



## Niagara Falls – 2278 Mountain Road

<b>Organization:</b> City of Niagara Falls	GM BluePlan Project No: 621014
<b>Attention:</b> Jessica Brownlee	Date: July 26, 2023
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## 1 Project Scope

The City of Niagara Falls has retained GM BluePlan Engineering to assess the impacts of a proposed development on the City’s existing wastewater systems. The proposed development would consist of a 6-story apartment building containing 70 residential units located on 1.02 ha of land. The site is located at the intersection of Mountain Road and St. Paul Avenue, shown in **Figure 1**.



**Figure 1: Development Location**

### 1.1 Hydraulic Sanitary Model

The system was assessed using:

- The City’s existing wastewater model that was developed as part of the City’s Pollution Prevention Control Plan (2016) and updated as part of the Region’s Master Servicing Plan Update (2022).

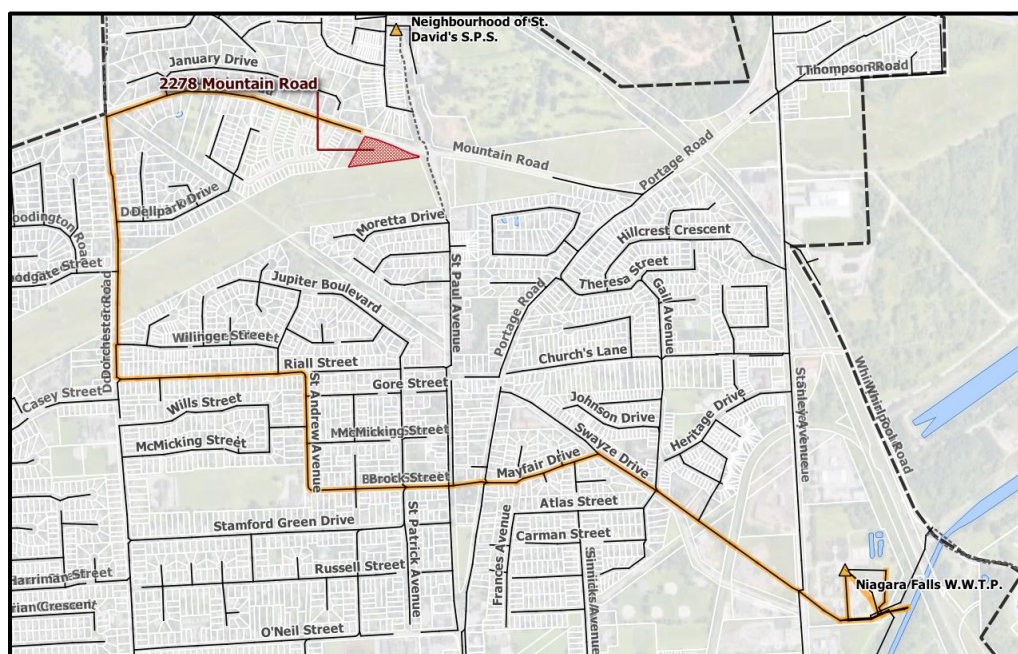
## 2 Sanitary System Review

### 2.1 Local System

The proposed site would tie-in to the existing 250 mm sanitary sewer that runs along the Mountain Road. Downstream of the site, the flows would follow the sewer alignment as shown on **Figure 2**, before ultimately discharging into the Region's Niagara Falls Wastewater Treatment Plant:

- 638 m of 300 mm sewer on Mountain Road;
- 962 m of 250 & 300 mm sewer on Dorchester Road;
- 658 m of 350 & 400 mm sewer on Dorchester Road;
- 962 m of 750 & 825mm sewer along Riall Street;
- 612 m of 900 mm sewer along St Andrew Avenue;
- 155 m of 1050 mm sewer along St Andrew Avenue;
- 1044 m of 1050 & 1350 mm sewer along Brock Street;
- 379 m of 1350 mm sewer along Mayfair Drive;
- 891 m of 1350 & 1500 mm sewer along Swayze Drive which discharges to the Niagara Falls Wastewater Treatment Plant (WWTP);

The sanitary flows originating at this proposed development have the potential to contribute to the overflow at the Niagara Falls WWTP.



**Figure 2: Wastewater Flow Route**



## 2.2 Wastewater Flow Analysis

The system was evaluated under both existing and post-development conditions to gauge the development impact holistically on the sanitary system. Post-development sanitary flows were calculated by Upper Canada Consultants and supplied in Appendix A of their Functional Servicing Report. The Upper Canada Consultants flow rates were reviewed against City of Niagara Falls Engineering Design Standards Manual *Section 3: Sanitary Drainage Systems* methodology, outlined below, with an updated average domestic flow allowance of 255 L/cap/d based on the recently completed 2021 MSPU.

$$Q(d) = \frac{PqM}{86.4} + (I A)$$

Where:

- P = design population in thousands
- q = avg. daily per capita flow in l/cap.day
- M = peaking factor =  $5 / P^{0.2}$ ) (Babbitt Formula)
- I = infiltration in l/ha. sec
- A= tributary area in ha
- Q(d) = peak domestic sewage flow in l/sec (including extraneous flows)

- a) for design purposes a maximum infiltration allowance of 0.28 l/ha.sec has been provided
- b) for design purposes a maximum avg. domestic flow allowance of 450 l/cap.day has been provided
- c) check with Municipal staff when designing sewers in areas where high I/I has been identified

**Table 1** below summarizes the Upper Canada Consultants calculated flows against the methodology outlined in the Design Standards Manual. It is noted that the Upper Canada Consultants report used a mixture of values that partially differed from the City's criteria to estimate sanitary flows. The flow value calculated in the Upper Canada Consultants report is higher than the value generated using the City's methodology. The GM BluePlan system review was completed using the flow results generated using the values provided by Upper Canada Consultants without RDII contributions, as a conservative estimate.

**Table 1: Sanitary Flows**

	Upper Canada Consultants	Niagara Falls D.C.	Units
Lot Area	1.02		ha
Population	<b>Apartments</b> 70 units @ 3ppu <b>210pop</b>	<b>Apartments</b> 70 units @ 1.55ppu <b>109 pop</b>	pop
Per Capita Flow	320	255	L/cap/day
Avg Domestic Flow	0.78	0.32	L/s
Peaking Factor	4.14	4.0 (Harmon)	
Peak Domestic Flow	3.22	1.28	L/s
Infiltration Allowance	0.28	0.286	L/s/ha
RDII	0.28 (0.0*)	0.0*	L/s
Design Flow	<b>3.50 (3.22 without RDII)</b>	1.28	L/s

\*Redevelopment of existing area. No new RDII contributions.

## 2.3 Impact on Sanitary Sewer System Performance

### 2.3.1 Sewer System Capacity

For existing sewer capacities, sewer performance criteria were assessed using the following conditions:

- Maintaining depth of flow in pipe is equal to or less than obvert elevation ( $d/D \leq 1$ ); and, if failing to do so then,
- Maintain system hydraulic grade line (HGL) of a surcharging sewer is below the basement protection freeboard of 1.8 meters below grade.

Under dry weather flow conditions, no downstream sewer surcharging, or system overflows are anticipated under both existing and post-development conditions.

The system performance was reviewed under a variety of design storm conditions under the 2-year, 5-year, and 10-year design storms using the City's existing wastewater model. **Table 2** below summarizes the sewer system performance before and after development.

As seen in **Table 2**, the existing sewer shows significant surcharging under design storm conditions along:

- The sewer downstream of development from Mountain Rd to Woodgate Street has the potential to surcharge to surface under the existing 2, 5, and 10-year design storms
- The sewer on Dorchester Rd from Woodgate St Riall St surcharges beyond the basement protection freeboard of 1.8m below grade under the existing 2, 5, and 10-year design storms
- The sewer on Swayze Drive from Heritage Drive to Stanley Avenue surcharges under the existing 2, 5, and 10-year design storms, however, surcharging remains below the basement projection freeboard of 1.8m below grade
- When the proposed growth is applied, the surcharging is further increased; however, the total increase in system flow are negligible compared to existing baseline flows

More localized flow monitoring and updated site conditions would be required to ascertain the magnitude of the flood risks. However, a preliminary assessment would suggest that to lower the HGL below the basement flooding risk level of 1.8 m below grade under the 10-year design storms, the following are recommended:

- Upgrade the 300mm sewers on Mountain Road at Carmella Place to Dorchester Road to 450mm
- Upgrade the 250mm sewers on Dorchester at Mountain Road to Dellpark Drive to 450mm
- Upgrade the 300mm sewers on Dorchester at Dellpark Drive to Woodgate Street to 600mm
- Upgrade the 425mm sewers on Dorchester Road at Woodgate Street to Riall Street to 675mm

		Development to Mountain Rd at Dorchester Rd (250 to 300mm City Sewer)		Dorchester Rd at Mountain Rd to Dorchester Rd at Woodgate St (250mm to 300mm City Sewer)		Dorchester Rd at Woodgate St to Dorchester Rd at Riall St (350mm to 400mm City Sewer)		Dorchester at Riall St to St. Andrew Ave at McMicking St (750mm to 900mm City Sewer)		St. Andrew Ave at McMicking St to Swayze Dr at Heritage Dr (1050 to 1350mm City Sewer)		Swayze Dr at Heritage Dr to Stanley Ave (1350 to 1500mm City Sewer)	
Scenario		d/D	Freeboard (m)	d/D	Freeboard (m)	d/D	Freeboard (m)	d/D	Freeboard (m)	d/D	Freeboard (m)	d/D	Freeboard (m)
1:2 Year	Pre-Dev	>1	To Surface	>1	To Surface	>1	0.8	0.5	Within Obvert	0.5	Within Obvert	>1	2.6
	Post-Dev						0.8	0.5		0.5			2.6
1:5 Year	Pre-Dev						0.7	0.6		0.6			2.6
	Post-Dev						0.7	0.6		0.6			2.6
1:10 Year	Pre-Dev						0.7	0.6		0.6			2.5
	Post-Dev						0.7	0.6		0.6			2.5

**Table 2** Wastewater Surge Depth & HGL Results

### 3 Summary and Recommendations

Based on the analysis, the impact of the 2278 Mountain Road development on the wastewater system are as follows:

- There is significant existing sewer surcharging downstream of the development, with portions of the sewer currently above the basement flooding protection freeboard of 1.8m below grade under the design 2-year storm.
- When the proposed growth is applied, the surcharging is further increased; however, the total increase in system flow are negligible compared to existing baseline flows.
- More localized flow monitoring and updated site conditions would be required to ascertain the magnitude of the flood risks. However, to lower the HGL below the basement protection freeboard of 1.8 m below grade under the 10-year design storms, the following are recommended:
  - Upgrade the 300mm sewers on Mountain Road at Carmella Place to Dorchester Road to 450mm
  - Upgrade the 250mm sewers on Dorchester at Mountain Road to Dellpark Drive to 450mm
  - Upgrade the 300mm sewers on Dorchester at Dellpark Drive to Woodgate Street to 600mm
  - Upgrade the 425mm sewers on Dorchester Road at Woodgate Street to Riall Street to 675mm

Based on the above findings, the proposed development is not expected to have a significant impact on the existing downstream sewer system. However, it is noted that portions of the existing wastewater sewers downstream of the proposed addition do not meet the City's capacity and performance targets under existing conditions.