

**SANITARY CAPACITY ANALYSIS REPROT**

**RITZ-CARLTON HOTEL, SPA, & RESIDENCES  
144 JOHN STREET EAST**

**Town of Niagara-on-the-Lake  
Project: 2026-5625**

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## **1.0 INTRODUCTION**

Schaeffer and Associates Ltd. (SCE) has been retained to prepare a sanitary capacity analysis report in support of the proposed development at 144 & 176 John Street and 200 John Street & 586 Charlotte Street. The proposed development consists of 5 residence buildings, a Ritz Carlton and a spa. The subject site is located southeast of the intersection of Charlotte Street and John Street East and northwest of the intersection of John Street East and Niagara River Parkway. The location of the subject site is illustrated in **Figure 2.1**.

This report has been prepared to assess the capacity of the existing downstream network and determine if any upgrades are required to support the proposed development. The analysis was completed using Infoworks ICM for dynamic modelling of the sewer network. The Infoworks ICM model was developed based on the calibrated InfoSWMM model prepared by the Niagara Region. The assessment considers both Dry Weather Flow (DWF) and Wet Weather Flow (WWF) conditions for the downstream sanitary system servicing the subject lands. WWF conditions are based on the 5-year return period storm event and Design Rainfall-Derived Inflow and Infiltration (Design RDII) as defined in the Niagara Regional Model.

## 2.0 SANITARY CAPACITY ANALYSIS

### 2.1 Sanitary Servicing Design Criteria

The Niagara Region and the Niagara-on-the-Lake Design Parameters have been compared and taken from the following documents:

- NOTL’s Municipal Engineering Standards (November 2020);
- Niagara Region’s Water-Wastewater Project Design Manual (July 2023);
- Niagara Region’s Development Charges Background Study (May 2022);
- Niagara Region’s Water and Wastewater Master Servicing Plan (2016);
- Niagara Region’s Water and Wastewater Master Servicing Plan (2021); and
- Ontario Ministry of the Environment, Conservation, and Parks (MOECC) Design Guidelines for Sewage Works (2008).

**Table 2-1 – Niagara Region and Niagara-on-the-Lake Design Parameters**

Parameter	Town of NOTL/ Region of Niagara standards
Population for Low Density*	2.929 person/unit
Population for Medium Density*	2.093 person/unit
Population for High Density – 1Bedroom*	1.214 person/unit
Population for High Density – 2Bedrooms+*	1.991 person/unit
Population for Commercial	1 person / 500sqft
Residential Generation Rate	255 L/c/d
Employment Generation Rate	310 L/c/d
Infiltration Allowance – New Development	0.286 L/ha/s
Peaking Factor M	Harmon Formula
Minimum Freeboard for Hydraulic Grade Line in Wet Weather Flow conditions.	1.8m

\*Population density as per Niagara Reion’s 2022 Development Charges Background Study

As per the Niagara Region’s Water-Wastewater Project Design Manual in 2023, the capacity of the gravity sewer is assumed to be overcommitted when it runs surcharged during Design Peak DWF, or when it runs surcharged during Design Peak WWF with a peak HGL less than 1.8m below ground elevation. In this assessment, the Design RDII as defined in the Region’s model and the 5-year Storms have been selected as the WWF events to assess the sewer performance. Details refer to **Section 2.5**.

## 2.2 Existing Condition

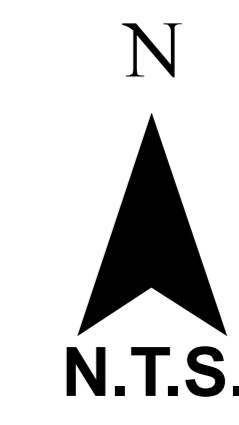
### 2.2.1 Existing Sanitary Network

The existing sanitary sewer network was characterized from the plan and profiles of the downstream network as well as the previously mentioned InfoSWMM model provided by the Region. There is an existing 250 mm diameter sanitary sewer along Charlotte Street. This sewer drains from the northeast and the southwest towards Paffard Street. The Paffard Street sewer is a 300 mm sewer that drains to the northwest. The sewer proceeds to route northeast along King Street, northwest along Gage Street, southwest along Mississauga Street, and northwest along William Street. The sanitary sewer along William Street discharges into a Sanitary Pumping Station (SPS) known as the William SPS. This sanitary Pumping station directs sanitary flows to the NOTL sanitary Sewerage Treatment Plant. The existing sanitary network including the downstream route of the sanitary sewer to the William SPS is illustrated in **Figure 2.1**. Excerpts from the Master Servicing Plan Update (MSP), provided in **Appendix A**, illustrate the forcemains and pumps that convey the sanitary sewerage from the William SPS to the Wastewater Treatment Plant (WWTP).

### 2.2.2 Existing Sanitary Demands

The Niagara Region provided an InfoSWMM model, which was considered up to date as of 2016 when it was developed for the 2016 MSP. Dry weather flows (DWF) provided in the model represent the sanitary demands of the existing buildings as of the latest monitoring data. To assess the remaining sanitary servicing capacity in the sewer network, the model was updated to account for new developments since 2016. These new developments were identified through a review of Public Notices, Official Plan Amendments, Zoning information, and aerial imagery.

The identified new developments are illustrated in **Figure 2.1** and detailed population estimates for these developments are provided in **Appendix B**.



# Existing Sewer Network

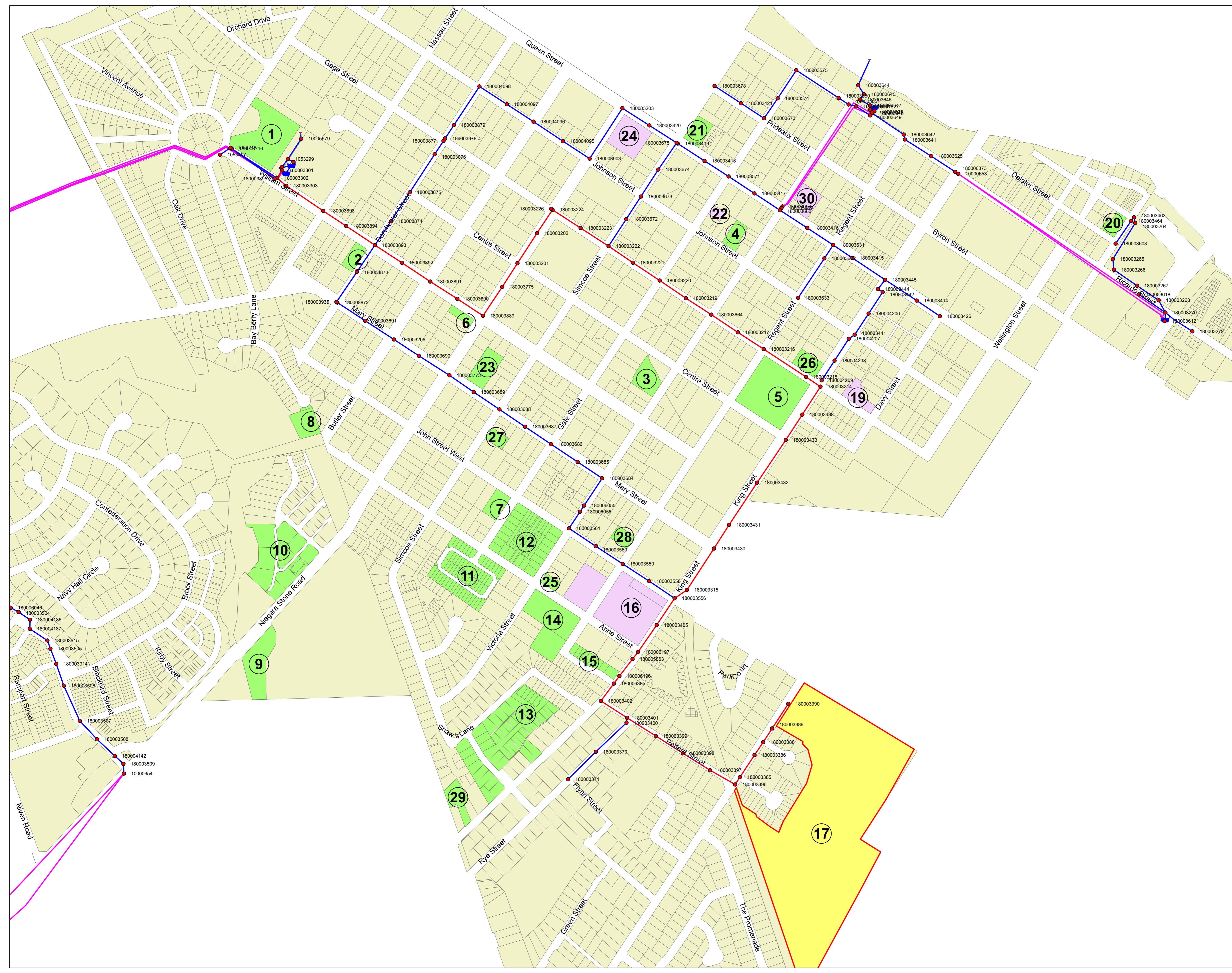
**Legend**

**Conduit TYPE**

- Sanitary Sewers (Blue line)
- Downstream Routing (Red line)

**Pump TYPE**

- Active (Pink line)
- Commercial Dev. (Purple shaded area)
- Residential Developments (Green shaded area)
- Subject\_Site (Yellow shaded area)



## 2.3 Proposed Development

The proposed development plan consists of 5 residence buildings, a Ritz Carlton hotel and a spa. Based on the architectural drawings received on 8 April 2022 from Peter J. Lesdow Architect, the total estimated population is 795. Detailed population estimate is provided in **Appendix B** and summarised in **Table 2-3**. The relevant architectural drawings are provided in **Appendix A**.

**Table 2-2 – Population Estimate**

Tenure Type	Unit / GFA (ha)	Population Rate	Population
<b>Residence Site</b>			
Residential – 1Bed+D, 2Bed	198	1.99 person/unit	395
Residential – 1Bed	36	1.21 person/unit	44
Commercial – Tennis Club & Clubhouse	0.09	1 person/500sqft	20
<b>Sub-total</b>			<b>459</b>
<b>Ritz Carlton Hotel / Spa Site</b>			
Hotel Suites – Units*	111	1.99 person/unit	221
Hotel - Commercial	0.25	1 person/500sqft	55
Spa - Commercial	0.27	1 person/500sqft	60
<b>Sub-total</b>			<b>659</b>
<b>Total</b>			<b>795</b>

\*Flow from hotel suites will be estimated as employment flow in the following.

**Table 2-3** summarises the proposed sanitary demands from the proposed development. Detailed calculations are provided in **Appendix B**. It is proposed that the sanitary flow from the subject site will be conveyed to the existing sewer at the intersection of Charlotte Street and Paffard Street through a pump system. This flow will be represented in the model as a constant discharge at peak demand under post-development conditions.

**Table 2-3 – Proposed Sanitary Demands**

Average Demand (L/s)	Total Population	Harmon Peaking Factor, M	Area (ha)	Infiltration* (L/s)	Total Peak Flow (L/s)
2.573	795	3.86	13.59	3.89	13.82

\* Based on 0.286 L/s/ha of gross area for the Subject Site

## **2.4 Proposed Servicing**

Sanitary flow from the subject site is proposed to be conveyed to a pumping station located west of the SWM pond within the site. The pumping station will discharge flows via a proposed force main to the existing manhole at the intersection of Charlotte Street and Paffard Street.

## **2.5 Method of Analysis**

The Region provided an InfoSWMM model representing the sewershed for the Niagara-on-the-Lake Wastewater Treatment Plant. This InfoSWMM model was originally developed for the Niagara Region’s 2016 Master Servicing Plan Update. The existing conditions in the InfoSWMM model have been moderately updated to describe some new developments before being released to SCE for this downstream analysis.

For the purpose of this capacity assessment, the InfoSWMM model was imported into InfoWorks ICM. The InfoSWMM model contains many scenarios for existing, and 2041 conditions. For each condition, there are DWF, Design RDII, 2-year, and 5-year scenarios.

As outlined in the Niagara Region’s 2021 MSP, the Peak WWF condition should consider two flow scenarios: 1) Design RDII and 2) 5-year storm. Accordingly, both scenarios were simulated as part of this assessment to assess the sewer performance under WWF conditions. In addition, the sewer shall maintain a minimum 1.8 m HGL freeboard to the ground surface under WWF conditions as discussed in section C.1.2.2.2 of the Niagara Regions Water Wastewater Project Design Manual.

### **2.5.1 Updates to the Region’s Model to Reflect Existing Conditions**

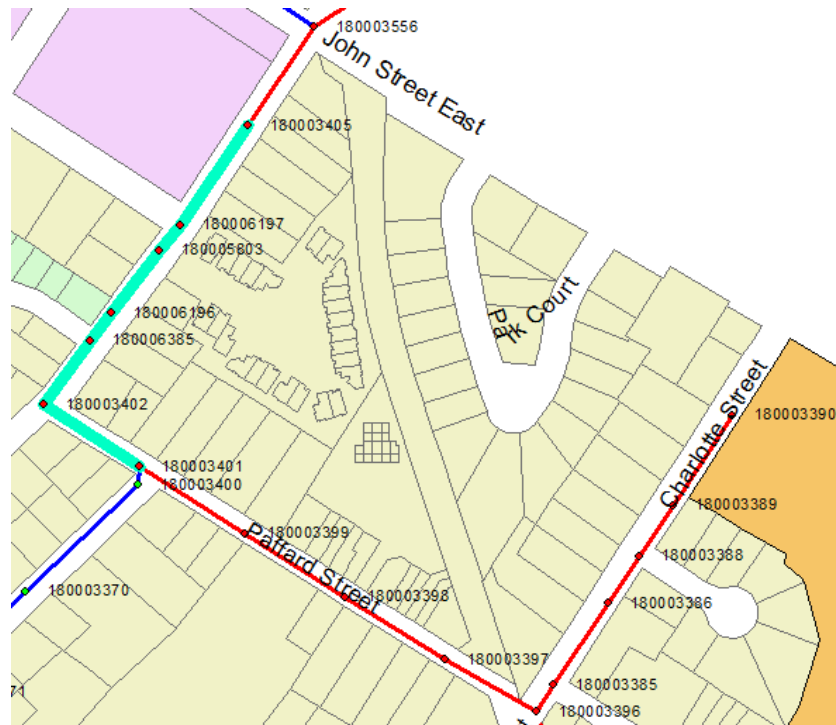
To utilize the Region’s model to analyze the conditions in the downstream sanitary sewer network, the model must be updated using the best available information for new sewers, developments, and other infrastructure changes. The known and expected changes to sewers, developments, and other infrastructure shall be discussed in the following sections.

#### **2.5.1.1 Sewers**

To analyze the sanitary sewer network, the sewers represented in the model must be verified and updated if required. No sewer upgrades were identified in the sewershed draining to the William Street Sanitary Pumping Station. However, a few pipes were identified as having incorrect information and were subsequently corrected.

These pipes were flagged since the pipes did not appear to follow standard design practices. Specifically, one pipe was identified with an unusually flat slope, followed by downstream pipes with decreasing diameters, which is not typical for sewer design. Plan and Profile drawings were obtained to review these inconsistencies and verify the accuracy of the modelled conditions.

The affected sewer segments include the last downstream leg on Paffard Street and the first two legs on King Street, as highlighted in light blue in **Figure 2.2** below.



**Figure 2.2 - Sanitary Sewers Recharacterized**

Through investigation of the available plan and profile drawings, it was determined that the three pipes which were flagged as unusual were in fact, incorrectly defined in the model. Additionally, the next three downstream sewers were identified as having incorrect invert information and were corrected. These other pipes have also been identified in light blue in **Figure 2.2**. **Table 2-4** below outlines the changes to the sewer network.

**Table 2-4 – Sanitary Sewer Characteristics Update**

Street	Manhole ID		Original			Updated		
			Invert		Dia. (mm)	Invert		Dia. (mm)
	US	DS	US	DS		US	DS	
Paffard Street	180003401	180003402	84.750	84.750	300	84.832	84.610	300
King Street	180003402	180006385	84.750	84.460	250	84.570	84.394	350
King Street	180006385	180006196	84.460	84.414	250	84.394	84.318	350

King Street	180006196	180005803	84.414	84.300	450	84.318	84.197	450
King Street	180005803	180006197	84.300	84.149	450	84.197	84.147	450
King Street	180006197	180003405	84.147	83.981	450	84.147	83.981	450

### 2.5.1.2 Developments

Since the completion of the model in 2015, and the completion of the MSP report in 2016, the Old Town of NOTL has had a few new subdivisions and Official Plan Amendments. These changes, along with some proposed minor variances, lead to an increased population in existing conditions. These changes have been incorporated into all scenarios to reflect expected existing and expected future conditions. The identified developments are illustrated in **Figure 2.1** and a detailed flow estimate of these developments is provided in **Appendix B**.

### 2.5.1.3 Generation Rates & Theoretical Trends

The sanitary model provided by the Region was developed as an unsteady model. This model included sanitary generation rates and trends based on monitoring data. The sanitary generation rates and trends identified through flow monitoring do not apply to the new developments in the system. As such, theoretical diurnal generation trends have been created to best account for the unsteady nature of the new developments in the model.

Sanitary generation rates were based on the design criteria of 255 L/c/d for residential and 310 L/c/d for employment developments. The diurnal sanitary generation trends were developed based on a typical generation trend and modified such that the peak flow during the morning peak matches with the Harmon peaking factor associated with the sewershed. A total of two sanitary generation trends were identified to account for the other developments in the sewershed. It should be noted that since the subject site is proposed to be serviced by a pumped solution, the flow into the sewer was estimated using a constant flow.

A diurnal trend with a peaking factor of 3.1 was assigned to each new population. This peaking factor accounts for the full population of the sewershed draining to the William Street Pumping Station. This peaking factor is appropriate for the new developments since the majority of the sanitary flow from these new developments is lateral to the downstream sewer at the intersection of William Street and Dorchester Street which is only a few sewer legs away from the William Street SPS. For each peaking factor, a generation trend was developed for residential as well as non-residential. It is noted that for hotel-type developments, the residential diurnal pattern was applied in conjunction with the employment-based generation rate, as the usage characteristics are

similar to residential and this approach is considered conservative. A summary of these trends has been provided in **Appendix C**.

## 2.6 Dry Weather Flow (DWF) and Design RDII WWF Analysis

The updated model, as previously described, was run in DWF and Design RDII conditions, considering 2041 growth conditions, and pre-development and post-development conditions. The scenarios that were run are outlined as follows:

- 2041 DWF – Pre-development;
- 2041 DWF – Post-development;
- 2041 Design RDII – Pre-development; and
- 2041 Design RDII – Post-development;

### 2.6.1 DWF Analysis

**Table 2-5** summarises the flow and depth results within the downstream sanitary sewers under the 2041 DWF scenario.

The results indicate that no sewers are expected to surcharge under both pre-development and post-development conditions, satisfying the Region’s criteria. Therefore, the existing downstream sewer could adequately support the proposed development during the 2041 DWF condition.

### 2.6.2 Design RDII WWF Analysis

**Table 2-6** and **Table 2-7** summarise the flow and depth and HGL results within the downstream sanitary sewers during the 2041 Design RDII scenarios. Details of the sewer profiles and model outputs are provided in **Appendix D**.

The results indicate that no sewers are expected to be surcharged and a minimum freeboard of 1.8 m is maintained at all nodes under both pre-development and post-development conditions, satisfying the Region’s criteria. Therefore, the existing downstream sewer could adequately support the proposed development during 2041 Design RDII conditions

Detailed sewer profiles and model outputs of the analysis are provided in **Appendix D**.

**Table 2-5 – 2041 DWF Flow and Depth Result (Pre-development vs Post-development)**

Location	Link ID	Manhole		Pipe				Flow (q) (L/s)		Flow Capacity (q/Q <sub>full</sub> )		Depth (d) (m)		Depth Capacity (d/D)	
		U/S	D/S	Size (m)	Length (m)	Slope (%)	Q <sub>full</sub> (L/s)	Pre dev.	Post dev.	Pre dev.	Post dev.	Pre dev.	Post dev.	Pre dev.	Post dev.
		No Highlighting Indicates No Capacity Constraints Yellow Indicates q/Q > 100%, d/D < 100% Red Indicates q/Q > 100%, d/D > 100%													
Pafford Street <sup>(1)</sup>	189001794	180003396	180003397	0.300	68.30	0.15	37.6	3.0	16.8	8%	45%	0.06	0.15	20.4%	48.7%
Pafford Street	189001793	180003397	180003398	0.300	76.20	0.29	52.0	3.0	16.9	6%	32%	0.08	0.16	26.8%	54.0%
Pafford Street	189001792	180003398	180003399	0.300	76.50	0.14	36.0	4.2	18.0	12%	50%	0.08	0.16	26.8%	54.0%
Pafford Street	189001791	180003399	180003401	0.300	80.80	0.76	84.5	4.2	18.0	5%	21%	0.05	0.09	15.2%	31.3%
Pafford Street	189001790	180003401	180003402	0.300	74.10	0.30	52.7	6.2	20.6	12%	39%	0.07	0.14	24.3%	45.3%
King Street	189004273	180003402	180006385	0.350	51.50	0.34	85.3	9.5	23.3	11%	27%	0.09	0.13	26.3%	38.5%
King Street	189004218	180006385	180006196	0.350	22.30	0.34	85.2	12.9	26.8	15%	31%	0.09	0.13	26.5%	38.5%
King Street	189004061	180006196	180005803	0.450	51.10	0.24	138.7	12.9	26.8	9%	19%	0.09	0.13	20.7%	30.0%
King Street	189004113	180005803	180006197	0.450	21.10	0.24	138.8	13.0	26.8	9%	19%	0.10	0.14	22.1%	31.6%
King Street	189004053	180006197	180003405	0.450	77.90	0.21	131.6	13.0	26.8	10%	20%	0.10	0.14	22.1%	31.6%
King Street	189001289	180003405	180003556	0.450	76.50	0.34	166.5	13.0	26.9	8%	16%	0.09	0.12	19.1%	27.3%
King Street	189002039	180003556	180003315	0.450	35.40	0.34	165.3	13.1	27.0	8%	16%	0.09	0.12	19.1%	27.3%
King Street	189001290	180003315	180003430	0.450	117.40	0.36	170.5	13.5	27.3	8%	16%	0.09	0.12	19.0%	27.1%
King Street	189002045	180003430	180003431	0.450	66.80	0.36	170.2	13.5	27.3	8%	16%	0.09	0.12	19.2%	27.2%
King Street	189001291	180003431	180003432	0.450	120.50	0.35	168.5	13.5	27.3	8%	16%	0.09	0.13	20.0%	28.3%
King Street	189001292	180003432	180003433	0.450	122.10	0.34	167.2	13.5	27.4	8%	16%	0.09	0.13	20.0%	28.3%
King Street	189001293	180003433	180003438	0.450	19.70	0.36	171.2	16.9	30.7	10%	18%	0.26	0.28	57.2%	62.5%
King Street	189001295	180003438	180003214	0.450	79.20	0.35	168.9	17.1	30.9	10%	18%	0.10	0.13	21.5%	29.0%
Gage Street	189001296	180003214	180003215	0.450	41.30	0.37	172.4	17.4	31.2	10%	18%	0.10	0.13	21.8%	29.2%
Gage Street	189001298	180003215	180003216	0.450	120.30	0.35	168.5	17.5	31.3	10%	19%	0.10	0.13	21.8%	29.2%
Gage Street	189001299	180003216	180003217	0.450	73.40	0.36	170.7	17.5	31.3	10%	18%	0.10	0.13	21.8%	29.2%
Gage Street	189002043	180003217	180003664	0.450	75.70	0.35	168.4	17.5	31.3	10%	19%	0.10	0.13	21.8%	29.2%
Gage Street	189001300	180003664	180003219	0.450	71.70	0.35	169.4	17.5	31.3	10%	19%	0.10	0.13	21.8%	29.2%
Gage Street	189001301	180003219	180003220	0.450	75.30	0.35	168.5	17.6	31.4	10%	19%	0.10	0.13	22.3%	29.7%
Gage Street	189001302	180003220	180003221	0.450	76.40	0.35	168.2	18.4	32.2	11%	19%	0.10	0.13	22.3%	29.7%
Gage Street	189001303	180003221	180003222	0.450	69.90	0.35	169.1	18.4	32.2	11%	19%	0.14	0.17	31.4%	37.2%
Gage Street	189001613	180003222	180003223	0.600	79.30	0.23	293.3	34.6	48.9	12%	17%	0.14	0.17	23.5%	27.9%
Gage Street	189001614	180003223	180003224	0.600	79.50	0.26	310.3	33.8	48.2	11%	16%	0.15	0.18	25.4%	30.2%
Mississauga Street	189001616	180003224	180003202	0.600	66.70	0.16	248.2	33.8	48.2	14%	19%	0.15	0.18	25.4%	30.2%
Mississauga Street	189002015	180003202	180003201	0.600	85.20	0.22	290.7	33.5	47.9	12%	16%	0.14	0.16	23.1%	27.5%
Mississauga Street	189001780	180003201	180003775	0.600	66.70	0.24	300.7	34.0	48.4	11%	16%	0.14	0.16	23.1%	27.5%
Mississauga Street	189001779	180003775	180003889	0.600	82.50	0.33	354.5	33.8	48.1	10%	14%	0.15	0.17	24.7%	29.1%
William Street	189001617	180003889	180003890	0.600	72.90	0.20	276.7	34.9	49.1	13%	18%	0.15	0.17	24.7%	29.1%

Location	Link ID	Manhole		Pipe				Flow (q) (L/s)		Flow Capacity (q/Q <sub>full</sub> )		Depth (d) (m)		Depth Capacity (d/D)	
		U/S	D/S	Size (m)	Length (m)	Slope (%)	Q <sub>full</sub> (L/s)	Pre dev.	Post dev.	Pre dev.	Post dev.	Pre dev.	Post dev.	Pre dev.	Post dev.
		No Highlighting Indicates No Capacity Constraints Yellow Indicates q/Q > 100%, d/D <100% Red Indicates q/Q > 100%, d/D >100%													
William Street	189001618	180003890	180003891	0.600	76.40	0.36	366.4	34.8	48.9	9%	13%	0.16	0.20	27.4%	32.6%
William Street	189001619	180003891	180003892	0.600	80.90	0.10	197.9	34.8	49.0	18%	25%	0.17	0.21	29.0%	34.2%
William Street	18901620	180003892	180003893	0.600	76.47	0.18	261.8	34.7	48.7	13%	19%	0.20	0.23	33.7%	37.5%
William Street	18901622	180003893	180003894	0.600	81.88	0.17	256.6	61.1	75.2	24%	29%	0.20	0.23	33.7%	37.5%
William Street	18901623	180003894	180003898	0.600	65.32	0.25	308.6	60.9	75.1	20%	24%	0.20	0.22	32.8%	36.4%
William Street	18901624	180003898	180003303	0.600	106.18	0.21	279.5	60.9	75.0	22%	27%	0.20	0.22	32.8%	36.4%
William Street	18901625	180003303	180003302	0.600	28.49	0.34	356.4	60.9	75.0	17%	21%	0.17	0.18	27.7%	30.8%
William Street Sanitary Pumping Station	18902049	180003302	180003301	0.600	22.00	0.64	489.8	62.9	77.0	13%	16%	0.15	0.16	24.2%	26.8%

(1) – Nodes where the site discharges

**Table 2-6 – 2041 Design RDII Flow and Depth Result (Pre-development vs Post-development)**

Location	Link ID	Manhole		Pipe				Flow (q) (L/s)		Flow Capacity (q/Q <sub>full</sub> )		Depth (d) (m)		Depth Capacity (d/D)	
		U/S	D/S	Size (m)	Length (m)	Slope (%)	Q <sub>full</sub> (L/s)	Pre dev.	Post dev.	Pre dev.	Post dev.	Pre dev.	Post dev.	Pre dev.	Post dev.
		No Highlighting Indicates No Capacity Constraints Yellow Indicates q/Q > 100%, d/D <100% Red Indicates q/Q > 100%, d/D >100%													
Pafford Street <sup>(1)</sup>	189001794	180003396	180003397	0.300	68.30	0.15	37.6	6.6	20.4	20%	61%	0.09	0.16	29.9%	54.2%
Pafford Street	189001793	180003397	180003398	0.300	76.20	0.29	52.0	6.8	20.6	13%	40%	0.11	0.18	37.3%	60.8%
Pafford Street	189001792	180003398	180003399	0.300	76.50	0.14	36.0	8.6	22.4	24%	62%	0.11	0.18	37.3%	60.8%
Pafford Street	189001791	180003399	180003401	0.300	80.80	0.76	84.5	8.8	22.6	10%	27%	0.07	0.11	21.8%	35.3%
Pafford Street	189001790	180003401	180003402	0.300	74.10	0.30	52.7	29.6	43.4	56%	82%	0.17	0.22	55.6%	71.7%
King Street	189004273	180003402	180006385	0.350	51.50	0.34	85.3	37.7	51.5	44%	60%	0.17	0.20	49.1%	58.3%
King Street	189004218	180006385	180006196	0.350	22.30	0.34	85.2	41.5	55.3	49%	65%	0.17	0.20	49.1%	58.3%
King Street	189004061	180006196	180005803	0.450	51.10	0.24	138.7	41.6	55.4	30%	40%	0.17	0.20	38.2%	44.9%
King Street	189004113	180005803	180006197	0.450	21.10	0.24	138.8	42.0	55.8	30%	40%	0.18	0.21	40.0%	46.6%
King Street	189004053	180006197	180003405	0.450	77.90	0.21	131.6	42.5	56.3	32%	43%	0.18	0.21	40.0%	46.6%
King Street	189001289	180003405	180003556	0.450	76.50	0.34	166.5	42.6	56.4	26%	34%	0.16	0.18	35.0%	40.6%
King Street	189002039	180003556	180003315	0.450	35.40	0.34	165.3	43.4	57.3	26%	35%	0.16	0.18	35.3%	40.7%
King Street	189001290	180003315	180003430	0.450	117.40	0.36	170.5	45.5	59.3	27%	35%	0.16	0.18	35.4%	40.8%
King Street	189002045	180003430	180003431	0.450	66.80	0.36	170.2	45.7	59.5	27%	35%	0.16	0.18	35.6%	41.1%
King Street	189001291	180003431	180003432	0.450	120.50	0.35	168.5	45.9	59.7	27%	35%	0.17	0.19	36.8%	42.3%
King Street	189001292	180003432	180003433	0.450	122.10	0.34	167.2	46.0	59.8	27%	36%	0.17	0.19	36.8%	42.3%

Location	Link ID	Manhole		Pipe				Flow (q) (L/s)		Flow Capacity (q/Q <sub>full</sub> )		Depth (d) (m)		Depth Capacity (d/D)	
		U/S	D/S	Size (m)	Length (m)	Slope (%)	Q <sub>full</sub> (L/s)	Pre dev.	Post dev.	Pre dev.	Post dev.	Pre dev.	Post dev.	Pre dev.	Post dev.
		No Highlighting Indicates No Capacity Constraints Yellow Indicates q/Q > 100%, d/D < 100% Red Indicates q/Q > 100%, d/D > 100%													
King Street	189001293	180003433	180003438	0.450	19.70	0.36	171.2	49.7	63.5	29%	37%	0.31	0.32	68.1%	71.7%
King Street	189001295	180003438	180003214	0.450	79.20	0.35	168.9	51.5	65.3	30%	39%	0.17	0.19	38.0%	43.1%
Gage Street	189001296	180003214	180003215	0.450	41.30	0.37	172.4	52.8	66.6	31%	39%	0.17	0.20	38.6%	43.8%
Gage Street	189001298	180003215	180003216	0.450	120.30	0.35	168.5	53.0	66.8	31%	40%	0.17	0.20	38.6%	43.8%
Gage Street	189001299	180003216	180003217	0.450	73.40	0.36	170.7	53.0	66.8	31%	39%	0.17	0.20	38.6%	43.9%
Gage Street	189002043	180003217	180003664	0.450	75.70	0.35	168.4	53.2	67.0	32%	40%	0.17	0.20	38.6%	43.9%
Gage Street	189001300	180003664	180003219	0.450	71.70	0.35	169.4	53.2	67.0	31%	40%	0.17	0.20	38.7%	43.9%
Gage Street	189001301	180003219	180003220	0.450	75.30	0.35	168.5	53.4	67.3	32%	40%	0.18	0.20	39.5%	44.7%
Gage Street	189001302	180003220	180003221	0.450	76.40	0.35	168.2	55.4	69.2	33%	41%	0.18	0.20	39.5%	44.7%
Gage Street	189001303	180003221	180003222	0.450	69.90	0.35	169.1	55.5	69.3	33%	41%	0.24	0.26	53.7%	57.5%
Gage Street	189001613	180003222	180003223	0.600	79.30	0.23	293.3	99.2	112.5	34%	38%	0.24	0.26	40.3%	43.1%
Gage Street	189001614	180003223	180003224	0.600	79.50	0.26	310.3	98.1	111.4	32%	36%	0.26	0.28	43.7%	46.8%
Mississagua Street	189001616	180003224	180003202	0.600	66.70	0.16	248.2	98.5	111.8	40%	45%	0.26	0.28	43.7%	46.8%
Mississagua Street	189002015	180003202	180003201	0.600	85.20	0.22	290.7	98.2	111.5	34%	38%	0.24	0.26	40.1%	43.0%
Mississagua Street	189001780	180003201	180003775	0.600	66.70	0.24	300.7	99.8	113.1	33%	38%	0.24	0.26	39.8%	42.5%
Mississagua Street	189001779	180003775	180003889	0.600	82.50	0.33	354.5	99.4	112.8	28%	32%	0.26	0.27	42.5%	45.4%
William Street	189001617	180003889	180003890	0.600	72.90	0.20	276.7	103.5	116.9	37%	42%	0.26	0.27	42.5%	45.4%
William Street	189001618	180003890	180003891	0.600	76.40	0.36	366.4	103.2	116.6	28%	32%	0.29	0.31	48.6%	52.2%
William Street	189001619	180003891	180003892	0.600	80.90	0.10	197.9	103.6	117.1	52%	59%	0.30	0.32	50.3%	53.9%
William Street	18901620	180003892	180003893	0.600	76.47	0.18	261.8	103.3	116.7	39%	45%	0.34	0.36	57.0%	59.8%
William Street	18901622	180003893	180003894	0.600	81.88	0.17	256.6	160.8	174.3	63%	68%	0.34	0.36	57.0%	59.8%
William Street	18901623	180003894	180003898	0.600	65.32	0.25	308.6	160.7	174.2	52%	56%	0.33	0.35	55.1%	57.8%
William Street	18901624	180003898	180003303	0.600	106.18	0.21	279.5	162.1	175.6	58%	63%	0.33	0.35	55.1%	57.8%
William Street	18901625	180003303	180003302	0.600	28.49	0.34	356.4	162.1	175.6	45%	49%	0.28	0.29	46.0%	48.0%
William Street Sanitary Pumping Station	18902049	180003302	180003301	0.600	22.00	0.64	489.8	173.9	187.5	36%	38%	0.25	0.26	41.2%	42.9%

(1) – Nodes where the site discharges

**Table 2-7 – 2041 Design RDII HGL Results (Pre-development vs Post-development)**

Green Highlighting Shows HGL Freeboard is greater than 1.8 m									
Yellow Highlighting Shows Freeboard is less than 1.8 m, but the flow is contained within Pipe (i.e. no surcharge)									
Red Highlighting Shows Freeboard is less than 1.8 m and pipe is surcharging									
Location	Conduit (DS)	MH	T/G (m)	Max Allowable HGL (m)	Minimum Obvert	Pre-Development		Post Development	
						Maximum HGL (m)	Freeboard (m)	Maximum HGL (m)	Freeboard (m)
Pafford Street <sup>(1)</sup>	189001794	180003396	89.40	87.60	86.68	86.47	2.93	86.54	2.85
Pafford Street	189001793	180003397	89.67	87.87	86.58	86.35	3.32	86.41	3.26
Pafford Street	189001792	180003398	89.30	87.50	86.36	86.17	3.13	86.24	3.06
Pafford Street	189001791	180003399	89.16	87.36	86.23	86.00	3.16	86.04	3.12
Pafford Street	189001790	180003401	88.63	86.83	85.13	85.00	3.63	85.05	3.58
Pafford Street/King Street	189004273	180003402	88.24	86.44	84.91	84.73	3.51	84.77	3.48
King Street/Evergreen Lane	189004218	180006385	88.16	86.36	84.74	84.57	3.59	84.60	3.56
King Street	189004061	180006196	88.25	86.45	84.67	84.49	3.76	84.52	3.73
King Street	189004113	180005803	88.17	86.37	84.65	84.37	3.80	84.40	3.77
King Street/Anne Street	189004053	180006197	88.00	86.20	84.60	84.33	3.67	84.36	3.64
King Street	189001289	180003405	87.84	86.04	84.43	84.14	3.70	84.16	3.68
King Street/John Street West	189002039	180003556	87.38	85.58	84.17	83.88	3.50	83.90	3.48
King Street	189001290	180003315	86.34	84.54	84.05	83.76	2.58	83.78	2.56
King Street/Mary Street	189002045	180003430	85.99	84.19	83.63	83.34	2.65	83.36	2.62
King Street	189001291	180003431	86.90	85.10	83.39	83.10	3.79	83.13	3.77
King Street	189001292	180003432	86.34	84.54	82.97	82.69	3.65	82.71	3.62
King Street/Centre Street	189001293	180003433	87.59	85.79	82.36	82.22	5.37	82.24	5.35
King Street	189001295	180003438	87.65	85.85	82.29	82.01	5.64	82.04	5.61
King Street/Gage Street	189001296	180003214	87.86	86.06	82.02	81.74	6.13	81.76	6.10
Gage Street	189001298	180003215	87.48	85.68	81.86	81.59	5.89	81.61	5.87
Gage Street/Regent Street	189001299	180003216	86.81	85.01	81.44	81.17	5.65	81.19	5.62
Gage Street	189002043	180003217	86.01	84.21	81.18	80.90	5.10	80.93	5.08
Gage Street/Victoria Street	189001300	180003664	85.15	83.35	80.92	80.64	4.51	80.66	4.49
Gage Street	189001301	180003219	84.35	82.55	80.66	80.39	3.96	80.41	3.94
Gage Street/Gate Street	189001302	180003220	83.48	81.68	80.40	80.13	3.35	80.15	3.32
Gage Street	189001303	180003221	83.09	81.29	80.14	79.86	3.23	79.89	3.20
Gage Street/Simcoe Street	189001613	180003222	84.75	82.95	79.89	79.68	5.07	79.70	5.06
Gage Street	189001614	180003223	84.04	82.24	79.86	79.49	4.55	79.51	4.53
Gage Street/Mississagua Street	189001616	180003224	83.57	81.77	79.66	79.32	4.26	79.34	4.24
Mississagua Street	189002015	180003202	83.82	82.02	79.55	79.19	4.63	79.20	4.62
Mississagua Street/Centre Street	189001780	180003201	84.45	82.65	79.36	78.99	5.45	79.01	5.44
Mississagua Street	189001779	180003775	84.84	83.04	79.20	78.81	6.03	78.83	6.01
Mississagua Street/William Street	189001617	180003889	85.09	83.29	78.92	78.58	6.52	78.59	6.50
William Street	189001618	180003890	83.99	82.19	78.77	78.39	5.60	78.40	5.59
William Street/Butler Street	189001619	180003891	83.79	81.99	78.49	78.19	5.60	78.21	5.57

Green Highlighting Shows HGL Freeboard is greater than 1.8 m  
 Yellow Highlighting Shows Freeboard is less than 1.8 m, but the flow is contained within Pipe (i.e. no surcharge)  
 Red Highlighting Shows Freeboard is less than 1.8 m and pipe is surcharging

Location	Conduit (DS)	MH	T/G (m)	Max Allowable HGL (m)	Minimum Obvert	Pre-Development		Post Development	
						Maximum HGL (m)	Freeboard (m)	Maximum HGL (m)	Freeboard (m)
William Street	18901620	180003892	83.38	81.58	78.41	78.07	5.30	78.10	5.28
William Street/Dorchester Street	18901622	180003893	83.25	81.45	78.27	78.01	5.24	78.03	5.23
William Street	18901623	180003894	81.02	79.22	78.12	77.83	3.19	77.85	3.18
William Street/Nassau Street	18901624	180003898	80.86	79.06	77.96	77.69	3.17	77.71	3.15
William Street	18901625	180003303	80.56	78.76	77.66	77.33	3.22	77.35	3.21
William Street	18902049	180003302	81.89	80.09	76.83	76.48	5.41	76.49	5.40
William Street Sanitary Pumping Station		180003301	82.40	80.60	76.69	76.31	6.09	76.32	6.08

(1) – Nodes where the site discharges

## 2.7 5-Year Storms WWF Analysis

The 2016 MSP identified that the actual 5-year Storms RDII was higher than the design RDII for the Old Town NOTL sewershed that drained to the William Pumping Station. As such, the scenario with the highest flow in the received model was run to determine if conditions during an actual rain event would cause unsafe operation of the sanitary sewer system. The selected scenario was 2041, 5-Year flow model. This model was updated to demonstrate pre-development to post-development conditions.

The flow and depth and HGL results can be found in **Table 2-9** and **Table 2-10** below.

The results indicate that the water depth in 10 pipes exceeds the pipe obvert within the downstream network under the pre-development scenario. However, the majority of these pipes operate below 100% of their flow capacity. Only 3 of these 10 pipes exhibit flow capacity over 100%, demonstrating actual surcharge conditions resulting from the capacity deficiency of the sewer. A surcharge condition is considered when both the Flow Capacity ( $q/Q_{full}$ ) and Depth Capacity ( $d/D$ ) are over 100%.

Under post-development conditions, surcharge conditions are shown to increase. A total of 11 pipes exhibit water levels above the pipe obvert, of which four (4) pipes exceed 100% flow capacity, indicating surcharge conditions due to insufficient capacity of the sewer.

Despite these surcharged conditions, all affected pipes maintain a minimum hydraulic grade line (HGL) freeboard of at least 1.8 m below ground surface, satisfying the Region's design criteria. Therefore, it is anticipated that the existing downstream sewer could accommodate the sanitary flow from the proposed development during the 5-year storms WWF condition.

Detailed sewer profiles and model outputs of the analysis are provided in **Appendix D**.

Should the Town of Niagara-on-the-Lake require mitigation, upgrades could be implemented to eliminate conditions where flow capacity exceeds 100%. This would require the four (4) following upgrades outlined in **Table 2-8**. It should be noted that these surcharges are generally considered to be safe in WWF conditions in accordance with the Niagara Region design standards. As such, it is not recommended to perform these upgrades as the additional safety provided is marginal. Therefore, the sewer network has sufficient capacity to accept sanitary flow from the subject development without any network improvements.

**Table 2-8 – Potentially Sewer Upgrades**

Street Location	Upstream Manhole	Downstream Manhole	Existing Sewer Diameter (mm)	Downstream Sewer Diameter (mm)
Pafford Street	180003401	180003402	300	375
William Street	180003891	180003892	350	450
William Street	180003893	180003894	600	675
William Street	180003898	180003303	600	675

**Table 2-9 - 2041 5-Year RDII Flow and Depth Results (Pre-development vs Post-development)**

Location	Link ID	Manhole		Pipe				Flow (q) (L/s)		Flow Capacity (q/Q <sub>full</sub> )		Depth (d) (m)		Depth Capacity (d/D)	
		U/S	D/S	Size (m)	Length (m)	Slope (%)	Q <sub>full</sub> (L/s)	Pre dev.	Post dev.	Pre dev.	Post dev.	Pre dev.	Post dev.	Pre dev.	Post dev.
		No Highlighting Indicates No Capacity Constraints Yellow Indicates q/Q > 100%, d/D < 100% Red Indicates q/Q > 100%, d/D > 100%													
Pafford Street <sup>(1)</sup>	189001794	180003396	180003397	0.300	68.30	0.15	37.6	11.2	25.1	30%	67%	0.12	0.18	39.1%	61.0%
Pafford Street	189001793	180003397	180003398	0.300	76.20	0.29	52.0	11.6	25.5	22%	49%	0.14	0.21	48.0%	69.3%
Pafford Street	189001792	180003398	180003399	0.300	76.50	0.14	36.0	14.3	28.1	40%	78%	0.14	0.21	48.0%	69.3%
Pafford Street	189001791	180003399	180003401	0.300	80.80	0.76	84.5	14.8	28.6	17%	34%	0.08	0.12	28.3%	40.1%
Pafford Street	189001790	180003401	180003402	0.300	74.10	0.30	52.7	59.9	73.7	114%	140%	0.29	0.42	96.0%	140.5%
King Street	189004273	180003402	180006385	0.350	51.50	0.34	85.3	74.2	88.0	87%	103%	0.26	0.30	73.5%	84.8%
King Street	189004218	180006385	180006196	0.350	22.30	0.34	85.2	78.6	92.4	92%	109%	0.26	0.29	73.5%	83.5%
King Street	189004061	180006196	180005803	0.450	51.10	0.24	138.7	78.8	92.6	57%	67%	0.25	0.28	55.5%	61.5%
King Street	189004113	180005803	180006197	0.450	21.10	0.24	138.8	79.6	93.4	57%	67%	0.26	0.28	57.2%	63.1%
King Street	189004053	180006197	180003405	0.450	77.90	0.21	131.6	80.6	94.5	61%	72%	0.26	0.28	57.2%	63.1%
King Street	189001289	180003405	180003556	0.450	76.50	0.34	166.5	80.9	94.8	49%	57%	0.23	0.25	50.1%	55.0%
King Street	189002039	180003556	180003315	0.450	35.40	0.34	165.3	82.8	96.6	50%	58%	0.23	0.25	50.6%	55.3%
King Street	189001290	180003315	180003430	0.450	117.40	0.36	170.5	87.0	100.9	51%	59%	0.23	0.25	50.8%	55.5%
King Street	189002045	180003430	180003431	0.450	66.80	0.36	170.2	87.4	101.2	51%	59%	0.23	0.25	51.3%	56.0%
King Street	189001291	180003431	180003432	0.450	120.50	0.35	168.5	87.8	101.7	52%	60%	0.24	0.26	52.4%	56.9%
King Street	189001292	180003432	180003433	0.450	122.10	0.34	167.2	88.0	101.8	53%	61%	0.24	0.26	52.4%	56.9%
King Street	189001293	180003433	180003438	0.450	19.70	0.36	171.2	92.3	106.2	54%	62%	0.35	0.37	78.9%	82.2%
King Street	189001295	180003438	180003214	0.450	79.20	0.35	168.9	96.0	109.8	57%	65%	0.24	0.27	54.3%	59.0%
Gage Street	189001296	180003214	180003215	0.450	41.30	0.37	172.4	98.7	112.5	57%	65%	0.25	0.27	55.2%	60.0%
Gage Street	189001298	180003215	180003216	0.450	120.30	0.35	168.5	99.0	112.9	59%	67%	0.25	0.27	55.2%	60.0%
Gage Street	189001299	180003216	180003217	0.450	73.40	0.36	170.7	99.0	112.9	58%	66%	0.25	0.27	55.3%	60.1%
Gage Street	189002043	180003217	180003664	0.450	75.70	0.35	168.4	99.5	113.3	59%	67%	0.25	0.27	55.3%	60.1%
Gage Street	189001300	180003664	180003219	0.450	71.70	0.35	169.4	99.5	113.3	59%	67%	0.25	0.27	55.4%	60.2%
Gage Street	189001301	180003219	180003220	0.450	75.30	0.35	168.5	99.9	113.7	59%	67%	0.26	0.28	56.7%	61.5%
Gage Street	189001302	180003220	180003221	0.450	76.40	0.35	168.2	103.4	117.2	61%	70%	0.26	0.28	56.7%	61.5%
Gage Street	189001303	180003221	180003222	0.450	69.90	0.35	169.1	103.7	117.5	61%	69%	0.34	0.36	76.3%	79.9%
Gage Street	189001613	180003222	180003223	0.600	79.30	0.23	293.3	183.4	197.4	63%	67%	0.34	0.36	57.2%	59.9%
Gage Street	189001614	180003223	180003224	0.600	79.50	0.26	310.3	182.2	196.6	59%	63%	0.37	0.39	62.3%	65.3%
Mississauga Street	189001616	180003224	180003202	0.600	66.70	0.16	248.2	182.8	197.2	74%	79%	0.37	0.39	62.3%	65.3%
Mississauga Street	189002015	180003202	180003201	0.600	85.20	0.22	290.7	182.6	196.8	63%	68%	0.34	0.37	57.5%	60.9%
Mississauga Street	189001780	180003201	180003775	0.600	66.70	0.24	300.7	185.3	197.9	62%	66%	0.34	0.44	56.3%	74.0%
Mississauga Street	189001779	180003775	180003889	0.600	82.50	0.33	354.5	185.0	192.3	52%	54%	0.52	0.66	86.1%	109.8%
William Street	189001617	180003889	180003890	0.600	72.90	0.20	276.7	186.3	198.9	67%	72%	0.61	0.73	102.0%	121.8%

Location	Link ID	Manhole		Pipe				Flow (q) (L/s)		Flow Capacity (q/Q <sub>full</sub> )		Depth (d) (m)		Depth Capacity (d/D)	
		U/S	D/S	Size (m)	Length (m)	Slope (%)	Q <sub>full</sub> (L/s)	Pre dev.	Post dev.	Pre dev.	Post dev.	Pre dev.	Post dev.	Pre dev.	Post dev.
		No Highlighting Indicates No Capacity Constraints Yellow Indicates q/Q > 100%, d/D < 100% Red Indicates q/Q > 100%, d/D > 100%													
William Street	189001618	180003890	180003891	0.600	76.40	0.36	366.4	185.0	199.1	50%	54%	0.82	0.92	135.9%	153.8%
William Street	189001619	180003891	180003892	0.600	80.90	0.10	197.9	186.8	201.0	94%	102%	0.84	0.93	139.3%	155.5%
William Street	18901620	180003892	180003893	0.600	76.47	0.18	261.8	187.1	201.2	71%	77%	0.91	0.99	150.8%	164.7%
William Street	18901622	180003893	180003894	0.600	81.88	0.17	256.6	283.1	298.2	110%	116%	0.91	0.99	150.8%	164.7%
William Street	18901623	180003894	180003898	0.600	65.32	0.25	308.6	283.2	298.3	92%	97%	0.90	0.95	150.0%	158.2%
William Street	18901624	180003898	180003303	0.600	106.18	0.21	279.5	287.1	302.1	103%	108%	0.90	0.95	150.0%	158.2%
William Street	18901625	180003303	180003302	0.600	28.49	0.34	356.4	287.1	302.1	81%	85%	1.00	1.02	167.2%	170.0%
William Street Sanitary Pumping Station	18902049	180003302	180003301	0.600	22.00	0.64	489.8	311.7	326.7	64%	67%	1.82	1.83	303.3%	305.2%

(1) – Nodes where the site discharges

**Table 2-10 2041 5-Year RDII HGL Results (Pre-development vs Post-development)**

Location	Conduit (DS)	MH	T/G (m)	Max Allowable HGL (m)	Minimum Obvert	Pre-Development		Post Development	
						Maximum HGL (m)	Freeboard (m)	Maximum HGL (m)	Freeboard (m)
						Green Highlighting Shows HGL Freeboard is greater than 1.8 m Yellow Highlighting Shows Freeboard is less than 1.8 m, but the flow is contained within Pipe (i.e. no surcharge) Red Highlighting Shows Freeboard is less than 1.8 m and pipe is surcharging			
Pafford Street <sup>(1)</sup>	189001794	180003396	89.40	87.60	86.68	86.50	2.90	86.56	2.83
Pafford Street	189001793	180003397	89.67	87.87	86.58	86.38	3.30	86.43	3.25
Pafford Street	189001792	180003398	89.30	87.50	86.36	86.20	3.10	86.27	3.04
Pafford Street	189001791	180003399	89.16	87.36	86.23	86.02	3.14	86.05	3.10
Pafford Street	189001790	180003401	88.63	86.83	85.13	85.12	3.51	85.25	3.38
Pafford Street/King Street	189004273	180003402	88.24	86.44	84.91	84.82	3.42	84.87	3.38
King Street/Evergreen Lane	189004218	180006385	88.16	86.36	84.74	84.65	3.51	84.69	3.47
King Street	189004061	180006196	88.25	86.45	84.67	84.56	3.68	84.59	3.66
King Street	189004113	180005803	88.17	86.37	84.65	84.45	3.72	84.47	3.70
King Street/Anne Street	189004053	180006197	88.00	86.20	84.60	84.40	3.60	84.43	3.57
King Street	189001289	180003405	87.84	86.04	84.43	84.20	3.64	84.22	3.61
King Street/John Street West	189002039	180003556	87.38	85.58	84.17	83.95	3.43	83.97	3.41
King Street	189001290	180003315	86.34	84.54	84.05	83.83	2.51	83.85	2.49
King Street/Mary Street	189002045	180003430	85.99	84.19	83.63	83.41	2.58	83.43	2.56
King Street	189001291	180003431	86.90	85.10	83.39	83.17	3.72	83.20	3.70
King Street	189001292	180003432	86.34	84.54	82.97	82.76	3.58	82.78	3.56
King Street/Centre Street	189001293	180003433	87.59	85.79	82.36	82.27	5.32	82.28	5.31
King Street	189001295	180003438	87.65	85.85	82.29	82.09	5.57	82.11	5.54

Green Highlighting Shows HGL Freeboard is greater than 1.8 m  
 Yellow Highlighting Shows Freeboard is less than 1.8 m, but the flow is contained within Pipe (i.e. no surcharge)  
 Red Highlighting Shows Freeboard is less than 1.8 m and pipe is surcharging

Location	Conduit (DS)	MH	T/G (m)	Max Allowable HGL (m)	Minimum Obvert	Pre-Development		Post Development	
						Maximum HGL (m)	Freeboard (m)	Maximum HGL (m)	Freeboard (m)
King Street/Gage Street	189001296	180003214	87.86	86.06	82.02	81.81	6.05	81.83	6.03
Gage Street	189001298	180003215	87.48	85.68	81.86	81.66	5.82	81.68	5.80
Gage Street/Regent Street	189001299	180003216	86.81	85.01	81.44	81.24	5.57	81.26	5.55
Gage Street	189002043	180003217	86.01	84.21	81.18	80.98	5.03	81.00	5.01
Gage Street/Victoria Street	189001300	180003664	85.15	83.35	80.92	80.71	4.43	80.74	4.41
Gage Street	189001301	180003219	84.35	82.55	80.66	80.46	3.88	80.48	3.86
Gage Street/Gate Street	189001302	180003220	83.48	81.68	80.40	80.21	3.27	80.23	3.25
Gage Street	189001303	180003221	83.09	81.29	80.14	79.94	3.15	79.96	3.13
Gage Street/Simcoe Street	189001613	180003222	84.75	82.95	79.89	79.78	4.97	79.80	4.95
Gage Street	189001614	180003223	84.04	82.24	79.86	79.59	4.45	79.60	4.43
Gage Street/Mississagua Street	189001616	180003224	83.57	81.77	79.66	79.43	4.14	79.45	4.13
Mississagua Street	189002015	180003202	83.82	82.02	79.55	79.29	4.53	79.31	4.51
Mississagua Street/Centre Street	189001780	180003201	84.45	82.65	79.36	79.09	5.35	79.12	5.33
Mississagua Street	189001779	180003775	84.84	83.04	79.20	78.90	5.94	79.04	5.80
Mississagua Street/William Street	189001617	180003889	85.09	83.29	78.92	78.84	6.26	78.98	6.11
William Street	189001618	180003890	83.99	82.19	78.77	78.78	5.21	78.90	5.09
William Street/Butler Street	189001619	180003891	83.79	81.99	78.49	78.72	5.07	78.82	4.97
William Street	18901620	180003892	83.38	81.58	78.41	78.64	4.74	78.74	4.64
William Street/Dorchester Street	18901622	180003893	83.25	81.45	78.27	78.57	4.68	78.66	4.60
William Street	18901623	180003894	81.02	79.22	78.12	78.40	2.63	78.46	2.56
William Street/Nassau Street	18901624	180003898	80.86	79.06	77.96	78.26	2.60	78.31	2.55
William Street	18901625	180003303	80.56	78.76	77.66	78.03	2.53	78.05	2.51
William Street	18902049	180003302	81.89	80.09	76.83	77.97	3.92	77.98	3.91
William Street Sanitary Pumping Station		180003301	82.40	80.60	76.69	77.91	4.49	77.92	4.48

(1) – Nodes where the site discharges

### 3.0 CONCLUSIONS

This sanitary analysis report presents the impact of the proposed development on the existing sanitary sewer network under multiple scenarios. The analysis was completed using an Infoworks ICM model, which was developed based on the InfoSWMM model provided by Niagara Region. The model was updated to reflect new developments in the sewershed and correct pipe information as per the plan and profile drawings. The analysis simulated pre-development and post-development scenarios under 2041 DWF, 2041 Design RDII and 2041 5-year Storm conditions as defined in the Region's model. The following is the summary of the assessment:

- The total estimated population of the proposed development is 795 people. Under post-development conditions, a peak constant flow of 13.82 L/s was applied in the model to represent the proposed development, as flows will be discharged to the existing sewer system via a pumping solution.
- The 2041 DWF and 2041 Design RDII results indicated no surcharge conditions along the downstream sewer under pre-development and post-development scenarios. Therefore, it is anticipated that the existing downstream sewer has adequate capacity to support the proposed development during 2041 DWF and 2041 Design RDII conditions.
- The 2041 5-year Storm results indicate that several pipes experience water levels above the pipe obvert under pre-development and post-development scenarios. However, the majority of them operate below 100% of their flow capacity. Only 4 of them exceed 100% flow capacity in the post-development scenario, demonstrating actual surcharge conditions due to the capacity deficiency of the sewer. It is noted that these surcharged sewers could provide a minimum freeboard of 1.8m, satisfying the Region's criteria for WWF conditions. Therefore, it is anticipated that the existing downstream sewer has adequate capacity to support the proposed development during the 2041 5-year Storm WWF condition.
- Potential upgrades can be implemented to eliminate locations where flow capacity exceeds 100%, if requested by the Town. However, these surcharge conditions are generally considered safe under WWF conditions in accordance with Niagara Region design standards. As such, upgrades are not recommended, as the incremental benefit would be

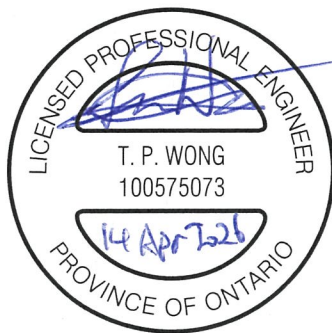
minimal. The potential upgrades are summarized below:

Street Location	Upstream Manhole	Downstream Manhole	Existing Sewer Diameter (mm)	Downstream Sewer Diameter (mm)
Pafford Street	180003401	180003402	300	375
William Street	180003891	180003892	350	450
William Street	180003893	180003894	600	675
William Street	180003898	180003303	600	675

We trust that you will find the contents of this report satisfactory. Should you have any questions or comments, please do not hesitate to contact the undersigned.

Respectfully Submitted,

**SCHAEFFER & ASSOCIATES LTD.**



**Tsz Pok (Paul) Wong, P.Eng.**  
Water Resource Engineer

# **Appendix A**

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## **Background Information**

## A.1 – Architectural Drawings

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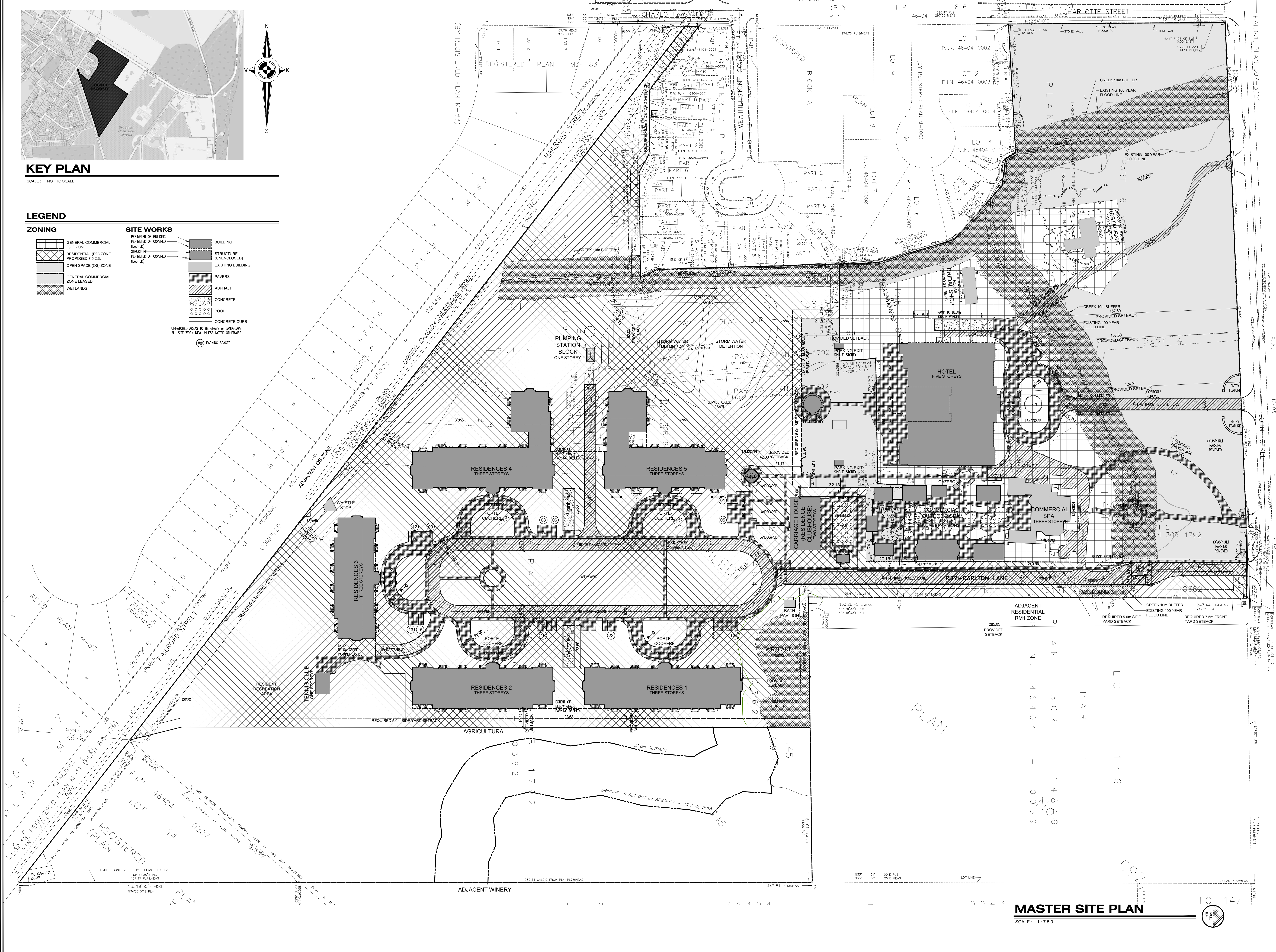
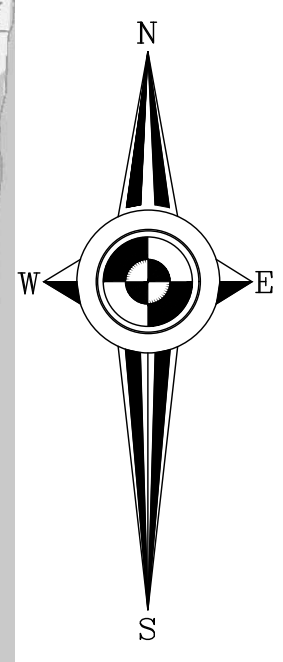


**KEY PLAN**

SCALE: NOT TO SCALE

**LEGEND**

- |  |  |
|--|--|
| <b>ZONING</b>  | <b>SITE WORKS</b>  |
| <ul style="list-style-type: none"> <li>[Symbol] GENERAL COMMERCIAL (GC) ZONE</li> <li>[Symbol] RESIDENTIAL (RD) ZONE</li> <li>[Symbol] OPEN SPACE (OS) ZONE</li> <li>[Symbol] GENERAL COMMERCIAL ZONE LEASED</li> <li>[Symbol] WETLANDS</li> </ul> | <ul style="list-style-type: none"> <li>[Symbol] PERIMETER OF BUILDING (DASHED)</li> <li>[Symbol] STRUCTURE (UNENCLOSED)</li> <li>[Symbol] PERIMETER OF COVERED (DASHED)</li> <li>[Symbol] EXISTING BUILDING</li> <li>[Symbol] PAVERS</li> <li>[Symbol] ASPHALT</li> <li>[Symbol] CONCRETE</li> <li>[Symbol] POOL</li> <li>[Symbol] CONCRETE CURB</li> <li>[Symbol] UNWATCHED AREAS TO BE GRASS OR LANDSCAPE</li> <li>[Symbol] ALL SITE WORK NEW UNLESS NOTED OTHERWISE</li> <li>[Symbol] PARKING SPACES</li> </ul> |



**Peter J. Lesdow**  
architect

ONARIO ASSOCIATION  
OF ARCHITECTS

PETER J. LESDOW  
LICENSE  
3745

**MASTER SITE PLAN**  
144, 176 & 200 John St,  
856 Charlotte St

DATE	REVISIONS	DATE	REVISIONS
14-07-20	FOR ZONING		

**RITZ-CARLTON DEVELOPMENT**

144, 176 & 200 John St, 856 Charlotte St  
Niagara-on-the-Lake

DATE: Nov. 18/22  
SCALE: 1:750  
DRAWN BY: MRW  
CHECK BY: PJL

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**A101**

**MASTER SITE PLAN**  
SCALE: 1:750

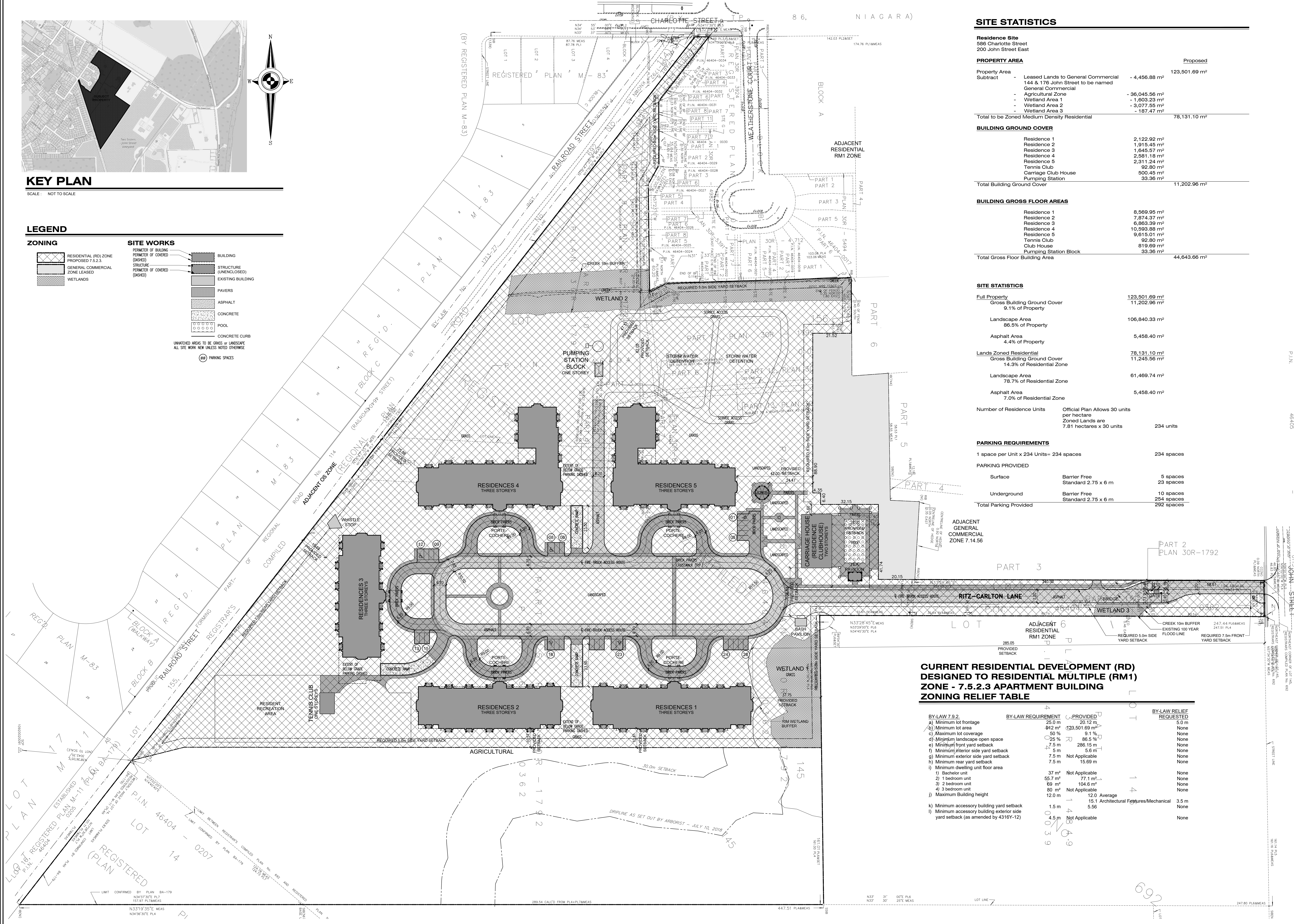


**KEY PLAN**

SCALE: NOT TO SCALE

**LEGEND**

ZONING	SITE WORKS
RESIDENTIAL (RD) ZONE PROPOSED 7.5.2.3	PERIMETER OF BUILDING
GENERAL COMMERCIAL ZONE LEASED	STRUCTURE (UNENCLOSED)
WETLANDS	STRUCTURE (ENCLOSED)
	EXISTING BUILDING
	PAVERS
	ASPHALT
	CONCRETE
	POOL
	CONCRETE CURB
	UNATCHED AREAS TO BE GRADED OR LANDSCAPED
	ALL SITE WORK NEW UNLESS NOTED OTHERWISE
	PARKING SPACES



**SITE STATISTICS**

Residence Site		Proposed	
586 Charlotte Street		123,501.69 m <sup>2</sup>	
200 John Street East			
PROPERTY AREA			
Property Area	Leased Lands to General Commercial	- 4,456.88 m <sup>2</sup>	123,501.69 m <sup>2</sup>
Subtract	144 & 176 John Street to be named General Commercial		
	Agricultural Zone	- 36,045.56 m <sup>2</sup>	
	Wetland Area 1	- 1,603.23 m <sup>2</sup>	
	Wetland Area 2	- 3,077.55 m <sup>2</sup>	
	Wetland Area 3	- 187.47 m <sup>2</sup>	
Total to be Zoned Medium Density Residential			78,131.10 m <sup>2</sup>
BUILDING GROUND COVER			
Residence 1		2,122.92 m <sup>2</sup>	
Residence 2		1,915.45 m <sup>2</sup>	
Residence 3		1,645.57 m <sup>2</sup>	
Residence 4		2,581.18 m <sup>2</sup>	
Residence 5		2,311.24 m <sup>2</sup>	
Tennis Club		92.80 m <sup>2</sup>	
Carriage Club House		500.45 m <sup>2</sup>	
Pumping Station		33.36 m <sup>2</sup>	
Total Building Ground Cover			11,202.96 m <sup>2</sup>
BUILDING GROSS FLOOR AREAS			
Residence 1		8,569.95 m <sup>2</sup>	
Residence 2		7,874.37 m <sup>2</sup>	
Residence 3		6,963.39 m <sup>2</sup>	
Residence 4		10,593.88 m <sup>2</sup>	
Residence 5		9,815.01 m <sup>2</sup>	
Tennis Club		92.80 m <sup>2</sup>	
Club House		819.69 m <sup>2</sup>	
Pumping Station Block		58.96 m <sup>2</sup>	
Total Gross Floor Building Area			44,643.66 m <sup>2</sup>

**SITE STATISTICS**

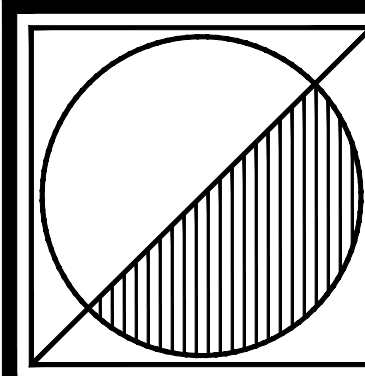
Full Property		123,501.69 m <sup>2</sup>
Gross Building Ground Cover	9.1% of Property	11,202.96 m <sup>2</sup>
Landscape Area	86.5% of Property	106,840.33 m <sup>2</sup>
Asphalt Area	4.4% of Property	5,458.40 m <sup>2</sup>
Lands Zoned Residential		78,131.10 m <sup>2</sup>
Gross Building Ground Cover	14.3% of Residential Zone	11,245.56 m <sup>2</sup>
Landscape Area	78.7% of Residential Zone	61,469.74 m <sup>2</sup>
Asphalt Area	7.0% of Residential Zone	5,458.40 m <sup>2</sup>
Number of Residence Units	Official Plan Allows 30 units per hectare	
	Zoned Lands are 7.81 hectares x 30 units	234 units
PARKING REQUIREMENTS		
1 space per Unit x 234 Units =	234 spaces	234 spaces
PARKING PROVIDED		
Surface	Barrier Free	5 spaces
	Standard 2.75 x 6 m	23 spaces
Underground	Barrier Free	10 spaces
	Standard 2.75 x 6 m	254 spaces
Total Parking Provided		292 spaces

**CURRENT RESIDENTIAL DEVELOPMENT (RD) DESIGNED TO RESIDENTIAL MULTIPLE (RM1) ZONE - 7.5.2.3 APARTMENT BUILDING ZONING RELIEF TABLE**

BY-LAW 7.9.2	BY-LAW REQUIREMENT	PROVIDED	BY-LAW RELIEF REQUESTED
a) Minimum lot frontage	25.0 m	20.12 m	5.0 m
b) Minimum lot area	912 m <sup>2</sup>	123,501.69 m <sup>2</sup>	None
c) Maximum lot coverage	50 %	9.1 %	None
d) Minimum landscape open space	25 %	86.5 %	None
e) Minimum front yard setback	7.5 m	286.15 m	None
f) Minimum interior side yard setback	5 m	5.6 m	None
g) Minimum exterior side yard setback	7.5 m	Not Applicable	None
h) Minimum rear yard setback	7.5 m	15.69 m	None
i) Minimum dwelling unit floor area			
1) Bachelor unit	37 m <sup>2</sup>	Not Applicable	None
2) 1 bedroom unit	55.7 m <sup>2</sup>	77.1 m <sup>2</sup>	None
3) 2 bedroom unit	69 m <sup>2</sup>	104.6 m <sup>2</sup>	None
4) 3 bedroom unit	80 m <sup>2</sup>	Not Applicable	None
j) Maximum Building height	12.0 m	12.0 m Average	1.4 m
k) Minimum accessory building yard setback	1.5 m	5.56 m	None
l) Minimum accessory building exterior side yard setback (as amended by 4316Y-12)	4.5 m	Not Applicable	None

**ZONING SITE PLAN - RESIDENTIAL**

SCALE: 1:750



**Peter J. Lesdow**  
architect

ONTARIO ASSOCIATION OF ARCHITECTS  
PETER J. LESDOW  
LICENSE  
3745

**ZONING PLAN**  
RESIDENTIAL  
200 John St &  
856 Charlotte St

DATE	REVISIONS	DATE	REVISIONS
14-07-20	FOR ZONING		

**RITZ-CARLTON DEVELOPMENT**  
144, 176 & 200 John St, 856 Charlotte St  
Niagara-on-the-Lake

DATE: Nov. 18/ 22  
SCALE: 1:750  
DRAWN BY: MRW  
CHECK BY: PJL

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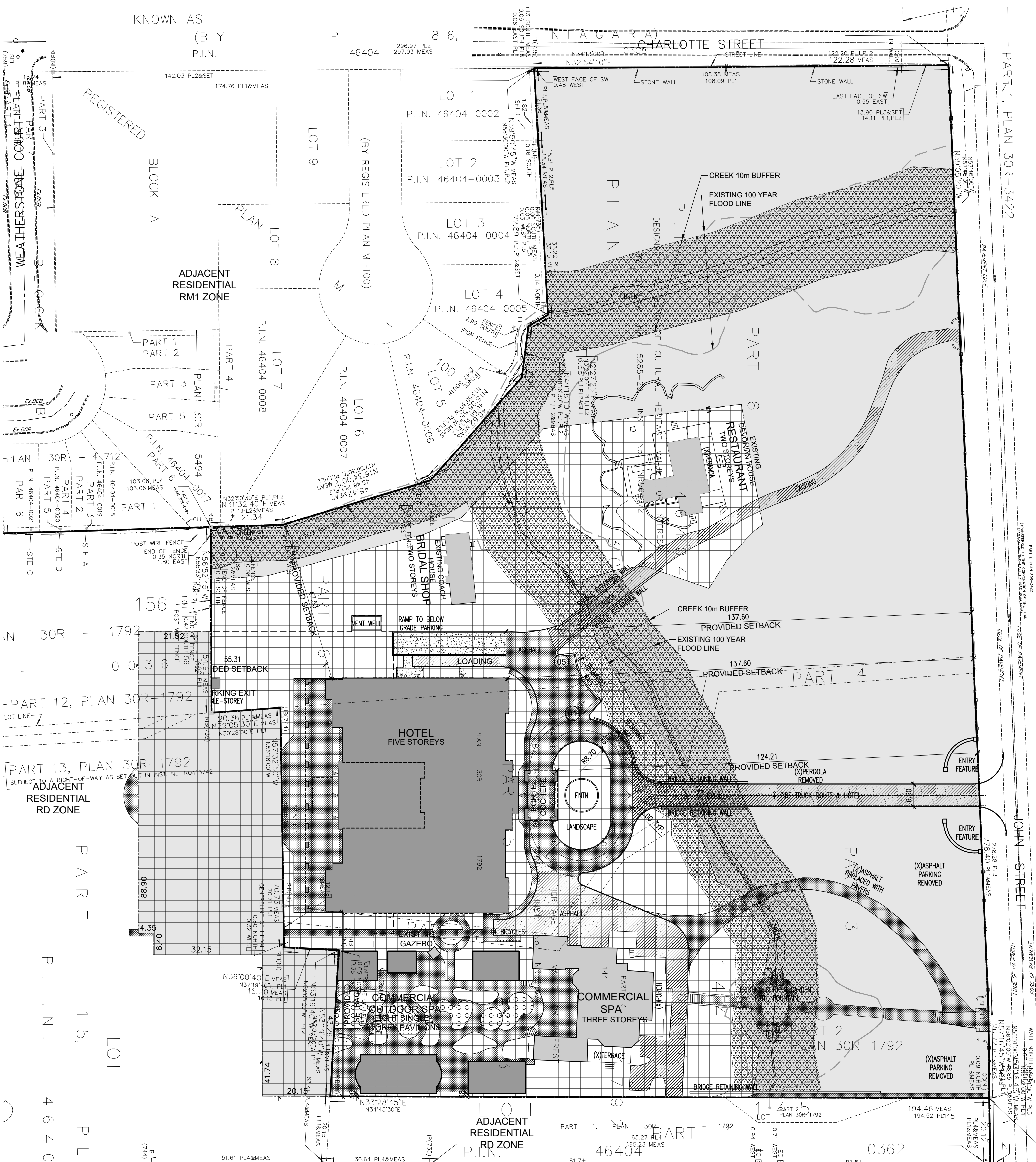


**KEY PLAN**

SCALE: 1:750

**LEGEND**

ZONING	SITE WORKS
GENERAL COMMERCIAL (G.C.) ZONE	PERIMETER OF BUILDING
OPEN SPACE (OS) ZONE	PERIMETER OF COVERED (DASHED)
GENERAL COMMERCIAL ZONE (LEASED)	STRUCTURE (UNENCLOSED)
WETLANDS	STRUCTURE (ENCLOSED)
	PERIMETER OF COVERED (DASHED)
	PAVERS
	ASPHALT
	CONCRETE
	POOL
	CONCRETE CURB
	UNHATCHED AREAS TO BE GRASS OR LANDSCAPE
	ALL SITE WORK NEW UNLESS NOTED OTHERWISE
	(#) PARKING SPACES



**ZONING SITE PLAN - GENERAL COMMERCIAL & OPEN SPACE**

SCALE: 1:750

**SITE STATISTICS**

PROPERTY AREA	Area	Proposed
Ritz Carlton Hotel / Spa Site 144 and 176 John Street		
Commercial Zoned Area Plus	53,262.42 m <sup>2</sup>	
Lease Lands from Ritz Carlton Residences Long Term 583 Charlotte Street and 200 John Street East	+4,751.56 m <sup>2</sup>	
Minus Existing Open Space Zone	-30,564.84 m <sup>2</sup>	
<b>Total to be Zoned General Commercial Area</b>		<b>27,449.14 m<sup>2</sup></b>
<b>BUILDING GROUND COVER</b>		
Ritz Carlton Hotel	3,567.73 m <sup>2</sup>	
Rand Spa	769.57 m <sup>2</sup>	
Outdoor Spa Pavilions	938.00 m <sup>2</sup>	
Coach House	146.6 m <sup>2</sup>	
Devonian House	253.73 m <sup>2</sup>	
<b>Total Building Ground Cover</b>		<b>5,695.63 m<sup>2</sup></b>
<b>BUILDING GROSS AREAS</b>		
Ritz Carlton Hotel	2,350.71 m <sup>2</sup>	
Basement	7,159.17 m <sup>2</sup>	
Ground Floor	3,567.73 m <sup>2</sup>	
Second Floor	2,880.33 m <sup>2</sup>	
Third Floor	2,880.33 m <sup>2</sup>	
Fourth Floor	2,880.33 m <sup>2</sup>	
Fifth Floor	2,880.33 m <sup>2</sup>	
Mechanical Penthouse	2,927.77 m <sup>2</sup>	
<b>Total</b>		<b>24,659.43 m<sup>2</sup></b>
Rand Spa	880.56 m <sup>2</sup>	
Existing Building	769.57 m <sup>2</sup>	
Basement	329.7 m <sup>2</sup>	
Ground Floor	312.85 m <sup>2</sup>	
Second Floor	27.25 m <sup>2</sup>	
Third Floor		
Widows Walk		
<b>Total</b>		<b>2319.93 m<sup>2</sup></b>
Outdoor Spa Pavilions	938 m <sup>2</sup>	
Coach House	146.6 m <sup>2</sup>	
Existing Building	102.4 m <sup>2</sup>	
<b>Total</b>		<b>249 m<sup>2</sup></b>
Devonian House	253.73 m <sup>2</sup>	
Existing Building	253.73 m <sup>2</sup>	
<b>Total</b>		<b>507.46 m<sup>2</sup></b>
<b>Total Gross Building Area</b>		<b>28,680.8 m<sup>2</sup></b>

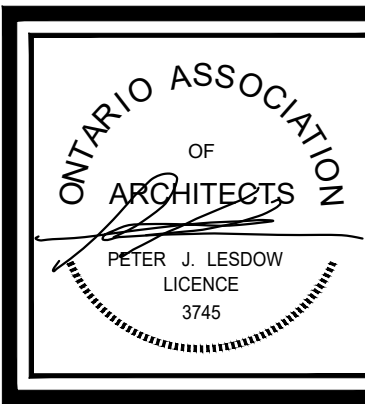
SITE STATISTICS	Value
Full Property	
Gross Building Ground Cover	5,695.63 m <sup>2</sup>
10.7% of Property	
Landscaped Area	45,085.06 m <sup>2</sup>
84.6% of Property	
Asphalt Area	2,481.73 m <sup>2</sup>
4.7% of Property	
Land Zoned General Commercial	
Gross Building Ground Cover	5,695.63 m <sup>2</sup>
20.7% of G.C. Zone	
Landscaped Area	20,249.66 m <sup>2</sup>
73.8% of G.C. Zone	
Asphalt Area	1,503.83 m <sup>2</sup>
5.5% of G.C. Zone	

PARKING REQUIREMENTS	Hotel Components	Vehicle Parking Required	Bicycle Parking Required
Hotel Rooms	111	1 per guestroom in addition to other uses	111 spaces
Restaurants			
River View Restaurant	Seats: 99, Area: 288.48 m <sup>2</sup>		
Upper Banquet Room	240, 336.45 m <sup>2</sup>		
Grand Salon	39, 169.57 m <sup>2</sup>		
Private Lounge	94, 40.9 m <sup>2</sup>		
Lower Restaurant	118, 87.3 m <sup>2</sup>		
Lower Banquet Room	266, 349.16 m <sup>2</sup>		
Subtotal	738, 1,271.86 m <sup>2</sup>	1 per 9m <sup>2</sup> GFLA	141 spaces
Restaurant - Outdoor Patio	Seats: 104, Area: 414.46 m <sup>2</sup>	1 per 30 m <sup>2</sup> GFLA of Outdoor Patio Area in addition to the requirements for a restaurant or take-out restaurant.	14 spaces
Conference Rooms on Areas Used in Conjunction with Other uses	Meeting Room A: 94.52 m <sup>2</sup> , Meeting Rooms B, C, D & E: 187.99 m <sup>2</sup> , Conference Room: 43.46 m <sup>2</sup> , Subtotal: 325.97 m <sup>2</sup>	1 per 18.5 m <sup>2</sup> GFLA	18 spaces
Office	Front Reception: 69.26 m <sup>2</sup> , Human Resources: 95.19 m <sup>2</sup> , Management and Marketing: 231.04 m <sup>2</sup> , Accounting: 84.13 m <sup>2</sup> , Subtotal: 469.62 m <sup>2</sup>	1 per 28 m <sup>2</sup> GFLA	17 spaces
Retail Sales	Wine Shop: 38.20 m <sup>2</sup> , Gift Shop: 25.70 m <sup>2</sup> , Subtotal: 63.9 m <sup>2</sup>	1 per 18.5 m <sup>2</sup> GFLA	4 spaces

PROPERTY COMPONENTS	Area	Requirement	Spaces
Existing Rand Mansion - Conversion to Spa	Total GFLA of Mansion: 2,086.43 m <sup>2</sup> , Area of to be Used as Spa (Other Areas Unoccupied): 1,260.86 m <sup>2</sup>	1 per 15 m <sup>2</sup> GFLA	85 spaces
Outdoor Spa Pavilions	Combined Area of Pavilions: 980.64 m <sup>2</sup>	1 per 15 m <sup>2</sup> GFLA	66 spaces
Existing Devonian House - Ground Floor Conversion to Restaurant (Remainder Unoccupied)	Dining Area: 178.50 m <sup>2</sup> , Outdoor Covered Porch Area: 188.27 m <sup>2</sup>	1 per 9 m <sup>2</sup> GFLA, 1 per 30 m <sup>2</sup> GFLA of Outdoor Patio Area	20 spaces, 6 spaces
Existing Coach House - Ground Floor Conversion to Bridal Shop (Remainder Unoccupied)	Ground Floor to be Used Only (Second Storey Unoccupied): 135 m <sup>2</sup>	1 per 18.5 m <sup>2</sup> GFLA	8 spaces
<b>TOTAL PARKING REQUIRED</b>			<b>484 spaces</b>
<b>PARKING PROVIDED</b>			
Surface	Barrier Free: 1 space, Standard 2.75x6.0 m: 4 spaces		5 spaces
Underground	Barrier Free: 8 spaces, Standard 2.75x6.0 m: 209 spaces		217 spaces
<b>TOTAL PARKING PROVIDED</b>			<b>222 spaces</b>

**EXISTING SITE-SPECIFIC GENERAL COMMERCIAL 7.14.56 ZONING RELIEF TABLE**

BY-LAW 7.14.56	BY-LAW REQUIREMENT	PROVIDED	BY-LAW RELIEF REQUESTED
a) Minimum Lot Frontage	300.0 m	305.12 m	None
b) Minimum Lot Depth	120 m	121 m	None
c) Minimum Landscaped Open Space	50%	73.8 %	None
d) Maximum Lot Coverage	12%	20.7 %	None
e) Minimum main building setbacks in accordance with Figure 7.14.56(F)	93.75 m	137.6 m	None
f) Minimum vehicular access ramp setback	30.48 m	137.6 m	None
g) Maximum building height	17.35 m	24.74 m	8.09 m
h) Maximum seating capacity for restaurant	200 seats	99 seats River View Restaurant, 240 seats Upper Banquet Room, 39 seats Grand Salon, 34 seats Private Lounge, 118 seats Lower Restaurant, 266 seats Lower Banquet Room, 786 seats Total	600 seats, 5 rooms
i) Maximum number of rooms for the hotel	106	111	5 rooms
j) Maximum ground floor area of all buildings in the commercial zone	4,181 m <sup>2</sup>	5,695.6 m <sup>2</sup>	1,600 m <sup>2</sup>
k) Maximum floor area of the spa	185.8 m <sup>2</sup>	1,707.6 m <sup>2</sup>	400 m <sup>2</sup>
l) Maximum ground floor area of Arts & Learning Center	1250 m <sup>2</sup>	Not Applicable	None
m) Devonian House: No other commercial use shall be permitted except for a maximum of 8 guest rooms associated as part of the hotel use		Restaurant	Restaurant Use to be permitted



**ZONING PLAN  
GENERAL COMMERCIAL  
& OPEN SPACE  
144 & 176 John St**

DATE	REVISIONS	DATE	REVISIONS
14-C-07/20	FOR ZONING		

**RITZ-CARLTON DEVELOPMENT**  
144, 176 & 200 John St, 856 Charlotte St  
Niagara-on-the-Lake

DATE: Nov. 18/22  
SCALE: 1:100  
DRAWN BY: MRW  
CHECK BY: PJL

**A.2 – Excerpt from Niagara Region 2016 Master Servicing Plan**  
**Volume 4 – Part D**

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## D. NIAGARA-ON-THE-LAKE WASTEWATER TREATMENT PLANT

### D.1 Existing System Overview

The Niagara-on-the-Lake wastewater system services the Old Town and Virgil areas of the Town of Niagara-on-the-Lake. The system services an existing population of 10,297 and 5,990 employees.<sup>1</sup>

The system is serviced by the Niagara-on-the-Lake Wastewater Treatment Plant, located on 1550 Lakeshore Road, Niagara-on-the-Lake. The Niagara-on-the-Lake Wastewater Treatment Plant is a conventional treatment facility with a current rated capacity of 8.0 MLD, a peak flow capacity of 34.7 MLD<sup>2</sup>.

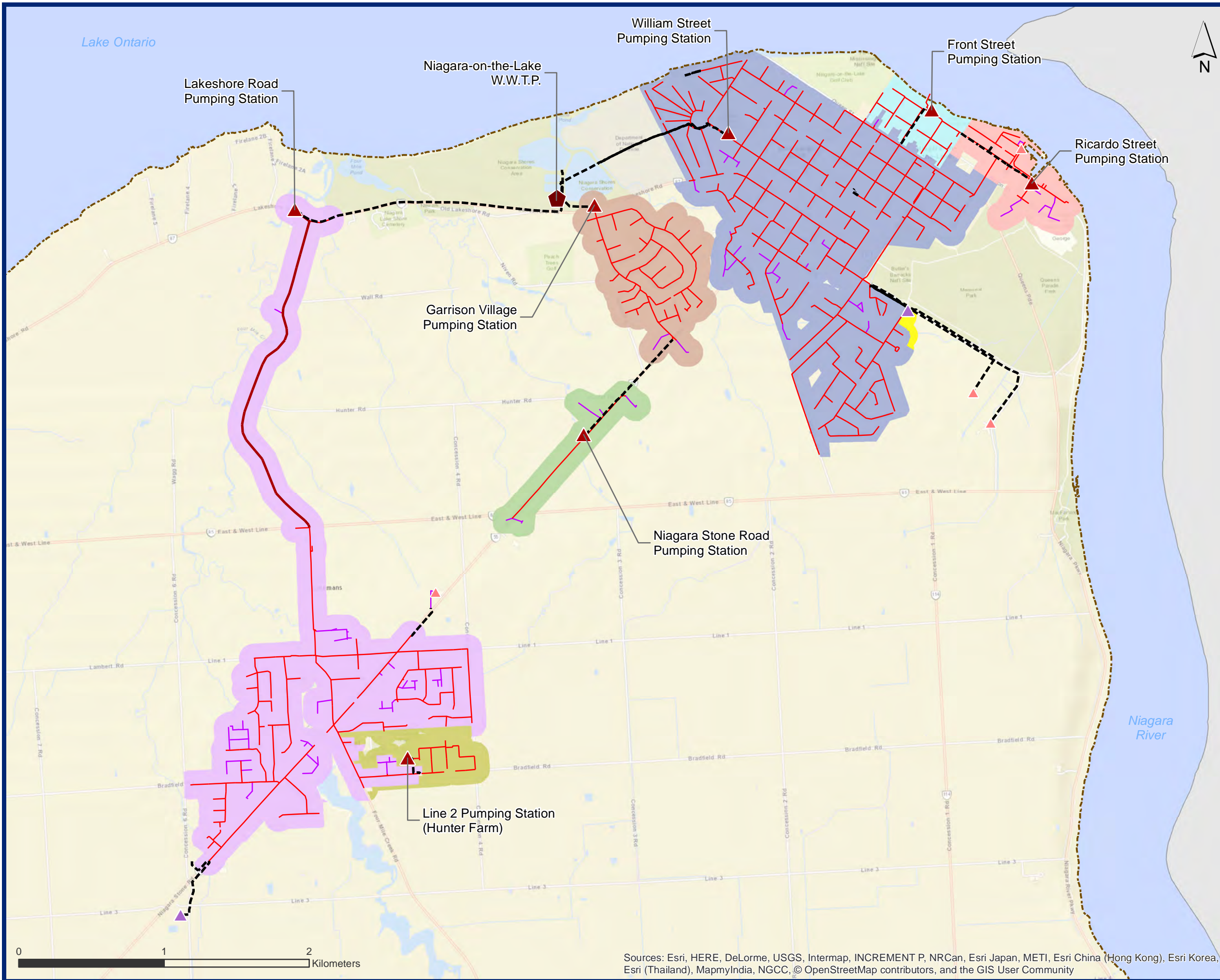
Figure 4.D.1 presents an overview of the wastewater system, and Figure 4.D.2 shows a schematic of the wastewater system.

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<sup>1</sup> Hemson Consulting Ltd, 2016. *Niagara Region TAZ Forecasts to 2041*

<sup>2</sup> Ministry of Environment, 10 September 2014. *Ammeded Environmental Compliance Approval. Number 8314-9MHHJQ*

Lake Ontario



Wastewater Facilities

- Wastewater Treatment Plant
- Combined Sewage Detention Facility
- Lagoon
- Odour Control Facility
- Leachate Pumping Station
- Regional Pumping Station
- Municipal Pumping Station
- Private Pumping Station
- Regional Wastewater Network
- Local Wastewater Network
- Private Wastewater Network
- Forcemain

Wastewater Catchments\*

\*Catchment limits are shown based on property boundaries and are within 100 m of sewers.

- Front Street
- Garrison Village
- Lakeshore Road
- Line 2 (Hunter Farm)
- Niagara Stone Road
- Ricardo Street
- Romance Cards Inc.
- St. Michaels Catholic Elementary School
- William Street

Figure 4.D.1 Existing Wastewater System Niagara-on-the-Lake WWTP

0 1 2 Kilometers

Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), MapmyIndia, NGCC, © OpenStreetMap contributors, and the GIS User Community







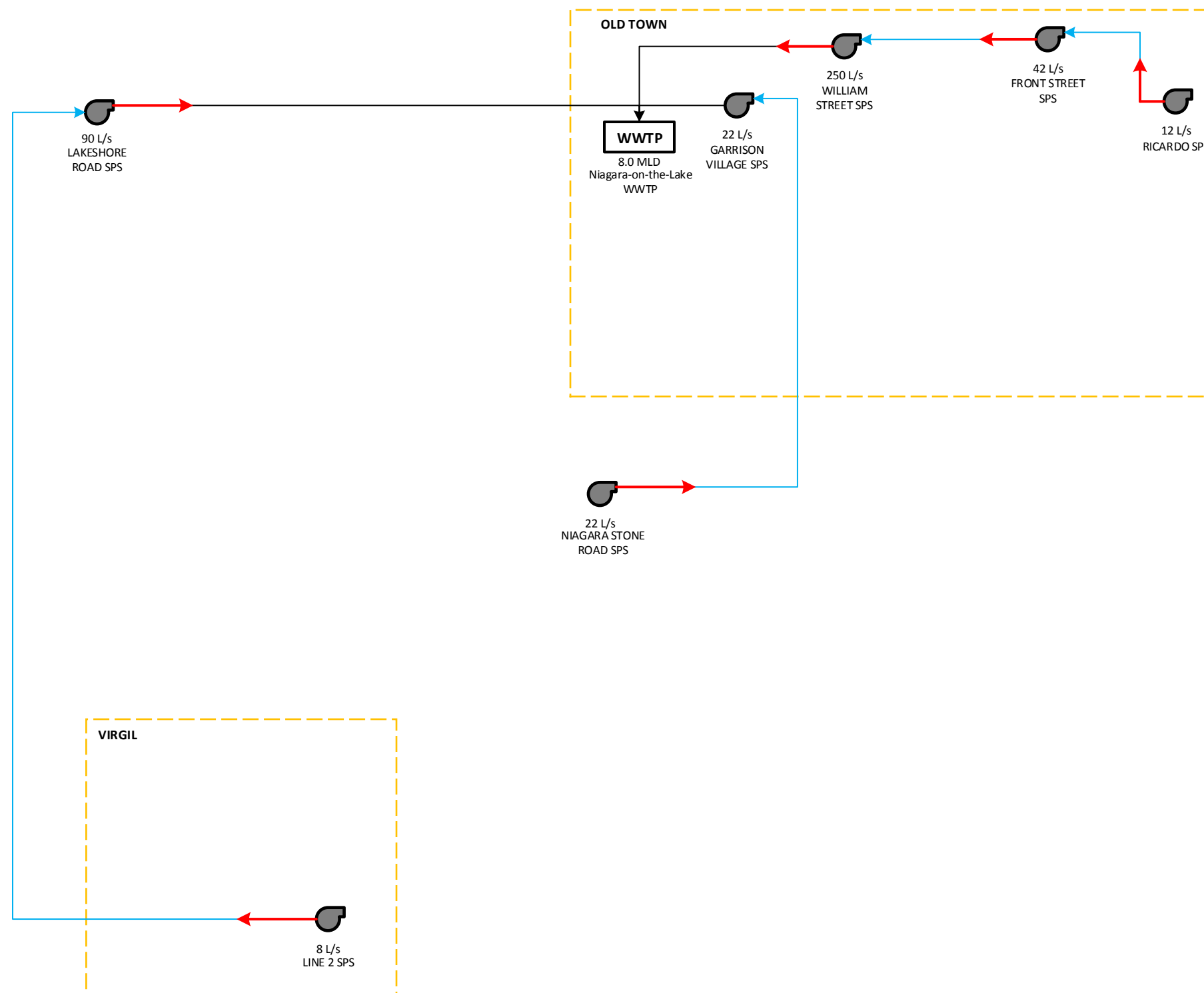
### 2016 Master Servicing Plan

Niagara-on-the-Lake WWTP

### EXISTING COLLECTION SCHEMATIC

#### Legend

- WWTP** (Rated Capacity) Wastewater Treatment Plant
-  (Firm Capacity) Sewage Pumping Station
-  Forcemain
-  Connection from SPS to SPS
-  Connection from SPS to WWTP



### D.1.1 Service Area Overview

Table 4.D.1 provides a list of facility catchments and their areas. Refer to Figure 4.D.1 for the catchment areas of each facility.

**Table 4.D.1 Facilities and Catchment Areas**

Facility	Catchments	Catchment Area (ha)
Niagara-on-the-Lake Wastewater Treatment Plant (WWTP)	<b>Niagara-on-the-Lake WWTP</b> (Including Sub Catchments) Garrison Village SPS Lakeshore Road SPS William Street SPS	785.7
	<b>Niagara-on-the-Lake WWTP</b> (Excluding Sub Catchments)	0.0
Garrison Village Sewage Pumping Station (SPS)	<b>Garrison Village SPS</b> (Including Sub Catchments) Niagara Stone Road SPS	112.3
	<b>Garrison Village SPS</b> (Excluding Sub Catchments)	78.9
Niagara Stone Road SPS	Niagara Stone Road SPS	33.4
Lakeshore Road SPS	<b>Lakeshore Road SPS</b> (Including Sub Catchments) Line 2 SPS	295.4
	<b>Lakeshore Road SPS</b> (Excluding Sub Catchments)	267.3
Line 2 SPS	Line 2 SPS	28.0
William Street SPS	<b>William Street SPS</b> (Including Sub Catchments) Front Street SPS	378.1
	<b>William Street SPS</b> (Excluding Sub Catchments)	321.1
Front Street SPS	<b>Front Street SPS</b> (Including Sub Catchments) Ricardo Street SPS	56.9
	<b>Front Street SPS</b> (Excluding Sub Catchments)	20.8
Ricardo Street SPS	Ricardo Street SPS	36.1

### D.1.2 Facility Overview

**Table 4.D.2 Wastewater Treatment Plant Overview**

Plant Name	Niagara-on-the-Lake Wastewater Treatment Plant
Address	1550 Lakeshore Road, Niagara-on-the-Lake
Discharge Water	Lake Ontario
Rated Capacity: Average Daily Flow	8.0 MLD
Rated Capacity: Peak Flow Rate (Dry Weather)	Not Available
Rated Capacity: Peak Flow Rate (Wet Weather)	34.7 MLD
Key Processes	<ul style="list-style-type: none"> <li>• Mechanical bar screens with air bubble diffuser system</li> <li>• Grit classifier with cyclone separators</li> <li>• Aeration</li> <li>• Final clarification</li> <li>• Sludge thickening</li> <li>• Anaerobic digestion</li> </ul>

**Table 4.D.3 Wastewater Treatment Plant Effluent Objectives**

<b>Effluent Parameter</b>	<b>Objective Concentration<sup>3</sup></b>
<b>CBOD<sub>5</sub></b>	15.0 mg/L
<b>TSS</b>	15.0 mg/L
<b>Total Phosphorus</b>	0.5 mg/L
<b>Total Ammonia Nitrogen</b> <i>April, May, and October</i>	5 mg/L
<i>June – September</i>	2 mg/L
<i>November – March</i>	10 mg/L
<b>E. Coli</b>	100 organisms/100 mL
<b>Total Chlorine Residual</b>	0.01 mg/L

<sup>3</sup> Ministry of Environment, 10 September 2014. Amended Environmental Compliance Approval. Number 8314-9MHHJQ

**Table 4.D.4 Pumping Station Overview**

Sewage Pumping Station	Location	Number of Pumps	ECA Firm Capacity (L/s)	Operational Firm Capacity (L/s)	Total Dynamic Head (m)
Garrison Village Sewage Pumping Station (SPS)	1788 Lakeshore Road, Niagara-on-the-Lake	2	62.0	21.7	25.0
Niagara Stone Road SPS	1974 Niagara Stone Road, Niagara-on-the-Lake	3	24.0	22.0	20.5
Lakeshore Road SPS	1340 Lakeshore Road, Niagara-on-the-Lake	2	90.0	90.0	31.5
Line 2 SPS	Hunter Farm Subdivision, Line 2 Road, Virgil	2	Unknown	8.0	Unknown
William Street SPS	433 William Street, Niagara-on-the-Lake	3	250.0	250.0	35.0
Front Street SPS	Front Street, Niagara-on-the-Lake	2	41.5	41.5	10.7
Ricardo Street SPS	Ricardo Street, Niagara-on-the-Lake	2	17.6	11.9	14.0

**Table 4.D.5 Forcemain Overview**

Sewage Pumping Station	Pump Station Operational Capacity (L/s)	Length (m)	Diameter (mm)	Capacity @ 2.5 m/s (L/s)
Garrison Village Sewage Pumping Station (SPS)	21.7	355	200	78.5
Niagara Stone Road SPS	22.0	902	150	44.2
Lakeshore Road SPS	90.0	2,078	300	176.7
Line 2 SPS	8.0	175	100	19.6
William Street SPS	250.0	846	400	436.9
Front Street SPS	41.5	360	200	78.5
Ricardo Street SPS	11.9	624	150	44.2

### D.1.3 Flows Overview

Table 4.D.6 shows the historical system flows obtained from wastewater treatment plant production data for 2011 to 2015. Table 4.D.7 shows the existing wastewater system flows by catchment.

**Table 4.D.6 Historic Niagara-on-the-Lake Wastewater Treatment Plant Flows**

Year	Average Dry Weather Flow		Average Daily Flow		Peak Daily Flow	
	MLD	L/s	MLD	L/s	MLD	L/s
<b>2011</b>	4.8	55.6	5.0	57.9	16.1	186.3
<b>2012</b>	3.9	45.1	4.1	47.5	8.7	100.7
<b>2013</b>	4.8	55.6	4.9	56.7	8.6	99.5
<b>2014</b>	4.1	47.5	4.3	49.8	10.2	118.1
<b>2015</b>	3.9	45.1	4.0	46.3	8.2	94.9
<b>5 Year Average</b>	4.3	49.8	4.4	50.9	10.3	119.2
<b>5 Year Peak</b>	4.8	55.6	5.0	57.9	16.1	186.3

**Table 4.D.7 Existing Wastewater System Flows by Catchment**

Catchment	Total Service Equivalent Population	Existing Average Dry Weather Flow (L/s)	Existing Design Peak Wet Weather Flow (L/s)	Existing 2-Year Flow (L/s)	Existing 5-Year Flow (L/s)
<b>Niagara-on-the-Lake Wastewater Treatment Plant (WWTP)</b>	16,287	50.9	326.4	276.7	358.8
<b>Niagara-on-the-Lake WWTP</b>	0	0.0	0.0	0.0	0.0
<b>Garrison Village Sewage Pumping Station (SPS)</b>	4,082	7.3	46.7	37.0	50.0
Garrison Village SPS	769	6.5	35.6	27.2	36.7
Niagara Stone Road SPS	3,313	0.8	11.1	9.8	13.3
<b>Lakeshore Road SPS</b>	4,866	12.8	110.1	75.0	101.0
Lakeshore Road SPS	3,533	9.8	96.1	68.1	91.7
Line 2 SPS	1,333	3.0	14.1	6.9	9.3
<b>William Street SPS</b>	7,339	30.7	169.6	180.0	247.1
William Street SPS	7,058	21.2	134.3	156.0	211.0
Front Street SPS	281	9.5	35.3	24.0	36.1
<i>Front Street SPS</i>	211	3.4	12.8	9.4	14.1
<i>Ricardo Street SPS</i>	70	6.1	22.5	14.6	22.0

Note: Flow numbers may not sum due to rounding.

## D.2 Growth Projections

### D.2.1 Population Projections and Allocations

Table 4.D.8 and Table 4.D.9 outline the existing and projected serviced population and employment by catchment.

**Table 4.D.8 Niagara-on-the-Lake Wastewater Treatment Plant Existing and Projected Serviced Population by Catchment**

Catchment	2014	2021	2026	2031	2036	2041	Growth 2014 - 41
Front Street Sewage Pumping Station (SPS)	102	106	107	108	111	115	12
Garrison Village SPS	742	870	983	1,071	1,103	1,111	369
Lakeshore Road SPS	2,069	2,448	3,008	3,192	3,257	3,317	1,248
Line 2 SPS	1,333	1,368	1,391	1,414	1,469	1,485	152
Niagara Stone Road SPS	1,776	1,666	1,656	1,768	2,013	2,129	353
Ricardo Street SPS	44	46	46	46	47	48	3
William Street SPS	4,229	4,458	4,492	4,536	4,636	4,748	518
<b>Total</b>	<b>10,297</b>	<b>10,961</b>	<b>11,684</b>	<b>12,135</b>	<b>12,635</b>	<b>12,953</b>	<b>2,657</b>

Note: Population numbers may not sum due to rounding.

**Table 4.D.9 Niagara-on-the-Lake Wastewater Treatment Plant Existing and Projected Serviced Employment by Catchment**

Catchment	2014	2021	2026	2031	2036	2041	Growth 2014 - 41
Front Street Sewage Pumping Station (SPS)	108	115	116	117	117	119	10
Garrison Village SPS	26	56	63	67	81	101	74
Lakeshore Road SPS	1,464	1,637	1,667	1,696	1,728	1,776	312
Line 2 SPS	0	0	0	0	0	0	0
Niagara Stone Road SPS	1,537	1,786	1,859	1,925	2,013	2,133	596
Ricardo Street SPS	26	27	27	27	27	28	2
William Street SPS	2,829	2,960	2,997	3,024	3,061	3,117	288
<b>Total</b>	<b>5,990</b>	<b>6,582</b>	<b>6,729</b>	<b>6,856</b>	<b>7,028</b>	<b>7,273</b>	<b>1,282</b>

Note: Population numbers may not sum due to rounding.

## D.2.2 Future Flow Projections

Table 4.D.10 and Table 4.D.11 summarize the projected peak dry weather flow and peak wet weather flow by catchment.

**Table 4.D.10 Projected Peak Dry Weather Flow by Catchment**

Catchment	2021 Design Peak Dry Weather Flow (L/s)	2026 Design Peak Dry Weather Flow (L/s)	2031 Design Peak Dry Weather Flow (L/s)	2036 Design Peak Dry Weather Flow (L/s)	2041 Design Peak Dry Weather Flow (L/s)
Front Street Sewage Pumping Station (SPS)	6.9	7.0	7.0	7.0	7.1
Garrison Village SPS	15.0	16.4	17.5	18.0	18.4
Lakeshore Road SPS	25.4	31.5	33.6	34.6	35.7
Line 2 SPS	6.5	6.7	7.0	7.6	7.8
Niagara Stone Road SPS	3.0	3.7	5.6	9.1	11.5
Ricardo Street SPS	12.2	12.2	12.2	12.2	12.3
William Street SPS	46.0	46.7	47.4	48.7	50.3
<b>Total</b>	<b>115.1</b>	<b>124.2</b>	<b>130.3</b>	<b>137.3</b>	<b>143.1</b>

The following presents an example calculation of projected peak dry weather flow.

$$\begin{aligned}
 & \text{2041 Peak Dry Weather Flow for William Street Sewage Pumping Station:} \\
 & = (2014 \text{ Average Dry Weather Flow} \times \text{Peaking Factor}) + \\
 & (2041 \text{ Equivalent Population} - 2014 \text{ Equivalent Population}) \times 275 \text{ L/cap/day} \times \\
 & 1 \text{ day}/86400 \text{ s} \times \text{Harmon Peaking Factor for Growth Population} \\
 & = (21.23 \text{ L/s} \times 2.0) + (7,865 - 7,058 \text{ people}) \times 275 \text{ L/cap/day} \times 1 \text{ day}/86400 \text{ s} \times 3.06 \\
 & = 50.3 \text{ L/s}
 \end{aligned}$$

**Table 4.D.11 Projected Peak Wet Weather Flow by Catchment**

Catchment	2021 Design Peak Wet Weather Flow (L/s)	2026 Design Peak Wet Weather Flow (L/s)	2031 Design Peak Wet Weather Flow (L/s)	2036 Design Peak Wet Weather Flow (L/s)	2041 Design Peak Wet Weather Flow (L/s)
Front Street Sewage Pumping Station (SPS)	12.9	12.9	12.9	13.0	13.1
Garrison Village SPS	37.6	39.0	40.1	40.6	40.9
Lakeshore Road SPS	101.9	108.0	110.1	111.1	112.1
Line 2 SPS	14.5	14.7	15.0	15.7	15.8
Niagara Stone Road SPS	12.6	13.3	15.1	18.7	21.1
Ricardo Street SPS	22.6	22.6	22.6	22.6	22.6
William Street SPS	137.8	138.5	139.2	140.5	142.1
<b>Total</b>	<b>339.8</b>	<b>348.9</b>	<b>355.0</b>	<b>362.1</b>	<b>367.8</b>

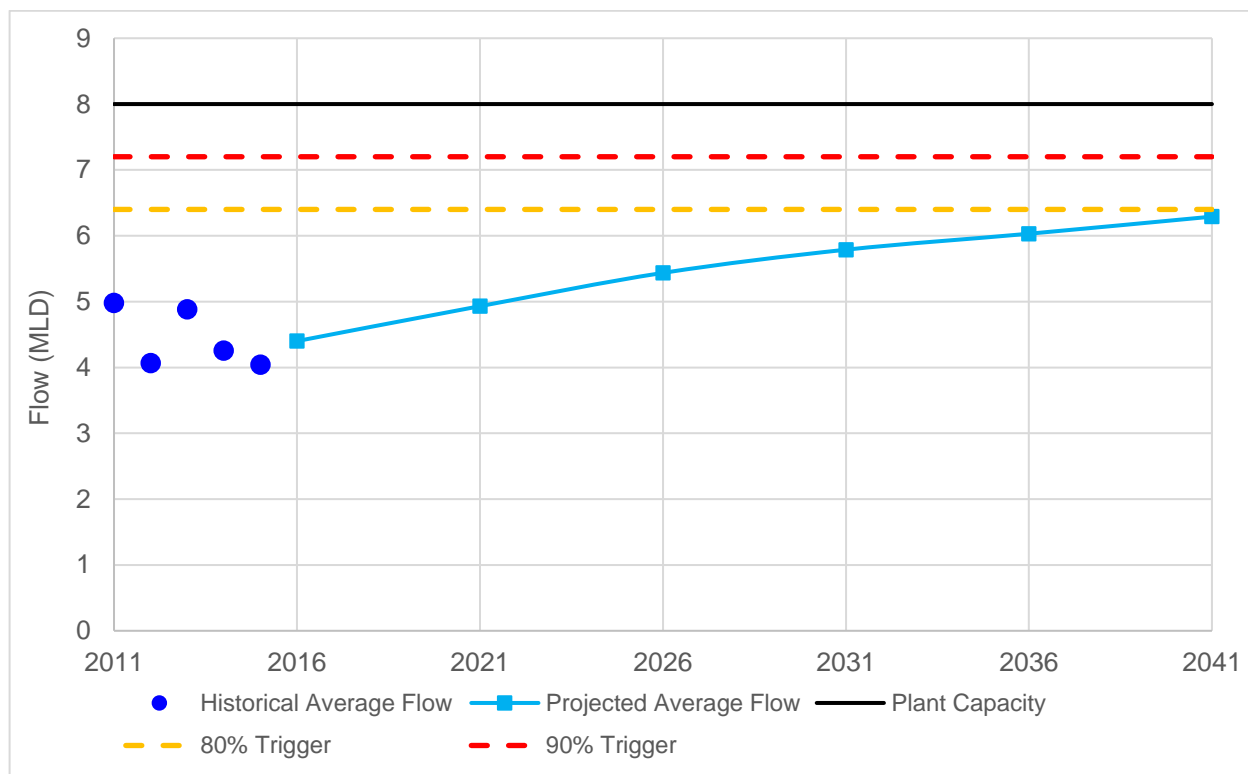
The following presents an example calculation of projected peak wet weather flow.

2041 Peak Wet Weather Flow for William Street Sewage Pumping Station:  
 = 2041 Peak Dry Weather Flow + 2041 Design RDII  
 = 2041 Peak Dry Weather Flow + (2041 Catchment Area x 0.286 L/s/ha)  
 = 50.3 L/s + (321.1 ha x 0.286 L/s/ha)  
 = 142.1 L/s

### D.3 Assessment of Wastewater Infrastructure (Existing and Future)

#### D.3.1 Treatment Plant Capacity

Figure 4.D.3 shows the projected future demands at the Niagara-on-the-Lake Wastewater Treatment Plant. The plant has surplus capacity and will not reach 80% capacity within the 2041 time horizon.



**Figure 4.D.3 Projected future demands at Niagara-on-the-Lake Wastewater Treatment Plant**

#### D.3.2 Sewage Pumping Station

Table 4.D.12 highlights the sewage pumping station existing and projected capacity.

**Table 4.D.12 System Sewage Pumping Station Performance**

Sewage Pumping Station	Contributing Catchments	Facility Operational Capacity (L/s)	Existing Design Peak Wet Weather Flow (L/s)	2041 Design Peak Wet Weather Flow (L/s)	2041 Surplus/Deficit (L/s)
Garrison Village Sewage Pumping Station (SPS)	Garrison Village SPS Niagara Stone Road SPS	21.7	46.7	60.9	-39.2
Niagara Stone Road SPS	Niagara Stone Road SPS	22.0	11.1	21.1	0.9
Lakeshore Road SPS	Lakeshore Road SPS Line 2 SPS	90.0	110.1	127.2	-37.2
Line 2 SPS	Line 2 SPS	8.0	14.1	15.8	-7.8
William Street SPS	William Street SPS Front Street SPS	250.0	169.6	177.7	72.3
Front Street SPS	Front Street SPS Ricardo Street SPS	41.5	35.3	35.6	5.9
Ricardo Street SPS	Ricardo Street SPS	11.9	22.5	22.6	-10.7

The following sewage pumping stations have projected pumping deficits:

- Garrison Village Sewage Pumping Station
- Lakeshore Road Sewage Pumping Station
- Line 2 Sewage Pumping Station
- Ricardo Street Sewage Pumping Station

### D.3.3 Forcemain

Table 4.D.13 highlights the existing and projected forcemain performance.

**Table 4.D.13 Forcemain Performance**

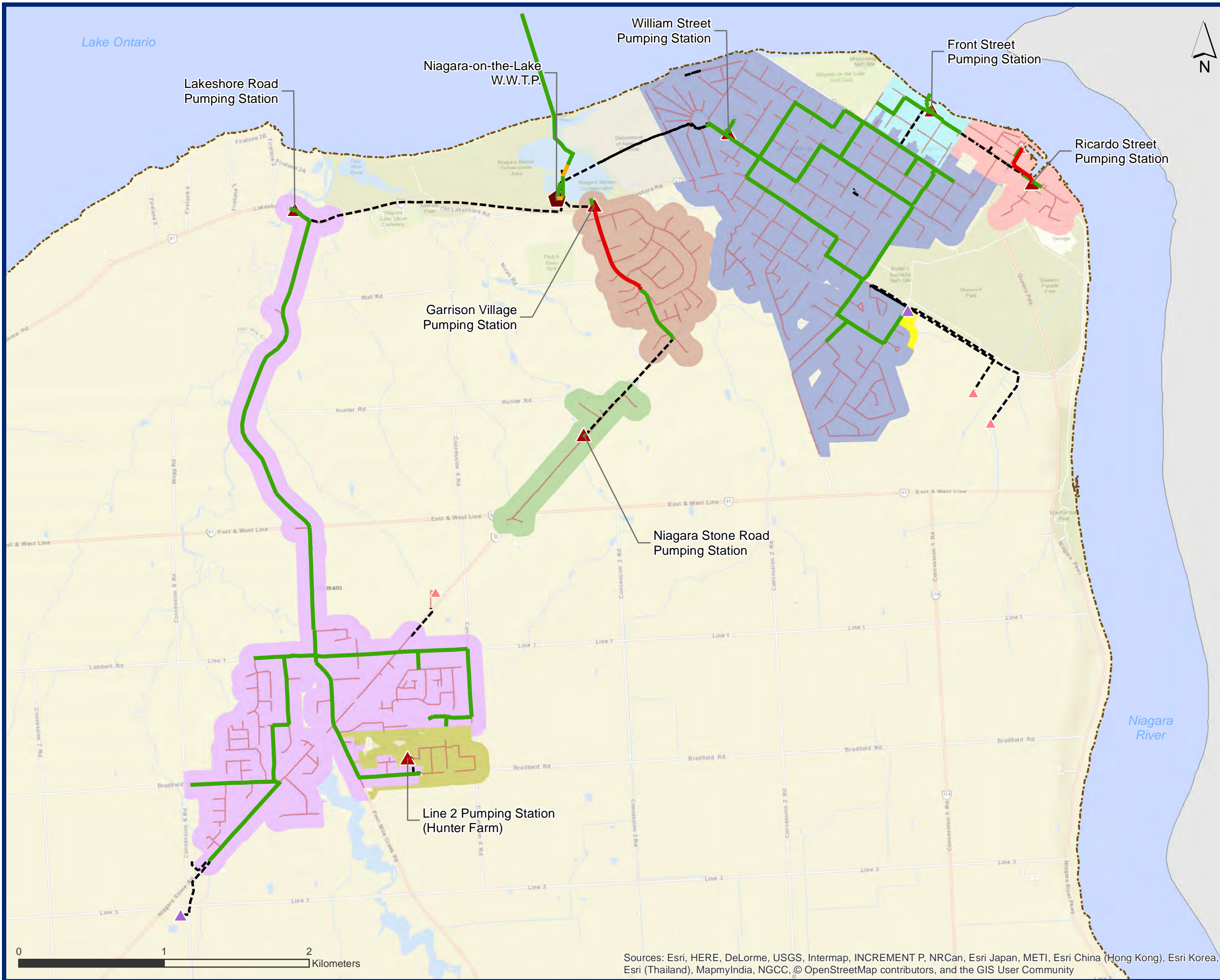
Sewage Pumping Station	Pump Station Operational Capacity (L/s)	Capacity @ 2.5 m/s (L/s)	Existing Design Peak Wet Weather Flow (L/s)	2041 Design Peak Wet Weather Flow (L/s)	2041 Surplus/Deficit (L/s)
Garrison Village SPS	21.7	78.5	46.7	60.9	17.6
Niagara Stone Road SPS	22.0	44.2	11.1	21.1	23.1
Lakeshore Road SPS	90.0	176.7	110.1	127.2	49.5
Line 2 SPS	8.0	19.6	14.1	15.8	3.8
William Street SPS	250.0	436.9	169.6	177.7	259.2
Front Street SPS	41.5	78.5	35.3	35.6	42.9
Ricardo Street SPS	11.9	44.2	22.5	22.6	21.6

All forcemains have a projected surplus capacity.

### D.3.4 Trunk Sewer

Figure 4.D.4 and Figure 4.D.5 highlight the existing and projected peak wet weather flow, respectively. Trunk sewers in the Garrison Village Sewage Pumping Station and Ricardo Street Sewage Pumping Station catchments are approaching capacity within the 2041 time horizon.

Lake Ontario



Wastewater Facilities

- Wastewater Treatment Plant
  - Combined Sewage Detention Facility
  - Lagoon
  - Odour Control Facility
  - Leachate Pumping Station
- Pumping Stations
    - Regional
    - Municipal
    - Private
  - Wastewater Network
    - Sanitary Sewers
    - Forcemain

Wastewater Catchments\*

\*Catchment limits are shown based on property boundaries and are within 100 m of sewers.

- Front Street
- Garrison Village
- Lakeshore Road
- Line 2 (Hunter Farm)
- Niagara Stone Road
- Ricardo Street
- Romance Cards Inc.
- St. Michaels Catholic Elementary School
- William Street

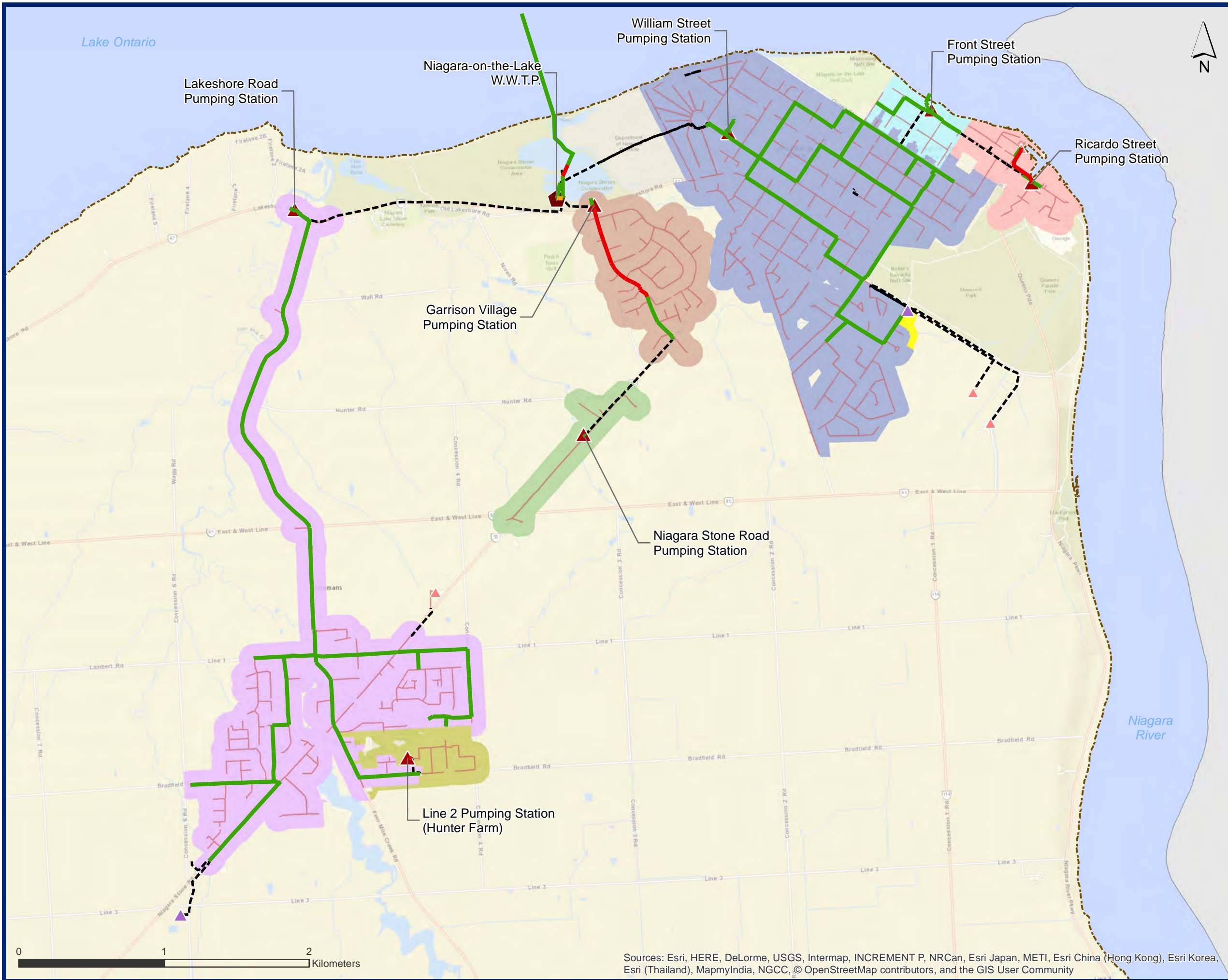
Capacity (d/D)

- < 0.85
- 0.85 - 0.99
- > 1.00

Figure 4.D.4  
Existing Peak Wet  
Weather Flow  
Niagara-on-the-Lake WWTP

0 1 2 Kilometers

Lake Ontario



Wastewater Facilities

- Wastewater Treatment Plant
- Combined Sewage Detention Facility
- Lagoon
- Odour Control Facility
- Leachate Pumping Station
- Regional Pumping Station
- Municipal Pumping Station
- Private Pumping Station
- Sanitary Sewers
- Forcemain

Wastewater Catchments\*

\*Catchment limits are shown based on property boundaries and are within 100 m of sewers.

- Front Street
- Garrison Village
- Lakeshore Road
- Line 2 (Hunter Farm)
- Niagara Stone Road
- Ricardo Street
- Romance Cards Inc.
- St. Michaels Catholic Elementary School
- William Street

Capacity (d/D)

- < 0.85
- 0.85 - 0.99
- > 1.00

Figure 4.D.5  
2041 Peak Wet  
Weather Flow  
Niagara-on-the-Lake WWTP

0 1 2 Kilometers

## D.4 System Opportunities and Constraints

Figure 4.D.6 highlights the existing opportunities and constraints.

### D.4.1 Niagara-on-the-Lake Wastewater Treatment Plant

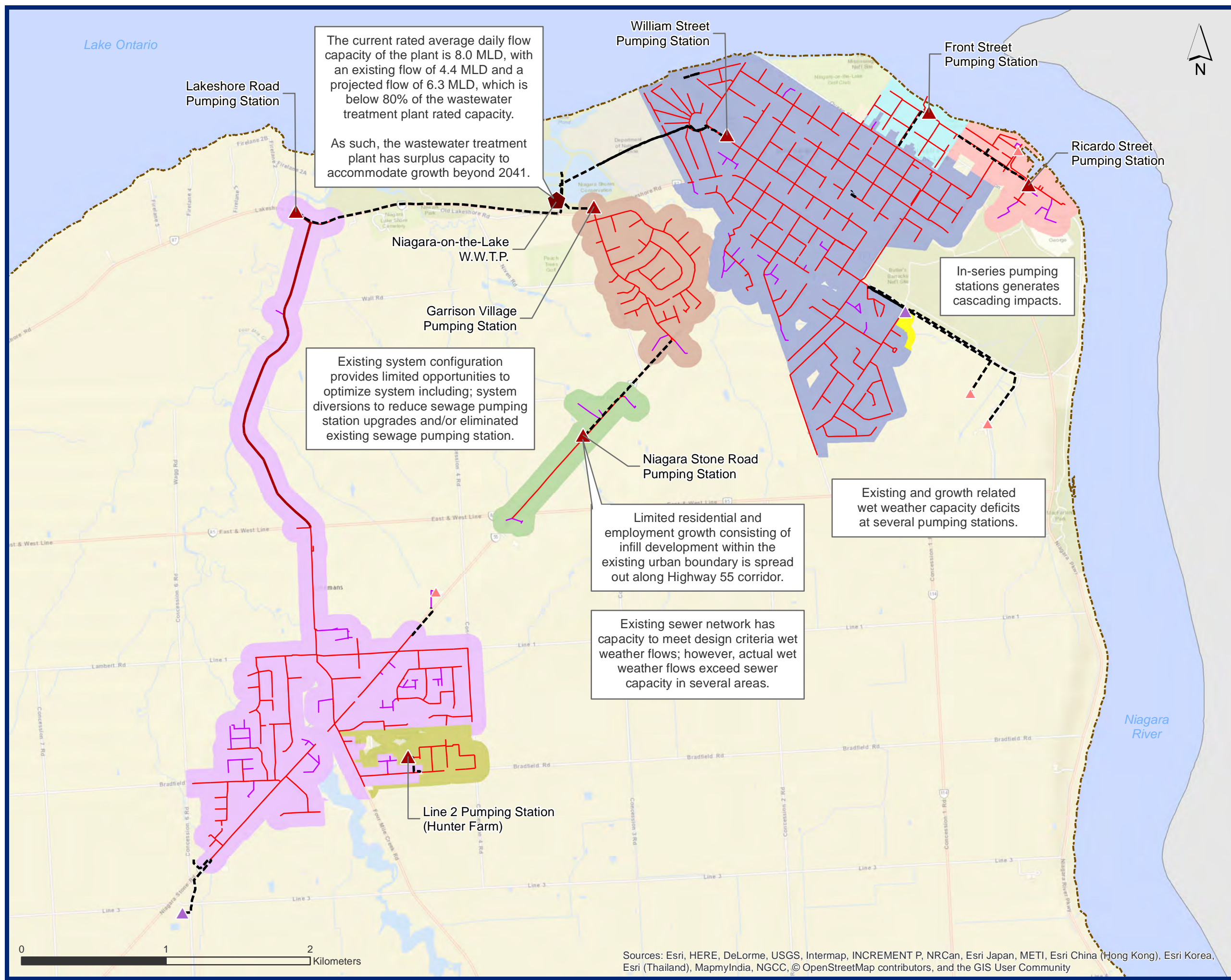
- The current rated average daily flow capacity of the plant is 8.0 MLD, with an existing flow of 4.4 MLD and a projected flow of 6.3 MLD, which is below 80% of the wastewater treatment plant rated capacity. As such, the wastewater treatment plant has surplus capacity to accommodate growth beyond 2041.

### D.4.2 Niagara-on-the-Lake

- Limited residential and employment growth consisting of infill development within the existing urban boundary is spread out along the Highway 55 corridor.
- Existing and growth related wet weather capacity deficits at several pumping stations.
- Existing sewer network has capacity to meet design criteria wet weather flows; however, actual wet weather flows exceed sewer capacity in several areas.

### D.4.3 System Optimization Opportunities

- In-series pumping stations generates cascading impacts.
- Existing system configuration provides limited opportunities to optimize system, including system diversions to reduce sewage pumping station upgrades and/or eliminate existing sewage pumping stations.



The current rated average daily flow capacity of the plant is 8.0 MLD, with an existing flow of 4.4 MLD and a projected flow of 6.3 MLD, which is below 80% of the wastewater treatment plant rated capacity.

As such, the wastewater treatment plant has surplus capacity to accommodate growth beyond 2041.

Existing system configuration provides limited opportunities to optimize system including; system diversions to reduce sewage pumping station upgrades and/or eliminated existing sewage pumping station.

Limited residential and employment growth consisting of infill development within the existing urban boundary is spread out along Highway 55 corridor.

Existing sewer network has capacity to meet design criteria wet weather flows; however, actual wet weather flows exceed sewer capacity in several areas.

Existing and growth related wet weather capacity deficits at several pumping stations.

In-series pumping stations generates cascading impacts.



Wastewater Facilities

- |  |                                    |  |                             |
|--|------------------------------------|--|-----------------------------|
|  | Wastewater Treatment Plant         |  | Regional Pumping Station    |
|  | Combined Sewage Detention Facility |  | Municipal Pumping Station   |
|  | Lagoon                             |  | Private Pumping Station     |
|  | Odour Control Facility             |  | Regional Wastewater Network |
|  | Leachate Pumping Station           |  | Local Wastewater Network    |
|  |                                    |  | Forcemain                   |

Wastewater Catchments\*

\*Catchment limits are shown based on property boundaries and are within 100 m of sewers.

- |  |                      |  |   |
|--|----------------------|--|---|
|  | Front Street         |  | Ricardo Street                          |
|  | Garrison Village     |  | Romance Cards Inc.                      |
|  | Lakeshore Road       |  | St. Michaels Catholic Elementary School |
|  | Line 2 (Hunter Farm) |  | William Street                          |
|  | Niagara Stone Road   |  |   |

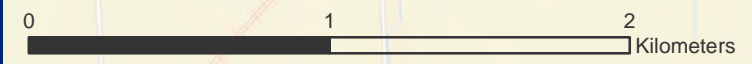


Figure 4.D.6  
System Opportunities and Constraints  
Niagara-on-the-Lake WWTP

## D.5 Assessment of Alternatives

No further alternatives beyond application of the hybrid management strategy below were identified.

- Provide capacity within Regional pumping stations and trunk sewers to convey peak wet weather flows up to the design criteria of 0.286 L/s/ha.
- Provide upstream flow management and peak flow management to address peak flows in systems where peak wet weather flows exceed the design criteria of 0.286 L/s/ha resulting in potential basement flooding and overflow risks.

## D.6 Preferred Servicing Strategy

The following is a summary of the Niagara-on-the-Lake wastewater servicing strategy, presented in Figure 4.D.7 and Figure 4.D.8:

- The Niagara-on-the-Lake Wastewater Treatment Plant is a newly constructed facility. The wastewater treatment plant has sufficient capacity to support growth to year 2041.
- The wastewater strategy comprises only of a few sewage pumping station capacity upgrades to address additional flows from growth.

### D.6.1 Pumping Stations

The following sewage pumping station upgrades are required:

- Lakeshore Road Sewage Pumping Station pump replacement: Increase capacity from 90 L/s to 142 L/s.
- Niagara Stone Road Sewage Pumping Station pump replacement: Increase capacity from 22 L/s to 27 L/s.
- Line 2 SPS pump replacement: Increase capacity from 8 L/s to 17 L/s.
- Garrison Village SPS pump replacement: Increase capacity from 62 L/s to 68 L/s.
- Ricardo SPS has no flow monitoring data, so flows are based on parcel allocation. Operations staff report no known capacity issues and there is no growth allocated to the catchment. As such, no project has been identified at Ricard SPS.

### D.6.2 Wet Weather

A significant element of the Niagara Region wastewater servicing strategy is the wet weather management program. The program is intended to deal with existing capacity constraints, and to provide for growth-related capacity without expanding/upgrading existing trunk infrastructure, or by minimizing the required expansion/upgrade.

The wet weather management program currently identifies overall preliminary priority, staging of location and target amount of inflow and infiltration reduction across all systems. This program provides for a proactive and targeted approach to addressing wet weather impacts. These wet weather management programs will need to be a joint initiative between the Region and local municipalities.

For the Niagara-on-the-Lake system, the following priority areas are identified:

- Virgil area, consisting of the Lakeshore Road Sewage Pumping Station catchment.
- Niagara-on-the-Lake, consisting of the William Street Sewage Pumping Station catchment.

Further flow monitoring and area-specific wet weather flow studies, including Pollution Prevention Control Plan, Inflow and Infiltration Study, Intensification Studies, Preferred Servicing Strategy are needed to identify area specific strategies and projects required to achieve the wet weather flow reduction objectives. Following the outcomes of the further studies, targeted funding can be applied outside the priority areas if the projects are found to address capacity issues and support growth capacity needs.

## **D.7 Capital Program**

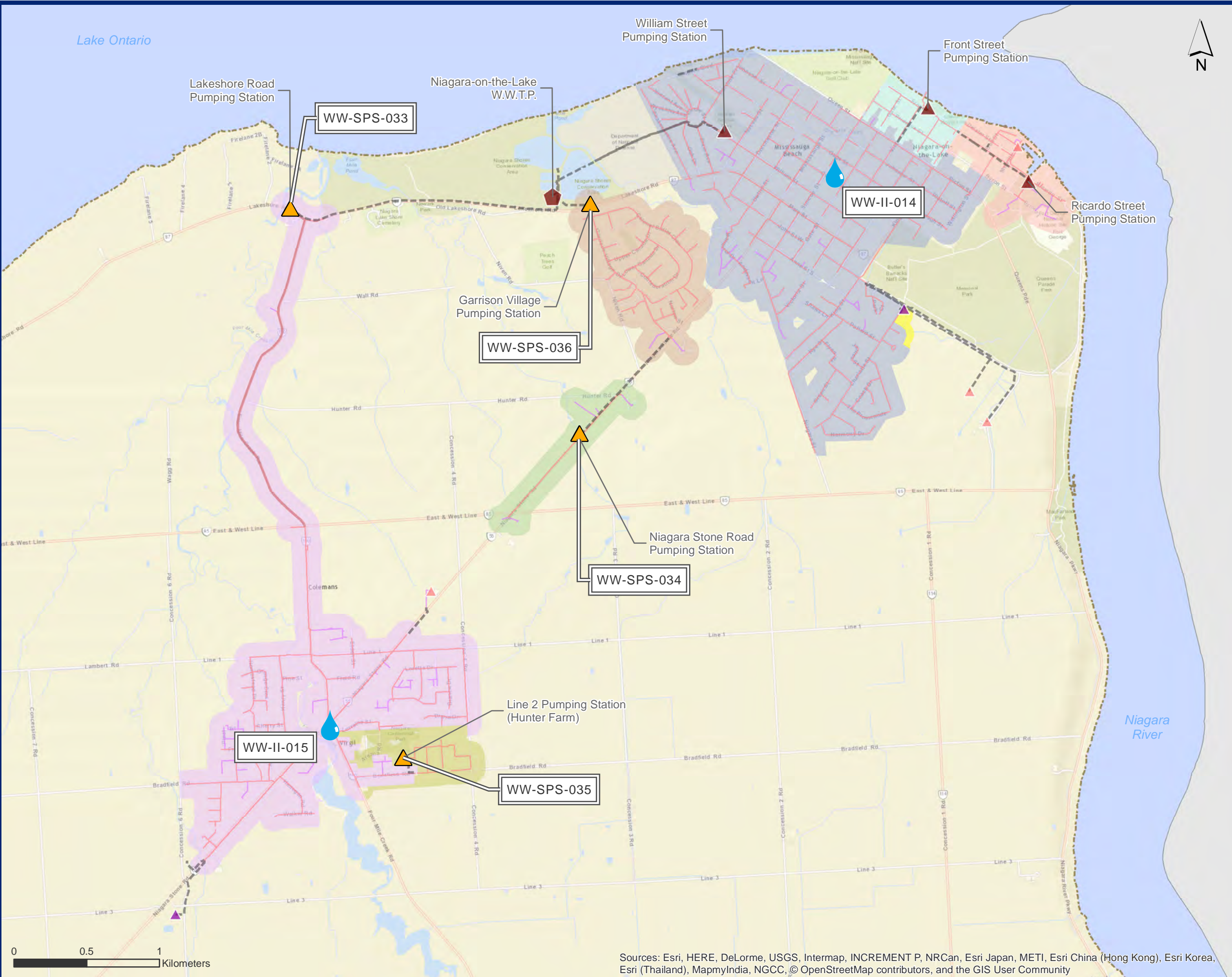
Table 4.D.14 summarizes the recommended project costing, implementation schedule and Class EA requirements.

### **D.7.1 Schedule B Project Files**

No Schedule B projects are anticipated for the Niagara-on-the-Lake Wastewater Treatment Plant system.

**Table 4.D.14 Summary of Niagara-on-the-Lake Wastewater Treatment Plant Capital Program**

Master Plan ID	Name	Description	Size / Capacity	Year in Service	Municipality	Class EA Schedule	Class EA Status	Project Type	Total Component Estimated Cost
WW-II-014	Wet weather reduction in Northeast Niagara-on-the-Lake	Wet weather reduction in Northeast Niagara-on-the-Lake	5 L/s reduction	2022-2031	Niagara-on-the-Lake	N/A	Dependent on outcome of wet weather flow study	Wet Weather Reduction	\$750,000
WW-II-015	Wet weather reduction in Virgil	Wet weather reduction in Virgil – Niagara-on-the-Lake	5 L/s reduction	2022-2031	Niagara-on-the-Lake	N/A	Dependent on outcome of wet weather flow study	Wet Weather Reduction	\$750,000
WW-SPS-033	Lakeshore Road Sewage Pumping Station (SPS) Pump Replacement - Niagara-on-the-Lake	Increase station capacity from 90 L/s to 142 L/s	142 L/s	2032-2041	Niagara-on-the-Lake	A+	Satisfied	Pumping	\$1,512,000
WW-SPS-034	Niagara Stone Road SPS Pump Replacement - Niagara-on-the-Lake	Increase station capacity from 22 L/s to 27 L/s	27 L/s	2032-2041	Niagara-on-the-Lake	A+	Satisfied	Pumping	\$834,000
WW-SPS-035	Line 2 SPS Pump Replacement - Niagara-on-the-Lake	Increase station capacity from 8 L/s to 17 L/s	17 L/s	2017-2021	Niagara-on-the-Lake	A+	Satisfied	Pumping	\$665,000
WW-SPS-036	Garrison Village SPS Pump Replacement - Niagara-on-the-Lake	Increase station capacity from 62 L/s to 68 L/s	68 L/s	2032-2041	Niagara-on-the-Lake	A+	Satisfied	Pumping	\$1,250,000
<b>Total</b>									<b>\$5,761,000</b>



MSP Wastewater Projects

- Treatment Plant
- Pumping Station
- Wet Weather Reduction
- Sanitary Sewer Projects
- Forcemain Projects

Wastewater Facilities

- |                                    |                             |
|------------------------------------|-----------------------------|
| Wastewater Treatment Plant         | Regional Pumping Station    |
| Combined Sewage Detention Facility | Municipal Pumping Station   |
| Lagoon                             | Private Pumping Station     |
| Odour Control Facility             | Regional Wastewater Network |
| Leachate Pumping Station           | Private Wastewater Network  |
|                                    | Local Wastewater Network    |
|                                    | Forcemain                   |

Wastewater Catchments\*

\*Catchment limits are shown based on property boundaries and are within 100 m of sewers.

- |                      |   |
|----------------------|---|
| Front Street         | Ricardo Street                          |
| Garrison Village     | Romance Cards Inc.                      |
| Lakeshore Road       | St. Michaels Catholic Elementary School |
| Line 2 (Hunter Farm) | William Street                          |
| Niagara Stone Road   |   |

Figure 4.D.7  
Preferred Wastewater Strategy  
Niagara-on-the-Lake WWTP

0 0.5 1 Kilometers

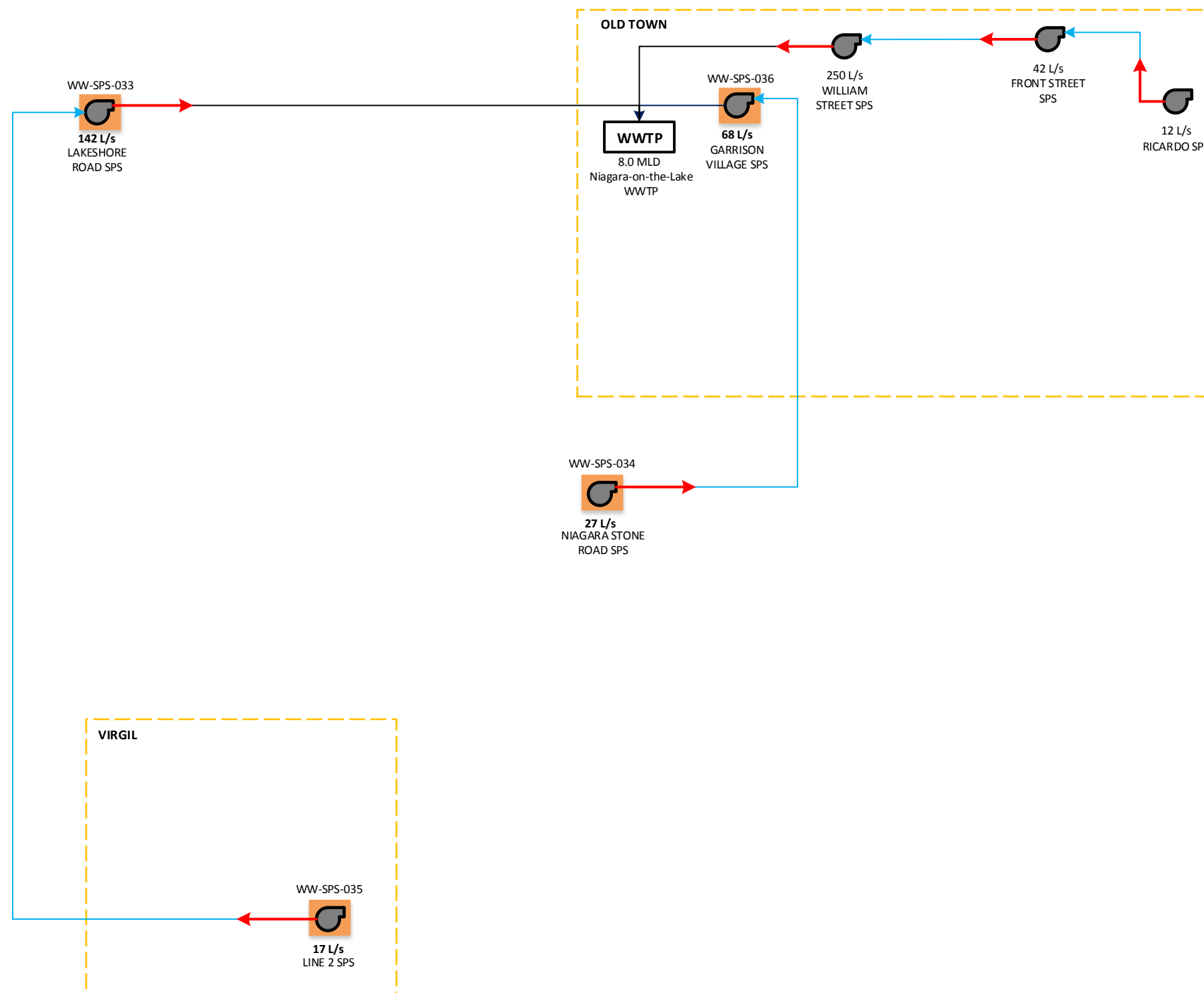
Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), MapmyIndia, NGCC, © OpenStreetMap contributors, and the GIS User Community



# 2016 Master Servicing Plan

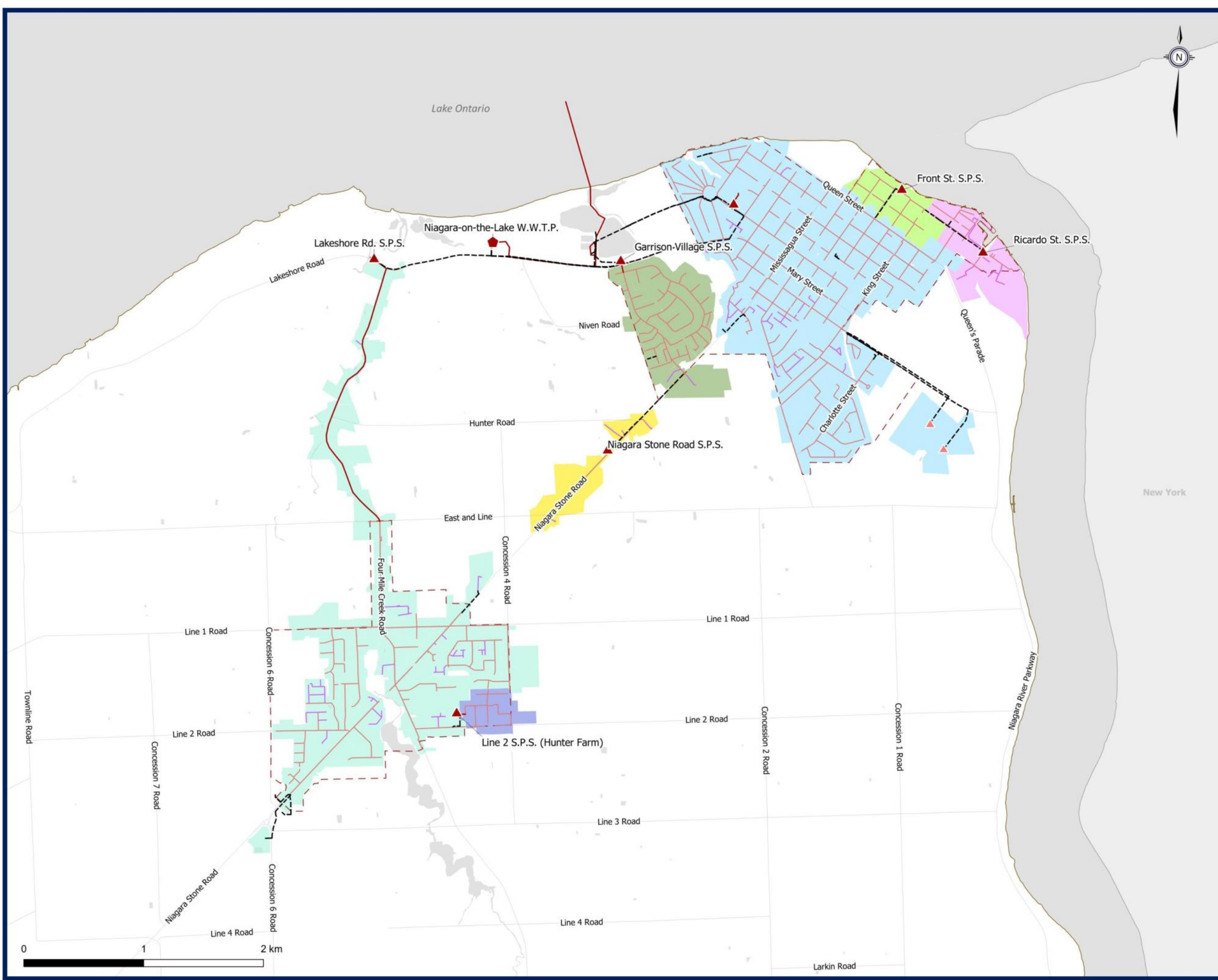
Niagara-on-the-Lake WWTP

## 2041 COLLECTION SCHEMATIC



- WWTP**  
RATED CAPACITY  
Wastewater Treatment Plant
- FIRM CAPACITY  
Sewage Pumping Station
- Forcemain
- Connection from SPS to SPS
- Connection from SPS to WWTP
- Facility Upgrade
- Upgrade Forcemain or Sewer
- New Forcemain or Sewer
- Decommission Project

## A.3 – Excerpt from Niagara Region 2021 Master Servicing Plan **Volume 4 – Part D**



**Existing Wastewater Infrastructure**

◆ Wastewater Treatment Plant (WWTP)	◆ Leachate Pumping Station
■ Biosolids Storage Facility	<b>Sanitary Pumping Stations (SPS)</b>
* Odour Control Facility	▲ Regional
	▲ Municipal
	▲ Private

**Wastewater Network**

--- Force Mains	— Local Sewers
— Regional Mains	— Private Sewers

**Wastewater Catchments**

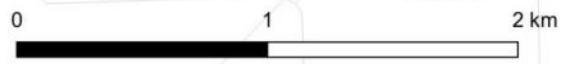
■ Front Street	■ Niagara Stone Road
■ Garrison Village	■ Ricardo Street
■ Lakeshore Road	■ William Street
■ Line 2	

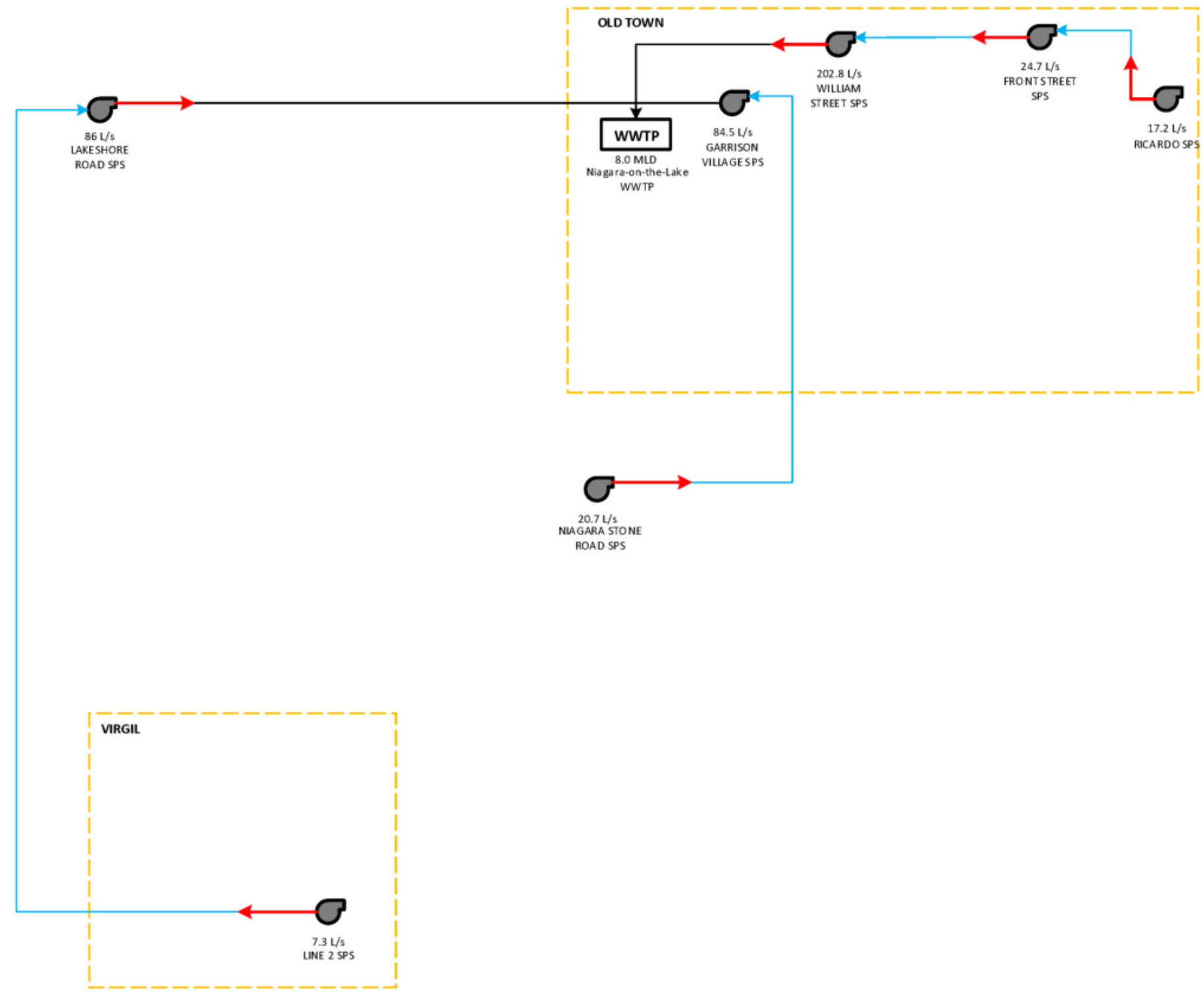
**Other Features**








□ Municipal Boundary
■ Waterbodies
□ Urban Area Boundary



**Figure 4.D.1**  
**NOTL WWTP System**  
Existing Wastewater Infrastructure





-  Wastewater Treatment Plant
-  RATED CAPACITY
-  Sewage Pumping Station
-  FIRM CAPACITY
-  Forcemain
-  Connection from SPS to SPS
-  Connection from SPS to WWTP

**Figure 4.D.2**  
**Niagara-on-the-Lake WWTP**  
Existing Wastewater Infrastructure Schematic

## D.2.2 Growth Population Projections and Allocations

Table 4.D.6 outlines the existing and projected serviced population and employment by catchment.

Table 4.D.6 NOTL Wastewater Treatment Plant Existing and Projected Serviced Population by Catchment

Sewage Pumping Station (SPS)	Existing Population & Employment			2051 Population & Employment			Post 2051 Population & Employment			2021-2051 Growth		
	Population	Employment	Population & Employment	Population	Employment	Population & Employment	Population	Employment	Population & Employment	Population Growth	Employment Growth	Total Growth
↳ Garrison Village SPS	1,268	288	1,555	1,270	341	1,611	1,380	370	1,751	3	53	56
↳ Niagara Stone Road SPS	128	58	187	141	90	231	158	101	259	13	32	45
↳ Lakeshore Road SPS	3,642	878	4,520	4,635	1,652	6,287	4,949	1,732	6,682	993	774	1,768
↳ Line 2 SPS	376	113	489	407	158	565	506	163	670	31	45	76
↳ William Street SPS	4,202	2,018	6,221	4,778	2,373	7,151	5,065	2,440	7,505	576	355	930
↳ Front Street SPS	231	415	646	233	534	767	234	543	776	2	119	121
↳ Ricardo Street SPS	211	381	592	214	490	705	216	498	714	4	109	113
<b>TOTAL</b>	<b>10,058</b>	<b>4,152</b>	<b>14,210</b>	<b>11,678</b>	<b>5,639</b>	<b>17,318</b>	<b>12,509</b>	<b>5,848</b>	<b>18,356</b>	<b>1,621</b>	<b>1,487</b>	<b>3,108</b>

Note: Population numbers may not sum due to rounding.

## D.3 System Performance

### D.3.1 Wastewater Treatment Plant

The starting point flow for the Crystal Beach WWTP was calculated using historic SCADA flow data. Ten years of data (2011 to 2020) was reviewed to provide historical context and assess overall long-term trends; however, the most recent five years of data was used to determine the average daily flow. **Table 4.D.7** shows the historical system flows obtained from wastewater treatment plant production data. Data from 2011-2019 were from the NOTL Lagoon and the 2020 data were from the new NOTL WWTP.

**Table 4.D.7 Historic NOTL Wastewater Treatment Plant Flows**

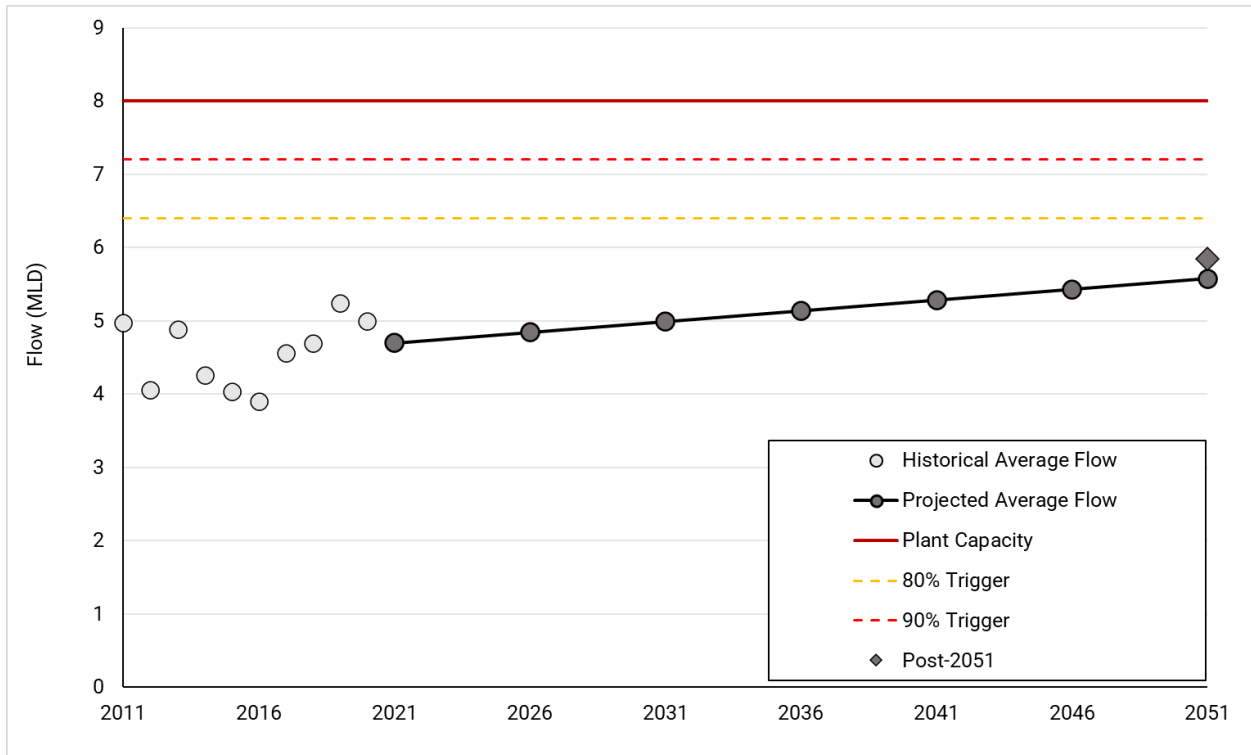
Year	Average Daily Flow		Peak Daily Flow	
	(MLD)	(L/s)	(MLD)	(L/s)
2011	5.0	57.6	16.1	186.4
2012	4.1	47.0	8.7	100.5
2013	4.9	56.5	8.6	99.2
2014	4.3	49.3	10.2	117.5
2015	4.0	46.8	0.0	0.0
<i>5 Year Average</i>	<b>4.4</b>	<b>51.4</b>	<b>8.7</b>	<b>100.7</b>
<i>5 Year Peak</i>	<b>5.0</b>	<b>57.6</b>	<b>16.1</b>	<b>186.4</b>
2016	3.9	45.7	8.0	92.9
2017	4.6	52.8	8.2	94.6
2018	4.7	54.2	8.1	93.6
2019	5.2	60.6	7.8	89.9
2020	5.0	58.3	18.1	209.7
<b>5-Year Average</b>	<b>4.7</b>	<b>54.3</b>	<b>10.0</b>	<b>116.1</b>
<b>5-Year Peak</b>	<b>5.2</b>	<b>60.6</b>	<b>18.1</b>	<b>209.7</b>
<b>10-Year Average</b>	<b>4.6</b>	<b>52.9</b>	<b>9.4</b>	<b>108.4</b>
<b>10-Year Peak</b>	<b>5.2</b>	<b>60.6</b>	<b>18.1</b>	<b>209.7</b>

<sup>(1)</sup> 2020 new NOTL WWTP data

The 10-year trend analysis showed that flows to the NOTL WWTP continue to reflect high flows in wetter years. The 5-year average flow has increased 6% from the 2016 MSP starting point.

The starting point flow used for the NOTL WWTP was 4.7 MLD.

**Figure 4.D.3** shows the projected future flows at the NOTL WWTP. The plant has surplus capacity and will not reach 80% capacity within the 2051-time horizon.



**Figure 4.D.3 Projected Sewage Generation at NOTL Wastewater Treatment Plant**

### D.3.2 Sewage Pumping Station

**Table 4.D.8** highlights the sewage pumping station operational firm capacities and the existing and projected flows. The existing average and peak dry weather flows were estimated using the wastewater system model, which was updated using the best available billing, flow monitoring, and SCADA data from 2018 to 2020.

**Table 4.D.8 System Sewage Pumping Station Performance**

Sewage Pumping System	Station Capacity	2021 Flows				2051 Flows			Post-2051 Flows		
	Operational Firm Capacity	Average Dry Weather Flow	Peak Dry Weather Flow	Design Allowance Peak Wet Weather Flow	5-Year Storm Peak Wet Weather Flow	Peak Dry Weather Flow	Design Allowance Peak Wet Weather Flow	5-Year Storm Peak Wet Weather Flow	Peak Dry Weather Flow	Design Allowance Peak Wet Weather Flow	5-Year Storm Peak Wet Weather Flow
	(L/s)	(L/s)	(L/s)	(L/s)	(L/s)	(L/s)	(L/s)	(L/s)	(L/s)	(L/s)	(L/s)
↳ Garrison Village SPS	84.5	12.9	14.8	55.2	38.6	16.2	56.7	40.2	18.3	58.8	42.2
↳ Niagara Stone Road SPS	20.7	2.3	2.9	14.2	11.2	3.5	14.8	11.8	3.9	15.2	12.2
↳ Lakeshore Road SPS	86.0	17.1	22.6	133.0	167.7	44.1	162.7	197.3	49.0	167.6	202.3
↳ Line 2 SPS	7.3	0.6	0.9	7.8	10.5	2.0	8.8	11.6	3.3	10.1	12.8
↳ William Street SPS	202.8	67.5	76.5	244.8	158.4	90.8	262.7	176.3	94.7	266.6	180.2
↳ Front Street SPS	24.7	13.3	25.0	51.7	83.2	28.4	55.2	86.7	28.7	55.4	86.9
↳ Ricardo Street SPS	17.2	6.2	7.2	23.9	14.5	8.9	25.6	16.2	9.1	25.8	16.3

The following SPS have existing and future deficiencies under both design allowance PWWF and 5-year storm, requiring upgrades to support existing and future flows.

- Lakeshore Road SPS
- Line 2 SPS
- Front Street SPS

The following SPS have existing and future deficiencies under the design allowance PWWF; however, the existing and projected 5-year storm PWWF is within the station's capacity, as such, the stations capacity is sufficient to support future flows.

- William Street SPS
- Ricardo Street SPS

The following stations have surplus capacity to support future flows.

- Garrison Village SPS
- Niagara Stone Road SPS

## **Appendix B**

---

### Population and Flow Estimate

Changes to Update the Niagara Region Sanitary Model for the Town of Niagara-on-the-Lake

Project: RITZ-CARLTON HOTEL, SPA, & RESIDENCES 144 JOHN STREET EAST  
 Project Number: 5625  
 Date: 2026-04-08  
 Designed By: T.P.Wong, P.Eng.  
 Checked by: T.P.Wong, P.Eng.



InfoSWMM Model Layout Map ID	Address	Proposed Breakdowns							Node Assigned	Applied Peaking Factor <sup>(1)</sup>	Area [ha]	Infiltration [L/s]	
		Units/GFA (ha)					Population						Average Flow
		Low density	Medium Density	High Density - 1bed	High Density - 2bed+	Commercial GFA (ha)	Res	Non-Res					[L/s]
<b>Variances as identified from the Public Notices</b>													
1	455 William Street	5					15	0	0.0443	180003895	3.1	Infill Development	
2	425 Dorchester Street	2					6	0	0.0177	180003873	3.1	Infill Development	
3	373 Victoria Street	1					3	0	0.0089	180003889	3.1	Infill Development	
4	125 Johnson Street	1					3	0	0.0089	180003220	3.1	Infill Development	
4	129 Johnson Street	1					3	0	0.0089	180003220	3.1	Infill Development	
5	325 King Street <sup>(5)</sup>				129	0.18	0	296	1.0620	180003433	3.1	Infill Development	
6	409 Mississauga St	1					3	0	0.0089	180003889	3.1	Infill Development	
7	513 Gate Street	2					6	0	0.0177	180003688	3.1	Infill Development	
8	551 Butler Street	2					6	0	0.0177	180003872	3.1	Infill Development	
9	2203 Niagara Stone Road		9				19	0	0.0561	180003935	3.1	Infill Development	
19	25 & 43 Castlereagh St					0.06	0	14	0.0502	180003214	3.1	Infill Development	
20	61 Melville Street		12				26	0	0.0767	180003464	3.1	Infill Development	
21	187 Queen Street	2					6	0	0.0177	180003419	3.1	Infill Development	
22	222 Gate Street <sup>(5)</sup>				18		0	36	0.1292	180003220	3.1	Infill Development	
23	223-227 Mary Street			24	17		63	0	0.1859	180003689	3.1	Infill Development	
24	228 Queen Street <sup>(5)</sup>				81	0.08	0	179	0.6422	180003420	3.1	Infill Development	
25	237 Anne Street	1					3	0	0.0089	180003561	3.1	Infill Development	
26	287 King Street	1					3	0	0.0089	180003215	3.1	Infill Development	
27	474 Simcoe Street	1					3	0	0.0089	180003688	3.1	Infill Development	
28	489 Regent Street	1					3	0	0.0089	180003559	3.1	Infill Development	
29	Vacant Northwest Parcel between 727 and 737 King Street				17		34	0	0.1003	180003402	3.1	Infill Development	
30	Royal George Theatre					0.50	0	107	0.3839	180003660	3.1	Infill Development	
<b>New Subdivisions as identified by inspection of historic aerial images and Official Plan Designations</b>													
10	Aberdeen Ln South	42					124	0	0.3660	180003935	3.1	1.68 0.48	
11	Windsor Circle	58					170	0	0.5017	180003688	3.1	1.74 0.50	
12	George Mannor	120					352	0	1.0389	180003688	3.1	1.65 0.47	
13	Shaw's Ln	58					170	0	0.5017	180003402	3.1	4.16 1.19	
14	46-100 Anne Street	73					214	0	0.6316	180006385	3.1	1.18 0.34	
15	Evergreen Ln	9					27	0	0.0797	180006385	3.1	0.32 0.092	
<b>New Commercial Area as identified in the Official Plan</b>													
16	526 Regent Street <sup>(5)</sup>	0					0	204	0.7327	180003559	3.1	2.27 0.649	
<b>Subject development</b>													
17	Residence Site			36	198	0.09	438	20	1.3645	180003396	3.86	13.59 3.89	
	Ritz Carlton Hotel / Spa <sup>(5)</sup>				111	0.52	0	333	1.1948	180003396	3.86		

Notes:

1	Peaking factors assigned to existing new developments set based on total sewershed population. The majority of new sanitary demand flows are lateral to node 180003893 which is at the intersection of Dorchester Street and William Street. This node is near to the William SPS and as such, the peaking factor based on the sewershed is appropriate. It should be note that the peaking factor was based on the total equivalent population in 2021. Using this peaking factor criteria into the future will conservatively estimate peak flows.																								
2	Peaking factor for subject site set based on population draining to node 180003396 including subject site and neighbouring hotel plan. This allows for conservative estimation of downstream flows.																								
3	New Commercial Area population calculated based on lot area times 90 pph/ha																								
4	For details on the population, infiltration rates, and average flows, please refer to the Functional Servicing Report for the Subject Site. Subject lands serviced by pumping station. Flow rate from pumping station set the peak flow from the subject lands.																								
5	The application is proposed to be developed as a hotel. Population estimated from bed-room types should be considered as non-residential population. Employment generation rate of 310 L/c/d used to estimate the average flow.																								
6	<p><b>Population Density (From Nigara Region's 2022 Development Charge Background Study)</b></p> <table border="0"> <tr> <td>Low Density</td> <td>2.929</td> <td>ppu</td> </tr> <tr> <td>Medium Density</td> <td>2.093</td> <td>ppu</td> </tr> <tr> <td>High Density - 1-Bed</td> <td>1.214</td> <td>ppu</td> </tr> <tr> <td>High Density - 2-Bed+</td> <td>1.991</td> <td>ppu</td> </tr> <tr> <td>Commercial</td> <td>500</td> <td>sqft/person</td> </tr> </table> <p><b>Generation Rate (From Nigara Region's 2021 Water Wastewater Master Servicing Plan)</b></p> <table border="0"> <tr> <td>Residential</td> <td>255</td> <td>L/c/d</td> </tr> <tr> <td>Employment</td> <td>310</td> <td>L/c/d</td> </tr> </table> <p><b>Infiltration Rate (From Nigara Region's 2021 Water Wastewater Master Servicing Plan)</b></p> <table border="0"> <tr> <td>New Developments</td> <td>0.286</td> <td>L/s/ha</td> </tr> </table>	Low Density	2.929	ppu	Medium Density	2.093	ppu	High Density - 1-Bed	1.214	ppu	High Density - 2-Bed+	1.991	ppu	Commercial	500	sqft/person	Residential	255	L/c/d	Employment	310	L/c/d	New Developments	0.286	L/s/ha
Low Density	2.929	ppu																							
Medium Density	2.093	ppu																							
High Density - 1-Bed	1.214	ppu																							
High Density - 2-Bed+	1.991	ppu																							
Commercial	500	sqft/person																							
Residential	255	L/c/d																							
Employment	310	L/c/d																							
New Developments	0.286	L/s/ha																							

# **Appendix C**

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## **Model Inputs**

PROJECT No.: 5625  
 DATE: 2026-04-10  
 DESIGNED BY: T.P.Wong  
 CHECKED BY: T.P.Wong

**Updated Sanitary Sewer Information**



**SCHAEFFERS**  
 Consulting Engineers

SCHAEFFER & ASSOCIATES LTD.

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Pafford Street and King Street Sewer Information from Drawings: NOTLSAN-0044, NOTLSAN-0126, NOTLSAN-0271, NOTLWAT-0212

Location		US Invert (ft)	Length (ft)	US Invert (m)	DS Invert (m)	Length (m)	Grade	Size (in)	Size (mm)
180003401	180003402	278.32	235	84.832	84.610	71.63	0.0031	12	300
180003402	180006385			84.570	84.394	51.50	0.0034	14	350
180006385	180006196			84.394	84.318	22.30	0.0034	14	350
180006196	180005803			84.318	84.197	51.10	0.0024	18	450
180005803	180006197			84.197	84.147	21.10	0.0024	18	450
180006197	180003405			84.147	83.981	77.90	0.0021	18	450

Value Taken Directly From Plan and Profile Drawing

Value Calculated From Measurement

**Scaled Peaking Factor Diurnal Profiles**

Profile ID	Res-3.1	Non-Res-3.1
population	6300-8000	6300-8000
Peaking factor		
0:00	3.1	3.1
1:00	0.378	0.390
2:00	0.089	0.177
3:00	0.024	0.066
4:00	0.000	0.000
5:00	0.035	0.018
6:00	0.252	0.144
7:00	1.417	0.334
8:00	3.100	1.118
9:00	2.454	1.394
10:00	1.832	2.020
11:00	1.373	3.100
12:00	1.161	2.259
13:00	0.950	1.871
14:00	0.831	1.373
15:00	0.695	1.285
16:00	0.670	1.095
17:00	0.728	1.015
18:00	0.893	1.031
19:00	1.146	1.078
20:00	1.343	1.087
21:00	1.368	1.122
22:00	1.333	0.961
23:00	1.158	0.746
	0.775	0.317
	Residential	Non-Residential

Average	1.000	1.000
Sum	24.002	24.000

# **Appendix D**

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## **Model Outputs**

2041 Conditions - Dry Weather Flow - Pre-development to Post-Development Comparison															
								No Highlighting Indicates No Capacity Constraints				No Highlighting Indicates No Capacity Constraints			
								Yellow Indicates q/Q > 100%, d/D <100%				Yellow Indicates d/D > 70%			
								Red Indicates q/Q > 100%, d/D >100%				Red Indicates d/D > 100%			
Location	Link ID	Manhole		Pipe				Flow (q) (L/s)		Flow Capacity (q/Q <sub>full</sub> )		Depth (d) (m)		Depth Capacity (d/D)	
		U/S	D/S	Size (m)	Length (m)	Slope (%)	Q <sub>full</sub> (L/s)	Pre dev.	Post dev.	Pre dev.	Post dev.	Pre dev.	Post dev.	Pre dev.	Post dev.
Pafford Street*	189001794	180003396	180003397	0.300	68.30	0.15	37.6	3.0	16.8	8%	45%	0.06	0.15	20.4%	48.7%
Pafford Street	189001793	180003397	180003398	0.300	76.20	0.29	52.0	3.0	16.9	6%	32%	0.08	0.16	26.8%	54.0%
Pafford Street	189001792	180003398	180003399	0.300	76.50	0.14	36.0	4.2	18.0	12%	50%	0.08	0.16	26.8%	54.0%
Pafford Street	189001791	180003399	180003401	0.300	80.80	0.76	84.5	4.2	18.0	5%	21%	0.05	0.09	15.2%	31.3%
Pafford Street	189001790	180003401	180003402	0.300	74.10	0.30	52.7	6.2	20.6	12%	39%	0.07	0.14	24.3%	45.3%
King Street	189004273	180003402	180006385	0.350	51.50	0.34	85.3	9.5	23.3	11%	27%	0.09	0.13	26.3%	38.5%
King Street	189004218	180006385	180006196	0.350	22.30	0.34	85.2	12.9	26.8	15%	31%	0.09	0.13	26.5%	38.5%
King Street	189004061	180006196	180005803	0.450	51.10	0.24	138.7	12.9	26.8	9%	19%	0.09	0.13	20.7%	30.0%
King Street	189004113	180005803	180006197	0.450	21.10	0.24	138.8	13.0	26.8	9%	19%	0.10	0.14	22.1%	31.6%
King Street	189004053	180006197	180003405	0.450	77.90	0.21	131.6	13.0	26.8	10%	20%	0.10	0.14	22.1%	31.6%
King Street	189001289	180003405	180003556	0.450	76.50	0.34	166.5	13.0	26.9	8%	16%	0.09	0.12	19.1%	27.3%
King Street	189002039	180003556	180003315	0.450	35.40	0.34	165.3	13.1	27.0	8%	16%	0.09	0.12	19.1%	27.3%
King Street	189001290	180003315	180003430	0.450	117.40	0.36	170.5	13.5	27.3	8%	16%	0.09	0.12	19.0%	27.1%
King Street	189002045	180003430	180003431	0.450	66.80	0.36	170.2	13.5	27.3	8%	16%	0.09	0.12	19.2%	27.2%
King Street	189001291	180003431	180003432	0.450	120.50	0.35	168.5	13.5	27.3	8%	16%	0.09	0.13	20.0%	28.3%
King Street	189001292	180003432	180003433	0.450	122.10	0.34	167.2	13.5	27.4	8%	16%	0.09	0.13	20.0%	28.3%
King Street	189001293	180003433	180003438	0.450	19.70	0.36	171.2	16.9	30.7	10%	18%	0.26	0.28	57.2%	62.5%
King Street	189001295	180003438	180003214	0.450	79.20	0.35	168.9	17.1	30.9	10%	18%	0.10	0.13	21.5%	29.0%
Gage Street	189001296	180003214	180003215	0.450	41.30	0.37	172.4	17.4	31.2	10%	18%	0.10	0.13	21.8%	29.2%
Gage Street	189001298	180003215	180003216	0.450	120.30	0.35	168.5	17.5	31.3	10%	19%	0.10	0.13	21.8%	29.2%
Gage Street	189001299	180003216	180003217	0.450	73.40	0.36	170.7	17.5	31.3	10%	18%	0.10	0.13	21.8%	29.2%
Gage Street	189002043	180003217	180003664	0.450	75.70	0.35	168.4	17.5	31.3	10%	19%	0.10	0.13	21.8%	29.2%
Gage Street	189001300	180003664	180003219	0.450	71.70	0.35	169.4	17.5	31.3	10%	19%	0.10	0.13	21.8%	29.2%
Gage Street	189001301	180003219	180003220	0.450	75.30	0.35	168.5	17.6	31.4	10%	19%	0.10	0.13	22.3%	29.7%
Gage Street	189001302	180003220	180003221	0.450	76.40	0.35	168.2	18.4	32.2	11%	19%	0.10	0.13	22.3%	29.7%
Gage Street	189001303	180003221	180003222	0.450	69.90	0.35	169.1	18.4	32.2	11%	19%	0.14	0.17	31.4%	37.2%
Gage Street	189001613	180003222	180003223	0.600	79.30	0.23	293.3	34.6	48.9	12%	17%	0.14	0.17	23.5%	27.9%
Gage Street	189001614	180003223	180003224	0.600	79.50	0.26	310.3	33.8	48.2	11%	16%	0.15	0.18	25.4%	30.2%
Mississagua Street	189001616	180003224	180003202	0.600	66.70	0.16	248.2	33.8	48.2	14%	19%	0.15	0.18	25.4%	30.2%
Mississagua Street	189002015	180003202	180003201	0.600	85.20	0.22	290.7	33.5	47.9	12%	16%	0.14	0.16	23.1%	27.5%
Mississagua Street	189001780	180003201	180003775	0.600	66.70	0.24	300.7	34.0	48.4	11%	16%	0.14	0.16	23.1%	27.5%
Mississagua Street	189001779	180003775	180003889	0.600	82.50	0.33	354.5	33.8	48.1	10%	14%	0.15	0.17	24.7%	29.1%
William Street	189001617	180003889	180003890	0.600	72.90	0.20	276.7	34.9	49.1	13%	18%	0.15	0.17	24.7%	29.1%
William Street	189001618	180003890	180003891	0.600	76.40	0.36	366.4	34.8	48.9	9%	13%	0.16	0.20	27.4%	32.6%
William Street	189001619	180003891	180003892	0.600	80.90	0.10	197.9	34.8	49.0	18%	25%	0.17	0.21	29.0%	34.2%
William Street	18901620	180003892	180003893	0.600	76.47	0.18	261.8	34.7	48.7	13%	19%	0.20	0.23	33.7%	37.5%
William Street	18901622	180003893	180003894	0.600	81.88	0.17	256.6	61.1	75.2	24%	29%	0.20	0.23	33.7%	37.5%
William Street	18901623	180003894	180003898	0.600	65.32	0.25	308.6	60.9	75.1	20%	24%	0.20	0.22	32.8%	36.4%
William Street	18901624	180003898	180003303	0.600	106.18	0.21	279.5	60.9	75.0	22%	27%	0.20	0.22	32.8%	36.4%
William Street	18901625	180003303	180003302	0.600	28.49	0.34	356.4	60.9	75.0	17%	21%	0.17	0.18	27.7%	30.8%
William Street Sanitary Pumping St	18902049	180003302	180003301	0.600	22.00	0.64	489.8	62.9	77.0	13%	16%	0.15	0.16	24.2%	26.8%

Maximum Hydraulic Gradeline (HGL) Results

Printed on: 2026-04-14

Green Highlighting Shows HGL Freeboard is greater than 1.8 m

Yellow Highlighting Shows Freeboard is less than 1.8 m, but flow is contained within Pipe (i.e. no surcharge)

Red Highlighting Shows Freeboard is less than 1.8 m and pipe is surcharging

2041 Conditions - Dry Weather Flow - Pre-development to Post-Development Comparison

Location	Conduit (US)	MH	T/G (m)	Max Allowable HGL (m)	Minimum Obvert	Pre-Development		Post Development	
						Maximum HGL (m)	Freeboard (m)	Maximum HGL (m)	Freeboard (m)
Charlotte Street/Pafford Street*	189001794	180003396	89.40	87.60	86.68	86.44	2.95	86.53	2.87
Pafford Street	189001793	180003397	89.67	87.87	86.58	86.33	3.34	86.40	3.28
Pafford Street	189001792	180003398	89.30	87.50	86.36	86.14	3.16	86.22	3.08
Pafford Street	189001791	180003399	89.16	87.36	86.23	85.98	3.18	86.03	3.13
Pafford Street	189001790	180003401	88.63	86.83	85.13	84.90	3.73	84.97	3.66
Pafford Street/King Street	189004273	180003402	88.24	86.44	84.91	84.65	3.59	84.69	3.55
King Street/Evergreen Lane	189004218	180006385	88.16	86.36	84.74	84.49	3.67	84.53	3.63
King Street	189004061	180006196	88.25	86.45	84.67	84.41	3.83	84.45	3.79
King Street	189004113	180005803	88.17	86.37	84.65	84.29	3.88	84.33	3.84
King Street/Anne Street	189004053	180006197	88.00	86.20	84.60	84.25	3.75	84.29	3.71
King Street	189001289	180003405	87.84	86.04	84.43	84.07	3.77	84.10	3.74
King Street/John Street West	189002039	180003556	87.38	85.58	84.17	83.81	3.57	83.84	3.54
King Street	189001290	180003315	86.34	84.54	84.05	83.69	2.65	83.72	2.62
King Street/Mary Street	189002045	180003430	85.99	84.19	83.63	83.27	2.72	83.30	2.68
King Street	189001291	180003431	86.90	85.10	83.39	83.03	3.87	83.07	3.83
King Street	189001292	180003432	86.34	84.54	82.97	82.61	3.72	82.65	3.69
King Street/Centre Street	189001293	180003433	87.59	85.79	82.36	82.17	5.42	82.20	5.39
King Street	189001295	180003438	87.65	85.85	82.29	81.94	5.71	81.97	5.68
King Street/Gage Street	189001296	180003214	87.86	86.06	82.02	81.66	6.20	81.69	6.17
Gage Street	189001298	180003215	87.48	85.68	81.86	81.51	5.97	81.55	5.94
Gage Street/Regent Street	189001299	180003216	86.81	85.01	81.44	81.09	5.72	81.12	5.69
Gage Street	189002043	180003217	86.01	84.21	81.18	80.83	5.18	80.86	5.14
Gage Street/Victoria Street	189001300	180003664	85.15	83.35	80.92	80.56	4.58	80.60	4.55
Gage Street	189001301	180003219	84.35	82.55	80.66	80.31	4.04	80.35	4.00
Gage Street/Gate Street	189001302	180003220	83.48	81.68	80.40	80.05	3.43	80.08	3.39
Gage Street	189001303	180003221	83.09	81.29	80.14	79.79	3.30	79.82	3.27
Gage Street/Simcoe Street	189001613	180003222	84.75	82.95	79.89	79.58	5.17	79.61	5.15
Gage Street	189001614	180003223	84.04	82.24	79.86	79.39	4.64	79.42	4.62
Gage Street/Mississagua Street	189001616	180003224	83.57	81.77	79.66	79.21	4.36	79.24	4.34
Mississagua Street	189002015	180003202	83.82	82.02	79.55	79.08	4.74	79.11	4.71
Mississagua Street/Centre Street	189001780	180003201	84.45	82.65	79.36	78.89	5.55	78.92	5.53
Mississagua Street	189001779	180003775	84.84	83.04	79.20	78.72	6.12	78.74	6.09
Mississagua Street/William Street	189001617	180003889	85.09	83.29	78.92	78.47	6.63	78.49	6.60
William Street	189001618	180003890	83.99	82.19	78.77	78.30	5.70	78.32	5.67
William Street/Butler Street	189001619	180003891	83.79	81.99	78.49	78.06	5.72	78.10	5.69
William Street	18901620	180003892	83.38	81.58	78.41	77.95	5.42	77.98	5.40
William Street/Dorchester Street	18901622	180003893	83.25	81.45	78.27	77.87	5.38	77.89	5.36
William Street	18901623	180003894	81.02	79.22	78.12	77.70	3.32	77.73	3.30
William Street/Nassau Street	18901624	180003898	80.86	79.06	77.96	77.56	3.30	77.58	3.28
William Street	18901625	180003303	80.56	78.76	77.66	77.23	3.33	77.24	3.32
William Street	18902049	180003302	81.89	80.09	76.83	76.38	5.51	76.39	5.50
William Street Sanitary Pumping Station		180003301	82.40	80.60	76.69	76.20	6.20	76.22	6.18





2041 Conditions - Design RDII WWF - Pre-development to Post-Development Comparison															
Location	Link ID	Manhole		Pipe				Flow (q) (L/s)		Flow Capacity (q/Q <sub>full</sub> )		Depth (d) (m)		Depth Capacity (d/D)	
		U/S	D/S	Size (m)	Length (m)	Slope (%)	Q <sub>full</sub> (L/s)	Pre dev.	Post dev.	Pre dev.	Post dev.	Pre dev.	Post dev.	Pre dev.	Post dev.
		No Highlighting Indicates No Capacity Constraints Yellow Indicates q/Q > 100%, d/D <100% Red Indicates q/Q > 100%, d/D >100%													
Pafford Street*	189001794	180003396	180003397	0.300	86.68	0.12	33.3	6.6	20.4	20%	61%	0.09	0.16	29.9%	54.2%
Pafford Street	189001793	180003397	180003398	0.300	76.20	0.29	52.0	6.8	20.6	13%	40%	0.11	0.18	37.3%	60.8%
Pafford Street	189001792	180003398	180003399	0.300	76.50	0.14	36.0	8.6	22.4	24%	62%	0.11	0.18	37.3%	60.8%
Pafford Street	189001791	180003399	180003401	0.300	80.80	0.76	84.5	8.8	22.6	10%	27%	0.07	0.11	21.8%	35.3%
Pafford Street	189001790	180003401	180003402	0.300	74.10	0.30	52.7	29.6	43.4	56%	82%	0.17	0.22	55.6%	71.7%
King Street	189004273	180003402	180006385	0.350	51.50	0.34	85.3	37.7	51.5	44%	60%	0.17	0.20	49.1%	58.3%
King Street	189004218	180006385	180006196	0.350	22.30	0.34	85.2	41.5	55.3	49%	65%	0.17	0.20	49.1%	58.3%
King Street	189004061	180006196	180005803	0.450	51.10	0.24	138.7	41.6	55.4	30%	40%	0.17	0.20	38.2%	44.9%
King Street	189004113	180005803	180006197	0.450	21.10	0.24	138.8	42.0	55.8	30%	40%	0.18	0.21	40.0%	46.6%
King Street	189004053	180006197	180003405	0.450	77.90	0.21	131.6	42.5	56.3	32%	43%	0.18	0.21	40.0%	46.6%
King Street	189001289	180003405	180003556	0.450	76.50	0.34	166.5	42.6	56.4	26%	34%	0.16	0.18	35.0%	40.6%
King Street	189002039	180003556	180003315	0.450	35.40	0.34	165.3	43.4	57.3	26%	35%	0.16	0.18	35.3%	40.7%
King Street	189001290	180003315	180003430	0.450	117.40	0.36	170.5	45.5	59.3	27%	35%	0.16	0.18	35.4%	40.8%
King Street	189002045	180003430	180003431	0.450	66.80	0.36	170.2	45.7	59.5	27%	35%	0.16	0.18	35.6%	41.1%
King Street	189001291	180003431	180003432	0.450	120.50	0.35	168.5	45.9	59.7	27%	35%	0.17	0.19	36.8%	42.3%
King Street	189001292	180003432	180003433	0.450	122.10	0.34	167.2	46.0	59.8	27%	36%	0.17	0.19	36.8%	42.3%
King Street	189001293	180003433	180003438	0.450	19.70	0.36	171.2	49.7	63.5	29%	37%	0.31	0.32	68.1%	71.7%
King Street	189001295	180003438	180003214	0.450	79.20	0.35	168.9	51.5	65.3	30%	39%	0.17	0.19	38.0%	43.1%
Gage Street	189001296	180003214	180003215	0.450	41.30	0.37	172.4	52.8	66.6	31%	39%	0.17	0.20	38.6%	43.8%
Gage Street	189001298	180003215	180003216	0.450	120.30	0.35	168.5	53.0	66.8	31%	40%	0.17	0.20	38.6%	43.8%
Gage Street	189001299	180003216	180003217	0.450	73.40	0.36	170.7	53.0	66.8	31%	39%	0.17	0.20	38.6%	43.9%
Gage Street	189002043	180003217	180003664	0.450	75.70	0.35	168.4	53.2	67.0	32%	40%	0.17	0.20	38.6%	43.9%
Gage Street	189001300	180003664	180003219	0.450	71.70	0.35	169.4	53.2	67.0	31%	40%	0.17	0.20	38.7%	43.9%
Gage Street	189001301	180003219	180003220	0.450	75.30	0.35	168.5	53.4	67.3	32%	40%	0.18	0.20	39.5%	44.7%
Gage Street	189001302	180003220	180003221	0.450	76.40	0.35	168.2	55.4	69.2	33%	41%	0.18	0.20	39.5%	44.7%
Gage Street	189001303	180003221	180003222	0.450	69.90	0.35	169.1	55.5	69.3	33%	41%	0.24	0.26	53.7%	57.5%
Gage Street	189001613	180003222	180003223	0.600	79.30	0.23	293.3	99.2	112.5	34%	38%	0.24	0.26	40.3%	43.1%
Gage Street	189001614	180003223	180003224	0.600	79.50	0.26	310.3	98.1	111.4	32%	36%	0.26	0.28	43.7%	46.8%
Mississagua Street	189001616	180003224	180003202	0.600	66.70	0.16	248.2	98.5	111.8	40%	45%	0.26	0.28	43.7%	46.8%
Mississagua Street	189002015	180003202	180003201	0.600	85.20	0.22	290.7	98.2	111.5	34%	38%	0.24	0.26	40.1%	43.0%
Mississagua Street	189001780	180003201	180003775	0.600	66.70	0.24	300.7	99.8	113.1	33%	38%	0.24	0.26	39.8%	42.5%
Mississagua Street	189001779	180003775	180003889	0.600	82.50	0.33	354.5	99.4	112.8	28%	32%	0.26	0.27	42.5%	45.4%
William Street	189001617	180003889	180003890	0.600	72.90	0.20	276.7	103.5	116.9	37%	42%	0.26	0.27	42.5%	45.4%
William Street	189001618	180003890	180003891	0.600	76.40	0.36	366.4	103.2	116.6	28%	32%	0.29	0.31	48.6%	52.2%
William Street	189001619	180003891	180003892	0.600	80.90	0.10	197.9	103.6	117.1	52%	59%	0.30	0.32	50.3%	53.9%
William Street	18901620	180003892	180003893	0.600	76.47	0.18	261.8	103.3	116.7	39%	45%	0.34	0.36	57.0%	59.8%
William Street	18901622	180003893	180003894	0.600	81.88	0.17	256.6	160.8	174.3	63%	68%	0.34	0.36	57.0%	59.8%
William Street	18901623	180003894	180003898	0.600	65.32	0.25	308.6	160.7	174.2	52%	56%	0.33	0.35	55.1%	57.8%
William Street	18901624	180003898	180003303	0.600	106.18	0.21	279.5	162.1	175.6	58%	63%	0.33	0.35	55.1%	57.8%
William Street	18901625	180003303	180003302	0.600	28.49	0.34	356.4	162.1	175.6	45%	49%	0.28	0.29	46.0%	48.0%
William Street Sanitary Pumping St	18902049	180003302	180003301	0.600	22.00	0.64	489.8	173.9	187.5	36%	38%	0.25	0.26	41.2%	42.9%

Maximum Hydraulic Gradeline (HGL) Results

Printed on: 2026-04-14

Green Highlighting Shows HGL Freeboard is greater than 1.8 m

Yellow Highlighting Shows Freeboard is less than 1.8 m, but flow is contained within Pipe (i.e. no surcharge)

Red Highlighting Shows Freeboard is less than 1.8 m and pipe is surcharging

2041 Conditions - Design RDII WWF - Pre-development to Post-Development Comparison

Location	Conduit (US)	MH	T/G (m)	Max Allowable HGL (m)	Minimum Obvert	Pre-Development		Post Development	
						Maximum HGL (m)	Freeboard (m)	Maximum HGL (m)	Freeboard (m)
Charlotte Street/Pafford Street*	189001794	180003396	89.40	87.60	86.68	86.47	2.93	86.54	2.85
Pafford Street	189001793	180003397	89.67	87.87	86.58	86.35	3.32	86.41	3.26
Pafford Street	189001792	180003398	89.30	87.50	86.36	86.17	3.13	86.24	3.06
Pafford Street	189001791	180003399	89.16	87.36	86.23	86.00	3.16	86.04	3.12
Pafford Street	189001790	180003401	88.63	86.83	85.13	85.00	3.63	85.05	3.58
Pafford Street/King Street	189004273	180003402	88.24	86.44	84.91	84.73	3.51	84.77	3.48
King Street/Evergreen Lane	189004218	180006385	88.16	86.36	84.74	84.57	3.59	84.60	3.56
King Street	189004061	180006196	88.25	86.45	84.67	84.49	3.76	84.52	3.73
King Street	189004113	180005803	88.17	86.37	84.65	84.37	3.80	84.40	3.77
King Street/Anne Street	189004053	180006197	88.00	86.20	84.60	84.33	3.67	84.36	3.64
King Street	189001289	180003405	87.84	86.04	84.43	84.14	3.70	84.16	3.68
King Street/John Street West	189002039	180003556	87.38	85.58	84.17	83.88	3.50	83.90	3.48
King Street	189001290	180003315	86.34	84.54	84.05	83.76	2.58	83.78	2.56
King Street/Mary Street	189002045	180003430	85.99	84.19	83.63	83.34	2.65	83.36	2.62
King Street	189001291	180003431	86.90	85.10	83.39	83.10	3.79	83.13	3.77
King Street	189001292	180003432	86.34	84.54	82.97	82.69	3.65	82.71	3.62
King Street/Centre Street	189001293	180003433	87.59	85.79	82.36	82.22	5.37	82.24	5.35
King Street	189001295	180003438	87.65	85.85	82.29	82.01	5.64	82.04	5.61
King Street/Gage Street	189001296	180003214	87.86	86.06	82.02	81.74	6.13	81.76	6.10
Gage Street	189001298	180003215	87.48	85.68	81.86	81.59	5.89	81.61	5.87
Gage Street/Regent Street	189001299	180003216	86.81	85.01	81.44	81.17	5.65	81.19	5.62
Gage Street	189002043	180003217	86.01	84.21	81.18	80.90	5.10	80.93	5.08
Gage Street/Victoria Street	189001300	180003664	85.15	83.35	80.92	80.64	4.51	80.66	4.49
Gage Street	189001301	180003219	84.35	82.55	80.66	80.39	3.96	80.41	3.94
Gage Street/Gate Street	189001302	180003220	83.48	81.68	80.40	80.13	3.35	80.15	3.32
Gage Street	189001303	180003221	83.09	81.29	80.14	79.86	3.23	79.89	3.20
Gage Street/Simcoe Street	189001613	180003222	84.75	82.95	79.89	79.68	5.07	79.70	5.06
Gage Street	189001614	180003223	84.04	82.24	79.86	79.49	4.55	79.51	4.53
Gage Street/Mississagua Street	189001616	180003224	83.57	81.77	79.66	79.32	4.26	79.34	4.24
Mississagua Street	189002015	180003202	83.82	82.02	79.55	79.19	4.63	79.20	4.62
Mississagua Street/Centre Street	189001780	180003201	84.45	82.65	79.36	78.99	5.45	79.01	5.44
Mississagua Street	189001779	180003775	84.84	83.04	79.20	78.81	6.03	78.83	6.01
Mississagua Street/William Street	189001617	180003889	85.09	83.29	78.92	78.58	6.52	78.59	6.50
William Street	189001618	180003890	83.99	82.19	78.77	78.39	5.60	78.40	5.59
William Street/Butler Street	189001619	180003891	83.79	81.99	78.49	78.19	5.60	78.21	5.57
William Street	18901620	180003892	83.38	81.58	78.41	78.07	5.30	78.10	5.28
William Street/Dorchester Street	18901622	180003893	83.25	81.45	78.27	78.01	5.24	78.03	5.23
William Street	18901623	180003894	81.02	79.22	78.12	77.83	3.19	77.85	3.18
William Street/Nassau Street	18901624	180003898	80.86	79.06	77.96	77.69	3.17	77.71	3.15
William Street	18901625	180003303	80.56	78.76	77.66	77.33	3.22	77.35	3.21
William Street	18902049	180003302	81.89	80.09	76.83	76.48	5.41	76.49	5.40
William Street Sanitary Pumping Station		180003301	82.40	80.60	76.69	76.31	6.09	76.32	6.08





2041 Conditions - 5-year Storms WWF- Pre-development to Post-Development Comparison															
								No Highlighting Indicates No Capacity Constraints				No Highlighting Indicates No Capacity Constraints			
								Yellow Indicates q/Q > 100%, d/D <100%				Yellow Indicates d/D > 70%			
								Red Indicates q/Q > 100%, d/D >100%				Red Indicates d/D > 100%			
Location	Link ID	Manhole		Pipe				Flow (q) (L/s)		Flow Capacity (q/Q <sub>full</sub> )		Depth (d) (m)		Depth Capacity (d/D)	
		U/S	D/S	Size (m)	Length (m)	Slope (%)	Q <sub>full</sub> (L/s)	Pre dev.	Post dev.	Pre dev.	Post dev.	Pre dev.	Post dev.	Pre dev.	Post dev.
Pafford Street*	189001794	180003396	180003397	0.300	68.30	0.15	37.6	11.2	25.1	30%	67%	0.12	0.18	39.1%	61.0%
Pafford Street	189001793	180003397	180003398	0.300	76.20	0.29	52.0	11.6	25.5	22%	49%	0.14	0.21	48.0%	69.3%
Pafford Street	189001792	180003398	180003399	0.300	76.50	0.14	36.0	14.3	28.1	40%	78%	0.14	0.21	48.0%	69.3%
Pafford Street	189001791	180003399	180003401	0.300	80.80	0.76	84.5	14.8	28.6	17%	34%	0.08	0.12	28.3%	40.1%
Pafford Street	189001790	180003401	180003402	0.300	74.10	0.30	52.7	59.9	73.7	114%	140%	0.29	0.42	96.0%	140.5%
King Street	189004273	180003402	180006385	0.350	51.50	0.34	85.3	74.2	88.0	87%	103%	0.26	0.30	73.5%	84.8%
King Street	189004218	180006385	180006196	0.350	22.30	0.34	85.2	78.6	92.4	92%	109%	0.26	0.29	73.5%	83.5%
King Street	189004061	180006196	180005803	0.450	51.10	0.24	138.7	78.8	92.6	57%	67%	0.25	0.28	55.5%	61.5%
King Street	189004113	180005803	180006197	0.450	21.10	0.24	138.8	79.6	93.4	57%	67%	0.26	0.28	57.2%	63.1%
King Street	189004053	180006197	180003405	0.450	77.90	0.21	131.6	80.6	94.5	61%	72%	0.26	0.28	57.2%	63.1%
King Street	189001289	180003405	180003556	0.450	76.50	0.34	166.5	80.9	94.8	49%	57%	0.23	0.25	50.1%	55.0%
King Street	189002039	180003556	180003315	0.450	35.40	0.34	165.3	82.8	96.6	50%	58%	0.23	0.25	50.6%	55.3%
King Street	189001290	180003315	180003430	0.450	117.40	0.36	170.5	87.0	100.9	51%	59%	0.23	0.25	50.8%	55.5%
King Street	189002045	180003430	180003431	0.450	66.80	0.36	170.2	87.4	101.2	51%	59%	0.23	0.25	51.3%	56.0%
King Street	189001291	180003431	180003432	0.450	120.50	0.35	168.5	87.8	101.7	52%	60%	0.24	0.26	52.4%	56.9%
King Street	189001292	180003432	180003433	0.450	122.10	0.34	167.2	88.0	101.8	53%	61%	0.24	0.26	52.4%	56.9%
King Street	189001293	180003433	180003438	0.450	19.70	0.36	171.2	92.3	106.2	54%	62%	0.35	0.37	78.9%	82.2%
King Street	189001295	180003438	180003214	0.450	79.20	0.35	168.9	96.0	109.8	57%	65%	0.24	0.27	54.3%	59.0%
Gage Street	189001296	180003214	180003215	0.450	41.30	0.37	172.4	98.7	112.5	57%	65%	0.25	0.27	55.2%	60.0%
Gage Street	189001298	180003215	180003216	0.450	120.30	0.35	168.5	99.0	112.9	59%	67%	0.25	0.27	55.2%	60.0%
Gage Street	189001299	180003216	180003217	0.450	73.40	0.36	170.7	99.0	112.9	58%	66%	0.25	0.27	55.3%	60.1%
Gage Street	189002043	180003217	180003664	0.450	75.70	0.35	168.4	99.5	113.3	59%	67%	0.25	0.27	55.3%	60.1%
Gage Street	189001300	180003664	180003219	0.450	71.70	0.35	169.4	99.5	113.3	59%	67%	0.25	0.27	55.4%	60.2%
Gage Street	189001301	180003219	180003220	0.450	75.30	0.35	168.5	99.9	113.7	59%	67%	0.26	0.28	56.7%	61.5%
Gage Street	189001302	180003220	180003221	0.450	76.40	0.35	168.2	103.4	117.2	61%	70%	0.26	0.28	56.7%	61.5%
Gage Street	189001303	180003221	180003222	0.450	69.90	0.35	169.1	103.7	117.5	61%	69%	0.34	0.36	76.3%	79.9%
Gage Street	189001613	180003222	180003223	0.600	79.30	0.23	293.3	183.4	197.4	63%	67%	0.34	0.36	57.2%	59.9%
Gage Street	189001614	180003223	180003224	0.600	79.50	0.26	310.3	182.2	196.6	59%	63%	0.37	0.39	62.3%	65.3%
Mississagua Street	189001616	180003224	180003202	0.600	66.70	0.16	248.2	182.8	197.2	74%	79%	0.37	0.39	62.3%	65.3%
Mississagua Street	189002015	180003202	180003201	0.600	85.20	0.22	290.7	182.6	196.8	63%	68%	0.34	0.37	57.5%	60.9%
Mississagua Street	189001780	180003201	180003775	0.600	66.70	0.24	300.7	185.3	197.9	62%	66%	0.34	0.44	56.3%	74.0%
Mississagua Street	189001779	180003775	180003889	0.600	82.50	0.33	354.5	185.0	192.3	52%	54%	0.52	0.66	86.1%	109.8%
William Street	189001617	180003889	180003890	0.600	72.90	0.20	276.7	186.3	198.9	67%	72%	0.61	0.73	102.0%	121.8%
William Street	189001618	180003890	180003891	0.600	76.40	0.36	366.4	185.0	199.1	50%	54%	0.82	0.92	135.9%	153.8%
William Street	189001619	180003891	180003892	0.600	80.90	0.10	197.9	186.8	201.0	94%	102%	0.84	0.93	139.3%	155.5%
William Street	18901620	180003892	180003893	0.600	76.47	0.18	261.8	187.1	201.2	71%	77%	0.91	0.99	150.8%	164.7%
William Street	18901622	180003893	180003894	0.600	81.88	0.17	256.6	283.1	298.2	110%	116%	0.91	0.99	150.8%	164.7%
William Street	18901623	180003894	180003898	0.600	65.32	0.25	308.6	283.2	298.3	92%	97%	0.90	0.95	150.0%	158.2%
William Street	18901624	180003898	180003303	0.600	106.18	0.21	279.5	287.1	302.1	103%	108%	0.90	0.95	150.0%	158.2%
William Street	18901625	180003303	180003302	0.600	28.49	0.34	356.4	287.1	302.1	81%	85%	1.00	1.02	167.2%	170.0%
William Street Sanitary Pumping St	18902049	180003302	180003301	0.600	22.00	0.64	489.8	311.7	326.7	64%	67%	1.82	1.83	303.3%	305.2%

Green Highlighting Shows HGL Freeboard is greater than 1.8 m

Yellow Highlighting Shows Freeboard is less than 1.8 m, but flow is contained within Pipe (i.e. no surcharge)

Red Highlighting Shows Freeboard is less than 1.8 m and pipe is surcharging

2041 Conditions - 5-year Storms WWF- Pre-development to Post-Development Comparison

Location	Conduit (US)	MH	T/G (m)	Max Allowable HGL (m)	Minimum Obvert	Pre-Development		Post Development	
						Maximum HGL (m)	Freeboard (m)	Maximum HGL (m)	Freeboard (m)
Charlotte Street/Pafford Street*	189001794	180003396	89.40	87.60	86.68	86.50	2.90	86.56	2.83
Pafford Street	189001793	180003397	89.67	87.87	86.58	86.38	3.30	86.43	3.25
Pafford Street	189001792	180003398	89.30	87.50	86.36	86.20	3.10	86.27	3.04
Pafford Street	189001791	180003399	89.16	87.36	86.23	86.02	3.14	86.05	3.10
Pafford Street	189001790	180003401	88.63	86.83	85.13	85.12	3.51	85.25	3.38
Pafford Street/King Street	189004273	180003402	88.24	86.44	84.91	84.82	3.42	84.87	3.38
King Street/Evergreen Lane	189004218	180006385	88.16	86.36	84.74	84.65	3.51	84.69	3.47
King Street	189004061	180006196	88.25	86.45	84.67	84.56	3.68	84.59	3.66
King Street	189004113	180005803	88.17	86.37	84.65	84.45	3.72	84.47	3.70
King Street/Anne Street	189004053	180006197	88.00	86.20	84.60	84.40	3.60	84.43	3.57
King Street	189001289	180003405	87.84	86.04	84.43	84.20	3.64	84.22	3.61
King Street/John Street West	189002039	180003556	87.38	85.58	84.17	83.95	3.43	83.97	3.41
King Street	189001290	180003315	86.34	84.54	84.05	83.83	2.51	83.85	2.49
King Street/Mary Street	189002045	180003430	85.99	84.19	83.63	83.41	2.58	83.43	2.56
King Street	189001291	180003431	86.90	85.10	83.39	83.17	3.72	83.20	3.70
King Street	189001292	180003432	86.34	84.54	82.97	82.76	3.58	82.78	3.56
King Street/Centre Street	189001293	180003433	87.59	85.79	82.36	82.27	5.32	82.28	5.31
King Street	189001295	180003438	87.65	85.85	82.29	82.09	5.57	82.11	5.54
King Street/Gage Street	189001296	180003214	87.86	86.06	82.02	81.81	6.05	81.83	6.03
Gage Street	189001298	180003215	87.48	85.68	81.86	81.66	5.82	81.68	5.80
Gage Street/Regent Street	189001299	180003216	86.81	85.01	81.44	81.24	5.57	81.26	5.55
Gage Street	189002043	180003217	86.01	84.21	81.18	80.98	5.03	81.00	5.01
Gage Street/Victoria Street	189001300	180003664	85.15	83.35	80.92	80.71	4.43	80.74	4.41
Gage Street	189001301	180003219	84.35	82.55	80.66	80.46	3.88	80.48	3.86
Gage Street/Gate Street	189001302	180003220	83.48	81.68	80.40	80.21	3.27	80.23	3.25
Gage Street	189001303	180003221	83.09	81.29	80.14	79.94	3.15	79.96	3.13
Gage Street/Simcoe Street	189001613	180003222	84.75	82.95	79.89	79.78	4.97	79.80	4.95
Gage Street	189001614	180003223	84.04	82.24	79.86	79.59	4.45	79.60	4.43
Gage Street/Mississagua Street	189001616	180003224	83.57	81.77	79.66	79.43	4.14	79.45	4.13
Mississagua Street	189002015	180003202	83.82	82.02	79.55	79.29	4.53	79.31	4.51
Mississagua Street/Centre Street	189001780	180003201	84.45	82.65	79.36	79.09	5.35	79.12	5.33
Mississagua Street	189001779	180003775	84.84	83.04	79.20	78.90	5.94	79.04	5.80
Mississagua Street/William Street	189001617	180003889	85.09	83.29	78.92	78.84	6.26	78.98	6.11
William Street	189001618	180003890	83.99	82.19	78.77	78.78	5.21	78.90	5.09
William Street/Butler Street	189001619	180003891	83.79	81.99	78.49	78.72	5.07	78.82	4.97
William Street	18901620	180003892	83.38	81.58	78.41	78.64	4.74	78.74	4.64
William Street/Dorchester Street	18901622	180003893	83.25	81.45	78.27	78.57	4.68	78.66	4.60
William Street	18901623	180003894	81.02	79.22	78.12	78.40	2.63	78.46	2.56
William Street/Nassau Street	18901624	180003898	80.86	79.06	77.96	78.26	2.60	78.31	2.55
William Street	18901625	180003303	80.56	78.76	77.66	78.03	2.53	78.05	2.51
William Street	18902049	180003302	81.89	80.09	76.83	77.97	3.92	77.98	3.91
William Street Sanitary Pumping Station		180003301	82.40	80.60	76.69	77.91	4.49	77.92	4.48





## **Appendix E**

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Digital Copy of Model  
(Refer to submission package)