Council Meeting
September 18, 2023

Comments Received Regarding Item 10.3

Rainwater Management Financial Plan, Stormwater Fee Development and Consideration of Green Stormwater Infrastructure

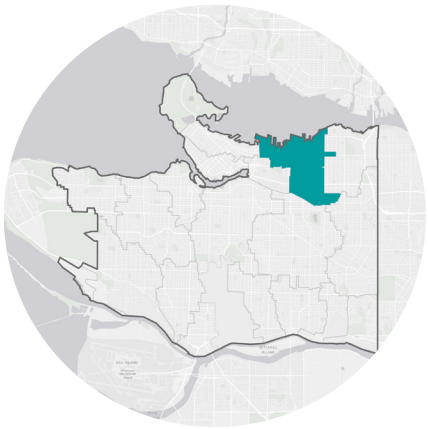
Woodland & 2nd

Rain City Strategy **Green Infrastructure Implementation**

Last Updated: 2022

Woodland Dr & 2nd Ave E

Location



Grandview Woodland Watershed

Location of bioswale

Project overview

Within the Grandview Woodland Community Plan, increasing a range of affordable housing units is a key principle. Increasing density to allow for more affordable housing units will add pressure to an already strained sewer and storm system. This bioswale helps to capture close to 3,000 sq. meters of rainwater runoff, keeping 3.8 million liters of rainwater runoff out of the sewer annually and in doing so, free capacity for higher density development. In addition to adding capacity for increased density, this project also help to address other key objectives in the Grandview Woodland Community Plan such as adding a protected bike lane for increased sustainable transportation options, and enhancing the accessible green space within Alice Townley Park.

Project delivery

This project was designed and constructed by City of Vancouver designers, engineers, and construction crews. It pilots innovative inlet designs, construction material reuse, protection of all existing trees, and work around multiple utility conflicts. Working with internal City crews allowed for creative field fit solutions, re-use of existing City stock piled materials, and minimal change orders. Ongoing monitoring of inlet function, sustainable material performance, groundwater levels, and plant health is in place to evaluate design performance and inform future GRI design standards.

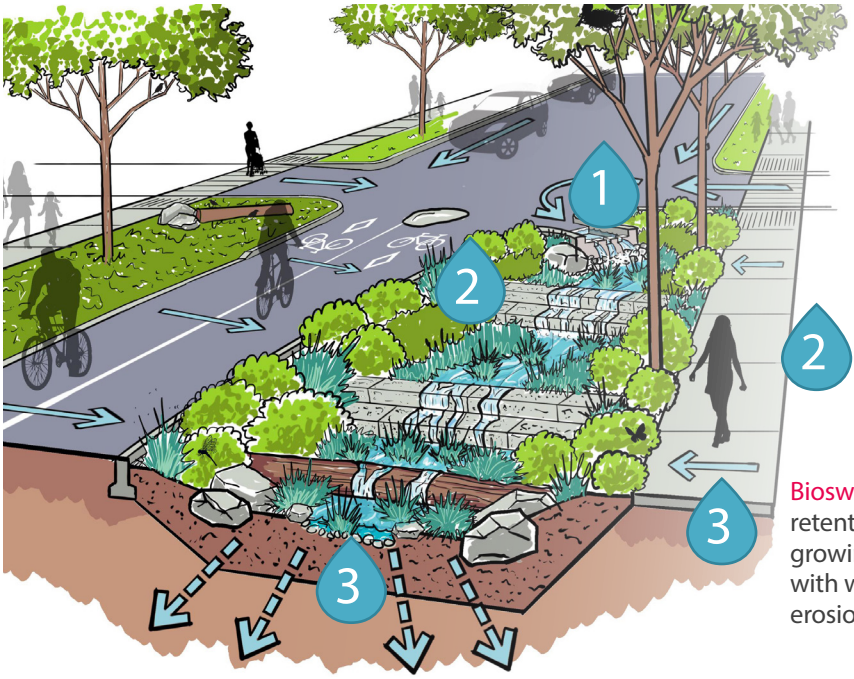
What is Green Rainwater Infrastructure (GRI)?

GRI is a cost-effective approach to rainwater management that protects, restores, and mimics the natural water cycle. It uses soils, plants, trees, and engineered structures to capture, store, and clean urban rainwater runoff before returning it to our waterways and atmosphere.

GRI delivers essential drainage services as well as additional co-benefit services such as reducing climate change risks, providing ecosystem services, and offering opportunities to stimulate the local economy.

Woodland & 2nd

Rain City Strategy **Green Infrastructure Implementation**



Project design

Project elements

1 **Inlet** captures rainwater runoff from Woodland Drive and helps to slow down the movement of water and capture sediment before entering the bioswale.

2 **Weir Walls** help to slow rainwater runoff collected from Woodland Drive and lane way and in turn, increases ponding area, infiltration, and reduces risk of erosion.

3 **Bioswale** allows for a large volume of water retention and infiltration within specialty growing medium. Plants throughout help with water uptake through their roots, erosion control, and pollinator habitat.

Design Components

Granite Blocks were re-used from retired City curbs to form naturalized weir walls.

Habitat Log provides opportunity for decay and nutrients for fungi, insects and plants.

Inlet Stamps add interest and sense of place to an otherwise large concrete surface.

GI Chamber collects water from multiple catch basins and distributes throughout the bioswale.

Design considerations

Existing Trees
Along the bioswale were protected during construction and included within the bioswale design.

Utilities
Multiple existing utilities and offset requirements played a significant role in design and layout.

Planting palette
Emphasizes the use of hardy, native species.

Woodland & 2nd

Rain City Strategy **Green Infrastructure Implementation**

200m²
Bioretention planting area

3.0thousand m²
impervious area managed

3.8 thousand m³
urban rainwater runoff diverted from sewer system annually

Timeline & partners for GRI

The GRI components of the project were internally designed and constructed, led by the Green Infrastructure Implementation Branch. In the timeline below, key partners that supported the delivery of GRI are identified at each stage of the project.

Planning
2016
Grandview Woodland Community Plan

Conceptual design
2019
RainCity Strategy Approved by City Council - Site Selection

Detailed design
2021
Internal Design

Construction
Spring 2022
Internal Crews

Planting
Fall 2022
External contractors

Public opening
Fall 2022

Operating, monitoring, maintaining
Fall 2022 onwards
External contractors

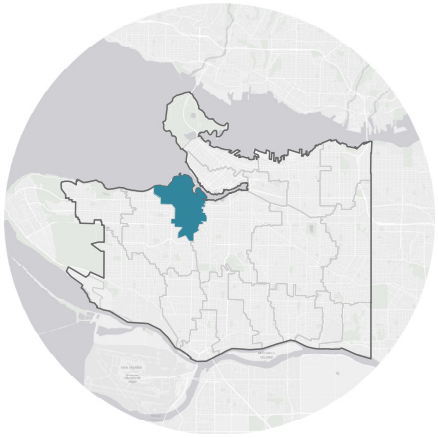
Pine Street

Rain City Strategy **Green Infrastructure Implementation**

Last updated: 2022

About Pine Street

Location



South Hill Watershed

Location of bioswale

Project overview

As part of the Pine Street sewer main upgrade, three new bioretention corner bulges were designed and installed to help capture and clean rainwater runoff from Pine Street, 7th Ave and 8th Ave. All three bioretention bulges include best practice green infrastructure designs such as concrete sediment pads to help reduce maintanece requirements. Wier walls have been designed to help slow the movement of rainwater runoff and increase infiltration. All three sites will help to capture roadway pollutants as well as add a number of co-benefits such as pollinator habitat and increased biodiversity.

Why was GRI implemented?

Pine Street underwent a major infrastructure upgrade to replace aging storm and sanitary sewer mains between West 4th Avenue and West 8th Avenue. The construction involved opening up the street and removing existing curbs. This provided an opportunity for the TDE and GI branches to work together on traffic calming and rainwater management objectives.

In total, six corner bulges have been installed, three of which are bioretention corner bulges designed to capture and clean urban rainwater runoff. Opting for bioretention corner bulges eliminated the need to relocate three existing catch basins and install new sewer connections. By not spending $30,000 on relocating the catch basins, more value was added by improving urban rainwater runoff quality, reducing the risk of overland flooding, and supporting biodiversity and ecosystem services.

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Pine Street

Rain City Strategy **Green Infrastructure Implementation**

Project design

Project elements

1 **Outlet** the existing Catch Basin was re-used as an outlet for any overflow during large rain events.

2 **GI curb** helps to protect the existing boulevard trees by reducing erosion and minimize changes to hydrolic conditions.

3 **River rock** helps to disperse energy of incoming rainwater runoff and in turn, helps to reduce water ruts and erosion.

Design components

Inlet directs water into the bioswale and removes sediment.

Weir wall helps to slow water flow and in turn, increases opportunity for ponding and infiltration.

Diverse planting helps to increase local biodiversity and create year-round interest.

The subdrain removes excess rainwater when soil is saturated.

Design considerations

Bioretention soil consists of a specialized mix of sand and organic matter. The design allows for infiltration while still providing adequate nutrients to support thriving plant communities.

Clearances from underground utilities, including street lighting, BC Hydro utilities above and below ground.

Planting palette developed in coordination with Street Activities.

Pine Street

Rain City Strategy **Green Infrastructure Implementation**

49 m²
Bioretention planting area

2.5 thousand m²
impervious area managed

3.1 thousand m³
urban rainwater runoff treated onsite annually

Timeline & partners for GRI

The GRI components of the project were internally designed and externally constructed, led by the Green Infrastructure Implementation Branch. In the timeline below, key partners that supported the delivery of GRI are identified at each stage of the project.

Planning
2019
Urban Forestry, Transportation Design, Streets Design

Conceptual design
2020
Transportation Design, Streets Design

Detailed design
2020
Transportation Design, Streets Design

Construction
Spring 2021
External Contractor, Development and Major Projects Branch

Planting
Spring 2021
External contractors

Public opening
Spring 2021

Establishment period for planting
May 2021-May 2023
External contractors

Operating, monitoring, maintaining
May 2021 onwards

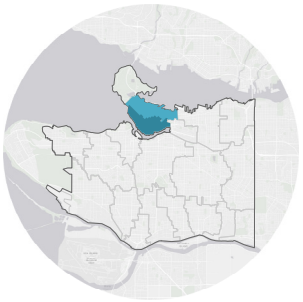
Richards Street

Rain City Strategy **Green Infrastructure Implementation**

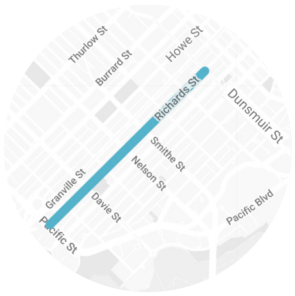
Last Updated: 2022

About Richards Street

Location



Downtown North and Downtown South Watersheds



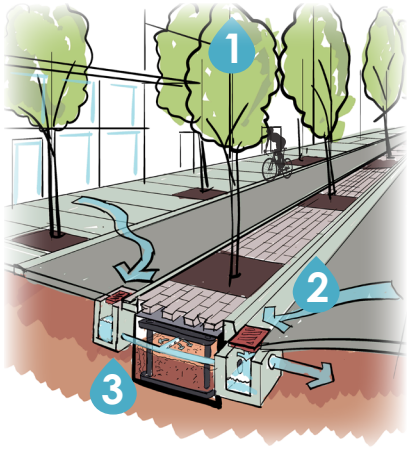
Location of rainwater tree trenches along Richards Street

Project overview

Richards Street between Cordova and Pacific Street is part of the first installment of a citywide blue-green system. The system creates corridors that deliver rainwater management, provide active transportation routes to walk, bike, and roll, and add green spaces for the community and wildlife to enjoy. The rainwater tree trenches between Dunsmuir and Pacific capture and clean urban rainwater runoff, while the protected bike path creates safe travelling options. The addition of trees along this corridor contributes to the growth of the urban forest, enhancement of biodiversity, and mitigation of the urban heat island effect.

What is a rainwater tree trench?

Rainwater tree trenches are versatile green rainwater infrastructure assets that are well suited for Vancouver's dense urban environment. The urban rainwater runoff collected on Richards Street and the bike lane is redirected into the rainwater tree trenches. By natural filtration and tree uptake the urban rainwater runoff is absorbed, cleaned and kept from entering the sewer and drainage system.



1. Trees uptake rainwater through their roots, diverting water from entering our sewer system.
2. Rainwater collection captures runoff into the tree trench through inlets, catch basins, and permeable pavers.
3. Infiltration into the soil helps clean urban rainwater runoff and reduces the amount of water entering our sewers.

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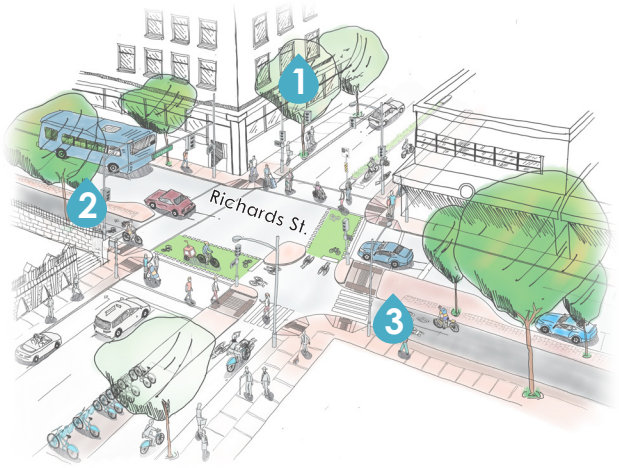
Richards Street

Rain City Strategy **Green Infrastructure Implementation**

Project design

Project elements



1 **Trees** are nature's air conditioner and purifier. They provide shade, moderate the local climate, mitigate urban heat island effect, and improve air quality. Additionally, they reduce the amount of urban rainwater runoff, store carbon, and provide food, protection, and homes for many birds, pollinators, and small mammals.

2 **Green rainwater infrastructure** collects, cleans, and absorbs polluted rainwater from streets and sidewalks, improving the quality of water in our surrounding water bodies and protecting marine life and recreation.

3 **Bike lanes** are all two-way and fully protected providing an All Ages and Abilities active transportation route.

Design components

Permeable pavers allow for infiltration of rainwater into the tree trench while also providing an accessible walking surface. The pattern adds a playful element to Richards Street.

Structural soil has small pockets of growing medium and air between larger rocks that allow for root growth and water infiltration while still being compactable.

Silva cells are engineered frames that hold large volumes of growing medium for tree roots and rainwater infiltration. Silva cells can be compacted on all sides.

Design considerations

Management of all GRI phases of the project, from planning, design, and procurement to inspection and lifecycle operations and maintenance.

Accommodation of four significant utilities in the corridor, including BC Hydro, Water, Sewer, and Electrical.

Coordination with over 20 internal and external stakeholders and procurement of over 30 materials from 5 external vendors.

Richards Street

Rain City Strategy **Green Infrastructure Implementation**

8 blocks, two-way
All Ages and Abilities separated bike lane

100+
new trees

50,973 kg
carbon sequestration over 50 years

16 sensors installed
monitoring soil moisture levels

1.1 hectares
impervious area managed

15 million litres
urban rainwater runoff treated onsite annually

11 million litres
urban rainwater runoff diverted from sewers annually

Timeline & partners for GRI

The Richards Street project as a whole involved numerous Engineering divisions and City departments. The GRI components were internally designed and constructed, led by the Green Infrastructure Implementation branch. In the timeline below, key partners that supported the delivery of GRI are identified at each stage of the project.

Planning
2012-2019
Engineering Projects & Development Services, Transportation, Streets, Water & Sewers

Conceptual design
2019-2020
Engineering Projects & Development Services, Transportation, Streets, Water & Sewers

Detailed design
2020
Engineering Projects & Development Services, Transportation, Streets, Water & Sewers

Procurement
2020-2021
Finance, Risk, & Supply Chain Management

Construction
Spring 2020 - Fall 2021
Street Operations

Planting
Fall 2020 - Fall 2021
Park Board

Public opening
Spring 2021 (Phase 1) & Fall 2021 (Phase 2)
Engineering Projects & Development Services, Transportation, Streets

Operating, monitoring, maintaining
2021-2070+