



# Green Resilience: Implementing restoration and green infrastructure in the Greater Saint John Area



**Green Resilience: Implementing restoration and green infrastructure in the Greater Saint John region**

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The Green Resilience project would not have been possible the selfless efforts of thousands of community volunteers. We are proud to say that the list of dedicated contributors is large and ever-growing, and we sincerely appreciate the contribution of every individual, in making Saint John a more natural and resilient city.



**SAINT JOHN**



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## Introduction

Climate change in Saint John, New Brunswick is now recognized as an emergent risk to residents, infrastructure, and habitats. In 2019 the City of Saint John (the “City”) declared a climate emergency and has committed to actions to reduce emissions as well as adapt to an already changing climate. Within the past five years, the City of Saint John has faced two major riverine floods, countless inland floods following heavy rainfall, and the loss of multiple mature trees following post-tropical storm events. Work to mitigate these risks will be an ongoing process and ACAP Saint John has built upon the momentum of a successful climate change adaptation plan to build resilience to climate impacts such as heavy rainfall, increasing temperatures, and riverine flooding. This year's project, *Green Resilience: Implementing restoration and green infrastructure in the Greater Saint John region*, initiated this work and demonstrated to the community that natural solutions to climate change make Saint John a more diverse, healthy, and adaptable city.

## Green Infrastructure Primer

Green infrastructure (GI) refers to stormwater management methods that promote natural infiltration and retention rather than methods that focus on directing surface runoff into water treatment facilities, storage ponds, or natural systems (Buckland-Nicks, 2016). Studies have shown that green infrastructure significantly mitigates flooding risk in urban spaces (Depietri and McPhearson, 2017). In watersheds with more than 25% impermeable surfaces, the likelihood of a 1 in 100-year flood is increased to a likelihood of 1 in 5 years (Trice, 2017).

For municipalities, green infrastructure and natural asset restoration can be more cost-effective to maintain than engineered structures (Depietri and McPhearson, 2017). Besides the cost, the co-benefits of natural assets include a range of ecosystem services that provide flood and erosion control, heat moderation, pollination, carbon dioxide storage, and enhancement of community well-being.

## Climate Change Context

The City of Saint John will see an increase in temperatures, annual precipitation, riverine and coastal flooding, and extreme weather as the climate continues to change (Table 1). For further information, ACAP Saint John has completed a background report, *Understanding Climate Change in Saint John (2020)*, which provides a more in-depth analysis of climate change projections and the associated impacts.

Table 1: Climate change projections for the greater Saint John area (ACAP Saint John, 2020).

Category	Projections:
<b>Temperature</b>	<ul style="list-style-type: none"><li>● Mean annual temperature increases by 3.5°C by 2071-2100 compared to 1970-2000.</li><li>● Average winter temperature above -1°C by 2071-2100.</li><li>● Up to 70 annual hot days (25°C +) by 2071-2100.</li><li>● Annual freeze-thaw days increase from 82 to 87 by the year 2070.</li></ul>
<b>Precipitation</b>	<ul style="list-style-type: none"><li>● Annual rainfall increases by 85 mm by the year 2100 compared to 1970-2000.</li><li>● Precipitation patterns become more erratic and rainfall intensity increases by 10%.</li><li>● Approximately 21 more rain days by 2070-2100.</li></ul>

<b>Extreme Weather</b>	<ul style="list-style-type: none"> <li>● Increased severity and frequency of summer convective storms and ice storms.</li> <li>● Increased severity and frequency of flooding from extreme rainfall, mid-winter thaws, ice breakups, and ice-jam flooding.</li> <li>● Increased forest fire occurrence in Canada: 25% by 2030, 75-140% by 2100.</li> <li>● Higher severity of drought: water deficit of 110% by the year 2080.</li> <li>● Windstorm frequency increases by 8-15% (by the year 2050).</li> </ul>
<b>Sea Level Rise</b>	<ul style="list-style-type: none"> <li>● Saint John sea level rise of 86 cm +/- 38 cm from 2010 to 2100.</li> <li>● Annual storm surge levels increase by 0.8 m compared to 2010.</li> <li>● 1 in 100-year storm levels increase by 1.3 m by 2100 compared to 2010.</li> <li>● Current coastal erosion rates of 0.59-0.99 m/yr.</li> </ul>

Impacts of climate change were assessed by ACAP Saint John in 2020 in the *Saint John Climate Change Adaptation Plan* (Table 2). Saint John can expect to be impacted by climate change risks in the future such as sea level rise, increased precipitation, increased temperature. Saint John is especially vulnerable to spring freshet flooding (high vulnerability) as well as habitat loss and infrastructure damage due to flooding (medium-high vulnerability). Increasing temperatures can have impacts on vulnerable populations in the City, especially when air quality is poor or during heat waves. Implementing GI in the City of Saint John can reduce vulnerability by building new habitat, protecting infrastructure, absorbing increased precipitation, regulating temperatures, and improving air quality.

Table 2: Identified risks and vulnerabilities in the *Saint John Climate Change Adaptation Plan* (ACAP Saint John, 2020).

RISK RATING	Climatic Change	Impact Statement	Vulnerability Ranking
Medium - High	Increased Precipitation	Higher spring freshet flooding due to increased precipitation	5 (High)
	Sea level rise	Increased risk of habitat loss due to coastal squeeze	4 (Medium-high)
Medium	Increased precipitation	Damages to infrastructure/ properties due to localized flooding	4 (Medium-high)
	Increased temperature	Increased risk of heat stress on vulnerable populations due to extreme heat	3 (Medium)
	Increased temperature	Reduced health quality due to a reduction in air quality	3 (Medium)

## Climate Change Adaptation Plan Goals

The *Saint John Climate Change Adaptation Plan*, completed by ACAP Saint John in 2020, addresses the risks to the City posed by climate change. An Action Register was developed to implement adaptation actions and was divided into eight objectives. The objectives of the Action Register include:

- Objective 1: Integrate climate change impacts into community planning.
- Objective 2: Reduce shoreline erosion & promote natural infrastructure.



- Objective 3: Protect natural spaces, local habitats & migration routes.
- Objective 4: Provide public education on how to deal with the impacts of climate change.
- Objective 5: Reduce the impact of climate change on human health.
- Objective 6: Support vulnerable groups to increase adaptive capacity.
- Objective 7: Increase resilience to flooding & sea level rise.
- Objective 8: Increase resilience to extreme weather (ACAP Saint John, 2020).

The Green Resilience project addresses Objective 4-25 from the adaptation plan, which aims to develop pilot projects to educate the public about using green infrastructure and low impact development to manage the impacts of climate change.

## Projects

ACAP Saint John completed four GI projects in Saint John during the 2021 field season: (A) a rain garden that will reduce inland flooding in an urban neighbourhood, (B) a De-Pave project that will help reduce erosion in a West Side park, (C) naturalization of a stormwater retention pond to manage stormwater and filter pollutants at a North End church, and (D) tree plantings to improve habitat and regulate temperature throughout the City. Each of these projects engaged volunteers throughout the planning and execution phases to educate these community members on the impacts of GI in the city.

### A. Montgomery Crescent Park Rain Garden

ACAP Saint John was approached by two community members in 2020 with interest in managing stormwater runoff in Montgomery Crescent Park, a vacant greenspace along Montgomery Crescent. The park is centrally located behind many residential properties on Montgomery Crescent, in the North End of Saint John. The open, unstructured park is used and enjoyed by many people as a space to go for a short walk and get some fresh air and is an appreciated component of the neighbourhood. The park is located in a low-lying area and the existing grass cover is slow to absorb rainwater/snowmelt, leaving the area frequently flooded (Figure 1). A 200 m<sup>2</sup> rain garden on the southeastern side of the park was proposed to collect water that would run downhill from the adjacent slope. ACAP received additional funding for this project from the City of Saint John's *Land for Public Purposes Grant*.



*Figure 1: Montgomery Crescent Park following a heavy rainfall.*

Rain gardens are gardens that are built in low-lying areas with water-tolerant plants to help absorb rainwater and runoff. They are low maintenance and can improve the ecosystem by providing natural infiltration for stormwater, pollinator habitat, and attractive features to the community. Stormwater management traditionally relies on built infrastructure and as these assets age, the role of the natural stormwater management system becomes increasingly important. Rain gardens can increase the longevity of stormwater infrastructure and directly benefit neighbourhoods by providing a beautiful space to enjoy the outdoors and watch nature.

Public consultation was completed during the project by distributing two flyers to residents in the neighbourhood to explain the purpose of the project, the details surrounding the installation of the rain garden, and how to get involved. Approximately 220 flyers were distributed overall (Appendix A).

Site prep was completed the week before the planting event. The sod was dug by a volunteer with a mini excavator. The excavator removed an additional six inches from the centre of the garden to allow runoff to be captured and slowly infiltrated into the ground (Figure 2). The removed material was used to build the berm that will limit water from overflowing into the park. The northern portion of the garden was filled in with bioretention mix by ACAP Saint John staff to prepare it for the volunteering planting.





Figure 2: Montgomery Crescent rain garden construction.

On October 23, 2021, more than thirty volunteers filled in the remainder of the garden with bioretention mix, planted 420 native perennial plants, and spread mulch and beach stone to complete the garden (Figure 3). The berm was planted with wildflower seeds to bloom in the spring.



Figure 3: Before and after Montgomery Crescent Rain Garden.

### B. Seaside Park De-Pave

A large proportion of urban areas are made up of impervious surfaces that do not allow natural water infiltration and thus contribute to overland flooding and pollution transport. De-paving is a process that aims to transform impervious surfaces into green spaces, reintroducing the natural ecosystem services that help to reduce flooding and erosion while also providing natural habitat and increasing biodiversity. The program De-pave Paradise aims to get community members involved in this process by providing a unique hands-on opportunity to bring nature back into urban spaces. The program is designed to have volunteers physically remove the unwanted asphalt, building a sense of ownership and connection to nature.



After clearing the site, the volunteers also participate in the transformation by creating green spaces that allow natural processes like infiltration to occur. The unique experience of de-paving is intriguing for individuals and provides an educational opportunity that may otherwise be missed.

ACAP Saint John partnered with Green Communities Canada to be part of the De-Pave Paradise program to remove a 100 m<sup>2</sup> section of asphalt from Seaside Park in Saint John's West Side. The de-pave site is located at the base of a steep hill where installation of a garden will help to capture runoff, reduce pollution, and limit erosion (Figure 4). Following communication with the Friends of Seaside Park group, a widened section of the paved walking track was removed to reduce tripping hazards as this section of asphalt was already heavily damaged.



Figure 4: Site plan for de-pave project in Seaside Park, Saint John.

Site prep was completed the week before the volunteer event. ACAP contracted a demolition and excavation company, Digger Dean, to break up the section of asphalt into manageable pieces to be removed by volunteers. On November 6, 2021, twenty-seven volunteers removed the asphalt from the area and filled in an eroded section of a trail further downhill (Figure 5). The remainder of the project will be completed in spring 2022, when a garden will be planted.



Figure 5: Volunteers removing asphalt (Left) and after completion (Right).

### C. RiverCross Church Stormwater Pond

Parking lots, whether paved or gravel, generally do not allow water infiltration due to soil compaction from vehicle traffic. Naturalizing stormwater retention ponds can improve the function and quality of these systems. By introducing plants to this system, water will be more efficiently absorbed into the ground or transpire through plant tissue. Parking lots concentrate multiple vehicles into one area, and stormwater runoff from parking lots can introduce sediment, fuel, oil, road salt, and other chemicals into the environment. Trees and grasses in a stormwater retention pond can reduce pollutants in the environment by 1) slowing down sediment transport, thereby reducing suspended solids in stormwater; and 2) incorporate nutrients from stormwater runoff into plant tissues (WSP Canada Inc. et al., 2015).

In 2021, ACAP Saint John was approached by a member of the RiverCross Church to naturalize a stormwater retention pond located in a gravel overflow parking lot behind the church. With the help of volunteers, ACAP Saint John added two tandem loads of topsoil to the upper portions of the pond and planted twenty-five native trees around the pond. The topsoil was seeded with grass seed to prevent erosion. In-kind support was provided by the Smart Energy Company™ for the use of a tractor to spread the topsoil around the pond (Figure 6).





Figure 6: Spreading soil and planting trees at River Cross Church, October 26, 2021.

### D. Tree Plantings

Trees contribute a variety of ecosystem services to communities, including air and water filtration, soil stabilization, stormwater management, wildlife habitat, aesthetic value, and temperature regulation. Planting trees is a relatively low-cost and low-barrier method of implementing green infrastructure in a variety of locations and is a great method to engage the public.

Approximately 1,300 trees were planted across ten sites throughout the City of Saint John in the fall of 2021 (Table 3). As part of a larger project funded by WWF-Canada, *Growing Canada's Forests in WWF-Canada Priority Places*, native trees and shrubs were planted to enhance parks, riparian zones, and greenspaces throughout the Great Saint John region. ACAP chose sites that were threatened by certain climate change impacts such as riverine flooding, heavy precipitation, and increased temperatures, as well as Emerald Ash Borer (EAB) infestations.

Table 3: Trees planted in climate change risk areas in Saint John, NB in 2021.

Site	# Trees	Climate Change Risks
Caledonia Stormwater Pond	200	Heavy precipitation, pollutants
Spar Cove	250	Riverine flooding & heavy precipitation
Randolph Island	359	Riverine flooding & heavy precipitation
Crescent Valley	12	Increased temperatures
Little River Reservoir	20	Increased temperatures

516 Bay Street	210	Riverine flooding, Emerald Ash Borer
Major's Brook	208	Heavy precipitation, Sea level rise
Montgomery Crescent Rain Garden	5	Heavy precipitation
River Cross Church	25	Heavy precipitation
<b>Total</b>	<b>1,289</b>	

In the spring of 2018 and 2019, the City of Saint John experienced record spring freshet flooding from the Wəlastəkw which impacted infrastructure along the Wəlastəkw and Kennebecasis River. In both 2018 and 2019, the City of Saint John issued a voluntary evacuation for Randolph Island. Other impacted areas included Bay Street and Spar Cove. Trees planted in these areas will help manage stormwater during heavy precipitation events and stabilize the shoreline during spring freshet floods.

In urban areas, trees provide temperature regulation and refugia from heavily developed areas. Trees planted in the Crescent Valley neighbourhood will help to reduce impacts of increasing temperatures and provide more spaces for residents to connect with nature. Trees planted in the Little River Reservoir will provide cooling to nearby streams that are fish bearing and contain valuable habitat in an urban environment (Figure 7).



Figure 7: Tree plantings at Little River Reservoir (Left) and Majors Brook (Right).

With increasing rainfall amounts and intensity in Saint John, many areas of the City will experience localized flooding following heavy rainfall events. Planting trees in areas at risk of localized flooding such as Montgomery Crescent Park and Major's Brook will help absorb rainwater more quickly after a rainfall as well as filter pollutants from stormwater and prevent this runoff from entering nearby streams. Approximately two hundred trees



were also planted at the Caledonia Stormwater Pond to help further naturalize and improve habitat in this area (Figure 8).



Figure 8: Volunteer tree planting at Caledonia Stormwater Pond.

Planting a variety of trees creates a diversity of species that serve to increase resiliency of the urban forest to climate change. At the Bay Street site, the existing tree species were primarily Ash (*Fraxinus* sp.). A variety of oak, maple and birch were planted at this site to improve diversity and reduce the impacts of the EAB.

## Conclusion

Over the 2021 field season, ACAP Saint John worked with the community to incorporate four unique GI solutions into the urban environment. Throughout these events, ACAP Saint John explained the connection of this work to climate change impacts and the benefits that GI has for increasing resiliency in the City of Saint John. Throughout the tenure of this project, ACAP Saint John and community volunteers installed a 200m<sup>2</sup> rain garden containing over 400 plants, removed 100m<sup>2</sup> of asphalt from a community park, naturalized a stormwater retention pond, and planted almost 1,300 trees. Through this work, ACAP has had the opportunity to demonstrate that GI is an effective method for climate change adaptation and has generated more discussions with community members, City councillors and institutions to move this work forward in Saint John.

## References

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## Appendix A: Montgomery Crescent Rain Garden Flyer

### MONTGOMERY CRESCENT RAIN GARDEN

Dear Neighbour,

You may remember a flyer much like this one delivered to your mailbox last spring. This is an update to that letter!

**Project Update:** We are working to install a rain garden in Montgomery Crescent Park, and have secured \$5,000 in funding from the City of Saint John's Land for Public Purposes (LPP) fund. We've partnered with ACAP Saint John, who have expertise and experience installing rain gardens around town and we are very excited to have them on board. They've helped us design a great garden and we also hope to recruit some volunteers for Planting Day later this fall.

**What the heck is a rain garden and why do we want that?** If you recall, a rain garden is a shallow dugout planted with native, water-tolerant, perennial plants with deep roots. Rainwater collects in the depression and infiltrates into the ground, absorbing 30-40% more than a regular grassy area helping to reduce or prevent localized flooding due to heavy rainfalls and sudden melts. The park is an ideal location for this type of green infrastructure and will help ease the strain on built infrastructure (the sewer system) and reduce water entry into basements or crawlspaces of nearby homes. Rain gardens also provide habitat and food sources for birds, bees, and butterflies, and are a nice bit of nature in the city for everyone to enjoy.

**Plants and Maintenance:** The rain garden would be allowed to naturalize and won't require any ongoing maintenance. The plants will be deer-resistant and pollinator-friendly. A fence will be put in place to keep any wildlife away from the new plants, giving them time to establish.

Here are a few types of plants that we'll be planting!



Blue Flag Iris



Ostrich Fern



Swamp Milkweed



Black Eyed Susan



**When will this happen?** It may sound unconventional, but we have scheduled the Planting Day for **Saturday, October 23, 2021**. While most gardens are planted in the spring, ACAP has had great success with planting rain gardens in October. The plants will mostly be dormant and won't look very pretty at first, but they will overwinter in their new home and come springtime they will establish themselves early and have all season to grow!

The rain garden will be about 40m x 5m, at the base of the hill, as shown in the picture below. Rainwater and runoff will collect in the rain garden and be drawn into the soil by the deep-rooted plants. Excess water will be diverted to the existing stormwater drain in the park, which will now be surrounded by the garden (marked by the little red dot on the picture). If all goes well, it's possible we'll be able to expand the garden in future phases.



**How can YOU help?**

Please let us know by email if you'd be interested in volunteering to help build and plant the garden on **Saturday, October 23 at 10:00 am!**

A mini excavator will have removed the sod and dug to the appropriate depth ahead of time. Volunteers will be helping to put soil berms in place, plant the plants (about 500 of them!), fill the garden with bioretention soil mix, and install deer fencing around the perimeter so that all our hard work doesn't get eaten.

**Questions? Comments? Interested to Volunteer?**  
Please send your emails to [office@acapsj.org](mailto:office@acapsj.org)

Thanks for reading!

Sincerely,  
The Montgomery Crescent Rain Garden Project Team



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