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Credit Valley Conservation – inspired by nature

Sustainability in Green Infrastructure Maintenance

Source to Stream Conference

26 March 2024

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Background & Context

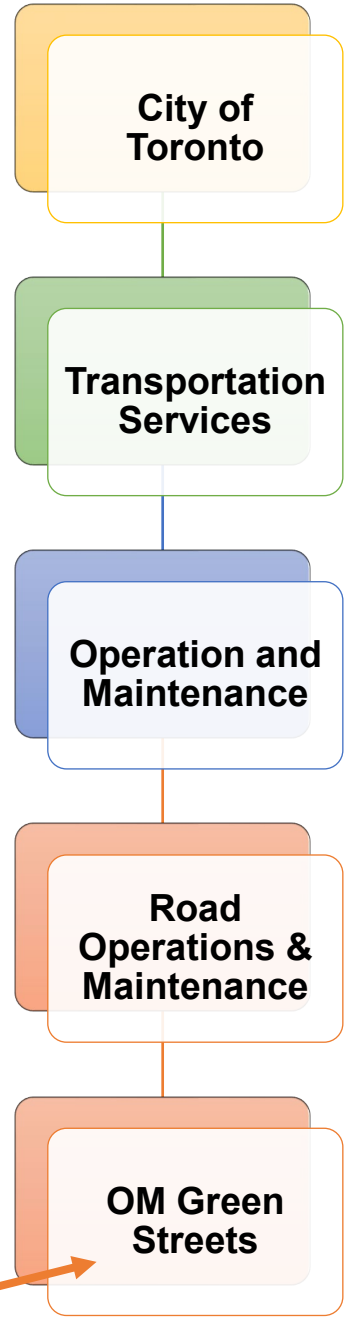
Green Streets Operations and Maintenance

O&M Green Streets

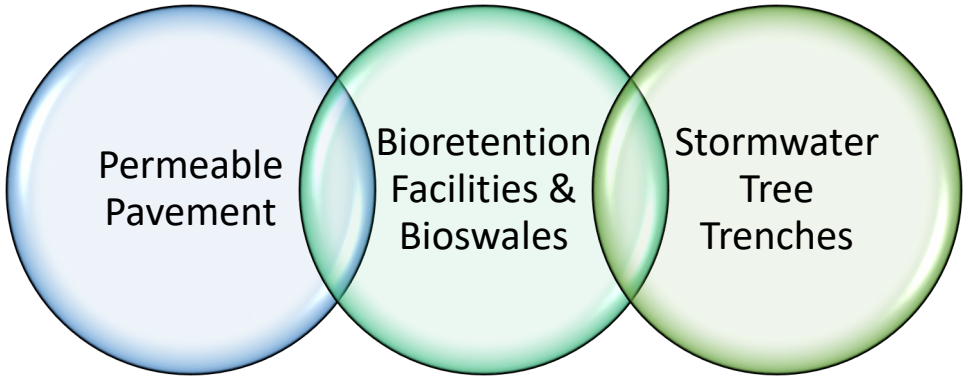
Established in 2021, O&M Green Streets is a sub-unit within Transportation Services tasked to:

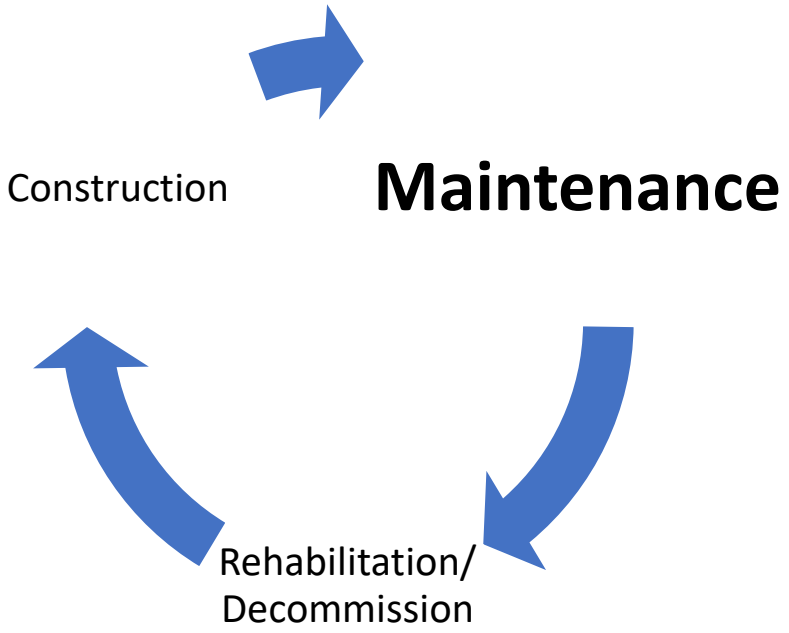
- Develop & deliver a City of Toronto Green Infrastructure (GI) O&M program as per industry best practices.
- Deliver services to other right-of-way horticulture (RH) planters (as required by TMC Chapter 743).

Maintenance partners include Parks, Forestry & Rec, Toronto Water, Solid Waste Management, BIAs, various resident and community groups.



Definitions:
Green Infrastructure (GI) Maintenance





- The three **Green infrastructure** types found in the public right-of-way

- **Maintenance** refers to all activities performed between construction completion and decommission. Differentiated as preventative and corrective maintenance.

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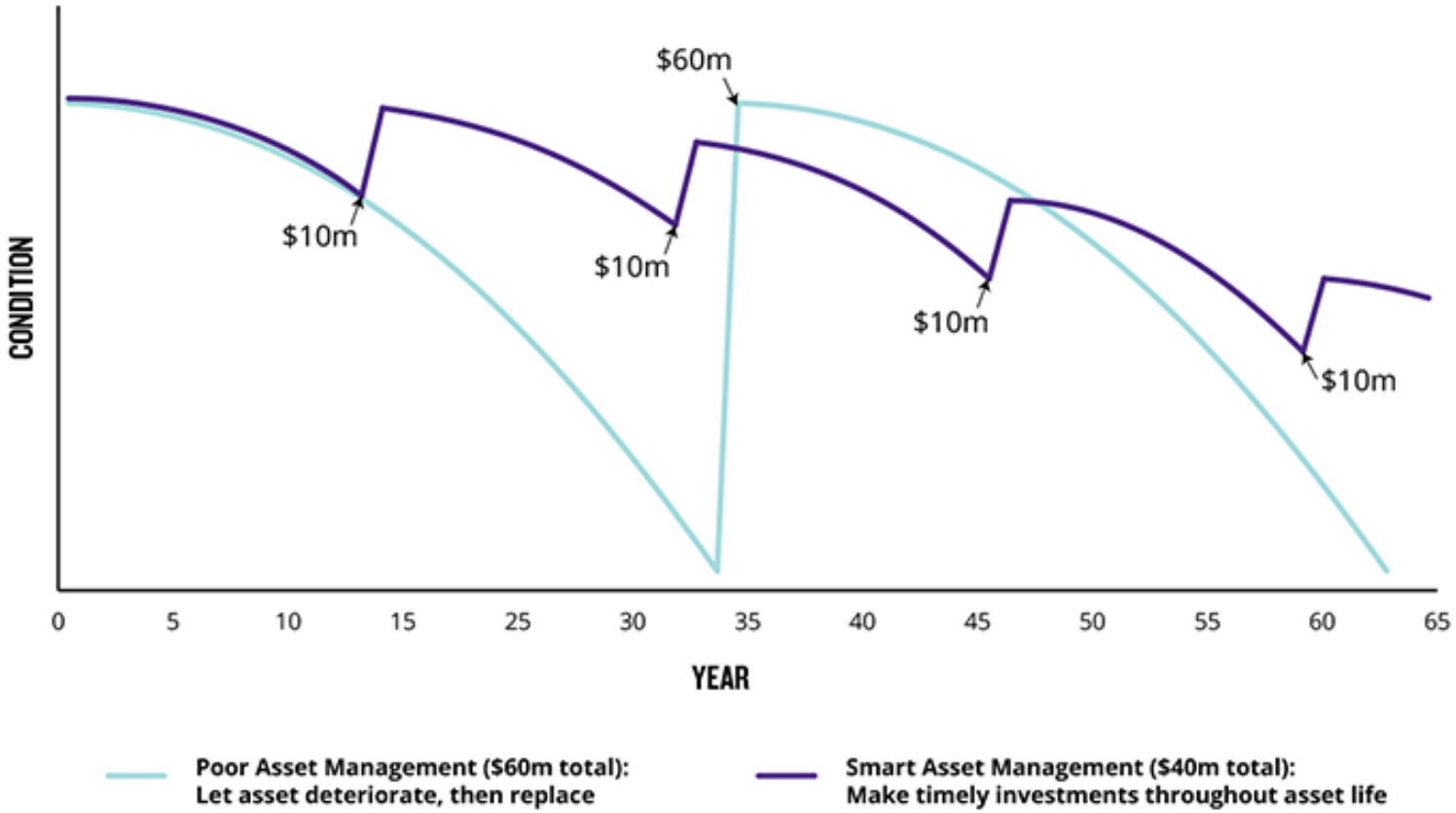
Why maintain GI?

For MOST GI assets, maintenance WILL be the largest lifecycle cost.

- **Functionality -** Preserve and/or increase asset performance over time.
- **Financial Efficiency -** Routine maintenance is SIGNIFICANTLY cheaper, less disruptive, and less wasteful than major rehabilitation.
- **Public Perception -** Defects are often highly visible (e.g. poor vegetation health, surface ponding, sediment accumulation, etc) and may impact acceptance towards future GI projects.

Condition and Maintenance over Time

Figure 4: **Small but Timely Renewal Investments Save Money**



Strategic maintenance can save significant resources over asset lifetime.

Source: Ontario's Long-Term Infrastructure Plan 2017

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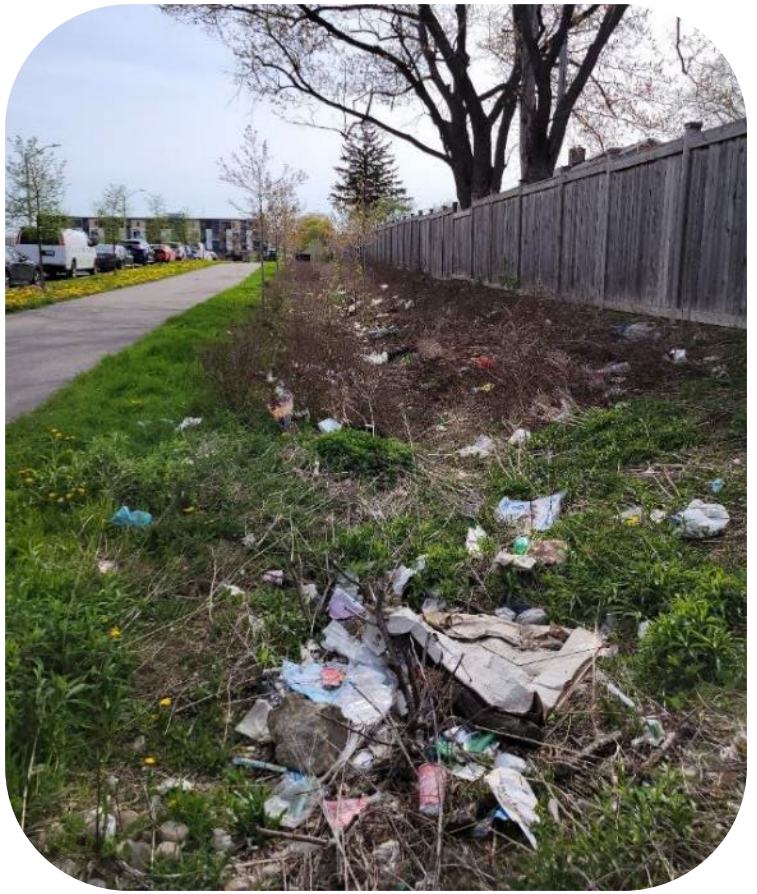
Highly Visible Deficiencies



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Sites in the City

- 2024: Twenty-Six (26) GI Sites; 70-80 assets
  - 7sq m. BR planter to largest a 5,400 sq m. bioswale.

- Breakdown by Asset type
  - Bioretention : 17 sites, 28 assets, ~9,000 sq m (36%)
  - Permeable Pavements : 5 sites, 5 assets , ~2,000 sq m (8%)
  - Stormwater Tree Trenches : 7 sites, 30 assets, ~14,000 sq m (56%)

- **RAPIDLY GROWING:** expected to increase 3-4x by 2027.
  - Upcoming GI – All transit expansion projects, Portlands cluster, Waterfront East LRT, Downsview, various Green Streets capital projects, various cycling & pedestrian safety projects.

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Green Streets O&M Services

Service Category	Service Delivery	Delivery Agent
Pavement & ROW function	(Existing) Road & Sidewalk repair program. (Existing) Street sweeping program (Existing) Winter maintenance program Curb-cut inlet repairs	In-house crews, Various contracted services
Vegetation & Softscape	Scheduled horticulture maintenance Plant replacement Grass Cutting Litter and debris clearing	Adj. Private Property Owner/Groups Workforce development crew (GI) Contract (ROW Landscaping) Contract (Grass Cutting)
Drainage, retention, infiltration.	Annual Infiltration Testing (P.Pavements) Scheduled inlet inspection & maintenance Grade & drainage area inspection & repairs. CCTV Inspection & Flushing (*developing*)	Workforce development crew (GI) In-house crews (TS/TW) TBC

Preventative maintenance

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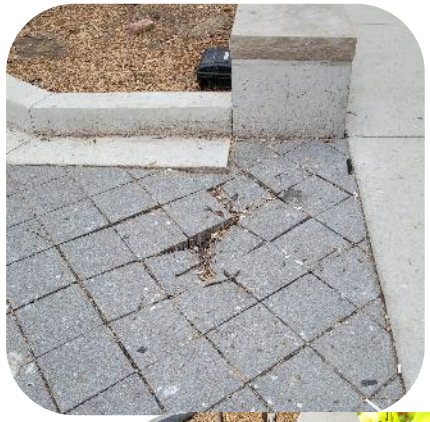
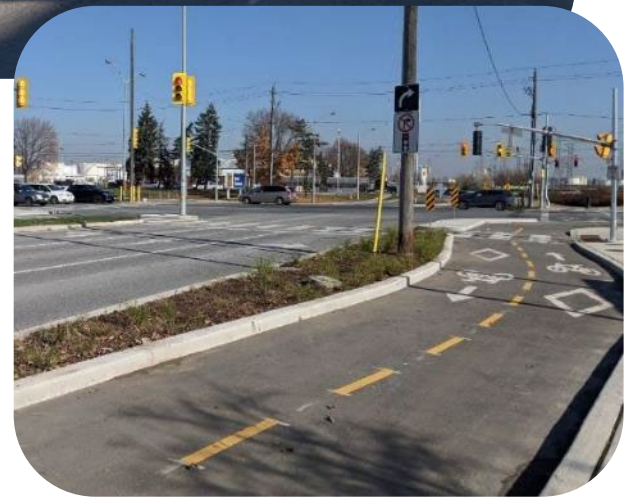
Corrective maintenance





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Developing GI maintenance Best Practices

Strategy & Approaches

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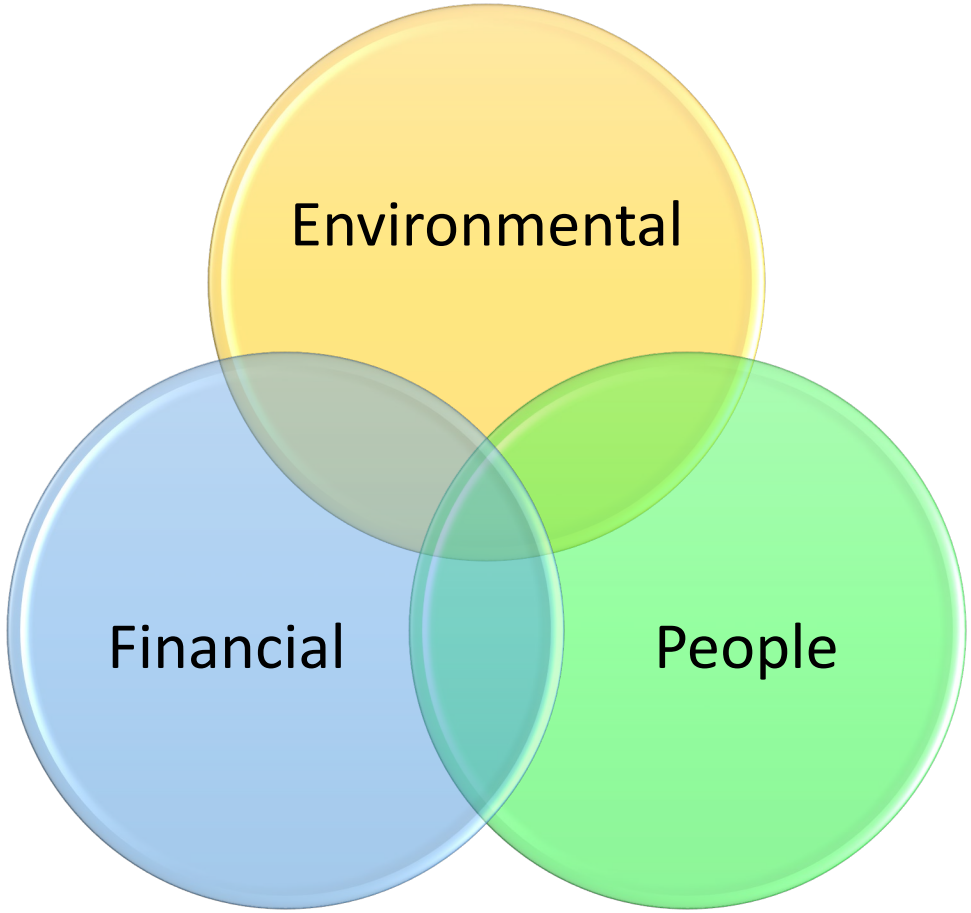
Sustainability as a goal



- **Environmental**:
  Materials used, carbon footprint, ecological benefits.
- **Financial**:
  Dollar efficiency, accurate long-term costing, reliable funding source.
- **People**:
  H&S, skill development, diversity, culture.

Getting there

Data-driven best practices

- External resources (STEP, GI exchange, other municipalities)
- Internal evaluations– currently focusing on lifecycle questions like:
  - What is the baseline asset condition graph (performance over time)?
  - How does different service type & frequency impacts performance over time?
  - Where/when is the best time to implement service?
- Always asking – is there a better way?

Workforce Development Program: GreenforceTO

- Launched in 2021, entering 4th year in 2024.
- Partnered with two social enterprises:

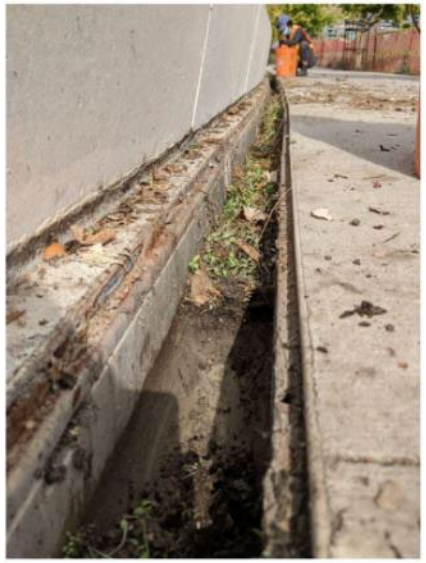
RAIN scapeTO — *Eco-landscaping specialist*

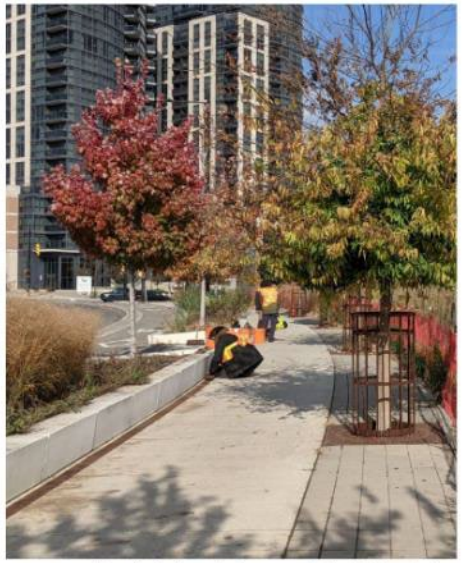
BuildingUP — *Construction pre-apprentice program focusing on groups with barriers to employment*

- Provides training & experience in:
  - Landscaping & Horticulture maintenance.
  - GI-specific maintenance (inlet clearing, infiltration testing, CCTV inspection).
  - Plant identification & pollinator habitat creation
  - Health & Safety (WHMIS, First Aid, MTO Book 7)

GreenforceTO

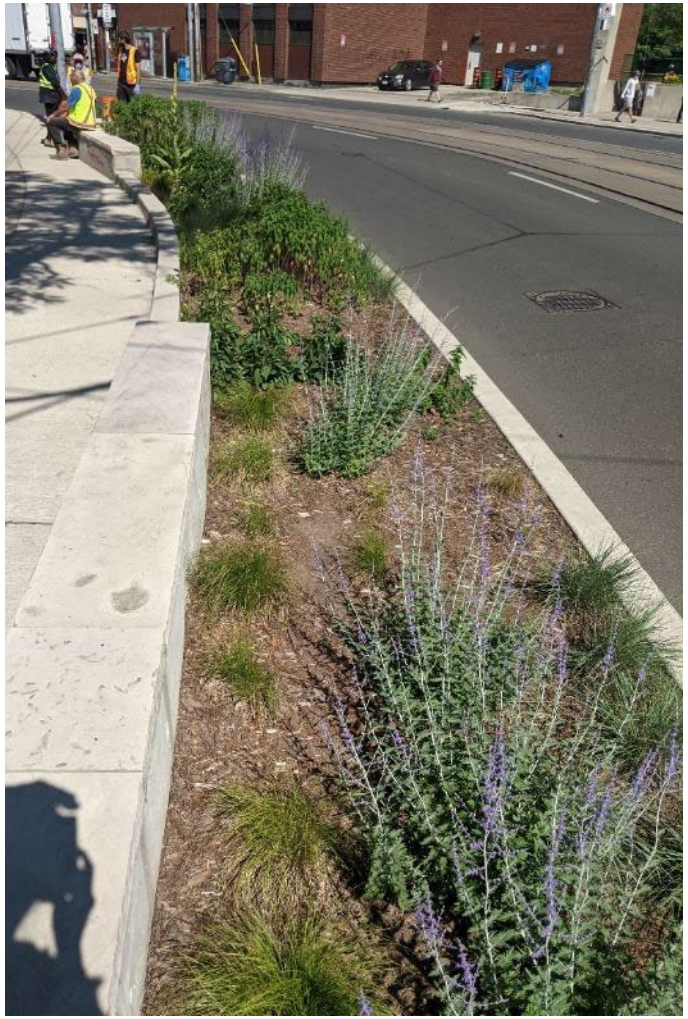
ROW horticulture planter at Woodbine Ave and O'Connor Drive





Trench drain maintenance at Six Points planters

Transplanting plants to reduce waste



Dundas/Bathurst planters to be temporarily removed due to construction.

Plants were moved to Woodbine/O'Connor site to preserve plants & reduce waste, majority survived despite mid-summer conditions.

Boulevard Sod Alternative Pilot

- Multi-year pilot to evaluate use of various wildflower/sod mixes to create a low-maintenance, pollinator-friendly boulevard treatment (as an alternative to sod).

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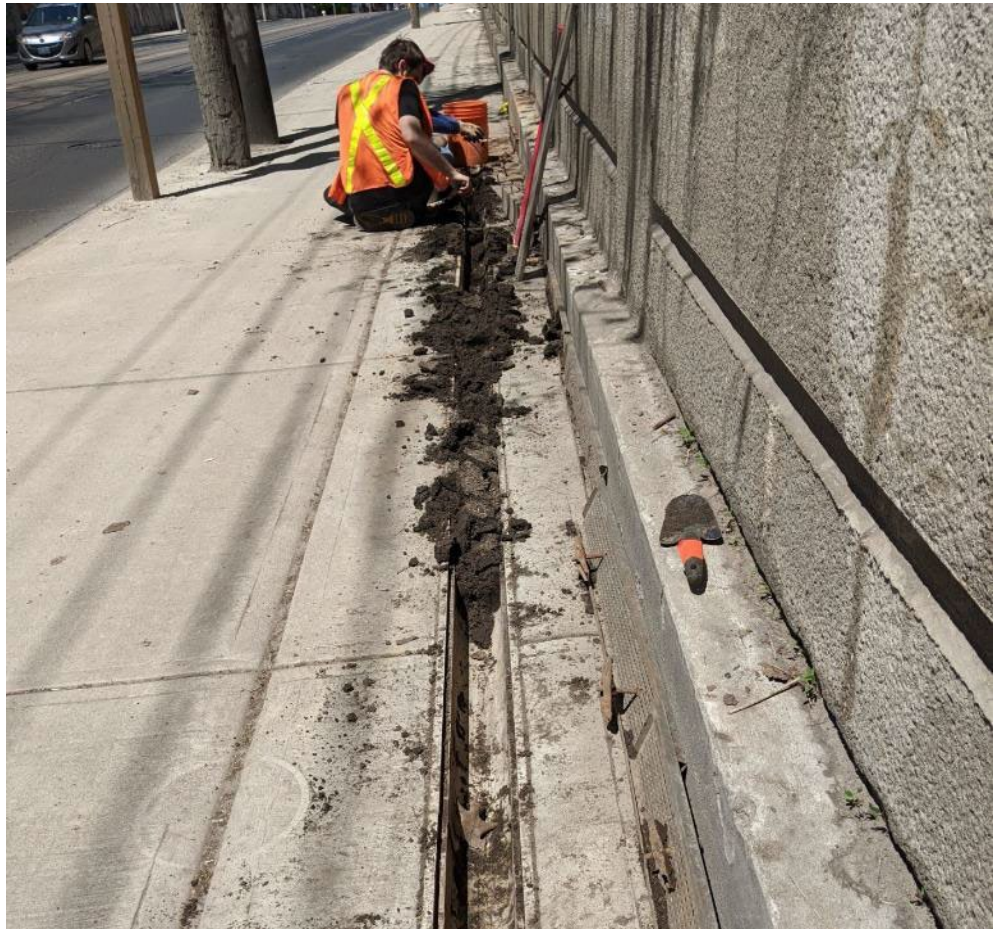
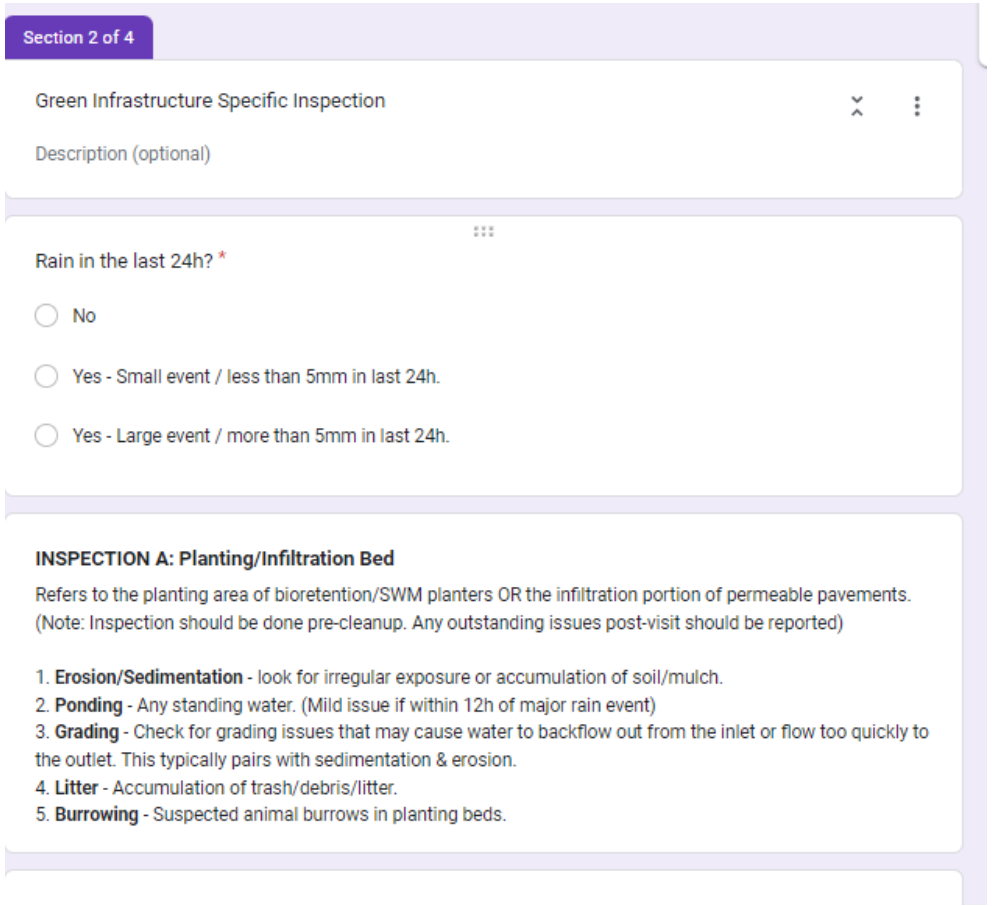
Trench Drain Maintenance Pilot & Evaluation



(left): Bathurst/Davenport Trench Drains
(top,right): Ryerson Ave Trench Drains

Regular GI Inspections (2-3weeks)



Section 2 of 4

Green Infrastructure Specific Inspection

Description (optional)

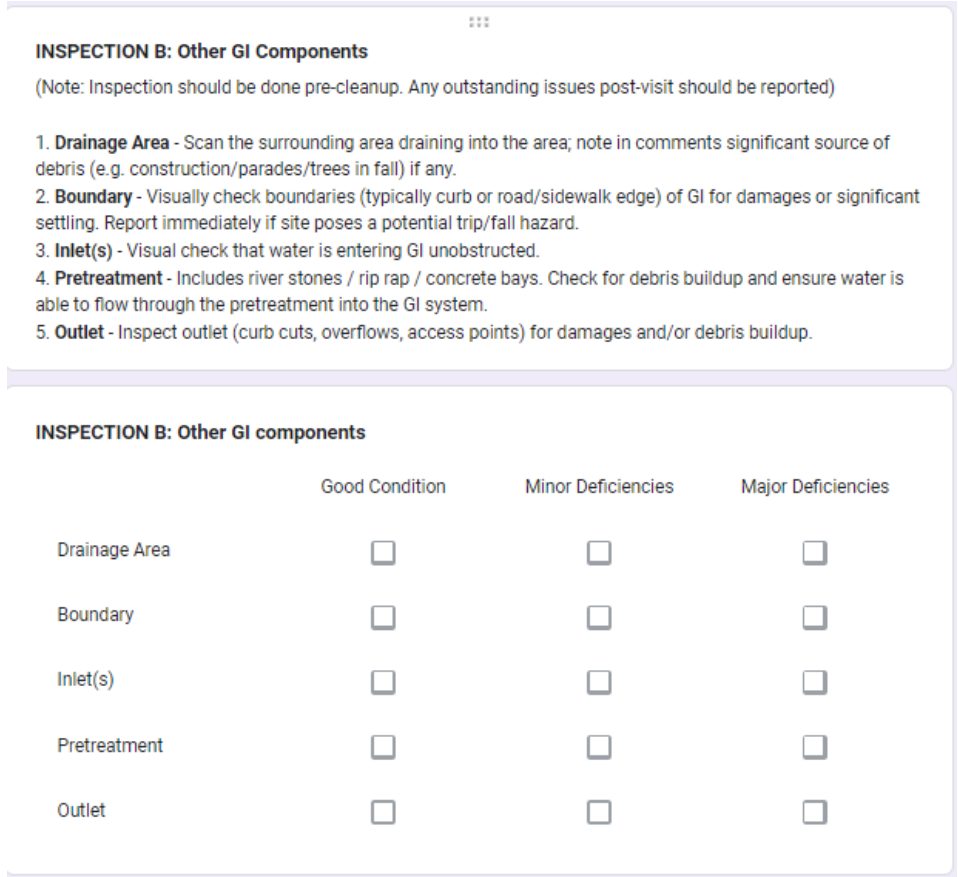
Rain in the last 24h? *

- No
- Yes - Small event / less than 5mm in last 24h.
- Yes - Large event / more than 5mm in last 24h.

INSPECTION A: Planting/Infiltration Bed

Refers to the planting area of bioretention/SWM planters OR the infiltration portion of permeable pavements. (Note: Inspection should be done pre-cleanup. Any outstanding issues post-visit should be reported)

1. **Erosion/Sedimentation** - look for irregular exposure or accumulation of soil/mulch.
2. **Ponding** - Any standing water. (Mild issue if within 12h of major rain event)
3. **Grading** - Check for grading issues that may cause water to backflow out from the inlet or flow too quickly to the outlet. This typically pairs with sedimentation & erosion.
4. **Litter** - Accumulation of trash/debris/litter.
5. **Burrowing** - Suspected animal burrows in planting beds.



INSPECTION B: Other GI Components

(Note: Inspection should be done pre-cleanup. Any outstanding issues post-visit should be reported)

1. **Drainage Area** - Scan the surrounding area draining into the area; note in comments significant source of debris (e.g. construction/parades/trees in fall) if any.
2. **Boundary** - Visually check boundaries (typically curb or road/sidewalk edge) of GI for damages or significant settling. Report immediately if site poses a potential trip/fall hazard.
3. **Inlet(s)** - Visual check that water is entering GI unobstructed.
4. **Pretreatment** - Includes river stones / rip rap / concrete bays. Check for debris buildup and ensure water is able to flow through the pretreatment into the GI system.
5. **Outlet** - Inspect outlet (curb cuts, overflows, access points) for damages and/or debris buildup.

INSPECTION B: Other GI components

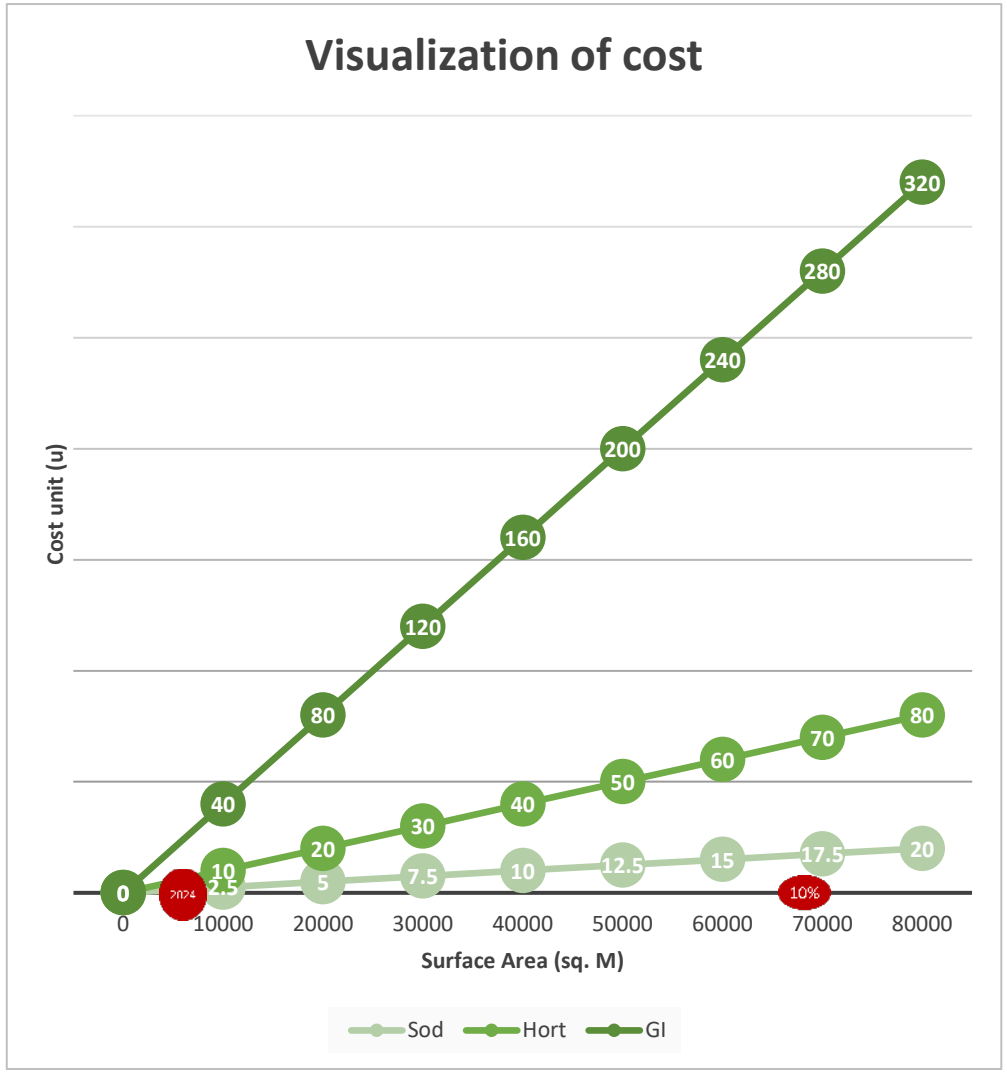
	Good Condition	Minor Deficiencies	Major Deficiencies
Drainage Area	☐	☐	☐
Boundary	☐	☐	☐
Inlet(s)	☐	☐	☐
Pretreatment	☐	☐	☐
Outlet	☐	☐	☐

Maintenance Cost

Comparing 2023 cost per square metre (12 visit/yr) for contracted service.

- Grass Cutting : 0.25u
- ROW Horticulture : 1u
- Green Infrastructure* : 4u
  - *Cost includes inspections, workforce development, and a significantly broader scope of work (e.g. infiltration testing, inlet cleaning, routine inspection).

Reducing unit cost is paramount if GI are to be implemented **<u>at scale</u>**.



2024 Current 2024 Scenario (~6,000 sq. m)

10% 10% of Toronto streets implements a 1.2m continuous bioswale/green gutter with horticulture (~684,000 sq.m)

Challenges & Lessons Learned

Reoccurring Challenges

1. Poorly constructed/designed GI leads to hard-to-maintain/problem prone GI.
2. Maintenance partners falling through due to turnover.
3. Insufficient maintenance performed during establishment/warranty period – leading to early plant mortality.
4. Out of control factors (e.g. construction, pests) causing accelerated degradation.
5. Logistics and cost of custom components (e.g. pavers, grates)
6. Plant theft in spring.

Lessons Learned

1. **Good Recordkeeping**: Keeping track & organizing inspection reports, maintenance agreements & other documents to ensure consistency over time.
2. **Establishment period (~2y) matters**: Ensure maintenance is covered during warranty period. Explore financial instruments to enforce maintenance contractor is supposed to maintain GI during warranty period. Include option for irrigation.
3. **Documentation & Communication**: Documenting challenges & making it a priority to communicate it to implementors.
4. **Maintenance. Friendly. Design. !!!!**

Maintenance Friendly GI

(and a few not-so-friendly ones)

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Plants and Vegetation!

- Horticulture or Sod?
  - Maintenance resource, road use, litter load, other functionality (structure, visual barrier, place-making, drainage conveyance)
- Maintenance-friendly horticulture tips:
  - Drought-tolerant hardy perennials are the best performers.
  - Salt-tolerance important where applicable.
  - Manicured edge provides impression of a managed planter.
  - Height-appropriate shrubs/grasses (visual structure & sightlines).
  - Pollinator-friendly and/or native preferred.

Drought-tolerant, hardy perennials

Byng Ave (& Albion) native plantings showing resilience during the dry summer month vs. sod in 2020 and 2022.

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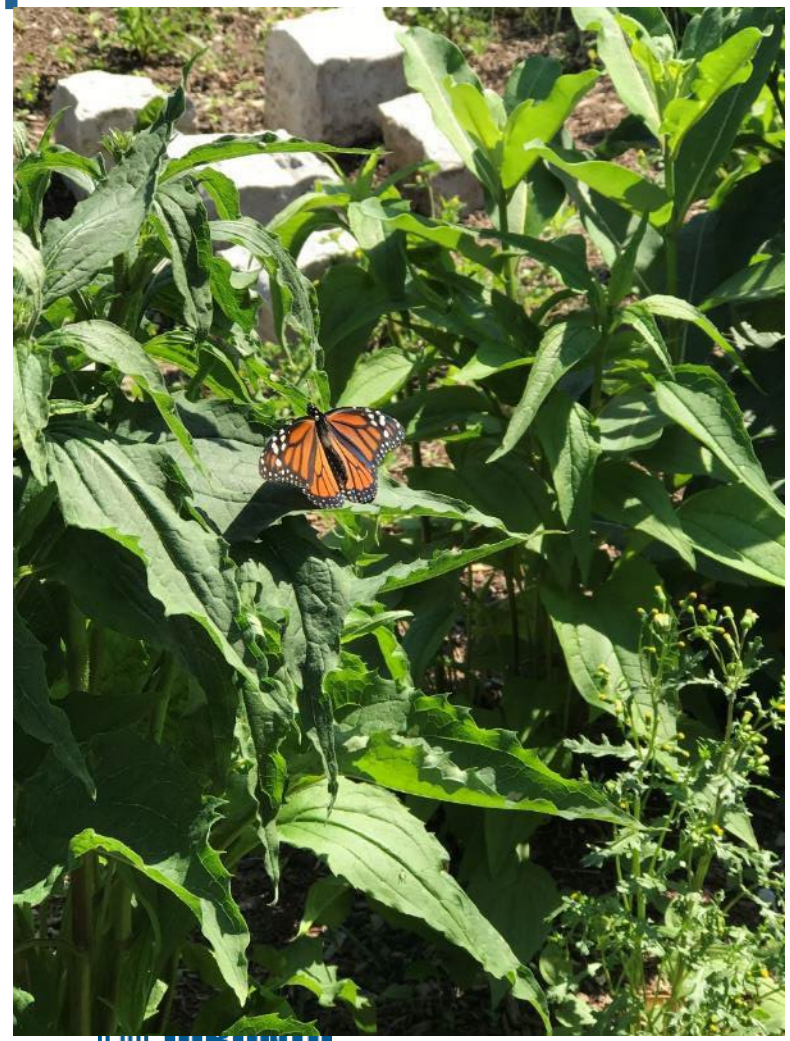
Pollinator-friendly species



Be mindful of succession: sunny to shade under trees

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Inlets

- Curb cut inlets
  - Width & number of inlet matters
  - Sediment pad recommended but evaluate base on sediment load and I/P ratio.
  - Minimize use of river rocks
- Trench drains and other grated inlets
  - Width, bolts, grate slits matters.
  - Minimize grated inlets use, ESPECIALLY trench drains <300mm wide.

Inlets & Pre-treatment – (1)

Murray Ross Parkway Bioretention (left) and Green Gutter (right)

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Inlets & Pre-treatment – (2)

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Maintenance Enemy #1: Trench Drains

Trench drains cleaning are time and labour intensive and expose workers to awkward positions pre-cursors of Musculoskeletal Disorders (MSD).

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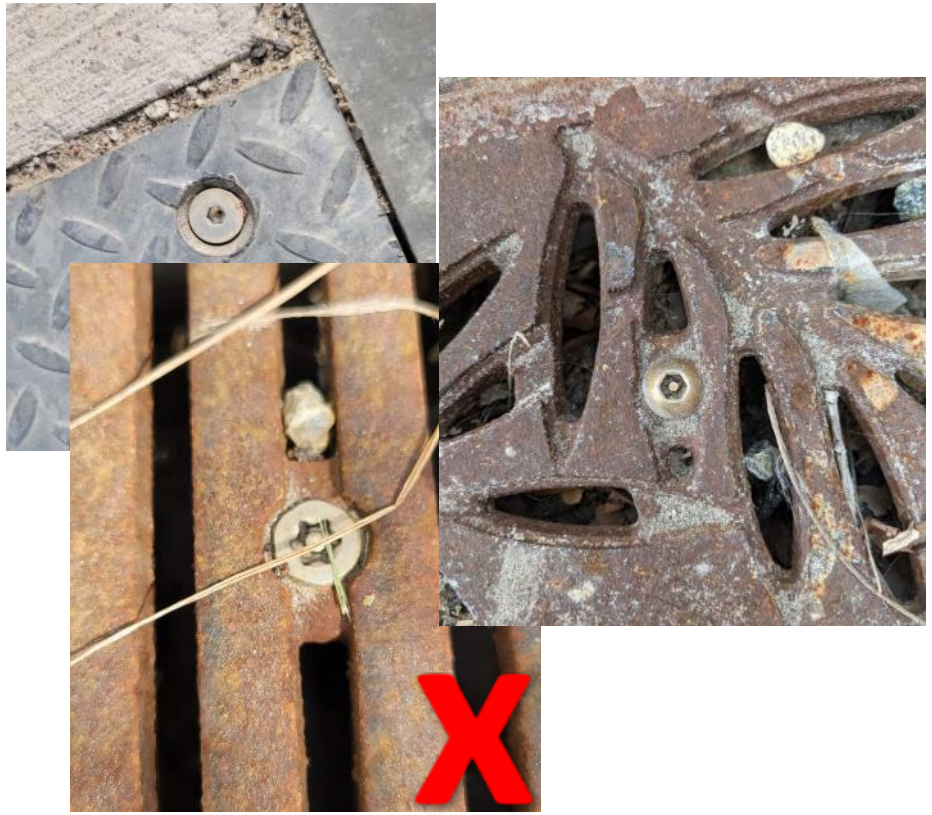
Bolts & fasteners of trench grates & cover.



Eliminate trench drains or use boltless trench drains if possible. Otherwise, use industrial grade protruding (male) boltheads. Recess pit to maintain flush surface surface flush (in consideration of plow blades & trip hazards).

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Cleanout/Flushout caps

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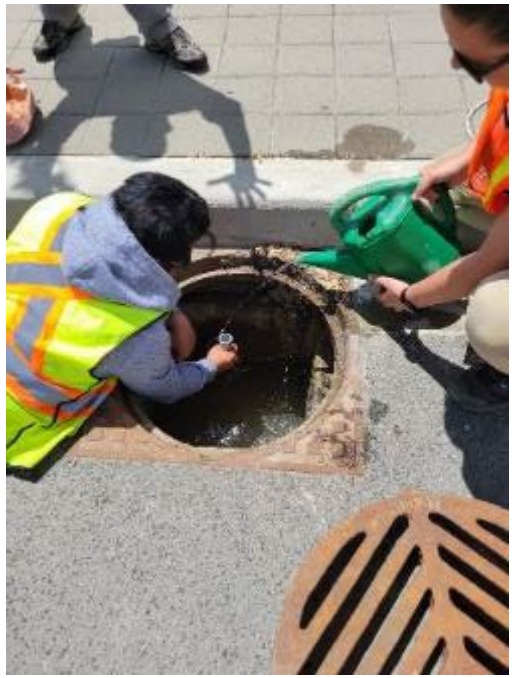
Access point & CCTV manoeuvrability



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Streetscape level considerations

- Seasonal changes in streetscape (winter, rain, fall, cafeTO).
- Sediment load (litter, dust, leaves).
- Existing road use patterns
  - Motor vehicle: Heavy vehicles, parking, turning radii, sightlines.
  - Pedestrians: trampling, trip/fall hazards.
  - Others: pets, pests, wildlife

CONSIDER: Winter Conditions (Salt, Snow, Visibility)

Carr Ave & Ryerson Ave Bioretention Bumpout
NO Visibility during winter.

Morningside & Steeles Bioretention
Shrubs provides visibility during winter.

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Motor Vehicle Patterns

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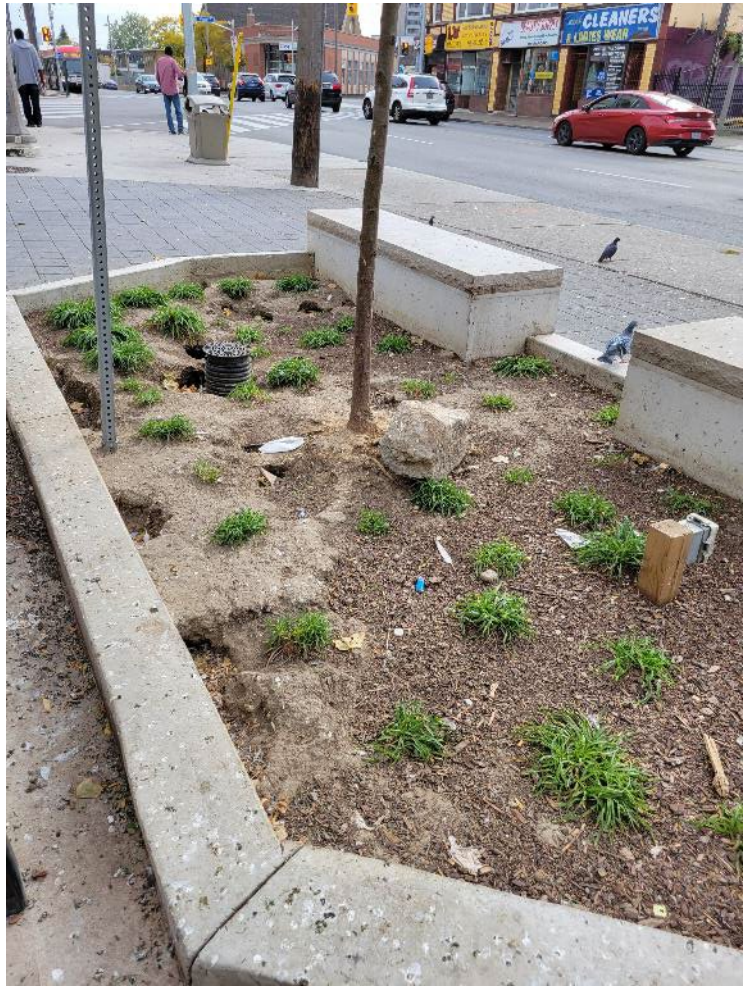
Signs help! (maybe)

Other unexpected GI enjoyers



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Closing Remarks

- GI maintenance is important.
- O&M program sustainability (environment, finance, people) important for at-scale implementation of GI.
  - Maintenance friendly design helps.
- Industry is still young – much to learn and much to do.
- Good communication and collaboration has been immensely helpful for us – so let's keep it up as an industry.

Thank you!

Jen-Sion Tan

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