

**APPENDICES** 

# APPENDIX C TECHNICAL MEMORANDUM No.2 – ALTERNATIVE DESIGN CONCEPTS FOR PROSPECT PARK WPP EXPANSION



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## TECHNICAL MEMORANDUM No. 2 ALTERNATIVE DESIGN CONCEPTS FOR PROSPECT PARK WPP EXPANSION

Prepared for:

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#### **APPENDICES**

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#### 1. INTRODUCTION

The water supply for the Town of Acton (the Town) currently consists of three well fields that are owned and operated by the Region of Halton (the Region): Prospect Park Well Field, Davidson Well Field, and the Fourth Line Well Field. The Prospect Park Well Field and Water Purification Plant (WPP), located in Halton Hills, currently provides approximately 40 percent of the Town's average daily water supply.

The Region plans to expand production from the Prospect Park Well Field from the current permitted limits to 3,500 m³/day year round, in order to provide long term water servicing for future growth in Acton to 2031. To meet the servicing requirements of future growth in the service area, the Prospect Park Well Field and WPP will have to be expanded from the current permitted limits. As such, this project is a "Schedule C" activity under the Municipal Class Environmental Assessment (Class EA) process.

This Technical Memorandum (TM) identifies a number of alternative water treatment plant design concepts to provide future servicing requirements, along with an evaluation of these alternative design concepts.

#### 1.1 Objectives

The objectives of this TM are to:

- 1. Identify alternative design concepts to meet future water treatment requirements for the Town of Acton; and
- 2. Complete a preliminary evaluation of the alternative design concepts and identify a recommended design concept that meets the Class EA objectives.

#### 2. ALTERNATIVE DESIGN CONCEPTS

Four design concepts which meet the study objectives and would fulfil the capacity needs at the existing WPP were developed. XCG Consultants Ltd. (XCG) previously conducted a desktop capacity assessment of the Prospect Park WPP (TM No. 1), which identified that the major unit process limiting capacity at the WPP is filtration. As such, all four alternative design concepts include expansion of the filtration system at the Prospect Park WPP, although the configuration of the filters differs among the four options.

Additional upgrades and other modifications to the Prospect Park WPP that are common to all four alternatives include:

- a building expansion either to the North (Building Layout A) or East (Building Layout B) side of the existing facility to accommodate the upgraded filtration system and new process areas;
- a new scrubber room;
- new chemical rooms for chlorine, and potassium permanganate storage and feed equipment; and
- a new electrical room.

The layout of upgrades and modifications to the WPP differs in each alternative.

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Certain upgrades to the site are common to all the alternatives presented, including installation of a new flow meter at the existing well house, construction of two new 150 mm raw water mains from the well house to the WPP, construction of two new pre-oxidation contactors and piping upgrades. The layout of Design Concept No. 1 and No. 2 allow for additional parking on the west side of the building.

The recommended upgrades to the general site are presented in Appendix A.

The following section provides a review of the alternative design concepts that could be used to expand the Prospect Park WPP.

For the purposes of developing the alternative design concepts, the following assumptions were made:

- All expansions will be located on the existing site; and
- Existing infrastructure will be reused to the extent possible.

#### 2.1 Design Concept 1 - One New Shorter Filter (Building Layout A)

In this alternative the existing two filters remain in operation and a new filter with a larger diameter is constructed to provide additional treatment capacity on the north side of the building.

The upgrades required to the existing Prospect Park WPP for this option are outlined below.

Expansion of the north side of the building would include:

- One new 4 m diameter filter
- Scrubber room
- Chlorine room
- Potassium permanganate room
- Fluoride room
- Vestibule with the emergency shower and eye wash station

Modifications to the existing building would include:

- New laboratory and electrical room
- Modified lunch and control room

Figure 1 provides the layout for the upgrades with one new shorter filter for Building Layout A.

#### 2.2 Design Concept 2 -Three New Shorter Filters (Building Layout A)

In this alternative a new filter is constructed and the existing two old filters are replaced to provide additional treatment capacity. All three new filters have a diameter of 4 m and as a result are shorter than the existing filters to improve access to ancillary equipment above and below the filters within the existing building. Staged replacement of the two existing filters (i.e. install new filter, replaced and commission existing filters one at a time) can be considered to ensure that the WPP remains in operation during construction.

The upgrades required to the existing Prospect Park WPP for this option are outlined below.

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Expansion of the north side of the building would include:

- One new 4 m diameter filter
- Scrubber room
- Chlorine room
- Potassium permanganate room
- Fluoride room
- Vestibule with the emergency shower and eye wash station;

Modifications to the existing building would include:

- Replace the existing old filters with two new 4 m diameter filters
- New laboratory and electrical rooms
- Modified lunch and control room

Figure 2 provides the layout for the upgrades with three new shorter filters for Building Layout A.

#### 2.3 Design Concept 3 - Three New Taller Filters (Building Layout B)

In this alternative three new filters are constructed and the two existing old filters are decommissioned. All three new filters have a diameter of 2.5 m and as a result are taller than the existing filters. The existing filter room can then be retrofitted to accommodate new areas and equipment.

The upgrades required to the existing Prospect Park WPP for this option are outlined below.

Expansion of the west side of the building would include:

• Three new 2.5 m diameter filter

Modifications to the existing building would include:

- Decommission the existing filters
- Scrubber room
- Chlorine room
- Retrofitted potassium permanganate room
- Retrofitted fluoride room
- New laboratory and electrical rooms
- Retrofitted lunch and control room

Figure 3 provides the layout for the upgrades with three new taller filters for Building Layout B.

#### 2.4 Design Concept 4 - One New Filter (Building Layout B)

In this alternative the building is expanded to the west side of the existing facility to accommodate one new 2.5 m diameter filter and the existing two filters. The existing filter room is retrofitted to accommodate new areas and equipment.

The building is expanded on the west side to accommodate the new filter.

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The upgrades required to the existing Prospect Park WPP for this option are outlined below.

Expansion of the west side of the building would include:

- One new 2.5 m diameter filter
- The existing two old filters

Modifications to the existing building would include:

- Scrubber room
- Chlorine room
- Retrofitted potassium permanganate room
- Retrofitted fluoride room
- New laboratory and electrical rooms
- Retrofitted lunch and control room

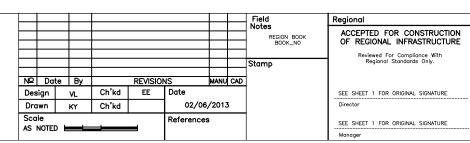
Figure 4 provides the layout for the upgrades with one new filter for Building Layout B.

#### GROUND FLOOR PLAN - CONCEPT 1 - ONE NEW FILTER (BUILDING LAYOUT A)

NOTES:

- BASED ON THE EXISTING GROUND FLOOR PLAN DWG: A-542.
   NEW AND EXISTING CHEMICAL ROOMS WILL HAVE NEW HVAC, CONTAINMENT FLOOR AND CURB ALONG WITH NEW SAFETY SHOWER, FEVE WASH STATIONS.

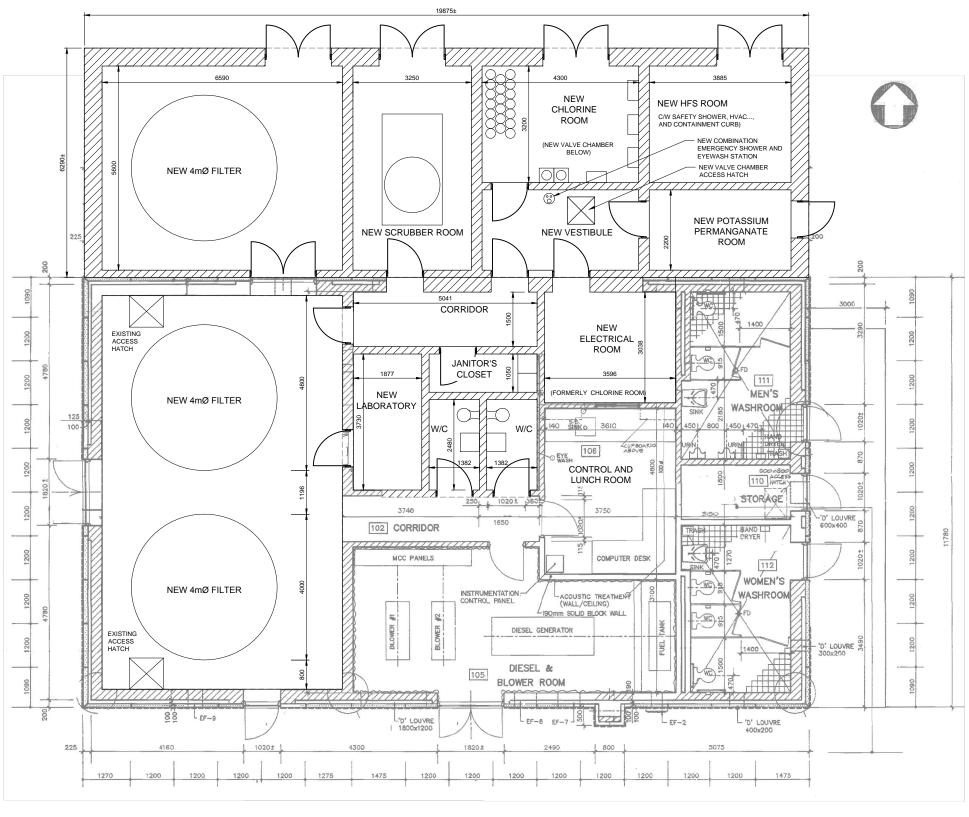
  BLOWERS, DIESEL GENERATOR, AND FUEL TANK WILL BE REPLACED WITH NEW.
- 4. NEW PUBLIC WASHROOMS ON EAST SIDE OF BUILDING.



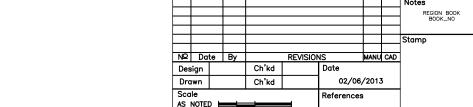
THE REGIONAL MUNICIPALITY OF HALTON PROSPECT WATER TREATMENT PLANT

PROCESS DESIGN CONCEPT 1 ONE NEW FILTER (BUILDING LAYOUT A)

Consultant File № 20125530	Regional Drawing № P001
CONTRACT Nº	Drawing №
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#### GROUND FLOOR PLAN - DESIGN CONCEPT 2 - THREE NEW SHORTER FILTERS (BUILDING LAYOUT A)



### ACCEPTED FOR CONSTRUCTION OF REGIONAL INFRASTRUCTURE SEE SHEET 1 FOR ORIGINAL SIGNATURE SEE SHEET 1 FOR ORIGINAL SIGNATURE



THE REGIONAL MUNICIPALITY OF HALTON PROSPECT WATER TREATMENT PLANT PROCESS

CONTRACT Nº

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DESIGN CONCEPT 2

THREE NEW SHORTER FILTERS (BUILDING LAYOUT A) Consultant File № Regional Drawing № 20125530 P002

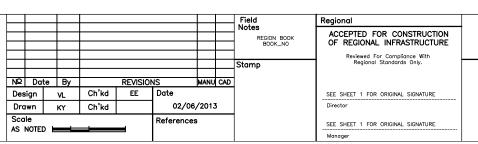
Drawing №

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#### GROUND FLOOR PLAN - DESIGN CONCEPT 3 - THREE NEW TALLER FILTERS (BUILDING LAYOUT B)

#### NOTES:

- BASED ON THE EXISTING GROUND FLOOR PLAN DWG: A-542.
   NEW AND EXISTING CHEMICAL ROOMS WILL HAVE NEW HVAC, CONTAINMENT FLOOR AND CURB ALONG WITH NEW SAFETY SHOWER, FEW WASH STATIONS.
   BLOWERS, DIESEL GENERATOR, AND FUEL TANK WILL BE REPLACED WITH NEW.
- 4. NEW PUBLIC WASHROOMS ON EAST SIDE OF BUILDING.



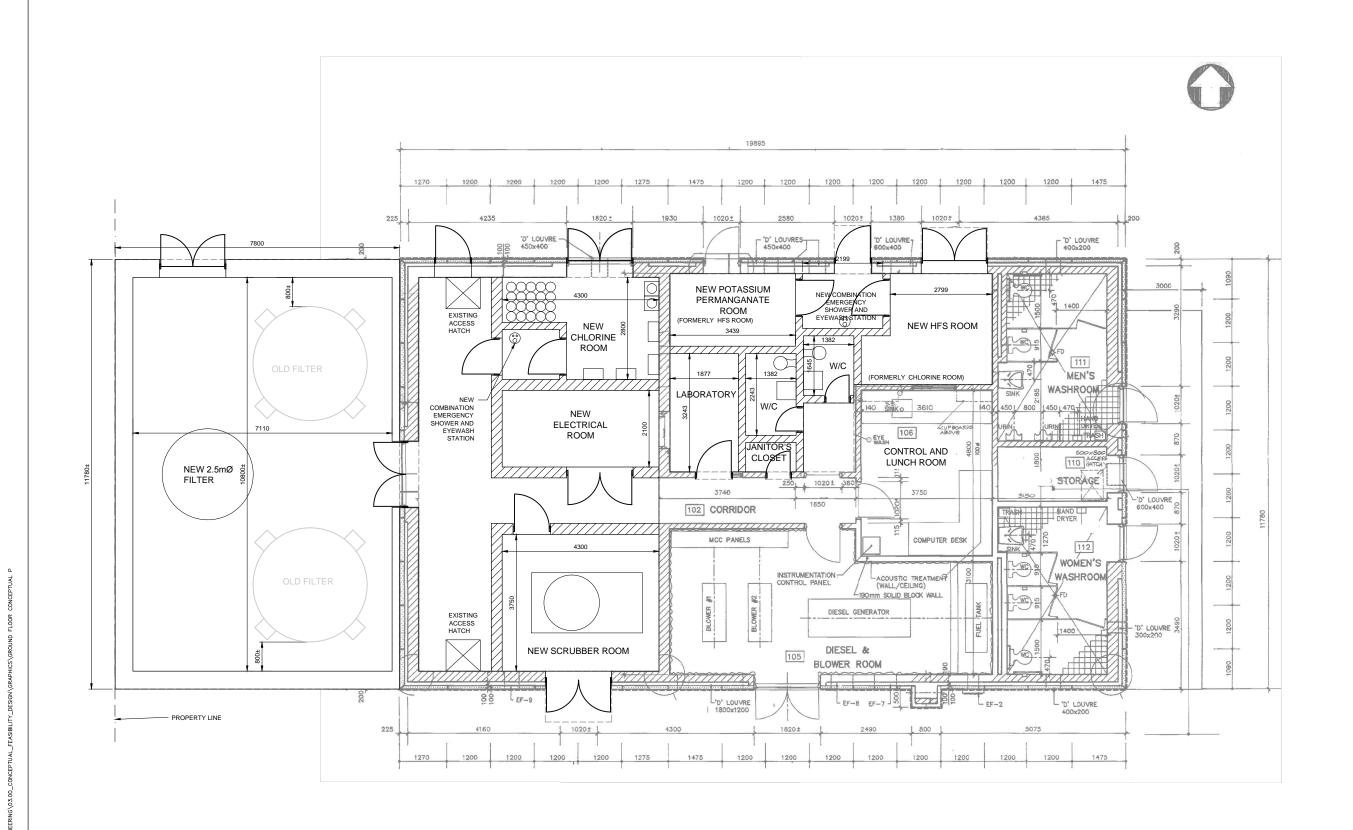


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THE REGIONAL MUNICIPALITY OF HALTON PROSPECT WATER TREATMENT PLANT PROCESS

DESIGN CONCEPT 3

THREE NEW TALLER FILTERS ( BUILDING LAYOUT B)

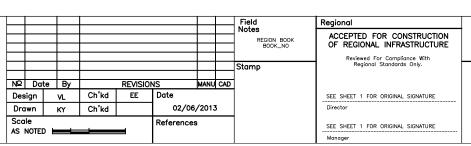
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#### GROUND FLOOR PLAN - DESIGN CONCEPT 4 - ONE NEW FILTER (BUILDING LAYOUT B)

#### NOTES:

- BASED ON THE EXISTING GROUND FLOOR PLAN DWG: A-542.
   NEW AND EXISTING CHEMICAL ROOMS WILL HAVE NEW HVAC, CONTAINMENT FLOOR AND CURB ALONG WITH NEW SAFETY SHOWER, FEW WASH STATIONS.
   BLOWERS, DIESEL GENERATOR, AND FUEL TANK WILL BE REPLACED WITH NEW.
- 4. NEW PUBLIC WASHROOMS ON EAST SIDE OF BUILDING.





TITLE
THE REGIONAL MUNICIPALITY OF HALTON PROSPECT WATER TREATMENT PLANT PROCESS

DESIGN CONCEPT 4 ONE NEW FILTER (BUILDING LAYOUT B)

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CONTRACT Nº	Drawing №	
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#### 3. Preliminary Evaluation of Design Concepts

#### 3.1 Evaluation Methodology

The evaluation criteria presented in Table 1 were used to evaluate the design concepts described in Section 2 of this TM. The potential for phasing of construction to maintain plant operation was evaluated for each alternative, with additional consideration given to impacts on the natural environment, technical factors, social/ cultural/ community environments and cost.

For the purposes of the evaluation, all evaluation groups were assumed to be equally weighted.

Table 1 Evaluation Criteria

Group	Criteria	Definition				
Natural Environment	Effects on surface water and groundwater	This criterion refers to the effects of the construction and operation of the alternative design concept on Fairy Lake water quality, quantity and aquatic ecosystems, and the aquifer quality and quantity.				
	Displacement of vegetation	This criterion refers to the displacement of vegetation during construction.				
Technical Environment	Constructability	This criterion addresses the ability to maintain the performance of the treatment process during construction.				
	Ease of operation	This criterion refers to the operational complexity of the concept in terms of operator attention and staffing requirements.				
	Performance reliability	This criterion refers to the performance reliability of the concept.				
	Compatibility with existing infrastructure	This criterion refers to the compatibility of the concept with existing infrastructure in terms of the application/use of existing equipment and ability for retrofit.				
	Ability to consistently meet Region's treated water quality criteria	This criterion refers to the ability for the concept to consistently be able to meet the Region's treated water quality criteria.				
Social/Cultural/ Community Environments	Disruption of adjacent residential, community and recreational features (noise, dust, traffic)	This criterion addresses the potential short-term nuisance impacts on adjacent land owners, residents during construction.				
	Disruption to park visitors	This criterion addresses the potential short-term nuisance impacts and permanent long-term impacts on park visitors.				
Economic Environment	Capital costs	This criterion provides an estimate of capital cost of construction and land acquisition costs.				
	Annual operating costs	This criterion provides an estimate of annual operating costs.				



A matrix was prepared to present information on each alternative design concept. Each alternative design concept was assigned a score based on the impact on the natural, technical, social and economic environments.

A score was assigned to each alternative for each evaluation criteria, as follows:

- O Meets criterion objectives / least negative impact / lowest cost
- Meets most aspects of the criterion / moderate impact
- Meets some aspects of the criterion / potential for negative impact
- Does not meet criterion objectives / negative impact / highest cost

For each alternative, a score was assigned to each individual criterion. Each group (Environmental, Technical, Social and Economical) was considered to have equal weight. Based on the results of the evaluation, design concepts were ranked from most preferred to least preferred. The alternative design concept with the most preferred ranking was selected as the preferred alternative design concept.

#### 3.2 Preliminary Evaluation Results

Table 2 presents the information matrix for the evaluation of alternative design concepts.



	Natural Environment		Technical Environment		Social/Cultural/ Community Environments		Economic Environment		Overall
	Criteria / Evaluation	Score	Criteria / Evaluation	Score	Criteria / Evaluation	Score	Criteria / Evaluation	Score	Rank
Concept 1 - One New Shorter Filter (Building Layout A)	<ul> <li>Effect on surface water and groundwater</li> <li>Minor to moderate impacts to Fairy Lake and aquifer from increased water taking.</li> <li>All construction impacts can be mitigated through good construction techniques.</li> </ul>		Constructability     Building expansion to the North side of the existing facility.     One new filter will be installed in expanded building.     Existing two old filters will remain in operation.     Minor disruption to treatment process during construction.		Disruption of adjacent residential, community and recreational features (noise, dust, traffic)  Minor noise and dust on adjacent land owners and residents during construction activities.  Moderate traffic during construction activities.		Capital costs     Low capital costs of construction relative to all other concepts.     Land acquisition costs similar to all other concepts.	•	
	<ul> <li>Displacement of vegetation</li> <li>Largest construction footprint, same as Concept 2.</li> <li>Four trees to the North of the facility will be displaced.</li> <li>Potential to replant trees displaced during construction.</li> </ul>		<ul> <li>Ease of operation</li> <li>Difficult flow splitting between different sized filters.</li> <li>Most difficult to operate.</li> <li>Performance reliability</li> <li>Low to medium reliability.</li> <li>The two existing filters will need to be replaced once they reach the end of their useful life.</li> <li>Two existing filters may require additional maintenance in the interim.</li> <li>Compatibility with existing infrastructure</li> <li>Poor compatibility with existing infrastructure.</li> <li>Some retrofits required to split flow to different sized filters</li> <li>Ability to consistently meet Region's treated water quality criteria</li> <li>New filter able to consistently meet treated water quality criteria.</li> <li>Two old filters may consistently meet treated quality water criteria.</li> </ul>		<ul> <li>Disruption to park visitors</li> <li>Moderate temporary disruption anticipated to Prospect Park during construction.</li> <li>Major temporary disruption anticipated to baseball diamond during construction.</li> <li>Minor permanent disruption anticipated to adjacent baseball field from building expansion to the West side of the existing facility.</li> </ul>		Annual operating costs     Similar annual operations costs compared to other concepts.		3
	Group Average Score		Group Average Score	•	Group Average Score		Group Average Score		



	Natural Environment		Technical Environment		Social/Cultural/ Community Environments		Economic Environment		Overall
	Criteria / Evaluation	Score	Criteria / Evaluation	Score	Criteria / Evaluation	Score	Criteria / Evaluation	Score	Rank
Concept 2 - Three New Shorter Filters (Building Layout A)	Effect on surface water and groundwater     Minor to moderate impacts to Fairy Lake and aquifer from increased water taking.     All construction impacts can be mitigated through good construction techniques.		Constructability     Building expansion to the North side of the existing facility.     Three new filters will be installed in expanded building.     Existing old filters will be decommissioned and replaced individually to ensure the WPP remains in operation at all times.     Medium disruption to treatment process during construction.		Disruption of adjacent residential, community and recreational features (noise, dust, traffic)  • Minor noise and dust on adjacent land owners and residents during construction activities.  • Moderate traffic during construction activities.		Capital costs  High capital costs of construction relative to all other concepts.  Land acquisition costs similar to all other concepts.	•	
	<ul> <li>Displacement of vegetation</li> <li>Largest construction footprint, same as Concept 1.</li> <li>Four trees to the North of the facility will be displaced.</li> <li>Potential to replant trees displaced during construction.</li> </ul>		<ul> <li>Ease of operation</li> <li>Difficult flow splitting between different sized filters. Once two old filters are replaced, flow through process with relatively simple operation control requirements.</li> <li>Performance reliability</li> <li>Low to medium reliability while the two old filters are in operation.</li> <li>High performance reliability for three new filters, once the two old filters are replaced.</li> <li>Compatibility with existing infrastructure</li> <li>Some temporary retrofits required to split flow to different sized filters.</li> <li>Good compatibility with existing infrastructure once two old filters are replaced.</li> <li>Ability to consistently meet Region's treated water quality criteria         Able to consistently meet treated quality water criteria once all filters are replaced.     </li> </ul>		<ul> <li>Disruption to park visitors</li> <li>Moderate temporary disruption anticipated to Prospect Park during construction.</li> <li>Major temporary disruption anticipated to baseball diamond during construction.</li> <li>Minor permanent disruption anticipated to adjacent baseball field from building expansion to the West side of the existing facility.</li> </ul>		Annual operating costs  • Similar annual operations costs compared to other concepts.		2
	Group Average Score		Group Average Score		Group Average Score		Group Average Score		1



	Natural Environment		Technical Environment		Social/Cultural/ Community Environments		Economic Environment		Overall
	Criteria / Evaluation	Score	Criteria / Evaluation	Score	Criteria / Evaluation	Score	Criteria / Evaluation	Score	Rank
Concept 3 - Three New Taller Filters (Building Layout B)	<ul> <li>Effect on surface water and groundwater</li> <li>Minor to moderate impacts to Fairy Lake and aquifer from increased water taking.</li> <li>All construction impacts can be mitigated through good construction techniques.</li> </ul>		<ul> <li>Constructability</li> <li>Building expansion to the West side of the existing facility.</li> <li>Three new filters will be installed in expanded building.</li> <li>Existing old filters will be decommissioned once new filters are in operation.</li> <li>Allows for retrofits to existing building after new filters are installed.</li> <li>Some disruption to treatment process during construction.</li> </ul>		Disruption of adjacent residential, community and recreational features (noise, dust, traffic)  Minor noise and dust on adjacent land owners and residents during construction activities.  Moderate traffic during construction activities.		Capital costs     High capital costs of construction relative to all other concepts.     Land acquisition costs similar to all other concepts.	•	
	<ul> <li>Displacement of vegetation</li> <li>Smallest construction footprint, same as Concept 4.</li> <li>Four trees to the North of the facility and three trees to the South of the facility will be displaced.</li> <li>Potential to replant trees displaced during construction.</li> </ul>		Ease of operation     Flow through process with relatively simple operation control requirements  Performance reliability     High performance reliability for three new filters.  Compatibility with existing infrastructure     Good compatibility with existing infrastructure.  Ability to consistently meet Region's treated water quality criteria  Able to consistently meet treated water quality criteria.		Disruption to park visitors     Moderate temporary disruption anticipated to Prospect Park during construction.     Moderate temporary disruption anticipated to baseball diamond during construction.     Moderate permanent disruption anticipated to adjacent baseball field from building expansion to the North side of the existing facility.		Annual operating costs     Similar annual operations costs compared to other concepts.		1
	Group Average Score		Group Average Score		Group Average Score		Group Average Score		



	Natural Environment		Technical Environment		Social/Cultural/ Community Environments		Economic Environment		Overall
	Criteria / Evaluation	Score	Criteria / Evaluation	Score	Criteria / Evaluation	Score	Criteria / Evaluation	Score	Rank
Concept 4 - One New Filter (Building Layout B)	<ul> <li>Effect on surface water and groundwater</li> <li>Minor to moderate impacts to Fairy Lake and aquifer from increased water taking.</li> <li>All construction impacts can be mitigated through good construction techniques.</li> </ul>		<ul> <li>Constructability</li> <li>Building expansion to the West side of the existing facility.</li> <li>One new filter will be installed in expanded building. Existing two old filters will be moved to the expanded building.</li> <li>Minor disruption to treatment process during construction.</li> </ul>		Disruption of adjacent residential, community and recreational features (noise, dust, traffic)  Minor noise and dust on adjacent land owners and residents during construction activities.  Moderate traffic during construction activities.		Capital costs     Low capital costs of construction relative to all other concepts.     Land acquisition costs similar to all other concepts.		
	<ul> <li>Displacement of vegetation</li> <li>Smallest construction footprint, same as Concept 3.</li> <li>Four trees to the North of the facility and three trees to the South of the facility will be displaced.</li> <li>Potential to replant trees displaced during construction.</li> </ul>		<ul> <li>Ease of operation</li> <li>Difficult flow splitting between different sized filters.</li> <li>Most difficult to operate.</li> <li>Performance reliability</li> <li>Low to medium reliability.</li> <li>The two existing filters will need to be replaced once they reach the end of their useful life.</li> <li>Two existing filters may require additional maintenance in the interim.</li> <li>Compatibility with existing infrastructure</li> <li>Poor compatibility with existing infrastructure.</li> <li>Some retrofits required to split flow to different sized filters.</li> <li>Ability to consistently meet Region's treated water quality criteria</li> <li>New filter able to consistently meet treated water quality criteria.</li> <li>Two old filters may consistently meet treated water quality criteria.</li> </ul>		<ul> <li>Disruption to park visitors</li> <li>Moderate temporary disruption anticipated to Prospect Park during construction.</li> <li>Moderate temporary disruption anticipated to baseball diamond during construction.</li> <li>Moderate permanent disruption anticipated to adjacent baseball field from building expansion to the North side of the existing facility.</li> </ul>		Annual operating costs     Similar annual operations costs compared to other concepts.		4
	Group Average Score		Group Average Score	•	Group Average Score		Group Average Score		
Notes:  Least Impact / Lowes	et Cost								



#### 4. Preferred Design Concept

The preferred alternative design concept to meet the study objectives is Design Concept 3 – Three New Taller Filters (Building Layout B). The preferred design concept for upgrading and expanding the Prospect Park WPP involves:

- Construction of three new filters and decommissioning of the existing filters to provide water servicing for growth in the Town of Acton.
- Expansion of the west side of the building using the existing blow-out wall to accommodate the new filters.
- Modifications to the existing building would include a new scrubber room, a new chlorine room, a new electrical room, a retrofitted potassium permanganate room, a new laboratory, and retrofitted fluoride room.

Although this design concept has the highest capital cost, it offers the following advantages relative to the other alternatives:

#### Three New Taller Filters vs. One New Filter

- Utilizing the same sized filters will ensure that the plant hydraulics are not negatively affected.
- Construction of three new filters and decommissioning the two old filters will ensure that the existing two filters will not require upgrades and/or maintenance.
- Operation of the existing plant can be maintained during the construction of the building expansion and installation of the new filters.

#### Three New Taller Filters vs. Three New Shorter Filters

Constructing the three new taller filters will ensure that the upgrades and
modifications are completed all at once. Design Concept 2 - Three New Filters
(Building Layout A) will require more complex construction staging to
continuously provide an adequate water supply which will likely extend the
project completion date.

In addition to the advantages summarized above, Design Concept 3 - three new taller filters (Building Layout B) has the smallest footprint.

However, this alternative does reduce the set-back from the existing baseball field; consultations with the Town are recommended to ensure that the land is available and that there are no objections to reducing the distance between the WPP and the baseball field.



### APPENDIX A GENERAL SITE PLANS FOR ALL DESIGN CONCEPTS



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AS NOTED