# Hydraulic Capacity and Modeling Analysis Cardinal Creek Village South Development

# Technical Memorandum

**FINAL**

**Prepared for:**
David Schaeffer Engineering Ltd.
120 Iber Road, Unit 103
Stittsville, ON K2S 1E9

**Prepared by:**
GeoAdvice Engineering Inc.
Unit 203, 2502 St. John's Street
Port Moody, BC V3H 2B4

**Submission Date:** December 2, 2024

**Contact:** Mr. Werner de Schaetzen, Ph.D., P.Eng.
**Project:** 2021-077-DSE

# Document History and Version Control

| Revision No. | Date | Document Description | Revised By | Reviewed By |
|---|---|---|---|---|
| **R0** | January 31, 2022 | Draft | Ben Loewen | Werner de Schaetzen |
| **R1** | May 31, 2022 | Updated Draft | Ben Loewen/Cole Dinsdale | Werner de Schaetzen |
| **R2** | June 16, 2022 | Final | Ben Loewen/Cole Dinsdale | Werner de Schaetzen |
| **R3** | November 26, 2024 | Draft | Jim Lee | Werner de Schaetzen |
| **R4** | November 29, 2024 | Updated Draft | Jim Lee | Werner de Schaetzen |
| **R5** | December 2, 2024 | Final | Jim Lee | Werner de Schaetzen |



## Statement of Qualifications and Limitations

This document represents GeoAdvice Engineering Inc. best professional judgment based on the information available at the time of its completion and as appropriate for the project scope of work. Services performed in developing the content of this document have been conducted in a manner consistent with that level and skill ordinarily exercised by a member of the engineering profession currently practicing under similar conditions. No warranty, express or implied is made.

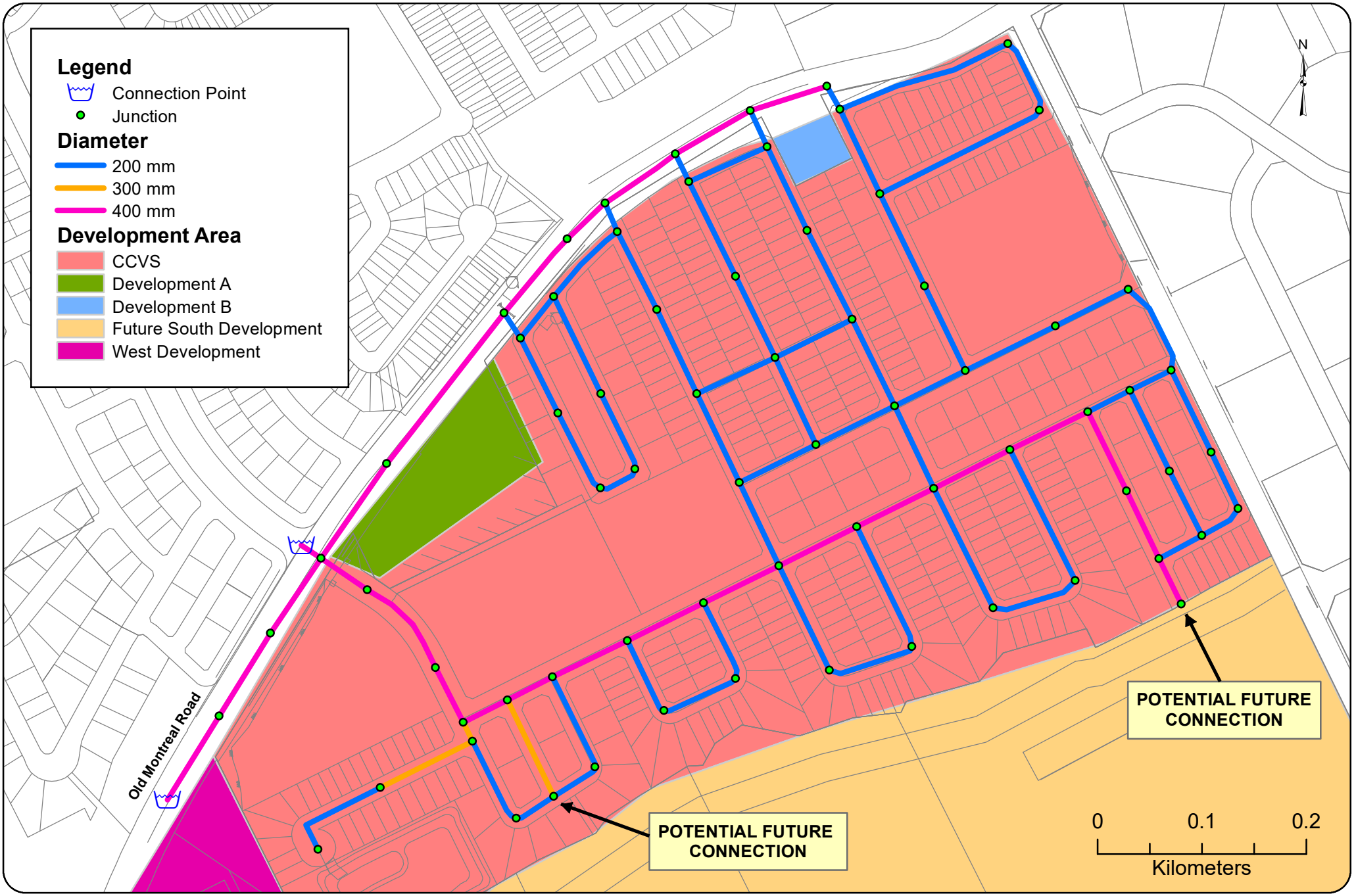
# 1 Introduction

GeoAdvice Engineering Inc. ("GeoAdvice") was retained by David Schaeffer Engineering Ltd. ("DSEL") to size the proposed water main network for the Cardinal Creek Village South (CCVS) development ("Development") in the City of Ottawa, ON ("City").

The development will have two (2) connections to the City's water distribution system along Old Montreal Road. The development site is shown in **Figure 1.1** on the following page, with the final recommended pipe diameters.

This memo describes the assumptions and results of the hydraulic modeling and capacity analysis using InfoWater (Innovyze), a GIS water distribution system modeling and management software application.

The results presented in this memo are based on the analysis of steady state simulations. The predicted available fire flows, as calculated by the hydraulic model, represent the flow available in the water main while maintaining a residual pressure of 20 psi at the hydrant. No extended period simulations were completed in this analysis to assess the water quality or to assess the hydraulic impact on storage and pumping.




GeoAdvice Engineering Inc.

Project: **Hydraulic Capacity and Modeling Analysis**
**Cardinal Creek Village South**
Client: **David Schaeffer Engineering Ltd.**
Date: **November 2024**
Created by: **JL**
Reviewed by: **WdS**

DISCLAIMER: GeoAdvice does not warrant in any way the accuracy and completeness of the information shown on this map. Field verification of the accuracy and completeness of the information shown on this map is the sole responsibility of the user.

# Site Layout and Connection Points

**Figure 1.1**

# 2 Modeling Considerations

## 2.1 Water Main Configuration

The water main network was modeled based on drawings prepared by DSEL (1153_grad_coord.dwg) and provided to GeoAdvice on October 30th, 2024.

## 2.2 Elevations

Elevations of the modeled junctions were assigned according to a preliminary site grading plan at road level, which was prepared by DSEL (1153_grad_coord.dwg) and provided to GeoAdvice on October 30th, 2024.

## 2.3 Consumer Demands

The proposed residential demands for the CCVS development were based on a demand rate of 280 L/cap/d as per City of Ottawa technical bulletin ISTB 2018-01. The park and school rate of 28,000 L/ha/d was assumed as per the City of Ottawa design guidelines and is consistent with similar previously completed developments within the City of Ottawa. Demand factors used for this analysis were taken according to the peaking factors based on population of 3,001-10,000 capita from the MOE Design Guidelines. Population densities were assigned based on Table 4.1 *Per Unit Populations* from the City of Ottawa Design Guidelines. Relevant data for this development is summarized in **Table 2.1**.

Furthermore, demands for the future development located to the south of the CCVS development were included to consider potential future connections and were based on the demand rates from the Cardinal Creek Village Master Servicing Study (Veritec report, April 2013), as provided by DSEL. Demands from three (3) additional adjacent development areas (Developments A, B, and West) were incorporated into the CCVS analysis due to their downstream location relative to the City's boundary conditions. These developments are shown in **Figure 1.1** and summarized in **Appendix A**.

**Table 2.1: City of Ottawa and MOE Demand Factors**

| Demand Type | Amount | Units |
|---|---|---|
| **Average Day Demand** | | |
| Residential | 280 | L/c/d |
| Park | 28,000 | L/ha/d |
| School | 28,000 | L/ha/d |
| **Maximum Daily Demand** | | |
| Residential | 2.0 x avg. day | L/c/d |
| Park | 1.5 x avg. day | L/ha/d |
| School | 1.5 x avg. day | L/ha/d |
| **Peak Hour Demand** | | |
| Residential | 3.0 x avg. day | L/c/d |
| Park | 1.8 x max. day | L/ha/d |
| School | 1.8 x max. day | L/ha/d |
| **Minimum Hour Demand** | | |
| Residential | 0.5 x avg. day | L/c/d |
| Park | 0.5 x avg. day | L/ha/d |
| School | 0.5 x avg. day | L/ha/d |

**Table 2.2** and **Table 2.3** summarize the water demand calculations for CCVS development.

**Table 2.2: Development Population and Demand Calculations – CCVS Development ǂ**

| Dwelling Type | Number of Units | Persons Per Unit* | Population | Average Day Demand (L/s) | Maximum Day Demand (L/s) | Peak Hour Demand (L/s) |
|---|---|---|---|---|---|---|
| Single Detached | 333 | 3.4 | 1,133 | 3.67 | 7.34 | 11.02 |
| Back-to-Back Townhome | 152 | 2.7 | 411 | 1.33 | 2.66 | 4.00 |
| Traditional Townhome | 261 | 2.7 | 705 | 2.28 | 4.57 | 6.85 |
| **Total** | **746** | | **2,249** | **7.29** | **14.58** | **21.87** |

*City of Ottawa Design Guidelines.
ǂ Peaking factors based on development population of 3,001-10,000 capita from the MOE Design Guidelines.

**Table 2.3: Non Residential Demand Calculations – CCVS Development ǂ**

| Land Use Type | Area (ha) | Average Day Demand (L/s) | Maximum Day Demand (L/s) | Peak Hour Demand (L/s) |
|---|---|---|---|---|
| Park | 1.58 | 0.51 | 0.77 | 1.38 |
| School | 4.90 | 1.59 | 2.38 | 4.29 |
| Commercial | 2.40 | 0.78 | 1.17 | 2.10 |

ǂ Peaking factors based on the City of Ottawa Design Guidelines

**Table 2.4** and **Table 2.5** summarize the water demand calculations for the future development adjacent to the CCVS development.

**Table 2.4: Development Population and Demand Calculations – Additional Developments‡**

| Development | Population | Average Day Demand (L/s) | Maximum Day Demand (L/s) | Peak Hour Demand (L/s) |
|---|---|---|---|---|
| Future Development South of CCVS | 3,683 | 8.26 | 12.73 | 27.47 |
| Development A | 73 | 0.24 | 0.47 | 0.71 |
| Development B | 28 | 0.09 | 0.18 | 0.27 |
| West Development | 991 | 3.21 | 6.42 | 9.63 |
| **Total** | **4,775** | **11.80** | **19.80** | **38.08** |

‡ Peaking factors based on the previous water main hydraulic analysis (Veritec report, April 2013)

**Table 2.5: Non Residential Demand Calculations – Additional Developments‡**

| Land Use Type | Area (ha) | Average Day Demand (L/s) | Maximum Day Demand (L/s) | Peak Hour Demand (L/s) |
|---|---|---|---|---|
| Park | 2.50 | 0.25 | 0.25 | 0.32 |
| School | 2.00 | 0.20 | 0.20 | 0.26 |
| Commercial | 1.49 | 0.48 | 0.72 | 1.30 |

‡ Peaking factors based on the previous water main hydraulic analysis (Veritec report, April 2013)

The demand rates used are for preliminary design purposes. It is recommended that the development network be modeled and sized according to the City's standards during the detailed design phase. Detailed demand calculations are provided in **Appendix A**.

## 2.4 Fire Flow Demand

Fire flow values were based on a previous report submitted by GeoAdvice on June 16, 2022. Fire flow simulations were completed at each model node under the required fire flow scenarios listed below. The locations of nodes do not necessarily represent hydrant locations.

Each building type was assigned the following required fire flows:

- 167 L/s (single-family and traditional townhouse units)
- 200 L/s (back-to-back townhouse units, accounting for one (1) firewall)
- 250 L/s (required fire flow of Area A, as confirmed by DSEL

Please note that the required fire flow for the school blocks and commercial area has been assumed as 150 L/s, as per the Master Municipal Construction Documents (MMCD). Where multiple fire flow conditions were present, the most conservative fire flow requirement was assigned.

The figure illustrating the spatial allocation of the required fire flows is provided in **Appendix B**.

## 2.5 Boundary Conditions

The boundary conditions were provided by the City of Ottawa in the form of Hydraulic Grade Line (HGL) at the following locations:

- Connection 1: Old Montreal Road
- Connection 2: Old Montreal Road at Cardinal Creek Drive

The connections are illustrated in **Figure 1.1**.

Boundary conditions were provided for Peak Hour (PHD), Maximum Day plus Fire (MDD+FF) and Average Day (high pressure check, ADD) demand conditions.

The City boundary conditions were provided to GeoAdvice on October 30, 2024 and can be found in **Appendix C**.

The demands from the future development south of the CCVS development and the additional Developments A, B and West were included in the boundary condition request as they are located downstream from the connection points used in the boundary conditions.

# 3 Hydraulic Capacity Design Criteria

## 3.1 Pipe Characteristics

Pipe characteristics of internal diameter (ID) and Hazen-Williams C factors were assigned in the model according to the City of Ottawa Design Guidelines for PVC water main material. Pipe characteristics used for the development are outlined in **Table 3.1** below.

**Table 3.1: Model Pipe Characteristics**

| Nominal Diameter (mm) | ID PVC (mm) | Hazen Williams C-Factor (/) |
|---|---|---|
| **200** | 204 | 110 |
| **300** | 297 | 120 |
| **400** | 400 | 120 |

## 3.2 Pressure Requirements

As outlined in the City of Ottawa Design Guidelines, the generally accepted best practice is to design new water distribution systems to operate between 350 kPa (50 psi) and 480 kPa (70 psi). The maximum pressure at any point in the distribution system in occupied areas outside of the public right-of-way shall not exceed 552 kPa (80 psi). Pressure requirements are outlined in **Table 3.2.**

**Table 3.2: Pressure Requirements**

| Demand Condition | Minimum Pressure | | Maximum Pressure | |
|---|---|---|---|---|
| | (kPa) | (psi) | (kPa) | (psi) |
| **Normal Operating Pressure (maximum daily flow)** | 350 | 50 | 480 | 70 |
| **Peak Hour Demand (minimum allowable pressure)** | 276 | 40 | - | - |
| **Maximum Fixture Pressure (Ontario Building Code)** | - | - | 552 | 80 |
| **Maximum Distribution Pressure (minimum hour check)** | - | - | 552 | 80 |
| **Maximum Day Plus Fire** | 140 | 20 | - | - |

# 4 Hydraulic Capacity Analysis

The proposed water mains within the development were sized to the minimum diameter which would satisfy the greater of maximum day plus fire and peak hour demand. Modeling was carried out for average day demand (ADD), peak hour demand (PHD) and maximum day demand plus fire flow (MDD+FF) using InfoWater.

## 4.1 Development Pressure Analysis

Modeled service pressures for the proposed CCVS development are summarized in **Table 4.1** below. Figures showing the pressures under ADD and PHD scenarios are provided in **Appendix D**.

**Table 4.1: Summary of Available Service Pressures**

| Average Day Demand Maximum Pressure | Peak Hour Demand Minimum Pressure |
|---|---|
| 76 psi (524 kPa) | 41 psi (282 kPa) |

As outlined in the City of Ottawa Design Guidelines, the generally accepted best practice is to design new water distribution systems to operate between 350 kPa (50 psi) and 480 kPa (70 psi). The maximum pressure at any point within the distribution system in occupied areas outside of the public right-of-way shall not exceed 552 kPa (80 psi) and the minimum pressure at any point within the distribution system shall not fall below 270 kPa (40 psi). **The maximum service pressure is 76 psi, below the 80 psi threshold, therefore no PRVs are required for the proposed development. The minimum service pressure is 41 psi, meeting the required 40 psi threshold.**

## 4.2 Development Fire Flow Analysis

**Table 4.2: Summary of the Minimum Available Fire Flows**

| Required Fire Flow | Minimum Available Flow* |
|---|---|
| 167 L/s | 170 L/s |
| 200 L/s | 201 L/s |
| 250 L/s | >500 L/s |

*The predicted available fire flows, as calculated by the hydraulic model, represent the flow available in the water main while maintaining a residual pressure of 20 psi at the hydrant. High available fire flows (>500 L/s) are theoretical values. Actual available fire flow is limited by the hydraulic losses through the hydrant lateral and hydrant port sizes.

**As summarized in Table 4.2 the fire flow requirements can be met at all junctions within the development.**

The figure showing the available fire flows at 20 psi under MDD + FF scenario can be found in **Appendix E**.

## Submission

**Prepared by:**

Jim Lee, E.I.T.
Hydraulic Modeler / Project Engineer

**Approved by:**

Dec 02, 2024
W. B. F. de Schaetzen, P.Eng.
100116349
LICENSED PROFESSIONAL ENGINEER
PROVINCE OF ONTARIO

Werner de Schaetzen, Ph.D., P.Eng.
Senior Modeling Review / Project Manager

# Appendix A Domestic Water Demand Calculations and Allocation

## Consumer Water Demands

| Dwelling Type | Number of Units | Population | | Average Day Demand | | | Max Day | Peak Hour |
|---|---|---|---|---|---|---|---|---|
| | | Persons per Unit | Population Per Dwelling Type | (L/c/d) | (L/d) | (L/s) | 2 x Avg. Day (L/s) | 3 x Avg. Day (L/s) |
| Single Detached | 32 | 3.4 | 109 | 280 | 30,520 | 0.35 | 0.71 | 1.06 |
| Back-to-Back Townhome | 40 | 2.7 | 108 | | 30,240 | 0.35 | 0.70 | 1.05 |
| Traditional Townhome | 35 | 2.7 | 95 | | 26,600 | 0.31 | 0.62 | 0.92 |
| **Subtotal** | **107** | | **312** | | **87,360** | **1.01** | **2.02** | **3.03** |

**Non Residential Demands - CCV South Phase 1**

| Property Type | Area (ha) | | Average Day Demand | | | Max Day | Peak Hour |
|---|---|---|---|---|---|---|---|
| | | | (L/ha/d) | (L/d) | (L/s) | 1.5 x Avg. Day (L/s) | 1.8 x Max Day (L/s) |
| Commercial | 2.40 | | 28,000 | 67,200 | 0.78 | 1.17 | 2.10 |
| **Subtotal** | **2.40** | | | **67,200** | **0.78** | **1.17** | **2.10** |

**Residential Demands - CCV South Phase 2***

| Dwelling Type | Number of Units | Population | | Average Day Demand | | | Max Day | Peak Hour |
|---|---|---|---|---|---|---|---|---|
| | | Persons per Unit | Population Per Dwelling Type | (L/c/d) | (L/d) | (L/s) | 2 x Avg. Day (L/s) | 3 x Avg. Day (L/s) |
| Single Detached | 78 | 3.4 | 266 | 280 | 74,480 | 0.86 | 1.72 | 2.59 |
| Back-to-Back Townhome | 0 | 2.7 | - | | - | - | - | - |
| Traditional Townhome | 54 | 2.7 | 146 | | 40,880 | 0.47 | 0.95 | 1.42 |
| **Subtotal** | **132** | | **412** | | **115,360** | **1.34** | **2.67** | **4.01** |

**Non Residential Demands - CCV South Phase 2**

| Property Type | Area (ha) | | Average Day Demand | | | Max Day | Peak Hour |
|---|---|---|---|---|---|---|---|
| | | | (L/ha/d) | (L/d) | (L/s) | 1.5 x Avg. Day (L/s) | 1.8 x Max Day (L/s) |
| School (Block 59) | 2.44 | | 28,000 | 68,320 | 0.79 | 1.19 | 2.14 |
| **Subtotal** | **2.44** | | | **68,320** | **0.79** | **1.19** | **2.14** |

**Residential Demands - CCV South Phase 3***

| Dwelling Type | Number of Units | Population | | Average Day Demand | | | Max Day | Peak Hour |
|---|---|---|---|---|---|---|---|---|
| | | Persons per Unit | Population Per Dwelling Type | (L/c/d) | (L/d) | (L/s) | 2 x Avg. Day (L/s) | 3 x Avg. Day (L/s) |
| Single Detached | 61 | 3.4 | 208 | 280 | 58,240 | 0.67 | 1.35 | 2.02 |
| Back-to-Back Townhome | 72 | 2.7 | 195 | | 54,600 | 0.63 | 1.26 | 1.90 |
| Traditional Townhome | 62 | 2.7 | 168 | | 47,040 | 0.54 | 1.09 | 1.63 |
| **Subtotal** | **195** | | **571** | | **159,880** | **1.85** | **3.70** | **5.55** |

**Residential Demands - CCV South Phase 4***

| Dwelling Type | Number of Units | Population | | Average Day Demand | | | Max Day | Peak Hour |
|---|---|---|---|---|---|---|---|---|
| | | Persons per Unit | Population Per Dwelling Type | (L/c/d) | (L/d) | (L/s) | 2 x Avg. Day (L/s) | 3 x Avg. Day (L/s) |
| Single Detached | 39 | 3.4 | 133 | 280 | 37,240 | 0.43 | 0.86 | 1.29 |
| Back-to-Back Townhome | 40 | 2.7 | 108 | | 30,240 | 0.35 | 0.70 | 1.05 |
| Traditional Townhome | 69 | 2.7 | 187 | | 52,360 | 0.61 | 1.21 | 1.82 |
| **Subtotal** | **148** | | **428** | | **119,840** | **1.39** | **2.77** | **4.16** |

**Non Residential Demands - CCV South Phase 4**

| Property Type | Area (ha)‡ | | Average Day Demand | | | Max Day | Peak Hour |
|---|---|---|---|---|---|---|---|
| | | | (L/ha/d) | (L/d) | (L/s) | 1.5 x Avg. Day (L/s) | 1.8 x Max Day (L/s) |
| Park (Block 58) | 1.58 | | 28,000 | 44,240 | 0.51 | 0.77 | 1.38 |
| **Subtotal** | **1.58** | | | **44,240** | **0.51** | **0.77** | **1.38** |

**Residential Demands - CCV South Phase 5***

| Dwelling Type | Number of Units | Population | | Average Day Demand | | | Max Day | Peak Hour |
|---|---|---|---|---|---|---|---|---|
| | | Persons per Unit | Population Per Dwelling Type | (L/c/d) | (L/d) | (L/s) | 2 x Avg. Day (L/s) | 3 x Avg. Day (L/s) |
| Single Detached | 123 | 3.4 | 419 | 280 | 117,320 | 1.36 | 2.72 | 4.07 |
| Back-to-Back Townhome | - | 2.7 | - | | - | - | - | - |
| Traditional Townhome | 41 | 2.7 | 111 | | 31,080 | 0.36 | 0.72 | 1.08 |
| **Subtotal** | **164** | | **530** | | **148,400** | **1.72** | **3.44** | **5.15** |

**Non Residential Demands - CCV South Phase 5**

| Property Type | Area (ha) | | Average Day Demand (L/ha/d) | Average Day Demand (L/d) | Average Day Demand (L/s) | Max Day 1.5 x Avg. Day (L/s) | Peak Hour 1.8 x Max Day (L/s) |
|---|---|---|---|---|---|---|---|
| School (Block 34) | 2.464 | | 28,000 | 68,992 | 0.80 | 1.20 | 2.16 |
| **Subtotal** | **2.464** | | | **68,992** | **0.80** | **1.20** | **2.16** |

**Residential Demands - Area A ***

| Dwelling Type | Number of Units | Population Persons per Unit | Population Population Per Dwelling Type | Average Day Demand (L/c/d) | Average Day Demand (L/d) | Average Day Demand (L/s) | Max Day 2 x Avg. Day (L/s) | Peak Hour 3 x Avg. Day (L/s) |
|---|---|---|---|---|---|---|---|---|
| Multi-Family Residential (area 0.53 ha) ǂ | 27 | 2.7 | 73 | 280 | 20,412 | 0.24 | 0.47 | 0.71 |
| **Subtotal** | **27** | | **73** | | **20,412** | **0.24** | **0.47** | **0.71** |

**Non Residential Demands - Area A**

| Property Type | Area (ha) | | Average Day Demand (L/ha/d) | Average Day Demand (L/d) | Average Day Demand (L/s) | Max Day 1.5 x Avg. Day (L/s) | Peak Hour 1.8 x Max Day (L/s) |
|---|---|---|---|---|---|---|---|
| Commercial ǂ | 1.49 | | 28,000 | 41,720 | 0.48 | 0.72 | 1.30 |
| **Subtotal** | **1.49** | | | **41,720** | **0.48** | **0.72** | **1.30** |

**Residential Demands - Area B***

| Dwelling Type | Number of Units | Population Persons per Unit | Population Population Per Dwelling Typeǂ | Average Day Demand (L/c/d) | Average Day Demand (L/d) | Average Day Demand (L/s) | Max Day 2 x Avg. Day (L/s) | Peak Hour 3 x Avg. Day (L/s) |
|---|---|---|---|---|---|---|---|---|
| Single Family Residential (area 0.43 ha) ǂ | - | - | 28 | 280 | 7,840 | 0.09 | 0.18 | 0.27 |
| **Subtotal** | **-** | | **28** | | **7,840** | **0.09** | **0.18** | **0.27** |

**Residential Demands - Development west of CCV South***

| Dwelling Type | Number of Units | Population Persons per Unit | Population Population Per Dwelling Typeǂ | Average Day Demand (L/c/d) | Average Day Demand (L/d) | Average Day Demand (L/s) | Max Day 2 x Avg. Day (L/s) | Peak Hour 3 x Avg. Day (L/s) |
|---|---|---|---|---|---|---|---|---|
| Multi-Family Residentialǂ | - | - | 991 | 280 | 277,480 | 3.21 | 6.42 | 9.63 |
| **Subtotal** | **-** | | **991** | | **277,480** | **3.21** | **6.42** | **9.63** |

**Residential Demands - Future Development south of CCV Southǂ**

| Dwelling Type | Number of Units | Population Persons per Unit | Population Population Per Dwelling Type | Average Day Demandǂǂ (L/unit/d) | Average Day Demandǂǂ (L/d) | Average Day Demandǂǂ (L/s) | Max Day (L/s)ǂǂ | Peak Hour (L/s)ǂǂ |
|---|---|---|---|---|---|---|---|---|
| Single Detached | 368 | 3.4 | 1,252 | 570 | 209,760 | 2.43 | 6.90 | 18.13 |
| Back-to-Back Townhome | 245 | 2.7 | 662 | 560 | 137,200 | 1.59 | 1.59 | 2.54 |
| Traditional Townhome | 655 | 2.7 | 1,769 | 560 | 366,800 | 4.25 | 4.25 | 6.79 |
| **Subtotal** | **1,268** | | **3,683** | | **713,760** | **8.26** | **12.73** | **27.47** |

**Non Residential Demands - Future Development south of CCV Southǂ**

| Property Type | Area (ha) | | Average Day Demandǂǂ (L/ha/d) | Average Day Demandǂǂ (L/d) | Average Day Demandǂǂ (L/s) | Max Day (L/s)ǂǂ | Peak Hour (L/s)ǂǂ |
|---|---|---|---|---|---|---|---|
| School | 2.00 | | 8,500 | 17,000 | 0.20 | 0.20 | 0.26 |
| Park | 2.50 | | 8,500 | 21,250 | 0.25 | 0.25 | 0.32 |
| **Subtotal** | **4.50** | | | **38,250** | **0.44** | **0.44** | **0.58** |

| | | **Avg. Day** | **Max Day** | **Peak Hour** |
|---|---|---|---|---|
| **Total (Connection Points 1 & 2)** | | **22.39** | **39.13** | **68.26** |

*Peaking factors based on development population of 3,001-10,000 capita from the MOE Design Guidelines

ǂProvided by DSEL

ǂǂPeaking factors from the previous Cardinal Creek Village Study (Veritec, 2013)

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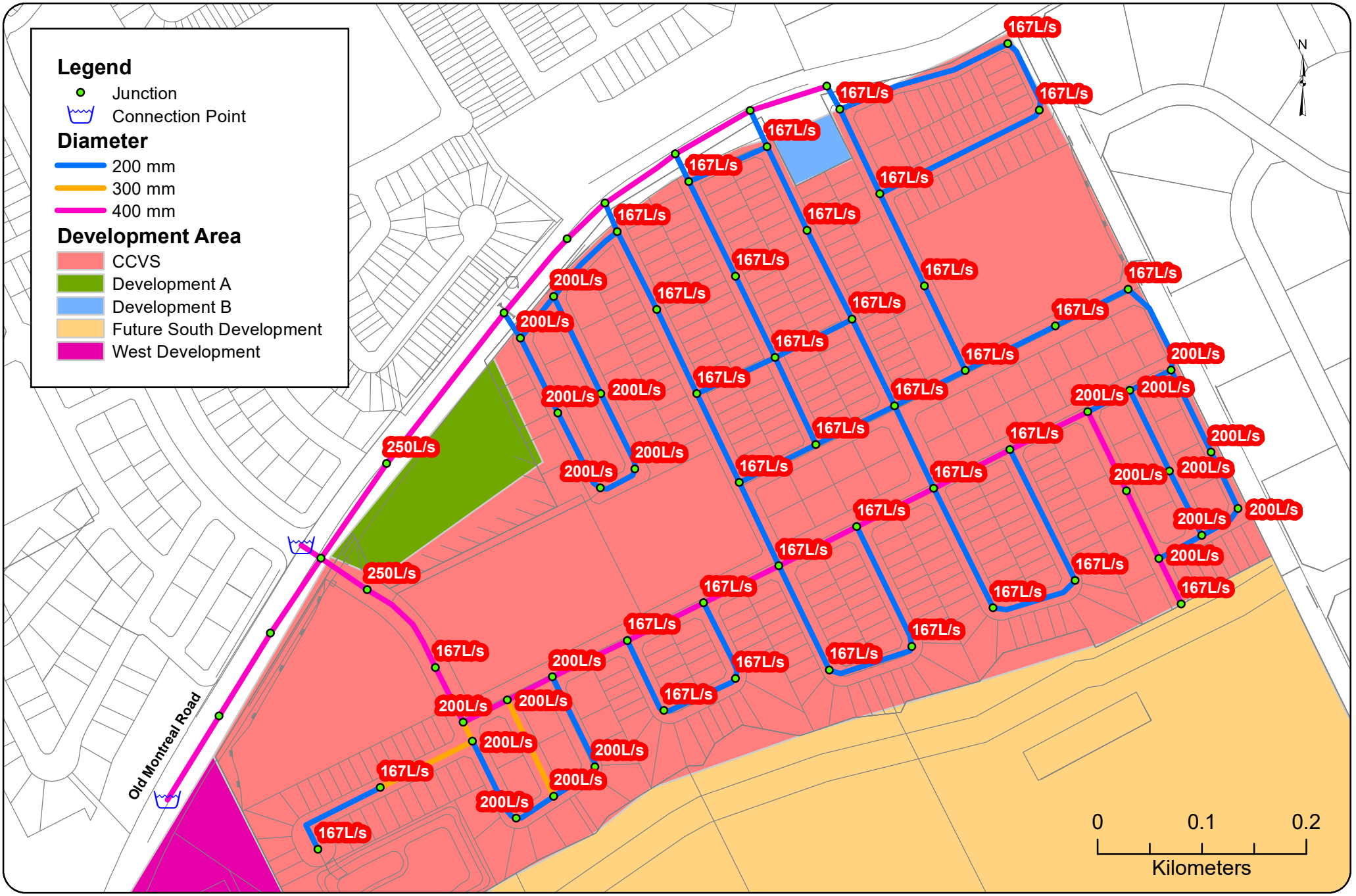
# Appendix B Required Fire Flow Allocation




GeoAdvice Engineering Inc.

Project: **Hydraulic Capacity and Modeling Analysis**
**Cardinal Creek Village South**
Client: **David Schaeffer Engineering Ltd.**
Date: **November 2024**
Created by: **JL**
Reviewed by: **WdS**



**Required Fire Flow**

**Figure B.1**

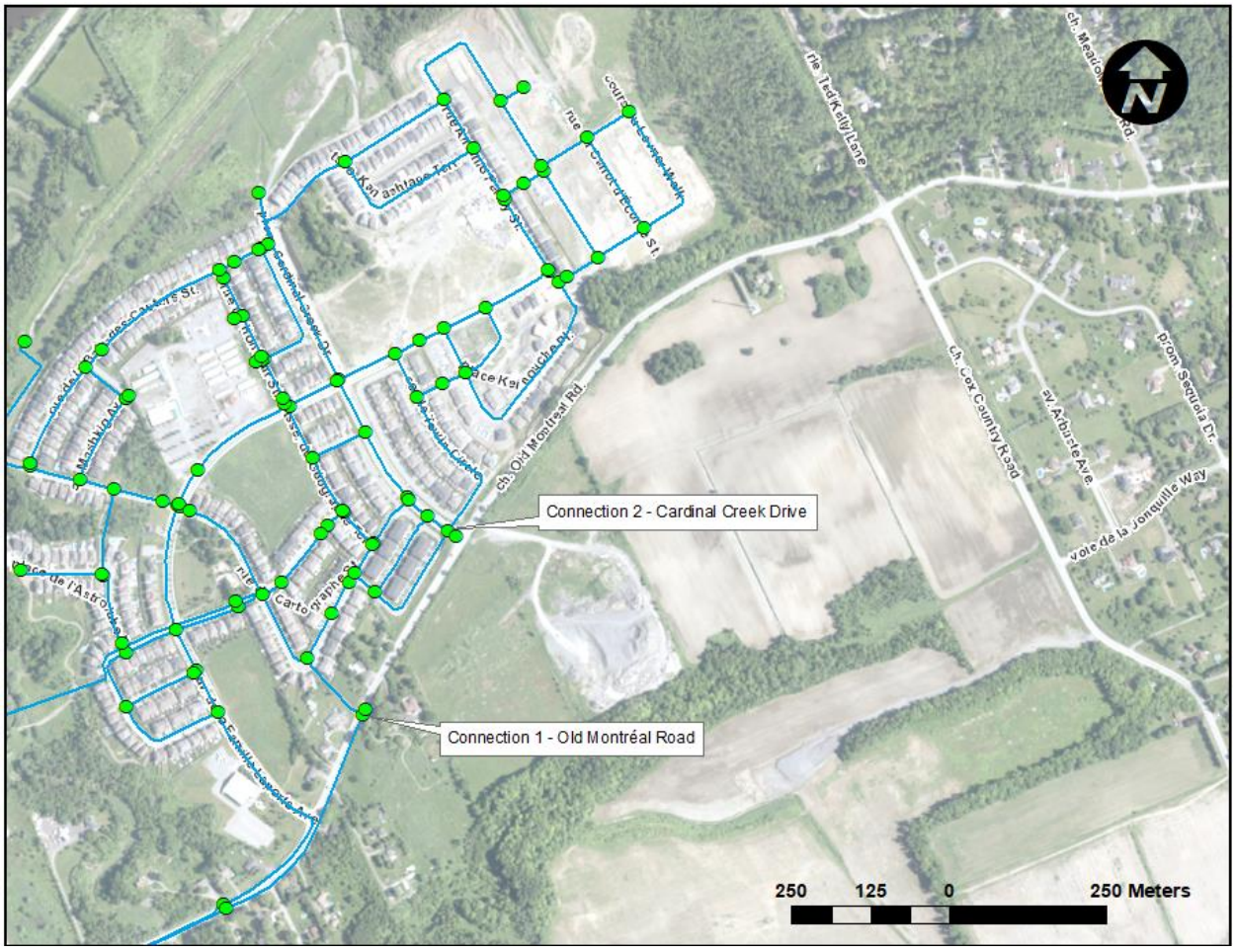
# Appendix C Boundary Conditions

# Boundary Conditions
# Cardinal Creek Village South – E4 & E5 UEA

## Provided Information

| Scenario | Demand | |
|---|---|---|
| | L/min | L/s |
| Average Daily Demand | 1,343 | 22.39 |
| Maximum Daily Demand | 2,348 | 39.13 |
| Peak Hour | 4,096 | 68.26 |
| Fire Flow Demand #1 | 10,000 | 166.67 |
| Fire Flow Demand #2 | 15,000 | 250.00 |

## Location



## Results

### Connection 1 – Old Montréal Road

| Demand Scenario | Head (m) | Pressure[1] (psi) |
|---|---|---|
| Maximum HGL | 130.2 | 80.6 |
| Peak Hour | 124.9 | 73.1 |
| Max Day plus Fire Flow #1 | 123.6 | 71.2 |
| Max Day plus Fire Flow #2 | 119.8 | 65.8 |

Ground Elevation = 73.5 m

### Connection 2 – Cardinal Creek Drive

| Demand Scenario | Head (m) | Pressure[1] (psi) |
|---|---|---|
| Maximum HGL | 130.1 | 76.5 |
| Peak Hour | 124.7 | 68.8 |
| Max Day plus Fire Flow #1 | 121.3 | 63.9 |
| Max Day plus Fire Flow #2 | 115.2 | 55.2 |

Ground Elevation = 76.3 m

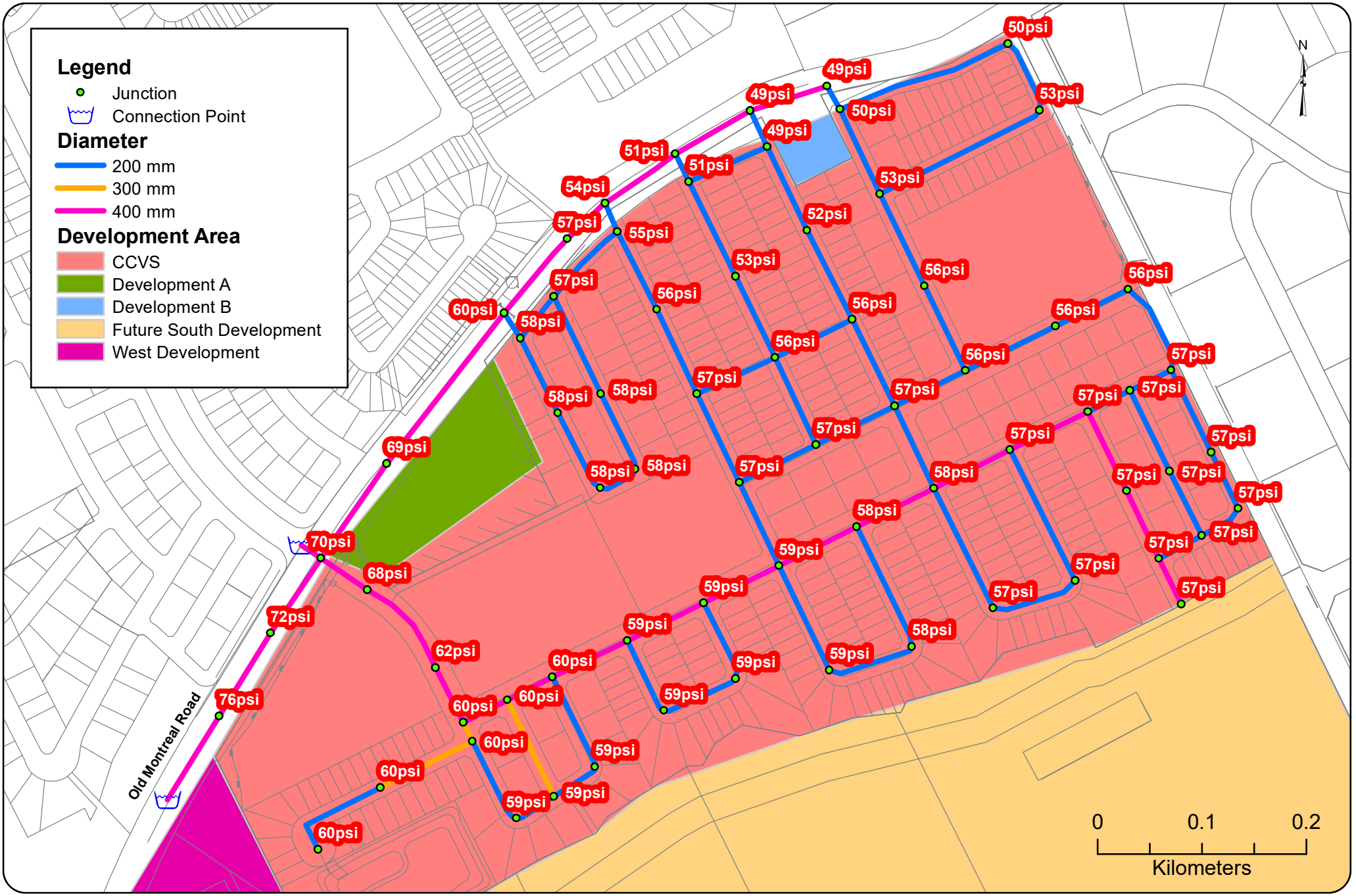
### Notes

1. As per the Ontario Building Code in areas that may be occupied, the static pressure at any fixture shall not exceed 552 kPa (80 psi.) Pressure control measures to be considered are as follows, in order of preference:
    a. If possible, systems to be designed to residual pressures of 345 to 552 kPa (50 to 80 psi) in all occupied areas outside of the public right-of-way without special pressure control equipment.
    b. Pressure reducing valves to be installed immediately downstream of the isolation valve in the home/ building, located downstream of the meter so it is owner maintained.
2. No additional pumps turned on during different scenarios.

### Disclaimer

*The boundary condition information is based on current operation of the city water distribution system. The computer model simulation is based on the best information available at the time. The operation of the water distribution system can change on a regular basis, resulting in a variation in boundary conditions. The physical properties of watermains deteriorate over time, as such must be assumed in the absence of actual field test data. The variation in physical watermain properties can therefore alter the results of the computer model simulation. Fire Flow analysis is a reflection of available flow in the watermain; there may be additional restrictions that occur between the watermain and the hydrant that the model cannot take into account.*

# Appendix D ADD and PHD Pressures

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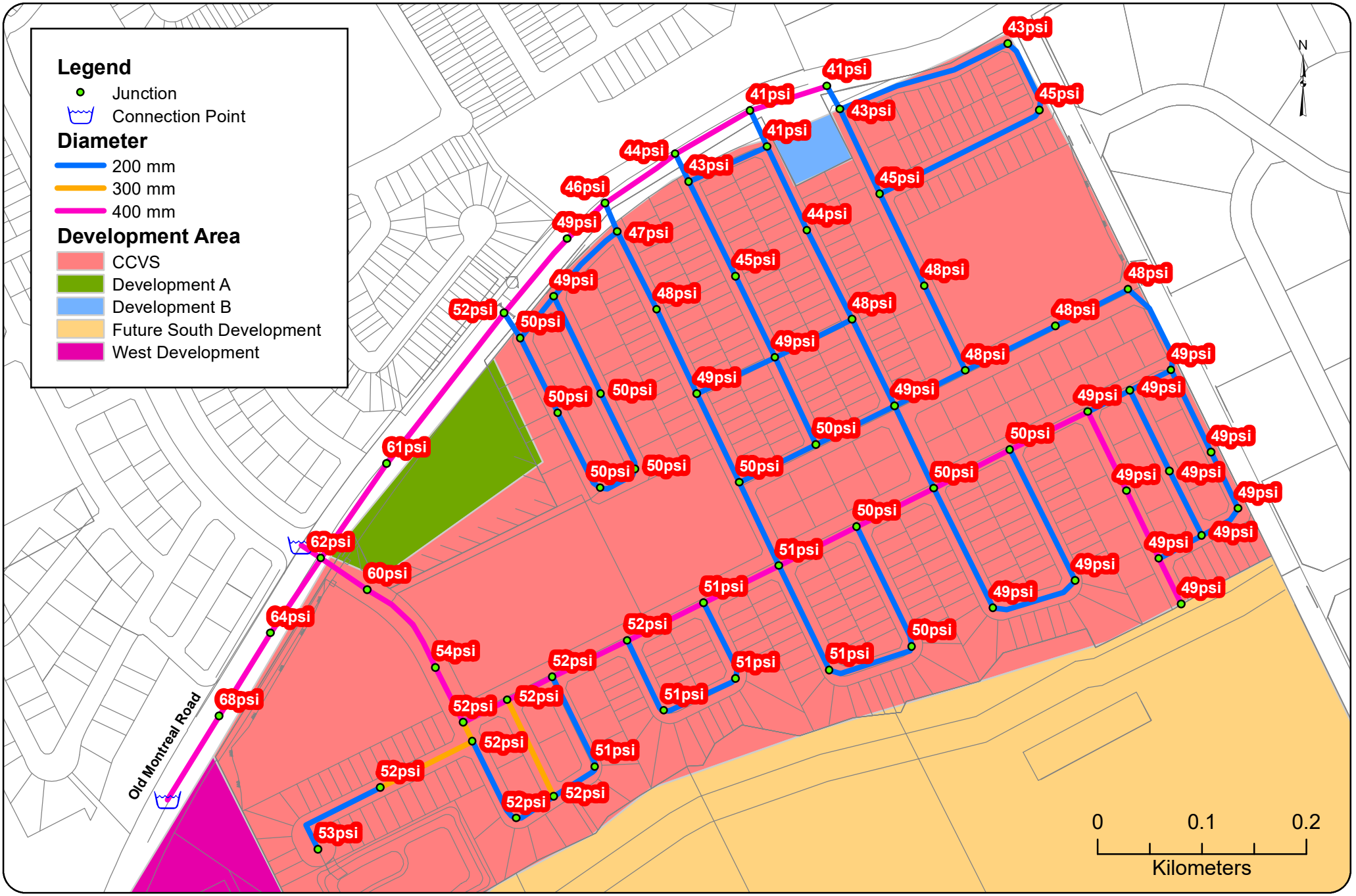
Reviewed by: **WdS**



**ADD Pressure Results**

**Figure D.1**

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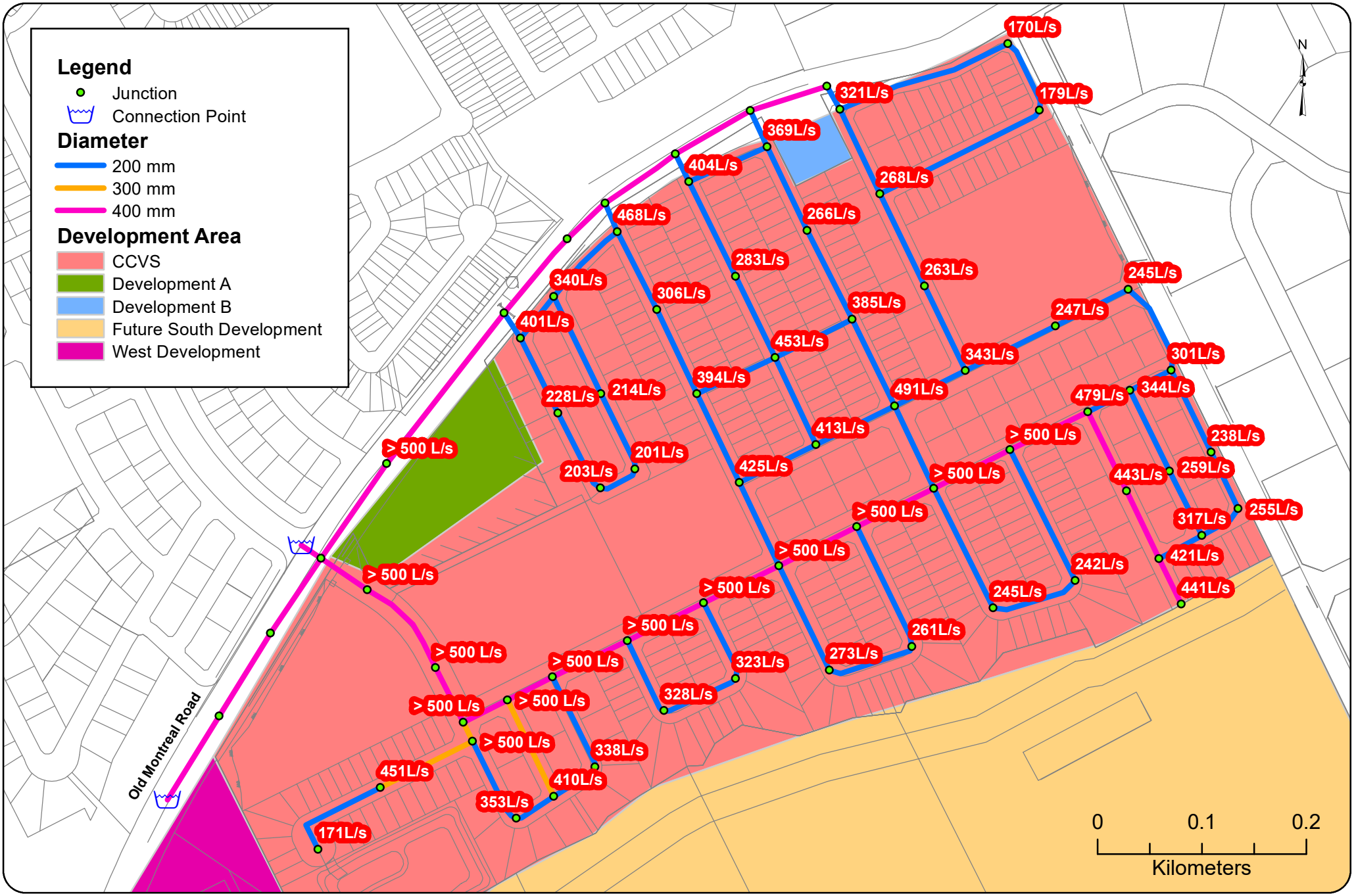
**PHD Pressure Results**

**Figure D.2**

# Appendix E MDD+FF Model Results

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**Available Fire Flow @ 20 psi MDD + FF Scenario**

**Figure E.1**