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An Urban Natural Channel Design Case Study

Converting Aging Concrete Infrastructure to a Natural Channel in Brampton

Presented by: Jeremi Madsen
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Restoration and Resource Management | Restoration and Infrastructure

March 26, 2024

Toronto and Region Conservation Authority

Agenda

1. TRCA's Natural Channel Program
2. Ten Year Channel Study
3. Jefferson, Jordan and Jayfield Parks Natural Channel Restoration
4. Eastbourne Park Natural Channel Restoration
5. What's Next?
6. Q&A

TRCA's Natural Channel Program

- Restore natural channel form and function
- Remove barriers to fish passage
- Provide connectivity to headwaters
- Provide floodplain storage and attenuating flows
- Improve overall fish habitat and spawning areas
- Improve water quality
- Remove failing infrastructure (hardened channels at end of life)
- Nature based solutions to extreme flooding and erosion

Concrete-Lined Channels

- Many watercourses in Brampton were channelized approximately 50 years ago with concrete linings or other hard bed and bank treatments to improve stream conveyance of storm flows.
- Many of these channels are now failing which can lead to uncontrolled erosion that may place property and infrastructure at risk as well as contribute to local flooding and environmental impacts.
- The rate of deterioration may accelerate as a result of extreme weather events and major failures have already been observed.

TRCA's Natural Channel Program: Upper Mimico (2007)

- Started with Upper Mimico stream restoration
- Channelized reach approximately 1200m long
- Hardened bank and bed treatments

TRCA's Natural Channel Program: Alfred Kuehne (2012)

Pre-Construction Conditions

- 500m concrete channel
- Fish species absent
- Non-native plants
- Flash flood events
- Poor water quality

Post Construction Conditions

- Concrete channel decommissioned
- 500 meters of natural channel restored
- Floodplain wetlands incorporated
- Six new fish species present
- Native trees and shrubs planted

Before **After**

Ten Year Channel Study

Ten Year Strategic Plan for Urban Stream Restoration in City of Brampton

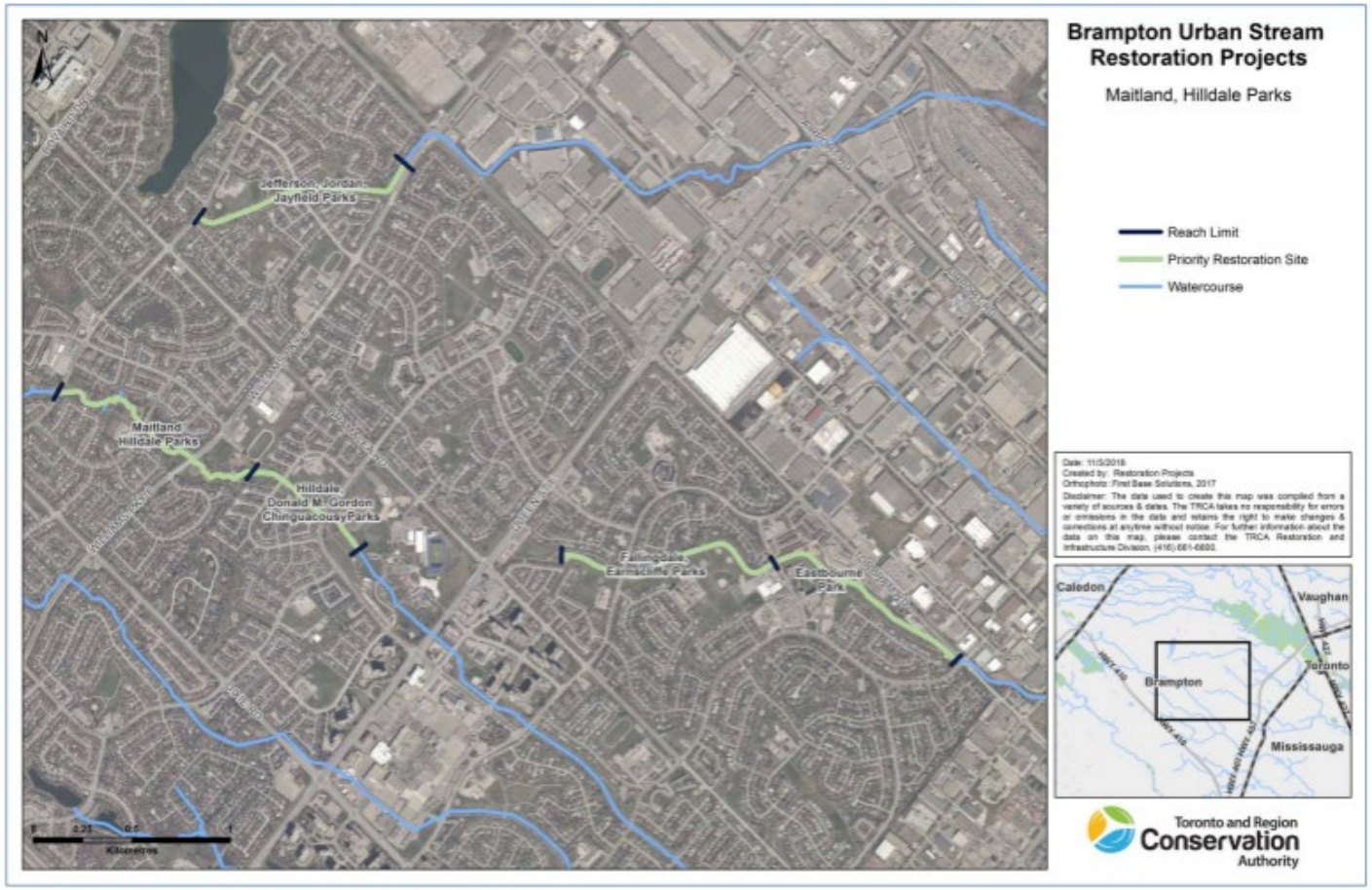

Figure 1: Overview of the five proposed restoration project sites.

Ten Year Strategic Plan for Urban Stream Restoration in City of Brampton

- In 2018 TRCA completed a 10-year Natural Channel Rehabilitation Plan, which identified and prioritized channels requiring attention throughout the City of Brampton

- Reaches that did not impact downstream if concrete was removed were assessed for natural channel restoration potential

- 5 Priority Sites identified:
    - Jefferson, Jordan and Jayfield Parks
    - Eastbourne Park
    - Fallingdale and Earnscliffe Park
    - Donald M. Gordon Chinguacousy and Hilldale Parks
    - Maitland and Hilldale Parks


Brampton Urban Stream Restoration Projects
Maitland, Hilldale Parks
Reach Limit
Priority Restoration Site
Watercourse
Jefferson, Jordan, Jayfield Parks
Maitland Hilldale Parks
Hilldale, Donald M. Gordon Chinguacousy Parks
Fallingdale, Earnscliffe Parks
Eastbourne Park
BOVAIRD DRIVE
AIRPORT RD
WILLIAMS PKWY
BRAMALEA RD
QUEEN ST E
TORBRAM RD
DIXIE RD
Date: 11/5/2018
Created by: Restoration Projects
Orthophoto: First Base Solutions, 2017
Disclaimer: The data used to create this map was compiled from a variety of sources & dates. The TRCA takes no responsibility for errors or omissions in the data and retains the right to make changes & corrections at anytime without notice. For further information about the data on this map, please contact the TRCA Restoration and Infrastructure Division. (416) 661-6600.
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Site 1 of Ten Year Channel Study

Jefferson, Jordan and Jayfield (JJJ) Park

- Concrete lined straightened channel, built in the late 1960's
- Channel and associated infrastructure showing signs of degradation and failure
- Lacks natural morphology and habitat features
- Reduced the capacity of the channel to convey large volumes of water during storm events
- Lacked natural cover, native riparian plants and connection to the floodplain

Jefferson, Jordan and Jayfield Parks (JJJ) Natural Channel Restoration (2020)

- Consisted of 1000m of Natural Channel restoration including 150m of new trail alignment
- Eco Park amenities installed (Outdoor Amphitheatre, Outdoor Classroom, Log play structure, log benches and lookout areas)
- Trees Planted: 8,425 trees and shrubs, 360 calipers, 7000 bioengineering stakes

Jefferson Park: Before and After

Channelized stream before restoration

New channel immediately post-construction

Restored channel with native plantings on banks

Brampton's Eco Parks Strategy

- **Brampton Eco Park** is the interconnected network of sustainable urban and natural spaces interwoven and embedded in the city's urban form.
- Brampton Eco Park fosters local stewardship and pride, encourages active and connected communities, and helps builds attractive neighbourhoods, all the while connecting people with nature, responsibly. It also helps protect and support City infrastructure while conserving, enhancing, and celebrating Brampton's natural landscapes.

Eco Park Principles

1. Maximize ecological value
2. Provide opportunities for social services
3. Make nature visible
4. Design with nature
5. Integrate with the surrounding community
6. Support innovation
7. Reflect local identify

JJJ Today: A High-Functioning ECO SPACE

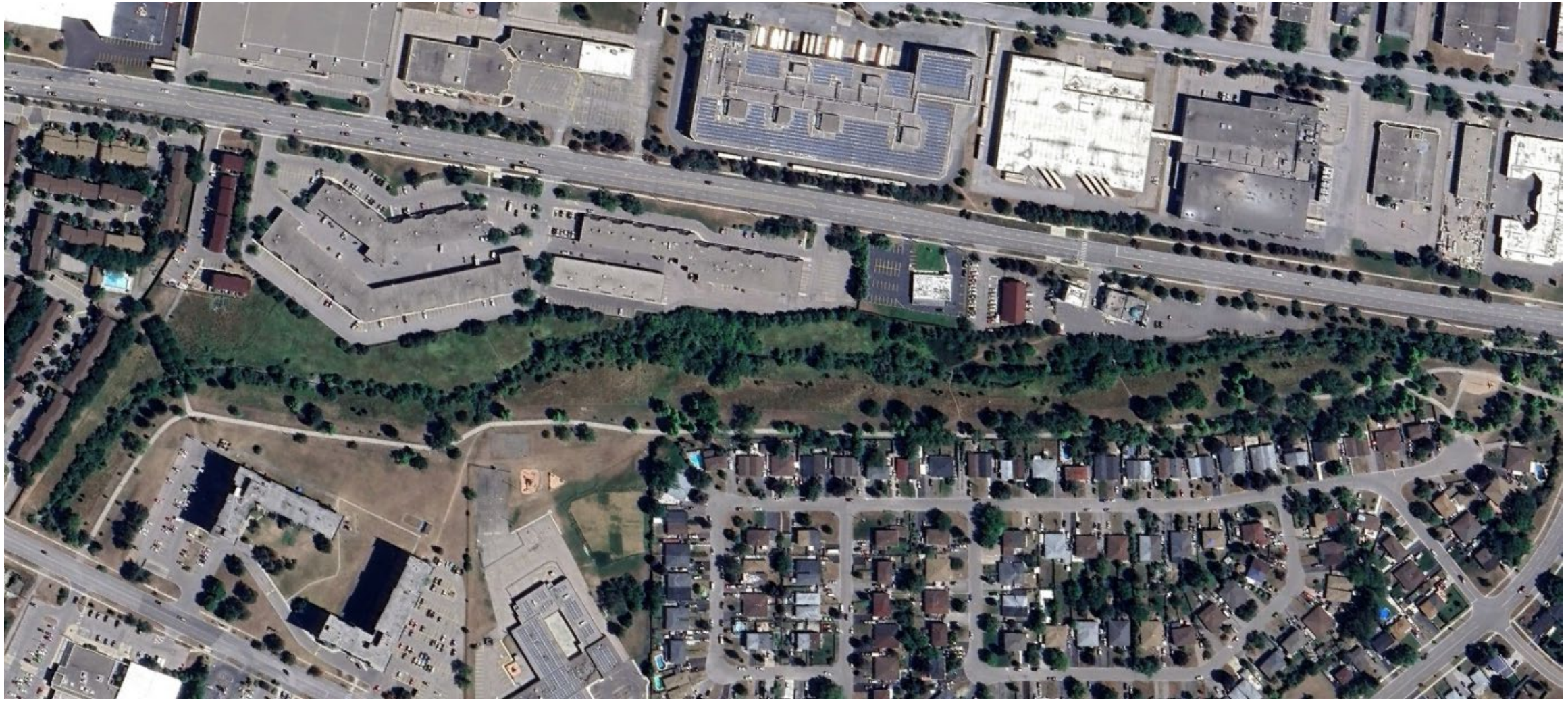
Channel naturalization

Tree plantings

Seating areas

Viewing nodes

Eastbourne Park Natural Channel Restoration (2023)



Historic Photos

Eastbourne Park 1967

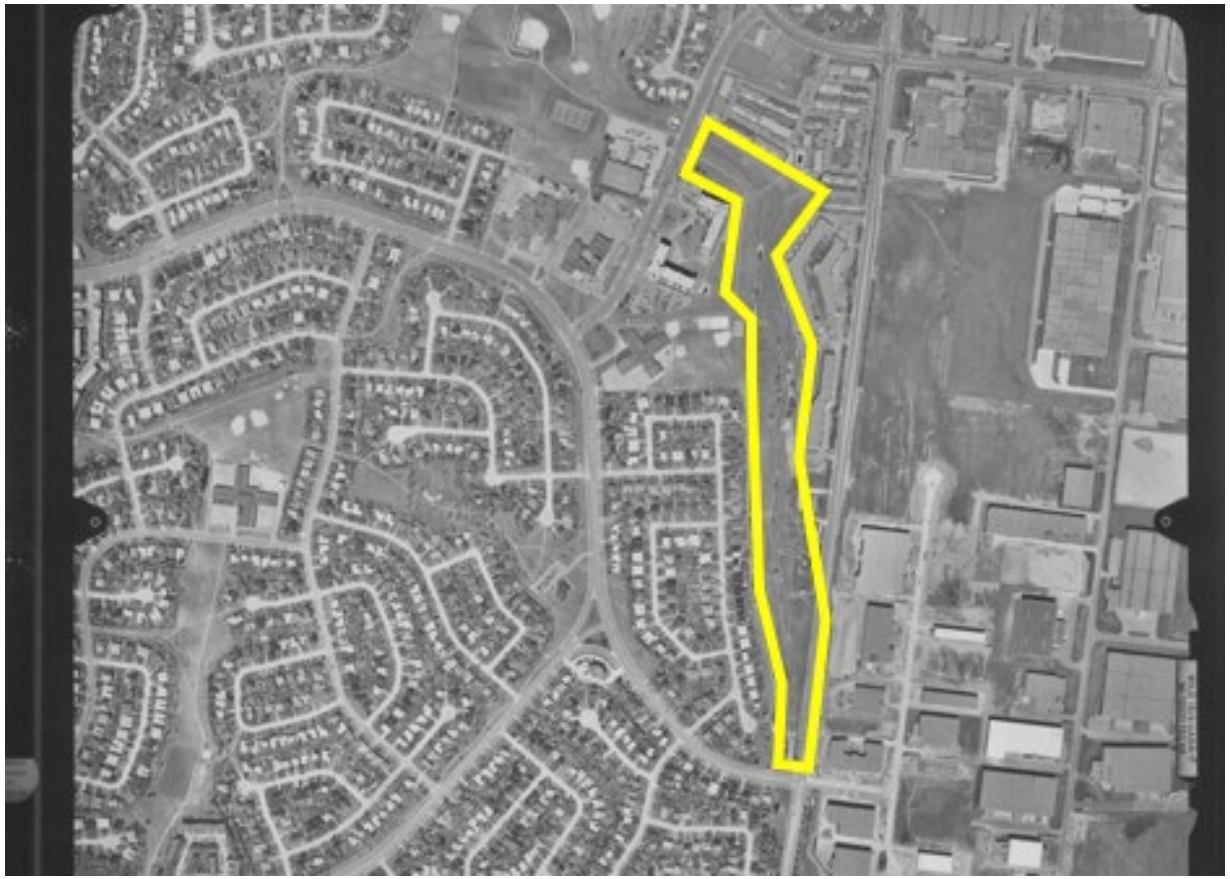
- Natural channel meandering through agricultural lands.
- Beginning of subdivision development.

Eastbourne Park 1976

- Concrete channelization at the top of the park, downstream remains natural.
- Expansion of subdivision developments west and north of the park.

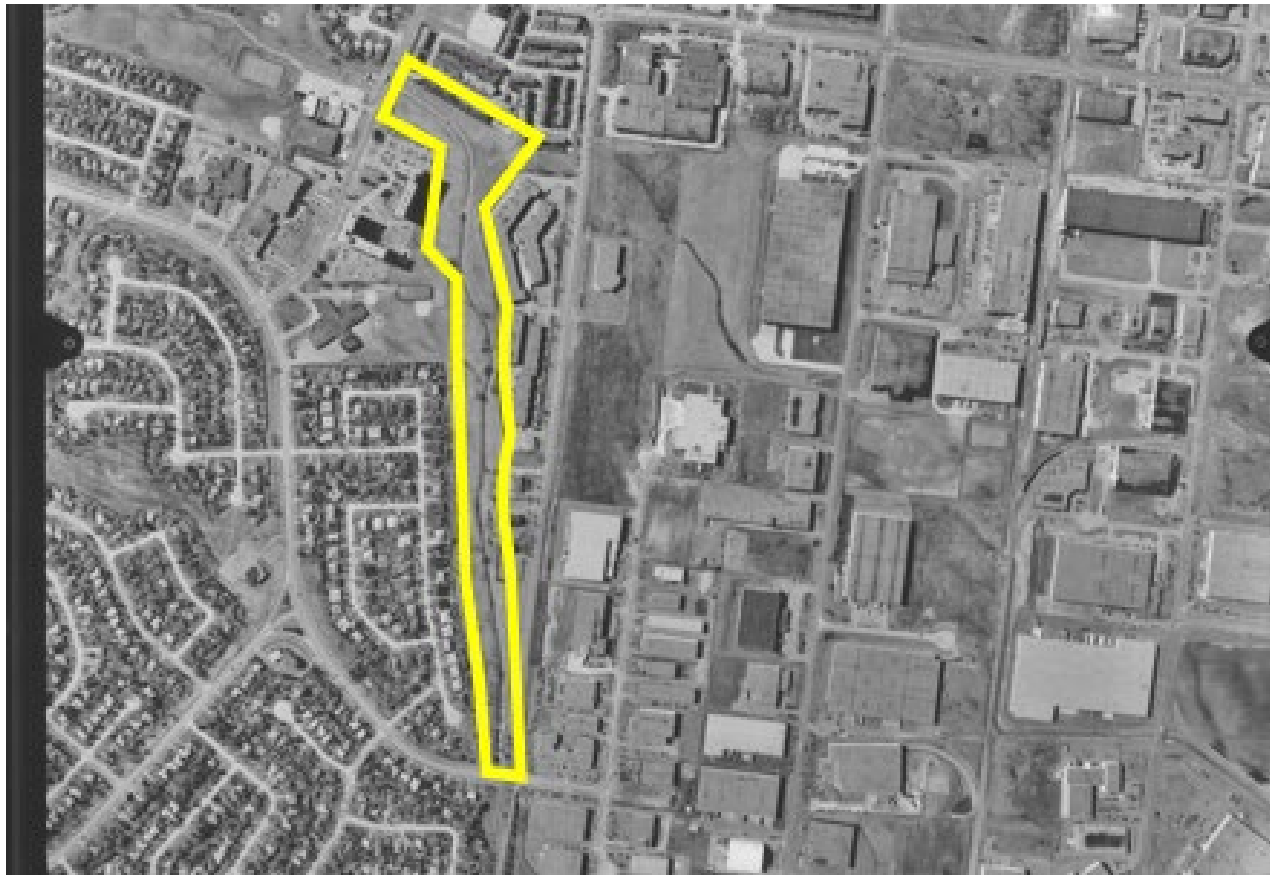
Historic Photos

Eastbourne Park 1989



- Full channelization of the of the Creek by 1989.
- Housing and commercial developments flanking the creek on both sides.

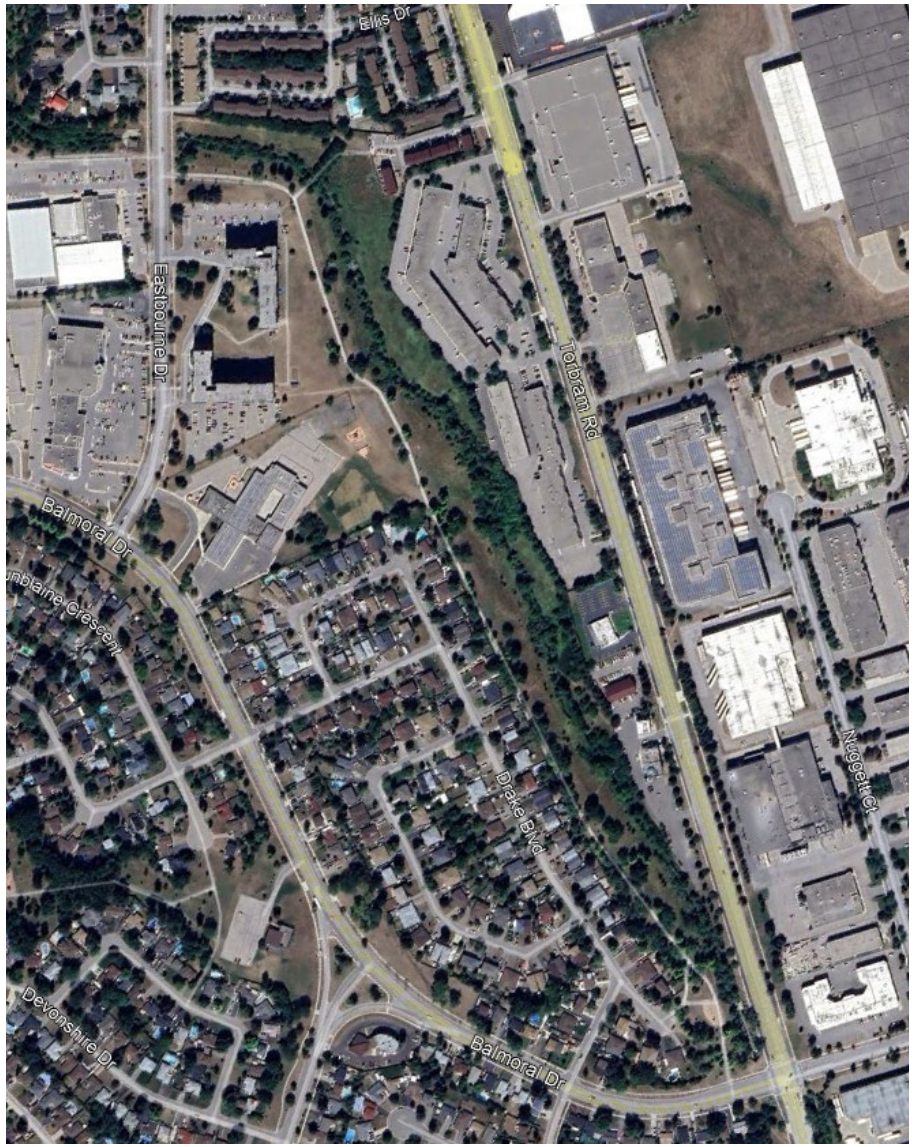
Eastbourne Park 1993



- Similar to pre-restoration day appearance.
- Minimal natural cover and riparian area.

Park Background and Use

- Open greenspace located within the Mimico Creek watershed
- Primarily residential surrounding uses, with some commercial and institutional uses (ex. Eastbourne Drive Public School)
- Existing trail along the western edge of the park provides connections from Eastbourne Drive to Balmoral Drive
- A pedestrian bridge provides access to the trail from an apartment complex north of the park
- Playground located at the south end of the park
- Various informal crossings



Existing Conditions

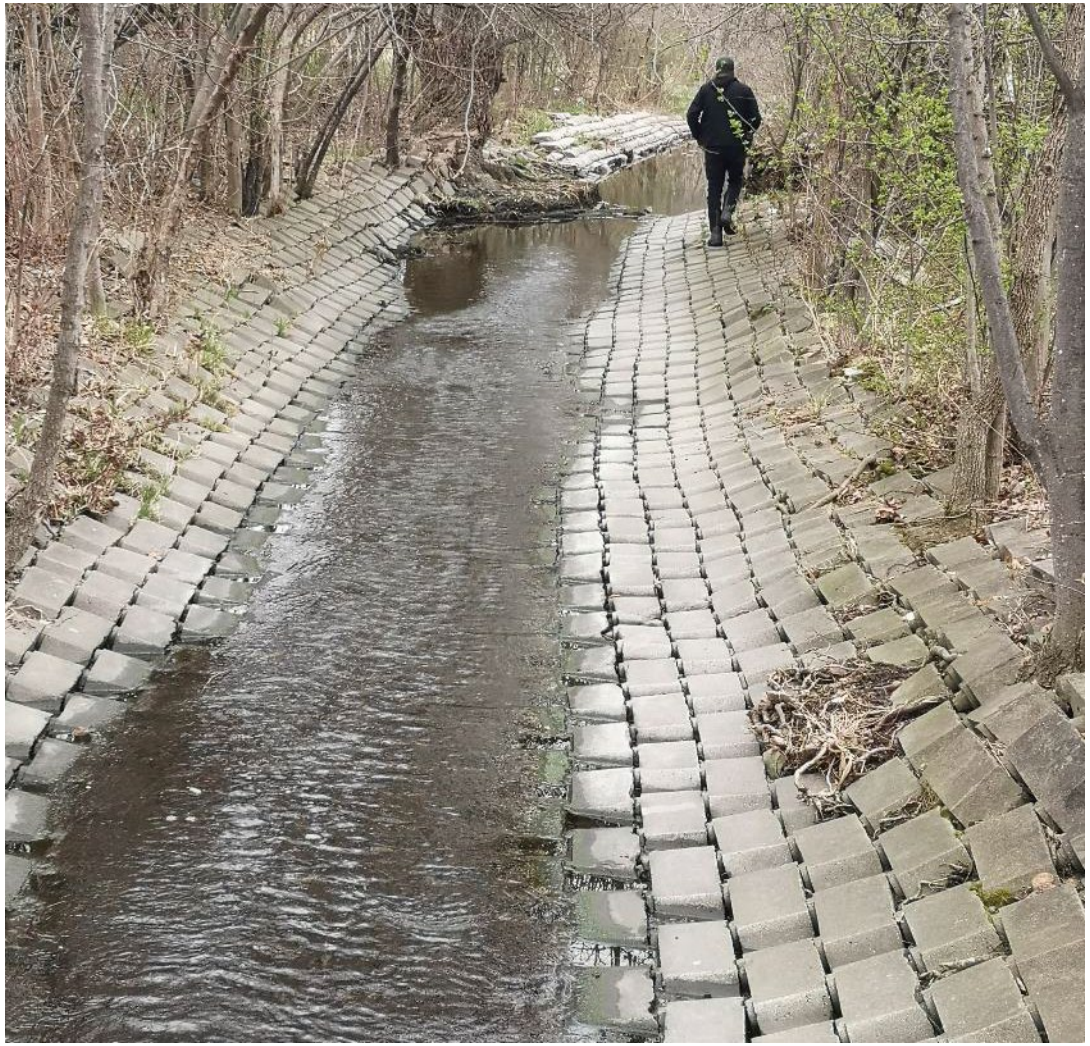
- Narrow riparian buffer of trees and shrubs surrounded by parkland and grasses
- TRCA's existing data for flora and fauna was reviewed; no locally significant flora or fauna were identified
- No capture of fish species have been recorded within the reach

Existing Channel

- Bed and banks of much of the reach were hardened with concrete and concrete matting
- 12 concrete drop structures acted as barriers to fish passage
- Channel widening and active migration observed in areas that were unarmoured or where armouring had failed
- Elevated stormwater outfalls were undermined throughout the reach

Failing Infrastructure

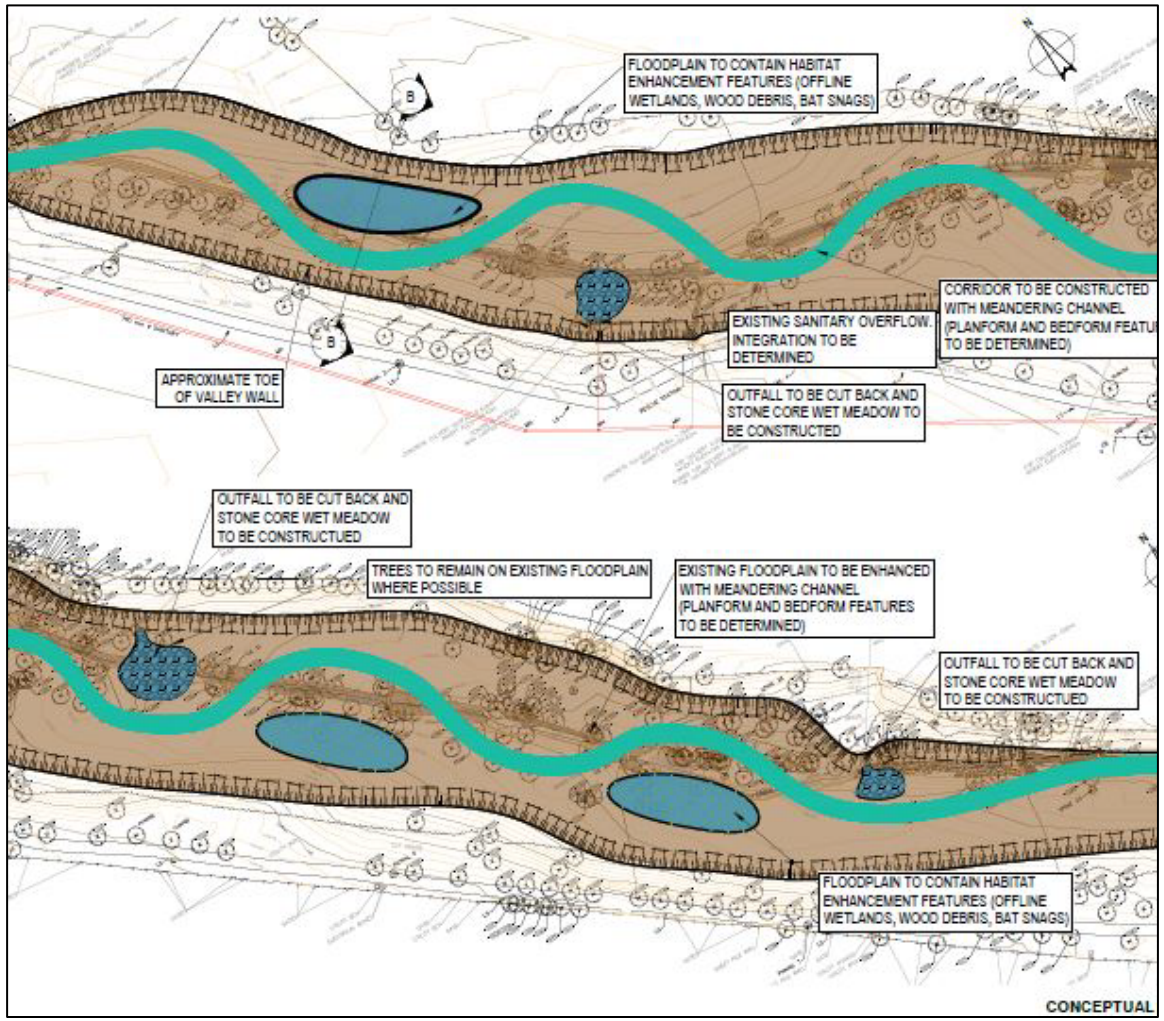
Failing Infrastructure (cont.)



Drop Structures

Design

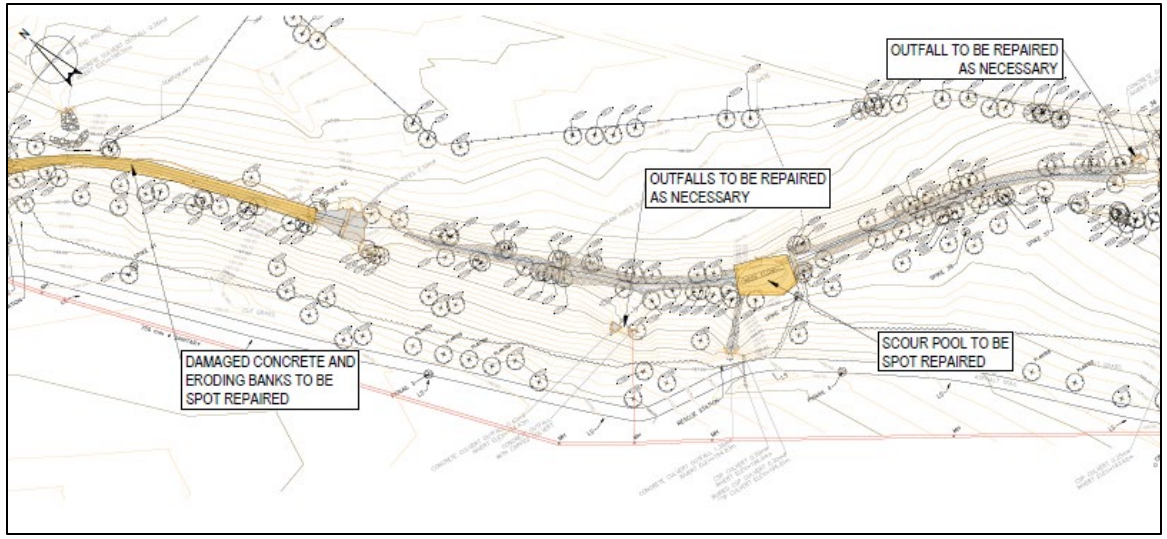
- TRCA retained a consultant to provide fluvial geomorphology and engineering services.
- A geomorphic assessment was completed, and design alternatives were developed for the restoration and re-naturalization of Eastbourne Park.



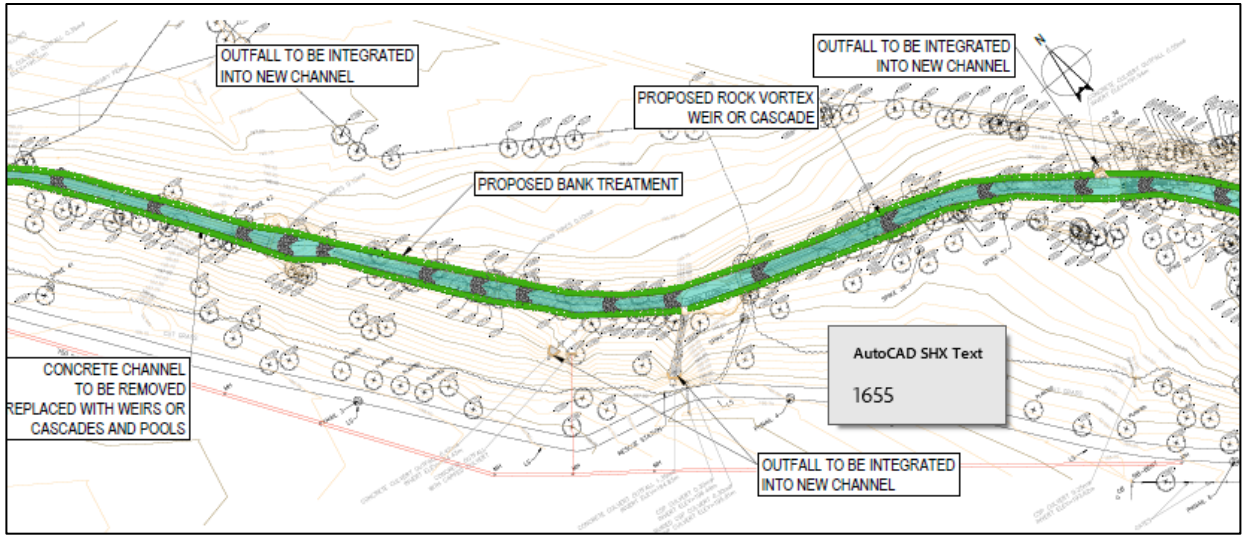
Design Alternatives

- **Do Nothing Approach -** Leave as is; continued deterioration of channel.
- **Repair in Place -** Spot repair failing concrete treatments, outfalls, and associated bank scour and pool erosion.
- **Weir/Cascades and Pools -** Replace hard treatments with a channel consisting of pools and rock vortex weirs or cascades
- **Natural Channel Design -** Replace hard treatments with a new natural channel design with pools, weirs, and cascades.
- **Corridor with Meandering Channel -** Removal of the hard treatments and replacement with a naturalized stream corridor with meandering channel, fully widened floodplain and offline wetlands

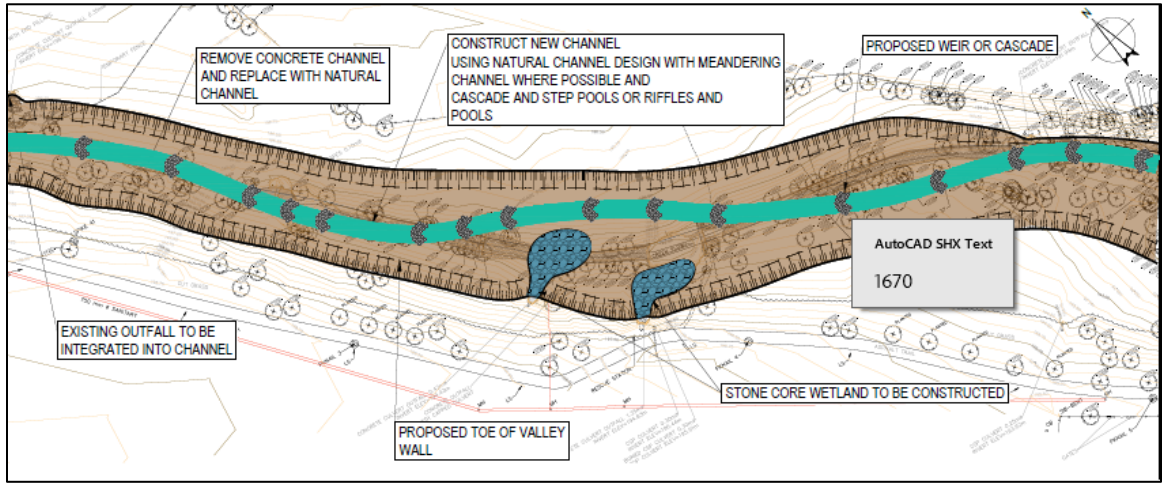
Design Alternatives (cont.)



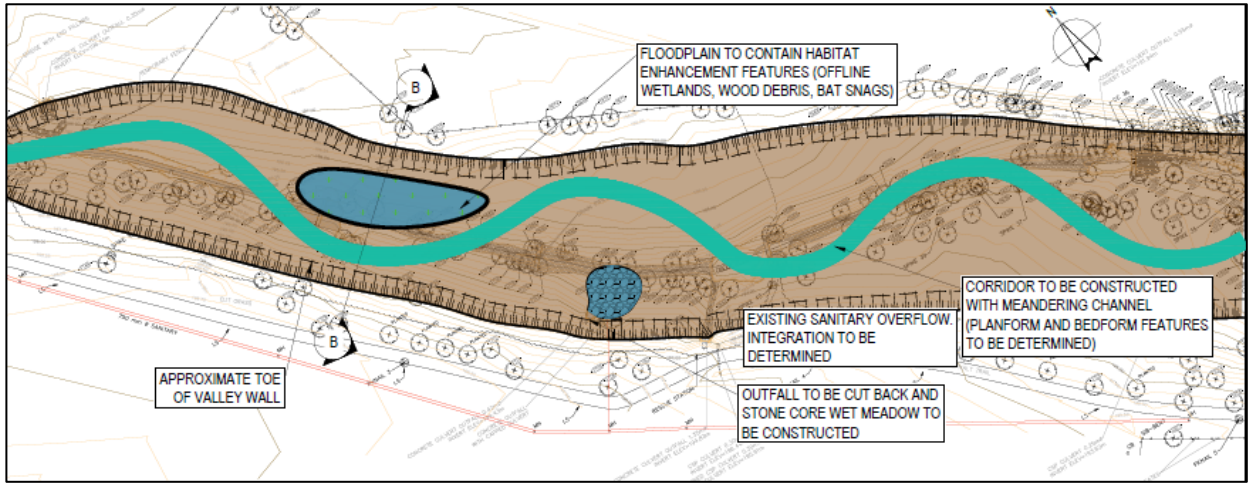
Repair in Place



Weir/Cascades and Pools



Natural Channel Design

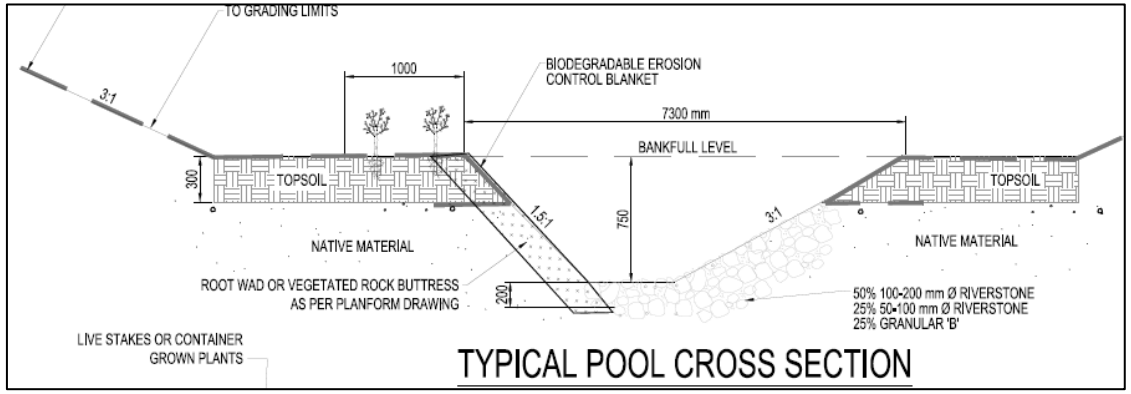


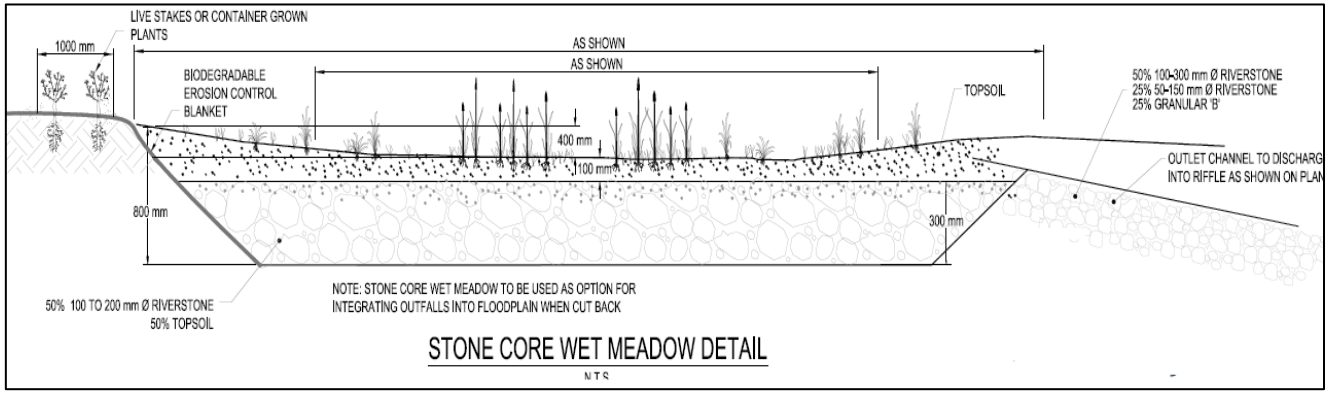
Corridor with Meandering Channel

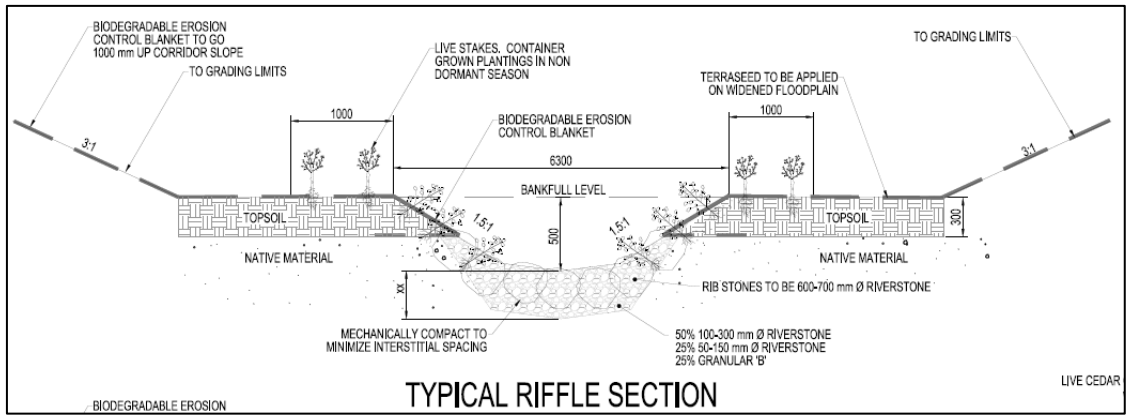
Design Drawings: Preferred Option

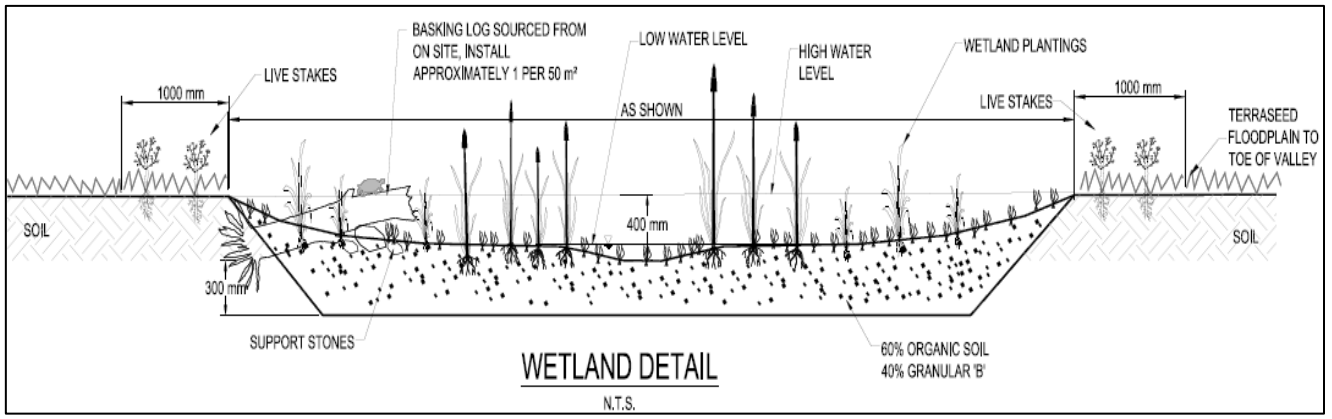
- Mitigation of the steep channel grade and dependence on weirs/drop structures through a meandering design.
- Improvement in aquatic habitat quality through riffles, pools, and streambank vegetation.
- Riparian wetlands and plantings provide the opportunity to incorporate additional habitat features (woody debris, bat snags, etc.)
- Increased connectivity of the channel with its floodplain resulting in improved floodwater management by riparian wetlands.

Design Drawings: Details









Community Engagement

- Public meeting held to engage local residents and obtain feedback.

Construction

Construction (cont.)

Before and After Photos

Before and After (cont.)

Floodplain Wetlands

Next Phase: Fallingdale and Earnscliffe Parks

- Parks located directly upstream of Eastbourne Restoration Project
- Replace hardened channel with softer semi-natural treatments.
- Remove barriers to fish passage.
- Work with Brampton to incorporate SWM objectives into project.

Q & A

Thank You

✉ Jeremi.Madsen@trca.ca – TRCA

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