394 Bronson Avenue Ottawa
Assessment of Adequacy of Public Services

Project # CW-01-13

Prepared for:

SOMA Studio

By:

Arch-Nova Design Inc.

March 2018

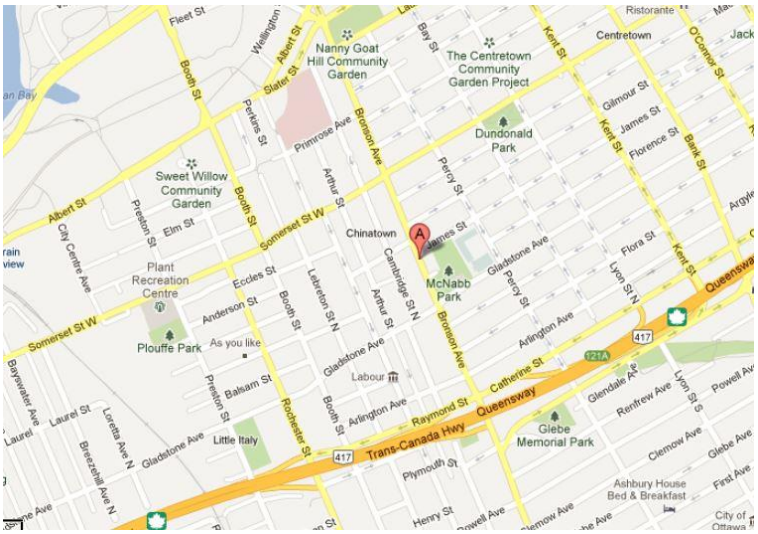
Table of Contents

1. Introduction

The subject property is located at 394 Bronson Avenue, Ottawa. The proposed work comprises of a 3-storey+basement apartment building. For the purpose of this report the site is considered to run east-west.

Currently, a 2-storey house is located on the east side of the property. It is unoccupied and scheduled for demolition. A yard covered with grass is located on the west side of the property. In the south-west corner of the property there is a driveway along the south side of site. Adjacent properties are also residential.

The area is serviced by municipal water and combined sewer systems.



394 Bronson Avenue, Ottawa: Location

2. Public Services Capacity

This section of the report will analyze existing municipal services and the potential impact of the proposed building at 394 Bronson Avenue on the existing service capacity.

2.1 Water Supply

[1]The following are boundary conditions, HGL, for a hydraulic analysis at 394 Bronson Avenue, connecting to the 203 mm watermain:

Max Day + FF = 104.2 m assuming a fire flow of 150 L/s

Minimum HGL = 102.3 m

Maximum HGL = 115.7 m, the estimated ground elevation is 70.57 m, the maximum pressure is estimated to be 64.47 psi. at the top of the building (90.3 m asl) 31.3 psi which is in required range (above 20 psi).

Table 1 presents the City of Ottawa design criteria based on MOE Guidelines.

Design Parameter	Value
Residential Average Apartment	1.8 P/unit
Residential Average Daily Demand	350 L/d/P
[2]Residential Maximum Daily Demand	2.5 x Average Daily
Residential Maximum Hourly	2.2 x Maximum Daily
Commercial Demand	2.5 L / m2 /d
Commercial Maximum Daily Demand	1.5 x Average Daily
Commercial Maximum Hourly	1.8 x Maximum Daily
Minimum Watermain Size	150mm diameter
Minimum Depth of Cover	2.4m from top of watermain to finished grade
During Peak Hourly Demand operating pressure must remain within	275kPa and 552kPa (40-80 psi; 28-56m)
During fire flow operating pressure must not drop below	140kPa (20 psi; 14 m)

Table 1: Water Supply Design Criteria

[1] City of Ottawa boundary condition information is based on current operation of the city water distribution system (also see Appendix A for complete correspondence information)

[2] Residential Max. Daily and Max. Hourly peaking factors per MOE Guidelines for Drinking-Water Systems Table 3-3 for 0 to 500 persons.

The consumption is expected to increase from **4.55 l/min (0.07 l/sec)** to **29.54 l/min (0.49 L/sec)** for peak period. The fire flow for residential spaces was estimated to be 9,000 l/min (150 l/sec)[3] .

The table below summarizes the pressure for the designed parameters:

Design Parameter	Anticipated Demand[1] (L/min)	Boundary Condition[2] (m)
Average Daily Demand	5.47	
Max Day + Fire Flow	9,013.48	104.2
Peak Hour	29.54	102.3

Table 2: Water Demand and Boundary Conditions

2.2 Sanitary Sewer

Current sanitary sewer outflow from the location of 394 Bronson Avenue is estimated **0.07 l/sec** (peak flow+wet weather). The estimated outflow for the new buildings is **0.36 l/sec** (peak flow+wet weather), therefore the maximum flow increase is estimated to be **0.29 l/sec**.

Design Parameter	Value[4]
Residential Average Apartment	1.8 P/unit
Average Daily Demand	350 L/d/per
Peaking Factor	Harmon's Peaking Factor. Max 4.0, Min 2.0
Commercial Space	5L/m2/day
Infiltration and Inflow Allowance	0.28L/s/ha
Sanitary sewers are to be sized employing the Manning's Equation	$Q = (1/n)AR^{2/3}S^{1/2}$
Minimum Sewer Size	200mm diameter
Minimum Manning's 'n'	0.013
Minimum Depth of Cover	2.5m from crown of sewer to grade
Minimum Full Flowing Velocity	0.6m/s
Maximum Full Flowing Velocity	3.0m/s

Table 3: Wastewater Design Criteria

Sewer connection is proposed to connect to combined sewer 750 mm which has a capacity of 166.0 l/sec for 1.4% slope (84.9 m section length).

[3] OBC SectionA.3.2.5.7, Table 2.
[4] Extracted from Sections 4 and 6 of the City of Ottawa Sewer Design Guidelines, November 2004.

Detailed calculation of pre and post development flow is presented in Appendix A.

3. Stormwater

3.1 Existing Site Stormwater Services

The subject property is covered with different surfaces as shown in the Table 4. The roof drains onto the green area and on the driveway on the south side. No other storm water services (i.e. storage, ponds) are on the property.

Surface Type	ID	Area (ha)	Percent of total Area	C	A X C (ha)
Backyard	**A1**	0.0120	41.1%	0.25	0.003
Shed roof	**A2**	0.0012	4.1%	0.90	0.001
Roof	**A3**	0.0012	4.0%	0.90	0.001
Roof	**A4**	0.0011	3.7%	0.90	0.001
Driveway	**A5**	0.0090	30.9%	0.90	0.008
Roof	**A6**	0.0020	6.9%	0.90	0.002
Roof	**A7**	0.0019	6.6%	0.90	0.002
Front Porch	**A8**	0.0008	2.6%	0.90	0.001
TOTAL		0.0292	100.0%		0.018
Weighted C =					0.50

Table 4: Current Drainage Areas

Entire site drains uncontrolled over surface to Bronson Avenue and to the backyard lawn. Predevelopment C=0.5 is used for the calculation for the post development calculation.

A municipal stormwater service is combined 750 mm and it is provided on Bronson Avenue. It's capacity is 166.0 l/sec for slope of 1.4%.

3.2 Proposed Development

The proposed 6-storey building will cover the main part of the property however the impervious surface is increased with increased runoff from the site. At the same time the time of concentration is increased having the roof at elevation of 20 m above ground which in comparison to existing situation increases the flow distance for more than 100%. For the purpose

of calculation for the post development and to include a safety factor, the time of concentaration for the post development was assumed as Tc=20 min. With this assumption the postdevelopment runoff increased from 4.22 l/sec to 6.07 l/sec. This makes 1.85 l/sec of total increase of runoff. As conclusion, the recommendation is not to have any storage on site. The receiving pipe has sufficient capacity to absorb increased inflow.

For the 100-year runoff the postdevelopment flow the increase is 1.25 l/sec in comparison to the pre development as direct result of increased time of concertation.

The main drainage routes, such as the roof drains to the front (Bronson Ave.) will remain unchanged.

The drainage system comprises of weeping tiles around the building and a connection to the combined sewer lateral 200 mm and then further to the 750 mm sewer trunk at Bronson Avenue. Details are presented in the Site Services and Grading Plan.

The rear yard at the back will be graded to route stormwater over the driveway to the front (Bronson Ave).

Four scuppers on the roof will provide direct drainage from the roof to the ground and further to the front (Bronson Ave.)

4. Conclusion and Recommendation

4.1 Water Supply

The water supply demand calculation is based on the fire flow requirement for residential buildings; it is 9,000 l/min (150 l/sec). Under this condition the City personnel provided calculated a pressure of 104.2 m, which is sufficient for the fire protection (estimated building height is 20.3 m) and ground level is at 70.57 m.

4.2 Sanitary Sewer

The proposed combined sewer 750 mm under 1.4% is expected to provide a flow of approximately 166.0 l/s and with a velocity of 0.37 m/sec. An increase of 0.29 l/sec for the peak wet weather flow will not overload the pipe. The connection from the site will be by gravity (as presented on the plan).

The basement area is to be equipped with sanitary ejector pump system to the gravity lateral as shown on the Services and Grading Plan.

4.3 Stormwater

The stormwater system (weeping system) of the property will be connected to proposed 200 mm lateral combined sewer pipe. A municipal stormwater service is provided by proposed 750 mm combined sewer pipe on Bronson Avenue and has capacity of 166.0 l/sec for slope of 1.4%. There will be 1.85 l/sec of increase of runoff for the 5-year return event. The 100-year runoff will be increase for 1.25 l/sec as a direct result of increased time of concentration from 10 minutes to 20 minutes. The main reason for the increase of time of concentration is in fact that the roof of the new building will be at 20 m height in comparison to the existing situation.

Drainage area and a storm calculation sheets (pre and post-development) are shown in Appendix A[5].

Increase in runoff of 1.85 l/sec will not create any problem to the receiving pipe so the recommendation is to release all water from the site uncontrolled.

Details are presented in Appendix A.

[5] Post Development calculation

Based on the information provided by the City of Ottawa, the existing municipal services are adequate and will not be overloaded after the construction of the buildings at 394 Bronson.

Prepared by:

_____

Zoran Mrdja, P.Eng.

March 2018

Professional Engineers Ontario

Authorized by Professional Engineers of Ontario to provide professional services to public

APPENDIX A: CALCULATIONS

FUS Fire Flow Calculations

Project: 394 Bronson Avenue Ottawa

Calculations Based on 1999 Publication "Water Supply for Public Fire Protection " by Fire Underwriters' Survey (FUS)
Project Name: 394 Bronson Avenue, Ottawa — Fire Flow Calculation #: 1
Date: March 18.2018 — Building Type/Description/Name: Mixed Use Building
Data input by: Zoran Mrdja, P.Eng.

Table A: Fire Underwriters Survey Determination of Required Fire Flow - Long Method

Step	Task	Term	Options	Multiplier Associated with Option	Choose:	Value Used	Unit	Total Fire Flow (L/min)
		Framing Material						
1	Choose Frame Used for Construction of Unit	Coefficient related to type of construction (C)	Wood Frame	1.50	Ordinary Construction	1.00	m	
			Ordinary construction	1.00				
			Non-combustible construction	0.80				
			Fire resistive construction (< 2 hrs)	0.70				
			Fire resistive construction (> 2 hrs)	0.60				
		Floor Space Area						
2	Choose Type of Housing (if TH, Enter Number of Units Per TH Block)	Type of Housing	Single Family	1	Other (Comm, ind)	1	Units	
			Townhouse - indicate # of units	1				
			Other (Comm, Ind, etc.)	1				
2.2	# of Storeys	Number of Floors/ Storeys in the Unit (do not include basement):			6	6	Storeys	
3	Enter Ground Floor Area of One Unit	Enter Ground Floor Area (A) of One Unit Only :			115	690	Area in Square Meters (m^2)	
		Measurement Units	Square Feet (ft^2)	0.093	Square Metres (m^2)			
			Square Metres (m^2)	1				
			Hectares (ha)	10000				
4	Obtain Required Fire Flow without Reductions	Required Fire Flow(without reductions or increases per FUS) (F = 220 * C * √A) Round to nearest 1000L/min						5,779
5	Apply Factors Affecting Burning	Reductions/Increases Due to Factors Affecting Burning						
5.1	Choose Combustibility of Building Contents	Occupancy content hazard reduction or surcharge	Non-combustible	-0.25	Limited combustible	-0.15	N/A	-867
			Limited combustible	-0.15				
			Combustible	0.00				
			Free burning	0.15				
			Rapid burning	0.25				
5.2	Choose Reduction Due to Presence of Sprinklers	Sprinkler reduction	Complete Automatic Sprinkler Protection	-0.3	None	0.00	N/A	0
			None	0				
5.3	Choose Separation Distance Between Units	Exposure Distance Between Units	North Side	0-3.0 m	0.25	0.70	m	4,045
			East Side	10.1-20.0 m	0.15			
			South Side	0-3.0 m	0.25			
			West Side	30.1-45.0	0.05			
6	Obtain Required Fire Flow, Duration & Volume	Total Required Fire Flow, rounded to nearest 1000 L/min, with max/min limits applied:						9,000
		Total Required Fire Flow (above) in L/s:						150
		Required Duration of Fire Flow (hrs)						2.00
		Required Volume of Fire Flow (m^3)						1080

Note: The most current FUS document should be referenced before design to ensure that the above figures are consistent with the intent of the Guideline

Legend	
	Drop down menu - choose option, or enter value.
	No Information, No input required.

Note:

The most current FUS document should be referenced before design to ensure that the above figures are consistent with the intent of the Guideline.

Water Supply Design Criteria

Design Parameter	Value
Residential Average Apartment	1.8 P/unit
Residential Average Daily Demand	350 L/d/P
Residential Maximum Daily Demand	2.5 x Average Daily *
Residential Maximum Hourly	2.2 x Maximum Daily *
Commercial Demand	2.5 L / m2 /d
Commercial Maximum Daily Demand	1.5 x Average Daily
Commercial Maximum Hourly	1.8 x Maximum Daily
Minimum Watermain Size	150mm diameter
Minimum Depth of Cover	2.4m from top of watermain to finished grade
must remain within	275kPa and 552kPa (40-80 psi; 28-56m)
During fire flow operating pressure must not drop below	140kPa (20 psi; 14 m)
* Residential Max. Daily and Max. Hourly peaking factors per MOE Guidelines for Drinking-Water Systems Table 3-3 for 0 to 500 persons.	

Domestic Demand

Type of Housing	Per / Unit	Units	Pop
Single Family	3.4	1	3
Semi-detached	2.7		0
Townhouse	2.7		0
Apartment			0
Bachelor	1.4		0
1 Bedroom	1.4		0
2 Bedroom	2.1		0
3 Bedroom	3.1		0

	Pop	Avg. Daily		Max Day		Peak Hour	
		m^3/d	L/min	m^3/d	L/min	m^3/d	L/min
Total Domestic Demand	3	1.19	0.83	2.98	2.07	6.55	4.55

Institutional / Commercial / Industrial Demand

				Avg. Daily		Max Day		Peak Hour	
Property Type	**Unit Rate**		**Units**	m^3/d	L/min	m^3/d	L/min	m^3/d	L/min
Commercial floor space	2.5	L/m2/d	0	0.00	0.00	0.00	0.00	0.00	0.00
Office	75.0	L/9.3m2/d							
Restaurant*	125.0	L/seat/d							
Industrial -Light	35,000.0	L/gross ha/d							
Industrial -Heavy	55,000.0	L/gross ha/d							
Total I/C/I Demand				0.00	0.00	0.00	0.00	0.00	0.00

Total Demand	1.19	0.83	2.98	2.07	6.55	4.55

* Estimated number of seats at 1seat per 9.3m2

Wastewater Design Criteria

Design Parameter	Value
Residential Average Apartment	1.8 P/unit
Average Daily Demand	350 L/d/per
Peaking Factor	Harmon's Peaking Factor. Max 4.0, Min 2.0
Commercial Space	5L/m2/day
Infiltration and Inflow Allowance	0.28L/s/ha
Sanitary sewers are to be sized employing the Manning's Equation	$Q = (1/n)AR^{2/3}S^{1/2}$
Minimum Sewer Size	200mm diameter
Minimum Manning's 'n'	0.013
Minimum Depth of Cover	2.5m from crown of sewer to grade
Minimum Full Flowing Velocity	0.6m/s
Maximum Full Flowing Velocity	3.0m/s
Extracted from Sections 4 and 6 of the City of Ottawa Sewer Design Guidelines, November 2004.	

394 Bronson Ave. Ottawa
Current Conditions

Sanitary Sewer Post Development Outflow

Site Area	**0.046 ha**
Extraneous Flow Allowances	
Infiltration / Inflow	**0.01288 L/s**

Domestic Contributions

Unit Type	Unit Rate	Units	**Pop**
Single Family	3.4	1	3.4
Semi-detached and duplex	2.7		0
Duplex	2.3		0
Townhouse	2.7		0
Apartment			
Bachelor	1.4		0
1 Bedroom	1.4		0
2 Bedroom	2.1		0
3 Bedroom	3.1		0
Average	1.8		0
Total Population			**3.4**
Average Domestic Flow			**0.01 L/s**
Peaking Factor			**4.00**
Peak Domestic Flow			**0.06 L/s**

Institutional / Commercial / Industrial Contributions

Property Type	**Unit Rate**	**No. of Units**	**Avg Wastewater (L/s)**
Commercial floor space*	5 L/m2/d		0
Hospitals	900 L/bed/d		
School	70 L/student/d		
Industrial - Light**	35,000 L/gross ha/d		
Industrial - Heavy**	55,000 L/gross ha/d		
Average I/C/I Flow			**0**
Peak Institutional / Commercial Flow			
Peak Industrial Flow**			
Peak I/C/I Flow			

Total Estimated Average Dry Weather Flow Rate	**0.01**
Total Estimated Peak Dry Weather Flow Rate	**0.06**
Total Estimated Peak Wet Weather Flow Rate	**0.07**

* assuming a 12 hour commercial operation

** peak industrial flow per City of Ottawa Sewer Design Guidelines Appendix 4B

Water Supply Design Criteria

Design Parameter	Value
Residential Average Apartment	1.8 P/unit
Residential Average Daily Demand	350 L/d/P
Residential Maximum Daily Demand	2.5 x Average Daily *
Residential Maximum Hourly	2.2 x Maximum Daily *
Commercial Demand	2.5 L / m2 /d
Commercial Maximum Daily Demand	1.5 x Average Daily
Commercial Maximum Hourly	1.8 x Maximum Daily
Minimum Watermain Size	150mm diameter
Minimum Depth of Cover	2.4m from top of watermain to finished grade
must remain within	275kPa and 552kPa (40-80 psi; 28-56m)
During fire flow operating pressure must not drop below	140kPa (20 psi; 14 m)
* Residential Max. Daily and Max. Hourly peaking factors per MOE Guidelines for Drinking-Water Systems Table 3-3 for 0 to 500 persons.	

Domestic Demand

Type of Housing	Per / Unit	Units	Pop
Single Family	3.4		0
Semi-detached	2.7		0
Townhouse	2.7		0
Apartment			0
Bachelor	1.4	1	1
1 Bedroom	1.4	4	6
2 Bedroom	2.1	7	15
3 Bedroom	3.1		0

	Pop	Avg. Daily		Max Day		Peak Hour	
		m^3/d	L/min	m^3/d	L/min	m^3/d	L/min
Total Domestic Demand	22	7.60	5.27	18.99	13.19	41.77	29.01

Institutional / Commercial / Industrial Demand

				Avg. Daily		Max Day		Peak Hour	
Property Type	**Unit Rate**		**Units**	m^3/d	L/min	m^3/d	L/min	m^3/d	L/min
Commercial floor space	2.5	L/m2/d	0	0.00	0.00	0.00	0.00	0.00	0.00
Office	75.0	L/9.3m2/d	35	0.28	0.20	0.42	0.29	0.76	0.53
Restaurant*	125.0	L/seat/d							
Industrial -Light	35,000.0	L/gross ha/d							
Industrial -Heavy	55,000.0	L/gross ha/d							
Total I/C/I Demand				0.28	0.20	0.42	0.29	0.76	0.53

Total Demand	7.88	5.47	19.41	13.48	42.53	29.54

* Estimated number of seats at 1seat per 9.3m2

Water Demand and Boundary Conditions

Proposed Conditions

Design Parameter	Anticipated Demand[1] (L/min)	Boundary Condition[2] (m)
Average Daily Demand	5.47	
Max Day + Fire Flow	9,013.48	104.2
Peak Hour	29.54	102.3

[1)] Water demand calculation per Water Supply Guidelines. See Appendix B for detailed calculations.

[2)] Boundary conditions supplied by the City of Ottawa. See Appendix B for correspondence with the City.

Wastewater Design Criteria

Design Parameter	Value
Residential Average Apartment	1.8 P/unit
Average Daily Demand	350 L/d/per
Peaking Factor	Harmon's Peaking Factor. Max 4.0, Min 2.0
Commercial Space	5L/m2/day
Infiltration and Inflow Allowance	0.28L/s/ha
Sanitary sewers are to be sized employing the Manning's Equation	$Q = (1/n)AR^{2/3}S^{1/2}$
Minimum Sewer Size	200mm diameter
Minimum Manning's 'n'	0.013
Minimum Depth of Cover	2.5m from crown of sewer to grade
Minimum Full Flowing Velocity	0.6m/s
Maximum Full Flowing Velocity	3.0m/s
Extracted from Sections 4 and 6 of the City of Ottawa Sewer Design Guidelines, November 2004.	

394 Bronson Ave. Ottawa
New Development

Sanitary Sewer Post Development Outflow

Site Area	**0.046 ha**
Extraneous Flow Allowances	
Infiltration / Inflow	**0.01288 L/s**

Domestic Contributions

Unit Type	Unit Rate	Units	**Pop**
Single Family	3.4		0
Semi-detached and duplex	2.7		0
Duplex	2.3		0
Townhouse	2.7		0
Apartment			
Bachelor	1.4	1	1.4
1 Bedroom	1.4	4	5.6
2 Bedroom	2.1	7	14.7
3 Bedroom	3.1		0
Average	1.8		0
Total Population			**21.7**
Average Domestic Flow			**0.09 L/s**
Peaking Factor			**4.00**
Peak Domestic Flow			**0.35 L/s**

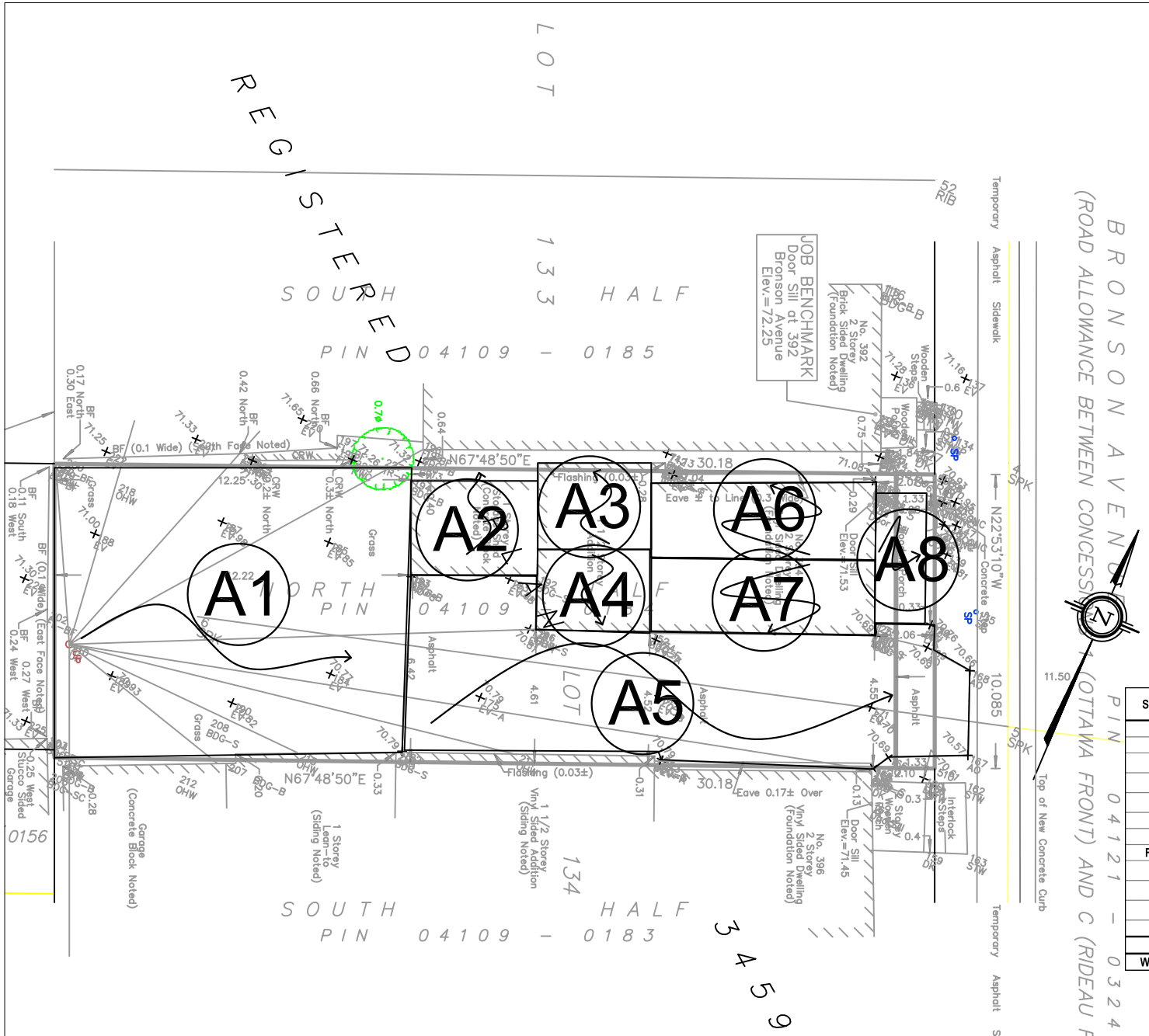
Institutional / Commercial / Industrial Contributions

Property Type	**Unit Rate**	**No. of Units**	**Avg Wastewater (L/s)**
Commercial floor space*	5 L/m2/d	35	0.0041
Hospitals	900 L/bed/d		
School	70 L/student/d		
Industrial - Light**	35,000 L/gross ha/d		
Industrial - Heavy**	55,000 L/gross ha/d		
Average I/C/I Flow			**0.0041**
Peak Institutional / Commercial Flow			
Peak Industrial Flow**			
Peak I/C/I Flow			

Total Estimated Average Dry Weather Flow Rate	**0.09**
Total Estimated Peak Dry Weather Flow Rate	**0.35**
Total Estimated Peak Wet Weather Flow Rate	**0.36**

* assuming a 12 hour commercial operation

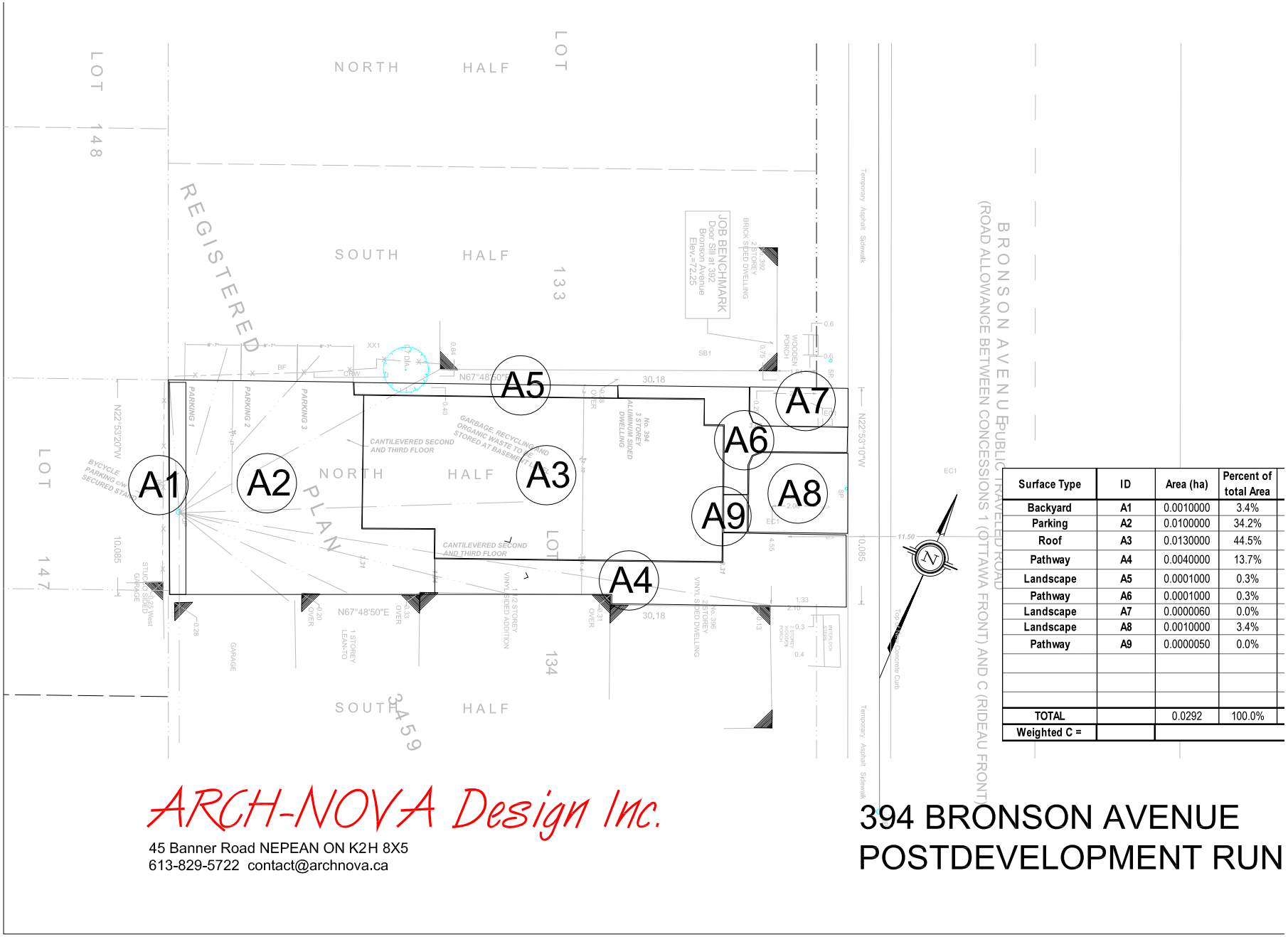
** peak industrial flow per City of Ottawa Sewer Design Guidelines Appendix 4B



Surface Type	ID	Area (ha)	Percent of total Area	C	A X C (ha)
Backyard	A1	0.0120	41.1%	0.25	0.003
Shed roof	A2	0.0012	4.1%	0.90	0.001
Roof	A3	0.0012	4.0%	0.90	0.001
Roof	A4	0.0011	3.7%	0.90	0.001
Driveway	A5	0.0090	30.9%	0.90	0.008
Roof	A6	0.0020	6.9%	0.90	0.002
Roof	A7	0.0019	6.6%	0.90	0.002
Front Porch	A8	0.0008	2.6%	0.90	0.001
TOTAL		0.0292	100.0%		0.018
Weighted C =					0.50

ARCH-NOVA Design Inc.
45 Banner Road NEPEAN ON K2H 8X5
613-829-5722 contact@archnova.ca

394 BRONSON AVENUE
PREDEVELOPMENT RUNOFF



Surface Type	ID	Area (ha)	Percent of total Area
Backyard	A1	0.0010000	3.4%
Parking	A2	0.0100000	34.2%
Roof	A3	0.0130000	44.5%
Pathway	A4	0.0040000	13.7%
Landscape	A5	0.0001000	0.3%
Pathway	A6	0.0001000	0.3%
Landscape	A7	0.0000060	0.0%
Landscape	A8	0.0010000	3.4%
Pathway	A9	0.0000050	0.0%
TOTAL		0.0292	100.0%
Weighted C =			

ARCH-NOVA Design Inc.
45 Banner Road NEPEAN ON K2H 8X5
613-829-5722 contact@archnova.ca

394 BRONSON AVENUE
POSTDEVELOPMENT RUN

Project Number: CW-02-13 394 Bronson Ave., Ottawa

ARCH-NOVA DESIGN INC.
Architecture
Engineering
Consulting

PRE-DEVELOPMENT

The pre-development time of concentration is 10 minutes

where:

$I_5 = 998.071 / (Tc + 6.053)^{0.814}$ $I_{100} = 1735.688 / (Tc + 6.014)^{0.820}$

I_5 = 104.2 mm/hr I_{100} = **178.6 mm/hr**

Surface Type	ID	Area (ha)	Percent of total Area	C	A X C (ha)
Backyard	A1	0.0120	41.1%	0.25	0.003
Shed roof	A2	0.0012	4.1%	0.90	0.001
Roof	A3	0.0012	4.0%	0.90	0.001
Roof	A4	0.0011	3.7%	0.90	0.001
Driveway	A5	0.0090	30.9%	0.90	0.008
Roof	A6	0.0020	6.9%	0.90	0.002
Roof	A7	0.0019	6.6%	0.90	0.002
Front Porch	A8	0.0008	2.6%	0.90	0.001
TOTAL		0.0292	100.0%		0.018
Weighted C =					0.50

0.632588

$Q_{5pre} = (2.78)*(C)*(I_5)*(A)$
$Q_{5pre} = 2.78 \times 0.50 \times 104.2 \times 0.0292$
$Q_{5pre} = 4.22$ L/s

$Q_{100pre} = (2.78)*(C)*(I_{100})*(A)$
$Q_{100pre} = 2.78 \times 0.63 \times 178.6 \times 0.0292$
$Q_{100pre} = 9.05$ L/s

C=0.5 used for predevelopment calculation (City of Ottawa requirement)

POST-DEVELOPMENT (UNCONTROLLED RUNOFF)

The post-development time of concentration is 20 minutes

where:

$I_5 = 998.071 / (Tc + 6.053)^{0.814}$ $I_{100} = 1735.688 / (Tc + 6.014)^{0.820}$

I_5 = 70.3 mm/hr I_{100} = **120.0 mm/hr**

Surface Type	ID	Area (ha)	Percent of total Area	C	A X C (ha)
Backyard	A1	0.0010000	3.4%	0.85	0.001
Parking	A2	0.0100000	34.2%	0.90	0.009
Roof	A3	0.0130000	44.5%	0.90	0.012
Pathway	A4	0.0040000	13.7%	0.70	0.003
Landscape	A5	0.0001000	0.3%	0.25	0.000
Pathway	A6	0.0001000	0.3%	0.70	0.000
Landscape	A7	0.0000060	0.0%	0.25	0.000
Landscape	A8	0.0010000	3.4%	0.25	0.000
Pathway	A9	0.0000050	0.0%	0.70	0.000
TOTAL		0.0292	100.0%		0.025
Weighted C =					0.85

$Q_{5post} = (2.78)*(C)*(I_5)*(A)$
$Q_{5post} = 2.78 \times 1.06 \times 70.3 \times 0.0292$
$Q_{5post} = 6.07$ L/s

$Q_{100post} = (2.78)*(C)*(I_{100})*(A)$
$Q_{100post} = 2.78 \times 1.06 \times 120.0 \times 0.0292$
$Q_{100post} = 10.35$ L/s

Storage Volumes (5-Year Storm)

Project: 394 Bronson Avenue

Tc = 20 (mins)
C_{AVG} = 0.85 (dimmensionless)
Area = 0.0292 (hectares)
Storm = 5 (year)
Release Rate = 4.22 (L/sec)
Time Interval = 5 (mins)

Duration (min)	Rainfall Intensity (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m^3)
1	204	0.7	4.22		
6	132	2.7	4.22	-1.50	-0.54
11	99	3.8	4.22	-0.46	-0.30
16	80	4.4	4.22	0.22	0.21
21	68	4.7	4.22	0.48	0.60
26	59	4.1	4.22	-0.13	-0.20
31	53	3.6	4.22	-0.58	-1.09
36	48	3.3	4.22	-0.94	-2.03
41	43	3.0	4.22	-1.23	-3.02
46	40	2.8	4.22	-1.46	-4.04
51	37	2.6	4.22	-1.66	-5.09
56	35	2.4	4.22	-1.83	-6.16
61	33	2.2	4.22	-1.98	-7.24
66	31	2.1	4.22	-2.11	-8.34
71	29	2.0	4.22	-2.22	-9.45
76	28	1.9	4.22	-2.32	-10.57
81	26	1.8	4.22	-2.41	-11.71
86	25	1.7	4.22	-2.49	-12.84
91	24	1.7	4.22	-2.56	-13.99
96	23	1.6	4.22	-2.63	-15.14
101	22	1.5	4.22	-2.69	-16.30
106	21	1.5	4.22	-2.75	-17.46
111	21	1.4	4.22	-2.80	-18.63
116	20	1.4	4.22	-2.85	-19.80
121	19	1.3	4.22	-2.89	-20.98
126	19	1.3	4.22	-2.93	-22.16
131	18	1.3	4.22	-2.97	-23.34
136	18	1.2	4.22	-3.01	-24.53

Notes

1) For a storm duration that is less than the time of concentration the peak flow is equal to the product of 2.78CIA and the ratio of the storm duration to the time of concentration.

2) Rainfall Intensity, I = 998.071 / (Tc + 6.053)^0.814 (5 year, City of Ottawa)
3) Peak Flow = Duration/Tc x 2.78 x C x I x A (Duration < Tc)
4) Peak Flow = 2.78 x C x I x A (Duration > Tc)
5) Storage = Duration x Storage Rate

Storage Volumes (100-Year Storm)

Tc = 20 (mins)
C_{AVG} = 0.85 (dimmensionless)
Area = 0.0292 (hectares)
Storm = 100 (year)
Release Rate = 4.22 (L/sec)
Time Interval = 5 (mins)

Duration (min)	Rainfall Intensity (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m^3)
1	351	1.2	4.22		
6	226	4.7	4.22	0.46	0.16
11	170	6.5	4.22	2.23	1.47
16	138	7.6	4.22	3.37	3.24
21	116	8.0	4.22	3.80	4.79
26	101	7.0	4.22	2.76	4.30
31	90	6.2	4.22	1.98	3.67
36	81	5.6	4.22	1.36	2.95
41	74	5.1	4.22	0.87	2.14
46	68	4.7	4.22	0.47	1.29
51	63	4.4	4.22	0.13	0.39
56	59	4.1	4.22	-0.16	-0.55
61	55	3.8	4.22	-0.41	-1.51
66	52	3.6	4.22	-0.63	-2.50
71	49	3.4	4.22	-0.82	-3.51
76	47	3.2	4.22	-1.00	-4.54
81	45	3.1	4.22	-1.15	-5.58
86	43	2.9	4.22	-1.29	-6.64
91	41	2.8	4.22	-1.41	-7.70
96	39	2.7	4.22	-1.52	-8.78
101	38	2.6	4.22	-1.63	-9.87
106	36	2.5	4.22	-1.72	-10.96
111	35	2.4	4.22	-1.81	-12.07
116	34	2.3	4.22	-1.89	-13.18
121	33	2.3	4.22	-1.97	-14.29
126	32	2.2	4.22	-2.04	-15.42
131	31	2.1	4.22	-2.10	-16.54
136	30	2.1	4.22	-2.17	-17.68

Notes

1) For a storm duration that is less than the time of concentration the peak flow is equal to the product of 2.78CIA and the ratio of the storm duration to the time of concentration.

2) Rainfall Intensity, I = 1735.688 / (Tc + 6.014)^0.820 (100 year, City of Ottawa)
3) Peak Flow = Duration/Tc x 2.78 x C x I x A (Duration < Tc)
4) Peak Flow = 2.78 x C x I x A (Duration > Tc)
5) Storage = Duration x Storage Rate

APPENDIX B: CORRESPODENCE

zoran@archnova

From: Zoran Archnova <zoran@archnova.ca>
Sent: April 30, 2013 9:34 PM
To: zoran@archnova.ca
Subject: Fwd: 394 Bronson Avenue: boundary conditions

Zoran Mrdja
Sent from my iPhone

Begin forwarded message:

> **From:** Zoran Archnova <zoran@archnova.ca>
> **Date:** 19. april 2013. 19.30.31 GMT-0400
> **To:** "White, Joshua" <Joshua.White@ottawa.ca>
> **Subject: Re: 394 Bronson Avenue: boundary conditions**
>
> Thank you,
>
> In addition, the sewer system is combined. Any specific requirement for the sewer and storm connections?
>
> Regards,
>
> Zoran Mrdja
> Sent from my iPhone
>
> On 19.04.2013., at 13.31, "White, Joshua" <Joshua.White@ottawa.ca> wrote:
>
> > Hi Zoran,
> >
> > We made the assumption that you would be connecting into the 406mm PVC Water main please find your boundary conditions below.
> >
> > Cheers
> >
> > Josh
> >
> > Joshua White
> > Project Manager, Infrastructure Approvals
> > Development Review, Urban Services, City of Ottawa
> > Phone: (613) 580-2424 ext 15843
> > Email: joshua.white@ottawa.ca
> >

The following are boundary conditions, HGL, for hydraulic analysis at 394 Bronson (zone 1W) assumed to be connected to the 406mm on Bronson (see attached PDF for location)

Minimum HGL = 102.3m

Maximum HGL = 115.7m

Max Day + FF (150L/s) = 104.2m

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: zoran@archnova [mailto:zoran@archnova.ca]
Sent: April 18, 2013 9:35 PM
To: White, Joshua
Subject: RE: 394 Bronson Avenue: boundary conditions

Hello Josh,

We have received the latest services plans for Bronson Avenue from Bruce Kenny (City of Ottawa). Several pipes seem to be disconnected and replaced with a new ones however, the pipe sizes suggest that they are either a transmission lines or a large trunks.

Please could you advice what pipes we should connect our service lines to?

Also we are still waiting for the boundary conditions for the location.

Regards,

Zoran Mrdja, P.Eng.
Arch-Nova Design Inc.

From: White, Joshua [mailto:Joshua.White@ottawa.ca]
Sent: April 2, 2013 5:20 PM
To: 'zoran@archnova'
Subject: RE: 394 Bronson Avenue: boundary conditions

Hi Zoran,

Before I send the request for boundary conditions off to Infrastructure Services I need the following information.

- Could you please include the Max Day flow as a separate flow.
- Please clarify the type of development (2 story residential apartment building, 3 story Mixed use building, etc)
- If the application is for a development with less than 500 persons, please use the Table 3-3 from the MOE Design Guidelines for Drinking-Water Systems to determine the peaking factors.
- Please indicate what method was used to determine the Fire Flow Requirements

Joshua White
Project Manager, Infrastructure Approvals
Development Review, Urban Services, City of Ottawa
Phone: (613) 580-2424 ext 15843
Email: joshua.white@ottawa.ca
Please consider the environment before printing this e-mail.

From: zoran@archnova [mailto:zoran@archnova.ca]
Sent: April 01, 2013 6:43 PM
To: White, Joshua
Cc: Buchanan, Richard
Subject: 394 Bronson Avenue: boundary conditions

Hello Josh,

Could you please provide us with the boundary conditions for the location of 394 Bronson Avenue:

Design Parameter	Anticipated Demand (L/min)	Boundary Condition (kPa)
Average Daily Demand	2.16	
Max Day + Fire Flow	9,005.26	108
Peak Hour	11.49	108.3

The second floor height is 10.014 m, the ground elevation in front of the property is 70.57.

Regards,

Zoran Mrdja, P.Eng.
Arch-Nova Design Inc.
Email: zoran@archnova.ca
Phone: 613-829-5722

intended recipient(s) is unauthorized. If you are not the intended recipient, please notify me at the telephone number shown above or by return e-mail and delete this communication and any copy immediately. Thank you.

Le présent courriel a été expédié par le système de courriels de la Ville d'Ottawa. Toute distribution, utilisation ou reproduction du courriel ou des renseignements qui s'y trouvent par une personne autre que son destinataire prévu est interdite. Si vous avez reçu le message par erreur, veuillez m'en aviser par téléphone (au numéro précité) ou par courriel, puis supprimer sans délai la version originale de la communication ainsi que toutes ses copies. Je vous remercie de votre collaboration.

This e-mail originates from the City of Ottawa e-mail system. Any distribution, use or copying of this e-mail or the information it contains by other than the intended recipient(s) is unauthorized. If you are not the intended recipient, please notify me at the telephone number shown above or by return e-mail and delete this communication and any copy immediately. Thank you.

Le présent courriel a été expédié par le système de courriels de la Ville d'Ottawa. Toute distribution, utilisation ou reproduction du courriel ou des renseignements qui s'y trouvent par une personne autre que son destinataire prévu est interdite. Si vous avez reçu le message par erreur, veuillez m'en aviser par téléphone (au numéro précité) ou par courriel, puis supprimer sans délai la version originale de la communication ainsi que toutes ses copies. Je vous remercie de votre collaboration.

<394 Bronson April 2013.pdf>