ST GEORGE RAINWAY 2022 BIOBLITZ REPORT-BACK









- Reduce street flooding
- Treat rainwater pollutants from roadways

INTRODUCTION

- Reduce combined sewer overflows into local waterways
- Enhance climate resiliency
- Increase biodiversity
- Cool the neighbourhood during summer heat

Green Rainwater Infrastructure (GRI) uses nature and engineering to help capture, convey and clean polluted urban rainwater runoff. These systems can also provide many environmental and social benefits to a community, like increased biodiversity. St. George Rainway, between Broadway and E 5th Ave will use plants and soils in a series of rain gardens to help manage polluted rainwater. This newly added green corridor will provide important food sources and habitat for a variety of wildlife, including pollinators, birds, small mammals, and insects.



Current conditions of St. George St at E 7th Ave (left) and proposed Rainway design (right)

St. George Rainway will also be considered part of a blue-green system, a network of connected park-like streets that manage water and land in a way that is inspired by nature and designed to replicate natural functions and provide ecosystem services. Included in those ecosystem services are food, shelter, water and habitat that support biodiversity.

The State of Biodiversity in Vancouver

Vancouver is an urban landscape consisting of habitat patches fragmented by urban development, roads, utilities and other land uses. Habitat fragmentation can negatively impact ecosystem services and reduce the dispersal ability of plants and animals. Every species of plant and animal have a range in which it can travel. By connecting habitat patches together with larger "anchors" of natural space such as Stanley Park, the Fraser River, and Pacific Spirit Regional Park, we can create an ecological network or connected system that can support birds, pollinators, insects and mammals.

In Vancouver, forests and marine habitats are still relatively abundant, but streams, wetlands, and meadows are rare because of Vancouver's history of urban development. Climate change, invasive species and environmental contaminants are further stressors impacting the health and well-being of ecosystems in the City. The St. George Rainway will add meadow and forest habitats and help to connect critical species to other biodiversity hotspots in the city including Guelph Park, Hinge Park, Sahalli Park and Robson Park.



Examples of how GRI can recreate forest habitat (left) and meadow habitat (right)



To learn more about how Vancouver is trying to improve biodiversity in the city, take a look at the <u>Biodiversity Strategy</u> and the <u>Vancouver Bird Strategy</u>.

Biodiversity on the St. George Rainway

By understanding what is already in the ecosystem, and what is nearby, we can adopt planting design, maintenance and stewardship strategies that provide resources these species need including food, water and shelter. To help us better understand the current state and quantify the future changes in biodiversity along St. George Rainway, we need to first measure what types of plants and animals currently use the space. In 2022, the City hosted a citizen science campaign to help to measure the baseline biodiversity conditions along St. George Street. Using the application iNaturalist as well as manual counts, data was collected on the existing birds, plants, trees, insects, and mammals that currently use St. George Street.



St George Rainway Bioblitz project pages on iNaturalist



Enhancing ecosystem services and creating connected biodiversity corridors are two of the goals of the St. George Rainway. The bioblitz project is being used to both inform and monitor the success of those goals. The project has been informed by three objectives:

Objective 1: Quantify changes and increases in biodiversity on the Rainway

- Determine the baseline biodiversity along St George St by collecting data on biodiversity pre-construction
- Collect data on biodiversity continuously post-construction to determine if GRI changes and/or increases biodiversity in this corridor

Objective 2: Evaluate current species to inform Rainway design

- Determine what native and beneficial animals, pollinators and insects are already using this space, to assist with providing those animals with food sources and habitat
- Identify plants and animals that might be a hindrance to establishment of new plants once the GRI on St George St is built, including invasive species and indicator species of environmental degradation
- See what plants and animals are missing from the landscape, and design habitat and planting plans to accommodate those species

Objective 3: Encourage the community to learn more about biodiversity and urban nature

- Work with members of the community to collect biodiversity data through seasonal bioblitzes
- Develop biodiversity resource sheets to support ongoing learning about biodiversity



Community members joined City of Vancouver staff as citizen scientists to help collect data over four events in 2022. The first three events had a specific focus, and the final culminating event encompasses all species. The four events were:

- Birds, February 2022
- Plants, April 2022
- Insects, July 2022
- All species, October 2022

The data collection area was St George Street between E 5th Avenue and Broadway, except for the birding bioblitz, which also covered four blocks surrounding this area and local parks. Observations were contained to public areas and did not include private property.



Map of bioblitz area. Pink represents the area inventoried for plants and insects, yellow for birds.

We did not host an event to inventory mammals in our bioblitz, as the main mammals we would expect in this urban environment would be largely nocturnal (skunks, raccoons). Vancouver does support healthy populations of coast mole, striped skunk, raccoon and coyote, but we would expect to see a small number of individuals among the mammals.

We collected very limited data on fungi, as fungi is very difficult to identify by amateurs, and due to the seasons we collected data in.

In all events, we asked citizen scientists to record their data in two ways: iNaturalist for the species identification, and on paper or on a map to record the count for that observed species. As our citizen scientists had varying levels of familiarity with species identification, we also provided handouts and resources with commonly observed species. We also encouraged using the iNaturalist app for help with identification. Several community observers within iNaturalist assisted with identification, or verified identification, after the events, leading to many of our observations becoming research grade.

After each event, we downloaded the data from iNaturalist, and added to the dataset observations we had received from citizen scientists on paper. Observations that were identified in iNaturalist to be "cultivated or captive" were removed from the biodiversity count, as these are organisms that are intended to be in that place (I.e a planted shrub, a pet). Citizens were encouraged to include observations outside of the bioblitz theme, however the analysis on each bioblitz excluded those observations. For example, a plant observed during the bird bioblitz was not included in the biodiversity number for the bird bioblitz. These observations were still helpful in informing planting design.

To determine what species the Rainway is best suited to support, we compared the data collected to the Indicator Species from <u>Conserving Biodiversity in Greater</u> <u>Vancouver: Indicator Species and Habitat Quality</u>. Indicator species are a species or group of species that reflect the current state of an environment. They indicate the impacts of environmental change, as well as the diversity of species within an area. Four indicator species were found in the project area.



Want to learn more about identifying plant and animals? Here are a few resources:

- <u>St George Rainway Bird handout</u>
- <u>St George Rainway Plant handout</u>
- Delta Naturalists Nature Brochures
- iNaturalist Birds of Vancouver Guide
- Flora of the Lower Mainland
- Animals of the Lower Mainland
- Learning to identify Trees of the Pacific
 Northwest Rainforest

We also reviewed the data to determine what native pollinator species are within flight range of the Rainway project area and could also be supported through the design. Six native pollinator species were recorded within range of the Rainway area.

We also determined what kinds of beneficial insects are currently located within range of the Rainway. Beneficial insects can be a natural form of pest control and though small, are integral to ecosystem health.

Finally, the data was reviewed for invasive species and indicator species of environmental degradation. 11 species were found ranging from birds, mammals, insects and plants. Removal and mitigation strategies were recommended based on their potential impact to ecosystem health.



Example of species inventoried on iNaturalist project page.

ST. GEORGE ST. BIODIVERSITY

During the 4 bioblitzes, we observed 164 unique species. The number of species observed were all very low in comparison to typical species counts in natural areas. iNaturalist citizen science species counts in Metro Vancouver regional parks all have close to or over 1,000 species observed. Stanley Park has a total species count of 1,230. However, these counts do include habitat that is not found along St. George Rainway, such as intertidal zones and marine habitat that takes into account species of marine algae, phytoplankton, zooplankton and fish.

Table 1: Summary of species number, count of individuals and biodiversity index for each bioblitz

Date of Bioblitz	Type of Bioblitz	Number of Species
February 2022	Birds	22
April 2022	Plants	56
July 2022	Insects	50
October 2022	All	66



Figure 2: Map of specie counts in Metro Vancouver Parks. Data collected from iNaturalist December 9, 2022



Birds provide important ecosystem services including pollination, seed dispersal and pest control. Bird tourism can also provide economic benefits to a community and help to create links between people and their local environment. According to the city's Biodiversity Strategy, many native birds in Vancouver are declining. Migrating songbirds are abundant, but shoreline birds, insectivores and forest dependent birds are reducing in numbers. The February bioblitz allowed us to document native birds that do not migrate. February was also selected as less vegetation on trees helps with bird identification.

Bird watching was divided into four zones that went from Brunswick St on the west to Prince Albert St on the east, and East Broadway to the south, and Great Northern Way to the north and included Guelph Park and Sahalli Park. Citizen scientists observed 22 different species, the majority of which are very common species to this area. None of the species are on any endangered species lists. We documented large numbers of each of these species.

During the October bioblitz, the observations were conducted only along St George St from East Broadway to East 5th ave. Citizens observed 11 species of birds, 10 of which were also observed in the first bioblitz. Overall, the total number of bird species observed during the bioblitzes were 23.

Twenty of these birds were native to Canada species, equating to native bird population of 87% (source: iNaturalist). According to a 2001 study using the largest existing global dataset for birds in cities, urban areas retain on average 8% of their native bird species. While the biodiversity index of birds may be low, (meaning a low variety and quantity of birds in the project area) they are largely native species.

BIRD INDICATOR SPECIES

Two birds identified in the bioblitz are indicator species:

Coopers Hawk Accipiter cooperii	Spotted Towhee <i>Piplio maculatus</i>
 Indicators of forest and riparian	 Indicator of loss or changes
ecosystem health Deterrent for several pests,	to breeding habitat, loss or
including House sparrows and	changes to winter food supply Vulnerable to habitat loss from
European Starlings	land clearing and development

Another two birds were identified as indicator species of ecosystem degradation:

European Starling Sturnus vulgaris	House Sparrow Passer domesticus
 Adapted to urban environments and aggressively compete with native birds for nest space, leading to declines in some native bird species Encouraging birds of prey and supporting native species through food and habitat can help control population 	 Originally native to Eurasia south and Northern Africa Cavity nesters with a preference for human modified environments and micro- climates Often out-compete native birds potential nest cavities Strategies for population control include encouraging birds of prey, using native plants to encourage native songbirds, prune back trees and shrubs to avoid dense habitat areas



Figure 3: location of bird observations. Black dot=bird observation, green star-Cooper's Hawk, blue star-Spotted Towhee, red star-house sparrow, orange star-European Starling

Plants, Lichens and Fungi

Within an ecosystem, plants provide many important ingredients that both animals and soils need for their survival. In addition to producing oxygen, the fruits, leaves, seeds, branches and stems of plants become food sources, nest material, and shelter for several different organisms.

The April bioblitz focused on plants, as the blooms of spring can be the easiest way to identify plants. Casual IDs from iNaturalist were removed from the count as these were identified by the user as being captive or cultivated. Tree observations were compared against the <u>City tree street map</u>, and only street trees were included in the counts. Trees observations are only counted in the plant bioblitz, and not the final bioblitz to avoid double counting the street trees.

During the April bioblitz, 56 species were observed. Overall, the April plant bioblitz combined with the plants observed during the final bioblitz resulted in 87 species

being observed. Of the 87 species observed, 2 are native species, 80 are non-native and 5 of the non-native are considered invasive.

PLANT INDICATOR SPECIES

Native plant species are integral to ecosystem health, as they support other native bird, mammal and insect populations. While not all introduced species pose a threat, native animal populations may not seek them out as food and shelter sources, creating ideal environments for urban-adaptive birds and mammals such as the Eastern Grey Squirrel and European Starlings.

Invasive species are plants animals, or organisms that have been introduced in an area they are not usually found and have negative impacts on the environment, people or the economy. Five of the species found on the Rainway are considered invasive, which is equivalent to 6% of the species found.

- Japanese knotweed *Reynoutria japonica*: an aggressive growing plant, typically found in road right of ways, outcompetes native vegetation and is very challenging to remove.
- Himalayan Blackberry *Rubus americanus*: A shrub that invades disturbed sites, roadsides and stream banks. It crowds out low-growing vegetation and creates dense thickets that limit the movement of larger animals.
- Field Bindweed *Convolvulus arvensis*: A highly adaptive and drought resilient vine that hinders native species growth by winding around plants and chocking them out, competing for nutrients, and creating shade.
- English Ivy *Hedera helix*: A vine that inhibits growth and regeneration of native wildflowers, shrubs and trees through shading and smothering. This also impacts the ability of wildlife to forage.
- Common periwinkle *Vinca minor*: A perennial groundcover that crowds out and discourages growth of native plants by forming dense mats.



Figure 4: location of iNaturalist plant observations and invasive species. Black dotplant observations, red star-Bindweed, purple star-English Ivy, orange star-Himalayan Blackberry, yellow star- Common Periwinkle, blue star-Japanese Knotweed

8 species of lichen, 8 species of moss and 2 species of fungi were spotted during the bioblitz. Vancouver is part of the Costal Temperate Rainforest, where mosses, lichens, and fungi are common residents on both trees and forest floors in this ecosystem. These species have very reciprocal relationships with plants, animals and soils – providing food sources, nesting materials, protection from rain, wind and snow, soil stabilization, rainwater absorption, carbon sinking and pollution filtration. Found in the right places, they are a sign of a productive ecosystem, and can support healthy soils and urban environments.



Orange rock hair moss (top) and Jewelled Amanita (bottom) were ID'd on the future Rainway. Credit: Mike Potts, Davide Puddu Insects, Spiders, Slugs and Snails

Insects are the largest and most diverse group of organisms on Earth, with over 1 million species currently identified on the planet. The July bioblitz was focused on insects. Citizens were given nets and magnifying glasses to help capture and identifying insects from both in trees and on the ground.

During the July bioblitz, a total of 50 species were observed including several butterflies, bees, spiders, slugs, snails and beetles species. Two invasive species were observed – the European chafer beetle and the brown stink bug. As well, western bumble bees were observed which are known to be species of special concern. The October bioblitz had less species observed in this category, but four new ones, bringing the overall species count to 54.

INSECT INDICATOR SPECIES

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Of the 54 species of insects counted at the bioblitz, there was a range of both flying and ground dwelling invertebrates. Many of the insects recorded during the bioblitzes are considered beneficial insects. Supporting these species in the Rainway can be a natural, cost effective and ecological way to control pests. Many beneficial insects are predators, and they feed on aphids, mites and other common pests. Some of the beneficial insects spotted during the bioblitzes include:

- Ladybird beetles Coccinellinae
- Ground beetles *Carabus*
- Hover flies *Syrphidae*
- Yellowjacket wasps Vespula
- Spiders Araneae

Native bees in Vancouver are a species in decline that have been heavily impacted by habitat loss, pesticides, disease and competition from non-native honeybees. There are an estimated 450 native bee species in British Columbia, and five of those were documented along the Rainway, including two indicator species:

- Bumble Bee *Genus Bombus*: A ground nesting bee with a foraging range of 600-1700 m. They are an important bee to the BC economy, ranked as the most important pollinator of cranberries.
- Mason Bee *Genus Osmia*: A cavity nesting bee with a foraging range of 20 m. They are important as a cross-pollinator and are particularly effective at pollinating fruit trees.

A Western Bumble Bee *Bombus occidentalis* was also noted in the project area, which is a species of special concern. Once a common site in western Canada, its population has declined from habitat loss, pesticides, and competition with commercial bees. It is a generalist forager that needs a wide variety of flowers to get all the nutrients they require.



Did you know?

One-quarter of bumble bees in Norther America are facing some degree of extinction. Four of these bee's can be found in British Columbia, and one was spotted in the future St. George Rainway:

- Morrison Bumble Bee
- Obscure Bumble Bee
- Western Bumble Bee
- Yellow Bumble Bee

Pollination is an important component of the ecosystem cycle that ensures the reproductive cycle of plants, which in turn creates food and habitat sources for a variety of birds, mammals, insects and reptiles. Pollinators often forage within a limited range, so connected corridors of nectar sources are integral for their survival. iNaturalist data within 100 m of the project site was examined to determine what other pollinator species could potentially benefit from connections to the Rainway. Species seen in the area include:

- Mourning Clock Numphalis antiopa
- California Tortoiseshell Nyphalis californica
- Western Tiger Swallowtail Papilio rutulus
- Red Admiral Vanessa atalanta



Mourning Cloak Credit: Alena Rodriguez



California Tortoiseshell Credit: Lauren Sobkoviak



Western Tiger Swallowtail Credit: Tom Benson



Red Admiral Credit: Stuart Tingley

Two invasive and nuisance insects were found during the bioblitzes:

- European Chafer Beetle Amphimallon <u>majale</u>: This beetle reproduces rapidly and feeds on the roots of all kinds of plants, including grass.
- <u>Stink Bug Halyomorpha haly</u>s: A serious pest for agricultural crops that injects digestive juices into crops causing infections. Considered a nuisance pest in homes where they come together in large numbers to hibernate in winter.



Get to know your pollinators! <u>This handy guide</u> from the Environmental Youth Alliance is a great tool for learning the most common pollinators of BC.



Figure 5: Location of iNaturalist insect observations. Black dot-insect observation, green star-native bee observation, red- stink bug observation, orange star-European chafer beetle observation.

DESIGN, MAINTENANCE & STEWARDSHIP RECOMMENDATIONS

All plants and animals need three key ingredients to sustain themselves: **Food**, **Water** and **Shelter**

We not only need to design to create these resources, but also consider how our maintenance and stewardship strategies can support them in the long term. The following is a list of recommendations on our approaches to design, maintenance and stewardship that will support indicator, pollinator and beneficial species while reducing the threats posed by invasive and nuisance species.

- Design and maintenance strategies should focus on supporting indicator species, nearby pollinators and beneficial insects that are already located on or near the Rainway.
- Plant placement is equally important as plant selection when designing for biodiversity. Food sources, particularly for bees, should be located near nesting and hibernation areas.
- Encourage the presence of predator species and beneficial insects as they will support healthy growth of native species (flora and fauna) and provide natural pest management
- Create micro-habitat supports throughout the Rainway to support a wide variety of biodiversity, including mud puddles, decaying wood, insect water dishes, bare soil areas for nesting, pollinator hotels, perches, and hollow stems.
- Employ maintenance strategies that allow for optimal ecosystem services for flora and fauna, including leaving seed heads and stems over winter for food and nesting material in spring; retaining leaves and twigs along edges of garden where feasible to restore soil nutrients and provide habitat; and allow early noninvasive weeds such as dandelions to flower to support early food sources for bees
- Encourage community stewardship to support ongoing biodiversity growth
- Create a community St. George Rainway plant list that encourages other members of the community to contribute to the Rainway ecosystem corridor.



Two indicator species birds reside on the Rainway. To encourage their use of the Rainway, the following is recommended:

- Coopers Hawks: Add a perching pole or tall trees for perching
- Spotted Towhee: Include its preferred nesting shrubs:
 - Willow Salix
 - Nootka rose *Rosa nutka*
 - Hardhack Spiraea douglasii
 - Trailing Blackberry Rubus ursinus

To further encourage native insectivores and forest-dependent birds:

- Include plants into planting plan that provide seeds and berries, particularly in winter months when food is hard to find.
- Leave seed heads uncut through winter months. Some suggestions include:
 - Coneflower Echinacea
 - Black Eyed Susan Rudbeckia hirta
 - Sedum
 - Tick seed *Coreopsis*
 - Nootka Rose *Rosa nutka*
 - Oceanspray Holodicus discolour
 - Oregon Grape *Mahonia nervosa*
 - Sword Fern *Polustichum munitum*
 - Knickkinnick Arcotstaphylos uva-ursi
 - Snowberry *Symphoricarpos*
 - Heather *Calluna*
 - Woolly Lambs Ear Stachys byzantina
 - Goldenrod *Solidago*
- Include evergreen species that provide shade in summer heat and shelter in winter.



Each pollinator species is attracted to a mix of plants based on the size, shape, and colour of their flowers. Recommendations for supporting pollinator species spotted on or near St. George Street include:

Species	Plant Preferences	Design Recommendations
Bumble Bee Genus Bombus	Foxglove <i>Digitalis</i> Lupins <i>Lupinus</i> Sunflowers <i>Helianthus</i> Poppies <i>Papaver</i> Dandelion <i>Taraxacum</i> Sedum <i>Sedum</i> Goldenrod <i>Solidago</i> , Fireweed <i>Chamaenerion</i> <i>angustifolium</i> Rhododendron <i>Rhododendron</i> Blueberry <i>Vaccinium</i> Heather <i>Calluna</i> Mint family plants <i>Mentha</i>	 Incorporate decaying wood, undisturbed soil and small rock piles into the design for nesting areas Select early blooming plants from their preferred palette to locate near nurse logs and decaying wood so bumble bees have quick access to food when emerging from hibernation Plan for blooms that last from early spring to fall to support their lifecycle Consider installation of bumblebee boxes
Mason Bee Genus Osmia	Strawberry <i>Fragaria</i> Aster <i>Asteraceae</i> Black-eyed susans <i>Rudbeckia</i> Bleeding Heart <i>Lamprocapnos</i> <i>spectabilis</i> Columbine <i>Aquilegia</i> Clover <i>Trifolieae</i> Goldenrod <i>Solidago</i> Lupins <i>Lupinus</i> Beardtongues <i>Penstemon</i> Poppies <i>Papaver</i> Sage <i>Salvia</i>	 Incorporate mason bee's preferred plants with spring to fall bloom times, all within 20 m of each other Designate a few nesting areas, where stems of 7-8 mm diameter are left stems upright over winter as nesting cavities. Place some mason bee preferred plants directly adjacent to nesting areas. Retain bare soil spaces for "mud" areas. Use community members to keep these areas wet

Species (continued)	Plant Preferences	Design Recommendations
Mason Bee Genus Osmia (continued)	Purple coneflower <i>Echinacea</i> <i>purpurea</i> Wild rose <i>Rosa</i> Yarrow <i>Achilea millefolium</i> Verivan <i>Verbena</i> (any colour but red) Bee balm <i>Monarda</i> Lavender <i>Lavendula</i> Hyssop <i>Hyssopus officinalis</i>	 Add mason bee nesting boxes – blocks of wood (2x4's, and 4x4's with holes 7-8 mm in diameter. Holes should have closed ends. Pine or fir recommended. Do not use cedar.
Mourning Cloak Numphalis antiopa	Butterflies prefer tree sap from: Maple Acer Poplar Populus Oak Quercus Birch Betula Preferred food sources for caterpillars: Elms Ulmus Willows Salix Hackberries Celtis Paper birch Betula papyrifera Trembling aspen Populus tremuloides	 Plant preferred food sources nearby to nurse logs that fit within bioretention growing conditions. Consider adding smaller log piles to site design. Create mud puddles throughout the Rainway using community support to keep them moist.
California Tortoiseshell <i>Nyphalis</i> californica	Generalized feeder	 Native plant selection should provide food and habitat. Create mud puddles throughout Rainway using resident support to keep them moist
Western Tiger Swallowtail <i>Papilio rutulus</i>	Caterpillars: • Cottonwood and Aspen <i>Populus</i> • Willows <i>Salix</i> • Wild cherry, <i>Prunus</i> • Ash, <i>Fraxinus</i>	 Incorporate preferred food sources for both the caterpillars and butterflies that fit within bioretention growing conditions

Species (continued)	Plant Preferences	Design Recommendations
Western Tiger Swallowtail Papilio rutulus (continued)	 Butterflies: Thistles, <i>Cirsium</i> Abelia, <i>Vesalea</i> California buckeye <i>Aesculus californica</i> Zinnia, <i>Zinnia</i> Yerba santa, <i>Eriodictyon</i> Sage, <i>Salvia</i> Lavender, <i>Lavandula</i> Anise, <i>Pimpinella asium</i> Catmint, <i>Nepeta</i> 	
Red Admiral Vanessa atalanta	Stinging nettle <i>Urtica dioica</i>	 Plant stinging nettle in a quieter area of the Rainway Incorporate plants with berries and fruit into the design
Western Bumble Bee <i>Bombus</i> occidentalis	California Lilac, <i>Ceanothus</i> Knapweed, <i>Centaurea</i> Thistle, <i>Cirsium</i> Geranium Gumweed, <i>Grindellia</i> Lupins <i>Lupinus</i> Sweet clovers <i>Melilotus</i> <i>Monardella macrantha</i> Goldernrod <i>Solidago</i> Clover <i>Trifolium</i>	 Create nesting areas using nurse logs, smaller log piles, open areas of soil and piles of stone. Incorporate a variety of blooms starting in early spring nearby to nesting sites. Consider installing bumble bee houses

Designing for Beneficial Insects

Incorporating plants that are preferred food sources for beneficial insects is one of the best ways to invite them into the Rainway. A selection of plants from the list below should be incorporated and maintained in the Rainway.

Plant(s)	Beneficial insects
 Plants from the Mint <i>Mentha</i> family including: Anise hyssop <i>Agastache foeniculum</i> Lemon balm <i>Melissa officinalis</i> Cat nip <i>Nepeta cataria</i> Penny royal <i>Mentha pulegium</i> 	Attracts butterflies, bees and hover flies, while repel white cabbage butterflies.
 Plants from the carrot family including: Dill Anethum graveolens Fennel Foeniculum vulgare Parsley Petroselinum crispum Coriander Coriandrum sativum Lovage Levisticum officinale Flowering carrot Daucus carota 	Beneficial lady bugs, parasticic wasps, hover flies, tachinid flies, lacewings
Yarrow Achilea millefolium	Bees, aphid eating lady bugs, hover flies and parasitic wasps
Marigolds <i>Tagetes</i>	Pollinating bees, as well as hover flies, lady bugs and parasitic wasps
Asters Asteraceae, including:Calendula Caleundula officinalis	Several species of beneficial insects

- Feverfew Tanacetum parthenium
- Daises Bellis perennis
- Candy tuft Iberis
- Speedwells Veronica
- Goldenrod, Soldigo
- Stonecrop, Sedum
- Verivan Verbena
- Cinquefoil Potentilla
- Helitrope Heliotropium
- Alliums Alliums

Insects need water and shelter too. Other design tactics that can support beneficial insects include:

- Providing shallow dishes with pebbles and stones for water during dry summer months.
- Invite community members to add water as they pass by.
- Creating refuge by covering bare soil with organic mulches or ground covering plants



Designing for Healthy Soils

Soils are the building blocks of a healthy ecosystem - 1 tablespoon of healthy soils has more living organisms in it than people on this planet. They are not only important as habitat for micro-organisms, but also help to cycle nutrients for plants, store carbon dioxide, regulate temperature, and filter water.

Soil composition naturally changes over time, and the soils in the Rainway will need to work extra hard to support urban rainwater management.

Soils have to have large pore spaces to support the Rainway's design goal to capture and clean 48 mm of rainwater per day. They also need to have ample nutrients to support the plants. Through design and maintenance strategies, we can encourage porous and healthy soils over the long term. Two nurse logs will be placed in the Rainway that will slowly decay over time creating an ecological niche for mosses, plants, trees, insects and animals. Other strategies to foster healthy soils include:



Example of a nurse log in a forest

- Nutrient Support:
 - Adding a compost mulch to the Rainway ever two years
 - Leave leaf litter and brush along the slide slopes of the Rainway to decompose
 - Encourage the growth of fungi on the nurse log through inoculation
- Soil porosity:
 - Encourage the presence of ground dwelling insects with brush piles, leaf litter and rocks.
 - Ground dwelling insects will create new soil pores, which helps maintain rainwater storage capacity over time.

STRATEGIES TO MITIGATE INVASIVE SPECIES AND SPECIES OF ECOSYSTEM DEGRADATION

The table below lists potential strategies to reduce or mitigate the impacts of invasive species and indicator species of ecosystem degradation:

Species	Recommendation
European Chafer Beetle <i>Amphimallon</i> <i>majale</i>	 Deterrent strategies including creating lawns with thick roots and long grass stems, Consider grass alternative for the boulevard plantings on the west side of the road such as beetle resistant grass blends, moss, woody plants, creeping thyme, micro-clover, little star creeper
Stink Bug Halyomorpha halys	 Can be controlled through spiders, ladybugs and lacewings Promote beneficial insects in the Rainway can help to control their population
European Starling <i>Sturnus</i> <i>vulgaris</i> House Sparrow <i>Passer</i> <i>domesticus</i>	 Encourage the presence of native songbirds through planting and habitat creation Install tall perching polls and trees to attract birds of prey
Eastern Grey Squirrel <i>Sciurus</i> carolinensis	 Provide public education around not feeding wildlife
Himalayan Blackberry <i>Rubus</i> americanus	 Remove all Himalayan blackberry within public right of way prior to construction Monitor for presence and manage through manual removal Encourage quick establishment of plant communities in Rainway

Four additional invasive plants were found in the project area and could impact the Rainway: Japanese knotweed Reynoutria japonica, Field Bindweed Convolvulus arvensis, English Ivy Hedera helix, Common periwinkle Vinca minor. All these species were located on private property, and City staff will work with the community to encourage the removal and proper disposal of invasive plants in the neighbourhood. The Rainway will be routinely monitored for invasive species and mitigation and removal strategies will be employed as needed.



To add to the biodiversity in the Mount Pleasant neighbourhood and Vancouver more broadly, St George Rainway planting will be designed to benefit pollinator and bird species, by providing food, water and shelter within the green infrastructure systems.

City of Vancouver's green infrastructure team will be taking the design considerations proposed in this report and developing a final planting design for the Rainway that balances the many ecological, social and cultural needs of the Rainway.

The Rainway is scheduled to being construction in February 2023. Once completed, a second set of bioblitzes will be held in 2024-2025 to measure the impact to biodiversity provided by the Rainway.



The St. George Rainway Bioblitz team includes 6 members of the Green Infrastructure Implementation branch and the Integrated Strategies, Development and Utilities branch who provided technical expertise, event coordination, and communications support:

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Yette Gram

A special thank you to the 52 community members who joined us as citizen scientists for this project. You made this happen!

Disclaimer

This report is based on data collected by citizen scientists and has not been verified independently.



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Bird Counts - February 2022

Species	Scientific Name	iNaturalist Count	Map Count	Total
American Crow	Corvus	23	29	52
American Robin	Turdus migratorius	2	7	9
Anna's Hummingbird	Calypte anna	2	4	6
Bald Eagle	Haliaeetus leucocephalus	1	1	2
Black-capped Chickadee	Poecile atricapillus	9	16	25
Common Raven	Corvus corax	1	1	2
Cooper's Hawk	Accipiter cooperii	3	0	3
Dark-eyed Junco	Junco hyemalis	7	18	25
Downy Woodpecker	Dryobates pubescens	1	1	2
European Starling	Sturnus vulgaris	8	31	39
Glaucous-winged Gull	Larus glaucescens	5	16	21
Golden-crowned Sparrow	Zonotrichia atricapilla	1	6	7
House Finch	Haemorhous mexicanus	3	10	13
House Sparrow	Passer domesticus	8	6	14
Northern Flicker	Colaptes auratus	3	3	6
Pine Siskin	Spinus pinus	1	1	2
Ring-billed Gull	Larus delawarensis	1	1	2
Rock Pigeon	Columba livia	9	37	46
Sharp-shinned Hawk	Accipiter striatus	1	2	3
Song Sparrow	Melospiza melodia	2	0	2
Spotted Towhee	Pipilo maculatus	2	2	4
White-crowned Sparrow	Zonotrichia leucophrys	2	0	2



Plants Count - April 2022

Species	Scientific Name	iNaturalist Count	Map Count	Total
Azalea	Rhododendron	0	1	1
Bindweed	Convolvulus	2	4	6
Bluebell	Hyacinthoides	3	3	6
Brambles	Rubus	1	1	2
Burning bush hedge	Euonymus	0	1	1
Buttercup	Ranunculus	3	3	6
Cat's-Ear	Hypochaeris	8	4	12
Chickweed	Stellaria media	17	8	25
Clover	Trifolium	6	8	14
Common periwinkle	Vinca	0	1	1
Creeping jenny	Lysimachia nummularia	1	1	2
Daisy	Bellis perennis	2	5	7
Dandelion	Taraxacum	6	12	18
Deadnettle	Lamium	6	5	11
Dicot	Magnoliopsida	3	0	3
Dock	Rumex	4	2	6
Fescue	Festuca	0	1	1
Field Parsley piert	Alchemilla arvensis	1	1	2
Fireweed	Chamaenerion angustifolium	1	0	1
Fleabanes & horseweeds	Erigeron	1	1	2
Goutweed	Aegopodium podagraria	1	2	3
Grass	Poaceae	13	7	20
Hairy bittercress	Cardamine hirsuta	2	2	4
Hawkweed	Hieracium	0	0	0
Hedge mustard	Sisymbrium officinale	0	2	2
Herb robert	Sisymbrium officinale	3	1	4
Heuchera	Heuchera	0	1	1
Himalayan blackberry	Rubus bifrons	1	1	2
Huckleberry	Vaccinium	0	1	1
Hyancinth	Hyacinthus	0	3	3
lvy	Glechoma hederacea	3	1	4
Jointed charlock	Raphanus raphanistrum	1	1	2

Knotweed	Polygonum	1	1	2
Labrador violet	Viola labradorica	0	1	1
Leatherleaf viburnum	Viburnum rhytidophyllum	0	1	1
Mock-orange bush	Philadelphus	0	1	1
Moss	Bryophyta	5	4	9
Multiflower rose	Rosa	0	1	1
Nightshade	Solanum dulcamara	1	0	1
Nipplewort	Lapsana	0	2	2
Pink-lady quince	Chaenomeles	0	1	1
Plantain	Plantago	15	10	25
Prickly sowthistle	Sonchus asper	1	1	2
Seaside goldenrod	Solidago	0	1	1
Shepherd's-purse	Capsella bursa- pastoris	3	5	8
Slender parsley piert	Alchemilla australis	0	1	1
Sorrel	Rumex acetosa	1	0	1
Speedwell	Veronica arvensis	5	4	9
Sticky Willy	Galium aparine	0	1	1
Storks Bill	Erodium	0	1	1
Sweet woodruff	Galium odoratum	1	1	2
Thistle	Cirsium	3	0	3
Trailing blackberry	Rubus ursinus	1	1	2
Tulip	Tulipa	0	1	1
Yarrow	Achillea millefolium	1	1	2
Yellow archangel	Lamium galeobdolon argentatum	2	1	3
Street Trees				
Morgan Red Maple	Acer xfreemanii 'Morgan'	0	9	9
Bigleaf Maple	Acer macrophyllum	0	1	1
Bowhall Red Maple	Acer rubrum 'Bowhall'	0	2	2
Bloodgood Japanese Maple	Acer palmatum 'Bloodgood'	0	3	3
Red Maple	Acer rubrum	0	4	4
Northwood Red maple	Acer rubrum 'Northgood'	0	2	2
Rancho Sargent Cherry	Prunus sargentii 'Rancho'	0	1	1
Japanese Flowering Crabapple	Malus floribunda	0	1	1

Fungi, Lichen and Mosses Count -April 2022

Species	Scientific Name	iNaturalist Count	Map Count	Total Count
Fungi				
Wine-cap Stropharia	Stropharia rugosoannulata	1		1
Jewelled amanita	Amanita junquillea	1		1
Lichen				
Powdered Speckled Shield Lichen	Punctelia jeckeri	8		8
Common Script Lichen	Graphis scripta	1		1
Oak Leaf Blister	Taphrina caerulescens	1		1
Gold Dust Lichen	Chrysothrix candelaris	2		2
Fringed Rosette Lichen	Physcia tenella	1		1
Candleflame Lichen	Candelaria concolor	1		1
Tree Flute Lichen	Menegazzia subsimilis	1		1
Sinewed Bushy Lichen	Ramalina americana	1		1
Mosses				
Seductive Entodon Moss	Entodon seductrix	1		1
Orthotrichaceae	Orthotrichaceae	1		1
Feather-moss	Brachythecium albicans	2		2
Brocade moss	Callicladium imponens	1		1
Broom Forkmoss	Dicranum scoparium	1		1
Ciliate Hoarmoss	Hedwigia ciliata	1		1
Mosses	Bryophyta	4	4	8
Lyell's Bristle-moss	Pulvigera lyellii	1		1



Insect Count - July 2022

Species Name	Scientific Name	Total Count
Adalia	Adalia	1
Threeband Slugs	Ambigolimax	3
Common Roadside-Skipper	Amblyscirtes vialis	1
European Chafer	Amphimallon majale	1
Aphids	Aphididae	20
Western Honey Bee	Apis mellifera	5
Spiders	Araneae	50
Typical Orbweavers	Araneinae	1
Araneoid Spiders	Araneoidea	2
Cross Orbweaver	Araneus diadematus	2
Bumble Bees	Bombus	6
Fuzzy-Horned Bumble Bee	Bombus mixtus	1
Common Eastern Bumble Bee	Bombus impatiens	4
Western Bumble Bee	Bombus occidentalis	4
Yellow-faced Bumble Bee	Bombus vosnesenskii	13
Brachyceran Flies	Brachycera	5
Longhorn Beetles	Cerambycidae	1
Coccinella	Coccinella	2
Seven-spotted Lady Beetle	Coccinella septempunctata	10
Black-spotted Lady Beetles	Coccinellini	10
Western Polished Lady Beetle	Cycloneda polita	10
Flies	Diptera	30
Entelegyne Spiders	Entelegynae	2
Ants	Formicidae	20
F-winged Barklouse	Graphopsocus cruciatus	10
Brown Marmorated Stink Bug	Halyomorpha halys	6
Asian Lady Beetle	Harmonia axyridis	10
Helicoid Land Snails	Helicoidea	1
Lasius	Lasius	10
Butterflies and Moths	Lepidoptera	50
Lucilia	Lucilia	50
Common European Greenbottle Fly	Lucilia sericata	50
Meconema	Meconema	2

Plant Bugs	Miridae	2
Nematoceran Flies	Nematocera	1
Nepytia	Nepytia	1
Orthotylus	Orthotylus	1
Common Rough Woodlouse	Porcellio scaber	20
Winged and Once-winged Insects	Pterygota	1
Globetails	Sphaerophoria	50
Stenocranus	Stenocranus	1
Common Land Snails and Slugs	Stylommatophora	3
Syritta	Syritta	3
Hover Flies	Syrphidae	20
Black-margined Flower Fly	Syrphus opinator	5
Crab Spiders	Thomisidae	1
Thatching Ant	Formica sp.	10
German Yellowjacket	Vespula germanica	1
Pill Bug	Armadillidium vulgare	10
European Earwig	Forficula auricularia	1

All Species Count - October 2022

Species	Scientific Name	Total Count
Birds		
American Crow	Corvus brachyrhynchos	17
Dark Eyed-Junco	Junco hyemalis	1
Chickadee	Poecile atricapillus	2
Northern Flicker	Colaptes auratus	1
Hummingbird	Trochilidae	4
Bushtit	Psaltriparus minimus	10
Pigeon	Columba livia	4
Gull	Larus glaucescens	4
European Starling	Sturnus vulgaris	1
Common Raven	Corvus corax	1
Song Swallow	Melospiza melodia	4
Insects		
Woodlouse	Porcellio scaber	7
Pillbug	Armadillidium	3
Orbweave	Araneidae	8
Winged and Once-winged Insects	Pterygota	104
Fall Cankerworm Moth	Alsophila pometaria	3
Common Eastern Bumble Bee	Bombus impatiens	4
Cabbage White	Pieris rapae	6
Fly	Diptera	161
German Yellowjacket	Vespula germanica	8
Ants	Formicidae	116
Tent Caterpillar Moths	Malacosoma	1
Brown Marmorated Stink Bug	Halyomorpha halys	3
Asian Lady Beetle	Harmonia axyridis	2
Aphid	Aphidoidea	200
Hornets, Paper Wasps, Potter Wasps, and Allies	Vespidae	1

Plants		
Searocket	Cakile edentula	2
Nightshade	Solanum dulcamara	1
Grass	Poaceae	41
Butterfly bush	Buddleja davidii	1
Cat's-ear	Hypochaeris	53
Stonecrop	Phedimus spurius	1
Moss	Bryophyta	7
Clover	Trifolium	108
Colonial bent	Agrostis capillaris	1
Comfrey	Symphytum officinale	2
Dandelion	Taraxacum	206
Laburnum	Laburnum anagyroides	1
Mugwort	Artemisia vulgaris	1
Plantain	Plantago	125
Sow-thistle	Sonchus oleraceus	5
St. john's wort	Hypericum perforatum	1
Yarrow	Achillea millefolium	51
Buttercup	Ranunculus	10
lvy	Glechoma hederacea	2
Bramble	Rubus	1
Holly	llex aquifolium	1
Bamboo	Bambusa balcooa	1
Goutweed	Aegopodium podagraria	2
Hawkbit	Leontodon saxatilis	15
Blackberry	Rubus bifrons	2
Horseweed	Erigeron canadensis	1
Knotweed	Polygonum	36
Bindweed	Convolvulus	3
Meadowsweet	Spiraea	1
Oregano	Origanum vulgare	1
Pearlworts	Sagina	1
Pineapple-weed	Matricaria discoidea	5
Spotted spurge	Euphorbia maculata	2
Tansies	Tanacetum	1