LAKEVIEW VILLAGE

FUNCTIONAL NATURAL HERITAGE SYSTEM DESIGN BRIEF

LAKEVIEW
COMMUNITY PARTNERS LIMITED

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LAKEVIEW

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Sustainable landscape features within the public realm

Executive Summary

The subject lands are located on the former 177-acre site of the Lakeview Generating Station, a coal fired power plant that operated from 1962 to 2005. Following the closure of the plant and eventual decommissioning of the site, Ontario Power Generation (OPG) sold the lands through a competitive bidding process to the Lakeview Community Partners consortium in 2018. The purchase and sale agreement for these lands includes a provision which will ensure the conveyance of 67.1 ha of the OPG lands to the City of Mississauga. This report provides preliminary natural heritage design information in support of proposed Zoning By-Law Amendment and Draft Plan of Subdivision application for the subject lands.

This report fulfils DARC 18-20Z submission requirements and addresses City of Mississauga and Toronto Region Conservation Authority comments for the subject site. The natural heritage system presented in this report has been developed in conjunction with the greater consulting team and should be considered in conjunction with their work.

The proposed Lakeview Village development will incorporate open space and natural heritage features that will help the City of Mississauga and Credit Valley Conservation achieve their goal of creating a sustainable community and rehabilitated corridor on the waterfront.

The legal description of the site is Part of Lots 7, 8 and 9, Concession 3, south of Dundas Street in front of Lot 7 (Geographic Township of Toronto, County of Peel), City of Mississauga, Regional Municipality of Peel.

The Lakeview Village Development Master Plan (2018) identified several open space elements within the development which are to define Lakeview Village community. One of these elements is Serson Creek channel and the creation of a Natural Heritage System (NHS) that identifies, protects, restores and enhances the diversity and connectivity of natural areas and features.

Satellite view of the existing OPG Lakeview Lands

INTRODUCTION

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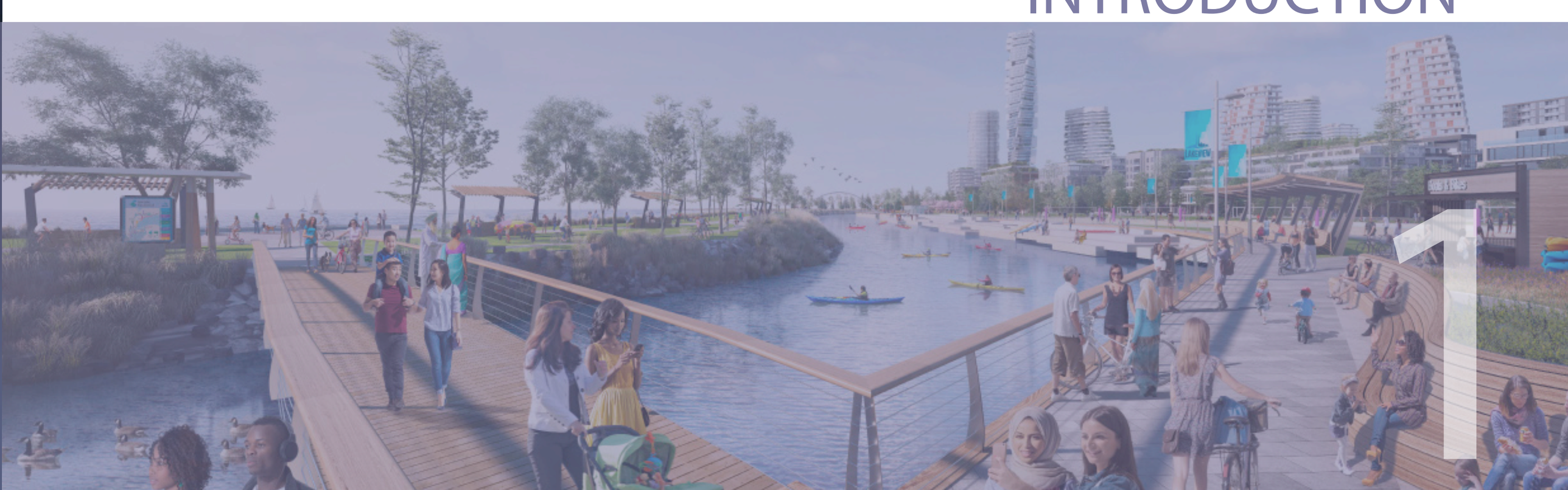

Introduction

1.1 SERSON CREEK

The Lakeview Village Development Master Plan (2018) identified several open space elements within the development which are to define Lakeview Village community. One of these elements is Serson Creek channel and the creation of a Natural Heritage System (NHS) that identifies, protects, restores and enhances the diversity and connectivity of natural areas and features.

Serson Creek is a highly engineered / historically realigned channel within the Lakeview Village lands. The corridor is currently highly altered and impaired. The frequent flows in Serson Creek are currently diverted into a pipe north of the G.E. Booth Wastewater Treatment Plant (WWTP), which conveys flows to the lake at the southeast side of the WWTP. Downstream of the diversion, a straight stormwater channel is situated at the east limit of the Lakeview Village lands, adjacent to the WWTP. This channel conveys less frequent flood flows in Serson Creek directly to the lake. Given this configuration, fish are unable to migrate from Lake Ontario to Serson Creek as there is a physical separation in elevations downstream of the flow diversion. The current configuration of the creek is constrained in terms of conveyance capacity, which results in localized flooding on to the Lakeview Village lands, the Plaster Form Inc. lands (east of the creek, south of Lakeshore Road), and the WWTP (Region of Peel property).

A key element of the Serson Creek NHS restoration is the realignment / redirection of the low flow channel from the current diverted alignment to the perched section of Serson Creek along the east limit of the Lakeview Village lands. The proposed realignment was recommended in the Lakeview Waterfront Connection Environmental Assessment (2014) as well as the recent CVC Living By the Lake Action Plan (2018). The ongoing WWTP upgrades also assume that the diversion will be completed.

1.2 KEY OBJECTIVES

The Living By the Lake study neatly summarized the key objectives and recommendations for Serson Creek between Lakeshore Road East and Lake Ontario. These objectives will be referenced in the relevant report sections:

R1-1 (Manage Stormwater Quantity)
Reduce flooding of structures in Serson Creek through improved flow conveyance and other methods (e.g., improve stormwater management, remove structures, etc.).

R1-5 (Improve Habitat Quality)
Improve instream and riparian habitat in Serson Creek by increasing diversity of structures and bed form through the Jim Tovey Lakeview Conservation Area and Lakeview Village initiatives.

R1-7 (Improve Habitat Quality)
Increase cover of wetlands in the coastal reach through Jim Tovey Lakeview Conservation Area. Channel works associated with land redevelopment should consider pocket wetlands within the creek corridor. Wet meadow should be considered in the hydro corridor associated with Serson Creek, as feasible.

R1-10 (Connect Habitat)
Maintain existing terrestrial connectivity between Serson Creek, G.E Booth woodland, Applewood Creek, and Marie Curtis Park.

R1-12 (Connect Habitat)
Improve fish passage from the lake to the upper reaches of Serson Creek for spawning, feeding and rearing.

1.3 ADDITIONAL OBJECTIVES

Additional objectives established in the Lakeview Village DMP and Lakeview Waterfront Connection EA include:

- Elimination of the flow diversion
- Restore channel to historical alignment, where feasible.
- Creation of pedestrian / cycling links between the lake and Lakeshore Road East

The objective of the proposed channel / NHS restoration described in the aforementioned studies and in this functional design brief is to achieve functional improvements over the existing system and to link existing fragmented natural features to create a strengthened, connected NHS extending to the future Jim Tovey Lakeview Conservation Area and Lake Ontario.

1.4 SUPPORTING STUDIES

The servicing and development strategies presented in this report have been developed in conjunction with the greater consulting team and should be considered in conjunction with their work. The following studies are included in the appendices:

- Preliminary Geotechnical Investigation - DS Consulting Report (October 2018)
- Shoreline Hazard Assessment - Baird (December 2018)
- Arborist Report – Beacon Environmental (August 2018)
- Lakeview Waterfront Connection Project – Applewood and Serson Creeks Design Brief – TRCA, GHD (December 2015)
- CVC Living by the Lake Action Plan (December 2018)
- Lakeview Village – Development Master Plan (September 2018)
- Air Quality and Noise Land-Use Feasibility Assessment – RWDI (October 2018)

Aerial View of Preliminary Site Construction in 2018

NATURAL HERITAGE SYSTEM DESIGN

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NATURAL HERITAGE SYSTEM DESIGN

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2.1 CHANNEL HYDRAULICS

Appendix C describes the hydraulic modelling completed as part of preliminary NHS design. This memo summarizes the following:

- Existing Flood Mapping
- Proposed Flood Mapping
- Interim Flood Mapping
- Riparian Storage Analysis (Existing vs. Proposed)
- Culvert sizing
- Channel velocities
- Flood Depth Analysis

REQUIREMENT	DELIVERABLE	IMPACT
Existing Flood Mapping	Delineation of Existing Flood Hazard	Does not affect proposed NHS design but included for comparison purposes.
Proposed Flood Mapping	Delineation of Proposed / Ultimate Flood Hazard for establishing development limits.	Required to demonstrate that the channel block is sufficiently sized for conveyance
Interim Flood Mapping	Delineation of Interim Flood Hazard for establishing development limits if channel is partially completed.	May be required (at detailed design) subject to hold out property participation for realignment of the north reach.
Riparian Storage Analysis (Existing vs. Proposed)	Summarize existing riparian storage volume targets for range of return period events and the Regional Storm; Ensure riparian storage in the interim and ultimate channel corridors matches or exceeds existing riparian storage;	Not required for this reach of Serson Creek – there are no lands downstream of this reach as it discharges to the Lake and flooding is not a concern.
Culvert sizing	Guide culvert sizing for the future road crossing at Remembrance Road (to be refined during Stage 2 detailed channel design);	Required to demonstrate that the preliminary culvert size for the New Haig / Street "I" crossings is sufficiently sized for conveyance
Channel velocities	Establish channel velocities	Required at detailed design for input into the fluvial geomorphological analysis / low flow channel design.

MODEL METHODOLOGY

To achieve the modelling objectives described in the preceding section, the U.S. Army Corps of Engineers' River Analysis System (HEC-RAS) was utilized. HEC-RAS is designed to perform one-dimensional steady and unsteady flow river hydraulics calculations, sediment transport-mobile bed modelling, and water temperature analysis. The HEC-RAS software supersedes the HEC-2 river hydraulics package.

The modelling system calculates water surface profiles for steady gradually varied flow. The system can handle a full network of channels, a dendritic system, or a single river reach. The steady flow component is capable of modelling subcritical, supercritical, and mixed flow regime water surface profiles.

The basic computational procedure is based on the solution of the one-dimensional energy equation. Energy losses are evaluated by friction (Manning's equation) and contraction/expansion (coefficient multiplied by the change in velocity head). The momentum equation is utilized in situations where the water surface profile is rapidly varied. These situations include mixed flow regime calculations (i.e., hydraulic jumps), hydraulics of bridges, and evaluating profiles at river confluences (stream junctions).

This model has the ability to consider the effects of various obstructions, such as bridges, culverts, dams, weirs, and other structures in the floodplain on water levels. The steady flow system is designed for application in floodplain management, estimation of floodplain storage, and for assessing the change in water surface profiles due to channel modifications.

The model requires the following input:

- channel geometry (low flow centerline profile and cross-sections; culvert crossing details);
- Manning's roughness for main channel and overbank areas;
- cumulative flow; and,
- downstream boundary conditions.

NATURAL HERITAGE SYSTEM DESIGN

EXISTING CONDITIONS

The existing model was obtained from CVC staff in June 2018 and updated to reflect current site conditions / improved topographic mapping. The Manning's roughness for the existing channel (main channel and overbank areas) varied considerably in the CVC model; this was updated to conservative values of 0.035 for the main channel and 0.080 for the overbank areas. Buildings within the floodplain were modeled as blocked obstructions.

Contraction and expansion coefficients were set to 0.3 and 0.5, respectively, for smooth transitions between cross-sections. At abrupt transitions (upstream and downstream of culverts, bends in channel direction, and wetlands), the contraction and expansion coefficients were increased to 0.3 and 0.5, respectively. The downstream water level boundary condition used in the CVC model was 74.8m.

The channel geometry was based on the CVC cross-section data, augmented with additional topographic mapping data. The existing design flows in the HEC-RAS model provided by CVC in June 2018 are noted below:

Location	2-year	5-year	10-year	25-year	50-year	100-year	Regional
XS 1197 (u/s of Lakeshore Road East)	6.97	10.23	14.42	16.96	19.12	22.22	18.74
XS 1140 (d/s of Lakeshore Road East)							
XS 720 (Diversion to downstream)	6.74	10.24	14.25	16.91	19.31	24.66	23.6
Approximate Flow to diversion (not modelled)							

A decrease in flows was noted at the location of the existing diversion of the low flow channel, with a higher flow approaching from Lakeshore Road East and a lower flow remaining in the perched channel downstream. As is common practice, it appears that the CVC model assumed that the diversion / flow split does not occur for the regulatory storms (100-year / Regional). In this case, the 100-year peak flow governs.

As shown in the existing flood mapping drawing FP-1, the current Serson Creek configuration results in overtopping of the channel banks and flooding within the Lakeview Village, Plaster Form Inc., and WWTP (Region of Peel) lands. The following table indicates the approximate area of flooding on each property:

Existing	Floodplain area
Lakeview Village	1.20 ha
Plaster Form Inc.	1.18 ha
WWTP	1.1 ha & SPILL
Total	3.48 ha

ULTIMATE CONDITIONS

Under ultimate conditions, the existing flow diversion to the WWTP will be eliminated, and the channel will be partially realiged south of Lakeshore Road East in an effort to return the NHS to it's original alignment and provide a connection to the G.E. Booth Woodland.

The flows in the proposed channel are assumed to be constant throughout (no reduction / no diversion) as follows:

Location	2-year	5-year	10-year	25-year	50-year	100-year	Regional
XS 1197 (u/s Lakeshore Road East)	6.97	10.23	14.42	16.96	19.12	22.22	18.74
XS 1140 (d/s lakeshore Road East)	7.07	10.98	15.6	18.61	21.22	24.66	22.05
XS 720 (former Diversion to downstream)	7.07	10.98	15.6	18.61	21.22	24.66	23.6

The 100-year peak flow was used for hazard mapping.

The proposed Manning's roughness and other hydraulic loss parameters were identical to the existing model as it is assumed that the channel will be similarly vegetated in the future.

It was assumed that the channel invert elevations will remain relatively similar to existing conditions, since the channel grades are fixed at Lakeshore Road and at the Jim Tovey Lakeview Conservation Area / Lake Ontario. A trapezoidal channel geometry was established to convey the peak flows without overtopping the channel banks. The model was iterated with a range of bottom widths and depths to optimize the 100-year flow conveyance. The resulting channel sections capable of conveying the peak flow are described below:

<u>Re-aligned channel ("North" Reach)</u>

- Top width = 22 to 24 m
- 2.0m deep
- 9.0 m bottom width
- 3:1 side slopes

<u>Improved Existing channel ("South" Reach)</u>

- Top width = 18 m
- 1.8m deep
- 9.0 m bottom width
- 3:1 right side slope, and
- 2:1 left side slope along WWTP (avoids disturbance to existing banks)

<u>Low flow channel dimensions</u>

- 2.5 to 3.0m low flow channel width
- 0.5m deep

The resulting 100-year / regulatory floodplain can be fully contained in the proposed channel sections as shown on Drawing FP-2, and significant floodplain reductions can be realized as illustrated in the following table.

Existing	Floodplain area
Lakeview	1.12 ha
Plaster Form Inc.	0.9 ha
WWTP	-
Total	2.02 ha

<u>Objective achieved: R1-1 (Manage Stormwater Quantity)</u> - Reduce flooding of structures in Serson Creek through improved flow conveyance and other methods (e.g., improve stormwater management, remove structures, etc.).

2.2 CROSSINGS

The existing Lakeshore Road East culvert crossing is approximately 27.5m long and has a conveyance area approximately 8.1m wide by 1.25m high (1.45m above the invert of the channel). The headwall structure includes two storm sewer outlets for Lakeshore Road. The crossing has a natural bottom and wingwalls. The culvert slope is approximately 0.55%.

The proposed Draft Plan indicates a crossing of the Serson Creek corridor with future New Haig Road / Street "I". This culvert is situated less than 200m downstream of the Lakeshore Road crossing, therefore as a preliminary estimate, the proposed culvert will be identical in size / height to the culvert at Lakeshore Road East. This culvert is proposed to be an open span crossing to allow for a naturalized channel bottom to promote fish movement through the crossing. A dry "shelf" will be implemented above the low flow channel within the crossing to encourage wildlife passage.

Objectives achieved: R1-12 (Connect Habitat) – Improve fish passage from the lake to the upper reaches of Serson Creek for spawning, feeding and rearing.

2.3 FLUVIAL GEOMORPHOLOGY

As the majority of the channel is constrained along the WWTP / Serson Innovation Corridor lands, the proposed channel design will implement bio-engineering design principles and armoring where required to minimize channel movement.

Key goals of the geomorphological design component will be to create a more sinuous bankfull channel through the corridor and improve bedform features through pool and riffle morphology and habitat features.

The low flow channel and culvert design will consider fish passage as it relates to acceptable velocities.

Objectives achieved:

R1-5 (Improve Habitat Quality) - Improve instream and riparian habitat in Serson Creek by increasing diversity of structures and bed form through the Jim Tovey Lakeview Conservation Area and Lakeview Village initiatives.

R1-12 (Connect Habitat) – Improve fish passage from the lake to the upper reaches of Serson Creek for spawning, feeding and rearing.

2.4 ECOLOGICAL CONDISERATIONS

The existing Lakeshore Road East culvert crossing is approximately 27.5m long and has a conveyance area approximately 8.1m wide by 1.25m high (1.45m above the invert of the channel). The headwall structure includes two storm sewer outlets for Lakeshore Road. The crossing has a natural bottom and wingwalls. The culvert slope is approximately 0.55%.

Currently, Serson Creek is a "disconnected" system with approximately 60% of the channel "offline" in that it does not receive frequent flows. The following table summarizes the "online" and "offline components of the existing system as well as the existing channel lengths through each property. The area noted on the table corresponds to the approximate vegetated corridor width measured from the apparent top of channel banks / "valley" where applicable.

Existing	Online NHS Area and Length	Offline NHS area and Length	Total Corridor area and Length
Lakeview Village	0.25 ha / 250 m	0.70 ha / 530 m	0.95 ha / 780 m
Plaster Form Inc.	0.16 ha / 158 m	-	0.16 ha / 158 m
WWTP	-	-	-
Total	0.41 ha / 408 m	0.70 ha / 530 m	1.11 ha / 938 m

The proposed ecological rehabilitation of Serson Creek will benefit from the removal of the diversion, as well as debris and seasonal barriers to improve fish passage and wildlife movement. A suitable wildlife shelf will be implemented into the proposed culvert design.

Connectivity between the G.E. Booth Woodland will be improved with the proposed channel alignment, which approximates the historical channel that originally traversed the lands east of Lakeview Village. An increase in the riparian area and native riparian vegetation is proposed and the low flow channel will be designed with intermittent online wetlands and bio-engineered habitat features.

Collectively, the revitalized creek corridor will enhance fish and wildlife habitat and strengthen ecological connectivity between the Jim Tovey Lakeview Conservation Area and City of Mississauga Natural Area LV2.

The following table describes the proposed "online" versus "offline" channel length and area (all of the proposed channel will receive low flows as a result of removing the flow diversion to the WWTP). There will be a net increase in the overall "online" NHS length and area.

Proposed	Online NHS Area and Length	Offline NHS area and Length	Total Corridor area and Length
Lakeview	1.12 ha / 615 m	-	1.12 ha / 615 m
Plaster Form Inc.	0.9 ha / 400 m	-	0.9 ha / 400 m
WWTP	-	-	-
Total	2.02 ha / 1015 m		2.02 ha / 1015 m

ECOLOGICAL OBJECTIVES ACHIEVED

R1-7 (Improve Habitat Quality) - Increase cover of wetlands in the coastal reach through Jim Tovey Lakeview Conservation Area. Channel works associated with land redevelopment should consider pocket wetlands within the creek corridor. Wet meadow should be considered in the hydro corridor associated with Serson Creek, as feasible.

R1-10 (Connect Habitat) - Maintain existing terrestrial connectivity between Serson Creek, G.E Booth woodland, Applewood Creek, and Marie Curtis Park.

R1-12 (Connect Habitat) – Improve fish passage from the lake to the upper reaches of Serson Creek for spawning, feeding and rearing.

Additional objectives achieved:

- Elimination of flow diversion to WWTP
- Restore channel to original alignment, as feasible.

2.5 RESTORATION

The following considerations are proposed for the various Serson Creek restoration design components:

Main channel:

- All plantings to be comprised of native tree and shrub species
- The main channel and slopes will be planted with shrubs.
- The top of valley will be planted with a mix of trees and shrubs.
- Generous fish and wildlife habitat elements to be incorporated

West side (private setback along Serson Innovation Corridor):

- The west interface will comprise a combination of future commercial, residential and employment uses (Serson Innovation Corridor), with building, parking and open spaces forming the edge condition along Serson Corridor.
- A *minimum 6m setback* is proposed on private property from the top of bank to satisfy the provincial requirement for access to the channel. The setback is proposed to be entirely within *private property* and will form part of the Serson Innovation Corridor "Campus" / trail system.
- The setback will vary in size and will consist of pedestrian / cycling trails, plantings, and will connect the NHS to the Serson Innovation Corridor area
- The continuously linked trail and cycling system will be a key component of Lakeview Village, connecting future neighbourhoods with the surrounding community, parks and conservation lands.
- A 2.4m wide trail (granular or asphalt) to be provided above the top of bank along the west side of the corridor.

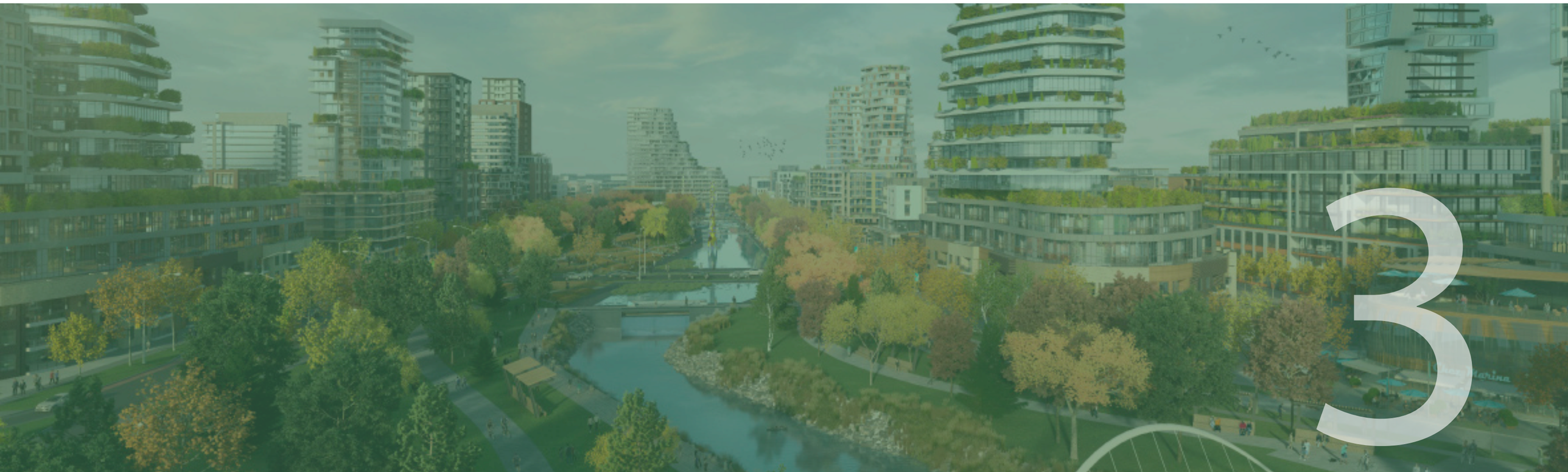
East side (channel banks along WWTP):

- The interface condition along the east side will be predominantly characterized by the G.E. Booth Wastewater Treatment Facility.
- Additional planted screening is desired along this edge to buffer undesirable views to the plant facilities.

Additional Objectives Achieved

- Creation of pedestrian / cycling links between the lake and Lakeshore Road East

NHS DESIGN SUMMARY



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Existing site conditions of Lakeview Village

3 NHS DESIGN SUMMARY

3.1 NHS DESIGN SUMMARY

The preceding sections illustrate how the key objectives for the Serson Creek rehabilitation can be achived.

There is an overall net gain in "online" NHS length and area and a net reduction in total floodplain area, which benefits not only the Lakeview Village lands but also the adjacent properties (Plaster Form Inc. and the Region of Peel's WWTP).

The following table compares the existing and proposed Serson Creek NHS system and demonstrates the net gain achievable.

Existing	Online NHS Area and Length	Offline NHS area and Length	Total Corridor area and Length	Floodplain area
Lakeview Village	0.25 ha / 250 m	0.70 ha / 530 m	0.95 ha / 780 m	1.20 ha
Plaster Form Inc.	0.16 ha / 158 m	-	0.16 ha / 158 m	1.18 ha
WWTP	-	-	-	1.1 ha & SPILL
Total	0.41 ha / 408 m	0.70 ha / 530 m	1.11 ha / 938 m	3.48 ha

Proposed	Online NHS Area and Length	Offline NHS area and Length	Total Corridor area and Length	Floodplain area
Lakeview	1.12 ha / 615 m	-	1.12 ha / 615 m	1.12 ha
Plaster Form Inc.	0.9 ha / 400 m	-	0.9 ha / 400 m	0.9 ha
WWTP	-	-	-	-
Total	2.02 ha / 1015 m		2.02 ha / 1015 m	2.02 ha

Proposed	Online NHS Area and Length	Offline NHS area and Length	Total Corridor area and Length	Floodplain area
Lakeview	+0.87 ha / +365 m	-0.70 ha / -530 m	+0.17 ha / -165 m	-0.08 ha
Plaster Form Inc.	+0.74 ha / +242 m	-	+0.74 ha / +242 m	-0.28 ha
WWTP	-	-	-	-1.1 ha & NO SPILL
Total	+1.61 ha / +607 m	-0.70 ha / -530 m	+0.91 ha / +77 m	-0.35 ha

TERMS OF REFERENCE FOR DETAILED NHS DESIGN

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Figure 7a - Preliminary Inspiration Point district concept

4 TERMS OF REFERENCE FOR DETAILED NHS DESIGN

4.1 TERMS OF REFERENCE FOR DETAILED DESIGN

The Lakeview Village Development Master Plan and Draft Plan are anticipated to evolve over time. At this time, the preceding functional design brief has outlined the key design concepts and channel block requirements for the rehabilitated Serson Creek corridor. It is recognized that additional supporting studies and design work are required to complete the detailed NHS design brief. At a minimum, the following items should be incorporated into the detailed NHS design brief:

- Detailed fluvial geomorphologic design brief including erosion hazard assessment and detailed planform / natural channel design
- CVC Culvert crossing fact sheets
- Detailed channel grading (plan & profile, cross-sections)
- Geotechnical study with emphasis on proposed slope stability / slope design
- Detailed restoration plan including species list, planting details
- Wildlife passage details
- Aquatic and terrestrial habitat design
- Detailed design of future culvert crossing
- Detailed design of tie-in to Jim Tovey Lakeview Conservation Area
- Trail alignment and design concepts
- Detailed hydraulic analysis and floodplain mapping including summary of water levels
- Hydraulic analysis of interim conditions, if applicable
- Impact assessment / water balance for G.E. Booth Woodland
- Wildlife barrier design, if applicable
- Stormwater management strategy and impact to channel flows for blocks adjacent to Serson Creek
- NHS Operation and Maintenance Recommendations
- Detailed Channel Staging/Implementation and Erosion and Sediment Control plans