



Lands West of Buffalo Road to Rosehill Road – Hydraulic Modelling Analysis, and Engineering Services Assignment

Attention: 2282344 Ontario Inc	GM BluePlan Project No: 621095-1
Project: Lands West of Buffalo Road to Rosehill Road	Date: July 1, 2021



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1 Project Scope

1.1 Study Area

A 10 hectare (ha) residential development is proposed at 0 Nigh Road within the Town of Fort Erie. The proposed development is generally bounded by Nigh Road to the north, properties fronting Buffalo Road to the east, vacant lands to the west, and Royal York Road to the south, noting that the development is not currently located within the Town’s existing Urban Boundary and an extension of both the existing water and wastewater servicing would be required. **Figure 1** details the general location of the proposed development.

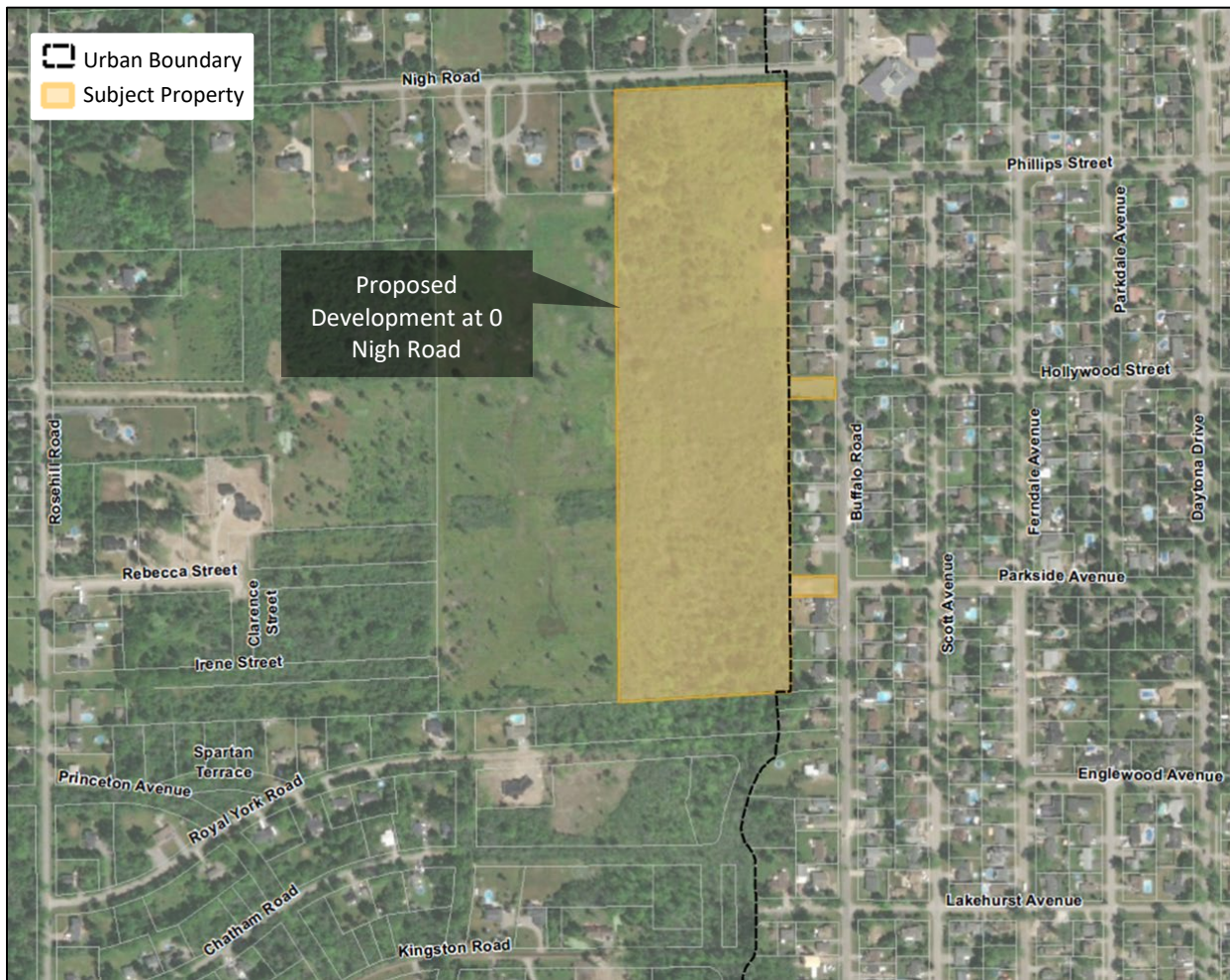


Figure 1: Study Area

A private developer retained GM BluePlan to perform a water and wastewater analysis for the proposed development to determine potential impacts to the existing and future systems. The system was assessed using the Town of Fort Erie’s existing water and wastewater models, developed, updated, and locally calibrated in 2016/17 as part of the Niagara Region’s 2016 Master Servicing Plan (MSP) Update, Fort Erie Water Distribution System Master Plan (WDSMP), and Fort Erie Pollution Prevention and Control Plan and Wastewater Master Plan (PPCP&MP) Study.

2 Growth Population

As the proposed development does not currently have a lot plan or layout, development populations were assumed based on previous density targets, within the Town of Fort Erie, established in the Region’s 2016 MSP, Town’s WDSMP, and Town’s PPCP. A comparison of the estimated residential populations per hectare (ppha) was made using the various sources and is outlined in **Table 1**.

The growth densities within specific developments, as outlined in the PPCP and MP, identified targets between 23-43 ppha with the upper population density a combined residential and commercial land use. The MCR provided general population density of 29 ppha, combining both greenfield development and infill residential development within the Town. As such, the average of both the individual identified developments and the MCR density, as well as the average of all presented densities is approximately 30 ppha which will be carried forward in this analysis.

Table 1: Growth Densities

Source		Land Use Type	Growth Population	Area (ha)	Population per Hectare (ppha)
MSP	Municipal Comprehensive Review	Residential	12,724	437.7	29
WDSMP					
PPCP	Miller’s Creek Marina	Residential/ Commercial	1,040	24	43
	North Residential Development	Residential	2,400	100	24
	Golf Course Development	Residential	1,760	34	23
Average	-	-	-	-	30

It is noted that under the Province’s Places to Grow Amendment 3, a density target of 55 ppha is proposed and based on this density target, the development may have an upper population of 556 people.

2.1 Water Demands

Table 2 summarizes the projected water demands for the proposed development derived using the established density targets 30 ppha and 55 ppha outlined in **Section 2.0** and design criteria established in the Region's 2016 MSP. These growth demands were assumed to be supplemental to any previously identified growth allocations.

Table 2: Water Demands

Description	Area	Density	Population	ADD ⁽¹⁾	MDD ⁽²⁾
Estimated MCR Population Density	10 ha	30 ppha	304 people	1.05 L/s	1.73 L/s
Province's Population Density	10 ha	55 ppha	556 people	1.93 L/s	3.17 L/s

⁽¹⁾ Average Day Demand (ADD) was calculated using a per capita rate of 300 L/c/d

⁽²⁾ Maximum Day Demand (MDD) was calculated using a peaking factor of 1.64

2.2 Wastewater Flows

Table 3 summarizes the projected water demands for the proposed development derived using the established density targets 30 ppha and 55 ppha outlined in **Section 2.0** and design criteria established in the Region's 2016 MSP. These growth flows were assumed to be supplemental to any previously identified growth allocations.

Table 3: Wastewater Flows

Description	Area	Density	Population	ADWF ⁽¹⁾	RDII ⁽²⁾	PWWF ⁽³⁾
Estimated MCR Population Density	10 ha	30 ppha	304 people	0.97 L/s	1.52 L/s	5.46 L/s
Province's Population Density	10 ha	55 ppha	556 people	1.77 L/s	1.52 L/s	8.51 L/s

⁽¹⁾ Average Dry Weather Flow (ADWF) was calculated using a per capita rate of 275 L/c/d

⁽²⁾ Rainfall Derived Inflow and Infiltration (RDII) was calculated using an extraneous flow rate of 0.15 L/s/ha

⁽³⁾ Peak Wet Weather Flow (PWWF) was calculated using a Harmon's peaking factor on ADWF and adding RDII.
 $PWWF = ADWF \times Peaking\ Factor + RDII$

3 Water System Review

3.1 Basis of Analysis

The system was assessed by utilizing the Region’s existing Rosehill water model, developed/updated in 2017 as part of the Town’s Water Distribution Master Plan.

The performance analysis was based on providing the following performance objectives

- Maintain system pressures greater than 40 psi under peak hour demand
- Maintain system pressures greater than 20 psi under max day demand plus fire flow

Within the Town’s Water Distribution Master Plan fire flow analysis used a land use base approach. Table 4 provides the land use fire flow criteria. As the final unit mix is unknown, both the Residential and Residential Multi fire flow were considered.

Table 4: Target Fire Flows by Land Use

Land Use	Fire Flow Criteria
Single Family Dead End and Rural	50 L/s
Residential (Single/Semi)	75 L/s
Residential Multi (Apartments)	150 L/s
Commercial	175 L/s
Institutional	175 L/s
Industrial	250 L/s

3.2 Local System








The Town of Fort Erie operates as a single pressure zone with a hydraulic grade line (HGL) of 241 m with the system supplied by the Rosehill Water Treatment Plant (WTP). The local development is not currently within the urban boundary and would likely be serviced via a 150 mm watermain extension of the existing water system from the 150 mm watermain on Buffalo Road at Nigh Road. **Figure 2** shows the location of the proposed development and the proposed connection to the existing watermain.

0 Nigh Road




Lands West of Buffalo Road to Rosehill Road






Water Network

-  Water Treatment Plant
-  Reservoir
-  Elevated Tank
-  Pumping Station
-  Local Watermain
-  Regional Watermain
-  Pressure Zone 241

Proposed Water Upgrades

-  Development Parcel
-  Proposed Watermain
-  Proposed Development Connection

General Features

-  Municipal Boundary
-  Urban Boundary
-  Waterbody

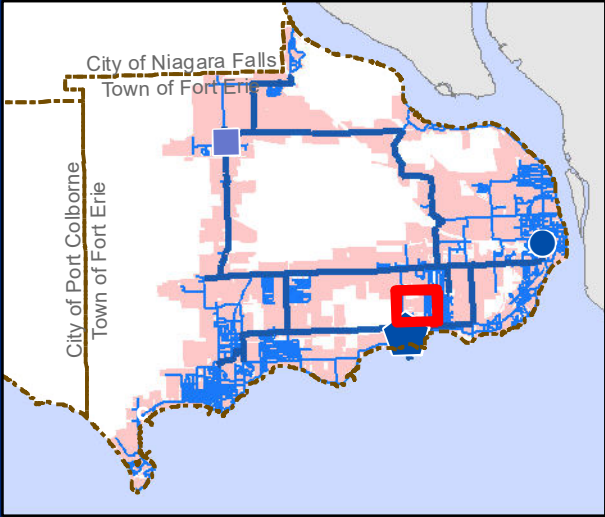
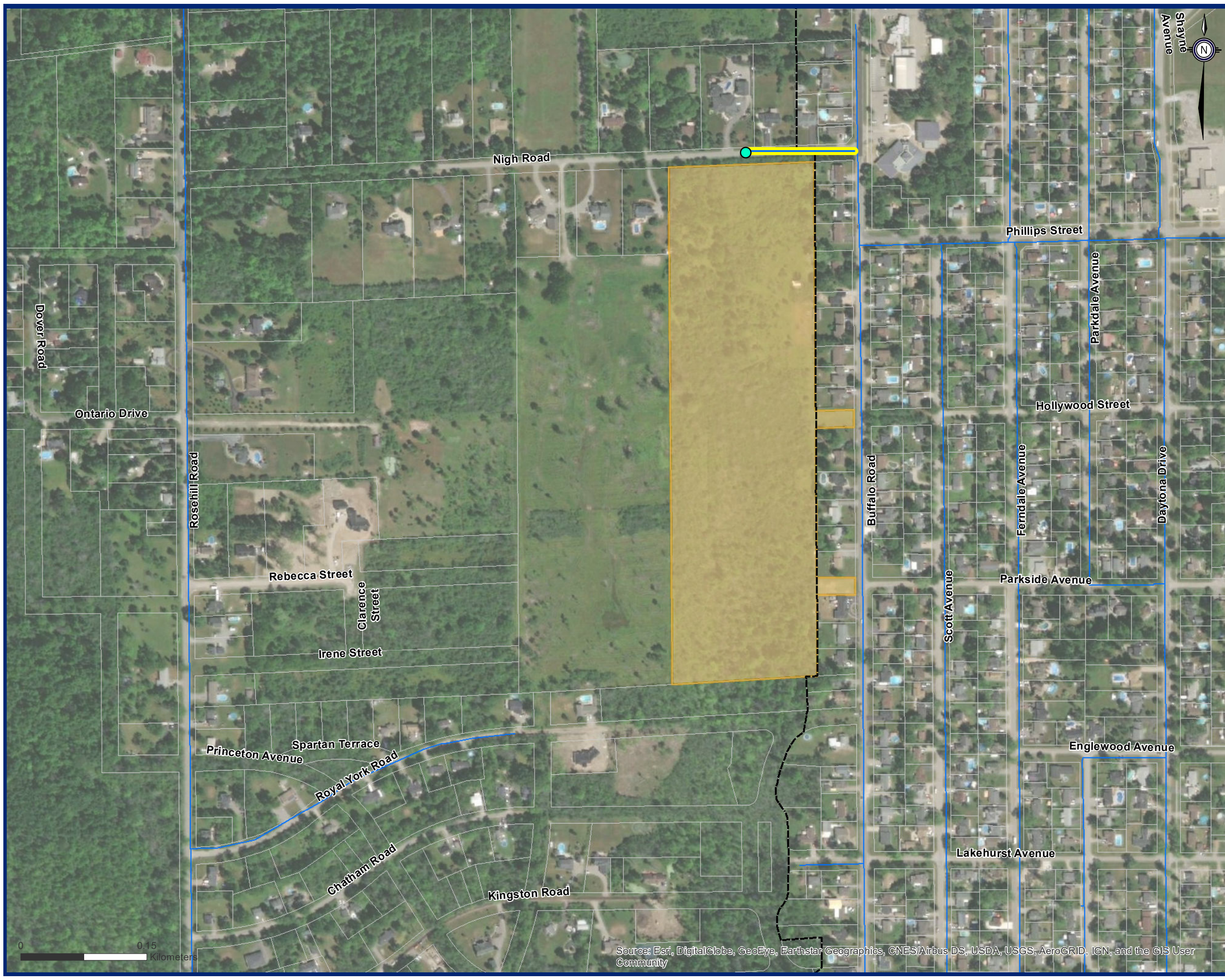


Figure 2
Existing Water System

0 0.15 Kilometers

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community



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3.3 Water System Performance

Table 5 presents the summary of the system impact analysis at the property boundary along Nigh Street. The difference between the 30 ppha and 55 ppha generally does not impact the water system performance. Internal development water system performance was not assessed at this time as the proposed layout is not known. The local study area, due to the proximity from the transmission watermains and scope of impacts, is bounded by Garrison Road to the north, Kraft Road to the east, Dominion Road to the south, and Rose Hill Road to the west.

Table 5: Local Water System Performance – Pressures and Fire Flow

Scenario	Demand	Requirement	At Development Boundary	Local Study Area	
				Average	Extreme
Existing	ADD	Max Pressure (psi)	88	89	96
	MDD	Min Pressure (psi)	75	76	65
	MDD + FF	Fire Flow (L/s)	102	213	57
		% of Hydrants Below Criteria ⁽¹⁾	-	1.8%	
Existing + Development	ADD	Max Pressure (psi)	88	89	96
	MDD	Min Pressure (psi)	74	76	65
	MDD + FF	Fire Flow (L/s)	102	212	57
		% of Hydrants Below Criteria	-	1.8%	
2041	ADD	Max Pressure (psi)	87	88	94
	MDD	Min Pressure (psi)	68	69	58
	MDD + FF	Fire Flow (L/s)	79	178	45
		% of Hydrants Below Criteria	-	12.0%	
2041 + Development	ADD	Max Pressure (psi)	87	88	94
	MDD	Min Pressure (psi)	66	68	57
	MDD + FF	Fire Flow (L/s)	79	177	45
		% of Hydrants Below Criteria	-	12.0%	

⁽¹⁾ Land use based fire flow targets were established as part of the City's WDSMP

The following water analysis results were observed:

- **Pressure**
 - Local system has sufficient capacity to accommodate pressures between 40-100 psi at the development property boundary and within the local study area under both an average day and peak hour demands
- **Fire Flow**
 - Fire flow requirements were determined in the Fort Erie WSDMP with residential single-family target as 75 L/s and residential multiple family target as 150 L/s
 - Under both existing and 2041 conditions fire flows to the development property boundary exceed the 75 L/s single family fire flow target but not the 150 L/s multiple family fire flow target
 - Due to the size of the development, it is likely that internal to the development, the fire flow target of 75 L/s may not be met as projected fire flows are moderately exceeding 75 L/s under future conditions; as such, it is recommended at minimum to loop the proposed 150 mm watermain along Nigh Road from Buffalo Road to Rose Hill Road
 - If the proposed residential development is to have any multiple family units, the 150 L/s fire flow target cannot be achieved under the proposed upgrades previously outlined and would require an upsized watermain along Nigh Road from Buffalo Road to Rose Hill Road to, at minimum, 200 mm
 - Additional analysis should be done to confirm watermain upgrade needs to the development based on internal watermain layout and proposed residential land use types
 - Fire flows to the local study area are minimally impacted by the additional demands to the development with no additional fire flow deficiencies, as established in the Fort Erie WSDMP, created as a result of the development
- Increased demands are within the established growth targets and are anticipated to be within the future facility capacities (storage, pumping, and supply)

4 Wastewater System Review

4.1 Basis of Analysis

The Town's most recent Pollution Prevention and Control Plan and Wastewater Master Plan (PPCP&MP) Study and Niagara Region's most recent Water and Wastewater Master Plan (MSP) Study were used to support the assessment of existing system capacities, identification of planned system upgrades, and identification of system performance objectives. The model developed for the PPCP&MP was utilized to complete the system analysis.

4.1.1 Pump Station Level of Service Target

Niagara Region owns and operates the wastewater pumping station within the Town. The Region's pump station firm capacities are designed to safely convey the peak wet weather flows from a design allowance of 0.286 L/s/ha and a peaking factor of 2 for average dry weather flows.

4.1.2 Gravity Sewer Level of Service Targets

The Town generally owns and maintains the majority of trunk sewers within the wastewater system. For existing sewer capacities, sewer surcharging conditions were defined and assessed when peak system hydraulic grade line (HGL) within a pipe satisfied both of the following conditions:

- Depth of flow in pipe is equal to or less than obvert elevation ($d/D = 1$); and
- HGL elevation is less than 1.8 meters below grade.

The Town has identified a current system performance target of meeting the design 5 year storm.

4.2 Local System

The local development is located adjacent to the Dominion Road sewage pumping station (SPS) catchment, which ultimately conveys flows to the Anger Avenue wastewater treatment plant (WWTP). The local development is not currently within the urban boundary and connection to the existing wastewater system would likely be via the 200 mm sewer on Buffalo Road conveying flows south and east to the Dominion Road SPS. **Figure 3** shows the location of the proposed development and proposed connection to the existing wastewater system.

The property generally slopes from north to south with a ground elevation of 184 m at the north to 181 m at the south. Based on existing contours the most logical tie in location would be at the intersection of Buffalo Road and Parkside Avenue. It is noted that the existing manholes on Buffalo Road are relatively shallow, with less than 2 m of ground cover. While the existing manhole invert at Buffalo Road and Parkside Avenue, based on best available information, of 179.75 m does allow for the full property to be serviced via gravity, one of two approaches will be required to achieve a sewer cover of more than 2 m.

- Filling of the site.
- Lowering of the existing sewer on Buffalo Road from the tie-in point to Dominion Road.

0 Nigh Road Lands West of Buffalo Road to Rosehill Road



Wastewater Network

- | | | | |
|--|-----------------------------------|--|----------------------------------|
| | Wastewater Treatment Plant | | Alliston Ave S.P.S. |
| | Leachate Pumping Station | | Anger Avenue W.W.T.P. |
| | Pumping Station | | Bardol S.P.S. |
| | Sanitary Force mains | | Catherine St. S.P.S. |
| | Sanitary Gravity Mains (Local) | | Dominion Road S.P.S. |
| | Sanitary Gravity Mains (Regional) | | Lakeshore Rd. S.P.S. (Fort Erie) |
| | | | Rose Ave. S.P.S. |
| | | | Thompson Road S.P.S. |

Proposed Wastewater Upgrades

- | | | | |
|--|--------------------|--|---------------------------------|
| | Development Parcel | | Proposed Development Connection |
|--|--------------------|--|---------------------------------|

General Features

- | | | | |
|--|--------------------|--|-----------|
| | Municipal Boundary | | Waterbody |
| | Urban Boundary | | |

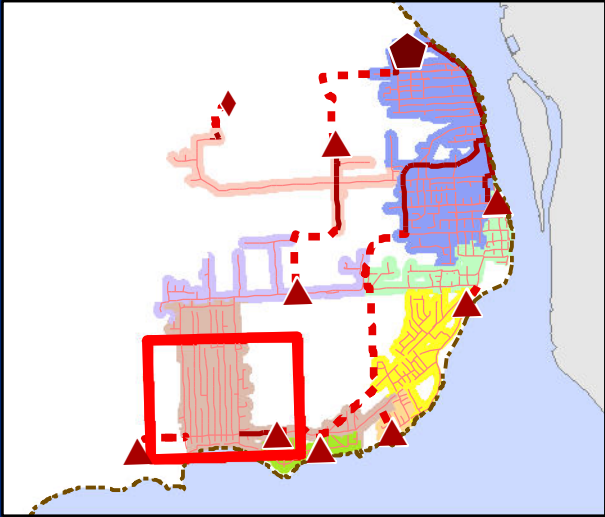
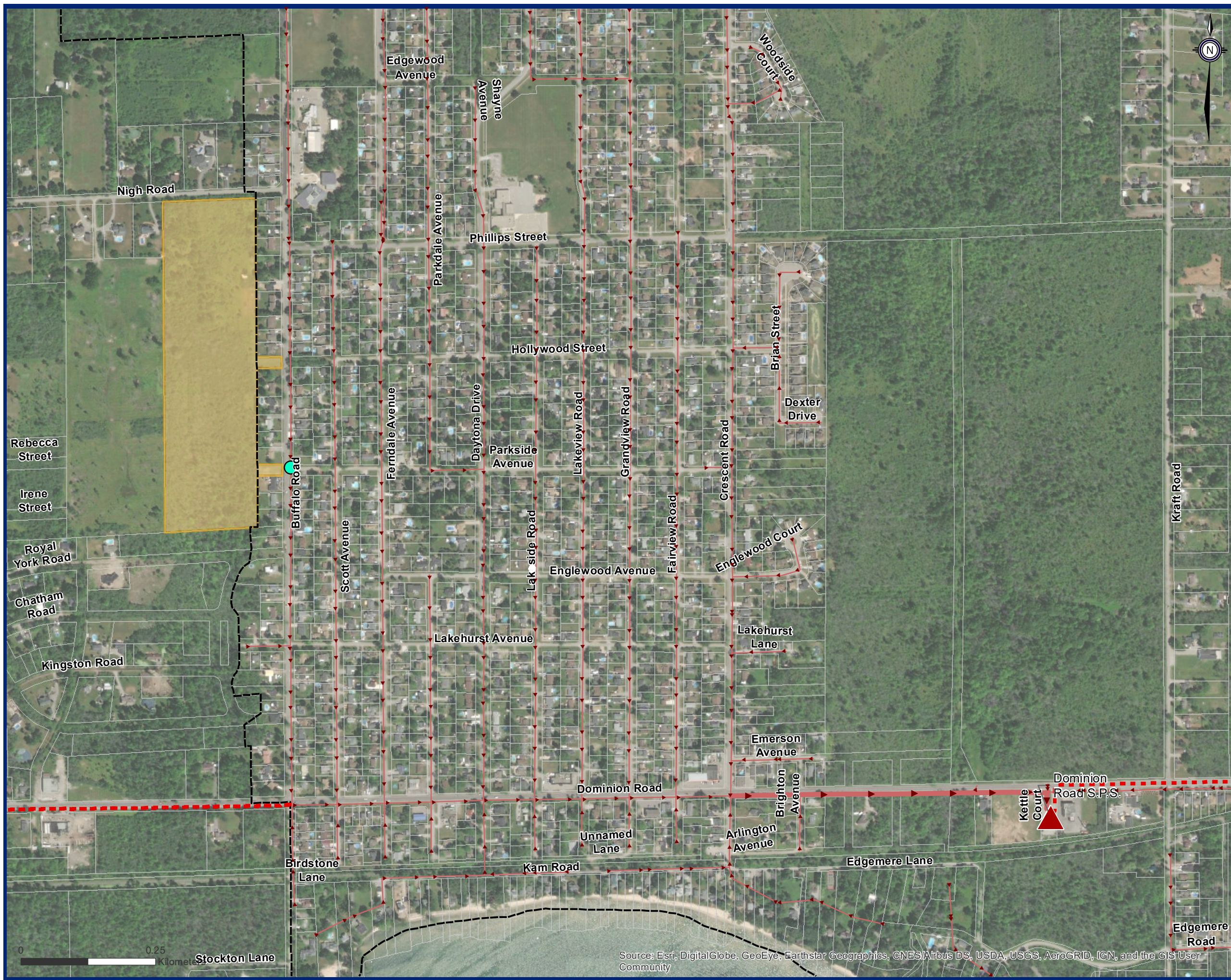


Figure 3
Existing Wastewater System

0 0.25 Kilometers

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community



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4.3 Previous Assessment and Upgrade Recommendations

The Town’s PPCP&MP identified existing capacity restrictions along the existing Dominion Road sewer and downstream Dominion SPS, however, these restrictions were primarily the result of high inflow and infiltration.

The MSP did not identify any upgrades at the Dominion SPS, as the existing and projected peak flows under the Region’s inflow and infiltration allowance of 0.286 L/s/ha did not exceed the existing capacity of the station. The PPCP and MP did not identify any sewer upgrades within the Dominion Road sewer; however, the following inflow and infiltration reductions were recommended.

- Implement approximately 125 L/s reduction in wet weather flows within Dominion Road Sewer catchment west of the Dominion SPS.
- Implement approximately 110 L/s reduction in wet weather flows within Dominion Road Sewer catchment east of the Dominion SPS.

4.4 Wastewater Pump Station Performance

The existing and future projected flows as identified in the MSP are summarized in **Table 6**. It is noted that the Region’s Pump Station Capacity Assessment was completed using the Region’s design allowance of 0.286 L/s/ha.

Table 6: Summary of Dominion SPS flows and capacity based on Region MSP

Scenario	Average Dry Weather Flow (L/s)	Design Peak Wet Weather Flow (L/s)	Station Firm Capacity (L/s)
Existing	17.4	143	215
MSP 2041	22.8	162.7	
MSP 2041 + Proposed Lands (30 ppha)	23.8	168.2	
MSP 2041 + Proposed Lands (55 ppha)	24.6	171.2	

Using the Region’s criteria, the Dominion SPS’s MSP listed capacity of 215 L/s is sufficient to accommodate the proposed development’s additional flow contributions.

However, when reviewing the projected design storm flows to the Dominion SPS, based on observed flow monitoring data, the estimated peak 5 year is 847 L/s exceeding the station’s existing and future firm capacity. As such, keeping in line with the Town’s performance objectives and recommendation to implement a demonstrated reduction matching the development’s peak wet weather flow, before the development can proceed, in order to maintain the existing station’s level surcharging. The total wet weather reduction would therefore be increased to approximately 250 L/s total reduction within the Dominion SPS catchment area.

4.5 Gravity Sewer Capacity

The existing Buffalo Road sewer, downstream of the proposed tie in point on Parkside Avenue, consists of 200 mm to 250 mm sewer with slopes ranging from 0.2% to 0.33%. **Table 7** summarizes the existing Buffalo Road sewer capacities and 5-year peak flows.

Table 7: Buffalo Road Sewer Capacity

Sewer	Slope (%)	Capacity (L/s)	Existing 5 Year Peak Flow (L/s)
200 mm	0.33	18.8	16
250 mm	0.2	26.0	19

Based on the existing sewer capacity, there is insufficient capacity within the Buffalo Road sewer to accommodate the additional flows, under the existing 5 year design storm, without triggering sewer surcharging exceeding the Town’s 1.8 m below ground elevation target. As such, the Buffalo Road sewer would need to be upgraded to a minimum of 300 mm.

The Buffalo Road sewer discharges into the 350 mm to 600 mm sewer on Dominion Road. This sewer currently surcharges under the existing 5 year design storm, however, the peak HGL remains marginally below the Town’s 1.8 m below ground elevation target. The addition of the site’s peak wet weather flows triggers some localized sewer surcharging above the Town’s 1.8 m target; however, a demonstrated reduction in the peak wet weather flows matching the development’s peak flows, in catchment upstream of the west Dominion Road sewer, is sufficient to maintain the existing sewer surcharging levels.

5 Summary

- The proposed 10 ha residential development is proposed at 0 Nigh Road within the Town of Fort Erie; however, it is located outside of the urban boundary
- As the proposed development does not have a site plan, residential populations were estimated using a 30 ppha as determined using previous growth studies conducted with the Town of Fort Erie and using an upper density of 55 ppha which is suggested by the Province's Places to Grow, Amendment 3
- Water system analysis results
 - Local system can accommodate the additional demands while maintaining 40-100 psi under average day and peak hour demand conditions for both existing and 2041
 - Fire flows to the development exceed the 75 L/s single family residential target and not the 150 L/s multi family residential target under existing and future conditions; additional upgrades and/or are required to improve local fire flows which may not be achieved internal to the development
 - Increased demands are within the established growth targets and are anticipated to be within the future facility capacities (storage, pumping, and supply)
- Wastewater system analysis results
 - The Town's PPCP&MP identified existing capacity restrictions along the existing Dominion Road sewer and downstream Dominion SPS, however, these restrictions were primarily the result of high inflow and infiltration.
 - Based on the existing sewer capacity, there is insufficient existing capacity within the Buffalo Road sewer to accommodate the additional flows, under the existing 5-year design storm, without triggering sewer surcharging. As such, the Buffalo Road sewer would need to be upgraded to a minimum of 300 mm.
 - Using the Region's criteria, the Dominion SPS MSP listed capacity of 215 L/s is sufficient to accommodate the proposed developments additional flow contributions.
 - A demonstrated reduction in the peak wet weather flows in the catchment upstream of the west Dominion Road sewer is needed to maintain existing sewer surcharging levels within the Dominion Road Sewer below the Town's 1.8 m criteria.