



## **APPENDIX B**

# **Technical Memorandum: Water Model Development and Results**

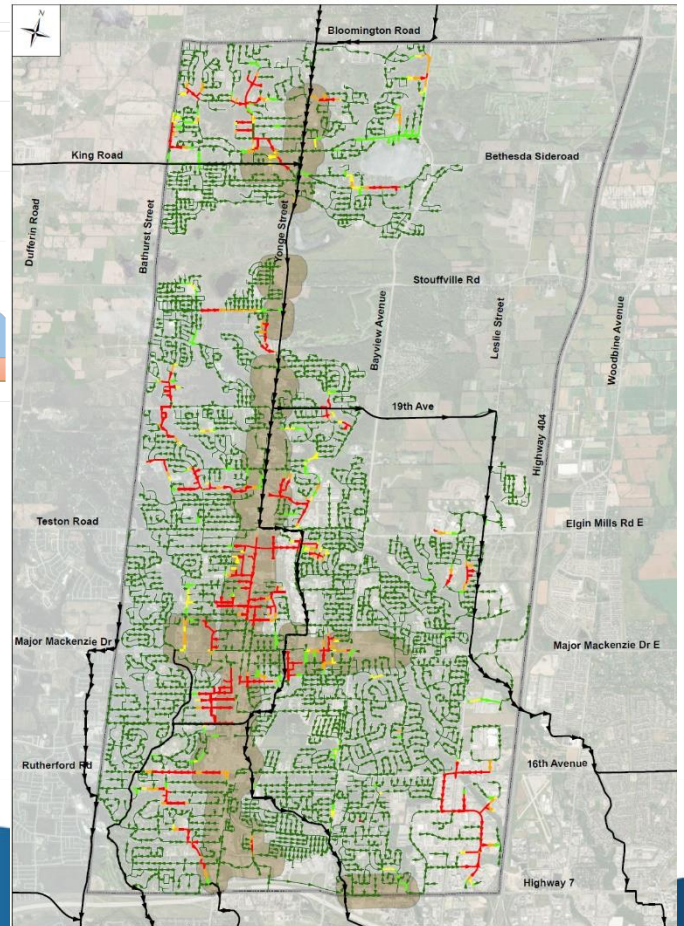
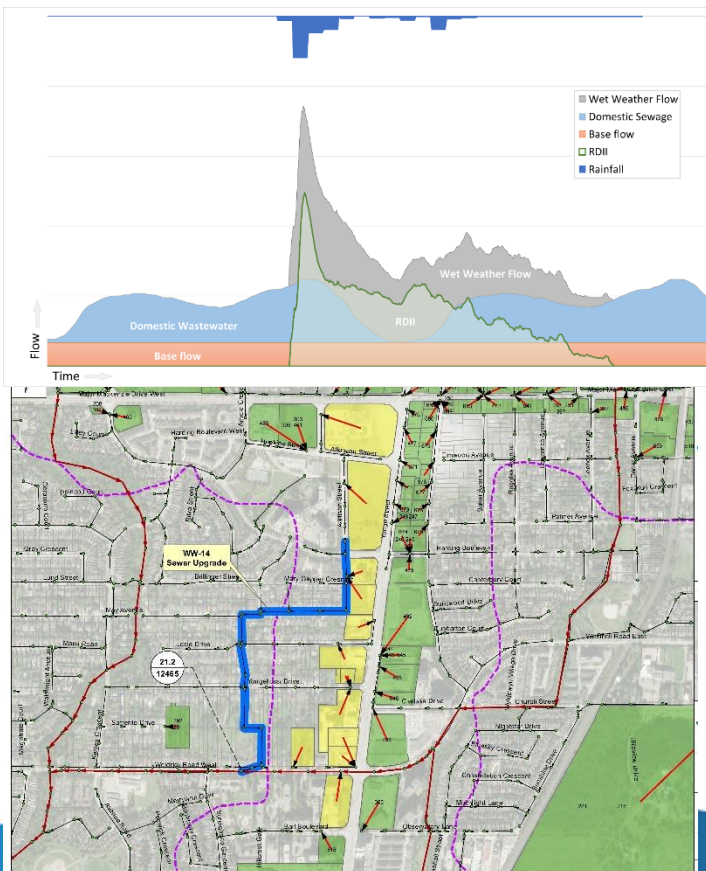
# City of Richmond Hill

Civica Reference: RIC18-0004

## Urban MESP Update Study

### Final Technical Memorandum: Water Model Development and Results

October 31, 2023



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October 31, 2023

**CIVICA Ref: RIC18-0004**

City of Richmond Hill  
225 East Beaver Creek Rd,  
Richmond Hill, ON L4B 3P4

**Attention:** Jeff Walters P.Eng., Development Engineering Manager

Dear Mr. Walters,

**RE: Water Servicing Technical Memorandum**

Please find the following draft water model technical memorandum for your review.

Do not hesitate to contact us for further clarification and/or comment.

Sincerely,

**CIVICA INFRASTRUCTURE INC.**



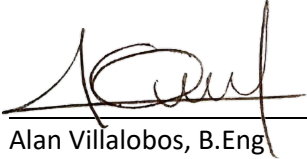
Alan Villalobos  
Project Manager

cc: Edward Graham, Civica Infrastructure

Encl. Water Servicing Technical Memorandum

## Document History & QA/QC

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## Revision History

Name	Date	Reason for Change	Version
Arash Shahmansouri	2019-03-13	First Draft	Version 1
Walid Abi Akar	2023-04-06	Updated Growth and Solutions	Version 2
Walid Abi Akar	2023-08-28	Updated Growth and Solutions	Version 3
Malihe Mohammadiun	2023-09-27	Address City's and Region's comments	Draft Final
Alan Villalobos	2023-10-06	Address City's and Region's comments	Final
Alan Villalobos	2023-10-31	Address City's and Region's comments	Final

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#### Document History & QA/QC

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#### Appendix V. Proposed Solutions Cost Estimate

## 1.0 Introduction

### 1.1 Purpose

This Technical Memorandum (TM) describes a summary of the water distribution system analysis and required infrastructure upgrades to serve the City of Richmond Hill Intensification Areas to the Ultimate Build-Out Condition. The primary purpose of the study is to update the 2014 Urban MESP and hydraulic model based on the revised population growth and updated system information. The objective is to evaluate new data, review current information, upgrade the hydraulic water distribution model in InfoWater, project the future needs, and develop recommendations for system improvements necessary to maintain an adequate level of water service to the current and future customers. It is worth mentioning that existing inadequate levels of service that are not caused by population growth will not be addressed in this TM.

### 1.2 Study Area

As shown in **Figure 1-1**, the study area of this project consists of seven Official Plan (OP) land use intensification Areas in addition to three (3) Emerging Growth Centres (EGC):

#### OP Intensification Areas:

- Village Local Centre
- Key Development Areas
- Local Development Areas
- Local Mixed Use Corridor
- Oak Ridges Local Centre
- Regional Mixed Use Corridors
- Richmond Hill Centre

#### Emerging Growth Centres:

- Newkirk GO Local Centre
- Bathurst and Highway 7 Centre
- East Beaver Creek and Highway 7 Centre

### 1.3 Richmond Hill Water Network

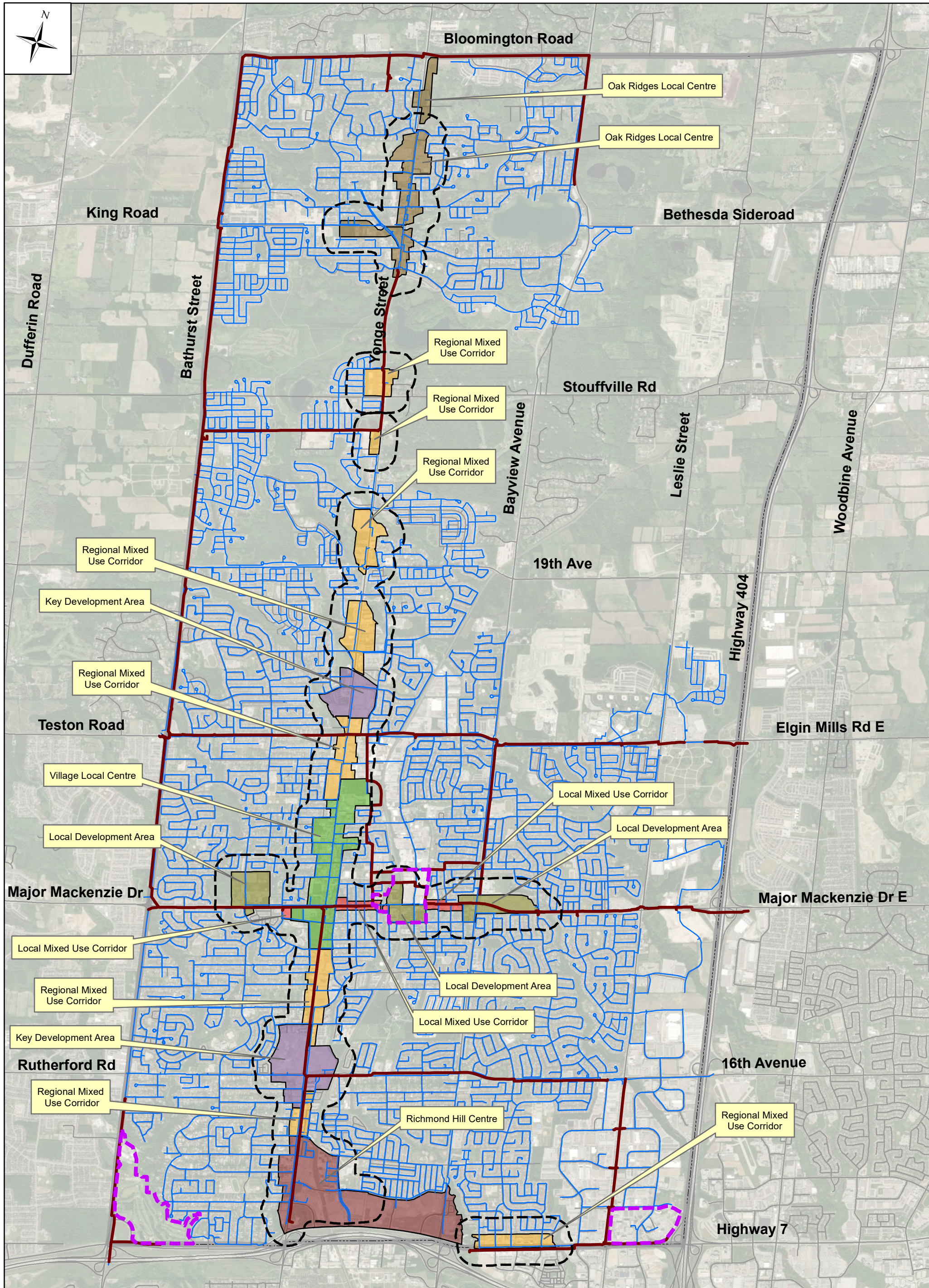
The City's water distribution system is a part of the York Region's system. City provides water to its customers through four (4) Pressure Districts: Regional Districts of 6, 7, 8, and 9 (PD6, PD7, PD8, and PD9, respectively). Before 2017, a sub-sector of the network, called Flow Modulated Area, was isolated by the Region. The 2016 pressure districts, including Flow Modulated Area (FMA), are displayed in **Figure 4-1**. Richmond Hill FMA was removed in 2017, which is discussed later in the report.

### 1.4 Report Organization

Section 2 discusses model assumptions, boundary conditions, infrastructure, and demand allocation. In Section 3, investigation methodology, water system criteria and requirements are discussed. Existing system condition and model results are presented in Section 4. Future condition model results (Ultimate

## **1.4 Report Organization**

Section 2 discusses model assumptions, boundary conditions, infrastructure, and demand allocation. In Section 3, investigation methodology, water system criteria and requirements are discussed. Existing system condition and model results are presented in Section 4. Future condition model results (Ultimate Build-Out, 2041, 2051) and system deficiencies are summarized in Section 5. Evaluation of different alternatives is presented in Section 6 while Section 7 completes the report with proposed system results, recommended system improvement plan and cost estimate.



Dufferin Road

King Road

Bloomington Road

Oak Ridges Local Centre

Oak Ridges Local Centre

Bethesda Sideroad

Bathurst Street

Yonge Street

Regional Mixed Use Corridor

Regional Mixed Use Corridor

Regional Mixed Use Corridor

Stouffville Rd

Bayview Avenue

Leslie Street

Woodbine Avenue

19th Ave

Highway 404

Regional Mixed Use Corridor

Key Development Area

Regional Mixed Use Corridor

Teston Road

Elgin Mills Rd E

Village Local Centre

Local Development Area

Local Mixed Use Corridor

Local Development Area

Major Mackenzie Dr

Major Mackenzie Dr E

Local Mixed Use Corridor

Regional Mixed Use Corridor

Local Development Area

Local Mixed Use Corridor

Key Development Area

Rutherford Rd

Regional Mixed Use Corridor

Richmond Hill Centre

16th Avenue

Regional Mixed Use Corridor

Highway 7

**Richmond Hill** CIVICA

**RIC18-0004 - Richmond Hill UMESP Update**

Legend	
<span style="color: green;">■</span>	Village Local Centre
<span style="color: purple;">■</span>	Key Development Areas
<span style="color: olive;">■</span>	Local Development Areas
<span style="color: red;">■</span>	Local Mixed Use Corridor
<span style="color: brown;">■</span>	Oak Ridges Local Centre
<span style="color: orange;">■</span>	Regional Mixed Use Corridors
<span style="color: brown;">■</span>	Richmond Hill Centre
<span style="border: 1px dashed black; display: inline-block; width: 10px; height: 10px;"></span>	2014 UMESP Study Area
<span style="border: 1px dashed purple; display: inline-block; width: 10px; height: 10px;"></span>	Emerging Growth Centres
<span style="border: 1px solid grey; display: inline-block; width: 10px; height: 10px;"></span>	Municipal Boundary
<span style="color: blue;">—</span>	Local Watermains
<span style="color: red;">—</span>	Regional Watermains

**Figure 1-1: UMESP Study Area**

Drawn By: J.H. Date: Oct 28, 2023

0 500 1,000 2,000 Meters

## 2.0 Model Development

The previous 2014 City-wide model was developed to simulate the water distribution system under 2011 conditions and was used to analyze the system until the Ultimate Build-Out. As a part of this study, Civica Infrastructure (Civica) updated the 2011 model employing the updated data provided by the City and York Region. The model is also verified in terms of assumptions and infrastructures and the required changes were made. New model scenarios are defined to simulate the water distribution network under 2041, 2051, and Ultimate Build-Out conditions.

### 2.1 2011 Model Assumptions

The 2011 InfoWater model was developed as a steady state model; therefore, every connection to the Regional feed points, pumping stations, reservoir, and elevated tanks were modeled as fixed-head reservoirs. The head levels of the fixed-head reservoirs were established based on information obtained from the Region at the time. Valve settings (check valves, pressure reducing valves [PRVs], and flow control valves) were obtained from the City and the 2010 pressure monitoring report by Genivar. In terms of Hazen-William C factors, City's design values were assigned.

### 2.2 Updates for Current Water Master Plan Model

Civica examined the 2011 model assumptions and updated the model for 2016 conditions. Changes were made as required, employing information obtained from the City and Region. This included assumptions for model configuration, supply points, boundary conditions, watermains, pressure district boundaries, and valve settings.

#### 2.2.1 Model Configuration

The major updates applied to 2011 model are as follows:

- The hydraulic model configuration was examined; an arrangement of system components was fixed based on new information and consultation with the City.
- More than 400 new watermains were added to the model. InfoWater was used to build the nodes associated with the pipes. The elevations were updated using digital elevation model (DEM) obtained from the City.
- Richmond Hill PD8 pumping station has been offline and replaced by the new East Vaughan PD7/PD8 pumping station located on Bathurst and Elgin Mills Road. The model was updated accordingly.
- The two Regional points of supply at Bathurst-McCallum and Bathurst-Weldrick assumed to be constructed in 2016 in the previous model, were not constructed and were removed.
- The FMA was removed by the City in 2017 and all valves separating the FMA from the pressure district 6 and 7 were opened (except V2447 at the intersection of Major Mackenzie Drive and Spadina Road). Although the 2016 (existing condition) model includes the valves FMA, the area previously considered as FMA is a part of PD7 after 2017. As a result, the FMA valve setting was changed in the future condition scenarios (2041, 2051, and Ultimate Build-Out), with consultation with the City. The area has check valves between PD6 to PD7 to provide required flow demands.

- Some valve settings were changed. The Pressure Districts were set to show the current and future conditions of the system based on data received from the City.
- The Regional watermain at Highway 404 and Major Mackenzie Drive is a part of PD6, according to the City and Region. The watermain status and connections (valve settings) were modified in the model accordingly.
- The Transmission main at Bathurst Street and Major Mackenzie Drive was set closed for an existing condition, according to the City's Operation Division. The Transmission main will be open in future condition models.
- The 900 mm transmission main at Bathurst and Major Mackenzie (assumed to be constructed in 2016 in the previous model) has not been constructed and was removed from the model.
- According to the City, the 300 mm watermain on Major Mackenzie Drive (between Bathurst St and Yonge), currently inactive, will be placed back into the service before 2031, after the completion of repairs. Therefore, the watermain set active in future Scenarios.
- The future model includes the new watermains on the BRT line located on Yonge Street, south of Major Mackenzie Drive.
- All watermains under construction or design stages have been included in the future model scenarios. This includes King Road watermain replacement and Bethesda sideroad and Leslie Street new watermains.

### **2.2.2 Watermains**

New watermains (installed after 2012) were added to the existing condition model. Similar to the 2011 model, Hazen-William C values were assumed as City's designed values. Model calibration is not in the scope of this study.

### **2.2.3 Regional Supply Points (Boundary Conditions)**

Boundary conditions of the system were verified and updated using Regional data. All points of supply to the distribution system were modeled as fixed-head reservoirs. The head levels of the fixed-head reservoirs were established based on information obtained from the Region.

### **2.2.4 Valves**

Control valves settings (open/closed) were applied to the model based on the City's GIS information and verified by the City's Operation Division. As mentioned, the valve settings for valves isolating FMA were changed in future condition scenarios (2041, 2051, and Ultimate Build-Out). The FMA valve setting for the existing scenario (2016) remained the same as the 2011 model.

For pressure control valves and flow control valves, settings from the previous UMESP and/or Technical Memorandum by Genivar, 2010, were used. For pressure reducing valves (PRVs), settings were also examined based on the Pressure District hydraulic grade line (HGL) ranges and supplemented by hydrant pressure test data. The set points of the PRVs were updated where necessary, according to information from the City's Operation's Department. The settings of two PRVs in Pressure District 9 were not available; therefore, the set points were estimated using available pressure data in surrounding areas.

### 2.2.5 Static Pressures

The City provided Civica with extensive static pressure readings from the tests undertaken in 2016. The static pressures were assigned to the model and utilized to verify the existing model results.

### 2.2.6 Demand Allocation

Similar to the previous model, nodes within the InfoWater model were identified as demand nodes if they were part of the City distribution system, and non-demand nodes if they were part of the Region supply system. For proposed developments in the study area, demand nodes were decided based on the servicing reports or as instructed by City.

Similar to the sanitary model, water demands were allocated to the model using the population and according to the City’s and York Region’s standards summarized in **Table 2-1**. Total water consumption during 2016 at each meter as well as total 2016 population (residential and ICI) for Traffic Zones was obtained from the City and Region. The 2016 water consumption for meters close to each demand node were calculated, and the population was assigned to the node proportional to the average water consumption. The Average Day, Max Day, and Peak Hour demands were then calculated for each demand node using the assigned populations (ICI and Residential) and agreed upon York Region and City’s design standards. For new developments, populations were assigned as described in the wastewater Technical Memorandum.

For the existing scenario (2016) population, the City’s water demand rate of 365 lpcd was used for both residential and ICI demands as per the City design criteria. For future population demand calculations, forecasted water demand rates from York Region’s 2016 Water and Wastewater Masterplan were adopted. Similarly the regional Maximum day and peak hour demand factors were used for future demand calculations. Adopted water demand rates and peak factors are summarized in **Table 2-1**.

The City does not have a criterion for the minimum hour demand, therefore, the minimum rate factor of 0.8 was assumed as per MECP recommendation.

**Table 2-1: City of Richmond Hill Standard Design Demand Factors <sup>1</sup>**

Year	Residential Demand	ICI Demand	Maximum Day Demand Factor	Peak Hour Demand Factor
2016	365 Lpcd	365 Lpcd	1.8	2.7
2041	189 Lpcd	144 Lpcd	1.8	2.7
2051	189 Lpcd	144 Lpcd	1.8	2.7
Ultimate Build-Out	189 Lpcd	144 Lpcd	1.8	2.7

1. City of Richmond Hill has no minimum rate recommendation. A minimum rate factor of 0.8 was used to calculate minimum hour demand in this project, as per MECP recommendation for communities with the population greater than 150,000

### 3.0 Investigation Methodology

The updated model was employed to investigate the capability of the water distribution system to provide water with acceptable pressure and sufficient flow for fire flow demands under existing and future conditions. Minimum Hour, Average Day, Maximum Day, and Peak Hour Demand Scenarios were established for 2016, 2041, 2051, and Ultimate Build-Out conditions. Scenarios were also developed for the proposed modifications to the water system.

The existing model was evaluated using 2016 static pressure data. Static pressures were incorporated into the InfoWater model and compared with the modeling results of the existing scenario (2016). The static pressure (along with the hydrant ID) is attached in the model to the nodes within 50 m distance of the tested hydrants. As per the previous UMESP, the modeling results within the 100 KPa of the observed pressures were assumed acceptable. The following sections describe the criteria used for the investigations.

#### 3.1 Static Pressure

Available static pressure at demand nodes was calculated by the model under existing and future conditions. The acceptable criteria for static pressure were as follows:

- Minimum pressure during the peak hourly demand, 275 KPa
- Maximum pressure during average day demand 690 KPa

#### 3.2 Fire flow Demands

##### 3.2.1 Minimum Pressure

The minimum pressure at all demand nodes should be more than 140 KPa when the system is tested for fire flow during maximum day demand conditions. It is worth noting that Richmond Hill design criteria indicate that the City's minimum pressure during fire flow plus maximum day demand should be 275 KPa. After communications with the City, the minimum pressure of 140 KPa was used. The later value (140 KPa) was also used in the previous UMESP.

##### 3.2.2 Required Fire Flow

The City's fire flow requirements are listed in **Table 3-1**. The City's Standards and Specifications Manual has no recommendation for the fire flow requirements for high rises.

**Table 3-1: Fire Flow Requirements - City of Richmond Hill**

Structure Type	FF Demand (L/s)
Single Family, 30 m separation	36
Single Family, 15 m separation	48
Single Family, 6 m separation	60
Single Family or semi-detached, 3 m separation	64
Cityhouse, maximum 2-1/2 story	68
Apartment 3 stories or with close shaft, no exposure	72
Institutional, no exposure	120 - 190

Structure Type	FF Demand (L/s)
Industrial, no exposure	72 - 190
Commercial, no exposure	185 - 480

In order to recommend the fire flow requirements for high rises, criteria for several communities in Canada as well as the Fire Underwriters Survey (FUS) were reviewed and investigated. The results are summarized in **Table 3-2**. “Water Supply for Public Fire Protection by Fire Underwriters Survey, 1999” was also used to calculate recommended fire flows by FUS.

For the purposes of this study, fire flow demands of 317 l/s are recommended for high rises. Required fire flow demand was recommended for each land use designation by reviewing the City’s land use policy explained in Richmond Hill Official Plan, and after consultation with the City. **Table 3-3** summarizes the recommended fire flow demands used in this study. The recommended flows are more comprehensive and applicable for this study than **Table 3-1** that has a more detailed subdivision of type of structures, not known at the study level. Note that the proposed fire flow values are for the planning purpose. New development applications should investigate the required and available fire flow as per the City’s process (using FUS procedure and flow tests).

**Table 3-2: Summary Fire Flow Demand Criteria for High Rises and Multi-Family Residential**

City or Town	Fire Flow Demand Criteria (l/s)	Comments	Reference
Town of New Market	250	Criteria for Apartments	Design Standards, Town of Newmarket, 2018
City of Toronto	317	Criteria for High-Rise Residential	Design Criteria for Sewers and Watermains, City of Toronto, 2014
City of Waterloo	150-225	Multi-Family: 150 l/s City Center – Future: 225 l/s	Water Distribution Master Plan, City of Waterloo, 2017
City of Burnaby	200 -250	Multi-Family Residential (MF): 200 l/s MF/Commercial Mix: 250 l/s	Design Criteria Manual, Engineering Department, City of Burnaby, 2014
Town of Whitchurch-Stouffville	150	Criteria for Apartments	Water and Wastewater Master Plan Study, Town of Whitchurch-Stouffville, 2017
City of Winnipeg	200	Criteria for Multi-Family Residential	Water Demand Estimation and Design Guidelines, City of Winnipeg, 2019
City of Edmonton	180 - 300	Mid-Value Multi-Family Residential: 180 l/s High-Value Multi-Family Residential: 300 l/s	Design and Construction Standards, Volume 4, 2017
Town of Newmarket	250	Criteria for Apartments	Design Standards, Town of Newmarket, 2018

**Table 3-3: Recommended Fire Flow Demand for Land Use Designations**

<b>Structure Type</b>	<b>FF Demand (L/s)</b>
Single Family	67
Townhouses and Apartments up to 3 storeys	100
Institutional, Industrial, Commercial	190
Apartments up to 8 storeys	190
Medium to High-Rise buildings	317
Big box Retail	317

## 4.0 Existing (2016) System Condition

The 2016 hydrant test pressures were employed to validate the functionality of the model. As calibration was not a part of the study, the functionality of the model was investigated by comparing the 2016 static pressure readings versus the modeled static pressures. The City's model was run under both 2016 Maximum Day Demand and 2016 Peak Hour Demand Scenarios. The actual pressure data along with the verified model were used to review the existing conditions of the water distribution system. **Figure 4-1** shows the 2016 pressure districts.

### 4.1 Hydrant Static Pressures (Observed)

**Figure 4-2** shows observed static pressures according to the results of 2016 hydrant test. Most locations in the City are in the acceptable range of 275 – 690 KPa, with the following exceptions:

- A. South of Major Mackenzie Drive, east of Yonge Street (more than 690 KPa),
- B. North of Major Mackenzie Drive, east of Bayview Street, south of Elgin Mills (more than 690 KPa),
- C. North of Elgin Mills and south of 19th Street, east and west of Yonge (more than 690 KPa),
- D. A small area north of Gamble Street and East of Bathurst Street (less than 275 KPa),

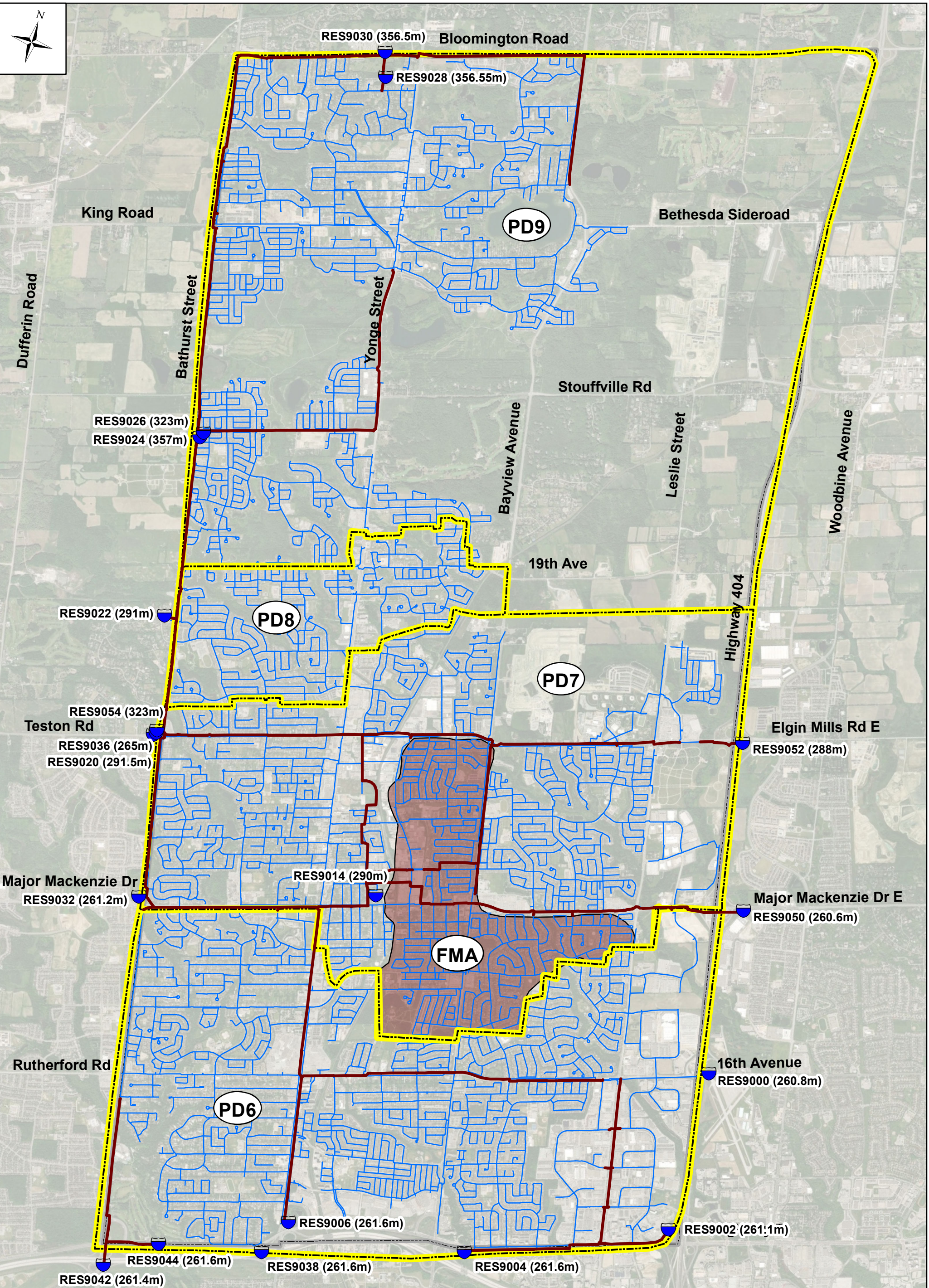
Among the above areas, areas **A.** and **C.** are inside the study area.

### 4.2 Model Verification and Results







To verify the modeling results versus City static pressure test data, the model was run under 2016 Maximum Daily Demand and Peak Hour Demand. The difference between the model pressures and the 2016 observed pressures are summarized in **Figure 4-3** and **Figure 4-4**. The modelling results are generally within 100 kPa of the hydrant test results. The areas with modeled pressures more than 100 KPa difference with the hydrant test data are:

- A. South of Major Mackenzie Drive and east of Bayview: this area is the south part of the old FMA. As mentioned before, FMA no longer exists and the area is now a part of PD7;
- B. South of Major Mackenzie Drive and east of Yonge Street;
- C. North of Gamble Street and west of Yonge Street. This area consists of subdivisions in PD9 with five PRVs in the area. The PRV settings are not available at the time of this study, which affects the modeling results. According to the City, the area has high-pressure fluctuations, which affects the hydrant test results.

Results outside of 100 KPa range tend to be clustered, which could indicate operational issues that aren't modelled correctly (partially-closed valves or possibly nearby watermains temporarily closed for operational/maintenance purposes), or hydrant test data that was not undertaken during the daily peak demand hour. **Figure 4-5** to **Figure 4-7** show modeled pressures and available fire flows under existing (2016) conditions.

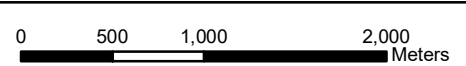


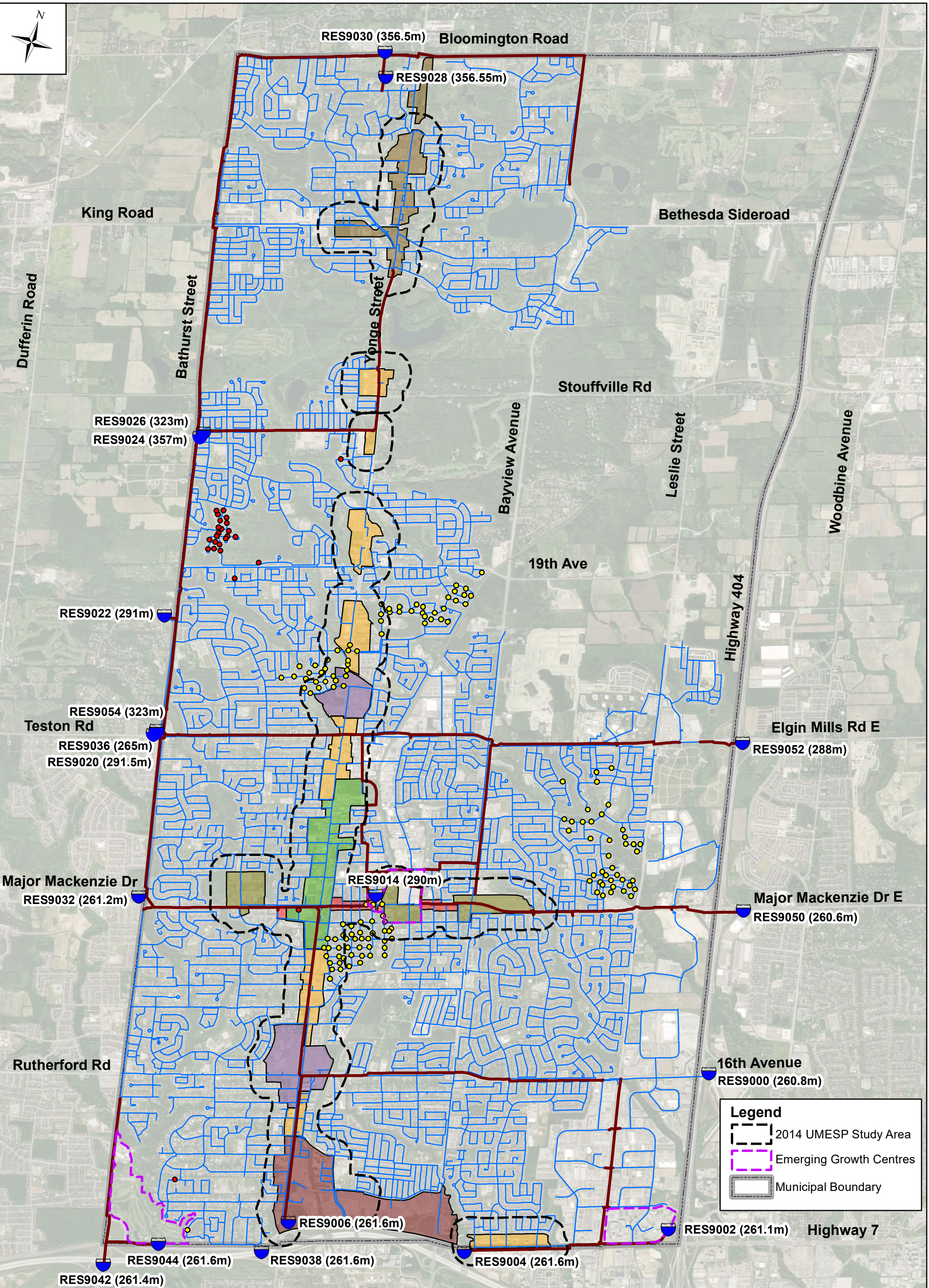
**Legend**

-  York Region Reservoir Locations (19) (Head (m))
-  Local Watermains
-  Regional Watermains
-  (PD9) Pressure District Zones
-  FMA Area
-  Municipal Boundary

**Figure 4-1:  
2016 Pressure Districts**

Drawn By: J.H. Date: Sep 27, 2023





**Legend**

- 2014 UMESP Study Area
- Emerging Growth Centres
- Municipal Boundary

**Legend**

**Observed Pressure (KPa)**

- < 275
- > 690

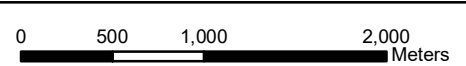
Note: Nodes with normal pressure (275 - 690 KPa) are not shown

- York Region Reservoir Locations (19) (Head (m))
- Local Watermains
- Regional Watermains

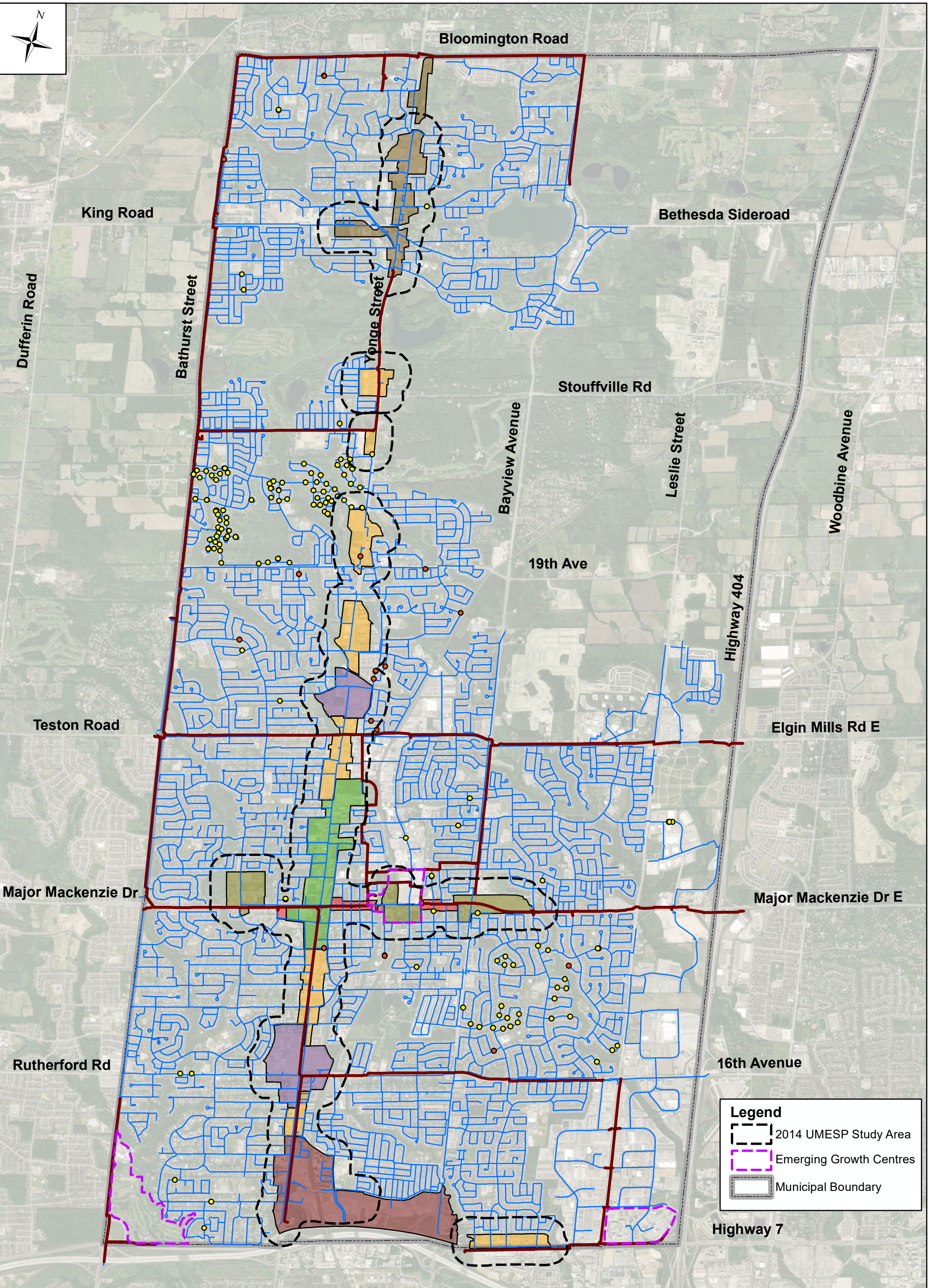
- Village Local Centre
- Key Development Areas
- Local Development Areas
- Local Mixed Use Corridor
- Oak Ridges Local Centre
- Regional Mixed Use Corridors
- Richmond Hill Centre

**Figure 4-2:  
2016 Observed Pressures**

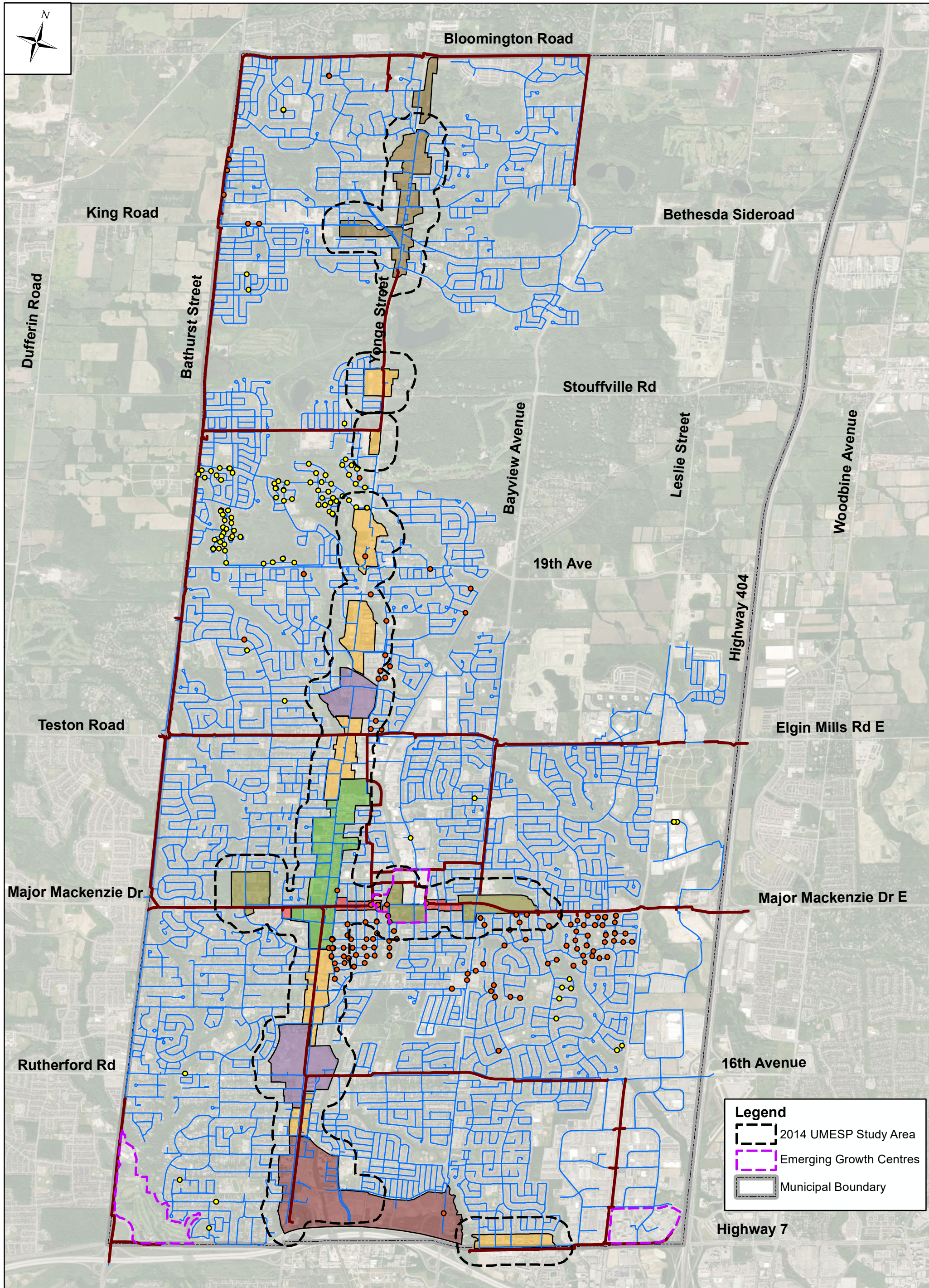
Drawn By: J.H. Date: Oct 28, 2023



**RIC18-0004 -  
Richmond Hill UMESP Update**



Legend	
<span style="color: red;">●</span>	Observed Pressure 100KPa Higher than Modeled
<span style="color: yellow;">●</span>	Modeled Pressure 100KPa Higher than Observed
<span style="color: blue;">—</span>	Local Watermains
<span style="color: brown;">—</span>	Regional Watermains
<span style="color: green;">■</span>	Village Local Centre
<span style="color: purple;">■</span>	Key Development Areas
<span style="color: olive;">■</span>	Local Development Areas
<span style="color: red;">■</span>	Local Mixed Use Corridor
<span style="color: brown;">■</span>	Oak Ridges Local Centre
<span style="color: orange;">■</span>	Regional Mixed Use Corridors
<span style="color: maroon;">■</span>	Richmond Hill Centre



**Legend**

- 2014 UMESP Study Area
- Emerging Growth Centres
- Municipal Boundary

*Richmond Hill* CIVICA

**RIC18-0004 - Richmond Hill UMESP Update**

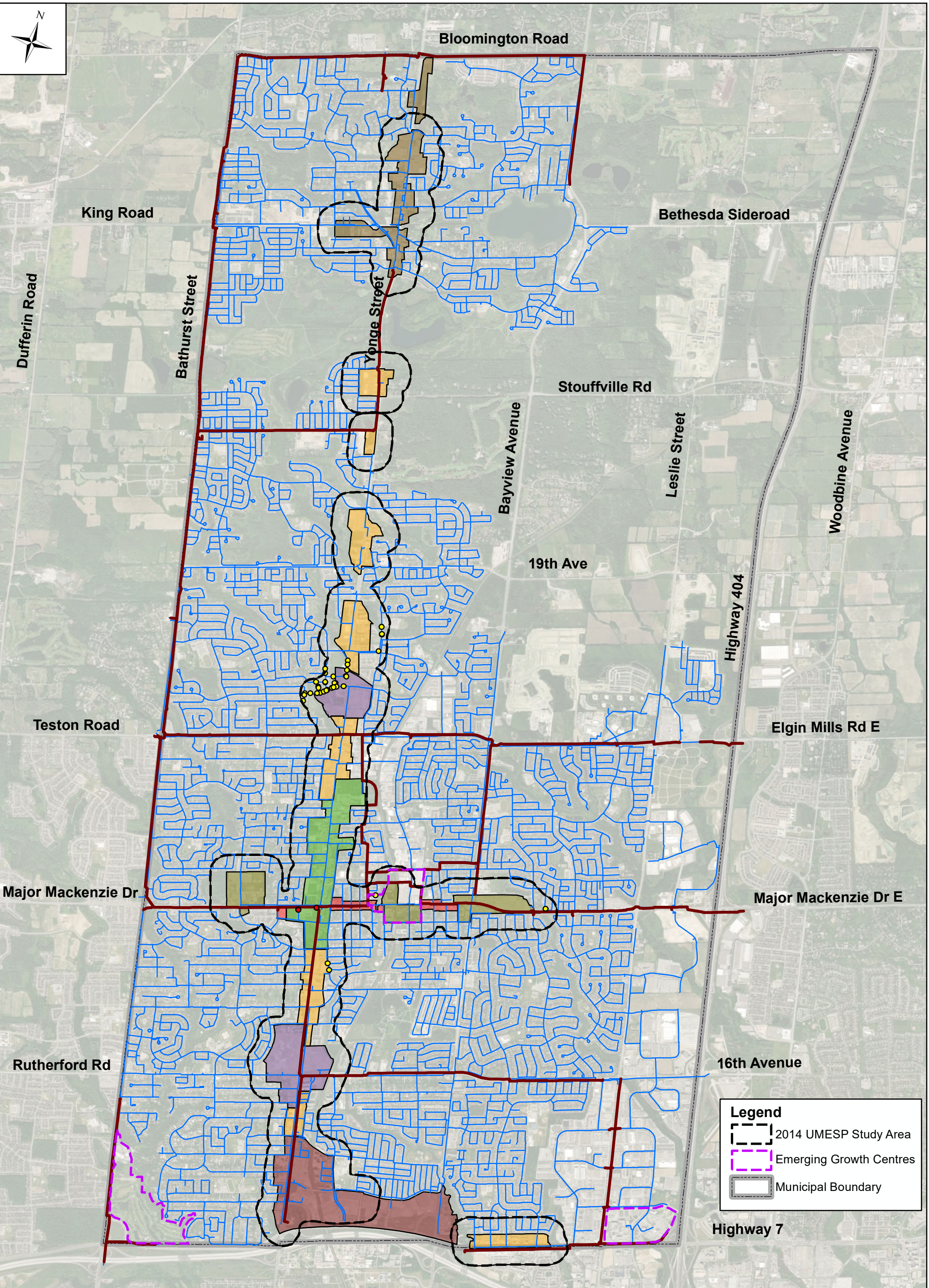
**Legend**

- Observed Pressure 100KPa Higher than Modeled
- Modeled Pressure 100KPa Higher than Observed
- Local Watermains
- Regional Watermains
- Village Local Centre
- Key Development Areas
- Local Development Areas
- Local Mixed Use Corridor
- Oak Ridges Local Centre
- Regional Mixed Use Corridors
- Richmond Hill Centre

**Figure 4-4: Modeled Peak Hour Demand Pressures v.s. 2016 Observed Pressures**

Drawn By: J.H. Date: Oct 28, 2023

0 500 1,000 2,000 Meters



**Legend**

- 2014 UMESP Study Area
- Emerging Growth Centres
- Municipal Boundary

**Peak Hour Demand Pressure (KPa)**

- < 275
- > 690

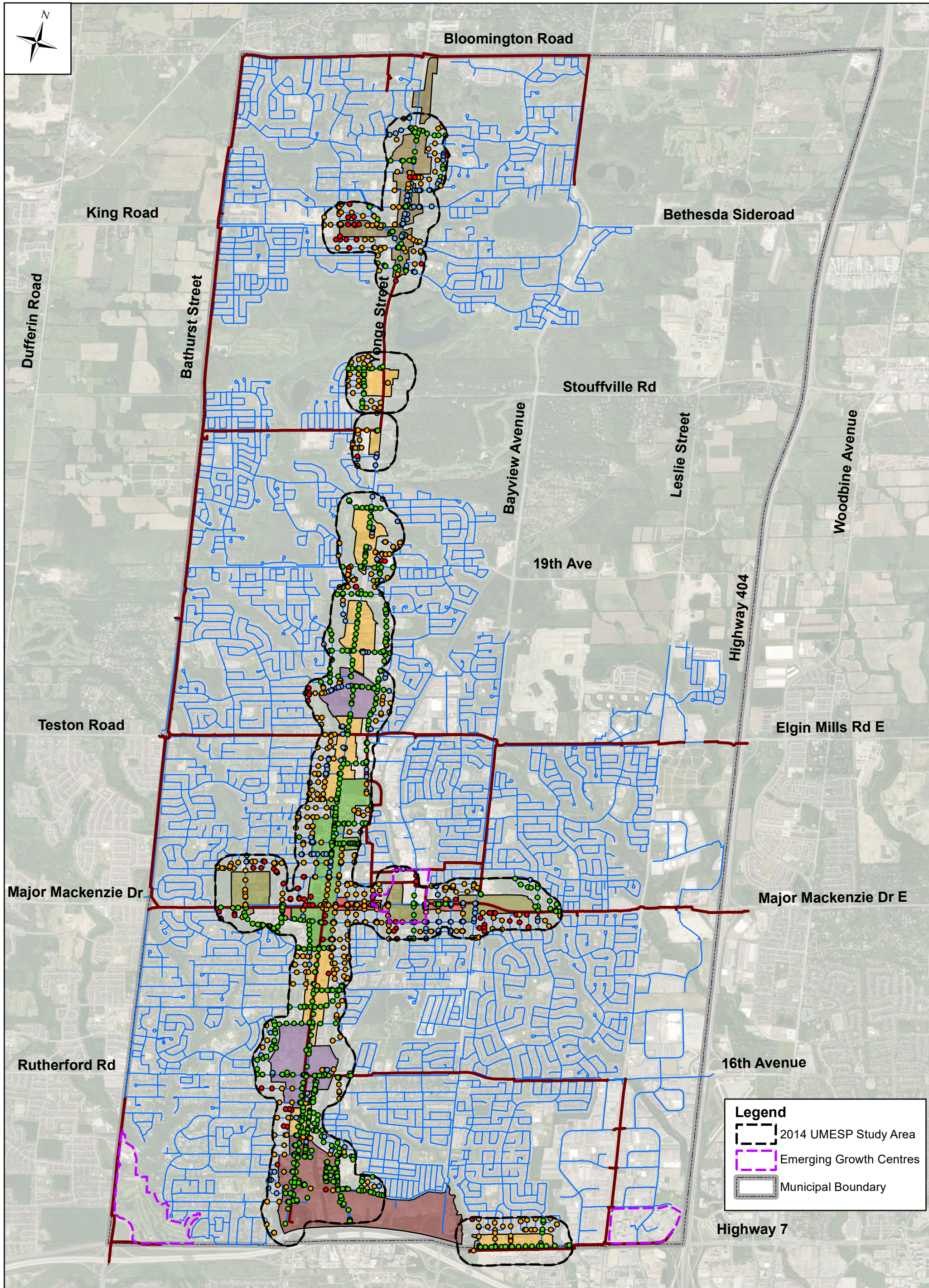
Note: Nodes with normal pressure (275 - 690 KPa) are not shown

- Local Watermains
- Regional Watermains
- Village Local Centre
- Key Development Areas
- Local Development Areas
- Local Mixed Use Corridor
- Oak Ridges Local Centre
- Regional Mixed Use Corridors
- Richmond Hill Centre

**Figure 4-5:  
Peak Hour Demand Pressures  
During 2016 (Modeled)  
(Inside the Study Area)**

Drawn By: J.H.    Date: Oct 28, 2023

0    500    1,000    2,000  
Meters



Available Fire Flow (L/s)

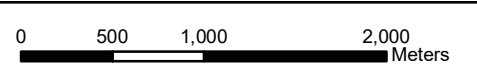
- < 100
- 100 - 200
- 200 - 316
- > 316

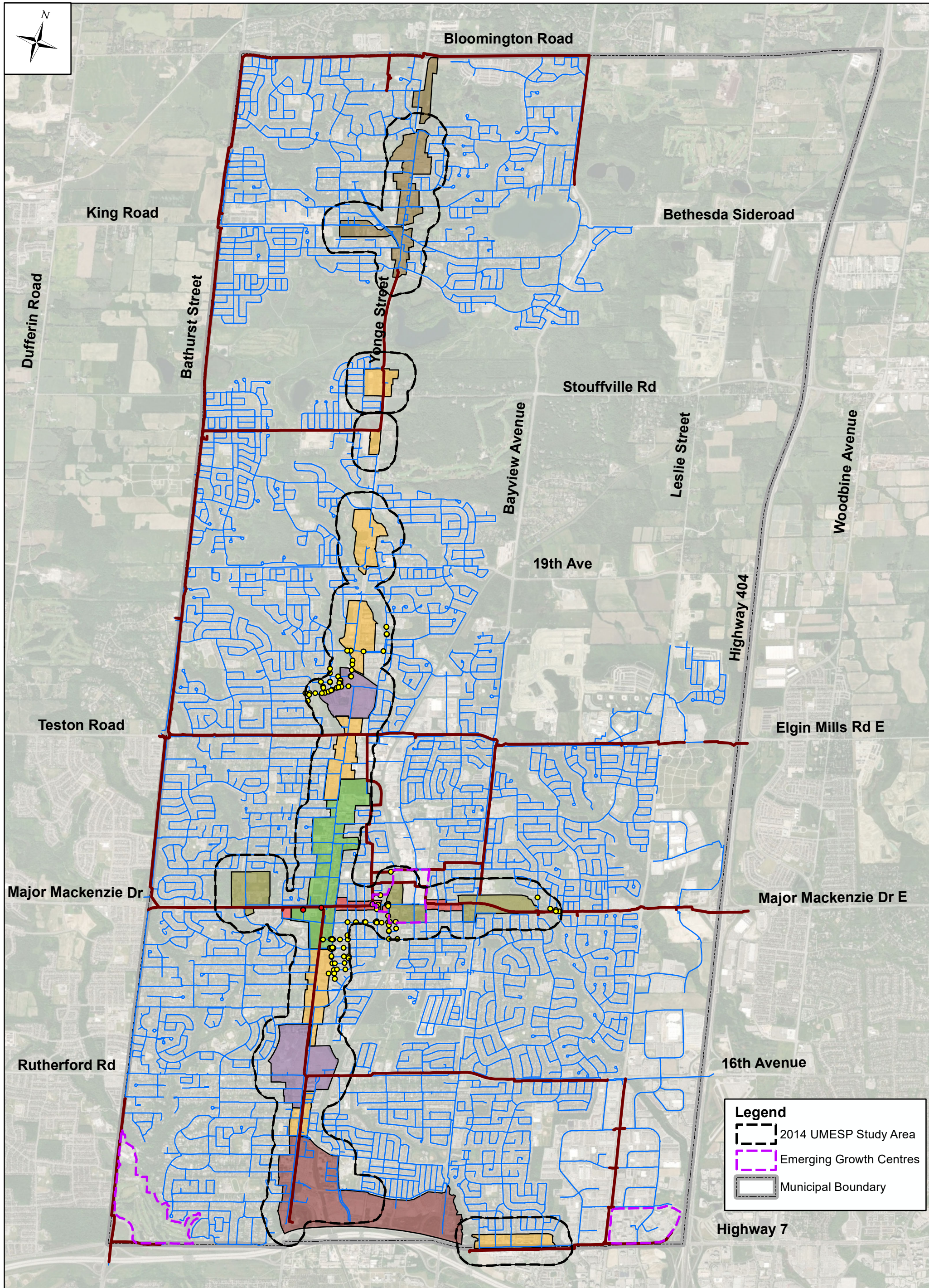
- Local Watermains
- Regional Watermains

- Village Local Centre
- Key Development Areas
- Local Development Areas
- Local Mixed Use Corridor
- Oak Ridges Local Centre
- Regional Mixed Use Corridors
- Richmond Hill Centre

**Figure 4-6:**  
Available Fire Flow During 2016 Maximum Day Demand (Modeled)

Drawn By: J.H. Date: Oct 28, 2023





**Minimum Hour Demand Pressure (KPa)**

- < 275
- > 690

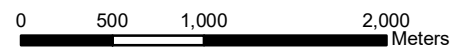
Note: Nodes with normal pressure (275 - 690 KPa) are not shown

- Local Watermains
- Regional Watermains

- Village Local Centre
- Key Development Areas
- Local Development Areas
- Local Mixed Use Corridor
- Oak Ridges Local Centre
- Regional Mixed Use Corridors
- Richmond Hill Centre

**Figure 4-7:  
Minimum Hour Demand Pressures  
During 2016 (Modeled)  
(Inside the Study Area)**

Drawn By: J.H. Date: Oct 28, 2023



## 5.0 Future System Condition

The areas and populations added in each future scenario have been defined in consultation with the City and from the best available planning documents, e.g. Traffic Zone Projections and Development Applications. Initially, the future population was estimated and distributed using the Traffic Zone Projections. These estimations were further refined based on known development applications. This means that the estimated population from known development applications was subtracted from the projected Traffic Zone population. For example, if the projected 2041 population for a given TZ is 10,000 people, and in that TZ there are some development applications with an estimated population of 2,000 people, then, it is assumed that the final projected TZ population to be distributed within the study area is 8,000 people.

A breakdown of the estimated future population, the Average Day Demand (ADD), Max Day Demand (MDD), and Peak Hour Demand (PHD) for each growth scenario is presented in **Table 5-1**.

Furthermore, **Table 5-2** shows population distribution and estimated demand for each pressure district with growth scenarios.

The estimated future population from known development applications and Traffic Zone Projections is shown in **Appendix I**. The water connection points to the municipal water distribution network for each forecasted growth area is also shown in **Appendix II**.

**Table 5-1: Population Breakdown, ADD, and MDD Per Growth Scenario**

Description	Growth Scenario		
	2016 2041	2041 2051	2051 Ultimate Buildout
Residential population <sup>1</sup>	107,192	126,097	247,539
Employment population <sup>2</sup>	30,571	42,715	92,295
Other residential and employment population <sup>3</sup>			39,122
<b>Total Population</b>	<b>140,977</b>	<b>31,049</b>	<b>210,144</b>
ADD (L/d)	26,037,207	5,868,261	39,717,216
MDD (L/d)	46,866,973	10,562,870	71,490,989
PHD (L/d)	70,300,459	15,844,305	107,236,483

**Notes:**

<sup>1)</sup> 2016 to 2041 growth includes residential population from active development applications (where population was greater than original 2021 forecast). In TZ where population decreased, the 2016 population was kept.

<sup>2)</sup> In TZ where employment decreased, the 2016 employment numbers were kept.

<sup>3)</sup> Includes additional population growth from Richmond Hill Centre Secondary Plan, OPAs for Oak Ridges Local Centre and the Village Core, beyond original 2021 forecast.

**Table 5-2: Population distribution and estimated demand for each pressure district**

Pressure District	2016 2041		2041 2051		2051 Ultimate Buildout	
	Population	Total Demand (L/s)	Population	Total Demand (L/s)	Population	Total Demand (L/s)
PD6	51315	309.2915	17338	309.2915	110685	448.7713
PD7	40181	307.0754	7609	307.0754	67308	426.3541
PD8	8903	65.7208	1425	65.7208	7237	104.8515
PD9	37364	166.7432	4677	166.7432	24914	200.2364

The proposed solutions were defined based on future development connections, obtained from the City. To review the need for infrastructure upgrades within the study areas, the InfoWater model was run under the following scenarios:

- Ultimate Build-Out Peak Hour Demand: the model was run under this scenario to examine if the future demands can be supplied while maintaining the minimum pressure of 275 KPa;
- 2041 Minimum Hour Demand: the model was run under the 2041 minimum day demand to examine if the future demands can be supplied while maintaining the maximum pressure of 690 KPa.
- Fire Flow Scenario: the model was run under Ultimate Build-Out Maximum Day Demand plus fire flow demands to investigate the available fire flow at each node while maintaining a minimum pressure of 140 KPa in demand nodes.

As discussed, the model was validated with 2016 observed data and valve setting; however, the valve setting in FMA was changed in 2017 which applied to the future condition model. **Figure 5-1** displays the updated Pressure districts after removing the FMA. The transmission main at Bathurst and Major Mackenzie will be recommissioned by the City before 2031 and feed the system in the future conditions. The future model also includes the new watermains on the BRT line located on Yonge Street, south of Major Mackenzie Drive.

Note that the purpose of this study was to investigate water network conditions within the study area. It is proposed that the City conducts studies to investigate the effect of the new developments on conditions outside of the study area. For example, the area south of Lake Wilcox and some areas north of Gamble Road would not meet the City’s criteria under future conditions.

### **5.1 Minimum Pressure During the Peak Hourly Demand**

The minimum pressure was investigated under Ultimate Build-Out, Peak Hour Demand. Results are shown in **Figure 5-2**. All nodes within the study area satisfy the minimum pressure requirement (275 KPa), except for a small area in Downtown Local Center.

### **5.2 Maximum Pressure During the Minimum Hourly Demand**

The maximum pressure was investigated under 2041 Minimum Hour Demand. As shown in **Figure 5-3**, there are two areas with pressures higher than 690 KPa inside or close to the study area:

- Yonge Street north of Elgin Mills, and Canyon Hill Avenue west of Yonge and Elgin Mills Key Development Area
- Church Street, south of Major Mackenzie Dr and east of Yonge Street

As high pressures exceeding 690 kPa are not caused by population growth, solutions for these areas will not be recommended in this study.

There are thirteen (13) Pressure Reducing Valves (PRVs) in various pressure districts. **Table 5-3** Shows the list and specification of these PRVs in each pressure district.

**Table 5-3: Pressure Reducing Valves in each pressure district.**

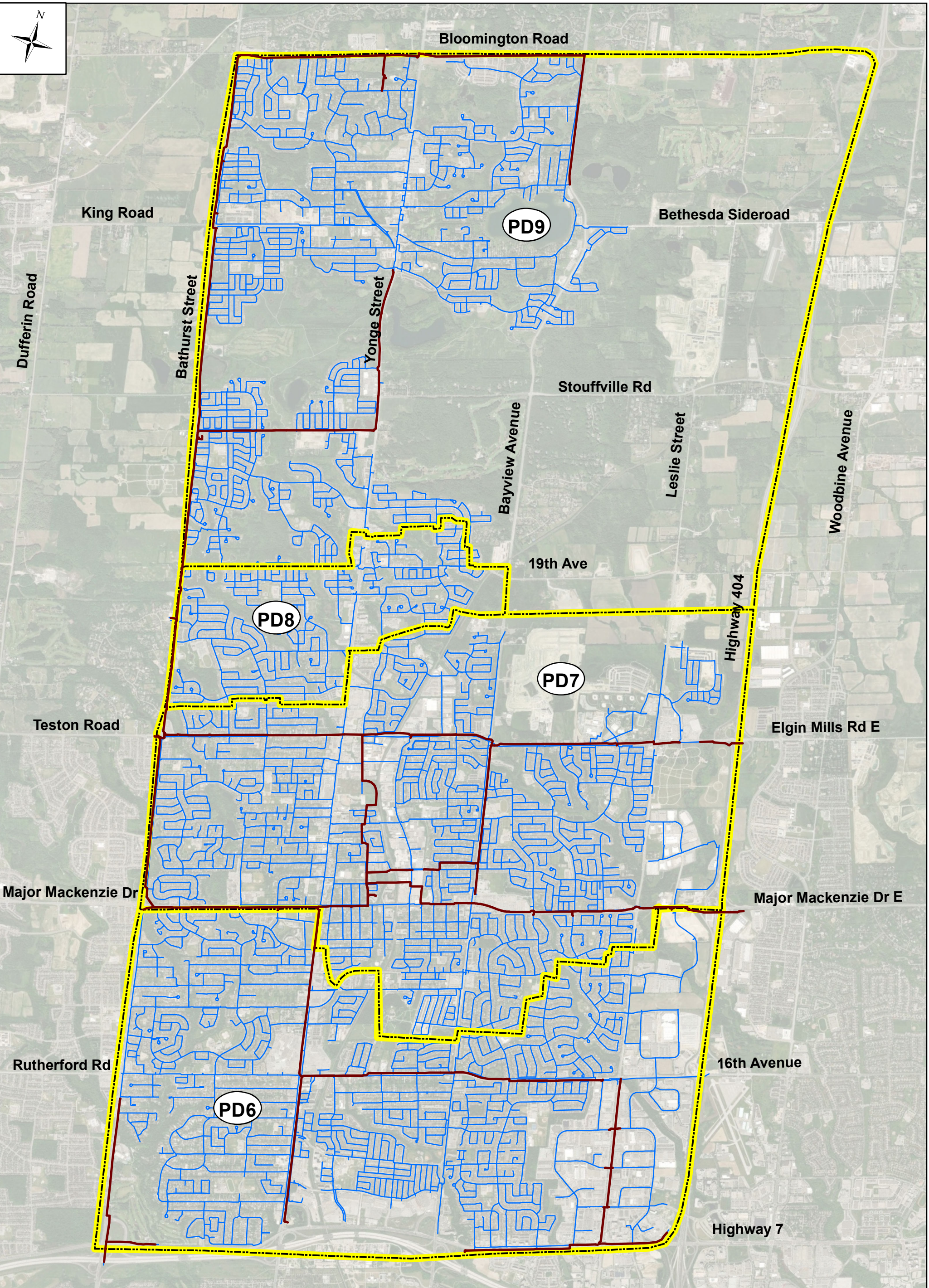
No.	ID (Char)	PD	Diameter (mm)	Setting (Kpa)
1	V8004	7	150	580
2	V8006	7	300	589
3	V8008	7	300	589
4	V8010	7	300	491
5	V8012	7	300	589
6	V8014	7	300	589
7	V8016	7	300	600
8	V8020	7	750	276
9	V8018	9	400	447
10	V8026	9	200	328
11	V8028	9	250	435
12	V8030	9	200	450
13	V8032	9	200	328

### 5.3 Fire Flow Demand

Available fire flow required for each land use and development application was investigated by considering the fire flow demands discussed in previous sections under the Ultimate Build-Out maximum day demand. Figures in **Appendix II** show the required and available fire flows (for a minimum pressure of 140 kPa) for every OP Intensification Area, Emerging Growth Centre and Development application in the study area. Major fire flow deficiencies were observed in the following areas:

- Oak Ridges Local Center at Yonge Street and Elm Grove Avenue. The existing watermains cannot support the institutional and commercial growth in the area.
- Yonge Street at Stouffville Road and Murihead Crescent. There are no existing municipal watermains to service growth east of Yonge Street.
- Yonge Street North of Gamble Road. There are no existing municipal watermains to service growth west of Yonge Street.
- Yonge Street East Side, North of Silverwood Ave. There are not any existing municipal watermains to service growth east of Yonge Street.

- Yonge Street & Oxford Street. The existing watermains cannot support the growth west of Yonge Street.
- Church Street. Existing 150mm watermain cannot support the growth west of Church Street between Lorne Avenue and Dunbarton Court.
- Yonge Street between Major Mackenzie Drive East and Elmwood Avenue. The existing 150mm watermain cannot support the growth east of Yonge Street.
- 150 mm watermains on Cedar Avenue, Norfolk Avenue and Old Markham Road cannot support growth in these areas.
- Yonge Street at Yonghurst Drive and Clarissa Drive. Existing watermains cannot support growth or not available to service future intensification areas east side of Yonge Street.
- Spruce Avenue, Oak Avenue, Edgar Avenue, Scott Drive, Mackay Drive and Garden Avenue at intersections with Yonge Street. Existing 150 mm watermains cannot support growth in these areas.
- Richmond Hill Centre: High Tech Road between Yonge St and Red Maple Rd. Existing 150 mm watermains cannot support growth in the area.



Dufferin Road

King Road

Bloomington Road

PD9

Bethesda Sideroad

Bathurst Street

Yonge Street

Stouffville Rd

Bayview Avenue

Leslie Street

Woodbine Avenue

19th Ave

PD8

PD7

Highway 404

Teston Road

Elgin Mills Rd E

Major Mackenzie Dr

Major Mackenzie Dr E

Rutherford Rd

PD6

16th Avenue

Highway 7



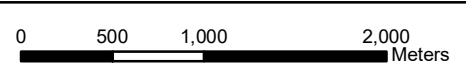
RIC18-0004 - Richmond Hill UMESP Update

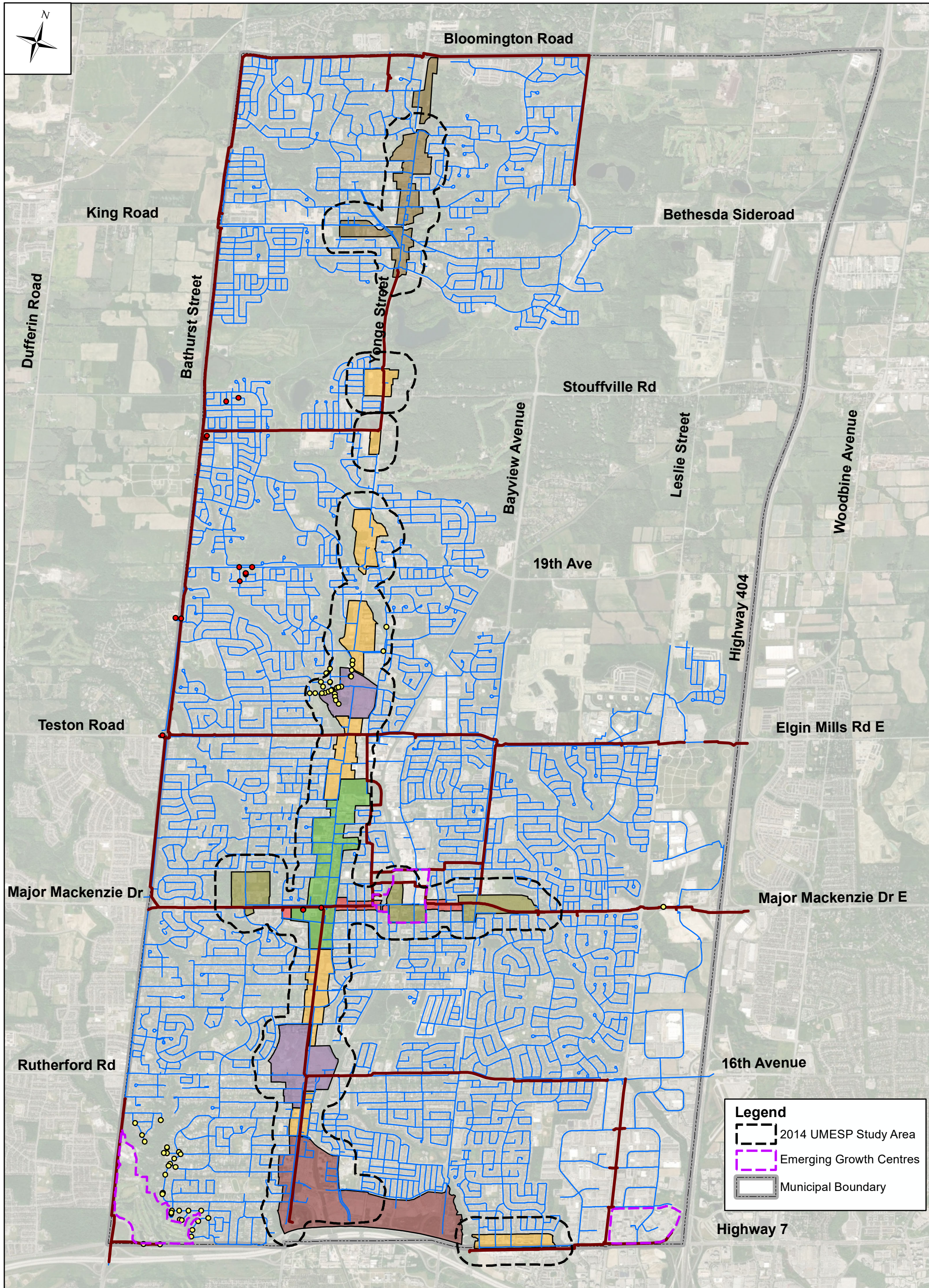
Legend

- (PD9) Pressure District Zones
- Municipal Boundary
- Local Watermains
- Regional Watermains

Figure 5-1: Updated Pressure Districts After Removing FMA (2017)

Drawn By: J.H. Date: Sep 27, 2023





**Peak Hour Demand Pressure (KPa)**

- < 275
- > 690

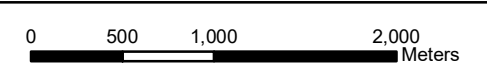
Note: Nodes with normal pressure (275 - 690 KPa) are not shown

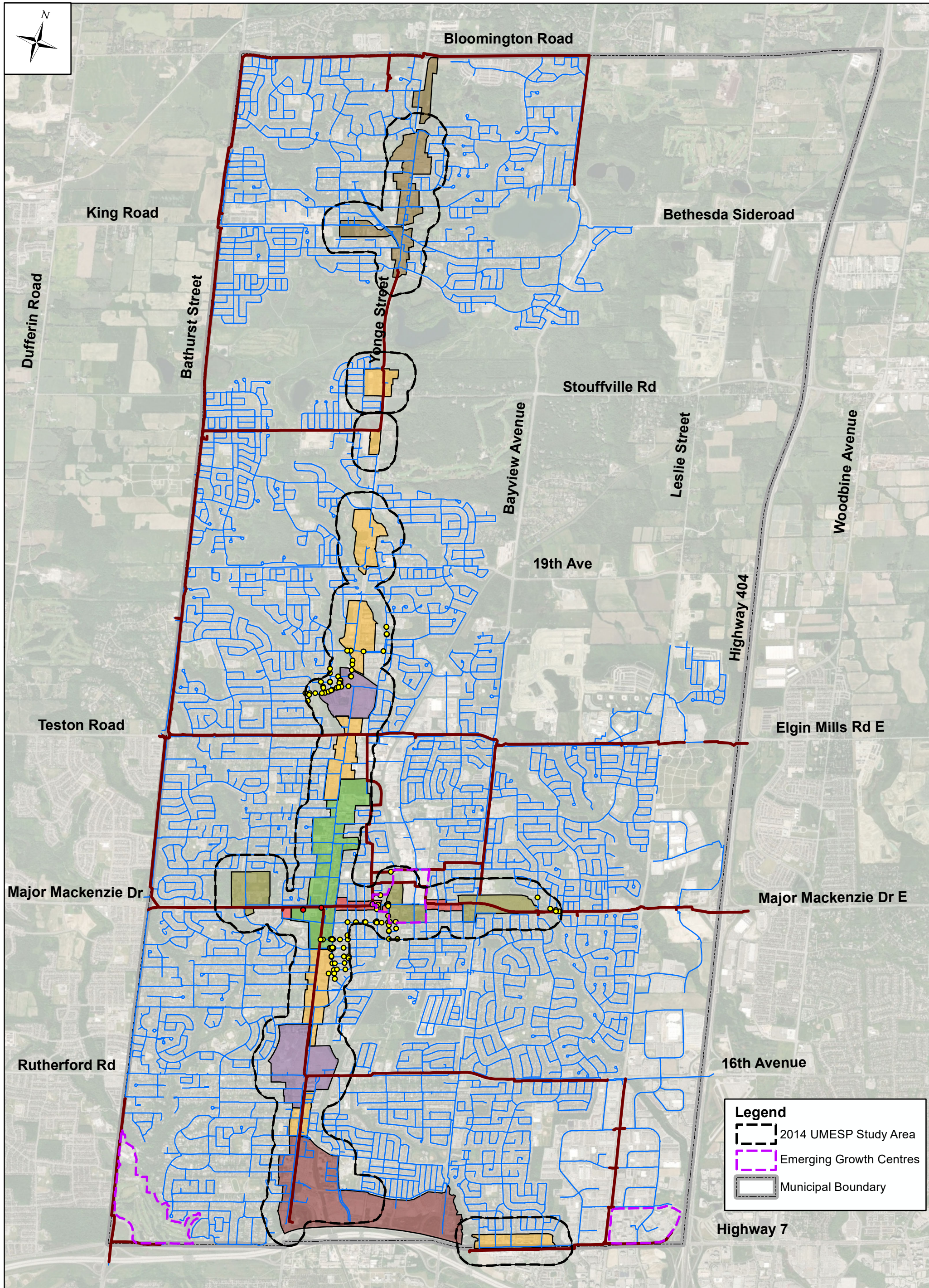
- Local Watermains
- Regional Watermains

- Village Local Centre
- Key Development Areas
- Local Development Areas
- Local Mixed Use Corridor
- Oak Ridges Local Centre
- Regional Mixed Use Corridors
- Richmond Hill Centre

**Figure 5-2:  
Peak Hour Demand Pressures  
under Ultimate Built-Out Condition**

Drawn By: J.H. Date: Oct 28, 2023





**Minimum Hour Demand Pressure (KPa)**

- < 275
- > 690

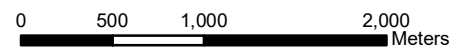
Note: Nodes with normal pressure (275 - 690 KPa) are not shown

- Local Watermains
- Regional Watermains

- Village Local Centre
- Key Development Areas
- Local Development Areas
- Local Mixed Use Corridor
- Oak Ridges Local Centre
- Regional Mixed Use Corridors
- Richmond Hill Centre

**Figure 5-3:  
Minimum Hour Demand Pressures Under 2041 Conditions (Inside the Study Area)**

Drawn By: J.H. Date: Oct 28, 2023



## 6.0 Evaluation of Alternatives

To minimize the risk of inadequate level of service triggered by the ultimate buildout population, four (4) alternative solutions were evaluated, following the previous 2014 UMESP. These alternative solutions are described in **Table 6-1** below.

**Table 6-1: Evaluation of Water Alternatives**

Alternative	Description	Results of Evaluation
<b>1. Do Nothing</b>	A do-nothing scenario would allow buildout of the urban structure in accordance with the Official Plan, without making improvements to the water distribution system.	This approach would result in a substandard level of service through some parts of the City, with the potential for the water supply system providing substandard pressures and insufficient flows in the event of fire events. This could then trigger. This alternative does not satisfy the objectives associated with the problem statement for this project but provides an important baseline for comparison to other viable solutions.
<b>2. Limit Community Growth</b>	This alternative would require updating the Official Plan in order to limit the extent of intensification to only what could be accommodated within the existing watermains. In order to accommodate the provincially-mandated growth, the City would have to designate additional areas within the City for intensification, where sufficient reserve water supply capacity exists.	This alternative solution would ultimately negate some of the planning processes that have been undertaken to date, and therefore be unsatisfactory with respect to the objectives associated with the problem statement for this project.
<b>3. Implement Water Conservation Procedures</b>	This alternative solution would effectively increase the population that could be serviced through the existing distribution system by decreasing the average per-capita flow rates across the City.	As observed in previous sections, main deficiencies observed under future conditions are in relation with unsatisfactory fire flows based on the Official Plan land use and build form projections, and not with substandard pressures due to increased domestic demand. While, implementing water conservation procedures is recommended and applied in the future scenarios following York Region recommendations, it is not sufficient to meet future fire flow requirements without upgrading / expanding the existing water system
<b>4. Enhance / Expand the Existing Distribution System</b>	This alternative would have the City plan for strategic enhancements to and/or expansion of the existing distribution system in order to accommodate the planned populations at the prescribed level of service in accordance with the City's design criteria.	The future condition model was used to identify the extent of system upgrades needed to compensate for observed shortfalls.

## 7.0 Proposed Upgrades

### 7.1 Proposed Upgrades

Based on the evaluation of the four (4) Alternatives discussed in Section 6.0 and the results discussed in previous sections, upgrades to the existing system are recommended to address the future growth. As per City's guideline, no upgrades were proposed for areas with existing deficiencies.

To identify the required solutions, Civica initially investigated the deficiencies in the study area and reported the possible deficiencies to the City. The recognized areas were reviewed by the City and the final solutions were proposed for the locations where upgrades were necessary. **Figure 7-1** illustrates a schematic of the required improvements in the water network and **Table 7-1** summarizes the proposed improvement projects. Figures showing the details of each project are presented in **Appendix III**.

The followings are the areas with proposed upgrades.

#### 7.1.1 Oak Ridges Local Centre

A new 150mm watermain is proposed on Yonge Street between Elm Grove and Maple Grove Avenues to service future developments on the west side of Yonge Street. The new watermain will form a loop with the existing watermains in the area and increase pressures and fire flows for these developments.

#### 7.1.2 Yonge Street, North of Elgin Mills Road

Several projects are proposed to service future intensification to service new developments fronting Yonge Street. Solutions include new watermains at Muirhead Crescent, between Harris Avenue and Jefferson Side Road, North of Gamble Road, North of Silverwood Avenue and a new watermain along the west side of Yonge Street to connect with the existing watermain located on Leyburn Avenue south-west of Yonge Street and Canyon Hiull Avenue.

#### 7.1.3 Downtown Local Centre: Yonge and Church Streets

##### Yonge Street

To address observed deficiencies for future developments located at the southeast corner of Yonge Street and Major Mackenzie intersection, the existing 150mm watermains on Yonge Street, east side, are proposed to be replaced by one 300mm watermain connecting north and south to existing watermains on Major Mackenzie and Elmwood Avenue respectively. Additionally, the existing watermain on Palmer Avenue is proposed to connect to the Yonge Street 300mm watermain. This connection will allow to provide sufficient pressures and fire flows to the developments on Palmer and Yonge.

Further south, the existing 150mm watermain at Yonge Street and Clarissa Drive is proposed to be upsized to 300mm and further extended north to service future developments on Yonge Street East, north of Clarissa Drive.

##### Church Street

As observed in **Appendix II** figures, many deficiencies are observed on Church street 150mm watermain that cannot support growth to take place on the west side of Church Street between Lorne Avenue and Dunbarton Court. The following upgrades are proposed:

- Replacement of 150mm watermain on Lorne Avenue and Church Street north of Major Mackenzie Drive with a 250mm watermain;
- Replacement of the 150mm watermain on Church Street south of Major Mackenzie Drive up to Dunbarton Court with a 300mm watermain; and,
- Replacement of 20 m long 150mm watermain on Harding Boulevard connecting to Church Street.

#### **7.1.4 Side Streets West of Yonge Street**

Several 150 mm watermains connecting to the Yonge Street municipal watermain are proposed to be replaced. These connections are located at Oxford Street, Yonghurst Drive, Spruce Avenue, Oak Avenue, Edgar Avenue, Scott Drive, Mackay Drive and Garden Avenue. 250mm and 300mm watermains are proposed instead. The upgrades will provide additional pressures and fire flows to the intensification areas taking place in the mentioned streets and fronting Yonge Street West Side.

#### **7.1.5 Major Mackenzie Drive, East of Yonge Street**

Areas at the east of Yonge Street and South of Major Mackenzie Drive have fire flow deficiencies under ultimate build-out conditions, as illustrated in **Appendix II** figures. These areas are in Cedar Avenue and Norfolk Avenue.

It is proposed to replace the northern parts of the 150mm watermains in these streets connecting to Major Mackenzie Drive watermain, with 250mm watermains to ensure proper pressures and fire flows for the future developments surrounding Cedar and Norfolk Avenues.

#### **7.1.6 Bayview Local Development Area, Old Markham Road**

It is proposed to upsize the existing watermains on Old Markham Road to a 300 mm pipe in order to increase the available fire flow for the new developments.

#### **7.1.7 Richmond Hill Centre, High Tech Road**

As observed in **Appendix II** figures, deficiencies are observed on High Tech Road existing 150mm watermains that cannot support growth in the area.

It is proposed to connect the existing watermains on High Tech Road together through a new 300mm watermain and upsize the existing 150mm watermains on the same road. The new watermain will provide a connection to the future developments east of the GO train corridor from Yonge Street which will improve pressures and fire flows on High Tech Road but also improve security of supply in Richmond Hill Centre.

### **7.2 Phasing of Proposed Upgrades**

The deficient fire flows and high pressures occur when the indicated population growth happens, which is under 2041 conditions for most OP intensification areas and all development applications. Therefore, all but two (2) of the recommended improvement projects will be required prior to 2041, either fully or partially.

Only projects W-6 and W-9 that are recommended for construction by 2051 when the population growth is forecasted to start. **Table 7-2** summarizes the implementation phases for each project.

All recommended pipe replacements refer to replacing an existing pipe with a larger sized pipe (i.e. upsizing/upgrading). Although, it has been assumed that most of the proposed solution will be located within the City’s right-of-way, some of the crossings, new pipes, and new connections and will be affecting the Regional infrastructure. **Table 7-3** lists the solutions impacting the Region’s infrastructure.

**Table 7-1. Proposed Projects - Water Distribution System**

Project ID	Description	OP Area	Location	Length (m)	Year
W1	New 150 mm Watermain	Oak Ridges Local Centre	Yonge Street South of Elm Grove Avenue	136	2041
W2.1	Watermain Replacement (150mm to 300mm)	Regional Mixed Use Corridor	Yonge Street & Murihead Crescent	50	2041
W2.2	New 300 Watermain	Regional Mixed Use Corridor	Yonge Street between Murihead Crescent and Stouffville Road	210	2041
W2.3	New 200 mm Watermain	Regional Mixed Use Corridor	Yonge Street North of Murihead Crescent	55	2041
W3.1	New 250 mm Watermain	Regional Mixed Use Corridor	Yonge Street & Harris Avenue	55	2041
W3.2	New 300 Watermain	Regional Mixed Use Corridor	Yonge Street between Harris Avenue and Jefferson Sideroad	235	2041
W3.3	New 300 Watermain	Regional Mixed Use Corridor	Yonge Street (Easement) West Side, North of Gamble Road	135	2041
W4	New 250 mm Watermain	Regional Mixed Use Corridor	Yonge Street (Easement), East Side, North of Silverwood Ave	400	2041
W5	New 300 mm Watermain	Key Development Area	South of Yonge St and Canyon Hill Ave	345	2041
W6.1	Watermain Replacement (150mm to 300mm)	Regional Mixed Use Corridor	Yonge St. North of Oxford St.	25	2051
W6.2	Watermain Replacement (150mm to 250mm)	Regional Mixed Use Corridor	Yonge St. & Oxford St.	35	2051
W7.1	Watermain Replacement (150mm to 250mm)	Downtown Local Centre	Lorne Ave & Church St. North of Major Mackenzie	465	2041

Project ID	Description	OP Area	Location	Length (m)	Year
W7.2	Watermain Replacement (150mm to 300mm)	Downtown Local Centre / Regional Mixed Use Corridor	Church St. South of Major Mackenzie	835	2051
W8.1	Watermain Replacement (150mm to 300mm)	Downtown Local Centre	Yonge St East Side between Major Mackenzie Dr. and Elmwood Ave.	140	2041
W8.2	New 300 Watermain	Downtown Local Centre	Yonge St East Side between Major Mackenzie Dr. and Elmwood Ave.	80	2041
W8.3	New 150 mm Watermain	Downtown Local Centre	Yonge St & Palmer Ave.	25	2041
W9.1	Watermain Replacement (150mm to 200mm)	Loyal Development Area	Cedar Ave. South of Major Mackenzie Dr.	140	Ultimate
W9.2	Watermain Replacement (150mm to 250mm)	Loyal Development Area	Norfolk Ave. South of Major Mackenzie Dr.	110	2051
W10	Watermain Replacement (150mm to 300mm)	Loyal Development Area	Old Markham Rd. & Bayview Ave.	215	2041
W11.1	Watermain Replacement (150mm to 250mm)	Regional Mixed Use Corridor	Yonghurst Drive at Yonge Street Intersection	15	2041
W11.2	New 300 Watermain	Regional Mixed Use Corridor	Yonge Street, (Easement), East Side North of Clarissa Dr.	100	2041
W11.3	Watermain Replacement (150mm to 300mm)	Regional Mixed Use Corridor	Yonge Street East Side North of Clarissa Dr.	55	2041
W12.1	Watermain Replacement (150mm to 250mm)	Regional Mixed Use Corridor	Spruce Avenue At Yonge St. Intersection	120	2041
W12.2	Watermain Replacement (150mm to 250mm)	Regional Mixed Use Corridor	Oak Avenue at Yonge St. Intersection	110	2041
W12.3	Watermain Replacement (150mm to 250mm)	Regional Mixed Use Corridor	Edgar Avenue at Yonge St. Intersection	95	2041

Project ID	Description	OP Area	Location	Length (m)	Year
W13.1	Watermain Replacement (150mm to 250mm)	Regional Mixed Use Corridor / Richmond Hill Centre	Scott Drive at Yonge St. Intersection	120	2041
W13.2	Watermain Replacement (150mm to 250mm)	Richmond Hill Centre	Mackay Drive at Yonge St. Intersection	140	Ultimate
W14.1	Watermain Replacement (150mm to 300mm)	Richmond Hill Centre	High Tech Road between Yonge St and Red Maple Rd.	85	2041
W14.2	New 300 Watermain	Richmond Hill Centre	High Tech Road between Yonge St and Red Maple Rd.	205	2041
W14.3	Watermain Replacement (150mm to 300mm)	Richmond Hill Centre	High Tech Road between Yonge St and Red Maple Rd.	150	2041
W15	Watermain Replacement (150mm to 250mm)	Richmond Hill Centre	Garden Avenue At Yonge St. Intersection	120	2041

The locations of proposed City infrastructure shown in this report are conceptual only and the location of infrastructure within or adjacent to Regional road allowances will be subject to review by both the City and York Region through a detailed design approval process. The Region has advised that new City infrastructure shall generally be located within an easement along the frontage of private properties adjacent to a Regional road allowance.

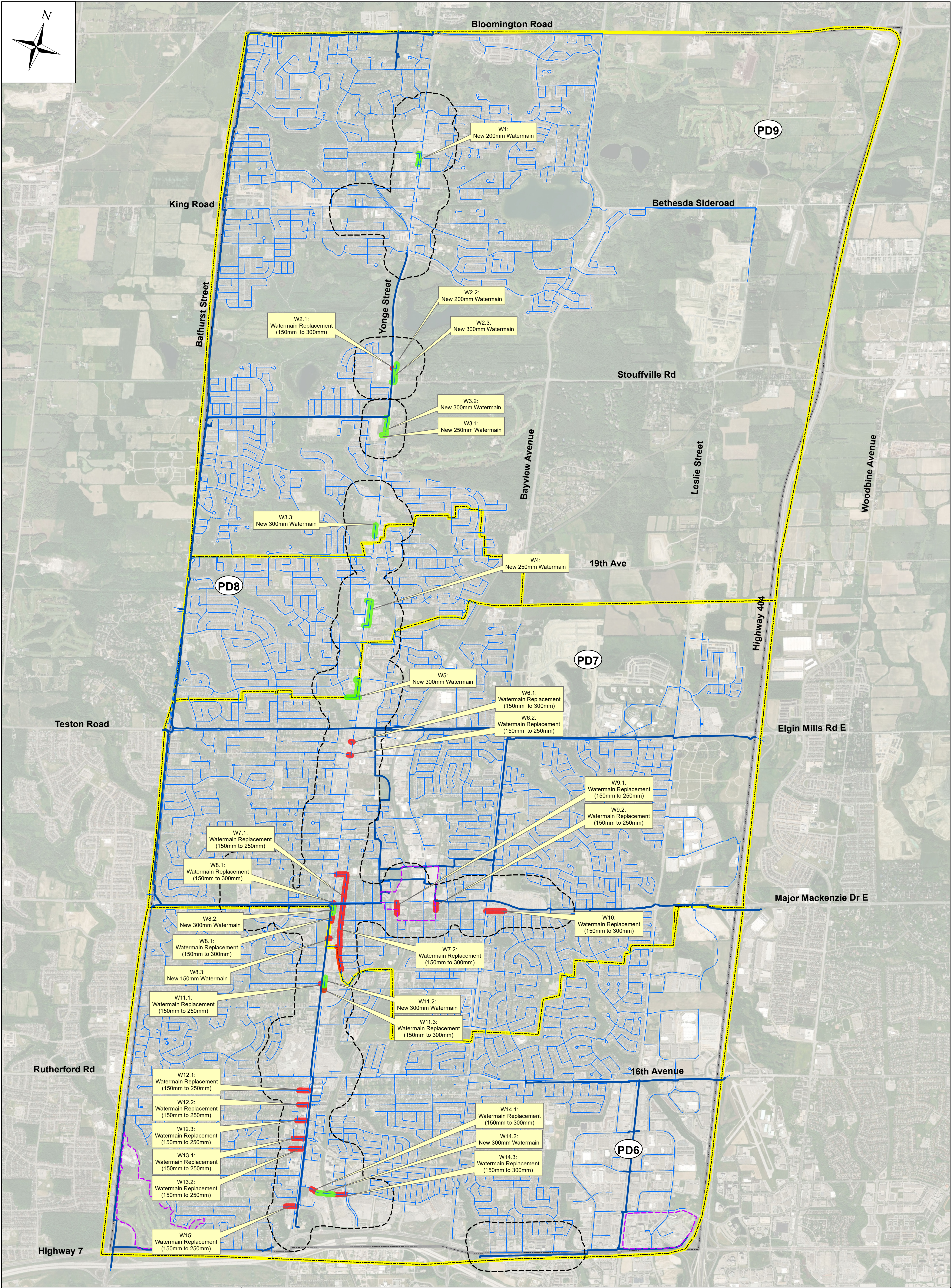
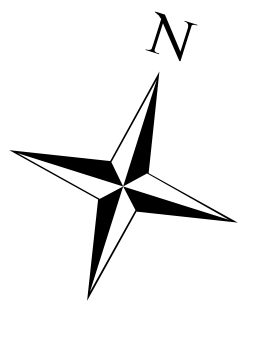
**Table 7-2. Proposed Projects – Implementation Phase**

Project ID	Implementation Phase		
	2041	2051	Ultimate Build-out
W-1	Fully	-	-
W-2	Fully (W2.1, W2.2 & W2.3)	-	-
W-3	Fully (W3.1, W3.2 & W3.3)	-	-
W-4	Fully	-	-
W-5	Fully (W5.1 & W5.2)	-	-
W-6	-	Fully (W6.1 & W6.2)	-
W-7	Partially (W7.1)	Partially (W7.2)	-
W-8	Fully (W8.1, W8.2 & W8.3)	-	-
W-9	-	Partially (W9.2)	Partially (W9.1)

W-10	Fully	-	-
W-11	Fully (W11.1, W11.2 & W11.3)	-	-
W-12	Fully (W12.1, W12.2 & W12.3)	-	-
W-13	Partially (W13.1)	-	Partially (W13.2)
W-14	Fully (W14.1, W14.2 & W14.3)	-	-
W-15	Fully	-	-

**Table 7-3: Watermains Solutions Affecting Regional Infrastructure**

Water Project ID	Location	Sewer Type	Regional Infrastructure
W1	Yonge St	New Watermains	Region ROW
W2	Yonge St	New Watermains Watermain Replacement	Region ROW, Cross Yonge St, New connection with Regional Watermain
W3	Yonge St	New Watermains	Region ROW
W4	Yonge St	New Watermains	Region ROW, Cross Yonge St
W5	Yonge St	New Watermains	Region ROW
W6	Yonge St	Watermain Replacement	Cross Yonge St
W7	Lorne Ave & Church St	Watermain Replacement	Cross Yonge St, Cross Major Mackenzie Drive East, Cross Regional Watermain
W8	Yonge St	New Watermains Watermain Replacement	Region ROW, Cross Yonge St, Cross Major Mackenzie Drive East, Cross Regional Watermain
W9	Cedar Ave & Norfolk Ave	Watermain Replacement	Cross Major Mackenzie Drive East
W10	Old Markham Rd	Watermain Replacement	Cross Bayview Ave
W11	Yonge St	New Watermain Watermain Replacement	Region ROW



**Legend**

- 2014 UMESP Study Area
- Emerging Growth Centres
- Regional Watermain
- Local Watermains

**Proposed Solution**

- Proposed Watermain Replacement
- Proposed New Watermain
- Proposed District Boundary
- City Boundary

**Figure 7-1  
Ultimate Water Solutions**

Drawn By: W.A. Date: Aug 22, 2023



### **7.3 Results Under Proposed System**

Minimum pressure, explored under the Ultimate Build-Out Peak Hour Demand, is illustrated in **Figure 7-2**. Available fire flows under Ultimate Build-Out are shown in **Appendix IV** figures.

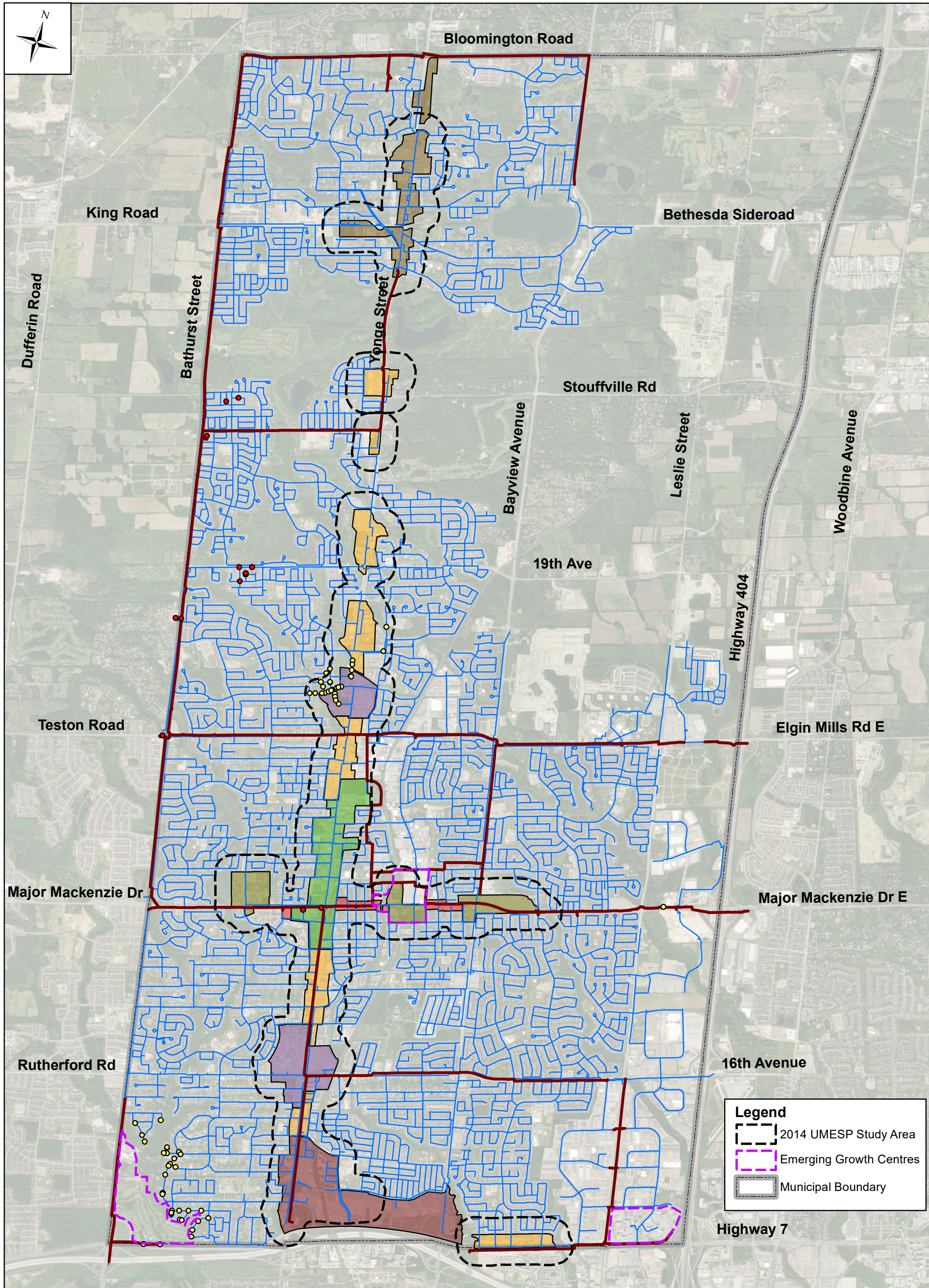
### **7.4 Cost Estimate**

AACE type Class 4 cost estimate has been employed to determine the preliminary cost estimates of the identified projects in the study area. Civica's 2020 unit price database was used as a baseline for the cost estimate analysis. The unit prices were adjusted to 2023 prices using Infrastructure Cost Indexes from Statistics Canada. A trend analysis using data from 2010 to 2019 was used to extrapolate the index values to 2023. Moreover, a 25% multiplier for project delivery allowance and 25% for Class 4 Contingency have been applied to the cost estimates. The project delivery allowance is a multiplier for preliminary design, tendering, construction services, insurance, mobilization & demobilization, traffic control, utility impacts/relocations, etc...

The total cost of the proposed projects is **\$ 21,668,980** and includes HST. More than 70% of the cost is proposed by 2041. **Table 7-4** summarizes the estimated cost per project and per implementation phase. Details are presented in **Appendix V**.

**Table 7-4. Proposed Water System Projects – Cost Estimate**

Project	2041 (\$)	2051(\$)	Build Out (\$)	Total Cost (2023)(\$)
<b>W1</b>	<b>400,209</b>	-	-	<b>400,209</b>
W2.1	293,996	-	-	293,996
W2.2	949,595	-	-	949,595
W2.3	179,444	-	-	179,444
<b>W2 Subtotal</b>	<b>1,423,035</b>	-	-	<b>1,423,035</b>
W3.1	226,330	-	-	226,330
W3.2	960,621	-	-	960,621
W3.3	547,119	-	-	547,119
<b>W3 Subtotal</b>	<b>1,734,071</b>	-	-	<b>1,734,071</b>
<b>W4</b>	<b>1,666,022</b>	-	-	<b>1,666,022</b>
<b>W5</b>	<b>1,417,573</b>	-	-	<b>1,417,573</b>
W6.1	-	163,898	-	163,898
W6.2	-	218,101	-	218,101
<b>W6 Subtotal</b>	-	<b>381,999</b>	-	<b>381,999</b>
W7.1	1,855,100	-	-	1,855,100
W7.2	-	3,606,203	-	3,606,203
<b>W7 Subtotal</b>	<b>1,855,100</b>	<b>3,606,203</b>	-	<b>5,461,303</b>
W8.1	848,983	-	-	848,983
W8.2	457,982	-	-	457,982
W8.3	147,101	-	-	147,101
<b>W8 Subtotal</b>	<b>1,454,067</b>	-	-	<b>1,454,067</b>
W9.1	-	-	550,041	550,041
W9.2	-	522,027	-	522,027
<b>W9 Subtotal</b>	-	<b>522,027</b>	<b>550,041</b>	<b>1,072,068</b>
<b>W10</b>	<b>937,539</b>	-	-	<b>937,539</b>
W11.1	81,305	-	-	81,305
W11.2	546,810	-	-	546,810
W11.3	346,433	-	-	346,433
<b>W11 Subtotal</b>	<b>974,547</b>	-	-	<b>974,547</b>
W12.1	498,929	-	-	498,929
W12.2	439,537	-	-	439,537
W12.3	403,367	-	-	403,367
<b>W12 Subtotal</b>	<b>1,341,833</b>	-	-	<b>1,341,833</b>
W13.1	485,805	-	-	485,805
W13.2	-	-	578,173	578,173
<b>W13 Subtotal</b>	<b>485,805</b>	-	<b>578,173</b>	<b>1,063,979</b>
W14.1	366,785	-	-	366,785
W14.2	847,386	-	-	847,386
W14.3	627,636	-	-	627,636
<b>W14 Subtotal</b>	<b>1,841,807</b>	-	-	<b>1,841,807</b>
<b>W15</b>	<b>498,929</b>	-	-	<b>498,929</b>
<b>Total</b>	<b>16,030,537</b>	<b>4,510,228</b>	<b>1,128,214</b>	<b>21,668,980</b>



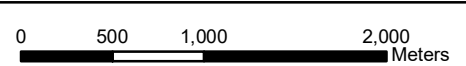
**Peak Hour Demand Pressure (KPa)**

- < 275
- > 690
- Note: Nodes with normal pressure (275 - 690 KPa) are not shown
- Local Watermains
- Regional Watermains

- Village Local Centre
- Key Development Areas
- Local Development Areas
- Local Mixed Use Corridor
- Oak Ridges Local Centre
- Regional Mixed Use Corridors
- Richmond Hill Centre

**Figure 7-2:  
Peak Hour Demand Pressures  
under Proposed Ultimate  
Build-Out Condition**

Drawn By: J.H. Date: Oct 28, 2023



## 8.0 Conclusion

Fifteen (15) improvement projects are proposed for the City's water distribution system to accommodate the potential intensifications through 2041, 2051, and Ultimate Build-Out. The total length of new watermains, including watermain replacements, is about 5,006 meters. All projects are triggered by fire flow insufficiencies based on the recommended fire flow demands and designated land use and build form of the future developments in the intensification areas.

Main improvement areas include new watermains on Yonge Street corridor and watermain replacements on side streets west of Yonge Street to service future developments, as well as 1,410 m of watermain replacements on Church Street in the Downtown Local Centre. Other areas include watermain replacements in Local Development Areas south of Major Mackenzie Drive East as well as in Richmond Hill Centre.

Thirteen (13) of the fifteen (15) projects are required to be implemented before 2041 either fully or partially with only two (2) projects required after 2041.

The total cost of the proposed projects is \$ 21,668,980 of which \$ 16,030,537 required before 2041.

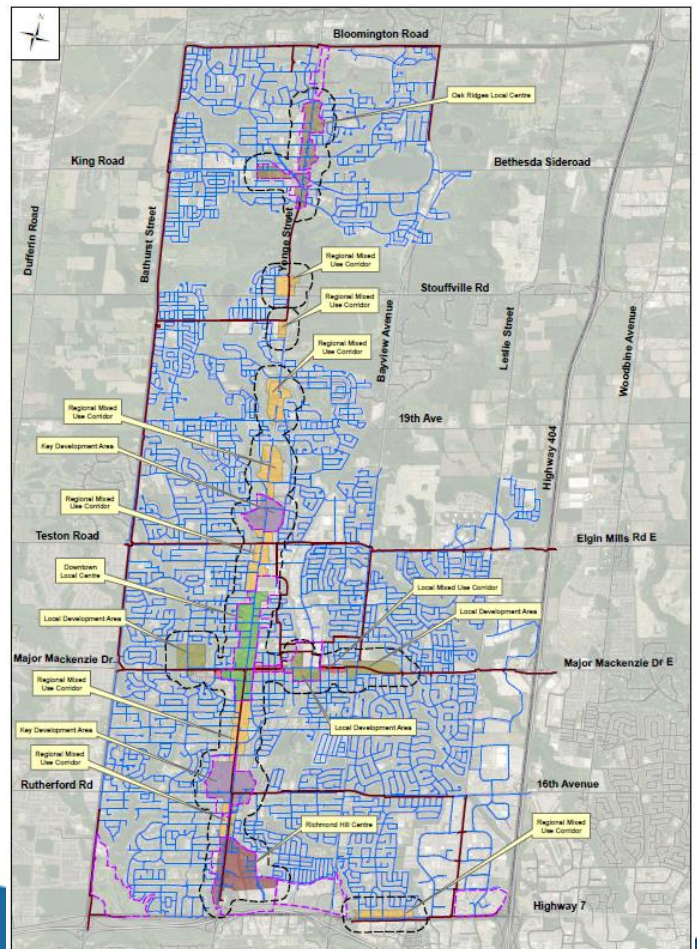
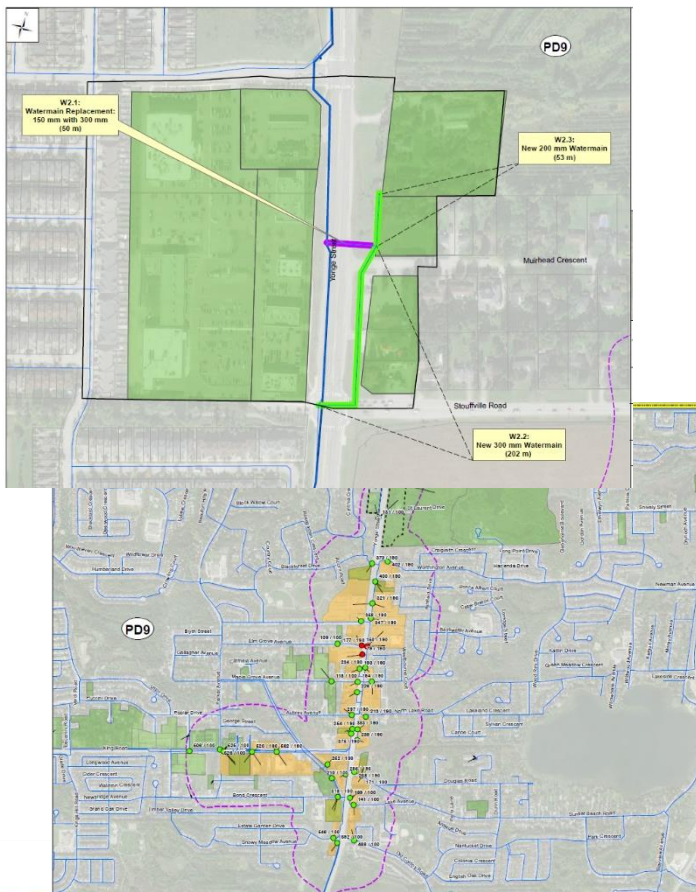
In addition to the proposed system upgrades, the below is recommended:

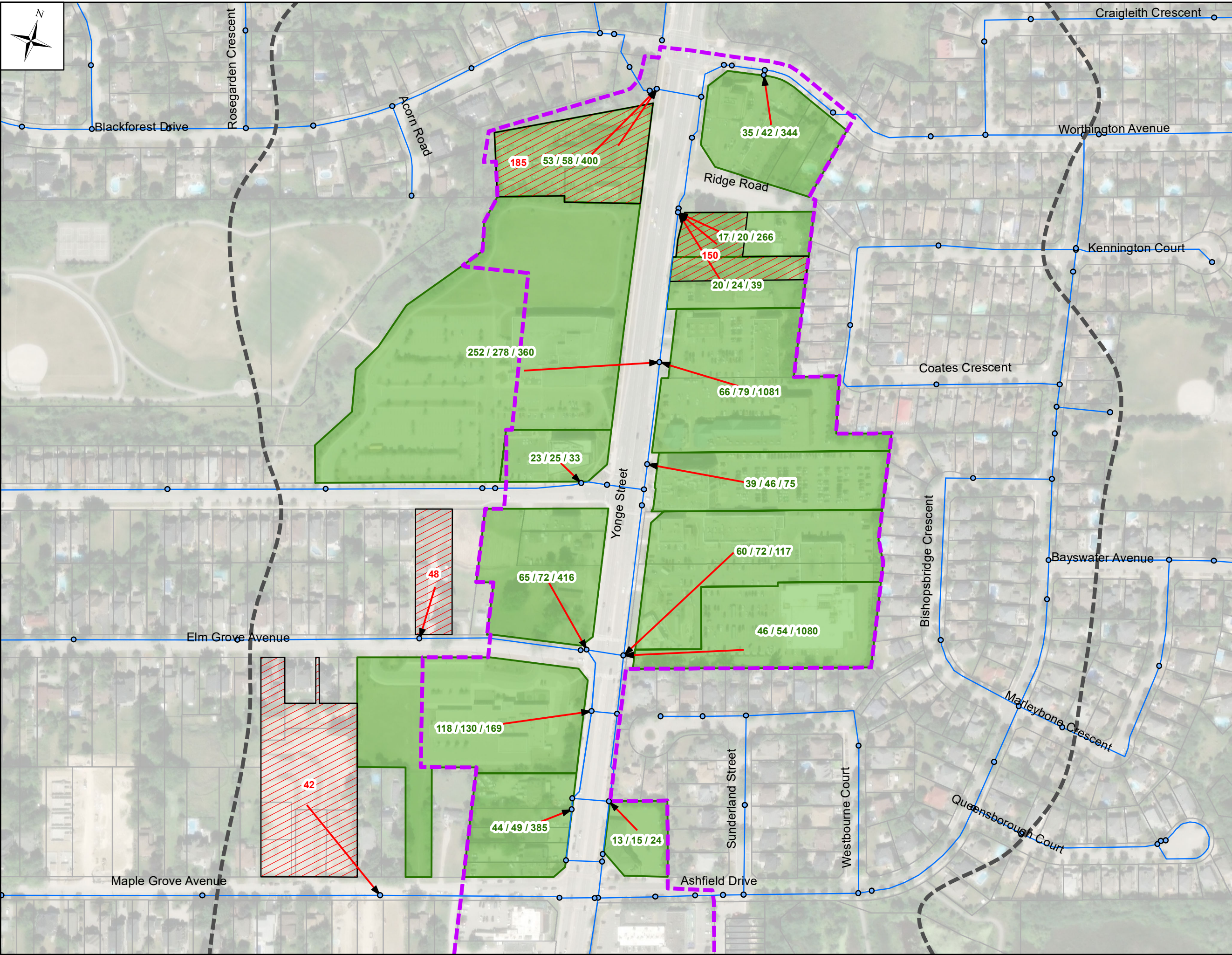
- Model Calibration is not part of the scope of this study. It is recommended that the existing model is updated and calibrated based on the most recent existing water consumption records, SCADA data, pressure monitoring data as well as asserts and operational configuration. Following calibration, the findings of the study under existing and future scenarios should be confirmed or fine-tuned.
- At locations where insufficient fire flows and/or pressures are observed in the current study, Hydrant Flow Tests are recommended to confirm the model results. Tests and their results can be part of the recommended calibration process.

# Appendix I

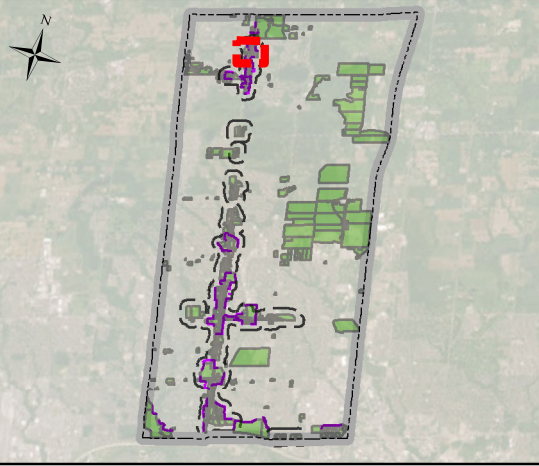
## Future Growth and Connections to Water Distribution System

Tuesday, October 31, 2023





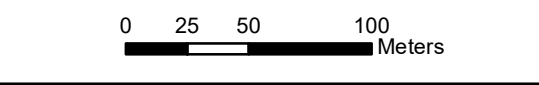
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  - Regional Watermains
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  - New Development Application (Population 2041)
  - OP Intensification Areas & Emerging Growth Centres (Population 2041/2051/Buildout)
  - Study Area Boundary
  - Emerging Growth Centres
  - Municipal Boundary



**RIC18-004 -  
Richmond Hill UMESP Update**

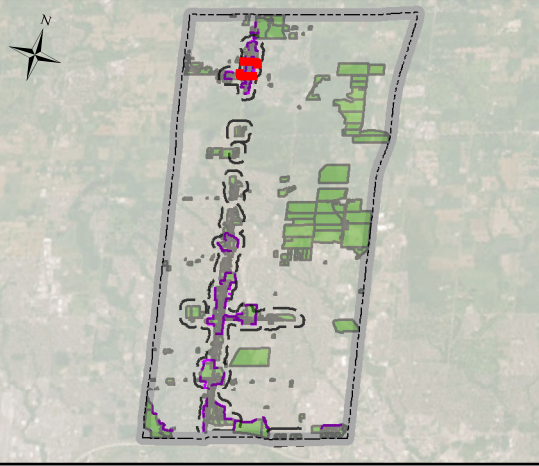
**Future Growth  
and Connection (1)  
(2021 Data)**

Drawn By: J.H.    Date: Sep 20, 2023





- Legend**
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  - Emerging Growth Centres
  - ▭ Municipal Boundary

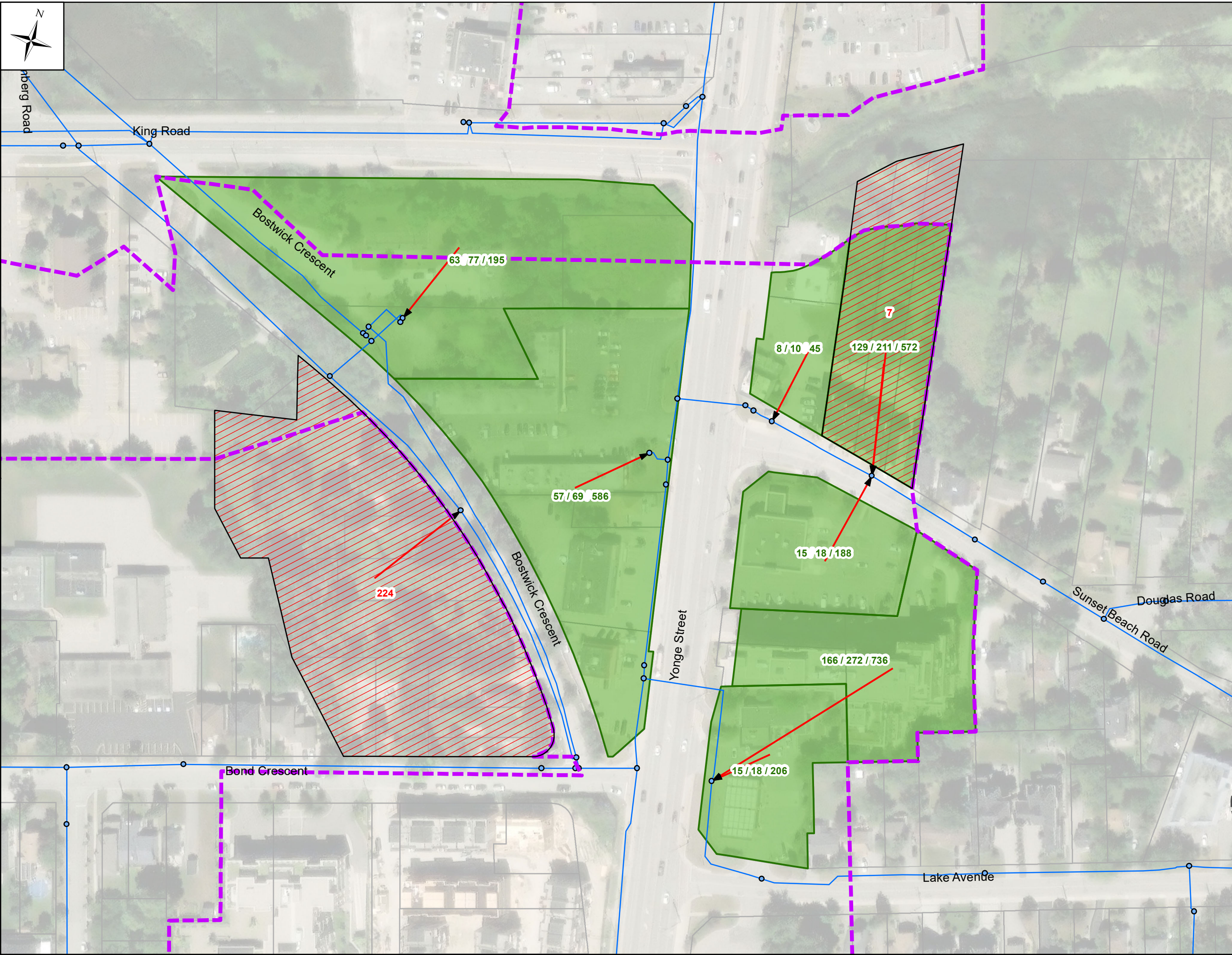


**RIC18-0004 -  
Richmond Hill UMESP Update**



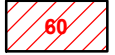


**Future Growth  
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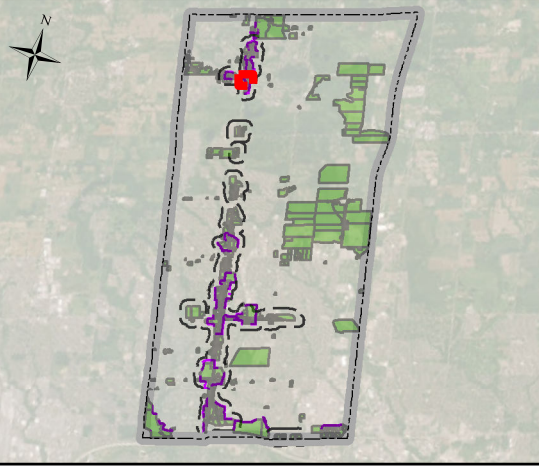
Drawn By: J.H.    Date: Sep 20, 2023





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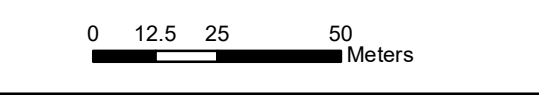
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-  Study Area Boundary
-  Emerging Growth Centres
-  Municipal Boundary

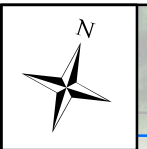


**RIC18-0004 -  
Richmond Hill UMESP Update**

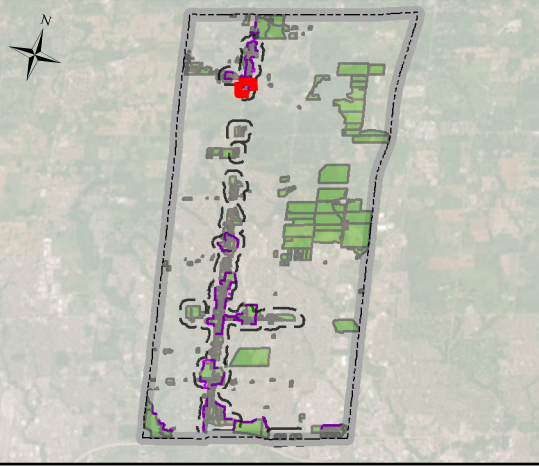
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Drawn By: J.H.    Date: Sep 20, 2023





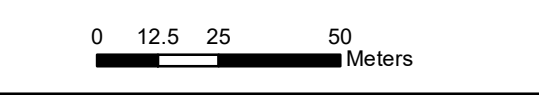
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  - Emerging Growth Centres
  - Municipal Boundary

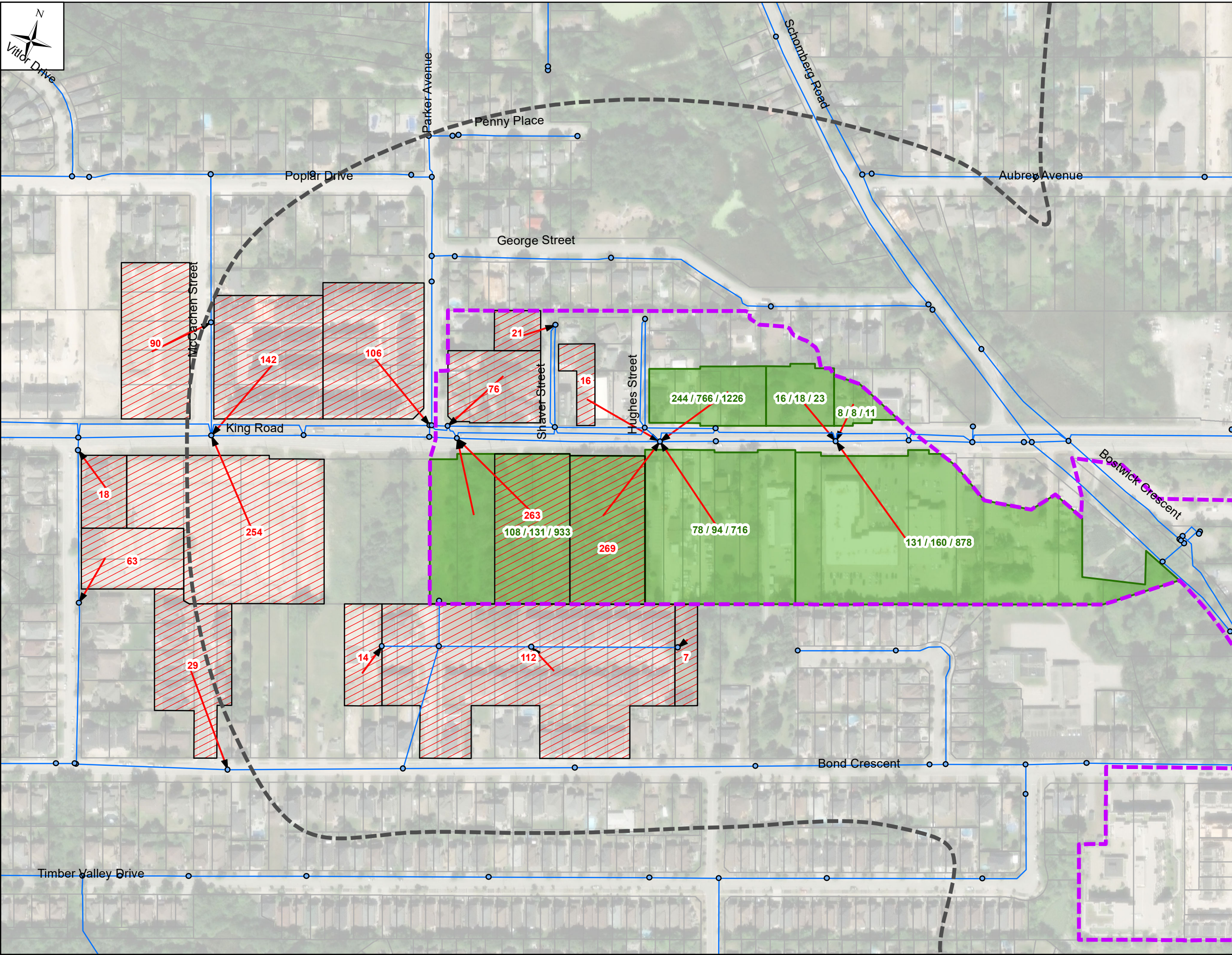


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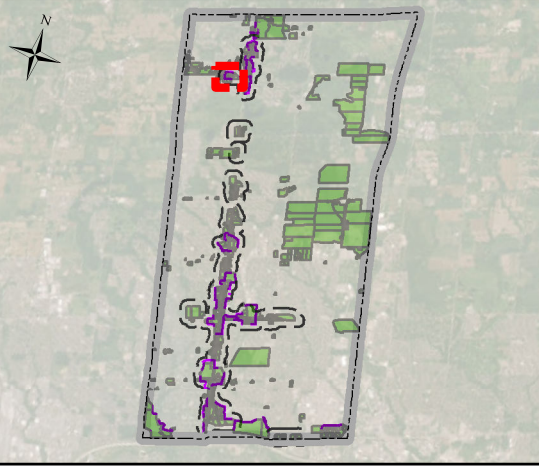
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Drawn By: J.H.      Date: Sep 20, 2023





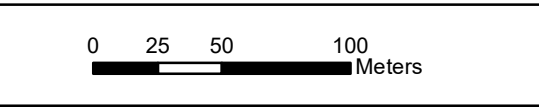
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  - 0/2/50 OP Intensification Areas & Emerging Growth Centres (Population 2041/2051/Buildout)
  - Study Area Boundary
  - Emerging Growth Centres
  - Municipal Boundary



**RIC18-0004 -  
Richmond Hill UMESP Update**

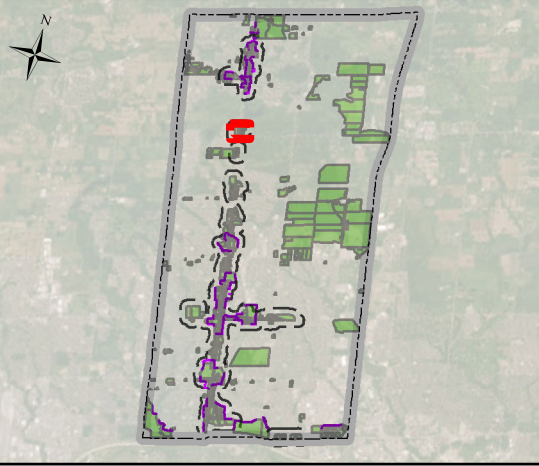
**Future Growth  
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(2021 Data)**

Drawn By: J.H. Date: Sep 20, 2023





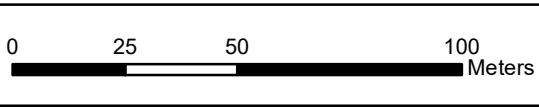
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  - ▭ Emerging Growth Centres
  - ▭ Municipal Boundary

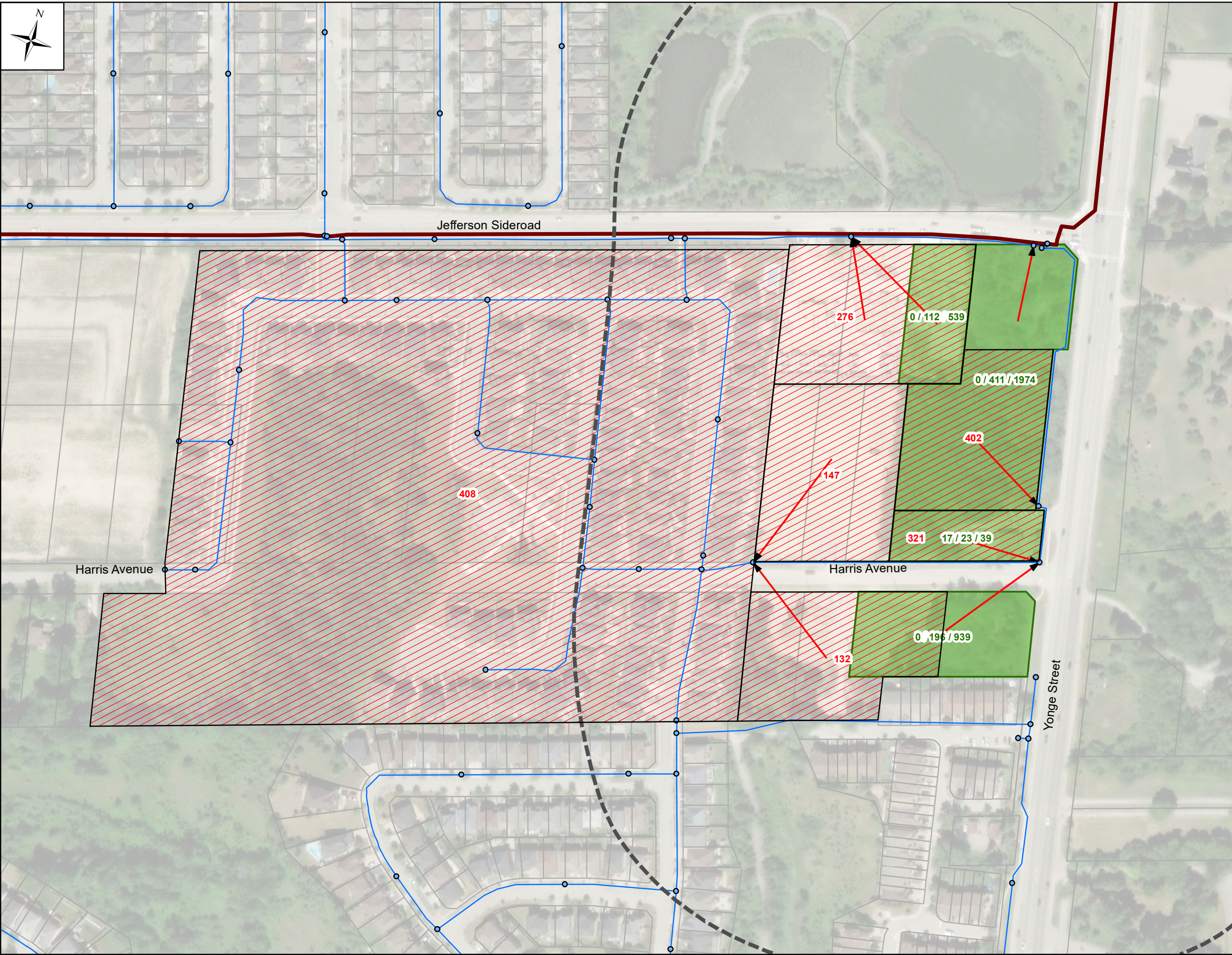


**RIC18-0004 -  
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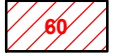




**Future Growth  
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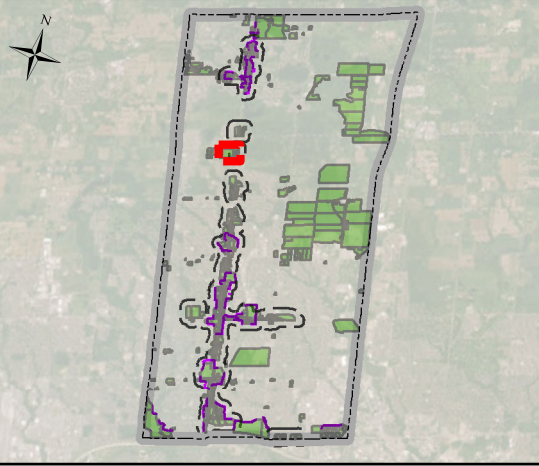
Drawn By: J.H.    Date: Sep 20, 2023





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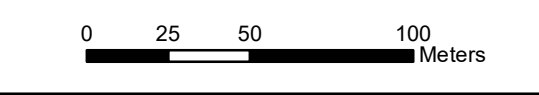
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-  Emerging Growth Centres
-  Municipal Boundary

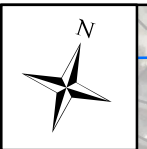


**RIC18-0004 -  
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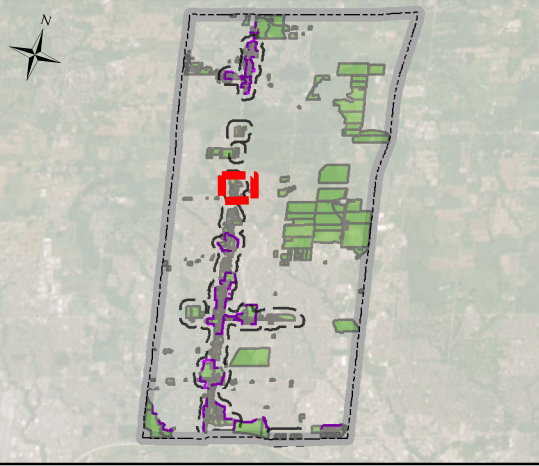
**Future Growth  
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(2021 Data)**

Drawn By: J.H.    Date: Sep 20, 2023





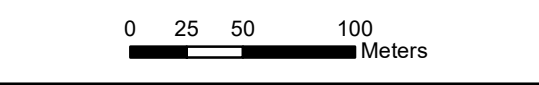
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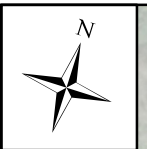


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Richmond Hill UMESP Update**


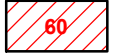



**Future Growth  
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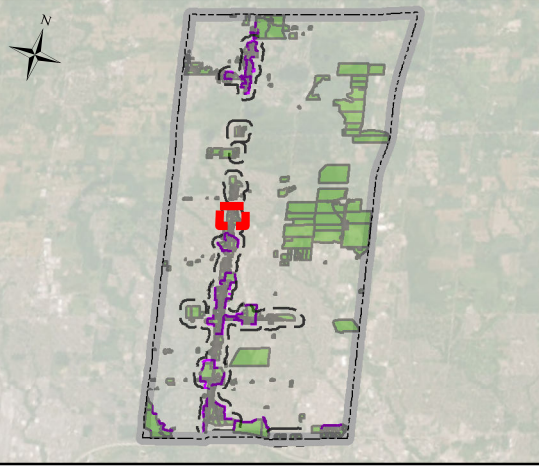
Drawn By: J.H.    Date: Sep 20, 2023





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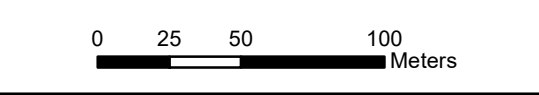
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**RIC18-004 -  
Richmond Hill UMESP Update**

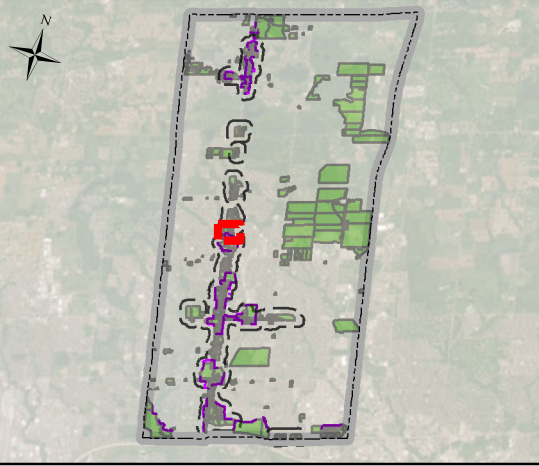
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Drawn By: J.H.    Date: Sep 20, 2023





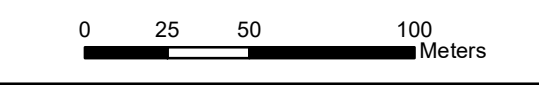
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  - ▭ Municipal Boundary

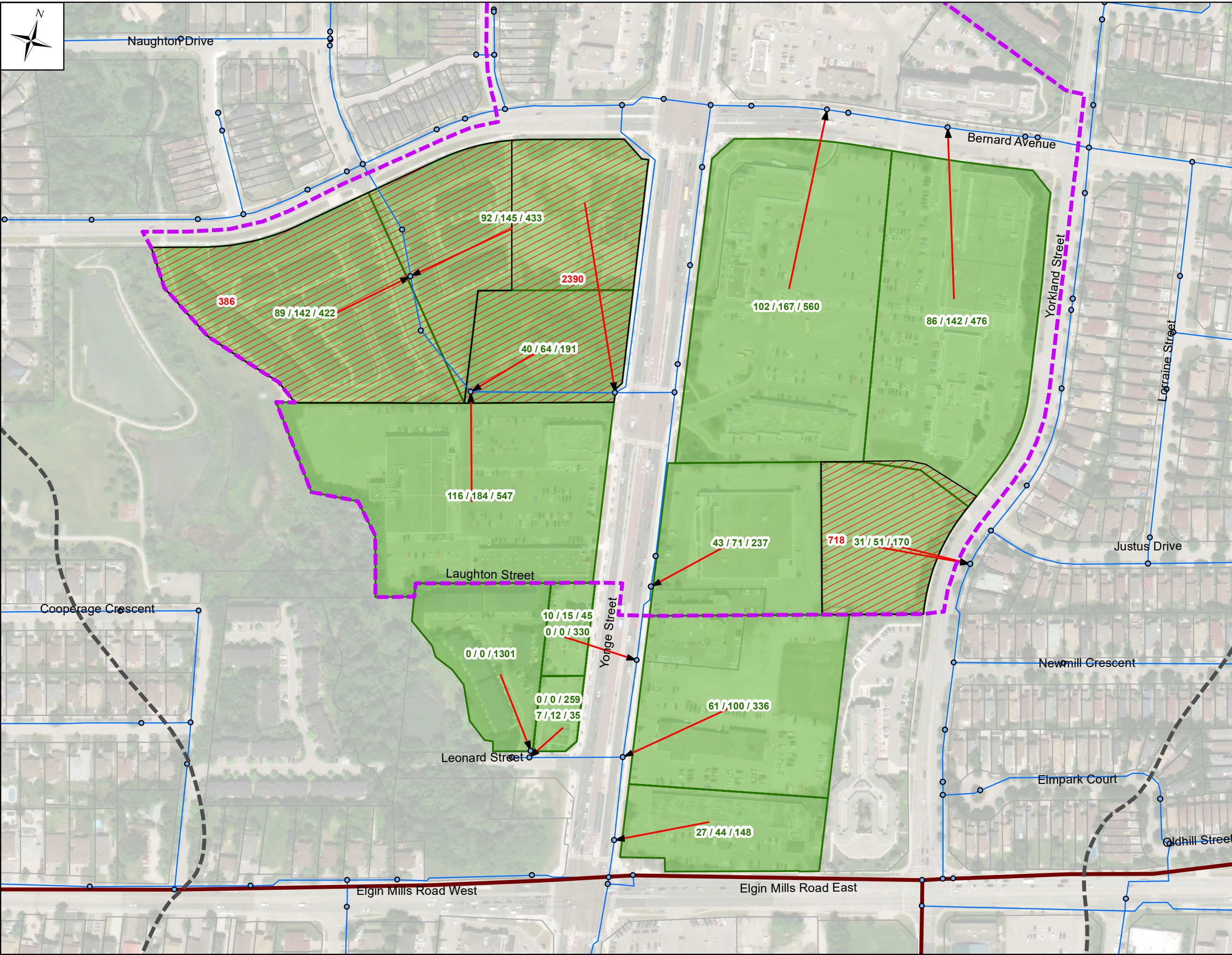


**RIC18-0004 -  
Richmond Hill UMESP Update**

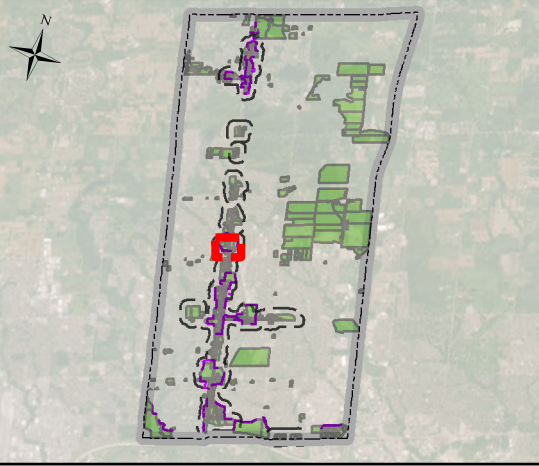
**Future Growth  
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(2021 Data)**

Drawn By: J.H. Date: Sep 20, 2023





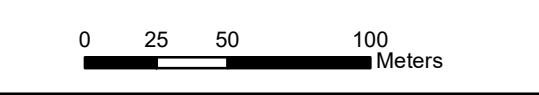
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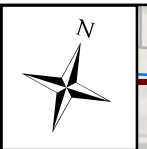


**RIC18-0004 -  
Richmond Hill UMESP Update**








**Future Growth  
and Connection (11)  
(2021 Data)**

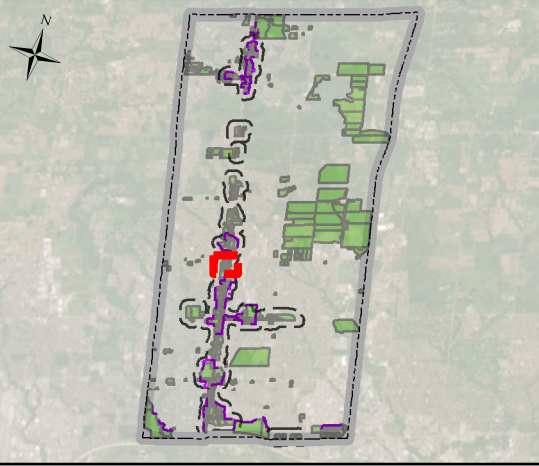
Drawn By: J.H.    Date: Sep 20, 2023





**Legend**

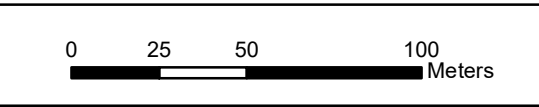
-  Junctions
-  Local Watermains
-  Regional Watermains
-  Ultimate Build-Out Proposed Catchment Connection Point
-  New Development Application (Population 2041)
-  OP Intensification Areas & Emerging Growth Centres (Population 2041/2051/Buildout)
-  Study Area Boundary
-  Emerging Growth Centres
-  Municipal Boundary

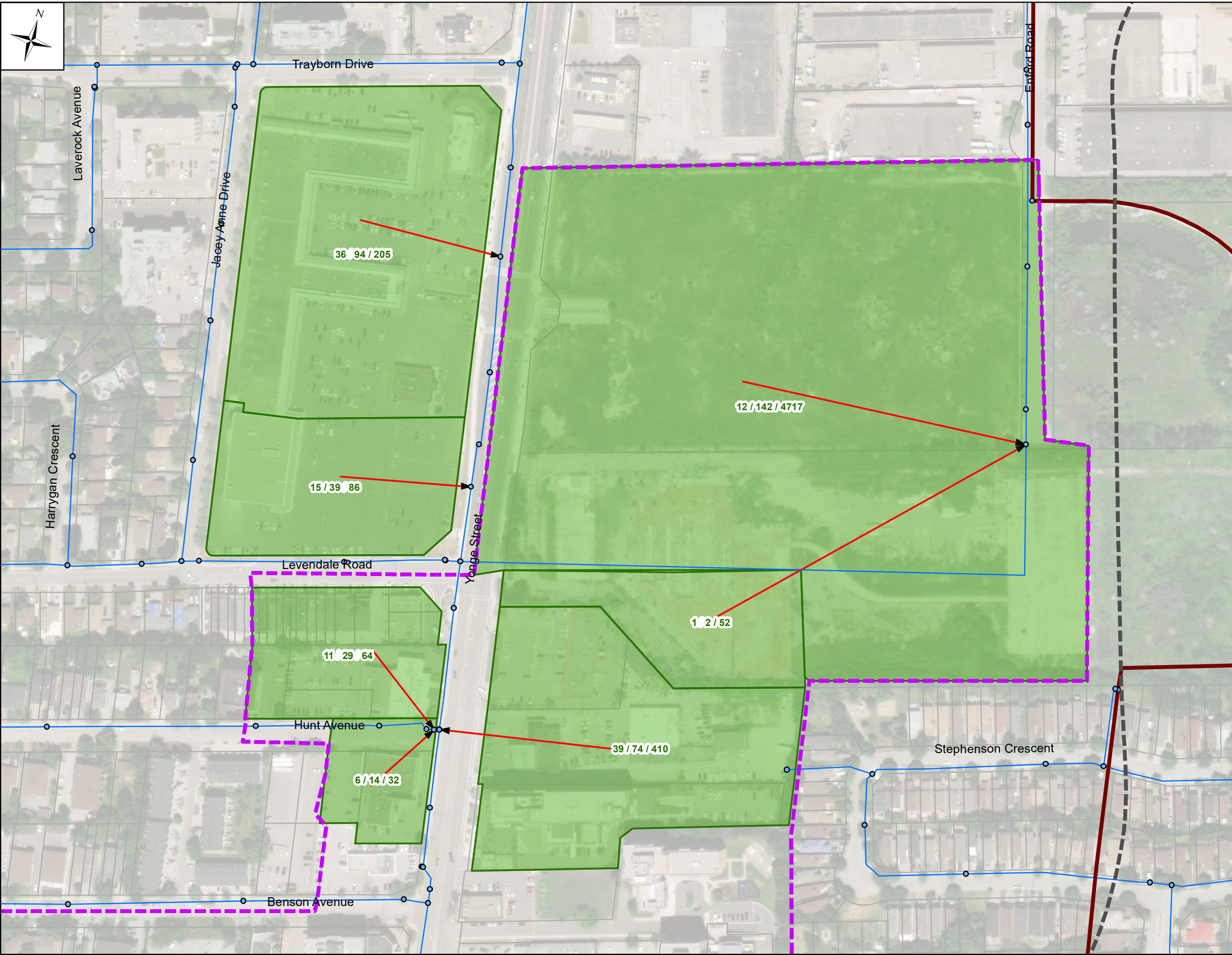


**RIC18-0004 -  
Richmond Hill UMESP Update**

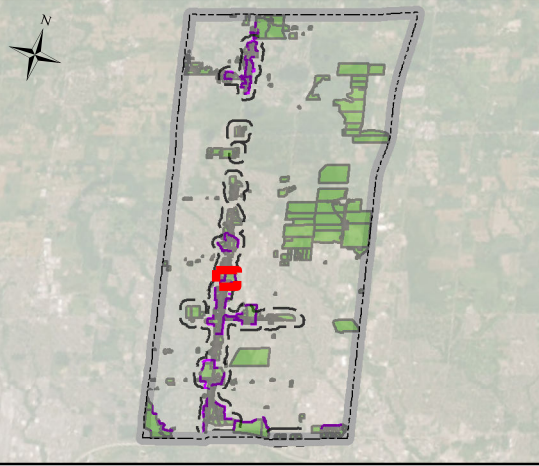
**Future Growth  
and Connection (12)  
(2021 Data)**

Drawn By: J.H.    Date: Sep 20, 2023





- Legend**
- Junctions
  - Local Watermains
  - Regional Watermains
  - Ultimate Build-Out Proposed Catchment Connection Point
  - ▨ 60 New Development Application (Population 2041)
  - ▨ 0/2/50 OP Intensification Areas & Emerging Growth Centres (Population 2041/2051/Buildout)
  - ▭ Study Area Boundary
  - ▭ Emerging Growth Centres
  - ▭ Municipal Boundary

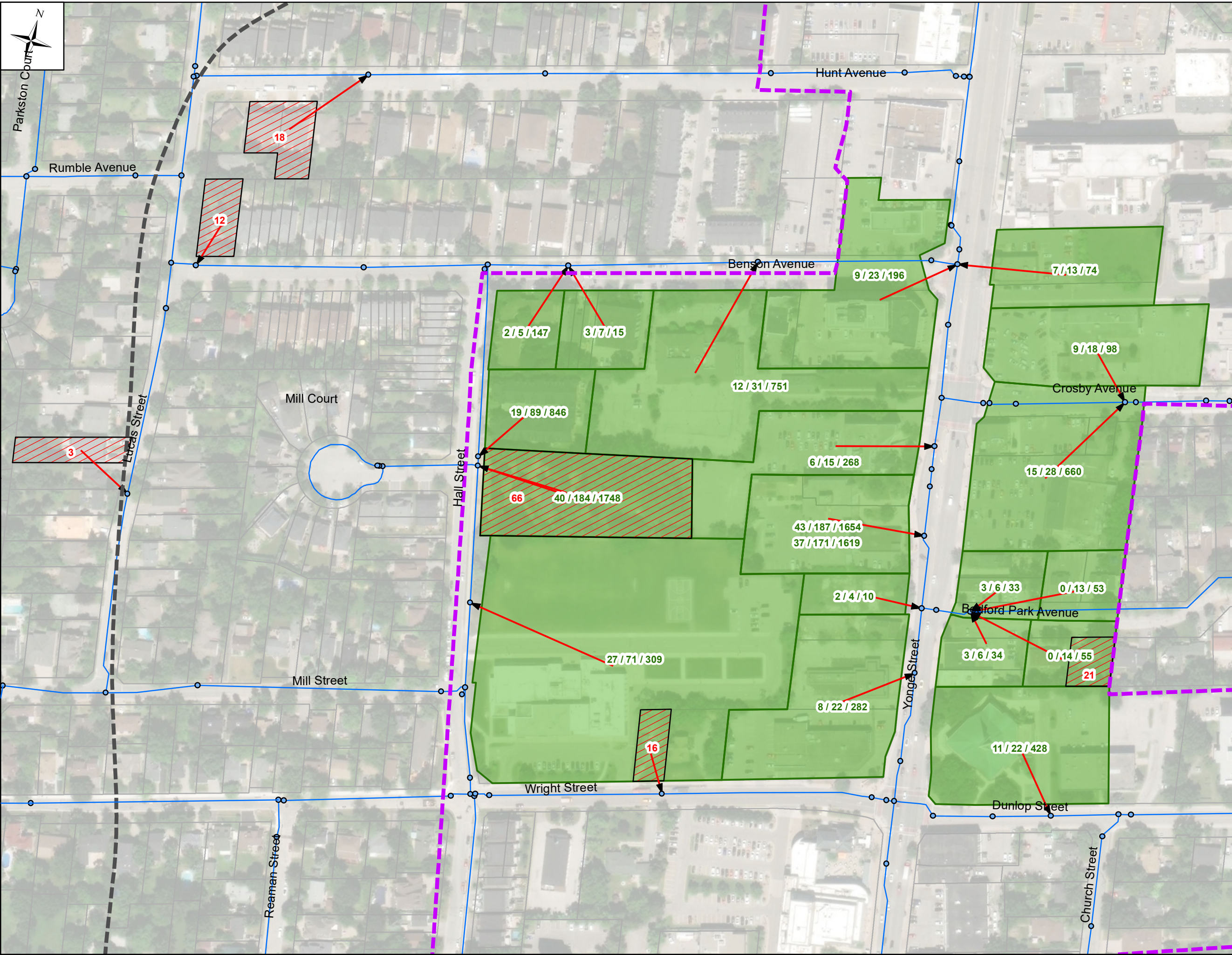


**RIC18-0004 -  
Richmond Hill UMESP Update**

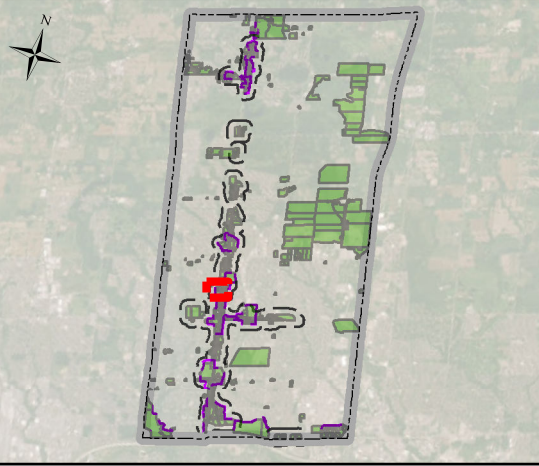
**Future Growth  
and Connection (13)  
(2021 Data)**

Drawn By: J.H.    Date: Sep 20, 2023





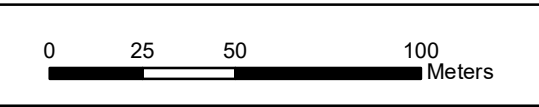
- Legend**
- Junctions
  - Local Watermains
  - Regional Watermains
  - Ultimate Build-Out Proposed Catchment Connection Point
  - ▨ 60 New Development Application (Population 2041)
  - ▨ 0/2/50 OP Intensification Areas & Emerging Growth Centres (Population 2041/2051/Buildout)
  - ▭ Study Area Boundary
  - ▭ Emerging Growth Centres
  - ▭ Municipal Boundary

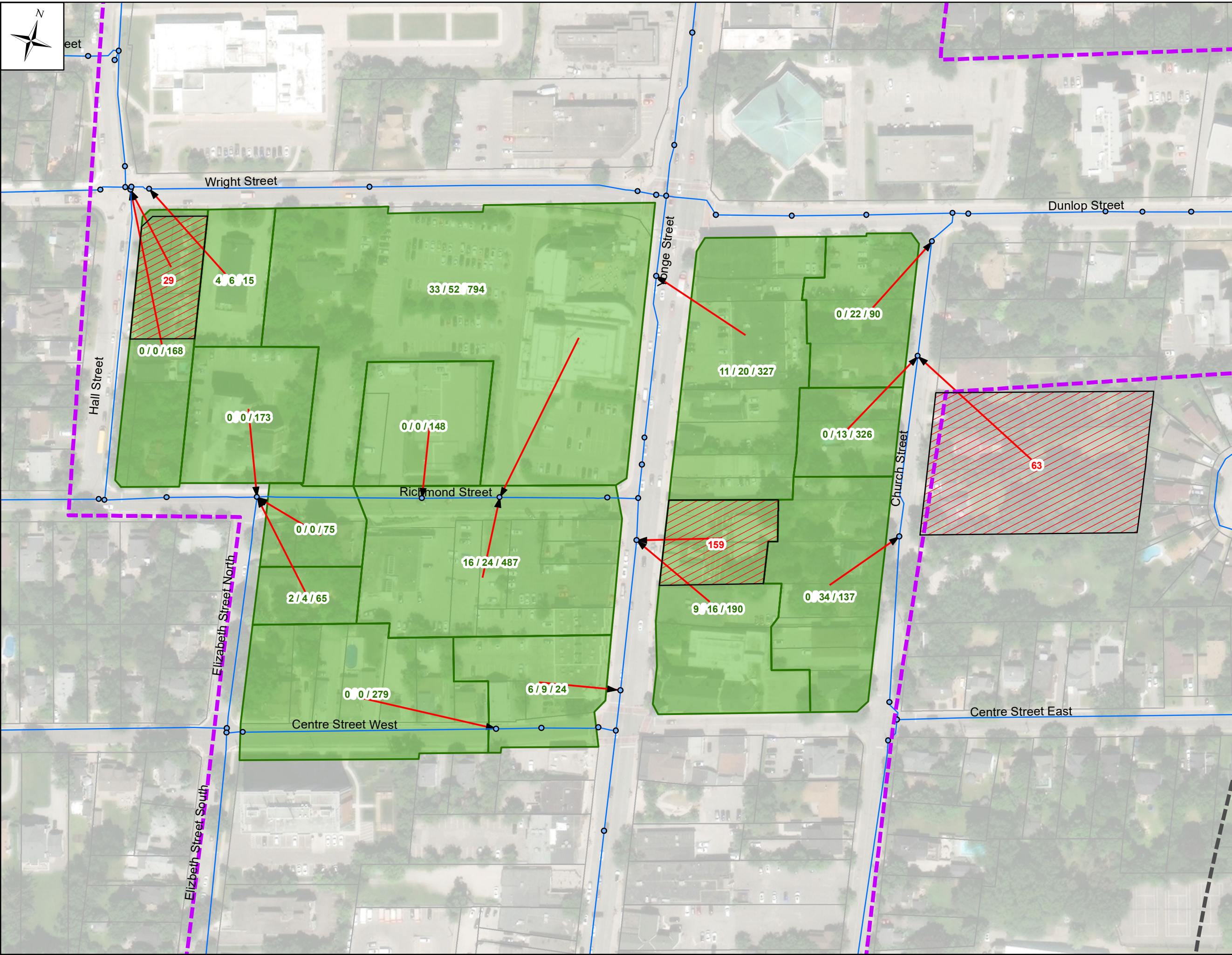


**RIC18-0004 -  
Richmond Hill UMESP Update**

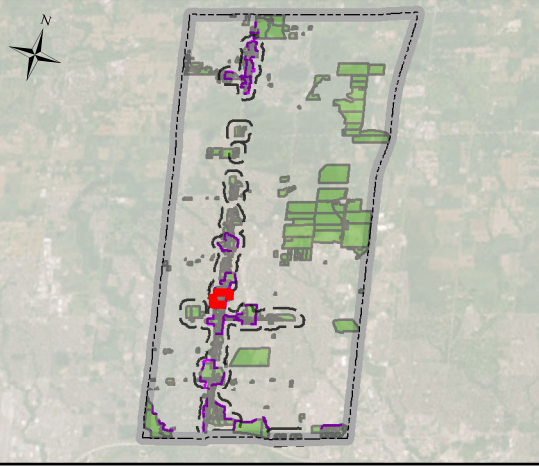
**Future Growth  
and Connection (14)  
(2021 Data)**

Drawn By: J.H.    Date: Sep 20, 2023





- Legend**
- Junctions
  - Local Watermains
  - Regional Watermains
  - Ultimate Build-Out Proposed Catchment Connection Point
  - ▨ 60 New Development Application (Population 2041)
  - 0/2/50 OP Intensification Areas & Emerging Growth Centres (Population 2041/2051/Buildout)
  - ▭ Study Area Boundary
  - ▭ Emerging Growth Centres
  - ▭ Municipal Boundary

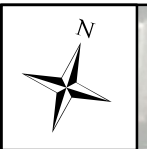


**RIC18-0004 -  
Richmond Hill UMESP Update**







**Future Growth  
and Connection (15)  
(2021 Data)**

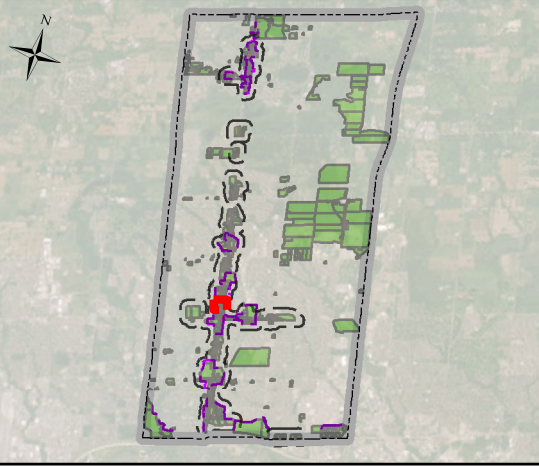
Drawn By: J.H. Date: Sep 20, 2023





**Legend**

-  Junctions
-  Local Watermains
-  Regional Watermains
-  Ultimate Build-Out Proposed Catchment Connection Point
-  New Development Application (Population 2041)
-  OP Intensification Areas & Emerging Growth Centres (Population 2041/2051/Buildout)
-  Study Area Boundary
-  Emerging Growth Centres
-  Municipal Boundary

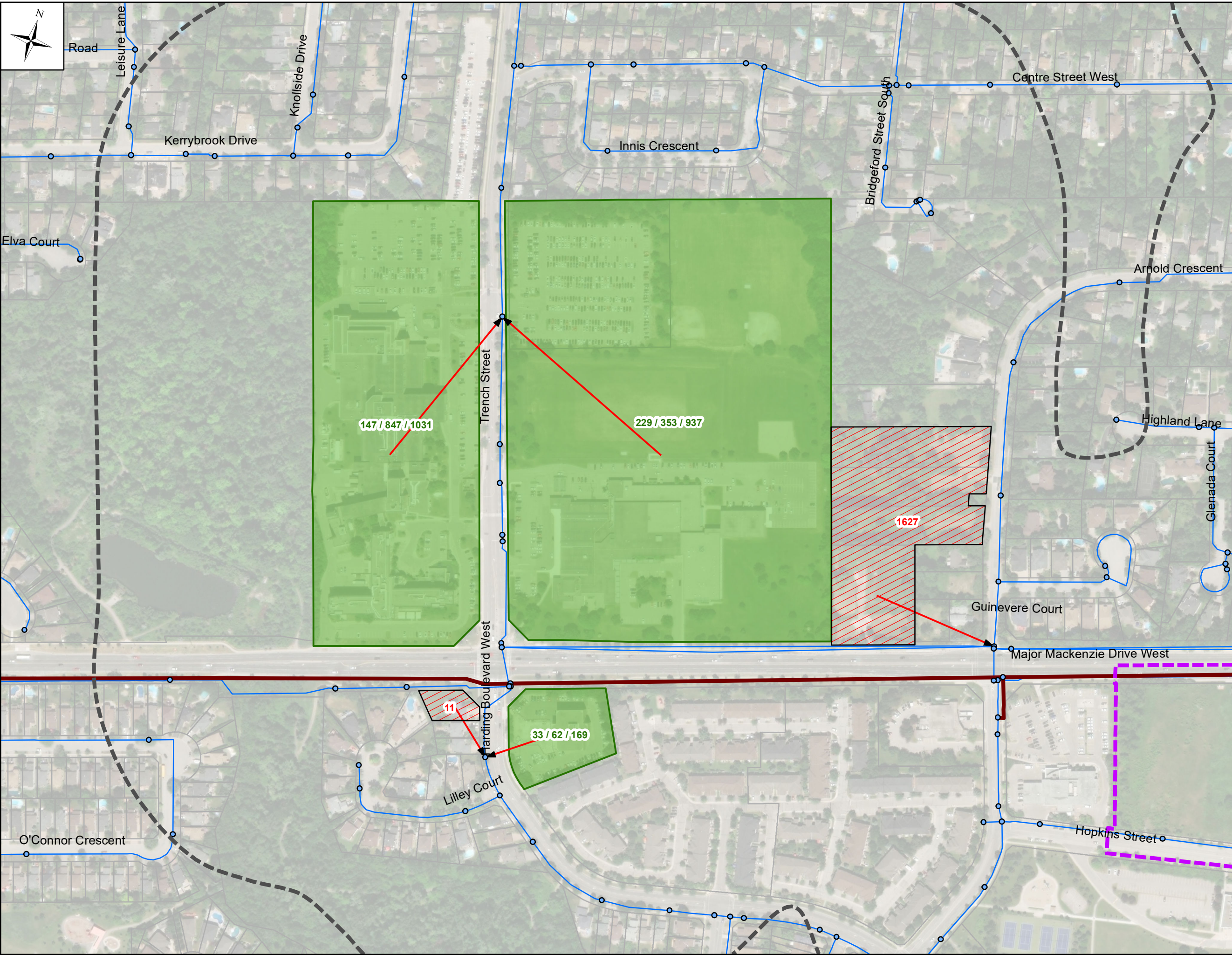


**RIC18-0004 -  
Richmond Hill UMESP Update**

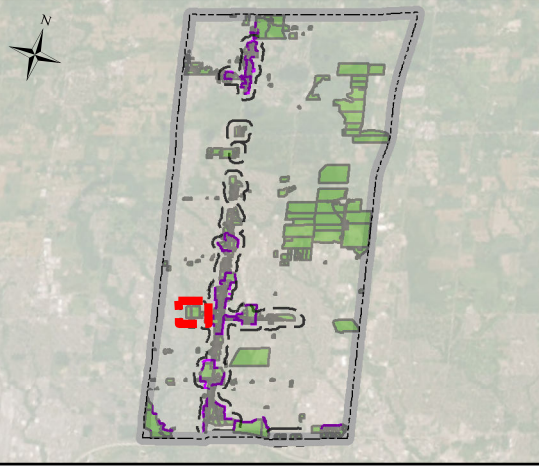
**Future Growth  
and Connection (16)  
(2021 Data)**

Drawn By: J.H.    Date: Sep 20, 2023





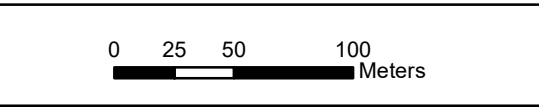
- Legend**
- Junctions
  - Local Watermains
  - Regional Watermains
  - Ultimate Build-Out Proposed Catchment Connection Point
  - ▨ 60 New Development Application (Population 2041)
  - ▨ 0/2/50 OP Intensification Areas & Emerging Growth Centres (Population 2041/2051/Buildout)
  - Study Area Boundary
  - Emerging Growth Centres
  - ▭ Municipal Boundary

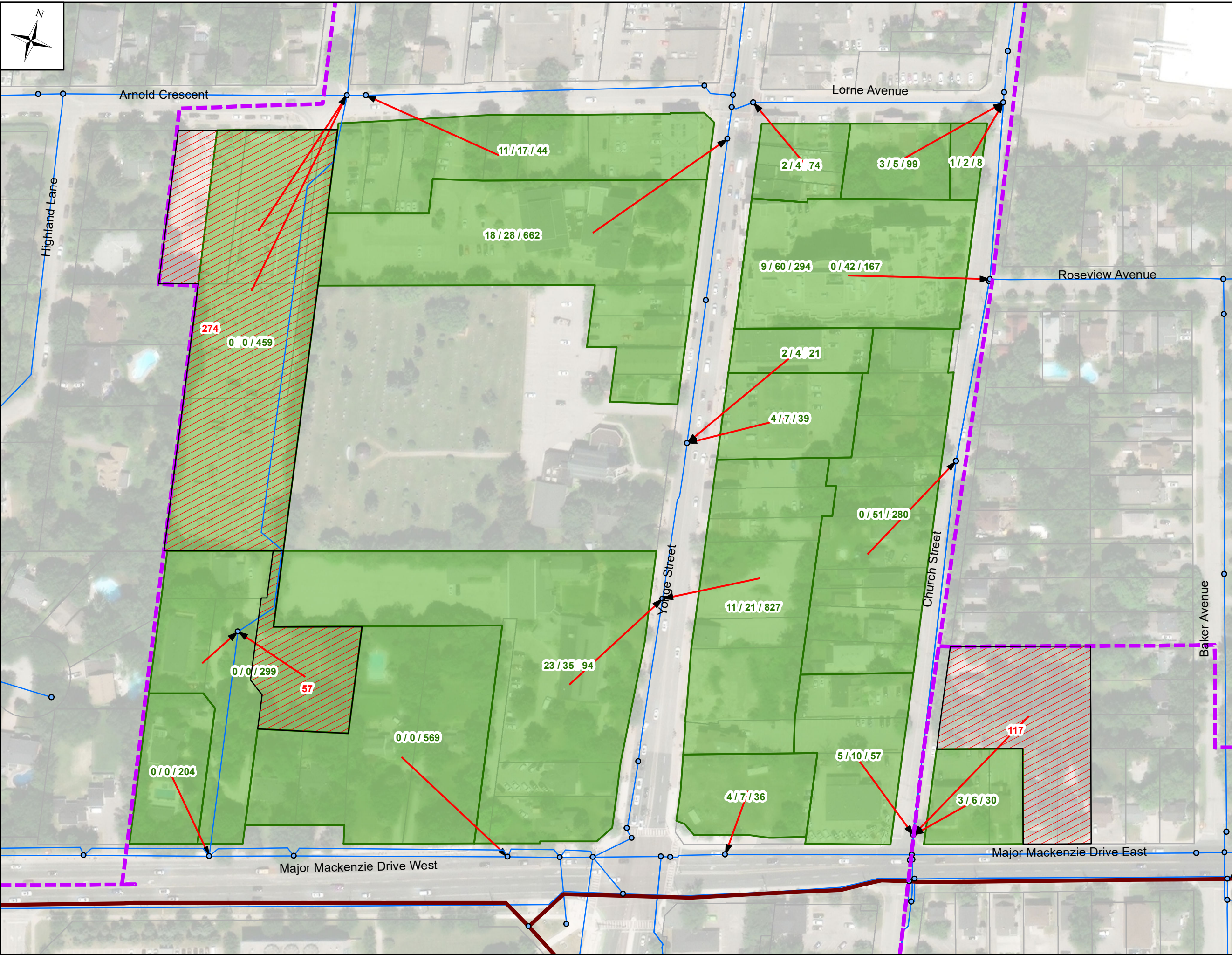


**RIC18-0004 -  
Richmond Hill UMESP Update**

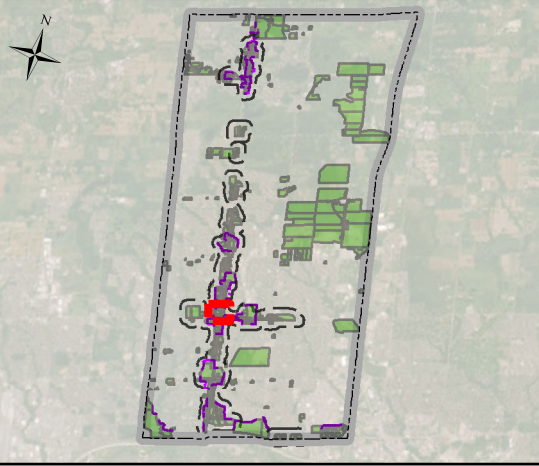
**Future Growth  
and Connection (17)  
(2021 Data)**

Drawn By: J.H. Date: Sep 20, 2023





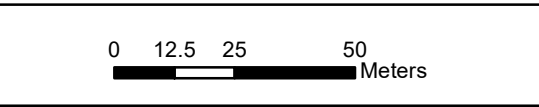
- Legend**
- Junctions
  - Local Watermains
  - Regional Watermains
  - Ultimate Build-Out Proposed Catchment Connection Point
  - ▨ 60 New Development Application (Population 2041)
  - ▨ 0/2 50 OP Intensification Areas & Emerging Growth Centres (Population 2041/2051/Buildout)
  - ▭ Study Area Boundary
  - ▭ Emerging Growth Centres
  - ▭ Municipal Boundary

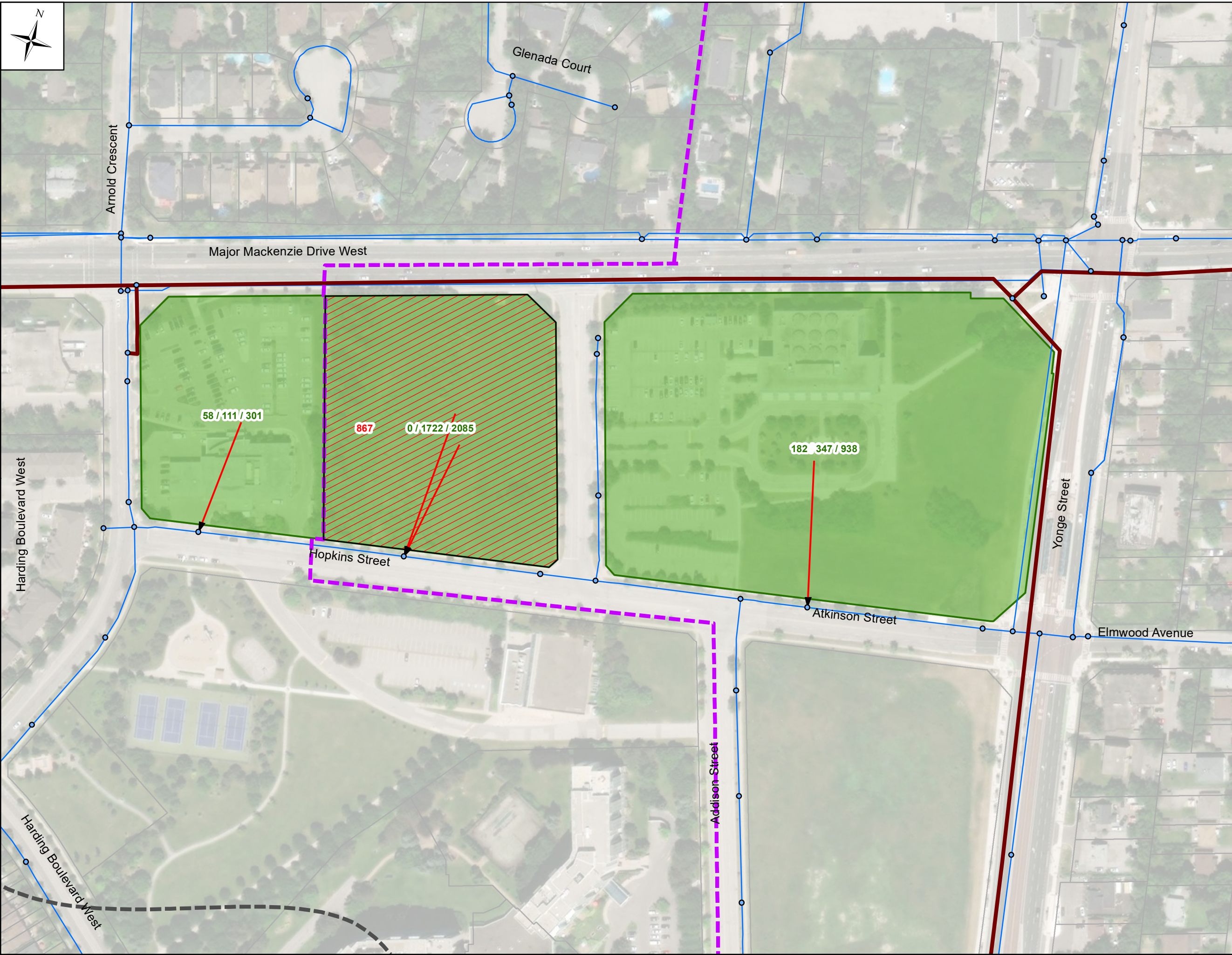


**RIC18-0004 -  
Richmond Hill UMESP Update**

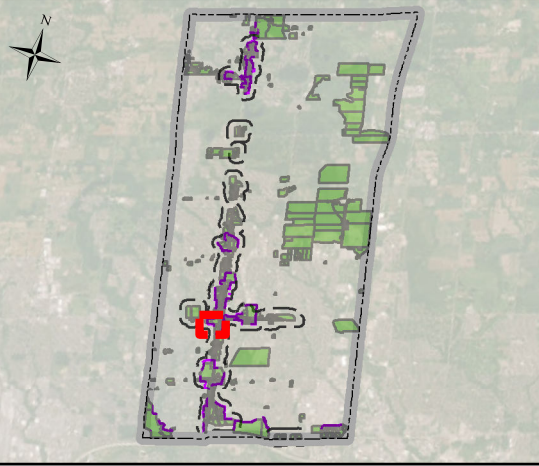
**Future Growth  
and Connection (18)  
(2021 Data)**

Drawn By: J.H.    Date: Sep 20, 2023





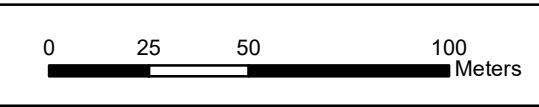
- Legend**
- Junctions
  - Local Watermains
  - Regional Watermains
  - Ultimate Build-Out Proposed Catchment Connection Point
  - ▨ 60 New Development Application (Population 2041)
  - 0/2/50 OP Intensification Areas & Emerging Growth Centres (Population 2041/2051/Buildout)
  - Study Area Boundary
  - Emerging Growth Centres
  - ▭ Municipal Boundary

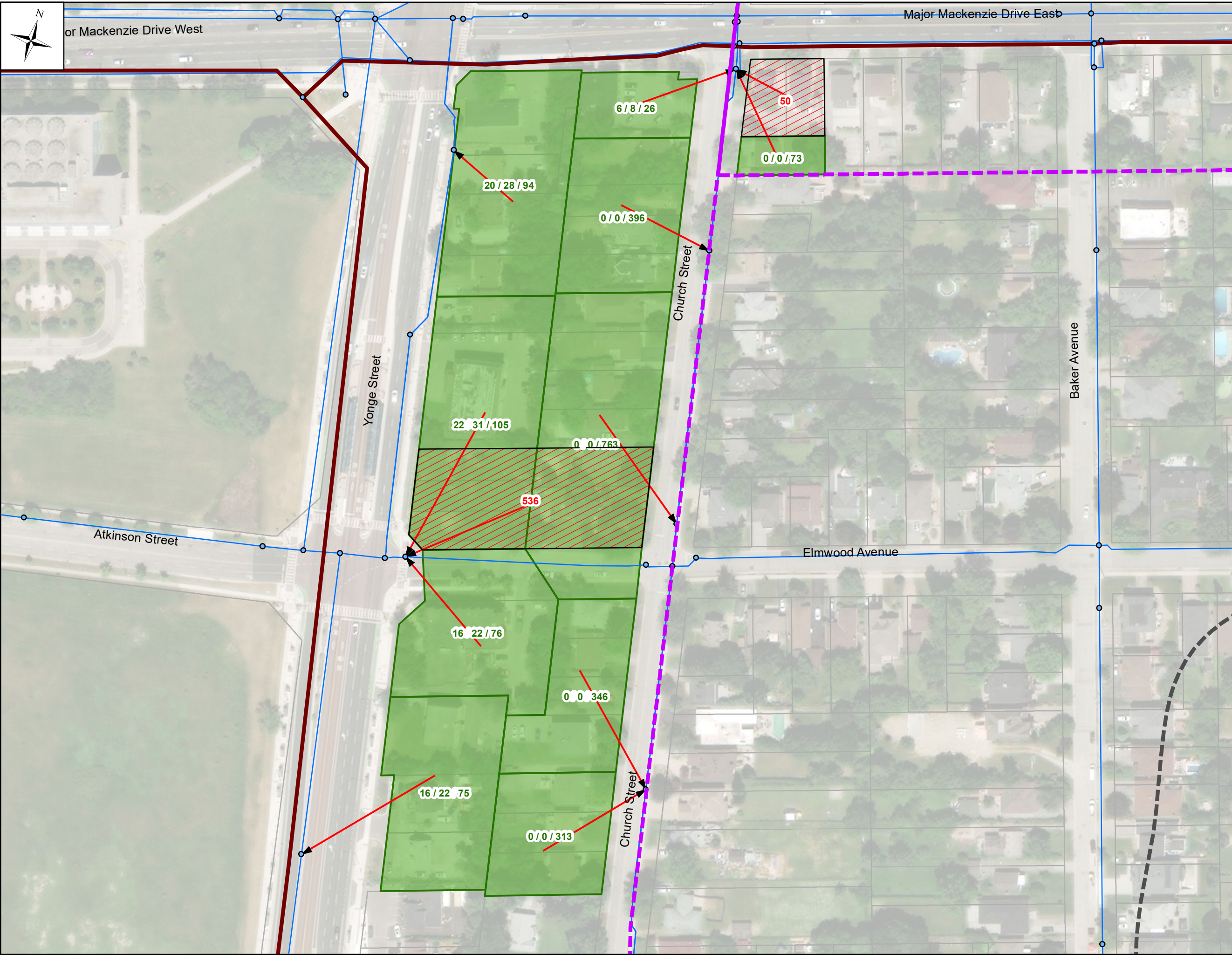


**RIC18-004 -  
Richmond Hill UMESP Update**

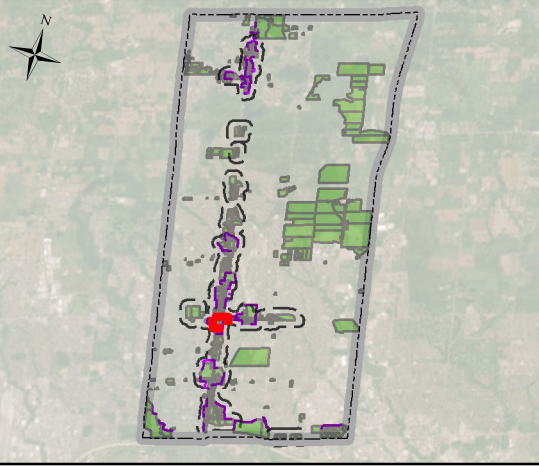
**Future Growth  
and Connection (19)  
(2021 Data)**

Drawn By: J.H. Date: Sep 20, 2023





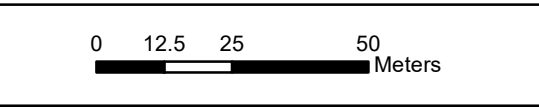
- Legend**
- Junctions
  - Local Watermains
  - Regional Watermains
  - Ultimate Build-Out Proposed Catchment Connection Point
  - ▨ 60 New Development Application (Population 2041)
  - ▨ 0/2/50 OP Intensification Areas & Emerging Growth Centres (Population 2041/2051/Buildout)
  - Study Area Boundary
  - Emerging Growth Centres
  - Municipal Boundary

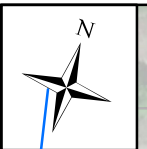
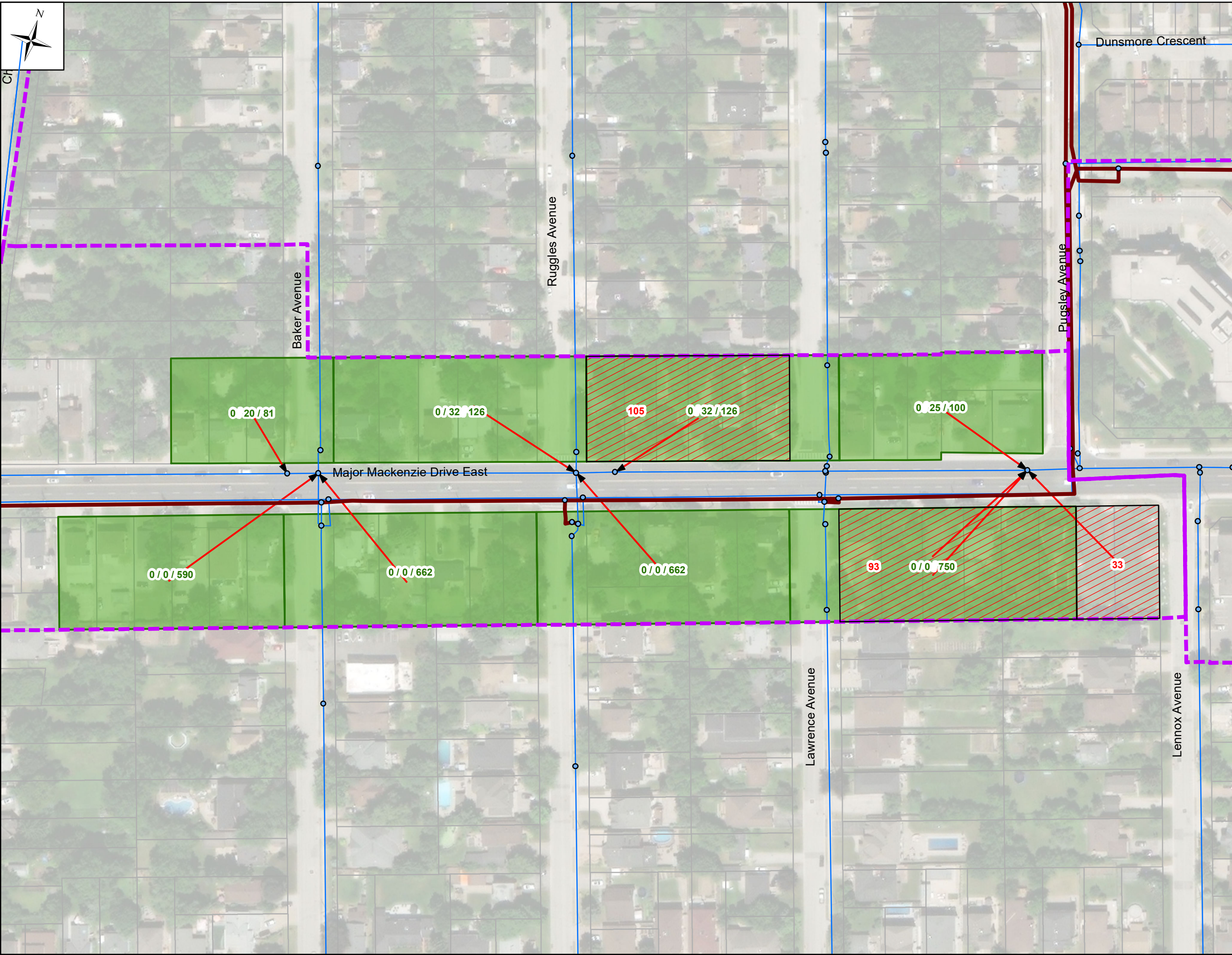


**RIC18-0004 -  
Richmond Hill UMESP Update**

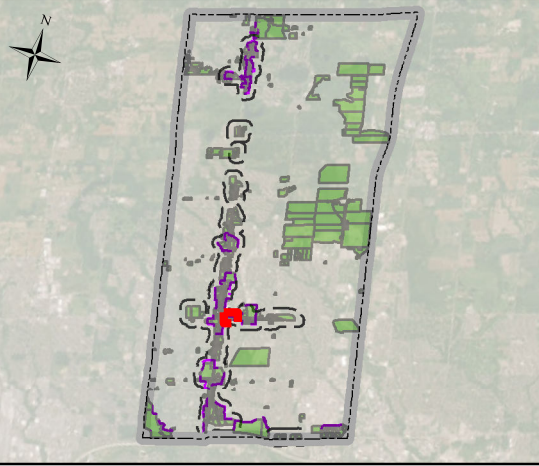
**Future Growth  
and Connection (20)  
(2021 Data)**

Drawn By: J.H.    Date: Sep 20, 2023





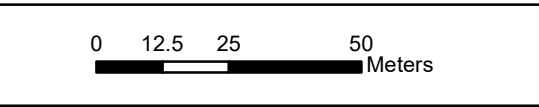
- Legend**
- Junctions
  - Local Watermains
  - Regional Watermains
  - Ultimate Build-Out Proposed Catchment Connection Point
  - New Development Application (Population 2041)
  - OP Intensification Areas & Emerging Growth Centres (Population 2041/2051/Buildout)
  - Study Area Boundary
  - Emerging Growth Centres
  - Municipal Boundary

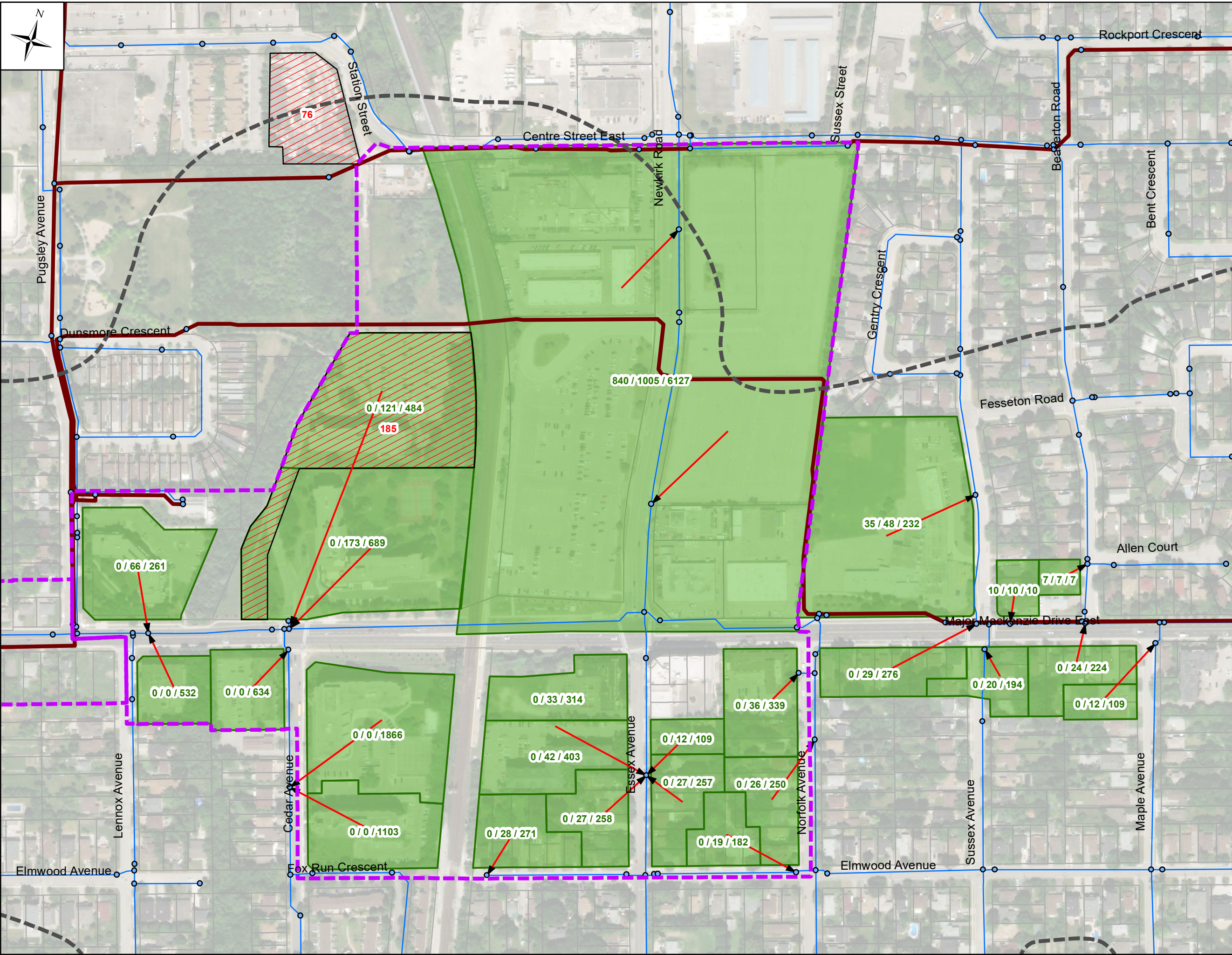


**RIC18-0004 -  
Richmond Hill UMESP Update**

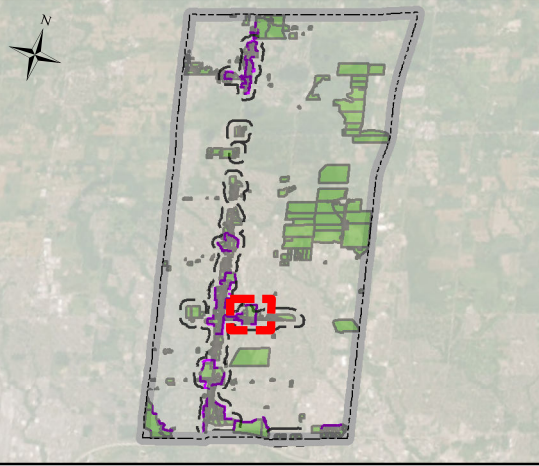
**Future Growth  
and Connection (21)  
(2021 Data)**

Drawn By: J.H.      Date: Sep 20, 2023





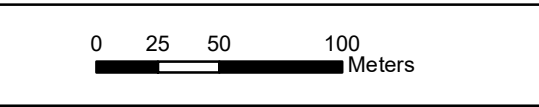
- Legend**
- Junctions
  - Local Watermains
  - Regional Watermains
  - Ultimate Build-Out Proposed Catchment Connection Point
  - ▨ 60 New Development Application (Population 2041)
  - ▨ 0/2/50 OP Intensification Areas & Emerging Growth Centres (Population 2041/2051/Buildout)
  - - - Study Area Boundary
  - - - Emerging Growth Centres
  - ▭ Municipal Boundary

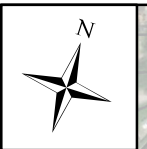


**RIC18-004 -  
Richmond Hill UMESP Update**

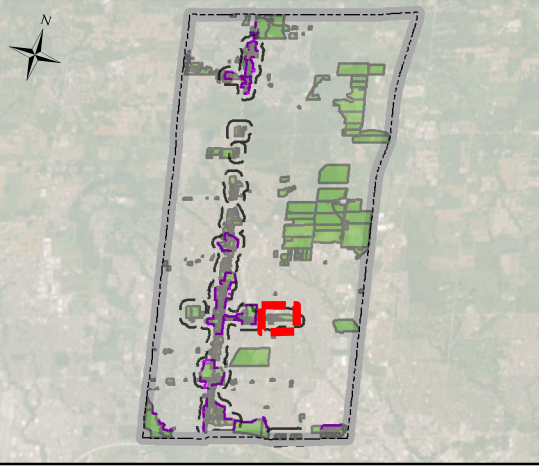
**Future Growth  
and Connection (22)  
(2021 Data)**

Drawn By: J.H. Date: Sep 20, 2023





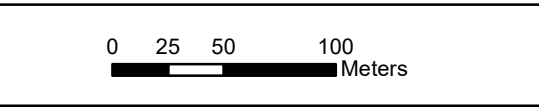
- Legend**
- Junctions
  - Local Watermains
  - Regional Watermains
  - ▶ Ultimate Build-Out Proposed Catchment Connection Point
  - New Development Application (Population 2041)
  - 0/2 / 50 OP Intensification Areas & Emerging Growth Centres (Population 2041/2051/Buildout)
  - Study Area Boundary
  - Emerging Growth Centres
  - Municipal Boundary

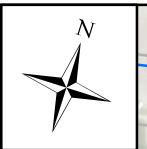


**RIC18-0004 -  
Richmond Hill UMESP Update**

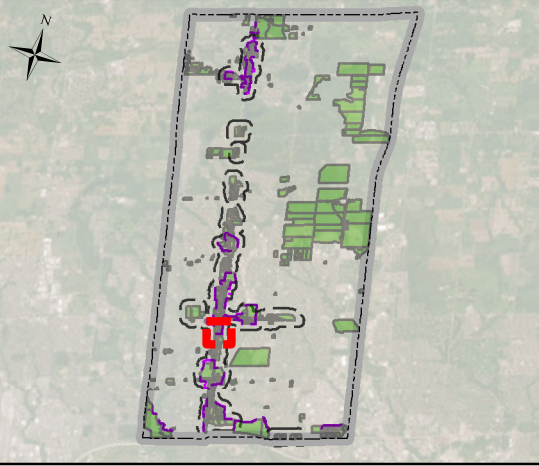
**Future Growth  
and Connection (23)  
(2021 Data)**

Drawn By: J.H.    Date: Sep 20, 2023





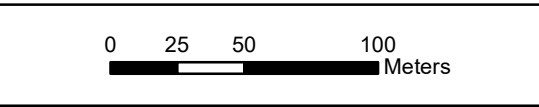
- Legend**
- Junctions
  - Local Watermains
  - Regional Watermains
  - Ultimate Build-Out Proposed Catchment Connection Point
  - New Development Application (Population 2041)
  - OP Intensification Areas & Emerging Growth Centres (Population 2041/2051/Buildout)
  - Study Area Boundary
  - Emerging Growth Centres
  - Municipal Boundary

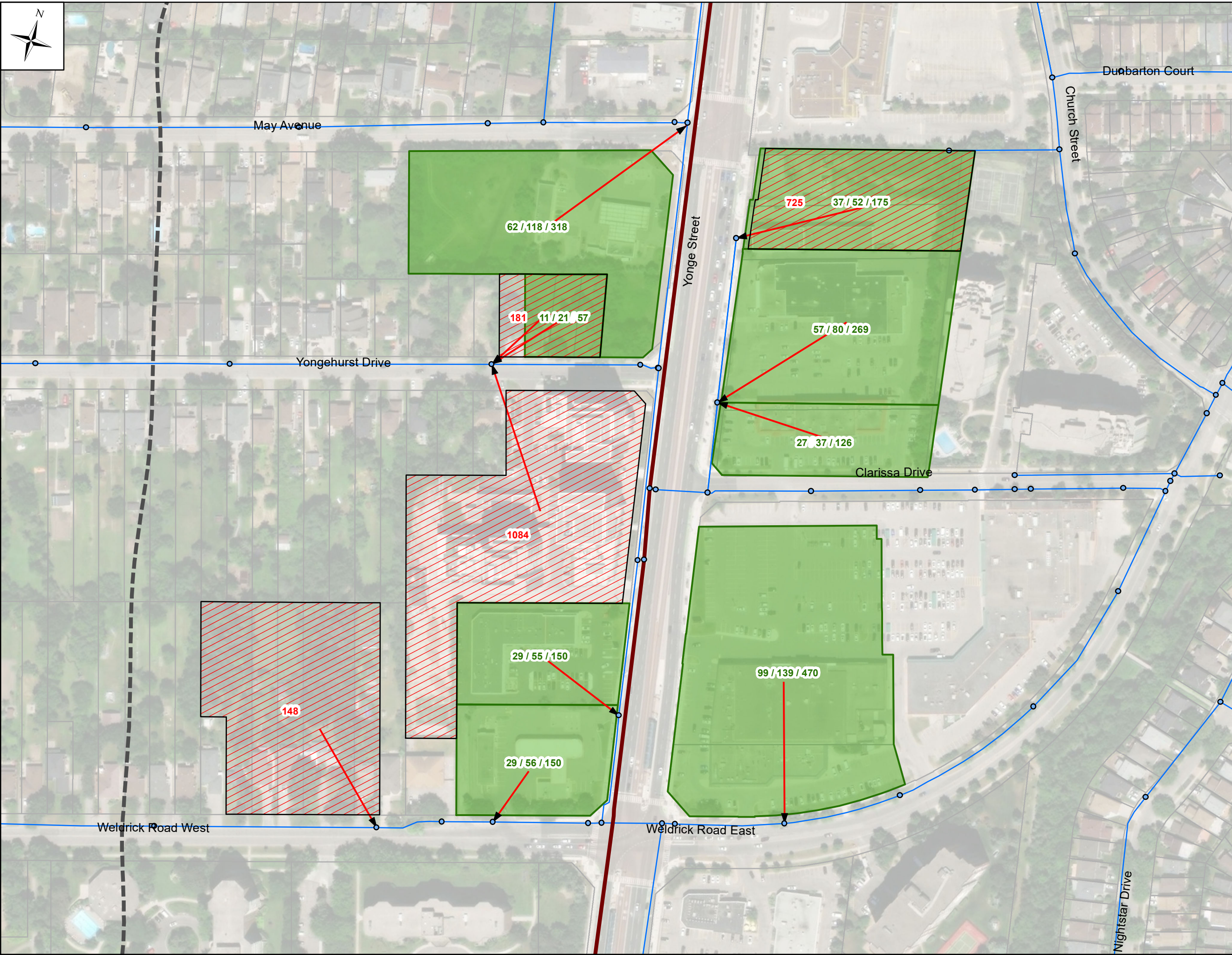
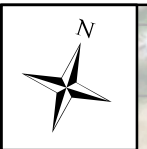


**RIC18-0004 -  
Richmond Hill UMESP Update**






**Future Growth  
and Connection (24)  
(2021 Data)**

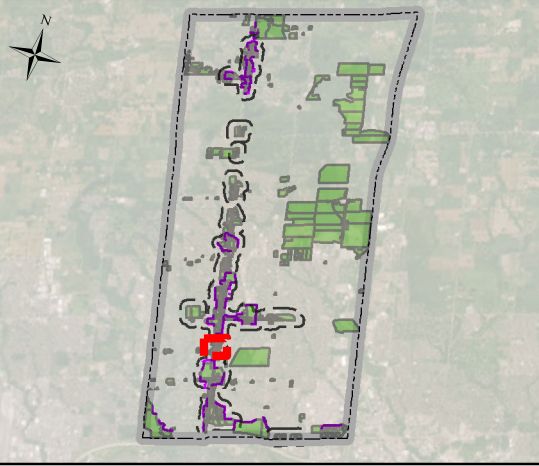
Drawn By: J.H. Date: Sep 20, 2023





**Legend**

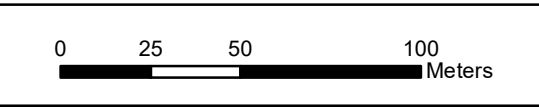
-  Junctions
-  Local Watermains
-  Regional Watermains
-  Ultimate Build-Out Proposed Catchment Connection Point
-  New Development Application (Population 2041)
-  OP Intensification Areas & Emerging Growth Centres (Population 2041/2051/Buildout)
-  Study Area Boundary
-  Emerging Growth Centres
-  Municipal Boundary

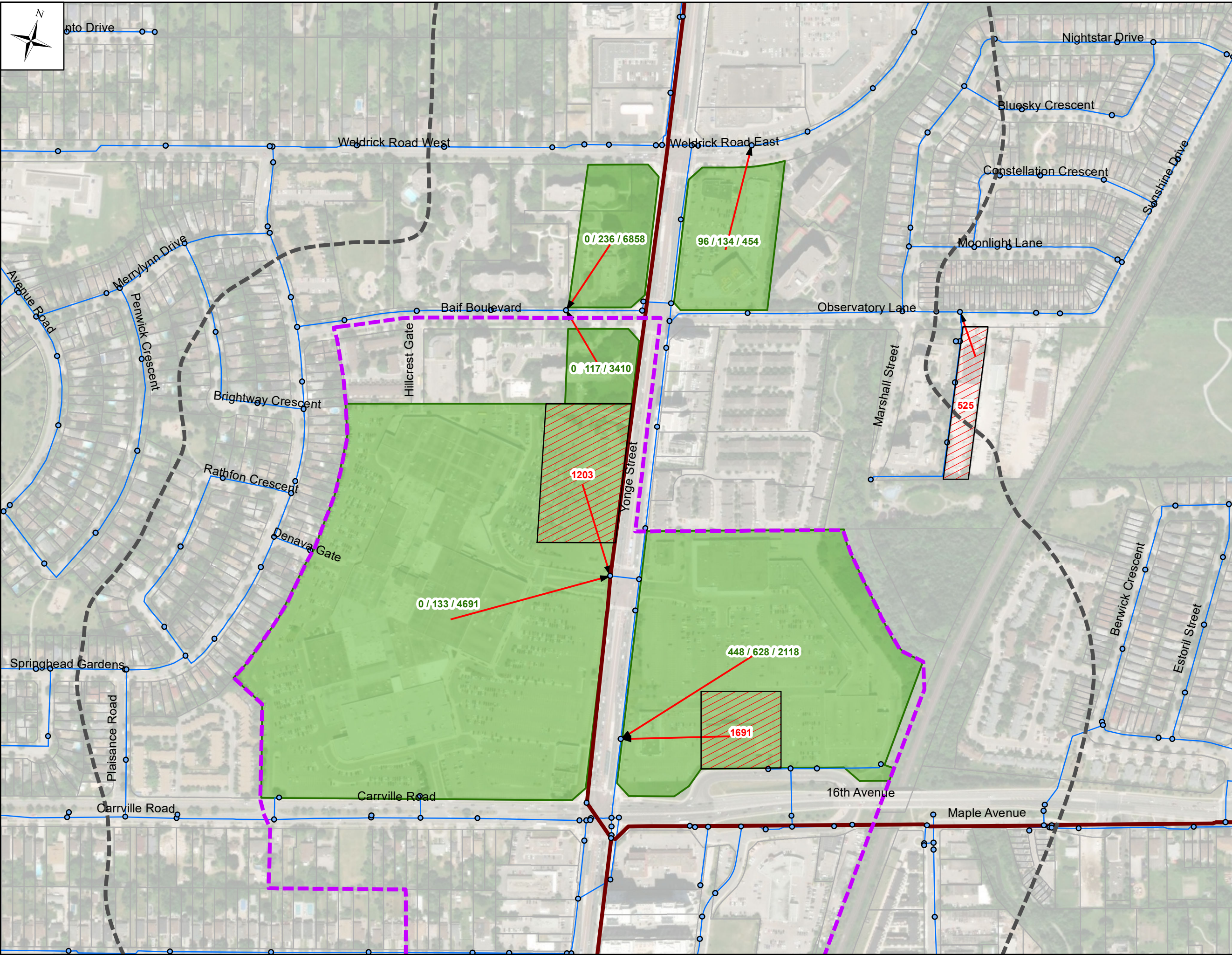


**RIC18-004 -  
Richmond Hill UMESP Update**

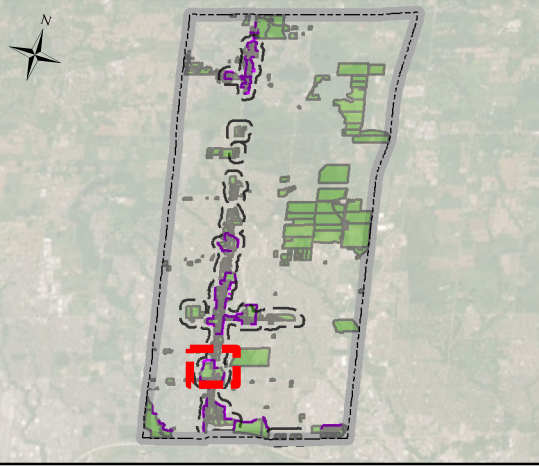
**Future Growth  
and Connection (25)  
(2021 Data)**

Drawn By: J.H.    Date: Sep 20, 2023





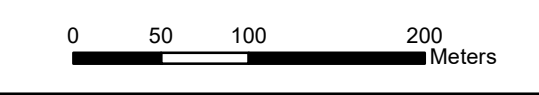
- Legend**
- Junctions
  - Local Watermains
  - Regional Watermains
  - Ultimate Build-Out Proposed Catchment Connection Point
  - New Development Application (Population 2041)
  - OP Intensification Areas & Emerging Growth Centres (Population 2041/2051/Buildout)
  - Study Area Boundary
  - Emerging Growth Centres
  - Municipal Boundary

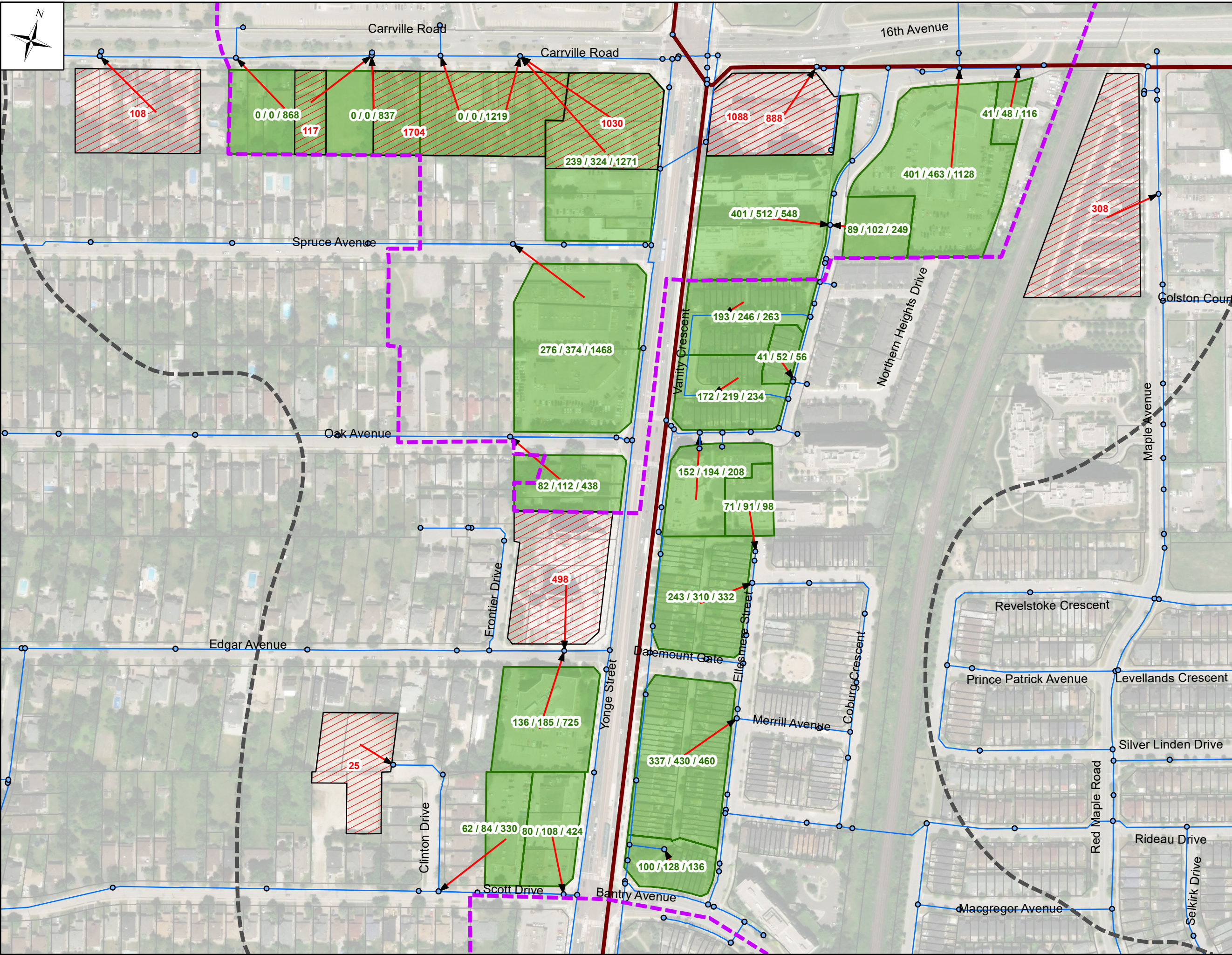


**RIC18-004 -  
Richmond Hill UMESP Update**

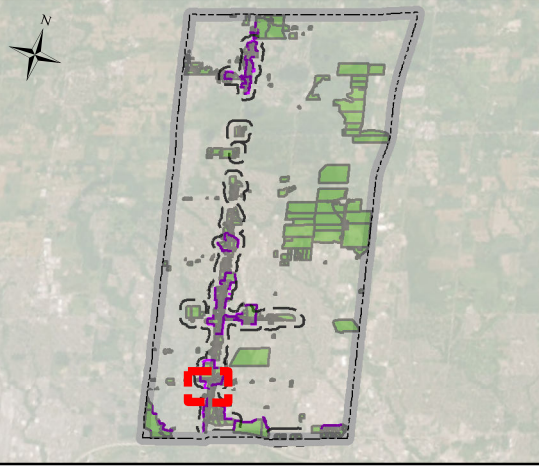
**Future Growth  
and Connection (26)  
(2021 Data)**

Drawn By: J.H.    Date: Sep 20, 2023





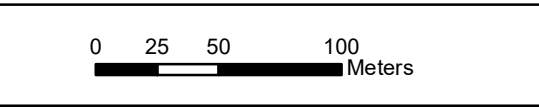
- Legend**
- Junctions
  - Local Watermains
  - Regional Watermains
  - Ultimate Build-Out Proposed Catchment Connection Point
  - ▨ 60 New Development Application (Population 2041)
  - ▨ 0/2/50 OP Intensification Areas & Emerging Growth Centres (Population 2041/2051/Buildout)
  - Study Area Boundary
  - Emerging Growth Centres
  - ▭ Municipal Boundary

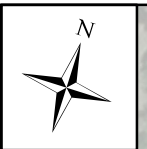


**RIC18-0004 -  
Richmond Hill UMESP Update**






**Future Growth  
and Connection (27)  
(2021 Data)**

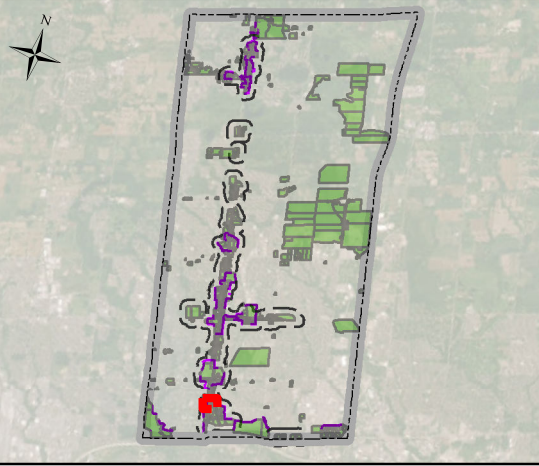
Drawn By: J.H. Date: Sep 20, 2023





**Legend**

-  Junctions
-  Local Watermains
-  Regional Watermains
-  Ultimate Build-Out Proposed Catchment Connection Point
-  New Development Application (Population 2041)
-  OP Intensification Areas & Emerging Growth Centres (Population 2041/2051/Buildout)
-  Study Area Boundary
-  Emerging Growth Centres
-  Municipal Boundary



**RIC18-0004 -  
Richmond Hill UMESP Update**

**Future Growth  
and Connection (28)  
(2021 Data)**

Drawn By: J.H. Date: Sep 20, 2023





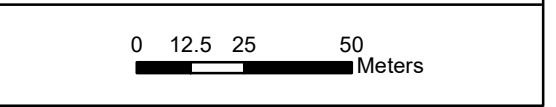
- Legend**
- Junctions
  - Local Watermains
  - Regional Watermains
  - Ultimate Build-Out Proposed Catchment Connection Point
  - New Development Application (Population 2041)
  - OP Intensification Areas & Emerging Growth Centres (Population 2041/2051/Buildout)
  - Study Area Boundary
  - Emerging Growth Centres
  - Municipal Boundary



**RIC18-0004 -  
Richmond Hill UMESP Update**



**Future Growth  
and Connection (29)  
(2021 Data)**

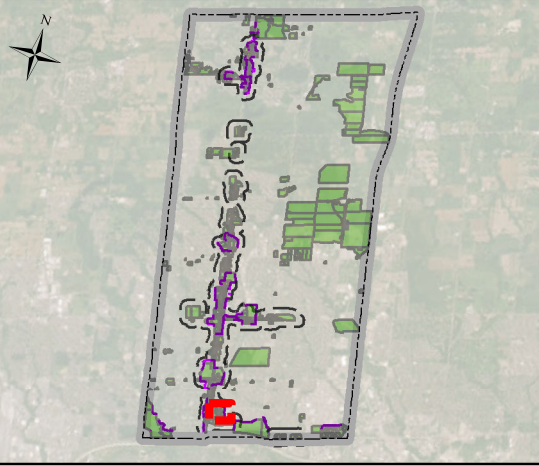
Drawn By: J.H.    Date: Sep 20, 2023





**Legend**

-  Junctions
-  Local Watermains
-  Regional Watermains
-  Ultimate Build-Out Proposed Catchment Connection Point
-  New Development Application (Population 2041)
-  OP Intensification Areas & Emerging Growth Centres (Population 2041/2051/Buildout)
-  Study Area Boundary
-  Emerging Growth Centres
-  Municipal Boundary

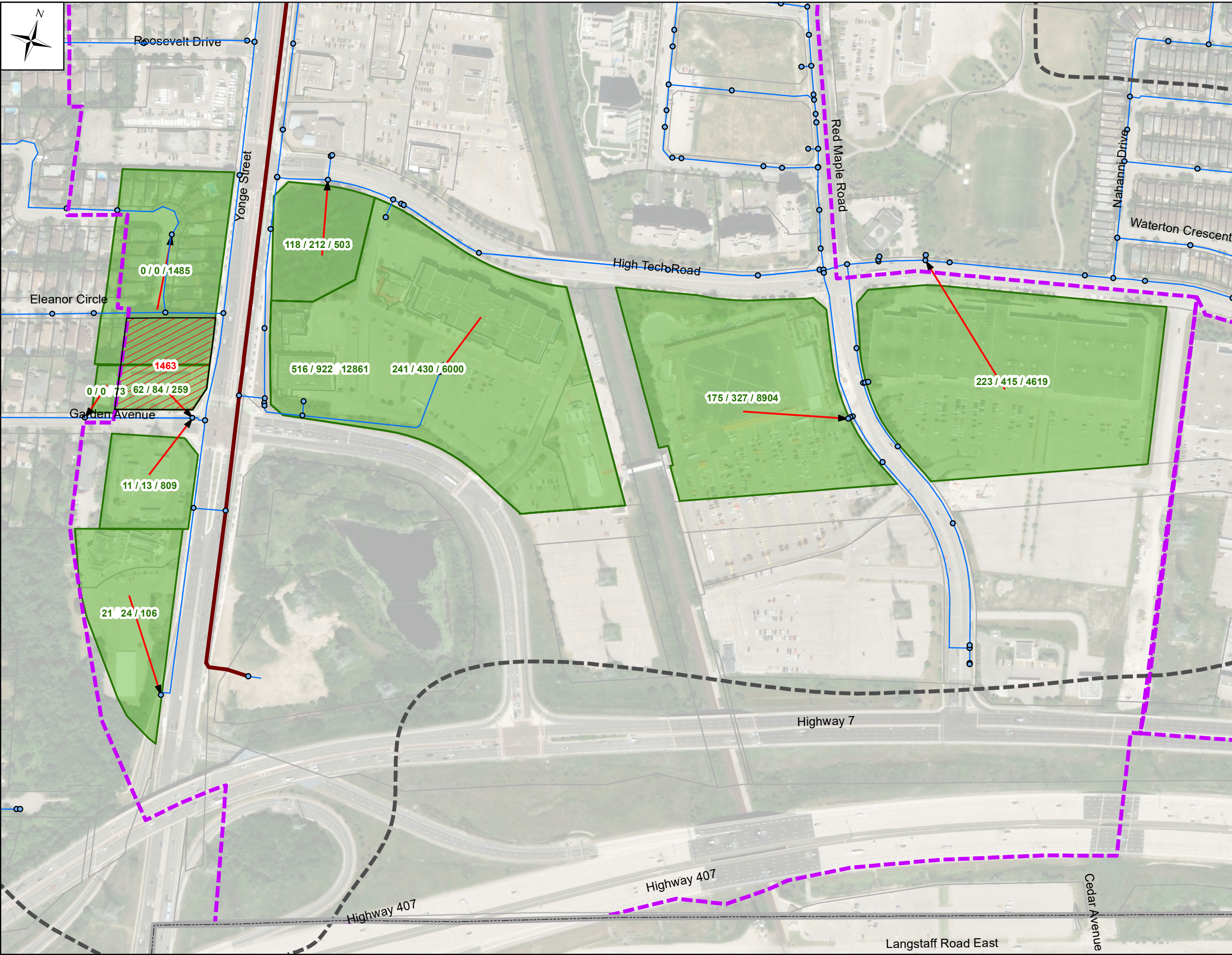


**RIC18-004 -  
Richmond Hill UMESP Update**

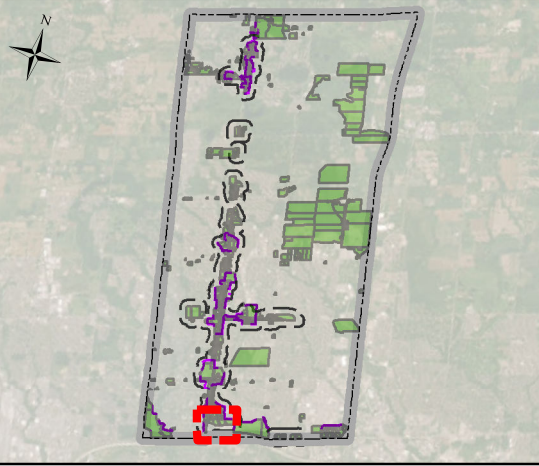
**Future Growth  
and Connection (30)  
(2021 Data)**

Drawn By: J.H.    Date: Sep 20, 2023





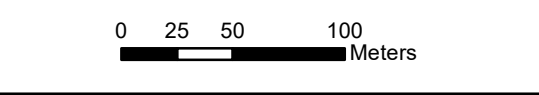
- Legend**
- Junctions
  - Local Watermains
  - Regional Watermains
  - Ultimate Build-Out Proposed Catchment Connection Point
  - ▨ 60 New Development Application (Population 2041)
  - ▨ 0/2/50 OP Intensification Areas & Emerging Growth Centres (Population 2041/2051/Buildout)
  - Study Area Boundary
  - Emerging Growth Centres
  - ▭ Municipal Boundary

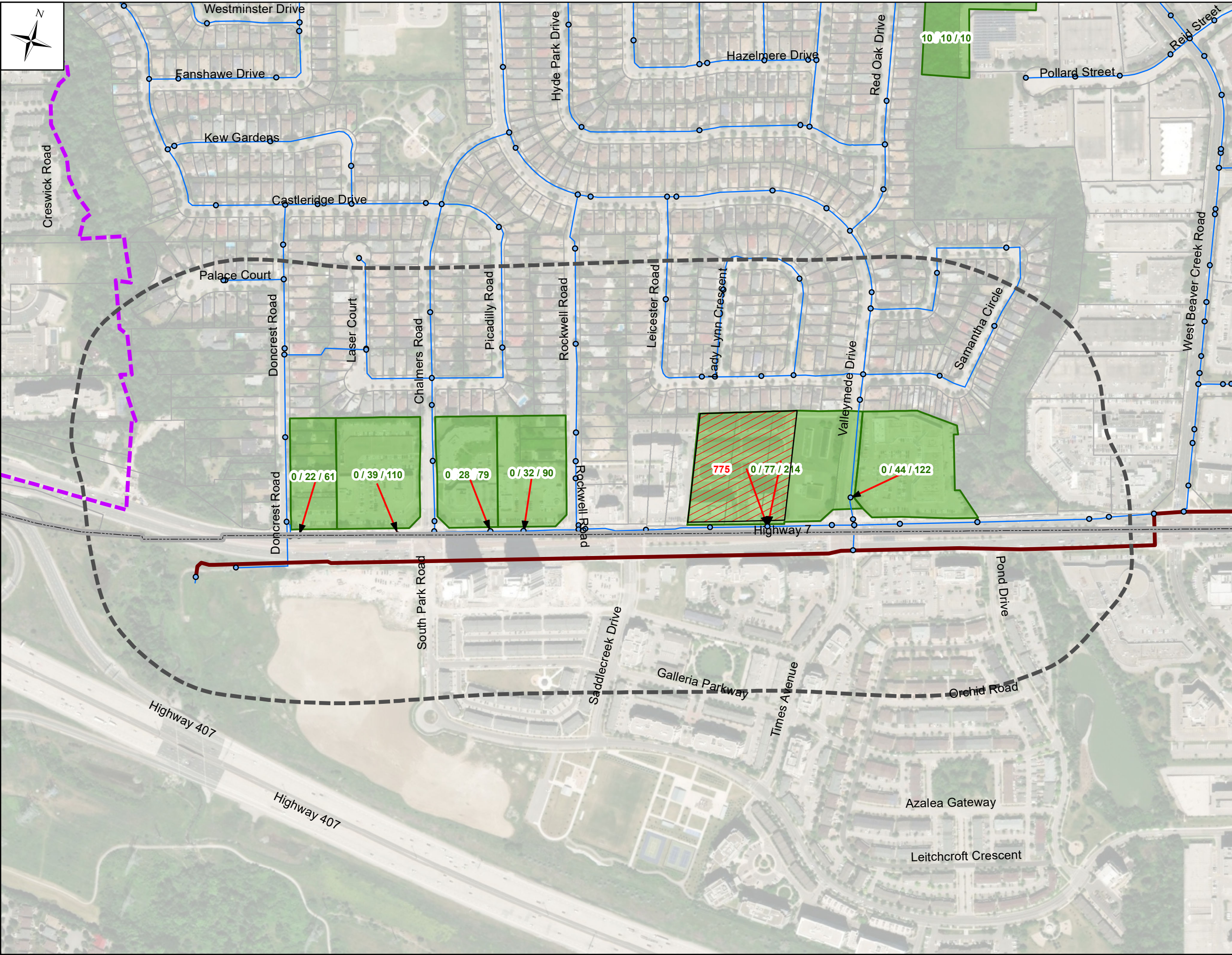


**RIC18-0004 -  
Richmond Hill UMESP Update**

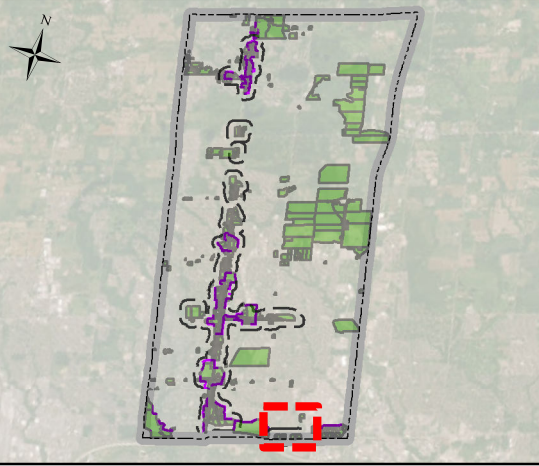
**Future Growth  
and Connection (31)  
(2021 Data)**

Drawn By: J.H. Date: Aug 31, 2023





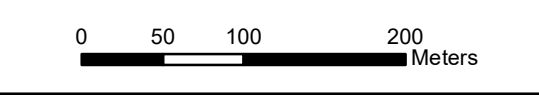
- Legend**
- Junctions
  - Local Watermains
  - Regional Watermains
  - Ultimate Build-Out Proposed Catchment Connection Point
  - ▨ 60 New Development Application (Population 2041)
  - ▭ 0/2/50 OP Intensification Areas & Emerging Growth Centres (Population 2041/2051/Buildout)
  - Study Area Boundary
  - ▭ Emerging Growth Centres
  - ▭ Municipal Boundary



**RIC18-0004 -  
Richmond Hill UMESP Update**

**Future Growth  
and Connection (32)  
(2021 Data)**

Drawn By: J.H.    Date: Aug 31, 2023



Map labels include: Westminster Drive, Fanshawe Drive, Kew Gardens, Castleridge Drive, Palace Court, Doncrest Road, Laser Court, Chalmers Road, Picadilly Road, Rockwell Road, Hyde Park Drive, Leicester Road, Lady Lynn Crescent, Valleymede Drive, Samantha Circle, Red Oak Drive, Pollard Street, Reid Street, West Beaver Creek Road, Doncrest Road, South Park Road, Saddlecreek Drive, Galleria Parkway, Times Avenue, Orchid Road, Highway 407, Azalea Gateway, Leitchcroft Crescent, and Highway 7.

0/22/61

0/39/110

0/28/79

0/32/90

775

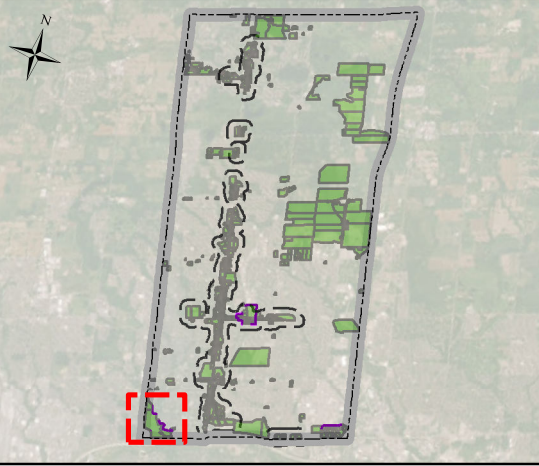
0/77/214

0/44/122

10/10/10



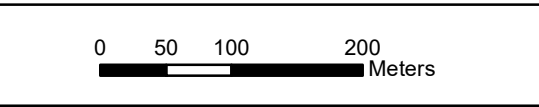
- Legend**
- Junctions
  - Local Watermains
  - Regional Watermains
  - Ultimate Build-Out Proposed Catchment Connection Point
  - ▨ 60 New Development Application (Population 2041)
  - ▭ 0/2/50 OP Intensification Areas & Emerging Growth Centres (Population 2041/2051/Buildout)
  - Study Area Boundary
  - Emerging Growth Centres
  - ▭ Municipal Boundary



**RIC18-0004 -  
Richmond Hill UMESP Update**

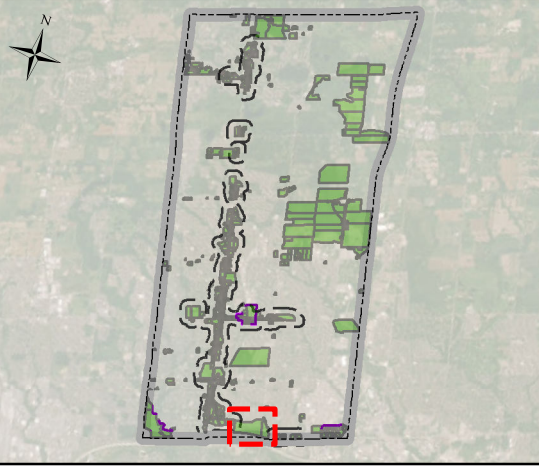
**Future Growth  
and Connection (33)  
(2021 Data)**

Drawn By: J.H. Date: Oct 28, 2023





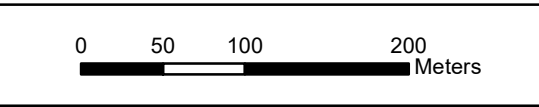
- Legend**
- Junctions
  - Local Watermains
  - Regional Watermains
  - Ultimate Build-Out Proposed Catchment Connection Point
  - ▨ 60 New Development Application (Population 2041)
  - ▨ 0 / 2 / 50 OP Intensification Areas & Emerging Growth Centres (Population 2041/2051/Buildout)
  - Study Area Boundary
  - ▭ Emerging Growth Centres
  - ▭ Municipal Boundary

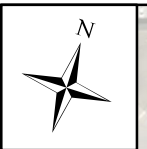
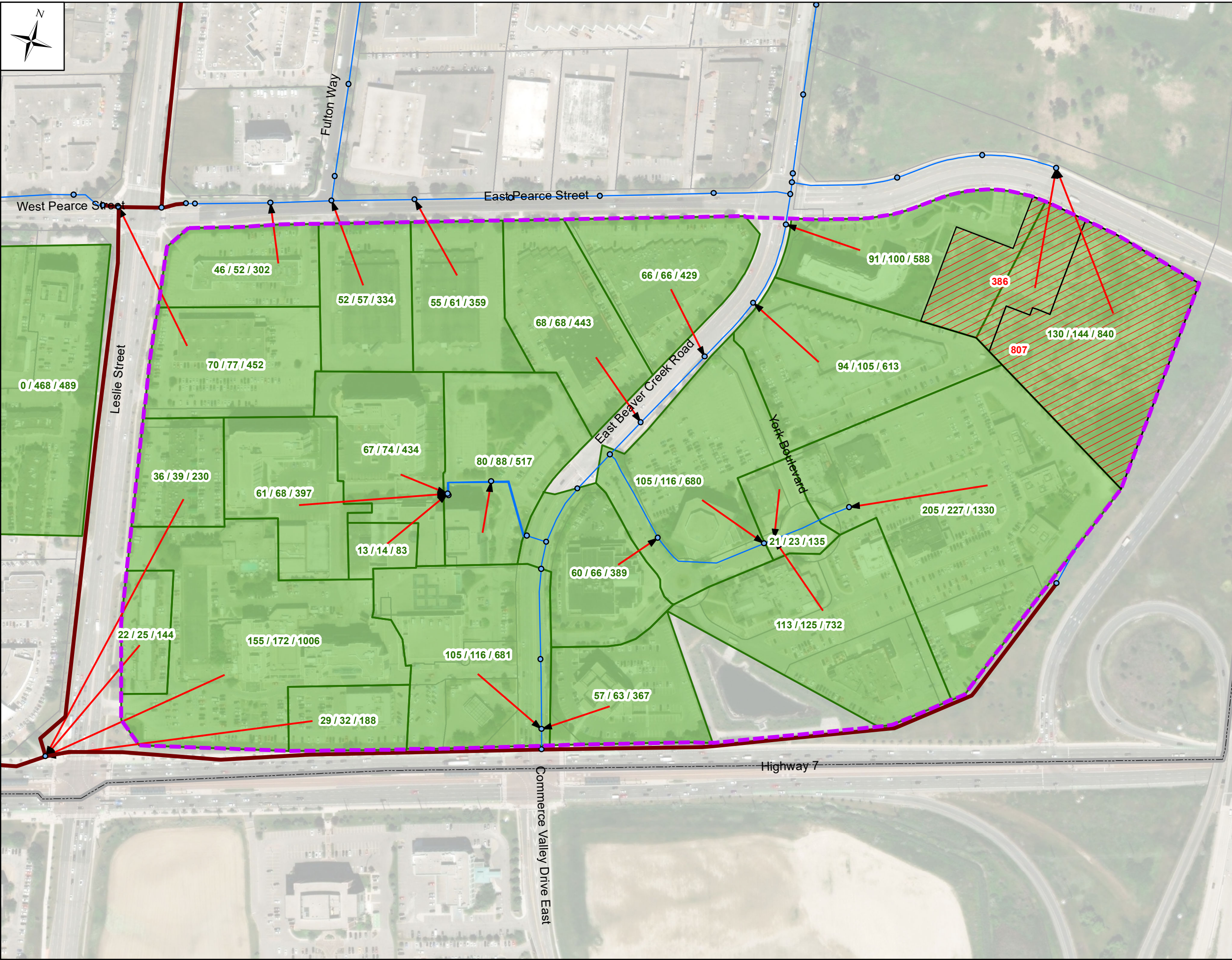


**RIC18-0004 -  
Richmond Hill UMESP Update**

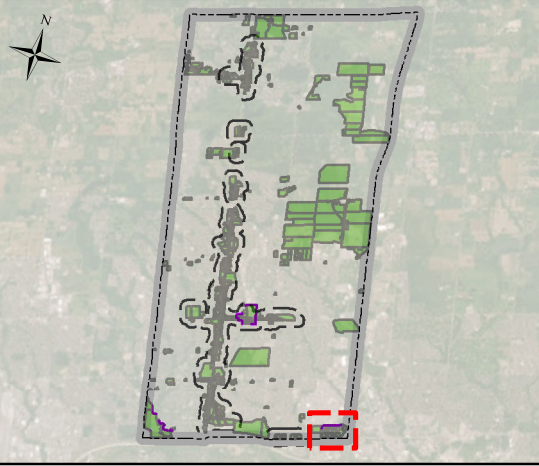
**Future Growth  
and Connection (34)  
(2021 Data)**

Drawn By: J.H. Date: Oct 28, 2023





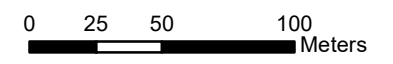
- Legend**
- Junctions
  - Local Watermains
  - Regional Watermains
  - Ultimate Build-Out Proposed Catchment Connection Point
  - ▨ 60 New Development Application (Population 2041)
  - ▭ 0/2/50 OP Intensification Areas & Emerging Growth Centres (Population 2041/2051/Buildout)
  - ▭ Study Area Boundary
  - ▭ Emerging Growth Centres
  - ▭ Municipal Boundary

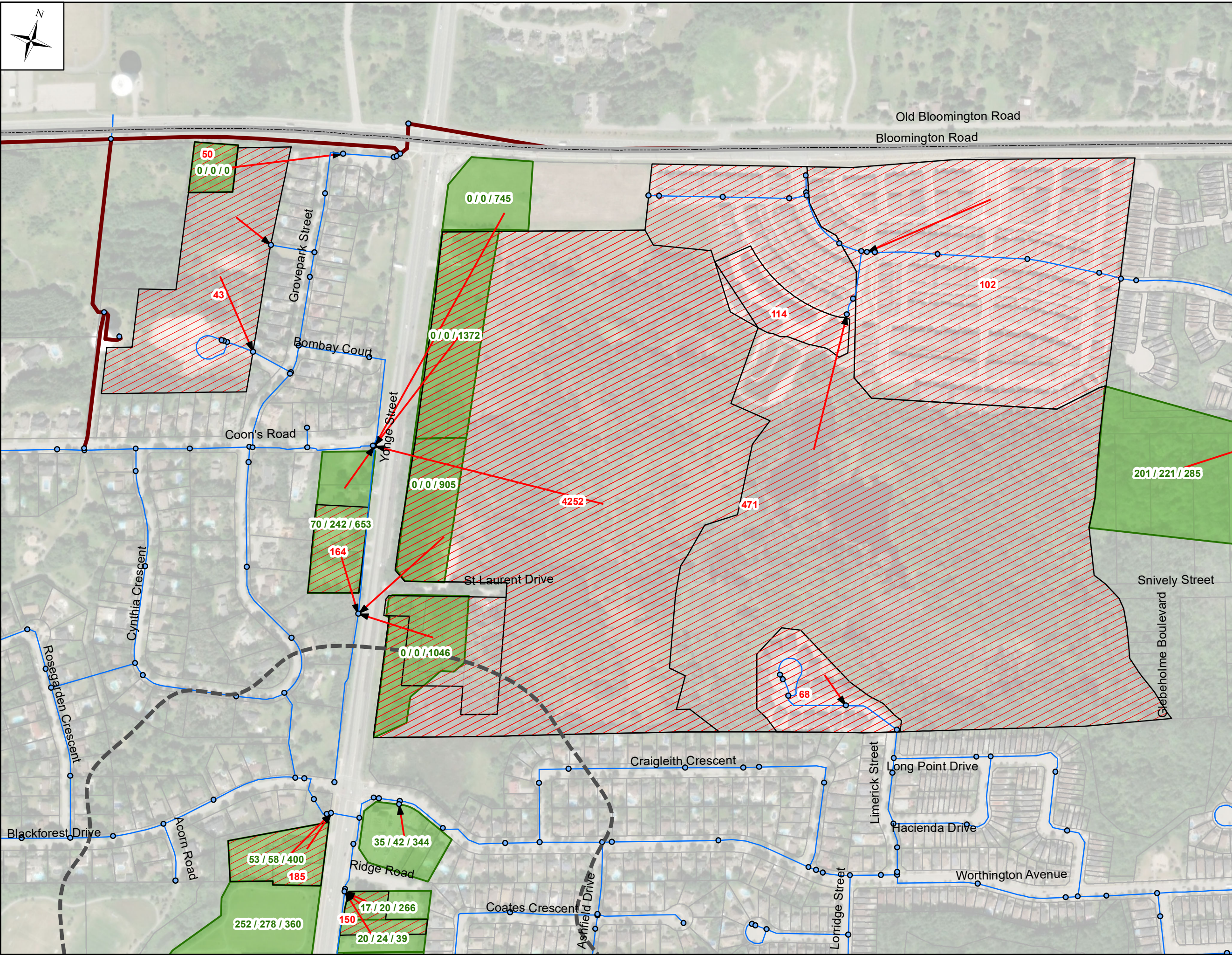
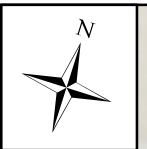


**RIC18-0004 - Richmond Hill UMESP Update**









**Future Growth and Connection (35) (2021 Data)**

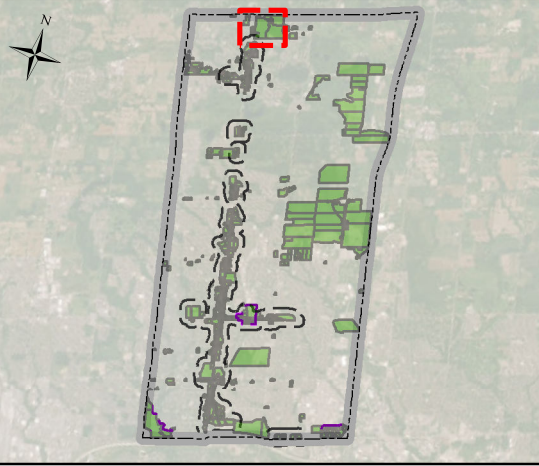
Drawn By: J.H. Date: Oct 28, 2023





**Legend**

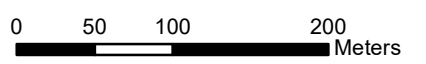
-  Junctions
-  Local Watermains
-  Regional Watermains
-  Ultimate Build-Out Proposed Catchment Connection Point
-  New Development Application (Population 2041)
-  OP Intensification Areas & Emerging Growth Centres (Population 2041/2051/Buildout)
-  Study Area Boundary
-  Emerging Growth Centres
-  Municipal Boundary



**RIC18-0004 -  
Richmond Hill UMESP Update**

**Future Growth  
and Connection (36)  
(2021 Data)**

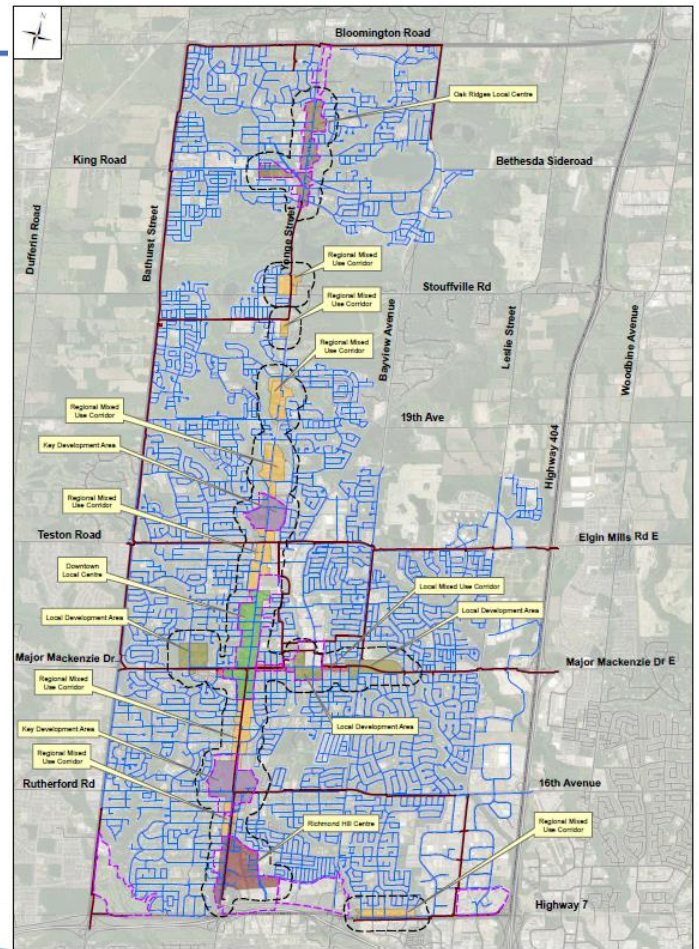
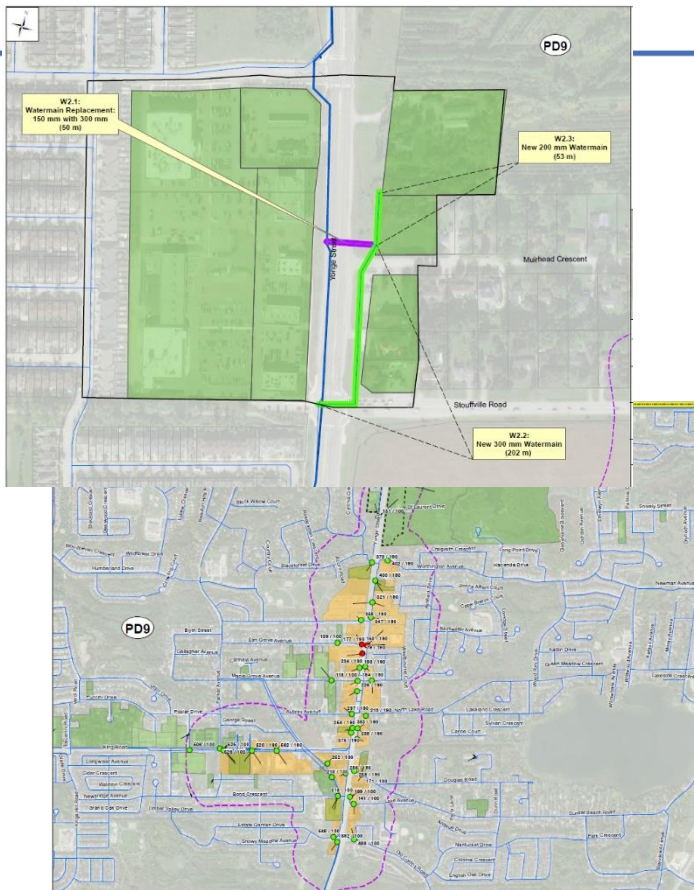
Drawn By: J.H. Date: Oct 28, 2023

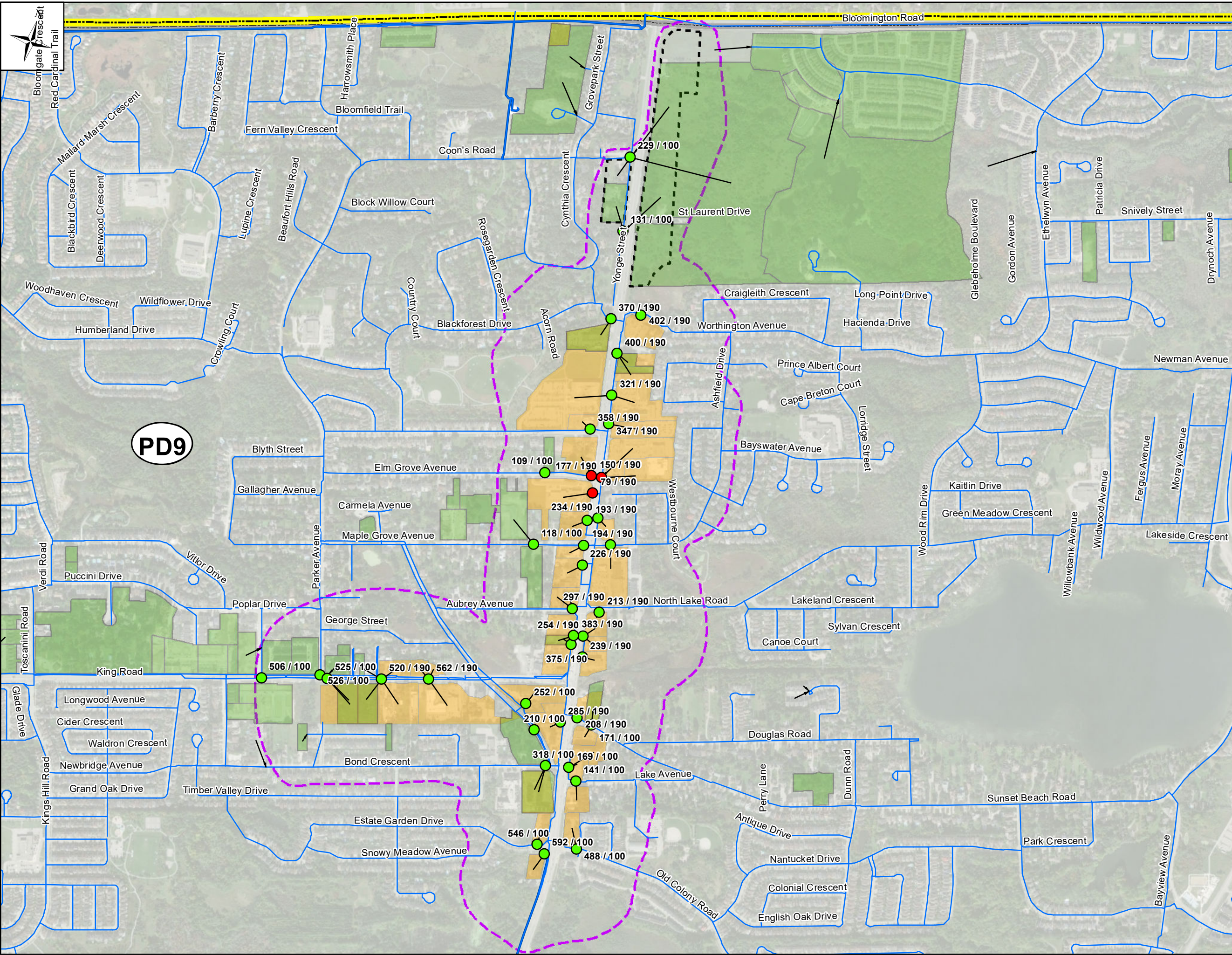


## Appendix II

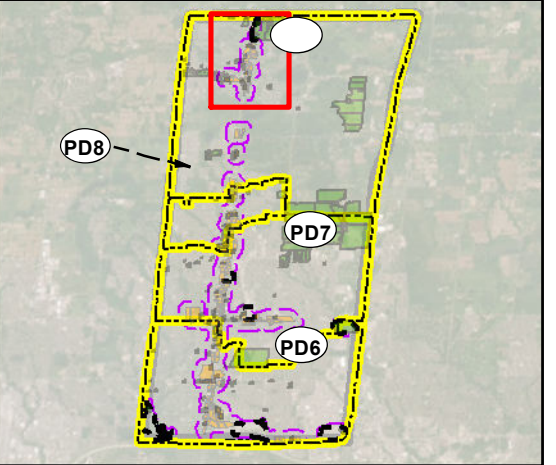
# Available and Required Fire Flows under Ultimate Build-Out Conditions

Tuesday, October 31, 2023





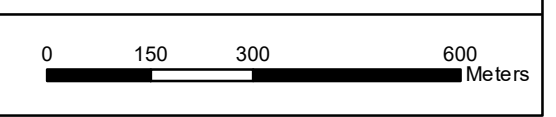
- Legend**
- Watermains
  - Regional Watermains
  - Proposed Connection
  - Fire Flow Not Available at 140 kPa
  - Fire Flow Available at 140 kPa
  - 450 / 317** Available Fire Flow / Fire Demand in litres/second
  - Study Area Boundary
  - PD9 Pressure District Boundary
  - Town of Richmond Hill Boundary
  - OP Intensification Area
  - Development Application
  - Emerging Growth Centre

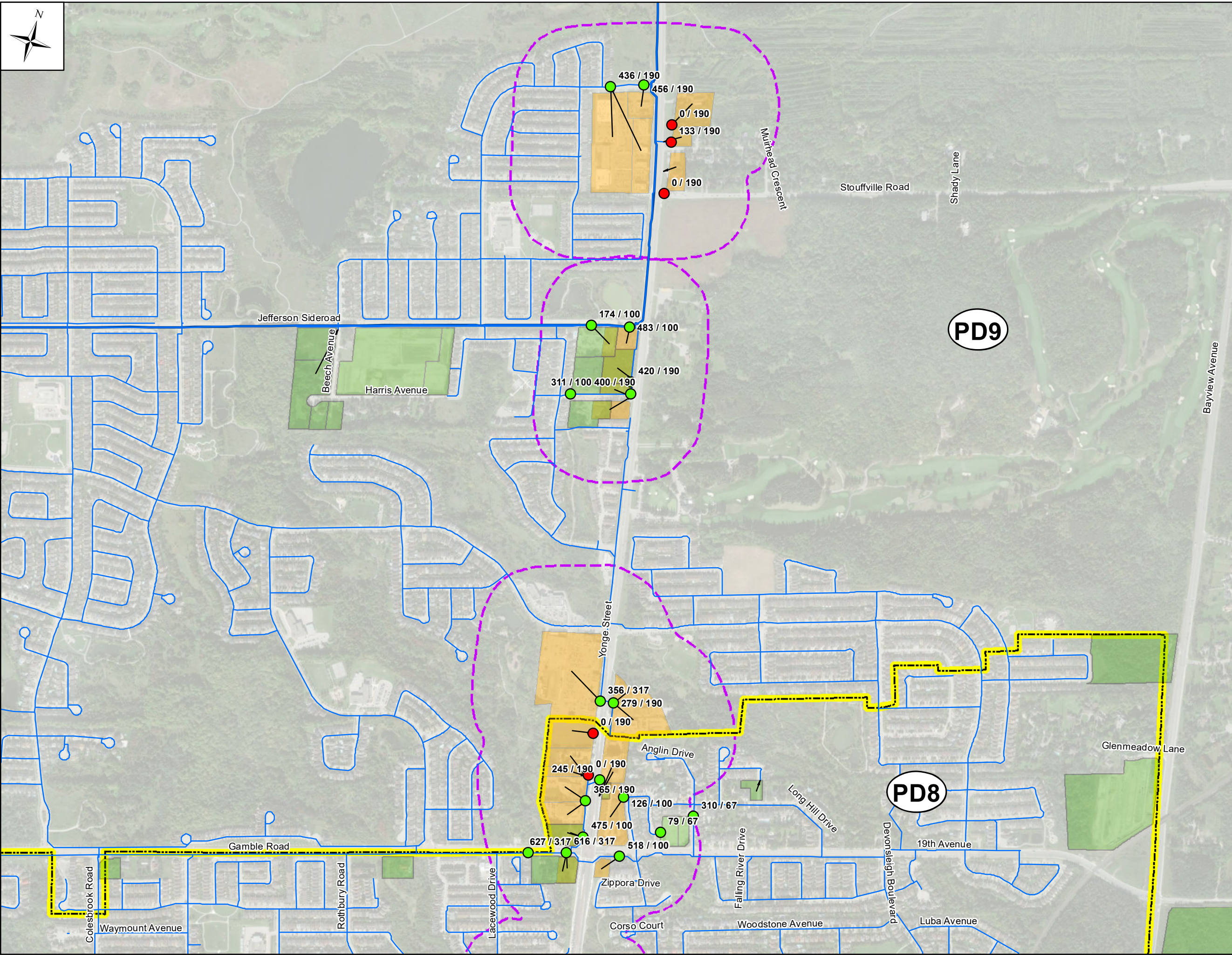
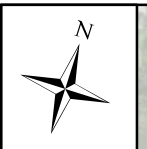


**RIC18-0004 -  
Richmond Hill UMESP Update**

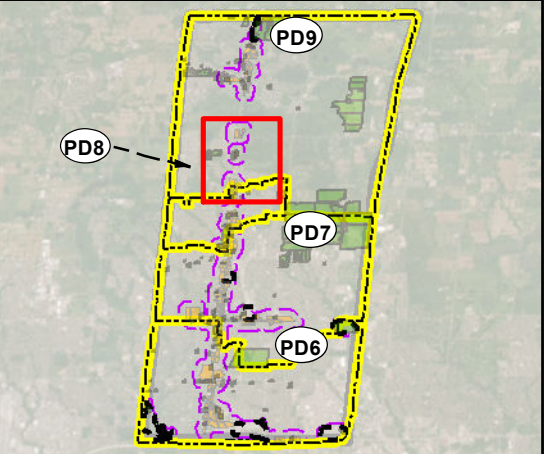
**Fire Flows At Ultimate  
Conditions  
(1 OF 7)**

Drawn By: W.A.    Date: Jan. 25, 2023





- Legend**
- Watermains
  - Regional Watermains
  - Proposed Connection
  - Fire Flow Not Available at 140 kPa
  - Fire Flow Available at 140 kPa
  - 450 / 317** Available Fire Flow / Fire Demand in litres/second
  - Study Area Boundary
  - Pressure District Boundary
  - Town of Richmond Hill Boundary
  - Intensification Area
  - Development Application
  - Emerging Growth Centre

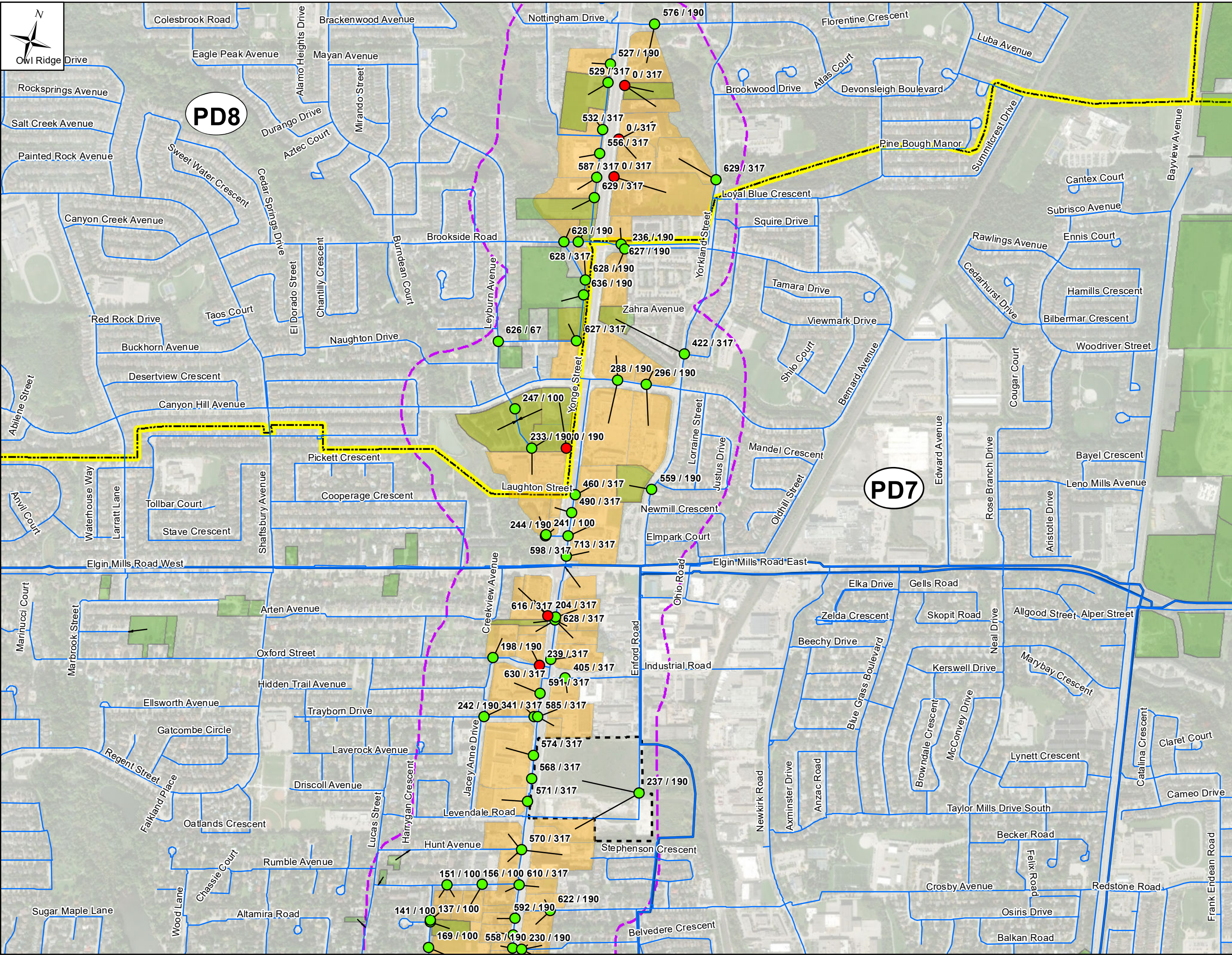


**RIC18-0004 -  
Richmond Hill UMESP Update**

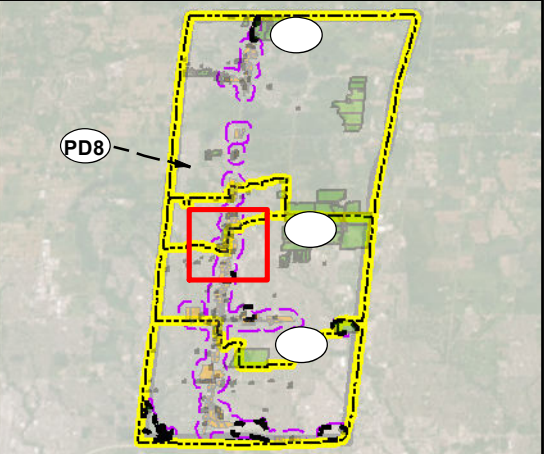
**Fire Flows At Ultimate  
Conditions  
(2 OF 7)**

Drawn By: W.A.    Date: Jan. 25, 2023





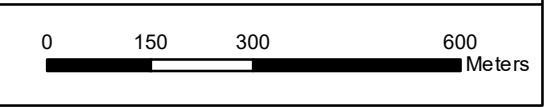
- Legend**
- Watermains
  - Regional Watermains
  - Proposed Connection
  - Fire Flow Not Available at 140 kPa
  - Fire Flow Available at 140 kPa
  - 450 / 317** Available Fire Flow / Fire Demand in litres/second
  - Study Area Boundary
  - Pressure District Boundary
  - Town of Richmond Hill Boundary
  - Intensification Area
  - Development Application
  - Emerging Growth Centre

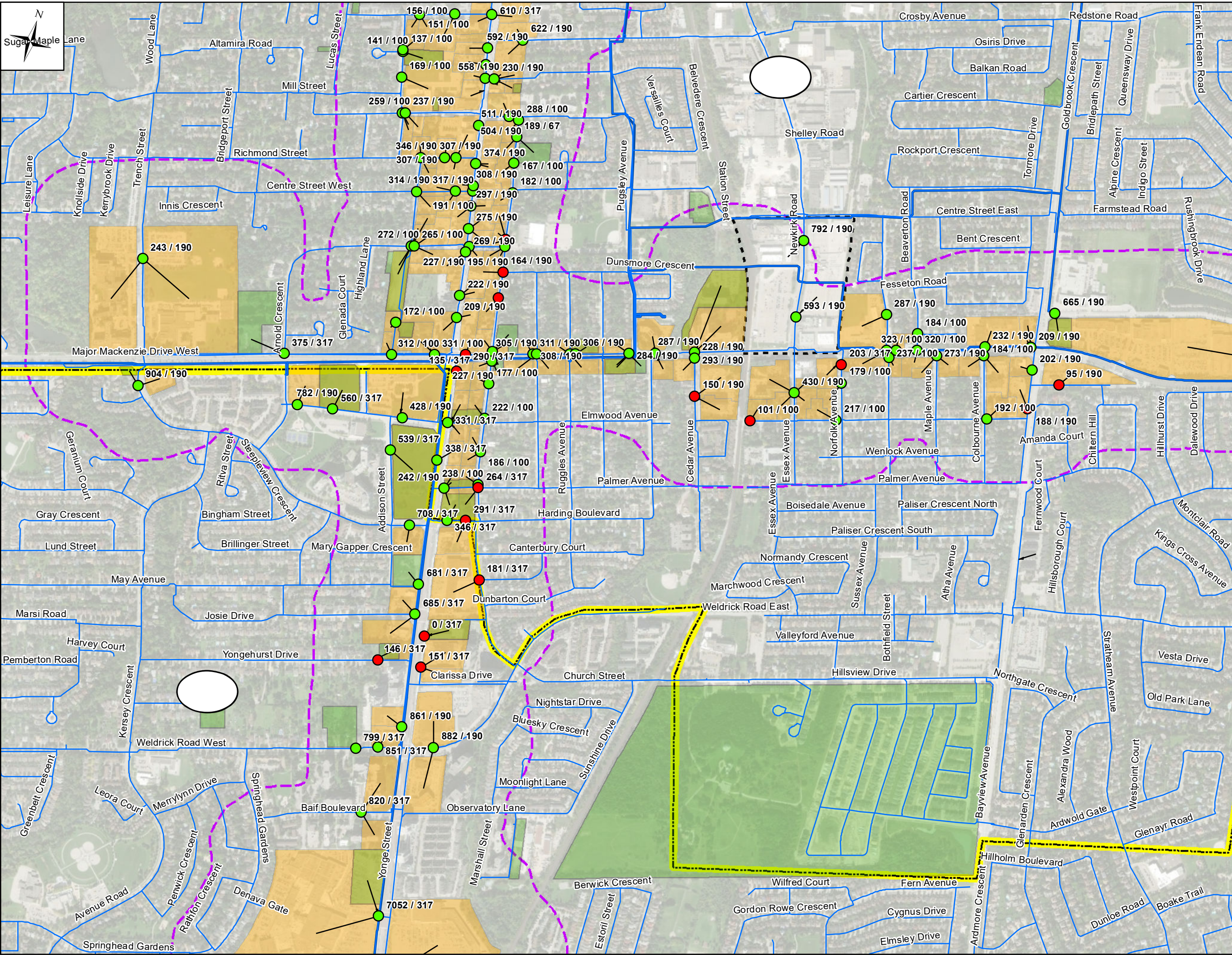


**RIC18-0004 -  
Richmond Hill UMESP Update**

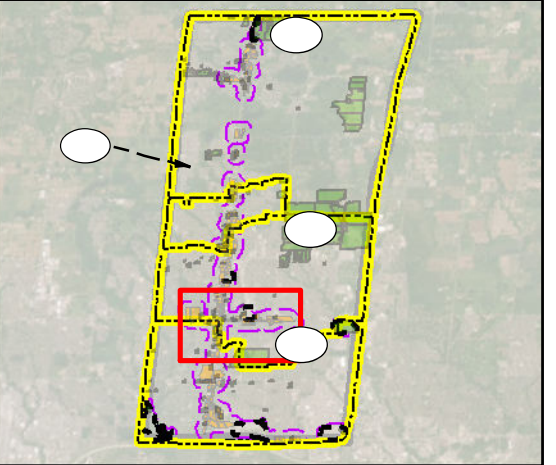
**Fire Flows At Ultimate  
Conditions  
(3 OF 7)**

Drawn By: W.A. Date: Jun. 06, 2023





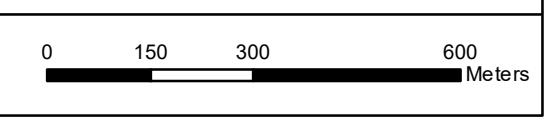
- Legend**
- Watermains
  - Regional Watermains
  - Proposed Connection
  - Fire Flow Not Available at 140 kPa
  - Fire Flow Available at 140 kPa
  - 450 / 317** Available Fire Flow / Fire Demand in litres/second
  - Study Area Boundary
  - PD9 Pressure District Boundary
  - Town of Richmond Hill Boundary
  - Intensification Area
  - Development Application
  - Emerging Growth Centre

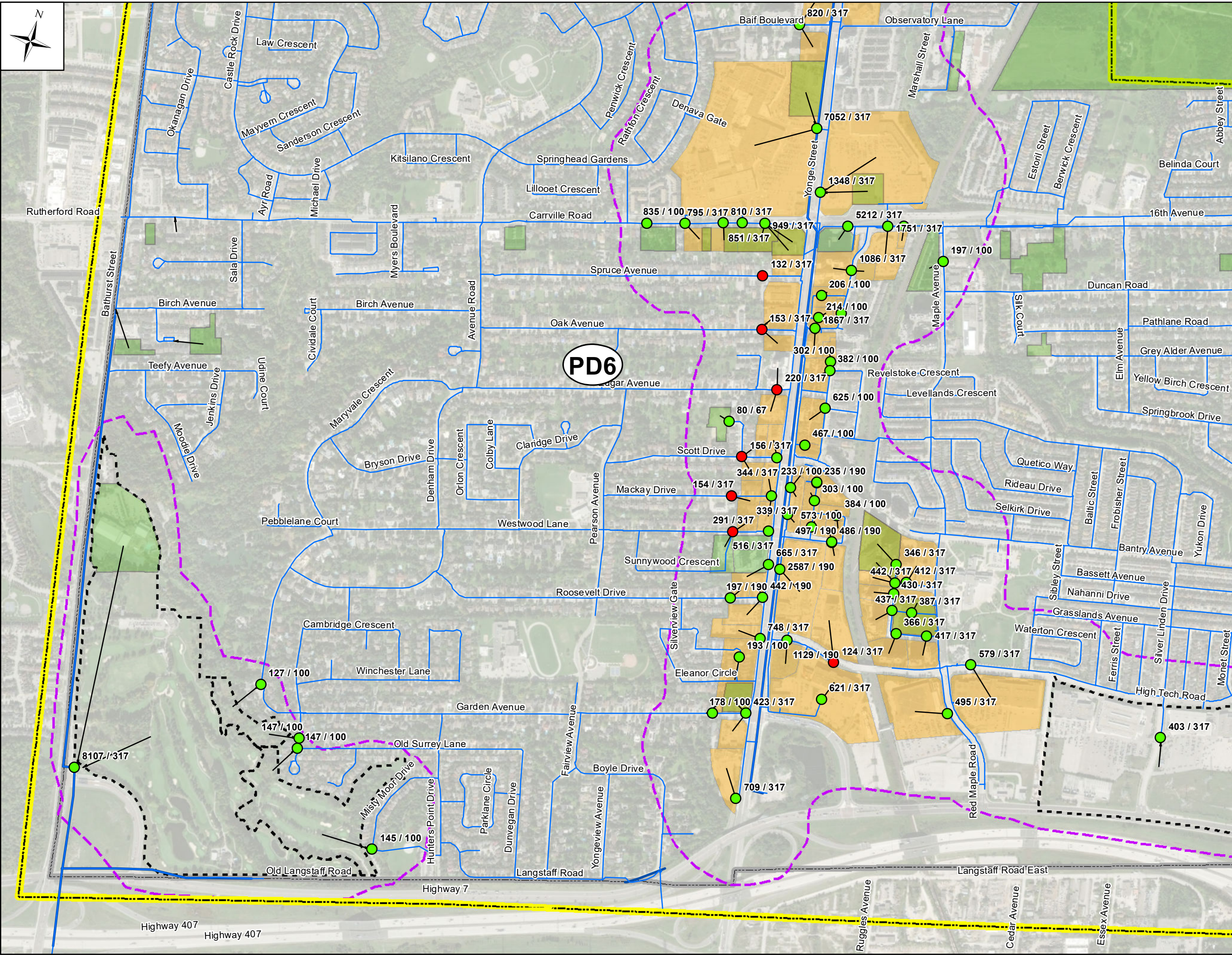


**RIC18-0004 -  
Richmond Hill UMESP Update**

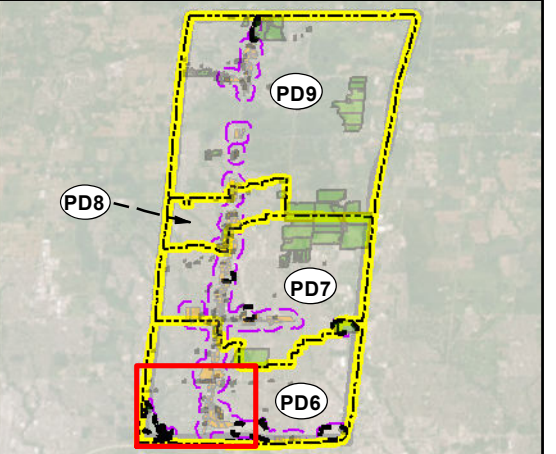
**Fire Flows At Ultimate  
Conditions  
(4 OF 7)**

Drawn By: W.A. Date: Jan. 25, 2023





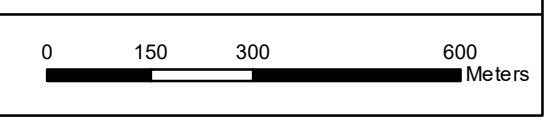
- Legend**
- Watermains
  - Regional Watermains
  - Proposed Connection
  - Fire Flow Not Available at 140 kPa
  - Fire Flow Available at 140 kPa
  - 450 / 317** Available Fire Flow / Fire Demand in litres/second
  - Study Area Boundary
  - Pressure District Boundary
  - Town of Richmond Hill Boundary
  - Intensification Area
  - Development Application
  - Emerging Growth Centre

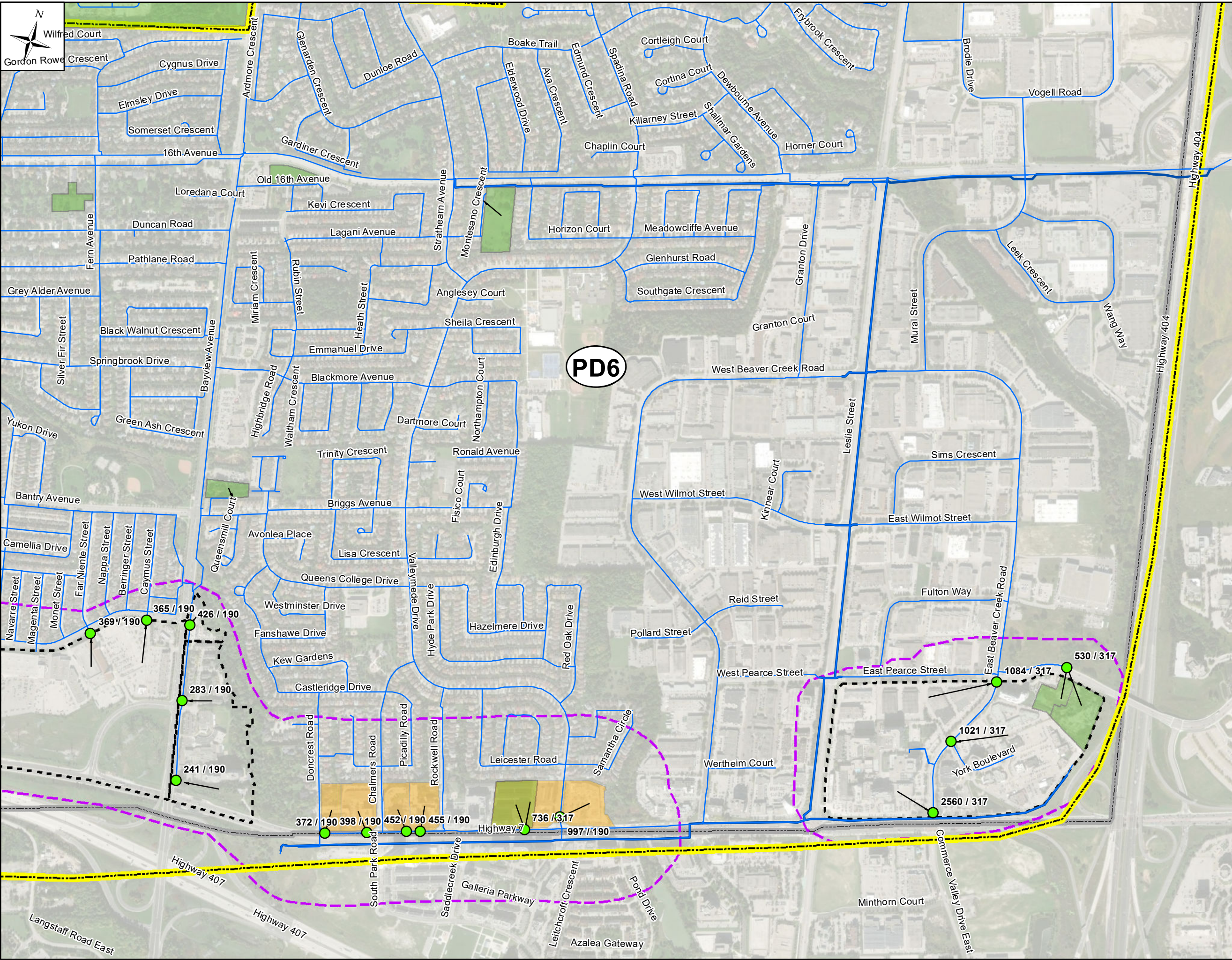


**RIC18-004 -  
Richmond Hill UMESP Update**

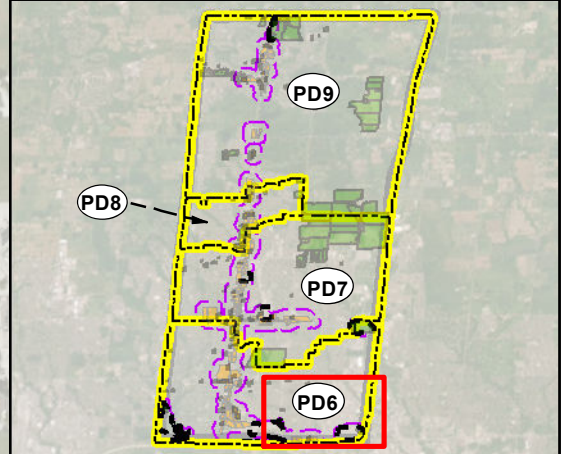
**Fire Flows At Ultimate  
Conditions  
(5 OF 7)**

Drawn By: W.A. Date: Jan. 25, 2023





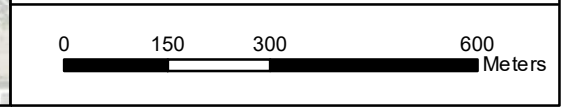
- Legend**
- Watermains
  - Regional Watermains
  - Proposed Connection
  - Fire Flow Not Available at 140 kPa
  - Fire Flow Available at 140 kPa
  - 450 / 317** Available Fire Flow / Fire Demand in litres/second
  - Study Area Boundary
  - Pressure District Boundary
  - Town of Richmond Hill Boundary
  - Intensification Area
  - Development Application
  - Emerging Growth Centre

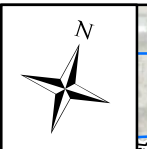
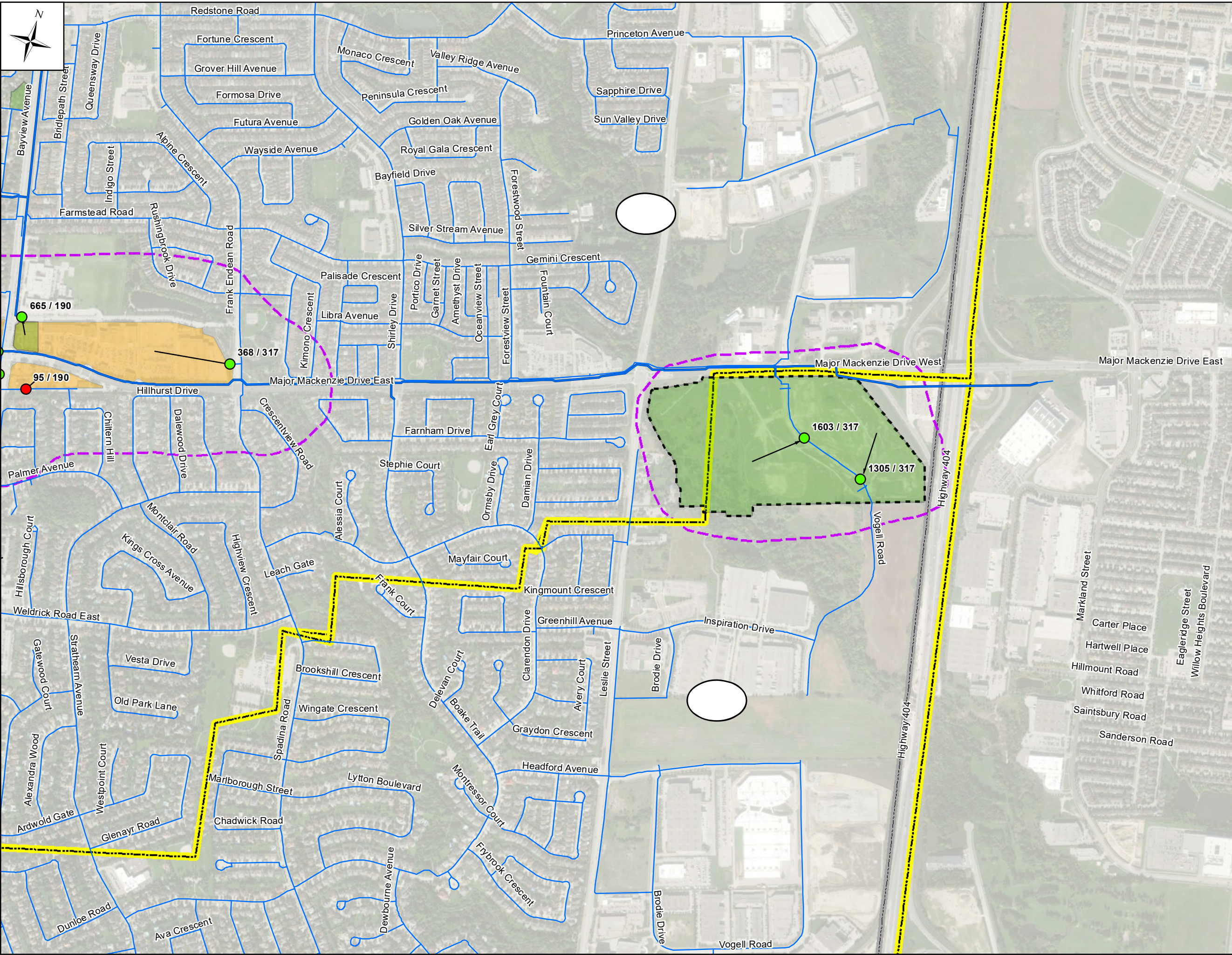


**RIC18-0004 -  
Richmond Hill UMESP Update**

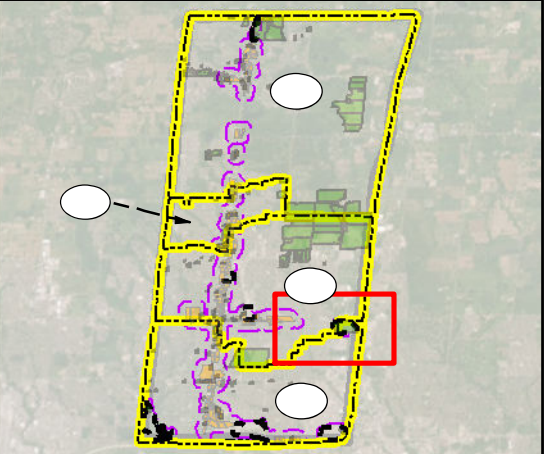
**Fire Flows At Ultimate  
Conditions  
(6 OF 7)**

Drawn By: W.A.    Date: Jan. 25, 2023





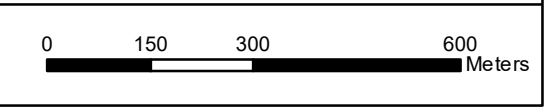
- Legend**
- Watermains
  - Regional Watermains
  - Proposed Connection
  - Fire Flow Not Available at 140 kPa
  - Fire Flow Available at 140 kPa
  - 450 / 317** Available Fire Flow / Fire Demand in litres/second
  - Study Area Boundary
  - Pressure District Boundary
  - Town of Richmond Hill Boundary
  - Intensification Area
  - Development Application
  - Emerging Growth Centre



**RIC18-0004 -  
Richmond Hill UMESP Update**

**Fire Flows At Ultimate  
Conditions  
(7 OF 7)**

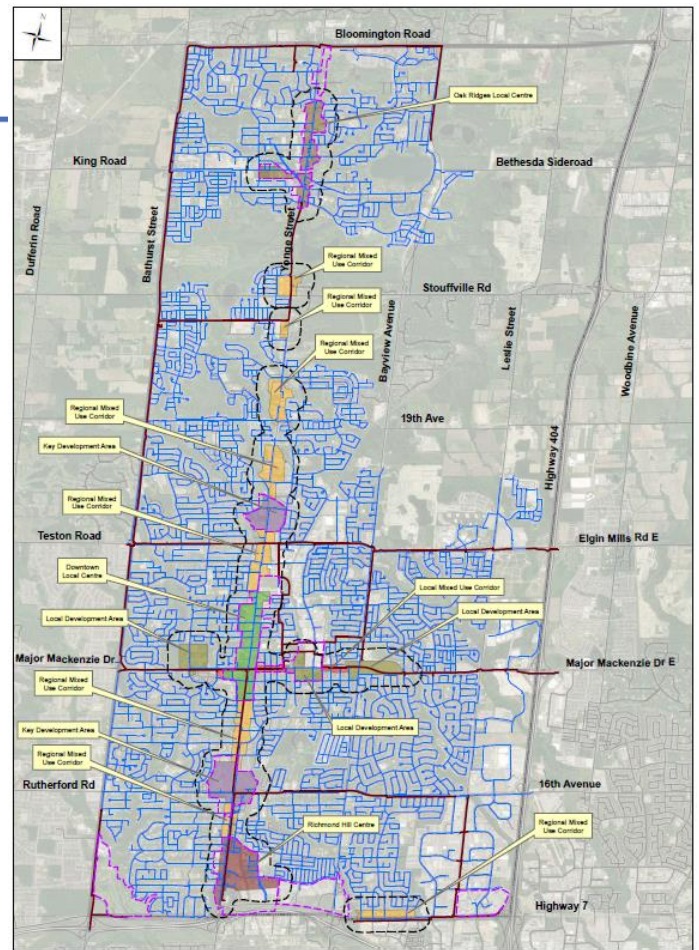
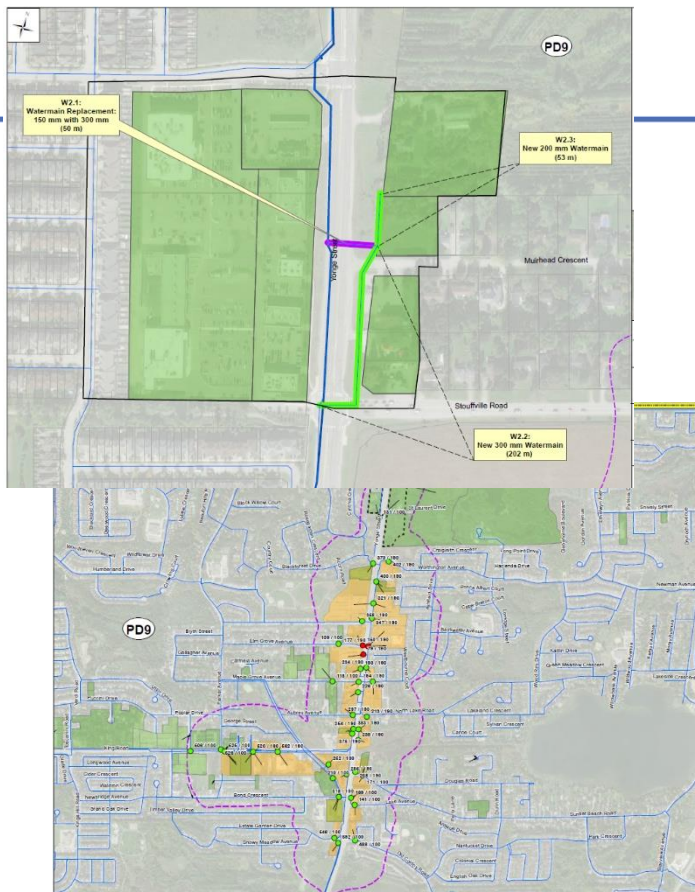
Drawn By: W.A. Date: Jan. 25, 2023

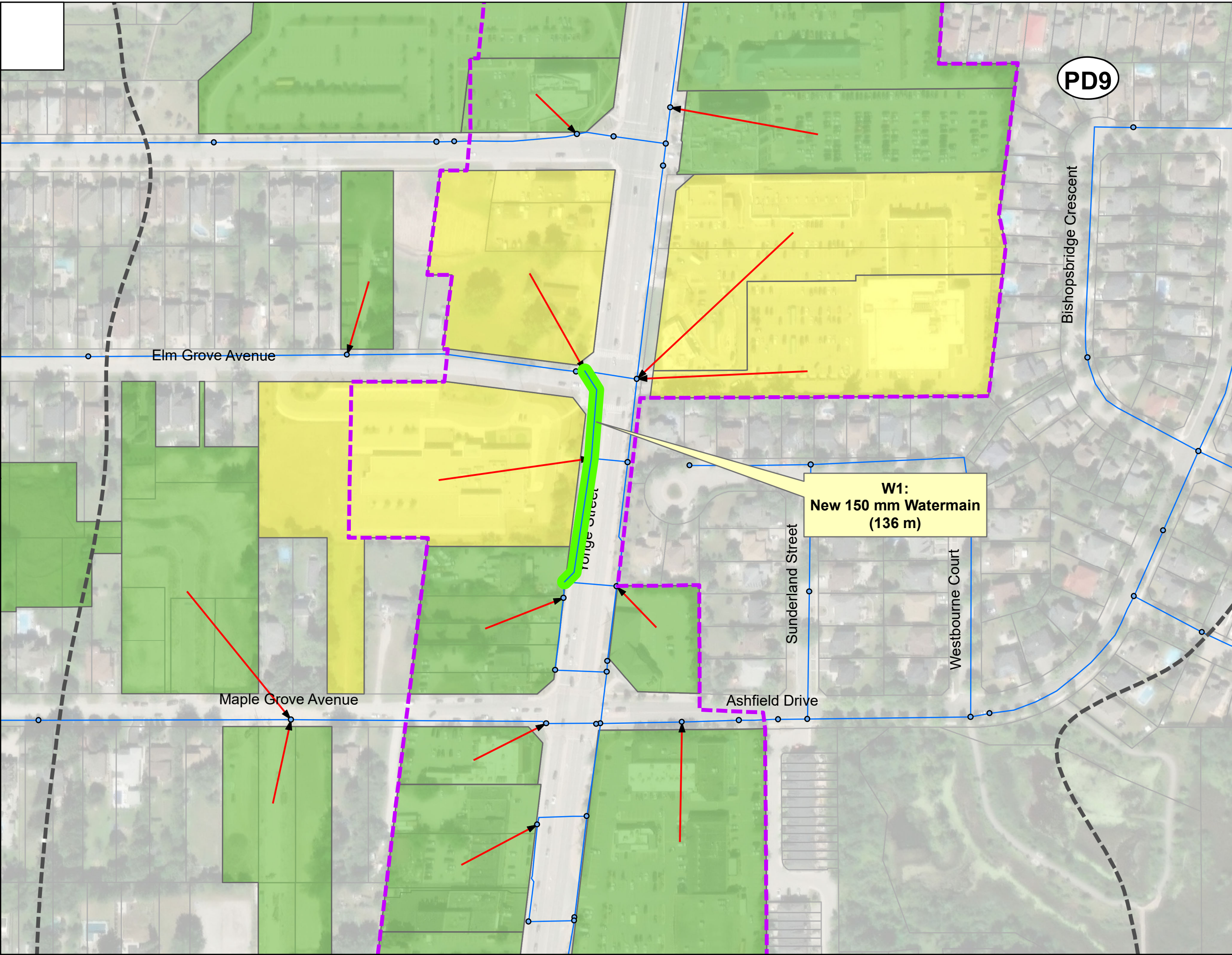


# Appendix III

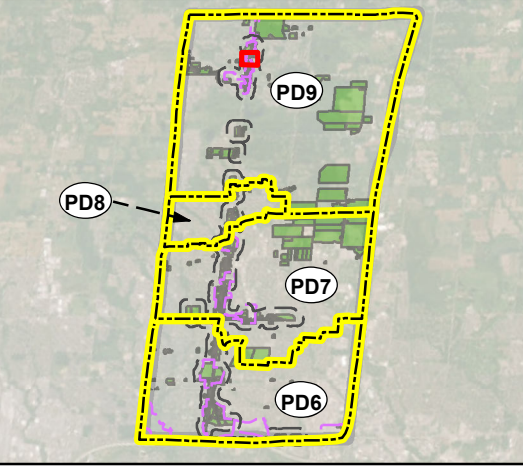
## Water Distribution System Proposed Upgrades

Tuesday, October 31 2023





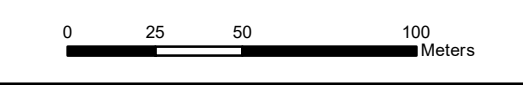
- Legend**
- Junctions
  - Local Watermains
  - Regional Watermains
  - Ultimate Build-Out Proposed Catchment Connection Point
  - New Watermain
  - Watermain Replacement
  - Projected Growth Triggering Proposed Solution
  - Planned Growth
  - PD9 Pressure District Boundary
  - Study Area Boundary
  - Emerging Growth Centres

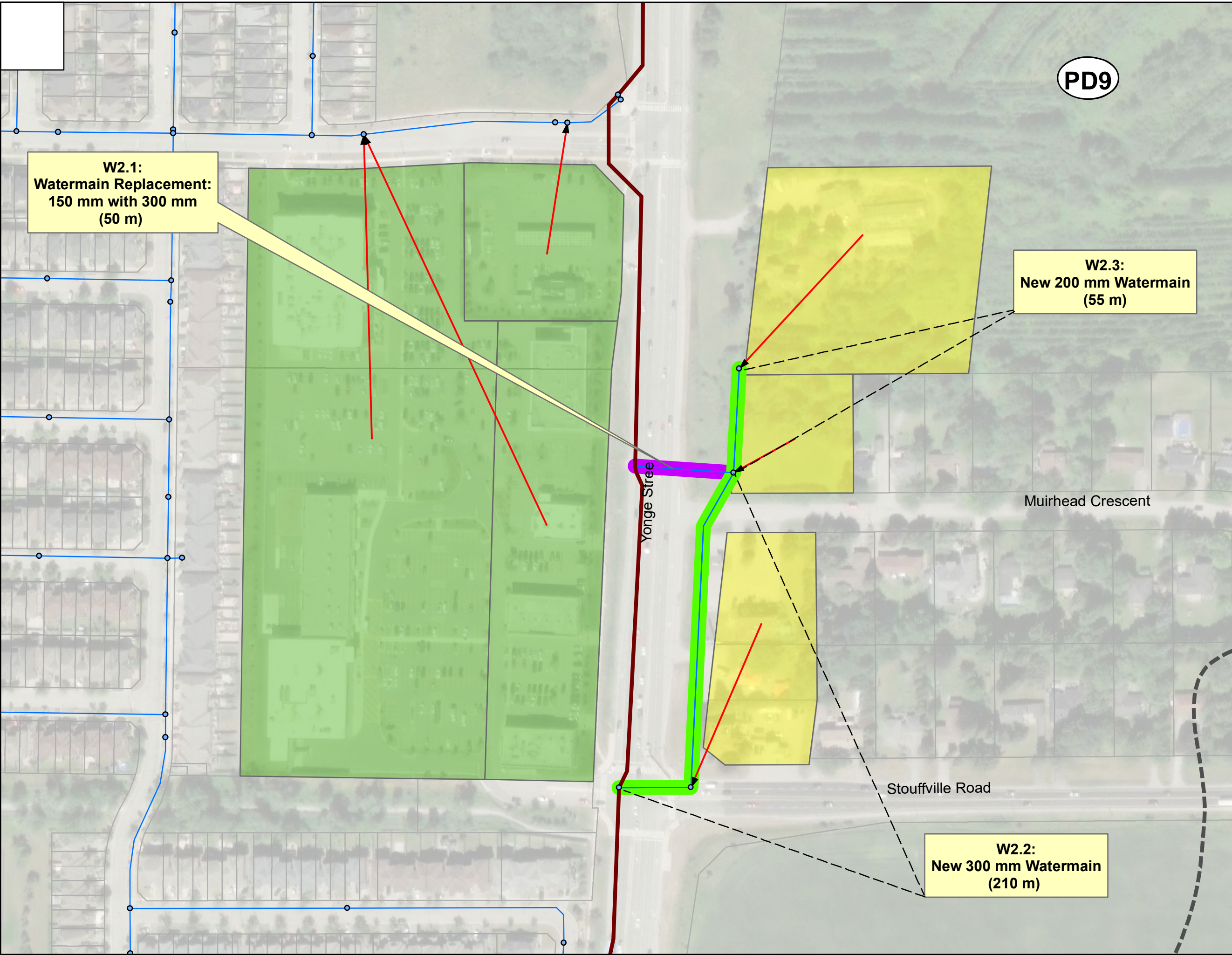


**RIC18-0004 -  
Richmond Hill UMESP Update**

**Ultimate Build-Out  
Water Solution W1**

Drawn By: J.H.    Date: Oct 4, 2023





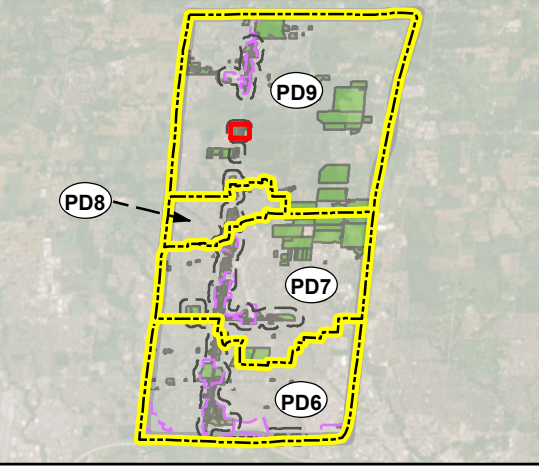
**PD9**

**W2.1:**  
Watermain Replacement:  
150 mm with 300 mm  
(50 m)

**W2.3:**  
New 200 mm Watermain  
(55 m)

**W2.2:**  
New 300 mm Watermain  
(210 m)

- Legend**
- Junctions
  - Local Watermains
  - Regional Watermains
  - Ultimate Build-Out Proposed Catchment Connection Point
  - New Watermain
  - Watermain Replacement
  - Projected Growth Triggering Proposed Solution
  - Planned Growth
  - PD9 Pressure District Boundary
  - Study Area Boundary
  - Emerging Growth Centres

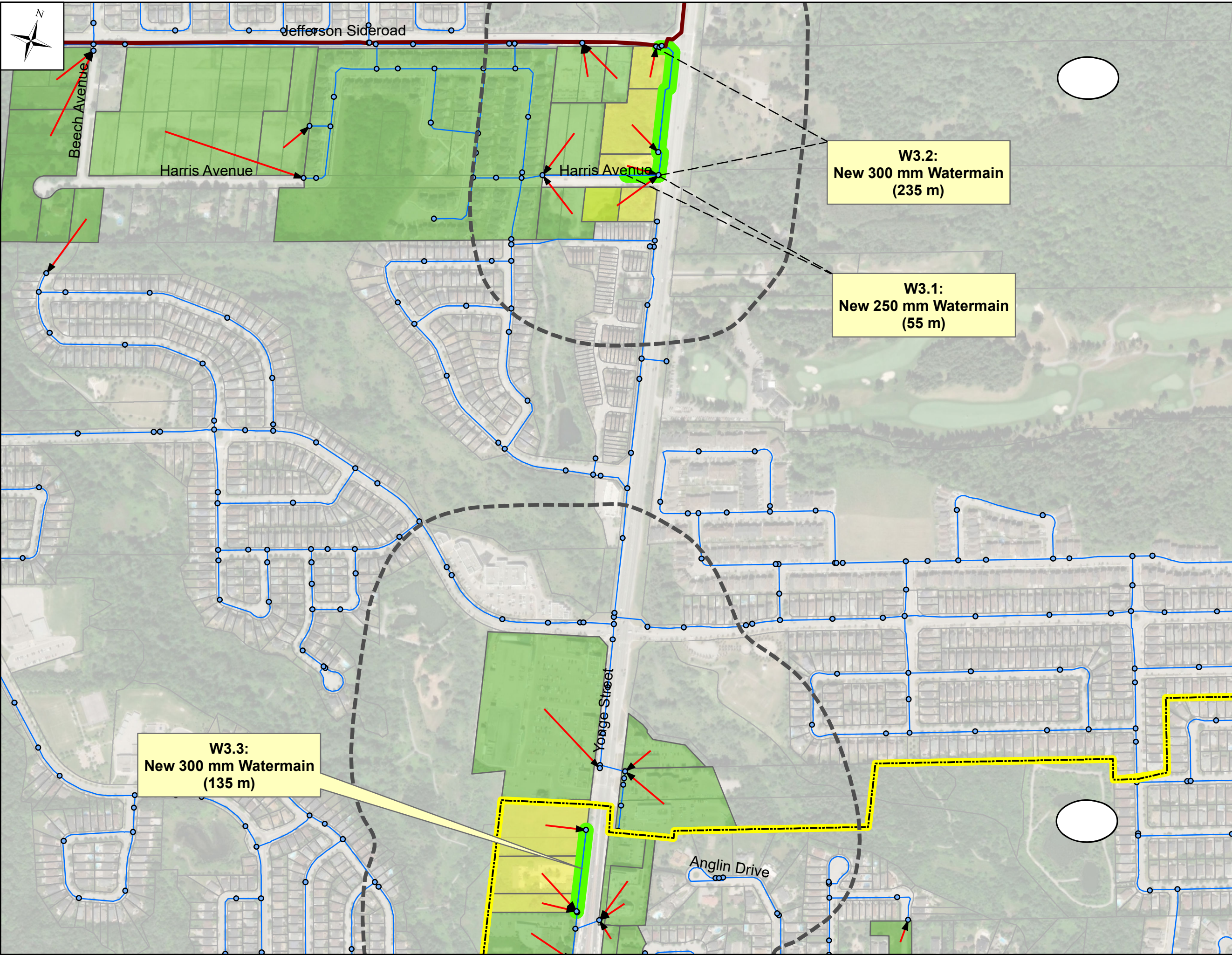


**RIC18-0004 -  
Richmond Hill UMESP Update**

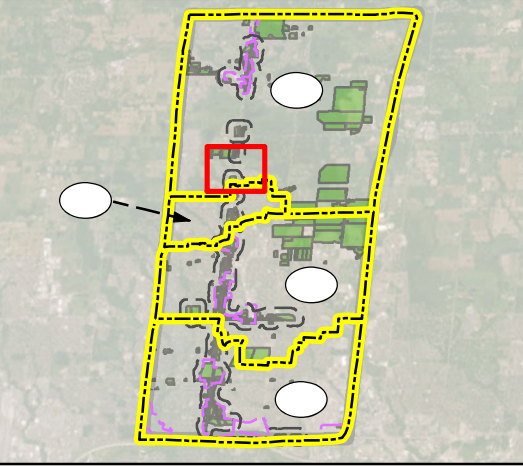
**Ultimate Build-Out  
Water Solution W2**

Drawn By: J.H. Date: Oct 4, 2023





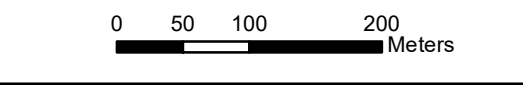
- Legend**
- Junctions
  - Local Watermains
  - Regional Watermains
  - Ultimate Build-Out Proposed Catchment Connection Point
  - New Watermain
  - Watermain Replacement
  - Projected Growth Triggering Proposed Solution
  - Planned Growth
  - Pressure District Boundary
  - Study Area Boundary
  - Emerging Growth Centres

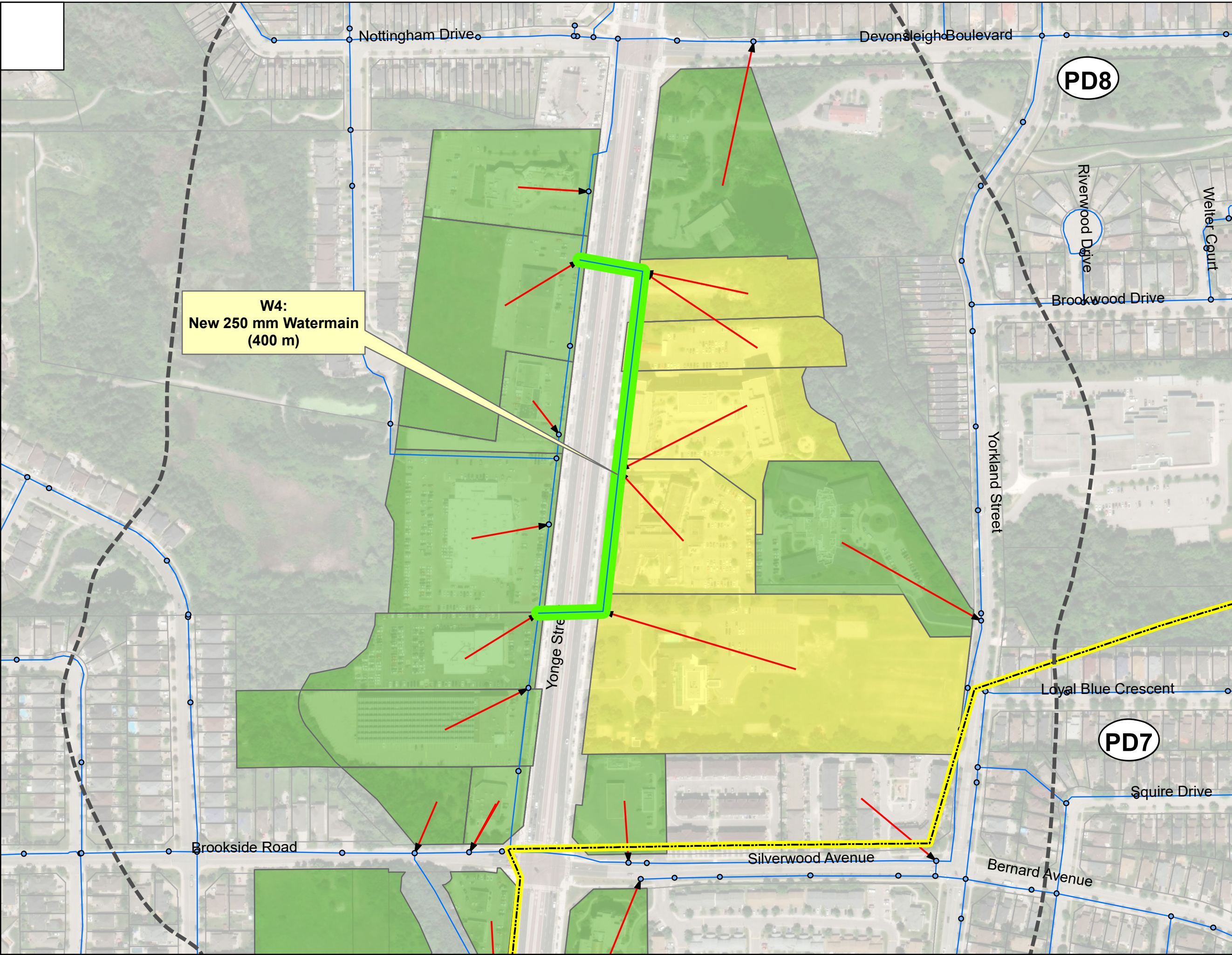


**RIC18-0004 -  
Richmond Hill UMESP Update**

**Ultimate Build-Out  
Water Solution W3**

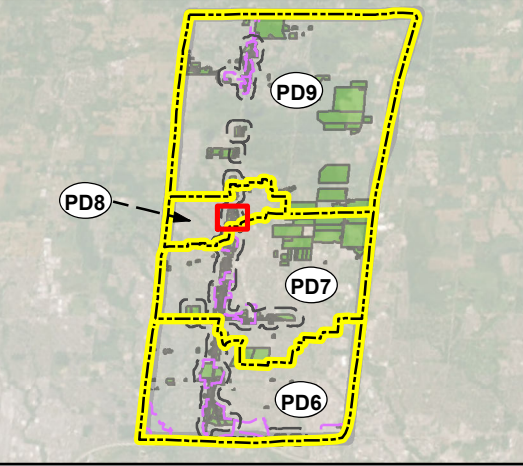
Drawn By: J.H.    Date: Oct 4, 2023





**W4:**  
New 250 mm Watermain  
(400 m)

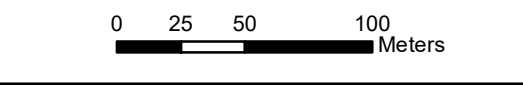
- Legend**
- Junctions
  - Local Watermains
  - Regional Watermains
  - Ultimate Build-Out Proposed Catchment Connection Point
  - New Watermain
  - Watermain Replacement
  - Projected Growth Triggering Proposed Solution
  - Planned Growth
  - PD9 Pressure District Boundary
  - Study Area Boundary
  - Emerging Growth Centres

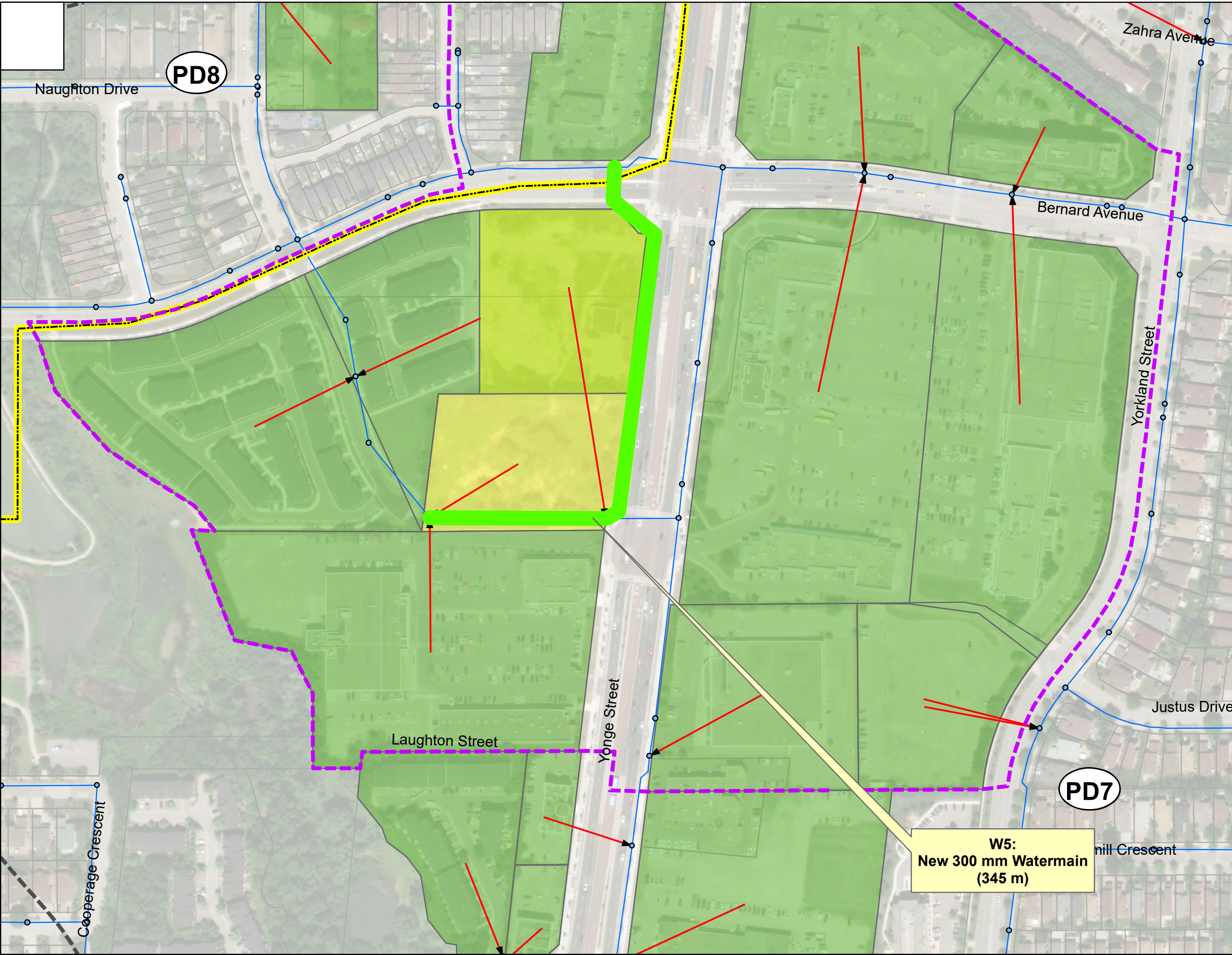


**RIC18-0004 -  
Richmond Hill UMESP Update**

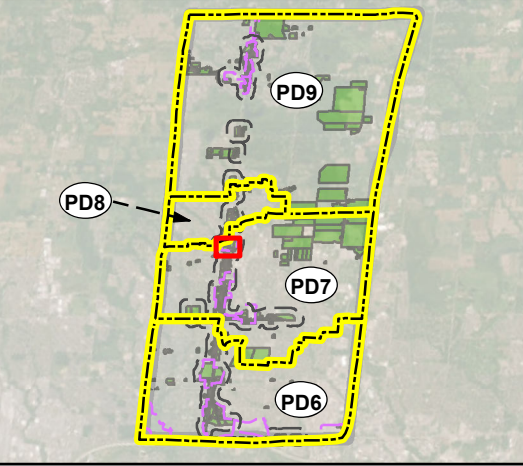
**Ultimate Build-Out  
Water Solution W4**

Drawn By: J.H.    Date: Oct 4, 2023





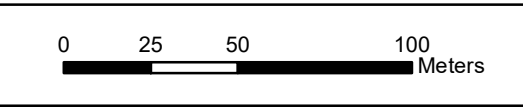
- Legend**
- Junctions
  - Local Watermains
  - Regional Watermains
  - Ultimate Build-Out Proposed Catchment Connection Point
  - New Watermain
  - Watermain Replacement
  - Projected Growth Triggering Proposed Solution
  - Planned Growth
  - ⬡ (PD9) Pressure District Boundary
  - ⬡ Study Area Boundary
  - ⬡ Emerging Growth Centres

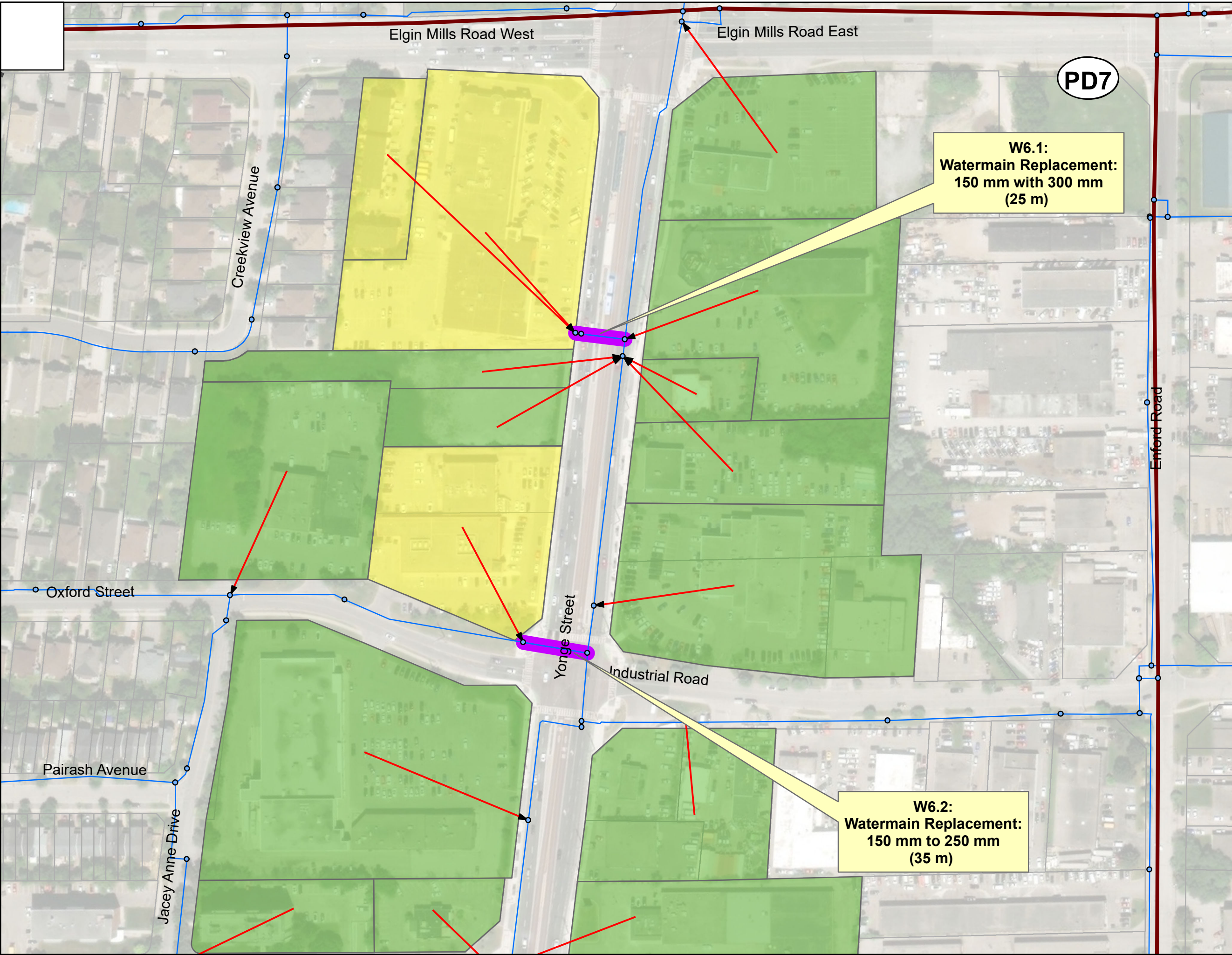


**RIC18-0004 -  
Richmond Hill UMESP Update**

**Ultimate Build-Out  
Water Solution W5**

Drawn By: J.H. Date: Oct 4, 2023

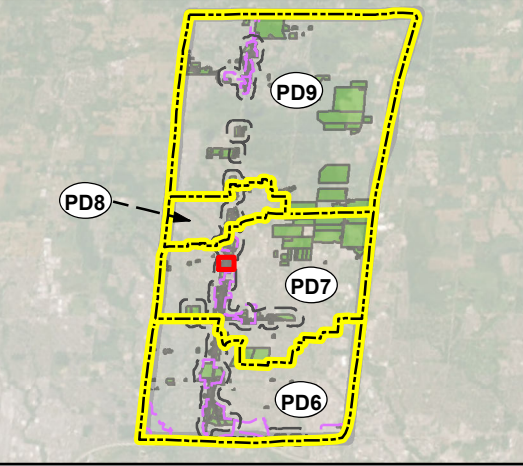




**W6.1:**  
**Watermain Replacement:**  
 150 mm with 300 mm  
 (25 m)

**W6.2:**  
**Watermain Replacement:**  
 150 mm to 250 mm  
 (35 m)

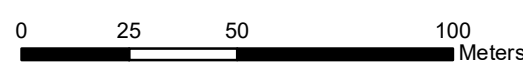
- Legend**
- Junctions
  - Local Watermains
  - Regional Watermains
  - Ultimate Build-Out Proposed Catchment Connection Point
  - New Watermain
  - Watermain Replacement
  - Projected Growth Triggering Proposed Solution
  - Planned Growth
  - PD9 Pressure District Boundary
  - Study Area Boundary
  - Emerging Growth Centres

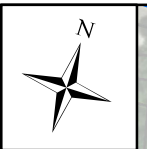
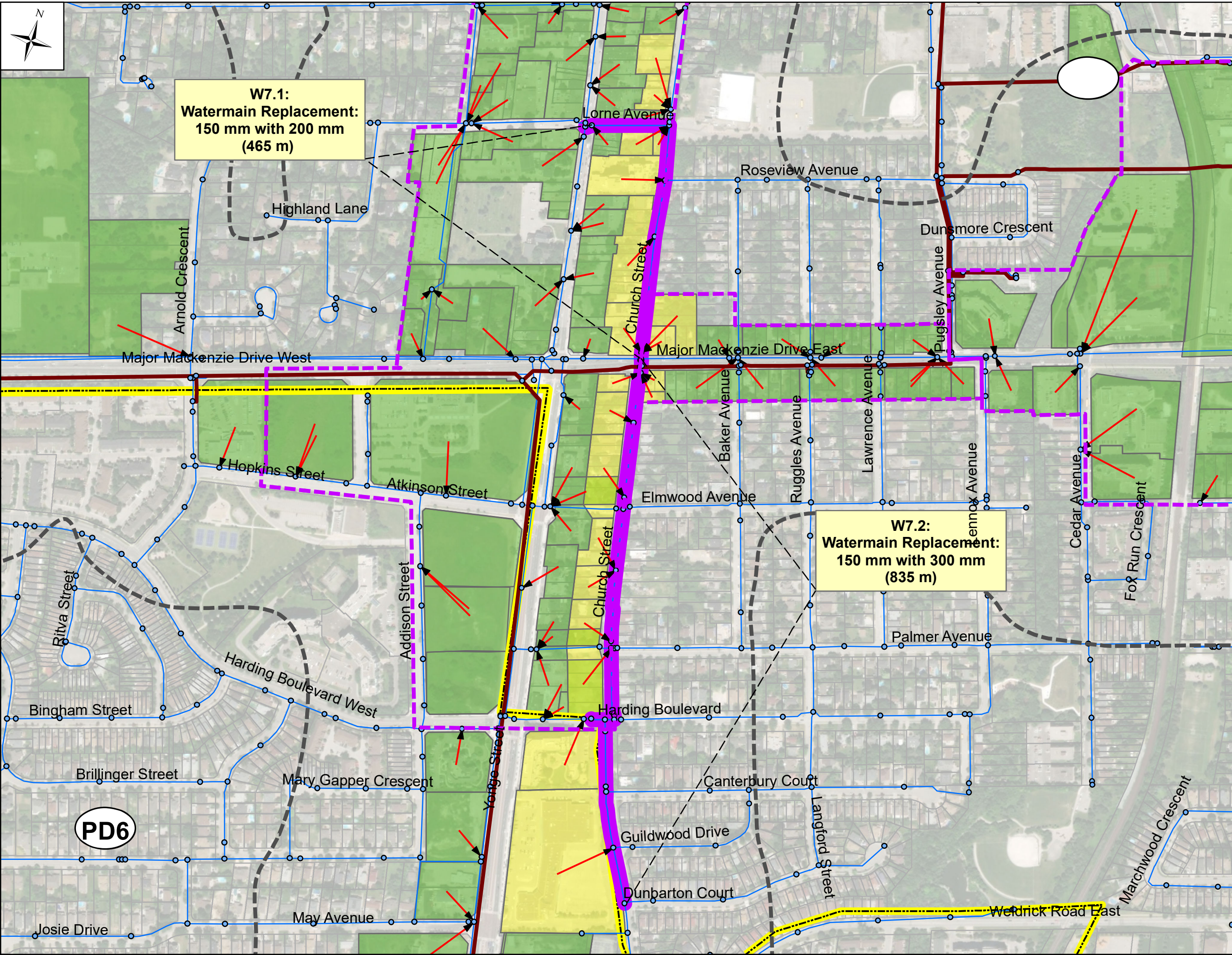


**RIC18-0004 -**  
**Richmond Hill UMESP Update**

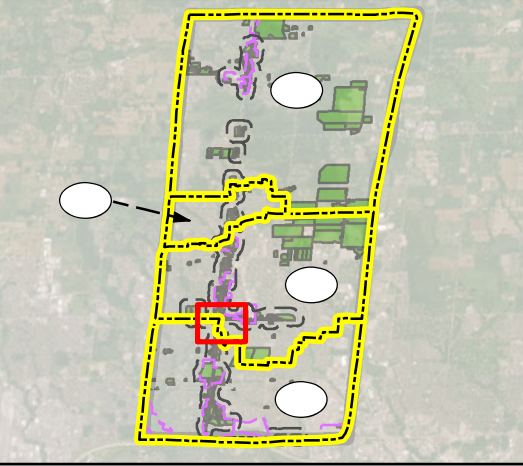
**Ultimate Build-Out**  
**Water Solution W6**

Drawn By: J.H.    Date: Oct 4, 2023





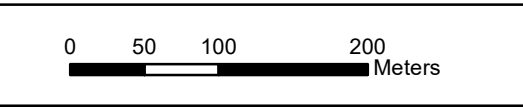
- Legend**
- Junctions
  - Local Watermains
  - Regional Watermains
  - Ultimate Build-Out Proposed Catchment Connection Point
  - New Watermain
  - Watermain Replacement
  - Projected Growth Triggering Proposed Solution
  - Planned Growth
  - Pressure District Boundary
  - Study Area Boundary
  - Emerging Growth Centres



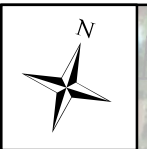
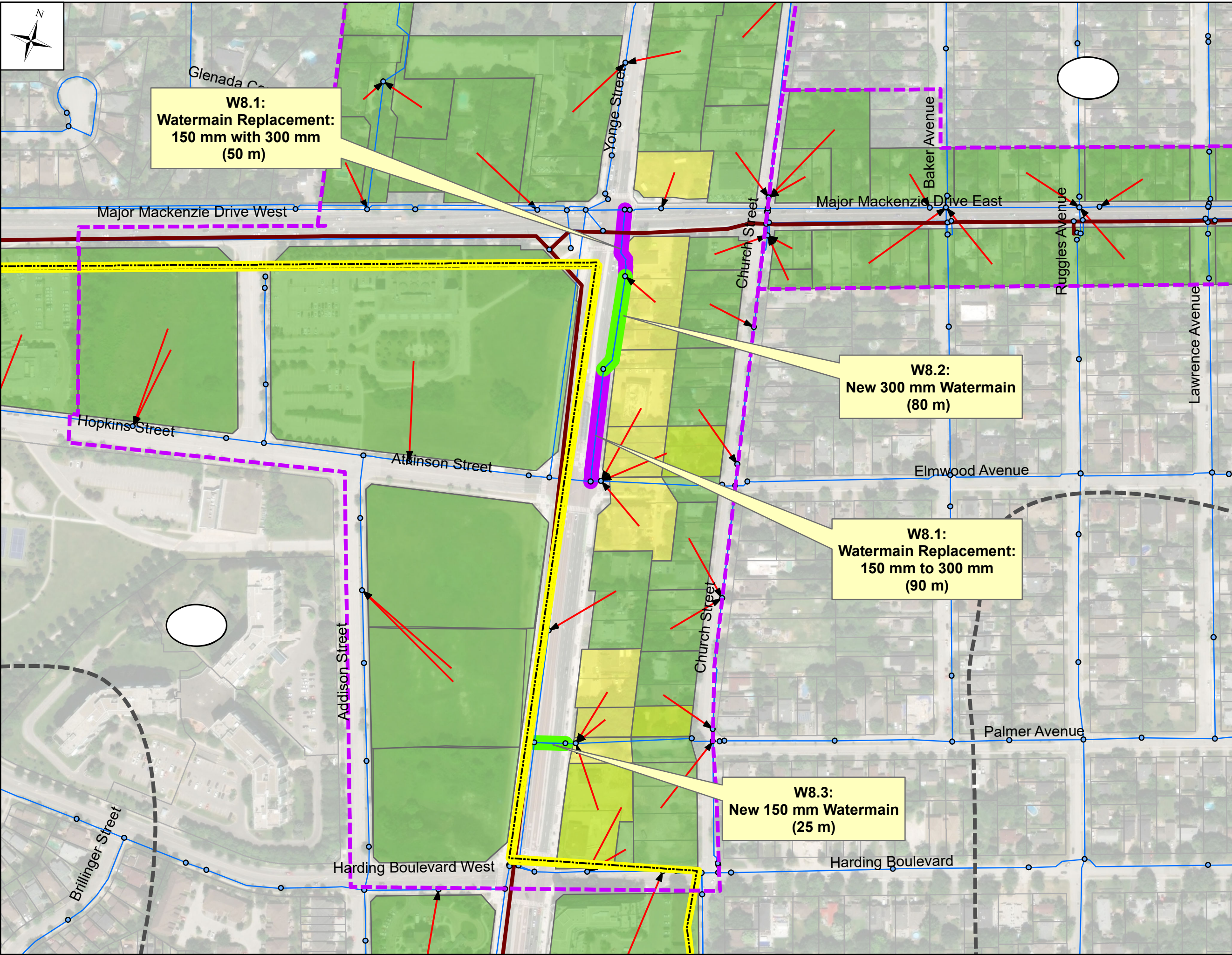
**RIC18-0004 -  
Richmond Hill UMESP Update**

**Ultimate Build-Out  
Water Solution W7**

Drawn By: J.H. Date: Oct 4, 2023



**PD6**



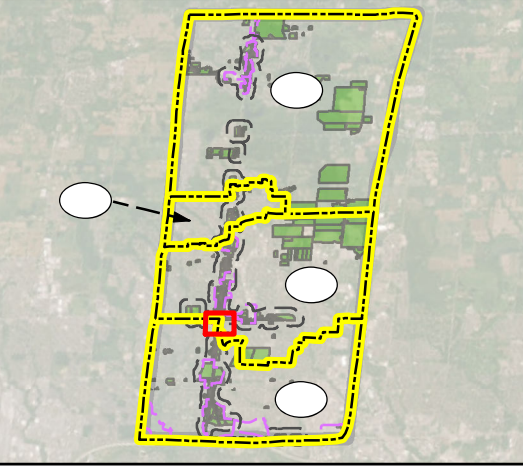
**W8.1:**  
**Watermain Replacement:**  
**150 mm with 300 mm**  
**(50 m)**

**W8.2:**  
**New 300 mm Watermain**  
**(80 m)**

**W8.1:**  
**Watermain Replacement:**  
**150 mm to 300 mm**  
**(90 m)**

**W8.3:**  
**New 150 mm Watermain**  
**(25 m)**

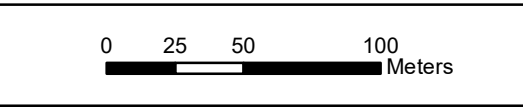
- Legend**
- Junctions
  - Local Watermains
  - Regional Watermains
  - Ultimate Build-Out Proposed Catchment Connection Point
  - New Watermain
  - Watermain Replacement
  - Projected Growth Triggering Proposed Solution
  - Planned Growth
  - Pressure District Boundary
  - Study Area Boundary
  - Emerging Growth Centres

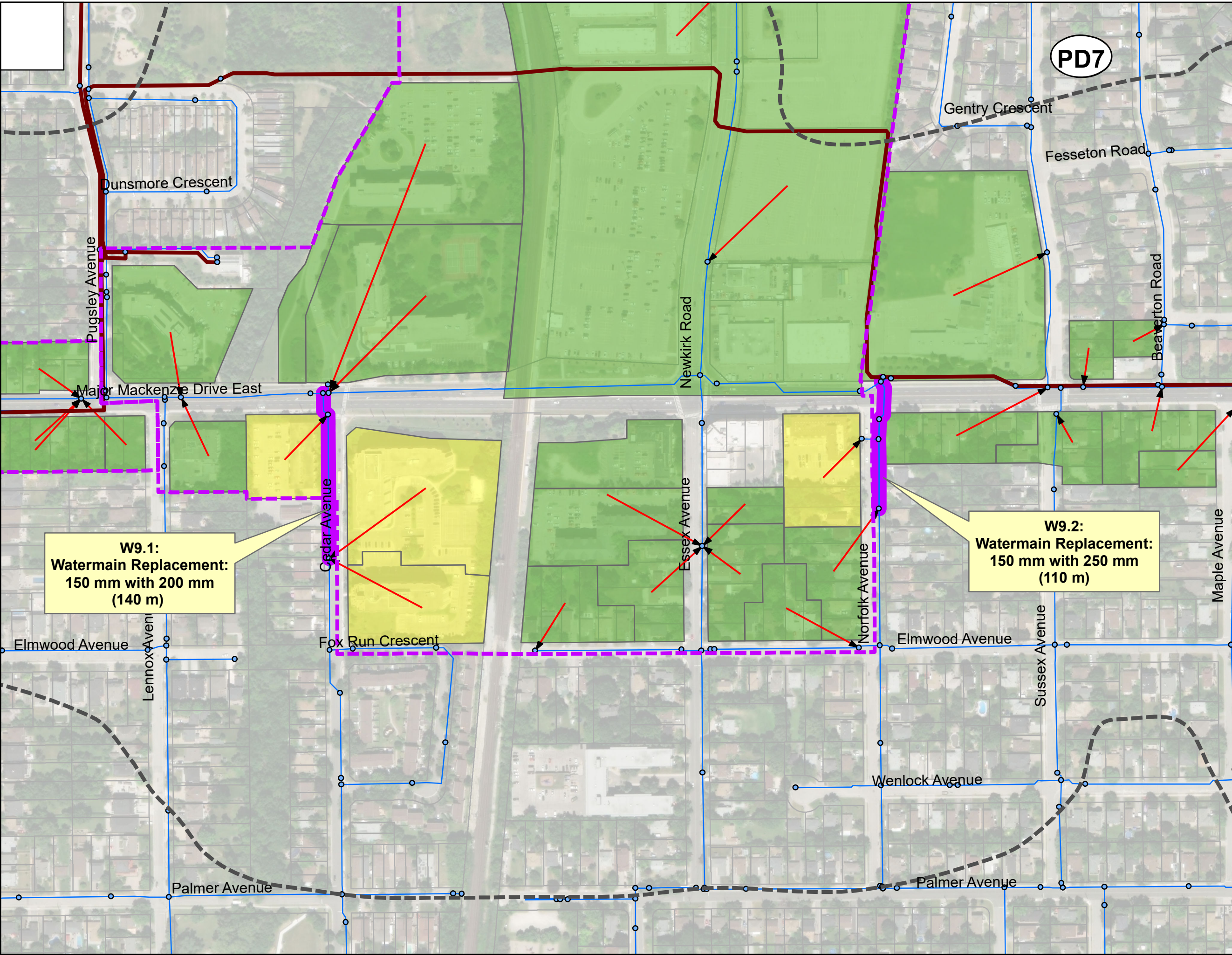


**RIC18-0004 -**  
**Richmond Hill UMESP Update**

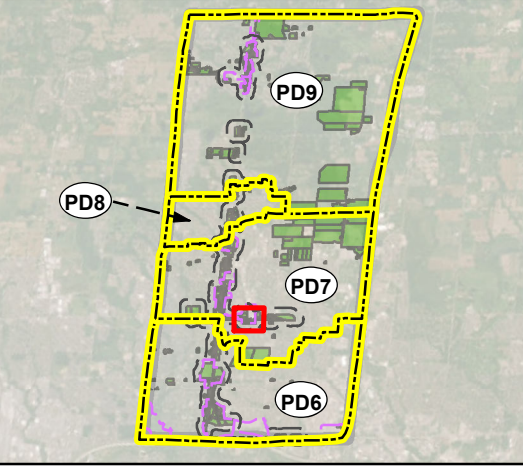
**Ultimate Build-Out**  
**Water Solution W8**

Drawn By: J.H.    Date: Oct 4, 2023





- Legend**
- Junctions
  - Local Watermains
  - Regional Watermains
  - Ultimate Build-Out Proposed Catchment Connection Point
  - New Watermain
  - Watermain Replacement
  - Projected Growth Triggering Proposed Solution
  - Planned Growth
  - PD9 Pressure District Boundary
  - Study Area Boundary
  - Emerging Growth Centres



**W9.1:**  
Watermain Replacement:  
150 mm with 200 mm  
(140 m)

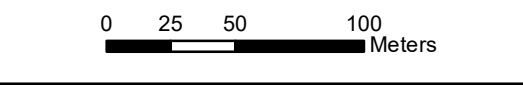
**W9.2:**  
Watermain Replacement:  
150 mm with 250 mm  
(110 m)

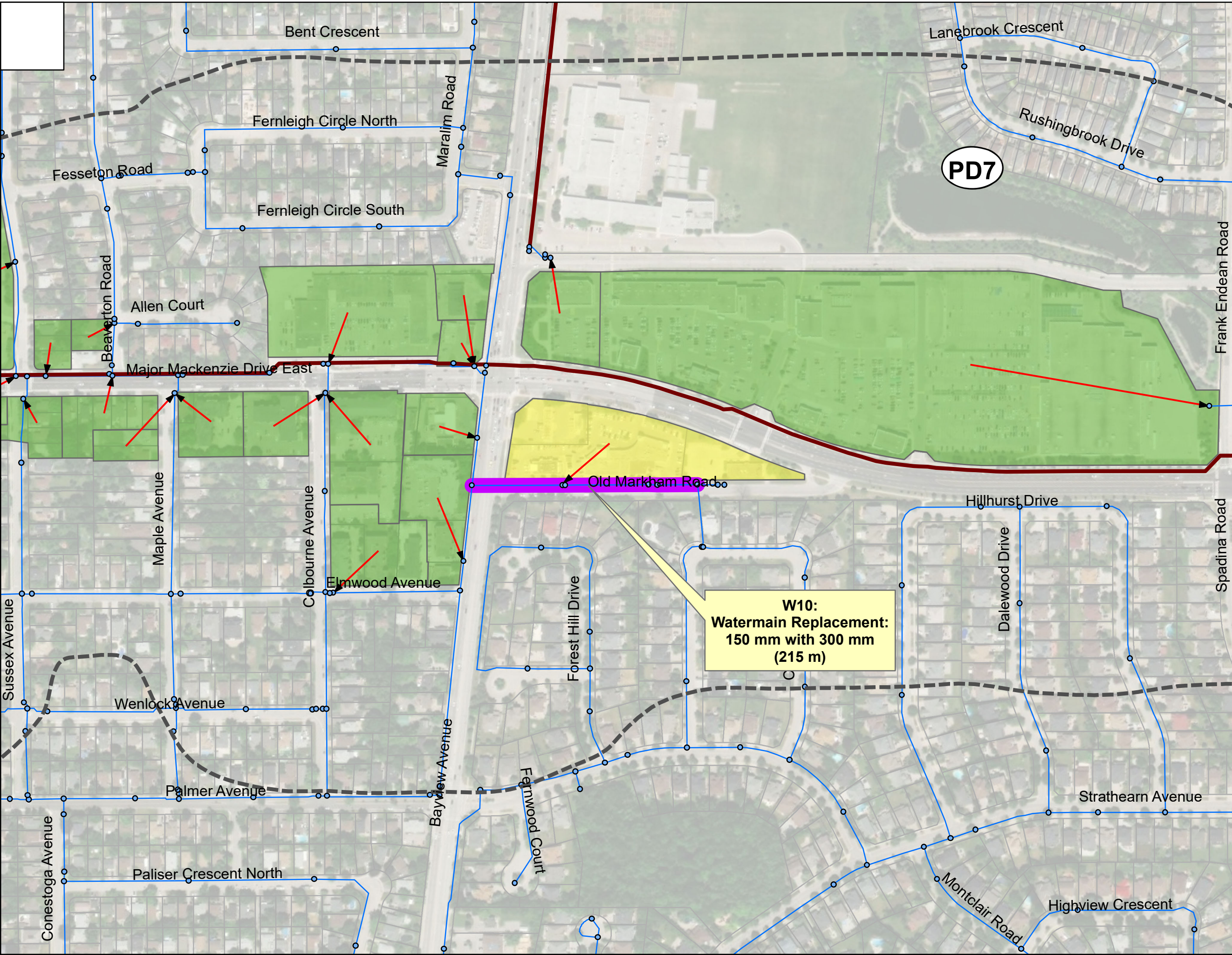


**RIC18-0004 -  
Richmond Hill UMESP Update**

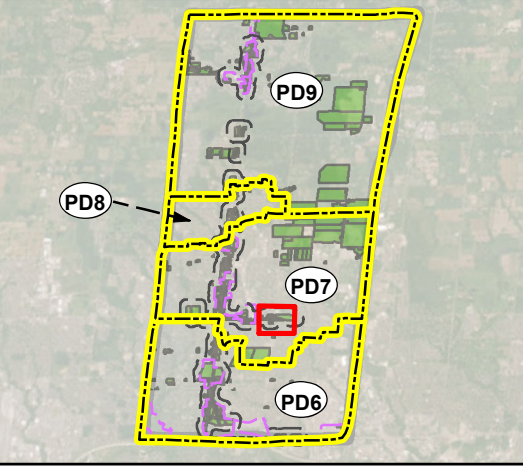
**Ultimate Build-Out  
Water Solution W9**

Drawn By: J.H.    Date: Oct 4, 2023





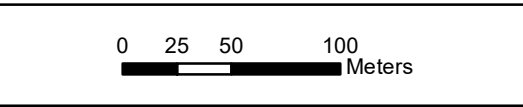
- Legend**
- Junctions
  - Local Watermains
  - Regional Watermains
  - Ultimate Build-Out Proposed Catchment Connection Point
  - New Watermain
  - Watermain Replacement
  - Projected Growth Triggering Proposed Solution
  - Planned Growth
  - PD9 Pressure District Boundary
  - Study Area Boundary
  - Emerging Growth Centres

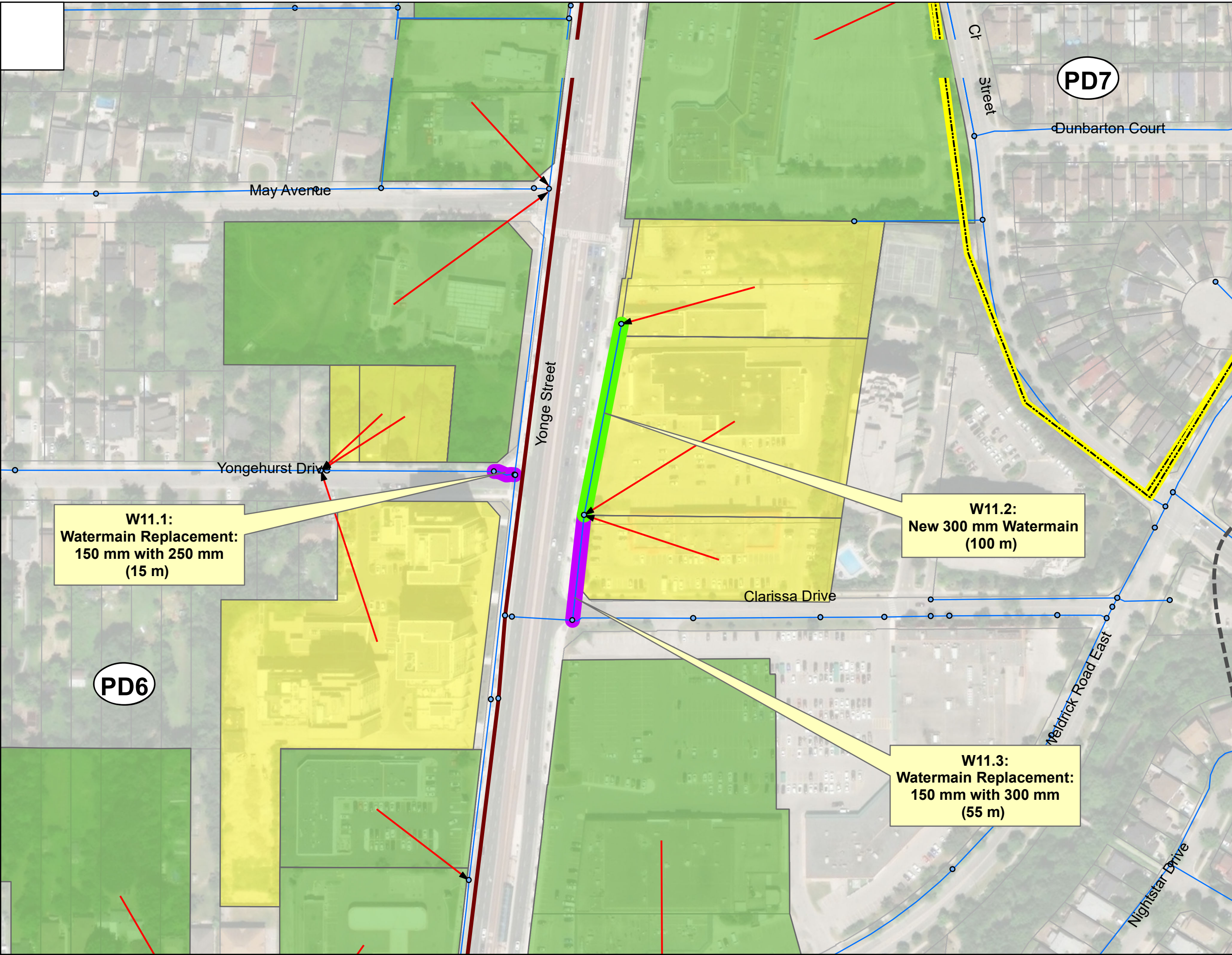


**RIC18-0004 -  
Richmond Hill UMESP Update**

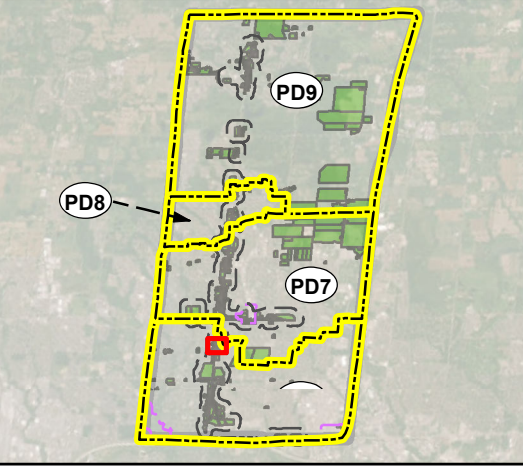
**Ultimate Build-Out  
Water Solution W10**

Drawn By: J.H.    Date: Oct 4, 2023





- Legend**
- Junctions
  - Local Watermains
  - Regional Watermains
  - Ultimate Build-Out Proposed Catchment Connection Point
  - New Watermain
  - Watermain Replacement
  - Projected Growth Triggering Proposed Solution
  - Planned Growth
  - PD9 Pressure District Boundary
  - Study Area Boundary
  - Emerging Growth Centres



**W11.1:**  
Watermain Replacement:  
150 mm with 250 mm  
(15 m)

**W11.2:**  
New 300 mm Watermain  
(100 m)

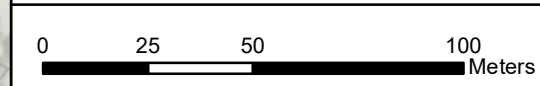
**W11.3:**  
Watermain Replacement:  
150 mm with 300 mm  
(55 m)

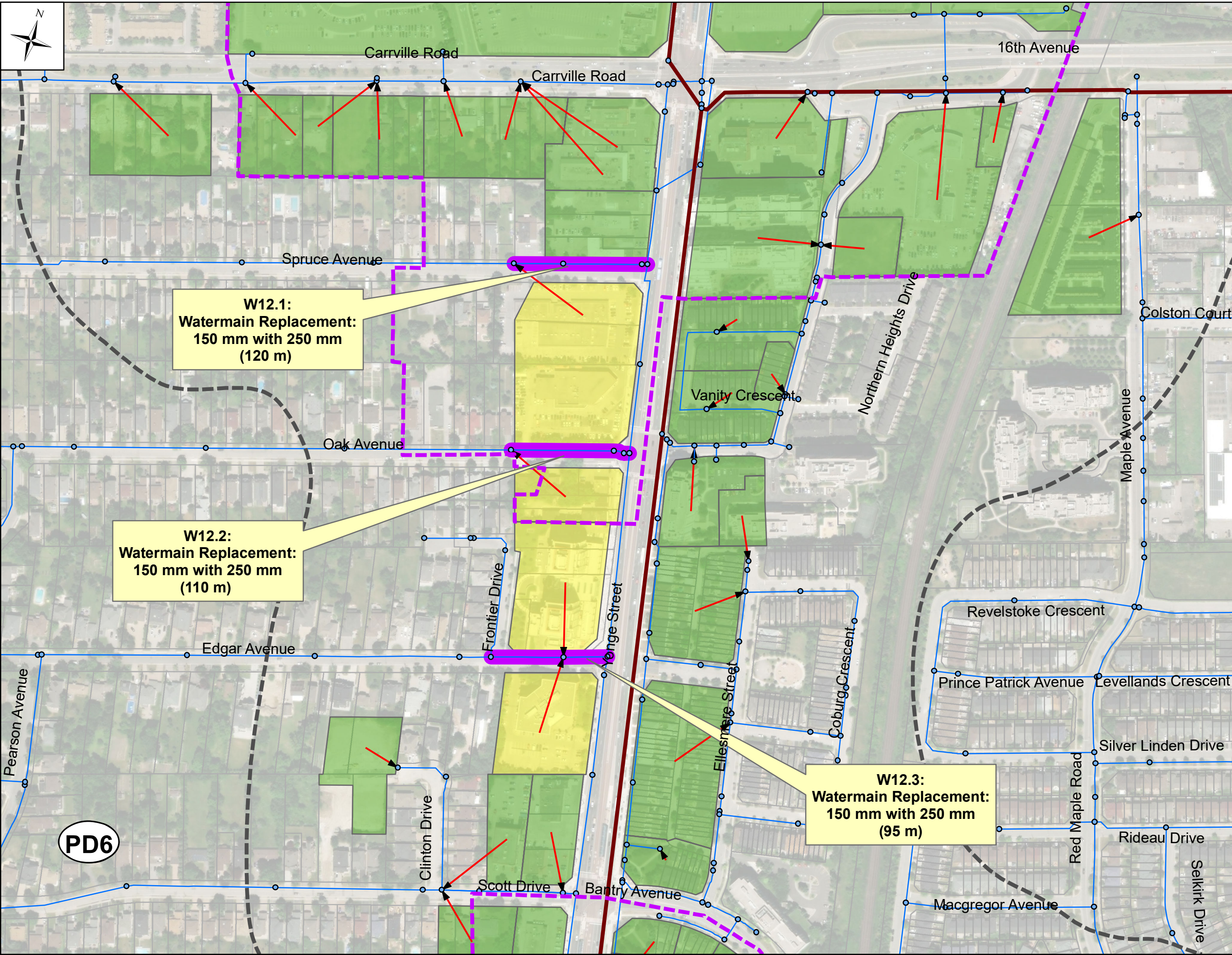


**RIC18-0004 -  
Richmond Hill UMESP Update**

**Ultimate Build-Out  
Water Solution W11**

Drawn By: J.H.    Date: Oct 28, 2023



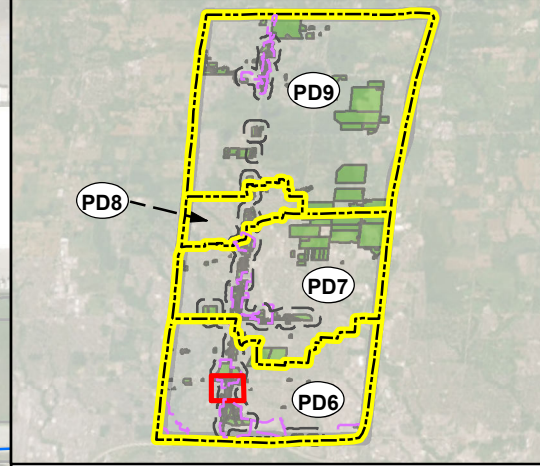


**W12.1:**  
**Watermain Replacement:**  
 150 mm with 250 mm  
 (120 m)

**W12.2:**  
**Watermain Replacement:**  
 150 mm with 250 mm  
 (110 m)

**W12.3:**  
**Watermain Replacement:**  
 150 mm with 250 mm  
 (95 m)

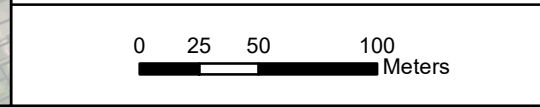
- Legend**
- Junctions
  - Local Watermains
  - Regional Watermains
  - Ultimate Build-Out Proposed Catchment Connection Point
  - New Watermain
  - Watermain Replacement
  - Projected Growth Triggering Proposed Solution
  - Planned Growth
  - PD9 Pressure District Boundary
  - Study Area Boundary
  - Emerging Growth Centres



**RIC18-0004 -**  
**Richmond Hill UMESP Update**

**Ultimate Build-Out**  
**Water Solution W12**

Drawn By: J.H.    Date: Oct 4, 2023



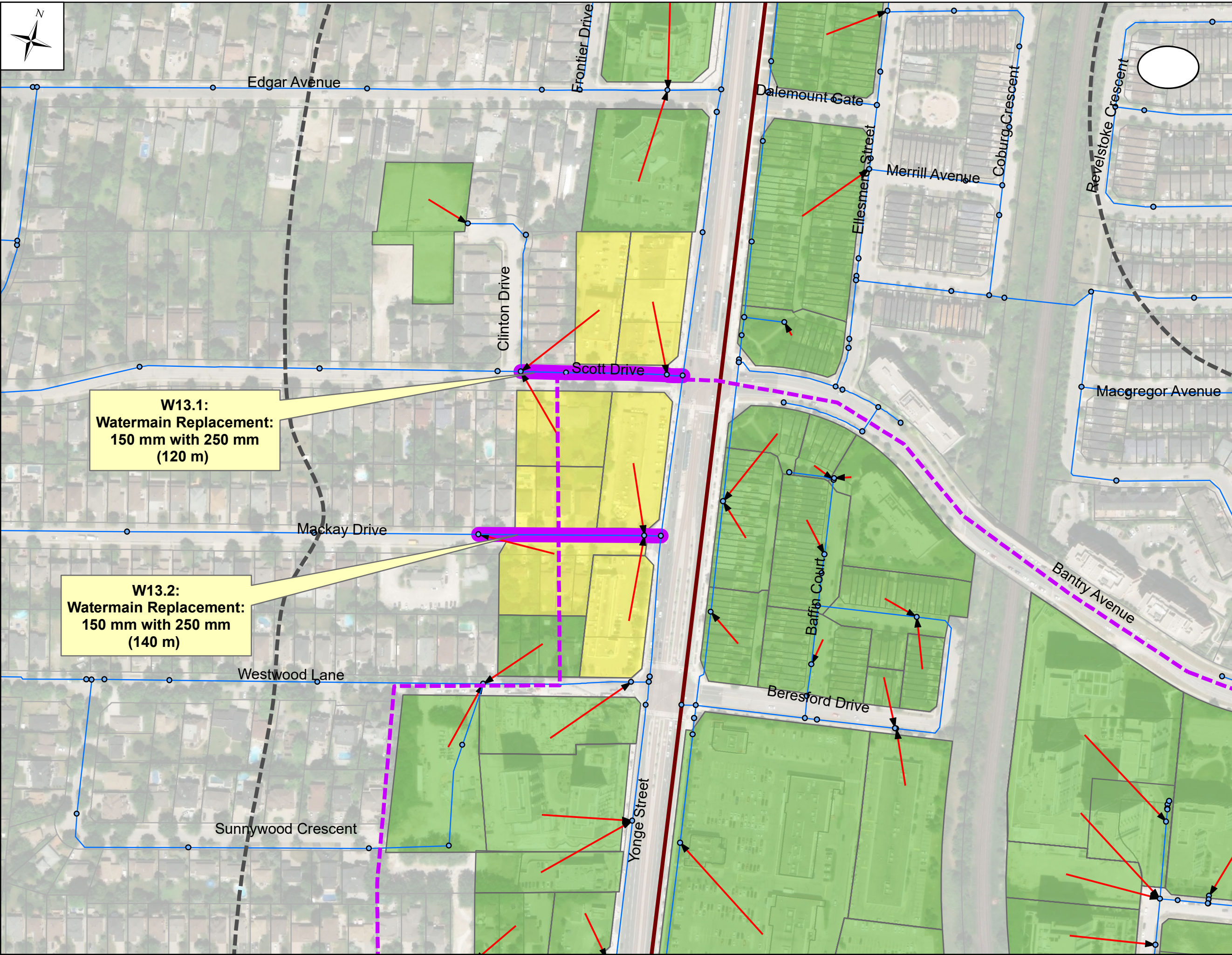
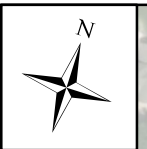
PD6

PD8

PD9

PD7

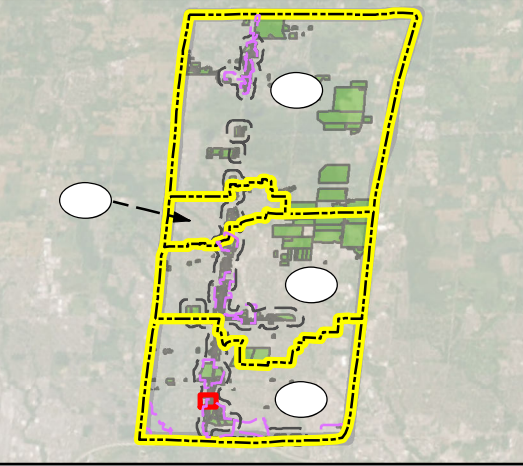
PD6



- Legend**
- Junctions
  - Local Watermains
  - Regional Watermains
  - Ultimate Build-Out Proposed Catchment Connection Point
  - New Watermain
  - Watermain Replacement
  - Projected Growth Triggering Proposed Solution
  - Planned Growth
  - Pressure District Boundary
  - Study Area Boundary
  - Emerging Growth Centres

**W13.1:**  
Watermain Replacement:  
150 mm with 250 mm  
(120 m)

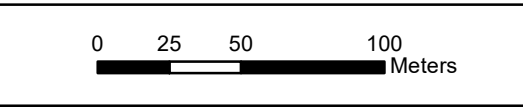
**W13.2:**  
Watermain Replacement:  
150 mm with 250 mm  
(140 m)

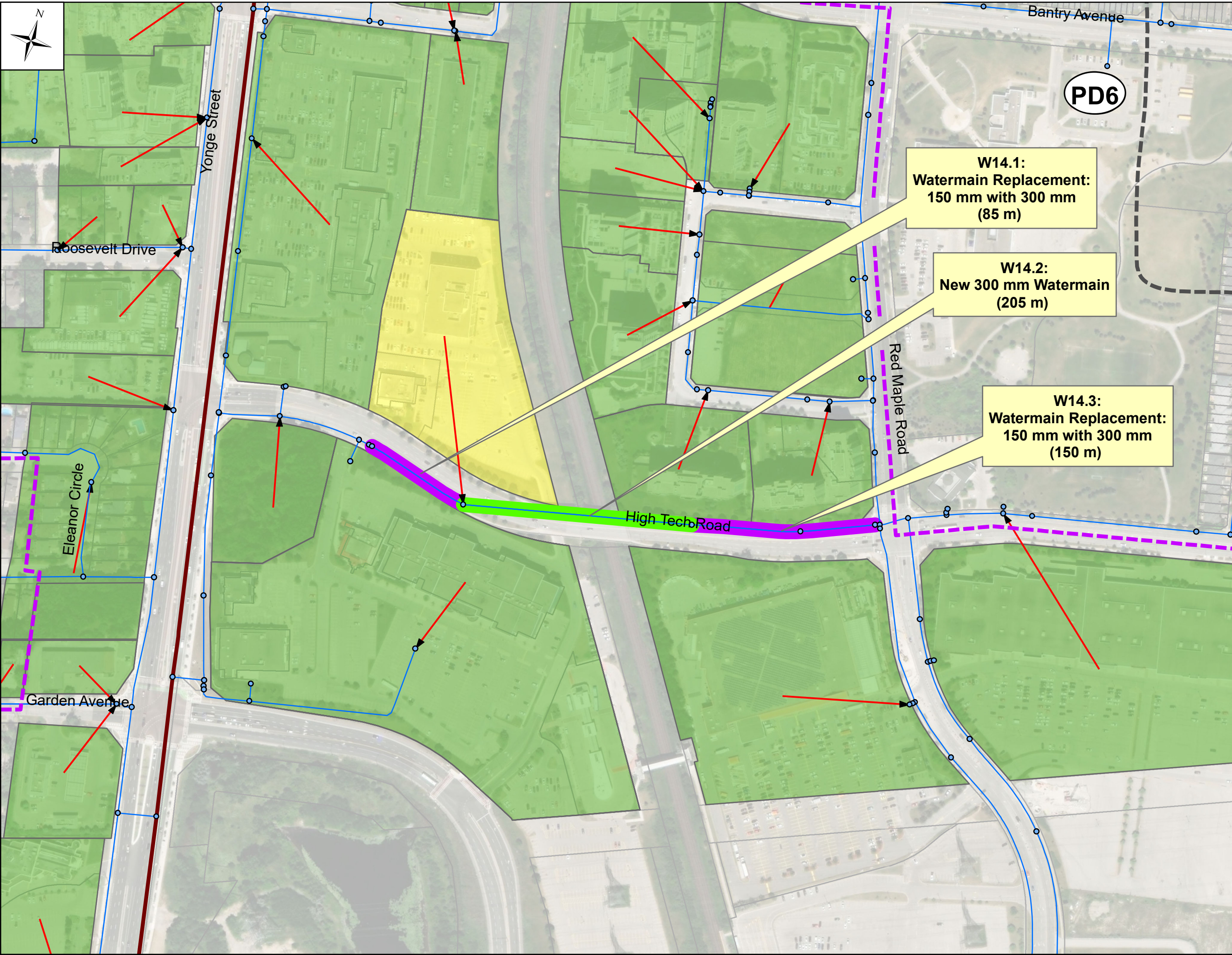


**RIC18-0004 -**  
**Richmond Hill UMESP Update**

**Ultimate Build-Out**  
**Water Solution W13**

Drawn By: J.H.    Date: Oct 4, 2023



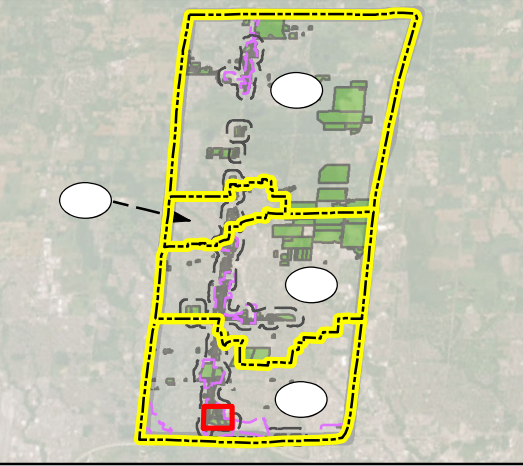


- Legend**
- Junctions
  - Local Watermains
  - Regional Watermains
  - Ultimate Build-Out Proposed Catchment Connection Point
  - New Watermain
  - Watermain Replacement
  - Projected Growth Triggering Proposed Solution
  - Planned Growth
  - PD9 Pressure District Boundary
  - Study Area Boundary
  - Emerging Growth Centres

**W14.1:**  
Watermain Replacement:  
150 mm with 300 mm  
(85 m)

**W14.2:**  
New 300 mm Watermain  
(205 m)

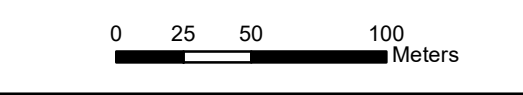
**W14.3:**  
Watermain Replacement:  
150 mm with 300 mm  
(150 m)

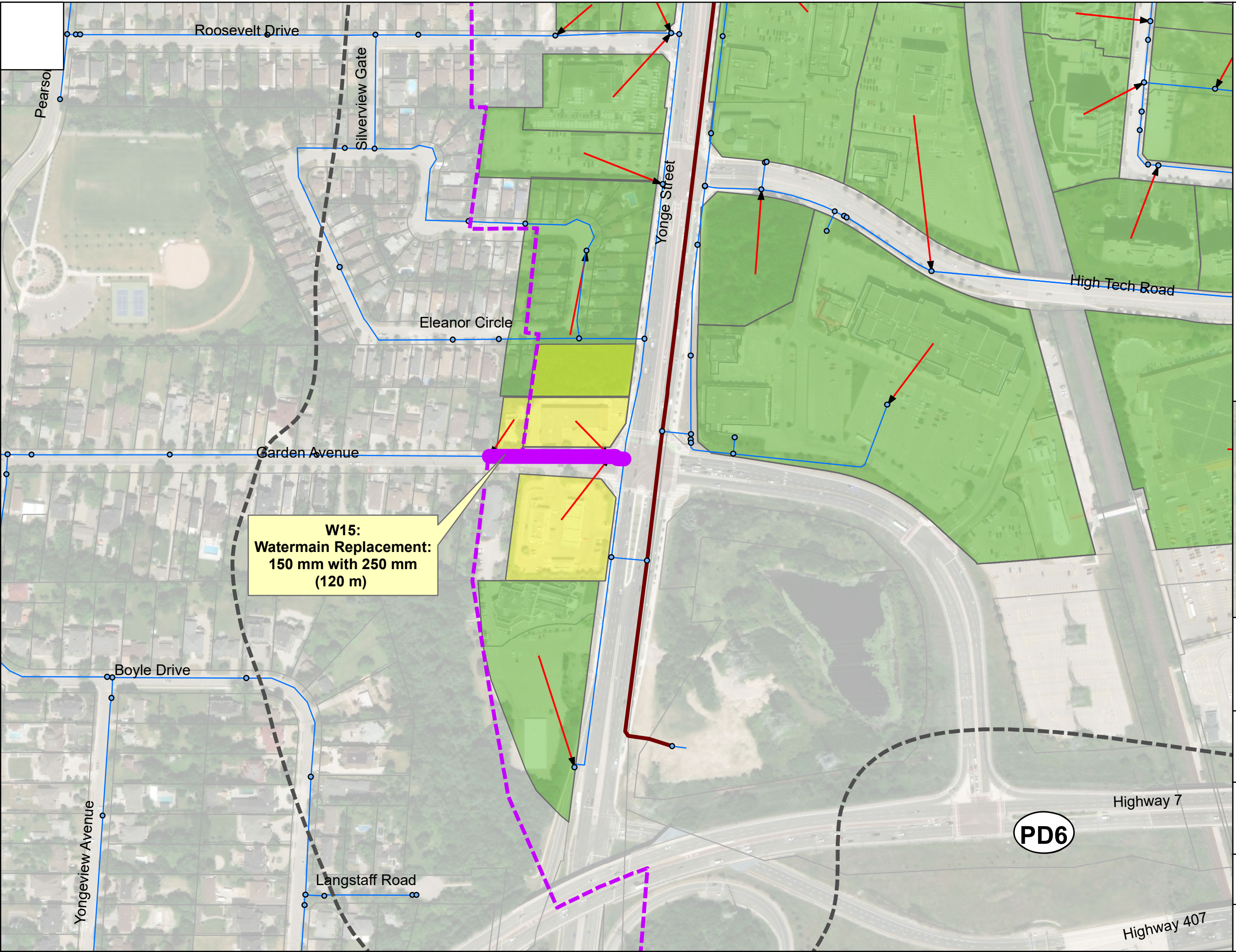


**RIC18-0004 -  
Richmond Hill UMESP Update**

**Ultimate Build-Out  
Water Solution W14**

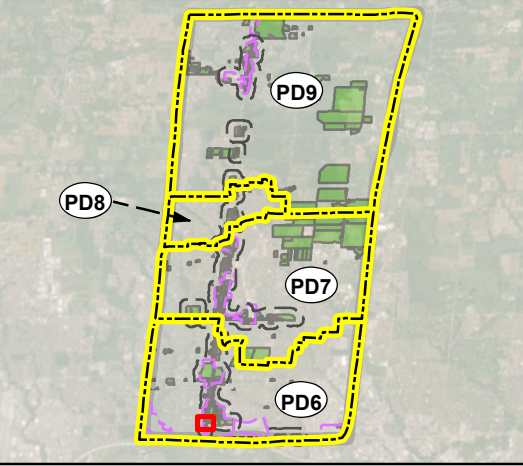
Drawn By: J.H.    Date: Oct 4, 2023





- Legend**
- Junctions
  - Local Watermains
  - Regional Watermains
  - Ultimate Build-Out Proposed Catchment Connection Point
  - New Watermain
  - Watermain Replacement
  - Projected Growth Triggering Proposed Solution
  - Planned Growth
  - PD9 Pressure District Boundary
  - Study Area Boundary
  - Emerging Growth Centres

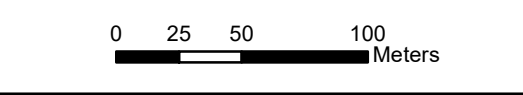
**W15:  
Watermain Replacement:  
150 mm with 250 mm  
(120 m)**



**RIC18-0004 -  
Richmond Hill UMESP Update**

**Ultimate Build-Out  
Water Solution W15**

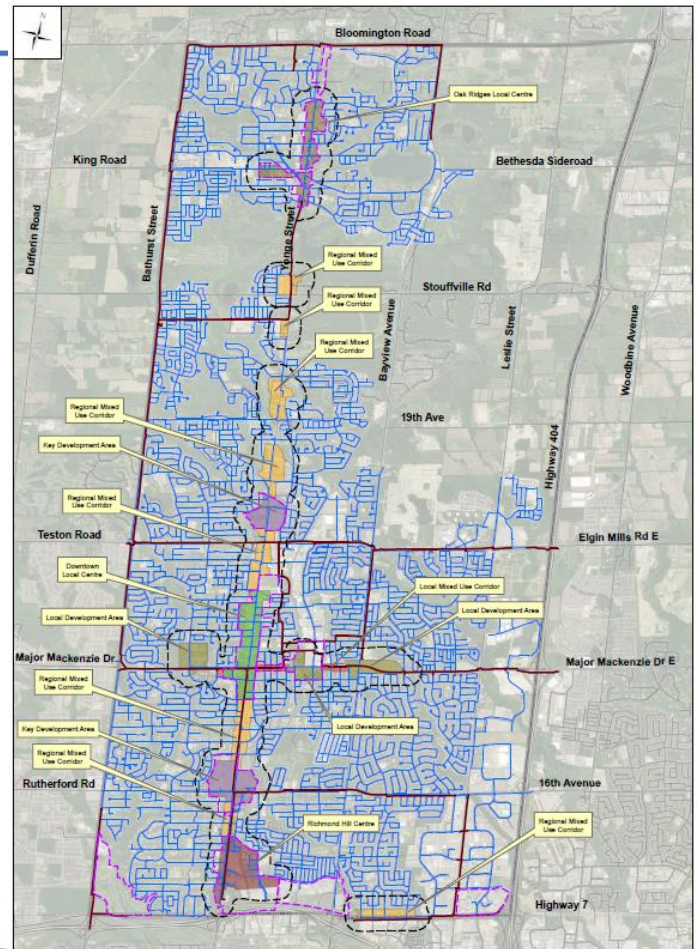
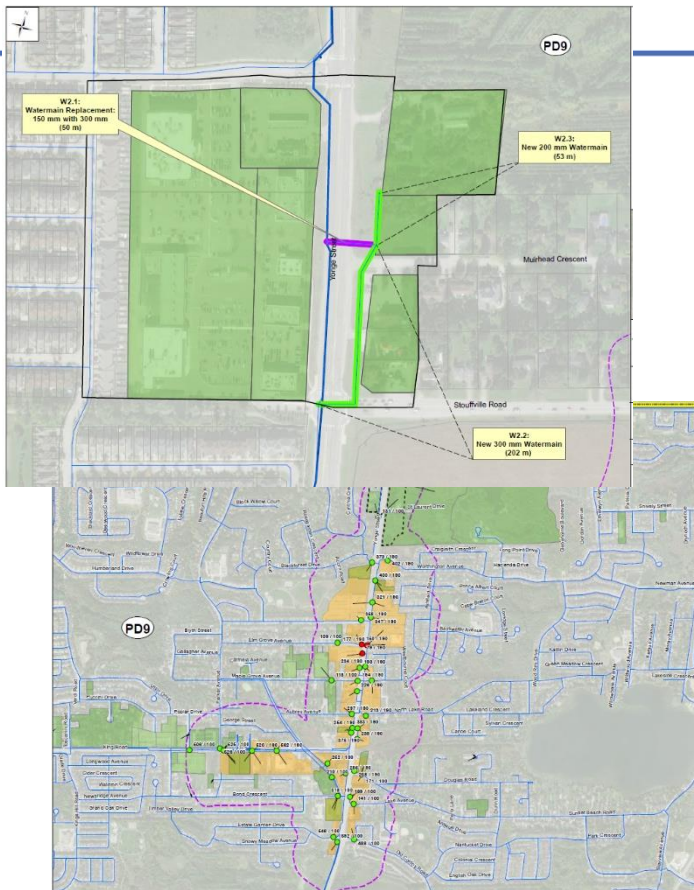
Drawn By: J.H.    Date: Oct 4, 2023

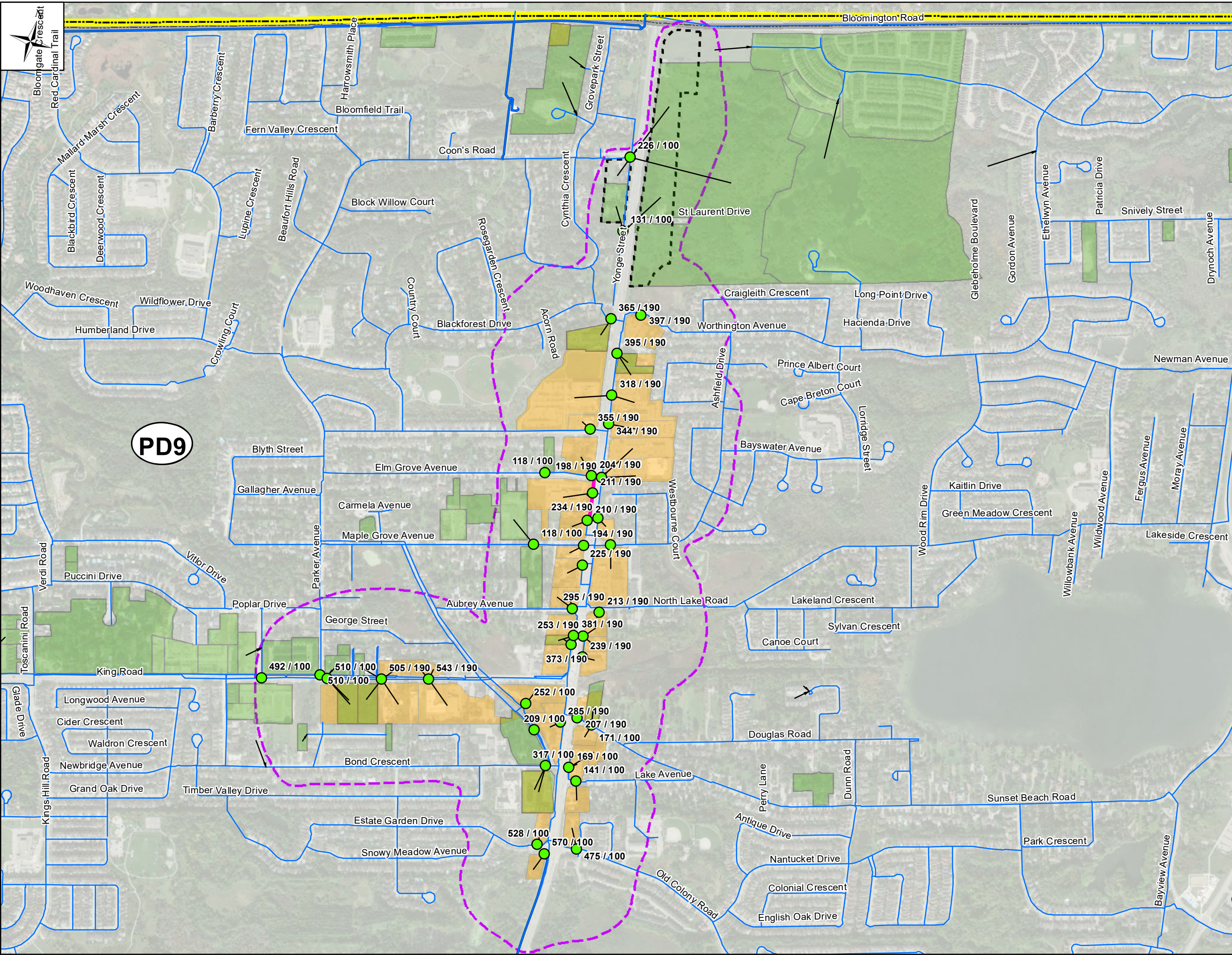


## Appendix IV

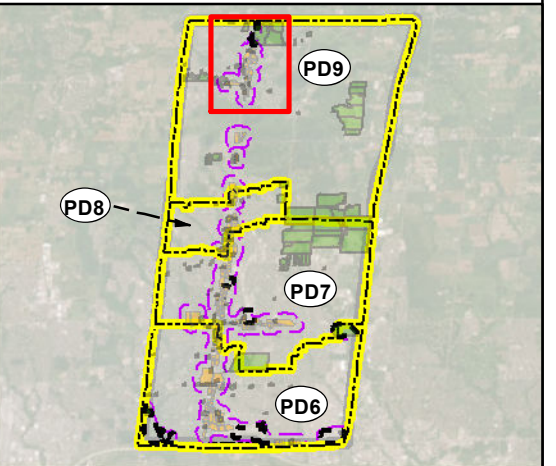
# Available and Required Fire Flows under Proposed Ultimate Build-Out Conditions

Tuesday October 31, 2023





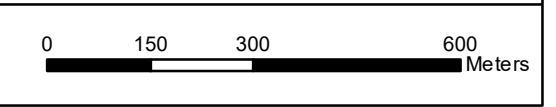
- Legend**
- Watermains
  - Regional Watermains
  - Proposed Solution
  - Proposed Connection
  - Fire Flow Not Available at 140 kPa
  - Fire Flow Available at 140 kPa
  - 450 / 317** Available Fire Flow / Fire Demand in litres/second
  - Study Area Boundary
  - PD9 Pressure District Boundary
  - Town of Richmond Hill Boundary
  - Intensification Area
  - Development Application
  - Emerging Growth Centre

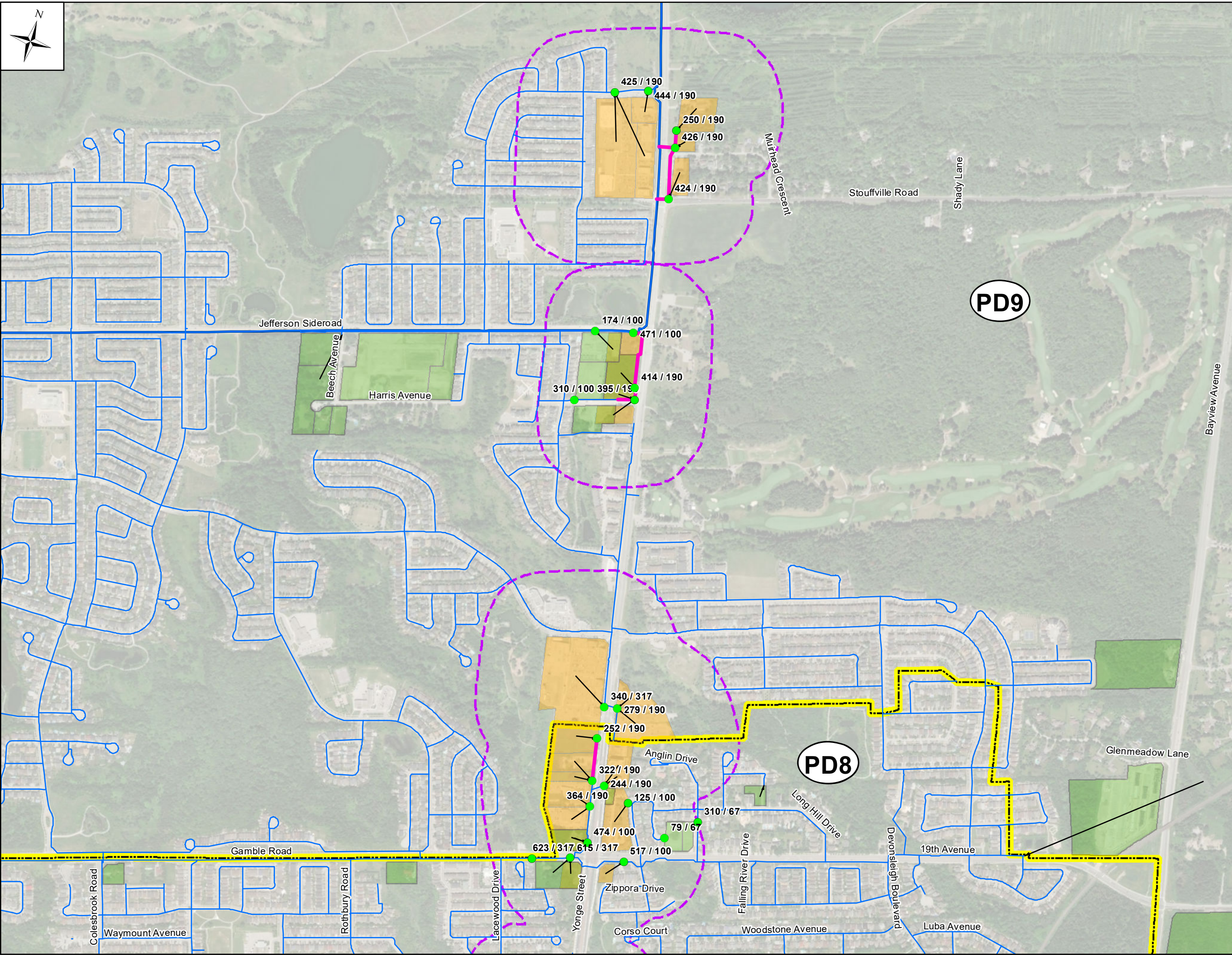
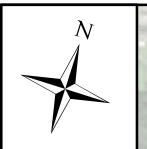


**RIC18-004 -  
Richmond Hill UMESP Update**

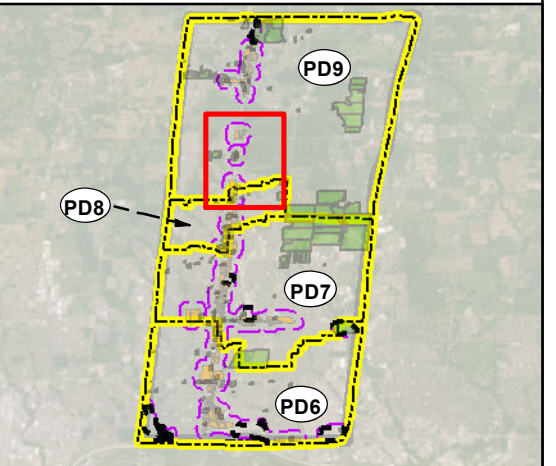
**Fire Flows At Proposed Ultimate Conditions  
(1 of 7)**

Drawn By: W.A.    Date: Jan. 25, 2023





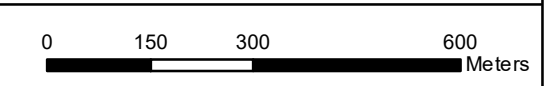
- Legend**
- Watermains
  - Regional Watermains
  - Proposed Solution
  - Proposed Connection
  - Fire Flow Not Available at 140 kPa
  - Fire Flow Available at 140 kPa
  - 450 / 317** Available Fire Flow / Fire Demand in litres/second
  - Study Area Boundary
  - Pressure District Boundary
  - Town of Richmond Hill Boundary
  - Intensification Area
  - Development Application
  - Emerging Growth Centre

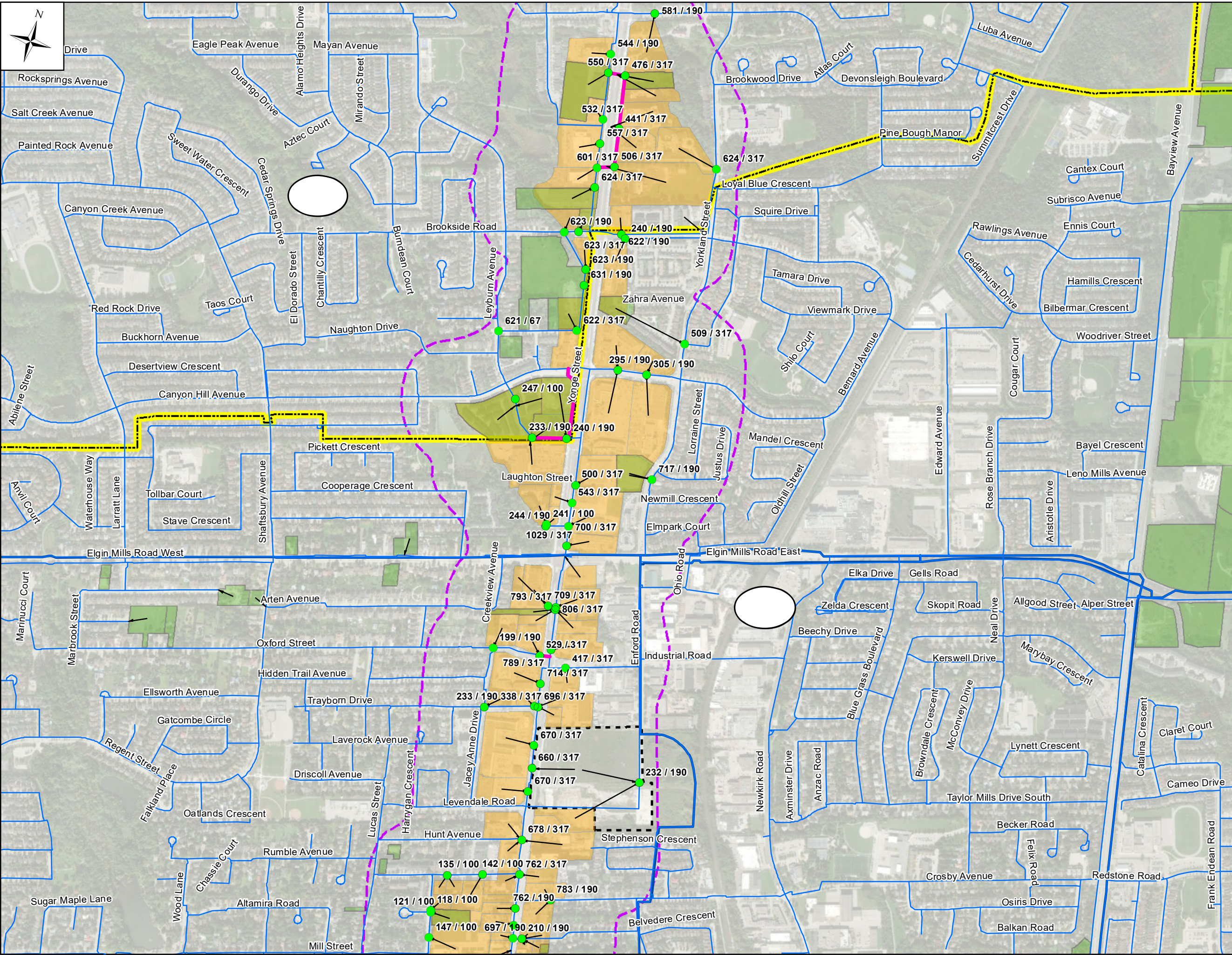


**RIC18-0004 -  
Richmond Hill UMESP Update**

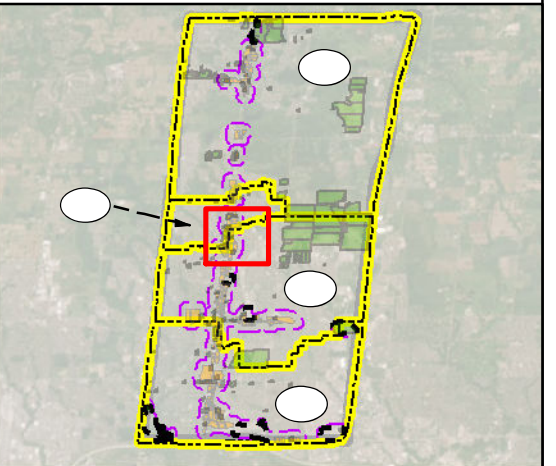
**Fire Flows At Proposed Ultimate  
Conditions  
(2 of 7)**

Drawn By: W.A. Date: Aug. 22, 2023





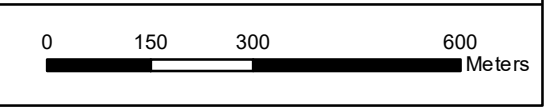
- Legend**
- Watermains
  - Regional Watermains
  - Proposed Solution
  - Proposed Connection
  - Fire Flow Not Available at 140 kPa
  - Fire Flow Available at 140 kPa
  - 450 / 317** Available Fire Flow / Fire Demand in litres/second
  - Study Area Boundary
  - Pressure District Boundary
  - Town of Richmond Hill Boundary
  - Intensification Area
  - Development Application
  - Emerging Growth Centre

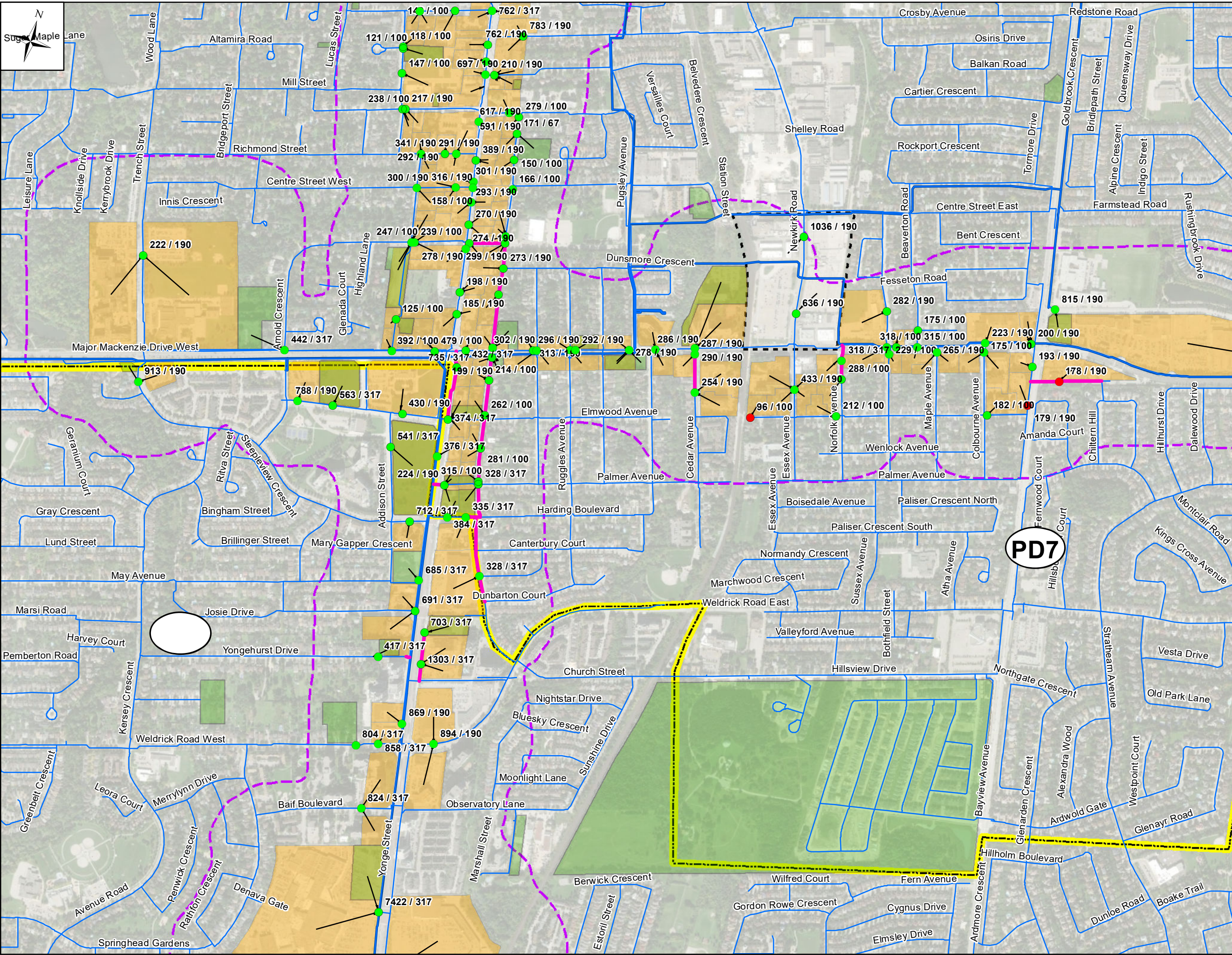


**RIC18-004 -  
Richmond Hill UMESP Update**

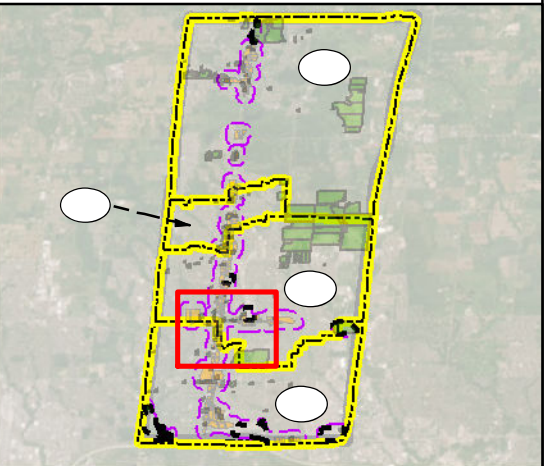
**Fire Flows At Proposed Ultimate  
Conditions  
(3 of 7)**

Drawn By: W.A. Date: Jun. 12, 2023





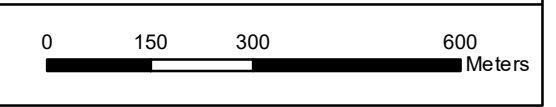
- Legend**
- Watermains
  - Regional Watermains
  - Proposed Solution
  - Proposed Connection
  - Fire Flow Not Available at 140 kPa
  - Fire Flow Available at 140 kPa
  - 450 / 317** Available Fire Flow / Fire Demand in litres/second
  - Study Area Boundary
  - Pressure District Boundary
  - Town of Richmond Hill Boundary
  - Intensification Area
  - Development Application
  - Emerging Growth Centre

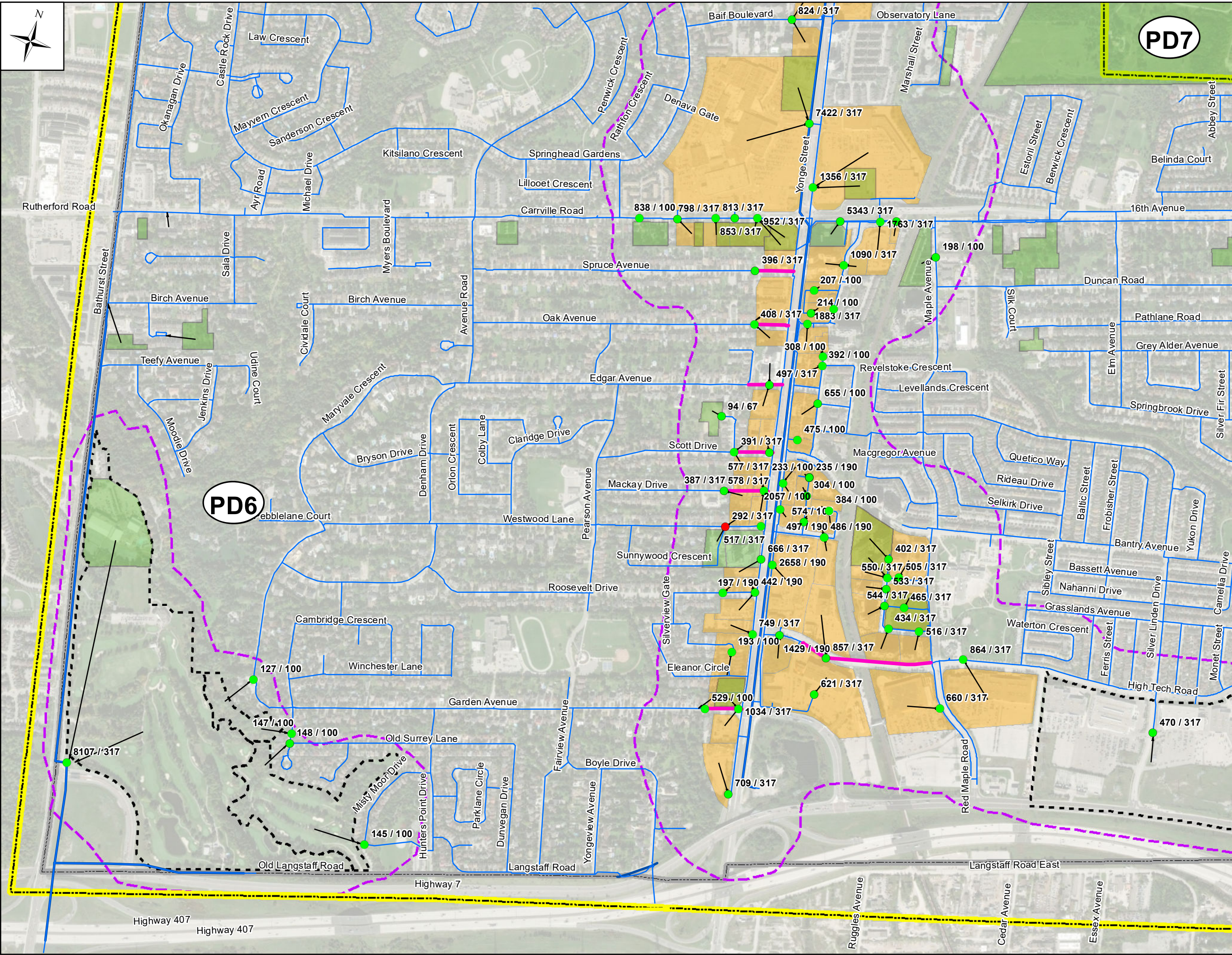


**RIC18-004 -  
Richmond Hill UMESP Update**

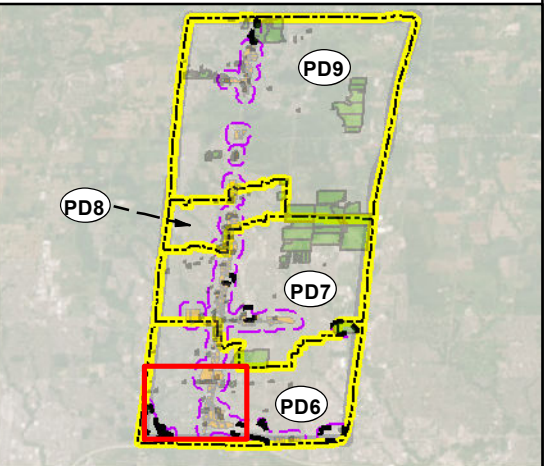
**Fire Flows At Proposed Ultimate  
Conditions  
(4 of 7)**

Drawn By: W.A. Date: Jan. 25, 2023





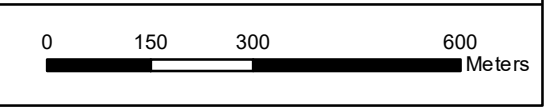
- Legend**
- Watermains
  - Regional Watermains
  - Proposed Solution
  - Proposed Connection
  - Fire Flow Not Available at 140 kPa
  - Fire Flow Available at 140 kPa
  - 450 / 317** Available Fire Flow / Fire Demand in litres/second
  - Study Area Boundary
  - Pressure District Boundary
  - Town of Richmond Hill Boundary
  - Intensification Area
  - Development Application
  - Emerging Growth Centre

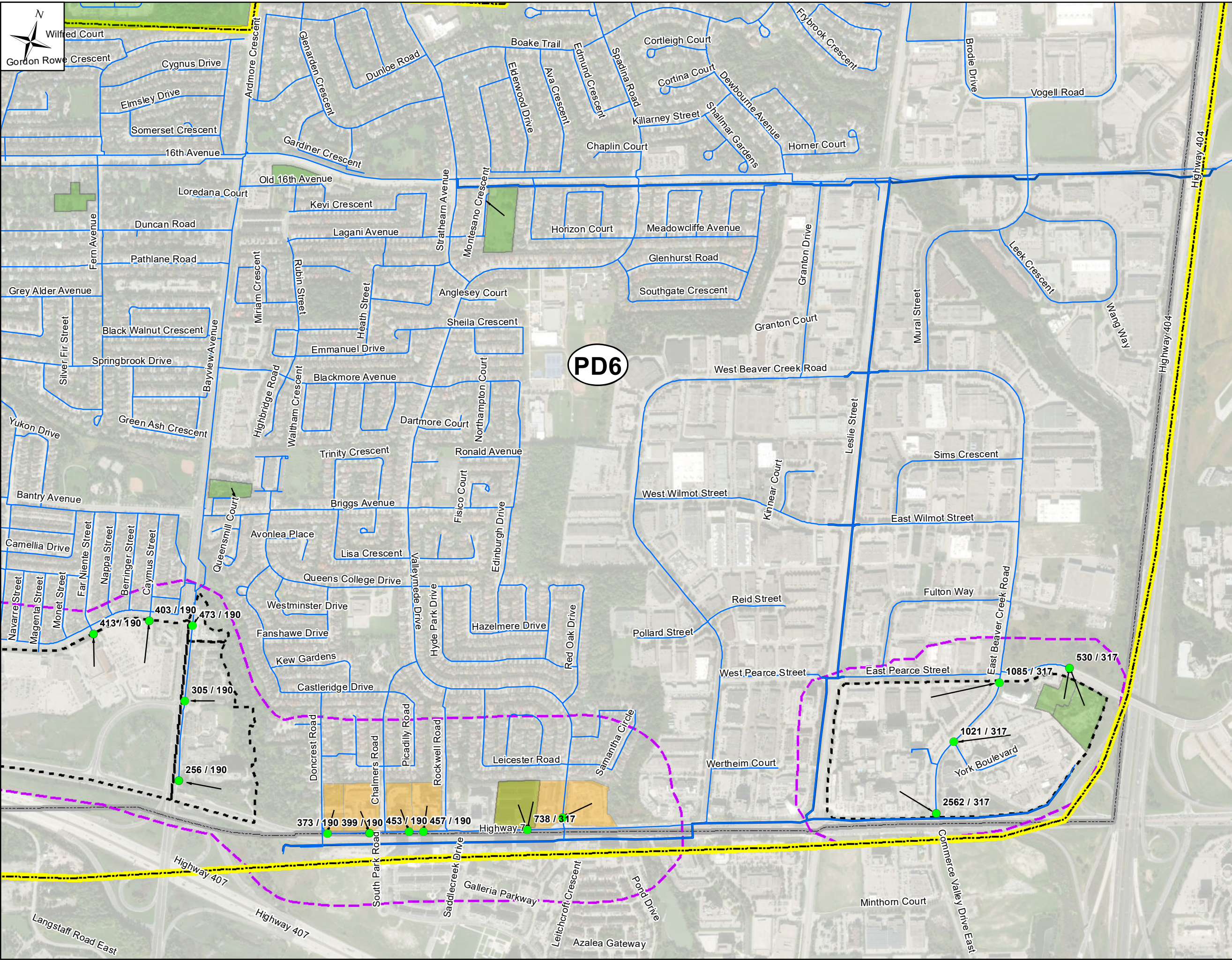


**RIC18-004 -  
Richmond Hill UMESP Update**

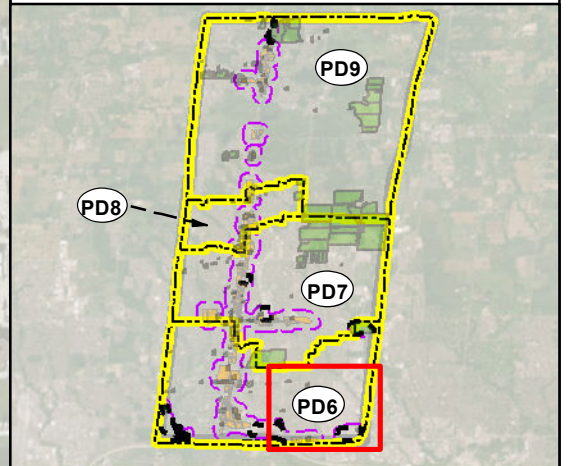
**Fire Flows At Proposed Ultimate  
Conditions  
(5 of 7)**

Drawn By: W.A. Date: Jan. 25, 2023





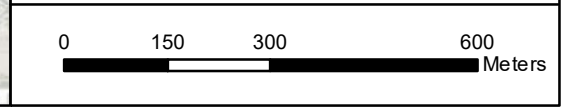
- Legend**
- Watermains
  - Regional Watermains
  - Proposed Solution
  - Proposed Connection
  - Fire Flow Not Available at 140 kPa
  - Fire Flow Available at 140 kPa
  - 450 / 317** Available Fire Flow / Fire Demand in litres/second
  - Study Area Boundary
  - (PD9)** Pressure District Boundary
  - Town of Richmond Hill Boundary
  - Intensification Area
  - Development Application
  - Emerging Growth Centre

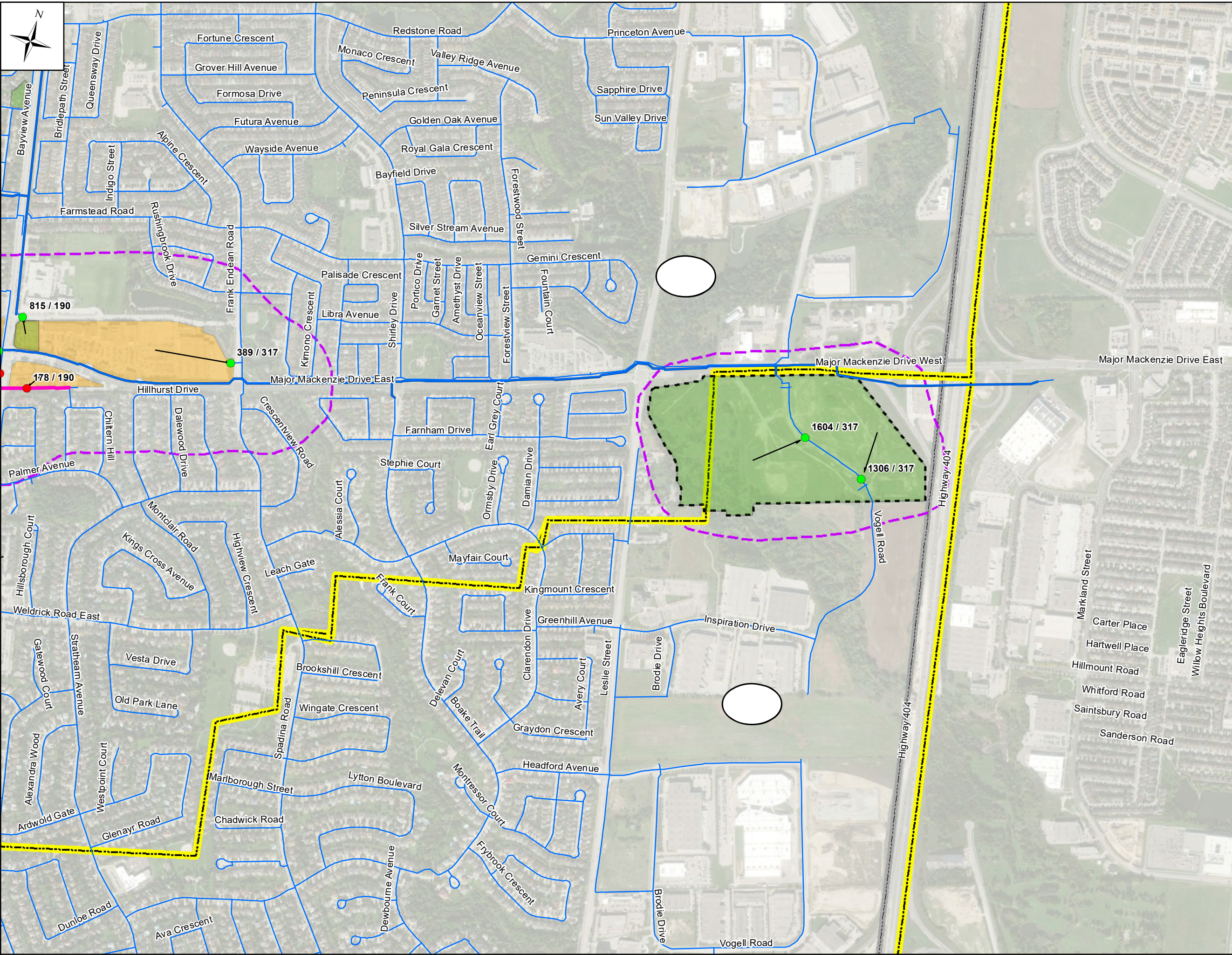


**RIC18-004 -  
Richmond Hill UMESP Update**

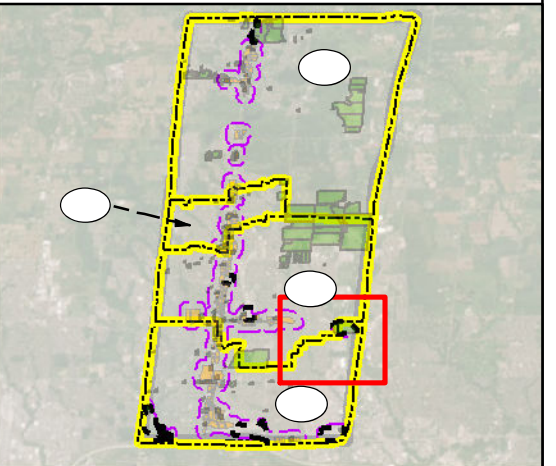
**Fire Flows At Proposed Ultimate Conditions  
(6 of 7)**

Drawn By: W.A. Date: Jan. 25, 2023





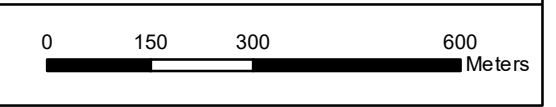
- Legend**
- Watermains
  - Regional Watermains
  - Proposed Solution
  - Proposed Connection
  - Fire Flow Not Available at 140 kPa
  - Fire Flow Available at 140 kPa
  - 450 / 317** Available Fire Flow / Fire Demand in litres/second
  - Study Area Boundary
  - Pressure District Boundary
  - Town of Richmond Hill Boundary
  - Intensification Area
  - Development Application
  - Emerging Growth Centre



**RIC18-0004 -  
Richmond Hill UMESP Update**

**Fire Flows At Proposed Ultimate  
Conditions  
(7 of 7)**

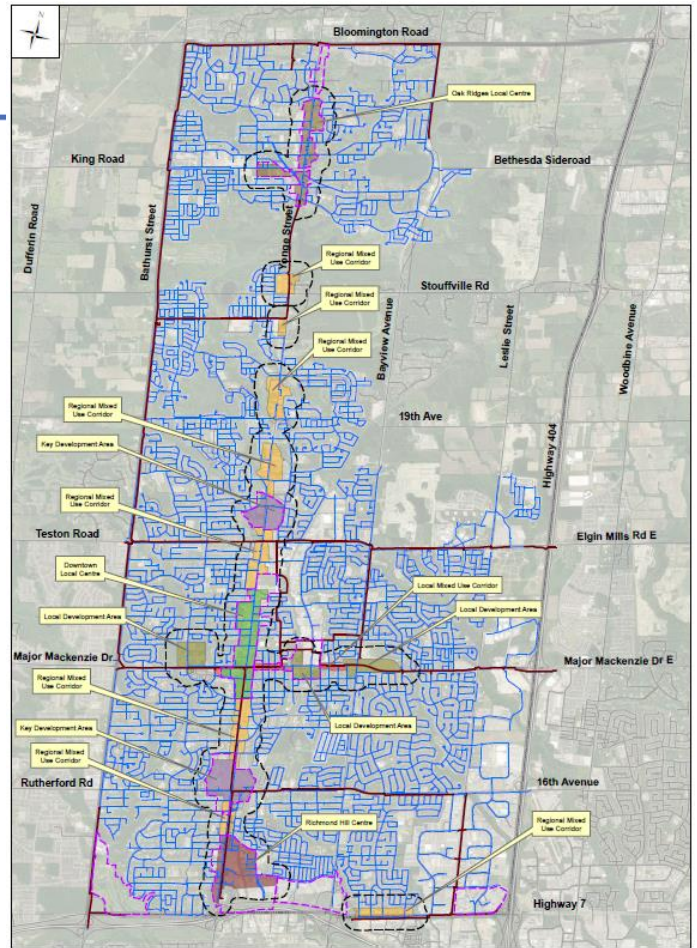
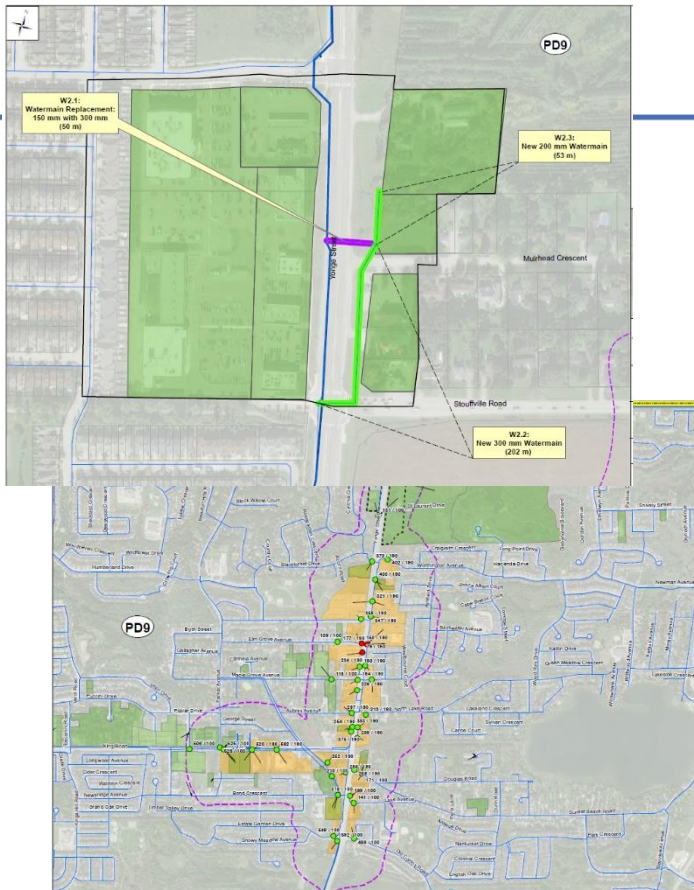
Drawn By: W.A.    Date: Jan. 25, 2023



# Appendix V

## Proposed Solutions Cost Estimate

Tuesday, October 31, 2023



Project ID W-1

Item	Description	Qty	Unit	Rate (2020)	Amount (2020)	Amount (2023)
<b>A.</b>	<b>Construction</b>					
	Supply and install 150 mm PVC pressure pipe	136	m	\$ 925	\$ 125,800	\$ 146,842
	Supply and install 150 mm gate valve and valve box	3	each	\$ 5,250	\$ 15,750	\$ 18,384
	Supply and install new hydrant, complete	2	each	\$ 12,818	\$ 25,636	\$ 29,924
	Connect new watermain to existing watermain, (all sizes) complete	3	each	\$ 9,000	\$ 27,000	\$ 31,516
<b>Capital Cost</b>					\$ 194,186	\$ 226,667
<b>B.</b>	<b>Project Delivery Allowance</b>					
	Multiplier for Preliminary Design, Tendering, Construction Services, Insurance, Mobilization & Demobilization, Traffic Control, Utility Impacts/Relocations			25%	\$ 48,547	\$ 56,667
<b>Sub-Total (A+B)</b>					\$ 242,733	\$ 283,334
<b>C.</b>	<b>Contingency</b>					
	Class 4 Cost Estimate Multiplier			25%	\$ 60,683	\$ 85,573
<b>Sub-Total (A+B+C)</b>					\$ 303,416	\$ 354,168
<b>HST (@ 13%)</b>					\$	\$ 46,042
<b>Total Project Cost</b>					\$	\$ 400,209

City of Richmond Hill  
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Project ID W-2

Item	Description	Qty	Unit	Rate (2020)	Amount (2020)	Amount (2023)
<b>A.</b>	<b>Construction</b>					
	Supply and install 300 mm PVC pressure pipe, (Horizontal Directional Drill Method)	90 m		\$ 2,525	\$ 227,250	\$ 265,262
	Supply and install 200 mm PVC pressure pipe	55 m		\$ 1,350	\$ 74,250	\$ 86,670
	Supply and install 300 mm PVC pressure pipe	170 m		\$ 1,750	\$ 297,500	\$ 347,263
	Supply and install 300 mm gate valve and valve box	3 each		\$ 7,400	\$ 22,200	\$ 25,913
	Supply and install new hydrant, complete	4 each		\$ 12,818	\$ 51,272	\$ 59,848
	Connect new watermain to existing watermain, (all sizes) complete	2 each		\$ 9,000	\$ 18,000	\$ 21,011
	<b>Capital Cost</b>				\$ 690,472	\$ 805,967
<b>B.</b>	<b>Project Delivery Allowance</b>					
	Multiplier for Preliminary Design, Tendering, Construction Services, Insurance, Mobilization & Demobilization, Traffic Control, Utility Impacts/Relocations			25%	\$ 172,618	\$ 201,492
	<b>Sub-Total (A+B)</b>				\$ 863,090	\$ 1,007,458
<b>C.</b>	<b>Contingency</b>					
	Class 4 Cost Estimate Multiplier			25%	\$ 215,773	\$ 304,276
	<b>Sub-Total (A+B+C)</b>				\$ 1,078,863	\$ 1,259,323
	<b>HST (@ 13%)</b>					\$ 163,712
	<b>Total Project Cost</b>					\$ 1,423,035

City of Richmond Hill  
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Project ID W-2.1

Item	Description	Qty	Unit	Rate (2020)	Amount (2020)	Amount (2023)
<b>A.</b>	<b>Construction</b>					
	Supply and install 300 mm PVC pressure pipe, (Horizontal Directional Drill Method)	50	m	\$ 2,525	\$ 126,250	\$ 147,368
	Supply and install 200 mm PVC pressure pipe	0	m	\$ 1,350	\$ -	\$ -
	Supply and install 300 mm PVC pressure pipe	0	m	\$ 1,750	\$ -	\$ -
	Supply and install 300 mm gate valve and valve box	1	each	\$ 7,400	\$ 7,400	\$ 8,638
	Supply and install new hydrant, complete	0	each	\$ 12,818	\$ -	\$ -
	Connect new watermain to existing watermain, (all sizes) complete	1	each	\$ 9,000	\$ 9,000	\$ 10,505
	<b>Capital Cost</b>				\$ 142,650	\$ 166,511
<b>B.</b>	<b>Project Delivery Allowance</b>					
	Multiplier for Preliminary Design, Tendering, Construction Services, Insurance, Mobilization & Demobilization, Traffic Control, Utility Impacts/Relocations			25%	\$ 35,663	\$ 41,628
	<b>Sub-Total (A+B)</b>				\$ 178,313	\$ 208,139
<b>C.</b>	<b>Contingency</b>					
	Class 4 Cost Estimate Multiplier			25%	\$ 44,578	\$ 62,863
	<b>Sub-Total (A+B+C)</b>				\$ 222,891	\$ 260,173
	<b>HST (@ 13%)</b>					\$ 33,823
	<b>Total Project Cost</b>					\$ 293,996

City of Richmond Hill  
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Project ID W-2.2

Item	Description	Qty	Unit	Rate (2020)	Amount (2020)	Amount (2023)
<b>A.</b>	<b>Construction</b>					
	Supply and install 300 mm PVC pressure pipe, (Horizontal Directional Drill Method)	40	m	\$ 2,525	\$ 101,000	\$ 117,894
	Supply and install 200 mm PVC pressure pipe	0	m	\$ 1,350	\$ -	\$ -
	Supply and install 300 mm PVC pressure pipe	170	m	\$ 1,750	\$ 297,500	\$ 347,263
	Supply and install 300 mm gate valve and valve box	2	each	\$ 7,400	\$ 14,800	\$ 17,276
	Supply and install new hydrant, complete	3	each	\$ 12,818	\$ 38,454	\$ 44,886
	Connect new watermain to existing watermain, (all sizes) complete	1	each	\$ 9,000	\$ 9,000	\$ 10,505
	<b>Capital Cost</b>				\$ 460,754	\$ 537,824
<b>B.</b>	<b>Project Delivery Allowance</b>					
	Multiplier for Preliminary Design, Tendering, Construction Services, Insurance, Mobilization & Demobilization, Traffic Control, Utility Impacts/Relocations			25%	\$ 115,189	\$ 134,456
	<b>Sub-Total (A+B)</b>				\$ 575,943	\$ 672,280
<b>C.</b>	<b>Contingency</b>					
	Class 4 Cost Estimate Multiplier			25%	\$ 143,986	\$ 203,044
	<b>Sub-Total (A+B+C)</b>				\$ 719,928	\$ 840,350
	<b>HST (@ 13%)</b>					\$ 109,245
	<b>Total Project Cost</b>					\$ 949,595

City of Richmond Hill  
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Project ID W-2.3

Item	Description	Qty	Unit	Rate (2020)	Amount (2020)	Amount (2023)
<b>A.</b>	<b>Construction</b>					
	Supply and install 300 mm PVC pressure pipe, (Horizontal Directional Drill Method)	0	m	\$ 2,525	\$ -	\$ -
	Supply and install 200 mm PVC pressure pipe	55	m	\$ 1,350	\$ 74,250	\$ 86,670
	Supply and install 300 mm PVC pressure pipe	0	m	\$ 1,750	\$ -	\$ -
	Supply and install 300 mm gate valve and valve box	0	each	\$ 7,400	\$ -	\$ -
	Supply and install new hydrant, complete	1	each	\$ 12,818	\$ 12,818	\$ 14,962
	Connect new watermain to existing watermain, (all sizes) complete	0	each	\$ 9,000	\$ -	\$ -
	<b>Capital Cost</b>				\$ 87,068	\$ 101,632
<b>B.</b>	<b>Project Delivery Allowance</b>					
	Multiplier for Preliminary Design, Tendering, Construction Services, Insurance, Mobilization & Demobilization, Traffic Control, Utility Impacts/Relocations			25%	\$ 21,767	\$ 25,408
	<b>Sub-Total (A+B)</b>				\$ 108,835	\$ 127,040
<b>C.</b>	<b>Contingency</b>					
	Class 4 Cost Estimate Multiplier			25%	\$ 27,209	\$ 38,369
	<b>Sub-Total (A+B+C)</b>				\$ 136,044	\$ 158,800
	<b>HST (@ 13%)</b>					\$ 20,644
	<b>Total Project Cost</b>					\$ 179,444

City of Richmond Hill  
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Project ID W-3

Item	Description	Qty	Unit	Rate (2020)	Amount (2020)	Amount (2023)
<b>A.</b>	<b>Construction</b>					
	Supply and install 250 mm PVC pressure pipe	55	m	\$ 1,600	\$ 88,000	\$ 102,720
	Supply and install 300 mm PVC pressure pipe	370	m	\$ 1,750	\$ 647,500	\$ 755,807
	Supply and install 300 mm gate valve and valve box	2	each	\$ 7,400	\$ 14,800	\$ 17,276
	Supply and install new hydrant, complete	5	each	\$ 12,818	\$ 64,090	\$ 74,810
	Connect new watermain to existing watermain, (all sizes) complete	3	each	\$ 9,000	\$ 27,000	\$ 31,516
	<b>Capital Cost</b>				\$ 841,390	\$ 982,128
<b>B.</b>	<b>Project Delivery Allowance</b>					
	Multiplier for Preliminary Design, Tendering, Construction Services, Insurance, Mobilization & Demobilization, Traffic Control, Utility Impacts/Relocations			25%	\$ 210,348	\$ 245,532
	<b>Sub-Total (A+B)</b>				\$ 1,051,738	\$ 1,227,661
<b>C.</b>	<b>Contingency</b>					
	Class 4 Cost Estimate Multiplier			25%	\$ 262,934	\$ 370,782
	<b>Sub-Total (A+B+C)</b>				\$ 1,314,672	\$ 1,534,576
	<b>HST (@ 13%)</b>					\$ 199,495
	<b>Total Project Cost</b>					\$ 1,734,071

City of Richmond Hill  
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Project ID W-3.1

Item	Description	Qty	Unit	Rate (2020)	Amount (2020)	Amount (2023)
<b>A.</b>	<b>Construction</b>					
	Supply and install 250 mm PVC pressure pipe	55	m	\$ 1,600	\$ 88,000	\$ 102,720
	Supply and install 300 mm PVC pressure pipe		m	\$ 1,750	\$ -	\$ -
	Supply and install 300 mm gate valve and valve box		each	\$ 7,400	\$ -	\$ -
	Supply and install new hydrant, complete	1	each	\$ 12,818	\$ 12,818	\$ 14,962
	Connect new watermain to existing watermain, (all sizes) complete	1	each	\$ 9,000	\$ 9,000	\$ 10,505
	<b>Capital Cost</b>				\$ 109,818	\$ 128,187
<b>B.</b>	<b>Project Delivery Allowance</b>					
	Multiplier for Preliminary Design, Tendering, Construction Services, Insurance, Mobilization & Demobilization, Traffic Control, Utility Impacts/Relocations			25%	\$ 27,455	\$ 32,047
	<b>Sub-Total (A+B)</b>				\$ 137,273	\$ 160,234
<b>C.</b>	<b>Contingency</b>					
	Class 4 Cost Estimate Multiplier			25%	\$ 34,318	\$ 48,394
	<b>Sub-Total (A+B+C)</b>				\$ 171,591	\$ 200,292
	<b>HST (@ 13%)</b>					\$ 26,038
	<b>Total Project Cost</b>					\$ 226,330

City of Richmond Hill  
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Project ID W-3.2

Item	Description	Qty	Unit	Rate (2020)	Amount (2020)	Amount (2023)
<b>A.</b>	<b>Construction</b>					
	Supply and install 250 mm PVC pressure pipe	0	m	\$ 1,600	\$ -	\$ -
	Supply and install 300 mm PVC pressure pipe	235	m	\$ 1,750	\$ 411,250	\$ 480,039
	Supply and install 300 mm gate valve and valve box	1	each	\$ 7,400	\$ 7,400	\$ 8,638
	Supply and install new hydrant, complete	3	each	\$ 12,818	\$ 38,454	\$ 44,886
	Connect new watermain to existing watermain, (all sizes) complete	1	each	\$ 9,000	\$ 9,000	\$ 10,505
	<b>Capital Cost</b>				\$ 466,104	\$ 544,069
<b>B.</b>	<b>Project Delivery Allowance</b>					
	Multiplier for Preliminary Design, Tendering, Construction Services, Insurance, Mobilization & Demobilization, Traffic Control, Utility Impacts/Relocations			25%	\$ 116,526	\$ 136,017
	<b>Sub-Total (A+B)</b>				\$ 582,630	\$ 680,086
<b>C.</b>	<b>Contingency</b>					
	Class 4 Cost Estimate Multiplier			25%	\$ 145,658	\$ 205,402
	<b>Sub-Total (A+B+C)</b>				\$ 728,288	\$ 850,107
	<b>HST (@ 13%)</b>					\$ 110,514
	<b>Total Project Cost</b>					\$ 960,621

City of Richmond Hill  
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Project ID W-3.3

Item	Description	Qty	Unit	Rate (2020)	Amount (2020)	Amount (2023)
<b>A.</b>	<b>Construction</b>					
	Supply and install 250 mm PVC pressure pipe	0	m	\$ 1,600	\$ -	\$ -
	Supply and install 300 mm PVC pressure pipe	135	m	\$ 1,750	\$ 236,250	\$ 275,767
	Supply and install 300 mm gate valve and valve box	1	each	\$ 7,400	\$ 7,400	\$ 8,638
	Supply and install new hydrant, complete	1	each	\$ 12,818	\$ 12,818	\$ 14,962
	Connect new watermain to existing watermain, (all sizes) complete	1	each	\$ 9,000	\$ 9,000	\$ 10,505
	<b>Capital Cost</b>				\$ 265,468	\$ 309,873
<b>B.</b>	<b>Project Delivery Allowance</b>					
	Multiplier for Preliminary Design, Tendering, Construction Services, Insurance, Mobilization & Demobilization, Traffic Control, Utility Impacts/Relocations			25%	\$ 66,367	\$ 77,468
	<b>Sub-Total (A+B)</b>				\$ 331,835	\$ 387,341
<b>C.</b>	<b>Contingency</b>					
	Class 4 Cost Estimate Multiplier			25%	\$ 82,959	\$ 116,986
	<b>Sub-Total (A+B+C)</b>				\$ 414,794	\$ 484,176
	<b>HST (@ 13%)</b>					\$ 62,943
	<b>Total Project Cost</b>					\$ 547,119

City of Richmond Hill  
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Project ID W-4

Item	Description	Qty	Unit	Rate (2020)	Amount (2020)	Amount (2023)
<b>A.</b>	<b>Construction</b>					
	Supply and install 250 mm PVC pressure pipe, (Horizontal Directional Drill Method)	110 m		\$ 2,325	\$ 255,750	\$ 298,529
	Supply and install 250 mm PVC pressure pipe	290 m		\$ 1,600	\$ 464,000	\$ 541,613
	Supply and install 250 mm gate valve and valve box	3 each		\$ 6,450	\$ 19,350	\$ 22,587
	Supply and install new hydrant, complete	4 each		\$ 12,818	\$ 51,272	\$ 59,848
	Connect new watermain to existing watermain, (all sizes) complete	2 each		\$ 9,000	\$ 18,000	\$ 21,011
	<b>Capital Cost</b>				\$ 808,372	\$ 943,588
<b>B.</b>	<b>Project Delivery Allowance</b>					
	Multiplier for Preliminary Design, Tendering, Construction Services, Insurance, Mobilization & Demobilization, Traffic Control, Utility Impacts/Relocations			25%	\$ 202,093	\$ 235,897
	<b>Sub-Total (A+B)</b>				\$ 1,010,465	\$ 1,179,484
<b>C.</b>	<b>Contingency</b>					
	Class 4 Cost Estimate Multiplier			25%	\$ 252,616	\$ 356,231
	<b>Sub-Total (A+B+C)</b>				\$ 1,263,081	\$ 1,474,356
	<b>HST (@ 13%)</b>					\$ 191,666
	<b>Total Project Cost</b>					\$ 1,666,022

City of Richmond Hill  
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Project ID W-5

Item	Description	Qty	Unit	Rate (2020)	Amount (2020)	Amount (2023)
<b>A.</b>	<b>Construction</b>					
	Supply and install 300 mm PVC pressure pipe	345	m	\$ 1,750	\$ 603,750	\$ 704,739
	Supply and install 300 mm gate valve and valve box	2	each	\$ 7,400	\$ 14,800	\$ 17,276
	Supply and install new hydrant, complete	4	each	\$ 12,818	\$ 51,272	\$ 59,848
	Connect new watermain to existing watermain, (all sizes) complete	2	each	\$ 9,000	\$ 18,000	\$ 21,011
	<b>Capital Cost</b>				\$ 687,822	\$ 802,873
<b>B.</b>	<b>Project Delivery Allowance</b>					
	Multiplier for Preliminary Design, Tendering, Construction Services, Insurance, Mobilization & Demobilization, Traffic Control, Utility Impacts/Relocations			25%	\$ 171,956	\$ 200,718
	<b>Sub-Total (A+B)</b>				\$ 859,778	\$ 1,003,592
<b>C.</b>	<b>Contingency</b>					
	Class 4 Cost Estimate Multiplier			25%	\$ 214,944	\$ 303,108
	<b>Sub-Total (A+B+C)</b>				\$ 1,074,722	\$ 1,254,490
	<b>HST (@ 13%)</b>					\$ 163,084
	<b>Total Project Cost</b>					\$ 1,417,573

City of Richmond Hill  
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Project ID W-6

Item	Description	Qty	Unit	Rate (2020)	Amount (2020)	Amount (2023)
<b>A.</b>	<b>Construction</b>					
	Supply and install 300 mm PVC pressure pipe, (Horizontal Directional Drill Method)	25	m	\$ 2,525	\$ 63,125	\$ 73,684
	Supply and install 250 mm PVC pressure pipe, (Horizontal Directional Drill Method)	35	m	\$ 2,325	\$ 81,375	\$ 94,987
	Supply and install 300 mm gate valve and valve box	1	each	\$ 7,400	\$ 7,400	\$ 8,638
	Supply and install 250 mm gate valve and valve box	1	each	\$ 6,450	\$ 6,450	\$ 7,529
	Connect new watermain to existing watermain, (all sizes) complete	3	each	\$ 9,000	\$ 27,000	\$ 31,516
	<b>Capital Cost</b>				\$ 185,350	\$ 216,353
<b>B.</b>	<b>Project Delivery Allowance</b>					
	Multiplier for Preliminary Design, Tendering, Construction Services, Insurance, Mobilization & Demobilization, Traffic Control, Utility Impacts/Relocations			25%	\$ 46,338	\$ 54,088
	<b>Sub-Total (A+B)</b>				\$ 231,688	\$ 270,442
<b>C.</b>	<b>Contingency</b>					
	Class 4 Cost Estimate Multiplier			25%	\$ 57,922	\$ 81,680
	<b>Sub-Total (A+B+C)</b>				\$ 289,609	\$ 338,052
	<b>HST (@ 13%)</b>					\$ 43,947
	<b>Total Project Cost</b>					\$ 381,999

City of Richmond Hill  
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Project ID W-6.1

Item	Description	Qty	Unit	Rate (2020)	Amount (2020)	Amount (2023)
<b>A.</b>	<b>Construction</b>					
	Supply and install 300 mm PVC pressure pipe, (Horizontal Directional Drill Method)	25	m	\$ 2,525	\$ 63,125	\$ 73,684
	Supply and install 250 mm PVC pressure pipe, (Horizontal Directional Drill Method)	0	m	\$ 2,325	\$ -	\$ -
	Supply and install 300 mm gate valve and valve box	1	each	\$ 7,400	\$ 7,400	\$ 8,638
	Supply and install 250 mm gate valve and valve box	0	each	\$ 6,450	\$ -	\$ -
	Connect new watermain to existing watermain, (all sizes) complete	1	each	\$ 9,000	\$ 9,000	\$ 10,505
	<b>Capital Cost</b>				\$ 79,525	\$ 92,827
<b>B.</b>	<b>Project Delivery Allowance</b>					
	Multiplier for Preliminary Design, Tendering, Construction Services, Insurance, Mobilization & Demobilization, Traffic Control, Utility Impacts/Relocations			25%	\$ 19,881	\$ 23,207
	<b>Sub-Total (A+B)</b>				\$ 99,406	\$ 116,034
<b>C.</b>	<b>Contingency</b>					
	Class 4 Cost Estimate Multiplier			25%	\$ 24,852	\$ 35,045
	<b>Sub-Total (A+B+C)</b>				\$ 124,258	\$ 145,042
	<b>HST (@ 13%)</b>					\$ 18,855
	<b>Total Project Cost</b>					\$ 163,898

City of Richmond Hill  
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Project ID W-6.2

Item	Description	Qty	Unit	Rate (2020)	Amount (2020)	Amount (2023)
<b>A.</b>	<b>Construction</b>					
	Supply and install 300 mm PVC pressure pipe, (Horizontal Directional Drill Method)	0 m		\$ 2,525	\$ -	\$ -
	Supply and install 250 mm PVC pressure pipe, (Horizontal Directional Drill Method)	35 m		\$ 2,325	\$ 81,375	\$ 94,987
	Supply and install 300 mm gate valve and valve box	0 each		\$ 7,400	\$ -	\$ -
	Supply and install 250 mm gate valve and valve box	1 each		\$ 6,450	\$ 6,450	\$ 7,529
	Connect new watermain to existing watermain, (all sizes) complete	2 each		\$ 9,000	\$ 18,000	\$ 21,011
	<b>Capital Cost</b>				\$ 105,825	\$ 123,526
<b>B.</b>	<b>Project Delivery Allowance</b>					
	Multiplier for Preliminary Design, Tendering, Construction Services, Insurance, Mobilization & Demobilization, Traffic Control, Utility Impacts/Relocations			25%	\$ 26,456	\$ 30,882
	<b>Sub-Total (A+B)</b>				\$ 132,281	\$ 154,408
<b>C.</b>	<b>Contingency</b>					
	Class 4 Cost Estimate Multiplier			25%	\$ 33,070	\$ 46,635
	<b>Sub-Total (A+B+C)</b>				\$ 165,352	\$ 193,010
	<b>HST (@ 13%)</b>					\$ 25,091
	<b>Total Project Cost</b>					\$ 218,101

City of Richmond Hill  
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Project ID W-7

Item	Description	Qty	Unit	Rate (2020)	Amount (2020)	Amount (2023)
<b>A.</b>	<b>Construction</b>					
	Supply and install 250 mm PVC pressure pipe	450	m	\$ 1,600	\$ 720,000	\$ 840,434
	Supply and install 250 mm PVC pressure pipe, (Horizontal Directional Drill Method)	15	m	\$ 2,325	\$ 34,875	\$ 40,709
	Supply and install 300 mm PVC pressure pipe	810	m	\$ 1,750	\$ 1,417,500	\$ 1,654,604
	Supply and install 300 mm PVC pressure pipe, (Horizontal Directional Drill Method)	25	m	\$ 2,525	\$ 63,125	\$ 73,684
	Supply and install 250 mm gate valve and valve box	7	each	\$ 6,450	\$ 45,150	\$ 52,702
	Supply and install 300 mm gate valve and valve box	14	each	\$ 7,400	\$ 103,600	\$ 120,929
	Supply and install new hydrant, complete	13	each	\$ 12,818	\$ 166,634	\$ 194,507
	Connect new watermain to existing watermain, (all sizes) complete	11	each	\$ 9,000	\$ 99,000	\$ 115,560
	<b>Capital Cost</b>				\$ 2,649,884	\$ 3,093,127
<b>B.</b>	<b>Project Delivery Allowance</b>					
	Multiplier for Preliminary Design, Tendering, Construction Services, Insurance, Mobilization & Demobilization, Traffic Control, Utility Impacts/Relocations			25%	\$ 662,471	\$ 773,282
	<b>Sub-Total (A+B)</b>				\$ 3,312,355	\$ 3,866,409
<b>C.</b>	<b>Contingency</b>					
	Class 4 Cost Estimate Multiplier			25%	\$ 828,089	\$ 1,167,745
	<b>Sub-Total (A+B+C)</b>				\$ 4,140,444	\$ 4,833,012
	<b>HST (@ 13%)</b>					\$ 628,292
	<b>Total Project Cost</b>					\$ 5,461,303

City of Richmond Hill  
UMESP



Project ID W-7.1

Item	Description	Qty	Unit	Rate (2020)	Amount (2020)	Amount (2023)
<b>A.</b>	<b>Construction</b>					
	Supply and install 250 mm PVC pressure pipe	450	m	\$ 1,600	\$ 720,000	\$ 840,434
	Supply and install 250 mm PVC pressure pipe, (Horizontal Directional Drill Method)	15	m	\$ 2,325	\$ 34,875	\$ 40,709
	Supply and install 250 mm gate valve and valve box	7	each	\$ 6,450	\$ 45,150	\$ 52,702
	Supply and install new hydrant, complete	5	each	\$ 12,818	\$ 64,090	\$ 74,810
	Connect new watermain to existing watermain, (all sizes) complete	4	each	\$ 9,000	\$ 36,000	\$ 42,022
	<b>Capital Cost</b>				\$ 900,115	\$ 1,050,676
<b>B.</b>	<b>Project Delivery Allowance</b>					
	Multiplier for Preliminary Design, Tendering, Construction Services, Insurance, Mobilization & Demobilization, Traffic Control, Utility Impacts/Relocations			25%	\$ 225,029	\$ 262,669
	<b>Sub-Total (A+B)</b>				\$ 1,125,144	\$ 1,313,345
<b>C.</b>	<b>Contingency</b>					
	Class 4 Cost Estimate Multiplier			25%	\$ 281,286	\$ 396,661
	<b>Sub-Total (A+B+C)</b>				\$ 1,406,430	\$ 1,641,682
	<b>HST (@ 13%)</b>					\$ 213,419
	<b>Total Project Cost</b>					\$ 1,855,100

City of Richmond Hill  
UMESP



Project ID W-7.2

Item	Description	Qty	Unit	Rate (2020)	Amount (2020)	Amount (2023)
<b>A.</b>	<b>Construction</b>					
	Supply and install 300 mm PVC pressure pipe	810	m	\$ 1,750	\$ 1,417,500	\$ 1,654,604
	Supply and install 300 mm PVC pressure pipe, (Horizontal Directional Drill Method)	25	m	\$ 2,525	\$ 63,125	\$ 73,684
	Supply and install 300 mm gate valve and valve box	14	each	\$ 7,400	\$ 103,600	\$ 120,929
	Supply and install new hydrant, complete	8	each	\$ 12,818	\$ 102,544	\$ 119,696
	Connect new watermain to existing watermain, (all sizes) complete	7	each	\$ 9,000	\$ 63,000	\$ 73,538
	<b>Capital Cost</b>				\$ 1,749,769	\$ 2,042,451
<b>B.</b>	<b>Project Delivery Allowance</b>					
	Multiplier for Preliminary Design, Tendering, Construction Services, Insurance, Mobilization & Demobilization, Traffic Control, Utility Impacts/Relocations			25%	\$ 437,442	\$ 510,613
	<b>Sub-Total (A+B)</b>				\$ 2,187,211	\$ 2,553,064
<b>C.</b>	<b>Contingency</b>					
	Class 4 Cost Estimate Multiplier			25%	\$ 546,803	\$ 771,084
	<b>Sub-Total (A+B+C)</b>				\$ 2,734,014	\$ 3,191,330
	<b>HST (@ 13%)</b>					\$ 414,873
	<b>Total Project Cost</b>					\$ 3,606,203

City of Richmond Hill  
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Project ID W-8

Item	Description	Qty	Unit	Rate (2020)	Amount (2020)	Amount (2023)
<b>A.</b>	<b>Construction</b>					
	Supply and install 150 mm PVC pressure pipe, (Horizontal Directional Drill Method)	25	m	\$ 1,925	\$ 48,125	\$ 56,175
	Supply and install 300 mm PVC pressure pipe, (Horizontal Directional Drill Method)	220	m	\$ 2,525	\$ 555,500	\$ 648,418
	Supply and install 150 mm gate valve and valve box	1	each	\$ 5,250	\$ 5,250	\$ 6,128
	Supply and install 300 mm gate valve and valve box	3	each	\$ 7,400	\$ 22,200	\$ 25,913
	Supply and install new hydrant, complete	3	each	\$ 12,818	\$ 38,454	\$ 44,886
	Connect new watermain to existing watermain, (all sizes) complete	4	each	\$ 9,000	\$ 36,000	\$ 42,022
	<b>Capital Cost</b>				\$ 705,529	\$ 823,542
<b>B.</b>	<b>Project Delivery Allowance</b>					
	Multiplier for Preliminary Design, Tendering, Construction Services, Insurance, Mobilization & Demobilization, Traffic Control, Utility Impacts/Relocations			25%	\$ 176,382	\$ 205,886
	<b>Sub-Total (A+B)</b>				\$ 881,911	\$ 1,029,428
<b>C.</b>	<b>Contingency</b>					
	Class 4 Cost Estimate Multiplier			25%	\$ 220,478	\$ 310,911
	<b>Sub-Total (A+B+C)</b>				\$ 1,102,389	\$ 1,286,785
	<b>HST (@ 13%)</b>					\$ 167,282
	<b>Total Project Cost</b>					\$ 1,454,067

City of Richmond Hill  
UMESP



Project ID W-8.1

Item	Description	Qty	Unit	Rate (2020)	Amount (2020)	Amount (2023)
<b>A.</b>	<b>Construction</b>					
	Supply and install 150 mm PVC pressure pipe, (Horizontal Directional Drill Method)	0	m	\$ 1,925	\$ -	\$ -
	Supply and install 300 mm PVC pressure pipe, (Horizontal Directional Drill Method)	140	m	\$ 2,525	\$ 353,500	\$ 412,630
	Supply and install 150 mm gate valve and valve box	0	each	\$ 5,250	\$ -	\$ -
	Supply and install 300 mm gate valve and valve box	2	each	\$ 7,400	\$ 14,800	\$ 17,276
	Supply and install new hydrant, complete	2	each	\$ 12,818	\$ 25,636	\$ 29,924
	Connect new watermain to existing watermain, (all sizes) complete	2	each	\$ 9,000	\$ 18,000	\$ 21,011
	<b>Capital Cost</b>				\$ 411,936	\$ 480,840
<b>B.</b>	<b>Project Delivery Allowance</b>					
	Multiplier for Preliminary Design, Tendering, Construction Services, Insurance, Mobilization & Demobilization, Traffic Control, Utility Impacts/Relocations			25%	\$ 102,984	\$ 120,210
	<b>Sub-Total (A+B)</b>				\$ 514,920	\$ 601,050
<b>C.</b>	<b>Contingency</b>					
	Class 4 Cost Estimate Multiplier			25%	\$ 128,730	\$ 181,531
	<b>Sub-Total (A+B+C)</b>				\$ 643,650	\$ 751,313
	<b>HST (@ 13%)</b>					\$ 97,671
	<b>Total Project Cost</b>					\$ 848,983

City of Richmond Hill  
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Project ID W-8.2

Item	Description	Qty	Unit	Rate (2020)	Amount (2020)	Amount (2023)
<b>A.</b>	<b>Construction</b>					
	Supply and install 150 mm PVC pressure pipe, (Horizontal Directional Drill Method)		0 m	\$ 1,925	\$ -	\$ -
	Supply and install 300 mm PVC pressure pipe, (Horizontal Directional Drill Method)		80 m	\$ 2,525	\$ 202,000	\$ 235,788
	Supply and install 150 mm gate valve and valve box		0 each	\$ 5,250	\$ -	\$ -
	Supply and install 300 mm gate valve and valve box		1 each	\$ 7,400	\$ 7,400	\$ 8,638
	Supply and install new hydrant, complete		1 each	\$ 12,818	\$ 12,818	\$ 14,962
	Connect new watermain to existing watermain, (all sizes) complete		0 each	\$ 9,000	\$ -	\$ -
	<b>Capital Cost</b>				\$ 222,218	\$ 259,388
<b>B.</b>	<b>Project Delivery Allowance</b>					
	Multiplier for Preliminary Design, Tendering, Construction Services, Insurance, Mobilization & Demobilization, Traffic Control, Utility Impacts/Relocations			25%	\$ 55,555	\$ 64,847
	<b>Sub-Total (A+B)</b>				\$ 277,773	\$ 324,235
<b>C.</b>	<b>Contingency</b>					
	Class 4 Cost Estimate Multiplier			25%	\$ 69,443	\$ 97,926
	<b>Sub-Total (A+B+C)</b>				\$ 347,216	\$ 405,294
	<b>HST (@ 13%)</b>					\$ 52,688
	<b>Total Project Cost</b>					\$ 457,982

City of Richmond Hill  
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Project ID W-8.3

Item	Description	Qty	Unit	Rate (2020)	Amount (2020)	Amount (2023)
<b>A.</b>	<b>Construction</b>					
	Supply and install 150 mm PVC pressure pipe, (Horizontal Directional Drill Method)	25	m	\$ 1,925	\$ 48,125	\$ 56,175
	Supply and install 300 mm PVC pressure pipe, (Horizontal Directional Drill Method)	0	m	\$ 2,525	\$ -	\$ -
	Supply and install 150 mm gate valve and valve box	1	each	\$ 5,250	\$ 5,250	\$ 6,128
	Supply and install 300 mm gate valve and valve box	0	each	\$ 7,400	\$ -	\$ -
	Supply and install new hydrant, complete	0	each	\$ 12,818	\$ -	\$ -
	Connect new watermain to existing watermain, (all sizes) complete	2	each	\$ 9,000	\$ 18,000	\$ 21,011
	<b>Capital Cost</b>				\$ 71,375	\$ 83,314
<b>B.</b>	<b>Project Delivery Allowance</b>					
	Multiplier for Preliminary Design, Tendering, Construction Services, Insurance, Mobilization & Demobilization, Traffic Control, Utility Impacts/Relocations			25%	\$ 17,844	\$ 20,828
	<b>Sub-Total (A+B)</b>				\$ 89,219	\$ 104,142
<b>C.</b>	<b>Contingency</b>					
	Class 4 Cost Estimate Multiplier			25%	\$ 22,305	\$ 31,453
	<b>Sub-Total (A+B+C)</b>				\$ 111,523	\$ 130,178
	<b>HST (@ 13%)</b>					\$ 16,923
	<b>Total Project Cost</b>					\$ 147,101

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Project ID W-9

Item	Description	Qty	Unit	Rate (2020)	Amount (2020)	Amount (2023)
<b>A.</b>	<b>Construction</b>					
	Supply and install 200 mm PVC pressure pipe	110	m	\$ 1,350	\$ 148,500	\$ 173,339
	Supply and install 200 mm PVC pressure pipe, (Horizontal Directional Drill Method)	30	m	\$ 2,125	\$ 63,750	\$ 74,413
	Supply and install 250 mm PVC pressure pipe	85	m	\$ 1,600	\$ 136,000	\$ 158,749
	Supply and install 250 mm PVC pressure pipe, (Horizontal Directional Drill Method)	25	m	\$ 2,325	\$ 58,125	\$ 67,848
	Supply and install 200 mm gate valve and valve box	2	each	\$ 5,500	\$ 11,000	\$ 12,840
	Supply and install 250 mm gate valve and valve box	3	each	\$ 6,450	\$ 19,350	\$ 22,587
	Supply and install new hydrant, complete	3	each	\$ 12,818	\$ 38,454	\$ 44,886
	Connect new watermain to existing watermain, (all sizes) complete	5	each	\$ 9,000	\$ 45,000	\$ 52,527
	<b>Capital Cost</b>				\$ 520,179	\$ 607,189
<b>B.</b>	<b>Project Delivery Allowance</b>					
	Multiplier for Preliminary Design, Tendering, Construction Services, Insurance, Mobilization & Demobilization, Traffic Control, Utility Impacts/Relocations			25%	\$ 130,045	\$ 151,797
	<b>Sub-Total (A+B)</b>				\$ 650,224	\$ 758,986
<b>C.</b>	<b>Contingency</b>					
	Class 4 Cost Estimate Multiplier			25%	\$ 162,556	\$ 229,231
	<b>Sub-Total (A+B+C)</b>				\$ 812,780	\$ 948,733
	<b>HST (@ 13%)</b>				\$	\$ 123,335
	<b>Total Project Cost</b>				\$	\$ 1,072,068

City of Richmond Hill  
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Project ID W-9.1

Item	Description	Qty	Unit	Rate (2020)	Amount (2020)	Amount (2023)
<b>A.</b>	<b>Construction</b>					
	Supply and install 200 mm PVC pressure pipe	110	m	\$ 1,350	\$ 148,500	\$ 173,339
	Supply and install 200 mm PVC pressure pipe, (Horizontal Directional Drill Method)	30	m	\$ 2,125	\$ 63,750	\$ 74,413
	Supply and install 200 mm gate valve and valve box	2	each	\$ 5,500	\$ 11,000	\$ 12,840
	Supply and install new hydrant, complete	2	each	\$ 12,818	\$ 25,636	\$ 29,924
	Connect new watermain to existing watermain, (all sizes) complete	2	each	\$ 9,000	\$ 18,000	\$ 21,011
	<b>Capital Cost</b>				\$ 266,886	\$ 311,528
<b>B.</b>	<b>Project Delivery Allowance</b>					
	Multiplier for Preliminary Design, Tendering, Construction Services, Insurance, Mobilization & Demobilization, Traffic Control, Utility Impacts/Relocations			25%	\$ 66,722	\$ 77,882
	<b>Sub-Total (A+B)</b>				\$ 333,608	\$ 389,410
<b>C.</b>	<b>Contingency</b>					
	Class 4 Cost Estimate Multiplier			25%	\$ 83,402	\$ 117,611
	<b>Sub-Total (A+B+C)</b>				\$ 417,009	\$ 486,762
	<b>HST (@ 13%)</b>					\$ 63,279
	<b>Total Project Cost</b>					\$ 550,041

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Project ID W-9.2

Item	Description	Qty	Unit	Rate (2020)	Amount (2020)	Amount (2023)
<b>A.</b>	<b>Construction</b>					
	Supply and install 250 mm PVC pressure pipe	85	m	\$ 1,600	\$ 136,000	\$ 158,749
	Supply and install 250 mm PVC pressure pipe, (Horizontal Directional Drill Method)	25	m	\$ 2,325	\$ 58,125	\$ 67,848
	Supply and install 250 mm gate valve and valve box	3	each	\$ 6,450	\$ 19,350	\$ 22,587
	Supply and install new hydrant, complete	1	each	\$ 12,818	\$ 12,818	\$ 14,962
	Connect new watermain to existing watermain, (all sizes) complete	3	each	\$ 9,000	\$ 27,000	\$ 31,516
	<b>Capital Cost</b>				\$ 253,293	\$ 295,661
<b>B.</b>	<b>Project Delivery Allowance</b>					
	Multiplier for Preliminary Design, Tendering, Construction Services, Insurance, Mobilization & Demobilization, Traffic Control, Utility Impacts/Relocations			25%	\$ 63,323	\$ 73,915
	<b>Sub-Total (A+B)</b>				\$ 316,616	\$ 369,576
<b>C.</b>	<b>Contingency</b>					
	Class 4 Cost Estimate Multiplier			25%	\$ 79,154	\$ 111,621
	<b>Sub-Total (A+B+C)</b>				\$ 395,770	\$ 461,970
	<b>HST (@ 13%)</b>					\$ 60,056
	<b>Total Project Cost</b>					\$ 522,027

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Project ID W-10

Item	Description	Qty	Unit	Rate (2020)	Amount (2020)	Amount (2023)
<b>A.</b>	<b>Construction</b>					
	Supply and install 300 mm PVC pressure pipe	215	m	\$ 1,750	\$ 376,250	\$ 439,185
	Supply and install 300 mm gate valve and valve box	3	each	\$ 7,400	\$ 22,200	\$ 25,913
	Supply and install new hydrant, complete	3	each	\$ 12,818	\$ 38,454	\$ 44,886
	Connect new watermain to existing watermain, (all sizes) complete	2	each	\$ 9,000	\$ 18,000	\$ 21,011
	<b>Capital Cost</b>				\$ 454,904	\$ 530,995
<b>B.</b>	<b>Project Delivery Allowance</b>					
	Multiplier for Preliminary Design, Tendering, Construction Services, Insurance, Mobilization & Demobilization, Traffic Control, Utility Impacts/Relocations			25%	\$ 113,726	\$ 132,749
	<b>Sub-Total (A+B)</b>				\$ 568,630	\$ 663,744
<b>C.</b>	<b>Contingency</b>					
	Class 4 Cost Estimate Multiplier			25%	\$ 142,158	\$ 200,466
	<b>Sub-Total (A+B+C)</b>				\$ 710,788	\$ 829,680
	<b>HST (@ 13%)</b>					\$ 107,858
	<b>Total Project Cost</b>					\$ 937,539

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Project ID W-11

Item	Description	Qty	Unit	Rate (2020)	Amount (2020)	Amount (2023)
<b>A.</b>	<b>Construction</b>					
	Supply and install 250 mm PVC pressure pipe	15	m	\$ 1,600	\$ 24,000	\$ 28,014
	Supply and install 300 mm PVC pressure pipe, (Horizontal Directional Drill Method)	155	m	\$ 2,525	\$ 391,375	\$ 456,840
	Supply and install 250 mm gate valve and valve box	1	each	\$ 6,450	\$ 6,450	\$ 7,529
	Supply and install 300 mm gate valve and valve box	1	each	\$ 7,400	\$ 7,400	\$ 8,638
	Supply and install new hydrant, complete	2	each	\$ 12,818	\$ 25,636	\$ 29,924
	Connect new watermain to existing watermain, (all sizes) complete	2	each	\$ 9,000	\$ 18,000	\$ 21,011
	<b>Capital Cost</b>				\$ 472,861	\$ 551,956
<b>B.</b>	<b>Project Delivery Allowance</b>					
	Multiplier for Preliminary Design, Tendering, Construction Services, Insurance, Mobilization & Demobilization, Traffic Control, Utility Impacts/Relocations			25%	\$ 118,215	\$ 137,989
	<b>Sub-Total (A+B)</b>				\$ 591,076	\$ 689,945
<b>C.</b>	<b>Contingency</b>					
	Class 4 Cost Estimate Multiplier			25%	\$ 147,769	\$ 208,379
	<b>Sub-Total (A+B+C)</b>				\$ 738,845	\$ 862,431
	<b>HST (@ 13%)</b>					\$ 112,116
	<b>Total Project Cost</b>					\$ 974,547

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Project ID W-11.1

Item	Description	Qty	Unit	Rate (2020)	Amount (2020)	Amount (2023)
<b>A.</b>	<b>Construction</b>					
	Supply and install 250 mm PVC pressure pipe	15	m	\$ 1,600	\$ 24,000	\$ 28,014
	Supply and install 300 mm PVC pressure pipe, (Horizontal Directional Drill Method)		m	\$ 2,525	\$ -	\$ -
	Supply and install 250 mm gate valve and valve box	1	each	\$ 6,450	\$ 6,450	\$ 7,529
	Supply and install 300 mm gate valve and valve box		each	\$ 7,400	\$ -	\$ -
	Supply and install new hydrant, complete		each	\$ 12,818	\$ -	\$ -
	Connect new watermain to existing watermain, (all sizes) complete	1	each	\$ 9,000	\$ 9,000	\$ 10,505
	<b>Capital Cost</b>				\$ 39,450	\$ 46,049
<b>B.</b>	<b>Project Delivery Allowance</b>					
	Multiplier for Preliminary Design, Tendering, Construction Services, Insurance, Mobilization & Demobilization, Traffic Control, Utility Impacts/Relocations			25%	\$ 9,863	\$ 11,512
	<b>Sub-Total (A+B)</b>				\$ 49,313	\$ 57,561
<b>C.</b>	<b>Contingency</b>					
	Class 4 Cost Estimate Multiplier			25%	\$ 12,328	\$ 17,385
	<b>Sub-Total (A+B+C)</b>				\$ 61,641	\$ 71,951
	<b>HST (@ 13%)</b>					\$ 9,354
	<b>Total Project Cost</b>					\$ 81,305

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Project ID W-11.2

Item	Description	Qty	Unit	Rate (2020)	Amount (2020)	Amount (2023)
<b>A.</b>	<b>Construction</b>					
	Supply and install 250 mm PVC pressure pipe	0	m	\$ 1,600	\$ -	\$ -
	Supply and install 300 mm PVC pressure pipe, (Horizontal Directional Drill Method)	100	m	\$ 2,525	\$ 252,500	\$ 294,735
	Supply and install 250 mm gate valve and valve box	0	each	\$ 6,450	\$ -	\$ -
	Supply and install 300 mm gate valve and valve box	0	each	\$ 7,400	\$ -	\$ -
	Supply and install new hydrant, complete	1	each	\$ 12,818	\$ 12,818	\$ 14,962
	Connect new watermain to existing watermain, (all sizes) complete	0	each	\$ 9,000	\$ -	\$ -
	<b>Capital Cost</b>				\$ 265,318	\$ 309,697
<b>B.</b>	<b>Project Delivery Allowance</b>					
	Multiplier for Preliminary Design, Tendering, Construction Services, Insurance, Mobilization & Demobilization, Traffic Control, Utility Impacts/Relocations			25%	\$ 66,330	\$ 77,424
	<b>Sub-Total (A+B)</b>				\$ 331,648	\$ 387,122
<b>C.</b>	<b>Contingency</b>					
	Class 4 Cost Estimate Multiplier			25%	\$ 82,912	\$ 116,920
	<b>Sub-Total (A+B+C)</b>				\$ 414,559	\$ 483,902
	<b>HST (@ 13%)</b>					\$ 62,907
	<b>Total Project Cost</b>					\$ 546,810

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Project ID W-11.3

Item	Description	Qty	Unit	Rate (2020)	Amount (2020)	Amount (2023)
<b>A.</b>	<b>Construction</b>					
	Supply and install 250 mm PVC pressure pipe		m	\$ 1,600	\$ -	\$ -
	Supply and install 300 mm PVC pressure pipe, (Horizontal Directional Drill Method)	55	m	\$ 2,525	\$ 138,875	\$ 162,104
	Supply and install 250 mm gate valve and valve box		each	\$ 6,450	\$ -	\$ -
	Supply and install 300 mm gate valve and valve box	1	each	\$ 7,400	\$ 7,400	\$ 8,638
	Supply and install new hydrant, complete	1	each	\$ 12,818	\$ 12,818	\$ 14,962
	Connect new watermain to existing watermain, (all sizes) complete	1	each	\$ 9,000	\$ 9,000	\$ 10,505
	<b>Capital Cost</b>				\$ 168,093	\$ 196,210
<b>B.</b>	<b>Project Delivery Allowance</b>					
	Multiplier for Preliminary Design, Tendering, Construction Services, Insurance, Mobilization & Demobilization, Traffic Control, Utility Impacts/Relocations			25%	\$ 42,023	\$ 49,052
	<b>Sub-Total (A+B)</b>				\$ 210,116	\$ 245,262
<b>C.</b>	<b>Contingency</b>					
	Class 4 Cost Estimate Multiplier			25%	\$ 52,529	\$ 74,075
	<b>Sub-Total (A+B+C)</b>				\$ 262,645	\$ 306,578
	<b>HST (@ 13%)</b>					\$ 39,855
	<b>Total Project Cost</b>					\$ 346,433

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Project ID W-12

Item	Description	Qty	Unit	Rate (2020)	Amount (2020)	Amount (2023)
<b>A.</b>	<b>Construction</b>					
	Supply and install 250 mm PVC pressure pipe	325	m	\$ 1,600	\$ 520,000	\$ 606,980
	Supply and install 250 mm gate valve and valve box	4	each	\$ 6,450	\$ 25,800	\$ 30,116
	Supply and install new hydrant, complete	4	each	\$ 12,818	\$ 51,272	\$ 59,848
	Connect new watermain to existing watermain, (all sizes) complete	6	each	\$ 9,000	\$ 54,000	\$ 63,033
	<b>Capital Cost</b>				\$ 651,072	\$ 759,976
<b>B.</b>	<b>Project Delivery Allowance</b>					
	Multiplier for Preliminary Design, Tendering, Construction Services, Insurance, Mobilization & Demobilization, Traffic Control, Utility Impacts/Relocations			25%	\$ 162,768	\$ 189,994
	<b>Sub-Total (A+B)</b>				\$ 813,840	\$ 949,970
<b>C.</b>	<b>Contingency</b>					
	Class 4 Cost Estimate Multiplier			25%	\$ 203,460	\$ 286,913
	<b>Sub-Total (A+B+C)</b>				\$ 1,017,300	\$ 1,187,463
	<b>HST (@ 13%)</b>					\$ 154,370
	<b>Total Project Cost</b>					\$ 1,341,833

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Project ID W-12.1

Item	Description	Qty	Unit	Rate (2020)	Amount (2020)	Amount (2023)
<b>A.</b>	<b>Construction</b>					
	Supply and install 250 mm PVC pressure pipe	120	m	\$ 1,600	\$ 192,000	\$ 224,116
	Supply and install 250 mm gate valve and valve box	1	each	\$ 6,450	\$ 6,450	\$ 7,529
	Supply and install new hydrant, complete	2	each	\$ 12,818	\$ 25,636	\$ 29,924
	Connect new watermain to existing watermain, (all sizes) complete	2	each	\$ 9,000	\$ 18,000	\$ 21,011
	<b>Capital Cost</b>				\$ 242,086	\$ 282,579
<b>B.</b>	<b>Project Delivery Allowance</b>					
	Multiplier for Preliminary Design, Tendering, Construction Services, Insurance, Mobilization & Demobilization, Traffic Control, Utility Impacts/Relocations			25%	\$ 60,522	\$ 70,645
	<b>Sub-Total (A+B)</b>				\$ 302,608	\$ 353,224
<b>C.</b>	<b>Contingency</b>					
	Class 4 Cost Estimate Multiplier			25%	\$ 75,652	\$ 106,682
	<b>Sub-Total (A+B+C)</b>				\$ 378,259	\$ 441,530
	<b>HST (@ 13%)</b>					\$ 57,399
	<b>Total Project Cost</b>					\$ 498,929

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Project ID W-12.2

Item	Description	Qty	Unit	Rate (2020)	Amount (2020)	Amount (2023)
<b>A.</b>	<b>Construction</b>					
	Supply and install 250 mm PVC pressure pipe	110	m	\$ 1,600	\$ 176,000	\$ 205,439
	Supply and install 250 mm gate valve and valve box	1	each	\$ 6,450	\$ 6,450	\$ 7,529
	Supply and install new hydrant, complete	1	each	\$ 12,818	\$ 12,818	\$ 14,962
	Connect new watermain to existing watermain, (all sizes) complete	2	each	\$ 9,000	\$ 18,000	\$ 21,011
	<b>Capital Cost</b>				\$ 213,268	\$ 248,941
<b>B.</b>	<b>Project Delivery Allowance</b>					
	Multiplier for Preliminary Design, Tendering, Construction Services, Insurance, Mobilization & Demobilization, Traffic Control, Utility Impacts/Relocations			25%	\$ 53,317	\$ 62,235
	<b>Sub-Total (A+B)</b>				\$ 266,585	\$ 311,176
<b>C.</b>	<b>Contingency</b>					
	Class 4 Cost Estimate Multiplier			25%	\$ 66,646	\$ 93,982
	<b>Sub-Total (A+B+C)</b>				\$ 333,231	\$ 388,971
	<b>HST (@ 13%)</b>					\$ 50,566
	<b>Total Project Cost</b>					\$ 439,537

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Project ID W-12.3

Item	Description	Qty	Unit	Rate (2020)	Amount (2020)	Amount (2023)
<b>A.</b>	<b>Construction</b>					
	Supply and install 250 mm PVC pressure pipe	95	m	\$ 1,600	\$ 152,000	\$ 177,425
	Supply and install 250 mm gate valve and valve box	2	each	\$ 6,450	\$ 12,900	\$ 15,058
	Supply and install new hydrant, complete	1	each	\$ 12,818	\$ 12,818	\$ 14,962
	Connect new watermain to existing watermain, (all sizes) complete	2	each	\$ 9,000	\$ 18,000	\$ 21,011
	<b>Capital Cost</b>				\$ 195,718	\$ 228,456
<b>B.</b>	<b>Project Delivery Allowance</b>					
	Multiplier for Preliminary Design, Tendering, Construction Services, Insurance, Mobilization & Demobilization, Traffic Control, Utility Impacts/Relocations			25%	\$ 48,930	\$ 57,114
	<b>Sub-Total (A+B)</b>				\$ 244,648	\$ 285,569
<b>C.</b>	<b>Contingency</b>					
	Class 4 Cost Estimate Multiplier			25%	\$ 61,162	\$ 86,249
	<b>Sub-Total (A+B+C)</b>				\$ 305,809	\$ 356,962
	<b>HST (@ 13%)</b>					\$ 46,405
	<b>Total Project Cost</b>					\$ 403,367

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Project ID W-13

Item	Description	Qty	Unit	Rate (2020)	Amount (2020)	Amount (2023)
<b>A.</b>	<b>Construction</b>					
	Supply and install 250 mm PVC pressure pipe	260	m	\$ 1,600	\$ 416,000	\$ 485,584
	Supply and install 250 mm gate valve and valve box	4	each	\$ 6,450	\$ 25,800	\$ 30,116
	Supply and install new hydrant, complete	3	each	\$ 12,818	\$ 38,454	\$ 44,886
	Connect new watermain to existing watermain, (all sizes) complete	4	each	\$ 9,000	\$ 36,000	\$ 42,022
	<b>Capital Cost</b>				\$ 516,254	\$ 602,607
<b>B.</b>	<b>Project Delivery Allowance</b>					
	Multiplier for Preliminary Design, Tendering, Construction Services, Insurance, Mobilization & Demobilization, Traffic Control, Utility Impacts/Relocations			25%	\$ 129,064	\$ 150,652
	<b>Sub-Total (A+B)</b>				\$ 645,318	\$ 753,259
<b>C.</b>	<b>Contingency</b>					
	Class 4 Cost Estimate Multiplier			25%	\$ 161,329	\$ 227,502
	<b>Sub-Total (A+B+C)</b>				\$ 806,647	\$ 941,574
	<b>HST (@ 13%)</b>					\$ 122,405
	<b>Total Project Cost</b>					\$ 1,063,979

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Project ID W-13.1

Item	Description	Qty	Unit	Rate (2020)	Amount (2020)	Amount (2023)
<b>A.</b>	<b>Construction</b>					
	Supply and install 250 mm PVC pressure pipe	120	m	\$ 1,600	\$ 192,000	\$ 224,116
	Supply and install 250 mm gate valve and valve box	2	each	\$ 6,450	\$ 12,900	\$ 15,058
	Supply and install new hydrant, complete	1	each	\$ 12,818	\$ 12,818	\$ 14,962
	Connect new watermain to existing watermain, (all sizes) complete	2	each	\$ 9,000	\$ 18,000	\$ 21,011
	<b>Capital Cost</b>				\$ 235,718	\$ 275,146
<b>B.</b>	<b>Project Delivery Allowance</b>					
	Multiplier for Preliminary Design, Tendering, Construction Services, Insurance, Mobilization & Demobilization, Traffic Control, Utility Impacts/Relocations			25%	\$ 58,930	\$ 68,787
	<b>Sub-Total (A+B)</b>				\$ 294,648	\$ 343,933
<b>C.</b>	<b>Contingency</b>					
	Class 4 Cost Estimate Multiplier			25%	\$ 73,662	\$ 103,876
	<b>Sub-Total (A+B+C)</b>				\$ 368,309	\$ 429,916
	<b>HST (@ 13%)</b>					\$ 55,889
	<b>Total Project Cost</b>					\$ 485,805

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Project ID W-13.2

Item	Description	Qty	Unit	Rate (2020)	Amount (2020)	Amount (2023)
<b>A.</b>	<b>Construction</b>					
	Supply and install 250 mm PVC pressure pipe	140	m	\$ 1,600	\$ 224,000	\$ 261,468
	Supply and install 250 mm gate valve and valve box	2	each	\$ 6,450	\$ 12,900	\$ 15,058
	Supply and install new hydrant, complete	2	each	\$ 12,818	\$ 25,636	\$ 29,924
	Connect new watermain to existing watermain, (all sizes) complete	2	each	\$ 9,000	\$ 18,000	\$ 21,011
	<b>Capital Cost</b>				\$ 280,536	\$ 327,461
<b>B.</b>	<b>Project Delivery Allowance</b>					
	Multiplier for Preliminary Design, Tendering, Construction Services, Insurance, Mobilization & Demobilization, Traffic Control, Utility Impacts/Relocations			25%	\$ 70,134	\$ 81,865
	<b>Sub-Total (A+B)</b>				\$ 350,670	\$ 409,326
<b>C.</b>	<b>Contingency</b>					
	Class 4 Cost Estimate Multiplier			25%	\$ 87,668	\$ 123,626
	<b>Sub-Total (A+B+C)</b>				\$ 438,338	\$ 511,658
	<b>HST (@ 13%)</b>					\$ 66,516
	<b>Total Project Cost</b>					\$ 578,173

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Project ID W-14

Item	Description	Qty	Unit	Rate (2020)	Amount (2020)	Amount (2023)
<b>A.</b>	<b>Construction</b>					
	Supply and install 300 mm PVC pressure pipe	415	m	\$ 1,750	\$ 726,250	\$ 847,729
	Supply and install 300 mm PVC pressure pipe, (Horizontal Directional Drill Method)	25	m	\$ 2,525	\$ 63,125	\$ 73,684
	Supply and install 300 mm gate valve and valve box	3	each	\$ 7,400	\$ 22,200	\$ 25,913
	Supply and install new hydrant, complete	5	each	\$ 12,818	\$ 64,090	\$ 74,810
	Connect new watermain to existing watermain, (all sizes) complete	2	each	\$ 9,000	\$ 18,000	\$ 21,011
	<b>Capital Cost</b>				\$ 893,665	\$ 1,043,147
<b>B.</b>	<b>Project Delivery Allowance</b>					
	Multiplier for Preliminary Design, Tendering, Construction Services, Insurance, Mobilization & Demobilization, Traffic Control, Utility Impacts/Relocations			25%	\$ 223,416	\$ 260,787
	<b>Sub-Total (A+B)</b>				\$ 1,117,081	\$ 1,303,934
<b>C.</b>	<b>Contingency</b>					
	Class 4 Cost Estimate Multiplier			25%	\$ 279,270	\$ 393,818
	<b>Sub-Total (A+B+C)</b>				\$ 1,396,352	\$ 1,629,918
	<b>HST (@ 13%)</b>					\$ 211,889
	<b>Total Project Cost</b>					\$ 1,841,807

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Project ID W-14.1

Item	Description	Qty	Unit	Rate (2020)	Amount (2020)	Amount (2023)
<b>A.</b>	<b>Construction</b>					
	Supply and install 300 mm PVC pressure pipe	85	m	\$ 1,750	\$ 148,750	\$ 173,631
	Supply and install 300 mm PVC pressure pipe, (Horizontal Directional Drill Method)	0	m	\$ 2,525	\$ -	\$ -
	Supply and install 300 mm gate valve and valve box	1	each	\$ 7,400	\$ 7,400	\$ 8,638
	Supply and install new hydrant, complete	1	each	\$ 12,818	\$ 12,818	\$ 14,962
	Connect new watermain to existing watermain, (all sizes) complete	1	each	\$ 9,000	\$ 9,000	\$ 10,505
	<b>Capital Cost</b>				\$ 177,968	\$ 207,737
<b>B.</b>	<b>Project Delivery Allowance</b>					
	Multiplier for Preliminary Design, Tendering, Construction Services, Insurance, Mobilization & Demobilization, Traffic Control, Utility Impacts/Relocations			25%	\$ 44,492	\$ 51,934
	<b>Sub-Total (A+B)</b>				\$ 222,460	\$ 259,671
<b>C.</b>	<b>Contingency</b>					
	Class 4 Cost Estimate Multiplier			25%	\$ 55,615	\$ 78,427
	<b>Sub-Total (A+B+C)</b>				\$ 278,075	\$ 324,588
	<b>HST (@ 13%)</b>					\$ 42,196
	<b>Total Project Cost</b>					\$ 366,785

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Project ID W-14.2

Item	Description	Qty	Unit	Rate (2020)	Amount (2020)	Amount (2023)
<b>A.</b>	<b>Construction</b>					
	Supply and install 300 mm PVC pressure pipe	180	m	\$ 1,750	\$ 315,000	\$ 367,690
	Supply and install 300 mm PVC pressure pipe, (Horizontal Directional Drill Method)	25	m	\$ 2,525	\$ 63,125	\$ 73,684
	Supply and install 300 mm gate valve and valve box	1	each	\$ 7,400	\$ 7,400	\$ 8,638
	Supply and install new hydrant, complete	2	each	\$ 12,818	\$ 25,636	\$ 29,924
	Connect new watermain to existing watermain, (all sizes) complete	0	each	\$ 9,000	\$ -	\$ -
	<b>Capital Cost</b>				\$ 411,161	\$ 479,935
<b>B.</b>	<b>Project Delivery Allowance</b>					
	Multiplier for Preliminary Design, Tendering, Construction Services, Insurance, Mobilization & Demobilization, Traffic Control, Utility Impacts/Relocations			25%	\$ 102,790	\$ 119,984
	<b>Sub-Total (A+B)</b>				\$ 513,951	\$ 599,919
<b>C.</b>	<b>Contingency</b>					
	Class 4 Cost Estimate Multiplier			25%	\$ 128,488	\$ 181,189
	<b>Sub-Total (A+B+C)</b>				\$ 642,439	\$ 749,899
	<b>HST (@ 13%)</b>				\$	\$ 97,487
	<b>Total Project Cost</b>				\$	\$ 847,386

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Project ID W-14.3

Item	Description	Qty	Unit	Rate (2020)	Amount (2020)	Amount (2023)
<b>A.</b>	<b>Construction</b>					
	Supply and install 300 mm PVC pressure pipe	150	m	\$ 1,750	\$ 262,500	\$ 306,408
	Supply and install 300 mm PVC pressure pipe, (Horizontal Directional Drill Method)	0	m	\$ 2,525	\$ -	\$ -
	Supply and install 300 mm gate valve and valve box	1	each	\$ 7,400	\$ 7,400	\$ 8,638
	Supply and install new hydrant, complete	2	each	\$ 12,818	\$ 25,636	\$ 29,924
	Connect new watermain to existing watermain, (all sizes) complete	1	each	\$ 9,000	\$ 9,000	\$ 10,505
	<b>Capital Cost</b>				\$ 304,536	\$ 355,475
<b>B.</b>	<b>Project Delivery Allowance</b>					
	Multiplier for Preliminary Design, Tendering, Construction Services, Insurance, Mobilization & Demobilization, Traffic Control, Utility Impacts/Relocations			25%	\$ 76,134	\$ 88,869
	<b>Sub-Total (A+B)</b>				\$ 380,670	\$ 444,344
<b>C.</b>	<b>Contingency</b>					
	Class 4 Cost Estimate Multiplier			25%	\$ 95,168	\$ 134,202
	<b>Sub-Total (A+B+C)</b>				\$ 475,838	\$ 555,430
	<b>HST (@ 13%)</b>					\$ 72,206
	<b>Total Project Cost</b>					\$ 627,636

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Project ID W-15

Item	Description	Qty	Unit	Rate (2020)	Amount (2020)	Amount (2023)
<b>A.</b>	<b>Construction</b>					
	Supply and install 250 mm PVC pressure pipe	120	m	\$ 1,600	\$ 192,000	\$ 224,116
	Supply and install 250 mm gate valve and valve box	1	each	\$ 6,450	\$ 6,450	\$ 7,529
	Supply and install new hydrant, complete	2	each	\$ 12,818	\$ 25,636	\$ 29,924
	Connect new watermain to existing watermain, (all sizes) complete	2	each	\$ 9,000	\$ 18,000	\$ 21,011
	<b>Capital Cost</b>				\$ 242,086	\$ 282,579
<b>B.</b>	<b>Project Delivery Allowance</b>					
	Multiplier for Preliminary Design, Tendering, Construction Services, Insurance, Mobilization & Demobilization, Traffic Control, Utility Impacts/Relocations			25%	\$ 60,522	\$ 70,645
	<b>Sub-Total (A+B)</b>				\$ 302,608	\$ 353,224
<b>C.</b>	<b>Contingency</b>					
	Class 4 Cost Estimate Multiplier			25%	\$ 75,652	\$ 106,682
	<b>Sub-Total (A+B+C)</b>				\$ 378,259	\$ 441,530
	<b>HST (@ 13%)</b>					\$ 57,399
	<b>Total Project Cost</b>					\$ 498,929

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