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32 Years

2175 Prince of Wales Drive
Ottawa, Ontario

Serviceability Report

Engineering excellence. Planning precision. Inspired landscapes.

NOVATECH
Engineers, Planners & Landscape Architects

September 10, 2015

BY COURIER

City of Ottawa
Planning and Growth Management Department
4th Floor
110 Laurier Avenue West
Ottawa, Ontario
K1P 1J1

Attention: Steve Belan, Planner II

Dear Mr. Belan:

Re: 2175 Prince of Wales Drive
Serviceability Report
Our File No.: 107005

Please find enclosed five (5) copies of the above noted report dated September 2015. This report is submitted in support of a Zoning Amendment Application for the property at 2175 Prince of Wales Drive.

If you have any questions, please contact the undersigned.

Yours truly,

NOVATECH

Cara Ruddle, P.Eng.
Project Manager

cc:

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List of Appendices

1.0. INTRODUCTION

Novatech has been retained by S. Thomson to prepare a Serviceability Report in support of a Zoning Amendment Application. The site is located at 2175 Prince of Wales Drive within the City of Ottawa. *Figure 1* is a Key Plan showing the site location.

2.0. EXISTING AND PROPOSED DEVELOPMENT

The property is approximately 3.22 hectares in size. The property is currently undeveloped vacant land with 2 existing accesses from Prince of Wales Drive and 2 existing accesses from Waterbend Lane. The topography of the site is relatively flat with a gentle slope towards the east side of the site. The slope increases along the east side of the property adjacent to the Rideau River and it also increases as it drains to an existing watercourse outletting to the Rideau River. The site is bounded by West Hunt Club Rd and the existing watercourse to the north, Rideau River to the east, residences fronting on Waterbend Lane to the south, and Prince of Wales Drive to the West. *Figure 2* shows the existing conditions.

The proposed development is not defined at this time. It is anticipated that a commercial or industrial use building will be constructed.

The purpose of this report is to demonstrate that commercial and/or industrial uses can be serviced with the existing Municipal infrastructure surrounding the subject site.

3.0. WATER SERVICING

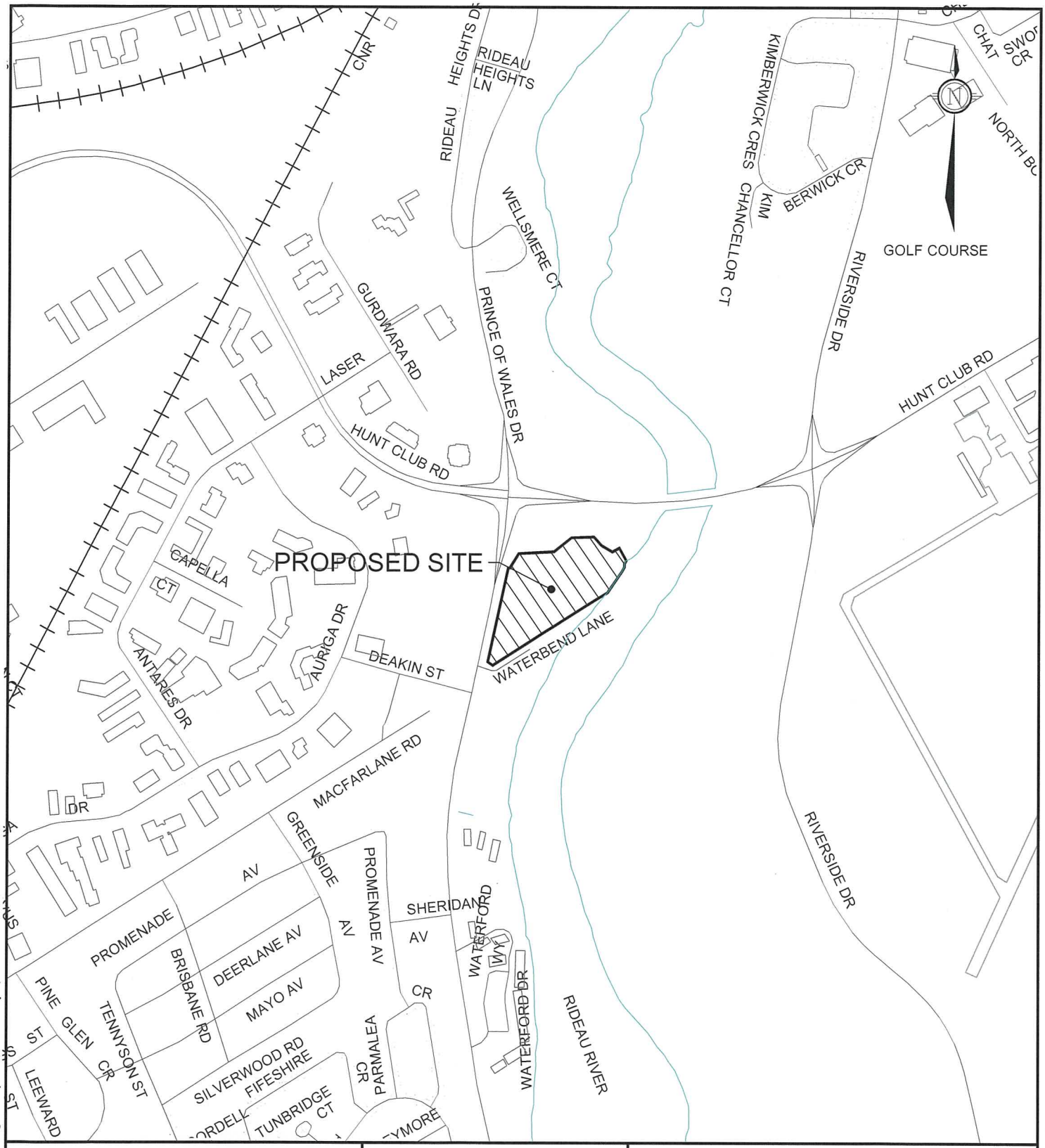
There is an existing 400mm diameter watermain within the Prince of Wales right-of-way and a 150mm diameter watermain in Waterbend Lane. A portion of the City watermain mapping is provided in Appendix A for reference.

A water service connection could be made to either of the two existing watermains noted above to service the subject property. Calculations have been prepared for both industrial and commercial uses. Preliminary water demands and fire flows have been calculated as follows:

Use	Ave. Daily Demand (L/s)	Max. Daily Demand (L/s)	Peak Hour Demand (L/s)	Fire Flow (L/s)
Industrial Use	2.05	3.08	5.54	267
Commercial Use	1.04	1.56	2.81	150

The maximum water demands were provided to the City and the following boundary conditions were provided for both the 150mm watermain in Waterbend Lane and the 400mm watermain in Prince of Wales Drive. Correspondence is provided in Appendix A for reference.

Waterbend Lane:
Minimum HGL = 125.2m (54.3 psi)
Maximum HGL = 136.9m (71.0 psi)
Max Day + Fire Flow (155L/s) = 101.1m (20 psi)



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Ottawa, Ontario, Canada K2M 1P6

Telephone (613) 254-9643
Facsimile (613) 254-5867
Website www.novatech-eng.com

2175 PRINCE OF WALES DRIVE

KEY PLAN

SCALE: NTS

DATE	JOB	FIGURE
MAR 2015	107005	1

M:\2007\107005\CAD\2015-FIGURES\107005-KP.dwg, KP, Apr 01, 2015 - 1:15pm, tbrooks

SHT8X11.DWG - 216mmx279mm

M:\2007\107005\CAD\2015-FIGURES\107005-FIG2.dwg, EXCOND, Feb 06, 2015 - 11:27am, mhrehoriak

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2175 PRINCE OF WALES DRIVE

EXISTING CONDITIONS

SCALE	DATE	JOB	FIGURE
1 : 2500 (0, 25, 50, 75, 100)	MAR 2015	107005	2

SHT11X17.DWG - 279mmX432mm

Prince of Wales:
Minimum HGL = 125.3m (54.5 psi)
Maximum HGL = 137.0m (71.1 psi)
Max Day + Fire Flow (167L/s) = 126.6m (56.3 psi)
Max Day + Fire Flow (267L/s) = 128.0m (58.3 psi)

The water results are summarized in the table below.

Table 3.0 Water Analysis Results Summary

Condition	Street	Demand (L/s)	Min/Max Allowable Operating Pressures (psi)	Limits of Design Operating Pressures (psi)
High Pressure	Waterbend	2.05	80psi (Max)	71.0
	Prince of Wales			71.1
Maximum Daily Demand and *Fire Flow* Commercial / industrial	Waterbend	155	20psi (Min)	20.0
	Prince of Wales	167 / 267		56.3 / 58.3
Peak Hour	Waterbend	5.54	40psi (Min)	54.3
	Prince of Wales			54.5

Therefore, based on the boundary conditions provided by the City, both the watermain along Prince of Wales and Waterbend Lane could provide adequate water supply for domestic water and fire flow demands. It is recommended that the connection be made to the existing watermain along Waterbend Lane to service the property since this is the more cost effective option. There is also the possibility of upsizing a portion of the existing watermain along Waterbend Lane to a 200 or 300mm diameter watermain to service the property. This can be reviewed when a defined development concept has been prepared.

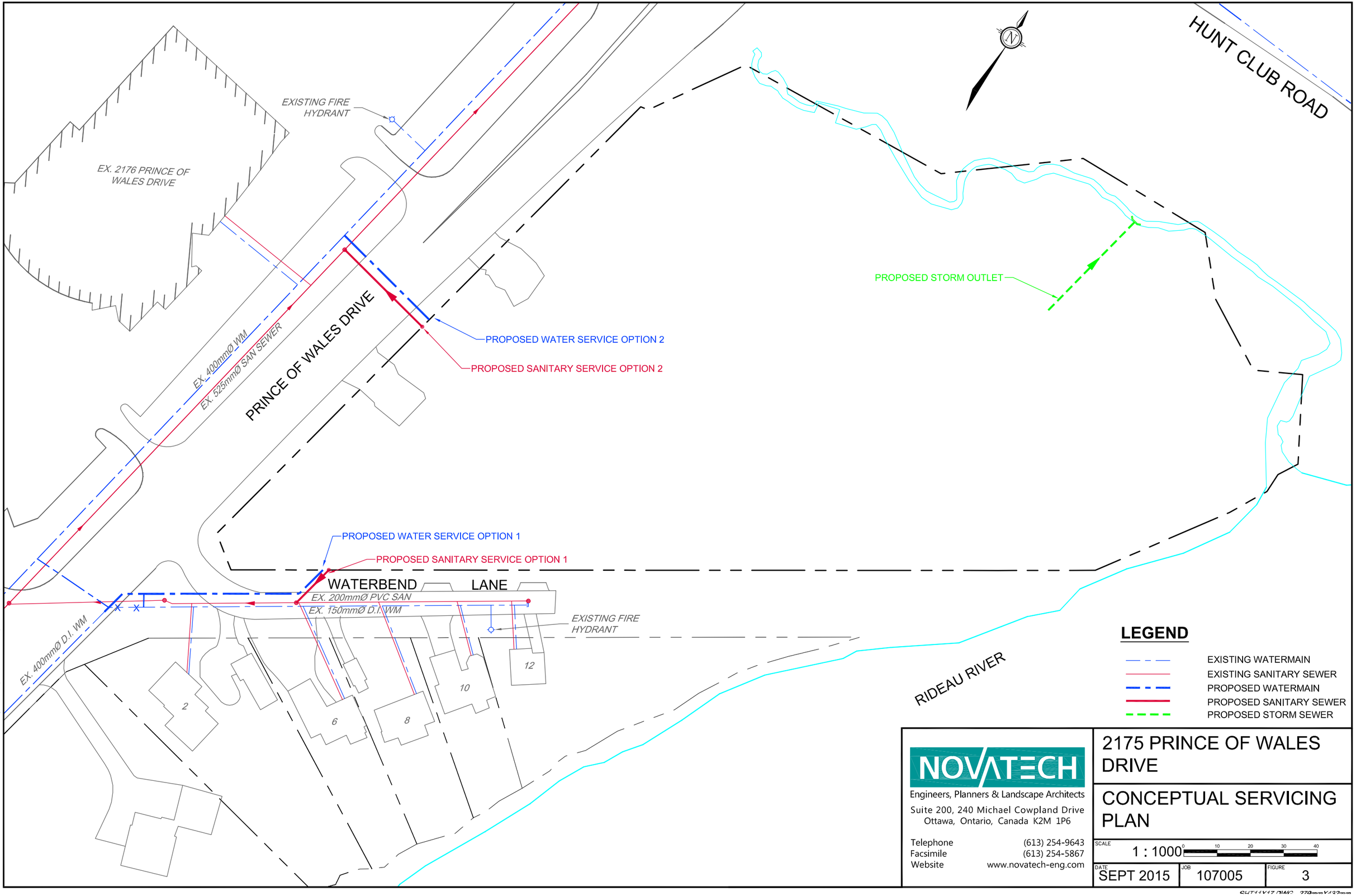
Therefore, the existing watermain infrastructure can provide adequate water supply for domestic water and fire flow demands. Refer to *Figure 3* Conceptual Servicing Plan for the existing watermain information and proposed service locations.

4.0. SANITARY SERVICING

There is an existing 525mm diameter sanitary sewer within the Prince of Wales right-of-way and an existing 200mm diameter sanitary sewer within the Waterbend Lane right-of-way. A portion of the City sewer mapping is included in Appendix B for reference.

Flows for the proposed development have been estimated for both industrial and commercial uses and are 11.0 L/s and 4.2 L/s respectively. Sanitary flow calculations are also included in Appendix B for reference.

The subject property can be serviced with a connection to either of the two existing sanitary sewers noted above. *Figure 3* Conceptual Servicing Plan shows the two servicing options. The existing sanitary sewer along Waterbend Lane only services the 5 existing residential dwellings along this road and has excess capacity to service the subject property. This existing sewer drains into the existing 525mm diameter sanitary sewer along Prince of Wales Drive. The



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2175 PRINCE OF WALES DRIVE

CONCEPTUAL SERVICING PLAN

SCALE 1 : 1000 (0, 10, 20, 30, 40)

DATE SEPT 2015 | JOB 107005 | FIGURE 3

M:\2007\107005\CAD\2015-FIGURES\107005-FIG4.dwg, GS, Sep 09, 2015 - 4:45pm, amcauley

525mm diameter sanitary sewer along Prince of Wales Drive is considered a collector sewer and a direct service connection will likely not be the City's preferred alternative.

Therefore, the site is serviceable from the existing municipal sanitary sewer system and the recommended option is to connect to the existing sanitary sewer along Waterbend Lane.

5.0. STORM SERVICING

As indicated previously the site is currently undeveloped vacant land. Stormwater currently sheet drains to the Rideau River along the east side of the property and to the existing watercourse along the north side of the property that drains into the Rideau River. The existing watercourse along the north property limit is an outlet for an existing 1650mm diameter trunk storm sewer servicing an area west of Prince of Wales Drive. A portion of the City sewer mapping is included in Appendix C for reference.

Development of the subject property would cause an increase in the existing storm runoff from the property. Therefore, stormwater management is required including both quality and quantity control. However, due to the close proximity to the Rideau River, it is recommended that storm flows be released directly from the site without quantity control. Storm flows from the site would outlet into the Rideau River well before the natural peak occurs in the river from the upstream watershed.

The site will continue to outlet to the Rideau River in post-development conditions. During detailed design, the velocity of the stormwater being released will need to be reviewed to ensure there are no negative impacts or erosive effects to the receiving watercourse. Refer to *Figure 3* Conceptual Servicing Plan for a proposed storm outlet location. Quality control of stormwater can be provided through the installation of an Oil Grit Separator (OGS) unit prior to release from the site.

Preliminary stormwater calculations have been prepared. The pre-development release rate is calculated to be 112.4 L/s and 240.8 L/s for the 5 and 100 year storm events respectively. Post-development flows are estimated to be 477.6 L/s and 914.9 L/s for the 5 and 100 year storm events respectively. A drainage area plan and stormwater calculations are provided in Appendix C for reference.

During storms, in excess of the 100 year storm event, the existing overland flow route is to the Rideau River. This overland flow route would be maintained and incorporated into the design of the subject property.

Therefore, the site is serviceable in terms of storm servicing and stormwater management. Once a defined development plan has been prepared, detailed stormwater calculations can be provided.

6.0. EROSION AND SEDIMENT CONTROL MEASURES

Temporary erosion and sediment control measures will be implemented on-site during construction in accordance with the Best Management Practices for Erosion and Sediment Control. This includes the following temporary measures:

- Filter bags will be placed under the grates of nearby catchbasins and manholes, and will remain in place until vegetation has been established and construction is completed;
- Silt fencing will be placed along the surrounding construction limits;
- Mud mats will be installed at the site entrances;
- The contractor will be required to perform regular street sweeping and cleaning as required, to suppress dust and to provide safe and clean roadways adjacent to the construction site;

The erosion and sediment control measures will be implemented prior to construction and will remain in place during all phases of construction. Regular inspection and maintenance of the erosion control measures will be undertaken

7.0. CONCLUSIONS AND RECOMMENDATIONS

The conclusions of this report are as follows:

- Water servicing, including both domestic and fire protection, can be provided by connection to the existing watermain infrastructure within Waterbend Lane or Prince of Wales Drive.
- Sanitary servicing can be provided from the existing sanitary sewer within Waterbend Lane or Prince of Wales Drive.
- Stormwater can outlet, as per existing conditions, to the Rideau River or the existing watercourse along the north property limit.
- Stormwater management is required for the development however, quantity control is not recommended given the close proximity of the site to the Rideau River. The velocity of stormwater will be reviewed as part of the detailed design to ensure there are no negative impacts to the receiving watercourse.
- Quality control of stormwater can be provided through the installation of an oil grit separator unit prior to release of stormwater from the site.
- An overland flow route will be provided.
- Erosion and sediment control measures will be implemented during construction.

NOVATECH

Prepared by:

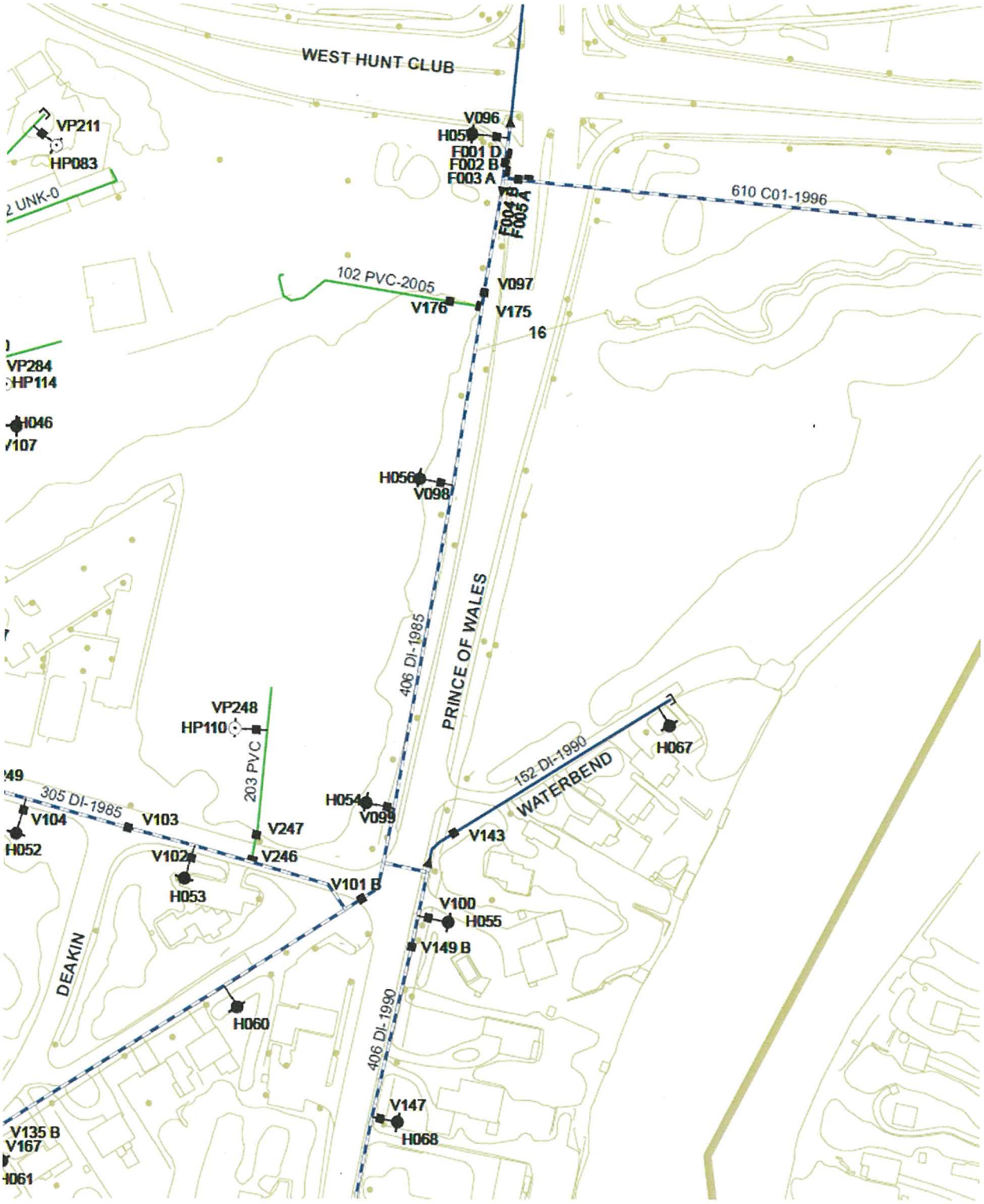
LICENSED PROFESSIONAL ENGINEER
C. J. RUDDLE
PROVINCE OF ONTARIO
ISSUED FOR REVIEW
Sept 10/18

Cara Ruddle, P.Eng.
Project Manager

Reviewed by:

J. Lee Sheets, CET
Sr. Project Manager

APPENDIX A
Watermain Information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VP211
HP083
2 UNK-0
V096
H05
F001 D
F002 B
F003 A
F004
F005 A
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102 PVC-2005
V176
V097
V175
16
VP284
HP114
H046
V107
H056
V098
406 DI-1985
PRINCE OF WALES
VP248
HP110
203 PVC
H067
152 DI-1990
WATERBEND
H054
V099
V143
305 DI-1985
V104
H052
V103
V247
V102
V246
H053
V101 B
V100
H055
V149 B
DEAKIN
H060
406 DI-1990
V147
H068
V135 B
V167
H061

PROJECT #: 107005
PROJECT NAME: 2175 PRINCE OF WALES DRIVE
LOCATION: CITY OF OTTAWA

NOVATECH
Engineers, Planners & Landscape Architects

DATE PREPARED: March 31, 2015

Table 1

Water Demand

	Area (ha)	Demand (L/s)		
		Avg Day	Max. Daily	Peak Hour
Industrial Use	**3.22**	2.05	3.08	5.54
Commercial Use	**3.22**	1.04	1.56	2.81

Notes:

Avg. Daily Demand:		
- Heavy Industrial	55000	L/ha/day
- Commercial	28000	L/ha/day
Max. Daily Demand:	1.5	x Avg. Day
Peak Hourly Demand:	1.8	x Max. Day

Per City of Ottawa *Water Distribution Systems Design Guidelines, 2010*

2175 Prince of Wales
Fire Flow Calculations - Commercial Building

As per Fire Underwriter's Survey Guidelines

PROJECT: 2175 PRINCE OF WALES DRIVE | **DATE: March 31, 2015**

JOB#: 107005 | **REVISED: September 4, 2015**

C	**Coefficient related to type of construction**	[yes/no]			
	• Wood frame		1.5		
	• Ordinary construction		1		
	• Non-combustible construction		0.8		
	• Fire resistive construction (> 3 hrs)	yes	0.6		
	• Interpolation (Using FUS Tables)				
	Gross Floor Area (m^2)	88,000			
	Assumed 11 Storeys @ 8000m^2 each				
A	**Area of structure considered (m^2)**	24,000	<==>	258,336	ft^2
	A=2 Storeys x FloorArea + 2 Storeys x 50% x FloorArea				
F	**Required fire flow (L/min)**				
	$F = 220\ C\ (A)^{0.5}$			***20,000 L/min***	
	Occupancy hazard reduction of surcharge	[yes/no]			
	• Non-combustible		-25%		
	• Limited combustible	yes	-15%		
	• Combustible		0%		
	• Free burning		15%		
	• Rapid burning		25%		
				17,000 L/min	**(1)**
	Sprinkler Reduction				
	• Adequately Designed System (NFPA 13)	yes	-30%	-30%	
	• Standard Water Supply	yes	-10%	-10%	
	• Fully Supervised System	yes	-10%	-10%	
			Cumulative Total	-50%	
				-8,500 L/min	**(2)**
	Exposure surcharge (cumulative (%))	[yes/no]			
	0 - 3 m		25%		
	3.1 - 10 m		20%		
	10.1 - 20 m		15%		
	20.1 - 30 m		10%		
	30.1- 45 m		5%		
			Cumulative Total	**0%**	
				0 L/min	
	Fire Wall Separation				
	• Number of Party Walls * 1000 L/min	0 walls			
	(As per City of Ottawa Standard)			***0 L/min***	**(3)**

REQUIRED FIRE FLOW [(1) - (2) + (3)]			***9,000 L/min***
(2,000 L/min < Fire Flow < 45,000 L/min)		***or***	***150 L/s***
Rounded to nearest 1000L/min		***or***	***1,982 IGPM***

BY: *Matt Hrehoriak*

2175 Prince of Wales
Fire Flow Calculations - Industrial Building

As per Fire Underwriter's Survey Guidelines

PROJECT: 2175 PRINCE OF WALES DRIVE | **DATE: March 31, 2015**
JOB#: 107005 | **REVISED: September 4, 2015**

		[yes/no]			
C	**Coefficient related to type of construction**				
	• Wood frame		1.5		
	• Ordinary construction		1		
	• Non-combustible construction	yes	0.8		
	• Fire resistive construction (> 3 hrs)		0.6		
	• Interpolation (Using FUS Tables)				
	Gross Floor Area (m^2)	24,000			
	Assumed 3 Storeys @ 8,000 m^2 each				
A	**Area of structure considered (m^2)**	**24,000**	<==>	258,336	ft^2
F	**Required fire flow (L/min)**				
	$F = 220\ C\ (A)^{0.5}$			***27,000 L/min***	
	Occupancy hazard reduction of surcharge	[yes/no]			
	• Non-combustible		-25%		
	• Limited combustible		-15%		
	• Combustible	yes	0%		
	• Free burning		15%		
	• Rapid burning		25%		
				27,000 L/min	**(1)**
	Sprinkler Reduction				
	• Adequately Designed System (NFPA 13)	yes	-30%	-30%	
	• Standard Water Supply	yes	-10%	-10%	
	• Fully Supervised System		-10%		
			Cumulative Total	-40%	
				-10,800 L/min	**(2)**
	Exposure surcharge (cumulative (%))	[yes/no]			
	0 - 3 m		25%		
	3.1 - 10 m		20%		
	10.1 - 20 m		15%		
	20.1 - 30 m		10%		
	30.1- 45 m		5%		
			Cumulative Total	**0%**	
				0 L/min	
	Fire Wall Separation				
	• Number of Party Walls * 1000 L/min	0 walls			
	(As per City of Ottawa Standard)			***0 L/min***	**(3)**

REQUIRED FIRE FLOW [(1) - (2) + (3)]		***16,000 L/min***
(2,000 L/min < Fire Flow < 45,000 L/min)	***or***	***266.7 L/s***
Rounded to nearest 1000L/min	***or***	***3,523 IGPM***

BY: *Matt Hrehoriak*

Cara Ruddle

From: Robertson, Syd <Syd.Robertson@ottawa.ca>
Sent: February-12-15 9:58 AM
To: Cara Ruddle
Subject: Prince of Wales Dr_2175 - Boundary Conditions Request
Attachments: 2175 Prince of Wales Feb 2015.pdf

Hi Cara:

The following are boundary conditions, HGL, for hydraulic analysis at 2175 Prince of Wales (zone 2W) assumed to be connected to either the 152mm on Waterbend or the 406mm on Prince of Wales (see attached PDF for location).

	Waterbend Connection	Prince of Wales Connection
Min HGL	125.2m	125.3m
Max HGL	136.9m	137.0m
MaxDay (3.08 L/s) + FireFlow (167 L/s)	Available Flow= 155 L/s assuming a residual of 20 psi and a ground elevation of 87.1m	126.6m
MaxDay (3.08 L/s) + FireFlow (267 L/s)		128.0m

These are for current conditions and are based on computer model simulation.

Disclaimer: The boundary condition information is based on current operation of the city water distribution system. The computer model simulation is based on the best information available at the time. The operation of the water distribution system can change on a regular basis, resulting in a variation in boundary conditions. The physical properties of watermains deteriorate over time, as such must be assumed in the absence of actual field test data. The variation in physical watermain properties can therefore alter the results of the computer model simulation.

From: Cara Ruddle [mailto:c.ruddle@novatech-eng.com]
Sent: February 06, 2015 2:14 PM
To: Robertson, Syd
Subject: RE: Prince of Wales Dr_2175 - Boundary Conditions Request

Syd:
I am looking for boundary conditions for the existing watermain infrastructure for a proposed development at 2175 Prince of Wales. Per your request below I provide the following information:

1. Commercial/Industrial development
2. 2 possible service locations shown on the attached sketch. A service could be connected to either the 400mm diameter wm along Prince of Wales or to the 150mm diameter wm along Waterbend Road.
3. Fire flow = 167 to 267 L/s depending on commercial or industrial
4. Average Daily Demand = 2.05 L/s
5. Maximum Daily Demand = 3.08 L/s
6. Maximum Hourly Daily Demand = 5.54 L/s

Thanks.

Cara Ruddle, P.Eng.
Project Manager
NOVATECH Engineers, Planners & Landscape Architects
240 Michael Cowpland Drive, Suite 200, Ottawa, ON, K2M 1P6 | Tel: 613.254.9643 x 220 | Fax: 613.254.5867

From: Robertson, Syd [mailto:Syd.Robertson@ottawa.ca]
Sent: February-06-15 11:05 AM
To: Cara Ruddle
Subject: Prince of Wales Dr_2175 - Boundary Conditons Request

Hi Cara:

Boundary condition requests must include the location of the service and the expected loads required by the proposed development.

Please provide the following required information:

1. Type of development
2. Location of service
3. Amount of fire flow required.
4. Average daily demand: ___ l/s.
5. Maximum daily demand: ___l/s.
6. Maximum hourly daily demand: ___ l/s.

Mark the location of the proposed water services (scenario 1 & 2) on the attached snip of the 2014 Water Distribution Plan.

Thanks

Syd Robertson, C.E.T.
Project Manager, Infrastructure Approvals
Development Review Services Branch, Urban Outer Core
Planning & Growth Management Department
110 Laurier Ave. W., 4th Floor E
Ottawa, ON K1P 1J1

PLANNING AND GROWTH MANAGEMENT
URBANISME ET GESTION DE LA CROISSANCE

City of Ottawa | Ville d'Ottawa
613.580.2424 ext./poste 27916
ottawa.ca/planning / ottawa.ca/urbanisme

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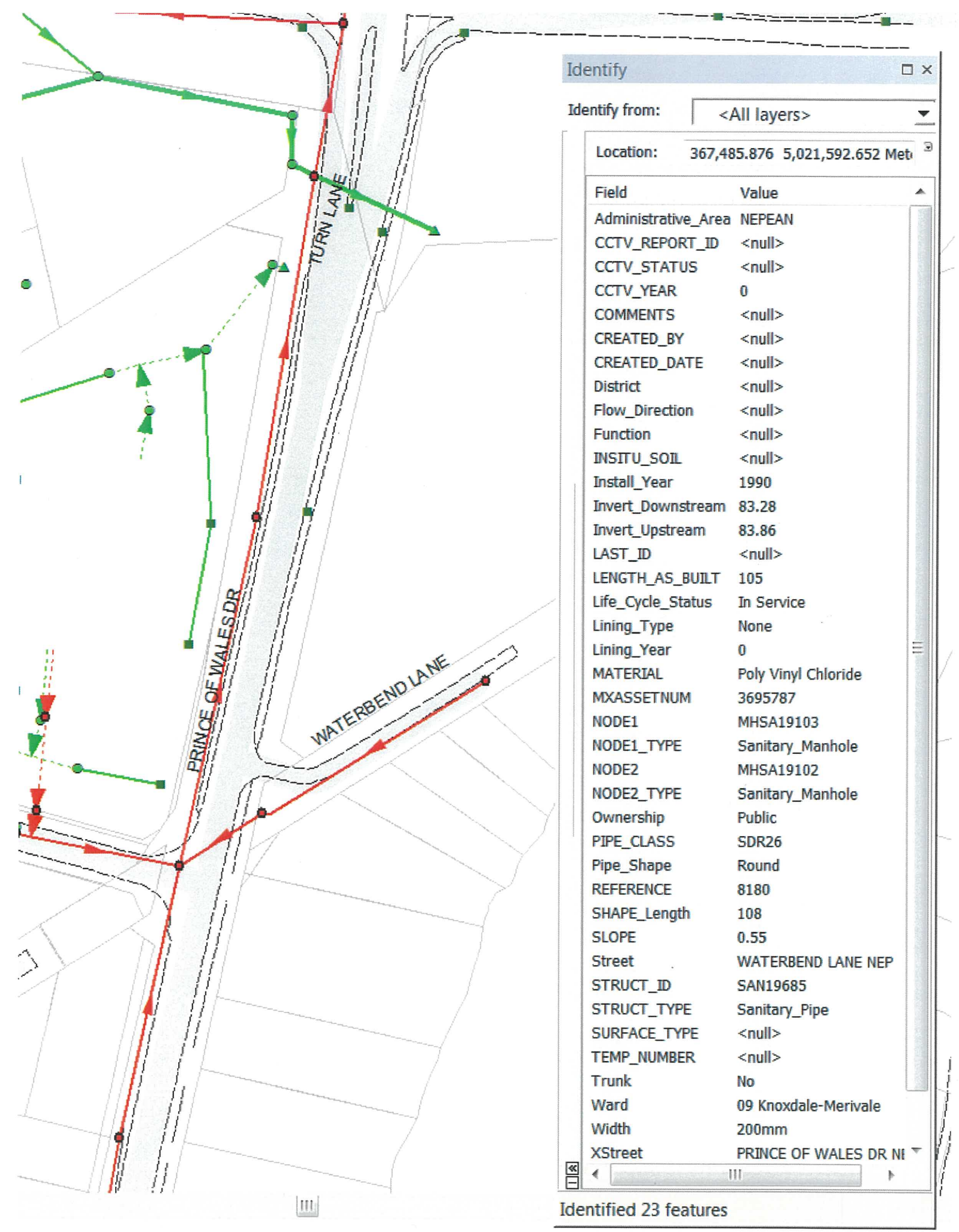
APPENDIX B
Sanitary Calculations



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CCTV_STATUS	<null>
CCTV_YEAR	0
COMMENTS	<null>
CREATED_BY	<null>
CREATED_DATE	<null>
District	<null>
Flow_Direction	<null>
Function	<null>
INSITU_SOIL	<null>
Install_Year	1990
Invert_Downstream	83.28
Invert_Upstream	83.86
LAST_ID	<null>
LENGTH_AS_BUILT	105
Life_Cycle_Status	In Service
Lining_Type	None
Lining_Year	0
MATERIAL	Poly Vinyl Chloride
MXASSETNUM	3695787
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NODE1_TYPE	Sanitary_Manhole
NODE2	MHSA19102
NODE2_TYPE	Sanitary_Manhole
Ownership	Public
PIPE_CLASS	SDR26
Pipe_Shape	Round
REFERENCE	8180
SHAPE_Length	108
SLOPE	0.55
Street	WATERBEND LANE NEP
STRUCT_ID	SAN19685
STRUCT_TYPE	Sanitary_Pipe
SURFACE_TYPE	<null>
TEMP_NUMBER	<null>
Trunk	No
Ward	09 Knoxdale-Merivale
Width	200mm
XStreet	PRINCE OF WALES DR NI

Identified 23 features

PROJECT #: 107005
PROJECT NAME: 2175 PRINCE OF WHALES DRIVE
LOCATION: CITY OF OTTAWA

NOVATECH
Engineers, Planners & Landscape Architects

DATE PREPARED: March 31, 2015

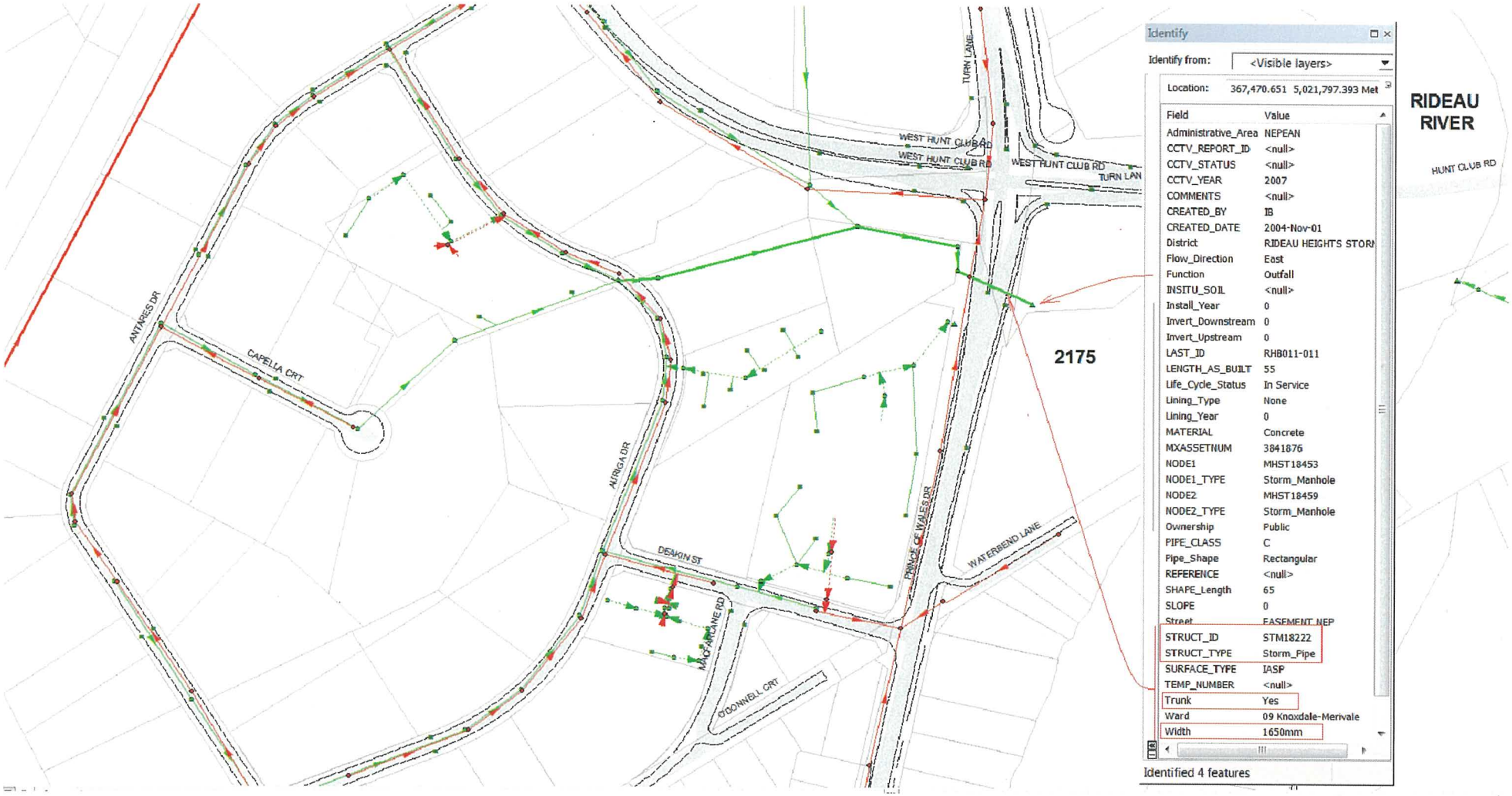
Analysis of Existing Sanitary Sewer on Waterbend Lane

LOCATION			EXISTING RESIDENTIAL					ICI				INFILTRATION				PIPE					
Site Use	FROM	TO	SINGLES Units	SINGLES Pop.	Accum. Pop.	Peak Factor	Peak Flow (l/s)	Commercial Area (ha)	Industrial Area (ha)	Accum. Area (ha)	Peak Flow (l/s)	Total Area (ha)	Accum. Area (ha)	Infilt. Flow (l/s)	Total Flow (l/s)	Size (mm)	Slope (%)	Length (m)	Capacity (l/s)	Full Flow Vel. (m/s)	Q/Q_{full} (%)
Industrial	EX SANMH 2	EX SANMH 1	5	16.5	16.5	4.0	0.3		3.22	3.22	9.6	4.08	4.08	1.1	11.0	200	0.55	81	25.4	0.78	43.5%
Commercial	EX SANMH 2	EX SANMH 1	5	16.5	16.5	4.0	0.3	3.22		3.22	2.8	4.08	4.08	1.1	4.2	200	0.55	81	25.4	0.78	16.6%

Design Parameters:

Extraneous Flows = 0.28 l/s/ha
Industrial Flow = 55,000 l/ha/day
Commercial Flow = 50,000 l/ha/day
Peaking Factor Commercial = 1.5
Peaking Factor Heavy Industrial = 4.7 **(Based on Appendix 4-B.1, *Ottawa Sewer Deisgn Guidelines*)**
Domestic Flow:
Avg Flow/Person 350 l/day
Population Density: 3.3 people/unit
Residential Peaking Factor = Harmon Equation (max 4, min 2)
Pipe Friction n = 0.013

APPENDIX C
Stormwater Management Calculations



2175 Prince of Wales Dr – ArcMAP (2015) – Storm Sewer Data

LEGEND

- MAJOR OVERLAND FLOW
- TRIBUTARY AREA
- PRE / 1.94ha / 0.20 — AREA I.D / DRAINAGE AREA / RUNOFF COEFFICIENT
- PROPOSED STM SEWER

HUNT CLUB ROAD

EX. 2176 PRINCE OF WALES DRIVE

PRINCE OF WALES DRIVE

PROPOSED STORM OUTLET

PRE 1.94ha 0.20

POST 1.94ha 0.85

WATERBEND LANE

RIDEA

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2175 PRINCE OF WALES DRIVE

DEVELOPMENT DRAINAGE PLAN

SCALE 1 : 1000 (0 10 20 30 40)

DATE SEPT 2015 | JOB 107005 | FIGURE 4

SHT11X17.DWG 279mmX432mm

M:\2007\107005\CAD\2015-FIGURES\107005-FIG5.dwg, GS, Sep 09, 2015 - 2:16pm, tbrooks

PROJECT #: 107005

PROJECT NAME: 2175 Prince of Wales Dr
LOCATION: Ottawa, ON
DATE PREPARED: March 2015
DATE REVISED:

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TABLE C1: Free Flow **Pre-Development**

Pre-Development Runoff Coefficient "C"

			1:5 Year Event		1:100 Year Event	
Area	Surface	Ha	C	C_5	C	C_{100}
Total	Hard	0.000	0.90	0.20	1.00	0.25
1.940	Soft	1.940	0.20		0.25	

Runoff Coefficient Equation
$C_5 = (A_{hard} \times 0.9 + A_{soft} \times 0.2)/A_{Tot}$
$C_{100} = (A_{hard} \times 1.0 + A_{soft} \times 0.25)/A_{Tot}$

* Runoff Coefficient increases by 25% up to a maximum value of 1.00 for the 100-Year event

Pre-Development Free Flows

Outlet Options	Area (ha)	$Q_{5\ Year}$ (L/s)	$Q_{100\ Year}$ (L/s)
Overland Free flow	1.940	**112.4**	**240.8**

Time of Concentration	Tc=	10	min
Rainfall Intensity (5 Year Event)	I_5=	104.19	mm/hr
Rainfall Intensity (100 Year Event)	I_{100}=	178.56	mm/hr

100 year Intensity = 1735.688 / (Time in min + 6.014) $^{0.820}$
5 year Intensity = 998.071 / (Time in min + 6.053)$^{0.814}$

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TABLE C2: Free Flow **Post-Development**

Post-Development Runoff Coefficient "C"

			1:5 Year Event		1:100 Year Event	
Area	Surface	Ha	C	C_5	C	C_{100}
Total	Hard	1.804	0.90	0.85	1.00	0.95
1.940	Soft	0.136	0.20		0.25	

Runoff Coefficient Equation
$C_5 = (A_{hard} \times 0.9 + A_{soft} \times 0.2)/A_{Tot}$
$C_{100} = (A_{hard} \times 1.0 + A_{soft} \times 0.25)/A_{Tot}$

* Runoff Coefficient increases by 25% up to a maximum value of 1.00 for the 100-Year event

Post-Development Free Flows

Outlet Options	Area (ha)	$Q_{5\ Year}$ (L/s)	$Q_{100\ Year}$ (L/s)
Overland Free flow	1.940	**477.6**	**914.9**

Time of Concentration	Tc=	10	min
Rainfall Intensity (5 Year Event)	I_5=	104.19	mm/hr
Rainfall Intensity (100 Year Event)	I_{100}=	178.56	mm/hr

100 year Intensity = 1735.688 / (Time in min + 6.014) $^{0.820}$
5 year Intensity = 998.071 / (Time in min + 6.053)$^{0.814}$