

August 17, 2020

REQUEST FOR PROPOSAL "RFP" NO. PS20200892
CONSULTANT SERVICES - NATURAL CARBON SEQUESTRATION

ADDENDUM NO. 1

RE: PART B, Section 2

PLEASE ADD: Brightspot Climate Inc. report dated February 3, 2020 and attached below.

This addendum must be completed, and attached to your Proposal form.

NAME OF VENDOR

SIGNATURE OF AUTHORIZED SIGNATORY

DATE

Dino Goundouvas
Contracting Specialist



City of Vancouver

> Climate Emergency Response
Big Move 6 Conceptual Framework



February 3, 2020



This page intentionally blank

Contents

| | |
|--|----|
| Contents | i |
| Introduction to Big Move 6: Restored forests and coasts..... | 1 |
| Carbon Sequestration Progress in British Columbia..... | 2 |
| 1. City of Vancouver | 2 |
| 2. Metro Vancouver | 4 |
| 3. British Columbia Government..... | 6 |
| 4. Broader in British Columbia | 9 |
| 5. International..... | 10 |
| Big Move 6 Conceptual Framework..... | 11 |
| 6. Objectives..... | 11 |
| 7. Definition of Natural Carbon Sequestration (NCS)..... | 11 |
| 8. Emission Reduction Credits – Two Forms | 11 |
| 9. Guiding Principles for NCS Actions..... | 12 |
| 10. Pathways for NCS in British Columbia | 13 |
| A Forests..... | 13 |
| B Freshwater Wetlands | 14 |
| C Agriculture and Grasslands..... | 14 |
| D Coastal Wetlands..... | 15 |
| E Cross-Sectoral Approaches..... | 15 |
| Next Steps | 16 |
| Preliminary Work Plan | 17 |
| Appendix: List of Leading NCS Practitioners..... | 19 |

Introduction to Big Move 6: Restored forests and coasts

On April 29, 2019, the City of Vancouver approved the Climate Emergency Response report to increase efforts to tackle climate change. The report contained six Big Moves and 53 accelerated actions to help ramp up local action immediately. This short report, Big Move 6 Conceptual Framework, addresses Big Move 6: Restored forests and coasts. The purpose of this report is to provide background on key concepts, terms, research pathways and a draft work plan for this Big Move.

Broadly, sequestration encompasses the processes through which carbon dioxide (CO₂) is captured from the atmosphere through biological, chemical, and physical processes. The intent of Big Move 6 (BM6) is to remove carbon dioxide from the atmosphere through natural sequestration for climate mitigation purposes. Natural sequestration encompasses a variety of carbon capture pathways, including sequestration into trees through reforestation, into soils through modified agricultural practices, and into coastal plant matter and the soil profile through targeted planting efforts. Natural sequestration efforts often have co-benefits, including increasing resilience to sea level rise associated with climate change, supporting cultural practices, improving soil health, and providing ecosystem services and resilience to people and wildlife, both in Vancouver and in surrounding areas.

The Intergovernmental Panel on Climate Change (IPCC) has stated that all pathways that limit global warming to 1.5°C with limited or no overshoot project the use of carbon dioxide removal on the order of one hundred to one thousand gigatonnes CO₂ cumulatively from the early 2020s through end of the 21st century¹. Aggressive planning to achieve these carbon sequestration targets must take place between now and 2030 due to slow natural carbon uptake processes. Following any planned natural sequestration projects, the uptake and capture of carbon will be minimal as it takes ecosystems time to develop.

The initial carbon dioxide sequestration target defined in the Climate Emergency Response report is set such that by 2030, sufficient efforts will have been completed that the resulting atmospheric carbon dioxide removal and sequestration reaches one million tonnes annually by 2060.

The City has some experience in natural carbon sequestration projects, although sequestration has not been a primary driver for these projects. This brief provides an overview of existing sequestration efforts that have been undertaken across British Columbia, a framework to guide BM6 efforts including a rough work plan for the efforts through to 2030, and a list of experts and networks who have knowledge and expertise in the field of natural carbon sequestration.

¹ One million tonnes = one megatonne.
One billion tonnes = one gigatonne.

Carbon Sequestration Progress in British Columbia

The City of Vancouver and other jurisdictions across the province have implemented strategies and projects that feature natural carbon sequestration actions as a co-benefit. This section provides a list and a short summary of these strategies and projects.

1. City of Vancouver

Greenest City Action Plan (2015)

The Greenest City Action Plan, mapping out Vancouver to become the world's greenest city by 2020, includes ten goal areas. This Action Plan was originally created in 2011 and updated several times, with the latest update published in 2018. Goal 5: Access to Nature, includes several references to sequestration efforts:

- Planting 150,000 new trees
- Increasing canopy cover to 22%
- Refers to the TreeKeepers Program, supporting private property tree planting
- Priority actions include creating a new inventory system for trees on City land and replacing the current VanTree system

Rain City Strategy (2019)

The City's Rain City Strategy provides a long-term roadmap for greening rainwater infrastructure and advancing and evolving rainwater management practices and services. The Strategy refers to rainwater tree trenches or green rainwater infrastructure (GRI). Elements of GRI practices, like trees, plants, and soil, can play a critical role in absorbing and sequestering carbon dioxide, especially if planned, operated, and maintained strategically.

Urban Forest Strategy (2018)

The City's Urban Forest Strategy, developed in 2014 and updated in 2018, was created to protect, plant, and manage trees to create a diverse, resilient, and beautiful urban forest on public and private lands across the city. The Strategy document refers to a 2015 i-Tree Canopy analysis that provided an initial estimate of the quantity of carbon dioxide sequestered each year by Vancouver's urban forests to be 24,000 metric tonnes of CO₂ per year.

Biodiversity Strategy (2016)

The Park Board and City's Biodiversity Strategy provides a foundation for protecting and restoring natural areas, species, and ecological processes, and for improving access to nature in all of Vancouver's neighbourhoods. It describes strategies to restore priority habitats such as forests, wetlands, streams, meadows, shorelines, and subtidal habitats as part of a city-wide ecological network. The Strategy provides key habitat data that could be useful in developing an inventory and in enhancing carbon sequestration efforts:

- Forests cover about 713 hectares (6% of the city), of which 474 hectares are classified as native forest. Most large native forests (>0.5 ha; dominated by native trees and shrubs) are contained within parks and are generally stable or increasing in area. The largest areas of native

forest are found in Stanley Park, Fraserview Golf Course, Everett Crowley Park, Musqueam Park, and Jericho Beach Park. Stanley Park accounts for over 75% of the native forests in the city, and together these five parks account for 66% of the city's entire urban forest.

- About 53 hectares of freshwater wetlands are currently found in the city. The largest freshwater wetlands are Lost Lagoon, Beaver Lake, Trout Lake, Jericho Ponds, and Sanctuary Pond in Hastings Park. Wetland creation and restoration, such as enlargement of Avalon Pond in Everett Crowley Park, has resulted in a minor increase in the extent of wetlands over the past 10 years.
- There are approximately 9 kilometers of permanently flowing streams remaining: Musqueam Creek, Vivian Creek, Still Creek, Spanish Bank Creek, and Beaver Creek. This is less than 9% of the 105 kilometers of streams that were present in the city historically. Ongoing restoration of Still Creek and proposed projects to daylight Hastings Creek in Hastings Park, Salmonberry Creek in Spanish Bank, and Tatlow Creek in Kitsilano are slowly increasing the amount of stream in the city.
- Vancouver has about 70 kilometers of intertidal shoreline of which 22 kilometers (31%) are considered predominantly natural. There are about 241 hectares of intertidal habitat, which includes Spanish Bank, Stanley Park shoreline, and portions of the Musqueam Marsh. The richest intertidal habitats are in Stanley Park where tidal currents enhance intertidal life, and in the marshes at the mouth of the North Arm of the Fraser River.
- Subtidal habitat conditions in Vancouver range from poor in areas of historical industrial use like False Creek and Coal Harbour, to healthy near First Narrows and Brockton Point. Bull kelp, an important component of biodiversity in shallow subtidal habitats with rock substrates, is recolonizing some areas of Burrard Inlet. Dense eelgrass is generally rare but small patches are present in some areas such as Jericho Beach.

Climate Change Adaptation Strategy (2018)

The Climate Change Adaptation Strategy aims to prepare Vancouver for the shocks and stresses associated with new climate normals. This Strategy reinforces ideas from the Urban Forest Strategy and the Rain City Strategy. The Strategy, originally undertaken in 2012 and renewed in 2018, includes five core action areas, with the three relevant areas to natural carbon sequestration being the following:

- Climate Robust Infrastructure, which encourages the increased use of green infrastructure where appropriate
- Healthy and Vigorous Natural Areas and Green Space, which encourages supporting the implementation of the Urban Forest Strategy, moving urban forest maintenance from reactive to a proactive standard of excellence, and soil preservation
- Coastline Preparedness, which encourages studying climate change impacts including coastal processes related to sediment transport, water chemistry and erosion, and sea level rise for Vancouver Parks and natural areas

Resilient Vancouver Strategy (2019)

The Resilient Vancouver strategy is aimed at enhancing the capacity of neighbourhoods, government and buildings and infrastructure to serve Vancouver's diverse communities, to reduce chronic stresses, and to withstand and recover from inevitable shocks.

Objective 3.2 of the Resilient Vancouver strategy is to plan, design and upgrade civic facilities to serve the current and future needs of our diverse communities and changing environmental conditions.

Carbon sequestration is applicable to the following components of this objective:

- Explore options to accelerate climate and seismic upgrades or redevelopment of civic buildings to enhance community recovery capacity
- Integrate updated climate and seismic priority projects into the capital plan process

2. Metro Vancouver

Sensitive Ecosystem Inventory

A Sensitive Ecosystem Inventory (SEI) was conducted for Metro Vancouver and Abbotsford from January 2010 to May 2012. Sensitive, relatively unmodified, ecosystems including wetlands, older forests and woodlands were identified and mapped using high-resolution orthophotos largely from 2009. In addition, ecosystems such as seasonally flooded agricultural fields and young forests, which are human modified but still have ecological value and importance to biodiversity were included in the mapping process. The project area totaled 367,000 ha, consisting of over 330,000 ha of terrestrial lands plus several thousand hectares of rivers, freshwater bodies, intertidal and estuarine zones. The first SEI was released in 2013 based on 2009 imagery. This was the first GIS inventory of ecologically significant lands for the region. In 2018, an update was released based on 2014 imagery.

Metro Vancouver provides an [interactive map](#) illustrating the different ecosystems and changes in land use since the map became available.

Metro Vancouver Regional Carbon Dataset

In 2016, 3GreenTree was awarded a contract with Metro Vancouver to revise the existing regional carbon dataset and improve its potential applications for natural areas in the region. The results of this project were used to better support land use decision-making by local government.

The project used multiple data systems and methods, including the Vegetation Resources Inventory (VRI)², Land Cover Classification (LCC)³, Sensitive Ecosystem Inventory (SEI), and Agriculture Soil Carbon (AGR)⁴ to create a carbon database for Metro Vancouver.

In 2020, Metro Vancouver will be investigating the impacts of policy actions and climate change on regional carbon storage from areas such as forests, wetlands, and agricultural soils. Metro Vancouver will endeavour to understand how the region's natural carbon storage areas, based on the 2016

² Developed by the Forest Analysis and Inventory Branch of the B.C. Ministry of Forests, Lands, Natural Resource Operations and Rural Development

³ Developed by the Corporate Services Department of Metro Vancouver

⁴ Developed by Dr. Sean Smukler of the Faculty of Land and Food Systems at the University of British Columbia

dataset, will fare by 2030 and 2050 based on proposed policy actions and projected climate change impacts.

New Brighton Park Shoreline Habitat Restoration Project (Vancouver Fraser Port Authority and Vancouver Park Board)

The New Brighton Park Shoreline Habitat Restoration Project is situated within New Brighton Park, along the south side of Burrard Inlet, west of the Second Narrows Bridge in Vancouver, B.C. The Vancouver Fraser Port Authority and the Vancouver Board of Parks and Recreation, along with Musqueam, Squamish and Tsleil-Waututh Nations, worked together on this collaborative project that supports the Park Board's Strategic Plan, Rewilding Action Plan, and Biodiversity Strategy.

The intention of this project was to benefit fish & wildlife species and the overall ecological function of the area. The project included an extensive planting program, including 25,000 salt marsh plugs, 200 native trees, and 4,000 coastal shrubs. Annual monitoring is completed by biologists and coastal engineers.

Burns Bog

Burns Bog Ecological Conservation Area (BBECA) is part of a unique raised bog ecosystem located within the boundaries of the City of Delta, British Columbia, and one of the world's largest protected natural areas in an urban landscape. It was designated in March 2004 when four levels of government came together to purchase approximately 2,042 ha of land that covers about two thirds of the original area of the bog.

In 2015, a study was undertaken by 3GreenTree to develop a framework for a Carbon Emission Reduction Project Plan on the BBECA. Carbon calculations associated with the project are derived from a methodology developed and approved under the Verified Carbon Standard (VCS), entitled "Methodology for Rewetting Drained Temperate Peatlands". The project design document for the project includes a monitoring plan and key metrics to measure performance.

Metro Vancouver sponsored the Burns Bog project, which was created to enable emission reductions in line with the requirements of the B.C. Climate Action Charter and the Green Communities Committee.

Regional Food System Strategy and Climate 2050

These two strategies have been developed by Metro Vancouver. The Regional Food System Strategy contains some detail in relation to targeting natural carbon sequestration. Sample actions include government and agency efforts to plan and implement agricultural land-based carbon sequestration projects. Other proposed actions to be driven by Metro Vancouver include developing quantification protocols to measure carbon sequestration on agricultural lands and associated certification standards.

Climate 2050 encompasses the aforementioned Burns Bog project and includes a minor reference to natural carbon sequestration for agricultural activities, mentioning that agricultural soils can play a substantial role in carbon sequestration.

3. British Columbia Government

Pacific Carbon Trust, Carbon Offsets, and B.C. Climate Action Charter

Background

The Pacific Carbon Trust (PCT) was established in 2008 to stimulate the growth of B.C.'s green economy and deliver on government carbon neutrality as outlined in the Greenhouse Gas Reduction Targets Act (GGRTA), superseded by the Climate Change Accountability Act (CCAA). The mandate of the PCT was thus to deliver high-quality GHG emission offsets and support the province's climate change efforts. These efforts included:

- Participation in cap-and-trade post-2012
- Accelerate development of B.C.'s carbon market
- Support B.C. municipalities in becoming carbon neutral
- Growing investments in B.C. based low carbon technologies

B.C.'s carbon market and participation in cap-and-trade did not occur, devaluing carbon offsets within the province. However, the development of the CleanBC Program for Industry points to potential renewed interest and value in them from a regulatory compliance perspective.

Simultaneous to the development of the PCT was the 2007 launch of the B.C. Climate Action Charter, a voluntary agreement between the B.C. government, Union of B.C. Municipalities (UCBM) and each local government signatory to take action on climate change. Signatory local governments committed to be carbon neutral in their operations by 2012. To date, 187 of 190 municipalities, regional districts and the Islands Trust have all signed the Charter. PCT-approved projects were thus expected to fill some of the demand for offsets from the B.C. Climate Action Charter.

In its early years, the PCT issued Expressions of Interest for several types of offset projects including afforestation and forest management projects, which could be categorized as natural carbon sequestration projects.

Issues with the PCT

The PCT ran into credibility issues when, in 2013, a report by the Office of the Auditor General examined two offset projects in the province – the Darkwoods Forest Carbon project (a natural carbon sequestration project), and the Encana Underbalanced Drilling Project (an industrial project). Together, these two projects accounted for almost 70% of the offsets purchased for the 2010 Carbon Neutral Government requirements under the GGRTA. The report findings indicated that these two projects would still have occurred in the absence of a carbon finance scheme, and consequently, that public funds were subsidizing private practices that had no real environmental outcome. The PCT was subsequently closed and management of the B.C. Offsets program was reassigned to the Resilience and Clean Government Branch of the Ministry of Environment and Climate Change Strategy.

B.C. Offsets Program

The Resilience and Clean Government Branch follows a rigorous selection process for procuring offsets as part of the Carbon Neutral Government Program. British Columbia's 2018 offset portfolio includes offsets from improved forest management practices in the following projects:

- The Great Bear Rainforest (South Central Coast) project reduces timber harvest levels and protects extensive areas of forest that were previously slated for logging thereby increasing carbon stocks as the trees continue to grow.
- The Great Bear Rainforest (North and Central Mid-Coast) project reduces timber harvest levels in the world's largest intact coastal temperate rainforest, thus increasing carbon stocks and protecting healthy ecosystems.
- Great Bear Rainforest (Haida Gwaii) is reducing emissions caused by harvesting, road building and other forestry-related operations, while supporting important Haida cultural sites.
- The Quadra Island forest conservation offset project reduces emissions by protecting forested land from logging and development of recreational lots.

The “Protocol for the Creation of Forest Carbon Offsets in British Columbia” - also known as the Forest Carbon Offset Protocol or FCOP, Version 1.0⁵ - is not currently an approved protocol for new offset projects under B.C.'s Greenhouse Gas Industrial Reporting and Control Act (GGIRCA). As such, offsets that originated from the projects described above were subject to review and subsequently grandfathered in from the previous regulatory regime.

There continues to be some disagreement on measurement and monitoring methods included in the Protocol for forest carbon sequestration projects in B.C. As such, it is currently not best practice in the province to plan and implement new forest carbon sequestration offset projects. A Working Group led by the B.C. Climate Action Secretariat has been established to redevelop and republish forest carbon offset protocols.

B.C. Climate Action Charter

When the PCT was closed, the options for the signatories to the B.C. Climate Action Charter became limited and subject to further scrutiny. The Provincial-UBCM Green Communities Committee (GCC) thus was established under the Climate Action Charter providing multiple options for signatories to achieve carbon neutrality beyond the reduction of their own corporate emissions. These options are:

- Option 1—Invest in a GCC Supported Project—allows local governments to invest locally while ensuring that the projects are credible and result in measurable GHG reductions. The GCC has identified five types of emission reduction projects (energy efficient building retrofits / fuel switching, solar hot water, household organic waste composting, low emission vehicles and forestry) that local governments could undertake;
- Option 2—Invest in Alternate Community GHG Reduction Projects— recognizes that local governments will have additional ideas (beyond Option 1) for measurable emission reduction projects that could be undertaken outside their corporate emissions boundary; and
- Option 3—Purchase Offsets from a Credible Provider.

⁵ Developed by the Climate Action Secretariat of the Ministry of Environment & Climate Change Strategy, the Ministry of Forests, Lands, Natural Resource Operations & Rural Development, and the Ministry of Indigenous Relations and Reconciliation in collaboration with the Delphi Group.

Consequently, there is a distinction to be made between the two types of emission reductions assigned credit value (where value does not necessarily indicate monetary value):

- “**offset credits**”, those emission reductions categorized under Option 3 by the GCC and eligible for use in the B.C. Offsets Program; and
- “**emissions credits**”, or those emission reductions categorized under Options 1 and 2 by the GCC.

There is currently no strong demand for offset credits in B.C. However, the CleanBC Program for Industry under development points to regulated emitters subject to government-approved emissions benchmarks. The B.C. government could elect to designate the purchase of offset credits as a compliance option. This would incentivize the development of offset projects in the province, including those focused on natural carbon sequestration.

Emission credit projects are continually incentivized by the demand of signatories to the B.C. Climate Action Charter. However, since the charter is almost fully subscribed to across the province, it is unlikely for this demand to grow. Due to the incentive for communities to reduce their own emissions, it is more likely for demand to decline over time.

Forest Carbon Initiative

The development of forest carbon sequestration projects by the province is managed by the B.C. Ministry of Forests, Lands, Natural Resource Operations & Rural Development. The Forest Carbon Initiative (FCI) was launched in 2017 as a key element of B.C.'s commitment to take action on climate change. FCI takes a portfolio approach to enable a range of forest carbon projects and activities across the province including reforestation, fertilization, increased fibre utilization and tree improvement projects.

British Columbia is partnering with the Forest Enhancement Society of British Columbia (FESBC), British Columbia Timber Sales (BCTS), Forests-for-Tomorrow (FFT), and others to deliver FCI. FCI is supported by funding from the federal government's Low Carbon Economy Leadership Fund (LCELFF). Together, the province and federal government have committed \$290 million to FCI from 2017/18 to 2021/22.

The FCI provides a [project portal](#) illustrating project investments. The data collected in these projects could help inform the carbon sequestration capacity of forest sequestration projects across the province.

Natural Resources Mitigation Tools

The British Columbia government has created the LANDIS-II (LANDscape Disturbance & Succession) model to simulate forest succession, disturbance, climate change and seed dispersal across large landscapes. The spatially explicit simulation model helps natural resource managers understand the effects of a changing environment on forests, including carbon dynamics and the availability of dead wood habitat.

The Carbon Budget Model of the Canadian Forest Sector (CBM-CFS3) is a stand and landscape-level modelling framework. The CBM-model is developed and maintained by Natural Resources Canada.

These two tools could help inform the carbon sequestration potential of forest stands in the province over time, encompassing aspects like forest fire and pest events.

4. Broader in British Columbia

Pacific Institute for Climate Solutions (PICS) – The Forest Carbon Management Project

The Forest Carbon Management Project is a major project undertaken by PICS and led by Dr. Werner Kurz. The purpose of this project is to design, evaluate and recommend potential climate change mitigation strategies comprised of activities aimed at reducing GHG emissions and increasing carbon sinks. These strategies include sequestration through forest management, afforestation, forest conservation and the use of harvested wood products.

The methodological approach to carbon sequestration measurement undertaken in this project could assist with the goals outlined in BM6.

Nature Conservancy of Canada (NCC) – Darkwoods

In 2008, the NCC acquired the Darkwoods lands near Nelson, British Columbia, spanning more than 136,000 acres (55,000 hectares). Darkwoods' forests and wetlands absorb and store large amounts of carbon and create carbon offsets by preventing large-scale timber harvesting. The project also protects important ecological benefits for biodiversity and provides essential habitat for many species at risk.

The project was previously a project that generated offset credits for the Pacific Carbon Trust. As mentioned earlier in this report, the findings of a report by the Office of the Auditor General in 2013 indicated that the project did not meet key criteria for offset credits. It was subsequently removed from the offset credit portfolio purchased by the B.C. government for the Carbon Neutral Government Program. The project is now evaluated against the Verified Carbon Standard, a voluntary carbon market framework.

An understanding of this project, its history, and lessons learned for offset credits will be invaluable in developing an approach to BM6.

Parks Canada – Blue Carbon on the West Coast

Parks Canada coastal ecologist Marlow Pellatt and his team are researching the ability of eelgrass and salt marshes to absorb carbon dioxide. Research to date indicates that shallow water ecosystems are a strong opportunity to hold three to five times the amount of carbon absorbed by forests. However, it also shows that eelgrass ecosystems in colder climates underperform as carbon sinks in comparison to their tropical counterparts. In contrast, salt marshes are considered to be on par as carbon sinks with other marshes globally. The expertise of Dr. Pellatt could contribute to a strong understanding of the potential of natural carbon sequestration in local blue carbon ecosystems.

Project Watershed – Blue Carbon Initiative

Project Watershed consists of a community of divers in Comox, British Columbia, planting eelgrass and restoring salt marshes as part of the Blue Carbon initiative. The initial pilot project observed a 300% increase in marine flora. The Comox Valley Project Watershed Society has developed a community-based protocol to allow coastal organizations in the Salish Sea to assess and identify Blue Carbon opportunities in their local estuary. The methodology used by Project Watershed could be key in determining a rigorous measurement approach for the sequestration potential of blue carbon in local ecosystems.

University of Victoria Spectral Remote Sensing Laboratory

The goal of this laboratory is to facilitate the use of satellite and other remote sensing systems by developing bio-optical models to effectively identify and quantify constituents in coastal and riverine waters. Ultimately, this will improve spatial-temporal understanding of the impacts of forestry, agriculture, aquaculture and pollution, and climate change in Salish Sea waters. The research undertaken by this Laboratory could help inform a rigorous approach to carbon sequestration measurement in coastal waters.

UBC Sustainable Agriculture Landscapes (SAL) Lab Projects

The SAL lab projects are focused on assessing various aspects of the relationships between agricultural production and the environment. Projects such as the “Quantification and mitigation of GHG emissions from high-value agricultural production systems in British Columbia” with Dr. Sean Smukler include research components related to carbon sequestration above and below ground.

The experts, projects, and measurement and calculation tools from the SAL Lab could be key to determining the potential for agricultural carbon sequestration in the province.

Indigenous-led Agricultural Initiatives

Several Vancouver and regional Indigenous-led land stewardship initiatives support both ecosystem restoration and opportunities for harvesting of Indigenous foods, including Nuu-chah-nulth Seafood Limited Partnership’s recent partnership to develop a west coast seaweed venture.

The inclusion of initiatives such as these would help indicate that engagement with stakeholders including Indigenous communities is a priority in developing an approach to BM6.

5. International

Urban Sustainability Directors Network and Carbon Neutral Cities Alliance’s Urban Drawdown Initiative

The purpose of this project is to enable cities to redirect a significant quantity of resources – particularly organic materials – into climate stabilizing resources. When turned into beneficial resources for land-based sequestration, these materials enable both climate stabilization and rural land and community regeneration. This project will build and refine the tools cities need to quantify and redirect organic waste streams into these climate stabilizing resources in ways that generate new economic opportunities and enhance equitably distributed community benefits—for both urban and adjacent rural communities.

Lessons learned, tools developed, and research completed through this project will ensure that an approach to BM6 taken by the City of Vancouver (currently an observer on the project) takes a current and equitable approach to natural carbon sequestration projects in cities.

Big Move 6 Conceptual Framework

6. Objectives

Big Move 6 represents an ambitious effort by the City of Vancouver. As such, it is important that a framework shaping the accelerated work to take place be intentional in its objectives.

The objectives for defining this framework are to:

- Communicate the purpose and objectives of BM6;
- Define the scope of the work to be undertaken to achieve BM6; and
- Initiate discussion amongst relevant parties involved in the Climate Emergency Response.

This framework serves as a reference to stakeholders and City staff as they work to fully develop the work plan to achieve BM6.

7. Definition of Natural Carbon Sequestration (NCS)

Natural Carbon Sequestration or NCS refers to natural biological processes and systems that sequester carbon into living systems. Within NCS, there are two ecological settings within which action can be taken—land-based actions, and ocean/aquatic drawdown actions.

Land-based sequestration—Actions of this type include land management treatments such as reforestation, land-based farming, composting, biochar or other soil enhancement techniques.

Ocean/aquatic sequestration—These actions includes ocean farming, wetland management, coastal restoration, riverine and riparian area restoration, and other systems that use the unique characteristics of water dominated ecosystems to accelerate carbon capture and sequestration.

8. Emission Reduction Credits – Two Forms

As defined through the development of B.C.’s carbon offsets program and the B.C. Climate Action Charter and described earlier in this report, there are two forms of emission reduction credits currently available in the province:

- **“offset credits”**, those emission reductions categorized under Option 3 by the GCC and eligible for use in the B.C. Offsets Program
- **“emissions credits”**, or those emission reductions categorized under Options 1 and 2 by the GCC.

Offset projects that create offset credits are subject to approval by the Climate Action Secretariat within the B.C. Ministry of the Environment and Climate Change Strategy and the requirements of approved Protocols. Emission reduction projects that create emissions credits for the purposes of the B.C. Climate Action Charter are subject to the requirements of GCC guidance and associated approval.

Current demand for both forms of credits is low. However, offset credits may be incentivized in the near future through the CleanBC Program for Industry. This program is expected to set benchmarks for several industrial sectors whereby regulated emitters for each sector would be required to meet the benchmark for any given compliance year. These regulated emitters may have several compliance

options, including reducing emissions internally, paying into the CleanBC Industry Fund, or purchasing offset credits.

9. Guiding Principles for NCS Actions

Natural carbon sequestration actions vary widely. To ensure that the efforts are successful in meeting the objectives of BM6, NCS actions should share the following set of principles.

1. Integrated sequestration approach

Give priority to sequestration actions that build on existing programs or policies and those that provide co-benefits with other community priorities. Sample evaluation criteria include:

- Aligned with key City of Vancouver Strategies
- Aligned with key Metro Vancouver Strategies
- Aligned with key B.C. Government Strategies
- Aligned with key First Nation Strategies
- Aligned with key Canadian government Strategies
- Aligned with key international Strategies

2. Engage actively across geographic and disciplinary boundaries

Proactive engagement and communication with stakeholders including but not limited to experts, all levels of government, the public, Indigenous peoples, and the business community, will build trust and support for NCS actions and is a priority. Sample evaluation criteria include:

- Level of involvement of stakeholders, including individuals, neighbourhoods, districts, Indigenous communities, municipalities, the provincial government, the federal government, the business community, local experts, Canadian experts, U.S. experts, and international experts
- Level of understanding of stakeholders

3. Maintain key ecological processes

Ensure that key biological and ecological processes currently in place are not adversely affected. Sample evaluation criteria include:

- Complete environmental assessment
- Evaluation of sequestration potential versus other environmental processes
- Incorporation of traditional ecological knowledge (TEK)

4. Select the right project for the right place

Ensure that sequestration actions intended for climate change mitigation are complementary to local community goals and strategies: think global, act local. Sample evaluation criteria include:

- Complementary to social sustainability in the community
- Complementary to Reconciliation with Indigenous peoples

- Complementary to equity seeking peoples and groups within the community

5. Use accurate and evidence-based monitoring

Use the best, most up-to-date science available for measuring and reporting progress and for further refining the strategy. It is, however, important that this principle does not preclude small-to-medium sequestration projects from participation in any larger NCS effort. Sample evaluation criteria include:

- Ownership of emission reductions clearly established
- Emission reductions verifiably beyond business-as-usual (additional)
- Sequestration method verifiably permanent
- Consistent emission reduction calculation methodology (avoidance of double counting)
- No leakage of emissions to other jurisdictions

6. Measure progress

Progress must be measured across all NCS projects using a standardized accounting approach. Sample evaluation criteria include:

- Replicable and verifiable indicators used
- Periodic progress updates communicated to relevant stakeholders

10. Pathways for NCS in British Columbia

A variety of pathways are possible for natural carbon sequestration. This section describes the possible pathways in Vancouver and in British Columbia for five distinct categories in the province, namely forests, freshwater wetlands, agriculture and grasslands, coastal wetlands, and cross-sectoral approaches.

A Forests

Forests cover 70% of the province, more than any other biome. This large extent includes a wide variety moisture and temperature conditions which are reflected in a vast diversity of forest types. These types can be roughly characterized as dry forest (forests of the southern interior), wet forests (forests along the coast or in the interior wet belt) and northern forest (the boreal forests of the north).

Within the forests category, there are several possible pathways for carbon sequestration, including:

- Reforestation
- Forest protection
- Improved forest management
- Improved timber plantations
- Avoided fuelwood harvest
- Forest fire management

Measurement and monitoring methodologies exist under REDD+ (reducing emissions from deforestation and forest degradation) programmes and have been widely dispersed. Several Ministries within the Government of British Columbia (the Climate Action Secretariat of the Ministry of Environment & Climate Change Strategy, the Ministry of Forests, Lands, Natural Resource Operations & Rural Development, and the Ministry of Indigenous Relations and Reconciliation) in collaboration with the Delphi Group have developed a methodology specifically pertaining to improved forest management practices.

B Freshwater Wetlands

Wetlands are areas where fresh water is at or near the surface for most of the year. They include bogs, fens, swamps and marshes. Wetlands cover just 7% of the province but provide a disproportionate service to biodiversity. As a provider of ecosystem services, they are renowned for absorbing water quickly and releasing it slowly with improved quality. Thus, they buffer environmental extremes, filter sediments, pollutants and excess nutrients, recharge groundwater, help maintain stream flows, control runoff and store floodwaters.

Natural carbon sequestration pathways for freshwater wetlands could include:

- Freshwater wetland restoration
- Freshwater wetland rewetting
- Freshwater wetland protection

The IPCC has developed detailed methodologies quantifying emission reductions from carbon sequestration into freshwater wetlands along with measurement and monitoring processes. The Burns Bog Ecological Conservation Area project protocol is a good local example of carbon accounting and sequestration for this pathway.

C Agriculture and Grasslands

Grasslands cover less than 1% of British Columbia's land base but provide essential habitat for more than 30% of British Columbia's terrestrial species of conservation concern. About 90% of British Columbia's grasslands are grazed by domestic stock.

Agricultural natural carbon sequestration pathways include the following:

- Cropland nutrient management
- Conservation agriculture
- Avoided grassland conversion
- Agroforestry or silvopasture
- Improved animal management
- Improvements to livestock feed
- Legume planting for livestock grazing
- Livestock grazing optimization

Agricultural emission reductions are widely sought after due to combined effects of efficiency and sustainability in production. As such, a wide range of jurisdictions worldwide including Alberta Environment and Parks within the Government of Alberta in collaboration with Viresco Solutions have developed methodologies to measure and monitor emission reductions from agricultural and grasslands activities.

D Coastal Wetlands

In British Columbia, coastal wetlands, also known as 'blue carbon' ecosystems, include tidal salt marshes and eelgrass meadows. Coastal wetlands mainly comprise estuarine ecosystems, covering little more than 2% of the province's coastline.

Natural sequestration into coastal wetlands could include:

- Coastal wetland restoration
- Coastal wetland protection

The IPCC and the Blue Carbon Initiative have developed detailed methodologies quantifying emission reductions from carbon sequestration into coastal wetlands along with measurement and monitoring processes.

E Cross-Sectoral Approaches

Governments can coordinate across sectors to decrease emissions, including through natural carbon sequestration. Examples of taking a cross-sectoral approach include: integrating infrastructure planning with conservation goals; promoting sustainable landscape programs between forestry and agriculture; developing policies for compensating impacts of infrastructure development on forests or wetlands; combining natural and built infrastructure for coastal protection, implementing land use planning with ecosystem disaster risk management; or ensuring tree cover for hydropower efficiency.

Cross-sectoral approaches applicable to British Columbia include:

- Urban forestation
- Green Rainwater Infrastructure
- Vertical (urban) farming
- Reduction of urban nitrogen fertilizer use
- Wetlands constructed for wastewater treatment
- Pyrolysis or biochar creation

The cross-sectoral approaches identified generally make use of existing forests methodologies (such as for green rainwater infrastructure) or agricultural methodologies (such as for vertical farming). Research into the sequestration potential of biochar continues to progress, with the International Biochar Initiative, The Climate Trust, and The Prasino Group having published a biochar sequestration quantification methodology document in 2015 ultimately rendered inactive by the American Carbon Registry.

Next Steps

A great deal of action has been undertaken thus far in the province as it related to natural carbon sequestration. Success for Big Move 6 on the scale described in the City of Vancouver's Climate Emergency Response report will require a substantial increase in effort.

The following steps will lead to significant carbon sequestration efforts by 2030:

- Create NCS External Committee to guide future work efforts
- Create NCS Expert Advisory Group to provide relevant feedback on work efforts as they are completed
- Connect with the Climate Action Secretariat of the B.C. Ministry of the Environment and Climate Change Strategy and the Forest Carbon Protocol Working Group to understand the status of a redeveloped Forest Carbon Offset Protocol
- Complete in-depth research into carbon sequestration efforts in B.C. that should also answer several key questions:
 - Ownership: Who owns the emission reductions from sequestration efforts across the province? Who is responsible for operations and maintenance for the efforts?
 - Forest carbon: Is there a reasonable pathway for forest carbon projects to ramp up in the province? Is this via offset credits, emission reduction credits, or another mechanism?
 - Financial strategy: What financial mechanisms exist, and what mechanisms must be built to incentivize NCS projects? Do these mechanisms differ by NCS pathway? How do offset credits and emissions credits align with these?
 - Targets and milestones: What is a reasonable target for NCS to be achieved by 2060 with sequestration efforts fully underway by 2030?

The completion of this research effort will provide the City with a meaningful path forward for Big Move 6 and NCS efforts in the province.

Preliminary Work Plan

In order to achieve meaningful emission reductions by 2030, natural carbon sequestration actions by the City of Vancouver must be accelerated. A work plan has been drafted for the City through to 2030.

A summary of the work plan is provided in tabular format below.

| Task | Completion Date |
|--|-----------------|
| Initial Workshop with NCS Experts | April 2020 |
| Establish NCS Expert Advisory Group | May 2020 |
| Vendor Procurement | June 2020 |
| Confirm NCS Principles and Most Likely Pathways in British Columbia | July 2020 |
| Inventory of NCS Actions to date – City of Vancouver | July 2020 |
| Inventory of NCS Actions to date – COV and Metro Vancouver | August 2020 |
| Identify Existing NCS Quantification Methodologies | August 2020 |
| Optimization of Likely Pathways for NCS in British Columbia <ul style="list-style-type: none"> - Inventory of Existing Natural Assets - New Protection of Designated Natural Assets - Enhancement of Identified Natural Assets | September 2020 |
| NCS Expert Advisory Review of Baseline NCS Inventory | September 2020 |
| Confirm NCS Work Plan for 2021-2025 | October 2020 |
| Report to Council: <ul style="list-style-type: none"> - Confirmed NCS Baseline Inventory (COV, MV) - Confirmed principles and likely pathways for NCS, optimized for variables including time, space, tonnage, and investment per tonne - Identify BM6 targets for 2023, 2025, 2027, 2030, 2040, 2050, 2060 - Identify synergies between BM5 and BM6 - Identify benefits and challenges associated with BM6 targets - Outline potential approaches to collaboration with Musqueam, Squamish, Tseil-Waututh, MV, other government agencies - Draft budget for BM6 from 2021-2025 | October 2020 |
| Identification of Possible NCS Pathways – Rest of British Columbia | December 2020 |
| Collaborative Workshop on Potential NCS Pilot Projects | March 2021 |
| Pilot Project Development and Proposals | June 2021 |
| Pilot Projects Selection | August 2021 |
| Report to Council: <ul style="list-style-type: none"> - Pilot Projects 5-Year Work Plan - Draft budget for Pilot Projects 2022-2027 | October 2021 |
| Start of Pilot Projects | June 2022 |
| First Report on Pilot Projects | June 2023 |
| Second Report on Pilot Projects | June 2024 |

| Task | Completion Date |
|--|-----------------|
| Third Report on Pilot Projects | June 2025 |
| Fourth Report on Pilot Projects | June 2026 |
| Final Report on Pilot Projects | June 2027 |
| Report to Council on Pilot Projects: <ul style="list-style-type: none"> - Summary of Learnings from Pilot Projects - Optimized NCS Project Locations - Draft budget 2028-2030 | October 2027 |
| First phase of NCS work in COV and MV | 2030 |

Appendix: List of Leading NCS Practitioners

The following table provides a preliminary list of leading researchers and practitioners in the field of natural carbon sequestration.

| Name | Organization | Area of Expertise |
|-----------------------------------|--|--|
| <i>Organizations and Networks</i> | | |
| - | 3Green Tree | Forest ecosystem asset development, acquisition, and management; Metro Vancouver carbon dataset; Darkwoods project |
| - | BC Bioenergy Network | Wood waste and bioenergy |
| - | British Columbia Timber Sales (BCTS) | Manages annual cut for Crown timber |
| - | Blue Carbon Initiative | Blue carbon |
| - | C40 | Urban action towards climate mitigation |
| - | Canadian Parks and Wilderness Society | Nature-based solutions to climate change |
| - | Carbon Neutral Cities Alliance | Collaboration of leading global cities working to cut greenhouse gas emissions by 80-100% by 2050 or sooner |
| - | Climate Action Secretariat | Coordinates climate action activities across Government and with stakeholders |
| - | Commission for Environmental Cooperation | Blue Carbon in Canada, US, Mexico |
| - | David Suzuki Foundation | Carbon capture and storage |
| - | Dendra.io | Integrated analytics and planting solutions for large-scale ecosystem restoration |
| - | Det Norske Veritas (DNV) | Consulting; Darkwoods project |
| - | Ducks Unlimited | Wetlands conservation |
| - | ERA Ecosystem Restoration Associates | Global forest carbon project development, ecosystems services, and conservation finance |
| - | Forest Enhancement Society of British Columbia (FESBC) | Forest resilience to wildfire and climate change |
| - | Forests-for-Tomorrow (FFT) | Responds to catastrophic wildfires in southern and central interior, and mountain pine beetle epidemic |
| - | Grasslands Conservation Council of British Columbia | Grasslands |
| - | Green Analytics | Research, analysis related to ecosystem services |

| Name | Organization | Area of Expertise |
|--------------------|---|---|
| - | Green Communities Committee | Support for local governments in taking climate action |
| - | International Institute for Environment and Development | Ecosystem-based approaches to climate change adaptation |
| - | IPCC | Quantification methodologies - wetlands |
| - | Nature Conservancy of Canada | Darkwoods project |
| - | Nature-Based Climate Solutions Summit | Ottawa conference (February 2020) focused on nature-based climate solutions |
| - | Pachama | Machine learning, satellite and LiDAR to verify and monitor forest carbon projects |
| - | Pacific Institute for Climate Solutions | Climate change impacts; approaches to mitigation & adaptation; Forest Carbon Management Project |
| - | Pembina Institute | Carbon capture and storage |
| - | Project Watershed | Blue Carbon Initiative |
| - | Rainforest Alliance | Work worldwide with stakeholders to conserve biodiversity and ensure sustainable livelihoods; Darkwoods project |
| - | Scientific Certification Systems | Consulting; Darkwoods project |
| - | University of Victoria Spectral Remote Sensing Laboratory | Impacts of forestry, agriculture, aquaculture and pollution, and climate change in Salish Sea waters |
| - | Urban Drawdown Initiative | Network to accelerate implementation of carbon removal strategies |
| - | Vancouver Board of Parks and Recreation | Sequestration efforts in City parks; New Brighton Park Shoreline Habitat Restoration; Princess Louisa Inlet |
| <i>Individuals</i> | | |
| Clive Welham | 3Green Tree | Burns Bog project |
| Emily MacNair | BC Agriculture and Food Climate Action Initiative | Agricultural climate adaptation |
| Hrissa Soumpassis | BC Parks Foundation | BC parks system; wildlife |
| Brenda Hopkin | Canfor | Forest Investment Account – Land Base Investment Program |
| Tim Lesiuk | Climate Action Secretariat | British Columbia emissions trading regulations |
| Dennis Paradine | Climate Change and Integrated Planning Branch | Forests and carbon |
| Brodie Guy | Coast Funds | British Columbia conservation finance with First Nations |

| Name | Organization | Area of Expertise |
|---------------------|--|---|
| Stephan Wehr | Delphi Group | GHG and air emission quantitative analysis and modeling (forestry, agriculture, biofuels) |
| Joseph Pallant | Ecotrust Canada | Offset projects – forestry |
| Robert Falls | ERA Ecosystem Associates | Darkwoods project |
| Brad Warren | Global Ocean Health | Ocean-related sequestration in Washington State |
| M. Fernanda Adame | Griffith University, Australian Rivers Institute | Wetlands and their role in mitigating carbon emissions and improving water quality |
| Emad Kahevei | Griffith University, School of Engineering and Built Environment | Green stormwater infrastructure, carbon footprint |
| Kathryn Martell | Islands Trust Conservancy | Forest sequestration efforts in BC |
| Jason Emmert | Metro Vancouver | Air Quality Planning |
| Connor Reynolds | Metro Vancouver | Air Quality & Environment team |
| Stephen Kull | Natural Resources Canada | Forests Carbon Budget Model |
| Bill Hunt | NC State University | Stormwater wetlands, innovative wet ponds, green roofs, permeable pavement |
| Werner Kurz | Pacific Forestry Centre | Forest management; land-use change on forest carbon budgets; Forest Carbon Management Project |
| Marlow Pellatt | Parks Canada | Ability of eelgrass and salt marshes to absorb carbon dioxide |
| Elizabeth Nelson | Parks Canada | Climate Change Adaptation Framework for Parks and Protected Areas |
| Laura Plant | PricewaterhouseCoopers | Measurement and valuation of ecosystem services |
| Ralph Torrie | Torrie Smith Associates | Climate change response strategies |
| Sean Smukler | UBC Faculty of Land and Food Systems | Carbon sequestration and emissions reduction potential in agricultural lands in the Fraser Valley |
| Mary O'Connor | UBC Faculty of Science | Adaptive capacity of biodiversity and ecosystem function in changing environments |
| Justin Bull | UBC Sauder School of Business | Forestry and sustainability |
| Gary Bull | UBC School of Forestry | Forestry offsets and carbon markets |
| Brian McConkey | Viresco Solutions | Soils carbon sequestration |
| Karen Haugen-Kozyra | Viresco Solutions | Soils carbon sequestration |