Functional Site Servicing and Stormwater Management Report
166 Boyd Street, Carleton Place, ON

Client:
A&B Bulat Homes Ltd.
11 Gifford Street
Ottawa, ON K2E 7S3

Submitted for:
Zoning By-law Amendment and Draft Plan of Subdivision

Project Name:
166 Boyd Street

Project Number:
OTT-00262415-A0

Prepared By:
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Date Submitted:
July 12, 2022

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1 Introduction

1.1 Overview

EXP Services Inc. (EXP) was retained by A&B Bulat Homes Ltd. to prepare a Functional Site Servicing and Stormwater Management Report for the proposed redevelopment of 166 Boyd Street in support of Zoning By-law Amendment and Plan of Subdivision applications.

The 2.35 hectare site is situated in the middle of Boyd Street bound by Jackson Ridge Subdivision to the south-east, residential properties on Mississippi Road to the south-west and residential apartments and parklands on Woodward Street on the north-west as illustrated in **Figure 1-1** below. The site is within the Town of Carleton Place and subject to an additional 5m road widening along the Boyd Street. Hence, the effective area of the site is 2.27 Ha.

The description of the subject property is noted below:

- All of Lots 9, 11, 13 15 & 17 on Registered Plan 7211 and, consisting of PIN 051280418, PIN 051280041, and PIN 051280042
- Part of Lot 7 on Part of Block 121 Registered Plan 72925 consisting of PIN 051280419

The proposed development will consist of seventy-one (71) townhomes and shall contain a dry pond within the site.

This report will discuss the adequacy of the adjacent municipal watermain, sanitary sewers and storm sewers to provide the required water supply, convey the sewage and stormwater flows that will result from the proposed development.

Figure 1-1 - Site Location

2 Existing Conditions

The existing site contained a single home that has already been demolished. Most of the ground surface contains sparse vegetation, fill material from adjacent construction, with a small area of trees in the north-western portion of the site.

The existing site topography slopes in a northerly direction, ranging in elevation from ±146m to ±143m and having an average slope of 1.2%.

3 Existing Infrastructure

The property is currently vacant however the existing servicing stubs from the demolished home for water, storm, and sanitary shall be located before construction. The stubs found within the property shall be grouted and capped at the property line.

Along the northeast side of the property is an approximate 15.0 metre wide municipal right-of-way (Boyd Street), however the Town shall be widening this right of way into the development by 5m to expand the right-of-way to approximately 20m.

From review of the sewer and watermain mapping, and as-built drawings, the following summarizes the infrastructure within the subject property and the infrastructure on the adjacent streets along the frontage of the property and adjacent offsite infrastructure:

<u>Boyd Street</u>

- 300mm PVC watermain
- 300mm PVC storm sewer
- 200mm PVC sanitary sewer

<u>Arthur Street</u>

- 300mm PVC watermain
- 600mm Concrete storm sewer
- 200mm PVC sanitary sewer

As-built drawings obtained from the Town of Carleton Place are included in **Appendix F** for reference.

4 Pre-Consultation / Permits / Approvals

A pre-consultation meeting was held with Lanark County (County) and the Town of Carleton Place (Town) prior to design commencement. This meeting outlined the submission requirements and provided information to assist with the development proposal. The proposed site is located within the Mississippi Valley Conservation Authority (MVCA) jurisdiction, therefore signoff from the MVCA will be required prior to final approval. The MVCA was contacted to confirm the stormwater management quality control requirements. A copy of the correspondence with the MVCA is included in the pre-consultation meeting noted attached in **Appendix E**. Specific design criteria noted in the Pre-Consultation meeting is further described in the relevant sections of this report.

It is expected that an Environmental Compliance Approval (ECA) will be required from the Ministry of Environment, Conservation and Parks (MECP) for the municipal Sewage Works. The onsite Sewage Works will include the onsite stormwater works for flow controls and associated stormwater detention. Further discussions with the town staff will be required to confirm the ECA requirements.

- Stormwater Management Planning and Design Manual, Ontario Ministry of the Environment and Climate Change, March 2003 (SMPDM).
- Design Guidelines for Drinking-Water Systems, Ontario Ministry of the Environment and Climate Change, 2008 (GDWS).
- Fire Underwriters Survey, Water Supply for Public Fire Protection (FUS), 1999.
- Ontario Building Code 2012, Ministry of Municipal Affairs and Housing.

In addition, various City of Ottawa design guidelines were referred to in preparing the current report including:

- Bulletin ISDTB-2012-4 (20 June 2012)
  - Technical Bulletin ISDTB-2014-01 (05 February 2014)
  - Technical Bulletin PIEDTB-2016-01 (September 6, 2016)
  - Technical Bulletin ISDTB-2018-01 (21 March 2018)
  - Technical Bulletin ISDTB-2018-04 (27 June 2018)
- Ottawa Design Guidelines – Water Distribution, July 2010 (WDG001), including:
  - Technical Bulletin ISDTB-2014-02 (May 27, 2014)
  - Technical Bulletin ISTB-2018-02 (21 March 2018)

5 Water Servicing

5.1 Existing Water Servicing Conditions

The site is within the Town of Carleton Place limits, south of the Mississippi River. As previously noted, a 300 mm watermain runs along Boyd Street.

5.2 Water Servicing Proposal

The proposed water supply system will consist of 200mm diameter watermain and associated appurtenances to provide water for consumption and fire protection. The site will be serviced by connecting into the existing watermain along Boyd Street at two locations to provide a looped feed through the subdivision.

Water supply for each townhome will be provided by individual water services connecting to the proposed municipal watermain. The proposed servicing plan is provided in **Appendix F**

5.3 Water Servicing Design Criteria

The design parameters that were used to establish water and fire flow demands are summarized **Table 5-1**.

Table 5-1 - Summary of Water Supply Design Criteria

Design Parameter	Value	Applies
Population Density – Single-family Home	3.4 persons/unit	
Population Density – Semi-detached Home	2.7 persons/unit	
Population Density – Townhome or Terrace Flat	2.7 persons/unit	✓
Population Density – Bachelor Apartment	1.4 persons/unit	
Population Density – Bachelor + Den Apartment	1.4 persons/unit	
Population Density – One Bedroom Apartment	1.4 persons/unit	
Population Density – One Bedroom plus Den Apartment	1.4 persons/unit	
Population Density – Two Bedroom Apartment	2.1 persons/unit	
Population Density – Two Bedroom plus Den Apartment	2.1 persons/unit	
Average Day Demands – Residential	350 L/person/day	✓
Average Day Demands – Commercial / Institutional	28,000 L/gross ha/day	
Average Day Demands – Light Industrial / Heavy Industrial	35,000 or 55,000 L/gross ha/day	
Maximum Day Peak Factor – Residential	2.5 x Average Day Demands	✓
Maximum Day Demands Peak Factor – Commercial / Institutional	1.5 x Average Day Demands	
Peak Hour Factor – Residential	2.5x2.2 = 5.5 x Average Day Demands	✓
Peak Hour Factor – Commercial / Institutional	2.7 x Average Day Demands	
Fire Flow Requirements Calculation	FUS	✓
Depth of Cover Required	2.4m	✓
Maximum Allowable Pressure	551.6 kPa (80 psi)	✓
Minimum Allowable Pressure	275.8 kPa (40 psi)	✓
Minimum Allowable Pressure during fire flow conditions	137.9 kPa (20 psi)	✓

5.4 Fire Flow Requirements

Water for fire protection will be available utilizing the proposed fire hydrants located along the adjacent roadways. The required fire flows for all proposed buildings were calculated based on typical values as established by the Fire Underwriters Survey 1999 (FUS). The following equation from the Fire Underwriters document "Water Supply for Public Fire Protection", 1991, was used for calculation of the on-site supply rates required to be supplied by the hydrants:

$F = 200 * C * \sqrt{(A)}$

where:

F	=	Required Fire flow in Litres per minute
C	=	Coefficient related to type of Construction
A	=	Total Floor Area in square metres

The proceeding **Table 5-2** summarizes the parameters used for estimating the Required Fire Flows (RFF) based on the Fire Underwriters Survey (FUS) and the latest City of Ottawa Technical Bulletins. The RFFs were estimated in accordance with ISTB-2018-02 and based on floor areas provided by the architect. The following summarizes the parameters used for the proposed types of residential buildings.

Table 5-2 : Summary of FUS Method Parameters Used for Proposed Building Types

Design Parameter	Townhome
Type of Construction (Coeff, C) Wood-Framed (C=1.5), Ordinary (C=1.0), Non-Combustible (C=0.8), Fire-Resistive (C=0.6)	Wood Framed
Occupancy Type Non-combustible (-25%), Limited Combustible (-15%), Combustible (0%), Free Burning (+15%), Rapid Burning (+25%)	Limited Combustible
Sprinkler Protection Sprinkler Conforming to NFPA 13 (-30%), Standard Water Supply (-10%), Fully Supervised Sprinkler (-10%)	None

The following **Table 5-3** below summarizes the individual parameters used and the resultant Required Fire Flows (RFFs) for the proposed building type. Detailed calculations of the RFFs necessary for the building type is provided in **Appendix B.**

Table 5-3 : Summary of Parameters Used and Estimation of Required Fire Flows (RFF)

	Townhomes	
	4 Unit	5 Unit
Construction Coefficient, C	1.5	1.5
Total Floor Area (m2)	827.6	1102.4
Fire Flow prior to reduction (L/min)	9,000	11,000
Reduction Due to Occupancy	-15%	-15%
Reduction due to Sprinkler	0%	0%
Increase due to Exposures	61%	63%
Capped at 10,000 L/min (167 L/sec) based on ISTB-2014-02" (yes/no)	No	No
Total RFF	200	250

The estimated required fire flows (RFFs) based on the FUS Method ranges from200 L/sec to 250 L/sec.

5.5 Boundary Conditions

Hydraulic Grade Line (HGL) boundary conditions were obtained from the J.L.Richards Memorandum dated September 16, 2013. A copy of the Memorandum is provided in **Appendix E.** The memo provides the water distribution system for future development.

The following hydraulic grade line (HGL) boundary conditions are summarized in **Table 5-4** below:

Table 5-4 : Boundary Conditions and Pressures Summary

Demand Scenario	Connection #1 – Boyd Street	Connection #2 – Boyd Street
	Pressure kpa (psi)	Pressure kpa (psi)
Maximum HGL	<=450 kpa (65)	<=450 kpa (65)
Peak Hour	<=450 kpa (65)	<=450 kpa (65)
Max Day + Fire Flow		

The above noted pressures are based on the J.L.Richards Memorandum active scenarios. This results in a system water pressure of less than or equal to 65 psi and greater than 43 psi at each connection points during peak hour conditions.

5.6 Water Servicing Design

The water servicing requirements for the proposed development is designed in accordance with the City of Ottawa Design Guidelines (July 2010). The following steps indicate the basic methodology that was used in our analysis:

- Estimated water demands under average day, maximum day and peak hour conditions. As the total population estimate was less than 500, the residential peaking factors were used based on MECP Table 3-3.
- Estimated the required fire flow (RFF) based on the Fire Underwriters Survey (FUS).
- Obtained hydraulic boundary conditions (HGL) from J.L. Richards Memorandum, based on the above water demands and required fire flows.
- Boundary condition data and water demands were used to estimate the pressure at the proposed junctions, and this was compared to the City's design criteria.

Please refer to **Appendix B** for detailed calculations of the total water demands.

5.7 Estimated Water Demands

Table 5-5 below summarizes the anticipated domestic water demands for all units under average day, maximum day and peak hour conditions.

Table 5-5 : Total Water Demand Summary

Water Demand Conditions	Water Demands (L/sec)
Average Day	0.78
Max Day	3.52
Peak Hour	5.31

Due to the high pressures provided at the connection points, no further analysis is required. From the J.L.Richards Memorandum dated September 16, 2013 total available flow from the 300mm watermain on Boyd Street for max day + fire flow condition is 300 L/sec and approximate peak hour residual pressure of 65 psi at the two closest nodes on either sides of the site. Therefore, it is estimated that the proposed 200mm watermain connecting to 300mm watermain on the Boyd Street has sufficient capacity to service the proposed development for domestic and fire flow demands.

No pressure reducing measures are required as operating pressures are within 50 psi and 80 psi.

6 Sewage Servicing

6.1 Existing Sewage Conditions

The site is an open field with no services within the site. Any existing stub coming off the existing sanitary sewer from Boyd Street to the demolished home that occupied the property, to be capped and grouted at the property line and removed from within the property to the town's satisfaction before construction.

6.2 Proposed Sewage Conditions

As per the pre-consultation meeting, the Town of Carleton Place required Bulat Homes to extend the 200mm diameter Sanitary from the existing manhole at Boyd/Arthur Street to the existing manhole (115) at Boyd/Taber Street. The sanitary sewers were sized based on a population flow with an area-based infiltration allowance. A 200mm diameter sanitary sewer is proposed with a minimum 0.32% slope, having a capacity of 18.9 L/sec based on Manning's Equation under full flow conditions. **Table 6-1** below summarizes the design parameters used.

Table 6-1 – Summary of Wastewater Design Criteria / Parameters

Design Parameter	Value	Applies
Population Density – Single-family Home	3.4 persons/unit	
Population Density – Semi-detached Home	2.7 persons/unit	
Population Density – Duplex	2.3 persons/unit	
Population Density – Townhome (row)	2.7 persons/unit	✓
Population Density – Bachelor Apartment	1.4 persons/unit	
Population Density – Bachelor + Den Apartment	1.4 persons/unit	
Population Density – One Bedroom Apartment	1.4 persons/unit	
Population Density – One Bedroom plus Den Apartment	1.4 persons/unit	
Population Density – Two Bedroom Apartment	2.1 persons/unit	
Population Density – Two Bedroom plus Den Apartment	2.1 persons/unit	
Average Daily Residential Sewage Flow	280 L/person/day	✓
Average Daily Commercial / Intuitional Flow	28,000 L/gross ha/day	
Average Light / Heavy Industrial Daily Flow	35,000 / 55,000 L/gross ha/day	
Residential Peaking Factor – Harmon Formula (Min = 2.0, Max =4.0, with K=0.8)	$M = 1 + \frac{14}{4 + P^{0.5}} * k$	✓
Commercial Peaking Factor	1.5	
Institutional Peaking Factor	1.5	
Industrial Peaking Factor	As per Table 4-B (SDG002)	
Unit of Peak Extraneous Flow (Dry Weather / Wet Weather)	0.05 or 0.28 L/s/gross ha	

Unit of Peak Extraneous Flow (Total I/I)	0.33 L/s/gross ha	✓

The total estimated peak sanitary flow rate from the proposed property is **2.19L/sec** based on City of Ottawa Design Guidelines. Sewage rates below include a total infiltration allowance of 0.33 L/ha/sec based on the total gross site area.

Table 6-2 – Summary of Anticipated Sewage Rates

Sewage Condition	Sanitary Sewage Flow (L/sec)
Peak Residential Flow	2.19
Infiltration Flow (at 0.33 L/ha/sec)	0.75
Peak Wet Weather Sewage Flow	2.94

The proposed 200mm diameter sanitary sewer from the site will connect into an existing 200mm sanitary sewer along Boyd Street in two separate locations.

Currently there are 4 homes along Boyd Street serviced by the 200mm sanitary sewer with a peak sanitary flow of 0.15L/sec. Therefore, the new peak sanitary flow is expected to be 2.34 L/sec and the total flow including infiltration would be 3.09 L/sec. The existing sanitary has a capacity of 18.85 L/sec and will be able to handle the revised peak sewage flows.

7 Storm Servicing & Stormwater Management

7.1 Background

As the proposed site is located within the Mississippi Valley Conservation Authority (MVCA) jurisdiction, the stormwater works are therefore subject to both MVCA, the County and the Town approval.

There is a 600mm storm sewer adjacent to the site that runs along Arthur Street.

7.2 Design Criteria & Constraints

From the pre-consultation notes the following summarizes the design criteria and constraints that will be followed:

- Criteria #1: An enhanced level of stormwater quality control is recommended per the MOE Design Manual.
- Criteria #2: Stormwater quantity should be controlled such that post-development flows equal pre-development levels.
- Criteria #3: Measures to maintain infiltration should be considered and integrated into the stormwater management design where possible.

Other design criteria were taken from MOE Design Manual which apply to the stormwater design are included.

- The storm sewer was sized based on the Rational Method and Manning's Equation under free flow conditions for the 5-year storm using a 10-minute inlet time.
- The major system has been designed to accommodate on-site detention with sufficient capacity to attenuate the 100-year design storm.
- Calculation of the required storage volume for up to 100-year storm event has been prepared based on the Modified Rational Method.

- Overland flow routes are provided.
- The vertical distance from the spill elevation and the ground elevation at the building is at least 150mm.
- The emergency overflow spill elevation is at least 30 cm below the lowest building opening.
- Minimum sewer slopes to be based on minimum velocities for storm sewers of 0.80 m/sec.

7.3 Runoff Coefficients

Average runoff coefficients for all catchments were calculated using area weighting routine in excel (**Appendix D – Table D3**). The runoff coefficients for all catchments were area weighted to derive at average runoff coefficients based on hard surfaces (concrete or asphalt) having an imperviousness of 95%, soft surfaces (landscaping surfaces) having a percent imperviousness of 5%. The conversion from an imperviousness percent to a runoff coefficient was taken as C = (IMP*0.70) / 100 + 0.20, with the imperviousness (IMP) as a percentage.

The average runoff coefficient for the overall site area under post-development conditions was calculated to be 0.61. Runoff coefficients for individual catchment ranged from 0.47 to 0.71. The runoff coefficients for pre-development and post-development catchments are summarized in **Table 7-1** below.

Table 7-1 – Summary of Runoff Coefficients

Location	Area (hectares)	Pre-Development Runoff Coefficient, C_{AVG}	Post-Development Runoff Coefficient, C_{AVG}
Entire Site	2.277	0.22	0.61

Runoff coefficients for each sub catchments based on the area-weighted values derived in excel were used in the storm sewer design sheet (**Appendix D – Table D3**).

7.4 Calculation of Allowable Release Rate

The release rate from the site is controlled to match the pre-development rates for up-to 100-year storm event. The total site area is 2.277 hectares. Based on the pre-development site conditions, the pre-development runoff coefficient is assumed to be 0.22 and the Time of Concentration was calculated based on Federal Aviation Formula (Airport Method) from the MTO Drainage Manual. **Table D1 and D2** in **Appendix D** shows the detailed calculation of pre-development flow rates.

The Rational Method and following parameters were used to determine the allowable release rates from the proposed site to the existing 600mm storm sewer at Boyd/Arthur intersection which conveys stormwater in the northeasterly direction along Arthur Street.

Q_{ALL} = 2.78 C I A

where:

Q_{ALL}	=	Peak Discharge (L/sec)
C	=	Runoff Coefficient (C=0.22*1.25 = 0.28)
I	=	Average Rainfall Intensity for return period (mm/hr)
	=	1735.688/(Tc+6.014)^0.820 (100-year)
Tc	=	Time of concentration (mins)
A	=	Drainage Area (hectares)

Q_{ALL} = 2.78 * 0.28 * 78.82 mm/hr * 2.277 ha = 137.2 L/sec

The allowable discharge rate, based on the 100-year storm, was estimated at 137.2 L/sec. To control runoff from the site it will be necessary to limit post-development flows for all storm return periods up to the 100-year event using flow control and detention of runoff, as noted in the following sections.

7.5 Pre-Development Runoff

As mentioned in Section 7.4, pre-development runoff for each storm events up to 100-year storm were calculated for comparison. Pre-development runoff coefficient was estimated to be 0.22 and Time of Concentration was calculated to be 37.40 mins based on the Federal Aviation Formula (Airport Method) from the MTO Drainage Manual. **Table 7-2** below summarizes the pre-development runoff for 2-year, 5-year and 100-year storms.

Table 7-2 – Estimation of Pre-Development Peak Flows

Catchment No.	Area (ha)	Time of Conc, Tc (min)	Storm = 2 yr			Storm = 5 yr			Storm = 100 yr		
			I_2 (mm/hr)	C_{AVG}	Q_{2PRE} (L/sec)	I_5 (mm/hr)	C_{AVG}	Q_{5PRE} (L/sec)	I_{100} (mm/hr)	C_{AVG}	Q_{100PRE} (L/sec)
Full Site	2.2774	37.40	34.44	0.22	48.0	46.33	0.22	64.5	78.82	0.28	137.2
Total	2.2774				**48.0**			**64.5**			**137.2**

7.6 Post-Development Runoff and Required Storage

Table 7-3 below summarizes post-development discharge rates for up to 100-year storm event. The post-development average runoff coefficient was calculated as 0.61 for the entire site in excel using the area weighted method with the area obtained from AutoCAD (Refer to **Table D4**). Based on the storm drainage areas, the post-development peak flows were calculated using the Rational Method.

Table 7-3 – Summary of Post-Development Flows

Area No	Area (ha)	Time of Conc, Tc (min)	Storm = 2 year			Storm = 5 year			Storm = 100 year		
			C_{AVG}	Q (L/sec)	Q_{CAP} (L/sec)	C_{AVG}	Q (L/sec)	Q_{CAP} (L/sec)	C_{AVG}	Q (L/sec)	Q_{CAP} (L/sec)
S1	0.1620	10	0.54	18.8		0.54	25.5		0.68	54.6	
S2	0.1135	10	0.54	13.0		0.54	17.6		0.67	37.8	
S3	0.3160	10	0.47	31.5	**(29.2)**	0.47	42.7	**(50.4)**	0.58	91.5	**(137.2)**
S4	0.5296	10	0.71	79.8		0.71	108.2		0.88	231.9	
S5	0.2057	10	0.68	29.7		0.68	40.3		0.85	86.4	

S6	0.5758	10	0.71	87.4		0.71	118.5		0.89	254.0	
S7	0.2556	10	0.56	30.7		0.56	41.6		0.70	89.1	
S8	0.1193	10	0.20	5.1		0.20	6.9		0.25	14.8	
Total =	2.2774			295.9	**(29.2)**		401.4	**(50.4)**		859.9	**(137.2)**

The unrestricted post-development flows were found to be higher than the allowable discharge rate due to the proposed land development and higher average runoff coefficient. Therefore, a flow control device will be used at the dry pond outlet. **Table 7-4** below summarizes the required storage calculated using the Modified Rational Method. Maximum required storage is 549.4 m^3 for 100-year storm and the storage provided in dry pond is 862.6 m^3. An orifice type ICD is to be provided at the pond outlet. The size of orifice is calculated to be 0.24m diameter, based on the 100-year water level in pond and allowable release rate of 137.2 L/sec for 100-year storm (**Appendix D – Table D8**).

Table 7-4 – Summary of Post Development Release Rates and Storage Requirements.

Area No.	Area (ha)	Release Rate (L/s)			Storage Required (m3)			Storage Provided (m3)		Control Method
		2-yr	5-yr	100-yr	2-yr	5-yr	100-yr	Dry Pond	Total	
S1	0.1620	29.2	50.4	137.2	236.53	287.68	549.36	862.6	862.6	ICD (0.24m dia. orifice) @ Dry Pond Outlet Pipe
S2	0.1135									
S3	0.3160									
S4	0.5296									
S5	0.2057									
S6	0.5758									
S7	0.2556									
S8	0.1193									
Total =	2.2774				236.53	287.68	549.36		862.6	

The outlet of the dry pond will be at an invert of 142.20m which will allow for a maximum ponding depth of 1.85m from the spill elevation of 144.05m. The orifice is designed with the 100-year water head estimated to be at 143.70m (1.5m head).

7.7 Proposed Storm Servicing

Due to the stormwater management criteria, a stormwater facility (dry pond) is necessary where the discharge flow to the 600mm storm sewer on Arthur Street will be controlled to pre-development discharge rates. The proposed subject property will be serviced with a conventional stormwater collection system. The minor storm collection system will consist of a typical storm system including manholes and catchbasins in the roadway and catchbasins and landscape inlets in the rear yards. For the rear-yards, each catchbasin will be independently connected to the proposed storm sewer as per the Town's requirements. The roadway catchbasins and rear yard catchbasin leads will be 250mm diameter which will convey the runoffs for up to 5-year storm events to the storm sewer. The storm sewers are design to carry the runoffs from the proposed site to the dry-pond for up-to 5-year storms without any surface ponding. During the storm events bigger than 5-year, the minor and major system will carry the runoff from the site to the dry-pond. Major system flow pattern is shown on Drawing #C500 – Post-Development Storm Catchment Plan. Due to shallow invert elevation of the storm sewer at the connection on Arthur/Boyd Street and 100-year water level in dry pond, a sump-pump and backflow preventer will be required for each 100mm foundation drain discharge pipe connecting to the proposed storm sewer. Design sheets for 5-year storm sewer system are included in **Appendix D**.

For the quality control, a 2.4m diameter EFO8 Stormceptor (or equivalent) oil grit separator has been proposed at the outlet pipe from the dry pond connecting into the 600mm storm sewer on Boyd/Arthur Street intersection. The sizing report for EFO8 has been attached in **Appendix E.**

8 Erosion & Sediment Control

During all construction activities, erosion and sedimentation shall be controlled by the following techniques:

- Filter cloth shall be installed between the frame and cover of all adjacent catch basins and catch basin manhole structures.
- Heavy duty silt fencing will be used to control runoff around the construction area. Silt fencing locations are identified on the site grading and erosion control plan.
- A mud mat will be installed at the construction entrance to help avoid mud from being transported to offsite roads.
- Visual inspection shall be completed daily on sediment control barriers and any damage repaired immediately. Care will be taken to prevent damage during construction operations.
- In some cases, barriers may be removed temporarily to accommodate the construction operations. The affected barriers will be reinstated at night when construction is completed.
- Sediment control devices will be cleaned of accumulated silt as required. The deposits will be disposed of as per the requirements of the contract.
- During the course of construction, if the engineer believes that additional prevention methods are required to control erosion and sedimentation, the contractor will install additional silt fences or other methods as required to the satisfaction of the engineer.
- Construction and maintenance requirements for erosion and sediment controls are to comply with Ontario Provincial Standard Specification (OPSS) OPSS 805 and Town of Carleton Place specifications.

9 Conclusions and Recommendations

This Servicing & Stormwater Report outlines the rationale which will be used to service the proposed development. The following summarizes the servicing requirements for the site:

Water

- Domestic water demands of 0.78, 3.52, and 5.31 L/sec was estimated based on Town of Carleton Place Guidelines.
- Required Fire Flows for all buildings based on the Fire Underwriters Survey (FUS) method is estimated at 250 L/sec and 200 L/sec for 5-Units Townhouses and 4-Units Townhouses, respectively.
- Based on J.L.Richards Memorandum dated September 16, 2013, peak hour residual pressure at closest node to the site is 65 psi and available flows for Max Day + Fire flow is 300 L/sec which is estimated to be sufficient to service the proposed site.
- 200mm connections are proposed at two locations to service the site from the existing 300mm watermain on Boyd Street.

Sewage

- The estimated total sewage flows including infiltration flows from the proposed site is 2.94 L/sec. Therefore, the total sanitary flow expected from the proposed site and 4 existing single-family homes discharging in the sanitary sewer on Boyd Street will be 3.09 L/sec. The capacity of 200mm sanitary sewer on Boyd Street is 18.85 L/sec and hence it does not identify any capacity issues to accommodate the additional peak flow.

Stormwater

- Stormwater drainage for the proposed site has been designed to meet the pre-development discharge rates for up to 100-year storm event.
- The peak flow for the proposed site during the 2-year, 5-year and 100-year storm events is calculated to be 296 L/sec, 401 L/sec and 860 L/sec, respectively. The maximum allowable discharge rate under a 100-year storm event was calculated as 137.2 L/sec. Therefore, an on-site storage facility will be required to meet the allowable discharge rates.
- An on-site dry pond is designed with the maximum storage capacity of 862 m^3, with 1.85m of total ponding depth and 1 ha of surface area.
- The storm sewer was sized based on the Rational Method and Manning's Equation under free flow conditions for the 5-year storm using a 10-minute inlet time to carry the runoff from the entire site to the dry pond.
- For storm events greater than 5-year, will be carried to the dry pond via minor systems and major overland flows. Overland flow pattern is shown on drawing #C500 in **Appendix F**.
- Inlet control device will be used at the dry pond outlet. A 0.24m diameter orifice ICD is estimated to be sufficient to restrict the discharge rate to 137.2 L/sec with a 1.2m head from the centroid under 100-year storm event. The rear yard catchbasins and roadway catchbasins will independently connect to the storm sewer system. No ICD is proposed at any catchbasins.
- Stormceptor EFO8 or equivalent oil grit separator has been proposed for the quality control.

10 Legal Notification

This report was prepared by EXP Services Inc. for the account of A&B Bulat Homes Ltd.

Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. EXP Services Inc. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this project.

Appendix A – Figures

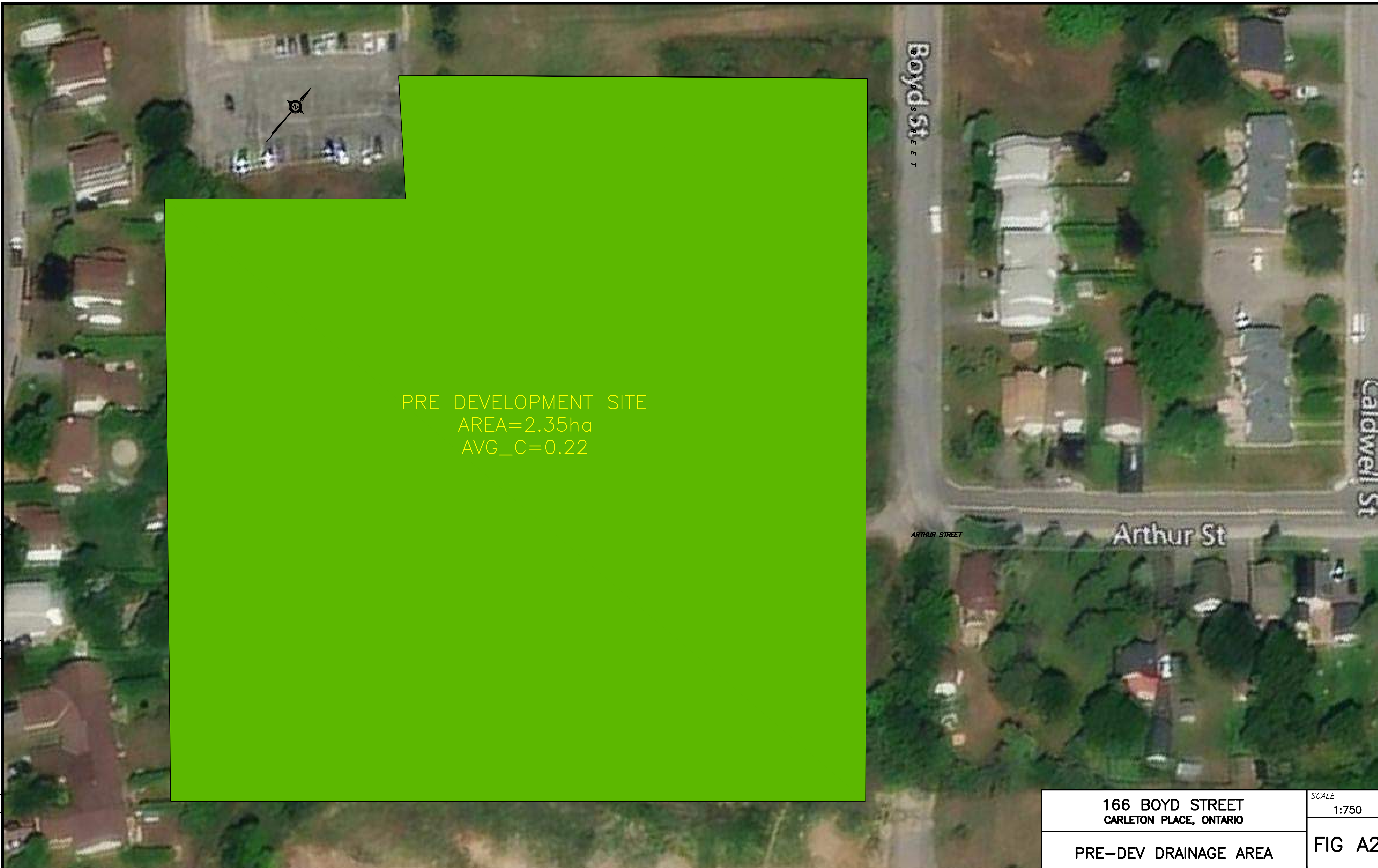
Figure A1– Site Location Plan

Figure A2– Pre-Development Runoff Coefficients

Figure A3 – Post-Development Drainage Areas

Figure A4 – Post-Development Runoff Coefficients

FIGURE A-1 - SITE LOCATION PLAN



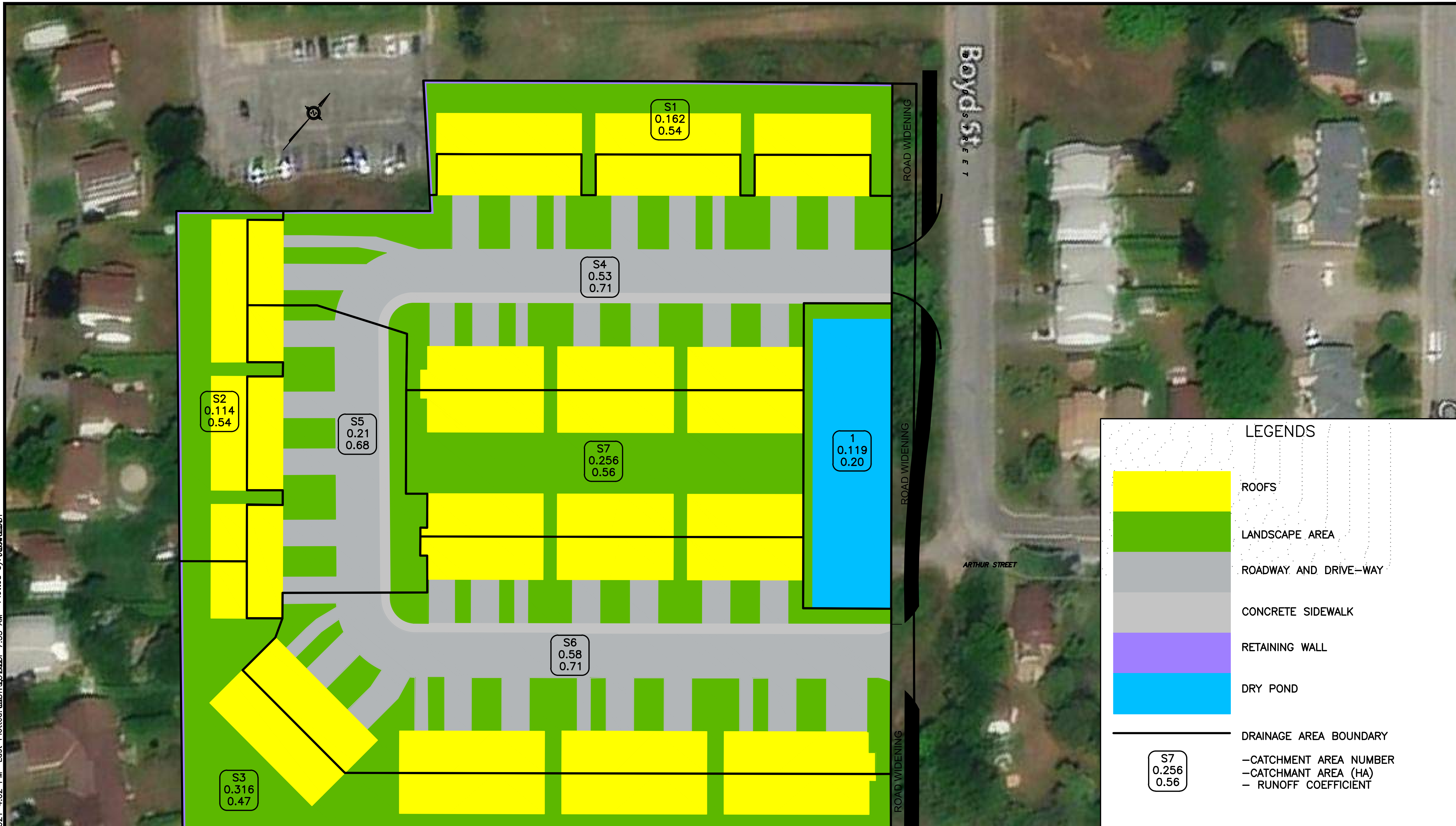
166 BOYD STREET
CARLETON PLACE, ONTARIO

PRE–DEV DRAINAGE AREA

SCALE 1:750

FIG A2

Filename: ELLIOTT–00262415–A0\60 Execution\65 Drawings\FIGURES.dwg
Last Saved: May 26, 2021 3:18 PM Last Plotted: May 26, 2021 3:52 PM Plotted by: PLOTTEDBY

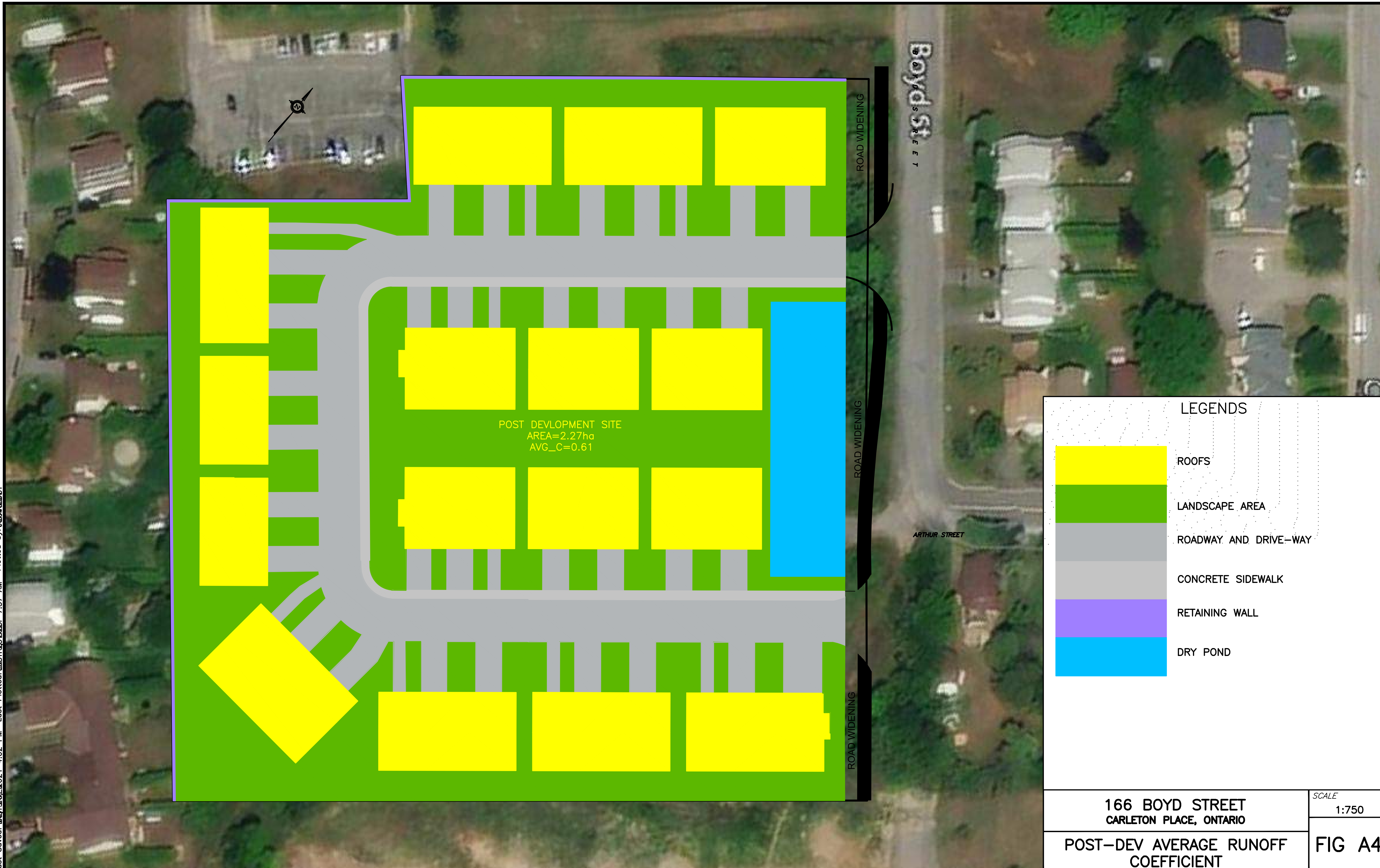


166 BOYD STREET
CARLETON PLACE, ONTARIO

SCALE 1:750

POST–DEV DRAINAGE AREA

FIG A3



Boyd St
BOYD STREET
ARTHUR STREET
ROAD WIDENING
ROAD WIDENING
ROAD WIDENING
POST DEVLOPMENT SITE
AREA=2.27ha
AVG_C=0.61
LEGENDS
ROOFS
LANDSCAPE AREA
ROADWAY AND DRIVE-WAY
CONCRETE SIDEWALK
RETAINING WALL
DRY POND
166 BOYD STREET
CARLETON PLACE, ONTARIO
POST-DEV AVERAGE RUNOFF COEFFICIENT
SCALE
1:750
FIG A4

Appendix B – Water Servicing Tables

Table B1 – Water Demand Chart

Table B2 – Summary of Required Fire Flows (RFF) for 166 Boyd Street

Table B3 – Fire Flow Requirements Based on Fire Underwriters Survey (FUS) – Townhome (4 Units)

Table B4 – Fire Flow Requirements Based on Fire Underwriters Survey (FUS) – Townhome (5 Units)

TABLE B1: Water Demand Chart

Location: 166 Boyd, Carleton Place
Project No: OTT-00262415
Designed by: A. Jariwala
Checked By: B. Thomas
Date Revised: July 2021

Water Consumption
Residential = **350** L/cap/day

Population Densities

Single Family	3.4	person/unit
Semi-Detached	2.7	person/unit
Duplex	2.3	person/unit
Townhome (Row)	2.7	person/unit
Bachelor Apartment	1.4	person/unit
1 Bedroom Apartment	1.4	person/unit
2 Bedroom Apartment	2.1	person/unit
3 Bedroom Apartment	3.1	person/unit
4 Bedroom Apartment	4.1	person/unit
Avg. Apartment	1.8	person/unit

Proposed	No. of Residential Units: Singles/Semis/Towns: Single Family	Semi-Detached	Duplexz	Townhome	Apartments: Bachelor	1 Bedroom	2 Bedroom	3 Bedroom	4 Bedroom	Avg Apt.	Total Persons (pop)	Residential Demands in (L/sec): Avg. Day Demand (L/day)	Peaking Factors (x Avg Day): Max Day	Peak Hour	Max Day Demand (L/day)	Peak Hour Demand (L/day)	Commercial: Area (m^2)	Avg Demand (L/day)	Peaking Factors (x Avg Day): Max Day	Peak Hour	Max Day Demand (L/day)	Peak Hour Demand (L/day)	Total Demands (L/sec): Avg Day (L/s)	Max Day (L/s)	Max Hour (L/s)
Site				71							191.7	67,095	4.54	6.84	304,517	459,198							0.78	3.52	5.31
				71																					

PEAKING FACTORS FROM MOECC TABLE 3-3 (Peaking Factors for Water Systems Servicing Fewer Than 500 persons

Dwelling Units Serviced	Equiv Pop	Night Min Factor	Max Day Factor	Peak Hour Factor
10	30	0.10	9.50	14.30
50	150	0.10	4.90	7.40
100	300	0.20	3.60	5.40
150	450	0.30	3.00	4.50
167	500	0.40	2.90	4.30

TABLE B2

Summary of Required Fire Flows (RFF) for 166 Boyd Street

Type of Resdential	Reference Table	Requried Fire Flow (L/s)
Townhomes (4 Units)	TABLE B2	200
Townhomes (5 Units)	TABLE B3	250

TABLE B3

FIRE FLOW REQUIREMENTS BASED ON FIRE UNDERWRITERS SURVEY(FUS) 1999

Building # / Type: **Townhomes (4 Units)**

An estimate of the Fire Flow required for a given fire area may be estimated by:

F = 220 * C * SQRT(A)

where: F = required fire flow in litres per minute

A = total floor area in m^2 (including all storeys, but excluding basements at least 50% below grade)

C = coefficient related to the type of construction

Task	Options	Multiplier	Input			Value Used	Fire Flow Total (L/min)
Choose Building Frame (C)	Wood Frame	1.5	Wood Frame			1.5	
	Ordinary Construction	1					
	Non-combustible Construction	0.8					
	Fire Resistive Construction	0.6					
Input Building Floor Areas (A)			Area	% Used	Area Used	827.6 m²	
	Floor 2		413.8	100%	413.8		
	Floor 1		413.8	100%	413.8		
	Basement		413.8	0%	0		
Fire Flow (F)	F = 220 * C * SQRT(A)						9,493
Fire Flow (F)	Rounded to nearest 1,000						**9,000**

Reductions/Increases Due to Factors Effecting Burning

Task	Options	Multiplier	Input	Value Used	Fire Flow Change (L/min)	Fire Flow Total (L/min)
Choose Combustibility of Building Contents	Non-combustible	-25%	Limited Combustible	-15%	-1,350	7,650
	Limited Combustible	-15%				
	Combustible	0%				
	Free Burning	15%				
	Rapid Burning	25%				
Choose Reduction Due to Sprinkler System	**Adequate** Sprinkler Conforms to NFPA13	-30%	No Sprinkler	0%	0	7,650
	No Sprinkler	0%				
	Standard Water Supply for Fire Department Hose Line and for Sprinkler System	-10%	Not Standard Water Supply or Unavailable	0%	0	7,650
	Not Standard Water Supply or Unavailable	0%				
	Fully Supervised Sprinkler System	-10%	Not Fully Supervised or N/A	0%	0	7,650
	Not Fully Supervised or N/A	0%				

Task	Exposures	Separation Dist (m)	Cond	Separation Conditon	Exposing Wall type	Exposed Wall Length: Length (m)	No of Storeys	Length-height Factor	Sub-Conditon	Charge (%)	Total Charge (%)	Total Exposure Charge (L/min)	
Choose Structure Exposure Distance	Side 1	3.0	1	0 to 3	Type A	15.1	2	30.2	1A	22%	61%	4,667	12,317
	Side 2	3	1	0 to 3	Type A	15.1	2	30.2	1A	22%			
	Front	30.5	5	30.1 to 45	Type A	24	2	48	5B	5%			
	Back	14.7	3	10.1 to 20	Type A	9.2	2	18.4	3A	12%			

Task		
Obtain Required Fire Flow	Total Required Fire Flow, Rounded to the Nearest 1,000 L/min =	**12,000**
	Total Required Fire Flow (RFF), L/sec =	**200**
	Can the Total Fire Flow be Capped at 10,000 L/min (167 L/sec) based on "TECHNCAL BULLETIN ISTB-2018-02", (yes/no) =	**No**
	Total Required Fire Flow (RFF). If RFF < 167 use RFF (L/sec) =	**200**

Exposure Charges for Exposing Walls of Wood Frame Construction (from Table G5)

Type A	Wood-Frame or non-conbustible
Type B	Ordinary or fire-resisitve with unprotected openings
Type C	Ordinary or fire-resisitve with semi-protected openings
Type D	Ordinary or fire-resisitve with blank wall

Conditons for Separation

Separation Dist	Condition
0m to 3m	1
3.1m to 10m	2
10.1m to 20m	3
20.1m to 30m	4
30.1m to 45m	5
> 45.1m	6

TABLE B4
FIRE FLOW REQUIREMENTS BASED ON FIRE UNDERWRITERS SURVEY(FUS) 1999
Building # / Type: Townhomes (5 Units)

An estimate of the Fire Flow required for a given fire area may be estimated by:

F = 220 * C * SQRT(A)

where:
F = required fire flow in litres per minute
A = total floor area in m^2 (including all storeys, but excluding basements at least 50% below grade)
C = coefficient related to the type of construction

Task	Options	Multiplier	Input			Value Used	Fire Flow Total (L/min)
Choose Building Frame (C)	Wood Frame	1.5	Wood Frame			1.5	
	Ordinary Construction	1					
	Non-combustible Construction	0.8					
	Fire Resistive Construction	0.6					
Input Building Floor Areas (A)			Area	% Used	Area Used	1102.4 m^2	
	Floor 2		551.2	100%	551.2		
	Floor 1		551.2	100%	551.2		
	Basement (At least 50% below grade, not included)		551.2	0%	0		
Fire Flow (F)	F = 220 * C * SQRT(A)						10,957
Fire Flow (F)	Rounded to nearest 1,000						11,000

Reductions/Increases Due to Factors Effecting Burning

Task	Options	Multiplier	Input	Value Used	Fire Flow Change (L/min)	Fire Flow Total (L/min)
Choose Combustibility of Building Contents	Non-combustible	-25%	Limited Combustible	-15%	-1,650	9,350
	Limited Combustible	-15%				
	Combustible	0%				
	Free Burning	15%				
	Rapid Burning	25%				
Choose Reduction Due to Sprinkler System	**Adequate** Sprinkler Conforms to NFPA13	-30%	No Sprinkler	0%	0	9,350
	No Sprinkler	0%				
	Standard Water Supply for Fire Department Hose Line and for Sprinkler System	-10%	Not Standard Water Supply or Unavailable	0%	0	9,350
	Not Standard Water Supply or Unavailable	0%				
	Fully Supervised Sprinkler System	-10%	Not Fully Supervised or N/A	0%	0	9,350
	Not Fully Supervised or N/A	0%				

Task	Exposures	Separ-ation Dist (m)	Cond	Separation Conditon	Exposing Wall type	Exposed Wall Length: Length (m)	No of Storeys	Length-height Factor	Sub-Conditon	Charge (%)	Total Charge (%)	Total Exposure Charge (L/min)	
Choose Structure Exposure Distance	Side 1	3.0	1	0 to 3	Type A	14.8	2	29.6	1A	22%	63%	5,891	15,241
	Side 2	3	1	0 to 3	Type A	14.8	2	29.6	1A	22%			
	Front	32	5	30.1 to 45	Type A	37.9	2	75.8	5C	5%			
	Back	13	3	10.1 to 20	Type A	37.9	2	75.8	3C	14%			

Task		
Obtain Required Fire Flow	Total Required Fire Flow, Rounded to the Nearest 1,000 L/min =	**15,000**
	Total Required Fire Flow (RFF), L/sec =	**250**
	Can the Total Fire Flow be Capped at 10,000 L/min (167 L/sec) based on "TECHNCAL BULLETIN ISTB-2018-02", (yes/no) =	**No**
	Total Required Fire Flow (RFF). If RFF < 167 use RFF (L/sec) =	**250**

Exposure Charges for Exposing Walls of Wood Frame Construction (from Table G5)

Type A	Wood-Frame or non-conbustible
Type B	Ordinary or fire-resisitve with unprotected openings
Type C	Ordinary or fire-resisitve with semi-protected openings
Type D	Ordinary or fire-resisitve with blank wall

Conditons for Separation

Separation Dist	Condition
0m to 3m	1
3.1m to 10m	2
10.1m to 20m	3
20.1m to 30m	4
30.1m to 45m	5
> 45.1m	6

Appendix C – Sanitary Sewer Design Sheets

Table C1 – Sanitary Sewer Design Sheet

TABLE C1: SANITARY SEWER CALCULATION SHEET

LOCATION: Street	LOCATION: U/S MH	LOCATION: D/S MH	LOCATION: Area Number	RESIDENTIAL: Area (ha)	NUMBER OF UNITS: Singles	NUMBER OF UNITS: Semis	NUMBER OF UNITS: Towns	NUMBER OF UNITS: Batch or 1-Bed Apt.	NUMBER OF UNITS: 2-Bed Apt.	NUMBER OF UNITS: 3-Bed Apt.	Total Units	POPULATION: INDIV	POPULATION: ACCU	Peak Factor	Peak Flow (L/sec)	COMMERCIAL AREA (ha): INDIV	COMMERCIAL AREA (ha): ACCU	COMMERCIAL: Peak Flow (L/sec)	INDUSTRIAL AREA (ha): INDIV	INDUSTRIAL AREA (ha): ACCU	INDUSTRIAL: Peak Factor (per MOE)	INSTITUTIONAL: AREA (Ha)	INSTITUTIONAL: ACCU AREA (Ha)	INFILTRATION AREA (ha): INDIV	INFILTRATION AREA (ha): ACCU	INFILT FLOW (L/s)	TOTAL FLOW (L/s)	SEWER DATA: Nom Dia (mm)	SEWER DATA: Actual Dia (mm)	SEWER DATA: Slope (%)	SEWER DATA: Length (m)	SEWER DATA: Capacity (L/sec)	SEWER DATA: Q/Q_{CAP} (%)	SEWER DATA: Full Velocity (m/s)
166 Boyd	SANMH 04	SANMH 03	1	0.4500			13				13	35.1	35.1	3.67	0.42									0.4500	0.45	0.15	0.57	200	201.2	0.30	61.10	18.25	0.03	0.57
	SANMH 03	SANMH 02													0.42												0.57	200	201.2	0.30	12.87	18.25	0.03	0.57
	SANMH 02	SANMH 01	2	0.8900			28				28	75.6	75.6	3.62	0.89									0.8900	0.8900	0.29	1.18	200	201.2	0.30	116.95	18.25	0.06	0.57
	SANMH05	SANMH 06	3	0.9300			30				30	81	81.0	3.61	0.95									0.9300	0.9300	0.31	1.25	200	201.2	0.35	115.92	19.72	0.06	0.61
	SANMH 04	SANMH 05													0.95												1.25	200	201.2	0.48	14.57	23.09	0.05	0.72
Existing					4						4	13.6	13.6	3.72	0.16																			
200mm Sanitary on Boyd													205.3	3.52	2.34											0.75	3.09	200	201.2	0.32	102.37	18.85	0.16	0.59
				2.2700	**4**		**71**				**75**	**205.3**												**2.2700**							**423.78**			

Residential Avg. Daily Flow, q (L/p/day) =	280	Commercial Peak Factor =	1.5	(when area >20%)	
Commercial Avg. Daily Flow (L/gross ha/day) =	28,000		1.0	(when area <20%)	
or L/gross ha/sec =	0.324				
Institutianal Avg. Daily Flow (L/day/ha) =	28,000	Institutional Peak Factor =	1.5	(when area >20%)	
or L/gross ha/day =	0.324		1.0	(when area <20%)	
Light Industrial Flow (L/gross ha/day) =	35,000				
or L/gross ha/sec =	0.40509	Residential Correction Factor, K =	0.80		
Light Industrial Flow (L/gross ha/day) =	55,000	Manning N =	0.013		
or L/gross ha/sec =	0.637	Peak extraneous flow, I (L/s/ha) =	0.33	(Total I/I)	

Peak Population Flow, (L/sec) =	P*q*M/86.4	Unit Type	Persons/Unit
Peak Extraneous Flow, (L/sec) =	I*Ac	Singles	3.4
Residential Peaking Factor, M =	1 + (14/(4+P^0.5)) * K	Semi-Detached	2.7
A_c = Cumulative Area (hectares)		Townhomes	2.7
P = Population (thousands)		Batchelor or 1-bed Apt. Unit	1.4
Sewer Capacity, Qcap (L/sec) = (Manning's Equation)	$1/N\ S^{1/2} R^{2/3} A_c$	2-bed Apt. Unit	2.1
		3-bed Apt. Unit	3.1
		4-bed Apt. Unit	3.8

Designed:	Project:
A. Jariwala	166 Boyd Street
Checked:	Location:
J. Diaz, P.Eng.	Ottawa, Ontario
File Reference:	Page No:
262415 Sanitary - Sewer Design Sheet, May 2021.xlsx	**1 of 1**

Appendix D – Stormwater Servicing Tables

Table D1 – Calculation of Catchment Time of Concentration for Pre-Development Conditions

Table D2 – Calculation of Pre-Development Peak Flows

Table D3 – Calculation of Post-Development Average Runoff Coefficients

Table D4 – Summary of Post-Development Peak Flows (Uncontrolled and Controlled)

Table D5 – Summary of Post-Development Storage Requirements

Table D6 – Storage Volumes Required for 2-Year, 5-Year and 100-Year Storms

Table D7 – 5-Year Storm Sewer Calculation Sheet

Table D8 – Inlet Control Device (ICD) Sizing

TABLE D-1: ESTIMATION OF CATCHMENT TIME OF CONCENTRATION (PRE-DEVELOPMENT CONDITIONS)

Catchment No.	Area (ha)	High Elev (m)	Low Elev (m)	Flow Path Length (m)	Indiv Slope	Avg. C	Time of Conc. Tc (min)	Description
Full Site	2.2774	145.50	143.25	190.0	1.2%	0.22	37.40	See Note 1
Totals	2.2774							

Notes

1) For Catchments with Runoff Coefficient less than C=0.40, Time of Concentration Based on Federal Aviation Formula (Airport Method), from MTO Drainage Manual Equation 8.16, where: $T_C = 3.26* (1.1\text{-}C)* L^{0.5} / S_W^{0.33}$

2) For Catchments with Runoff Coefficient greater than C=0.40, Time of Concentration Based on Bransby Williams Equation, from MTO Drainage Manual Equation 8.15, where: $T_C = 0.057*L / (S_W^{0.2}*A^{0.1})$

TABLE D-2: ESTIMATION OF PEAK FLOWS (PRE-DEVELOPMENT CONDITIONS) USING CALCULATED TIME OF CONCENTRATION

Catchment No.	Area (ha)	Outlet Location	Time of Conc, Tc (min)	Storm = 2 yr			Storm = 5 yr			Storm = 100 yr		
				I_2 (mm/hr)	Cavg	Q_{2PRE} (L/sec)	I_5 (mm/hr)	Cavg	Q_{5PRE} (L/sec)	I_{100} (mm/hr)	Cavg	Q_{100PRE} (L/sec)
Full Site	2.2774		37.40	34.44	0.22	48.0	46.33	0.22	64.5	78.82	0.28	137.2
Totals	2.2774					48.0			64.5			137.2

Notes

1) Intensity, $I = 732.951/(Tc+6.199)^{0.810}$ (2-year, City of 0ttawa)

2) Intensity, $I = 998.071/(Tc+6.035)^{0.814}$ (5-year, City of 0ttawa)

3) Intensity, $I = 1735.688/(Tc+6.014)^{0.820}$ (100-year, City of Ottawa)

4) Cavg for 100-year is increased by 25% to a maximum of 1.0

TABLE D-3: AVERAGE RUNOFF COEFFICIENTS (Post-Development)

Runoff Coeffients $C_{ASPH/CONC}$ = 0.90 C_{ROOF} = 0.90 C_{GRASS} = 0.20

Area No.	Asphalt & Conc Areas (m^2)	A * C_{ASPH}	Roof Areas (m^2)	A * C_{ROOF}	Grassed Areas (m^2)	A * C_{GRASS}	Sum AC	Total Area (m^2)	C_{AVG} (see note)	Comment
S1	60.3	54.3	733.9	660.5	825.4	165	879.9	1619.6	0.54	
S2	48.1	43.3	497.2	447.5	590.0	118	608.8	1135.3	0.54	
S3	29.7	26.7	1173.1	1055.8	1956.8	391	1473.9	3159.6	0.47	
S4	2281.3	2053.1	1543.7	1389.3	1470.9	294	3736.6	5295.8	0.71	
S5	950.4	855.4	451.2	406.1	655.2	131	1392.5	2056.8	0.68	
S6	2415.6	2174.0	1786.1	1607.5	1556.2	311	4092.7	5757.8	0.71	
S7		0.0	1321.0	1188.9	1234.9	247	1435.9	2555.9	0.56	
S8		0.0		0.0	1193.1	239	238.6	1193.1	0.20	
Totals							13858.9	22,774	0.61	

Notes

TABLE D-4: SUMMARY OF POST-DEVELOPMENT PEAK FLOWS (Uncontrolled and Controlled)

Area No	Area (ha)	Time of Conc, Tc (min)	Storm = 2 yr				Storm = 5 yr				Storm = 100 yr				Comments
			C_{AVG}	I_2 (mm/hr)	Q (L/sec)	Q_{CAP} (L/sec)	C_{AVG}	I_5 (mm/hr)	Q (L/sec)	Q_{CAP} (L/sec)	C_{AVG}	I_{100} (mm/hr)	Q (L/sec)	Q_{CAP} (L/sec)	
S1	0.1620	10	0.54	76.81	18.8		0.54	104.19	25.5		0.68	178.56	54.6		
S2	0.1135	10	0.54	76.81	13.0		0.54	104.19	17.6		0.67	178.56	37.8		
S3	0.3160	10	0.47	76.81	31.5		0.47	104.19	42.7		0.58	178.56	91.5		
S4	0.5296	10	0.71	76.81	79.8	**(29.2)**	0.71	104.19	108.2	**(50.4)**	0.88	178.56	231.9	**(137.2)**	**To Dry Pond**
S5	0.2057	10	0.68	76.81	29.7		0.68	104.19	40.3		0.85	178.56	86.4		
S6	0.5758	10	0.71	76.81	87.4		0.71	104.19	118.5		0.89	178.56	254.0		
S7	0.2556	10	0.56	76.81	30.7		0.56	104.19	41.6		0.70	178.56	89.1		
S8	0.1193	10	0.20	76.81	5.1		0.20	104.19	6.9		0.25	178.56	14.8		
Total =	2.2774				295.9	**(29.2)**			401.4	**(50.4)**			859.9	**(137.2)**	
pre-dev =						***48.0***				***64.5***				***137.2***	

Notes

2-yr Storm Intensity, I = 732.951/(Tc+6.199)^0.810 (City of Ottawa)

5-yr Storm Intensity, I = 998.071/(Tc+6.035)^0.814 (City of Ottawa)

100-yr Storm Intensity, I = 1735.688/(Tc+6.014)&^0.820 (City of Ottawa)

Time of Concentration (min), Tc = ***10***

For Flows under column Qcap which are shown in brackets ***(0.0)*** *, denotes flows that are controlled*

TABLE D-5: SUMMARY OF POST DEVELOPMENT STORAGE REQUIREMENTS

Area No.	Area (ha)	Release Rate (L/s)			[1] Storage Required (m^3)			Storage Provided (m^3)					Control Method
		2-yr	5-yr	100-yr	2-yr	5-yr	100-yr	Pond	Surface Ponding	UG Storage	UG CB/MHs	Total	
S1	0.1620												
S2	0.1135												
S3	0.3160												
S4	0.5296	29.2	50.4	137.2	236.5	287.7	549.4	862.6				862.6	ICD (0.24m dia orifice)
S5	0.2057												
S6	0.5758												
S7	0.2556												
S8	0.1193												
Total =	**2.2774**				**236.5**	**287.7**	**549.4**	**862.6**		**0.0**		**862.6**	

Notes

1) Storage Requried Based on the Modified Rational Method (MRM) for the relase rates noted.

Table D-6 - Storage Volumes for 2-year, 5-Year and 100-Year Storms

Area No: **S1-S8**
C_{AVG} = 0.61
C_{AVG} = 0.76 (100-yr, Max 1.0)
Time Interval = 5.00 (mins)
Drainage Area = 2.2774 (hectares)

Duration (min)	Release Rate = 29.2 (L/sec)					Release Rate = 50.4 (L/sec)					Release Rate = 137.2 (L/sec)				
	Return Period = 2 (years)					Return Period = 5 (years)					Return Period = 100 (years)				
	IDF Parameters, A = 732.951			, B =	0.810	IDF Parameters, A = 998.071			, B =	0.814	IDF Parameters, A = 1735.688			, B =	0.820
	(I = A/(T_c+C)			, C =	6.199	(I = A/(T_c+C)			, C =	6.053	(I = A/(T_c+C)			, C =	6.014
	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m^3)	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m^3)	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m^3)
0	167.2	644.3	29.19	615.1	0.00	230.5	888.0	50.367	837.6	0.00	398.6	1919.7	137.230	1782.5	0.00
5	103.6	399.0	29.19	369.8	110.95	141.2	543.9	50.367	493.6	148.07	242.7	1168.9	137.230	1031.6	309.49
10	76.8	295.9	29.19	266.7	160.03	104.2	401.4	50.367	351.1	210.64	178.6	859.9	137.230	722.7	433.62
15	61.8	238.0	29.19	208.8	187.91	83.6	321.9	50.367	271.6	244.40	142.9	688.2	137.230	550.9	495.85
20	52.0	200.5	29.19	171.3	205.53	70.3	270.7	50.367	220.3	264.35	120.0	577.7	137.230	440.4	528.53
25	45.2	174.0	29.19	144.8	217.24	60.9	234.6	50.367	184.3	276.38	103.8	500.1	137.230	362.9	544.34
30	40.0	154.3	29.19	125.1	225.16	53.9	207.8	50.367	157.4	283.33	91.9	442.4	137.230	305.2	549.36
35	36.1	138.9	29.19	109.7	230.45	48.5	186.9	50.367	136.6	286.77	82.6	397.7	137.230	260.5	546.97
40	32.9	126.6	29.19	97.4	233.82	44.2	170.2	50.367	119.9	287.68	75.1	361.9	137.230	224.7	539.20
45	30.2	116.5	29.19	87.3	235.75	40.6	156.5	50.367	106.2	286.65	69.1	332.5	137.230	195.3	527.35
50	28.0	108.0	29.19	78.8	236.53	37.7	145.1	50.367	94.7	284.10	64.0	308.0	137.230	170.8	512.31
55	26.2	100.8	29.19	71.6	236.40	35.1	135.3	50.367	85.0	280.35	59.6	287.1	137.230	149.9	494.72
60	24.6	94.6	29.19	65.4	235.52	32.9	126.9	50.367	76.6	275.60	55.9	269.2	137.230	132.0	475.04
65	23.2	89.2	29.19	60.0	234.02	31.0	119.6	50.367	69.2	270.02	52.6	253.5	137.230	116.3	453.62
70	21.9	84.4	29.19	55.2	231.98	29.4	113.2	50.367	62.8	263.74	49.8	239.8	137.230	102.6	430.73
75	20.8	80.2	29.19	51.0	229.49	27.9	107.4	50.367	57.1	256.86	47.3	227.6	137.230	90.3	406.57
80	19.8	76.4	29.19	47.2	226.60	26.6	102.3	50.367	52.0	249.46	45.0	216.7	137.230	79.4	381.33
85	18.9	73.0	29.19	43.8	223.37	25.4	97.7	50.367	47.4	241.60	43.0	206.9	137.230	69.6	355.13
90	18.1	69.9	29.19	40.7	219.83	24.3	93.6	50.367	43.2	233.33	41.1	198.0	137.230	60.8	328.09
95	17.4	67.1	29.19	37.9	216.02	23.3	89.8	50.367	39.4	224.71	39.4	189.9	137.230	52.7	300.31
100	16.7	64.5	29.19	35.3	211.97	22.4	86.3	50.367	36.0	215.77	37.9	182.5	137.230	45.3	271.85
Max =					**236.53**					**287.68**					**549.36**

Notes
1) Peak flow is equal to the product of 2.78 x C x I x A
2) Rainfall Intensity, I = $A/(Tc+C)^B$
3) Release Rate = Min (Release Rate, Peak Flow)
4) Storage Rate = Peak Flow - Release Rate
5) Storage = Duration x Storage Rate
6) Maximium Storage = Max Storage Over Duration
7) Parameters a,b,c are for City of Ottawa

TABLE D-7: 5-YEAR STORM SEWER CALCULATION SHEET

Return Period Storm =	**5-year**	(2-year, 5-year, 100-year)
Default Inlet Time=	10	(minutes)
Manning Coefficient =	0.013	(dimensionless)

From Node	To Node	Street	AREA INFO				FLOW (UNRESTRICTED)							INDIV CAP FLOW (L/s)	CUMUL CAP FLOW (L/s)	SEWER DATA						Velocity (m/s)		Time in Pipe, Tt (min)	Hydraulic Ratios	
			Area No.	Area (ha)	∑ Area (ha)	Average R	Indiv. 2.78*A*R	Accum. 2.78*A*R	Tc (mins)	I (mm/h)	Indiv. Flow	Return Period	Q (L/s)			Dia (mm) Actual	Dia (mm) Nominal	Type	Slope (%)	Length (m)	Capacity, Q_{CAP} (L/sec)	Vf	Va		Q/Q_{CAP}	Va/Vf
STMMH 307	STMMH 302	UNNAMED	S4	0.316	0.316	0.47	0.410	0.410	10.00	104.19	42.7	5-year	42.7			447.9	450	PVC	0.30	15.82	154.20	0.98	0.69	0.38	0.28	0.70
STMMH 302	STMMH301	UNNAMED	S1						10.00	104.19		5-year														
		UNNAMED	S4	0.316	0.316	0.47	0.410	0.410	10.00	104.19	42.7	5-year	42.7			447.9	450	PVC	0.30	95.65	154.20	0.98	0.69	2.32	0.28	0.70
STMMH 303	STMMH301	UNNAMED	S4	0.316	0.316	0.47	0.410	0.410	10.00	104.19	42.7	5-year	42.7			447.9	450	PVC	0.30	5.53	154.20	0.98	0.69	0.13	0.28	0.70
STMMH301	DRY POND	UNNAMED	S4	0.316	0.316	0.47	0.410	0.410	12.32	93.35	38.3	5-year	38.3			447.9	450	PVC	0.30	16.56	154.20	0.98	0.66	0.42	0.25	0.67
STMMH 307	STMMH 306	UNNAMED	S2	0.162	0.162	0.54	0.245	0.245	10.00	104.19	25.5	5-year	25.5													
		UNNAMED	S5	0.530	0.692	0.71	1.039	1.283	10.00	104.19	108.2	5-year	133.7			447.9	450	PVC	0.30	62.29	154.20	0.98	0.98	1.06	0.87	1.00
STMMH 306	STMMH 305	UNNAMED	S3	0.114	0.114	0.54	0.169	0.169	10.00	104.19	17.6	5-year	17.6													
		UNNAMED	S6	0.206	1.173	0.68	0.387	2.084	11.06	98.92	38.3	5-year	206.2			610.0	600	PVC	0.30	14.10	351.46	1.19	1.07	0.22	0.59	0.90
STMMH 305	STMMH 304	UNNAMED	S6	0.206	1.173	0.68	0.387	2.084	11.28	97.90	37.9	5-year	204.1			610.0	600	PVC	0.30	97.31	351.46	1.19	1.07	1.52	0.58	0.90
STMMH 308	STMMH 304	UNNAMED	S6	0.206	0.319	0.68	0.387	0.556	10.00	104.19	40.3	5-year	58.0			610.0	600	PVC	0.30	5.93	351.46	1.19	0.70	0.14	0.16	0.59
STMMH 304	DRY POND	UNNAMED	S6	0.206	1.173	0.68	0.387	2.084	12.79	91.44	35.4	5-year	190.6			610.0	600	PVC	0.30	20.63	351.46	1.19	0.84	0.41	0.54	0.71
DRY POND	STORM MAIN	BOYD STREET	S7	0.576	0.5758	0.71	1.138	1.138	10.00	104.19	118.5	5-year	118.5													
		BOYD STREET	S8	0.256	2.1581	0.56	0.399	3.786	13.20	89.86	35.9	5-year	340.2	138.0	138.0	610.0	600	PVC	0.15	20.63	248.52	0.84	0.59	0.58	0.56	0.71
TOTALS =				**1.26**			**1.639**																			

Definitions:
Q = 2.78*AIR, where
Q = Peak Flow in Litres per second (L/s)
A = Watershed Area (hectares)
I = Rainfall Intensity (mm/h)
R = Runoff Coefficients (dimensionless)

Ottawa Rainfall Intensity Values from Sewer Design Guidelines, SDG002

	a	b	c
2-year	732.951	6.199	0.810
5-year	998.071	6.053	0.814
100-year	1735.688	6.014	0.820

Designed:	Project:	
A.Jariwala, P.Eng.	166 Boyd Street	
Checked:	Location:	
J. Diaz, P.Eng.	166 Boyd Street	
Dwg Reference:	File Ref:	Sheet No:
C100 - Site Servicing Plan	**262415 Storm Design Sheets, May 2021.xlsx**	1 of 1

Table D-8

Inlet Control Device (ICD) Sizing

Orifice Location:	**Dry Pond**	Max Elev (m) =	**143.700**
Orifice Type:	**Custom Dia**	Min Elev (m) =	142.200
OrificeDia (mm):	**242.7**	Interval (m)=	**0.1500**
Orifice Area (mm^2):	46,262		
Orifice Centroid:	142.500	Max Depth (m) =	1.500
Outlet Pipe Invert (m):	**142.200**		
Outlet Pipe Diamter (m):	**0.600**		
Orifice Coefficient :	0.61		

Stage (m)	Head above Orifice (m)	Orifice Flow (L/sec)	Comment
146.550	4.050	251.97	
146.400	3.900	247.26	
146.250	3.750	242.46	
146.100	3.600	237.56	
145.950	3.450	232.56	
145.800	3.300	227.45	
145.650	3.150	222.22	
145.500	3.000	216.86	
145.350	2.850	211.37	
145.200	2.700	205.73	
145.050	2.550	199.94	
144.900	2.400	193.97	
144.750	2.250	187.81	
144.600	2.100	181.44	
144.450	1.950	174.84	
144.300	1.800	167.98	
144.150	1.650	160.83	
144.000	1.500	153.34	
143.850	1.350	145.47	
143.700	1.200	137.15	Max Elev
143.550	1.050	128.30	
143.400	0.900	118.78	
143.250	0.750	108.43	
143.100	0.600	96.98	
142.950	0.450	83.99	
142.800	0.300	68.58	
142.650	0.150	48.49	
142.500	0.000	0.00	
142.350	-0.150	0.00	
142.200	-0.300	0.00	Min Elev

Preliminary Sizing

$Q = C A (2 g H)^{0.5}$ (Orifce Equation)

C = coefficient = 0.61

H = Head above centroid of orifice (m)

A = Orifice Area (m^2)

g = gravity (m/s^2) = 9.81

Given, Q = **137.20 L/sec**

Max WL = 143.700 m

Max Head from Orifice Centroid , H = 1.200 m

Solving For Orifice Area

$$A = \frac{Q}{C \times (2 \times g \times H)^{0.5}}$$

$$A = \frac{137.2}{0.6 \times (2 \times 9.81 \times 1.200)^{0.5}}$$

$$A = \frac{0.1372}{2.964704}$$

A = 0.0463 m^2

Since A = ¶ x R^2, Solving for R

R = √ (A / ¶)

R = SQRT(0.0463 / 3.14159)

R = 0.121 m

or D= **0.2427 m Circular**

Appendix E – Background Information

Pre-Consultation Meeting Notes – Lanark County

Pre-Consultation Comments from the Town

Town of Carleton Place – Hydraulic Water Memo by J.L Richards (16th September 2013)

Pre-Consultation Checklist

Stormceptor EFO8 Sizing Report

Pre-Consultation Meeting Notes
Virtual zoom meeting – October 15, 2020
Prepared By: Julie Stewart

In Attendance
Ankica Bulat – Bulat Homes
Bruce Thomas - exp
Tracy Zander – ZanderPlan
Niki Dwyer – Director of Development Services, Town of Carleton Place
Robin Daigle – Engineering Manager, Town of Carleton Place
Julie Stewart – County Planner, County of Lanark

The subject lands are located on Boyd Street in the Town of Carleton Place.
In 2013, a draft plan of subdivision application was filed by Devcore, for Part of Lots 3, 5, 7 and all of Lots 9, 11, 13, 15 and 17, Plan 7211, geographic Township of Beckwith, Town of Carleton Place. The block map as provided by the owner is attached.

The applicant is proposing a development consisting of 77 townhouse units. A concept plan provided by Bulat Homes is attached.

Town staff commented on the density policies of the Official Plan. Town staff noted that historically, Council has a concern with developments containing townhouses across from townhouses. Concerns are related to townhouse developments in terms of parking, on-street parking, concentration of development and neighbourhood compatibility.

The Lanark County Pre-Consultation Checklist is attached. The reports / studies / plans as noted on the attached checklist are required to be submitted at the time of application. The Town of Carleton Place provided written comments for the developers consideration in regards to the discussion of the virtual meeting. These are also attached. Additional comments are provided below.

Diane Reid – Environmental Planner, MVCA, was unable to participate in the virtual meeting, however provided preliminary information regarding stormwater management in an e-mail to the County Planner prior to the meeting. The information was read at the meeting and is included below:

- An enhanced level of stormwater quality control is recommended per the MOE Design Manual.
- Stormwater quantity should be controlled such that post-development flows equal pre-development levels.
- Measures to maintain infiltration should be considered and integrated into the stormwater management design where possible. Credit Valley Conservation has an LID Design Guide available at http://www.creditvalleyca.ca/low-impact-development/low-impact-development-support/stormwater-management-lid-guidance-documents/low-impact-development-stormwater-management-planning-and-design-guide/ that provides guidance for the infiltration of clean runoff.

Environmental Impact Study

- In regards to the requirements for an Environmental Impact Study, the County Planner has contacted MVCA and requested confirmation on what the submission requirements will be. This information will be circulated when provided.

Planning Rationale Report

- Development Permit and conformance with the Official Plan are to be addressed within. Density and bonussing should be included within the report.

Urban Design Brief

- Is required

Servicing Options Statement

- As the site is will be on public services, a Conceptual Servicing Report shall be submitted with the application.

Stormwater Drainage Plan

- See MVCA comments above
- See Town's comments attached

Archaeological

- A minimum Stage 1 Archaeological Assessment is required to be submitted

OTHER

Traffic Study

- The Town advised this will be required and should justify why the density is appropriate

Geotechnical Report

-is required to be submitted

Environmental Site Assessment

- A Phase 1 Environmental Site Assessment and a Phase 2 Environmental Site Assessment were submitted with the 2013 draft plan of subdivision. Confirmation on the status of these reports should be provided with the submission, or new / updated reports should be provided with the submission. The owner / agent shall consult with the Ministry of the Environment, Conservation and Parks directly in regards to the ESA.

Corporation of the Town of Carleton Place

175 Bridge Street, Carleton Place, ON K7C 2V8 Phone: (613) 257-6200 Fax: (613) 257-8170

October 30, 2020

Julie Stewart, RPP MCIP
County Planner
Lanark County
(jstewart@lanarkcountry.ca)

Re: Boyd Street Infill Subdivision (Bulat Homes)

Ms Stewart,

Further to the virtual meeting you hosted on October 15th, 2020 respecting the proposed infill subdivision by Bulat Homes at the intersection of Boyd Street and Arthur Street, the Town of Carleton Place offers the following comments for the developers consideration prior to further consultation:

Density

- While the Official Plan does not prescribe an upper limit of density for infill developments of less than 3 ha, it is the principal of the general provisions of both the Official Plan and Development Permit Bylaw to see a mix of housing types that create visual interest on the streetscape and provide a range of housing options. Specifically, the developer shall have regard for the policies found in Section 2.0 of the Official Plan and Section 14.3.2 of the Development Permit Bylaw in considering a design of the subdivision.
- Any development in excess of 35 units per ha will be reviewed in accordance with the Town's policies for density bonusing located in Section 3.5.5 of the Official Plan.

Parkland Development

- The context of the neighbourhood and the development lands have been reviewed and discussed with the Manager of Recreation and it is recommended that in this case the development contribute cash in lieu of parkland due to the size of the land area of a possible contribution. Cash in lieu of parkland is to be provided in accordance with the Municipality's bylaw, a copy of which is enclosed herein.

Road Upgrades and Geometry

- The Town would like to see the development integrated within the existing street alignment. Opportunities for connectivity to Arthur Street should be explored as an option.
- The developer will be required to complete the connection of Boyd Street to the completed connection in the Jackson Ridge subdivision the design of which will include asphalt and curbing.
- Boyd Street presently exhibits of width of approximately 12m. A road widening on the western edge of the existing allowance of approximately 5m will be required to be dedicated to the Municipality.

Corporation of the Town of Carleton Place

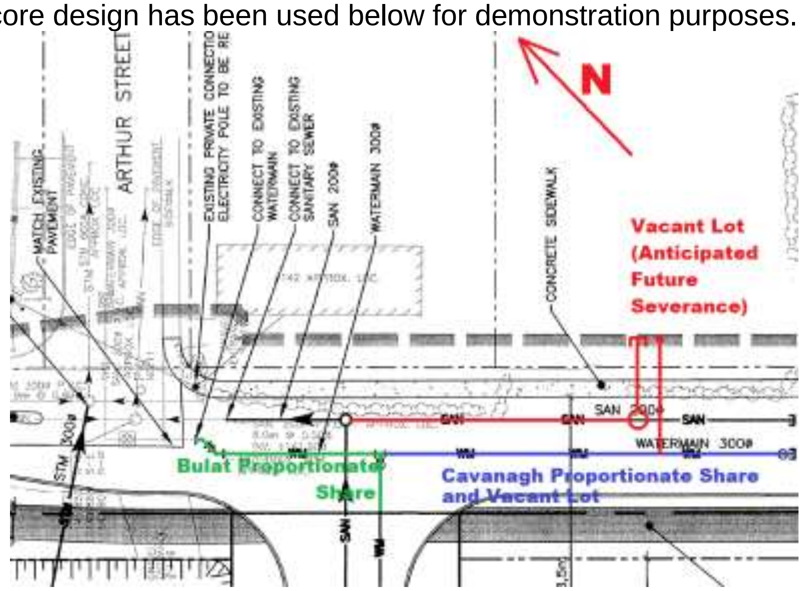
175 Bridge Street, Carleton Place, ON K7C 2V8   Phone: (613) 257-6200   Fax: (613) 257-8170

- The developer will be required to construct the continuous pathway from Jackson Ridge subdivision to the parkland at the corner of Woodward and Boyd Streets.   This construction will be considered part of the roadway cross-section and will not contributed to “parkland” dedications.
- Internal roadway cross-sections shall have a minimum right of way width of 20m unless expressly justified for a reduction to no less than 18m.

Servicing

Water Service

- Cavanagh Developments is required (as Part of the Bodnar Subdivision) to extend a watermain from the Jackson Ridge Subdivision to the cap at Arthur Street; this project will need to be coordinated with the developer. Preliminary thoughts are as follows:
    - That the developer be responsible for the portion of watermain from Arthur Street to their own site entrance and Cavanagh would be responsible for the remainder to the Jackson Ridge Subdivision; see below sketch for reference.
    - As the developer is responsible for the road, the design for the watermain should be included in the Boyd Street Subdivision design scope.
    - Should timing require Cavanagh to construct the watermain before the Boyd Street Subdivision proceeds, Cavanagh will be required to make provisions for the Boyd Street Subdivision (i.e install a watermain service stub) and the developer will be required to pay their proportionate share for this project.
    - Should the developer require the connection first, the developer will be required to install the watermain and make the connection to the Jackson Ridge Subdivision, the Town would in turn require Cavanagh to reimburse the developer Cavanagh’s proportionate share.
    - The Devcore design has been used below for demonstration purposes.



- The site has access to a 300mm diameter watermain. No capacity constraints are anticipated. This will need to be confirmed within the developer servicing report.
- Town can provide system modelling results and have our water modelling consultant provide boundary conditions if necessary at the developer's expense.

Sanitary

- Town will require the Boyd Street sanitary extension as shown above in red. The Town would then charge the vacant lot 50% of the cost of the road along the frontage of a severed lot + the cost to install the sanitary main and lateral and water service prior to Building permit issuance for this lot.
- The Town does not anticipate that sanitary sewer constraints will impede the development, however the developer will need to verify this fact within the Servicing Report.

Cost-Sharing Contributions

- The properties are presently subject to two Cost-sharing bylaws the details of which are as follows:
    - By-law 06-2017/59-2018
        - $31,400.00 Enbridge Works + CPI (January 2017 to Present – Adjusted Annually) + HST as Per By-Law 2018-59.
    - By-Law 26-1994
        - $122,678.27 ("Ritchie" Parcels) + CPI (December 1994 to Present – Adjusted Annually) + HST
        - $5,627.44 ("Blackburn" Parcel) + CPI (December 1994 to Present – Adjusted Annually) + HST
        - Note the By-law applies a 9.25% annual interest rate however Staff would commit to having this amended to CPI subject to Council Approval.

Stormwater

- The developer is expected to match post development run-off rates with pre-development rates for storms up to the 100 yr event. Storm sewers are to be sized to a 5 yr minimum design storm. Water quality shall meet a normal treatment level unless higher levels are required by outside agencies (I.e MVCA).
- A wet pond is likely not a desirable option given the size of this site. A combination of oil/grit separators and a dry pond will likely be the preferred option of the Town. As discussed underground storage options can be considered.

Application Submission Requirements

- The Town will require the following minimum submission documents for consideration of the application:
    - Traffic Impact Assessment (to include an on-street parking plan)
    - Urban Design Brief
    - Planning Rational (to include preferred scenarios for density bonusing)

…3/4

- Stormwater Management Report
- Servicing Report
- Geotechnical Report
- Scoped Environmental Impact Study (to be confirmed by MVCA)

The Town looks forward to receiving an additional conceptual proposal for review and further comment prior to final submission of a subdivision application.

Kindest Regards,

Niki Dwyer, RPP MCIP
Director of Development Services
Town of Carleton Place
ndwyer@carletonplace.ca

cc: Robin Daigle, Engineering Manager (rdaigle@carletonplace.ca)

J.L. Richards
& Associates Limited
864 Lady Ellen Place
Ottawa, ON Canada
K1Z 5M2
Tel: 613 728 3571
Fax: 613 728 6012

MEMORANDUM

TO: Paul Knowles, P.Eng.
Chief Administrative Officer
Town of Carleton Place

FROM: Mark Buchanan, P.Eng

RE: Town of Carleton Place – Hydraulic Water Model Investigation
Future Development

DATE: September 16, 2013

JOB NO.: 25819-01

CC: Dave Young, Director of Public Works
Town of Carleton Place
Brian Hein, P.Eng.
J.L. Richards & Associates Limited

INTRODUCTION

The Town of Carleton Place (Town) has identified numerous potential future development areas located within and outside of the current Town limits (refer to the attached Drawing). The purpose of this Memorandum is to report on the estimated impacts that the potential future development will have on the existing water distribution network during a maximum day demand plus coincidental fire flow (i.e. considered the worst case conditions). The Town's existing hydraulic water model (previously updated in 2010) was updated based on recent watermain replacements and was used to evaluate the impact of the potential future development.

METHODOLOGY

Based on the scope of the possible future development (refer to the attached Drawing) and discussions with the Town, the following seven (7) scenarios were developed and analyzed in the hydraulic water model:

1) Existing Water Distribution System;
2) Build-out of future development within the existing Town Limits;
3) Future development north of the Mississippi River (within the Town Limits);
4) Future development south of the Mississippi River (within the Town Limits);
5) Existing plus future development outside of the Town Limits (excluding development within Town Limits);
6) Build-out of all proposed future development; and
7) Build-out of all proposed future development under peak hour demand.

This analysis was conducted in accordance with MOE Water Distribution Design Guidelines that recommend systems meet the following criteria:

1) Maximum day plus coincidental fire flow at a minimum 140 kPa (20 psi) system pressure throughout; and
2) Minimum peak hour system pressure of 275 kPa (40 psi) throughout.

Typically, watermain sizing is dictated by the maximum day plus coincidental fire flow conditions since this demand condition generates the highest flow rates through watermains resulting in higher frictional losses. All scenarios were evaluated under this demand condition. As an additional check of the water distribution system a peak hour demand condition was simulated under the build-out of all potential future development. New watermains added to the model ranged in diameters from 150 mm to 300 mm. It should be noted that while 200 mm diameter watermains were modelled south of Highway No. 7 and east of McNeely Avenue, it is recommended that 300 mm diameter trunk watermains be constructed in these areas since the actual extent of development is unknown at this time. The installation of 300 mm diameter trunk watermains would be consistent with previous Town development.

It is understood that water plant upgrades (including high lift pump upgrades) and additional water storage would be required to support the proposed future development. The water distribution network is the focus of this investigation.

WATER DEMANDS

Anticipated land use in the future development areas consists of residential, commercial and light industrial. Water demands and residential peaking factors were estimated based on the consumption rates recommended in MOE Design Guidelines. The peaking factors for commercial and light industrial development were obtained from the City of Ottawa Design Guidelines. For residential development, a unit density of 2.5 people/unit was applied. The following Table summarizes the water demand parameters applied to future development areas (refer to the attached tables for detailed water demands applied under each scenario).

Table 1: Future Development Water Demand Parameters

Land Use	Average Day	Maximum Day	Peak Hour
Residential	350 L/cap/day	2.0 x Average Day	3.0 x Average Day
Commercial	28,000 L/ha/day	1.5 x Average Day	2.7 x Average Day
Light Industrial	35,000 L/ha/day	1.5 x Average Day	2.7 x Average Day

BOUNDARY CONDITIONS

Maximum day plus fire flow simulations were carried out using HLPs No. 1 and No. 4 and an Elevated Storage Tank (EST) level of 181.1 m. This scenario was modelled assuming a minimum pressure of 140 kPa (20 psi) at any junction or hydrant within that zone. Based on revised high lift pump curves, the model extrapolated flows to the 140 kPa (20 psi) level because the pumps run-out point is anywhere between 440 kPa (63.8 psi) and 410 kPa (59.4 psi).

The peak hour demand condition was simulated using HLPs No. 1 and No. 3 and EST level of 181.1 m. The resulting system pressures were compared to the minimum operating pressure of 275 kPa (40 psi) recommended in the MOE Guidelines.

MODEL RESULTS AND OBSERVATIONS

The following Table presents a summary of the fire flows estimated that can be delivered to the various junctions in the system under the simulated scenarios. The simulation results are expressed in terms of a percentage of total system junctions that are capable of delivering the fire flow listed under the column heading.

Table 2: Maximum Day + Fire Flow Junction Performance Summary

Scenario	Water Demand (L/s)	Percentage (%) of Junctions Capable of Meeting the Fire Flow Indicated				
		Fire Flow				
		50 L/s	75 L/s	100 L/s	150 L/s	300 L/s
Existing	86	97	85	73	51	21
Town Limits (T.L.)	197	99	90	79	52	18
North of River (T.L.)	112	96	86	73	50	20
South of River (T.L.)	172	99	90	79	56	29
Outside (T.L.)	192	99	90	76	49	16
Build-out	302	99	86	75	48	14

The potential build-out future development condition represents a 216 L/s or 250% increase in the maximum day demand from existing conditions. Given this significant growth, the model results indicate that overall the water distribution system provides a relatively consistent level of service from existing conditions. This is indicative of a well planned watermain network capable of supporting ample future development (refer to the attached WaterCAD results).

The junction performance summary indicates improved fire flows South of the River within the Town Limits scenario. Available fire flows increased when compared to existing conditions in the southwest quadrant of the Town. This improvement is attributed to potential watermain looping and redundancy created by connecting Morris Street, extending the existing 300 mm watermain along Boyd Street and future connections on the west side of Dunham Street.

In the northeast quadrant of the Town, existing fire flows are below 50 L/s and up to 75 L/s in the commercial/industrial area. The model results of future development in this area indicate that similar levels of services can be expected under build-out conditions. Additional investigation will likely be required to determine if these are acceptable levels of service for future commercial and industrial development. Relatively higher ground elevations and small watermain diameter (150 mm) are identified as constraints to this future development.

Build-out - Peak Hour Demand

As a conservative check, a peak hour scenario was simulated under the projected build-out condition. This scenario peaked domestic water demands at 445 L/s, an increase of 305 L/s or 218% from the existing peak hour demand of 140 L/s. The results of this investigation indicate that the minimum peak hour pressure requirement of 275 kPa (40 psi) is achieved across the majority of the water distribution system, with noted deficiencies at the periphery of the system on the north side of the Mississippi River. The deficient pressures range between 235 kPa to 273 kPa and are located in the future commercial/industrial development and the existing Moffat, Thomas and Bridge Street areas. Watermain upgrades and/or booster stations may be required to adequately service these areas in the future. Once the timing and scope of future development areas are defined, it is recommended that a specific hydraulic investigation be undertaken for the new development as a final check that adequate water servicing can be delivered by the existing water distribution network.

CONCLUSION AND RECOMMENDATIONS

The results of the foregoing hydraulic investigation indicate that the majority of the existing water distribution system can accommodate significant levels of future development. The level of service provided under existing maximum day demand plus coincidental fire flow is maintained following build-out of the proposed future development areas. It is recommended that watermain looping be constructed when developing new areas, particularly in the southwest quadrant of the Town. It should be noted that while 200 mm diameter watermains were simulated in the south east quadrant it is recommended that 300 mm diameter trunk feedermains be installed in this area since the precise scope of future development is unknown at this time. The installation of 300 mm diameter trunk watermains would be consistent with the previous Town development. Once the timing and scope of future development areas are defined, it is recommended that a specific hydraulic investigation be undertaken for the new development as a final check that adequate water servicing can be delivered by the existing water distribution network.

Should you have any questions, please do not hesitate to contact the undersigned at your convenience.

Prepared by:

J.L. RICHARDS & ASSOCIATES LIMITED

Mark Buchanan

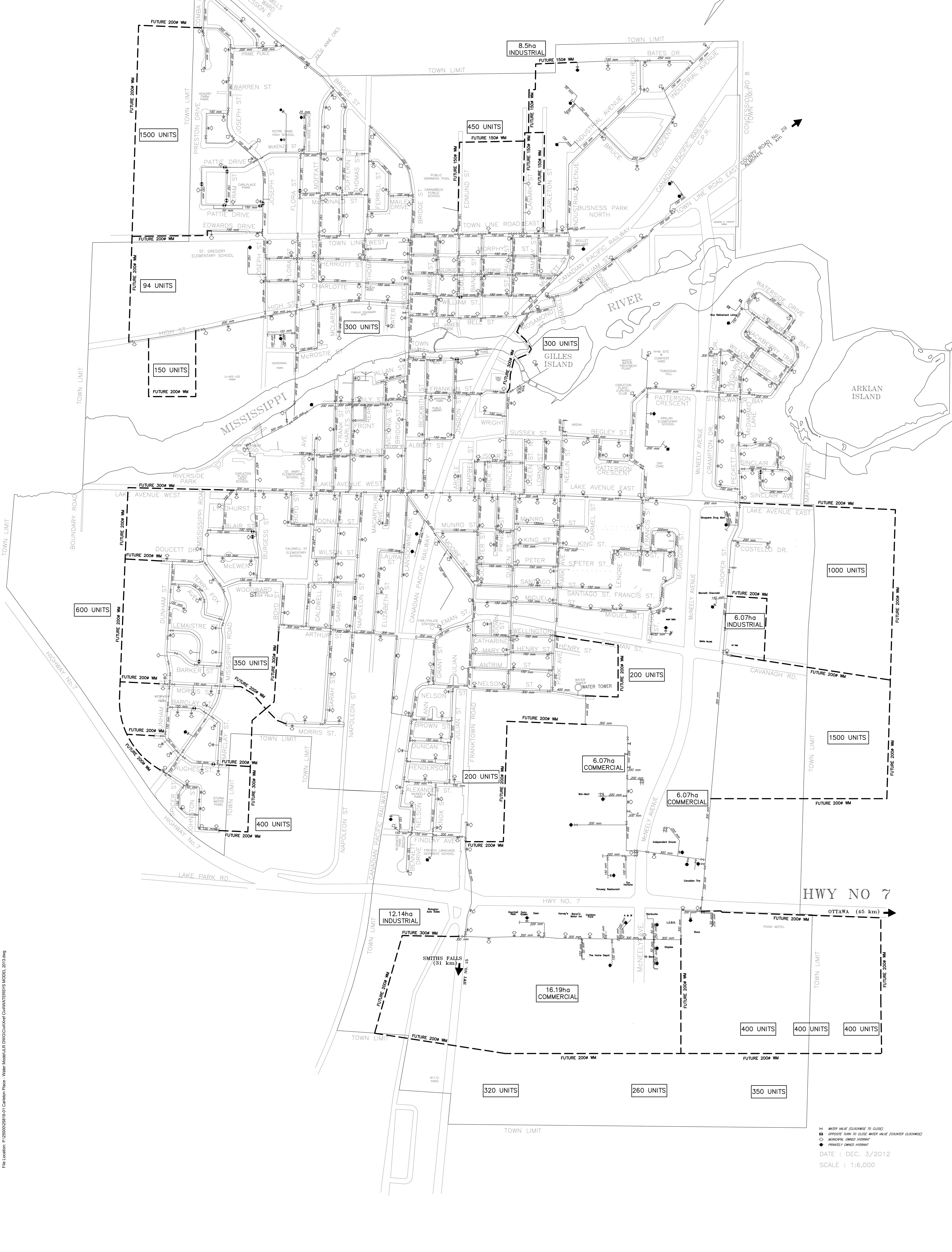
Mark Buchanan, P.Eng.

MB:jd
Attach.

ATTACHMENT NO. 1

Future Development Drawing

TOWN OF CARLETON PLACE
WATER DISTRIBUTION SYSTEM
FUTURE DEVELOPMENT

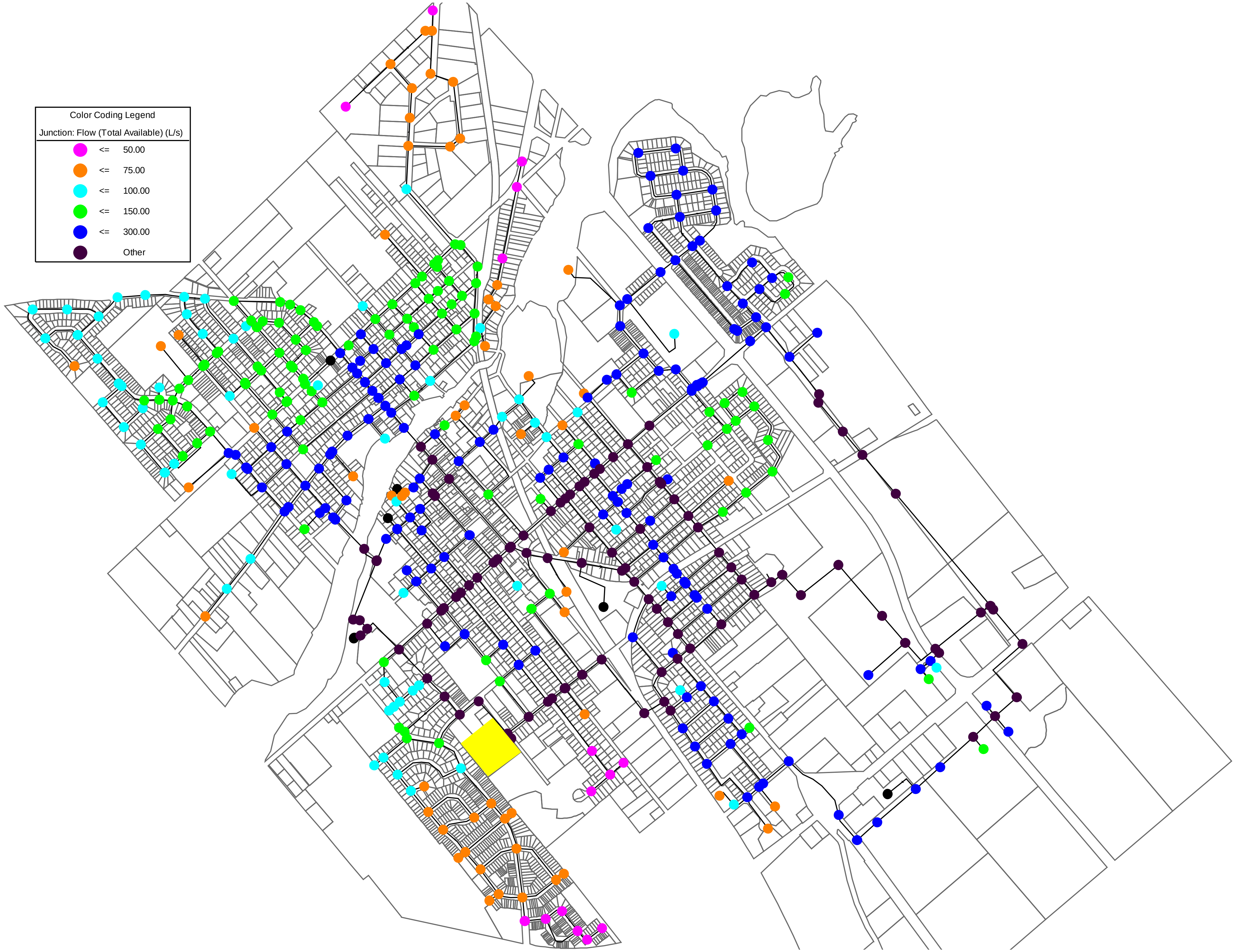


File Location: P:\25000\25819-01 Carleton Place - Water Model\ULR DWG\Civil\Xref Civil\WATERSYS MODEL 2013.dwg

ATTACHMENT NO. 2

Water Demands and WaterCAD Results

Active Scenario: Max Day plus Fire Flow Demand



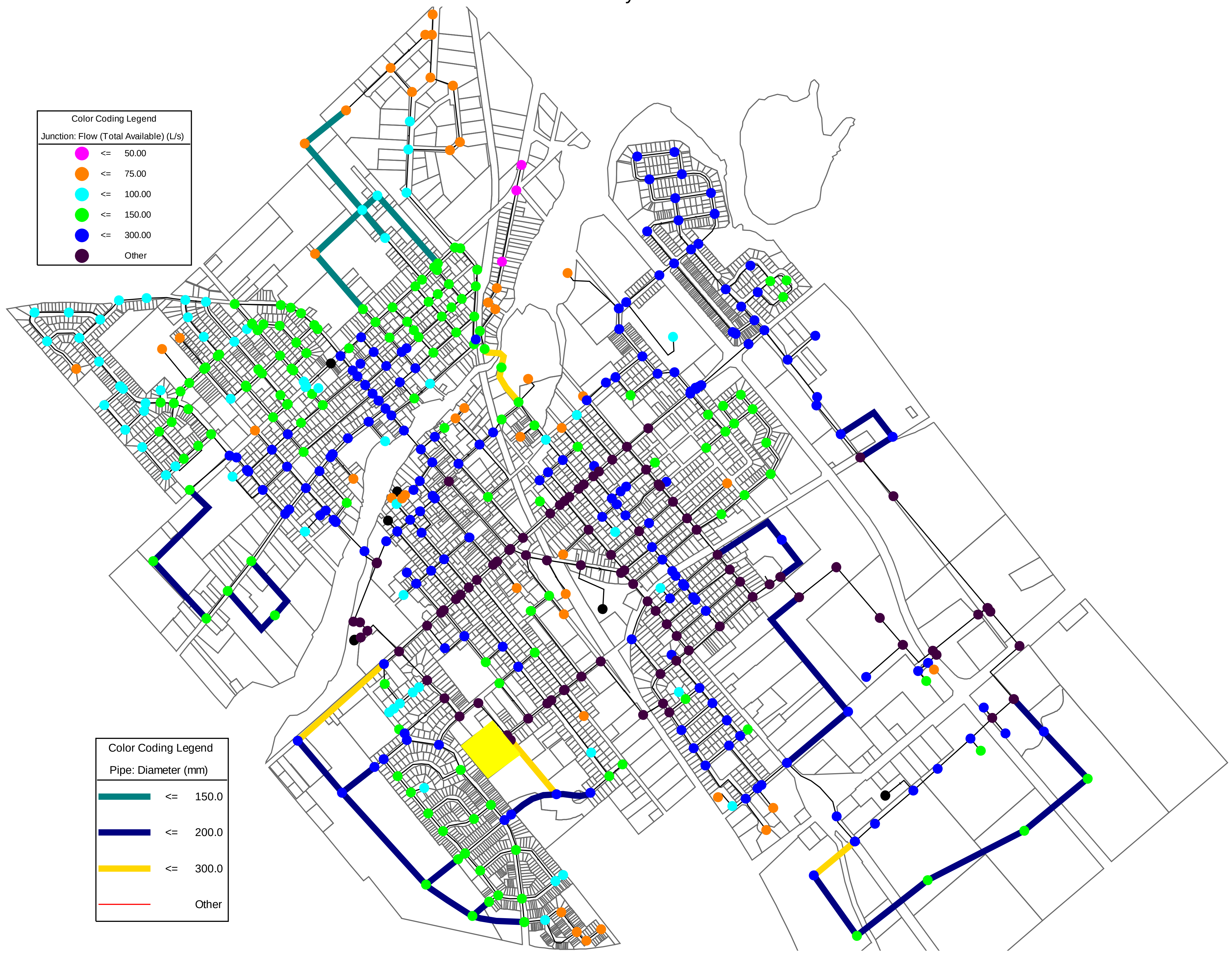
Town of Carleton Place
Future Development within Town Limits
Water Demands

Node	Zoning	Units or Area (ha)	Demand (L/s)	
			Average Day	Maximum Day
181	Res	300	3.04	6.08
895	Comm	6.07	1.97	2.95
904	Res	0	0.00	0.00
905	Res	300	3.04	6.08
906	Res	300	3.04	6.08
907	Res	0	0.00	0.00
908	Res	350	3.54	7.09
909	Res	200	2.03	4.05
910	Res	150	1.52	3.04
911	Res	0	0.00	0.00
912	Res	94	0.95	1.90
913	Res	225	2.28	4.56
914	Res	225	2.28	4.56
915	Res	0	0.00	0.00
916	Res	0	0.00	0.00
917	Res	200	2.03	4.05
918	Res	0	0.00	0.00
919	Indust.	12.14	4.92	7.38
920	Res	0	0.00	0.00
921	Res	320	3.24	6.48
921	Comm	8.09	2.62	3.93
922	Res	260	2.63	5.27
922	Comm	8.09	2.62	3.93
923	Res	350	3.54	7.09
924	Res	400	4.05	8.10
925	Res	300	3.04	6.08
926	Comm	6.07	1.97	2.95
927	Res	0	0.00	0.00
928	Indust.	6.07	2.46	3.69
936	Indust.	8.5	3.44	5.16
	Total		**60.24**	**110.49**

Parameters

Unit Density	2.5	people/unit
Average Day	350	L/cap/day
Maximum Day Peaking Factor	2.0	x Avg
Light Industrial Avg Day Demand	35000	L/ha/day
Commercial Average Day Demand	28000	L/ha/day
Max Day Peaking Factor	1.5	x Avg

Active Scenario: Max Day + Fire within Town Limits

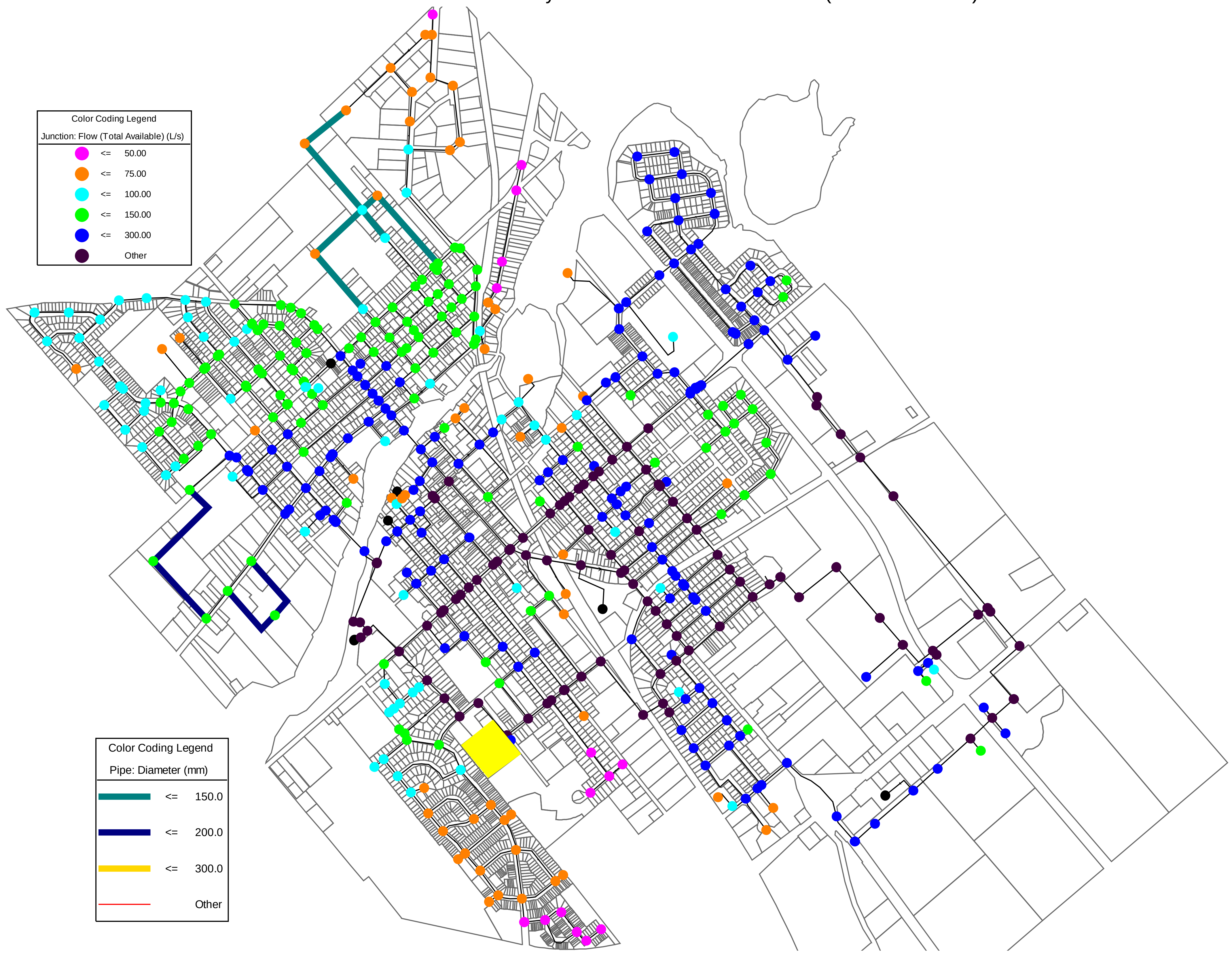


Town of Carleton Place
Future Development
North of Mississippi River (within Town Limit)
Water Demands

Node	Zoning	Units or Area (ha)	Demand (L/s)		
			Average Day	Maximum Day	
181	Res	300	3.04	6.08	
910	Res	150	1.52	3.04	
911	Res	0	0.00	0.00	
912	Res	94	0.95	1.90	
913	Res	225	2.28	4.56	
914	Res	225	2.28	4.56	
915	Res	0	0.00	0.00	
916	Res	0	0.00	0.00	
936	Indust.	8.5	3.44	5.16	20.13
	Total		**13.51**	**25.30**	

Parameters		
Unit Density	2.5	people/unit
Average Day	350	L/cap/day
Maximum Day Peaking Factor	2.0	x Avg
Light Industrial Avg Day Demand	35000	L/ha/day
Commercial Average Day Demand	28000	L/ha/day
Max Day Peaking Factor	1.5	x Avg

Active Scenario: Max Day + Fire within Town Limits (North of River)

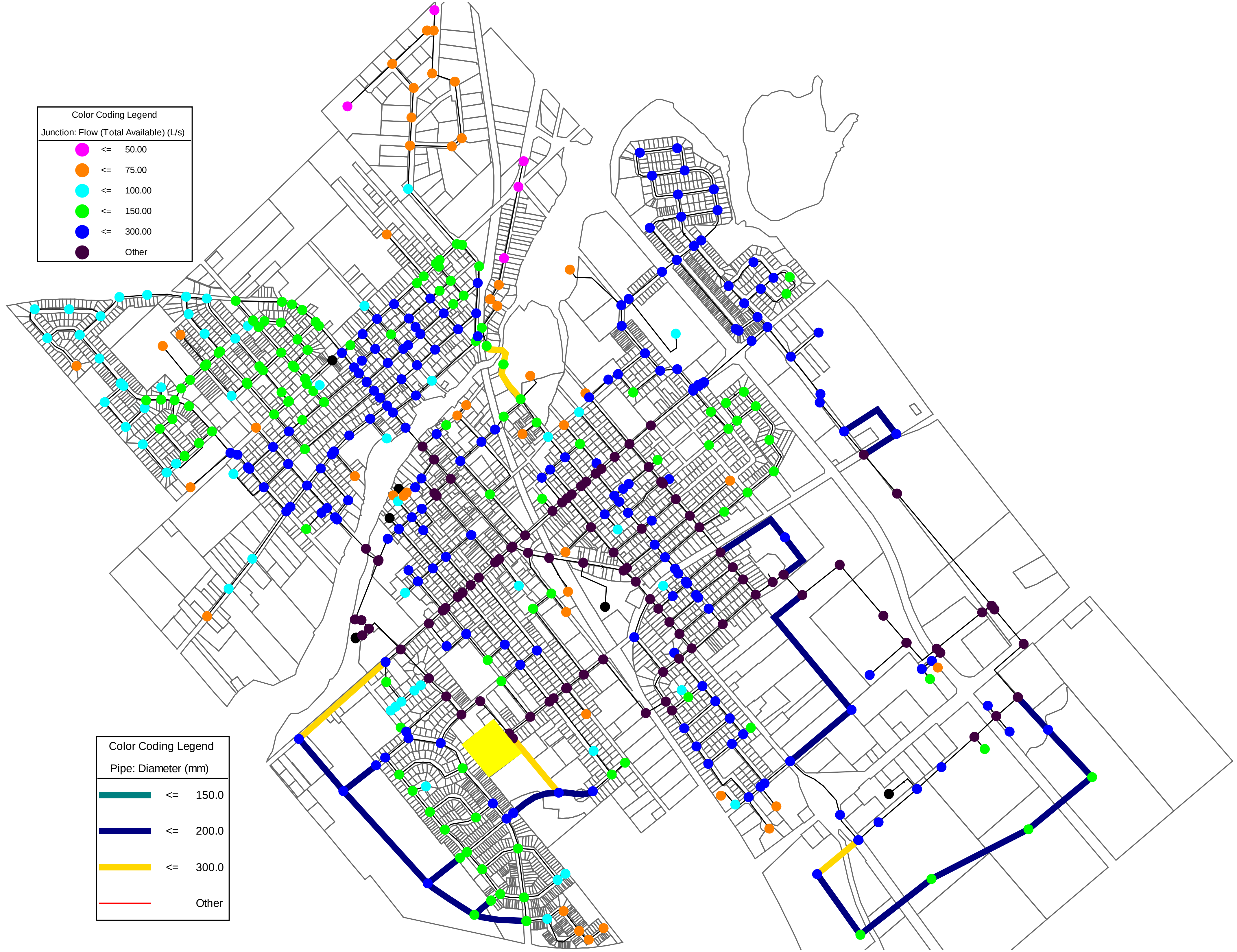


Town of Carleton Place
Future Development within Town Limits
South of Mississippi River (within Town Limit)
Water Demands

Node	Zoning	Units or Area (ha)	Demand (L/s)	
			Average Day	Maximum Day
895	Comm	6.07	1.97	2.95
904	Res	0	0.00	0.00
905	Res	300	3.04	6.08
906	Res	300	3.04	6.08
907	Res	0	0.00	0.00
908	Res	350	3.54	7.09
909	Res	200	2.03	4.05
917	Res	200	2.03	4.05
918	Res	0	0.00	0.00
919	Indust.	12.14	4.92	7.38
920	Res	0	0.00	0.00
921	Res	320	3.24	6.48
921	Comm	8.09	2.62	3.93
922	Res	260	2.63	5.27
922	Comm	8.09	2.62	3.93
923	Res	350	3.54	7.09
924	Res	400	4.05	8.10
925	Res	300	3.04	6.08
926	Comm	6.07	1.97	2.95
927	Res	0	0.00	0.00
928	Indust.	6.07	2.46	3.69
	Total		**46.73**	**85.19**

Parameters		
Unit Density	2.5	people/unit
Average Day	350	L/cap/day
Maximum Day Peaking Factor	2.0	x Avg
Light Industrial Avg Day Demand	35000	L/ha/day
Commercial Average Day Demand	28000	L/ha/day
Max Day Peaking Factor	1.5	x Avg

Active Scenario: Max Day + Fire within Town Limits (South of River)



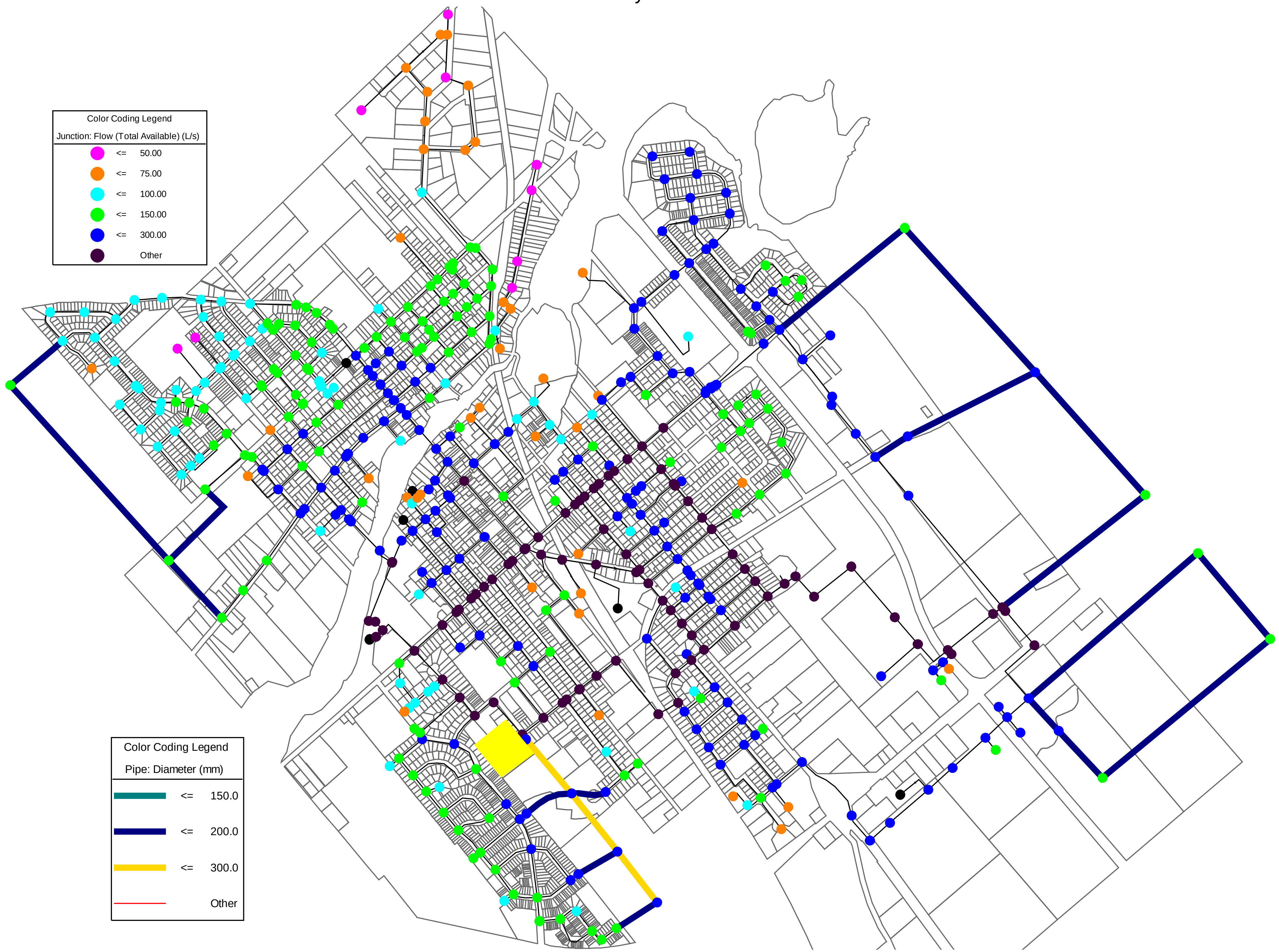
Town of Carleton Place
Future Development Outside Town Limits
Water Demands

Node	Zoning	Units or Area (ha)	Demand (L/s)	
			Average Day	Maximum Day
930	Res	800	8.10	16.20
931	Res	750	7.60	15.19
932	Res	1250	12.66	25.32
933	Res	500	5.06	10.13
934	Res	200	2.03	4.05
935	Res	200	2.03	4.05
937	Res	1500	15.19	30.38
	Total		**52.66**	**105.32**

Parameters

Unit Density	2.5	people/unit
Average Day	350	L/cap/day
Maximum Day Peaking Factor	2.0	x Avg
Light Industrial Avg Day Demand	35000	L/ha/day
Commercial Average Day Demand	28000	L/ha/day
Max Day Peaking Factor	1.5	x Avg

Active Scenario: Max Day + Fire outside Town Limits

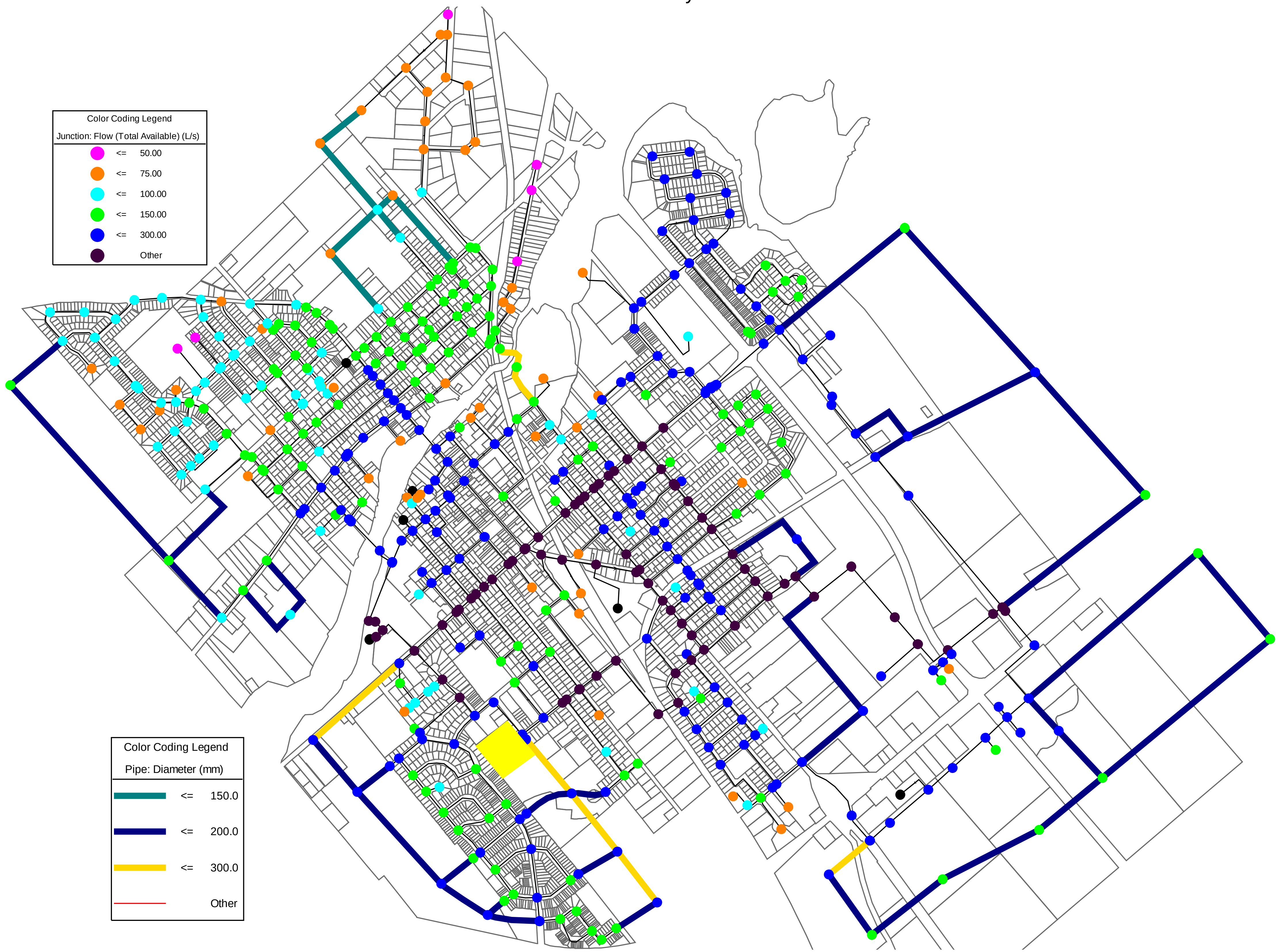


Town of Carleton Place
Future Development Build-out
Water Demands

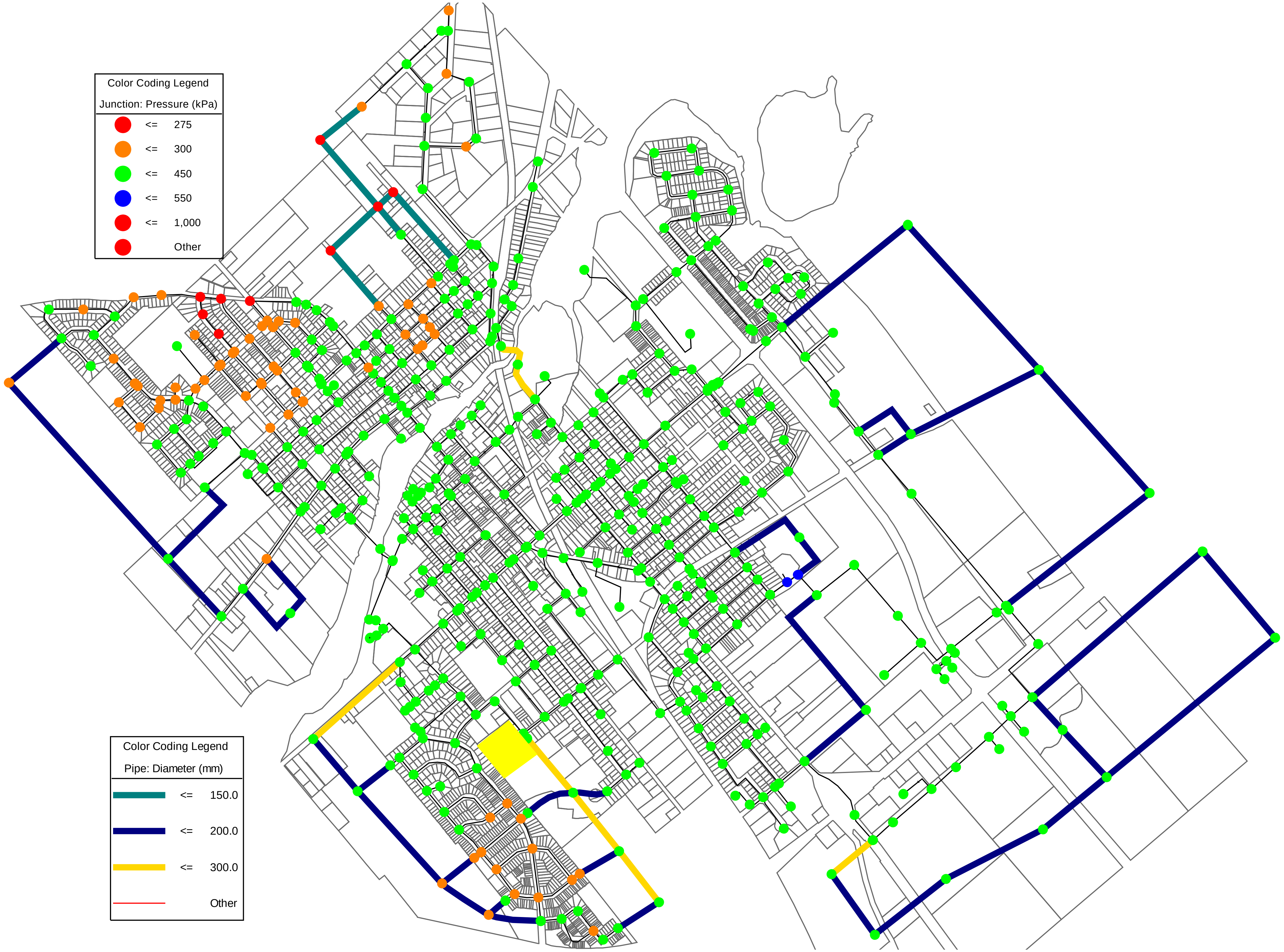
Node	Zoning	Units or Area (ha)	Demand (L/s)		
			Average Day	Maximum Day	Peak Hour
181	Res	300	3.04	6.08	8.20
895	Comm	6.07	1.97	2.95	5.31
904	Res	0	0.00	0.00	0.00
905	Res	300	3.04	6.08	8.20
906	Res	300	3.04	6.08	8.20
907	Res	0	0.00	0.00	0.00
908	Res	350	3.54	7.09	9.57
909	Res	200	2.03	4.05	5.47
910	Res	150	1.52	3.04	4.10
911	Res	0	0.00	0.00	0.00
912	Res	94	0.95	1.90	2.57
913	Res	225	2.28	4.56	6.15
914	Res	225	2.28	4.56	6.15
915	Res	0	0.00	0.00	0.00
916	Res	0	0.00	0.00	0.00
917	Res	200	2.03	4.05	5.47
918	Res	0	0.00	0.00	0.00
919	Indust.	12.14	4.92	7.38	13.28
920	Res	0	0.00	0.00	0.00
921	Res	320	3.24	6.48	8.75
921	Comm	8.09	2.62	3.93	7.08
922	Res	260	2.63	5.27	7.11
922	Comm	8.09	2.62	3.93	7.08
923	Res	350	3.54	7.09	9.57
924	Res	400	4.05	8.10	10.94
925	Res	300	3.04	6.08	8.20
926	Comm	6.07	1.97	2.95	5.31
927	Res	0	0.00	0.00	0.00
928	Indust.	6.07	2.46	3.69	6.64
929	Res	0	0.00	0.00	0.00
930	Res	800	8.10	16.20	21.88
931	Res	750	7.60	15.19	20.51
932	Res	1250	12.66	25.32	34.18
933	Res	500	5.06	10.13	13.67
934	Res	200	2.03	4.05	5.47
935	Res	200	2.03	4.05	5.47
936	Indust.	8.5	3.44	5.16	9.30
937	Res	1500	15.19	30.38	41.02
	Total		**112.91**	**215.81**	**304.85**

Parameters		
Unit Density	2.5	people/unit
Average Day	350	L/cap/day
Maximum Day Peaking Factor	2.0	x Avg
Peak Hour Peaking Factor	3.0	x Avg
Light Industrial Avg Day Demand	35000	L/ha/day
Commercial Average Day Demand	28000	L/ha/day
Max Day Peaking Factor	1.5	x Avg
Peak Hour Peaking Factor	2.7	x Avg

Active Scenario: Max Day + Fire - Build-out



Active Scenario: Peak Hour - Build-out



LANARK COUNTY

PLANS OF SUBDIVISION

PRE-CONSULTATION - checklist
OCTOBER 15, 2020
BULAT HOMES

Report	Comments	Required Yes/No
Planning Rationale	Include justification - Must have regard for PPS Lanark County Official Plan compatibility Local Official Plan compatibility	✓
~~Hydrogeological Study, Terrain Analysis~~ MUNICIPAL PIPED SERVICES	Availability and suitability of water and waste water MOE – D-5-4 Guidelines MOE – D-5-5 Guidelines ODWSOG Checklist Summary & Sign-off	N/A
Environment Impact Study Scoped EIS - to be confirmed by MVCA	SAR & Significant Habitat Wetlands Organic Soils Natural Heritage Features & Systems Significant Wetlands Significant Woodlands Significant Valleylands Significant Wildlife ANSI Fish Habitat	✓
Servicing ~~Options Statement~~	Guidelines – MOE D-5-3	
Stormwater Drainage /Mgmt Plan	Guidelines - MOE-2003 / MNR-2001 Checklist Summary & Sign-off - MVCA comments	✓
Grading Plan	Sloping land within lot to direct flow of surface water away from foundations & abutting properties.	

LANARK COUNTY

PLANS OF SUBDIVISION

PRE-CONSULTATION - checklist

Report	Comments	Required Yes/No
Sediment and Erosion Control Hazardous Sites	Flooding, erosion hazard Slope and Soil Stability Organic Soils Karst Topography	
Archeological Investigation	Standards & Guidelines 2011 - STAGE 1 - minimum	
Tree Preservation Plan or Tree Conservation Plan	Check with local municipality	
Other	• SEE BELOW & • SEE ATTACHED SUMMARY FROM TOWN OF CARLETON PLACE	
Draft Plan	To include: Planning Act 50(17) Ont. Reg. 544/06 Lot and block configuration Compatibility with adjacent uses Road access, street layout & Pedestrian amenities Parks & Open Space amenities Easement and right-of-way requirements	✓

→ TRAFFIC STUDY
- justification for why density is appropriate for a lot proposed

→ URBAN DESIGN BRIEF

→ GEOTECHNICAL REPORT

→ PHASE 1 & PHASE II ENVIRONMENTAL SITE ASSESSMENT -

Stormceptor®EF Sizing Report

FORTERRA

STORMCEPTOR®

ESTIMATED NET ANNUAL SEDIMENT (TSS) LOAD REDUCTION

05/20/2021

Province:	Ontario
City:	ottawa
Nearest Rainfall Station:	OTTAWA MACDONALD-CARTIER INT'L AP
NCDC Rainfall Station Id:	6000
Years of Rainfall Data:	37
Site Name:	166 Boyd
Drainage Area (ha):	2.27
Runoff Coefficient 'c':	0.64
Particle Size Distribution:	Fine
Target TSS Removal (%):	80.0
Required Water Quality Runoff Volume Capture (%):	90.00
Estimated Water Quality Flow Rate (L/s):	52.50
Oil / Fuel Spill Risk Site?	Yes
Upstream Flow Control?	Yes
Upstream Orifice Control Flow Rate to Stormceptor (L/s):	138.00
Peak Conveyance (maximum) Flow Rate (L/s):	138.00
Site Sediment Transport Rate (kg/ha/yr):	

Project Name:	166 Boyd
Project Number:	262415
Designer Name:	Aaditya Jariwala
Designer Company:	EXP Inc
Designer Email:	aaditya.jariwala@exp.com
Designer Phone:	613-816-5961
EOR Name:	
EOR Company:	
EOR Email:	
EOR Phone:	

Net Annual Sediment (TSS) Load Reduction Sizing Summary

Stormceptor Model	TSS Removal Provided (%)
EFO4	60
EFO6	73
EFO8	80
EFO10	84
EFO12	87

Recommended Stormceptor EFO Model: EFO8

Estimated Net Annual Sediment (TSS) Load Reduction (%): 80

Water Quality Runoff Volume Capture (%): > 90

imbrium

THIRD-PARTY TESTING AND VERIFICATION

►**Stormceptor® EF and Stormceptor® EFO** are the latest evolutions in the Stormceptor® oil-grit separator (OGS) technology series, and are designed to remove a wide variety of pollutants from stormwater and snowmelt runoff. These technologies have been third-party tested in accordance with the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators** and performance has been third-party verified in accordance with the **ISO 14034 Environmental Technology Verification (ETV)** protocol.

PERFORMANCE

►**Stormceptor® EF and EFO** remove stormwater pollutants through gravity separation and floatation, and feature a patent-pending design that generates positive removal of total suspended solids (TSS) throughout each storm event, including high-intensity storms. Captured pollutants include sediment, free oils, and sediment-bound pollutants such as nutrients, heavy metals, and petroleum hydrocarbons. Stormceptor is sized to remove a high level of TSS from the frequent rainfall events that contribute the vast majority of annual runoff volume and pollutant load. The technology incorporates an internal bypass to convey excessive stormwater flows from high-intensity storms through the device without resuspension and washout (scour) of previously captured pollutants. Proper routine maintenance ensures high pollutant removal performance and protection of downstream waterways.

PARTICLE SIZE DISTRIBUTION (PSD)

►The **Canadian ETV PSD** shown in the table below was used, or in part, for this sizing. This is the identical PSD that is referenced in the Canadian ETV ***Procedure for Laboratory Testing of Oil-Grit Separators*** for both sediment removal testing and scour testing. The Canadian ETV PSD contains a wide range of particle sizes in the sand and silt fractions, and is considered reasonably representative of the particle size fractions found in typical urban stormwater runoff.

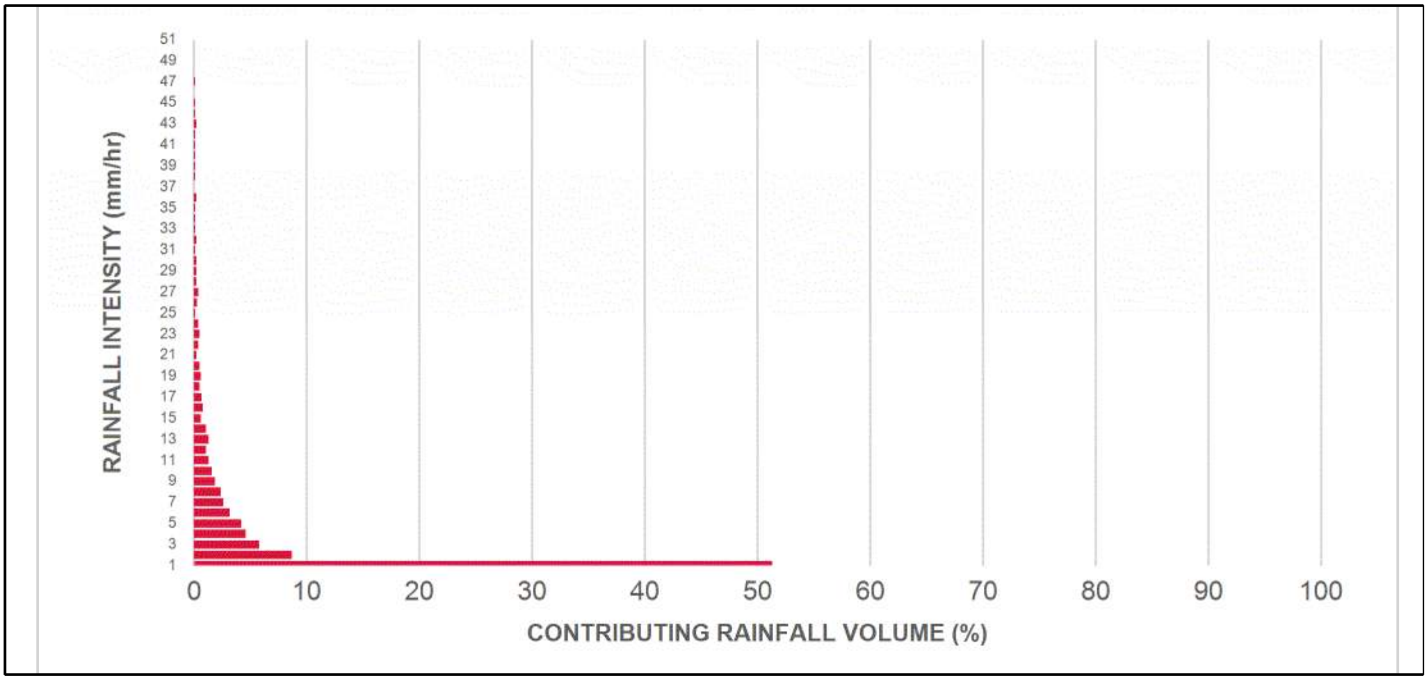
Particle Size (μm)	Percent Less Than	Particle Size Fraction (μm)	Percent
1000	100	500-1000	5
500	95	250-500	5
250	90	150-250	15
150	75	100-150	15
100	60	75-100	10
75	50	50-75	5
50	45	20-50	10
20	35	8-20	15
8	20	5-8	10
5	10	2-5	5
2	5	<2	5

Upstream Flow Controlled Results

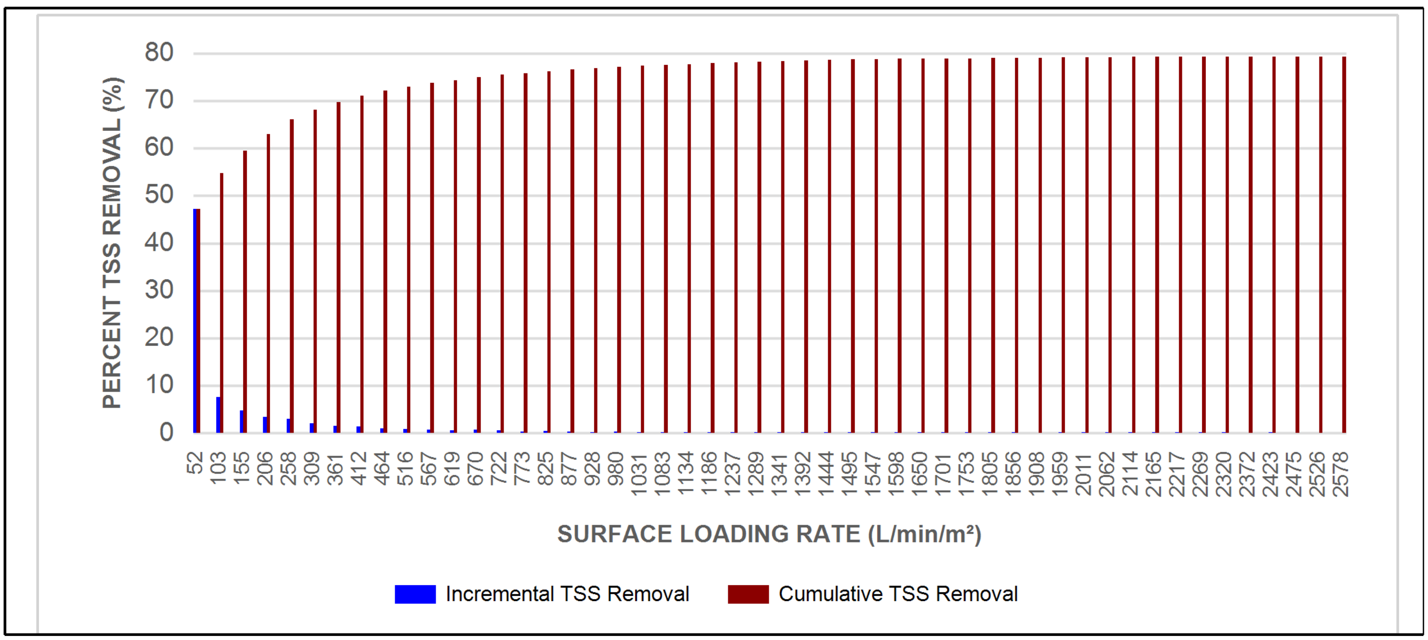
Rainfall Intensity (mm / hr)	Percent Rainfall Volume (%)	Cumulative Rainfall Volume (%)	Flow Rate (L/s)	Flow Rate (L/min)	Surface Loading Rate (L/min/m²)	Removal Efficiency (%)	Incremental Removal (%)	Cumulative Removal (%)
1	51.3	51.3	4.04	242.0	52.0	92	47.2	47.2
2	8.7	60.0	8.08	485.0	103.0	87	7.6	54.8
3	5.8	65.8	12.12	727.0	155.0	81	4.7	59.5
4	4.6	70.4	16.16	969.0	206.0	76	3.5	63.0
5	4.2	74.6	20.19	1212.0	258.0	72	3.0	66.0
6	3.2	77.8	24.23	1454.0	309.0	66	2.1	68.1
7	2.6	80.4	28.27	1696.0	361.0	62	1.6	69.7
8	2.4	82.8	32.31	1939.0	412.0	58	1.4	71.1
9	1.9	84.7	36.35	2181.0	464.0	56	1.1	72.1
10	1.6	86.3	40.39	2423.0	516.0	55	0.9	73.0
11	1.3	87.6	44.43	2666.0	567.0	53	0.7	73.7
12	1.1	88.7	48.47	2908.0	619.0	52	0.6	74.3
13	1.3	90.0	52.50	3150.0	670.0	52	0.7	75.0
14	1.1	91.1	56.54	3393.0	722.0	51	0.6	75.5
15	0.6	91.7	60.58	3635.0	773.0	51	0.3	75.8
16	0.8	92.5	64.62	3877.0	825.0	51	0.4	76.2
17	0.7	93.2	68.66	4120.0	877.0	51	0.4	76.6
18	0.5	93.7	72.70	4362.0	928.0	50	0.3	76.8
19	0.6	94.3	76.74	4604.0	980.0	50	0.3	77.1
20	0.5	94.8	80.78	4847.0	1031.0	50	0.2	77.4
21	0.2	95.0	84.81	5089.0	1083.0	49	0.1	77.5
22	0.4	95.4	88.85	5331.0	1134.0	49	0.2	77.7
23	0.5	95.9	92.89	5574.0	1186.0	48	0.2	77.9
24	0.4	96.3	96.93	5816.0	1237.0	48	0.2	78.1
25	3.7	100.0	100.97	6058.0	1289.0	47	1.7	79.9

Rainfall Intensity (mm / hr)	Percent Rainfall Volume (%)	Cumulative Rainfall Volume (%)	Flow Rate (L/s)	Flow Rate (L/min)	Surface Loading Rate (L/min/m²)	Removal Efficiency (%)	Incremental Removal (%)	Cumulative Removal (%)
26	0.3	100.3	105.01	6301.0	1341.0	47	0.1	80.0
27	0.4	100.7	109.05	6543.0	1392.0	46	0.2	80.2
28	0.2	100.9	113.09	6785.0	1444.0	45	0.1	80.3
29	0.2	101.1	117.12	7027.0	1495.0	43	0.1	80.4
30	0.2	101.3	121.16	7270.0	1547.0	42	0.1	80.4
31	-1.3	100.0	125.20	7512.0	1598.0	41	N/A	79.9
32	0.2	100.2	129.24	7754.0	1650.0	39	0.1	80.0
33	-0.2	100.0	133.28	7997.0	1701.0	38	N/A	79.9
34	0.0	100.0	137.32	8239.0	1753.0	37	0.0	79.9
35	0.0	100.0	138.00	8280.0	1762.0	37	0.0	79.9
36	0.0	100.0	138.00	8280.0	1762.0	37	0.0	79.9
37	0.0	100.0	138.00	8280.0	1762.0	37	0.0	79.9
38	0.0	100.0	138.00	8280.0	1762.0	37	0.0	79.9
39	0.0	100.0	138.00	8280.0	1762.0	37	0.0	79.9
40	0.0	100.0	138.00	8280.0	1762.0	37	0.0	79.9
41	0.0	100.0	138.00	8280.0	1762.0	37	0.0	79.9
42	0.0	100.0	138.00	8280.0	1762.0	37	0.0	79.9
43	0.0	100.0	138.00	8280.0	1762.0	37	0.0	79.9
44	0.0	100.0	138.00	8280.0	1762.0	37	0.0	79.9
45	0.0	100.0	138.00	8280.0	1762.0	37	0.0	79.9
46	0.0	100.0	138.00	8280.0	1762.0	37	0.0	79.9
47	0.0	100.0	138.00	8280.0	1762.0	37	0.0	79.9
48	0.0	100.0	138.00	8280.0	1762.0	37	0.0	79.9
49	0.0	100.0	138.00	8280.0	1762.0	37	0.0	79.9
50	0.0	100.0	138.00	8280.0	1762.0	37	0.0	79.9
							Estimated Net Annual Sediment (TSS) Load Reduction =	**80 %**

RAINFALL DATA FROM OTTAWA MACDONALD-CARTIER INT'L AP RAINFALL STATION



INCREMENTAL AND CUMULATIVE TSS REMOVAL FOR THE RECOMMENDED STORMCEPTOR® MODEL



Maximum Pipe Diameter / Peak Conveyance

Stormceptor EF / EFO	Model Diameter		Min Angle Inlet / Outlet Pipes	Max Inlet Pipe Diameter		Max Outlet Pipe Diameter		Peak Conveyance Flow Rate	
	(m)	(ft)		(mm)	(in)	(mm)	(in)	(L/s)	(cfs)
EF4 / EFO4	1.2	4	90	609	24	609	24	425	15
EF6 / EFO6	1.8	6	90	914	36	914	36	990	35
EF8 / EFO8	2.4	8	90	1219	48	1219	48	1700	60
EF10 / EFO10	3.0	10	90	1828	72	1828	72	2830	100
EF12 / EFO12	3.6	12	90	1828	72	1828	72	2830	100

SCOUR PREVENTION AND ONLINE CONFIGURATION

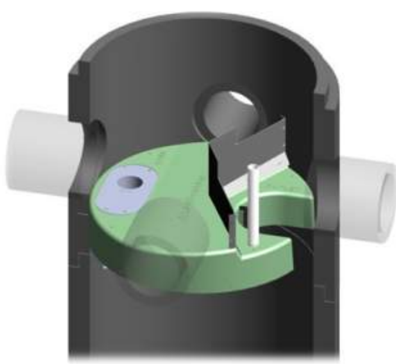
►**Stormceptor® EF and EFO** feature an internal bypass and superior scour prevention technology that have been demonstrated in third-party testing according to the scour testing provisions of the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators**, and the exceptional scour test performance has been third-party verified in accordance with the ISO 14034 ETV protocol. As a result, Stormceptor EF and EFO are approved for online installation, eliminating the need for costly additional bypass structures, piping, and installation expense.

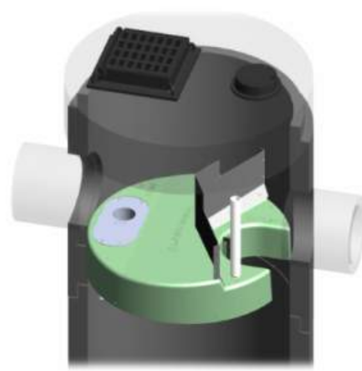
DESIGN FLEXIBILITY

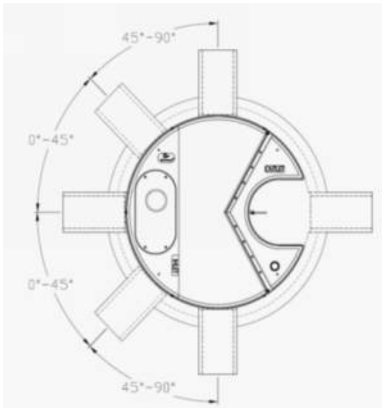
►**Stormceptor® EF** and **EFO** offers design flexibility in one simplified platform, accepting stormwater flow from a single inlet pipe or multiple inlet pipes, and/or surface runoff through an inlet grate. The device can also serve as a junction structure, accommodate a 90-degree inlet-to-outlet bend angle, and can be modified to ensure performance in submerged conditions.

OIL CAPTURE AND RETENTION

►While Stormceptor® EF will capture and retain oil from dry weather spills and low intensity runoff, **Stormceptor® EFO** has demonstrated superior oil capture and greater than 99% oil retention in third-party testing according to the light liquid re-entrainment testing provisions of the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators**. Stormceptor EFO is recommended for sites where oil capture and retention is a requirement.







INLET-TO-OUTLET DROP

Elevation differential between inlet and outlet pipe inverts is dictated by the angle at which the inlet pipe(s) enters the unit.
0° - 45° : The inlet pipe is 1-inch (25mm) higher than the outlet pipe.
45° - 90° : The inlet pipe is 2-inches (50mm) higher than the outlet pipe.

HEAD LOSS

The head loss through Stormceptor EF is similar to that of a 60-degree bend structure. The applicable K value for calculating minor losses through the unit is 1.1. For submerged conditions the applicable K value is 3.0.

Pollutant Capacity

Stormceptor EF / EFO	Model Diameter		Depth (Outlet Pipe Invert to Sump Floor)		Oil Volume		Recommended Sediment Maintenance Depth *		Maximum Sediment Volume *		Maximum Sediment Mass **	
	(m)	(ft)	(m)	(ft)	(L)	(Gal)	(mm)	(in)	(L)	(ft^3)	(kg)	(lb)
EF4 / EFO4	1.2	4	1.52	5.0	265	70	203	8	1190	42	1904	5250
EF6 / EFO6	1.8	6	1.93	6.3	610	160	305	12	3470	123	5552	15375
EF8 / EFO8	2.4	8	2.59	8.5	1070	280	610	24	8780	310	14048	38750
EF10 / EFO10	3.0	10	3.25	10.7	1670	440	610	24	17790	628	28464	78500
EF12 / EFO12	3.6	12	3.89	12.8	2475	655	610	24	31220	1103	49952	137875

*Increased sump depth may be added to increase sediment storage capacity
** Average density of wet packed sediment in sump = 1.6 kg/L (100 lb/ft^3)

Feature	Benefit	Feature Appeals To
Patent-pending enhanced flow treatment and scour prevention technology	Superior, verified third-party performance	Regulator, Specifying & Design Engineer
Third-party verified light liquid capture and retention for EFO version	Proven performance for fuel/oil hotspot locations	Regulator, Specifying & Design Engineer, Site Owner
Functions as bend, junction or inlet structure	Design flexibility	Specifying & Design Engineer
Minimal drop between inlet and outlet	Site installation ease	Contractor
Large diameter outlet riser for inspection and maintenance	Easy maintenance access from grade	Maintenance Contractor & Site Owner

STANDARD STORMCEPTOR EF/EFO DRAWINGS

For standard details, please visit http://www.imbriumsystems.com/stormwater-treatment-solutions/stormceptor-ef

STANDARD STORMCEPTOR EF/EFO SPECIFICATION

For specifications, please visit http://www.imbriumsystems.com/stormwater-treatment-solutions/stormceptor-ef

STANDARD PERFORMANCE SPECIFICATION FOR “OIL GRIT SEPARATOR” (OGS) STORMWATER QUALITY TREATMENT DEVICE

PART 1 – GENERAL

1.1 WORK INCLUDED

This section specifies requirements for selecting, sizing, and designing an underground Oil Grit Separator (OGS) device for stormwater quality treatment, with third-party testing results and a Statement of Verification in accordance with ISO 14034 Environmental Management – Environmental Technology Verification (ETV).

1.2 REFERENCE STANDARDS & PROCEDURES

ISO 14034:2016 Environmental management – Environmental technology verification (ETV)

Canadian Environmental Technology Verification (ETV) Program’s **Procedure for Laboratory Testing of Oil-Grit Separators**

1.3 SUBMITTALS

1.3.1 All submittals, including sizing reports & shop drawings, shall be submitted upon request with each order to the contractor then forwarded to the Engineer of Record for review and acceptance. Shop drawings shall detail all OGS components, elevations, and sequence of construction.

1.3.2 Alternative devices shall have features identical to or greater than the specified device, including: treatment chamber diameter, treatment chamber wet volume, sediment storage volume, and oil storage volume.

1.3.3 Unless directed otherwise by the Engineer of Record, OGS stormwater quality treatment product substitutions or alternatives submitted within ten days prior to project bid shall not be accepted. All alternatives or substitutions submitted shall be signed and sealed by a local registered Professional Engineer, based on the exact same criteria detailed in Section 3, in entirety, subject to review and approval by the Engineer of Record.

PART 2 – PRODUCTS

2.1 OGS POLLUTANT STORAGE

The OGS device shall include a sump for sediment storage, and a protected volume for the capture and storage of petroleum hydrocarbons and buoyant gross pollutants. The minimum sediment & petroleum hydrocarbon storage capacity shall be as follows:

2.1.1	4 ft (1219 mm) Diameter OGS Units:	1.19 m^3 sediment / 265 L oil
	6 ft (1829 mm) Diameter OGS Units:	3.48 m^3 sediment / 609 L oil
	8 ft (2438 mm) Diameter OGS Units:	8.78 m^3 sediment / 1,071 L oil
	10 ft (3048 mm) Diameter OGS Units:	17.78 m^3 sediment / 1,673 L oil
	12 ft (3657 mm) Diameter OGS Units:	31.23 m^3 sediment / 2,476 L oil

PART 3 – PERFORMANCE & DESIGN

3.1 GENERAL

The OGS stormwater quality treatment device shall be verified in accordance with ISO 14034:2016 Environmental management – Environmental technology verification (ETV). The OGS stormwater quality treatment device shall remove oil, sediment and gross pollutants from stormwater runoff during frequent wet weather events, and retain these pollutants during less frequent high flow wet weather events below the insert within the OGS for later removal during maintenance. The Manufacturer shall have at least ten (10) years of local experience, history and success in engineering design, manufacturing and production and supply of OGS stormwater quality treatment device systems, acceptable to the Engineer of Record.

3.2 SIZING METHODOLOGY

The OGS device shall be engineered, designed and sized to provide stormwater quality treatment based on treating a minimum of 90 percent of the average annual runoff volume and a minimum removal of an annual average 60% of the sediment (TSS) load based on the Particle Size Distribution (PSD) specified in the sizing report for the specified device. Sizing shall be determined using historical rainfall data and a sediment removal performance curve derived from the actual third-party verified laboratory testing data. The OGS device shall also have sufficient annual sediment storage capacity as specified and calculated in Section 2.1.

3.3 CANADIAN ETV or ISO 14034 ETV VERIFICATION OF SCOUR TESTING

The OGS device shall have Canadian ETV or ISO 14034 ETV Verification of third-party scour testing conducted in accordance with the Canadian ETV Program's **Procedure for Laboratory Testing of Oil-Grit Separators.**

3.3.1 To be acceptable for on-line installation, the OGS device must demonstrate an average scour test effluent concentration less than 10 mg/L at each surface loading rate tested, up to and including 2600 L/min/m^2.

3.4 LIGHT LIQUID RE-ENTRAINMENT SIMULATION TESTING

The OGS device shall have Canadian ETV or ISO 14034 ETV Verification of completed third-party Light Liquid Re-entrainment Simulation Testing in accordance with the Canadian ETV **Program's Procedure for Laboratory Testing of Oil-Grit Separators,** with results reported within the Canadian ETV or ISO 14034 ETV verification. This re-entrainment testing is conducted with the device pre-loaded with low density polyethylene (LDPE) plastic beads as a surrogate for light liquids such as oil and fuel. Testing is conducted on the same OGS unit tested for sediment removal to assess whether light liquids captured after a spill are effectively retained at high flow rates.

3.4.1 For an OGS device to be an acceptable stormwater treatment device on a site where vehicular traffic occurs and the potential for an oil or fuel spill exists, the OGS device must have reported verified performance results of greater than 99% cumulative retention of LDPE plastic beads for the five specified surface loading rates (ranging 200 L/min/m2 to 2600 L/min/m2) in accordance with the Light Liquid Re-entrainment Simulation Testing within the Canadian ETV Program's **Procedure for Laboratory Testing of Oil-Grit Separators.**However, an OGS device shall not be allowed if the Light Liquid Re-entrainment Simulation Testing was performed with screening components within the OGS device that are effective at retaining the LDPE plastic beads, but would not be expected to retain light liquids such as oil and fuel.

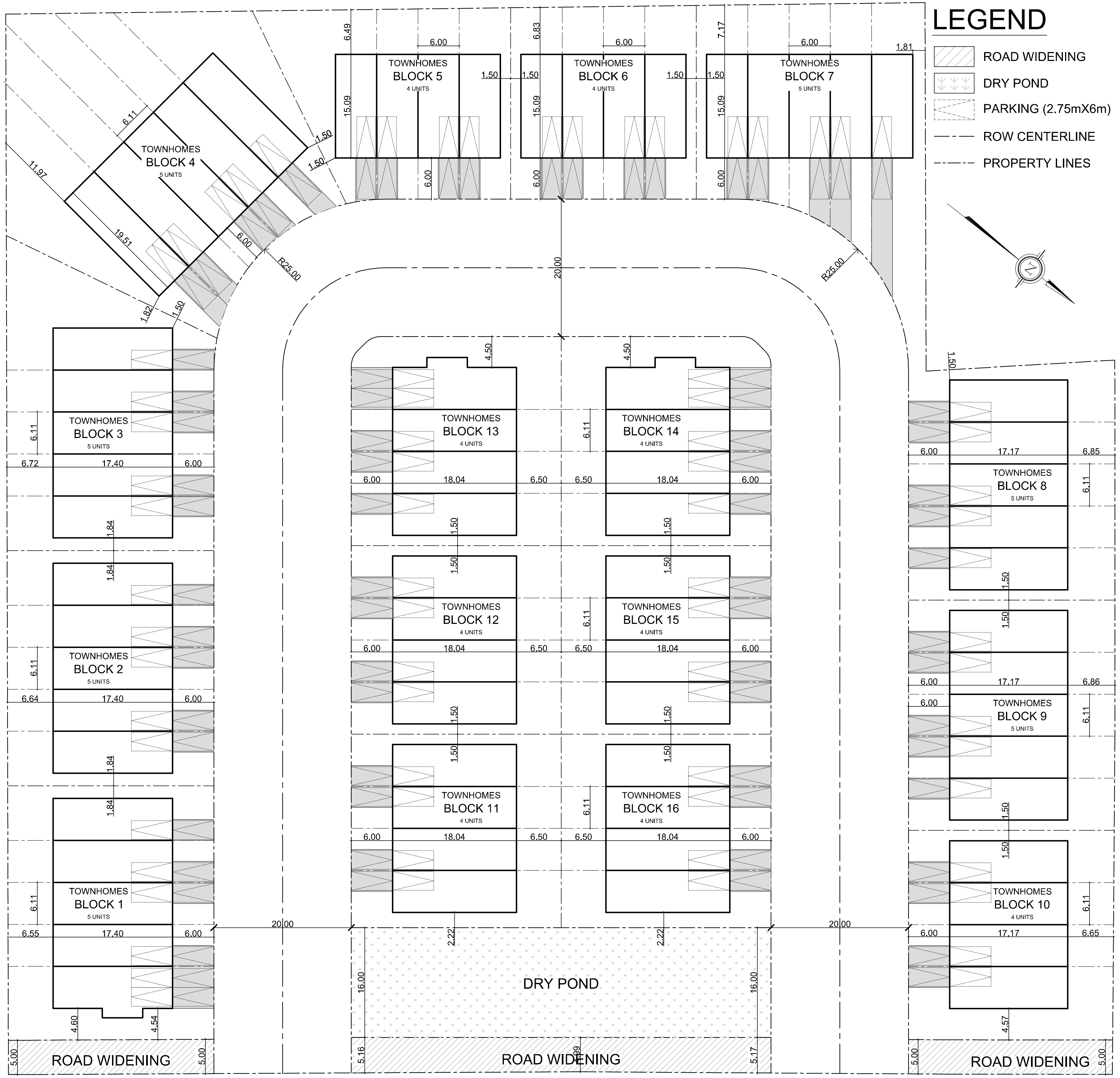
Appendix F – Drawings

Site Plan & Survey Drawings

- Site Plan, S1.0 (27-04-2021)
- Topographic Plan, (file:492-20, Nov 12, 2020)
- Boyd Street AS-Built Drawings (May, 1987 & June, 2015)
- Arthur Street As-Built Drawing (May, 1987)

Engineering Drawings

- C001 – Existing Conditions and Removals Plan – Rev.1
- C002 – Notes and Legend Sheet – Rev.1
- C003 – Detail Sheet – Rev.1
- C100 – Site Servicing Plan – Rev.1
- C200 – Site Grading Plan – Rev.1
- C300 – Erosion and Sediment Control Plan – Rev.1
- C400 – Pre-Development Storm Catchments – Rev.1
- C500 – Post-Development Storm Catchments – Rev.1
- C600 – Sanitary Drainage Area Plan – Rev.1



SITE INFORMATION

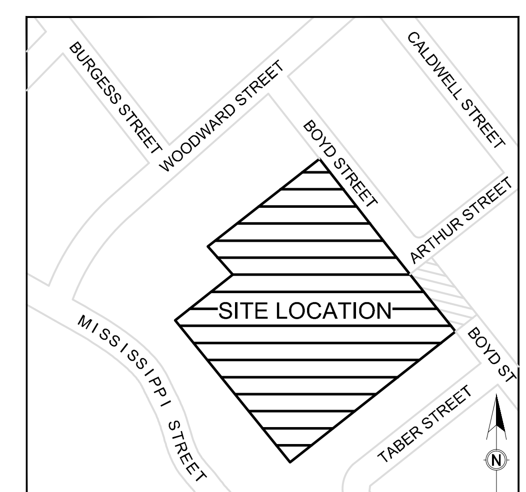
TOTAL SITE AREA	5.82 ac
TOTAL BUILDING AREA	xx
SITE COVERAGE	%
DEVELOPPED AREA	3.93 ac
ROAD AREA	1.50 ac
ROAD WIDENING AREA	0.15 ac
DRY POND AREA	0.24 ac
TOTAL NUMBER OF UNITS	71
EXISTING DISTRICT	RESIDENTIAL

BLOCK COVERAGE INFORMATION

BLOCK NO.	AREA (m²)	COVERAGE (m²)	COVERAGE (%)	NO. OF DWELLINGS
1	xx	xx	xx	xx
2	xx	xx	xx	xx
3	xx	xx	xx	xx
4	xx	xx	xx	xx
5	xx	xx	xx	xx
6	xx	xx	xx	xx
7	xx	xx	xx	xx
8	xx	xx	xx	xx
9	xx	xx	xx	xx
10	xx	xx	xx	xx
11	xx	xx	xx	xx
12	xx	xx	xx	xx
13	xx	xx	xx	xx
14	xx	xx	xx	xx
15	xx	xx	xx	xx
16	xx	xx	xx	xx

DEVELOPMENT STANDARDS - TOWNHOME DWELLINGS

SITE PROVISIONS	REQUIREMENTS	PROVIDED
LOT AREA (MIN)	NIL	
LOT COVERAGE (MAX)	60%	
LOT FRONTAGE (MIN)	5.5 M (18.04 FT)	
FRONT YARD BUILD WITHIN AREA	4.5 M, MIN (14.7 FT) 7.5 M, MAX (24.6 FT)	
EXTERIOR SIDE YARD BUILD WITHIN AREA	4.5 M, MIN (14.7 FT) 7.5 M, MAX (24.6 FT)	
INTERIOR SIDE YARD (MIN)	1.5 M (4.9 FT)	
REAR YARD DEPTH (MIN)	6.5 M (21.3 FT)	
USABLE LANDSCAPED OPEN SPACE IN THE REAR YARD (MIN)	30 SQM (538 SQFT)	
BUILDING HEIGHT (MAX)	11 M (36 FT)	
DWELLING UNIT AREA (MIN)	83.1 SQM (900 SQFT)	
NO ENCROACHMENT AREA FROM FRONT OR EXTERIOR SIDE LOT LINE	2.5 M (8.2 FT)	
PARKING SPACES	2 SPACES / DWELLING UNIT, ONE OF WHICH MAY BE PROVIDED WITH GARAGE	
GARAGE WIDTH	70% OVERALL LOT FRONTAGE (MAX)	
MAIN GARAGE FOUNDATION	SET BACK 6 M FROM FRONT OR EXT SIDE LOT (MIN)	



KEY PLAN

BULAT HOMES

202 - 11 GIFFORD STREET
NEPEAN, ONTARIO K2E 7S3
TEL: 723-1008 FAX: 727-0209

I HAVE REVIEWED THE PLANS AND ACCEPT RESPONSIBILTY FOR THE DESIGN.

INDIVIDUAL BCIN: 100692

X

REVISIONS

PROJECT NAME:
XX

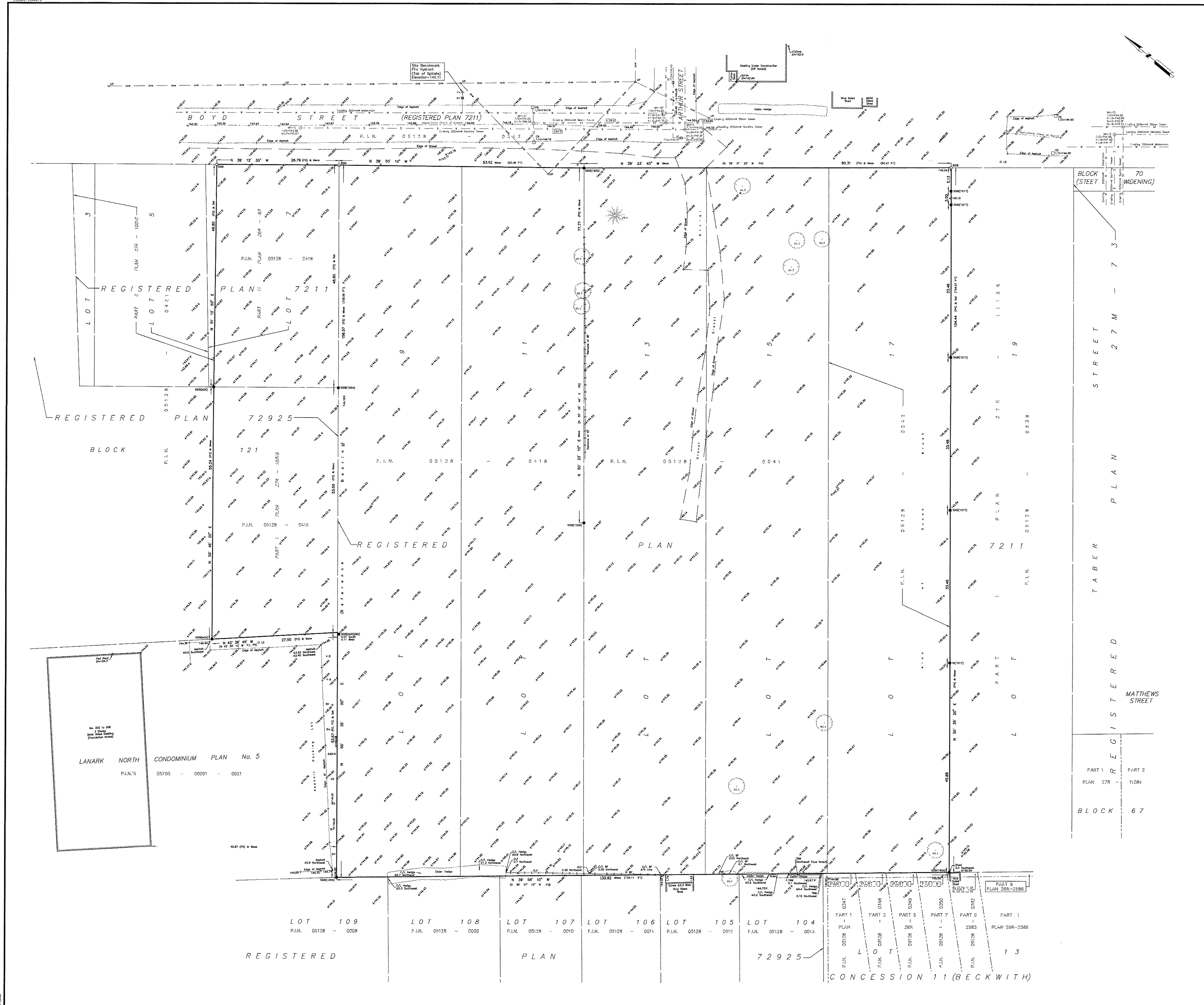
AREA: N/A SQFT APPROX

LOCATION:
BOYD STREET
CARLETON PLACE

SHEET TITLE:
SITE PLAN

SCALE: 3/16" = 1'-0"
DRAWN: R LAROCQUE
DATE: 25/09/2020
PRINT DATE: 27/04/2021 - 3:51pm

DWG. NO.
S1.0



TOPOGRAPHIC PLAN OF SURVEY OF

ALL OF LOTS 9, 11, 13, 15 & 17 AND PART OF LOT 7 REGISTERED PLAN 7211 AND PART OF BLOCK 121 REGISTERED PLAN 72925

TOWN OF CARLETON PLACE
COUNTY OF LANARK

FARLEY, SMITH & DENIS SURVEYING LTD. 2020

Scale 1: 250

0 2.5 5 7.5 10 12.5 15 20 25 metres

Metric Note

Distances and coordinates on this plan are in metres and can be converted to feet by dividing by 0.3048.

Distance Note

Distances shown on this plan are ground distances and can be converted to grid distances by multiplying by the combined scale factor of 0.99989.

Bearing Note

Bearings hereon are grid, referred to the northerly limit of Lot 9 on Registered Plan 7211 having a bearing of N50°35'00"E as shown on Plan 27R-10519 and are referred to the Central Meridian of MTM Zone 9 (76°30' West Longitude) Nad-83 CSRS (2010).

For bearing comparisons, a rotation of 0°21'40" counter-clockwise was applied to bearings on P2 and P6.
For bearing comparisons, a rotation of 0°29'00" counter-clockwise was applied to bearings on P5.

Elevation Notes

1. Elevations shown are geodetic and are referred to the Town of Carleton Place Benchmark List Benchmark No. 28 the top of spindle of a fire hydrant at the intersection of Woodward Street and Burgess Street having a published elevation of 144.076 metres.
2. Elevations shown are geodetic and are referred to Geodetic Datum CGVD-1928 :1978.
3. It is the responsibility of the user of this information to verify that the job benchmark has not been altered or disturbed and that it's relative elevation and description agrees with the information shown on this drawing.

Utility Notes

1. This drawing cannot be accepted as acknowledging all of the utilities and it will be the responsibility of the user to contact the respective utility authorities for confirmation.
2. Only visible surface utilities were located.
3. Underground utility data compiled from Municipal utility sheet reference: Drawing No. 96048-P1 & M-037-07.
4. Sanitary and storm sewer grades and inverts were derived from: Field measurement .
5. A field location of underground plant by the pertinent utility authority is mandatory before any work involving breaking ground, probing, excavating etc.

Notes & Legend

	Denotes
	Survey Monument Planted
	Survey Monument Found
SIB	Standard Iron Bar
SSIB	Short Standard Iron Bar
(Wit)	Witness
Meas	Measured
(P1)	Registered Plan 7211
(P2)	Lanark North Condominium Plan No. 5
(P3)	Plan 27R-10519
(P4)	Plan 27R-11136
(P5)	Plan 27R-6955
(P6)	Registered Plan 72925
MH-ST	Maintenance Hole (Storm)
MH-S	Maintenance Hole (Sanitary)
VC	Valve Chamber (Watermain)
ST	Underground Storm Sewer
S	Underground Sanitary Sewer
W	Underground Water
OHW	Overhead Wires
UP	Utility Pole
LS	Light Standard
CB	Catch Basin
FH	Fire Hydrant
WV	Water Valve
B	Bollard
	Gate
Ø	Diameter
CLF	Chain Link Fence
BF	Board Fence
TRW	Timber Retaining Wall
Inv.	Invert
T/G	Top of Grate
U/Eave	Underside of Eave
TpFdn	Top of Foundation
C/L	Centreline
+65.00	Location of Elevations
+65.00	Top of Concrete Curb Elevation
	Property Line
	Deciduous Tree
	Coniferous Tree

ASSOCIATION OF ONTARIO LAND SURVEYORS
PLAN SUBMISSION FORM
2139120

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Surveyor's Certificate

I certify that :

1. This survey and plan are correct and in accordance with the Surveys Act, the Surveyors Act and the Regulations made under them.
2. The survey was completed on the 29th day of October, 2020.

Nov. 12/20
Date

Daniel Robinson
Ontario Land Surveyor

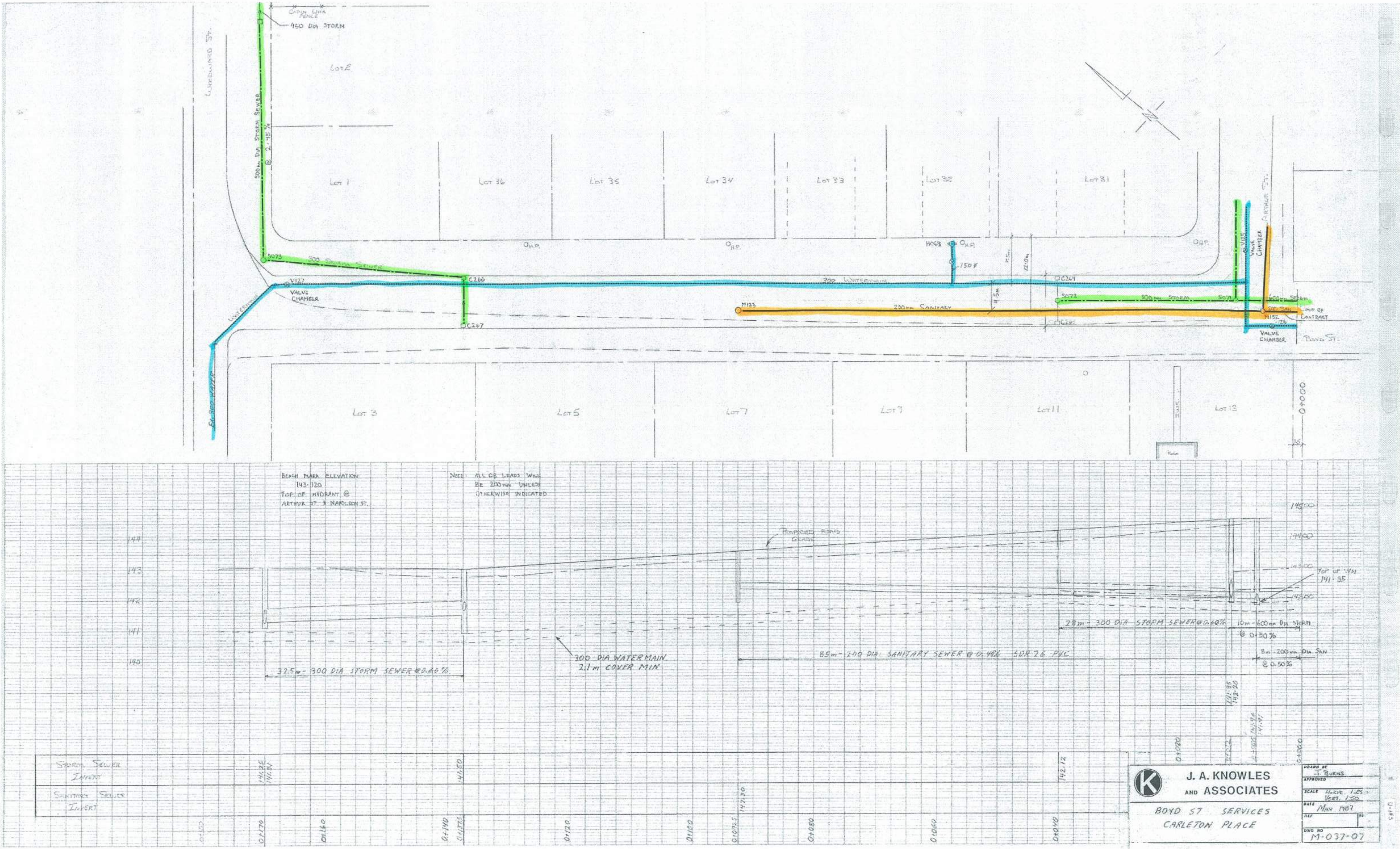
FARLEY, SMITH & DENIS SURVEYING LTD.

ONTARIO LAND SURVEYORS
CANADA LAND SURVEYORS

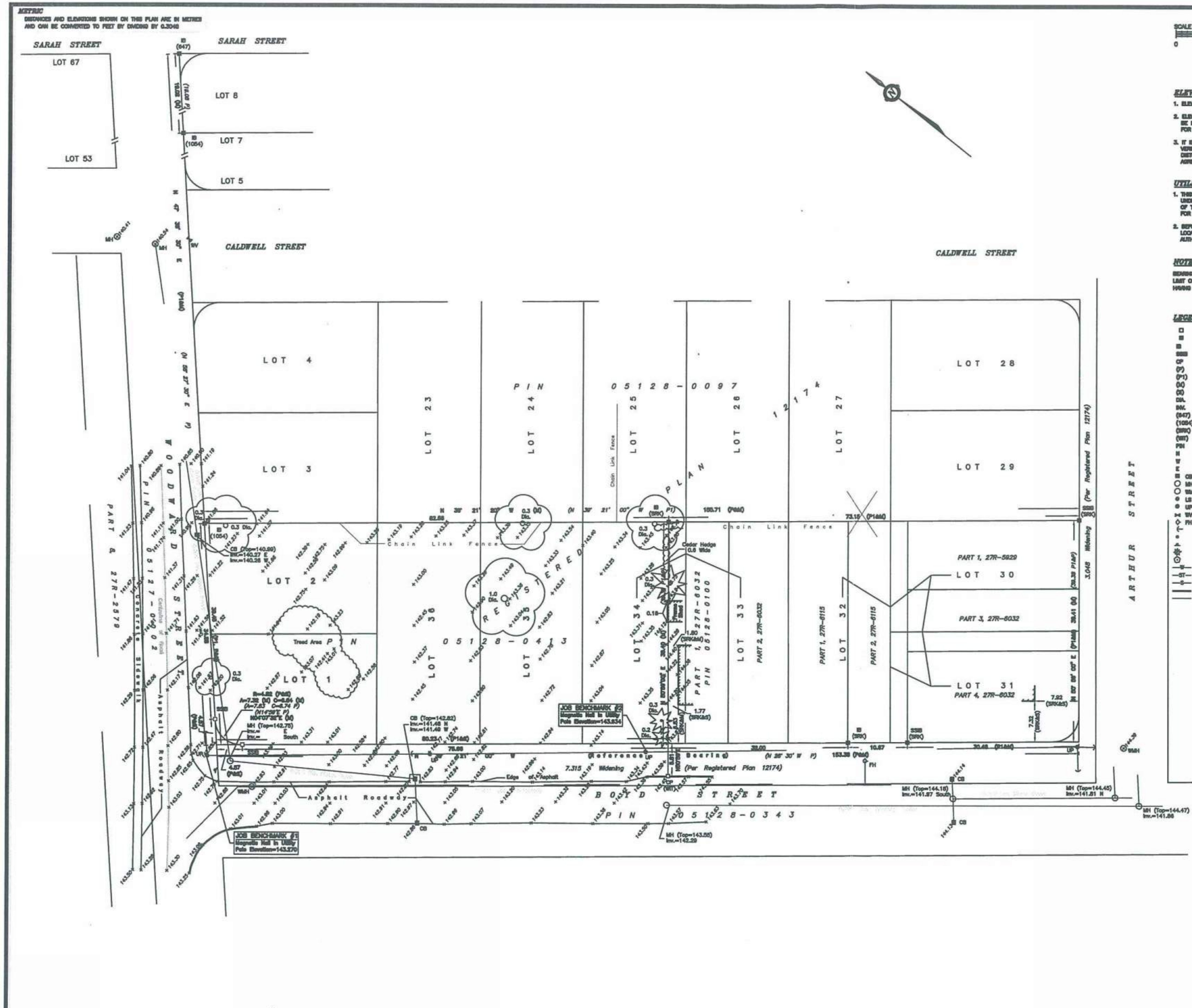
190 COLONNADE ROAD, OTTAWA, ONTARIO K2E 7J5
TEL. (613) 727-8226 FAX. (613) 727-1826

FILE No. 492-20

_166 Boyd St_CP_Topo\Final\492-20 166 Boyd Str_1,3,5,7,9,11,13,15,17 RP7211_B1121 RP72925_Topo_1.dwg



CHAIN LINK FENCE
450 DIA STORM
LOT 2
WOODWARD ST.
300mm DIA STORM SEWER @ 2.45%
LOT 1
LOT 36
LOT 35
LOT 34
LOT 33
LOT 32
LOT 31
ARTHUR ST.
O.H.P.
S073
C266
C267
V127
VALVE CHAMBER
WATERMAIN
300 WATERMAIN
H068
150 ø
C269
C268
M133
200mm SANITARY
300mm STORM
VALVE CHAMBER
LIMIT OF CONTRACT
M152
BOYD ST.
LOT 3
LOT 5
LOT 7
LOT 9
LOT 11
LOT 13
0+000
BENCH MARK ELEVATION
143.120
TOP OF HYDRANT @
ARTHUR ST & NAPOLEON ST.
NOTE: ALL CB LEADS WILL
BE 200mm UNLESS
OTHERWISE INDICATED
PROPOSED ROAD GRADE
TOP OF WM. 141.35
144
143
142
141
140
28m - 300 DIA STORM SEWER @ 0.40%
10m - 600mm DIA STORM @ 0.30%
85m - 200 DIA SANITARY SEWER @ 0.48% SDR 26 PVC
8m - 200mm DIA SAN @ 0.30%
300 DIA WATERMAIN
2.1m COVER MIN
32.5m - 300 DIA STORM SEWER @ 2.40%
STORM SEWER INVERT
SANITARY SEWER INVERT
J. A. KNOWLES
AND ASSOCIATES
BOYD ST SERVICES
CARLETON PLACE
DRAWN BY J BURNS
APPROVED
SCALE HORIZ. 1:250 VERT. 1:50
DATE MAY 1987
DWG NO M-037-07



ORIGINAL PLAN
SCALE: 1:180

SCALE 1 : 300

0 5 10 20 30 metres

ELEVATION NOTES

1. ELEVATIONS SHOWN HEREON ARE REFERRED TO GEODETIC DATUM.
2. ELEVATIONS FOR MANHOLE COVERS AND CATCH BASINS HAVE TO BE INDEPENDENTLY CONFIRMED BEFORE THEY CAN BE ACCEPTED FOR FINAL DESIGN OR CONSTRUCTION PURPOSES.
3. IT IS THE RESPONSIBILITY OF THE USER OF THIS INFORMATION TO VERIFY THAT THE JOB BENCHMARKS HAVE NOT BEEN ALTERED OR DISTURBED AND THAT THEIR RELATIVE ELEVATION AND DESCRIPTION AGREE WITH THE INFORMATION SHOWN ON THIS DRAWING.

UTILITY NOTES

1. THIS DRAWING CANNOT BE ACCEPTED AS ACKNOWLEDGING ANY UNDERGROUND UTILITIES AND IT WILL BE THE RESPONSIBILITY OF THE USER TO CONTACT THE RESPECTIVE UTILITY AUTHORITIES FOR CONFIRMATION OR LOCATION.
2. BEFORE ANY WORK INVOLVING PROBING, EXCAVATING, ETC., A FIELD LOCATION OF UNDERGROUND PLANT BY THE PERTINENT UTILITY AUTHORITY IS MANDATORY.

NOTES

BEARINGS HEREON ARE ASTRONOMIC AND ARE REFERRED TO THE EASTERLY LIMIT OF BOYD STREET (AS WIDENED) AS SHOWN ON PLAN 27R-5929, HAVING A BEARING OF N 38° 21' 00" W.

LEGEND

□	– SURVEY MONUMENT SET
■	– SURVEY MONUMENT FOUND
IB	– IRON BAR
SSIB	– SHORT STANDARD IRON BAR
CP	– CONCRETE PIN
(P)	– PLAN REGISTERED PLAN 12174
(P1)	– PLAN 27R-5929
(M)	– MEASURED
(S)	– SET
DIA.	– DIAMETER
INV.	– INVERT
(947)	– H. R. FARLEY, O.L.S.
(1054)	– GEO W. BRACKEN, O.L.S. (REF. 3501)
(SRK)	– SURY, ROWE & KASPRZAK LTD., O.L.S. (REF. 0-059-94)
(WIT)	– WITNESS
PIN	– PROPERTY IDENTIFIER NUMBER
N	– NORTH
W	– WEST
E	– EAST
■ CB	– CATCH BASIN
○ MH	– MANHOLE
○ WMH	– WATER MANHOLE
● LS	– LAMP STANDARD
● UP	– UTILITY POLE
WV	– WATER VALVE
FH	– FIRE HYDRANT
	– GUY WIRE AND ANCHOR
●	– BOLLARD
	– SIGN
	– CONIFEROUS TREE
	– DECIDUOUS TREE
—W—	– WATERMAIN
—ST—	– STORM SEWER
—S—	– SANITARY SEWER
	– CURB
	– OVERHEAD UTILITY WIRES

Pierre J. Tabet *architecte*

167 Rue De Roquebrune, Gatineau Qc J8T 7Y6
Tel. :819-568-3994/ 613-797-5375 Fax : 819-246 4312
E-Mail : pierre.tabet@hotmail.com

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Sceau

Projet

CARLETON PLACE PROJECT
WOODWARD/BOYD, OTTAWA, ON

Titre

ORIGINAL PLAN

Projet No.	Echelle	Date
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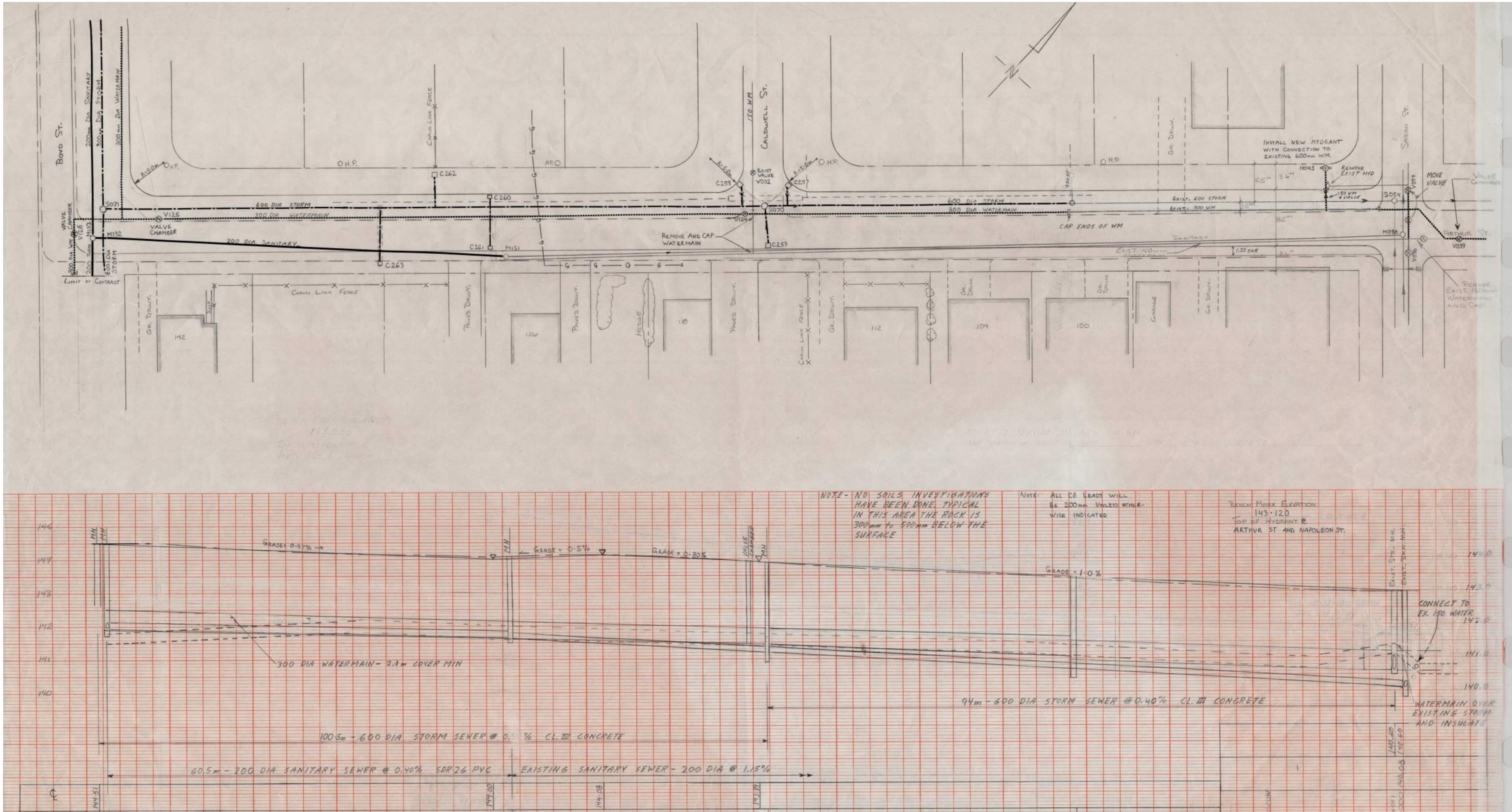

J. A. KNOWLES AND ASSOCIATES

ARTHUR ST SERVICES
CARLETON PLACE

DRAWN BY	J. BURNS
APPROVED	
SCALE	HORIZ. 1:250 VERT. 1:50
DATE	MAY 1987
REF	
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