December 14, 2017

Jennifer Kluke, Planner
Development Review, Central Branch
Planning, Infrastructure and Economic Development Department
City of Ottawa
110 Laurier Avenue West, 4th floor
Ottawa, ON K1P 1J1

Re: Servicing Brief & Estimation of Fire Flow Requirements for 305/307 Wilbrod St, Ottawa

Dear Ms. Kluke:

On behalf of our client, Chartier Physiotherapy, please accept this Servicing Brief letter report to address the City's concern regarding the required versus the available fire flows for the subject property. Exp Services Inc. has estimated fire flow requirements of 150 L/sec based on the City's recommended method, the Fire Underwriters Survey (FUS), and compared this to the hydraulic boundary conditions (HGL) of the existing water system at the subject property provided by the City of Ottawa.

We can confirm that the estimated fire flow requirement of 150 L/sec exceeds the available flow/pressure in the City's water system, which is more than 200 L/sec under maximum day plus fire flow conditions.

We trust that the attached Servicing Brief is acceptable for its intended purpose, which is to address the City's concern for fire flow requirements. If you have any questions or concerns, please do not hesitate to contact either of the undersigned at any time.

Respectively submitted,

Jason Fitzpatrick, P.Eng.   Bruce Thomas, P.Eng.
Project Engineer   Senior Project Manager
Infrastructure Services   Infrastructure Services

exp Services Inc.

cc: John Wu, City of Ottawa.
       Dan Paquette, Paquette Planning Associates Ltd.
       Nathalie Chartier, Chartier Physiotherapy.

1   Introduction & Background

Chartier Physiotherapy retained **exp** Services Inc. (EXP) to undertake a site servicing brief in support of a rezoning application for a property located at 305/307 Wilbrod Street in the Sandy Hill area of the City of Ottawa. The property is situated on the north side of Wilbrod Street between Nelson Street and Friel Street in the City of Ottawa, Ontario, as shown on Figure 1 in Appendix A.

This report will address the fire flow requirements for the existing building and the adequacy of the existing municipal watermain. The request for the estimation of the fire flow requirements resulted from the proposed rezoning of the property to add a medical facility as a permitted use on the property. The current residential uses for the property will need to be re-zoned to allow for mixed-use commercial.

The 0.0809-hectare property currently consists of a three (3) storey building that includes an 86.3 m^2 (or 929 square feet) apartment on the ground floor at 307 Wilbrod Street, and seven (7) apartment units located at 305 Wilbrod Street having a combined floor area of approximately 511 m^2 (or 5,497 square feet). Additional storage and bonus areas in the basement include an additional 102.3 m^2 (or 1101 square feet) of floor area.

An existing 300mm diameter PVC watermain, 250mm sanitary sewer, and 300mm storm sewer are present on Wilbrod Street along the frontage of the property.

A site visit was completed on December 5, 2017, to review the existing building information that is necessary for the estimation of the fire flow requirements. This information included the building construction materials, floor areas, use of sprinklers, external exposures to other buildings, and use of fire walls. Information on the interior building uses was provided by the client for use in determining the overall floor area. The building information is summarized below.

Building Information:

-	1st floor	Apt # 1. 4-bedroom.	1,565 sq.ft.	(305 Wilbrod)
-	1st floor	Apt # 2. 2-bedroom.	929 sq.ft.	(307 Wilbrod)
-	2nd floor	Apt # 3. 2-bedroom.	943 sq.ft.	(305 Wilbrod)
-	2nd floor	Apt # 4. 1-bedroom.	1,299 sq.ft.	(305 Wilbrod)
-	3rd floor	Apt # 5. 1-bedroom.	502 sq.ft.	(305 Wilbrod)
-	3rd floor	Apt # 6. 1-bedroom.	657 sq.ft.	(305 Wilbrod)
-	Basement	Apt # 7. 1-bedroom.	531 sq.ft.	(305 Wilbrod)
-	Basement	Storage Area.	864 sq.ft.	(305, 307 Wilbrod)
-	Basement	Bonus Area	417 sq.ft.	(305, 307 Wilbrod)

2   Referenced Guidelines

Various documents were referred to in preparing the current report, including:

- Ottawa Design Guidelines – Water Distribution (WDG001), July 2010, City of Ottawa including:
    - Technical Bulletin ISDTB-2014-02 (May 27, 2014)
- 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
- Ottawa Design Guidelines, Second Edition, (SDG002), October 2012.

3   Watermain Demands

3.1   Domestic Water Demands

The domestic water demands are estimated below, using parameters from the SDG002 and the GDWS. The following summarizes the parameters used.

Population

-	4-1 Bedroom apartment x 1.4 person/unit	= 5.6
-	2-2 Bedroom apartment x 2.1 person/unit	= 4.2
-	1-4 Bedroom apartment x 3.1 person/unit	<u>= 3.1</u>
		= 12.9 persons (use 13)

Daily Water Consumption

-     Average daily water consumption   = 350 L/person/day

Peaking Factor

-     Maximum Day Factor   = 9.5 x Avg. Day (from GDWS, Table 3-3)
-     Peak Hour Factor   = 14.3 x Avg. Day (from GDWS, Table 3-3)

Water Demands

The average, maximum day, and peak hour domestic demands for the building are as follows:

-     Average Day   = 350 x 13 / 86,400 sec/day = 0.053 L/sec
-     Maximum Day   = 9.5 x 0.053 = 0.50 L/sec
-     Peak Hour   = 14.3 x 0.053 = 0.76 L/sec

4   Fire Flow Requirements

Water for fire protection will be available from the existing fire hydrant located near the south-west corner of the property, which is located directly on the north side of Wilbrod Street. This hydrant is 9.5m from the south-west corner of the building, with the next closest hydrant being 120m east of this hydrant on Wilbrod Street. The existing 300mm diameter PVC watermain (year 1999) is located on the north side of Wilbrod Street

The gross floor area was used rather than the apartment areas provided, as required in the FUS guidelines. The exposure distances from the exterior walls to adjacent buildings were measured using a laser distance meter. The measured exposure distances were compared to the distances taken from the City of Ottawa's GIS buildings layer. The floor areas and exposure distances determined onsite are shown in Figure 2.

The following summarizes the floor areas and exposure distances calculated:

- 3rd floor = 165 m^2
- 2nd floor = 208 m^2
- Ground floor = 263 m^2
- Basement floor = 263 m^2
- East exposure distance = 11.7 m
- North exposure distance = 4.0 m
- South exposure distance = 11.0 m (to centre of street)
- East exposure distance = 6.0 m

The required fire flows for the proposed site were estimated based on the Fire Underwriters Survey. The following equation from the latest version of the Fire Underwriters Survey (1999) was used to calculate the supply rates required to be supplied by the hydrant.

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

where:

F   = the required fire flow in liters per minute
C   = coefficient related to the type of construction
A   = the total floor area in square metres

The fire flow requirement for the building is dependent on the total floor area as noted in the above equation, and the results depend on the inclusion of the basement floor area. The total floor area includes all storeys but excludes the basement floor area if it is at least 50% below ground surface.

For this analysis, two scenarios were developed: one excludes the basement floor and the other includes it. The scenario including the basement floor area was only developed to determine the maximum fire flow required for the property; we would expect that the fire flow requirement should **not** include the basement area. Table 3-1 below summarizes the fire flow requirements based on the two scenarios:

Table 4-1: Summary of Required Fire Flow Protection

Item	Scenario 1 - Excludes Basement Area	Scenario 2 - Includes Basement Area
Floors Above Grade	3 floors	4 floors
Construction Coefficient	1.0	1.0
Fire Protection Type	none	none
Building Area (square meters)	636	899
$F=220C\sqrt{A}$ (L/min)	6,000	7,000
Reduction due to low Occupancy	-25%	-25%
Increase due to Separation	+70%	+70%
Fire Flow Requirement L/min or (L/sec)	9,000 (150)	10,000 (167)

For Scenario 1, the estimated fire flow required is 6,000 L/min before reductions and exposure factors are applied. A reduction for low hazard occupancy of -25% for non-combustible, 0% due to the presence of an automatic sprinkler system, and an increase for fire area exposure of +70% results in an estimated required fire flow of 9,000 L/min (or 150 L/sec).

Due to the increase in floor area under Scenario 2, the estimated fire flow required would increase to 10,000 L/min (or 167 L/sec). The detailed calculation of the fire flow requirements based on the Fire Underwriter's Survey (FUS) is provided in Tables 1 and 2 of the Appendix.

5 Available Water System Capacity

Hydraulic boundary conditions were obtained from the City of Ottawa on December 8, 2017. These boundary conditions were provided based on an estimated Maximum Day + Fire Flow of 150.5 L/sec. To assess the water system's response and sensitivity to various fire flow demands, hydraulic grade line (HGL) boundary conditions for 100 L/sec, 150 L/sec, and 220 L/sec were requested.

The following summarizes the information provided by the City:

- Minimum HGL   = 106.7m
- Maximum HGL   = 115.8m
- Max Day + Fire Flow (100 L/s)   = 107.7m (Condition 1)
- Max Day + Fire Flow (150 L/s)   = 107.2m (Condition 2)
- Max Day + Fire Flow (200 L/s)   = 106.7m (Condition 3)

Based on the information provided, the water system pressures were estimated at the property based on roadway centerline elevation of ±69.7m. Table 5-1 summarizes the boundary conditions provided by the City converted to pressures.

Table 5-1: Summary of Required Fire Flow Protection

Condition	Flow (L/sec)	HGL (m)	Pressures		
			(m)	Pa	psi
Maximum	-----	115.8	46.10	452241	65.6
Condition 1	100	107.7	38.00	372780	54.1
Condition 2	150	107.2	37.50	367875	53.4
Condition 3	200	106.7	37.00	362970	52.6
Minimum	-----	106.7	37.00	362970	52.6
Approx. Elev at property = 69.70 m					

A graph of the HGL boundary conditions is illustrated below. The maximum HGL is indicated by the orange line, whereas the minimum HGL is red. The blue line represents the three (3) flow/pressure conditions provided by the city, which represent the watermain supply capacity.
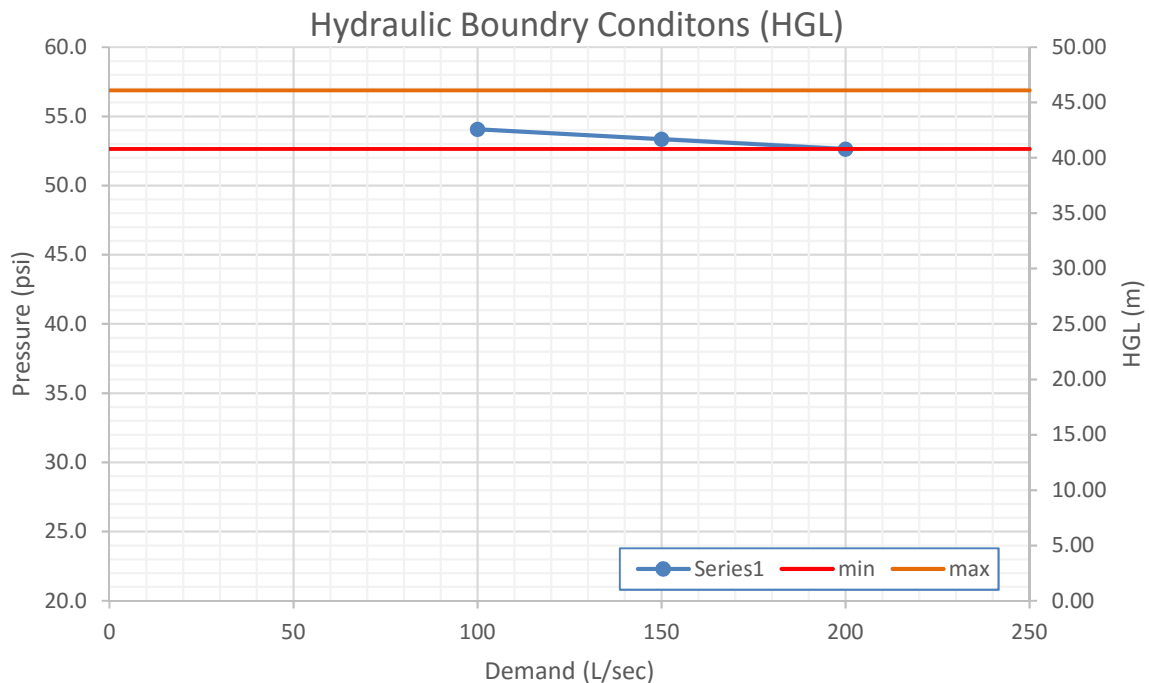
The results of the HGL and the associated pressures under the three flow conditions indicate that at a minimum 200 L/sec of fire flow is available within the water system at the subject property.

The minimum allowable pressure under maximum fire flow conditions is 20 psi (140 kPa) as noted in Section 4.2.2 of the WDG001; therefore, we can conclude that the existing water distribution system has adequate capacity to supply the fire flow demands of either 150 L/sec (no basement) or 167 L/sec (including the basement floor area).

6   Conclusions & Recommendations

EXP's review of the fire flow requirements for the building at 305/307 Wilbrod has determined that adequate capacity is available within the municipal system for firefighting purposes.

The 3-storey brick and stucco building, consists of six (6) residential apartments at 305 Wilbrod, and one (1) apartment at 307 Wilbrod, which is being used as a physiotherapy office. An application for rezoning has triggered the necessity for determining the fire flow requirements for the subject property. EXP personnel completed a site visit to confirm building floor areas, construction types, and exposure distances to other structures.

The fire flow requirements for the building were estimated for two scenarios. One scenario included the basement floor area, and the other excluded the basement area. Fire flow requirements based on the Fire Underwriter Survey, FUS (1999) were estimated for each scenario, although the lower fire flow requirement is more appropriate as the basement is at least 50% below grade.

The estimate foreflows were 150 L/sec and 167 L/sec for the two scenarios, respectively. Hydraulic grade line (HGL) information provided by the City of Ottawa indicates that at least 200 L/sec is available within the water system at the subject site. As the allowable pressure under maximum day plus fire flow conditions is 20 psi, we can conclude that additional fire flow would be available exceeding 200 L/sec at this lower pressure.

In summary, based on our site visit, estimation of fire flow requirements, and boundary conditions provided by the City of Ottawa, adequate system capacity is available at the property for firefighting purposes.

Appendix A – Background Information

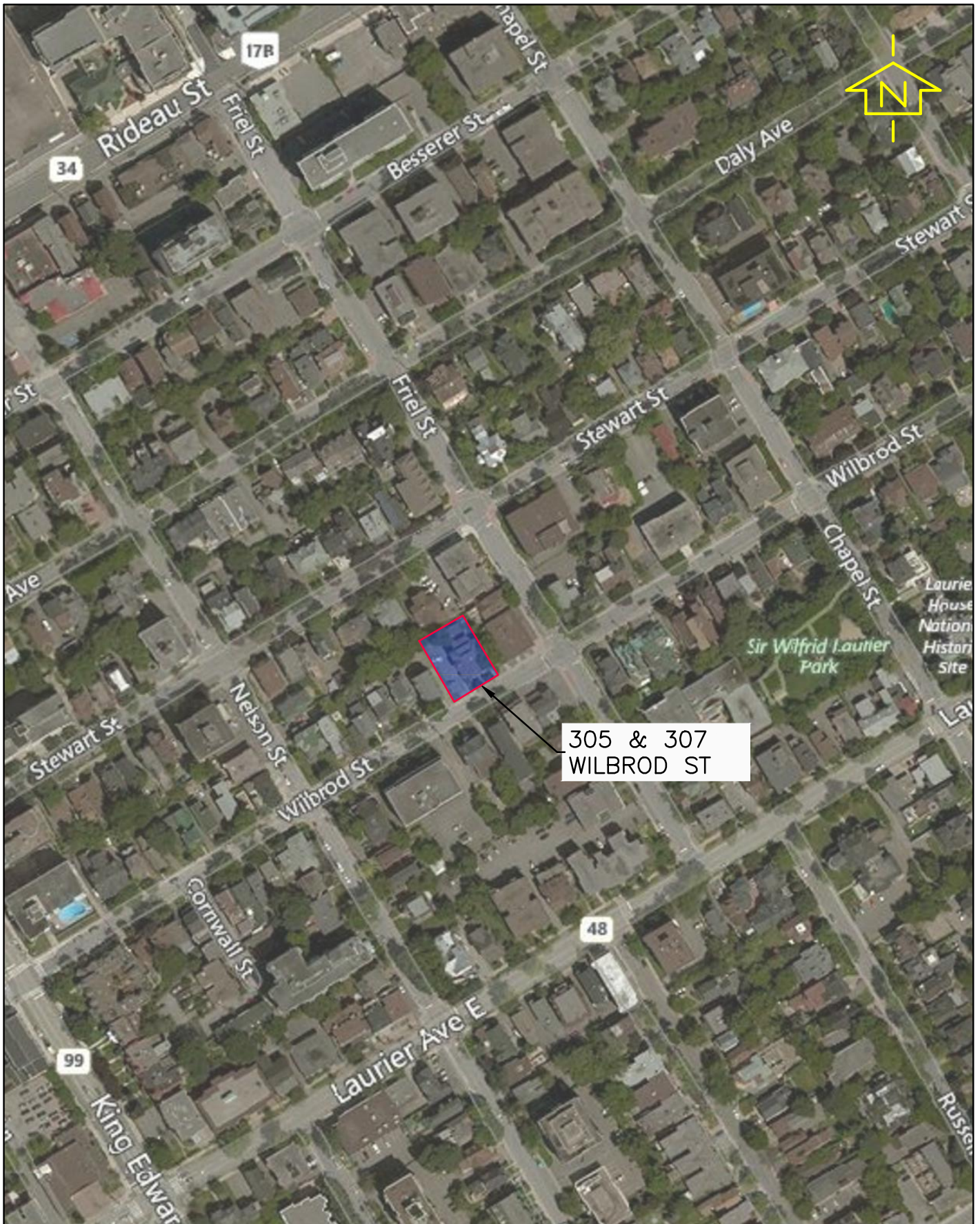**Figure 1: Site Location Plan**

Figure 2: Building Areas & Exposure Distances
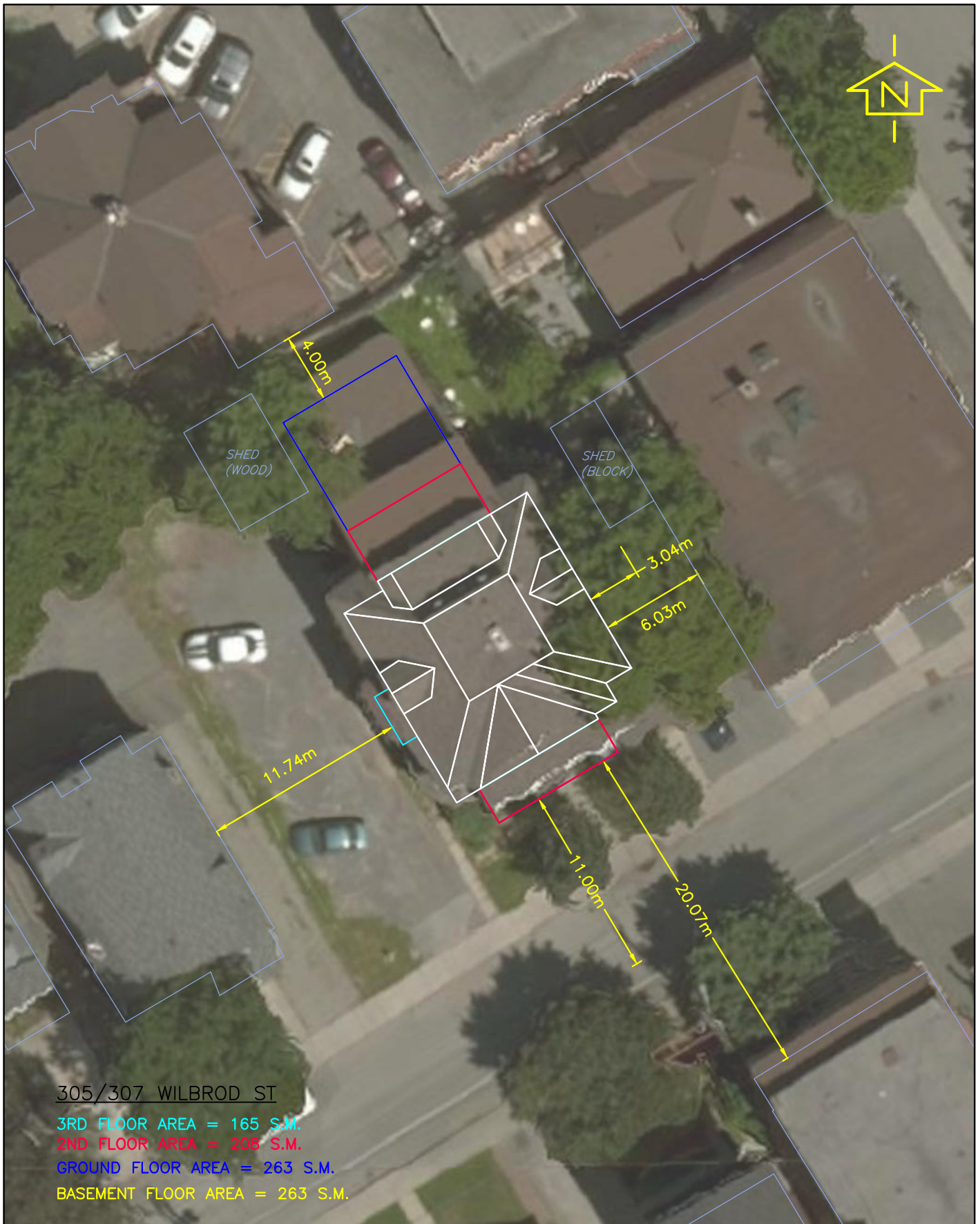
Table 1: Calculation of Fire Flow Requirements

Table 2: Calculation of Fire Flow Requirements – Includes Basement

Correspondence from City of Ottawa

305 & 307
WILBROD ST

DESIGN	ARO	305/307 WILBROD ST	SCALE
DRAWN	ARO	CHARTIER PHYSIOTHERIE	1:2,500
DATE	DEC 2017	SITE	SKETCH NO
FILE NO	244045	LOCATION PLAN	FIG 1

4.00m

3.04m

6.03m

11.74m

11.00m

20.07m

SHED
(WOOD)

SHED
(BLOCK)

N

305/307 WILBROD ST

3RD FLOOR AREA = 165 S.M.
2ND FLOOR AREA = 208 S.M.
GROUND FLOOR AREA = 263 S.M.
BASEMENT FLOOR AREA = 263 S.M.

DESIGN	ARO	305/307 WILBROD ST	SCALE
DRAWN	ARO	CHARTIER PHYSIOTHERIE	1:2,500
DATE	DEC 2017	BUILDING AREAS &	SKETCH NO
FILE NO	244045	EXPOSURE DISTANCES	FIG 2

TABLE 1: CALCULATION OF FIRE FLOW REQUIREMENTS
305/307 WILBROD STREET - 3 STOREY BRICK/STUCCO BUILDING
Calculation Based on Fire Underwriters Survey, 1999

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

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

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 Change (L/min)	Fire Flow Total (L/min)
Choose Building Frame (C)	Wood Frame	1.5	Ordinary Construction	1		
	Ordinary Construction	1				
	Non-combustible Construction	0.8				
	Fire Resistive Construction	0.6				
Input Building Floor Areas (A)	Third Floor		165	636.0 m²		
	Second Floor		208			
	First Floor		263			
	Basement (At least 50% below grade, not included)		0			
Fire Flow (F)	$F = 220 \ \times C \times \sqrt{A}$					5,548
Round Fire Flow (F)	Round to nearest 1,000					**6,000**
	Reductions/Increases Due to Factors Effecting Burning					
Choose Combustibility of Building Contents	Non-combustible	-25%	Non-combustible	-25%	-1,500	4,500
	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	4,500
	No Sprinkler	0%				
	Standard Water Supply for Fire Department Hose Line and for Sprinkler System	-10%	Not Standard Water Supply or Unavailable	0%	0	4,500
	Not Standard Water Supply or Unavailable	0%				
	Fully Supervised Sprinkler System	-10%	Not Fully Supervised or N/A	0%	0	4,500
	Not Fully Supervised or N/A	0%				
Choose Structure Exposure Distance	North Side - 4m	20%	3.1 m to 10.0 m	70%	4,200	8,700
	East Side - 6m	20%	3.1 m to 10.0 m			
	South Side - 11m	15%	10.1 m to 20.0 m			
	West Side - 11.7m	15%	10.1 m to 20.0 m			
Obtain Required Fire Flow	Total Required Fire Flow, Rounded to the Nearest 1,000 L/min =					**9,000**
	Total Required Fire Flow (L/sec) =					**150**

TABLE 2: CALCULATION OF FIRE FLOW REQUIREMENTS
305/307 WILBROD STREET - 3 STOREY BRICK/STUCCO BUILDING - INCLUDES BASEMENT
Calculation Based on Fire Underwriters Survey, 1999

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

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

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 Change (L/min)	Fire Flow Total (L/min)
Choose Building Frame (C)	Wood Frame	1.5	Ordinary Construction	1		
	Ordinary Construction	1				
	Non-combustible Construction	0.8				
	Fire Resistive Construction	0.6				
Input Building Floor Areas (A)	Third Floor		165	899.0 m²		
	Second Floor		208			
	First Floor		263			
	Basement (At least 50% below grade, not included)		263			
Fire Flow (F)	$F = 220 \ \times \ C \ \times \ \sqrt{A}$					6,596
Round Fire Flow (F)	Round to nearest 1,000					**7,000**
	Reductions/Increases Due to Factors Effecting Burning					
Choose Combustibility of Building Contents	Non-combustible	-25%	Non-combustible	-25%	-1,750	5,250
	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	5,250
	No Sprinkler	0%				
	Standard Water Supply for Fire Department Hose Line and for Sprinkler System	-10%	Not Standard Water Supply or Unavailable	0%	0	5,250
	Not Standard Water Supply or Unavailable	0%				
	Fully Supervised Sprinkler System	-10%	Not Fully Supervised or N/A	0%	0	5,250
	Not Fully Supervised or N/A	0%				
Choose Structure Exposure Distance	North Side - 4m	20%	3.1 m to 10.0 m	70%	4,900	10,150
	East Side - 6m	20%	3.1 m to 10.0 m			
	South Side - 11m	15%	10.1 m to 20.0 m			
	West Side - 11.7m	15%	10.1 m to 20.0 m			
Obtain Required Fire Flow	Total Required Fire Flow, Rounded to the Nearest 1,000 L/min =					**10,000**
	Total Required Fire Flow (L/sec) =					**167**

Jason Fitzpatrick

From: Wu, John <John.Wu@ottawa.ca>
Sent: Friday, December 8, 2017 9:22 AM
To: Jason Fitzpatrick
Subject: RE: HGL Boundary Conditions at 305/307 Wilbrod Street
Attachments: 305-307 Wilbrod Dec 2017.pdf

Categories: RECEIVED - TO FILE

Here is the result:

****The following information may be passed on to the consultant, but do NOT forward this e-mail directly.****

The following are boundary conditions, HGL, for hydraulic analysis at 305-307 Wilbrod (zone 1W) assumed to be connected to the 305mm on Wilbrod (see attached PDF for location).

Minimum HGL = 106.7m

Maximum HGL = 115.8 m

Max Day + Fire Flow (100 L/s) = 107.7m

Max Day + Fire Flow (150 L/s) = 107.2m

Max Day + Fire Flow (200 L/s) = 106.7m

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.

Thanks.

John