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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

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

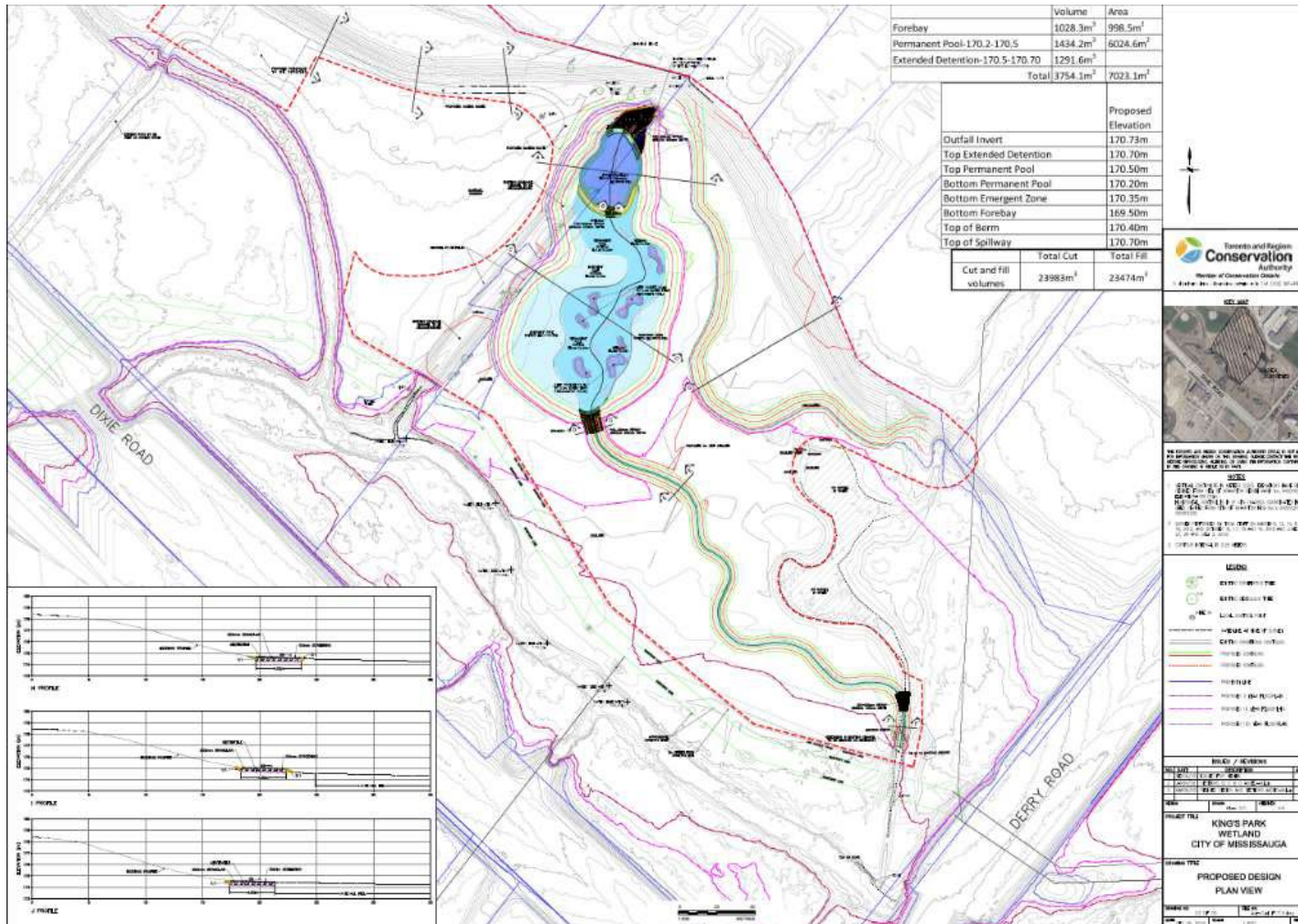


- King's Park is located within the City of Mississauga, at the intersection of Dixie Rd and Derry Rd
- 1946-1985- Agricultural Purposes
- 1987- 1989 an outfall and 225m conveyance channel was created to capture and drain approximately 28 hectares of an industrial/commercial area
- Identified as a location 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

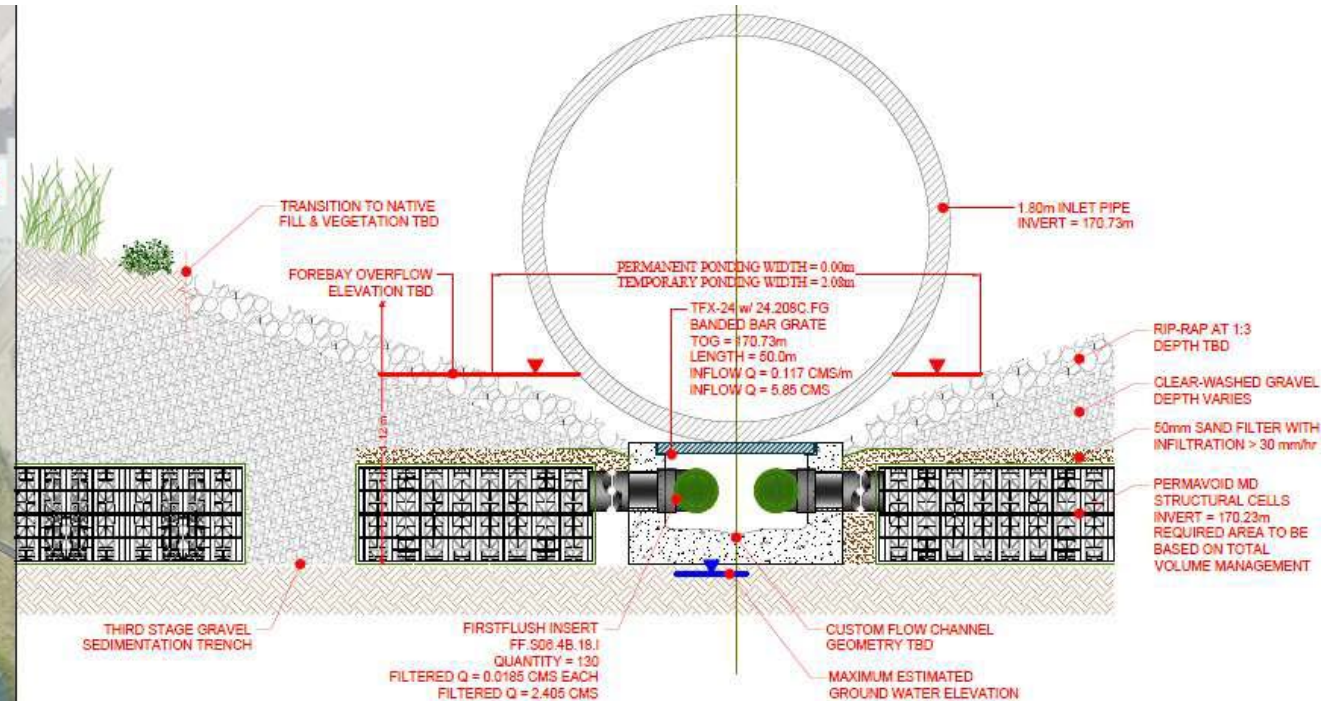
- Given the proximity to the Toronto Pearson International Airport, the designs were sent to the governing body of the airport, the Greater Toronto Airports Authority (GTAA) for their review and comment
- After reviewing the design, they expressed some concerns:
 - Open water design and attractiveness to birds
 - Close proximity to Canada's busiest runway (1000m away)
 - Could not support this project





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



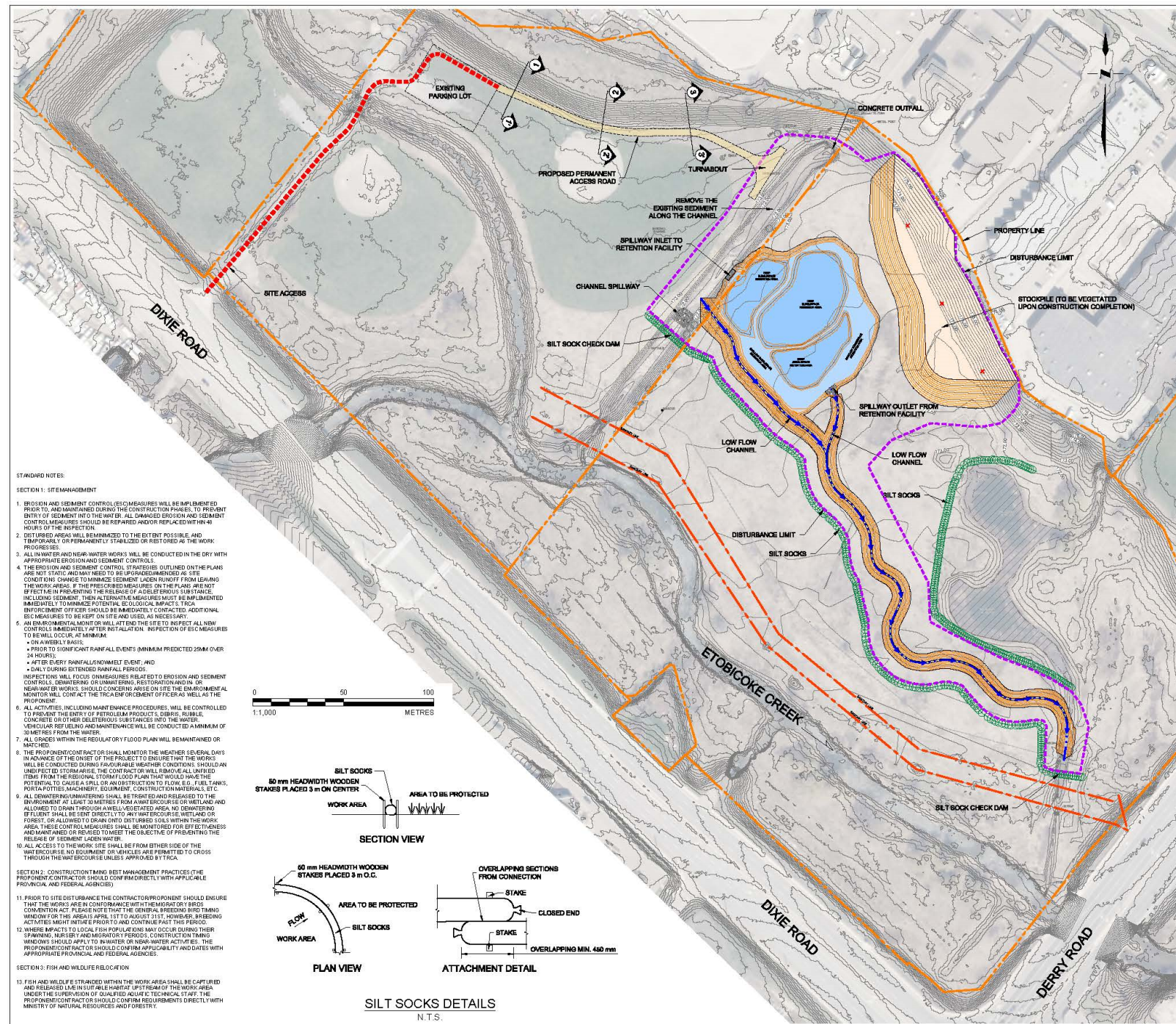
- New sub-surface treatment design out of stone
- Water would enter directly from the outfall into the facility, and then outlet back into the existing outfall channel closer to the Etobicoke Creek
- Issue with sediment would accumulation or clogging at the inlet making maintenance (cleanouts) a very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



STANDARD NOTES:

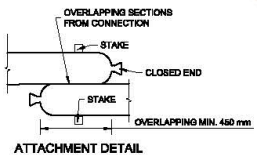
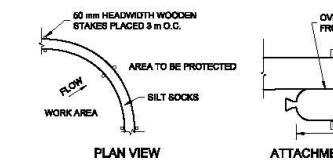
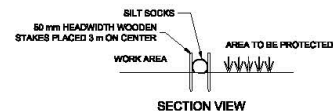
SECTION 1: SITE MANAGEMENT

1. EROSION AND SEDIMENT CONTROL (ESC) MEASURES WILL BE IMPLEMENTED PRIOR TO, AND MAINTAINED DURING THE CONSTRUCTION PHASES, TO PREVENT ENTRY OF SEDIMENT INTO THE WATER. ALL DAMAGED EROSION AND SEDIMENT CONTROL MEASURES SHOULD BE REPAIRED AND/OR REPLACED WITHIN 48 HOURS OF THE INSPECTION.
2. DISTURBED AREA WILL BE REMEDIATED TO THE EXTENT POSSIBLE, AND TEMPORARILY OR PERMANENTLY STABILIZED OR RESTORED AS THE WORK PROGRESSES.
3. ALL IN-WATER AND NEAR-WATER WORKS WILL BE CONDUCTED IN THE DRY WITH APPROPRIATE EROSION AND SEDIMENT CONTROLS.
4. THE EROSION AND SEDIMENT CONTROL STRATEGIES OUTLINED ON THE PLANS ARE NOT STATIC AND MAY NEED TO BE UPGRADED/REMOVED AS SITE CONDITIONS CHANGE TO MINIMIZE SEDIMENT LOADS RUNOFF FROM LEAVING THE WORK AREAS. IF THE PRESCRIBED MEASURES ON THE PLANS ARE NOT EFFECTIVE IN PREVENTING THE RELEASE OF A DISPERSED SUBSTANCE, INCLUDING SEDIMENT, THEN ALTERNATIVE MEASURES MUST BE IMPLEMENTED IMMEDIATELY TO MINIMIZE POTENTIAL ECOLOGICAL IMPACTS. TRCA ENFORCEMENT OFFICER SHOULD BE IMMEDIATELY CONTACTED. ADDITIONAL ESC MEASURES TO BE KEPT ON SITE AND USED, AS NECESSARY.
5. AN ENVIRONMENTAL MONITOR OR WILL ATTEND THE SITE TO INSPECT ALL NEW CONTROLS IMMEDIATELY AFTER INSTALLATION. INSPECTION OF ESC MEASURES TO BE WILL OCCUR, AT MINIMUM:
 - ON A WEEKLY BASIS;
 - PRIOR TO SIGNIFICANT RAINFALL EVENTS (MINIMUM PREDICTED 25MM OVER 24 HOURS);
 - AFTER EVERY RAINFALL SIGNIFICANT EVENT; AND
 - DAILY DURING EXTENDED RAINFALL PERIODS.INSPECTIONS WILL FOCUS ON MEASURES RELATED TO EROSION AND SEDIMENT CONTROL, SEWERING OR UNSEWERING, RESTORATION AND/OR NEAR-WATER WORKS. SHOULD CONCERNS ARISE ON SITE THE ENVIRONMENTAL MONITOR WILL CONTACT THE TRCA ENFORCEMENT OFFICER AS WELL AS THE PROPONENT.
6. ALL ACTIVITIES, INCLUDING MAINTENANCE PROCEDURES, WILL BE CONTROLLED TO PREVENT THE ENTRY OF PETROLEUM PRODUCTS, DEBRIS, RUBBLE, CONCRETE OR OTHER DELETERIOUS SUBSTANCES INTO THE WATER. VEHICULAR REFUELLING AND MAINTENANCE WILL BE CONDUCTED A MINIMUM OF 30 METRES FROM THE WATER.
7. ALL GRADERS WITHIN THE REGULATORY FLOOD PLAIN WILL BE MAINTAINED OR MAINTAINED.
8. THE PROPONENT/CONTRACTOR SHALL MONITOR THE WEATHER SEVERAL DAYS IN ADVANCE OF THE ONSET OF THE PROJECT TO ENSURE THAT THE WORKS WILL BE CONDUCTED DURING FAVOURABLE WEATHER CONDITIONS. SHOULD AN UNEXPECTED STORM ARISE, THE CONTRACTOR WILL ADVISE ALL UNPAID ITEMS FROM THE REGION'S STORM FLOOD PLANS THAT WOULD HAVE THE POTENTIAL TO CAUSE A SPILL OR AN OBSTRUCTION TO FLOW, E.G., FUEL TANKS, PORTA-POTTIES, MACHINERY, EQUIPMENT, CONSTRUCTION MATERIALS, ETC.
9. ALL DRAINAGE/UNWATERING SHALL BE TREATED AND RELEASED TO THE ENVIRONMENT AT LEAST 30 METRES FROM AN ADJACENT WETLAND OR FOREST, OR ALLOWED TO DRAIN ONTO DISTURBED SOILS WITHIN THE WORK AREA. THESE CONTROL MEASURES SHALL BE MONITORED FOR EFFECTIVENESS AND MAINTAINED OR REVISED TO MEET THE OBJECTIVE OF PREVENTING THE RELEASE OF SEDIMENT INTO THE WATER.
10. ALL ACCESS TO THE WORK SITE SHALL BE FROM OTHER SIDE OF THE WATER COURSE. NO EQUIPMENT OR VEHICLES ARE PERMITTED TO CROSS THROUGH THE NEW ESC MEASURES APPROX. 17' FROM.

- ### SECTION 2: CONSTRUCTION TIMING & SITE MANAGEMENT PRACTICES (THE PROPONENT/CONTRACTOR SHOULD CONFIRM DIRECTLY WITH APPLICABLE PROVINCIAL AND FEDERAL AGENCIES)
11. PRIOR TO SITE DISTURBANCE THE CONTRACTOR/PROPOONENT SHOULD ENSURE THAT THE WORKS ARE IN CONFORMANCE WITH THE MORTARATORY BIRDS CONVENTION ACT. PLEASE NOTE THAT THE GENERAL BREEDING AND NESTING WINDOW FOR THE AREA IS APRIL 1ST TO AUGUST 31ST. HOWEVER, BREEDING ACTIVITIES MOST INTENSIVE PRIOR TO AND CONTINUE PAST THIS PERIOD.
 12. WHERE IMPACTS TO LOCAL FISH POPULATIONS MAY OCCUR DURING THEIR SPawning, NURSERY AND MIGRATORY PERIODS CONSTRUCTION TIMING WINDOWS SHOULD APPLY TO IN-WATER OR NEAR-WATER ACTIVITIES. THE PROPONENT/CONTRACTOR SHOULD CONFIRM APPLICABILITY AND DATES WITH APPROPRIATE PROVINCIAL AND FEDERAL AGENCIES.

SECTION 3: FISH AND WILDLIFE LOCATION

13. FISH AND WILDLIFE STRAINED WITHIN THE WORK AREAS SHALL BE CAPTURED AND RELEASED LIVE IN SUFFICIENT UPSTREAM OF THE WORK AREA UNDER THE SUPERVISION OF QUALIFIED ADULT TECHNICAL STAFF. THE PROPONENT/CONTRACTOR SHOULD CONFIRM REQUIREMENTS DIRECTLY WITH MINISTRY OF NATURAL RESOURCES AND FORESTRY.



SILT SOCKS DETAILS
N.T.S.

KEY MAP N.T.S.



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NOTES

VERTICAL CONTROL IS IN METERS (SSC). ELEVATIONS HAVE BEEN DERIVED FROM CITY OF BRAMPTON BENCH MARK NO. 042010219 - ELEVATION=186.750m.
HORIZONTAL CONTROL IS IN UTM (NAD83). COORDINATES HAVE BEEN DERIVED FROM CITY OF BRAMPTON HCM No. 042010219 AND 042010220.
SURVEY PERFORMED BY TRCA STAFF ON MARCH 8, 13, 14, 6 AND 19, 2012, AND OCTOBER 15, 17, 18 AND 19, 2018 AND JUNE 26, 27, 28 AND JULY 2, 2019.

CONTOUR INTERVAL IS 0.25 METERS.

LEGEND

- EXISTING CONTOURS (0.25 m INTERVAL)
- PROPOSED CONTOURS (0.25 m INTERVAL)
- PROPERTY LINES
- EXISTING SANITARY LINE
- SUBSURFACE RETENTION AREA
- LOW FLOW CHANNEL
- STOCKPILE
- DISTURBANCE LIMIT
- SITE ACCESS ROUTE
- PROPOSED 4 m WIDE PERMANENT ACCESS ROAD
- SILT SOCKS

ISSUED / REVISIONS

REV.	DATE	DESCRIPTION	APPROVED
A	2022-07-25	FOR REVIEW	
B	2022-10-28	REVISED BASED ON CITY OF MISSISSAUGA COMMENTS	

DESIGNED	DRAWN	CHECKED
	MY	

PROJECT TITLE

**KINGS PARK
SUBSURFACE RETENTION FACILITY**

DRAWING TITLE

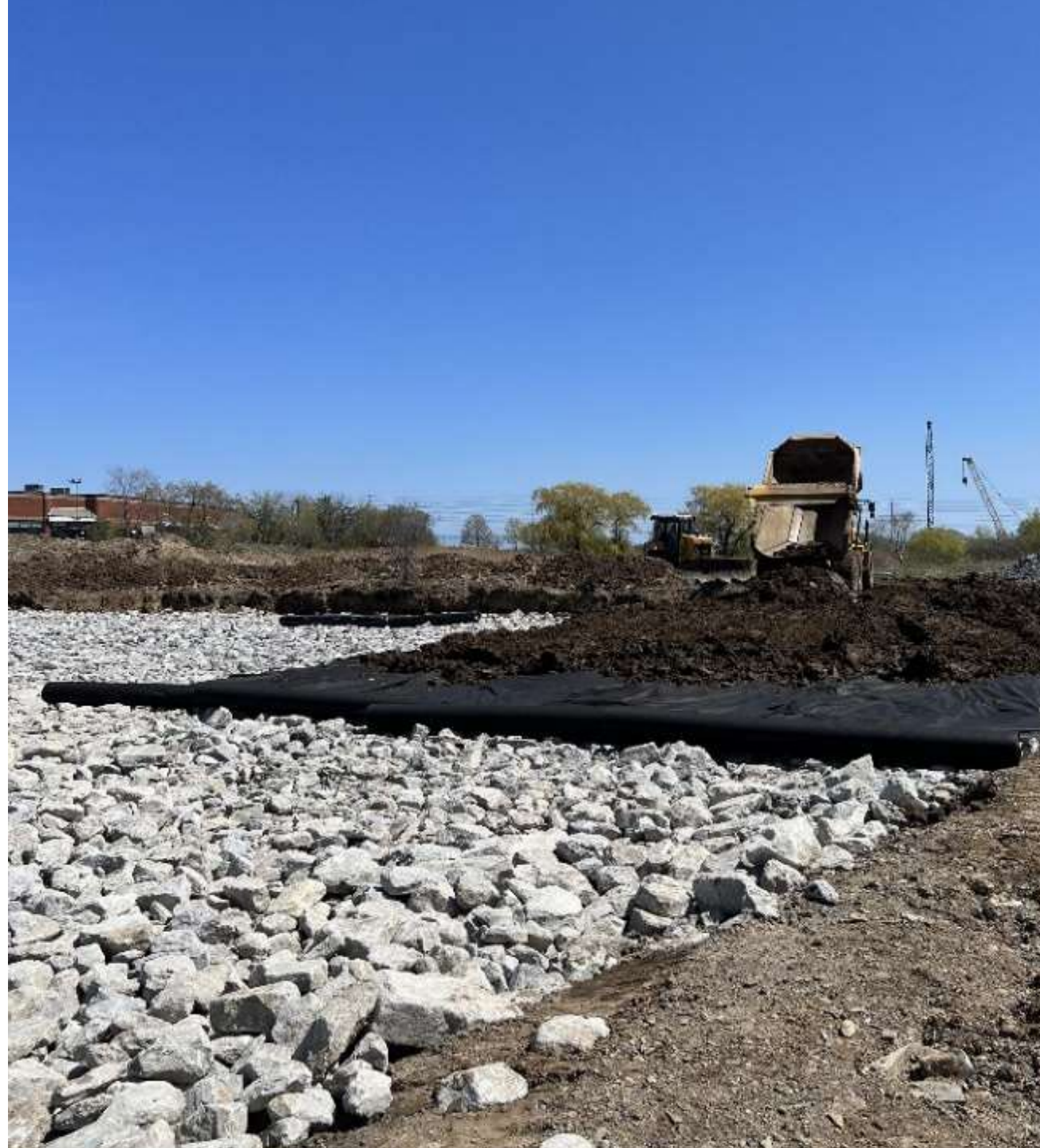
**SITE LOCATION PLAN
ACCESS AND ESC PLAN**

FILE NAME	DRAWING NO.	1 OF 7
001-KingsParkRetard.dwg		
DATE	SCALE	REV.
	AS SHOWN	B

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)







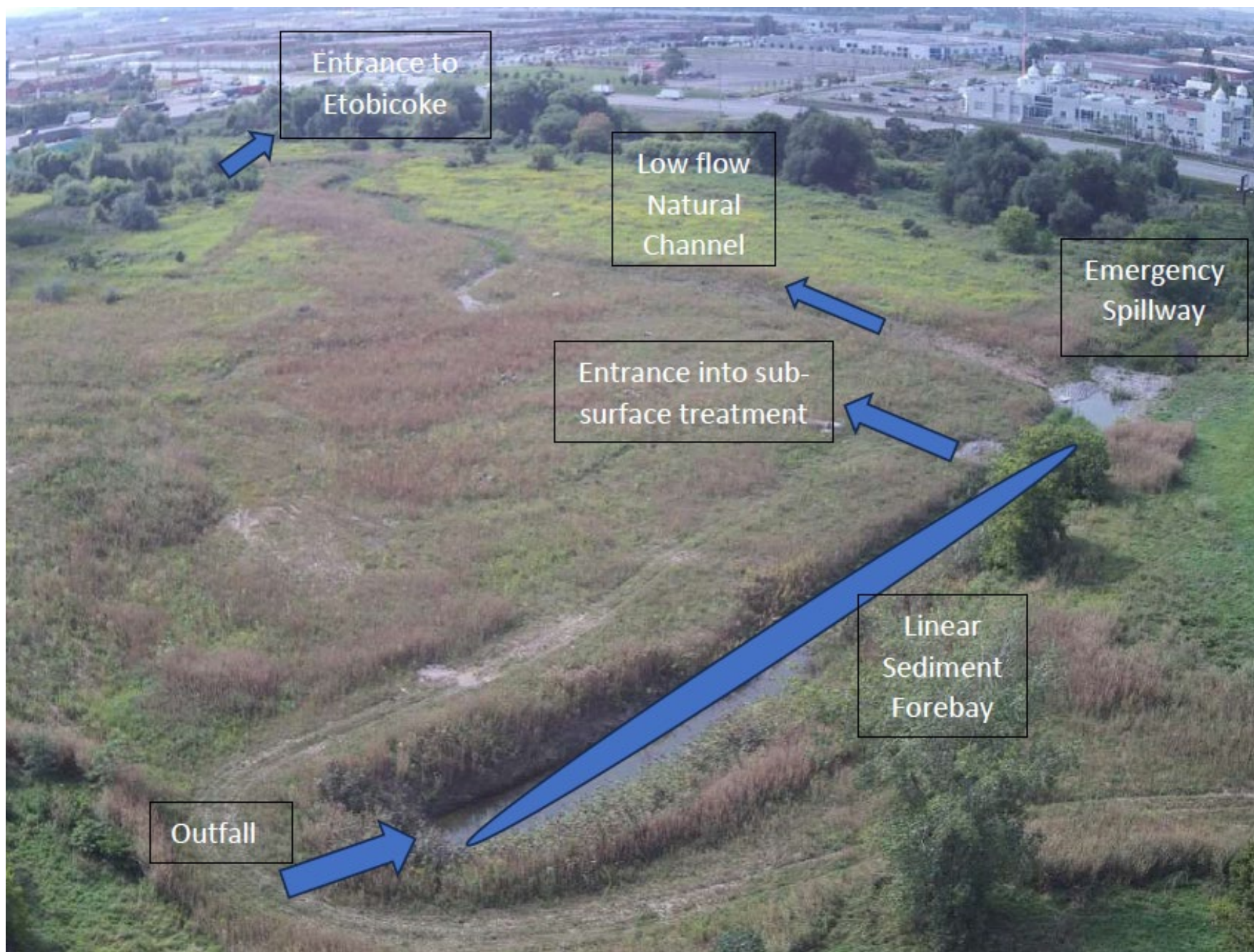


Before



After





Planting Plan



City of Mississauga King's Park 2023 Planting Site Contact: John MacKinnon

T1 (5,990 m²): 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 m²): 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	<i>Platanus occidentalis</i>	60-100 cm bare root	50		50
American/White Elm	<i>Ulmus americana</i>	60-100 cm bare root	40		40
Silver Maple	<i>Acer saccharinum</i>	60-100 cm bare root	30		30
Bitternut Hickory	<i>Carya cordiformis</i>	60-100 cm bare root	30		30
Bur Oak	<i>Quercus macrocarpa</i>	60-100 cm bare root	50		50
		SUBTOTAL	200	0	200
SHRUBS (Bare root)					
Red Osier Dogwood	<i>Cornus stolonifera</i>	40-60 cm bare root	100		100
Winterberry Holly	<i>Ilex verticillata</i>	40-60 cm bare root	100		100
Chokecherry	<i>Prunus virginiana</i>	40-60 cm bare root	100		100
Pussy Willow	<i>Salix discolor</i>	40-60 cm bare root	100		100
(American) Highbush Cranberry	<i>Viburnum opulus var. americanum</i>	40-60 cm bare root	100		100
		SUBTOTAL	500	0	500
CONIFEROUS (Potted)					
Tamarack	<i>Larix laricina</i>	2 gal pot	100		100
Eastern White Cedar	<i>Thuja occidentalis</i>	2 gal pot	100		100
		SUBTOTAL	200	0	200
REFORESTATION (Seedlings)					
Silver Maple	<i>Acer saccharinum</i>	Seedling (1+0)	50	100	150
Bitternut Hickory	<i>Carya cordiformis</i>	Seedling (2+0)	50	50	100
Hackberry	<i>Celtis occidentalis</i>	Seedling (1+0)		50	50
Black Walnut	<i>Juglans nigra</i>	Seedling (1+0)		100	100
Bur Oak	<i>Quercus macrocarpa</i>	Seedling (2+0)		100	100
Tamarack	<i>Larix laricina</i>	Seedling (1+1)		300	300
White Spruce	<i>Picea glauca</i>	Seedling (1+2)		900	900
White Pine	<i>Pinus strobus</i>	Seedling (2+2)		600	600
Eastern White Cedar	<i>Thuja occidentalis</i>	Seedling (2+2)		800	800
Norway Spruce	<i>Picea abies</i>	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



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



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



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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