



# TECHNICAL MEMORANDUM

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Copy:	<b>Nava Pokharel, M.Sc., P.Eng.</b>	Date:	<b>October 27, 2023</b>
Subject:	<b>Watermain Hydraulic Assessment of the Lynden Gardens Development</b>		

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**Urbantech Consulting**

## **Watermain Hydraulic Assessment of the Lynden Gardens Development**

**C3 WATER INC.**

**October 27, 2023**



# TECHNICAL MEMORANDUM

VERSION	DATE	DESCRIPTION OF REVISIONS	REVISED BY	REVIEWED BY
1	June 2, 2022	Draft #1	Jessica Pringle Michelle Scott	Samuel Ziemann
2	June 22, 2022	Draft #2 – Updated to reflect new grading plan	Jessica Pringle Michelle Scott	Samuel Ziemann, Rob Merwin (Urbantech)
3	July 4, 2022	Final	Michelle Scott	Samuel Ziemann
4	October 20, 2023	Draft #3 – Updated to reflect latest populations and road layout	Ryan Bolger Michelle Scott	Sam Ziemann, Rob Merwin (Urbantech)
5	October 27, 2023	Final	Michelle Scott	Samuel Ziemann

## SIGN OFF

This document, entitled “**Watermain Hydraulic Assessment of the Lynden Gardens Development**”, was prepared by C3 Water Inc. for **Urbantech Consulting**.

C3W certifies that the information contained in this report is accurate, complete and in accordance with the terms of our engagement. This assessment is based, in part, on information provided by others. Unless specifically noted, C3W has assumed that this information is correct, and has relied on it in the development of conclusions.

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DATE: October 27, 2023

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Reviewed by: **Sam Ziemann, P.Eng., President**





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## 1.0 INTRODUCTION AND BACKGROUND

C3 Water (C3W) was retained by Urbantech Consulting (Urbantech) to conduct a hydraulic assessment of the proposed Lynden Gardens development and its impact on the existing distribution system within the City of Brantford (City). The hydraulic analysis was completed using the City's InfoWater Pro model.

The proposed development is located in PD2/3 on the east side of Town and encompasses a total area of approximately 57.8 ha. The development is surrounded by undeveloped land to the north, east and south, and is bounded by existing residential lots to west. The proposed development will consist of residential housing with a neighborhood centre, corridor and park. The development will be serviced via a network of watermain connected to the existing 300 mm watermain on Garden Avenue. Figure 1-1 below provides an overview of proposed watermain configuration based on the watermain concept completed by Urbantech (October 2022). The watermain concept is included in Appendix A.

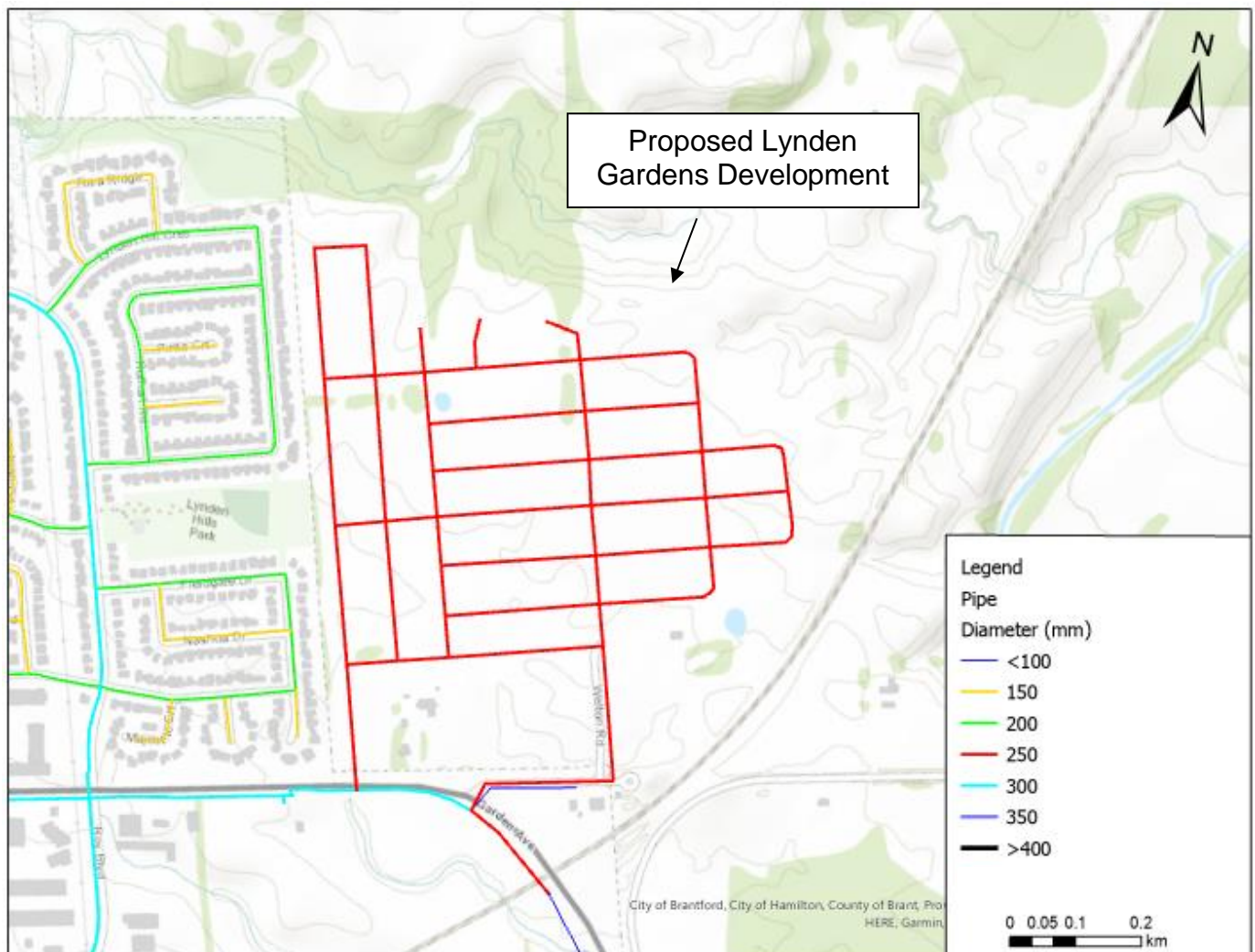


Figure 1-1 Proposed Development Area Site Overview (NTS)

PD 2/3 is supplied by the Tollgate, Wayne Gretzky and Albion Pump Stations (PSs). Floating storage is provided by the King George Elevated Tank (ET) which has a top water level (TWL) of 281 m and sets the hydraulic grade line (HGL) for PD 2/3.

The model controls in the 2016 scenarios at the PD2/3 PSs were modified based on input provided by the City on April 27, 2022 and are summarized in Table 1-1 below.

**Table 1-1 PD 2/3 Model Controls – 2016 Scenarios**

Tollgate PS		Wayne Gretzky PS		Albion PS	
Discharge Pressure (psi)	King George ET level (m)	Discharge Pressure (psi)	King George ET level (m)	Pump 2 Status	King George ET level (m)
62	Above 44	80	Constant	Off	Above 41.7
67	Below 42			On	Below 41
72	Below 41.5				
75	Below 41.3				

## 1.1 Limitations

This TM is intended to provide servicing results for the proposed development based on the City's hydraulic water model. This water model was built and calibrated by others. As with any modelling assignment, limitations related to the state of the model, the software capabilities, and theoretical data inputs should be considered. The model software also has inherent limitations and assumptions related to the calculation engine and inputs.

## 1.2 Design Standards

The City's 2021 Water Master Plan (2021 WMP) provides design criteria for the water system. The 2021 WMP states that under average day (ADD), maximum day (MDD) and peak hour demands (PHD), water system pressures should be between 40-100 psi. Under MDD and fire flow (FF) demands, the minimum allowable pressure is 20 psi. The 2021 WMP requires that the velocity in new watermain be less than 1.5 m/s. If velocity is greater than 2.0 m/s in an existing watermain, it should be flagged for review and mitigation.

## 1.3 Demand and Fire Flow

Water demand estimates for the proposed development were calculated based on criteria provided in the 2021 WMP. The development population was provided by Urbantech based on the Sanitary Sewer Design Sheet (September 2022). Table 1-2 below summarizes the values used and demands calculated.

**Table 1-2 Criteria Used and Demands Calculated**

Criteria	Value/ Source
Population Estimate	3203
Demands	ADD: 270 L/c/d MDD: 1.8 x ADD
ADD	10.0L/s
MDD	18.0L/s

The recommended fire flow targets from the 2021 WMP are summarized in Table 1-3 below. Specific dwelling types have not yet been established for the proposed development. As such, a fire flow target of 150 L/s was used for the proposed development based on the largest fire flow target for residential land uses stated in the 2021 WMP.

**Table 1-3 Brantford 2021 WMP range of Recommended Fire Flow Targets**

Land Use	Typical FUS Range (L/s)	# of Hydrants	Target Fire Flow (L/s)
Dead End Residential	27-100 L/s	-	50 (4.3 MLD)
Single/ Semi Family	27-162 L/s	1	75 (6.5 MLD)
Townhouse/ Row House	82-167 L/s	1-2	125 (10.8 MLD)
<b>Multi Family</b>	<b>117-368 L/s</b>	<b>2</b>	<b>150 (13.0 MLD)</b>
Commercial	111-185 L/s	2-3	175 (15.1 MLD)
Institutional	96-334 L/s	2-3	175 (15.1 MLD)
Industrial	133-299 L/s	3-4	250 (21.6 MLD) <sup>(1)</sup>
City Center	-	3	225 (19.4 MLD)

#### **1.4 Development Area Watermains**

The site will be serviced by a network of new watermains connected to the existing watermain on Garden Avenue. The new watermains were modelled with a C-factor (roughness) of 110 per the City of Brantford's Linear Municipal Infrastructure Standards. The Garden Avenue watermain is documented in the City's model as polyethylene with a C-factor of 130 and a diameter that transitions from 300 mm to 75 mm downstream of the proposed development.

## 2.0 MODELLING RESULTS

The proposed development area was assessed with the City's InfoWater model using the existing (2016), ADD and MDD scenarios. The demands were split evenly across nodes within the development and under each scenario the model was run for a 48 – hour period.

The development was also modelled under the 2051 ADD and MDD scenarios. These scenarios include future projected demands and proposed infrastructure upgrades as per the 2021 WMP. Some of the infrastructure projects within PD 2/3 that are expected to impact this development include:

- W-M-001: 750mm King George Watermain
- W-M-018: 400mm Lynden Road Trunk Watermain Upgrades
- W-M-027: 600mm Upsize Fairview Drive/Lynden Road Trunk Watermain
- W-ET-001: New PD2/3 ET
- W-D-001: Decommissioning of King George ET
- W-D-002: Decommissioning of Albion PS

### 2.1 Pressure Results

Based on the Lynden Gardens grading concept plan completed by Urbantech, the range of ground elevations within the development is approximately 214–223 mAMSL. Based on the City's WMP, the existing target hydraulic grade line (HGL) for PD2/3 is approximately 281 mAMSL based on the TWL of the King George ET. Therefore, the static pressure at the development is expected to be approximately 58– 67 m or 82–95 psi.

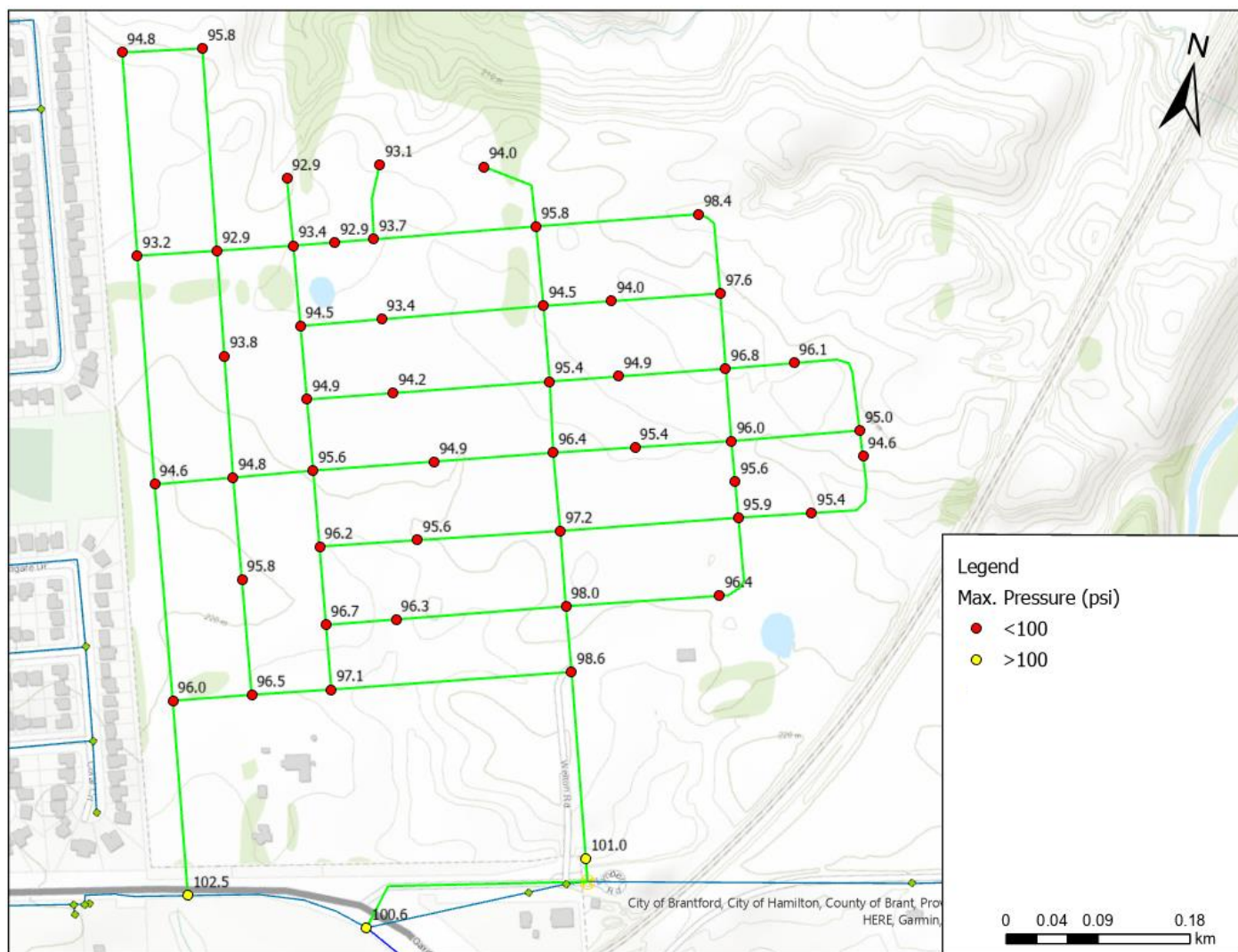
Based on the City's model, the TWL of the future PD 2/3 ET is 285.5. The static pressure at the development is expected to be approximately 61.5– 71.5 m or 87.5–101.7 psi at this HGL.

Existing and future ADD and MDD pressure conditions were modelled within the proposed development. The model pressure results are summarized in Table 2-1 below.

**Table 2-1 Development Pressures (psi)**

Scenario	Average	Min	Max
<b>ADD 2016 Existing</b>	87	83	95
<b>MDD 2016 Existing</b>	84	77	94
<b>ADD 2051 Future</b>	90	79	106
<b>MDD 2051 Future</b>	88	81	103

The existing ADD and MDD development pressures ranged from 77-95 psi, which is within the City's requirement of 40-100 psi. The future ADD and MDD development pressures ranged from 79-106 psi, slightly exceeding the City's requirements. A pressure reducing valve may needed to decrease development pressures depending on the future HGL of PD 2/3. Figure 2-1 below summarizes the maximum pressure results under future MDD conditions.



**Figure 2-1 MDD 2051 Future Development Pressures**

To evaluate the impact of the proposed development on surrounding areas, pre- and post-development MDD pressure conditions were assessed on Garden Avenue. Table 2-2 below summarizes the results obtained.

**Table 2-2 Garden Avenue Pressures (psi)**

Scenario	Average	Min	Max
MDD 2016 Existing Pre-Development	91	87	95
MDD 2016 Existing Post-Development	90	85	94

The development was not found to significantly impact pressures on Garden Avenue.

## 2.2 Fire Flow Results

Modelling was conducted to determine the available fire flows at a residual pressure of 20 psi at 12:00 PM under MDD conditions. The fire flow simulation was run under existing (2016) and future (2051) MDD conditions. The fire flow results predicted by the model are representative of the amount of water available in a watermain and not the extent of flows available from a hydrant. Several hydrants may need to be operated to provide desired fire flows but may not be equivalent to model results.

A range of watermain sizes were modelled within the proposed development. It was found that 250 mm watermains were required throughout the proposed development to achieve the fire flow target of 150 L/s at all locations within the development under existing conditions. It is not expected that all areas of the development will require a Multi-Family fire flow of 150 L/s and subsequent 250 mm watermains. Single family homes only require a fire flow of 75 L/s and would likely require a small watermain size. At this point details of the development are not available and the largest residential fire flow has been carried forward for analysis. When planning the layout and location of the different unit types, the amount of fire flow should be considered. It is important to minimize the size of watermains as oversizing watermains at the extremity of a water system can lead to water quality concerns and operational difficulties. Once there is further detail available in regard to location and types of units, the watermain layout should be revisited.

The fire flow target was met at Garden Avenue as well as each node within the proposed development when the proposed pipes were sized as 250 mm. Results are summarized in Table 2-3 below. As additional details of the development become available, the fire flow requirements should be revisited and the watermain sizing updated accordingly.

The available fire flow in the development area was found to increase under 2051 conditions with the 2021 WMP proposed linear upgrades on Lynden Road.

**Table 2-3 Available Fire Flow Results (L/s) – 250mm Proposed Watermains**

Scenario	Garden Ave Connection 1	Garden Avenue Connection 2	Development Min	Development Max
MDD 2016 Existing	242	226	167	205
MDD 2051 Future	683	507	258	385

## 2.3 Velocity Results

Existing ADD and MDD velocity conditions were assessed within each pipe in the proposed development with the pipes sized as 250 mm. The modelling results are summarized in Table 2-4 below.

**Table 2-4 Maximum Velocity within Development (m/s) – 250mm Proposed Watermains**

Scenario	Max Velocity
<b>ADD 2016 Existing</b>	0.3
<b>MDD 2016 Existing</b>	0.4

The existing ADD and MDD development velocities met the City's requirement of less than 1.5 m/s for new watermains.

## 2.4 PD 2/3 Analysis

To further evaluate the impact of the development on surrounding water systems, maximum discharge flow under existing ADD and MDD pre- and post-development conditions was assessed at the following PD 2/3 pumping stations.

- Albion PS
- Wayne Gretzky PS
- Tollgate PS

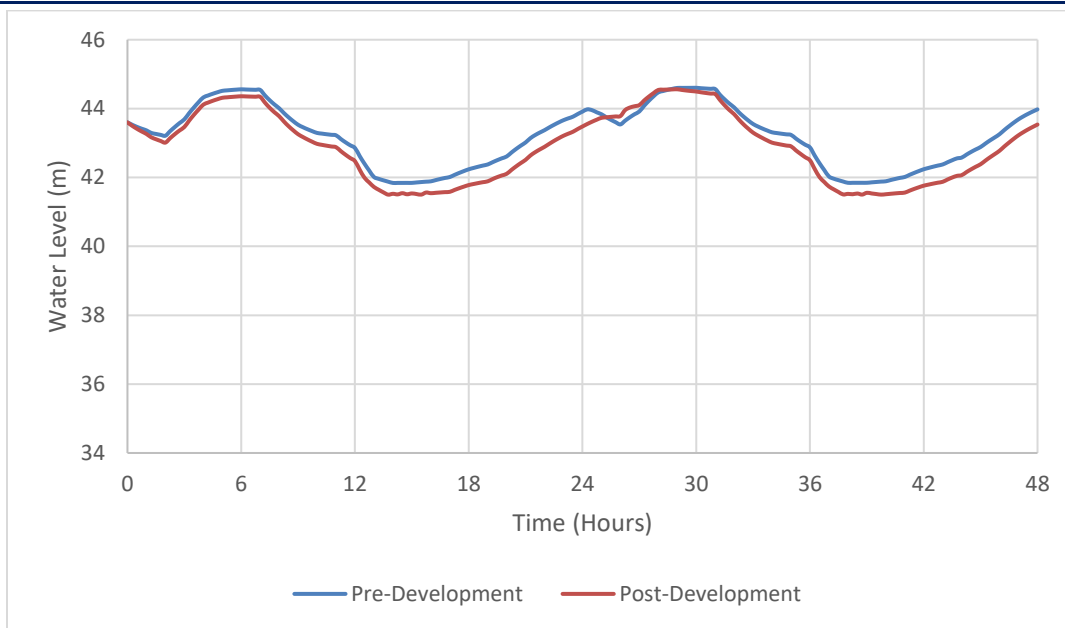
Table 2-5 below summarizes the model results.

**Table 2-5 Maximum Discharge Flow at Nearby Pumping Stations (L/s)**

Scenario	Albion PS	Wayne Gretzky PS	Tollgate PS
<b>Firm Capacity</b>	265	784	810
<b>Pre-Development</b>			
<b>ADD 2016 Existing</b>	0	123	112
<b>MDD 2016 Existing</b>	0	208	194
<b>Post-Development</b>			
<b>ADD 2016 Existing</b>	0	145	118
<b>MDD 2016 Existing</b>	0	221	200

The discharge flows were found to increase slightly under post-development conditions at the Wayne Gretzky and Tollgate pumping stations. The discharge flows were well under the firm capacity of the pumping stations. The Albion pump station did not turn on under pre- or post-development conditions.

The level within the nearby King George ET was also assessed under MDD existing pre- and post- development conditions. Figure 2-3 summarizes results obtained.



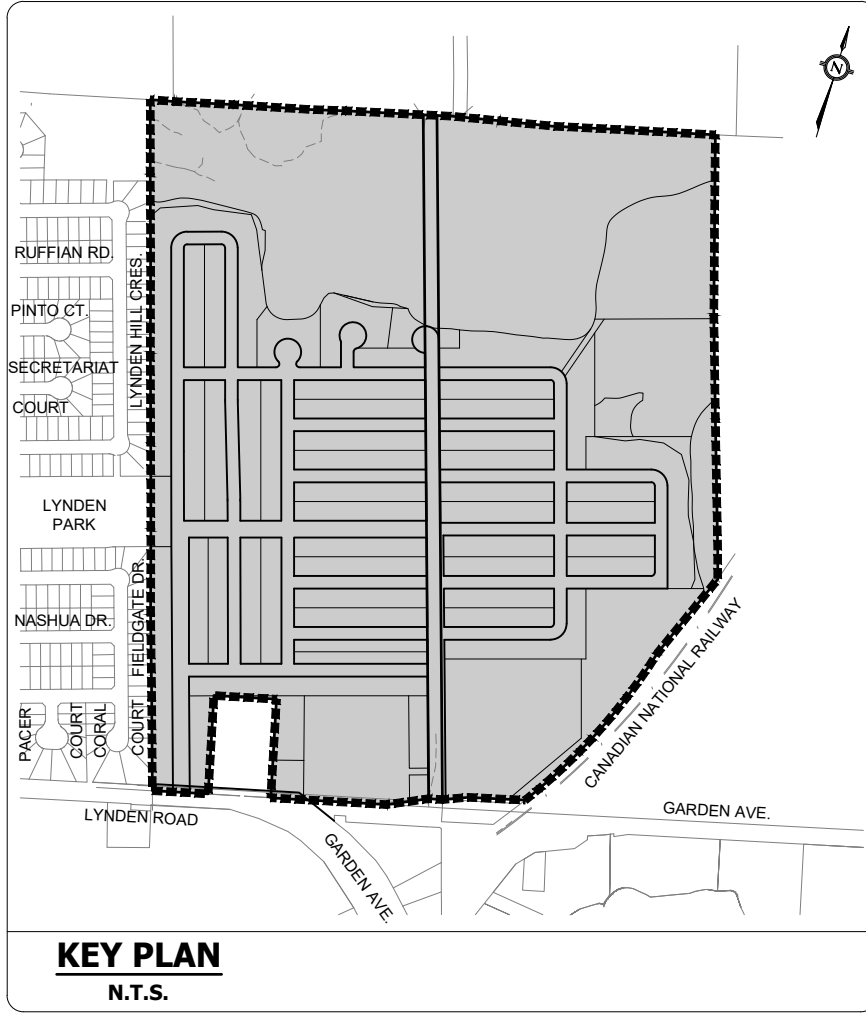
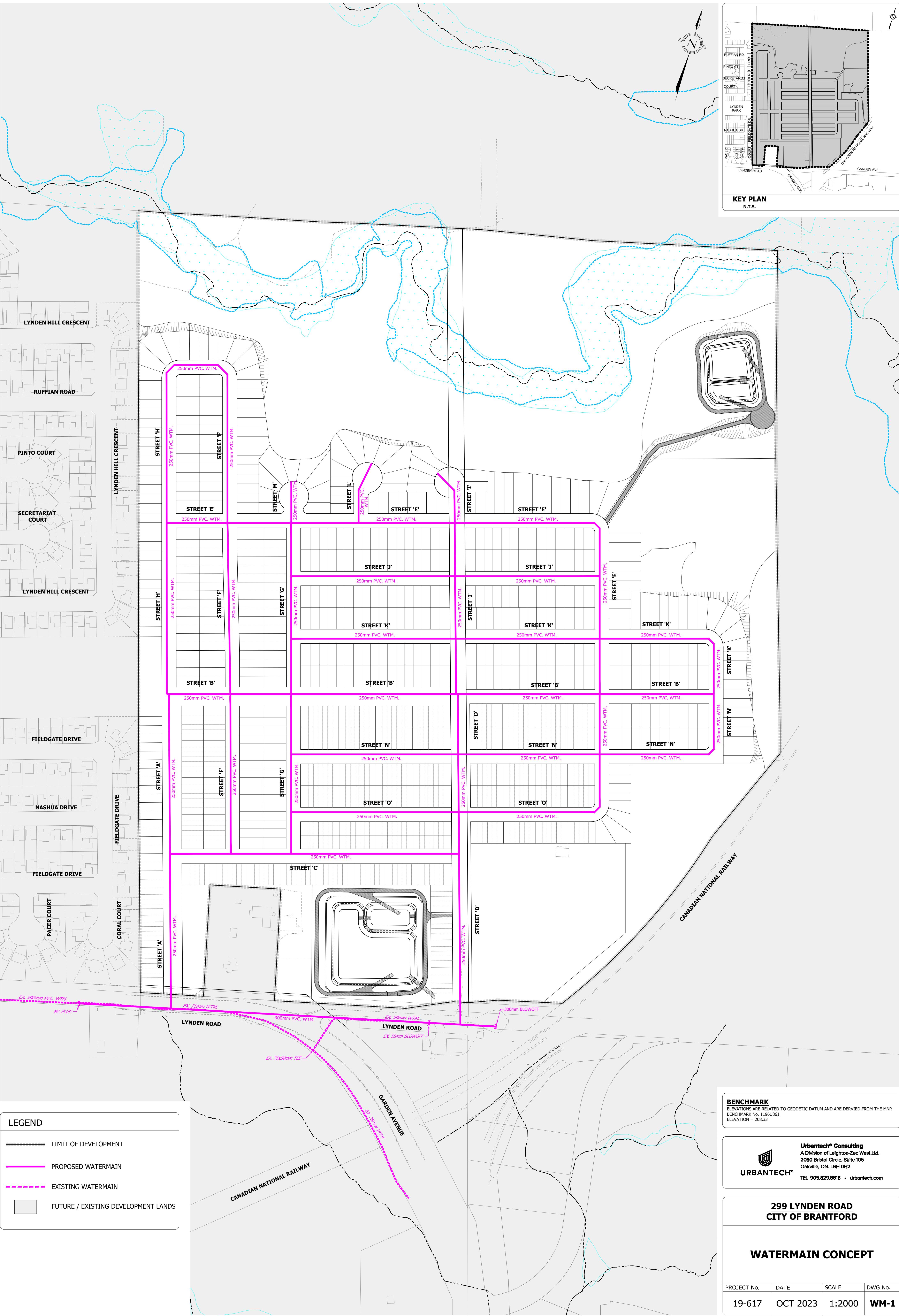
**Figure 2-2 Pre- and Post-Development MDD 2016 King George ET Level Over 48 hr**

Under existing MDD conditions, the proposed development did not significantly impact the water level within the King George ET. Under pre-development conditions the minimum water level was 41.8 m and under and post-development conditions it was 41.5 m.

### 3.0 SUMMARY AND RECOMMENDATIONS

1. Based on the model results, development pressure is expected to range from 77-95 psi under 2016 (existing) conditions, which is within the City's preferred operating range of 40–100 psi. Under 2051 (future) conditions the pressure is expected to range from 79-106 psi which exceeds the City's preferred range. The development pressures under future conditions are increased due to the proposed new PD2/3 HGL which is based on the proposed PD 2/3 ET. PRVs may be required once the PD2/3 HGL is increased.
2. The proposed development was not found to significantly impact pressures on Garden Avenue. Discharge flows at the Tollgate, Wayne Gretzky and Albion pumping stations or the level within the King George ET were similarly not significantly impacted.
3. A watermain size of 250mm was required throughout the proposed development to achieve the fire flow target of 150 L/s at all locations within the development under existing conditions. The available fire flow in the development area was found to increase under future conditions with the linear upgrades on Lynden Road and the increased PD2/3 HGL.
4. It is recommended that the fire flow analysis and watermain sizing is revisited once additional details of the development are available. Results within this report are based on an assumed watermain configuration and based on the City's fire flow requirement of 150 L/s for multi-family dwellings.

## **APPENDIX A – Watermain and Grading Plans**



KEY PLAN  
N.T.S.

LEGEND

LIMIT OF DEVELOPMENT

PROPOSED WATERMAIN

EXISTING WATERMAIN

FUTURE / EXISTING DEVELOPMENT LANDS

BENCHMARK

ELEVATIONS ARE RELATED TO GEODETIC DATUM AND ARE DERIVED FROM THE MNR  
BENCHMARK No. 1196U861  
ELEVATION = 208.33

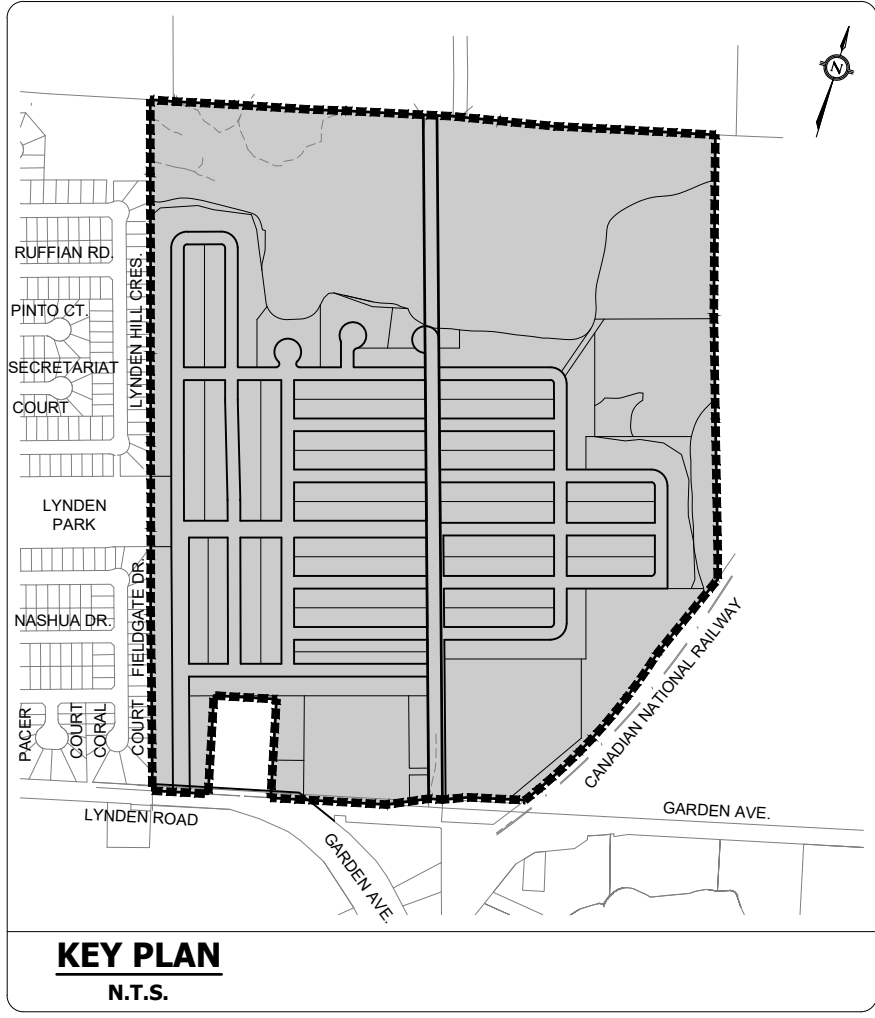
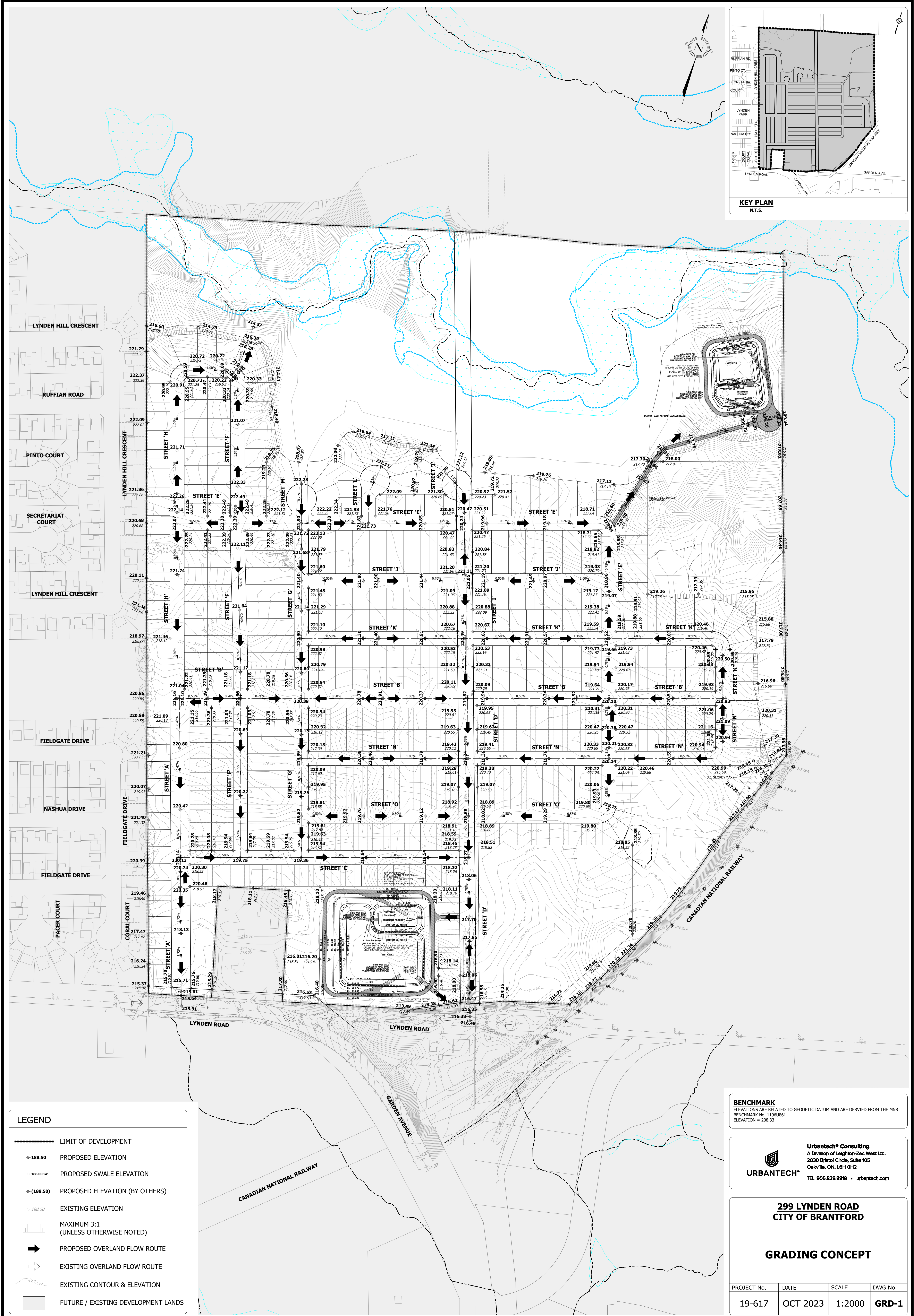
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299 LYNDEN ROAD  
CITY OF BRANTFORD

WATERMAIN CONCEPT

PROJECT No.	DATE	SCALE	DWG No.
19-617	OCT 2023	1:2000	WM-1



LEGEND

- ===== LIMIT OF DEVELOPMENT
- ◆ 188.50 PROPOSED ELEVATION
- ◆ 188.00SW PROPOSED SWALE ELEVATION
- ◆ (188.50) PROPOSED ELEVATION (BY OTHERS)
- ◆ 188.50 EXISTING ELEVATION
- ||||| MAXIMUM 3:1 (UNLESS OTHERWISE NOTED)
- ➡ PROPOSED OVERLAND FLOW ROUTE
- ➡ EXISTING OVERLAND FLOW ROUTE
- EXISTING CONTOUR & ELEVATION
- FUTURE / EXISTING DEVELOPMENT LANDS

**BENCHMARK**  
ELEVATIONS ARE RELATED TO GEODETIC DATUM AND ARE DERIVED FROM THE MNR  
BENCHMARK No. 1196U861  
ELEVATION = 208.33



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**299 LYNDEN ROAD**  
CITY OF BRANTFORD

GRADING CONCEPT

PROJECT No.	DATE	SCALE	DWG No.
19-617	OCT 2023	1:2000	GRD-1