

## TECHNICAL MEMORANDUM TM1

DATE	December 22, 2017
TO	<b>Shivan Narine, York Region</b>
SUBJECT	Stouffville Water System Upgrades Class EA <b>Identification of Problem or Opportunity</b>
FROM	Kevin Brown, P.Eng
PROJECT NUMBER	16107

### 1 Background

As part of the Stouffville Water System Upgrades Class Environmental Assessment (Class EA), TMIG has undertaken a review of the background information relating to the community's water supply. The purpose of this technical memorandum is to confirm the Problem Statement for the Class EA.

Stouffville is the largest urban area within the Town of Whitchurch-Stouffville. All references to "Stouffville" relate to the community that is the focus of this Class EA, while references to "the Town" or to "Whitchurch-Stouffville" relate to the larger municipality.

Stouffville is serviced by a combination of groundwater (through five wells) and lake water (provided via the City of Toronto to York Region's ("The Region") McCowan/North Markham PD6 Reservoir as shown in **Figure 2**).

This memo details the existing facilities servicing Stouffville, confirms the Regional water servicing design criteria that apply to the service area, documents past supply data, and establishes the requirements for the current Planning Horizon (established as 2041), with a look-ahead to post-period servicing requirements up to 2061.

### 2 Existing Facilities

The Stouffville Water System is comprised of three pressure districts, Zones 1, 2, and 3. All water supplied into the system is through Zone 2. Zone 1 is supplied through a Booster Pumping Station. Zone 3 is supplied through pressure reducing valves (PRV's) located between Zone 2 and Zone 3. The existing populations, demands and facilities divided by zone can be seen in **Table 1**.

There are five operational wells providing water to the Stouffville water system, in three separate sites as shown in **Figure 2**:

- Wells 1 and 2;
- Well 3; and,
- Wells 5 and 6.

Storage in the system is provided through two elevated water tanks and an in-ground reservoir. The two elevated tanks are the Stouffville Zone 1 Elevated Tank and the Stouffville (Zone 2) Elevated Tank. The reservoir is the Stouffville Reservoir, which is split into the East and West cells and equipped with a high lift pumping station.

There are two (2) booster stations supplying the Stouffville water system, two (2) high lift stations and three (3) well pumping stations. These are:

- Highway 48 Booster Pumping Station (located at Wells 5&6),
- Stouffville Zone 1 Booster Pumping Station (located at Well 3),
- Stouffville Zone 2 Pumping Station/Re-chlorination Facility (located at McCowan/North Markham Reservoir),
- Stouffville High Lift Pumping Station (located at Wells 5&6)
- Wells 5&6 Low Lift Pumping Station

- Well 3 Pumping Station, and
- Wells 1&2 Pumping Station

The Highway 48 Booster Pumping station services a small subdivision north of Bloomington Side Road on Highway 48. The Zone 1 Booster pumping station services all of Zone 1. The Stouffville Zone 2 Pumping Station/Re-chlorination Facility provides lake based water to Zone 2. The Well 3 pumping station, Wells 1&2 pumping station and Stouffville High Lift Pumping Station (located at wells 5&6) all supply well water to Zone 2. Refer to **Figure 3** for the locations of the various facilities.

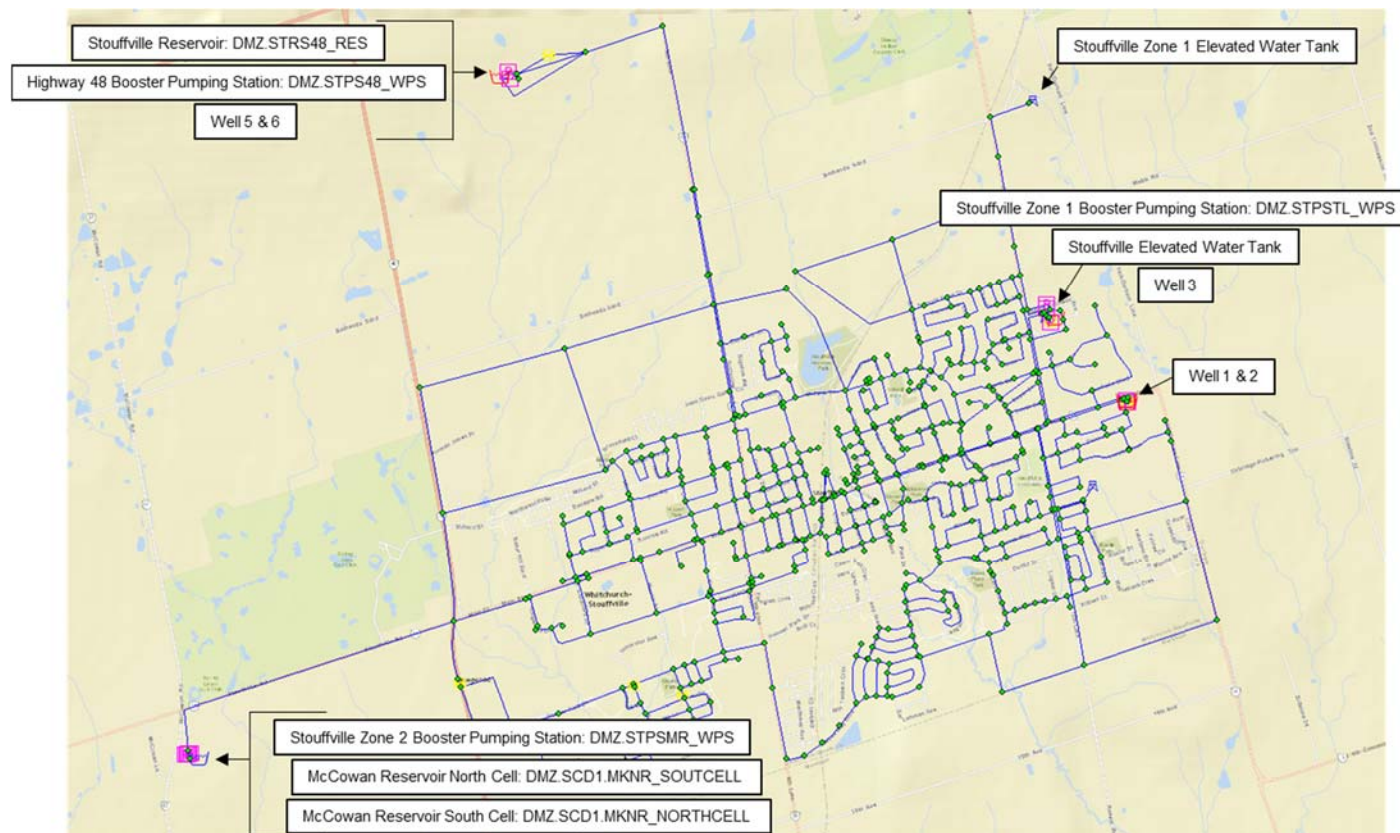
**TABLE 1**      **EXISTING SERVICING CONDITIONS <sup>[1]</sup>**

Zone	2016 Residential Population	2016 Employment Population	2016 Total Population	2016 Residential Demand [m <sup>3</sup> /d]	2016 Employment Demand [m <sup>3</sup> /d]	2016 Total Demand [m <sup>3</sup> /d]	Facilities
1	4,038	1,021	5,059	1,700	330	2,030	1. Stouffville Zone 1 Elevated Tank 2. Stouffville Zone 1 Booster Pumping Station
2	25,073	6,060	31,133	10,530	1,980	12,510	1. Stouffville (Zone 2) Elevated Tank 2. Wells 1, 2, 3, 5 and 6 3. Stouffville Reservoir (East and West Cells) 4. Stouffville Zone 2 Pumping Station 5. Highway 48 Booster Pumping Station 6. McCowan/North Markham Reservoir One PRV
3	1,139	2,011	3,150	480	660	1,140	1. PRV 1, 2 and Future PRV
Total	30,250	9,092	39,342	12,710	2,970	15,680	

1. Values from Water Model, Based on York Region's 2016 Water and Wastewater Master Plan (WWMP)

Please refer to **Figure 1** for a map showing the existing facilities. Included are the SCADA tag names of the various facilities, as well as the terminology for these facilities that will be carried throughout this report.

**FIGURE 1 - STOUFFVILLE EXISTING FACILITIES**



## 2.1 Supply Wells and Treatment Processes

There are six wells supplying the Stouffville Water System, as shown in **Figure 2**. The supply well details are provided in **Table 2**.

Wells 1 and 2 are located at 6985 Main Street, Stouffville and were commissioned in 1999<sup>1</sup>. The pumping capacities of Wells 1 and 2 are 34.1 L/s each at a TDH of 94.73 – 117.76 m. (Stouffville Water Supply System, Engineer's Report. Giffels. 2001).

Well 3 is located at 12519 Tenth Line, Stouffville, and was commissioned in 1984, with upgrades in 2004. The pumping capacity of this well is 39.8 L/s at a TDH of 75 m. 2004 (Stouffville Well No. 3 Condition Assessment Report, 2014).

Wells 5 and 6 are located at 13461 Highway 48, Stouffville and were commissioned in 1967, with upgrades in 2002, 2004, and 2005. The pumping capacities of Wells 5 and 6 are 34.0 L/s at a TDH of 24.4 m and 26.5 L/s at a TDH of 25.6 m respectively (Stouffville Well No. 5 and 6 Condition Assessment Report, 2014).

The well firm capacity of the system is 11,120 m<sup>3</sup>/d based on the Permits to Take Water (PTTW) for each well system. This assumes that the highest capacity well (Well 3) is out of service.

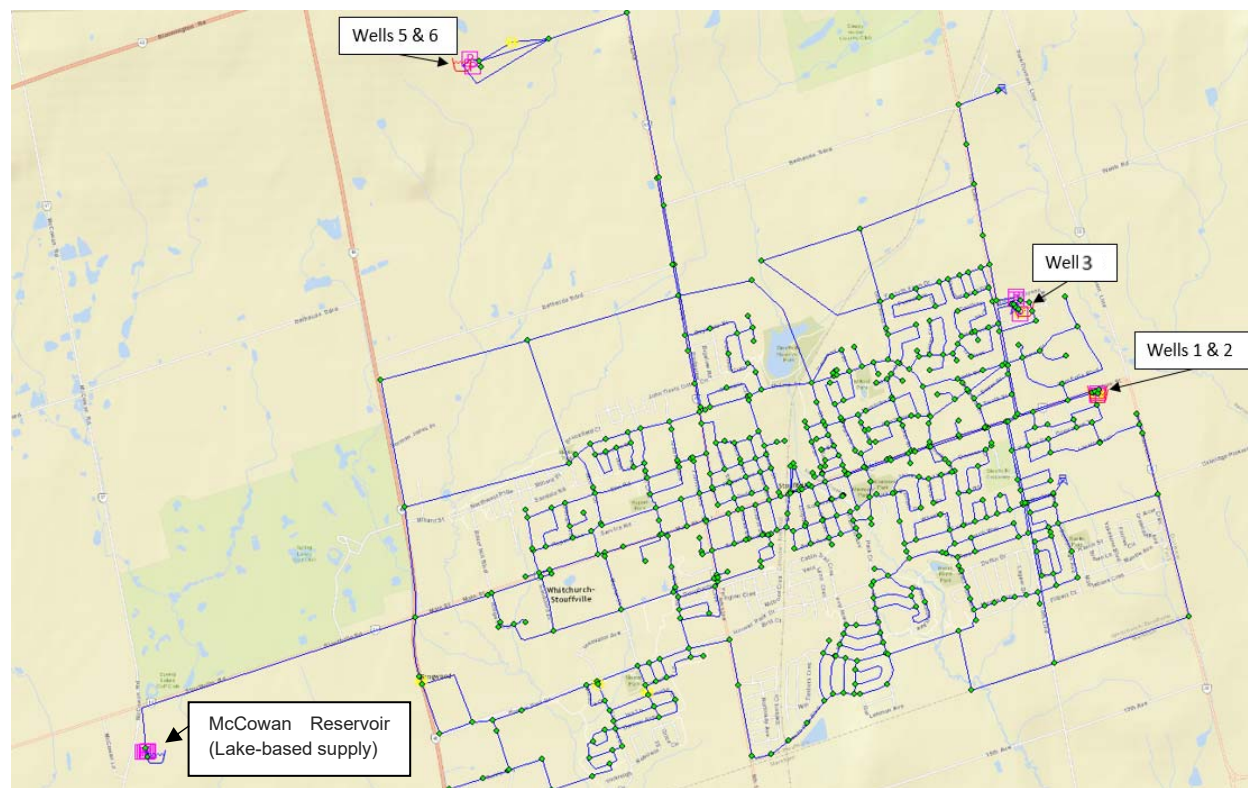
Wells 1 and 2, have sodium hypochlorite added for disinfection as well as sodium silicate for iron and manganese sequestering. Well 3 has gaseous chlorine added for disinfection along with sodium silicate for iron and manganese

<sup>1</sup> Facility commissioned dates are approximate, but are expected to be accurate to +/- 1 year. Discrepancies can arise as facilities are sometimes constructed across two calendar years, and the dates on the drawings might refer to the *start* of construction. For the purposes of this memo, this potential error is not significant.

sequestering. Wells 5 and 6 use an Ultraviolet system for primary disinfection, with gaseous chlorine added for secondary disinfection and to maintain a chlorine residual in the water leaving the facility.

The Stouffville Zone 2 Pumping Station is located at 12157 McCowan Road. There are four booster pumps in the Zone 2 Pumping Station, supplying lake based water from the McCowan/North Markham Reservoir. BP1, BP2 and BP3 have a capacity of 88 L/s at 75 m TDH, while BP4 has a capacity of 44 L/s at 67 m TDH and operates as a jockey pump during typical lower flow periods. The two larger pumps combine to provide the firm capacity of 15 MLD or 176 L/s with the third large pump and the jockey as standby.

**FIGURE 2      STOUFFVILLE WATER SUPPLY LOCATIONS**



Well details from the Region's Permit to Take Water (Number 8125-AJ8Q32) are also provided in **Table 2**.

**TABLE 2 WATER SUPPLY SYSTEM DETAILS**

Source	Location	Commissioned	PTTW Max Daily Water Taking [m <sup>3</sup> /d]	2015 Max Daily Water Taking [m <sup>3</sup> /d]	2015 Avg Daily Water Taking [m <sup>3</sup> /d]	Pumping Capacity [m <sup>3</sup> /d]	Treatment Capacity [m <sup>3</sup> /d]	Net Supply Capacity <sup>2</sup> [m <sup>3</sup> /d]
Well 1	6985 Main Street	1999	2,946 <sup>[1]</sup>	1,920 <sup>[7]</sup>	588 <sup>[7]</sup>	2,946 <sup>[3]</sup>	Sodium Hypochlorite metering pump: 5,892 m <sup>3</sup> /d <sup>[3]</sup>	5,892
Well 2		1999 <sup>[3]</sup>	2,946 <sup>[1]</sup>	1,838 <sup>[7]</sup>	550 <sup>[7]</sup>	2,946 <sup>[3]</sup>	Sodium Hypochlorite Storage: 9 days <sup>[3]</sup> Sodium Silicate: Storage of 36 days <sup>[3]</sup>	
Well 3	12519 Tenth Line	1983 (upgrades in 2004)	2,946 <sup>[1]</sup>	2,046 <sup>[8]</sup>	1,104 <sup>[8]</sup>	3,439 <sup>[4]</sup>	Chlorine Gas Storage: 103 Days <sup>[4]</sup> CT: Flow is greater than mechanical capacity of pumps 3,439 m <sup>3</sup> /d (39.8 L/s) <sup>[4]</sup> Sodium Silicate: Storage of 55 days <sup>[4]</sup>	2,946
Well 5	13461 Highway 48	1967 (upgrades in 2002, 2004, 2005)	3,110 <sup>[1]</sup>	1,415 <sup>[9]</sup>	80 <sup>[9]</sup>	2,938 LL <sup>[5]</sup> 3,974 HL <sup>[5]</sup>	Two Treatment Trains Chlorine Gas Chlorinator Capacity: 0.38 kg/hr <sup>[5]</sup>	5,228
Well 6		1967 (upgrades in 2002, 2004, 2005)	2,290 <sup>[1]</sup>	1,393 <sup>[9]</sup>	789 <sup>[9]</sup>	2,290 LL <sup>[5]</sup> 3,974 HL <sup>[5]</sup>	CT: Flow is greater than mechanical capacity of pumps 7,948 m <sup>3</sup> /d (92 L/s) <sup>[5]</sup> UV: 6,221 m <sup>3</sup> /d <sup>[5]</sup>	
Lake-Based Stouffville Zone 2 Pumping Station	12,157 McCowan Road	2009	15,000 <sup>[6]</sup>	7,820	4,050	15,000 <sup>[6]</sup>	Re-chlorination Facility	15,000
Total Capacity			29,238			29,559		29,066
Firm Capacity			26,128			26,120		26,120

1. Stouffville Permit to Take Water

2. Lower of PTTW Max Daily Water Taking, Pumping Capacity, and Treatment Capacity

3. Operations Manual Wells 1&amp;2

4. Operations Manual Well 3

5. Wells 5&amp;6, Disinfection Building, Reservoir, High Lift Pumping Station, Hwy. 48 Booster Pumping Station Operations Manual

6. Zone 2 Booster Pumping Station Operations Manual

7. SCADA Data from Region, Stouffville Wells 1 and 2 2015

8. SCADA Data from Region, Stouffville Well 3 2015

9. SCADA Data from Region, Stouffville Wells 5 and 6 2015

## 2.2 Inter-Zone Transfers

### 2.2.1 Booster Station

There are two booster pumping stations in the Stouffville Water System:

- the Highway 48 Booster Pumping Station (located at Wells 5 & 6 site);
- the Stouffville Zone 1 Booster Pumping Station (located at Well 3 site); and,

Refer to **Figure 3** for a map of the locations of the booster pumping stations. Refer to **Table 3** for existing booster pump details.

The Highway 48 booster pumping station was commissioned in 1983 and consists of two Submersible multi-stage centrifugal pumps each at 3.2 L/s with a TDH of 67.6 m, resulting in a firm capacity of 3.2 L/s (277 m<sup>3</sup>/day). This station services a small separate service area to the north of Wells 5 and 6.

The Stouffville Zone 1 Booster Pumping Station is located at 12519 Tenth Line and consists of two centrifugal pumps each rated at 62.5 L/s and a TDH of 21.6 m to 32.6 m, resulting in a firm capacity of 62.5 L/s.

**TABLE 3 EXISTING BOOSTER PUMP DETAILS**

Zone	Name	Location	Commissioned	Rated Capacity [m <sup>3</sup> /day]	2015 Max Daily Pumpage [m <sup>3</sup> /d]	2015 Avg Daily Pumpage [m <sup>3</sup> /d]
-	Highway 48 Booster Pumping Station	13461 Highway 48 <sup>[1]</sup>	1983 <sup>[1]</sup>	272 <sup>[2]</sup>	260.93	47.52
1	Stouffville Zone 1 Pumping Station	12,519 Tenth Line <sup>[2]</sup>	2007 <sup>[3]</sup>	5,400 <sup>[2]</sup>	0	0

1. Stouffville High Lift Pumping Station & Highway 48 BPS CA Report

2. York Region Drinking Water System DWWP

3. W-T0511-001-COVER-AR, Stouffville Zone 1 Booster Pumping Station Drawing Set

### 2.2.2 Pressure-Reducing Valves

There are two existing Pressure Reducing Valves from the Zone 2 to Zone 3 transfer in the Stouffville Water System and one future PRV to be installed in 2021 (as per the York Region's 2016 Water and Wastewater Master Plan):

- PRV 1 located near the intersection of Sandiford Drive and Hoover Park Drive
- PRV 2 located on Mostar Street near Clamerten Road/Goudie Crescent
- Future PRV located on Highway 48 North of Hoover Park Drive and South of Main Street

Additionally, there is one existing PRV for Zone 1 to Zone 2 transfer, but currently is not in operation. There is also another future planned PRV for Zone 1 to Zone 2 transfer as per the Hatch "Optimization Study and Transient Analysis of the Stouffville Zone 2/3 System". Refer to **Table 4** for information on existing and future planned PRVs.

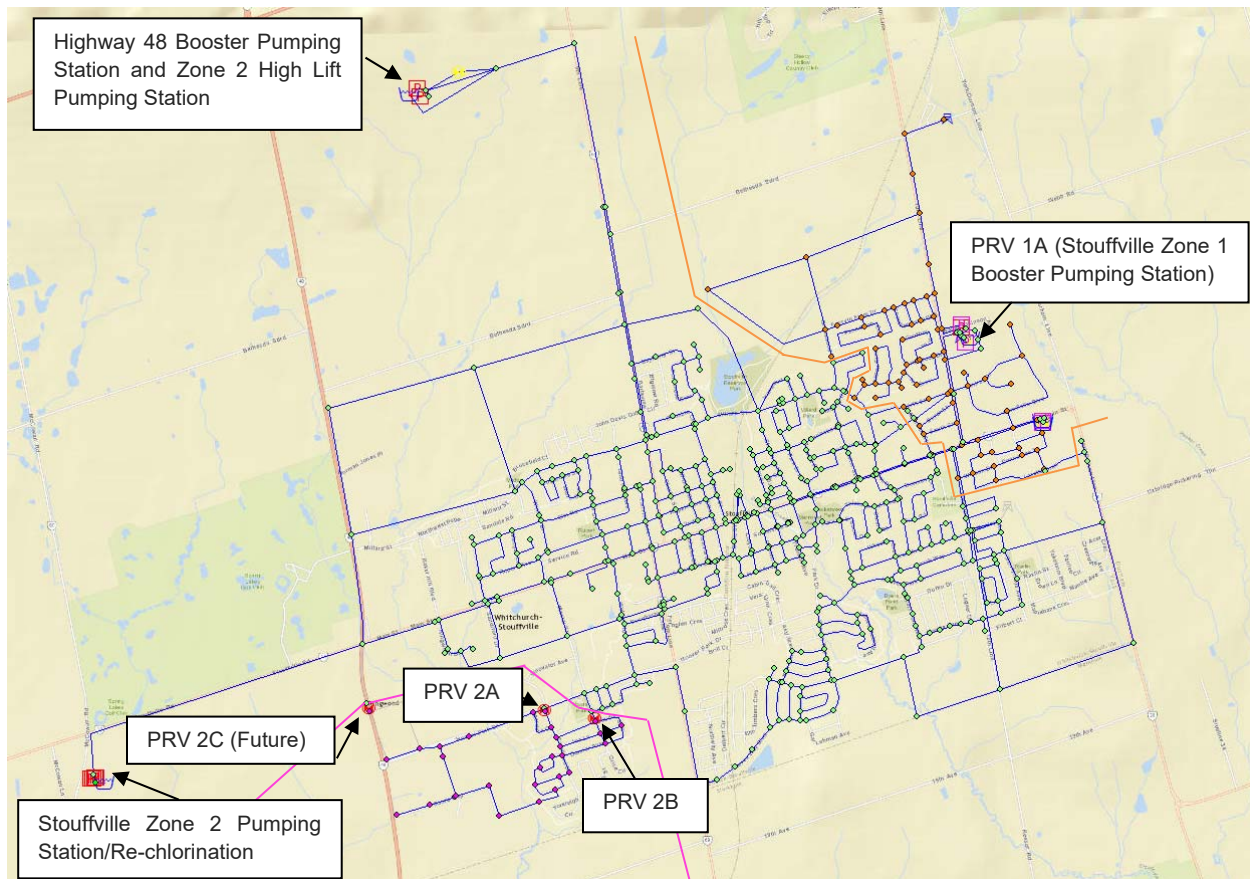


**TABLE 4 PRESSURE REDUCING VALVES <sup>[1]</sup>**

PRV	Zone From → To	Location	Diameter [mm]	Setting [m]
1A	1 → 2	Zone 1 Booster Pumping Station		
2A	2 → 3	Hoover Park Drive and Sandiford Drive	300	53.2
2B	2 → 3	Mostar Street and Clamerten Road	250	51.1
2C (Future)	2 → 3	Highway 48, South of Hoover Park Drive	400	48.0

1. Diameter and Setting extracted from Water Model provided by the Region, based on York Region's 2016 Water and Wastewater Master Plan (WWMP)

**FIGURE 3 BOOSTER PUMPING STATION AND PRV LOCATIONS**



## 2.3 Water Storage

Water Storage in the Stouffville water system is provided by two elevated water tanks, Stouffville Zone 1 Elevated Tank, and the Stouffville (Zone 2) Elevated Water Tank. There is pumped inground storage available at the Stouffville Reservoir. Refer to **Figure 4** for a map of the locations of water storage in the Stouffville Water System, and **Table 5** for Existing Water Storage Details.

The Stouffville Zone 1 Elevated Tank was commissioned in 2007 and has a volume of 6,140 m<sup>3</sup>. The tank has an operating range between 337.31 m and 349.35 m.

The Stouffville (Zone 2) Elevated Tank was commissioned in 1983 with a volume of 3,400 m<sup>3</sup> (Condition Assessment Report, Stouffville Zone II CET, 2016). It has an operating range of 313.94 m – 323.09 m.

**TABLE 5 EXISTING WATER STORAGE DETAILS**

Zone	Name	Location	Commissioned	Volume [m <sup>3</sup> ]	HGL Operating Range [m]
1	Stouffville Zone 1 Elevated Tank <sup>[1]</sup>	6842 Bethesda Road <sup>[1]</sup>	2007 <sup>[1]</sup>	6,140 <sup>[1]</sup>	345.5 – 347.0 <sup>[7]</sup>
2	Stouffville (Zone 2) Elevated Tank <sup>[2]</sup>	12519 Tenth Line <sup>[2]</sup>	1983 <sup>[2]</sup>	3,400 <sup>[2]</sup>	319.5 – 322.9 <sup>[7]</sup>
-	Stouffville Reservoir East Cell <sup>[3]</sup>	13461 Highway 48 <sup>[3]</sup>	1967 <sup>[6]</sup>	2,136 <sup>[3]</sup>	308.2 – 308.4 <sup>[7]</sup>
-	Stouffville Reservoir West Cell <sup>[3]</sup>		1967 <sup>[6]</sup>	2,996 <sup>[3]</sup>	
Total				14,672	
* It is assumed that the McCowan/North Markham Reservoir's storage (60,000 m <sup>3</sup> ), is storage for PD6 and not used for the Stouffville Water System Storage					

1. Stouffville Zone 1 Elevated Tank Operations Manual

2. Stouffville (Zone 2) Elevated Tank Operations Manual

3. Wells 5&6, Disinfection Building, Reservoir, High Lift Pumping Station, Hwy. 48 Booster Pumping Station Operations Manual

4. Stouffville Zone 1 Elevated Water Storage Tank, Tank Section Drawing

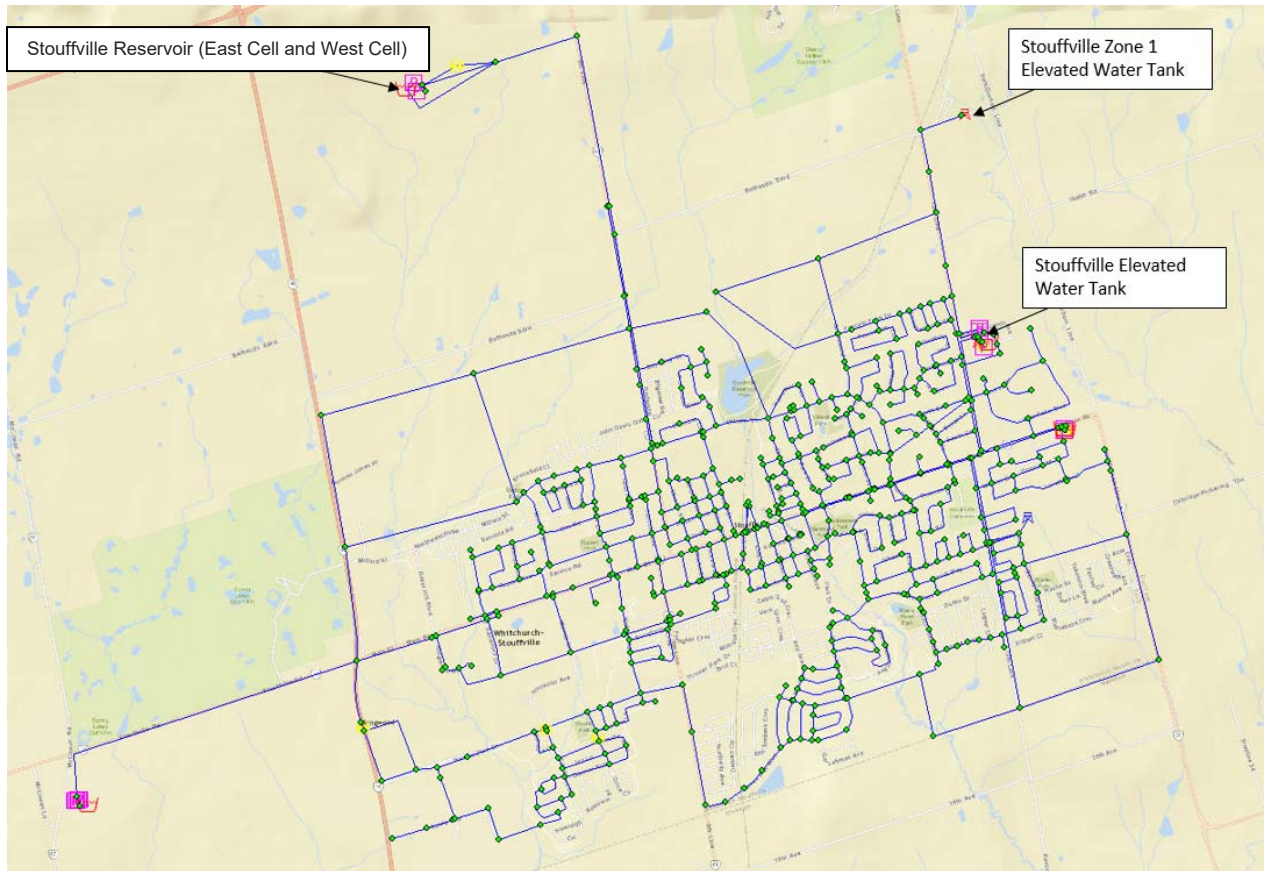
5. W-348234-003-1-AC.TIF, Stouffville Elevated Tank Drawing

6. Detailed Condition Assessment, Stouffville Reservoir, The Regional Municipality of York, Cole Engineering. August 2015.

7. York Region's 2016 Water and Wastewater Master Plan (WWMP)



**FIGURE 4 WATER STORAGE LOCATIONS**



### 3 Population Data

Below is a table outlining the population projections as per the planning data and York Region's 2016 Water and Wastewater Master Plan Model. Populations used for the Master Plan were provided. TMIG have been advised that these are still current.

**TABLE 6 POPULATION PROJECTIONS FROM YORK REGION'S 2016 WATER AND WASTEWATER MASTER PLAN (WWMP)<sup>[1]</sup>**

Source	2016	2021	2026	2031	2036	2041
Water Service Area	39,342	48,412	57,476	60,351	62,093	64,671
Zone 1 Residential Population	4,038	6,688	9,339	9,821	10,000	10,498
Zone 1 Employment Population	1,021	1,426	1,712	1,814	1,928	2,033
Zone 1 Total	5,059	8,114	11,051	11,635	11,928	12,531
Zone 2 Residential Population	25,073	29,644	34,214	35,685	36,250	37,531
Zone 2 Employment Population	6,060	7,042	8,002	8,463	8,938	9,278
Zone 2 Total	31,133	36,686	42,216	44,148	45,188	46,809
Zone 3 Residential Population	1,139	1,300	1,462	1,559	1,700	1,868
Zone 3 Employment Population	2,011	2,312	2,747	3,009	3,277	3,463
Zone 3 Total	3,150	3,612	4,209	4,568	4,977	5,331

1. Populations are from the projections used in York Region's 2016 Water and Wastewater Master Plan (WWMP)

## 4 Design Criteria

The per capita demands were based on York Region's 2016 Water and Wastewater Master Plan values received from the Region. Refer to **Table 7** below for an overview of the consumption rates across the various years.

**TABLE 7 UNIT CONSUMPTION RATES <sup>[1]</sup>**

Pressure District	2016	2021	2026	2031	2036	2041
<b>Residential Unit Rates by Year (L/c/d)</b>	233.0	218.0	211.0	201.0	195.0	189.0
<b>Employment Unit Rates by Year (L/c/d)</b>	182.0	164.0	160.0	155.0	149.0	144.0
<b>Combined Unit Rates by Year (L/c/d)</b>	327.0	306.0	295.0	282.0	276.0	265.0

1. York Region's 2016 Water and Wastewater Master Plan Design Criteria
2. Design Criteria has been duplicated from 2041 for 2051 and 2061

The peaking factor used was 1.8. This value was obtained from York Region's Water and Wastewater Master Plan design basis provided by the Region.

The fire flow was based on the Region's design criteria. Sentence 14.4.2.1.g. of the York Region Water System Design Guideline describes the fire demands:

*"The water distribution system must be adequate to meet all of the demands in the system, including fire demand from the highest potential fire risk in the district. Fire demands to be determined using the "Water Supply for Public Fire Protection – a Guide to Recommended Practice 1991", by the Fire Underwriters Survey. In addition a commercial or industrial fire of 17,000 L/min for a duration of 3.5 hours to be used for all large pressure districts and a fire of 10,000 L/min for a duration of 2 hours to be used for smaller pressure districts with smaller commercial, medium and high density residential developments."*

In the case of this system, the criteria of 17,000 L/min for a duration of 3.5 hours has been used.

## 5 Water Supply Requirements

### 5.1 Recent Water Consumption

TMIG have reviewed the daily water production records provided by the Region from January 2011 through to and including December 2015. A summary of that data is provided in **Table 8**.

**TABLE 8 HISTORICAL WATER PRODUCTION DATA (2011-2015)**

	2011	2012	2013	2014	2015
Population	31,971 <sup>[3]</sup>	33,443	34,917	36,392	37,866
Average Day Well Supply (m <sup>3</sup> /d) <sup>[1]</sup>	3,800	3,693	3,786	3,508	3,833
Average Day McCowan Reservoir Supply (m <sup>3</sup> /d)	3,955	3,993	3,640	4,019	4,050
Average Day Total (m <sup>3</sup> /d)	7,755	7,686	7,426	7,527	7,883
Average Per-Capita Consumption (Lpcd)	243	230	213	207	208
Maximum Day Production (m <sup>3</sup> /d) <sup>[1]</sup>	14,576	13,448	11,810	10,928	14,830
Maximum Per-Capita Production (Lpcd)	456	402	338	300	392
Maximum Day Factor <sup>[2]</sup>	1.88	1.75	1.59	1.45	1.88

1. SCADA Data from Region
2. MDF Factor is from York Region's 2016 Water and Wastewater Master Plan
3. Population data for 2011 was extrapolated from values in York Region's 2016 Water and Wastewater Master Plan assuming same growth rate as 2016-2021

This data shows that the recent water consumption trends (208 – 243 Lpcd in an average day) are lower than the design values (327 Lpcd for 2016). The actual values are at approximately 75% of the design values.

The design values are appropriately conservative for a planning-level analysis.

### 5.2 Projected Supply Requirements

The existing and buildout water supply requirements are presented in **Table 9**, based on the projected populations and design criteria.

While the current firm water supply capacity (26,120 m<sup>3</sup>/day) exceeds the 2061 projected maximum day demand (21,445 m<sup>3</sup>/day), there would be an overall decline in the available supply capacity if any of the existing wells were to be retired at the end of their design life (without a commensurate increase in the supply from the Lake-Based supply).

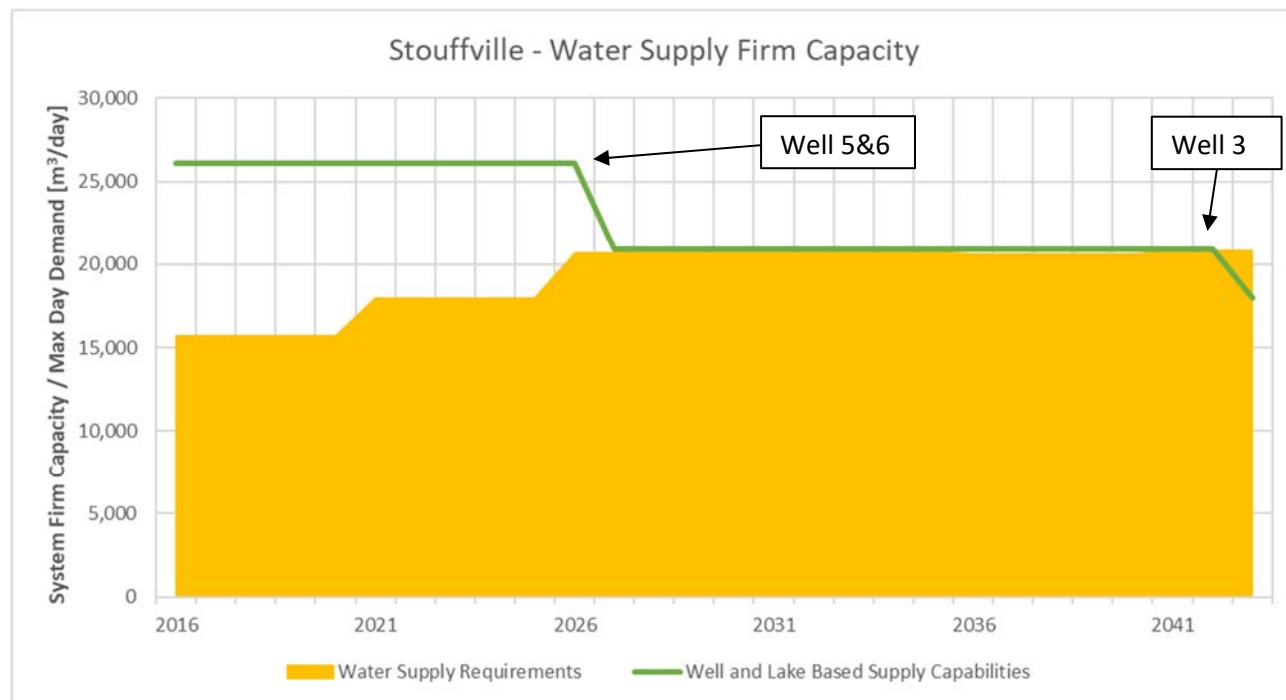
**Table 10** and **Figure 5** show how the existing water supply system would fail to meet the overall demands when factoring in the Stouffville firm water supply capacity and estimated available service life for each of the wells. In other words, **Table 10** and **Figure 5** highlight decision points where the Region will have to choose to either re-invest in existing infrastructure or modify operational strategy. This total supply capacity considers the highest capacity well at any given year examined out of service. Based on the information provided, Wells 1 and 2 will reach their design life by year 2048, Wells 5, and 6 by 2026, and Well 3 by 2043. Note in **Table 10**, Well 3 is set to 0 for firm supply reasons as it has the largest supply capacity of the wells.

**Figure 6** demonstrates that the Zone 1 Booster Pumping Station (effectively, the Zone 1 supply) has sufficient long-term capacity to meet the projected maximum day demands from that zone.

**TABLE 9 DESIGN WATER SUPPLY REQUIREMENTS BY ZONE**

Source <sup>[1]</sup>	2016	2021	2026	2031	2036	2041
Total Max Day Demands (m <sup>3</sup> /day)	15,686	17,955	20,657	20,767	20,627	20,821
Zone 1 Residential Demand (m <sup>3</sup> /day)	1,696	2,625	3,543	3,560	3,507	3,573
Zone 1 Employment Demand (m <sup>3</sup> /day)	334	421	491	506	519	528
Zone 1 Total (m <sup>3</sup> /day)	2,030	3,046	4,034	4,066	4,026	4,101
Zone 2 Residential Demand (m <sup>3</sup> /day)	10,534	11,635	12,980	12,935	12,714	12,774
Zone 2 Employment Demand (m <sup>3</sup> /day)	1,985	2,081	2,299	2,361	2,409	2,410
Zone 2 Total (m <sup>3</sup> /day)	12,519	13,716	15,279	15,296	15,123	15,184
Zone 3 Residential Demand (m <sup>3</sup> /day)	478	510	555	565	596	636
Zone 3 Employment Demand (m <sup>3</sup> /day)	659	683	789	840	882	900
Zone 3 Total (m <sup>3</sup> /day)	1,137	1,193	1,344	1,405	1,478	1,536

1. Demands Extracted from York Region's 2016 Water and Wastewater Master Plan

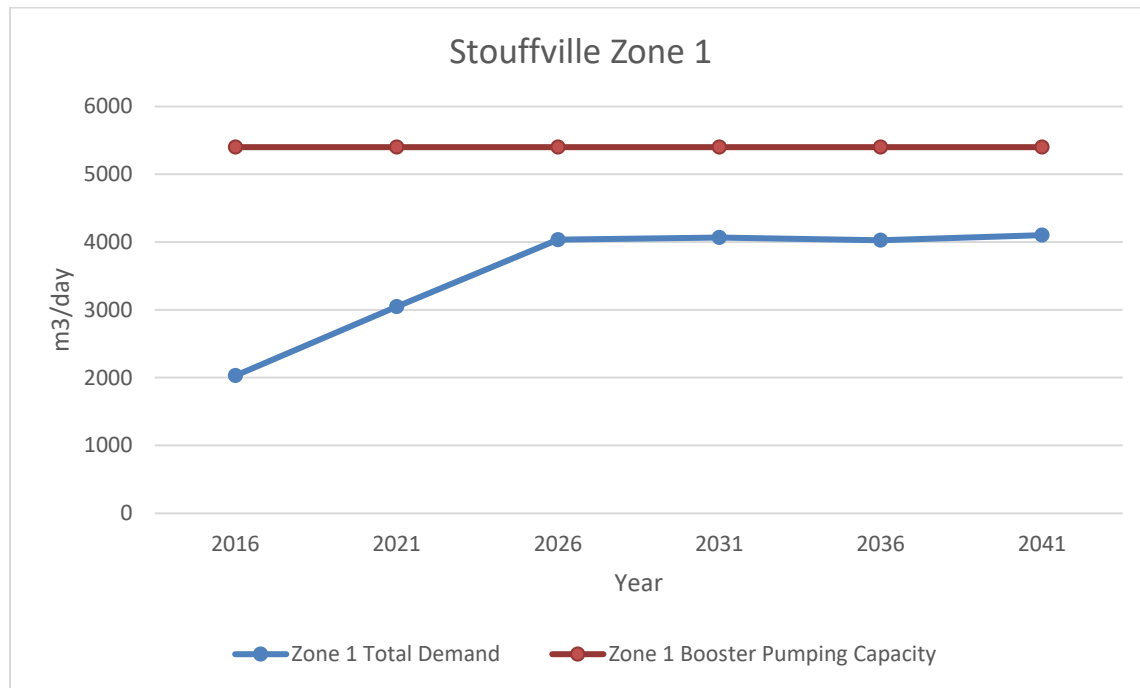
**FIGURE 5      STOUFFVILLE SYSTEM**

**TABLE 10      STOUFFVILLE WATER SUPPLY FIRM CAPACITY WITH END OF LIFE FOR WELLS**

	2016	2021	2026	2031	2036	2041
Population	39,342	48,412	57,476	60,351	62,093	64,671
MDD (m <sup>3</sup> /day)	15,686	17,955	20,657	20,767	20,627	20,821
Well 1 (m <sup>3</sup> /day)	2,946	2,946	2,946	2,946	2,946	2,946
Well 2 (m <sup>3</sup> /day)	2,946	2,946	2,946	2,946	2,946	2,946
Well 3 (m <sup>3</sup> /day)	0	0	0	0	0	0
Well 5 (m <sup>3</sup> /day)	2,938	2,938	2,938	0	0	0
Well 6 (m <sup>3</sup> /day)	2,290	2,290	2,290	0 <sup>(2)</sup>	0	0
Lake Based Supply (m <sup>3</sup> /day)	15,000	15,000	15,000	15,000	15,000	15,000
Firm <sup>(1)</sup> (m <sup>3</sup> /day)	26,120	26,120	26,120	20,892	20,892	20,892

1. Highest Capacity Well out of service (denoted by italics)
2. Well 6 decommission date from Master Plan Water Schematics states 2010, as this is not the case, the decommission date of 2026 from Well 5 has been used for Well 6



**FIGURE 6**      **STOUFFVILLE ZONE 1 CAPACITY**



From **Figure 6** above it can be seen that the Zone 1 Total Demand does not exceed the Zone 1 Booster Pumping Capacity for the years analyzed.

## 6 Water Storage Requirements

Design storage volume is typically established based on the sum of the following:

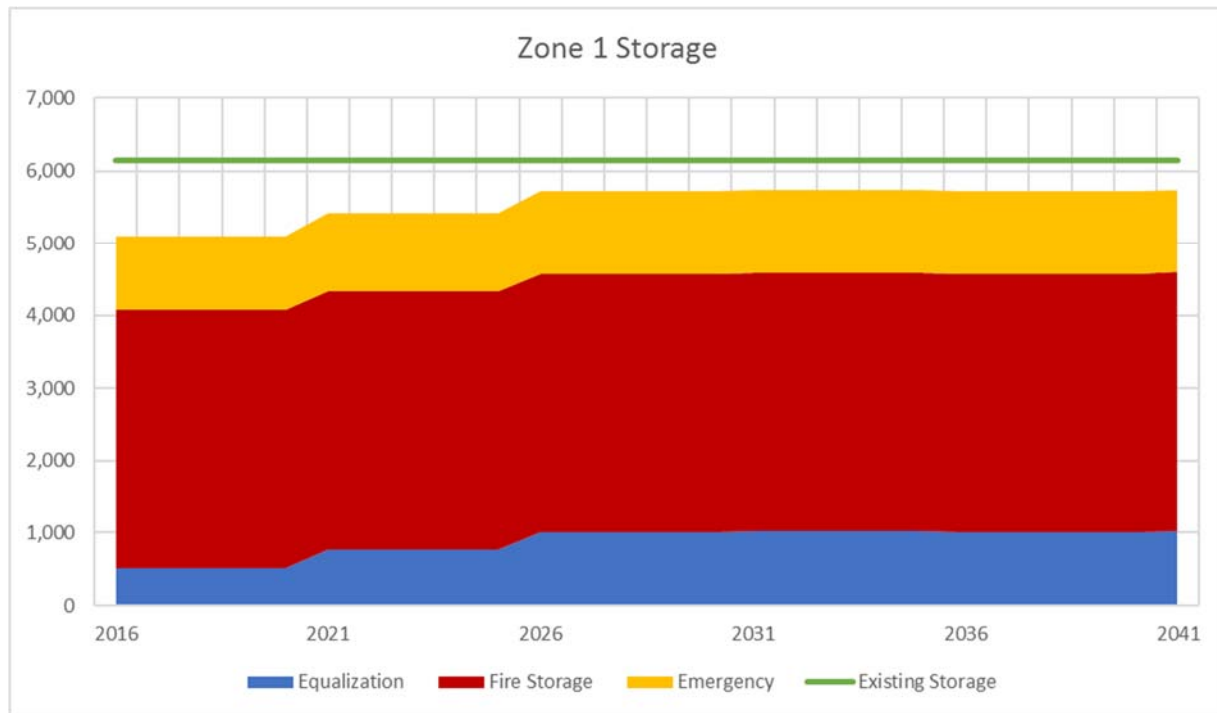
- A. **Fire Storage:** For smaller pressure districts and per York Region Design Guidelines a fire flow requirement of 17,000 L/min for a duration of 3.5 hours has been used. This results in a Fire Storage requirement of **3,570 m³**.
- B. **Equalization Storage:** The equalization storage is typically established as 25% of the maximum day demand. From the York Region's 2016 Water and Wastewater Master Plan data and provided water model this value is **508 m³** for Zone 1 and **3,414 m³** for Zone 2+3 for 2016.
- C. **Emergency Storage:** The emergency storage is recommended to be equal to 25% of the sum of the Fire and Equalization Storage Volumes. In this case, the emergency storage requirement would be **1,020 m³** for Zone 1 and **1,746 m³** for Zone 2+3 for 2016 (assuming dedicated fire storage in Zone 1 and Zone 2+3)

The existing storage requirements for Zone 1 are 5,098 m³ and 8,730 m³ for Zone 2/3. These requirements are based on population projections shown in the following figures.

Assumptions include the following:

- Fire Volume of 3,570 m³ (based on York Region Guidelines for larger pressure districts);
- Fire storage can be shared between Zones, so we have shown the storage requirements for Zone 2&3 assuming Fire Storage can be provided in the Zone 1 Elevated Tank and supplied to the lower zones when required. (Refer to **Figure 7** Below), and with dedicated Zone 2&3 fire storage (Refer to **Figure 8** Below).
- Excess Zone 1 storage is available to Zone 2 + 3.

**FIGURE 7 ZONE 1 STORAGE REQUIREMENTS**

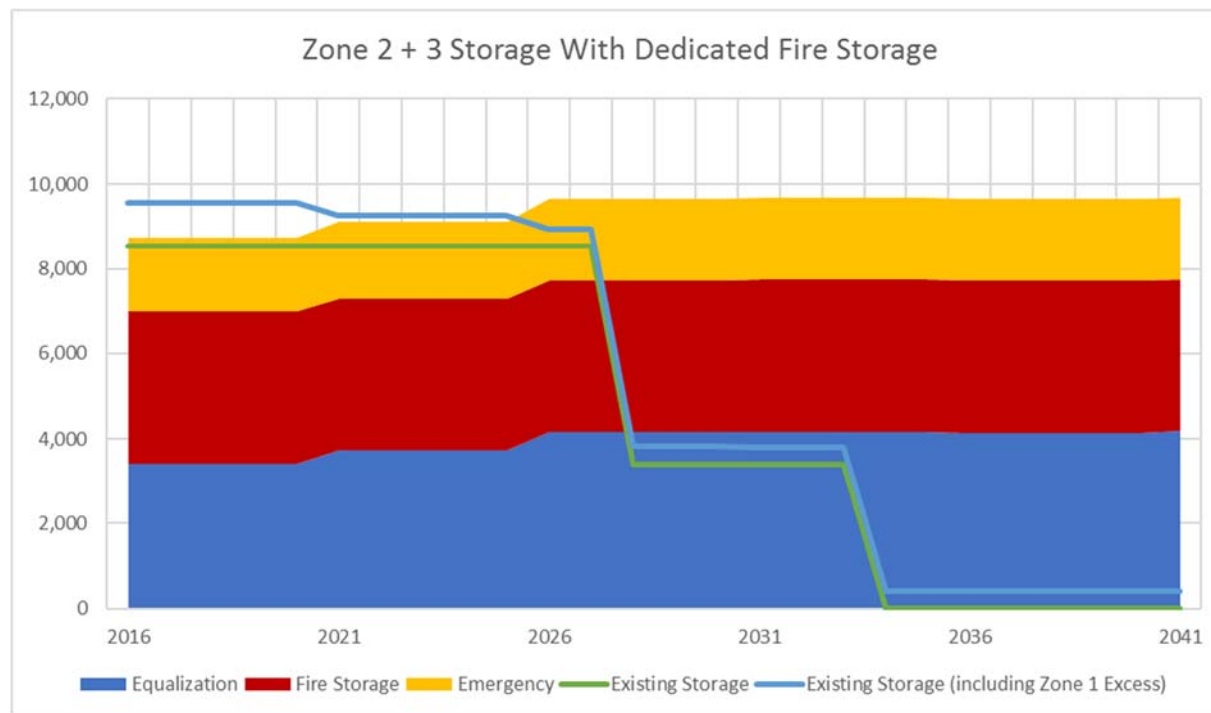


**TABLE 11 ZONE 1 STORAGE REQUIREMENTS**

	2016	2021	2026	2031	2036	2041
Population	39,342	48,412	57,476	60,351	62,093	64,671
MDD (m³/day)	15,686	17,955	20,657	20,767	20,627	20,821
Required Storage Volume (m³)	5,097	5,414	5,723	5,733	5,721	5,744

In **Figure 7** and **Table 11** above the Elevated Zone 1 storage is shown. Here the horizontal line shows the existing storage available at the storage tank (6,140 m³), and the blue, red, and yellow areas as the equalization, fire storage, and emergency storage requirements respectively. There is sufficient existing storage volume in the Zone 1 Elevated Tank through 2041.

**FIGURE 8 ZONE 2+3 STORAGE REQUIREMENTS WITH DEDICATED FIRE STORAGE**



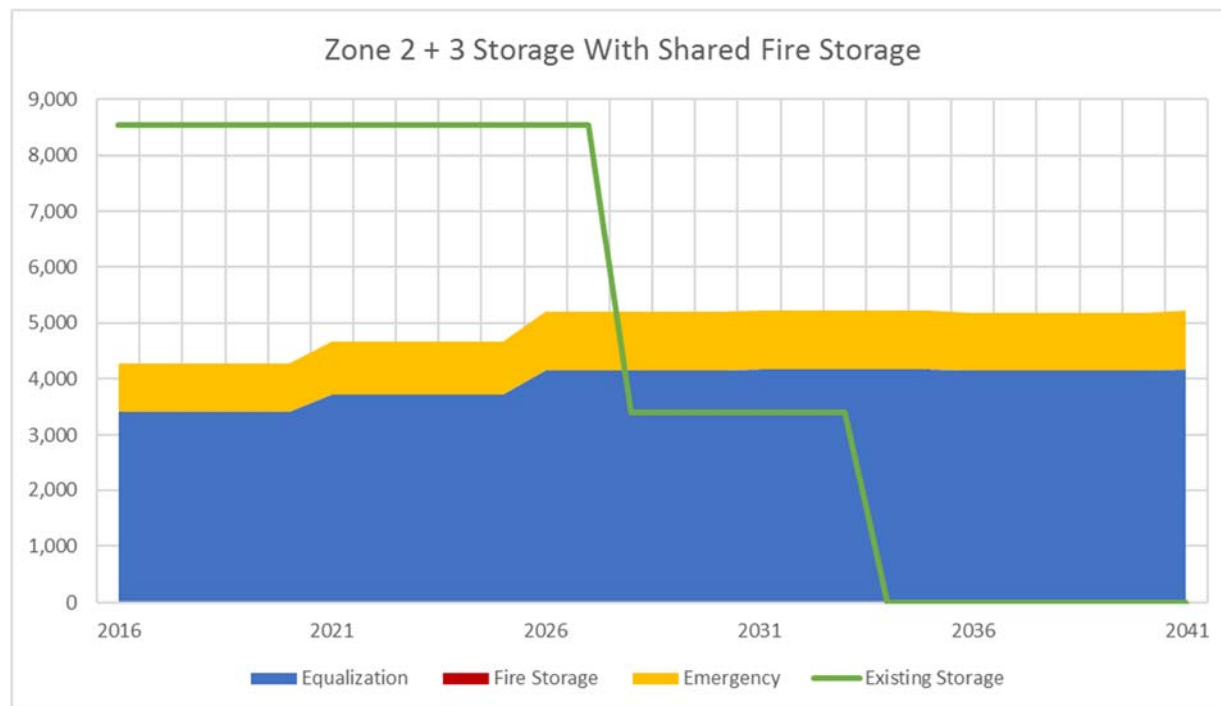
**TABLE 12 ZONE 2+3 REQUIRED STORAGE REQUIREMENTS WITH DEDICATED FIRE STORAGE**

	2016	2021	2026	2031	2036	2041
Population	34,283	40,298	46,425	48,716	50,165	52,140
MDD (m³/day)	13,656	14,909	16,623	16,701	16,601	16,420
Required Storage Volume (m³)	8,730	9,122	9,657	9,682	9,649	9,687

In **Figure 8** and **Table 11** above the Stouffville Zone 2 + 3 storage need is shown. Here, the storage is supplied through the Stouffville Zone 2 Elevated Tank and the Stouffville Reservoir. The high lift pumps at the Reservoir cannot provide the required fire flows, so the Reservoir cannot be considered as active Fire Storage. As such, sufficient fire storage must be available in the Zone 2 tank to support the fire storage requirement of Zone 2 + 3. In this analysis, the Reservoir is still providing equalization and emergency storage for Zone 2 + 3.

Similarly, to the figure for the Stouffville Zone 1 Elevated Tank, the horizontal lines represent the total existing storage in the Elevated Tank and the Stouffville Reservoir (3,400 m³ and 5,132m³ respectively) while the blue, red, and yellow areas represent the equalization, fire storage, and emergency storage. The second line shows the existing storage for Zone 2 + 3 plus the additional excess storage available from the Stouffville Zone 1 Elevated Tank. This figure assumes that the dedicated fire storage is provided for Zone 2 + 3. From the figure, there is insufficient existing storage for all the years modelled (2016-2061), but considering the excess available storage from Zone 1, there will only be a storage deficit from 2026 onward.

**FIGURE 9 ZONE 2+3 STORAGE REQUIREMENTS WITH SHARED FIRE STORAGE FROM ZONE 1**



**TABLE 13 REQUIRED ZONE 2+3 STORAGE WITH SHARED FIRE STORAGE FROM ZONE 1**

	2016	2021	2026	2031	2036	2041
Population	34,283	40,298	46,425	48,716	50,165	52,140
MDD (m³/day)	13,656	14,909	16,623	16,701	16,601	16,420
Required Volume Storage (m³)	4,267	4,659	5,194	5,219	5,186	5,225

In **Figure 9** and **Table 11** above, Zone 2 + 3 Storage with Fire Storage Shared from Zone 1 is shown. Similarly, to the previous figure, the existing storage is shown as a horizontal line, while the equalization storage is shown in blue, and the emergency storage shown in yellow. Here, it is assumed that the required Zone 2 + 3 fire storage is shared with the dedicated Zone 1 fire storages. In this scenario, the required storage does not exceed the existing storage for the years considered in York Region's 2016 Water and Wastewater Master Plan.

From the above it can be seen that there is either insufficient storage to service growth past 2026 if the Zone 2 Elevated Tank is retired at the end of its design life. If fire storage is shared, then there is sufficient storage to supply the entire system from the Zone 1 Elevated Water Tank and the Stouffville Reservoir when the Zone 2 Elevated Tank is taken out of service for recoating. Relying on the Zone 1 Elevated Tank for fire storage would require redundancy in the PRVs allowing Zone 1 water to be supplied to Zone 2. With only a single PRV currently, that redundancy is not provided.

## 7 Problem Statement

The Problem Statement for the Stouffville Water Storage Class EA is provided below.

*The 2016 York Region Water and Wastewater Master Plan Update identified the need to construct additional water storage infrastructure in Zone 2 (elevated tank) and additional inter-zone water supply capacity (pumps and valves). The current water storage and supply infrastructure is reaching the end of their service life and new infrastructure is needed.*

*To better understand the impacts and requirements of the increase in storage capacity and water supply, York Region has initiated an Environmental Assessment (Class EA) to study and address these issues. The goal is to meet the long-term supply and storage needs for all three Stouffville water pressure zones while also considering what will best meet the needs of York Region and the community. Providing service to 2041 may require an increase in the storage volumes.*

## 8 Appendices

Attached are the process flow charts for Wells 1 and 2, Well 3, and Wells 5 and 6.