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SERVICES AND SOLUTIONS FOR A LIVABLE REGION

METRO VANCOUVER REGIONAL DISTRICT
CLIMATE ACTION COMMITTEE

MEETING

Thursday, October 5, 2023
9:00 am
Meeting conducted electronically/in-person pursuant to the Procedure Bylaw
28th Floor Committee room, 4515 Central Boulevard, Burnaby, British Columbia
Webstream available at http://www.metrovancouver.org

A G E N D A[1]

1. ADOPTION OF THE AGENDA

1.1 October 5, 2023 Meeting Agenda
That the Climate Action Committee adopt the agenda for its meeting scheduled for October 5, 2023 as circulated.

2. ADOPTION OF THE MINUTES

2.1 September 7, 2023 Meeting Minutes *pg. 3*
That the Climate Action Committee adopt the minutes of its meeting held September 7, 2023 as circulated.

3. DELEGATIONS

4. INVITED PRESENTATIONS

4.1 Diana Stephenson, Senior Vice President, Customer and Corporate Affairs, and Chris Sandve, Chief Regulatory Officer, BC Hydro
Subject: BC Hydro Update on our Electrified Future

4.2 Melina Scholefield, Executive Director, and Darla Simpson, Retrofit Program Manager, Metro Vancouver Zero Emissions Innovation Centre
Subject: Zero Emissions Innovation Centre (ZEIC) – Metro Vancouver Retrofit Accelerator

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

5. REPORTS FROM COMMITTEE OR STAFF

5.1 2024 – 2028 Financial Plan Overview

Verbal Update

Designated Speakers: Jerry W. Dobrovolny, Commissioner/Chief Administrative Officer and Harji Varn, Chief Finance Officer/General Manager, Financial Services

5.2 2024-2028 Financial Plan – Air Quality and Climate Action

Verbal Update

Designated Speakers: Conor Reynolds, Director, Air Quality and Climate Action Services and Kathy Preston, Director, Environmental Regulation and Enforcement

5.3 Regional Electric Vehicle Charging Analysis and Guidance

pg. 8

That the Climate Action Committee receive for information the report dated September 19, 2023, titled "Regional Electric Vehicle Charging Analysis and Guidance Report".

5.4 Manager's Report

pg. 108

That the Climate Action Committee receive for information the report dated September 14, 2023, titled "Manager's Report".

6. INFORMATION ITEMS

6.1 Sensitive Ecosystem Inventory 2020 Update – Change Summary

pg. 114

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

That the Climate Action Committee adjourn its meeting of October 5, 2023

Membership:

Dominato, Lisa (C) – Vancouver	Gu, Alison – Burnaby	Pope, Catherine – North Vancouver District
Johnstone, Patrick (VC) – New Westminster	Lahti, Meghan – Port Moody	Ross, Jamie – Belcarra
Berry, Ken – Lions Bay	Leonard, Andrew – Bowen Island	Ruimy, Dan – Maple Ridge
Bose, Mike – Surrey	McCutcheon, Jen – Electoral Area A	vanPopta, Misty – Langley Township
Carr, Adriane – Vancouver	McNulty, Bill – Richmond	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 at 9:00 am on Thursday, September 7, 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
Councillor Mike Bose, Surrey
Councillor Adriane Carr, Vancouver
Councillor Alison Gu, Burnaby
Mayor Meghan Lahti, Port Moody
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 (departed at 10:30 am)
Councillor Rosemary Wallace*, Langley City

MEMBERS ABSENT:
Mayor Ken Berry, Lions Bay

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

1. ADOPTION OF THE AGENDA

1.1 September 7, 2023 Meeting Agenda

It was MOVED and SECONDED
That the Climate Action Committee adopt the agenda for its meeting scheduled for September 7, 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 July 6, 2023 Meeting Minutes

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

CARRIED

3. DELEGATIONS

No items presented.

4. INVITED PRESENTATIONS

No items presented.

5. REPORTS FROM COMMITTEE OR STAFF

5.1 Appointment of Enforcement Officers

Report dated August 16, 2023, from Julie Saxton, Program Manager, Enforcement and Regulation Air Quality, Parks and Environment, providing the MVRD Board with recommended appointments of Enforcement Officers for consideration.

It was MOVED and SECONDED
That the MVRD Board:

a) pursuant to the *Greater Vancouver Regional District Air Quality Management Bylaw 1082, 2008* and the *Environmental Management Act*:
   i. rescind the appointment of Ana Nic Lochlainn as an officer; and
   ii. appoint Metro Vancouver employees Jason Assam, Karnjit Bains, Cynthia Barros, Amanda Craft, and Mike Mijares as officers; and

b) pursuant to section 28 of the *Offence Act* for the purpose of serving summons for alleged violations under the *Greater Vancouver Regional District Air Quality Management Bylaw 1082, 2008*:
   i. rescind the appointment of Ana Nic Lochlainn; and
   ii. appoint Metro Vancouver employees Jason Assam, Karnjit Bains, Cynthia Barros, and Amanda Craft.

CARRIED

5.2 Metro Vancouver's Climate 2050 Agriculture Roadmap

Report dated July 27, 2023, from Carla Stewart, Senior Planner, Regional Planning and Housing Services, seeking MVRD Board endorsement of the *Climate 2050 Agriculture Roadmap*.

Members were presented with the vision, goals and targets, and strategic actions of the *Climate 2050 Agriculture Roadmap*.

The Committee provided feedback on the *Climate 2050 Agriculture Roadmap* and noted the importance of taking food security into consideration in the roadmap.

Presentation material titled "Climate 2050 Agriculture Roadmap" is retained with the September 7, 2023 Climate Action Committee agenda.

It was MOVED and SECONDED
That the MVRD Board:

a) endorse the Climate 2050 Agriculture Roadmap as attached to the report dated July 27, 2023, titled "Metro Vancouver's Climate 2050 Agriculture Roadmap" as the initial Roadmap to achieve the Climate 2050 vision, goals, and targets for a net-zero and resilient agricultural sector; and
b) direct staff to continue working with member jurisdictions and other partners to implement the actions in the Climate 2050 Agriculture Roadmap; and
c) direct staff to update the Roadmap, as needed, in response to new information.

CARRIED

5.3 Metro Vancouver Climate 2050 Annual Report 2022/2023

Report dated July 24, 2023, from Johann Zerbe, Policy Analyst, Air Quality and Climate Action Services, providing the MVRD Board with information on the progress in implementing *Climate 2050*.

Members were presented with a snapshot of the *Climate 2050* Annual Report, including a status update of *Climate 2050* actions.

10:30 am Councillor vanPopta departed the meeting.

Presentation material titled "Climate 2050 Annual Report – 2022/2023" is retained with the September 7, 2023 Climate Action Committee agenda.

It was MOVED and SECONDED
That the MVRD Board receive for information the report dated July 24, 2023, titled "Metro Vancouver Climate 2050 Annual Report 2022/2023".

CARRIED

The meeting was recessed at 10:36 am.
The meeting resumed at 10:43 am.

5.4 Initial Engagement Outcomes on Developing GHG Emission Reduction Requirements for Existing Large Buildings

Report dated August 22, 2023, from Navjot Hundle, Senior Policy and Planning Analyst, Air Quality and Climate Action Services and Lucy Duso, Division Manager, Collaboration and Engagement, External Relations, providing the MVRD Board with results of the initial engagement and next steps for the development of the Metro Vancouver GHG emission reduction requirements for existing large buildings over 2,322 m2 (25,000 ft2).

It was MOVED and SECONDED
That the MVRD Board receive for information the report dated August 22, 2023, titled "Initial Engagement Outcomes on Developing GHG Emission Reduction Requirements for Existing Large Buildings".

CARRIED

5.5 Metro Vancouver's Application to Intervene in the BC Utilities Commission Proceeding Related to BC Hydro's 2021 Integrated Resource Plan
Report dated August 16, 2023, from Nicole Chan, Project Engineer, Air Quality and Climate Action Services, providing the MVRD Board with information regarding Metro Vancouver's application as an intervener in the BC Utilities Commission proceeding related to BC Hydro's 2021 Integrated Resource Plan, and how staff will evaluate the Plan for alignment with *Climate 2050.*

It was MOVED and SECONDED
That the MVRD Board receive for information the report dated August 16, 2023, titled "Metro Vancouver's Application to Intervene in the BC Utilities Commission Proceeding Related to BC Hydro's *2021 Integrated Resource Plan*".

CARRIED

5.6 Manager's Report
Report dated August 31, 2023, from Conor Reynolds, Director, Air Quality and Climate Action Services, providing the Climate Action Committee with an update on the Climate Action Committee Work Plan, 2023 UBCM Resolutions on Air Quality and Climate Action from Metro Vancouver Member Jurisdictions, and information on a Water Sustainability Innovation Fund Project on next generation snowpack monitoring.

Members were provided a verbal update on an upcoming opportunity to set up a joint meeting between the Climate Action Committee and Regional Planning Committee to discuss critical items within the collective terms of reference of the committees.

It was MOVED and SECONDED
That the Climate Action Committee receive for information the report dated August 31, 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. ADJOURNMENT/CONCLUSION

It was MOVED and SECONDED
That the Climate Action Committee conclude its meeting of September 7, 2023.

CARRIED
(Time: 11:33 am)

Rapinder Khaira,
Legislative Services Coordinator

Lisa Dominato,
Chair

61602366 FINAL

To: Climate Action Committee

From: Morgan Braglewicz, Air Quality Planner, Air Quality and Climate Action Services

Date: September 19, 2023 Meeting Date: October 5, 2023

Subject: **Regional Electric Vehicle Charging Analysis and Guidance Report**

RECOMMENDATION

That the Climate Action Committee receive for information the report dated September 19, 2023, titled "Regional Electric Vehicle Charging Analysis and Guidance Report".

EXECUTIVE SUMMARY

Metro Vancouver, with partners BC Hydro and TransLink, has produced the Regional EV Charging Guidance as a resource to guide and align deployment of public and multifamily residential building EV charging in the region, supporting progress towards greenhouse gas reduction targets.

Meeting the targets outlined in the *Transportation Roadmap* requires shifting to sustainable modes and vehicle electrification. There has been strong uptake of electric vehicles (EVs) in the Metro Vancouver region, and momentum in EV sales is expected to grow. Consequently, there will be a need for the rapid deployment of EV charging infrastructure across the region over the next 30 years. Between 4,600 to 7,700 public direct current fast charging ports and 54,700 to 97,600 public Level 2 ports will be needed to meet demand. Significant capital investment is needed in both public charging and multifamily building retrofits, estimated to total $2.1 billion to $2.9 billion by the year 2050. Responsibilities for the planning, investment, and operation of EV charging are shared among multiple orders of government, as well as BC Hydro and the private sector.

PURPOSE

To provide a summary of the analysis, results, and key guidance from the Regional Electric Vehicle Charging Analysis and Guidance project.

BACKGROUND

To meet the *Climate 2050 Transportation Roadmap* target that by 2050, "All passenger vehicles on the road are zero emission, powered by clean, renewable electricity or hydrogen by 2050", it is critical to accelerate the transition from fossil fuel to electric powered vehicles. The *Regional EV Charging Analysis and Guidance* (Attachment 1) responds to action 2.4 in the *Transportation Roadmap* to develop a regional EV charging strategy by providing guidance for coordinated deployment of EV charging at a regional scale in Metro Vancouver.

REGIONAL TRANSITION TO ELECTRIC VEHICLES

Light-duty vehicles (cars, light trucks, and SUVs) or "LDVs" are the Metro Vancouver region's largest source of greenhouse gas (GHG) emissions, accounting for about one-third of regional emissions. LDVs also represent one of the best opportunities to start reducing emissions through intentional

land use planning that supports walking, cycling, transit, and other shared mobility modes, alongside vehicle electrification.

EV sales in the Metro Vancouver region are growing quickly, accounting for over 20% of all new vehicle sales in 2022, the highest numbers in BC. This growth has been supported by the BC *Zero-Emission Vehicles Act* (ZEV Act), which requires an increasing proportion of new vehicles sales to be battery electric or plug in hybrid electric (reaching 90% of sales by 2030 and 100% of sales by 2035), and meeting near term climate objectives will require an even faster transition to EVs. EV charging infrastructure must be well planned and expanded to meet growing demand to avoid slowing down the transition to EVs.

Rapid and coordinated expansion of EV charging at a regional scale will provide numerous benefits to the region in addition to climate action, including cleaner air, lower transportation costs, job creation, and revenue generation for utilities and charging network operators, all of which contribute to a prosperous regional economy.

REGIONAL EV CHARGING ANALYSIS AND GUIDANCE

The objective of the Regional EV Charging Analysis and Guidance project is to estimate the amount and types of EV charging infrastructure needed to support the rapid uptake of light duty EVs over the next 30 years across the region, and to recommend actions for Metro Vancouver member jurisdictions and other key actors to plan for and deploy public and multifamily building EV charging. Metro Vancouver, BC Hydro, and TransLink partnered together to deliver this project.

The project analysis includes EV adoption and charging needs forecasts, an equity assessment, and business case, culminating in a regional EV charging guidance document. This guidance will support planning and investment in the regional EV charging network by regional actors, local governments, utilities, private companies, as well as other governments and public sector organizations.

Regional EV Adoption Forecast

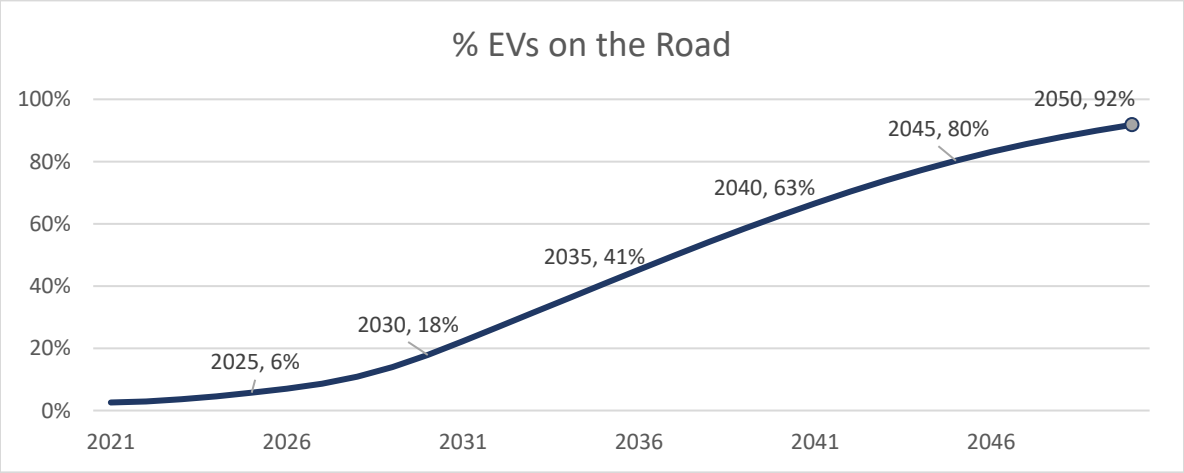
The foundation of the analysis for this project is an EV adoption forecast for the region. The forecast includes the anticipated impacts of the *ZEV Act* sales mandate as well as an assumption that Metro Vancouver will continue to lead in EV sales BC in the coming years. By 2035, 100% of sales will be EVs, resulting in near complete transition to EVs by 2050 or earlier (Figure 1). Additional climate policy can further accelerate EV uptake.

Regional Charging Needs Assessment

Charging at home will play the largest role to support the EV transition. Installing EV charging is relatively simple and low cost for most single family homes, duplexes, triplexes and row houses. Most new multifamily residential buildings in the region will be constructed to be ready for EV charger installation. However, this will be more challenging for existing multifamily residential buildings due to legal, financial, technical, and logistical barriers. Charging in locations outside the home, such as in the workplace, in the public realm, and at privately owned retail locations will be the only choice for residents who do not have access to home charging, making public charging a critical part of the regional EV charging system. A complete overview of charging technologies and

their characteristics is available in the *Primer on EV Charging Infrastructure* developed for this project (Attachment 2).

Figure 1: Forecasted EVs on the road in Metro Vancouver, as a % of all Light Duty Vehicles



This project produced an EV charging needs assessment to forecast demand for EV charging. The results of the study suggest that by 2035, 2,200 to 2,900 public direct current fast charging (DCFC) ports and 32,000 to 47,000 public Level 2 ports (approximately two-thirds of which could be work place charging) will be needed. By 2050, the region will need between 4,600 to 7,700 public DCFC ports and 54,700 to 97,600 public Level 2 ports. Currently, there are approximately 1,660 Level 2 ports and 270 DCFC ports in Metro Vancouver. Rapid and widespread expansion of the EV charging network will be needed to keep pace with the expected rapid uptake of EVs, and is critical to avoid slowing the transition to EVs if people do not feel confident in their ability to access charging.

The level of public charging needed will depend on the degree of access to home charging. Comprehensive retrofits to make parking spots in multifamily residential buildings ready for EV charger installation will be needed to support access to home charging. The wide range in anticipated public charging resulting from this analysis reflects high and low retrofit scenarios, and represent bookends to the expected need for public charging. The best solution for Metro Vancouver jurisdictions will likely lie somewhere in between.

The results point to a need for significant capital investment in both public charging and multifamily building retrofits, totaling approximately $1.2 billion by 2035 and $2.1 billion to $2.9 billion in cumulative capital costs by 2050. This does not include electrical service upgrade costs, which vary widely and can be significant. Total costs of deploying EV charging infrastructure can be reduced with widespread access to charging at home, particularly in multifamily residential buildings.

Recommendations for Local Governments and Other Actors

Deploying EV charging infrastructure at the scale necessary requires big, coordinated actions from governments, utilities and others. The purpose of the guide developed through this project is to help local governments and other key actors collaboratively plan and deploy public and multifamily building EV charging infrastructure for LDVs.

The guidance includes the following recommendations and actions for key actors:

- **Local governments** can **streamline permitting,** ensure **timely project approvals,** adopt **EV-ready building requirements**, and **provide charging** on strategically located and municipally owned sites, either directly or in partnership with BC Hydro.

- **BC Hydro** can continue to **deploy EV charging** across the region. On July 28, 2023, the utility filed an application to the BC Utilities Commission for a 10-year levelized public charging rate along with a 10-year deployment plan to increase investment in both DCFC and public Level 2 charging (Reference 1). Additionally, BC Hydro has an important role to play in facilitating other public and private deployment of charging, including timely **electrical service extensions**. Further, expanded EV charging will lead to increase in electricity use. Fortunately, this demand for electricity is flexible and offers significant opportunities for load management to minimize impacts on peak demand.

- **The BC and Canadian governments** should **increase funding** for the deployment of EV charging. Both orders of government currently provide funding, but many existing programs have become fully subscribed very quickly and are insufficient to meet growing demand. Additional funding will be needed to support the significant level of investment needed over the coming years. Additionally, the BC Government can take policy action to **support EV ready parking** in new and existing buildings across the province.

The recommended principles and actions in this guide were developed to provide a starting point for coordinated deployment of EV charging in the region. Many of the recommendations involve multiple organizations, such as establishing targets, investing in infrastructure, and educating the public. Clear roles and mechanisms for coordination among actors in the Metro Vancouver region will be critical to avoid duplication and align efforts.

ALTERNATIVES
This is an information report. No alternatives are presented.

FINANCIAL IMPLICATIONS
There are no financial implications for this report.

CONCLUSION
By the year 2050, almost all of the light duty vehicles in the region will be electric. This will require significant investment and rapid deployment of both home and public EV charging to ensure that EV uptake is not delayed due to a lack of access to charging. Local governments, BC Hydro, the BC and Canadian governments, and the private sector all have important roles to play in this transition. The Regional EV Charging Guidance is a resource for these groups to guide and align deployment of public and multifamily EV charging in the region, supporting progress towards GHG reduction targets. The guidance in this document is a starting point for coordinated regional action, and staff will work with key partners to advance actions in the guide.

ATTACHMENTS

1. "Keeping it Current: Guidance for Collaborative Deployment of EV Charging in Metro Vancouver", dated August 2023
2. "Keeping it Current: Primer on EV Charging Infrastructure", dated August 2023
3. Presentation re: "Regional Electric Vehicle Charging Analysis and Guidance", dated October 5, 2023

REFERENCE

1. BC Hydro Public EV Charging Service Rates

ATTACHMENT 1

Keeping it Current

Guidance for Collaborative Deployment of EV Charging in Metro Vancouver

metrovancouver
SERVICES AND SOLUTIONS FOR A LIVABLE REGION

TRANSLINK

BC Hydro
Power smart

August 2023

dunsky
Energy + Climate

Submitted to:

metrovancouver
SERVICES AND SOLUTIONS FOR A LIVABLE REGION

TRANSLINK

BC Hydro
Power smart

This report has been reviewed by representatives of Metro Vancouver and TransLink, who commissioned the study, but the interpretation of the results of this study, as expressed in the report, is entirely the responsibility of the consultant authors and does not imply endorsement of specific points of view by Metro Vancouver or TransLink. The findings and conclusions expressed in the report are the opinion of the authors of the study and may not necessarily be supported by Metro Vancouver or TransLink.

Any use by a third party of the information presented in this report, or any reliance on or decisions made based on such information, is solely the responsibility of such third party.

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With support from:

Licker Geospatial Consulting

Table of Contents

List of Abbreviations and Terms

BC: British Columbia

BCUC: British Columbia Utilities Commission

CCS: Combined Charging System

CSA: Canadian Standards Association

DCFC: Direct Current Fast Charging

EV: Electric Vehicle

EVEMS: Electric Vehicle Energy Management System

LCFS: Low Carbon Fuel Standard

LDV: Light-duty Vehicles

MHDV: Medium- and Heavy-duty Vehicles

OCPP: Open Charge Point Protocol

1. About this Document

1.1 Purpose of the Guide

The purpose of this guide is to help Metro Vancouver local governments and other key actors plan public and multifamily building EV charging infrastructure for light-duty vehicles (LDVs).

Metro Vancouver has the highest EV adoption rate of any region in Canada: in Q4 2022, 25% of new vehicles registered in Metro Vancouver were EVs.[1] EVs now comprise approximately 5% of all vehicles in Metro Vancouver.[2]

This progress is the result of leadership by many actors. Significant progress on charging infrastructure has been made to date. For example, many Metro Vancouver municipalities have adopted best-in-class rules requiring new construction to be EV ready. Meanwhile, BC Hydro and other actors have invested in a foundational network public EV charging stations. To keep up with continued EV adoption—and ensure equitable access to electric mobility—continued expansion of EV charging infrastructure is necessary.

The recommended principles and actions in this guide are based on the latest information about EV adoption and infrastructure and can be implemented in the near to medium term (two to five years). Implementation practices should continue to be re-evaluated over time as policy, technology and the region itself change.

It takes an ecosystem to deploy and operate a charging network. **This guide was developed with Metro Vancouver municipalities and First Nations anticipated as the primary audience, along with the project sponsors (Metro Vancouver, TransLink and BC Hydro).** Other key actors that can use this guidance include building owners, landowners, charging network companies, and other orders of government.

1.2 Navigating the Guide

This guide covers the following questions:

- **What are the basics EV charging infrastructure?** See Section 1
- **What should be our guiding principles for EV charging infrastructure planning and deployment?** See Section 3
- **Who should do what?** See Section 4
- **What actions should local and regional governments take in the near to medium term?** See Section 5
- **How much infrastructure do we need?** See Section 6
- **How do we make our strategies equitable?** See Section 6.2
- **What are the operational considerations?** See Section 7

[1] https://electricautonomy.ca/2023/02/13/canada-zev-sales-q4-2022/
[2] Derived from the Province of BC's Zero-Emissions Vehicle Update 2022 and Statistics Canada's Table 23-10-0308-01 Vehicle registrations, by type of vehicle and fuel type

2. EV Charging Basics

For light-duty vehicles (LDVs - cars, vans, SUVs and light trucks) there are three main charging levels: Level 1, Level 2, and direct current fast charging (DCFC), sometimes referred to as Level 3 or, simply, fast charging. The main characteristics of these charging types for LDVs are provided in Table 2-1.

Table 2-1. Main characteristics of different charging types for LDVs

Charging Type	Charging Power	Approx. charging time for 300 km of range[3]		Charging Location					Type of light-duty EV that can use
		Typical car	Typical SUV/ light truck	Other resid-ential	Multi-fam. bldg	Pub-lic	Dep-ot	Shared comm-ercial	
Level 1	1.3-2.4 kW	46-25 h	69-37.5 h						BEV and PHEV
Level 2	3 kW	20 h	30 h						BEV and PHEV
	7 kW	8.5 h	13 h						
	9.6 kW	6 h	9.5 h						
	19.2 kW	3.25 h	4.75 h						
DCFC	25 kW[4]	2.5 h	3.5 h						BEV
	50 kW[5]	1.25 h	1.75 h						
	100 kW	36 min	54 min						
	150 kW	24 min	36 min						
	350 kW	10 min	15 min						

[3] Many vehicles do not require a full 300 km charge on a typical day.

[4] While 25 kW chargers use direct current, they are not considered "fast" chargers. As seen in the charging times, they are only appropriate where vehicles are staying for over two hours.

[5] While 50 kW chargers use direct current, they are increasingly not considered sufficiently "fast" to provide on-the-go charging. Deployment organizations are increasingly focusing on charging speeds of 75kW and above.

Charging at home (whether in ground-oriented homes or in multifamily buildings) plays the largest role in the charging ecosystem in terms of the number of ports and the overall amount of energy dispensed at those locations. According to a survey of BC EV drivers conducted by BC Hydro in late 2022 of their public EV charging network members, 86% of EV drivers respondents use home charging. Meanwhile, most of these drivers also use public charging at least some of the time; 88% and 77% of EV drivers respondents use BC Hydro and other public charging stations, respectively.[6]

Despite the importance of home charging, **public charging** plays a critical role in the ecosystem for three principal reasons:

1. It is the only choice for residents who do not have access to home charging, which includes:
   - **"Garage orphans":** a term sometimes used for people without any access to private home parking. This group includes people in all housing types. They will always rely on public charging.
   - **People living in multifamily buildings** who have access to parking, but where that parking space has not had the electrical upgrades required to support the installation of EV charging. This second group can use public charging, or their parking space can be retrofitted to become EV ready. As more multifamily buildings are retrofitted, fewer members of this group will rely exclusively on public charging.
2. The presence and visibility of **public charging** is crucial to helping consumers overcome range anxiety and feel confident purchasing an EV.
3. Providing opportunities for mid-day charging may become increasingly important to the electrical system to **balance loads** as more low-cost solar energy comes onto the grid.

We consider four categories of charging in this Guide:

1. **Ground-oriented home charging.** People living in ground-oriented housing (single family homes, duplexes, triplexes and row houses) are more likely to have access to, and ownership of, a parking space attached to their living space (e.g. a private garage or parking pad). Installation of EV charging in these settings can be relatively simple, although panel and/or service upgrades or other electrical works are sometimes required and implementing appropriate EV energy management systems in these building types can be complicated.
2. **Multifamily building charging.** Multifamily building apartments feature shared parking areas. It is more challenging for multifamily building residents to install EV charging, even when they do have access to a parking spot, due to legal, financial, technical and logistical barriers inherent in both condominiums and rental apartments.
3. **Public charging,** which includes:
   - **Community charging,** which can be on-street (curbside) or off-street (for example, in publicly accessible parking lots or garages).
   - **Highway charging,** which is provided on major corridors, mostly serving people making long trips.

[6] BC Hydro, 2023. Public EV Charging Service Rates Application submitted to BCUC. Exhibit B-1.

- **Workplace charging,** which is mainly used by employees but could be publicly accessible, and can be provided on- or off-street.

4. **Shared commercial charging.** This type of charging is shared among fleets but is exclusively dedicated to commercial vehicles. It is placed in strategic locations for fleets like taxi stands and downtown delivery zones.

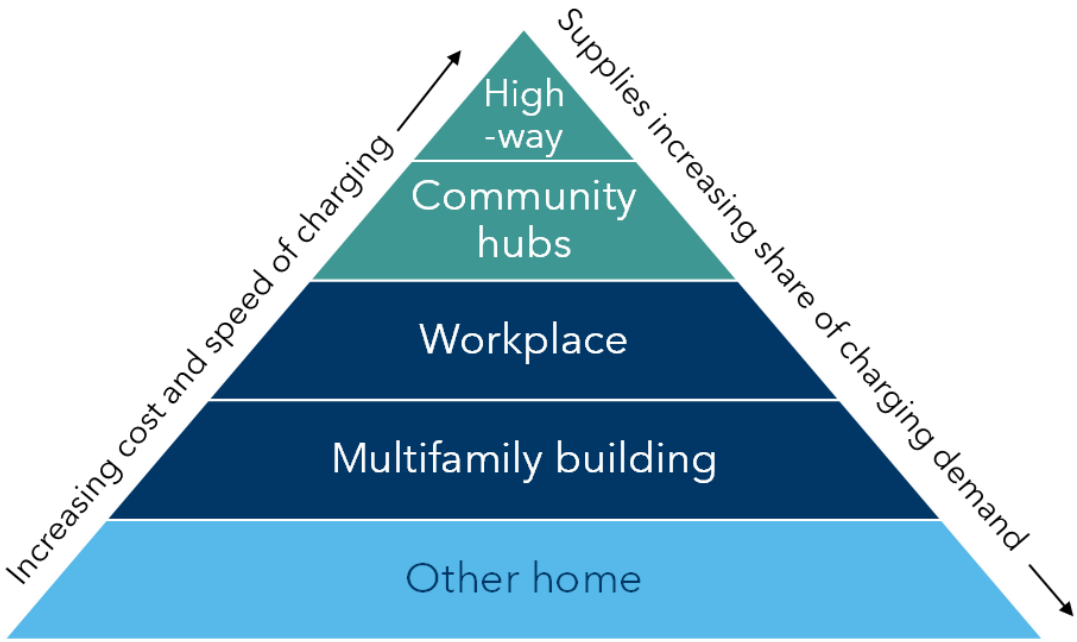

Figure 2-1. Relative importance of different charging categories, by total energy dispensed[7]

[7] Figure adapted from: U.S Department of Energy, *A Guide to the Lessons Learned from the Clean Cities Community Electric Vehicle Readiness Projects*, 2014.

2.1 Potential Revenues from EV Charging

Potential revenues from operating public charging infrastructure include the following:

- **User fees.** User fees can be applied for parking and/or for use of charging infrastructure. Fees for charging are usually structured on a time basis ($/minute); however, regulations introduced by Measurement Canada in February 2023 now allow site hosts to charge on a volumetric basis ($/kWh, $/kW).
- **BC Low Carbon Fuel Standard and Canada Clean Fuel Regulations.** BC's Renewable and Low Carbon Fuel Requirements currently provide a robust market for carbon credits. These credits are generated by providing EV charging; wholesalers of polluting gasoline and diesel must procure these credits in increasing quantities. This provides an exceptional opportunity for revenue that can make offering many forms of EV charging profitable. However, the value of these credits in the future is uncertain; it is possible their value will reduce and providing EV charging will accordingly become less lucrative.
  Utility services, such as demand response. Utilities are increasingly offering voluntary rates and/or programs that provide financial rewards to customers operating equipment (e.g. EV chargers) that can be controlled in such a way to provide benefits to the electricity grid. For example, EV chargers can provide demand response services, reducing power consumption when wholesale electricity prices are high and/or the grid is congested. This provides revenue opportunities for network operators.
- **Advertising.** Charging infrastructure, screens and apps can feature advertising, presenting revenue opportunities for networks.

3. Strategic Principles

Local and regional governments should adopt the following strategic principles in their efforts to support EV charging infrastructure deployment in their communities:

STRATEGIC PRINCIPLES FOR LOCAL GOVERNMENTS

1. Embrace the **critical role of local governments** in providing public EV charging infrastructure
2. Continue to prioritize **active and shared modes**
3. Ensure **equitable access** to EV charging
4. Take a **futureproofing** approach
5. Focus on convenient EV charging located **where vehicles already park**
6. Enable **private-sector and utility investment**
7. Advocate for **senior government and utility policies** that support EV charging

Below, we briefly describe the rationale for each of these principles. The principles inform the recommended Deployment Actions that follow in Section 5.

Principle 1. Embrace the critical role of local governments in providing public EV charging infrastructure

Local and regional governments have a critical role to play in the supply of EV charging to residents.

Local governments directly control land use, use of the right-of-way, business licencing, and parking in their communities, while also owning and operating public lands. Local governments therefore **control many of the opportunities to provide public charging**. By deploying, allowing, and/or requiring EV charging to be deployed, local governments can speed the transition to EVs.

Specifically, the key tools at local governments' disposal include:

- **Policy/regulation:** adopting bylaws, business licencing requirements, and land development approaches that require EV charging deployment on private lands.
- **Providing lands:** cities own rights of way, parking facilities, and other public lands that are strategic public charging sites.
- **Engagement, partnerships and education:** bringing together charging service providers, other orders of government, landowners, developers, financial institutions and others to collaborate on EV charging deployment. Likewise, local governments can inform their residents about opportunities to implement EV charging.
- **Planning and target setting:** local governments have intimate knowledge of their residents needs, travel patterns, use of public space, and future infrastructure and land development plans. As such, municipalities should be involved in setting deployment strategies to ensure alignment with other policy objectives.

- **Investment:** procuring or otherwise funding the deployment of public, multifamily, and shared commercial charging. Further discussion of deployment and operation models is provided in the next paragraph.

There can be significant benefits to municipally-led charging networks, including a greater ability to match location, charging type and pricing in line with local public interests. Municipalities should only seek to establish or expand their own independently managed EV charging networks if they have dedicated sufficient capital, operating and staff resources, and plan to achieve significant economies of scale. Alternately, local governments could partner with BC Hydro with the municipality providing sites to host public charging; BC Hydro has indicated their interest in such partnerships.

Principle 2. Continue to prioritize active and shared modes

The transition to EVs must not come at the expense of more sustainable modes of transportation, including walking, biking, and transit. When planned and designed appropriately, EV charging infrastructure can complement and even **enhance the experience of people using other transportation modes.** For example:

- Public charging stations located on mid-road islands can double as protected bike lanes or curb bulges.
- EV charging can supply power for food trucks or other on-street amenities, reducing air and noise pollution and enhancing the pedestrian experience.
- Supporting the electrification of carsharing and passenger directed fleets (ridehailing and taxis) can help improve the business case for these modes, reduce emissions from high mileage fleets, and support drivers who are less likely to have home charging access.

Local governments must **coordinate internally to avoid conflicts with active and shared modes**; for example, planning the cycling network and on-street chargers on different corridors. Further, while there is a strong rationale for subsidizing EV charging, local governments should ensure that policies do not inadvertently oversupply or underprice parking in ways that incentivise vehicle use.

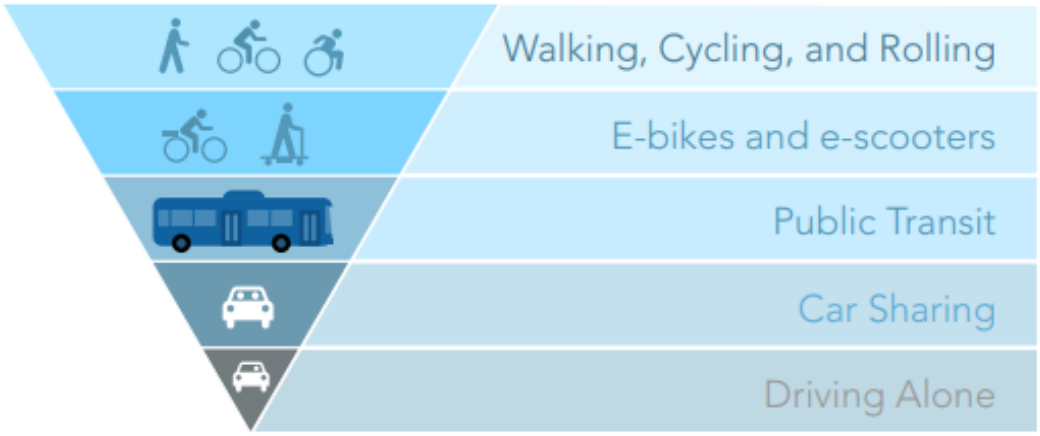

Figure 3-1. Transportation hierarchy[8]

Principle 3. Ensure equitable access to EV charging

It is critical that historically disenfranchised and equity-deserving groups (including low-income households, recent immigrants, disabled people, and renters) **face no additional barriers** to accessing EV charging compared to more privileged members of Metro Vancouver's communities.

Likewise, it critical that EV charging infrastructure is designed to be **safe** (including for women in public spaces) and **designed for accessibility**. Section 6.2 includes further guidance on how to plan and deploy EV charging infrastructure with a focus on social equity.

Principle 4. Take a futureproofing approach

EV adoption is already growing rapidly in Metro Vancouver and it will accelerate over the next decade, driven by increasing consumer interest, decreasing costs, and especially the BC Zero-Emission Vehicle (ZEV) sales mandate. According to forecasting conducted for this project, the number of light-duty EVs on the road in the region will surpass **0.5 million by 2033** and **1 million by 2038**, up from about 90,000 today. While the rate of adoption is somewhat uncertain, the end state is known—by 2035, 100% of sales will be EVs, resulting in near complete fleet turnover by 2050 or earlier.

Accordingly, in the next five to 10 years, **there is little risk of building too much public charging infrastructure**; demand will soon catch up with any temporary oversupply. Rather, there is a risk of under-building, which could slow the transition to EVs if people do not feel confident adopting EVs. An undersupply could even threaten the viability of policies like BC's ZEV sales requirements, which are predicated on all residents being empowered to adopt an EV if they are going to drive a personal vehicle. Accordingly, **local governments must facilitate rapid and widespread deployment of EV charging infrastructure**.

[8] Source: Metro Vancouver Climate 2050 Transportation Roadmap

Principle 5. Focus on convenient EV charging located where vehicles already park

The best place to charge is a place where the vehicle is already parked, whether at home overnight, at work during the day, or at retail establishments or other amenities. Key locations include transit hubs and park and rides (where taxi and ridehailing fleets, as well as individuals) often conduct pickup and drop-offs. Local governments have the best knowledge and data on travel behaviour and use of public space.

Where possible, Metro Vancouver and its members should maximize the potential of EV charging at drivers' **homes, workplaces and regular destinations**, as opposed to new dedicated public charging locations where drivers must make special trips. This approach will be **more convenient for drivers**, while **reducing the space devoted to cars**. Accordingly, public EV charging hubs should be **close to amenities** (such as food and washrooms), with charging speeds aligned with typical vehicle parking dwell times and frequency of visits (**faster charging for shorter stays and slower charging for longer parking times**).

Principle 6. Enable private-sector and utility investment

EV charging infrastructure will be deployed by several organizations in Metro Vancouver, including BC Hydro, the private sector, and local governments. Successful deployments rely upon the timely and low-cost approval of projects by local governments, but in some cases, legacy regulations or inappropriate processes pose barriers. For example, some municipalities unnecessarily apply building permitting to public charging stations or do not count dedicated EV charging parking towards parking minimums. Local governments should **strive to be "open for business" for private sector and utility EV charging networks.** See Action 2.1 for further information.

Principle 7. Advocate for senior government and utility policies that support EV charging

Local governments can also call for and support federal, provincial and utility policies that help improve the business case for charging investment. For example, **Local governments should continue to serve as a strong voice for effective climate and energy policy** that serves their interests as operators of charging infrastructure and more importantly the interests of their communities.

4. Roles for Key Actors

Deploying EV charging infrastructure at the scale necessary requires **big, coordinated actions** across the ecosystem from governments, utilities and third parties. **There are significant benefits to publicly owned charging infrastructure,** including setting locations and charging fees in the public interest. This is particularly important to ensure service to historically and currently underserved communities. **Overall, some level of public sector intervention is required to ensure equitable access to EVs and charging.**

There are some responsibilities that only certain actors can address. For example, municipalities and provinces have **unique regulatory powers** (land use approvals, zoning, right of way permissions) that must be leveraged. Likewise, successful deployment is not possible without timely **electrical service extensions** provided by the utility.

On many other fronts, multiple actors have the opportunity and responsibility to act, including **establishing targets, investing in infrastructure, and educating the public**. This means that setting clear roles and mechanisms for coordination among actors in the Metro Vancouver region will be critical to avoid duplication and align efforts. Table 4-1illustrates the most important roles to be played by these different actors.

Table 4-1. Roles for key actors

Action	Fed. Govt.	Prov. Govt.	MVRD, Trans-Link	Local govts.	BC Hydro	First Nat-ions	Prop-erty owners	Charging service providers
Establish deployment **targets**; monitor and evaluate								
Invest in charging infrastructure								
Ensure **equitable access** for underserved communities								
Provide **public data** that support planning								
Provide **lands** for infrastructure deployment								
Invest in **workforce** training and development								
Establish a supportive **regulatory framework**								
Use **regulatory tools** to require private sector deployment								
Provide timely **approvals**								
Develop **demand response programs** & utility-integrated EV Energy Management Systems (EVEMS)								
Develop **electricity supply** to meet future demand								
Provide timely **electrical services**								

4.1 Role for Local and Regional Governments

When local and regional governments deploy charging infrastructure, they must choose from **several possible deployment models**, including:

- **Partnering with BC Hydro to deploy infrastructure**. BC Hydro encourages this approach (see Section 4.2);
- **Investing directly,** by:
  - Funding the deployment of infrastructure by third parties through grants or procurement;
  - Owning their own infrastructure but outsourcing operations; or
  - Owning and operating their own infrastructure.

Despite the potential revenues outlined in Section 2.1, the ability to recover the investment costs of public charging infrastructure is uncertain, due especially to uncertainties around the price and future availability of Low Carbon Fuel Standard credits, charging demand, capital costs, maintenance costs, electricity rates and demand charges.

Accordingly, there is a crucial role for the public sector to support deployment of charging infrastructure, to ensure that a lack of charging in not-profitable areas does not present a barrier to EV adoption. In this context, local and regional governments should expect that providing EV charging in the public interest may mean operating these services at a loss in some cases.[9] Further discussion of considerations for municipal-led deployment are explored further in Section 6 Deployment Planning.

[9] While there is a strong rationale for subsidizing EV charging, there is no justification for subsidizing *parking* in general. It is recommended that local governments ensure that policies do not oversupply or underprice parking in ways that incentivise excessive private vehicle use or incur unnecessary construction costs.

MUNICIPAL PRIORITY AREAS FOR EV CHARGING

There are specific strategic charging sites on lands that local and regional governments and authorities control, influence, or understand, including:

- Employment and commercial hubs
- Tourism sites
- Park and rides at transit stations
- Taxi and ridehailing stands
- Concentrations of people without home charging
- Equity-deserving areas

Whether local and regional governments are deploying their own infrastructure or partnering with BC Hydro or third parties for deployment, they can make sure these sites of municipal interest are incorporated into plans. See Section 6 Deployment Planning for further guidance on area prioritization and site selection.

4.2 Role for BC Hydro

At the end of the 2023 fiscal year, BC Hydro had deployed 141 DCFC ports across 83 sites in British Columbia. Of those sites, 31 serve urban populations (greater than 30,000 residents) and the remainder serve non-urban and corridor charging. BC Hydro's network currently represents about 14% of the public DCFC market share and less than 1% of the public Level 2 market share.[10]

BC Hydro's Electrification Plan (2021) established its current plan to have 325 fast chargers (around 450 DC ports) at 145 sites by the end of 2025.

On July 28, 2023 BC Hydro filed an application to the BCUC for a 10-year levelized public charging rate, along with a 10-year reference deployment plan to expand BC Hydro owned and operated public charging stations to 2000+ DC ports and 1200+ Level 2 charging ports by 2033. The plan includes a wide spectrum of public charging power levels from Level 2 through 350kW DCFC.[11]

While the outcome of this regulatory process will not be known until after the completion of this report, this proposed plan by BC Hydro is substantial and indicates to local governments that BC Hydro is ready to provide significantly more public EV charging infrastructure. BC Hydro encourages local governments to start or continue working with BC Hydro to ensure sites in their communities are ready and secured for investment by BC Hydro.

[10] BC Hydro (2023). BC Hydro Public Electric Vehicle Charging Rates Workshop presentation.

[11] Details of the BCUC proceeding (as of August 2023) can be viewed here: https://www.bcuc.com/OurWork/ViewProceeding?applicationid=1139

4.3 Role for First Nations

As shown in Table 4-1, First Nations will generally have a similar role to municipalities when it comes EV charging. Like municipalities, First Nations may set targets for EV charging deployment in their communities and pursue deployment independently or through partnerships. In this regard, the recommended actions for local governments in this guide may also support First Nations in their planning.

Furthermore, local and regional governments must consult First Nations in developing their EV charging infrastructure strategies. The action plan (Section 5) includes recommendations to this effect.

5. EV Charging Deployment Actions

This section presents **policies, procedures, investments and partnerships** that municipal governments, Metro Vancouver and Translink should take to support deployment of EV charging infrastructure, along with actions by other actors that local and regional governments can advocate for. Actions in Table 5-1 are grouped into the following categories:

1.0 Formalize EV charging strategies

2.0 Require and support public charging on private property

3.0 Invest in municipal/regional charging networks

4.0 Adopt design practices that support access and integration

5.0 Require and support EV ready multifamily residential buildings

6.0 Call upon the Province of BC, the BC Utilities Commission, and BC Hydro to continue to adopt a supportive regulatory environment

Table 5-1 also provides information to support implementation, including:

- **The appropriate lead organization**:
  - Local government (LG)
  - Regional entity which includes Metro Vancouver and Translink (Reg.)
  - BC Hydro (BCH)
  - BC Utilities Commission (BCUC)
  - Province of BC (Prov.)
- **The type of action** (policy, procedure, investment, engagement or partnership)
- **Time frame** (indicates a combination of urgency and ease of implementation)
- **Cost to government** ($, $$, or $$$). Regulatory and policy actions are considered low cost while investments and programs entail greater costs.

Table 5-1. Action plan

Action		Lead	Action Type	Time Frame	Cost to Govt.
1.0	**Formalize EV charging strategies** (multifamily, public and shared commercial charging)				
1.1	**Adopt charging infrastructure targets, plans and strategies**	LG & Reg.	Policy	0-2 yrs	$
2.0	**Require and support public charging on private property** (public and shared commercial charging)				
2.1	**Streamline municipal regulatory regimes and provide timely project approvals**	LG	Procedure	0-3 yrs	$
2.2	**Adopt EV ready requirements for parking in new non-residential developments**	LG	Policy	0-2 yrs	$
2.3	**Develop regulatory incentives for installation of EV charging infrastructure on appropriate commercial land uses**	LG	Policy	0-4 yrs	$
2.4	**Secure additions to public fast charging networks in appropriate new development approvals**	LG	Procedure	0-4 yrs	$
3.0	**Invest in municipal/regional charging networks** (multifamily, public and shared commercial charging)				
3.1	**Establish an agreement with BC Hydro to support deployment of public, workplace and residential EV charging; and/or establish or formalize local government EV charging services**	LG & BCH	Investment	0-2 yrs	$ - $$$
3.2	**Explore a regional government EV charging service**	Reg.	Investment, Partnership	0-2 yrs	$$$
3.3	**Engage with First Nations to support the deployment of infrastructure**	Reg.	Engagement, Partnership	0+ yrs	$
3.4	**Support access to parking and charging for carshare**	LG &/or Reg.	Policy, Investment	0-4 yrs	$$
3.5	**Support access to charging for taxis and ridehailing**	LG &/or Reg.	Policy, Investment	0-4 yrs	$$
3.6	**Establish a coordination body to oversee the deployment of public EV charging services**	Reg.	Engagement, Partnership	0-5 yrs	$

Action		Lead	Action Type	Time Frame	Cost to Govt.
4.0	**Adopt design practices that support access and integration** (multifamily, public and shared commercial charging)				
4.1	**Enable curbside EV charging with electricity sourced from an adjacent building or utility connection point**	LG	Procedure	0-4 yrs	$
4.2	**Integrate public EV charging into street design in a way that is compatible with other land uses**	LG	Procedure	0-2 yrs	$
4.3	**Develop procedures and practices for ensuring deployment is universally accessible and safe**	LG	Procedure	0-2 yrs	$
5.0	**Require and support EV ready multifamily residential buildings** (multifamily charging)				
5.1	**Adopt EV ready requirements for new residential developments**	LG	Policy	0-1 yrs	$
5.2	**Provide top-up incentives complementary to the EV ready Incentive Program**	LG	Investment	0-2 yrs	$$$
5.3	**Explore financing mechanisms, "make ready" programs, and other initiatives to support EV ready retrofits of multifamily buildings and workplaces**	LG &/or Reg.	Partnership	0-2 yrs	$-$$$
5.4	**Educate residents, rental building owners and strata corporations on options for providing EV charging infrastructure in multifamily buildings**	LG &/or Reg.	Policy	0-2 yrs	$
6.0	**Call upon the Province of BC, the BC Utilities Commission, and BC Hydro to continue to adopt a supportive regulatory environment** (multifamily, public and shared commercial charging)				
6.1	**Ensure BC Hydro has a comprehensive regulatory mandate to deploy and to facilitate private sector deployment of EV charging infrastructure**	Prov., BCUC, BCH	Policy	0-2 yrs	$
6.2	**Adopt Province-wide EV ready new construction requirements**	Prov.	Policy	0-3 yrs	$
6.3	**Set Province-wide targets and plans for comprehensive EV ready retrofits of existing multifamily buildings**	Prov.	Policy	0-3 yrs	$
6.4	**Ensure the regulations developed under the Strata Property Amendment Act, 2023 appropriately define Electrical Planning Reports and improve standards of practice for EV ready Plans**	Prov.	Policy	0-3 yrs	$

1.0 Formalize EV charging strategies

1.1 Adopt charging infrastructure targets, plans and strategies

Local governments should adopt charging infrastructure targets and actions into municipal/regional policy, plans and strategies, either in a standalone EV charging strategy or within other planning documents (e.g. Official Community Plans; climate, transportation, and neighbourhood plans. These strategies should:

- Establish EV charging deployment targets, particularly for local government charging networks. Include targets for equity-deserving communities.
- Engage the public in policy development, including equity-deserving communities.
- Formally acknowledge the importance of transportation electrification to achieve GHG reduction goals, improved air quality, reduce noise pollution.
- Acknowledge EVs' position in transportation hierarchies (e.g. continue to prioritize active modes, transit, etc.).
- Providing the mandate for all departments and services to facilitate deployment of EV charging.
- Commit to actions. Consider those noted in this document.

2.0 Require and support public charging on private property

2.1 Streamline municipal regulatory regimes and provide timely project approvals

Local regulatory regimes can impose unintended barriers to expanding public, workplace and residential charging. Local governments should review and update regulations, permitting and licensing requirements to remove barriers to investment in EV charging. Priorities include:

- Ensure zoning and parking requirements do not create unnecessary barriers (e.g. excessive minimum drive aisles and parking space dimensions). Dedicated EV charging parking spaces should count toward parking minimums to avoid requiring additional parking in new or retrofitted buildings. Consider clarifying that EV charging in visitor parking may be accessed by residents of a property.
- Do not apply building permits to EV charging infrastructure deployments.
- Clarify that premises collecting EV user fees for EV charging do not require a separate business license for that activity.
- Frontline municipal staff should be educated on relevant regulations and policies.

2.2 Adopt EV ready requirements for parking in new non-residential developments

Local governments should ensure they have EV ready requirements for new non-residential construction requiring that 20 to 40% of parking spaces be EV ready. Alternate compliance mechanisms may also be offered.

Requirements should provide for both workplace (longer-term) and visitor (shorter-term) EV charging applications; consider published best practice resources and local precedents for how to best achieve these policy objectives.[12]

[12] McEwen. 2021. *"EV ready" Requirements for New Buildings: A Best Practice Guide for BC Local Governments.*

Many Metro Vancouver municipalities have been world leaders in establishing these requirements; several have been adopted and more are underway.

See also Action 5.1 for residential EV ready requirements.

2.3 Develop regulatory incentives for installation of EV charging infrastructure on appropriate commercial land uses

Land uses such as service stations, public parking facilities, retail and assembly destinations are excellent opportunities for public EV charging; local governments can compel owners of these types of properties to provide EV charging. Local governments should consider:

- Replicating the City of Vancouver's business licence regime for EV charging. Effective January 2025, gas stations must provide at least 50kW of charging capacity, and public parking lots 26 kW (equivalent to four dedicated Level 2 chargers). Businesses that do not meet these requirements will pay an extra $10,000 on their business license annually.
- Flexible compliance mechanisms as part of the regimes, including allowing businesses to comply by building infrastructure offsite when onsite conditions are overly challenging. A few years' lead time should be provided.

Metro Vancouver should also consider developing requirements for charging as part of its authority to regulate air quality.

2.4 Secure additions to public fast charging networks in appropriate new development approvals

Local governments should develop policies to secure additions to publicly-accessible EV charging networks as a consideration of rezoning and/or development approvals for appropriate new developments. Consider the opportunity for a private property site to convey ownership and operations of the EV charging infrastructure to local government, BC Hydro, or other public charging networks.

3.0 Invest in municipal/regional charging networks

3.1 Establish an agreement with BC Hydro to support deployment of public, workplace and residential EV charging; and/or establish or formalize local government EV charging services

As part of its July 2023 application to the BCUC, BC Hydro filed a 10-year reference deployment plan for EV charging. This plan signals BC Hydro's interest in collaborating with BC local governments to deploy EV charging.

Metro Vancouver municipalities are recommended to engage with BC Hydro to develop agreements (for example, memorandums of understanding) on how to collaborate in deploying public charging infrastructure. Likewise, the agreements can identify respective roles to support home and workplace charging.

Likewise, as discussed in Principle 1, in appropriate circumstances, there are benefits to local governments investing in their own public EV charging assets to supply public, workplace, and potentially multifamily building charging. Local governments that choose to invest and operate EV charging services should establish sufficiently resourced and budgeted local government public EV charging services. Local governments deploying their own EV charging networks should:

- Define the objectives of the public charging service which should include some cost recovery, but not necessarily seek full cost recovery or profitability.
- Formally recognize the environmental and social benefits of charging

infrastructure investments, and explicitly plan for equitable deployment. This may entail operating at a loss, particularly in early years.

- Establish a preliminary target market share. For local governments, it is reasonable to aim to deploy 10% to 30% of the total charging infrastructure demand forecast.[13]
- Include targets for investments in equity-deserving communities.
- Include a commitment to meet all demand for workplace charging at city facilities; workplace charging can support talent retention and demonstrate leading by example.
- Formalize an operational unit to provide EV charging services, with sufficient resources to meet targets.
- Engage consultants and EV charging service providers to support network deployments.
- Plan medium-term (e.g. next 5 years) EV charging deployments, including cost estimates. Incorporate plans into municipal capital and operating budgets.
- Charge user fees to achieve some degree of cost recovery and encourage efficient use of infrastructure by community members.
- Pursue revenue streams from Low Carbon Fuel Standard credits, utility demand response programs, and potentially other sources.
- Periodically evaluate targets and performance.

3.2 Explore a regional EV charging service

As noted in Action 3.1, responsible stewardship of public resources when building EV charging networks requires dedicated professional management of EV charging networks and a sufficient scale of investment to achieve economies of scale. To ensure sufficient resources and scale, there may be a case for regional coordination of certain EV charging services – including building public charging infrastructure, as well as efforts to support workplace and residential charging.

It is recommended that Metro Vancouver and its member municipalities consider the business case for a regional public charging network in partnership with BC Hydro, to achieve appropriate scale and professional network management, particularly amongst smaller Metro Vancouver member municipalities.

3.3 Engage with First Nations to support the deployment of infrastructure in First Nations communities according to First Nations' identified needs

One model that may be of interest is increasing funding available for EV charging in First Nations communities and ensuring community ownership of the infrastructure.

3.4 Support access to charging for carshare, taxis and ridehailing

Carshare services are a critical service to enable households to forgo owning a car. Potentially, viability of carsharing can be bolstered through the transition to EVs.

One of the biggest barriers to the expansion of carsharing services is a lack of access to parking. As a result, local and regional

[13] The recommended 10 to 30% market share is based on estimates of how much BC Hydro and private actors will build, as well as a high-level estimation of the amount of parking controlled by local governments.

governments should use all available tools to expand carshare access to parking, including:

- Providing preferential charging at designated on-street carshare parking spaces.
- Leveraging developments review, business license incentives, grants and other mechanisms to support spaces and charging for carshare in residential and non-residential developments.
- Enabling carshare access in existing private parkades, which will reduce the demand for more parking and improve the business case for charging in existing buildings.

The two main types of carshare service include **round-trip carsharing** (members begin and end their trip at the same location) and **one-way carsharing** (members begin and end their trip at different locations). Each service type requires a different approach to charging: round-trip carsharing requires a permanent parking space with Level 2 charging. One-way carsharing can make use of publicly available charging, both Level 2 and fast charging. Across Canada, some providers are basing their model for EV carsharing on the premise that users will charge the EV (necessitating affordable overnight Level 2 charging) while others have staff that take care of charging the vehicles (necessitating access to fast charging). Local governments should engage further with carsharing providers in their jurisdictions to determine specific needs.

Given the regional nature of carsharing use, charging for carsharing is a strong candidate for regional coordination.

3.5 Support access to charging for taxis and ridehailing

Supporting the electrification of taxi and ridehailing services offers an excellent opportunity to reduce emissions, expand EV adoption, and support equity. Drivers can cover upwards of 300 kilometres per day, meaning that the business case for taxi and ridehailing electrification is strong, but drivers need support to overcome (a) the high capital cost of the vehicle and (b) access to charging.

To support charging for taxi and ridehailing drivers, local governments should:

- **Ensure there is a network of very fast charging (e.g. 350kW) at key pickup/dropoff points and taxi stands.** Consider providing this network exclusively to commercial vehicles (at least during peak demand hours) to ensure low wait times. (This model has been pursued in London, UK).
- **Explore opportunities to provide access to home charging for drivers.** (This model is being pursued by the Atmospheric Fund in Toronto).

Given the regional nature of taxi/ridehailing use, charging for carsharing is a strong candidate for regional coordination.

3.6 Establish a coordination body and develop tools for the scaling of public EV charging services

There are a variety of EV charging infrastructure deployment models involving local governments that would benefit from the adoption of replicable design approaches, bulk procurement/deployment, and central administration.

Deployment at scale will benefit from collaboration between BC Hydro, local governments, and EV charging service providers. Such coordination could be facilitated via the Local Government EV Peer Network, the Regional Engineering Advisory Committee, or other fora.

As part of this coordination, regional actors like Metro Vancouver and TransLink could develop the following tools to support rapid and cost-effective local government procurement and deployment:

- **Model Request for Proposal** documents that accelerate the process of establishing performance criteria for the design and operation of charging infrastructure.
- **Joint procurement** processes to help local governments procure infrastructure quickly and cost-effectively.
- **Model bylaws** to expedite the development and adoption of municipal rules including EV ready requirements (Actions 2.2 and 5.1), EV charging requirements within business licencing regimes, and processes to secure public EV charging in new developments.
- **Regular collection and dissemination to local governments of market intelligence about planned charging investments by other actors**. At a minimum, the coordination body would liaise between BC Hydro and EV charging service providers deploying public charging (e.g. Tesla, Electrify Canada, ChargePoint, etc.) to understand their deployment plans.

4.0 Adopt design practices that support access and integration

4.1 Enable curbside EV charging

On-street EV charging can be most cost-effective when it uses power supplied from an adjacent building (as opposed to a new electrical service), and/or when timely electrical and civil works create the opportunity for a utility grid connection to the parking space. Local governments should consider how best to enable curbside EV charging using power supplied from private property, while ensuring other policy goals for the street are realized. As part of this effort, local governments should:

- Formalize processes to designate "EV Only" or "EV Preferred" parking where charging is provided;
- Incorporate accessibility standards;
- Avoid conflicts with current or future municipal infrastructure, including proactively designating acceptable and unacceptable locations for charging;
- Adopt policies to allow for cost-recovery of electricity and charging infrastructure by those providing these amenities (e.g. the adjacent building), while ensuring municipalities retain control over curbside charging pricing;
- Require new developments implementing changes to the right of way to provide power to on-street EV charging. Alternately, require developers to install "make ready" conduits along the curbside when replacing the curb and sidewalk as part of the new development, connection between the parking space and the developments electrical room or a suitable utility connection point. Collaborate with BC Hydro and development stakeholders to establish consistent specifications;
- Enable use of extension cords to provide curbside charging in residential neighbourhoods, with appropriate rules for covers over sidewalks for safety and accessibility. Consider the City of Vancouver's EV Cord Cover License as a model.

4.2 Integrate public EV charging into street design in a way that is compatible with other land uses

EV charging can integrate well into the public realm but when not properly designed, can result in conflicts with other modes, stranded assets or excessive costs (if chargers need to be moved or modified).

Local governments should coordinate EV charging with other relevant plans, including active transportation networks, parking and curb access, food trucks, street engineering, facilities planning and design, and green infrastructure. When major street or facility works are planned, always consider opportunities to integrate EV charging. See Section 6.3 below for further guidance on siting EV charging infrastructure.

4.3 Develop practices and procedures for ensuring EV charging is universally accessible and safe by design

Incorporating accessible and safe design considerations as mandatory criteria at the inception of the project will ensure all EV users have access to barrier-free charging while ensuring regulatory compliance and avoiding costly renovations in the future.

Key accessibility considerations include the **physical accessibility** of the parking stall and the connector, as well as the **accessibility of all related communications interfaces** (apps, payment system, etc.)

While there are currently no regulations or consistent standards for accessibility of EV charging stations in Canada, there are several resources available (see Section 7.1.1).

Incorporating safety by design principles means ensuring groups that experience more harassment and violence in the public realm (women and gender diverse people, racialized people) **feel safe** using the infrastructure. Considerations include **visibility to the site, good maintenance, good lighting, and availability of cell phone reception**.[14]

In all cases, involving and consulting people with lived experience in setting design standards is critical. To ensure consistency across the region, a regional entity may be best suited to support the development and dissemination of best practices.

5.0 Require and support EV ready multifamily residential buildings

5.1 Adopt EV ready requirements for new residential developments

The most cost-effective way to provide charging access in new multifamily buildings is to require the EV ready components to be installed at the time of construction. Without this future-proofing approach, it becomes more costly and complicated to retrofit multifamily buildings to have EV charging.

Local governments should adopt requirements stipulating that 100% of parking in new residential developments be EV ready. Many Metro Vancouver municipalities have already taken this step, which represents the best practice internationally.

5.2 Provide top-up incentives complementary to the EV ready Incentive Program

BC's EV Ready Rebate Program for multifamily buildings provides a funding for building owners to future-proof multifamily buildings with EV charging infrastructure at scale. Local governments should consider providing top-up funding to the program.

Local governments should also explore other opportunities to support EV ready retrofits in collaboration with other regional stakeholders (see Action 5.3).

5.3 Explore financing mechanisms, "make ready" programs, and other

[14] See for example SNC Lavalin and Atkins, 2021. Draft Report: Getting Home Safely.

initiatives to support EV ready retrofits of multifamily buildings and workplaces

Local governments should work with other actors (including private sector finance, federal and provincial governments, and utilities) to assess options for EV ready retrofit project financing. Project financing for EV Ready Retrofits can help condominiums, rental buildings and other multifamily developments pursue comprehensive EV Ready futureproofing strategies that tend to be much more cost-effective on a life cycle basis, without needing to make a one-time major cash outlay. Currently, there are limited private sector financing offerings for this type of retrofit, particularly for the condominium sector. Development of appropriate financing mechanisms could be pursued by the Metro Vancouver Zero Emissions Innovation Centre. Consideration should be given for how best to integrate consideration for other building electrification actions into project delivery of EV ready retrofits.

Likewise, comprehensive EV charging futureproofing of multifamily buildings and workplaces could enabled by directing electrical utilities to pay for and rate-base the cost of EV Ready retrofit projects. Similar "Make Ready" programs have been established by New York and California utilities. Metro Vancouver should engage with the Province, BC Hydro and BCUC to explore opportunities for BC Hydro to rate-base the cost of EV Ready retrofits.

Finally, consider collaborating with BC Hydro and the EV charging industry on a standard specification for EV chargers, EV charging management systems, and EVEMS. Such standards would help ensure multifamily residents receive the best value from the EV charging services that are associated with 100% EV ready buildings.

5.4 Educate residents, rental building owners and strata corporations on options for providing EV charging infrastructure in multifamily buildings

Many multifamily residents and owners do not yet have a good understanding of their options for EV charging infrastructure in their properties. Local governments are often regarded as trusted impartial sources of information. Local governments can facilitate information about different opportunities to implement EV charging infrastructure, including comprehensive future-proofing with EV ready retrofits. This could be coordinated regionally, to achieve economies of scale and consistency. There are many resources already available to support education; see Appendix A for a list.

6.0 Call upon the Province of BC, the BCUC, and BC Hydro to continue to adopt a supportive regulatory environment

6.1 Ensure BC Hydro has a comprehensive regulatory mandate to deploy and to facilitate private sector deployment of EV charging infrastructure

BC Hydro currently operates one of BC's largest public charging networks and is actively planning further expansion. Likewise, BC Hydro tariffs and interconnection processes have a significant influence on the costs of deploying charging infrastructure. Metro Vancouver and its member municipalities should engage with the Province, BCUC and BC Hydro to ensure:

a) **BC Hydro has a strong mandate to invest** in its public charging network, especially in urban locations. This should include announcing targets for public EV charging deployment.
b) **Tariffs are designed to support EV charging**. Metro Vancouver and its municipalities could advocate for (1) predictable service extension fees; (2) EV-friendly rate design and the development of demand response programs. This latter category includes

actions like managing the impacts of demand charges, dynamic pricing and/or demand response programs that reflect the real-time cost of power.

c) **Improved transparency of the capacity of different locations on the distribution grid** (capacity on feeders) to accommodate charging infrastructure. Consider requiring BC Hydro to publish a regularly updated "hosting capacity analysis" map.[15]

6.2 Adopt Province-wide EV ready new construction requirements

Province-wide EV ready requirements for new construction should be adopted via legislation or the BC Building Code. Such rules are necessary to support the Province's adoption targets under the *Zero-Emissions Vehicle Act,* which mandates 90% of car sales to be zero-emissions by 2030 and 100% by 2035.

Such EV ready requirements will increase consistency for the development industry across BC while significantly reducing the time and effort required by local governments to adopt their own requirements. It will also support effective future-proofing and associated cost savings, for residents in municipalities that have not yet adopted requirements.

This action should not be implemented unless the Province matches the best practice EV ready requirements adopted by leading Metro Vancouver municipalities that require 100% EV ready residential parking in new developments, and 20% to 45% EV ready non-residential parking. Local governments should continue to expediently implement EV ready requirements in the absence of provincial action.

6.3 Set Province-wide targets and plans for comprehensive EV ready retrofits of existing multifamily buildings

Based on analysis as part of this project, comprehensive EV ready retrofits of existing multifamily buildings (as well as other buildings, such as workplaces and fleet parking) typically represents a more cost-effective and convenient method of providing EV charging at scale, compared to serving multifamily residents with public charging.

Accordingly, it is recommended that Metro Vancouver advocate for Provincial targets for EV ready retrofits be established. Target that all suitable multifamily buildings be 100% EV Ready by 2030. These targets should be supported by plans, including actions to drive adoption of these retrofits (actions for exploration are noted below).

6.4 Ensure the regulations developed under the *Strata Property Amendment Act, 2023* appropriately define Electrical Planning Reports and improve standards of practice for EV Ready Plans

BC *Bill 22 – 2023 The Strata Property Amendment Act, 2023* received Royal Assent on May 11, 2023. Among other actions, it will require that strata corporations obtain an "Electrical Planning Report". The detailed scope of this report will be determined in subsequent regulations, which will likely be drafted in 2023.

These Reports will help stratas understand their electrical systems' capacity in their buildings to support EV charging and electrify other end uses like space heating, hot water, and cooking. Likewise, the CleanBC EV Ready Rebate Program supports EV Ready Plans (i.e. feasibility

[15] See the Interstate Renewable Energy Council. 2020. "Validation Is Critical to Making Hosting Capacity Analysis a Clean Energy Game-Changer".

studies) with incentives, and defines the standards of practice of eligible Plans.

Metro Vancouver should engage with the Province and BC Hydro to ensure that the Electrical Planning Reports and the EV Ready Plans:

a) Help stratas understand their options to make all parking EV Ready, while also electrifying other building loads like space heat, hot water, cooking, etc. This includes understanding how much spare electrical capacity is available in the building to serve these loads, and the electrical design strategies that can provide power to these loads.

b) Are supported by automated, accurate provision of data from electric utilities wherever possible, to help minimize the costs of these reports.

c) Are performed by suitably qualified people.

d) Cannot be easily deferred, given the importance of stratas having this information to achieve regional transportation and buildings decarbonization goals.

6. Deployment Planning

6.1 Assessing Charging Needs

EV adoption is already growing rapidly in Metro Vancouver and it will accelerate over the next decade, driven by increasing consumer interest, decreasing costs, and especially the BC ZEV sales mandate. The Province's proposed update to this regulation will bring the mandate to 26% of sales by 2026, 90% by 2030, and 100% by 2035.

According to forecasting conducted by Dunsky for Metro Vancouver, TransLink and BC Hydro, the number of light-duty EVs on the road in the region will surpass **0.5 million by 2033** and **1 million by 2038**. While the rate of adoption is somewhat uncertain, the end state is known—by 2035, 100% of sales will be EVs, resulting in near complete fleet turnover by 2050 or earlier.

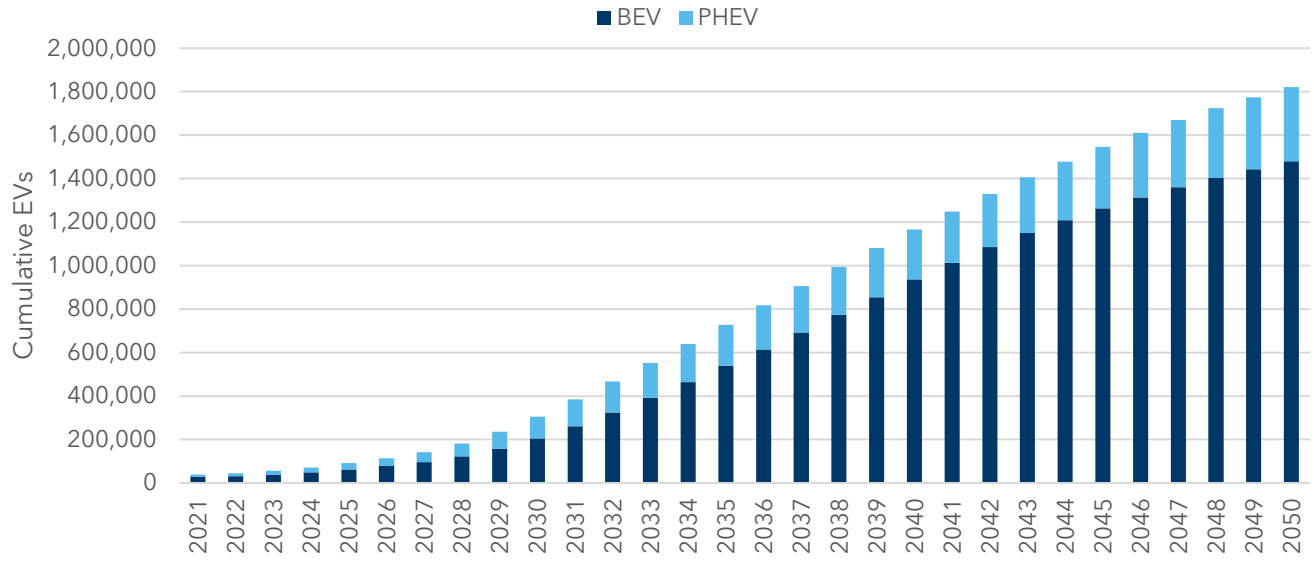

Figure 6-1. Results: Forecasted cumulative EVs on the road, by BEV and PHEV

This growth in adoption must be met with an increase in charging infrastructure.[16] The number and type of public ports required depends especially on the degree of access to home charging among adopters or potential adopters. Many Metro Vancouver residents do not have access to parking at home. These users will always rely on public charging.

Other residents have access to parking but due to the additional challenges related to installation in multifamily buildings, they do not currently have access to charging. Thirteen of 24 Metro Vancouver members, covering most of Metro Vancouver's population, have adopted parking design requirements in parking or zoning bylaws requiring EV ready

[16] Dunsky's charging needs assessment is based on nominal ratios of EVs on the road to EV charging infrastructure required, developed by the National Renewable Energy Laboratory (NREL) and adapted for Canadian communities. This method takes into account key factors such as the relative share of battery electric vehicles (BEVs) and plug-in hybrid electric vehicles (PHEVs); local urban density, climate and driving distances; and assumptions about average charging power.

parking for 100% or near-100% of residential parking in new developments. These rules ensure that charging equipment can be easily installed in any parking provided in new developments.

For existing buildings, parking space retrofits allow for installation of charging equipment. The charging needs assessment that follows is provided under two distinct scenarios to demonstrate the impact that multifamily retrofits can have on (a) the overall demand for public charging and (b) the total infrastructure costs. They are:

1. **High multifamily building retrofit scenario**: 90% (about 350,000) of existing multifamily building units' parking spaces are made EV ready by 2035.
2. **Low multifamily building retrofit scenario:** no additional EV ready retrofits of existing multifamily buildings are carried out; these users rely exclusively on public charging.

Cumulatively, **by 2035,** Metro Vancouver will need:

- **2,200 to 2,900 public DCFC ports** (on corridors, community hubs and for taxi and ridehailing vehicles), and
- **32,000 to 47,000 public L2 ports** (of which about two-thirds would be workplace charging).

Table 6-1 shows the total number of ports and installed power that needs to be added across the region, cumulatively, along with other key outputs include EV to charger ratios. Table 6-2 shows the total number of ports and installed power that needs to be added in five-year increments. Each five-year number should be added to the previous one.

These scenarios represent bookends: the highest and lowest possible approaches to multifamily retrofits. The best solution for Metro Vancouver jurisdictions will likely lie somewhere in between, and local governments can play a role in striking the right balance.

In Appendix B, we provide the disaggregated forecasts for each Metro Vancouver member (municipalities and First Nations). Please refer to the **Modelling Results Report** for further details, assumptions and sensitivities behind the modelling.

Table 6-1. Results: Summary of charging needs (cumulative)

Metric	Scenario	Current	2025	2030	2035	2040	2045	2050
Vehicles on the road								
Total number of LDV on the road (millions)	**All**	**1.5**	**1.6**	**1.7**	**1.8**	**1.9**	**1.9**	**2.0**
Light-duty EVs (thousands)	All	44	91	304	728	1,166	1,547	1,821
Charging needs (cumulative)								
Total public DCFC	**High retro.**	**270**	**931**	**1,196**	**2,152**	**3,362**	**4,203**	**4,627**
	Low retro.	**270**	**937**	**1,417**	**2,926**	**4,911**	**6,574**	**7,707**
Corridor DCFC	All		51	91	211	347	410	410
Community DCFC	High retrofit		840	1,030	1,801	2,859	3,622	4,029

Metric	Scenario	Current	2025	2030	2035	2040	2045	2050
	Low retrofit	270[17] in total	846	1,253	2,575	4,408	5,993	7,109
Shared commercial DCFC	All	0	40	75	140	156	171	188
Total public L2 (including workplace)	**High retro.**	**1,660**	**6,857**	**19,401**	**32,460**	**40,027**	**47,857**	**54,781**
	Low retro.	**1,660**	**6,907**	**23,696**	**46,729**	**62,228**	**79,906**	**97,622**
Workplace L2	High retrofit	1,660 in total	4,526	12,804	21,424	26,418	31,586	36,156
	Low retrofit		4,559	15,639	30,841	41,071	52,738	64,431
Other public L2	High retrofit		2,332	6,596	11,036	13,609	16,272	18,626
	Low retrofit		2,349	8,057	15,888	21,158	27,168	33,191
Total multifamily parking spaces retrofit (cumulative)	**High retro.**	**22,396[18]**	**34,769**	**278,350**	**353,754**	**353,754**	**353,754**	**353,754**
	Low retro.	**22,396**	**0**	**0**	**0**	**0**	**0**	**0**
Other outputs								
BEV/DCFC port ratio	High retrofit	106	68	171	250	278	301	320
	Low retrofit	106	67	144	184	191	192	192
EV/L2 port ratio	High retrofit	27	13	16	22	29	32	33
	Low retrofit	27	13	13	16	19	19	19
EV/total public port ratio	High retrofit	23	12	15	21	27	30	31
	Low retrofit	23	12	12	15	17	18	17
DCFC MW installed[19]	High retrofit	14	78	145	549	1,008	1,261	1,388
	Low retrofit	14	79	167	742	1,473	1,972	2,312
L2 MW installed	High retrofit	10	43	120	201	248	297	340
	Low retrofit	10	43	147	290	386	495	605

[17] We did not assign current ports to any of the sub-categories

[18] The current number of electrified stalls is estimated at 5% of the multifamily building stock. There is no available data to confirm.

[19] The total kW installed is calculated as the number of ports multiplied by the assumed average charging power level of those ports. For higher-power DCFC, the average charging power is lower than the nominal power of the charger most of the time. The ability of vehicles to take a high-power charge will increase over time. If the average power level in the future is different than the forecasts, the revised number of ports can be obtained by dividing the total installed power by the average charging power. The total installed power is **not** equivalent to the load impact; the load impact is much smaller because not all ports will be used at any given time. See the load impacts section for more information.

Table 6-2. Results: Summary of charging needs (in five-year increments)

Metric	Scenario	Current	2025	2030	2035	2040	2045	2050
Charging needs (five-year)								
Annual public DCFC	**High retro.**	**270**	**661**	**265**	**956**	**1,210**	**841**	**424**
	Low retro.	**270**	**667**	**480**	**1,509**	**1,985**	**1,663**	**1,133**
Corridor DCFC	All	270[20] in total	51	40	120	136	63	0
Community DCFC	High retrofit		840	190	771	1,058	763	407
	Low retrofit		846	407	1,322	1,833	1,585	1,116
Shared commercial DCFC	All	0	40	35	65	16	15	17
Total public L2 (including workplace)	**High retro.**	**1,660**	**5,197**	**12,544**	**13,059**	**7,567**	**7,830**	**6,924**
	Low retro.	**1,660**	**5,247**	**16,789**	**23,033**	**15,499**	**17,678**	**17,716**
Workplace L2	High retrofit	1,660 in total	4,526	8,278	8,620	4,994	5,168	4,570
	Low retrofit		4,559	11,080	15,202	10,230	11,667	11,693
Other public L2	High retrofit		2,332	4,264	4,440	2,573	2,663	2,354
	Low retrofit		2,349	5,708	7,831	5,270	6,010	6,023
Total multifamily parking spaces retrofit	**High retro.**	**22,396[21]**	**12,373**	**243,581**	**75,404**	**0**	**0**	**0**
	Low retro.	**22,396**	**0**	**0**	**0**	**0**	**0**	**0**
Installed power (five-year)								
DCFC MW installed[22]	High retrofit	14	65	81	469	540	722	667
	Low retrofit	14	66	102	641	833	1140	1173
L2 MW installed	High retrofit	10	33	87	114	134	163	177
	Low retrofit	10	33	114	176	210	285	320

[20] We did not assign current ports to any of the sub-categories

[21] The current number of electrified stalls is estimated at 5% of the multifamily building stock. There is no available data to confirm.

[22] The total kW installed is calculated as the number of ports multiplied by the assumed average charging power level of those ports. For higher-power DCFC, the average charging power is lower than the nominal power of the charger most of the time. The ability of vehicles to take a high-power charge will increase over time. This value is provided to support planning; if the average power level changes, the revised necessary number of ports can be obtained by dividing the total MW installed by the average charging power. However, it is important to note that the total installed power is **not** equivalent to the load impact; the load impact is much smaller because not all ports will be used at any given time. See the load impacts section for more information.

6.1.1 Futureproofing

Local governments should consider future-proofing charging investment plans; that is, deploying (or supporting the deployment of) infrastructure at a rate that stays ahead of demand to not artificially constrain EV adoption. There is little risk of overbuilding when considering the long-term outlook. While charging equipment technologies may change, the basic electrical and civil infrastructure needed to facilitate the installation of charging equipment will not.

6.1.2 Choosing charging types

The recommended share of community DCFC and L2 charging in the needs assessment is determined using the methodology laid out by the National Renewable Energy Laboratories which has been calibrated for North American communities. However, the right mix of fast-charging hubs and community L2 charging (at workplaces, along residential streets, etc.) will ultimately be a strategic choice that can be made by municipalities and other EV charging deployers according to community input and urban form. In choosing between charging types for specific sites, local governments should consider the following:

- **Past financial performance/utilization** of similar infrastructure in the area and pro forma analysis.
- **Use profile of the candidate sites.** Sites with relatively high turnover (30- to 90-minute typical parking times) make good candidates for DC fast charging. Longer parking times (four or more hours) are best suited to Level 2. See Table 2-1 for further information on charging times.

For planning the EV charging network, a broader set of considerations includes:

- **Needs of the potential users.** Level 2 is most appropriate for charging in most employment and residential areas due to the longer parking times. Much of what may be considered "workplace charging" will be in publicly accessible parking spaces where workers tend to park. Meanwhile, very fast charging is most appropriate for high pickup and drop-off areas, including those used by taxi and ridehailing drivers, who need to top up on the go.
- **Public input.** Public engagement on EV strategies and deployment plans may reveal charging type preferences or insights from specific neighbourhoods or charging sites. See the results of a recent BC Hydro customer survey for an example.[23]
- **Presence of BEV versus PHEV.** PHEVs cannot generally use DCFC charging.

In the results above, the relative importance of L2 charging peaks in the 2030-2035 period when a maximum of PHEVs is expected to be on the road and declines beyond that point as BEV become the dominant technology. As a high-level rule of thumb, **the ratio of L2 to DCFC ports ranges from approximately eight to 12** over our 30-year planning horizon. If a municipality or other user of this guidance chooses to further prioritize DCFC charging hubs over L2 deployment, this rule of thumb could be used to shift some of the anticipated public L2 demand to DCFC ports. It would be most appropriate to make this shift from the pool of "other public L2," since workplace charging is a good use case for L2.

[23] BC Hydro (2023). BC Hydro Public Electric Vehicle Charging Rates Workshop presentation.

6.2 Equitable Deployment

6.2.1 Equity in EV Charging

Incorporating **equity** into government decision-making requires going beyond the notion of "equality" to recognize the root causes (historic and current) of oppression,[24] and being alert to the circumstances of specific groups. Moreover, equity includes both *outcomes* ("who gets what resources?") and *process* ("who is involved in making the decisions?"), as shown in Figure 6-2.

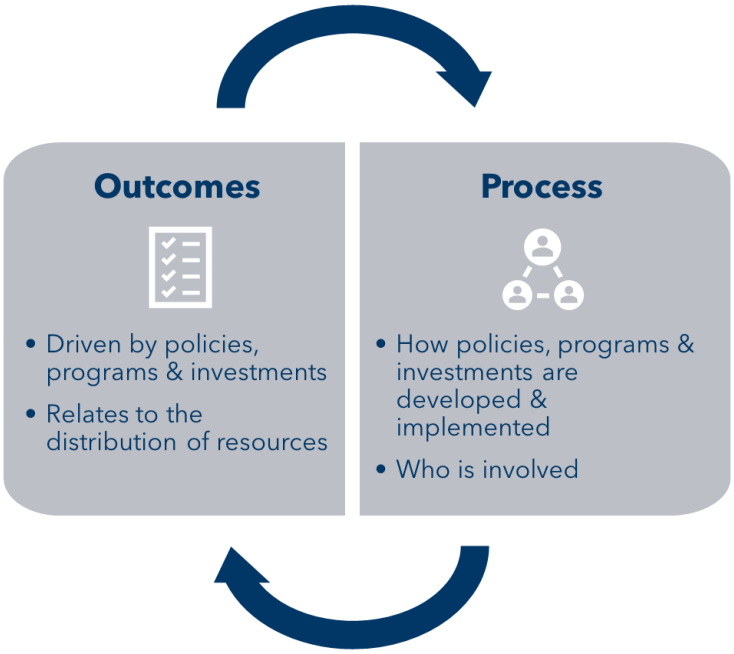

Figure 6-2. The key elements of an equity approach

Equity considerations can and should be applied to the transportation system, including transportation electrification infrastructure. Communities, organizations and advocates are increasingly recognizing the following elements as being a fundamental part of **transportation equity**:

- **Accessibility:** how many opportunities (jobs, services, amenities) can an individual access in a reasonable time and at an accessible cost, by the transportation means they have available?[25]
- **Safe and dignified mobility as a human right:** moving away from the focus on "choice" to a focus on dignity.[26]

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[24] City of Vancouver (2021). Equity Framework. Report to Council. RTS No.: 14507. VanRIMS No.: 08-2000-20. Also informative are the four lenses that the City of Vancouver incorporated within its Equity Framework. They are: Indigenous Rights, racial justice, intersectionality, and systems orientation.
[25] Grisé, Boisjoly, Maguire and El-Geneidy (article in press). Elevating access: Comparing accessibility to jobs by public transport for individuals with and without a physical disability. *Transportation Research Part A*.
[26] Sarah Brown (2021). Study: How We Talk About Racism in Transportation – And Why it Matters. Blog published on StreetsBlog USA. Also informed by a presentation from Charles T. Brown.

- Ensuring that the **benefits and burdens** of a program are **fairly distributed.**[27]
- **Engaging the communities** that a program is designed to serve, **meeting their needs, and building their capacity** to participate in decisions about transportation programs.[28]

Notable commitments to transportation (and land use) equity by governments and agencies in Metro Vancouver include:

- **2015:** Metro Vancouver Board adopts resolution endorsing the Truth and Reconciliation Commission of Canada Report.
- **2019:** Metro Vancouver released *A Review of Social Equity in Regional Growth Management*. Identifies equity-deserving groups in the region and where they live spatially.
- **2021:** Metro Vancouver Board recommitted to reconciliation and adopted a Strategic Plan identifying "strengthening relationships with First Nations" as a primary objective.
- **2022:** TransLink adopts *Transport 2050*, which includes equity and reconciliation as key strategic lenses through which all the actions of the Strategy are considered.
- **2022:** TransLink applied an Equity Evaluation Framework as part of its 10-year priorities, which identifies disadvantaged groups of interest and key metrics/barriers facing these groups.[29]
- **2023:** Metro Vancouver commissioned an annotated bibliography of social equity tools and resources in support of its Clean Air Plan.

6.2.2 Criteria for equitable access to EV charging infrastructure

Cost and access to charging are two of the predominant barriers to EV adoption facing people in poverty and recent immigrants (who are all more likely to be renters and live in multifamily buildings[30],[31]). When examining access to charging specifically, there are several additional barriers facing these and other groups, as shown in Table 6-3. This analysis of barriers faced by specific groups supports the identification of **priority communities** that Metro Vancouver, local governments and their partners should focus on when evaluating equity in charging deployment plans.

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[27] Smart Electric Power Alliance (SEPA) (2022). Benchmarking Equitable Transportation Electrification. Toolkit and Modules referenced throughout this report. This citation is from the Insight Brief, p. 8.
[28] Ibid.
[29] In this document, Translink puts forward the following definition of social equity: *The promotion of justice and fairness and the removal of systemic barriers that may cause or aggravate disparities experienced by different groups of people. This can include the many dimensions of identity, such as socioeconomic status, ethnicity, sex, age, disability, gender, sexuality, religion, indigeneity, class, and other equity-related issues.*
[30] Low-income people are about twice as likely as other people to be renters (Source: Statistics Canada, Housing Experiences in Canada: People in poverty, 2016).
[31] In Vancouver, 77% of renters lived in apartments in multiunit structures compared to 44% of owner households (Source: City of Vancouver, 2022, Housing Needs Report.(

Table 6-3. Barriers to EV charging[32]

Barrier	Description	Groups disadvantaged
Ability to install home charging	• More difficult in multifamily buildings • Split incentives between renters/landlords (including small businesses that rent their storefront)	• Multifamily building residents • Renters • Low-income people • Racialized people
Ability to use charging	• Many chargers cannot be used by people without banking, credit cards, smart phone applications, English or tech proficiency, etc. • Lack of accessible design standards for stations and application interfaces	• Unbanked people • People with disabilities • Non-English speakers
Greater cost & time burden	• At-home charging is cheaper, but multifamily building residents and renters more often have to rely on more expensive public charging • Private sector is less interested in investing in areas where current EV adoption is low • The price of public charging will likely increase over time • There is a greater time burden associated with public charging (home charging is more convenient) • Charging costs represent a greater share of household spending • Without careful futureproofing, the limited electrical capacity in existing buildings for EV charging can be exhausted by early adopters, making subsequent additions of EV charging for later adopters (who will be lower income on average) much more expensive	• Multifamily building residents • Renters • Low-income people • Racialized people
Lower access to programs	• Managed load programs may be limited to homeowners • Multifamily building residents or people that rely on on-street parking can be barred from accessing managed load programs	• Multifamily building residents • People without parking at their home • Renters

[32] Key sources for this table are: ACEEE (2021). Siting Electric Vehicle Supply Equipment (EVSE) With Equity In Mind; SEPA (2022). Benchmarking Equitable Transportation Toolkit - Report and Modules.

Spatial analysis can be used to evaluate the extent to which current infrastructure and future plans serve priority communities, in cases where those communities tend to be concentrated spatially (Table 6-4).

In many cases, **spatial equity** priority areas also align with areas of high **anticipated public EV charging demand** (e.g. dense urban areas with a high proportion of the population living in apartments). However, governments should apply caution when conducting data-driven equity analysis because:

- Frameworks and decisions must be informed by direct engagement with members of the priority communities.
- Aggregated data can mask nuances at the local level or among members of a given community (e.g. certain newcomer communities may face more barriers than others).
- Spatial analysis only reveals the presence of certain priority communities. Disabled people, for example, face barriers to accessing EV charging that must be eliminated through other actions.

Table 6-4. Priority communities who potentially face greater barriers to EV charging in Metro Vancouver

Priority Community	For spatial equity analysis	For outreach and involvement
First Nations		
Racialized people		
Recent immigrants		
Low-income people		
Multifamily building residents		
Renters		
Taxi and ridehailing drivers		
People with disabilities		
Unbanked people		
Non-English speakers		
Women and gender non-conforming people		

6.3 Planning and Site Selection

Local and regional governments should establish their priority areas for public and workplace deployment so they are prepared to prioritize sites, whether as part of funding or deploying their own networks, when partnering with or advising BC Hydro or other third parties on site selection, or when seeking to secure charging as part of private development (for example, as a consideration of rezoning).

Local and regional governments should:

- **Consider demand for charging and equity when prioritizing areas for EV charging**. Locating EV charging can often be opportunistic, depending on circumstances such as the occurrence of other street civil works; construction or renovation of municipal

buildings; enthusiastic neighbours or partners at a particular site; and other factors. There will be rapidly growing demand, and EV charging will be required widely across our communities. Accordingly, local governments need not necessarily engage in extensive mapping exercises to identify candidate locations.

- Nevertheless, some local governments will benefit from using spatial analysis to identify priority sites. Key factors to consider include the immediate demand for EV charging; equity between neighbourhoods; and the extent of EV charging infrastructure already serving particular communities, and whether it is at capacity. Table 6-5 below summarizes the types of areas to prioritize to meet EV charging demand as well as equity, and spatial indicators that can be used in analysis. Note that equity indicators and demand are often correlated. These areas represent "no regrets" opportunities for investment in public EV charging.

Table 6-5. Priority areas for public EV charging investment

Areas to prioritize	Rationale		Spatial indicators
	Demand	Equity	
High multifamily residential buildings			• Dwelling type (StatsCan)
High renters			• Housing tenure (StatsCan)
High vehicle use			• High vehicle trip origin/destination & mode (Trip Diary Survey)
High population density			• Population density (StatsCan)
High car-based employment density			• Employment density and trip mode (Trip Diary Survey)
Low public charging access			• NRCan Station locator • PlugShare
High taxi/ridehailing activity			• Major origins & destinations (transportation network service data)
Low income/wealth			• Low Income Measure (StatsCan) • Index of Multiple Deprivation (StatsCan) • Household spending data (e.g. Environics)
High recent immigrants			• Recent immigrants (Census)
First Nations communities			• Community/reserve locations
Indigenous identity			• Indigenous identity (Census)

- **Seek alignment, synergies and integration with other municipal infrastructure**. Inventory the parking at local government facilities, parks, and on-street locations. Engage with other local government departments to determine the key opportunities for synergies with EV charging infrastructure, as well as to identify challenges and risks of stranded assets. Explore options for maximizing the utility of EV charging infrastructure. For example, consider whether the same parking can provide workplace charging during the day and public or fleet parking during the evenings.
  - Consider plans for active transportation networks; parking and curb access; food trucks; street engineering; facilities planning and design; green infrastructure; and

other potential synergies and conflicts with EV charging infrastructure. Determine at what existing streets or facilities could EV charging be implemented with low risk of stranded assets or conflicts. When street or facility works are planned, always consider of opportunities to integrate EV charging.

- **Minimize costs by taking advantage of pre-existing electrical services with available capacity.** A new electrical service can significantly increase the costs of providing EV charging infrastructure, particularly public Level 2 charging. Local governments and other stakeholders should optimize opportunities to take advantage of existing electrical services when deploying EV charging infrastructure. This includes:
  - Prioritize deployment of EV charging at municipal facilities where it is possible to take advantage of existing electrical services.
  - Consider opportunities for street-light and power-pole EV charging. The City of New Westminster, in partnership with BCIT, have piloted such opportunities. While street-light circuits generally cannot provide fast charging, in some circumstances they can be useful for longer duration day-time or overnight charging. Seek to comprehensively inventory the potential for streetlight charging in any locations with on-street parking and streetlights. Consider especially such opportunities during LED retrofits.
  - Consider sites adjacent to utility infrastructure (e.g. low profile transformers - LPTs) that *may* (not always) result in lower utility extension fees. Inventory neighbourhood LPTs.
- **Engage with utilities early regarding candidate sites.** Seek guidance on locations where extension fees will be lower. As BC Hydro processes may evolve, continue to actively coordinate with BC Hydro and note the importance of timely guidance on where service extensions are likely to be more cost effective in advance of detailed electrical design.
- **Minimize costs through economies of scale and futureproofing infrastructure.** Seek opportunities to deploy multiple chargers at sites to achieve economies of scale by reducing the per-unit capital cost of "bulky" infrastructure (e.g. electrical services and equipment). When deploying EV charging infrastructure, always include consideration of subsequent expansion in the design process.

7. Managing Local Government Owned Public Charging Infrastructure

If local governments elect to manage their own charging infrastructure, they should ensure that it provides great customer service and is well managed. This section summarises recommended practices for administering, siting, designing and operating local government owned public EV charging infrastructure. Local governments should also follow guidance included in BC Hydro's *EV Fast Charging Design and Operational Guidelines for Public DCFC Stations in BC* and the *Level 2 Public Sector Charging Stations Best Practices Guideline*.

7.1 Designing systems

Local and regional government EV charging network operators should:

- **Follow best practice design and operations guidance.** Detailed design and operational guidelines are beyond the scope of this project. BC Hydro has published two key guides[33]. These resources (which are also linked in Appendix A) provide extensive design guidance (station placement on sites, lighting, surveillance, signage, landscaping, and civil works), as well as operating guidance (best practices for selecting vendors and contractors, maintenance, repairs, customer service, emergency response plan, and monitoring and dashboards). It is recommended that all public charging operators carefully consider these guidelines and adhere to all relevant guidance. Note that these guidelines are undergoing an update in consultation with the Local Government EV Peer Network.
- **Consider appropriate connector standards.** All installations going forward should include CCS, with a planned path to NACS (formerly the Tesla connector). It is currently recommended to have one CHAdeMO connector for the next two or three years to accommodate older EVs that require this connector type. Level 2 charging should always feature the J1772 connector in the short term, but should also consider the possibility of migrating to NACS in the future.
- **Seek scale and futureproofing for expansion.** Always consider opportunities to include multiple chargers and connectors at a site. This will often reduce costs, as some infrastructure costs are relatively fixed and not completely proportional to the number of chargers at a site. Likewise, explore opportunities to futureproof the infrastructure to accommodate later expansion. While the number of parking spaces that can be devoted exclusively to EV charging may be limited currently, futureproofing infrastructure can provide options for when more vehicles are EVs and devoting more parking to be exclusively for EVs becomes more acceptable.

[33] BC Hydro: EV Fast Charging Design and Operational Guidelines for Public DCFC Stations in BC and Level 2 Public Sector Charging Stations Best Practices Guideline.

7.1.1 Ensuring accessible charging station design

Organizations deploying or procuring EV charging must ensure that all drivers can use the infrastructure. Unfortunately, as the Canadian Standards Association (CSA) has noted, there are currently no regulations or consistent standards for accessibility of EV charging infrastructure at federal nor provincial levels.[34] Unfortunately, many stations to date are not barrier-free.

Incorporating accessible design considerations as mandatory criteria at the inception of the project will ensure all EV users have access to barrier-free charging while ensuring regulatory compliance and avoiding costly renovations in the future.

High-level accessibility considerations are listed here, but users of this guide should consult the key resources listed below and in Appendix A and seek input from users with lived experience with disabilities. Considerations include:

- **Ensuring physical accessibility of the infrastructure**:
  - Ensuring a person using a wheelchair or mobility device can physically access the charging interface, connector, and connect it to her/his vehicle. This means removing curbs, slopes and bollards, choosing a level parking stall, and ensuring sufficient parking stall width. Cable management systems should be designed such that all users are able to easily access and lift the cables (which are sometimes heavy) to and from their vehicles.
  - Assigning an appropriate number of chargers to designated accessible parking stalls.
  - Ensuring proper location relative to pedestrian entrances to the parking area.
- **Ensuring accessibility of communication features** such as display screens, apps, and card readers:
  - These components must be compatible with the needs of all EV users including those who are deaf or hard of hearing, visually impaired, have dexterity limitations or other disabilities.
  - Some features that increase accessibility include user interfaces or display screens (including apps) that are compatible with screen readers, the use of tactile and braille controls, and audio descriptions or speech output.

As a starting place, system and site designers should adhere to all accessibility requirements for parking in the BC Building Code[35] and to all relevant requirements and standards under the Accessible British Columbia Act, either currently enacted or forthcoming.

These resources provide guidance on **accessible parking**, which is an important component of **accessible EV charging**. The only design guidance in North America specifically related to EV charging to date has been released by the U.S. Access Board, in its resource called Design Recommendations for Accessible EV Charging Stations.[36] This document is an important resource. In Canada, the CSA Group is moving to consider appropriate standards.

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[34] Thirgood, J. (2022) *Charging Ahead: Ensuring Equity and Reliability in Canada's Electric Vehicle Network*. Canadian Standards Association.

[35] See the BC Building Accessibility Handbook 2020.

[36]

7.2 Administering EV charging services

7.2.1 Appropriate resourcing and priority-setting

Local and regional government EV charging network operators should **establish stable, well-resourced administration of EV charging services**. Local governments should ensure that their public charging networks are positioned for success. As noted in Section 3.1, local governments should consider formally establishing EV charging services to provide public charging as well as workplace charging for their employees. It is recommended to:

- Ensure sufficient human resources, capital and operating funds, and full-time staff to plan, design and deploy EV charging services and to sustain an excellent quality of service. This will require dedicated staff time and could well require new staff position(s). Staff roles should be formalized in work plans and job descriptions, and made less *ad hoc*. Likewise, it may require funding consultants to assist with planning, design and operations.
- Explicitly define the triple bottom line objectives of public charging services. Staff and network operators should have a mandate and structural incentives to optimize financial performance; however, local governments should formally recognize that EV charging services may not achieve full cost-recovery nor profitability.
    - There is much uncertainty influencing the operations of EV charging networks, notably regarding the price of credits that can be made through provincial and federal low carbon fuel requirements; depending on these credit prices (which are difficult to predict) EV charging may be quite profitable or conversely operate at a loss.
    - Municipalities should formally recognize the environmental and social benefits of investments in charging infrastructure, and that these benefits justify the risk of losses.
    - However, local governments are also encouraged to consider the opportunity to generate revenues to reinvest in other public services, and pursue all opportunities to profitably operate EV charging, provided these strategies do not impede other EV charging network from operating in their communities or otherwise slow EV adoption.
- Set targets for deployment. It recommended this be on the order of 10% to 30% of the total charging infrastructure demand forecast for communities.
- Commit to meeting demand for workplace charging at City facilities where parking is provided.
- Administer competitively procured relationships with EV charging service providers that will typically operate charging infrastructure on behalf of site hosts (i.e. municipalities).
- Plan to achieve sufficient economies of scale in the next 3-5 years to make investment worthwhile (e.g. a minimum total CAPEX of ~$500k+ over 3-5 years).
- Make a strong commitment to excellent customer service. This includes ensuring stations have very high uptime (e.g. 99%) and that maintenance and emergency repairs will be implemented expediently.

7.2.2 Establishing user fees

Local and regional government EV charging network operators should **establish user fees and capitalize on other revenue streams.** User fees support cost recovery and encourage drivers to use the limited resource of EV charging efficiently. User fees should be set high enough to encourage drivers to charge at home or at work where feasible, thereby reducing how much space must be devoted to public charging, but low enough to offer significant savings compared to fossil fuels. Monitor and consider prices from peer networks in the region (e.g. BC Hydro).

Seek carbon credit revenues under provincial and federal low carbon fuel requirements to the greatest extent possible. Likewise, explore utility demand response and other credit opportunities.

7.2.3 Procuring operators

Even when local and regional governments choose to manage their own infrastructure, they will likely outsource operation. In this case, they should **carefully procure EV charging service network providers to manage EV charging networks**. T

The choice of an EV charging network partner to deploy and manage locally-owned charging infrastructure is probably the most important decision facing local governments when deploying locally-owned charging infrastructure. Local governments should administer competitive procurement processes to select EV charging service provider partners. Key considerations include:

- Customer service. Select charging service providers with evidence of strong local maintenance and servicing capacity, 24/7 troubleshooting services, and other evidence of good customer service.
- Stable market position.
- Open protocols. Drive demand for entities to pursue full certification by the Open Charge Alliance for Open Charge Point Protocol (OCPP, a *de facto* industry protocol) 1.6 or higher for both charging stations and charging management systems. OCPP is intended to ensure compatibility between EV chargers and the charging management systems that charging network operators use to control them. It can help avoid stranded assets should a local government choose to change charging service provider partners. Note, however, that use of OCPP does not necessarily guarantee full interoperability; engage with service providers to seek demonstration of functionality. Likewise, in the future, demand IEC 63110, a forthcoming international standard for interoperable charging station and management system communications. Notwithstanding the value of moving towards open systems, recognize that in the current market there may be trade-offs between use of open systems and other key considerations (e.g. local capacity and customer service) when selecting charging service providers.
- Compatibility with multiple charging connector interfaces, including NACS, CCS, and CHAdeMO.
- Privacy and cybersecurity. The service provider must take appropriate steps to protect user data. They should consider whether data stored in Canada and secure the process for remote firmware updates.
- Capacity to valorize low carbon fuel requirement credits, if not separately being pursued by local governments.

Consider the opportunity for model or joint RFP administered by Metro Vancouver or other entities operating at the regional level.

7.2.4 Rewarding performance

Local and regional governments that choose to manage their own infrastructure should aim to **reward desirable performance** by key players. They should seek to structure compensation and/or contractual reward schemes for charging service providers, and potentially for municipal staff, for achieving key performance indicators, including equipment uptime and customer satisfaction.

8. Conclusions

Metro Vancouver has Canada's highest rate of EV adoption and, in accordance with BC's *Zero Emission Vehicle Act,* the number of EVs on the road will increase exponentially over the next decade. By the 2040s, nearly all passenger vehicles in Metro Vancouver will be EVs. This transition will largely eliminate GHG emissions and tailpipe criteria air contaminants from this sector, and result in significant economic benefits for Metro Vancouver by reducing the spending on gasoline and diesel that leaves the region.

Rapid deployment of EV charging infrastructure is critical to enabling the transition to EVs. Metro Vancouver and its municipalities are crucial to deploying EV charging. Through land use, business licensing, air quality regulation and other powers, local governments can support EV charging infrastructure deployment on private property. Additionally, local governments can partner with BC Hydro to deploy charging infrastructure, as well as invest directly in their own EV charging networks. Further, they can advocate for action by the Federal and Provincial governments, utilities, and BCUC. Local governments must focus on speed, scale and social equity in EV charging infrastructure deployment.

This document provides guidance on the key **principles** that should inform efforts to deploy charging infrastructure; **roles** for different stakeholders; **actions** for Metro Vancouver and its municipalities; deployment **planning**; and **management strategies** for municipal EV charging networks. By supporting rapid, well-considered deployment of charging infrastructure, Metro Vancouver local governments can realize the considerable benefits of EV adoption for the region.

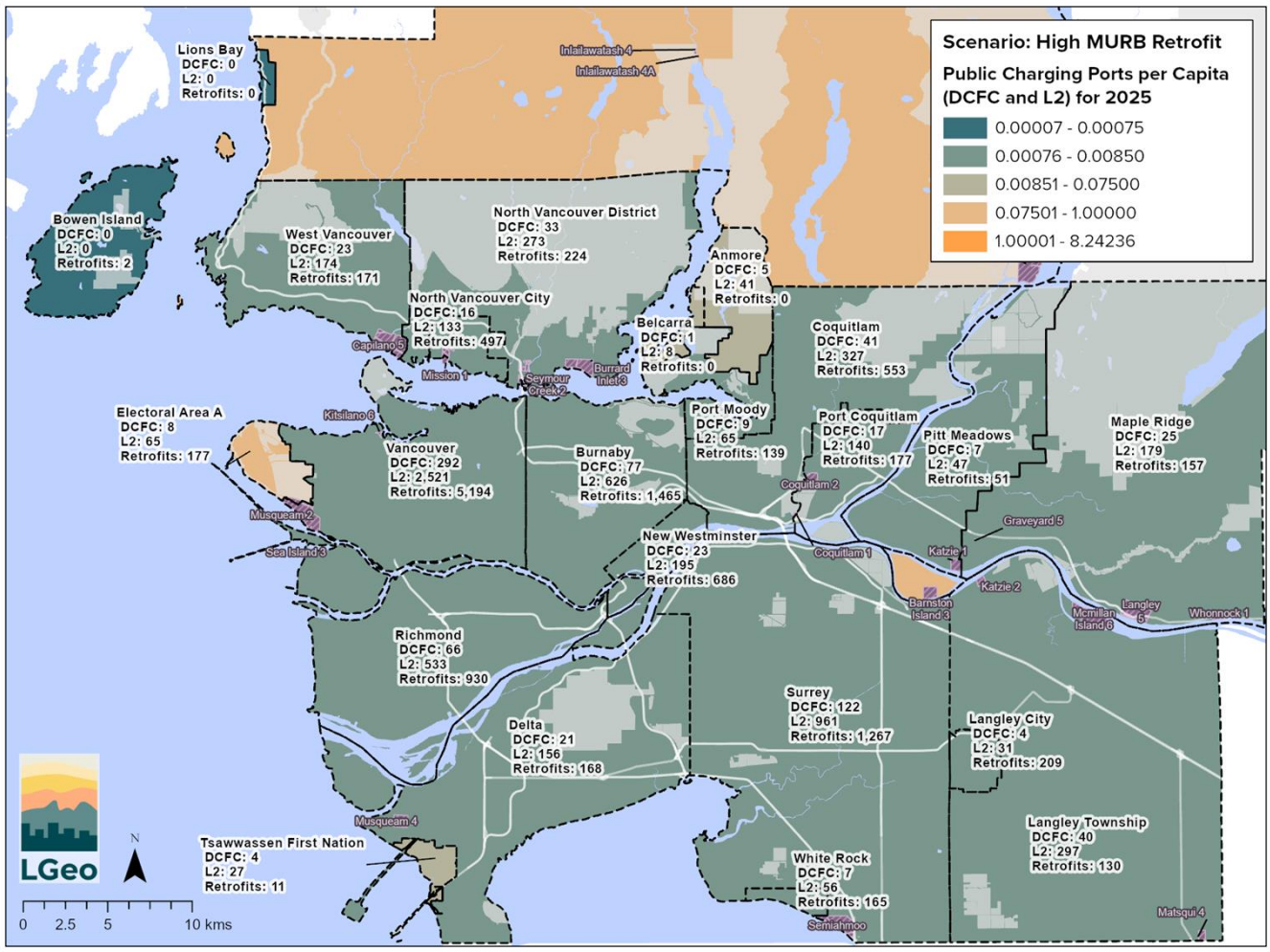
Appendix A: Complementary Resources

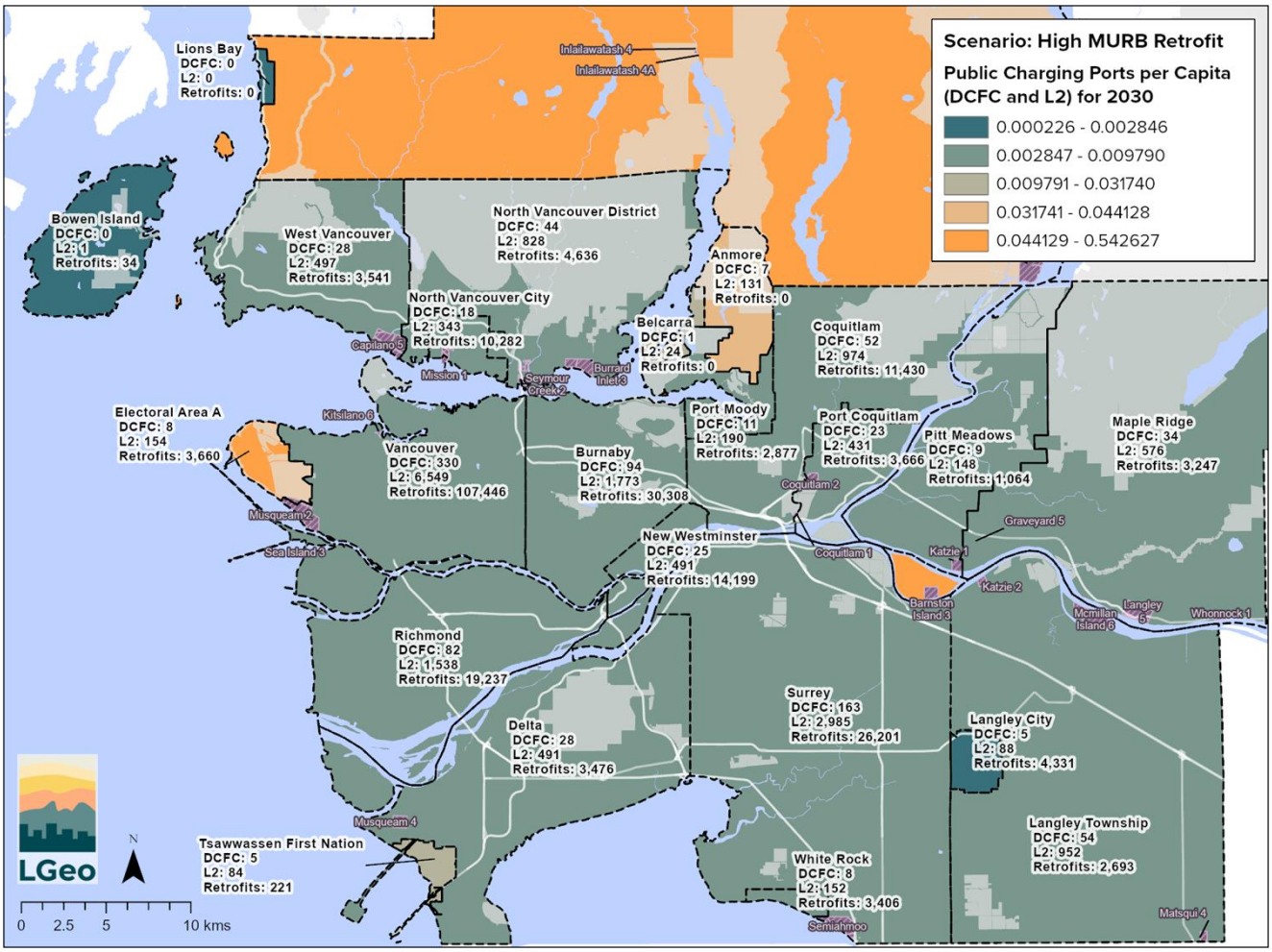
Topic	Author	Title & Link
Public Charging	BC Hydro	EV Fast Charging Design and Operational Guidelines for Public DCFC Stations in BC
	BC Hydro	Level 2 Public Sector Charging Stations Best Practices Guideline
Accessible & Equitable Design	Government of BC	BC Building Accessibility Handbook 2020
	Canadian Standards Association	Charging Ahead: Ensuring Equity and Reliability in Canada's Electric Vehicle Network
	US Department of Transportation	Design Recommendations for Accessible Electric Vehicle Charging Stations
Multifamily Charging	Plug In BC; Government of BC	A Guide to Installing EV Charging in MURBs
		A template survey to explore level of support for EV infrastructure from fellow residents in your building
	District of Saanich for the BC Sustainable Communities Network	A template Request for Proposals (RFP) that can be used by strata corporations to solicit quotes for EV Ready Plans
	Plug In BC	EV ready Plan Vetting Questions – to help strata corporations choose the right contractor for their EV ready Plan

Appendix B: Charging Needs Forecasts by Metro Vancouver Member

See also the Results Dashboard (Excel).

Cumulative EV Charging Needs (Scenario 1: High Multifamily Building Retrofit)




Scenario: High MURB Retrofit
Public Charging Ports per Capita (DCFC and L2) for 2030
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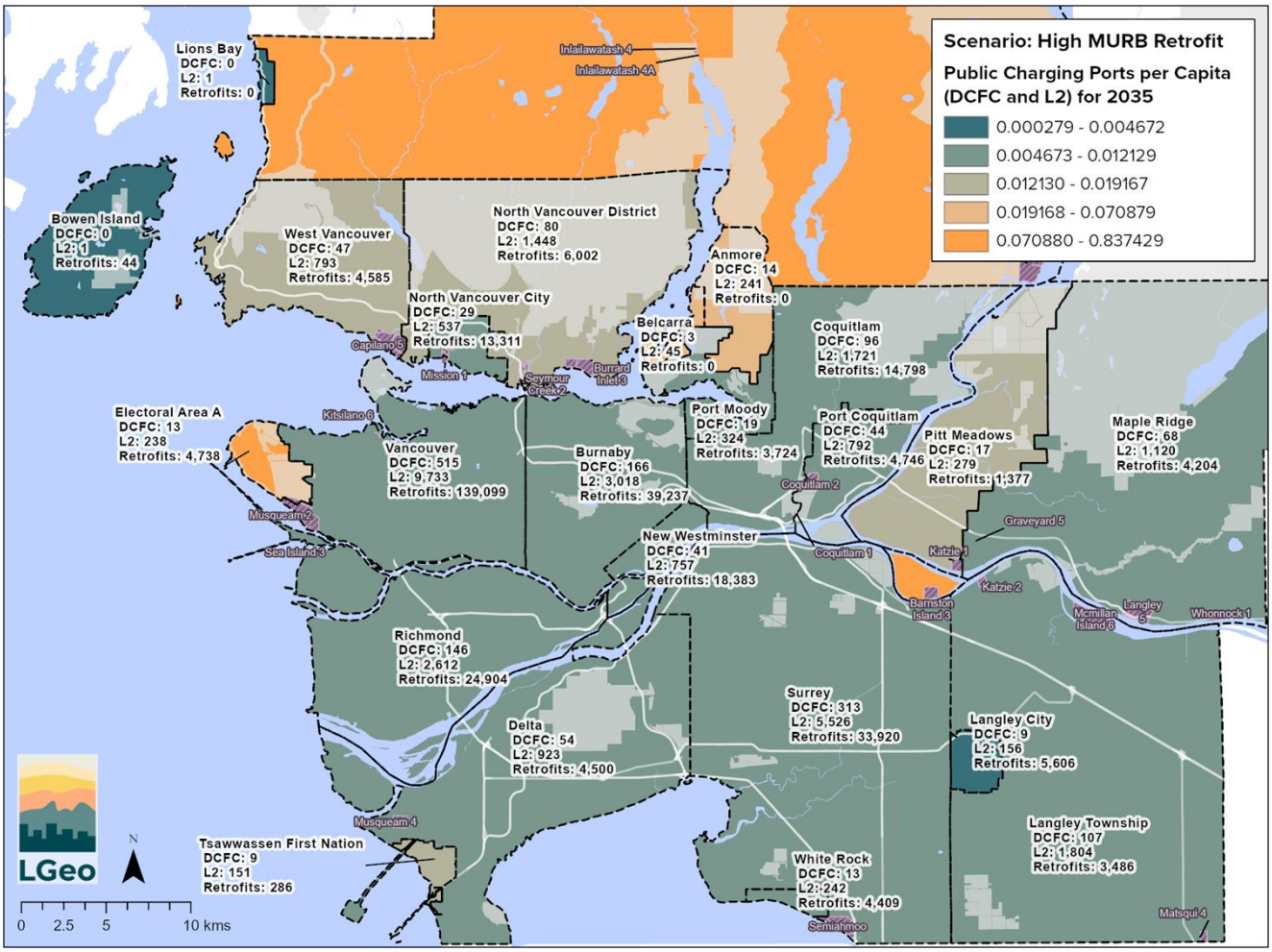
0.002847 - 0.009790
0.009791 - 0.031740
0.031741 - 0.044128
0.044129 - 0.542627
Lions Bay DCFC: 0 L2: 0 Retrofits: 0
Bowen Island DCFC: 0 L2: 1 Retrofits: 34
West Vancouver DCFC: 28 L2: 497 Retrofits: 3,541
North Vancouver District DCFC: 44 L2: 828 Retrofits: 4,636
North Vancouver City DCFC: 18 L2: 343 Retrofits: 10,282
Capilano 5
Mission 1
Seymour Creek 2
Burrard Inlet 3
Inlailawatash 4
Inlailawatash 4A
Anmore DCFC: 7 L2: 131 Retrofits: 0
Belcarra DCFC: 1 L2: 24 Retrofits: 0
Coquitlam DCFC: 52 L2: 974 Retrofits: 11,430
Port Moody DCFC: 11 L2: 190 Retrofits: 2,877
Port Coquitlam DCFC: 23 L2: 431 Retrofits: 3,666
Pitt Meadows DCFC: 9 L2: 148 Retrofits: 1,064
Maple Ridge DCFC: 34 L2: 576 Retrofits: 3,247
Coquitlam 2
Graveyard 5
Katzie 1
Katzie 2
Coquitlam 1
Barnston Island 3
Mcmillan Island 6
Langley 5
Whonnock 1
Electoral Area A DCFC: 8 L2: 154 Retrofits: 3,660
Kitsilano 6
Vancouver DCFC: 330 L2: 6,549 Retrofits: 107,446
Burnaby DCFC: 94 L2: 1,773 Retrofits: 30,308
Musqueam 2
Sea Island 3
New Westminster DCFC: 25 L2: 491 Retrofits: 14,199
Richmond DCFC: 82 L2: 1,538 Retrofits: 19,237
Surrey DCFC: 163 L2: 2,985 Retrofits: 26,201
Delta DCFC: 28 L2: 491 Retrofits: 3,476
Langley City DCFC: 5 L2: 88 Retrofits: 4,331
Musqueam 4
Tsawwassen First Nation DCFC: 5 L2: 84 Retrofits: 221
Langley Township DCFC: 54 L2: 952 Retrofits: 2,693
White Rock DCFC: 8 L2: 152 Retrofits: 3,406
Semiahmoo
Matsqui 4
LGeo
N
0 2.5 5 10 kms


Scenario: High MURB Retrofit
Public Charging Ports per Capita (DCFC and L2) for 2035
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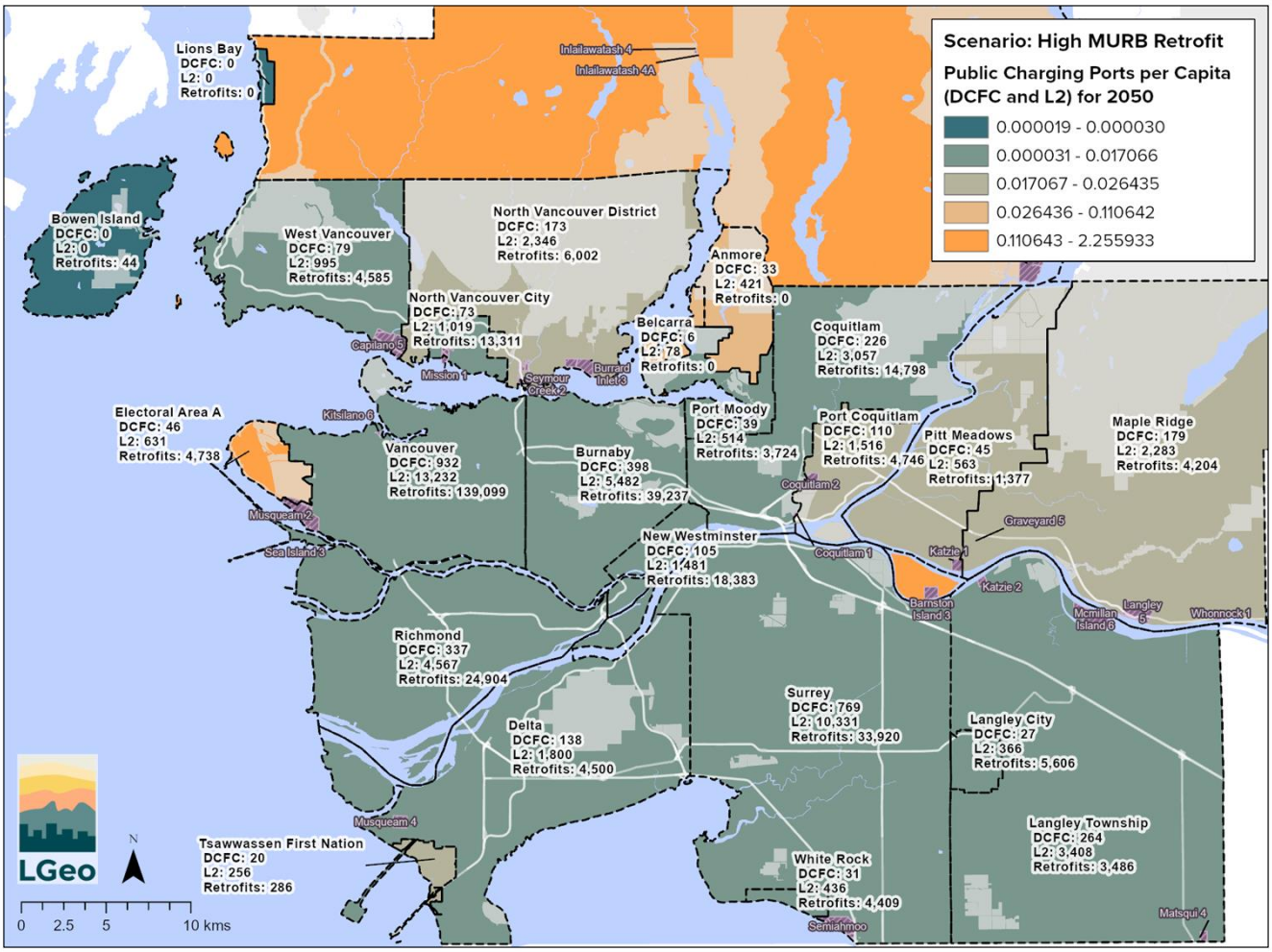
0.004673 - 0.012129
0.012130 - 0.019167
0.019168 - 0.070879
0.070880 - 0.837429
Lions Bay DCFC: 0 L2: 1 Retrofits: 0
Bowen Island DCFC: 0 L2: 1 Retrofits: 44
West Vancouver DCFC: 47 L2: 793 Retrofits: 4,585
North Vancouver District DCFC: 80 L2: 1,448 Retrofits: 6,002
North Vancouver City DCFC: 29 L2: 537 Retrofits: 13,311
Capilano 5
Mission 1
Seymour Creek 2
Burrard Inlet 3
Inlailawatash 4
Inlailawatash 4A
Anmore DCFC: 14 L2: 241 Retrofits: 0
Belcarra DCFC: 3 L2: 45 Retrofits: 0
Coquitlam DCFC: 96 L2: 1,721 Retrofits: 14,798
Electoral Area A DCFC: 13 L2: 238 Retrofits: 4,738
Kitsilano 6
Vancouver DCFC: 515 L2: 9,733 Retrofits: 139,099
Burnaby DCFC: 166 L2: 3,018 Retrofits: 39,237
Port Moody DCFC: 19 L2: 324 Retrofits: 3,724
Port Coquitlam DCFC: 44 L2: 792 Retrofits: 4,746
Coquitlam 2
Pitt Meadows DCFC: 17 L2: 279 Retrofits: 1,377
Maple Ridge DCFC: 68 L2: 1,120 Retrofits: 4,204
Graveyard 5
Musqueam 2
Sea Island 3
New Westminster DCFC: 41 L2: 757 Retrofits: 18,383
Coquitlam 1
Katzie 1
Katzie 2
Barnston Island 3
Mcmillan Island 6
Langley 5
Whonnock 1
Richmond DCFC: 146 L2: 2,612 Retrofits: 24,904
Surrey DCFC: 313 L2: 5,526 Retrofits: 33,920
Delta DCFC: 54 L2: 923 Retrofits: 4,500
Langley City DCFC: 9 L2: 156 Retrofits: 5,606
Musqueam 4
Tsawwassen First Nation DCFC: 9 L2: 151 Retrofits: 286
Langley Township DCFC: 107 L2: 1,804 Retrofits: 3,486
White Rock DCFC: 13 L2: 242 Retrofits: 4,409
Semiahmoo
Matsqui 4
LGeo
N
0 2.5 5 10 kms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Public Charging Ports per Capita (DCFC and L2) for 2050
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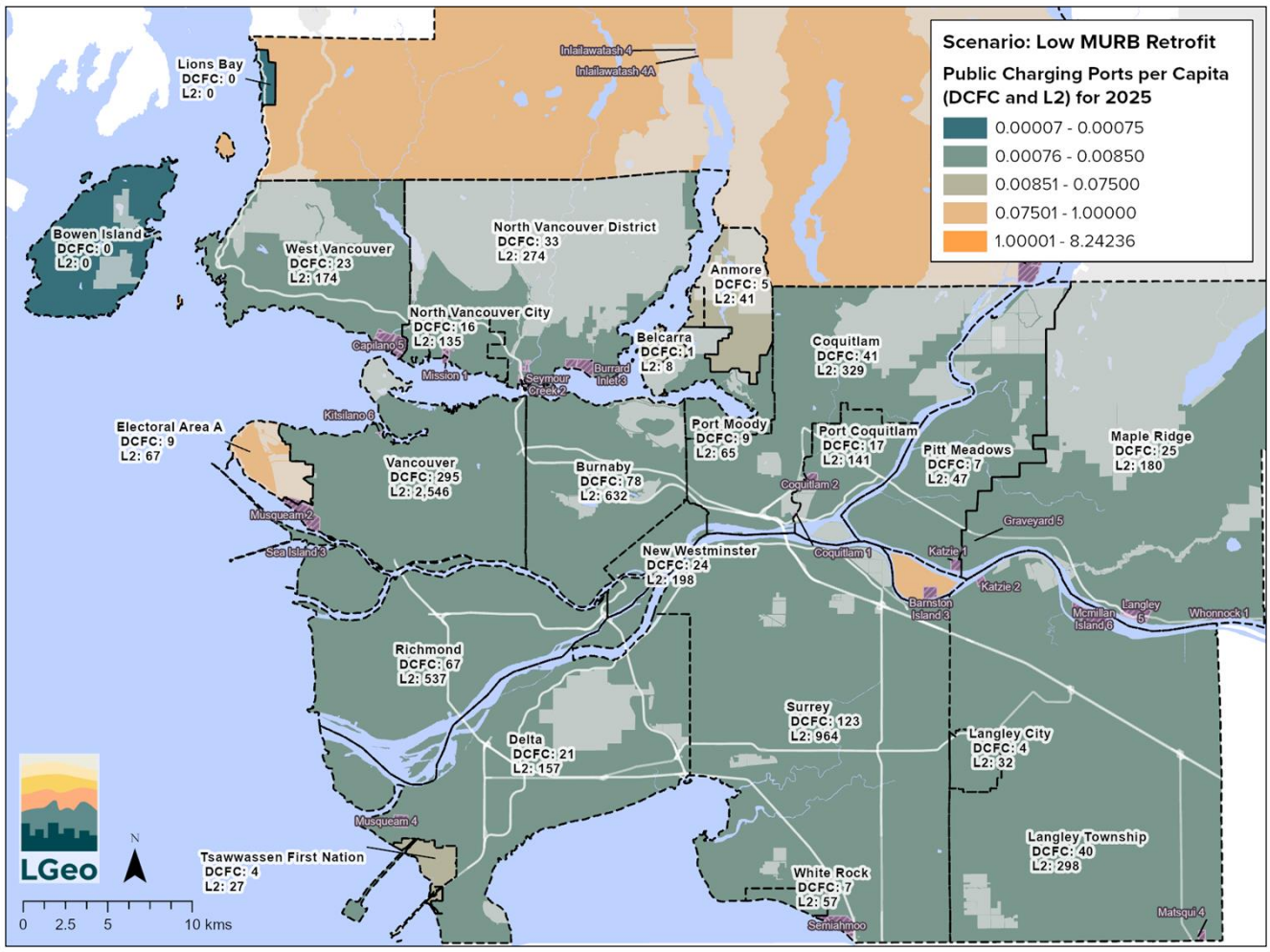
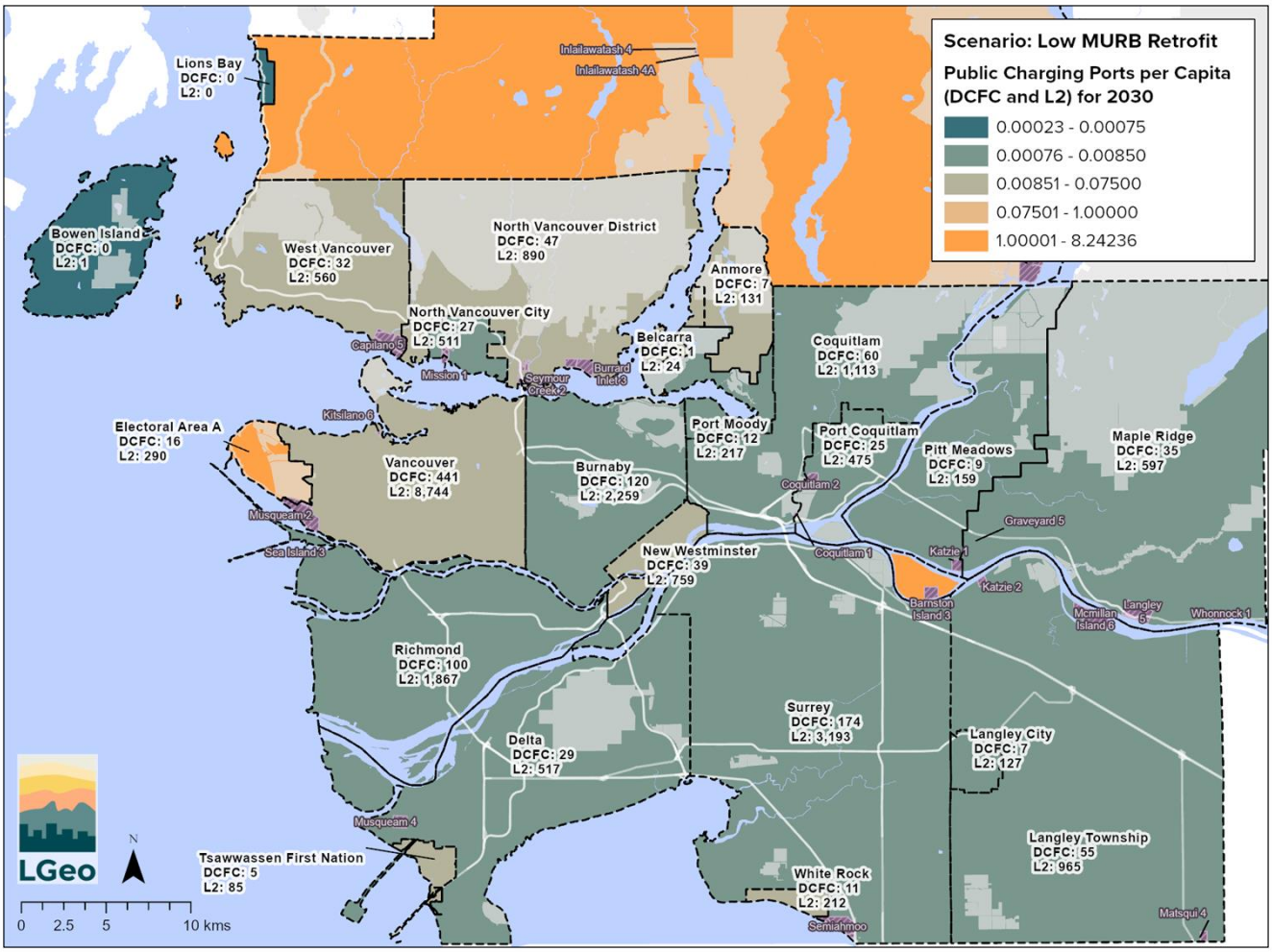
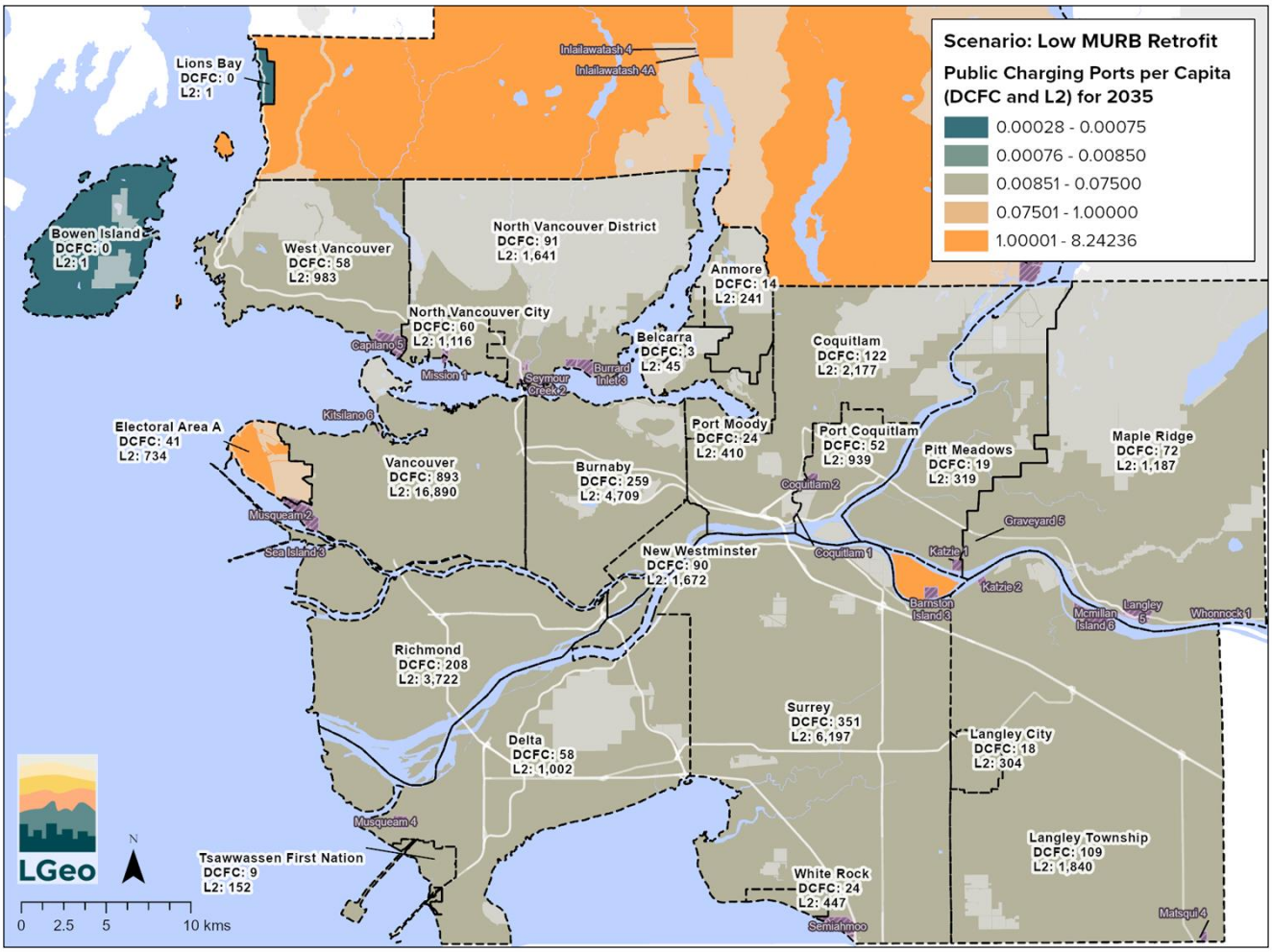
0.000031 - 0.017066
0.017067 - 0.026435
0.026436 - 0.110642
0.110643 - 2.255933
Lions Bay DCFC: 0 L2: 0 Retrofits: 0
Inlailawatash 4
Inlailawatash 4A
Bowen Island DCFC: 0 L2: 0 Retrofits: 44
West Vancouver DCFC: 79 L2: 995 Retrofits: 4,585
North Vancouver District DCFC: 173 L2: 2,346 Retrofits: 6,002
Anmore DCFC: 33 L2: 421 Retrofits: 0
North Vancouver City DCFC: 73 L2: 1,019 Retrofits: 13,311
Capilano 5
Mission 1
Seymour Creek 2
Burrard Inlet 3
Belcarra DCFC: 6 L2: 78 Retrofits: 0
Coquitlam DCFC: 226 L2: 3,057 Retrofits: 14,798
Electoral Area A DCFC: 46 L2: 631 Retrofits: 4,738
Kitsilano 6
Vancouver DCFC: 932 L2: 13,232 Retrofits: 139,099
Burnaby DCFC: 398 L2: 5,482 Retrofits: 39,237
Port Moody DCFC: 39 L2: 514 Retrofits: 3,724
Port Coquitlam DCFC: 110 L2: 1,516 Retrofits: 4,746
Pitt Meadows DCFC: 45 L2: 563 Retrofits: 1,377
Maple Ridge DCFC: 179 L2: 2,283 Retrofits: 4,204
Coquitlam 2
Musqueam 2
Sea Island 3
New Westminster DCFC: 105 L2: 1,481 Retrofits: 18,383
Graveyard 5
Coquitlam 1
Katzie 1
Katzie 2
Barnston Island 3
Langley 5
Whonnock 1
Richmond DCFC: 337 L2: 4,567 Retrofits: 24,904
Surrey DCFC: 769 L2: 10,331 Retrofits: 33,920
Delta DCFC: 138 L2: 1,800 Retrofits: 4,500
Langley City DCFC: 27 L2: 366 Retrofits: 5,606
Musqueam 4
Tsawwassen First Nation DCFC: 20 L2: 256 Retrofits: 286
Langley Township DCFC: 264 L2: 3,408 Retrofits: 3,486
White Rock DCFC: 31 L2: 436 Retrofits: 4,409
Semiahmoo
Matsqui 4
LGeo
N
0 2.5 5 10 kms

Cumulative EV Charging Needs (Scenario 2: Low Multifamily Building Retrofit)




Scenario: Low MURB Retrofit
Public Charging Ports per Capita (DCFC and L2) for 2030
0.00023 - 0.00075
0.00076 - 0.00850
0.00851 - 0.07500
0.07501 - 1.00000
1.00001 - 8.24236
Lions Bay DCFC: 0 L2: 0
Inlailawatash 4
Inlailawatash 4A
Bowen Island DCFC: 0 L2: 1
West Vancouver DCFC: 32 L2: 560
North Vancouver District DCFC: 47 L2: 890
Anmore DCFC: 7 L2: 131
North Vancouver City DCFC: 27 L2: 511
Capilano 5
Mission 1
Belcarra DCFC: 1 L2: 24
Burrard Inlet 3
Seymour Creek 2
Coquitlam DCFC: 60 L2: 1,113
Kitsilano 6
Electoral Area A DCFC: 16 L2: 290
Vancouver DCFC: 441 L2: 8,744
Port Moody DCFC: 12 L2: 217
Port Coquitlam DCFC: 25 L2: 475
Pitt Meadows DCFC: 9 L2: 159
Maple Ridge DCFC: 35 L2: 597
Burnaby DCFC: 120 L2: 2,259
Coquitlam 2
Musqueam 2
Sea Island 3
Graveyard 5
Coquitlam 1
Katzie 1
New Westminster DCFC: 39 L2: 759
Katzie 2
Barnston Island 3
Langley 5
Whonnock 1
Mcmillan Island 6
Richmond DCFC: 100 L2: 1,867
Surrey DCFC: 174 L2: 3,193
Delta DCFC: 29 L2: 517
Langley City DCFC: 7 L2: 127
Musqueam 4
Tsawwassen First Nation DCFC: 5 L2: 85
Langley Township DCFC: 55 L2: 965
White Rock DCFC: 11 L2: 212
Semiahmoo
Matsqui 4
LGeo
N
0 2.5 5 10 kms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Public Charging Ports per Capita (DCFC and L2) for 2035
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0.00076 - 0.00850
0.00851 - 0.07500
0.07501 - 1.00000
1.00001 - 8.24236
Lions Bay DCFC: 0 L2: 1
Inlailawatash 4
Inlailawatash 4A
Bowen Island DCFC: 0 L2: 1
West Vancouver DCFC: 58 L2: 983
North Vancouver District DCFC: 91 L2: 1,641
Anmore DCFC: 14 L2: 241
North Vancouver City DCFC: 60 L2: 1,116
Capilano 5
Mission 1
Belcarra DCFC: 3 L2: 45
Burrard Inlet 3
Seymour Creek 2
Coquitlam DCFC: 122 L2: 2,177
Kitsilano 6
Electoral Area A DCFC: 41 L2: 734
Port Moody DCFC: 24 L2: 410
Port Coquitlam DCFC: 52 L2: 939
Pitt Meadows DCFC: 19 L2: 319
Maple Ridge DCFC: 72 L2: 1,187
Vancouver DCFC: 893 L2: 16,890
Burnaby DCFC: 259 L2: 4,709
Coquitlam 2
Musqueam 2
Sea Island 3
Graveyard 5
Coquitlam 1
Katzie 1
New Westminster DCFC: 90 L2: 1,672
Katzie 2
Barnston Island 3
Langley 5
Whonnock 1
Richmond DCFC: 208 L2: 3,722
Surrey DCFC: 351 L2: 6,197
Delta DCFC: 58 L2: 1,002
Langley City DCFC: 18 L2: 304
Musqueam 4
Tsawwassen First Nation DCFC: 9 L2: 152
Langley Township DCFC: 109 L2: 1,840
White Rock DCFC: 24 L2: 447
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Matsqui 4
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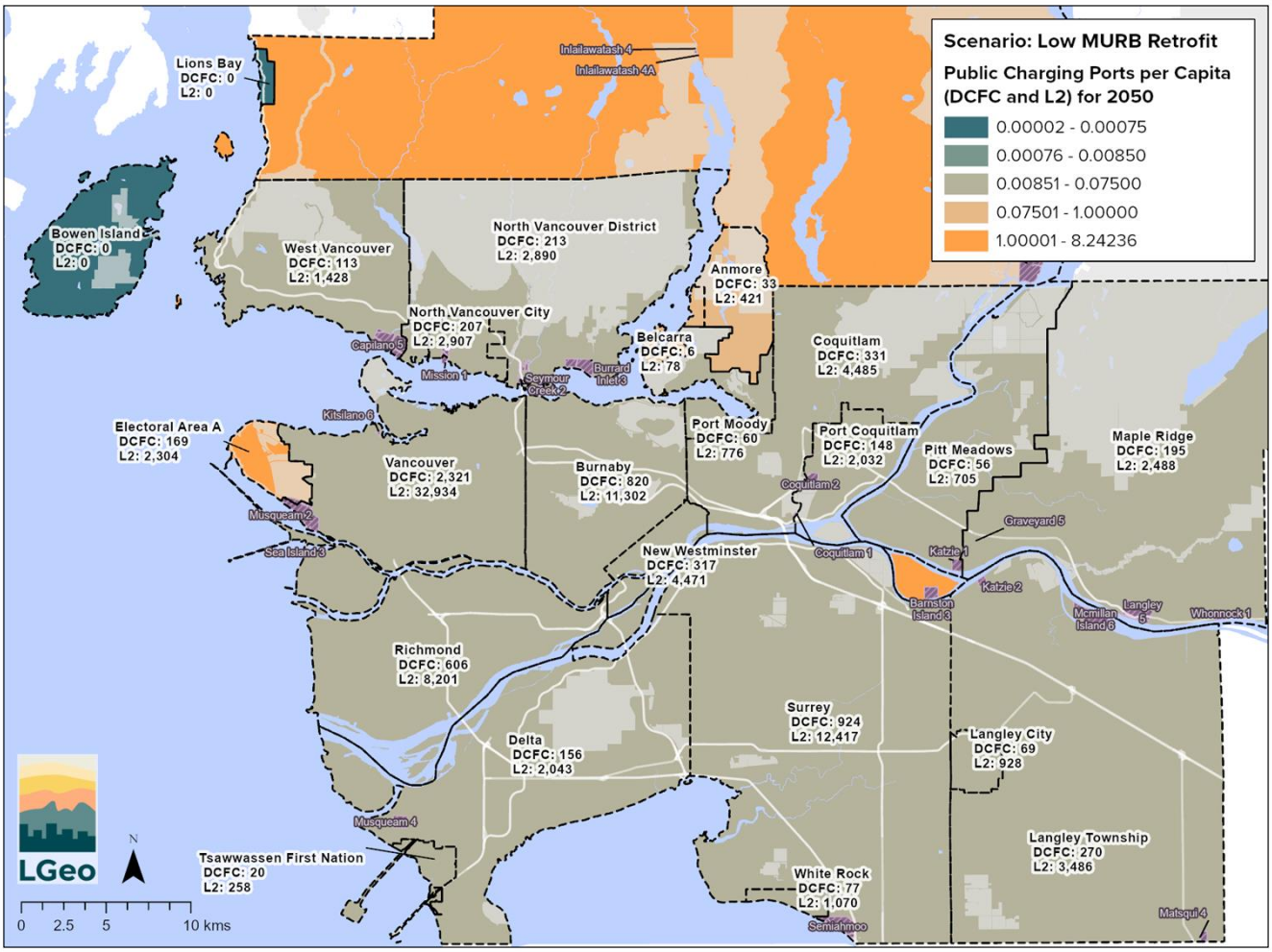
N
0 2.5 5 10 kms


Scenario: Low MURB Retrofit
Public Charging Ports per Capita (DCFC and L2) for 2050
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0.00076 - 0.00850
0.00851 - 0.07500
0.07501 - 1.00000
1.00001 - 8.24236
Lions Bay DCFC: 0 L2: 0
Inlailawatash 4
Inlailawatash 4A
Bowen Island DCFC: 0 L2: 0
West Vancouver DCFC: 113 L2: 1,428
North Vancouver District DCFC: 213 L2: 2,890
Anmore DCFC: 33 L2: 421
North Vancouver City DCFC: 207 L2: 2,907
Capilano 5
Mission 1
Seymour Creek 2
Belcarra DCFC: 6 L2: 78
Burrard Inlet 3
Coquitlam DCFC: 331 L2: 4,485
Kitsilano 6
Electoral Area A DCFC: 169 L2: 2,304
Port Moody DCFC: 60 L2: 776
Port Coquitlam DCFC: 148 L2: 2,032
Pitt Meadows DCFC: 56 L2: 705
Maple Ridge DCFC: 195 L2: 2,488
Vancouver DCFC: 2,321 L2: 32,934
Burnaby DCFC: 820 L2: 11,302
Coquitlam 2
Musqueam 2
Sea Island 3
Graveyard 5
Coquitlam 1
Katzie 1
New Westminster DCFC: 317 L2: 4,471
Katzie 2
Barnston Island 3
Langley 5
Whonnock 1
Mcmillan Island 6
Richmond DCFC: 606 L2: 8,201
Surrey DCFC: 924 L2: 12,417
Delta DCFC: 156 L2: 2,043
Langley City DCFC: 69 L2: 928
Musqueam 4
Tsawwassen First Nation DCFC: 20 L2: 258
Langley Township DCFC: 270 L2: 3,486
White Rock DCFC: 77 L2: 1,070
Semiahmoo
Matsqui 4
LGeo
N
0 2.5 5 10 kms

"NO DISCLAIMERS" POLICY

This report was prepared by Dunsky Energy + Climate Advisors, an independent firm focused on the clean energy transition and committed to quality, integrity and unbiased analysis and counsel. Our findings and recommendations are based on the best information available at the time the work was conducted as well as our experts' professional judgment.
Dunsky is proud to stand by our work.

ATTACHMENT 2

Keeping it Current

Primer on EV Charging Infrastructure

metrovancouver
SERVICES AND SOLUTIONS FOR A LIVABLE REGION

TRANSLINK

BC Hydro
Power smart

August 2023

dunsky
Energy + Climate

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ABOUT THIS REPORT

Well-planned EV charging infrastructure is a core component of supporting continued EV adoption. As a federation of 21 municipalities, one electoral area, and one treaty First Nation representing nearly 2.5 million people, Metro Vancouver is well placed to develop a long-term regional strategy for EV charging infrastructure investment, in line with its commitments in its *Climate 2050 Transportation Roadmap* and *Clean Air Plan*.

Metro Vancouver and its partners, TransLink and BC Hydro, have retained Dunsky Energy + Climate Advisors to develop guidance for the development of EV infrastructure that will support local governments, utilities, and companies in the region by suggesting where charging infrastructure of different types should be located, outlining the estimated costs and business case for building and operating this charging infrastructure, and identifying policies that governments can implement to enable construction.

This Charging Technology Brief, which represents Task 1 of this project, summarizes information regarding EV charging technologies relevant for this project, including:

- **Charging users and locations** (Section 1), including the categorization of charging that will be used in our modelling and analysis;
- **Charging technologies** (Section 2), including networked chargers and load management practices;
- **Charging installation approaches** (Section 3), including EV-ready parking and buildings and considerations for planning and installing public charging infrastructure;
- **Charging networks and operations** (Section 4), including how to work with EV charging service providers and options for ownership models and payment structures; and
- **Indicative EV infrastructure costs** (Section 5).

While the EV charging guidance will be focused on infrastructure for light-duty vehicles, this document includes information on charging for medium- and heavy-duty vehicles as well.

The concepts and prevailing understandings outlined here will underpin the assumptions and principles used to develop the subsequent EV charging guidance. This report can also be used as a tool for internal and stakeholder education on key EV and charging concepts.

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List of Abbreviations and Terms

DCFC: Direct current fast charging
EV: Electric vehicle
EVSE: Electric Vehicle Service Equipment (e.g., "EV chargers")
EVEMS: EV energy management systems
OCPP: Open Charge Point Protocol
LDV: Light-duty vehicles
MHDV: Medium- and heavy-duty vehicles
Multifamily building: sometimes referred to as multi-unit residential building (MURBs) (e.g., apartment or strata buildings)

1. Charging Users & Locations

1.1 Overview

Electric vehicle (EV) charging users include the **public** (residents, workers, and tourists) and **fleet operators**. Each of these user groups has different needs related to how, when, and how much they charge; as a result, they each use different combinations of charging locations, as shown in Figure 1.[1]

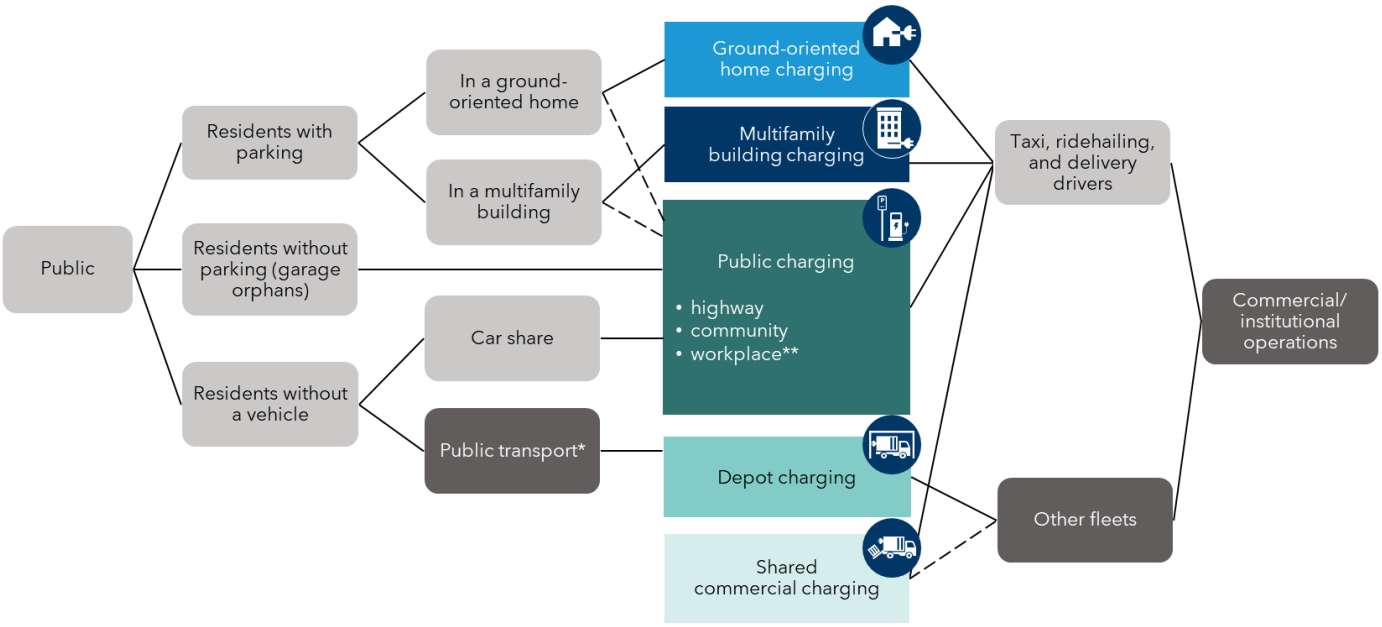


Figure 1. Charging Users and the Charging Categories that Meet their Needs

* Public transport fleets occasionally use on-the-go/overhead charging, but this practice is not yet widespread.

** We consider workplace charging to be a form of public charging because it serves the public, even if sometimes workplace charging is only open to employees.

1.2 People without Home Charging

The group of people without home charging is made up of the following two groups:

1. **Garage orphans:** people without any access to private home parking. For example, many pre-war neighbourhoods in urban centres, many multifamily buildings, as well as secondary suites or apartments within ground-oriented homes, do not have onsite parking. Likewise, some households that have garages use all potential parking spaces for other purposes (storage, etc.). Garage orphans who use EVs must rely fully on public charging.
2. People living in multifamily buildings who have access to parking, but where that parking space has not had the electrical upgrades required to support the installation of EV charging; or, where

[1] The EV Charging Needs Assessment that will be produced as a later step of this work will cover only charging for light-duty vehicles (LDVs); however, this document covers charging for medium- and heavy-duty vehicles (MHDVs) as well.

the resident is otherwise prevented from installing EV charging. This second group can use public charging, or their parking space can be retrofitted to become EV ready (see Section 3.1). As more multifamily buildings are retrofitted, this group will rely less on public charging.

While detailed data about parking access by housing type is unavailable in Canada, a survey of current EV owners showed that only 12% of current EV owners in Canada live in multifamily buildings,[2] whereas 33% of Canadians live in multifamily buildings overall. In Metro Vancouver, this share is even greater. As of 2021, 43% of residents lived in apartments, and this share is growing: since two-thirds of new dwellings that were put on the market between 2016 and 2021 were apartments.[3] This suggests that barriers to EV access are higher for multifamily building residents in general, though variations in urban form exist from one community to the next.

1.3 Characteristics of Different Charging Locations

Charging at home (whether in ground-oriented homes or in multifamily buildings) plays the largest role in the charging ecosystem in terms of the number of ports and the overall amount of energy dispensed at those locations (Figure 2), and this will continue in the future. According to a survey of BC EV drivers conducted by BC Hydro in late 2022 of their public EV charging network members, 86% of EV drivers respondents use home charging. Meanwhile, most of these drivers also use public charging at least some of the time; 88% and 77% of EV drivers respondents use BC Hydro and other public charging stations, respectively.[4]

However, the important role of public charging cannot be overlooked. It is the only choice for residents who do not have access to home charging, as described above. Further, the presence and visibility of public charging is crucial to helping consumers overcome range anxiety and feel confident purchasing an EV.

A similar dynamic plays out for commercial vehicles. Most commercial vehicle charging takes place at the depot (the facility where commercial vehicles park), but shared commercial charging outside of the depot (see definition below) enables electrification of certain fleets who, for a range of reasons, cannot rely on depot charging.

The role of governments and utilities is particularly important in the development of robust public and shared commercial charging infrastructure, since public charging is more costly to develop and requires access to land in key locations.

[2] Pollution Probe (2022). Assessment of the Consumer EV Charging Experience in Canada. Commissionned by Innovation, Science and Economic Development Canada.
[3] Metro Vancouver (2022). Metro Vancouver Housing Book.
[4] BC Hydro, 2023. Public EV Charging Service Rates Application submitted to BCUC. Exhibit B-1.

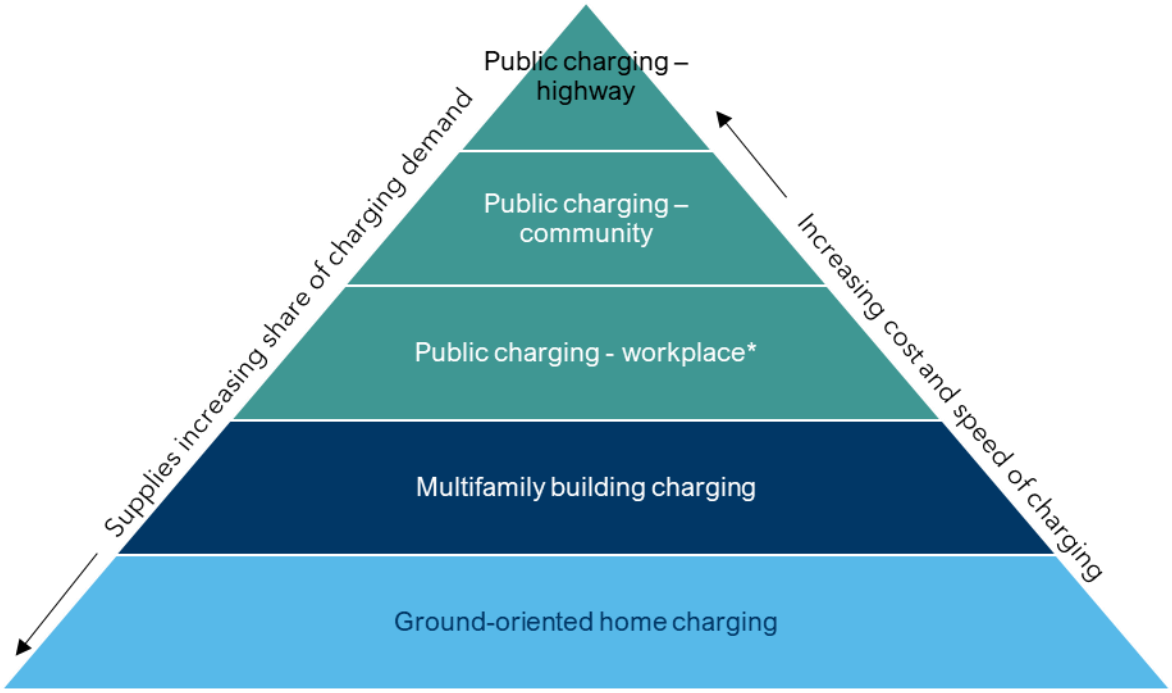


Figure 2. Relative Importance of Different Charging Categories, by Total Energy Dispensed[5]
* We consider workplace charging to be a form of public charging because it serves residents, even if sometimes workplace charging is only open to employees.

For the purposes of this brief and the analysis that will follow, charging locations are divided into the following categories:

- Ground-oriented home charging
- Multifamily building charging
- Public charging, which includes workplace, community and highway charging
- Shared commercial charging
- Depot charging

The following sections describe each of these charging categories in further detail.

[5] Figure adapted from: U.S Department of Energy, *A Guide to the Lessons Learned from the Clean Cities Community Electric Vehicle Readiness Projects*, 2014.

Ground-oriented Home Charging

People living in ground-oriented housing (single family homes, duplexes, triplexes and row houses) are more likely to have access to, and ownership of, a parking space attached to their living space (e.g. a private garage or parking pad). Installation of EV charging in these settings can be relatively simple, although panel and/or service upgrades or other electrical works are sometimes required; indeed, load management in townhomes, duplexes or any building with multiple meters can sometimes be complicated. Generally, these building types are amenable to incremental additions of EV charging infrastructure as households adopt EVs. Many municipalities in BC have adopted requirements to ensure that new residential construction be built with EV-ready parking, meaning that panel and service upgrades will not be required for residents of new homes.

Multifamily Building Charging

Multifamily building apartments feature shared parking areas. It is more challenging for multifamily building residents to install EV charging, even when they do have access to a parking spot, due to legal, financial, technical and logistical barriers inherent in both condominiums and rental apartments. Nonetheless, home charging remains the most attractive, affordable and convenient option for the one-third of Canadians that live in multifamily buildings.[6] Emerging best practice, stemming in particular from leadership in BC, is to provide charging infrastructure in multifamily buildings where parking is available.

Public Charging

Reliable and widespread public charging infrastructure is crucial to:

- Reassure prospective EV adopters that they will be able to charge on long-distance trips,
- Provide charging for people without EV charging at home,
- Provide charging for people with EV charging at home but whose daily trip surpasses their battery's capacity,
- Provide charging for carshare fleets, and
- Provide charging for tourists.

There are three sub-categories of public charging:

- **Community charging,** which can be on-street (curbside) or off-street (for example, in publicly accessible parking lots or garages).

[6] Statistics Canada. (2017). Census in Brief: Dwellings in Canada.

    - Many cities are prioritizing off-street public charging where feasible, to preserve space in the public right-of-way for other uses (cycling, walking, public realm, green infrastructure), avoid accessibility concerns, and save costs (curbside charging is generally more expensive).[7]
    - However, in some neighbourhoods, curbside charging can be accommodated and is the best option to serve residents and workers. The City of New York, which has piloted curbside charging deployment in neighbourhoods surrounding a major employer (hospital), commissioned the report *Curb Enthusiasm*[8] to highlight best practices for on-street EV charging deployment.
- **Workplace charging,** which is designed for employees, can also be provided on- or off-street.
    - Workplace charging can be an excellent option for people without home charging, as it is provided at a place where they are already going.
    - More studies are needed to examine the viability of workplace charging for office workers as many employees are adopting hybrid work policies. If employees are commuting less often, they will be less able to rely on workplace chargers.
- **Highway charging,** which is provided on major corridors, mostly serving people making long trips, such as for vacations or trips.

Depot Charging

For fleet operators with "back-to-base" operations (where vehicles return to the same parking space after each shift), depot charging is expected to meet most charging needs. Examples of fleets with back-to-base operations include delivery vehicles, government fleets and public transit.

Like home charging, depot charging typically takes place in the evening/night.

Shared Commercial Charging

Shared commercial charging is different from public charging in that it is exclusively dedicated to fleets. It is shared among users and placed in strategic locations for fleets. For example, shared commercial charging can be established at taxi stands, downtown delivery zones (where trucks already park), and on trucking routes.

Fleet operators use shared commercial charging in the following circumstances:

- When fleet vehicles do not return to the depot, for example, long distance trucks and intercity buses. These heavy-duty vehicles will need ultra-fast charging (see section 2.2).
- When the vehicles' daily duty cycle exceeds the capacity of the battery.
- When the vehicles do not belong to a depot. This group includes taxi and ridehailing fleets (such as Uber and Lyft) and sometimes telecom fleets. Notably, drivers of these vehicles will also use home charging where the driver has access, as well as general public charging. This

[7] Source: Interviews conducted by Dunsky with the cities of Montreal, San Fransisco, New York. October 2021.
[8] City of New York, 2019. *Curb Enthusiasm*.

group also includes owner-operator drivers, which represent approximately 26% of truck drivers employed in Canada and 35% in BC.[9]

- When the depot does not yet have sufficient EV charging installed.

Modelling suggests that shared commercial charging, specifically charging provided for taxi and ridehailing vehicles, offers a potential profitability that is higher than most fast charging infrastructure due to these vehicles' higher drive cycles (and therefore higher energy demand) and their business need for fast charging. As a result, strategically designed shared commercial charging networks could help finance broader investment in public fast charging.

[9] Source: Statistics Canada, *Statistiques sur l'emploi dans l'industrie du camionnage selon les provinces et territoires,* 2015.

2. Charging Technologies

2.1 Charging for Light-Duty Vehicles

For light-duty vehicles (LDVs) (cars, vans, SUVs and light trucks) there are three main charging levels: Level 1, Level 2, and direct current fast charging (DCFC), sometimes referred to as Level 3 or, simply, fast charging. The main characteristics of these charging types for LDVs are provided in Table 1.

Table 1. Main Characteristics of Different Charging Types for LDVs

Charging Type	Charging Power	Approx. charging time for 300 km of range[10]		Charging Location					Type of light-duty EV that can use
		Typical car	Typical SUV/ light truck	Ground-oriented	Multifamily building	Public	Depot	Shared commercial	
Level 1	1.3-2.4 kW	46-25 h	69-37.5 h						BEV and PHEV
Level 2	3 kW	20 h	30 h						BEV and PHEV?
	7 kW	8.5 h	13 h						
	9.6 kW	6 h	9.5 h						
	19.2 kW	3.25 h	4.75 h						
DCFC	25 kW	2.5 h	3.5 h						BEV
	50 kW[11]	1.25 h	1.75 h						
	100 kW	36 min	54 min						
	150 kW	24 min	36 min						
	350 kW	10 min	15 min						

Although most electrical systems use alternating current, EV batteries use direct current. A converter, which is installed in an EV, converts alternating to direct current. Charging supplied by Level 1 and 2 charging ports passes through the converter, while fast charging supplies the battery directly, bypassing the converter (Figure 3).

[10] Many vehicles do not require a full 300 km charge on a typical day.

[11] While many public DCFC today are 50 kW, it is recommended to install minimum 100 kW DCFC for public charging in most instances, except where users are consistently staying for over two hours.

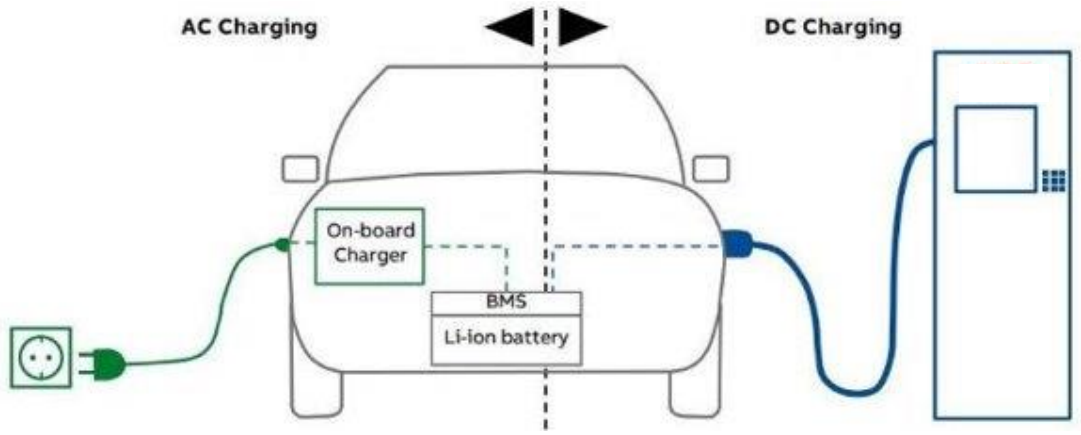


Figure 3. Configuration of direct current and alternating current charging, showing the function of the converter (on-board charger). Source: ABB.com

DCFC

As shown in Table 1, DCFC provide a charge faster than Level 2 and 1 EV charging, but they are much more expensive to install and operate. For LDVs, DCFC is mostly used for public charging. Frequently a new electrical service is required to enable the installation of DCFC at a given site.

DCFC encompass a wide range of charging power from 25 to 350 kW. Not all vehicle models are capable of charging at higher levels; however, market trends show that new models are increasingly designed for higher charging powers, as shown in Figure 4. Indeed, the following models can charge at rates between 250 and 350 kW: Porsche Taycan, Audi e-tron GT, Hyundai IONIQ 5, KIA EV6 and Lucid Air.

As the charging capacity of EVs on the road increases, the need to supply higher power fast charging increases as well. Based on a non-quantitative scan,[12] most non-Tesla public fast charging stations in Metro Vancouver offer 50 kW ports. However, an increasing number of faster ports (100-150 kW) are planned or under construction. Tesla charging ports typically offer a higher power; in Metro Vancouver the Tesla supercharger stations range from 72 to 250 kW.

Notably, most plug-in hybrid EVs (PHEVs) cannot use DCFC charging. For this reason, the share of PHEVs versus BEVs in the total EV population influences the relative share of Level 2 versus DCFC public charging that is needed, alongside other factors. There is significant uncertainty about the role of PHEVs in the vehicle landscape going forward; studies show that they will need to be phased out in the 2030s if Canada is to meet its net-zero targets.[13]

[12] Using PlugShare.com

[13] International Council on Clean Transportation (ICCT), 2022. Canada's Path to 100% Zero-Emission Light-Duty Vehicle Sales: Regulatory Options and Greenhouse Gas Impacts.

Level 2

Level 2 charging is appropriate for instances where the vehicle will be parked for a longer period of time, for example overnight or during a work shift.

Level 2 charging requires a 208V or 240V outlet. Since the charge required can often be achieved in three to five hours (shorter than the full overnight period), Level 2 charging presents opportunities to sync charging time and power draw with the overall needs of the grid or building, by avoiding charging during building or grid peak hours. See Section 2.5 for further discussion of energy management opportunities.

Level 1

Level 1 charging is the simplest form of charging, since it uses a typical household 120V outlet and a single electrical cable. Given the particularly long charging times, Level 1 charging is only used in a residential setting and is not suitable for vehicles with long daily drive cycles. In a survey of current EV owners in Canada, 81% of respondents with home charging use a level 2 charging station, while 13% use a level 1 standard wall electrical outlet.[14]

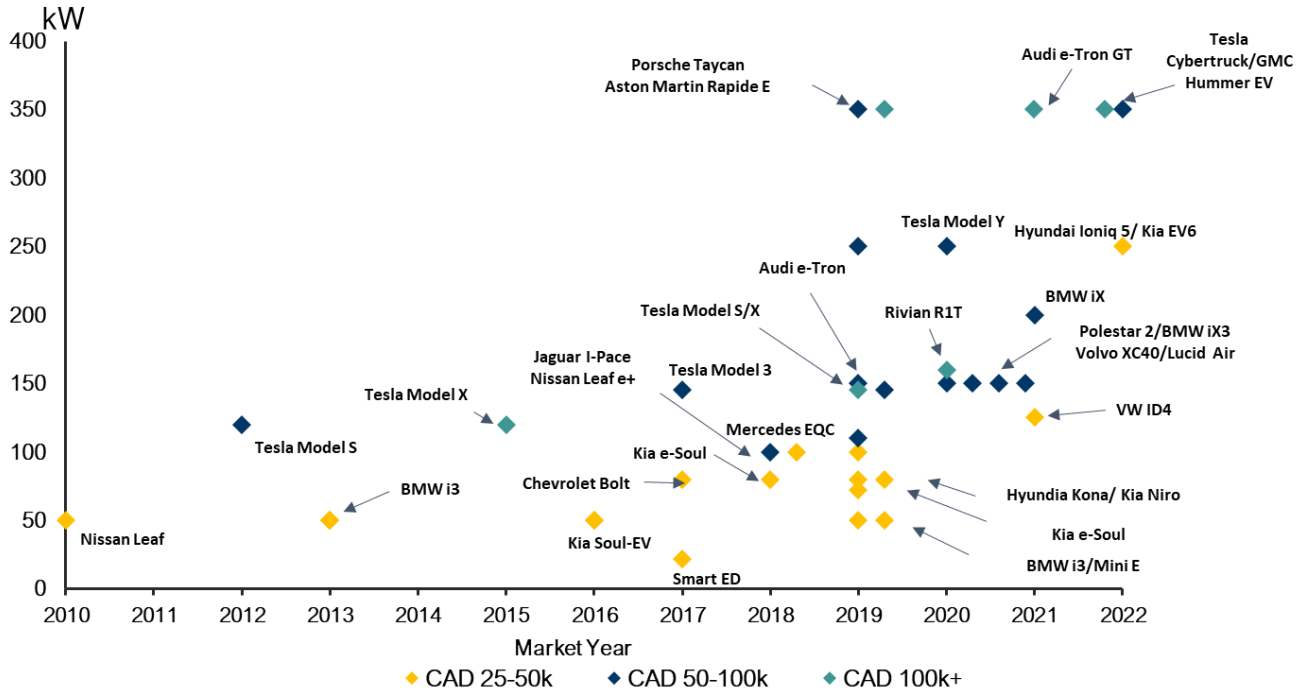


Figure 4. Maximum Fast Charging Power Capabilities for Different EV Models, 2010-2022

[14] Pollution Probe (2022).

2.2 Charging for Medium- and Heavy-duty Vehicles

The main characteristics of the different charging types for medium- and heavy-duty vehicles (MHDVs) are provided in Table 2. As shown in the table, heavy-duty vehicles like garbage trucks and transit buses typically need a DCFC of 50 kW or more for overnight charging in a depot. For long-distance heavy-duty trucks, or other trucks operating with multiple drivers without a long pause overnight, ultra-fast DCFC of 1 MW or more will generally be needed.

Table 2. Main Characteristics of Different Charging Types for MHDVs

Characteristics		Level 2	DCFC	Ultra-fast DCFC / MCS
Typical charging power		3 kW-19 kW	25 kW-350 kW	1 MW plus
Charging time for 300 km of range	Medium truck	~ 9.5-26 h	~ 30 min. – 7h	~ 11 min.
	Heavy truck	~ 19-51 h	~ 1 h – 14h	~ 22 min.
Charging location				
• Depot charging				
• Shared commercial charging				
Type of EV that can use		Medium-duty BEV (too slow for heavy-duty)	Medium- or heavy-duty BEV	Medium- or heavy-duty BEV

Megawatt Charging Standard

The Megawatt Charging Standard (MCS), which allows the supply of charging at 1 MW or more, is currently under development by Daimler Trucks, Tesla, and other manufacturers. Some pilot projects are underway, and commercialization is expected in 2025.

2.3 EV Charging Connectors

Table 3 shows the range of connector types that are available globally, by region and by type of current.

All EVs sold in North America are compatible with J 1772 connectors, which are used for Level 1 and 2 charging (in the case of Tesla vehicles, an adapter is required to use a J 1772 connector).

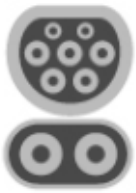
For fast charging, most vehicles in North America use a CCS Combo connector, although some use CHAdeMO connectors (these are vehicles manufactured in Japan, namely the Nissan LEAF and the Mitsubishi Outlander PHEV).

Currently, most fast charging stations in Metro Vancouver (other than Tesla stations) offer both CCS Combo and CHAdeMO connectors, based on a non-quantitative scan.[15] However, manufacturers

[15] Using PlugShare.com

using CHAdeMO connectors have announced that they will move toward CCS Combo connectors only. Moreover, Tesla has recently deployed a CCS Combo adapter in Europe and South Korea.

Table 3. Connector Types by Region and Charging Power

	North America	Japan	Europe	China	Others
Alternating current (Level 2, 3 to 19.2 kW)	**J 1772 Type 1** 	**J 1772 Type 1** 	**Mennekes (Level 2)** 	**GB/T** 	**Tesla***  *Tesla offers adapters allowing users to charge with a J1772 charger
Direct current (Fast charging, 25 to 350kW)	**CCS Combo Type 1 / SAE** 	**CHAdeMO** 	**CCS Combo Type 2** 	**GB/T** 	

2.4 Networked Chargers

For the purposes of this report, the term **networked chargers** refers to EV chargers that can communicate over an electronic communications network such as a cellular, wireless, or ethernet network. Such network communications capabilities allow for chargers to accommodate a variety of functions, including:

- EV energy management (see Section 2.5),
- Utility demand response (whereby EV loads are adjusted based on grid operator signals to optimize charging to reduce grid-system costs),
- Remote monitoring and diagnostics,
- Reservation systems for shared chargers, and
- Tracking use and applying time-based or volumetric user fees (e.g. per kilowatt hour).

The term "smart chargers" is often used to refer to what we define as networked chargers above.

Open Protocols

Networked chargers can communicate via either proprietary or open protocols. The benefit of using open communications protocols is that different chargers and charging management systems can communicate with one another, reducing the risks of stranded assets. The Open Charge Point Protocol (OCPP) administered by the Open Charge Alliance is the predominant open protocol. It can facilitate communications between EV chargers, EV energy management systems (see Section 2.5) and charging service providers' management systems (see Section 4).

2.5 Load Management and EV Energy Management Systems

Unlike some electric equipment, EV charging is a flexible load that offers significant opportunities for managing loads to minimize impacts on peak demand at the building or grid level.

EXAMPLE OF LOAD MANAGEMENT OPPORTUNITIES FOR RESIDENTIAL CHARGING

- 89% of Canadian EV drivers travel less than 60 km per day.[16]
- Most home charging takes place using a Level 2 port.[17]
- Therefore, for a typical vehicle energy consumption of 20 kWh/km, the charging time required to top up the battery is approximately **one hour and 45 minutes.**
- Meanwhile, the vehicle is likely parked for **eight** or more hours overnight, illustrating the opportunity to displace or spread out the energy demand to the most beneficial time for the electrical grid, with no negative impact on the consumer.

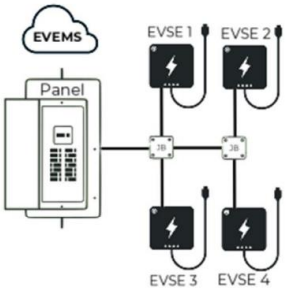
The textbox above illustrates the opportunity for load management for residential charging. Networked charging enables utility grid operators to provide signals specifying when it is most valuable for an EV to charge (for example, when wholesale power prices are low and the distribution grid is not congested).

Similarly, EV energy management systems (EVEMS) monitor and control loads so as not to exceed the capacity of an electrical circuit. They can be used can be accommodate more EV charging at a facility than could otherwise occur without EVEMS. EVEMS make it possible to provide large amounts of parking (e.g., 100% of parking in an apartment building) with EV charging. By controlling the rate and timing of charging, EVEMS charge multiple vehicles while reducing the required circuit capacity.

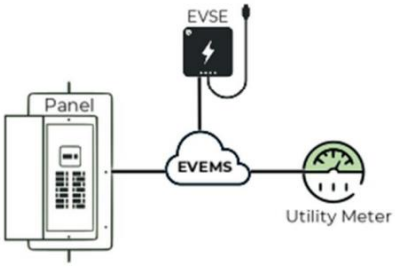
While the speed of charging slows when multiple EVs are charging simultaneously on a shared circuit, using reasonable amounts of load sharing is perfectly appropriate in situations where vehicles are parked for longer periods of time (e.g., overnight in residential parking, or the course of a day at a workplace). Notably, load sharing approaches are appropriate not only in residential and workplace settings, but also in depots for commercial fleet charging.

Most networked chargers are compatible with EVEMS. As shown in Figure 5, there are multiple possible EVEMS configurations.

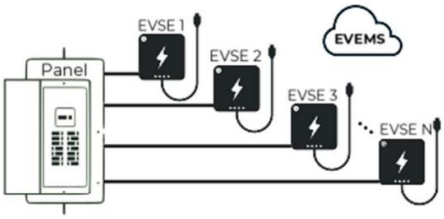
[16] Roulez Électrique (2014). Les distances moyennes de déplacement au Canada : étonnamment courtes!
[17] Pollution Probe (2022).



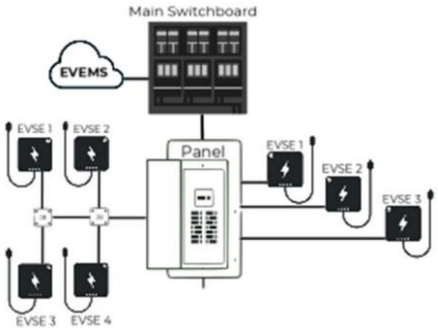
Circuit sharing: Multiple EV chargers on a circuit, with control to ensure capacity is not exceeded.



Feeder sharing (demand control charger): On-off control of EV charging based on available capacity on the supply to an electrical panel.



Panel sharing: EV charging loads in excess of panel, with control to ensure capacity is not exceeded.



Service monitoring: Monitoring of spare capacity on building's main electrical board and control of EV loads accordingly.

Figure 5. Possible EVEMS Configurations. Source: Brendan McEwen and AES Engineering.

2.6 Wireless and Overhead Charging

Wireless Charging

Wireless charging is an emerging technology that is not yet widely commercialized. It can be broken down into two categories: static wireless charging when the vehicle is parked, and dynamic wireless charging while the vehicle is in motion.

Static wireless charging is a direct substitute for traditional conductive charging with a cable. Wireless charging uses electromagnetic induction, similar to what is used for wireless charging of smartphones and other electronic devices. This approach is primarily seen as a convenience feature for personal vehicles but may also be a key enabler for applications that benefit from frequent top-ups, such as taxis in a queue or emergency vehicles that spend considerable amounts of time idling but that may need to leave quickly. Wireless charging may be a necessity to enable fully autonomous vehicles.

There has been limited commercial availability of static wireless charging solutions so far, with aftermarket retrofit options available for certain EV models, but no automaker has yet included static wireless charging as a factory option. SAE International has released the J2954 standard that establishes industry-wide specifications for static wireless charging to ensure safety, performance and interoperability across manufacturers.

If static wireless charging becomes more common in the future, it will be able to use much of the electrical infrastructure implemented for physically connected EV chargers used today. Therefore, static wireless systems do not present a substantial risk of stranded assets.

Dynamic wireless charging relies on inductive charging infrastructure that is integrated into the road surface. This approach is at a much lower level of technology readiness, with a limited number of proof-of-concept trials currently under development. It has yet to be seen whether this technology can be deployed cost effectively. If technical and economic barriers can be addressed, it would likely be at least a decade before this technology can be commercialized and incorporated into production vehicles. Most analysts foresee that dynamic wireless charging, if it ever gains appreciable scale, would be used more for goods movement vehicles and not light-duty passenger vehicles. That said, if dynamic wireless charging becomes viable, it could have a significant impact on the demand for other types of charging – vehicles that can charge while on the highway (or portions thereof) would have no need for fast charging infrastructure to enable longer trips.

Overhead charging

Overhead charging may be used for heavy truck and bus charging at depots or on-route charging facilities. The SAE J3105 standard was established to ensure safety and interoperability of such systems. Results of overhead charging pilots by transit agencies have presented mixed results so far.

Overhead wires could allow pantographs to connect vehicles to a source of power as they move, similar in concept to how trolley buses are used today (catenary charging). Such systems are being piloted on major corridors to support electrification of heavy trucks for goods movement in Norway.

3. Charging Installation Approaches

3.1 EV-Ready Parking and Buildings

As described in Section 1.3, emerging best practice is to provide charging infrastructure in multifamily buildings where parking is available. Multifamily building charging represents a more affordable, convenient, and attractive alternative to public charging for apartment and strata dwellers.

DEFINITIONS

EV ready parking is a parking space that features an adjacent electrical outlet (a junction box or a receptacle) capable of providing at least Level 2 EV charging (as defined by the SAE standard J1772). See Figure 6. This definition is reflected in the requirements for access to the BC Hydro EV charging rebates for apartment and condo buildings.[18]

We define **EV ready buildings** as those buildings where EV ready parking is provided at scale:

- For residential: where **100%** of parking stalls (or at least one stall per dwelling) are EV ready.
- For commercial: where **20%-40%** of parking stalls are EV ready, depending on context.

Fully EV ready residential buildings are the most cost-effective, practical, and fair way to ensure charging access in existing multifamily buildings. This comprehensive approach is reflected in the municipal bylaws for new construction adopted in many BC municipalities, as referenced in Table 4.

[18] BC Hydro. EV charging rebates for apartment and condo buildings.

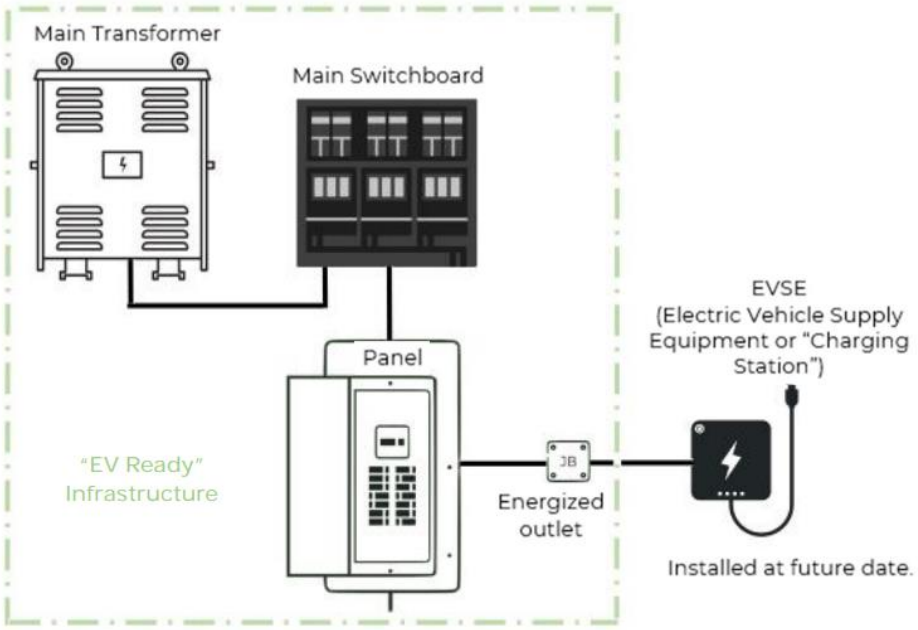


Figure 6. EV Ready Installation Showing All Infrastructure Required up to the Energized Outlet

New Construction

Thirteen of 23 Metro Vancouver members, covering a majority of the Metro Vancouver population, have adopted parking design requirements in parking or zoning bylaws requiring EV Ready parking for 100% or near-100% of residential parking in new developments. Eight members also require significant proportion of new commercial parking to be EV Ready, ranging from five to 45%. The Province of BC has clarified that the BC Building Act does not prohibit local governments from making such requirements.

Table 4. Metro Vancouver Members Having Adopted EV Ready Requirements

Metro Vancouver Member	EV Ready Requirement	
	Residential	Commercial
City of Vancouver	100%	45%
City of North Vancouver	100%	45%
City of Port Moody	100%	20%
City of Surrey	100%	20%
District of North Vancouver	100%	20%
City of Richmond	100%	In development
City of Burnaby	100%	--
City of New Westminster	100%	--
District of West Vancouver	100%	--
City of Coquitlam	1 EV ready/dwelling	--
Township of Langley	1 EV ready/dwelling	--

Metro Vancouver Member	EV Ready Requirement	
	Residential	Commercial
City of Port Coquitlam	1 rough-in/dwelling[19]	--
Village of Anmore	--	--
Village of Belcarra	--	--
Bowen Island Municipality	--	--
City of Delta	--	--
Electoral Area A	--	--
City of Langley	--	--
Village of Lions Bay	--	--
City of Maple Ridge	--	--
City of Pitt Meadows	--	--
Tsawwassen First Nation	--	--
City of White Rock	100%	--

Existing Buildings

For existing buildings, there are unfortunately complex barriers to pursuing EV-ready retrofits, spanning high upfront costs and limited access to capital, the need to foster the appropriate services and approach amongst engineering consultants and contractors, a lack of awareness among rental building owners and strata boards, and complicated strata decision-making processes. EV-ready retrofits involve ensuring there is sufficient electrical capacity to supply EV charging (often via an electrical upgrade) and installing all necessary electrical infrastructure to supply the parking stalls with a wired outlet (which often involves civil works and renovations).

There are different approaches to retrofitting multifamily buildings. A **comprehensive EV ready retrofit** is an approach that can help overcome these barriers, and is particularly valuable for multifamily condominiums, rental housing, workplaces, retail, and many depots. In this approach, a building undertakes an electrical renovation to make a significant proportion of parking EV ready. For example:

- A strata makes all parking EV ready, to accommodate all drivers adopting an EV in the coming decades.
- A workplace implements a 10% EV ready retrofit to accommodate parking for the foreseeable future). As drivers adopt EVs, EV chargers are installed at their assigned parking space.

Comprehensive EV ready retrofits are an alternative to incremental additions of EV chargers, wherein a building implements a few chargers at a time, typically in common parking areas (such as visitor parking) to be shared by multiple residents or building occupants. Over time, as more EVs are

[19] City of Port Coquitlam is unique in Metro Vancouver for requiring "roughed in" electrical circuit breaker on a branch panel and raceway to the parking space. Dunsky recommends EV Ready (i.e. wired outlets) future-proofing. However, such rough-in requirements are better than nothing.

adopted, new electrical renovations are undertaken to implement more charging. Comprehensive EV ready retrofits offer multiple benefits over an incremental approach, as shown in Table 5.

BC Hydro's globally-leading EV charging rebates for apartment and condo buildings programs provides funding for building owners to conduct an EV ready study before proceeding to retrofits, in order to encourage a comprehensive approach.

Table 5. Benefits and Challenges of Comprehensive EV Ready Retrofits versus an Incremental Approach

Benefits		**Comprehensive EV ready retrofits**		**Incremental additions of EV chargers**	
To building owner or investor	Upfront cost		Higher one-time upfront cost		Lower individual project costs (but significantly more expensive in aggregate)
	Project manage-ment		One project		Series of smaller projects
	Total cost		Lower total cost		Higher total cost
	Future proofing		Avoids stranded assets		Initial installations may not be designed for later expansion; some potential for stranded assets
To resident or user	Certainty of access to charging		Typically, can ensure that all drivers get access to charging		Potential to exhaust limited electrical capacity if design for EVEMS not considered, meaning some drivers may not get access
	Charger installation experience		Simple process to install chargers (after initial comprehensive electrical renovation)		Process to implement new chargers is frequently lengthy, and usually complicated
	User experience		Charging can be conveniently located in drivers' assigned parking space		Often, initially in visitor parking; though sometimes in assigned parking

Launched in 2021, the CleanBC GoElectric program provides rebates for the following aspects of EV-ready retrofits:

- EV Ready plan rebate: up to $3,000 for creation of EV Ready plan – strategy for a building to make at least one parking space per residential unit EV Ready.
- EV Ready infrastructure rebate: up to 50% of costs to install electrical infrastructure required to implement EV Ready plan, to a maximum of $600 per parking space, and a project maximum of $120,000.
- EV charger rebate: up to $1,400 per to purchase and install L2 networked EV chargers to implement a building's EV Ready plan, to a maximum of $14,000.

BC communities are at an advantage compared to other jurisdictions in that this program offers building owners the option to implement comprehensive EV ready retrofits, an approach that will, in many circumstances, provide the greatest value over the lifetime of the building and most cost-effectively enable wide-spread EV adoption, optimizing use of public and/or utility ratepayer funds.

3.2 Public EV Charging Siting, Design and Operational Considerations

There are many important considerations relating to the siting, design, and operations of EV charging systems. Key goals for policy makers and charging network operators should include:

- **Cost efficacy.** Minimizing the capital and operating costs of EV charging is important to enabling successful deployment at scale. The electrical upgrade costs associated with implementing DCFC, as well as many Level 2 public charging installations are significant, which means that siting the infrastructure with a view to grid capacity is key.
  - Privately-operated public charging service providers will expect to make a return on charging infrastructure, while public sector or utility operators may consider operating these networks at a loss, since the availability of public charging fosters EV adoption and the associated societal benefits (reduction in greenhouse gas and air contaminant emissions).
  - Likewise, it is important that user fees are set at rates that users can afford and that these fees are competitive compared to gasoline and other fuels.
- **Siting infrastructure proximate to demand.** This project forecasts the demand for EV charging across different geographies in Metro Vancouver.
- **Physical safety**. The station should be Is the station well-lit, and have additional safety features such as security cameras, help buttons, and visibility to passers-by. Further, the equipment should meet applicable technical safety standards.
- **Accessibility.** EV charging infrastructure should be provided in wheelchair accessible spaces and all infrastructure should be designed so that people with a range of disabilities can use the chargers and associated interfaces and mobile applications.
- **Durability**. The equipment should withstand frequent use and seasonality.
- **Comfort and amenities**. Charging stations should be sited in proximity to amenities such as food, drink, washrooms, parks or public attractions within easy walking distance. Stations should be weather-protected and comfortable for users.
- **Site safety**. There should be bollards or other designs to protect the charging equipment.
- **Visibility, signage and branding**. Road users should be able to navigate easily to the charging station.

- **Uptime, reliability and availability.** A very high degree of charger uptime (i.e. time when the charger is not in need of repair) is paramount to ensure drivers have reliable access to EV charging. To ensure that users are confident they can access public charging conveniently when they need it, it is important that enough public charging is available in a given area and that it is priced appropriately to avoid overstays.
- **Effective customer service**. It is important that drivers have a convenient means of troubleshooting issues when they are accessing public charging.
- **Privacy and cybersecurity**. The service provider must take appropriate steps to protect user data. They should consider whether data stored in Canada and secure the process for remote firmware updates.

Detailed design and operational guidelines are beyond the scope of this project. BC Hydro has published *EV Fast Charging Design and Operational Guidelines for Public DCFC Stations in BC* and a *Level 2 Public Sector Charging Stations Best Practices Guideline*. It is recommended that all public charging operators carefully consider these guidelines, and adhere to all relevant guidance.

4. Charging Networks and Operations

4.1 EV Charging Service Providers

There are many actors in the EV charging ecosystem. Some companies focus on selling charging equipment only. In the public charging space, it is more common for the companies that provide the charging equipment to also operate the network as part of a full service offering. These players are referred to as **EV charging service providers.** They manage public charging networks and, in some cases, work with various entities including multifamily buildings (building owners and strata groups), employers, fleet owners, public charging site hosts, to support EV charging. Some examples of EV charging service providers include FLO, Chargepoint, Tesla, GreenLots, SWTCH Energy, Electrify Canada, Petro-Canada, and BC Hydro.

EV charging service providers that operate public networks will often work with **site hosts** that wish to implement public charging at their facilities. Site hosts can include municipalities and businesses.

In addition to supplying charging equipment, EV charging service providers typically also supply management systems with functions that include:

- User apps and administrator dashboards
- Access controls and reservation platforms
- The ability to reconcile electricity costs by applying user fees
- EV energy management services
- Warranties
- Operations and maintenance
- Customers assistance and support
- Management of opportunities to create value for sites through, for example:
  - Utility demand response
  - Valorizing carbon credits through the BC Renewable and Low Carbon Fuel Requirements

EV charging service providers will typically use networked chargers.

4.2 Ownership Models

Public charging infrastructure rarely has an attractive rate of return for private investors. Some exceptions to this rule include charging ports in very high-demand areas, or investors that have a broader financial incentive to offer charging (for example, utilities who will drive more electricity consumption, retail outlets who want to attract customers, or automakers who want to sell more EVs). As a result, there is a crucial role for municipalities and First Nations in deploying infrastructure to meet residents' needs and ensure that a lack of charging does not present a barrier to EV adoption.

In deploying a public charging network, the deploying organization needs to choose from among a range of potential models for owning, operating and maintaining the infrastructure. In a **vertically integrated model**, sometimes referred to as "charging as a service," the EV charging service provider offers a full service, providing the charging equipment and charging management systems while also being responsible for maintenance, reporting, and often price setting.

In a **decoupled** model, the deploying organization takes on and coordinates more of the activities while contracting out one or more aspects of deployment. For example, under a decoupled model, a

municipality might issue an RFP for the design and construction of the EV charging station, and a separate contract for operation.

There are benefits and drawbacks to each model; broadly speaking, a vertically integrated solution requires fewer resources from the deploying organization but also affords less control, whereas a decoupled solution offers more flexibility and control, but at the cost of needing more skilled in-house resources. A full comparison of these models is presented in Table 6.

Table 6. Strengths and Weaknesses of Vertically Integrated versus De-coupled Vendor and Network Solutions

		Vertically integrated (proprietary) solutions ("charging as a service")		**Decoupled solutions**
Complexity		One vendor relationship and packaged sourcing Less complex process for site owner Full service offering		Internal staff needed to coordinate between vendors and handle technical issues
Harmonization		Alignment of infrastructure with payment method		Payment solution between hardware and software may not be aligned Hardware and software may not work perfectly together
Flexibility		Less flexible Software customization features may not be possible		Flexibility in selecting vendors
Resilience		Possibility of stranded assets if proprietary service terminated operations		Offers potentially higher resilience if one network's connection is no longer available
Vendor cost		Potentially higher costs		Potentially lower costs
OCPP compliance		Most solutions moving towards OCPP compatibility		All open standard solutions are OCPP framework compliant

4.3 Payment Systems and User Fees

Although early public charging networks have sometimes offered free charging, networks are now moving away from this model. Though some public charging operators offer free charging as an amenity or to attract visitors, increasingly users are expected to pay for the electricity that their vehicles use.

Regulatory amendments in recent years have clarified the ability of various third parties to charge user fees for EV charging:

- In 2018, BC made a legislative update to *Strata Property Regulation 6.9* to clarify the ability of strata corporations, by bylaw or rule, to create a variable user fee for the use of EV chargers.[20]
- In 2019, BC granted an exemption with respect to the BC Utilities Commission (BCUC)'s regulation of EV charging services, clarifying that third parties can charge fees for EV charging use without being subject to regulation by BCUC, based on a recommendation and inquiry by the BCUC. [21]
- In 2023, Measurement Canada granted a temporary dispensation to allow charging site operators to set fees on a volumetric basis for fast chargers (it is so far unclear whether this dispensation applies to Level 2 charging). [22] This means that operators can set fees on a per kilowatt hour basis, rather than a per minute basis.

EV charging user fees can be set in the following ways:

1. By the amount of time the charger is in use, with per minute rates set according to charging power (ports with load sharing can offer reduced rates),
2. By the amount of power used on a volumetric basis (see Measurement Canada update above),
3. Through other network subscription fee models (e.g. flat rate for unlimited charging in a month; etc).

In terms of the mechanism by which the user pays for the electricity, charging equipment can support a variety of payment options, including:

- For EV drivers with existing user accounts (customer registers with the charging network and maintains an account balance to pay for charging):
  - Payment by RFID card (customer receives a physical RFID card that can be swiped to enable charging and the account deducted according to the usage fee structure).
  - Payment by mobile application (customer downloads an app on their mobile phone that enables user login and payment authentication).
- For EV drivers without a user account:
  - Payment by direct credit card transaction (charging equipment includes a credit card reader that enables charging)
  - Payment by credit card via a toll-free phone number provided on site (customer calls a toll-free number and provides credit card information to customer support to remotely authenticate charging).

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[20] Government of British Columbia. "Changes to strata legislation since 2011."
[21] BCUC (2018). BCUC Regulation of Electric Vehicle Charging Service Inquiry (Project No. 1598941).
[22] Government of Canada (2023). "Temporary dispensation for Level 3+ electric vehicle supply equipment. "

5. Infrastructure Costs

The cost to install EV charging infrastructure varies widely across projects, depending especially on:

- The **power output** of the charging ports.
- **Whether a new or upgraded utility service is required** (high connection costs can prevent projects from moving forward). The costs of new or upgraded services is highly variable between different sites, and is very difficult to predict prior to a detailed request for a service extension from electric utilities.
- **The scale of the investment.** Comprehensive EV-ready upgrades in residential buildings and depots can reduce the per-port cost significantly.
- **The extent to which EVEMS is used** to reduce electrical capacity per vehicle and share infrastructure, like branch circuits, between vehicles.
- In the case of public chargers, the **location of the charging station**. Curbside charging is typically more expensive than off-street charging.
- The **quality of the design**. The use of load management techniques can significantly reduce per-port costs.

Table 7 summarizes high level indicative cost estimates for different Level 2 EV charging infrastructure systems based on in-house knowledge of representative projects.

Table 7. Indicative Per-Port Costs of Level 2 Charging Infrastructure

EV Charging System	Approximate Cost Per Port			
	New Utility Connection	Equipment	Installation	Total Installed
Onsite ground-oriented home charging	Typically NA	$300-$3,000	$100-$2,000	**$400-$5,000**
multifamily building – Incremental approach (a few chargers at a time)	Typically NA	$1,000-$4,000	$3,000-$15,000	**$4,000-$20,000**
multifamily building – Comprehensive EV Ready Retrofit	Typically NA	$1000-$3000	Avg $1,300	**$2,000-$5,000**
Public L2 Charging*	$0 - $20k+	$1,000-$6,000	$3000-$10,000+	**$4,000-$16,000 plus connection costs**

* Public L2 charging on an existing service (e.g., a streetlight or building) will have no new utility connection costs. Generally, public L2 charging located at the curbside (rather than off-street) is at the higher end of the cost range.

A number of studies have estimated average per-port costs for fast charging infrastructure, including both the charging equipment itself and additional installation costs. Figure 7 compares estimates made under previous studies by the International Council for Clean Transportation,[23] the National Renewable Energy Lab,[24] and RMI,[25] showing variation between their estimates. As an outlier, Tesla has been reported to achieve significantly lower per-port costs down to between $60,000 and $80,000 CAD.[26] This suggests that as deployment volumes increase and deploying organizations build internal knowledge and a network of suppliers, per-port costs will come down.

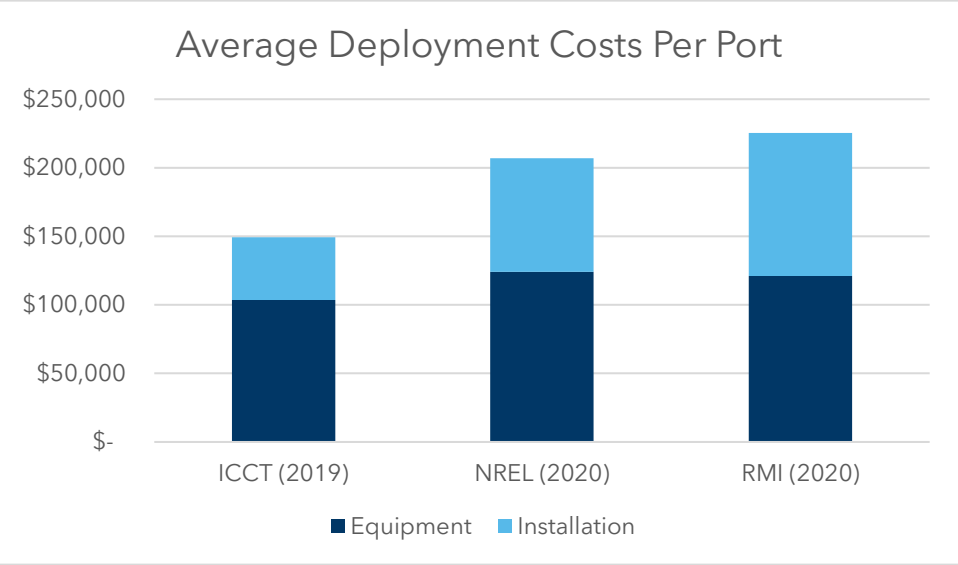


Figure 7. Comparison of per-port DCFC cost estimates across different studies. These values represent an average per-port cost across sites of various sizes using 150kW DCFC.

Moreover, these studies have also demonstrated the economies of scale that can be achieved when multiple ports are installed at the same site (electrical upgrades are used more efficiently in this case). ICCT's study estimated the per-port cost savings associated with larger deployments, shown in Figure 8.

[23] International Council on Clean Transportation (ICCT) (2019). Estimating electric vehicle charging infrastructure costs across major U.S. metropolitan areas.
[24] Borlaug, B., Salisbury, S., Gerdes, M. and Muratori, M. (2020). Levelized Cost of Charging Electric Vehicles in the United States. *Joule,* Volume 4, Issue 7, 15 July 2020, Pages 1470-1485.
[25] Chris Nelder and Emily Rogers, Reducing EV Charging Infrastructure Costs, Rocky Mountain Institute, 2019.
[26] Templeton, B. "Tesla's Texas Charger Grant Applications Fail; It's Bad For Texas But Reveals Tesla's Super-Low Costs." *Forbes,* April 22, 2022.

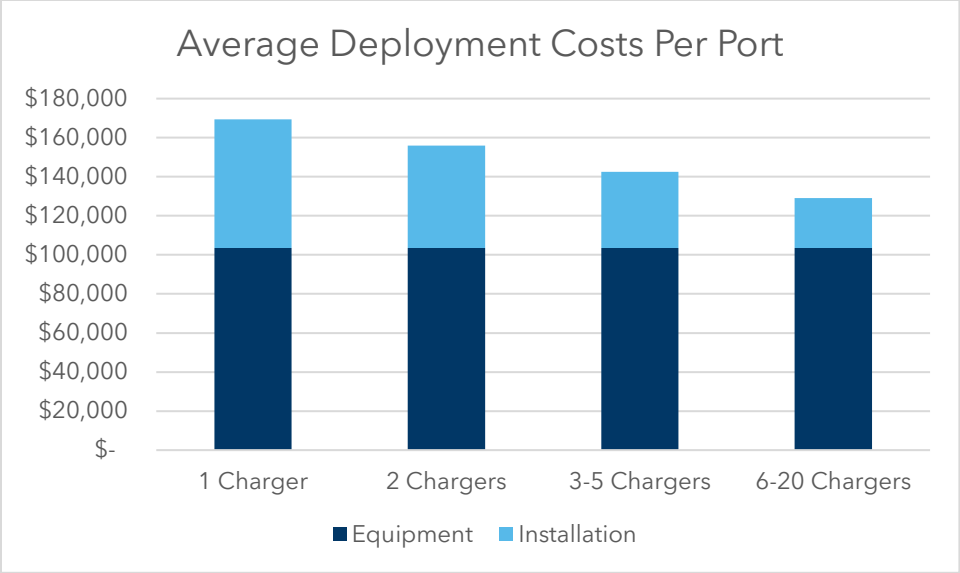


Figure 8. Comparison of per-port DCFC costs as a function of the number of ports per site, using 150kW DCFC. (Source: ICCT, 2019)

Table 8. Indicative Costs of DCFC Charging Infrastructure

Charging Power		1-2 port site			
	New Utility Connection ($)	Equipment ($/port)	Installation ($/port)	**Total ($/port)**	
Public DCFC - 50kW	0 - 100k+	45,000	40,000	**85,000**	
Public DCFC - 150kW	0 - 100k+	80,000	70,000	**150,000**	
Public DCFC - 350kW	0 - 100k+	140,000	84,000	**224,000**	
		4 port site			
	New Utility Connection ($)	Equipment ($/port)	Installation ($/port)	**Total ($/port)**	**Total ($/site)**
Public DCFC - 50kW	0 - 100k+	45,000	24,000	**69,000**	**276,000**
Public DCFC - 150kW	0 - 100k+	80,000	42,000	**122,000**	**488,000**
Public DCFC - 350kW	0 - 100k+	140,000	50,400	**190,400**	**761,600**

"NO DISCLAIMERS" POLICY

This report was prepared by Dunsky Energy + Climate Advisors, an independent firm focused on the clean energy transition and committed to quality, integrity and unbiased analysis and counsel. Our findings and recommendations are based on the best information available at the time the work was conducted as well as our experts' professional judgment. **Dunsky is proud to stand by our work.**

ATTACHMENT 3

Electric Vehicle Charging

Regional Electric Vehicle Charging Analysis and Guidance

Guidance for Collaborative Deployment of EV Charging in Metro Vancouver

Morgan Braglewicz
Air Quality Planner, Air Quality and Climate Action Services

Climate Action Committee, October 5, 2023
62391220

metrovancouver

PROJECT OVERVIEW

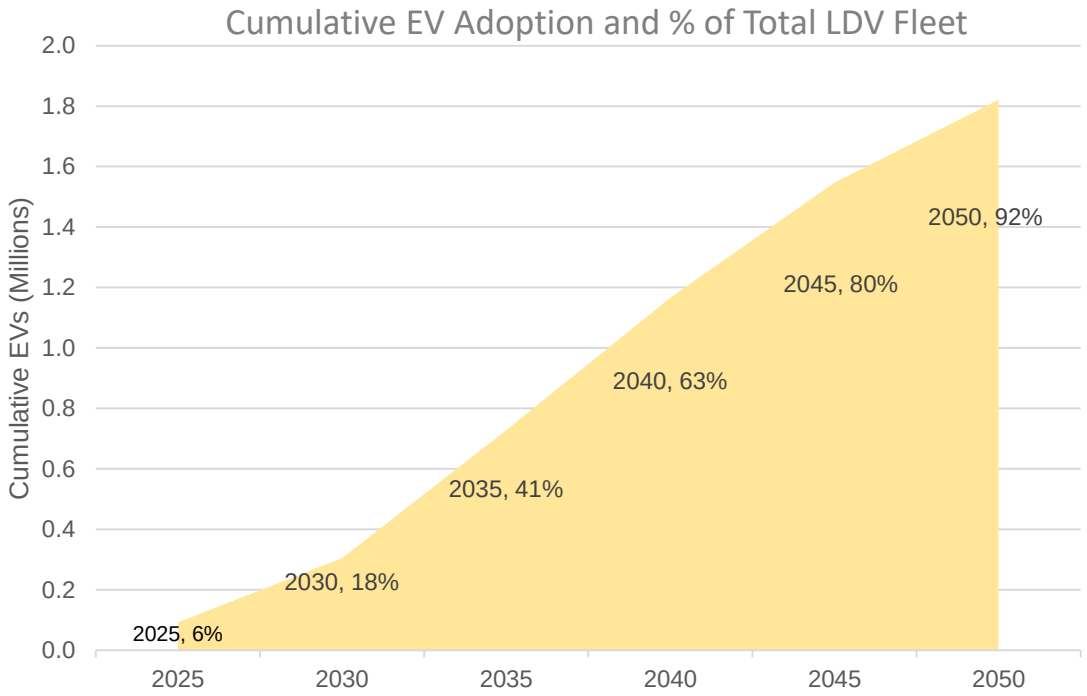
Regional EV Charging and Guidance

Purpose: To help Metro Vancouver, its members, and partners plan for and support the deployment of charging infrastructure for light-duty electric vehicles.

- Forecast EV uptake and demand for charging infrastructure
- Assess how EV charging demand can be met through home and public charging
- Estimate costs of EV charging deployment
- Identify proposed roles for key actors
- Recommend policy and actions to support EV charging deployment

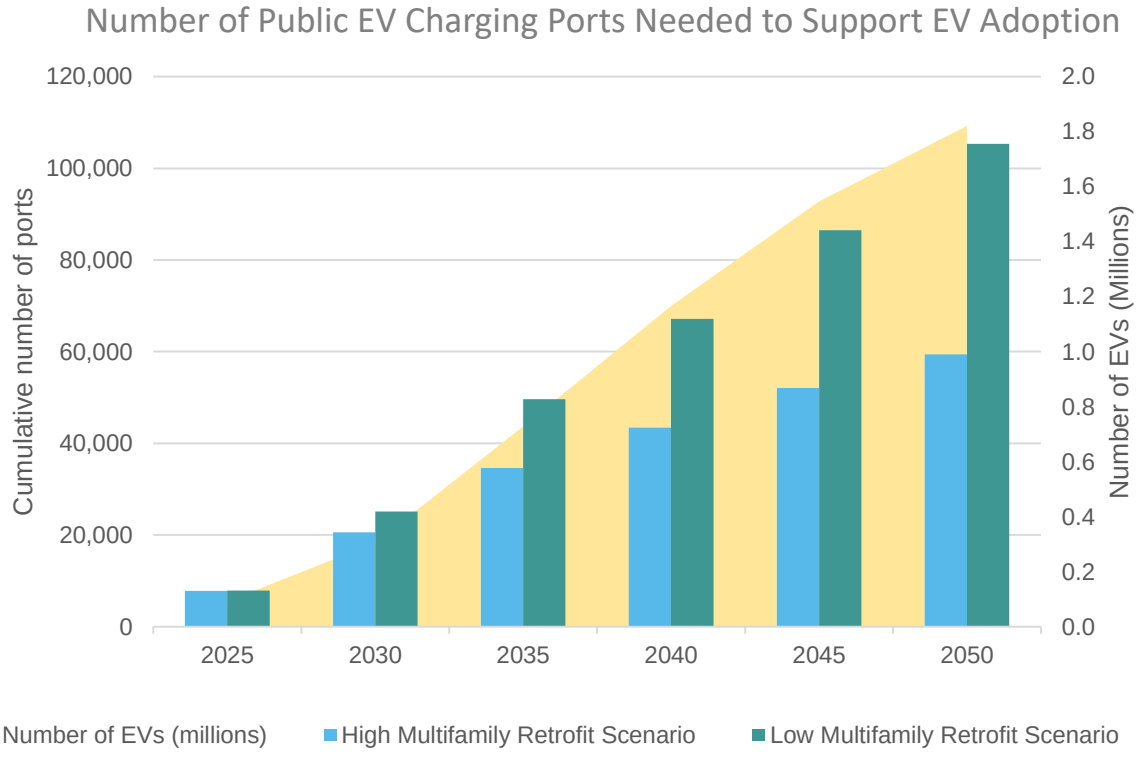
REGIONAL EV UPTAKE AND CHARGING NEEDS

Analysis Results



REGIONAL EV UPTAKE AND CHARGING NEEDS

Analysis Results



GUIDANCE FOR LOCAL GOVERNMENTS

Key Actions

- Provide timely project approvals, remove permitting and regulatory barriers to support private sector EV charging investment
- Adopt EV ready requirements for parking in new developments
- Use development approvals processes to secure additions to public charging network on private lands
- Advocate to provincial and federal governments for increased funding for public charging

KEY TAKEAWAYS

- Rapid expansion of EV charging needed to keep pace with EV uptake and avoid delaying transition to EVs
- Significant capital investment in EV charging for public charging and in multifamily homes will be needed
  - $1.2 billion by 2035
  - $2.1 - $2.9 billion by 2050
- Big, coordinated action across multiple actors in the region will be needed

Thank you

metrovancouver

To: Climate Action Committee

From: Conor Reynolds, Director, Air Quality and Climate Action Services

Date: September 14, 2023 Meeting Date: October 5, 2023

Subject: **Manager's Report**

RECOMMENDATION
That the Climate Action Committee receive for information the report dated September 14, 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.

Metro 2050 Climate Policy Enhancement Joint Workshop
Members of the Regional Planning Committee will be invited to attend in-person a workshop during the first part of the Climate Action Committee meeting being held at 9:00am on November 2, 2023. The workshop is being coordinated by staff to be able to discuss possible *Metro 2050* climate policy amendments with both committees as committed to through the approvals process for *Metro 2050*. At that time, the Climate Action Committee requested to be part of discussions with the Regional Planning Committee on potential amendments to *Metro 2050* to strengthen language and policies on climate action. Input from the workshop will be considered and proposed amendments to *Metro 2050* will be presented to the Regional Planning Committee and Board early in 2024 for consideration.

2022 Annual Air Quality Summary
Metro Vancouver's *2022 Annual Air Quality Summary* (Reference 1) summarizes notable air quality and weather events in 2022, describes air quality trends since 2011, and reports on achievement of regional air quality objectives. The 2022 summary is being reported for the first time in this format, and will continue to be published each year as a record of air quality conditions in Metro Vancouver and the Fraser Valley.

Air quality trends show that most air pollutant levels have improved over the last decade, even while the region's population has grown. However, hot, sunny weather and wildfire smoke led to four air quality advisories in the Lower Fraser Valley in 2022. The region was under an advisory for 22 days, matching 2018 for the most days under an advisory in a given year.

The summary complements the comprehensive annual Lower Fraser Valley Air Quality Monitoring Reports (Reference 2), which include more detailed analyses of data from Metro Vancouver's air quality monitoring network, and are typically released at a later stage. The summary also complements the *Climate 2050 Annual Report 2022/2023* (Reference 3), which provides status

updates on the implementation of the *Climate 2050* Roadmaps. Together, the *2022 Annual Air Quality Summary* and *Climate 2050 Annual Report 2022/2023* help track Metro Vancouver's progress towards improving regional air quality and working towards a carbon neutral, climate-resilient region.

***Go Electric Parks!* Zero-Emission Vehicle, Equipment, and Services Showcase**

On May 31, 2023, Metro Vancouver Regional Parks hosted a trade show event branded *Go Electric Parks!* The event showcased battery-powered vehicles and equipment to over 225 municipal park operations, procurement, and fleet services staff from across the region. The showcase was held at Surrey Civic Plaza, and displayed a wide array of zero-emission vehicles, small hand-held electric equipment, and presentations from industry leaders including staff from Metro Vancouver's Air Quality and Climate Action Services team. The goal was to help owners and operators become more knowledgeable about choosing electric alternatives to support climate action, aligned with Metro Vancouver's *Climate 2050* strategy.

The event was funded by Metro Vancouver's Sustainability Innovation Fund (SIF) and brought together industry, academia, and local government to demonstrate a shared commitment to a better region and a cleaner planet. Partners and sponsors included: British Colombia Institute of Technology (BCIT), PlugInBC, MBS Equipment Co., BC Hydro - Power Smart, and the City of Surrey. Presentations and exhibits left attendees enthusiastic about the future of sustainable park operations. In total, 33 vendors interacted with the attendees in a trade show environment, while demonstrating how their e-products can replace traditional fossil-fueled alternatives and still meet work requirements while reducing emissions.

Post event survey results demonstrated that over 90% of attendees felt that the event instilled more confidence that innovation in the electric equipment industry is resulting in the availability of electric alternatives that can "do the job" in our park operations and maintenance applications. Almost the same percentage of survey respondents felt that the event influenced how soon they will start to plan, purchase, and utilize certain pieces of electric equipment or vehicles where operationally appropriate. To learn more about how Metro Vancouver Regional Parks is leading the switch to electric industrial tools like lawn mowers, blowers and utility vehicles, please see the showcase video (Reference 4).

Figure 1: Display of electric equipment on the grounds of Surrey Civic Plaza.

Climate Action Dialogues: Decarbonizing Buildings – November 21 & 22, 2023

Metro Vancouver's Climate Action Dialogues return this fall with a focus on the economic case, challenges, and opportunities from decarbonizing the region's buildings. This is the second installment of a regional dialogues series that highlights key areas of the region's climate strategy, *Climate 2050*. The *Climate 2050 Buildings Roadmap* outlines the strategies and actions for all homes and buildings to be zero emissions and resilient by 2050. These targets cannot be met without awareness and support from the region's residents, and bold action by businesses, investors, all levels of government, and other community leaders.

Dialogues will take place November 21 in North Vancouver and November 22 in New Westminster, and offer an identical program. Speakers are:

- Conor Reynolds, Director, Air Quality and Climate Action Services, Metro Vancouver
- Local business representatives showcasing case studies on the successful electrification of existing buildings
- Darla Simpson, Retrofit Program Manager, Zero Emissions Building Exchange (ZEBx)

These short presentations will be followed by a question and answer period. Networking and refreshments will be offered before and after the events. The second session will also be livestreamed on our website. Climate Action Committee members are welcome to register online or by contacting Lisa Williams, External Relations (Climate2050@metrovancouver.org).

A link to the Climate Action Dialogues page of the Metro Vancouver website has been included as Reference 5.

Climate Literacy Learning Program Direct Delivery

Climate Literacy is a free learning program designed for residents to increase their climate knowledge and build confidence in climate conversations. Research and observation show that residents struggle to identify priority areas for emissions reductions and to see climate action in their local community. Climate Literacy provides local and global content on climate science and climate action. Metro Vancouver promoted the learning program from May 1 to August 31, 2023, through our website, newsletter, and social media. The promotion resulted in over 13,000 visits to the Climate Literacy webpages.

CityHive has been engaged to deliver the learning program across the region in October and November. This youth-driven, non-profit, engagement organization will draw on established connections and existing channels, such as public library forums, youth organizations, community associations, large employers, secondary school campuses, non-profit organizations, and more. Direct delivery will see a combination of in-person and virtual learning environments, and self-directed and group learning settings. Following direct delivery by CityHive, staff will share outcomes of reach, participation, and learner experience, at a subsequent meeting.

A link to the Climate Literacy Learning Program page of the Metro Vancouver website has been included as Reference 6.

Metro Vancouver's PNE Showcase

Metro Vancouver's annual showcase at the PNE ran from August 19 to September 4. Visitors explored the "Metro Vancouver: Together We Make Our Region Strong" showcase to discover the scope and scale of regional services and infrastructure. Now in its third year, the 6,000-square-foot showcase provided an opportunity for residents to learn about the services and projects that keep our region livable. Visitors to the Air Quality and Climate Action Services area found information about air quality – how it is measured and what we have done to reduce contaminant emissions over time; and climate action – what the biggest sources of regional emissions are and actions to reduce those emissions, with a focus on buildings.

Figure 2: "Climate Action" pledge wall at Metro Vancouver's PNE showcase

Zero Waste Conference – "Climate Action through Circularity" – November 1 & 2, 2023

This year's Zero Waste Conference will explore the power of circular economy and regenerative principles to drive climate action. Bringing together leaders and practitioners from across business, government, and civil society, the event is a catalyst for transformational change. At the September Climate Action Committee meeting, members requested more information on the conference program and registration. An email with this information was subsequently sent to members on September 20, 2023. A link to the Zero Waste Conference website has been included as Reference 7 and for assistance with registration, members can contact Ysabel Lim, External Relations (ZWConference@metrovancouver.org).

Local Government Climate Action Program – 2023 Funding and Reporting

On July 31, 2023, Metro Vancouver submitted its 2023 response to meet reporting requirements for the BC Local Government Climate Action Program (LGCAP) (Reference 8). LGCAP replaced the Climate Action Revenue Incentive Program (CARIP) in 2022, and provides funding to local governments and Modern Treaty Nations to support the implementation of climate change mitigation and adaptation projects. LGCAP funding is based on each community's population and a base amount. Previously under CARIP, funding was distributed to local governments based on the amount of carbon tax paid. Metro Vancouver will receive $250,000 in funding under LGCAP annually from 2022 to 2025, with funding being provided each September. Metro Vancouver's LGCAP funding is slightly higher than what was received under CARIP (with amounts ranging from $200,000 to $220,000 in recent years).

Metro Vancouver's 2023 LGCAP response has been publicly posted to Metro Vancouver's website (Reference 9), which is a requirement of the program. Reporting requirements include measurement and reporting on corporate GHG emissions, investment in climate action initiatives, and reporting on projects linked to the objectives of the *CleanBC Roadmap to 2030* and/or the draft Climate Preparedness and Adaptation Strategy. For 2023, reporting requirements were expanded to include reporting on how LGCAP funds were used in the previous reporting year. In 2022, Metro Vancouver's LGCAP funding supported: Corporate GHG reduction projects; Participation in BCUC proceedings; Analysis to support development of large buildings emissions regulations; and the Driving Down Emissions project. The $250,000 received for 2022 contributed to the Climate Change Policy and Management budget, which also includes contributions from Metro Vancouver's Sustainability Innovation Fund (SIF).

Climate action initiatives and projects reported in 2023 align with reporting in Metro Vancouver's *Climate 2050 Annual Report 2022/2023* (Reference 3). As noted in the 2023 LGCAP response, Metro Vancouver will be reporting on 2022 energy-related corporate GHG emissions in fall 2023, and will be continuing to update its 2022 regional GHG emission inventory in coming months, as data is made available.

Cascadia Grey to Green Conference Comes to Vancouver This Fall – November 3 & 4, 2023
On November 3-4, Green Roofs for Healthy Cities (Reference 10) brings the Cascadia Grey to Green Conference (Reference 11) to Vancouver, with a focus on green infrastructure solutions that support climate action in cities and the broader Cascadia region. The conference will take a plenary approach, bringing together leading practitioners and researchers to share knowledge in designing and operating green buildings, walls and roofs, and advancements in integrated storm water management. Green roofs can play an important role in cities achieving their overall sustainability objectives, and are one of many nature-based solutions described in the *Climate 2050 Nature and Ecosystems Roadmap*, adopted by the Metro Vancouver Board in April of 2023.

REFERENCES

1. Metro Vancouver's *2022 Annual Air Quality Summary*
2. Lower Fraser Valley Air Quality Monitoring Reports
3. Climate 2050 Annual Report 2022/2023
4. *Go Electric Parks!* Showcase Video
5. Metro Vancouver Climate Action Dialogues Home Page
6. Metro Vancouver Climate Literacy Home Page
7. Zero Waste Conference Website
8. BC Local Government Climate Action Program (LGCAP)
9. Metro Vancouver 2023 LGCAP Response
10. Green Roofs for Healthy Cities
11. Cascadia Grey to Green Conference

ATTACHMENT

1. "Climate Action Committee 2023 Work Plan", dated September 14, 2023

Climate Action Committee 2023 Work Plan
Date: September 14, 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	Complete
Overview of air quality advisory program and preparedness for 2023 season	Complete
3rd Quarter	**Status**
Emission regulation for cannabis production and processing	Complete
SIF - status report on previously approved water projects	Complete
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	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 energy and GHG 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	In progress
Annual budget and five-year financial plan	In progress

To: Climate Action Committee

From: Laurie Bates-Frymel, Senior Planner, Regional Planning and Housing Services

Date: September 14, 2023 Meeting Date: October 5, 2023

Subject: **Sensitive Ecosystem Inventory 2020 Update – Change Summary**

At its meeting on September 7, 2023 the Metro Vancouver Regional Planning Committee received the attached report, titled "Sensitive Ecosystem Inventory 2020 Update – Change Summary" for information. The report will also be presented to the MVRD Board on September 29, 2023 and to the Regional Parks Committee on October 4, 2023 for information.

The report summarizes the results of the 2020 Sensitive Ecosystem Inventory (SEI) update, which identifies and maps ecologically important areas in Metro Vancouver as part of performance monitoring for *Metro 2050*, the Regional Growth Strategy (Reference 1). The 2020 SEI update supports the urgent need to take collective action toward the *Metro 2050* target to "increase the area of lands protected for nature from 40% to 50% of the region's land base by the year 2050" (Policy Action 3.2.1(a)), and implement the associated policy actions that seek to protect, enhance, restore, and connect ecosystems in *Metro 2050*, the *Climate 2050 Nature and Ecosystems Roadmap* (Reference 2), the *Regional Parks Plan* (Reference 3), and the *Regional Parks Land Acquisition 2050 Strategy* (Reference 4).

ATTACHMENT

1. Regional Planning Committee Report titled "Sensitive Ecosystem Inventory 2020 Update – Change Summary", dated August 15, 2023.

REFERENCES

1. *Metro 2050*
2. *Climate 2050 Nature and Ecosystems Roadmap*
3. *Regional Parks Plan*
4. *Regional Parks Land Acquisition 2050 Strategy*

To: Regional Planning Committee

From: Laurie Bates-Frymel, Senior Planner, Regional Planning and Housing Services

Date: August 15, 2023 Meeting Date: September 7, 2023

Subject: **Sensitive Ecosystem Inventory 2020 Update - Change Summary**

RECOMMENDATION

That the MVRD Board receive for information the report dated August 15, 2023, titled, "Sensitive Ecosystem Inventory 2020 Update - Change Summary".

EXECUTIVE SUMMARY

This report summarizes the results of the 2020 Sensitive Ecosystem Inventory update, which identifies and maps ecologically important areas in Metro Vancouver as part of *Metro 2050* performance monitoring. Between 2014 and 2020, approximately 900 ha (0.5%) of Sensitive and Modified Ecosystems were lost due to human activity in the region, with over 600 ha (67%) of that loss occurring within the regional core (the majority of which was 'modified' ecosystems). The region experienced significant population growth, economic activity, and development during this period, and although ecosystem loss was not unexpected in areas planned for development, the speed and scale of the loss observed is concerning, given the associated loss of the critical ecosystem services (e.g., carbon storage and sequestration, cooling, floodwater absorption, pollination, recreation, human health benefits) that support community resilience, and the loss of habitat connectivity. The 2020 SEI update supports the urgent need to take collective action toward the *Metro 2050* target to "increase the area of lands protected for nature from 40% to 50% of the region's land base by the year 2050", and implement the associated policy actions that seek to protect, enhance, restore, and connect ecosystems.

PURPOSE

This report provides the Regional Planning Committee and the MVRD Board with the results from the latest update to the Regional Sensitive Ecosystem Inventory.

BACKGROUND

During its meeting on January 14, 2022, the Regional Planning Committee received a report titled "Land Cover Classification and Sensitive Ecosystem Inventory Update – Scope of Work", which provided an overview of the process to update the regional Land Cover Classification (LCC) dataset and the Sensitive Ecosystem Inventory (SEI) (Reference 1). Metro Vancouver retained a consultant to update these datasets using full feature LiDAR (where available), multispectral satellite imagery and orthophotos from 2020, as well as several ancillary datasets. The LCC informs other Regional Planning geospatial analyses, such as tree canopy cover and impervious surfaces, carbon storage, ecosystem connectivity, and the SEI. This report focuses on the 2020 SEI update and change over time as compared to the 2014 SEI.

THE METRO VANCOUVER SENSITIVE ECOSYSTEM INVENTORY

The SEI was first created in response to the need for up-to-date, standardized ecological information to inform land use and conservation planning in the Metro Vancouver region, and to increase awareness of ecosystem presence and declines. Employing provincial inventory standards, the SEI identifies and maps ecosystems to support the use of ecological data in decision making. 'Sensitive Ecosystems' are ecologically fragile, rare or at-risk (e.g., wetland, estuarine, old and mature forest, riparian, alpine, woodland). The SEI also includes 'Modified Ecosystems' that have been altered (e.g., young forest, old field), but that have significant ecological value and importance for biodiversity, particularly in fragmented landscapes where Sensitive Ecosystems have been lost. In the SEI, both Sensitive and Modified Ecosystems are further categorized into ecosystem classes and subclasses, and the quality of each polygon is rated. References 2, 3 and 4 provide additional technical information about the SEI.

Use of the Sensitive Ecosystem Inventory

Several *Metro 2050* policy actions refer to the SEI (Map 11 – Reference 5), and it is critical for *Metro 2050's* performance monitoring and reporting. Two indicators are currently being tracked:

- Change in hectares of land identified as a Sensitive or Modified Ecosystem; and
- Change in hectares of identified Sensitive and Modified Ecosystems rated high quality.

Other levels of government, industry, non-profit groups, academia, and several Metro Vancouver plans refer to the SEI data, including the: *Ecological Health Framework*, *Natural Resource Management Framework*, *Regional Parks Land Acquisition 2050 Strategy*, *Regional Parks Plan*, and the *Climate 2050 Nature and Ecosystems Roadmap* (References 6-10).

UPDATING THE SENSITIVE ECOSYSTEM INVENTORY

To ensure that the SEI continues to be an effective and relevant land use and conservation planning tool, it must be updated regularly. This inventory is updated every 6 years, in alignment with the collection of regional remote sensing data. These updates report changes to the region's Sensitive and Modified Ecosystems over time and quantify the amount, rate, and type of ecosystem loss. The 2020 SEI update employed the same methodology as the 2014 update, using automation where possible to improve efficiency. Using 2020 regional orthophotos, ecosystem polygons were reviewed, and any loss or disturbance was documented. Polygons within Metro Vancouver Regional Parks were also updated using detailed mapping.

SENSITIVE ECOSYSTEM INVENTORY RESULTS

Region and Regional Core

Map 1 shows the two SEI reporting areas (Map 1):

- The Region, which includes the region's drinking water supply, estuarine and intertidal areas. As of 2020, 53% of the Region was considered Sensitive or Modified Ecosystem; and
- The Regional Core, which is the more urbanized southern part of the region and excludes the large parks and estuaries under provincial management, watersheds and other higher elevation areas. The Regional Core is most relevant for local policy and land use planning, and it is where local decisions and actions typically have the most impact. As of 2020, 20% of Regional Core was Sensitive or Modified Ecosystem.

Ecosystem Loss Between 2014 and 2020

Tables 1 and 2 below summarize ecosystem losses for the Region and the Regional Core. Between 2014 and 2020, just over 900 ha (0.5%) of the region's Sensitive and Modified Ecosystems were lost due to human activity, and over 600 ha (67%) of that loss occurred within the Regional Core, where Modified Ecosystems experienced the most loss (e.g. Young Forest, Old Field, Mature Forest and Freshwater).

Map 1 – The SEI's Region and Regional Core Extents

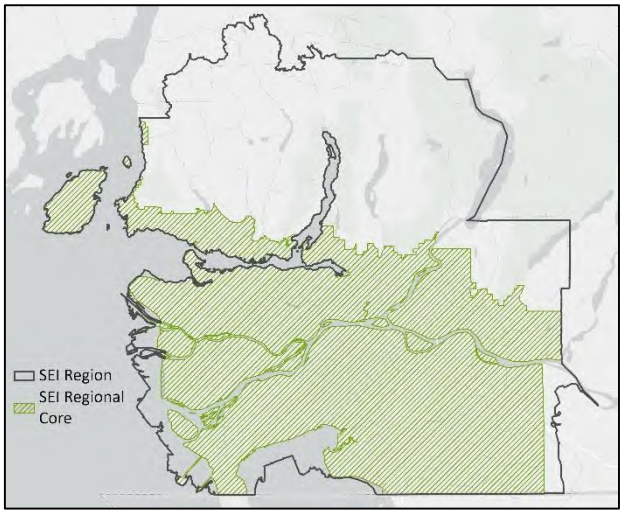


Table 1 - Sensitive and Modified Ecosystem loss between 2014 and 2020

	Sensitive Ecosystems (SE)				Modified Ecosystems (ME)				Totals – SE and ME			
	2014 (ha)	**2020 (ha)**	**Loss (ha)**	**% Loss**	**2014 (ha)**	**2020 (ha)**	**Loss (ha)**	**% Loss**	**2014 (ha)**	**2020 (ha)**	**Loss (ha)**	**% Loss**
Region	149,952	149,617	335	0.2%	27,378	26,811	566	2.0%	177,330	176,429	901	**0.5%**
Regional Core (subset)	24,785	24,578	207	0.8%	9,376	8,977	399	4.2%	34,161	33,554	607	**1.8%**

As shown in Table 2 below, losses for the 5-year period were highest for young forest, old field, mature forest, riparian, and wetland ecosystems.

Table 2 – Loss by Ecosystem Type and Class between 2014 and 2020

	Region				Regional Core			
Ecosystem *Type* Class	**2014 (ha)**	**2020 (ha)**	**Loss (ha)**	**% Loss**	**2014 (ha)**	**2020 (ha)**	**Loss (ha)**	**% Loss**
Sensitive Ecosystems								
Alpine	14,573	14,573	0	0.0%	0	0	0	0.0%
Estuarine	8,581	8,580	0.5	0.0%	1,211	1,210	0.5	0.0%
Freshwater (SE)[1]	7,094	7,093	0.9	0.0%	401	399	0.9	0.2%
Herbaceous	109	109	0	0.0%	85	85	0	0.0%
Intertidal	8,154	8,154	0	0.0%	223	223	0	0.0%
Mature Forest (SE)[2]	21,719	21,524	196	0.9%	7,517	7,435	82	1.1%
Old Forest	34,322	34,318	4	0.0%	118	118	0	0.0%

[1] Freshwater Ponds and Lakes are classified as Sensitive Ecosystems, while Freshwater Reservoirs are Modified Ecosystems.
[2] Mature Forests are classified as Sensitive Ecosystems if they are coniferous or mixed and over 5 ha in size. Coniferous or mixed Mature Forests less than 5 ha, and broadleaf of any size, are considered Modified Ecosystems.

Riparian	30,604	30,526	77	0.3%	7,902	7,835	67	0.8%
Sparsely Vegetated	9,125	9,125	0.1	0.0%	98	98	0	0.0%
Woodland	5,689	5,689	0.5	0.0%	314	314	0.5	0.1%
Wetland	9,983	9,927	56	0.6%	6,917	6,861	56	0.8%
Total - Sensitive Ecosystems (SE)	**149,952**	**149,617**	**335**	**0.2%**	**24,785**	**24,578**	**207**	**0.8%**
Modified Ecosystems								
Freshwater (ME)[1]	141	141	0.3	0.2%	139	139	0.3	0.2%
Mature Forest (ME)[2]	4,478	4,428	49	1.1%	2,180	2,139	41	1.9%
Old Field[3]	1,745	1,528	216	12.4%	1,745	1,528	216	12.4%
Young Forest	21,014	20,714	300	1.4%	5,312	5,170	142	2.6%
Total – Modified Ecosystems (ME)	**27,378**	**26,811**	**566**	**2.1%**	**9,376**	**8,977**	**399**	**4.2%**
Total – SE and ME	**177,330**	**176,428**	**901**	**0.5%**	**34,161**	**33,555**	**607**	**1.8%**

CHARACTERIZING ECOSYSTEM LOSS

The nature of ecosystem loss observed over the last five years ranges widely, from the clearing of large, high quality ecosystems, to small, disturbed remnant patches. This loss often involved the removal of relatively small pieces from the edges of larger areas, best described as 'nibbling'. Further analysis into the nature and causes of ecosystem loss will enable policymakers to make informed conservation and land use planning decisions. Attachment 1 includes details about the causes of loss and further detail is provided below for the ecosystem classes that experienced the greatest losses within the regional core.

Mature and Young Forest Ecosystems

The Provincial parks and protected watersheds in the northern part of the region are home to large amounts of 'Old Forest' (>250 years old), but outside of these areas, the remaining forests are categorized as 'Mature Forest' (80-250 years old) or 'Young Forest' (30-80 years old). Between 2014 and 2020, Young Forests saw the greatest losses of all ecosystem classes across the region. Only patches of Young Forest greater than 5 ha are considered as part of the standard provincial SEI process. However, Metro Vancouver also maps 'Small Young Forest' because smaller patches of Young Forest are still important, particularly given the rate and extent of forest loss across the region. Small Young Forest is included in Table 3 below to provide a more complete picture of regional forest loss.

As summarized in Table 3, almost 700 ha (or 1%) of the region's Mature and Young Forests were converted to other land uses over the 5-year period, and nearly 400 ha (or 60%) of that loss occurred within the Regional Core. The main causes of Mature and Young Forest losses in the regional core were residential development, followed by clearing / mowing, commercial and services, and agriculture.

[3] Although this is reported as a 'loss' in the SEI, Old Field ecosystems may be actively farmed and then left fallow, or planted with cover crops during the winter. This snapshot in time does not capture the temporal variation in Old Field ecosystems.

Table 3 – Loss of Mature and Young Forest Ecosystems between 2014 and 2020

	Region				Regional Core			
	2014 (ha)	**2020 (ha)**	**Loss (ha)**	**% Loss**	**2014 (ha)**	**2020 (ha)**	**Loss (ha)**	**% Loss**
Mature Forest (SE and ME)	26,197	25,952	245	0.9%	9,697	9,574	123	1.3%
Young Forest (ME)	21,014	20,714	300	1.4%	5,312	5,170	142	2.7%
Small Young Forest (non SE or ME)	4,965	4,816	149	3.0%	2,821	2,690	131	4.6%
Total	**52,176**	**51,481**	**694**	**1.3%**	**17,830**	**17,434**	**396**	**2.2%**

Old Field Ecosystems

Old Field ecosystems are found on agricultural lands that were formerly cultivated or grazed but have since been left fallow and now feature well-developed herbaceous vegetation, some shrubs and a few young trees. Old Fields may revert back to active agriculture over time based on the producer's management decisions. Table 2 shows that over 210 ha of Old Field ecosystems were lost in the region, all of which occurred in the regional core. The main causes of change in Old Field ecosystems in the regional core were agriculture, clearing or mowing, and industrial.

Riparian Ecosystems

Riparian areas are generally located along rivers, streams, and creeks, and for the purposes of the SEI, they also include fringes around lakes. Nearly 80 ha of Riparian ecosystems were lost in the region, and nearly 70 ha (or 87%) of that loss occurred within the regional core. The main drivers of Riparian loss in the regional core were agriculture, residential development, clearing or mowing, and transportation and communications.

Wetland Ecosystems

Wetlands 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. Over 55 ha of the region's freshwater Wetland ecosystems were lost between 2014 and 2020 and most of those losses occurred in the regional core. The main causes of Wetland losses in the regional core included clearing or mowing, industrial, agriculture, residential development, and commercial and services.

Ecosystem Loss and The Regional Growth Strategy

Charts 1 and 2 below summarize the losses within each of the *Metro 2040* regional land use designations and the causes of loss. Note that the focus of this analysis is on the *Metro 2040* regional land use designations, not those from *Metro 2050*, since the SEI was updated using imagery from 2020, which is prior to the adoption of *Metro 2050* in February of 2023.

Chart 1 – Ecosystem Loss by Metro 2040 Land Use Designation (2014-2020)

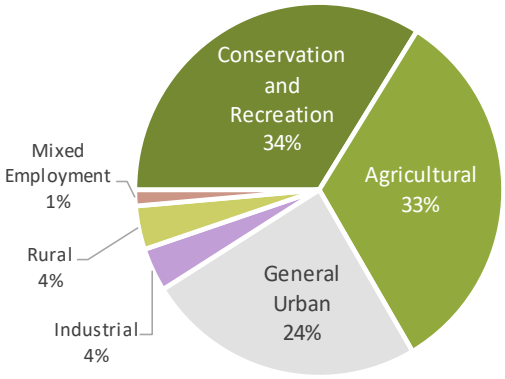
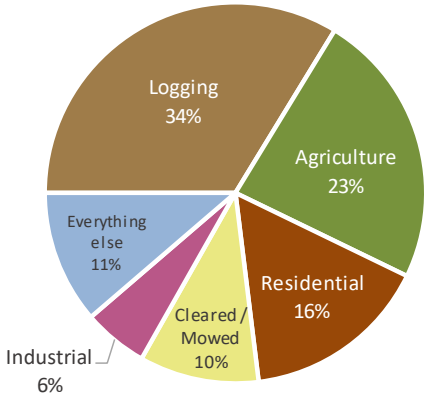


Chart 2 – Causes of Ecosystem Loss in the Region (2014-2020)



The results show that 34% of the ecosystem losses occurred within lands designated as Conservation and Recreation, with the majority of loss due to logging of mature and young forests in the Ridge-Meadows sub-region. Ecosystem change is expected within the Conservation and Recreation lands 'Natural Resource Areas' overlay, which contains "existing provincially-approved natural resource uses within the Conservation and Recreation regional land use designation that may not be entirely consistent with the designation, but continue to reflect its long-term intent. These uses include a landfill; quarries; lands with active forest tenure managed licences; and wastewater and drinking water treatment facilities". The expectation is that harvested forests within the Conservation and Recreation land use designation will move through natural succession and they will be returned to the SEI as Young Forest after they reach 30 years of age.

Approximately 33% of loss occurred within lands with an Agricultural regional land use designation, and although most of that loss (57%) was from conversion of Old Field ecosystems to active agriculture, young forests, wetlands and riparian areas were also lost on agricultural lands. Roughly 24% of losses occurred within the General Urban designated lands, where residential development was the top cause of loss, followed by mowing and clearing (which may not be permanent loss).

Sub-regional breakdowns

Staff have also produced summaries of ecosystem presence, loss, and proportions by sub-region (Attachment 2). This information can also be generated by specific member jurisdiction and provided on request.

SEI Trends and Policy Implications

2020 SEI update is the second time ecosystem loss has been quantified at the regional level, with the 2009 SEI as the baseline for comparison. Table 4 compares the losses between 2009 and 2014 to the losses between 2014 and 2020.

Table 4 – Sensitive and Modified Ecosystem Change between 2009-2014 and 2014-2020

Area	Change 2009-2014	Change 2014-2020
Region	- 1,600 ha (0.9%)	- 900 ha (0.5%)
Regional Core	- 1,200 ha (3.4%)	- 600 ha (1.8%)

Between 2014 and 2020, the overall loss was significantly less pronounced than the previous 5-year interval. The region experienced significant population growth, economic activity, and development during this period and although ecosystem loss was not unexpected, the speed and scale of the loss observed is concerning, given the associated loss of the critical ecosystem services (e.g., carbon storage and sequestration, cooling, floodwater absorption, pollination, recreation, human health benefits) that support community resilience, and the loss of habitat connectivity.

In 2020, 53% of the region was Sensitive or Modified Ecosystem. Over the next thirty years, it is projected that the region's population will grow by approximately one million people and it is understood that member jurisdictions have plans to develop additional lands to accommodate housing, support local food security, and foster a sustainable economy. However, *Metro 2050* has also set a science-based regional target to "**increase the area of lands protected for nature from 40% to 50% of the region's land base by the year 2050**", recognizing the need to set aside additional space for the region's growing population to access and recreate in nature, and support community and individual health and well-being. It is recognized that in this land constrained and rapidly urbanizing region, competing priorities will have to be considered. Meeting this target will involve making trade-offs between land use choices, but the federation is well positioned to work collaboratively toward this target by implementing key policy actions in *Metro 2050*, as well as other regional and local strategies, including:

2014-2020 SEI trend	**Relevant Policy in Regional Plans**
34% of total losses occurred on **Conservation and Recreation lands** **Ecosystems lost** - Mature Forests - Young Forests **Main cause of loss** - Logging	Metro Vancouver will: • Advocate to the Province to make ecosystem health and biodiversity conservation the overarching priority of forest management (*Climate 2050 Nature and Ecosystems Roadmap* Action 1.5) • Monitor ecosystem gains and losses on lands with a Conservation and Recreation regional land use designation and the Natural Resources Areas[4] therein, as identified in Map 9 (*Metro 2050* Policy Action 3.1.4) Member jurisdictions will: • Adopt Regional Context Statements that include policies that support the protection and enhancement of lands with a Conservation and Recreation land use designation (*Metro 2050* Policy Action 3.1.9b))
33% of total losses occurred on **Agricultural lands** **Ecosystems lost** - Old Field - Young Forests - Riparian - Wetland	Metro Vancouver will: • Advocate to the Province to provide incentives to encourage land management practices that … protect natural assets, and maintain ecosystem services from agricultural land (*Metro 2050* Policy Action 2.3.10) • Collaborate with the Province and member jurisdictions to explore and build a long-term funding mechanism that includes payment for ecosystem services on agricultural land (Draft *Climate 2050 Agriculture Roadmap* Action 3.6)

[4] Based on new information about private managed forests in the region, updates to 'Natural Resource Areas' overlay will be proposed as part of the next *Metro 2050* housekeeping amendment.

2014-2020 SEI trend	Relevant Policy in Regional Plans
Main causes of loss - Agriculture - Cleared / mowed - Residential	• Protect and Enhance Ecosystem Goods and Services (*Regional Food System Strategy* Action 5.1) • Identify a regional green infrastructure network that connects ecosystems and builds on existing local networks, while maximizing resilience, biodiversity, and human health benefits; and prepare implementation guidelines to assist with the protection, enhancement, and restoration of ecosystems (*Metro 2050* Policy Action 3.2.3 c) and d))
24% of total losses occurred on **General Urban lands** **Ecosystems lost** - Mature Forests - Young Forests - Riparian **Main causes of loss** - Residential - Cleared or mowed - Transportation and Communications	Metro Vancouver will: • Manage Metro Vancouver assets and collaborate with member jurisdictions, First Nations, and other agencies to protect, enhance, and restore ecosystems as identified on Map 11 (*Metro 2050* Policy Action 3.2.3a)) • Champion the protection of the region's important natural areas a) Promote the regional parks land acquisition strategy with others who have interest in or responsibility for land protection b) Review potential acquisitions with pertinent member jurisdictions and other stakeholders during the annual review (*Regional Parks Land Acquisition 2050 Strategy* Action 4.1) Member jurisdictions will: • Adopt Regional Context Statements that: a) identify local ecosystem protection … targets, and demonstrate how these targets will contribute to the regional targets in Action 3.2.1 b) refer to Map 11 or more detailed local ecological and cultural datasets and include policies that: i) support the protection, enhancement, and restoration of ecosystems through measures such as land acquisition, density bonusing, development permit requirements, subdivision design, conservation covenants, land trusts, and tax exemptions ii) seek to acquire, restore, enhance, and protect lands, in collaboration with adjacent member jurisdictions and other partners, that will enable ecosystem connectivity in a regional green infrastructure network iii) discourage or minimize the fragmentation of ecosystems through low impact development practices that enable ecosystem connectivity iv) indicate how the interface between ecosystems and other land uses will be managed to maintain ecological integrity using edge planning, and measures such as physical buffers, or development permit requirements (*Metro 2050* Policy Action 3.2.7)

Next Steps

Further analysis of the SEI dataset will be undertaken, including:

- Identifying which sensitive ecosystems are protected and which are not. As part of *Metro 2050's* performance monitoring, staff are collating protection status information from

various organizations. A report on the new *Metro 2050* 'Change in hectares of land protected for nature' measure will be shared with the Regional Planning Committee when complete.

- Assessing changes in ecosystem quality (e.g., condition, size) at the regional, regional core, and sub-regional levels.

The findings produced from the SEI update will be disseminated to staff from member jurisdictions and others on request, and the spatial dataset will be published on Metro Vancouver's open data portal. Updates to *Metro 2050* Map 11 (SEI Map) and the Natural Resource Areas overlay in Map 9 will be proposed as part of the next *Metro 2050* housekeeping amendment.

ALTERNATIVES

This is an information report. No alternatives are presented.

FINANCIAL IMPLICATIONS

Costs associated with updating the Regional Land Cover Classification and Sensitive Ecosystem Inventory were included in the Board-approved 2022 Regional Planning budget.

CONCLUSION

The 2020 Sensitive Ecosystem Inventory update provides key insights into the state of the region's most important ecological areas and changes that occurred between 2014 and 2020. The amount, rate and type of ecosystem loss was quantified for both the region and regional core. While the losses were less pronounced between 2014-2020 than the previous 5-year interval, the speed and scale of ecosystem loss observed is concerning, given the associated loss of critical ecosystem services (e.g., carbon storage, cooling, stormwater absorption, pollination) and habitat connectivity. The 2020 SEI update supports the urgent need to take collective action toward the *Metro 2050* regional target to "increase the area of lands protected for nature from 40% to 50% of the region's land base by the year 2050" and to implement *Metro 2050's* policy actions that seek to protect, enhance, restore and connect ecosystems. Further analysis of the SEI dataset will be completed, including identifying the protection status of sensitive ecosystems, and assessing changes in ecosystem quality over the 5-year period. The information produced from the SEI update will be finalized and disseminated to staff from member jurisdictions and others, on request. The spatial dataset will also be posted on Metro Vancouver's open data portal.

ATTACHMENTS

1. Sensitive and Modified Ecosystem Loss by Ecosystem Class (2014-2020)
2. 2020 Sensitive Ecosystem Inventory - Sub-regional Profiles
3. Presentation re: Sensitive Ecosystem Inventory 2020 Update – Change Summary

REFERENCES

1. "Land Cover Classification and Sensitive Ecosystem Inventory Update – Scope of Work" report
2. Sensitive Ecosystem Inventory for Metro Vancouver and Abbotsford - Technical Report (2009)
3. Update of the Sensitive Ecosystem Inventory for Metro Vancouver (2014)
4. Metro Vancouver Regional District Regional Land Cover Classification and Sensitive Ecosystem Inventory Update – Summary Report (2020)

5. *Metro 2050* Map 11 Sensitive Ecosystem Inventory
6. *Ecological Health Framework*
7. *Regional Parks Land Acquisition 2050 Strategy*
8. *Natural Resource Management Framework*
9. *Regional Parks Plan*
10. *Climate 2050 Nature and Ecosystems Roadmap*

56948450

Causes of Ecosystem Loss

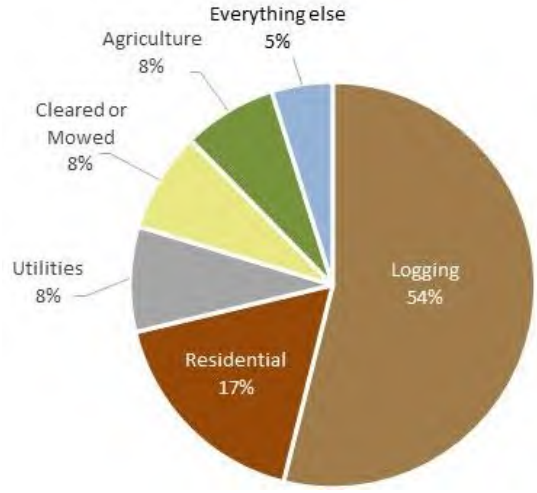
2020 Sensitive Ecosystem Inventory

The following charts present the causes of loss for the Sensitive and Modified Ecosystem classes that experienced the most loss between 2014 and 2020.

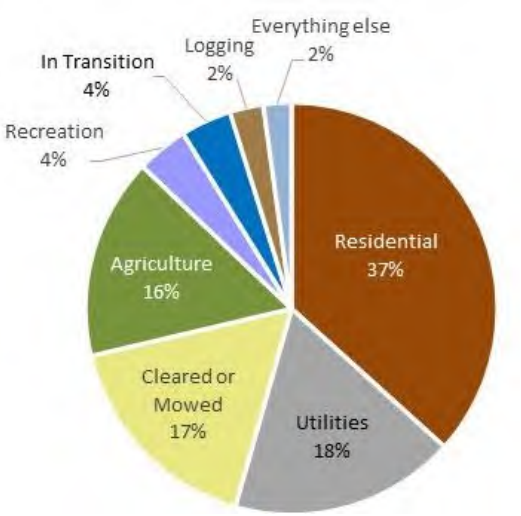
Region

Regional Core

Young Forest

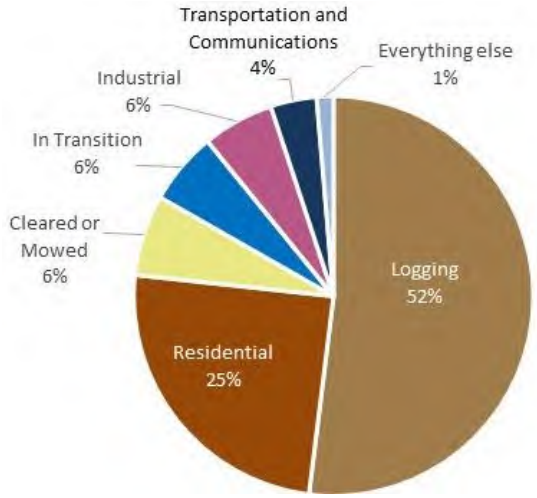


Causes of loss for Young Forest (30-80 years) ecosystems in the Region
Loss = 300 ha

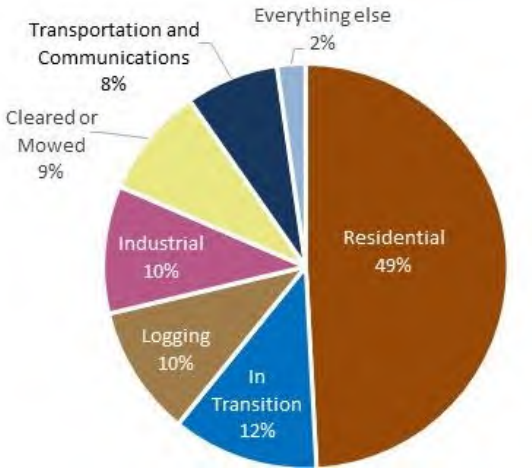


Causes of loss for Young Forest (30-80 years) ecosystems in the Regional Core
Loss = 142 ha

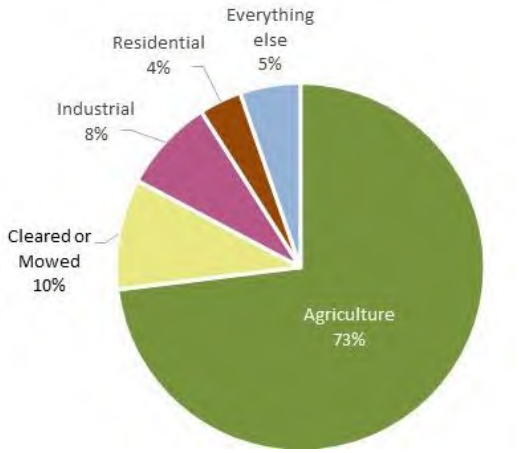
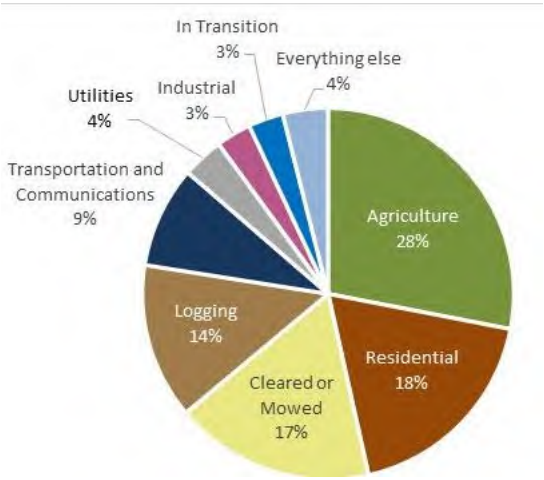
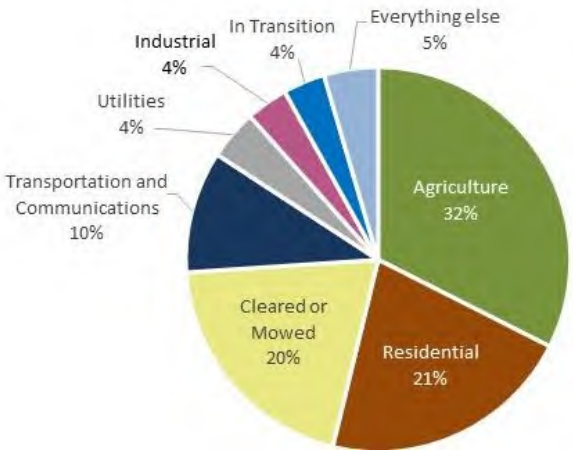
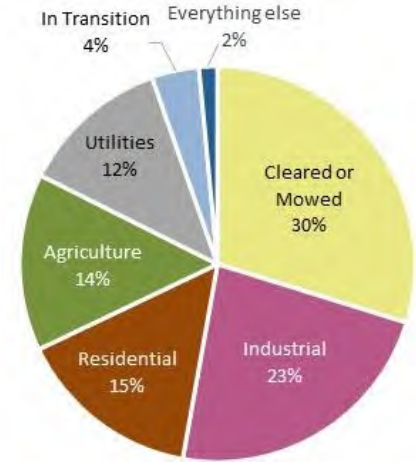
Mature Forest



Causes of loss for Mature Forest (80-250 years) ecosystems in the Region
Loss = 245 ha



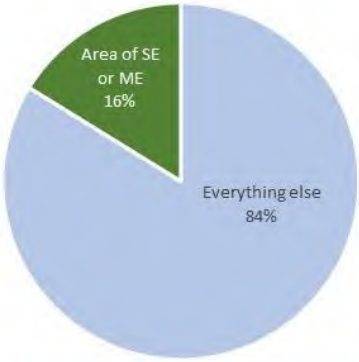
Causes of loss for Mature Forest (80-250 years) ecosystems in the Regional Core
Loss = 123 ha

	Region	Regional Core
Old Field	Same as Regional Core (i.e., all losses occurred in the Regional Core)	 Causes of loss for Old Field ecosystems in the Regional Core Loss = 216 ha
Riparian	 Causes of loss for Riparian ecosystems in the Region Loss = 78 ha	 Causes of loss for Riparian ecosystems in the Regional Core Loss = 67 ha
Wetland	Same as Regional Core (i.e., all losses occurred in the Regional Core)	 Causes of loss for Wetland ecosystems in the Region Loss = 56 ha

Burrard Peninsula

2020 Sensitive Ecosystem Inventory Sub-regional Profile

Map of Sub-region

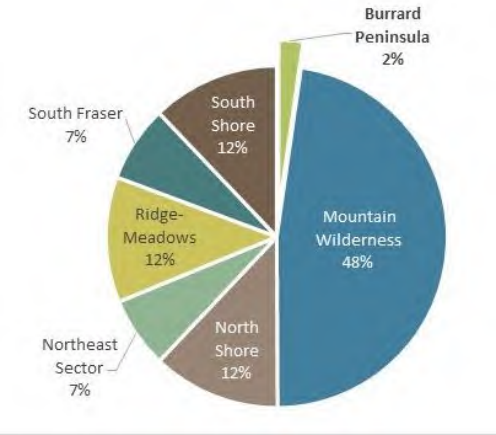


Proportion of the Burrard Peninsula that is Sensitive (SE) or Modified Ecosystem (ME)

Ecosystems in 2020

Top 3 Sensitive or Modified Ecosystems (area)

Mature forest	1,246 ha
Riparian	1,001 ha
Young forest	499 ha



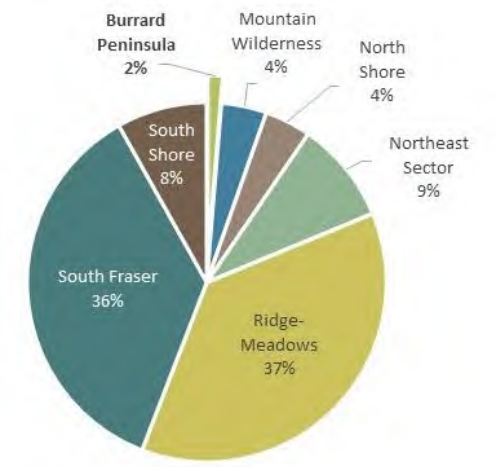
Proportion of regional Sensitive and Modified Ecosystems within the Burrard Peninsula Sub-region

Ecosystem Loss (2014-2020)

- **12 ha** of SE and ME were lost in the Burrard Peninsula

- Top 3 ecosystems lost (area, % loss for this sub-region)
    - Young Forest (-7 ha, -1.3%)
    - Riparian (-3 ha, -0.3%)
    - Wetland (-2 ha, -0.3%)

- Top 3 causes of loss in the Burrard Peninsula
    1. Commercial and services (-7 ha)
    2. In transition (construction was in progress but the purpose was unclear) (-3 ha)
    3. Industrial (-3 ha)

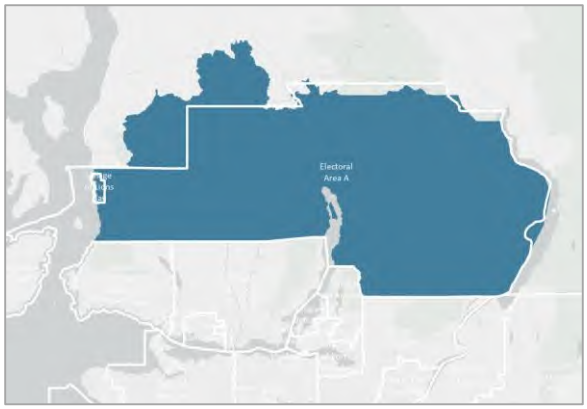


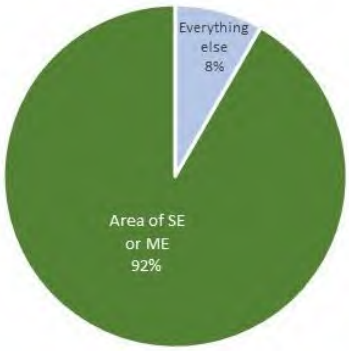
Proportion of regional loss that occurred within the Burrard Peninsula Sub-region

Mountain Wilderness

2020 Sensitive Ecosystem Inventory Sub-regional Profile

Map of Sub-region



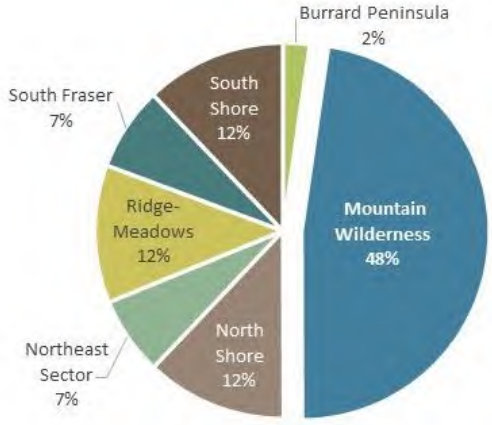


Proportion of the Mountain Wilderness that is Sensitive (SE) or Modified Ecosystem (ME)

Ecosystems in 2020

Top 3 Sensitive or Modified Ecosystems (area)

Old forest	28,708 ha
Alpine	13,672 ha
Riparian	10,539 ha



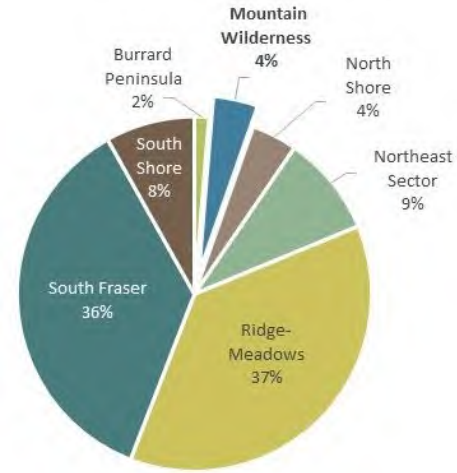
Proportion of Regional Sensitive and Modified Ecosystems within the Mountain Wilderness Sub-region

Ecosystem Loss (2014-2020)

- **37 ha** of SE and ME were lost in the Mountain Wilderness

- Top ecosystems lost (area, % loss for this sub-region)
    - Young Forest (-37 ha, -0.6%)

- Cause of loss in the Mountain Wilderness
    - Logging (-37 ha)

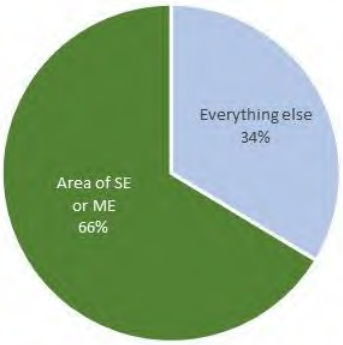


Proportion of regional loss that occurred within the Mountain Wilderness Sub-region

North Shore

2020 Sensitive Ecosystem Inventory Sub-regional Profile

Map of Sub-region

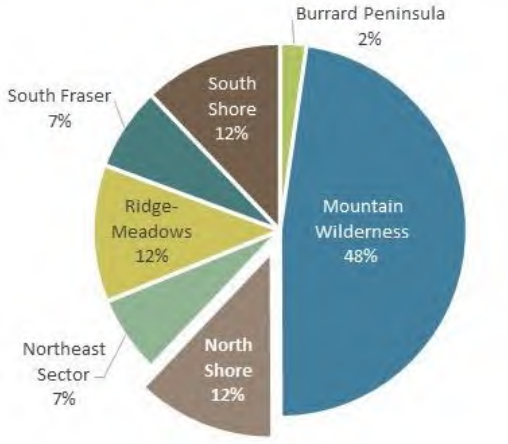


Proportion of the North Shore that is Sensitive (SE) or Modified Ecosystem (ME)

Ecosystems in 2020

Top 3 Sensitive or Modified Ecosystems (area)

Mature forest	6,863 ha
Young forest	4,100 ha
Old forest	3,751 ha



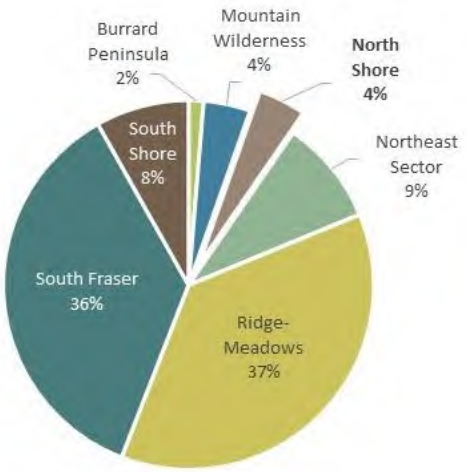
Proportion of Regional Sensitive and Modified Ecosystems within the North Shore Sub-region

Ecosystem Loss (2014-2020)

- **38 ha** of SE and ME were lost on the North Shore

- Top ecosystems lost (area, % loss for this sub-region)
    - Mature Forest (-27 ha, -0.4%)
    - Riparian (-10 ha, -0.1%)

- Top 3 causes of loss on the North Shore
    1. In transition (construction was in progress but the purpose was unclear) (-16 ha)
    2. Residential (-11 ha)
    3. Transportation and Communications (-8 ha)

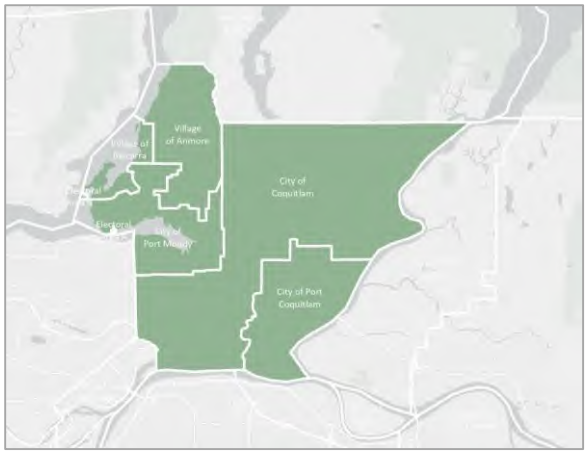


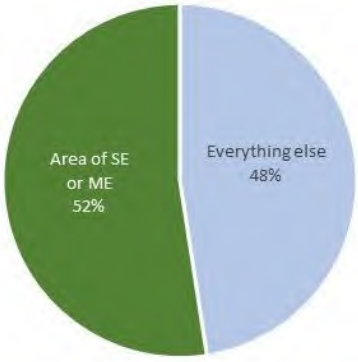
Proportion of regional loss that occurred within the North Shore Sub-region

Northeast Sector

2020 Sensitive Ecosystem Inventory Sub-regional Profile

Map of Sub-region



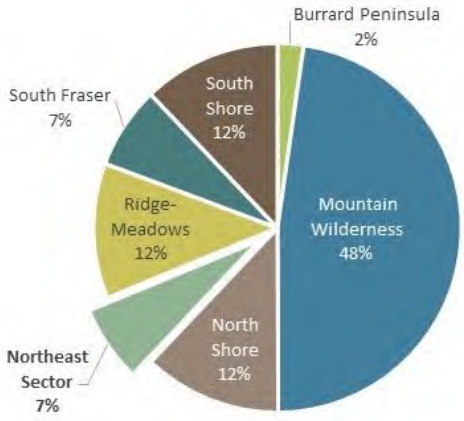


Proportion of the Northeast Sector that is Sensitive (SE) or Modified Ecosystem (ME)

Ecosystems in 2020

Top 3 Sensitive or Modified Ecosystems (area)

Mature forest	4,082 ha
Riparian	2,679 ha
Young forest	2,442 ha



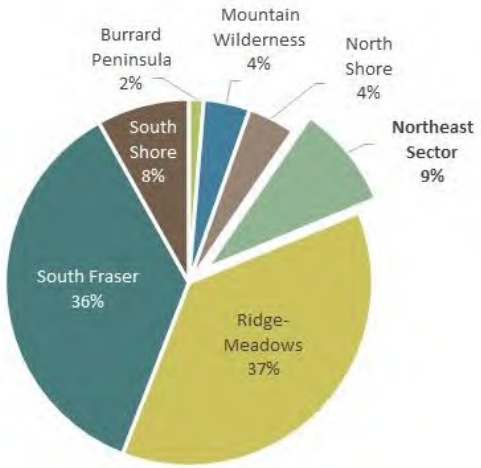
Proportion of Regional Sensitive and Modified Ecosystems found within the Northeast Sector Sub-region

Ecosystem Loss (2014-2020)

- **83 ha** of SE and ME were lost in the Northeast Sector

- Top 3 ecosystems lost (area, % loss for this sub-region)
  - Mature Forest (-51 ha, -1.2%)
  - Young Forest (-17 ha, -0.7%)
  - Riparian (-8 ha, -0.2%)

- Top 3 causes of loss in the Northeast Sector
  1. Residential (-67 ha)
  2. Industrial (-9 ha)
  3. Transportation and Communications (-9 ha)

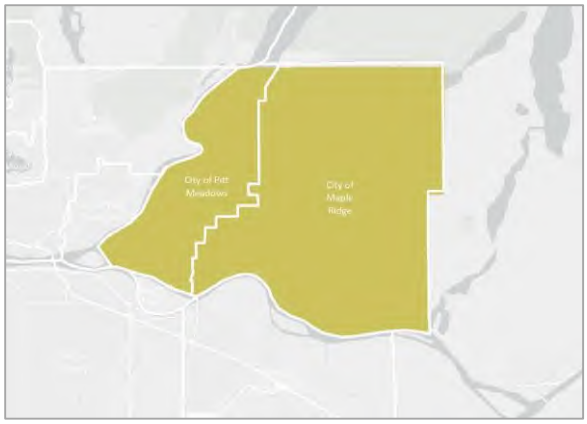


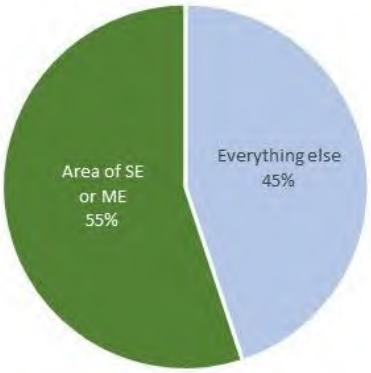
Proportion of regional loss that occurred within the Northeast Sector Sub-region

Ridge-Meadows

2020 Sensitive Ecosystem Inventory Sub-regional Profile

Map of Sub-region



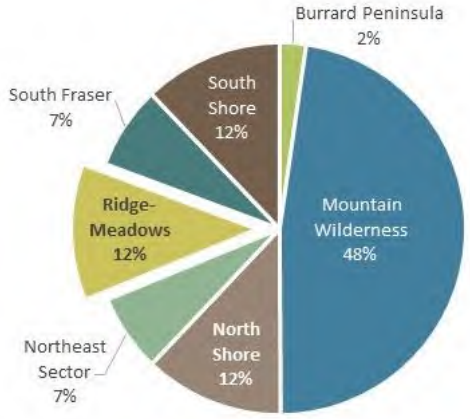


Proportion of Ridge-Meadows that is Sensitive (SE) or Modified Ecosystem (ME)

Ecosystems in 2020

Top 3 Sensitive or Modified Ecosystems (area)

Mature forest	6,603 ha
Young forest	4,953 ha
Riparian	4,413 ha



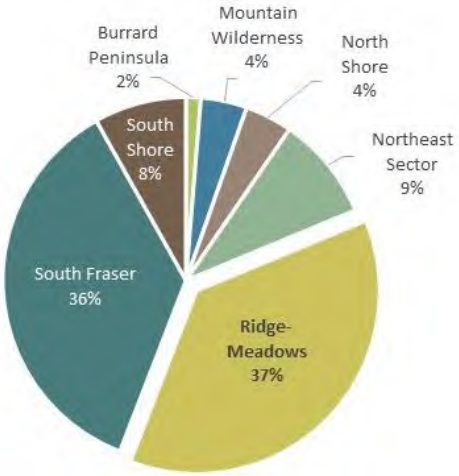
Proportion of Regional Sensitive and Modified Ecosystems found within the Ridge-Meadows Sector Sub-region

Ecosystem Loss (2014-2020)

- **334 ha** of SE and ME were lost in Ridge-Meadows

- Top 3 ecosystems lost (area, % loss for this sub-region)
  - Mature Forest (-149 ha, -2.3%)
  - Young Forest (-133 ha, -2.7%)
  - Old field (-31 ha, -29.6%)

- Top 3 causes of loss in Ridge-Meadows
  1. Logging (-283 ha)
  2. Agriculture (-23 ha)
  3. Cleared or Mowed (-21 ha)

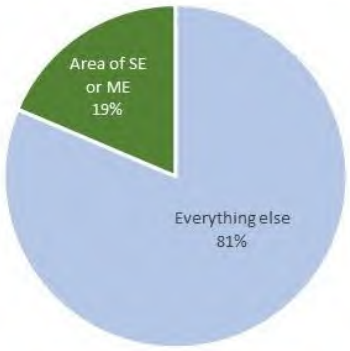


Proportion of regional loss that occurred within the Ridge Meadows Sub-region

South Fraser

2020 Sensitive Ecosystem Inventory Sub-regional Profile

Map of Sub-region

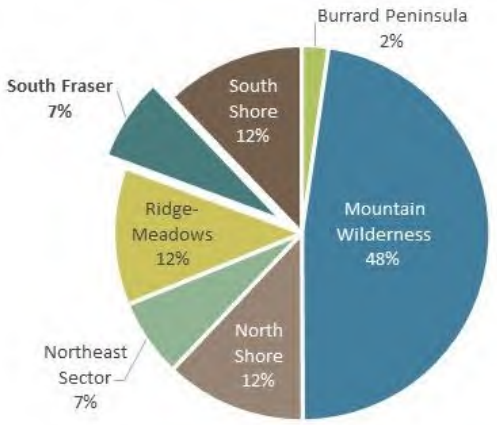


Proportion of South Fraser that is Sensitive (SE) or Modified Ecosystem (ME)

Ecosystems in 2020

Top 3 Sensitive or Modified Ecosystems (area)

Riparian	4,713 ha
Young forest	2,063 ha
Wetland	1,944 ha



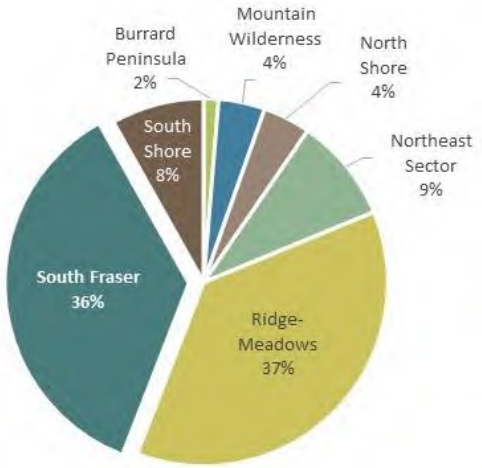
Proportion of Regional Sensitive and Modified Ecosystems found within the South Fraser Sub-region

Ecosystem Loss (2014-2020)

- **324 ha** of SE and ME were lost in South Fraser

- Top 3 ecosystems lost (area, % loss for this sub-region)
  - Old field (-131 ha, -17.2%)
  - Young Forest (-107 ha, -5.2%)
  - Riparian (-37 ha, -0.8%)

- Top 3 causes of loss in South Fraser
  1. Agriculture (-171 ha)
  2. Residential (-108 ha)
  3. Cleared or Mowed (-79 ha)

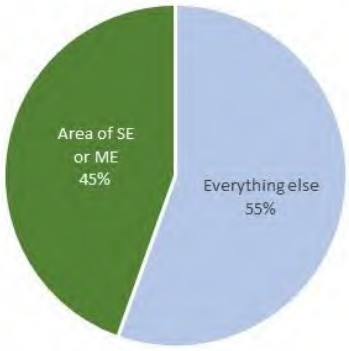


Proportion of regional loss that occurred within the South Fraser Sub-region

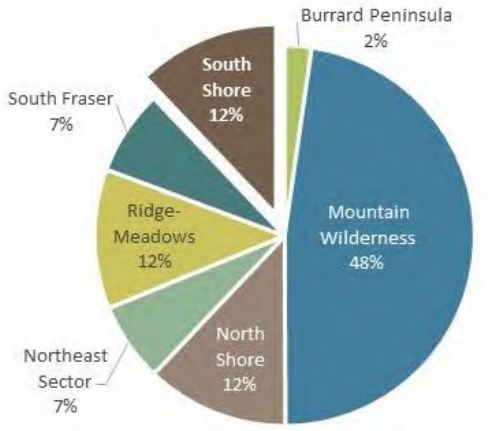
South Shore

2020 Sensitive Ecosystem Inventory Sub-regional Profile

Map of Sub-region



Proportion of South Fraser that is Sensitive (SE) or Modified Ecosystem (ME)



Proportion of Regional Sensitive and Modified Ecosystems found within the South Shore Sub-region

Ecosystems in 2020

Top 3 Sensitive or Modified Ecosystems (area)

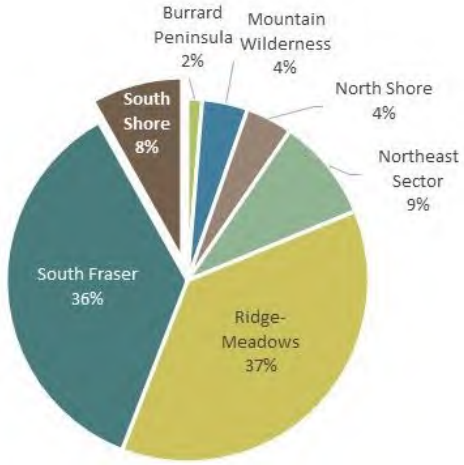
Estuarine	7,105 ha
Intertidal	6,561 ha
Riparian	3,657 ha

Ecosystem Loss (2014-2020)

- **73 ha** of SE and ME were lost on the South Shore

- Top 3 ecosystems lost (area, % loss for this sub-region)
    - Old field (-54 ha, -14.9%)
    - Wetland (-18 ha, -0.5%)

- Top 3 causes of loss on the South Shore
    1. Agriculture (-43 ha)
    2. Industrial (-15 ha)
    3. Cleared or Mowed (-5 ha)

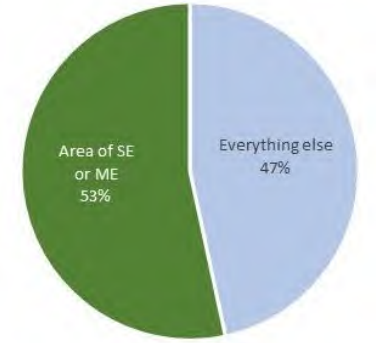


Proportion of regional loss that occurred within the South Shore Sub-region

Region

2020 Sensitive Ecosystem Inventory Regional Profile

Map of Region



Proportion of the Region that is Sensitive (SE) or Modified Ecosystem (ME)

Ecosystems in 2020

Top 3 Sensitive or Modified Ecosystems (area)

Old forest	34,318 ha
Riparian	30,526 ha
Mature forest	25,952 ha

Ecosystem Loss (2014-2020)

- **901 ha** of Sensitive and Modified Ecosystems were lost in the Region

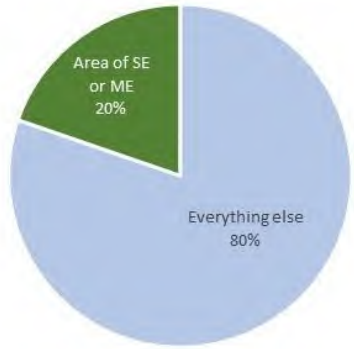
- Top 3 ecosystems lost (area, % loss for this ecosystem in the Region)
    - Young forest (-300 ha, -1.4%)
    - Mature forest (-245 ha, -0.9%)
    - Old field (-216 ha, -14.1%)

- Top 3 causes of loss
    1. Logging (-320 ha)
    2. Agriculture (-238 ha)
    3. Residential (-204 ha)

Regional Core

2020 Sensitive Ecosystem Inventory Regional Core Profile

Map of Regional Core



Proportion of the Regional Core that is Sensitive (SE) or Modified Ecosystem (ME)

Ecosystems in 2020

Top 3 Sensitive or Modified Ecosystems (area)

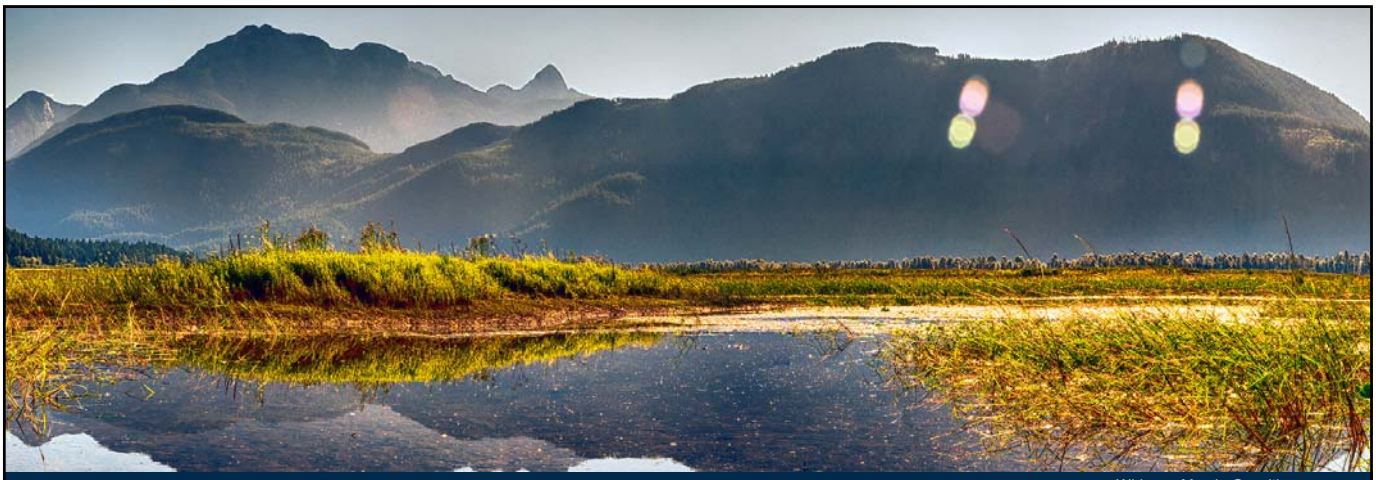
Mature forest	9,574 ha
Riparian	7,835 ha
Wetland	6,861 ha

Ecosystem Loss (2014-2020)

- **607 ha** of SE and ME were lost in the Regional Core

- Top 3 ecosystems lost (area, % loss for this ecosystem in the Regional Core)
    - Old field (-216 ha, -14.4%)
    - Young forest (-142 ha, -2.7%)
    - Mature forest (-123 ha, -1.3%)

- Top 3 causes of loss
    1. Agriculture (-238 ha)
    2. Residential (-204 ha)
    3. Cleared or Mowed (-108 ha)



Widgeon Marsh, Coquitlam

Sensitive Ecosystem Inventory Update

2014-2020 CHANGE SUMMARY

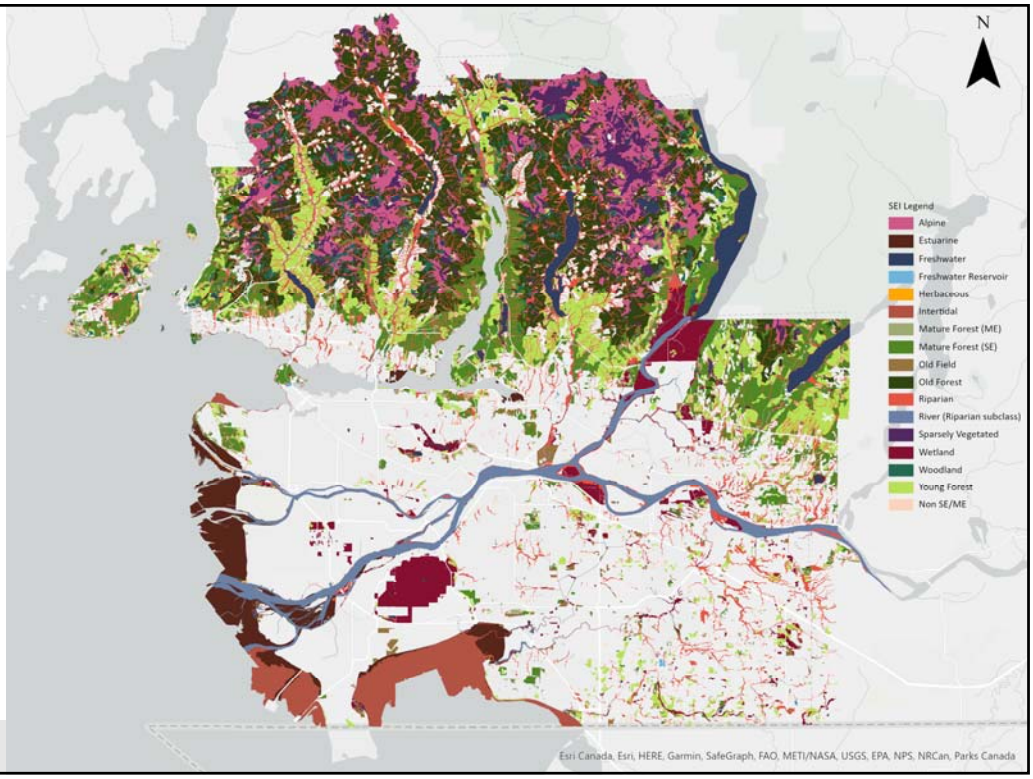
Laurie Bates-Frymel
Senior Planner (Environment), Regional Planning and Housing Services

Regional Planning Committee | September 7, 2023

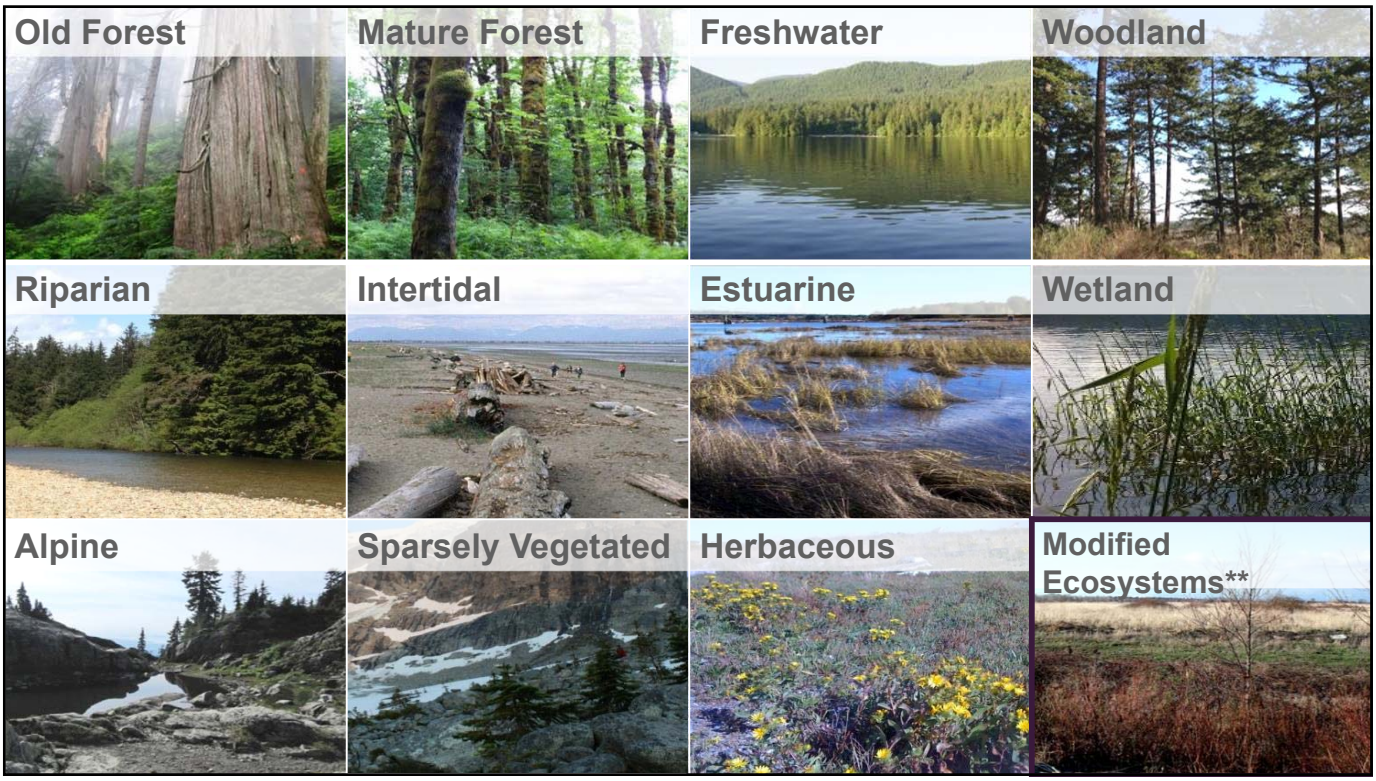
metrovancouver

SENSITIVE ECOSYSTEM INVENTORY (SEI)

- GIS dataset
- Identifies and classifies ecologically-important areas
- Quality

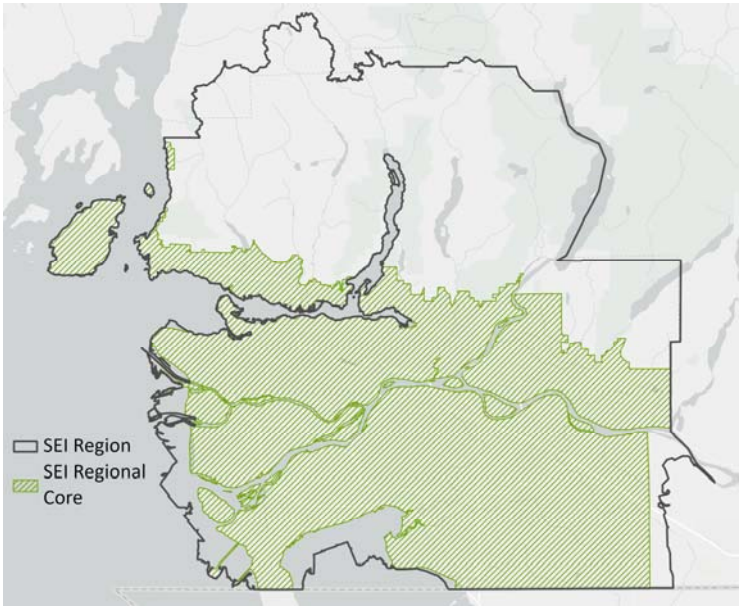


metrovancouver



REPORTING AREAS

- Region
  - o **53%** is Sensitive or Modified Ecosystem
- Regional Core
  - o **20%** is Sensitive or Modified Ecosystem



SENSITIVE ECOSYSTEM CHANGE

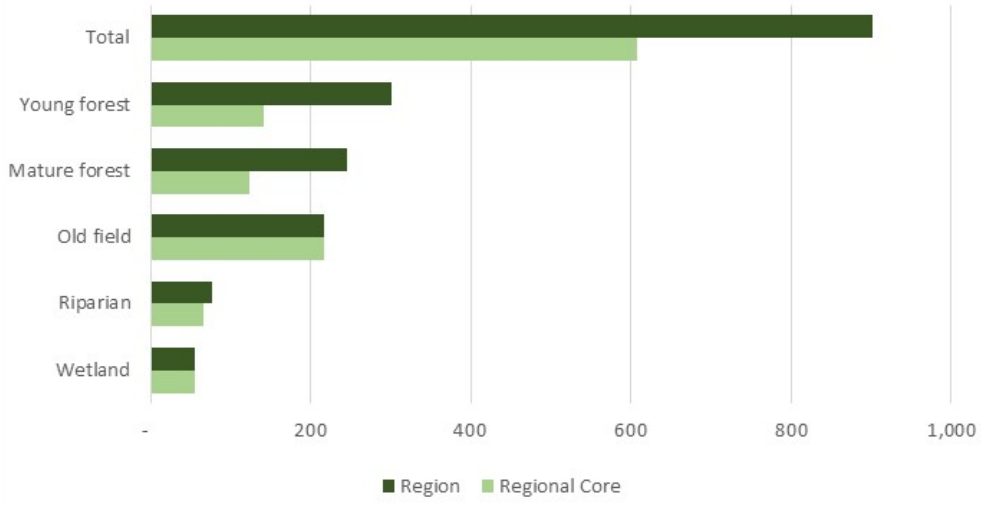
- Losses:

Area	Change 2009-2014	Change 2014-2020
Region	- 1,600 ha (-0.9%)	- 900 ha (-0.5%)
Regional Core	- 1,200 ha (-3.4%)	- 600 ha (-1.8%)

- Gains: 8 ha

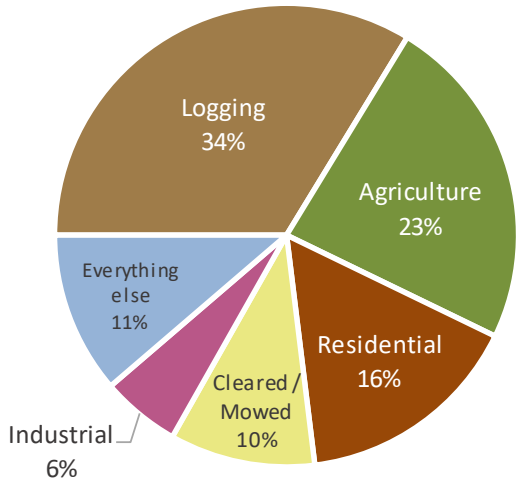
Burnaby Lake, Burnaby

Sensitive and Modified Ecosystem Loss Between 2014 and 2020 - Total and Top 5 Classes*



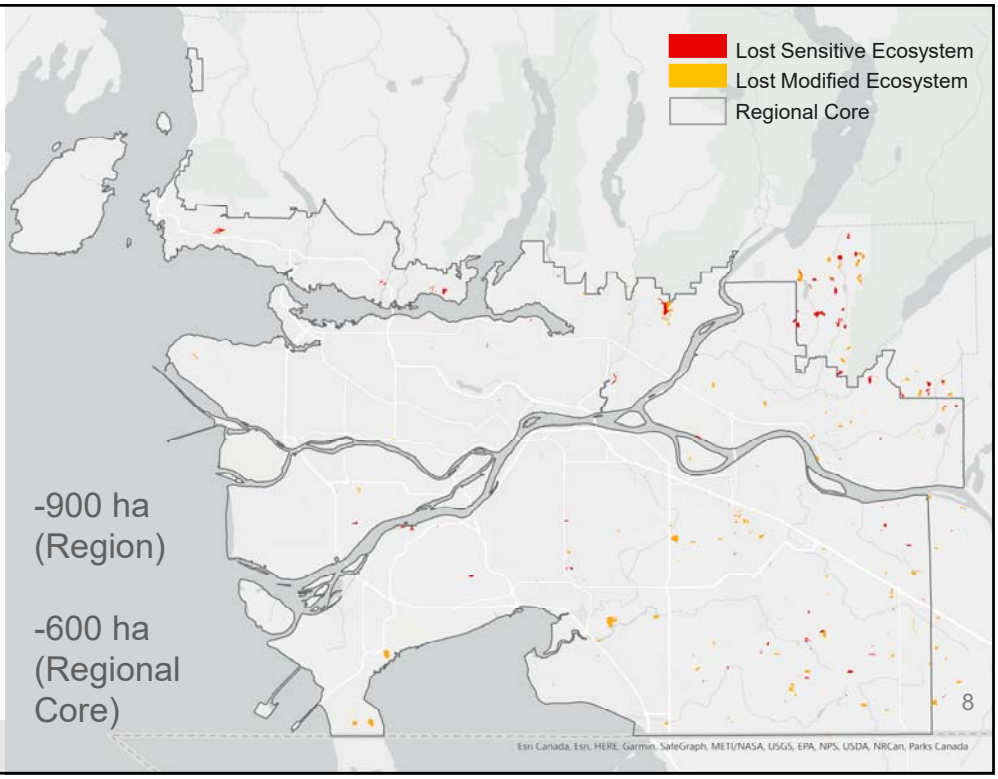
CAUSES OF SENSITIVE AND MODIFIED ECOSYSTEM LOSS IN THE REGION (2014-2020)

1. Logging of young and mature forests
2. Old fields converted to active agriculture
3. Residential development



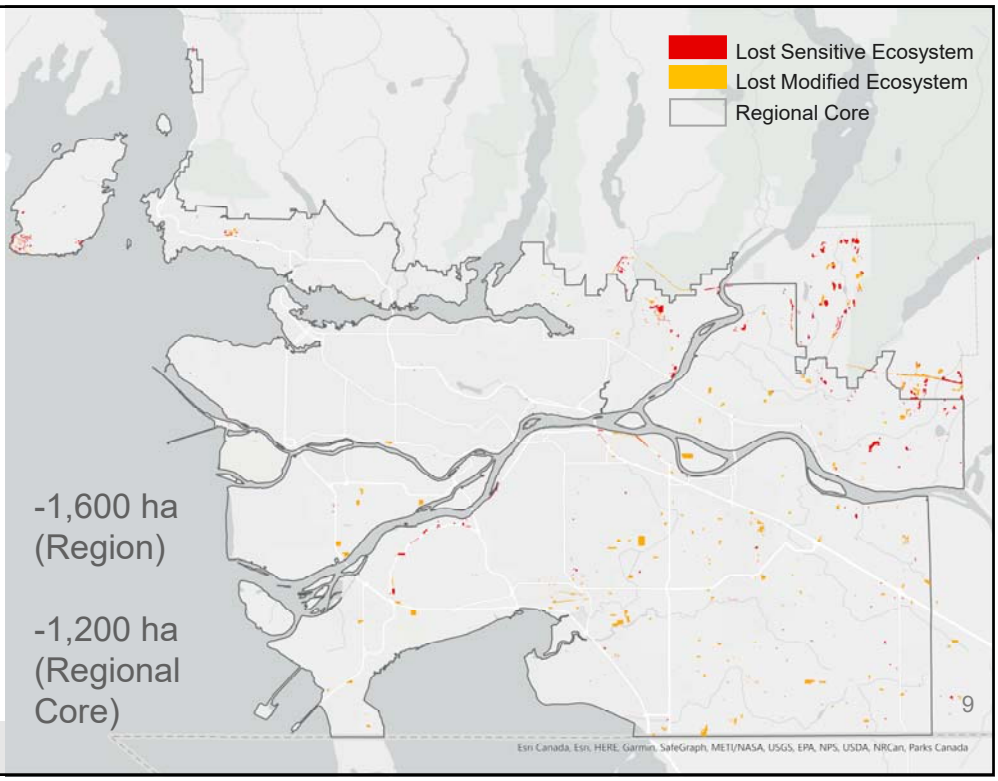
ECOSYSTEM LOSS

2014-2020



ECOSYSTEM LOSS

2009-2014



-1,600 ha (Region)

-1,200 ha (Regional Core)

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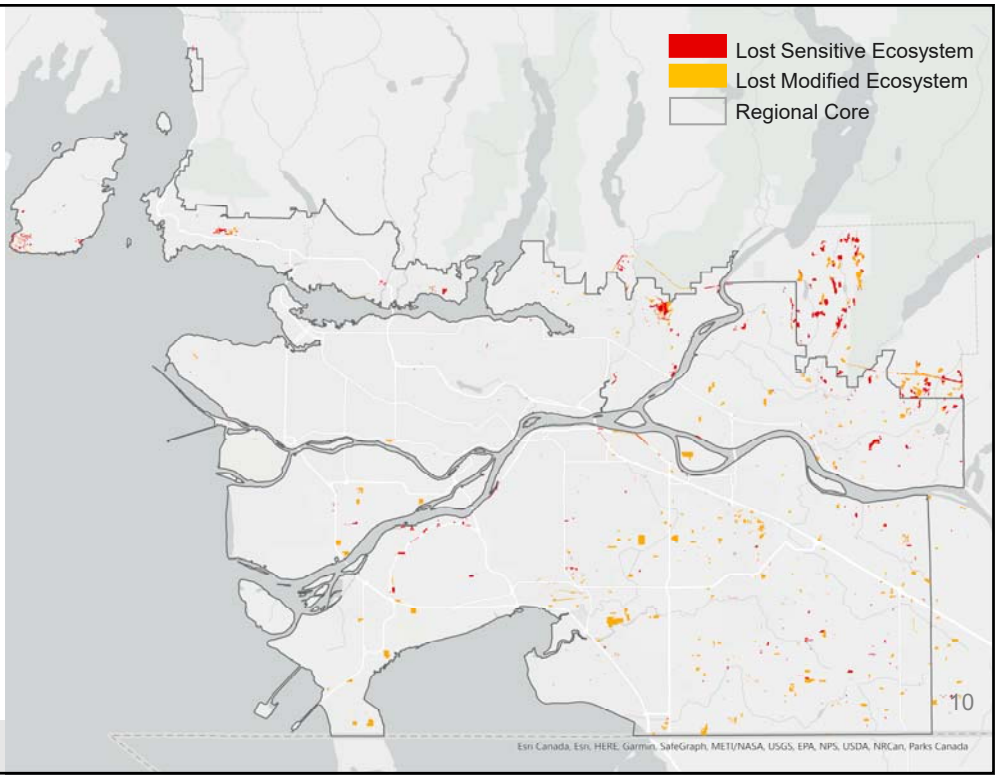
ECOSYSTEM LOSS

2009-2020
=
2,500 ha
(~1.5%) in the Region

1,800 ha (~5%) in the Regional Core over 10 years



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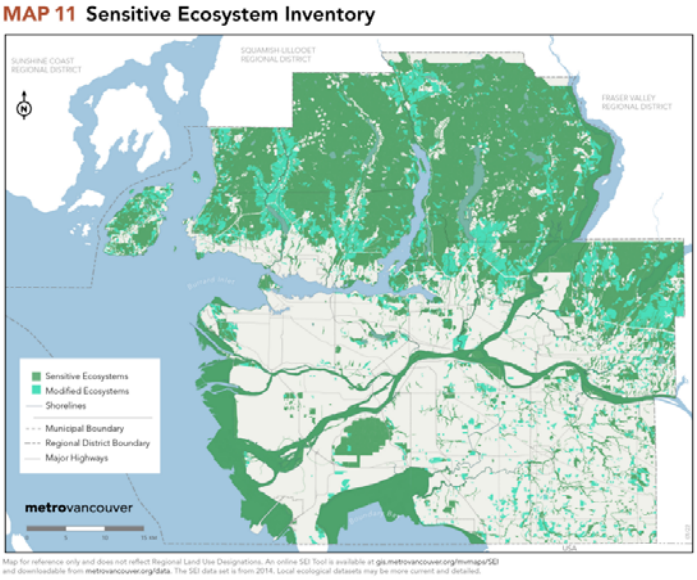
Aldergrove Regional Park, Langley Township

IMPLICATIONS OF LOSS

- Ecosystem service provision
  - Carbon storage
  - Mitigation of natural hazards
  - Human health
- Climate change resiliency
- Habitat and connectivity

NEXT STEPS

- Share data
- Additional data analyses
- *Metro 2050* Map 11
- Policy implementation
  - *Metro 2050*
  - *Regional Parks Land Acquisition 2050*
  - *Climate 2050*



Burns Bog, Delta

Thank you

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