

**PREPARED BY: VANESSA SUN**  
UBC SUSTAINABILITY  
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**PREPARED FOR: JUDY O'LEARY**  
NETWORK COORDINATOR,  
CLIMATE CAUCUS

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# **CLIMATE CAUCUS COUNCILLOR'S HANDBOOK**

## **Nature-Based Solutions**

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EXECUTIVE SUMMARY  
MARCH, 2021



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THE UNIVERSITY  
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### DISCLAIMER

This report was produced as part of the UBC Sustainability Scholars Program, a partnership between the University of British Columbia and various local governments and organizations in support of providing graduate students with opportunities to do applied research on projects that advance sustainability across the region.

This project was conducted under the mentorship of Climate Caucus staff. The opinions and recommendations in this report and any errors are those of the author and do not necessarily reflect the views of Climate Caucus or the University of British Columbia.

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## EXECUTIVE SUMMARY

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Climate Caucus is a non-partisan network of 300+ elected local climate leaders across Canada working to create and implement socially-just climate policies. Climate Caucus is acting on the need to move beyond “local government boundaries” and creating a centralized location for climate leaders to define problems and share solutions. The mission of Climate Caucus is 1-10-0, one planet, ten years, no one left behind. Climate Caucus has become a network of equitable, regenerative, decarbonized, and resilient communities thriving within planetary limits by 2030.

The Councillor’s Handbook is one of the main projects of Climate Caucus. The Handbook serves as a toolkit for elected leaders and their allies to take action on climate change. The living handbook provides councillors across Canada the resources needed to present climate solutions to their council. Resources such as foundational research on the solution, an assessment of potential barriers and benefits, and successful case studies, are all information that assists councillors in gaining support in their council.

The author was hired by the Sustainability Scholars Program to work for Climate Caucus to assemble the Nature-Based Solutions (NBS) portion of the Handbook. Research was gathered through interviews with municipal staff and ENGOS, an analysis of government documents, an analysis of ENGO documents, and through a facilitation of working groups consisting of councillors, city staff, NBS professionals, and climate leaders.

As the intended audience are councillors, the Handbook is written in a short and concise manner to ensure that councillors are able to find important information in a timely manner. The Handbook highlights the reports and findings of many ENGOS to minimize a duplication of efforts. Bylaws and council reports completed by municipal staff are also a key feature in the Handbook.

# INTRODUCTION

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The Government of Canada is using nature-based solutions (NBS) to fight climate change and reach the goal of protecting 25% of its land and 25% of its oceans by 2025 and achieving net-zero greenhouse gas emissions by 2050 [1]. Municipalities can help lead this effort through incorporation of nature-based solutions. The Honourable Jonathan Wilkinson, Minister of Environment has claimed that NBS can provide up to one third of total carbon dioxide reduction and contribute to keeping global warming to below 2 degrees Celsius [2].

Metcalf's Nature-based Solutions Indigenous-led Conservation and Carbon Storage in Canada report [3], demonstrates the many benefits NBS brings. NBS reduces greenhouse gas (GHG) emissions, captures and stores additional carbon dioxide from the atmosphere, improves land management practices, and protects carbon-rich ecosystems [4]. Environment and Climate Change Canada argues that "intact wilderness absorbs twice as much carbon as other landscapes. By protecting these spaces, we ensure nature's stored carbon isn't released" [5].

Important to note is the interchangeable use of the terms "nature-based solutions" and "green infrastructure." Both terms have been widely used and are synonyms. The term "nature-based solutions" emerged in academia as of 2015 whereas "green infrastructure" has been identified in academic literature as early as 2007 [6]. Green infrastructure, however, has also been granted many definitions globally. For example, green infrastructure has been defined as clean technology by the federal government of Canada. Whereas in the United States, green infrastructure has been used for natural stormwater management practices. In Europe, green infrastructure is referred to as a natural area connectivity. However, in Asia green infrastructure is referred to as greenways like daylighting a streams and walkways [7]. This report will use the term "nature-based solutions."

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[1] "Climate change adaptation plans and actions," Government of Canada, <https://www.canada.ca/en/environment-climate-change/services/climate-change/adapting/plans.html>

[2] "Scaling Canada's Nature-Based Solutions: Who, How and What's Next?," *Globe Series*, October 15, 2020, [www.globeseries.com/clean-recovery-breakthrough-series](http://www.globeseries.com/clean-recovery-breakthrough-series)

[3] Justin Townsend and Mary-Kate Craig, "Nature-Based Solutions: Indigenous-led Conservation and Carbon Storage in Canada," *Metcalf Foundation*, February 2020, [https://metcalffoundation.com/site/uploads/2020/02/CRP\\_Indig\\_NatureBasedSolutions\\_2020Report\\_final.pdf](https://metcalffoundation.com/site/uploads/2020/02/CRP_Indig_NatureBasedSolutions_2020Report_final.pdf)

[4] Ibid.

[5] Environment and Climate Change Canada, "Government of Canada supports climate action by Nature Canada," *NewsWire*, September 3, 2019, <https://www.newswire.ca/news-releases/government-of-canada-supports-climate-action-by-nature-canada-892337523.html>

[6] Michelle Sawka, "Introduction to Green Infrastructure," NBS Working Group, December 18, 2020

[7] Ibid.

## INTRODUCTION

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Nature-based solutions can be applied through a variety of methods: Indigenous communities practice of Traditional knowledge and solutions, green stormwater management, green roofs, urban forest, urban agriculture, and protecting and restoring nature are just a few categories. The categories listed above are the ones selected by the Nature-Based Solutions Working Group to be the primary focus of the Handbook.

## INDIGENOUS COMMUNITIES, TRADITIONAL KNOWLEDGE, & SOLUTIONS

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Climate change has heavily impacted Indigenous communities across Canada [8]. The ecosystems the Indigenous communities rely on have been heavily altered; increasing food insecurity, housing insecurity, fear of displacement, socio-economic impacts, and impacts on health and well-being [9]. Past conservation efforts have often failed to include Indigenous communities, even though they have been the guardians of our environment for thousands of years, protecting the earth with traditional knowledge [10].

In Canada, there has been an increase in Indigenous leadership in climate and conservation policy. At a municipal level, many municipalities have implemented successful nature-based solution projects in collaboration with Indigenous communities. For example, in Winnipeg, Manitoba, an Indigenous Peoples Garden has been created through careful planning led by Indigenous landscape and architectural designers [11]. The garden was designed as a space to rediscover the culture of Canada's first inhabitants while offering a place for Indigenous peoples to share their traditions, wisdom, and connection with the land. The garden will allow the relationships of Indigenous cultures with the environment, both past, and present to be explored.

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[8] Townsend, "Nature-Based Solutions: Indigenous-led Conservation and Carbon Storage in Canada," 9.

[9] Ibid, 9

[10] Joe McCarthy, "How Indigenous Activists Are Championing Nature-Based Solutions to Climate Change," *Global Citizen*, September 16, 2020, <https://www.globalcitizen.org/en/content/conservation-international-indigenous-voices/>

[11] "Explore the Gardens," Assiniboine Park, <https://www.assiniboinepark.ca/leaf/welcome/explore-gardens>

Another example is the partnership between the City of Vancouver and Musqueam First Nations to develop an Integrated Stormwater Management Plan for the Musqueam Creek Watershed [12]. The goal of the plan is to balance environmental protection with land use and development planning. The plan will examine factors that influence stormwater – trees and landscape, building design, and public infrastructure. The City of Surrey and the City of Delta have also worked in collaboration with the Semiahmoo First Nation to create a living dike to protect the salt marsh near their communities [13]. The project plans to deposit sediment in the marsh over three decades to raise its elevation and create a natural dike that can survive sea level rise.

## GREEN STORMWATER MANAGEMENT SYSTEMS

The built urban areas such as streets, parking lots, and buildings do not absorb rain and stormwater like natural areas. For example, in Ottawa, many of the older urban areas were developed with minimal consideration to stormwater management [14]. An issue arises when stormwater, created from rain or melted snow, moves quickly into the storm sewers that flow directly into natural waterways like rivers and streams. The stormwater collects dirt, gravel, and pollutants when water flows from the rooftops, driveways, lawns, streets and sidewalks into the community storm drains. Often the stormwater would be treated at a facility prior to being discharged into the bodies of water because of the combined sewer system (CSS). However, when large volumes of water (e.g., during heavy rainfalls) overwhelm the CSS, combined sewer overflow (CSO) happens. CSO is when the untreated or partially treated stormwater enters the natural bodies of water [15]. Large volumes of water can also cause issues of increased risk flooding, increased erosion, increased risk of unclean drinking water (if from groundwater), and biodiversity loss [16].

[12] "Musqueam Integrated Stormwater Management Plan," City of Vancouver" <https://vancouver.ca/home-property-development/musqueam-integrated-stormwater-management-plan.aspx>

[13] Stephanie Wood, "How a salt marsh could be a secret weapon against sea level rise in B.C.'s Fraser delta," *The Narwhal*, June 20, 2020, <https://thenarwhal.ca/bc-climate-salt-marsh-sea-level-rise-fraser-delta/>

[14] "Rainwater and your property," City of Ottawa, <https://ottawa.ca/en/living-ottawa/environment-conservation-and-climate/protecting-ottawas-waterways/rainwater-and-your-property>

[15] "National Pollution Discharge Elimination System (NDPES)," United States Environmental Protection Agency, <https://www.epa.gov/npdes/combined-sewer-overflows-csos>

[16] Christine Mettler, "Rain is a Resource: Green Infrastructure in Urban Environments," All Caucus Call, November 2, 2020

Nature-based solutions can address the issues of stormwater management through utilizing green technologies and natural processes. According to Green Infrastructure Ontario, green stormwater infrastructure (GSI), also called Low Impact Development, reduces the amount of runoff entering sewers during rain events through absorbing, intercepting, and holding stormwater [17]. This reduction of runoff discharged into water bodies decreases the chance for combined sewer system overflow events. Additionally, the absorption and storage stage improves water quality by filtering pollutants [18].

## Examples of green stormwater systems municipalities have implemented are:

1. **Bioswales:** vegetated open channels designed to reduce and treat stormwater runoff for a specific water volume. A distinguishing feature of a bioswale to a rain garden is the sloped base to facilitate the water movement [19].



The City of Coquitlam has incorporated Bioswales in parking lots. *Source: City of Coquitlam, Featured Projects*



The City of Calgary has incorporated engineered rain gardens into its public space. *Source: City of Calgary, Rain Gardens*

2. **Rain gardens:** a shallow, gently sloped channel filled with topsoil and plants. The topsoil stores runoff from small and frequent rain showers and treats the rainwater. The rainwater is cleaned and cooled, providing nutrients to wildlife. Water flows and enters the municipal drainage system when the topsoil is full. Rain gardens are also able to soak up 30% more water into the ground than a regular lawn [20].

[17] "Stormwater Systems," Green Infrastructure Ontario, <https://greeninfrastructureontario.org/stormwater-systems/>

[18] Ibid.

[19] "Bioswales," Capital Regional District, <https://www.crd.bc.ca/education/stormwater-wastewater-septic/green-stormwater-infrastructure/bioswales>

[20] "Rain Gardens," Township of Langley, <https://www.tol.ca/at-your-service/sustainability/gardens/rain-gardens/>



3. **Storm ponds:** temporarily capture and contain stormwater long enough to clean out sediments and pollutants before discharging into rivers and streams [21]. There are two types of storm ponds:

- a. **Dry ponds:** can have playing fields in it because it is dry 95% of the time. During heavy downpours, dry ponds can fill up with water very quickly and take as long as 24 hours to drain when it stops raining [22].
- b. **Wet ponds:** can be a storm pond or constructed wetlands that captures and stores stormwater. A **wetland** is an area that is either permanently or seasonally saturated with water. Often, the wetlands contain plants and shallow water before a storm [23].

A dry pond in the City of Toronto. *Source: City of Toronto, Stormwater Ponds.*



A wet pond in the City of Lethbridge. *Source: City of Lethbridge, Storm Ponds.*



Permeable Pavement in the City of Vancouver. *Source: City of Vancouver GRI Typologies.*

4. **Permeable Pavements:** a porous hard surface that allows rain to filter into an underlying reservoir base. The rainwater will either be removed by a subsurface drain or infiltrated to underlying soils. This can be used instead of concrete or asphalt when surfacing parking areas, driveways, and sidewalks [24].

[21] "Stormwater Management." City of Calgary, <https://www.calgary.ca/uep/water/water-and-wastewater-systems/storm-drainage-system/storm-drainage-system.html>

[22] Ibid

[23] Ibid

[24] "Permeable Paving," Capital Regional District., <https://www.crd.bc.ca/education/stormwater-wastewater-septic/green-stormwater-infrastructure/permeable-paving>

5. **Stormwater Fee Program:** a sustainable funding operation where the capital gained from the fees are reinvested into stormwater projects for the municipality. Some methods of conducting a stormwater fee can consist of a flat rate system, a tiered flat rate system or a charge based on the impervious area. For example, The City of Kitchener, Ontario has a tiered flat rate system [25].

6. **Stormwater Credit Program:** incentivizes property owners to build green stormwater infrastructure on their own property [26]. The City of Saskatoon, Saskatchewan has a credit program to reduce storm water charges to multi-residential or non-residential property owners who implement a best management practice (BMP) for storm water and pollution [27].

## GREEN ROOFS

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A popular green stormwater infrastructure are green roofs. Green roof development involves the creation of “contained” green space (trees, shrubs, crops or grass) on top of a human-made structure [28]. Green roofs leverage wasted roof space to fight climate change and create healthier communities [29]. Green roofs can be applied anywhere: public structures like government-owned buildings and private structures like residential houses, apartments, etc. Green roofs can provide a wide range of both public and private benefits. Public benefits include: opportunities for local food production to address food security, stormwater management, urban heat island reduction, employment opportunities, climate change mitigation, increased tax revenue, aesthetic improvements, health and wellness benefits, supported biodiversity, and improved air quality. Private benefits consist of increased marketability of a building, energy use reduction, increased roof lifespan, property value, membrane durability, and noise reduction [30].

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[25] "Stormwater utility," City of Kitchener, <https://www.kitchener.ca/en/water-and-environment/stormwater-utility.aspx>

[26] "Stormwater Management Credit Program," City of Saskatoon, <https://www.saskatoon.ca/services-residents/power-water-sewer/storm-water/storm-water-management-credit-program>

[27] Ibid.

[28] "About Green Roofs," Green Roofs For Healthy Cities, <https://greenroofs.org/about-green-roofs>

[29] Steven Peck, "Green Roofs Benefits & Policy Development," NBS Working Group, February 12, 2021

[30] Ibid.

## GREEN ROOFS

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Green roofs in the City of Vancouver.  
Left: Vancouver Convention Centre,  
Right: VanDusen Botanical Garden,  
*Source: City of Vancouver GRI Typologies.*



### Examples of existing green roofs policies, bylaws, and incentive programs:

1. A **zoning bylaw** to have a mandatory green roof requirement
2. An **eco-roof incentive program** that provides a grant for green roofs to be built in accordance with a green roof standard.
3. An **education program** for the public to understand the positive impacts of green roofs

The Handbook also highlights a Green Roofs' Starter's Guide for Councillors. The Guide consists of a step-by-step process of how councillors can build support to implement green roofs in their municipality. Additionally, the Guide provides councillors with answers to overcome myths regarding green roofs.

## URBAN FORESTS

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On December 14, 2020, the Federal Government of Canada launched their plan to plant two billion trees (2B) in the next 10 years, with an investment of \$3.16 billion [31]. The goal is to address climate change by reducing carbon pollution and is key in Canada's efforts to achieve net-zero greenhouse gas emissions by 2050. Planting locations will focus on: community and urban forests, Indigenous communities, crown and private land.

Urban forests are critical in contributing to the daily quality of the community. Increasing scientific literature has proven how green spaces and trees have direct and indirect benefits for human health [32]. Other benefits of urban forests include: increased carbon sequestration, increased property values, reduced heat island effect, reduced stormwater run-off and flood risk, reduced noise and dust pollution, increased urban resilience, and much more [33].

### Examples of urban forest bylaws, policies, & strategies:

1. **Municipal grants and incentives programs.** An example is the District of Saanich in British Columbia has a Forest Reserve Fund to support voluntary replacement, provide incentive for residents to plant trees, and pay for technology to make small spaces appropriate to plant trees.
2. **Tree protection bylaws** to regulate the cutting, removal, or damaging of trees.
3. A **shade tree management plan or a tree canopy bylaw.** This is a good first step to incorporate into an urban forest management plan.

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[31] "Minister O'Regan Launches Canada's Plan to Plant Two Billion Trees," Government of Canada, December 14, 2020, <https://www.canada.ca/en/natural-resources-canada/news/2020/12/minister-oregan-launches-canadas-plan-to-plant-two-billion-trees.html>

[32] "Ottawa's Urban Forest Management Plan," City of Ottawa, <https://ottawa.ca/en/living-ottawa/environment-conservation-and-climate/trees-and-urban-forests/ottawas-urban-forest-management-plan>

[33] Erin Wittingham and Vilbert Vabi, "Nature Canada on the 2 Billion Tree Initiative: Hope for Nature and the Climate?" NBS Working Group, January 15, 2021

## URBAN AGRICULTURE

Urban agriculture provides many benefits alongside environmental benefits. A benefit urban agriculture can produce is a promotion of community involvement, wellness and recreation [34]. Another benefit is the opportunity for community economic development through creation of new job opportunities and new local food production enterprises [35]. Urban agriculture also has health benefits such as increasing accessibility to fresh food and reducing food waste [36].

### Examples of urban agriculture:

**1. Community gardens:** provide health and well-being to the community through social interaction and neighbourhood building. Community gardens also help address food insecurity through food production. Additional benefits are environmental education, habitat development, and a connection to nature [37].



The City of Edmonton introduced pop-up community gardens in 2020. *Source: City of Edmonton*

**2. Restoring key pollinator areas:** pollinators are essential to maintaining a healthy and diverse ecosystem. One third of the food consumed are due to the works of the pollinators. However, pollinators are threatened by climate change, habitat loss, pests and disease [38].



The David Suzuki Foundation's Butterflyway Project has helped pollinators find shelter and food in over 400 communities. *Source: David Suzuki Foundation Butterflyway Project*

[34] "Urban Agriculture," City of Port Moody, <https://www.portmoody.ca/en/home-and-property/urban-agriculture.aspx>

[35] "Urban Agriculture Policy Planning and Practice," City of Hamilton, <https://www.hamilton.ca/sites/default/files/media/browser/2015-03-06/urbanagriculturepolicyplanningandpractice.pdf>

[36] "Pop-up Community Gardens," City of Edmonton,

[https://www.edmonton.ca/programs\\_services/landscaping\\_gardening/pop-up-community-gardens-pilot.aspx](https://www.edmonton.ca/programs_services/landscaping_gardening/pop-up-community-gardens-pilot.aspx)

[37] Ibid.

[38] "Pollinators," City of Victoria, <https://www.victoria.ca/EN/main/residents/parks/growing-in-the-city/pollinators.html>

## PROTECTING & RESTORING NATURE

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Natural areas are important spaces that must be protected and restored. Natural areas like the wetlands, meadows, and forests all provide services that perform significant ecological functions while supporting human prosperity and well-being. Natural areas can promote mental wellness and strengthen a sense of community by providing a space to gather and interact [39].

### Examples of protecting & restoring:

1. Amending Official Community Plans using Development Permit Areas to designate protected natural areas.
2. **Daylighting rivers, streams, and creeks.** Daylighting is a process of uncovering all or part of a waterway that has been buried in pipes, drainage systems, culverts, or other impervious materials [40].

## CONCLUSION

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This report provides a brief overview of information and resources shared in the Nature-Based Solutions Handbook. Please visit the Nature-Based Solutions Councillor's Handbook at Climate Caucus for a more comprehensive report. Please also note that the Handbook is a part of a living document that may be subject to change from the time of publication of this report. Further research on Natural Assets and Protection and Restoration of Nature will also be included in the Handbook.

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[39] "Natural Heritage," Green Infrastructure Ontario, <https://greeninfrastructureontario.org/natural-heritage/>

[40] Michelle Molnar, Jake Sahi, Michael Thompson, Joel Borggard, "Municipal Natural Assets Initiative: District of West Vancouver, British Columbia, *MNAI*, [https://mnai.ca/media/2018/07/MNAI\\_WestVan-final.pdf](https://mnai.ca/media/2018/07/MNAI_WestVan-final.pdf)

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