



TECHNICAL MEMORANDUM

To: **Ken Kaden, P.Eng.** Company: **Town of Collingwood**
Project Coordinator, Environmental Services

From: **Emma Thompson, P.Eng.** Project Ref. #: **75-41-171235**

Copy: Date: **September 23, 2020**

Subject: **Watermain Hydraulic Assessment of the Silver Creek Development**

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TOWN OF COLLINGWOOD

Watermain Hydraulic Assessment of the Proposed Silver Creek Development

C3 WATER INC.

September 23, 2020

Ministry of Culture

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September 30, 2008

Holly Martelle
Timmins Martelle Heritage Consultants Inc.
205 Oxford Street East, Suite 203A
London, ON

Dear Ms Martelle,

Re: Review and acceptance into the provincial register of reports the archaeological assessment report entitled "Stage 1 & 2 Archaeological Assessment, Three Development Properties, 11403, 1453 & 11461 Highway 26 West, Geographic Township of Nottawasaga, Town of Collingwood, Simcoe County, Ontario" written November 2006, received on November 14, 2006

PIF: P064-119-2006

RIMS: 43CS013

Your #: 2006-058

This office has reviewed the above-mentioned report, which has been submitted to this Ministry as a condition of licensing in accordance with Part VI of the Ontario Heritage Act, R.S.O. 1990, c 0.18. This review is to ensure that the licensed professional consultant archaeologist has met the terms and conditions of their archaeological licence, that archaeological sites have been identified and documented according to the 1993 technical guidelines set by the Ministry and that the archaeological fieldwork and report recommendations ensure the conservation, protection and preservation of the cultural heritage of Ontario.

No materials of archaeological significance were discovered, and it is recommended that the property as depicted in Figure 14 of the report be considered free from further concern for archaeology. The Ministry of Culture concurs with this recommendation and accepts this report into the provincial register of archaeology reports.

Please feel free to contact me regarding this project should you have any questions.

Yours,

Paige Campbell
Acting Archaeology Review Officer
cc Century 21 Offord Realty Limited



TECHNICAL MEMORANDUM

VERSION	DATE	DESCRIPTION OF REVISIONS	REVISED BY	REVIEWED BY
1	September 16, 2020	Draft #1	Michelle Scott Alexandra Laleva	Emma Thompson Sam Ziemann Ken Kaden
2	September 23, 2020	Final	Michelle Scott	Emma Thompson Sam Ziemann

SIGN OFF


This document, entitled “**Watermain Hydraulic Assessment of the Silver Creek Development**”, was prepared by C3 Water Inc. for the **Town of Collingwood**.

C3W certifies that the information contained in this report is accurate, complete and in accordance to 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.

The material herein reflects C3 Water’s best judgement based upon the information available at the time of preparation. Any use which a third party makes of this report or any reliance on or decisions made based on it, are the responsibilities of such third parties. C3 Water Inc. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based upon this report.


DATE: September 23rd, 2020

SEAL



Prepared by: **Emma Thompson, P. Eng.,
Project Engineer – Water Systems**

SEAL



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



Table of Contents

1.0 Introduction and Background 1
1.1 Design Standards 2
1.2 Demand and Fire Flow 2
1.3 Model Development..... 3
2.0 Modelling Results..... 3
2.1 Pressure Results 3
2.2 Fire Flow Results..... 9
3.0 Summary and Recommendations 13

List of Figures

Figure 1-1 Proposed Development Area Site Overview (NTS) 1
Figure 2-1 MDD 2016 - Minimum Pressure – Pre-Development 5
Figure 2-2 ADD 2016 - Average Pressure – Post-Development 6
Figure 2-3 MDD 2016 - Minimum Pressure – Post-Development..... 7
Figure 2-4 MDD 2032 - Minimum Pressure – Post-Development..... 8
Figure 2-5 MDD 2016 - Development Fire Flows 10
Figure 2-6 MDD Near Future - Development Fire Flows 11
Figure 2-7 MDD 2032 - Development Fire Flows 12

List of Tables

Table 1.1 Town of Collingwood Design Standards 2
Table 1.2 Demand Calculated Values 2
Table 1.3 Fire Flow Requirements (L/s) 3
Table 1.4 MECP Guidelines for C-Factors..... 3
Table 2.1 Highway 26 Pressure Results..... 4
Table 2.2 Development Pressures (psi) 4
Table 2.3 Available Fire Flow 9

List of Appendices

APPENDIX A Servicing and Stormwater Management Implementation Report (Crozier, 2020)

1.0 INTRODUCTION AND BACKGROUND

C3 Water (C3W) has been requested to conduct a watermain hydraulic assessment of the proposed Silver Creek development and its impacts on the existing distribution system. Figure 1-1 below provides an overview of the proposed development area. A servicing plan developed by Crozier Consulting Engineers (Crozier) is included in the Servicing and Stormwater Management Implementation Report (SSWMIR) in Appendix A.

The proposed development is located in pressure Zone 1 on the lands of 11403, 11453 and 11461 Highway 26, encompassing an area of approximately 4.98 ha. The Subject Lands are bounded by Highway 26 to the north and east, a private condominium development to the south (Wyldeewood), a Road Allowance (closed) to the west. The development plan consists of two (2) 4-storey apartment buildings totaling approximately 200 units, a 1-storey amenity building, and thirteen (13) 2-storey townhome buildings totaling approximately 60 units. The new area is proposed to be serviced by 200mm internal watermains which will be connected to both the 300 mm diameter watermain along the north side of Highway 26 at the south access intersection and to the 150 mm diameter watermain within the Wyldeewood Condominium lands.

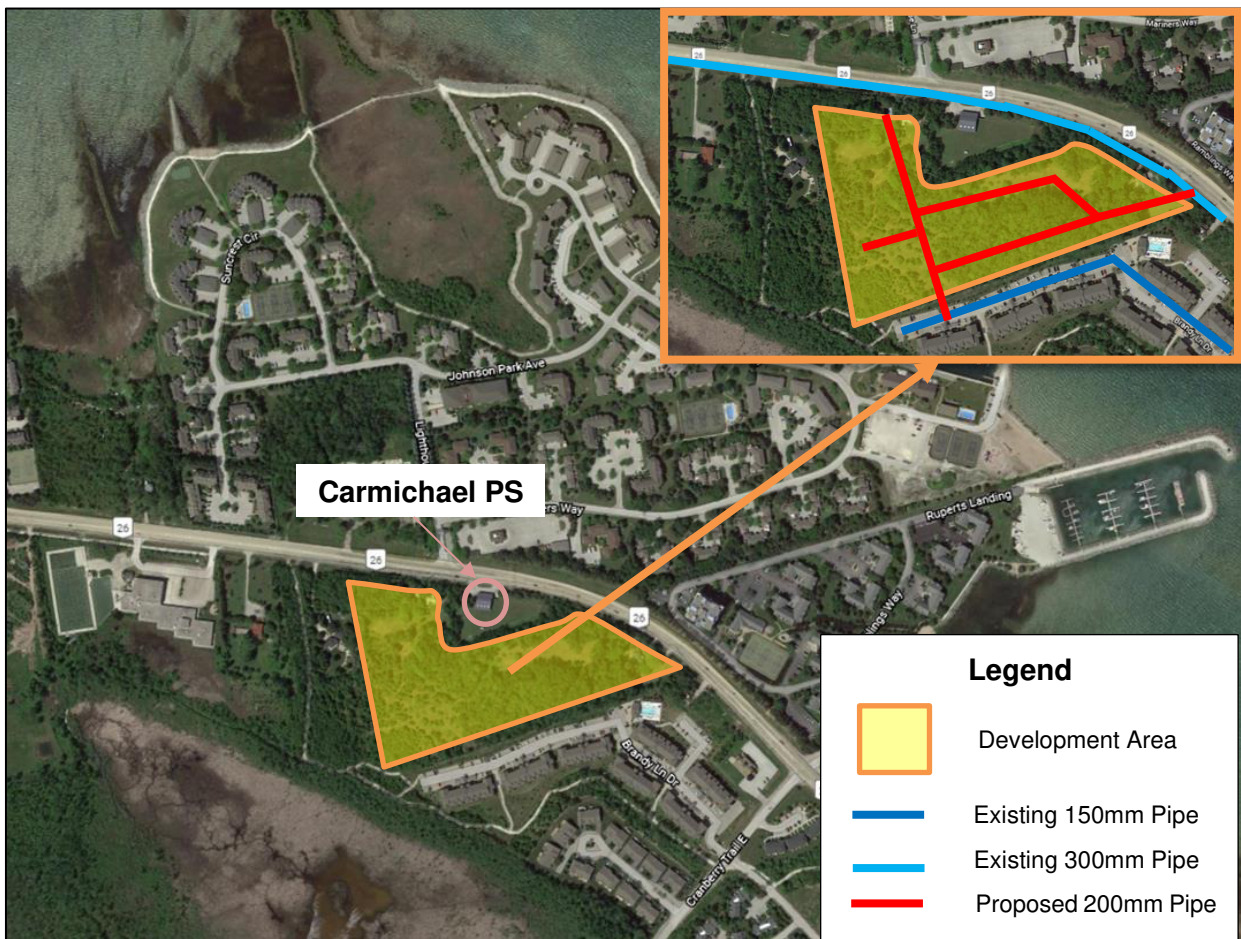


Figure 1-1 Proposed Development Area Site Overview (NTS)



1.1 Design Standards

The Town of Collingwood Development Standards (Town Standards) provide design criteria for assessing the impact of proposed developments. The Town Standards recommend that watermains be designed to provide maximum day demands plus fire flows according to the land use type. The Town Standards also outline minimum pressure requirements, as shown in Table 1.1.

Table 1.1 Town of Collingwood Design Standards

	Minimum	Preferred
Fire Flow Requirements		
Single-Family Residential	57 L/s	76 L/s
Institutional/Convenience/Commercial	91 L/s	114 L/s
Industrial/Commercial Subdivisions	136 L/s	154 L/s
Downtown Commercial	136 L/s	189 L/s
Pressure Requirements		
Maximum Day Demands + Fire Flows	20 psi	
Standard Operating Conditions	40 psi (Peak Hour)	50 - 80 psi

1.2 Demand and Fire Flow

Water demand calculations for the proposed development were completed by Crozier. The calculations were based on densities of 1.9 persons/unit for apartments and 2.4 persons/unit for townhouses. The average demand of 450 L/day per person was applied based on the Town Standards. The average demand of 450 L/day per person is considered conservative and was updated through the Collingwood Water and Sanitary Sewer Systems Master Plan (Master Plan, 2019). The official Town Standards are expected to be updated accordingly, but at this time the developer's demand calculation was used.

The Maximum Day Demands (MDD) and Peak Hour Demands (PHD) were calculated based on recommended peaking factors of 2 for MDD and 4.5 for PHD as per MECF Design Guidelines for Drinking Water Systems 3.4.5.1 and Town Standards. The domestic demands for the proposed development are summarized in Table 1.2 below and detailed calculations are provided the SSWMIR in Appendix A.

Table 1.2 Demand Calculated Values

Scenario	Demand (L/s)
ADD	2.88
MDD	5.76
PHD	12.95

The Crozier SSWMIR stated a maximum fire flow requirement for the development of 317 L/s for 4.0 hours per the Fire Underwriter's Survey (FUS), and 150 L/s required per Ontario Building Code (OBC). The calculated fire flow requirement for each building type is summarized in Table 1.3 below and detailed calculations are provided in Appendix A. A note on the use of sprinkler credits in the calculation had been added in Appendix A and should be reviewed to confirm required fire flows.

Table 1.3 Fire Flow Requirements (L/s)

Buildings	FUS	OBC
Apartment 1	150	150
Apartment 2	317	150
Amenity Building	83	45
Townhome Block (5 Units)	150	45

1.3 Model Development

The proposed watermains were added to the existing Town model based on the Crozier servicing drawing. A 200mm watermain loop is proposed to service the development buildings. In the site layout, the 200mm watermain connects to the existing 300 mm diameter watermain located within the Highway 26 Right-of-Way. At the south side of the development, the 200mm watermain connects to the existing 150 mm diameter stub.

C-factors were applied to the proposed watermains in the model based on the MECP guidelines as specified in Table 1.4 below. The required demand for each scenario was applied distributed across the model nodes based on the servicing layout. Elevations were assigned to each node based on the proposed drawings.

Table 1.4 MECP Guidelines for C-Factors

Pipe Diameter (mm)	C-Factor
150	100
200-250	110
300-600	120
> 600	130

2.0 MODELLING RESULTS

The proposed development area was assessed using the model's existing (2016), near future, and anticipated future (2032) ADD and MDD scenarios. In the future scenarios, the Carmichael BPS is expected to be upgraded with variable frequency drives (VFDs) on the pumps and a new inlet configuration that allows water to be pumped to only the west part of Zone 1 under normal conditions. A valve on the discharge piping of the pumping station is expected to be implemented so that it will open automatically to supply all of Zone 1 based on tower level and low upstream pressure thresholds.

2.1 Pressure Results

The range of ground elevations within the development area is approximately 180.0 – 183.0 mAMSL. The current target hydraulic grade line (HGL) for pressure Zone 1 is approximately 227 mAMSL. Therefore, the pressure at the development is expected to be approximately 44 – 47 m or 62 – 67 psi.

The existing pre-development MDD minimum pressure results are presented in Figure 2-1 below. The minimum pressures in areas surrounding the proposed development were found to range from 40 – 50 psi. Some areas fell below 40 psi for a brief time between 2:00am and 5:00am on a maximum day when the Carmichael Reservoir is typically filled and when the Town has observed peak demands. This development is located on the inlet side of the Carmichael Reservoir, and will remain the case after upgrades to the Carmichael PS discharge configuration.



The existing pressure results on Highway 26 pre- and post-development are summarized in Table 2.1 below. The proposed development was found to cause a decrease in pressure at Hwy 26 of roughly 1 psi. The demands and watermain loop in the proposed development were found to cause a brief decrease in minimum MDD pressure of 3 psi, to below 40 psi.

Table 2.1 Highway 26 Pressure Results

Scenario	Average	Min	Max
Pre-Development			
ADD 2016 Existing	62	56	77
MDD 2016 Existing	57	40	73
Post-Development			
ADD 2016 Existing	61	55	76
MDD 2016 Existing	56	37	72

The pressure results within the proposed development are summarized in Table 2.2 below. The development pressures were found to range from 33 – 76 psi under existing conditions and 61 – 68 psi under future conditions. The existing ADD average pressures in the development and surrounding area are shown in Figure 2-2 below. The MDD minimum pressures in the development and surrounding area are shown in Figure 2-3 and Figure 2-4 for existing and future conditions, respectively.

The pressure results were within the Town’s preferred operating criteria of 50 – 80 psi, with the exception of existing MDD conditions. Under existing MDD conditions, the pressures at the development were found to drop below 40 psi from approximately 2:00am – 5:00am for the reasons stated above.

Upgrades to the Carmichael PS and proposed new Zone 1 ET are expected to improve this issue. The anticipated discharge configuration upgrades will allow Carmichael to be filled at any point throughout the day and ideally in advance of peak demands. Furthermore, the Carmichael pumps will be able to run continuously to maintain pressure, and support low pressure to the east based on tower levels. Low pressure in the model may also be exaggerated due to low C-factors on Hwy 26, which have not been recently calibrated. Updates and calibration of the model are also anticipated.

Table 2.2 Development Pressures (psi)

Scenario	Average	Min	Max
ADD 2016 Existing	59	52	76
MDD 2016 Existing	54	33	72
ADD 2032 Proposed	65	61	68
MDD 2032 Proposed	63	61	65

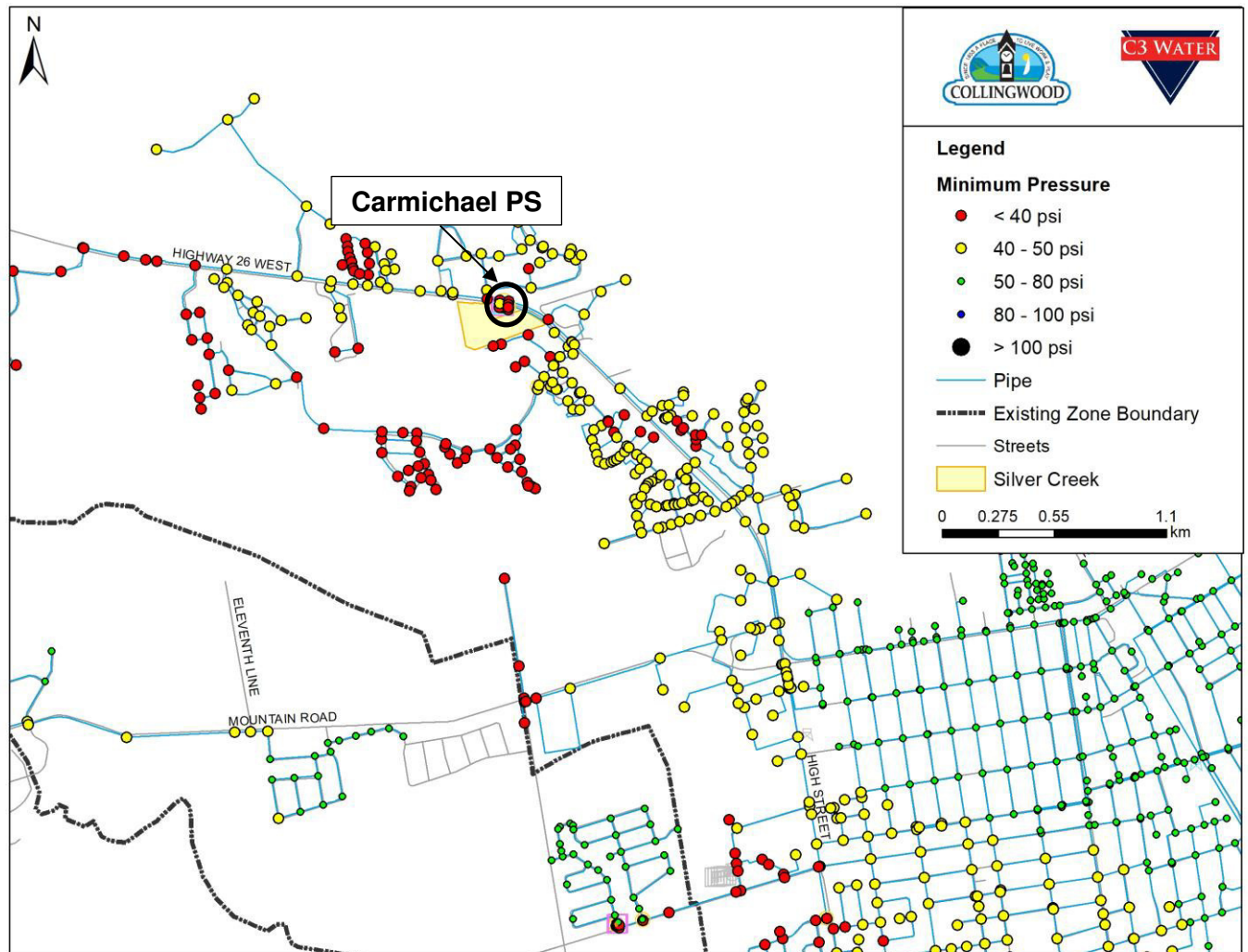


Figure 2-1 MDD 2016 - Minimum Pressure – Pre-Development

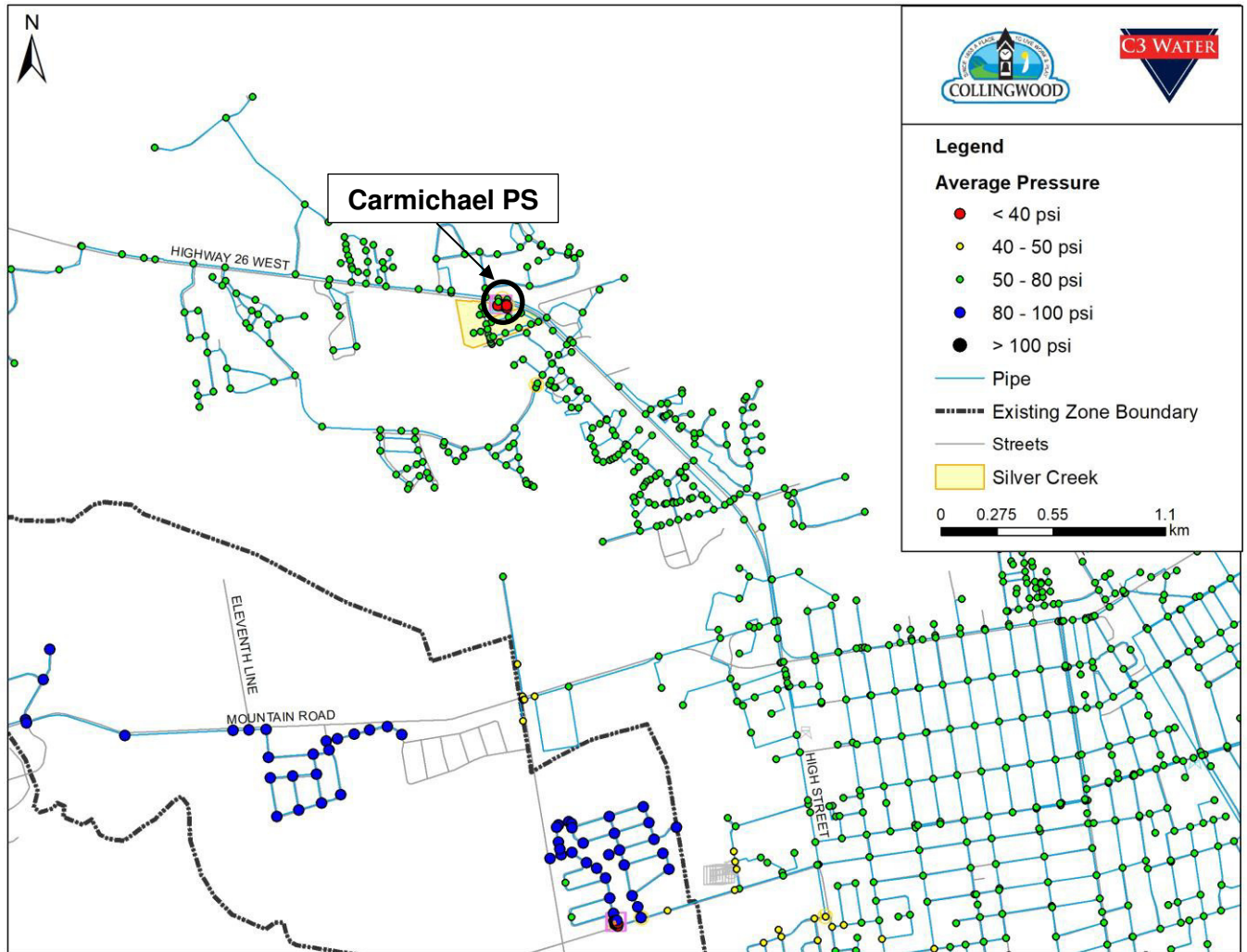


Figure 2-2 ADD 2016 - Average Pressure – Post-Development

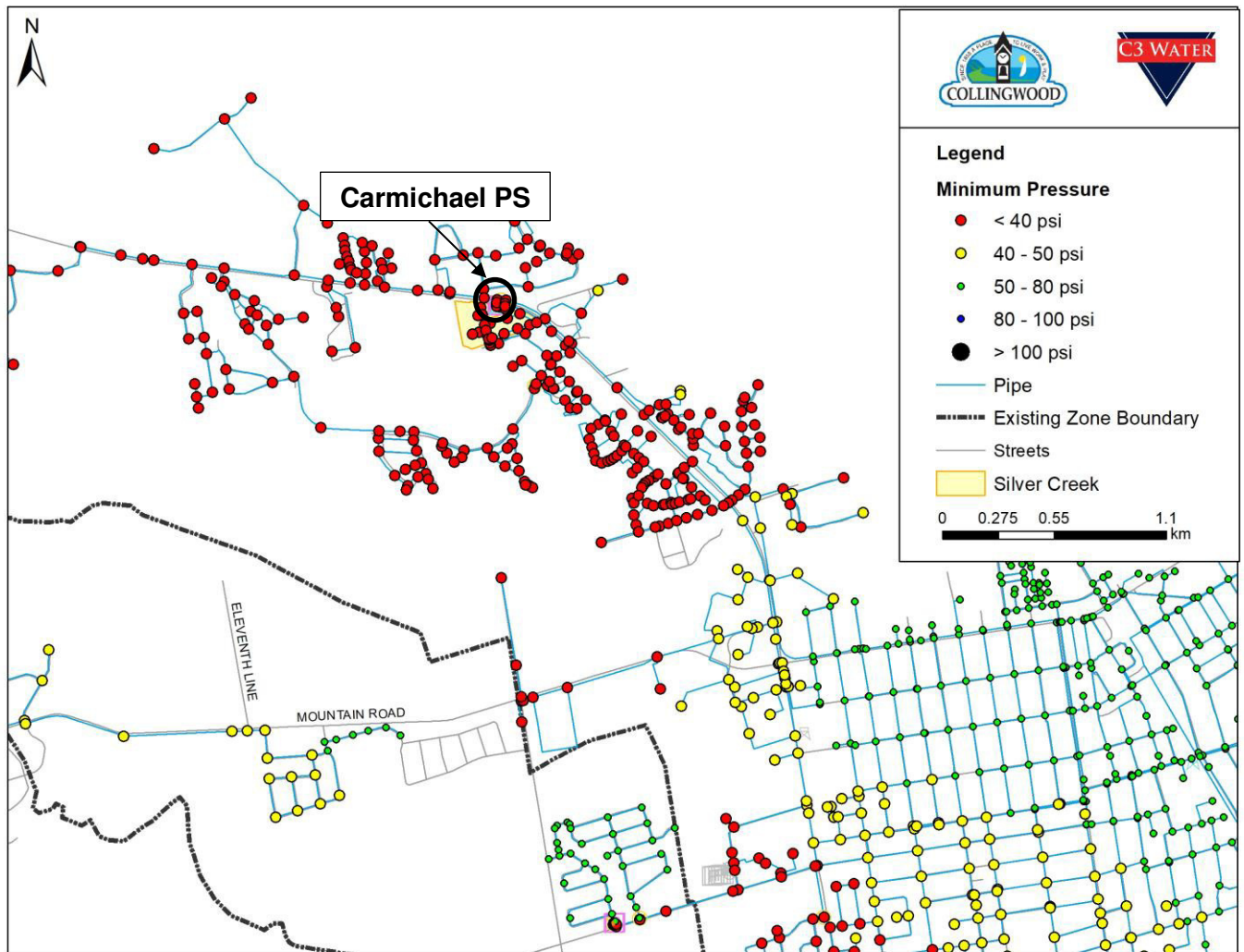


Figure 2-3 MDD 2016 - Minimum Pressure – Post-Development

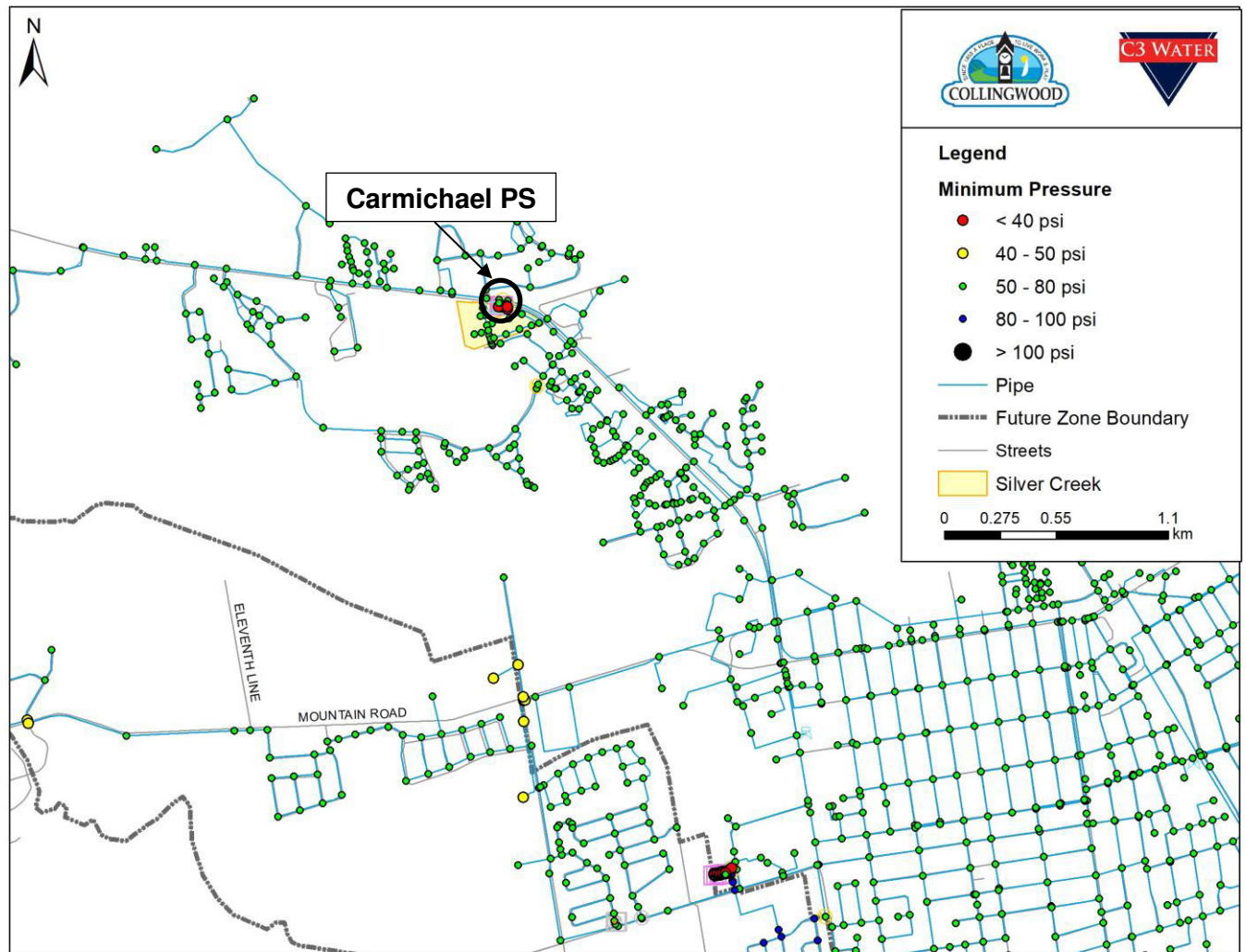


Figure 2-4 MDD 2032 - Minimum Pressure – Post-Development

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 Carmichael PS was operated at firm capacity (300 L/s) for the duration of the fire flow event. Under future conditions, it was found that the proposed control valve at the upgraded Carmichael PS in the model opened to allow flow to the east of the station during the fire flow event based on the tower level. The fire flow simulation was run under the following scenarios which are described in Table 2.3 below:

1. Existing (2016)
2. Near Future
3. Future (2032)

The fire flow results predicted by the model are representative of the amount of water available in a watermain and not the extent of flow available from a hydrant. Several hydrants may need to be operated to provide the desired fire flows. Typically, large buildings such as the proposed apartments and amenity building have sprinkler systems connected directly to the municipal water supply. It is unclear whether the proposed building will be designed with sprinkler systems (see note in Appendix A). As such, the fire flow available at the building connections and the nearest hydrants were reported below.

Under these conditions, fire flows in the development area ranged from 162 to 287 L/s, meeting the preferred FUS flow requirements at all buildings with the exception of Apartment Building 2. The fire flow results are presented in Table 2.3 and Figure 2-5, Figure 2-6 and Figure 2-7 below. The limiting scenario was MDD near future conditions (Figure 2-6), which should be used for available fire flow considerations.

The FUS fire flow requirement of 317 L/s for 4-hours at Apartment Building 2 cannot be achieved for the development area. To further test this concern, an extended period simulation was run under each scenario with a 4-hour duration fire flow demand from 12:00pm – 4:00pm of 317 L/s at the proposed hydrant closest to Apartment 2. Under MDD near future condition, a fire flow greater than 165L/s for 2 hours is expected to cause pressure to drop below the minimum 20 psi.

Table 2.3 Available Fire Flow

Scenario		MDD 2016	MDD Near Future	MDD 2032 Proposed
Carmichael Status		Existing 2 Pumps, up to firm capacity 300 L/s	Proposed upgrades 2 Pumps, up to firm capacity 300 L/s	Proposed upgrades 2 Pumps, up to firm capacity 300 L/s
Zone 1 ET Status		Existing	Existing	Proposed in MSP
	Required Fire Flow (L/s)	Available Fire Flow (L/s) (for 2 hours)		
Apartment Building 1	150 L/s, 2 hours	180 (hydrant) 187 (connection)	162 (hydrant) 168 (connection)	165 (hydrant) 171 (connection)
Apartment Building 2	317 L/s, 4 hours	203 (hydrant) 185 (connection)	183 (hydrant) 165 (connection)	188 (hydrant) 169 (connection)
Amenity Building	83 L/s, 2 hours	185 (connection)	165 (connection)	169 (connection)
Townhouse Block	150 L/s, 2 hours	232 - 287	211 - 268	218 - 280

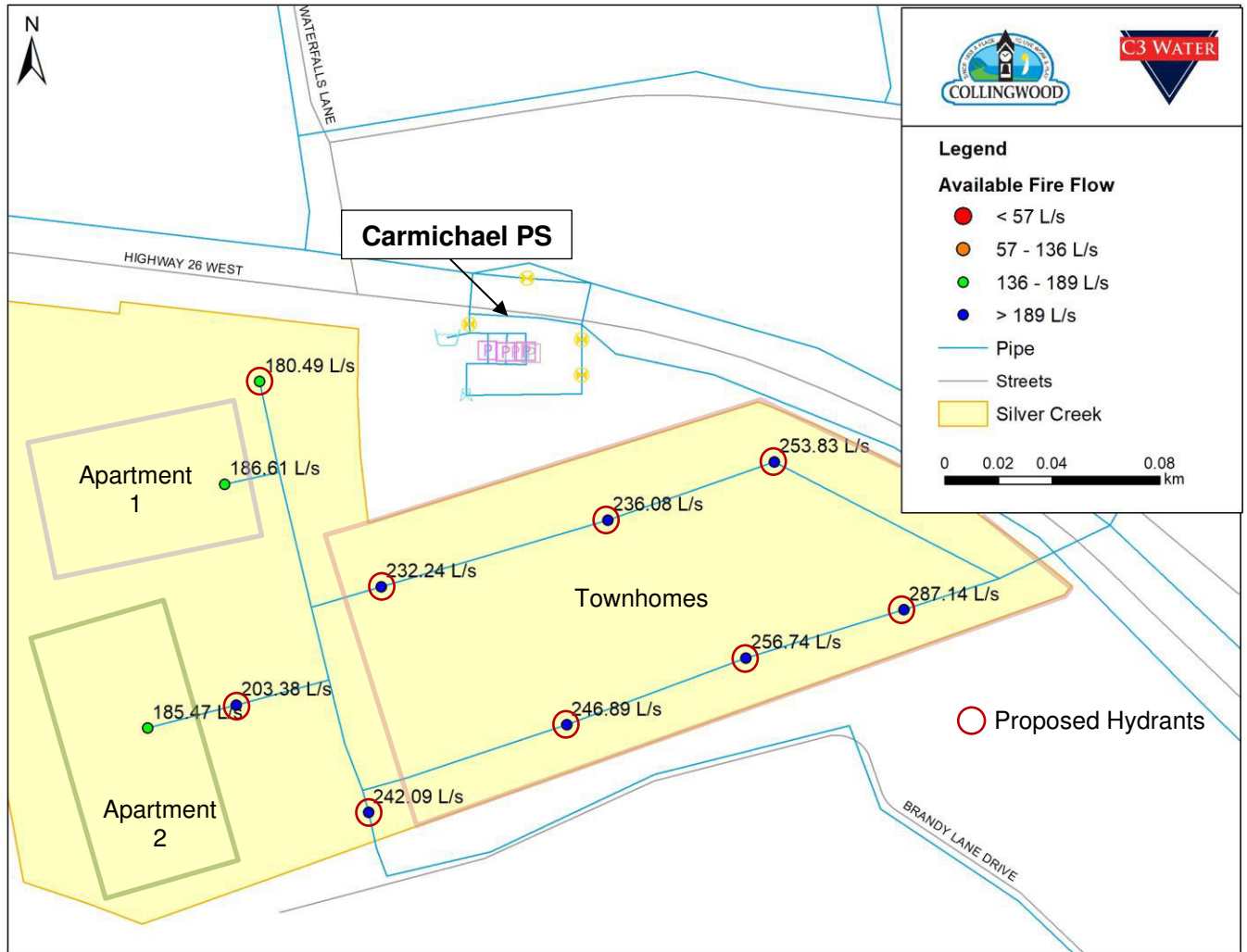


Figure 2-5 MDD 2016 - Development Fire Flows

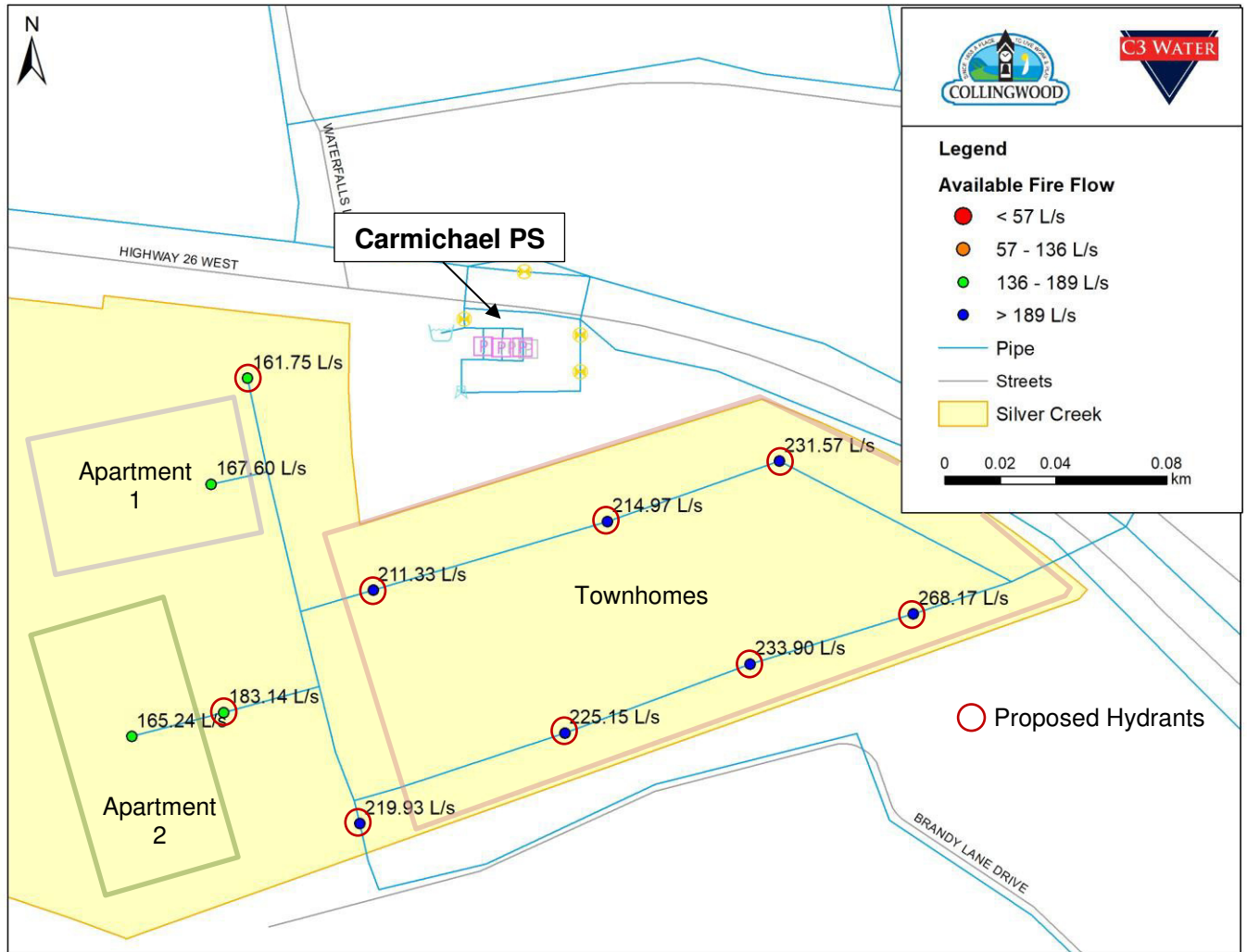


Figure 2-6 MDD Near Future - Development Fire Flows

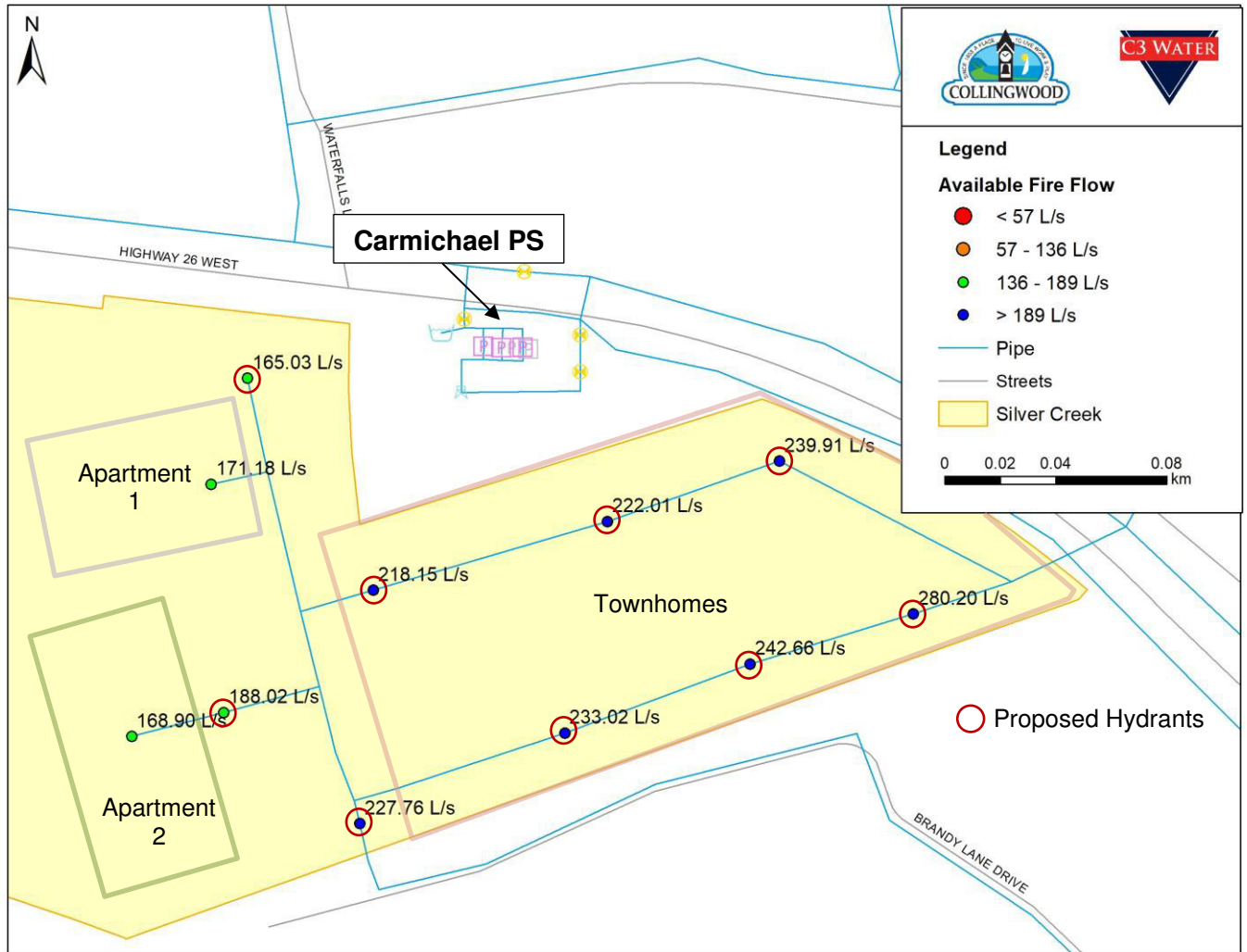


Figure 2-7 MDD 2032 - Development Fire Flows

3.0 SUMMARY AND RECOMMENDATIONS

1. The average pressure at the proposed development are expected to range from 54 – 59 psi under existing conditions and 63 – 65 psi under future conditions. The average pressures were found to be within Town’s preferred operating range of 50 – 80 psi.
2. The minimum pressure during existing MDD scenario was found to drop below 40 psi briefly from 2:00am – 5:00am when the Carmichael Reservoir is typically filled, and the Town has observed peak water use. The minimum pressures are expected to be improved with the upgrade of the Carmichael PS, and will be verified through future model update and calibration.
 - a. Efforts to reduce night-time peak demand (from automatic irrigation for example) are encouraged.
3. Phasing of the development should be limited until the proposed upgrades to the WTP and/or Carmichael PS are completed. Further model verification may be required based on final design of upgrades.
4. Under MDD near future conditions, the available fire flows in the proposed development were found to range from 162 to 268 L/s at 20 psi, meeting the calculated FUS requirements for the Townhouses, Apartment 1 and the Amenity building.
 - a. A note on the use of sprinkler credits in the calculations had been added in Appendix A and should be reviewed to confirm required fire flows.
5. The fire flow requirement of 317 L/s at Apartment 2 could not be met. The development should be designed to meet available fire flows shown in near future conditions in Figure 2-6. The developer may consider alternative construction options.



**APPENDIX A –
Servicing and Stormwater
Management Implementation Report Excerpts (Crozier, 2020)**

**SERVICING & STORMWATER
MANAGEMENT IMPLEMENTATION REPORT**

**RESIDENCES AT SILVER CREEK
TOWN OF COLLINGWOOD**

**PREPARED FOR:
SKYDEVCO INC.**

**PREPARED BY:
C.F. CROZIER & ASSOCIATES INC.
40 HURON STREET, SUITE 301
COLLINGWOOD, ON L9Y 4R3**

JULY 2020

CFCA FILE NO. 1790-5382

The material in this report reflects best judgment in light of the information available at the time of preparation. Any use which a third party makes of this report, or any reliance on or decisions made based on it, are the responsibilities of such third parties. C.F. Crozier & Associates Inc. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.



TABLE OF CONTENTS

1.0	INTRODUCTION	1
2.0	BACKGROUND & SITE DESCRIPTION	1
3.0	SITE ACCESS, ROADWAY & SERVICING COORIDOR	2
4.0	UTILITIES.....	3
5.0	SANITARY SEWAGE SYSTEM.....	3
5.1	Existing Sanitary Sewer Infrastructure	3
5.2	Proposed Sanitary Servicing Strategy.....	3
6.0	POTABLE WATER SUPPLY.....	4
6.1	Existing Water Infrastructure	4
6.2	Proposed Water Servicing Strategy.....	4
7.0	STORMWATER MANAGEMENT AND SITE DRAINAGE.....	6
7.1	Stormwater Management Criteria	6
7.2	Existing Drainage Conditions	7
7.3	Proposed Drainage Conditions	7
7.4	Hydrologic Parameterization	9
7.5	Stormwater Quantity Controls.....	9
7.6	Stormwater Quality Controls	13
7.7	Stormwater Erosion Control	14
7.8	Water Balance	14
7.9	Phosphorous Loading.....	14
8.0	NATURAL HAZARDS	15
9.0	EROSION & SEDIMENT CONTROLS	16
10.0	CONCLUSIONS AND RECOMMENDATIONS.....	16

Based on these values it is estimated that peak sanitary flow from the site will be **12.52 L/s**.

The proposed routing of the internal sanitary sewers will follow the internal roadways. The layout of these sewers is shown in DWG 102 and sanitary sewer calculations are included in Appendix B.

6.0 POTABLE WATER SUPPLY

6.1 Existing Water Infrastructure

The existing potable water distribution network fronting the Site is a 300 mm diameter watermain along the north side of Highway 26. There is also the existing Carmichael Reservoir adjacent to the Site with a 300 mm diameter watermain along the south side of Highway 26 which feeds the reservoir. Based on correspondence with the Town, connection to the existing distribution network is to be made to the watermain on the north side of Highway 26 as this is the discharge side of the Town Reservoir. There is a stub provided at the southern property line of the site which provides connection to the existing 150 mm diameter watermain within the Wyldewood condominiums. It is our understanding that the watermain within the Wyldewood site is owned and operated by the Town of Collingwood. It is also noted that the Town is anticipating an expansion to the Carmichael Pumping Station as identified in the Collingwood Master Plan prepared by Cole. Correspondence with the Town is provided in Appendix C.

The Town has identified that the Water Treatment Plant is currently operating at 80% capacity as identified in the Collingwood Master Plan prepared by Cole. The Town has initiated an Environmental Assessment (EA) for the upgrades to the Water Treatment Plant to increase the capacity to meet the demand of the planned and anticipated development in Collingwood. It is our understanding that the Town is applying a hold provision on developments until the execution of development agreements and that upon the execution of the development agreements, the Town will allocate capacity if available.

6.2 Proposed Water Servicing Strategy

The internal watermain will be connected to both the 300 mm diameter watermain along the north side of Highway 26 at the south access intersection and to the 150 mm diameter watermain within the Wyldewood Condominium lands. The internal watermain within the proposed development will become part of the public system and operated by the Town. Therefore, the proposed water distribution system within the Residences at Silver Creek development is designed in according to Town of Collingwood Standards and MECP Guidelines for Drinking Water (2008).

Individual service connections will be extended to the apartment buildings and the recreational facility from the local watermain and will have backflow prevention internal to the buildings per OBC requirements. Water services will be provided for each of the townhome units. Fire protection for the site will be provided by a series of fire hydrants connected to the internal watermain and siamese connections for the apartment buildings. The sizing of the internal watermain will be confirmed through Town updates to the Municipal water system model. Available pressures expected throughout the proposed development will likewise be confirmed.

Based on the current practices in the Town of Collingwood, it is assumed that the Municipality will assume ownership of the watermain distribution network located in the privately held portions of the development. This typically includes all watermains, hydrants, valves and services up to and including curb stops. An easement in favour of the Town is to be provided along the alignment of the watermain through the privately held portions of the development.

Water demands for the site were estimated using the following criteria per the Town of Collingwood Standards, MECP Design Guidelines Drinking Water and the Ontario Building Code.

- Average Flow Rate
 - Apartments 450 L/cap/day
 - Townhomes 450 L/cap/day
 - Amenity Building 40 L/person/day
- Max Day/Peak Hour Factor 2.0/4.5
- Population Density
 - Apartments 1.9 Persons/Unit
 - Townhouses 2.4 Persons/Unit
 - Amenity Building 0.75 Persons/m²

Based on these values it is estimated that water demands for the site are as follows:

- Average Daily Flow 2.88 L/s
- Max Day 5.76 L/s
- Peak Hour 12.95 L/s

The proposed routing of the internal watermain will follow the internal roadways. The design of this watermain is shown in DWG 102. Water demand and fire flow calculations are included in Appendix C.

Preliminary fire flows required to service the subject site were determined to be **317 L/s** per the Fire Underwriter's Survey, and 150 L/s required per Fire Marshal (OBC). The total design flow for the internal water distribution system is **329.95 L/s**. Required fire flow rates are subject to refinement based on the building design and further coordination with the Architect which may include the use of firebreaks, inclusion of a fire pump, etc. Final hydrant placement and the locations of the fireline services to the building are subject to coordination with the building design and location of the Siamese connections. Refer to Appendix C for potable water servicing demand and fire flow demand calculations.

It is anticipated that the boundary water distribution network can support the domestic water demand for the proposed development. However, it is acknowledged that the Town is currently reviewing the water usage and the water treatment plant capacity through the Environmental Assessment process. Based on the modeling of the water distribution network summarized in the Master Study prepared by Cole, the anticipated available fire flows are as outlined in Table 1 below. Actual available fire flows will need to be confirmed by the Town's water distribution model and will be compared with the required site fire flows. Therefore, the sizing of the internal watermain is subject to change.

Table 1: Anticipated Fire Flow Available

Node Location	¹Existing Conditions – Fire Flows Available (L/s)	²Existing Conditions – Fire Flow Available with Buildout of Planned Development (L/s)	³Preferred Alternative – Fire Flow Available with Buildout of Planned Development (L/s)	⁴Preferred Alternative – Fire Flow Available with Buildout of Planned & Anticipated Development (L/s)
Highway 26	> 189	> 189	> 189	> 189
Wyldeewood Condominiums	57 – 136	57 – 136	< 57 L/s	< 57 L/s

1. Available fire flow in 2016 under existing conditions determined from Figure 5-9 of the Master Study prepared by Cole (December 2019).
2. Available fire flow in 2032 under existing conditions and full buildout of planned developments determined from Figure 7-15 of the Master Study prepared by Cole (December 2019).
3. Available fire flow in 2032 with upgrades to the water distribution system per the preferred alternative and full buildout of planned developments determined from Figure 8-6 of the Master Study prepared by Cole (December 2019).
4. Available fire flow in 2044 with upgrades to the water distribution system per the preferred alternative and full buildout of planned and potential developments determined from Figure 8-7 of the Master Study prepared by Cole (December 2019).

7.0 STORMWATER MANAGEMENT AND SITE DRAINAGE

7.1 Stormwater Management Criteria

The stormwater management for this site will focus on the lands being developed on the subject property. Management of stormwater and site drainage for the proposed development must comply with the following policies and standards:

- Town of Collingwood Development Standards (July 2007);
- NVCA Stormwater Technical Guide (December 2013); and
- The Ministry of Environment Stormwater Management Planning and Design Manual (March 2003).

The stormwater management criteria for the future development include:

- **Water Quantity Control:** Control post-development peak flow rates to pre-development flow rates for all storm return periods up to and including the 100-year storm per Town of Collingwood and NVCA requirements.
- **Water Quality Control:** "Enhanced Protection" given Cranberry Marsh and Georgian Bay as the ultimate receivers.
- **Erosion Control:** 5mm retained on-site.
- **Water Balance:** Target of achieving pre-development annual infiltration volumes.
- **Phosphorous Loading:** "Best Efforts" to achieve pre-development phosphorous loading rates.
- **Development Standard:** Urban road cross-section complete with 100-year subsurface storm sewer system and overland flow routes for storms exceeding the 100-year event.

APPENDIX C

Potable Water Calculations

Potable Water Demand Calculations
Fire Flow Calculations

Residences at Silver Creek - Future Development Water Demand

Site Area	4.98 ha
Number of Units and Land Usage	
1) Apartments	200 Units
2) Townhomes	60 Units
3) Amenity Building	430 m ²
Person Per Residential Unit	
1) Apartments (Per email correspondence)	1.9 persons/unit
2) Townhomes (Per email correspondence)	2.4 persons/unit
3) Amenity Building (Per OBC Table 3.1.17.1.)	0.75 persons/sq.m
Populations	
Residential Population (Apartments)	380 Persons
Residential Population (Townhomes)	144 Persons
Amenity Building - Equivalent Residential Populations	29 Persons
Total Population	553 Persons
Domestic Water Design Flows	
Residential (Per Collingwood Engineering Standards, 2007)	450 L/C-day
Amenity Building (Per OBC Table 8.2.1.3.B.)	40 L/person-day
Total Domestic Water Design Flows	
Average Residential Daily Flow (Apartments)	1.98 L/sec
Average Residential Daily Flow (Townhomes)	0.75 L/sec
Average Daily Flow (Amenity Building)	0.15 L/sec
Total Average Daily Flow	2.88 L/sec
Max Day Peak Factor (Per Collingwood Engineering Standards, 2007)	2.0
Max Day Demand Flow (Apartments)	3.96 L/sec
Max Day Demand Flow (Townhomes)	1.50 L/sec
Max Day Demand Flow (Amenity Building)	0.30 L/sec
Total Max Day Demand Flow	5.76 L/sec
Peak Hour Factor (Per Collingwood Engineering Standards, 2007)	4.5
Peak Hour Flow (Apartments)	8.91 L/sec
Peak Hour Flow (Townhomes)	3.38 L/sec
Peak Hour Flow (Amenity Building)	0.67 L/sec
Total Peak Hour Flow	12.95 L/sec



Project.: Residences at Silver Creek
 Project No.: 1790-5382
 File.: Fire Flow Calcs
 Date.: 6/15/2020

**Fire Protection Volume Calculation Summary
 Residences at Silver Creek**

**WATER SUPPLY FOR PUBLIC FIRE PROTECTION (1999)
 FIRE UNDERWRITER'S SURVEY**

Unit Block #	Total Floor Area (m ²)	Flow (L/min)	Reduction (L/min)	Exposure Surcharge (L/min)	Required Flow (L/min)	Required Storage Volume (m ³)	Required Flow (L/s)
Apartment Building 1	5,871	13,000	-5,265	1,658	9,000	1,080	150
Apartment Building 2	11,883	19,000	-7,695	8,075	19,000	4,560	317
Amenity Building	427	5,000	-750	850	5,000	525	83
Townhome Block (5 Units)	729	6,000	-900	4,080	9,000	1,080	150

**OFFICE OF FIRE MARSHAL
 Part 3 of OBC**

Unit Block #	K	Volume (m ³)	S _{Tot}	Required Flow (L/min)	Required Storage (OBC) (m ³)	Required Flow (L/s)
Apartment Building 1	23	75,149	1.00	9,000	1,728	150
Apartment Building 2	23	152,102	1.00	9,000	3,498	150
Amenity Building	23	1,366	1.00	2,700	31	45
Townhome Block (5 Units)	23	2,005	2.00	2,700	92	45

SUMMARY:

- 1) Fire Flow required per FUS **317 L/s**
- 2) Fire flow required per Fire Marshal (OBC) **150 L/s**

Water Supply for Public Fire Protection - 1999
Fire Underwriters Survey

Part II - Guide for Determination of Required Fire Flow

1. An estimate of fire flow required for a given area may be determined by the formula:

$$F = 220 * C * \sqrt{A}$$

where

- F = the required fire flow in litres per minute
- C = coefficient related to the type of construction
 - = 1.5 for wood frame construction (structure essentially all combustible)
 - = 1.0 for ordinary construction (brick or other masonry walls, combustible floor and interior)
 - = 0.8 for non-combustible construction (unprotected metal structural components)
 - = 0.6 for fire-resistive construction (fully protected frame, floors, roof)
- A = The total floor area in square metres (including all storeys, but excluding basements at least 50 percent below grade) in the building considered.

Proposed Buildings

4 number of floors
 1468 sq.m. floor area
 5871 sq.m. total floor area

Ordinary construction

0.8 C

Therefore F= 13,000 L/min (rounded to nearest 1000 L/min)
("Value obtained in No. 1")

Fire flow determined above shall not exceed:
 30,000 L/min for wood frame construction
 30,000 L/min for ordinary construction
 25,000 L/min for non-combustible construction
 25,000 L/min for fire-resistive construction

2. Values obtained in No. 1 may be reduced by as much as 25% for occupancies having low contents fire hazard or may be increased by up to 25% surcharge for occupancies having a high fire hazard.

Non-Combustible	-25%	Free Burning	15%
Limited Combustible	-15%	Rapid Buring	25%
Combustible	No Charge		

Low fire Hazard occupancy for dwellings -15% reduction
-1,950 L/min reduction

"Value obtained in No. 2" 11,050

Note: Flow determined shall not be less than 2,000 L/min

3. Sprinklers - The value obtained in No. 2 above maybe reduce by up to 50% for complete automatic sprinkler protection.

Buildings will not have sprinklers (typical 30% reduction)
-3,315 L/min reduction

From FUS 1999, Page 18:

"The credit for the system will be a maximum of 30% for an adequately designed sprinkler system conforming to NFPA 13 and other NFPA sprinkler standards."

This calculation states that no sprinkler system will be installed, therefore no credit should be applied. Or perhaps the text is incorrect?

Water Supply for Public Fire Protection - 1999
Fire Underwriters Survey

Part II - Guide for Determination of Required Fire Flow

4. Exposure - To the value obtained in No. 2, a percentage should be added for structures exposed within 45 metres by the fire area under consideration. The percentage shall depend upon the height, area, and construction of the building(s) being exposed, the separation, openings in the exposed building(s), the length and height of exposure, the provision of automatic sprinklers and/or outside sprinklers in the building(s) exposed, the occupancy of the exposed building(s) and the effect of hillside locations on the possible spread of fire.

Separation	Charge	Separation	Charge
0 to 3 m	25%	20.1 to 30 m	10%
3.1 to 10 m	20%	30.1 to 45 m	5%
10.1 to 20 m	15%		

Exposed buildings

Name	Distance (m)			
North Adjacent Dwelling	>45	0%		0
South Adjacent Dwelling	19	15%		1,658
East Adjacent Dwelling	>45	0%		0
West Adjacent Dwelling	>45	0%		0
1,658 L/min Surcharge				

Determine Required Fire Flow

No. 2	11,050		
No. 3	-3,315 reduction		
No. 4	<u>1,658</u> surcharge		
Required Flow:	9,393 L/min		
Rounded to nearest 1000l/min:	9,000 L/min	or	150.0 L/s 2,378 USGPM

Required Duration of Fire Flow

Flow Required L/min	Duration (hours)
2,000 or less	1.0
3,000	1.25
4,000	1.5
5,000	1.75
6,000	2.0
8,000	2.0
10,000	2.0
12,000	2.5
14,000	3.0
16,000	3.5
18,000	4.0
20,000	4.5
22,000	5.0
24,000	5.5
26,000	6.0
28,000	6.5
30,000	7.0
32,000	7.5
34,000	8.0
36,000	8.5
38,000	9.0
40,000 and over	9.5

Determine Required Fire Storage Volume

Flow from above	9,000 L/min
Required duration	2.00 hours
Therefore:	1,080,000 Litres or 1,080 cu.m. is the required storage volume

Fire Protection Water Supply Guideline
Part 3 of the Ontario Building Code (2006)

$$Q = KVS_{TOT}$$

- Q = minimum supply of water in litres (L)
K = water supply coefficient
V = total building volume in cubic metres
S_{TOT} = total of spatial coefficient values from property line exposures on all sides

- K = 23 Group C building with non-combustible construction (Table 1)
V = 75149 Total building volume in cubic meters (3.2m per storey)
S_{TOT} = 1 S_{TOT} Need Not Exceed 2.0

Q = 1728422 L

Based on ranges listed in Table 2, the required minimum water supply flow rate is **9000 L/min**

150 L/s

Water Supply for Public Fire Protection - 1999
Fire Underwriters Survey

Part II - Guide for Determination of Required Fire Flow

1. An estimate of fire flow required for a given area may be determined by the formula:

$$F = 220 * C * \text{sqrt } A$$

where

- F = the required fire flow in litres per minute
- C = coefficient related to the type of construction
 - = 1.5 for wood frame construction (structure essentially all combustible)
 - = 1.0 for ordinary construction (brick or other masonry walls, combustible floor and interior)
 - = 0.8 for non-combustible construction (unprotected metal structural components)
 - = 0.6 for fire-resistive construction (fully protected frame, floors, roof)
- A = The total floor area in square metres (including all storeys, but excluding basements at least 50 percent below grade) in the building considered.

Proposed Buildings

4 number of floors
 2971 sq.m. floor area
 11883 sq.m. total floor area

Ordinary Construction

0.8 C

Therefore F= 19,000 L/min (rounded to nearest 1000 L/min)
("Value obtained in No. 1")

Fire flow determined above shall not exceed:
 30,000 L/min for wood frame construction
 30,000 L/min for ordinary construction
 25,000 L/min for non-combustible construction
 25,000 L/min for fire-resistive construction

2. Values obtained in No. 1 may be reduced by as much as 25% for occupancies having low contents fire hazard or may be increased by up to 25% surcharge for occupancies having a high fire hazard.

Non-Combustible	-25%	Free Burning	15%
Limited Combustible	-15%	Rapid Buring	25%
Combustible	No Charge		

Low fire Hazard occupancy for dwellings -15% reduction
-2,850 L/min reduction

"Value obtained in No. 2" 16,150 L/min

Note: Flow determined shall not be less than 2,000 L/min

3. Sprinklers - The value obtained in No. 2 above maybe reduce by up to 50% for complete automatic sprinkler protection.

Building will not have sprinklers (typical 30% reduction)
-4,845 L/min reduction

Water Supply for Public Fire Protection - 1999
Fire Underwriters Survey

Part II - Guide for Determination of Required Fire Flow

4. Exposure - To the value obtained in No. 2, a percentage should be added for structures exposed within 45 metres by the fire area under consideration. The percentage shall depend upon the height, area, and construction of the building(s) being exposed, the separation, openings in the exposed building(s), the length and height of exposure, the provision of automatic sprinklers and/or outside sprinklers in the building(s) exposed, the occupancy of the exposed building(s) and the effect of hillside locations on the possible spread of fire.

Separation	Charge	Separation	Charge
0 to 3 m	25%	20.1 to 30 m	10%
3.1 to 10 m	20%	30.1 to 45 m	5%
10.1 to 20 m	15%		

Exposed buildings

Name	Distance (m)			
North Adjacent Dwelling	20	15%	2,423	
South Adjacent Dwelling	40	5%	808	
East Adjacent Dwelling	30	10%	1,615	
West Adjacent Dwelling	10	20%	3,230	
				8,075 L/min Surcharge

Determine Required Fire Flow

No. 2	16,150	
No. 3	-4,845 reduction	
No. 4	<u>8,075</u> surcharge	
Required Flow:	19,380 L/min	
Rounded to nearest 1000/min:	19,000 L/min	or 316.7 L/s 5,019 USGPM

Determine Required Fire Storage Volume

Flow from above	19,000 L/min
Required duration	4.00 hours
Therefore:	4,560,000 Litres or 4,560 cu.m. is the required storage volume

Required Duration of Fire Flow

Flow Required L/min	Duration (hours)
2,000 or less	1.0
3,000	1.25
4,000	1.5
5,000	1.75
6,000	2.0
8,000	2.0
10,000	2.0
12,000	2.5
14,000	3.0
16,000	3.5
18,000	4.0
20,000	4.5
22,000	5.0
24,000	5.5
26,000	6.0
28,000	6.5
30,000	7.0
32,000	7.5
34,000	8.0
36,000	8.5
38,000	9.0
40,000 and over	9.5

Fire Protection Water Supply Guideline
Part 3 of the Ontario Building Code (2006)

$$Q = KVS_{TOT}$$

- Q = minimum supply of water in litres (L)
K = water supply coefficient
V = total building volume in cubic metres
S_{TOT} = total of spatial coefficient values from property line exposures on all sides

- K = 23 Group C building with combustible construction (Table 1)
V = 152102 Total building volume in cubic meters (3.2m per storey)
S_{TOT} = 1 S_{TOT} Need Not Exceed 2.0

Q = 3498355 L

Based on ranges listed in Table 2, the required minimum water supply flow rate is

9000 L/min

150 L/s

Water Supply for Public Fire Protection - 1999
Fire Underwriters Survey

Part II - Guide for Determination of Required Fire Flow

1. An estimate of fire flow required for a given area may be determined by the formula:

$$F = 220 * C * \text{sqrt } A$$

where

- F = the required fire flow in litres per minute
- C = coefficient related to the type of construction
 - = 1.5 for wood frame construction (structure essentially all combustible)
 - = 1.0 for ordinary construction (brick or other masonry walls, combustible floor and interior)
 - = 0.8 for non-combustible construction (unprotected metal structural components)
 - = 0.6 for fire-resistive construction (fully protected frame, floors, roof)
- A = The total floor area in square metres (including all storeys, but excluding basements at least 50 percent below grade) in the building considered.

Proposed Buildings

1 number of floors
 427 sq.m. floor area
 427 sq.m. total floor area

Ordinary Construction

1.0 C

Therefore F= 5,000 L/min (rounded to nearest 1000 L/min)
("Value obtained in No. 1")

Fire flow determined above shall not exceed:
 30,000 L/min for wood frame construction
 30,000 L/min for ordinary construction
 25,000 L/min for non-combustible construction
 25,000 L/min for fire-resistive construction

2. Values obtained in No. 1 may be reduced by as much as 25% for occupancies having low contents fire hazard or may be increased by up to 25% surcharge for occupancies having a high fire hazard.

Non-Combustible	-25%	Free Burning	15%
Limited Combustible	-15%	Rapid Burning	25%
Combustible	No Charge		

Low fire Hazard occupancy for dwellings -15% reduction
-750 L/min reduction

"Value obtained in No. 2" 4,250 L/min

Note: Flow determined shall not be less than 2,000 L/min

3. Sprinklers - The value obtained in No. 2 above maybe reduce by up to 50% for complete automatic sprinkler protection.

Building will not have sprinklers (typical 30% reduction)
0 L/min reduction

Water Supply for Public Fire Protection - 1999
Fire Underwriters Survey

Part II - Guide for Determination of Required Fire Flow

4. Exposure - To the value obtained in No. 2, a percentage should be added for structures exposed within 45 metres by the fire area under consideration. The percentage shall depend upon the height, area, and construction of the building(s) being exposed, the separation, openings in the exposed building(s), the length and height of exposure, the provision of automatic sprinklers and/or outside sprinklers in the building(s) exposed, the occupancy of the exposed building(s) and the effect of hillside locations on the possible spread of fire.

Separation	Charge	Separation	Charge
0 to 3 m	25%	20.1 to 30 m	10%
3.1 to 10 m	20%	30.1 to 45 m	5%
10.1 to 20 m	15%		

Exposed buildings

Name	Distance (m)			
North Adjacent Dwelling	>45	0%	0	
South Adjacent Dwelling	>45	0%	0	
East Adjacent Dwelling	10	20%	850	
West Adjacent Dwelling	>45	0%	0	
850 L/min Surcharge				

Determine Required Fire Flow

No. 2	4,250	
No. 3	0 reduction	
No. 4	<u>850</u> surcharge	
Required Flow:	5,100 L/min	
Rounded to nearest 1000/min:	5,000 L/min or	83.3 L/s
		1,321 USGPM

Determine Required Fire Storage Volume

Flow from above	5,000 L/min
Required duration	1.75 hours
Therefore:	525,000 Litres or 525 cu.m. is the required storage volume

Required Duration of Fire Flow

Flow Required L/min	Duration (hours)
2,000 or less	1.0
3,000	1.25
4,000	1.5
5,000	1.75
6,000	2.0
8,000	2.0
10,000	2.0
12,000	2.5
14,000	3.0
16,000	3.5
18,000	4.0
20,000	4.5
22,000	5.0
24,000	5.5
26,000	6.0
28,000	6.5
30,000	7.0
32,000	7.5
34,000	8.0
36,000	8.5
38,000	9.0
40,000 and over	9.5

Fire Protection Water Supply Guideline
Part 3 of the Ontario Building Code (2006)

$$Q = KVS_{TOT}$$

Q = minimum supply of water in litres (L)

K = water supply coefficient

V = total building volume in cubic metres

S_{TOT} = total of spatial coefficient values from property line exposures on all sides

K = 23 Group C building with combustible construction (Table 1)

V = 1366 Total building volume in cubic meters (3.2m height)

S_{TOT} = 1 S_{TOT} Need Not Exceed 2.0

$$Q = 31427 \text{ L}$$

Based on ranges listed in Table 2, the required minimum water supply flow rate is

2700 L/min

45 L/s

Water Supply for Public Fire Protection - 1999
Fire Underwriters Survey

Part II - Guide for Determination of Required Fire Flow

1. An estimate of fire flow required for a given area may be determined by the formula:

$$F = 220 * C * \text{sqrt } A$$

where

- F = the required fire flow in litres per minute
- C = coefficient related to the type of construction
 - = 1.5 for wood frame construction (structure essentially all combustible)
 - = 1.0 for ordinary construction (brick or other masonry walls, combustible floor and interior)
 - = 0.8 for non-combustible construction (unprotected metal structural components)
 - = 0.6 for fire-resistive construction (fully protected frame, floors, roof)
- A = The total floor area in square metres (including all storeys, but excluding basements at least 50 percent below grade) in the building considered.

Proposed Buildings

1 number of floors
 729 sq.m. floor area
 729 sq.m. total floor area

Ordinary Construction

1.0 C

Therefore F= 6,000 L/min (rounded to nearest 1000 L/min)
("Value obtained in No. 1")

Fire flow determined above shall not exceed:
 30,000 L/min for wood frame construction
 30,000 L/min for ordinary construction
 25,000 L/min for non-combustible construction
 25,000 L/min for fire-resistive construction

2. Values obtained in No. 1 may be reduced by as much as 25% for occupancies having low contents fire hazard or may be increased by up to 25% surcharge for occupancies having a high fire hazard.

Non-Combustible	-25%	Free Burning	15%
Limited Combustible	-15%	Rapid Buring	25%
Combustible	No Charge		

Low fire Hazard occupancy for dwellings -15% reduction
-900 L/min reduction

"Value obtained in No. 2" 5,100 L/min

Note: Flow determined shall not be less than 2,000 L/min

3. Sprinklers - The value obtained in No. 2 above maybe reduce by up to 50% for complete automatic sprinkler protection.

Building will not have sprinklers (typical 30% reduction)
0 L/min reduction

Water Supply for Public Fire Protection - 1999
Fire Underwriters Survey

Part II - Guide for Determination of Required Fire Flow

4. Exposure - To the value obtained in No. 2, a percentage should be added for structures exposed within 45 metres by the fire area under consideration. The percentage shall depend upon the height, area, and construction of the building(s) being exposed, the separation, openings in the exposed building(s), the length and height of exposure, the provision of automatic sprinklers and/or outside sprinklers in the building(s) exposed, the occupancy of the exposed building(s) and the effect of hillside locations on the possible spread of fire.

Separation	Charge	Separation	Charge
0 to 3 m	25%	20.1 to 30 m	10%
3.1 to 10 m	20%	30.1 to 45 m	5%
10.1 to 20 m	15%		

Exposed buildings

Name	Distance (m)			
North Adjacent Dwelling	15.3	15%	765	
South Adjacent Dwelling	19.3	15%	765	
East Adjacent Dwelling	3	25%	1,275	
West Adjacent Dwelling	3	25%	1,275	
				4,080 L/min Surcharge

Determine Required Fire Flow

No. 2	5,100		
No. 3	0 reduction		
No. 4	4,080 surcharge		
Required Flow:	9,180 L/min		
Rounded to nearest 1000/min:	9,000 L/min	or	150.0 L/s 2,378 USGPM

Determine Required Fire Storage Volume

Flow from above	9,000 L/min	
Required duration	2.00 hours	
Therefore:	1,080,000 Litres or 1,080 cu.m.	is the required storage volume

Required Duration of Fire Flow

Flow Required L/min	Duration (hours)
2,000 or less	1.0
3,000	1.25
4,000	1.5
5,000	1.75
6,000	2.0
8,000	2.0
10,000	2.0
12,000	2.5
14,000	3.0
16,000	3.5
18,000	4.0
20,000	4.5
22,000	5.0
24,000	5.5
26,000	6.0
28,000	6.5
30,000	7.0
32,000	7.5
34,000	8.0
36,000	8.5
38,000	9.0
40,000 and over	9.5

Fire Protection Water Supply Guideline
Part 3 of the Ontario Building Code (2006)

$$Q = KVS_{TOT}$$

Q = minimum supply of water in litres (L)

K = water supply coefficient

V = total building volume in cubic metres

S_{TOT} = total of spatial coefficient values from property line exposures on all sides

K = 23 Group C building with combustible construction (Table 1)

V = 2005 Total building volume in cubic meters (2.75m height)

S_{TOT} = 2 S_{TOT} Need Not Exceed 2.0

$$Q = 92219 \text{ L}$$

Based on ranges listed in Table 2, the required minimum water supply flow rate is

2700 L/min

45 L/s