THE MUNICIPAL INFRASTRUCTURE GROUP LTD.
8800 Dufferin Street, Suite 200
Vaughan, Ontario L4K 0C5
T 905.738.5700
F 905.738.0065
www.tmig.ca

TECHNICAL MEMORANDUM TM6

DATE	June 5, 2020
TO	**Luis Carvalho, York Region**
CC	
SUBJECT	Stouffville Water System Upgrades Class EA **Evaluation of the Impact of Alternative Solutions**
FROM	Kevin Brown, P.Eng.
PROJECT NUMBER	17100

1 Introduction

This technical memorandum presents the evaluation of the alternatives carried forward in the Class EA Process.

The alternatives being carried forward under potential Storage Options for the Stouffville Water system are:

1. **Do Nothing:** Permit the Growth, but do not increase the water storage capacity;
2. **Limit Community Growth:** Limit growth to the capacity of the existing water storage;
3. **Implement Water Conservation:** 'Stretch' the existing water storage by using less water per person;
4. **Build Additional Zone 2 Storage (No Shared Fire Storage Between Zones 1 and 2+3):** Compensate storage deficit caused by community growth and retiring of existing facilities by building new Zone 2 Storage while ensuring Fire Storage is present in Zone 2;
5. **Facilitate Shared Fire Storage Between Zones 1 and 2+3, and Build Additional Zone 2 Storage:** Compensate storage deficit caused by community growth and retiring of facilities by building new Zone 2 Storage while sharing Fire Storage with Zone 1

The alternatives being carried forward under potential Supply Options for the Stouffville Water system are:

1. **Do Nothing:** Permit the Growth, but do not increase the water supply;
2. **Limit Community Growth:** Limit growth to the capacity of the existing water supply;
3. **Implement Water Conservation:** 'Stretch' the existing water supply by using less water per person;
4. **Change the Percentage of Water Supplied from Lake-Based System:** Compensate supply deficit caused by community growth and retiring of facilities by increasing the percentage of water being supplied from the Lake-Based System;
5. **Expand Existing Wells:** Compensate supply deficit caused by community growth and retiring of facilities by Expanding Existing Well Sites;
6. **Develop New Well Sites:** Compensate supply deficit caused by community growth and retiring of facilities by Developing New Well Sites

These alternative solutions for both the Storage Options and Supply Options will be evaluated based on the following criteria:

- The solution's Technical Feasibility;
- Its ability to satisfy the Stouffville growth projections;
- Its ability to satisfy Regional Design Standards;
- Its ability to comply with Legislative Requirements;
- The solution's Operational Flexibility (present, and future expandability);
- The potential impacts on the Natural Environment;
- The potential impacts on the Social-Cultural Environment; and,
- The life-cycle cost of the solution.

The evaluation is a *qualitative* assessment, with the assessment of the impacts rated relative to the other alternatives as follows:

Lowest Impact ---- Most Preferred			Greatest Impact ---- Least Preferred

2 Description of Storage Alternatives

The Storage Alternatives described below only address Zone 2+3, as it was confirmed in Technical Memorandum #1 that the Storage for Zone 1 is sufficient through 2041.

York Region only supplies water to Zone 2, though there is a local Zone 3 operated by the Town, via local pressure-reducing valves. So while the Region formally recognizes 'Zone 2', it also considers the storage requirements for 'Zone 3'. Please note that for the purposes of this report, the references to 'Zone 2' and 'Zone 2+3' are equivalent.

The current effective storage available in Zone 2+3 is 4,642 m^3. This effective storage is calculated using the full capacity of the Zone 2 Elevated Tank (3,400 m^3) and adding in the usable storage of the Stouffville Reservoir (1,242 m^3). Since High Lift pumps coming from the Stouffville Reservoir are used to distribute water to the Stouffville Zone 2 system, the Stouffville Reservoir is limited to the output of these High Lift pumps in the current system setup. The capacity of the High Lift Pumps at the Stouffville Reservoir is 3,974 m^3/day (46 L/s). Using Ministry of Enivronment, Conservation and Parks (MECP) design guidelines only 25% of this can be attributed to available equalization storage, and only 25% of this equalization storage can be attributed to emergency storage. There is no Fire Storage at this reservoir due to the incapability of the high lift pumps to provide adequate fire flow rates. Thus, the total effective storage at the Stouffville Reservoir is 1,242 m^3. This brings the total current effective storage in Zone 2 to the previously mentioned 4,642 m^3.

With this said, it has been indicated by the Region that the Zone 2 Elevated Tank will reach its original service life in 2043. Since the planning horizon is to 2041, all scenarios examined below for storage will include the Zone 2 Elevated Tank being decommissioned at that time, as this will occur just beyond the official planning horizon. This brings the available 2041 effective storage in Zone 2 to 1,242 m3. Please refer to Table 2-1 for a summary of the total available storage in Zone 2+3.

TABLE 2-1 - TOTAL AND EFFECTIVE STORAGE AVAILABLE FOR ZONE 2+3

	2016		**2041**	
Storage Facility	**Total Storage**	**Effective Storage**	**Total Storage**	**Effective Storage**
Stouffville Reservoir	5,132 m^3	1,242 m^3	5,132 m^3	1,242 m^3
Zone 2 Elevated Tank	3,400 m^3	3,400 m^3	0	0
McCowan Reservoir	0	0	0	0
TOTAL STORAGE	**8,532 m^3**	**4,642 m^3**	**5,132 m^3**	**1,242 m^3**

The total required storage for Zone 2+3 has been determined using MECP Design guidelines. York Region's policies allow fire storage from a higher pressure zone (in this instance, Zone 1) to be used as fire storage in a lower pressure zone (Zone 2+3), provided that there is sufficient hydraulic flow capacity and redundancy in pressure-reducing valves. In this instance sharing of the Zone 1 fire storage results in a lower storage volume requirement for Zone 2+3. This is detailed in Table 2-2.

TABLE 2-2 REQUIRED STORAGE FOR ZONE 2+3

	2016		2041	
	With Dedicated Zone 2 Fire Storage	**With Shared Zone 1 Fire Storage**	**With Dedicated Zone 2 Fire Storage**	**With Shared Zone 1 Fire Storage**
Required Storage	8,730 m^3	4,267 m^3	9,687 m^3	5,225 m^3
ASSESSMENT	Insufficient. Additional 4,088 m^3 (4,642 – 8,730 m^3 = -4,088 m^3) required for dedicated fire storage.	Sufficient, with fire storage shared with Zone 1 (4,642 – 4,267 m^3 > 0)	Insufficient. Additional 8,445 m^3 (1,242 – 9,687 m^3 = -8,445 m^3) required for dedicated fire storage.	Insufficient. Additional 3,983 m^3 (1,242 – 5,225 m^3 = -3,983 m^3) required, with fire storage shared with Zone 1.

The following serves as an overview of the storage alternatives analysed for Stouffville up to the 2041 design horizon. The details of the various storage alternative solutions can be found in the subsections below.

It should be noted that in the cases where “Maintain Zone 2 Elevated Tank” are included in the option, the cost for this maintenance has been assumed to be the same as constructing a new storage facility of the same size at the same location. Given that 2041 is the end of the service life for the Zone 2 Elevated Tank and that no cost has been identified for extending the life of this facility in the most recent Condition Assessment past this date, this assumption is a conservative estimate as to the repair works that would likely be required on an aged storage structure above grade.

2.1 Do Nothing

The “Do Nothing” alternative is a mandatory consideration for the Class EA Process. While it may not ultimately be a viable alternative, it is always considered. It means that the proposed growth would occur, but that no changes would be made to the water storage infrastructure to address the growth. In the case of this EA, the Do Nothing Storage alternative will involve measures for maintaining the Stouffville Reservoir and High Lift Pumping Station’s current capacity and decommissioning of the Zone 2 Elevated Tank at the end of its expected service life (anticipated to be 2043, based on the current tank rehabilitation project).

Thus the “Do Nothing” alternative involves a total effective storage of 1,242 m^3 for 2041. The 2041 total Storage Requirement for Zone 2 + 3 is 9,687 m^3, but this can be reduced to 5,225 m^3 with fire storage provided from Zone 1. Either way, the Do Nothing Alternative fails to meet the storage requirements for Stouffville Zones 2 + 3 in 2041.

The total cost estimate for this scenario is estimated at $2,307,000.

2.2 Limit Community Growth

The option of “Limiting Community Growth” would maintain the existing water storage capacity but restrict the amount of approvable growth to the capacity of the existing system.

The total effective storage available in this alternative for 2041 is 1,242 m^3. This fails to supply event the current water storage requirement for Zones 2 and 3, even with fire storage provided from the Zone 1 Elevated Tank. As such, limiting the growth of the community cannot address the projected 2041 water storage shortfall.

The total cost estimate for this scenario is estimated at $2,307,000.

2.3 Implement Water Conservation

This option involves a conscious reduction in water consumption on a daily basis which in turn will reduce the required storage for the community. The Region may impose regulatory measures (such as lawn watering restrictions) or provide incentives (such as rebates on retrofitting existing plumbing fixtures to low-water versions) in order to achieve the

conservation requirement. Alternatively, the residents may voluntarily reduce their daily consumption to meet the requirements of a larger population.

The total effective storage available in this alternative for 2041 is 1,242 m^3. The 2041 Storage Requirements for Zones 2 + 3 are 9,688 m^3 of which 3,570 m^3 is required for Fire Storage. Even if water conservation were implemented, the available storage facilities in the Zones 2 + 3 for 2041 would be insufficient for supplying Fire Storage. As such this alternative fails to meet the storage requirements for Stouffville Zones 2 + 3 in 2041.

The total cost estimate for this scenario which includes the additional efforts at encouraging water conservation within the community is estimated at $2,617,000.

2.4 Build Additional Zone 2 Storage (No Shared Fire Storage Between Zones 1 and 2+3)

The Zone 2 2041 storage requirement is 9,687 m^3 with dedicated Fire Storage in Zone 2. This includes 4,180 m^3 of Equalization Storage (25% of Maximum Day Demand), 3,570 m^3 of Fire Storage (as per Region's Fire Storage requirements), and 1,938 m^3 of Emergency Storage (25% of the sum of Equalization and Fire Storage).

As demonstrated above, the 2041 required storage requirement (9,687 m^3) exceeds the 2041 effective storage available in Zone 2 (1,242 m^3). Therefore, additional storage capacity is required.

2.4.1 Sub-Scenario (A1) – No Storage Facilities Retired

This sub-scenario involves maintaining the Zone 2 Elevated Tank, while upgrading the Stouffville Reservoir under two sub scenarios:

i. Rehabilitating one cell of the reservoir (west cell) while decommissioning the second (east cell); and,
ii. Rehabilitating both reservoir cells.

Both sub-scenarios require upgrading the HLPS.

2.4.1.1 (i) Build New Storage Facility, Rehabilitate 1 Reservoir Cell, Rehabilitate Zone 2 Elevated Tank

This secondary sub-scenario involves building a new storage facility with a capacity of 3,291 m^3 and rehabilitating the 3,400 m^3 Zone 2 Elevated Tank. It also involves upgrading the Stouffville Reservoir West Cell to accommodate a storage capacity of 2,996 m^3 in the West Cell while decommissioning the East Reservoir. Making effective use of the reservoir storage volume will require upgrading the High Lift Pumping Station to 110 L/s with 3 Pumps (2 Duty/1 Standby @ 55 L/s).

The capital cost estimate for this alternative with a standpipe for the additional storage requirement is approximately $14,415,000. If an in-ground reservoir is considered, this cost increases to approximately $16,006,000.

2.4.1.2 (ii) Build New Storage Facility, Rehabilitate Both Reservoir Cells, Rehabilitate Zone 2 Elevated Tank

This secondary sub-scenario involves building a new storage facility with a capacity of 1,155 m^3 and maintaining the 3,400 m^3 Zone 2 Elevated Tank. It also involves upgrading both cells of the Stouffville Reservoir to provide a storage capacity of 5,132 m^3, as well as upgrading the High Lift Pumping Station to 190 L/s with 3 Pumps (2 Duty/1 Standby @ 95 L/s).

The capital cost estimate for this alternative with a standpipe for the additional storage requirement is approximately $10,683,000. If an in-ground reservoir is considered, this cost increases to approximately $12,274,000.

2.4.2 Sub-Scenario (B1) – Retire Zone 2 Elevated Tank

This sub-scenario involves decommissioning the Zone 2 Elevated Tank, while upgrading the Stouffville Reservoir under two sub scenarios:

i. Rehabilitating one cell of the reservoir (west cell) while decommissioning the other (east cell); and,
ii. Rehabilitating both reservoir cells.

Both sub-scenarios require upgrading the HLPS.

2.4.2.1 (i) Build New Storage Facility, Rehabilitate 1 Reservoir Cell, Retire Zone 2 Elevated Tank

This secondary sub-scenario involves building a new storage facility with a capacity of 6,691 m^3, and decommissioning the Zone 2 Elevated Tank. It also involves upgrading Stouffville Reservoir West Cell to accommodate a storage capacity of 2,996 m^3 in the West Cell while decommissioning the East Reservoir. Making effective use of the reservoir storage volume will require upgrading the High Lift Pumping Station to 110 L/s with 3 Pumps (2 Duty/1 Standby @ 55 L/s).

The capital cost estimate for this alternative with a standpipe for the additional storage requirement is approximately $14,558,000. If an in-ground reservoir is considered, this cost increases to approximately $17,614,000.

2.4.2.2 (ii) Build New Storage Facility, Rehabilitate Both Reservoir Cells, Retire Zone 2 Elevated Tank

This secondary sub-scenario involves building a new storage facility with a capacity of 4,555 m^3 and decommissioning the Zone 2 Elevated Tank. It also involves upgrading both cells of the Stouffville Reservoir to 5,132 m^3, as well as upgrading the High Lift Pumping Station to 190 L/s with 3 Pumps (2 Duty/1 Standby @ 95 L/s).

The capital cost estimate for this alternative with a standpipe for the additional storage requirement is approximately $11,993,750. If an in-ground reservoir is considered, this cost increases to approximately $14,381,000.

2.4.3 Sub-Scenario (C1) – Retire Stouffville Reservoir and High Lift Pumping Station

This sub-scenario involves decommissioning the Stouffville Reservoir and High Lift Pumping Station. It would require a new storage facility with a capacity of 6,287 m^3, while maintaining the 3,400 m^3 Zone 2 Elevated Tank.

The capital cost estimate for this alternative with a standpipe for the new storage facility is approximately $18,881,000. If a new in-ground reservoir is considered, this cost increases to approximately $21,752,000.

2.4.4 Sub-Scenario (D1) – Retire Stouffville Reservoir, High Lift Pumping Station, and Zone 2 Elevated Tank

This sub-scenario involves decommissioning the Stouffville Reservoir and High Lift Pumping Station, as well as the Zone 2 Elevated Tank. It would require the Region to build a new storage facility with a capacity of 9,687 m.

The capital cost estimate for the sandpipe is approximately $19,368,000 which includes 25% engineering fees or approximately $23,794,000 for an in-ground reservoir (inclusive of 25% engineering fees).

2.5 Facilitate Shared Fire Storage Between Zones 1/2, Build Additional Zone 2+3 Storage

As discussed in the introductory paragraph in Section 2, the current effective storage available in Zone 2 is 4,642 m^3 with only 1,242 m^3 being considered for potential 2041 storage because of the required decommissioning of the Zone 2 Elevated Tank in 2043. In this scenario, fire storage between Zone 1 and Zone 2+3 would be shared, thus Zone 2+3 does not require dedicated fire storage. This brings the 2041 storage requirement for Zone 2 to 5,225 m^3. This includes 4,180 m^3 of Equalization Storage (25% of Maximum Day Demand), 0 m^3 of Fire Storage (shared with Zone 1), and 1,045 m^3 of Emergency Storage (25% of the sum of Equalization and Fire Storage).

As can be seen, the 2041 required storage (5,225 m^3) exceeds the 2041 effective storage available in Zone 2+3 (1,242 m^3). Therefore, additional storage capacity is required to be provided either by means of additional storage or increased pumping capacity at the reservoir's high lift pumps or some combination therein.

2.5.1 Sub-Scenario (A2) – No Storage Facilities Retired

This sub-scenario involves maintaining the Zone 2 Elevated Tank, while upgrading the Stouffville Reservoir under two sub scenarios:

i. Rehabilitating one cell of the reservoir (west cell) while decommissioning the second (east cell); and,
ii. Rehabilitating both reservoir cells.

Both sub-scenarios require upgrading the HLPS.

2.5.1.1 (i) Build New Storage Facility, Rehabilitate 1 Reservoir Cell, Rehabilitate Zone 2 Elevated Tank

This secondary sub-scenario involves building a new PRV chamber and maintaining the 3,400 m^3 Zone 2 Elevated Tank. It also involves upgrading Stouffville Reservoir West Cell to accommodate a storage capacity of 2,996 m^3 in the West Cell while decommissioning the East Reservoir. Making effective use of the reservoir storage volume will require upgrading the High Lift Pumping Station to 110 L/s with 3 Pumps (2 Duty/1 Standby @ 55 L/s).

The total capital cost estimate is approximately $9,104,000.

2.5.1.2 (ii) Build New Storage Facility, Rehabilitate Both Reservoir Cells, Rehabilitate Zone 2 Elevated Tank

This secondary sub-scenario involves building a new PRV chamber and maintaining the 3,400 m^3 Zone 2 Elevated Tank. It also involves upgrading both cells of the Stouffville Reservoir to 5,132 m^3. Making effective use of the reservoir storage volume will require upgrading the High Lift Pumping Station to 190 L/s with 3 Pumps (2 Duty/1 Standby @ 95 L/s).

The total capital cost estimate is approximately $8,983,000.

2.5.2 Sub-Scenario (B2) – Retire Zone 2 Elevated Tank

This sub-scenario involves decommissioning the Zone 2 Elevated Tank, while upgrading the Stouffville Reservoir under two sub scenarios:

i. Rehabilitating one cell of the reservoir (west cell) while decommissioning the other (east cell); and,
ii. Rehabilitating both reservoir cells.

Both sub-scenarios require upgrading the HLPS.

2.5.2.1 (i) Build New Storage Facility, Rehabilitate 1 Reservoir Cell, Retire Zone 2 Elevated Tank

This secondary sub-scenario involves building a new PRV chamber, and storage facility with a capacity 2,229 m^3 and decommissioning the Zone 2 Elevated Tank. It also involves upgrading Stouffville Reservoir West Cell to accommodate a storage capacity of 2,996 m^3 in the West Cell while decommissioning the East Reservoir. Making effective use of the reservoir storage volume will require upgrading the High Lift Pumping Station to 110 L/s with 3 Pumps (2 Duty/1 Standby @ 55 L/s).

The capital cost estimate with a standpipe for the additional storage requirement is approximately $9,742,000. Providing the additional storage as an in-ground reservoir would increase the cost to approximately $11,126,000.

2.5.2.2 (ii) Build New Storage Facility, Rehabilitate Both Reservoir Cells, Retire Zone 2 Elevated Tank

This secondary sub-scenario involves building a new storage facility with a minimum capacity of 93 m^3 and a new PRV chamber and decommissioning the Zone 2 Elevated Tank. It also involves upgrading both cells of the Stouffville Reservoir to 5,132 m^3. Making effective use of the reservoir storage volume will require upgrading the High Lift Pumping Station to 190 L/s with 3 Pumps (2 Duty/1 Standby @ 95 L/s).

The total capital cost estimate is approximately $3,996,000.

2.5.3 Sub-Scenario (C2) – Retire Stouffville Reservoir and High Lift Pumping Station

This scenario involves building a new storage facility with a capacity 1,825 m^3 and new PRV chamber and maintaining the 3,400 m^3 Zone 2 Elevated Tank. It also involves decommissioning the Stouffville Reservoir and the High Lift Pumping Station.

The capital cost estimate for a sandpipe is approximately $14,163,000. Providing the required storage in an in-ground reservoir would approximately cost the same at $14,163,000.

2.5.4 Sub-Scenario (D2) – Retire Stouffville Reservoir, High Lift Pumping Station, and Zone 2 Elevated Tank

This scenario involves building a new storage facility with a capacity 5,225 m^3 and a new PRV chamber. It also involves decommissioning the Zone 2 Elevated Tank, Stouffville Reservoir and the High Lift Pumping Station.

The capital cost estimate for a sandpipe is approximately $11,676,000. Providing the required storage in an in-ground reservoir would increase the cost to approximately $12,301,000.

3 Evaluation of Storage Alternatives

3.1 Shortlisting of Storage Alternatives

Based on discussions with the Region it has been communicated that the sharing of fire storage with Zone 1 is a component of the preferred solution. As such all options in 2.4 “Build Additional Zone 2 Storage (No Shared Fire Storage Between Zones 1 and 2+3)”, will be removed from further evaluation.

As such the storage alternatives that will be carried through in the EA process include:

1. Do Nothing
2. Limit Community Growth
3. Implement Water Conservation
4. Facilitate Shared Fire Storage Between Zone 1 to Zone 2 and Build Additional Zone 2 Storage
    a. No Storage Facilities Retired
        i. Upgrade Stouffville Reservoir (West Cell) and HLPS to 110.96 L/s (3 Pumps, 2 Duty/1 Standby @ 55.5 L/s), Maintain Zone 2 Elevated Tank, Decommission East Stouffville Reservoir Cell, and Construct New PRV Chamber
        ii. Upgrade Stouffville Reservoir (Both East and West Cells) and HLPS to 190.07 L/s (3 Pumps, 2 Duty/1 Standby @ 95 L/s), Maintain Zone 2 Elevated Tank, and Construct New PRV Chamber
    b. Retire Zone 2 Elevated Tank
        i. Build New Storage Facility of Size 2,229 m^3, Upgrade Stouffville Reservoir (West Cell) and HLPS to 110.96 L/s (3 Pumps, 2 Duty/1 Standby @ 55.5 L/s), Decommission Zone 2 Elevated Tank, Decommission East Cell Reservoir, and Construct New PRV Chamber
        ii. Build New Storage Facility of Size 93 m^3, Upgrade Stouffville Reservoir (Both East and West Cells) and HLPS to 190.07 L/s (3 Pumps, 2 Duty/1 Standby
    c. Retire Stouffville Reservoir and High Lift Pumping Station (HLPS)
        i. Build New Storage Facility of Size 1,825 m^3, Maintain Zone 2 Elevated Tank, Decommission Stouffville Reservoir (Both Cells) and HLPS, and Construct New PRV Chamber
    d. Retire Stouffville Reservoir, HLPS and Zone 2 Elevated Tank
        i. Build New Storage Facility of Size 5,225 m^3, Decommission Stouffville Reservoir (Both Cells), Decommission Zone 2 Elevated Tank, and Construct New PRV Chamber

3.2 Evaluation of Shortlisted Storage Alternatives

3.2.1 Technical Considerations

The section reviews the technical feasibility of each of the alternative solutions. This review considers the likelihood that the solution will perform as intended.

Aside from the Do Nothing, Limit Community Growth and Implement Water Conservation alternatives, the remaining alternatives identified have the ability to satisfy the Problem Statement.

TABLE 3-1 TECHNICAL FEASILITY OF THE ALTERNATIVE SOLUTIONS

Alternative			Technically Feasible?
1) Do Nothing			No
Not technically feasible, the required storage volume for 2041 (5,225 m^3) exceeds effective available storage in 2041 (1,242 m^3). Further the Stouffville Reservoir is incapable of providing fire storage due to insufficient pumping capacity.			
2) Limit Community Growth			No
Not technically feasible, the required storage volume for 2041 (5,225 m^3) exceeds effective available storage in 2041 (1,242 m^3). Further the Stouffville Reservoir is incapable of providing fire storage due to insufficient pumping capacity.			
3) Implement Water Conservation			No
Not technically feasible, the required storage volume for 2041 (5,225 m^3) exceeds effective available storage in 2041 (1,242 m^3). In addition, the Stouffville Reservoir is incapable of providing fire storage due to insufficient pumping capacity. Further the Region's fire requirement is based on size of pressure district thus implementing water conservation would not aide in decreasing the required fire storage volume (3,570 m^3) which exceeds effective storage.			
4) Facilitate Shared Fire Storage Between Zone 1 to Zone 2+3			
	a) No Storage Facilities Retired		
		i)	- Upgrade Stouffville Reservoir (West Cell, 2,996 m^3) and HLPS to 110.96 L/s (3 Pumps, 2 Duty/1 Standby @ 55.5 L/s) - Maintain Zone 2 Elevated Tank (3,400 m^3) - Decommission East Cell Reservoir - New PRV Chamber	Yes
	Upgrading the Stouffville Reservoir's West Cell and HLPS to 110.96 L/s to include 3 Pumps, 2 Duty/1 Standby each at 55 L/s allows for a usable storage capacity in the West Cell of 2,996 m^3. Maintaining the Zone 2 Elevated Tank results in a usable storage of 3,400 m^3. The combination of these two results in a total available storage of 6,396 m^3 which is sufficient to meet the 2041 storage requirement for Zones 2 + 3 of 5,225 m^3. A new PRV chamber will also be required to facilitate the sharing of Fire Storage between Zone 1 and 2 + 3.		

Alternative			Technically Feasible?
	ii)	- Upgrade Stouffville Reservoir (East and West Cells, 5,132 m^3) and HLPS to 190.07 L/s (3 Pumps, 2 Duty/1 Standby @ 95 L/s) - Maintain Zone 2 Elevated Tank (3,400 m^3) - New PRV Chamber	Yes
	Upgrading the Stouffville Reservoir's East and West Cells and HLPS to 190.07 L/s to include 3 Pumps, 2 Duty/1 Standby each at 95 L/s allows for a usable storage capacity in the Stouffville Reservoir of Cell of 5,132 m^3. Maintaining the Zone 2 Elevated Tank results in a usable storage of 3,400 m^3. The combination of these two results in a total available storage of 8,532 m^3 which is much more than sufficient to meet the 2041 storage requirement for Zones 2 + 3 of 5,225 m^3. A new PRV chamber will also be required to facilitate the sharing of Fire Storage between Zone 1 and 2 + 3.		
	b) Retire Zone 2 Elevated Tank		
	i)	- Build New Storage Facility of Size 2,229 m3 - Upgrade Stouffville Reservoir (West Cell, 2,996 m3) and HLPS to 110.96 L/s (3 Pumps, 2 Duty/1 Standby @ 55.5 L/s) - Decommission Zone 2 Elevated Tank - Decommission East Cell of Reservoir - New PRV Chamber	Yes
	It is assumed that the New Storage Facility will be constructed at either the Zone 2 Elevated Tank Site location or the Stouffville Reservoir site. As such land acquisition is not being proposed form this option. The new storage facility would be sized to 2,229 m^3. Upgrading the Stouffville Reservoir's West Cell and HLPS to 110.96 L/s to include 3 Pumps, 2 Duty/1 Standby each at 55 L/s allows for a usable storage capacity in the West Cell of 2,996 m^3. The new Storage Facility in conjunction with the upgrades to the West Cell of the Reservoir and HLPS would result in a total storage available to Zones 2 + 3 of 5,225 m^3 adequate to meet the 2041 requirements of 5,225 m^3. A new PRV chamber will also be required to facilitate the sharing of Fire Storage between Zone 1 and 2 + 3.		
	ii)	- Build New Storage Facility of Minimum Size 93 m^3 - Upgrade Stouffville Reservoir (East and West Cells, 5,132 m^3) and HLPS to 190.07 L/s (3 Pumps, 2 Duty/1 Standby @ 95 L/s) - Decommission Zone 2 Elevated Tank - New PRV Chamber	Yes
	It is assumed that the New Storage Facility will be constructed at either the Zone 2 Elevated Tank Site location or the Stouffville Reservoir site. As such land acquisition is not being proposed form this option. The new storage facility		

Alternative		Technically Feasible?
would be of a minimum size of 93 m^3. Since this is an impractical size for a storage facility the Region should consider oversizing this facility. Upgrading the Stouffville Reservoir's East and West Cells and HLPS to 190.07 L/s to include 3 Pumps, 2 Duty/1 Standby each at 95 L/s allows for a usable storage capacity in the Stouffville Reservoir of Cell of 5,132 m^3. The new Storage Facility in conjunction with the upgrades to the East and West Cell of the Reservoir and HLPS would result in a total storage available to Zones 2 + 3 of 5,225 m^3 adequate to meet the 2041 requirements of 5,225 m^3. A new PRV chamber will also be required to facilitate the sharing of Fire Storage between Zone 1 and 2 + 3.		
c) Retire Stouffville Reservoir and HLPS		
i)	- Build New Storage Facility of Size 1,825 m^3 - Maintain Zone 2 Elevated Tank (3,400 m^3) - Decommission Stouffville Reservoir and HLPS - New PRV Chamber	Yes
It is assumed that the New Storage Facility will be constructed at the Stouffville Reservoir Site location given that it is decommissioned in this scenario. As such land acquisition is not being proposed form this option. The new storage facility would be of 1,825 m^3. Maintaining the Zone 2 Elevated Tank results in a usable storage of 3,400 m^3. The combination of a new Storage Facility and Maintaining the Zone 2 Elevated Tank results in a total available storage of 5,225 m^3 which is much sufficient to meet the 2041 storage requirement for Zones 2 + 3 of 5,225 m^3. A new PRV chamber will also be required to facilitate the sharing of Fire Storage between Zone 1 and 2 + 3.		
d) Retire Stouffville Reservoir, HLPS, and Zone 2 Elevated Tank		
i)	- Build New Storage Facility of Size 5,225 m^3 - Decommission Stouffville Reservoir and HLPS - Decommission Zone 2 Elevated Tank - New PRV Chamber	Yes
It is assumed that the New Storage Facility will be constructed at either Zone 2 Elevated Tank site location or the Stouffville Reservoir, given that both are being decommissioned in this scenario. As such land acquisition is not being proposed form this option. The new storage facility would be of 5,225 m^3. A new PRV chamber will also be required to facilitate the sharing of Fire Storage between Zone 1 and 2 + 3.		

LEGEND

Lowest Impact ---- Most Preferred			Greatest Impact ---- Least Preferred

3.2.2 Ability to Satisfy the Planned Population Growth

The Town of Stouffville's growth projections have been approved by Town and Regional Council and proposes growing the community to 64,671 persons. This population increase includes both residential and employment populations for Zones 1, 2 and 3. Population growth for Zones 2 + 3 only, are projected at 52,140 persons (this value includes both residential and employment population).

Except for Do Nothing, Limit Community Growth, and Water Conservation, all of the alternative solutions have the potential to accommodate the population growth proposed for 2041.

TABLE 3-2 ABILITY OF ALTERNATIVE SOLUTIONS TO SATISFY PLANNED POPULATION GROWTH

Alternative			Satisfies Planned Population Growth?
1) Do Nothing			No
Not technically feasible, the required storage volume for 2041 (5,225 m^3) exceeds effective available storage in 2041 (1,242 m^3). Further the Stouffville Reservoir is incapable of providing fire storage due to insufficient pumping capacity.			
2) Limit Community Growth			No
Not technically feasible, the required storage volume for 2041 (5,225 m^3) exceeds effective available storage in 2041 (1,242 m^3). Further the Stouffville Reservoir is incapable of providing fire storage due to insufficient pumping capacity.			
3) Implement Water Conservation			No
Not technically feasible, the required storage volume for 2041 (5,225 m^3) exceeds effective available storage in 2041 (1,242 m^3). In addition, the Stouffville Reservoir is incapable of providing fire storage due to insufficient pumping capacity. Further the Region's fire requirement is based on size of pressure district thus implementing water conservation would not aide in decreasing the required fire storage volume (3,570 m^3) which exceeds effective storage.			
4) Facilitate Shared Fire Storage Between Zone 1 to Zone 2			
	a) No Storage Facilities Retired		
		i) - Upgrade Stouffville Reservoir (West Cell, 2,996 m^3) and HLPS to 110.96 L/s (3 Pumps, 2 Duty/1 Standby @ 55.5 L/s) - Maintain Zone 2 Elevated Tank (3,400 m^3) - Decommission East Cell Reservoir - New PRV Chamber	Yes
	Upgrading the Stouffville Reservoir's West Cell and HLPS to 110.96 L/s to include 3 Pumps, 2 Duty/1 Standby each at 55 L/s allows for a usable storage capacity in the West Cell of 2,996 m^3. Maintaining the Zone 2 Elevated Tank results in a usable storage of 3,400 m^3. The combination of these two results in a total available storage of 6,396 m^3 which is sufficient to meet the 2041 storage requirement for Zones 2 + 3 of 5,225 m^3. Thus, this alternative satisfies the planned community growth. A new PRV chamber will also be required to facilitate the sharing of Fire Storage between Zone 1 and 2 + 3.		

Alternative			Satisfies Planned Population Growth?
	ii)	- Upgrade Stouffville Reservoir (East and West Cells, 5,132 m^3) and HLPS to 190.07 L/s (3 Pumps, 2 Duty/1 Standby @ 95 L/s) - Maintain Zone 2 Elevated Tank (3,400 m^3) - New PRV Chamber	Yes
	Upgrading the Stouffville Reservoir's East and West Cells and HLPS to 190.07 L/s to include 3 Pumps, 2 Duty/1 Standby each at 95 L/s allows for a usable storage capacity in the Stouffville Reservoir of Cell of 5,132 m^3. Maintaining the Zone 2 Elevated Tank results in a usable storage of 3,400 m^3. The combination of these two results in a total available storage of 8,532 m^3 which is much more than sufficient to meet the 2041 storage requirement for Zones 2 + 3 of 5,225 m^3. Thus, this alternative satisfies the planned community growth. A new PRV chamber will also be required to facilitate the sharing of Fire Storage between Zone 1 and 2 + 3.		
	b) Retire Zone 2 Elevated Tank		
	i)	- Build New Storage Facility of Size 2,229 m^3 - Upgrade Stouffville Reservoir (West Cell, 2,996 m^3) and HLPS to 110.96 L/s (3 Pumps, 2 Duty/1 Standby @ 55.5 L/s) - Decommission Zone 2 Elevated Tank - Decommission East Cell of Reservoir - New PRV Chamber	Yes
	It is assumed that the New Storage Facility will be constructed at either the Zone 2 Elevated Tank Site location or the Stouffville Reservoir site. As such land acquisition is not being proposed form this option. The new storage facility would be sized to 2,229 m^3. Upgrading the Stouffville Reservoir's West Cell and HLPS to 110.96 L/s to include 3 Pumps, 2 Duty/1 Standby each at 55 L/s allows for a usable storage capacity in the West Cell of 2,996 m^3. The new Storage Facility in conjunction with the upgrades to the West Cell of the Reservoir and HLPS would result in a total storage available to Zones 2 + 3 of 5,225 m^3 adequate to meet the 2041 requirements of 5,225 m^3. Thus, this alternative satisfies the planned community growth. A new PRV chamber will also be required to facilitate the sharing of Fire Storage between Zone 1 and 2 + 3.		
	ii)	- Build New Storage Facility of Minimum Size 93 m^3 - Upgrade Stouffville Reservoir (East and West Cells, 5,132 m^3) and HLPS to 190.07 L/s (3 Pumps, 2 Duty/1 Standby @ 95 L/s) - Decommission Zone 2 Elevated Tank - New PRV Chamber	Yes
	It is assumed that the New Storage Facility will be constructed at either the Zone 2 Elevated Tank Site location or the Stouffville Reservoir site. As such land acquisition is not being proposed form this option. The new storage facility		

Alternative		Satisfies Planned Population Growth?
would be of a minimum size of 93 m^3. Since this is an impractical size for a storage facility the Region should consider oversizing this facility. Upgrading the Stouffville Reservoir's East and West Cells and HLPS to 190.07 L/s to include 3 Pumps, 2 Duty/1 Standby each at 95 L/s allows for a usable storage capacity in the Stouffville Reservoir of Cell of 5,132 m^3. The new Storage Facility in conjunction with the upgrades to the East and West Cell of the Reservoir and HLPS would result in a total storage available to Zones 2 + 3 of 5,225 m^3 adequate to meet the 2041 requirements of 5,225 m^3. Thus, this alternative satisfies the planned community growth. A new PRV chamber will also be required to facilitate the sharing of Fire Storage between Zone 1 and 2 + 3.		
c) Retire Stouffville Reservoir and HLPS		
i)	- Build New Storage Facility of Size 1,825 m^3 - Maintain Zone 2 Elevated Tank (3,400 m^3) - Decommission Stouffville Reservoir and HLPS - New PRV Chamber	Yes
It is assumed that the New Storage Facility will be constructed at the Stouffville Reservoir Site location given that it is decommissioned in this scenario. As such land acquisition is not being proposed form this option. The new storage facility would be of 1,825 m^3. Maintaining the Zone 2 Elevated Tank results in a usable storage of 3,400 m^3. The combination of a new Storage Facility and Maintaining the Zone 2 Elevated Tank results in a total available storage of 5,225 m^3 which is much sufficient to meet the 2041 storage requirement for Zones 2 + 3 of 5,225 m^3. Thus, this alternative satisfies the planned community growth. A new PRV chamber will also be required to facilitate the sharing of Fire Storage between Zone 1 and 2 + 3.		
d) Retire Stouffville Reservoir, HLPS, and Zone 2 Elevated Tank		
i)	- Build New Storage Facility of Size 5,225 m^3 - Decommission Stouffville Reservoir and HLPS - Decommission Zone 2 Elevated Tank - New PRV Chamber	Yes
It is assumed that the New Storage Facility will be constructed at either Zone 2 Elevated Tank site location or the Stouffville Reservoir, given that both are being decommissioned in this scenario. As such land acquisition is not being proposed form this option. The new storage facility would be of 5,225 m^3. Thus, this alternative satisfies the planned community growth. A new PRV chamber will also be required to facilitate the sharing of Fire Storage between Zone 1 and 2 + 3.		

LEGEND

Lowest Impact ---- Most Preferred			Greatest Impact ---- Least Preferred

3.2.3 Ability to Satisfy Regional Design Standards

For the Town of Stouffville, the Region has established a residential unit rate of 189 Lpcd and an Employment unit rate of 144 Lpcd for 2041 as well as a maximum day factor of 1.80. For the proposed population of 64,671 this amounts to a maximum day water supply capacity of 20,821 m^3/day. Storage requirements for Stouffville Zones 2 + 3 in 2041 is 9,688 m^3 assuming dedicated fire storage provided in Zone 2, and 5,225 m^3 if fire storage is shared between Zones 1 to Zone 2. Wells 1, 2, and 3 have an approved maximum day water supply capacity of 2,946 m^3/day, while Well 5 has an approved capacity of 3,110 m^3/day and Well 6 an approved capacity of 2,290 m^3/day.

In addition, it has been indicated by the Region that they desire to maintain their permit to take water (PTTW, 14,238 m^3/day), and that 2041 average day demand (11,567 m^3/day) must be supplied by the Well production capacity only (excluding Lake-Based Supply). For the purposes of the following evaluation these will also be considered as "Design Guiding Principles" and the alternatives will be analysed against them in addition to the items mentioned above.

As can be seen in **Table 3-3** below, except for Do Nothing, Limit Community Growth, and Water Conservation all of the alternative solutions have the potential to meet Regional Design Guidelines.

TABLE 3-3 ABILITY OF ALTERNATIVE SOLUTIONS TO SATISFY DESIGN STANDARDS

Alternative			Satisfies Design Standards?
1) Do Nothing			No
Not technically feasible, the required storage volume for 2041 (5,225 m^3) exceeds effective available storage in 2041 (1,242 m^3). Further the Stouffville Reservoir is incapable of providing fire storage due to insufficient pumping capacity.			
2) Limit Community Growth			Somewhat
While not technically feasible, as the required storage volume for 2041 (5,225 m^3) exceeds the effective available storage in 2041 (1,242 m^3), by limiting the community growth, the difference between what is required and what is available is closer than both the Do Nothing and Implement Water Conservation alternatives. Hence, the lower score.			
3) Implement Water Conservation			No
Not technically feasible, the required storage volume for 2041 (5,225 m^3) exceeds effective available storage in 2041 (1,242 m^3). In addition, the Stouffville Reservoir is incapable of providing fire storage due to insufficient pumping capacity. Further the Region's fire requirement is based on size of pressure district thus implementing water conservation would not aide in decreasing the required fire storage volume (3,570 m^3) which exceeds effective storage.			
4) Facilitate Shared Fire Storage Between Zone 1 to Zone 2			
	a) No Storage Facilities Retired		
		i)	- Upgrade Stouffville Reservoir (West Cell, 2,996 m^3) and HLPS to 110.96 L/s (3 Pumps, 2 Duty/1 Standby @ 55.5 L/s) - Maintain Zone 2 Elevated Tank (3,400 m^3) - Decommission East Cell Reservoir - New PRV Chamber — Yes
	Upgrading the Stouffville Reservoir's West Cell and HLPS to 110.96 L/s to include 3 Pumps, 2 Duty/1 Standby each at 55 L/s allows for a usable storage capacity in the West Cell of 2,996 m^3. Maintaining the Zone 2 Elevated Tank		

Alternative		Satisfies Design Standards?
results in a usable storage of 3,400 m^3. The combination of these two results in a total available storage of 6,396 m^3 which is sufficient to meet the 2041 storage requirement for Zones 2 + 3 of 5,225 m^3. A new PRV chamber will also be required to facilitate the sharing of Fire Storage between Zone 1 and 2 + 3. This alternative satisfies Regional Design Standards.		
ii)	- Upgrade Stouffville Reservoir (East and West Cells, 5,132 m^3) and HLPS to 190.07 L/s (3 Pumps, 2 Duty/1 Standby @ 95 L/s) - Maintain Zone 2 Elevated Tank (3,400 m^3) - New PRV Chamber	Yes
Upgrading the Stouffville Reservoir's East and West Cells and HLPS to 190.07 L/s to include 3 Pumps, 2 Duty/1 Standby each at 95 L/s allows for a usable storage capacity in the Stouffville Reservoir of Cell of 5,132 m^3. Maintaining the Zone 2 Elevated Tank results in a usable storage of 3,400 m^3. The combination of these two results in a total available storage of 8,532 m^3 which is much more than sufficient to meet the 2041 storage requirement for Zones 2 + 3 of 5,225 m^3. A new PRV chamber will also be required to facilitate the sharing of Fire Storage between Zone 1 and 2 + 3. This alternative satisfies Regional Design Standards.		
b) Retire Zone 2 Elevated Tank		
i)	- Build New Storage Facility of Size 2,229 m^3 - Upgrade Stouffville Reservoir (West Cell, 2,996 m^3) and HLPS to 110.96 L/s (3 Pumps, 2 Duty/1 Standby @ 55.5 L/s) - Decommission Zone 2 Elevated Tank - Decommission East Cell of Reservoir - New PRV Chamber	Yes
It is assumed that the New Storage Facility will be constructed at either the Zone 2 Elevated Tank Site location or the Stouffville Reservoir site. As such land acquisition is not being proposed for this option. The new storage facility would be sized to 2,229 m^3. Upgrading the Stouffville Reservoir's West Cell and HLPS to 110.96 L/s to include 3 Pumps, 2 Duty/1 Standby each at 55 L/s allows for a usable storage capacity in the West Cell of 2,996 m^3. The new Storage Facility in conjunction with the upgrades to the West Cell of the Reservoir and HLPS would result in a total storage available to Zones 2 + 3 of 5,225 m^3 adequate to meet the 2041 requirements of 5,225 m^3. A new PRV chamber will also be required to facilitate the sharing of Fire Storage between Zone 1 and 2 + 3. This alternative satisfies Regional Design Standards.		
ii)	- Build New Storage Facility of Minimum Size 93 m^3 - Upgrade Stouffville Reservoir (East and West Cells, 5,132 m^3) and HLPS to 190.07 L/s (3 Pumps, 2 Duty/1 Standby @ 95 L/s)	

Alternative			Satisfies Design Standards?
		- Decommission Zone 2 Elevated Tank - New PRV Chamber	Yes
	It is assumed that the New Storage Facility will be constructed at either the Zone 2 Elevated Tank Site location or the Stouffville Reservoir site. As such land acquisition is not being proposed form this option. The new storage facility would be of a minimum size of 93 m^3. Since this is an impractical size for a storage facility the Region should consider oversizing this facility. Upgrading the Stouffville Reservoir's East and West Cells and HLPS to 190.07 L/s to include 3 Pumps, 2 Duty/1 Standby each at 95 L/s allows for a usable storage capacity in the Stouffville Reservoir of Cell of 5,132 m^3. The new Storage Facility in conjunction with the upgrades to the East and West Cell of the Reservoir and HLPS would result in a total storage available to Zones 2 + 3 of 5,225 m^3 adequate to meet the 2041 requirements of 5,225 m^3. A new PRV chamber will also be required to facilitate the sharing of Fire Storage between Zone 1 and 2 + 3. This alternative satisfies Regional Design Standards.		
	c) Retire Stouffville Reservoir and HLPS		
	i)	- Build New Storage Facility of Size 1,825 m^3 - Maintain Zone 2 Elevated Tank (3,400 m^3) - Decommission Stouffville Reservoir and HLPS - New PRV Chamber	Yes
	It is assumed that the New Storage Facility will be constructed at the Stouffville Reservoir Site location given that it is decommissioned in this scenario. As such land acquisition is not being proposed form this option. The new storage facility would be of 1,825 m^3. Maintaining the Zone 2 Elevated Tank results in a usable storage of 3,400 m^3. The combination of a new Storage Facility and Maintaining the Zone 2 Elevated Tank results in a total available storage of 5,225 m^3 which is much sufficient to meet the 2041 storage requirement for Zones 2 + 3 of 5,225 m^3. A new PRV chamber will also be required to facilitate the sharing of Fire Storage between Zone 1 and 2 + 3. This alternative satisfies Regional Design Standards.		
	d) Retire Stouffville Reservoir, HLPS, and Zone 2 Elevated Tank		
	i)	- Build New Storage Facility of Size 5,225 m^3 - Decommission Stouffville Reservoir and HLPS - Decommission Zone 2 Elevated Tank - New PRV Chamber	Yes

Alternative		Satisfies Design Standards?
	It is assumed that the New Storage Facility will be constructed at either Zone 2 Elevated Tank site location or the Stouffville Reservoir, given that both are being decommissioned in this scenario. As such land acquisition is not being proposed form this option. The new storage facility would be of 5,225 m^3. A new PRV chamber will also be required to facilitate the sharing of Fire Storage between Zone 1 and 2 + 3. This alternative satisfies Regional Design Standards.	

LEGEND			
Lowest Impact ---- Most Preferred			Greatest Impact ---- Least Preferred

3.2.4 Ability to Comply with Legislative Requirements

The primary legislative requirements pertaining to the Stouffville Water system are as follows:

- Environmental Requirements, per the Ministry of the Environment and Climate Change (MOECC), the Ministry of Natural Resources and Forestry (MNRF), and the Conservation Authorities Act;
- Archaeological and Historical/Cultural Requirements, per the Ministry of Tourism, Culture and Sport (MTCS);
- Obtaining a Permit to Take Water (PTTW), Drinking Water Works Permit (DWWP) and Drinking Water System License (DWSL) from the MOECC; and,
- The Oak Ridges Moraine Conservation Plan (ORMCP), per the Ministry of Municipal Affairs and Housing (MMAH).

Based on a desktop review of the environmental and socio-cultural features within the Study Area, it is highly likely that any proposed facilities requiring land will be able to be sited in a location that will have no greater than a low impact" on the natural or socio-cultural environments such that these impacts can be reduced to near-zero or acceptable/approvable levels through the provision of reasonable mitigative measures.

As such, the main legislative concern for the purposes of this Class EA is the Oak Ridges Moraine Conservation Plan, which prohibits *partial servicing* in Settlement Areas within the ORMCP area. As such, any new development must be serviced via:

a) Full municipal/communal water supply and wastewater treatment; or
b) On-site water and sewage systems.

When the ORMCP was approved, all existing development was grand-fathered, so the existing community (which is partially-serviced) is permitted to remain partially-serviced. Any new development cannot be partially-serviced.

Further, Section 1.6.6.4 of the Provincial Policy Statement Under the *Planning Act* (MMAH, 2014) states that:

> *Where municipal sewage services and municipal water services or private communal sewage services and private communal water services are not provided, individual on-site sewage services and individual on-site water services may be used provided that site conditions are suitable for the long-term provision of such services with no negative impacts.* ***In settlement areas, these services may only be used for infilling and minor rounding out of existing development****.*

The various storage alternatives will comply with all current legislative requirements, and as such all have the same assessment value.

TABLE 3-4 ABILITY TO COMPLY WITH LEGISLATIVE REQUIREMENTS

Alternative	Complies with Legislative Requirements?
1) Do Nothing	Yes
Complies with legislative requirements	
2) Limit Community Growth	Yes
Complies with legislative requirements	
3) Implement Water Conservation	Yes
Complies with legislative requirements	
4) Facilitate Shared Fire Storage Between Zone 1 to Zone 2	

Alternative			Complies with Legislative Requirements?
	a) No Storage Facilities Retired		
	i)	- Upgrade Stouffville Reservoir (West Cell, 2,996 m^3) and HLPS to 110.96 L/s (3 Pumps, 2 Duty/1 Standby @ 55.5 L/s) - Maintain Zone 2 Elevated Tank (3,400 m^3) - Decommission East Cell Reservoir - New PRV Chamber	Yes
	Complies with legislative requirements		
	ii)	- Upgrade Stouffville Reservoir (East and West Cells, 5,132 m^3) and HLPS to 190.07 L/s (3 Pumps, 2 Duty/1 Standby @ 95 L/s) - Maintain Zone 2 Elevated Tank (3,400 m^3) - New PRV Chamber	Yes
	Complies with legislative requirements		
	b) Retire Zone 2 Elevated Tank		
	i)	- Build New Storage Facility of Size 2,229 m^3 - Upgrade Stouffville Reservoir (West Cell, 2,996 m^3) and HLPS to 110.96 L/s (3 Pumps, 2 Duty/1 Standby @ 55.5 L/s) - Decommission Zone 2 Elevated Tank - Decommission East Cell of Reservoir - New PRV Chamber	Yes
	Complies with legislative requirements		
	ii)	- Build New Storage Facility of Minimum Size 93 m^3 - Upgrade Stouffville Reservoir (East and West Cells, 5,132 m^3) and HLPS to 190.07 L/s (3 Pumps, 2 Duty/1 Standby @ 95 L/s) - Decommission Zone 2 Elevated Tank - New PRV Chamber	Yes
	Complies with legislative requirements		
	c) Retire Stouffville Reservoir and HLPS		

Alternative			Complies with Legislative Requirements?
	i)	- Build New Storage Facility of Size 1,825 m^3 - Maintain Zone 2 Elevated Tank (3,400 m^3) - Decommission Stouffville Reservoir and HLPS - New PRV Chamber	Yes
	Complies with legislative requirements		
	d) Retire Stouffville Reservoir, HLPS, and Zone 2 Elevated Tank		
	i)	- Build New Storage Facility of Size 5,225 m^3 - Decommission Stouffville Reservoir and HLPS - Decommission Zone 2 Elevated Tank - New PRV Chamber	Yes
	Complies with legislative requirements		

LEGEND

Lowest Impact ---- Most Preferred			Greatest Impact ---- Least Preferred

3.2.5 Provision of Operational Flexibility

Any modifications to the water supply facility should also be evaluated as to how they impact (positively or negatively) the operational flexibility of the overall system.

It is important to maintain operational flexibility such that individual processes can be taken out of service on occasion for planned or emergency maintenance, and for to accommodate unexpectedly high demands which may arise.

For the purposes of the evaluation, alternatives which provide greater operational flexibility are preferred to those which maintain the existing flexibility. Specifically, floating storage is said to have grater operational flexibility due to reduced operating constraints when compared with Pumped Storage. Additionally, alternatives with storage provided between two or more facilities are considered to have greater operation flexibility compared to those reliant on a single storage facility due to security of storage.

The first three alternatives Do Nothing, Limit Community Growth, and Implement Water Conservation have an assessment rating that Negatively Impacts operational flexibility. This is due to insufficient storage provided to meet 2041 storage requirements.

Alternatives 4) a) i), 4) a) ii), and 4) b) i) have an assessment rating of Somewhat Enhanced due to the reliance on Pumped and Floating storage. 4) b) ii) has an assessment rating of Reduced due to the greatest reliance on Pumped Storage of the alternatives. Alternative 4) c) i) has the lowest assessment rating of “Greatest Enhancement” due to storage being provided by 2 elevated facilities. Alternative 4) d) i) has an assessment rating of Enhanced due to storage being provided by potentially 1 new elevated storage tank.

TABLE 3-5 ASSESSMENT OF OPERATIONAL FLEXIBILITY OF ALTERNATIVE SOLUTIONS

Alternative			Impact on Operational Flexibility
1) Do Nothing			Negative Impact
Doing Nothing to expand the available water storage to meet the needs of the proposed growth would negatively impact operational flexibility, as the water storage available in Zones 2 + 3 supply would be insufficient to meet the water demands from the community.			
2) Limit Community Growth			Negative Impact
This alternative would negatively impact operational flexibility, as the water storage available in Zones 2 + 3 supply would be insufficient to meet the water demands from the community.			
3) Implement Water Conservation			Negative Impact
This alternative would negatively impact operational flexibility, as the water storage available in Zones 2 + 3 supply would be insufficient to meet the water demands from the community.			
4) Facilitate Shared Fire Storage Between Zone 1 to Zone 2			
	a) No Storage Facilities Retired		
	i)	- Upgrade Stouffville Reservoir (West Cell, 2,996 m^3) and HLPS to 110.96 L/s (3 Pumps, 2 Duty/1 Standby @ 55.5 L/s) - Maintain Zone 2 Elevated Tank (3,400 m^3) - Decommission East Cell Reservoir	Somewhat Enhanced

Alternative			Impact on Operational Flexibility
		- New PRV Chamber	
	This alternative involves two storage facilities providing Zone 2 + 3 with equalization and emergency storage, the West Cell of the Stouffville Reservoir and the Zone 2 Elevated Storage Tank. Fire Storage would be supplied from Zone 1. Storage requirements for Zone 2 + 3 being met by 3 facilities increases operational flexibility as an emergency affecting one of the facilities will have a lesser impact on the Region's ability to provide adequate water storage to the community. Further the split between floating and pumped storage through the West Cell of the Stouffville Reservoir and Zone 2 Elevated Tank provide additional operational flexibility in terms of meeting the required demand flow rates.		
	ii)	- Upgrade Stouffville Reservoir (East and West Cells, 5,132 m^3) and HLPS to 190.07 L/s (3 Pumps, 2 Duty/1 Standby @ 95 L/s) - Maintain Zone 2 Elevated Tank (3,400 m^3) - New PRV Chamber	Somewhat Enhanced
	This alternative involves two storage facilities providing Zone 2 + 3 with equalization and emergency storage, both Cells of the Stouffville Reservoir and the Zone 2 Elevated Storage Tank. Fire Storage would be supplied from Zone 1. Storage requirements for Zone 2 + 3 being met by 3 facilities increases operational flexibility as an emergency affecting one of the facilities will have a lesser impact on the Region's ability to provide adequate water storage to the community. Further the split between floating and pumped storage through the Full Stouffville Reservoir and Zone 2 Elevated Tank provide additional operational flexibility in terms of meeting the required demand flow rates.		
	b) Retire Zone 2 Elevated Tank		
	i)	- Build New Storage Facility of Size 2,229 m^3 - Upgrade Stouffville Reservoir (West Cell, 2,996 m^3) and HLPS to 110.96 L/s (3 Pumps, 2 Duty/1 Standby @ 55.5 L/s) - Decommission Zone 2 Elevated Tank - Decommission East Cell of Reservoir - New PRV Chamber	Somewhat Enhanced
	This alternative involves two storage facilities providing Zone 2 + 3 with equalization and emergency storage, the West Cell of the Stouffville Reservoir and a New Storage Facility. Fire Storage would be supplied from Zone 1. Storage requirements for Zone 2 + 3 being met by 3 facilities increases operational flexibility as an emergency affecting one of the facilities will have a lesser impact on the Region's ability to provide adequate water storage to the community. Further depending on the type of new storage facility constructed (floating or pumped) there is the possibility that storage would be split between floating and pumped storage through the new Facility and the West Reservoir Cell which would provide additional operational flexibility in terms of meeting the required demand flow rates.		
	ii)	- Build New Storage Facility of Minimum Size 93 m^3	

Alternative			Impact on Operational Flexibility
		- Upgrade Stouffville Reservoir (East and West Cells, 5,132 m^3) and HLPS to 190.07 L/s (3 Pumps, 2 Duty/1 Standby @ 95 L/s) - Decommission Zone 2 Elevated Tank - New PRV Chamber	Reduced
	In this scenario Storage requirements for Zone 2 + 3 is primarily provided by two facilities, the Stouffville Reservoir (both cells) and the Zone 1 Elevated Tank (providing fire storage). As such while it provides reduced operational flexibility for Zones 2+3 as equalization and emergency storage is primarily being provided by only 1 facility and this facility is pumped (meeting adequate demand flow rates will be more difficult compared to a floating facility).		
	c) Retire Stouffville Reservoir and HLPS		
	i)	- Build New Storage Facility of Size 1,825 m^3 - Maintain Zone 2 Elevated Tank (3,400 m^3) - Decommission Stouffville Reservoir and HLPS - New PRV Chamber	Greatest Enhancement
	This alternative involves two storage facilities providing Zone 2 + 3 with equalization and emergency storage, the Zone 2 Elevated Tank and a New Storage Facility. Fire Storage would be supplied from Zone 1. Storage requirements for Zone 2 + 3 being met by 3 facilities increases operational flexibility as an emergency affecting one of the facilities will have a lesser impact on the Region's ability to provide adequate water storage to the community. Further depending on the type of new storage facility constructed (floating or pumped) there is the possibility that storage would be split between floating and pumped storage through the new Facility and Zone 2 Elevated Tank or be entirely floating based which would provide additional operational flexibility in terms of meeting the required demand flow rates.		
	d) Retire Stouffville Reservoir, HLPS, and Zone 2 Elevated Tank		
	i)	- Build New Storage Facility of Size 5,225 m^3 - Decommission Stouffville Reservoir and HLPS - Decommission Zone 2 Elevated Tank - New PRV Chamber	Enhanced
	In this scenario Storage requirements for Zone 2 + 3 is primarily provided by two facilities, a New Storage Facility and the Zone 1 Elevated Tank (providing fire storage). As such while it provides enhanced operational flexibility compared to current operating conditions, it is less so than the provision of (3 or more) storage facilities. With this said there is the possibility that there could be enhanced capabilities of meeting the various demand flow rates if the constructed facility is Floating.		
LEGEND			

Alternative		Impact on Operational Flexibility	
Lowest Impact ---- Most Preferred			Greatest Impact ---- Least Preferred

3.2.6 Impact on Natural Environment

In previous stages of this Class EA process, a technical memorandum has documented the extent of the natural environment (TM4, dated May 31, 2018) and the overall impacts of the proposed alternative solutions on the natural environments (TM5, dated June 19, 2018).

From **Table 3-6** below it can be seen that the first three alternatives Do Nothing, Limit Community Growth, and Implement Water Conservation along with alternative 4) a) i) and 4) a) ii) have the lowest impact on the Natural Environment of the alternatives evaluated. This is to be expected, as they involve no new facilities to be constructed. Upgrades to the facilities in these options occur within the existing footprint of the facilities, and as such have minimal impacts to the Natural Environment.

The remaining alternatives have an assessment of Moderate to Potentially Significant. The impact will ultimately depend on the proximity of the to be determined site locations to residential, commercial, and industrial land uses. These may be mitigable by locating the new storage facility on existing land where other facilities are currently in use and planned for decommissioning. This will be dependent on the availability of space within existing site locations. Reasonable protective measures and best practices can also help mitigate the impact on the Natural Environment for some of these options.

TABLE 3-6 ALTERNATIVE SOLUTION'S IMPACT ON THE NATURAL ENVIRONMENT

Alternative			Impact on Natural Environment
1) Do Nothing			Minor Impact
Decommissioning of the Zone 2 Elevated Tank is required in this alternative along with upgrades to the Stouffville Reservoir and High Lift Pumping Station to maintain current capacities. Upgrades to the Stouffville Reservoir involve alterations within the existing footprint of the current Reservoir.			
2) Limit Community Growth			Minor Impact
Decommissioning of the Zone 2 Elevated Tank is required in this alternative along with upgrades to the Stouffville Reservoir and High Lift Pumping Station to maintain current capacities. Upgrades to the Stouffville Reservoir involve alterations within the existing footprint of the current Reservoir.			
3) Implement Water Conservation			Minor Impact
Decommissioning of the Zone 2 Elevated Tank is required in this alternative along with upgrades to the Stouffville Reservoir and High Lift Pumping Station to maintain current capacities. Upgrades to the Stouffville Reservoir involve alterations within the existing footprint of the current Reservoir.			
4) Facilitate Shared Fire Storage Between Zone 1 to Zone 2			
	a) No Storage Facilities Retired		
	i)	- Upgrade Stouffville Reservoir (West Cell, 2,996 m^3) and HLPS to 110.96 L/s (3 Pumps, 2 Duty/1 Standby @ 55.5 L/s) - Maintain Zone 2 Elevated Tank (3,400 m^3) - Decommission East Cell Reservoir	Minor Impact

Alternative			Impact on Natural Environment
		- New PRV Chamber	
	Upgrades to the Stouffville Reservoir and the Elevated Tank involve alterations within the existing footprint of the current Reservoir. Decommissioning of the East Cell of the Stouffville Reservoir will also be required but will involve little Natural Environment Impact.		
	ii)	- Upgrade Stouffville Reservoir (East and West Cells, 5,132 m^3) and HLPS to 190.07 L/s (3 Pumps, 2 Duty/1 Standby @ 95 L/s) - Maintain Zone 2 Elevated Tank (3,400 m^3) - New PRV Chamber	Minor Impact
	Upgrades to the Stouffville Reservoir and the Elevated Tank involve alterations within the existing footprint of the current Reservoir.		
	b) Retire Zone 2 Elevated Tank		
	i)	- Build New Storage Facility of Size 2,229 m^3 - Upgrade Stouffville Reservoir (West Cell, 2,996 m^3) and HLPS to 110.96 L/s (3 Pumps, 2 Duty/1 Standby @ 55.5 L/s) - Decommission Zone 2 Elevated Tank - Decommission East Cell of Reservoir - New PRV Chamber	Minor Impact
	This alternative involves the construction of a new Storage Facility of size 2,229 m^3. This storage facility is of comparable size to the Zone 2 Elevated Tank that is set for decommissioning in 2043. It is assumed that since the Zone 2 Elevated Tank is being decommissioned in the scenario, the site location can be re-purposed for this new Storage Facility. Thus, no new land will be required, and construction can occur in the footprint of an existing facility. Decommissioning of the Zone 2 Elevated Tank is also required. Similar to the alternatives above a New PRV chamber will also be required to be built. Upgrades to the Stouffville Reservoir will occur within the existing footprint of the Reservoir (resulting in minimal impact to the natural environment from this upgrade).		
	ii)	- Build New Storage Facility of Minimum Size 93 m^3 - Upgrade Stouffville Reservoir (East and West Cells, 5,132 m^3) and HLPS to 190.07 L/s (3 Pumps, 2 Duty/1 Standby @ 95 L/s) - Decommission Zone 2 Elevated Tank - New PRV Chamber	Moderate, but mitigable during construction

Alternative		Impact on Natural Environment
This alternative involves the construction of a new Storage Facility of minimum size 93 m^3. While this required storage is minimal it might make sense for the Region to consider constructing a larger facility for future storage accommodations. It is assumed that since the Zone 2 Elevated Tank is being decommissioned in the scenario, the site location can be re-purposed for this new Storage Facility. Thus, no new land will be required, and construction can occur in the footprint of an existing facility. As this option requires the decommissioning of a large facility (Zone 2 Elevated Tank), it is assumed the impact to the natural environment will be greater than alternatives which involve the decommissioning of smaller facilities (or only portions of larger facilities). Decommissioning of the Zone 2 Elevated Tank is also required. Similar to the alternatives above a New PRV chamber will also be required to be built. Upgrades to the Stouffville Reservoir will occur within the existing footprint of the Reservoir (resulting in minimal impact to the natural environment from this upgrade).		
c) Retire Stouffville Reservoir and HLPS		
i)	- Build New Storage Facility of Size 1,825 m^3 - Maintain Zone 2 Elevated Tank (3,400 m^3) - Decommission Stouffville Reservoir and HLPS - New PRV Chamber	Moderate, but mitigable during construction
This alternative involves the construction of a new Storage Facility of size 1,825 m^3. It is assumed that since the Stouffville Reservoir and HLPS are being decommissioned, the site location can be re-purposed for this new Storage Facility. Thus, no new land will be required, and construction can occur in the footprint of an existing facility. As this option requires the decommissioning of a large facility (entirety of the Stouffville Reservoir), it is assumed the impact to the natural environment will be greater than alternatives which involve the decommissioning of smaller facilities. Maintenance to keep the Zone 2 Elevated Tank operational past 2043 is also required. Similar to the alternatives above a New PRV chamber will also be required to be built.		
d) Retire Stouffville Reservoir, HLPS, and Zone 2 Elevated Tank		
i)	- Build New Storage Facility of Size 5,225 m^3 - Decommission Stouffville Reservoir and HLPS - Decommission Zone 2 Elevated Tank - New PRV Chamber	Greatest Impact
This alternative involves the construction of a new Storage Facility of size 5,225 m^3. It is assumed that since the Stouffville Reservoir and HLPS along with the Zone 2 Elevated Tank are being decommissioned, one of these site locations can be re-purposed for this new Storage Facility. Thus, no new land will be required. As this option requires the decommissioning of several facilities (entirety of the Stouffville Reservoir, and Zone 2 Elevated Tank), along with the construction of a new large facility it is assumed the impact to the natural environment will be greater than alternatives which involve the decommissioning of smaller facilities.		

Alternative		Impact on Natural Environment
	Similar to the alternatives above a New PRV chamber will also be required to be built.	

LEGEND			
Lowest Impact --- Most Preferred			Greatest Impact --- Least Preferred

3.2.7 Impact on Socio-Cultural Environment

In previous stages of this Class EA process, two previous technical memoranda have documented the extent of the socio-cultural environment (TM4, dated May 31, 2018) and the overall impacts of the proposed alternative solutions on the socio-cultural environments (TM5, dated June 19, 2018).

Below is a summary of the potential impact the various storage alternatives pose to the socio-cultural environment.

All alternatives evaluated carry social impact relating to the water supply, with Do Nothing, and Implement Water Conservation having the lowest assessment rating of Low. Limit Community Growth has the highest assessment rating of Significant.

TABLE 3-7 ALTERNTIVE SOLUTION'S IMPACT ON SOCIO-CULTURAL ENVIRONMENT

Alternative			Impact on Socio-Cultural Environment
1) Do Nothing			Low
Noise and Vibration, isolated works to install new PRVs and upgrades to Stouffville Reservoir and High Lift Pumping Station. Potential service disruption to residential, commercial, industrial consumers during upgrades and PRV installation			
2) Limit Community Growth			Significant
Noise and Vibration, isolated works to install new PRVs and upgrades to Stouffville Reservoir and High Lift Pumping Station. Potential service disruption to residential, commercial, industrial consumers during upgrades and PRV installation. The approved growth of the Town would have to be reconsidered which could affect several socio-cultural areas such as property value, and other approved infrastructure projects.			
3) Implement Water Conservation			Low
Noise and Vibration, isolated works to install new PRVs and upgrades to Wells/Booster Pumping Station to maintain current capacities. Potential service disruption to residential, commercial, industrial consumers during upgrades and PRV installation.			
4) Facilitate Shared Fire Storage Between Zone 1 to Zone 2			
	a) No Storage Facilities Retired		
		i) - Upgrade Stouffville Reservoir (West Cell, 2,996 m^3) and HLPS to 110.96 L/s (3 Pumps, 2 Duty/1 Standby @ 55.5 L/s) - Maintain Zone 2 Elevated Tank (3,400 m^3) - Decommission East Cell Reservoir - New PRV Chamber	Low
	Noise and Vibration, isolated works to install new PRVs and upgrades to Stouffville Reservoir and High Lift Pumping Station. Potential service disruption to residential, commercial, and industrial consumers during upgrades and PRV installation.		

Alternative			Impact on Socio-Cultural Environment
	Noise and Vibration impacts will be present due to the decommissioning of the East Cell Reservoir. Noise and Vibration impacts will be present due to the upgrades required to maintain the Stouffville Zone 2 Elevated Tank.		
	ii)	- Upgrade Stouffville Reservoir (East and West Cells, 5,132 m^3) and HLPS to 190.07 L/s (3 Pumps, 2 Duty/1 Standby @ 95 L/s) - Maintain Zone 2 Elevated Tank (3,400 m^3) - New PRV Chamber	Low
	Noise and Vibration, isolated works to install new PRVs and upgrades to Stouffville Reservoir and High Lift Pumping Station. Potential service disruption to residential, commercial, and industrial consumers during upgrades and PRV installation. Noise and Vibration impacts will be present due to the upgrades required to maintain the Stouffville Zone 2 Elevated Tank.		
	b) Retire Zone 2 Elevated Tank		
	i)	- Build New Storage Facility of Size 2,229 m^3 - Upgrade Stouffville Reservoir (West Cell, 2,996 m^3) and HLPS to 110.96 L/s (3 Pumps, 2 Duty/1 Standby @ 55.5 L/s) - Decommission Zone 2 Elevated Tank - Decommission East Cell of Reservoir - New PRV Chamber	Low
	Noise and Vibration, isolated works to install new PRVs and upgrades to Stouffville Reservoir and High Lift Pumping Station. Potential service disruption to residential, commercial, and industrial consumers during upgrades and PRV installation. Temporary noise and vibration disruption isolated to the selected site location will be present for the construction of the new Storage Facility. This can be mitigated by constructing the New Storage Facility at the Stouffville Reservoir East Cell site location (to be decommissioned in this scenario). Depending on type of storage facility constructed and its location there could be additional residential, commercial and industrial impacts due to proximity to the facility. Noise and Vibration impacts will be present due to the decommissioning of the Stouffville Zone 2 Elevated Tank and East Reservoir Cell.		
	ii)	- Build New Storage Facility of Minimum Size 93 m^3 - Upgrade Stouffville Reservoir (East and West Cells, 5,132 m^3) and HLPS to 190.07 L/s (3 Pumps, 2 Duty/1 Standby @ 95 L/s)	Low

Alternative			Impact on Socio-Cultural Environment
		- Decommission Zone 2 Elevated Tank - New PRV Chamber	
	Noise and Vibration, isolated works to install new PRVs and upgrades to Stouffville Reservoir and High Lift Pumping Station. Potential service disruption to residential, commercial, and industrial consumers during upgrades and PRV installation. Temporary noise and vibration disruption isolated to the selected site location will be present for the construction of the new Storage Facility. Depending on type of storage facility constructed and its location there could be additional residential, commercial and industrial impacts due to proximity to the facility. Due to the full Stouffville Reservoir being used in this scenario the location of the New Storage Facility will need to be at the Zone 2 Elevated Tank site location. This site is a densely populated area and as such carries a greater socio-cultural environmental impact. Noise and Vibration impacts will be present due to the decommissioning of the Stouffville Zone 2 Elevated Tank.		
	c) Retire Stouffville Reservoir and HLPS		
	i)	- Build New Storage Facility of Size 1,825 m^3 - Maintain Zone 2 Elevated Tank (3,400 m^3) - Decommission Stouffville Reservoir and HLPS - New PRV Chamber	Moderate
	Potential service disruption to residential, commercial, and industrial consumers during upgrades and PRV installation. Temporary noise and vibration disruption isolated to the selected site location will be present for the construction of the new Storage Facility. This can be mitigated by constructing the New Storage Facility at the Stouffville Reservoir site location (which is to be decommissioned in this scenario). Noise and Vibration impacts will be present due to the decommissioning of the Stouffville Zone 2 Elevated Tank and Stouffville Reservoir. As this option requires the decommissioning of a large facility (entirety of the Stouffville Reservoir), it is assumed the impact to the natural environment will be greater than alternatives which involve the decommissioning of smaller facilities. There will be a small agricultural impact due to the acquisition of a site for the new storage reservoir. Depending on type of storage facility constructed and its location there could be additional residential, commercial and industrial impacts due to proximity to the facility.		
	d) Retire Stouffville Reservoir, HLPS, and Zone 2 Elevated Tank		
	i)	- Build New Storage Facility of Size 5,225 m^3 - Decommission Stouffville Reservoir and HLPS - Decommission Zone 2 Elevated Tank	Greatest Impact

Alternative			Impact on Socio-Cultural Environment
		- New PRV Chamber	
	Potential service disruption to residential, commercial, and industrial consumers during upgrades and PRV installation. Temporary noise and vibration disruption isolated to the selected site location will be present for the construction of the new Storage Facility. Noise and Vibration impacts will be present due to the decommissioning of the Stouffville Zone 2 Elevated Tank and Stouffville Reservoir and HLPS. As this option requires the decommissioning of several facilities (entirety of the Stouffville Reservoir, and Zone 2 Elevated Tank), along with the construction of a new large facility it is assumed the impact to the socio-cultural environment will be greater than alternatives which involve the decommissioning of smaller facilities. There will be a small agricultural impact due to the acquisition of a site for the new storage reservoir. Depending on type of storage facility constructed and its location there could be additional residential, commercial and industrial impacts due to proximity to the facility. This can be mitigated by constructing the New Storage Facility at the Stouffville Reservoir Site location (which is to be decommissioned in this scenario).		

LEGEND			
Lowest Impact ---- Most Preferred			Greatest Impact ---- Least Preferred

3.2.8 Capital Costs

Below is a summary of the project cost estimate (excluding lifecycle costs) for the various alternatives analysed. This includes a cost estimate associated with required upgrades as well new infrastructure for the various scenarios being evaluated. All of the costs below include a 25% allowance for permitting and approvals, engineering and other design elements, plus a contingency.

From **Table 3-8** below, the first three alternatives Do Nothing, Limit Community Growth, and Implement Water Conservation have the lowest capital costs associated with them, ranging from $2,310,000 – 2,620,000. The remaining alternatives range in costs from $3,556,000 – 12,300,000.

TABLE 3-8 ASSESSMENT OF CAPITAL COSTS

Alternative			Capital Cost Comparison
1) Do Nothing			Lowest of Options Examined
The project cost of this alternative would be around $2,307,000. Costs associated with this alternative include upgrading the Stouffville Reservoir and High Lift Pumping Station to maintain current capacity and Decommissioning the Stouffville Zone 2 Elevated Tank.			
2) Limit Community Growth			Lowest of Options Examined
The project cost of this alternative would be around $2,307,000. Costs associated with this alternative include upgrading the Stouffville Reservoir and High Lift Pumping Station to maintain current capacity and Decommissioning the Stouffville Zone 2 Elevated Tank.			
3) Implement Water Conservation			Second Lowest of Options Examined
The project cost of this alternative would be around $2,617,00. Costs associated with this alternative include upgrading the Stouffville Reservoir and High Lift Pumping Station to maintain current capacity and Decommissioning the Stouffville Zone 2 Elevated Tank.			
4) Facilitate Shared Fire Storage Between Zone 1 to Zone 2			
	a) No Storage Facilities Retired		
	i)	- Upgrade Stouffville Reservoir (West Cell, 2,996 m^3) and HLPS to 110.96 L/s (3 Pumps, 2 Duty/1 Standby @ 55.5 L/s) - Maintain Zone 2 Elevated Tank (3,400 m^3) - Decommission East Cell Reservoir - New PRV Chamber	Moderate
	The project cost of this alternative would be around $9,104,000. Costs associated with this scenario include upgrading the Stouffville Reservoir to make full use of the West Cell, upgrading the HLPS to 110.96 L/s, maintaining the Zone 2 Elevated Tank, Decommissioning the East Cell of the Stouffville Reservoir, and the construction of a New PRV Chamber.		

Alternative			Capital Cost Comparison
	ii)	- Upgrade Stouffville Reservoir (East and West Cells, 5,132 m^3) and HLPS to 190.07 L/s (3 Pumps, 2 Duty/1 Standby @ 95 L/s) - Maintain Zone 2 Elevated Tank (3,400 m^3) - New PRV Chamber	Moderate
	The project cost of this alternative would be around $8,983,000. Costs associated with this scenario include upgrading the Stouffville Reservoir to make full use of both Reservoir Cells, upgrading the HLPS to 190.07 L/s, maintaining the Zone 2 Elevated Tank, and the construction of a New PRV Chamber.		
	b) Retire Zone 2 Elevated Tank		
	i)	- Build New Storage Facility of Size 2,229 m^3 - Upgrade Stouffville Reservoir (West Cell, 2,996 m^3) and HLPS to 110.96 L/s (3 Pumps, 2 Duty/1 Standby @ 55.5 L/s) - Decommission Zone 2 Elevated Tank - Decommission East Cell of Reservoir - New PRV Chamber	Moderate – Very High
	The project cost of this alternative would be around $9,742,000 assuming the new Storage Facility is an Elevated Tank or Standpipe and $11,126,000 assuming the new Storage Facility is an Inground Reservoir with Pumping Station. Costs associated with this scenario include construction of a New Storage Facility of size 2,229 m^3, upgrading the Stouffville Reservoir to make full use of the West Reservoir Cell, upgrading the HLPS to 110.96 L/s, Decommissioning the Zone 2 Elevated Tank, Decommissioning the East Cell of the Reservoir, and the construction of a New PRV Chamber.		
	ii)	- Build New Storage Facility of Minimum Size 93 m^3 - Upgrade Stouffville Reservoir (East and West Cells, 5,132 m^3) and HLPS to 190.07 L/s (3 Pumps, 2 Duty/1 Standby @ 95 L/s) - Decommission Zone 2 Elevated Tank - New PRV Chamber	Low
	The project cost of this alternative would be around $3,996,000. Costs associated with this scenario include upgrading the Stouffville Reservoir to make full use of both Reservoir Cells, upgrading the HLPS to 190.07 L/s, Decommissioning the Zone 2 Elevated Tank, and the construction of a New PRV Chamber.		
	c) Retire Stouffville Reservoir and HLPS		

Alternative			Capital Cost Comparison
	i)	- Build New Storage Facility of Size 1,825 m^3 - Maintain Zone 2 Elevated Tank (3,400 m^3) - Decommission Stouffville Reservoir and HLPS - New PRV Chamber	Moderate – Very High
	The project cost of this alternative would be around $14,163,000 assuming the new Storage Facility is an Elevated Tank or Standpipe and approximately the same assuming the new Storage Facility is an Inground Reservoir with Pumping Station. Costs associated with this scenario include construction of a New Storage Facility of size 1,825 m^3, Decommissioning of the Stouffville Reservoir and HLPS, Upgrading the Zone 2 Elevated Tank to maintain operation past 2043, and the construction of a New PRV Chamber.		
	d) Retire Stouffville Reservoir, HLPS, and Zone 2 Elevated Tank		
	i)	- Build New Storage Facility of Size 5,225 m^3 - Decommission Stouffville Reservoir and HLPS - Decommission Zone 2 Elevated Tank - New PRV Chamber	Very High
	The project cost of this alternative would be around $14,168,000 assuming the new Storage Facility is an Elevated Tank or Standpipe and $12,301,000 assuming the new Storage Facility is an Inground Reservoir with Pumping Station. Costs associated with this scenario include construction of a New Storage Facility of size 5,225 m^3, Decommissioning of the Stouffville Reservoir and HLPS, Decommissioning of the Zone 2 Elevated Tank, and the construction of a New PRV Chamber.		

LEGEND

Lowest Impact ---- Most Preferred			Greatest Impact ---- Least Preferred

3.2.9 Lifecycle Costs

The final evaluation criteria is the Project Lifecycle Cost Estimates. This includes a net present value evaluation of the cost associated with required upgrades as well new infrastructure and operation and maintenance costs up to the planning horizon (2041) for the various scenarios being evaluated.

Operation and Maintenance costs associated with each facility in each alternative were determined by developing a unit cost for each major facility type. These unit costs were then scaled on a per m^3 basis to the facilities involved in the considered alternative. The per unit costs were derived from the Stouffville's existing facilities based on historical O&M costs provided by the Region. The O&M costs include estimates based on scaling for the following:

- Diesel
- Utilities (electricity, water, heat)
- Treatment/Chemicals
- Labour

Timing for new infrastructure was calculated based on the end of life for each facility as per the Region standards for Elevated Tanks, Reservoirs, and Pumping Stations as well as the most recent Condition Assessments available for each facility.

From Table 3-8 above, the first three alternatives Do Nothing, Limit Community Growth, and Implement Water Conservation have the lowest lifecycle project costs associated with them, ranging from $2,413,000 – 2,723,000. The remaining alternatives range in project lifecycle costs from $4,762,000 – $13,675,000.

TABLE 3-9 ASSESSMENT OF LIFECYCLE COSTS

Alternative	Lifecycle Cost Comparison
1) Do Nothing	Lowest of Options Examined
The lifecycle NPV (assuming a 2% interest rate) for this scenario is $2,413,000. Costs associated with this alternative include upgrading the Stouffville Reservoir and High Lift Pumping Station to maintain current capacity and Decommissioning the Stouffville Zone 2 Elevated Tank. Timing for the construction, decommissioning and maintenance of the facilities is as follows: - Upgrade HLPS: 2027 - Upgrade Stouffville Reservoir: 2027 - Decommission Zone 2 Elevated Tank: 2041	
2) Limit Community Growth	Lowest of Options Examined
The lifecycle NPV (assuming a 2% interest rate) for this scenario is $2,413,000. Costs associated with this alternative include upgrading the Stouffville Reservoir and High Lift Pumping Station to maintain current capacity and Decommissioning the Stouffville Zone 2 Elevated Tank. Timing for the construction, decommissioning and maintenance of the facilities is as follows: - Upgrade HLPS: 2027 - Upgrade Stouffville Reservoir: 2027 - Decommission Zone 2 Elevated Tank: 2041	
3) Implement Water Conservation	Second Lowest of Options Examined

<table>
<tr><th colspan="3">Alternative</th><th>Lifecycle Cost Comparison</th></tr>
<tr><td colspan="4">The lifecycle NPV (assuming a 2% interest rate) for this scenario is $2,723,000.

Costs associated with this alternative include upgrading the Stouffville Reservoir and High Lift Pumping Station to maintain current capacity, Decommissioning the Stouffville Zone 2 Elevated Tank, and Knowledge Transfer for Water Conservation.

Timing for the construction, decommissioning and maintenance of the facilities is as follows:

- Water Conservation: 2016

- Upgrade HLPS: 2027

- Upgrade Stouffville Reservoir: 2027

- Decommission Zone 2 Elevated Tank: 2041</td></tr>
<tr><td colspan="3">4) Facilitate Shared Fire Storage Between Zone 1 to Zone 2</td><td rowspan="2"></td></tr>
<tr><td></td><td colspan="2">a) No Storage Facilities Retired</td></tr>
<tr><td></td><td>i)</td><td>- Upgrade Stouffville Reservoir (West Cell, 2,996 m^3) and HLPS to 110.96 L/s (3 Pumps, 2 Duty/1 Standby @ 55.5 L/s)

- Maintain Zone 2 Elevated Tank (3,400 m^3)

- Decommission East Cell Reservoir

- New PRV Chamber</td><td>Moderate</td></tr>
<tr><td></td><td colspan="3">The lifecycle NPV (assuming a 2% interest rate) for this scenario is $7,579,000.

Costs associated with this scenario include upgrading the Stouffville Reservoir to make full use of the West Cell, upgrading the HLPS to 110.96 L/s, maintaining the Zone 2 Elevated Tank, Decommissioning the East Cell of the Stouffville Reservoir, and the construction of a New PRV Chamber.

Timing for the construction, decommissioning and maintenance of the facilities is as follows:

- New PRV Chamber: 2016

- Upgrade HLPS: 2019

- Upgrade Stouffville Reservoir West Cell: 2027

- Decommission East Reservoir Cell: 2027

- Maintain Zone 2 Elevated Tank: 2041</td></tr>
<tr><td></td><td>ii)</td><td>- Upgrade Stouffville Reservoir (East and West Cells, 5,132 m^3) and HLPS to 190.07 L/s (3 Pumps, 2 Duty/1 Standby @ 95 L/s)

- Maintain Zone 2 Elevated Tank (3,400 m^3)

- New PRV Chamber</td><td>Moderate</td></tr>
<tr><td></td><td colspan="3">The lifecycle NPV (assuming a 2% interest rate) for this scenario is $8,358,000.</td></tr>
</table>

Alternative		Lifecycle Cost Comparison
Costs associated with this scenario include upgrading the Stouffville Reservoir to make full use of both Reservoir Cells, upgrading the HLPS to 190.07 L/s, maintaining the Zone 2 Elevated Tank, and the construction of a New PRV Chamber. Timing for the construction, decommissioning and maintenance of the facilities is as follows: - New PRV Chamber: 2016 - Upgrade HLPS: 2019 - Upgrade Stouffville Reservoir Both Cells: 2027 - Maintain Zone 2 Elevated Tank: 2041		
b) Retire Zone 2 Elevated Tank		
i)	- Build New Storage Facility of Size 2,229 m^3 - Upgrade Stouffville Reservoir (West Cell, 2,996 m^3) and HLPS to 110.96 L/s (3 Pumps, 2 Duty/1 Standby @ 55.5 L/s) - Decommission Zone 2 Elevated Tank - Decommission East Cell of Reservoir - New PRV Chamber	Moderate – Very High
The lifecycle NPV (assuming a 2% interest rate) for this scenario assuming New Storage constructed is Floating Storage (Elevated Tank or Standpipe) is $7,968,000. If New Storage is an In-Ground Reservoir then the Lifecycle NPV would be $8,812,000. Costs associated with this scenario include construction of a New Storage Facility of size 2,229 m^3, upgrading the Stouffville Reservoir to make full use of the West Reservoir Cell, upgrading the HLPS to 110.96 L/s, Decommissioning the Zone 2 Elevated Tank, Decommissioning the East Cell of the Reservoir, and the construction of a New PRV Chamber. Timing for the construction, decommissioning and maintenance of the facilities is as follows: - New PRV Chamber: 2016 - Upgrade HLPS: 2019 - Upgrade Stouffville Reservoir West Cell: 2027 - Decommission East Reservoir Cell: 2027 - Build New Storage Facility: 2041 - Decommission Zone 2 Elevated Tank: 2041		
ii)	- Build New Storage Facility of Minimum Size 93 m^3 - Upgrade Stouffville Reservoir (East and West Cells, 5,132 m^3) and HLPS to 190.07 L/s (3 Pumps, 2 Duty/1 Standby @ 95 L/s) - Decommission Zone 2 Elevated Tank - New PRV Chamber	Moderate

Alternative			Lifecycle Cost Comparison
	The lifecycle NPV (assuming a 2% interest rate) for this scenario is $5,318,000. Costs associated with this scenario include upgrading the Stouffville Reservoir to make full use of both Reservoir Cells, upgrading the HLPS to 190.07 L/s, Decommissioning the Zone 2 Elevated Tank, and the construction of a New PRV Chamber. Timing for the construction, decommissioning and maintenance of the facilities is as follows: - New PRV Chamber: 2016 - Upgrade HLPS: 2019 - Upgrade Stouffville Reservoir Both Cells: 2027 - Build New Storage Facility: 2041 - Decommission Zone 2 Elevated Tank: 2041		
	c) Retire Stouffville Reservoir and HLPS		
	i)	- Build New Storage Facility of Size 1,825 m^3 - Maintain Zone 2 Elevated Tank (3,400 m^3) - Decommission Stouffville Reservoir and HLPS - New PRV Chamber	Moderate – Very High
	The lifecycle NPV (assuming a 2% interest rate) for this scenario assuming New Storage constructed is Floating Storage (Elevated Tank or Standpipe) is $11,530,000. If New Storage is an In-Ground Reservoir then the Lifecycle NPV would be $12,209,000. Costs associated with this scenario include construction of a New Storage Facility of size 1,825 m^3, Decommissioning of the Stouffville Reservoir and HLPS, Upgrading the Zone 2 Elevated Tank to maintain operation past 2043, and the construction of a New PRV Chamber. Timing for the construction, decommissioning and maintenance of the facilities is as follows: - New PRV Chamber: 2016 - Build New Storage Facility: 2019 - Decommission Stouffville Reservoir and HLPS: 2027 - Maintain Zone 2 Elevated Tank: 2041		
	d) Retire Stouffville Reservoir, HLPS, and Zone 2 Elevated Tank		
	i)	- Build New Storage Facility of Size 5,225 m^3 - Decommission Stouffville Reservoir and HLPS - Decommission Zone 2 Elevated Tank	Very High

Alternative			Lifecycle Cost Comparison
		- New PRV Chamber	
	The lifecycle NPV (assuming a 2% interest rate) for this scenario assuming New Storage constructed is Floating Storage (Elevated Tank or Standpipe) is $10,947,000. If New Storage is an In-Ground Reservoir then the Lifecycle NPV would be $13,674,000. Costs associated with this scenario include construction of a New Storage Facility of size 5,225 m^3, Decommissioning of the Stouffville Reservoir and HLPS, Decommissioning of the Zone 2 Elevated Tank, and the construction of a New PRV Chamber. Timing for the construction, decommissioning and maintenance of the facilities is as follows: - New PRV Chamber: 2016 - Build New Storage Facility: 2019 - Decommission Stouffville Reservoir and HLPS: 2027 - Decommission Zone 2 Elevated Tank: 2041		

LEGEND			
Lowest Impact ---- Most Preferred			Greatest Impact ---- Least Preferred

3.2.10 Overall Ranking of Storage Alternatives

The table below compiles the assessments of each of the evaluation criteria presented above into a matrix which allows for a comparative assessment of the alternatives.

TABLE 3-10 OVERALL ASSESSMENT

Alternative		Technical Feasibility	Satisfies Planned Growth	Satisfies Design Standards	Complies with Legislative Requirements	Provides Operational Flexibility	Impact on Natural Environment	Impact on Socio-Cultural Environment	Cost	Lifecycle Costs	OVERALL SCORE
1	Do Nothing	4	4	4	1	4	1	2	1	1	2.44
2	Limit Community Growth	4	4	3	1	4	1	4	1	1	2.56
3	Implement Water Conservation	4	4	4	1	4	1	2	1	1	2.44
4	Facilitate Shared Fire Storage Between Zone 1 to Zone 2										
a) i)	Rehabilitate 1 Reservoir Cell, Rehabilitate Zone 2 Elevated Tank	1	1	1	1	3	1	2	2	2	***1.56***
a) ii)	Rehabilitate Both Reservoir Cells, Rehabilitate Zone 2 Elevated Tank	1	1	1	1	3	1	2	2	3	1.67
b) i)	Build New Storage Facility, Rehabilitate 1 Reservoir Cell, Retire Zone 2 Elevated Tank	1	1	1	1	3	1	2	3	3	1.78
b) ii)	Build New Storage Facility, Rehabilitate Both Reservoir Cells, Retire Zone 2 Elevated Tank	1	1	1	1	4	3	2	1	1	1.67
c) i)	Build New Storage Facility, Retire Stouffville Reservoir, Rehabilitate Zone 2 Elevated Tank	1	1	1	1	1	3	3	4	4	2.11
d) i)	Build New Storage Facility, Retire Stouffville Reservoir, Retire Zone 2 Elevated Tank	1	1	1	1	2	4	4	4	*4*	*2.44*

Alternative	Technical Feasibility	Satisfies Planned Growth	Satisfies Design Standards	Complies with Legislative Requirements	Provides Operational Flexibility	Impact on Natural Environment	Impact on Socio-Cultural Environment	Cost	Lifecycle Costs	OVERALL SCORE

LEGEND			
Lowest Impact 1 Most Preferred	2	3	Greatest Impact 4 Least Preferred

According to the overall ranking in the Table 9, the following list describes the alternatives from best to least viable:

1) Rehabilitate 1 Reservoir Cell, Rehabilitate Zone 2 Elevated Tank [(4) a) i)]
    - Capital Cost = $9,104,000
    - Lifecycle Costs = $7,580,000
2) Rehabilitate Both Reservoir Cells, Rehabilitate Zone 2 Elevated Tank [(4) a) ii)]
    - Capital Cost = $8,983,000
    - Lifecycle Costs = $8,358,000
3) Build New Storage Facility, Rehabilitate Both Reservoir Cells, Retire Zone 2 Elevated Tank [(4) b) ii)]
    - Capital Cost = $3,996,000
    - Lifecycle Costs = $5,319,000
4) Build New Storage Facility, Rehabilitate 1 Reservoir Cell, Retire Zone 2 Elevated Tank [(4) b) i)]
    - Capital Cost = $9,742,0000 (New Storage = Floating), $11,126,000 (New Storage = In-Ground Reservoir)
    - Lifecycle Costs = $7,969,000 (New Storage = Floating), $8,812,000 (New Storage = In-Ground Reservoir)
5) Build New Storage Facility, Retire Stouffville Reservoir, Rehabilitate Zone 2 Elevated Tank [(4) c) i)]
    - Capital Cost = $14,163,000 (New Storage = Floating), $14,163,000 (New Storage = In-Ground Reservoir)
    - Lifecycle Costs = $11,531,000 (New Storage = Floating), $12,209,000 (New Storage = In-Ground Reservoir)
6) Build New Storage Facility, Retire Stouffville Reservoir, Retire Zone 2 Elevated Tank [(4) d) i)]
    - Capital Cost = $11,676,000 (New Storage = Floating), $12,301,000 (New Storage = In-Ground Reservoir)
    - Lifecycle Costs = $11,144,000 (New Storage = Floating), $13,675,000 (New Storage = In-Ground Reservoir)
7) Implement Water Conservation
    - Capital Cost = $2,617,000
    - Lifecycle Costs = $2,723,000
8) Do Nothing
    - Capital Cost = $2,307,000
    - Lifecycle Costs = $2,413,000
9) Limit Community Growth
    - Capital Cost = $2,307,000
    - Lifecycle Costs = $2,413,000

3.3 Recommendations and Conclusions for Storage Alternatives

Overall, the recommended preferred storage solution is alternative 4) a) i), which involves:

- Shared Fire Storage Between Zones 1 to 2/3;
- Construction of a new PRV Chamber to provide redundancy in the transfer of water from Zone 1 to Zone 2 during fire or emergency conditions;
- Decommissioning of the East Cell at the Stouffville Reservoir;
- Rehabilitation of the West Cell of the Stouffville Reservoir (2,996 m^3);
- Upgrades to the HLPS to allow for 110 L/s firm pumping capacity (3 Pumps, 2 Duty/1 Standby); and,

- Future Rehabilitation to allow the Zone 2 Elevated Tank to remain operational past 2043 (3,400 m^3).

Upgrades to the HLPS to a capacity of 110 L/s will allow for the complete use of the 2,996 m^3 available in the West Cell of the reservoir. In this preferred storage alternative, Fire Storage would be provided by Zone 1, while Equalization and Emergency Storage would be provided by a combination of the Upgraded Stouffville West Reservoir Cell (capacity of 2,996 m^3) and the Zone 2 Elevated Tank (3,400 m^3). It should be noted that the storage under this scenario would be oversized for the 2041 storage requirements for Zones 2 + 3 Equalization and Emergency Storage (5,225 m^3). Under this scenario the available Equalization and Emergency Storage is 6,396 m^3, or 1,171 m^3 more than what is required.

The estimated project costs for this alternative include:

- Upgrading the Stouffville Reservoir (West Cell 2,996 m^3) and High Lift Pumping Station to 110.96 L/s (3 Pumps, 2 Duty/1 Standby @ 55.5 L/s): $2,147,000
- Upgrades to the Zone 2 Elevated Tank (3,400 m^3): $6,250,000
- Decommissioning of the East Cell of the Stouffville Reservoir: $394,000
- Construction of a New PRV Chamber: $313,000
- *Total (including 25% for permits and approvals, Engineering, and Contingencies): $9,104,000*
- *Total Lifecycle Costs = $7,580,000*

4 Description of Water Supply Alternatives

The following serves as an overview of the servicing alternatives analysed for Stouffville water system up to the 2041 Design horizon.

	2016		2041	
	Total Supply	**Firm Supply**	**Total Supply**	**Firm Supply**
Well 1	34 L/s (2,946 m^3/day)	34 L/s (2,946 m^3/day)	34 L/s (2,946 m^3/day)	34 L/s (2,946 m^3/day)
Well 2	34 L/s (2,946 m^3/day)	34 L/s (2,946 m^3/day)	34 L/s (2,946 m^3/day)	(Largest Well Out of Service)
Well 3	34 L/s (2,946 m^3/day)	(Largest Well Out of Service)	28 L/s (2,419 m^3/day)	28 L/s (2,419 m^3/day)
Wells 5 and 6	46 L/s (3,974 m^3/day)	46 L/s (3,974 m^3/day)	46 L/s (3,974 m^3/day)	46 L/s (3,974 m^3/day)
Groundwater Sub-Total	148 L/s (12,787 m^3/day)	114 L/s (9,850 m^3/day)	142 L/s (12,269 m^3/day)	108 L/s (9,331 m^3/day)
Total Possible Lake-Based Supply	174 L/s (15,000 m^3/day)	174 L/s (15,000 m^3/day)	174 L/s (15,000 m^3/day)	174 L/s (15,000 m^3/day)
TOTAL SUPPLY	**322 L/s (27,821 m^3/day)**	**288 L/s (24,883 m^3/day)**	**316 L/s (27,302 m^3/day)**	**282 L/s (24,365 m^3/day)**
	Average Day	**Maximum Day**	**Average Day**	**Maximum Day**
Required Supply	101 L/s (8,714 m^3/day)	182 L/s (15,686 m^3/day)	134 L/s (11,567 m^3/day)	241 L/s (20,821 m^3/day)
Assessment	Excess capacity of 221 L/s (19,107 m^3/day)	Excess capacity of 103 L/s (8,899 m^3/day)	Excess capacity of 182 L/s (15,725 m^3/day)	Excess capacity of 41 L/s (3,542 m^3/day)

It should be noted that there is an excess supply capacity as of 2016 of 103 L/s (8,899 m^3/day). The alternatives described below will be bench marked against this excess supply capacity available to determine the water requirements for the Stouffville Water system in 2041. The details of the various servicing alternative solutions can be found below. In addition, a more detailed cost analysis of the alternatives can be found in Appendix A.

As per the report prepared by Golder, *"Production Well Capacity and Raw Water Quality Assessment for Stouffville Production Wells – Stouffville Water System Upgrades Class EA, York Region"*, it has been indicated that the safe yield of Well 3 to 2041 is 28 L/s. As such for the purposes of this analysis the capacity of Well 3 will be taken as 34 L/s for 2016 and 28 L/s for 2041. Further the Golder report also mentions that Well 5 can produce 25.5 L/s when Well 6 is operating at 23 L/s. In other words, the maximum combined production of the two Wells running simultaneously is 48.5 L/s. As such this constraint will be carried as the maximum output of these Wells in this analysis. However, the high lift pumps for this facility currently only pump at 46 L/s.

Further it should be noted that based on the results of Golder report, the exceedance of the proposed MAC for Manganese (by Health Canada) in Well 3 by 2030 would in theory limit (or eliminate) this Well's production unless Manganese removal is instituted. Based on discussions with the Region, the implications of this has been deferred to a future TM that will address Water Quality concerns directly.

4.1 Do Nothing

The “Do Nothing” alternative is a mandatory consideration for the Class EA Process. It means that the proposed growth would occur, but that no changes would be made to the water supply infrastructure to address the growth. However, it would involve measures for maintaining the existing water supply capacity.

The “Do Nothing” alternative for the purposes of the water supply system in this Class EA involves retiring no wells and regular maintenance and rehabilitation of existing wells to maintain permitted capacity of the supply wells. The additional water requirement to meet the 2041 growth target is 59 L/s (5,098 m^3/day). Since this is less than the excess supply available as of 2017 (103 L/s), no additional water is required in 2041 for this “Do Nothing” alternative.

The total cost estimate for this scenario is around $4,890,000.

4.2 Limit Community Growth

The option of “Limiting Community Growth” would maintain the existing water supply capacity but restrict the amount of approvable growth to the capacity of the existing system.

In this instance the existing well system can supply the projected growth. As such, this alternative is effectively the same as “Do Nothing” alternative.

4.3 Implement Water Conservation

This option involves a conscious reduction in water consumption on a daily basis. The Region may impose regulatory measures (such as lawn watering restrictions) or provide incentives (such as rebates on retrofitting existing plumbing fixtures to low-water versions) in order to achieve the conservation requirement. Alternatively, the residents may voluntarily reduce their daily consumption to meet the requirements of a larger population.

In this instance the existing well system can supply the projected growth. As such, additional water conservation is not required, and this alternative is effectively the same as “Do Nothing” alternative.

4.4 Change Percentage of Water Supplied from Lake-Based System

As there could be significant costs identified in upgrading the water treatment requirements in order to maintain the existing well supplies (ie: the “Do Nothing” alternative), consideration should be given to retiring these wells and replacing the lost supply with an increase in the lake-based supply to Stouffville.

The following sub-scenarios (A-G) represent the possible permutations of retiring various Well facilities while increasing the percentage of water supplied from the lake-based system to meet both the 2041 growth target as well as the additional water requirement from retiring the relevant Wells.

It should be noted that the current average pumping rate based on available SCADA data for from the McCowan Reservoir is 77 l/s (6,653 m^3/day) for 2017. Knowing this, the total additional potential water taking from the McCowan Reservoir with the current pump setup is 99 L/s (8,554 m^3/day) based on a firm installed capacity at the Zone 2 Booster Pumping Station (at the McCowan Reservoir) of 176 L/s (15,206 m^3/day).

The Region has stated that the Average Day Demand is to be supplied by the firm capacity of the Wells or the Lake-Based System provided that there is redundancy on the forcemain that carries the lake-based supply to the Stouffville water system. In the existing infrastructure there is no redundancy on the forcemain coming from McCowan Reservoir thus, it cannot be included in the Average Day Demand requirement of the Region. Therefore, in order to meet the Region’s average day demand requirement, some of the sub-scenarios under 1.1.4 “Change the Percentage of Water Supplied from the Lake-Based System” require the forcemains coming from the McCowan Reservoir be twinned. This twinning will allow there to be redundancy on the lake-based supply and in turn allow the inclusion of the lake-based supply in the calculation for average day demand. Twinning of the forcemain based on a forcemain length of 2,510 m with 240 m of creek crossings, 125 m of highway crossings, and 4 watermain chambers is around $7,320,000 (excluding engineering fees).

4.4.1 Sub-Scenario (A) Retire Wells 1 and 2

Retiring Wells 1 and 2 results in an increased water requirement of 68 L/s (5,786 m^3/day). The increased water requirement to meet the 2041 growth target is 59 L/s (5,098 m^3/day). Thus, the total additional water requirement necessary to meet the 2041 requirement as well as the increased requirements from retiring wells 1 and 2 is 127 L/s (8,035 m^3/day).

Since the sum of the water requirement due to retiring the Wells 1/2 and the requirement to meet the 2041 growth target (127 L/s) is greater the excess 2016 supply available (103 L/s), and additional 24 L/s is required. However, the firm capacity of the Zone 2 BPS (which is listed at 176 L/s) is based on using 2 of the largest pumps (each rated for 88 L/s) and with a third large pump (rated at 88 L/s) and jockey pump (rated for 44 L/s) working in standby mode. Operating the jockey pump in combination with the 2 duty pumps would us allow to supply the additional 24 L/s that is required. This operating scheme would increase the firm capacity of the Zone 2 Booster Pumping Station to meet the projected demands. Maintenance and upgrades to keep the current capacity of Wells 3, 5 6 are required for this sub-scenario. Decommissioning of Wells 1 and 2 would also be required. Twinning of the forcemain coming from the Zone 2 Booster Pumping Station is also required for redundancy and inclusion of the lake-based supply in the calculation of ADD.

The total capital cost estimate for this sub-scenario is approximately $12,800,000.

4.4.2 Sub-Scenario (B) Retire Well 3

Retiring Well 3 results in an increased water requirement of 28 L/s (2,419 m^3/day). The increased water requirement to meet the 2041 growth target is 59 L/s (5,098 m^3/day). Thus, the total additional water requirement necessary to meet the 2041 requirement as well as the increased requirements from retiring well 3 is 87 L/s (7,517 m^3/day).

Since the required increased capacity (87 L/s or 7,517 m^3/day) is less than the maximum additional potential water taking from the McCowan Reservoir (103 L/s or 8,899 m^3/day), no new pumps are required at the Zone 2 Booster Pumping Station. Maintenance and upgrades to keep the current capacity of Well 1, 2, 5, 6, and Zone 2 Booster Pumping Station will be required for this scenario. Groundwater rebound control at Well 3 will also be required, due to Well 3 being in a shallow aquifer. Treatment requirements for groundwater rebound control will need to be examined based on to be determined discharge location. Well 3 may also need to be decommissioned. Twinning of the forcemain coming from the Zone 2 Booster Pumping Station is also required for redundancy and inclusion of the lake-based supply in the calculation of ADD.

The total capital cost estimate for this sub-scenario is approximately $13.450,000.

4.4.3 Sub-Scenario (C) Retire Wells 5 and 6

Retiring Wells 5 and 6 results in an increased water requirement of 48.5 L/s (4,190 m^3/day). The increased water requirement to meet the 2041 growth target is 59 L/s (5,098 m^3/day). Thus, the total additional water requirement necessary to meet the 2041 requirement as well as the increased requirements from retiring wells 5 and 6 is 107.5 L/s (9,288 m^3/day).

Since the total additional water requirement (107.5 L/s or 9,288 m^3/day) is greater than the maximum additional potential water taking from the McCowan Reservoir (103 L/s or 8,899 m^3/day), an additional 4.5 L/s is required. Operating the jockey pump in combination with the 2 duty pumps would us allow to supply the additional 4.5 L/s that is required. Maintenance and upgrades to keep the current capacity of Well 1, 2, and 3 will be required for this scenario. Rebound control at Wells 5 and 6 will also be required, due to Wells 5 and 6 being in a shallow aquifer. Treatment requirements will need to be examined based on to be determined discharge location. Wells 5 and 6 will need to be decommissioned for this scenario. Twinning of the forcemain coming from the Zone 2 Booster Pumping Station is also required for redundancy and inclusion of the lake-based supply in the calculation of ADD.

The total capital cost estimate for this sub-scenario is approximately $12,340,000.

4.4.4 Sub-Scenario (D) Retire Wells 1, 2, and 3

Retiring Wells 1, 2 and 3 results in an increased water requirement of 96 L/s (8,294 m^3/day). The increased water requirement to meet the 2041 growth target is 59 L/s (5,098 m^3/day). Thus, the total additional water requirement

necessary to meet the 2041 requirement as well as the increased requirements from retiring wells 1, 2, and 3 is 155 L/s (13,392 m^3/day).

Since the total additional water requirement (155 L/s or 13,392 m^3/day) is greater than the maximum additional potential water taking from the McCowan Reservoir (103 L/s or 8,899 m^3/day), an additional 52 L/s is required. One new pump rated at 88 L/s is required at the Zone 2 Booster Pumping Station to replace the smaller 44 L/s pump currently installed. This would bring the firm capacity of the Zone 2 Booster Pumping Station up to 264 L/s from the current 176 L/s. Maintenance and upgrades to keep the current capacity of Well 5 and 6 will be required for this scenario. Decommissioning of Wells 1, 2, and 3 will also be required. Rebound control at Well 3 will need to be considered, due to Well 3 being in a shallow aquifer. Treatment requirements for groundwater rebound control will need to be examined based on to be determined discharge location. Twinning of the forcemain coming from the Zone 2 Booster Pumping Station is also required for redundancy and inclusion of the lake-based supply in the calculation of ADD.

The total capital cost estimate for this sub-scenario is approximately $12,660,000.

4.4.5 Sub-Scenario (E) Retire Wells 1, 2, 5, and 6

Retiring Wells 1, 2, 5 and 6 results in an increased water requirement of 114.5 L/s (9,893 m^3/day). The increased water requirement to meet the 2041 growth target is 59 L/s (5,098 m^3/day). Thus, the total additional water requirement necessary to meet the 2041 requirement as well as the increased requirements from retiring wells 1, 2, 5 and 6 is 190 L/s (16,416 m^3/day).

Since the total additional water requirement (190 L/s or 14,990 m^3/day) is greater than the maximum additional potential water taking from the McCowan Reservoir (103 L/s or 8,899 m^3/day), an additional 87 L/s is required. One new pump rated at 88 L/s is required at the Zone 2 Booster Pumping Station to replace the smaller 44 L/s pump currently installed. This would bring the firm capacity of the Zone 2 Booster Pumping Station up to 264 L/s from the current 176 L/s. Maintenance and upgrades to keep the current capacity of Well 3 will be required for this scenario. Decommissioning of Wells 1, 2, 5 and 6 will be required. Rebound control at Wells 5 and 6 will need to be considered, due to Wells 5 and 6 being in a shallow aquifer. Treatment requirements for groundwater rebound control will need to be examined based on to be determined discharge location. Twinning of the forcemain coming from the Zone 2 Booster Pumping Station is also required for redundancy and inclusion of the lake-based supply in the calculation of ADD.

The total capital cost estimate for this sub-scenario is approximately $11,550,000.

4.4.6 Sub-Scenario (F) Retire Wells 3, 5, and 6

Retiring Wells 3, 5 and 6 results in an increased water requirement of 76.5 L/s (6,610 m^3/day). The increased water requirement to meet the 2041 growth target is 59 L/s (5,098 m^3/day). Thus, the total additional water requirement necessary to meet the 2041 requirement as well as the increased requirements from retiring wells 3, 5 and 6 is 135.5 L/s (11,707 m^3/day).

Since the total additional water requirement (135.5 L/s or 11,707 m^3/day) is greater than the maximum additional potential water taking from the McCowan Reservoir (103 L/s or 8,899 m^3/day),), an additional 32.5 L/s is required. Operating the jockey pump in combination with the 2 duty pumps would us allow to supply the additional 32.5 L/s that is required. Maintenance and upgrades to keep the current capacity of Well 1 and 2 will be required for this scenario. Rebound control at Wells 3, 5 and 6 will need to be considered, due to Wells 3, 5 and 6 being in a shallow aquifer. Treatment requirements for groundwater rebound control will need to be examined based on to be determined discharge location. Decommissioning of Wells 3, 5, and 6 will be required. Twinning of the forcemain coming from the Zone 2 Booster Pumping Station is also required for redundancy and inclusion of the lake-based supply in the calculation of ADD.

The total capital cost estimate for this sub-scenario is approximately $11,750,000.

4.4.7 Sub-Scenario (G) Retire Wells 1, 2, 3, 5, and 6

Retiring Wells 1, 2, 3, 5 and 6 results in an increased water requirement of 144.5 L/s (12,485 m^3/day). The increased water requirement to meet the 2041 growth target is 59 L/s (5,098 m^3/day). Thus, the total additional water requirement

necessary to meet the 2041 requirement as well as the increased requirements from retiring wells 1, 2, 3, 5 and 6 is 203.5 L/s (17,582 m^3/day).

The additional water requirement (144.5 L/s or 12,485 m^3/day) is greater than the maximum additional potential water taking from the McCowan Reservoir (103 L/s or 8,899 m^3/day), an additional 41.5 L/s is required. One new pump rated at 88 L/s is required at the Zone 2 Booster Pumping Station to replace the smaller 44 L/s pump currently installed. Rebound control at Wells 3, 5 and 6 will need to be considered, due to Wells 3, 5 and 6 being in a shallow aquifer. Treatment requirements for groundwater rebound control will need to be examined based on to be determined discharge location. Wells 1, 2, 3, 5 and 6 will need to be decommissioned. Twinning of the forcemain coming from the Zone 2 Booster Pumping Station is also required for redundancy and inclusion of the lake-based supply in the calculation of ADD.

The total capital cost estimate for this sub-scenario is approximately $10.970,000.

4.5 Expand Existing Wells

As with the “Increase Lake-Based Supply” Alternative, this alternative considers retiring some of the existing wells in favour of replacing that lost capacity at other existing well sites.

The following sub-scenarios (A2-G2) represent the possible permutations of retiring the various Well facilities while also expanding the remaining wells to meet both the 2041 growth target as well as the additional water requirement from retiring the relevant Wells.

4.5.1 Sub-Scenario (A2) Retire Wells 1 and 2

Retiring Wells 1 and 2 results in an increased water requirement of 68 L/s (5,786 m^3/day). The increased water requirement to meet the 2041 growth target is 59 L/s (5,098 m^3/day). Thus, the total additional water requirement necessary to meet the 2041 requirement as well as the increased requirements from retiring Wells 1 and 2 is 127 L/s (10,973 m^3/day).

The additional water requirement (127 L/s or 10,973 m^3/day) is greater than the maximum additional potential water taking from the McCowan Reservoir (103 L/s or 8,899 m^3/day) by 24 L/s (2,074 m^3/day), thus some combination of wells 3, 5, and 6 need to be upgraded and expanded such that the firm capacity of well supply within the Stouffville system is increased by 24 L/s. In addition, wells 1 and 2 will need to be decommissioned. The Zone 2 Booster Pumping Station will also have to be maintained such that it is capable of maintaining current capacity of 174 L/s or 15,000 m^3/day. Wells 3, 5 and 6 will need to be maintained to keep current capacities.

The total capital cost estimate for this sub-scenario is approximately $6,300,000.

4.5.2 Sub-Scenario (B2) Retire Well 3

Retiring Well 3 results in an increased water requirement of 28 L/s (2,419 m^3/day). The increased water requirement to meet the 2041 growth target is 59 L/s (5,098 m^3/day). Thus, the total additional water requirement necessary to meet the 2041 requirement as well as the increased requirements from retiring well 3 is 87 L/s (7,517 m^3/day).

The additional water requirement (87 L/s or 7,517 m^3/day) is less than the maximum additional potential water taking from the McCowan Reservoir (103 L/s or 8,899 m^3/day), thus no additional Well expansion is required. For this sub-scenario Wells 1, 2, 5 and 6 will need to be maintained. The Zone 2 Booster Pumping Station will also have to be maintained such that it can continue to supply 174 L/s or 15,000 m^3/day. In addition, rebound control at Well 3 will need to occur due to Well 3 being in a shallow aquifer Well. Well 3 will also need to be decommissioned.

The total capital cost estimate for this sub-scenario is approximately $5,360,000.

4.5.3 Sub-Scenario (C2) Retire Wells 5 and 6

Retiring Wells 5 and 6 results in an increased water requirement of 48.5 L/s (4,190 m^3/day). The increased water requirement to meet the 2041 growth target is 59 L/s (5,098 m^3/day). Thus, the total additional water requirement

necessary to meet the 2041 requirement as well as the increased requirements from retiring wells 5 and 6 is 107.5 L/s (9,288 m^3/day).

The additional water requirement (107.5 L/s or 9,288 m^3/day) is greater than the maximum additional potential water taking from the McCowan Reservoir (103 L/s or 8,889 m^3/day) by 4.5 L/s (389 m^3/day), thus some combination of wells 1, 2, and 3 need to be upgraded and expanded such that the firm capacity of well supply within the Stouffville system is increased by 4.5 L/s. In addition, rebound control at Wells 5 and 6 will need to be considered, due to Wells 5 and 6 being in a shallow aquifer well. The Zone 2 Booster Pumping Station will also have to be maintained such that it is capable of providing 174 L/s or 15,000 m^3/day. Wells 5 and 6 will need to be decommissioned.

The total capital cost estimate for this sub-scenario is approximately $5,320,000.

4.5.4 Sub-Scenario (D2) Retire Wells 1, 2, and 3

Retiring Wells 1, 2 and 3 results in an increased water requirement of 96 L/s (8,294 m^3/day). The increased water requirement to meet the 2041 growth target is 59 L/s (5,098 m^3/day). Thus, the total additional water requirement necessary to meet the 2041 requirement as well as the increased requirements from retiring wells 1, 2, and 3 is 155 L/s (13,392 m^3/day).

The additional water requirement (155 L/s or 13,392 m^3/day) is greater than the maximum additional potential water taking from the McCowan Reservoir (103 L/s or 8,899 m^3/day) by 52 L/s (4,493 m^3/day), thus some combination of Wells 5 and 6 need to be upgraded and expanded such that the firm capacity of well supply within the Stouffville system is increased by 52 L/s. In addition, rebound control at Well 3 will need to be considered, due to Well 3 being in a shallow aquifer well. Wells 1, 2 and 3 will need to be decommissioned. The Zone 2 Booster Pumping Station will have to be maintained such that it is capable of providing 174 L/s or 15,000 m^3/day.

The total capital cost estimate for this sub-scenario is approximately $6,260,000.

4.5.5 Sub-Scenario (E2) Retire Wells 1, 2, 5 and 6

Retiring Wells 1, 2, 5 and 6 results in an increased water requirement of 114.5 L/s (9,893 m^3/day). The increased water requirement to meet the 2041 growth target is 59 L/s (5,098 m^3/day). Thus, the total additional water requirement necessary to meet the 2041 requirement as well as the increased requirements from retiring wells 1, 2, 5 and 6 is 190 L/s (14,990 m^3/day).

The additional water requirement (114.5 L/s or 9,983 m^3/day) is greater than the maximum additional potential water taking from the McCowan Reservoir (103 L/s or 8,899 m^3/day) by 70.5 L/s (6,091 m^3/day), thus Wells 3 needs to be upgraded and expanded such that the firm capacity of well supply within the Stouffville system is increased by 70.5 L/s. In addition, rebound control at Wells 5 and 6 will need to be considered, due to Wells 5 and 6 being in a shallow aquifer well. Wells 1, 2, 5 and 6 will need to be decommissioned. The Zone 2 Booster Pumping Station will also have to be maintained such that it is capable of providing 174 L/s or 15,000 m^3/day.

The total capital cost estimate for this sub-scenario is approximately $6,220,000.

4.5.6 Sub-Scenario (F2) Retire Wells 3, 5 and 6

Retiring Wells 3, 5 and 6 results in an increased water requirement of 76.5 L/s (6,610 m^3/day). The increased water requirement to meet the 2041 growth target is 59 L/s (5,098 m^3/day). Thus, the total additional water requirement necessary to meet the 2041 requirement as well as the increased requirements from retiring wells 3, 5 and 6 is 135.5 L/s (11,707 m^3/day).

The additional water requirement (135.5 L/s or 11,707 m^3/day) is greater than the maximum additional potential water taking from the McCowan Reservoir (103 L/s or 8,899 m^3/day) by 32.5 L/s (2,808 m^3/day), thus some combination of Wells 1 and 2 need to be upgraded and expanded such that the firm capacity of well supply within the Stouffville system is increased by 32.5 L/s. In addition, rebound control at Wells 3, 5 and 6 will need to be considered, due to Wells 3, 5 and 6 being in a shallow aquifer well. Wells 3, 5 and 6 will need to be decommissioned. The Zone 2 Booster Pumping Station will also have to be maintained such that it is capable of providing 174 L/s or 15,000 m^3/day.

The total capital cost estimate for this sub-scenario is approximately $5,040,000.

4.5.7 Sub-Scenario (G2) No Wells Retired

Retiring no Wells results in only needing to meet the 2041 growth target of 59 L/s (5,098 m^3/day). Thus, the total additional water requirement necessary to meet the 2041 requirement as well as the increased requirements from retiring the wells (0 L/s in this scenario) is 59 L/s (5,098 m^3/day).

The additional water requirement (59 L/s or 5,098 m^3/day) is less than the maximum additional potential water taking from the McCowan Reservoir (103 L/s or 8,899 m^3/day), thus no additional Well expansion is required. For this sub-scenario Wells 1, 2, 3, 5 and 6 will need to have upgraded treatment to maintain current capacity. In addition, The Zone 2 Booster Pumping Station will also have to be maintained such that it can continue to supply 174 L/s or 15,000 m^3/day.

The total capital cost estimate for this sub-scenario is around $4,890,000. It should be noted that this is the same as the Do Nothing alternative described in Section 4.1.

4.6 Develop New Well Sites

This alternative considers developing new well sites as an alternative to maintaining and updating treatment at existing well sites.

The following sub-scenarios (A3-H3) represent the possible permutations of retiring the various Well facilities while also developing new wells to meet both the 2041 growth target as well as the additional water requirement from retiring the relevant Wells.

4.6.1 Sub-Scenario (A3) Retire Wells 1 and 2

Retiring Wells 1 and 2 results in an increased water requirement of 68 L/s (5,786 m^3/day). The increased water requirement to meet the 2041 growth target is 59 L/s (5,098 m^3/day). Thus, the total additional water requirement necessary to meet the 2041 requirement as well as the increased requirements from retiring Wells 1 and 2 is 127 L/s (10,973 m^3/day).

The additional water requirement (127 L/s or 10,973 m^3/day) is greater than the maximum additional potential water taking from the McCowan Reservoir (103 L/s or 8,899 m^3/day) by 24 L/s (2,074 m^3/day), thus new well sites capable of providing 24 L/s will need to be constructed. In addition, maintenance and upgrades to keep the current capacity of Wells 3, 5 and 6 are required for this scenario. Wells 1 and 2 will need to be decommissioned. The Zone 2 Booster Pumping Station will also have to be maintained such that it is capable of providing 174 L/s or 15,000 m^3/day.

The total capital cost estimate for this sub-scenario is approximately $7,540,000.

4.6.2 Sub-Scenario (B3) Retire Well 3

Retiring Well 3 results in an increased water requirement of 28 L/s (2,419 m^3/day). The increased water requirement to meet the 2041 growth target is 59 L/s (5,098 m^3/day). Thus, the total additional water requirement necessary to meet the 2041 requirement as well as the increased requirements from retiring well 3 is 87 L/s (7,517 m^3/day).

The additional water requirement (87 L/s or 7,517 m^3/day) is less than the maximum additional potential water taking from the McCowan Reservoir (103 L/s or 8,899 m^3/day), thus no additional Well sites are required. For this sub-scenario Wells 1, 2, 5 and 6 will need to be maintained. The Zone 2 Booster Pumping Station will also have to be maintained such that it can continue to supply 174 L/s or 15,000 m^3/day. In addition, rebound control at Well 3 will need to occur due to Well 3 being in a shallow aquifer Well. Well 3 will also need to be decommissioned.

The total capital cost estimate for this sub-scenario is approximately $2,125,000.

4.6.3 Sub-Scenario (C3) Retire Wells 5 and 6

Retiring Wells 5 and 6 results in an increased water requirement of 48.5 L/s (4,190 m^3/day). The increased water requirement to meet the 2041 growth target is 59 L/s (5,098 m^3/day). Thus, the total additional water requirement

necessary to meet the 2041 requirement as well as the increased requirements from retiring wells 5 and 6 is 107.5 L/s (9,288 m^3/day).

The additional water requirement (107.5 L/s or 9,288 m^3/day) is greater than the maximum additional potential water taking from the McCowan Reservoir (103 L/s or 8,889 m^3/day) by 4.5 L/s (389 m^3/day), thus new Well sites capable of providing 23 L/s will need to be constructed. In addition, rebound control at Wells 5 and 6 will need to be considered, due to Wells 5 and 6 being in a shallow aquifer well. Wells 5 and 6 will need to be decommissioned. The Zone 2 Booster Pumping Station will also have to be maintained such that it is capable of providing 174 L/s or 15,000 m^3/day. Wells 1, 2 and 3 will also need upgrades to maintain current capacities.

The total capital cost estimate for this sub-scenario is approximately $6,440,000.

4.6.4 Sub-Scenario (D3) Retire Wells 1, 2, and 3

Retiring Wells 1, 2 and 3 results in an increased water requirement of 96 L/s (8,294 m^3/day). The increased water requirement to meet the 2041 growth target is 59 L/s (5,098 m^3/day). Thus, the total additional water requirement necessary to meet the 2041 requirement as well as the increased requirements from retiring wells 1, 2, and 3 is 155 L/s (13,392 m^3/day).

The additional water requirement (155 L/s or 13,392 m^3/day) is greater than the maximum additional potential water taking from the McCowan Reservoir (103 L/s or 8,899 m^3/day) by 52 L/s (4,493 m^3/day), thus new Well sites capable of providing 62 L/s will need to be constructed. In addition, rebound control at Well 3 will need to be considered, due to Well 3 being in a shallow aquifer well. Wells 1, 2, and 3 will need to be decommissioned. The Zone 2 Booster Pumping Station will also have to be maintained such that it is capable of providing 174 L/s or 15,000 m^3/day. Wells 5 and 6 will require upgrades to maintain current capacities.

The total capital cost estimate for this sub-scenario is approximately $8,580,000.

4.6.5 Sub-Scenario (E3) Retire Wells 1, 2, 5 and 6

Retiring Wells 1, 2, 5 and 6 results in an increased water requirement of 114.5 L/s (9,893 m^3/day). The increased water requirement to meet the 2041 growth target is 59 L/s (5,098 m^3/day). Thus, the total additional water requirement necessary to meet the 2041 requirement as well as the increased requirements from retiring wells 1, 2, 5 and 6 is 190 L/s (14,990 m^3/day).

The additional water requirement (114.5 L/s or 9,983 m^3/day) is greater than the maximum additional potential water taking from the McCowan Reservoir (103 L/s or 8,899 m^3/day) by 70.5 L/s (6,091 m^3/day), thus new Well sites capable of providing 74 L/s will need to be constructed. In addition, rebound control at Wells 5 and 6 will need to be considered, due to Wells 5 and 6 being in a shallow aquifer well. Wells 1, 2, 5 and 6 will need to be decommissioned. The Zone 2 Booster Pumping Station will also have to be maintained such that it is capable of providing 174 L/s or 15,000 m^3/day.

The total capital cost estimate for this sub-scenario is approximately $9,090,000.

4.6.6 Sub-Scenario (F3) Retire Wells 3, 5 and 6

Retiring Wells 3, 5 and 6 results in an increased water requirement of 76.5 L/s (6,610 m^3/day). The increased water requirement to meet the 2041 growth target is 59 L/s (5,098 m^3/day). Thus, the total additional water requirement necessary to meet the 2041 requirement as well as the increased requirements from retiring wells 3, 5 and 6 is 135.5 L/s (11,707 m^3/day).

The additional water requirement (135.5 L/s or 11,707 m^3/day) is greater than the maximum additional potential water taking from the McCowan Reservoir (103 L/s or 8,899 m^3/day) by 32.5 L/s (2,808 m^3/day), thus new Well sites capable of providing 40 L/s will need to be constructed. In addition, rebound control at Wells 3, 5 and 6 will need to be considered, due to Wells 3, 5 and 6 being in a shallow aquifer well. Decommissioning of Wells 3, 5 and 6 will need to occur. The Zone 2 Booster Pumping Station will also have to be maintained such that it is capable of providing 174 L/s or 15,000 m^3/day.

The total capital cost estimate for this sub-scenario is approximately $8,110,000.

4.6.7 Sub-Scenario (G3) Retire Wells 1, 2, 3, 5 and 6

Retiring Wells 1, 2, 3, 5 and 6 results in an increased water requirement of 144.5 L/s (12,485 m^3/day). The increased water requirement to meet the 2041 growth target is 59 L/s (5,098 m^3/day). Thus, the total additional water requirement necessary to meet the 2041 requirement as well as the increased requirements from retiring wells 1, 2, 3, 5 and 6 is 203.5 L/s (17,582 m^3/day).

The additional water requirement (203.5 L/s or 17,582 m^3/day) is greater than the maximum additional potential water taking from the McCowan Reservoir (103 L/s or 8,899 m^3/day) by 100.5 L/s (8,683 m^3/day), thus new Well sites capable of providing 100.5 L/s will need to be constructed. In addition, rebound control at Wells 3, 5 and 6 will need to be considered, due to Wells 3, 5 and 6 being in a shallow aquifer well. Decommissioning of Wells 1, 2, 3, 5 and 6 will need to occur. The Zone 2 Booster Pumping Station will also have to be maintained such that it is capable of providing 174 L/s or 15,000 m^3/day.

The total capital cost estimate for this sub-scenario is approximately $10,880,000.

4.6.8 Sub-Scenario (H3) No Wells Retired

Retiring no Wells results in only needing to meet the 2041 growth target of 59 L/s (5,098 m^3/day). Thus, the total additional water requirement necessary to meet the 2041 requirement as well as the increased requirements from retiring the wells (0 L/s in this scenario) is 59 L/s (5,098 m^3/day).

The additional water requirement (59 L/s or 5,098 m^3/day) is less than the maximum additional potential water taking from the McCowan Reservoir (103 L/s or 8,899 m^3/day), thus no additional Well expansion is required. For this sub-scenario Wells 1, 2, 3, 5 and 6 will need to have upgraded treatment to maintain current capacity. In addition, The Zone 2 Booster Pumping Station will also have to be maintained such that it can continue to supply 174 L/s or 15,000 m^3/day.

The total capital cost estimate for this sub-scenario is around $4,890,000. It should be noted that this is the same as the Do Nothing alternative described in Section 4.1.

5 Evaluation of Water Supply Alternatives

5.1 Shortlisting of Supply Alternatives

Based on discussions with the Region, there is the understanding that the Region desires to maintain its Permit to Take Water (PTTW), in order to ensure redundancy, security and autonomy of supply. Thus, the premise of the following evaluation is that we will not allow the total water taking from groundwater sources to decrease. If a well is retired, its supply capacity will be replaced with a new well of equivalent capacity.

Also, the Region desires that the 2041 ADD (134 L/s) be supplied by the wells only (excluding Lake-Based Supply). As such all alternatives and scenarios which replace supply from Well based systems with increased Lake Based Supply will not be carried forward. This includes the alternative described in Section 4.4, and all secondary scenarios within.

In addition, all scenarios (A3-H3) within the alternative described in Section 4.6 will also not be carried forward in the EA process. This is due to the fact that there is no reason to consider replacing a retired well with a well on a new site. It is more costly and incurs a greater environmental impact when compared to expanding wells on existing well sites (alternative described in Section 4.5) as per the estimates provided in Appendix A. With this understanding, there is no driving rationale to consider developing new well sites at this time. This alternative and all its scenarios described in Section 4.6 will not be carried forward in the EA process.

Because the Region desires to maintain its PTTW, Limit Community Growth, and Implement Water Conservation end up being the same as the Do Nothing alternative as there is no additional requirement to limit growth or to enact conservation upon. That is to say by maintaining the Wells and the Zone 2 Booster Pumping Station capacities, there is sufficient supply to meet the 2041 growth targets, thus no limiting of community growth or water conservation needs to be considered. As such the Do Nothing, Limit Community Growth, and Water Conversation will be combined into one alternative for evaluation purposes.

Any Sub-Scenarios involving the retiring of Wells 1 and 2 will also not be carried forward in the EA process. There is no justification for retiring Wells 1 and 2 as they have the most recent commissioning date (1999) thus have the longest remaining life and possess similar or better water quality to the remaining site locations currently in use as well as other sites explored by the Region.

There is no reason to consider retiring Wells 5 and 6 at this time, given that they exhibit the best water quality of existing Wells. As such scenarios C2, E2, and F2 in the alternative Expand Existing Wells will not be carried forward in the EA process.

With the above considered, the Water Supply alternatives that will be carried forward in the evaluation are:

1. Do Nothing / Limit Community Growth / Implement Water Conservation
2. Retire Well 3 and replace that supply capacity at an existing well site.

5.2 Evaluation of Shortlisted Supply Alternatives

5.2.1 Technical Feasibility

The section reviews the technical feasibility of each of the alternative solutions. This review considers the likelihood that the solution will perform as intended.

Both alternatives above in Section 5.1 have the ability to satisfy the Problem Statement. It should be noted that Alternative 2 may require an additional PTTW depending on whether or not the groundwater rebound at Well 3 counts against the Region's current PTTW.

TABLE 5-1 TECHNICAL FEASILITY OF SUPPLY ALTERNATIVE SOLUTIONS

Alternative	Technically Feasible?
1 Do Nothing / Limit Community Growth / Implement Water Conservation	Yes
This Alternative is technically feasible in which if all wells are maintained along with the Zone 2 Booster Pumping Station at their current capacities, there is sufficient supply to meet the 2041 MDD as well as the Region's mandate of having the Wells supply the ADD for 2041. This alternative involves the additional water supply due to growth being supplied by increasing the pumping rate from the Zone 2 Booster Pumping Station.	
2 Expand Existing Wells	
a) Retire Well 3	
i) - Upgrade and Expand Wells 1, 2, 5 and 6 such that Firm Capacity is increased by 28 L/s - Decommission Well 3 - Groundwater Rebound Control (Well 3) - Maintain Existing Zone 2 Booster Pumping Station Capacity of 174 L/s	Yes
Decommissioning Well 3 while upgrading and expanding Wells 1, 2, 5 and 6 such that Firm Capacity is increased by 34 L/s, is sufficient to meet the MDD for 2041. In addition, this alternative can also meet the Region's ADD requirement of ADD being supplied by the Wells only and maintains the Region's PTTW. This alternative involves the additional water supply due to growth being supplied by increasing the pumping rate from the Zone 2 Booster Pumping Station. The additional water required by decommissioning Well 3 is 34 L/s (2,938 m^3/day) is to be supplied through the expansion of Wells 1, 2, 5 and 6. The Zone 2 Booster Pumping Station would need to be maintained such that it can continue to operate at its current capacity. Should groundwater Rebound Control at the Well 3 site count against the Region's PTTW, the PTTW will have to be increased or a separate PTTW will be required.	

LEGEND			
Lowest Impact ---- Most Preferred			Greatest Impact ---- Least Preferred

5.2.2 Ability to Satisfy the Planned Population Growth

The Town of Stouffville's growth projections have been approved by Town and Regional Council and proposes growing the community to 64,671 persons. This population increase includes both residential and employment populations for Zones 1, 2 and 3. Population growth for Zones 2 + 3 only are projected at 52,140 persons (this value includes both residential and employment population). The maximum day demand that correlates to the total population for the community is 20,821 m^3/day.

Both alternatives identified above in Section 5.1 have the potential to accommodate the population growth proposed for 2041.

TABLE 5-2 ABILITY OF ALTERNATIVE SUPPLY SOLUTIONS TO SATISFY PLANNED POPULATION GROWTH

Alternative			Satisfies Planned Population Growth?
1 Do Nothing / Limit Community Growth / Implement Water Conservation			Yes
This Alternative is technically feasible in which if all the wells are maintained along with the Zone 2 Booster Pumping Station at their current capacities, there is sufficient supply to meet the 2041 MDD caused through growth in population of the community as well as the Region's mandate of having the Wells supply the ADD for 2041, and the Region's requirement of maintaining its PTTW.			
2 Expand Existing Wells			
	a) Retire Well 3		
	i)	- Upgrade and Expand Wells 1, 2, 5 and 6 such that Firm Capacity is increased by 28 L/s - Decommission Well 3 - Groundwater Rebound Control (Well 3) - Maintain Existing Zone 2 Booster Pumping Station Capacity of 174 L/s	Yes
	Decommissioning Well 3 while upgrading and expanding Wells 1, 2, 5 and 6 such that Firm Capacity is increased by 34 L/s, is sufficient to meet the MDD for 2041 and thus the satisfy the planned population growth for the community. In addition, this alternative can also meet the Region's ADD requirement of ADD being supplied by the Wells only, and maintains the Region's PTTW.		

LEGEND			
Lowest Impact ---- Most Preferred			Greatest Impact ---- Least Preferred

5.2.3 Ability to Satisfy Regional Design Standards

For the Town of Stouffville, the Region has established a residential unit rate of 189 Lpcd and an Employment unit rate of 144 Lpcd for 2041 as well as a maximum day factor of 1.80. For the proposed population of 64,671 this amounts to a maximum day water supply capacity of 20,821 m^3/day. Wells 1, 2, and 3 have an approved maximum day water supply capacity of 2,946 m^3/day, while Well 5 has an approved capacity of 3,110 m^3/day and Well 6 an approved capacity of 2,290 m^3/day.

In addition, it has been indicated by the Region that they desire to maintain their permit to take water (PTTW), and that 2041 average day demand must be supplied by the Well production capacity only (excluding Lake-Based Supply). For the purposes of the following evaluation these will also be considered as “standards” and the alternatives will be analysed against them in addition to the items mentioned above.

Both alternatives show in Section 5.1 are capable of satisfying regional design standards.

TABLE 5-3 ABILITY OF ALTERNATIVE SUPPLY SOLUTIONS TO SATISFY REGIONAL DESGIN STANDARDS

Alternative			Satisfies Regional Design Standards?
1 Do Nothing / Limit Community Growth / Implement Water Conservation			Yes
The existing well sites and Zone 2 Booster Pumping Station would be capable of providing the full water supply requirement for the proposed community growth, at the Region's design criteria. In addition, by maintaining all the Wells the Region is capable of keeping their current PTTW and achieve the ADD for 2041 being supplied by Well production only.			
2 Expand Existing Wells			
	a) Retire Well 3		
	i)	- Upgrade and Expand Wells 1, 2, 5 and 6 such that Firm Capacity is increased by 28 L/s - Decommission Well 3 - Groundwater Rebound Control (Well 3) - Maintain Existing Zone 2 Booster Pumping Station Capacity of 174 L/s	Yes
	Decommissioning Well 3 while upgrading and expanding Wells 1, 2, 5 and 6 such that Firm Capacity is increased by 34 L/s, is sufficient to meet the MDD for 2041 and thus the satisfy the regional design standards. In addition, by replacing the lost Well production capacity through the decommissioning of Well 3 with an equivalent expanded Well production at Wells 1, 2, 5 and 6 the PTTW is able to be maintained, as well as satisfying the requirement of providing 2041 ADD from Well production only. It should be noted that if groundwater rebound control is required at Well 3, a sperate or expanded PTTW may be required to be obtained by the Region.		

LEGEND

Lowest Impact ---- Most Preferred			Greatest Impact ---- Least Preferred

5.2.4 Ability to Comply with Legislative Requirements

The primary legislative requirements pertaining to the Stouffville Water system are as follows:

- Environmental Requirements, per the Ministry of the Environment and Climate Change (MOECC), the Ministry of Natural Resources and Forestry (MNRF), and the Conservation Authorities Act;
- Archeological and Historical/Cultural Requirements, per the Ministry of Tourism, Culture and Sport (MTCS);
- Obtaining a Permit to Take Water (PTTW), Drinking Water Works Permit (DWWP) and Drinking Water System License (DWSL) from the MOECC; and,
- The Oak Ridges Moraine Conservation Plan (ORMCP), per the Ministry of Municipal Affairs and Housing (MMAH).

Based on a desktop review of the environmental and socio-cultural features within the Study Area, it is highly likely that any proposed facilities requiring land will be able to be sited in a location that will have no greater than a low impact" on the natural or socio-cultural environments such that these impacts can be reduced to near-zero or acceptable/approvable levels through the provision of reasonable mitigative measures.

As such, the main legislative concern for the purposes of this Class EA is the Oak Ridges Moraine Conservation Plan, which prohibits *partial servicing* in Settlement Areas within the ORMCP area. As such, any new development must be serviced via:

c) Full municipal/communal water supply and wastewater treatment; or
d) On-site water and sewage systems.

When the ORMCP was approved, all existing development was grand-fathered, so the existing community (which is partially-serviced) is permitted to remain partially-serviced. Any new development cannot be partially-serviced.

Further, Section 1.6.6.4 of the Provincial Policy Statement Under the *Planning Act* (MMAH, 2014) states that:

> *Where municipal sewage services and municipal water services or private communal sewage services and private communal water services are not provided, individual on-site sewage services and individual on-site water services may be used provided that site conditions are suitable for the long-term provision of such services with no negative impacts.* ***In settlement areas, these services may only be used for infilling and minor rounding out of existing development****.*

The two supply alternatives comply with all foreseen legislative requirements, and as such all have the same assessment value.

TABLE 5-4 ABILITY OF ALTERNATIVE SUPPLY SOLUTIONS TO COMPLY WITH LEGISLATIVE REQUIREMENTS

Alternative			Complies with Legislative Requirements?
1 Do Nothing / Limit Community Growth / Implement Water Conservation			Yes
Complies with legislative requirements.			
2 Expand Existing Wells			
	a) Retire Well 3		
	i)	- Upgrade and Expand Wells 1, 2, 5 and 6 such that Firm Capacity is increased by 28 L/s - Decommission Well 3 - Groundwater Rebound Control (Well 3) - Maintain Existing Zone 2 Booster Pumping Station Capacity of 174 L/s	Yes
	Complies with legislative requirements		

LEGEND			
Lowest Impact ---- Most Preferred			Greatest Impact ---- Least Preferred

5.2.5 Provision of Operational Flexibility

Any modifications to the water supply facility should also be evaluated as to how they impact (positively or negatively) the operational flexibility of the overall system. It is important to maintain operational flexibility such that individual processes can be taken out of service on occasion for planned or emergency maintenance, and for to accommodate unexpectedly high demands which may arise.

For the purposes of the evaluation, alternatives which provide greater operational flexibility are preferred to those which maintain the existing flexibility. Both alternatives identified in Section 5.1 provide enhanced operational flexibility. As noted in the table there is an additional 40 L/s (3,456 m^3/day) after allocation of supply to the growth requirements from 2041 for both alternatives being evaluated, that can be used from the Zone 2 Booster Pumping Station. This additional 40 L/s is beneficial as it allows for added flexibility for load shifting from a Well should this be required for emergency maintenance or to accommodate exceedingly high demands.

TABLE 5-5 ASSESSMENT OF OPERATIONAL FLEXIBILITY OF ALTERNATIVE SUPPLY SOLUTIONS

Alternative	Impact on Natural Environment
1 Do Nothing / Limit Community Growth / Implement Water Conservation	Enhanced
This alternative involves maintaining all existing wells and the Zone 2 Booster Pumping Station. As such there are several facilities in operation that can be cycled as needed providing operational flexibility. In addition, there is an additional potential water taking from the Zone 2 Booster Pumping Station of 40 L/s (3,456 m^3/day) with the current pump capacity installed, which allows for load shifting from a Well if necessary.	
2 Expand Existing Wells	
a) Retire Well 3	
i) - Upgrade and Expand Wells 1, 2, 5 and 6 such that Firm Capacity is increased by 28 L/s - Decommission Well 3 - Groundwater Rebound Control (Well 3) - Maintain Existing Zone 2 Booster Pumping Station Capacity of 174 L/s	Enhanced
This alternative involves maintaining all existing wells and the Zone 2 Booster Pumping Station with the exception of Well 3 which will be decommissioned. To accommodate this loss in water production Wells 1, 2, 5, and 6 will be expanded such that Firm Capacity is increased by 34 L/s. As such there are several facilities in operation that can be cycled as needed providing operational flexibility. In addition, there is an additional potential water taking from the Zone 2 Booster Pumping Station of 40 L/s (3,456 m^3/day) with the current pump capacity installed, which allows for load shifting from a Well if necessary.	

LEGEND

Lowest Impact ---- Most Preferred			Greatest Impact ---- Least Preferred

5.2.6 Impact on Natural Environment

In previous stages of this Class EA process, a technical memorandum has documented the extent of the natural environment (TM4, dated May 31, 2018) and the overall impacts of the proposed alternative solutions on the natural environments (TM5, dated June 19, 2018).

The following table summarizes the potential impacts that the two alternatives being evaluated pose to the natural environment. From the table it can be seen that the Do Nothing / Limit Community Growth / Implement Water Conservation alternative has little to no impact to the natural environment as no new facilities are being constructed, only modifications to existing facilities which can occur within their respective existing footprints. Alternative 2 has an assessment rating of Moderate, as it involves the decommissioning of Well 3, groundwater rebound control, and the expansion of existing Well site to accommodate for lost production capacity from retiring Well 3.

TABLE 5-6 ASSESSMENT OF IMPACTS ON THE NATURAL ENVIRONMENT

Alternative	Impact on Natural Environment
1 Do Nothing / Limit Community Growth / Implement Water Conservation	No Impact
This alternative requires no additional infrastructure only upgrades to existing facilities which can be contained within the existing footprint of the facility. As such there is no impact to the natural environment.	
2 Expand Existing Wells	
a) Retire Well 3	
i) - Upgrade and Expand Wells 1, 2, 5 and 6 such that Firm Capacity is increased by 28 L/s - Decommission Well 3 - Groundwater Rebound Control (Well 3) - Maintain Existing Zone 2 Booster Pumping Station Capacity of 174 L/s	Moderate, but mitigatable
This alternative requires the decommissioning of Well 3, potentially conducting groundwater rebound control which would require discharge to the environment, and the expansion of existing Well sites. These will have moderate impacts to the Natural Environment.	

LEGEND

Lowest Impact ---- Most Preferred			Greatest Impact ---- Least Preferred

5.2.7 Impact on Socio-Cultural Environment

In previous stages of this Class EA process, two previous technical memoranda have documented the extent of the socio-cultural environment (TM4, dated May 31, 2018) and the overall impacts of the proposed alternative solutions on the socio-cultural environments (TM5, dated June 19, 2018).

As can be seen in the following table, the Do Nothing / Limit Community Growth / Implement Water Conservation alternative has a lower assessment rating as it requires no additional infrastructure and does not have groundwater rebound control issues as no Wells are retired.

TABLE 5-7 ASSESSMENT OF IMPACTS ON THE SOCIO-CULTURAL ENVIRONMENT

Alternative			Impact on Socio-Cultural Environment
1 Do Nothing / Limit Community Growth / Implement Water Conservation			Low
There is no new infrastructure required in the Do Nothing / Limit Community Growth / Implement Water Conservation alternative. There would only be minor works associated with upgrading the Wells and Zone 2 Booster Pumping Station which may cause low levels of Noise and Vibration.			
2 Expand Existing Wells			
	a) Retire Well 3		
	i)	- Upgrade and Expand Wells 1, 2, 5 and 6 such that Firm Capacity is increased by 28 L/s - Decommission Well 3 - Groundwater Rebound Control (Well 3) - Maintain Existing Zone 2 Booster Pumping Station Capacity of 174 L/s	Moderate
	Upgrading and Expanding Wells 1, 2, 5 and 6 such that Firm Capacity is increased by 34 L/s will cause minor levels of noise and vibration. The decommissioning of Well 3 could result in groundwater table rebound which could impact basements if control measures are not put in place. Should groundwater rebound control and Wells 1, 2, 5 and 6 be expanded, there would be an increase in aquifer drawdown and requiring an expansion to the existing PTTW or creation of a separate PTTW for the rebound control at Well 3.		

LEGEND			
Lowest Impact ---- Most Preferred			Greatest Impact ---- Least Preferred

5.2.8 Capital Costs

Below is a summary of the capital cost estimate (excluding lifecycle costs) for the various alternatives analysed. This includes a cost estimate associated with required upgrades as well new infrastructure for the various scenarios being evaluated. All of the costs below include a 25% allowance for permitting and approvals, engineering and other design elements, plus a contingency.

The Do Nothing / Limit Community Growth / Implement Water Conservation alternative has an assessment rating of Low as it has the lowest cost of the alternatives evaluated. This is to be expected as no additional facilities are being expanded or constructed, only upgrades to existing facilities to allow them to maintain current capacities. The second alternative has an assessment rating of Moderate, as it involves the decommissioning of a Well, groundwater rebound control at the decommissioned Well site location, and the expansion of Existing Wells to compensate for lost Well production from the retired Well 3.

TABLE 5-8 ASSESSMENT OF CAPITAL COSTS

Alternative			Capital Cost Comparison
1 Do Nothing / Limit Community Growth / Implement Water Conservation			Low
This alternative has the lowest cost of the evaluated options of $4,890,000. This cost includes upgrading Wells 1, 2, 3, 5 and 6 to maintain current capacity, as well as upgrade costs to the Zone 2 Booster Pumping Station to allow it to maintain exiting capacity.			
2 Expand Existing Wells			
	a) Retire Well 3		
		i) - Upgrade and Expand Wells 1, 2, 5 and 6 such that Firm Capacity is increased by 28 L/s - Decommission Well 3 - Groundwater Rebound Control (Well 3) - Maintain Existing Zone 2 Booster Pumping Station Capacity of 174 L/s	Moderate, highest of costs examined
	This alternative has the highest cost of the evaluated options of $5,360,000. This cost includes upgrading Wells 1, 2, 3, 5 and 6 to maintain current capacity, upgrades to the Zone 2 Booster Pumping Station to allow it to maintain existing capacity, and groundwater rebound control at Well 3.		

LEGEND			
Lowest Impact ---- Most Preferred			Greatest Impact ---- Least Preferred

5.2.9 Lifecycle Costs

The final evaluation criteria is the Project Lifecycle Cost Estimates. This includes a net present value evaluation of the cost associated with required upgrades as well new infrastructure and operation and maintenance costs up to the planning horizon (2041) for the various scenarios being evaluated. For the purposes of this evaluation an interest rate of 2.0% has been used. The Do Nothing / Limit Community Growth / Implement Water Conservation alternative has an assessment rating of Low as it has the lowest cost of the alternatives evaluated. This is to be expected as no additional facilities are being expanded or constructed, only upgrades to existing facilities to allow them to maintain current capacities. The second alternative has an assessment rating of Moderate, as it involves the decommissioning of a Well, groundwater rebound control at the decommissioned Well site location, and the expansion of Existing Wells to compensate for lost Well production from the retired Well 3.

TABLE 5-9 ASSESSMENT OF LIFECYCLE COSTS

Alternative			Lifecycle Cost Comparison
1 Do Nothing / Limit Community Growth / Implement Water Conservation			Low
This alternative has the lowest cost of the evaluated options of $11,310,000. This cost includes upgrading Wells 1, 2, 3, 5 and 6 to maintain current capacity, as well as upgrade costs to the Zone 2 Booster Pumping Station to allow it to maintain exiting capacity, along with operational and maintenance costs for the facilities to the year 2041 brought back to a net present value.			
2 Expand Existing Wells			
	a) Retire Well 3		
	i)	- Upgrade and Expand Wells 1, 2, 5 and 6 such that Firm Capacity is increased by 28 L/s - Decommission Well 3 - Groundwater Rebound Control (Well 3) - Maintain Existing Zone 2 Booster Pumping Station Capacity of 174 L/s	Moderate, highest of costs examined
This alternative has the highest cost of the evaluated options of $11,970,000. This cost includes upgrading Wells 1, 2, 3, 5 and 6 to maintain current capacity, upgrades to the Zone 2 Booster Pumping Station to allow it to maintain existing capacity, and groundwater rebound control at Well 3, along with operational and maintenance costs for the facilities to the year 2041 brought back to a net present value.			

LEGEND			
Lowest Impact ---- Most Preferred			Greatest Impact ---- Least Preferred

5.2.10 Overall Ranking Servicing Alternatives

The table below compiles the assessments of each of the evaluation criteria presented above into a matrix which allows for a comparative assessment of the alternatives.

TABLE 5-10 OVERALL ASSESSMENT

Alternative	Technical Feasibility	Satisfies Planned Growth	Satisfies Design Standards	Complies with Legislative Requirements	Provides Operational Flexibility	Impact on Natural Environment	Impact on Socio-Cultural Environment	Capital Cost	Life Cycle Costs	OVERALL RANKING
1 Do Nothing / Limit Community Growth / Implement Water Conservation	1	1	1	1	1	1	2	2	2	***1.3***
2 Expand Existing Wells	1	1	1	1	1	3	3	3	3	1.9
LEGEND										
Lowest Impact 1 Most Preferred	2----3			3----4			Greatest Impact 4 Least Preferred			

According to the overall ranking in the Table 9, the following list describes the alternatives from most to least viable:

1) Do Nothing / Limit Community Growth / Implement Water Conservation
   - Capital Cost Estimate = $4,890,000
   - Lifecycle Cost Estimate = $11,310,000
2) Expand Existing Wells
   - Capital Cost Estimate = $5,360,000
   - Lifecycle Cost Estimate = $11,970,000

5.3 Recommendations and Conclusion for Servicing Alternatives

Overall, the recommended preferred solution for Water Supply in the Stouffville community is the Do Nothing alternative. This alternative involves upgrading Wells 1, 2, 3, 5, 6 to maintain current capacity.

In this scenario the water requirement to meet the 2041 growth target will be supplied by the excess available supply from the Zone 2 Booster Pumping Station as described in Section 5.2.5.

Upgrading Wells 1 and 2 involves the following items:

- Electrical and I&C Upgrades: $462,000
- Mechanical (HVAC + Building + Plumbing) Upgrades: $516,000
- Process Upgrades: $143,000
- Well Pumps and Well Casing Upgrades: $162,000
- *Total: $1,282,000*

Upgrading Well 3 would involve the following items:

- Electrical and I&C Upgrades: $76,000
- Mechanical (HVAC + Building + Plumbing): $709,000
- Process Upgrades: $30,000
- Well Pumps and Well Casing Upgrades: $57,000
- *Total: $871,000*

Upgrading Wells 5 and 6 would involve the following items:

- Electrical and I&C Upgrades: $286,000
- Mechanical (HVAC + Building + Plumbing): $1,127,000
- Process Upgrades: $344,000
- *Total: $1,757,000*

The total cost for this preferred solution is $4,890,000 (including 25% for permits and approvals, Engineering, and Contingencies). Estimated Lifecycle costs for the preferred solution is $9,970,000.

6 Recommendations and Conclusions

From the above evaluation the preferred solutions are as follows:

- Storage: Facilitation of Shared Fire Storage Between Zones 1 to 2/3, Rehabilitation of the West Cell of the Stouffville Reservoir (2,996 m^3), upgrades to the HLPS to allow for 110.96 L/s pumps (3 Pumps, 2 Duty/1 Standby), upgrades to allow the Zone 2 Elevated Tank to remain operational past 2043 or construct new storage at same site location (3,400 m^3), decommissioning of the East Cell at the Stouffville Reservoir, and the construction of a New PRV Chamber to provide redundancy in the transfer of water from Zone 1 to Zone 2.
- Supply: Do Nothing except upgrade Wells 1, 2, 3, 5 and 6 to maintain current capacity.

The estimated project costs (excluding lifecycle costs) as per Appendix A for the preferred solutions are:

- Storage: $9,104,000
- Supply: $4,890,000