**Water Supply Calculations**

| | |
|---|---|
| LRL File No. | 210216-02 |
| Date | June 9, 2023 |
| Prepared by | K. Herold |
| Project Location | 6001/6005 Renaud |

**Residential Demand based on the City of Ottawa Design Guidelines-Water Distribution, 2010**

| Unit Type | Persons Per Unit | Number of Units | Population |
|---|---|---|---|
| Townhouse | 2.7 | 20 | 54.0 |
| | **Total** | **20** | **54.0** |

| | | | | |
|---|---|---|---|---|
| Average Water Consumption Rate | 280 | L/c/d | | |
| **Average Day Demand** | **15,120** | **L/d** | **0.18** | **L/s** |
| Maximum Day Factor | 7.5 | | (MOE Table 3-3) | |
| **Maximum Daily Demand** | **112,697** | **L/d** | **1.30** | **L/s** |
| Peak Hour Factor | 11.2 | | (MOE Table 3-3) | |
| **Maximum Hour Demand** | **1,263,509** | **L/d** | **14.62** | **L/s** |

**Water Service Pipe Sizing**

**Q = VA**

Where: V = velocity
A = area of pipe
Q = flow rate

**Assuming a maximum velocity of 1.8m/s, the diameter of pipe is calculated as:**

| | | | |
|---|---|---|---|
| **Minimum pipe diameter (d) =** | $(4Q/\pi V)^{1/2}$ | | |
| **=** | 0.102 | m | |
| **=** | 102 | mm | |
| **Proposed pipe diameter (d) =** | **150** | mm | |
| **=** | **6** | Inches | |

# Fire Flow Calculations
## 6001 / 6005 Renaud - Block A

| | |
|---|---|
| LRL File No. | 210216-02 |
| Date | June 9, 2023 |
| Method | Fire Underwriters Survey (FUS) |
| Prepared by | K. Herold |

| Step | Task | Term | Options | Multiplier | Choose: | Value | Unit | Fire Flow |
|---|---|---|---|---|---|---|---|---|
| **Structural Framing Material** | | | | | | | | |
| **1** | Choose frame used for building | Coefficient C related to the type of construction | Wood Frame | 1.5 | Wood Frame | **1.5** | | |
| | | | Ordinary Construction | 1.0 | | | | |
| | | | Non-combustible construction | 0.8 | | | | |
| | | | Fire resistive construction <2 hrs | 0.7 | | | | |
| | | | Fire resistive construction >2 hrs | 0.6 | | | | |
| **Floor Space Area (A)** | | | | | | | | |
| **2** | Total area (building area of 360m2, 4 stories) | | | | | **1,440** | $m^2$ | |
| **3** | Obtain fire flow before reductions | Required fire flow | Fire Flow = 220 x C x $A^{0.5}$ | | | | L/min | **12,523** |
| **Reductions or surcharge due to factors affecting burning** | | | | | | | | |
| **4** | Choose combustibility of contents | Occupancy hazard reduction or surcharge | Non-combustible | -25% | Limited combustible | **-15%** | L/min | **10,644** |
| | | | Limited combustible | -15% | | | | |
| | | | Combustible | 0% | | | | |
| | | | Free burning | 15% | | | | |
| | | | Rapid burning | 25% | | | | |
| **5** | Choose reduction for sprinklers | Sprinkler reduction | Full automatic sprinklers | -30% | False | **0%** | L/min | **10,644** |
| | | | Water supply is standard for both the system and fire department hose lines | -10% | False | **0%** | | |
| | | | Fully supervised system | -10% | False | **0%** | | |
| **6** | Choose separation | Exposure distance between units | North side | 20.1 to 30m | 10% | | L/min | **15,966** |
| | | | East side | 3.1 to 10m | 20% | | | |
| | | | South side | >45m | 0% | | | |
| | | | West side | 3.1 to 10m | 20% | **50%** | | |
| **Net required fire flow** | | | | | | | | |
| **7** | Obtain fire flow, duration, and volume | Minimum required fire flow rate (rounded to nearest 1000) | | | | | L/min | **16,000** |
| | | Minimum required fire flow rate | | | | | L/s | **266.7** |
| | | Required duration of fire flow | | | | | hr | **4.25** |

## Fire Flow Calculations
## 6001 / 6005 Renaud - Block B

| | |
|---|---|
| LRL File No. | 210216-02 |
| Date | June 9, 2023 |
| Method | Fire Underwriters Survey (FUS) |
| Prepared by | K. Herold |

| Step | Task | Term | Options | Multiplier | Choose: | Value | Unit | Fire Flow |
|---|---|---|---|---|---|---|---|---|
| **Structural Framing Material** | | | | | | | | |
| **1** | Choose frame used for building | Coefficient C related to the type of construction | Wood Frame | 1.5 | Wood Frame | **1.5** | | |
| | | | Ordinary Construction | 1.0 | | | | |
| | | | Non-combustible construction | 0.8 | | | | |
| | | | Fire resistive construction <2 hrs | 0.7 | | | | |
| | | | Fire resistive construction >2 hrs | 0.6 | | | | |
| **Floor Space Area (A)** | | | | | | | | |
| **2** | Total area (building area of 360m2, 4 stories) | | | | | **1,440** | $m^2$ | |
| **3** | Obtain fire flow before reductions | Required fire flow | Fire Flow = 220 x C x $A^{0.5}$ | | | | L/min | **12,523** |
| **Reductions or surcharge due to factors affecting burning** | | | | | | | | |
| **4** | Choose combustibility of contents | Occupancy hazard reduction or surcharge | Non-combustible | -25% | Limited combustible | **-15%** | L/min | **10,644** |
| | | | Limited combustible | -15% | | | | |
| | | | Combustible | 0% | | | | |
| | | | Free burning | 15% | | | | |
| | | | Rapid burning | 25% | | | | |
| **5** | Choose reduction for sprinklers | Sprinkler reduction | Full automatic sprinklers | -30% | False | **0%** | L/min | **10,644** |
| | | | Water supply is standard for both the system and fire department hose lines | -10% | False | **0%** | | |
| | | | Fully supervised system | -10% | False | **0%** | | |
| **6** | Choose separation | Exposure distance between units | North side | 20.1 to 30m | 10% | | L/min | **15,966** |
| | | | East side | 3.1 to 10m | 20% | | | |
| | | | South side | >45m | 0% | | | |
| | | | West side | 3.1 to 10m | 20% | **50%** | | |
| **Net required fire flow** | | | | | | | | |
| **7** | Obtain fire flow, duration, and volume | Minimum required fire flow rate (rounded to nearest 1000) | | | | | L/min | **16,000** |
| | | Minimum required fire flow rate | | | | | L/s | **266.7** |
| | | Required duration of fire flow | | | | | hr | **4.25** |

**Pipe Pressure Losses Calculations**

**LRL File No.** 210216-02
**Project** Navan Stacked Townhomes
**Location:** 6001/6005 Renaud Road
**Date** June 9, 2023
**Designed:** K. Herold

## Piezometric Head Equation (Derived from Bernoulli's Equation)

$$h = \frac{p}{\gamma} + z$$

Where:

h = HGL (m)
p = Pressure (Pa)
γ = Specific weight (N/m3) = 9810
z = Elevation of centreline of pipe (m) = 73.6

| Water Pressure on Huron Street | | | |
|---|---|---|---|
| HGL (m) | | Pressure | |
| | | kPa | psi |
| Minimum = | 126.7 | 520.91 | 75.55 |
| Maximum = | 130.7 | 560.15 | 81.24 |
| Max. Day + Fire = | 115.5 | 411.04 | 59.62 |

## Hazen Williams Equation

$$h_f = \frac{10.67 \times Q^{1.85} \times L}{C^{1.85} \times d^{4.87}}$$

Where:

$h_f$ = Head loss over the length of pipe (m)
Q = Volumetric flow rate ($m^3/s$)
L = Length of pipe (m)
C = Pipe roughness coefficient
d = Pipe diameter (m)

## Scenario 1: maximum daily demand

| | |
|---|---|
| Q (L/s) | 1.30 |
| C | 150 |
| L (m.) | 121.5 |

| | | |
|---|---|---|
| I.D. (mm) | 150 | |
| V (m/s) | 0.07 | |
| $h_f$ (m) | 0.01 | |
| Head Loss (psi) | 0.01 | |
| Min. Pressure (psi) | 75.54 | |
| Max. Pressure (psi) | 81.23 | |
| Service Obv. @ Street Connection (m) | 70.86 | |
| Service Obv. @ Building Connection (m) | 72.50 | |
| Pressure Adjustment (psi) | -2.33 | (due to service elevation difference from street to buildir |
| Adjusted Min. Pressure (psi) | 73.21 | (must not be less than 50psi) |
| Adjusted Max. Pressure (psi) | 78.90 | (must not be more than 80psi) |

**Scenario 2: maximum hourly demand**

| | | |
|---|---|---|
| Q (L/s) | 14.62 | |
| C | 150 | |
| L (m.) | 121.5 | |
| I.D. (mm) | 150 | |
| V (m/s) | 0.83 | |
| $h_f$ (m) | 0.51 | |
| Head Loss (psi) | 0.72 | |
| Min. Pressure (psi) | 74.83 | |
| Max. Pressure (psi) | 80.52 | |
| Service Obv. @ Street Connection (m) | 70.86 | |
| Service Obv. @ Building Connection (m) | 72.50 | |
| Pressure Adjustment (psi) | -2.33 | (due to service elevation difference from street to buildir |
| Adjusted Min. Pressure (psi) | 72.50 | (must not be less than 40psi) |
| Adjusted Max. Pressure (psi) | 78.19 | (must not be more than 80psi) |

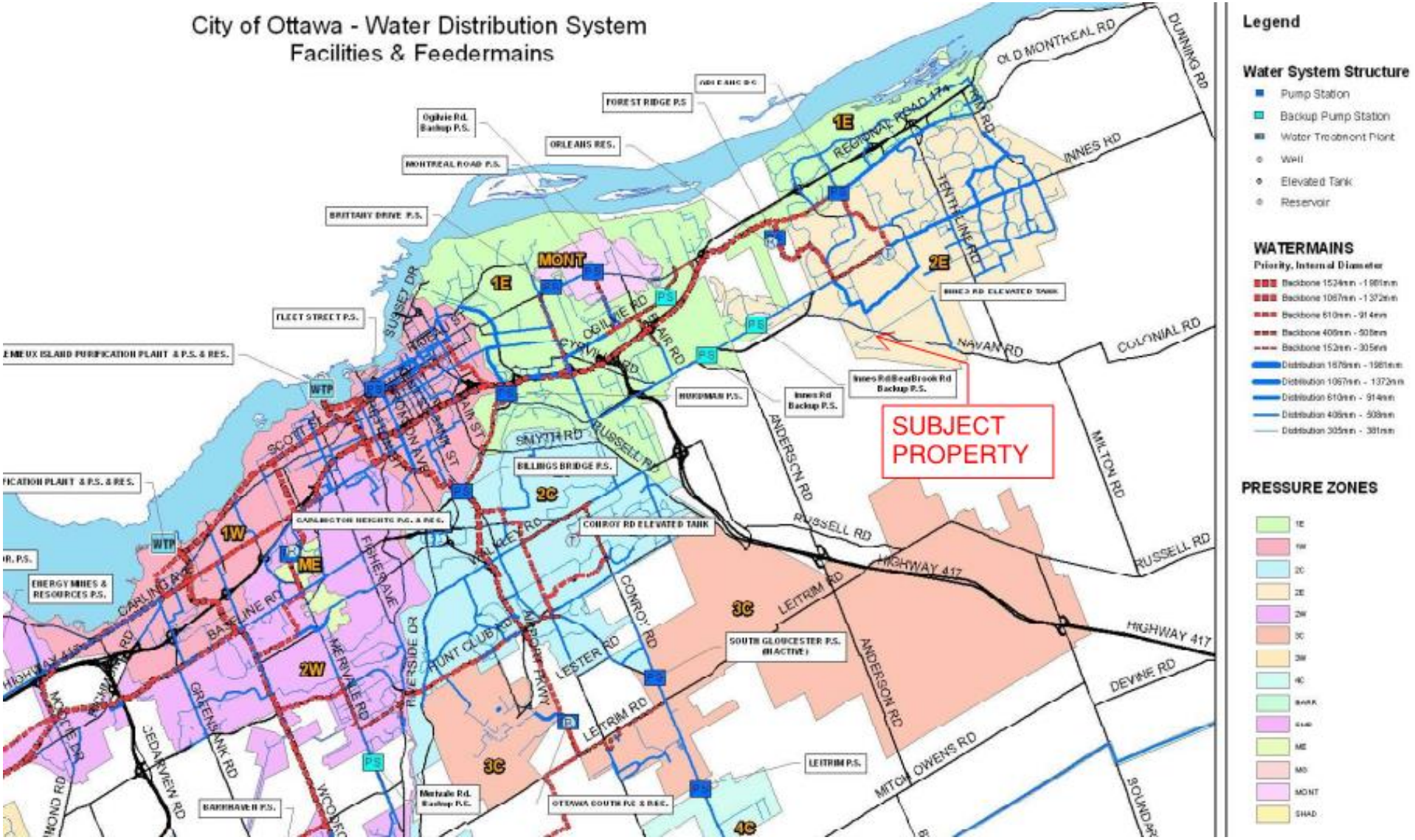
**City of Ottawa Boundary Conditions (Multi-Hydrant Analysis)**

| | Quantity | Max Capacity (L/min)* | Available Fire Flow** (L/min) |
|---|---|---|---|
| Fire Hydrant(s) Within 76m | 2 | 5678 | 11356 |
| Fire Hydrant(s) Within 76m to 152m | 6 | 3785 | 22710 |
| Fire Hydrant(s) Within 152m to 305m | | 2839 | 0 |
| Available Combined Fire Flow (L/min) | | | 34066 |
| Max Day + Fire Flow Demand (L/min) | | | 16000 |

*as per Table 18.5.4.3. of ISTB-2018-02

**assumed class AA hydrants

***flow provided from all hydrants within 76m is more than adaquate to accomcodate fire flow requirements, balance of hydrants within 152m and 305m not considered in design


City of Ottawa - Water Distribution System
Facilities & Feedermains
SUBJECT PROPERTY
Legend
Water System Structure
Pump Station
Backup Pump Station
Water Treatment Plant
Well
Elevated Tank
Reservoir
WATERMAINS
Priority, Internal Diameter
PRESSURE ZONES
1E
1W
2C
2E
2W
3C
3E
4C
ME
MD
MONT
SHAD
OLD MONTREAL RD
DUNNING RD
REGIONAL ROAD 174
INNES RD
TENTH LINE RD
COLONIAL RD
NAVAN RD
RUSSELL RD
HIGHWAY 417
ANDERSON RD
MILTON RD
LEITRIM RD
CONROY RD
DEVINE RD
MITCH OWENS RD
LESTER RD
HUNT CLUB RD
MERIVALE RD
BASELINE RD
CARLING AVE
FISHER AVE
RIVERSIDE DR
GREENBANK RD
JEDBURGH RD
MONTREAL ROAD P.S.
ORLEANS RES.
FOREST RIDGE P.S.
Ogilvie Rd. Backup P.S.
BRITTANY DRIVE P.S.
FLEET STREET P.S.
Innes Rd Backup P.S.
Innes Rd/BearBrook Rd Backup P.S.
BILLINGS BRIDGE P.S.
CONROY RD ELEVATED TANK
SOUTH GLOUCESTER P.S. (INACTIVE)
LEITRIM P.S.
BARRHAVEN P.S.
Merivale Rd. Backup P.S.
OTTAWA SOUTH P.S. & RES.
ENERGY MINES & RESOURCES P.S.
WTP

# Boundary Conditions
## 6001-6005 Renaud Road

**Provided Information**

| Scenario | Demand | |
|---|---|---|
| | L/min | L/s |
| Average Daily Demand | 11 | 0.18 |
| Maximum Daily Demand | 78 | 1.30 |
| Peak Hour | 877 | 14.62 |
| Fire Flow Demand #1 | 16,002 | 266.70 |

**Location**


**Results**

**Connection 1 – Ziegler St.**

| Demand Scenario | Head (m) | Pressure[1] (psi) |
|---|---|---|
| Maximum HGL | 130.7 | 81.2 |
| Peak Hour | 126.7 | 75.5 |
| Max Day plus Fire Flow | 115.5 | 59.5 |

[1] Ground Elevation = 73.6 m

**Notes**

1. As per the Ontario Building Code in areas that may be occupied, the static pressure at any fixture shall not exceed 552 kPa (80 psi.) Pressure control measures to be considered are as follows, in order of preference:

a. If possible, systems to be designed to residual pressures of 345 to 552 kPa (50 to 80 psi) in all occupied areas outside of the public right-of-way without special pressure control equipment.
b. Pressure reducing valves to be installed immediately downstream of the isolation valve in the home/ building, located downstream of the meter so it is owner maintained.

**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. Fire Flow analysis is a reflection of available flow in the watermain; there may be additional restrictions that occur between the watermain and the hydrant that the model cannot take into account.*

# FIRE HYDRANT LOCATIONS FIGURE


**Table 18.5.4.3 Maximum Fire Hydrant Fire Flow Capacity**

| Distance to Building[a] | | Maximum Capacity[b] | |
|---|---|---|---|
| (ft) | (m) | (gpm) | (L/min) |
| ≤ 250 | ≤ 76 | 1500 | 5678 |
| > 250 and ≤ 500 | > 76 and ≤ 152 | 1000 | 3785 |
| > 500 and ≤ 1000 | > 152 and ≤ 305 | 750 | 2839 |

[a]Measured in accordance with 18.5.1.4 and 18.5.1.5.
[b]Minimum 20 psi (139.9 kPa) residual pressure.