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King's Park Stormwater Management Project:

Utilizing Green-Infrastructure and Natural Channel Design Techniques

Presented by: Clifton Coppolino
Senior Project Manager, Restoration Projects
Restoration and Resource Management | Restoration and Infrastructure

March 27, 2025

Toronto and Region Conservation Authority

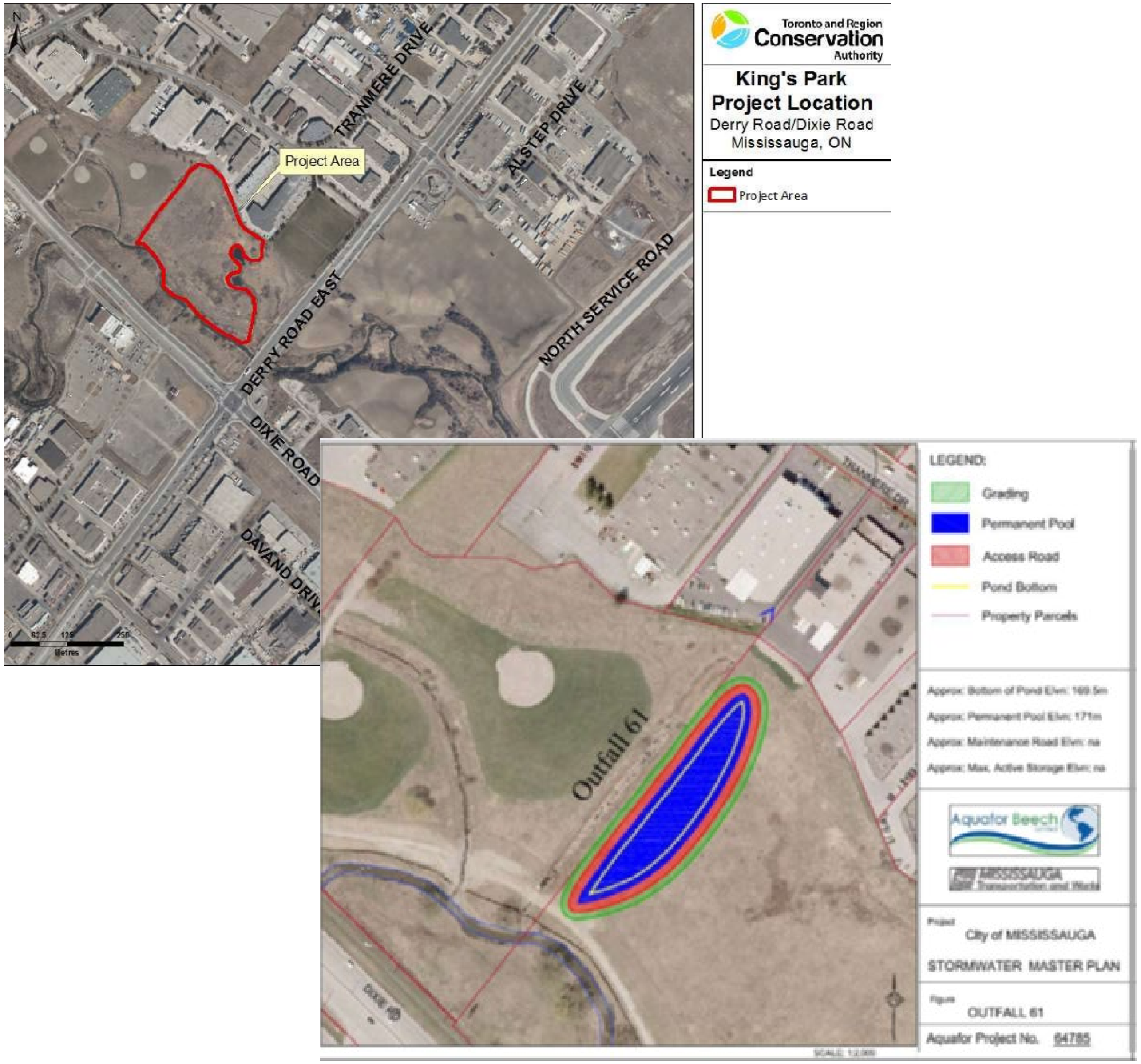
Agenda

1. Project Background
2. Concept and Original Design
3. Project Constraints
4. Design Alternatives
5. Design Solution
6. Implementation
7. Monitoring
8. Initial Findings and Next Steps

Peel Green Infrastructure Program Objectives

- Work closely with partner municipalities and private industry to implement innovative technologies to address future impacts related to an urban development, sustainable communities and changing climate
- Design, construct, and maintain green infrastructure and Low Impact Development (LID) projects in priority urban sites that provide significant benefit to both the water resources and the community

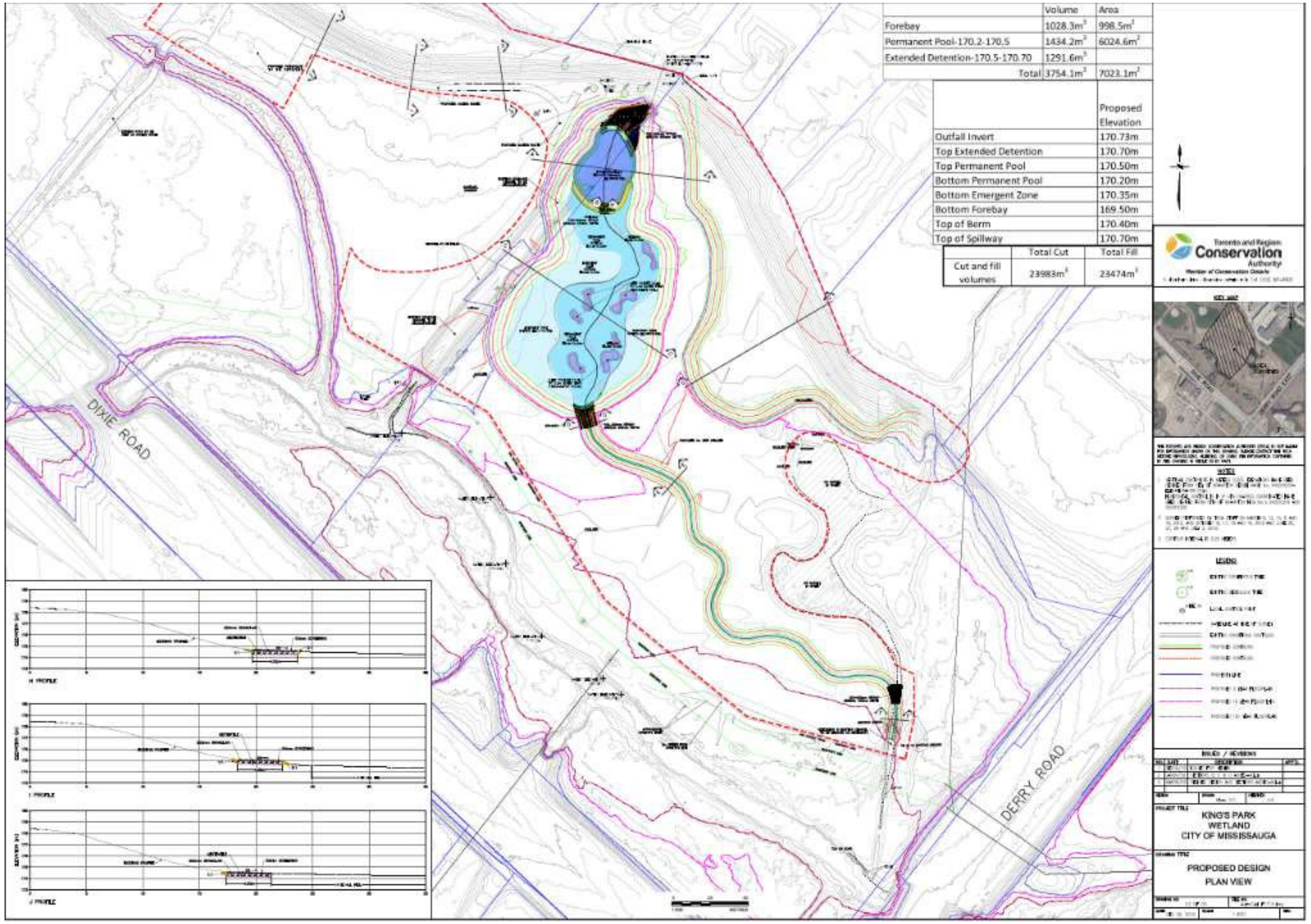
King’s Park- Project Site



- King’s Park is located within the City of Mississauga, at the intersection of Dixie Rd and Derry Rd
- 1946-1985- Agricultural Purposes
- 1987- 1989 an outfall and 225m conveyance channel was created to capture and drain approximately 28 hectares of an industrial/commercial area
- Identified as a location for a stormwater management pond under the City of Mississauga’s stormwater management master plan update (2017)

King's Park Concept Plan

Original Design Package



- Based on the concept, a final design package that achieved treatment of 60-80% Total Suspended Solids (TSS), similar to a typical wet pond, was created
- This consisted of a sediment forebay directly at the location of the outfall, combined with a low-lying tertiary treatment wetland and meandering low flow natural channel to increase the latency period prior to entering the Etobicoke Creek

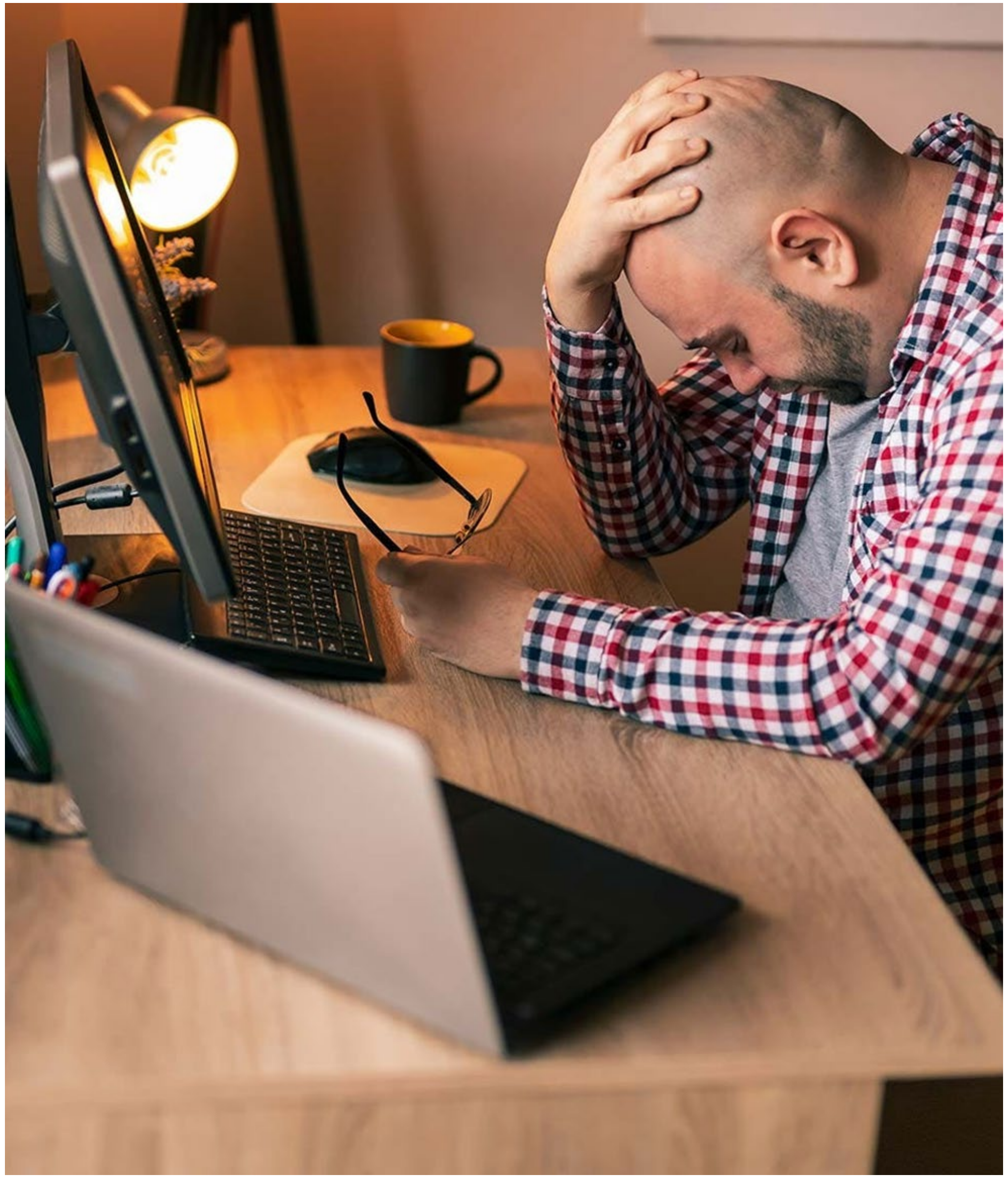
Project Constraints

- Given the proximity to the Toronto Pearson International Airport, the designs were sent to the governing body of the airport, the Greater Toronto Airports Authority (GTAA) for their review and comment
- After reviewing the design, they expressed some concerns:

  - Open water design and attractiveness to birds

  - Close proximity to Canada’s busiest runway (1000m away)

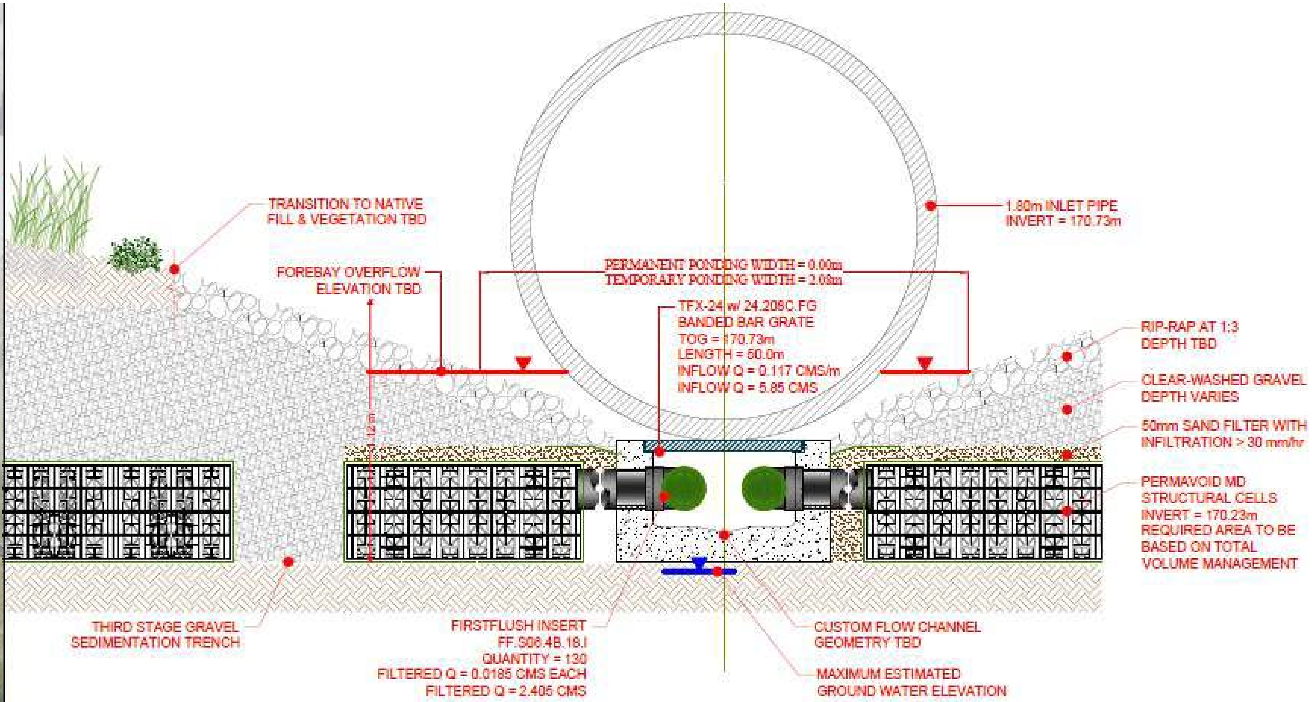
  - Could not support this project




GO BACK AND
START AGAIN

Revised Design- Alternative 1

- Engineered modular units with a 95% void ratio, ultra-shallow profile, linear chamber system with accompanying proprietary filters to help achieve water quality targets from the City
- The system satisfied water quality objective, and there would be no open water to attract birds. However, the system was too costly for the budget allocated, not to mention that the proprietary filters would have to be replaced every year or so. As a result of overall cost to purchase and install, as well as the ongoing maintenance requirements over its lifespan, the technical review team decided against this option and we moved on to Alternative 2



Revised Design- Alternative 2

- A seemingly simple design that would offer a range of benefits to the area including: increasing the latency period from the outfall to the Etobicoke Creek, plantings and habitat structures within the riparian area to provide beneficial vegetation to aid in water quality improvements
- The downfall to this option, albeit the cheapest to implement, would not achieve the overall water quality targets that a typical stormwater management pond would. As a result, this was not selected as the preferred option, and we moved onto Alternative 3

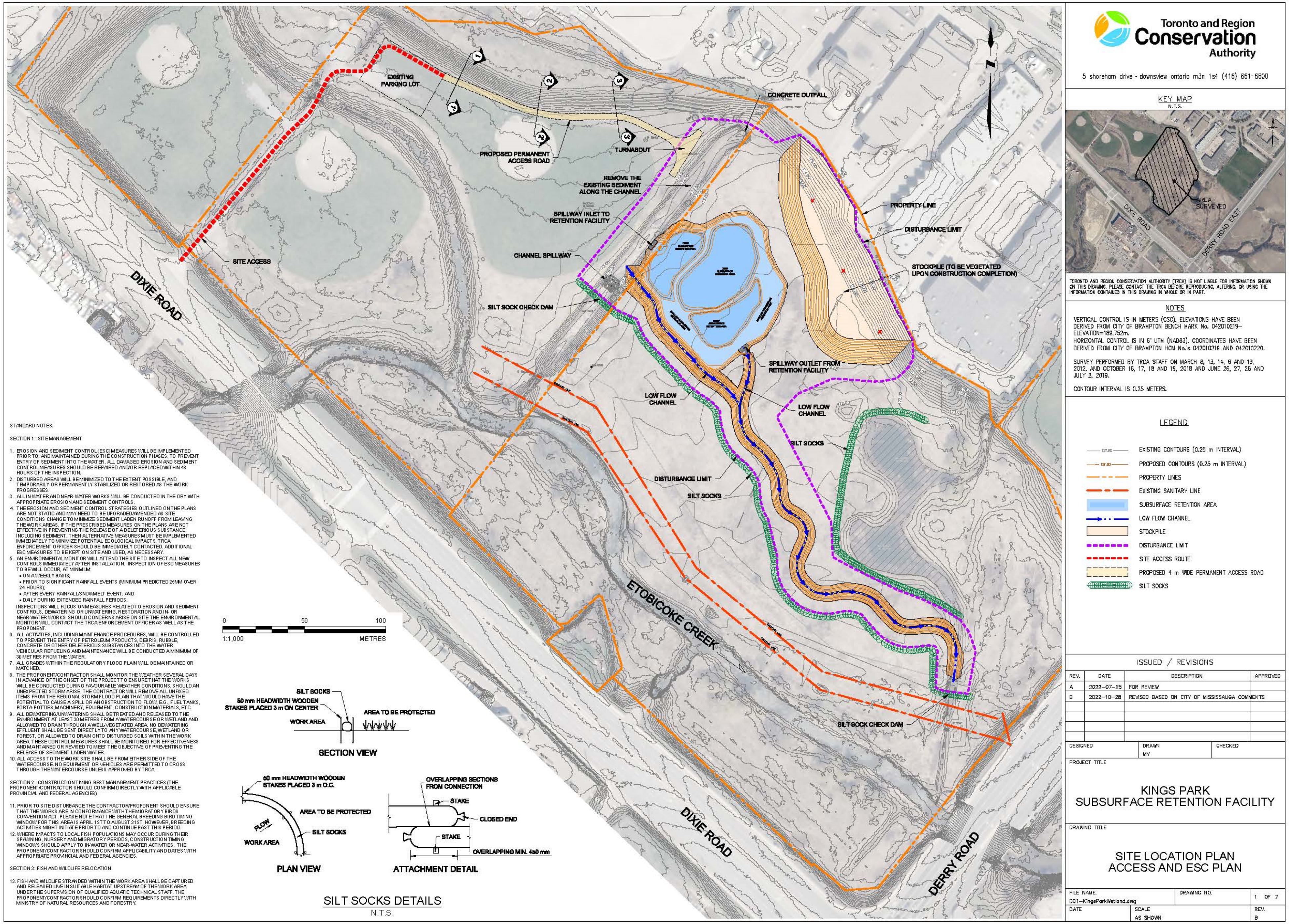
Revised Design- Alternative 3

- New sub-surface treatment design out of stone
- Water would enter directly from the outfall into the facility, and then outlet back into the existing outfall channel closer to the Etobicoke Creek
- Issue with sediment would accumulation or clogging at the inlet making maintenance (cleanouts) a very expensive and seemingly constant endeavor

Revised Design- Alternative 4

- Building on Alternative 3, we came up with a hybrid design that incorporated features of previous alternatives:
  - utilizing the existing outfall channel to act as the 'sediment forebay';
  - creating a spillway in the outfall channel to back up water into both the subsurface treatment facility and low flow natural channel;
  - incorporating a meandering low flow natural channel that accepts water under low flow conditions and lastly;
  - incorporating a subsurface treatment facility similar to Alternative 3, that only accepts water during rain events

Revised Design- Alternative 4



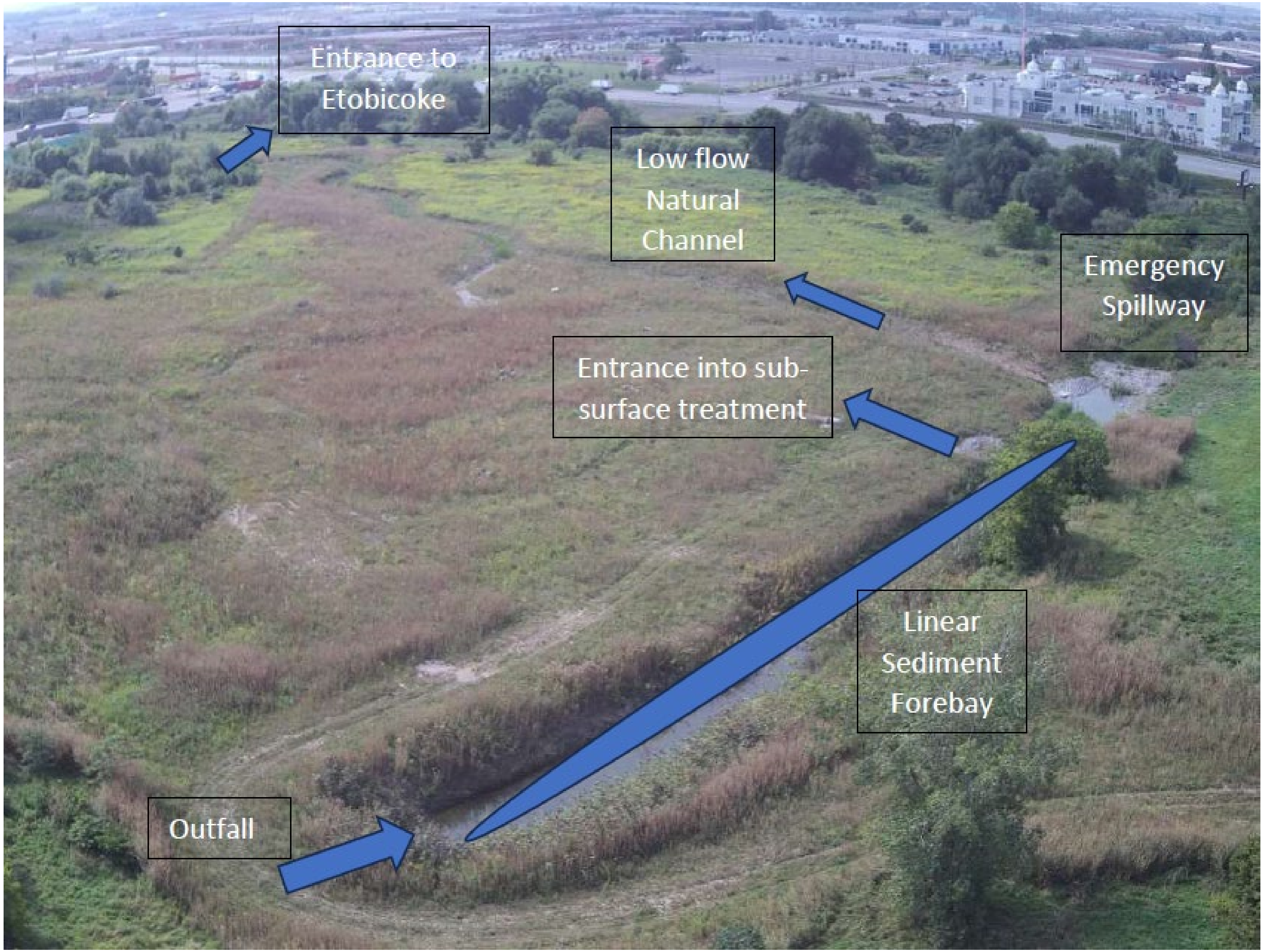
Construction

- Construction occurred in the Spring/Summer of 2023, taking approximately 4.5 months to complete
- A significant amount of material was excavated in order to create the sub-surface facility measuring approximately 7225m2, and was filled with approximately 10,000 tonnes of various sized stone material
- Given the budget constraints, all of the cut material remained on site, creating a large berm along the northeast section of the park (potential future trail)

Before


Off The Bone Meat Products
Gurfateh Sewa Centre
Aldertruckrepair
Print It Now
Derry Rd
Derry Rd
gle Earth
90 m

After


Entrance to Etobicoke
Low flow Natural Channel
Emergency Spillway
Entrance into sub-surface treatment
Linear Sediment Forebay
Outfall

Planting Plan

City of Mississauga
King's Park
2023 Planting Site

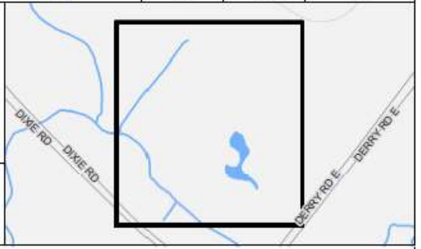
Contact: John MacKinnon

T1 (5,990 m^2): Plant bare root shrubs and potted conifers along constructed channel and around retention cells. Plant bare root deciduous trees and remaining conifers behind shrubs. Increase density by planting seedlings between tall stock.
T2 (17,960 m^2): Plant single species rows in the following pattern: Pw-Sw-Deciduous-Sn-Ce. Replace white pine with white spruce every 3rd cycle. Plant tamarack in wet spots.

Common Name	Botanical Name	Size/ Condition	T1 0.60 ha	T2 1.79	Total Quantity
DECIDUOUS (Bare root)					
Sycamore	*Platanus occidentalis*	60-100 cm bare root	50		50
American/White Elm	*Ulmus americana*	60-100 cm bare root	40		40
Silver Maple	*Acer saccharinum*	60-100 cm bare root	30		30
Bitternut Hickory	*Carya cordiformis*	60-100 cm bare root	30		30
Bur Oak	*Quercus macrocarpa*	60-100 cm bare root	50		50
		SUBTOTAL	**200**	**0**	**200**
SHRUBS (Bare root)					
Red Osier Dogwood	*Cornus stolonifera*	40-60 cm bare root	100		100
Winterberry Holly	*Ilex verticillata*	40-60 cm bare root	100		100
Chokecherry	*Prunus virginiana*	40-60 cm bare root	100		100
Pussy Willow	*Salix discolor*	40-60 cm bare root	100		100
(American) Highbush Cranberry	*Viburnum opulus var. americanum*	40-60 cm bare root	100		100
		SUBTOTAL	**500**	**0**	**500**
CONIFEROUS (Potted)					
Tamarack	*Larix laricina*	2 gal pot	100		100
Eastern White Cedar	*Thuja occidentalis*	2 gal pot	100		100
		SUBTOTAL	**200**	**0**	**200**
REFORESTATION (Seedlings)					
Silver Maple	*Acer saccharinum*	Seedling (1+0)	50	100	150
Bitternut Hickory	*Carya cordiformis*	Seedling (2+0)	50	50	100
Hackberry	*Celtis occidentalis*	Seedling (1+0)		50	50
Black Walnut	*Juglans nigra*	Seedling (1+0)		100	100
Bur Oak	*Quercus macrocarpa*	Seedling (2+0)		100	100
Tamarack	*Larix laricina*	Seedling (J+1)		300	300
White Spruce	*Picea glauca*	Seedling (J+2)		900	900
White Pine	*Pinus strobus*	Seedling (2+2)		600	600
Eastern White Cedar	*Thuja occidentalis*	Seedling (2+2)		800	800
Norway Spruce	*Picea abies*	Seedling (2+2)		800	800
		SUBTOTAL	**100**	**3800**	**3900**
Tree Shelters		**SUBTOTAL**	100	400	**500**
Rodent Guards		**SUBTOTAL**	200	0	**200**
Coco Mats		**SUBTOTAL**	900	0	**900**
		TOTAL	**1000**	**3800**	**4800**

Legend

- Property Boundary
- Reforestation
- Wetland - Tree and Shrub
- Watercourse



Date: 2023-01-23
Created by: Kelly Gibson
Orthophoto: MNRF, 2019

Toronto and Region Conservation Authority

Baseline Data Collection- 2020

ANALYTE	UNIT	PWQO	WQ1			
			10-Jun-20	09-Jul-20	04-Aug-20	Average
Run-Off	n/a	n/a	0mm (none)	6.2mm (low)	0.8mm (none/low)	n/a
Dissolved Solids	mg/L		52.9	**1020**	126	400
Suspended Solids (TSS)	mg/L		3.1	**29.7**	3.7	12.2
Total Phosphorus (TP)	mg/L	0.03	0.027	**0.14**	0.017	0.061

- **3 Water Quality grab samples collected in Summer of 2020 (at Outfall)**
- **Run-Off Conditions are noted as follows:**
  - **None:** No rain within 72 h of sampling
  - **Low:** No rain on sampling date and < 10 mm of rain within 72 h of sampling
  - **Medium:** Between 10-25 mm of rain within 72 hours of sampling
  - **High**: >25 m rain within 72 h of sampling

Monitoring Locations

Post-Construction Monitoring Results- Year 1

Date	Analyte	Run-Off	Units	Site 1	Site 5	Difference
June 11, 2024	Dissolved Solids	Low	mg/L	1110	493	617
June 11, 2024	Suspended Solids (TSS)	Low	mg/L	4.7	1.5	3.2
June 11, 2024	Total Phosphorus (TP)	Low	mg/L	0.027	0.032	-0.005
June 11, 2024	E. coli	Low	CFU/100mL	30	53	-23

- A total of nine samples were collected at all 5 monitoring locations
- Two samples collected per month were taken between June and September, and one sample was taken in October
- Table 2 represents the initial sample taken on June 11th showing a slight decrease in TSS from Site 1 to Site 5

Monitoring Results: Run-off and E.coli

Sample Dates	Run-Off Category	E. coli CFU/100mL
Jun 11 2024	None	30
Jun 27 2024	Low	280
Jul 11 2024	High	1800
Jul 26 2024	Medium	840
Aug 9 2024	Medium	440
Aug 27 2024	None	30
Sept 23 2024	High	40000
Sept 27 2024	Low	170

Post Construction Monitoring Results

Post-construction water quality monitoring results of Site 1 shows similar average units of TSS and TP, and increased levels of E. coli when compared to the Provincial Water quality station

Stormwater Outfall 2024 (WQ1)

Analyte		PWQO	Average	Min	Max
			N=9		
Total Suspended Solids	mg/L		15	1	71
Total Phosphorus as P	mg/L	0.03	0.0346	0.022	0.061
E. coli	CFU/100 mL	100	5448	30	40,000

PWQMN Site#80007 2019-2023

Analyte		N	Average	Min	Max	StdDev
Total Suspended Solids (TSS)	mg/L	50	17	1	254	38
Phosphorus, Total	mg/L	50	0.070	0.012	0.419	0.072
Escherichia coli (E. coli)	CFU/100 mL	46	346	3	2100	452

Post Construction Monitoring Results

When you compare the average values from Site 1 vs right before the system outlets into Etobicoke Creek at Site 5, you notice a couple of things – average TSS and TP values at both locations are very similar, however the average E. coli counts appear to decrease

WQ1 vs WQ5 (average)

Average n=9	WQ1	WQ5
E. Coli (n=8)	5449	3665
Suspended Solids (TSS)	15	14
Total Phosphorus (TP)	0.035	0.036

Initial Findings and Next Steps

- Year 1 data showed no significant improvements in overall water quality entering the Etobicoke Creek
- Monitoring program will continue to collect 5 years post construction data
- Expect to see improvements has site greens up through ongoing riparian and terrestrial plantings

- Focus on comparing results of Site 1 (outfall) to Site 3 (Sub-surface retention facility outlet)
- Tracer testing
  - Where does the water track once it leaves the outfall at Site 1 under all run-off conditions?
  - What storm event/run-off condition does water enter the sub-surface treatment facility? (confirm 2yr storm as designed)
  - How long does the water remain in the sub-surface treatment facility before outletting into the natural channel?
- Thermal Imagery
  - Continue drone thermal imagery for year over year comparison

Thank You!

Clifton.Coppolino@trca.ca – TRCA

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