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SERVICES AND SOLUTIONS FOR A LIVABLE REGION

METRO VANCOUVER REGIONAL DISTRICT
CLIMATE ACTION COMMITTEE

MEETING

Thursday, June 8 2023
9:00 am
Meeting conducted electronically/in-person pursuant to the Procedure Bylaw
28th Floor Committee room, 4515 Central Boulevard, Burnaby, British Columbia

A G E N D A[1]

1. ADOPTION OF THE AGENDA

1.1 June 8, 2023 Meeting Agenda
That the Climate Action Committee adopt the agenda for its meeting scheduled for June 8, 2023 as circulated.

2. ADOPTION OF THE MINUTES

2.1 May 11, 2023 Meeting Minutes *pg. 3*
That the Climate Action Committee adopt the minutes of its meeting held May 11, 2023 as circulated.

3. DELEGATIONS

4. INVITED PRESENTATIONS

5. REPORTS FROM COMMITTEE OR STAFF

5.1 Air Quality Advisory Program and Preparedness for 2023 *pg. 7*
That the MVRD Board receive for information the report dated May 23, 2023, titled "Air Quality Advisory Program and Preparedness for 2023".

5.2 2023 Update on Regional District Sustainability Innovation Fund Projects *pg. 20*
That the Climate Action Committee receive for information the report dated May 23, 2023, titled "2023 Update on Regional District Sustainability Innovation Fund Projects."

[1] *Note: Recommendation is shown under each item, where applicable.*

5.3 Manager's Report *pg. 52*

That the Climate Action Committee receive for information the report dated June 1, 2023, titled "Manager's Report".

6. INFORMATION ITEMS

6.1 Metro Vancouver Media Advisory: Seasonal Residential Indoor Wood Burning Prohibition in Effect May 15 *pg. 56*

6.2 Agricultural Ecosystem Services in Metro Vancouver *pg. 57*

7. OTHER BUSINESS

8. BUSINESS ARISING FROM DELEGATIONS

9. RESOLUTION TO CLOSE MEETING

Note: The Committee must state by resolution the basis under section 90 of the Community Charter on which the meeting is being closed. If a member wishes to add an item, the basis must be included below.

10. ADJOURNMENT/CONCLUSION

That the Climate Action Committee adjourn/conclude its meeting of June 8, 2023.

Membership:

Dominato, Lisa (C) – Vancouver
Johnstone, Patrick (VC) – New Westminster
Berry, Ken – Lions Bay
Bose, Mike – Surrey
Carr, Adriane – Vancouver
Gu, Alison – Burnaby
Lahti, Meghan – Port Moody
Leonard, Andrew – Bowen Island
McCutcheon, Jen – Electoral Area A
McNulty, Bill – Richmond
Pope, Catherine – North Vancouver District
Ross, Jamie – Belcarra
Ruimy, Dan – Maple Ridge
vanPopta, Misty – Langley Township
Wallace, Rosemary – Langley City

METRO VANCOUVER REGIONAL DISTRICT
CLIMATE ACTION COMMITTEE

Minutes of the Regular Meeting of the Metro Vancouver Regional District (MVRD) Climate Action Committee held 9:00 am on Thursday, May 11, 2023 in the 28th Floor Committee Room, 4515 Central Boulevard, Burnaby British Columbia.

MEMBERS PRESENT:
Chair, Councillor Lisa Dominato, Vancouver
Vice Chair, Mayor Patrick Johnstone*, New Westminster
Mayor Ken Berry*, Lions Bay
Councillor Mike Bose, Surrey
Councillor Adriane Carr, Vancouver (arrived at 9:05 am)
Councillor Alison Gu, Burnaby
Mayor Andrew Leonard*, Bowen Island
Director Jen McCutcheon, Electoral Area A
Councillor Bill McNulty, Richmond
Councillor Catherine Pope*, North Vancouver District
Mayor Jamie Ross*, Belcarra
Mayor Dan Ruimy*, Maple Ridge
Councillor Misty vanPopta*, Langley Township
Councillor Rosemary Wallace*, Langley City

MEMBERS ABSENT:
Mayor Meghan Lahti, Port Moody

STAFF PRESENT:
Conor Reynolds, Director, Air Quality and Climate Change
Heather McNell, Deputy Chief Administrative Officer, Policy and Planning
Morgan Mackenzie, Legislative Services Coordinator, Board and Information Services

1. ADOPTION OF THE AGENDA

1.1 May 11, 2023 Meeting Agenda

It was MOVED and SECONDED
That the Climate Action Committee adopt the agenda for its meeting scheduled for May 11, 2023 as circulated.

CARRIED

*denotes electronic meeting participation as authorized by section 3.6.2 of the *Procedure Bylaw*

2. ADOPTION OF THE MINUTES

2.1 April 6, 2023 Meeting Minutes

It was MOVED and SECONDED
That the Climate Action Committee adopt the minutes of its meeting held April 6, 2023 as circulated.

CARRIED

3. DELEGATIONS

No items presented.

4. INVITED PRESENTATIONS

No items presented.

5. REPORTS FROM COMMITTEE OR STAFF

5.1 Metro Vancouver's Climate 2050 Industry and Business Roadmap

Report dated April 19, 2023, from Sheryl Cumming, Senior Project Engineer, Parks and Environment, seeking the MVRD Board endorsement of the *Climate 2050 Industry and Business Roadmap*.

9:05 am Councillor Carr arrived at the meeting

Members were provided with a presentation on the *Climate 2050 Industry and Business Roadmap*, highlighting the goals and targets for emissions reduction and climate resilience, the strategies used for emissions reduction and climate resilience, the potential impacts of the strategies, the 2022 engagement feedback, and the roadmap implementation.

Members discussed the targets for emissions reduction, the actions related to advocacy and engagement with other levels of government and business groups, the economic impacts for businesses, and concerns with carbon leakage.

Presentation material titled "*Climate 2050 Industry and Business Roadmap*" is retained with the May 11, 2023 Climate Action Committee agenda.

It was MOVED and SECONDED
That the MVRD Board:

a) endorse the *Climate 2050 Industry and Business Roadmap* as attached to the report dated April 19, 2023, titled "Metro Vancouver's *Climate 2050 Industry and Business Roadmap*" as part of a series of Roadmaps towards achievement of the *Climate 2050* vision, goals, and targets for greenhouse gas reduction and resilience in the industry and business sector;

b) direct staff to continue working with member jurisdictions and other partners to implement the actions in the *Climate 2050 Industry and Business Roadmap*; and
c) direct staff to update the Roadmap, as needed, in response to changes in science, technology and policy.

CARRIED

5.2 2023 Update on Liquid Waste Sustainability Innovation Fund Projects

Report dated April 21, 2023, from Lillian Zaremba, Program Manager, Liquid Waste Services, providing the Climate Action Committee with an update on projects funded under the Liquid Waste Sustainability Innovation Fund.

Members were provided with a presentation on Liquid Waste Sustainability Innovation Fund projects, highlighting updates on the hydrothermal processing demonstration, pump station optimization, the high efficiency aeration demonstration, intelligent water systems, multiphase composite coating for concrete sewers, advanced resource recovery from sludge, the handheld wastewater microbial DNA monitor, and the innovative building material, biorock.

Presentation material titled "2023 Update on Sustainability Innovation Fund Projects" is retained with the May 11, 2023 Climate Action Committee agenda.

It was MOVED and SECONDED

That the Climate Action Committee receive for information the report dated April 21, 2023, titled "2023 Update on Liquid Waste Sustainability Innovation Fund Projects."

CARRIED

5.3 MVRD Agricultural Boilers Emission Regulation Amendment Bylaw No. 1350, 2022

Report dated April 19, 2023, from Marina Richter, Senior Policy Analyst, Parks and Environment, and Esther Berube, Division Manager, Parks and Environment, seeking MVRD Board adoption of amendments to fees in Bylaw 1098 to align with Bylaw 1330, adopted by the MVRD Board in October 2021.

It was MOVED and SECONDED

That the MVRD Board:

a) give first, second, and third reading to *Metro Vancouver Regional District Agricultural Boilers Emission Regulation Amendment Bylaw No. 1350, 2022*; and
b) pass and finally adopt *Metro Vancouver Regional District Agricultural Boilers Emission Regulation Amendment Bylaw No. 1350, 2022*.

CARRIED

5.4 Manager's Report

Report dated May 2, 2023, from Conor Reynolds, Director, Air Quality and Climate Change, providing the Climate Action Committee with updates on the Youth and Education Advisory Panel, the Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report, Canada's National Inventory Report on Greenhouse Gas Emissions for 2021, the food recovery network and food waste reduction efforts, the Robert Banks Terminal 2 Project and the Climate Action Committee 2023 Work Plan.

It was MOVED and SECONDED

That the Climate Action Committee receive for information the report dated May 2, 2023, titled "Manager's Report".

CARRIED

6. INFORMATION ITEMS

No items presented.

7. OTHER BUSINESS

No items presented.

8. BUSINESS ARISING FROM DELEGATIONS

No items presented.

9. RESOLUTION TO CLOSE MEETING

No items presented.

10. ADJOURNMENT/CONCLUSION

It was MOVED and SECONDED

That the Climate Action Committee conclude its meeting of May 11, 2023.

CARRIED

(Time: 11:02 am)

Morgan Mackenzie,
Legislative Services Coordinator

Lisa Dominato,
Chair

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To: Climate Action Committee

From: Geoff Doerksen, Air Quality Planner, Air Quality and Climate Change
Ken Reid, Superintendent, Air Quality and Climate Change

Date: May 23, 2023 Meeting Date: June 8, 2023

Subject: **Air Quality Advisory Program and Preparedness for 2023**

RECOMMENDATION
That the MVRD Board receive for information the report dated May 23, 2023, titled "Air Quality Advisory Program and Preparedness for 2023".

EXECUTIVE SUMMARY
Metro Vancouver issues air quality advisories to help protect public health during periods of degraded air quality. The air quality advisory program covers the entire Lower Fraser Valley airshed, including Metro Vancouver and parts of the Fraser Valley Regional District, when air quality is degraded or is expected to become degraded. Metro Vancouver works closely with health authorities, and other partners each year to update messaging and public outreach materials with actions people can take to reduce their exposure to air contaminants.

New this year, ongoing air quality status updates will be posted on Metro Vancouver's website to increase awareness of the potential for an air quality advisory or as conditions change during an advisory. Wildfire smoke advisories in six of the last eight summers and elevated ground-level ozone due to extreme heat waves emphasize how climate change is presenting new challenges for air quality management. On May 15, 2023, the region experienced its earliest ground-level ozone advisory since the advisory program began 30 years ago.

PURPOSE
To provide information about Metro Vancouver's air quality advisory program, wildfire smoke preparedness and advisory planning activities for the 2023 summer advisory season.

BACKGROUND
Under the BC *Environmental Management Act*, Metro Vancouver has the delegated authority to manage air quality, and operates an air quality monitoring network and advisory program for the entire Lower Fraser Valley airshed, including Metro Vancouver and parts of the Fraser Valley Regional District. This report provides an overview of the advisory program and preparedness for the 2023 summer advisory season, including information on the procedure to provide advanced email notification to Climate Action Committee members, Board Chair, and Board Vice-Chair.

METRO VANCOUVER AIR QUALITY ADVISORY PROGRAM
Air quality advisories are issued to the public when air quality is degraded or is expected to become degraded relative to Metro Vancouver's ambient air quality objectives, which are benchmarks for acceptable air quality. The advisory program is delivered in collaboration with Environment and

Climate Change Canada, BC Ministry of Environment and Climate Change Strategy (BC ENV), Fraser Valley Regional District (FVRD), Vancouver Coastal Health (VCH), Fraser Health Authority (FHA), First Nations Health Authority (FNHA), and the BC Centre for Disease Control (BC CDC). BC ENV provides an air quality advisory program for the remainder of the province.

Air Contaminants of Primary Concern

Metro Vancouver operates a comprehensive network of air quality monitoring stations in the region, including stations located in the FVRD, which have been operated by Metro Vancouver under a service agreement with the FVRD. Data are available in real time on Metro Vancouver's website airmap.ca (References 1 and 2), and informs the air quality advisory program. The contaminants of primary concern for Metro Vancouver's air quality advisory program are:

- **Ground-level ozone (O_3)**: produced when nitrogen oxides (NO_X; emitted when fuels are burned) and volatile organic compounds (VOCs; emitted from solvents, plants, and other sources) react in sunlight on hot summer days.
- **Fine particulate matter ($PM_{2.5}$)**: particles that are less than 2.5 microns in diameter (less than 1/30th the thickness of a human hair), allowing them to penetrate deep into the lungs and into the bloodstream. These particles can be emitted directly (primarily from fuel combustion and wildfires) or formed indirectly, such as when nitrogen oxides or sulphur oxides react with ammonia.

These contaminants have the greatest potential to reach levels in the region that may be harmful to human health. Metro Vancouver has established ambient air quality objectives for these contaminants, which indicate acceptable levels for different periods of exposure such as one-hour, eight-hour, 24-hour, and annual.

2023 Improvements to Advisory Program

In preparation for air quality advisories in 2023, improvements to the program include:

- Working with health authorities to update advisory messaging and public outreach materials with actions people can take to reduce their exposure to degraded air quality (e.g., visiting public air-conditioned buildings with cleaner and cooler air).
- Providing the public with better ongoing communication of air quality conditions in advance of or during air quality advisories as needed. Air quality status updates will be posted on Metro Vancouver's website.
- Translation options for air quality advisories within the updated Metro Vancouver website.
- Revising the format of air quality advisories to improve public communication, including clearer identification of the locations for which advisories are "in effect".

AIR QUALITY ADVISORY PROCEDURES

Metro Vancouver staff provide on-call/stand-by coverage seven days a week during the summer advisory season from early June to mid-September, and start the season earlier or extend the season when needed. Historically, wildfire smoke and ground-level ozone occur in the Lower Fraser Valley between June and September. With climate change, heat waves and wildfire seasons are occurring earlier and ending later.

Staff use many tools to guide decisions about issuing an advisory such as data from the air quality monitoring network; air quality and wildfire smoke forecasts; weather forecasts; and satellite imagery. Regular updates are provided to advisory program partners as air quality conditions change, and partners are consulted when a decision to issue an air quality advisory is made.

During periods of degraded air quality, and during advisories, a brief summary of air quality conditions will be posted on Metro Vancouver's website with the intent to make municipalities, emergency managers, and the public aware of the potential for an air quality advisory. An automated email will also be sent to residents that have subscribed online to receive these air quality status updates. The content of the updates will include the advisory outlook for today and tomorrow, using a rating of 'high', 'medium' and 'low'. The public update may be used by municipalities and emergency managers to help inform the need to open clean air shelters or provide other air quality services to the public.

Advisories are issued when degraded regional air quality exceeds thresholds defined by Metro Vancouver's air quality objectives. Air quality advisories are intended to reflect degraded regional air quality and not specific localized issues such as a small structure fire. When a decision has been made to issue an advisory, an advanced email notification will be provided to Climate Action Committee members, Board Chair, Vice-Chair, and other internal staff. The air quality advisory is then widely distributed to media outlets, a public subscription list, health authorities, and other government agencies by email.

The advisory will be posted on Metro Vancouver's home page and included in the status banner on airmap.ca. The advisory will also be posted by the provincial government and Environment and Climate Change Canada will issue a Special Air Quality Statement (SAQS) via the Weather Office website that acknowledges that an air quality advisory is in effect within the Lower Fraser Valley. Metro Vancouver staff contacts will be referenced on the advisory and will be available to answer media and public inquiries.

Metro Vancouver may also provide supportive information by social media before and during an advisory. Social media posts may include technical information (e.g., satellite images), or information on important topics such as: ways to reduce exposure to wildfire smoke; use of portable air cleaners; health advice; how to receive advisory notices; where to find current air quality data and the Air Quality Health Index (AQHI); and links to Metro Vancouver and BC CDC factsheets.

EARLY GROUND-LEVEL OZONE ADVISORY - MAY 2023

A one-day air quality advisory for ground-level ozone was issued for Metro Vancouver Northeast, the Central Fraser Valley and the Eastern Fraser Valley on May 15, 2023. Historically, ground-level ozone advisories have been issued from June to September, but unseasonably hot, sunny weather in Metro Vancouver and the Fraser Valley led to the earliest ground-level ozone advisory since 1993, when the air quality advisory program began. Spring heat waves can cause degraded air quality as well as summer-like weather conditions that can increase the risk of wildfires. Many large wildfires are already burning in northern BC and Alberta, causing significant air quality impacts due to wildfire smoke in those areas and across Canada and other parts of North America as smoke is

transported by dominant weather patterns. Ongoing preparedness of Metro Vancouver's advisory program ensures that the public are notified of degraded air quality, even when extreme weather occurs outside of the typical "advisory season".

IMPLICATIONS FOR FUTURE AIR QUALITY

Attachment 1 to this report provides information on historical trends related to air quality advisories, including contributing factors to advisory events. In recent summers, the Metro Vancouver region has been impacted by air quality advisories related to both ground-level ozone and wildfire smoke.

Climate Change Impacts on Air Quality

Our region is experiencing more severe and more frequent days of degraded air quality due to climate change. With a changing climate, we expect warmer, drier summers, longer periods of drought, and drier forest conditions. More heat waves and wildfires, due to our changing climate, mean that we expect more frequent and severe wildfire smoke and elevated levels of ground-level ozone. We must prepare our communities for air quality impacts of climate change while reducing our emissions to lessen the impacts.

Occurrences of wildfire smoke impacting Metro Vancouver has seen an upward trend in recent years. Six of the last eight summers have experienced widespread wildfire smoke throughout the region for many days. In 2022, the region was impacted by smoke from fires burning in BC as well as the US. Significant smoke can reach our region from wildfires in Washington, Oregon and California where similar trends are being observed.

The summer heat dome in 2021 saw a return to ground-level ozone levels not experienced since the 1980s, and a heat wave in 2022 also resulted in elevated ground-level ozone concentrations. Metro Vancouver's air quality program has had a historical focus on ozone and smog, and the *Regional Ground-Level Ozone Strategy*, adopted in 2014 by the Metro Vancouver and Fraser Valley Regional District Boards, has used a science-based approach for management actions to reduce emissions within the airshed that contribute to ground-level ozone. However, more extreme temperatures and new sources of emissions, including wildfires, have necessitated an update to the Strategy, which is part of the Climate Action Committee's work plan in 2023.

Metro Vancouver's *Climate 2050* strategy has identified the need for adaptation to climate-related impacts on regional air quality. For example, the Buildings Roadmap has actions to accelerate the use of electric heat pumps to enable summer cooling in homes while also reducing GHG emissions. The *Clean Air Plan* outlines strategies for continuous improvement in regional air quality, including actions to provide better protection against wildfire smoke such as clean air shelters in public buildings, develop resources to help residents and businesses manage indoor air quality, and provide high quality information to the public during air quality advisories.

ALTERNATIVES

This is an information report. No alternatives are presented.

FINANCIAL IMPLICATIONS

Staff time for monitoring and analyzing air quality information, issuing air quality advisories and responding to requests from media and the public is included in annual operating budgets, including overtime for evening and weekend work during the summer period. In the last three advisory seasons (2020 to 2022), weekend staff coverage for the advisory program has been extended past the typical ending on Labour Day, by three to five weeks, due to longer wildfire seasons and ongoing threats of wildfire smoke to the region. Consideration of increased resource levels is made during annual budget preparation and may be needed if wildfire activity continues to increase in the future.

SUMMARY / CONCLUSION

Public notification of degraded air quality is delivered by Metro Vancouver's air quality advisory program. There is considerable public and media interest in air quality, especially when advisories are in place. In preparation for advisory season, Metro Vancouver undertook improvements to the advisory program, in particular to public outreach materials such as a revised webpage and more clear advisory messaging. Wildfire smoke advisories in six of the last eight years and extreme heat waves emphasize how climate change is presenting new challenges for air quality management and the need for adaptation to climate-related impacts on regional air quality.

Attachments

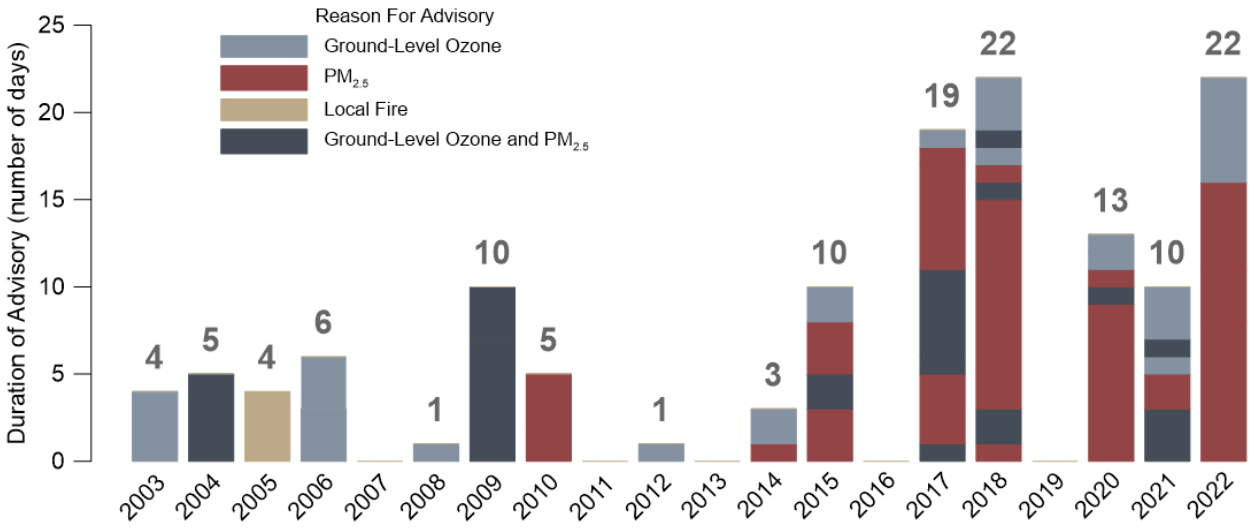
1. Air Quality Advisory Trends
2. Presentation re: Air Quality Advisory Program and Preparedness for 2023

References

1. Metro Vancouver Home Page - Updates
2. Metro Vancouver's Current Air Quality - Air Map
3. BC Provincial Government Air Quality Advisories

Air Quality Advisory Trends

In the last twenty years, the number of days on which air quality advisories were in place has ranged from zero to twenty-two days annually. Shown in Figure 1 is the historical trend of the number of days the Lower Fraser Valley was under an advisory. The legend indicates the reason for the advisory being issued.



Notes:

- Trigger levels for advisories have changed over the years; care must be taken when interpreting advisory trends.
- The advisory in 2005 was the result of a large fire in Burns Bog Ecological Conservation Area.

Figure 1: Number of days of air quality advisories in the Lower Fraser Valley.

Air Quality Advisory Program and Preparedness for 2023

Geoff Doerksen, M.Sc.
Air Quality Planner, Air Quality and Climate Change

Ken Reid, M.Sc.
Superintendent, Environmental Sampling and Monitoring, Air Quality and Climate Change

Climate Action Committee Meeting, June 8, 2023

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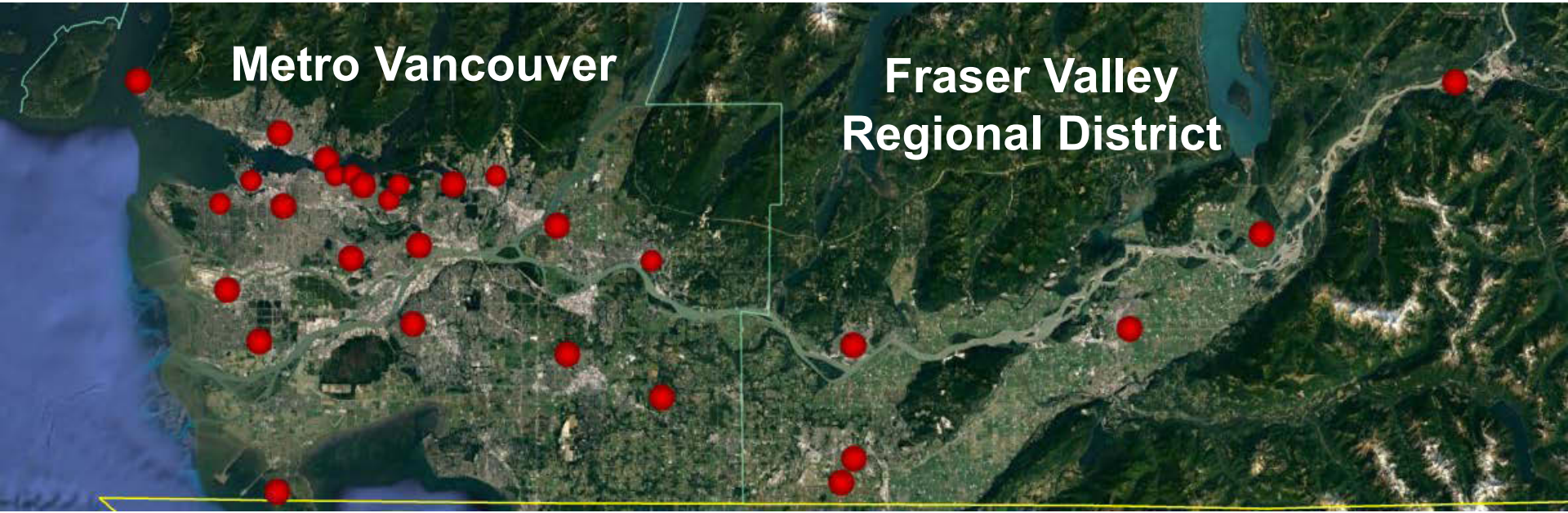
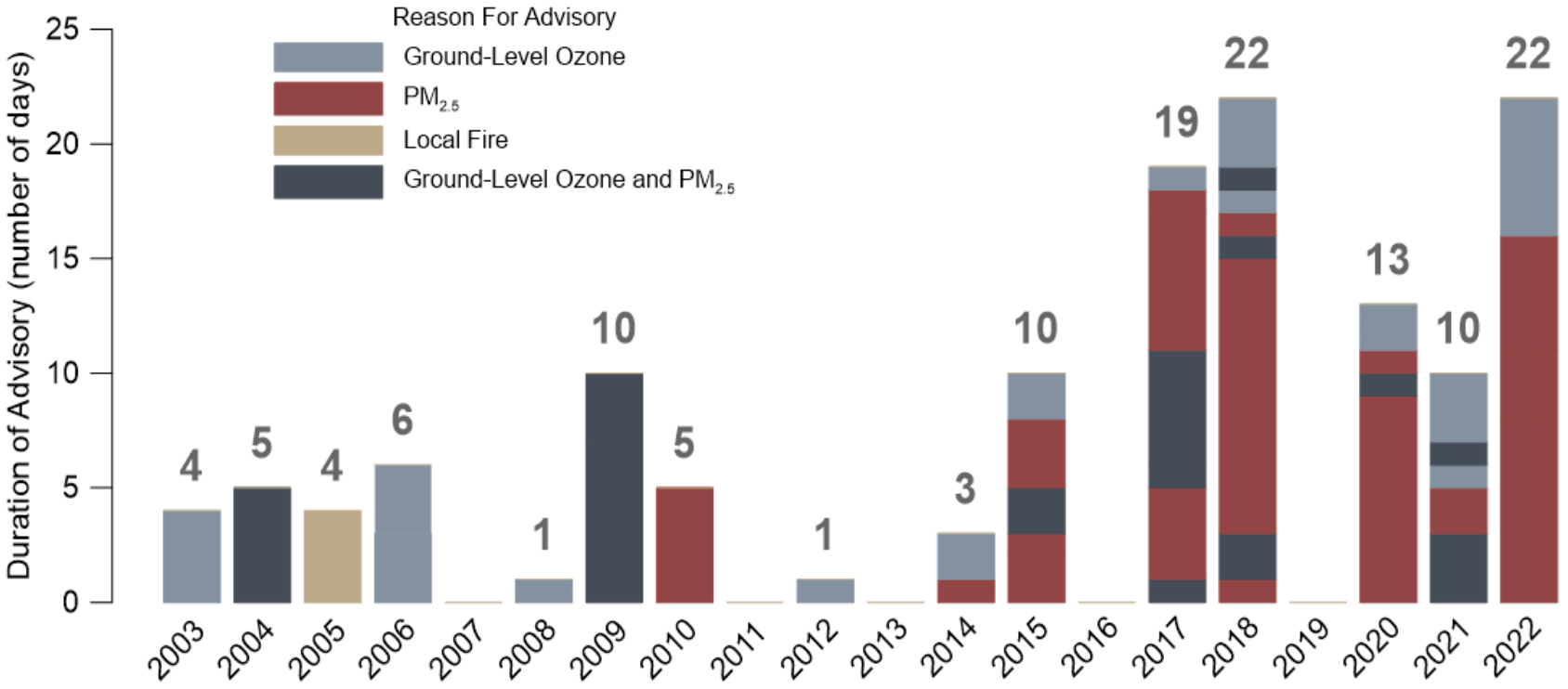
METRO VANCOUVER AIR QUALITY ADVISORY PROGRAM



British Columbia Ministry of Environment and Climate Change Strategy
Fraser Valley Regional District
Environment and Climate Change Canada
Vancouver Coastal Health
fraserhealth
First Nations Health Authority
BC Centre for Disease Control

AIR QUALITY ADVISORIES 2003-2022



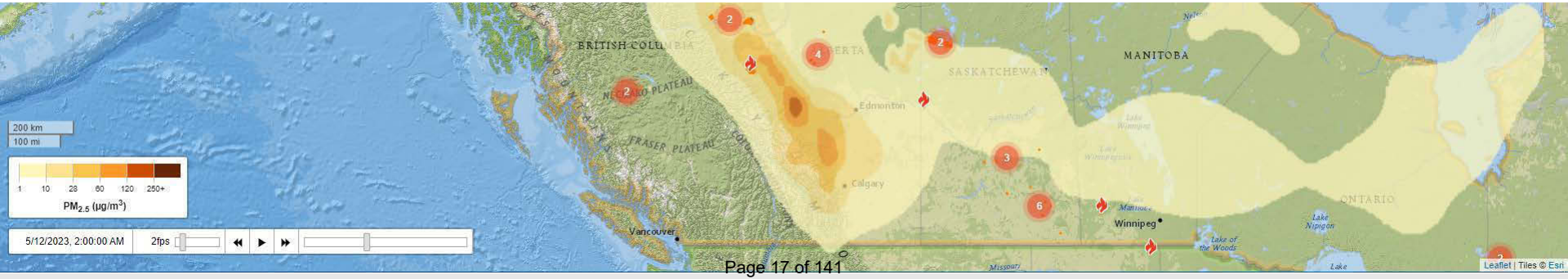
ADVISORY PREPARATION

- Work with partners and health authorities
- Improvements to public outreach materials
- Public air quality status updates

Date Issued	Advisory Outlook - Today	Summary	Advisory Outlook - Tomorrow
July 25, 2022 9:45 am	Medium	Environment Canada has issued a Heat Warning for Metro Vancouver and the Fraser Valley. The current forecast calls hot weather for the entire week, which will lead to enhanced ground-level ozone (O3) formation. The highest temperatures are forecast from Tuesday to Thursday but it will likely remain hot until at least the weekend. The Nohomin Creek Fire currently burning near Lytton, BC is also generating some smoke which may intermittently impact the region with light smoke but it is not expected to have significant ground-level impacts at this time. Currently, fine particulate matter (PM2.5) concentrations are low and are expected to remain low today.	High

ADVISORY PROCESS

- Tools used to guide decisions
- Consultation with partners
- Advance notification to CAC members
- Media and public release
- Supportive information by social media



IMPLICATIONS FOR FUTURE AIR QUALITY

- 6 of 8 recent summers had widespread wildfire smoke
- Changing climate will increase frequency and severity of wildfire smoke and heat waves
- *Clean Air Plan* outlines strategies for continuous improvement in regional air quality

Wildfire smoke on Bowen Island, BC (July 2015)

Questions?

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Together we make our region strong

To: Climate Action Committee

From: Conor Reynolds, Director, Air Quality and Climate Change
Parks and Environment Department

Date: May 23, 2023 Meeting Date: June 8, 2023

Subject: **2023 Update on Regional District Sustainability Innovation Fund Projects**

RECOMMENDATION

That the Climate Action Committee receive for information the report dated May 23, 2023, titled "2023 Update on Regional District Sustainability Innovation Fund Projects."

EXECUTIVE SUMMARY

This report provides an update on 24 projects that were approved for funding in 2019 through to 2022 under the MVRD Sustainability Innovation Fund. The projects cover a wide variety of sustainability and climate action topics, including: climate engagement and literacy; advanced air quality monitoring; buildings decarbonization and resilience; ecosystem protection; and innovations in climate policy. Of the 24 projects, four have been recently completed, one has been discontinued (primarily due to the impact of COVID-19), and the rest are in progress.

The Climate Literacy Modules project is highlighted in this report because the online tool has been completed and will be widely promoted in the coming months. The modules comprise engaging and interactive learning materials on the fundamentals of climate change and climate action, in addition to a series of five action-focused modules that highlight the climate outcomes related to food scraps recycling, walkable communities, heating and cooling buildings, managing stormwater, and consumer choices.

Attachment 1 provides detailed updates on the other projects.

PURPOSE

To provide an update on projects funded under the Regional District Sustainability Innovation Fund.

BACKGROUND

The Metro Vancouver Regional District Sustainability Innovation Fund (Fund) was created by the Board in 2004 to provide financial support to regional district projects that contribute to the region's sustainability. The MVRD Board adopted the *Regional District Sustainability Innovation Fund Policy* on June 27, 2014, with further amendments in 2016 and 2021, to guide the use and management of the Fund. The policy requires that the Climate Action Committee be updated on an annual basis on the deliverables, outcomes and measurable benefits of the projects receiving funding.

This report presents an update on projects that have not yet been reported as complete to the Climate Action Committee, including status, amount spent, and project outcomes.

STATUS OF SUSTAINABILITY INNOVATION PROJECTS (APPROVAL YEARS: 2019 – 2022)

Table 1 below provides summary information on the status of each project. Additional details are provided in the Attachment 1. Updates on a number of the projects have been provided to the Climate Action Committee on an individual basis in previous meetings.

Table 1. MVRD Sustainability Innovation Fund Project Status

Project	Approval Year	Amount Approved	Status
Climate Literacy Modules	2019	$160,000	In progress
Preventing Smoke Emissions from Agricultural Waste Management	2020	$140,000	In progress
Mobile Monitoring of Fugitive and Other Industrial Air Emissions with "Flying Labs"	2020	$100,000	In progress
Building Resilience: Exploring the Potential of Renewable Energy Building Infrastructure	2020	$200,000	In progress
Step Code Implementation Impacts for Building Envelope Rehabilitation of Existing Buildings	2020	$90,000	In progress
Clean Air for Students and Schools (CLASS)	2020	$200,000	Discontinued
Assessment of Carbon Capture Technology in the Metro Vancouver Region	2021	$200,000	In progress
Lights, Camera, Climate Action!	2021	$200,000	In progress
Sharing Data for Zero Emission Buildings (SDZEB)	2021	$200,000	In progress
Responding to the Climate Emergency: Enhanced Stakeholder Engagement	2021	$200,000	In progress
Social and Community Data Land Use Model	2021	$60,000	**Completed**
Regional Land Use Assessment	2021	$200,000	**Completed**
Housing Retrofit Evolution – Pembina Institute Reframed Initiative	2021	$200,000	**Completed**
Managing Capacity and Reducing Emissions: Real-time Parking Availability in Regional Parks	2021	$300,000	In progress
Natural Asset Management in Regional Parks	2021	$160,000	In progress
Promoting Peatland Recovery in Areas Affected by Wildfire in Burns Bog Ecological Conservancy Area	2021	$199,000	In progress
Showcasing Innovation in Alternative Powered Park Operations and Maintenance Equipment to Reduce Emissions	2022	$35,000	In progress
Social and Community Data Model	2022	$180,000	In progress
Net Zero Water Technology Accelerator	2022	$175,000	**Completed**
Integrating greenhouse gases requirements into air emission permits and regulations	2022	$150,000	In progress
Taking out the Trash: Transitioning to Zero-Carbon Heavy Duty Vehicles through Waste Collection Trucks	2022	$400,000	In progress
Large Building Retrofit Accelerator	2022	$850,000	In progress
Driving Down Emissions: Developing a Regional Policy to Reduce Transportation Emissions	2022	$455,000	In progress
Smart Cities: Hyperlocal Air Quality Monitoring	2022	$250,000	In progress

Climate Literacy Modules: In Progress

A goal of the *Climate 2050 Engagement and Public Outreach Strategy* is to strengthen and build support for the actions that will be implemented in this region, and particularly the Big Moves identified in roadmaps. Improving residents' climate literacy is a fundamental step to increasing everyone's ability and confidence to engage in solution oriented conversations. Research indicates residents have a high level of concern about climate change, but low knowledge and confidence in speaking about solutions. This project creates a toolkit to support increased climate literacy, for use by Metro Vancouver and member jurisdiction staff, First Nations, youth, residents and other interested parties. The output is a building block for knowledge, in the form of online climate learning modules. The modules explore questions such as:

- How do we consider and combine Indigenous knowledge and western science in climate solutions?
- What do words like 'mitigation', 'adaptation', 'net zero', 'zero-emissions', and other climate action terminology really mean?
- How does protecting nature in turn protect us?
- What are the biggest things we can start to do today?
- What do decisions about land use have to do with climate outcomes?

There was a soft launch of the first component, a module on climate change fundamentals (e.g., climate change, climate action, examples, perspectives, terminology, etc.), for Earth Day 2022. The remaining content was developed over 2022/2023. Content is now complete and includes an additional series of five action-focused modules highlighting the climate outcomes related to food scraps recycling, walkable communities, heating buildings, managing stormwater, and consumer choices (see Reference).

Remaining budget for this project will be allocated to promotion of the literacy tool. Staff generated a social media promotion through May and June 2023, and a contract is in place for in-community training, and direct-delivery of the content into fall 2023 (e.g., to libraries, large employers, community associations and similar). Staff will track uptake of the modules through data analytics. Content will be revised regularly, and the toolkit is designed to accommodate new action modules in future.

ALTERNATIVES

This is an information report. No alternatives are presented.

FINANCIAL IMPLICATIONS

The projects summarized in this report had funding approved by the MVRD Board from 2019-2022. The disbursals of funds were made in accordance with the applicable *Sustainability Innovation Fund Policy* that governs the use and management of the Funds. Table 2 below outlines the funding approved and the amount spent to date for each project. Any unspent funds for completed or discontinued projects remain in the Sustainability Innovation Fund reserve.

Table 2. MVRD Sustainability Innovation Fund Project Funding Status

Project	Total Amount of Funding Approved	Est. Spent (as of April 30, 2023)
2019 Approval Year		
Climate Literacy Modules	$160,000	$100,000
2020 Approval Year		
Preventing Smoke Emissions from Agricultural Waste Management	$140,000	$112,000
Mobile Monitoring of Fugitive and Other Industrial Air Emissions with "Flying Labs"	$100,000	$19,260
Building Resilience: Exploring the Potential of Renewable Energy Building Infrastructure	$200,000	$0
Step Code Implementation Impacts for Building Envelope Rehabilitation of Existing Buildings	$90,000	$0
Clean Air for Students and Schools (CLASS)	$200,000	$0
2021 Approval Year		
Assessment of Carbon Capture Technology in the Metro Vancouver Region	$200,000	$67,097
Lights, Camera, Climate Action!	$200,000	$53,457
Sharing Data for Zero Emission Buildings (SDZEB)	$200,000	$147,500
Responding to the Climate Emergency: Enhanced Stakeholder Engagement	$200,000	$20,000
Social and Community Data Land Use Model	$60,000	$55,452
Regional Land Use Assessment	$200,000	$180,000
Housing Retrofit Evolution – Pembina Institute Reframed Initiative	$200,000	$200,000
Managing Capacity and Reducing Emissions: Real-time Parking Availability in Regional Parks	$300,000	$38,315
Natural Asset Management in Regional Parks	$160,000	$5,000
Promoting Peatland Recovery in Areas Affected by Wildfire in Burns Bog Ecological Conservancy Area	$199,000	$140,000
2022 Approval Year		
Showcasing Innovation in Alternative Powered Park Operations and Maintenance Equipment to Reduce Emissions	$35,000	$11,800
Social and Community Data Model	$180,000	$18,907
Net Zero Water Technology Accelerator	$175,000	$175,000
Integrating greenhouse gases requirements into air emission permits and regulations	$150,000	$0
Taking out the Trash: Transitioning to Zero-Carbon Heavy Duty Vehicles through Waste Collection Trucks	$400,000	$9,199
Large Building Retrofit Accelerator	$850,000	$275,000
Driving Down Emissions: Developing a Regional Policy to Reduce Transportation Emissions	$455,000	$210,000
Smart Cities: Hyperlocal Air Quality Monitoring	$250,000	$0

The balance in the Metro Vancouver Regional District Sustainability Innovation Fund at December 31, 2022 was $12 million.

CONCLUSION

This report provides an update on 24 projects funded under the Metro Vancouver Regional District Sustainability Innovation Fund between 2019 and 2022. The projects cover a wide range of climate action and sustainability topics. The Sustainability Innovation Funds were created by the Board in 2004 to provide financial support to utility or regional district projects that contribute to the region's sustainability.

Attachments

1. Update on Metro Vancouver Regional District Sustainability Innovation Fund Projects
2. Presentation re 2023 Update on Regional District Sustainability Innovation Fund Projects

Reference

Climate Literacy in Metro Vancouver

UPDATE ON METRO VANCOUVER REGIONAL DISTRICT SUSTAINABILITY INNOVATION FUND PROJECTS

Preventing Smoke Emissions from Agricultural Waste Management: In Progress
Open burning of vegetative debris is a source of air contaminants harmful to human health and the environment. This project was initiated in 2020 to study alternatives to open burning for managing agricultural vegetative debris in the Metro Vancouver region. The study findings identified barriers to using alternative methods of vegetative debris disposal for farmers in the region, which included cost, complexity, practical feasibility, crop disease considerations, and equipment availability.

During the second phase of the project in 2021-2023, a multi-language Best Practices Guide on Alternatives to Open Burning for farm operators in Metro Vancouver was developed. The purpose of the guide is to provide practical and easy-to-use information on alternatives to open burning practices of agricultural vegetative debris disposal in various languages in an effort to reduce air emissions. The guide is tailored toward operators who are involved in crop pruning and removal, field renovations, and land or brush clearing on farmland in Metro Vancouver. The local agriculture sector, including farmers and representatives of farming associations, educational institutions, and BC Ministry of Agriculture, Food and Fisheries have been involved and provided input in the development of the guide.

The guide is planned to be used as an educational and promotional tool for the new *Metro Vancouver Regional District Open Burning Emission Regulation Bylaw 1355, 2022* (MVRD Bylaw 1355), which includes requirements to consider the use of alternatives to open burning of vegetative debris. The English version of the guide is expected to be published after MVRD Bylaw 1355 takes effect in May 2023. The translated versions in Punjabi and simplified Chinese (Mandarin) will be released later in 2023. This project is expected to be completed within 2023.

Mobile Monitoring of Fugitive and Other Industrial Air Emissions with "Flying Labs": In Progress
The objective of the "Flying Labs" project was to assess the feasibility and cost of using mobile monitoring using drone-mounted small sensors to measure emissions of air contaminants in the region that are otherwise difficult to monitor, and, hence provide an additional tool to promote compliance with Metro Vancouver's bylaws, regulations, and permits. Flights with drones carrying small sensors were conducted in three locations in the Metro Vancouver region in the summer of 2021. Results revealed practicality issues in using drone-based monitoring platforms and challenges in collecting data of sufficient quality to effectively assess emissions with the relatively new technology of small sensors. At its March 11, 2022 meeting, the Climate Action Committee received a report titled "Mobile Air Quality Monitoring Using Drone-Based Sensors" describing the test flight results and recommended next steps. The Committee approved an alternative approach to test small sensors on other mobile platforms to address some of the issues and limitations identified during test flights. In 2022, staff identified suitable sensor-based instruments and potential partners for the deployment of the mobile monitoring units.

In 2023, staff expect to complete the project by procuring sensor-based instruments and collaborating with academic partners to deploy and evaluate the instruments mounted on ground-oriented mobile monitoring platforms. This work will examine key air emissions sources and

air quality impacts in the surrounding communities. This project will assess the effectiveness of ground-oriented mobile monitoring platforms as additional tools to promote compliance with Metro Vancouver's air quality bylaws, regulations, and permits.

Building Resilience: Exploring the Potential of Renewable Energy Building Infrastructure: In Progress

The study will investigate types of sustainable domestic hot water for affordable multi-family housing retrofit projects. Domestic hot water heating accounts for approximately 30% of building greenhouse gas emissions and this study will help Metro Vancouver Housing to meet Metro Vancouver's *Climate 2050* greenhouse gas emissions reductions targets. The results will be shared regionally to inform other multi-family housing providers of best practices and technologies. Staff have begun the process to retain a consultant to conduct this work, which will include two phases:

> **Phase one – High Level Analysis:** This phase will investigate sustainable systems to heat domestic hot water. The consultant team will complete a high level analysis focusing on capital, maintenance, operations and life cycle of technologies available in the Metro Vancouver region. The consultant will provide this information in the form of a report and presentation to Metro Vancouver Housing stakeholders.
>
> **Phase two – Pilot Project Plan:** The consultant will focus on mutually selected technologies from phase one to create a plan for a pilot project. The pilot project will be conducted using buildings within the Metro Vancouver Housing portfolio. The pilot project may involve one site comparing and monitoring multiple buildings or several sites, depending on the proposed approach. It will include a business case and monitoring program. The business case will be shared with members, partners, and housing providers across the region to facilitate change in building energy infrastructure and reduce carbon emissions from housing.

Step Code Implementation Impacts for Building Envelope Rehabilitation of Existing Buildings: In Progress

The purpose of this project is to better understand the levels of the BC Energy Step Code for buildings, and the cost and performance implications for major renewals of Metro Vancouver Housing's housing stock. The BC Building Code is written for implementation with new building construction, but does not strictly apply to building renewals. A large portion of Metro Vancouver Housing's existing housing sites were constructed ~40 years ago and many major building components (e.g., roofing, windows, cladding, etc.) are reaching the end of their service lives. The near future requirement for major capital investment into the existing housing stock creates the opportunity for performance upgrades to align with Metro Vancouver's strategies, plans, and policies, and the Step Code. An in-depth understanding of the economic and performance implications of the Step Code is of great interest for Metro Vancouver Housing.

This study will:

- Create a guide for making informed decisions when designing and constructing upcoming major building renewals;
- Provide insight on performance metrics (e.g., energy consumption, greenhouse gas emissions); and

- Provide insight on marginal and long-term maintenance costs.

Metro Vancouver Housing's Capital Maintenance team have been working with the Pembina Institute on a related project, Reframed (e.g., deep retrofits). Pembina has been working with RDH consultants and has produced a report that contains information that will overlap well with the SIF *Step Code Implementation Impacts for Building Envelope Rehabilitation of Existing Buildings* research and report. Metro Vancouver Housing received a proposal from a consultant to build on the Pembina report, and to conduct additional research to develop the specific requirements and cost implications to achieve the various Step Code levels in existing buildings. Learnings with respect to Step Code implementation into existing buildings are still underway with the Pembina Reframed Program. Project workshops have been completed, and the findings from these workshops will be included in the consultant report. A change to the BC Building Code is coming with respect to rehabilitation of existing buildings. Metro Vancouver Housing staff are collaborating with the consultant and the team working on the Step Code upgrade to ensure information and work efforts are being shared to enhance both projects.

Clean Air for Students and Schools (CLASS): Discontinued

The Clean Air for Students and Schools (CLASS) project was originally proposed in 2019, and was intended to be undertaken in partnership with schools and teachers. The objective was to identify actions to reduce exposure to traffic-related air pollution at and around schools, pilot selected actions, and report on the feasibility of the actions piloted. However, due to the COVID-19 pandemic there was an extended period with limited access to schools, and consequently the CLASS project has been on hold since 2020. The decision has now been made to discontinue the CLASS project, as progress has been made in several areas related to air quality while the project was on hold, which are addressing key objectives in the original project proposal:

- **New school resources on reducing exposure to traffic-related air pollution:** In October 2021, the US Environmental Protection Agency published a best practices guide for reducing exposure to traffic-related air pollution at schools (Reference 1). This guide contains information on actions schools could take to reduce their exposure to air contaminants, which accomplishes one of the project objectives for CLASS. Additionally, Vancouver Coastal Health is developing guidance for schools related to managing and reducing exposure of school occupants to wildfire smoke.
- **Shifting focus to indoor air quality at schools:** As in-person classes resumed, many schools turned their focus to improving indoor air quality to reduce the spread of airborne diseases. For example, the provincial and federal governments are continuing to invest in school maintenance, including upgrading ventilation and filtration systems (Reference 2).
- **Advancing the use of small air sensors:** The use of small air sensors, which were intended to lend an innovative approach to CLASS, has advanced in recent years. Small air sensors are now being more commonly used by researchers and other government agencies. In addition, another SIF project, "Smart Cities: Hyperlocal Air Quality Monitoring", is investigating how Metro Vancouver can integrate small sensors into the regional air monitoring network, and where possible that project will explore opportunities to further the objectives of CLASS.

For the above reasons, staff are discontinuing the CLASS project, and the project budget will remain in the SIF reserve.

Assessment of Carbon Capture Technology in the Metro Vancouver Region: In Progress
Industrial facilities contribute approximately 17% of the 15 million tonnes of greenhouse gas emissions in the Metro Vancouver region, next to buildings and transportation emissions. The SIF Project "Assessment of Carbon Capture Technology in the Metro Vancouver Region" aims to support early identification of the applicable technological approaches for capturing and removing carbon dioxide (CO_2) from industrial flue gas streams in large industrial facilities in the Metro Vancouver region, and storing the collected CO_2 in a way that prevents its release into the atmosphere.

The first phase of the project is evaluating the decarbonization potential of carbon capture, utilization, and storage (CCUS) systems for the range of industrial facilities in the region that release over 10,000 tonnes of CO_2 per year. These facilities include cement manufacturing, petroleum refining, energy generation, and Metro Vancouver's Waste to Energy Facility, district energy systems, chemical production, and food and wood products manufacturing. The study considered the following criteria in examining various types of CCUS technologies:

- Applicability of carbon capture systems, including sensitivity to flue gas rates, CO_2 concentrations, and other process conditions;
- Plans for electrification or fuel switching, as part of facility's overall decarbonization strategy, which will likely impact the role and need of carbon capture systems in the facility's overall strategy; and
- Location of the emitting facilities, which will inform decisions about potential CCUS hubs, CO_2 transportation methods, and geological storage opportunities to maximize efficiencies and reduce costs.

The next phase of the SIF project will explore options by clustering industrial sources of CO_2 and evaluating potential CO_2 utilization, transportation, and storage scenarios. The project will identify key policies, limitations and opportunities that may impact development and deployment of CCUS projects in the region (e.g., costs/incentives, penalties/disincentives, and regulation/approval processes, associated timeframes).

The SIF project is supported by strong coordination with external partners, such as the Government of BC (Climate Action Secretariat and Ministry of Energy, Mines, and Low Carbon Innovation), and UBC Clean Energy Research Centre. In addition, Metro Vancouver's Solid Waste Services is exploring the role of carbon capture, utilization, and storage in reducing CO_2 emissions from the Waste to Energy facility.

Lights, Camera, Climate Action!: In Progress
Lights, Camera, Climate Action is a project that has been undertaken to recommend alternative clean and modular power sources to replace portable diesel generators currently used extensively in the film industry. This project will explore cleaner technology alternatives to diesel generators in order to reduce GHG emissions, improve air quality, and reduce ambient noise, while also ensuring the alternatives recommended are viable solutions in terms of user experience, fulfilling power

requirements, and are cost effective. The second phase of the SIF project will include the implementation of a clean power alternative at a regional park as a prototype for future expansion of the initiative.

A technical feasibility study has been undertaken by consultants (Green Spark Group). The report includes information on current energy use of the film industry, a preliminary assessment of possible overlap with related user groups (e.g., food trucks, events, and construction), film production energy use data collection and a compilation of high frequency film site locations in Metro Vancouver. The report notes Metro Vancouver's Clean Energy Discounted Rate for filming fees and encourages member jurisdictions to incentivize the use of cleaner technology alternatives to diesel generators such as the use of electric portable generators, or by tying into existing hard wired power sources. The report will be posted on the Metro Vancouver website when finalized.

The second phase of the project will include the capital cost of installing a permanent clean power kiosk, wired-in at a Metro Vancouver regional park site. This would provide the film industry the opportunity to connect directly to a permanent power source, thereby eliminating the need for portable power generators at the selected site. Staff are working with Creative BC's Reel Green™ initiative to select the trial site (Reference 3). This national partnership is managed by the film commission helping Canada's motion picture industry to unite to improve production practices and reduce environmental impacts through strategic collaboration and practical tools.

Sharing Data for Zero Emission Buildings (SDZEB): In Progress
The purpose of the Sharing Data for Zero Emission Buildings (SDZEB) project is to create a database that estimates the attributes and GHG emissions of detached homes, row homes and townhomes at the building level. This database is a foundational tool needed to design effective GHG reduction policies and retrofit programs in the region.

The development of this database (constituting the first phase of SDZEB) is nearly complete. The database contains key building characteristics alongside *estimated* energy use and greenhouse gas emissions for every single-family home in the Metro Vancouver region. The database will also contain cost estimates for various retrofit packages, stratified by groupings of homes with similar retrofit opportunities. The end result will be a building-by-building database with information about each home and suggestions on how to improve its emissions performance.

In the second phase of this project, which is expected to begin in Q3 2023, staff will continue to develop and optimize the database into a dynamic and shareable resource for use by Metro Vancouver, municipalities, and other key partners. Concurrently, partnering municipalities (including the City of Vancouver and Township of Langley) will use the retrofit packages from phase one to develop and pilot retrofit support and incentive programs in their communities.

Staff and the project partners are also contributing learnings from phase one to inform an initiative by the Province, which is using a similar methodology to develop a province-wide database. Based on the scope of the Province's initiative, the second phase of SIF funding may no longer be necessary, or may present new opportunities to advance this work in the region. Staff will continue to evaluate this opportunity and update the Committee as the provincial initiative is advanced.

Responding to the Climate Emergency: Enhanced Stakeholder Engagement: In Progress
In response to the climate emergency, an innovative public and stakeholder engagement strategy is needed that can build a vocal constituency to champion *Climate 2050* and the actions in it. In April 2022, the project team brought a progress report to Climate Action Committee, proposing a strategy for engagement on climate action for Metro Vancouver.

Staff subsequently developed the *Climate 2050 Engagement and Public Education Strategy*, which was brought to the Climate Action Committee in March 2023. Portions of the strategy are being implemented, while other activities are in planning and development stages. Examples of implementation include: Climate Action Dialogues, launch of the Climate Literacy toolkit, initiation of a Community of Practice for member jurisdiction staff with responsibilities in climate engagement and outreach, progress on strategies to improve engagement with First Nations, progress on a strategy to improve engagement with youth (including direct input from Metro Vancouver's new Youth and Education Advisory Panel), as well as continued engagement support for both developing the Climate 2050 Roadmaps and implementation of substantial actions.

Next steps include:

- preparing to host a non-government Community of Practice for non-profits and other community educators working in the climate action space, and
- working with technical writers to develop plain language engagement materials, and determining a path to develop the Climate Leadership Collaborative.

In addition, there will be ongoing support for engagement on climate actions with those most likely to comment, be impacted or have a role in implementation. Funds will in part support contractors with the appropriate expertise to develop effective programs, as well as delivery.

Social and Community Data Land Use Model: Completed
The focus of this project was to determine how residents make neighbourhood location decisions around the region. The results were broken out by postal code, demographics, age, income, household composition, and immigration status.

The following household characteristics were analyzed:

- Those that immigrated to the lower mainland and where they ended up (by postal code);
- Those that emigrated from the region (from which postal code); and
- Those that migrated intra-regionally, and which postal codes they moved to and from.

The project identified four categories of "mover type" within the region over the last five years:

- Sticker: those who have not moved / have stayed at the same postal code;
- Mover: those who have moved once;
- Bouncer: those who have moved several times; and
- Emigrant: those who have left the region.

The project provided good insights into the regional population's moving patterns based on their demographics. The analysis was based on disaggregated Census data, and provides a detailed quantitative summary of population moving trends within the region over the past twenty years.

This data will be an important input into the digital land use model that is currently being developed. It will support the preparation of different land use scenarios to help staff and decision makers better understand the demand trends by housing type and location as the region's age, income, and ethnicity shift over time. The project was completed in 2022.

Regional Land Use Assessment Project: Completed
The Regional Land Use Assessment compiled information about lands and uses across the region, and provides a unique and relevant lens to assess the land availability, capacity, and needs over the planning horizon to the year 2050. Going forward, this work will inform long range land use policy objectives and decisions by Metro Vancouver, member jurisdictions, and other regional agencies.

Starting in early 2022, Metro Vancouver initiated the Regional Land Use Assessment project funded by the Sustainability Innovation Fund. The project work was undertaken by a consultant and completed in early 2023. The project involved collecting parcel-level land use data across the region to establish a comprehensive, region-wide inventory of all land uses and their respective attributes, based on official community plan (or equivalent) land use designations and the associated development densities. A set of standardized land use categories was then prepared.

The project included using the standardized land uses to then prepare a regional 'land budget' of the current supply and anticipated projected demand by land use category. This land supply/demand model was compared to the regional projections for population, housing, and employment that were prepared for *Metro 2050,* the Regional Growth Strategy.

This analysis provides staff a needed data input for a forecasting model which is currently being developed by Regional Planning. The data from the project will also assist with Metro Vancouver utility planning to better understand development and potential intensity, and where infrastructure investments would be priorities. The results may also inform the evaluation of tradeoffs and future opportunities for more optimized locations and uses of land to support regional policy objectives, infrastructure investments, and evaluation of possible regional land use and policy change requests.

Housing Retrofit Evolution – Pembina Institute Reframed Initiative: Complete
Metro Vancouver Housing is a member of the "Reframed" Initiative, a joint initiative of the Pembina Institute, BC Housing, BC Non-Profit Housing Association, and the City of Vancouver. Members are working together to demonstrate the technical and economic feasibility of whole-building deep resiliency retrofits that include reduction of energy use intensity by at least 50% from the pre-retrofit baseline, decarbonization, and upgrades relating to climate adaptation, seismic, and fire safety. The aim is to decarbonize building operations, eliminate climate pollution, reduce energy waste to keep the bills low and improve tenant comfort, increase resiliency to extreme weather events like heat waves, flooding, and forest fires, seismically upgrade the structures, and create healthier homes.

This project involves deep energy retrofits of three Metro Vancouver Housing buildings and three BC Housing buildings. In June 2022, six design consultants were retained (three by Metro Vancouver Housing and three by BC Housing) for the concept design phase; the concept designs are now completed. Currently, the proposals for the detailed design phase for Prime Consultant are being solicited, and a request for proposals is due to close June 2023. The Prime Consultants for the

detailed design phase will use the concepts developed during the exploration labs. The SIF funding paid for the additional costs associated with the exploration labs; the exploration labs and subsequent concept designs are now complete.

Managing Capacity and Reducing Emissions: Real-time Parking Availability in Regional Parks: In Progress

The Real-time Parking Availability Pilot Project will design and implement an advanced electronic parking availability system for the public for selected regional parks experiencing parking capacity issues. The primary goal of the project is to bring about a change in practice by park visitors who travel to busy regional parks by personal vehicle, by providing them with real-time information on parking availability before they leave their home. This will allow the public to make better decisions about how to access the park, when to access the park or to consider alternate destinations if parking lots are full.

Phase I of the Feasibility Study is complete. The study focused on research and technology exploration and innovation opportunities to inform creation of a new parking stall capacity monitoring program. Investigations and the subsequent report outlined opportunities to adapt existing technology or install new kinds of data loggers, cameras or sensors, and develop a customized algorithm with supporting software for use in real-time monitoring of vehicle parking availability at selected park sites.

Phase II (technology acquisition and deployment) is well underway. Metro Vancouver has selected its preferred technology proponent. This phase includes strategically placing sensor/camera installations and developing the supporting software platform for rapid parking availability analysis. The plan is to complete design, installation, and deployment at two pilot regional parks (Iona Beach in the City of Richmond, and Boundary Bay in the City of Delta) in the coming months.

Natural Asset Management in Regional Parks: In Progress

This Parks' project seeks to make significant advances in the integration of natural assets into Metro Vancouver's asset management systems. The project includes the following components:

- Developing a natural asset inventory and condition assessment.
- Conducting a high-level valuation of the benefits provided by regional park ecosystems.
- Completing an in-depth study of natural assets and ecosystem services at a pilot location.
- Developing a framework to support prioritization of management actions.
- Maximizing knowledge transfer to others interested in advancing natural asset management.

Preparatory work completed in 2021 and 2022 has focused on scoping planned work and updating all ecological mapping for regional parks (Terrestrial Ecosystem Mapping and Sensitive Ecosystem Inventory mapping), including filling deficiencies identified during scoping. A process to retain a consultant for this study is underway and work is expected to be underway by summer 2023.

A Natural Assets Technical Advisory Group will be established for the duration of the project, providing an opportunity for other Metro Vancouver departments and member jurisdiction staff to learn and contribute expertise. Methodologies and tools created through the project will be designed to enable their ongoing use and transferability to other sites. Project outputs and

learnings will advance the integration of natural assets into the Metro Vancouver's asset management system and support multi-year financial planning of natural asset management.

Promoting Peatland Recovery in Areas Affected by Wildfire in Burns Bog Ecological Conservancy Area: In Progress

The purpose of this project is to reduce lodgepole pine regeneration in an area of the Burns Bog Ecological Conservancy Area and promote recovery of plant communities to restore and maintain peatland function. The 37-hectare project area was developing extremely dense pine seedling stands after wildfire impacted the area in 2016. Through shading, rain interception, enhanced evapotranspiration, and root systems piercing the peat mass, tree cover draws down the water table causing peat compaction, decomposition and the decline of open bog plant species. Furthermore, forest stands in bog ecosystems increase wildfire risk not only in interface areas but also across the entire forested portion of the conservancy area. The encroachment and establishment of forest communities within Burns Bog is of significant concern.

During 2022, 11.5 ha of seedlings were removed from the project area. Work continues this year with an additional 2.5 ha removed to date. In total, 16 ha of seedlings have been removed from the burn zone with some being accomplished in a pilot study between 2018 and 2020. It is anticipated that more than 20 ha of the project area will have been cleared of seedlings by the end of 2023.

As part of the project, three study sites were established to measure soil greenhouse gas exchange; one in the 2016 wildfire zone undergoing seedling removal, one in a 2005 wildfire site that has not had seedling removal, and one at an unburned control site. Each site consists of three areas representing specific pre fire ecosystem types. Four greenhouse gas measurement chambers were installed in each of the sampling sub sites at which monthly samples were extracted since October 2021. A preliminary report on greenhouse gas study results has been received. Additional instrumentation to evaluate greenhouse gas exchange from areas affected by wildfire will be installed during 2023.

This study will continue to assess the effect of seedling removal on greenhouse gas exchange for several years post seedling removal. A vegetation monitoring program established after the 2016 fire will also continue as part of the research program. It is anticipated that the combination of pine seedling removal, bog vegetation recovery and rising water table elevation will contribute to meeting land management and ecological objectives.

Showcasing Innovation in Alternative Powered Park Operations and Maintenance Equipment to Reduce Emissions: In Progress

In 2022, Regional Parks secured funding from SIF to plan and facilitate a series of events that showcase electric equipment technologies in municipal and regional park operations, while supporting directives set out in Metro Vancouver's *Climate 2050* strategy. The purpose of this initiative is to support the integration and uptake of zero emission vehicles and equipment in park operations throughout the region.

The first event was an educational seminar, titled "*Innovation in Electric Parks Operation and Maintenance Equipment*" that was held on October 25, 2022. This in-person 'Lunch and Learn'

hosted 150 regional and municipal parks operations, fleet and equipment services, and procurement staff as they heard from three speakers focused on the following topics:

- Metro Vancouver's 30-year regional climate action strategy, *Climate 2050*.
- Mode shifting from single occupancy vehicles.
- The Silent Gardener: all-electric and sustainable landscaping services.

To compliment this seminar, Metro Vancouver will be hosting an in-person trade show style event on Wednesday, May 31, 2023 called "*Go Electric Parks*!" at Surrey City Hall & Plaza. This event will provide an opportunity for over 50 commercial vehicle and equipment manufacturers, suppliers and vendors to showcase innovation in electric products. The event will be attended by over 200 staff from regional and municipal parks operations, fleet and equipment services and procurement.

Go Electric Parks! will feature:

- Vehicle and equipment displays set up on the outdoor plaza
- Indoor displays set up in the City Hall atrium
- Presentations and panel discussions

It is intended that by bringing stakeholders together from member jurisdictions and commercial/ business sectors, that regional and municipal staff responsible for the purchase, operation, and maintenance of fleet and equipment can learn about innovations that are here, or coming, to support the successful transition from gasoline or diesel powered vehicles and equipment to electric alternatives.

Social and Community Data Model: In Progress

The main objective of this project is to develop a behavioural model that seeks to better understand the housing and neighbourhood choices of residents within the Metro Vancouver region.

This project explores the more qualitative perspective of residents' location interests and choices, and includes a survey targeting two population groups: residents and recent immigrants. The survey results will be used to develop a better understanding of people's preferences on location choices concerning which can be incorporated into the digital land use model when preparing alternative scenarios.

Phase one of this project has two main outputs:

a) A region-wide survey designed to understand residents' stated preferences for housing and neighbourhood choices, with a focus on resident and recent immigrant target groups; and
b) ArcGIS file geodatabase with geocoded survey records (by postal code) and Excel file with associated survey answers.

Progress: A region-wide survey was finalized in April 2023 (Output "A"); a consultant was retained to prepare output tables and ArcGIS files (Output "B"), with an expected delivery at the end of May. Phase two of the project is the Behavioural Model development, which will be designed after phase one is completed. The model design depends on the results from phase one. Phase two will be completed by the end of 2023.

Net Zero Water Tech Accelerator: Complete
In collaboration with Foresight Canada, the Net Zero Water Technology Accelerator project was undertaken to support water tech industry development and accelerate the Metro Vancouver region's capacity to solve global challenges in water systems, such as mitigating and adapting to climate change. The primary activities undertaken were:

- To better understand the water tech sector, Invest Vancouver undertook a research study to discern the region's capabilities and recommend actions to support this clean tech opportunity. This report was released in July 2022 and can be found on the Invest Vancouver website (Reference 4).
- To build capacity for net zero applications, Foresight Canada launched a Climate & Water Toolkit that outlines seven value propositions, as well as a range of action pathways and case studies, for water technologies to advance climate mitigation and adaptation priorities (Reference 5).
- To support the sector capacity, Foresight Canada carried out acceleration activities for 14 Metro Vancouver-based water technology firms. Supports included accelerator programming, investment readiness training, pilot readiness training, industry and investor matchmaking, and growth strategy.

Lastly, to support investment in this industry, in June 2023 Invest Vancouver and Foresight Canada hosted a global showcase event, offering five BC-based water tech companies advancing climate mitigation and adaptation the opportunity to pitch their technologies. Attendees included representatives from the investment community, utilities and industry, government, academics, startups/SMEs, and other enablers.

Invest Vancouver is continuing its promotion of the water tech sector through the development of investor-focused materials on the region's water tech industry. Additionally, Foresight Canada will be advancing this work through its BC Net Zero Innovation Network initiative, which secured $7.5 million in Federal and Provincial funding. Water will be one of the three initial clusters, along with mining and bioeconomy.

Integrating greenhouse gases requirements into air emission permits and regulations: In Progress
This project intends to explore innovative approaches to integrate management of greenhouse gas emissions into Metro Vancouver's air permits and emission regulations, which have historically focused on improving regional and local air quality. The project is underway with development of a project scope, aiming to retain a consultant for the study later in 2023. Metro Vancouver has a unique delegated authority from the BC Government to manage and regulate the discharge of air contaminants in the region. An integrated process to consider impacts from industrial sources of air contaminants, including greenhouse gases, is the key innovation element and a potentially novel concept in Canada and within North America.

Results of this project will inform Metro Vancouver's permitting and regulation processes for industries, trades and businesses by providing guidance, approaches, and options for reducing GHG emissions from industrial facilities. This would include potential co-benefits and trade-offs between greenhouse gases and health-harming air contaminants. Key phases within the project will involve modelling the impact of existing and upcoming provincial and federal climate policy on industrial emissions within Metro Vancouver, as compared to Metro Vancouver's GHG target of a 35%

reduction by 2030 and carbon-neutrality for industrial facilities by 2050. This project will identify and develop policy and program options to close the potential gap between projected GHG emissions and the 2030 and 2050 targets, and to accelerate GHG emission reductions ahead of the targets.

Taking out the Trash: Transitioning to Zero-Carbon Heavy Duty Vehicles through Waste Collection Trucks: In Progress
Metro Vancouver is seeking to identify ways to expedite the transition to zero-carbon emission trucks used in the curbside collection of municipal solid waste. Metro Vancouver is collaborating with member municipalities and hauling contractors on this project.

The first phase of the project was to identify the benefits, challenges, leadership opportunities, and research needed to reduce emissions from waste collection trucks in the near term. An initial business case analyzed during the first phase demonstrated that electric waste collection trucks are available on the market that may be able to meet the needs of municipally owned and contracted fleets. There is also continued interest in emerging hydrogen fuel cell technology for those vehicles. In June 2023, a workshop on findings from the first phase and municipal and hauler experiences will be conducted for municipal staff, Metro Vancouver representatives, hauling contractors, and solid waste facility operators. The workshop will inform recommendations for the next phase of the project, which will include a feasibility study on advancing regional truck decarbonization. This feasibility study will be completed by 2024 or, if the development of charging infrastructure is recommended, it could be extended to 2026.

A parallel business case analysis is underway to identify opportunities to accelerate the transition to zero-carbon trucks used by contracted solid and liquid waste residuals hauling. These hauling operations contribute over 40% of Metro Vancouver's corporate GHG emissions (2020).

Large Building Retrofit Accelerator: In Progress
The purpose of this project is to develop a Metro Vancouver Large Building Retrofit Accelerator, which will act as a one-stop resource hub and concierge service to support building owners to decarbonize existing buildings in the region. This project is underway through a partnership with the Zero Emissions Innovation Centre (ZEIC) and project deliverables include:

- Completing a gap analysis to identify needs and opportunities for building owner supports in the region;
- Scoping and developing the initial program offerings with input from an advisory committee; and
- Developing a funding and finance model for the Retrofit Accelerator, including identifying opportunities and partnerships to fund the Retrofit Accelerator beyond the SIF funding term.

To date, a partnership agreement has been established with ZEIC. In addition, through the Natural Resources Canada (NRCAN) Deep Retrofit Accelerator Initiative, ZEIC has submitted an application for $14 million (between 2024-2027) to support developing a Retrofit Accelerator at a Provincial scale, a portion of which would support regional Retrofit Accelerator project priorities. If successful,

this funding will allow for accelerated development and launch of programs supporting commercial, market rental, strata-owned, and non-profit housing building sectors.

The next step will be to establish the Metro Vancouver Retrofit Accelerator Advisory Committee and building sector working groups, which will be comprised of key government and utility stakeholders and will provide overarching direction to the structure of the Retrofit Accelerator and ensure alignment with related programs, including incentives.

Driving Down Emissions: Developing a Regional Policy to Reduce Transportation Emissions: In Progress

Light-duty vehicles (e.g., cars, light trucks, SUVs) are the largest source of GHG emissions in the region, at about 35%. Solutions exist to reduce these emissions, including supporting low or zero emission modes of transport (e.g., walking, rolling, biking and public transit), switching to zero emission vehicles, and choosing urban design that supports reduced driving. The aim of this project is to provide recommendations for policies to reduce GHG emissions from light-duty vehicles, targeting a 65% reduction by 2030, from 2010 levels.

Metro Vancouver is working with TransLink and consultants to deliver this project. Currently, the team is conducting technical research and analysis of a list of policy options, and researching public attitudes towards those policies. Policy design will consider equity, fairness and affordability. It will also consider implementation and jurisdiction. The policy focus is to shift trips to low or zero emission modes and accelerate the transition to electric and other zero emission vehicles. Both supportive and regulatory policies are being considered.

The project supports actions in the *Climate 2050 Transportation Roadmap*, the *Clean Air Plan*, *Metro 2050* and TransLink's *Transport 2050*. The project team is coordinating with the BC Government staff developing the provincial Clean Transportation Action Plan (part of the *CleanBC Roadmap to 2030*). The project team is also engaging with member jurisdictions through several regional advisory forums. The project team expects to present draft project deliverables to decision makers at Metro Vancouver and TransLink later in 2023.

Smart Cities: Hyperlocal Air Quality Monitoring: In Progress

The Smart Cities: Hyperlocal Air Quality Monitoring project aims to use small sensor air quality monitoring technology to create a dense, neighbourhood-specific air quality monitoring network. The project will support Metro Vancouver's ongoing air quality monitoring programs, including the regional air quality monitoring network, and lead to a framework that can be used to guide deployment of similar high density networks in the region. Hyperlocal monitoring could help identify impacts from major transportation routes and industrial emitters, inequities in air quality experienced at the neighbourhood level, the efficacy of emission reduction strategies and a better understanding of localized health outcomes related to air quality.

Phases one and two are both in progress with phase one focusing on studying existing hyperlocal air quality networks around the world as well as developing recommendations for suitable monitoring technology, monitoring network design and methodology, and the identification of neighbourhoods in the region to potentially deploy this network. Phase two has also begun and will entail procurement of technology. There are active discussions with federal partners to supply Metro

Vancouver with small sensors from a Canadian company that is developing small sensors for urban monitoring networks through funding from Innovative Solutions Canada (ISC).

Once phase one is complete, additional monitoring technology will be procured in phase two based on the outcome of phase one. Phase three will involve testing the small sensors and conducting co-location studies at various monitoring stations within Metro Vancouver's air quality monitoring network. In the final phase, the network will be fully deployed and a report will be created detailing the results and methodology used by Metro Vancouver to deploy this style of network. The report is intended to be a reference for deployment of similar high density networks in the region. It is expected that this project will lead to small sensors supplementing our regional air quality monitoring network and increasing monitoring in more locations across the region.

References

1. United States EPA: Best Practices for Reducing Near-Road Pollution Exposures at Schools
2. Province of British Columbia: Students Get Improved Air Quality in B.C. Schools
3. Reel Green™ at Creative BC
4. Invest Vancouver: The Metro Vancouver Region's Untapped Clean Tech Opportunity
5. Foresight Canada: Climate and Water Toolkit

ATTACHMENT 2

2023 Update on Sustainability Innovation Fund Projects

REGIONAL DISTRICT

Conor Reynolds

Director, Air Quality and Climate Change

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CLIMATE LITERACY MODULES

In progress

Purpose: Increase climate literacy to broaden participation in the conversation about climate solutions

Outcomes: Toolkit users are more confident in their climate action knowledge, participate in conversations about solutions, and are supportive of actions by local governments.

CLEAN AIR FOR STUDENTS AND SCHOOLS (CLASS)

Discontinued

On hold since 2020 due to the COVID-19 pandemic.

Since then, changes have affected the relevance of this project:

- New school resources on reducing exposure to traffic-related air pollution have been published.
- Interest has shifted to indoor air quality at schools from outdoor air quality.
- The use of small air sensors has advanced.

SMART CITIES: HYPERLOCAL AIR QUALITY MONITORING

In progress

Purpose: To better understand neighbourhood level variations in air quality using lower cost sensors

Proposed outcomes:

- Enhance the regional monitoring network.
- Identify new and existing emission sources.
- Roadmap for installing hyperlocal systems in neighbourhoods.
- Collaboration with aligned organizations.

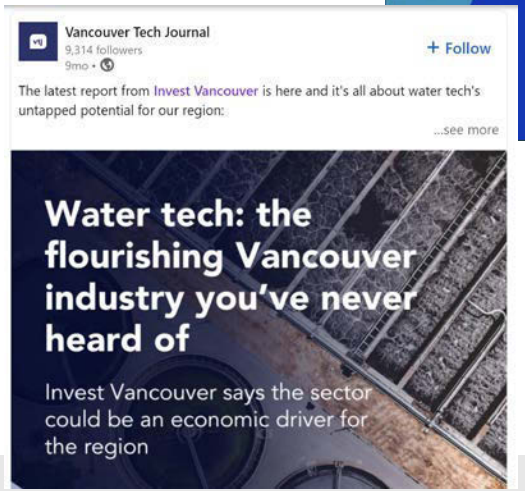
NET ZERO WATER TECH ACCELERATOR

Complete

Purpose: To accelerate regional water technology innovation ecosystem to solve global challenges in water systems

Outcomes:

- Research study of the region's water tech capabilities and recommended actions.
- Climate & Water Toolkit for water tech firms.
- Acceleration activities for 14 firms.
- Global showcase event with five BC-based climate focused water tech companies.



HOUSING RETROFIT EVOLUTION – REFRAMED INITIATIVE

Complete

Purpose: Exploration Labs to define replicable deep retrofits for six demonstration projects

Outcomes:

- Accelerate development and adoption of emergent building retrofit technologies.
- Labs are complete.
- Three demonstration projects with Metro Vancouver Housing are moving into implementation phase.

LARGE BUILDING RETROFIT ACCELERATOR

In progress

Purpose: To develop a one-stop resource hub to support building owners to decarbonize large buildings in the region

Proposed outcomes:

- Program streams for multi-unit residential and commercial buildings.
- Funding and finance model to fund and scale up the Retrofit Accelerator model.

DRIVING DOWN EMISSIONS: DEVELOPING A REGIONAL POLICY TO REDUCE TRANSPORTATION EMISSIONS

In progress

Purpose: To develop recommended policies to reduce greenhouse gas emissions from light-duty vehicles by 65% by 2030, from 2010 levels

Proposed outcomes:

- A policy recommendation to elected officials based on technical analysis and public research, and considerations for equity, fairness, affordability and jurisdiction.

TAKING OUT THE TRASH: TRANSITIONING TO ZERO-CARBON HEAVY DUTY VEHICLES THROUGH WASTE COLLECTION TRUCKS

In progress

Purpose: To accelerate the transition to zero-carbon waste collection trucks

Proposed outcomes:

- Business case analysis of in-market options.
- Analyses of opportunities to accelerate transition to zero-carbon technology.
- Feasibility study related to trucks and charging infrastructure.

LIGHTS, CAMERA, CLIMATE ACTION!

In progress

Purpose: To recommend alternative clean and modular power sources for portable diesel generators currently used in the film industry

Proposed outcomes:

- Technical report completed, including recommendations for Metro Vancouver and member jurisdictions to promote use of clean alternatives.
- Next phase: Installation of a clean power kiosk at a regional park site.

ADDITIONAL PROJECTS

PARKS

Real-time Parking Availability in Regional Parks

Natural Asset Management in Regional Parks

Promoting Peatland Recovery in Wildfire-Affected Areas in Burns Bog

Showcasing Innovation in Alternative Powered Park Operations and Maintenance Equipment to Reduce Emissions

HOUSING

Building Resilience: Exploring the Potential of Renewable Energy Building Infrastructure

Step Code Implementation Impacts for Building Envelope Rehabilitation of Existing Buildings

ADDITIONAL PROJECTS

AIR QUALITY & CLIMATE CHANGE

- Preventing Smoke Emissions from Agricultural Waste Management
- Mobile Monitoring of Fugitive and Other Industrial Air Emissions with "Flying Labs"
- Assessment of Carbon Capture Technology in the Metro Vancouver Region
- Sharing Data for Zero Emission Buildings
- Responding to the Climate Emergency: Enhanced Stakeholder Engagement
- Integrating greenhouse gases requirements into air emission permits and regulations

Regional Planning

- Social and Community Data Land Use Model
- Regional Land Use Assessment Project
- Social and Community Data Model

Aldergrove Regional Park

Thank you

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Together we make our region strong

To: Climate Action Committee

From: Conor Reynolds, Director, Air Quality and Climate Change

Date: June 1, 2023 Meeting Date: June 8, 2023

Subject: **Manager's Report**

RECOMMENDATION
That the Climate Action Committee receive for information the report dated June 1, 2023 titled "Manager's Report".

Climate Action Committee 2023 Work Plan
The attachment sets out the Committee's Work Plan for 2023. The status of work plan priorities is indicated as pending, in progress, or complete. The work plan is updated, as needed, to include new priorities that arise, items requested by the Committee, and changes to the schedule.

New Requirements for Open Burning of Vegetative Debris
Metro Vancouver Regional District Open Burning Emission Regulation Bylaw No. 1355, 2022 (MVRD Bylaw 1355) took effect on May 15, 2023. MVRD Bylaw 1355 applies to the outdoor burning of vegetative debris such as leaves, branches, and other plant material from activities including agriculture, land clearing, and residential yard maintenance. Smoke emissions from open burning of vegetative debris contain fine particulate matter, nitrogen oxides, volatile organic compounds, and other harmful substances. These air contaminants can affect health and the environment, and some contribute to climate change. Because of the population density in parts of Metro Vancouver, smoke emissions from open burning can impact many people. Within the region, open burning activities are authorized for specific times under certain conditions, and this can create the potential for short-term exposure to elevated levels of smoke unless specified requirements are met.

There are two routes to obtaining a Metro Vancouver authorization for open burning. Property owners and occupants intending to burn vegetative debris in the open air can register and meet the requirements under MVRD Bylaw 1355 or apply for a time-limited Open Burning Approval. MVRD Bylaw 1355 provides a simpler and more efficient way to manage open burning of vegetative debris in cases where specified requirements are met to protect air quality and health. More information about MVRD Bylaw 1355, registration, and approvals is available on Metro Vancouver's website by searching for "open burning vegetative debris" (Reference 1).

BC Medium- and Heavy-Duty Zero-Emission Vehicles Mandate: 2023 Consultation Paper
In October 2021, the Province released the *CleanBC Roadmap to 2030*, which committed to a suite of policies to help reach the Province's legislated greenhouse gas emission reduction targets. This included a commitment to establish regulated zero-emission vehicle (ZEV) requirements for medium- and heavy-duty vehicles in consultation with automakers, businesses and industry, and in alignment with the state of California and leading jurisdictions.

In May, the Province issued a consultation paper seeking input on a suite of potential ZEV requirements for medium and heavy-duty vehicles. This includes annual sales targets for medium and heavy-duty ZEVs, as well as specific requirements for fleets, public transit agencies, small off-road engines, and other select vehicle types. The proposed sales targets and phase-in timeline are ambitious, with 2036 proposed as the target year for 100% ZEV sales for all vehicle types. This aligns with a big move in the *Climate 2050 Transportation Roadmap* and *Clean Air Plan* for the BC Government to set mandatory zero emission sales targets for medium and heavy-duty vehicles, and is a critical policy to reduce emissions from these vehicles in the region.

The proposed regulations are largely based on leading regulations in California, which Washington and Oregon have committed to following as well. Additionally, the Government of Canada has announced that it will develop Canada-wide medium and heavy-duty ZEV sales requirements. Metro Vancouver staff are reviewing the consultation paper and will provide comments to the Province for their June 27, 2023 deadline.

New E-bike Rebate Program Launching June 1

Starting June 1, 2023, the Province of BC will be offering a rebate on eligible new e-bike purchases (Reference 2). The rebates will be based on a person's income and will range from $350 to $1400. This program builds on an announcement in July 2021 that BC Provincial Sales Tax will be eliminated on e-bikes, and is an additional step to make e-bikes more affordable (Reference 3).

Unlike a previous e-bike rebate program, individuals will no longer need to scrap a vehicle to be eligible for the rebate. The program will be available for applicants who are at least 19 years old, and eligible e-bikes must cost at least $2000 before taxes, and be purchased from a participating e-bike retailer listed on the program's website (Reference 4).

This program aligns with Metro Vancouver's *Clean Air Plan* (Action 1.1.7) and the *Climate 2050 Transportation Roadmap* (Action 1.7) to support residents and businesses in active transportation. It also supports the Province's *CleanBC* goals by encouraging a shift towards active transportation.

Engagement Update for June CAC

Metro Vancouver held the second Community of Practice for municipal staff with a role in engagement or public education on climate action. As requested by participants, Metro Vancouver brought in Re.Climate, a recognized think tank considered Canada's go-to centre for training, research and strategy on climate change communications and public engagement. The next session will be in the fall.

Staff were active on social media for May and June promoting the Climate Literacy initiative to residents throughout the region. These promotions were also shared on our youth-oriented social channels. The literacy modules saw 3300 visitors during the promotions, and it was notable that the average viewing length was in the range of four to ten minutes, in comparison to a typical average website visit of 2 minutes.

The first Climate Action Dialogues were held in Surrey and Vancouver May 29 and 30. Both venues attracted a range of residents and business sectors and NGOs. Surrey had about 30 in attendance and Vancouver 110 and 70 on the livestream. Special thanks to Directors Kruger and Johnstone for offering opening remarks. Speakers explored the connections between the urgency to take action on climate, and the economic benefits of some of the solutions.

Attachment
Climate Action Committee 2023 Work Plan, dated June 1, 2023.

References

1. Metro Vancouver Open Burning Vegetative Debris
2. Rebates make new e-bike purchases more affordable | BC Gov News
3. E-bike incentive to benefit users, environment | BC Gov News
4. BC E-Bike Rebate Program (bcebikerebates.ca)

Climate Action Committee 2023 Work Plan
Report Date: June 1, 2023

Priorities

1st Quarter	**Status**
Climate Action Committee orientation	Complete
Climate Action Committee meeting schedule and work plan	Complete
Amendments to air quality ticketing bylaws	Complete
Sustainability Innovation Fund (SIF) – 2023 proposals	Complete
2nd Quarter	**Status**
Climate 2050 nature and ecosystems roadmap	Complete
Climate 2050 industry and business roadmap	Complete
Climate 2050 energy roadmap	Complete
SIF - status report on previously approved liquid waste projects	Complete
SIF - status report on previously approved regional district projects	In progress
Overview of air quality advisory program and preparedness for 2023 season	In progress
3rd Quarter	**Status**
Climate 2050 annual progress report	In progress
Draft Climate 2050 roadmap for land use and urban form	In progress
Climate 2050 agriculture roadmap	In progress
Draft Climate 2050 roadmap for human health and well-being	In progress
Annual air quality report	In progress
Update to internal carbon price policy	In progress
Amendments to boilers and process heaters emission regulation	In progress
Next phase of engagement on large buildings GHG emission regulation	Pending
Emission regulation for cannabis production and processing	Pending
SIF - status report on previously approved water projects	In progress
4th Quarter	**Status**
Climate 2050 human health and well-being roadmap	Pending
Climate 2050 land use and urban form roadmap	Pending
Draft Climate 2050 roadmap for water and wastewater infrastructure	Pending
Corporate status report on carbon neutrality and energy management	In progress
Initiate engagement on emission regulation for lawn and garden equipment	Pending
Update to regional ground level ozone strategy	In progress
Report on 2023 air quality advisory season	Pending
Annual budget and five-year financial plan	Pending

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SERVICES AND SOLUTIONS FOR A LIVABLE REGION

MEDIA ADVISORY

May 15, 2023

SEASONAL RESIDENTIAL INDOOR WOOD BURNING PROHIBITION IN EFFECT MAY 15

Metro Vancouver's annual seasonal prohibition on the use of indoor wood burning appliances, such as wood stoves and fireplaces, begins on May 15 and lasts until September 15.

The seasonal prohibition is meant to protect the public from the effects of wood smoke during a time when indoor heating is used less frequently. The seasonal prohibition does not apply when wood burning is the only source of heat in a residence, during an emergency, and for those living off-grid in rural parts of the region.

The Residential Indoor Wood Burning Emission Regulation Bylaw aims to reduce emissions from indoor wood burning appliances through the use of best burning practices and lower-emitting wood-burning appliances. Those using wood-burning appliances are required to declare their use of best burning practices, and register their appliances located within Metro Vancouver's Urban Containment Boundary.

Residential wood smoke is the most significant source of fine particulate matter emissions in the region, contributing more than a quarter of the annual total fine particulate matter emissions. When breathed in, the particles penetrate deep into a person's lungs and bloodstream and can be harmful to health, particularly for infants, the elderly, and people with diabetes, lung disease, or heart disease.

Residents can now receive increased rebates for trading in their old, uncertified wood-burning appliance for a new low-emission appliance, through Metro Vancouver's Community Wood Smoke Reduction Program. Rebates from Metro Vancouver can be combined with provincial CleanBC incentives, where applicable.

Metro Vancouver operates an extensive air quality monitoring network with 31 permanent stations and one mobile unit. The regional district sets air quality objectives, responds to air quality complaints, and enforces bylaws pertaining to air emissions from industry, businesses, and residences. Residents can monitor regional air quality using AirMap.

Media contact:
Don Bradley, Division Manager, Media Relations & Issues Management c. 604-788-2821

Metro Vancouver is a federation of 21 municipalities, one electoral area and one treaty First Nation that collaboratively plans for and delivers regional-scale services. Its core services are drinking water, wastewater treatment and solid waste management. Metro Vancouver also regulates air quality, plans for urban growth, manages a regional parks system and provides affordable housing. The regional district is governed by a Board of Directors of elected officials from each local authority.

To: Climate Action Committee

From: Carla Stewart, Senior Planner, Regional Planning and Housing Services

Date: May 15, 2023 Meeting Date: June 8, 2023

Subject: Agricultural Ecosystem Services in Metro Vancouver

At its meeting on May 12, 2023, the Regional Planning Committee received the attached report titled "Agricultural Ecosystem Services in Metro Vancouver". The report provides a synopsis of a recently completed study commissioned by Metro Vancouver titled *Scoping Ecosystem Services on Agricultural Land within Metro Vancouver*, which describes the many benefits provided by ecosystem services within the region's agricultural areas, including supporting resilience to climate change impacts, supporting the production of local food, and contributing to the wider livability of the region. The study also identifies approaches and provides recommendations to establish stable, long-term regulatory and financial support for the continued use of ecosystem services on agricultural land.

At its May 12, 2023 meeting, the Regional Planning Committee passed the following recommendation as presented in the report:

> *That the MVRD Board direct staff to prepare a white paper considering the feasibility of the recommendations contained in the Scoping Ecosystem Services on Agricultural Land within Metro Vancouver study, as presented in the report dated April 19, 2023, titled "Agricultural Ecosystem Services in Metro Vancouver.*

The report and study is presented here to the Metro Vancouver Climate Action Committee for its information.

Attachment
Regional Planning Committee report titled "Agricultural Ecosystem Services in Metro Vancouver", dated April 19, 2023.

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SERVICES AND SOLUTIONS FOR A LIVABLE REGION

To: Regional Planning Committee

From: Carla Stewart, Senior Planner, Regional Planning and Housing Services

Date: April 19, 2023 Meeting Date: May 12, 2023

Subject: **Agricultural Ecosystem Services in Metro Vancouver**

RECOMMENDATION

That the MVRD Board direct staff to prepare a white paper considering the feasibility of the recommendations contained in the Scoping Ecosystem Services on Agricultural Land within Metro Vancouver study, as presented in the report dated April 19, 2023, titled "Agricultural Ecosystem Services in Metro Vancouver".

EXECUTIVE SUMMARY

A recently completed study commissioned by Metro Vancouver, titled *Scoping Ecosystem Services on Agricultural Land within Metro Vancouver*, describes the many benefits provided by ecosystem services within the region's agricultural areas including supporting resilience to climate change impacts, supporting the production of local food, and contributing to the wider livability of the region. The study also identifies approaches and provides recommendations to establish stable, long-term regulatory and financial support for the continued use of ecosystem services on agricultural land.

PURPOSE

To convey to the MVRD Board the results from the *Scoping Ecosystem Services on Agricultural Land within Metro Vancouver* study completed by Upland Agriculture Consulting Ltd. and to describe the next steps in advancing the use of ecosystem services on agricultural land throughout the region (Attachment).

BACKGROUND

In 2011, Metro Vancouver completed the *Regional Food System Strategy*, a foundational document that identified the use and benefits of ecosystem services as key components in achieving a sustainable, resilient and healthy regional food system (Reference). Since that time, continuing to support and expand the use of ecosystem services on agricultural land has been identified and supported in many other plans and strategies including *Metro 2050* and the draft *Climate 2050 Agriculture Roadmap*.

The MVRD Board approved funding to support examining the benefits and potential uses of ecosystem services in agricultural lands in the region, and in October 2021, Upland Agricultural Consultants Ltd. was retained to complete a two-phase *Scoping Agricultural Ecosystem Services within Metro Vancouver* study to: identify the locations of the types of ecosystems present on agricultural land in the region; determine the overall services and benefits these areas provide; and recommend policies, regulations and financial mechanisms that can be used to expand the long-term viability of using agricultural land for these services. The Phase 1 results were shared with the

Agricultural Advisory Committee in September 2022 with the intent to share the completed study once available. Phase 2 results were completed in December 2022 with the final report being submitted by the consultant in January 2023. The Agricultural Advisory Committee reviewed the final report at their April 20, 2023 meeting and indicated support for the recommendations contained in the study.

ECOSYSTEM SERVICES ON AGRICULTURAL LAND

Ecosystem services are defined as natural assets that serve to benefit both people and wildlife, such as clean air and water, healthy riparian (fish-supporting stream) systems, healthy soils, and appropriate habitat for species at risk. Ecosystem services are also key components to building land-based, nature-based climate adaptation and mitigation solutions. The purpose of examining in more detail the presence and role of ecosystem services on agricultural lands in this region is to better understand how these natural areas support agricultural resilience, long-term food production and the overall livability of residents in the region. While there is a significant amount of research and practice that supports the use of ecosystem services in agricultural areas, a baseline of the benefits and capabilities of ecosystems on agricultural land in Metro Vancouver needed to be established in order to support ongoing work.

Phase 1 Results

Data collection and analysis conducted during Phase 1 of the study focused on literature and jurisdictional reviews and analyzing maps using multiple datasets from Metro Vancouver, the Province, Fraser Basin Council and the Watershed Salmon Society. This work identified the following:

- There are numerous programs and initiatives that have developed as support mechanisms for the agriculture sector over the past decade but they are largely managed by non-profit organizations and provide nominal incentives to farmers to enhance ecosystem services on their lands.
- The Agricultural Land Reserve comprises approximately 20% of the total area of Metro Vancouver, which includes over 40% of Metro Vancouver's total sensitive ecosystems, representing approximately 60% of wetlands and 40% of riparian areas within the region.
- Metro Vancouver's Sensitive Ecosystem Inventory data does not capture other types of ecosystems that also provide significant beneficial services to farms such as agricultural ditches, hedgerows and vegetative buffers.
- Benefits to agricultural operations vary according to ecosystem types but can generally be grouped into eight classifications including: water quality, water quantity, nutrient cycling, soil development, carbon storage, erosion control, habitat and biodiversity, and pollination.
- Best management practices are useful tools to support effective levels of restoration, conservation and maintenance and can be applied individually to improve production practices, improve farm yields, and overall increase the health and resilience of farm operations.

Phase 2 Results
Beyond identifying the types and benefits of ecosystem services in the region, the Study also focuses on identifying approaches for the long-term investment in, and support of, the use of ecosystem services. This can occur through several mechanisms including:

- *Policy* – Regional Growth Strategy, official community plans, agricultural and climate adaptation strategies.
- *Regulation* – zoning bylaws, development permit areas.
- *Financial Assistance* – fees, parcel tax, property transfer tax, property value tax.

With these mechanisms in mind, the Study identifies two approaches that Metro Vancouver can use simultaneously to initiate and support the long-term use of ecosystem services on agricultural lands:

Approach #1: Collaborate with local governments and the Province on policies and regulations that support ecosystem services on agricultural land. This involves developing a comprehensive regional approach for documenting and creating policy and implementation measures required for the long-term sustainability of ecosystem services.

Approach #2: Establish as regional conservation fund to support programs that steward ecosystem services on agricultural land. This involves developing a regional funding mechanism to provide financial incentives to the farming community to invest in ecosystem services protection and enhancement.

Each approach relies on the other for full effectiveness but each also requires a separate and robust review to determine appropriateness and feasibility. Regional polling may also be needed to understand how important ecosystem services are to the wider community to determine if or how willing residents would be to financially support a long-term payment plan for an ecosystem services protection program.

STUDY RECOMENDATIONS
The *Scoping Agricultural Ecosystem Services within Metro Vancouver* study provides five recommendations for moving forward with a long-term strategy to support the use of ecosystem services on agricultural land in the region:

1. Collaborate internally and externally to further explore and build a regional conservation fund that includes payment for ecosystem services on agricultural land;
2. Conduct polling across Metro Vancouver to gauge willingness and support to pay for ecosystem services on agricultural land;
3. Conduct in-depth mapping of ecosystem services on agricultural land in Metro Vancouver;
4. Estimate the financial value of ecosystem services on agricultural land in Metro Vancouver; and

5. Review and access options to align with the ongoing work to establish a Regional Green Infrastructure Network to further support ecosystem services on agricultural land.

Metro Vancouver Staff Analysis

The recommendations and next steps identified in the *Scoping Agricultural Ecosystem Services within Metro Vancouver* study reveal that, despite the work that has been undertaken to-date, a more comprehensive and consistent approach is needed to effectively and efficiently support the long-term use of ecosystem services on agricultural land across the region.

Staff support the Study recommendations for a number of reasons:

- Existing funding programs are inconsistent and unreliable and depend on non-profit organizations having sufficient capacity to apply for and manage funding that may be available on an ad-hoc bases. A region-wide payment for ecosystem services program would allow for a consistent and stable funding model with shared investment by and benefit to all Metro Vancouver residents;
- Restoring, maintaining and setting-aside natural areas located on farmland adds costs to agricultural operations that are often not financially manageable on a long-term basis. Payment for ecosystem services to participating farmers acknowledges these costs and provides the ability for farmers to continue to not use these lands for active agricultural production;
- Conducting region-wide polling will provide an opportunity for Metro Vancouver to determine the support among residents for a payment for ecosystem services program;
- The current Sensitive Ecosystem Inventory does not include other ecosystem types on agricultural land, such as hedgerows and agricultural buffers, that also contribute to ecosystem services. Preparing an in-depth map of the services that are provided will give a better understanding of which areas provide the highest benefit, and which areas may require interventions to increase benefit;
- Natural assets valuations are important to contribute to the discussion of payment for ecosystem services so that a complete picture is available to include in the discussion; and
- Aligning with existing work creates opportunities to increase internal efficiencies, take advantage of existing engagement opportunities, and create co-benefits for funding applications.

NEXT STEPS

The recommendations from the *Scoping Agricultural Ecosystem Services within Metro Vancouver* study require further review and analysis to determine feasibility, and a scope of work and budget for future work. As such, staff are recommending that a white paper be prepared that includes a thorough analysis of all five of the Study's recommendations. The white paper will be vetted and reviewed by the Agricultural Advisory Committee, Ministry of Agriculture, Agricultural Land Commission, and Regional Planning Advisory Committee prior to being forwarded to the Regional Planning Committee and MVRD Board for consideration. The intent of the white paper will be to further explore the feasibility of each of the Study's recommendations with an aim to advance the

utilization of a regional payment for ecosystem services program to leverage, encourage, and support the long-term utilization of ecosystem services on agricultural land within the Metro Vancouver region.

ALTERNATIVES

1. That the MVRD Board direct staff to prepare a white paper considering the feasibility of the recommendations contained in the Scoping Ecosystem Services on Agricultural Land within Metro Vancouver study as presented in the report dated April 19, 2023, titled "Agricultural Ecosystem Services in Metro Vancouver".
2. That the MVRD Board receive for information the report dated April 19, 2023, titled "Agricultural Ecosystem Services in Metro Vancouver" and provide alternate direction to staff.

FINANCIAL IMPLICATIONS

The funds for the *Scoping Ecosystem Services on Agricultural Land within Metro Vancouver* study were split over the Board-approved 2021 and 2022 Regional Planning budgets. Any potential financial implications associated with payment or compensation for the protection of ecosystem services would need to be determined through further analysis and consideration.

CONCLUSION

A recently completed study commissioned by Metro Vancouver, titled *Scoping Ecosystem Services on Agricultural Land within Metro Vancouver*, describes the many benefits provided by ecosystem services within the region's agricultural areas, identifies approaches and provides recommendations to establish stable, long-term regulatory and financial support for the continued use of ecosystem services on agricultural land. After reviewing all existing programs and the long-term investment tools available to support ecosystem services on agricultural land, the study concludes by identifying that investing in healthy ecosystems on agricultural lands is a collective action that would not only benefit agricultural producers but also the region as a whole.

Attachment

Scoping Agricultural Ecosystem Services within Metro Vancouver study

References

Regional Food System Strategy

56234358

Scoping Ecosystem Services on Agricultural Land in Metro Vancouver

upland
agricultural consulting

Acknowledgements

This project was completed by Upland Agricultural Consulting with assistance from Dave Zehnder, for Metro Vancouver Regional District in 2022.

Metro Vancouver is situated on the ancestral, traditional and unceded territories of the shared territories of many Indigenous peoples, including ten local First Nations: qićəy̓ (Katzie), qʷɑ:nˀ ƛ̓ əṅ (Kwantlen), kʷikʷəƛ̓ əm (Kwikwetlem), máthxwi (Mˀ atsqui), xʷməθkʷəyəm (Musqueam), qiqéyt (Qaˀ yqayt), seˀmyaˀme (Semiahmoo), Sḵwx̱wú7mesh Úxwumixw (Squamish), scəwaθən məsteyəxʷ (Tsawwassen), səˀ líl̓wətaʔɬ (Tsleil-Waututh). These First Nations have lived in the area for thousands of years, working with natural systems to shape the land and food systems.

Cover Photo: Pacific Great Blue Heron actively foraging in a grassland set-aside field in West Delta. Credit: Delta Farmland & Wildlife Trust.

Executive Summary

When agricultural producers are supported in the care and management of ecosystems on agricultural land, the whole region benefits. The rationale for conserving and enhancing ecosystem services on agricultural land within Metro Vancouver is compelling. Agricultural lands host several ecosystem types from forests to wetlands to riparian areas; all with the ability to provide ecosystem services that can benefit the region and agricultural producers, particularly by building resilience within the face of climate change.

Financially supporting ecosystem services on agricultural land can be viewed as reallocating resources to manage and invest in ecosystems for the following benefits:

- Improved regional food security.
- Partnerships with First Nations to grow projects regarding Indigenous food systems.
- Preservation of natural assets and green infrastructure.
- Job creation for the food agriculture sector, and spin-off enterprises.
- Increased agri-tourism opportunities.
- New education and learning programs.

Investing in healthy ecosystems on agricultural lands can also be viewed as a type of 'collective insurance' since heathy ecosystems mitigate costs and damages to local governments associated with extreme weather events (e.g., floods and droughts) that will occur more frequently due to climate change. Understanding the economic value that healthy ecosystems can provide to minimize damages to infrastructure is crucial for decision-making when allocating resources to the management of natural assets and green infrastructure. Restoring and conserving ecosystems on a regional basis increases collective resiliency to disturbances, such as climate change, and can provide benefits to all citizens and sectors of Metro Vancouver for current and future generations.

Metro Vancouver undertook this *Scoping Ecosystem Services on Agricultural Land within Metro Vancouver* study with the following two objectives:

- To understand the benefits provided by ecosystem services within agricultural areas to resiliency, food production and the livability of the wider region, and,
- To identify and recommend policy, regulatory or financial actions and mechanisms that can be taken to expand the long-term viability of supporting ecosystem services on agricultural land.

Farmland within the Agricultural Land Reserve (ALR) makes up approximately 20% of the land base within Metro Vancouver Regional District (MVRD). The potential of these agricultural lands to support ES to the region has been recognized by MVRD in several planning and policy documents. For example in the *Regional Food System Strategy*, *Ecological Health Framework*, the *Climate 2050 Roadmap for Agriculture (DRAFT)*, and *Metro 2050 (DRAFT),* among many other policy documents.

Ecosystem Services on Agricultural Lands

> Over 40% of Metro Vancouver's total sensitive ecosystems are in the Agricultural Land Reserve.
>
> This includes approximately 60% of wetlands and 40% of riparian areas.

The type and amount of ecosystem services provided by agricultural land depends on agricultural practices and the ecosystems present. The results from this project's mapping exercise found that the ALR within Metro Vancouver hosts a diversity of ecosystems including forests, riparian areas, and wetlands. Within the Metro Vancouver regional core, the ALR hosts over 40% (14,459 ha) of Metro Vancouver's total sensitive ecosystems.[1] Approximately 60% (4,167 ha) of wetlands and 40% (3,318 ha) of riparian areas occur within the ALR in Metro Vancouver. This points to the importance of the ALR and the need to support agricultural producers in restoring and maintaining ecosystems to provide ES for the region.

Ecosystem services on agricultural lands and associated benefits are summarized in the following table:

Service Type	Benefits
Supporting Services	○ Habitat for many wildlife species and primary between fragmented landscapes. ○ Soil development and water retention.
Regulating Services	○ Riparian areas and wetlands slow down water movement and soil lost to erosion during floods. ○ Water storage helps to recharge groundwater, increasing and prolonging water availability for crops and irrigation. ○ Increased vegetation draws carbon dioxide out of the air. ○ Nutrient loading into watercourses from manure and fertilizer run-off is filtered by vegetation, which improves water quality. ○ Better drainage reduces ponding in fields and improves livestock health by reducing saturated pastures. ○ Beneficial insects such as lady bugs and bees improve pollination.
Provisioning Services	○ Forests and farm fields provide food and wood for residents and wildlife. ○ Riparian areas provide food, nutrients and clean water to all in-stream and downstream fish habitats.
Cultural Services	○ Healthy ecosystems increase the resiliency of farms for on-going access to local food. ○ Traditional food and medicine values for Indigenous communities are supported by healthy riparian ecosystems. ○ Residents benefit from trails, recreation, bird and animal watching opportunities in agricultural areas. ○ Healthy ecosystems contribute to clean air and clean waters, which benefits the health of all residents.

[1] The regional core is the more urbanized southern part of the region and excludes the large parks (e.g. North Shore Mountains) and estuaries under Provincial management, watersheds and other higher elevation areas. The regional core is most relevant to policy and planning and is where municipal decisions and actions will have the most impact.

Many of the ecosystem services on agricultural land can help to reduce some of the impacts from extreme weather events that are exacerbated by climate change. For example, during a flood, wetlands can store excess water flowing from farm fields, and a healthy riparian area can retain soil and reduce erosion of stream banks. During droughts, riparian areas provide a cool microclimate for fish, animals and insects.

While the benefits of restoring and conserving healthy ecosystems on agricultural land outweigh the disadvantages, it is acknowledged that drawbacks can arise. For example, a healthy riparian buffer may reduce the area available for planting crops. Healthy forest stands may increase grazing pressure from deer and elk, and an increase in beavers removing trees and building dams can cause localized flooding.[2] Some of these disadvantages can be mitigated by installing wildlife fencing or beaver guards, but there are still financial costs associated with this infrastructure.

Current Programs and Support for Ecosystem Services on Agricultural Land

Over the past decade, numerous programs and initiatives have developed in the region that support enhancing ecosystem services on agricultural lands. Most programs are undertaken by non-profit organizations with support from local municipalities, MVRD, and provincial and federal governments. Notable programs include Delta Farmland & Wildlife Trust, Langley Ecosystem Services Initiatives program, and Farmland Advantage. Most successful ecosystem services programs on farmland provide payments to farmers and/or landowners for ecosystem restoration and maintenance activities.

Assigning monetary value to ecosystem services is challenging. As part of the approach to assign values to ecosystem services, qualitative surveys can be used to understand how important ecosystem services are to the community and how much residents would be willing to pay. Recent findings from surveys in the City of Delta and the Township of Langley included indications that:

1. Respondents understood the important role that farmland plays in protecting and stewarding the environment, and
2. Respondents are willing to financially support the stewardship of ecosystem services on agricultural lands.

Approaches for Long-term Support of Ecosystem Services on Agricultural Land

Policy, financial and regulatory mechanisms were considered as part of this study, including:

- Policy: Official Community Plans, RGSs, and other local government plans and strategies.
- Regulatory: Zoning and land use bylaws, Statutory Right of Ways, and covenants on title.
- Financial: Fees, parcel tax, property transfer tax, and property value tax to fund stewardship of agricultural ES.

[2] George W. Powell. (2015). Agriculture and Ecological Services: Recommendations for Support Programming in British Columbia.

Two approaches emerged for Metro Vancouver to further explore for long-term support of ecosystem services on agricultural lands.

Approach #1: Collaborate with local governments and the province on policies and regulations that support ES on agricultural land.

- MVRD, along with most member municipalities, have expressed support for ecosystem services on farmland in planning documents and through various zoning and land use bylaws. However, there is no comprehensive regional approach for documenting and creating policy related to ecosystem services on agricultural lands, and additional efforts to implement existing policy statements are required for the long-term sustainability of ecosystem services on agricultural lands.

Approach #2: Establish a regional conservation fund to support programs that steward ecosystem services on agricultural land.

- A conservation fund is a local government service that is funded through a dedicated tax or fee, held and overseen by local government, and earmarked for the specific purpose of undertaking priority conservation projects throughout the region. Initiatives that support ecosystem services on agricultural lands can be established and operationalized through conservation funds. Several regional districts across the province have implemented conservation funds including the Regional District of East Kootenay, Regional District of Central Kootenay, Regional District of North Okanagan, and the Regional District Okanagan Similkameen. These funds provide support to local non-profit organizations for conservation and restoration projects that have led to healthier ecosystems.

It is acknowledged that each approach would require a separate robust review to determine appropriateness and feasibility.

Recommendations

The report provides 5 recommendations for Metro Vancouver, each of which is detailed in the table on the following page:

1. Collaborate internally and externally to further explore and build a regional conservation fund (or other appropriate funding mechanism) that includes payment for ecosystem services on agricultural land.
2. Conduct polling across Metro Vancouver to gauge support and willingness to pay for ecosystem services on agricultural land.
3. Conduct in-depth mapping of ecosystem services on agricultural land in Metro Vancouver.
4. Estimate the financial value of ecosystem services on agricultural land in Metro Vancouver.
5. Review and assess options to align with ongoing work to establish a Regional Green Infrastructure Network to support ecosystem services on agricultural land.

Recommendation	Rationale	Recommended Timeline
1. Collaborate internally and externally to further explore and build a regional conservation fund that includes payment for ecosystem services on agricultural land.	Internally, MVRD staff working on increasing resilience of the regional agricultural sector and the Regional Green Infrastructure Network can look for opportunities to align objectives with a conservation fund. Externally, staff can continue to collaboration with the Fraser Delta Farmland Protection and Stewardship Working Group. Engagement with Indigenous communities is also recommended.	Ongoing
2. Conduct polling across Metro Vancouver to gauge support and willingness to pay for ecosystem services on agricultural land.	Region-wide polling would assist MVRD decision-makers in understanding if residents support a regional conservation fund, and what types of projects residents would prioritize for improving the health of ecosystems.	Within 1 year
3. Conduct in-depth mapping of ecosystem services on agricultural land in Metro Vancouver.	Areas with the highest opportunity to focus efforts for stewardship of ecosystem services on agricultural lands should be identified. This mapping will inform ecosystem valuation calculations and can be aligned with Regional Green Infrastructure Network mapping.[3]	Within 1 -2 years
4. Estimate the financial value of ecosystem services on agricultural land in Metro Vancouver.	A detailed estimate of the economic value of ecosystem services on agricultural lands in Metro Vancouver would greatly assist decision-makers and the public in understanding the benefit to society from agricultural land stewardship. This will also assist in determining appropriate funding amounts for a regional conservation fund and what ecosystems should be prioritized for support.	Within 1-2 years
5. Review and assess options to align with the ongoing work to establish a Regional Green Infrastructure Network to support ecosystem services on agricultural land.	A Regional Green Infrastructure Network would acknowledge and identify all areas with significant ecosystem services in the region, including on agricultural land. The RGIN could be used to signify policy objectives for those lands, clarify decision-making requirements, and potentially minimize non-agricultural development.	Within 2 -3 years.

Recent plans and strategies adopted by Metro Vancouver recognize the importance of healthy ecosystems for a livable region and articulate that agriculture can play an important role in this respect. Several programs have been successful in incentivizing farmers to conserve and restore ecosystems in return for modest financial compensation; however, an overarching regional approach is missing. MVRD has an opportunity to provide a leadership role in connecting existing programs and leveraging regional initiatives to support payment for ecosystem services program for agricultural lands through the establishment of a regional conservation fund.

[3] Staff communication, Metro Vancouver. 2022. Update on Advancing the Regional Green Infrastructure Network.

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Definitions

Agricultural Lands	For the purposes of this report, the term 'agricultural lands' denotes lands with the Agricultural Land Reserve (ALR) as well as lands outside the ALR that are capable of supporting agriculture, whether they are being actively farmed at present time or not. The focus of the scope of this report is on agricultural lands when discussing ecosystem services broadly, and the ALR when analyzing land within Metro Vancouver specifically.
Ecosystems	Ecosystems are the dynamic complex set of relationships between plant, animal, and micro-organism communities and their non-living environment interacting as a functional unit.[4]
Ecosystem Services	Ecosystem services are the many ways that humans benefit from and depend on healthy functioning ecosystems. This dependency extends from essential support for life (e.g., because ecosystems produce oxygen and food) to security (e.g., by mitigating extreme weather events) and quality of life (e.g., by supporting psychological well-being).[5] Examples of ecosystem services include, but are not limited to, habitat for wildlife and Species at Risk from tree stands and hedgerows between fields, healthy riparian areas along streams for salmon habitat and flood mitigation, healthy soils that retain nutrients and carbon, and the production of food.
Healthy Ecosystems	Ecosystems that are healthy have the ability to maintain their plant and animal structure and functions (e.g. nutrient cycling, water cycling, etc.) over time and in the face of stressors.[6]

[4] Convention on Biological Diversity. Article 2. Terms of Use: https://www.cbd.int/convention/articles/?a=cbd-02
[5] Value of Nature to Canadians Study Taskforce. (2017). Completing and Using Ecosystem Service Assessment for Decision-Making: An Interdisciplinary Toolkit for Managers and Analysts. Ottawa, ON: Federal, Provincial, and Territorial Governments of Canada.
[6] Costanza, R., & Mageau, M. (1999). What is a healthy ecosystem?. Aquatic ecology, 33(1), 105-115.

Acronyms

AEP	Annual Exceedance Probability
ALR	Agricultural Land Reserve
BCCAF	BC Climate Agri-Solutions Fund
BMPs	Beneficial Management Practices
DFWT	Delta Farmland & Wildlife Trust
DPA	Development Permit Area
EAP	Ecological Accounting Process
ES	Ecosystem Services
ha	Hectares
MV	Metro Vancouver
MVRD	Metro Vancouver Regional District
PES	Payment for Ecosystem Services
RGIN	Regional Green Infrastructure Network
SEI	Sensitive Ecosystem Inventory
SROW	Statutory Right of Way
TEV	Total Economic Value
ToL	Township of Langley

1.0 Introduction

Amidst a rapidly changing climate and increasing urban pressures it is important to understand the value of ecosystem services on agricultural lands and how to support and enhance their continued benefits to society. Ecosystem services (ES) are the benefits that humans and society obtain from healthy ecosystems and their natural processes. Such services include flood mitigation, carbon sequestration, robust salmon populations, and clean air. Restoring and conserving ecosystems on a regional basis increases our collective resiliency to disturbances, such as climate change, and can provide benefits to all citizens and sectors of Metro Vancouver for current and future generations.

Figure 1. Planting native species to stabilize riverbank on agricultural land.[1]

Farmland within the Agricultural Land Reserve (ALR) makes up approximately 20% of the land base within the Metro Vancouver Regional District (MVRD) and its member municipalities. The potential of these agricultural lands to support ES to the region has been recognized by MVRD in several planning and policy documents. For example in the *Regional Food System Strategy*, *Ecological Health Framework*, the *Climate 2050 Roadmap for Agriculture (DRAFT)*, and *Metro 2050 (DRAFT),* among many other policy documents. However, further inquiry is needed to identify the breadth of possibilities and mechanisms that MVRD can use to support ecosystem services on agricultural lands over the long term.

MVRD undertook this *Scoping Ecosystem Services on Agricultural Land within Metro Vancouver* study with the following two objectives:

- To understand the benefits provided by ES within agricultural areas to resiliency, food production and the livability of the wider region, and,
- To identify and recommend policy, regulatory or financial actions and mechanisms that can be taken to expand the long-term viability of supporting agricultural ES.

This study identifies ecosystems on agricultural lands, outlines the value of ES to the region and provides recommendations for next steps in the long-term support for ES on agricultural lands.

2.0 Project Methodology

2.1 Phases 1 and 2

This study was separated into two phases. Phase 1 was completed from October 2021 to July 2022. A focused background, literature and jurisdictional document review, and mapping analysis was completed to investigate and describe the following topics:

- The impetus and support for agricultural ES within MVRD policies and plans;
- Current programs and initiatives within the region that are supporting ecosystem services on agricultural lands;
- The ecosystems and ES present on agricultural lands within the region;
- The benefits provided by ES on agricultural lands to the agricultural sector, general public, and to enhancing the overall health of regional ecosystems and increasing resilience to climate change impacts;
- Beneficial management practices (BMPs) to ensure effective restoration, conservation and maintenance of ES on agricultural lands; and,
- A mapping exercise to identify areas of the ALR within MV that have high opportunity for the provisioning of ES.

Phase Two, was completed between July 2022 and January 2023. A further secondary document and review was conducted into existing research on the value of ES on agricultural lands, and residents' willingness to pay for ES on agricultural lands in the region. Research and analysis was conducted to identify and understand the policy, regulatory and financial actions and mechanisms available to support long-term stewardship of ES on agricultural land. How these various approaches could work within the MV context, and a comparison of the two most feasible approaches was completed. Recommendations for next steps to further stewardship of ecosystem services on agricultural lands are outlined.

2.2 Limitations

Metro Vancouver is situated on the ancestral, traditional and unceded territories of the shared territories of many Indigenous peoples, including ten local First Nations: qićəy̓ (Katzie), qʷɑ:nˀ ƛ̓ əńˀ (Kwantlen), kʷikʷəƛ̓ əm (Kwikwetlem), máthxwi (Mˀ atsqui), xʷməθkʷəyəm (Musqueam), qiqéyt (Qaˀ yqayt), seˀmyaˀme (Semiahmoo), Sḵwx̱wú7mesh Úxwumixw (Squamish), scəwaθən məsteyəxʷ (Tsawwassen), səˀ líl̓wətaʔɬ̓ (Tsleil-Waututh). These First Nations have lived in the area for thousands of years, working with natural systems to shape the land and food systems. Engagement with First Nation communities did not occur as a part of this study, because the focus of this work was on an assessment landscape level ecosystem services and policy options, rather than on management options for specific parcels of land. However, future phases of work could and should include research and collaboration into the intersection of ecosystem services on agricultural lands and Indigenous land stewardship. This is also reflected in the recommendations.

3.0 MVRD Policy Foundation for Ecosystem Services on Agricultural Land

Metro Vancouver Regional District has adopted several frameworks, plans and strategies which identify opportunities to support agricultural ES and aim to conserve and enhance natural ecosystems. Four key documents are further described below: the *Regional Food System Strategy*, *Ecological Health Framework*, the *Climate 2050 Roadmap for Agriculture (DRAFT)*, and *Metro 2050 (DRAFT).*

The *Regional Food System Strategy,* adopted in 2011*,* is a foundational document that outlines goals, strategies and actions for achieving the vision of a regional food system that takes a "collaborative approach to a sustainable, resilient and healthy food system that will contribute to the well-being of all residents and the economic prosperity of the region while conserving ecological legacy." Several of the strategies in this document include support for farmers in implementing beneficial practices for ecosystem services to improve ecosystem health.[7]

In 2018, MVRD endorsed the *Ecological Health Framework* which underscores MVRD's role in supporting ecological health while setting out a clear vision, along with guiding principles, goals and strategies for actively advancing ecological health in the region. The *Ecological Health Framework* envisions MV as a "beautiful, healthy, and resilient environment for current and future generations." To achieve this vision there are three main goals, 1) building ecological resilience and minimizing impacts, 2) protecting natural areas and conserving ecosystem services, and 3) nurturing nature within communities.[8]

The *Climate 2050 Roadmap for Agriculture (DRAFT)* (2021) outlines several goals and strategies for the agriculture sector in MV to assist the region in becoming carbon neutral by 2050. Many of these strategies include supporting ecosystem services on agricultural lands to achieve net-zero emissions and a resilient local food system. The strategies that align most directly with this project are[9]:

- Strategy 1.6: Protect Agricultural Land for Ecosystem Services: Metro Vancouver will examine the use of ecosystem services as a benefit to the regional agricultural sector including what programs are most beneficial to farmers financially and what methods are most effective in securing land for ecosystem services and for ensuring the long-term health and resiliency of farming operations.
- Strategy 3.2: Support and Expand Ecosystem Services: Work with the BC Government, member jurisdictions, the farming community and other regional partners such as Farmland Advantage to determine how much agricultural land is available and appropriate to be used for ecosystem services, how individual farms can benefit from the restoration and protection of these lands (including riparian areas) on their farms, and how farmers and land owners can be compensated for keeping these lands set aside for ecosystem services. Metro Vancouver will provide regionally-appropriate guidance on the valuation methodologies, tools and decision-making frameworks needed to identify, preserve,

[7] Metro Vancouver. 2011. Regional Food System Strategy.
[8] Metro Vancouver. 2018. Ecological Health Framework.
[9] Metro Vancouver. 2021. Report to Climate Action Committee: Draft Climate 2050 Agriculture Roadmap.

restore, and, where necessary, expand natural ecosystems on agricultural land and will examine the benefits of connecting these areas within a regional Green Infrastructure Network.

In 2022, *Metro 2050 (DRAFT)*, the Regional Growth Strategy, was released and identifies the importance of protecting agricultural lands for the ongoing production of fresh and local food which contributes to a secure food supply and economic resilience, and recognizes the value of ecosystem services on agricultural lands (Goal 2, Strategy 2.3).[10] *Metro 2050 (DRAFT)* acknowledges the vulnerability of agriculture to impacts from climate change and supports policies that promote the adoption of farm practices to improve the health of on-farm ecosystems, which increases the region's capacity to adapt to and mitigate effects from climate change.

Numerous other MVRD documents also speak to the importance of robust ES for a liveable region through strategic management of public spaces such as regional, municipal parks, greenway corridors, and agricultural lands (Table 1). MVRD also has numerous regulations to support waste management, air quality control, climate change adaptation and mitigation and sustainable land use development to protect and enhance ecosystem services.

Table 1 Examples of Metro Vancouver Plans and Strategies with objectives to support healthy ecosystems.

DATE	DOCUMENT TITLE
2022	Metro 2050 (Draft)
2022	Climate 2050 Agriculture Roadmap (Draft)
2022	Regional Parks Plan
2021	Clean Air Plan
2020	Regional Greenways 2050
2019	Climate 2050 Strategic Framework
2018	Ecological Health Framework
2016	Regional Parks Plan
2016	Regional Food System Action Plan
2015	Green Infrastructure in Metro Vancouver
2015	Connecting the Dots: Regional Green Infrastructure Network Resource (
2014	Sensitive Ecosystem Inventory
2011	Regional Food System Strategy
2011	Metro 2040: Shaping our Future, Regional Growth Strategy
2008	Strategic Directions for Biodiversity Conservation

3.1 Programs and Initiatives Supporting Ecosystem Services on Agricultural Land

Over the past decade, numerous programs and initiatives have developed in the region that support enhancing ES on agricultural lands. The programs have been and are currently undertaken by non-profit organizations with the support from local municipalities, MVRD, and the provincial and federal governments. These programs provide incentives and support to farmers to enhance

[10] Metro Vancouver. 2022. Metro 2050.

the ecosystem services on their land, which are not traded in the marketplace but have great public value. The programs identify the ES that can be conserved, restored, enhanced, and maintained and develop plans to preserve them. Implementation may include actions such as regulating water or stream setbacks, using strategic fencing, restoration plantings, creating grassland set asides, and using cover cropping, to name a few. In addition, there is a vast amount of academic research being conducted in the region by several local universities and colleges relating to this topic.

Taking stock of the current projects, programs and initiatives in the region is helpful for MVRD to understand where they could play a role in this area and helps to inform this project's recommendations. Table 2 describes current initiatives in the region that are most closely aligned with supporting ES on agricultural lands. However, this is not an exhaustive list as there are countless non-profit organizations as well as provincial and federal programs that may overlap and have connection with the objectives of supporting ES on agricultural land.

Table 2 Examples of programs within Metro Vancouver supporting ES on agricultural lands.

Project Name	Organization	Description
BC Climate Agri-Solutions Fund	Investment Agriculture Foundation of BC	The BC Climate Agri-Solutions Fund (BCCAF) provides funding to help farmers tackle climate change by adopting BMPs that store carbon and reduce GHGs, specifically nitrogen management, cover cropping, and rotational grazing.
Environmental Farm Plan: Beneficial Management Practices	Investment Agriculture Foundation of BC	Funded by the Canadian Agricultural Partnership (CAP) Program, the Environmental Farm Plan Program's (EFP) objective is to provide farm and ranch operators with the means to identify agri-environmental risks and opportunities. Farms with EFPs may be eligible to apply for cost-shared incentives through the BMP program. There are BMPs which support farms to act on ecosystem services such as building soil health, increasing water retention, enhancing biodiversity, and sequestering carbon.
Farmland Advantage	Investment Agriculture Foundation of BC	Farmland Advantage is a BC-based Payment for Ecosystem Services (PES) program that provides financial compensation to farmers and ranchers to protect and enhance ecosystem services. The program identifies sensitive ecosystems in agricultural areas and then works with producers and Indigenous communities to restore degraded land. Since 2021, the program has worked within Metro Vancouver with farmers in the Bertrand Creek watershed and the Little Campbell River watershed.
Langley Ecosystem Services Initiative	Langley Sustainable Agriculture Foundation	This program ran as a pilot project from 2015 – 2019 with farmers in the Bertrand Creek watershed. This was a PES program that paid agricultural producers to use practices that resulted in an increase in ecological integrity. It was a farmer-led initiative and has since been folded into the Farmland Advantage program.
Stewardship Programs	Delta Farmland & Wildlife Trust	This program helps steward over 1,416 ha (3,500 acres) of wildlife habitat on farmland through co-operative arrangements with local farmers. Programs include: grassland set-asides, winter cover crops, and forage enhancement. This includes cost sharing payments to local farmers to help lessen the financial burden for farms to take land out of production for conservation purposes.

4.0 Ecosystems Services on Agricultural Lands in Metro Vancouver

Agricultural lands present a unique opportunity for the long-term provision of ES due to the development restrictions placed through the *Agricultural Land Commission Act* and the *Agricultural Land Reserve Regulation*. Almost 20% of the land within MV is designated as ALR, a portion of which is often left in a more natural state (such as watercourses, wetlands, and forests). This natural state is conducive to implementing BMPs that can conserve, restore and maintain ES. Additionally, in recent years, the potential of certain management practices on agricultural lands to assist in mitigating and adapting to climate change has become clearer, and academic and field research is being conducted to determine the most effective BMPs for sequestering carbon and reducing greenhouse gas emissions on farmland.

Identifying which ecosystems are present in the ALR within MV through mapping helps to determine where the greatest opportunities are for supporting ES. The Sensitive Ecosystem Inventory (SEI) mapping, conducted for MVRD in 2014 and updated in 2020, was used to inform the types and locations of ecosystems in the ALR (Table 3 below and Figure 2 next page). The SEI provides information for the locations of 'sensitive' and 'modified' ecosystems. Sensitive ecosystems are at-risk or are ecologically fragile in the context of the provincial landscape because of the diversity of species they support.[11] A 'modified' ecosystem is younger and more human-modified but still has ecological value and is important to biodiversity. The results of this project's mapping exercise indicated that the ALR within MV hosts a diversity of ecosystems such as forests, riparian areas and wetlands. Within the MV regional core, the ALR hosts over 40% of major ecosystem types (Table 3)[12] including approximately 60% of wetlands and 40% of riparian areas. This points to the high level of opportunity to leverage existing funding and support producers in restoring and maintaining these ecosystems to provide ES for the region.

Table 3 Top five ecosystems within the ALR in Metro Vancouver as classified by the SEI.[13]

	Ecosystem	*Total ha within Regional Core*	*Total ha within ALR*	*Percentage of ALR ha within Regional Core*
1	Forests	15,432	5,334	35%
2	Wetlands	6,900	4,167	60%
3	Riparian	7,937	3,318	42%
4	Old Fields[14]	2,134	1,418	66%
5	Freshwater	565	222	39%
	Total	**32,968**	**14,459**	**44%**

[11] Del Meidinger, Josephine Clark, & David Adamoski. 2014. Metro Vancouver. Sensitive Ecosystem Inventory, Technical Report
[12] The regional core is the more urbanized southern part of the region and excludes the large parks (e.g. North Shore Mountains) and estuaries under Provincial management, watersheds and other higher elevation areas. The regional core is most relevant to policy and planning and is where municipal decisions and actions will have the most impact.
[13] Numbers includes sensitive and modified ecosystems. Del Meidinger, Josephine Clark, & David Adamoski. 2014. Metro Vancouver. Sensitive Ecosystem Inventory, Technical Report; and. J. Clark. 2020. Metro Vancouver. Update of the Metro Vancouver Sensitive Ecosystem Inventory (2009 – 2014).
[14] Old field ecosystems are agricultural lands that were formerly cultivated or grazed but have since been abandoned and have well-developed herbaceous vegetation, some shrubs and potentially a few young trees. They may revert back to active agriculture over time based on the producer's management decisions.

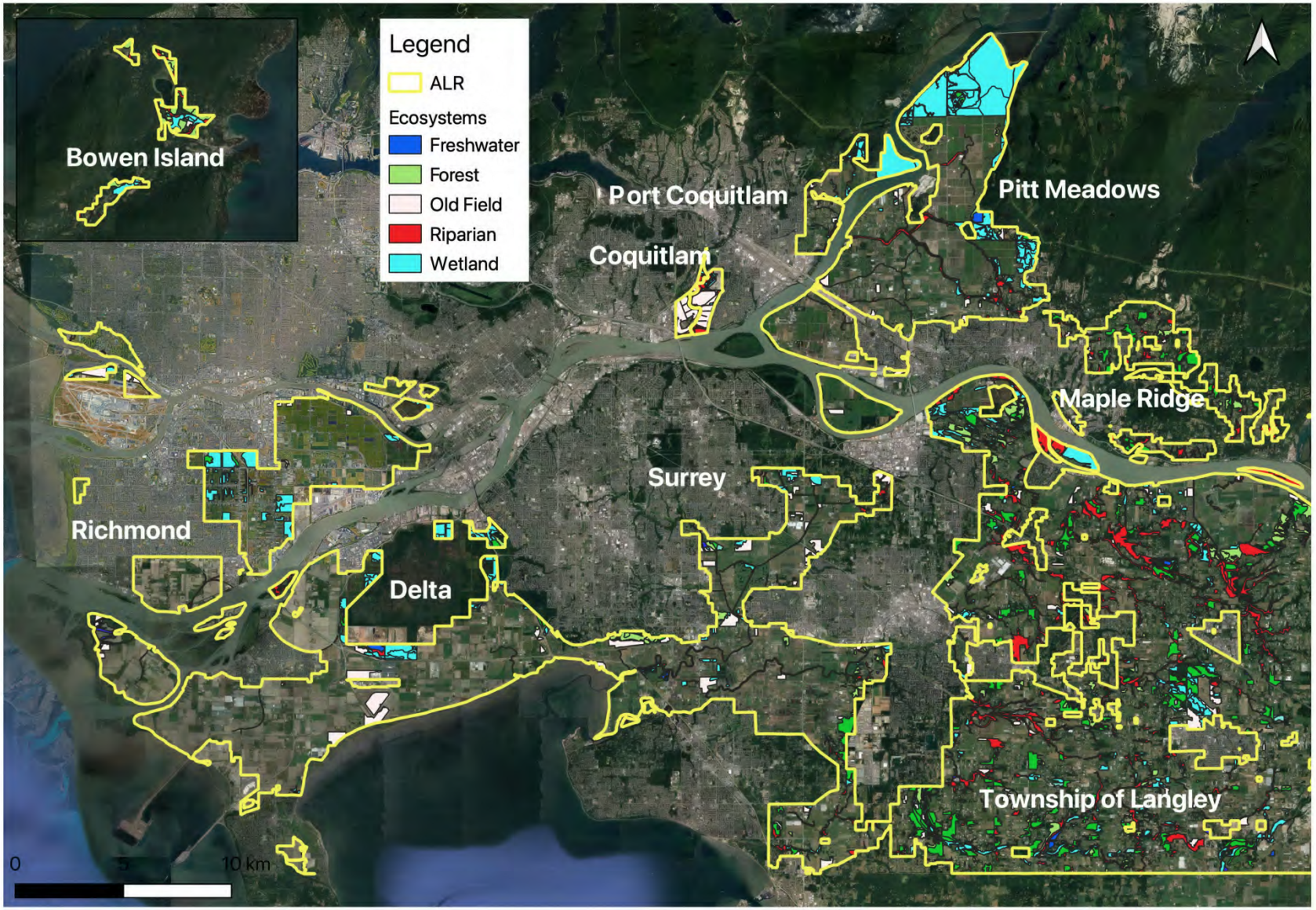

Figure 2 Top 5 ecosystems identified in the SEI within the ALR in Metro Vancouver.

4.1 Categories of Ecosystem Services

A list of the ecosystem services provided by agricultural land within MV is presented in Table 4. There are four key categories of ES:[15] [16]

1. **Supporting**: These are services necessary for ecosystem health and are the foundation for other services.
2. **Regulating**: Services that ecosystems provide by acting as regulators of ecosystem processes.
3. **Provisioning**: The products and materials provided by ecosystems.
4. **Cultural**: The non-material benefits of ecosystem that relate more directly to livability for the regions' residents and visitors.

Table 4 Examples of ecosystem services provided by agricultural land in Metro Vancouver.

	Supporting				*Regulating*					*Provisioning*			*Cultural*		
Ecosystem	Soil Health	Plant Growth	Biodiversity	Nutrient Cycling	Shading	Water Quality & Quantity	Carbon Storage	Clean Air	Pollination	Food & Fish	Fresh Water	Wood	Human Health	Recreation	Tourism & Beauty
Forest	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓
Riparian	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Wetland	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓
Freshwater			✓			✓				✓	✓		✓	✓	✓
Old Fields & Hedgerows	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓

Ecosystem services provided by healthy ecosystems on farmland benefit the wider region and society and agricultural producers. The subsequent sections describe these beneficial ecosystem services for each ecosystem present in the ALR. Examples of BMPs that can be implemented on agricultural lands to support healthy ecosystems are also outlined.

[15] Millennium Ecosystem Assessment. 2003)=. Ecosystems and Human Well-being: A Framework for Assessment.

[16] There are several international frameworks that have been developed for categorizing ES such as, the Millennium Ecosystem Assessment (2003), the Economics of Ecosystems and Biodiversity (2010); and the Common International Classification of Ecosystem Services (2016). The ES described in all three frameworks remain consistent and descriptions of ES are interchangeable between methodologies. To stay consistent with previous MV reports, this study uses the categories outlined in the MV Ecological Health Framework, which follow the Millennium Ecosystem Assessment Framework most closely.

4.2 Forest Ecosystem Services and Agricultural BMPs

There are a range of forest types and associated tree stand ages within the ALR in MV that provide a wide array of ES. There are mature forests which have trees that are over 80 years old, immature forests that are between 30-80 years old, and young forests that are less than 30 years old.[17] There are a diversity of forest stands and tree species in the region ranging from conifers, broadleaf and mixed species. Table 5 describes examples of ES provided by forests.

Table 5 Examples of ecosystem services provided by forests within the ALR in Metro Vancouver.[18]

Services	Description
Supporting *(soil development, nutrient cycling, photosynthesis, habitat, biodiversity)*	○ Forests are important habitat areas for many wildlife species, increasing animal and plant biodiversity, and serve as connections between ecosystems in a highly fragmented landscape. ○ The presence of vegetation with deep roots and biomass for increased decomposition assists in soil development and erosion control.
Regulating *(shading, water quantity, water quality, carbon storage, clean air, pollination)*	○ Vegetation increases filtration of water as it moves through the forest and increases water storage by slowing down the water which allows for greater water infiltration as it moves over the soil. ○ Trees and shrubs provide shading which helps to reduce temperatures nearby and contributes to clean air through photosynthesis. ○ The increase in plant biodiversity provides habitat for beneficial insects like pollinators. ○ During droughts, the water stored in soils by the forests is slowly released, providing water to adjacent ecosystems. ○ Forests draw carbon dioxide out of the air and stores it both above and below the ground.
Provisioning *(food, fish, fresh water, wood)*	○ Trees and native plant species within forests can provide food and wood. ○ Water storage and filtration benefit fish stock health.
Cultural *(human health, recreation, tourism, beauty)*	○ Healthy forests can increase the resiliency of farms for on-going access to local food. ○ Traditional food and medicine values for First Nation communities are supported. ○ Humans can benefit from trails, recreation, bird and animal watching opportunities. ○ Humans gain aesthetic value from forest landscapes. ○ Forests contribute to clean air and clean waters, which benefits the health of nearby residents.

[17] Del Meidinger, Josephine Clark, & David Adamoski. 2014. Metro Vancouver. Sensitive Ecosystem Inventory, Technical Report.
[18] Sources include: Del Meidinger, Josephine Clark, & David Adamoski. (2014). Metro Vancouver. Sensitive Ecosystem Inventory, Technical Report.; Felipe-Lucia, M. R., Soliveres, S., Penone, C., Manning, P., van der Plas, F., Boch, S., ... & Allan, E. 2018. Multiple forest attributes underpin the supply of multiple ecosystem services. Nature communications, 9(1), 1-11.;Gallay, I., Olah, B., Gallayová, Z., & Lepeška, T. 2021. Monetary Valuation of Flood Protection Ecosystem Service Based on Hydrological Modelling and Avoided Damage Costs. An Example from the Čierny Hron River Basin, Slovakia. Water, 13(2), 198.

4.2.1 Ecosystems Services Provided by Forests to Agriculture

Restoring, maintaining and conserving forest ecosystems on agricultural lands also provides benefits to agriculture. Table 6 describes examples of specific ES provided by forests that benefit agriculture.

Table 6 Examples of the benefits to agriculture from ecosystem services provided by forests and tree stands.

Ecosystem Services	Benefit to Agriculture
Water Quality	○ Forested areas filter water and reduce nutrient loading from manure run-off into watercourses, which improves water quality and provides cleaner water for irrigation or livestock watering.
Water Quantity	○ Water stored in forest ecosystems helps to recharge groundwater which can increase and prolong water availability for crops and irrigation. ○ Better drainage and flood control reduces in-field ponding and water-saturated soils. This can also improve livestock herd health by reducing foot rot in saturated pastures caused by poor drainage.
Nutrient Cycling	○ Forest ecosystems help to keep nutrients cycling through the soil, increasing availability for nearby crops.
Soil Development	○ Increased vegetation helps to retain soils through stable roots and build soils through increased biomass decomposition.
Carbon Storage	○ Forests and trees on agricultural lands where bare land was previously, increases soil carbon.
Erosion Control	○ Forests and tree on agricultural lands hold soils with their root systems and reduce soil erosion from wind and rain events.
Habitat and Biodiversity	○ Beneficial insects such as lady bugs, ground beetles, parasitoid wasps, syrphid flies and native bees improve pollination and can help reduce pest pressure on crops. ○ An increase in trees and shrubs can provide shade for livestock and can protect crops from strong winds.
Pollination	○ Better crop yields from native pollinators and honeybees that are using the ecosystems as habitats.

4.2.2 Agricultural BMPs for Forest Ecosystems

Examples of agricultural BMPs that enhance ecosystem services in forests and woodland areas include[19]:

- Planting locally adapted species, favouring native species.
- Managing the timing and intensity of livestock use of forested pastures and tree/shrub stands in native pastures to avoid heavy browsing and maintain healthy shrub/tree populations.
- Identifying existing forest stands for protection from cutting and deadwood removal.

[19] BC Ministry of Agriculture, Food and Fisheries. 2016. Developing a Riparian Management Plan Version 2.0. (Excerpts taken from the Riparian Management Field Workbook & Biodiversity Guide).

- Protecting nests built by large birds, such as raptors and herons by establishing vegetation buffers and minimizing activities near the nests.
- Establishing or maintaining non-timber forest products such as berries, nuts, mushrooms, vines, specialty trees, and shrubs.
- Leaving large rotting or hollow logs for habitat.
- Creating habitat and improving nutrient cycling by leaving branches, tree tops, cull logs, and log portions at felling sites, when possible.
- Replanting or allowing natural regeneration to (re)connect wooded areas on the farm.
- Integrating management of trees and livestock pasture (silvopasture).
- Conserving wildlife trees, rock piles, and other wildlife habitat features.
- Undertaking forest operations when soils are dry or frozen to minimize soil and root disturbance.
- Avoiding tree felling during breeding seasons of known wildlife species.
- Removing and controlling other invasive species and implementing other BMPs related to invasive species that have already been developed for MV.[20]

4.3 Wetland, Riparian, and Freshwater Ecosystem Services and Agricultural BMPs

The wetland, riparian and freshwater ecosystems within Metro Vancouver's agricultural lands are of particular importance as the health of these ecosystems heavily influence freshwater resources, landscapes, and species of significance, such as salmon.

- Wetland ecosystems are found where soils are saturated by water for enough time that the excess water and resulting low oxygen levels influence the vegetation and soil. They encompass a range of plant communities that include western red cedar/skunk cabbage swamps, cattail marshes, and peat moss dominated bogs.[21]

- Riparian ecosystems are associated with and influenced by freshwater. They generally occur along rivers, streams, and creeks, and fringes around lakes. These ecosystems are influenced by factors such as erosion, sedimentation, flooding, and/or irrigation due to proximity to the water body.[22]

- Freshwater ecosystems include bodies of water such as lakes and ponds that usually lack floating vegetation. On agricultural lands there may also be freshwater reservoirs that include smaller, modified ponds - even though the natural hydrology of reservoirs is modified, they are still important freshwater habitat.[23]

Most drainage ditches on agricultural lands are not fish-bearing; however, these ditches can be an important part of the region's watercourses as they connect with creeks, streams and rivers

[20] Invasive Species Council of Metro Vancouver has guidance on BMPs, relevant to agricultural lands.
[21] Del Meidinger, Josephine Clark, & David Adamoski. 2014. Metro Vancouver. Sensitive Ecosystem Inventory, Technical Report.
[22] Ibid.
[23] Ibid.

therefore influencing the health of those waters. Table 7 (next page) describes ES provided by these ecosystems on agricultural lands.

As the frequency and intensity of drought and flooding events continue to occur in the region, many of the services that these ecosystems provide can help to reduce some of the negative impacts from these events. For example, during a flood event, wetlands can store excess water and a healthy riparian area can retain soil and reduce erosion of stream banks. During droughts, vegetated areas can provide a cool microclimate for animals and insects, and there may be more water available for irrigation during droughts from water stored and slowly released from these ecosystems.

Table 7 Ecosystem services provided by wetlands, riparian areas, and watercourses on agricultural lands.[24]

Services	Description
Supporting *(soil development, nutrient cycling, photosynthesis, habitat, biodiversity)*	○ Healthy riparian areas reduce the loss of land to erosion as established native vegetation often have deep roots which stabilize banks and hold soil together. ○ Reduced erosion means less sediment is transported and keeps fish spawning areas clear of silt, reduces nutrient overloading and increases water quality. ○ Healthy wetland and riparian areas support a high number of native plant and animal species. Connected riparian areas allow fish, birds, mammals, amphibians and other species to move through the landscape.
Regulating *(shading, water quantity, water quality, carbon storage, clean air, pollination)*	○ Healthy wetlands and riparian areas improve flood control along watercourses by storing excess water and moderating the release of that water, reducing damage to adjacent areas during floods. ○ Riparian vegetation moderates water temperature, reduces input of silt and soil and filters and absorbs excess nutrients/contaminants to improve water quality. ○ The canopy of trees and shrubs provide shading of the water, moderating water temperature which is important for success of aquatic species such as fish. ○ Vegetated buffers draw carbon dioxide out of the air and store it both above and below the ground.
Provisioning *(food, fish, fresh water, wood)*	○ Riparian areas provide benefits to salmon and other fish populations as they provide food, nutrients and clean water to all in-stream and downstream fish habitats. This in turn positively impacts the health of salmon stocks for human economic and cultural activities.
Cultural *(human health, recreation, tourism, beauty)*	○ Humans benefit from access to food produced on farms and healthy riparian areas can increase the resiliency of farms for on-going access to local food. ○ Traditional food and medicine values for First Nation communities are supported. ○ Biodiversity in plants and animals can benefit farmers and the general public alike through pest control, increased pollination, allowing for bird watching opportunities, scientific research and nature-based recreation activities. ○ Residents gain aesthetic value from these landscapes.

[24] Sources Include: BC Government. (nd). Riparian Areas.; Perry, L. G., Reynolds, L. V., Beechie, T. J., Collins, M. J., & Shafroth, P. B. 2015. Incorporating climate change projections into riparian restoration planning and design. Ecohydrology, 8(5), 863-879.; Mike Pearson, David Zehnder, & DG Blair. 2018. The Stewardship Centre for British Columbia. Lands Near Water, Riparian Restoration & Enhancement.; Riis, T., Kelly-Quinn, M., Aguiar, F. C., Manolaki, P., Bruno, D., Bejarano, M. D., ... & Dufour, S. 2020. Global overview of ecosystem services provided by riparian vegetation. BioScience, 70(6), 501-514.

4.3.1 Ecosystems Services Provided by Riparian, Wetland, and Freshwater Ecosystems to Agriculture

Restoring, maintaining and conserving wetland, riparian and freshwater ecosystems on agricultural lands provide benefits to agricultural production and the agriculture sector. Table 8 describes specific ES that provided by these ecosystems that benefit agriculture.

Table 8 Examples of the benefits to agriculture from ecosystem services provided by wetlands, riparian areas, and watercourses.

Ecosystem Services	Benefit to Agriculture
Water Quality	○ Riparian areas filter water and reduce nutrient loading from manure run-off into the watercourses, which improves water quality and provides cleaner water for irrigation or livestock watering.
Water Quantity	○ Well managed wetland and watercourses can provide better drainage and flood control which reduces in-field ponding and water-saturated soils. This can also improve livestock herd health by reducing foot rot in saturated pastures. ○ Water is stored in these ecosystems and helps to recharge the groundwater which can increase and prolong water availability for crops and irrigation.
Nutrient Cycling	○ Riparian ecosystems help to keep nutrients in the area and cycling nutrients through the soil, possibly increasing availability for nearby crops.
Carbon Storage	○ Increased vegetation in riparian ecosystems on agricultural lands where bare land was previously, increases soil carbon.
Soil Development	○ Vegetation in riparian and wetland ecosystems helps to retain soils through stable roots and build soils through increased biomass and decomposition.
Erosion Control	○ Vegetative wetlands and riparian areas stabilize stream banks which reduces erosion of agricultural lands.
Habitat and Biodiversity	○ Beneficial insects such as lady bugs, ground beetles, parasitoid wasps, syrphid flies and native bees improve pollination and can help reduce pest pressure on crops.
Pollination	○ Better crop yields from native pollinators and honeybees that are using the ecosystems as habitats.

4.3.2 Agricultural BMPs for Riparian, Wetland, and Freshwater Ecosystems

Riparian Areas

Specific land management practices that protect riparian areas and enhance ES include[25]:

- Avoiding overuse of fertilizers or manure that may be transported into riparian areas.
- Protecting against loss of plant diversity and vitality in riparian areas.
- Protecting against the establishment of invasives species.
- Avoiding practices that artificially alter streamflow.

[25] BC Ministry of Agriculture, Food and Fisheries. 2021. British Columbia Environmental Farm Plan Reference Guide 6th Edition.

In some cases, the condition of the riparian area may require some investment to bring the area up to a healthier or proper functioning condition. Improvement of agricultural riparian areas can occur by implementing the following practices[26],[27]:

- Retaining a wide variety of native plants that are adapted to living in riparian areas.
- Encouraging a diverse mix of plant species and age that:
    - Are adapted to the climate, soil and water conditions;
    - Foster a good rooting system for stream bank stability.
- Developing off-channel watering and/or constructing fencing that controls livestock access to riparian areas and watercourses.
- Improving ground stability with erosion control structures by:
    - Contouring terraces with earthworks and seeding;
    - Stabilizing gullies and watercourses with erosion control matting, silt fencing, seeding;
    - Stabilizing banks through bank shaping, riprap, re-vegetation, and blanketing; and,
    - Protecting riparian trees and shrubs from rodents such as beavers.
- Managing the timing and extent of grazing in riparian areas to protect native species, leaving ample residue/litter, and avoiding creating wet trampled spots (e.g., avoiding overgrazing of forbs and shrubs).
- Constructing or relocating facilities and roads away from riparian areas.
- Where appropriate, using thorny shrubs (e.g., hawthorn) or dense plantings of conifers to deter livestock from using riparian areas.
- Avoiding or minimizing the impact of farm machinery use in or around riparian areas.
- Connecting or reconnecting riparian habitats by leaving an uncultivated corridor and planting native vegetation, a shelterbelt, or a hedgerow between them.
- Removing and controlling invasive species and implementing other BMPs related to invasive species that have already been developed for MV.[28]

Agricultural use of riparian areas can occur when the function of the riparian area is maintained. If livestock are well managed, forages grown in riparian areas can be harvested by grazing such as in riparian pastures. Specialty crops that can be harvested by hand can be grown in riparian areas and can include:

- Floral crops (pussy willow, contorted willow, ferns);
- Medicinal crops (cascara bark, hawthorn leaves and fruit);
- Food crops (fiddleheads, berries, nuts) and conifer boughs for the Christmas market.

[26] BC Ministry of Agriculture, Food and Fisheries. 2021. British Columbia Environmental Farm Plan Reference Guide 6th Edition..
[27] BC Ministry of Agriculture, Food and Fisheries. 2016. Developing a Riparian Management Plan Version 2.0. (Excerpts taken from the Riparian Management Field Workbook & Biodiversity Guide).
[28] Invasive Species Council of Metro Vancouver has guidance on BMPs, relevant to agricultural lands.

Wetland and Freshwater Areas

Examples of BMPs that protect wetland and freshwater areas and enhance ES include[29]:

- Keeping farm equipment above the high water mark.
- Where possible, allowing natural cycles and events to take place (e.g., periodic flooding; fallen trees left in stream to provide habitat).
- Enhancing aquatic habitat by maintaining features that provide habitat complexity, such as large woody debris.
- Avoiding obstructing water flows with crop harvesting debris.
- Allowing selected areas to flood to provide habitat for migratory waterfowl.
- Re-establishing drained wetlands by restoring their original drainage pattern.
- Limiting storm water movement into natural watercourses.
- Constructing artificial wetlands to improve water quality and enhance aquatic habitat.
- Minimizing the risk of trapping fish in seasonally wetted connections to aquatic habitat.
- Appropriately sizing and placing culverts so that fish passage is not impeded.
- Incorporating natural substrates such as gravel in open bottom culverts when constructing fish passage.
- Joining wetland and freshwater habitats by planting native vegetation, a shelterbelt, or a hedgerow between them.
- Removing aquatic invasive species such as yellow flag iris, purple loosestrife, parrot's feather and bullfrogs.[30]
- Removing and controlling other invasive species and implementing other BMPs related to invasive species that have already been developed for MV.[31]

4.4 Old Fields and Hedgerows Ecosystem Services and Agricultural BMPs

Old field ecosystems are agricultural lands that were formerly cultivated or grazed but have since been abandoned and have well-developed herbaceous vegetation, some shrubs and potentially a few young trees. The SEI includes old fields in the ecosystem inventory because this specific range in vegetation types and heights provides a variety of habitat for birds, animals and plants that increase biodiversity.[32] Without management, old fields will eventually become forests. However, there is also the possibility that old fields may be brought back into production, changing the state of vegetation and changing the ES provided by this specific ecosystem. Their important role in ecosystem health is noted based on their current ability to support critical habitat, regardless as to whether or not the use may change over time.

[29] BC Ministry of Agriculture, Food and Fisheries. 2016. Developing a Riparian Management Plan Version 2.0. (Excerpts taken from the Riparian Management Field Workbook & Biodiversity Guide).

[30] Invasive Species Council of Metro Vancouver has guidance on BMPs, relevant to agricultural lands.

[31] Ibid.

[32] Josephine Clark & Del Meidinger. 2020. Metro Vancouver. Update of the Metro Vancouver Sensitive Ecosystem Inventory (2009 -2014).

Hedgerows are an important component of old fields, as well as on actively farmed lands, however they are not specifically measured within the SEI. Obtaining information regarding specific areas covered by hedgerows is difficult because comprehensive mapping has not been completed. Hedgerows can be managed (planted) or un-managed (left to occur naturally) on agricultural lands and act as important habitat for birds and small mammals and vegetative buffers along roads or adjacent to suburban and urban areas.

Table 9 provides examples of how old fields and hedgerows in the ALR provide ecosystem service.

Table 9 Ecosystem services provided by old fields and hedgerows.[33]

Services	Description
Supporting *(soil development, nutrient cycling, photosynthesis, habitat, biodiversity)*	○ Old fields and hedgerows contribute to soil development, nutrient cycling, and provide habitat for insects and small mammals. For example, they can provide refuge for small mammals from predatory birds and be used for nesting for small birds.
Regulating *(shading, water quantity, water quality, carbon storage, clean air, pollination)*	○ There may be some potential for carbon storage if perennial species continue to grow in old fields and hedgerows. ○ Beneficial insects using old fields and hedgerows can increase pollination services.
Provisioning *(food, fish, fresh water, wood)*	○ These ecosystems may have native or wild plants that could provide food.
Cultural *(human health, recreation, tourism, beauty)*	○ Old fields can provide bird and animal watching opportunities. ○ Residents gain aesthetic value from these landscapes.

[33] Sources include: Bert, R., Steven, B., Victoria, N., Paul, P., & Kris, V. 2017. Ecosystem service delivery of agri-environment measures: A synthesis for hedgerows and grass strips on arable land. Agriculture, Ecosystems & Environment, 244, 32-51.; Del Meidinger, Josephine Clark, & David Adamoski. 2014. Metro Vancouver. Sensitive Ecosystem Inventory, Technical Report.

4.4.1 Ecosystems Services provided by Old Fields and Hedgerows to Agriculture

Old fields and hedgerow ecosystems can provide varying magnitudes of ES for agriculture, depending on the diversity and age of plants within the ecosystem. Table 10 describes specific ES from old fields and hedgerows that benefit agriculture.

Table 10 Examples of the benefits to agriculture from ecosystem services provided by old fields and hedgerows.

Ecosystem Service	Benefit to Agriculture
Nutrient Cycling	○ Old fields help to keep nutrients in the area and in cycling nutrients through the soil, possibly increasing availability for nearby crops.
Soil Development	○ The vegetation in old fields and hedgerows helps to retain soils through stable roots and builds soils through increased biomass and organic matter decomposition.
Erosion Control	○ Hedgerows on agricultural lands hold soils with their root systems and reduce soil erosion from winds and rain events.
Carbon Storage	○ Increased annual vegetation in these ecosystems on agricultural lands where bare land was previously, increases soil carbon.
Habitat and Biodiversity	○ Beneficial insects such as lady bugs, ground beetles, parasitoid wasps, syrphid flies and native bees improve pollination and can help reduce pest pressure on crops. ○ An increase in trees and shrubs in hedgerows can provide shade for livestock and can protect crops from strong winds.
Pollination	○ Better crop yields from native pollinators and honeybees that are using the ecosystems as habitats.

4.4.2 Agricultural BMPs for Old Fields and Hedgerow Ecosystem Services

Examples of BMPs in old fields and hedgerows areas include[34]:

- Using a variety of grazing management tools, including fencing (permanent and electric), herding, off-site watering, and strategically located salt, minerals, and supplemental feed in order to create a diverse plant community (types, sizes, ages).
- Using rotational grazing practices rather than season-long grazing to achieve rest and recovery of native plants.
- Becoming familiar with the growth cycle of key forage plants in order to better manage grazing.
- Allowing plants an effective rest period in order to establish good vegetative growth prior to grazing.
- Increasing the length and/or width of hedgerows on the farm.
- Implementing juvenile or pre-commercial thinning activities using manual, chemical, and/or mechanized techniques to prevent tree ingrowth.
- Controlling browsing by livestock so that hedgerows remain healthy and vigorous.

[34] BC Ministry of Agriculture, Food and Fisheries. 2016. Developing a Riparian Management Plan Version 2.0. (Excerpts taken from the Riparian Management Field Workbook & Biodiversity Guide).

- Connecting hedgerows, shrublands, and native pastures by planting local native species of forages, shrubs, and trees between them and by leaving an uncultivated corridor or tame pasture between them so natural infilling occurs.
- Deferring grazing in some areas that are used by ground-nesting birds until late in the nesting season.
- Using timed grazing to help control weeds. For example, to control the spread of Canada thistle, graze just before budding to weaken the plants and prevent them from going to seed.
- Removing and controlling invasive species and implementing other BMPs related to invasive species that have already been developed for MV.[35]

4.5 Dynamic Interactions between Agriculture and Ecosystem Services

Many of the benefits of healthy ecosystems to agricultural land have been identified; however, it is important to note the complexities in balancing the stewardship of ecosystems while producing agricultural products. While the benefits of healthy ecosystems on agricultural land outweigh the disadvantages, there can be negative impacts to agricultural productivity that can arise from increases in ES stewardship. For example, a reduction in planting area for ecosystem restoration set-asides, increased grazing pressure from deer and elk drawn to the natural areas, and an increase in beavers removing trees and building dams that can cause flooding.[36]

Agriculture can also have a negative impact on ecosystems (called ecosystem disservices) more generally. Ecosystem disservices from agriculture can include:[37]

- Habitat loss as land is cleared and developed for growing crops,
- Nutrient and chemical run-off into watercourses,
- Greenhouse gas emissions from farm equipment and livestock, and
- Soil loss due to erosion or tilling.

The ecosystem disservices arising from agriculture is highly dependent on the agricultural practices used and the agricultural products grown. There are numerous BMPs available and employed by farmers to address concerns around nutrient and chemical run-off, GHG emissions and soil loss. Increasingly, producers are proving that by employing BMPs and using sustainable and regenerative farming practices, agriculture can contribute positively to healthy ecosystems and climate change mitigation while producing food.

Regenerative agriculture is a holistic land management practice that holds potential to contribute to climate change mitigation by rebuilding soil organic matter and restoring degraded soil biodiversity resulting in carbon drawdown and improvement of the water cycle.[38] Regenerative

[35] Invasive Species Council of Metro Vancouver has guidance on BMPs, relevant to agricultural lands.
[36] George W. Powell. 2015. Agriculture and Ecological Services: Recommendations for Support Programming in British Columbia.
[37] Power, A. G. 2010. Ecosystem services and agriculture: tradeoffs and synergies. Philosophical transactions of the royal society B: biological sciences, 365(1554), 2959-2971.
[38] Metro Vancouver. 2022. Draft Agriculture Climate 2050 Roadmap.

agriculture practices contribute to ecosystem health and include no-till/minimum tillage, application of cover crops, crop rotations, compost, and animal manures, which restore the plant/soil microbiome to promote liberation, transfer, and cycling of essential soil nutrients, and well-managed grazing practices.[39]

Figure 2 outlines the complex interactions between farming, natural ecosystems, and ecosystem services and disservices.[40]

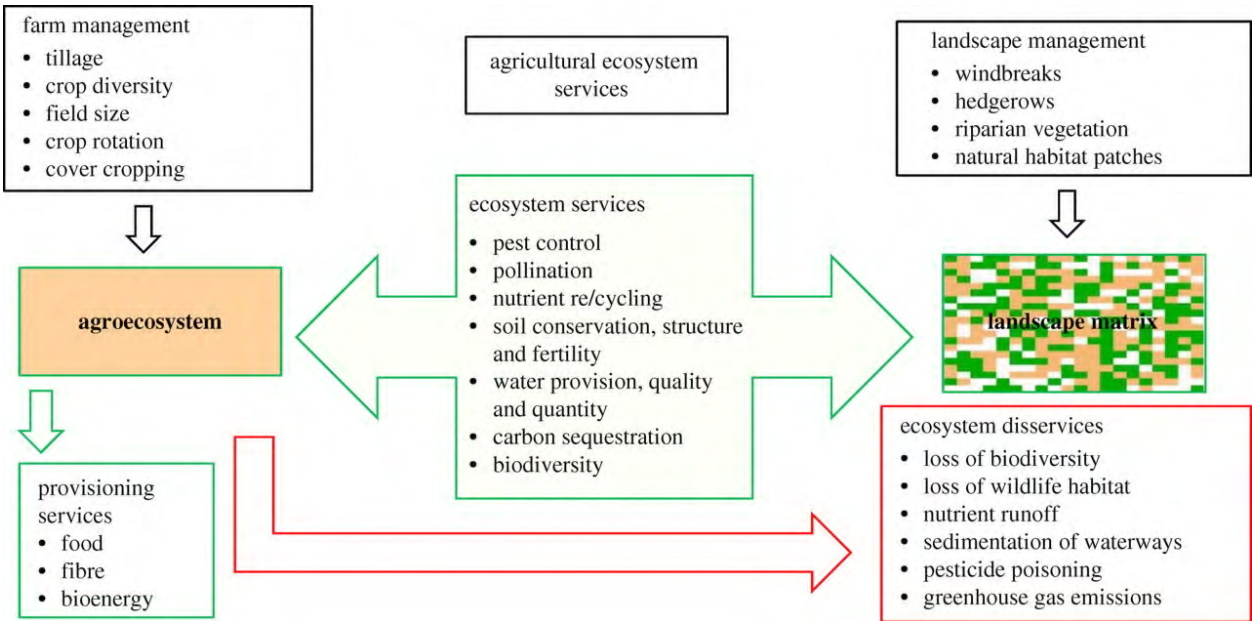

Figure 3 The complex interactions between agriculture and ecosystem services.[41]

[39] Regeneration International. 2017. What is Regenerative Agriculture?.
[40] Power, A. G. 2010. Ecosystem services and agriculture: trade-offs and synergies. Philosophical transactions of the royal society B: biological sciences, 365(1554), 2959-2971.
[41] Ibid.

5.0 Opportunities to Enhance Ecosystem Services on Agricultural Lands within Metro Vancouver

There are numerous opportunities for supporting ecosystem services in agricultural areas. These opportunities can be considered in two ways:

- Enhance and conserve existing natural areas on the farm, such as water-influenced and aquatic ecosystems (e.g. riparian, wetland, freshwater areas) and terrestrial ecosystems (e.g. hedgerows, grasslands and forested areas); and
- Employ sustainable and regenerative farm practices, such as cover cropping, crop rotations, reduced tillage, targeted grazing, and nutrient management, among many others.

For a more in-depth examination of these available opportunities, and given that approximately 60% of wetlands and 40% of riparian areas within the MV regional core occur on the ALR, this section will focus on how ecosystems influence water health by providing targeted analysis and examples.

Ecosystems influencing water health including wetlands, riparian areas and freshwater watercourses (creeks, streams, and fish-bearing agricultural ditches) were deemed the greatest opportunity for ecosystem enhancement on agricultural lands because these ecosystems currently provide, and have the future potential to expand crucial ecosystem services to the Metro Vancouver region such as clean water, fish and wildlife habitat, and flood impact mitigation. The changing climate is expected to cause longer lasting and more frequent droughts in the summer and increased precipitation and flooding events in the fall and winter.[42] If these water-influenced ecosystems are healthy[43], they are more resilient to disturbances and the ecosystem services they provide can help mitigate the effects of extreme flooding and droughts.

Ecosystems on agricultural lands also provide habitat for wildlife and salmon, acting as connections to different habitat types, and can serve as a buffer zone between natural areas and more intensive land uses.[44] There are over one hundred Species at Risk (SAR) within Metro Vancouver and the majority depend on wetland and riparian habitats including the Salish sucker, Nooksack dace, Oregon forest snail, Great Blue Heron and Oregon spotted frog, to name a few.[45] By better understanding the specific opportunities for conservation and restoration of aquatic ecosystems on agricultural lands, BMPs can be encouraged, supported and celebrated with the goal of improving the ecosystem services provided to the entire region.

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[42] Metro Vancouver. n.d. Climate Projections for Metro Vancouver.

[43] Healthy wetland and riparian ecosystems have many of the following characteristics: mature trees, dead standing snags, an understory of native grasses, shrubs and plants, and logs and woody debris on the ground. (Source: Mike Pearson, David Zehnder, & DG Blair. 2018. The Stewardship Centre for British Columbia. Lands Near Water, Riparian Restoration & Enhancement.)

[44] George W. Powell. 2015. Agriculture and Ecological Services: Recommendations for Support Programming in British Columbia.

[45] Biodiversity Conservation Strategy Partnership. 2008. Strategic Directions for Biodiversity Conservation in the Metro Vancouver Region.

5.1 Enhancing Ecosystems on Agricultural Land

Several areas across Metro Vancouver emerged during the mapping process as high opportunity areas for conservation and restoration on agricultural land. To begin the assessment, ALR mapping[46] was used to identify agricultural lands. Next, a mapping layer identifying watercourses (e.g. creeks, streams and agricultural channels), was used to target water-influenced ecosystems such as wetlands and riparian areas. This initial assessment indicated that approximately 1,330 km of watercourses are present in the ALR in Metro Vancouver. ALR land with watercourses was then grouped into the following three categories of areas with potential for:

1. Conserving established ecosystems,
2. Enhancing disconnected watercourses, and,
3. Mitigating flood impacts.

These categories and areas were informed by GIS mapping layers available at the time of analysis (see Appendix A for assumptions and limitations of the mapping process).

5.1.1 Areas with potential for conserving established ecosystems

Conservation of healthy ecosystems is necessary to maintain the ES that are currently provided and ensure future long-term consistent provision of these services. Wetlands, riparian areas, and freshwater assets identified in the MV SEI were used to identify healthy ecosystems as these areas are ecologically significant and relatively unmodified.[47]

In order to explore areas with potential for conserving established ecosystems, the following mapping layers were combined:

- ALR base map,
- Watercourses within the ALR, and,
- Riparian, Wetland, and Freshwater ecosystems as identified by the SEI.

This mapping exercise illustrated there are approximately 7,700 ha of SEI wetland, riparian and freshwater ecosystems in the ALR. Some of these areas are already conserved, through municipal or regional parks in the ALR, such as the Pitt-Addington Marsh in Pitt Meadows. However, there remains thousands of hectares of riparian areas and wetlands on private properties within the ALR that present opportunities for ecosystem conservation and/or restoration. Site specific visits to these areas would be required to determine appropriate restoration and conservation BMPs.

Examples of areas with potential for conserving existing ecosystem services are described in section 5.2. Figure 4 (next page) illustrates the riparian, wetland and freshwater ecosystems identified in the SEI in the ALR within MV with potential for conservation.

[46] Only agricultural land within the ALR were assessed due to the availability of mapping layers. There is a small area of land used for agriculture outside of the ALR within Metro Vancouver, which could also be supported in stewarding agricultural ES.
[47] Del Meidinger, Josephine Clark, & David Adamoski. 2014. Metro Vancouver. Sensitive Ecosystem Inventory, Technical Report.

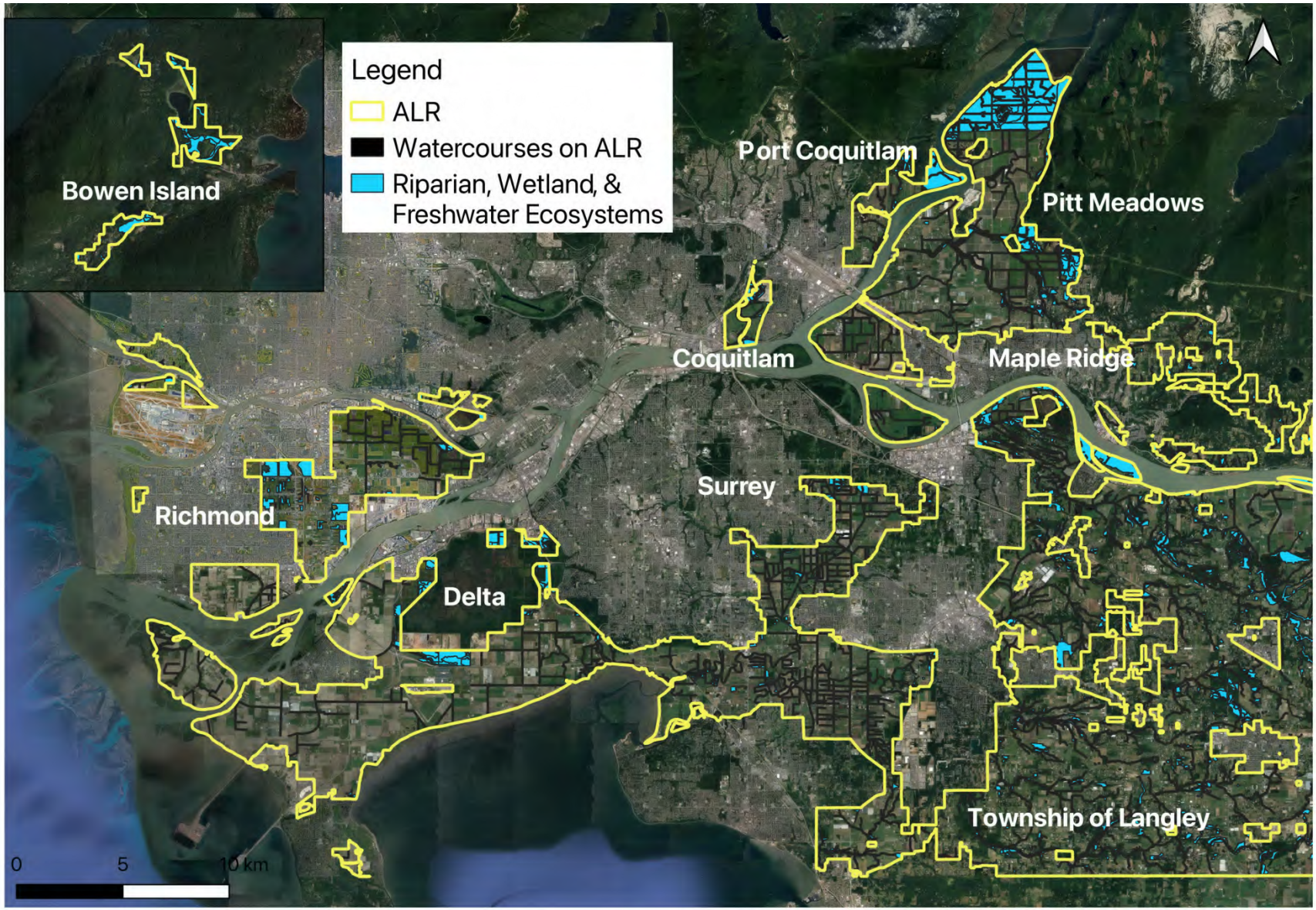

Figure 4 High opportunity areas for ecosystem conservation in the agricultural land reserve.

5.1.2 Areas with potential for ecosystem connectivity

Connecting watercourses within MV watersheds is another opportunity to target areas for restoring ecosystem services. Watercourses that are disconnected, meaning there is obstructive infrastructure (e.g. a pump station) that blocks the flow of water and/or there is a steep gradient of physical break in a water feature, present opportunities for potentially re-connecting riparian areas and watercourses.[48] Connected, healthy watercourses provide a greater level of ecosystem services, such as drainage, when compared to unconnected, fragmented watercourses. These can benefit both the farms within which they are found and the region as a whole.

A study completed in 2020 for Metro Vancouver identified areas of importance for ecosystem connectivity, which include agricultural lands along the southwest coast in Richmond and Delta.[49]

In order to explore examples of areas of opportunities for greater connectivity within the ALR, the following mapping layers were combined:

- ALR basemap,
- Watercourses within the ALR,
- Riparian, Wetland, and Freshwater ecosystems as identified by the SEI,
- Regional parks[50], and,
- Disconnected watercourses (mapping only available for watercourses leading to the Fraser River).

Based on the GIS mapping available, there are approximately 605 km of disconnected watercourses in the ALR within Metro Vancouver that appear to be discharging to the Fraser River. Figure 5 (next page) shows opportunities for areas of increasing or maintaining connectivity of water-influenced ecosystems.

These are the areas where the disconnected watercourses, regional parks and sensitive ecosystems intersect and/or are in proximity to one another. They are particularly prevalent in Pitt Meadows, Richmond, Delta, and north Langley – indicating opportunities for better drainage support. Site specific visits to these areas would be required to determine appropriate BMPs for increasing and/or maintaining ecosystem connectivity on a watercourse-by-watercourse basis. Examples are described in Section 5.2.

[48] A previous analysis to identify the disconnected watercourses leading to the Fraser River was undertaken by Watershed Watch Salmon Society and used in this mapping exercise with permission.

[49] Evaluation of Regional Ecosystem Connectivity, Metro Vancouver. 2020. Diamond Head Consulting.

[50] Areas adjacent to regional parks with natural areas and the SEI areas are examples of opportunities for connecting water-influenced habitats to more intact ecosystems.

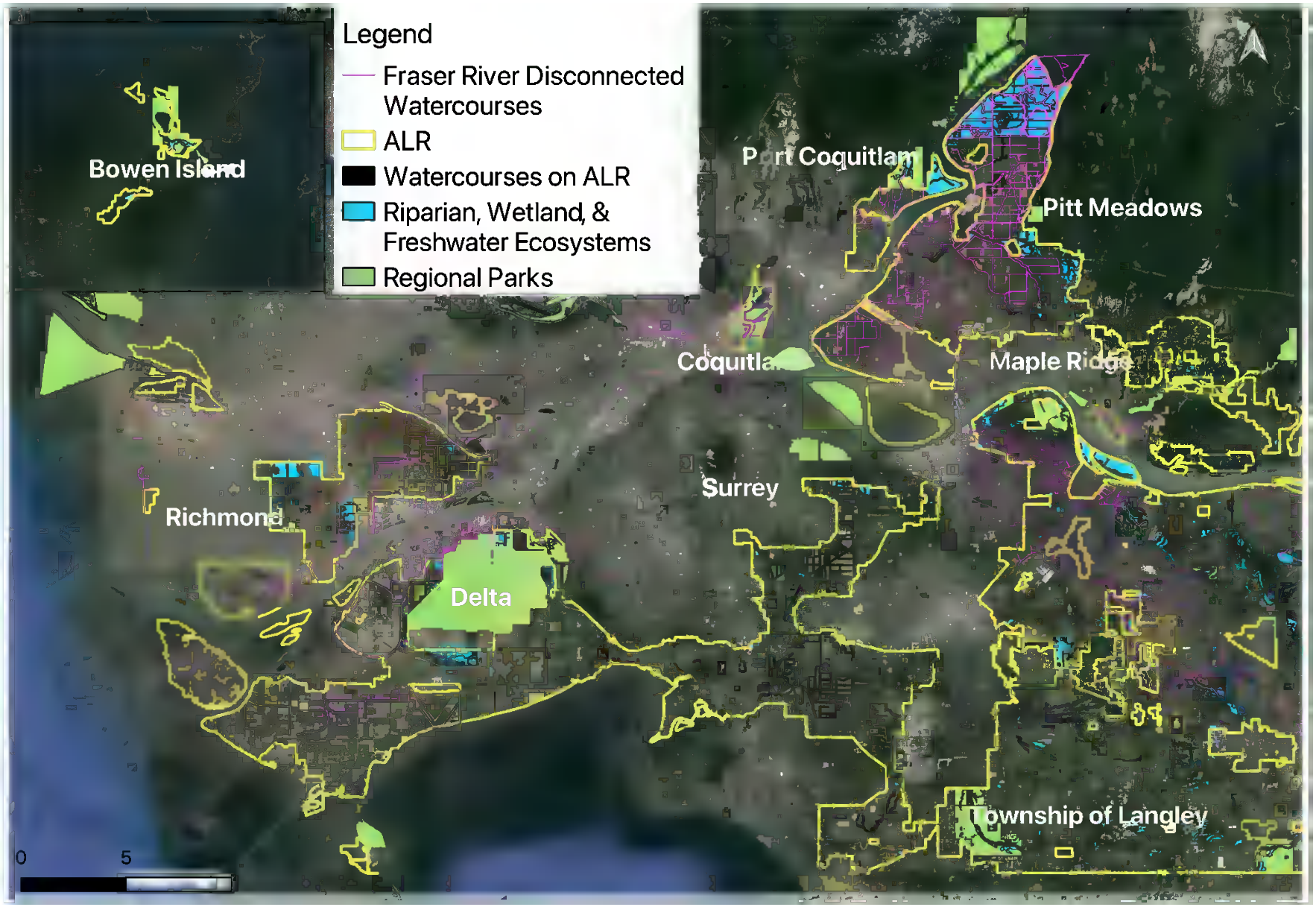

Figure 5 Examples of mapping data that can be used to identify areas with potential for connecting ecosystems.

5.1.3 Areas with potential to mitigate flood impacts

Healthy ecosystems have the potential to manage the flow and storage of water, which can help reduce the magnitude of flood damages in some instances.[51] Conserving and connecting existing aquatic ecosystems and restoring disconnected watercourses can help to manage the flow of water during a flood event. Targeting agricultural lands to restore and conserve ecosystems in flood risk areas can be part of a suite of tools to reduce a flood's impact within the region. To investigate the potential of the ALR to mitigate flood impacts, mapping data for three scenarios were explored[52] using mapping data that already aligns closely with projected impacts for the region due to climate change. Figures 6 and 7 (next pages) identify areas of the ALR that are projected to be impacted by Fraser River freshet flooding. The two flood scenarios estimate flood levels under projected climate change conditions in 2050.[53] The conditions include 0.5-metre sea level rise and changes in peak river flows. The two scenarios are a 1% Annual Exceedance Probability (AEP) flood (i.e. 100 year) or 0.2% AEP (i.e. 500 year) flood on the Fraser River.[54] These scenarios assume that dikes in different locations will overtop, but that no dikes will fully breach. Figure 8 (following pages) identifies a third scenario, whereby the ALR would be impacted by estimated flood levels of a 0.2% AEP (500 year) coastal storm surge flood under present day climate conditions and sea level. Table 11 presents the length of watercourses and area of riparian habitat in the ALR that would be within the flood extent of the three flood scenarios. These large numbers of watercourses and riparian areas illustrate the potential opportunities in the ALR to provide flood mitigation services.

Table 11 Length of watercourses and area of riparian habitat in the ALR impacted by three flood scenarios.

Flood Scenarios	Length of all watercourses within all ALR in MV (km)	Riparian habitat* within the ALR that would be flooded (ha)
2050 Fraser River Freshet 1% AEP (100 year) Flood	374	1,120
2050 Fraser River Freshet 0.2% (500 year) Flood	528	1,580
0.2% (500 year) Coastal Storm Surge Flood	819	2,460

*assumes 15m buffer on either side of watercourse

There are many additional flood scenarios that may occur, for example overland flooding from intense rainfall events and riverine flooding from major rivers (e.g. Alouette, Nicomekl, Serpentine and Little Campbell). In future analyses, these flood scenarios could be mapped to understand the full extent of flood mitigation potential of the ALR. It is likely that almost all of the ALR within MV could be impacted by overland, riverine and/or coastal flooding in the future.

[51] Aguiar, F. C., Manolaki, P., Bruno, D., Bejarano, M. D., ... & Dufour, S. 2020. Global overview of ecosystem services provided by riparian vegetation. BioScience, 70(6), 501-514.

[52] Fraser River Freshet Flood and Coastal Storm Surge Flood mapping layers were provided by the Fraser Basin Council.

[53] Fraser Basil Council. 2019. Flood Modelling and Mapping in BC's Lower Mainland: A Project Primer.

[54] Annual Exceedance Probability (AEP) Refers to the probability of a flood event occurring in any year. The probability is expressed as a percentage. For example, a large flood that may be calculated to have a 1% chance to occur in any one year is described as 1% AEP. The measure has replaced more traditional time-based expressions of probabilities: 2% = 50-year flood, 1% = 100-year flood, 0.5% = 200-year flood, 0.2% = 500-year flood.

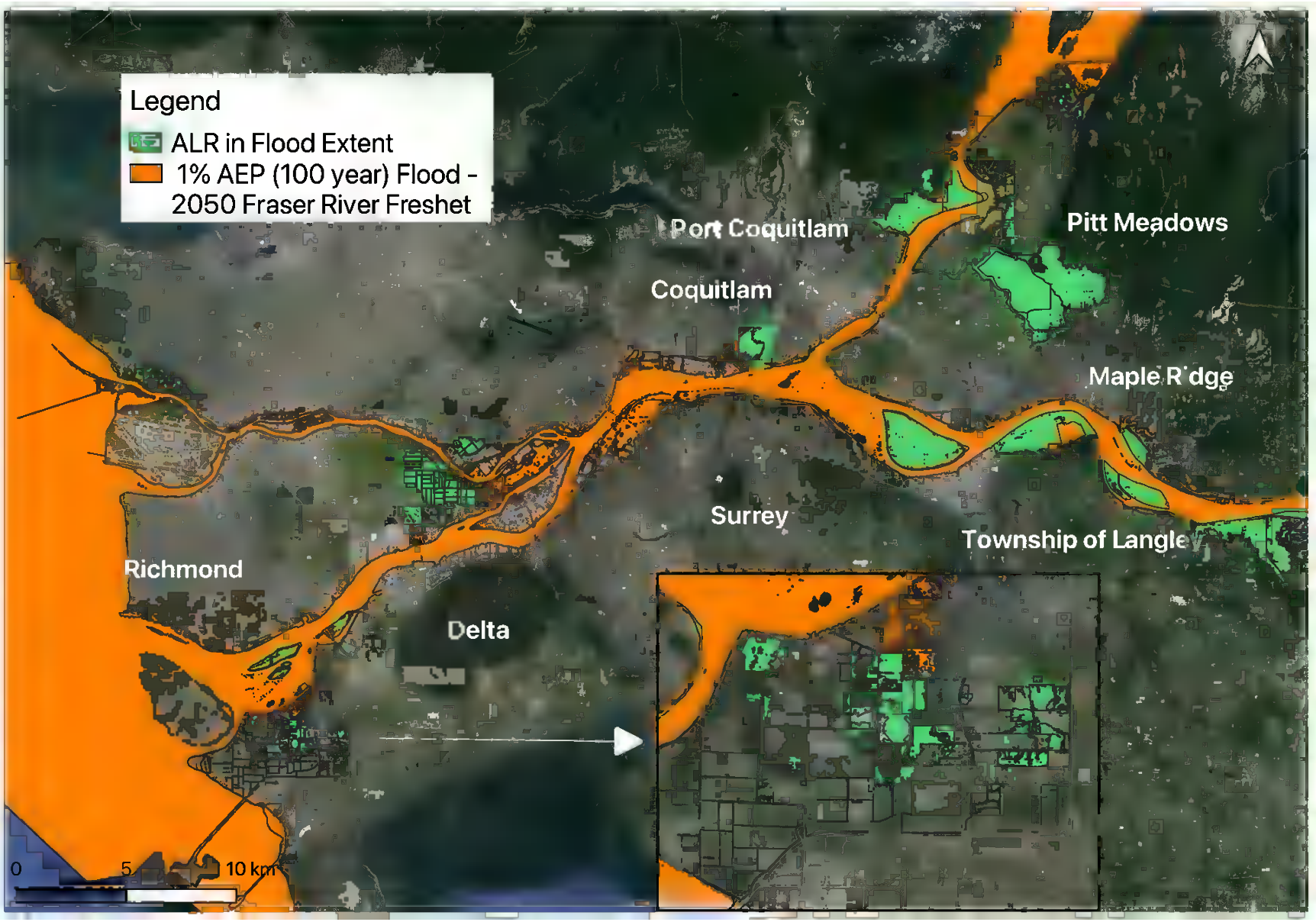

Figure 6 ALR that will be impacted by a 100-year Fraser River freshet flood event.

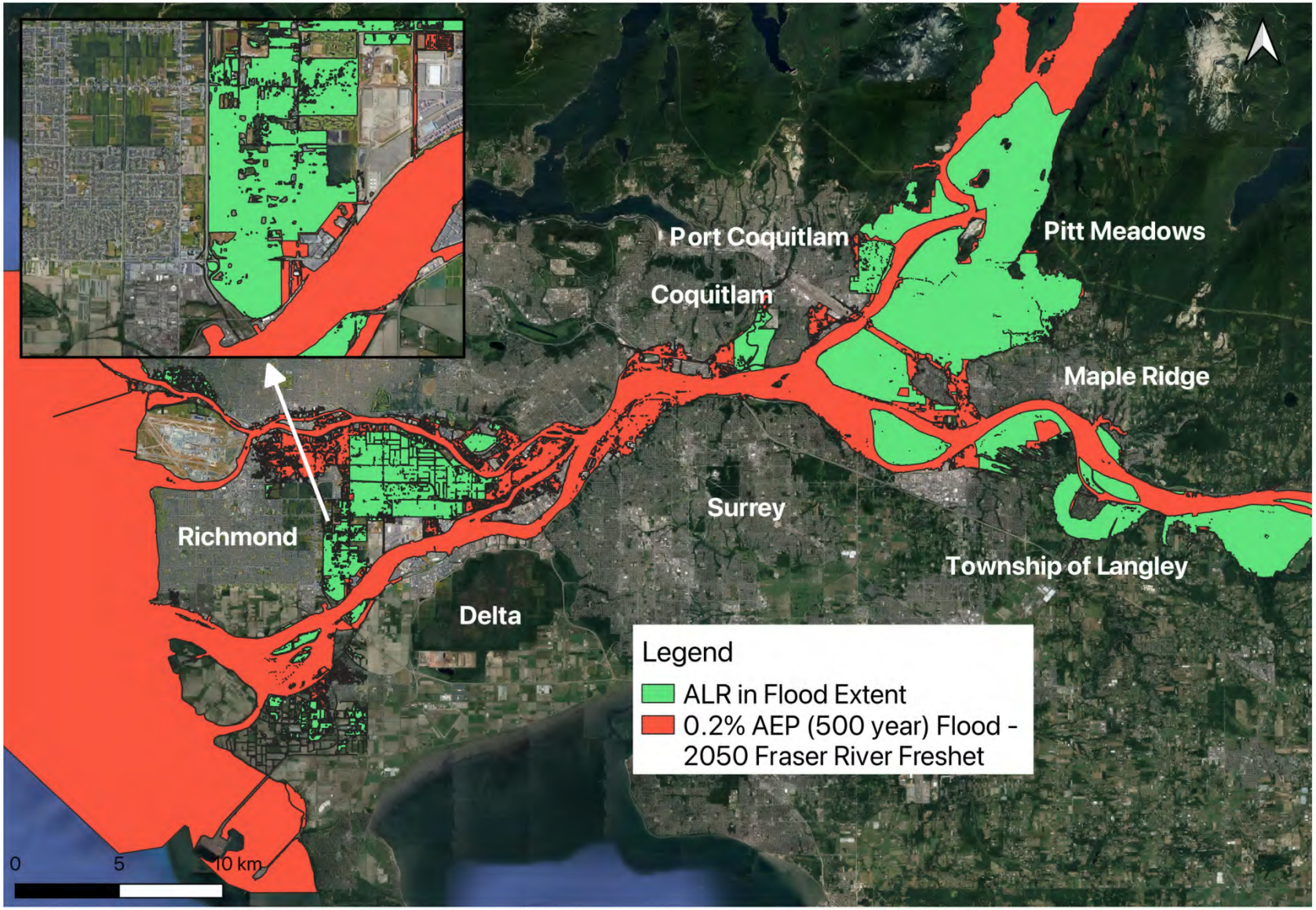

Figure 7 ALR that will be impacted by a 500-year Fraser River freshet flood event.

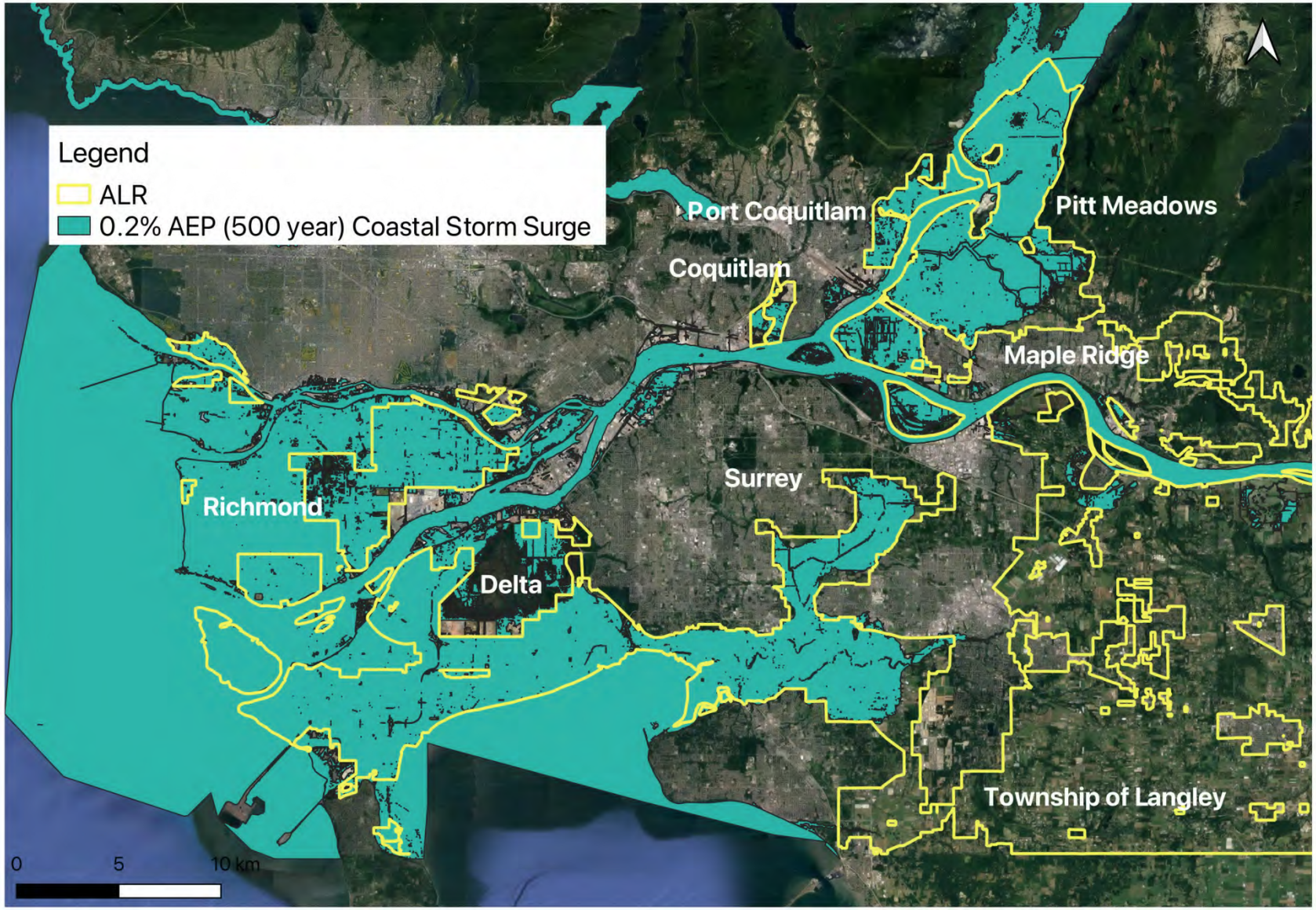

Figure 8 ALR that will be impacted by a 500-year coastal storm surge event.

5.2 Examples of Agricultural Lands Supporting Ecosystem Services

As identified through the mapping exercise and existing programs in the region, the total area and range of ecosystems in MV with opportunities to support ecosystem services within the ALR is vast. A selection were chosen to illustrate the wide-array of possibilities.

5.2.1 Maple Ridge: Riparian Area Conservation & Connectivity

Figure 9 presents an example of how agricultural lands provide corridors of connected habitat along watercourses. This area in Maple Ridge is classified as sensitive within the SEI indicating it is ecologically significant and relatively unmodified, presenting a good opportunity to conserve existing habitat. As illustrated in Figure 9, the vegetated areas along the watercourse in the ALR are connected to a regional park, providing a continuous riparian buffer and forested habitat. Figure 10 (next page) provides an example of the forest and riparian area along this watercourse. Examples of ecosystem services this area provides are: soil development and carbon storage, nutrient cycling, healthy habitat, biodiversity, increased water quality and water quantity (flood mitigation), clean air, and pollination among many others.

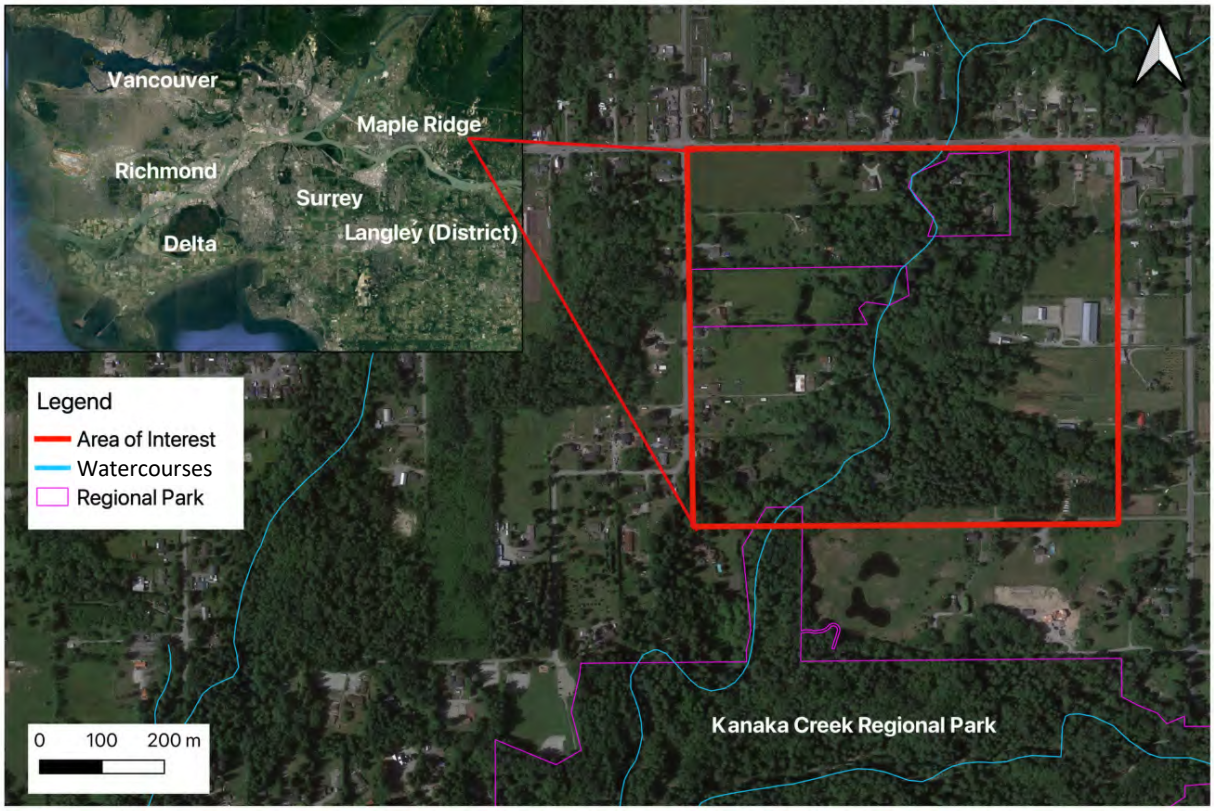

Figure 9 An example in Maple Ridge of an opportunity (red box) to conserve and connect ecosystems.

Figure 10 Example in the ALR of a watercourse with a riparian buffer that provides connectivity.

Examples of BMPs that landowners can employ to conserve this riparian buffer and forest ecosystems include the following:

- Identifying forest stands for protection from cutting and deadwood removal.
- Conserving wildlife trees, rock piles, and other wildlife habitat features.
- Retaining a wide variety of native plants that are adapted to living in riparian areas.
- Coordinating and implementing additional BMPs that have already been developed for MV, such as controlling invasive species.
- Avoiding or minimizing the impact of farm machinery use in or around riparian areas.
- Managing the timing and intensity of livestock use of forested pastures and tree/shrub stands to avoid heavy browsing and maintain healthy shrub/tree populations.

This is one of many areas in the ALR within Metro Vancouver that have healthy ecosystems. Assisting and engaging with landowners to conserve these areas is an opportunity to ensure these ecosystems stay healthy and provide the connectivity required for the robust provision of ecosystem services.

5.2.2 Pitt Meadows: Riparian Area Restoration & Connectivity

The area outlined in Figure 11 is an example of a watercourse within an agricultural area in Pitt Meadows that can be restored and connected to provide flood mitigation and habitat connectivity. The agricultural area is within the flood extent of the 0.2% AEP Fraser River freshet flood and the coastal storm surge, and the watercourse is classified as disconnected, indicating there are some obstructions limiting water passage. Some of this area is also classified at sensitive ecosystems, which provides the opportunity to conserve those ecosystems while connecting the entire watercourse to benefit drainage and restoring the riparian buffer where needed.

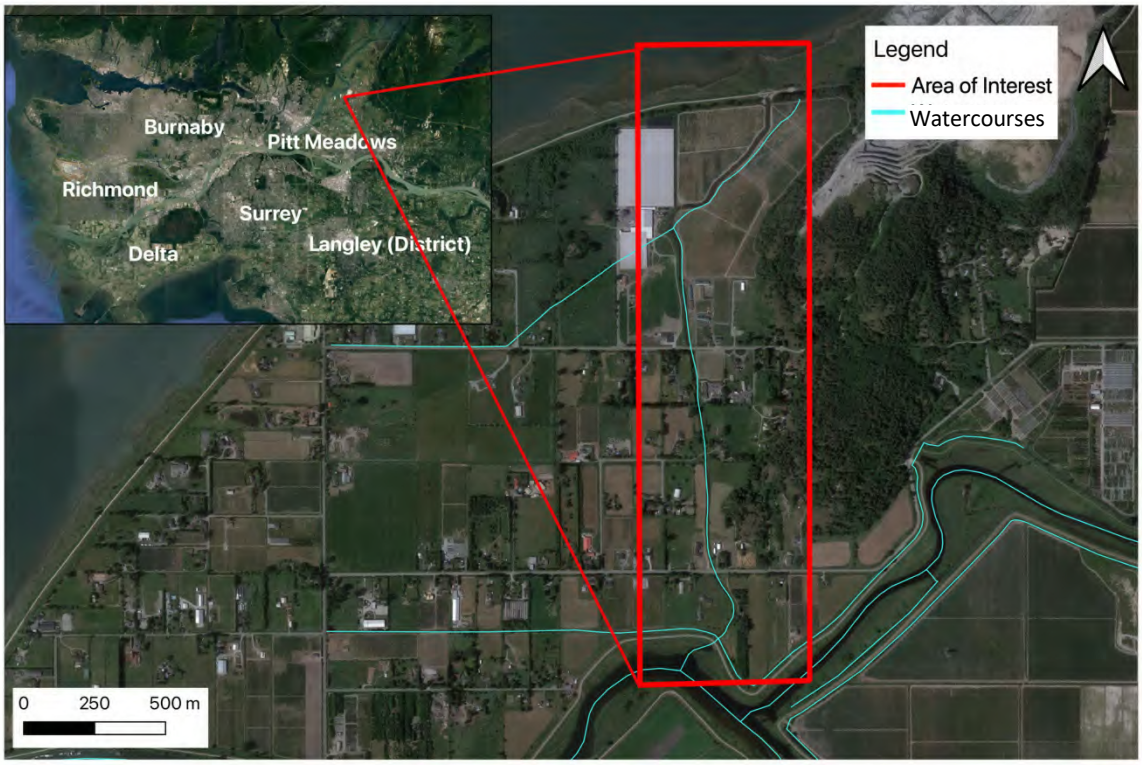

Figure 11 An example in Pitt Meadows of an opportunity (red box) to connect watercourses in flood extents.

Figure 12 (next page) illustrates examples of sites within this area where there are riparian areas with opportunities for restoration to improve drainage, water flow, and ecosystem health. In several places, there is no vegetation adjacent to the stream, or large areas of invasive species such as Himalayan blackberries, and/or no trees established.

Figure 12 Examples of disconnected watercourses that indicate opportunities for riparian restoration.

To increase the ecosystem services in these disconnected watercourses, riparian buffers can be restored with native species and obstructions in the watercourse can be removed. Restoring the vegetative riparian buffer allows for increased water storage, which can slow water movement during a flood event, and removing obstructions can assist with drainage.

Examples of BMPs the landowners can employ to restore the riparian buffer include the following[55]:

- Removing and controlling invasive species and implementing other BMPs related to invasive species that have already been developed for MV.[56]
- Avoiding or minimizing the impact of farm machinery use in or around riparian areas.
- Improving stability with erosion control structures by:
    - Contouring terraces with earthworks and seeding;
    - Stabilizing gullies and watercourses with erosion control matting, silt fencing, seeding;
    - Stabilizing banks through bank shaping, revetment, gabions, riprap, crib walls, re-vegetation, and blanketing; and
    - Protecting riparian trees and shrubs from rodents such as beavers.
- Appropriately sizing and placing culverts so that water movement is not impeded.
- Avoiding practices that artificially alter streamflow.

This is one of many areas in the ALR within Metro Vancouver that provides an opportunity to restore and connect watercourses to help manage flood impacts, increase habitat for wildlife, and improve drainage.

5.2.3 Township of Langley: Riparian Area Restoration & Conservation

Several agricultural producers in the Township of Langley participated in the Township's Ecosystem Services Initiative program from 2015-2019 and several have continued stewardship of ES in the Farmland Advantage program. Figure 13 and Figure 14 are examples of a property participating in the restoration and conservation of a riparian area over several years of being involved in PES programs. As part of the program, the landowner receives support in identifying BMPs for conserving and restoring the riparian buffer. The Farmland Advantage program assists with costs and coordination of the labour and equipment required to complete the restoration work. The landowner receives modest financial compensation for implementing the BMPs and is under contract to maintain healthy vegetation along the riparian area.

The landowner, in collaboration with local non-profit organizations, has implemented the following:

- Installed fencing along the creek to stop livestock access which has helped to reduce bank erosion and increase water quality.

[55] BC Ministry of Agriculture, Food and Fisheries. 2021. British Columbia Environmental Farm Plan Reference Guide 6th Edition.
[56] Invasive Species Council of Metro Vancouver has guidance on BMPs, relevant to agricultural lands.

- Eradicated Himalayan blackberry and planted native trees and shrubs to reduce erosion and capture sediment and nutrient run-off.
- Rehabilitated the stream channel with plantings and bank stabilization to limit impact of reed canary grass and restore ecosystem function.
- Maintained native plantings to ensure plants are established.

Examples of ecosystem services provided by this riparian area include soil development and carbon storage, nutrient cycling, healthy habitat, biodiversity, increased water quality and water quantity (flood mitigation), clean air, and pollination among many others.

Figure 13 Fencing to protect riparian area from livestock.[57]

[57] Farmland Advantage Program. Photo Credit: Darrel Zbeetnoff.

Figure 14 Recently planted native plants along the riparian area.[58]

5.2.4 Richmond: Grassland Set-Aside Fields

Several farmers in Richmond participate in the *Grassland Set-aside Stewardship Program* managed by the Delta Farmland & Wildlife Trust (DFWT). The program assists and compensates producers for planting grassland habitat on agricultural land and the grassland set-aside fields are left to rest for up to six years. Often farmers enroll in the program to restore degraded land, transition conventional fields into organic production or diversify options for crop rotations.

Fields brought out of production for grassland habitat provide many ecosystem services and benefits to producers including:

- Providing habitat for wildlife such as raptors, wading birds, songbirds, small mammals, and pollinating insects,
- Supporting high densities of the Townsend's Vole, a small native mammal, that is prey for a variety of raptors and wading birds,

[58] Ibid.

- Providing roosting habitat for ground-perching raptors, such as the Northern Harrier and Short-eared Owl, and
- Improving soil fertility including improved soil structure, reduced soil compaction, increased soil organic matter, and improved nutrient cycling.

Figure 15 Grassland set-aside field in Richmond.

5.2.5 Delta: Winter Cover Cropping

Winter cover cropping is a BMP that several farmers within the City of Delta employ, with the assistance of the DFWT *Winter Cover Crop Stewardship Program*. This program helps farmers establish vegetative cover on their fields after the harvest of their cash crop in late summer/early fall. A cost-share is offered to participating farmers to incentivize this sustainable practice.

Winter cover crops provide an array of ecosystem services and benefits to producers including:[59]

- Providing feeding habitat for herbivorous waterfowl and shorebirds,
- Providing food and habitat for soil microorganisms,
- Protecting the soil from erosion due to heavy winter rain,
- Scavenging excess nutrients such as nitrogen before they leach from the soil,
- Increasing soil organic matter,
- Reducing soil compaction,
- Improving water infiltration,
- Suppressing weeds, and,
- Increasing yields of cash crops.

[59] Delta Farmland & Wildlife Trust. Winter Cover Crop Stewardship Program.

Figure 16 Snow Geese grazing on a winter cover crop planted on farmland in Delta.[60]

6.0 Valuing and Supporting Ecosystems Services on Agricultural Land

Economic value is associated with products grown and sold from agricultural land, and to the land itself from a real estate perspective. However, other non-farming activities, such as stewarding healthy ecosystems, are rarely valued financially. Assigning monetary value to ecosystem services is a difficult task as they can neither be bought nor sold. However, numerous methods over the past decades have emerged in an attempt to measure their value. This include developing valuation frameworks, assessing public support, and evaluating services as green infrastructure assets. These are explored in the following sections.

[60] Bradbeer, David & Halpin, Luke. 2012. Managing cereal grasses as waterfowl lure crops: investigating planting dates and waterfowl feeding ecology. Delta Farmland & Wildlife Trust.

6.1 Valuation Frameworks for Ecosystem Services

Several reports have attempted to estimate the monetary value of ES provided by agricultural lands in MV.

- Using 2005 dollar values, a study found that the value of agricultural lands was $698 per ha for climate regulation (or stored carbon) and $422 per ha for recreation/tourism benefits.[61] In addition to the land used for crops, agricultural lands often have hedgerows, wetlands and/or forest stands which also store carbon and provide other ES benefits.
- A 2009 study conducted for MV concluded that the present value of public amenity benefits and ES provided by each ha of farmland in MV in 2007 was estimated to be $143,000 per ha.[62] This is about 10 times greater than the market value of farm products themselves, which were valued at $14,200 per ha. Amenity benefits associated with farmland that were identified in the report included access to local food, greenspace, lifestyle and viewscapes while ES included wildlife and fish habitat, and groundwater recharge.
- More recently, a 2020 study, provided estimates for grasslands that are set aside and hedgerow programs that are managed by the DFWT. The 220 ha of farmland under the grassland set aside program were estimated to provide annual ES value of $584,943, which is $2,660 per ha.[63] This includes ES provided by the grasslands such as improvements to air quality, water regulation, erosion control, soil formation, waste treatment, biological control, recreation and aesthetics, pollination services, public value/wildlife habitat, carbon storage and carbon sequestration. For the 3 ha of hedgerows, an annual average ES value of $4,053 was derived ($1,350 per ha), and there was a total contribution to public value for habitat of $3,885.[64]

These reports provide examples of the value of agricultural lands beyond food production. It is difficult to estimate the ES value of all agricultural lands in MV, but considering there are approximately 5,334 ha of forests, 3,318 ha of riparian areas and 4,167 ha of wetlands within the ALR, this amounts to vast economic benefits to the region from these ecosystems on agricultural lands. There are also several other benefits and opportunities that arise with the long-term stewardship of ES on agricultural lands such as improving partnerships with Indigenous communities to collaborate on traditional food system projects and developing research projects in partnership with local colleges and universities.

A new study to estimate the ES values contributed within the context of MV agricultural land would assist decision-makers and the public in understanding the benefit to society from the stewardship of agricultural lands.

[61] Wilson, Sara J. 2010. Natural Capital in BC's Lower Mainland: Valuing the Benefits from Nature. David Suzuki Foundation.
[62] Robbins, M., Olewiler, N., and M. Robinson. 2009. An Estimate of the Public Amenity Benefits and Ecological Goods provided by Farmland in Metro Vancouver.
[63] Kerr, Gillian. 2020. Ecosystem Services Assessment of Delta Farmland & Wildlife Trust Stewardship Programs.
[64] Ibid.

Case Study:
Valuing Bertrand Creek

In 2022, a study was completed in the Township of Langley that used the Ecological Accounting Process (EAP) to calculate the value of ecosystem services provided by Bertrand Creek. The EAP accounting system includes values from BC Assessment and Farm Credit Canada to determine the value of the protection and maintenance of the natural asset to the public. The EAP can be integrated into a Local Government Finance Strategy for sustainable infrastructure funding. In the ToL the EAP for Bertrand Creek was completed to describe and quantify the stream system's financial, social and ecological values. The study found that the value of Bertrand Creek is $1,550 per km and requires an annual management and maintenance value of $290,000 per year. Polling has shown that the residents of ToL are willing to pay a parcel tax fee for projects that improve ecosystem health on farmland. The value of Bertrand Creek calculated through the EAP process can help provide the baseline funding value required for a Payment for Ecosystem Services program for the watershed.

Figure 17 (next page) describes a framework, called the Total Economic Value (TEV), which is helpful in understanding the value of ES. The TEV framework indicates that agricultural lands are an important component of healthy regional ecosystems and have even greater potential to benefit the region if farm practices that increase the health of ecosystems are supported and incentivized.

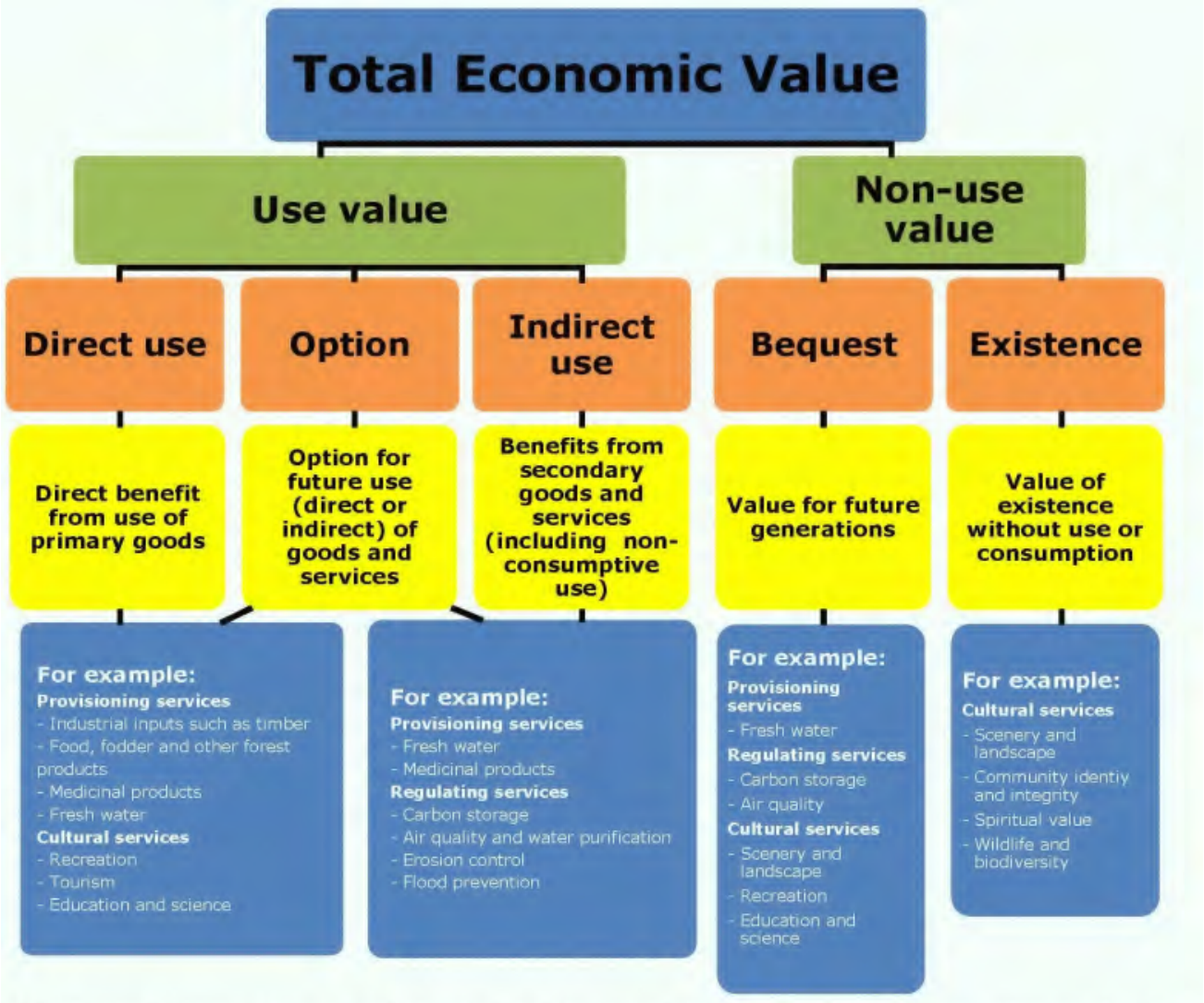

Figure 17 Description of the Total Economic Value Framework for valuing ecosystem services.[65]

[65] Statistics Canada.2013. Total Economic Value Framework.

6.2 Public Support for Stewardship of Ecosystem Services

As part of the approach to assign values to ES, qualitative surveys can be used to understand how important ES are to the community and how much residents would be willing to pay to support ES. Several recent studies and surveys have been conducted within MV that ask respondents to rank the importance of ES derived from agricultural land, and what, if any, monetary value they would be willing to contribute to a program that financially compensates agricultural producers for stewarding ES. Table 12 (next page) provides a summary of each study. The overall findings across all three studies were that:

1. Respondents understood the important role that farmland plays in protecting and stewarding the environment, and
2. Respondents are willing to financially support the stewardship of ES on agricultural lands.

In the broadest definition, the 'payment' in a payment for ecosystem services program can be viewed as a landowner contract designed to provide or maintain ecosystem services through the implementation of BMPs. For example, payments can be based on protecting a single ecosystem service (e.g. the mass of carbon sequestered) or a multitude of ecosystem services (e.g. maintaining riparian buffers that enhance wildlife habitat, soil conservation and control runoff).[66] PES programs can take many forms; however, most include some form of direct payments in exchange for a long term landowner agreement (e.g., a contract). Direct payment can be provided to the landowner or to local partners (e.g., restoration organizations) to implement and maintain the BMPs.

Direct payments may include:

- Cost-share programs, where the funder and farmer provide money (or in-kind labour), to implement or maintain BMPs. For example, the Provincial Environmental Farm Plan BMP program, which funds the implementation of winter cover crops to reduce exposed agricultural soils during winter.
- Compensation to offset opportunity costs from production lost to conservation or preservation. For example, DFWT program in which farmers are compensated for not cultivating an area of their land for several years and the land is planted with native grassland species.

[66] George W. Powell. 2015. Agriculture and Ecological Services: Recommendations for Support Programming in British Columbia.

Table 12 Recent polling results about the importance and willingness to pay for ecosystem services on agricultural lands.

Study Name	Delta Agriculture Plan Update Survey	Biodiversity Conservation Survey as part of the Birds and Biodiversity Conservation Strategy	Langley Ecological Services Initiative Community Survey
Date	2021	2019	2018
Municipality	City of Delta	City of Delta	Township of Langley
Organization	City of Delta	City of Delta	Langley Sustainable Agriculture Foundation
Objective(s)	To obtain feedback on issues, challenges, and opportunities as experienced by community members regarding the agriculture sector.	To determine local and community values and attitudes towards issues related to land, water, wildlife, agricultural lands, and heritage landscapes.	To determine the public acceptance of a sustainable funding method for a long term ecological services program in the Township of Langley.
Type	Online Survey	Phone Survey	Phone Survey
Responses	568	600	200
Findings	*I would be willing to pay higher taxes or fees to support ecosystem health on farmland* received an average agreement rating of 6.0/10. •80% responded yes to the question: *Do you support initiatives that work with farmers to protect natural areas?* • For the question: *How much would you be willing to pay more in taxes or fees per year to support ecosystem health on farmland?:* • 20% of respondents were willing to pay $0.50 – 4.99/year • 53% of respondents were willing to pay $5 -10/year • 9% were willing to pay more than $10/year • 12% of respondents were not willing to pay	• "Farmland supports birds and wildlife" received an average agreement rating of 8.9/10. • Among the 565 residents that travel on roads adjacent to farmer's fields in Delta, 69% indicate it is very important to them to conserve Delta's working agricultural landscape. • *I would be willing to pay higher taxes to protect the environment* received an average agreement rating of 6.1/10.	• 77% of respondents indicated support for the Langley Ecological Services Initiative (a PES project) with ecological protection, sustainability of farms and protection of ALR viewed as the key benefits. • 68% said they support compensating or making payments to farmers so they can take actions that protect and enhance natural areas on their farms. 18% did not support and 14% had no opinion. • All residents were asked what amount they believed would be a reasonable parcel tax on each property to provide sustainable funding for the initiative: • 44%, indicated an amount in the range of $10 to $20 • 26% indicated less than $10, and • 23% said no additional tax.

6.3 Linking Ecosystem Services, Green Infrastructure and Natural Assets on Agricultural Land

Local governments across the province, country and world are looking to green infrastructure and natural assets as a tool to adapt to climate change. Green infrastructure and natural assets are often defined in similar ways - they are the stock of natural resources or ecosystems (e.g., wetlands, forests, streams) that are relied upon, managed, or could be managed by a local government for the provision of one or more services to a community. They provide critical services and functions to communities both on their own and as part of infrastructure systems with engineered assets, including: soil quality and stability; flood protection; drainage and rainwater attenuation; water treatment and storage; recharge of aquifers, rivers and creeks; recreation; climate regulation; habitat and biodiversity; air quality regulation; and health and well-being.[67] Often green infrastructure includes 'bioengineered' approaches such as bioswales, rain gardens, green roofs, and others.[68] Increasingly there is growing evidence that through the management of natural assets, local governments can decrease capital, operations, and maintenance costs; increase levels of service; and, enhance their ability to adapt to climate change – all while protecting or enhancing the ES that natural assets bring to communities.[69]

Agricultural lands represent 20% of Metro Vancouver's land base, therefore these lands are home to a large part of the natural asset and green infrastructure network. Well managed agricultural lands can provide food along with ES to increase overall regional resiliency to climate change. There is an opportunity in MV in the planning and management of natural assets and green infrastructure to encourage, promote and incentivise increased stewardship of agricultural lands. This opportunity is identified in a research and planning project being undertaken by MVRD to advance a green infrastructure network across the region.[70] The primary objective of this Regional Green Infrastructure Network (RGIN) initiative is the protection of ecological connectivity and maximizing ES co-benefits. Agricultural lands are identified as important hubs for connectivity and providing ES, and compensation to farmers is mentioned. Other jurisdictions with MV have also conducted planning projects and strategies around the importance of supporting natural assets. For example the City of Surrey already has a green infrastructure network initiative established. While agricultural lands are recognized in regional and municipal planning projects as crucial to the resilience of natural assets, additional support is required to incentivize long-term stewardship of agricultural land and increase public awareness of the value of ES on agricultural land. Several options for support are describe in the next section.

[67] Asset Management BC. 2019. Integrating Natural Assets into Asset Management.
[68] Diamond Head Consulting, Ecoplan International, and Calypso Design. 2015. Connecting the Dots: Regional Green Infrastructure Network Resource Guide.
[69] Asset Management BC. 2019. Integrating Natural Assets into Asset Management.
[70] Staff communication, Metro Vancouver. 2022. Update on Advancing the Regional Green Infrastructure Network.

7.0 Approaches for Ecosystem Services Support on Agricultural Land

Policy, financial and regulatory mechanisms were researched and considered as approaches for supporting long-term agricultural ES within Metro Vancouver agricultural land. The approaches considered were:

- Policy: Official Community Plans, RGSs, and other local government plans and strategies.
- Regulatory: Zoning and land use bylaws, Statutory Right of Ways (SROWs), and covenants on title.
- Financial: Fees, parcels tax, property transfer tax, and property value tax to fund stewardship of ES on agricultural land.

The approaches were evaluated based on the following criteria:

- Effort of implementation,
- Timeframe to implement,
- Regional control and consistency, and
- Impact on the long-term stewardship of ecosystem services.

Based on the above criteria, the regulatory approaches of SROWs and covenants on title were deemed too improbable and time-consuming to implement on a regional scale over thousands of private properties due to costs, existing legislation, enforcement capacity, and the high cost of land in MV.

Provincial legislation limits local government authority to control activities within the ALR. The *Agricultural Land Commission Act* requires all local government bylaws to be consistent with the Act's mandate to protect farmland, however there is nothing with the ALC Act or regulations to suggest that restoration and maintenance of ecosystem services would not be supported. The *Farm Practices Protection (Right to Farm) Act* prohibits local government regulation from interfering with normal farm practices. Restricting agricultural uses on land within the ALR for ecological purposes must be done with caution so as not to limit the ability to farm the entire parcel. Covenants on agricultural land that stipulate certain stewardship activities, such as restoration and maintenance of 15 meters of vegetation next to streams, may be legal but would be challenging to monitor. These regulatory options would also require increased enforcement and compliance capacity within Metro Vancouver, and collaboration with member jurisdictions , to monitor any legal agreements on private lands.

Two approaches emerged as more appropriate for MV to initiate to support long-term ES benefits on agricultural land.

1. Support ES on agricultural land through policies and regulation in collaboration with local governments and the ALC.
2. Establish a regional conservation fund (or other appropriate funding mechanism) to support programs that steward PES programs on agricultural land.

These two approaches are described in more detail below. They do not preclude the ability for other projects, programs, or initiatives with similar ES objectives to operate alongside these approaches.

7.1 Supporting Stewardship of Ecosystem Services in the ALR through Policy, Zoning and Bylaws

As previously described, a significant portion of natural assets and green infrastructure in MV is in the ALR. This presents an opportunity, through policies and regulations, to encourage the stewardship of ES on agricultural land. Member municipalities and the MVRD already have the Regional Growth Strategy (RGS), OCPs, agricultural plans, climate change plans and other policy documents that support several aspects of agricultural stewardship such as encouraging soil conservation practices, wildlife friendly agricultural practices and acknowledgment of the potential for agricultural land to increase wildlife habitat and biodiversity and help the region adapt to and mitigate climate change.

In addition to policy statements, local governments have regulatory tools at their disposal such as zoning and land use bylaws, that can be used to support the ALR and its benefit as green infrastructure. However, at a regional district level, there are fewer options available as compared to the municipal level (see Table 13, next page). Local governments can use their zoning and Development Permit Area (DPA) guidelines to regulate the location of buildings and ancillary activities such as parking, and commercial uses, in favour of green infrastructure values.[71] Several municipalities already have DPAs related to environmental protection, streamside/watercourse protection, and farmland protection. However, the DPAs are not regionally consistent which can lead to different outcomes for the health of ecosystems on agricultural lands.

As previously mentioned, MVRD is working on a project to develop a Regional Green Infrastructure Network (RGIN). There is a strong opportunity to align the RGIN with agricultural lands to support ecosystem services. The RGIN is expected to acknowledge and identify all areas in the region with significant ES, including areas within the ALR. Once complete, while stopping short of regulating land use, the RGIN could be used to signify policy objectives, clarify decision-making requirements, and potentially minimize ALR applications for exclusion or non-farm use as it signals support for maintaining agricultural ES.

Overall, policies are important to create the foundation of support for ES on agricultural land. MVRD along with most member municipalities have expressed support in planning documents and though various zoning and land use bylaws. However, there is no comprehensive regional approach for documenting and creating policy for ES on agricultural land, and additional implementation efforts to follow through on the policy statements is required.

[71] University of Victoria, Environmental Law Centre. 2021. Green Bylaws Toolkit for Protecting and Enhancing the Natural Environment and Green Infrastructure.

Table 13 Differences in environmental protection authority for municipalities and regional districts.[72]

ENVIRONMENTAL PROTECTION AUTHORITY	MUNICIPAL	REGIONAL DISTRICT
Regional Growth Strategies	*Local Government Act* Part 13	*Local Government Act* Part 13
Official Community Plans (including Local Area & Watershed Plans)	*Local Government Act* ss.471-475, 477, 478, 510 (OCP) *Community Charter* s.69 (drainage)	*Local Government Act* ss.471-475, 477, 478, 510 (OCP) *Local Government Act* ss.306-307, 312 (drainage)
Zoning Density Bonus/Amenity Zoning Parking Runoff Control & Impermeable Surfaces	*Local Government Act* s.479 *Local Government Act* s.482 *Local Government Act* s.525 *Local Government Act* s.523	*Local Government Act* s.479 *Local Government Act* s.482 *Local Government Act* s.525 *Local Government Act* s.523
Development Permit Areas	*Local Government Act* ss.488-491	*Local Government Act* ss.488-491
Riparian Tax Exemption	*Community Charter* s.225	*Local Government Act* ss.394-395
Impact Assessment Development Approval Information Areas Development Process	*Local Government Act* ss.484-487 *Local Government Act* s.460	*Local Government Act* ss.484-487 *Local Government Act* s.460
Watercourse Protection Bylaw	*Community Charter* ss.8(3)(j), 9(3)(a) & 15 *Spheres of Concurrent Jurisdiction - Environment and Wildlife Regulation* s.2(1)(a)	
Rainwater Management Bylaw	*Local Government Act* s.523 (impermeable surfaces) *Community Charter* s.69 (drainage)	*Local Government Act* s.523 (impermeable surfaces) *Local Government Act* ss.306-307, 312 (drainage)
Landscaping Bylaw	*Local Government Act* s.527 *Community Charter* s.15	*Local Government Act* s.527
Tree Protection Bylaw	*Community Charter* ss.8(3)(c), 15 & 50	*Local Government Act* s.500
Soil Removal & Deposit Bylaw	*Community Charter* ss. 8(3)(m), 9(1)(e) & 15	*Local Government Act* s.327
Pesticide Use Bylaw	*Community Charter* ss.8(3)(j), 9(3)(a) & 15 *Spheres of Concurrent Jurisdiction - Environment and Wildlife Regulation* s.2(1)(b)(ii)	
Invasive Species Bylaw	*Community Charter* ss.8(3)(j), 8(3)(k), 9(3)(a) & 15 *Spheres of Concurrent Jurisdiction - Environment and Wildlife Regulation* s.2(1)(b)(iii) (control and eradication)	
Security	*Community Charter* ss.8(8)(c), 17 & 19 *Local Government Act* s.502	*Local Government Act* s.502
Subdivision Servicing Bylaw	*Local Government Act* s.506 *Land Title Act* ss.83, 86	*Local Government Act* s.506 *Land Title Act* ss. 83, 86
Development Cost Charges Bylaw	*Local Government Act* s.559-565	*Local Government Act* s.559-565

[72] University of Victoria, Environmental Law Centre. 2021. Green Bylaws Toolkit for Protecting and Enhancing the Natural Environment and Green Infrastructure.

7.2 Regional Conservation Fund for Supporting Ecosystem Services on Agricultural Land

The second approach considered in detail is the establishment of a regional conservation fund to support programs that steward ES on agricultural land. A conservation fund is a local government service that is funded through a dedicated tax or fee, held and overseen by local government, and earmarked for the specific purpose of undertaking projects that support environmental conservation and community sustainability. Conservation funds can be initiated by local governments or by non-governmental organizations, but often require partnership with municipal, regional and First Nation governments to implement fund procurement (for example through the adoption of a bylaw) and to oversee administration and management of how fund monies are spent. Several regional districts across the province have implemented conservation funds including the Regional District of East Kootenay, Regional District of Central Kootenay, Regional District of North Okanagan, and the Regional District Okanagan Similkameen. These funds provide support to local non-profit organizations for conservation and restoration projects that have led to healthier ecosystems.

For a regional conservation fund in MVRD, conservation and restoration of ecosystem services could be a strong component of the fund priorities, but other broader objectives for the region could also be included to allow for greater impact to improving ecosystem health and benefits to the region. For example, projects that align with the objectives of the RGIN could also be supported by a local conservation fund. The objective of a fund must be clear to the public, have strong public acceptability, and have limits on fees procured from the public. Based on the recent polling and surveys in the region (described in section 6.2), residents in Delta and ToL are willing to pay for projects that result in stewardship of ES on agricultural land, however more detailed region-wide polling is warranted.

The following section provides more details on potential financing approaches for a conservation fund. Appendix B provides in-depth details and examples of how a conservation fund could be structured and implemented in Metro Vancouver, along with examples of other regional conservation funds. Conducting region-wide public opinion surveys would be important in determining if there is region-wide support for a local conservation fund, in addition to discussions with MVRD and member municipality elected officials and First Nations.

What types of projects could be funded and what impacts would the projects have?

Example 1: Compensation for Winter Cover Cropping

The DFWT has a winter cover cropping program that offers a $123-173/ha cost-share for farmers. In MV, there are approximately 3,640 ha of annual vegetable crops grown that could be suitable for implementing cover crops once the cash crops are harvested (Source: 2016 Agricultural Land Use Inventory). Assisting producers across the region to plant cover crops would cost approximately $540,000 (assuming a cost-share of $148/acre for 3,640 ha). Collecting $1 per year from every household in MVRD would raise approximately one million dollars for a fund (2021 Census reported 1,043,315 Total Private Households in Metro Vancouver). That money could then be used to assist producers in cover crop plantings. The benefits of cover cropping to the MV region include soil building; carbon sequestration; reduction in erosion, soil and water retention during floods; and forage for wildlife (such as migratory birds in the Fraser River Delta).

Example 2: Compensation for Riparian Habitat Restoration

Since 2021, five farms in the Little Campbell River watershed within the City of Surrey have participated in the Farmland Advantage program to restore and enhance riparian areas on their properties. On these farms, invasive species such as blackberries and reed canary grass were removed and replaced with native species. Beaver guards were also installed to help secure the survival of young trees in the riparian zone. Farmland Advantage receives federal and provincial funding to provide limited funding to cover the cost of materials and labour to undertake ecosystem restoration work and pays the farmer $1,500 per year to maintain the restored area. A Metro Vancouver conservation fund could provide funding to programs such as Farmland Advantage, which then leverage other funding sources to maximize the number of contracts with agricultural landowners throughout the region.

7.2.1 Conservation Fund Financing Options

Potential options for financing a regional conservation fund are discussed below. If MVRD were to pursue a conservation fund for the region, discussions with municipal and regional staff and a legal team would be required to determine an appropriate mechanism for collecting monies for a fund.[73]

Property Value Tax

Local governments calculate property taxes on the basis of the assessed or net taxable value of land and improvements (e.g. house, garage), unless exempted, and on the local government tax rate.[74] Property value tax can also be calculated on land only or on improvements only. Most local governments calculate property taxes using the variable tax rate system where tax rates are based on an amount per $1,000 of assessed property value (e.g., $0.10 per $1,000 of assessed property value). Tax rates vary for different property classes of land such as agricultural, residential, industrial, and commercial, so if the tax rate stays the same but property values rise, the local government's property tax revenue rises.

Parcel Tax

Regional districts and municipalities can apply a parcel tax to properties that receive a particular service. A parcel tax can be imposed in one of three different ways: on the basis of the same amount for each parcel of land; on the taxable area of a parcel; or on the taxable frontage of the parcel. For conservation funds, a single amount for each parcel is the appropriate method to use.[75] Under this method, the service establishment bylaw states the maximum dollar amount that can be taxed or requestioned each year and that amount is divided equally across the taxable parcels in the service area. A parcel tax does not rise as property values increase. The maximum amount that can be taxed each year remains the same over time unless the bylaw includes a provision that the maximum is determined by so many dollars or cents per $1,000 of taxable assessed value in the service area. The local government must create a parcel tax roll to impose a parcel tax. The roll lists the parcels to be charged and includes the name and address of the owners of each parcel. Once the local government completes the parcel tax roll, they must make it available for public inspection. The local government must form a review panel to consider any complaints about the roll and to authenticate it.

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[73] Taxation for regional district residents is different than for municipalities. In accordance with the *Local Government Act* (RSBC 2015 c.1), regional districts do not have the authority to issue property tax notices to residents and businesses, nor collect taxation directly from residents. In most regions of the province, municipalities collect the regional district taxes directly from citizens within their boundaries. As such, regional districts do not set property tax rates (often referred to as mill rates) for the annual tax requisitions they require to fund the numerous services and capital projects they steward on behalf of the community. Instead, municipalities (cities, towns, villages, etc.) do this for those regional district services their communities participate in and the provincial Surveyor of Taxes does this for ratepayers living in all rural areas outside of the boundaries of a municipality (e.g. electoral areas). Regional districts can present a requisition of funds from municipalities. The annual operating budget of local governments determines what the tax rates (mill rate) will be.

[74] South Okanagan-Similkameen Conservation Program. (2022). Local Conservation Funds in British Columbia: A Guide for Local Governments and Community Organizations (3rd ed.). Penticton, B.C.

[75] Ibid.

Fees

Both municipalities and regional districts may recover costs on a fee-for-service basis provided the fee is associated with an already established service. For example, instead of imposing a tax on property, a fee could be collected from each household as part of a local government water service (e.g., for a rainwater management program) or from park facility users (e.g., for ecosystem restoration within parks).[76] Within MV municipalities, property taxes include levies (fees) for the following institutions:

1. School tax (BC Government)
2. Metro Vancouver Regional District
3. Municipal Finance Authority
4. BC Assessment
5. TransLink

Property Transfer Tax

Property Transfer Tax is primarily collected when a property is purchased but there may be other instances of transactions when this tax is collected, such as forfeiture or foreclosure.[77] The property transfer tax is based on the fair market value of the property (land and improvements) on the day it was registered with the Land Title Office. Transfer tax rates are determined based on the value of the property and if the purchaser is a foreign national. The property transfer tax rate is:

- 1% of the fair market value up to and including $200,000
- 2% of the fair market value greater than $200,000 and up to and including $2,000,000
- 3% of the fair market value greater than $2,000,000
- Additional 2% if the property has residential property worth over $3,000,000.

The property transfer tax monies go to the province. MVRD would have to discuss the possibility of a small increase or a small proportion of the existing property transfer tax rate which would be earmarked for use in a MVRD conservation fund. Legal advice would be required to determine if an additional property transfer tax to provide monies to a conservation fund could be added to properties in Metro Vancouver.

[76] South Okanagan-Similkameen Conservation Program. (2022). Local Conservation Funds in British Columbia: A Guide for Local Governments and Community Organizations (3rd ed.). Penticton, B.C.
[77] Government of British Columbia. Accessed December 2022. Property Transfer Tax.

Examples of financial arrangements from other funds

District of West Vancouver: Environmental Reserve Fund
The annual Environmental Levy amounts to $800,000, which is equivalent to 1.00% tax rate increase. Single Family Dwellings pay $65 and Strata pay $29.

Regional District of Okanagan Similkameen:
The annual maximum amount to be requisitioned for the cost of the service is not to exceed the greater of $450,000 or $0.0292 per $1,000 of net taxable value of land and improvements in the Regional District of Okanagan-Similkameen.

Regional District of North Okanagan:
The maximum amount that may be requisitioned annually for the service is not to exceed $102,000 or $0.02 per $1,000 of net taxable value of land and improvements included in the service area, whichever is greater.

Regional District of Central Kootenay:
The maximum amount that may be requisitioned annually for the service shall be $106,500 or the product of $0.062 per $1,000 of taxable assessed value of land and improvements, whichever is greater. This amounts up to $15 per parcel of land annually.

7.3 Comparing Approaches for Supporting Ecosystem Services on Agricultural Land

The following table compares the two approaches for supporting ecosystem services on agricultural land within the MVRD.

Table 14 Comparing approaches for supporting ecosystem services on agricultural land in MV.

	Approach	
	Policy, Zoning and Bylaws	**Regional Conservation Fund**
Effort of implementation	- Engagement with First Nations required - Requires staff time for analysis of what policies, zoning and land use bylaws are working well. - Including agricultural ES in the discussions and objectives of the RGIN could align staff capacity.	- Requires funding and staff time for front-end work to determine public and political acceptability of a new fee/tax for a fund (e.g. through polling and outreach). - Requires MVRD staff capacity to assist in fund development. - Each taxpayer/landowner contribution is likely to be small.
Timeframe to implement	- Likely one to three years, but depends on staff capacity.	- The process of gauging public support for a fund, passing a bylaw to establish the fund, and putting the fund administration into place would likely be at least three years.
Regional Control and Consistency	- Certain policies, zoning and land use bylaws are already in place for some member municipalities and EAs that are supportive of ES, while others would require updates or new policies, zoning or land use bylaws. MVRD has little control over implementation of these approaches in municipalities, so they may not be regionally consistent.	- Ideally all municipalities, electoral areas and First Nation communities would participate in the fund. - Projects funded would benefit the entire region.
Impact on the Long-Term Stewardship of Ecosystem Services	- The impact depends on the strength of the policies, zoning and land use bylaws. These tools can be weakened over time if not kept relevant or political or if public desire to support ES declines. Resources for compliance and enforcement of existing or new policies and regulations can also be a challenge for local governments.	- Relative impact on funding projects to improve/protect ecosystem services on agricultural land throughout the region would be high. - Healthy ecosystems can help avoid damage to infrastructure and mitigate costs of recovery (for example, reducing inundation of flood water by slowing the movement of water across fields to allow for increased infiltration).

8.0 Conclusions and Recommendations

When agricultural producers are supported in the care and management of ecosystems on agricultural land, the whole region benefits. These benefits range from improved water quality, fish habitat, flood protection, carbon sequestration and healthy wildlife populations. One fifth of the land base in MVRD is agricultural land. Ecosystems such as wetlands, riparian areas, watercourses, and forests are common on farms. Currently, there is a patchwork of policy, regulatory and financial mechanisms used to support ES on agricultural land in MV. [78] However, there lacks an overarching regional approach for stewardship of these ES and there are a limited number of incentives available to agricultural producers to provide long-term support for stewarding healthy ecosystems on agricultural land. Recent studies in Delta and ToL have illustrated support for the role that agricultural land plays in protecting and stewarding the environment, and a willingness to pay for the stewardship of ES on agricultural lands.

There exists a need to increase stable, long-term support to foster healthy ecosystems on agricultural land, and to leverage existing payment for ecosystem services programs, which will in turn provide benefits to all residents through food production, healthier watercourses, increased biodiversity, and landscape resiliency. Conservation funds are increasingly being used by regional districts to provide financial support for the long-term stewardship of ecosystems in region across BC and represent an opportunity worth exploring for Metro Vancouver.

Financially supporting ecosystem services on agricultural land can be viewed as reallocating resources to manage lands and providing an investment of taxpayer dollars into the following:

- Improved regional food security.
- Partnerships with First Nations to grow projects regarding Indigenous food systems.
- Preservation of natural assets and green infrastructure.
- Job creation for the food agriculture sector, and spin-off enterprises.
- Stimulation of agricultural support sector businesses (e.g., seed companies, soil amendments).
- Increased agri-tourism opportunities.
- New education and learning programs.

Investing in healthy ecosystems on agricultural lands can also be viewed as a type of 'collective insurance' since heathy ecosystems mitigate costs and damages to local governments associated with extreme weather events (e.g., floods and droughts) that will occur more frequently due to climate change. Understanding the economic value that healthy ecosystems can provide to minimize damages to infrastructure is crucial for decision-making when allocating resources to the management of natural assets and green infrastructure.

To improve the long-term stewardship of ecosystem services on agricultural lands in MV, the following five recommendations are identified (Table 15, next page).

[78] Metro Vancouver. (2020). Agriculture Discussion Paper to support Climate 2050 and the Clean Air Plan.

Table 15 Recommendations and rationale for long-term support of ecosystem services on agricultural lands in Metro Vancouver.

Recommendation	Rationale	Recommended Timeline	Resources Required
1. Collaborate internally and externally to further explore and build a regional conservation fund (or other appropriate funding mechanism) that includes payment for ecosystem services on agricultural land.	Internally, MVRD staff working on the Regional Green Infrastructure Network can look for opportunities to align objectives with a conservation fund. It is recommended that this include engagement with First Nations communities. Externally, staff can continue to collaboration with the Fraser Delta Farmland Protection and Stewardship Working Group, who have been working since 2019 on the concept of establishing a regional conservation fund for ES on agricultural lands.[79]	Ongoing	Staff time, and/or consultant fees.
2. Conduct polling across MV to gauge support and willingness to pay for ecosystem services on agricultural land.	Gauging the interest and support by the public would assist MVRD decision-makers in understanding if residents support a regional conservation fund, and what types of projects residents would prioritize for improving the health of ecosystems. Staff will also need to determine support internally at committee levels, management, and elected officials.	Within 1 year	Staff time to hire polling firm and manage the project. Estimated polling fees of $50,000 – $70,000 to conduct region-wide polling. Some fees may be cost-shared with other organizations or intiatives.
3. Conduct in-depth mapping of ecosystem services on agricultural land in MV	Areas in MV with the highest opportunities to focus efforts for stewardship of ES on agricultural lands should be mapped at a high resolution. This mapping will inform ES valuation calculations and can be aligned with RGIN mapping.[80]	Within 1 -2 years	Staff time to issue RFP, hire consultant and manage the project. Estimated consultant fees of $15,000 – $40,000 to complete the project.

[79] The Fraser Delta Farmland Protection Stewardship Working Group is a collective of representatives from local, provincial and federal governments, and non-profit organizations working together toward a vision where, "Farmland is protected and stewarded to support long-term sustainability and resiliency of farming while optimizing biodiversity in the Fraser River Delta."

[80] Staff communication, Metro Vancouver. 2022. Update on Advancing the Regional Green Infrastructure Network.

Recommendation	Rationale	Recommended Timeline	Resources Required
4. Estimate the financial value of ecosystem services on agricultural land in Metro Vancouver	A detailed estimate of the financial/economic value of ES on agricultural lands in MV would greatly assist decision-makers and the public in understanding the benefit to society from agricultural land stewardship. Understanding the economic value of agricultural ES will also assist in determining appropriate funding amounts for a regional conservation fund and what ecosystems should be prioritized for financial support.	Within 1-2 years	Staff time to issue RFP, hire consultant and manage the project. Estimated consultant fees of $30,000 – $60,000 to complete the project.
5. Review and assess options to align with the ongoing work to establish a Regional Green Infrastructure Network to support ES on agricultural land.	A Regional Green Infrastructure Network would acknowledge and identify a connected network of ecological elements in the region, including on agricultural land, some of which would provide ecosystem services. The RGIN could be used to signify policy objectives for those lands, clarify decision-making requirements, and potentially minimize non-agricultural development.	Within 2 -3 years.	Staff time, and/or consultant fees.

Appendix A: Assumptions & Limitations of Mapping Analysis and Layer Descriptions & Data Sources

Assumptions of Analysis:

- All mapping layers used were from secondary sources, no original mapping data was collected, and the assumption was made that there are no major errors in the mapping layers.
- Assume all watercourses have the potential for providing ecosystem services, to some extent.

Limitations of Data:

- The mapping results provide a good starting point for identifying and quantifying ES in the ALR; however, due to mapping limitations, this mapping exercise could not identify all ecosystems with potential for providing beneficial ES. For example, not all of the agricultural watercourses, hedgerows, or windrows were captured, nor beneficial farming practices such as cover cropping.
- The 'Disconnected Watercourses' layer only captures disconnected watercourses leading to the Fraser River, and not watercourses leading to other major rivers in the region (e.g. the Serpentine River or Nicomekl River).
- Crops and small agricultural ditches/canals can change from year to year, so analysis is a snapshot in time for locations of some smaller watercourses.
- While it was noted that some agricultural ditches were captured in the 'Watercourses' mapping layer, arial images shows additional locations of agricultural ditches that were not captured in the watercourses data layer used.

Table 16 Data Layer Sources and Descriptions.

Layer Name	Description	Source
SEI Wetlands, Riparian Areas and Freshwater ecosystems	Riparian ecosystems are associated with and influenced by freshwater. They generally occur along rivers, streams, and creeks, but for SEI, also include fringes around lakes. These ecosystems are influenced by factors such as erosion, sedimentation, flooding, and/or subterranean irrigation due to proximity to the water body. This Class includes all vegetation developmental stages, i.e., structural stages 1 through 7, but only in a natural or semi-natural state. To calculate the riparian areas buffers of 20 m were used for streams and 50 m were used for rivers and lakes. Wetland ecosystems are found where soils are saturated by water for enough time that the excess water and resulting low oxygen levels influence the vegetation and soil. The water influence is generally seasonal or year-round and occurs either at or above the soil surface or within the root zone of plants. Wetlands are usually found in areas of flat or undulating terrain. They encompass a range of plant communities that includes western red cedar/skunk cabbage swamps, cattail marshes, and peat-moss dominated bogs. The wetland class is for freshwater wetlands.	MV Open Data Catalogue: MV SEI

Layer Name	Description	Source
Watercourses	This layer originates from the Freshwater Atlas Stream Network dataset. It shows stream, creeks, and some agricultural watercourses but likely does not capture all agricultural watercourses (e.g. ditches, canals).	BC Data Catalogue: Freshwater Atlas Stream Network
Disconnected Watercourses	Disconnected watercourses leading to the Fraser River. Disconnection calculated based on stream gradient (12%) and obstructive infrastructure.	Watershed Watch Salmon Society
ALR	The spatial representation for a segment of the boundary of an Agricultural Land Reserve (ALR), which is a parcel of land, based on soil and climate, deemed necessary to be maintained for agricultural use.	BC Data Catalogue: ALC Agricultural Land Reserve Lines
Regional Parks	Boundaries for Metro Vancouver Regional Parks, Ecological Conservancy Areas and Regional Park Reserves.	MV Open Data Catalogue: Metro Vancouver Regional Parks – Park Boundaries
Fraser River Freshet Flood Scenarios under 2050 climate conditions	The two layers estimate flood levels under projected climate change conditions in 2050. The conditions include 0.5-metre sea level rise and changes in peak river flows. The two scenarios are a 1% Annual Exceedance Probability flood (i.e., 100 year) or 0.2% AEP (i.e. 500 year flood) flood on the Fraser River.[81] These scenarios assume that dikes in different locations overtop, but that no dikes breach. These maps originates from the Fraser Basin Council.	Source: Fraser Basin Council
Coastal Storm Surge Flood Scenario	This layer illustrates the estimated flood levels in a 0.2% AEP (500 year) coastal storm surge flood under present day climate conditions and sea level, during a still water ocean state. These maps originates from the Fraser Basin Council.	Source: Fraser Basin Council

[81] Annual Exceedance Probability (AEP) Refers to the probability of a flood event occurring in any year. The probability is expressed as a percentage. For example, a large flood that may be calculated to have a 1% chance to occur in any one year is described as 1% AEP. The measure has replaced more traditional time-based expressions of probabilities: 2% = 50-year flood, 1% = 100-year flood, 0.5% = 200-year flood, 0.2% = 500-year flood.

Appendix B: Example of a Conservation Fund for Metro Vancouver

Fund Purpose and Priorities

The purpose and priorities of the fund should be determined through polling of residents and by reviewing local government plans, policies and strategies that align with the objectives of supporting agricultural ES and environmental conservation.

Example Purpose: The Metro Vancouver Conservation Fund is a dedicated source of funding for the specific purpose of undertaking agricultural stewardship and environmental conservation projects within MVRD. The projects will improve the natural environment and food security, and ensure long-term sustainability of farms and healthy ecosystems in the region, that support a good quality of life in Metro Vancouver.

Example Priorities:

- Enhancing the sustainability, resilience and viability of local agriculture and food production.
- Protecting clean, abundant water resources.
- Preserving natural places for people to enjoy through recreation.
- Restoring and maintaining important habitats for Species at Risk, fish and wildlife, such as riparian areas through agricultural properties.
- Maintaining and enhancing ecosystem health to be more resilient to the effects of a changing climate, such as floods, fire, and drought, such as restoring riparian areas.
- Upgrading and maintaining key infrastructure such as ditches and dikes.

Example Targets and Issues:

Projects that can demonstrate a reduction of a known threat to an agricultural, ecosystem and/or biodiversity target will be given priority. The focus is on private land, but projects on both Crown and local government land could be considered. The targets are:

- Improving ecosystems on agricultural land,
- Land classified within the Sensitive Ecosystem Inventory,
- Land with high occurrences of invasive species,
- Land in or adjacent to parks and the green infrastructure network,
- Watersheds at important source water protection areas,
- Connectivity for natural areas and wildlife corridors,
- Native fish and wildlife habitat including for species at risk,
- Urban and rural wild-land interface areas, and,
- Land in floodplains or within projected flood extents of riverine and coastal floods.

Governance and Administration Options

The MVRD would be responsible for maintaining the fund including the responsibility of requisitioning funds, financial audits and providing final approval of potential projects. The MVRD would also appoint a Technical Advisory committee to assist in selection of potential projects to

be funded, which will help ensure projects of the highest merit receive funding, while still maintaining the final approval rights.

Example of process:

1. MVRD passes a bylaw that sets the stage for being able to requisition tax funds from municipalities for conservation purposes.
2. MVRD requisitions the funds to member municipalities through annual tax requisition, collects the fund money, selects/approves conservation projects, issues payments, and conducts financial audits of the fund.
3. MVRD can hire internal staff as the fund administrator/coordinator or hire a consultant.
4. Often a 'Technical Advisory Committee' is formed of subject matter experts who evaluate the project applications to the fund, and recommend to MVRD which projects should receive funding. Final approval of projects will be granted at a regular meeting of the MVRD Board of Directors.

Example of governance:

- This is a tax-based fund; therefore, in the decision-making process, taxpayers will be represented through their elected officials.
- The Fund was created to provide a conservation service. Technical merit is of utmost importance to determine which projects are supported.
- There is a relatively small amount of annual funding available and it is important to design a simple, cost effective decision-making structure.

Service Areas & Establishment Process

Establishment of a conservation fund within a regional district must be done through the creation of a bylaw. The bylaw can be established in two ways:

1. Assent voting (referendum) process.
2. Alternative approval process.

It is up to the regional district and member municipalities as to which option the bylaw is established.

Assent Voting Examples [82]

Columbia Valley Conservation Fund: Regional District of East Kootenay

The original goal was to have all municipalities and electoral areas in the RDEK participate in the service, however, the conservation fund idea only received support from the Upper Columbia Valley portion of the RDEK. The residents who were clear that they wanted the opportunity to vote on the initiative wanted it to happen in the most cost-effective way possible. This translated to an assent vote (referendum) being conducted in conjunction with a general election in 2008. Only electors in the service area (Upper Columbia Valley) were eligible to vote on the question of setting up a conservation fund. After a successful vote, the RDEK board adopted the bylaw to establish the Columbia Valley Local Conservation Fund service in the Upper Columbia Valley portion of the

[82] South Okanagan-Similkameen Conservation Program. (2022). Local Conservation Funds in British Columbia: A Guide for Local Governments and Community Organizations (3rd ed.). Penticton, B.C.

regional district, including the Village of Radium Hot Springs, District of Invermere, Village of Canal Flats, and RDEK electoral areas F & G.

Kootenay Lake Local Conservation Fund: Regional District of Central Kootenay
Even with residents' support, it was the elected officials' role to decide whether or not establishment would proceed. In this case, of the areas that indicated support at the public opinion research stage, one municipality opted out, and so the assent vote (referendum) question was posed, on a subregional basis, to voters in three RDCK electoral areas. The RDCK established the Kootenay Lake Local Conservation Fund after a successful vote in November 2014, which was held in conjunction with the local election in electoral areas A, D, and E. In October 2022, voters in the Slocan Valley (Area H) voted 'yes' to joining the Regional District of Central Kootenay Local Conservation Fund service that will support wildlife, habitat and water.

Alternative Approval Process Examples
South Okanagan Conservation Fund: Regional District of Okanagan-Similkameen
Elected officials decided whether their electoral area or municipality was interested in participating in the environmental conservation service. In the end, it was decided that the bylaw would be proposed as a subregional service for 6 of the 9 electoral areas and 3 of the 6 municipalities within the region (communities of Summerland, Penticton, and Oliver, and rural RDOS electoral areas A, C, D, E, I and F). Public approval for the bylaw was sought through alternative approval process conducted for the proposed sub-regional service as a whole. The alternative approval process was concluded with < 1% of eligible voters opposed to the proposed bylaw. In December 2016, the RDOS board approved the environmental conservation service bylaw that established the South Okanagan Conservation Fund.

North Okanagan Conservation Fund: Regional District of North Okanagan
The Okanagan Collaborative Conservation Program and its partners worked with Regional District staff and elected officials for 24 months to identify local conservation priorities for the fund's terms of reference and assisted with local government planning processes to create the fund. On January 22, 2020 the City of Armstrong, the Village of Lumby and Electoral Areas "B" through "F" established the service bylaw for a sub-regional conservation fund to support local conservation priories. The bylaw was established through the alternative approval process which notified property owners of a new conservation service in the form of a property tax. The alternative approval process easily passed with little to no opposition to establish the fund.

Fund Design

How the fund functions would be decided upon based on the priorities and targets. The following are examples of how a fund could be designed:

- A call for project proposals will be issued annually and will be advertised based on criteria set by the Consultant and approved by the MVRD Chief Administrative Officer or their designate.
- Funds will be dispersed annually, based on responses to calls for proposals. Any funds not dispersed can be carried forward to the next fiscal year.

- Projects must be in the Fund Service Area (e.g. the entire MVRD or certain municipalities/Electoral areas).
- Multi-year projects are acceptable to a maximum of a certain number of years. Such projects will receive annual funding approval, and will be subject to annual review by the Technical Advisory Committee to ensure they are on track.
- Projects should address MVRD threats identified and fall into at least one theme area.
- Proponents must be non-profit, have registered society status or must partner with an organization that has registered society status.
- Project evaluation by the Technical Advisory Committee includes consideration of conservation value for money.
- Proposals should reflect relationship to the MVRD Regional Growth Strategy and Municipal Official Community Plans.
- Proponents must be prepared to make a 10-minute presentation on the outcomes of their work on an annual basis, in addition to submitting written interim and final reports.
- Proponents will receive 80% of the grant upon signing a contribution agreement and 20% upon completion of the approved final report.
- Fund recognition. Proponents are required to acknowledge in all communications products including publications, public information releases, advertising, promotional announcements, activities, speeches, lectures, interviews, ceremonies and website materials related to the project, including on permanent signage. The MVRD logos must appear on all communications and promotional materials.
- Administrative costs should not exceed 7% of the annual fund amount.

Examples of other Conservation and Environmental Funds

There are several examples of local governments in BC that have created funds for environmental and conservation objectives (Table 16).

Table 17 Examples of Conservations Funds in BC.

	South Okanagan Conservation Fund	Columbia Valley Local Conservation Fund	Kootenay Lake Conservation Fund
Conservation Themes	Conservation of water quality and quantity stewardship, protection, enhancement and restoration of sensitive terrestrial and aquatic ecosystems, wildlife species & SAR and habitat for native fish and wildlife.	Water conservation, Wildlife and habitat conservation, open space conservation.	Aquatic systems, water conservation, wildlife and habitat conservation.
Fund purpose	Provide local financial support for projects (not under the responsibility of federal, provincial or local governments) that will	Provide local financial support for projects (not under the responsibility of the federal, provincial or local governments) that will contribute to the	Provide local financial support for projects (not under the responsibility of the federal, provincial or local governments) that will contribute to the

	contribute to conservation of natural areas.	conservation of our valuable natural areas.	conservation of our valuable natural areas.
	South Okanagan Conservation Fund	Columbia Valley Local Conservation Fund	Kootenay Lake Conservation Fund
Fund administration	RD maintains the fund, including decisions of awarding the grants, making payments, RD may hire a third party to administer the fund, or appoint a technical advisory committee to select projects and fund recipients.	RD maintains the fund, including final approval of all projects, grant payments and financial audits. The Kootenay Conservation Program is a partner in the fund and is responsible for all administrative activities pertaining to the fund other than direct financial administration and final approval of projects.	RD maintains the fund, including final approval of all projects, grant payments and financial audits. The Kootenay Conservation Program is a partner in the fund and is responsible for all administrative activities pertaining to the fund other than direct financial administration and final approval of projects.
Financing mechanism	Property tax- Fund not to exceed the greater of $450,000 or $0.0292 per thousand dollars of net taxable value of land and improvements in the RD.	Parcel tax of $0.5 per $1000 taxable assessed value, up to a maximum of $230,000 annually ($20 per parcel).	Parcel tax, $15/parcel/year applied to residential, commercial and industrial properties.
Fund Reach	38 grants funded, $1,528,791 awarded	From 2010-2020, 93 grants totaling $2.43 million	From 2016-2020, 29 grants, $400,000 awarded

District of West Vancouver Environmental Reserve Fund

Adopted by council on July 25, 2022[1], the District of West Vancouver adopted Bylaw number 5188, an Environmental Levy to fund efforts support and protect the natural environment through education, mitigation and adaptation efforts. Community engagement prior to the creation of this fund (December 2021- January 2022) showed a high level of concern for climate change and a support for the implementation of an environmental levy.

Mechanism and Amount:

- The annual Environmental levy would amount to $0.8M, which is equivalent to 1.00% tax rate increase.
- Single Family Dwellings will pay $65 and Strata will pay $29.

Purpose: Dedicated funds for climate change response, sustainability, and protecting the District's natural resources. The fund can be utilized by both internal and external bodies to contribute to the objective of the fund.

Administration: The new Manager of Climate Action & Environment (to be hired) will be responsible for creating a program to determine the best use of the Environmental Levy funds.

Table 18 Details of the West Vancouver Environmental Reserve Fund.

Source of financing	Use of Fund	Process of Funding of Services
Annual district environmental levy (property tax), Interest earned at the prevailing rate on the average annual balance in the Fund, Grants received from the district or external sources, any other amounts designated as contributions to the fund	The Fund may be used for external and District resources for: a) Programs that support the protection of the natural environment; b) Climate change response, mitigation, and adaptation; c) Sustainability and protection of the District's natural capital assets; and d) Reduction of Greenhouse Gas emissions both by corporate operations and the community.	Annual expenditures projected to be financed from the Fund shall form part of the Annual Financial Plan of the District, and no expenditures shall be made from the Fund that have not previously been included in the Annual Financial Plan as approved or amended, Monies from the Fund shall be expended pursuant to Council resolution.

Capital Regional District Land Acquisition Fund

In 2000 the Capital Regional District introduced the Land Acquisition Fund (LAF) for the exclusive purpose of expanding the regional parks system through land procurement. Since 2000, the CRD has secured 4,900 hectares of land into the parks system where is now serves as conservation space, habitat connectivity and recreational uses. The acquisition of land is guided by criteria laid out in the Regional Parks Land Acquisition Strategy. The LAF is funded by a household fee, which was initially set at $10 per household, but has since risen to $20 per household, with the expectation of the fee increasing to a maximum of $25 per household by 2029. The anticipated revenue stream will service up to $50 million of land purchases over 15 years, leveraging a net increase in land values of more than $100 million.

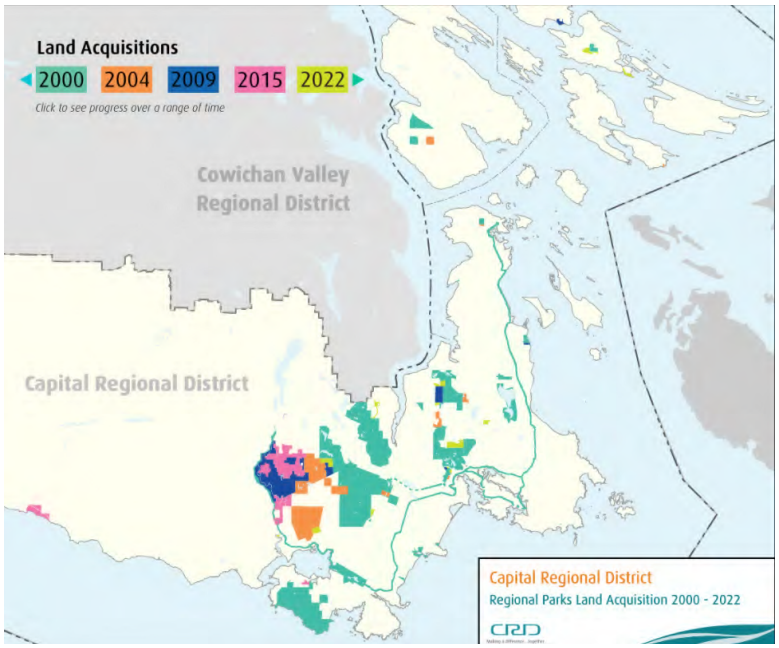

Figure 18 Land secured by the CRD Land Acquisition Fund, 2000 – 2022.

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