An Overview of Stormwater Management Ponds and Underground Tanks

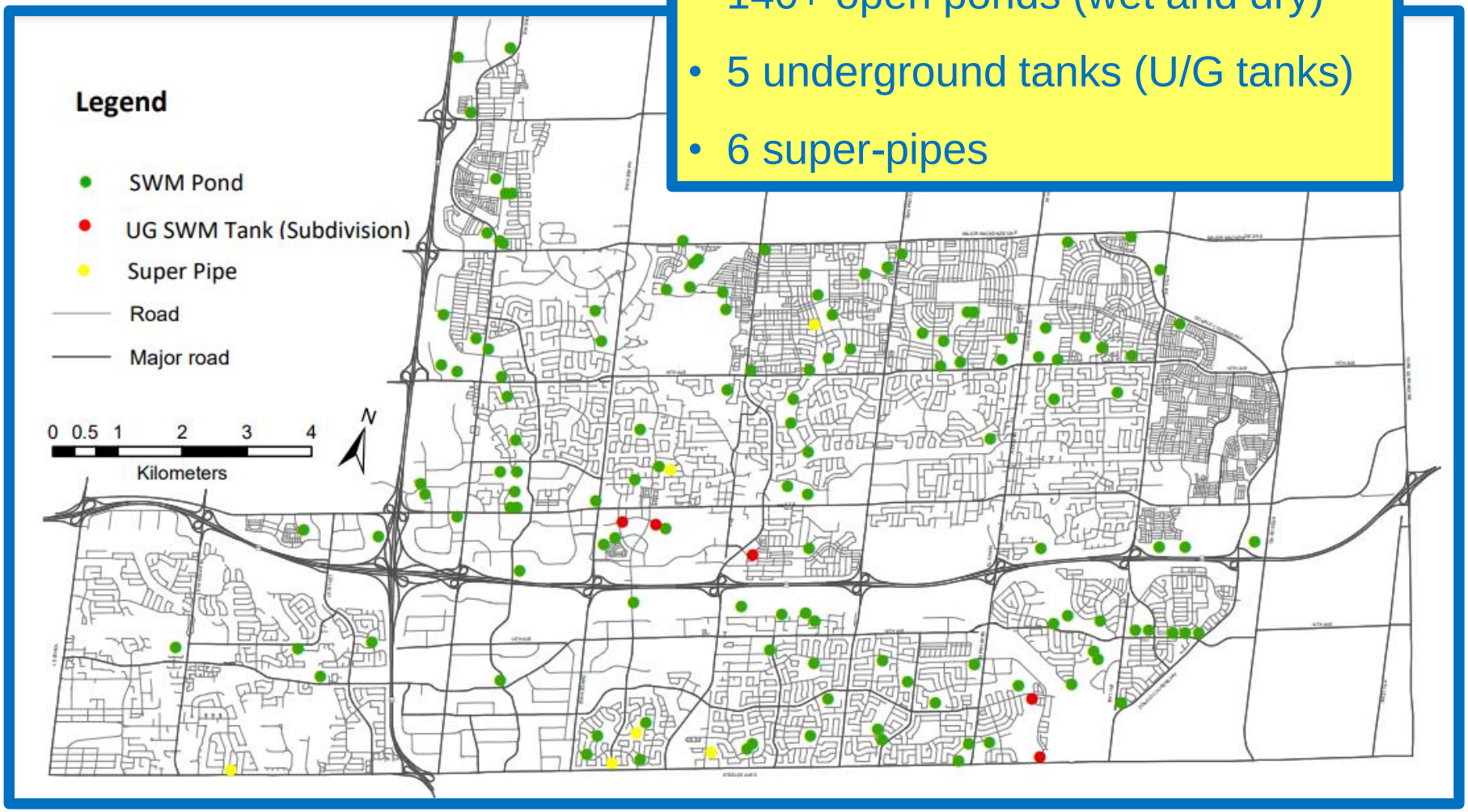
June 13, 2022

Agenda

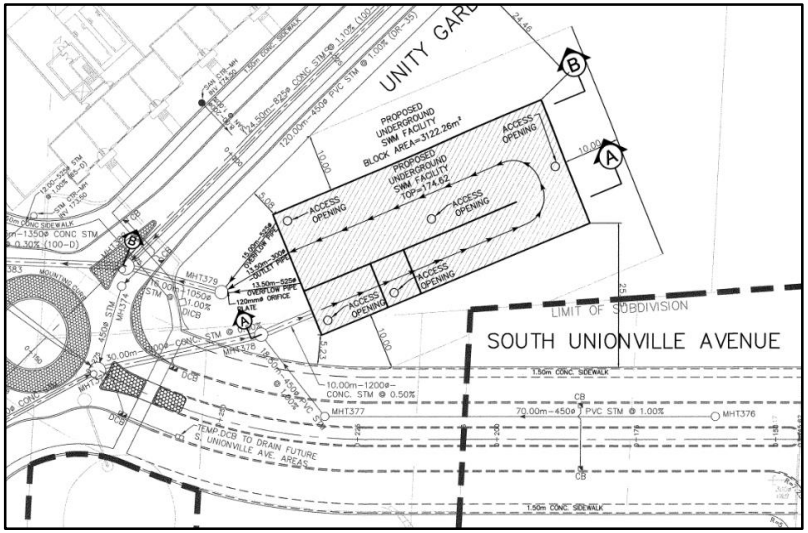
- Stormwater Facilities in Markham
- SWM Practices for UG Tanks
- Types of Underground SWM Facilities
- Open Pond and U/G Tank Comparison
- Markham's Alternative Infrastructure Policy
- Parkland Considerations & Issues
- Recommendations

Stormwater Management Facilities in Markham

- 140+ open ponds (wet and dry)
- 5 underground tanks (U/G tanks)
- 6 super-pipes



Stormwater Management Facilities in Markham



Example 1: South Unionville

- StormTrap® Concrete Tank
- Installation Year = 2009
- SWM Tank Volume = 2,656 m^3
- Drainage Area = 4.47 ha
- Surface Use = Park
- Parkland Credit – 50%

Stormwater Management Facilities in Markham

Example 2: Markham Centre – Times Group

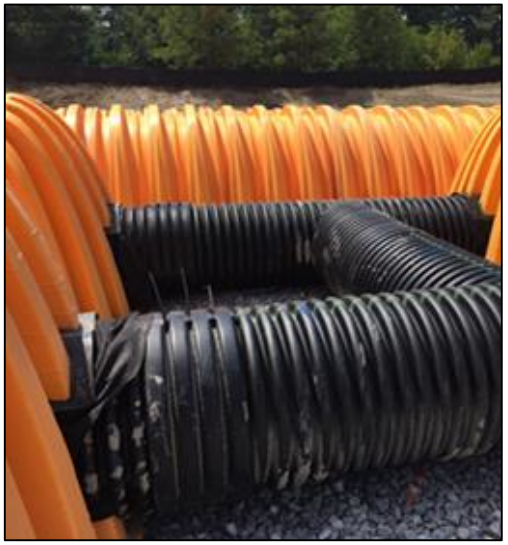
- StormTrap® Concrete Tank
- Installation Year = 2013
- SWM Tank Volume = 712 m^3
- Drainage Area = 5.17 ha
- Surface Use = Park
- Parkland Credit – 100%

Stormwater Management Facilities in Markham

Fairtree Subdivision

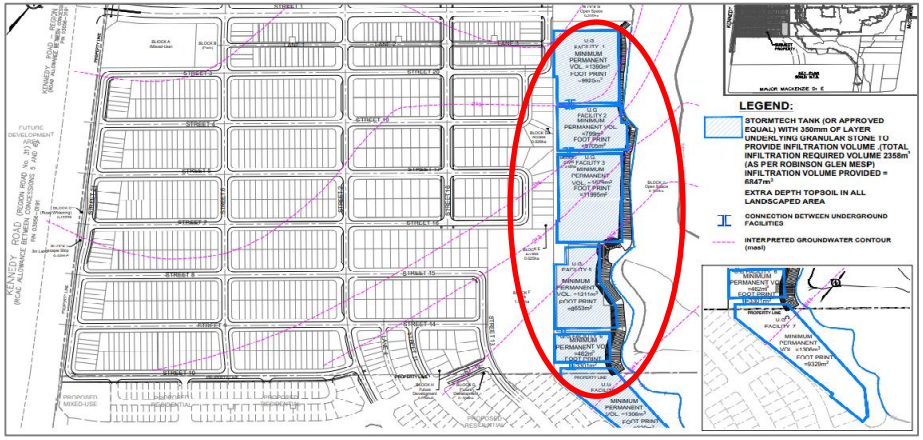
- StormTech® Arch SWM Tank (north location)
- Installation Year = 2019
- SWM Tank Volume = 8,354 m^3
- Drainage Area = 11.9 ha
- Surface Use = Open Space

*Impact-Modified Polypropylene



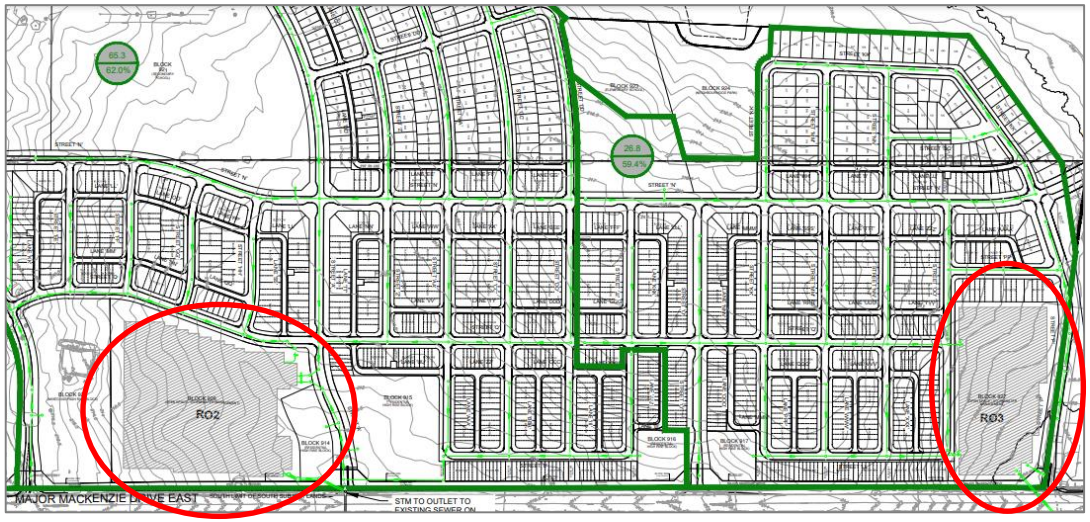
Stormwater Management Facilities in Markham

Current Proposal(s) of SWM Tank in Markham



FUA Robinson Glen

- Developer: Minotar Holdings
- 6 SWM Tanks – High Strength Plastic
- Total Tank Volume ~ 63,000 m^3
- Total Drainage Area ~75 ha



FUA Robinson Glen

- Developer: Major Kennedy South Developments
- 2 SWM Tanks - Concrete
- Total Tank Volume ~117,000 m^3
- Total Drainage Area ~92 ha

SWM Practices for U/G Tanks

Municipalities that have **not applied** U/G Tanks in **Subdivision Developments**

- Toronto
  - Etobicoke-York
  - Toronto-East York
  - North York
- Richmond Hill
- Brampton
- Mississauga
- Hamilton
- Oshawa
- Niagara Region
- Sault Ste. Marie
- LaSalle, ON
- Brantford
- Wasaga Beach

SWM Practices for U/G Tanks

Municipalities that have **applied** U/G Tanks in **Subdivision Developments**

	UG SWM Facility	Acceptance	Financial Compensation[1]	Surface Uses above SWM Tanks
Newmarket	• 2-Installations (<10 ha) • 2-Installations (>10 ha)	Case-By-Case	Yes	Passive open space; Roadway
Vaughan	• 7-Installations (<10 ha) • 1-Installations (>10 ha)	Case-By-Case	Yes	Park space; Passive open space; Mostly in Public ROW
Scarborough	• 1-Installations (<10 ha)	Case-By-Case	No	SWM block open space
Whitby	• 1-Installations (<10 ha)	Case-By-Case	Yes	Parking lot; Passive open space
Blue Mountain	• 1-Installations (<10 ha)	Case-By-Case	Yes	Passive green space
Thunder Bay	• 1-Installations (<10 ha)	Case-By-Case	Yes	Passive open space; Road boulevard

(1) Additional O&M Cost for UG SWM Tanks & Filters Accessories.

Types of Underground SWM Facilities

1. Concrete System
2. Plastic System - High Density Polyethylene [HDPE] or impact-modified Polypropylene [PP]
3. Super Pipe System

*Not for super pipe system

Types of Underground SWM Facilities

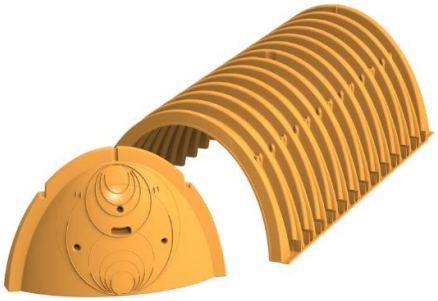
Concrete System

STORMTRAP® Concrete System

DECAST Concrete System

Types of Underground SWM Facilities

Plastic Systems



STORMTECH®

CULTEC®

Plastic Arch

ATLANTIS

ECOBLOC®

GREENSTORM®

Plastic Modular

Types of Underground SWM Facilities

Super-Pipe Systems

Open Pond vs. U/G Tank Comparison

Category	SWM Pond	SWM Tank
Hydrological	• Enhance hydrological / water budget cycle	• Not ideal for location with high groundwater
Environmental	• Compliments natural heritage system if next to greenway • Attracts wildlife, but may be an issue pending Pickering Airport regulations	• Allows for a more compatible built form in an urban setting. • There may be natural environmental benefits depending on the facility being constructed above
Aesthetic	• Beautified neighborhood with SWM Pond waterbody • There are occasional complaints from adjacent residents (e.g. trash, overgrown weeds, etc.)	• Eliminates illegal dumping of trash within open bodies of water; • Programmability of parks and playing fields on top of tanks
Water Quality	• Vegetation biological functions contribute to water quality treatment and nutrient removal from runoff	• Lower water quality treatment for nutrients (no vegetation uptake)
Thermal Impacts (Redside Dace habitat)	• Typically cooler stormwater discharge is difficult to achieve without creating a larger footprint and deeper pond.	• Cooler stormwater discharge can be achieved using a smaller footprint
Land Use	• Single-Use – Stormwater management use only	• Smaller footprint – more developable lands (increased housing supply and tax base) • High potential for Dual-uses – allows for recreational space above SWM tanks
Programming	• Passive programming such as recreation trails around SWM pond	• Passive and **active** programming of green space - soccer & baseball field, recreation trails
Health	• Properly designed and maintained ponds should not promote mosquito production • Potential drowning / falling through ice in winter	• Eliminates direct bird excrement and related bacteria accumulation (E. Coli) • Some designs eliminate open standing water – minimizes potential mosquito-borne illnesses

Open Pond vs. U/G Tank Comparison

Category	SWM Pond	SWM Tank
Operation / Maintenance	• Does not require structure replacement. Only repairs or rehabilitation	• Lack of industry experience on future replacement rehabilitation requirements • Potential disruption to recreational uses over top of tanks during maintenance and rehabilitation activities
Capital Cost	• Lower capital cost, per m^3 of storage volume, than SWM tank(1)	• Higher capital cost, per m^3 of storage volume, than SWM pond(1)
O&M Cost	• Lower O&M cost, per m^3 of storage volume or per drainage area, than SWM tank(2)	• Higher O&M cost, per m^3 of storage volume or per drainage area, than SWM pond(2)
Lifecycle Cost (LLC)	• Lower LLC, per m^3 of storage volume, than SWM tank(3)	• Higher LLC, per m^3 of storage volume, than SWM pond(3)

(1) Reference: NRC guidelines 2021 and Markham City consultant. (2) Analysis from Markham Environmental Services and Engineering.
(3) Analysis from Markham Environmental Services shows 100-yr lifecycle costs for Markham Project.

Markham's Alternative Infrastructure Policy (AIP)

- Developed in 2019 by Finance in consultation with different departments.
- Defines what is considered conventional and alternative infrastructure.
- Provides framework for Markham to approve alternative forms of infrastructure and recover additional costs incurred by the City over life of infrastructure.
- Policy applied to U/G tanks in the Villages of Fairtree subdivision.

Parkland Considerations and Issues

Possible impacts to park programming include:

1. Locations of:
   - Footings and foundations to support park structures and elements;
   - Underground infrastructure servicing infrastructure
   - Placement of access structures for UG tanks

2. Disruption to park facility use during periods of significant rehabilitation/replacement to SWM facility;

3. Potential for differential settlement on the surface access hatches and due to dry soils.

4. Parkland programming is dependent depth of UG tank and loading restrictions.

Parkland Credit Evaluation

Parkland Credit Application

- Determination of parkland credit for encumbered Parks would require the review of feasibility of programming, and O&M on a case-by-case basis.

- Percentage base credit is typically negotiated based on the following considerations:
    a. The limitations of the above grade parkland programming:
    b. The limitations of the City's ability to manage it's Parklands;
    c. The limitations for landscaping on top of the tank.

Recommendations (Specific to Robinson Glen)

1. The U/G tanks proposed for the two draft approved plans of subdivision in the FUA Robinson Glen Secondary Plan be permitted, subject to successful negotiations of parkland credits and the appropriate financial contribution to the City to offset the additional future operating and maintenance costs of U/G tanks;
2. The type, design and specifications of the U/G tanks proposed in the Robinson Glen Secondary Plan be to the satisfaction of Director of Engineering and Director of Environmental Services;
3. The design of the proposed uses on top of the U/G tanks in the Robinson Glen Secondary Plan be to the satisfaction of Directors of Planning, Engineering, Environmental Services and Operations;

Recommendations (General)

4. Proposals for U/G tanks be reviewed on a case by case basis by Engineering and Planning Departments, in consultation with Environmental Services Department, to ensure that the proposed location is appropriate and the proposed type of U/G tank meets the City's specifications and criteria;

5. Engineering Department, in consultation with Planning and Environmental Services Departments, procures the services of a professional engineering consultant to assist in the development of appropriate criteria of acceptance for the consideration of U/G tanks, along with the acceptable uses above the facilities, along with the necessary specifications on U/G tank facilities;

Recommendations (General)

6. Developers proposing to install U/G tanks in lieu of open stormwater ponds must provide the City with a financial contribution to offset the additional future costs to maintain and operate the U/G tanks and staff be authorized to negotiate the financial contribution from the developers; and

7. Planning Department be authorized to determine the applicability of parkland credits for proposed uses on top of U/G tanks and negotiate the appropriate parkland credit for proposed parks deemed suitable to be located on top of U/G tanks.

Questions ?