



Swan Lake Water Quality Improvement & Parks Refresh Program and Parks Improvements Projects

Community Meeting on Program Update

Environmental Services & Operations Departments

March 25, 2024



Background



Lake Formation and Land Development

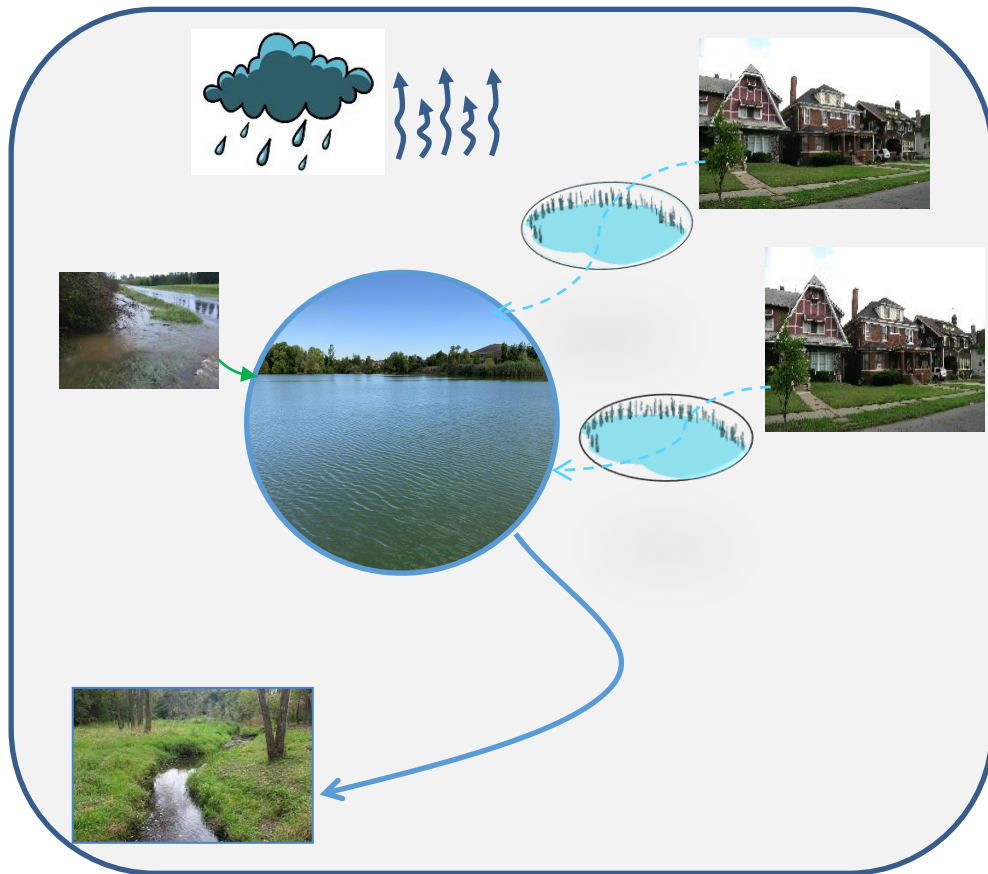
- Gravel pit in the 1960s and 1970s; construction waste dump in the early 1980s
- Lake formed when pumping for the gravel pit ceased operations
- Area draining to the Lake started as farmlands and rapidly changed to urban residential
- Drainage area fully developed.





Water Flow

- Water flows into the Lake from:
 - Direct Precipitation
 - Urban development ponds and oil and grit separators/ sewer system
 - Shoreline runoff
- Water leaves the Lake through:
 - Evaporation
 - Lake outfall to sewer and then to Mt. Joy Creek
- Groundwater exchange complex and uncertain





Natural Features

- Diverse community of terrestrial species
- Mute and trumpeter swans
- Small mammals and several bird species
- Snapping turtles
- Resident and migratory Geese
- Limited fish community
- Invasive species
- Designated as 'Other Greenway System Lands including naturalized stormwater management facilities'



Photo of birds and turtles courtesy of Donald and Cindy Fowler (through FOSLP)





Community Interest

- Original objective set out by the developers in 1993
- A community feature within the Swan Lake Park. The Park is widely used by residents and visitors.
- Many avid bird-watchers and photographers.
- Survey conducted by the Friends of Swan Lake in 2020

to transform the inactive gravel pit into a 'diverse natural habitat for aquatic and terrestrial wildlife... that incorporates passive use opportunities surrounding the Lake'.

residents "support a long-term plan that involves investment in sustainable solutions and restoration of the aquatic and land-based habitat".



Issues

- Phosphorus from sediment and geese resulting in algae growth
- Chloride from winter maintenance activities
- Limited flushing of contaminants in Lake



Opportunities

- Swan Lake and park are well used amenities with strong community support for sustainable solutions
- Existing stormwater management infrastructure to treat most of runoff

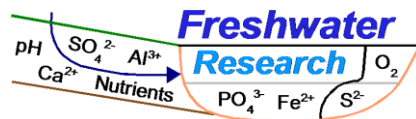


Water Quality Improvement Plan



Timeline 2011-2019

- 2011: Lake at Hyper-eutrophic level/ Monitoring started (external lake quality advisor hired)
- 2013: Phoslock application improved water quality
- 2014: Geese control initiated
- 2019: Water quality strategy study



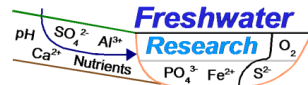


Developing a Long-Term Plan

- Goal Statement
- Targets derived considering local conditions
- Several potential mitigation measures reviewed by lake experts
- TRCA was consulted on respective measures
- Stakeholders' extensive input was considered

To improve the **overall health** of Swan Lake, which will provide **opportunities** for no-contact activities for the enjoyment of the **community**

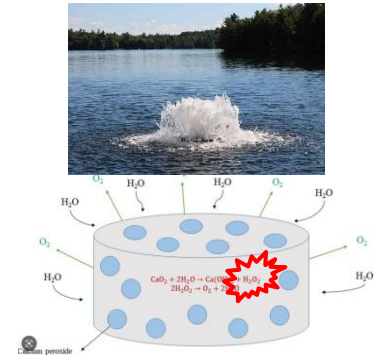
- Phosphorus: a low eutrophic condition in year 1 after treatment increasing in year 3
- Chloride: remain below acute guideline and close to 2013-2014 values
- Transparency: above 0.8 m





Screening of Ideas

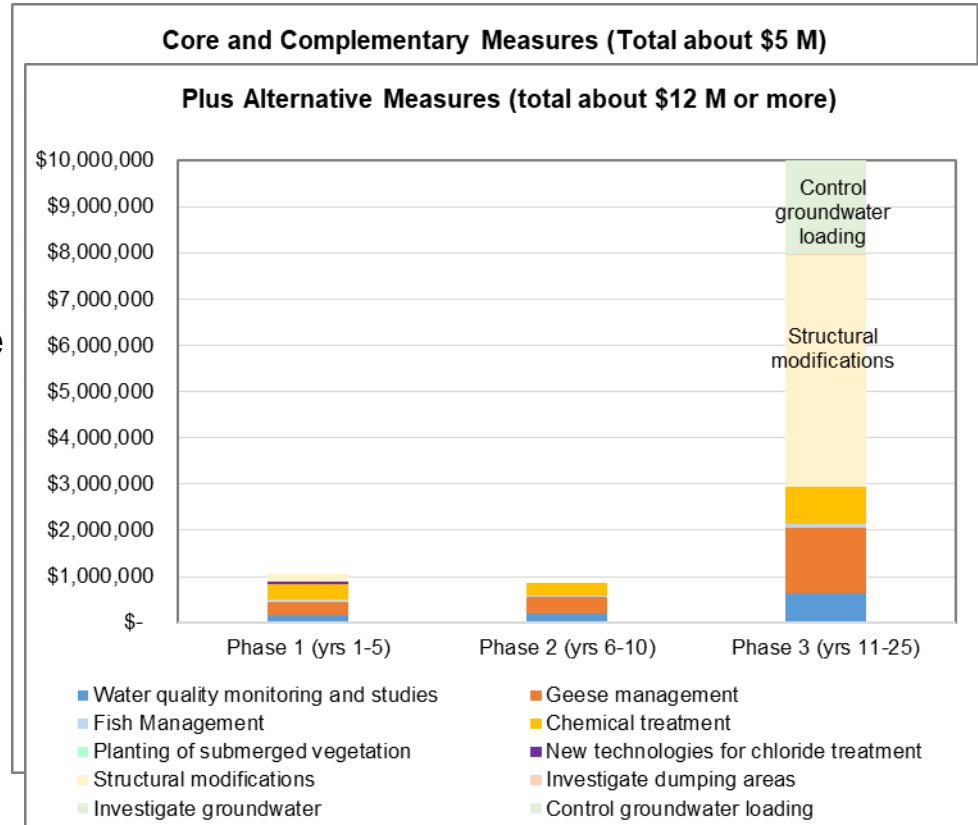
- ✓ Nutrient control focuses on governing contaminant (phosphorus)
- ✓ Chemical treatment most effective for nutrients from sediment
- ✓ Geese management most effective for nutrients from geese
- Mechanical aeration promotes release of nutrients from sediment
- Chemical oxygenation toxic for aquatic life
- Water circulation increases temperature and evaporation; costly and disruptive
- Sediment removal extremely costly and disruptive
- ✓ Stormwater re-direction and research into chloride removal technologies considered





Adaptive Plan

- A Long-Term Management Plan was approved by Council in 2021 for the next 25 years
- In three Phases to allow for reviewing and updating the Plan to adapt to Lake conditions
 - Core Measures: All years
 - Complementary Measures: years 6-10 (brought forward)
 - Alternative Measures: years 11-25 (partially brought forward)





BUILDING MARKHAM'S FUTURE TOGETHER
2020 – 2023 Strategic Plan



Plan Implementation



Monitoring, Inspections and Studies

- Important for understanding issues and planning mitigation measures and adapting the plan based on the results
- Includes chemistry and biology
- Water level logger and staff gauge
- Measurements and samples by City staff
- Analysis by accredited laboratories
- Regular site inspections and observations
- External experts hired for review and updates

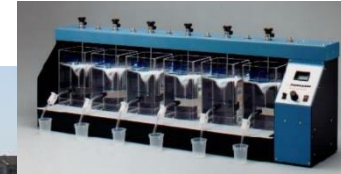




Water Treatment

- Most effective way to control release of nutrients from sediment
- Careful treatment planning and monitoring to avoid any adverse effect
- Repeated every three years or as needed based on review of monitoring results
- 2021 treatment very effective in reducing phosphorus and algae levels

$$ASP = P_{mob} \times SG \times SF \times TD \times \frac{g}{1000\ mg} \times \frac{10,000\ cm^2}{m^2}$$



August 3, 2021



August 5, 2021



August 19, 2021



Geese Management

- Hazing/chasing
- Geese relocation and egg/nest management
- Public education and geese count (see QR code)
- Fenced open spaces to prevent geese from accessing the water
- Low cost alternatives (e.g., strobe lights were tested)



Swan Lake Geese Count Survey QR Code





Fish Management / Aquatic Planting

- Removal of bottom-dwelling fish (to avoid disturbance of sediment)
- Fish management plan and fish stocking pending improved water quality
- Planting of submerged aquatic vegetation initiated as a pilot project in 2023 to improve transparency and promote aquatic habitat improvement





Maintenance

- In November 2021 the East pond inlet was cleared
- In August 2023, the outlet from Swan Club OGS was cleared
- Assumption by the City for the two private ponds underway
- Best practices for winter maintenance followed by the City and the Village





Stakeholder Engagement

- Annual reporting to Markham Subcommittee in May
- Consultation with TRCA and researchers
- Exchanges with FOSLP and other interested residents
- Swan Lake page on website
- Algae signs warn against contact with water
- Geese signs upgraded with info on geese impact
- An online application for public input into geese count
- Residents informed against releasing goldfish pets and poaching turtles

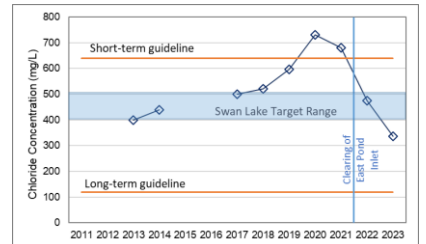
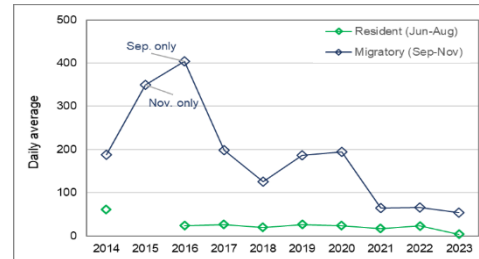
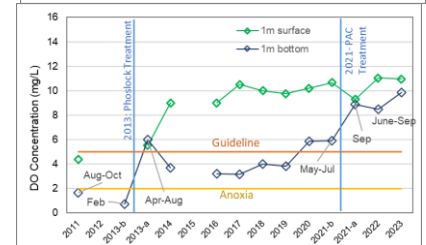
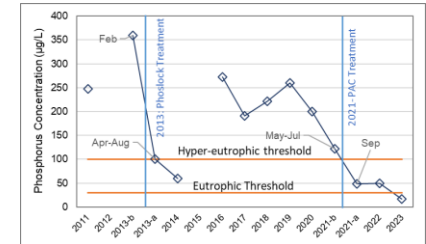
www.markham.ca/swanlake





Plan Accomplishments

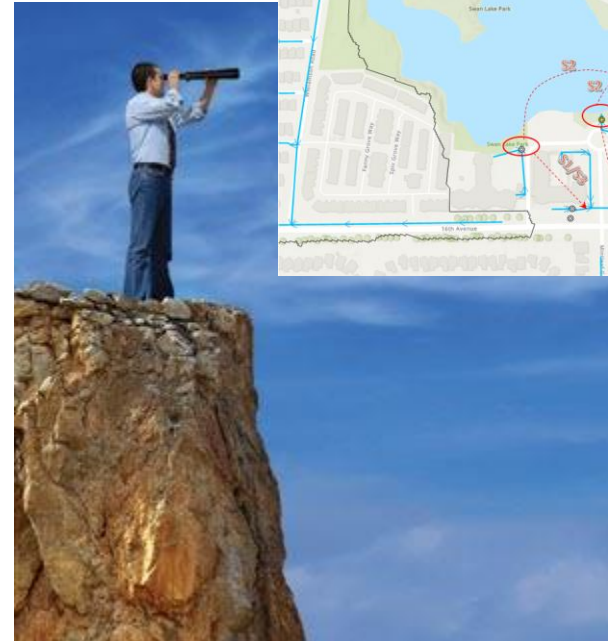
- Controlling internal and external sources of nutrients reduced phosphorus and nitrogen to below targets
- Enhanced oxygen levels
- Maintenance activities reduced chloride to below targets
- Geese management reduced the number of migratory geese by half
- Aquatic vegetation planting initiated to improve clarity and promote healthier habitat





Looking Ahead

- Continue monitoring of water quality
- Geese and fish management
- Water treatment followed by aquatic planting
- Opportunities to reduce loadings will be sought through Flow Diversion Study
- Chloride treatment research in 2024 as positive results could be a valuable tool
- Continue pond assumption process
- Research by Trent University on Rare Earth Elements





Summary of Parks Refresh Program and Parks Improvements Projects (2021 to 2023)





Parks Refresh Program 2 Year Project Complete



1. Pollinator planting in place of rain garden



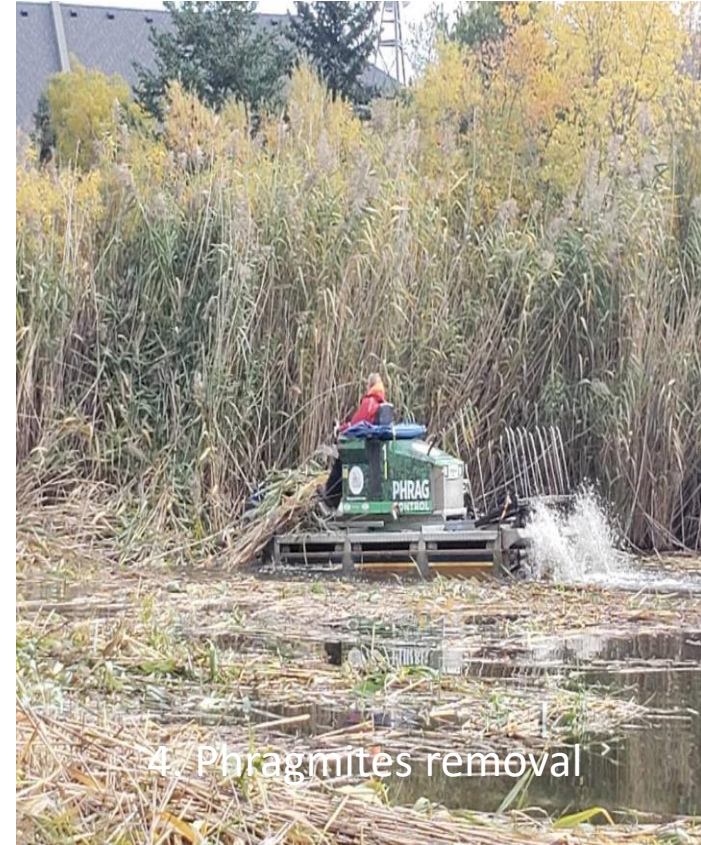
2. Pollinator Planting



3. Understory plantings



Parks Refresh Program 2 Year Project Complete



4. Phragmites removal



5. Shoreline improvements



GOOSE MANAGEMENT AREA



About Canada Geese

- I fly in large V-shaped flocks when migrating
- I can travel more than 1,000 km in one day
- I nest in the same area where I was born
- I mate for life, but I may partner else. I will take another mate
- I don't fly for six weeks in the early summer when I am growing new wing feathers (molt)

We are not hungry – please do not feed us!

- Bread hurts my stomach
- Grass & grains keep me healthy
- I won't migrate if you feed me



Help us control the Canada Geese population

Suburban is not urban areas! Geese need natural areas to graze and roost. Because of this, we have too many geese in our urban areas including Swan Lake. The population of Canada Geese at Swan Lake has contributed to poor water quality and other negative impacts to the environment. The City of Markham has a Geese Management Program to help sustainably reduce the number of geese present.

As a resident and visitor, we encourage you to help the City of Markham by submitting your observations about geese on the blog and by downloading the City's Geese Counting App.

Learn more: markham.ca/SwanLake

Environmental & Water Quality Impacts

- High nutrient concentrations from goose poop can lead to blooms of cyanobacteria which forms a layer of scum on the lake surface and may produce Nitrogen which is toxic to humans, pets and wildlife upon contact in Markham.
- Geese damage the hull through excessive sitting, and large numbers clog the hull so it cannot be used properly.
- Geese are now "NoCell" species meaning they no longer migrate so these problems can exist year round.





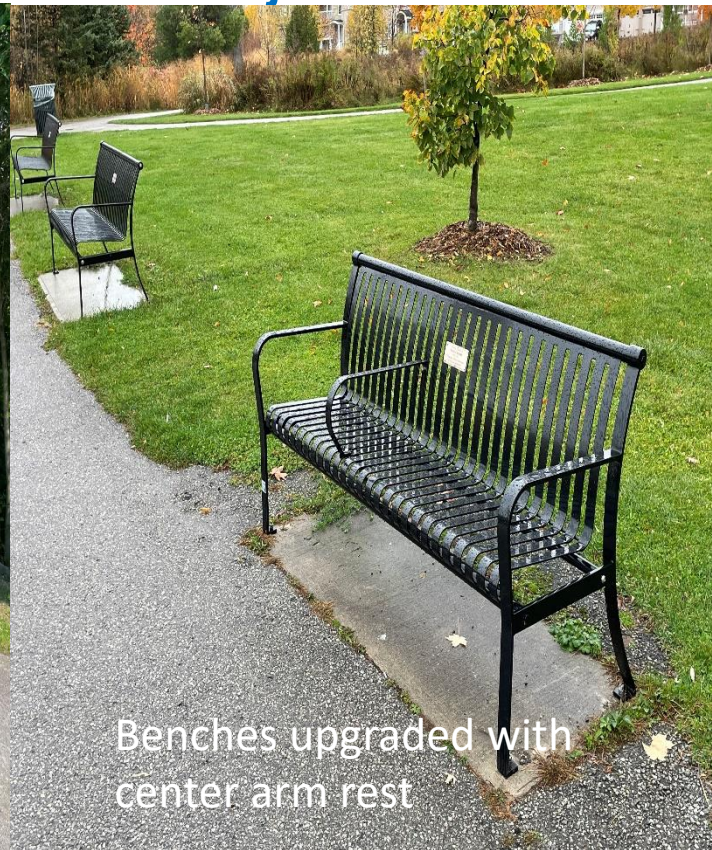
Swan Lake Park Improvement Projects



Bank erosion project



Post and rail replacement



Benches upgraded with
center arm rest



Swan Lake Park Improvement Projects



Surfacing

Pathway resurfacing



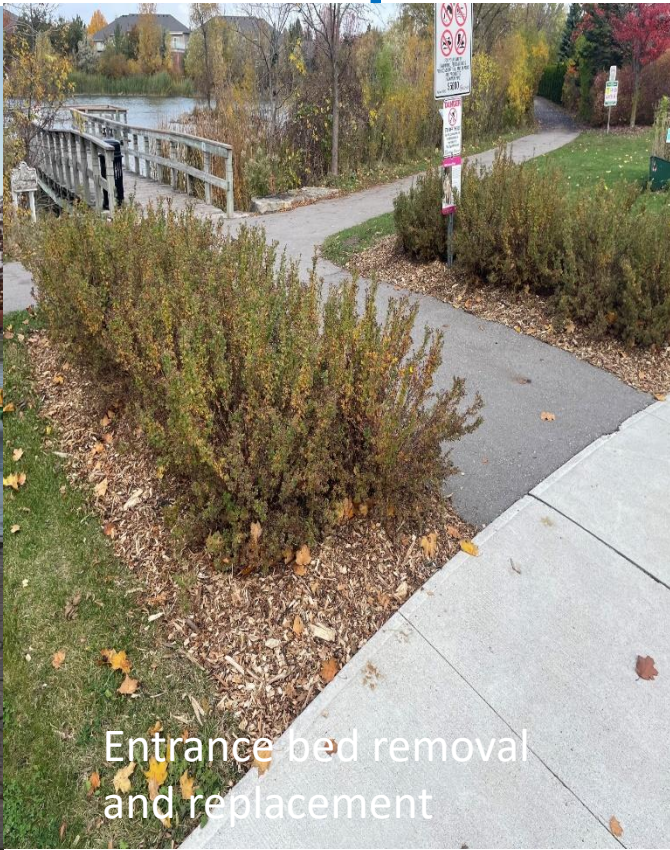
Mulch tree rings in



Swan Lake Park Improvement Projects



Playground and
Rubberized Surfacing
replacement



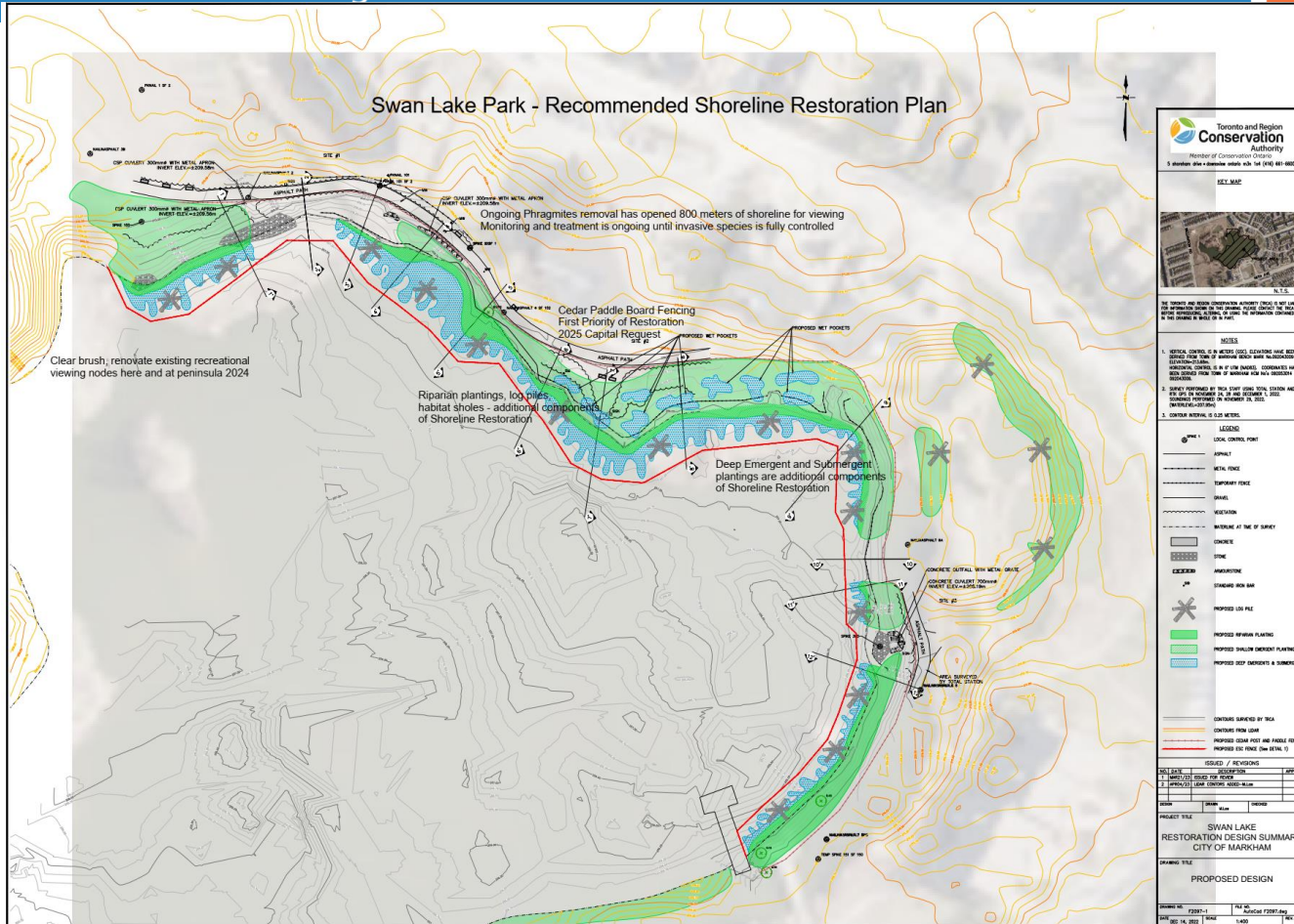
Entrance bed removal
and replacement



AMICA property trail
connection



Swan Lake Park - Recommended Shoreline Restoration Plan



Toronto and Region Conservation Authority
 Minister of Conservation Ontario
 5 Adelaide Street East, Toronto, ON M5H 4B7 Tel: (416) 497-6800

SET MAP

NOTES

- VERTICAL CONTROL IS IN METERS (FEET ELEVATIONS HAVE BEEN CONVERSION FROM FEET TO METERS USING THE FOLLOWING EQUATION: METERS = FEET * 0.3048. CONSIDERED HERE AS BEING DERIVED FROM THE TIME OF SURVEY FOR THIS DESIGN AND CHANGES INCURRED BY PROJECT TO DATE. (METERS = FEET * 0.3048)
- VERTICAL CONTROL IS IN FEET (FOOT ELEVATIONS HAVE BEEN CONVERSION FROM METERS TO FEET USING THE FOLLOWING EQUATION: FEET = METERS * 3.28084. CONSIDERED HERE AS BEING DERIVED FROM THE TIME OF SURVEY FOR THIS DESIGN AND CHANGES INCURRED BY PROJECT TO DATE. (FEET = METERS * 3.28084)
- CONTOUR INTERVAL IS 1.52 METERS.

LEGEND

- LOCAL CONTROL POINT
- ASPHALT
- METAL FENCE
- TEMPORARY FENCE
- DRAIN
- WALKWAY
- BOUNDARY OF THE LOT SURVEY
- OWNER
- TYPE
- PROPOSED
- STANDARD SIGNAGE
- PROPOSED SIGNAGE
- PROPOSED SHALLOW WETLAND PLANTING
- PROPOSED DEEP WETLANDS & SUBMERGENTS

CONTOUR SCHEDULE BY TRAIL

- CONTOUR FROM TRAIL
- PROPOSED SIGNAGE FROM TRAIL AND FENCE LINE
- PROPOSED FENCE LINE (SEE METAL 1)

DATE	DESCRIPTION	ISSUED / REVISIONS	APPROVAL
2024.01.10	ISSUED FOR PERMIT		
2024.01.10	ISSUED FOR PERMIT		
2024.01.10	ISSUED FOR PERMIT		

PROJECT TITLE
 SWAN LAKE RESTORATION DESIGN SUMMARY CITY OF MARKHAM

DRAWING TITLE
 PROPOSED DESIGN

SCALE
 1" = 100'

DATE
 2024.01.10

FILE NO.
 22021-1

PROJECT FORSYTH



Swan Lake Park Projects 2024

- Limestone pathway grading levelling
- Maintain plantings from previous years
- Maintain goose exclusion fencing until permanent fencing is erected
- Monitor Phragmites for reoccurrence and additional treatment
- Restoration of existing lake level viewing nodes on north shoreline, new viewing nodes are not being considered at this time

Operations has completed the Park Refresh and Shoreline Improvement consultation and will support Environmental Services on water quality improvement as the first priority. In 2024, staff will submit 2025 capital budget request to construct permanent goose exclusion fencing and plantings to further support water quality improvements



References

- www.markham.ca/swanlake
- Update on Swan Lake Water Quality (February, 2013)
- Swan Lake Water Quality Improvement Program (June, 2020)
- Geese Management at Swan Lake: Overview of Options and Path Forward (September, 2020)
- Swan Lake Long-Term Management Plan (November 2021)
- Swan Lake 2021 Water Quality Status and Updates (May 2022)
- Swan Lake 2022 Water Quality Status and Updates (May 2023)

Contact information:

Swan Lake Water quality:

Robert Muir
Manager, Stormwater, Environmental Services
✉: rmuir@markham.ca
☎: 905.477.7000 x 2357

Swan Lake Park:

City of Markham Contact Center:
✉: customerservice@markham.ca



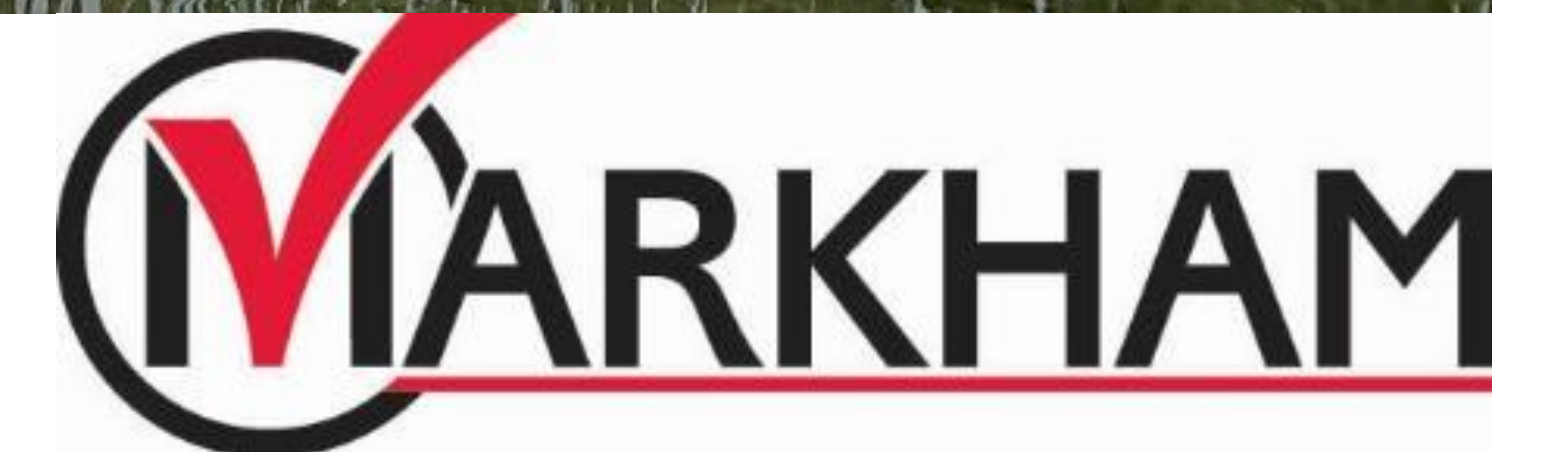
Questions?



WELCOME

Swan Lake Water Quality Improvement
Community Meeting on Program Update
March 25, 2024

March 25, 2024



Purpose of Swan Lake Water Quality Improvement

To improve the **overall health** of Swan Lake, which will provide **opportunities** for no-contact activities for the enjoyment of the **community**

Purpose of Public Information Meeting

- 💧 Provide details of the water quality improvement program
- 💧 Share achievements of the program since it started
- 💧 Inform the public about upcoming activities in 2024
- 💧 Discuss ways to get involved in improving water quality and habitat health
- 💧 Answer any questions the public may have

Swan Lake History



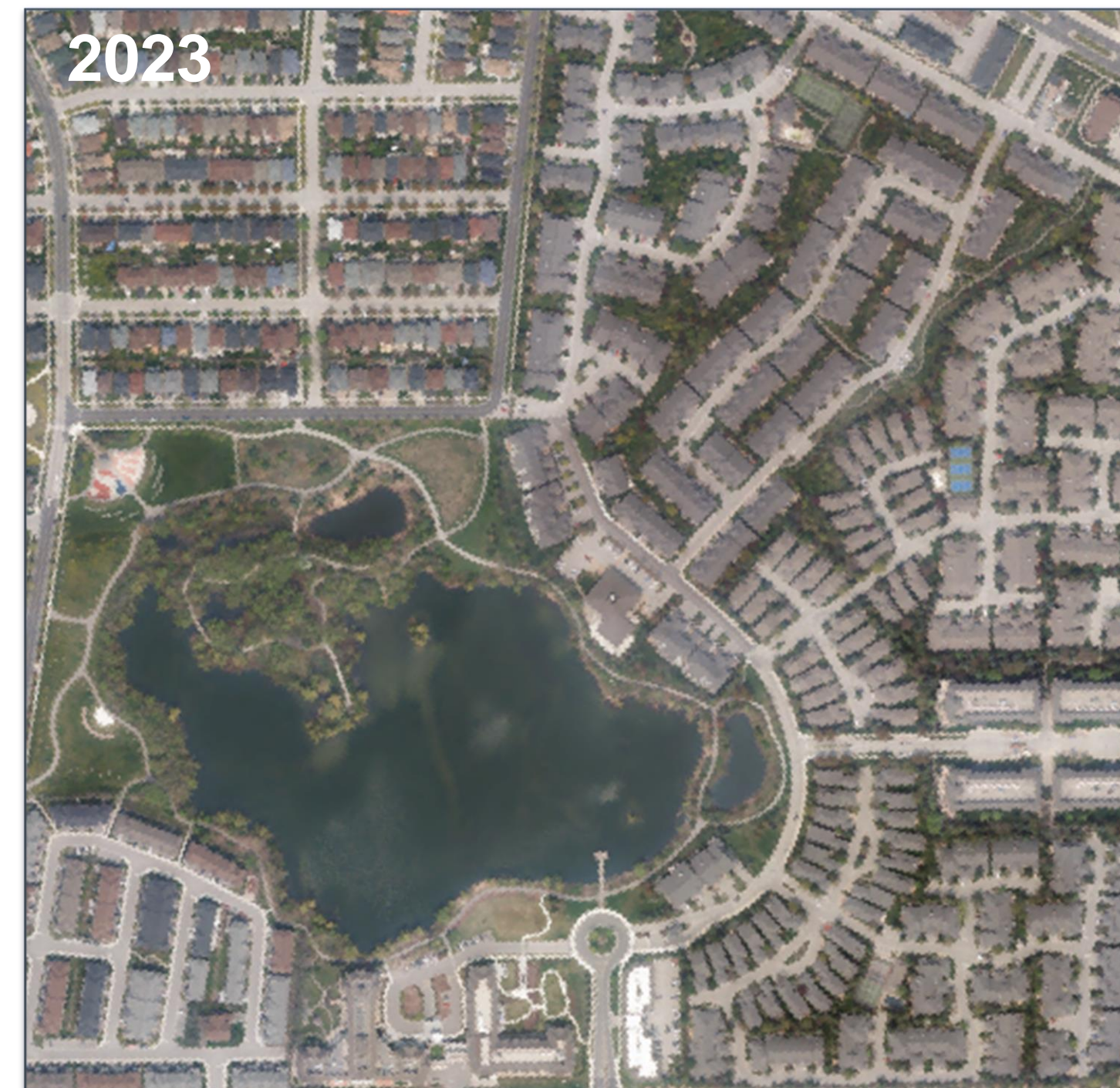
1967
Gravel pit in the 1960s and 1970s
Construction waste dump in the early 1980s



1995
Lake formed when pumping for the gravel pit ceased operations



2002
Area draining to the Lake started as farmlands and rapidly changed to urban residential



2023
Drainage area fully developed

Swan Lake Water Flow



Issues



Phosphorus from sediment and geese resulting in algae growth



Chloride from winter maintenance activities



Closed system with limited flushing of contaminants from Lake



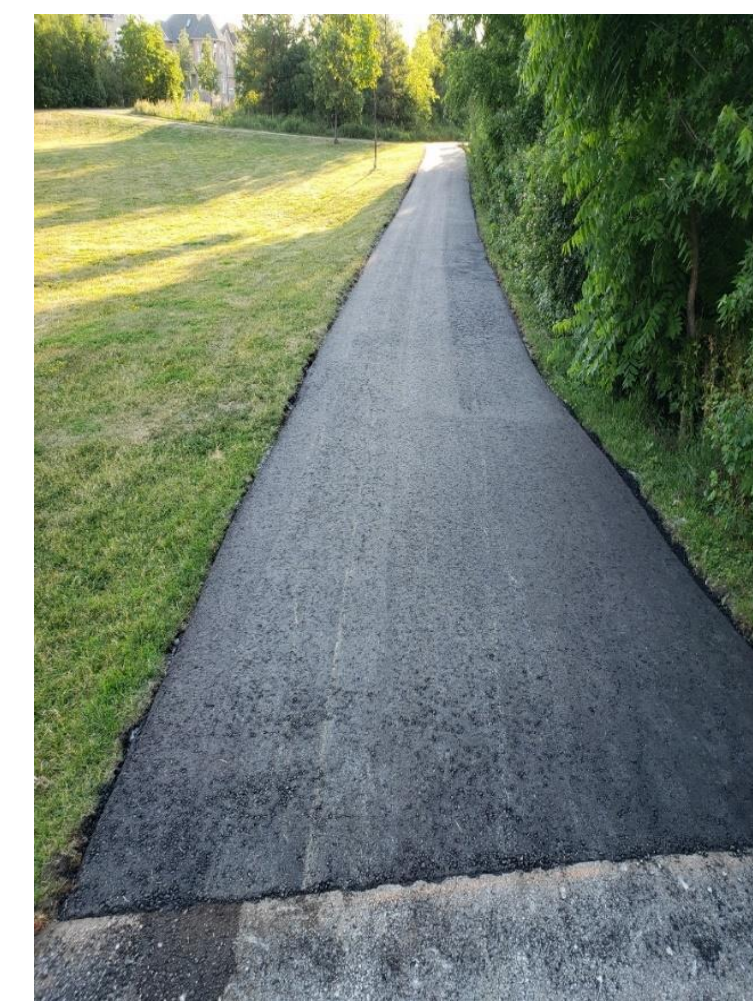
Limited aquatic community

- Brown Bullhead (Cattfish)
- Common Carp
- Fathead Minnow

Invasive species

- Dog-strangling vine
- Black Locust
- Phragmites (Common reed)

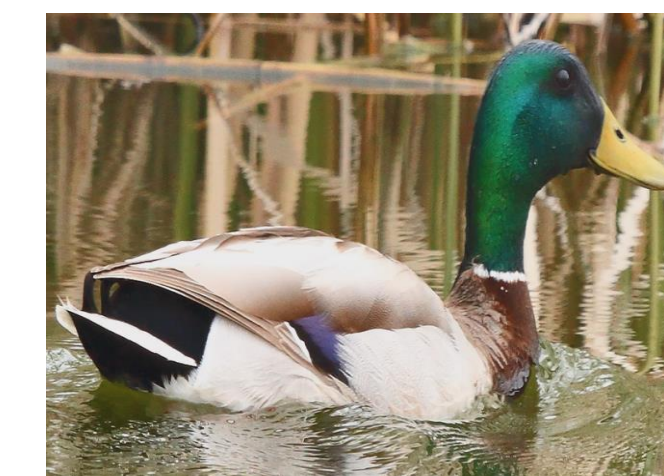
Opportunities



Swan Lake and park are well used **amenities** with strong community support for sustainable solutions



Existing stormwater management **infrastructure** to treat most of runoff



Diverse community of terrestrial species

Photo of birds and turtles courtesy of Donald and Cindy Fowler (through FOSLP)
 From top left: Trumpeter swan, Red-tailed hawk, Domestic duck, Great blue heron
 Cormorant, Black-crowned night heron, Ruby-crowned kinglet
 Mute swan, Yellow warbler, Painted turtles

Swan Lake Long-Term Management Plan

CORE MEASURES

- * Water quality monitoring
- * Geese management
- * Fish removal
- * Maintenance of stormwater facilities
- * Chemical treatment

COMPLEMENTARY MEASURES

- * Planting of submerged vegetation
- * Fish Management
- * New technologies for chloride treatment

ALTERNATIVE MEASURES

- * Investigate dumping areas
- * Investigate/control groundwater loading
- * Evaluate/implement structural modifications (runoff diversion)

Adaptive Plan

Stakeholder Engagement

Scientific Approach

Financial Stewardship

- **Core Measures**
- Phase 1: 2021-2025

Evaluate measures

- **Core and Complementary Measures**
- Phase 2: 2026-2030 *

Evaluate measures

- **Core and Alternative** Measures**
- Phase 3: 2031-2045

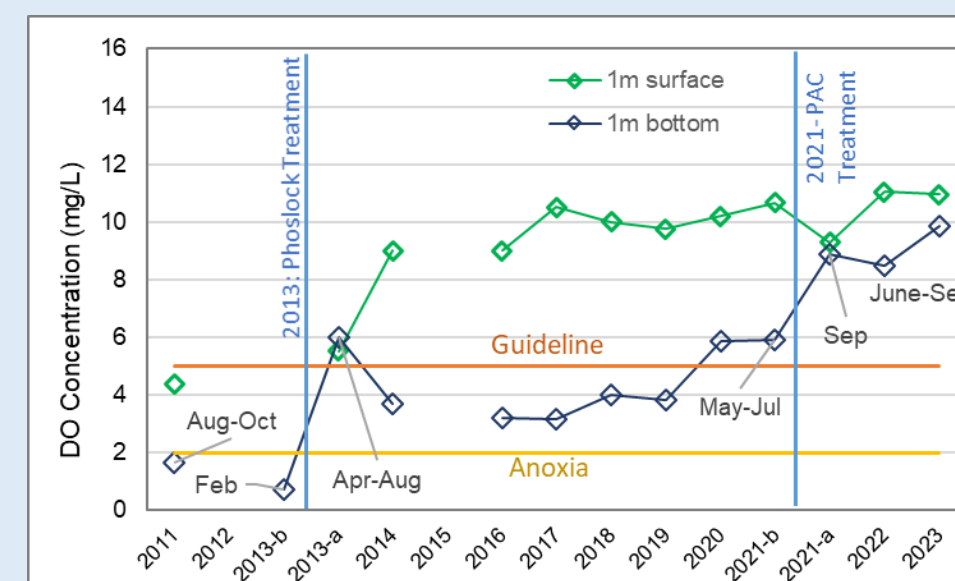
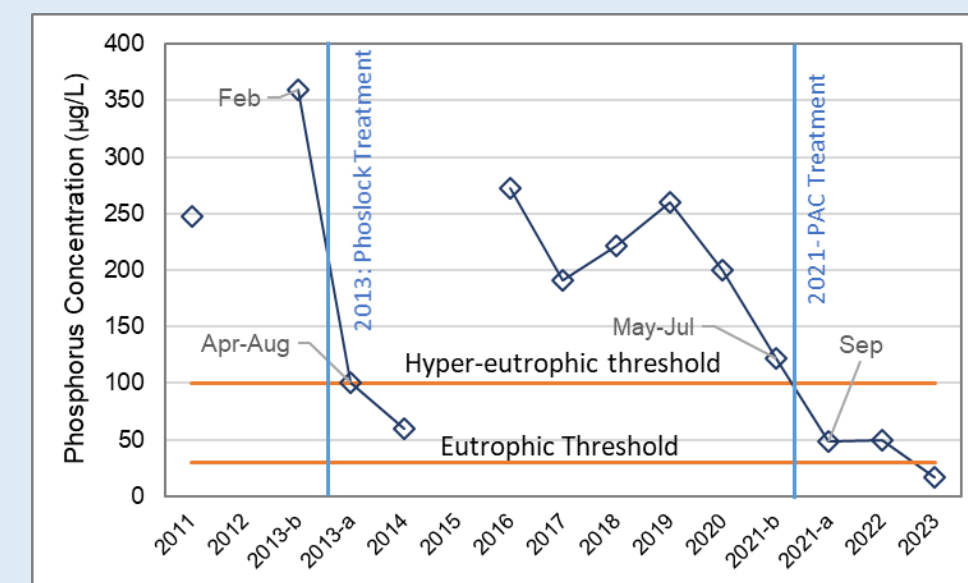
* Some complementary measures have been brought forward to Phase 1.

** Some alternative measures have been brought forward to Phase 1.

Water Quality Accomplishments

Water Treatment

- Most effective way to control release of nutrients from sediment
- Careful treatment planning and monitoring to avoid any adverse effect
- Repeated every three years or as needed based on review of monitoring results
- 2021 treatment very effective in reducing phosphorus and algae levels



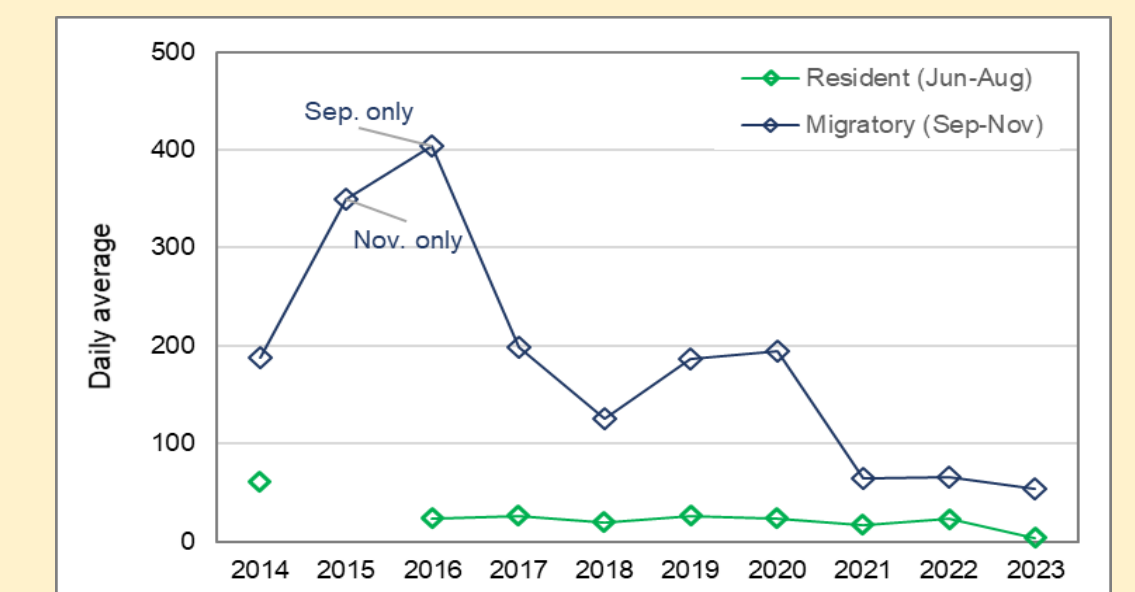
Fish Management and Aquatic Planting

- Removal of bottom-dwelling fish (to avoid disturbance of sediment)
- Planting of submerged aquatic vegetation initiated as a pilot project in 2023 to improve aquatic habitat



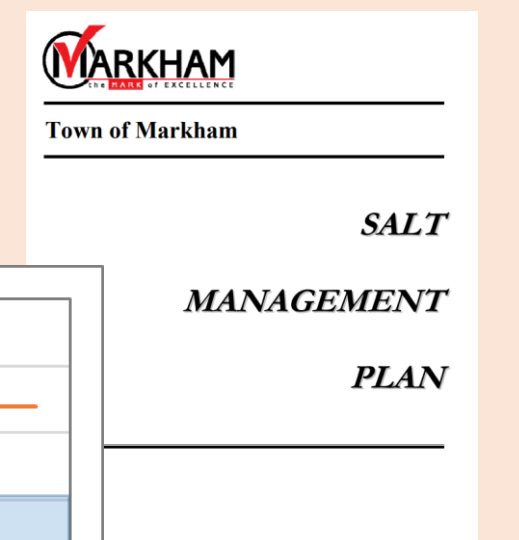
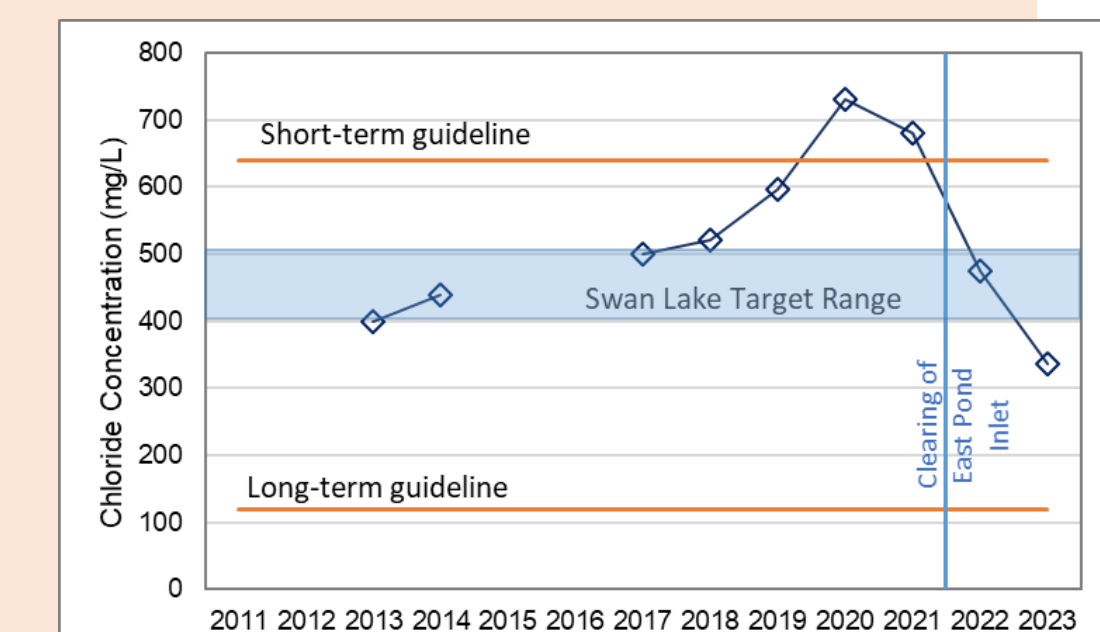
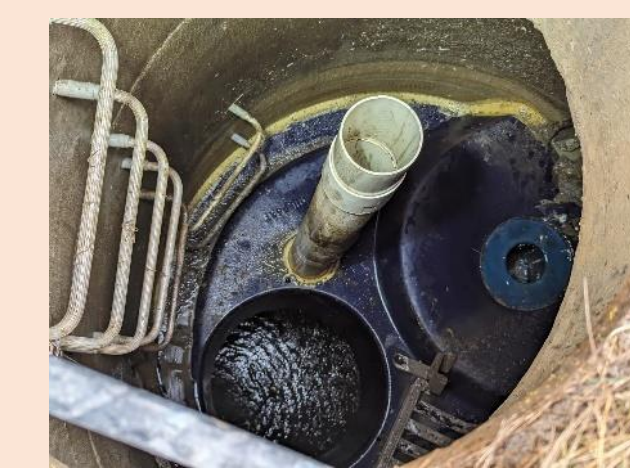
Geese Management

- Hazing /chasing
- Geese relocation and egg/nest management
- Geese count
- Public education sign
- Fenced open spaces to prevent geese from accessing the water
- Low cost alternatives (e.g., strobe lights were tested)



Source Control and Maintenance

- East pond inlet was cleared
- Outlet from Swan Club treatment device was cleared
- Assumption by the City for the two private ponds underway
- Best practices for winter maintenance followed by the City and the Village



Ongoing and Upcoming Work in 2024-2025

Water Quality Monitoring

- Important for understanding issues and planning mitigation measures
- Chemistry and biology
- Oxygen and temperature
- Water level



Geese Management

- Hazing /chasing
- Geese relocation and egg/nest management
- Public education
- Replacing temporary fencing with permanent features



Fish Management

- Removal of bottom-dwelling fish
- Consultation with OMNRF on fish stocking



Decorative image - OMNRF fish stocking using a helicopter

Water Treatment

- Planning and implementation of the second treatment



Planting of Aquatic Vegetation

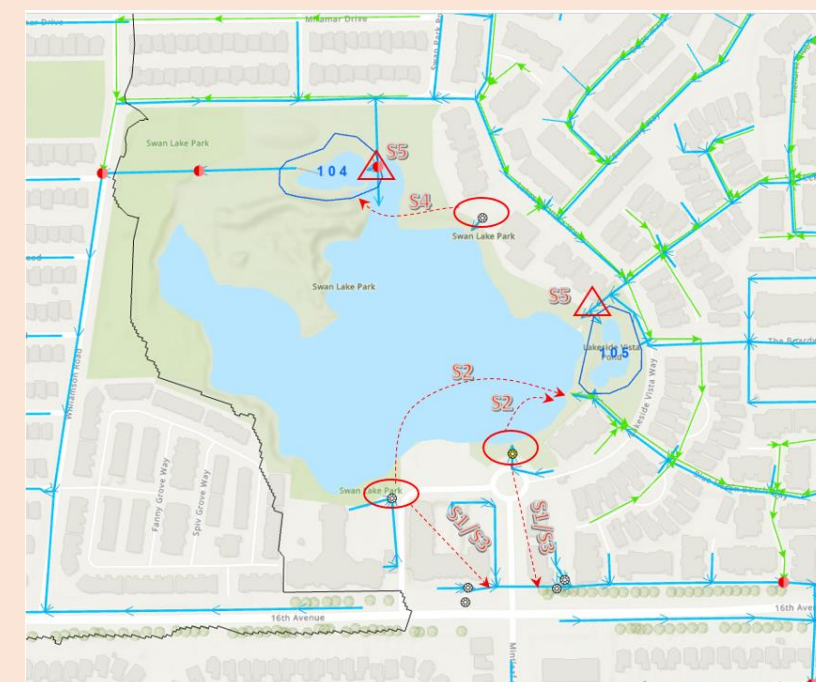
- Additional planting of submerged aquatic vegetation to improve aquatic habitat



Decorative image – submerged aquatic plants

Flow Diversion Study

- Study feasibility of flow redirection and potential impacts on flooding and chloride level
- Flow monitoring



New Technologies for Chloride Treatment

- Research by York University on chloride removal using biochar



Pond Assumption Process

- Continue engaging with the developers on maintenance and assumption of stormwater ponds



Parks Refresh Program 2 Year Project Complete



1. Pollinator planting in place of rain garden



2. Pollinator Planting



3. Understory plantings



4. Phragmites removal



5. Shoreline improvements



GOOSE MANAGEMENT AREA

About Canada Geese

- I fly in large V-shaped flocks when migrating
- I can travel more than 1,000 km in one day
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We are not hungry – please do not feed us!

- Bread hurts my stomach
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- I won't migrate if you feed me

Help us control the Canada Geese population

Suburban and urban areas provide ideal conditions for geese survival – plenty of food and space to roost, lack of natural predators and safe from hunters. Because of this, we have too many geese in our urban areas including Swan Lake. The population of Canada Geese at Swan Lake has contributed to poor water quality and other negative impacts to the environment. The City of Markham has a Geese Management Program to help sustainably reduce the number of geese present.

Area residents and visitors are encouraged to help the City's efforts by submitting their observations about geese on the lake and its shorelines to the City's Geese Counting App.

Learn more: markham.ca/SwanLake

Environmental & Water Quality Impacts

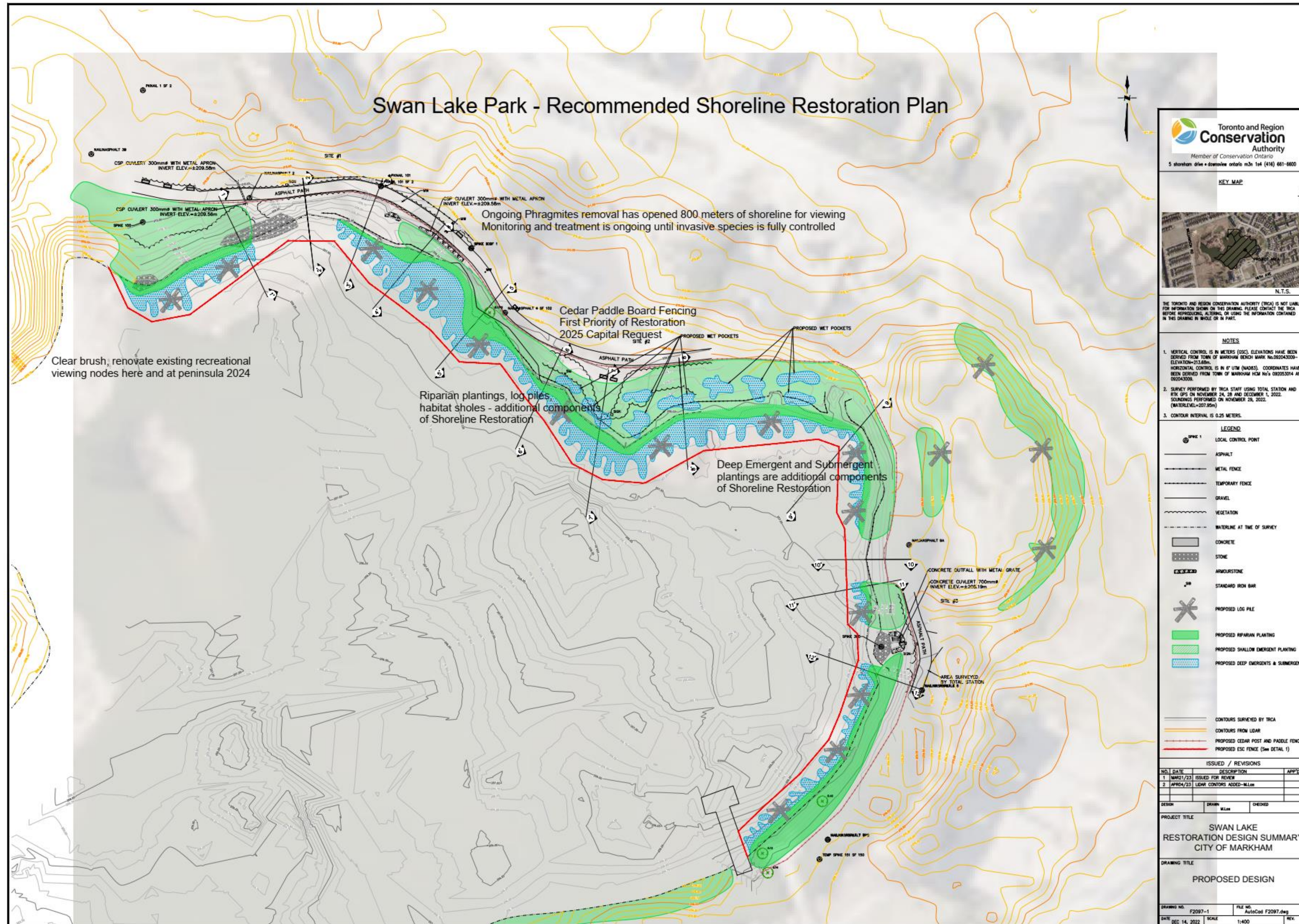
- Too many geese poop leads to contamination and over-fertilization (eutrophication) of water sources
- High nutrient concentrations from goose poop can lead to blooms of cyanobacteria which forms a layer of scum on the lake surface and may produce microcystins which is toxic to humans, pets and wildlife upon contact or ingestion
- Geese damage the turf through excessive eating, and large numbers compact the soil so nothing else will grow
- Geese are now "resident" species, meaning they no longer migrate so these problems can exist year round

Green MARKHAM
A Healthier Community

MARKHAM

6. Educational outreach

Swan Lake Park- Recommended Shoreline Restoration Plan



How You Can Help

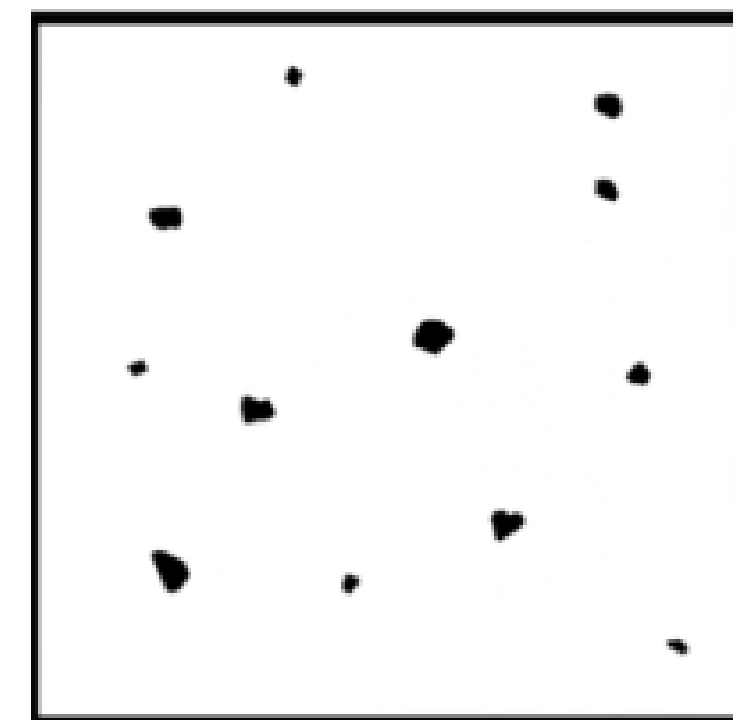
- Do not feed the geese
- Report geese count and other wildlife observations through an online application (scan QR code)



- Refrain from releasing goldfish pets and poaching turtles

- Follow best management practices for salt management, check the TRCA's Sustainable Salt Management Resources

<https://partnersinprojectgreen.com/resources/sustainable-salt-management-resource-hub/>



Black dots/salt showing how much salt should be applied - 50mg/m2.

Looking for More Information

- Annual meeting with Markham Subcommittee in May
- Swan Lake page contains past reports and presentations:
www.markham.ca/swanlake



Contact information:

Swan Lake Water quality:

Robert Muir
Manager, Stormwater, Environmental Services
✉: rmuir@markham.ca
☎: 905.477.7000 x 2357

Swan Lake Park:

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Senior Manager, Parks Horticulture and Forestry, Operations
✉ : dplant@markham.ca
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