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SERVICES AND SOLUTIONS FOR A LIVABLE REGION

To: George Massey Crossing Task Force

From: Neal Carley, General Manager, Parks and Environment

Date: March 23, 2022 Meeting Date: April 1, 2022

Subject: **Highway 99 Tunnel Program Update**

RECOMMENDATION

That the George Massey Crossing Task Force receive for information the report titled "Highway 99 Tunnel Program Update", dated March 23, 2022.

EXECUTIVE SUMMARY

Since the October 1, 2021 Task Force meeting, the Province has moved forward on the Highway 99 Tunnel Program. For the Fraser River Tunnel Project portion, the Province has awarded eight consulting contracts. For the Corridor Improvements portion, the Province recently announced the successful proponent for the Steveston Interchange Project with construction anticipated to start in the summer of 2022. The Province has also started construction on the three Transit and Cycling Improvements that will alleviate traffic congestion and improve transit and cycling infrastructure along the Highway 99 corridor.

PURPOSE

To provide an update on the Province's Highway 99 Tunnel Program.

BACKGROUND

The George Massey Crossing Task Force met on October 1, 2021 and received an update on the Province's Highway 99 Tunnel Program, which includes two main components:

1. Fraser River Tunnel Project
2. Corridor Improvements:
    a. Steveston Interchange Project
    b. Transit and Cycling Improvements

Fraser River Tunnel Project

Since October 1, 2021, the Province awarded eight technical and communications contracts for the Fraser River Tunnel Project (eight-lane immersed-tube tunnel):

a) Immersed Tunnel Owners Engineer – COWI North America, Ltd.
b) Highways Owners Engineer – R.F. Binnie & Associates Ltd.
c) Hydro-technical and River Hydraulics Services – Northwest Hydraulic Consultants Ltd.
d) Environmental Services – Golder Associates Ltd.
e) Archeological Services – Golder Associates Ltd.
f) Communications and Engagement Services – Lucent Quay Consulting Inc.
g) Marine Construction Advisor – RAM Consulting Inc.
h) Marine Navigation Advisor – TYPLAN Consulting Ltd.

The Province will initiate the environmental assessment process, including a 30-day public comment period, as part of the early engagement phase of the Environmental Assessment. The Province is confirming the engagement period timeline with the Environmental Assessment Office and will follow-up with details. As part of the public comment period, two in-person open houses and two virtual information sessions are expected. The Province will follow-up with details once confirmed with the Environmental Assessment Office.

Corridor Improvements
Since October 1, 2021, the corridor improvements have progressed.

Steveston Interchange Project
For the Steveston Interchange Project, the Province announced that the preferred proponent to design and build the project is Flatiron Constructors Canada Limited. The Province is currently finalizing the design-build agreement. Construction is anticipated to start in the summer of 2022 and be completed in 2025.

Transit and Cycling Improvements
All of the Transit and Cycling Improvements are now currently under construction:

a) Construction of the Bridgeport Bus Connection began in February 2022 and is anticipated to conclude in fall 2022.
b) Construction of the Highway 99/17A Off-Ramp Widening commenced in March 2022 and is anticipated to conclude in fall 2022.
c) Construction of Bus-on-Shoulder lanes south of the Fraser River began in December 2021 and is scheduled to be completed in summer 2023.

In addition, the Province is working collaboratively with TransLink on the Highway 99 Corridor Transit Study, which is set to kick off in spring 2022.

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

FINANCIAL IMPLICATIONS
There are no financial implications associated with this report. Any financial implications for Metro Vancouver that arise due to the Highway 99 Tunnel Program will be assessed and reported as the project is developed.

CONCLUSION
Since the October 1, 2021 Task Force meeting, the Province has moved forward on the Highway 99 Tunnel Program. For the Fraser River Tunnel Project portion, the Province has awarded eight contracts. For the Corridor Improvements portion, the Province recently announced the successful proponent for the Steveston Interchange Project with construction anticipated to start in the summer of 2022. The Province has also started construction on the three Transit and Cycling Improvements that will alleviate traffic congestion and improve transit and cycling infrastructure along the Highway 99 corridor.

To: Metro Vancouver Regional District Mayors Committee,
C/O Board and Information Services,
#4730 Kingsway, Burnaby,
BC, Canada, V5H 0C6,
delegations@metrovancouver.org
gvrdsec@metrovancouver.org
604-432-6250, 604.432.6284

From: Mr Roderick V. Louis,
[redacted],
White Rock, BC,
Canada, [redacted] ;
[redacted]
Alternative email:
[redacted]

April 04-2022

2-pages;

Pls regard this as a late request to appear before the Mayors Committee at its April 06-2022 meeting:
http://www.metrovancouver.org/boards/search/Pages/default.aspx
http://www.metrovancouver.org/boards/Mayors/MAY_2022-Apr-6_AGE.pdf

Dear Committee members,

My apologies for the lateness of this delegation request…I only became aware of the April 06 meeting, and its agenda subject matters (that are of significant interest to myself) yesterday...

I own property and pay taxes in White Rock, and as such am affected by the BC govt imposing commercial & housing projects on MV's municipalities; And am affected by the negative consequences- in emergencies- of not having one unified police dept for all of Metro Vancouver- instead of each MV member municipality having its own police dept or contracted RCMP detachment;

I wish to speak to agenda Items:

4.4 Considerations of (BC's) Legislative Changes to Municipal Permitting Powers for Housing Construction;

5.2 Regional Public Works Mutual Aid Agreement for Major Emergencies; and

5.3 Manager's Report re Mayors' Committee 2022 Work Plan

Re agenda item 4.4, the specific actions I am requesting of the committee are:

1) That the committee passes a motion that would require that a letter is sent from the committee (and or the MV RD Board) to BC's Minister of Transportation and Infrastructure, and the BC NDP govt:

A) Requesting that the "funding model" that is described in the *Surrey-Langley SkyTrain project* Business Case* is amended to:

a) Remove ($4.4 Billion in debt, $5.5 Billion debt ceiling!!**) Translink from being required to provide 2/3 of whatever funding is required to pay for the project's procurement and construction costs;
** https://www.dbrsmorningstar.com/research/386125/dbrs-morningstar-confirms-translink-at-aa-r-1-middle-stable-trends

b) Add the BC govt as a project funder- with BC govt funding replacing *all* of the funding that Translink is required to provide (pursuant to the "funding model" in the Jan 30-2020 project business case);

* The Business Case for the 16 km Surrey-Langley SkyTrain project was approved by Translink's board of

directors & Mayors Council on Jan 30-2020, & was immediately submitted to the BC govt for its approval....

B) Requesting that the BC govt allocates sufficient funding to enable the immediate commencement of procurement and construction of the Surrey-Langley SkyTrain project;

Why are A and B requests, above, relevant to the BC govt's imposing approvals for commercial and housing projects in MV's member municipalities??

Metro Vancouver's ***"South of Fraser"*** sub-region's municipalities (such as Surrey, Delta and the 2 Langley's) should not be forced by the BC govt to approve commercial and housing projects in such municipalities' urban centres and town centres... while rail rapid-transit (SkyTrain) mega-projects that for many years have been intended to link these urban centres and town centres...

... are needlessly- and destructively- being prevented from commencing construction as a result of BC's NDP govt refusals to honour their (2020) commitments to provide construction funding for such projects...

Re agenda items 5.2 and 5.3, the specific actions I am requesting of the committee are:

2) That the committee passes a motion that would require that a letter is sent from the committee (and or from the MV RD Board) to the BC govt requesting that:

A) Actions are expeditiously taken to publicly identify the specific policy, legislative and funding actions that would be required to establish a "***Metro Vancouver Police Department***"- that would be responsible for providing police services in all of MV's member municipalities... (the new MV Police dept would replace all of the Metro Vancouver Region's member municipalities' police forces and RCMP detachments);

3) That the committee passes a motion that would require that a letter is sent from the committee to the MV RD Board recommending that:

A) The draft ***Metro Vancouver 2050 Regional Growth Strategy***
http://www.metrovancouver.org/services/regional-planning/PlanningPublications/Metro2050.pdf
(given 1st and 2nd reading at MV RD board's March 25-2022 meeting)... is amended- before third reading- to add the following or similar actions :

a) Metro Vancouver will... assertively advocate to the BC govt for it to provide construction funding for major transportation mega projects- such as the Surrey-Langley SkyTrain project- that the BC govt/ its representatives have previously "committed" to provide funding for...

b) Metro Vancouver will... identify the specific policy, legislative and funding actions that would be required to establish a "***Metro Vancouver Police Department***"- that would be responsible for providing police services in all of MV's member municipalities... (the new MV Police dept would replace all of the Metro Vancouver Region's municipal police forces and municipal RCMP detachments);

I intend to prepare several very brief PPT slides for the meeting... and will email in advance if acceptable..

Pls confirm receipt of this delegation request, and of my last week's emailed x2 requests to be registered for the upcoming April 20-2022 public hearing re the draft Metro Vancouver Regional Growth Strategy...

Regards,

_____
Mr Roderick Louis,

To: Mayors Committee

From: Gregory Freeman, Senior Economist, Invest Vancouver
Megan Gerryts, Senior Policy Advisor, Invest Vancouver

Date: March 25, 2022 Meeting Date: April 6, 2022

Subject: **Clean Transportation: Findings and Actions to Strengthen the Sector in the Metro Vancouver Region**

RECOMMENDATION

That the Mayors Committee receive for information the report dated March 25, 2022, titled "Clean Transportation: Findings and Actions to Strengthen the Sector in the Metro Vancouver Region."

EXECUTIVE SUMMARY

The report *Clean Transportation: Findings and Actions to Strengthen the Sector in the Metro Vancouver Region* (Attachment 1) presents an overview of the categories and competencies in the sector, an analysis of the challenges faced by firms in the region, and recommended policies and actions to support and grow the sector. In the clean transportation sector as a whole, the most pressing challenges revolve around delays and uncertainty related to permitting and the general lack of available industrial land. These obstacles need to be urgently addressed as their persistence risks seeing growing, successful firms unwilling to invest further in the region or leaving entirely when they cannot find suitable space.

Released in November 2021, the clean transportation report has been followed by an activation phase to advocate for the recommendations contained in the report aimed at increasing the region's value proposition and overall competitiveness. Upcoming research reports for 2022 focus on other key industry clusters within the region. The next research report on the agritech sector will be presented to the Invest Vancouver Management Board at its meeting of April 20, 2022.

PURPOSE

To present to the Mayors Committee the findings and recommendations from Invest Vancouver's research into the clean transportation sector in the region.

BACKGROUND

Invest Vancouver provides independent, objective recommendations intended to position the region for success in a rapidly evolving global economy. Reports are intended to provide actionable intelligence that will better inform and guide the work of Invest Vancouver itself, as well as the deliberations and work of key decision makers.

The clean transportation sector was chosen as a first area of study due to its strong alignment with regional priorities for emissions reductions and "green jobs", as well as alignment with upcoming mobility-related events and the advancement of the B.C. Hydrogen Strategy.

CLEAN TRANSPORTATION

Clean transportation firms serve global markets, meaning that firms have a choice about where to locate, and do not necessarily need to do more than sell products, service, and technologies in the markets they serve. To support a flourishing clean transportation industry, the Metro Vancouver region needs to do more than create a consumer market for their products; it must position itself as an attractive place for such firms to site their headquarters and/or part of their operations. Therefore, this report seeks to understand two aspects of clean transportation in the Metro Vancouver region: What competitive advantages (if any) do firms in the industry enjoy by locating here? And what barriers (if any) keep the region from being a more attractive place for firms?

Methodology

This report is based on primary qualitative research, consisting of interviews with chief executives (CEOs), founders, and senior executives from clean transportation firms at all stages of development and ownership types. Invest Vancouver conducted in-depth interviews covering everything from business climate, infrastructure, physical spaces, capital, and workforce, to network organizations, R&D, suppliers and customers. Interviewees were encouraged to discuss the production and strategic gaps they have encountered along the product / service value chain continuums, from "idea" to "export", in this industry. The interviews were supplemented with secondary research consisting of a literature review of existing studies, data from Emsi Analyst and PitchBook and other sources.

Findings and Recommendations

The findings are divided into six economic development-related themes, with 13 recommendations across all themes. The themes were assigned an urgency level based on the risk that the underlying gaps could prompt clean transportation firms to leave the region, or choose another location to set up or expand their operations.

The recommendations are summarized in the table below:

Economic Development-Related Theme	Theme Urgency Level	Key Recommendations
Talent Development and Training Programs	Low	• Expand capacity within the BCIT Chemical and Environmental Technology program to increase the number of students graduating from 30 to 60 by 2025
Permitting Processes and Rules	High	• Modernize permitting processes for projects to provide greater accountability, certainty, predictability, and reduced risk • Update and harmonize rules governing hydrogen
Physical Spaces	High	• Invest in industry-critical physical spaces to be leased to firms at below-market rates • Amend the CleanBC Facilities Electrification Fund eligibility to include utility upgrades of warehouses to meet clean technology R&D power needs
Financial Capital Formation and Access	Medium	• Assess the capital formation and syndication relationships and network interactions within the region's clean transportation industry through predictive analytics work

Cluster Capacity Building Opportunities	High	• Launch a hydrogen hub • Fund a large-scale hydrogen powered heavy-duty vehicle demonstration project • Establish a centre to assert global leadership in hydrogen certification • Create certainty by establishing a long-term electric power rate for hydrogen production • Expand eligibility for zero-emission vehicle (ZEV) subsidies to include hydrogen fuel cell vehicles • Strive for technology-neutral rules whenever possible
Culture of Innovation	Medium	• Encourage greater participation in "Project Greenlight" and other public-private partnerships to encourage a culture of innovation across the Metro Vancouver region

All recommendations are intended to position the Metro Vancouver region for success and ensure the region is an attractive place for investors.

Activation Phase
Following release of the clean transportation report, staff at Invest Vancouver have been connecting with appropriate decision makers to activate the recommendations made in the report. To date activation activities have included:

- Presentations to Minister Ralston, Minister of Energy, Mines and Low Carbon Innovation and Minister Osborne, Minister of Municipal Affairs;
- Presentations to relevant Metro Vancouver Committees and Advisory Committees, including the Climate Action Committee;
- Advocacy letter to InBC Chair Christine Bergeron and CEO Jill Earthy, with follow up meetings scheduled;
- Advocacy letter to Minister Anne Kang, Minister of Advanced Education and Skills Training;
- Convening of municipal representatives to advance a hydrogen hub in the region; and,
- Follow up meetings with applicable Ministry staff.

In addition, as laid out in Invest Vancouver's 2022 Annual Plan (Reference 1) staff will be undertaking a review of permitting best practices and launching a data analytics program in support of the recommendations made in this report.

2022 Research Activities
Invest Vancouver staff will be undertaking three industry specific gap analyses in 2022 with the aim of providing actionable intelligence to regional decision makers. The next research report focused on the agritech sector will be presented to the Invest Vancouver Management Board at its meeting of April 20, 2022. Each industry gap analysis will be followed by an activation phase specific to the recommendations contained in the report.

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

FINANCIAL IMPLICATIONS
There are no financial implications associated with this report.

CONCLUSION

Invest Vancouver provides independent, objective recommendations intended to position the region for success in a rapidly evolving global economy. Reports are intended to provide actionable intelligence that will better inform and guide the work of Invest Vancouver itself, as well as the deliberations and work of key decision makers. This report presents an overview of the regional specializations and competencies in the sector, an analysis of the challenges faced by firms in the region, and recommended policies and actions to support and grow the sector. The high priority recommendations are related to permitting, physical spaces and opportunities to develop the hydrogen cluster in the region. These areas were assigned high priorities, as they represent the greatest threat to having clean transportation firms leave the region, or choose another location for their operations.

Invest Vancouver staff will be undertaking three industry specific gap analyses in 2022 with the aim of providing actionable intelligence to regional decision makers. The next research report focused on the agritech sector will be presented to the Invest Vancouver Management Board at its meeting of April 20, 2022.

Attachments

1. Clean Transportation: Findings and actions to strengthen the sector in the Metro Vancouver region

References

1. Invest Vancouver 2022 Annual Plan

51541241

Clean Transportation:

Findings and actions to strengthen the sector in the Metro Vancouver region

November 2021

Gregory Freeman, Senior Economist, Invest Vancouver

Megan Gerryts, Senior Policy Advisor, Invest Vancouver

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About Us

Invest Vancouver is the Metro Vancouver region's economic development leadership service, created to advance broadly shared prosperity for all residents of the region. This report has been prepared by Invest Vancouver, which offers independent, objective research, analysis, and economic development recommendations crafted to position the region for success in a rapidly evolving global economy; one in which capital is highly mobile and where firms have many choices about where to locate. The aim of the report is to provide actionable intelligence that will better inform and guide the strategic work of Invest Vancouver itself, as well as the work of key decision makers.

Invest Vancouver is a service of the Metro Vancouver Regional District, operating in support of the Metro Vancouver regional economy and the 2.7 million residents who depend on it.

I. Executive Summary

Advancements in clean transportation technologies are critical to reducing greenhouse gas emissions and addressing the ongoing climate emergency. The sector also presents an economic development opportunity, if the Metro Vancouver region can take urgent action to address obstacles faced by clean transportation firms seeking to start, locate or expand here.

The region is well-positioned for success, with a burgeoning clean transportation sector that includes strong entrants in particular niches and that has an advanced and growing hydrogen cluster. Invest Vancouver has undertaken this study as part of its work to build capacity in key industries in which the region has established and emerging industrial strengths, such as in the clean transportation sector.[1]

The key asset in the region's clean transportation sector is talent; firms in the sector overwhelmingly report that they are present in the region because of the access to and the leveragability of the collected knowledge and experience in the workforce. That talent is developed, supported, and supplemented by strong ties to research institutes and universities, incubators, and accelerators.

Policies that incentivize the reduction of greenhouse gas emissions are helping to create a local market in the Metro Vancouver region for clean transportation vehicles, components, and services. The firms that meet this demand, however, don't necessarily need to be located in the region. To support a flourishing clean transportation industry, the Metro Vancouver region needs to be an attractive place for firms that have a choice about where to locate.

Urgent Needs:

- Streamline industry-relevant permitting processes
- Invest in industry-critical physical spaces
- Launch a hydrogen hub in the region

In the clean transportation sector as a whole, the most pressing challenges revolve around delays and uncertainty related to permitting and the general lack of available industrial land. These obstacles need to be urgently addressed as their persistence risks seeing growing, successful firms unwilling to invest further in the region or leaving entirely when they cannot find suitable space.

The region also has a unique opportunity created by the presence of firms along the entire hydrogen value chain, from supply, transportation, and storage through membranes, fuel cells, and testing. The Metro Vancouver region has an early lead in the area due, in large part, to the presence and growth of Ballard Power Systems and the ecosystem that has developed around it. Other locations around the globe are moving forward with hydrogen; however, and the region needs to help early- and development- stage firms, particularly with the establishment of a hydrogen hub, if these firms are going to grow and thrive here.

Invest Vancouver seeks to understand two aspects of clean transportation in the Metro Vancouver region: What competitive advantages (if any) do firms in this industry enjoy by locating here? And what barriers (if any) keep the region from being a more attractive place for firms that have a choice about where to site their headquarters and operations? These questions are addressed based on primary qualitative research, consisting of interviews with chief executives (CEOs), founders, and senior executives from clean transportation firms at all stages of development and ownership types. This process led to the formulation of 13 recommendations to support a thriving clean transportation sector in the Metro Vancouver region.

1 For more on the regional economic development strategies pursued by Invest Vancouver, see the technical paper *Preparing Metro Vancouver for the Digital Economy*.

Recommendations Overview

Economic Development-Related Theme	Theme Urgency Level*	Key Recommendations
Talent Development and Training Programs	Low	• Expand capacity within the BCIT Chemical and Environmental Technology program to increase the number of students graduating from 30 to 60 by 2025
Permitting Processes and Rules	High	• Modernize permitting processes for projects to provide greater accountability, certainty, predictability, and reduced risk • Update and harmonize rules governing hydrogen
Physical Spaces	High	• Invest in industry-critical physical spaces to be leased to firms at below-market rates • Amend the CleanBC Facilities Electrification Fund eligibility to include utility upgrades of warehouses to meet clean technology research and development (R&D) power needs
Financial Capital Formation and Access	Medium	• Assess the capital formation and syndication relationships and network interactions within the region's clean transportation industry through predictive analytics work
Cluster Capacity Building Opportunities	High	• Launch a hydrogen hub • Fund a large-scale hydrogen powered heavy-duty vehicle demonstration project • Establish a centre to assert global leadership in hydrogen certification • Create certainty by establishing a long-term electric power rate for hydrogen production • Expand eligibility for zero-emission vehicle (ZEV) subsidies to include hydrogen fuel cell vehicles • Strive for technology-neutral rules whenever possible
Culture of Innovation	Medium	• Encourage greater participation in "Project Greenlight" and other public-private partnerships to encourage a culture of innovation across the Metro Vancouver region

*The urgency level has been assigned based on the risk that the underlying gaps could prompt clean transportation firms to leave the region, or choose another location to set up or expand their operations.

II. Clean Transportation Overview

The Metro Vancouver region is home to a vibrant network of emerging and mature clean transportation firms, which collectively benefit from the push to lower and eventually eliminate harmful transportation-related emissions. The sector is supported by research universities, specialized academic programs, start-up accelerators and incubators, and government policies.

Progressive municipal, regional, and provincial goals, targets, and initiatives aimed at lowering greenhouse gas emissions, particularly those from transportation, help create and sustain a local consumer market for low- and zero-emission mobility products and services. Indeed, the transition to clean transportation is well under way, with zero-emission vehicles (ZEVs) accounting for 9.4 percent of all light-duty vehicle sales in the province in 2020, the highest rate of adoption of ZEVs in North America.[2]

Creating a local market for clean transportation, while vital to meeting climate goals, is distinct from building and scaling a clean transportation *industry*. More specifically, ZEVs and their components, plus the related infrastructure, fuels, and services being adopted in the Metro Vancouver region, do not necessarily need to be designed, sourced or built locally. Firms located elsewhere, whether outside of the region or the nation, can and do meet many of these needs. **Supporting a clean transportation industry, therefore, begins with the recognition that firms serving global markets can choose where to site their headquarters, research and development (R&D) activities, and production facilities.**

To understand how to make the region an attractive place for clean transportation firms, consider the location decisions from their point of view. What is the cost and ease of doing business? How long does it take to get permits? Is a suitable location available? How difficult is it to find skilled workers? Are there opportunities to collaborate with and to transfer technologies out of research universities? Is it easy to connect with global suppliers, partners and customers? How is the access to capital? Are there investors? How hard will it be to find initial customers, especially for innovative early-stage products? This report considers these questions and more, with the **goal of identifying the challenges, roadblocks, and headaches faced by clean transportation firms in the Metro Vancouver region and recommending policies and actions to ameliorate them.**

2 Province of British Columbia, Zero-Emission Vehicle Update 2020.

Layout and Methodology

This report seeks to understand two aspects of clean transportation in the Metro Vancouver region: What competitive advantages (if any) do firms in the industry enjoy by locating here? And what barriers (if any) keep the region from being a more attractive place for firms? Answering these questions is critical for economic development, public policy, industry and labour association, and education and workforce development decision-makers. A purely statistical approach, such as an industry contribution analysis, would provide an estimate of economic, job, and fiscal impacts of clean transportation firms, but would not address competitive advantages or barriers. Indeed, there is no quantitative approach that will zero in on the answers to these specific questions.

Instead, this report is based on primary qualitative research, consisting of interviews with chief executives (CEOs), founders, and senior executives from clean transportation firms at all stages of development and ownership types, including, in certain instances, firms that no longer exist because they were acquired, or because they folded. Invest Vancouver conducted in-depth interviews lasting from 30 minutes to more than an hour covering everything from business climate, infrastructure, physical spaces, capital, and workforce, to network organizations, R&D, suppliers and customers. Interviewees were encouraged to discuss the production and strategic gaps they have encountered along the product / service value chain continuums, from "idea" to "export", in this industry.

Firms were identified for inclusion using existing industry resources and relevant news articles; by suggestions from local government members of the Invest Vancouver Advisory Committee; from industry associations and their memberships; by examining and classifying job postings aggregated by Emsi Analyst; by querying the PitchBook database of firms; and by reviewing relevant company materials.

Invest Vancouver met with interviewees from almost one-third of the region's clean transportation firms. The interviewees' experiences and insights underpin the report findings, and have not been attributed to specific individuals or firms to encourage candid discussion. Additional information was collected in helpful discussions with: the B.C. Ministry of Energy, Mines and Low Carbon Innovation; BC Hydro; FortisBC; and the Port of Vancouver, as well as with multiple industry associations.

Unless explicitly stated otherwise, the characterization of the industry gaps, and Invest Vancouver's recommendations for addressing them, do not represent the official policy or position of any of the firms, associations, or government entities mentioned in this report.

The report is presented in two sections. The first provides an overview of the clean transportation firms in the region, as well as the supporting assets that make it an advantage to locate, expand, hire and/or re-invest in the region. This section was prepared based on secondary research, including a literature review of previous studies supplemented with data from Emsi Analyst and PitchBook, and verified in discussions with the interviewees. The second describes the barriers preventing the region from being more attractive to clean transportation firms at different stages of firm development, and Invest Vancouver's specific, deployable recommendations for addressing them.

Identifying Clean Transportation Firms Based in the Metro Vancouver Region

The clean transportation sector is comprised of firms that are working to decarbonize transportation and to reduce greenhouse gas emissions. Following previous work done in this area, Metro Vancouver's clean transportation sector is divided into three categories: low- and zero-emission vehicles and components; renewable and low carbon fuels and charging infrastructure; and transferable technologies and services.

With these categories as a guide, deciding which firms to include still made for some hard choices. To be included, the firms have to be working on transportation (or an input to transportation, such as biofuels); their product, process, service, or technology needs to be exportable; and the firm has to be located in the Metro Vancouver region. Thus, local firms doing valuable work on renewable electricity, such as run-of-river hydroelectricity and tidal power, are not included despite the important contribution of clean energy to green transportation. Nor are firms doing innovative work on metal-air batteries, which are not primarily intended for transportation uses. There are firms providing mobility as a service that are helping reduce greenhouse gas emissions directly, for example by sharing electric cars or bikes, or indirectly by reducing demand for fossil fuel powered trips, that are not included because their focus is on the local market. And some leading B.C. companies in renewable fuels, for example, are not included because they are based outside the Metro Vancouver region.

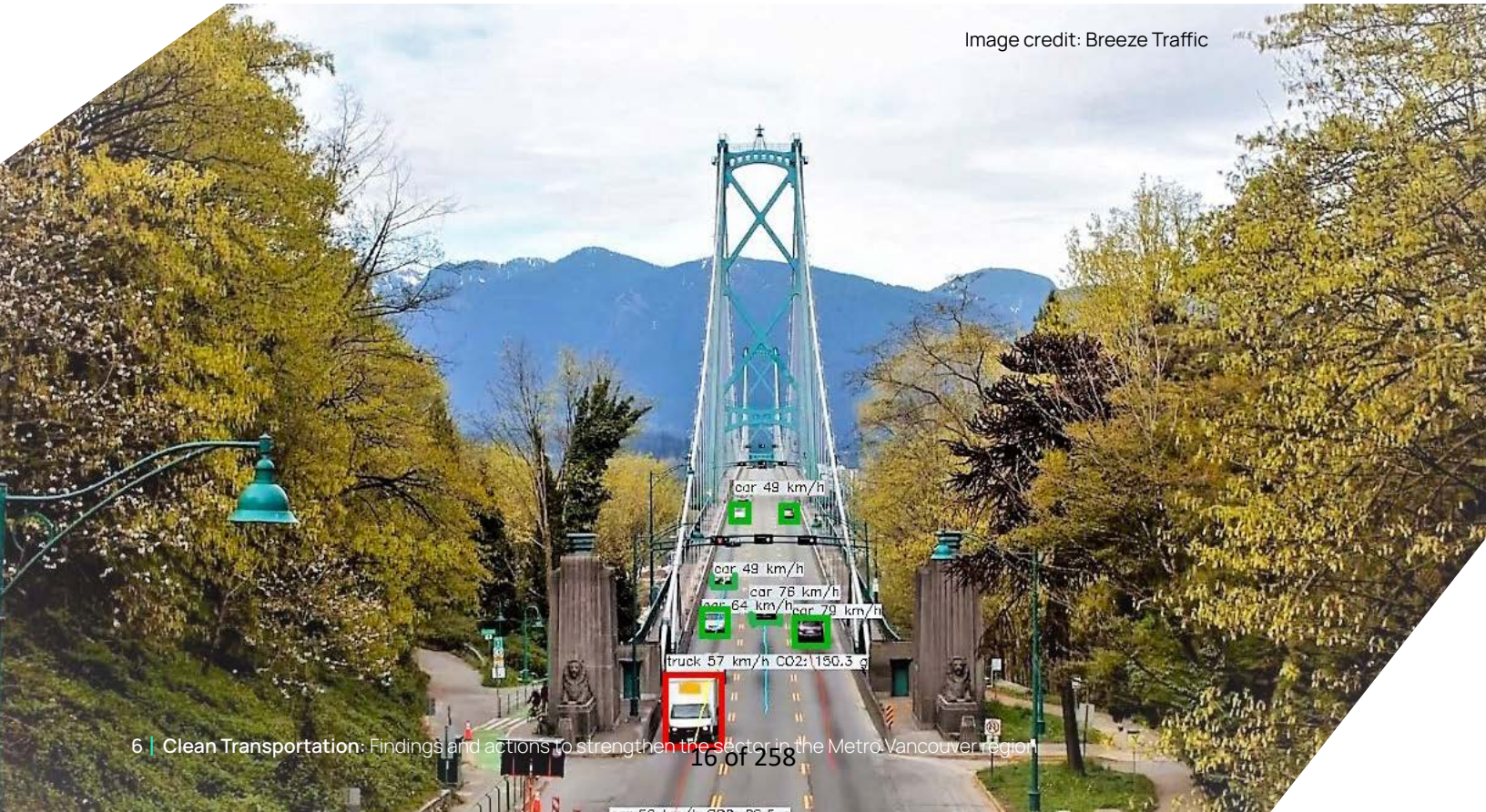


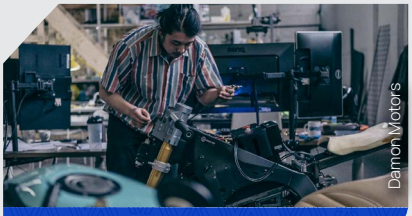
Image credit: Breeze Traffic

Clean Transportation Firms in the Metro Vancouver Region

In total, there are at least 60 export-oriented firms, of which 52 are firm headquarters, in the three above-identified clean transportation categories across the region. As locally anchored firms grow, their activity has major positive impacts, with a direct effect not only on employment, tax revenue, and earnings, which flow to the headquarters, but also on the municipalities in which they locate as they become part of the local social and community fabric. Region-wide, these firms directly employ more than 2,800 people,[3] and sustain many more indirect and induced jobs, which are created when the firms and their employees make purchases of goods and services in the local economy.

As a group, the firms are relatively young – 70 percent were founded in the past 15 years – which is unsurprising for an emerging field such as clean transportation. And, the presence of so many new and early-stage firms helps explain the median firm size of 21 employees.

Figure 1 lists firms in each clean transportation category in the region.

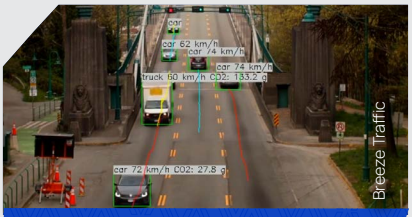


Low & Zero Emission Vehicles & Components

Alinker, AVL Fuel Cell Canada Inc., Ballard Power Systems, Blue-O Technology, cellcentric, Corvus Energy, Damon Motorcycles, ElectraMeccanica Vehicles, FTXT Energy Technology, FVT Research, GreenPower Motor Company, Grin Technologies, Ionomr Innovations, Loop Energy, Molicel, Nano One Materials, Rivian, Robert Allan Naval Architects and Marine Engineers, Sandvault, Unilia Fuel Cells, VeloMetro Mobility

Renewable & Low Carbon Fuels & Charging Infrastructure

AddEnergie Technologies, Analytics Systems, Consolidated Biofuels, Daanaa Resolution, Delta-Q Technologies, Ekona Power, Electrum Charging Solutions, Enbala, EverGen Infrastructure, G4, Greenlane Renewables, Greenlight Innovation, HTEC Hydrogen Technology and Energy Corporation, Hydra Energy, Hydrogen in Motion, IRDI System, Lab 498 Products/VoltSafe, Palcan Power Systems, Parkland Fuels, Powertech Inc, Quadrogen, Recharged Technologies, Shift Clean Energy, Tandem Technologies, West Coast Reduction, Westport Fuel Systems



Transferable Technologies & Services

7 Generation Capital, Breeze Traffic, Freightera, Greenline Technologies, Liftango, LOOPShare, Mojio, Plugzio, Poparide, Routific, Spare, Uplight, VuLog

Firms identified in green are within the hydrogen cluster.

Figure 1: Clean Transportation Firms by Category in the Metro Vancouver Region

3 The direct employment number will soon be higher still, as many of the firms report they are hiring now and/or expect to add more people soon.

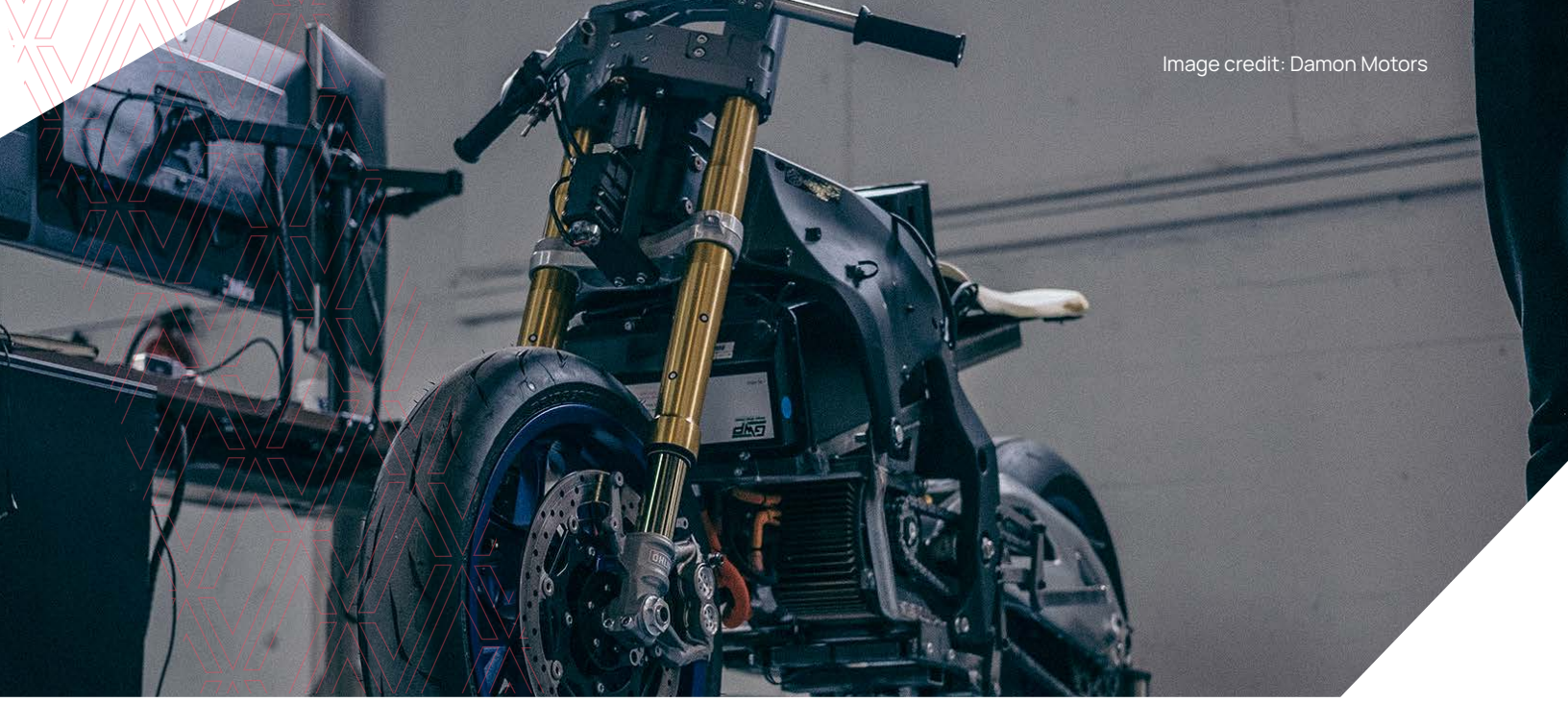


Image credit: Damon Motors

The internal combustion engine-based automotive manufacturing industry, including suppliers of parts and components, is highly concentrated in central Canada. Ontario accounts for virtually all light-duty passenger vehicles produced in Canada, while Quebec leads in recreational, heavy-duty, and speciality vehicles, plus buses. Given the deep supply chains and concentrations of talent there, it is unremarkable that Ford and GM are investing in battery electric vehicle production in Ontario.

The production of low- and zero-emission vehicles and components in the Metro Vancouver region, in contrast, is compromised of firms working in specialized niche markets. Surrey-based Damon Motors, for example, will soon begin commercial production of high-end electric motor cycles; Pitt Meadows-based FVT Research designs and installs electric drives that convert underground mining equipment to ZEVs; Vancouver-headquartered GreenPower Motor Company supplies electric buses; and Vancouver-based Robert Allan Naval Architects and Marine Engineers designs (among other things) electric tugboats. There is also an impressive collection of firms working on all aspects of hydrogen fuel cells, headlined by Burnaby-based Ballard Power Systems, cellcentric, and Loop Energy.

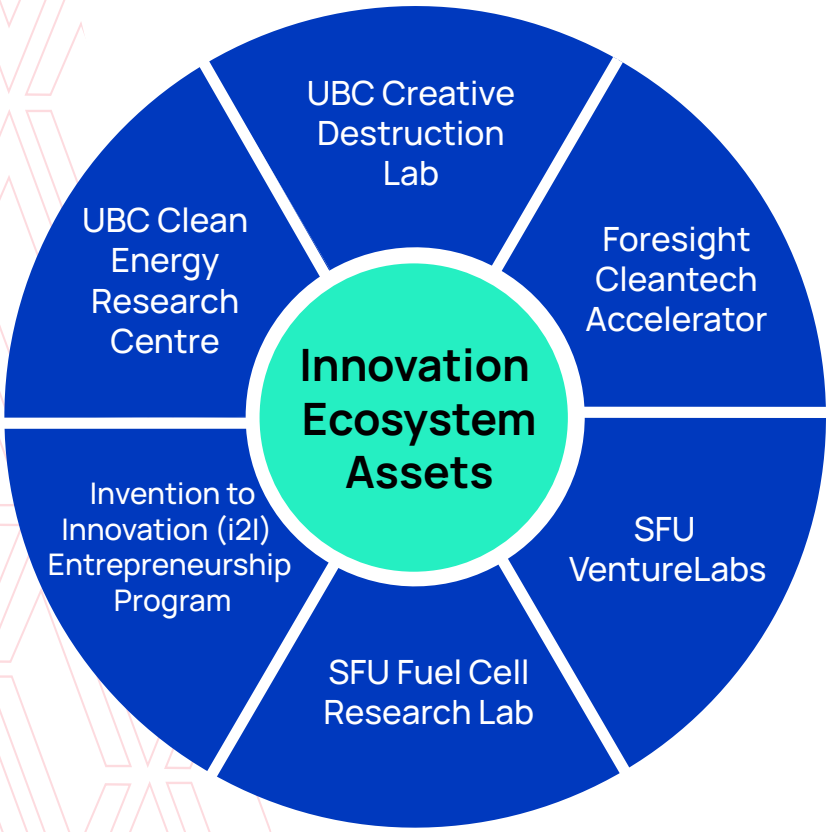
In renewables and low carbon fuels and charging infrastructure, there are firms working on renewable natural gas and biogas (such as Burnaby-based G4 and Quadrogen) and low carbon fuels (such as Burnaby-based Parkland Fuels, which uses feedstock from West Coast Reduction to produce biodiesel). Also batteries (Maple Ridge-based Molicel makes batteries for a variety of uses, including transportation) and battery chargers (Burnaby-based Delta-Q). Firms working on all aspects of hydrogen production and storage (such as Vancouver-based Ekona Power, Vancouver-based Hydrogen in Motion, North Vancouver-based HTEC, and many others) comprise the largest group in this category.

Transferable technologies and services is a small but exciting collection of firms working on clean transportation-related apps, software, technologies, and services. Vancouver-based Breeze Traffic, for example, converts "dumb" intersections to smart ones that can be optimized to reduce vehicles emissions using AI and machine vision; Richmond-based Plugzio sells a smart outlet and billing service that allows building owners to charge electric vehicle owners for power; and Vancouver-based 7 Generation Capital offers turn-key electric vehicle solutions for fleet operators.

Clean Transportation Assets in the Metro Vancouver Region

Firms across the clean transportation sector identify their top reason for locating in the Metro Vancouver region as frictionless access to skilled, "ready to work" talent. Firms started or moved here to take advantage of the knowledgeable and experienced workforce. In particular, the region has deep pools of talent in the following occupational categories: mechanical systems engineers; infrastructure team leads; fuel systems engineers; test engineers; and research scientists/engineers. The region's clean transportation sector is further supported by an active network structure and strong ties to research institutions and accelerators (see figure 2). Interviewees from firms in all three clean transportation categories praised the local innovation ecosystem.

Figure 2: Innovation Ecosystem Assets in the Metro Vancouver Region



Capital Investment

From 2017 through to 2021, firms headquartered in the region attracted more than $2.6 billion in capital investment (see figure 3).[4] This investment activity has been concentrated in low- and zero-emission vehicles and components (67%); followed by renewables and low-carbon fuels and charging infrastructure (29%), and transferable technologies and services (4%). The largest deals year-to-date are highlighted in the box (see figure 4).

Capital Investment (2017-2021)

Investment in Firms Headquartered in the Region		
Year	$ invested (millions)	Deal count
2017	94	22
2018	271	7
2019	102	19
2020	663	21
2021	1,536	16

Source: PitchBook 2021

Figure 3: Capital Investment in Firms Headquartered in the Region

2021 Deal Highlights

- $922M cellcentric (Daimler Truck AG and Volvo Group)
- $217M HTEC
- $139M Westport Fuel Systems
- $100M Loop

Source: PitchBook 2021

Figure 4: 2021 Deal Highlights

Public Sector Financial and Technical Support for the Clean Transportation Sector

B.C. Hydrogen Strategy is setting the course for B.C. to be a world leader in the growing hydrogen economy.

Scientific Research and Experimental Development (SR&ED) tax programs to encourage Canadian businesses of all sizes and in all sectors to conduct R&D in B.C. and Canada.

B.C. Low Carbon Fuel Standard provides a financial incentive for low carbon fuel use. This generates revenue for low carbon transportation fuel suppliers and supports investment in clean fuels and vehicles.

CleanBC Go Electric Advanced Research and Commercialization (ARC) program supports the development of companies operating in the zero-emission vehicle (ZEV) sector.

B.C. Centre for Innovation and Clean Energy will be an incubator for the research and commercialization of technologies, including carbon capture, utilization and storage, production and distribution of low-carbon hydrogen, biofuels, synthetic fuels, renewable natural gas and battery technologies.

BC-SMART Low Carbon Fuels Consortium brings together industry, the provincial government and UBC to encourage the production and use of drop-in biofuels to decarbonize long-distance transport.

4 The actual total is likely much higher, due to limitations with PitchBook which doesn't include, for example, a situation where a firm from outside the region sets up a new operation here.

III. Findings and Recommendations

Talent Development and Training Programs

Findings

The clean transportation sector requires specialized knowledge covering a wide range of occupations along the educational attainment continuum, including: mechanical and systems engineers; research scientists; technologists; machinists and technicians; and technical experts in areas ranging from software development to clean energy processes. The quality and specialization of the talent available in the Metro Vancouver region have been major draws for firms choosing to locate here. This is especially true of the hydrogen sector, where the engineering expertise in the region leads the world. Indeed, one firm described choosing to locate in the Metro Vancouver region "as a shortcut," because the ability to hire skilled engineers with hydrogen fuel cell expertise shaved years off its development schedule. Accordingly, this has also led to aggressive firm-to-firm competition for experienced engineers, with firms "poaching" talent from each other.

And while the clean transportation sector represents an attractive field for people looking for a career that contributes to a more sustainable future, the Metro Vancouver region faces significant challenges retaining talent and attracting new workers from outside the region due to the high overall cost of living, and in particular, high housing costs. This is especially seen in mid-career-level talent for in-demand positions, such as mechanical engineers, where a lack of affordable single-family homes deters relocations to the region. This could become an acute constriction point on growth as more affordable locales, such as the Calgary and Edmonton metropolitan regions, look to compete in the clean energy space, particularly in renewable natural gas (RNG).

Image credit: Loop Energy

Image credit: Damon Motors

In-Demand Hard Skills in the Hydrogen Cluster:

- New Product Development
- Mechanical Engineering
- Supply Chain
- Chemistry
- Instrumentation
- SolidWorks (CAD)
- Thermodynamics
- Chemical Engineering
- Data Analysis

Source: Emsi 2021.1

Figure 5: Top Hard Skills Identified in Hydrogen Sector Job Postings 2018-2021.

Technologists are an in-demand occupation in the region's hydrogen sector, with skills such as chemistry and instrumentation being highly sought after (figure 5). Technologists are also a critical component in the R&D phase of emerging clean energy technologies, such as hydrogen and biofuels. The British Columbia Institute of Technology (BCIT) Chemical and Environmental Technology program was specifically referenced during the interview process as an excellent program that graduates approximately 30 'ready to work' individuals per year in emerging clean energy fields. Often students graduating from this program have secured employment long before graduation, as their skill sets are in short supply. Fostering in-region talent is a critical step in offsetting the Metro Vancouver region's out-of-market talent attraction issues, as Metro Vancouver-based talent is often less willing to leave the region, housing challenges notwithstanding.

Recommendation:

Expand capacity within the BCIT Chemical and Environmental Technology program to increase the number of students graduating from 30 to 60 by 2025. A shortage of available technologists within the clean transportation sector has led to engineers and research scientists being underemployed as technologists. While BCIT currently does not have any plans to expand the program, it is in the midst of a program and curriculum review. That the program's graduates are effectively "over-subscribed" is clear evidence it is aligned with industry needs; increasing the capacity of such an industry-responsive program (or creating a similar program at another college or university campus) seems to be an easy choice.

Permitting Processes and Rules

Findings

Mirroring the experience of firms in other fast-growing industries, clean transportation firms are routinely encountering problems securing required permits in a timely fashion. Transferable technologies and services firms, whose physical space requirements are often modest, faced the least trouble, while those in renewable fuels and hydrogen reported the greatest difficulties. The process of getting permits for working with (and in particular, storing) hydrogen has been described by industry interviewees as "ridiculous," "frustrating," and "dreadful". In a related problem, existing regulatory regimes do not always account for hydrogen, as in rules covering the sale of gasoline and diesel at gas stations, which understandably did not anticipate the sale of hydrogen.

Interviewees were candid in describing the importance of a clear, timely, technology-based permitting process. One interviewee described the permitting issue as an "almost certain barrier to further in-region investment," and several interviewees acknowledged that their firms were adding space outside of the region in locations where permitting processes are perceived to be less onerous. The uncertainty, lack of transparency, and delays encountered in the permitting process could deter additional investments made in-market. Fixing burdensome and time-consuming permitting processes should be a top priority.

Recommendations:

Modernize permitting processes for projects to provide greater accountability, certainty, predictability, and reduced risk. Delays to obtaining permits are a significant barrier to success for clean transportation firms and risk future investments in this sector. A modernized approach needs to be implemented for the region to compete in this global market. As an example, Surrey City Council recently approved guaranteed permitting timelines as part of a shift to a more customer service-focused approach that includes multiple best practices such as:

- single point of contact / one project, one planner
- pre-application meetings
- enhanced digital service
- improved communications, including more regular permit status updates

A similar initiative of process reform should be considered by other cities within the Metro Vancouver region that are interested in attracting more clean transportation investment. Invest Vancouver will support this effort by conducting a best management practices scan of municipal permitting processes elsewhere in Canada and globally with the aim of identifying promising permit approval approaches that competitive firms expect when selecting a business location.

Update and harmonize rules governing hydrogen. There is currently a patchwork approach across the region to the rules governing hydrogen. Through relevant industry associations, such as the Canadian Hydrogen and Fuel Cell Association, industry and government should collaborate on a set of sample "model regulations" covering the distribution and sale of hydrogen that can be broadly relied upon, locally adapted, and eventually adopted by municipalities across the region.

Physical Spaces

Findings

Suitable physical spaces are in critical need for clean transportation firms, especially those that are engaged in industrial activities, such as storing of hydrogen and testing of hydrogen fuel cells or other clean energy processes including RNG or biofuels. The vacancy rate for industrial land region-wide has fallen below one percent (see figure 6), which is reflected in interviewees reporting site searches taking 12 to 18 months, or more. The problem is especially acute for light and heavy industrial spaces; the latter of which is required for chemical processes, for example, involved in low pressure hydrogen storage. Spaces larger than 50,000 square feet are particularly in need but hard to find, and those larger than 100,000 square feet are simply unavailable, which precludes many anchor-potential firms from considering and/or investing in the region.

Given these market conditions, it is unsurprising that many interviewees reported feeling "lucky" to have found the space(s) that they currently occupy. Policy makers should be worried about potential new entrants to the industry or market who are not as lucky, as well as existing firms looking to expand. All of the interviewees from firms in the hydrogen cluster, and many of those from non-hydrogen firms, reported their firms were growing, adding employees, and looking for space. If they were not currently looking for space, they expected to be looking within the next several years. If they are unable to find suitable industrial space in the region, these firms will be forced to look elsewhere, however deep the local pool of specialized talent.

Beyond issues of scarcity and cost, industrial land policy presents myriad challenges. From the perspective of clean transportation firms, they need options. As employers, they want centrally located, transit accessible sites that avoid burdening their employees with long commutes. Some firms working on RNG and hydrogen have addressed these needs by effectively converting warehouse space into de facto R&D spaces with addition of higher capacity electrical service. (Testing their prototypes, for example, requires considerably more power than is supplied to a typical warehouse, so the building's power supply has to be upgraded.)

Industrial Lands in Metro Vancouver

- Industrial lands comprise 4% of the region's land base, and accommodate 27% of the region's jobs.
- Industrial land prices in Metro Vancouver are amongst the highest in North America.
- Industrial jobs pay 10% higher than the regional average
- Business activity on industrial lands generates 30% of the region's total Gross Domestic Product (GDP).
- The Q3 2021 vacancy rate for industrial land in Metro Vancouver was 0.5%.

Sources: Metro Vancouver, Colliers

Figure 6: Industrial Lands in Metro Vancouver

Recommendations

Invest in sector-critical physical spaces to be leased to firms at below-market rates. For example, to assist with applied/translational research, prototyping, design, commercialization, production, and market penetration, the recently announced InBC fund should carve out a portion of the assets under management to invest in building or renovating clean transportation sector-supporting physical spaces, such as sites with hydrogen storage, and leasing them to clean transportation firms at below-market rates. Unlike investing directly or indirectly, through a fund-of-fund strategy or otherwise, in start-up and development-stage firms, investing in physical assets, such as sector-supporting facilities, would serve many vintages of start-up and development-stage firms, while providing the fund with an appreciating asset and coupon (in the form of lease payments) that could be re-invested in the fund.

Amend the CleanBC Facilities Electrification Fund eligibility to include utility upgrades of warehouses to meet clean technology R&D power needs. To reduce barriers to suitable industrial spaces, the eligibility of the CleanBC Facilities Electrification Fund should be amended to include clean technology R&D firms as eligible to receive a subsidy to upgrade their utility connections to meet their sizable power needs. Reducing the financial burden of having to upgrade warehouse spaces to suit their power needs will provide the clean transportation sector's R&D-intensive firms with more options when it comes to finding physical spaces in the region.

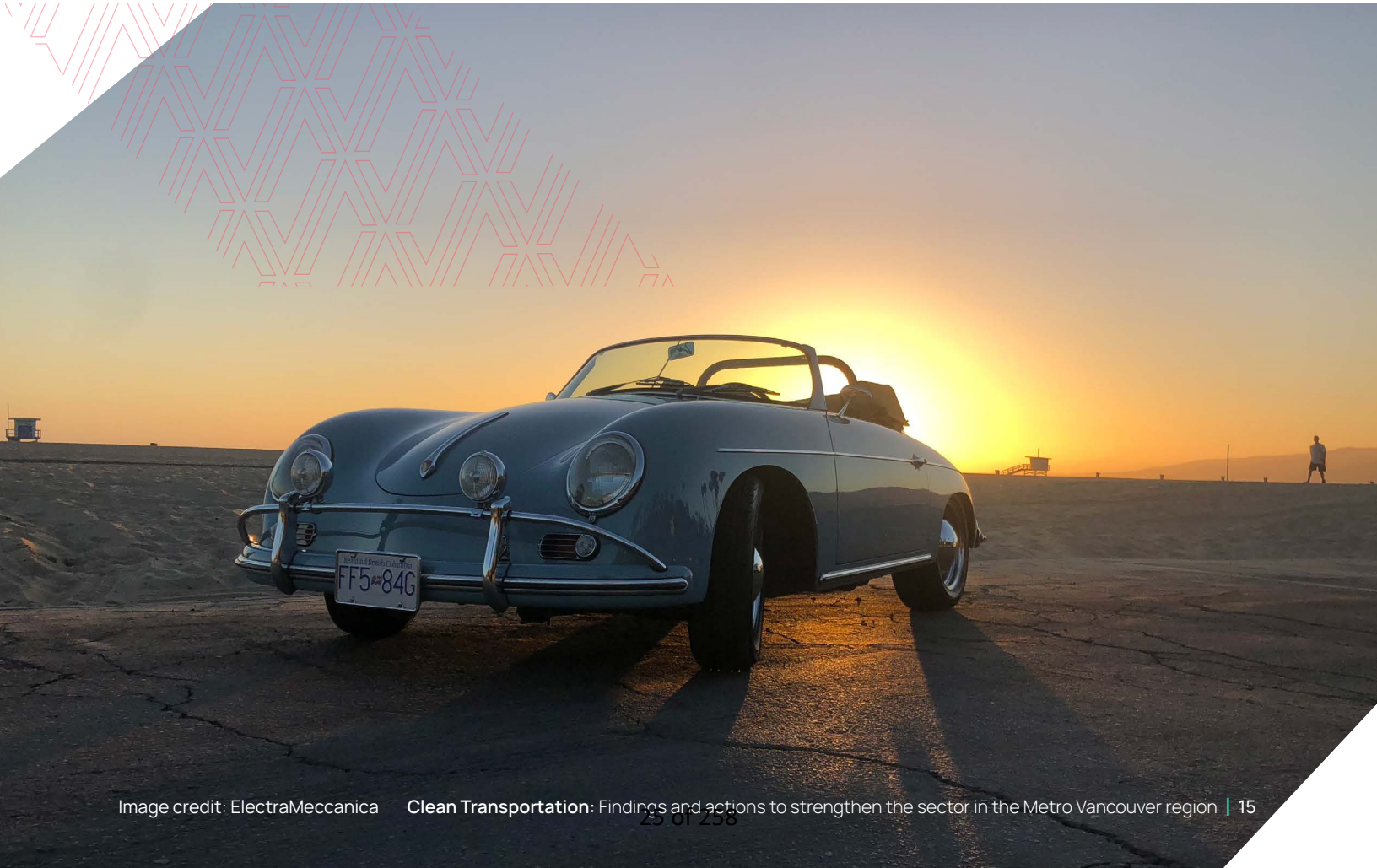


Image credit: ElectraMeccanica

Financial Capital Formation and Access

Findings

For firms operating in a globally competitive environment, access to debt, equity or specialty financial capital is a crucial input at every stage along a firm's development life-cycle. Many interviewees cited access to capital as a particular challenge. Fortunately, many of the interviewees said their firms have recently closed or are about to close funding rounds.

Generally, interviewees expressed support for the clean technology-related funding programs available through the federal and provincial governments, while still describing them as "difficult to access," even for interviewees who are serial entrepreneurs who have successfully secured funding from the same public sources for previous ventures. Some interviewees believed there is a public funding bias against certain clean fuel technologies, including hydrogen, associated with government funding programs. In addition, some interviewees also voiced concern that the financialization of real estate and the continued price escalations across most segments of the real estate market, with its potential for comparatively "quick and easy wins," were crowding out investment in other industries, including clean transportation.

Other interviewees expressed disappointment that despite the perceived environmentally conscious resident population of the province, local investors have been less willing to invest in clean transportation technologies compared to investors from the European Union and China. For some clean transportation firms, where the investment and demonstration opportunities for their technologies are coming from other countries, relocating out of the region becomes a more attractive option.

This was the case for Corvus Energy (Corvus), the battery technology company that found a receptive audience in Norway. In 2019, Corvus relocated their headquarters, effectively becoming a Norwegian company, with all the direct and downstream value-added economic benefits flowing to Norway instead of the Metro Vancouver region.

Finally, interviewees that had successfully built and 'exited' companies in the past were more easily able to navigate the capital finance and investing ecosystem due to relationships formed in past roles. This relationships-based funding often excludes women and communities of colour, who may be excluded from or not have access to the same network that traditionally offer connections to investors.

Recommendations

Assess the capital formation and syndication relationships and network interactions within the region's clean transportation industry through predictive analytics work. Private capital access, formation, and redeployment ('post-exit', for example) in the clean transportation sector, as well as across other industries in which the Metro Vancouver region has specialization, is a hotly debated issue; some believe there is a systemic lack of proof-of-concept, 'pre-seed', and 'seed'-stage capital in the Metro Vancouver region, while others believe the more pressing problem is not having enough "investment worthy" firms. And, of course, both could be equally or unequally true. This requires further analysis, as the economic development strategies differ markedly depending on what is found. For this reason, Invest Vancouver is undertaking a major investigation of the role of capital in this and other industries as a prelude to developing recommendations in this area.

Cluster Capacity Building Opportunities

Findings

A hydrogen-based industry cluster has developed in the Metro Vancouver region, encompassing all aspects of the hydrogen ecosystem, including production, transport, storage, membranes, fuel cells, testing, and consulting. Firms in the industry cluster have been attracting private capital investment and adding employees. The sector is poised to become an economic driver for the region if pressing challenges can be overcome, such as:

- breaking the supply/demand deadlock;
- creating opportunities to demonstrate hydrogen technology in the region; and
- addressing the lack of industrial space and resolving the difficulty with permits, as discussed above.

The growing hydrogen industry cluster represents a lucrative economic and fiscal opportunity for the region (see figure 7), as it is well positioned globally since so few other economic regions have an equally concentrated cluster of firms working with hydrogen. A concentration of firms in the same industry (or adjacent, complimentary industries) can foster the cross-pollination of ideas and create a reinforcing cycle where skilled workers are drawn to a regional industry's pooling of employment prospects in their respective fields, and new firms are attracted to or created by the collected pool of talent. This dynamic can be seen in the constellation of firms founded by former Ballard Power Systems employees, and the arrival in the region of AVL (an Austrian firm that is the world's largest independent powertrain company), as well as the joint venture between Daimler Truck and Volvo Group, cellcentric.

As touched on above, the hydrogen industry cluster's greatest strength is the presence of an unparalleled collection of experienced workers. It is bolstered by strong ties to the University of British Columbia (UBC), Simon Fraser University (SFU), and BCIT, along with locally-allied industry associations and accelerators, and the industry stands to benefit from provincial, and federal hydrogen strategies.

> It is estimated that by 2050 clean hydrogen will make up as much as 25 percent of the world's net-zero energy mix, generating a **$20 trillion** infrastructure investment opportunity, new technologies, companies, jobs, and ultimately a cheaper energy system.
>
> Source: Bloomberg New Energy Finance

Figure 7: the Future Hydrogen Economy

Yet, the development of the region's hydrogen industry cluster is at a critical juncture. The industry is plagued by a classic 'chicken-and-egg' problem with respect to supply and demand; namely, there is little incentive to supply hydrogen without demand, and such demand will never materialize without the promise of a steady supply. Access to readily available green hydrogen in the region (taking advantage of B.C.'s abundant supply of clean electricity) would encourage the testing of new technologies to lower greenhouse gas emissions, such as within heavy-duty vehicles. Firms that are pressing ahead with supply face multiple challenges, particularly with respect to regulations that do not account for hydrogen as a fuel.

Firms based here have to look elsewhere for demonstration opportunities, most notably in the Province of Alberta and countries, such as Italy, Germany, and China. One interviewee likened the situation in hydrogen to "trying to demonstrate a new computer graphics card by pointing to shelves full of computer parts in a room without an electrical outlet." Even more important than the obvious need to demonstrate new technologies, firms need opportunities for real-world testing. Multiple

Image credit: HTEC

interviewees stressed the importance of being able to test (and refine) their technologies closer to home. Deploying hydrogen applications in-region would be a powerful indication of support for the industry.

Permits and suitable workspace challenges (as described above) are acute for firms working with hydrogen. There is a real risk that unless these challenges can be overcome, firms will drift away one location, demonstration project, or permitting decision at a time, as happened with Corvus (described above).

Recommendations

Launch a hydrogen hub. Getting a reliable in-region hydrogen hub established in the Metro Vancouver region is a crucial component of the B.C. Hydrogen Strategy. The strategy emphasizes the importance of co-locating hydrogen production with end-use applications. In collaboration with the Ministry of Energy, Mines and Low Carbon Innovation and the Canadian Hydrogen and Fuel Cell Association, Invest Vancouver has agreed to convene member-municipalities to accelerate this project. Municipalities should support this effort as both a major economic development opportunity for the region's clean transportation sector and an opportunity to decarbonize hard-to-decarbonize sectors of the economy.

Fund a large-scale hydrogen powered heavy-duty vehicle demonstration project. No one wants to be the "first mover" on what are perceived to be unproven technologies. So understandably, municipalities and the Port of Vancouver are conservative in their procurement and purchasing decisions, and, for this reason, expecting them to commit huge sums to purchase early-stage technologies may not be realistic. The province, however, should purchase a small fleet (for example) of heavy-duty hydrogen-powered vehicles for lease to interested municipalities. By shifting some of the financial risk associated with early adoption, such a strategy might help encourage more expansive local deployment. And scaling up from tests to production will eventually help move hydrogen technologies along the cost curve towards lower prices and, most important, early deployments will serve as in-region 'test beds' for locally developed technologies. This is one way to move the industry along the development continuum from start-up stage, to development-stage, to commercial-stage, to production-stage, to global export-stage.

Establish a centre to assert global leadership in hydrogen certification. Create a centre that can test fuel cells and balance of plant components to the specifications of the U.S. Department of Energy, the European Union ("harmonized protocols", FCH-JU), and Japan (NEDO). The goal should be to follow the path in solar energy testing and certification blazed by Germany, and create accredited hydrogen

certification labs, much as the Fraunhofer Institute of Solar Energy Systems does for photovoltaics. This would deepen the R&D, design, and prototyping capacities of the hydrogen industry cluster here in the province, attract work from major original equipment manufacturers, and provide additional "stickiness" to the industry in the region. (Powertech Labs does some of the only global balance of system certification work and would be a logical partner.)

Create certainty by establishing a long-term electric power rate for hydrogen production. The new CleanBC industrial electrification rates offered by BC Hydro provide up to seven years of discounted power for industries setting up or expanding operations in B.C., including hydrogen. With the cost of major industrial facilities amortized over decades, it makes sense to create a matching, longer-lived rate structure as an incentive for "first movers" assuming the risk of building facilities for water electrolysis production of hydrogen in B.C. Certainty around the cost of green hydrogen production through electrolysis will act as signal to investors that hydrogen is a priority area for the province. Additionally, as more capital is invested in the production of hydrogen, technological improvements will be made and the cost of producing hydrogen will decline. Encouraging in-region production of green hydrogen will also mean that the need to use out-of-province higher carbon-intensity gray or blue hydrogen will decline in the region.

Expand eligibility for ZEV subsidies to include hydrogen fuel cell vehicles. Due to accelerating gains in productivity, specialization, and experience, hydrogen technologies will likely follow the same declining price per unit trend of other clean technologies, such as solar panels and electric vehicles. For now, hydrogen technology is earlier along the price curve (meaning it is more expensive), so the price cap for ZEV rebates, which were intended to prevent the public from subsidizing luxury battery electric vehicles, excludes fuel cell vehicles. The province should consider setting a provisionally higher limit for ZEV rebates specific to fuel cell vehicles, which would then decline over time as those productivity and other gains are realized and prices decline. This would have the effect of encouraging the use of hydrogen fuel cell vehicles in the province and Metro Vancouver region, providing industry with the opportunity to demonstrate their technologies and advancing improvements to bring the price down.

Strive for technology-neutral rules whenever possible. With rapidly changing technology, it is important to avoid locking in or locking out potential technological solutions, especially when the excluded ones just might beget entirely new industry sectors. For example, burning green hydrogen in a modified internal combustion engine is omitted from the provincial Commercial Vehicle Pilot program, and the Motor Fuel Tax regulation provides an exemption for hydrogen, but only "when used in fuel-cell vehicles." There is broad scope for applying this technological neutrality principle with respect to hydrogen in particular, and clean transportation in general. Technology-neutral policies should be standard, sending the signal to entrepreneurs and start-up companies all over the world that British Columbia offers a competitive landscape that values and wants you, your firm, and your intellectual property (and potential royalties) to come innovate, build, scale, headquarter, and export from here.

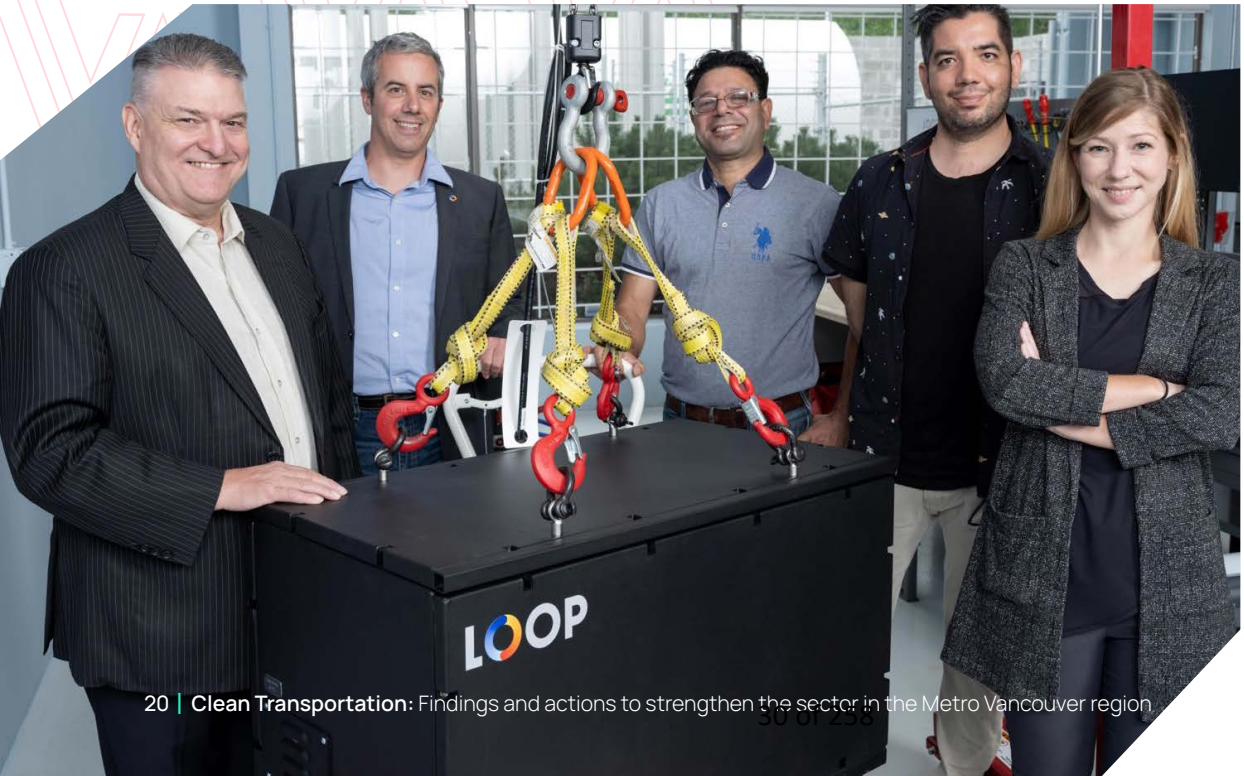
Culture of Innovation

Findings

Interviewees from firms in all three categories of clean transportation mentioned the need "to create a culture of innovation in the region." There is a general disappointment, amongst interviewees, that the commitment to tackling the climate emergency is not matched by public support for local firms developing the technologies that will make lowering greenhouse gas emissions possible. Municipalities, in particular, were cited for their "risk-aversion" when it comes to their procurement policies and purchasing new or emerging technologies from "home-grown" enterprises. Multiple firms described finding local governments in the U.S. and Alberta, for example, more open to supporting new technologies and enterprises in their procurement decisions than governments here.

Recommendations

Encourage greater participation in "Project Greenlight" and other public-private partnerships to encourage a culture of innovation across the Metro Vancouver region. Project Greenlight is a membership-driven demonstration platform that forges strategic partnerships between public and private enterprises ("members") and technology companies ("innovators"). Governments and government agencies should commit to greater participation in Project Greenlight, as well as in similar public-private partnership programs as a way to balance their understandable desire to de-risk their procurement decisions by purchasing "already commercialized" technologies with economic development. The goal should be to catalyze innovation and to build capacity within target industries, such as clean transportation, by using procurement levers to produce an environment in which innovative firms and new (and previously unknown) industry sectors can thrive, expand, hire and reinvest in the region.



IV. Conclusion

Talent, the innovation ecosystem, supporting incentive and regulatory environment, and leading hydrogen expertise mean that the Metro Vancouver region is well-positioned to seize the opportunities presented by the transition to a cleaner future. Yet, urgent action is needed to address barriers to investment for the clean transportation sector. Most time sensitive are the need to modernize and streamline the permitting process, improve access to highly-limited industrial space, and support a hydrogen hub to accelerate industry growth. The recommendations in this report will allow the region to go beyond creating a market for low carbon transportation and create a thriving clean transportation industry.

Invest Vancouver would like to thank all interviewees for their time and for sharing their insights.

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To: Electoral Area Committee

From: Tom Pearce, Regional Planner, Regional Planning and Housing Services

Date: March 7, 2022 Meeting Date: April 7, 2022

Subject: **Electoral Area A Geotechnical Study – Phase One Report**

RECOMMENDATION

That the Electoral Area Committee receive for information the report dated March 7, 2022, titled "Electoral Area A Geotechnical Study – Phase One Report".

EXECUTIVE SUMMARY

Metro Vancouver is the building inspection authority for the areas of Electoral Area A outside of UBC and UEL. To address the need to have local-scale geohazard maps and to help provide a better understanding of potential risk, including from the effects of climate change, the 2021 Board-approved budget included funding for an Electoral Area A Geotechnical Study for these areas. The recently finalized phase one portion of the study is presented in this report. Phase one involved the creation of geohazard maps that show areas at risk of or previously impacted by landslides, riverine and coastal flooding, and snow avalanches. The maps provide a good baseline of information regarding impacts that have occurred to date, and through modelling that incorporates climate change, will enable Metro Vancouver to better predict areas of future risk (phase two). Future phase two work will also focus on integrating the maps into the development approvals process for building permits, and will be considered as part of the 2023 Electoral Area Services financial plan discussions later this year.

PURPOSE

This report provides the Electoral Area Committee with the recently completed phase one portion of the Electoral Area A Geotechnical Study and describes planned phase two work.

BACKGROUND

The Electoral Area A Geotechnical Study was approved as part of the 2021 Board-approved budget for Electoral Area Services, and is a second quarter item on the 2022 Electoral Area Committee Work Plan. The phase one portion of the Study (Attachment) was recently finalized and is provided in accordance with the work plan.

DEVELOPMENT IN ELECTORAL AREA A (OUTSIDE UBC AND UEL)

Metro Vancouver is the building inspection authority for the areas of Electoral Area A outside of UBC and UEL, which are comprised of small established rural and remote communities, often located in steep or flood or landslide-susceptible terrain. There is a low volume of development activity in these areas, with fewer than 10 building permits per year and no rezonings or subdivisions.

Currently, due in part to a lack of geohazard mapping and guidance specific to Electoral Area A, applicants for building permits are routinely asked to provide a geotechnical report, regardless of the project's size (e.g. shed or new home) or location. The Electoral Area A Geotechnical Study is intended to address the need to have local-scale geohazard maps and to help provide a better

understanding of potential risk, including from the effects of climate change, to staff, applicants, and qualified professionals.

ELECTORAL AREA A GEOTECHNICAL STUDY

BGC Engineering Inc. was retained in 2021 to undertake work on a two-phased Electoral Area Geotechnical Study that would create a baseline of geohazard maps (Phase One), followed by work to integrate the maps and identified risks into Metro Vancouver's development approval process (i.e. building permit applications) (Phase Two).

Phase One – Geohazard Mapping (Attachment)

Phase one involved research to complete a desktop inventory and characterization of geohazards (landslide, riverine and coastal flooding, and snow avalanches) with the potential to affect developable lands in Electoral Area A (outside of UBC and UEL).

Tasks included:

1. Examining geotechnical reports on file;
2. Conducting new research (e.g. review of provincial mapping data) where there is limited or no information;
3. Preparing PDF maps and GIS data that identify high geohazard areas; and
4. Providing a methodology report for the mapping work. The methodology included reviewing existing reports, past air photos, existing Lidar data and an elevation model.

Phase Two – Modelling Future Risk and Integration with Development Approvals Process

Phase two will involve finer grain analysis of the geohazard maps, including modelling that incorporates climate change and preparing a report with advice on how to incorporate the geohazard mapping into the development approvals process. This would include acceptable risk thresholds, exemptions for low value and/or non-habitable space, mitigation best practices, and processes for public access for new reports. Proposed phase two work will be considered as part of the 2023 financial plan discussions for Electoral Area Services.

ALTERNATIVES

This is an information report. No alternatives are presented.

FINANCIAL IMPLICATIONS

Phase one of the study cost $30,000 from the 2021 Board-approved Electoral Area Services budget. Costs associated with phase two will be considered by Electoral Area Committee and MVRD Board as part of the 2023 financial plan.

CONCLUSION

Phase one of the Electoral Area Geotechnical Study fills a gap by making local-scale geohazard maps available when considering building permits in rural and remote portions of Electoral Area. Phase two work will better integrate these maps with the building permit application approval process, improving risk mitigation and streamlining the process for applications in low risk areas.

Attachment

Electoral Area A – Geohazard Mapping Report, dated March 30, 2022

Electoral Area A
Geohazard Mapping Report

Phase 1: Geohazards Inventory and Methodology

EXECUTIVE SUMMARY

BGC Engineering Inc. (BGC) was retained by Metro Vancouver to complete a desktop inventory and characterization of geohazards (landslide, riverine and coastal inundation, and snow avalanches) with the potential to affect key parcels in Metro Vancouver's Electoral Area A. This is Phase 1 of a two-phase project to characterize geohazards and translate results into technical and policy maps for use in the review of building and land development permit applications. The current work is based on new landslide and snow avalanche mapping and existing geohazard information compiled from published reports and geoscience/engineering reports held by Metro Vancouver. The deliverables for this project are several pdf maps and the supporting spatial database (geographical information system – GIS). These deliverables provide a starting point and structure to update and refine results once further information becomes available through more detailed assessments.

BGC recommends that Metro Vancouver proceeds with their planned Phase 2 for this project which consists of developing a methodology to incorporate the findings of the geohazard mapping in Metro Vancouver's review process of building permit (primarily) and land development applications in Electoral Area A.

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LIMITATIONS

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1.0 INTRODUCTION

BGC Engineering Inc. (BGC) was retained by Metro Vancouver to map geohazards of select sections of the Electoral Area A (Figure 1-1, Areas of Interest, AOI). BGC understands that the geohazard mapping in Metro Vancouver's Electoral Area A forms Phase 1 of a two-phase project. This first phase synthesizes previous geohazard studies in a spatial database (geographical information system – GIS), supplemented by terrain analyses to confirm, refine, or add to previously developed geohazard inventories. The second phase of the project will develop a methodology to incorporate the findings of the geohazard mapping in Metro Vancouver's review process of building permit (primarily) and land development applications in Electoral Area A. The work was performed under Metro Vancouver's Consulting and Professional Services Agreement with the limit of liability and insurance coverage outlined in Document 49096723, RFSQ No 21-364, and approved on November 16, 2021.

1.1. Scope

The scope for this project is to map geohazards (landslide, riverine and coastal inundation, and snow avalanches) with the potential to affect key parcels[1] in Electoral Area A (Figure 1-1). The work plan to support this scope includes:

- Compiling geohazard information in published reports and contained in geoscience/engineering reports held by Metro Vancouver
- Mapping new landslide and snow avalanche hazards to fill gaps in current knowledge.

1.2. Limitations and Exclusions

BGC notes the following limitations and exclusions for the scope of this project:

- Magnitude-frequency (how large and how often) characterization of geohazards in the project area, nor their intensity (velocity, depth, erosion potential, impact forces).
- Mapping or modelling to characterize the potential impact area of a landslide or snow avalanche.
- Generating geohazard zonation maps (zone of high, medium, low hazard within a hazard extent).
- Landslide or snow avalanche susceptibility mapping.
- Geohazard risk assessment (i.e., inclusion of geohazard consequences).
- Characterization of hazards initiating within the project area and impacting infrastructure or people outside Electoral Area A.
- Existing geohazard mitigation strategies.
- Coastal inundation hazards related to tsunamis or wind and boat-generated waves.
- Detailed assessment of the potential effects of wildfire, insect infestations, or climate change on geohazards.

[1] Key parcels were identified by Metro Vancouver (email from Tom Pearce, personal communication October 2021).

Geohazards that are not part of this scope include ground shaking and liquefaction due to earthquakes and landslide-generated impulse waves. While they were considered out-of-scope for this study, they still represent credible geohazard scenarios with the potential for intense and widespread damage. Ground shaking during an earthquake can generate landslides as documented during the 2012 Haida Gwaii earthquake (Barth et al., 2020). Liquefaction can occur in saturated sandy soil during an earthquake. Sections of Electoral Area A may be susceptible to earthquake-triggered landslide and liquefaction. While landslide-generated impulse waves are infrequent occurrences, they have been documented in southwestern British Columbia (BC) (Evans, 1989; Roberts et al., 2012; Hughes et al., 2021) and their potential in Howe Sound has been discussed (Jackson et al., 2014).

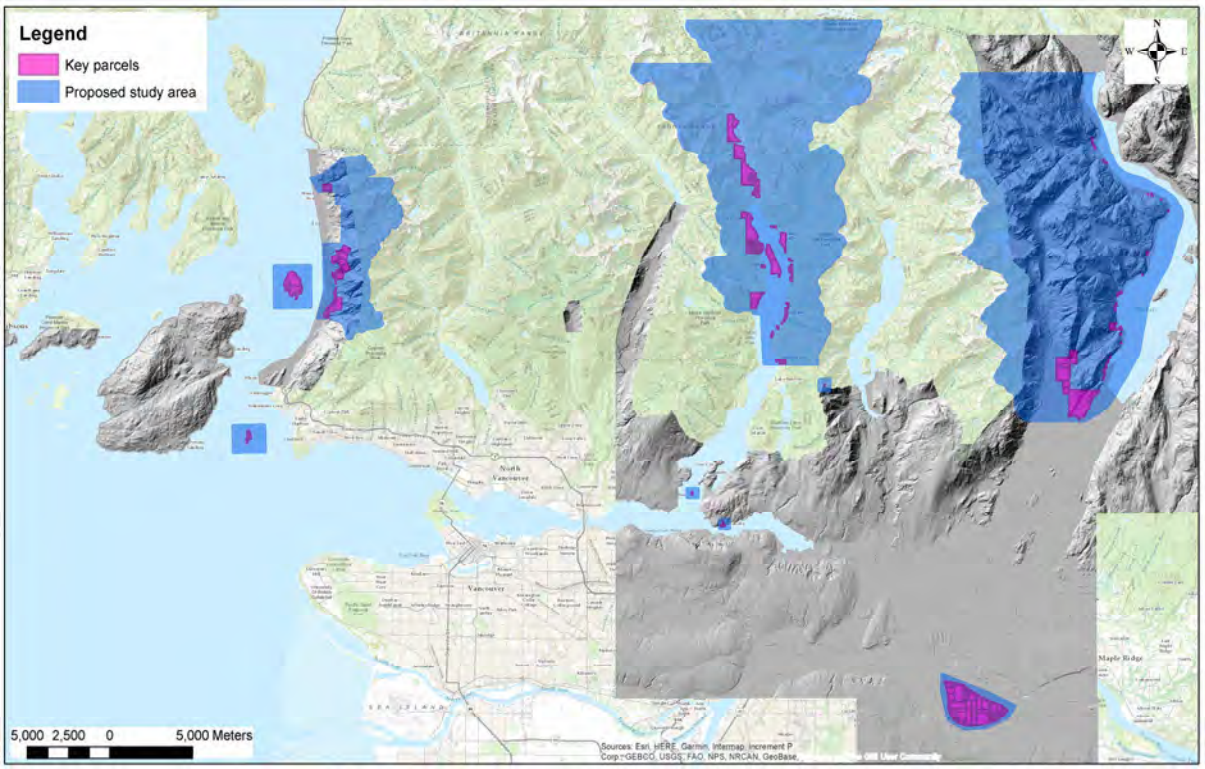


Figure 1-1. Project area showing the key parcels identified by Metro Vancouver and the extent of publicly available lidar.

As this project consists of a compilation of site-specific and regional-level geohazard assessments, one of its limitations is the variable mapping scale. That is, the entirety of the project area is not mapped at a set scale (e.g., 1:20,000). In the new mapping area, only landslides and snow avalanches of a size large enough to be observed on the consulted aerial photographs and imagery were recorded. As no fieldwork was conducted for this project, the geohazards were characterized based on the source material consulted during the desktop study. Based on the vintage of aerial photographs and imagery consulted, this represents a snapshot of 1953 to 1957 and 2018 to 2021. As additional past or present-day field observations become available these can be used to update the geohazard mapping and characterization. Empirical classification of steep creek geohazards (i.e., clear-water flood, debris-flood, or debris- flow hazards) was used in

this study as it can be applied to large regions. However, classification reliability is lower than for detailed studies, which typically combine multiple lines of evidence such as statistical, remote-sensed, and field observation data. Assigning each fan with one of three likely steep creek process types also does not recognize that there is a continuum between clear-water floods and steep-creek processes that is not accounted for in morphometrics. Simlarly, many creeks are prone to a specific hazard up to a certain return period, above which another process dominates.

1.3. Project Area

The select sections of Electoral Area A that are part of the project include a range of physiographic regions from rugged steep mountains of the Coast Mountain Range, to rocky islands and a low-lying island of surficial material (Holland, 1976; Armstrong and Hickock, 1980; Blais-Stevens, 2008). While the climate of the low-lying area differs from the high elevation peak, they typically all received significant amounts of precipitation (rain or snow) in the winter (Figure 1-2). The project area is also within the zone of influence of the Cascadia Subduction zone which represents a high seismic hazard (Figure 1-3).

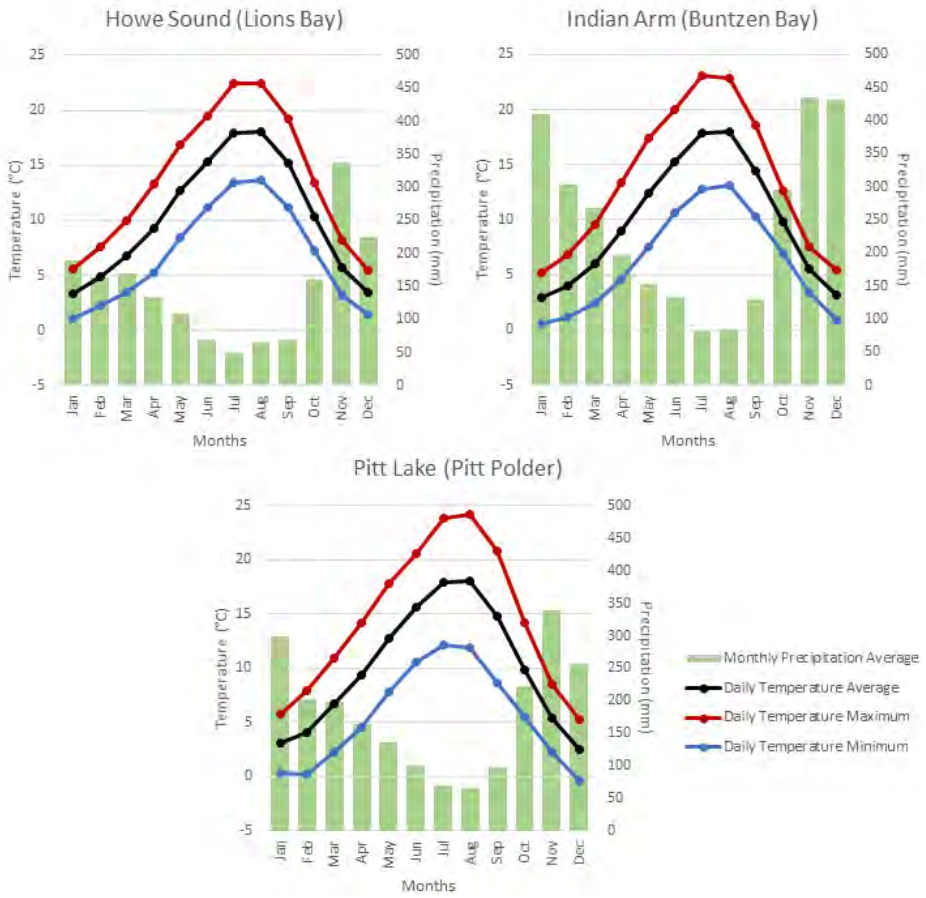


Figure 1-2. Climate Normals for three weather stations at or near sea level (data from PCIC, 2021).

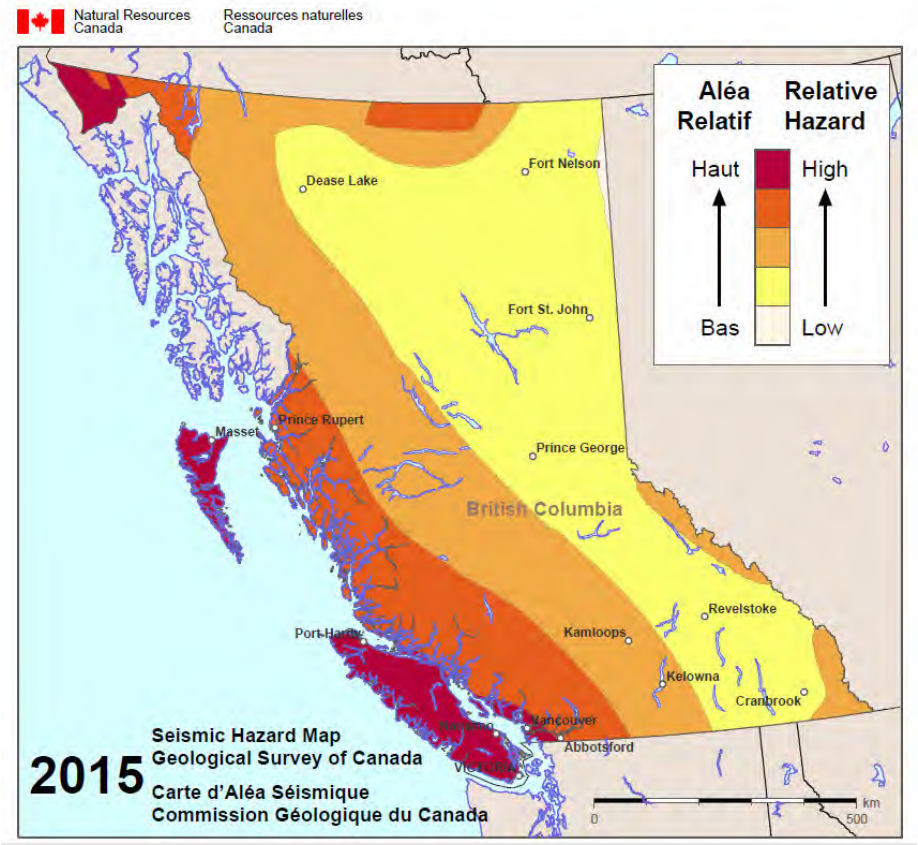


Figure 1-3. Simplified seismic hazard map for British Columbia (Natural Resources Canada, 2015).

2.0 METHODOLOGY

2.1. Landslide Mapping

In this geohazard compilation, landslide hazards were characterized using points, lines, and polygons (areas) depending on the spatial extent and uncertainty associated with the hazard. Points typically represent historical or potential hazards. Lines are predominantly used to represent the travel path of past landslides. Depending on context, areas can represent a potentially unstable section of the slope (e.g., block bounded by tension cracks) or the source and depositional areas (e.g., steep cliff and talus). The level of this project along with the inherent uncertainty associated with natural processes means that the absence of mapped feature does not represent an absence of hazard.

The landslide type classification by Hungr et al. (2014) was used in this report.

2.1.1. Previous Landslide Hazard Inventory

Landslide hazard information was extracted from geotechnical and geoscience reports provided by Metro Vancouver (See Table A1 in Appendix A for detailed list) and spatially compiled in a GIS environment. A spatial inventory of the parcels with previous geotechnical and geoscience assessments was generated by adding a point with details about report author and year in the centre of the associated parcel. Where landslide hazard specific to a landform was included in the previous reports, this information was represented as a point, line, or polygon (area) as appropriate. More details about the information recorded in the GIS layer is provided in Section 3.0 and Appendix B.

Of the different sections of the current project area, the Howe Sound corridor contains the most infrastructure (Highway 99 and CN Railway) and densely populated residential area. As such, it has been the subject of academic and governmental landslide hazard studies (e.g., Blais-Stevens, 2008; Blais-Stevens and Septer, 2008; Blais-Stevens et al., 2012). Landslide inventories complete for these studies were incorporated in the GIS compilation where applicable.

2.1.2. New Landslide Hazard Mapping

New screening-level landslide hazard mapping was completed by BGC using Google Earth imagery (all sections), 1952 to 1957 aerial photographs (all sections, see Table A2 in Appendix A for details), publicly available lidar (Howe Sound and Pitt Lake area, see Table A3 in Appendix A for details), and terrain mapping (Howe Sound and Indian Arm; Ryder et al. 1999 from BC Data Catalgue, 2010). The new landslide mapping is intended to supplement the information available in the geotechnical and geoscience reports held by Metro Vancouver. The new mapping focused on the area surrounding the parcels of interest but included some mapping of the upper reaches of the watershed reporting to the parcels of interest.

2.1.3. Fan Inventory

Fans are landforms created from the deposition of sediment by hydrogeomorphic processes (clear-water flood, debris flood or debris flow). While the presence of a fan indicates past geohazard occurrence, the lack of a fan on a steep creek does not necessarily rule out the potential for future geohazard occurrence. Also, some creeks discharge directly into the ocean, lakes or reservoirs. A fan likely exists but is submerged and thus not visible except in bathymetric information. As such, the fan inventory completed in this study should not be considered exhaustive. A fan inventory was compiled based on geomorphic mapping using the lidar and TRIM topographic map (GeoBC, 2016) along with review of previous geotechnical reports provided by Metro Vancouver. Each fan was assigned a process type based on empirical relationships between the Melton Ratio[2] and watershed length. These terrain factors are a useful screening-level indicator of the dominant hydrogeomorphic process (clear-water floods, debris floods, or debris flows) on a creek (Wilford et al., 2004; Holm et al., 2016). The morphometric values calculated by River Network Tool™ (RNT) were used alongside terrain interpretations (Table 2-1) to assign the dominant hydrogeomorphic process. They do not, however, acknowledge that processes on creeks may change depending on the chosen return period. For example, creeks subject to "floods" at higher return periods, become subject to debris floods, and, in some cases, at even higher return periods subject to debris flows (Jakob and Jordan, 2001). This implies that BGC's categorization should be understood as scoping level.

Table 2-1. Characteristics used to classify hydrogeomorphic process types on fans (after Lau, 2017).

	Debris flow	Debris flood	Flood
Air photo	Steep (>15°) average watershed channel gradient and typically small (< 3 km^2) watersheds with high relief Frequent sediment sources in upper watershed (rockfalls, debris avalanches, etc.) Inconsistent breaks in tree canopy on fan along stream channel.	Moderately steep (3-15°) average watershed channel gradient, medium to large watersheds with moderate to high relief Sediment sources in upper watershed (rockfalls, debris avalanches, etc.) Consistent break in tree canopy on fan along stream channel.	Low (<3°) average watershed channel gradient, medium to large watersheds with moderate to low relief. Wide channels Large gap in tree canopy along stream channel. Overbank deposits
Lidar	Fan gradient > 5° Levees along channel margin U-shaped channels (Boulder) lobes on fan surface Tongue-shaped boulder carpets Sharp deposit boundaries	Fan gradient 2-10° No levees along channel Potential lobes on fan surface Paired terraces	Fan gradient < 5° Wide channels Lack of lobes and levees along channel margin

[2] Melton ratio is watershed relief divided by the square root of watershed area (Melton, 1965).

2.2. Flooding and Coastal Inundation Mapping

2.2.1. Screening Level Flood Extents

Flood inundation extents and flood depths were approximated for each watercourse within the study area using a terrain-based mapping approach referred to as Height-Above-Nearest-Drainage (HAND) (Rennó et al., 2008). This mapping approach uses publicly available topographic and hydrometric data to approximate areas that could be inundated during a flood event as a practical alternative to hydraulic modelling over large spatial scales. The data required for HAND mapping includes a topographic model and a rules-based approach to classify the maximum predicted flood depth. This concept is illustrated in Figure 2-1 which shows that the HAND value for a given point represents the relative height between that point and the nearest stream that it drains to (Zheng et al., 2018). Therefore, any cell with a HAND value below a given threshold (a maximum predicted flood-depth) can be assumed to be within the inundation extents in the event of a flood reaching this level.

This terrain-based approach was used to estimate the approximate area that could be inundated in a 200-year return period flood event for all watercourses within the study area. The analyses were used to identify and prioritize areas subject to clear-water flooding and do not replace detailed floodplain mapping that includes bathymetric surveys and hydraulic modelling. The output of this process also serves as a basis for identifying locations where detailed floodplain mapping could be undertaken in the future.

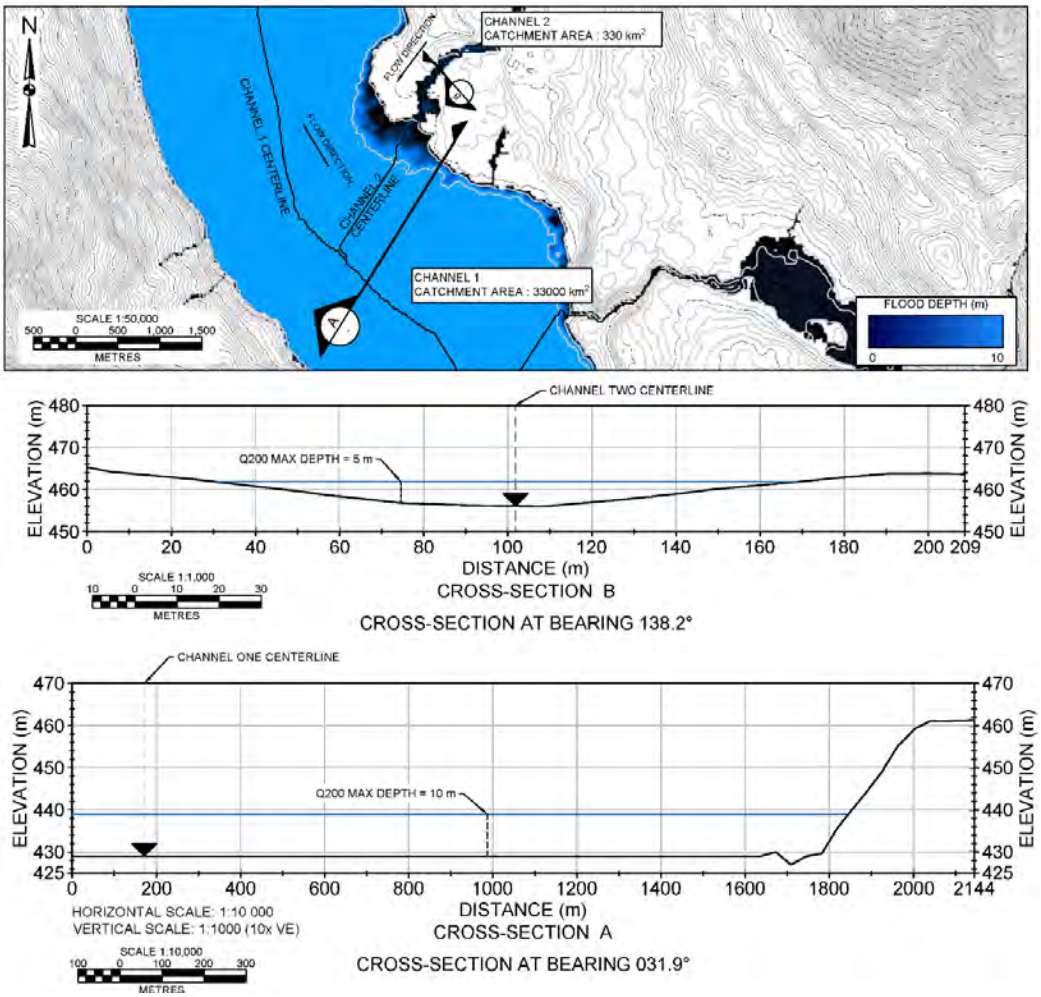


Figure 2-1. Illustration of the HAND concept (modified from Zheng et al., 2018).

HAND mapping was performed using a 30 m digital elevation model (DEM) for the study area acquired from the Shuttle RADAR Topography Mission (SRTM) (Farr et al., 2007). The analysis was performed using the Terrain Analysis Using Digital Elevation Models (TauDEM) GIS tool suite (Tarboton, 2016). TauDEM is a set of GIS-based tools designed for large-scale hydrological analysis of topographic data. The “Vertical Drop” function within this suite allows for the calculation of HAND using a stream network and flow accumulation model as inputs.

In order to identify appropriate HAND values to associate with flood depths, the relationship between catchment area and flood depth during a 200-yr return period flood was assessed. Hydrometric data from 205 Water Survey of Canada (WSC) (Environment and Climate Change Canada [ECCC], July 16, 2018) gauging stations with over 10 years of records located in southern BC were analyzed to provide a relationship between catchment area and flood depths. For each gauge, a stage-discharge curve was built using readings collected between June and July. These two months were selected as the rating curves are seasonally adjusted by the WSC so a stable period to generate the rating curves was required.

The HAND mapping exercise was carried out for all water bodies existing within the drainage network generated through TauDEM, these included rivers as well as lakes and reservoirs. The methodology for calculating the maximum 200-year flood depth did not differ based on the type of water body (i.e., lakes, rivers, and reservoirs were all treated the same way).

2.2.2. Coastal Inundation Mapping

Coastal inundation hazards result from a combination of processes including tides, storm surge, and wave action. These hazards and their contributing factors have been discussed in a series of provincial-level guidance documents (Ausenco Sandwell, 2011; Kerr Wood Leidal, 2011; BC FLNRORD, 2017; EGBC, 2017). As the scope for this project did not include a detailed site-specific assessment of the coastal inundation hazard, publicly available studies for the nearby Squamish (Kerr Wood Leidal, 2017), Egmont/Pender Harbour (Kerr Wood Leidal, 2015), Lions Bay (Cordilleran Geoscience, 2018), Vancouver (NHC, 2014), Lower Fraser Valley (Fraser Basin Council and NHC, 2017), and Victoria/Saanich Peninsula regions (Associated Engineering, 2021) were reviewed and their findings applied to the project area.

Based on the available studies (e.g., Ausenco Sandwell, 2011; NHC, 2014; KWL, 2015, 2017), the potential coastal flood area was estimated to a value of 4.35 m above the mean sea level. This value incorporates:

- Higher High Tide: 2.05 m Canadian Geodetic Vertical Datum 1928 (CGVD28)
- 500-year Storm Surge in the Salish Sea: 1.3 m CGVD28
- Global Sea Level Rise to 2100: 1.0 m above mean sea level.

KWL (2015) and Cordilleran Geoscience (2018) in an example application for the Sunshine Coast (British Columbia) and for the Village of Lions Bay studies respectively, also included the following general consideration for wave action, freeboard, and global sea level rise to 2200.

- Wave action of 1.2 m
- Freeboard of 1.0 m
- Global sea level rise from 2100 to 2200: 1.0 m above mean sea level.

Both studies rounded their total estimate of coastal inundation to 8 m.

In the Howe Sound section of the project area, the 8 m value was added to the 0 m above mean sea level value for extents covered by the 2016 lidar DEM[3]. For Indian Arm, which lies outside the available lidar extent, that value was applied to the 0 m CGVD28 from the SRTM DEM. The same data were also used for the HAND mapping described in Section 2.2.1. Because the SRTM DEM has a lower resolution and vertical accuracy than the available lidar, a 10 m buffer was applied on the extent of coastal inundation derived from the SRTM DEM. The 8 m line above the mean sea level represents a screening level coastal inundation estimate and it does not constitute a flood construction level (FCL) as site-specific modelling would be required to fully characterize

[3] The contributions of subsidence and uplift to coastal inundation were neglected in this study as the values reported in Ausenco Sandwell (2011) would, over a period of 100 to 200 years, be on the order of the uncertainty from the other factors considered.

the wave runup and freeboard allowance required for an FCL. Site-specific assessment by a qualified professional (QP) will supersede the estimated 8 m value from this study.

A coastal inundation level was not estimated for the Pitt Lake section of the study area as additional work will be required to assess the impact of sea level change, storm surge, or wave action for a narrow tidal lake in southern British Columbia (Ashley, 1977) and determine a representative inundation level.

2.3. Snow Avalanche Mapping

Sections of the land parcels that may be exposed to snow avalanche hazard were identified as part of this project. Recommendations for occupied structures outlined in Technical Aspects of Snow Avalanche Risk Management (TASARM), prepared by the Canadian Avalanche Association (CAA, 2016), indicate that snow avalanches up to a return period of 300 years should be identified.

Locator-level mapping as described by CAA (2016) was completed for this assessment, which identifies potential avalanche paths that could intersect with land parcels. This type of mapping provides baseline information on potential avalanche hazard areas but does not provide lateral extent or runout extents. The path lines originate at the top of a starting zone and extend into the runout zone. Other starting zones that runout in the same general area may exist adjacent to the starting zone identified with the line. The mapping was completed based on a snow supply assessment, identifying terrain steep enough to form snow avalanches, and sufficiently clear of vegetation to allow for avalanches to flow.

Snow depth was estimated for relevant elevations within the study area by computing linear regressions on freely available snowpack data obtained from nearby snow data sites operated by BC Ministry of Transportation and Infrastructure (BCMoTI), Metro Vancouver, and historical stations. The sites are summarized in Table 2-2. Extreme value statistical methods were used to estimate snow depths for each station for given return periods beyond the length of the data record (Figure 2-2). The estimated 100-year snow depth is 193 cm for an elevation of 300 m and 838 cm for an elevation of 1200 m. Figure 2-2 suggests that avalanche hazard may exist on sufficiently steep slopes above an elevation of approximately 200 m.

Climate change is anticipated to affect snowpack and avalanche conditions (IPCC, 2019). Since the study area is at relatively low elevation, future warming trends will likely result in a thinner average snowpack. However, avalanche events are common during the accumulation of snowfall amounts over a period of days, which is dependent on short-term winter weather. It is anticipated that such short-term weather fluctuations will continue even with a warming climate. More wet avalanches may result with climate change, which are likely the design events for the avalanche paths in the study area.

Table 2-2. Relevant snow data used for the snow supply assessment.

Station Name	Owner	Approximate Elevation (m)	Latitude (°)	Longitude (°)	Data Range (From-To)
Lions Bay Brunswick Pit	BCMoTI	130	49.371	-123.269	1983 to 1994
Eagle Ridge	BCMoTI	140	49.471	-123.237	2009 to 2021
Tantalus	BCMoTI	320	49.843	-123.143	2009 to 2021
Burwell Lake	Historical	880	49.536	-123.051	1945 to 1976
Palisade Lake	Metro Vancouver	880	49.400	-123.183	1946 to 2020
Loch Lomond	Historical	900	49.383	-123.077	1946 to 1982
Mount Seymour	Historical	1070	49.372	-122.962	1960 to 1989
Dog Mountain	Metro Vancouver	1080	49.366	-122.950	1945 to 2020
Grouse Mountain	Metro Vancouver	1100	49.466	-123.000	1936 to 2021
Hollyburn	Historical	1100	49.583	-123.083	1945 to 1987
Orchid Lake	Metro Vancouver	1190	49.454	-123.032	1972 to 2021

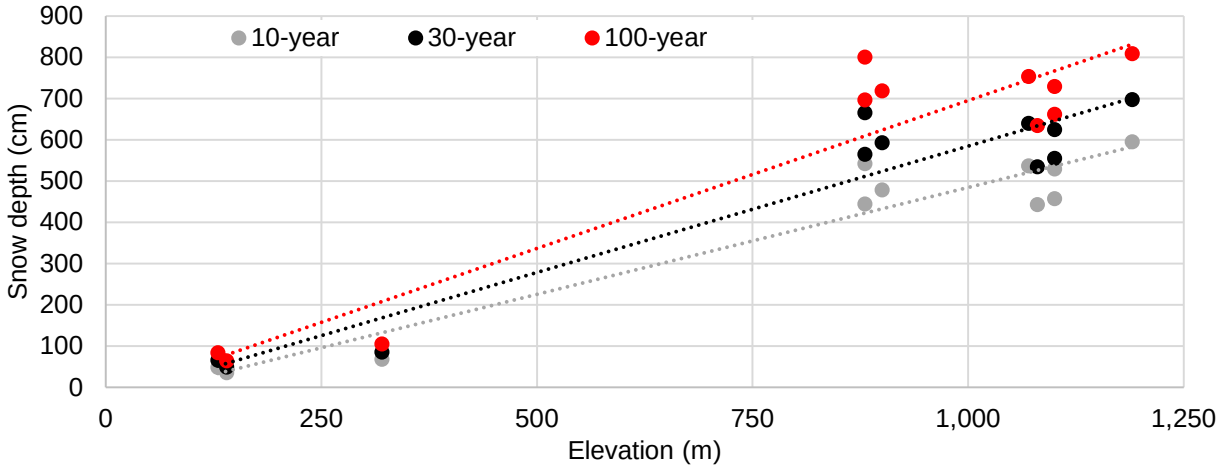


Figure 2-2. Estimated maximum snow depth assuming a linear relationship with respect to elevation for the study area.

2.3.1. Terrain and Vegetation

Slope angle was evaluated using the SRTM DEM (same as for HAND mapping in Section 2.2.1 and coastal inundation in Section 2.2.2). Vegetation cover was estimated using satellite imagery available on Google Earth, which was dated between 2019 to 2021. Terrain steeper than approximately 27° (Jamieson, 2018) with vegetation areas clear enough to form snow avalanches and the potential of travelling into land parcels was identified.

3.0 GIS COMPILATION

The geohazard mapping has been provided as Esri shapefiles representing the hazard as point, line, and polygon features (Table 3-1). The shapefiles use the NAD83 UTM Zone 10N projection. The geohazard mapping was completed in GIS software and Google Earth and was based on Appendix A and subject to the exclusions and limitations outlined in Section 1.2. The attributes compiled for each shapefile are described in Appendix B.

Table 3-1. Summary of geohazard mapping files provided with this report.

File name (data type)	Description
Landslide_mapping_points.shp (point)	Represents where previous geotechnical or geohazard assessment identified specific landslide occurrence or potential source of landslides
Previous_parcel_assessment_shp (point)	Inventories the parcels where previous geotechnical or geohazard assessment has been completed and filed with Metro Vancouver. Some parcels may have multiple reports associated with them.
Landslide_mapping_lines_shp (polyline)	Represents approximate travel path of actual landslide events as observed in the aerial photograph or imagery consulted. It may be an underestimate of the actual travel path as some of the distal debris might not be visible due to the resolution of the aerial photograph/imagery or vegetation cover.
Lineament_mapping.shp (polyline)	Represents a wide range of feature types such as potential tension cracks, scarps, trenches, or adversely oriented geological structures. Lineament type was not assigned to the features as part of this project. Lineaments were only recorded when noted above the parcels of interest.
Snow_avalanche_mapping_lines.shp (polyline)	Represent potential snow avalanche travel path as observed in the aerial photograph or imagery consulted. It may underestimate the actual travel of large events.
Landslide_mapping_polygons.shp (polygon)	Represents potential landslide source and runout zones of landslide activity. Polygon typically includes terrain (e.g., cliffs) and landforms (e.g., talus) associated with landslide activity. These polygons do not capture all the landscapes capable of producing landslides but only those with high potential as mapped at a regional scale.
Landslide_mapping_fans.shp (polygon)	Outlines the extent of fans based on lidar or TRIM dataset. Assigns a main hydrogeomorphic process to each fan based on empirical relationships.
SRTM_derived_coastal_inundation.shp (polygon)	Represents potential coastal inundation extent for area where only the SRTM elevation model was available.
lidar_derived_coastal_inundation.shp (polygon)	Represents potential coastal inundation extent for area where lidar elevation model was available.
Riverine_flooding.shp (polygon)	Represent potential river flowing extent based on the Height-Above-Nearest-Drainage approach.

4.0 DISCUSSION

This project provides the first compilation of geohazards for a select region of Metro Vancouver's Electoral Area A. While this work improves our understanding of geohazards at a screening level over a regional scale; landslide, inundation, and snow avalanche geohazards are complex phenomena that result from the interaction of site-specific conditions (e.g., topography, river profile, material type) and external forcing factors (e.g., precipitation, temperature, earthquake). The hazard level associated with these geohazards varies over time. The temporal scale can vary from seconds for an earthquake; hours and days for a rainstorm, weeks for the evolution of snow properties, months for the accumulation and melting of snowpack, or centuries to millennia in the case of progressive failure of rock slopes. As such the mapping presented in this work should be updated when additional and more detailed site-specific information becomes available. Table 4-1 discusses addtional factors that could influence geohazards in the study area.

The spatial scale of Drawings L01 to L14 and I01 to I17 summarizing the geohazard mapping from this project has been displayed at 1:25,000. As discussed in Section 1.2, information from various scales of mapping was compiled in preparing these drawings and 1:25,000 is representative of the overall scale at which it is intended to be used. This avoids overrepresenting the accuracy of the mapping by acknowledging that while detailed lidar was used for some of the analyses other relied on the coarser-resolution SRTM model. BGC anticipates that the geohazard mapping files provided with this report may be displayed digitally (e.g., via web application). Digital layer display is cautioned where scale can be adjusted by the user; BGC would be happy to discuss this issue further.

4.1. Landslide Hazard Mapping

Maps representing the potential hazard from landslides can take different form. As landslides occur more frequently on steep terrain, a slope map can be used approximate where landslide might occur. Slope maps tend to be conservative, do not account for material type, and do not identify fans (which have a gentle slope) as areas with a potential high landslide hazard. Slope maps were Metro Vancouver's main tool of characterizing landslide geohazards in Electoral Area A before this project. Geohazard inventory maps are the main deliverable of this project. They compile the known geohazard occurrence (recorded or observed) and can apply empirical relationships to provide a first estimate of where they might occur in the future.

While both slope and inventory maps are useful, the input from a QP is still often required for their interpretation. Development permit area (DPA) integrates information from slope map, inventory map, and regional knowledge to define map areas where development can occur without, with some, or with detailed geotechnical investigation. Composite hazard maps can further divide DPAs by considering the occurrence and intensity of multiple geohazards at a site thereby providing a more comprehensive characterization of the geohazards. The DPA and composite hazard maps require more effort to generate than slope or inventory maps. They are provided in format that can be interpreted by planners and approving officers.

Table 4-1. Summary of further considerations that were not incorporated in this work but could impact or improve our understanding of geohazard in Electoral Area A.

Parameter	Geohazard Affected	Description	Implication	Additional Work that could be Completed
Material type	Landslide	Material type refers to texture (e.g., clay, silt, sand, gravel) and the deposition mechanism (e.g., glacier, river, anthropogenic/construction). Glaciolacustrine and glaciomarine deposits are known to be susceptible to landslide activity and have been recognised in parts of the study area (Blais-Stevens, 2008; Cordilleran Geoscience, 2015). Anthropogenic ground can be suitable for a wide range of use when built for a specific purpose (e.g., mechanically stabilized earth landslide protection) or it can problematic if not specifically engineered or engineered for a different purpose (e.g., construction spoil).	A more detailed understanding of the texture, geotechnical properties, and spatial distribution of surficial and anthropogenic material would help understanding the variation of landslide susceptibility and erosion potential in the study area.	Desktop and field-based surficial geology mapping.
Old (legacy) logging roads	Landslide	Resource road upslope of parcel of interest were constructed at various times, using a range of techniques, based on different guidelines are currently under a range of utilization, maintenance efforts, and state of deactivation.	Old (legacy) logging roads can disrupt the natural drainage and redirect water onto sections of the slope that are not used to it, potentially triggering landslides. The fill from old logging roads can also be a source of landslides as the trees and logs lose their strength in decay. Unstable logging road sections have been documented in different parts of the study area (Cordilleran Geoscience 2017, 2020).	Compile inventory of location of old logging road based on lidar review and historical maps. Conditions of the road would need to be assessed on the ground. Landslide runout from such failures could be numerically modelled.
Magnitude and frequency	All geohazard	All geohazards have a magnitude-frequency distribution. While the exact relationship depends on the hazard type and terrain, the general trend is that small events happen more frequently compared to the rare large ones. The current work focuses on the geohazard potential and did not characterize their magnitude-frequency.	Uncertainty regarding the frequency of the hazard that could result in loss of life.	Preliminary qualitative or semi-quantitative risk assessment could be used to estimate which geohazard would benefit from a detailed site-specific investigation to define the magnitude-frequency of a hazard.
Change in vegetation	All geohazards	Changes in vegetation cover due to wildfire, insect infestation, disease, other geohazards, or anthropogenic activities.	Period of increased geohazard likelihood of occurrence and magnitude until the vegetation re-establish itself	Post-event mapping of the intensity of the disturbance could inform which areas could experience larger and more frequent, landslides, floods, and snow avalanches.
Climate change	All geohazards	Climate change refers to the change of temperature (extreme and average) and precipitation (yearly average, timing, intensity, type) observed globally since early 1900s and expected based the climate model. Climate change will affect the geohazard occurrence in the project area in different ways.	Climate change was considered in this study for the coastal inundation as it was straightforward to incorporate a first-order impact of sea-level rise. Climate change will also affect the other geohazards. Jakob and Owen (2021) historical data and climate model output and suggested that landslide frequency and size are likely to increase in the future. EGBC (2018) discusses potential implications for flood assessment.	Incorporating the latest output from the climate model for the Metro Vancouver area in the landslide and snow avalanche hazard models. Periodically update all geohazard models when significant new and/or higher resolution climate model become available.
Evolution of river profile	Riverine flooding and landslide	The evolution of the river profile due to channel migration, channel erosion, short- (months) to moderate- (years) term sediment storage.	Influences the local extent and depth of flooding. Bank erosion can also be a contributing factor to landslide occurrence.	Periodically evaluate the change in river profile for progressive change. Evaluate the change in river profile after significant flooding event. Use bank erosion models to predict bank erosion over time.
Coastal erosion	Coastal inundation and landslide	Coastal erosion is the progressive retreat of the coastline. The rate of change depends on the material type along the coast, sediment flux associated with longshore drift and is affected by the sea-level rise.	Coastal erosion can affect the area affected by coastal inundation and it can also generate landslide.	Periodically evaluate the change in coastline location and topographic profile. Evaluate the change in coastline after significant storm event. The 1-m sea level rise prescribed for BGC is also a mean (conservative) estimate. The tail end of the distribution could be evaluated (lower probability events with higher than expected sea levels.
Detection scale	Landslide	The size of geohazard mapped depends on the resolution of the imagery and DEM consulted.	A study by Brardinoni et al. 2003 of the Capilano Watershed demonstrated that remotely sensed inventory could miss up to 85% of landslide occurrences and up to 30% of the mass movement volumes when compared with results from field-based inventory.	Update geohazard inventory when more detailed imagery and DEM become available and supplement with field surveys.

5.0 SUMMARY AND RECOMMENDATIONS

The landslide mapping and snow avalanche locator-level mapping are summarized in Drawings L01 to L14. Landslide events or landslide potential have been mapped above the parcels of interest suggesting that they may be exposed to landslide hazards in the future. Land parcels with a locator-level line suggest that they may be exposed to snow avalanche hazards.

Parcels or parts of parcels were identified in Drawings I01 to I17 as within the preliminary riverine and coastal inundation areas and may be exposed to flooding hazards in the future.

5.1. Recommendations

While the geohazard inventory prepared in this project is a fundamental building block for understanding geohazards, additional steps will be needed to prepare maps and criteria for decision making. BGC recommends that Metro Vancouver proceeds with Phase 2, including the development of a framework to incorporate the results of this work into Electoral Area A decision processes, such as planning, policy, and regulation (building and development permits).

Next steps could include the following, which would be structured for potential incorporation into updated building and land development regulation within Electoral Area A:

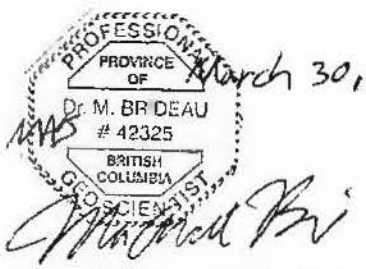
- **Maps and supporting information (basis for decision making).** These may include thematic maps (e.g., slope gradient thresholds and defined setbacks at slope crest or base), interpreted maps of terrain stability or hazard susceptibility, avalanche, landslide, or flood hazard scenario maps, and related policy maps where available knowledge supports their preparation. BGC also recommends Metro Vancouver distinguish between maps intended for use by decision makers (policy maps) and hazard maps intended for use by practitioners in support of site assessments. A wide range of effort can be associated with hazard map development. As such it is important to align mapping objectives (and associated cost) with their intended use. BGC can provide further details on mapping approaches on request, with reference to the forthcoming update to the EGBC landslide guidelines.
- **Decision making framework**. These may include hazard or risk-based decision protocols for decision makers, for the application of spatial information (maps) and supporting information in the permitting process. These materials would reflect hazard types present within Electoral Area A, and would be structured for potential inclusion in bylaws, such as Official Community Plans (OCPs). For example, prior to the development of a land parcel that may be exposed to snow avalanche hazard, a detailed zoning-level hazard assessment (CAA, 2016) should be completed by a QP and avalanche professional, or one person that meets both qualifications by virtue of education and experience. BGC can provide further details on request, with reference to the forthcoming update to the EGBC landslide guidelines.

6.0 CLOSURE

We trust the above satisfies your requirements at this time. Should you have any questions or comments, please do not hesitate to contact us.

Yours sincerely,

BGC ENGINEERING INC.
per:



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EGBC Permit to Practice 1000944

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APPENDIX A
MATERIAL CONSULTED

Table A1: List of reports consulted (provided by Metro Vancouver)

Report No.	Title	Author	Year	Notes
1	Debris training wall Lot 2 Montezambert Creek*	N.A. Skermer	1989	One page summary that the hazard category for debris torrents on Montizambert Creek is moderate and there is no known history of debris torrents in that creek
2	Shoreline Sales Program Hazard Study Indian Arm, Lillooet Lake and Harrison Lake	Northwest Hydraulic Consultants Ltd.	1990	Hazard assessment Indian Arm. Includes debris torrent potential in creeks along Indian Arm.
3	Lot 2 Montizambert Creek, Wynd	Thurber Engineering Ltd.	1990	Review of previous report by Skermer regarding the hazard assessment of debris torrents potential on Montizambert Creek.
4	Lot 2 Montizambert Creek, Wynd	N.A. Skermer	1990	Follow up after Thurber Engineering Ltd.'s report with design recommendations for a training wall.
5	Montizambert Creek	N.A. Skermer	1995	One page memo summarizing that fill placement on debris flow protection structure.
6	Assessment of Debris Flow Potential Newman Creek, Howe Sound	Vandine Geological Engineering Ltd.	1998	Outlines landslide event on Newman Creek in January 1998
7	Proposed Cabin, South 1/2, Block 1, District Lot 1027, North Vancouver, BC - Natural hazards assessment	Horizon Engineering Inc.	1998	No evidence of natural hazards were observed on the aerial photographs. Mentions that lack of trees suggests previous debris flows, and a crack of concern is located at the south end of the rock wedge
8	Montizambert Creek	BC Ministry of Environment	2000	e-mail chain notifying GVRD of failures in the upper reaches of M Creek and Newman Creek
9	Sunset Highlands housing development, Sunset Beach	Cordilleran Geoscience	2001	Excavation for highway found burried logs by a rock slide/rock avalanche.
10	Geotech assessment for Unit 1, Ocean Point Drive	Horizon Engineering Inc.	2002	Full geotech report for a property on Newman Creek Fan. Includes documented chronology of known events on the creek up to 2002
11	Supplement to geotechnical engineering review for existing Pitt Lake recreational cabin	Trow Consulting Engineers Ltd	2003	Recommendations on lakeshore and excavation slope remedial requirements
12	Geotechnical report proposed gatehouse, lot 1-16 Strachan Point Road, West Vancouver, B.C.	Davies Geotechnical Inc.	2003	Provides recommendations regarding slope stability, site preparation and foundation design for a proposed gatehouse structure.
13	Crown Lease Lots on Pitt and Harrison Lakes, BC Reconnaissance Level Geological Slope Hazard Assessment	Thurber Engineering Ltd.	2004	Rates the slope hazards on selected Crown lease lots
14	Main residence, Strachan Point, Howe Sound - Geotechnical Report	Tony Dell and Associates	2004	Geotech review of a proposed house
15	Slope hazard assessment Indian Arm property on the Lighthall Creek fan	Baumann Engineering	2004	Debris flow and flooding hazard assessment
16	Hazard, risk, and vulnerability analysis - Electoral Area A Greater Vancouver Regional District	EmergeX Planning Inc	2005	Provides an analysis of the hazards that may present risks to Electoral Area A of GVRD. Outlines geological hazards along Highway 99 including documenting past events
17	Harrison and Pitt Lakes shoreline hazards. Hydrogeomorphic hazard assessment	Northwest Hydraulic Consultants Ltd.	2005	Assesses waterfront properties on Harrison Lake and Pitt Lake that the province intends to sell. Overview-level hydrogeomorphic hazard assessment of 28 properties at Pitt Lake
18	Slope Hazard Assessment at 24 Johnson Bay, Indian Arm Provincial Park	Horizon Engineering Inc.	2005	Reviews slope hazards for existing house on subject property. This property is on the Lighthall Creek Fan, and comments on the frequency of debris flows
19	Geotechnical hazard assessment - Proposed subdivision, Montizambert properties	Golder Associates	2006	Table outlining air photos reviewed and if landslides were observed above subdivision. Specific description of the terrain above each plot, and the hazards that potentially exist
20	Charles Creek erosion during November 2006 event. Geotechnical and hydraulics study	Thurber Engineering Ltd.	2007	Study of erosion on Charles Creek (8 km north of horseshoe bay) after a November 2006 event.
21	Slope hazard assessment at Lot 7006 Block E Johnson Bay, Indian Arm Provincial Park - Updated report	Horizon Engineering Inc.	2007	Reviews slope hazards for existing house on subject property. This property is on the Carter Creek Fan, and comments on the frequency of debris flows.
22	Proposed residential development, Block E, District Lot 824, Group 1, Indian Arm BC. Geotechnical Report - Slope hazard assessment	Horizon Engineering Inc.	2008	Site located on Clementine Creek. Mentions rockfall potential and colluvium as evidence of previous rock fall

Report No.	Title	Author	Year	Notes
23	"M" Creek residential site - Block 7, Plan 4485, DL 2935, N.W. Group 1 Land District, site protection works	Geopacific Consultants Ltd.	2009	Provide recommendations for protecting a specific lot from Howe Sound waters and debris flows from "M creek".
24	Geotechnical engineering review and assessment. 10 Ocean Point Drive West Vancouver, B.C.	Jecth Consultants Inc.	2009	Recommendations for foundation design and construction of proposed development.
25	Geotechnical and hydrotechnical assessment. Block B, District Lot 7006, Group 1, New Westminster District	AJIA Canadian Building Systems Inc.	2009	Debris flow hazard assessment.
26	Geotechnical and Geohazards assessment, 7094 West Grant Channel, Pitt lake. District Lot 7094, Group 1, New Westminster District	Valley Geotechnical Engineering Services Ltd.	2010	Assess conditions of a site where an old cabin was demolished and a new one was proposed.
27	Block D DL 6955, Group 1, New Westminster District, Owner: Eagle Ridge Mechanical - Garth Moore, Geotechnical assessment (amended 18 December 2009 report)	Lasca Group Technical Services	2010	Reviews hazards on Isherwood Creek.
28	Report on Debris Slide Protection Works Completed July 2010 - "M" Creek Residential Site - Block7	Geopacific Consultants Ltd.	2011	Comments on construction of block wall and debris flow wall for M Creek
29	Geotechnical and Hydrotechnical Assessment for Lot 29 Johnson Bay, Indian Arm, BC	AJIA Canadian Building Systems Inc.	2011	Evaluate slope hazard potential.
30	Engineer/Inspector's Daily Report. RVYC/Generator Building/Wigwam.	Golder Associates	2011	Record of observing fill placement at Wigwam Inn
31	Lot B, DL 7233 on Pitt Lake, BC. Geotechnical assessment	Thurber Engineering Ltd.	2011	Summarizes previous reports on the lot.
32	Terrain Hazard Assessment for DL 7008A	BC Ministry of Forests, Lands and Natural Resource Operations	2012	Landslide hazard assessments for 27 lots in Indian Arm.
33	Terrain Hazard Assessment for DL 7008C	BC Ministry of Forests, Lands and Natural Resource Operations	2012	Landslide hazard assessments for 27 lots in Indian Arm.
34	Terrain Hazard Assessment for DL 7008D	BC Ministry of Forests, Lands and Natural Resource Operations	2012	Landslide hazard assessments for 27 lots in Indian Arm.
35	Terrain Hazard Assessment for DL 7019	BC Ministry of Forests, Lands and Natural Resource Operations	2012	Landslide hazard assessments for 27 lots in Indian Arm.
36	Terrain Hazard Assessment for DL 7026A	BC Ministry of Forests, Lands and Natural Resource Operations	2012	Landslide hazard assessments for 27 lots in Indian Arm.
37	Terrain Hazard Assessment for DL 7026B	BC Ministry of Forests, Lands and Natural Resource Operations	2012	Landslide hazard assessments for 27 lots in Indian Arm.
38	Terrain Hazard Assessment for DL 7058B	BC Ministry of Forests, Lands and Natural Resource Operations	2012	Landslide hazard assessments for 27 lots in Indian Arm.
39	Terrain Hazard Assessment for DL 7058C	BC Ministry of Forests, Lands and Natural Resource Operations	2012	Landslide hazard assessments for 27 lots in Indian Arm.
40	Terrain Hazard assessment for DL 824F	BC Ministry of Forests, Lands and Natural Resource Operations	2012	Landslide hazard assessments for 27 lots in Indian Arm.
41	Terrain Hazard assessment for DL 3150	BC Ministry of Forests, Lands and Natural Resource Operations	2012	Landslide hazard assessments for 27 lots in Indian Arm.
42	Terrain Hazard assessment for DL 3152A	BC Ministry of Forests, Lands and Natural Resource Operations	2012	Landslide hazard assessments for 27 lots in Indian Arm.
43	Terrain Hazard assessment for DL 3152B	BC Ministry of Forests, Lands and Natural Resource Operations	2012	Landslide hazard assessments for 27 lots in Indian Arm.
44	Terrain Hazard assessment for DL 4217B	BC Ministry of Forests, Lands and Natural Resource Operations	2012	Landslide hazard assessments for 27 lots in Indian Arm.
45	Terrain Hazard assessment for DL 6858	BC Ministry of Forests, Lands and Natural Resource Operations	2012	Landslide hazard assessments for 27 lots in Indian Arm.
46	Terrain Hazard assessment for DL 6955E	BC Ministry of Forests, Lands and Natural Resource Operations	2012	Landslide hazard assessments for 27 lots in Indian Arm.
47	Terrain Hazard assessment for DL 6955A	BC Ministry of Forests, Lands and Natural Resource Operations	2012	Landslide hazard assessments for 27 lots in Indian Arm.
48	Terrain Hazard assessment for DL 6955B	BC Ministry of Forests, Lands and Natural Resource Operations	2012	Landslide hazard assessments for 27 lots in Indian Arm.
49	Terrain Hazard assessment for DL 6955C	BC Ministry of Forests, Lands and Natural Resource Operations	2012	Landslide hazard assessments for 27 lots in Indian Arm.
50	Terrain Hazard assessment for DL 6981	BC Ministry of Forests, Lands and Natural Resource Operations	2012	Landslide hazard assessments for 27 lots in Indian Arm.
51	Terrain Hazard assessment for DL 6984A	BC Ministry of Forests, Lands and Natural Resource Operations	2012	Landslide hazard assessments for 27 lots in Indian Arm.
52	Terrain Hazard assessment for DL 6984C	BC Ministry of Forests, Lands and Natural Resource Operations	2012	Landslide hazard assessments for 27 lots in Indian Arm.
53	Terrain Hazard assessment for DL 7006A	BC Ministry of Forests, Lands and Natural Resource Operations	2012	Landslide hazard assessments for 27 lots in Indian Arm.
54	Terrain Hazard assessment for DL 7006C	BC Ministry of Forests, Lands and Natural Resource Operations	2012	Landslide hazard assessments for 27 lots in Indian Arm.
55	Terrain Hazard assessment for DL 7006D	BC Ministry of Forests, Lands and Natural Resource Operations	2012	Landslide hazard assessments for 27 lots in Indian Arm.
56	Terrain Hazard assessment for DL 7006E	BC Ministry of Forests, Lands and Natural Resource Operations	2012	Landslide hazard assessments for 27 lots in Indian Arm.
57	Terrain Hazard assessment for DL 7006F	BC Ministry of Forests, Lands and Natural Resource Operations	2012	Landslide hazard assessments for 27 lots in Indian Arm.

Report No.	Title	Author	Year	Notes
58	Terrain Hazard assessment for DL 7006H	BC Ministry of Forests, Lands and Natural Resource Operations	2012	Landslide hazard assessments for 27 lots in Indian Arm.
59	Terrain Hazard assessment for DL 7007B	BC Ministry of Forests, Lands and Natural Resource Operations	2012	Landslide hazard assessments for 27 lots in Indian Arm.
60	Proposed renovation of home and slope stability concerns - 4 Montizambert Wynd, West Vancouver, BC	Geotek Designs	2012	Reviews of the foundation excavations for the funicular proposed for the area adjacent to the north property line of the lot. Property that crosses Sclufield Creek, within "Montizambert Wynd", looking to do renovations.
61	Geotechnical Assessment proposed funicular foundations for Block 3 Montizambert Wynd	Islay Engineering Services Inc	2014	Reviews of the foundation excavations for the funicular proposed for the area adjacent to the north property line of the lot
62	Geotechnical hazard assessment, Private cabin on Pitt Lake, Blk 1, District Lot 3022, Group 1, NWD - North of Cozen Point - Pitt Lake	Braun Geotechnical Ltd.	2014	Assess and evaluate terrain hazard conditions with potential to impact the existing partially constructed residential cabin at the site
63	Geomorphology for the Indian River watershed: observations bearing on archeological site visibility.	Cordilleran Geoscience	2015	Discusses the deglacial and early post-glacial period deposits along with present day activity of the fans as it relates to the archeological potential of sites in the Indian River area.
64	Reservoir fill slope sign off	Cordilleran Geoscience	2015	Battani Creek reservoir (Howe Sound) fill slope required pullback to reduce the risk to downslope resources. Cordilleran Geoscience reviewed the work done on the reservoir fill slope pullback.
65	Geotechnical investigation report - Proposed residential development on lot 3 Ocean Point Drive	Geopacific Consultants Ltd.	2015	Geotech review and provides recommendations for design and construction of the proposed development. Includes slope stability analysis results
66	Application preventative maintenance dredging between Mile 20 bridge on CN's Squamish Subdivision and the Highway 99 Bridge over M (Yahoo) Creek	Canadian National Railway	2016	Application for maintenance dredging between CN and Ministry of Transportation and Infrastructure bridges
67	Geotechnical report to support recently constructed domestic water catchment and distribution system, Montizambert Creek, West Vancouver, BC	Cordilleran Geoscience	2016	Reviewed the water system for Montizambert Wynd subdivision from intake to termination making observations of terrain conditions at the site.
68	Revised geotechnical engineering report for proposed new single family residence at lot 12, Strachan Point Road, West Vancouver, BC	Phillips Engineering Ltd.	2016	Engineering recommendations on building.
69	Georisk assessment, 16 East Crocker Point, Indian Arm, near Vancouver, BC.	Cordilleran Geoscience	2017	Quantitative geohazard risk assessment for district lot 6921 F.
70	Geotechnical review - Natural hazards statement for new residential structure on #7 Montizambert Wynd, West Vancouver, B.C.	Terrane Geotechnical Group	2019	Determined whether the site is subject to natural hazards that would preclude "safe" development and prepare a natural hazard statement.
71	Landslide risk assessment, Moonshine Bay, Pitt Lake	Cordilleran Geoscience	2020	Notes on slide that hit Moonshine Bay in 1990
72	Gazebo building permit application. 17 Strachan Point Road, Metro Vancouver, BC. Geotechnical slope hazard assessment report	Horizon Engineering Inc.	2020	Describes some potential rockfall hazard to the gazebo
73	Study to determine the appropriate flood construction level at Barnston Island	Associated Engineering	2021	Provides guidance on the establishment of a flood construction level for Barnston island and potential additional flood mitigation recommendations
74	Geotechnical assessment for proposed new residence and detached garage/carriage house located at 6 Strachan Point Road, West Vancouver, B.C.	Phillips and Associates Engineering Consultants Ltd.	2021	Provides subsoil information and recommendations for site prep, foundation design etc. Discusses that lot is on the debris flow deposits of Charles Creek
75	Slope Stability Assessment for Proposed Residence Located at 6 Strachan Point Road, West Vancouver, B.C.	Phillips and Associates Engineering Consultants Ltd.	2021	Rock slope hazard assessment
76	Geotechnical Summary Report. Proposed renovation. Lot 49, Passage Island, BC	Horizon Engineering Inc.	2021	No mention of any landslide hazards

Notes: * Spelling used in the original report

Table A2: Aerial photograph consulted

Year	Flight line	Photograph	Project area
1952	BC 1632	26 to 35	Indian Arm
1952	BC 1632	47 to 55	Indian Arm
1952	BC 1632	102 and 103	Indian Arm
1952	BC 1633	40 to 43	Indian Arm
1952	BC 1634	59 to 64	Howe Sound
1953	BC 1806	68 to 78	Pitt Lake
1953	BC 1806	107 to 109	Pitt Lake
1953	BC 1807	1 and 2	Pitt Lake
1953	BC 1816	102 to 106	Pitt Lake
1957	BC 2326	69 to 74	Pitt Lake
1957	BC 2326	108 to 114	Pitt Lake
1957	BC 2327	1 to 5	Pitt Lake
1957	BC 2327	35 to 49	Pitt Lake
1957	BC 2336	79 to 98	Pitt Lake
1957	BC 2337	17 to 37	Pitt Lake
1957	BC 2337	103 to 108	Pitt Lake
1957	BC 2338	1 to 7	Pitt Lake
1957	BC 2338	63 to 65	Indian Arm
1957	BC 2339	75 to 89	Indian Arm
1957	BC 2340	30 to 48	Indian Arm
1957	BC 2341	45 to 47	Indian Arm
1957	BC 2341	63 to 81	Indian Arm
1957	BC 2345	93 to 107	Indian Arm
1957	BC 2346	61 to 75	Indian Arm
1957	BC 2347	20 to 27	Indian Arm
1957	BC 2347	80 to 82	Indian Arm
1957	BC 2348	75 to 84	Howe Sound
1957	BC 2349	18 to 29	Howe Sound
1957	BC 2349	49 to 53	Howe Sound
1992	BCB92018	136 and 137	Indian Arm
1992	BCB92018	45	Belcarra
1984	BC84016	77 and 78	Belcarra

Table A-3: Publicly available lidar consulting for this project

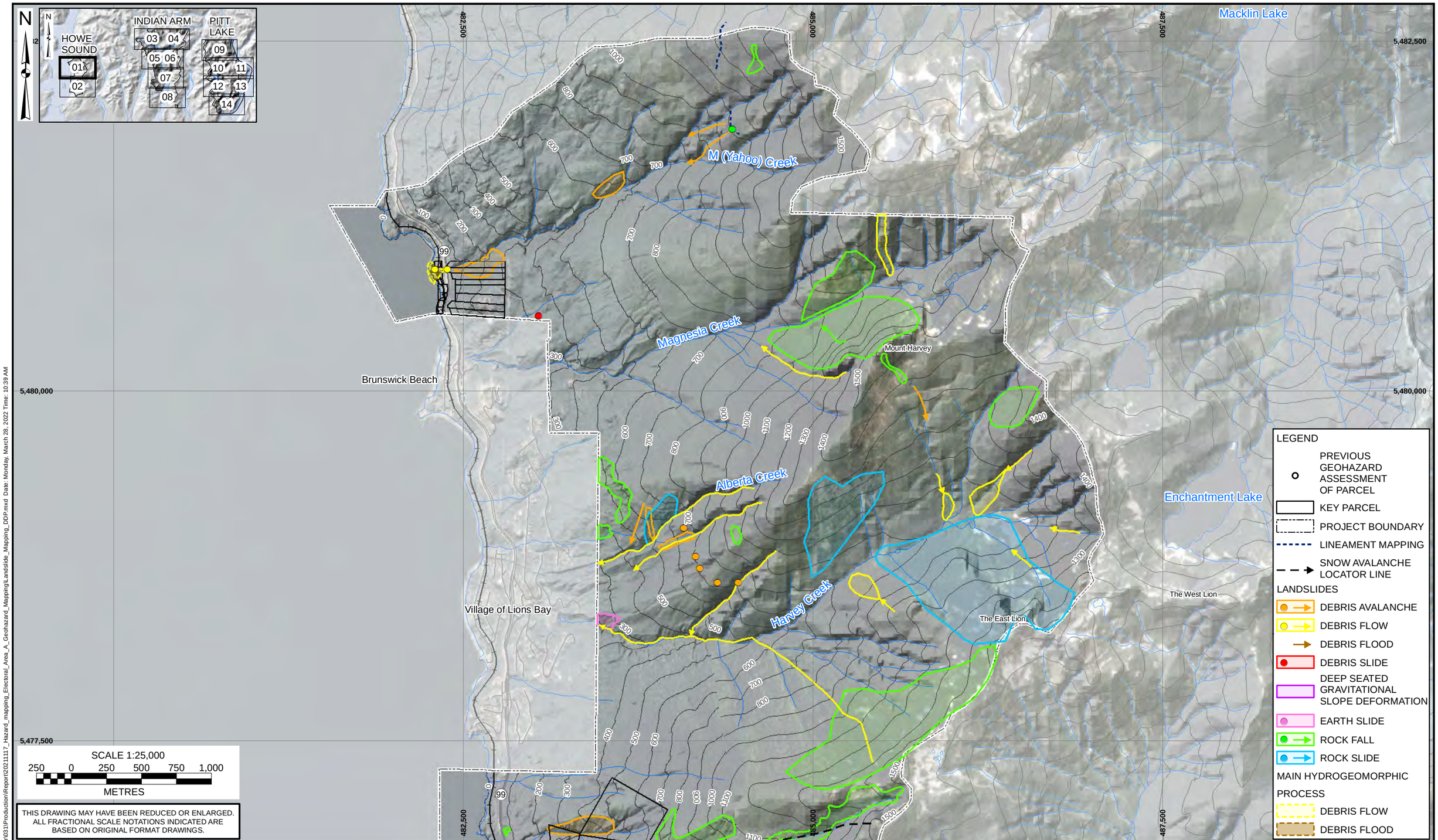
Tile	Source	Year	Resolution
bc_092g017_xl1m_utm10_170714	BC Government	2016	1 m
bc_092g026_xl1m_utm10_170713	BC Government	2016	1 m
bc_092g027_xl1m_utm10_170713	BC Government	2016	1 m
bc_092g034_xl1m_utm10_2019	BC Government	2019	1 m
bc_092g036_xl1m_utm10_170713	BC Government	2016	1 m
bc_092g044_xl1m_utm10_2019	BC Government	2019	1 m
bc_092g045_xl1m_utm10_170713	BC Government	2016	1 m
bc_092g046_xl1m_utm10_170713	BC Government	2016	1 m
dtm_1m_utm10_e_1_146	Natural Resource Canada	2016	1m
dtm_1m_utm10_e_2_146	Natural Resource Canada	2019	1m
dtm_1m_utm10_e_2_147	Natural Resource Canada	2019	1m
dtm_1m_utm10_e_2_147	Natural Resource Canada	2020	1m
dtm_1m_utm10_e_2_148	Natural Resource Canada	2019	1m
dtm_1m_utm10_e_2_148	Natural Resource Canada	2020	1m
dtm_1m_utm10_e_3_146	Natural Resource Canada	2019	1m
dtm_1m_utm10_e_3_147	Natural Resource Canada	2019	1m
dtm_1m_utm10_e_3_148	Natural Resource Canada	2019	1m

APPENDIX B
GEOHAZARD MAPPING ATTRIBUTES

Table B1: List of attributes for each GIS file

File name	Attribute	Possible values	Additional information
Landslide_mapping_points.shp	Slide_YN	Yes or no	Occurrence of a landslide
	Hazard_Typ	Debris flood, debris flow, debris avalanche, earth slide, rock fall, rock slide, rock avalanche	Landslide type according to Hungr et al. 2014 classification
	Reference	Site assessment report from which information was extracted	
Previous_parcel_assessment.shp	Parcel	First jurisdiction - roll number	
	Reference	Site assessment report from which information was extracted	
Landslide_mapping_lines.shp	Haz_type	Landslide type according to Hungr et al. 2014 classification	
	Reference	Source from which information was extracted	New mapping is referenced as BGC 2022
	Comment	Freeform field for additional details on the hazard	
	Hazard	Event or potential	
Lineament_mapping.shp	Reference	Source from which information was extracted	New mapping is referenced as BGC 2022
	Comment	lidar review or date of imagery	
	Hazard	Potential	All lineaments are considered potential hazard
Snow_avalanche_mapping_lines.shp	Source	Google Earth or aerial photograph	
	Process	Snow avalanche	
Landslide_mapping_polygons.shp	Haz_type	Landslide type according to Hungr et al. 2014 classification	
	Reference	Source from which information was extracted	New mapping is referenced as BGC 2022
	Comment	Freeform field for additional details on the hazard	
	Hazard	Event or potential	
Landslide_mapping_fans.shp	Reference	Source from which information was extracted	New mapping is referenced as BGC 2022
	MainProcess	Flood, debris flood, debris flow	
SRTM_derived_coastal_inundation.shp	Reference	BGC, 2022	New analysis performed for this project
lidar_derived_coastal_inundation.shp	Reference	BGC, 2022	New analysis performed for this project
Riverine_flooding.shp	Source	CDED	Dataset used for the analysis
	Reference	BGC, 2022	New analysis performed for this project

DRAWINGS



LEGEND

- PREVIOUS GEOHAZARD ASSESSMENT OF PARCEL
- KEY PARCEL
- PROJECT BOUNDARY
- LINEAMENT MAPPING
- SNOW AVALANCHE LOCATOR LINE

LANDSLIDES

- DEBRIS AVALANCHE
- DEBRIS FLOW
- DEBRIS FLOOD
- DEBRIS SLIDE
- DEEP SEATED GRAVITATIONAL SLOPE DEFORMATION
- EARTH SLIDE
- ROCK FALL
- ROCK SLIDE

MAIN HYDROGEOMORPHIC PROCESS

- DEBRIS FLOW
- DEBRIS FLOOD

SCALE 1:25,000

250 0 250 500 750 1,000

METRES

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CLIENT: metro vancouver

BGC

PROJECT: **ELECTORAL AREA A - GEOHAZARD MAPPING**

TITLE: **LANDSLIDE MAPPING HOWE SOUND**

PROJECT No.: **0431031**

DWG No: **L 01**

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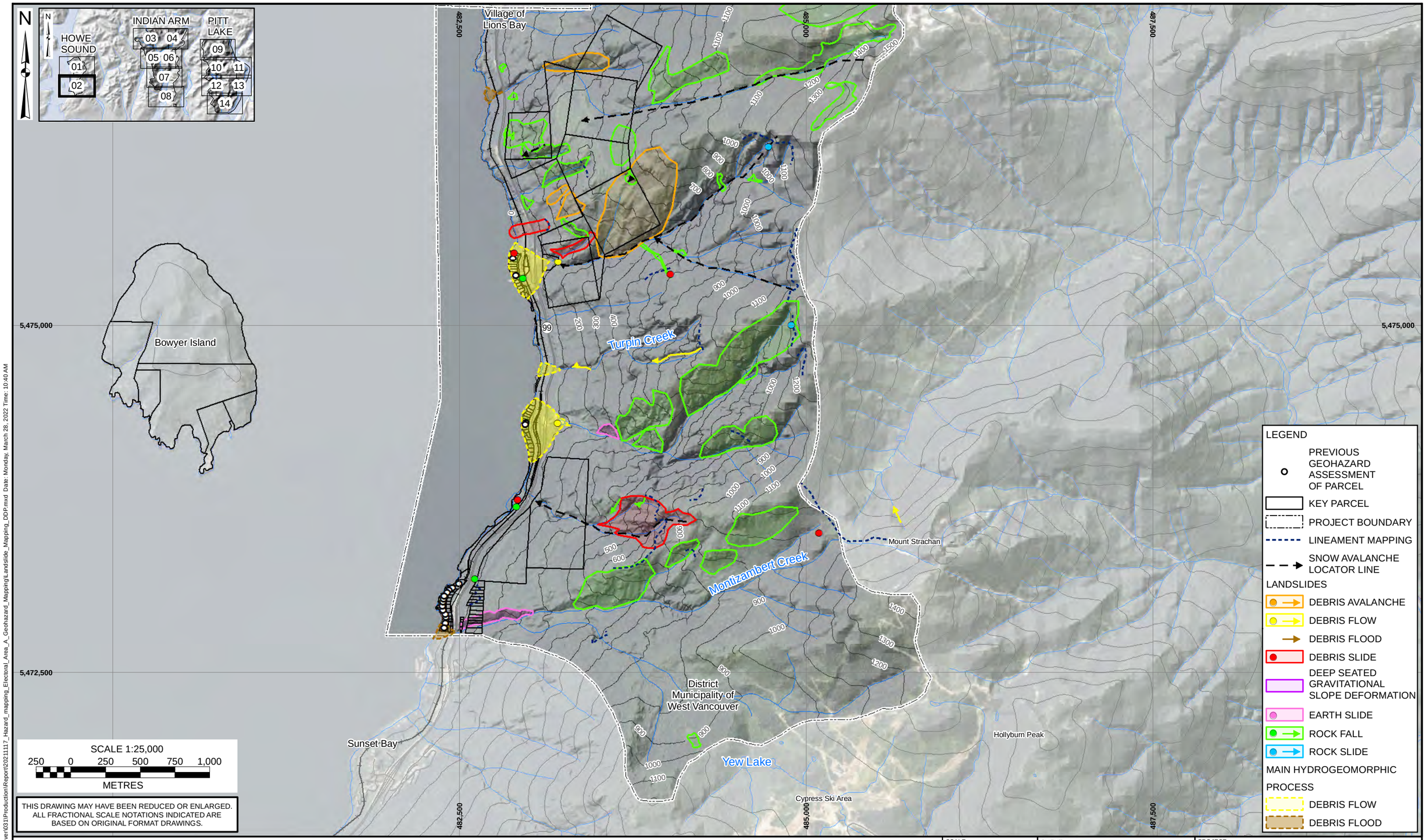

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BGC

PROJECT: **ELECTORAL AREA A - GEOHAZARD MAPPING**

TITLE: **LANDSLIDE MAPPING HOWE SOUND**

PROJECT No.: **0431031**

DWG No: **L 02**

LEGEND

- KEY PARCEL
- PROJECT BOUNDARY

LANDSLIDES

- DEBRIS AVALANCHE
- DEBRIS FLOW
- DEBRIS FLOOD
- DEBRIS SLIDE
- DEEP SEATED GRAVITATIONAL SLOPE DEFORMATION
- EARTH SLIDE
- ROCK FALL
- ROCK SLIDE

MAIN HYDROGEOMORPHIC PROCESS

- DEBRIS FLOW
- DEBRIS FLOOD

Indian River
Young Creek
Don Lake
Young Lake
Brandt Creek
Norton Creek
Norton Lake
Forestry Creek
Indian River
Hixon Creek

502,500 505,000 507,500 510,000
5,490,000
5,487,500
5,485,000

INDEX MAP

HOWE SOUND: 01, 02
INDIAN ARM: 03, 04, 05, 06, 07, 08
PITT LAKE: 09, 10, 11, 12, 13, 14

SCALE 1:25,000

250 0 250 500 750 1,000

METRES

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BGC

PROJECT: ELECTORAL AREA A - GEOHAZARD MAPPING

TITLE: LANDSLIDE MAPPING INDIAN ARM

PROJECT No.: 0431031

DWG No: L 03

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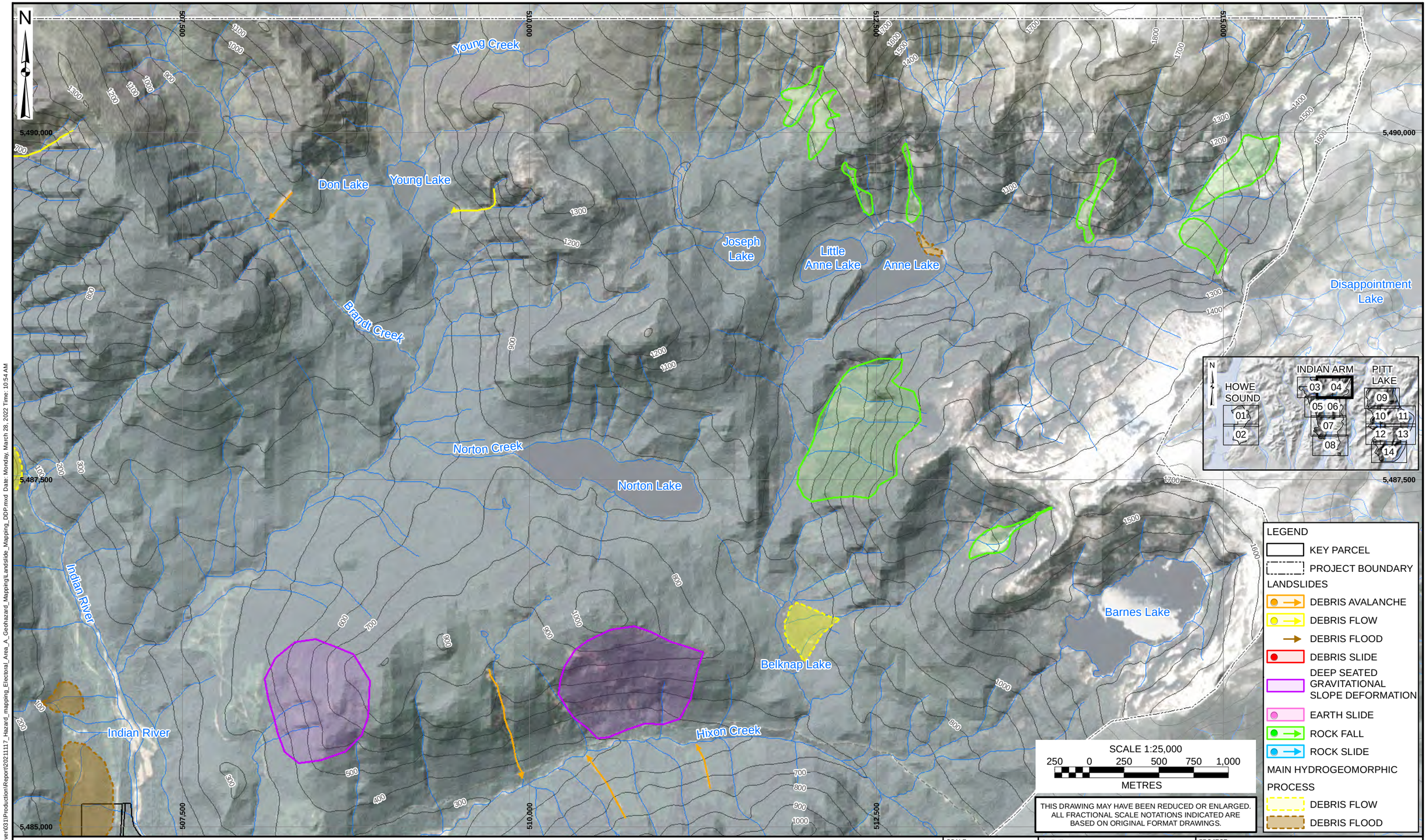

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PROJECT: **ELECTORAL AREA A - GEOHAZARD MAPPING**

TITLE: **LANDSLIDE MAPPING INDIAN ARM**

PROJECT No.: **0431031**

DWG No: **L 04**

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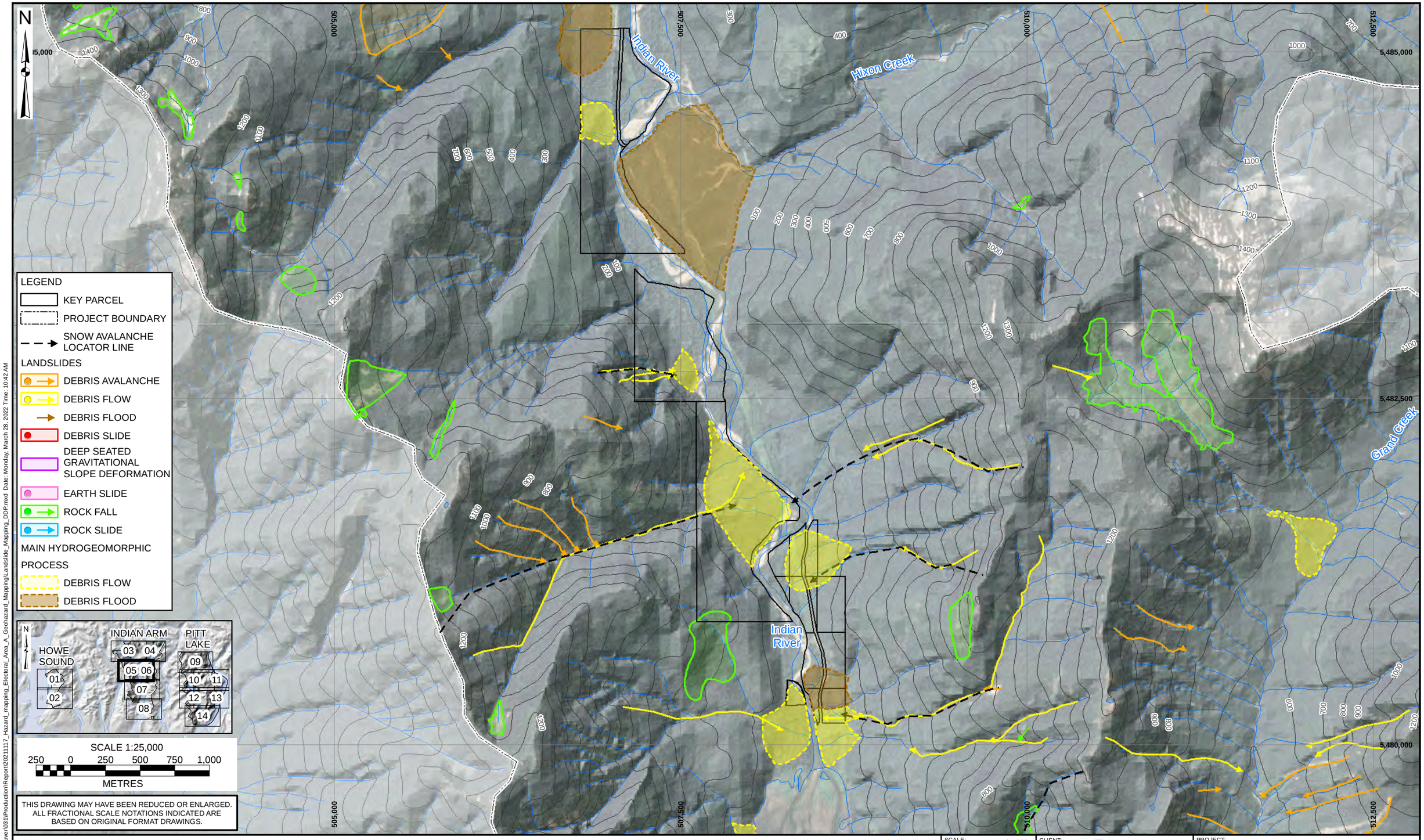

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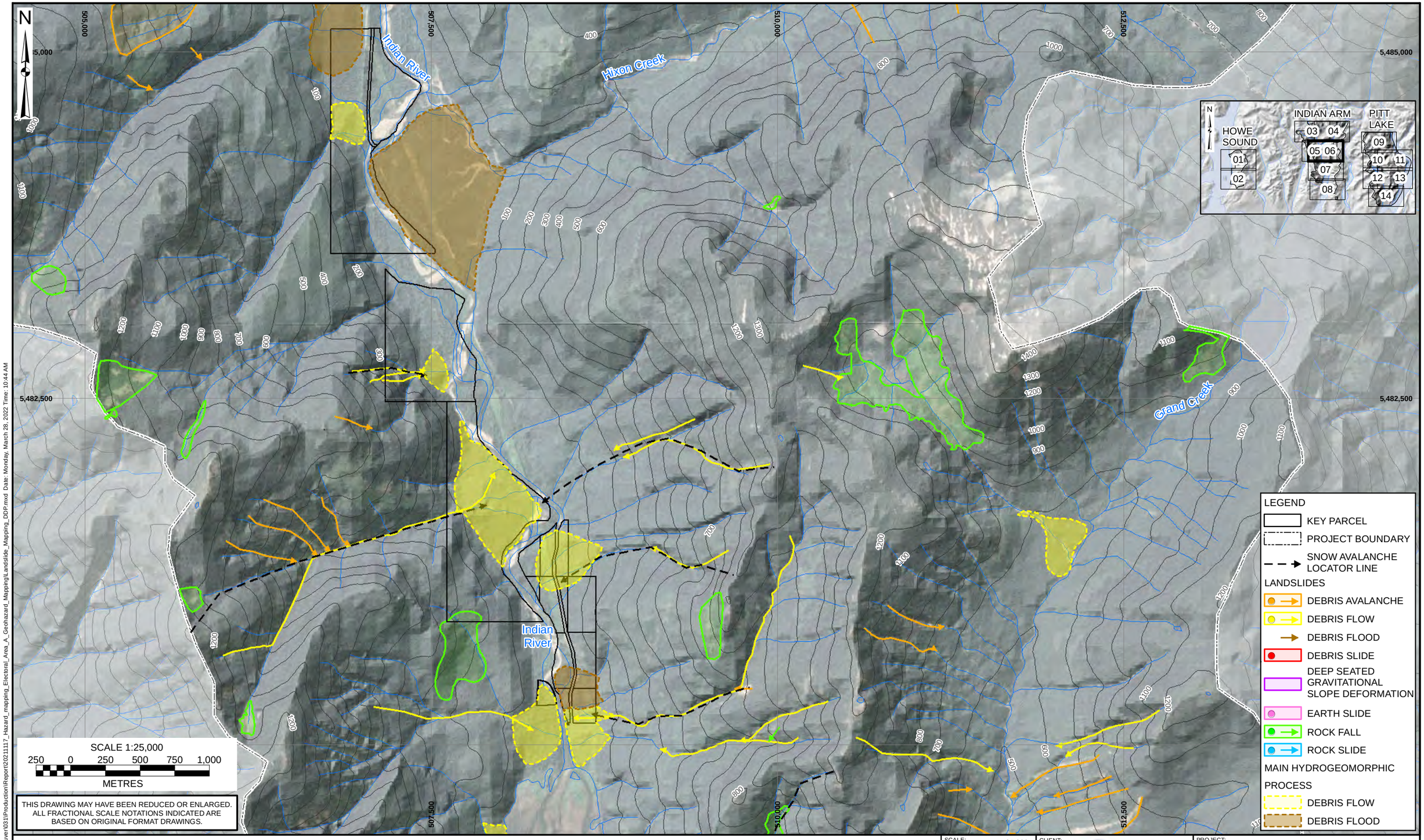
PROJECT: ELECTORAL AREA A - GEOHAZARD MAPPING

TITLE: LANDSLIDE MAPPING INDIAN ARM

PROJECT No.:	DWG No:
0431031	L 05



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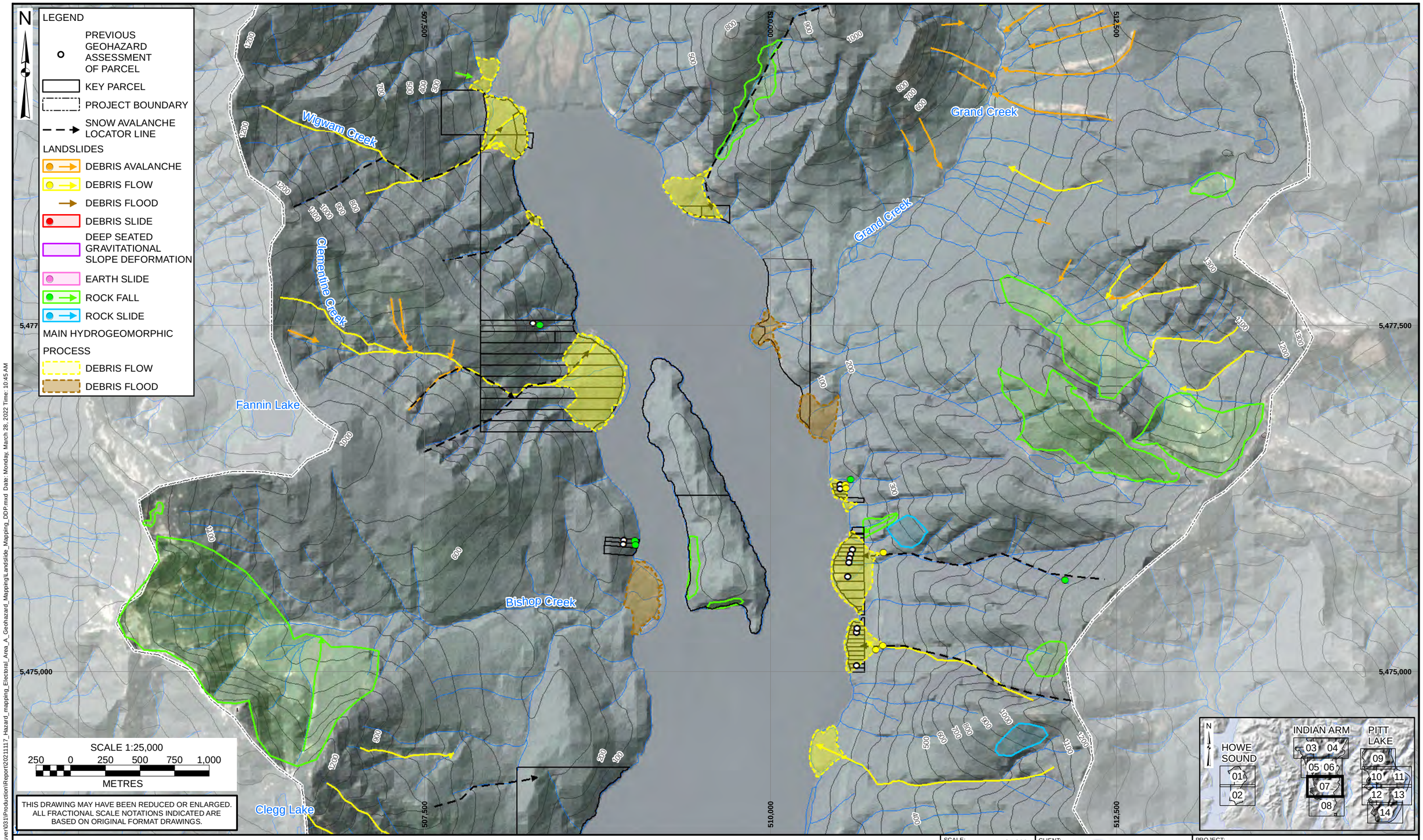
PROJECT: **ELECTORAL AREA A - GEOHAZARD MAPPING**

TITLE: **LANDSLIDE MAPPING INDIAN ARM**

PROJECT No.:	DWG No:
0431031	L 06



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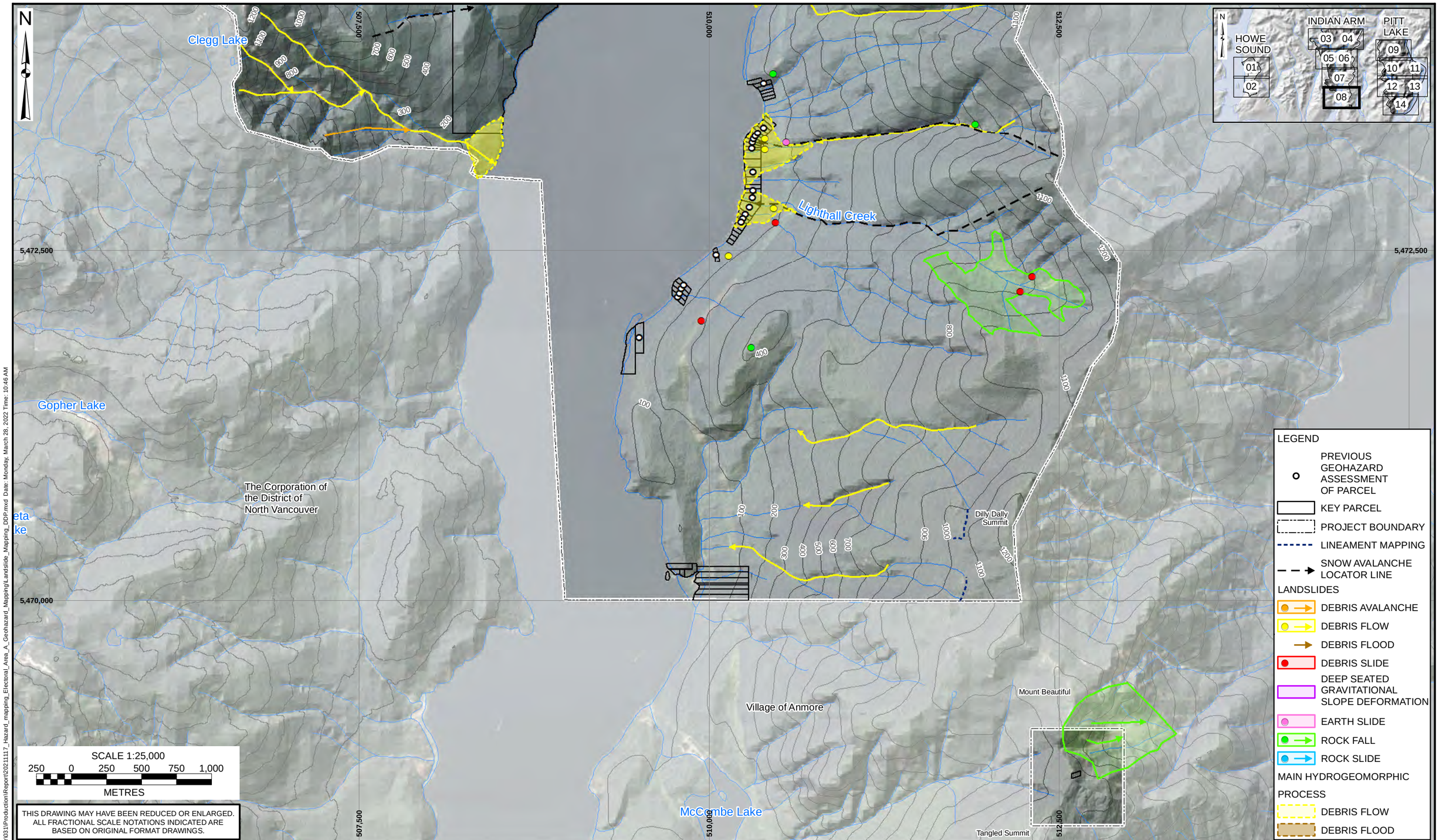
BGC

PROJECT: ELECTORAL AREA A - GEOHAZARD MAPPING

TITLE: LANDSLIDE MAPPING INDIAN ARM

PROJECT No.: 0431031

DWG No: L 07



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CLIENT: metro vancouver

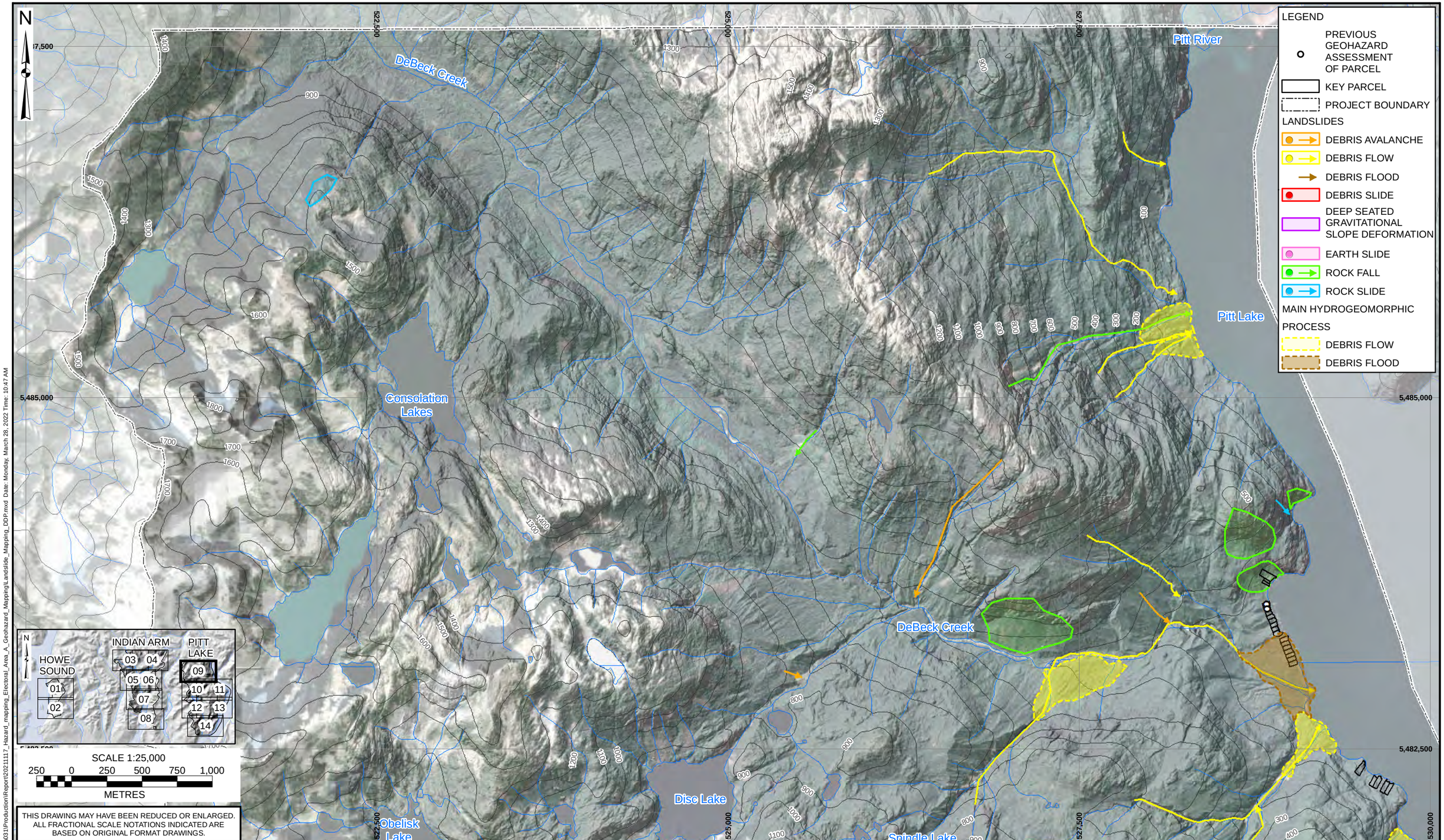
BGC

PROJECT: **ELECTORAL AREA A - GEOHAZARD MAPPING**

TITLE: **LANDSLIDE MAPPING INDIAN ARM**

PROJECT No.: **0431031**

DWG No: **L 08**



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DATE:	MAR 2022
DRAWN:	LL
REVIEW:	KH
APPROVED:	MAB

CLIENT: metro vancouver

BGC

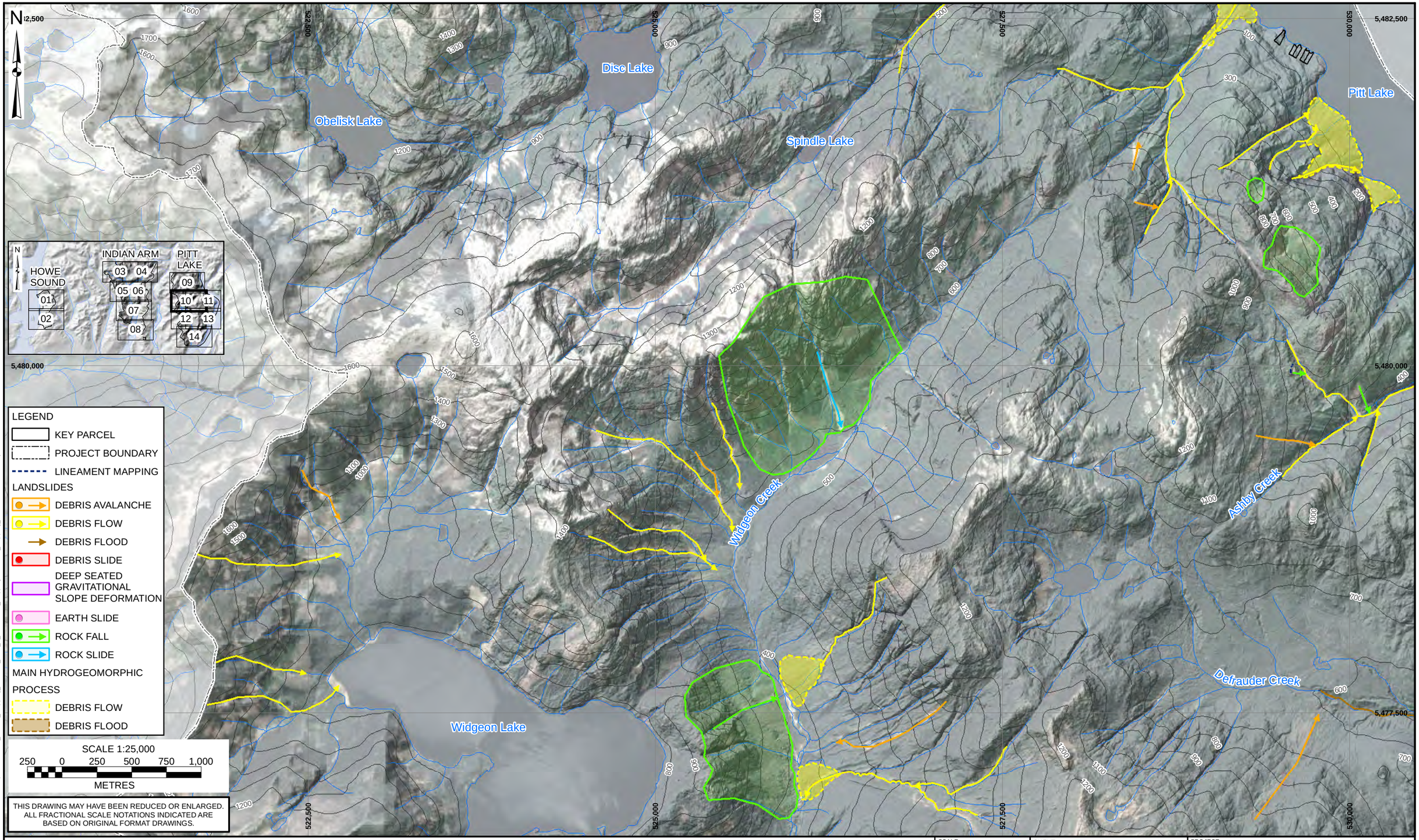
PROJECT: ELECTORAL AREA A - GEOHAZARD MAPPING

TITLE: LANDSLIDE MAPPING PITT LAKE

PROJECT No.: 0431031

DWG No: L 09

X:\Projects\0431 MetroVancouver\031\Production\Report\20211117_Hazard_mapping_Electoral_Area_A_Geohazard_Mapping\Landslide_Mapping_DDP.mxd Date: Monday, March 28, 2022 Time: 10:47 AM



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NOTES:

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DATE:	MAR 2022
DRAWN:	LL
REVIEW:	KH
APPROVED:	MAB

CLIENT: metro vancouver

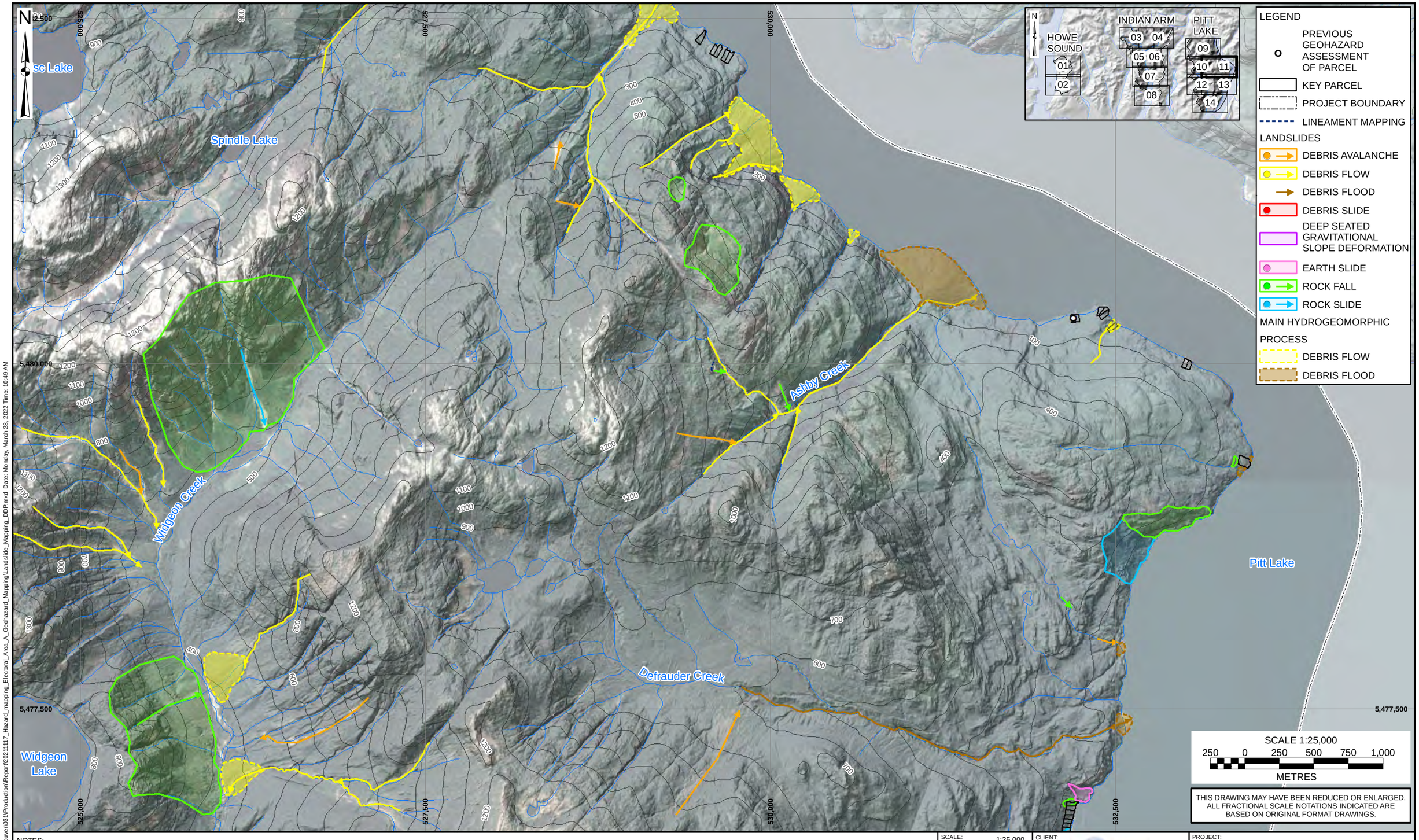
BGC

PROJECT: ELECTORAL AREA A - GEOHAZARD MAPPING

TITLE: LANDSLIDE MAPPING PITT LAKE

PROJECT No.: 0431031

DWG No: L 10



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DATE:	MAR 2022
DRAWN:	LL
REVIEW:	KH
APPROVED:	MAB

CLIENT: metro vancouver

BGC

PROJECT: **ELECTORAL AREA A - GEOHAZARD MAPPING**

TITLE: **LANDSLIDE MAPPING PITT LAKE**

PROJECT No.: **0431031**

DWG No: **L 11**

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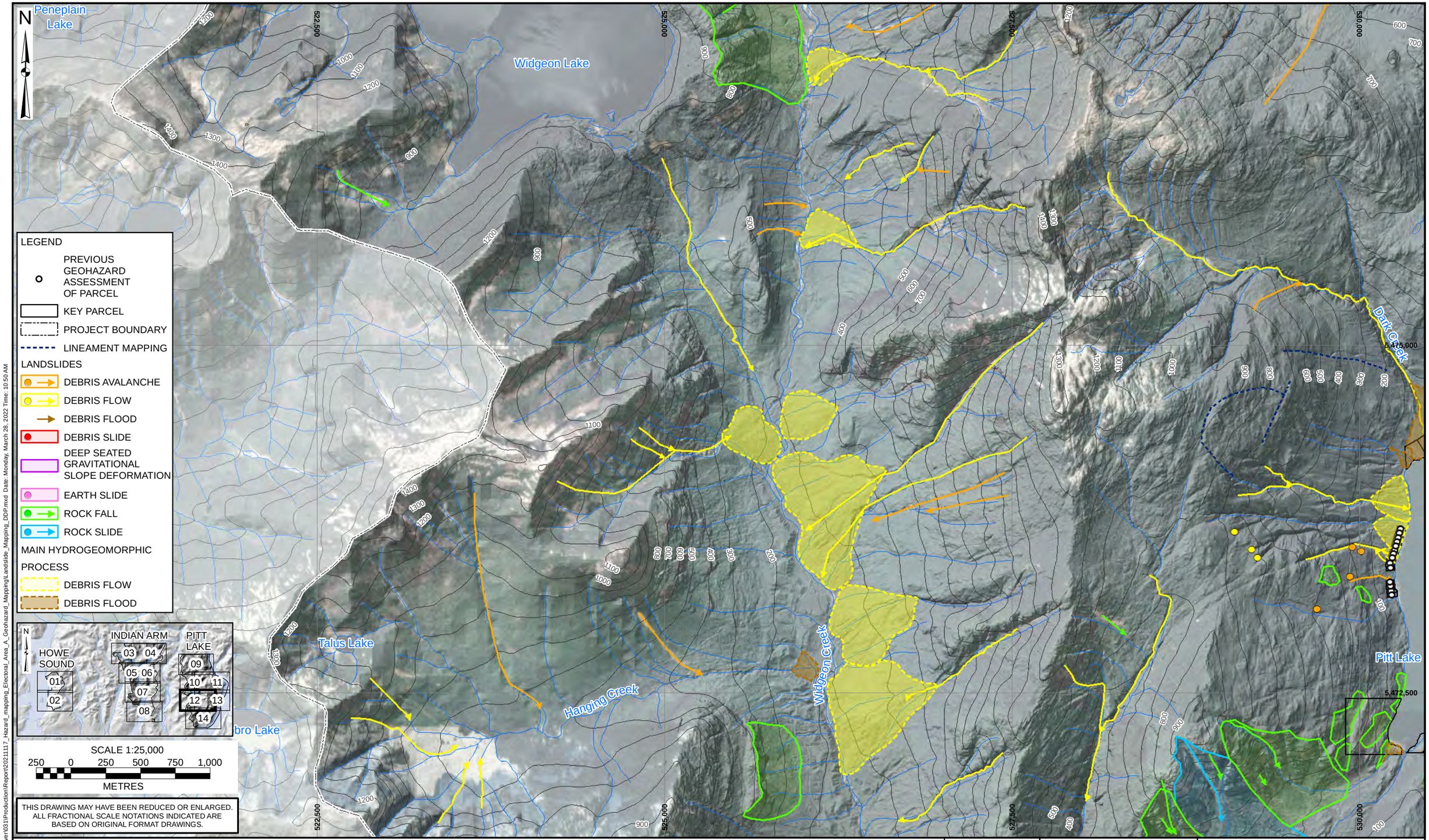

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SCALE:	1:25,000
DATE:	MAR 2022
DRAWN:	LL
REVIEW:	KH
APPROVED:	MAB

CLIENT: metro vancouver

BGC

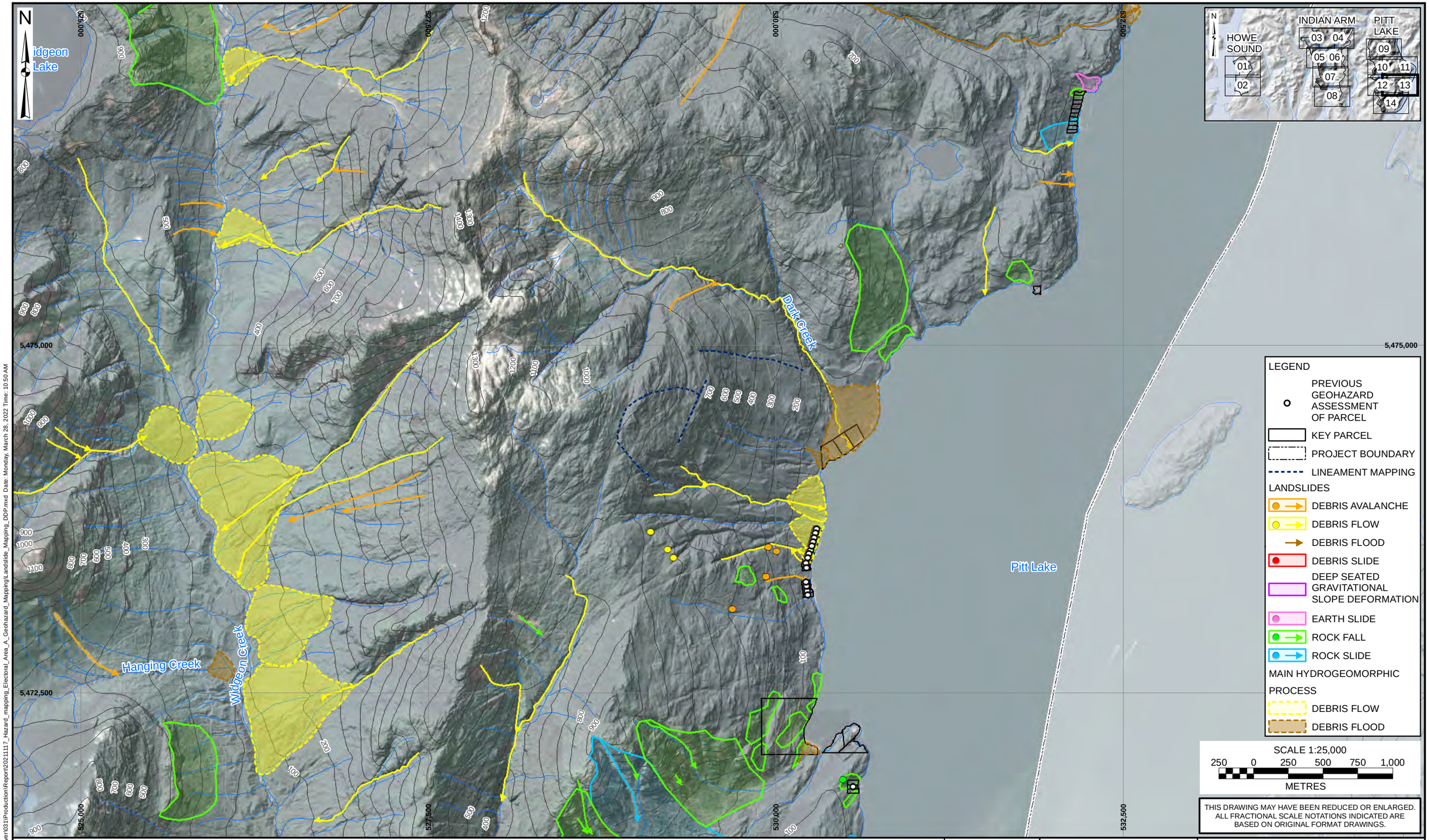
PROJECT: ELECTORAL AREA A - GEOHAZARD MAPPING

TITLE: LANDSLIDE MAPPING PITT LAKE

PROJECT No.: 0431031

DWG No: L 12

X:\Projects\0431 Metro Vancouver\031\Production\Report\20211117_Hazard_mapping_Electoral_Area_A_Geohazard_Mapping\Landslide_Mapping_DDP.mxd Date: Monday, March 28, 2022 Time: 10:50 AM



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DATE:	MAR 2022
DRAWN:	LL
REVIEW:	KH
APPROVED:	MAB

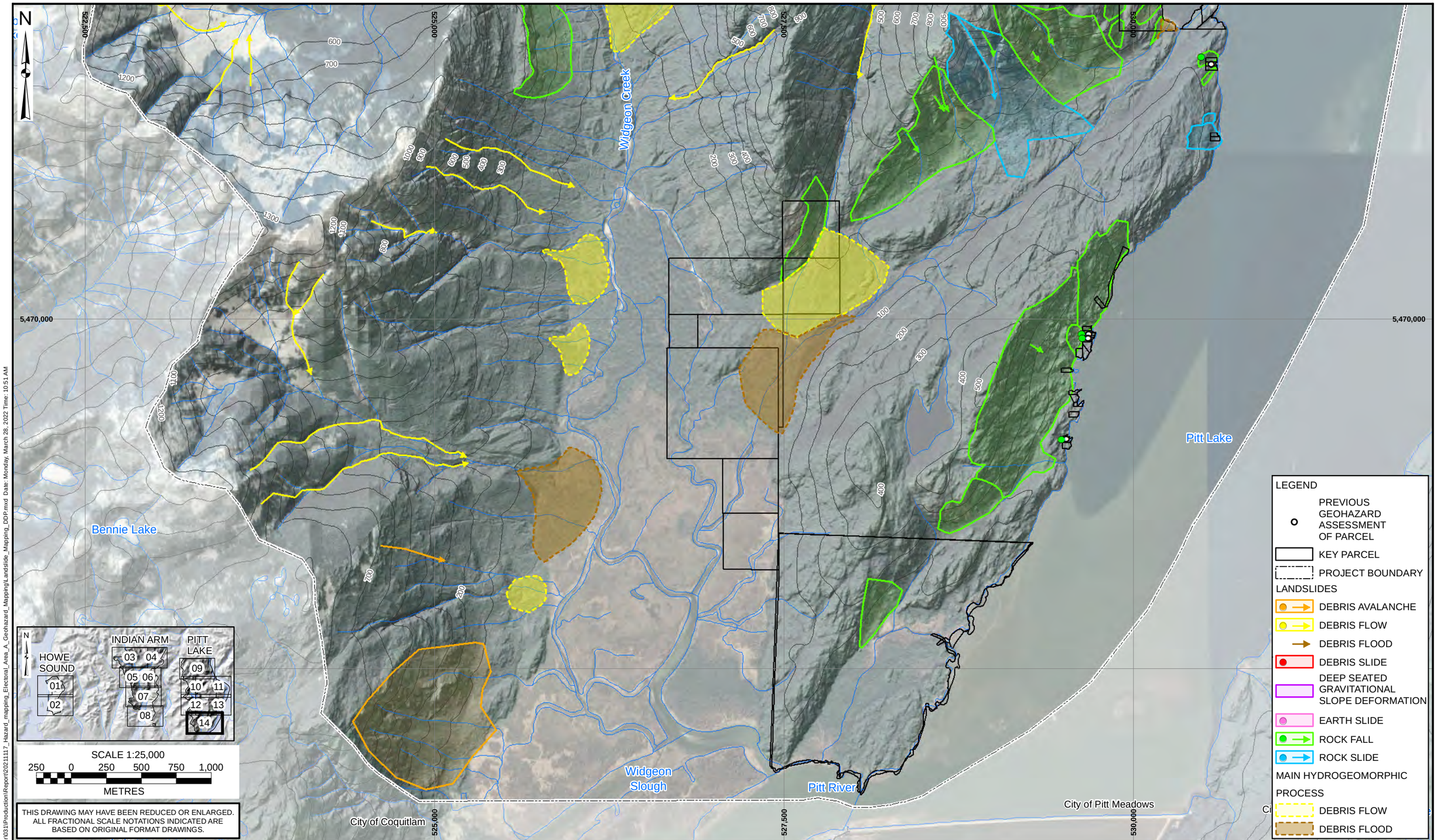
CLIENT: metro vancouver

BGC

PROJECT: **ELECTORAL AREA A - GEOHAZARD MAPPING**

TITLE: **LANDSLIDE MAPPING PITT LAKE**

PROJECT No.:	DWG No:
0431031	**L 13**



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SCALE:	1:25,000
DATE:	MAR 2022
DRAWN:	LL
REVIEW:	KH
APPROVED:	MAB

CLIENT: metro vancouver

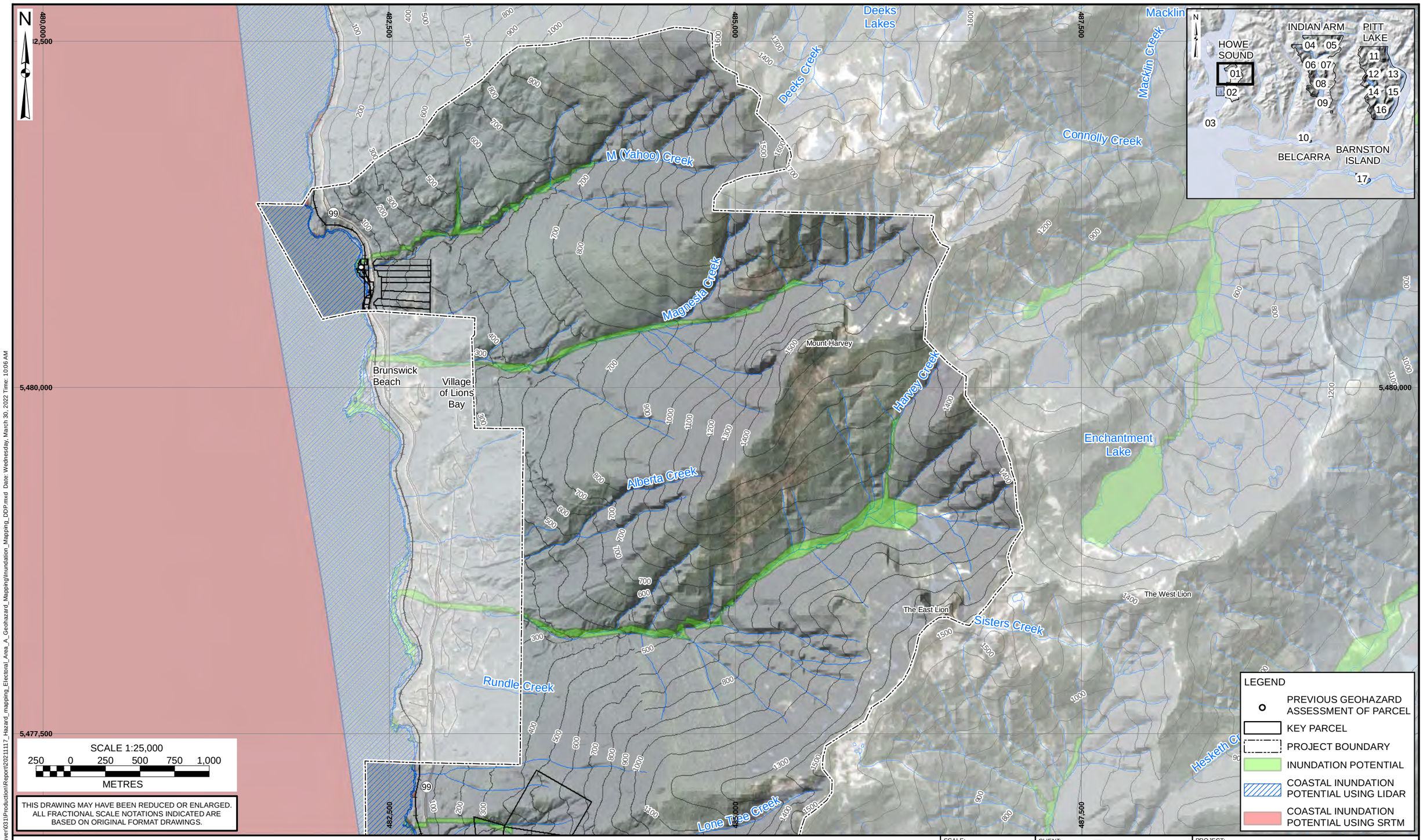
BGC

PROJECT: ELECTORAL AREA A - GEOHAZARD MAPPING

TITLE: LANDSLIDE MAPPING PITT LAKE

PROJECT No.: 0431031

DWG No: L 14



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SCALE:	1:25,000
DATE:	MAR 2022
DRAWN:	LL
REVIEW:	KH
APPROVED:	MAB

CLIENT: metro vancouver

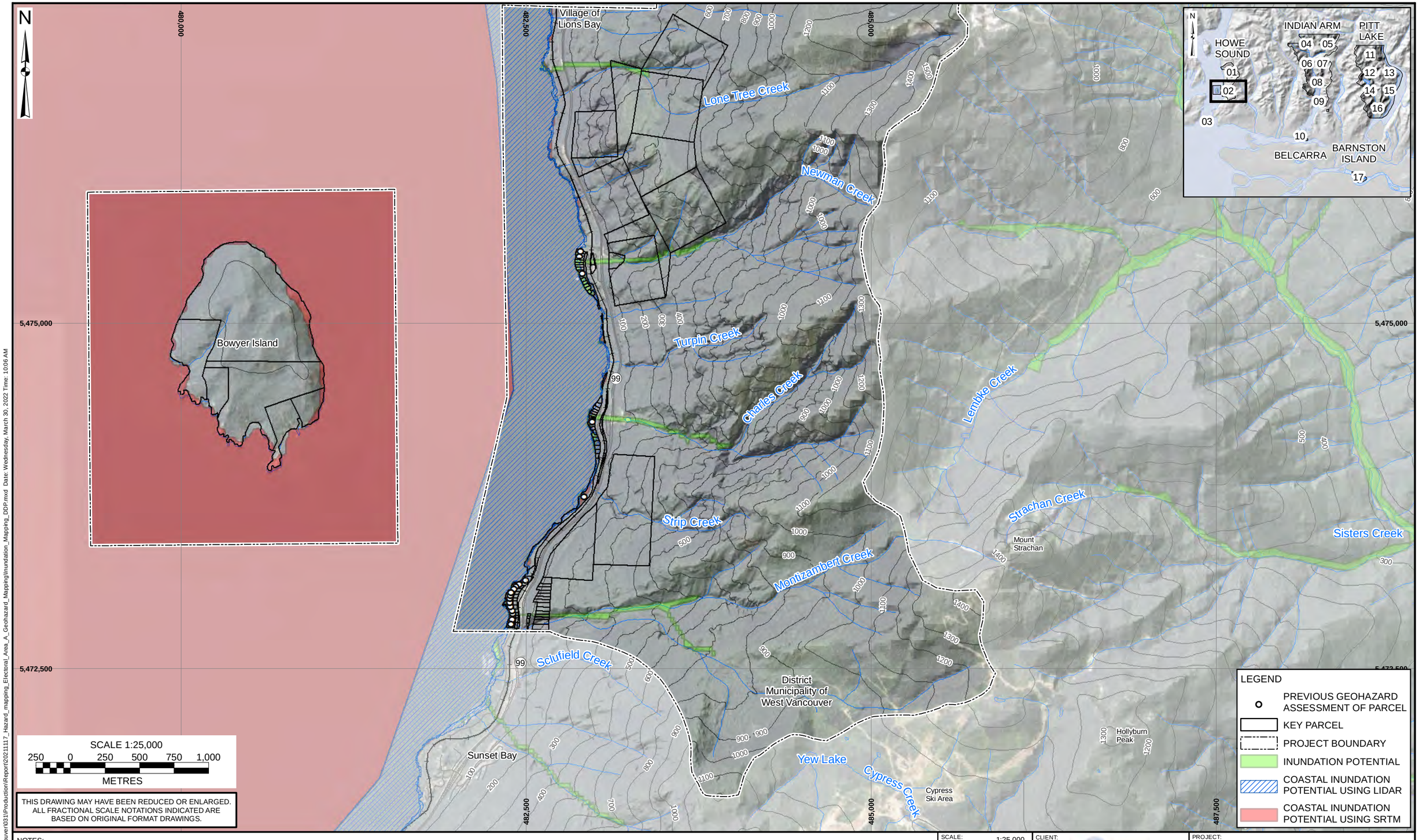
BGC

PROJECT: **ELECTORAL AREA A - GEOHAZARD MAPPING**

TITLE: **INUNDATION MAPPING HOWE SOUND**

PROJECT No.: **0431031**

DWG No: **I 01**



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SCALE:	1:25,000
DATE:	MAR 2022
DRAWN:	LL
REVIEW:	KH
APPROVED:	MAB

CLIENT: metro vancouver

BGC

PROJECT: ELECTORAL AREA A - GEOHAZARD MAPPING

TITLE: INUNDATION MAPPING HOWE SOUND

PROJECT No.: 0431031

DWG No: I 02

X:\Projects\0431 MetroVancouver\0331\Production\Report\20211117_Hazard_mapping_Electoral_Area_A_Geohazard_Mapping\Inundation_Mapping_DDP.mxd Date: Wednesday, March 30, 2022 Time: 10:06 AM

N

475,000

477,500

480,000

5,467,500

5,465,000

Emerald Creek

Optimist Creek

Bowen Island Municipality

Warwick Creek

Josephine Creek

Lee Creek

Horseshoe Bay Terminal

Eagle Island

Fishermans Cove

Passage Island

District Municipality of West Vancouver

Eagle Harbour

Caulfeild

Point Atkinson

HOWE SOUND

INDIAN ARM

PITT LAKE

BELCARRA

BARNSTON ISLAND

01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17

SCALE 1:25,000

250 0 250 500 750 1,000

METRES

THIS DRAWING MAY HAVE BEEN REDUCED OR ENLARGED. ALL FRACTIONAL SCALE NOTATIONS INDICATED ARE BASED ON ORIGINAL FORMAT DRAWINGS.

LEGEND

- PREVIOUS GEOHAZARD ASSESSMENT OF PARCEL
- KEY PARCEL
- PROJECT BOUNDARY
- COASTAL INUNDATION POTENTIAL USING LIDAR
- COASTAL INUNDATION POTENTIAL USING SRTM

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CLIENT: metro vancouver

BGC

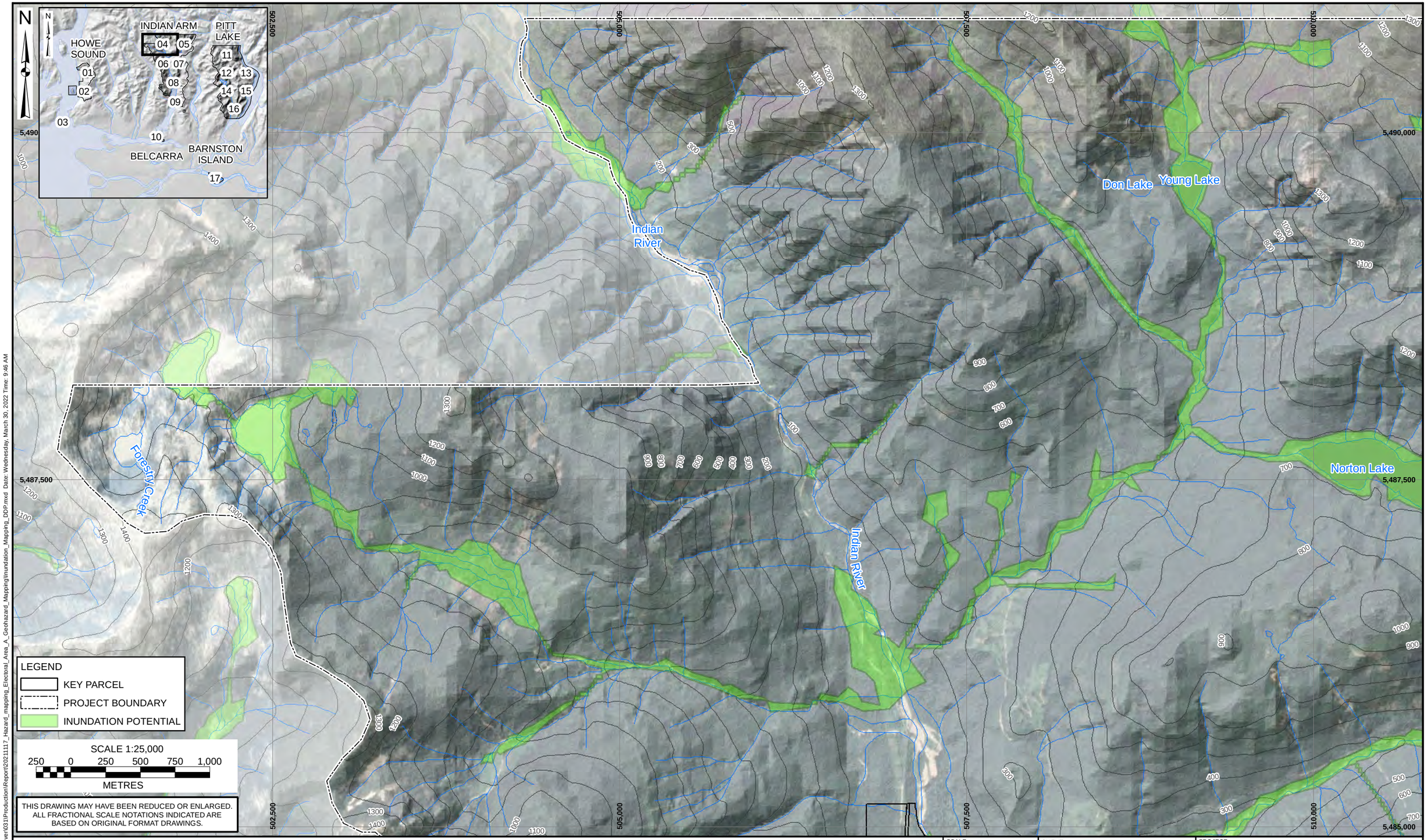
PROJECT: ELECTORAL AREA A - GEOHAZARD MAPPING

TITLE: INUNDATION MAPPING HOWE SOUND

PROJECT No.: 0431031

DWG No: I 03

X:\Projects\0431 MetroVancouver\031\Production\Report\20211117_Hazard_mapping_Electoral_Area_A_Geohazard_Mapping\Inundation_Mapping_DDP.mxd Date: Wednesday, March 30, 2022 Time: 10:06 AM



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DATE:	MAR 2022
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REVIEW:	KH
APPROVED:	MAB

CLIENT: metro vancouver

BGC

PROJECT: ELECTORAL AREA A - GEOHAZARD MAPPING

TITLE: INUNDATION MAPPING INDIAN ARM

PROJECT No.: 0431031

DWG No: I 04

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DATE:	MAR 2022
DRAWN:	LL
REVIEW:	KH
APPROVED:	MAB

CLIENT: metro vancouver

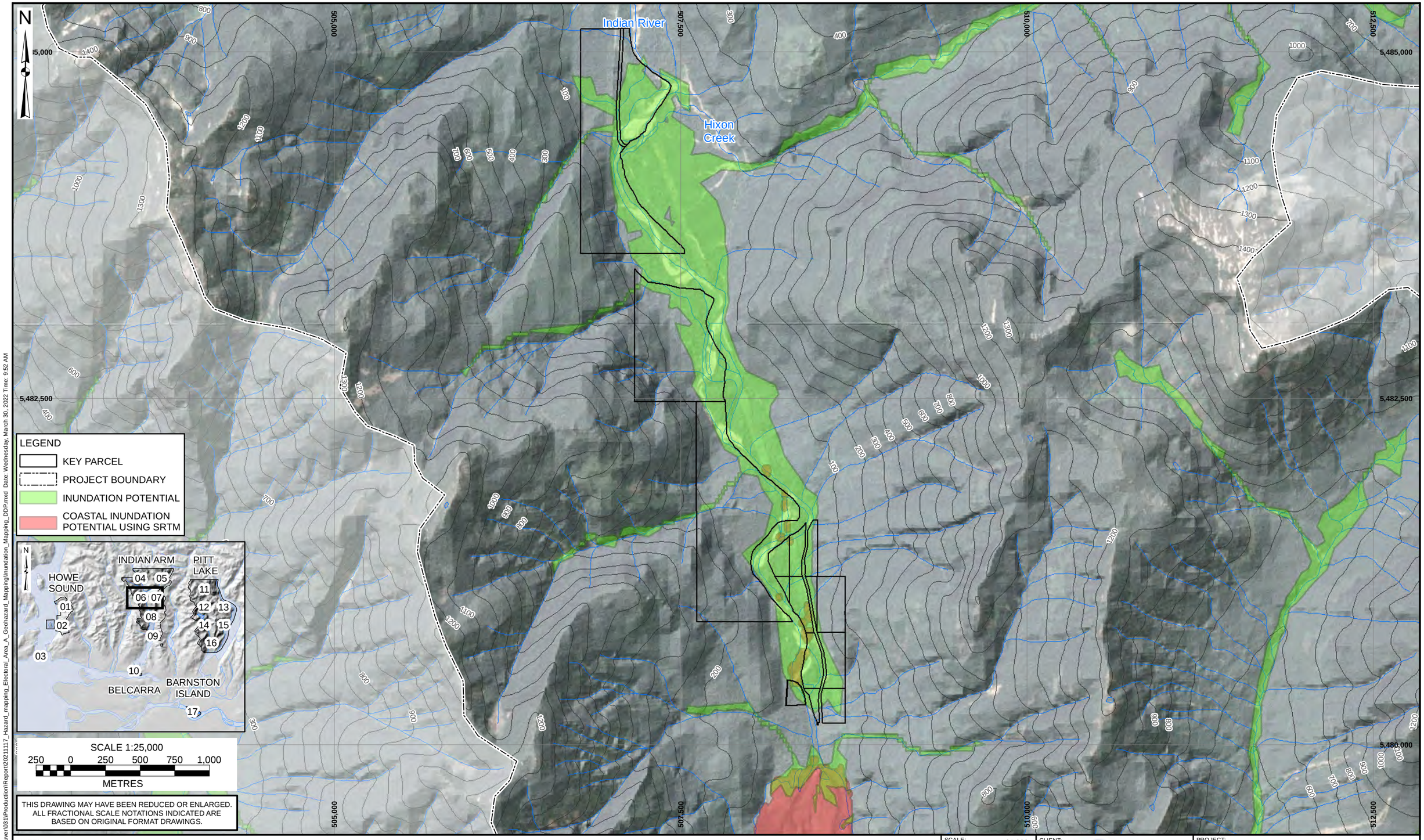
BGC

PROJECT: **ELECTORAL AREA A - GEOHAZARD MAPPING**

TITLE: **INUNDATION MAPPING INDIAN ARM**

PROJECT No.:	DWG No:
0431031	I 05

X:\Projects\0431 MetroVancouver\031\Production\Report\20211117_Hazard_mapping_Electoral_Area_A_Geohazard_Mapping\Inundation_Mapping_DDP.mxd Date: Wednesday, March 30, 2022 Time: 9:47 AM



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CLIENT: metro vancouver

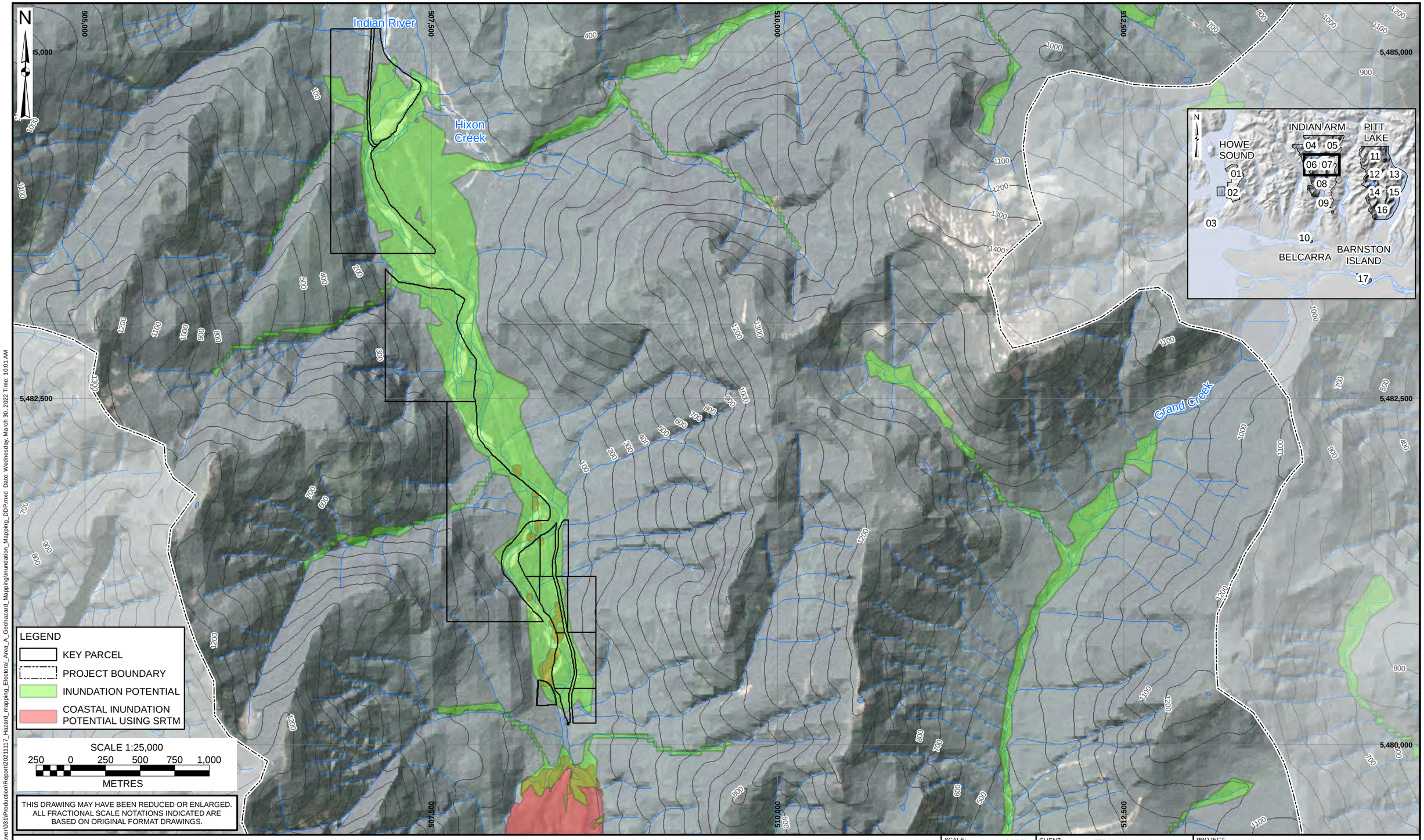
BGC

PROJECT: ELECTORAL AREA A - GEOHAZARD MAPPING

TITLE: INUNDATION MAPPING INDIAN ARM

PROJECT No.:	DWG No:
0431031	I 06

X:\Projects\0431 MetroVancouver\031\Production\Report\20211117_Hazard_mapping_Electoral_Area_A_Geohazard_Mapping\Inundation_Mapping_DDP.mxd Date: Wednesday, March 30, 2022 Time: 9:52 AM



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REVIEW:	KH
APPROVED:	MAB

CLIENT: metro vancouver

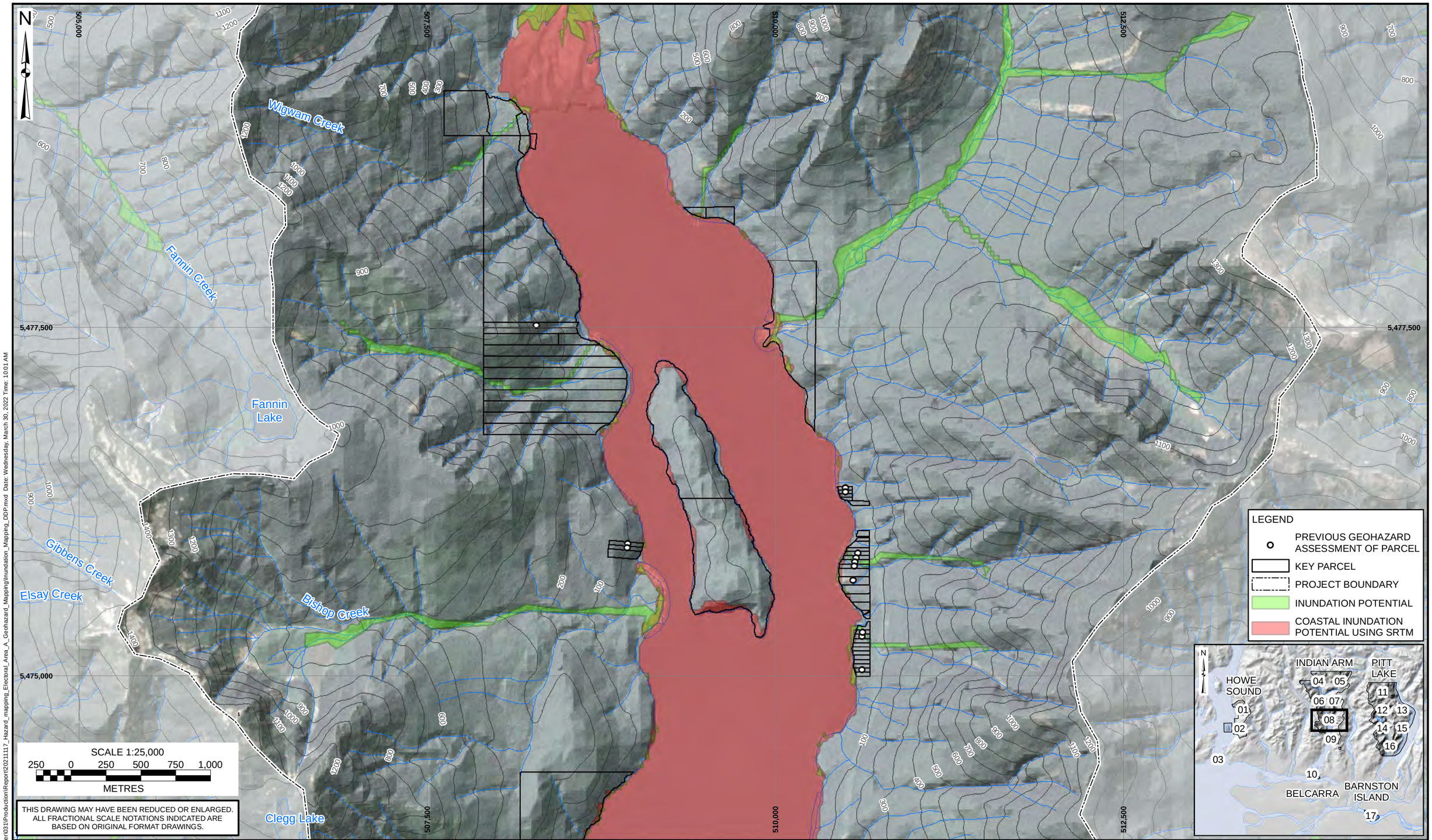
BGC

PROJECT: ELECTORAL AREA A - GEOHAZARD MAPPING

TITLE: INUNDATION MAPPING INDIAN ARM

PROJECT No.: 0431031

DWG No: I 07



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REVIEW:	KH
APPROVED:	MAB

CLIENT: metro vancouver

BGC

PROJECT: ELECTORAL AREA A - GEOHAZARD MAPPING

TITLE: INUNDATION MAPPING INDIAN ARM

PROJECT No.: 0431031

DWG No: I 08

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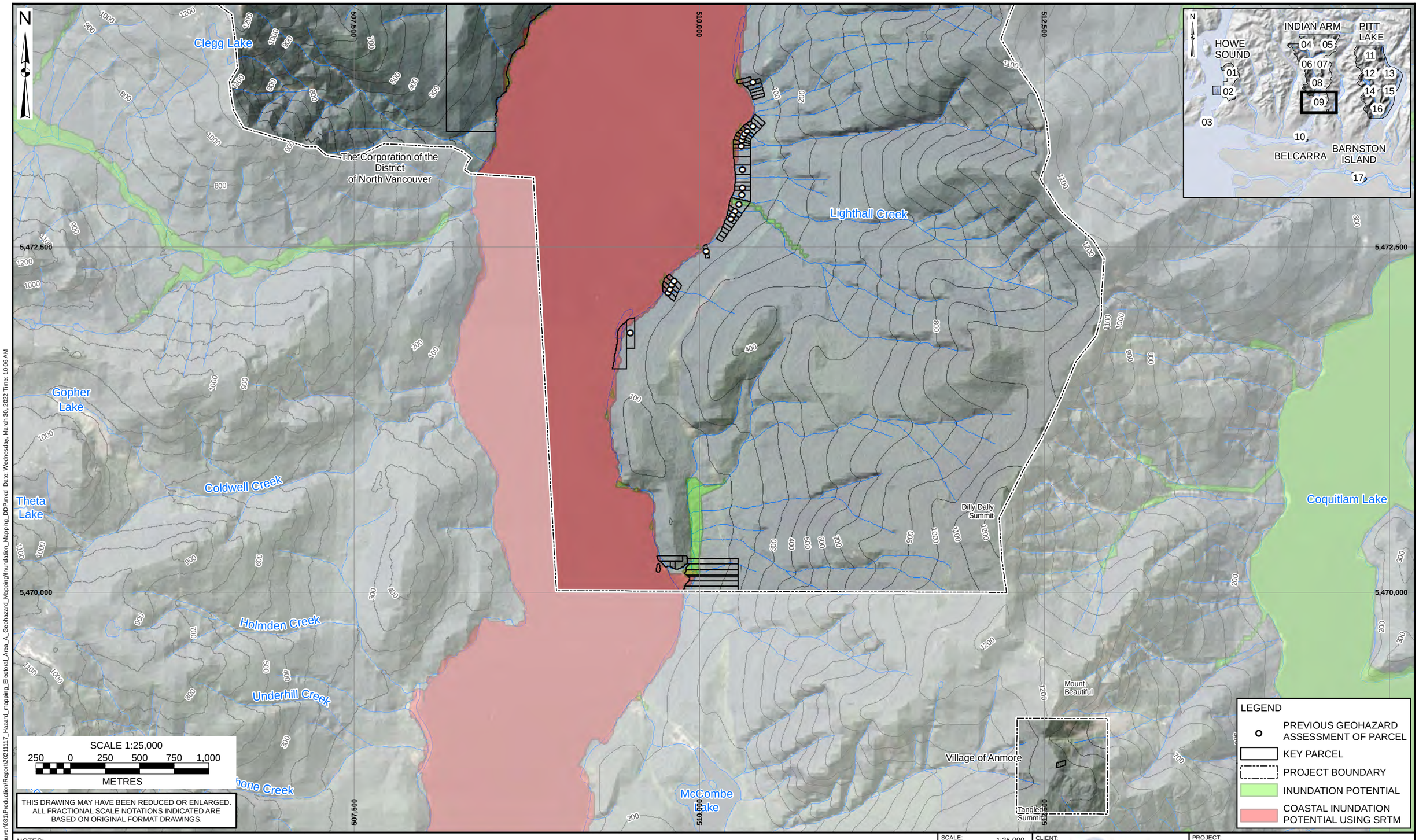

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BGC

PROJECT: **ELECTORAL AREA A - GEOHAZARD MAPPING**

TITLE: **INUNDATION MAPPING INDIAN ARM**

PROJECT No.: **0431031**

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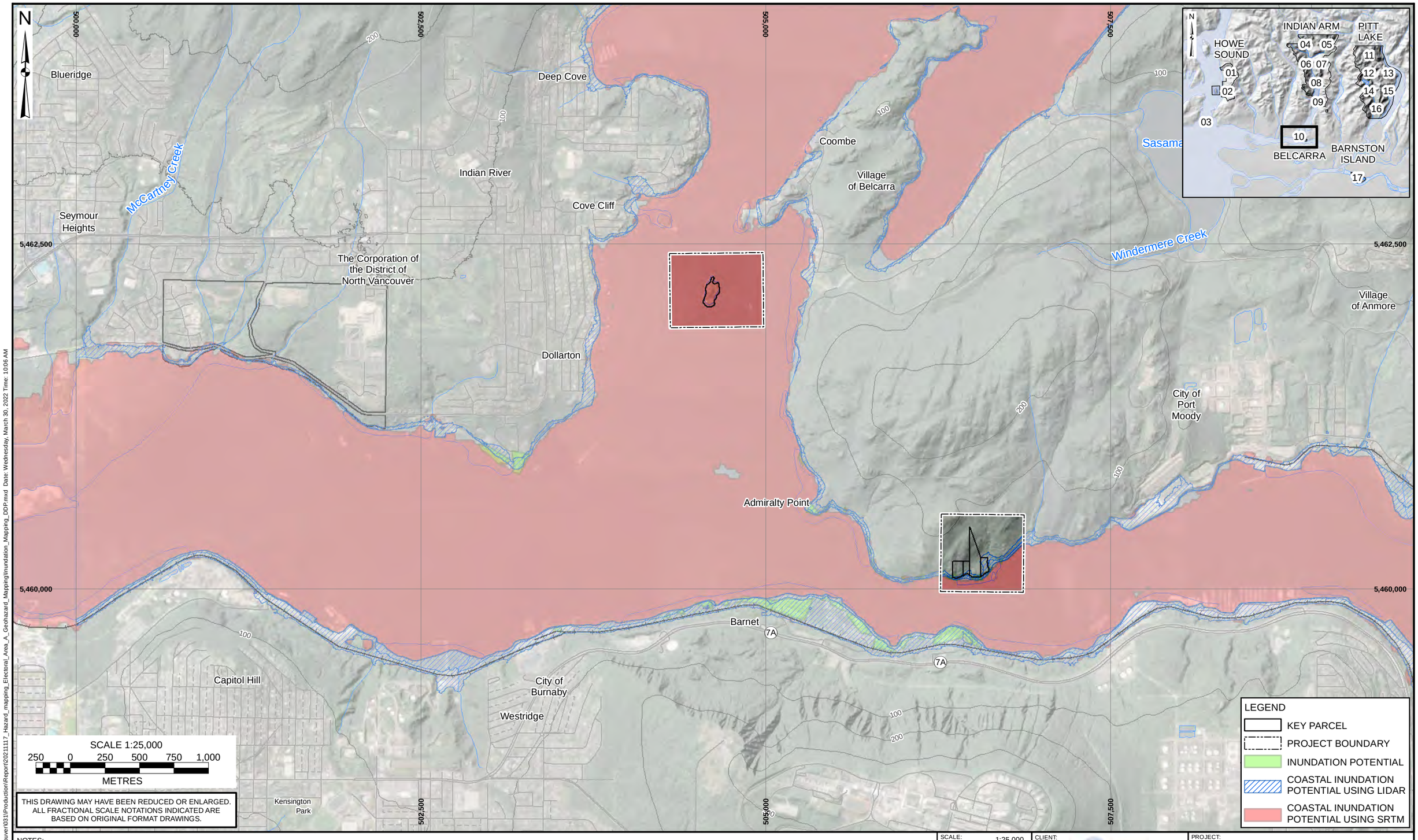

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PROJECT: **ELECTORAL AREA A - GEOHAZARD MAPPING**

TITLE: **INUNDATION MAPPING BELCARRA**

PROJECT No.: **0431031**

DWG No: **I 10**

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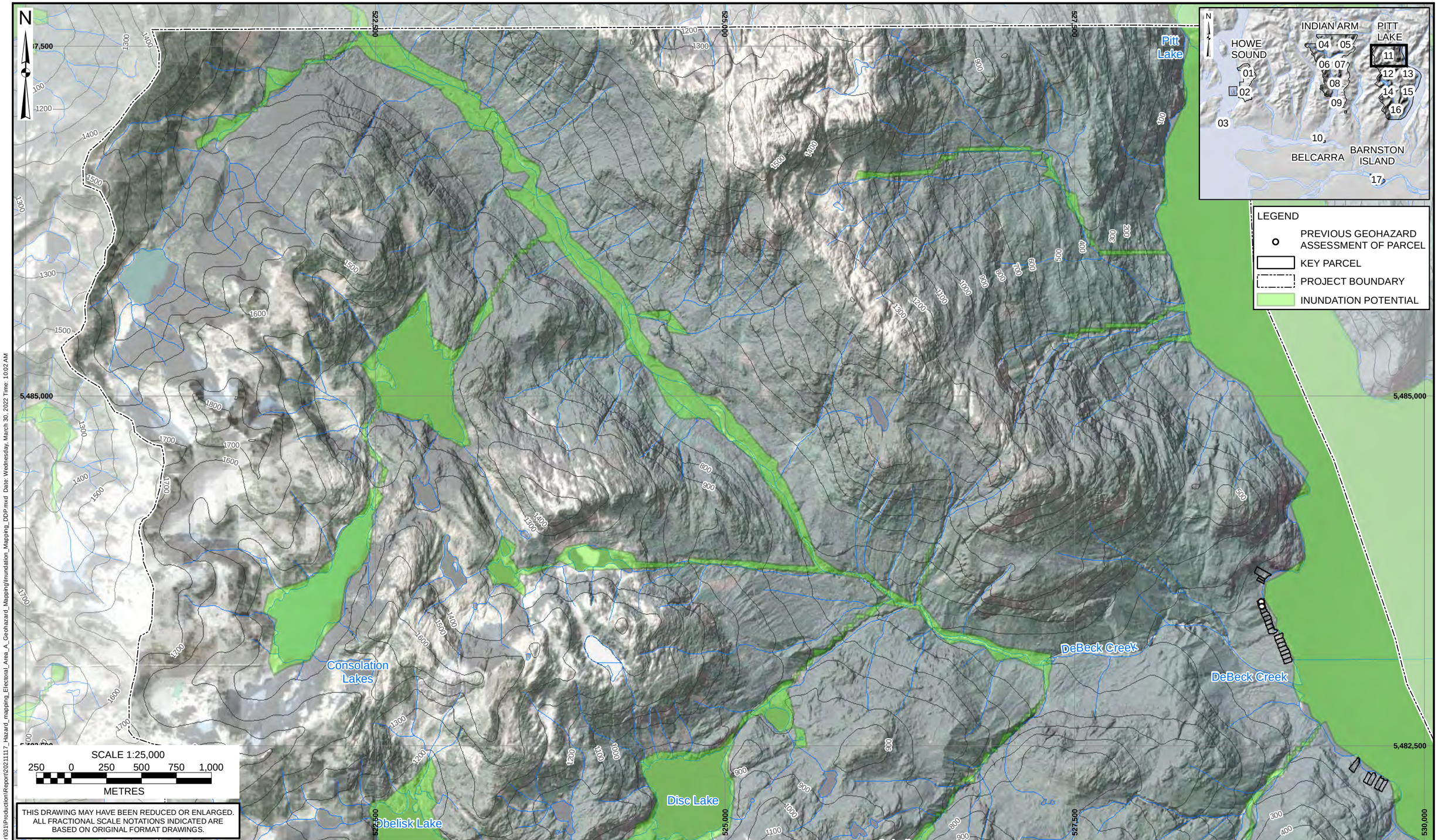

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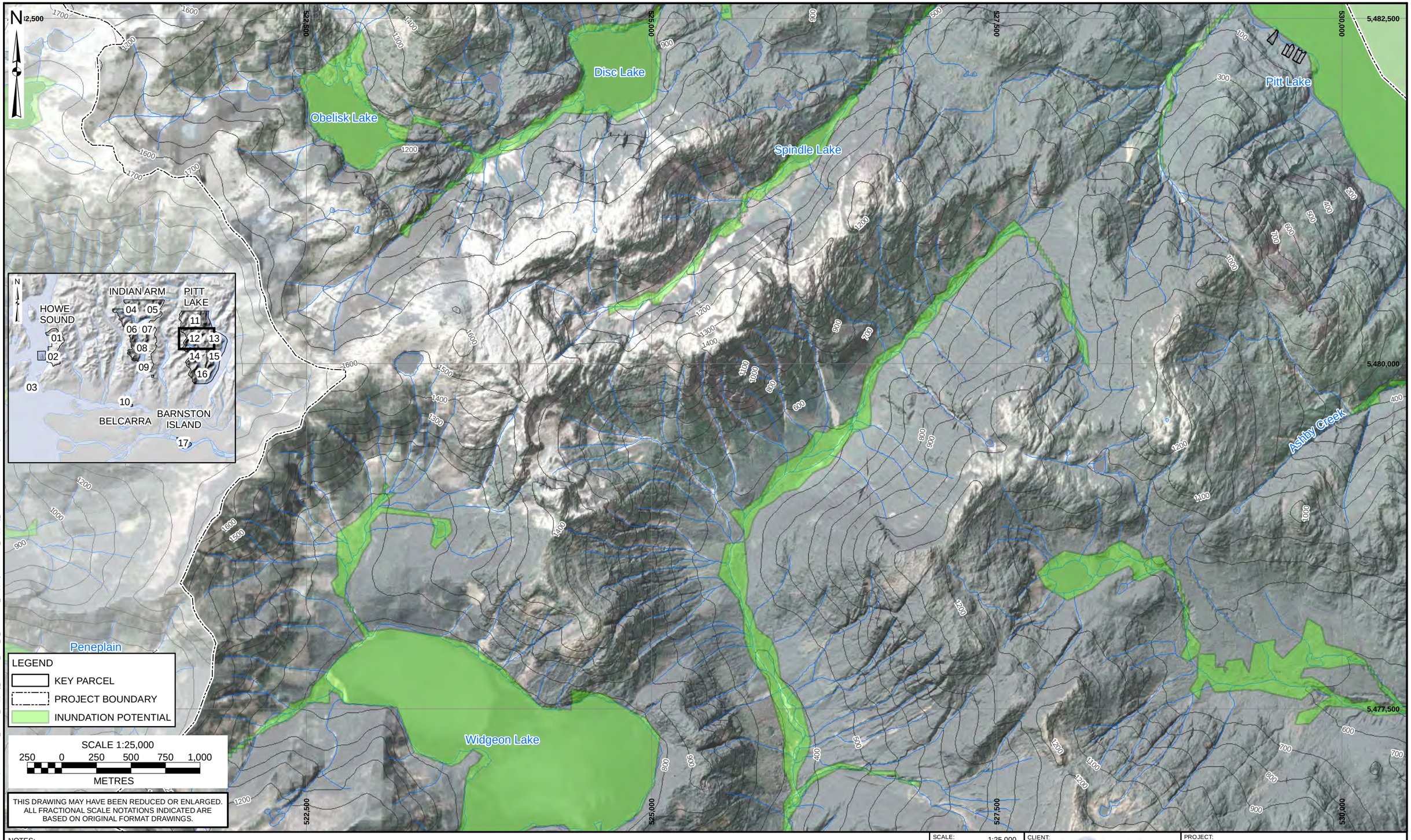
BGC

PROJECT: ELECTORAL AREA A - GEOHAZARD MAPPING

TITLE: INUNDATION MAPPING PITT LAKE

PROJECT No.:	DWG No:
0431031	I 11



LEGEND

- KEY PARCEL
- PROJECT BOUNDARY
- INUNDATION POTENTIAL

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PROJECT: ELECTORAL AREA A - GEOHAZARD MAPPING

TITLE: INUNDATION MAPPING PITT LAKE

PROJECT No.: 0431031

DWG No: I 12

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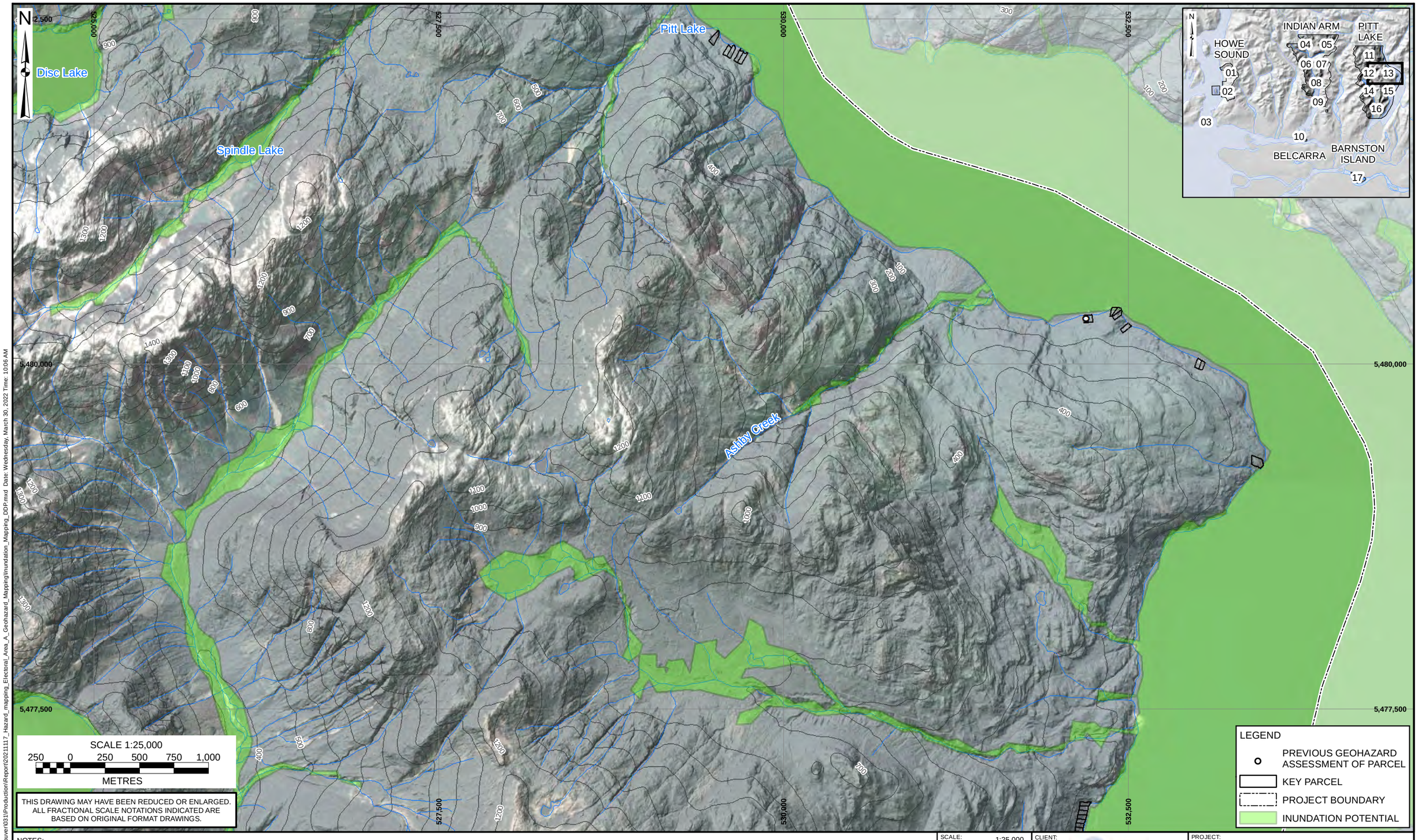

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CLIENT: metro vancouver

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PROJECT: **ELECTORAL AREA A - GEOHAZARD MAPPING**

TITLE: **INUNDATION MAPPING PITT LAKE**

PROJECT No.:	DWG No:
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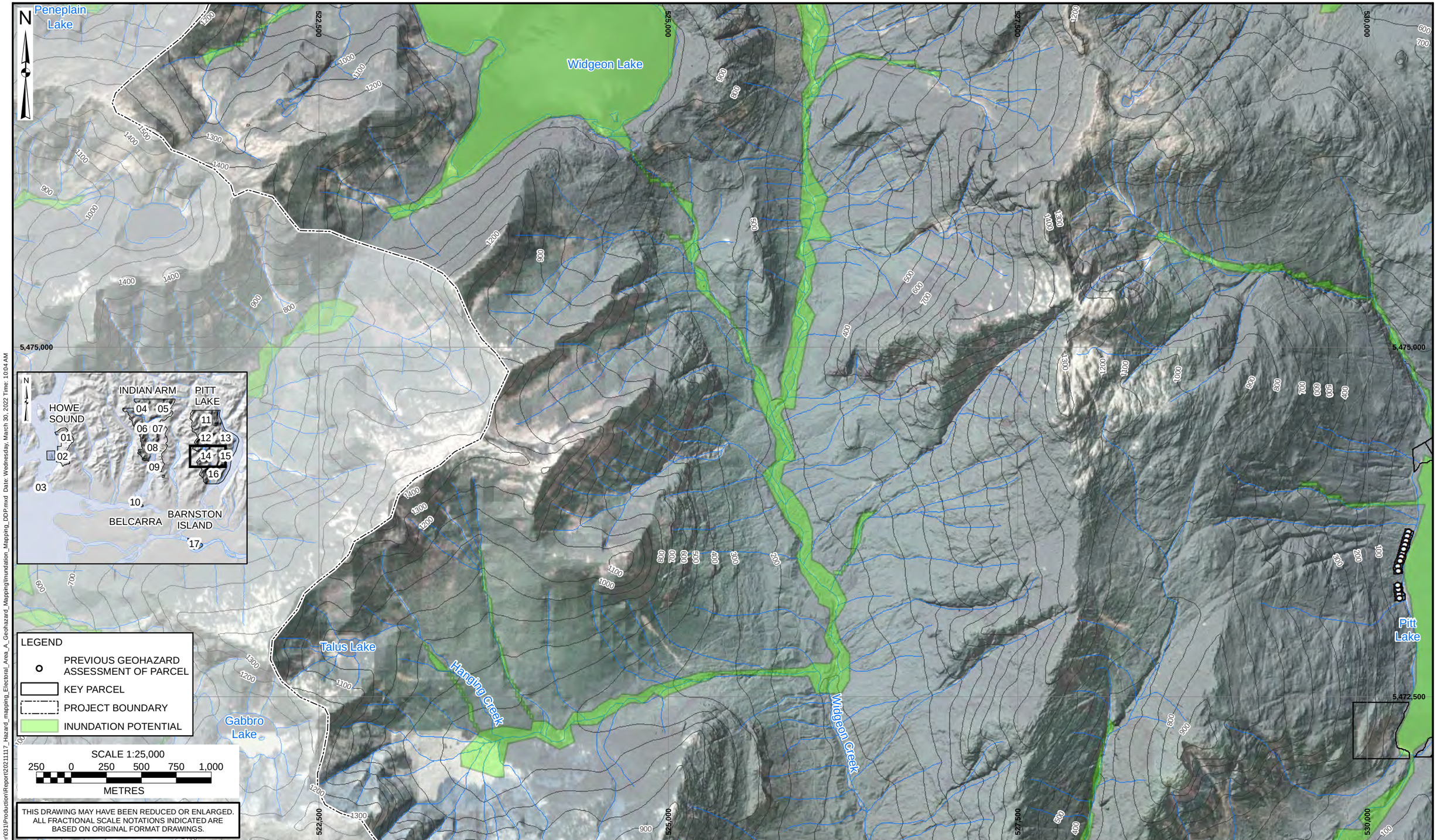

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PROJECT: ELECTORAL AREA A - GEOHAZARD MAPPING

TITLE: INUNDATION MAPPING PITT LAKE

PROJECT No.: 0431031

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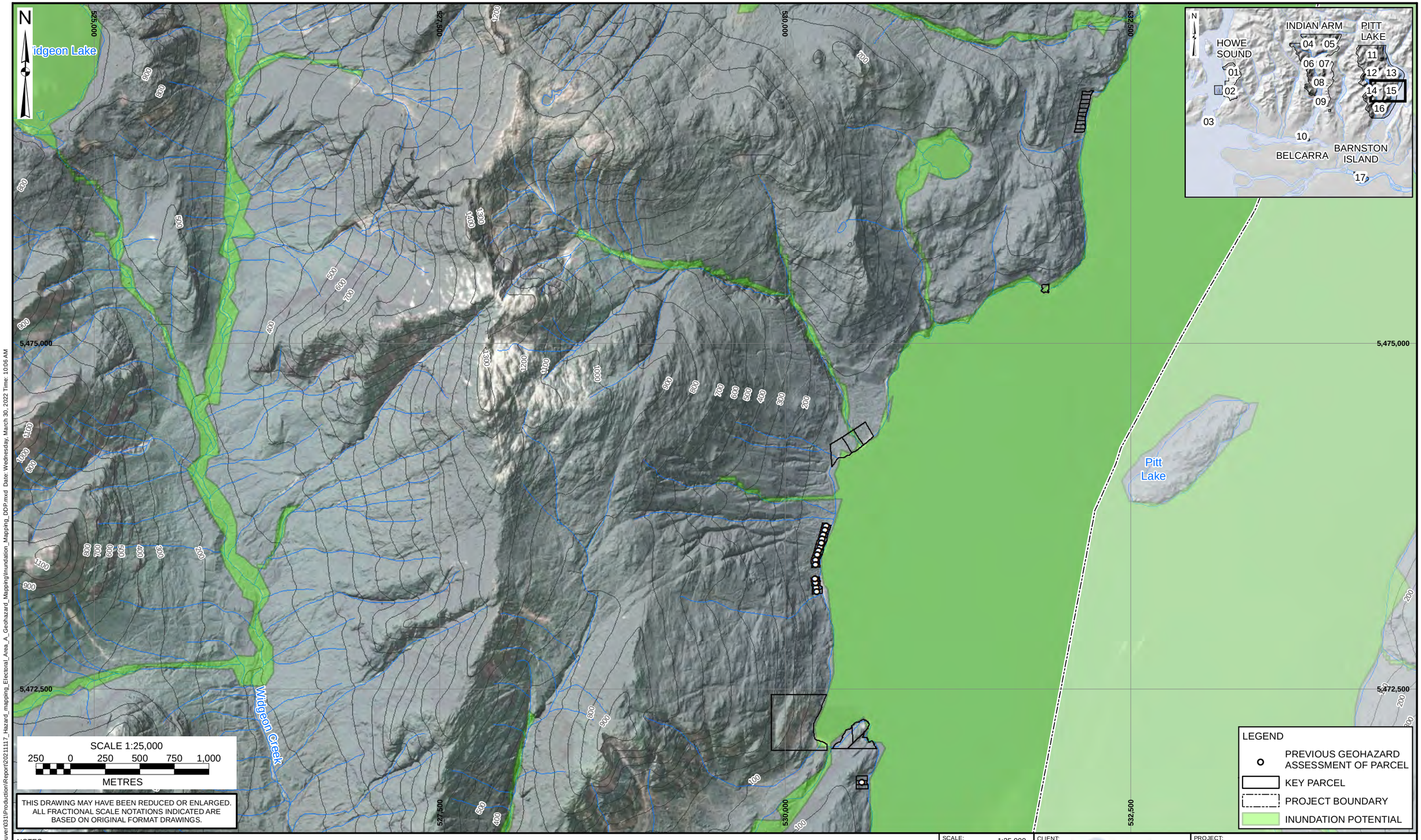

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PROJECT: **ELECTORAL AREA A - GEOHAZARD MAPPING**

TITLE: **INUNDATION MAPPING PITT LAKE**

PROJECT No.: **0431031**

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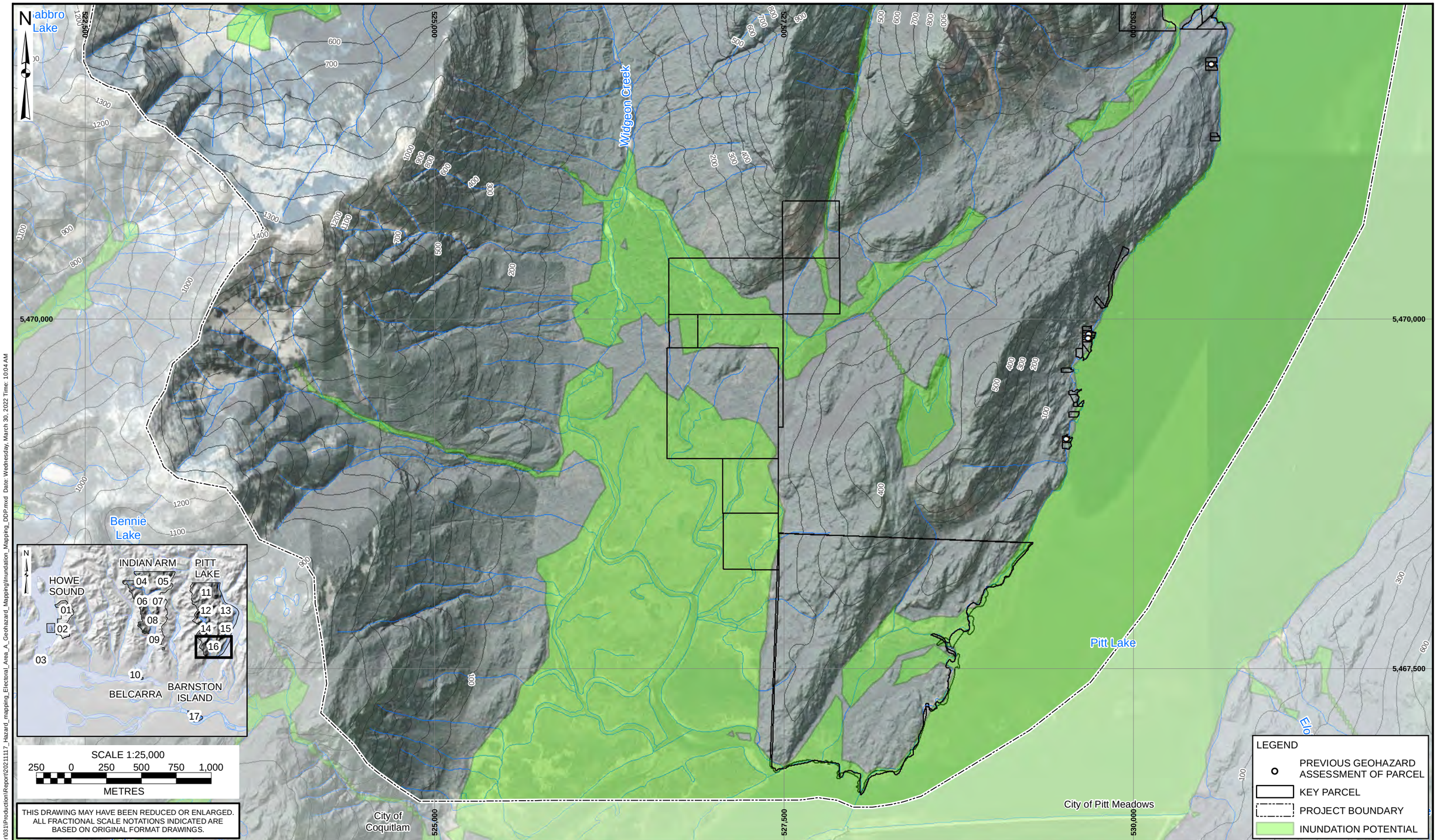

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PROJECT: **ELECTORAL AREA A - GEOHAZARD MAPPING**

TITLE: **INUNDATION MAPPING PITT LAKE**

PROJECT No.:	DWG No:
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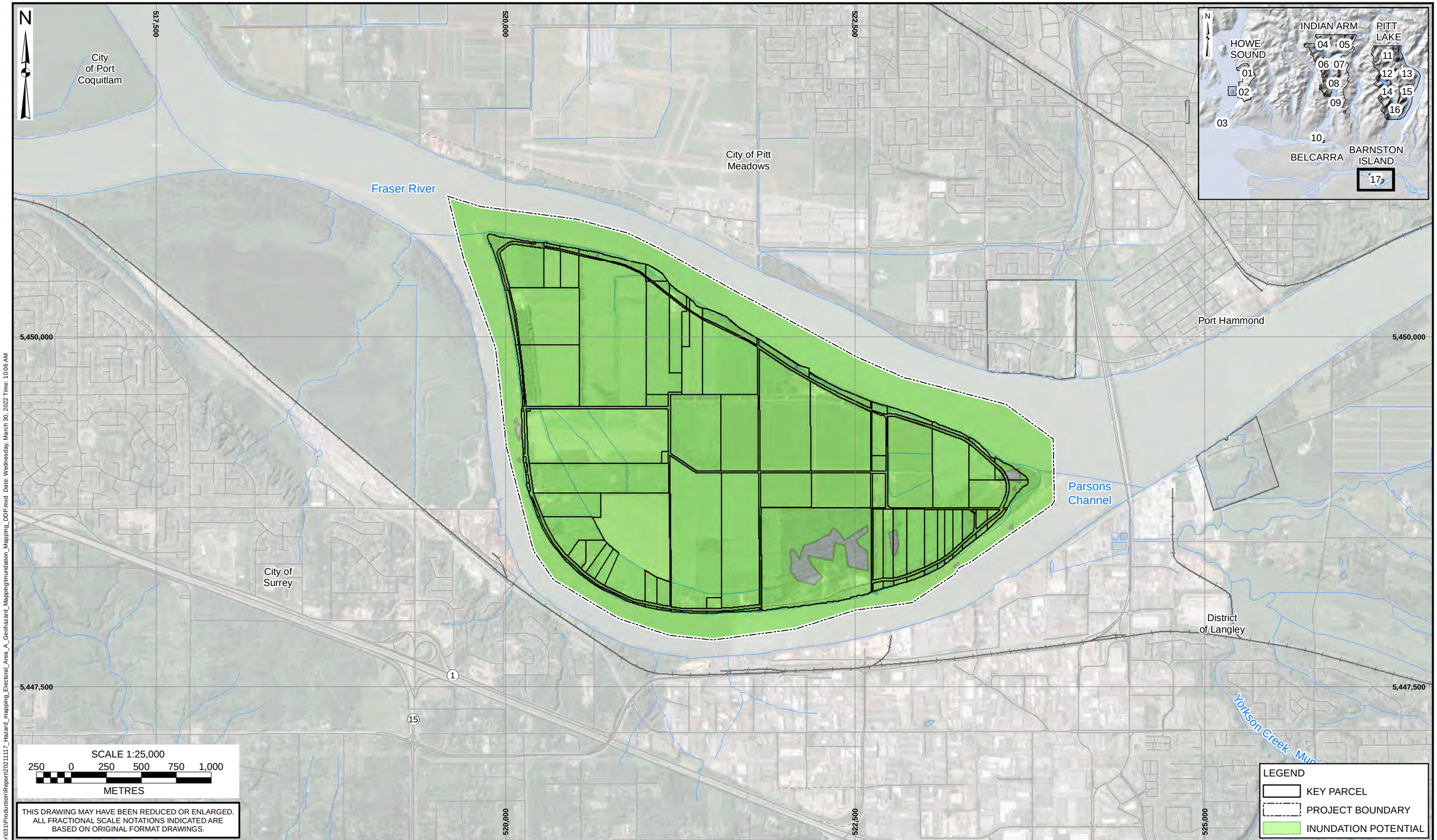

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BGC

PROJECT: **ELECTORAL AREA A - GEOHAZARD MAPPING**

TITLE: **INUNDATION MAPPING BARNSTON ISLAND**

PROJECT No.:	DWG No:
0431031	I 17

We would like to make a presentation to the Board meeting for the MVRD as well as to the Climate action committee. We are a loosely formed group of individuals and groups called the “Friends of Tilbury”. We are concerned about the development of the LNG industry in BC. Particularly how that development impacts the environment of the Fraser River and the environment and well being of our Metro communities.

Specifically, our presentation is about the proposed development of a marine jetty and the vast increase of LNG production and storage at the Tilbury facility in Delta; and the dangers this represents to much of the Greater Vancouver area.

However, there are many issues one of which should seriously concern the Board for Metro Vancouver: How does BC propose to meet our GHG emission targets.

The proposed export of BC LNG through this facility will not allow BC or Canada to live up to our Paris accord agreements. Recent science is clear; our Methane emissions are far greater than previously admitted. Our GHG emissions have not decreased, but only increased. We know that the fossil fuel industry is the second largest emitter of GHG. What isn’t commonly known is that the LNG industry is one of the largest emitters of Methane gas. The increase in planned production, use or export will only set us back in our efforts to become carbon neutral.

https://www.env.gov.bc.ca/soe/indicators/sustainability/ghg-emissions.html

https://www.theenergymix.com/2022/02/23/breaking-fossils-emit-70-more-methane-than-governments-report-iea-tracker/

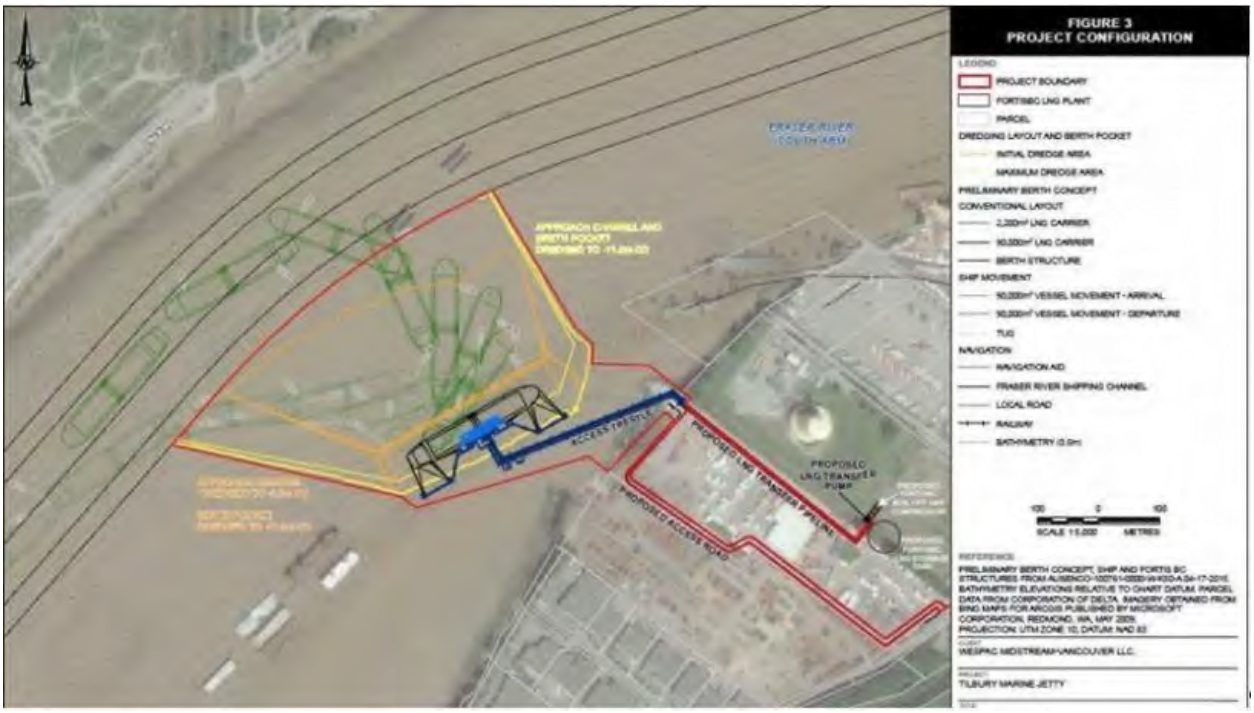
The facility is located directly across the Fraser River from the 85,000 liters Jet fuel tank farm. A small mistake, accident or natural occurrence could put the Jet fuel facility at risk. The link below is of the explosion that rocked Beirut in 2020.

https://www.youtube.com/watch?v=93tV6-0Ugwk

Fortis may argue that the likelihood of such an accident here is slim. However, it is a distinct possibility.

https://www.youtube.com/watch?v=uBAgvXPw1aI

Loading and maneuvering large LNG carriers add an untenable element of danger to the current facility and the Fraser River. A danger far too great for our communities. A ship loaded with LNG combined with 85,000 litres of jet fuel has more (possible) explosive power by *** than the explosion in Beirut.



Environmentally the Tilbury proposals are not in line with any provincial, national or international targets or movements. BC has been economically strong and capable of moving forward economically without the development of our LNG industry. If we allow the Tilbury proposals, we will be endangering our environment and our communities. As community leaders you have been elected to maintain or improve our quality of life.

If we are at all to achieve this the Tilbury proposals need to be opposed. A number of you have done so already and we ask that the Board of Metro Vancouver unite in opposition to the two Fortis proposals for Tilbury island.

Speakers: Eoin Finn, Peter van der Velden
We would like to make this presentation to the Climate action Committee on April 8, 2020

Conservation Funds for Nature-based Solutions to Climate Change


Blackie Spit, Surrey, BC

Amongst the many concerning highlights of the 2019 version of Canada's Changing Climate Report (CCCR)[1] issued by the Federal government was the statement that "the effects of widespread warming are evident in many parts of Canada and are projected to intensify in the future. In Canada, these effects include more extreme heat, less extreme cold, longer growing seasons, shorter snow and ice cover seasons, earlier spring peak streamflow, thinning glaciers, thawing permafrost, and rising sea level." The report also suggests that while summer precipitation levels may decline, winter and overall annual precipitation will continue to increase. The report also adds that "coastal flooding is expected to increase in many areas of Canada due to local sea level rise." Over the course of this decade, the average cost of severe weather claims is expected to grow by 138% to $5 billion per year according to the Insurance Institute of Canada's (IIC) 2020 report[2]. MetroVancouver is already experiencing the impacts of climate change and can expect climate change events to increase in frequency and intensity,

[1] Bush, E. and Lemmen, D.S., editors (2019): Canada's Changing Climate Report; Government of Canada, Ottawa, ON. 444 p. Available From: https://changingclimate.ca/site/assets/uploads/sites/2/2020/06/CCCR_FULLREPORT-EN-FINAL.pdf Accessed Date: 07-April-2022

[2] Climate Risks: Implications for the Insurance Industry in Canada, The Insurance Institute of Canada, 2020. Available From: https://www.insuranceinstitute.ca/en/resources/insights-research/Climate-risks-report. Accessed Date: 07-April-2022

To: Regional Parks Committee

From: Paul Brar, Division Manager, West Area, Regional Parks

Date: March 10, 2022 Meeting Date: April 13, 2022

Subject: **Pacific Spirit Regional Park – Wreck Beach Safety and Access Improvements**

RECOMMENDATION

That the Regional Parks Committee receive for information the report dated March 10, 2022 titled "Pacific Spirit Regional Park – Wreck Beach Safety and Access Improvements."

EXECUTIVE SUMMARY

Renowned for its natural beauty and its unique social character, Wreck Beach is a popular destination within Pacific Spirit Regional Park. As a result of its remote location and increasing high use, in recent years Metro Vancouver and its partner agencies have been responding to an increasing number of emergencies and public safety incidents. With input from emergency response providers, strategies have been developed to improve public safety and access to Wreck Beach. This multi-pronged action plan uses an integrated approach that takes into consideration site design, education, enforcement, and partnerships.

PURPOSE

At the November 10, 2021 Regional Parks Committee meeting staff reported out on meetings held with emergency response agencies regarding safety concerns at Wreck Beach. Staff committed to bringing forward an action plan early in 2022 to improve safety and access. This report is being brought forward to highlight key actions to be taken this spring in advance of the busy season to promote safe public use of Wreck Beach.

BACKGROUND

Wreck Beach is a popular destination within Metro Vancouver's Pacific Spirit Regional Park for both regional residents and tourists. Located along the west coast of Vancouver's Point Grey peninsula and extending 7 kilometers from Acadia Beach to the Musqueam Indian Reserve, Wreck Beach is one of the largest clothing-optional beaches in the world (see Attachment 1).

In the 1980s, the foreshore area known today as Wreck Beach was leased from the Province of British Columbia to the Vancouver Parks Board and was known as Foreshore Park. In 1983, the Attorney General of British Columbia established Wreck Beach as a clothing optional area. Administration of Wreck Beach passed to Metro Vancouver Regional Parks in 1989 when Pacific Spirit Regional Park was officially dedicated and the foreshore became integrated into the park.

INDIGENOUS HISTORY

The area referred to as Wreck Beach is of historic and cultural importance to the Musqueam Indian Band. Musqueam peoples have protected and stewarded this area since time immemorial. Generations have lived and died there, and ancestors are still buried here. The site was a fortified

lookout and an encampment, from which the Musqueam coordinated defense of their territory. The site is part of Musqueam oral histories, histories which speak to many other names around ʔəlqsən (Point Grey) describing the creation of aspects of the territory and encoding cultural teachings.

EMERGENCY RESPONSE CHALLENGES

Due to its physical isolation and the need to descend over 500 steps to access the main beach, Wreck Beach has historically been known for its unique social character. In recent years, however, the site's popularity has grown significantly. Since 2010, the number of visits to Wreck Beach have grown at an annual rate of 11%. For 2021, the number of visitors was over 700,000.

The isolation of Wreck Beach and this increasing high use has resulted in a number of challenges to managing the beach. This includes response to medical emergencies, which require a coordinated effort by multiple emergency responders including the RCMP (UBC Detachment), Vancouver Fire and Rescue Services (VFRS), BC Ambulance Service (BCAS), and the Canadian Coast Guard.

911 emergency calls are directed by E-Comm to the appropriate agency. The VFRS respond to large beach fires or forest fire incidents and typically assist BCAS with all medical calls. Due to the geographic isolation of Wreck Beach, the Coast Guard's hovercraft is heavily utilized to assist BCAS with medical emergencies. If the Coast Guard is unavailable to assist in transporting off the beach, the patient is carried by stretcher up the 500 steps to NW Marine Drive where they are transferred to an ambulance. The RCMP and/or Regional Parks staff typically support with crowd control and ensuring there is adequate emergency responder access.

The table below depicts the number of emergency calls for service to Wreck Beach for the period 2018-2021.

AGENCY	2018	2019	2020	2021
RCMP	44	49	29	54
VFRS	20	19	30	48
BCAS	45	26	47	41
CCG	20	7	14	35

ASPIRATIONS FOR THE SITE

Through meetings with partner agencies and user groups, feedback received from the public, and discussions with the Musqueam, the following vision statements have been identified to articulate a desired future state for Wreck Beach:

- Wreck Beach has a beach culture that is unique and vibrant but also safe, welcoming, and inclusive to all regional residents and visitors.
- The ecology and environment of Wreck Beach is valued and protected.
- The First Nations connection to the site and surrounding area is acknowledged in a manner that respects and celebrates indigenous history.

2022 ACTION PLAN

The following action plan was developed in consultation with the RCMP (UBC Detachment), VFRS, BCAS, and the Canadian Coast Guard. Additional stakeholders that were consulted in the process include the University of British Columbia (UBC), the University Endowment Lands (UEL), Vancouver Coastal Health, and the Ministry of Transportation and Infrastructure (MoTi). Communication with the Pacific Spirit Park Society (PSPS) and the Wreck Beach Preservation Society (WBPS) on the safety improvements took place as part of annual joint work planning processes.

Engagement with the Musqueam Indian Band on this topic took place through the quarterly Metro Vancouver Operational Working Group (MMOVG) meetings.

The multi-faceted action plan is an integrated approach that takes into account site design, education, enforcement, and partnerships.

Wreck Beach Log Clean-Up

Regional Parks staff conduct annual log clean-ups on Wreck Beach to remove debris from winter storms and improve public safety. In response to feedback from emergency service agencies, staff have created guidelines for a new log layout on the beach (see Attachment 2). The new log alignment creates more open space for the public to enjoy the beach, improves circulation, clears sightlines for patrols and evening sweeps, and ensures wide pathways for emergency responder access.

Trail Improvements

Given the site's physical isolation and heavy exposure to storm events, it is critical for the trails in and around Wreck Beach to be regularly maintained to ensure safe and consistent access for emergency responders. In preparation for the busy summer season, staff are making repairs to trail surfaces, wooden steps, railings, fencing, and signage. An important trail connection planned for later this year is the re-alignment of Trail 8 to connect Foreshore Trail to Wesbrooke Mall at SW Marine Drive, which will complete the trail network at the southern end of the site and reduce the negative impacts of visitors going off trail.

Signage Program

Staff have received feedback from emergency responders and partner organizations on ways to improve the signage program at Wreck Beach to better communicate regulations and educate the public on user expectations. The new signage program (see Attachment 3) at Wreck Beach will include:

- Installation of new street address signs at main entrances to assist Emergency Responders to access the area which stretches 7 kilometers and has multiple access points.
- Installation of new entrance signs at trailheads to inform park visitors of the park opening hours and park bylaws (e.g., no fires, no alcohol, no loud amplified noise, no camping)
- Installation of new navigational signs at strategic locations on the Foreshore Trail to assist emergency responders and park users navigate the area and respond to calls.

As part of the revised signage program, the Musqueam have provided Regional Parks staff with key messages on indigenous history at the site to highlight the cultural importance of the beach area to

visitors. Staff are working with the Pacific Parklands Foundation to seek funding for this component of the signage program through the 2022 REEL Green Earth Day campaign.

Education and Enforcement
Regional Parks staff patrol the beach regularly to ensure compliance with bylaws, and contact the RCMP to assist with matters that pertain to illegal activities or matters of public safety. Staff will continue their education and enforcement activities to seek voluntary compliance with beach use guidelines and the Regional Parks Regulation Bylaw No. 1177. In addition to regular beach patrols, staff will engage the public through welcoming information tents and sandwich board signs in support of public safety goals. Where necessary, enforcement actions in the form of ticketing will be taken where education efforts are not proving effective with repeat offenders.

The RCMP (UBC Detachment) are a critical partner agency in supporting Metro Vancouver in patrolling the beach. The RCMP support includes on-call access to one general duty officer several days a week, and two officers on overtime (as available) on weekends from May to September. Staff are in discussions with the RCMP to request additional policing resources so that there is an increased visible presence at the beach. The RCMP have indicated that their patrol and enforcement efforts are challenged by the remoteness and inaccessibility of the site, and have requested for Metro Vancouver to look at ways to improve this access for their officers. Staff are investigating the feasibility of different options as additional RCMP presence would greatly assist Regional Parks staff in responding to incidents and in closing the beach at night.

Fire Prevention Activities
Fires are a major concern at Wreck Beach. The potential for beach fires is reduced by removing extraneous beach logs that are used for firewood. Smoking is only permitted in designated smoking areas, which are assigned in locations considered low risk for fire, and are closed in high and extreme fire danger conditions. Fire danger ratings are closely monitored to reduce the risk of fires in the park, with restrictions on some activities such as smoking or use of barbecues in coordination with local fire authorities.

Security Lighting
To improve visibility at the top of Trail 6, a solar powered security light will be installed to assist public accessing/egressing from the area after sunset. The area is busy with beach visitors, and also used as a staging area for emergency responders at night.

Partnerships and Collaboration
While Wreck Beach is the jurisdiction of Metro Vancouver Regional Parks, there are a number of partner agencies that have an interest in public safety at the site. The Wreck Beach Incident Response Committee (WBIRC) was recently formed as a multi-agency task force to address the complex social and emergency response issues impacting the site. This committee is chaired by Metro Vancouver Regional Parks and is comprised of emergency service responders (RCMP, VFRS, BCAS, Coast Guard), and Vancouver Coastal Health (which manages the food and personal services vending permits).

Staff also work with outreach workers with the Ministry of Social Development and Poverty Reduction for advice and support in providing temporary housing options for individuals experiencing

homelessness. When staff meet an individual living in the park who does not wish to connect with the Ministry outreach worker, the individual is provided with a handout detailing the services provided through the City of Vancouver's Carnegie Community Centre (located in the Downtown Eastside) along with the Ministry of Social Services, which provides services to individuals experiencing homelessness.

This WBIRC will meet in the Spring before the busy summer season to coordinate services and action, and in the Fall to debrief on the success of implemented interventions and plan for future actions.

Coordination with the Musqueam Indian Band on matters related to Pacific Spirit Regional Park and Wreck Beach takes place through the Metro Vancouver Operational Working Group (MMOVG) meetings which are held quarterly.

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

FINANCIAL IMPLICATIONS
There are no financial implications resulting from this report. All costs related to safety and access improvements will be funded through the existing 2022 operating budget and 2022 capital maintenance and capital development budgets.

CONCLUSION
Regional Parks staff are currently working with the agencies involved in emergency response at Wreck Beach to identify ways to address safety and access challenges. Strategies that are being implemented include trail improvements, a new beach log layout plan, removal of excess debris that can be used for fires, improved signage, public education, installation of security lighting, and improved site access for emergency responders. The action plan identified in this report will be implemented in advance of the busy summer season.

Attachments
1. Pacific Spirit Regional Park – Wreck Beach Area Map
2. Wreck Beach Log Clean-Up Operational Guidelines Summary
3. Wreck Beach Signage Plan

49175671

WRECK BEACH AREA MAP

WRECK BEACH LOG CLEAN-UP OPERATIONAL GUIDELINES SUMMARY

Regional Parks staff conduct annual log sorts on Wreck Beach to improve public safety. In response to feedback from emergency services providers, staff have created operational guidelines for the log removal process which includes the following components: phasing, timing, limit of work, log selection and removal, log layout, and site clean-up. The log layout plan below shows an alignment that creates more open space for the public to enjoy the beach, improves circulation, clears sightlines for patrols and evening sweeps, and ensures wide pathways for emergency responder access.

Figure 1: Wreck Beach Pre Log Clean-up

Figure 2: Wreck Beach Post Log Clean-up

Figure 3: Wreck Beach Log Layout Plan

WRECK BEACH SIGNAGE PLAN

There are three signage types proposed for the Wreck Beach Signage Plan: address signs, new rules and regulations signs, and new trail location markers.

1. **Address signs** will be added at the top of each of the beach trails (Acadia Beach, Trails 3, 4, 6 & 7) to allow first responders to better find the locations. *(actual size 20 x 30 cm)*
2. New **rules and regulations signs** will be installed at the tops and bottoms of Trails 3, 4, 6 & 7. *(actual size 60 x 120 cm)*
3. New **trail location markers** will be installed as a pilot program along Foreshore Trail between Trail 6 and Trail 7 to assist park staff and first responders in responding to emergency situations. *(actual size 25 x 35 cm)*

Figure 1: Address Sign

Figure 2: Rules and Regulations Sign

Figure 3: Trail Location Markers

Figure 4: Signage Location Map

To: Performance and Audit Committee

From: Linda Sabatini, Acting Director, Financial Operations

Date: April 7, 2022 Meeting Date: April 14, 2022

Subject: **2021 Metro Vancouver Final Audit Findings Report**

RECOMMENDATION

That the Performance and Audit Committee receive for information the report dated April 7, 2022, titled "2021 Metro Vancouver Final Audit Findings Report" from BDO Canada LLP Chartered Professional Accountants.

EXECUTIVE SUMMARY

Under provincial legislation, an external audit must be undertaken annually for all Metro Vancouver Districts' and the Housing Corporation. The attached report, prepared by Metro Vancouver's external auditors, BDO Canada LLP Chartered Professional Accountants, summarizes the results of the annual audit for fiscal year 2021.

PURPOSE

To provide the committee with our external auditor's final report related to the annual audit for the Metro Vancouver Districts' and Housing Corporation for fiscal year 2021.

BACKGROUND

It is required, under provincial legislation, that an external audit be undertaken annually for all Metro Vancouver Districts' and the Housing Corporation. This audit must be conducted by a public accounting firm that is licensed to conduct such audits. The attached report summarizes the results of the annual audit for fiscal year 2021.

BDO Canada LLP Chartered Professional Accountants were appointed by the Board in July 2019 as our external auditors for a five-year period. Fiscal year 2021 is the third year of that five-year period.

ALTERNATIVES

This is an information report. No alternatives are presented.

FINANCIAL IMPLICATIONS

The annual audit fulfills our statutory responsibility.

CONCLUSION

As prepared by BDO Canada LLP Chartered Professional Accountants, our external auditors, the final report for the 2021 external audit of the Metro Vancouver Districts' and the Housing Corporation is presented to the committee for information.

Attachments:

1. 2021 Metro Vancouver Final Audit Findings Report

49178236

Metro Vancouver Regional District

Audit Findings Report to the Performance and Audit Committee for the year ended December 31, 2021

Dated April 6,2022 for presentation on April 14, 2022

START

To the Performance and Audit Committee of Metro Vancouver Regional District

We are pleased to provide you with this report to highlight and explain key issues which we believe to be relevant to the audit of Metro Vancouver Regional District ("MVRD"), Greater Vancouver Sewerage and Draining District ("GVSDD"), Greater Vancouver Water District ("GVWD"), and Metro Vancouver Housing Corporation ("MVHC") (together referred to as the "Districts") financial statements for the year ended December 31, 2021.

The enclosed report includes our approach to your audit, including: significant risks identified, the nature, extent, timing, and results of our audit work, and the terms of our engagement. We will also report any significant internal control deficiencies identified during our audit and confirm our independence.

During the course of our audit, management made certain representations to us—in discussions and in writing. We documented these representations in the audit working papers.

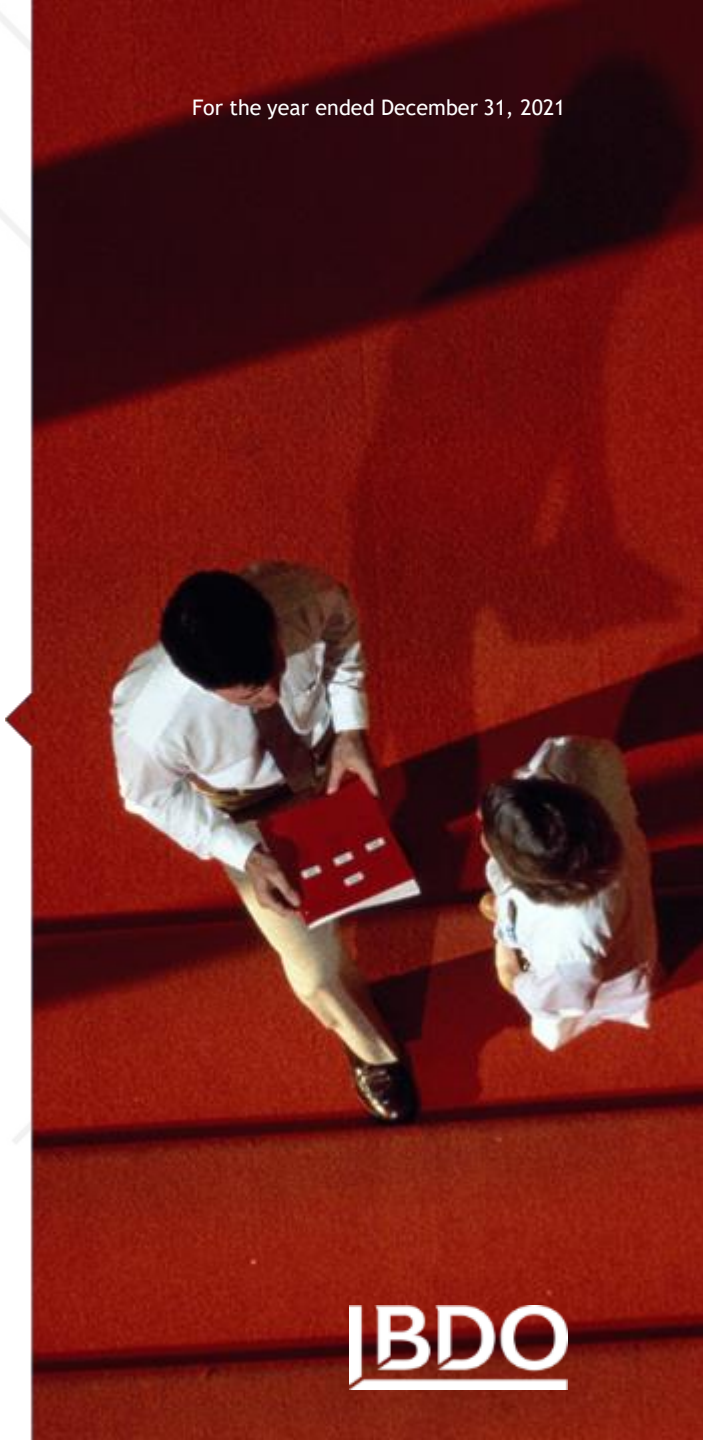
The business environment has changed for us all during the time of COVID-19. Cash flow, strategy, operations: each has received a rethink. As your auditors, we have relied on our digital audit suite to stay connected—among ourselves, with management, and with you.

We look forward to discussing our report with you. In the meantime, please feel free to contact us if you have any questions or concerns.

Yours truly,

BDO Canada LLP

BDO Canada LLP



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Audit at a glance

Preliminary materiality as communicated to you in our Planning Report to the Performance and Audit Committee, and final materiality are set out as follows:

	Preliminary materiality	Final Materiality
MVRD (consolidated)	$17,000,000	$17,000,000
MVRD (non-consolidated)	$15,300,000	$15,300,000
GVSDD	$13,600,000	$10,200,000
GVWD	$13,600,000	$5,500,000
MVHC	$2,000,000	$1,070,000

Overall materiality has been determined based on expenses. For our audit work over tangible capital assets ("TCA") and other assets and liabilities related to TCA, we have set a higher materiality based on the net book value of TCA. This is to recognize the fact that the Districts have a significant value of TCA which is much larger in comparison to its operating activities.

We are not aware of any fraud affecting the Districts. If you have become aware of changes to processes or are aware of any instances of actual, suspected, or alleged fraud since our discussions held at planning, please let us know.

We have complied with relevant ethical requirements and are not aware of any relationships between Metro Vancouver Regional District and our Firm that may reasonably be thought to bear on our independence.

LEAD PARTNER ON YOUR AUDIT

Brian Szabo, CPA, CA

Email: bszabo@bdo.ca

Direct: 604 646-3389

Status of the audit

We have substantially completed our audit of the year ended December 31, 2021 consolidated financial statements, pending completion of the following items:

- Receipt of outstanding legal confirmations
- Approval of consolidated financial statements by the Board of Directors.
- Subsequent events review through to the consolidated financial statements approval date
- Obtain signed management representation letter

We conducted our audit in accordance with Canadian generally accepted auditing standards. The objective of our audit was to obtain reasonable, not absolute, assurance about whether the consolidated financial statements are free from material misstatement. See Appendix A for our draft independent auditor's report.

The scope of the work performed was substantially the same as that described in our Planning Report to the Performance and Audit Committee dated January 13, 2022.

Audit findings

We identified the following areas of focus and significant risks that, in our judgment, require special audit consideration.

Areas of focus arise mainly because of complexity of the accounting rules, the extent of estimation and judgment involved in the valuation of these financial statement areas, and the existence of new accounting pronouncements that affect them. We request your input on the following areas of focus and whether there are any other areas of concern that the Performance and Audit Committee has identified.

MANDATORY AUDIT RISKS

The following areas of focus are mandatory areas of audit consideration required for all audits conducted under Canadian Audit Standards and are not specific to the Districts. As such, we are required to document and discuss these areas of focus with you:

Financial statement areas	Audit approach	Audit findings
Management Override of Internal Controls Management is in a unique position to perpetrate fraud because of their ability to directly or indirectly manipulate accounting records and prepare fraudulent financial statements by overriding controls that otherwise appear to be operating effectively. This is a mandatory risk to be addressed for all audits pursuant to Canadian audit standards	• Reviewed transactions recorded in the various ledgers for unusual or non-recurring adjustments not addressed by other audit procedures. • Tested the appropriateness of journal entries recorded in the general ledger. • Reviewed key estimates and other adjustments made in the preparation of the financial statements.	All audit testing in this area was executed as planned with no issues to be reported.

Audit findings (cont'd)

MANDATORY AUDIT RISKS (CONT'D)

Financial statement areas	Audit approach	Audit findings
Risk of Fraudulent Revenue Recognition Under Canadian auditing standards, we are required to consider whether there is a risk of material misstatement due to fraudulent revenue recognition in all audits. Based on our understanding of the Districts' significant revenue streams, we have rebutted this risk. However, there continues to be a risk of misstatement, unrelated to fraud, with respect to revenue as accounting standards over revenue recognition are complex and subject to variation in application.	• Grant funding received was confirmed through a review of agreements, which ensured that the amounts recorded exist. We also ensured the revenue was recorded accurately in accordance with the settlement of any stipulations. • Other revenues streams were reviewed to ensure revenue recognition was recorded in accordance with the latest revenue recognition standards.	We have proposed immaterial adjustments related to timing of revenue recognition and classification of revenue. Certain adjustments have not been recorded by management. Please refer to the Summary of Adjusted Differences and Summary of Unadjusted Differences. All other audit testing in this area was executed as planned with no issues to be reported.

Audit findings (cont'd)

OTHER AREAS OF FOCUS

Financial statement areas	Audit approach	Audit findings
Operational Impacts of COVID-19 The global health crisis known as 'COVID-19' continues to cause significant disruptions to workforces, financial markets, and the economy at large. Management has made changes to operations as a response to COVID-19' which continues to disrupt workforces, financial markets, and the economy at large. COVID-19 has impacted virtually all organizations across the world. Due to the nature of the Districts' operations, this continues to present unique risks and challenges that may impact its financial reporting.	• Continued to make enquiries with management relating to the impact of COVID-19 on operations to date, as well as other significant or unusual transactions that have occurred as a result of COVID-19. • We continued to review COVID-19 reporting prepared by management to the Committee to identify any items that may have a financial reporting implication. • We reviewed specific balances that may be susceptible to COVID-19 impacts such as investments, accounts receivable, and cost centers where incremental COVID-19 expenditures have been recorded. • We also reviewed financial statement disclosures to ensure that the impact of COVID-19 continues to be appropriately disclosed, as required.	All audit testing in this area was executed as planned with no issues to be reported.
Landfill Closure and Post-Closure Costs A complex area that requires much estimation and reliance on expert reports and management assumptions and calculations.	• We enquired with management regarding any significant changes to the remaining life and associated costs of the landfill. We also evaluated key inputs used in the valuation of the landfill post-closure liability and reviewed of calculations and disclosure prepared by management.	All audit testing in this area was executed as planned with no issues to be reported.

Audit findings (cont'd)

OTHER AREAS OF FOCUS

Financial statement areas	Audit approach	Audit findings
Contaminated Sites and Asset Retirement Obligations The contaminated sites standard is complex and therefore there is a risk that liabilities may not be identified and/or appropriately accounted for. The new standard PS 3280 Asset Retirement Obligations will be implemented by the Districts in F2023.	• Reviewed potential contaminated sites, and management's assessment of whether a liability exists. • Obtained an update of liabilities recorded for contaminated sites identified in prior years to determine if the accounting treatment continues to be appropriate and accurate. • We continued to work with management to provide guidance as needed towards the future implementation of PS 3280.	All audit testing in this area was executed as planned with no issues to be reported.
Staff Compensation and Employee Future Benefits Staff compensation is a significant expenditure category that covers many employees and departments. As a public body, this figure is often of particular interest to financial statement users (taxpayers). Employee future benefits is a complex area that requires much estimation and reliance on actuarial experts. The Districts record a liability for post-retirement and post-employment liabilities in the consolidated financial statements. As the GVSDD, GVWD and MVHC do not have any employees directly, there is no liability recorded in those financial statements.	• We performed tests of controls and substantive procedures over payroll transactions and year-end accruals. • We reviewed actuarial reports and audited the significant assumptions and data inputs provided by the Districts for completeness and accuracy. • We directly communicated with the external actuary. • We reviewed the consistency and appropriateness of allocations of staff costs and liabilities from Metro Vancouver Regional District to the other Districts and MVHC.	All audit testing in this area was executed as planned with no issues to be reported.

Audit findings (cont'd)

OTHER AREAS OF FOCUS

Financial statement areas	Audit approach	Audit findings
Contingent Liabilities There are various lawsuits pending against the Districts, arising in the ordinary course of business and from specific events. There is a risk that potential losses related to these lawsuits have not been appropriately accrued for, or disclosed in, the financial statements. The Districts carry insurance to minimize the overall financial impacts of adverse outcomes.	• We enquired with management of ongoing litigation, and potential claims that have an impact on the Districts. • We obtained confirmations from external solicitors of any potential contingent liabilities. • We also reviewed financial statement disclosures to ensure that disclosures are complete and in accordance with Canadian public sector accounting standards.	All audit testing in this area was executed as planned with no issues to be reported. See below regarding discussion over the NSWWTP.

Audit findings (cont'd)

OTHER AREAS OF FOCUS

Financial statement areas	Audit approach	Audit findings
North Shore Wastewater Treatment Plant The North Shore Wastewater Treatment Plant ("NSWWTP") is a new tertiary treatment facility being built by GVSDD on the North Shore. The project design and construction began in 2014. On October 15, 2021, the District served notice to terminated its contract with the vendor hired to design, build and commission the NSWWTP, having determined that the vendor was in breach of contract. As of December 31, 2021, the District has paid $309.5 million, net of GST rebates, to the vendor for work completed, which reflects management's best estimate of the cost of work in progress. Subsequent to yearend, the District drew on an irrevocable letter of credit of $50.0 million available in the case of breach of contract. Also subsequent to yearend, the vendor commenced legal action against the District as a result of the termination of the contract.	• We enquired with management of the current status of the NSWWTP capital project and ongoing litigation and claims. • We obtained confirmations from external solicitors over the existence of claims to date. • We obtained an understanding of the environmental obligations and potential consequences of non-compliance with respect to Federal regulations over wastewater treatment. • We discussed with management the impact of the termination of contract over the valuation of work-in-progress assets as at December 31, 2021, and corroborated with information from the Project Delivery department. • We reviewed supporting documentation from independent certifiers regarding the status of the last progress draw prior to the termination of contract. • We reviewed supporting documentation regarding the letter of credit which was drawn subsequent to year end. • We reviewed the disclosure management has included in the notes to the financial statements regarding the estimation uncertainty over valuation of assets, contingencies, and subsequent events.	Due to the nature of the contractual payments made to the vendor under the terminated contract, the outstanding litigation and uncertainty surrounding the value of the new contract for completion of the project, the amount recorded as work-in-progress on the NSWWTP project represents management's best estimate. This amount may be subject to material change as new information becomes available. We agree with management's approach to disclose this material uncertainty in the notes to the financial statements.

Internal control matters

During the audit, we performed the following procedures regarding the Districts' internal control environment:

- Documented operating systems to assess the design and implementation of control activities that were relevant to the audit.
- Discussed and considered potential audit risks with management.

We considered the results of these procedures in determining the extent and nature of audit testing required.

We are required to report to you in writing about any significant deficiencies in internal control that we have identified during the audit.

A significant deficiency is defined as a deficiency or combination of deficiencies in internal control that merits the attention of those charged with governance.

The audit expresses an opinion on the Districts' consolidated financial statements. As a result, it does not cover every aspect of internal controls—only those relevant to preparing the consolidated financial statements and designing appropriate audit procedures. This work was not for the purpose of expressing an opinion on the effectiveness of internal control.

No control deficiencies were noted that, in our opinion, are of significant importance to discuss. We have issued a management letter of observations where we believe improvements can be made; however, none of these items is considered to be significant.

Adjusted and unadjusted differences

Summary of unadjusted differences

The following is a summary of unadjusted differences noted during the course of our audit engagement:

	Increase (Decrease)				
	Assets	Liabilities	Accumulated surplus, opening balance	Revenues	Expenses
MVRD					
Accumulated surplus Other revenue *To correct revenue recognized in the current year related to a land transfer which occurred in the prior fiscal year.*			$ 10,305,000	$ (10,305,000)	
GVSDD					
Interest income Grant contributions *To reclassify unrestricted interest income eared from grant revenue to interest revenue.*				$ 1,038,000 $ (1,038,000)	
GVWD					
Cash Deferred revenue *To record deferred rent collected in advance.*	$ 325,000	$ 325,000			

Adjusted and unadjusted differences

Summary of unadjusted differences (cont'd)

	Increase (Decrease)				
	Assets	Liabilities	Accumulated surplus, opening balance	Revenues	Expenses
MVHC					
Operating expenses Accumulated surplus *To correct for expenses recorded in 2021 related to 2020.*			$ (390,000)		$ (390,000)
Amortization expense Accumulated surplus *To correct amortization expense for assets put into use in 2020.*			$ (266,000)		$ (266,000)
Accounts payable Operating expenses *To record accrual for expenses.*		$ 90,000			$ 90,000
Total unadjusted differences	**$ 325,000**	**$ 415,000**	**$ 9,649,000**	**$ (10,305,000)**	**$ (566,000)**

Adjusted and unadjusted differences

Summary of adjusted differences

The following is a summary of differences that were corrected by management during the course of our audit engagement :

	Increase (Decrease)			
	Assets	Liabilities	Accumulated surplus, opening balance	Annual surplus
GVSDD				
Deferred revenue Grant revenue *To record grant revenue earned during the year.*		$ (15,420,000)		$ 15,420,000
Total unadjusted differences	**$ -**	**$ (15,420,000)**	**$ -**	**$ 15,420,000**

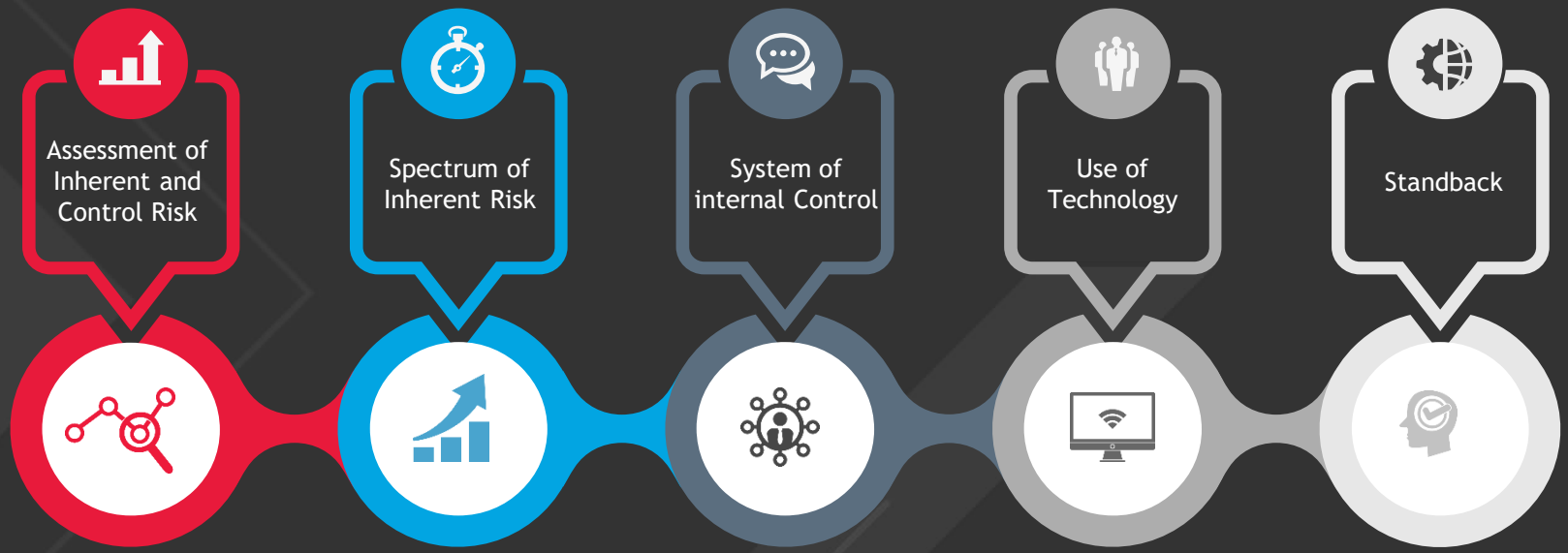
Summary of disclosure omissions

The following is a summary of disclosures that have not been made within the consolidated financial statements :

Disclosure omission	Management's response
None noted.	NA

Coming soon: updates to our audit process

Canadian Auditing Standard 315, *Identifying and Assessing the Risks of Material Misstatement*, was significantly revised with a greater focus on more robust Risk Identification, Assessment and Response procedures. The standard will be effective for periods beginning on or December 15, 2021. The updates described below will impact mainly Steps 1 through 3, of our current six step audit process. Key enhancements include:



Inherent risks (risk of material misstatement without consideration of control) and Control risks (risk of control not preventing or detecting material misstatement)

Conclude based on the assessment of likelihood and magnitude of misstatement, considering how inherent risk factors impact the degree to which inherent risk varies

Clarifying requirements on indirect and direct controls in the system of internal control and the need for evaluation of design and implementation of controls

Deeper dive in the use of Technology (IT environment and IT general controls) and related risks

More explicit Standback requirement for evaluation of completeness and appropriateness of risk assessment process

IMPACT TO YOU?

More inquiry, observation and inspection procedures, especially for risks related to the use of Technology

No change to communicating significant risks

Audit procedures focused on addressing risks identified

More consistent and effective audits with improved responses to identified risks improving audit quality for all stakeholders

BDO's digital audit suite

Our digital audit suite of technologies enables our engagement teams to conduct consistent risk-based audits, both domestically and internationally, with maximum efficiency and minimal disruption to our clients' operations and people.

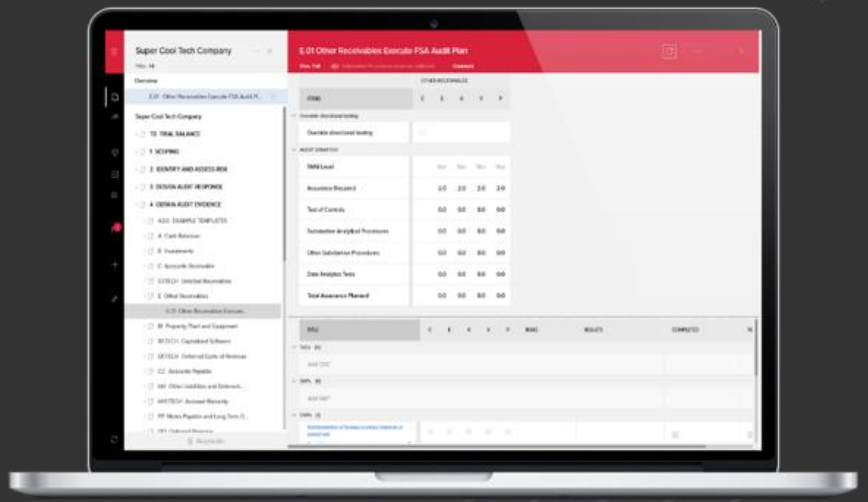
APT Next Gen

Our audit software and documentation tool, APT, is an integral part of our audit methodology. Our professionals engage APT to devise and perform appropriate, risk-based audit procedures and testing based on applicable Canadian Auditing Standards (CASs), as well as to factor in engagement and industry-specific objectives and circumstances.

APT enables us to deliver an audit that fits your organization—whether large or small; complex or basic.

This sophisticated tool also amplifies two key attributes of our audits: consistency and quality. The quality framework that we developed measures our audit performance with hard quality indicators and reflects our indispensable culture for quality. To see our audit quality and consistency in action, look no further than how our teams share best audit practices for continuous improvement.

Through a strategic alliance with Microsoft and the introduction of new technology, this global, cloud-based application can now streamline and focus the audit process in even more ways for BDO professionals and their clients.



BDO Portal

BDO Portal transforms and enhances your digital experience with your BDO advisors. Available at any time, Portal enables you to access all services, tools, apps, and information and to collaborate with your advisors in a seamless way through a flexible, appealing, and secure environment.

SECURE DOCUMENT SHARING
BDO Portal allows BDO and the clients to collaborate securely through features like multi-factor authentication, DocuSign, data storage encryption, secure document exchange, and audit logging.

ONE PLATFORM, CUSTOMER AT THE CENTRE
BDO Portal is a customer-centric solution that reflects your needs through quarterly platform releases.

SEAMLESS AND INTEGRATED EXPERIENCE
BDO Portal is an open platform enabling firms to integrate local applications and languages. This creates a seamless and tailored experience.

24/7 ACCESS TO BDO SERVICES
BDO Portal provides 24/7 access to BDO services, modern tools, and apps as well as insights tailored to your industry and business.

ENHANCE COLLABORATION
BDO Portal offers a real time collaboration space for BDO and its clients, including project, task and team management.

NOTIFICATIONS
Within the BDO Portal you can set the interval for when and which notifications you want to receive about the changes in the BDO Portal.

Recommended resources

Resuming the public sector in the new normal

The COVID-19 pandemic has created a new working normal for public sector organizations. In this video, BDO discusses some of the biggest challenges facing public sector organizations as Canada enters a new phase of recovery.

BUSINESS NOT AS USUAL

How to protect against fraud and security attacks

Given the current state of vulnerability, hackers are in a prime position to take advantage. Explore optimizing the cloud for data and AI technologies, critically assessing security risks, examining best practices for online collaboration, and more.

FRAUD AND SECURITY

COVID-19: From surviving to thriving

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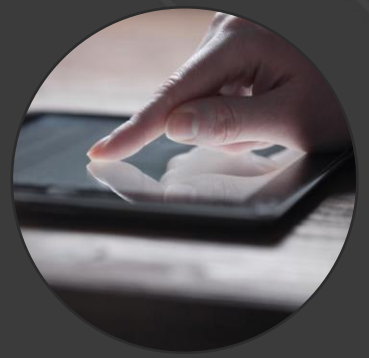
Key changes to financial reporting



When the rules of reporting change, you may need to fine-tune how to present financial statements and govern the organization.

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Transformative world events—an international health crisis, social movements, shareholder and investor values, global supply chains, energy transition, smart cities, and sustainable finance—are transforming Canadian business.

Standards and regulations are rapidly changing to reflect the goals of all your stakeholders. Organizations, investors, and customers are embracing environmental, social, and governance (ESG) considerations as important measures of success. Non-financial and financial information is becoming more interconnected.

How climate change became a business issue worth reporting

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Why manufacturers should be reviewing their ESG strategy now

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What executives need to do to align ESG with strategy

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How does COVID-19 impact the environment?

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EXPLORE NOW

ESG, and the business case for dealing with climate change

READ ARTICLE

Appendices

- Appendix A: Independent auditor's report
- Appendix B: Representation letter
- Appendix C: Management letter

Appendix A: Independent auditor's report

Please refer to the draft financial statements which have our independent auditor’s reports attached.

Appendix B: Representation letter

Metro Vancouver Regional District

April 29, 2022

BDO Canada LLP
Chartered Professional Accountants
1055 West Georgia Street PO Box 11101
Vancouver, BC V6E 3P3

This representation letter is provided in connection with your audit of the financial statements of Metro Vancouver Regional District and the following controlled entities (collectively the "Districts") for the year ended December 31, 2021, for the purpose of expressing an opinion as to whether the financial statements are presented fairly, in all material respects, in accordance with Canadian Public Sector Accounting Standards:

- Greater Vancouver Sewerage and Drainage District ("GVSDD")
- Granter Vancouver Water District ("GVWD")
- Metro Vancouver Housing Corporation ("MVHC")

We confirm that to the best of our knowledge and belief, having made such inquiries as we considered necessary for the purpose of appropriately informing ourselves:

Financial Statements

We have fulfilled our responsibilities, as set out in the terms of the audit engagement letter dated December 18, 2019, for the preparation of the financial statements in accordance with Canadian Public Sector Accounting Standards; in particular, the financial statements are fairly presented in accordance therewith.

- The methods, significant assumptions, and data used in making accounting estimates and their related disclosures are appropriate to achieve recognition, measurement and/or disclosure that are reasonable in accordance with Canadian Public Sector Accounting Standards.
- Related party relationships and transactions have been appropriately accounted for and disclosed in accordance with the requirements of Canadian Public Sector Accounting Standards.
- All events subsequent to the date of the financial statements and for which Canadian Public Sector Accounting Standards require adjustment or disclosure have been adjusted or disclosed.
- The financial statements of the entity use appropriate accounting policies that have been properly disclosed and consistently applied.
- The effects of uncorrected misstatements are immaterial, both individually and in the aggregate, to the financial statements as a whole. A list of the uncorrected misstatements is attached to the representation letter.
- We have reviewed and approved all journal entries recommended by the practitioners during the audit. A list of the journal entries is attached to the representation letter.

Information Provided

- We have provided you with:
  - access to all information of which we are aware that is relevant to the preparation of the financial statements, such as records, documentation and other matters;
  - additional information that you have requested from us for the purpose of the audit; and
  - unrestricted access to persons within the entity from whom you determined it necessary to obtain audit evidence.
- We are responsible for the design, implementation and maintenance of internal controls to prevent, detect and correct fraud and error, and have communicated to you all deficiencies in internal control of which we are aware.
- All transactions have been recorded in the accounting records and are reflected in the financial statements.
- We have disclosed to you all known instances of non-compliance or suspected non-compliance with laws and regulations whose effects should be considered when preparing the financial statements.
- We have disclosed to you the identity of the entity's related parties and all the related party relationships and transactions of which we are aware.

Fraud and Error

- We have disclosed to you the results of our assessment of the risk that the financial statements may be materially misstated as a result of fraud.
- We have disclosed to you all information in relation to fraud or suspected fraud that we are aware of and that affects the entity and involves:
  - management;
  - employees who have significant roles in internal control; or
  - others where the fraud could have a material effect on the financial statements.
- We have disclosed to you all information in relation to allegations of fraud, or suspected fraud, affecting the entity's financial statements communicated by employees, former employees, analysts, regulators, or others.

General Representations

- Where the value of any asset has been impaired, an appropriate provision has been made in the financial statements or has otherwise been disclosed to you.
- We have provided you with significant assumptions that in our opinion are reasonable and appropriately reflect our intent and ability to carry out specific courses of action on behalf of

the entity when relevant to the use of fair value measurements or disclosures in the financial statements.

- Except as disclosed in the financial statements, there have been no changes to title, control over assets, liens or assets pledged as security for liabilities or collateral.
- The entity has complied with all provisions in its agreements related to debt and there were no defaults in principal or interest, or in the covenants and conditions contained in such agreements.
- There have been no plans or intentions that may materially affect the recognition, measurement, presentation or disclosure of assets and liabilities (actual and contingent).
- The nature of all material uncertainties have been appropriately measured and disclosed in the financial statements, including all estimates where it is reasonably possible that the estimate will change in the near term and the effect of the change could be material to the financial statements.
- There were no direct contingencies or provisions (including those associated with guarantees or indemnification provisions), unusual contractual obligations nor any substantial commitments, whether oral or written, other than in the ordinary course of business, which would materially affect the financial statements or financial position of the entity, except as disclosed in the financial statements.

Other Representations Where the Situation Exists

- We have informed you of all known actual or possible litigation and claims, whether or not they have been discussed with legal counsel. When applicable, these litigation and claims have been accounted for and disclosed in the financial statements.
- We will provide to you, when available and prior to issuance by the entity, the final version of the document(s) comprising the annual report.
- We confirm the accrual related to ongoing expropriation land claims is complete and based on management's best estimate using the appropriate information and assessment of likelihood of outcome as at the date of this letter.
- We have specifically considered the impacts of COVID-19 on the amounts and disclosures in the financial statements. To the best of our knowledge and believe, the disclosures in the financial statements are accurate and complete.
- We confirm we have informed you of all known actual or possible litigation, claims, and penalties with respect to the ongoing North Shore Waste Water Treatment Plant.
- We confirm the amounts recorded as work in progress over the North Shore Waste Water Treatment Plant represents management's best estimate and that amounts may be subject to material change as new information becomes available.

Yours truly,

_____

Jerry W. Dobrovolny, P. Eng., MBA
Commissioner / Chief Administrative Officer

_____

Dean Rear, CPA, CA
General Manager, Chief Financial Officer

_____

Linda Sabatini, CPA, CA
Acting Director, Finance Operations

Appendix C: Management letter

Tel: 604.688.5421
Fax: 604.688.5132
www.bdo.ca

BDO Canada LLP
Unit 1100 - Royal Centre
1055 West Georgia Street
Vancouver, BC V6E 3P3

April 6, 2022

Metro Vancouver Regional District
Mr. Jerry Dobrovolny
Chief Administrative Officer
Metrotower III
4730 Kingsway
Burnaby, BC V5H 0C6

Dear Mr. Dobrovolny:

During the course of our audit of the consolidated financial statements ("financial statements") of Metro Vancouver Regional District (the "District") for the year ended December 31, 2021, we identified matters that may be of interest to management. The objective of an audit is to obtain reasonable assurance whether the financial statements are free of any material misstatement and it is not designed to identify matters that may be of interest to management in discharging its responsibilities. Accordingly an audit would not usually identify all such matters.

The responsibility for producing financial statements and ensuring adequate internal controls and sound business practices is the responsibility of the Board of Directors through management and is a part of management's overall responsibility for the ongoing activities of the District. Policies and procedures developed by the Districts to safeguard its assets and to provide reasonable assurance that errors and irregularities or illegal acts are promptly identified, must be properly monitored to ensure that all staff are complying with the guidelines provided. Where we determined, from our testing, that there exists a need for improvement in existing systems of internal control or if we detected that the District's staff are not complying with the critical accounting policies and procedures provided by management, we increased our year-end testing of account balances to ensure that audit risk was kept to an appropriately low level.

The comments and concerns expressed herein did not have a material effect on the District's financial statements and, as such, our opinion thereon was without reservation. However, in order for the District to ensure the safeguarding of its assets and the accuracy of its records, we believe our comments and concerns should be taken into consideration by management. Our comments are not intended to reflect upon the honesty or competence of the District's employees.

The matters we have identified are discussed in Appendix 1.

This communication is prepared solely for the information of management and is not intended for any other purposes. We accept no responsibility to a third party who uses this communication.

We shall be pleased to discuss with you further any matters mentioned in this report at your convenience.

Yours truly,

Brian Szabo, CPA, CA
Partner through a corporation
BDO Canada LLP
Chartered Professional Accountants

Current Year Management Letter Points

No items identified in the current year.

Prior Year Management Letter Points

1. Review of journal entries

   In 2020, we noted that all journal entries under $100,000 are automatically posted into Unit 4. A monthly journal entry report is sent to supervisors to review all journal entries posted to the cost centers under their supervision. The supervisors are not required to send a positive confirmation that they agree with the accuracy and appropriateness of the entries. Though there are compensating controls, we recommend that the finance department require supervisors to provide formal confirmation that they have reviewed and agree with the journal entries posted in their costs centers on a monthly basis. This confirmation should be retained as evidence of review.

   In 2021, Finance implemented a process for supervisors to review journal entries to confirm the accuracy and appropriateness of the entries.

2. Risk assessment process

   During 2020, we noted that the District did not have a consolidated enterprise risk matrix documenting the potential operating, financial, legal, reputational, and other risks the District is susceptible to, including risks relating to fraud. We recommended that management undertake a formal enterprise risk assessment to identify, document, and categorize the impact of each potential risks.

   Management is reviewing its current risk practices and working toward implementing a formal enterprise risk management framework in 2022.

3. Accounting for complex transactions

   In the prior year, we recommended management formally document the accounting position on transactions of large dollar value, particularly for large, complex infrastructure projects, before contracts are ratified, in particular where they involve complex or principles based standards. The position memo should include facts of the transaction, relevant agreement terms, a discussion of the appropriate Canadian Public Sector Accounting Standards ("PSAS") guidance and interpretation, as well as any alternative interpretations, before documenting management's conclusion. This will ensure the financial reporting impact can be thoroughly understood before the District finalizes an agreement, and will ensure the future impacts of the agreement are understood for subsequent financial reporting periods.

   Financial transactions are becoming more complex. Finance continues to work on improvements to processes to ensure conclusions on the accounting for such complex transactions and arrangements are appropriate based on requirements of PSAS.

4. Accruals for outstanding invoices

During 2019, we reviewed the recorded transactions for accruals over invoices that are outstanding but unpaid at year end. These invoices may span multiple departments and are overseen by various department heads. The amounts are recorded in the general ledger primarily through complex journal entries composed of numerous individual invoices.

During the current year audit, we continued to note cut off errors in recording operating expenses.

We continue to recommend reviewing the accrual and accounts payable reporting to explore ways to automate the process, reduce the manual inputs, and provide improved technology controls to reduce the risk for errors.

Management continues to investigate opportunities to improve reporting and the preparation of financial statements, including the implementation of a financial statement compilation tool for fiscal 2022.

To: Performance and Audit Committee

From: Joe Sass, Director, Financial Planning/Deputy CFO

Date: March 24, 2022 Meeting Date: April 14, 2022

Subject: **Capital Program Expenditure Update as at December 31, 2021**

RECOMMENDATION

That the Performance and Audit Committee receive for information the report dated March 24, 2022, titled "Capital Program Expenditure Update as at December 31, 2021."

EXECUTIVE SUMMARY

Updates on the capital program and its expenditures are brought to the Committee to keep members informed on Metro Vancouver's financial performance. This is the third and final report for the 2021 fiscal year. Attachment 1 provides a summary of the 2021 actual capital spending compared to the Board approved Capital Cash Flow Budget. Attachment 3 provides additional information and narrative by department regarding the spending variances outlined in Attachment 1.

For 2021, Metro Vancouver's capital cash flow expenditures were approximately 47% of budgeted and were underspent by $819.6 million. The underspend, primarily timing differences, is due to a variety of factors, including: delays in initiating construction, additional planning, design, and permitting requirements as well as delays in awarding of contracts and property negotiations and on-going issues related to Covid-19 pandemic.

PURPOSE

To present the Committee with the final report on the financial performance of the capital program for the year ending December 31, 2021.

BACKGROUND

Updates on the capital program and its expenditures are brought to the Committee to keep members informed on Metro Vancouver's financial performance. These updates include the actual financial progress of Metro Vancouver's capital expenditures compared to the approved cash flow limits.

Three updates were planned for the fiscal year 2021, which is consistent with the Performance and Audit Committee Terms of Reference. This is the third and final report for the 2021 fiscal year.

Separate reports containing the financial information specific to that function are also presented to the Water, Liquid Waste, Zero-Waste, Housing and Regional Parks Committees.

CAPITAL PROGRAM FUNDING

The Metro Vancouver capital spending, for Liquid Waste, Solid Waste and Water are funded through the Operating Budget by a combination of contribution to capital (pay-as-you-go funding) and debt service costs (principal and interest payments) which is generated annually from the regional

ratepayers. In 2021, the impact on the ratepayers for the Liquid Waste, Solid Waste and Water Capital cash flow of $1,462.0 million is the capital funding of $367.5 million (contribution to capital and debt service costs) included in the 2021 Operating Budget.

In the case of Regional Parks, capital spending is funded from existing reserves and grants. Contribution to these capital reserves is generated from the MVRD Tax Requisition. In 2021, the impact on the Operating Budget for the Regional Parks Capital Cash Flow Budget is the reserve contributions totaling $20.8 million, with the remaining $2.1M being funded from existing reserve balances.

For Housing Services, capital spending is funded through the Operating Budget from a combination of subsidies, grants, reserves, and debt service costs (principal and interest payments) which are primarily generated from housing rents. In 2021, the impact on the Operating Budget for the Housing Services Capital Cash Flow Budget is reserve contributions totaling $16.2M, $8.5M from grants and $5.2M from debt service costs.

2021 CAPITAL PROGRAM PROGRESS

The annual Capital Cash Flow Budget comprises the projected spending for a list of capital projects either continuing or to be started within the calendar year. Projecting the spending on these projects represents a timing exercise which is often subject to uncontrollable circumstances. These uncontrollable circumstances are more likely when projects are in certain phases of completion. Where a project is in the definition, pre-design or detailed design phases, it is more likely that a project may be subject to delays from necessary permitting, access, clarification of design details or procurement complexities which will result in a lag in spending. Conversely, when a project is within the construction phase where a contractor is in place and working effectively on site, actual spending is usually very close to budgeted expectations.

Attachment 1 provides a summary of the 2021 actual capital spending compared to the Board approved Capital Cash Flow Budget. Attachment 3 provides additional information and narrative by department regarding the spending variances outlined in Attachment 1.

For 2021, Metro Vancouver's capital expenditures were approximately 47% of budgeted cash flow and were underspent by $819.6 million.

Housing Services

Annual capital expenditures for Housing Services were $13.9M compared to the Capital Cash Flow Budget of $49.1 million, with the majority of the spending related to capital replacement and Kingston Gardens – Phase 1. The Capital Cash Flow Budget for Housing Services are funded through reserves, grants and mortgage proceeds.

The capital underspend in Housing Services is primarily due to additional lead time required for the design for Welcher Avenue that has, in turn, delayed the construction to 2022 and construction delays related to Kingston Gardens - Phase 1 due to permitting issues. Construction of Kingston Gardens – Phase 1 is now anticipated to commence in Q1 of 2022.

The "Housing Services Capital Expenditures Summary as of December 31, 2021" included in Attachment 3 provides further information.

Liquid Waste Services
Annual capital expenditures for Liquid Waste Services were $420.9 million compared to a Capital Cash Flow Budget of $934.5 million. The majority of the spending is related to the Northwest Langley Wastewater Treatment Project and the North Shore Wastewater Treatment Plant replacement.

The underspend is due to a variety of factors, including delays in tendering works or initiating construction, Covid-19 induced delays, protracted property negotiations and permitting delays. In addition, the North Shore Secondary Wastewater Treatment Plant project was previously forecasted to have two milestone payments in 2021, however the contract has been terminated.

The "Liquid Waste Services Capital Expenditures Summary as of December 31, 2021" included in Attachment 3 provided further information.

Regional Parks Services
Annual capital expenditures for Regional Parks were $22.2 million compared to the amended Capital Cash Flow Budget of $26.5 million, with the majority of the spending being for park land acquisition and capital maintenance. The 2021 amended Capital Cash Flow Budget for Regional Parks is funded through reserves. Any amounts unspent from 2021 will remain in the reserve for future use.

The underspends were predominantly related to Widgeon Marsh Regional Park development, and service yard projects in Crippen, Capilano and Pacific Spirit Regional Parks, which were all subject to additional planning, permitting, and First Nation engagement requirements that delayed planned capital expenditure. These projects have all advanced and are moving forward to implementation in 2022.

The "Regional Parks Capital Expenditures Summary as of December 31, 2021" included in Attachment 3 provides further information.

Solid Waste Services
Annual capital expenditures for Solid Waste Services were $46.2 million compared to a Capital Cash Flow Budget of $96.3 million with a majority of spending occurring in the Recycling and Waste Centre category.

The underspend is primarily due to longer than expected pre-construction phases for Waste-to-Energy Facility projects, and the property purchase timing for the North Surrey Recycling and Waste Centre recycling depot development.

The "Solid Waste Services Capital Expenditures Summary as of December 31, 2021" included in Attachment 3 provides further information.

Water Services
Annual capital expenditures for Water Services were $214.9 million compared to a Capital Cash Flow Budget of $431.3 million. A majority of spending occurred in the Growth projects including Kennedy Newton Main and Annacis Main No.5 and Resilience projects including Second Narrows Crossing Tunnel.

The current underspend is due to several factors including delays in permitting and land acquisition, as well as COVID-19 impacts.

The "Water Services Capital Expenditures Summary as of December 31, 2021" included in Attachment 3 provides further information.

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

FINANCIAL IMPLICATIONS
For 2021, primarily due to the Covid-19 pandemic and the timing of expenditures, Metro Vancouver's capital expenditures were approximately 47% of budgeted and were underspent by $819.6 million.

Regional Parks and Housing, whose capital expenditures are funded from reserves, will have no resulting surplus from the underspending of the 2021 Capital Cash Flow Budget as the monies will remain in the reserve. As the underspending is due to timing, these funds are expected to be expended in future years.

CONCLUSION
In 2021, Metro Vancouver's capital expenditures were approximately 47% of budgeted and were underspent by $819.6 million. The majority of the capital program relates to Liquid Waste, Solid Waste and Water with the underspending primarily due additional design requirements, permitting issues, delays in property acquisition and on-going issues related to the COVID-19 pandemic, which contributed to timing of expenditures differing from expectations.

Although the 2021 Capital Budget was underspent overall, the variances are generally a result of timing with the actual overall spending on a capital project expected to be close to or less than the overall budget for that project due to the savings of any budgeted contingencies.

Attachments
1. 2021 Capital Spending Summary as at December 31, 2021
2. Capital Expenditure Summary as at December 31, 2021 - Liquid Waste, Solid Waste and Water
3. Detailed Capital Expenditure Summaries – by Department
4. Capital Project Status Information – by Department

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ATTACHMENT 1

Metro Vancouver

2021 Capital Spending Summary
For the 12 months ending December 31, 2021

	2021 Budget	Actual Expenditures	% of Annual Budget
Housing Services			
Capital Replacement	9,488,000	8,727,718	
Development Capital	39,600,000	5,191,987	
	49,088,000	**13,919,705**	**28%**
Liquid Waste Services			
Infrastructure Growth Capital	270,800,000	196,292,587	
Infrastructure Maintenance Capital	193,050,000	44,830,620	
Infrastructure Resilience Capital	21,500,000	7,744,548	
Infrastructure Upgrade - WasteTreatment Capital	426,278,000	140,543,301	
Infrastructure Upgrade Capital	16,950,000	17,482,039	
Opportunity Capital	5,950,000	14,004,306	
	934,528,000	**420,897,400**	**45%**
Regional Parks			
Capital Development	7,040,000	2,637,014	
Capital Maintenance Projects	4,030,000	3,960,970	
Parkland Acquisition Fund Projects	15,435,000	15,563,340	
	26,505,000	**22,161,325**	**84%**
Solid Waste Services			
Infrastructure Opportunity Program	2,050,000	297,525	
Landfills	7,400,000	5,582,166	
Recycling and Waste Centre	62,800,000	39,306,059	
Waste to Energy Facility	24,000,000	972,417	
	96,250,000	**46,158,166**	**48%**
Water Services			
Infrastructure Growth Capital	167,550,000	65,740,372	
Infrastructure Maintenance Capital	91,200,000	52,099,076	
Infrastructure Resilience Capital	155,600,000	93,729,326	
Infrastructure Upgrade Capital	14,900,000	3,340,447	
Opportunity Capital	2,000,000	-	
	431,250,000	**214,909,221**	**50%**
Total	**1,537,621,000**	**718,045,817**	**47%**

ATTACHMENT 2

Metro Vancouver

Capital Expenditures Summary - by status
As at December 31, 2021

Liquid Waste Services	Total Budget	Total Projected Expenditures At Completion	Total Budget Less Projected Expenditures
Ongoing	$ 6,105,287,000	$ 6,441,874,000	$ (336,587,000)
Completed	249,250,000	248,180,000	1,070,000
Not Started	241,055,000	219,505,000	21,550,000
Cancelled	53,300,000	2,895,000	50,405,000
	$ 6,648,892,000	**$ 6,912,454,000**	**$ (263,562,000)**

Solid Waste Services	Total Budget	Total Projected Expenditures At Completion	Total Budget Less Projected Expenditures
Ongoing	$ 251,350,000	$ 251,205,000	$ 145,000
Completed	10,700,000	10,600,000	100,000
Not Started	253,350,000	253,350,000	-
Cancelled	-	-	-
	$ 515,400,000	**$ 515,155,000**	**$ 245,000**

Water Services	Total Budget	Total Projected Expenditures At Completion	Total Budget Less Projected Expenditures
Ongoing	$ 7,360,071,000	$ 7,341,966,000	$ 18,105,000
Completed	60,050,000	39,208,000	20,842,000
Not Started	751,200,000	751,200,000	-
Cancelled	-	-	-
	$ 8,171,321,000	**$ 8,132,374,000**	**$ 38,947,000**

Total	**$ 15,335,613,000**	**$ 15,559,983,000**	**$ (224,370,000)**

Metro Vancouver
Housing Services Capital Expenditures Summary
As of December 31, 2021

ATTACHMENT 3 - HOU

Project Name	Project Location	Current Year 2021 Budget	2021 Budget Amendments	Total 2021 Budget	Actual Expenditures	2021 Remaining Budget	Status	Comments
Grand Total Housing Services		**49,088,000**	**-**	**49,088,000**	**13,919,705**	**35,168,295**		
MVHC Capital Replacement		**9,488,000**	**-**	**9,488,000**	**8,727,718**	**760,282**	Ongoing	Underspend on large building envelopment projects due to delays during the consultant phase allowed for additional spending in minor repairs needed in rental units. Additional underspent attributed to less than expected emergency repair services.
MVHC Development Capital								
Heather Place - Building B	Vancouver	2,000,000	-	2,000,000	927,026	1,072,974	Ongoing	Abatement work was meant to begin in late 2021 but due to delays to the issuance of the city abatement permit, work is delayed until mid-2022.
Kingston Gardines - Phase 1	Surrey	17,600,000	-	17,600,000	2,244,681	15,355,319	Ongoing	Delay in permit issuance did not allow for main construction contract to commence in 2021. ESC and offsite work commenced late Q4 2021.
Malaspina	Coquitlam	500,000	-	500,000	208,425	291,575	Ongoing	Awarding of architect contract delayed from late 2021 to early 2022.
Welcher Avenue	Port Coquitlam	17,500,000	-	17,500,000	1,478,006	16,021,994	Ongoing	2021 activities include detailed project design and tendering. Construction start was anticipated for Q4 2021, but is now scheduled for Q2 2022.
Pitt Meadows Town Centre	Pitt Meadows	500,000	-	500,000	221,917	278,083	Ongoing	RFQ and RFP for project architect and design team issued and awarded in 2021. Schematic design phase proceeded through Q4 2021 and will be completed in Q1 2022.
Eastburn Square	Burnaby	500,000	-	500,000	71,509	428,491	Ongoing	Architect retention completed Dec 2021. Initital site studies commenced in Q4 2021 and will continue through Q1 2022.
Southwynde - Burnaby	Burnaby	500,000	-	500,000	40,423	459,577	Ongoing	Architect retention completed Nov 2021. Initital site studies commenced in Q4 2021 and will continue through Q1 2022.
23rd Street - CNV	North Vancouver	500,000	-	500,000	-	500,000	Cancelled	Project not proceeding.
		39,600,000	**-**	**39,600,000**	**5,191,987**	**34,408,013**		
Grand Total Housing Services		**49,088,000**	**-**	**49,088,000**	**13,919,705**	**35,168,295**		

Metro Vancouver

Liquid Waste Services Capital Expenditures Summary
As of December 31, 2021

ATTACHMENT 3 -LWS

Project Name	Project Location	Lifetime Total Project Budget	Lifetime Total Expenditures to Date	Lifetime Remaining Budget	Lifetime Projected Expenditures	Lifetime Total Budget Less Projected Expenditures	Lifetime Percent Complete	Status	Project on Schedule?	Note	Comments
Infrastructure Growth Capital											
AIWWTP Site Construction Layout	Delta	1,500,000	325,026	1,174,974	450,000	1,050,000	37%	Ongoing	Y		
Albert Street Trunk Sewer	Port Moody	8,250,000	9,006,527	(756,527)	9,200,000	(950,000)	98%	Ongoing	Y		Tunnelling resulted in increased costs. Construction is complete and sewer is in service
Annacis Outfall System	Delta	378,000,000	166,055,400	211,944,600	378,000,000	-	44%	Ongoing	Y		
Annacis Stage 5 Expansion Phase 1 T1 & T2	Delta	243,500,000	242,355,188	1,144,812	243,500,000	-	100%	Completed	Y		
Annacis Stage 5 Expansion Phase 2	Delta	22,000,000	17,901,112	4,098,888	22,000,000	-	81%	Ongoing	Y		
Annacis Stage 5 Expansion Phase 2a	Delta	180,000,000	176,861,944	3,138,056	180,000,000	-	98%	Ongoing	Y		
Annacis Stage 5 Expansion Phase 2b	Delta	390,000,000	37,799,281	352,200,719	390,000,000	-	10%	Ongoing	N		Project to be transferred to Project Delivery Department. Budget to be reassessed in 2022.
Burnaby Lake North Interceptor Cariboo Section	Burnaby	41,000,000	-	41,000,000	41,000,000	-	0%	Not Started	Y		Project scheduled to start in 2023
Burnaby Lake North Interceptor Winston Section	Burnaby	116,950,000	23,703,655	93,246,345	111,950,000	5,000,000	20%	Ongoing	Y	(1)(2)	Tunnel construction to start in Apr 2022. Project expected to be delivered under budget.
Burnaby South Slope Interceptor West Branch Extension	Burnaby	13,200,000	-	13,200,000	13,200,000	-	0%	Not Started	Y		Future project scheduled to start in 2022
Cloverdale Pump Station Capacity Upgrade	Surrey	36,400,000	296,977	36,103,023	36,400,000	-	1%	Ongoing	N		Delay to determine scope of upgrades
Cloverdale Trunk Sewer Capacity Upgrade	Surrey	29,000,000	-	29,000,000	29,000,000	-	0%	Not Started	Y		Future project scheduled to start in 2022
Glenbrook Combined Trunk Kingsway Sanitary Section	Burnaby	7,200,000	306,216	6,893,784	7,200,000	-	4%	Ongoing	N		Project delayed by about one year due to resourcing challenges, to be resumed in 2022
Hastings Sanitary Trunk Sewer No. 2	Burnaby	8,000,000	7,451,802	548,198	7,770,000	230,000	93%	Ongoing	Y	(1)(2)	Project in close out stages
Hastings-Cassiar Intake Connection	Vancouver	2,350,000	273,765	2,076,235	5,350,000	(3,000,000)	10%	Ongoing	N		Project delayed by one year to accommodate expanded scope (dynamically controlled gates) to improve functionality.
Lozells Sanitary Trunk Golf Course Section	Burnaby	27,650,000	-	27,650,000	27,650,000	-	0%	Not Started	Y		Future project scheduled to start in 2025
Lulu Island WWTP Digester No 3	Richmond	53,300,000	1,393,607	51,906,393	2,895,000	50,405,000	100%	Withdrawn	N		Project being withdrawn, some additional studies and analysis to improve system performance.
Marshend Pump Station Capacity Upgrade	Burnaby	13,775,000	649,235	13,125,765	13,775,000	-	5%	Ongoing	N		Project delyaed to properly define scope.
North Road Trunk Sewer	Coquitlam	11,675,000	6,755,667	4,919,333	11,675,000	-	58%	Ongoing	N		Majority of workis complete. Protracted permitting and negotiations are delaying the railway crossing component.
North Road Trunk Sewer Phase 2	Coquitlam	8,438,000	888,086	7,549,914	8,438,000	-	11%	Ongoing	Y		Construction deferred to 2022 at the request of the City of Coquitlam
North Vancouver Interceptor - Lynn Branch Pre-build	Dist of North Van	3,950,000	3,213,011	736,989	3,300,000	650,000	100%	Completed	Y		work complete
Northwest Langley Wastewater Treatment Program	Langley Township	1,330,700,000	198,397,652	1,132,302,348	1,629,700,000	(299,000,000)	12%	Ongoing	N	(5)	
NSI 104th Ave Extension	Surrey	12,950,000	4,938,694	8,011,306	12,950,000	-	38%	Ongoing	N		Project had been on hold for several years, and is being rescoped.
NSI Flow Management	Surrey	94,500,000	5,188,968	89,311,033	94,500,000	-	5%	Ongoing	N		Project delayed to confirm facility sizing and configuration, and address regulatory and permitting concerns
Port Moody Pump Station Capacity Upgrade	Port Moody	10,550,000	507,913	10,042,087	10,550,000	-	5%	Ongoing	N	(4)	Project on hold since Aug 2020 to revise scope with regard to revised flow requirements.
Port Moody South Interceptor Capacity Upgrade	Port Moody	3,450,000	-	3,450,000	3,450,000	-	0%	Not Started	Y		Future project scheduled to start in 2022
Rosemary Heights Pressure Sewer Capacity Upgrade	Surrey	10,750,000	-	10,750,000	10,750,000	-	0%	Not Started	Y		Future project scheduled to start in 2022
Sapperton Pump Station	New Westminster	82,003,000	74,658,883	7,344,117	77,549,000	4,454,000	98%	Ongoing	N	(1)	Substantial completion in July 2021, still to resolve defficiencies and complete decommissioning of old station.
South Surrey Interceptor Johnston Section	Surrey	84,026,000	49,523,360	34,502,640	84,026,000	-	59%	Ongoing	N		Final section delayed due to protracted property and permitting issues.
SSI - King George Section - Odor Control Facility (OCF) and Grit Chamber	Surrey	19,500,000	16,435,720	3,064,280	18,500,000	1,000,000	84%	Ongoing	N		Grit Chamber and 1 OCF operational, 2nd OCF delayed to address municipal servicing concerns.
		3,244,567,000	**1,044,887,686**	**2,199,679,314**	**3,484,728,000**	**(240,161,000)**					
Infrastructure Maintenance Capital											
AIWWTP Chemical Lab UPS System Replacement	Delta	600,000	9,497	590,503	600,000	-	2%	Ongoing	Y		
AIWWTP Cogen Building Refurbishment	Delta	1,500,000	95,415	1,404,585	1,500,000	-	6%	Ongoing	Y		
AIWWTP Fibre Optic Infrastructure	Delta	1,500,000	1,315,446	184,554	1,400,000	100,000	88%	Ongoing	Y		
AIWWTP ICS Replacement Program	Delta	14,350,000	-	14,350,000	14,350,000	-	0%	Not Started	N		Delayed to give way to Stage V Activities.
AIWWTP Influent System Remediation	Delta	82,500,000	416,865	82,083,135	82,500,000	-	1%	Ongoing	Y		Existing Annacis outfall condition led to change in risk profile and work scope of project. Conducting risk assessment prior to revising estimate and schedule
AIWWTP IPS Pump Building Roof Replacement Phase 2	Delta	830,000	-	830,000	830,000	-	0%	Not Started	N	(4)	Future project scheduled to start in 2024
AIWWTP Outfall Repair	Delta	1,800,000	-	1,800,000	1,800,000	-	0%	Not Started	N	(4)	Scope review underway to account for new inspection information.
AIWWTP Replacement of ICS Equipment in Galleries	Delta	2,895,000	2,558,316	336,684	2,895,000	-	88%	Ongoing	Y		
LC11121 AIWWTP Scheduled 64kV Potential & Current Transformer R	Delta	400,000	150,300	249,700	400,000	-		Ongoing			
LC11122 AIWWTP Scheduled 64kV Potential & Current Transformer R	Delta	400,000	-	400,000	400,000	-		Not Started			
AIWWTP Scheduled 64kV Potential & Current Transformer Replacements	Delta	800,000	150,300	649,700	800,000	-	19%	Ongoing	Y		
AIWWTP SCL Flow Balancing	Delta	2,450,000	913,895	1,536,105	2,450,000	-	37%	Ongoing	Y		
AIWWTP SCL Flow Control	Delta	31,500,000	18,277,418	13,222,582	31,500,000	-	58%	Ongoing	Y		
AIWWTP Scum Pump Replacement	Delta	1,350,000	-	1,350,000	1,350,000	-	0%	Not Started	Y	(4)	Future project scheduled to start in 2024

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ATTACHMENT 3 - LWS

		Lifetime									
Project Name	**Project Location**	**Total Project Budget**	**Total Expenditures to Date**	**Remaining Budget**	**Projected Expenditures**	**Total Budget Less Projected Expenditures**	**Percent Complete**	**Status**	**Project on Schedule?**	**Note**	**Comments**
AIWWTP Secondary Effluent Discharge Flowmeter Replacement	Delta	400,000	44,719	355,281	200,000	200,000	99%	Ongoing	Y	(2)	Project in final closeout phases, and will be completed significantly under budget by coordination with other works.
AIWWTP Spare Trickling Filter Pump & Motor Purchase	Delta	1,950,000	-	1,950,000	1,950,000	-	15%	Ongoing	N		tender for supply of pump was issued.
AIWWTP Station Battery Replacement - PHASE 2	Delta	400,000	155,083	244,917	400,000	-	39%	Ongoing	Y	(2)	
AIWWTP Trickling Filter Media & Distributor Arms & Ducting Replacement	Delta	90,700,000	32,890,863	57,809,137	90,700,000	-	50%	Ongoing	Y		
Annacis Island WWTP - ICS Component Replacement and Upgrade Program	Delta	1,500,000	1,405,577	94,423	1,500,000	-	94%	Ongoing	Y		
Annacis MCC 80 051, 80 070, 80 071 Replacement	Delta	2,844,000	2,171,429	672,571	2,844,000	-	76%	Ongoing	Y		
Annacis Secondary Clarifier Corrosion Repair and Leveling Phase 2	Delta	22,000,000	9,188,811	12,811,189	22,000,000	-	42%	Ongoing	Y		
Big Bend Forcemain - Gate Replacement	Richmond	2,680,000	70,209	2,609,791	2,680,000	-	3%	Ongoing	N	(4)	Project on hold to confirm scope of repairs
Cambie Trunk Sewer Relocation for Broadway Subway Project	Vancouver	4,500,000	1,155	4,498,845	1,500,000	3,000,000	1%	Ongoing	N		Externally driven and executed project. Scope has been clarified since original submission and expected MV costs reduced.
Combined Sewer Overflow Sampling Station Enhancements	Regional	1,900,000	515,480	1,384,520	1,900,000	-	27%	Ongoing	Y		
Crescent Beach FM - Replacement	Surrey	29,070,000	6,637,856	22,432,144	28,095,000	975,000	23%	Ongoing	Y		
English Bay/Balaclava Outfalls Improvement	Vancouver	900,000	-	900,000	900,000	-	0%	Not Started	Y		Future project scheduled to start in 2022
FSA Flow Metering Program	Regional	3,500,000	1,674,324	1,825,676	3,500,000	-	48%	Ongoing	Y		
FSA Statutory Right of Way Acquisitions Phase 1	Delta/Port Moody	24,000,000	-	24,000,000	35,100,000	(11,100,000)	0%	Ongoing	Y		For acquisition of rights-of-way as opportunities arise.
Gilbert/Brighouse Trunk Pressure Sewer Rehab Phase 5	Richmond	23,200,000	-	23,200,000	23,200,000	-	0%	Not Started	Y		Future project scheduled to start in 2023.
Gilbert/Brighouse Trunk Pressure Sewer Twinning Phase 3	Richmond	54,300,000	14,456,592	39,843,408	54,300,000	-	27%	Ongoing	N		Tender to be issued Feb. 2022 Construction to begin fall of 2022
Gilbert/Brighouse Trunk Pressure Sewer Twinning Phase 4	Richmond	41,800,000	1,105,049	40,694,951	41,800,000	-	3%	Ongoing	N		Tender to be issued Mar. 2022 Construction to begin end of 2022
Glen Eagles Forcemains Replacement Phase 2	West Vancouver	7,750,000	722,627	7,027,373	8,200,000	(450,000)	9%	Ongoing	N		Project delayed due to alignment changes and difficult site conditions.
Glen Eagles Pump Stations Phase 1	West Vancouver	22,500,000	1,472,180	21,027,820	22,500,000	-	7%	Ongoing	N		Delays in design due to permitting and properties. Design now complete.
Glen Eagles Pump Stations Phase 2	West Vancouver	5,000,000	-	5,000,000	5,000,000	-	0%	Not Started	Y		Future project scheduled to start in 2022
Harbour Pump Station Discharge Header Repair and Valve Replacements	Vancouver	1,500,000	-	1,500,000	1,500,000	-	0%	Not Started	Y		Design underway. Construction expected in summer 2023.
Harbour Pump Station Power Distribution Equipment Replacement	Vancouver	3,300,000	95,381	3,204,619	3,300,000	-	3%	Ongoing	Y		
Harbour West & East Interceptors Reloc & Protect	Vancouver	16,900,000	5,149,307	11,750,693	19,500,000	(2,600,000)	30%	Ongoing	Y		Externally driven and executed projects. Estimate based upon latest scope of work.
Highbury Interceptor Diversion Junction Chamber Wall Rehabilitation	Vancouver	6,000,000	-	6,000,000	6,000,000	-	0%	Not Started	N		Project delayed to coordinate with other work.
IIWWTP Digester 4 Roof Replacement & Mixing Replacement	Richmond	24,800,000	17,708,752	7,091,248	20,300,000	4,500,000	95%	Ongoing	Y	(2)	
IIWWTP Grit System Refurbishment	Richmond	8,100,000	7,503,949	596,051	8,100,000	-	93%	Ongoing	Y		
IIWWTP ICS IPS Control Replacement	Richmond	1,750,000	357,630	1,392,370	1,750,000	-	20%	Ongoing	Y		
IIWWTP ICS Replacement Program	Richmond	750,000	-	750,000	750,000	-	0%	Not Started	Y		
IIWWTP Influent Gate Refurbishment	Richmond	1,350,000	552,463	797,537	1,110,641	239,000	41%	Ongoing	Y		
IIWWTP IPS Drive Remediation	Richmond	1,400,000	-	1,400,000	1,400,000	-	0%	Not Started	N	(4)	Project was delayed to confirm scope
IIWWTP MCC/Power Distribution Assess/Replace - Phase 2	Richmond	1,000,000	603,103	396,897	750,000	250,000	99%	Ongoing	Y	(2)	Project at close out stages and will see a surplus.
IIWWTP PA-Sed Tank & Gallery Wall Refurbishment	Richmond	925,000	-	925,000	925,000	-	0%	Not Started	N		Work delayed to confirm scope of repair.
IIWWTP Replacement of CoGen Control System	Richmond	2,470,000	1,090,592	1,379,408	2,470,000	-	44%	Ongoing	Y		
IIWWTP Siphon Chamber Refurbishment	Richmond	2,150,000	-	2,150,000	2,150,000	-	0%	Not Started	N		Project delayed to allow improved coordination of other related works and improve safe operating conditions for work site.
IIWWTP Solids Handling Refurbishment	Richmond	30,500,000	30,293,884	206,116	30,350,000	150,000	99%	Ongoing	Y	(2)	
Iona Island Control & Instrumentation Replacement 2011	Richmond	2,750,000	2,033,547	716,453	2,750,000	-	74%	Ongoing	Y		
Jervis Pump Station 25kV Voltage Conversion	Vancouver	1,300,000	11,489	1,288,512	1,300,000	-	1%	Ongoing	Y		
Kent Pump Station High Voltage Switchgear Replacement	Vancouver	2,000,000	-	2,000,000	2,000,000	-	0%	Ongoing	Y		Future project scheduled to start in 2022
LIWWTP CCT Isolation Gates	Richmond	2,050,000	669,623	1,380,377	2,050,000	-	33%	Ongoing	Y		
LIWWTP High Efficiency Boiler	Richmond	1,330,000	156,382	1,173,618	1,330,000	-	12%	Ongoing	N	(4)	Rescheduled to after Biogas Cleanup Project is completed and in operation.
LIWWTP ICS Component Replacement	Richmond	360,000	338,299	21,701	360,000	-	94%	Ongoing	Y		
LIWWTP ICS Replacement Program	Richmond	6,750,000	454,996	6,295,004	6,750,000	-	7%	Ongoing	Y		
LIWWTP PA-Sed Tank Refurbishment	Richmond	4,115,000	46,529	4,068,471	4,115,000	-	1%	Ongoing	Y		
LSA Flow Metering Program	Richmond	300,000	76,399	223,601	300,000	-	25%	Ongoing	Y		
Marshend PS Rehab	Burnaby	7,000,000	1,037,052	5,962,948	7,000,000	-	15%	Ongoing	N		Project delayed to confirm scope, but is now proceeding.
New West Interceptor Grit Chamber	New Westminster	9,050,000	221,159	8,828,841	9,050,000	-	2%	Ongoing	N		Project delayed to coordinate with Sapperton PS completion and focus on higher priority work.
New Westminster Interceptor Repair Columbia St. Section	New Westminster	32,782,000	5,522,820	27,259,180	32,782,000	-	17%	Ongoing	N		Project under construction and experiencing some delays in execution.
NLWWTP Screw Pump Replacement	Langley City	1,550,000	1,218,261	331,739	1,550,000	-	79%	Ongoing	Y		
North Surrey Interceptor Annieville Channel Crossing Scour Protection	Regional	995,000	397,633	597,367	995,000	-	40%	Ongoing	Y		
NSA Flow Metering Program	West Vancouver	900,000	205,310	694,690	900,000	-	23%	Ongoing	Y		
NSA Scour Protection Upgrades	Regional	2,250,000	-	2,250,000	2,250,000	-	0%	Ongoing	Y		
NSI Rehab or Replacement	Surrey	46,463,000	3,894,715	42,568,285	46,463,000	-	8%	Ongoing	N		Port Mann rehabilitation nearing completion, Manson Road section delayed to confirm future flow requirements.
NWI - Annacis Section 2 Improvement	Delta	45,000,000	4,875,170	40,124,830	45,000,000	-	11%	Ongoing	N		Project delayed to improve scope definition, and coordination with other works.
NWL WWTP 25 kV Substation Replacement	Langley Township	10,025,000	8,704,590	1,320,410	8,666,000	1,359,000	87%	Ongoing	Y	(1)	

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ATTACHMENT 3 - LWS

		Lifetime									
Project Name	**Project Location**	**Total Project Budget**	**Total Expenditures to Date**	**Remaining Budget**	**Projected Expenditures**	**Total Budget Less Projected Expenditures**	**Percent Complete**	**Status**	**Project on Schedule?**	**Note**	**Comments**
Ocean Park Trunk Crescent Section (OPC) Pipe Rehabilitation/Replacement	Surrey	4,953,000	2,639,076	2,313,924	2,753,000	2,200,000	98%	Ongoing	N	(1)	Project in final closeout phases, and will be completed significantly under budget.
Ocean Park Trunk Manholes Lining	Surrey	550,000	-	550,000	550,000	-	0%	Not Started	Y		Future project scheduled to start in 2022
Port Coquitlam Pump Station Refurbishment	Port Coquitlam	9,250,000	263,866	8,986,134	51,100,000	(41,850,000)	1%	Ongoing	Y		Scope changed since original concept, and a replacement pump station is now likely required. The budget was updated in the 2022 Capital Plan
Port Moody Storm Drain Rehabilitation	Port Moody	1,650,000	-	1,650,000	1,650,000	-	0%	Not Started	N		Future project scheduled to start in 2023
Royal Ave PS Rehabilitation	New Westminster	7,238,000	1,364,859	5,873,141	8,238,000	(1,000,000)	16%	Ongoing	Y		Costs updated to reflect scope as per 70% detail design.
Sewer Relocations and Protections at Fraser Surrey Docks	Surrey	25,800,000	-	25,800,000	4,000,000	21,800,000	0%	Not Started	N		Externally driven and executed project. Scope has been reduced since BHP pulled out of terminal upgrade proposal.
Sewer Relocations and Protections for Pattullo Bridge Replacement Project	New Westminster	7,000,000	3,218	6,996,783	7,000,000	-	1%	Ongoing	N		Externally driven and executed project.
SSI Influent Control Chamber Repair and Replace Gates	Delta	1,305,000	13,554	1,291,446	1,305,000	-	1%	Ongoing	N	(4)	Project on hold to confirm scope of repairs
Surrey Corrosion Control Facility Replacement	Surrey	2,900,000	461,699	2,438,301	7,250,000	(4,350,000)	16%	Ongoing	N		Project delayed to confirm configuration and location of facility.
VSA Flow Metering Program	Regional	5,800,000	683,346	5,116,654	5,800,000	-	12%	Ongoing	Y		
Westridge FM Replacement	Burnaby	3,650,000	686,027	2,963,973	3,650,000	-	19%	Ongoing	N		Project delayed in early 2021 to focus on higher priority work
Westridge Pump Stations 1 & 2 Refurbishment	Burnaby	16,250,000	731,798	15,518,202	16,250,000	-	5%	Ongoing	Y		
White Rock Forcemain Rehabilitation	White Rock/Surrey	8,700,000	19,949	8,680,051	8,700,000	-	0%	Not Started	Y		Future project scheduled to begine in 2022
Works Yard	Burnaby	32,000,000	26,550,793	5,449,207	32,000,000	-	83%	Ongoing	Y		
		889,880,000	**222,886,326**	**666,993,674**	**919,059,641**	**(29,180,000)**					
Infrastructure Resilience Capital											
AIWWTP 69 kV Substation Modifications	Delta	5,500,000	2,575,199	2,924,801	5,500,000	-	47%	Ongoing	Y		
AIWWTP Automation of Influent Gates	Delta	3,700,000	3,583,620	116,380	3,694,681	5,000	97%	Ongoing	Y		
AIWWTP Cogeneration Backup Power	Delta	75,003,000	70,237,858	4,765,142	72,003,000	3,000,000	94%	Ongoing	Y		Project nearing completion and expected to come in under budget.
AIWWTP PST Area Walkway & Column Remediation	Delta	1,800,000	1,391,248	408,752	1,380,000	420,000	100%	Completed	Y	(1)(2)	Under budget due to efficient design, competitive market pricing and less tank defects than anticipated.
AIWWTP UPS Condition Monitoring System	Delta	550,000	-	550,000	550,000	-	0%	Not Started	N	(4)	Construction on hold until resolution of design issues.
Highbury Interceptor North Arm Crossing - Upgrade of Siphons	Vancouver	12,500,000	12,246,186	253,814	12,500,000	-	98%	Ongoing	N		Project execution delayed to coordinate safety approvals
IIWWTP - Biogas Lines Relocation	Richmond	5,780,000	3,942,379	1,837,621	5,780,000	-	75%	Ongoing	N		Delays due to challenges with approvals and supply chain issues.
IIWWTP Standby Diesel Generators	Richmond	5,000,000	2,791	4,997,209	5,000,000	-	1%	Ongoing	N		
LIWWTP Power Reliability	Richmond	8,202,000	1,830,816	6,371,184	8,202,000	-	22%	Ongoing	N		Project delayed due to procurement and to coordinate design issues.
SSI Sulfide Odour and Corrosion Control	Delta	7,700,000	1,074,954	6,625,046	7,700,000	-	14%	Ongoing	N		Project delayed due to procurement issues
VSA Emergency Backup Power	Vancouver	24,310,000	12,945,579	11,364,421	24,310,000	-	53%	Ongoing	N		5 of 7 units are complete, 2 stations (Jervis and Chilco PS) are delayed due to protracted property and permitting issues.
		150,045,000	**109,830,630**	**40,214,370**	**146,619,681**	**3,425,000**					
Infrastructure Upgrade - WasteTreatment Capital											
Iona Secondary Treatment Upgrade	Richmond	750,000,000	24,740,016	725,259,984	750,000,000	-	3%	Ongoing	Y	(5)(6)	
North Shore WWTP Secondary Upgrade and Conveyance	Dist of North Van	1,057,867,000	497,387,107	560,479,893	1,057,867,000	-	37%	Ongoing	N	(5)	
		1,807,867,000	**522,127,122**	**1,285,739,878**	**1,807,867,000**	**-**					
Infrastructure Upgrade Capital											
AIWWTP Ammonia Removal – Sidestream	Delta	125,900,000	734,499	125,165,501	125,900,000	-	1%	Ongoing	Y	(4)	Continuing with data collection with more analyses in 2022 to confirm study results. Design not scheduled to start until late in the decade.
AIWWTP Electrical Distribution System Protection Control and Monitoring	Delta	2,650,000	607,205	2,042,795	2,650,000	-	23%	Ongoing	Y		
AIWWTP Replacement of Protective Relays	Delta	3,258,000	2,242,665	1,015,335	3,258,000	-	69%	Ongoing	Y		
All WWTPs Power Quality Monitoring & Outage Alarming Network	Regional	2,870,000	2,632,027	237,973	2,870,000	-	92%	Ongoing	Y		
Biosolids Dryer	Delta	211,700,000	11,722,975	199,977,025	211,700,000	-	1%	Ongoing	Y		Project delayed to confirm location (AIWWTP vs NWL WWTP)
Ferguson Road Paving Refurbishment	Richmond	850,000	-	850,000	1,100,000	(250,000)	0%	Not Started	Y		Project Scheduled to start in 2022
Glenbrook Combined Trunk Sewer Separation	New Westminster	73,450,000	268,911	73,181,089	73,450,000	-	1%	Ongoing	Y		Initial phase (project scoping) is complete. Balance of project not scheduled to start for some years.
IIWWTP Biosolids Dewatering Facility	Richmond	61,300,000	56,409,219	4,890,781	61,300,000	-	92%	Ongoing	N		Project delayed due to construction and permitting issues, but is nearing completion
IIWWTP Sludge Lagoons Dewatering Facility	Richmond	4,000,000	1,949,205	2,050,795	4,000,000	-	90%	Ongoing	N		Delayed due to supply chain issues.
LIWWTP Effluent Heat Recovery Project	Richmond	10,000,000	-	10,000,000	10,000,000	-	0%	Not Started	Y		

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ATTACHMENT 3 - LWS

		Lifetime									
Project Name	**Project Location**	**Total Project Budget**	**Total Expenditures to Date**	**Remaining Budget**	**Projected Expenditures**	**Total Budget Less Projected Expenditures**	**Percent Complete**	**Status**	**Project on Schedule?**	**Note**	**Comments**
New CSO Management Gates for New Westminster Interceptor	New Westminster	5,925,000	608,135	5,316,865	5,925,000	-	10%	Ongoing	Y		
Ocean Park Trunk Sewer - Air Management Facility	Surrey	7,750,000	-	7,750,000	7,750,000	-	0%	Not Started	N	(4)	On hold due to protracted property negotiations
WWTPs Electrical System Studies & Upgrades	Regional	1,900,000	11,405	1,888,595	1,900,000	-	1%	Ongoing	N	(4)	Awaiting completion of AI Stage 5 Ph1 and AI Cogen projects studies.
		511,553,000	**77,186,246**	**434,366,754**	**511,803,000**	**(250,000)**					
Opportunity Capital											
AIWWTP Hydrothermal Processing Pilot	Delta	19,380,000	1,072,859	18,307,141	19,380,000	-	10%	Ongoing	Y		
Fraser Sewerage Area Integrated Resource Recovery (IRR) Study	Regional	1,200,000	137,146	1,062,854	1,200,000	-	11%	Ongoing	N		Adding scope to the sudy. Anticipated completion Fall 2022
LIWWTP Biogas Clean-up Project	Richmond	13,800,000	11,928,139	1,871,861	13,800,000	-	86%	Ongoing	Y		
LIWWTP Pilot Digestion Optimization Facility	Richmond	3,100,000	1,398,421	1,701,579	3,100,000	-	45%	Ongoing	Y		
North Surrey Interceptor - Port Mann Section - Odour Control	Surrey	7,500,000	253,199	7,246,801	7,500,000	-	2%	Ongoing	N		Project delayed due to resourcing and scope definition. Project now proceeding
		44,980,000	**14,789,764**	**30,190,236**	**74,580,000**	**(29,600,000)**					
Grand Total Liquid Waste Services		**6,648,892,000**	**1,991,707,776**	**4,657,184,224**	**6,912,454,000**	**(263,562,000)**					

Notes:

(1) Project will be completed under budget - savings due to competitive pricing.
(2) Full contingency not required.
(3) Design work done in house resulting in lower cost.
(4) Project on hold.
(5) Separate status reports are being provided to Liquid Waste Committee and Board.
(6) Project budget is for up to 2025 only.

Metro Vancouver

Regional Parks Capital Expenditures Summary
As of December 31, 2021

Project Name	Project Location	Current Year: 2021 Budget	2021 Budget Amendments	Total 2021 Budget	Actual Expenditures	2021 Remaining Budget	Status	Notes / Comments
Regional Parks Capital Expenditures Summary		**23,070,000**	**3,435,000**	**26,505,000**	**22,161,324**	**4,343,676**		
Capital Maintenance Projects		**4,030,000**	**-**	4,030,000	**3,960,970**	69,030		Budget fully expended. Extensive progress on asset management initatives throughout the regional park system.
Regional Parks Land Acquisition								
Regional Parks Land Acquisition program total		12,000,000	(12,000,000)	-	-	-		
Kanaka Creek - 27372 Dewdney Trunk Road, Maple Ridge		-	2,250,000	2,250,000	2,305,147	(55,147)	Completed	3.4 hectares of land for Kanaka Creek.
Codd Wetlands - 21198 Thompson Road, Pitt Meadows		-	11,500,000	11,500,000	11,552,808	(52,808)	Completed	59 hectares of land for Codd Wetlands.
Codd Wetlands - 14788 Neaves Road, Pitt Meadows		-	1,685,000	1,685,000	1,705,385	(20,385)	Completed	14.3 hectares for Codd Wetlands.
				-		-		
		12,000,000	**3,435,000**	**15,435,000**	**15,563,340**	**(128,340)**		
Capital Development Projects								
Widgeon Marsh - New Park Development	Coquitlam	4,500,000		4,500,000	653,577	3,846,423	Ongoing	A multi-year project to design and develop Widgeon Marsh Regional Park. Implementation planned for 2021 was deferred to 2022 to provide time for additional archeological investigation, relationship building and collaboration with First Nations.
Capilano - New Service Yard	North Vancouver	750,000		750,000	104,587	645,413	Ongoing	The Capilano River service yard is in the final stages of the development permitting process with District of North Vancouver. Construction will proceed in 2022.
Grouse - BCMC Realignment + Improvement	North Vancouver	350,000	200,000	550,000	417,267	132,733	Ongoing	A multi-year project to implement the Grouse Mountain Trail and Amenity Improvement project, funded by an Investing in Canada Infrastructure Grant. Significant improvements to the Grouse Grind and BCMC Trails were completed in 2021. Design, First Nation engagement, and implementation of the project will extend to 2024.
Burnaby Lake - Service Yard Replacement	Burnaby	450,000	(200,000)	250,000		250,000	Ongoing	Regional Park staff are advancing pre-planning and service yard location assesment. This project will move forward in 2022/2023.
Colony Farm - Sheep Paddocks Trail Rebuild	Port Coquitlam	100,000		100,000	21,370	78,630	Complete	This project is complete.
Boundary Bay - Perimeter Trail	Delta	-	150,000	150,000	154,773	(4,773)	Complete	This project is complete.
Derby Reach - Full Service Washroom	Langley	290,000		290,000	46,093	243,907	Ongoing	A multi-year project to construct a full service washroom facility in Derby Reach Regional Park. Consturction was initiated in 2021 and will be complete in 2022.
Crippen - Dorman Point Access and Amenities	Bowen Island	-	50,000	50,000	21,858	28,142	Ongoing	Site design initiated in 2021. Implementation is underway and will be complete in 2022.
Campbell Valley - Perimeter Greenway Trail	Langley	600,000	(200,000)	400,000	51,166	348,834	Ongoing	A multi-year project to implement the MVRD Board approved mangement plan. Design work was initiated in 2021. Construction will extend from 2022-2024 with implementation of priority trail and staging area improvements beginning in Spring 2022.
Crippen - New Service yard	Bowen Island			-	1,101,425	(1,101,425)	Substantially Complete	2020 capital project carryover expenses. Project is substantially complete.
Aldergrove - Phase 1 Management Plan	Langley			-	5,621	(5,621)	Complete	2020 capital project carryover expenses. Project complete.

Metro Vancouver

Regional Parks Capital Expenditures Summary
As of December 31, 2021

		Current Year						
Project Name	**Project Location**	**2021 Budget**	**2021 Budget Amendments**	**Total 2021 Budget**	**Actual Expenditures**	**2021 Remaining Budget**	**Status**	**Notes / Comments**
Crippen - Davies Orchard Cabins	Bowen Island			-	59,277	(59,277)	Ongoing	This project was awarded a $450,000 provincial grant. Design was finalized in 2021. Implementation will proceed through 2022.
		7,040,000	**-**	**7,040,000**	**2,637,014**	**4,402,986**		
Grand Total Regional Parks		**23,070,000**	**3,435,000**	**26,505,000**	**22,161,324**	**4,343,676**		

Metro Vancouver
Solid Waste Services Capital Expenditures Summary
As of December 31, 2021

Project Name	Project Location	Lifetime: Total Project Budget	Lifetime: Total Expenditures to Date	Lifetime: Remaining Budget	Lifetime: Projected Expenditures	Lifetime: Total Budget Less Projected Expenditures	Lifetime: Percent Complete	Lifetime: Status	Lifetime: Project on Schedule?	Note	Comments
Infrastructure Opportunity Program											
WTE Facility District Heating Opportunities	Burnaby	2,300,000	440,453	1,859,547	2,300,000	-	25%	Ongoing	Y		
		2,300,000	**440,453**	**1,859,547**	**2,300,000**	**-**					
Landfills											
Alternative Fuel and Recyclables Recovery Centre	Coquitlam	60,000,000	-	60,000,000	60,000,000	-	0%	Not Started	Y		
Coquitlam Landfill Closure*	Coquitlam	5,000,000	4,998,995	1,005	5,000,000	-	100%	Completed	Y		
Coquitlam Landfill East Closure	Coquitlam	5,000,000	-	5,000,000	5,000,000	-	0%	Not Started	Y		
Coquitlam Landfill Fly Ash Cell 2 Closure Final Cover*	Coquitlam	3,200,000	3,197,734	2,266	3,200,000	-	100%	Completed	Y		
Coquitlam Landfill Gas Collection Upgrades*	Coquitlam	3,100,000	2,856,423	243,577	3,100,000	-	92%	Ongoing	Y		
Coquitlam Landfill Gas Collection Upgrades Phase II*	Coquitlam	3,600,000	3,098,378	501,622	3,600,000	-	85%	Ongoing	Y		
Coquitlam Landfill Lot 3 Development*	Coquitlam	5,000,000	3,718,273	1,281,727	5,000,000	-	95%	Ongoing	Y		
Coquitlam Landfill Pump Station Upgrade*	Coquitlam	800,000	430,009	369,991	800,000	-	85%	Ongoing	Y		
Coquitlam Landfill: Leachate Collection System Grade Realignment	Coquitlam	1,000,000	-	1,000,000	1,000,000	-	0%	Not Started	Y		
		86,700,000	**18,299,812**	**68,400,188**	**86,700,000**	**-**					
Recycling and Waste Centre System											
United Boulevard Recycling and Waste Centre Compactor	Coquitlam	2,500,000	2,317,600	182,400	2,400,000	100,000	100%	Completed	Y		
United Boulevard Recycling and Waste Centre	Coquitlam	77,600,000	71,659,209	5,940,791	77,600,000	-	96%	Ongoing	N		Facility opened on March 14, 2022
Langley Recycling and Waste Centre Recycling Depot Expansion	Langley Township	5,500,000	-	5,500,000	5,500,000	-	0%	Not Started	Y		
Maple Ridge Recycling and Waste Centre Upgrades	Maple Ridge	2,000,000	-	2,000,000	2,000,000	-	0%	Not Started	Y		
North Shore Recycling and Waste Centre Compactor Replacement	North Vancouver	2,500,000	-	2,500,000	2,500,000	-	0%	Not Started	Y		
Central Surrey Recycling and Waste Centre	Surrey	62,300,000	40,541,940	21,758,060	62,300,000	-	85%	Ongoing	Y		Facility expected to open in early summer 2022
North Surrey Recycling and Waste Centre Compactor Replacement	Surrey	2,500,000	-	2,500,000	2,500,000	-	0%	Not Started	Y		
North Surrey Recycling and Waste Centre Recycling Depot Expansion	Surrey	25,500,000	-	25,500,000	25,500,000	-	0%	Not Started	N		Land acquisition expected early 2022. Project not started
Western Region Recycling and Waste Centre Replacement	Regional	75,000,000	-	75,000,000	75,000,000	-	0%	Not Started	Y		
		255,400,000	**114,518,749**	**140,881,251**	**255,300,000**	**100,000**					
Waste to Energy Facility											
Acid Gas Reduction	Burnaby	41,000,000	450,000	40,550,000	41,000,000	-	1%	Ongoing	Y		
Biosolids Processing	Burnaby	20,500,000	367,243	20,132,757	20,368,000	132,000	5%	Ongoing	y		
Bottom Ash Crane Replacement	Burnaby	1,500,000	-	1,500,000	1,500,000	-	0%	Ongoing	Y		
Bottom Ash Processing	Burnaby	6,800,000	6,248,214	551,786	6,800,000	-	92%	Ongoing	N		Project schedule impacted due to the timing of the procurement phase
Carbon Silo Replacement	Burnaby	2,400,000	-	2,400,000	2,400,000	-	0%	Not Started	Y		
Compressed Air System Replacement	Burnaby	3,000,000	8,423	2,991,577	3,000,000	-	5%	Ongoing	Y		
District Energy	Burnaby	40,000,000	-	40,000,000	40,000,000	-	0%	Not Started	Y		
Electrical Transformers Replacement	Burnaby	5,000,000	-	5,000,000	5,000,000	-	0%	Not Started	Y		
Fabric Filter Hopper and Pulse Header Refurbishment	Burnaby	2,250,000	-	2,250,000	2,250,000	-	5%	Ongoing	N		Consultant has been engaged for detailed design.
Feed Hopper/Chute	Burnaby	2,600,000	1,602,760	997,240	2,587,000	13,000	70%	Ongoing	Y		
Fly Ash Silo Refurbishment	Burnaby	1,000,000	-	1,000,000	1,000,000	-	0%	Not Started	Y		
Generation Bank Replacement	Burnaby	9,000,000	-	9,000,000	9,000,000	-	0%	Not Started	Y		
Lime Silo Replacement	Burnaby	3,600,000	-	3,600,000	3,600,000	-	0%	Not Started	Y		
Primary Economizer Replacement	Burnaby	5,000,000	93,851	4,906,149	5,000,000	-	2%	Ongoing	N		Authorization has been provided to Covanta
Primary Superheaters Replacement	Burnaby	4,000,000	-	4,000,000	4,000,000	-	0%	Not Started	Y		
Programmable Logic Controllers Replacement	Burnaby	2,000,000	-	2,000,000	2,000,000	-	0%	Not Started	Y		
Pug Mill Enclosure Ventilation System Replacement	Burnaby	1,000,000	-	1,000,000	1,000,000	-	0%	Not Started	Y		
Refuse Crane	Burnaby	14,000,000	73,539	13,926,461	14,000,000	-	1%	Ongoing	N		Consultant is preparing procurement documents for detailed design and refuse crane purchase.
Secondary Economizers Replacement	Burnaby	6,000,000	-	6,000,000	6,000,000	-	0%	Not Started	Y		
Stack Refurbishment	Burnaby	350,000	-	350,000	350,000	-	0%	Not Started	Y		
		171,000,000	**8,844,030**	**162,155,970**	**170,855,000**	**145,000**					
Grand Total Solid Waste Services		**515,400,000**	**142,103,045**	**373,296,955**	**515,155,000**	**245,000**					

NOTE:
* Coquitlam Landfill projects being completed as a part of the United Boulevard Recycling and Waste Centre construction project

Metro Vancouver
Water Capital Expenditures Summary As of
December 31, 2021

Project Name	Project Location	Lifetime Total Project Budget	Lifetime Total Expenditures to Date	Lifetime Remaining Budget	Lifetime Total Projected Expenditures	Lifetime Total Budget Less Projected Expenditures	Lifetime Percent Complete	Status	Project on Schedule?	Note	Comments
Infrastructure Growth Capital											
Annacis Main No. 5 (Marine Crossing)	New West/Surrey	488,000,000	50,061,989	437,938,011	488,000,000	-	10%	Ongoing	N		Design delays
Annacis Main No. 5 (North)	New Westminster	51,500,000	854,555	50,645,445	51,500,000	-	2%	Ongoing	Y		
Annacis Main No. 5 (South)	Surrey	56,900,000	4,061,247	52,838,753	56,900,000	-	7%	Ongoing	Y		
Cape Horn Pump Station No. 3	Coquitlam	171,550,000	1,302,111	170,247,889	171,550,000	-	1%	Ongoing	Y		
Coquitlam Intake No. 2 & Tunnel	Coquitlam	1,181,230,000	8,105,533	1,173,124,467	1,181,230,000	-	1%	Ongoing	N		Project delayed due to value engineering optimized options.
Coquitlam Intake No. 2 (Water Treatment)	Coquitlam	1,486,000,000	887,669	1,485,112,331	1,486,000,000	-	1%	Ongoing	N		Project delayed due to value engineering optimized options.
Coquitlam Main No. 4 (Cape Horn)	Coquitlam	152,600,000	1,988,799	150,611,201	152,599,723	-	1%	Ongoing	Y		
Coquitlam Main No. 4 (Central Section)	Coquitlam	204,470,000	5,826,397	198,643,603	204,470,000	-	3%	Ongoing	Y		
Coquitlam Main No. 4 (South Section)	Coquitlam	408,250,000	6,302,346	401,947,654	408,250,000	-	2%	Ongoing	N		South Section Prebuilds delayed due to longer detailed design.
Fleetwood Reservoir	Surrey	43,367,000	6,809,477	36,557,523	43,367,000	-	16%	Ongoing	N		Project delayed due to property approval.
Grandview Reservoir Unit No. 2	Surrey	26,000,000	-	26,000,000	26,000,000	-		Not Started	Y		
Haney Main No. 4 (West Section)	Port Coquitlam	74,050,000	370,846	73,679,154	74,050,000	-	1%	Ongoing	Y		
Hellings Tank No. 2	Delta	29,411,000	5,643,855	23,767,145	29,411,000	-	19%	Ongoing	Y		
Jericho Reservoir No. 1	Langley Township	38,065,000	39,971,888	(1,906,888)	40,565,000	(2,500,000)	99%	Ongoing	Y	(c) (h)	
Kennedy Newton Main	Surrey	132,550,000	58,765,976	73,784,024	116,710,000	15,840,000	44%	Ongoing	N	(b)	Route selection delays.
Newton Pump Station No. 2	Surrey	50,800,000	5,311,398	45,488,602	50,800,000	-	10%	Ongoing	N		Property acquisition delays.
Newton Reservoir Connection	Surrey	27,050,000	-	27,050,000	27,050,000	-	0%	Not Started	Y		
Port Mann Main No. 2 (South)	Surrey	36,800,000	31,534,819	4,500,000	36,034,819	765,000	95%	Ongoing	Y		
South Surrey Main No. 2	Surrey	143,700,000	91,086	143,608,914	143,700,000	-	1%	Ongoing	Y		
South Surrey Main No. 2 Nickomekl Dam Prebuild	Surrey	2,000,000	-	2,000,000	2,000,000	-	0%	Not Started	Y		
Whalley Kennedy Main No. 2	Surrey	96,000,000	-	96,000,000	96,000,000	-	0%	Not Started	Y		
Whalley Main	Surrey	31,800,000	29,834,419	1,965,581	31,800,000	-	95%	Ongoing	Y		
		4,932,093,000	**257,724,410**	**4,674,368,590**	**4,954,787,542**	**(22,695,000)**					
Infrastructure Maintenance Capital											
Annacis Main No. 2 - Queensborough Crossover Improvement	New Westminster	1,200,000	-	1,200,000	1,200,000	-	0%	Not Started	Y	(e)	Likely not required. MOTI may not relocate Queensborough Main.
Annacis Main No. 3 BHP Potash Facility Pipe Protection	Surrey	600,000	-	600,000	600,000	-	0%	Not Started	Y	(e)	
Beach Yard Facility - Site Redevelopment	Dist of North Van	45,500,000	-	45,500,000	45,500,000	-	0%	Not Started	Y		
Boundary Road Main No. 2 & No. 3 Decommissioning	Burnaby	1,500,000	424,821	1,075,179	1,500,000	-	50%	Ongoing	Y		
Burnaby Mountain Main No. 2	Burnaby	10,200,000	-	10,200,000	10,200,000	-	0%	Not Started	Y		
Burnaby Mountain Pump Station No. 2	Burnaby	21,000,000	242,082	20,757,918	21,000,000	-	1%	Ongoing	N		Scope of work under review.
Cape Horn Reservoir Condition Assessment and Structural Repair	Coquitlam	1,550,000	-	1,550,000	1,550,000	-	0%	Not Started	Y		
Capilano Main No. 5 (South Shaft to Lost Lagoon)	Vancouver	260,000,000	12,374,911	247,625,089	260,000,000	-	5%	Ongoing	N		Delayed due to project approval timelines.
Capilano Main No. 7 Line Valve & Swing Connection	Dist of North Van	2,100,000	1,962,662	137,338	2,100,000	-	100%	Completed	Y		
Capilano Raw Water Pump Station Bypass PRV Upgrades	Dist of North Van	1,500,000	95,796	1,404,204	1,500,000	-	6%	Ongoing	Y		
Capilano Watershed Security Gatehouse	Dist of North Van	2,300,000	534,219	1,765,781	2,300,000	-	23%	Ongoing	Y		
Central Park Main No. 2 (10th Ave to Westburnco)	Burnaby	28,350,000	28,454	28,321,546	28,350,000	-	0%	Not Started	N		Delayed due to project scope review.
Central Park Main No. 2 (Patterson to 10th Ave)	Burnaby	91,900,000	32,275,586	59,624,414	91,900,000	-	35%	Ongoing	Y		
Central Park Reservoir Structural Improvements	Burnaby	1,900,000	-	1,900,000	1,900,000	-	0%	Not Started	Y		
Central Park WPS Starters Replacement	Burnaby	8,000,000	1,346,916	6,653,084	8,000,000	-	17%	Ongoing	N		Delayed due to re-zoning.
CLD & SFD Fasteners Replacement & Coating Repairs	Dist of North Van	2,100,000	1,720,354	379,646	2,100,000	-	82%	Ongoing	Y		
Cleveland Dam - Lower Outlet HBV Rehabilitation	Dist of North Van	4,900,000	2,210,055	2,689,945	4,900,000	-	75%	Ongoing	Y	(g)	
Cleveland Dam Drumgate Seal Replacement	Dist of North Van	1,250,000	269,208	980,792	1,250,000	-	22%	Ongoing	Y		
Coquitlam Pipeline Road Remediation	Coquitlam	2,000,000	1,855,820	144,180	1,856,960	143,000	100%	Completed	Y	(f)	
CWTP Ozone Sidestream Pipe Heat Trace and Insulation	Coquitlam	900,000	9,374	890,626	900,000	-	1%	Ongoing	Y		
CWTP Ozone Sidestream Pump VFD Replacement	Coquitlam	1,400,000	60,882	1,339,118	1,400,000	-	4%	Ongoing	Y		
CWTP pH, Alkalinity Upgrades	Coquitlam	1,700,000	1,684,847	15,153	1,700,000	-	99%	Ongoing	Y		
Dechlorination for Reservoir Overflow and Underdrain Discharges	Burnaby	2,700,000	245	2,699,755	2,700,000	-	0%	Not Started	Y		
Douglas Road Main No. 2 - Kincaid Section	Burnaby	12,300,000	9,705,838	2,594,162	12,300,000	-	80%	Ongoing	N		Alignment changes.
Douglas Road Main No. 2 (Vancouver Heights Section)	Burnaby	21,486,000	19,869,722	1,616,278	21,486,000	-	95%	Ongoing	N	(b)	Procurement delays.
Douglas Road Main No. 2 Still Creek	Burnaby	63,100,000	16,027,392	47,072,608	63,100,000	-	25%	Ongoing	N		Alignment changes.
Douglas Road Main Protection	Burnaby	1,500,000	14,101	1,485,899	1,500,000	-	1%	Ongoing	Y	(e)	
E2 Shaft Phase 3	Dist of North Van	16,500,000	15,535,852	964,148	16,500,000	-	95%	Ongoing	Y		
First Narrows Tunnel Isolation Chamber Improvements	Dist of North Van	7,000,000	4,341,548	2,658,452	5,000,000	2,000,000	95%	Ongoing	Y	(a)(b)	
Improvements to Capilano Mains No. 4 and 5	Dist of North Van	1,700,000	108,039	1,591,961	1,700,000	-	6%	Ongoing	Y		
Kersland Reservoir No. 1 Structural Improvements	Vancouver	6,250,000	1,025,137	5,224,863	6,250,000	-	16%	Ongoing	Y		
Little Mountain Reservoir Roof Upgrades	Vancouver	3,450,000	1,019,331	2,430,669	1,650,000	1,800,000	100%	Completed	Y	(g)	
Lulu Island - Delta Main - Scour Protection Phase 2	Richmond	3,550,000	-	3,550,000	3,550,000	-	0%	Not Started	Y	(e)	
Lulu Island - Delta Main No. 2 (Marine Crossing)	Richmond	370,000,000	-	370,000,000	370,000,000	-	0%	Not Started	Y		
Maple Ridge Main West Lining Repairs	Maple Ridge	3,500,000	190,470	3,309,530	3,500,000	-	7%	Ongoing	N		Project delayed as a result of delays on Seymour Main No. 2 Joints Improvement project.
Newton Rechlorination Station No. 2	Surrey	5,000,000	-	5,000,000	5,000,000	-	0%	Not Started	N		Project delayed to coordinate with Newton Pump Station Project.
Port Mann Main No. 1 (Fraser River Crossing Removal)	Coq/Surrey	18,500,000	255,000	18,245,000	500,000	18,000,000	100%	Completed	Y		This project is no longer required.

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Project Name	Project Location	Lifetime Total Project Budget	Lifetime Total Expenditures to Date	Lifetime Remaining Budget	Lifetime Total Projected Expenditures	Lifetime Total Budget Less Projected Expenditures	Lifetime Percent Complete	Lifetime Status	Lifetime Project on Schedule?	Note	Comments
Port Moody Main No. 1 Christmas Way Relocation	Coquitlam	2,350,000	-	2,350,000	2,350,000	-	0%	Not Started	Y	(e)	
Port Moody Main No. 3 Dewdney Trunk Rd Relocation	Coquitlam	2,700,000	4,523	2,695,477	2,700,000	-	85%	Ongoing	Y	(e)	
Port Moody Main No. 3 Scott Creek Section	Coquitlam	12,000,000	277,851	11,722,149	12,000,000	-	4%	Ongoing	Y		
Queensborough Main Royal Avenue Relocation	New Westminster	7,500,000	8,342	7,491,658	7,500,000	-	5%	Ongoing	Y		
Rechlorination Station SHS Storage Tank Replacement	Regional	1,200,000	204,025	995,975	1,200,000	-	17%	Ongoing	Y		
Rechlorination Station Upgrades	Regional	15,000,000	407,302	14,592,698	15,000,000	-	3%	Ongoing	Y		
Rehabilitation of AN2 on Queensborough Bridge	New West/Delta	2,500,000	829,859	1,670,141	2,500,000	-	33%	Ongoing	Y		
Relocation and Protection for MOTI Expansion Project Broadway	Vancouver	8,900,000	65,004	8,834,997	8,900,000	-	1%	Ongoing	Y	(e)	
Relocation and Protection for MOTI George Massey Crossing Replacement	Delta / Richmond	2,450,000	-	2,450,000	2,450,000	-	0%	Not Started	Y	(e)	
Relocation and Protection for Translink Expansion Project Surrey Langley SkyTrain	Surrey	6,600,000	-	6,600,000	6,600,000	-	0%	Not Started	Y	(e)	
Sapperton Main No. 2 North Road Relocation and Protection	Coquitlam	6,500,000	-	6,500,000	6,500,000	-	0%	Not Started	Y		
SCFP Centralized Compressed Air System	Dist of North Van	900,000	39,769	860,231	900,000	-	4%	Ongoing	Y		
SCFP Clearwell Membrane Replacement	Dist of North Van	17,400,000	-	17,400,000	17,400,000	-	0%	Not Started	Y		
SCFP Concrete Coatings	Dist of North Van	2,500,000	2,501,262	(1,262)	2,501,262	(1,000)	100%	Completed	Y		
SCFP OMC Building Expansion	Dist of North Van	2,650,000	123,403	2,526,597	2,650,000	-	5%	Ongoing	Y		
SCFP Polymer System Upgrade	Dist of North Van	3,450,000	503,748	2,946,252	3,450,000	-	15%	Ongoing	Y		
SCFP SCADA/ICS Controller Replacement	Dist of North Van	1,400,000	-	1,400,000	1,400,000	-	0%	Not Started	Y		
South Delta Main No. 1 - Ferry Road Check Valve Replacement	Delta	600,000	106,185	493,815	600,000	-	18%	Ongoing	Y		
South Surrey Main No. 1 Nickomekl Dam Relocation	Surrey	7,100,000	-	7,100,000	7,100,000	-	0%	Not Started	N	(e)	Project delayed by City of Surrey.
South Surrey Supply Main (Serpentine River) Bridge Support Modification	Surrey	400,000	79,469	320,531	400,000	-	20%	Ongoing	Y		
Sunnyside Reservoir Unit 1 Upgrades	Surrey	8,850,000	7,894,106	955,894	7,950,000	900,000	100%	Completed	Y	(b)	
Tilbury Main North Fraser Way Valve Addition	Burnaby	3,100,000	398,828	2,701,172	3,100,000	-	13%	Ongoing	Y		
Water Chamber Improvements and Repairs	Burnaby	2,000,000	36,226	1,963,774	2,000,000	-	2%	Ongoing	Y		
Westburnco Pump Station No. 2 VFD Replacements	New Westminster	2,550,000	254,118	2,295,882	2,550,000	-	10%	Ongoing	Y		
		1,148,986,000	**138,922,683**	**1,010,063,317**	**1,128,644,222**	**20,342,000**					
Infrastructure Resilience Capital											
Barnston/Maple Ridge Pump Station - Back-up Power	Pitt Meadows	9,000,000	240,156	8,759,844	9,000,000	-	3%	Ongoing	N		Delayed due to property selection.
Burnaby Mountain Tank No. 2	Burnaby	21,650,000	64,104	21,585,896	21,650,000	-	1%	Ongoing	Y		
Burnaby Mountain Tank No. 3	Burnaby	21,400,000	-	21,400,000	21,400,000	-	1%	Ongoing	Y		
Cambie Richmond Main No. 3 (Marine Crossing)	Richmond/Van	490,250,000	2,069,434	488,180,566	490,250,000	-	2%	Ongoing	Y		
Cape Horn Pump Station 2 - Back-Up Power	Coquitlam	8,000,000	131,722	7,868,278	8,000,000	-	2%	Ongoing	Y		
Capilano Mid-Lake Debris Boom	Dist of North Van	750,000	15,610	734,390	750,000	-	2%	Ongoing	Y		
Capilano Raw Water Pump Station - Back-up Power	Dist of North Van	33,000,000	11,830,734	21,169,266	33,000,000	-	36%	Ongoing	N		Site selection delays.
Capilano Reservoir Boat Wharf	Dist of North Van	850,000	69,235	780,765	850,000	-	8%	Ongoing	Y		
Clayton Langley Main No. 2	Surrey	16,900,000	-	16,900,000	16,900,000	-	0%	Not Started	Y		
Cleveland Dam Power Resiliency Improvements	Dist of North Van	1,700,000	30,530	1,669,470	1,700,000	-	2%	Ongoing	Y		
Cleveland Dam Seismic Stability Evaluation	Dist of North Van	800,000	-	800,000	800,000	-	0%	Not Started	Y		This project phase to start in 2022 after completion of the CLD Canyon Amplification/Concrete Dam Analysis project
Coquitlam Intake Tower Seismic Upgrade	Coquitlam	26,000,000	1,431,915	24,568,085	26,000,000	-	6%	Ongoing	Y		
Critical Control Sites - Back-Up Power	Regional	1,800,000	-	1,800,000	1,800,000	-	0%	Not Started	Y		
CWTP Ozone Back-up Power	Coquitlam	7,450,000	-	7,450,000	7,450,000	-	0%	Not Started	Y		
Emergency Power Strategy for Regional Water Facilities	Regional	400,000	158,699	241,301	400,000	-	40%	Ongoing	Y		
Grandview Pump Station Improvements	Surrey	2,600,000	387,271	2,212,729	2,600,000	-	15%	Ongoing	Y		
Haney Main No. 4 (Marine Crossing)	P.Coq/P.Meadows	390,250,000	235,112	390,014,888	390,250,000	-	1%	Ongoing	Y		
Mackay Creek Debris Flow Mitigation	Dist of North Van	9,700,000	9,115,257	584,743	9,700,000	-	98%	Ongoing	N		Delays due to challenging ground conditions.
Pebble Hill Pump Station Seismic Upgrade	Delta	1,800,000	-	1,800,000	1,800,000	-	0%	Not Started	N	(d)	Coordinating with City of Delta.
Pebble Hill Reservoir No. 3 Seismic Upgrade	Delta	9,500,000	361,525	9,138,475	9,500,000	-	4%	Ongoing	Y		
Pebble Hill Reservoir Seismic Upgrade	Delta	14,800,000	1,342,314	13,457,686	12,800,000	2,000,000	15%	Ongoing	N	(b)	Design delays due to geotechnical conditions.
Reservoir Isolation Valve Automation	Regional	6,450,000	1,192,875	5,257,125	6,450,000	-	18%	Ongoing	N		Delayed due to scope refinement.
Scour Protection Assessments and Construction General	Regional	4,000,000	-	4,000,000	4,000,000	-	0%	Not Started	Y		
Second Narrows Crossing (Tunnel)	Burnaby/DNV	468,550,000	279,843,998	188,706,002	468,550,000	-	60%	Ongoing	Y		
Seymour Falls Boat Wharf	Dist of North Van	800,000	65,345	734,655	800,000	-	11%	Ongoing	Y		
Seymour Lake Debris Boom	Dist of North Van	800,000	287,175	512,825	800,000	-	36%	Ongoing	Y		
Seymour Main No. 2 Joint Improvements	Dist of North Van	5,252,000	663,540	4,588,460	5,252,000	-	16%	Ongoing	N		Work delayed to coordinate with Broadway Skytrain relocation work.
Seymour Main No. 5 III (North)	Dist of North Van	236,900,000	5,019,663	231,880,337	236,900,000	-	2%	Ongoing	Y		
Seymour Reservoir Mid-Lake Debris Boom	Dist of North Van	2,300,000	1,230,676	1,069,324	2,300,000	-	54%	Ongoing	Y		
Sunnyside Reservoir	Surrey	19,300,000	7,556,887	11,743,113	19,300,000	-	50%	Ongoing	Y		
Vancouver Heights System Resiliency Improvements	Burnaby	1,500,000	6,661	1,493,339	1,500,000	-	0%	Not Started	Y		
Westburnco Pump Station - Back-up Power	New Westminster	23,500,000	1,238,752	22,261,248	23,500,000	-	5%	Ongoing	N		Design delay, scope modification.
		1,837,952,000	**324,589,191**	**1,513,362,809**	**1,835,952,000**	**2,000,000**					
Infrastructure Upgrade Capital											
CWTP Ozone Generation Upgrades for Units 2 & 3	Coquitlam	7,000,000	3,271,087	3,728,913	7,000,000	-	47%	Ongoing	N		Delay due to operational requirements.
Lower Seymour Conservation Reserve Learning Lodge Replacement	Dist of North Van	5,000,000	876,931	4,123,069	5,000,000	-	18%	Ongoing	Y		
Online Chlorine Monitoring Stations	Regional	4,150,000	-	4,150,000	4,150,000	-	0%	Not Started	Y		

ATTACHMENT 3 - WS

Metro Vancouver
Water Capital Expenditures Summary As of
December 31, 2021

		Lifetime									
Project Name	**Project Location**	**Total Project Budget**	**Total Expenditures to Date**	**Remaining Budget**	**Total Projected Expenditures**	**Total Budget Less Projected Expenditures**	**Percent Complete**	**Status**	**Project on Schedule?**	**Note**	**Comments**
Sapperton Main No. 1 New Line Valve and Chamber	New Westminster	3,800,000	977,716	2,822,284	3,800,000	-	26%	Ongoing	N		Tie-ins delayed.
South Delta Main No. 1 - 28 Ave to 34B Ave	Delta	22,650,000	20,708,558	1,941,442	22,650,000	-	100%	Completed	N		Construction delays due to unforeseen environmental and geotechnical conditions.
South Delta Mains - 28 Ave Crossover	Delta	10,500,000	10,439,252	60,748	10,500,000	-	99%	Ongoing	N		Utility conflicts and additional scope of work.
Tilbury Junction Chamber Valves Replacement with Actuators	Richmond	5,600,000	4,542,070	1,057,930	5,600,000	-	81%	Ongoing	N		Tie-ins delayed due to railway permitting requirements.
Water Meter Upgrades	Regional	22,400,000	5,437,226	16,962,774	22,400,000	-	24%	Ongoing	N		Procurement delays.
Water Optimization - Flow Meters (Non-billing) Phase 1	Regional	16,500,000	-	16,500,000	16,500,000	-	0%	Not Started	Y		
Water Optimization - Flow Meters (Non-billing) Phase 2	Regional	19,500,000	-	19,500,000	19,500,000	-	0%	Not Started	Y		
Water Optimization - Instrumentation	Regional	11,400,000	-	11,400,000	11,400,000	-	0%	Not Started	Y		
Water Optimization Automation & Instrumentation	Regional	9,540,000	8,018,834	1,521,166	9,540,000	-	84%	Ongoing	N		Procurement delays.
		138,040,000	**54,271,675**	**83,768,325**	**138,040,000**	**-**					
Opportunity Capital											
Capilano Hydropower	Dist of North Van	114,250,000	218,368	114,031,632	114,250,000	-	1%	Ongoing	N		Project currently on hold.
		114,250,000	**218,368**	**114,031,632**	**114,250,000**	**-**					
Grand Total Water Capital		**8,171,321,000**	**775,726,327**	**7,395,594,673**	**8,132,374,000**	**38,947,000**					

Notes:

(a) Contingency not required.
(b) Construction costs lower than estimated.
(c) City of Surrey share - 33.72%, Township of Langley share - 66.28%.
(d) Cost sharing proposal with City of Delta
(e) Project start is dependent on a 3rd party. External agency yet to begin work.
(f) GVWD Cost Share City of Coquitlam, Fortis and BC Hydro
(g) Extent of construction scope less than originally anticipated.
(h) Design change/consutant

Capital Project Status Information
December 31, 2021

The progress details of the Metro Vancouver Housing Corporation (MVHC) capital projects are highlighted below:

Heather Place – Building B

Expenditures in 2021 were below the anticipated level as the issuance of the city abatement permit was later than scheduled. Abatement work was expected to begin in late 2021; however, the work is now delayed to mid-2022.

Kingston Gardens

Expenditures in 2021 were below the anticipated amount due to the delay in construction commencement, which was a result of the building permit issuance. Construction is expected to begin in Q1 of 2022.

Welcher Avenue

Overall expenditures were below anticipated amounts in 2021 due to the delay in construction commencement. 2021 activities included detailed project design and tendering. Construction was expected to begin in Q4 of 2021. The building permit application was submitted in April 2021 and an amended building permit was submitted in September 2021. Construction is expected to commence in Q2 2022.

Malaspina Village

Overall expenditures were below anticipated amounts in 2021 as the awarding of the architectural services contract was delayed from late 2021 to early 2022.

Pitt Meadows

Architectural services contract was awarded in September 2021. Schematic design phase proceeded through Q4 2021 and will continue in 2022. Archaeology draft report has been received and First Nations engagement is complete.

Eastburn Square

Architectural services contract was awarded in December 2021. Geotechnical site assessment has been completed. Schematic design will progress in 2022. Re-zoning application to be submitted in Q1 2022.

Southwynde

Architectural services contract was awarded in November 2021. Schematic design will progress in 2022. Re-zoning application to be submitted in Q1 2022.

Capital Project Status Information
December 31, 2021

GREATER VANCOUVER SEWERAGE & DRAINAGE DISTRICT (Liquid Waste Services)

Major GVS&DD liquid waste capital projects are generally proceeding on schedule and within budget. The following capital program items and exceptions are highlighted:

Infrastructure Growth Program

- **FSA – Albert Street Trunk Sewer** – The Albert St. Trunk Sewer is a sanitary sewer located in the City of Port Moody that was constructed in the 1960's and is in need of a capacity upgrade. Phase 1 construction was completed in 2019. Phase 2 of the project includes the upgrade of a section that is approx. 200 m long and crosses Barnet Hwy just north of St. John St using the microtunneling construction method. The sewer surcharges in a residential area under heavy rain. Construction was completed in late 2021.

- **FSA – Burnaby Lake North Interceptor – Winston Street Section** – Phase 1 of the sewer was completed in October 2021, and involves 880 m of 914 mm sewer constructed by open cut methods. It located to the east of Sperling Avenue. Phase 2 of the project involves 2.9 km of 2.1 m diameter sewer constructed primarily by tunneling. The RFP for the tunneling portion of the work closed in December 2021. The successful contractor was Pomerleau Bessac Infrastructure (PBI) and the construction contract was awarded in January 2022. Construction is scheduled to begin in April 2022. The project is projecting a surplus.

- **FSA – South Surrey Interceptor – King George Section Odour Control Facility (OCF) and Grit Chamber** - This project involves three separate installations: two odour control facilities (at King George Boulevard near 56 Ave in Surrey and at Highway 10 and Highway 91 in Delta) and a grit chamber at the King George location. The grit chamber portion of this project is complete and in service. Tritech Group Ltd., the contractor for the odour control facilities, has completed the facility at Highway 91, which has been operational since March 2020. Tritech is still working on the King George facility which is scheduled to be commissioned later in the spring of 2022. The project is projecting a surplus at the end of construction.

- **FSA – Annacis Island WWTP Stage 5 Expansion Phase 1** – This work involves expansion of treatment process units including primary sedimentation tanks, secondary clarifiers, solid contact tanks, and odour control facilities. This construction contract was awarded to Graham and AECON Joint Venture in April 2017. Substantial completion of the overall project was achieved in May 2021, and the various processes were all in service in late 2021.

- **FSA - Annacis Island WWTP Outfall – Surge Control** - This project involves the replacement of four hydraulic gates in the Influent Control Chamber and ancillary equipment to mitigate the risk of transient surges to upstream infrastructure. The construction contract was awarded to Maple Reinders Construction Limited in March 2021. Long lead equipment submittals have been approved for fabrication. Construction is approximately 10% complete. The project is tracking on schedule with the substantial completion in late Q3 2023.

Infrastructure Maintenance Program

- **LSA – Gilbert Trunk Sewer Twinning** - Construction of the 5.3 km long Phase 1 and 2 is complete. The remaining 2 Phases have a total length of 4.7 km consisting of 1.8 m diameter sewers. Phase 4, from Steveston Highway to the Lulu Island WWTP, was tendered in 2020 but due to contractual issues the process was collapsed and restarted. It has been re-tendered and is expected to close on March 31 2022. Phase 3 which extends from Blundell Road south to the Steveston Highway, is expected to be tendered in early April 2022. The Phase 4 construction contract is expected to be awarded in July 2022 and construction will begin in late 2022. Phase 3 is expected to be awarded in the fall of 2022 with construction commencing in late 2022 or early 2023.

- **FSA - North Surrey Interceptor Rehab or Replacement** - This project involves two components. The first is rehabilitating approximately 220m of the existing NSI near the Port Mann Bridge. It also involves relocation and upgrading of City of Surrey connection to the NSI. Work is currently underway and is expected to be completed in June 2022.

  The other part of this project is twinning and rehabilitation of approximately 760m of the existing NSI-Manson Road section. The project is currently moving on to preliminary design. Construction is expected to commence in mid-2023 for the twinning portion. Rehabilitation may begin earlier in 2022 depending on the result of an upcoming condition analysis.

- **FSA - Crescent Beach FM Replacement** – This project involves the design and construction of approximately 2 km of sanitary force main to replace the existing 500 mm diameter FRP (fiber reinforced plastic) pipe which is aging and in poor condition. JJM Construction was awarded the contract in July 2021. Construction started in the fall of 2021, and is scheduled to be completed by the end of 2022.

- **FSA - New Westminster Interceptor Repair – Columbia Street Section** – This project involves the rehabilitation of 1,600 m of the 1.5 m diameter New Westminster Interceptor from Front St. to McBride Blvd. The contract was awarded to Southland Holdings. Construction started in July 2021. Phase 1, which involves the first 800 m of sliplining, is scheduled to be completed in May 2022. Phase 2 and 3 will follow, with timing to be determined in conjunction with the Contractor, the City of New Westminster and the Ministry of Highways.

- **FSA - Ocean Park Trunk Crescent Section (OPC) Pipe Rehabilitation/Replacement** - This project involves the design and construction of a 420m long sewer between 24 Avenue and Bayview Street, in Surrey. It is a combination of open cut work and trenchless work using cured in place pipe (CIPP) technology. The contract was awarded to BEL Contracting. Work was finished in Q4 2021.

- **FSA – Annacis Island WWTP Secondary Clarifier Corrosion Repair** – This project involves replacing 12 secondary clarifier mechanisms that have been damaged by corrosion and are at the end of their service life. This project is combined with the Secondary Clarifier Flow Control project, which

involves the addition of 12 new influent flow balancing gates and the replacement of 12 effluent launders and weirs. The current construction contract, awarded to NAC Constructors Ltd. in March 2019 for the amount of $17.8M, consists of the replacement of the 5 remaining mechanism units, the addition of 9 flow balancing gates and the replacement of the 12 existing effluent launders and weirs. Construction started in May 2020 and is scheduled to be complete by end of 2022. To date 12 mechanisms, 8 launders and weirs have been replaced, and 11 flow balancing gates have been installed.

- **FSA – Annacis Island WWTP Trickling Filter Media, Distributor and FOA Duct Replacement** – This project replaces the rotary distributors, plastic media and foul air ducting for the four Trickling Filters (TF) at the AIWWTP. These components have been in service for over 20 years and are reaching the end of their service life. The distributors and ducting have experienced significant corrosion, resulting in recent equipment failures requiring emergency maintenance in the past few years. The construction will be completed in two contracts, with the first contract for two TFs and the second contract for the remaining two TFs. This work was to be executed one unit at a time with one TF per year during the low flow season. Maple Reinders Construction Ltd. have completed the refurbishment for the first TF (TF 1) started in April 2020 and was successfully completed in September 2020 before the start of the wet weather season. Refurbishment of the second TF (TF 3) started in mid-April 2021 and was completed in September 2021. The second contract for the refurbishment of the remaining two TFs (TF 2 and TF4) was awarded to Pomerleau in July 2021. There has been a delay due to delivery of equipment, and TF2 and TF4 will now be completed in 2023 and 2024 which is a 1 year delay.

- **FSA – Northwest Langley WWTP 25 kV Substation Replacement** - This project involves the design and construction of a new 25kV substation to replace the existing outdoor substation which transforms and distributes power to areas in the plant. Due to its age and poor condition of the switchgear enclosures, the existing substation has been assessed as unreliable for maintenance and operations. The contract was awarded to Pomerleau, and construction commenced in Q1 2019. The construction was substantially completed in July 2021. Project closeout and correction of minor deficiencies remain and Owner's acceptance of the project is expected in Q3 2022.

<u>Infrastructure Resilience Program</u>

- **VSA – Emergency Backup Power** - This project involves design, supply and installation of standby emergency backup generators at the Chilco, Columbia, Harbour, Hudson, Jervis, Kent and Willingdon pump stations to allow the stations to remain operational during power failure events and reduce the risk of a spill. Three separate tenders for the Columbia, Harbour, Hudson, Kent and Willingdon upgrades were issued in Q4 2019. The construction at Harbour, Hudson, Kent and Willingdon pump stations were completed earlier in 2021 and the generators were commissioned. The Columbia PS generator was completed and commissioned in Q4 of 2021. The Vancouver Parks Board approved the Jervis PS Generator concept in the fall of 2019, and the design and permitting of the Jervis facility is advancing. Construction has been rescheduled until late 2023, due to unresolved property issues. The Chilco facility concept is currently being reviewed with the Vancouver Parks Board, prior to starting the detailed design. To prevent future spills during power outages, MV is actively working on design and installation of temporary generators at both Chilco and Jervis PS later in 2022.

<u>Infrastructure Upgrade Program</u>

- **VSA – Iona Island WWTP Biosolids Dewatering Facility** – This project involves the construction of a mechanical dewatering facility to dewater on-going plant production of biosolids so that they can be transported for beneficial reuse or disposal. This facility will permit the decommissioning of the

four existing digested sludge lagoons and the sludge drying area to make space for the construction of the new tertiary treatment plant. The $55 million design-build contract was awarded to NAC Constructors in April 2019. The design phase is 99% completed, and the construction phase is about 95% complete as of December 2021. Ground improvement and civil works underground piping, foundations and concrete works are complete. The two Digested Sludge Storage Tanks, Dewatering Building, Truck Load-out Building, Mechanical/Electrical/Control Rooms have been erected, enclosed, and finished except for minor touch-up painting and remedial work. All mechanical process equipment such as the centrifuges, hoppers, pumps, and screw conveyors have been delivered and installed and will be rotationally-checked and functionally-tested in Q1 2022. The project has nearly completed the electrical installation phase – i.e. cable pulls, transformer installation, switchgear, motor control centers, and the wiring of field devices and instrumentation. The electrical switchgear and field devices will be loop-checked and functionally-tested in Q1 2022. The dewatering facility is targeted for acceptance by MV in Q3 2022 with 30 days of Owner Commissioning commencing in Q2 2022.

Opportunity Program

- **FSA – Annacis Island WWTP Hydrothermal Liquefaction** – This work involves the design and construction of a demonstration scale plant to convert wastewater biomass to biocrude as a low carbon fuel. The objective of the demonstration scale is to assess the technology performance and the feasibility of full-scale implementation at an existing or future WWTP. Six separate contracts are anticipated as part of this project including a qualitative risk analysis of the HTL system and an operations-maintenance contract independent of the AIWWTP facility operations. Procurement of a progressive design build contractor for the HTL system is underway and the design portion of the contract is expected to be awarded in Q1 2022. Design of the supporting ancillary systems outside of the HTL system is currently underway and is expected to be substantially completed in Q3 2022. The entire HTL demonstration plant is scheduled to be completed in 2025 and put in operation from 2025 to 2027.

- **LSA - Lulu Island WWTP Biogas Cleanup Project** - This project involves the design and construction of a new digester gas clean-up facility at LIWWTP for producing pipeline quality RNG (a.k.a. bio-methane) for sale to Fortis Energy Inc. This project supports Metro Vancouver's commitment to protect public health and the environment. This innovative treatment system will result in a decrease in the flaring of digester gas, a reduction in regional greenhouse gas emissions, and the reuse of a sustainable resource. The system will produce enough renewable natural gas to heat 400 homes and gas production will increase as our local population grows. The project is 97% completed as of December 2021 and is presently undergoing the 30-day commissioning period under the supervision of LIWWTP staff to prove out the system and remedy any deficiencies or performance shortcomings of the equipment as provided by the various suppliers and contractors. Owner's commissioning is expected to be completed by March of 2022.

- **LSA – LIWWTP Pilot Digestion Optimization Facility** - The Pilot Digestion Optimization Facility (PDOF) fabrication and installation was awarded to Tritech in Q1 2021. Fabrication of the equipment mounted in modular skids is currently underway in the contractor's facilities following a full review of shop drawings by MV in Q3 2021. The PDOF's purpose is to facilitate the evaluation of sludge digestion optimization techniques without risking full-scale operations. Lessons learnt at the pilot scale could be incorporated in existing and future plants leading to the deferral of significant investments such as building new digesters. The project is measured at 42% complete as of December 2021 with an expected completion date in Q3 2022. The PDOF is designed to be adaptable

and transportable (being built in modules) to other WWTP sites (such as AIWWTP or ARC) for further research and testing purposes. Experimentation, data collection and trend analyses will be undertaken by both MV PPA and O&M in cooperation with UBC Okanagan research staff.

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ATTACHMENT 4 - PARKS

Capital Project Status Information
December 31, 2021

2021 Regional Park Major Capital Project Update

Major Regional Parks capital projects are proceeding throughout the region. Project details are highlighted below:

Widgeon Marsh - Grouse Mountain Trail and Amenity Improvements

Phase 1 implementation work originally planned for 2021 was deferred to 2022 to provide time for relationship building and collaboration with First Nations. Regional Parks staff continue to engage First Nations in sharing information, seeking input and exploring collaborative opportunities. An archeological impact assessment and cultural study, that will guide park design and management over the long term, will conclude in spring 2022.

A rezoning application to the City of Coquitlam is also expected to conclude in Spring 2022 following First Nation engagement. Regional Parks staff continue to work closely with City staff through the rezoning process.

An application to the Investing in Canada Infrastructure Program – Community, Culture and Recreation Program was submitted in October 2020 to fund Phase 1 park improvements. Announcements on the grant program are expected in early 2022. The delay in Phase 1 implementation will ensure Metro Vancouver remains eligible for this grant, should the application be successful.

Crippen Regional Park – Davies Orchard Revitalization

In November 2017, the Metro Vancouver Board approved a concept plan for Davies Orchard with a vision to improve public access, add new features and amenities, and enhance the historic cottages and orchard.

In early 2021, this project was awarded a $450,000 provincial grant from the Unique Heritage Infrastructure stream of the Community Economic Recovery Infrastructure Program (CERIP). This funding will go towards Phase I of the project which includes upgrades to five cottage buildings, servicing improvements and deconstruction of one cottage in poor condition.

All required permits are now in place for Phase 1. Implementation will begin in Spring 2022 and extend through the year. Phase II, which includes site and public space improvements will proceed in 2023. Staff are working closely with Bowen Island Municipality and are planning a stakeholder workshop this spring.

Derby Reach Regional Park - Edgewater Bar Washrooms

Construction of a full service washroom facility at Edgewater Bar in Derby Reach Regional Park is underway and expected to conclude in December 2022. The new facility will improve the day use and camping visitor experience. Accessibility will be enhanced, capacity will be expanded, site circulation and open space will be improved and environmental impacts will be reduced.

Grouse Mountain Regional Park - Grouse Mountain Trail and Amenity Improvements

In 2020, the Government of Canada and Province of BC announced a $2.5 million grant for the Grouse Mountain Trail and Amenity Improvement Project under the Investing in Canada Infrastructure Program.

The purpose of the project is to implement the park management plan, and improve access and safety for park users. The project timeline is from 2020 to 2024.

Improvements to the Grouse Grind and BCMC Trail will continue throughout 2022. Detailed design of an expanded trailhead and lower mountain trail network is underway. First Nation engagement is ongoing and will continue through 2022.

Campbell Valley Regional Park Management Plan Implementation

A multidisciplinary team is guiding the implementation of the MVRD Board approved Campbell Valley Regional Park Management Plan. The scope of this project includes expanding the trail and greenway network, improving park access and ecology, enhancing the Little River Bowl area, and developing and opening McLean Pond for public access.

Advanced design and permitting will continue through 2022. Construction will extend from 2022-2024 with priority trail and staging area improvements beginning in Spring 2022.

Crippen Regional Park – Dorman Point Development

Regional Park staff have initiated site planning and design of trail access and site amenities for the recently acquired Dorman Point area of Crippen Regional Park. Ecological assessment, survey, and preliminary clearing of the access trail is complete. Detailed design and implementation will extend through 2022.

Regional Park Service Yards

Capilano River, Crippen and Pacific Spirit Regional Parks service yards are scheduled for replacement. These upgrades will ensure continued safe and efficient operation, maintenance and stewardship of regional parks sites.

Construction of the Crippen service yard is substantially complete and is expected to be fully operational in Spring 2022. Construction of the Pacific Spirit service yard is underway. The Capilano River service yard is in the final stages of the development permitting process with District of North Vancouver.

Capital Project Status Information – Solid Waste Services
December 31, 2021

The two recycling and waste centre construction projects, United Boulevard Recycling and Waste Centre and Central Surrey Recycling and Waste Centre are nearing completion. Major capital projects are expected to be completed within budget. Waste-to-Energy Facility projects and purchase of land for a new North Surrey Recycling and Waste Centre recycling depot are proceeding slower than expected and have resulted in reduced expenditures in 2021 compared to projected cash flows.

Recycling and Waste Centre Program

- The United Boulevard Recycling and Waste Centre construction started in May 2018 with site grading works. The full construction contract was awarded in December 2018. Construction is complete and the facility opened on March 14, 2022.
- The Central Surrey Recycling and Waste Centre project received rezoning and a development permit in late 2018. The construction contract was awarded in the summer of 2020. Construction was initiated in July of 2020. Construction is well underway and expected to be complete in June 2022.

Landfills Program

- Construction of Phase 2 landfill gas collection system upgrades is being completed as a part of the construction of the United Boulevard Recycling and Waste Centre. The new landfill gas infrastructure has been commissioned prior to United Boulevard Recycling and Waste Centre opening. A system upgrade is required which includes a new control room and compressor at the blower flare station. Preliminary design has been started and design work should be completed in 2022.

Waste-to-Energy Program

- The refuse crane replacement project commenced with preliminary engineering in 2019. The next phases of the project include detailed design and procurement of the major capital items.
- The second pass superheater replacement project is complete.
- Covanta commenced replacement of the back-up feedwater pumps as they have reached the end of their useful life.
- The feed hopper / chute replacement project started in late 2019. Feed hopper replacement is now complete with feed chute replacement to be completed in 2022.
- Ministry of Environment and Climate Change Strategy has approved proceeding with managing up to 25,000 tonnes per year of biosolids at the Waste-to-Energy Facility. Procurement for a detailed design engineering study commenced on February 10, 2022.
- The primary economizer project commenced with engineering and procurement services on November 6, 2020. Installation of the works is expected to occur in 2022.

- The compressed air system replacement project is underway, an engineering study commenced on October 18, 2021.
- The fabric filter / pulse header refurbishment project is underway, an engineering study commenced on December 2, 2021.

GVWD Capital Project Status Information

December 31, 2021

GREATER VANCOUVER WATER DISTRICT

Major GVWD capital projects are generally proceeding on schedule and within budget. The following capital program items and exceptions are highlighted:

Infrastructure Growth Program

- **Annacis Main No. 5 (Marine Crossing)** – A 2.3 km long, 4.5 metre diameter water supply tunnel is required under the Fraser River to meet growing water demand south of the Fraser and to provide increased system resiliency. Detailed design, and property acquisition are complete. The construction contract was awarded in late October 2021, and construction will commence in March 2022.

- **Annacis Main No. 5 (South)** – This project comprises approximately 3.0 km of 1.8 metre diameter steel pipe connecting the south shaft of the Annacis Water Supply Tunnel to the Kennedy Reservoir in the City of Surrey. Preliminary design has been completed and detailed design is in progress and expected to be complete in February 2022.

- **Cape Horn Pump Station No. 3** – Cape Horn Pump Station No. 3 with a back-up power system, will supplement the existing pump station to deliver Coquitlam source water to meet growing demand in the areas south of the Fraser River. Preliminary design of the new station started in Q1 2020 and is nearing completion. The RFP for detailed design and construction engineering services will be issued by end of Q1 2022

- **Coquitlam Intake No. 2** – A new intake, tunnel and treatment plant are proposed at the Coquitlam Reservoir to increase the regional supply from this source and meet growing future demand. A Value Engineering Optimization exercise, completed in early 2021, confirmed a preferred project option of a North Intake with Smaller Initial Filtration Treatment, which was endorsed by the Board. The Final Project Definition Report has been submitted for review. The project is now in the permitting and regulatory phase, which will focus on engagement with First Nations and stakeholders.

- **Coquitlam Main No. 4** – This 12 km long steel water main, consisting of the Central, South, South Tunnel and Cape Horn Sections, will increase the transmission capacity from the Coquitlam source to the Cape Horn Pump Station and Reservoir in the City of Coquitlam. This project is required to address capacity constraints in the existing Coquitlam transmission system and also provide additional transmission capacity for the Coquitlam Intake No. 2. Detailed design of the Central, South and Cape Horn Sections continues. Preliminary design of the South Tunnel Section is underway. Construction of the South Section Prebuild will commence in Q4 2022.

- **Fleetwood Reservoir** – Phase 1 of the Fleetwood Reservoir project includes a 13.6 ML reservoir, valve chamber, piping, access building and associated work located at Meagan Ann MacDougall Park in the City of Surrey. The City of Surrey has finalized the Property Lease Agreement and a Coordinated Works Agreement to include a portion of the city water main in the tender package and they are currently reviewing the building permit application. The construction tender has closed and will go

before the Board in March for award approval. Construction is expected to commence in Q2 2022.

- **Jericho Reservoir** – Phase 1 of the Jericho Reservoir project includes a 20.6 ML reservoir, chambers, piping and associated work located at 20400 73A Avenue in the Township of Langley. Construction is substantially complete with minor deficiencies remaining. The reservoir is currently in service.

- **Kennedy Newton Main** – This project comprises approximately 9.0 km of 1.8 metre diameter steel water main between the Kennedy Reservoir and the Newton Reservoir in the City of Surrey and is divided into 3 phases. Construction of Phase 1, between 72nd Avenue and 84th Avenue, is complete. Construction of Phase 2, between 72nd Avenue and Newton Reservoir commenced in September 2020 and is nearing completion. Design of the remaining Phase 3, from 84th Avenue to Kennedy Reservoir, is complete with the construction tender to be released in Q1 2022.

- **Newton Pump Station No. 2** – This project, located at 6287 128th Street in the City of Surrey, consists of replacing the existing Newton Pump Station and includes full back-up power redundancy, connections to existing and future infrastructure, and installation of new outlets to the existing Newton Reservoir. The detailed design is in progress with completion expected in Q1 2022. Construction of the new reservoir outlets is anticipated to start in fall 2022 with the main pump station construction planned in spring 2023.

- **Port Mann Main No. 2 (South)** – This 2.8 km long, 1.5 metre diameter steel water main will twin the existing Port Mann Main No. 1 between the south shaft of the Port Mann Water Supply Tunnel and the Whalley Main in the City of Surrey. The project is required to meet growing water demand south of the Fraser River. The water main installation and commissioning are now complete and the new main is now in service.

- **Whalley Main** – This 2.0 km long, 1.5 metre diameter steel main will twin the existing Whalley Clayton Main between the Whalley Reservoir and the Whalley Kennedy Link Main in the City of Surrey. The water main installation and commissioning are now complete and the new main is now in service.

Infrastructure Maintenance Program

- **Douglas Road Main No. 2 – Still Creek Section** - This project comprises approximately 2.5 km of 1.5 metre diameter steel pipe with trenchless crossings of Highway 1, Still Creek and the BNSF rail line. The water main alignment has been finalized in consultation with the City of Burnaby. The Project is planned to be constructed in three phases, with the North Open Cut Section and the Trenchless Crossing Section currently under construction. Design of the South Open Cut Section is underway.

- **Douglas Road Main No. 2 – Vancouver Heights Section** - This project comprises approximately 2.0 km of 1.5 metre diameter steel pipe connecting the Vancouver Heights Reservoir to the Douglas Road Main No. 2 at Beta Avenue and Albert Street in the City of Burnaby. The installation construction contract is complete. Final tie-ins and commissioning are planned for fall 2022.

- **Central Park Main No. 2 – Patterson to 10th Ave** - This project comprises approximately 7.0 km of 1.2 metre diameter steel pipe connecting the Central Park Pump Station in Burnaby to the existing Central Park Main in New Westminster at 10th Avenue. The water main is divided into three phases with the 500 m long Maywood Pre-build completed in December 2020. Construction of Phase 1 of the project commenced in October 2020 with completion anticipated in mid-2022. Design of Phase 2 is underway and is expected to be complete in summer 2022.

- **Capilano Main No. 5 (Stanley Park Section)** – This 1.4 km long steel water main, in a tunnel, will replace the aged existing Capilano Main No. 4 through Stanley Park to meet growing water demand and provide increased system resiliency. Detailed design is nearing completion. Work to secure permits and land agreements is on-going. The procurement phase for construction is scheduled to commence in April or May 2022, with construction anticipated to start in 2023.

Infrastructure Resilience Program

- **Mackay Creek Debris Flow Mitigation** – Construction commenced in spring 2019 and was completed in March 2020. Site restoration was completed in late 2021.

- **Second Narrows Water Supply Tunnel** – This project comprises a 1.1 km long, 6.5 metre diameter water supply tunnel under Burrard Inlet, between North Vancouver and Burnaby, to increase the reliability of supply in the event of a major earthquake and provide additional long-term supply capacity. Construction commenced in early 2019. Construction of the north and south shafts is complete. The Tunnel Boring Machine began tunnel excavation in the fall of 2020 and the tunnel was completed in fall 2021. Construction of the south valve chamber and installation of the steel water mains inside the tunnel commenced in late 2021. Overall construction is scheduled to be complete by late 2023, followed by site restoration and final tie-ins and commissioning in 2024 and 2025.

- **Capilano Raw Water Pump Station – Back-up Power** – This project consists of installing diesel generators to provide 8 MW of back-up power to the pump station. A portion of the equipment has already been delivered and the design for the construction tender is nearing completion. Construction is anticipated to start in early fall 2022 with overall project completion in 2024.

- **Coquitlam Intake Tower Seismic Upgrade** – The Coquitlam Intake Tower is located in the southeast corner of the Coquitlam Reservoir. Constructed in 1913, the tower provides the GVWD its primary intake of water from Coquitlam Reservoir. The Tower is a 27 metre-high and 5.5 metre diameter unreinforced concrete structure, founded on bedrock. Detailed design of the seismic upgrade is 75% complete. Completion of detailed design is expected in Q2 of 2022. Due to coordination with BC Hydro work and water supply operations, construction will be completed over two winter periods 2024 to 2026.

- **Pebble Hill Reservoir No. 1, 2 and 3 Seismic Upgrade** – Pebble Hill Reservoir in south Delta is comprised of three units. Construction is scheduled to be completed in stages, taking only one unit out of service at any time. Construction of Unit 1 is ongoing and will finish in the summer of 2022. Unit 2 will commence in the fall of 2022 and finish in the summer of 2023. A separate tender will be issued for Unit 3 which is not expected to start until 2025.

- **Westburnco Pump Station – Back-up Power** – This project consists of installing diesel generators to provide 5 MW's of back-up power to the pump station. Preliminary design was completed in 2019 and detailed design is underway.

- **Cambie-Richmond Water Supply Tunnel** – This project comprises an approximately 1 km long 4.5 m diameter tunnel under the Fraser River between the City of Vancouver and the City of Richmond to increase the reliability of supply in the event of a major earthquake and provide additional long-term supply capacity. Conceptual design commenced in 2019 and is almost complete. Preliminary design is scheduled to commence later this year.

Infrastructure Upgrade Program

- **Coquitlam Ozone Upgrade** – This project consists of upgrades to the ozone generators at the Coquitlam Water Treatment Plant. The generators for units 1, 2 and 3 have been replaced and units 1 and 2 are in service. Testing and commissioning of unit 3 is scheduled for Q1 2022. Completion of the upgrades to the ozone control system will follow.

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To: Performance and Audit Committee

From: Joe Sass, Director, Financial Planning/Deputy CFO

Date: March 24, 2022 Meeting Date: April 14, 2022

Subject: **Investment Position and Returns – September 1, 2021 to February 28, 2022**

RECOMMENDATION

That the Performance and Audit Committee receive for information the report dated March 24, 2022 titled "Investment Position and Returns – September 1, 2021 to February 28, 2022".

EXECUTIVE SUMMARY

Metro Vancouver's investment portfolio has met expectations this period, with 2021 annualized returns for Short-Term at 0.99%, Long-Term at 2.19% and Cultural Reserve Fund at 2.24%. Total investment income in 2021 was $9.8 million on an average portfolio balance of $1,097 million. Results and balance information have been included to the end of February 2022.

Interest rates are expected to rise as the Bank of Canada manages inflation. As a result, Metro Vancouver's investment return will increase as higher rates will be earned on investments and cash held in high interest savings accounts.

Staff report investment returns three times a year to this Committee. Beginning in June 2022, in tandem with the transition to quarterly reporting, staff will enhance this report to include a broader range of Treasury issues, including the spread between the costs of borrowing and the earnings realized on investments, the forecasted debt portfolio and inflationary impacts on capital construction, and other important macro-economic factors that Metro needs to consider in its long term planning.

PURPOSE

To report investment performance and related economic information for receipt by the Committee.

BACKGROUND

Investment updates are brought to the Committee to keep members informed on important updates relating to Metro Vancouver's investments. The *Corporate Investment Policy* requires that an investment update report be presented to the Committee three times per year. Given the timing of the report, the period covers the third and final report for 2021 and the first two months of the current year.

INVESTMENT CATEGORIES

Short term investments have terms of less than one year at the time of investment. These normally include Bankers' Acceptances, Canadian Bank Bonds and Credit Union Term Deposits.

Long term investments have terms greater than one year at the time of investment. These investments normally include Canada, Provincial, and Canadian Bank bonds, Guaranteed Investment Certificates and Credit Union Term Deposits greater than one year.

Cultural Reserve investments are long term investments whose revenues have been set aside to fund Metro Vancouver's annual contributions to cultural activities.

OVERALL INVESTMENT RETURNS

Table 1

2021-2022 SUMMARY OF INVESTMENT RESULTS				
PERIOD	**SHORT TERM***	**LONG TERM**	**CULTURAL RESERVE**	**TOTAL****
January	0.08%	0.20%	0.21%	0.13%
February	0.08%	0.17%	0.17%	0.12%
March	0.09%	0.18%	0.19%	0.13%
April	0.09%	0.18%	0.18%	0.13%
May	0.09%	0.18%	0.19%	0.13%
June	0.08%	0.18%	0.18%	0.10%
July	0.08%	0.19%	0.19%	0.11%
August	0.08%	0.19%	0.19%	0.10%
September	0.08%	0.18%	0.18%	0.10%
October	0.08%	0.18%	0.19%	0.10%
November	0.08%	0.18%	0.18%	0.10%
December	0.08%	0.18%	0.19%	0.10%
2021 Annualized	**0.99%**	**2.19%**	**2.24%**	**1.33%**
January	0.08%	0.18%	0.19%	0.10%
February	0.08%	0.17%	0.18%	0.10%
2022 Annualized Estimate	**0.96%**	**2.10%**	**2.22%**	**1.18%**

* Includes cash and high-interest savings account balances

**Weighted average return of short-term, long-term and cultural reserve fund

Short Term Investment Performance

As at February 28, 2022, the short term portfolio held a total of $112.5 million (at historic cost/book value) and represented 37.6% of total investments.

Appendix 1 details performance during the period compared to benchmarks. The Short Term portfolio's performance exceeded all benchmarks for the period.

The estimated annualized yield for 2022 for the Short Term portfolio is currently as 0.96%. Last year's annual yield was 0.99%. However, as these Short Term investments mature and are re-invested at higher rates, the actual rate of return is expected to be higher.

Long Term Investment Performance

As at February 28, 2022, the long term portfolio held a total of $184.9 million (at historical cost/book value) representing 61.7% of all investments.

Appendix 2 details performance during the period compared to our benchmarks. The Long Term portfolio's performance exceeded all benchmarks for the period.

The estimated annualized yield for the Long Term portfolio in 2022 is 2.10% compared to prior year's annual yield of 2.19%. However, as investments mature and are re-invested at higher rates, the actual rate of return is expected to be higher.

Culture Reserve Investment Performance
Cultural Reserve portfolio held $2.2 million (at historical cost/book value) in fixed income investments representing 0.7% of total investments. Estimated annualized yield for 2022 is 2.22% compared to prior year's annualized return of 2.24%. The decrease is due to re-investing maturities at a lower rate.

Investment Holdings and Limits
Investments by counterparty as percentage of the total portfolio and the maximum limits per the policy have been included in Appendix 5.

The portfolio is currently heavily weighted in financial institutions, mostly held in cash, due to the significant cash demands of the capital program and limited short-term investment options with comparable returns.

Looking at the "days to maturity" for all investments, 19.7% will mature in the next 12 months and 13.7% will mature beyond 12 months. The remaining 66.6% are held in high-interest savings accounts (HISA) and is fully liquid. The expected maturity by sector can be found in Appendix 4 of this report.

Investment Income
As illustrated in Appendix 3, the overall investment income of $9.8M in 2021 is lower compared to prior years due to the continued lower rates available for investment due to deep interest rate cuts 2020 in response to the global pandemic.

ONGOING MATTERS
Environmental, Social and Governance (ESG)
As part of the investment policy approved on November 27, 2020, staff will include an update on the Environmental, Social and Governance (ESG) investing environment to inform the continued evolution of the Metro Vancouver investment policy.

Environmental, Social and Governance (ESG) investing continues to gain popularity among investors. For investment purposes, the ongoing challenge is standardization of data as the scoring process is largely qualitative, informed by subjective data that companies choose to release. Nevertheless, there is progress being made in the measurement of ESG data.

In October 2021, Moody's, one of the top ratings agencies in Canada, published an updated methodology of its general principles for assessing environmental, social and governance risks. Currently, the details provided continue to be qualitative and Moody's does not expect any changes to the outstanding ratings for financial institutions.

An additional ESG development is the Bank of Canada's issuance of its first green bonds in late March 2022. The initial offering is for $5 billion worth of bonds. Proceeds will be earmarked for environmentally focused projects such as infrastructure spending on electric vehicle charging stations, public transit, pollution reduction and forestry preservation.

For investment purposes, the ongoing challenge is standardization of data as the scoring process is largely qualitative, informed by subjective data that companies choose to release. Nevertheless, there is progress being made in the measurement of ESG data as this topic continues to gain popularity among investors. Staff continue to closely monitor the development in this space.

Current Economic Impacts

The Bank of Canada increased its key interest rate by 25 basis points on March 2, 2022. This brought the overnight target rate to 0.50%. Inflation is expected to continue to be above the target range of 1-3% for the foreseeable future and additional interest rate increases are expected. The Bank's next scheduled meeting to announce any rate increases is April 13th.

The US Fed's increased its interest rates 25 basis points on March 16, 2022. This increases the rate to the range of 0.25-0.50%. Further rate hikes are expected in the coming months.

As illustrated in Table 2 below, the yield curve is higher compared to a year ago, but the longer range forecast is flatter than a year ago. At the end of February, a 10 year Canada benchmark bond traded at 2.0% compared to 1.3% a year ago and 1.2% in February 2019.

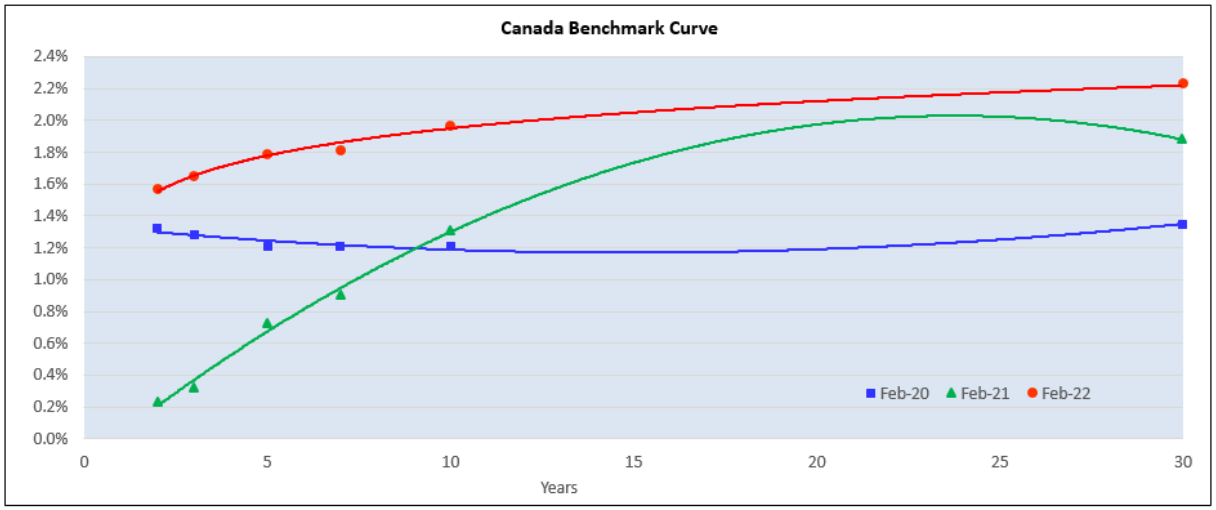

Table 2

Metro Vancouver's investment approach is to ensure the portfolio remains liquid and holds only the highest quality products to ensure safety of capital. Because the curve has levelled, staff are cautious about moving farther out the curve as rates are expected to continue to increase over the coming months. In addition, due to the high cash demands of the capital program Metro Vancouver's portfolio remains focused on shorter term products with a higher cash balance at this time. Staff are looking into a strategy to minimize the overall opportunity cost across the organization.

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

FINANCIAL IMPLICATIONS
Overall portfolio returns remain modest, a reflection of the priorities of preservation of capital and maintaining the necessary liquidity to meet operational requirements.

CONCLUSION
Overall, investment performance for the period, while modest, met expectations. Both the short term and long term investments exceeded returns on our benchmarks. Metro Vancouver's portfolios hold quality investments and are reasonably positioned to withstand the current market volatility. Overall rate of return is expected to increase in the next several months as a significant portion of portfolio will be matured and re-invested in higher rate short term and longer term products. At the same time the interest rate in the HISA accounts is also expected to increase.

Attachments:
Appendix 1 – Short Term Portfolio – Investment Results and Comparison to Benchmarks
Appendix 2 – Long Term Portfolio – Investment Results and Comparison to Benchmarks
Appendix 3 – 5 Year Comparison of Investment Income
Appendix 4 – Investment Maturity Charts
Appendix 5 – Investment Holdings and Maximum Limit

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APPENDIX 1

INVESTMENT RESULTS - SHORT TERM PORTFOLIOS 2021 -2022 Comparison to Benchmarks				
	SHORT TERM*	ONE MONTH B/A**	THREE MONTH B/A**	MFA MONEY MARKET FUND
January	0.08%	0.02%	0.02%	0.03%
February	0.08%	0.01%	0.01%	0.03%
March	0.09%	0.01%	0.02%	0.02%
April	0.09%	0.01%	0.02%	0.02%
May	0.09%	0.01%	0.02%	0.02%
June	0.08%	0.01%	0.02%	0.02%
July	0.08%	0.02%	0.02%	0.02%
August	0.08%	0.02%	0.02%	0.02%
September	0.08%	0.02%	0.02%	0.02%
October	0.08%	0.02%	0.02%	0.02%
November	0.08%	0.02%	0.02%	0.03%
December	0.08%	0.02%	0.02%	0.03%
2021 Annualized	**0.99%**	**0.19%**	**0.21%**	**0.29%**
January	0.08%	0.02%	0.04%	0.03%
February	0.08%	0.03%	0.05%	0.04%
2022 Annualized Estimate	**0.96%**	**0.34%**	**0.54%**	**0.43%**

* Includes cash and high-interest savings account balances

** Per IIROC BA Rate History

APPENDIX 2

2021 - 2022 INVESTMENT RESULTS - LONG TERM PORTFOLIOS Comparison to Benchmarks				
PERIOD	**LT PORTFOLIO**	**CULTURAL RES**	**MFA GOVT FOCUSED ULTRA-SHORT BOND FUND (Average Yield*)**	**MFA BOND FUND (Average Yield*)**
January	0.20%	0.21%	0.02%	0.05%
February	0.17%	0.17%	0.03%	0.07%
March	0.18%	0.19%	0.02%	0.07%
April	0.18%	0.18%	0.03%	0.07%
May	0.18%	0.19%	0.02%	0.07%
June	0.18%	0.18%	0.03%	0.08%
July	0.19%	0.19%	0.03%	0.07%
August	0.19%	0.19%	0.03%	0.07%
September	0.18%	0.18%	0.03%	0.09%
October	0.18%	0.19%	0.06%	0.12%
November	0.18%	0.18%	0.06%	0.12%
December	0.18%	0.19%	0.06%	0.12%
2021 Annualized	**2.19%**	**2.24%**	**0.43%**	**1.01%**
January	0.18%	0.19%	0.09%	0.15%
February	0.17%	0.18%	0.11%	0.16%
2022 Annualized Estimate	**2.10%**	**2.22%**	**1.18%**	**1.88%**
Average term-to-maturity	**2.41 Years**	**2.07 Years**	**0.80 Years**	**2.57 Years**

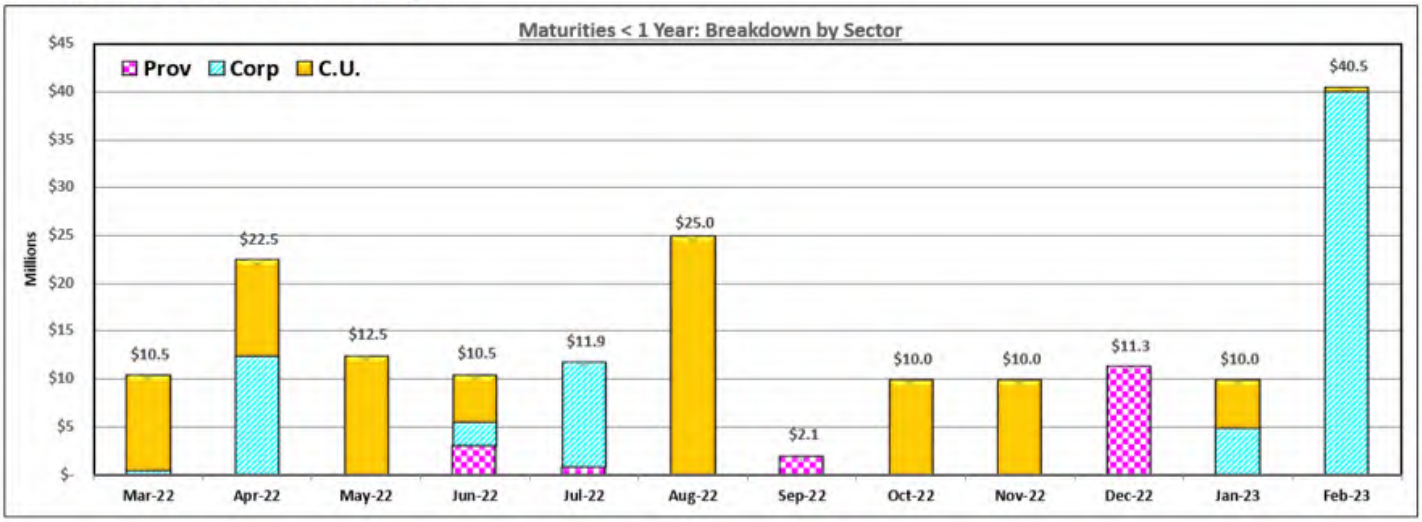
*Starting October 2020, MFA is no longer providing Average Yield in their monthly performance reports. Instead, MFA discloses the Yield to Maturity which is the total return anticipated if securities held in the fund are held until maturity.

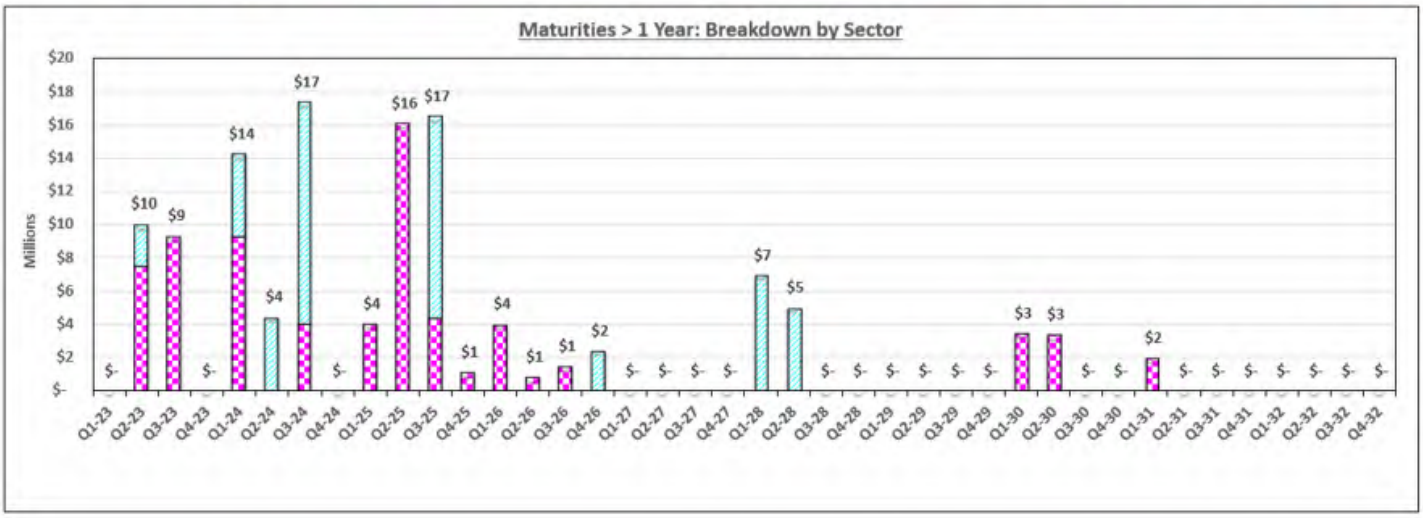
APPENDIX 3

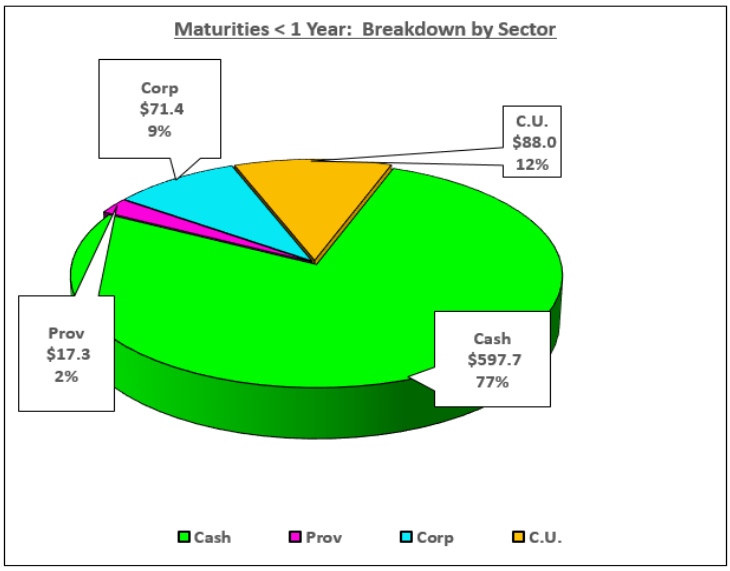
2017 - 2021 INVESTMENT INCOME* 5 Year Comparison					
In $000's	**2021**	**2020**	**2019**	**2018**	**2017**
Investment Income	$9,762	$15,409	$21,485	$17,482	$12,090
Weighted Average Portfolio Balance	$ 1,097,099	$835,711	$849,534	$768,172	$588,060
Rate of Return	**0.89%**	**1.84%**	**2.53%**	**2.28%**	**2.06%**

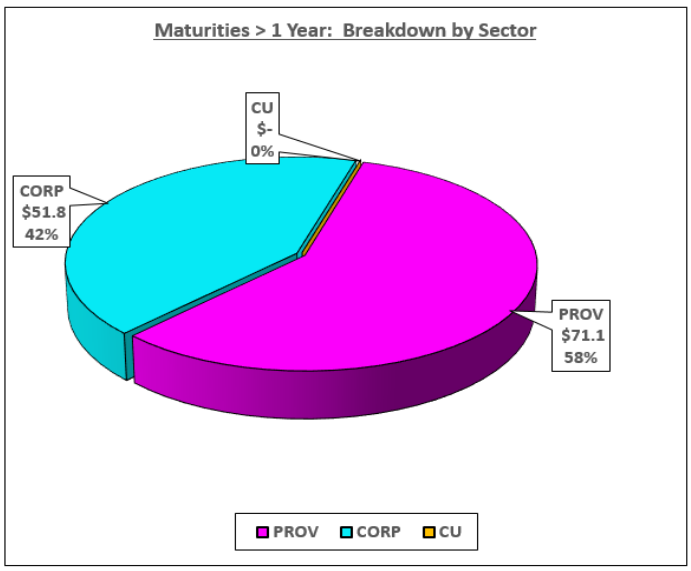
*Excludes cultural reserves

METRO VANCOUVER
MATURITIES BY SECTOR AS AT FEBRUARY 28, 2022









APPENDIX 5

METRO VANCOUVER
INVESTMENT HOLDINGS AND LIMITS AS AT FEBRUARY 28, 2022

	(% of total portfolio) Corporate Policy Limit	Investments as at February 28, 2022
Canada	100.0%	0.0%
Provinces rated AA- or better by S&P (or equivalent)		
British Columbia	50.0%	0.0%
Saskatchewan	50.0%	0.0%
Provinces rated A- or better by S&P (or equivalent)		
Alberta	30.0%	0.0%
New Brunswick	30.0%	0.2%
Ontario	30.0%	2.3%
Quebec	30.0%	4.4%
Manitoba	50.0%	1.2%
Nova Scotia	30.0%	0.4%
Newfoundland	30.0%	0.6%
Prince Edward Island	30.0%	0.0%
Subtotal	50.0%	9.1%
Municipal Finance Authority of BC	15.0%	1.8%
Government Term 11-30 years	5.0%	*0.0%*
SCHEDULE I/II BANKS		
Bank of Montreal	20.0%	10.1%
Bank of Nova Scotia	20.0%	20.0%
CIBC	20.0%	4.3%
Royal Bank of Canada	20.0%	11.6%
TD Bank	20.0%	7.8%
HSBC Bank Canada	15.0%	1.4%
National Bank of Canada	15.0%	15.0%
Manulife Bank	15.0%	0.0%
Canadian Western Bank	15.0%	9.1%
BC CREDIT UNIONS		
Vancity	20.0%	6.9%
CoastCapital	20.0%	0.0%
Westminster Credit Union	20.0%	0.0%
Blueshore	20.0%	2.2%
First West	20.0%	0.1%
Prospera	20.0%	0.0%
G&F Financial	20.0%	0.6%
Subtotal	50.0%	9.8%
BC Credit Union Long 2-5 years	30.0%	0.0%
Caisse Central Desjardins	5.0%	0.0%

To: Performance and Audit Committee

From: Roy Moulder, Director, Procurement
Procurement and Real Estate Services Department

Date: March 28, 2022 Meeting Date: April 14, 2022

Subject: **Tender/Contract Award Information – December 2021 to February 2022**

RECOMMENDATION

That the Performance and Audit Committee receive for information the report dated March 28, 2022 titled "Tender/Contract Award Information – December 2021 to February 2022".

EXECUTIVE SUMMARY

During the period December 1, 2021 and February 28, 2022, the Procurement Division issued twenty-three (23) new contracts, each with a value in excess of $500,000 (exclusive of taxes). In addition, there were eight (8) existing contracts requiring contract amendments which necessitate further reporting to the Performance and Audit Committee. The 8 amendments experienced additional scope resulting from either internal scope changes, unforeseen project extensions, unforeseen site conditions or third party regulatory requirements.

All awards and amendments were issued in accordance with the *"Officers and Delegation Bylaws 1208, 284 and 247 – 2014"* and the *"Procurement and Real Property Contracting Authority Policy".*

PURPOSE

To provide the Performance and Audit Committee information with regard to contracts, handled through the Procurement Division, with a total anticipated value at or in excess of $500,000 (exclusive of taxes).

BACKGROUND

The Procurement Division of Metro Vancouver awards contracts for goods, services and construction in accordance with the *"Officers and Delegation Bylaws 1208, 284 and 247 – 2014" (Bylaws)*, and the *"Procurement and Real Property Contracting Authority Policy" (Policy)* adopted by the Board of Directors on July 11, 2014, effective September 1, 2014. These *Bylaws* and *Policy* outline thresholds for competitive bidding and contracting authorities. Contracts in excess of $500,000 will be reported to the Performance and Audit Committee to align with the thresholds outlined in the Policy.

Capital projects may result in the awarding of one or more contracts to complete the project. Budget availability is verified prior to the execution of contracts.

NEW CONTRACTS - $500,000 to $5,000,000

The following contracts were **awarded** during the months of *December 2021 to February 2022* (Details attached as **APPENDIX A**):

		(Exclusive of taxes)	
1.	Vimar Equipment Ltd. RFP No. 21-032 *Supply and Delivery of three (3) Sewer Cleaning Trucks*	$2,371,667	MVRD
2.	AWC Process Solutions Tender No. 21-136 *Supply and Delivery of Metal-Seated Butterfly Valves and Rubber-Seated Butterfly Valves – Kennedy Newton Main Phase 3 and Other Related Projects*	$730,348	GVWD
3.	All Round Home Improvements & Restorations Ltd. Tender 21-299 *Pinewood Pitched Roof Replacement*	$519,640	MVHC
4.	Mack Kirk Roofing & Sheet Metal Ltd. Tender No. 21-462 *2751 Production Way Roof Renewal - West Section*	$899,800	GVS&DD
5.	All Round Home Improvements & Restorations Ltd. Tender No. 21-300 *Semlin Low-Slope Roof Replacement*	$620,460	MVHC
6.	Spartan Controls Ltd. Sole Source No. 21-516 *Annual Support Services for the SCADA System, the CDAC System at SCFP, and the CDAC System at CWTP*	$579,152	GVWD
7.	Kleanza Consulting Ltd. Sole Source No. 21-507 *Archaeological Support Services for the Iona Island Wastewater Treatment Plant (IIWWTP) Upgrade Project*	$2,256,923	GVS&DD
8.	Vancouver Pile Driving Ltd. Tender No. 21-234 *Construction Services for Capilano Middle-Lake Debris Boom*	$2,454,316	GVWD
9.	Lynch Bus Lines Ltd. RFP No. 21-077 *Bus Transportation Services*	$591,575	GVWD

10.	Vancouver Pile Driving Ltd. Tender No. 21-447 *Supply and Installation of Scour Protection for Tilbury Main South Arm Crossing*	$989,187	GVWD
11.	Worley Canada Services Ltd. (Advisian) RFP No. 21-238 *Iona Island (xʷəyeyət) Foreshore Ecological Restoration Projects: Data Collection, Modelling and Design*	$1,531,311	GVS&DD
12.	Pacific Blasting and Demolition Ltd. RFP No. 21-466 *Coquitlam Recycling and Waste Centre Demolition*	$726,030	GVS&DD
13.	Merrick Canada ULC RFP No. 20-225 *Progressive Design-Build of Hydrothermal Processing Demonstration Plant at Annacis Island Wastewater Treatment Plant*	$1,640,000	GVS&DD
14.	Jacob Bros. Construction Ltd. Tender No. 21-039 *Construction of the Lower Seymour Conservation Reserve Watershed Administration Building*	$3,197,000	GVWD
15.	British Columbia Hydro Sole Source No. 22-022 *BC Hydro Service Connection, Northwest Langley Wastewater Treatment Plant Upgrade*	$1,368,000	GVS&DD
16.	Integral Hospitality Inc. RFP No. 21-213 *General Housekeeping and Refuse Removal Services*	$4,180,012	MVHC
17.	Scooby's Dog Waste Removal Service NOIC No. 21-382 *Provision of Dog Waste Collection and Recycling at 17 Metro Vancouver Regional Park Sites*	$776,000	MVRD
18.	GreatPacific Consulting Ltd. RFP No. 22-012 *2022 Iona Deep Sea Outfall Receiving Environment Monitoring Program - Sediment Effects Survey*	$1,100,000	GVS&DD

19.	GreatPacific Consulting Ltd. RFP No. 22-013 *2022 Lions Gate Receiving Environment Monitoring Program - Sediment Effects Survey*	$1,250,000	GVS&DD
20.	NorLand Limited (Bell Contracting Division) RFP No. 21-334 *Construction of Hastings-Cassiar Intake Connection*	$2,942,425	GVS&DD

NEW CONTRACTS – BOARD APPROVED

The following contracts were **authorized for execution** by the GVS&DD and GVWD Boards of Directors during the months of *December 2021 to February 2022* (as such no further information is included in this report):

		(Exclusive of taxes)	
1.	Northwest Pipe Company RFQ No. 21-183 *Supply and Delivery of Large Diameter Steel Pipe – Coquitlam Main No. 4*	$15,739,689 USD	GVWD
2.	AECOM Canada Ltd. RFP No. 14-163 *Consulting Engineering Services for the Design and Construction of Burnaby Lake North Interceptor No. 2 – Winston Street Phase 2 – Phase C2 Engineering Construction Services*	$4,227,265	GVS&DD
3.	PCL Constructors Westcoast Inc. RFQ No. 21-457 *North Shore Wastewater Treatment Plant (NSWWTP) Project*	$40,000,000	GVS&DD

AMENDED CONTRACT

The following **'not previously reported'** contracts were **amended** during the months of *December 2021 to February 2022* (**APPENDIX B**):

		Value of Amendments	Total Amended Value of Contract
1.	Deloitte LLP RFP No. 14-217 *Financial and Commercial Advisory Services for the Lions Gate Secondary Wastewater Treatment Plant*	$951,100	$1,327,175
2.	Sandpiper Contracting Tender No. 21-380 *Water Meter Upgrade Project – Flowmeter M233*	$86,312	$571,872

The following **previously reported** contracts were **amended** during the months of *December 2021 to February 2022* (Details attached as **APPENDIX C**):

		Value of Amendments	Total Amended Value of Contract
1.	Graham Infrastructure LP & Aecon Water Infrastructure Inc., a Joint-Venture RFP No. 16-079 *Construction of Annacis Island Wastewater Treatment Plant Stage 5 Phase 1 Expansion Project*	$36,415,158	$289,073,537
2.	CH2M HILL Canada Limited (Jacobs) RFP No. 17-041 *Consulting Engineering Services for Iona Island Wastewater Treatment Plant Biogas Piping Relocation*	$514,066	$1,138,777
3.	Mott MacDonald Canada Limited RFP No. 17-163 *Coquitlam Intake Tower Seismic Upgrade Consulting Engineering Services*	$822,340	$1,513,386
4.	Mott MacDonald Canada Limited RFP No. 18-023 *Consulting Engineering Services for Capilano Main No. 5 - Stanley Park Water Supply Tunnel*	$1,681,592	$12,060,619
5.	AECOM Canada Ltd. RFP No. 18-043 *Consulting Engineering Services for Iona Island Wastewater Treatment Plant Project Definition*	$1,780,344	$11,638,746
6.	WSP RFP No. 18-189 *Project Management and Technical Services for Northwest Langley Wastewater Treatment Plant Projects*	$2,657,000	$7,547,502

COMPETITIVE SELECTION PACKAGES - anticipated to be greater than $500,000 (Issued but not awarded) (Details attached as **APPENDIX D**).

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

FINANCIAL IMPLICATIONS

The contract approval process includes a review of available budget. The contracts presented herein are consistent with budget authority provided by the respective Boards.

CONCLUSION

The contracts presented herein were awarded in accordance with the *"Officers and Delegation Bylaws 1208, 284 and 247 – 2014" (Bylaws)* and the *"Procurement and Real Property Contracting Authority Policy" (Policy)* and comply with competitive bidding laws and applicable legislation.

Further, the competitive selection packages were carefully crafted by teams of subject matter experts resulting in the award of contracts that are fiscally responsible, and balance risk, economic, ethical and legal obligations.

Attachments

APPENDIX A: Information with regard to newly awarded contracts - $500,000 to $5,000,000.

APPENDIX B: Contract amended to a value of more than $500,000 but not previously reported to the Performance and Audit Committee

APPENDIX C: Previously reported contracts that have been amended.

APPENDIX D: Competitive Selection Packages anticipated to be greater than $500,000 (Issued but not awarded).

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Appendix A
No. 1

AWARD OF CONTRACT

RFP No. 21-032

1. A contract was awarded, November 15, 2021 for the **Metro Vancouver Regional District.**

   To: ***Vimar Equipment Ltd.***

   in the anticipated amount of up to **$2,371,667** (exclusive of taxes) for Supply and Delivery of three (3) Sewer Cleaning Trucks. The initial award of $790,556 (exclusive of taxes) is for one (1) unit with an option to extend for two (2) one (1) year options upon mutual agreement. Metro Fleet anticipates the need for an additional two (2) units over the term of this contract. The initial award amount is a combination of the successful proponent's proposed price of $776,610 (exclusive of taxes) and an additional $13,946 (exclusive of taxes) to account for various optional pieces of equipment as allowed for in the RFP.

   The contract price is within the overall budget.

2. Proponents were invited by Metro Vancouver's and BC Bid websites and private invitation on February 9, 2021.

   Closing Date: March 31, 2021

3. Proposal received (exclusive of taxes):

Vimar Equipment Ltd.	$776,610

4. Proposal reviewed by:

   Contractual: Procurement Division Staff

   Technical: Fleet Services Division Staff

5. Award was made to the only compliant bidder based on the evaluation criteria established in the RFP.

Appendix A
No. 2

AWARD OF CONTRACT

TENDER No. 21-136

2. A contract was awarded, November 22, 2021 for the **Greater Vancouver Water District**.

   To: ***AWC Process Solutions***

   in the amount of **$730,348** (exclusive of taxes) for Supply and Delivery of Metal-Seated Butterfly Valves and Rubber-Seated Butterfly Valves – Kennedy Newton Main Phase 3 and Other Related Projects. This award was for Part B – Supply and Delivery of Rubber-seated butterfly valves.

   The contract price is within the overall budget.

3. Tenderers were invited by Metro Vancouver's and BC Bid websites and private invitation on August 25, 2021.

   Closing Date: September 22, 2021

4. Tenders received (exclusive of taxes):

	Part B only
AWC Process Solutions	$730,348
CB Process Instrumentation & Controls	$731,844
Tundra Process Solutions Ltd.	$1,137,841
John Brooks Company Limited	$1,291,813

5. Tenders reviewed by:

   Contractual: Procurement Division Staff

   Technical: Water Services Department Staff

6. Award was made to the lowest compliant bidders for Parts A and B. Part A did not exceed the reporting threshold and therefore is not identified in this information report.

Appendix A
No. 3

AWARD OF CONTRACT

TENDER No. 21-299

1. A contract was awarded, November 26, 2021 for the **Metro Vancouver Housing Corporation.**

   To: ***All Round Home Improvements & Restorations Ltd.***

   in the amount of **$519,640** (exclusive of taxes) for Pinewood Pitched Roof Replacement.

   The contract price is within the overall budget.

2. Tenderers were invited by Metro Vancouver's and BC Bid websites and private invitation on August 18, 2021.

   Closing Date: September 22, 2021

3. Tenders received (exclusive of taxes):

All Round Home Improvements & Restorations Ltd.	$519,640
Cambie Roofing Contractors Ltd.	$674,000

4. Tenders reviewed by:

   Contractual: Procurement Division Staff

   Technical: Regional Planning and Housing Services Staff

5. Award was made to the lowest compliant bidder.

Appendix A
No. 4

AWARD OF CONTRACT

TENDER No. 21-462

1. A contract was awarded, December 7, 2021 for the **Greater Vancouver Sewerage and Drainage District.**

   To: **Mack Kirk Roofing & Sheet Metal Ltd.**

   in the amount of **$899,800** (exclusive of taxes) for 2751 Production Way Roof Renewal - West Section.

   The contract price is within the overall budget.

2. Tenderers were invited by Metro Vancouver's and BC Bid websites and private invitation on November 2, 2021.

   Closing Date: November 23, 2021

3. Tenders received (exclusive of taxes):

Mack Kirk Roofing & Sheet Metal Ltd.	$899,800
Atlas-Apex Roofing (BC) Inc.	$1,093,000
Transwest Roofing Ltd.	$1,205,000

4. Tenders reviewed by:

   Contractual: Procurement Division Staff

   Technical: Liquid Waste Services Department Staff

5. Award was made to the lowest compliant bidder.

Appendix A
No. 5

AWARD OF CONTRACT

TENDER No. 21-300

1. A contract was awarded, December 13, 2021 for the **Metro Vancouver Housing Corporation.**

   To: ***All Round Home Improvements & Restorations Ltd.***

   in the amount of **$620,460** (exclusive of taxes) for Semlin Low-Slope Roof Replacement.

   The contract price is within the overall budget.

2. Tenderers were invited by Metro Vancouver's and BC Bid websites and private invitation on September 1, 2021.

   Closing Date: October 29, 2021

3. Tenders received (exclusive of taxes):

All Round Home Improvements & Restorations Ltd.	$620,460
Transwest Roofing Ltd.	$851,500
Marine Roofing (1996) Ltd.	$923,200
Advanced Systems Roofing & Waterproofing Ltd.	$1,217,355

4. Tenders reviewed by:

   Contractual: Procurement Division Staff

   Technical: Housing Maintenance and Capital Projects Department Staff

5. Award was made to the lowest compliant bidder.

Appendix A
No. 6

AWARD OF SOLE SOURCE CONTRACT

No. 21-516

1. A contract was awarded on December 15, 2021 for the **Greater Vancouver Water District.**

   To: ***Spartan Controls Ltd.***

   in the amount of **$579,152** (exclusive of taxes) for the purchase of Annual Support Services for the SCADA System, the CDAC System at SCFP, and the CDAC System at CWTP.

   A sole source contract was awarded to Spartan Controls Ltd. ("Spartan") for the supply of annual support services for the Corporation's SCADA system and its CDAC systems at Seymour Capilano Filtration Plant (SCFP) and at Coquitlam Water Treatment Plant (CWTP). Spartan is the only authorized service provider in Western Canada for these systems and as a result, the Corporation has sole sourced these services from them for the past 11 years.

Appendix A
No. 7

AWARD OF SOLE SOURCE CONTRACT

No. 21-507

1. A contract was awarded December 17, 2021 for the **Greater Vancouver Sewerage and Drainage District.**

   To: ***Kleanza Consulting Ltd.***

   in the amount of **$2,256,923** (exclusive of taxes) for the purchase of Archaeological Support Services for the IIWWTP Upgrade Project.

   A sole source contract was awarded to Kleanza Consulting Ltd. for provision of archaeological support services for the Iona Island Wastewater Treatment Plant (IIWWTP) Upgrade Project. Services will include conducting the Archaeological Impact Assessments (AIA) and providing monitoring during construction activities for the period of September 2021 to December 2022 (Phase 1). In accordance with Metro Vancouver's Procurement and Real Property Contracting Authority Policy archaeological services may be sole sourced when a preferred archaeologist is identified by the First Nation. In consultation with Musqueam Indian Band, Kleanza Consulting Ltd. was identified as that preferred archaeologist.

Appendix A
No. 8

AWARD OF CONTRACT

TENDER No. 21-234

1. A contract was awarded, January 5, 2022 for the **Greater Vancouver Water District.**

   To: ***Vancouver Pile Driving Ltd.***

   in the amount of **$2,454,316** (exclusive of taxes) for Construction Services for Capilano Middle-Lake Debris Boom.

   The contract price is within the overall budget.

2. Five firms were shortlisted as a result of RFQ No. 20-067 (publicly advertised on Metro Vancouver's and BC Bid websites) and invited to bid on ITT No. 21-234 on October 19, 2021.

   Closing Date: November 9, 2021

3. Tenders received (exclusive of taxes):

Vancouver Pile Driving Ltd.	$2,454,316
JJM Construction Ltd.	$2,825,000

4. Tenders reviewed by:

   Contractual: Procurement Division Staff

   Technical: Water Services Department Staff

5. Award was made to the lowest compliant bidder.

Appendix A
No. 9

AWARD OF CONTRACT

RFP No. 21-077

1. A contract was awarded, January 6, 2022 for the **Greater Vancouver Water District.**

   To: ***Lynch Bus Lines Ltd.***

   in the anticipated amount of up to $591,575 (exclusive of taxes) for Bus Transportation Services over a possible five (5) year period. The initial award of $343,540 (exclusive of taxes) is for a period of three (3) years with an option to extend for an additional two (2) year extension, upon mutual agreement with the successful proponent.

   The contract price is within the overall annual operation budget.

2. Proponents were invited by Metro Vancouver's and BC Bid websites and private invitation on July 20, 2021.

   Closing Date: August 13, 2021

3. Proposals received (exclusive of taxes):

Lynch Bus Lines Ltd.	$591,575
FirstCanada ULC	$638,895
TRAXX Holdings Inc.	$721,093

4. Proposals reviewed by:

   Contractual: Procurement Division Staff

   Technical: Water Services Department Staff

5. Award was made to the highest ranked proponent and lowest cost based on the evaluation criteria established in the RFP.

Appendix A
No. 10

AWARD OF CONTRACT

TENDER No. 21-447

1. A contract was awarded, January 13, 2022 for the **Greater Vancouver Water District.**

   To: ***Vancouver Pile Driving Ltd.***

   in the amount of **$989,187** (exclusive of taxes) for the Supply and Installation of Scour Protection for Tilbury Main South Arm Crossing.

   The contract price is within the overall budget.

2. Tenderers were invited by Metro Vancouver's and BC Bid websites and private invitation on November 29, 2021.

   Closing Date: December 21, 2021

3. Tender received (exclusive of taxes):

Vancouver Pile Driving Ltd.	$989,187

4. Tenders reviewed by:

   Contractual: Procurement Division Staff

   Technical: Water Services Department Staff

5. Award was made to the lowest compliant bidder.

6. The tender submitted by Vancouver Pile Driving Ltd. is the only compliant bid with the terms of the Tender. The work is subject to a DFO (Fisheries and Oceans Canada) permit which stipulates that work must be completed by February 15, 2022. Two other bids were received but did not meet the stated DFO requirements.

Appendix A
No. 11

AWARD OF CONTRACT

RFP No. 21-238

1. A contract was awarded, January 14, 2022 for the **Greater Vancouver Sewerage and Drainage District.**

   To: ***Worley Canada Services Ltd. (Advisian)***

   in the anticipated amount of up to **$1,531,311** (exclusive of taxes) for Iona Island (xʷəyeyət) Foreshore Ecological Restoration Projects: Data Collection, Modelling and Design. The anticipated amount is a combination of the successful consultants' proposed price of $1,492,441 (exclusive of taxes) and an additional $38,870 (exclusive of taxes) to account for issues identified during negotiations as allowed for in the RFP.

   The contract price is within the overall budget.

2. Proponents were invited by Metro Vancouver's and BC Bid websites and private invitation on August 20, 2021.

   Closing Date: October 6, 2021

3. Proposals received (exclusive of taxes):

Worley Canada Services Ltd. (Advisian)	$1,492,441
Northwest Hydraulic Consultants Ltd.	$1,826,561*
Golder Associates Ltd.	$1,585,281*

   *Values were adjusted for responses that didn't base the proposed fee on the estimated hours prescribed in the RFP, an average hourly rate was calculated and multiplied by the RFP prescribed hours in order to form a basis of comparison.

4. Proposals reviewed by:

   Contractual: Procurement Division Staff

   Technical: Project Delivery Department Staff

5. Award was made to the highest ranked proponent and lowest cost based on the evaluation criteria established in the RFP.

Appendix A
No. 12

AWARD OF CONTRACT

RFP No. 21-466

1. A contract was awarded, January 19, 2022 for the **Greater Vancouver Sewerage and Drainage District.**

   To: ***Pacific Blasting and Demolition Ltd.***

   in the anticipated amount of up to **$726,030** (exclusive of taxes) for Coquitlam Recycling and Waste Centre Demolition.

   The contract price is within the overall budget.

2. Proponents were invited by Metro Vancouver's and BC Bid websites and private invitation on November 12, 2021.

   Closing Date: December 7, 2021

3. Proposals received (exclusive of taxes):

Dallas Watt Demo Ltd.	$614,777
Secure Energy	$627,700
Priestly Demo Inc.	$698,573
Pacific Blasting and Demo Ltd.	**$726,030**
Evergreen Demo Ltd.	$859,650
MWL Demo Ltd.	$1,011,495
Lafarge Canada Inc.	$1,043,660
Klondike Contracting	$1,597,504

4. Proposals reviewed by:

   Contractual: Procurement Division Staff

   Technical: Solid Waste Services Department Staff

5. Award was made to the highest ranked proponent based on the evaluation criteria established in the RFP.

6. Pacific Blasting and Demolition Ltd. did not present the lowest lump sum pricing for the stated scope of work. However, their proposal demonstrated extensive corporate and staff experience, and a well-defined understanding of the scope of the project and technically sound work plan. Pacific Blasting and Demolition Ltd. is the highest overall scoring proponent based on the combined scoring of technical qualification and pricing.

Appendix A
No. 13

AWARD OF CONTRACT

RFP No. 20-225

1. A contract was awarded, January 21, 2022 for the **Greater Vancouver Sewerage and Drainage District.**

   To: ***Merrick Canada ULC***

   in the anticipated amount of up to **$1,640,000** (exclusive of taxes) for Progressive Design-Build of Hydrothermal Processing Demonstration Plant at Annacis Island Wastewater Treatment Plant. The initial award is limited to Phase 1 – Design of Inside Battery Limit (ISBL) at a cost of $1,640,000 (exclusive of taxes) and subsequent phases of the work will be awarded subject to mutual agreement. Any subsequent phase may be conditional on Board approval.

   The contract price is within the overall budget.

3. One (1) firm was shortlisted as a result of RFQ No. 20-224 (publicly advertised on Metro Vancouver's and BC Bid websites) and invited to provide proposal for RFP No. 20-224 on August 10, 2020.

   Closing Date: September 18, 2020

6. Proposal received (exclusive of taxes):

Merrick Canada ULC	$1,640,000

7. Proposal reviewed by:

   Contractual: Procurement Division Staff

   Technical: Liquid Waste Services Department Staff

8. Award was made to the only proposal selected to negotiate with.

Appendix A
No. 14

AWARD OF CONTRACT

TENDER No. 21-039

1. A contract was awarded, January 21, 2022 for the **Greater Vancouver Water District.**

   To: ***Jacob Bros. Construction Ltd.***

   in the amount of **$3,197,000** (exclusive of taxes) for Construction of the Lower Seymour Conservation Reserve Watershed Administration Building.

   The contract price is within the overall budget.

2. Tenderers were invited by Metro Vancouver's and BC Bid websites and private invitation on November 9, 2021.

   Closing Date: December 23, 2021

3. Tenders received (exclusive of taxes):

Jacob Bros. Construction Inc.	$3,197,000
Kenaidan Contracting Ltd.	$3,248,900
Industra Construction Corp.	$3,345,788
Kingston Construction Ltd.	$3,837,141

4. Tenders reviewed by:

   Contractual: Procurement Division Staff

   Technical: Water Services Department Staff

5. Award was made to the lowest compliant bidder.

Appendix A
No. 15

AWARD OF SOLE SOURCE CONTRACT

No. 22-022

2. A contract was awarded February 3, 2022 for the **Greater Vancouver Sewerage and Drainage.**

To: ***British Columbia Hydro***

in the amount of **$1,368,000** (exclusive of taxes) for the purchase of BC Hydro Service Connection, Northwest Langley Wastewater Treatment Plant Upgrade.

A sole source contract was awarded to British Columbia Hydro for the detailed design of the 25kV distribution service system for the Northwest Langley Wastewater Treatment Plant. No other companies in British Columbia can compete on the contract as it is under the provincial utilities corporations' responsibility.

Appendix A
No. 16

AWARD OF CONTRACT

RFP No. 21-213

1. A contract was awarded, February 4, 2022 for the **Metro Vancouver Housing Corporation.**

   To: ***Integral Hospitality Inc.***

   in the anticipated amount of up to **$4,180,012** (exclusive of taxes) for General Housekeeping and Refuse Removal Services over a five (5) year period. The initial award of $1,622,513 (exclusive of taxes) is for a period of two (2) years with an option to extend for an additional three (3) year extension, upon mutual agreement with the successful proponent.

   The contract price is within the overall annual operation budget.

2. Proponents were invited by Metro Vancouver's and BC Bid websites and private invitation on November 4, 2021.

   Closing Date: November 30, 2021

3. Proposals received (exclusive of taxes):

Deepak Management Ltd.	$1,119,320
Integral Hospitality Inc.	**$1,622,513**
On the Spot Services	$1,730,548
Tricom Building Maintenance	$2,210,346

4. Proposals reviewed by:

   Contractual: Procurement Division Staff

   Technical: Housing Operations Department Staff

5. Award was made to the highest ranked proponent based on the evaluation criteria established in the RFP.

6. Integral Hospitality Inc. offered best overall value (technical, management and financial) to the Corporation through a strong quality control process, allocation of adequate level of resources that meet the requirements of the RFP, and a strong detailed work plan.

Appendix A
No. 17

AWARD OF CONTRACT

NOIC No. 21-382

1. A contract was awarded, February 8, 2022 for the **Metro Vancouver Regional District.**

   To: ***Scooby's Dog Waste Removal Service***

   in the anticipated amount of up to **$776,000** (exclusive of taxes) for Provision of Dog Waste Collection and Recycling at 17 Metro Vancouver Regional Park Sites over a five (5) year period. The initial award of $402,036 (exclusive of taxes) is for a period of three (3) year with an option to extend the term for one additional two (2) year extension, upon mutual agreement with the successful proponent.

   The contract price is within the overall annual operation budget.

2. A Notice of Intent to Contract (NOIC) was advertised on Metro Vancouver & BC Bid web sites on September 3, 2021.

   Closing Date: September 24, 2021

3. No qualified objections were received.

4. Proposal reviewed by:

   Contractual: Procurement Division Staff

   Technical: Parks and Environmental Services Department Staff

5. Award was made to Scooby's Dog Waste Removal Service (Scooby's) for the provision of dog waste collection and recycling services at 17 Metro Vancouver Regional Park sites and the Lower Seymour Conservation Reserve (LSCR). Metro Vancouver reached out to the market and no other company other than Scooby's came forward to undertake the scope of services as listed in the most recent NOIC No. 21-382.

Appendix A
No. 18

AWARD OF CONTRACT

RFP No. 22-012

1. A contract was awarded, February 8, 2022 for the **Greater Vancouver Sewerage and Drainage District.**

   To: ***GreatPacific Consulting Ltd.***

   in the anticipated amount of up to **$1,100,000** (exclusive of taxes) for 2022 Iona Deep Sea Outfall Receiving Environment Monitoring Program - Sediment Effects Survey over a three (3) year period. The initial award for 2022 is anticipated to be up to $354,931. This amount is a combination of the successful consultants' proposed price of $270,038 (exclusive of taxes) and an additional $84,893 (exclusive of taxes) to account for additional optional components as allowed for in the RFP. Subject to satisfactory performance of the initial contract term and future annual budget approval, subsequent years two (2) and three (3) will be executed.

   The contract price is within the overall annual operation budget.

2. Proponents were invited by Metro Vancouver's and BC Bid websites and private invitation on December 8, 2021.

   Closing Date: January 18, 2022

3. Proposals received (exclusive of taxes):

GreatPacific Consulting Ltd.	$270,038
ENKON Environmental Limited	$308,585

4. Proposals reviewed by:

   Contractual: Procurement Division Staff

   Technical: Liquid Waste Services Department Staff

5. Award was made to the highest ranked proponent and lowest cost based on the evaluation criteria established in the RFP.

Appendix A
No. 19

AWARD OF CONTRACT

RFP No. 22-013

1. A contract was awarded, February 22, 2022 for the **Greater Vancouver Sewerage and Drainage District.**

   To: ***GreatPacific Consulting Ltd.***

   in the anticipated amount of up to **$1,250,000** (exclusive of taxes) for 2022 Lions Gate Receiving Environment Monitoring Program - Sediment Effects Survey over a three (3) year period. The initial award for 2022 is anticipated to be up to $350,116. This amount is a combination of the successful consultants' proposal price of $290,547 (exclusive of taxes) and an additional $59,569 (exclusive of taxes) to account for additional optional components as allowed for in the RFP. Subject to satisfactory performance of the initial contract term and future annual budget approval, subsequent years 2 and 3 will be executed.

   The contract price is within the overall annual operation budget.

2. Proponents were invited by Metro Vancouver's and BC Bid websites and private invitation on December 10, 2021

   Closing Date: January 18, 2022

3. Proposals received (exclusive of taxes):

GreatPacific Consulting Ltd.	$290,547
ENKON Environmental Limited	$296,530

4. Proposals reviewed by:

   Contractual: Procurement Division Staff

   Technical: Liquid Waste Services Department Staff

5. Award was made to the highest ranked proponent and lowest cost based on the evaluation criteria established in the RFP.

Appendix A
No. 20

AWARD OF CONTRACT

RFP No. 21-334

1. A contract was awarded, February 23, 2022 for the **Greater Vancouver Drainage and Sewerage District.**

   To: ***NorLand Limited (Bell Contracting Division)***

   in the anticipated amount of up to **$2,942,425** (exclusive of taxes) for Construction of Hastings-Cassiar Intake Connection.

   The contract price is within the overall budget.

2. Five (5) firms were shortlisted as a result of RFQ No. 21-329 (publicly advertised on Metro Vancouver's and BC Bid websites) and invited to bid on RFP No. 21-334 on November 10, 2021.

   Closing Date: December 15, 2021

3. Proposals received (exclusive of taxes):

NorLand Limited (Bell Contracting Division)	$2,942,425
Hall Constructors	$3,256,170
Clearway Construction Inc.	$4,928,100

4. Proposals reviewed by:

   Contractual: Procurement Division Staff

   Technical: Liquid Waste Services Department Staff

5. Award was made to the highest ranked proponent and lowest cost based on the evaluation criteria established in the RFP.

Appendix B
No. 1

CONTRACTS AMENDED TO A VALUE OF
MORE THAN $500,000
BUT NOT PREVIOUSLY REPORTED TO THE
PERFORMANCE AND AUDIT COMMITTEE

RFP No. 14-217
PURCHASE ORDER No. 133024

Deloitte LLP

Financial and Commercial Advisory Services for the Lions Gate Secondary Wastewater Treatment Plant for the **Greater Vancouver Sewerage and Drainage District**

1.	Original Value of Contract (exclusive of taxes):	$376,075
2.	Amendment Value (exclusive of taxes):	$951,100
3.	Amendment Number:	01
4.	Total Amended Value of Contract (exclusive of taxes):	$1,327,175

5. Budget Status:

   This contract is funded within the budget for this project.

6. Reasons for Amendment to Contract:

   Amendment No. 1 is for the continuation of financial advisory services in respect to replacing the existing Design Build Finance Structure with a new delivery model with purpose to attain a new contractor. Deloitte was initially engaged as a subject matter expert for the financial evaluation of the original project delivery model. Expertise and existing knowledge warranted expansion of their scope of services.

   This amendment consists of two (2) Contract Amendments. The first Contract Amendment in the value of $134,810 reflects anticipated scope during the original Design-Build competition from 2015. The second Contract Amendment is the value of $816,290 reflects additional financial analysis to support the decision to replace the initial Design Build Finance structure to a new delivery model, specifically providing strategic support, project support and risk review analysis.

Appendix B
No. 2

CONTRACTS AMENDED TO A VALUE OF
MORE THAN $500,000
BUT NOT PREVIOUSLY REPORTED TO THE
PERFORMANCE AND AUDIT COMMITTEE

TENDER No. 21-380
PURCHASE ORDER No. 732013

Sandpiper Contracting

Water Meter Upgrade Project – Flowmeter M233
for the **Greater Vancouver Water District**

1.	Original Value of Contract (exclusive of taxes):	$485,560
2.	Amendment Value (exclusive of taxes):	$86,312
3.	Amendment Number:	01
4.	Total Amended Value of Contract (exclusive of taxes):	$571,872

5. Budget Status:

   This contract is funded within the operation budget for this project.

6. Reasons for Amendment to Contract:

   Amendment No. 1 is to cover labour, equipment and material required for modifications to the relocated Port Moody Main 1. This includes the supply and install of a new 600 mm x 250 mm tee, along with the install of a 600 mm gate valve to allow flow into the new bypass line. This amendment value can be accommodated within the existing budget and will have no impact to the contingency.

Appendix C
No. 1

RFP No. 16-079
PURCHASE ORDER No. 620312

Construction of Annacis Island Wastewater Treatment Plant Stage 5 Phase 1 Expansion Project for the **Greater Vancouver Sewer & Drainage District**

1.	Name of Contractor:	Graham Infrastructure LP & Aecon Water Infrastructure Inc., a Joint-Venture
2.	Date Contract Reported:	**July 2017**
3.	Original Anticipated Reported Value of Contract (exclusive of taxes):	$252,658,379
4.	Amendment Number:	01
5.	Value of Amendment (exclusive of taxes):	$36,415,158
6.	Amendment Type:	Additional Services
7.	Total Revised Anticipated Amended Value of Contract (exclusive of taxes):	$289,073,537

8. Budget Status:

   This contract is funded within the capital budget for this program.

9. Amendment No. 1 is the result of numerous individual items over the four years of this construction contract. These include design changes, unexpected site conditions and risk mitigation measures to protect the Annacis Island Wastewater Treatment Plant operating environment. Over the course of construction, approximately 250 individual change orders were processed totaling approximately $14.4 million. The largest change order, CO No. 246, relates to final settlement of outstanding items with the contractor in the amount of $22, 000,000. In 2019 and 2020 the contractor submitted a number of claims for costs, disputed decisions and schedule extensions that had a value of approximately $115 million. On September 17, 2021, after more than a year of negotiations, including the participation of external experts, the contractor and the Corporation reached an agreement relating to these issues. Change order No. 246 is the culmination of those negotiations. The contract is now substantially complete and all processes are in operation. This amendment is offset by a reduction in the project contingency and remains within the overall project budget.

Appendix C
No. 2

AMENDMENT TO A PREVIOUSLY REPORTED CONTRACT

RFP No. 17-041
PURCHASE ORDER No. 144867

Consulting Engineering Services for Iona Island Wastewater Treatment Plant Biogas Piping Relocation for the **Greater Vancouver Sewerage and Drainage District**

1.	Name of Contractor:	CH2M HILL Canada Limited (Jacobs)
2.	Date Contract Reported:	**October 2017**
3.	Original Anticipated Reported Value of Contract: (exclusive of taxes):	$624,711
4.	Amendment Number:	01
5.	Value of Amendment (exclusive of taxes):	$514,066
6.	Amendment Type:	Additional Services
7.	Total Revised Anticipated Amended Value of Contract (exclusive of taxes):	$1,138,777

8. Budget Status:

   This contract is funded within the capital budget for this program.

9. Amendment No. 01 consists of nine (9) change orders over the life of the contract. Four of the change orders are related to design changes needed to meet new National Fire Protection Association standards. The remaining five change orders are related to the construction schedule delays which required the consultant to provide extra services to complete the project. The contractor on this project was required to offset a portion of these costs as credits to their construction contract. The additional consulting costs are offset by savings realized within the construction budget. There has been no negative impact to the project contingency.

Appendix C
No. 3

AMENDMENT TO A PREVIOUSLY REPORTED CONTRACT

RFP NO. 17-163
PURCHASE ORDER No. 146350

Coquitlam Intake Tower Seismic Upgrade Consulting Engineering Services
for the **Greater Vancouver Water District**

1.	Name of Contractor:	Mott MacDonald Canada Limited
2.	Date Contract Reported:	**February 2018**
3.	Original Awarded Value of Contract - Phase A:	$270,133
	Value of Awarded Amendment - Phase B:	$420,913
	Subtotal:	**$691,046**
4.	Amendment Number:	01
5.	Value of Amendment (exclusive of taxes):	$822,340
6.	Amendment Type:	Additional Services
7.	Total Revised Anticipated Amended Value of Contract (exclusive of taxes):	$1,513,386

8. Budget Status:

   This contract is funded within the capital budget for this program.

9. This amendment consists of three (3) change orders. As per the requirements and scope of the original RFP, a constructability review was conducted at the 75% design stage. Outcomes from that review resulted in the need to design a temporary electrical kiosk to be used during construction and design a new electrical kiosk to replace the existing. In addition, to mitigate risk during construction, enhancements to the abutment design were required to strengthen the tower. The additional fees associated with this amendment are accommodated within the original consulting budget for this project. There is no negative impact to the project contingency.

Appendix C
No. 4

AMENDMENT TO A PREVIOUSLY REPORTED CONTRACT

RFP No. 18-023
PURCHASE ORDER No. 147057

Consulting Engineering Services for Capilano Main No. 5 - Stanley Park Water Supply Tunnel
for the **Greater Vancouver Water District**

1.	Name of Contractor:	Mott MacDonald Canada Limited
2.	Date Contract Reported:	**July 2017**
3.	Original Awarded Value of Contract (Phase A):	$3,806,636
	Value of Board Approved Contract (Phase B):	$6,572,391
	Subtotal:	**$10,379,027**
4.	Amendment Number:	03
5.	Value of Amendment (exclusive of taxes):	$1,681,592
6.	Amendment Type:	Additional Services
7.	Total Revised Anticipated Amended Value of Contract (exclusive of taxes):	$12,060,619

8. Previous Amendment Explanations (Board Approvals reported to Performance and Audit Committee July 2018 and January 2020)

   Amendment No. 01 and 02 is the result of awarding Phase A – Preliminary Design and Phase B – Detailed Design Services.

9. Budget Status:

   This contract is funded within the capital budget for this program.

10. Amendment No. 03 is the result of change orders No. 1 to No. 5:

    - Change Order No. 1 -$115,000 (October 2018)
      - Metro Vancouver requested additional design considerations and increase in level of effort for the inclusion of a 1 in 10,000-year seismic return period analysis of the proposed tunnel piping.

- Change Order No. 2 - $130,965 (March 2019)
    - Metro Vancouver requested a change in scope for the tie-in configurations at the Chilco shaft site. The change in scope includes the following amendments:
        - Add – preliminary design of a new flowmeter and chamber for the connection to the City of Vancouver.
        - Add – study for location of flowmeters to be installed on Cap Main No. 4 (CA4), and Cap Main No. 5 (CA5).
        - Add – study of connection options for the re-chlorination facilities at the Chilco Secondary Disinfection Station.
        - Delete – 1-day Technical Review Board.

- Change Order No. 3 - $57,257 (July 2019)
    - Metro Vancouver requested a change for the design of the connection to the existing First Narrows South Shaft location. Rather than tie-into the existing valve chamber, the existing shaft cap, and valve chamber will be removed and a new valve chamber with a single valve will be installed. This would allow the new water supply tunnel to be connected directly into the South Shaft of the First Narrows crossing. The resulting system would have higher hydraulic efficiencies, superior seismic resiliency, and lower maintenance costs.

- Change Order No. 4 - $10,250 (March 2021)
    - In response to a new requirement from the City of Vancouver to obtain building permits for the two new valve chambers that will be constructed as part of the project. This change order provided for a code consultant to be engaged to provide an opinion on whether the chambers would require a permit or if there is anything in the code that would exempt the chambers.

- Change Order No. 5 - $1,368,120 (December 2021)
    - Prepared in response to (1) schedule delay costs associated with additional project management effort and (2) discrete components of extra work required to complete the design for the Project. Additional Components include:
        - Changes associated with the City of Vancouver building permit requirements (the most significant factor).
        - Detailed design of the new Chilco emergency disinfection system.
        - Changes to the detailed design required by Metro Vancouver's Operations and Maintenance teams.
        - Additional design work associated with the upgrade of the Pipeline Rd roundabout required by the Vancouver Board of Parks and Recreation.
        - Design of the temporary overland bypass water supply for Stanley Park.

Appendix C
No. 5

AMENDMENT TO A PREVIOUSLY REPORTED CONTRACT

RFP No. 18-043
PURCHASE ORDER No. 608136

Consulting Engineering Services for Iona Island Wastewater Treatment Plant Project Definition for the **Greater Vancouver Sewerage and Drainage District**

1.	Name of Contractor:	AECOM Canada Ltd.
2.	Date Contract Reported:	**October 2018**
3.	Original Reported Value of Contract:	$4,538,081
	Value of previous Amendment No. 01:	$599,625
	Value of previous Amendment No. 02:	$4,720,696
	Subtotal:	**$9,858,402**
4.	Amendment Number:	03
5.	Value of Amendment (exclusive of taxes):	$1,780,344
6.	Amendment Type:	Additional Services
7.	Total Revised Anticipated Amended Value of Contract (exclusive of taxes):	$11,638,746

8. Previous Amendment Explanation (Reported to Performance and Audit Committee January 2021 – Amendment No. 01 and October 2021 – Amendment No. 02)

   Amendment No. 01 is the result of a technical investigation of aerobic granular sludge (AGS) technology, additional modeling to characterize the site and assist in the geotechnical design, condition assessments of the existing facility to determine suitability and costs of reusing assets, development of additional design concepts to integrate existing and new facility, and an analysis of solids treatment options and operational impacts. In addition, as a result of these scope additions, design and support activities were required to modify and enhance process and mechanical design, construction sequencing, project schedule, cost estimates.

   Amendment No. 02 is the result of change orders 9 to 16 - Change order 9 accounted for additional work required to prepare a regulatory and permitting roadmap and a detailed permitting strategy for the project. Change order 10 accounted for additional work related to air dispersion modelling for the project. Change order 11 accounted for additional work related to incorporate anaerobic digesters into project definition report for the project. Change order

12 accounted for additional work related to the completion of indicative design concepts for the project. Change order 13 accounted for additional work related to the completion of a class 3 capital cost estimate for the project. Change order 14 accounted for additional work related to the completion of indicative design concepts for the project. Change order 15 accounted for additional work related to the completion of construction sequencing and phasing for the project. Change order 16 accounted for additional work required to support transition assignments that were identified as critical path tasks to continue the advancement of the IIWWTP upgrade project.

9. Budget Status:

   This contract is funded within the capital budget for this program.

10. Amendment No. 03 consists of two (2) change orders. The largest being change order No. 19 in the amount of $1,321,712. This change order related to additional scope to provide engineering services during the pilot testing period of the secondary treatment technology under consideration. This scope will include design of the pilot test and oversight of the first year of pilot testing. Change order No. 18, in the amount of $458,632 relates to additional efforts to support the overall permitting strategy. This includes the application of permits for major utilities, ground improvements, wharf construction, the Ferguson Rd. realignment and City of Richmond Development Permit. This amendment will be captured in the consulting services allocation of the budget and will have no impact to the contingency.

Appendix C
No. 6

AMENDMENT TO A PREVIOUSLY REPORTED CONTRACT

RFP No. 18-189
PURCHASE ORDER No. 611983

Project Management and Technical Services for Northwest Langley Wastewater Treatment Plant Projects for the **Greater Vancouver Sewerage and Drainage District**

1.	Name of Contractor:	WSP
2.	Date Contract Reported:	**January 2019**
3.	Original Anticipated Reported Value of Contract (exclusive of taxes):	$4,890,502
4.	Amendment Number:	01
5.	Value of Amendment (exclusive of taxes):	$2,657,000
6.	Amendment Type:	Additional Services
7.	Total Revised Anticipated Amended Value of Contract (exclusive of taxes):	$7,547,502

8. Budget Status:

   This contract is funded within the capital budget for this program.

9. Amendment No. 01 is the result of the additional program management and technical services needed to improve the program management functions as well as to complete a design peer review of the current Wastewater Treatment Plant (WWTP) design to bring the WWTP costs in line with benchmarks and identify substantial cost savings. It is to cover program management services additional costs from January to June 30, 2022. This amendment is offset by a reduction in the contingency budgeted for this project.

Appendix D
March 18, 2021

Competitive Selection Packages Anticipated to be greater than $500,000
(Issued but not awarded)

Note: All contracts listed below are within the project budgets approved by the Board of Directors

Tender/RFP	Closing Date
RFP No. 21-125 *Employee and Family Assistance Program – Metro Vancouver*	April 21, 2021
RFP No. 21-010 *Pre-Selection of Polymer Equipment for the Northwest Langley Wastewater Treatment Plant Upgrade* **(Cancelled)**	July 5, 2021
RFP No. 21-014 *Pre-Selection of Low Pressure Gas Holder and Pressurisation Blowers for the Northwest Langley Wastewater Treatment Plant Upgrade* **(Cancelled)**	September 16, 2021
RFP No. 21-006 *Pre-Selection of Rotary Drum Thickening Equipment for the Northwest Langley Wastewater Treatment Plant Upgrade* **(Cancelled)**	September 9, 2021
RFP No. 21-240 *Provision of Light and Medium Duty Lease Vehicles* **(Awarded less than $500K)**	October 8, 2021
RFP No. 21-353 *Record Centre Services* **(Cancelled)**	November 26, 2021
RFP No. 20-192 *Consulting Engineering Services for the Rechlorination Stations Upgrade (Cape Horn, Pitt River, Clayton)*	November 23, 2021
RFP No. 21-144 *Environmental Engineering Services Related to Remediation And Risk Assessment For Iona Island Wastewater Treatment Plant Upgrade Project*	November 19, 2021

RFP No. 21-272 November 18, 2021
Scour Protection Design and Construction Services for Maple Ridge Forcemain, North Surrey Interceptor, and Annacis Main No. 3
(Awarded less than $500K)

Tender No. 21-268 November 17, 2021
LSG Tank Inspection and Membrane Replacement at Annacis Island and Lulu Island WWTP

RFP No. 21-276 November 12, 2021
Consulting Engineering Services for Annacis Island Wastewater Treatment Plant (AIWWTP) Electrical Studies and Upgrade

RFP No. 21-460 December 21, 2021
Architect and Design Services for Affordable Housing Project - Malaspina Village Phases I & II

RFP No. 22-001 December 14, 2021
High Speed Wide Area Network (WAN) - Network Services

RFP No. 21-266 January 28, 2022
Supply and Delivery of Light and Medium Duty Vehicles

RFP No. 21-283 January 26, 2022
Program Management Consulting (PMC) Services for the Iona Island Wastewater Treatment Plant Projects

RFP No. 21-146 January 21, 2022
Geotechnical Exploration Services for the Iona Island Wastewater Treatment Plant Projects

RFP No. 21-459 February 25, 2022
Sludge Hauling Services for Northwest Langley Wastewater Treatment Plant

RFP No. 21-468 February 25, 2022
Newton Pump Station No. 2 – Reservoir Tunnelling & Outlets

RFP No. 22-003 February 17, 2022
Preliminary Design, Detailed Design and Construction Engineering Services North Surrey Interceptor No. 2 Tunnel

RFQ No. 21-498 February 17, 2022
Conceptual Design of the Haney Water Supply Tunnel – Pitt River Crossing

RFP No. 21-517 February 16, 2022
Operation and Maintenance of The Central Surrey Recycling and Waste Centre

RFP No. 21-519 February 15, 2022
Innovative Organics Processing

RFP No. 22-015 February 14, 2022
Supply and Delivery of Sodium Hypochlorite

Tender No. 21-001 February 2, 2022
Construction - Fleetwood Reservoir Phase 1

RFP No. 22-006 March 31, 2022
Construction of Gilbert Trunk Sewer No. 2 Gilbert Road South Section

RFP No. 21-485 March 31, 2022
Westburnco Pump Station No.2 Variable Frequency Drive (VFD) Replacement Project - Pre-Purchase VFD Equipment

RFP No. 21-425 March 22, 2022
Ground Improvements and Preload Engineering Services for the Iona Island Wastewater Treatment Plant (IIWWTP) Upgrades Program

RFP No. 22-048 March 18, 2022
Training Management System for Safety, Security & Emergency Management Training

RFP No. 22-039 March 11, 2022
Film Site Supervision Services

RFP No. 22-002 March 2, 2022
Delivery of School Programs for Metro Vancouver's Watershed Education Program

RFP No. 22-079 April 20, 2022
Consulting Engineering Services for Cleveland Dam Public Warning System

RFP No. 21-492 April 7, 2022
Kennedy Newton Main - Kennedy Reservoir to 84th Avenue

metrovancouver
SERVICES AND SOLUTIONS FOR A LIVABLE REGION

To: Invest Vancouver Management Board

From: Chris Heine, Vice President, Strategic Investment

Date: March 24, 2022 Meeting Date: April 20, 2022

Subject: **Investment Attraction and Lead Generation Report**

RECOMMENDATION

That the Invest Vancouver Management Board receive for information the report dated March 24, 2022 titled "Investment Attraction and Lead Generation Report."

EXECUTIVE SUMMARY

Since the launch of Invest Vancouver, the Strategic Investment function has made good progress to identifying qualified investment lead opportunities within the region. In support of this activity, Invest Vancouver, together with the Invest Vancouver Advisory Committee (IVAC), has also implemented a set of *Strategic Investment Guiding Principles.* The Guiding Principles serve as universally acknowledged compact "playbook" of engagement between Invest Vancouver, its integrated functions, and member jurisdiction partners. The progress to date is the result of collaboration with other investment attraction and promotion partner organizations, awareness building of Invest Vancouver as a regional economic development leadership service, and partner referrals. Feeding a growing deal pipeline is a key part of delivering a transparent and equitable service for member jurisdictions and supporting a level playing field across the region though comprehensive, end-to-end pursuit of strategic investment leads. Going forward, the integrated work undertaken by Invest Vancouver's three functional areas—Data Research & Policy, Collaboration, and Strategic Investment—guided by our 2022 Annual Plan's goals and objectives, will position Invest Vancouver to further undertake proactive lead generation activities on behalf of the region and build new capacity to serve qualified inbound opportunities.

PURPOSE

The purpose of this report is to provide the Invest Vancouver Management Board an overview of Invest Vancouver's Strategic Investment function activities, particularly lead generation and pipeline development from September 2021 to the period ending March 31, 2022.

BACKGROUND

Since the brand launch in 2021, Invest Vancouver has established itself as the regional "front door" to international business investor opportunities in our region. Invest Vancouver is actively servicing strategic investment prospects at various stages throughout the region and was established to offer valuable regional insights, provide meaningful local connections, navigate obstacles, and ultimately support informed investment decision making to advance economic growth and shared economic prosperity for the Metro Vancouver region and the member jurisdiction.

Invest Vancouver has also been working collaboratively with other investment attraction and promotion partners including economic sector government partners at the federal and provincial

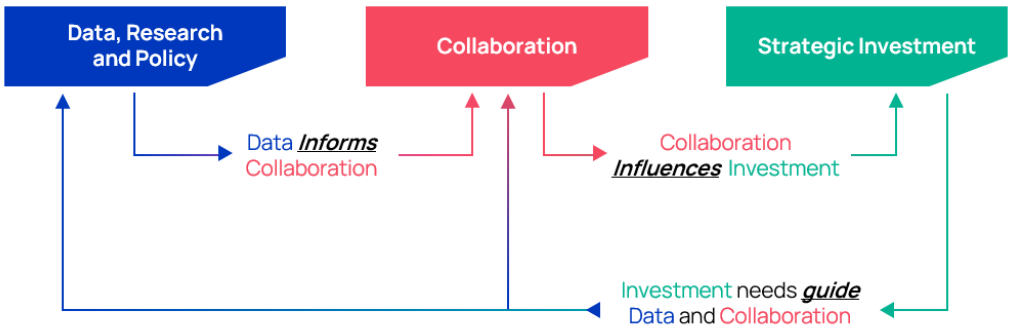
levels. This has resulted in increased awareness and recognition of Invest Vancouver's presence, profile and function in the region, thereby increasing the number of prospect referrals for which Invest Vancouver is able to provide value-added support on behalf of the member jurisdictions.

Strategic Investment Function and Role within Invest Vancouver

The November 2019 *Regional Economic Prosperity Service Business Plan*[1], approved by the Metro Vancouver Regional District board in 2019 identified attracting strategic investment collectively for the benefit of the entire region as a major gap. The Business Plan states:

> *Addressing this gap would require a single point of contact, working under a regional brand with global resonance, to serve as the key point of contact for incoming investors while working closely with stakeholders across the region to identify priorities in attracting new investment, and compiling the data and analysis required to do so.*

Given the priorities identified in the Business Plan and in order to address this regional gap, the Invest Vancouver structure was established in 2021 based on three integrated functional areas outlined in the original plan:



Additionally, in October 2021, Invest Vancouver, together with the Invest Vancouver Advisory Committee (IVAC), implemented a set of *Strategic Investment Guiding Principles.* The Guiding Principles serve as a universally acknowledged compact "playbook" of engagement between Invest Vancouver, its integrated functions, and member jurisdiction partners.

2022 Annual Plan Objectives to Attract and Retain Investment

Invest Vancouver is dedicated to a service aligned with four priorities in order to support economic growth and shared prosperity for the region:

1) Investing in our people
2) Catalyzing innovation capabilities
3) Building capacity in our key industries
4) Increasing global connectedness

[1] https://investvancouver.ca/Documents/REPS_Business_Plan.pdf

Underpinning the strategic priorities of *Building Capacity in our Key Industries* and *Increasing our Global Connectedness*, and of the nine goals identified in the 2022 Annual Plan, Invest Vancouver has outlined the following objectives in 2022 to deliver on the goal of attracting and retaining business investment in the Metro Vancouver region:

1) Generate qualified investment leads and provide member jurisdictions with end-to-end management of investment prospects
2) Promote Invest Vancouver's unique role and strategic investment mandate to foreign direct investment promotion partners in international markets
3) Activate targeted international investment attraction and outreach plans to identify unique prospects, cultivate account relationships, and generate leads
4) Complete and release "Doing Business in Metro Vancouver Guide"*
5) Develop sector-specific strategies for key industry clusters*
6) Build Pacific Northwest cross-border business development strategy*

* to be funded in part by CanExport Community Investments program through Global Affairs Canada

Investment Pipeline Results and Trends – Q4 2021, Q1 2022

Since the launch of Invest Vancouver in September 2021 to the period ending March 31, 2022, Invest Vancouver has received dozens of lead opportunities. The collaborative work of Invest Vancouver with its partners as noted above and the awareness and profile which has been built is paying dividends. Invest Vancouver has been receiving leads though a variety of channels including provincial and federal partners, peer organizations within Canada, member jurisdictions, as well as direct inquiries. To the period ending March 31, Invest Vancouver's Strategic Investment function has served, or continues to serve, thirty qualified investment projects. All of Invest Vancouver's seven key industry clusters (apart from apparel)—industries for which the region has unique specializations and competitive advantages—are represented:

Invest Vancouver Key Industry Cluster	Number of Qualified Leads Identified
Agritech	3
Digital Media & Entertainment	5
Green Economy	9
High-Tech	7
Life Sciences	2
Trade & Transportation	3

The number of qualified leads identified within the periods ending Q4 2021 and Q1 2022 are split evenly at fifteen per quarter.

The attachment to this report provides a breakdown of leads by sector and market origin.

Next Steps

As with any business development initiative, lead generation takes time to return maximum value. True conversion to outcomes in the form of investment decisions may take a year or more. It also takes time and resources to ensure quality leads and apportion the appropriate resources. Currently, Invest Vancouver's Strategic Investment function is focused on incoming referrals and direct client inquiries. The need to vet or qualify leads requires significant time to triage inquiries or referrals, to ascertain information, and determine lead quality. Discretionary judgment is required at times as to where effort is most effectively spent with limited resources.

As Invest Vancouver matures and increases capacity across its three integrated functional areas, the service must consider how best to tactically activate strategic investment lead generation in a proactive manner among target markets and identify the best target accounts. In-depth market and sector strategies backed by robust data analytics and business intelligence, and well-developed international marketing tools and assets are all keys to success. A thoughtful and well executed investment attraction strategy and tactics will also maximize the return on investment with respect to the allocation of resources, focusing efforts on prospects which have a markedly higher potentially of yielding outcomes supporting economic growth and shared prosperity for the region.

FINANCIAL IMPLICATIONS

Although there are no financial implications directly related to this report, as the volume and quality of leads handled by Invest Vancouver grows over time, additional staffing resources will be required to service client demands and support expansion and retention of existing investment projects.

CONCLUSION

Thus far, Invest Vancouver has been on the intake of fifteen qualified leads per quarter on average and has been on target vis-à-vis alignment with its seven key industry clusters. As awareness and recognition of Invest Vancouver's presence continue to build, particularly overseas, it is reasonable to expect this rate of intake will increase. Coupled with Invest Vancouver's continued activation on its 2022 Annual Plan, a repository of investor-facing tools and assets to be developed over time will enhance supportive resources available to prospects and lead generation partners, will likely enhance the quality of opportunities, and will better position Invest Vancouver to take an increasingly proactive approach to lead generation.

Attachments

1. Strategic Investment Pipeline Highlights

50649803

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Strategic Investment Pipeline Highlights

Cumulative Summary of Qualified Opportunities Identified – Launch of Invest Vancouver (September 2021) to March 31, 2022

Agritech

- Europe – Integrated agrifoods packaging solutions
- Europe – Beverage formulation, production and distribution
- India – Oil and botanical extraction

Digital Media & Entertainment

- Canada – Virtual production technology and services
- USA – Film and television production facility
- USA – Mobile app development
- USA – Digital games development studio
- USA – Animation studio

Green Economy

- Canada – Architecture and green building engineering
- Canada – Lithium processing/recycling
- East Asia – Hydrogen fuel cell systems R&D
- Europe – Hydrogen fuel cell systems R&D
- Europe – Hydrogen fuel cell systems R&D
- Europe – Green energy trading
- USA – Hydrogen liquefaction and distribution
- USA – Hydrogen hydrolysis and distribution
- USA – EV service and repair facility

High-Tech

- East Asia – Robotics engineering and design
- East Asia – ICT/wireless R&D
- East Asia – Software development
- Europe – Education tech mobile platform development
- USA – AI/machine vision software development
- USA – AI algorithms/machine learning R&D
- USA – Public infrastructure and amenity supporting software

Life Sciences

- Europe – Bio-manufacturing
- Europe – Pharmaceutical formulation and production

Trade & Transportation

- Europe – Third-party logistics provider to shipbuilding industry
- Europe – E-commerce and shipping solutions provider
- Europe – Urban delivery platform
- USA – Zero emissions last-mile delivery solutions

Apparel

- None

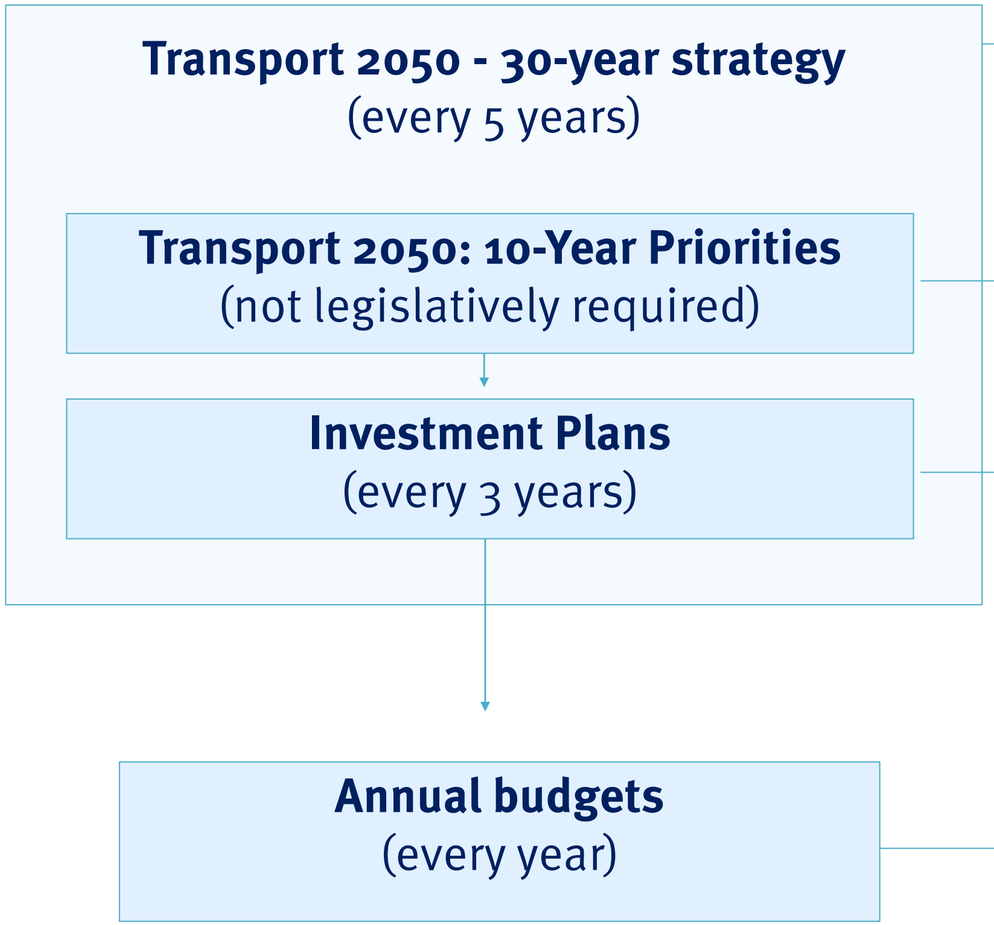
TransLink's 2022 Investment Plan

Metro Vancouver Finance Committee

TransLink Delegation
Sarah Ross, VP, Transportation Planning and Policy
Olga Kuznetsova, VP, Financial Services
April 21, 2022

Overview

TransLink's strategic planning framework



- Establishes goals, policies, and priorities for the regional transportation system
- Must consider regional and provincial objectives
- **Approved by TransLink Board and Mayors' Council**

- Prioritizes investments in the 30-year strategy for future funding in a 10-year investment plan
- **Approved by Mayors' Council and TransLink Board**

- Allocates new and existing funding to projects and programs
- Must be fully funded, over ten years, by identified secure revenue source(s)
- Must be guided by 30-year transportation strategy
- **Approved by TransLink Board and Mayors' Council**

- Authorizes actual operational and capital spending
- Must be consistent with 10-year investment plan
- **Approved by TransLink Board**

Two Plans Under Public Consultation

2022 Investment Plan

- Required by statute
- Consultation with MV required
- Must be fully funded over ten years
- Largely maintaining status quo

Transport 2050: 10 Year Priorities

- Not required by statute
- Sets ambitious priorities for next decade
- Will require overhaul in how transportation funded – no funding solutions identified

Investments and Funding

2022 Funding Stabilization Plan

- TransLink has bold ambition for the future (T2050, 10Y Priorities), but the financial footing need to be stabilized first
- Recognizing the uncertainties, we are taking a conservative approach to new revenues to limit the burden on the public
- We will continue to monitor ridership, study new funding sources, and review additional revenue needs prior to the next Investment Plan

Investments in the Plan

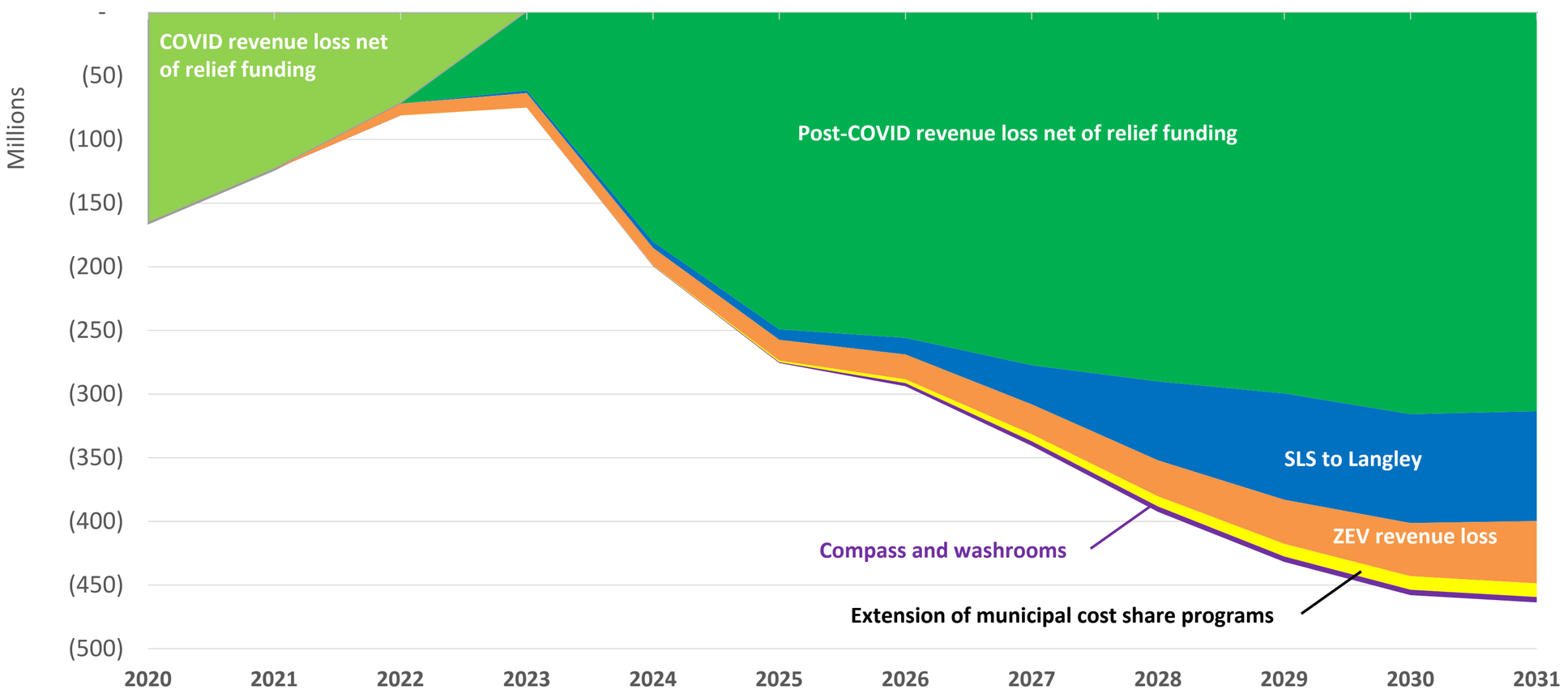
- **Local Transit** - Bus, SeaBus, and HandyDART
- **Bus Priority** – Enhanced bus speed and reliability
- **Technology investments and passenger facilities** - Compass, Washrooms
- **Reliable and Fast Transit** – Surrey-Langley SkyTrain, Rail, RapidBus, Major projects business casing
- **Safe Roads and People First Streets** – Roads, Walking and Cycling Investments
- **Infrastructure Resilience -** State of Good Repair, Low Carbon Fleet Strategy, Operations and Maintenance Centre (OMC5)

Funding the Investment Plan

- Given the uncertainty, taking a conservative approach to limit affordability impacts on public – any remaining funding gap can be filled in next Investment Plan
- For this Investment Plan, we'll raise an additional average $52 million annually through:
  - $23M from carbon credits, commercial revenue, and real estate development distributions
  - $29M in property tax – this translates to approximately $3 per residential property in 2023
- Transit fare increases are 2.3% through 2024, and 2% from 2025-2031
  - These increases are lower than previously planned. For example, fare rates previously anticipated for 2023 will not be reached until 2026 or 2027
  - Continues to offer free transit for children 12 and under, with support from the Province
- Continue to monitor ridership and revenue and work with the Province to develop a sustainable funding strategy prior to the next Investment Plan

Financial Impacts

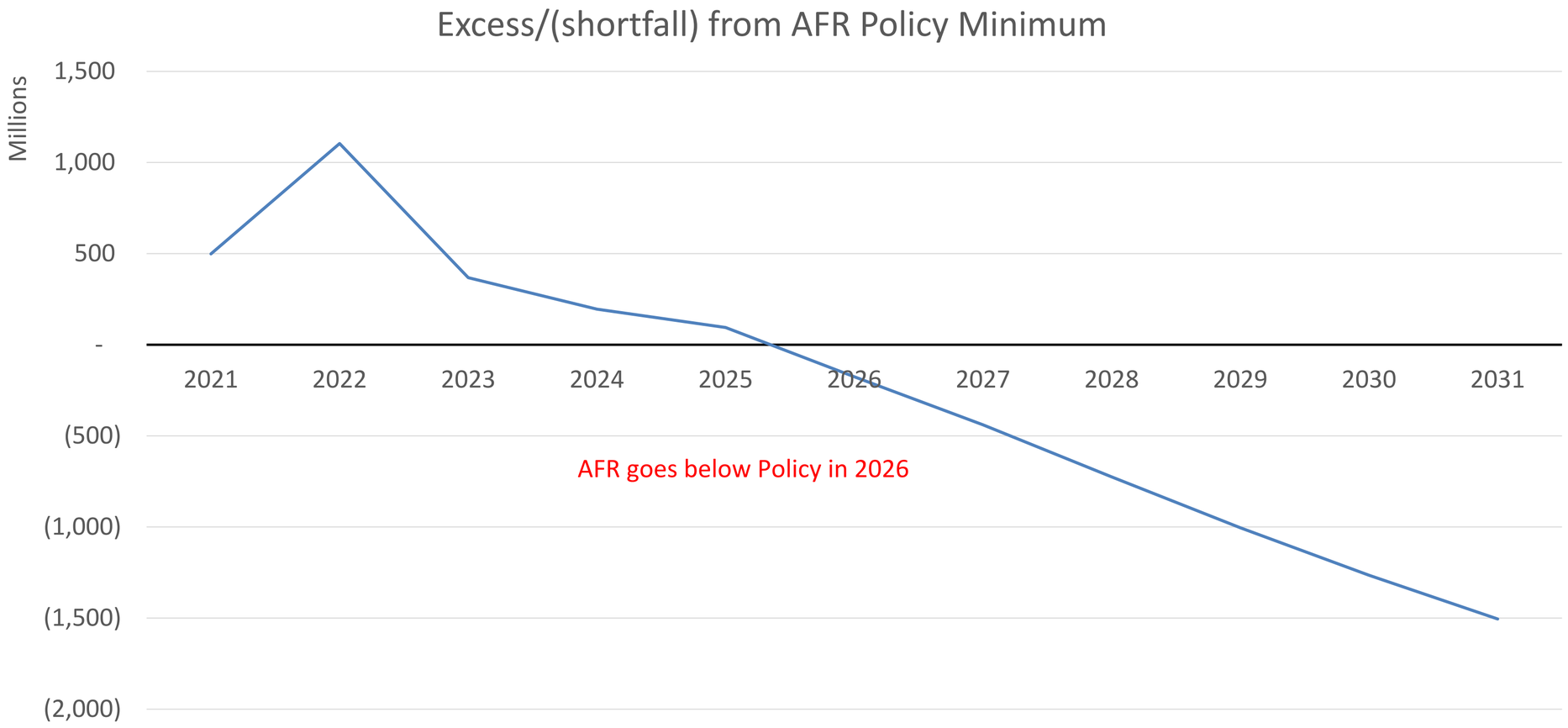
Items that contribute to TransLink's gap



	Average Annual Impact $M
COVID revenue loss*	120
Post-COVID revenue loss**	250
SLS	38
ZEV	25
Municipal cost share programs	5
Compass and washrooms	2

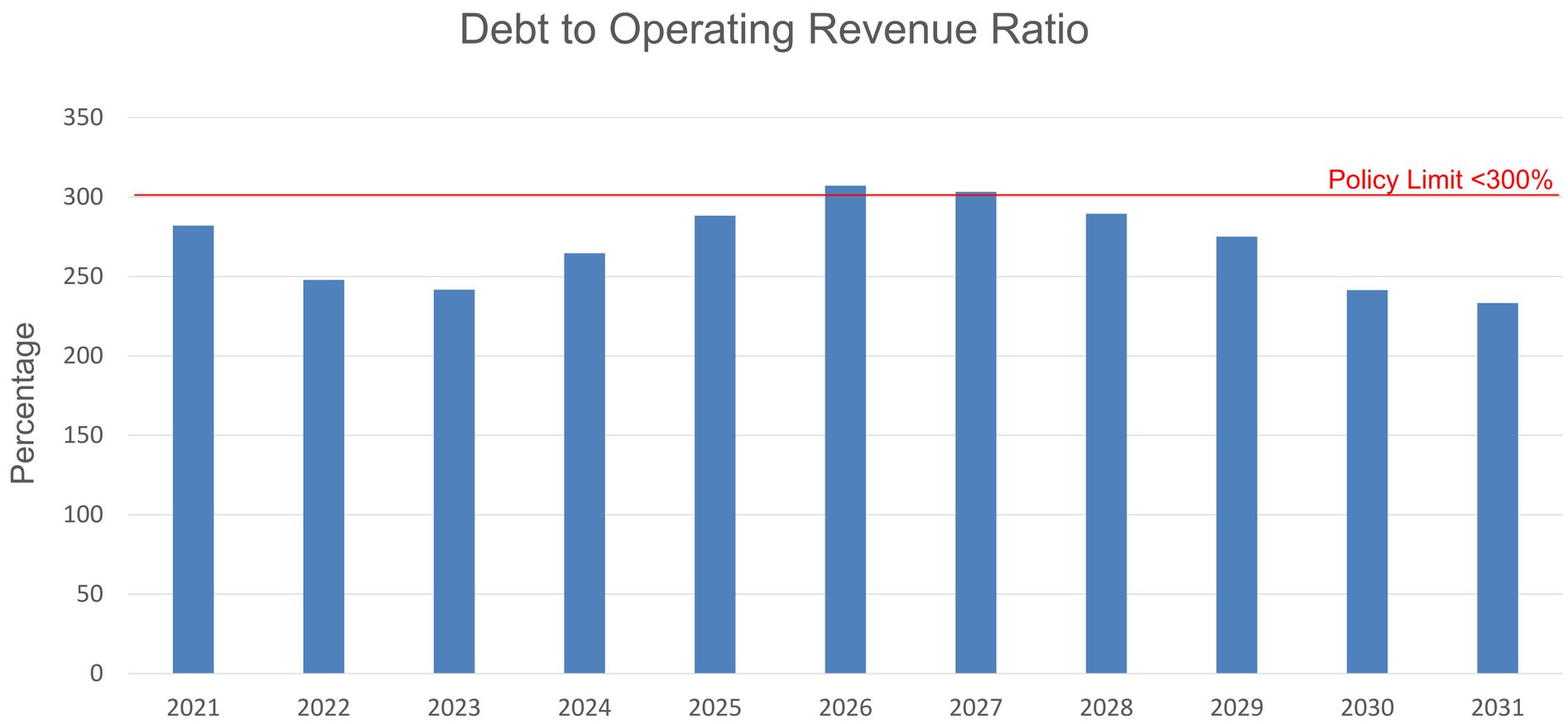
* Average 2020-22, net of relief funding
** Average 2023-31, net of relief funding

Accumulated Funding Resources



Note: based on mid-case ridership scenario

Debt to Revenue Ratio



Note: based on Mid-case ridership scenario; Exceeds policy in 2026 and 2027

What is the Debt to Revenue Ratio?

- The debt to revenue ratio reflects the amount of operating revenue available to support the level of net debt in a given year
- The ratio increasing above 300% indicates that TransLink is taking on more debt to support the capital program, without a proportionate increase in operating revenue sufficient to support that debt
- To address the pressure on the debt to revenue ratio, TransLink will:
  - Work with the Province and the Mayors' Council to identify additional / new sustainable revenue sources
  - Continue to prudently manage, prioritize and scrutinize capital program, ensuring that it is affordable
  - TransLink expects to address the pressures in the next Investment Plan

Debt limit

- The investment plan will require an increase in the borrowing limit from $5.5 billion to $6.8 billion

millions	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
	Actual	Forecast >>									
Established Borrowing Limit (Gross Direct Debt)	5,500	6,800	6,800	6,800	6,800	6,800	6,800	6,800	6,800	6,800	6,800
TransLink Gross Direct Debt	3,556	3,774	4,071	4,778	5,480	6,036	6,400	6,609	6,702	6,546	6,647
TransLink Net Debt (including other financing)	3,913	4,030	4,123	4,676	5,265	5,842	6,231	6,246	6,185	5,914	5,696

Note: based on mid-case ridership scenario

Capital Program and Funding Sources

Key Focus of the Capital Program

Surrey Langley Skytrain Project

- Main SLS project and enabling projects such as OMC 5 and Compass System Upgrades

State of Good Repair

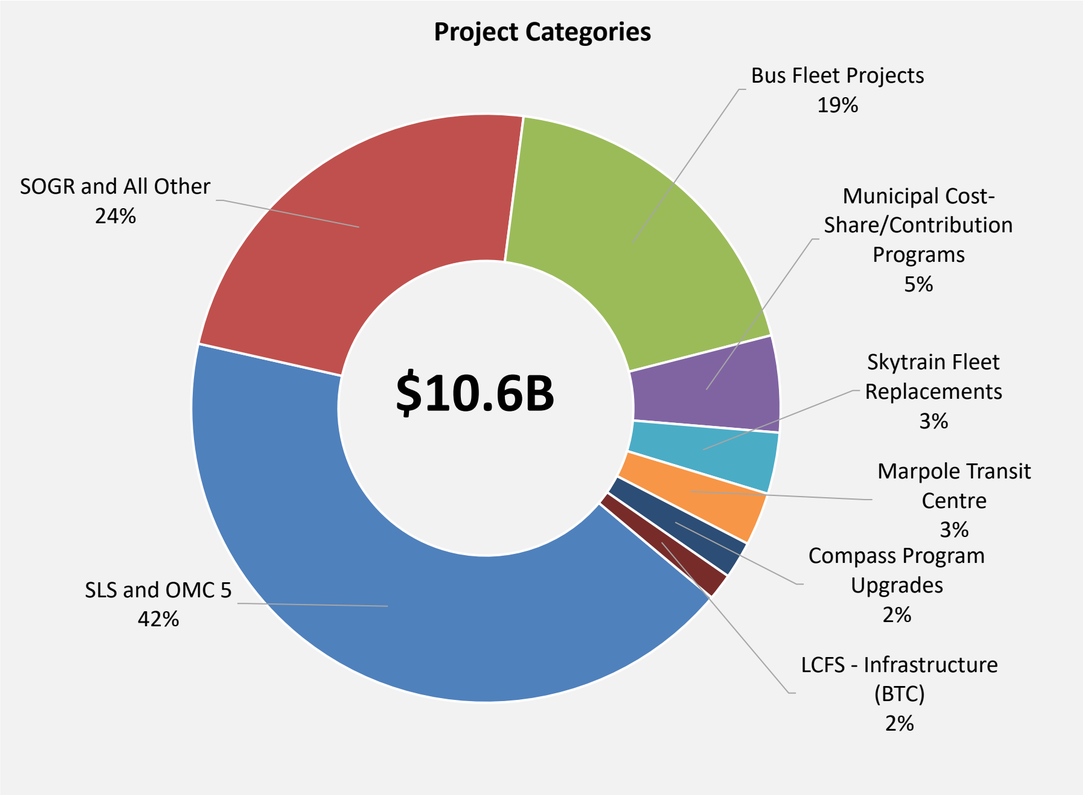
- To ensure service reliability and safety

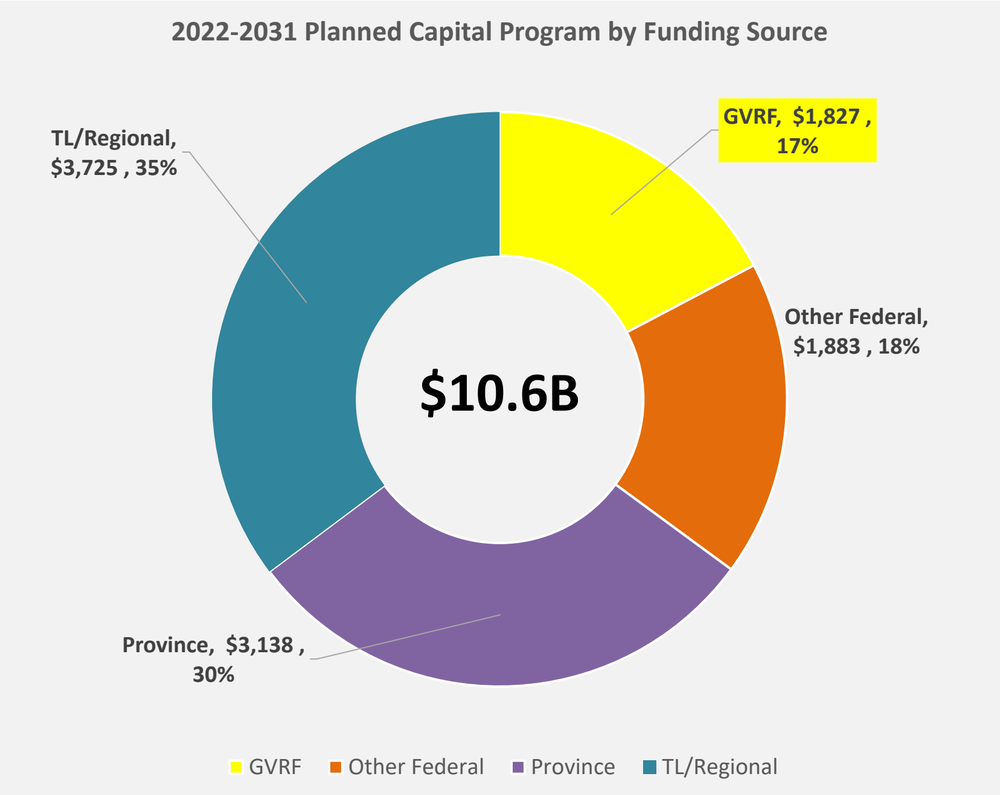
Advance the Low Carbon Fleet Strategy

- Continued investment in making the transit fleet carbon neutral and achieve GHG reduction goals

2022-2031 Capital Program - New Planned Projects

Investment Categories and Funding Sources

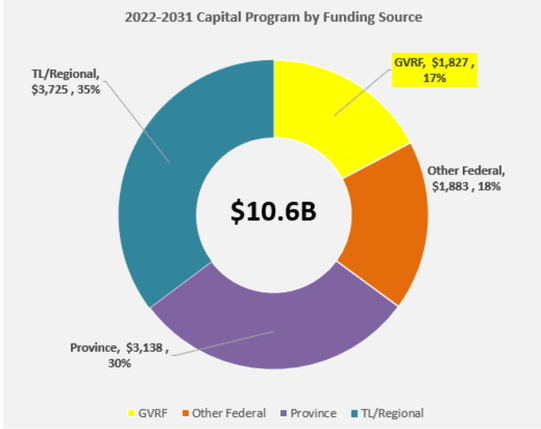


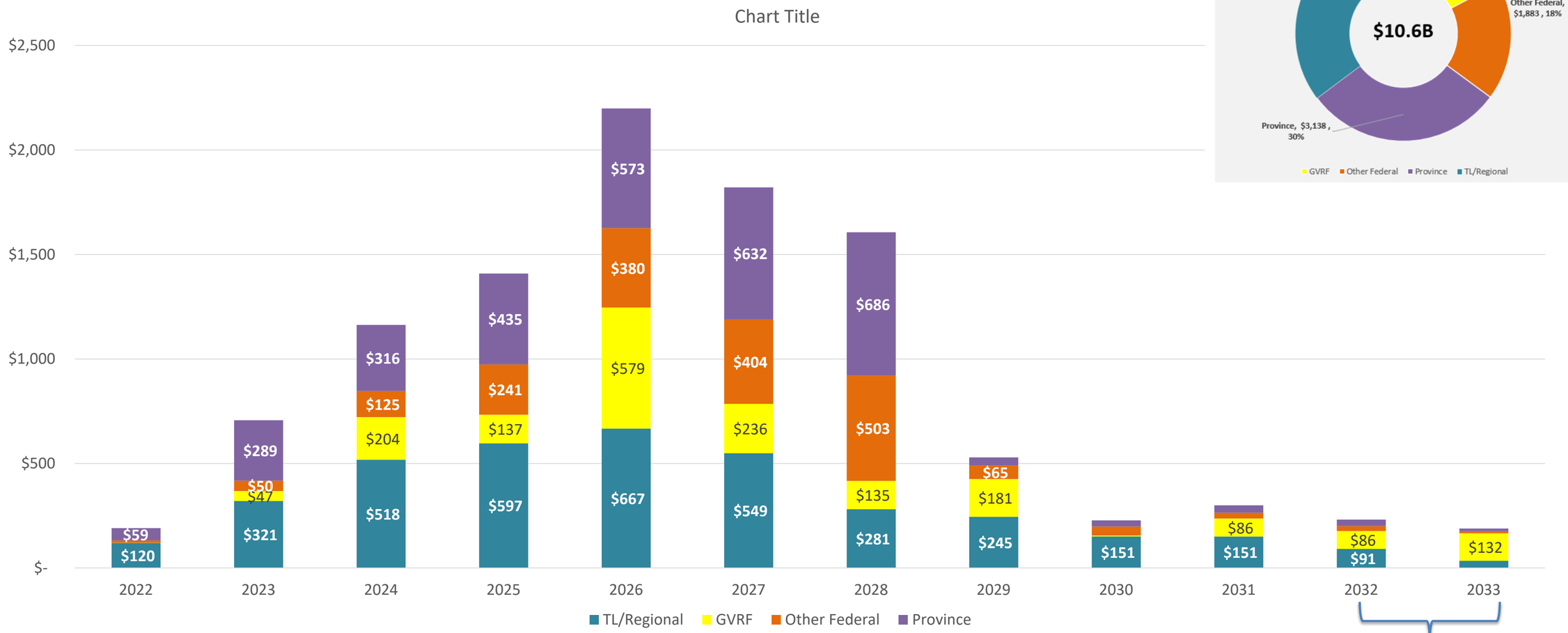


Note 1: Includes $358M already approved for program year 2022. 2023-2031 utilization of GVRF is $1.5B

Capital Program Cash Flow for Planned Projects

By Funding Source

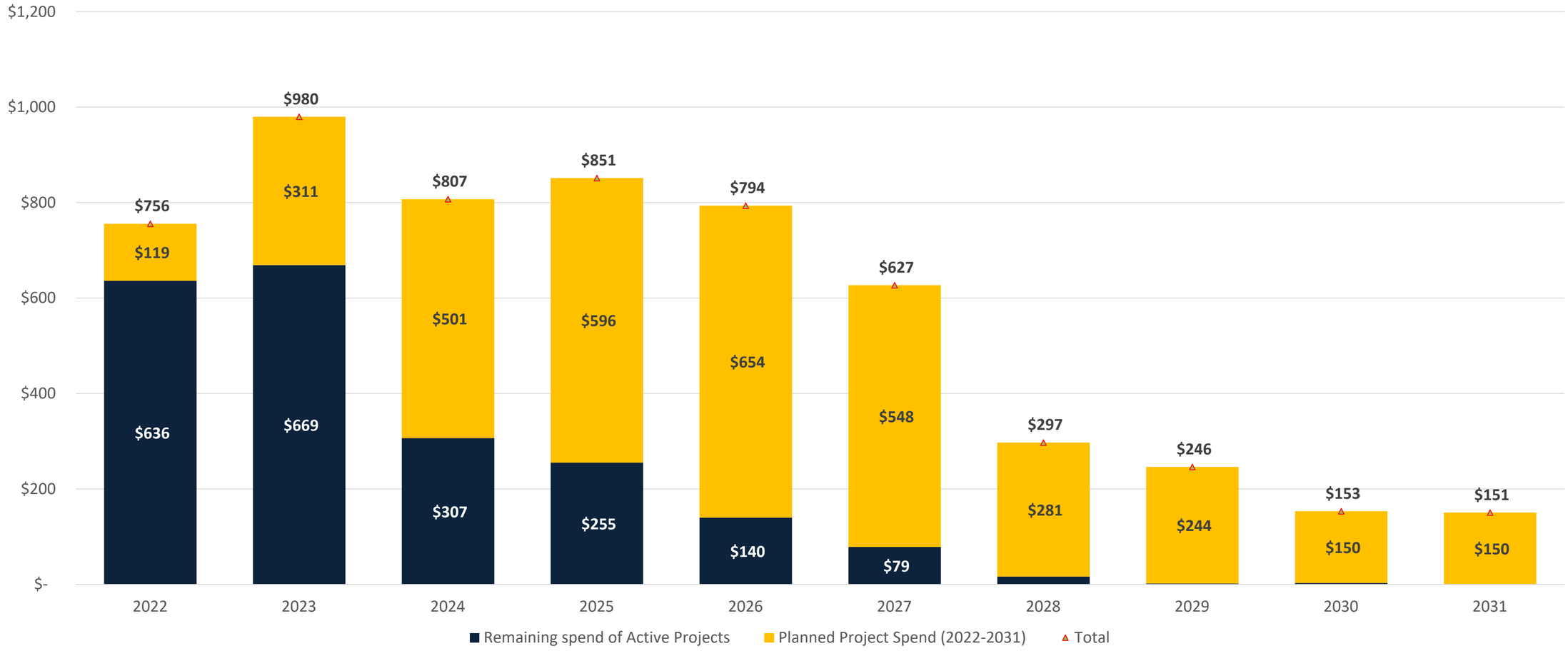




Projects initiated in 2031 have cash flows that extend out to 2032 and 2033

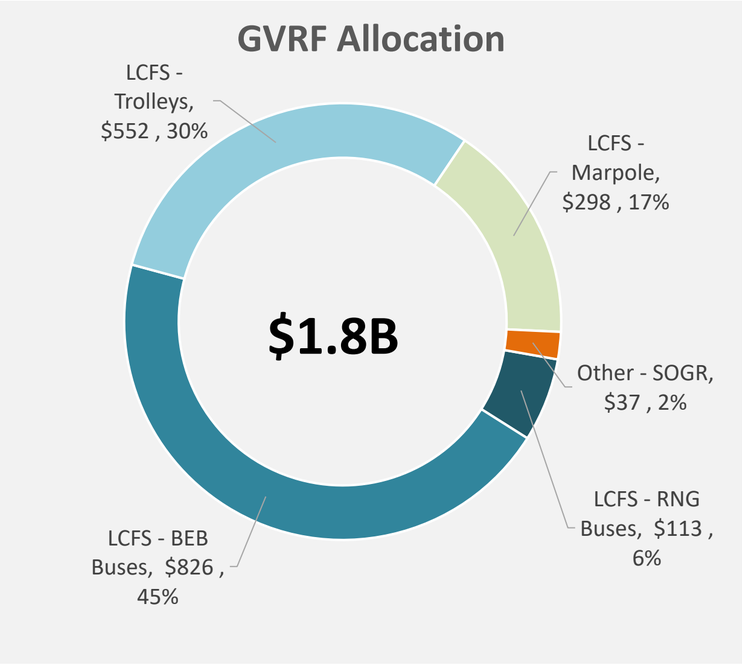
Capital Program Cash Flow 2022-2031

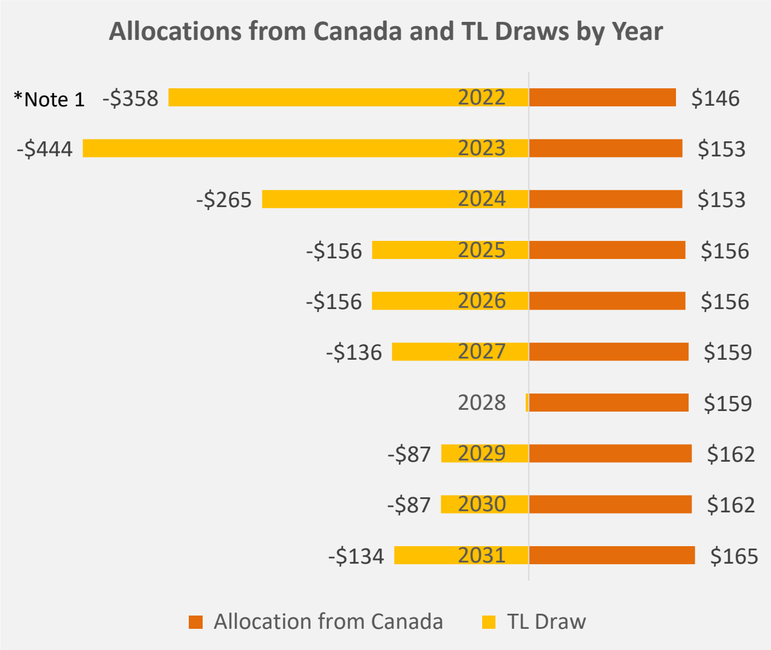
Active + Planned (Net of Funding $M)

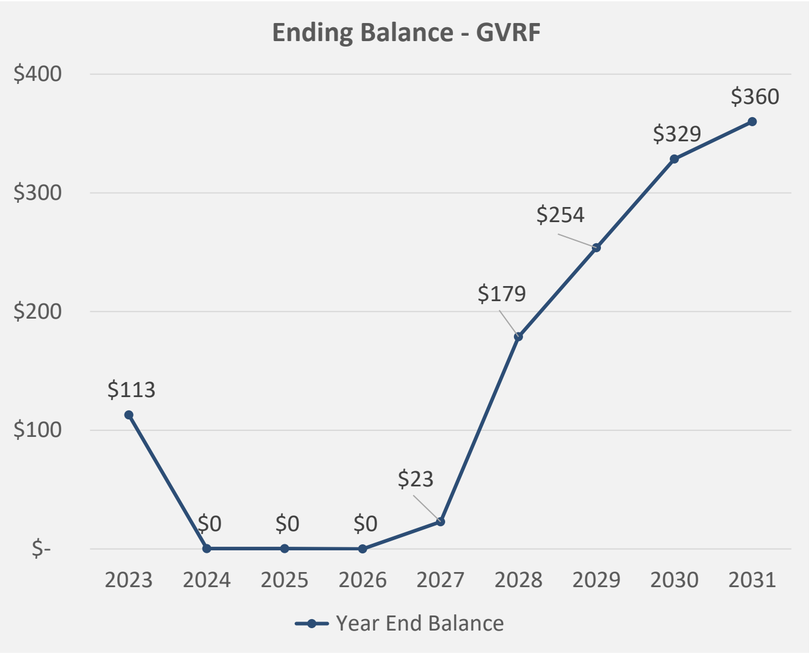


Greater Vancouver Regional Fund - Funding Utilization

- GVRF utilization for the 2022 Investment Plan focuses on advancing LCFS and reducing the GHG footprint of TransLink and the MV region
- TransLink will continue to look for opportunities to maximize other new funding sources (such as ZETF)
- $360M remaining at the end of 2031 expected to be fully utilized by 2034 for 2032-34 fleet replacements







*Note 1: Already approved in Q1 2022

Questions?

Resources

Principles Guiding Development of the Plan Bus Service Levels

- Maintain the usability of the network by:
  - Maintaining frequency on routes that run every 15 minutes or less; and
  - Maintaining morning and evening span on all routes
- Minimize overcrowding on the transit network
- Deliver urgent, deferred planned transit service improvements
- Fund transit service improvements by reallocating service from frequent routes with sufficient capacity and where there are alternate routes in the corridor

2022 Plan – Proposed Scope

Investment Area	What's included in this Plan
Bus	• Maintain the 4% reduction in service hours on existing bus routes • Reallocation of service to advance higher-urgency Phase Two projects beginning in 2022 (TBC based on ridership return; should ridership increase further than projected, some of these would be deferred to prioritize minimize overcrowding):
SeaBus	• Continuation of 10-minute peak service
HandyDART	• 3% increase in HandyDART service over pre-COVID levels in 2023
SkyTrain and West Coast Express	• Maintain pre-COVID service levels on Expo-Millennium Line and Canada Line through 2024 • Increase in service on Millennium Line with the opening of Broadway Subway in 2025, and on the Expo Line with the opening of Surrey Langley SkyTrain in 2028 • Re-introduce a 5th round trip for West Coast Express in 2023
Roads, Walking, Cycling Programs	• $19 million from 2022-2024 for Walking infrastructure to Transit (WITT) • $51 million from 2022-2024 Bicycle Infrastructure Capital Cost Sharing (BICCS) • $76 million from 2022-2024 for Major Road Network and Bike (MRNB) • $290 million from 2022-2031 for MRN pavement rehabilitation • $40 million annually for MRN OMR program, which is allocated annually to municipalities based on lane kilometres • $50 million from 2022-2024 for MRN structures program
Transit Priority Programs	• $18 million for enhanced Bus Speed and Reliability program • Continues existing funding for RapidBus Upgrades program • Planning and infrastructure for the R7 RapidBus
Capital	• State of good repair and other priority projects, including: SkyTrain fleet upgrades, cybersecurity, bus replacements including low carbon fleet, Customer Washrooms, Compass Upgrades

Note: In year of expenditure dollars

Property Tax – impact by year on average residential property of additional 1.15% annual increase

- Average TransLink portion of the tax bill in 2022: $300
- Average total property tax bill in 2022: ~$4,000

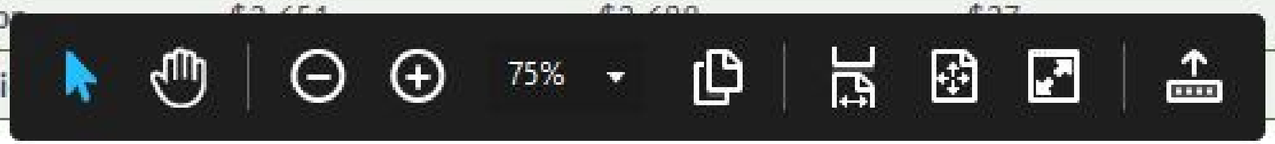
		2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	10-Year Total Impact	Average Annual Impact
Increase escalator by 1.15% - $29M average 4.15% annual growth beginning in 2023	**Revenue** (million)	$0M	$5M	$10M	$17M	$23M	$30M	$38M	$47M	$56M	$67M	**$294M**	**$29M**
	Household impact (per year)	$0	$3	$6	$10	$14	$18	$22	$26	$30	$34	**$163**	**$18**

Note: impacts shown are on a 1.15M residential property

Property Tax – Impacts by assessed value for residential and commercial in 2023

Proposed TransLink Property Tax Adjustment: Residential			
Assessed Value of Residential Property	Estimated 2023 TransLink Property Tax (without proposed increase)	Estimated 2023 TransLink Property Tax (with proposed increase)	Estimated Additional Annual Increase per Residential Property
$500,000	$112	$113	$1
$750,000	$168	$169	$1
$1,000,000	$223	$226	$3
$2,000,000	$447	$452	$5

Proposed TransLink Property Tax Adjustment: Commercial			
Assessed Value of Residential Property	Estimated 2023 TransLink Property Tax (without proposed increase)	Estimated 2023 TransLink Property Tax (with proposed increase)	Estimated Additional Annual Increase per Residential Property
$0.5 million	$365	$369	$4
$1.0 million	$730	$738	$8
$2.0 million	$1,460	$1,475	$15
$5.0 millio			
$10.0 milli			



Transit fares

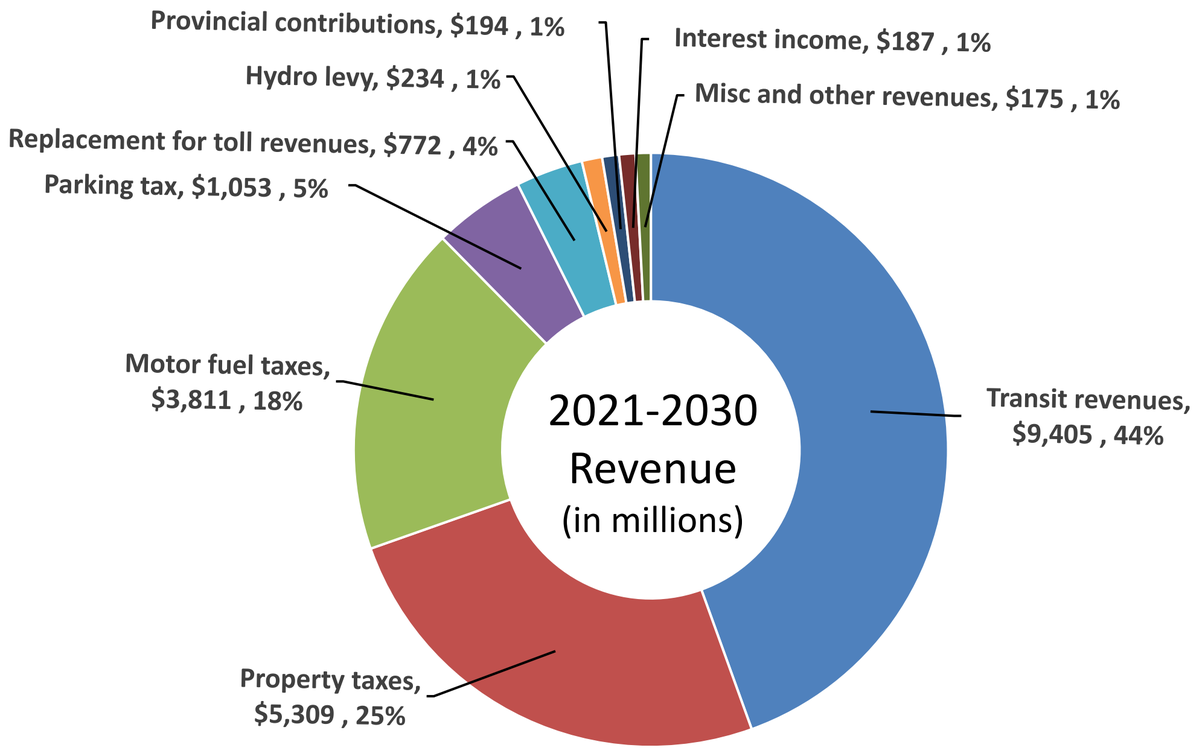
The annual fare increases will result in the following impacts to transit customers:

- By 2024, a youth or senior would pay $61.35 for unlimited travel across the region on a concession monthly pass (an increase of $2.75 compared to today), and an adult would pay $107.30 to $193.80 for a monthly pass, depending on the number of zones that the pass is for (an increase of $4.75 to $8.60 compared to today). These higher prices are comparable to or lower than our Canadian peers.

- By 2024, a youth or senior who takes transit only a few times a month on weekday evenings or weekends would pay a stored value or cash concession fare of $2.15 for a trip of any distance with a Compass card (an increase of 10 cents compared to today), and an adult would pay $2.60 for a one-zone trip with stored value on a Compass Card (an increase of 10 cents compared to today). During these times, people can travel all the way from Maple Ridge to Vancouver, or from Delta to Bowen Island, on a one-zone fare.

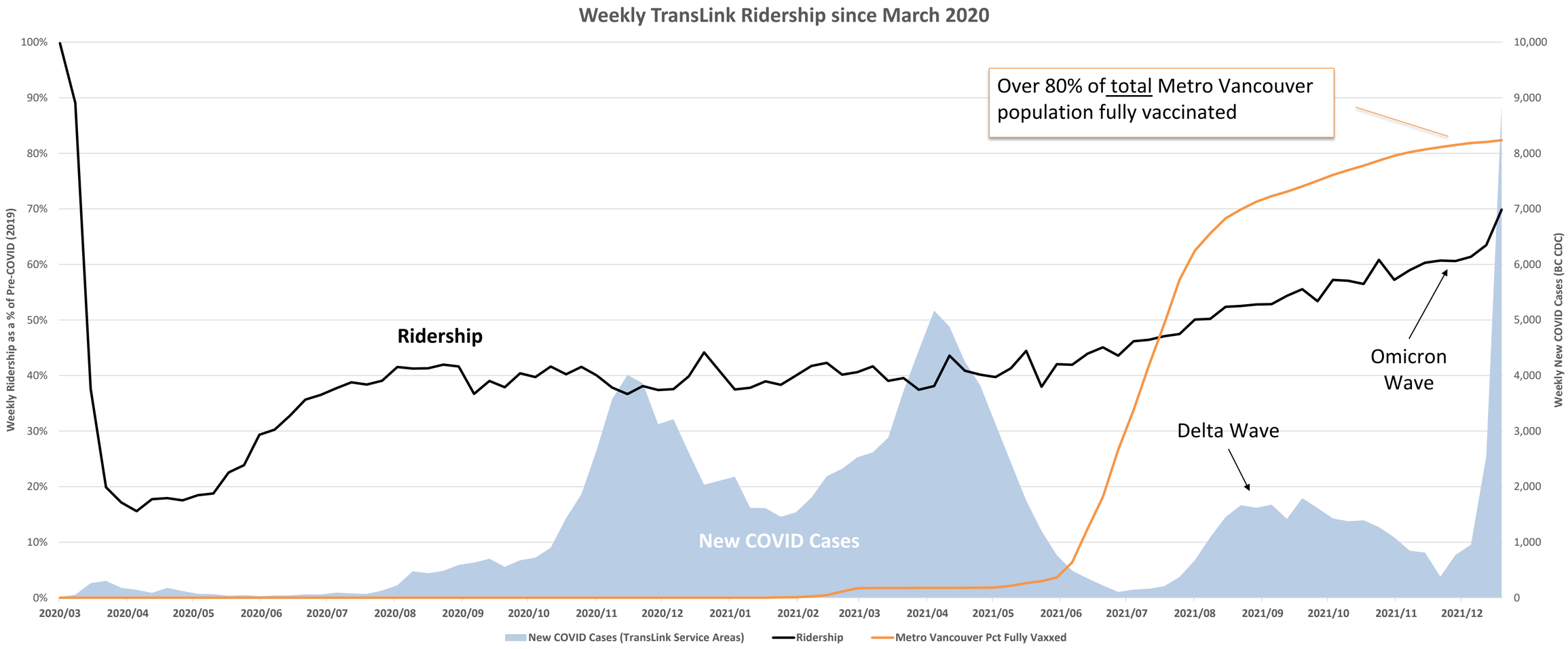
Pandemic Impact

Pre-Pandemic Revenue Sources



Before the Pandemic Transit revenue accounted for 44% of operating revenues

Ridership Loss



Senior Government Relief Funding

TransLink received Senior Government Relief Funding to help alleviate pressures caused by pandemic:

- 2020: $600M to offset net revenue losses in 2020-2021
- 2020: $44M for fare increases to not exceed 2.3% in 2021-2024
- 2021: $16.9M to offset lower fuel tax revenue
- 2022: $176M to help offset losses in 2023-2025