Waterfront Toronto

East Bayfront Class Environmental Assessment Master Plan Addendum

Stormwater Collection and Management System

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1 Introduction

1.1 Background

Waterfront Toronto and the City of Toronto completed in 2006 an infrastructure Master Plan to support re-development of the East Bayfront area. In addition to considering municipal servicing and transportation considerations, this Master Plan included a recommended stormwater collection and management system, and fulfilled Class EA Schedule C project requirements for the stormwater collection and management component through the consideration and assessment of alternative designs.

The 2006 Class EA Master Plan considered stormwater management in two parts. First, alternative stormwater management systems were considered, yielding a recommendation that included a combination of source, conveyance, and end-of-pipe controls, proposed utilization of the existing drainage system to the extent possible, and mandated the use of source controls. Separate conveyance systems were recommended to differentiate between clean (rooftop) and dirty (surface) runoff. Clean runoff was to be treated and utilized at source as much as possible, with the remainder conveyed via sewers and surface architectural features to the end-of-pipe facility. Dirty runoff was to be conveyed to two collection points for end-of-pipe treatment, via a conventional storm sewer system sized to accommodate a 5-year design storm.

Secondly, the Class EA Master Plan assessed alternative end-of-pipe facilities. The recommended alternative was described as 'sub-surface sedimentation tanks with filters and ultraviolet (UV) disinfection'. Dirty (surface) runoff generated by a 2" (50mm) event was to be captured within the two spatially separate tanks for sedimentation and subsequent UV treatment. The UV treated runoff was then to be combined with the clean (rooftop) runoff, filtered, and discharged to Lake Ontario. A total sedimentation tank volume of approximately 8,300 m^3 was established for capture of a 50mm event, with the first tank to be located within Sherbourne Park, and the second tank to be located within and at the top end of Parliament Slip.

1.2 Need for the EA Addendum

Efforts to implement the stormwater management recommendations of the Class EA Master Plan revealed several challenges, including:

- The sizing of tanks considered normal operating conditions only. Detailed sizing as part of implementation investigations revealed the need for additional space to accommodate accumulated sediment and access by maintenance personnel.
- Substantial excavation would be required for installation of the tanks. Unfavourable soil and water table conditions presented substantial excavation challenges.
- The soil and water table conditions do not provide suitable structural support for the tanks, and hence extensive structural support systems would be required as part of the construction.
- The recommended facility configuration would require filtration and UV treatment of peak flows, yielding high operations and maintenance effort.
- The system would rely on the capacity of constrained sanitary services to accept accumulated sediment from within the tanks.
- The system would partially rely on the existing storm sewer network, which is lacking in capacity, aged, and presently connected to existing combined sewer overflows (CSO's).
- Relatively clean, but untreated, rooftop runoff would be conveyed via surface features that are accessible by the public. Furthermore, the prevailing flat topography constrains recommended surface conveyance patterns. In addition, the urban environment of the development provided challenges to the conveyance of water along the surface.

While the approach recommended by the Class EA Master Plan was expected to satisfy water quality objectives of the discharge water, the implementation challenges described above provided the impetus to explore alternative strategies that would also satisfy these objectives, potentially offer additional benefits to the proposed community, and better achieve the principles of Waterfront Toronto's Sustainability Framework. This EA addendum documents the process that was undertaken to examine these alternative strategies. As a result of this process, a new stormwater management system is recommended.

The proposed change to the stormwater management system (see **Section 4** – Description of the Undertaking), while meeting the objectives of the Class EA Master Plan, were not identified nor proposed in the original Class EA Master Plan. Furthermore, the proposed changes will take the associated infrastructure outside of a public road allowance and result in new environmental effects which were not assessed in the Class EA Master Plan. As such, the preparation of a Class EA addendum is warranted.

1.3 Process to Amend the Master Plan

The 2006 Master Plan Report, in Section 11.0, outlines the process to amend the Master Plan. The process was followed and involved the following:

- WT and the City of Toronto will review the planning and design process to ensure that the project and the mitigation measures are still valid given the current planning context;
- Documentation of the circumstances necessitating the change, the environmental implications of the change, and the mitigation measures that can be implemented to minimize negative environmental effects;
- Notification to interested stakeholders and agencies of the amendments;
- Public issuing of a Revised Notice of Completion and providing a 30-day review period and the opportunity to request a Part II order (elevation request) under the EA Act.

This addendum documents:

- The baseline environmental conditions in the study area;
- An assessment and evaluation of alternatives;
- A description of the proposed undertaking;
- A description of potential project effects and mitigation measures that will be implemented to minimize or reduce these effects; and
- The advantages and disadvantages of the undertaking.

The recommended undertaking for stormwater collection and management that has been identified through this addendum process is considered to be a Schedule C project under the MEA Class EA as it involves a new stormwater detention facility where biological treatment is included and involves outfall to a receiving water body. This project has therefore been planned in accordance with the requirements for Schedule C projects, as described in the *Municipal Engineers Association's Municipal Class Environmental Assessment document (June 2000)*.

2 Description of Environment

2.1 Project Location

The East Bayfront Stormwater Management System is located along the Inner Harbour dockwall line South of Queens Quay, East of Jarvis Slip, West of Parliament Slip – including Head of Slip at Parliament Slip as shown in **Exhibit 2-1**.

2.2 Description of Biophysical Environment

The East Bayfront Precinct has been extensively developed for commercial and industrial uses. It is considered a brownfield site with large areas of underused, disturbed lands. There are no features of natural environmental significance (East Bayfront Class EA Master Plan, 2006). The following sections describe the existing biophysical habitat on the lands and in the adjacent portions of the Inner Harbour.

2.2.1 Aquatic Habitat and Fish Community

An assessment of the existing aquatic habitat conditions for East Bayfront was undertaken in the Class EA Master Plan, completed by Toronto Waterfront Revitalization Corporation (now known as Waterfront Toronto) in January 2006. This report notes that there is limited diversity of aquatic habitat along the East Bayfront Precinct as a result of urbanization and shoreline alteration. Additionally, high sediment loads which flow westerly from the Don River and the Keating Channel have a direct effect on water clarity and habitat quality in the East Bayfront area. High sediment loads, hard-edge dockwalls, and the lack of shallow or littoral zones to support aquatic vegetation and provide quality habitat/spawning areas are considered as the limiting factors to the health and diversity of the aquatic environment in this area (East Bayfront Class EA, 2006).

The Toronto and Region Conservation Authority (TRCA) staff completed an Environmental Monitoring program for the East Bayfront Precinct in 2007 and 2008. This assessment which included water chemistry, fisheries analysis and sediment sampling further substantiated the results described in the Class EA Master Plan. **Exhibit 2-2** shows area bathymetry and **Exhibit 2-3** shows locations of fish sampling conducted by the TRCA.

Fish Species found within the Jarvis Street Slip, Parliament Street Slip and along the East Bayfront breakwall between Jarvis and Parliament Slips (as indicated in **Exhibit 2-3**) include the following:

- At the Jarvis Street Slip – Alewife, Emerald Shiner, Rainbow Smelt, Rock Bass and Round Gobby
- Breakwall between Jarvis and Parliament Slips – No Catch
- At the Parliament Street Slip – Alewife, Chinook Salmon, Northern Pike, Rainbow Smelt, Spottail Shiner, Round Gobby, White Bass, White Sucker, Emerald Shiner and Brown Trout

2.2.2 Vegetation, Wildlife and Birds

Although there are nodes of good quality habitat for wildlife scattered throughout the Toronto Harbour, most of these habitats are concentrated along the north shore of the outer harbour, on Toronto Island and Tommy Thompson Park.

Continuous habitat linkages or isolated habitats for terrestrial movement are absent from the project site due to its built up nature. The East Bayfront Precinct area is comprised mainly of warehouse facilities and vacant lots consisting of concrete debris with sparse vegetation. There are no species at risk present at the site, as defined under the Species at Risk Act.

The project site is located within an important migratory zone, which encompasses both the Atlantic and the Mississippi flyways. Toronto Island, the Lower Don River and Tommy

Thompson Park provide habitat for local and migrating wildlife species. Over 290 species of birds have been observed (East Bayfront Class EA, 2006) in the Toronto Port area and the harbour supports a robust winter waterfowl population. Migratory birds observed by the TRCA include bufflehead, long-tailed duck, ring-billed gull and Canada goose.

Wildlife observations made during the preparation of the Class EA Master Plan consisted of species commonly spotted in urban landscapes and migratory species likely use the areas as stopover habitat. Species observed included common grackle, European Starling, rock dove, house sparrow and American robin. The aquatic habitat located within the harbour adjacent to East Bayfront provide a suitable habitat all year round for generalist urban species such as Canada goose and the ring-billed gull.

2.2.3 Air and Water Quality

Background air quality levels in the study area are influenced by local and long-range (cross border) contaminants. Currently, the dominant local source of air pollution in the Central Waterfront is vehicle traffic on the Gardiner Expressway and Lakeshore Boulevard, which cause elevated levels of carbon monoxide and total suspended particulates. Other contributors to air pollution include marine activity such as the Island ferries and various recreation and commercial vessels. There is currently no site-specific air quality data available for the East Bayfront.

The water quality in the Inner Harbour is generally poor. The Toronto Remedial Action Plan Stage 1 Report indicates that there have been exceedances of Provincial Water Quality Objectives for nutrients and fecal coliform bacteria along the entire Toronto Waterfront. Within the harbour, heavy metal and organic exceedances are particularly common. The water quality is negatively impacted by the highly contaminated waters from the combined loadings of the Don River and the numerous storms and combined sewer outfalls.

2.3 Description of Socio-Economic and Cultural Environment

2.3.1 Economic Activity

The economic activity in East Bayfront is currently in transition as part of the East Bayfront Precinct revitalization. It will transform from a range of commercial uses including auto dealerships, recreational sport tents, distribution centres and a film studio to a mixed use residential, commercial, educational, and office activities. The corner of Lower Jarvis and Queens Quay has a concentration of nightclubs and lounges. Businesses located in the study area either have been relocated or will be relocated prior to development of the East Bayfront.

To the east of study area, between Parliament and Cherry Streets the lands are vacant or under-utilized. To the west, on 95 Queens Quay East, is located the Redpath Sugar Refinery. The Refinery also contains a Sugar Museum, established in 1979. There is a large format Loblaws grocery store located along the north side of the Queens Quay to the west of the precinct. Further west are the LCBO offices, warehousing and retail store, the Toronto Star headquarter office building and a mix of residential, hotel, office, commercial and parking related activities.

2.3.2 Land Use

East Bayfront Precinct has a mixture of residential, commercial, community and open space land uses. The East Bayfront Zoning By-law (By-law 1049-2006) was enacted by Toronto Council on September 27th 2006. The By-law changed the land use permissions from industrial designation to permit RC (mixed commercial and residential) uses, as well as district energy and vacuum waste facilities. In addition, the By-law also designated areas as G and Gm, which allow for park and marine-related uses.

2.3.3 Cultural Environment

A review of historic maps of the Toronto waterfront indicates that the original shoreline is located several hundred metres north of the project site. As such, the project site was developed on material used to infill this portion of Lake Ontario.

Much of the present land area of Toronto's Central Waterfront is the result of human construction, including lakefill operations linked to industrial development and transportation. Between the 1830s and the 1930s the shoreline changed dramatically, and subsequent development has further altered the form and character of the landscape. As a result, many of the area's heritage resources—particularly those of an archaeological nature—lie buried in fill or encased in concrete (Archaeological Services Inc. 2003).

There is a built heritage resource adjacent to the East Bayfront Precinct, the Redpath Sugar Refinery. The refinery located at 95 Queens Quay East is identified as a significant heritage property for architectural and historical reasons. The refinery contains the Redpath Sugar Museum, established in 1979, which is used to display the history of the sugar industry and as an educational source for schools and the public.

2.3.4 Land Claims by Aboriginal Persons

The Mississaugas of the New Credit currently reside on the New Credit reserve 35 km southwest of Hamilton, Ontario. Their ancestors lived on the shores of Lake Ontario, at the mouth of the Credit River before the settlement of Toronto. The First Nations are in preliminary discussions with government for claims on the Toronto Islands and other matters related to the Toronto Purchase. The specific claim is likely to be outside the project sites. Given the urban nature of the project sites, there is unlikely to be current use of the sites for traditional purposes.

2.3.5 Recreational Boating, Commercial Vessels and Navigation

There are multiple companies that operate charter and tour boats in the Toronto Harbour with an approximate capacity of 8,000 passengers. These operations are primarily located along the dockwall and marine slips of the Central Waterfront, from Bathurst Quay to Parliament Street Slip. There is an Island Ferry, operated by the Royal Canadian Yacht Club (RCYC) at the Parliament Street Slip, which carries approximately 200,000 passengers across the harbour every year. The RCYC have signed a lease with the Toronto Port Authority and TEDCO providing for the relocation of the Island Ferry launch with the redevelopment of the Parliament Street Slip. Yankee Lady Yacht Charters of Toronto operates two yacht charters from the East Bayfront Terminal 29. Their main offices are located in 261 Queens Quay East. Each boat has capacity for up to 300 passengers.

In addition, Red Path Refinery uses the Jarvis Slip for mooring of large commercial vessels.

Issues related to recreational boating, commercial vessels and navigation as they relate to the proposed modification to the stormwater management system have been addressed in the East Bayfront CEAA screening.

Exhibit 2-1: Water's Edge Promenade and Stormwater Management System

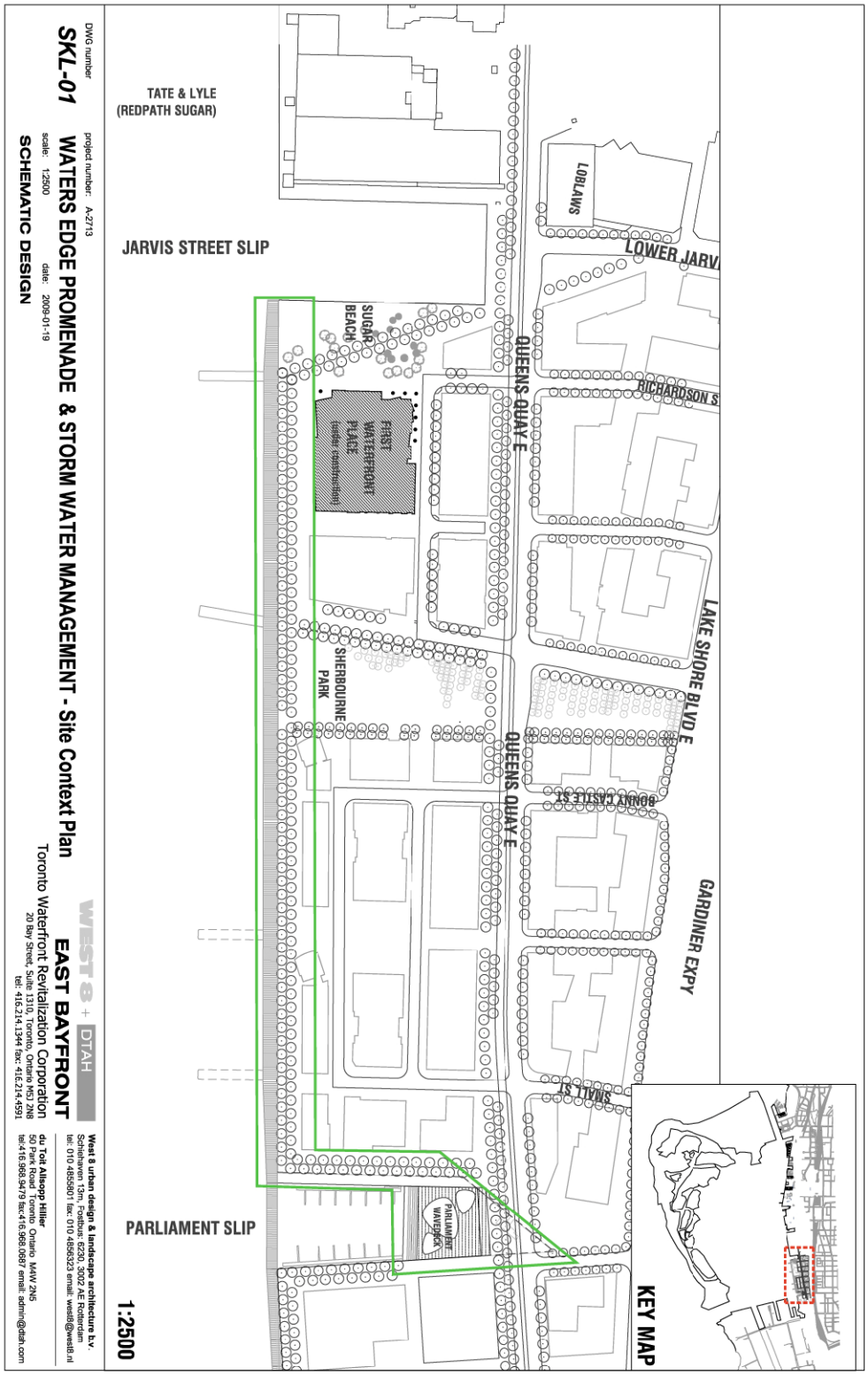


Exhibit 2-2: Central Waterfront Bathymetry

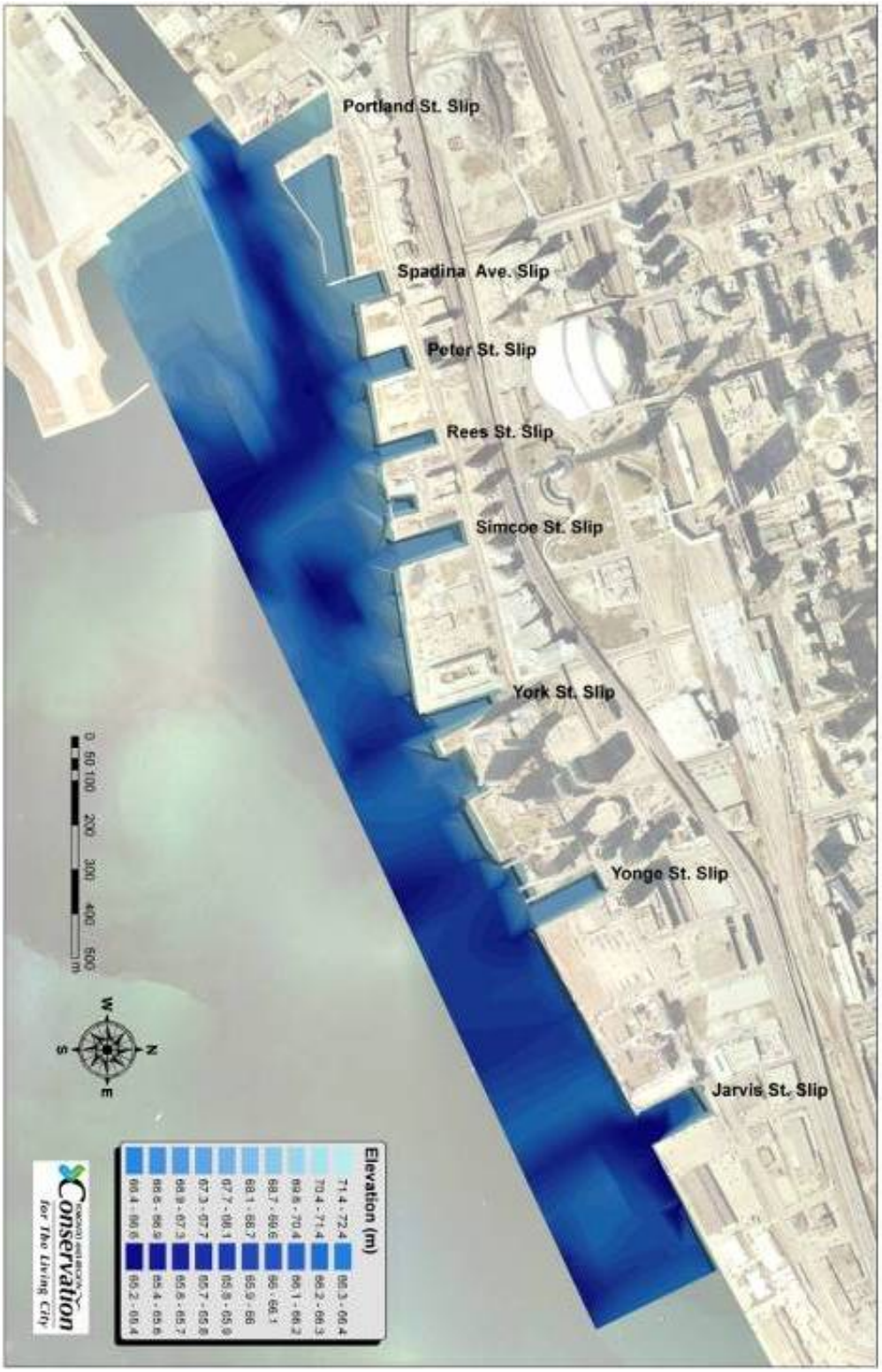
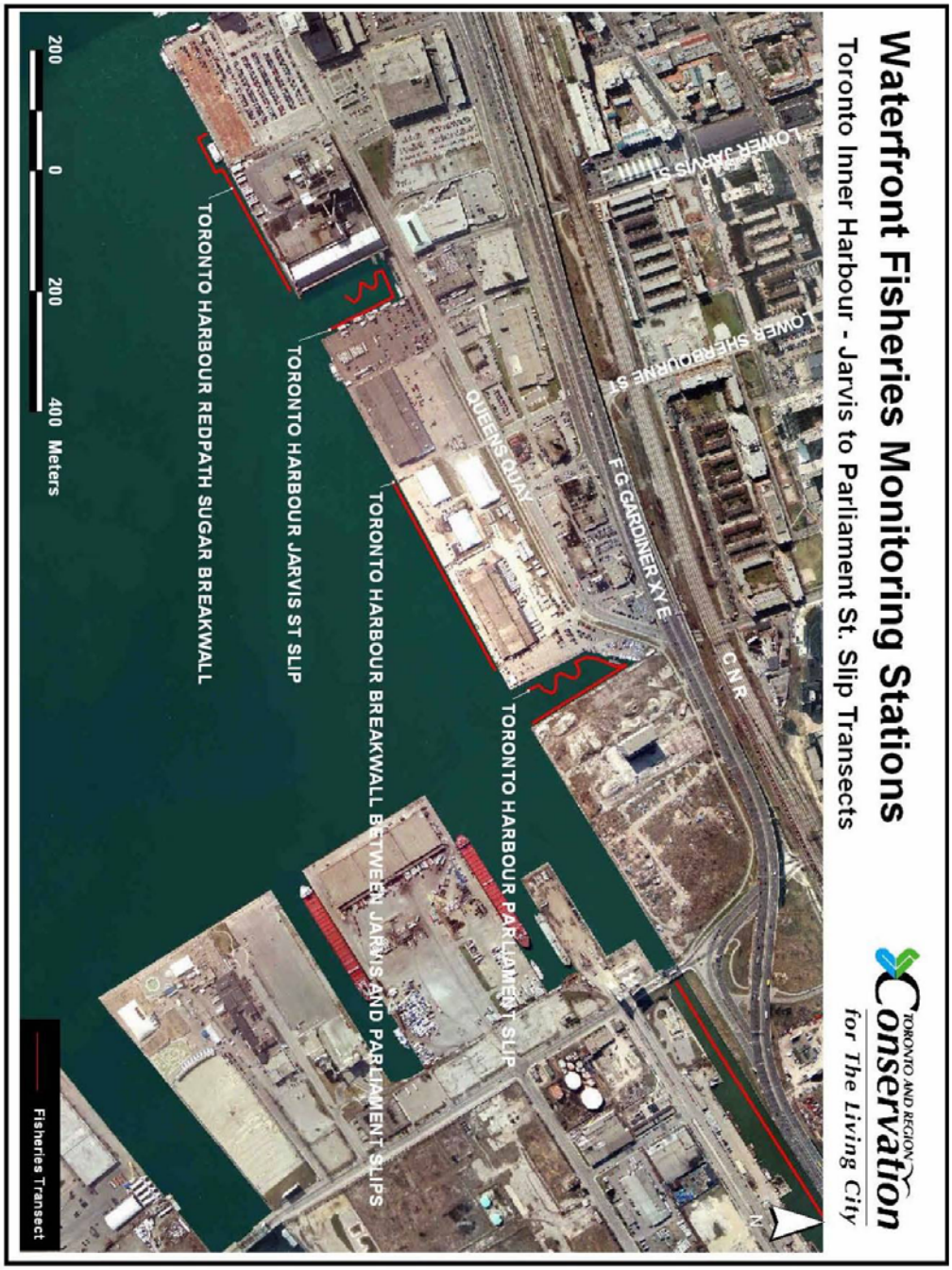


Exhibit 2-3: Waterfront Fisheries Monitoring Stations



3 Identification and Evaluation of Alternatives

The original Class EA Master Plan identified and assessed both 'alternative stormwater management systems' and 'alternative end-of-pipe designs', as described in **Section 1**. No change to the preferred stormwater management philosophy is proposed, which includes a combination of source control measures, conveyance systems and end-of-pipe controls. The proposed change relates to the previously recommended methods of conveyance and end-of-pipe designs that were described in the Master Plan. This chapter describes the new alternative designs that were developed and evaluated as part of this Class EA addendum process.

3.1 Project Alternatives

Four alternative designs were developed for assessment and evaluation. Also described is the previously recommended design that was developed through the Class EA Master Plan. As such, a total of five (5) design alternatives were considered in this addendum process.

3.1.1 Option A

Exhibit 3-1 illustrates the Option A configuration. This concept considers integration of the facility with the proposed boardwalk component of the lakefront promenade that will extend over the water. The facility would be positioned underneath the boardwalk along the length of the East Bayfront dock wall. In order to satisfy the volumetric requirement, the boardwalk would need to be widened from the currently envisioned 8 metres, which was established as part of the public realm design for the central waterfront, to 13 metres. Coordination with the storm servicing plan requires that the pond inlet be located centrally rather than at the end of the facility, to be achieved through the installation of a baffle wall that splits the forebay of the facility lengthwise and extends the flow path. A pipe and pump are required for connectivity with the UV disinfection facility.

Exhibit 3-1: Option A

The containment structure along the boardwalk would consist of caissons and sheet piling around the outside, with a rehabilitated dockwall forming the inner face. The existing dockwall requires substantial repair and rehabilitation; however, where the proposed containment structure abuts the dockwall, such extensive rehabilitation would not be required. From a structural perspective, the outer wall of the containment structure could also double as the support for the proposed boardwalk adjacent to the promenade.

This option conceals the facility from public realm lands, thus addressing possible aesthetic concerns. However, this negates the possibility of utilizing natural UV disinfection through exposure to sunlight.

The minimum recommended length-to-width ratio is greatly exceeded, which suggests that this configuration would be very effective in the settling of suspended particles. The preliminary estimated cost of constructing the Option A concept is $42 million.

3.1.2 Option B

This concept separates the end-of-pipe treatment into two distinct components: a "forebay" consisting of a single cell integrated with the proposed boardwalk (similar to Option A), and an off-shore cell that provides the secondary treatment and forms part of an in-lake aesthetic feature (see **Exhibit 3-2**). Semi-treated stormwater from the first cell would be conveyed to the second cell by a pipe within the lake. A second pipe and pump is needed to convey treated stormwater from the off-shore cell to the on-shore UV disinfection facility.

The distance between the first and second cells has not been established. Further investigation would be required to establish the location and configuration of the off-shore cell to avoid impact to existing navigational routes within the harbour.

Exhibit 3-2: Option B

The structure of the forebay section would be similar to that of Option A, i.e. a containment structure along the boardwalk consisting of caissons and sheet piling around the outside, with a rehabilitated dockwall forming the inner face. As with Option A, where the proposed containment structure abuts the dockwall, extensive rehabilitation of the dockwall would not be required. Similarly, the outer wall of the containment structure can also double as the support for the proposed boardwalk adjacent to the promenade. Where no containment structure is present, dockwall rehabilitation and boardwalk support would be required.

Although the first cell is concealed by the boardwalk, the second cell would be visible and become a significant feature of the waterfront. Through its exposure, the benefit of natural UV disinfection would also be realized. The siting of the second cell also yields a potential opportunity to treat lake water between storm events, which could contribute to an improvement of aquatic habitat quality in the harbour.

With respect to technical considerations, the conveyance of flow to and from the off-shore cell presents some construction and maintenance challenges. The preliminary estimated cost of constructing the Option B configuration is $52 Million.

3.1.3 Option C

The Option C concept, shown in **Exhibit 3-3**, includes a tri-celled rectangular facility approximately 300 metres long and 28.5 metres wide, positioned along the eastern half of the East Bayfront dock wall. Flows would enter the facility at the westernmost cell, with subsequent cells further clarifying runoff prior to discharge via an outlet pipe at the facility's east limit to the UV treatment system.

The construction of the containment structure is expected to be similar to that described for Options A and B, and hence the section of the facility abutting the dockwall may negate the need for extensive dockwall repairs and boardwalk structural support.

This configuration avoids the existing CSO outlets, and may integrate in part with the proposed boardwalk.. As the facility is largely exposed, it provides the opportunity for natural UV disinfection. The first cell of the facility could be covered with decking to address aesthetic concerns. A pipe and pump are required for connectivity with the UV disinfection facility. The preliminary estimated cost of constructing the Option C configuration is $49 Million.

Exhibit 3-3: Option C

3.1.4 Option D

Option D represents the tank option described and recommended through the Class EA Master Plan, with the sizing re-evaluated to reflect the findings and objectives outlined in the Functional Servicing Plan (**Exhibit 3-4**). The tank option requires a storage volume of approximately 12,000 m^3, to be provided by a containment structure or series of structures having total dimensions of 40m wide by 150m long, and 3.5m deep. Structural support for the tanks would be provided by either piles or a concrete slab.

Storm runoff would be conveyed to the tank(s) for storage in an effort to settle out sediments. The tanks would then discharge to the UV facility once the attenuated volume was of sufficient clarity.

A full rehabilitation of the dockwall and provision of a support structure for the boardwalk would be necessary along the entire length of the East Bayfront lands. The estimated cost of this option is $60 Million which includes anticipated costs for excavation and the management of potentially contaminated soils.

Exhibit 3-4: Option D

3.1.5 Option E

Option E, illustrated in **Exhibit 3-5**, is a variation of Option A that proposes a narrower (9.5m) concrete containment structure along the length of, and integrated with, the boardwalk, extending into a wetland feature at the head of Parliament Slip. To provide for natural UV disinfection through exposure to sunlight, the wetland incorporates an open element that would result in the stormwater treatment system being publically visible. From the wetland, clarified stormwater will be conveyed to the UV disinfection facility proposed within Sherbourne Park.

Along the water's edge, and varying from Option A, the containment structure would be comprised of a series of concrete cells, which together form a long linear settling tank. These cells also provide the structural support for the proposed boardwalk, and negate the need for the previously noted dockwall repairs. The overall facility provides the required footprint of 0.85 ha, and accommodates the active fluctuation depth of 0.5 metres. To avoid the existing CSOs, these will be by-passed through incorporation of piped segments that connect the facility's upstream and downstream concrete cells.

Storm runoff would enter the facility at two locations, roughly east and west of Sherbourne Park. As in Option A, a mid-span baffle wall will be introduced to direct flows first west and then east to maximize the flow length over which sediments and suspended solids will have an opportunity to settle. The estimated cost of this option is $42 Million.

Exhibit 3-5: Option E

3.2 Assessment and Evaluation of Alternatives

3.2.1 Evaluation Criteria

The evaluation of the alternatives was based on the following criteria groups which were built upon the criteria used to evaluate alternatives in the original Master Plan process. The criteria groups were considered of equal importance in the evaluation of the alternatives.

Technical – this category considered the constructability, feasibility, approvability, extensibility, and effectiveness of the proposed design in achieving criteria, along with the extent of future maintenance requirements.

Natural Environment – this category considered the potential impact of the facility design on the natural environment.

Socio-Economic Environment – this category considered the potential for the design to disturb or conflict with existing and anticipated economic and social activities, both during construction and over the life of the design.

Cultural Environment – this category considered effects of the design on existing and anticipated cultural and heritage resources, as well as the potential for aspects of the design to enhance the community as a cultural amenity.

Design Excellence – this category considered the sustainability, aesthetic, and 'landmark-potential' aspects of the design, along with the harmony with which the design would integrate into the surrounding community.

Cost – preliminary cost estimates of each design alternative were prepared for comparison purposes.

For each of these criteria groups, several criteria were developed which formed the basis of the effects assessment work.

3.2.2 Effects Assessment

On the basis of each criterion the potential effects of each alternative were assessed and described. Then for each criteria group, a relative preference ranking of the alternatives was made. The results of the effects assessment are presented in tabular format in **Table 3-1**.

Table 3-1: Alternatives Effects Assessment Summary

Category of Consideration / Evaluation Criteria	Option A (13m integrated boardwalk facility)	Option B (integrated boardwalk facility forebay + offshore facility)	Option C (tri-celled rectangular tank adjacent portion of dockwall)	Option D (underground storage tanks, Class EA Master Plan Recommended Option)	Option E (9.5m integrated boardwalk facility + parliament wetland)
TECHNICAL					
Constructability of proposed infrastructure	Require mid-span baffle wall Structural integrity of boardwalk facility In-water works Extension or bypass of CSO outlet pipes -------- **moderately difficult**	Structural integrity of boardwalk and off-shore elements Extension or bypass of CSO outlet pipes Challenge to connect boardwalk and off-shore elements Challenging in-water works, especially off-shore component -------- **very difficult**	Structural integrity of boardwalk facility In-water works -------- **difficult**	Extensive excavation work and potentially challenging material disposal Structural support for tanks Structural implications to all surrounding infrastructure Dewatering next to lake required and very difficult -------- **very difficult**	Require mid-span baffle wall Structural integrity of boardwalk facility In-water works Extension or bypass of CSO outlet pipes Challenges with wetland construction -------- **moderately difficult**
Overall effectiveness of solids removal	Satisfies established criteria Utilizes full lake depth -------- **effective**	Satisfies established criteria Utilizes full lake depth -------- **effective**	Satisfies established criteria Utilizes full lake depth -------- **effective**	Satisfies established criteria -------- **less effective**	Satisfies established criteria Utilizes full lake depth -------- **effective**
Overall effectiveness of pathogen reduction	Yes, with UV facility No 'natural' UV disinfection (covered system) -------- **effective**	Combination of UV facility and exposure to sunlight -------- **more effective**	Combination of UV facility and exposure to sunlight If open-water area includes wetland elements, more effective for treatment (phyto-remediation) -------- **more effective**	Yes, with UV facility No 'natural' UV disinfection (closed system) Pathogen reduction dependent on effective solids removal -------- **least effective**	Combination of UV facility and exposure to sunlight Wetland component typically more effective for treatment (phyto-remediation) -------- **most effective**

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Category of Consideration / Evaluation Criteria	Option A (13m integrated boardwalk facility)	Option B (integrated boardwalk facility forebay + offshore facility)	Option C (tri-celled rectangular tank adjacent portion of dockwall)	Option D (underground storage tanks, Class EA Master Plan Recommended Option)	Option E (9.5m integrated boardwalk facility + parliament wetland)
Frequency and complexity of future maintenance	Known UV and associated pump maintenance Clearing of accumulated sediment in boardwalk tank – accessible from land --- **low frequency** **moderately complex**	Known UV and associated pump maintenance Clearing of accumulated sediment in boardwalk tank – accessible from land Additional maintenance for pump between cells Dredging / clearing of accumulated sediment in off shore facility – requires training / education / equipment --- **low frequency** **most complex**	Known UV and associated pump maintenance Clearing of accumulated sediment in facility – accessible from land --- **low frequency** **complex**	Known UV and associated pump maintenance Clearing of accumulated sediment in tanks – accessible from land Increased frequency and park disturbance --- **high frequency** **moderately complex**	Known UV and associated pump maintenance Dredging / clearing of accumulated sediment in boardwalk tank and wetland – accessible from land --- **low frequency** **moderately complex**
Potential conflicts with existing municipal and utility services	Conflict with existing CSO outlet pipes --- **moderate conflict potential**	Potential conflict with existing CSO outlet pipes --- **low conflict potential**	Potential conflict with existing CSO outlet pipes --- **low conflict potential**	Requires coordination with other municipal and utility services --- **high conflict potential**	Conflict with existing CSO outlet pipes --- **moderate conflict potential**
Potential effects on infrastructure security and accident potential	Exposure to shipping traffic --- **moderate potential**	Exposure of boardwalk and offshore component to shipping traffic --- **very high potential**	Exposure to shipping traffic and public --- **high potential**	Exposure to public --- **low potential**	Exposure of boardwalk component to shipping traffic Public access to wetland --- **moderate potential**

Table 3-1: Alternatives Effects Assessment Summary

Category of Consideration / Evaluation Criteria	**Option A** **(13m integrated boardwalk facility)**	**Option B** **(integrated boardwalk facility forebay + offshore facility)**	**Option C** **(tri-celled rectangular tank adjacent portion of dockwall)**	**Option D** **(underground storage tanks, Class EA Master Plan Recommended Option)**	**Option E** **(9.5m integrated boardwalk facility + parliament wetland)**
Potential effects on overall efficiency of the stormwater management system	Relatively simplistic Lake depth permanent pool improves water quality treatment Long linear flow path increases solids removal efficiency No open-water component -------- **more efficient**	Increased length of pipe conveyance and pumping between boardwalk and off shore element Lake depth permanent pool improves water quality treatment Open-water component potentially increases long term efficiency -------- **moderately efficient**	Relatively simplistic Open-water component potentially increases long term efficiency Lake depth permanent pool improves water quality treatment -------- **more efficient**	No open-water component Minimum required permanent pool -------- **least efficient**	Relatively simplistic Lake depth permanent pool improves water quality treatment Open-water component potentially yields increased long term efficiency Long linear flow path increases solids removal efficiency -------- **most efficient**
Flexibility for future expansion of system to service other areas	Potential expansion of tanks possible but would require reconstruction and alteration of design concept Potential connectivity to similar systems -------- **flexible**	Potential expansion of tanks possible but would require reconstruction and alteration of design concept Potential expansion of off-shore element given modular design and continued compliance with design parameters (e.g. shipping constraints) -------- **more flexible**	Potential expansion of tanks possible but would require reconstruction and alteration of design concept -------- **more flexible**	No opportunity to expand tanks without extensive reconstruction -------- **least flexible**	Potential expansion of tanks possible but would require reconstruction and alteration of design concept Potential expansion or extension of wetland Potential connectivity to similar systems, especially to wetland from the east -------- **most flexible**

Table 3-1: Alternatives Effects Assessment Summary

Category of Consideration / Evaluation Criteria	**Option A** **(13m integrated boardwalk facility)**	**Option B** **(integrated boardwalk facility forebay + offshore facility)**	**Option C** **(tri-celled rectangular tank adjacent portion of dockwall)**	**Option D** **(underground storage tanks, Class EA Master Plan Recommended Option)**	**Option E** **(9.5m integrated boardwalk facility + parliament wetland)**
Acceptability of design and treatment methodology by review agencies	Conforms to City preference for covered elements Does not satisfy AHT preference for open-water elements -------- **acceptable**	Conforms to City preference for covered elements Conforms to AHT preference for open-water elements Potential navigable waters concerns Maintenance access concerns -------- **less acceptable**	Can conform to City preference for covered elements Conforms with AHT preference for open-water elements Potential navigable waters concerns Maintenance access concerns -------- **less acceptable**	Conforms to City preference for covered elements Does not satisfy AHT preference for open-water elements City has indicated reluctance to accept in-land tanks – strong opposition anticipated for infrastructure within parks -------- **least acceptable**	Conforms to City preference for covered elements Conforms with AHT preference for open-water elements -------- **most acceptable**
Construction risks	Challenges associated with near shore in-water works Phasing challenges for boardwalk -------- **moderate risk**	Challenges associated with near shore in-water works. Significant challenges with off-shore works -------- **very high risk**	Challenges associated with near shore in-water works -------- **moderate risk**	Challenges associated with in-ground works and ongoing coordination with construction of adjacent infrastructure -------- **high risk**	Challenges associated with near shore in-water works Phasing challenges for boardwalk -------- **moderate risk**
Timelines of approvals and construction	-------- **moderate timeline**	Potentially lengthy approval and construction processes for off shore elements -------- **long timeline**	-------- **moderate timeline**	Challenges associated with coordination of tank placement with other infrastructure could lengthen process -------- **long timeline**	-------- **moderate timeline**

Table 3-1: Alternatives Effects Assessment Summary

Category of Consideration / Evaluation Criteria	Option A (13m integrated boardwalk facility)	Option B (integrated boardwalk facility forebay + offshore facility)	Option C (tri-celled rectangular tank adjacent portion of dockwall)	Option D (underground storage tanks, Class EA Master Plan Recommended Option)	Option E (9.5m integrated boardwalk facility + parliament wetland)
SUMMARY: TECHNICAL	**3rd** -------- Although similar to Option E, the lack of an open water element and the extension of the facility further into the lake challenge both desired performance and approvability.	**4th** -------- The most significant challenges associated with this option, from a technical perspective, are the constructability and approvability of the in-lake component. While the combination of open-water and closed cell elements suggests a highly effective treatment process, the distance to the open-water component yields inefficiencies and complex maintenance requirements.	**2nd** -------- In relative terms, this option may be the simplest to construct, operate, and maintain. Technically, the utilization of lake depth and exposure to sunlight yield optimum levels of expected effectiveness. However, the placement of the facility into the harbour presents potential challenges with existing shipping routes. .	**5th** -------- This option is least desirable from a technical perspective. The tank has significantly reduced effectiveness due to its limited volume as compared to the options that utilize the full depth of the lake, and will thus require more frequent and disruptive maintenance. Furthermore, the prevailing soil and groundwater conditions yield a challenging construction process.	**1st** -------- This is the preferred alternative with respect to technical considerations. It incorporates both covered and vegetated open-water elements, and utilizes lake depth to yield more effective runoff treatment and satisfy agency expectations. It also maintains proximity and accessibility for construction, maintenance, and potential future expansion, thus further easing the approval process and timelines. In relative terms, construction effort is anticipated to be average.
NATURAL ENVIRONMENT					
Potential effects on fish habitat	Occupies portion of lake bed. Compensation for facility footprint required -------- **impact on fish habitat** **opportunity to mitigate impacts**	Occupies portion of lake bed. Compensation for facility footprint required Opportunity to augment indirect fish habitat via vegetated open water elements -------- **impact on fish habitat** **opportunity to mitigate impacts**	Occupies portion of lake bed. Compensation for facility footprint required Opportunity to augment indirect fish habitat via vegetated open water elements -------- **impact on fish habitat** **opportunity to mitigate impacts**	No impact on fish habitat -------- **no impact**	Occupies portion of lake bed. Compensation for facility footprint required Opportunity to augment indirect fish habitat via vegetated open water elements -------- **impact on fish habitat** **opportunity to mitigate impacts**

Table 3-1: Alternatives Effects Assessment Summary

Category of Consideration / Evaluation Criteria	Option A (13m integrated boardwalk facility)	Option B (integrated boardwalk facility forebay + offshore facility)	Option C (tri-celled rectangular tank adjacent portion of dockwall)	Option D (underground storage tanks, Class EA Master Plan Recommended Option)	Option E (9.5m integrated boardwalk facility + parliament wetland)
Potential effects on terrestrial habitat	n/a	n/a	n/a	n/a	n/a
Potential effects on known habitat for Species of Concern	n/a	n/a	n/a	n/a	n/a
Potential groundwater effects	Groundwater movement anticipated to be no different from existing dock wall -------- **least groundwater effect**	Groundwater movement anticipated to be no different from existing dock wall -------- **least groundwater effect**	Groundwater movement anticipated to be no different from existing dock wall -------- **least groundwater effect**	Extensive dewatering required for tank installation -------- **potential groundwater impacts associated with tank installation** **most groundwater effect**	Groundwater movement anticipated to be no different from existing dock wall -------- **least groundwater effect**
Overall improvement to Effluent Quality as contribution to natural environment	Achieves over 80%TSS removal and pathogen treatment Effectiveness augmented by utilization of full lake depth throughout facility -------- **most improvement**	Achieves over 80% TSS removal and pathogen treatment Effectiveness augmented by utilization of full lake depth throughout facility Vegetated open water element provides potential to reduce contaminants via phyto-remediation -------- **most improvement**	Achieves over 80% TSS removal and pathogen treatment Effectiveness augmented by utilization of full lake depth throughout facility Vegetated open water element provides potential to reduce contaminants via phyto-remediation -------- **most improvement**	Limited volume available within tanks for treatment -------- **least improvement**	Achieves over 80% TSS removal and pathogen treatment Effectiveness augmented by utilization of full lake depth throughout facility Vegetated open water element provides potential to reduce contaminants via phyto-remediation -------- **most improvement**
Potential effects from soil contamination	No interaction between facility and existing on-shore soils Some in-lake dredging required -------- **least effect**	No interaction between facility and existing on-shore soils Some in-lake dredging required -------- **least effect**	No interaction between facility and existing on-shore soils Some in-lake dredging required -------- **least effect**	Removal and disposal of potentially contaminated soils for park component -------- **most effect**	No interaction between facility and existing on-shore soils Some in-lake dredging required -------- **least effect**

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Category of Consideration / Evaluation Criteria	Option A (13m integrated boardwalk facility)	Option B (integrated boardwalk facility forebay + offshore facility)	Option C (tri-celled rectangular tank adjacent portion of dockwall)	Option D (underground storage tanks, Class EA Master Plan Recommended Option)	Option E (9.5m integrated boardwalk facility + parliament wetland)
SUMMARY: NATURAL ENVIRONMENT	**4th** -------- Alternatives A, B, C and E will all result in the removal of lakebed area and result in effects to fish and fish habitat. Aquatic habitat along shoreline area is poor. Proposed fish habitat compensation efforts would result in a net improvement of fish habitat. This alternative is less preferred than Alternatives B, C and E as the enclosed configuration limits the potential for indirect contribution to fish habitat.	**1st** -------- Options B, C, and E are all preferred with respect to the natural environment. Alternatives A, B, C and E will all result in the removal of lakebed are and effect fish and fish habitat. Aquatic habitat along shoreline area is poor. Proposed fish habitat compensation efforts would result in a net improvement of habitat. Alternatives B, C and E are preferred over Alternative A as the open configuration of the wet cells will indirectly contribute to fish habitat.	**1st** -------- See description under Option B	**5th** -------- This option is least desirable from a natural environment perspective. While the configuration does not impact fish habitat, placement of tanks underground necessitates dewatering as well as the removal and disposal of a substantial volume of contaminated material.	**1st** -------- See description under Option B
SOCIO-ECONOMIC ENVIRONMENT					
Potential for disturbing existing or future residences, businesses, community, institutional, and/or on- shore recreational facilities	-------- **least potential**	-------- **least potential**	-------- **least potential**	Tank installation will require disruption within future park, and long term periodic disturbance to future park users for operations and maintenance activity -------- **most potential**	-------- **least potential**

Table 3-1: Alternatives Effects Assessment Summary

Category of Consideration / Evaluation Criteria	Option A (13m integrated boardwalk facility)	Option B (integrated boardwalk facility forebay + offshore facility)	Option C (tri-celled rectangular tank adjacent portion of dockwall)	Option D (underground storage tanks, Class EA Master Plan Recommended Option)	Option E (9.5m integrated boardwalk facility + parliament wetland)
Potential for conflict with existing or future harbour activities; e.g., shipping, off-shore recreation	Interruption of marine uses during construction Potential long term marine implications of 13m boardwalk Not anticipated to be a significant conflict -------- **low potential conflict**	Interruption of marine uses during construction Off-shore component potentially significant conflict with harbour uses -------- **highest potential conflict**	Interruption of marine uses during construction Potential implications of 30m intrusion into harbour -------- **moderate potential conflict**	No anticipated conflicts -------- **least potential conflict**	Interruption of marine uses during construction Reduction in available area of Parliament Slip for harbour activities -------- **moderate potential conflict**
Potential for requiring private property	n/a	n/a	n/a	n/a	n/a
Enhancement to community amenity	Integrates fully with boardwalk -------- **no impact**	Arguable enhancement with off-shore component -------- **potential enhancement**	Arguable enhancement with extruding cell into lake -------- **potential enhancement**	Frequent disturbance to community for maintenance -------- **least**	Integrates and complements boardwalk and wavedeck elements -------- **greatest enhancement**
Potential impact on future parks	Minimal impact during infrequent maintenance Increased recreational space with wider boardwalk -------- **no impact**	Minimal impact during infrequent maintenance Potential increased recreational space with off-shore element -------- **no impact**	Minimal impact during infrequent maintenance Potential increased recreational space with rectangular facility element -------- **no impact**	Potential challenge to balance park uses with presence of tank Interruption to park facilities during routine maintenance -------- **negative impact**	Minimal impact during infrequent maintenance Increased recreational space with parliament slip wavedeck -------- **no impact**

Table 3-1: Alternatives Effects Assessment Summary

Category of Consideration / Evaluation Criteria	Option A (13m integrated boardwalk facility)	Option B (integrated boardwalk facility forebay + offshore facility)	Option C (tri-celled rectangular tank adjacent portion of dockwall)	Option D (underground storage tanks, Class EA Master Plan Recommended Option)	Option E (9.5m integrated boardwalk facility + parliament wetland)
SUMMARY: SOCIO-ECONOMIC ENVIRONMENT	**1st** -------- This is the preferred alternative from a socio-economic perspective, as the facility intrudes into the harbour the least amount, provides for new public realm space and would not impact open space users during maintenance.	**4th** -------- The off shore component of the facility represents a long-term interruption of harbour uses.	**3rd** -------- The 30 m intrusion of the cell into the harbour has the potential to affect harbour marine users and as such makes this alternative less preferred than Alternatives A or E.	**4th** -------- While this alternative offers the least imposition on existing marine and harbour uses, the presence of the tank within future park use requires frequent and disruptive maintenance.	**2nd** -------- The usage of a portion of Parliament Slip represents a permanent reduction in available recreational marine space within the slip. However this would be off-set by the creation of the wave deck that would provide new land based open space area. The width of the boardwalk is not anticipated to have material impact on harbour uses.
CULTURAL ENVIRONMENT					
Potential effects on existing and proposed cultural landscape and heritage resources	None of the alternatives will impact cultural or heritage resources	See description under Option A	See description under Option A	See description under Option A	See description under Option A
SUMMARY: CULTURAL ENVIRONMENT	equally ranked	equally ranked	equally ranked	equally ranked	equally ranked

Table 3-1: Alternatives Effects Assessment Summary

Category of Consideration / Evaluation Criteria	Option A (13m integrated boardwalk facility)	Option B (integrated boardwalk facility forebay + offshore facility)	Option C (tri-celled rectangular tank adjacent portion of dockwall)	Option D (underground storage tanks, Class EA Master Plan Recommended Option)	Option E (9.5m integrated boardwalk facility + parliament wetland)
DESIGN EXCELLENCE					
Sustainability	Use of harbour rather than tableland Covered system requires perpetual mechanical UV disinfection -------- **moderately sustainable**	Use of harbour and slip rather than tableland Open-water component – potential for natural UV disinfection Lost efficiencies due to length of pipe and conveyance required -------- **more sustainable**	Use of harbour and slip rather than tableland Open-water component – potential for natural UV disinfection -------- **more sustainable**	Closed system requires perpetual mechanical UV disinfection Tank component requires more maintenance -------- **least sustainable**	Use of harbour and slip rather than tableland Open-water component – potential for natural UV disinfection Use of facility for boardwalk support and dockwall rehabilitation -------- **most sustainable**
Aesthetic Impact	Facility is consistent with public realm vision for community – requires widening of boardwalk to 13m -------- **low impact**	Offshore element will have a significant aesthetic impact on the overall central waterfront and inner harbour -------- **high impact**	Facility represents departure from current public realm vision for community -------- **moderately sustainable**	Tanks will have little if any impact on aesthetics of the community -------- **no impact**	Integration with public realm elements Variation on existing slip usage -------- **low impact**
Harmony with surrounding structures and open space and integration with other design elements	Integrates fully with boardwalk Treated water supplies Sherbourne Park water features -------- **Fully integrated and partially complementary**	Partially integrates with boardwalk Offshore element represents new feature in inner harbour Treated water supplies Sherbourne Park water features -------- **partially integrated**	Facility stands out with respect to surrounding landscape Treated water supplies Sherbourne Park water features -------- **not integrated**	Facility entirely hidden underground Treated water supplies Sherbourne Park water features -------- **fully integrated but hidden**	Integrates and complements boardwalk and wavedeck elements Treated water supplies Sherbourne Park water features -------- **fully integrated and complementary**

Table 3-1: Alternatives Effects Assessment Summary

Category of Consideration / Evaluation Criteria	**Option A** **(13m integrated boardwalk facility)**	**Option B** **(integrated boardwalk facility forebay + offshore facility)**	**Option C** **(tri-celled rectangular tank adjacent portion of dockwall)**	**Option D** **(underground storage tanks, Class EA Master Plan Recommended Option)**	**Option E** **(9.5m integrated boardwalk facility + parliament wetland)**
Originality / Uniqueness / Landmark potential	Innovation in design, and multiple benefit of partial dockwall rehabilitation and boardwalk structural support -------- **More original / unique**	Very original and innovative design, offshore element has significant landmark potential -------- **Most original / unique**	Innovation in design, has some degree of landmark potential -------- **More original / unique**	Facility hidden and representative of traditional approaches -------- **Least original / unique**	Innovation in design, and multiple benefit of dockwall rehabilitation and boardwalk structural support Parliament wavedeck / wetland has landmark potential similar to Spadina wavedeck -------- **Most original / unique**
SUMMARY: DESIGN EXCELLENCE	**2nd**	**3rd**	**5th**	**4th**	**1st**
COST					
Capital cost (including land value)	$42 million --------	$52 million --------	$49 million --------	$60 million --------	$42 million --------
SUMMARY: COST	**1st**	**4th**	**3rd**	**5th**	**1st**
SUMMARY					
OVERALL RANKING	**2nd**	**4th**	**3rd**	**5th**	**1st**

3.2.3 Rationale for Preferred Alternative

Based on the assessment and evaluation results as presented in **Table 3-1** above, Alternative E (9.5m integrated boardwalk facility + Parliament Slip wetland) was identified as the preferred alternative (ranked 1st for four criteria groups, ranked 2nd for one criteria group and ranked equivalent to the other alternatives for one alternative group). The rationale for its ranking as preferred is as follows:

- It is preferred for the Technical criteria group as it incorporates both covered and vegetated open-water elements, and utilizes lake depth to yield more effective runoff treatment and satisfy agency expectations. It also maintains proximity and accessibility for construction, maintenance, and potential future expansion, thus further easing the approval process and timelines. The construction effort is anticipated to be similar to the other alternatives.
- Was ranked 1st for the Natural Environment criteria group as the affected lake bed areas are considered to be poor fish habitat and it will create opportunity for a net improvement to fish habitat through the fish habitat compensation efforts to be implemented. Further, the open nature of the wetland cells (within the planned wave deck) will indirectly contribute to aquatic habitat.
- Was ranked 2nd for the Socio-economic criteria group as the cells would intrude into the harbour the least amount (13 m), and although the wetland cell/ wavedeck in the Parliament St. slip will result in reduce marine area, the wavedeck will result in the creation of new land based public realm space.
- All of the alternatives are considered equivalent with respect to the Cultural Environment criteria group.
- In terms of Design Excellence, Alternative E is ranked 1st as it presents an innovative design and provides multiple benefit including dockwall rehabilitation, boardwalk structural support, the Parliament Slip wavedeck / wetland and provides “landmark potential”.
- In terms of cost, Alternative is the least capital cost at $42 million.

4 Description of the Undertaking

This section presents a description of the undertaken. The proposed modifications to the stormwater collection and management system differ from the system proposed in the Class EA Master Plan in the following ways:

- The runoff from the East Bayfront will be collected in a single-pipe storm sewer system, as opposed to the twin pipe system;
- Oil-grit separators are proposed to provide pre-treatment of runoff from the East Bayfront;
- The end of pipe stormwater management facilities consisting of sedimentation tanks have been replaced by a series of treatment tanks constructed along the dockwall in combination with a wet cell constructed at the Parliament Street Slip;
- The two treated stormwater outfalls shown in the Class EA Master Plan will not be required with the proposed modification as the treated stormwater will be discharged to the open water feature in Sherbourne Park; and

The elements of this system are discussed in the sections below. Further details are available in the separate April 2009 *East Bayfront Stormwater Management Facility Preliminary Design Report*.

4.1 Stormwater Collection System

The proposed new stormwater collection system is intended to provide an outlet for minor system flows, as well as safe conveyance for flows up to and including that generated by a 100-year return period event. In accordance with the City of Toronto's *Wet Weather Flow Master Plan*, the minor drainage system will convey all runoff generated by a two-year return-period event. The Class EA Master Plan suggested that the minor drainage system be sized for a five-year return-period level, but the two-year level is recommended to comply with City of Toronto criteria, and to follow the sustainability guidelines by minimizing infrastructure. In addition, smaller pipes transmit flow with a higher velocity allowing for more frequent attainment of self-cleansing velocities within the pipes.

Grading and road design for East Bayfront will provide safe conveyance of runoff generated by storms up to and including the 100-year return period event for discharge to Lake Ontario.

4.2 Stormwater Management System

The proposed new stormwater treatment strategy for East Bayfront proposes a range of mechanisms that span the on-site, conveyance, and end-of-pipe categories, as described in the Ministry of the Environment's *Stormwater Management Planning and Design Manual (March 2003)*.

4.2.1 On-Site Measures

On-site measures are proposed to be implemented to the extent feasible, consistent with both the City of Toronto's Wet Weather Flow Management Guidelines and LEED credit requirements. Recommended measures include green roofs and rainwater harvesting for landscape irrigation and water closets (toilets). Infiltration measures are not specifically recommended due to the prevailing soil and groundwater conditions. The specific on-site mechanisms need to be determined on a site-specific basis, but are required to achieve stipulated runoff reduction targets. These recommendations are consistent with the recommendations of the Class EA Master Plan.

4.2.2 Conveyance Measures

Conveyance measures are proposed in the form of four oil/grit separation devices to be distributed along the storm sewer network, which provide pre-treatment of runoff by removing

floatables and larger contaminant particles prior to conveyance to the end-of-pipe facility. While oil-grit separators were not specifically referenced in the Class EA Master Plan, the plan did recommend the use of source and conveyance measures to minimize end-of-pipe infrastructure requirements.

4.2.3 End-of-Pipe Measures

The end-of-pipe component of the stormwater treatment system represents the final phase of passive runoff treatment prior to discharge to Lake Ontario, and in concert with the on-site and conveyance controls described above, must reduce the suspended solids by a minimum of 80% to satisfy enhanced water quality criteria as defined by the Ministry of the Environment. A suitable reduction in suspended solid content is also needed to ensure sufficient runoff clarity to allow for the effective UV treatment of E.coli, which is a requirement of the City of Toronto's Wet Weather Flow criteria.

The proposed end-of-pipe treatment facility consists of:

- a linear bank of precast concrete treatment tanks to be located in the Toronto harbour along the dock wall,
- a wet cell/wetland in the Parliament Street Slip, and,
- a UV disinfection facility, and a clean water outfall into Lake Ontario (**Exhibit 4-1** to **Exhibit 4-4**).

The treatment tanks will be structurally supported by an engineered stone buttress. The precast concrete treatment tanks will be installed along the existing dock wall from a point just east of the Jarvis Street Slip to and along the western wall of the Parliament Street Slip, then crossing the Parliament Street Slip creating a wet cell isolated from the Inner Harbour. The width of the precast concrete treatment tanks will vary from 9.5m throughout the majority of the system to 6.5m in areas where the overlying boardwalk will transition to narrower segments.

The in-water treatment cells will also support a waterfront promenade boardwalk and Parliament Slip wavedeck that is not the subject of this Class EA but has been assessed by Waterfront Toronto as part of a separate CEAA screening.

An evaluation of the end-of-pipe volume requirements has yielded a desired permanent pool volume of 9700 m^3, consistent with that required to achieve a 95% suspended solid reduction, along with an active storage component of 4200 m^3 that provides for the capture and attenuation of runoff generated by all storms up to and including a 25mm (first flush) event. The permanent pool level will approximates the average annual lake levels, in order to minimize the structural load to the tank system that would result from the differential between lake and facility depth. In addition, the active storage above the permanent pool must be restricted to an elevation that minimizes the potential for excess surcharging of the upstream storm sewer system. A review of these considerations has identified an optimum permanent pool elevation of 74.5m, corresponding to the average lake level, and a maximum active storage fluctuation of 0.5 metres, from 74.5m to 75.0m. Additional review of lake level data should be undertaken as part of the detailed design to confirm or refine facility water levels.

The active storage volume and fluctuation requirements yield a facility footprint of 8500 m^2 (0.85 hectares). With a permanent pool depth of 7m and footprint of 8500 m^2, the available permanent pool is almost 60,000 m^3, this is more than six times the volume required to achieve 95% suspended solids removal. While a permanent pool volume in excess of the desired 9700 m^3 is not strictly required to achieve water quality and clarity objectives, the additional volume represents an ancillary benefit resulting from the active volume and footprint requirements, and suggests that the facility will provide treatment for quality, sediment, and E.coli to the maximum extent possible.

The tank system will culminate in a wet cell / wetland at the north end of Parliament Slip. The linear tank system provides the majority of the facility footprint requirement established above; the remaining footprint requirement is satisfied by the wet cell / wetland feature. Precast concrete boxes will be used to create a new north wall in the northern portion of the Parliament Street Slip, yielding an orphaned triangular body of water on the landward side of

the concrete boxes. This area will be backfilled to create new lands around the slip. The remaining sides of the wet cell will be formed by precast concrete boxes on the west and south sides, and repaired dockwall on the east side. The southerly bank of precast concrete boxes separate the wet cell / wetland feature from Lake Ontario. The configuration of the precast concrete boxes used to form the wet cell/ wetland will be consistent with those used in the linear portions of the treatment system having a width of 9.5m.

A timber wavedeck is proposed for placement above the Parliament Slip wet cell for public usage. Openings within the overlying wavedeck will provide opportunities for the introduction of vegetated elements into the wet cell for potential phytoremediation of contaminants, exposure of clarified runoff to sunlight for potential natural UV disinfection (**Exhibit 4-2**), and public education opportunities via a visible element of the stormwater management system. Portions of the wavedeck not supported by the treatment cells will be supported by concrete pilings. The wavedeck is not being assessed as part of this EA Addendum, but has been assessed by Waterfront Toronto as part of a separate CEAA screening process.

Treatment via the 'passive' components of the stormwater management system yields clarified stormwater of sufficient quality and clarity for effective ultraviolet (UV) disinfection. The proposed UV disinfection system (described in the following section) is to be located within Sherbourne Park, the central park feature within the East Bayfront Precinct. As such, clarified stormwater will be passively conveyed to the UV system in Sherbourne Park via a wet well and gravity pipe.

To compensate for the loss of aquatic habitat as a result of the placement of the cells in the Lake, an aquatic habitat compensation strategy has been developed which will include the placement of rock shoals and other features in the water. The approach for this strategy has been accepted by DFO and Toronto Conservation through the previously noted CEAA screening process. Refinements to the design of the aquatic habitat compensation plan will occur in conjunction with the detailed design of the stormwater management facility and in response to agency review of the design. Similarly, refinements to the dimensions and volume of the overall stormwater management system, including the precast concrete boxes, may occur through the design and review process.

4.2.4 Ultraviolet Disinfection System

An ultraviolet (UV) disinfection system is required to reduce concentrations of E.coli before discharge to Lake Ontario. The combined stormwater management and UV disinfection system is designed to reduce E.coli concentrations to an acceptable 100 counts per 100 ml, which is the Provincial Water Quality Objective (PWQO) for E.coli, a requirement of the City of Toronto Wet Weather Flow Management Plan, and also the threshold for water contact recreational activity. For East Bayfront, the availability of treated stormwater and the Waterfront Toronto Sustainability Framework encouraged the use of the treated stormwater for passive amenity uses. As such, UV treated water will be utilized by a series of public art water features within Sherbourne Park, which include three scrim wall / waterfall features and a newly constructed channel, before discharging into Lake Ontario.

To address public health concerns, more stringent criteria for E.coli disinfection than that required to satisfy the City's Wet Weather Flow Management guidelines will be adhered to. Consultation with Toronto Public Health has confirmed that the proposed stormwater treatment and UV disinfection system can satisfy the more stringent requirements. These consultations will continue through the detailed design process to ensure that the treatment levels provided by the system will address potential health concerns.

The outfall at Lake Ontario will be located below the water's edge promenade boardwalk, but above the high water level in the Lake. The aquatic habitat compensation plan will include elements to maximize or concentrate habitat potential in the area of the clean water outfall, while directing existing CSO discharges away from habitat-intensive areas via shaped rock shoals.

Through consultation with the City of Toronto during formulation of the stormwater management system, the City expressed interest in the exploration of optimization opportunities, specifically with respect to combining the stormwater management

infrastructure proposed for East Bayfront with that of adjacent waterfront redevelopment projects.

Evaluation of such opportunities was undertaken, yielding an opportunity to utilize and oversize the East Bayfront UV disinfection system to treat a portion of the Lower Don Lands Precinct in addition to the East Bayfront Precinct. The portion of the Lower Don Lands Precinct that lie west of Cherry Street, east of Parliament Street, north of the Keating Channel, and south of Lakeshore Boulevard, have been identified as the suitable area for treatment via the East Bayfront UV disinfection system. This area has been termed the 'North Keating West lands'. Stormwater management measures comparable to those proposed for East Bayfront will be required for the North Keating West lands, with treated and clarified runoff from this area to be conveyed to the Sherbourne Park UV disinfection facility for final treatment. As such, the configuration of the East Bayfront stormwater management system has accounted for the potential future inclusion of treated runoff in the design. Refinements, specifically with regards to flow rates and the design of the conveyance system for the North Keating West lands, will occur through the detailed design process.

Exhibit 4-1: Waters Edge Promenade and Stormwater Management –Site Context Plan

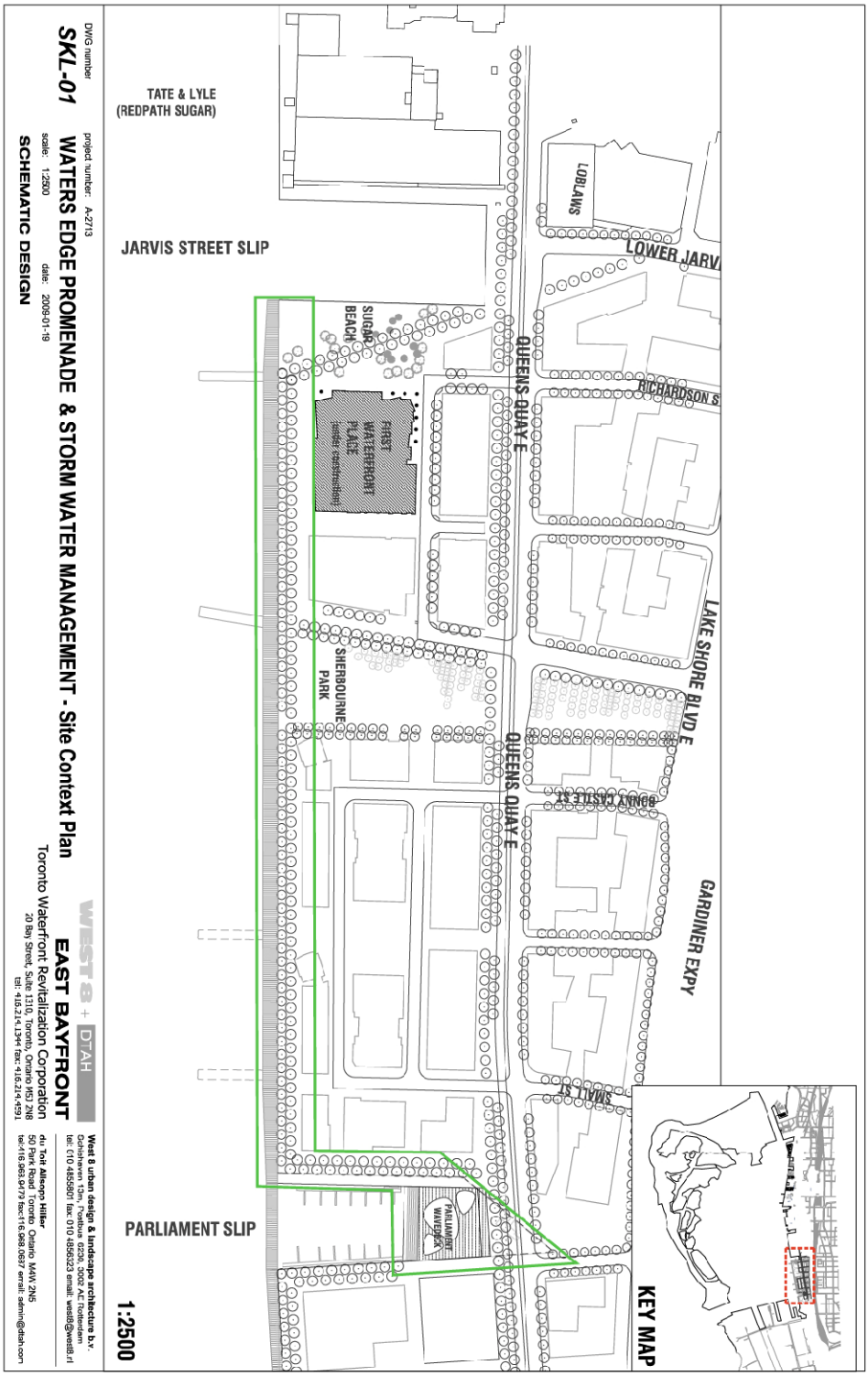


Exhibit 4-2: Waters Edge Promenade and Stormwater Management - Concept Drawing

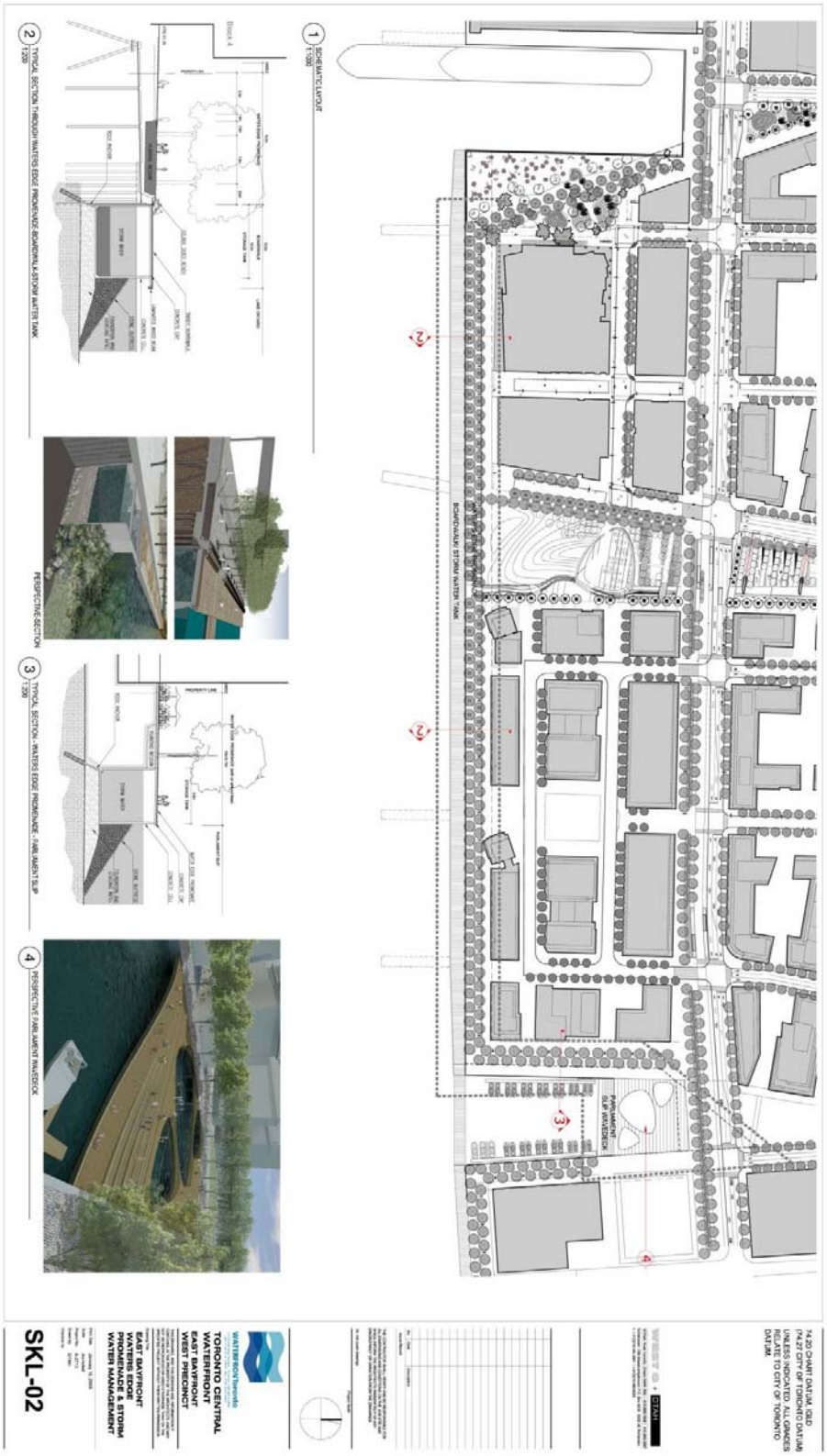


Exhibit 4-3: Waters Edge Promenade and Stormwater Management System

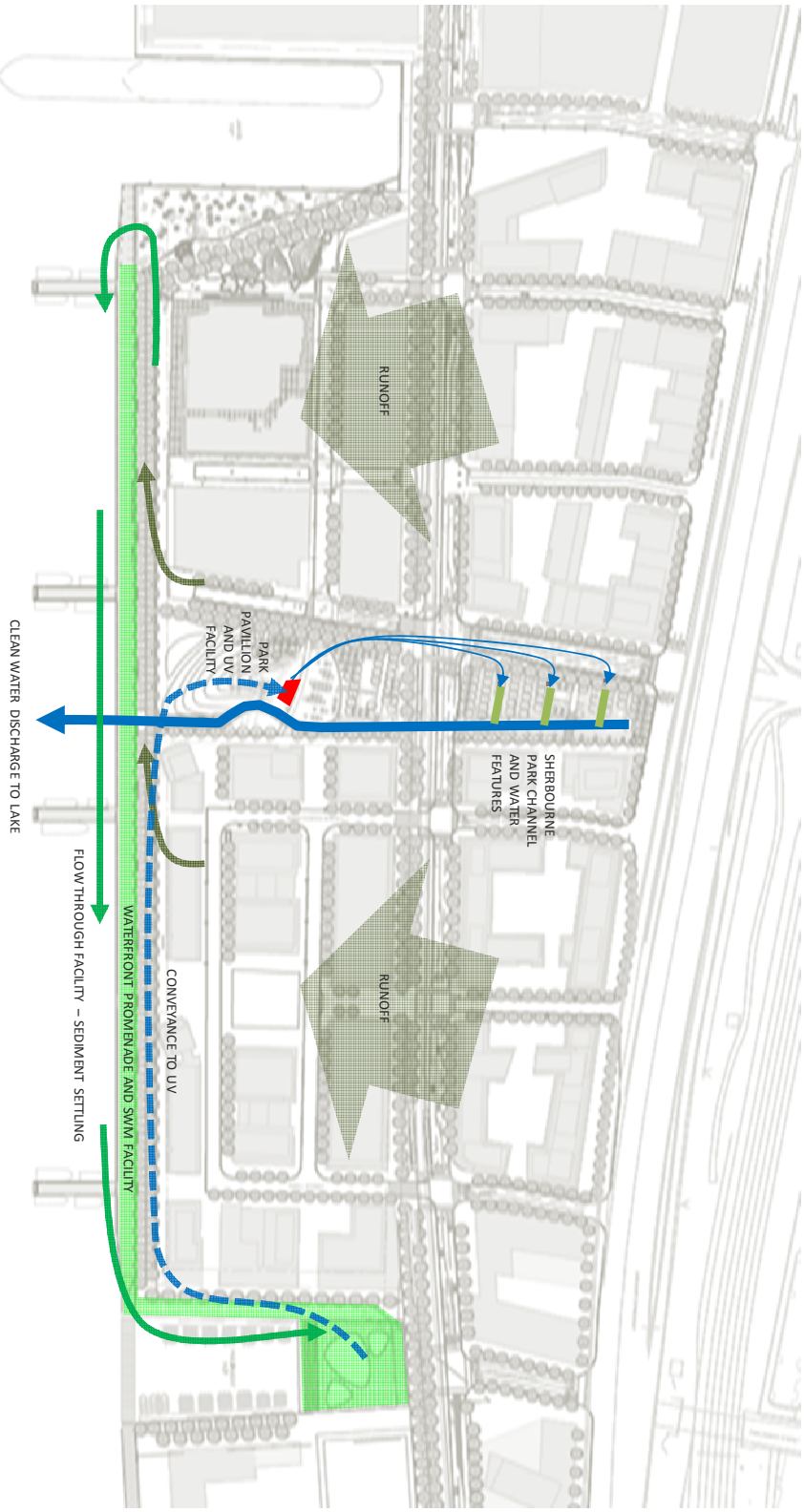
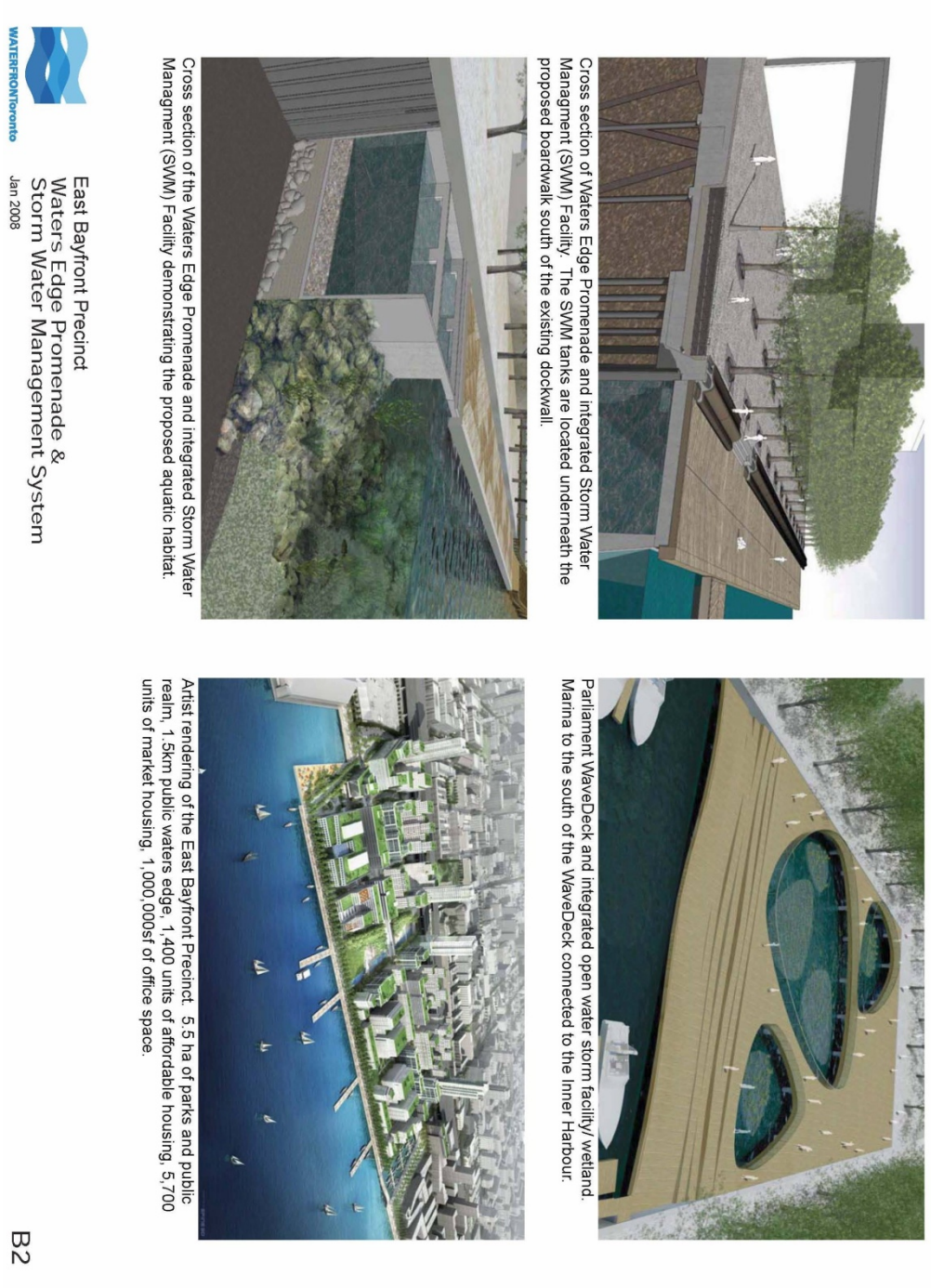


Exhibit 4-4: Waters Edge Promenade and Stormwater Management – Public Realm



5 Environmental Effects and Mitigation

5.1 Description of Effects and Proposed Mitigation

As part of this EA addendum process, an assessment of effects of the proposed project (the "undertaking" as described in **Section 4**) was conducted. This assessment examined the potential for effects that are expected to result from both short-term construction and long-term operations activities. Through this assessment, recommendations for mitigation and monitoring were made to avoid or minimize the anticipated effects. Waterfront Toronto is committed to the implementation of these mitigation measures.

This assessment considered effects with respect to the following components of the environment:

- Fish Habitat
- Surface Water
- Wildlife
- Air Quality
- Noise/Vibration.
- Socio-Economics (including recreation)
- Future Land Use
- Cultural Resources

Table 5-1 provides a description of the effects, the proposed mitigation, and the net effects of the proposed project.

Table 5-1: Description of Effects, Mitigation, and Net Effects

Description of Effect	Description of Mitigation	Net Effects
Fish Habitat		
Potential impacts to fish associated with the noise/vibration originating from pile driving activity include injury or death to fish. It is anticipated that fish will likely avoid the area when construction activity is underway. However, in the event that fish are immediately adjacent to pile driving they may sustain injury or death. It is anticipated that fish will likely avoid the area when construction activity is underway. However, in the event that fish are immediately adjacent to pile driving they may sustain injury or death. Pre-cast concrete and cast-in-place concrete (i.e. from the SWM cells and dock wall repairs) has the potential to affect fish through the introduction of deleterious substances including alkaline leachate from uncured concrete as well as dust and chips from cured cement. Portland cement, the active ingredient in concrete, mortar and grout is highly alkaline when introduced into water; this resulting high alkalinity can be harmful or deadly to aquatic organisms. Furthermore, Portland cement consists of very fine particles and as a result its introduction into the water can increase turbidity. Concrete wash-water also has the potential to be highly alkaline and has a very high content of suspended sediments. This project is anticipated to result in the harmful alteration, disruption or destruction (HADD) of fish habitat due to the loss of lakebed area associated with installation of the SWM system and pile construction to support the various structures (i.e. dockwall repairs and finger piers). The loss of lakebed substrate is not anticipated to have a considerable adverse effect on fish or fish/aquatic habitat as the lakebed consists primarily of silt and there is a limited presence of fish community in the immediate area.	For all in-water works to be conducted outside of the fisheries spawning window, an adaptive management approach will be taken. Baseline monitoring of in-water construction is occurring for like works at the Rees/Simcoe Slip(s) Wave Decks in order to quantify the varying levels of impact incurred. Based on collected data, an adaptive management plan will be implemented in order to minimize impacts to fish associated with the proposed construction activities including but not limited to stormwater cell installation, pile driving and the use of pre-cast and cast in place concrete. If deemed necessary through the adaptive management plan, the work area will be isolated by a sediment/silt curtain. If necessary due to the presence of fish, fish will be salvaged and relocated outside of the work area. The isolated work area will be inspected during construction to ensure that any fish that re-enter the work area are identified and relocated. Any in-water construction activities required to occur during the TRCA/DFO identified spawning window (March 31-July 1) is subject to Agency review and approval. Impacts associated with vibration/noise from pile driving, in-water construction will adhere to the permissible in-water timing window set fourth by the TRCA to avoid impacts to fish during sensitive spawning, incubation and emergence periods unless otherwise approved by the appropriate Agencies (i.e. TRCA, DFO). As a condition of the *Fisheries Act* authorization and as a part of the adaptive management plan, monitoring will be undertaken to assess the effectiveness of the silt curtain and adjustments will be made as necessary. In order to mitigate the loss of fish habitat, fish habitat installation measures will be provided consistent with the DFO's guiding principle to achieve a "net gain" of the productive capacity of fish habitat. An Aquatic Habitat Enhancement Plan is being developed through discussions with the regulatory agencies (i.e., DFO, TRCA, etc) and the incorporation of techniques identified in the Toronto Waterfront Aquatic Habitat Restoration Strategy (TWAHRS) to produce a net gain in fish and aquatic habitat for the project. The proposed Habitat Enhancement Plan along the East Bayfront dockwall and within the Parliament Street Slip consists of constructing riverstone surfaced embankments along the dockwall and projecting out into the Inner Harbour to enhance connectivity and add structural diversity Boulder clusters, sunken tree	A net positive effect is anticipated to result from the fish/aquatic habitat enhancement measures

Table 5-1: Description of Effects, Mitigation, and Net Effects

Description of Effect	Description of Mitigation	Net Effects
	and root masses and submergent wetlands will be constructed to provide shelter and create forage habitat for juvenile fish. It is anticipated that the increase in habitat and habitat diversity will result in greater attraction of fish to this area, increased inter-specific interactions and a more natural transition between shallow and deep water habitat. Monitoring of the habitat will be undertaken as per the monitoring plan that has been developed from the larger Central Waterfront Project (which is to occur for a 5 year period following the completion of the EBF-SWS Project).	
Surface Water		
During pile driving, impacts to water quality may result from suspended sediments and noise/vibration. Associated with the disturbance of lake sediments, there is also the potential for increased nutrient levels and trace metals related to the re-suspension of settled fines. During placement of granular foundation for concrete SWM cells, impacts to water quality may result from suspended sediments and noise/vibration. Associated with the disturbance of lake sediments, there is also the potential for increased nutrient levels and trace metals related to the re-suspension of settled fines. Potential accidental release of fuels or lubricants (see Accidents and Malfunctions). Reduced water quality and clarity due to fine debris entering the water.	Install and maintain silt and sediment controls as required according to the adaptive management plan (i.e. sediment curtain to be located close to the construction site), and monitor these controls to ensure they function effectively for the duration of the work phase. Refuel vehicles and equipment away from shoreline. Store all oils, lubricants, fuels and chemical products in secure areas to prevent their accidental release into the environment. Capture, contain and clean up any spills and leaks immediately and report spills, as required, to the Ministry of the Environment's 24-hour spills hotline. Ensure that there is an adequate supply of clean-up materials on site as well as crews fully trained on their use. Secure stockpiled materials where there is a risk that loose materials could be washed or floated away and enter the lake. Ensure all equipment that comes into contact with surface water is free of leaks and is sufficiently cleaned and degreased. Construction equipment must not be cleaned in the Harbour. Where possible, conduct in-water work during calm conditions. Ensure all materials placed below the high water mark are clean and free of silt and clay sized particles. All materials must meet provincial guidelines governing placement of fill in water bodies. (The fill will consist of clean stone and concrete around the base related to habitat enhancement). In order to minimize impacts associated with the installation of pre-cast concrete, the contractor shall physically remove (i.e., sweeping, water	No net effects provided mitigation measures implemented. Implementation of the storm water management system will have a net positive effect by improving water quality discharging to Lake Ontario.

Table 5-1: Description of Effects, Mitigation, and Net Effects

Description of Effect	Description of Mitigation	Net Effects
	spray, etc) all loose material (i.e., chips, dust) from pre-cast sections prior to installation. This will minimize the introduction of fine sediment that can potentially increase turbidity and alkalinity. Impacts to the aquatic community associated with cast-in-place concrete, placement of cement or grout below the high water mark will be minimized, where possible, through the implementation of construction methods to isolate the work area allowing work to occur in the dry. The work areas will remain isolated from the Lake for a minimum of 48 hours prior to allowing contact with water to allow for concrete curing and minimize the potential for the introduction of alkaline leachate. Furthermore, all concrete construction works (i.e. installation of pre-cast concrete structures, cast-in place) at/below the high watermark will occur within the permissible in-water timing window as directed by the TRCA, unless otherwise approved. Waste material associated with concrete construction including but not limited to concrete dust, concrete chips, concrete wash water will not be disposed of into the water and must be collected and disposed of off-site at an approved disposal site.	
Wildlife (Migratory Birds)		
Even though there is a lack of terrestrial habitat along the waterfront, there is still potential for minor disturbances to migratory birds during construction due to noise.	See proposed mitigation for noise.	No effects provided mitigation measures are implemented.
Air Quality		
Some minimal release of dust will occur due to the construction activities.	Ensure emission control devices on equipment are functional and effective. Monitor dust levels during construction activities, and when dust levels become visually apparent spray water to minimize the release of dust. Use chemical dust suppressants only where necessary on problem areas. Use new or well-maintained heavy equipment and machinery, preferably fitted with muffler/exhaust system baffles, and engine covers. Comply with operating specifications for heavy equipment and machinery. Position portable emission sources (e.g., portable diesel engines) as far as practical from sensitive receptors. Minimize vehicle idling. Avoid construction activities with potential to	No effects provided mitigation measures are implemented.

Table 5-1: Description of Effects, Mitigation, and Net Effects

Description of Effect	Description of Mitigation	Net Effects
	release airborne particulates, during windy and prolonged dry periods. Cover or otherwise contain loose construction materials that have potential to release airborne particulates during their transport, installation or removal.	
Noise and Vibration		
Short-term and intermittent noise associated with construction vehicles and activities. There are no residents in the immediate vicinity of the project site Noise levels will be at nuisance (approximately 75-90 dBA). Noise and vibration is expected to be generated during the pile driving activity.	Restrict construction activities to hours prescribed by local noise by-law. Ensure equipment is in sound working order. Workers will use appropriate noise protective equipment.	No effects provided mitigation measures are implemented.
Socio-Economics (Including Recreation)		
Noise and vibration during the construction period could disturb individuals involved in recreation activity in the area (e.g. boaters) Innovative stormwater management system will attract public interest and visitors to the area. The RCYC Island Ferry launch will be displaced by the development of storm water management facilities and public realm features in the Parliament Street Slip.	Measures required during construction with respect to boating activity in the area including notices, signs, etc, to ensure that boats remain clear of the area. The RCYC have signed a lease with the Toronto Port Authority and TEDCO providing for the relocation of the Island Ferry launch with the redevelopment of the Parliament Street Slip. The RCYC, in entering into this agreement, has demonstrated acceptance of the proposed mitigation.	Net positive effect through the creation of a facility that will create public interest.
Future Land Use		
The proposed stormwater management system will facilitate future development in East Bayfront.	None required.	Positive effect through the facility supporting future development plans for East Bayfront.
Cultural Resources		
No effect on cultural resources is anticipated as the area of disturbance is either on lands created by lakefill and/or has been heavily disturbed by previous commercial/industrial land use activity.	None required.	No effects.

6 Public and Agency Consultation

6.1 Consultation with the Public

This project has been discussed with stakeholders as part of the consultation program for the East Bayfront Precinct and Central Waterfront Public Realm Projects. There has been considerable information on the broad scope and objectives of these projects made available to the public via public forums and the media. In particular, a public meeting held on July 8, 2009 provided descriptions of the facility and EA addendum process within the context of the overall East Bayfront and Central Waterfront projects. In addition, Waterfront Toronto initiated discussions with the users of Jarvis and Parliament Slips including the Royal Canadian Yacht Club, Yankee Lady Yacht Charters and Red Path Refinery to identify issues related to commercial ship traffic and recreational use of the Inner Harbour.

6.2 Consultation with Government Agencies

Discussion with the Ontario Ministry of the Environment regarding the design of the SWM facility occurred on June 12, 2009. These consultations yielded input and advice with regards to specific details of the stormwater management design.

Discussions on the Aquatic Habitat Enhancement Plan regarding habitat compensation are occurring with: Aquatic Habitat Toronto [formerly Toronto Waterfront Aquatic Habitat Restoration Strategy], Fisheries and Oceans Canada (DFO); and the Toronto and Region Conservation Authority (TRCA). Waterfront Toronto has also briefed the Ministry of Natural Resources (MNR) regarding the Aquatic Habitat Enhancement Plan. The aquatic habitat enhancement plan was being developed at the same time that this EA Addendum was prepared.

Transport Canada has confirmed through Waterfront Toronto's consultation that the Navigable Waters Protection Act (NWPA) will be triggered by the proposed stormwater management system. Applicable approvals are being sought by Waterfront Toronto.

The Toronto Port Authority has also been consulted regarding the project through briefings on the project design.

As with the public consultations, the input received to-date has been concerned with specific details of the stormwater management system design, but has not affected the overall concept or configuration of proposed system.

6.3 Consultation with the City of Toronto

Consultations with the City of Toronto have been continuous throughout the East Bayfront Precinct and the Central Waterfront Public Realm projects, and are expected to continue throughout project design, permitting and approvals, and construction. The City of Toronto has provided comments at all stages of design. These comments have been addressed as part of the design, approval, and consultation processes, and integrated where applicable into the proposed stormwater management solution. Consultation with the City of Toronto is expected to continue through the detailed design and construction phases, yielding refinements to the design of the project. However, consultation that has occurred to-date has yielded general acceptance of the proposed stormwater management system for East Bayfront as described in this addendum.

As noted previously in this document, the use of the treated stormwater for passive recreational uses within Sherbourne Park raised concerns for Toronto Public Health. Efforts to alleviate these concerns, specifically with regards to the potential for human contact with treated stormwater, yielded a commitment to adhere to more stringent criteria for E.coli disinfection than that required to satisfy the City's Wet Weather Flow Management guidelines. Consultation with Toronto Public Health has confirmed that the proposed stormwater treatment and UV disinfection system can satisfy the more stringent requirements. These

consultations will continue through the detailed design process to ensure that the treatment levels provided by the system will address potential health concerns.

6.4 Consultation with Release of this Addendum

Waterfront Toronto will notify the public of the project by providing a public notice via newspaper advertisement and this addendum will be available for a 30 day public review. Notification letters will be issued to key stakeholders and agencies. Notice of the addendum will also be posted on the Waterfront Toronto website, with an allowance for the public to provide comments electronically.

7 Advantages and Disadvantages of the Undertaking

The project will result in an improvement of stormwater quality in the area, due to treatment of runoff where none presently exists, and result in a net positive effect on fish: habitat through enhancement measures incorporated into the design of the project; surface water quality; and support planned development for the East Bayfront area (and also potentially some of

The preceding summary of effects, mitigation, and net effects demonstrate that the project will have no negative effect on the environmental components that were assessed provided mitigation measures are implemented for: sediment control; hazardous materials storage and use; and noise.

Future land uses in East Bayfront and cultural resources are predicted to be positively affected by the proposed project.

Overall, the proposed modifications to the stormwater management system for East Bayfront will improve water quality in discharges to the Inner Harbour; enhance fish habitat; and provide a net benefit to the community. Table 7-1 summarizes the advantages and disadvantages of the project (the Undertaking).

Table 7-1: Advantages and Disadvantages of the Undertaking

Advantages	Disadvantages
Existing fish habitat will be enhanced by proposed fish habitat compensation measures designed and constructed as part of the project.	Loss of lakebed area which provides only poor fish habitat
Improvement in surface water quality discharging to the Inner Harbour	Construction may resuspend sediments but area of impact can be contained by sediment curtain around the work area.
Demonstration of innovative stormwater management system that combined with on-site measures result in a sustainable management solution for handling and treating stormwater.	Temporary and short term disruption effects to users of the inner harbour during construction.
Facilities improvements to the public realm through the integrated boardwalk, and elimination of repair requirements to existing dockwall.	Removal of lake area along the shoreline and within the Parliament Slip.

8 Conclusions

As noted in the 2006 Class EA Master Plan, the revitalization of the East Bayfront lands presents an enormous opportunity to improve the City by addressing derelict brownfield sites and associated infrastructure. The result will be a significant new neighbourhood that also provides new water's edge public spaces. Long term improvements to soil, groundwater, surface water, and socio-economic conditions will result from the implementation of the infrastructure projects outlined both in the original EA as well as this addendum. This addendum has explored additional opportunities to further enhance the design of the community through review and selection of an alternative stormwater management facility design, for improved consistency with Waterfront Toronto's Sustainability Framework, the City of Toronto's Wet Weather Flow Guideline, as well as stakeholder input obtained through the addendum process.

It is expected that there will be short term construction related disturbance effects, however these can be mitigated.

9 References

Archaeological Services Incorporated, September 2003. The Archaeological Master Plan of the Central Waterfront.

Toronto and Region Conservation Authority. Toronto Waterfront Aquatic Habitat Restoration Strategy.

Toronto and Region Conservation Authority. 2007. Aquatic Data Package.

Toronto Waterfront Revitalization Corporation. 2006 East Bayfront Class Environmental Assessment Master Plan.

The Municipal Infrastructure Group Ltd. 2009. East Bayfront Functional Servicing Report.

The Municipal Infrastructure Group Ltd. 2009. East Bayfront Stormwater Management Facility Preliminary Design Report.