organic matter for energy. A minimum 3:1 ratio of BOD:TKN is needed in the bioreactor influent for reliable denitrification. The actual ratio will depend on the operating conditions and substrate biodegradability. The type of substrate also affects the denitrification rate – higher denitrification rates are possible with methanol and fermentation end-products like volatile fatty acids (VFAs).

[1] Metcalf & Eddy (2003). Wastewater Treatment and Reuse 4th Ed. *Chapter 7-10: Biological Denitrification*. pp 622-623

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Appendix F

Health and Safety Inspection Checklist

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Carleton Place WPCP Health and Safety Inspection Checklist

Health and Safety Checklist of the Carleton Place WPCP				
Documentation	Yes	No	N/A	Comment
Facility Emergency/Contingency Plan	X			
INSPECTION REPORTS				
MOL Inspections				
• Inspection Reports			X	
• Ordered Items			X	
• Are there any outstanding items to be addressed?			X	
LABORATORY				
• Are MSDS's available and accessible at specified locations	X			
• Are doors labelled? Pipes labelled?		X		Fridge & microwave should be labeled "No Food" "Samples Only"
• Containers marked with proper identification and labelled?	X			
WORKPLACE SAFETY				
• Signage (e.g. chlorine, diesel, PPE, hearing protection, "No Trespassing", etc.)	X			Some chemical lines could be labeled better.
• Designated Substances (i.e. asbestos, silica, etc.)		X		Not to anyone's knowledge
• Fire Protection (exits, extinguishers, signage fire safety plan required?)	X			
• First Aid Stations / Kits	X			
• General Housekeeping and Physical Layout		X		There could be some better organization in garage and maintenance areas. The centrifuge room is tight and difficult to move around in. The Headworks/Truck Loading Bay is too small to load trucks in bay and therefore odours cannot be contained.
• Hazardous Materials (storage, labeling)	X			Some flammable containers should be stored in the fireproof cabinet.
• MSDS/SDS Binder available, all on site chemicals	X			

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Health and Safety Checklist of the Carleton Place WPCP				
Documentation	Yes	No	N/A	Comment
covered, and current				
• Ladders/Scaffolding/Platforms		X		Retaining walls require significant work.
• Lifting Devices / Hoists (tagged)	X			
• Machinery and Hand Tools		X		Mechanical Bar Screen is missing a panel that is considers a guarding hazard along with a come-along supporting the motor. Manual Skimmer are difficult along with access on east side.
• Electrical Concerns		X		The Centrifugal Room has many electrical panels that could be susceptible to off-gassing. Current the outdoor lights are operated off a timer.
• Slip and Trip Hazards		X		Headworks/Truck Loading Bay has a potential tripping hazard since temporary piping is now being utilized to load tanker trucks.
• Personal Protective Equipment (PPE) (mandatory, SCBA/respirators, hearing protection, etc.)		X		More Safety Rings (floating) located at the final clarifiers and possible the aeration tanks
• Safety Equipment (Emergency Eyewash Stations/deluge showers)		X		Some of the Shower/eye wash have been upgrades but the hot water tank would not be considered large enough for showers. The portable handheld units located in the digester complex but they don’t have an eyepiece
• Potential confined spaces?		X		All confined spaces at the facility have been identified

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