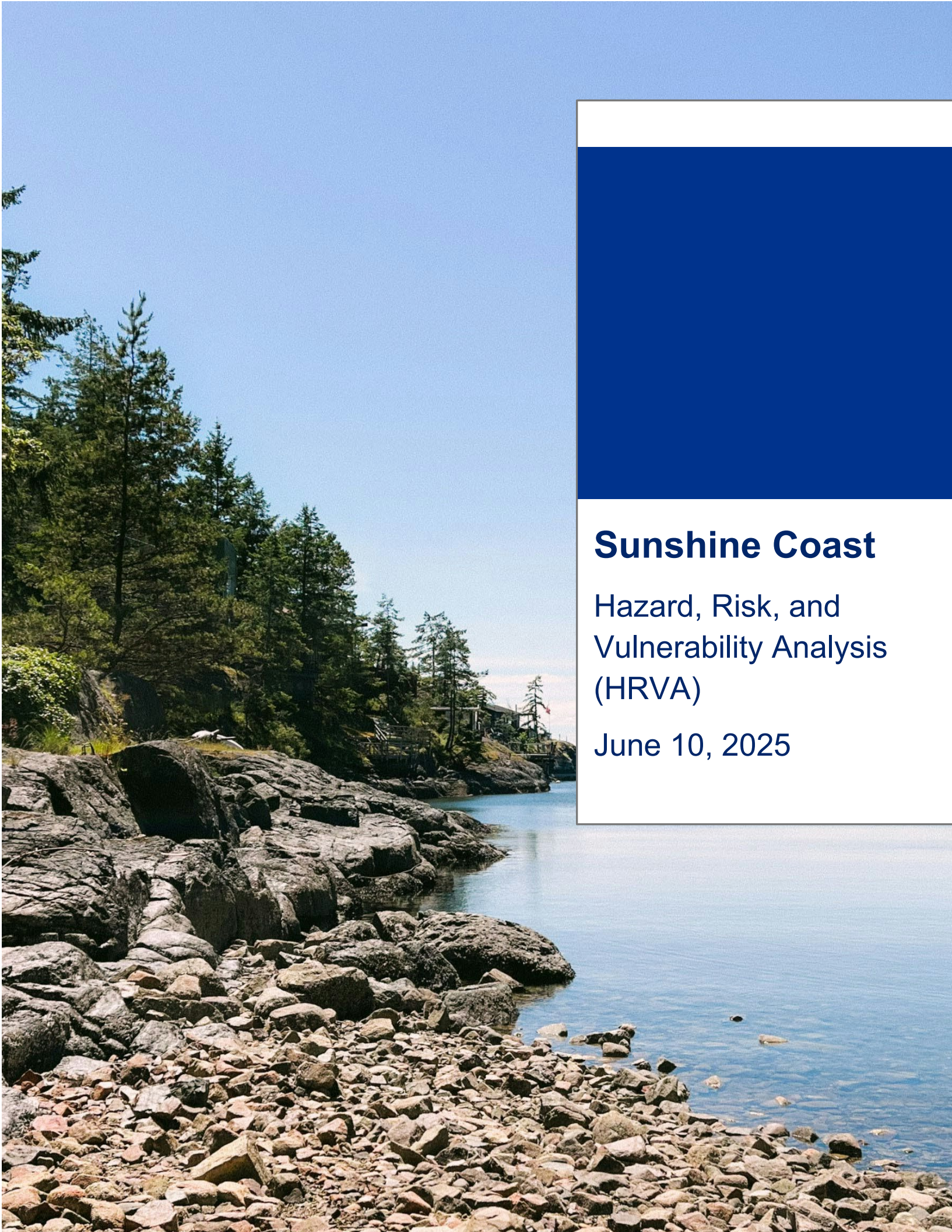

Sunshine Coast

Hazard, Risk, and Vulnerability Analysis (HRVA)

June 10, 2025

ACKNOWLEDGEMENTS

The updated Hazard, Risk and Vulnerability Analysis was informed by community representatives from across the Sunshine Coast, from stakeholders and partners including the shíshálh Nation. The collective input of all of those who call the Sunshine Coast home contributes valuable and important information to this Report.

TERRITORIAL ACKNOWLEDGEMENT

The Sunshine Coast Regional District is located on the territories of the shíshálh and Sḵwx̱wú7mesh Nations.

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GLOSSARY

CCG – Canadian Coast Guard

DPA – Development Permit Areas

DRR – Disaster Risk Reduction

EOC – Emergency Operations Centre

HRVA – Hazard, Risk and Vulnerability Analysis

RCM-SAR – Royal Canadian Marine Search and Rescue

OCP – Official Community Plan

RCMP – Royal Canadian Mounted Police

SAR – Search and Rescue

SCEP – Sunshine Coast Emergency Program

SCRD – Sunshine Coast Regional District

sNGD – shíshálh Nation Government District

EXECUTIVE SUMMARY

The Sunshine Coast Regional District (Sunshine Coast) updated its Hazard, Risk, and Vulnerability Analysis (HRVA) in spring 2024 with the goal of reducing risks and vulnerabilities facing the region and guiding resource investments to reduce risks and increase resilience of communities and ecosystems.

The purpose of an HRVA is to assist communities in answering the following questions:[1]

- What hazards are likely to occur in the Sunshine Coast?
- How resilient is the Sunshine Coast?
- How is climate change affecting the likelihood of hazards?
- How severe will the impact be on the Sunshine Coast's population, infrastructure, property, and environment?
- What risk reduction strategies can be implemented?

This report assesses 54 hazards applicable to the Sunshine Coast, many of which are influenced by a changing climate, as well as vulnerabilities of the community (e.g., the age and quality of the built environment) and resilience drivers (e.g., documents available to the community to help guide preparedness and response efforts to emergencies and disasters). A total of 34 tier 1 hazards were identified as having the highest probability of impacting the SCRD, with 20 determined to be tier 2 with a smaller likelihood and impact on the SCRD. Table 1 below presents each of the tier 1 hazards on a risk matrix. The corresponding colour code and likelihood / consequence range will be reflected in Section 5 (the individual hazard detail section) of this report. The placement of the hazards on the matrix are determined by the risk level, which is often expressed as an equation: risk level = likelihood X consequence.

[1] Emergency Management BC. 2020. Hazard, Risk and Vulnerability Analysis For Local Authorities and First Nations. Retrieved online: https://www2.gov.bc.ca/assets/gov/public-safety-and-emergency-services/emergency-preparedness-response-recovery/local-government/hrva/guides/companion_guide_to_the_hrva.pdf

Likelihood				0-5	6-13	14-21	22-29	30-37	38-44
	High	**Almost Certain** (annual chance ≥ 50%)	E	**Lightning**	**Extreme heat Electrical outages**	**Structural fire**	**Drought**		
		Likely (10% ≤ annual chance < 50%)	D		**Air quality Hail Snowstorm Subsidence Storm surge Land subsidence Marine Vessel Incident**	**Plant disease & pest infestation Landslides Local flooding Coastal flooding Freshet, river, creek flooding Flash flood Telecomm interruption Transportation interruption Water service interruption**	**Wildfire**		
	Med	**Possible** (2% ≤ annual chance < 10%)	C		**Food source interruption Wastewater interruption Fuel source interruption**	**HazMat spills**	**Public health crisis Liquefaction**	**High wind event / hurricane**	
	Low	**Unlikely** (1% ≤ annual chance <2%)	B			**Oil and gas pipeline spill**	**Tsunami**	**Earthquake**	
		Rare (annual chance <1%)	A		**Mine incident**	**Glacier outburst floods**		**Dam / spillway breach**	
					Low	**Medium**		**High**	
					Consequences				

Table 1: Risk matrix for tier one hazards identified for the Sunshine Coast.

Climate change will continue to have an impact on hazard risks experienced by the Sunshine Coast. Climate change is expected to increase the mean annual and seasonal mean temperatures across the SCRD. Climate models are predicting that summers will be hotter and drier, with a projected 3.7℃ increase in summer temperature and a decrease in summer precipitation of potentially up to 40%. There will be more days above 30℃ and fewer days below -15℃. The frost-free season will increase by approximately 63 days by 2051-2080 compared to the 1971-2001 period. The frequency and intensity of rainfall events is expected to increase. These changes each present significant and unique challenges to the Sunshine Coast, its environment and communities across the region.

Social, physical, and environmental elements contribute to the vulnerability of the Sunshine Coast communities. This includes locations of buildings within hazard zones, the age and quality of the built environment and whether buildings were constructed according to building codes. Vulnerability is also impacted by social factors, such as social networks and community services that can help keep people informed and provides services when needed, and environmental factors, including whether the local environment can remain resilient to hazards such as extreme heat and intense precipitation events. Together, these issues contribute to the vulnerability of a community, its people, and the natural environment to hazards.

While there are elements that contribute to the vulnerability of the community, there are also drivers of resilience in the community, including existing risk reduction measures and resilience strategies. Risk

reduction measures include the Voyent Alert! system as an important communication service for emergencies, public education (e.g., promoting personal and family emergency preparedness kits), building code enforcements, the repositioning of response resources (e.g., emergency response equipment staged in different areas across the Sunshine Coast), and zoning bylaws around hazardous areas (e.g., Development Permit Area requirements for building in hazardous areas). Together, these different actions help to increase the resilience of Sunshine Coast communities.

The HRVA was informed by community engagement as a key element to the risk assessment, including an engagement session with the Sunshine Coast HRVA steering committee, with the shíshálh Nation, the Town of Gibsons, the District of Sechelt, and with Vancouver Coastal Health. These sessions helped to support and strengthen information collected from primary and secondary sources.

SECTION 1: INTRODUCTION

1.1 PURPOSE

The purpose of the Hazard, Risk and Vulnerability Analysis (HRVA) is to inform risk-based decisions to address vulnerabilities, mitigate hazards, and prepare for, respond to, and recover from a range of emergencies. This HRVA assesses risk across the Sunshine Coast in relation to likelihood and severity, identifies key vulnerabilities for the Sunshine Coast, and assesses the impacts of each risk. This HRVA builds on previous HRVAs conducted in 2005 for Sunshine Coast Regional District, District of Sechelt, Town of Gibsons, Gambier and Keats Island, and the shíshálh Nation Government District. The Sunshine Coast HRVA can serve as a foundational element of the Sunshine Coast's disaster risk reduction strategies and will provide key insight into the prioritization of planning efforts, guiding the development of emergency management plans, and supporting the identification of tools and resources to support community preparedness and resilience.

1.2 SCOPE

This HRVA encompasses the entirety of the Sunshine Coast, including the shíshálh Nation Government District, the District of Sechelt, Town of Gibsons, Keats and Gambier Islands, and five electoral areas: Electoral Area A- Egmont/Pender Harbour, Electoral Area B- Halfmoon Bay, Electoral Area D- Roberts Creek, Electoral Area E- Elphinstone, and Electoral Area F- West Howe Sound. All 57 hazards identified within BC's HRVA Tool were considered in the analysis, with 54 being applicable to the Sunshine Coast. The report emphasizes a subset of tier 1 high-priority hazards that had been identified and confirmed during the analysis.

1.3 APPROACH

For this HRVA, 54 hazards were identified as applicable to the SCRD, out of the 57 hazards listed within the BC HRVA Tool. The hazards not included in this report – volcanic flow, nuclear incident, and rail incident – were determined to not be applicable to the SCRD given the geographic location and the nature of the activities in the Sunshine Coast. There are no volcanoes, nuclear facilities, or rail lines that present a risk to the Sunshine Coast.

For these 54 hazards, the likelihood of occurrence was assessed based on available historic and present-day data, as well as future projections. These likelihoods were rated on a scale of Rare (A) to Almost Certain (E) to occur, using the assessment matrix in Appendix B. This matrix was applied to determine historic likelihood, current likelihood, and future likelihood.

Each hazard was then assessed in terms of the potential impact of their occurrence across 11 different consequence categories (the matrix used is shown in Appendix C and the results across all 54 hazards is in Appendix D). This assessment was developed through feedback collected from partners and stakeholders, as well as relevant and publicly available data sets. Engagement included an in-person workshop with stakeholders and partners to work through hazard scenarios and determine their potential impacts to the Sunshine Coast, a survey issued to community subject matter advisors, and targeted interviews.

Risk scores were determined based on the results of the analysis of likelihood and consequence for each hazard. These risk scores are summarized for all 54 hazards in Appendix D.

The intention of the summaries for the Town of Gibsons, Keats Island and Gambier Island, the District of Sechelt, and the shíshálh Nation Government District for specific hazards is to identify specific risks and consequences for these communities within the HRVA for the SCRD. The overall HRVA summarizes the main hazards, risks and vulnerabilities for the Sunshine Coast. Some hazards identified in this HRVA have widespread effects and will impact all communities along the Sunshine Coast similarly (e.g., tsunamis, earthquakes). Only hazards that impact the specific communities of the Town of Gibsons, Keats Island and Gambier Island, the District of Sechelt, and the shíshálh Nation Government District in a distinct way from other areas of the Sunshine Coast – and for which information is available - are identified under specific hazards in this HRVA.

Throughout this report, Climatedata.ca is used as the primary source of information for climate change data. Climatedata.ca uses the most recent Coupled Model Intercomparison Project (CMIP6) climate model. When Climatedata.ca does not have information on a specific variable of interest (e.g., icing days, seasonal mean precipitation), the analysis relies on Climateatlas.ca to supplement our information. Climateatlas.ca uses CMIP5, which is the previous version of CMIP6. The analysis uses a high emissions scenario[2] (RCP8.5 for CMIP5 and SSP8.5 for CMIP6) from both datasets to understand the 'worst case scenario' for how a changing climate may impact tier one hazards in the Sunshine Coast. Though not all worst-case scenarios for all hazards are likely to materialize (and therefore not all hazards should be prioritized equally given limited staff and financial resources), the intention is to provide an estimation of what future scenarios may look like for tier one hazards that are susceptible to climate risk drivers, so that the Sunshine Coast can best prepare for these potential future scenarios. Baseline periods for Climatedata.ca are 1971-2000, and for Climateatlas.ca the baseline is 1976-2005.

Additionally, information found across the various documents provided by the Sunshine Coast Emergency Program and its partners is used to supplement the analysis of the anticipated impacts the Sunshine Coast is likely to experience because of a changing climate – including the Climate Science Report and the Future Climatic Projections summary (December 2021), and the Climate Change Vulnerability and Risk Assessment Report (Spring 2022). In all instances, the analysis uses a high emissions scenario in the data provided.

Interlinkages between hazards

The hazards facing the Sunshine Coast are interconnected and complex due to changing climate conditions, including more intense summer temperatures, changing precipitation patterns, and increased instances of drought and wildfire. One hazard can often trigger another, creating a chain of compounding hazards. For example, a lightning strike could spark a wildfire during a drought, disrupting transportation and impacting air quality.

These interconnected and compounding hazards can increase the complexity of emergency response and compromise resident safety, particularly if evacuation routes are closed due to wildfires. The effects of these hazards can be both short-term and long-term. For instance, hillsides burned by wildfire may become unstable and susceptible to landslides during a rainfall event. A landslide can trigger additional hazards, such as transportation route interruption, food and fuel supply interruption, and electrical outages, which could lead to water service and wastewater interruptions.

[2] A high emissions scenario is a future where few restrictions are placed on emissions and describes the most global warming.

These examples are not exhaustive, but they illustrate the complexity and interlinkages of hazards, many of which are influenced by climate risk drivers. The hazard summaries in this HRVA do not identify all possible interlinkages.

Use of maps

Using publicly available documents and documents provided by the Sunshine Coast Regional District staff, this report includes illustrative maps that provide risk-related information in each area, including areas at risk from specific hazards (e.g., coastal flooding, tsunami). These maps can be used to inform emergency response planning and are provided in the main body of the report. Additional maps are provided in Appendix I.

Some hazards do not include maps. This is due to the lack of geotechnical data (e.g., land subsidence, submarine slides) or detailed studies at a local level (e.g., structure fire risk for specific buildings). This HRVA relies on existing and publicly available maps only.

1.4 LIMITATIONS

The analysis for all HRVAs is constrained by both the time of subject matter advisors to provide input as well as the existing data that can support the assessment of risks. HRVAs rely on the availability and accuracy of data, which may vary from hazard to hazard. Data is only as accurate as the methods used to collect and record it. Data measurements or lived experiences may also vary greatly within the same geographic area. As analysis methods become more sophisticated, and data sets become more readily available, and risk and resilience factors evolve over time, so will the results of future HRVA risk scores. Additionally, the information provided within the HRVA is reflective of a 'point in time'. Due to the impacts of climate change, both the built and natural environments may have undergone significant changes. For instance, infrastructure such as sea walls and storm sewers may be constructed or upgraded to cope with more extreme weather events. As a result of these changes, the risks, vulnerabilities, and potential consequences associated with various hazards may also be evolving more quickly than in the past. This HRVA may need to be updated more frequently to accurately reflect an evolving situation.

SECTION 2: BACKGROUND/COMMUNITY PROFILE

2.1 GEOGRAPHY

The Sunshine Coast is located on the southern mainland coast of British Columbia, across the Salish Sea from Vancouver Island, on the territories/swiya of the shíshálh and Sḵwx̱wú7mesh Úxwumixw First Nations (see Figure 1 below). It borders on the qathet Regional District to the north, the Squamish-Lillooet Regional District to the east, and the Metro Vancouver District to the south. The Sunshine Coast is dependent on BC Ferries, as there is no road access to the Lower Mainland. The Sunshine Coast is approximately 3,770 km^2 in size and encompasses three municipal entities: District of Sechelt, Town of Gibsons, and the shíshálh Nation Government District. In addition, it includes five electoral areas: Electoral Area A- Egmont/Pender Harbour, Electoral Area B- Halfmoon Bay, Electoral Area D- Roberts Creek, Electoral Area E- Elphinstone, and Electoral Area F- West Howe Sound.

The Sunshine Coast includes many biogeoclimatic areas, with most of the area falling within the Coastal Western Hemlock zone, featuring low elevations and lots of rain. Summers are typically cool, but in recent years have become much warmer, increasing the threat of fires. An undulating erosional surface rises slowly

from the Strait of Georgia towards the 1300 metre elevation of the Coastal Mountains. Thin mantles of sediment and bedrock outcroppings cover much of the area.[3]

Figure 1: Sunshine Coast Regional District Map.[4]

[3] A Strategic Land Use Plan for the *shíshálh* Nation. (2007). Retrieved online: https://shishalh.com/wp-content/uploads/2018/08/shishalhStrategic-Land-Use-Plan.pdf

[4] Sunshine Coast Regional District Maps. Retrieved from: https://www2.gov.bc.ca/assets/gov/british-columbians-our-governments/local-governments/governance-powers/maps/cd29_sunshinecoast.pdf

2.2 DEMOGRAPHICS

Sunshine Coast Demographics

The Sunshine Coast has a population of approximately 32,671 (see Table 2 below) and is growing. The Sunshine Coast is a tourist destination and sees a significant increase in population during the summer months. Much of the Regional District is sparsely populated with much of the population concentrated along the coastal areas (i.e., Gibsons and Sechelt)[5], and in several boat-access-only, larger islands (Gambier, Keats, North Thormanby, South Thormanby, Hardy and Nelson), and smaller communities along the coast including Roberts Creek, Elphinstone, Davis Bay, Halfmoon Bay, Madeira Park, Pender Harbour, Egmont, and Earls Cove.[6]

Municipality/Electoral District	Population Size (2021 Census)	Population Growth Rate (2021 Census)	Occupied Private Dwellings	Median Household Income (2020)	Area (sq. Km.)
The District of Sechelt	10,847	6.2%	5,128	$73,500	39
Town of Gibsons	4,758	3.3%	2,285	$70,000	4.31
shíshálh Nation Government District	765	10%	333	N/A	11.03
Electoral Area A- Egmont/Pender Harbour	3,039	16%	1,565	$64,000	1,898
Electoral Area B- Halfmoon Bay	2,969	8.9%	1,370	$75,000	1,269.5
Electoral Area D- Roberts Creek	3,523	3.0%	1,550	$84,000	143.4
Electoral Area E- Elphinstone	3,883	6.0%	1,605	$87,000	21.6
Electoral Area F- West Howe Sound	2,407	17.8%	1,110	$80,000	380.8
Gambier Island	430	N/A	593	N/A	98
Keats Island	50-80	N/A	359	N/A	6
Total:	**32,671**	N/A	**15,898**	N/A	**3772.14**

Table 2: Demographics of the Sunshine Coast.[7]

Age

The population of the Sunshine Coast is aging, with at least half of the population over 50 years old in 2021, and projected increases in the median age in the short term. However, a projected increase in the number of adults aged 25 to 44 and children aged 0 to 14 aligns with anecdotal evidence that young families are

[5] Sunshine Coast House Needs Report (2020). Retrieved from: https://gibsons.ca/wp-content/uploads/2020/11/2020-11-17_SUNSHINECOAST_HNR-FINAL.pdf

[6] Sunshine Coast Destination Development Strategy. (2023). DestinationBC. Retrieved online: Sunshine-Coast-Destination-Development-Strategy_Final.pdf (destinationbc.ca)

[7] Statistics Canada. (2023). *Census Profile.* 2021 Census of Population. Sunshine Coast Regional District. Retrieved from https://www12.statcan.gc.ca/census-recensement/2021/dp-pd/prof/details/page.cfm?Lang=E&DGUIDlist=2021A00035929&GENDERlist=1,2,3&STATISTIClist=1&HEADERlist=0

increasingly moving to the Sunshine Coast from Metro Vancouver due to the relative affordability of the Coast.[8]

Languages Spoken

The primary language spoken in the Sunshine Coast is English, with approximately 29,385 individuals with English as a first language. French is spoken by about 515 individuals, with another 3,020 individuals who do not have English or French as a first language.[9] 85 individuals have knowledge of an Indigenous language, with ten individuals having an Indigenous language as a first language, and 15 individuals regularly speaking an Indigenous language at home.[10]

Economy

Historically, the Sunshine Coast economy was dependent on resource extraction industries (e.g., forestry). However, more recently, tourism, recreation and retirement have shifted the economy away from one based on resource extraction to more diversity including aquaculture, retail, arts and culture, and high tech.[11]

2.2.1 SHÍSHÁLH NATION GOVERNMENT DISTRICT SUMMARY

Population: 765

Area (sq km): 10.81

Average Age: 46.5

Dwellings: 335 (occupied private dwellings)

Language: 99% English as first language, 1.3% French as first language, and 25 individuals identifying Salish as a first language[12]

Community Summary

Thirty-three parcels of land compose the shíshálh Nation, stretching from Jervis Inlet's northern end to Pender Harbour in the west, to Texada Island in the southwest and Sechelt in the southeast. The community's labour force is varied, with high participation in trades, transport and equipment operations as well as in sales and service occupations. Others work in business, finance and administration, education, and law, social, community and government services. Approximately 165 individuals commute to work, with 39% (65 people) commuting

Figure 2: Boundaries of shíshálh Nation swiya.

[8] Sunshine Coast House Needs Report (2020). Retrieved from: https://gibsons.ca/wp-content/uploads/2020/11/2020-11-17_SUNSHINECOAST_HNR-FINAL.pdf

[9] Statistics Canada. (2023). *Census Profile.* 2021 Census of Population. Sunshine Coast Regional District. Retrieved from https://www12.statcan.gc.ca/census-recensement/2021/dp-pd/prof/details/page.cfm?Lang=E&DGUIDlist=2021A00035929&GENDERlist=1,2,3&STATISTICIist=1&HEADERlist=0

[10] Ibid

[11] Sunshine Coast Destination Development Strategy. (2023). DestinationBC. Retrieved from: Sunshine-Coast-Destination-Development-Strategy_Final.pdf (destinationbc.ca)

[12] Statistics Canada. (2023). *Census Profile.* 2021 Census of Population - shíshálh Nation. Retrieved from: https://www12.statcan.gc.ca/census-recensement/2021/dp-pd/ipp-ppa/details/page.cfm?Lang=E&DGUID=2021C1005494&HP=0&HH=0&GENDER=1&AGE=1&RESIDENCE=1&TABID=2

within the community and 48.5% (85 people) commuting to a different community within the Sunshine Coast. An additional 12% (20 people) commute outside the Sunshine Coast for work. The primary commuting mode is personal vehicle, followed by walking or "other methods".[13]

Vulnerabilities specific for the shíshálh Nation Government District

The shíshálh Nation relies on critical infrastructure pertaining to water supply, wastewater treatment, food distribution systems, transportation (BC Ferries, Highway 101, private and chartered boat/plane), health care facilities, energy and utilities, telecommunications, and information technology. Some shíshálh Nation communities are remote and accessible by boat or floatplane, with reduced access to resources like hospitals and longer response times from emergency services. Hazards like wildfire, drought, coastal flooding, and earthquake present threats to the functioning of essential services. Their interruption could incur negative social, economic, and physical ramifications.

The following is a summary of other physical, social, and economic vulnerability factors for shíshálh Nation that might be impacted by a hazard:

- The Chapman/Gray Watershed is the largest source of potable water on shíshálh land. It is particularly vulnerable to logging related slides.[14]
- There are about 220 homeowner occupied households, 50 renter occupied households and 70 dwellings provided by shíshálh Nation Government District.[15]
- Rural dwellings like those on Texada Island and those north of Egmont are only boat or plane accessible.
- Medical facilities and care homes may require additional emergency support services during an emergency event (e.g., to assist evacuation of those with mobility challenges). There are several medical facilities in close proximity to shíshálh Nation Government District, including:
    - Sechelt Hospital – 5544 Sunshine Coast Highway.
    - Silverstone Senior Care Centre – 5625 Derby Road.
    - Green Court Supportive Housing – 5817 Medusa Street.
    - Cowrie Medical Clinic – 5699 Cowrie Street.

Resilience Drivers

The Sechelt Fire Department provides services to both the District of Sechelt and the shíshálh Nation Government District. It is a hybrid career/paid-on-call department with a staff Fire Chief, two staff Deputy Chiefs, daytime career firefighters and support employees. Services are provided from a single station located in downtown Sechelt.[16] The Sechelt Fire Department has fire suppression agreements with the SCRD and the Ministry of Forests and assists with incidents as required under Mutual and Automatic Aid agreements with the Gibsons, Roberts Creek, Halfmoon Bay and Pender Harbour Fire Departments. [17]

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[13] Statistics Canada. (2023). *Census Profile.* 2021 Census of Population - shíshálh Nation. Retrieved from: https://www12.statcan.gc.ca/census-recensement/2021/dp-pd/ipp-ppa/details/page.cfm?Lang=E&DGUID=2021C1005494&HP=0&HH=0&GENDER=1&AGE=1&RESIDENCE=1&TABID=2

[14] 2021 shíshálh Land Use Plan, (2021). Retrieved online: https://thescca.ca/current-campaigns/forestry-land-use/2021-shishalh-land-use-plan/

[15] Statistics Canada. (2023). *Census Profile.* 2021 Census of Population - shíshálh Nation. Retrieved from: https://www12.statcan.gc.ca/census-recensement/2021/dp-pd/ipp-ppa/details/page.cfm?Lang=E&DGUID=2021C1005494&HP=0&HH=0&GENDER=1&AGE=1&RESIDENCE=1&TABID=2

[16] District of Sechelt. (2010). Official Community Plan. Retrieved from: https://www.sechelt.ca/en/business-and-development/resources/Documents/Official-Community-Plan-Bylaw-492-2010.pdf

[17] District of Sechelt. (2010). Official Community Plan. Retrieved from: https://www.sechelt.ca/en/business-and-development/resources/Documents/Official-Community-Plan-Bylaw-492-2010.pdf

The table below identifies the sections of this HRVA that include the hazards most likely to impact shíshálh Nation Government District. It is important to note that some hazards have widespread effects and will impact all communities of the Sunshine Coast. These hazards are not identified in the table below. Only those hazards that have a unique impact to shíshálh Nation Government District relative to other communities are included in the table below.

Unique Considerations for shíshálh Nation Government District			
Hazard	**Page Number**	**Hazard**	**Page Number**
#1 Extreme Heat	42	#7 Drought	85
#2 Public Health Crisis	50	#8 Coastal Flooding	93
#3 Structural Fire	58	#9 Dam and Spillway Breach	105
#4 Land Subsidence	65	#10 Wastewater Interruption	116
#5 Hazardous Materials Spills	79	#11 Water Service Interruption	119
#6 Mine Incident	81	#12 Marine Vessel Incident	123

Table 3: Unique Considerations for shíshálh Nation Government District.

2.2.2 TOWN OF GIBSONS SUMMARY

Population: 4,758

Area (sq km): 4.31

Average Age: 51.2

Dwellings: 2,282 (occupied private dwellings)

Language: 83.3% English as first language, 1.8% French as first language, 12.7% other language as first language[18]**Community Summary** The Town of Gibsons is about a 10-minute drive from the Langdale ferry terminal, which is the primary ferry terminal with access to Metro Vancouver (Horseshoe Bay). The labour force in the Town of Gibsons is diverse, including retail trade, manufacturing, scientific and technical services, educational services, health care and social assistance, accommodation, and

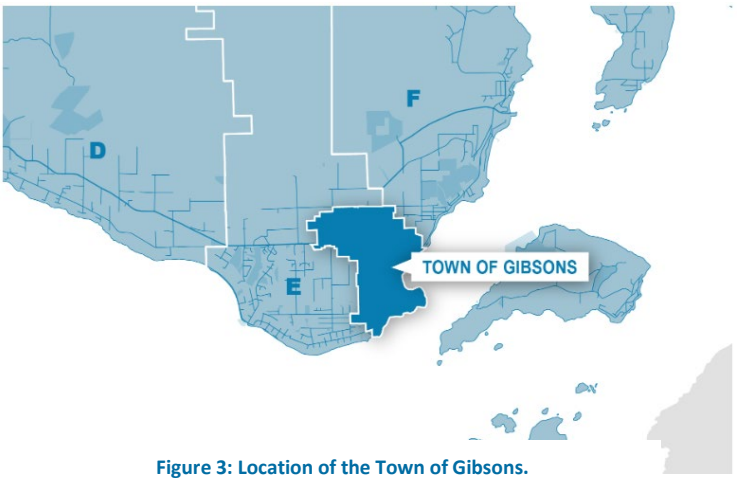

Figure 3: Location of the Town of Gibsons.

[18] Statistics Canada does not identify any resident of the Town of Gibsons as having an Indigenous language as a first language.

food services. Of the 1,205 people who commute for work, about half commute within the Town of Gibsons (685 people), and about

a quarter commute outside of the community (390 people). The remainder commute outside of the Sunshine Coast for work (130 people). The main mode of transportation is personal vehicle, followed by walking, public transit, and bicycle.[19]

Numerous hazards such as floods, interface fires, earthquakes, and human health emergencies can have a serious impact on vulnerable populations (i.e., the very old and the very young), just as certain types of disaster can have a tremendous impact on the housing market and local economy. Failure to consider these issues in the development of emergency management strategies can cause secondary, unanticipated problems such as the widespread displacement of families and low-income households.

Gibsons' geography includes creeks and low-elevation areas that, during a hazard, could present response or evacuation concerns. A formal evacuation guide has been prepared for the Bay Bluffs neighbourhood and further work on evacuation route planning is in development. Key roads for evacuation route planning for the Town of Gibsons includes:[20]

- School Road leading to Highway 101, Gibsons Way, Marine Drive (direct access to Highway 101 at Langdale Ferry terminal), Gower Point Road, Abbs Road, Franklin Road, Dougall Road, S. Fletcher Road, North Road, Pratt Road, Payne Road, Park Road, Reed Road, Hillcrest Road, and Seacot Way, for example.

Vulnerabilities specific for the Town of Gibsons

Critical assets that are essential for the functioning of the Town of Gibsons includes water provision (aquifers and wells), wastewater treatment, food distribution systems, transportation (e.g., BC Ferries, Highway 101), health care facilities, energy and utilities, telecommunications, and information technology. These critical assets are vulnerable to different hazards, including wildfire, drought, coastal flooding, high winds, and if the services these assets provide are interrupted, there could be potentially economic, social, and physical impacts to the residents of the Town of Gibsons.

The following is a summary of other social and economic vulnerability factors for the Town of Gibsons that might be impacted by a hazard:

- Regional growth is concentrated in Gibsons (and Sechelt), while the population is aging (36.5% of the population is 65 years and over, and 9.2% of the population is 14 years or younger).[21]
- There are approximately 1,715 owner occupied households and 570 renter occupied households. [22]
- Homelessness is on the increase, with the Gibsons shelter at capacity and waitlists for supportive housing that stretch longer than the current spaces provided.[23]
- Medical facilities and care homes may require additional emergency support services during an emergency event (e.g., to assist evacuation of those with mobility challenges):

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[19] Statistics Canada. (2023). *Census Profile.* 2021 Census of Population – Town of Gibsons. Retrieved from: https://www12.statcan.gc.ca/census-recensement/2021/dp-pd/prof/details/page.cfm?Lang=E&SearchText=gibsons&DGUIDlist=2021A00055929005&GENDERlist=1,2,3&STATISTIClist=1,4&HEADERlist=0

[20] Bay Bluff Evacuation Guide. Retrieved from: https://www.scrd.ca/wp-content/uploads/Evacuation-Route-Guide-Final-Bay-Bluff.pdf

[21] Statistics Canada. (2023). *Census Profile.* 2021 Census of Population – Town of Gibsons. Retrieved from: https://www12.statcan.gc.ca/census-recensement/2021/dp-pd/prof/details/page.cfm?Lang=E&SearchText=gibsons&DGUIDlist=2021A00055929005&GENDERlist=1,2,3&STATISTIClist=1,4&HEADERlist=0

[22] Ibid

[23] Sunshine Coast Housing Needs Report (2020). Retrieved from: 2020-11-17_SUNSHINECOAST_HNR-FINAL.pdf (gibsons.ca)

- Good Samaritan Christenson Village, 585 Shaw Rd, Gibsons.
- Coast Care Ltd (home care services) – Gibsons.
- Medical Associates (Gibsons Medical Clinic) – 211-1100 Sunshine Coast Highway, Gibsons.
- Gibsons Health Unit – 821 Gibsons Way, Gibsons.
- Christenson Village (long term care facility) – 585 Shaw Road, Gibsons.
- Sumac Place (28 bed mental health facility) – 841 Kiwanis Way, Gibsons.

Resilience Drivers

The SCRD and Town of Gibsons have plans and resources to respond to many of the hazards that present a threat to the region. Some incidents require the coordinated efforts of a variety of people and agencies. The Gibsons and District Volunteer Fire Department serves a population of approximately 12,000 including 4,758 in the Town of Gibsons and the fire protection district covers an area of roughly 22.7 square kilometers. Most communities within the SCRD are supported by local fire departments staffed by a combination of full-time and volunteer members, BC Ambulance Service Units and policing services provided by the RCMP (with community policing office in Gibsons). Mutual aid agreements exist between Gibsons' response agencies and those of neighbouring municipalities.

The table below identifies the sections of this HRVA that include the hazards most likely to impact the Town of Gibsons. It is important to note that some hazards have widespread effects and will impact all communities of the Sunshine Coast. These hazards are not identified in the table below. Only those hazards that have a unique impact to the Town of Gibsons relative to other communities are included in the table below.

Unique Considerations for the Town of Gibsons			
Hazard	**Page Number**	**Hazard**	**Page Number**
#1 Extreme Heat	42	#7 Mine Incident	81
#2 Public Health Crisis	50	#8 Drought	85
#3 Wildfire	55	#9 Local Flooding	90
#4 Landslides	62	#10 Coastal Flooding	94
#5 Land Subsidence	65	#11 Wastewater Interruption	116
#6 Earthquake	72	#12 Water Service Interruption	119

Table 4: Unique Considerations for the Town of Gibsons.

2.2.3 DISTRICT OF SECHELT SUMMARY

Population: 10,847

Area (sq km): 39.71

Average Age: 51.6

Language: 85% English as first language, 1.6 % French as first language, 11.3% non-official language as first language

Community Summary

Located on a narrow isthmus between the Sechelt Inlet and the Georgia Strait, the District of Sechelt covers approximately 39.71 km² of land. Backed by the Tetrahedron Mountain Range, Sechelt is accessible by boat (BC Ferries via Langdale) or by plane from the rest of the Lower Mainland, Vancouver Island, or coastal British Columbia. Sechelt lies 30 minutes by car from the Langdale ferry terminal. The community's labour force spans many categories, concentrating in sales and services, trades, transport and equipment operations, and business, finance and administration. Approximately 2,805 individuals commute to work, with 63.64% (1,785 people) travelling within Sechelt and 28.7% (805 people) travelling outside of Sechelt but within the census division. Additionally, about 6.9% (195 people) commute outside of the census division but within the province, and 0.7% (20 people) cross the bounds of British Columbia for work.[24]

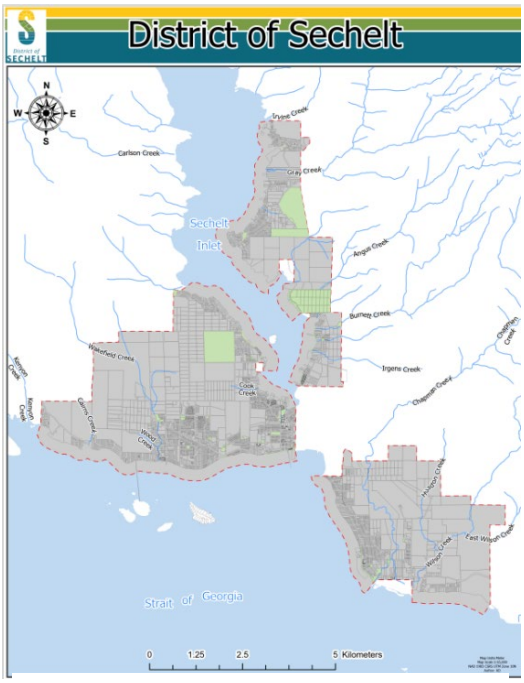

Figure 4: District of Sechelt Municipal Map.

Earthquakes, floods, wildfires, and tsunamis are possible threats to Sechelt. To bolster against these potential hazards, Sechelt is part of an Emergency Program that covers the District (along with the Town of Gibsons and the Shíshálh Nation). This program includes an Emergency Response and Recovery Plan[25], a Community Wildfire Protection Plan[26] and Tsunami Maps.[27] These documents cover the emergency response process and offer descriptions of the local area, threats, risks, and mitigation resources. Additionally, water availability becomes a concern for the area during the warmer months, with conservation regulations activating annually on May 1st.

Vulnerabilities specific for the District of Sechelt

Critical assets that are essential for the functioning of the District of Sechelt include water provision (aquifers and wells), wastewater treatment, food distribution systems, transportation (e.g., Highway 101), health care facilities, energy and utilities, telecommunications, and information technology. These critical assets are vulnerable to different hazards, including wildfire, drought, coastal flooding, high winds, and if the services these assets provide are interrupted, there could be potentially economic, social, and physical impacts to the residents of the District of Sechelt.

The following is a summary of other social and economic vulnerability factors for the District of Sechelt that might be impacted by a hazard:

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[24] Statistics Canada. (2023). *Census Profile.* 2021 Census of Population – District of Sechelt. Retrieved from: https://www12.statcan.gc.ca/census-recensement/2021/dp-pd/prof/details/page.cfm?Lang=E&DGUIDlist=2021A00055929011&GENDERlist=1&STATISTIClist=1&HEADERlist=0

[25] Sunshine Coast Emergency Response and Recovery Plan. (2017). Retrieved from: https://www.scrd.ca/wp-content/uploads/2022/11/2017-SUNSHINE-COAST-EMERGENCY-RESPONSE-RECOVERY-PLAN-rev.20170112.docx.pdf

[26] SCRD Community Wildfire Protection Plan. (2021). Retrieved from https://www.scrd.ca/wp-content/uploads/2022/11/Sunshine-Coast-Regional-District-Community-Wildfire-Protection-Plan-compressed.pdf

[27] SCRD Tsunami Maps. Retrieved from: https://www.scrd.ca/tsunami-maps/

- The population is aging (36.6% of is 65 and over, and 11.9% is 14 and under).[28]
- There are approximately 4,140 owner occupied households[29] and 990 renter-occupied households.
- Homelessness is on the increase, with the Sechelt shelter at capacity and waitlists for supportive housing that stretch longer than the current spaces provided.[30]
- Medical facilities and care homes may require additional emergency support services during an emergency event (e.g., to assist evacuation of those with mobility challenges):
    - Sechelt Hospital – 5544 Sunshine Coast Highway.
    - Silverstone Senior Care Centre – 5625 Derby Road.
    - Green Court Supportive Housing – 5817 Medusa Street.
    - Cowrie Medical Clinic – 5699 Cowrie Street.

Resilience Drivers

Sechelt and the Sunshine Coast Regional District have plans and resources to respond to many of the hazards that present a threat to the region. Some incidents require the coordinated efforts of a variety of people and agencies. Most communities within the SCRD, including Sechelt, are supported by local fire departments staffed by a combination of full time and volunteer members, BC Ambulance Service Units and policing services provided by the RCMP. Mutual aid agreements exist between Sechelt's response agencies and those of neighbouring municipalities.

The Sechelt Fire Department provides services to both the District of Sechelt and the shíshálh Nation Government District. It is a hybrid career/paid-on-call department with a staff Fire Chief, two staff Deputy Chiefs, daytime career firefighters and support employees. Services are provided from a single station located in downtown Sechelt.[31] The Sechelt Fire Department has fire suppression agreements with the SCRD and the Ministry of Forests and assists with incidents as required under Mutual and Automatic Aid agreements with Gibsons & District, Roberts Creek, Halfmoon Bay and Pender Harbour Fire Departments.[32]

The table below identifies the sections of this HRVA that include the hazards most likely to impact the District of Sechelt. It is important to note that some hazards have widespread effects and will impact all communities of the Sunshine Coast. These hazards are not identified in the table below. Only those hazards that have a unique impact to the District of Sechelt relative to other communities are included in the table below.

Unique Considerations for the District of Sechelt			
Hazard	**Page Number**	**Hazard**	**Page Number**
#1 Extreme Heat	43	#9 Mine Incident	81
#2 Public Health Crisis	50	#10 Drought	86
#3 Wildfire	55	#11 Local Flooding	91

[28] Statistics Canada. (2023). *Census Profile.* 2021 Census of Population – District of Sechelt. Retrieved from: https://www12.statcan.gc.ca/census-recensement/2021/dp-pd/prof/details/page.cfm?Lang=E&DGUIDlist=2021A00055929011&GENDERlist=1&STATISTIClist=1&HEADERlist=0

[29] Ibid

[30] Sunshine Coast Housing Needs Report (2020). Retrieved from: 2020-11-17_SUNSHINECOAST_HNR-FINAL.pdf (gibsons.ca)

[31] District of Sechelt. (2010). Official Community Plan. Retrieved from: https://www.sechelt.ca/en/business-and-development/resources/Documents/Official-Community-Plan-Bylaw-492-2010.pdf

[32] Ibid

#4 Structural Fire	58	#12 Coastal Flooding	95
#5 Landslides	63	#13 Dam and Spillway Breach	106
#6 Land Subsidence	65	#14 Wastewater Interruption	117
#7 Earthquake	73	#15 Water Service Interruption	119
#8 Liquefaction	75		

Table 4: Unique Considerations for the District of Sechelt.

2.2.4 KEATS ISLAND AND GAMBIER ISLAND SUMMARY

Population: Gambier: 430, Keats: 50-80

Area (sq km): Gambier: 98.02, Keats: 6[33]

Average Age: Gambier: 52.8, Keats: unclear

Dwellings: Gambier: 593 private dwellings, Keats: 359 developed properties

Language:

Gambier: 90.5% English as first language, 0% French as first language, 8.5% other language as first language[34]

Keats: Information not readily available

Community Summary

Gambier Island and Keats Island are members of Sunshine Coast Regional District (SCRD) and Islands Trust. Islands Trust is primarily responsible for the land use and planning associated with these unique communities; SCRD maintains a role in problem resolution and the coordination of services for Gambier and Keats Islands. The Island Trust undertakes the development of official community plans (OCP), zoning and other land use bylaws for the islands. These islands can exclusively be reached by boat, and many properties are only accessible by water, with no access to a developed road. Access options include private boat, water taxi from Gibsons or Horseshoe Bay, or a passenger ferry service from Langdale. Gambier Island and Keats Island are characterized by relatively moderate climates.

[33] Keats Island Official Community Plan. (2002). Retrieved from: http://keats-island.ca/images/gamkeabylbaseocp0077.pdf

[34] Statistics Canada does not identify any resident of the Island of Gambier as having an Indigenous language as a first language.

Gambier Island

Gambier Island is the largest of the Howe Sound Islands and is located approximately 10 km from Lions Bay, 15 km from Horseshoe Bay, and 40 km from Vancouver. BC Ferries has a foot passenger service between Langdale and New Brighton. Statistics Canada identifies about 430 residents on Gambier Island, and residents are primarily in New Brighton, Gambier Harbour, and West Bay.[35] Part time residents are a significant year-round presence, many spending 3-4 days a week on the island. Halkett Bay Marine Provincial Park is located on the southeastern shore of Gambier Island and is frequented by visitors seeking opportunities for hiking, swimming, canoeing, kayaking, and fishing. Public docks are an important and unique amenity on Gambier Island.[36] Public wharves are an essential service for planning area residents and are located at New Brighton (Transport Canada), Gambier Harbour, Port Graves, and Halkett Bay (Regional District) and West Bay.

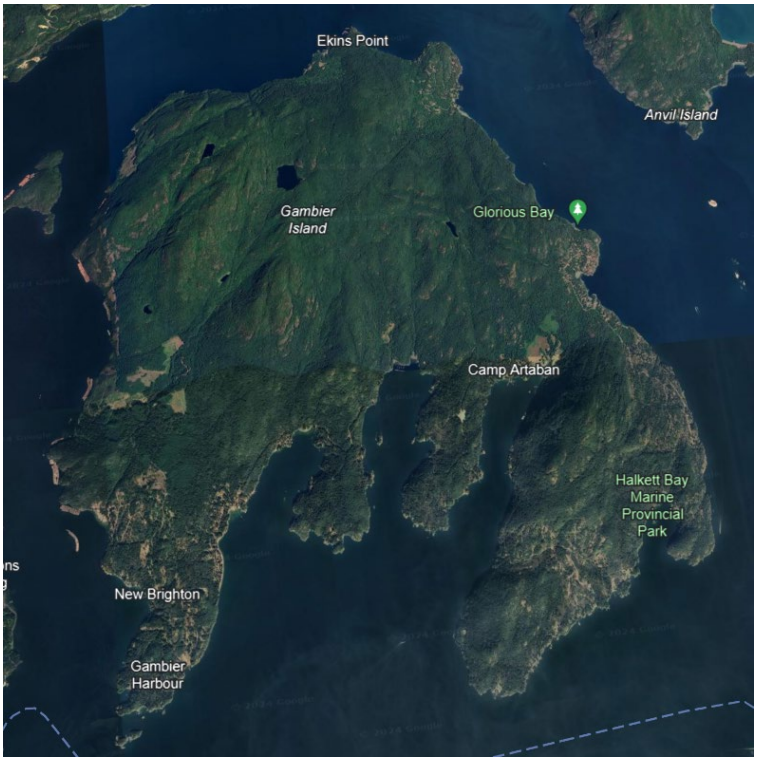

Figure 5A: Satellite image of Gambier Island. Source: Google Earth

The labour force on Gambier is composed of 105 individuals, primarily in the trades, transport, and equipment sector. Others work in education, law, social, community and government services, as well as in art, culture, recreation, and sport. About 45 Gambier residents commute to work. Approximately 66.7% (30 people) commute to a different community within the census division and 22.2% (10 people) travel outside the census division.[37]

Keats Island

Keats Island is also located in Howe Sound, less than one mile east of the Town of Gibsons. The island has an area of approximately 600 hectares (1500 acres), primarily made up of sloping terrain rising to a central ridge with summits around 200 meters (650 feet). The shoreline consists of rock bluffs, separated by beaches of

[35] Sunshine Coast Tourism. Gambier Island. Retrieved from: https://www.sunshinecoastcanada.com/explore/south-coast/gambier-island/

[36] Gambier Island Local Trust Committee. (July 2022). Shoreline Protection Discussion Paper – Draft. Retrieved from: https://webfiles.islandstrust.bc.ca/islands/local-trust-areas/gambier/current-projects/Gambier%20Island%20Official%20Community%20Plan%20Review/6.%20Other%20Information/Gambier%20Discussion%20Paper-Shoreline%20July%202022.pdf

[37] Statistics Canada. (2023). *Census Profile.* 2021 Census of Population –Gambier Island Trust Area (2021). Retrieved from: https://www12.statcan.gc.ca/census-recensement/2021/dp-pd/prof/details/page.cfm?Lang=E&DGUIDlist=2021A0006590005&GENDERlist=1&STATISTIClist=1&HEADERlist=0

sand or gravel at several points on all sides of the island. On the west side of the island, there is a small bay (Plumper Cove) protected by the two Shelter Islets. These islands are approximately 1.6 hectares (4 acres) and 0.6 hectares (1.5. acres) respectively. There are no lakes or major streams on the island, but ground water has been tapped at low elevations at several locations.

Figure 6B: Satellite image of Keats Island. Source: Google Earth

Keats Island is a rural residential and recreational island with no car ferry, no paved roads, relatively few automobiles, and limited year-round moorage potential for private boats. The only public access to Keats Island is by boat which can dock at one of two wharves on opposite ends of the island. However, there are many private docks accessible by homeowners. There is one public barge ramp facility adjacent to the Keats landing wharf, which is used to transport vehicles and heavy freight on and off the island. There is also a public dock located at Plumper Cove Provincial Marine Park.

The island is served by BC Hydro electric power. Telephone service is available. However, not all dwellings have a phone. There are 359 developed properties, of which around 20-25 are occupied full time with the remaining 339 being used seasonally or on a weekend basis. There are between 50 to 80 full time (year-round) residents concentrated around the Keats Landing Area, Eastbourne, the "10 acres" and Barnabas. Similar to other BC coastal islands, the number of people on the island can fluctuate from less than 50 to more than 1300 during the summer, including visitors to the island's 2 summer caps and Plumper Cove Marine Park. Keats and Barnabas camps can house 350 vacationers at any single point during the summer.[38] Income and labour on Keats Island come from the service and retail sector, originating from the island's two camps. Barnabas Family Ministries and Keats Baptist Camp each employ 2-3 families year round, and take on additional staff seasonally. The island has no stores, banks or other commercial services.[39]

Vulnerabilities specific for Keats Island and Gambier Island

Critical assets that are essential for the functioning of Keats Island and Gambier Island includes water provision (aquifers and wells), food distribution systems, transportation (e.g., BC Ferries and private water taxis to the islands), energy and utilities, telecommunications infrastructure. These critical assets are

[38] Keats Island Official Community Plan. (2002). Retrieved from: http://keats-island.ca/images/gamkeabylbaseocp0077.pdf
[39] Keats Island Community Profile. (2001). Retrieved from: http://www.keats-island.ca/images/Community%20Profile-2001.pdf

vulnerable to different hazards, including wildfire, drought, coastal flooding, high winds, and if the services these assets provide are interrupted, there could be potentially economic, social, and physical impacts to Keats Island and Gambier Island residents and visitors.

To ensure that risk to community members is minimized, Gambier Island has limited land use and development in areas of hazardous conditions such as steep slopes. For Gambier Island, buildings must be no closer than 15m from the natural boundary of the sea, lake, watercourse, or wetland.[40] Keats Island possesses a similar regulation whereby structures cannot be within 7.5m from the sea boundary, with the exception of utility houses, stairs or walkway to access the foreshore.[41]

Response time is a key concern for the communities on Keats Island and Gambier Island. The geographic isolation that attracts residents to Gambier and Keats may potentially put them at risk when a life-threatening situation occurs. Services located directly on these islands are limited, but their proximity to other communities in the SCRD and Vancouver dictates greater support capability.

The following is a summary of social and economic vulnerability factors for Keats Island and Gambier Island that might be impacted by a hazard:

- Response capability is of primary concern to the communities of Gambier and Keats Island. Response time is limited by the geographic isolation of these communities, potentially increasing risk when a life-threatening situation occurs. Response to most events requires the coordinated effort of a variety of organizations from surrounding communities. This coordination may be impeded when entire regions are facing similar response needs.
- Gambier Island is outside the fire protection region of local governments, given the challenges with accessibility to the boat access only island.
- Many properties are water access only, having no access to a developed road.
- Limited range of on-island services for people needing special needs.

Resilience Drivers

Gambier and Keats Island are supported by the Canadian Coast Guard (CCG), BC Ambulance Service (BCAS), Royal Canadian Mounted Police (RCMP), Search and Rescue (SAR), and the Royal Canadian Marine Search and Rescue (RCM-SAR). The Canadian Coast Guard, SAR and RCM-SAR work together (under the command of CCG) when there is a need for marine rescue services. Both Gambier and Keats Island have communal fire equipment. However, no official fire firefighting team is stationed on either island.

The communities of Gambier Island and Keats Island have developed and implemented a number of measures to prepare for and respond effectively to a number of hazards. The following resilience drivers were identified for these communities:

- Gambier Island and Keats Island address development on hazardous lands in their Official Community Plans (2001 and 2002, respectively) and municipal policies.
- The communities of Gambier Island and Keats Island have developed some fire suppression capability through equipment and training cooperatives. This decreases their vulnerability to structural fires and wildland interface fires as they are not supported by a local fire department.

[40] Gambier Official Community Plan. (2001). Retrieved from: islandstrust.bc.ca/document/gambier-island-ocp-bylaw-no-2023/

[41] Keats Official Community Plan. (2002). Retrieved from: http://keats-island.ca/images/gamkeabylbaseocp0077.pdf

- Gambier Island's Fire Equipment Group was formed in 1980 and has acquired and made available to island residents fire-fighting equipment (e.g., pumps, hoses) and provides demonstrations and practice sessions for islanders to become better prepared to protect their community against fires. There are fire equipment trailers in three primary communities (Gambier Harbour, New Brighton, and West Bay). [42]
- The climate on Gambier Island and Keats Island are one of the mildest in Canada. Heat waves, ice formation, and most extreme weather events have traditionally been rare occurrences in these communities. However, with climate change, these hazards are becoming more frequent and severe.

The table below identifies the sections of this HRVA that include the hazards most likely to impact Keats Island and Gambier Island. It is important to note that some hazards have widespread effects and will impact all communities of the Sunshine Coast. These hazards are not identified in the table below. Only those hazards that have a unique impact to Keats Island and Gambier Island relative to other communities are included in the table below.

Unique Considerations for Keats Island and Gambier Island			
Hazard	**Page Number**	**Hazard**	**Page Number**
#1 Extreme Heat	43	#10 Coastal Flooding	95
#2 Public Health Crisis	50	#11 Electrical Outages	108
#3 Wildfire	55	#12 Food Source Interruption	109
#4 Structural Fire	58	#13 Telecommunications Interruption	112
#5 Landslides	63	#14 Transportation Route Interruption	114
#6 Earthquake	73	#15 Wastewater Interruption	116
#7 Tsunami	76	#16 Water Service Interruption	120
#8 Mine Incident	81	#17 Marine Vessel Interruption	123
#9 Local Flooding	91		

Table 5: Unique Considerations for Keats Island and Gambier Island.

[42] The Gambier Island Community. GFEG Fire Practice. Retrieved from: https://www.gambierisland.org/Fire%20Protection.htm?utm_source=coast%20reporter&utm_campaign=coast%20reporter%3A%20outbound&utm_medium=referral

2.3 EMERGENCY MANAGEMENT CAPACITY

The Sunshine Coast Emergency Program (SCEP), which operates as part of the Regional District, is a multi-jurisdictional emergency service, responsible for Emergency Management on behalf of the local governments including the shíshálh Nation Government District, District of Sechelt, the Town of Gibsons and the SCRD. The emergency program supports emergency response by:

- Activating an emergency operations centre.
- Providing support for a declaration of a State of Local Emergency.
- Liaising with and coordinating local partners, provincial, and federal agencies for a multi-agency response.

SCEP has two full-time positions, an Emergency Program Coordinator and an Emergency Management Technician who provide additional services with community outreach and education, facilitating quarterly meetings with stakeholders and training internal staff.

There are four fire departments that operate under the jurisdiction of the Regional District (Gibsons & District, Roberts Creek, Halfmoon Bay, and Egmont & District), and two fire departments (Sechelt and Pender Harbour) which operate as Improvement Districts independent of the Regional District. BC Wildfire Services are in Sechelt and work closely with emergency program and fire departments. BC Ambulance Service has 3 stations and is in the final planning stages for a new, post-disaster constructed building in Pender Harbour. The Sunshine Coast has a robust Search and Rescue Team (SAR) and the Royal Canadian Marine Search and Rescue (RCM-SAR) have three strategically located stations. The Canadian Coast Guard (CCG), RCM-SAR and SAR work together (under the command of CCG) when there is a need for marine rescue services. Emergency Support Services and the Emergency Communications Team both meet and train regularly. All police services are provided by the RCMP.

SECTION 3: RESILIENCE DRIVERS

An HRVA contributes to building resilience to disasters by understanding risk, risk drivers, and risk reduction strategies. This section identifies the main community resilience drivers in the Sunshine Coast. This is a preliminary list that will be augmented through engagement with municipalities, first responders, subject matter experts and community members over time as new plans, procedures, and studies are developed.

3.1 EXISTING RISK REDUCTION MEASURES

Existing plans/documents

The following list includes a few of the main documents available to the community to help guide preparedness and response efforts to emergencies and disasters.

- Evacuation Plans are available for Egmont, Tuwanek, and The Bay/Bluff Area (Gibsons).
- The SCRD has an Emergency Response and Recovery Plan (ERRP) and a Community Wildfire Protection Plan.
    - There are a number of resources made available by the SCRD through the BC FireSmart Program, including tips to FireSmart homes and cost-effective wildfire home protection.
- An Emergency Preparedness Guide.
- A Drought Response Plan.

- An Extreme Heat Response Plan.

Emergency management program and approach content

The Sunshine Coast Emergency Program (SCEP) is the lead agency for emergency management on the Sunshine Coast.

In the event of an emergency, an Emergency Operations Center (EOC) is activated to provide support and coordination for a multi-agency response. Operational support, decision making, plan writing, and public information and safety will be coordinated from the EOC.[43]

Additional emergency procedures and processes that contribute to community resilience:

Early Warning Systems: The Sunshine Coast uses Voyent Alert! as the communication service for emergencies. Voyent Alert! sends alerts to residents, businesses and visitors during emergency events (e.g., earthquakes, fires or floods). The tool is free for subscribers and requires individuals to register for the service. Emergency information provided includes notification of an emergency event, evacuation alerts and orders, evacuation routes and locations for evacuee reception centres.[44] Other means of distributing emergency / evacuation-related information includes:

- TV, radio (e.g., ICON Radio) and print news.
- Social media platforms.
- Written information on community message boards.
- Information packages (e.g., pamphlets).
- Amateur radio emergency services

Public Education (e.g., promotion of developing personal preparedness kits): SCEP supports emergency preparedness utilizing the provincial programs for personal preparedness, neighbourhood preparedness and provides provincial material during public outreach. This ensures the public is receiving accurate, consistent and reliable information to improve emergency preparedness and community resilience. Guides and recommendations for households to prepare for emergencies are made available for the public.

Training and capabilities of response personnel: The SCRD continues to obtain emergency preparedness grant funding to enlist the Justice Institute of BC for locally held emergency management training. EOC refresher training and tabletop exercises are held and offered to local response agencies. The local fire departments train together for mutual aid in addition to wildfire response training.

Building code enforcements: Updated BC Building and Plumbing Codes came into effect March 8, 2024, province wide. These codes are based on the National Codes with some BC-specific variations to reflect the province's geography, climate, local government needs, industry practices, and provincial priorities. As it relates to emergencies the SCRD may experience, this includes adopting cooling requirements to provide one living space that does not exceed 26 degrees Celsius. Changes that will come into effect in March 2025 include early adoption of national requirements to improve earthquake design changes for housing and small

[43] SCRD. "Emergency Program". Retrieved from: https://www.scrd.ca/Emergency-Program#:~:text=The%20Sunshine%20Coast%20Regional%20District%20%28SCRD%29%2C%20through%20the,to%20be%20part%20of%20one%20integrated%20emergency%20program.

[44] SCRD. "Emergency Alert System." Retrieved from: https://www.scrd.ca/alert-system/

buildings with high seismic hazard values. The SCRD Building Bylaw No. 687 sets out penalties and enforcements for anyone who is in contravention of the building code, including a fine of up to $10,000 or imprisonment for contravention of the bylaw (if convicted).[45]

Prepositioning of response resources: The SCEP has emergency response equipment staged in different areas on the Coast, including two large containers located in Gibsons that hold equipment and supplies for a community reception centre and group lodging facility. There is equipment stored at the Gibsons and Area Community Centre, a storage container at the SCRD Field Road facility and work is currently underway to move a storage container to the Pender Harbour area for staging emergency equipment.

Zoning by-laws around hazardous areas: SCRD establishes requirements for development in hazardous areas (e.g., flooding, geotechnical) through Development Permit Areas (DPAs) indicated in seven Official Community Plan (OCP) bylaws. A review of OCPs, including DPAs, is being initiated in 2024.

3.2 RESILIENCE STRATEGIES

Sunshine Coast Disaster Risk Reduction Strategy: The Sunshine Coast Regional District, along with the municipalities of Gibsons, Sechelt, and the shíshálh Nation Government District, are working to reduce disaster risk, enhance community resilience and build a safer and more sustainable community. Key initiatives include a completed climate risk assessment to guide the Community Climate Action Plan, the Wildfire Community Protection Plan and FireSmart program, and the Extreme Heat Emergency Response Plan.

Personal and Neighbourhood Emergency Preparedness education and evacuation planning empower citizens to understand and fulfill their role in emergencies. Efforts are also underway to revise development permit areas to protect sensitive geography, such as preserving Riparian Areas, and to advocate for provincial disaster assistance funding adjustments to enable “building back better”.

Local governments have implemented various resilience strategies tailored to their needs. These include the Town of Gibsons Integrated Stormwater Management Plan, the shíshálh Nation Government District Drought Response Plan, SCRD Drought Response Plan, and the District of Sechelt Integrated Community Sustainability Plan. Each plan focuses on addressing specific local risks and enhancing the community’s ability to respond to and recover from disasters. Another example is the partnership between the Town of Gibsons, the SCRD, and Sḵwx̱wú7mesh Úxwumixw (Squamish) Nation on a long-term Aquifer 560 Watershed Agreement, which commits to monitoring programs across the aquifer recharge area extending up the mountain, Chaster, Charman, Gibson and Soames creeks, and the Gibsons harbour in Átl’ḵa7tsem/Howe Sound. Business Continuity Plans are under development to guide internal emergencies and increase the local authority’s ability to provide their critical services.

Implementing local Disaster Risk Reduction (DRR) strategies provides numerous benefits, including safeguarding social and human capabilities, promoting social equality, and reducing economic losses. These strategies sustain economic growth and help build a safe, reliable environment. By fostering decentralized

[45] SCRD Bylaw No. 687. “Part 20 – Penalties and Enforcement.”. Retrieved from: https://www.scrd.ca/wp-content/uploads/2023/02/687-Consolidated-Building-to-include-687.3-effective-2021-JAN-01-to-Present.pdf

competencies and optimizing resources, local DRR initiatives empower communities to be proactive. Collaboration among municipalities, Indigenous communities, and stakeholders ensures these strategies remains effective, creating a robust framework for continuous improvement and resilience building across the region.

The Sunshine Coast Disaster Risk Reduction Strategy will continue to evolve and improve as new work is completed and our understanding of risks and scientific knowledge advances. This dynamic approach ensures the community remains adaptive and resilient in the face of emerging challenges.

SECTION 4: VULNERABILITIES AND RISK DRIVERS

An underlying disaster risk driver are processes or conditions, often development-related, that influence the level of disaster risk by increasing levels of exposure and vulnerability or reducing capacity.

4.1 CRITICAL INFRASTRUCTURE VULNERABILITY

With a region spanning over 3,770 km^2 and serving approximately 30,000 people, there is a relatively extensive network of critical infrastructure along the Sunshine Coast. Critical asset infrastructure are assets that are essential for the functioning of government and society, specifically, water, food, transportation (e.g., BC Ferries), health, energy and utilities, safety, telecommunications and information technology, government, finance, and manufacturing.

Disasters can disrupt pre-existing networks of supply. When just-in-time delivery and inventory practices are followed, there can be gaps in supply and delays in restoring services, with impacts on mental and physical health of the population. The main transportation access to the Sunshine Coast is through marine (BC Ferries) and air access and one secondary highway route (Highway 101, also known as the Sunshine Coast Highway) connecting communities across the Sunshine Coast. These transportation options may be at risk of being interrupted in the event of an emergency or disaster, such as wildfire cutting off main transportation routes up the coast or an earthquake damaging port and airport infrastructure. The Sunshine Coast is ferry accessible via terminals at Earl's Cove in the north and Langdale in the south, both of which are operated by BC Ferries and are considered part of the provincial transportation network. The north terminal provides access to Powell River, itself another ferry access only community. Powell River is also linked to Vancouver Island via an additional ferry at a separate terminal. The south terminal at Langdale connects with West Vancouver and forms a critical transportation link with the rest of the mainland. The south terminal at Langdale is larger and is serviced by larger and more frequent ferries than the north terminal. This south ferry terminal is critical to the economic functioning and wellbeing of all communities on the Sunshine Coast.

There are physical limitations to transportation within the Sunshine Coast. Highway 101 is the main transportation route. This forms the only regional connection with most communities on the Sunshine Coast. In some locations there are bypasses and alternative routes. For example there is a chokepoint at Chapman Creek. The sole vehicle crossing of this creek is near Davis Bay Beach on Highway 101. This bridge is surrounded by forests. If this bridge were compromised, all areas north would be isolated and require servicing or evacuation via the Earl's Cove ferry or other routes.

Several communities are served by rural roads with no alternative access. This includes Port Mellon, Egmont, Garden Bay, portions of the shíshálh Nation Government District, and communities in the Sechelt Inlet. The

islands of Gambier, Keats, Thormanby, Nelson, Hardy and many others are isolated and accessed by boat only. These islands, as small communities, also have limited fire protection resources.

The interruption of supply chains (for example, if ferry service is disrupted) can increase the disaster risk for the Sunshine Coast if fuel, food, medicine and emergency personnel are unable to access communities hit by an emergency or disaster. Response actions and relief supplies may take longer to arrive if transportation routes are interrupted. These types of interruptions (supply chain, transportation routes) can have significant impacts on food security of communities and individuals on the Sunshine Coast.

There are a multitude of critical infrastructure owners and operators in the Sunshine Coast, including federal (e.g., small craft harbours), provincial (e.g., Highway 101, bridges), regional/local governments (e.g., community centres, water and wastewater services), as well as public and private agencies (e.g., airport). These critical infrastructure owners have responsibilities to plan and prepare for emergencies. Once regulations are developed under the new *Emergency and Disaster Management Act*, critical infrastructure owners may be required to develop business continuity plans to ensure adequate operations and availability of services, programs and operations and the timely resumption of services in the event of a major failure, emergency or disaster. Appendix E provides a list of critical asset infrastructure owned and operated by the SCRD and other authorities in the region.

4.2 SOCIAL AND ECONOMIC VULNERABILITIES

Hazard events in different communities reveal significant variations in consequences due to different levels of social vulnerabilities. Some individuals are more vulnerable to hazards than others, and this vulnerability is often influenced by age, economic, social, and political considerations.

Poverty is considered both a driver and consequence of disasters, and those who are economically less well-off tend to suffer the most from disasters. Inequality can limit access to resources, support systems, and information necessary to navigate the post-disaster environment. In BC, the cost of housing and building materials can exacerbate inequalities and increase the precariousness of individuals after an emergency. Those who rent or who cannot afford home insurance, for example, may be more at risk of displacement and homelessness after a disaster if they are unable to afford to re-build or if their rental is damaged and they need to find other housing options in an already expensive market. The Sunshine Coast – like many other communities across BC – has witnessed a steep rise in the price of homes, outstripping the increase in salaries and wages across the same time.

Changing population patterns can affect the vulnerability and resilience of social systems. Disasters can have a different effect on certain communities, specifically those without the necessary resources to cope with and recover from such events. The Sunshine Coast has a population of people 65 years and older of 10,695 (2021 census),[46] which is about 33% of the total population. Older individuals may require additional supports in the event of a disaster, and may be more susceptible to certain risk drivers, such as climate (extreme heat), increasing cost of housing while on a pension, and reduced ability to relocate due to disasters (earthquake that has damaged housing). As more people age, the Sunshine Coast will need more

[46] Statistics Canada. (2023). *Census Profile.* 2021 Census of Population – Sunshine Coast Regional District. Retrieved from: https://www12.statcan.gc.ca/census-recensement/2021/dp-pd/prof/details/page.cfm?Lang=E&DGUIDlist=2021A00035929&GENDERlist=1,2,3&STATISTIClist=1&HEADERlist=0

diverse and affordable housing options that are suited to seniors who wish to age in place and that are built in low-risk areas with climate changes (e.g., extreme heat) considered in the design of buildings.

The following is a summary of other social and economic vulnerability factors that might be impacted by a hazard.

- People with mobility considerations, whether determined by age, health, medical conditions, or physical disability, and those dependent upon others: These individuals may be located at hospitals in the region, or long-term care homes including Christenson Village (long term care facility), Silverstone Senior Care or in infant and childcare facilities. There are approximately 3,810 individuals who are between the ages of 0 and 14 in the Sunshine Coast, which represents about 11% of the total population.[47]
- People who are not proficient in English as their predominant language: There are approximately 120 individuals who either do not speak English (and only speak French) or do not speak either English or French. There are approximately 3,000 individuals whose mother tongue is neither English or French. There are 85 individuals who have knowledge of Indigenous languages, ten with an Indigenous language as a first language, and 15 who regularly speak an Indigenous language at home. Individuals who are not proficient in the language used in emergency response communications may be at risk of missing critical and potentially life saving communications from the Sunshine Coast Emergency Program or the Voyent Alert! system (e.g., related to alternate evacuation routes, or spread of wildfire).
- People with minimal social networks, such a people who have recently arrived in the community, tourists, or seasonal workers: There are approximately 5,850 individuals in the Sunshine Coast considered immigrants to the region, with 460 arriving in 2016 onwards. There are approximately 260 individuals considered as refugees. These individuals may have more limited social networks that would be available to assist in sharing emergency information, who may experience digital connectivity limitations if they do not have a cell phone or access to broadband internet, or who are not familiar with digital emergency platforms and would not easily receive digital alerts and warnings.
- People already displaced such as those experiencing homelessness, and people in transition houses: The Sunshine Coast's Housing Needs Report Implementation Framework states that over the last 15 years the Coast has experienced an increase in the cost of housing. Middle income earners are being priced out of the home ownership market, and renter households struggle to find affordable and available long-term rentals.[48] The Sunshine Coast Resource Centre 2021 Poverty Reduction Strategy indicates that homelessness increased by 40% from 2018 to 2020.[49] Shelters are at capacity and

[47] Statistics Canada. (2023). *Census Profile.* 2021 Census of Population – Sunshine Coast Regional District. Retrieved from: https://www12.statcan.gc.ca/census-recensement/2021/dp-pd/prof/details/page.cfm?DGUIDlist=2021A00035929&GENDERlist=1&HEADERlist=0&Lang=E&STATISTIClist=1&SearchText=Sunshine+Coast

[48] Sunshine Coast Housing Needs Report Implementation Framework. (December 2020), pg. 6. Retrieved from: https://gibsons.civicweb.net/document/89617/2021-01-12%20HNA%20Implementation%20Framework%20Report%20to%20.pdf?handle=92F53BD2211A4454A46988DE2F99C9C5

[49] The Sunshine Coast Resource Centre (2021). 2021 Poverty Reduction Strategy. Retrieved from https://resourcecentre.ca/plan/poverty-reduction/

waitlists for supportive housing are longer than the current spaces provided.[50] Seniors are also struggling to find housing, with 300 seniors on the waitlist for 150 senior housing units in 2021.[51]

- People who commute outside of their community for work: Of the approximately 7,850 individual who commute for work, about half (3,385) commute to a place of work within their municipality in which they live, with the other half (3,680) commuting to another municipality. The vast majority rely on personal vehicles (cars, trucks, vans) to commute to work, with the remainder using public transit (395), walking (805), bike (115) or other methods (390).
- Significant or large labour forces employed in a single industry (e.g., pulp mill): There is no predominant industry in the Sunshine Coast. The labour force is distributed across various sectors, with the major employment sectors including construction (1,805 individuals), retail trade (1,715 individuals), professional, scientific and technical services (1,485 individuals), health care and social assistance (1,775 individuals), and accommodation and food services (1,120 individuals).[52]
- People living in poverty with limited financial resources to support their personal emergency preparedness and adaptation to changing climate conditions: In 2021, 18% of residents on the Sunshine Coast were living in poverty, including 1 in 4 children and over half of single-parent households. Parents are also limited in their ability to earn a living due to lack of childcare, with 80% of parents on the Sunshine Coast unable to find licensed childcare. [53]
- Areas important for hunting, fishing, or other food harvesting: The Sḵwx̱wú7mesh Nation's Xay Temíxw (Sacred Land Use Plan) and shíshálh Nation's lil xemit tems swiya nelh mes stutula (Strategic Land Use Plan) provide information related to some areas of cultural importance.

4.3 PHYSICAL AND ENVIRONMENTAL VULNERABILITIES

The Sunshine Coast includes a diversity of sensitive aquatic and terrestrial ecosystems. These systems hold cultural, ecological and social value, including providing habitat for plants and animals, cultural heritage areas of interest (including Indigenous cultural areas of interest), and social values to communities and individuals across the Sunshine Coast who live and recreate within these ecosystems and environments. Ecosystems can also provide 'nature-based services' that can address socio-environmental issues, such as storm surge protection (e.g., coastal ecosystems), water filtration and provision (e.g., wetlands, lakes, streams, aquifers), enhance biodiversity (e.g., protected natural areas, Provincial and National Parks). However, environmental and biodiversity loss has significant and wide-ranging implications for communities. Declining ecosystems can be reflected in species loss, soil degradation, loss of fish stocks, deforestation, and pollution. The implications can include food insecurity, water shortages, erosion leading to heightened safety risks or loss of public and private property, reduced nature-based services (e.g., coastal protection), or loss of cultural heritage and tourism values.

The following is a summary of additional physical and environmental factors that may impact the vulnerability of the Sunshine Coast:

- Unregulated land use, or areas outside of local jurisdiction or control.

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[50] Sunshine Coast Housing Needs Report Implementation Framework. (December 2020), pg. 6. Retrieved from: https://gibsons.civicweb.net/document/89617/2021-01-12%20HNA%20Implementation%20Framework%20Report%20to%20.pdf?handle=92F53BD2211A4454A46988DE2F99C9C5

[51] The Sunshine Coast Resource Centre (2021). 2021 Poverty Reduction Strategy. Retrieved from https://resourcecentre.ca/plan/poverty-reduction/

[52] Statistics Canada. (2023). *Census Profile.* 2021 Census of Population – Sunshine Coast Regional District. Retrieved from: https://www12.statcan.gc.ca/census-recensement/2021/dp-pd/prof/details/page.cfm?DGUIDlist=2021A00035929&GENDERlist=1&HEADERlist=0&Lang=E&STATISTIClist=1&SearchText=Sunshine+Coast

[53] The Sunshine Coast Resource Centre (2021). 2021 Poverty Reduction Strategy. Retrieved from https://resourcecentre.ca/plan/poverty-reduction/

- Structures built prior to current building codes that may be more at risk of structural failure in the event of an emergency such as an earthquake.
- Structures built in hazardous areas, for example historical flood plains, or below projected sea water levels by 2100.
- Remote communities with limited access that may be more at risk of being cut off during an emergency, for instance, if landslides from heavy precipitation events cut off ingress and egress to remote communities.
- Hazardous industry or activities in the community, such as the Domtar (Howe Sound) Pulp and Paper Mill, which uses large quantities of hazardous materials like sulfuric acid, caustic soda, sodium chlorate, chlorine dioxide, hydrogen peroxide, and propane.
- Coastline and watersheds that may be susceptible to coastal surges or flooding events, impacting the built environment (e.g., coastal communities, critical infrastructure).
- Areas previously impacted by a disaster that may not have sufficiently recovered to the level that would be required to withstand another emergency or disaster.
- Changes in ecosystem health or diversity, including the loss of natural assets and nature-based services that would otherwise provide protection against certain emergencies, such as coastal habitats that protect against storm surges or protected areas in watersheds that hold greater amounts of water compared to the built environment.
- Unsustainable resource management practices that create vulnerabilities to the community, including tree species selection in the forestry sector that may be more prone to drought and wildfire.

4.4 SITES OF HERITAGE VALUE

The Sḵwx̱wú7mesh Nation's Xay Temíxw (Sacred Land Use Plan) and shíshálh Nation's lil xemit tems swiya nelh mes stutula (Strategic Land Use Plan) provide information related to some areas of cultural importance.

The SCRD maintains a Heritage Register of properties with heritage significance. These are wood-framed buildings and include several community halls, several of which were initially constructed as schools or churches.

4.5 CLIMATE CHANGE

Climate change is a current and evolving reality across Canada, British Columbia, and the Sunshine Coast. The Sunshine Coast is facing a wide range of climate impacts that will strain adaptive capacity and resources. Some of these instances include drought and wildfires, extreme heat such as the heat dome event of 2021, and extreme rainfall events such as the 2021 atmospheric river. These changes are largely driven by the emissions of greenhouse gases being released into the atmosphere by human-related activities. BC's coastal areas – including the Sunshine Coast – are experiencing sea level rise, coastal erosion and changes to aquatic ecosystems, with impacts to lives, livelihoods, communities, health and well-being, cultures and the natural environment.[54] The SCRD is projected to see changes in temperatures, precipitation patterns, drought and sea level rise, in both the mid-and long-term. Climate change can magnify disaster risk by increasing the

[54] Canada's National Adaptation Strategy. Retrieved from: https://www.canada.ca/en/services/environment/weather/climatechange/climate-plan/national-adaptation-strategy/full-strategy.html#toc0

hazard (e.g., extreme rain events, extreme heat events) while at the same time decreasing the ability of households and communities to be and remain resilient.

According to the World Meteorological Organization, there is a 66% likelihood that annual average near-surface global temperatures between 2023-2027 will be more than 1.5 0℃ above pre-industrial levels for at least one year, fuelled by GHG emissions and naturally occurring El Nino events.[55] Droughts, sea level rise, infectious diseases, wildfires, extreme rain, and extreme heat are some of the projected impacts of climate change that will drive disaster risk. However, disaster risk can be reduced through investments in infrastructure, local governance, and in services that support vulnerable populations.[56]

Appendix H has more information specific to climate risk drivers, including changes in temperature and precipitation because of climate change.

SECTION 5: HAZARD RISK ASSESSMENT

5.1 ALL HAZARDS SUMMARY

Table 7 below provides the methodology for how risk is determined for each of the hazards identified for the Sunshine Coast. The likelihood and consequence scores for each hazard were plotted on a Risk Matrix (below) to provide a summarized and visual representation of the risks across all tier one hazards identified for the Sunshine Coast. Additional details for each hazard are included in the hazard write up section immediately following the risk matrix.

[55] "Climate change drives disaster risk". PreventionWeb – UNDRR. Retrieved from: https://www.preventionweb.net/understanding-disaster-risk/risk-drivers/climate-change

[56] Ibid

Risk Matrix

Likelihood								
		Almost Certain (annual chance ≥ 50%)	E	**Lightning**	**Extreme heat Electrical outages**	**Structural fire**	**Drought**		
	High	**Likely** (10% ≤ annual chance < 50%)	D		**Air quality Hail Snowstorm Subsidence Storm surge Land subsidence Marine Vessel Incident**	**Plant disease & pest infestation Landslides Local flooding Coastal flooding Freshet, river, creek flooding Flash flood Telecomm interruption Transportation interruption Water service interruption**	**Wildfire**		
	Med	**Possible** (2% ≤ annual chance < 10%)	C		**Food source interruption Wastewater interruption Fuel source interruption**	**HazMat spills**	**Public health crisis Liquefaction**	**High wind event / hurricane**	
	Low	**Unlikely** (1% ≤ annual chance <2%)	B			**Oil and gas pipeline spill**	**Tsunami**	**Earthquake**	
		Rare (annual chance <1%)	A		**Mine incident**	**Glacier outburst floods**		**Dam / spillway breach**	
				0-5	6-13	14-21	22-29	30-37	38-44
				Low		**Medium**		**High**	
				Consequences					

Table 7: Risk matrix for tier one hazards identified for the Sunshine Coast.

As can be seen in the risk matrix, the most significant hazards which are of greatest concern for the Sunshine Coast are drought, wildfire, structural fire, and high wind events. Other hazards, such as lightning are almost certain to occur but with low consequence scores. Similarly, earthquakes are less likely to occur, but the consequences would be significant. These assessments are considered estimates based on information (often incomplete) at a specific moment in time. Given hazards and the risk drivers behind them are evolving, sometimes quickly, risk assessments should be updated regularly.

In the following section, each hazard write-up includes a summary table with *Current Likelihood, Consequence Score, Current Risk Level, Future Likelihood, Climate Risk Drivers* and *Anticipated Change In Likelihood From Climate Risk Drivers.*

Climate Risk Drivers are identified with icons to demonstrate if the hazard is influenced by the following climate variables (see table 8 below). Each of these variables and their projected changes that may be experienced in the Sunshine Coast is discussed in Appendix H: Climate Risk Drivers. The identification of specific climate risk drivers is intended to be illustrative of how a changing climate may impact existing hazards.

Climate Variable			
Annual mean temperature	Seasonal mean temperature	Temperature extremes	Annual mean precipitation
Seasonal mean precipitation	Max 5-day precipitation	Sea level rise	

Table 8: Primary climate variables and icons identified for tier 1 hazards.

Changes in likelihood from climate risk drivers

Hazard summary tables in the following section utilize arrows and circles as a visual tool to represent expected changes in the likelihood of various hazards due to climate risk drivers. The direction and color of these arrows carry specific meanings. For instance, green arrows pointing upwards or downwards signify an increase or decrease in likelihood, respectively. A blue circle is used to denote either no change in likelihood or less certainty regarding the impact of climate risk drivers on the likelihood of a hazard. Purple arrows upwards or downwards are used to indicate a predicted change in the frequency of a hazard, but this does not necessarily imply a change in the overall likelihood rating of the hazard. There are also instances where certain hazards, such as tsunamis or hazardous material spills, may not undergo any shift in likelihood due to climate risk drivers, and these are marked as "N/A". These indicators are designed to provide only a visual representation of potential future changes in hazard likelihood.

Icon	Meaning
	Increase or decrease in likelihood.
	Predicted change in frequency, but not necessarily a change in overall likelihood.
	No change in likelihood or lesser degree of certainty regarding a potential change in likelihood.
N/A	No link between climate change and likelihood of hazards.

1. ATMOSPHERIC

1.1. AIR QUALITY

Hazard and Climate Risk Assessment

Hazard	Current Likelihood	Consequence Score	Risk Level	Future Likelihood	Climate risk drivers	Anticipated change in likelihood
Air Quality	D	**12**	**High Likelihood / Low Consequence**	E		

Background of hazard

Air quality deteriorates and becomes a hazard when air contains particulate matter, gases, fumes, or odours in amounts that are harmful to humans, increasing incidences of stroke, heart disease and acute respiratory diseases. As seen in Figure 7, the Province of BC uses the Air Quality Health Index on a scale of 1 (low) to 10+ (very high) to report on the health risks posed by a mixture of pollutants, including particulate matter, ground-level ozone, and nitrogen dioxide. Wildfire smoke, specifically small particulate matter with a size of 2.5 micrometers or less is considered the biggest public health concern from outdoor air pollution in BC. The preference for woodfire heating in many households on the Sunshine Coast also contributes to increased smoke and reduced air quality.

Health Risk	AQHI Index	Health Messages	
		At Risk Population[1]	General Population
Low	1 - 3	**Enjoy** your usual outdoor activities.	**Ideal** air quality for outdoor activities.
Moderate (MOD)	4 - 6	**Consider reducing** or rescheduling strenuous activities outdoors if you are experiencing symptoms.	**No need to modify** your usual outdoor activities unless you experience symptoms such as coughing and throat irritation.
High	7 - 10	**Reduce** or reschedule strenuous activities outdoors. Children and the elderly should also take it easy.	**Consider reducing** or rescheduling strenuous activities outdoors if you experience symptoms such as coughing and throat irritation.
Very High	Above 10	**Avoid** strenuous activities outdoors. Children and the elderly should also avoid outdoor physical exertion.	**Reduce** or reschedule strenuous activities outdoors, especially if you experience symptoms such as coughing and throat irritation.

[1] People with heart or breathing problems are at greater risk. Follow your doctor's usual advice about exercising and managing your condition.

Figure 7: BC Air Quality Health Index.

Specific likelihood considerations

Given the extensive forested areas that characterize the Sunshine Coast and the common type of development (dense urban areas, wooden structure, isolation from rest of BC with reliance on marine transportation, critical infrastructure located within the wildland-urban interface), the SCRD is vulnerable to wildfires,[57] which can cause negative health impacts from deterioration in air quality, especially for individuals with pre-existing health conditions. The likelihood of deteriorated air quality in the SCRD is high.

[57] Sunshine Coast Regional District Community Wildfire Protection Plan. (2020). Retrieved from: https://www.scrd.ca/wp-content/uploads/2022/11/Sunshine-Coast-Regional-District-Community-Wildfire-Protection-Plan-compressed.pdf

Specific consequence considerations

Consequences of a deterioration in air quality from increase atmospheric ozone and particulate matter may include increased rates of respiratory illnesses and other physical impacts (e.g., headaches, eye irritation) which can be more severe for children, older adults and those with pre-existing medical conditions, and increased levels of residents seeking medical attention, which can put a drain on emergency support services (e.g., emergency rooms). If air quality in the SCRD deteriorates, there may be a reduction in tourism to the Coast, with associated implications for local businesses and sectors relying on tourism for livelihoods.

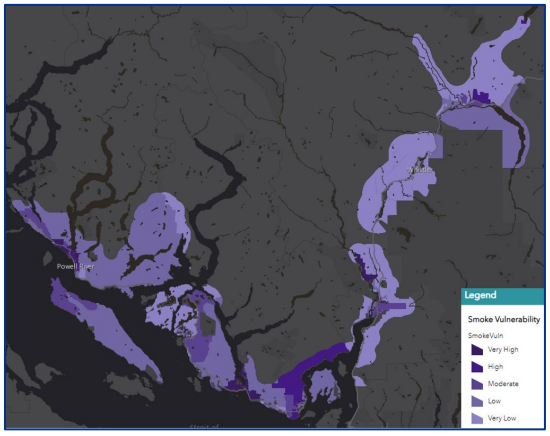

Figure 8: Smoke Vulnerability[58]

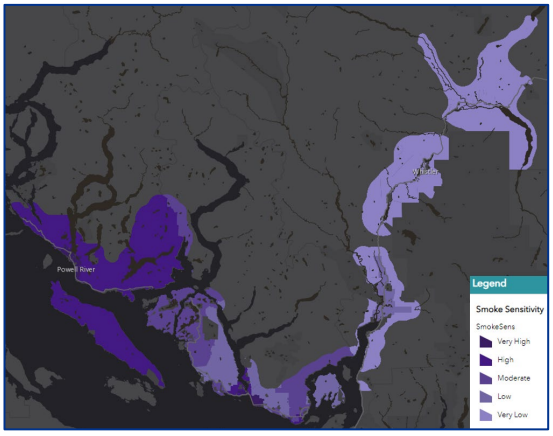

Figure 9: Smoke Sensitivity[58]

Figures 8 and 9 are part of a larger data series dedicated to the entire Vancouver Coastal Health region and show vulnerability to wildfire smoke events and sensitivity to wildfire smoke, respectively, across the SCRD (as well as neighbouring Districts). Community vulnerability is defined and mapped here as a function of exposure to wildfire smoke, sensitivity to its effects, and adaptive capacity to deal with these effects. Darker shades of purple indicate communities that are more vulnerable to wildfire smoke events than communities represented by lighter shades.

Sensitivity is determined by two key factors: the age of the population, and their pre-existing health conditions. Both sensitivity determinations were found by UBC researchers to affect individual health during wildfire smoke events. For example, inhaling wildfire smoke can exacerbate asthma and chronic obstructive pulmonary disease, especially in children and the elderly.

[58] Vancouver Coastal Health Mapping Tool. (2021). Retrieved from: https://vch.maps.arcgis.com/apps/webappviewer/index.html?id=ca25c32e25794ef0803868d38817bd2e

1.2. EXTREME HEAT

Hazard	Current Likelihood	Consequence Score	Risk Level	Future Likelihood	Climate risk drivers	Anticipated change in likelihood
Extreme Heat	**E**	**10**	**High Likelihood / Low Consequence**	**E**		

Background of hazard

Extreme heat can be characterized by temperatures significantly above the mean for an extended period, or by a combination of high temperatures with high humidity and a lack of air motion. In the SCRD, a Level 1 heat warning is triggered when there are two or more days in which forecasted daytime maximum temperatures are 29℃ or greater and overnight minimum temperatures are 16℃ or greater.[59] Level 2 extreme heat emergency warning is triggered when a Level 1 warning has been met and forecasts indicate that daily highs will substantially increase day over day for two days or more.

The SCRD has experienced an average of 0.5 days of heatwave conditions in the baseline period. According to the RCP8.5, the district can expect to see an average heatwave event occurring for 3.9 days in the 2051-2080 period. Overall, Western Canada is on average one to two degrees warmer than it was in the 1940s.[60]

Heat domes, as a special type of extreme heat, occur when high-pressure system traps heat near the surface of the earth and gets held in place by blocked jet streams.[61] From June 25-July 1, 2021, many parts of the province experienced an unprecedented heat dome that resulted in record high temperatures across many parts of the province that persisted over several days. There were 619 deaths attributed to this heat event, most of whom were older adults with compromised health due to multiple chronic diseases and who lived alone.[62]

Following the heat dome event, the Chief Coroner convened a death review panel to review the circumstances around these deaths to identify actions to improve public safety and prevent future deaths. The panel identified three key areas to reduce heat-related deaths:

- A coordinated provincial heat alert response system.
- Ensuring vulnerable populations are identified and supported during extreme heat events.
- Implementing prevention and longer-term risk mitigation strategies.

[59] Sunshine Coast Regional District Extreme Heat Plan. (February 2024). Retrieved from: https://www.scrd.ca/wp-content/uploads/2024-MAR-14-COW-Agenda-Package.pdf?utm_source=coast%20reporter&utm_campaign=coast%20reporter%3A%20outbound&utm_medium=referral

[60] "Be prepared for extreme heat and drought." (January 15, 2024). Government of British Columbia. Retrieved from: https://www2.gov.bc.ca/gov/content/safety/emergency-management/preparedbc/know-your-hazards/severe-weather/extreme-heat

[61] Draft BC Provincial Heat Alert and Response System. (BC HARS): 2023. Retrieved from: http://www.bccdc.ca/resource-gallery/Documents/Guidelines%20and%20Forms/Guidelines%20and%20Manuals/Health-Environment/Provincial-Heat-Alerting-Response-System.pdf

[62] BC Coroners Service. (June 7, 2022). Extreme Heat and Human Mortality: A Review of Heat-Related Deaths in BC in Summer 2021. Retrieved from: https://www2.gov.bc.ca/assets/gov/birth-adoption-death-marriage-and-divorce/deaths/coroners-service/death-review-panel/extreme_heat_death_review_panel_report.pdf

In response to the 2021 heat dome, the Province created a two-tier heat alert and response system (HARS), which was released in June 2022. The two tiers are: Heat Warning and Extreme Heat Emergency.[63]

The SCRD recently released a "Sunshine Coast Extreme Heat Plan" (February 2024)[64] developed to protect the health and safety of sensitive populations such as the elderly, children, and un-housed persons who are most susceptible to extreme temperature events. The goals of the plan are to:

- Alert the public and community partners to extreme heat risks.
- Increase public awareness regarding extreme heat preparedness and heat health safety.
- Validate extreme heat response measures and identify opportunities to improve.

The Vancouver Coastal Health's Heat and Smoke Plan, which includes communities on the Sunshine Coast, identifies key populations at risk to extreme heat as "older adults, infants and children, pregnant women, people with pre-existing medical conditions (including mental illness), people experiencing material and/or social deprivation; people who are socially isolated and/or live alone; people who live with addictions and substance use; people who are homeless and under-housed; people who live in homes without mechanical ventilation, air filtration systems or portable air cleaners".[65]

Specific likelihood considerations

Extreme heat days (particularly days above 32°C) are projected to become more common, with approximately a 70% probability of above normal temperatures.[66] In the southern coast region of BC, including much of the Sunshine Coast, the number of days over 30°C is projected to increase to 7 days between 2021-2050, up from 2 days average between 1976-2005.[67] The SCRD may see the average number of very hot days per year exceeding 14 days by 2080.[68] The forecasted average hottest day for the SCRD is projected to be 35°C by the 2051-2080 period.[69]

Climate scientists anticipate that the Vancouver Health Region, which includes communities in the Sunshine Coast, will experience heat dome events of this magnitude every 5 to 10 years by 2040, as shown in Figure 10.[70]

[63] Draft BC Provincial Heat Alert and Response System (BC HARS): 2023. Retrieved from: Provincial-Heat-Alerting-Response-System.pdf (bccdc.ca)
[64] Sunshine Coast Regional District Extreme Heat Plan. (February 2024). Retrieved from: 2024-MAR-14-COW-Agenda-Package.pdf (scrd.ca)
[65] Office of the Chief Medical Health Officer, Vancouver Coastal Health (2023). Heat and Smoke Plan.
[66] Environment Canada. Seasonal forecasts for Canada. (2023). Retrieved from: https://climate-scenarios.canada.ca/?page=cansips-prob&utm_source=coast%20reporter&utm_campaign=coast%20reporter%3A%20outbound&utm_medium=referral
[67] Climate Data Canada (2024). Retrieved from: https://climatedata.ca/explore/location/?loc=JBQWM&location-select-temperature=txgt_30&location-select-precipitation=prcptot&location-select-other=frost_days
[68] Sunshine Coast Regional District Extreme Heat Plan. (February 2024). Retrieved from: 2024-MAR-14-COW-Agenda-Package.pdf (scrd.ca)
[69] Canada Climate Data. (2024). Retrieved from: https://climatedata.ca/explore/location/?loc=JBQWM&location-select-temperature=tx_max&location-select-precipitation=prcptot&location-select-other=frost_days
[70] Vancouver Coastal Health (2023). Protecting Population Health in a Climate Emergency. Retrieved from https://www.vch.ca/sites/default/files/2024-02/vch-climate-change-health-report.pdf

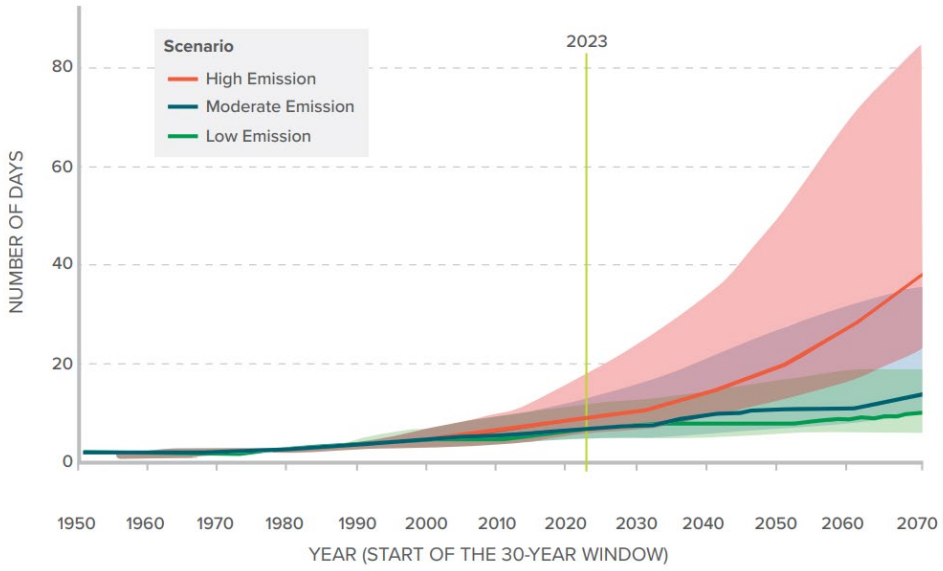

Figure 10: Number of days per year over 29C in the VCH region (averaged over 30 years using historical data from 2950-2014). Source: Vancouver Coastal Health, 2023.

Specific consequence considerations

Extreme heat can result in a variety of health disorders, including increased risk of respiratory and cardiac issues due to reduced air quality from increase atmospheric ozone and particulate matter.[71] An increase in hot days, average summer temperatures, and extended drought can lead to strain on water systems resulting in reduced water quality and quantity. Increased annual and seasonal temperatures, when combined with decreased summer precipitation can result in increased likelihood and frequency of wildfires. The 2021 Heat Dome was the first time some beaches in the SCRD were closed due to E. coli.[72]

Extreme heat can impact a utility or local government's ability to provide services the community relies upon, including: increased water treatment operating costs, unscheduled power outages, interruptions to government services (e.g., waste collection), increased demand for water resulting in water supply issues, limited municipal staff due to planned vacations, competition for local and regional cooling resources, supply chain interruptions, overwhelmed emergency services, reduced or modified hours of operation for outdoor services and the need for additional water breaks.[73]

[71] BC Government. (July 2019). Preliminary Strategic Climate Risk Assessment, pg. 309. Retrieved from: www2.gov.bc.ca/assets/gov/environment/climate-change/adaptation/prelim-strat-climate-risk-assessment.pdf

[72] Information provided directly by SCRD.

[73] Sunshine Coast Regional District Extreme Heat Plan. (February 2024). Retrieved from: https://www.scrd.ca/wp-content/uploads/2024-MAR-14-COW-Agenda-Package.pdf?utm_source=coast%20reporter&utm_campaign=coast%20reporter%3A%20outbound&utm_medium=referral

Many homes in the Sunshine Coast are not equipped with cooling systems, given the historically moderate summer temperatures. Further, with 40% or more of all renter households living in unaffordable housing across the Sunshine Coast (2016), there may be limited fiscal means for renters to purchase mobile air conditioners. Community provided official cooling centres – and adequate public transportation options for residents to access these centres – will be critical for the Sunshine Coast to provide as extreme heat events become more common. In the 2023 heat warning, the district made two air-conditioned spaces available for the community to take some time out of the heat (Gibsons & Area Community Centre and the Sechelt Aquatic Centre).

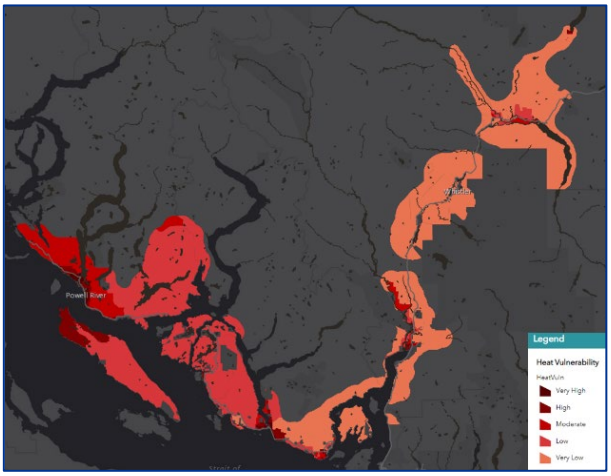

Figure 11: Heat Vulnerability

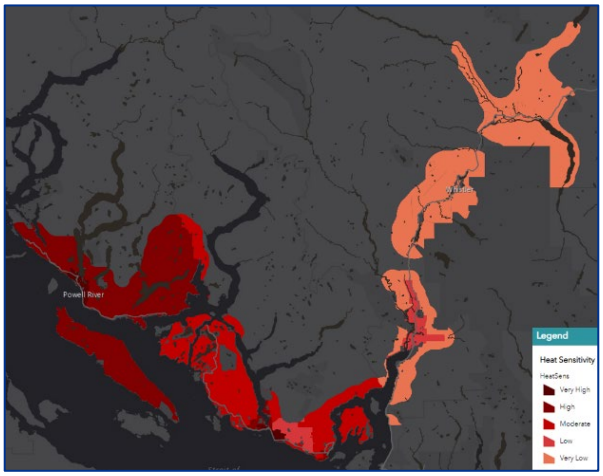

Figure 12: Heat Sensitivity

Figures 11 and 12 are part of a larger data series dedicated to the entire Vancouver Coastal Health region and show vulnerability to extreme heat events and sensitivity to extreme heat, respectively, across the Sunshine Coast (and neighbouring Districts). Community vulnerability is defined and mapped here as a function of exposure to higher temperatures, sensitivity to higher temperatures, and adaptive capacity to deal with these effects. Darker shades of red indicate communities that are more vulnerable to extreme heat events than communities represented by lighter shades.

Sensitivity is determined by two key factors: the age of the population, and their pre-existing health conditions. For example, elderly people are more prone to heat-related illnesses such as heat stroke and heat exhaustion. This layer of the map helps us understand where those people are located. Darker shades of red indicate communities that share similarly high numbers of elderly people and people with pre-existing health conditions that make them more sensitive to higher temperatures.

shíshálh Nation Government District

The shíshálh Nation Government District lands in the southeast adjacent to the District of Sechelt is connected to the Chapman Creek water system. During extreme and potentially prolonged heat events, water resources could be negatively affected (both in quantity and quality). Extreme heat events may be directly linked to water service interruption, impacting residents of the shíshálh Nation Government District.

Town of Gibsons

The Town of Gibsons provides water to most of its residents from the Gibsons Aquifer via a system of wells. Water is pumped from the aquifer using wells, which is then stored in reservoirs. The Town relies on the SCRD for emergency storage, specifically to meet fire flow standards. During extreme and potentially prolonged heat events, water sources may be overdrawn for landscaping purposes or for individuals to keep body temperatures down (e.g., portable pools). Water quality and quantity could be negatively affected. Heat events may be directly linked to water service interruption, impacting the Town of Gibsons residents.

District of Sechelt

The District of Sechelt is connected to the Chapman Creek water system. During extreme and potentially prolonged heat events, water resources could be negatively affected (both in quantity and quality). Extreme heat events may be directly linked to water service interruption, impacting the District of Sechelt and communities across the Sunshine Coast who are also connected to the Chapman Creek water system (or the North and South Pender water systems).

Keats and Gambier Islands

Most Keats Island properties are required to provide their own water supply. However, the Eastbourne, Keats landing, and Melody Point developments all have their own small-scale water supply and distribution systems. The Eastbourne water system supplies approximately 175 connections and consists of the following wells – 1) Gordon Well and Old East Well, two 6.1 m shallow wells, 2) Drilled Well, a 91.4 m deep well in the bedrock, and 3) Collector Well, a trench and sump system that collects surface water and groundwater. These wells rely on precipitation for recharge. [74] The water system is strained and at risk of not being able to meet the water demands of residents, with an estimated supply deficit of 25.92m^3/day.[75] Residents on this water system are regularly under Stage 4 water restrictions throughout the summer, with no redundancy in the water supply sources in case the only well producing during a drought situation (the drilled well) ran dry or had to be taken offline.[76] The availability of water may become more limited during extreme heat events, especially if the heat events are prolonged. Gambier Island does not have a centralized water supply system, with residents relying on wells. Extreme heat events may impact aquifers on Gambier Island differently, depending on the location and availability of water in the aquifer.

Past Events

- June 2021 heat dome event when consecutive days of record-setting heat hit the region.

[74] Sunshine Coast Regional District. (2024). Water Supply and Distribution – Eastbourne Water System. Retrieved from: https://www.scrd.ca/water-distribution/

[75] Committee of the Whole. (October 26, 2023). Sunshine Coast Regional District. Retrieved from: https://www.scrd.ca/wp-content/uploads/2023-OCT-26-COW-Agenda-PACKAGE.pdf?utm_source=coast%20reporter&utm_campaign=coast%20reporter%3A%20outbound&utm_medium=referral

[76] Ibid

1.3. HAIL

Hazard	Current Likelihood	Consequence Score	Risk Level	Future Likelihood	Climate Risk Drivers	Anticipated change in likelihood
Hail	**D**	**9**	**High Likelihood / Low Consequence**	**D**		

Background of hazard

Hail forms in the core of thunderstorms. Water vapour in warm, rapidly rising air masses condenses into water at higher, cooler altitudes. If it is cold enough, ice crystals can form around minute particles such as dust. Hail generally has a diameter of five millimeters or more, while smaller particles may be classified as either ice pellets or snow pellets. When the ice pellets are too heavy for the air currents to lift, they fall as hail. They may become larger, heavier, and more damaging if they collect more water on the way down. The impact and hazard of hailstorms is, in many respects, similar to blizzard conditions, as agriculture and property are both seriously damaged by hail.

Typically, these events occur in central Canada and throughout the prairies and do not generally occur along the Pacific coast where temperatures are warmer than the interior.

Specific likelihood considerations

Hail typically occurs in central Canada and not close to the coast. However, climate change may impact the frequency and severity of hail occurring in the SCRD. The extent to which the likelihood may change over time is uncertain.

Specific consequence considerations

Hail can grow larger than 10 centimetres, and hit the ground at 130 kilometres/hr, causing severe damage to crops, houses, and vehicles as well as injuries to people and animals. The insured losses can be extensive, with estimates of $8 to $14 billion a year in the US.[77]

[77] Henson, B. (March 2022). "Hailstorms and climate change: What to expect". Yale Climate Connections. Retrieved from: https://yaleclimateconnections.org/2022/03/hailstorms-and-climate-change-what-to-expect/

1.4. HURRICANE/HIGH WIND

Hazard	Current Likelihood	Consequence Score	Risk Level	Future Likelihood	Climate Risk Drivers	Anticipated change in likelihood
Hurricane / High Wind	**C**	**31**	**Medium Likelihood / High Consequence**	**C**		

Background of hazard

Hurricanes and high wind events are usually defined as storms with winds of greater than 110 km/hr, and usually over 600 kms in diameter. While the risk of an actual hurricane is low in BC, the effects of a hurricane or high wind event may be approximated in the local context by the severe winter storm. The effects of these storms can be extensive and costly, especially for coastal areas.

Generally, hurricane or hurricane-type storms approach coastal BC as remnants of typhoons that originate off Asia, or as extra-tropical storms traveling in a north-westerly direction from the Pacific Ocean.

Specific likelihood considerations

SCRD is not in a high-risk zone for these types of storms, but they have occurred with relative frequency and have capacity to cause widespread damage.

Specific consequence considerations

Hurricanes and high wind events can cause extensive flooding and damage critical infrastructure, including communication networks, power supplies, sewage systems, water supplies and transportation networks including ferry service, as heavy rains are often accompanied by high winds. Other related impacts include landslides, slumping or subsidence, as soil becomes waterlogged and saturated with rain and road washouts.

Past events

- October 12, 1962, BC received the final effects of Typhoon Freda, which hit Vancouver and Victoria, killing seven people and causing an estimated $10 million in damages to buildings and hydro lines. Winds were recovered at an average of 74 km/h with gusts reaching up to 145 km/h.[78]
- October 11-12, 1984, BC received the tail end of Hurricane Ogden which swept through the west coast of BC, killing five fishermen and causing considerable damage.[79]
- October 21, 2021, BC received wind warnings for several areas of the coast including Central Coast, Sunshine Coast, Haida Gwaii and parts of Vancouver Island, with gusts in some exposed areas reaching up to 120km/hr, which is Category 1 hurricane levels.

[78] Sunshine Coast Regional District. (2005). Hazard, Risk and Vulnerability Analysis, pg. 11. Retrieved from: https://www.scrd.ca/wp-content/uploads/2022/11/HRVA-SCRD_FINAL.pdf

[79] Ibid

1.5. LIGHTNING

Hazard	Current Likelihood	Consequence Score	Risk Level	Future Likelihood	Climate Risk Drivers	Anticipated change in likelihood
Lightning	E	**5**	**High Likelihood / Low Consequence**	E		

Background of hazard

Lightning is caused by the union of three contingent factors: moisture laden air, the instability of existing weather systems and a triggering agent which causes air near the ground to ascend. Climate change may be increasing the occurrence of lightning flashes.[80] It is estimated that with every one degree of warming, there is an 12% increase in lightning activity.[81]

Specific likelihood considerations

Lightning strikes are a common occurrence over the Sunshine Coast during summer months. There is a high likelihood of lightening occurring in the future.

Specific consequence considerations

Lightning strikes can damage transmission lines, affect aircraft, disrupt communication systems, damage or destroy structures, and cause forest fires (see additional hazard analysis related to wildfire and related consequences). In 2023 the Clowholm Lake wildfire was started by lightning. According to the BC government, most wildfires in BC are started by lightning strikes. The 10-year average, taken from 2012-2022 is 58% of wildfire starts were lightning caused.[82] Lightning strikes can also cause severe or fatal injuries to people. The SCRD has extensive forested areas intermixed with urban centres, which contributes to the vulnerability of the region to lightening-induced wildfires.

[80] Perez-Invernon, F., Gordillo-Vazquez, F., Huntrieser, H., and Jockel, P. (2023). Variation of lightning-ignited wildfire patterns under climate change. Nature Communications. 14(739).

81 Donaldson, D., Barnett, A., Brandes, O.M., Kriese, K., O'Riordan, J. (2024). Learning to Live with Fire: State of Wildfire in B.C., Policy, Programs & Priorities – A Primer. Victoria, Canada. POLIS Project on Ecological Governance, Centre for Global Studies, University of Victoria. Retrieved from: https://poliswaterproject.org/wp-content/blogs.dir/162/files/sites/162/2024/05/FINALDesigned_StateOfWildfire_WebCopy.pdf

[82] Wildfire averages. (2024). Province of British Columbia. Retrieved from: https://www2.gov.bc.ca/gov/content/safety/wildfire-status/about-bcws/wildfire-statistics/wildfire-averages

1.6. SNOWSTORM

Hazard	Current Likelihood	Consequence Score	Risk Level	Future Likelihood	Climate Risk Drivers	Anticipated change in likelihood
Snowstorm	**D**	**11**	**High Likelihood / Low Consequence**	**D**		

Background of hazard

Snowstorms vary from light sprinkles of snow to accumulations of several metres. Unlike blizzards, they are not associated with high winds. Blizzards are a dangerous type of winter storm characterized by strong winds, snow, and reduced visibility. Environment Canada issues a blizzard warning for snow events when winds of 40km/hr or greater are expected to cause widespread reductions in visibility to 400 meters or less, due to blowing snow, or blowing snow in combination with falling snow, for at least 4 hours.[83]

Populations in areas that do not usually receive much snow on an annual basis may be severely impacted by even moderate accumulations of snow. Snowstorms are made more hazardous when they are followed by rapidly warming temperatures, which can lead to surges in stream and water runoff flow resulting in flooding from rivers cresting their banks.

Specific likelihood considerations

Climate models anticipate an average 37% reduction in precipitation falling as snow during the winter season, increasing to a 56% reduction in the 2050s.[84] Increases in temperatures – both annual and seasonal – and decrease in cold days overall reduce the frequency of snowstorms affecting the Sunshine Coast. Though it is uncertain the extent to which the likelihood is reduced overall.

Specific consequence considerations

The wide distribution networks of hydroelectric and communication lines and towers are also affected by heavy snowfall. Accumulation of snow on those lines may cause breakage, disrupting service and power. Transportation, including ferry access to and from the Sunshine Coast may be interrupted or delayed due to heavy snowfall, and dangerous driving conditions may cause motor vehicle accidents as a corollary effect of inclement weather.

[83] Environment Canada. (2024). Criteria for public weather alerts. Retrieved from: https://www.canada.ca/en/environment-climate-change/services/types-weather-forecasts-use/public/criteria-alerts.html

[84] Data derived from the Pacific Climate Impacts Consortium's "Plan2Adapt" tool. Retrieved from: https://services.pacificclimate.org/plan2adapt/app/

2. DISEASE AND EPIDEMIC

2.1 PLANT DISEASE & PEST INFESTATION

Hazard	Current Likelihood	Consequence Score	Risk Level	Future Likelihood	Climate Risk Drivers	Anticipated change in likelihood
Plant Disease & Pest Infestation	**D**	**18**	**High Likelihood / Medium Consequence**	**D**		

Background of hazard

Plant diseases include invasive pests such as insects and mites, and plant pathogens including fungi, bacteria and viruses' impact upon crops, forests, and urban environments. An insect pest infestation is a recently detected insect pest population, including an incursion, or a sudden significant increase of an established insect, disease agents or weed population in an area leading to damage to plants in production fields, forests or natural habitats and causing substantial damage to productivity, biodiversity, or natural resources.[85]

The BC Invasive Species Council has identified the following "Species of Interest" to the SCRD:[86]

- European Green Crab
- American Bullfrog
- Eastern Grey Squirrel
- Spongy Moth
- Knotweed
- Scotch Broom
- Giant Hogweed
- Balsam Wooly Adelgid
- Common Tansy
- Eurasian Collared Dove
- Oxeye Daisy

Local governments have powers under the *Community Charter* to create bylaws and govern the growth of weeds on private property in BC.[87] For example, the Town of Gibsons has Bylaw No. 780 which requires property owners to clear their property of noxious weeds and the Town of Sechelt has Bylaw No. 522 which restricts the deliberate growth of noxious weeds on properties.[88]

Specific likelihood considerations

With the increase in annual temperatures, and decrease in cold days, coupled with drier conditions, the current and future likelihood of plant diseases and pests impacting the SCRD remains "likely". Extended growing seasons and increasing likelihood of drought conditions coupled with reduced water supply may improve conditions for some pests to become established and disrupt pollination patterns.

[85] International Standards for Phytosanitary Measures. (2007). ISPM No. 5 Glossary of Phytosanitary Terms. Retrieved from: https://www.ippc.int/largefiles/adopted_ISPMs_previousversions/en/ISPM_05_2007_En_2007-07-26.pdf
[86] Invasive Species Council of BC. Retrieved from: https://bcinvasives.ca/invasive-species-contacts-in-british-columbia/
[87] Coastal Invasive Species Committee. Retrieved from: https://www.coastalisc.com/bylaws-legislation/
[88] Ibid

Specific consequence considerations

Ecological and agricultural systems and urban areas could feel the consequences of plant disease and pest infestation. Invasive species can impact on ecological systems, outcompeting native species, and on agricultural systems by decreasing forage or human-consumption crops. New introductions and/or widespread outbreaks of plant diseases and pest infestations could have severe economic and environmental consequences on the SCRD, including impacts to terrestrial and aquatic ecosystems, tourism, or agricultural activities.

2.2 PUBLIC HEALTH CRISIS

Hazard	Current Likelihood	Consequence Score	Risk Level	Future Likelihood	Climate Risk Drivers	Anticipated change in likelihood
Public Health Crisis	**C**	**25**	**Medium Likelihood / Medium Consequence**	**C**	N/A	

Background of hazard

In BC, the *Public Health Act* supports dealing with current and emerging public health issues, and sets out the authority of the minister, public health officials, regional health authorities, local governments, and others. The *Public Health Act* works with two other public health statues – the *Drinking Water Protection Act* and the *Food Safety Act.*[89]

Two of BC's most acute public health crisis is the on-going COVID-19 pandemic and the overdose crisis from the highly toxic drug supply that was first declared a public health emergency in April 2016.[90] Other public health crisis could involve contamination of the drinking water supply by a hazardous material or extreme heat event.

Specific likelihood considerations

Advances in epidemiology and vaccine technologies, such as the rapid development of a COVID-19 vaccination, have reduced the risks of widespread infection from many communicable diseases. However, new disease or strains of diseases are of increasing concern.

Climate risk drivers are impacting the likelihood of public health crisis, most directly through hazards caused by extreme weather events such as heat and flooding. The change in distribution of plants and animals, the availability of food and water, and spread of invasive plants and diseases due to a changing climate can also increase the risk of a public health crisis.[91]

Specific consequence considerations

Public health crisis can impact the SCRD in different ways, from direct fatalities (e.g., extreme heat-related fatalities among vulnerable populations), psychosocial impact from transmittable diseases (e.g., COVID-19), or reputational and economic impact if tourism decreases due to a localized public health crisis in the SCRD (e.g., contaminated drinking water). Depending on the nature of the public health crisis, the availability and provision of community support services may be impacted (e.g., a pandemic restricting the ability of health care professionals to care for home-bound individuals). Vancouver Coastal Health provides regional health care to

[89] BC Government. (2017). Public Health Act. Retrieved from: https://www2.gov.bc.ca/gov/content/health/about-bc-s-health-care-system/legislation/public-health-act

[90] BC Government. (July 2021). Responding to British Columbia's Drug Poisoning Crisis: Progress Update January to July 2021. Retrieved from: https://www2.gov.bc.ca/assets/gov/health/about-bc-s-health-care-system/office-of-the-provincial-health-officer/overdose-response-progress-update-jan-july-2021.pdf

[91] BC Centre for Disease Control. (2024). Retrieved from: http://www.bccdc.ca/health-info/prevention-public-health/climate-change-health

the Sunshine Coast and oversight of the Sechelt hospital. In the event some care facilities are over capacity, patients may be able to go or be transferred to other facilities. Many community members that need to visit medical specialists travel by ferry to Vancouver for their appointments. In urgent cases when a patient needs to be evacuated, they can be transported by air.

The following medical facilities are located within the SCRD and could support response to public health emergencies, as well as fire, ambulance and police services.

- Medical Associates (Gibsons Medical Clinic)
- Gibsons Health Unit
- Sechelt Hospital
- Pender Harbour and District Health Centre
- shíshálh Nation Community Health and Nursing
- Cowrie Medical Clinic
- Upstream Family Medicine
- Arbutus Medical Clinic

However, in the event of a large-scale public health emergency, these medical centres may easily be overrun, or practitioners unable to provide critical roles in emergency responses (e.g., in the case of a pandemic). The BC Pandemic Provincial Coordination Plan describes the government's strategy for cross-ministry coordination, internal and external communications and provincial government business continuity in response to public health events that are pandemic in nature.[92]

shíshálh Nation Government District

In the event of a public health crisis, such as a disease outbreak or another pandemic, sNGD residents living close to the District of Sechelt would be able to access health facilities such as Sechelt Hospital, Cowrie Medical Clinic, Arbutus Medical Clinic. For shíshálh Nation members who live close to qathet Regional District, health facilities in Power River may be more accessible. However, these facilities could easily be overwhelmed. Medical health practitioners and service providers will also be susceptible to infection and may have difficulty fulfilling their role in emergency response.

Town of Gibsons

In the event of a public health crisis, such as a disease outbreak or another pandemic, Gibsons Medical Clinic, Gibsons Health Unit could easily be overwhelmed. Medical health practitioners and service providers will also be susceptible to infection and may have difficulty fulfilling their role in emergency response.

District of Sechelt

In the event of a public health crisis, such as a disease outbreak or another pandemic Sechelt Hospital, Cowrie Medical Clinic, Arbutus Medical Clinic could easily be overwhelmed. Medical health practitioners and service providers will also be susceptible to infection and may have difficulty fulfilling their role in emergency response.

[92] British Columbia Pandemic Provincial Coordination Plan. (2020). Retrieved from: https://www2.gov.bc.ca/assets/gov/public-safety-and-emergency-services/emergency-preparedness-response-recovery/provincial-emergency-planning/pandemic-provincial-coordination-plan.pdf

Keats and Gambier Islands

The remoteness of Gambier and Keats islands makes emergency response especially challenging given these communities and many residences on the islands are boat-access only. Access may be especially challenging during poor weather. However, this remoteness may also help provide advance warning to the communities before a disease or pandemic arrives from an urban centre. Given the nature of some island residents (many commute regularly off the island to other homes/communities), this remoteness should not be relied upon to keep diseases and pandemics away from the islands long-term. For residents who become incapacitated from a disease or pandemic, accessing medical services may be difficult.

Past Events

The following are all examples of recent and on-going public health crisis that have had severe consequences on communities across BC, including the SCRD.

- COVID-19 pandemic
- 2021 heat dome
- Current opioid crisis

3. FIRE

3.1 WILDFIRE (INTERFACE)

Hazard	Current Likelihood	Consequence Score	Risk Level	Future Likelihood	Climate Risk Drivers	Anticipated change in likelihood
Wildfire	**D**	**29**	**High Likelihood / Medium Consequence**	**E**		

Hazard Description

A wildfire is an unplanned fire - including unauthorized human-caused fires - occurring on forest or range lands, burning forest vegetation, grass, brush, scrub, peat lands, or a prescribed fire set under regulation which spreads beyond the area authorized for burning. The wildland urban interface (WUI) is any area where combustible forest fuel is found adjacent to homes, farm structures or other outbuildings. This may occur at the interface, where development and forest fuel (vegetation) meet at a well-defined boundary, or in the intermix, where development and forest fuel intermingle with no clearly defined boundary.[93]

Figures 13 and 14 describe the current and the future community wildfire risk. This is defined as a function of fuel conditions, weather, and terrain referred to as "wildfire behaviour potential". The Community Wildfire Protection Plan (CWPP) [94] identified Areas of Interest (AOIs) coupled with a potential wildfire behaviour threat analysis with a 500m

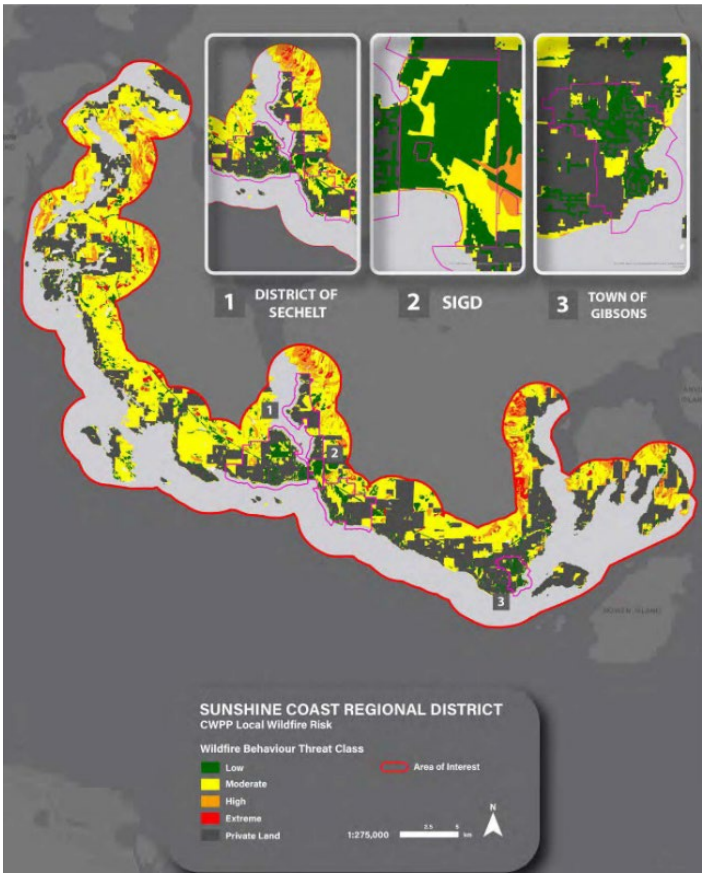

Figure 13: SCRD current wildfire behaviour threat class. Source: Community Wildfire Protection Plan (2021)

[93] Government of BC. (2023). Wildfire Glossary. Retrieved from: https://www2.gov.bc.ca/gov/content/safety/wildfire-status/about-bcws/glossary#W
[94] Sunshine Coast Regional District. (2021). Community Wildfire Protection Plan. Retrieved from: https://www.scrd.ca/wp-content/uploads/2022/11/Sunshine-Coast-Regional-District-Community-Wildfire-Protection-Plan-compressed.pdf

buffer surrounding the assets/values identified. The overall current wildfire risk within the overall AOI of the SCRD is high (as of 2021).

Wildfires that occur in urban areas are known as interface fires, and they can cause significant damage when they reach human settlements and crucial infrastructure. Wildland fires typically happen during hot, dry weather when forest fuels are highly susceptible to lightning strikes and human negligence. Interface fires can lead to substantial economic and environmental costs, including the expenses of suppression, damage to public and private infrastructure and property, and the disruption of local businesses. [95] The administrative boundaries of the District of Sechelt, Town of Gibsons, and the shíshálh Nation Government District are all within several kilometers of where urban development reaches a minimum density of six structures per hectare. [96]

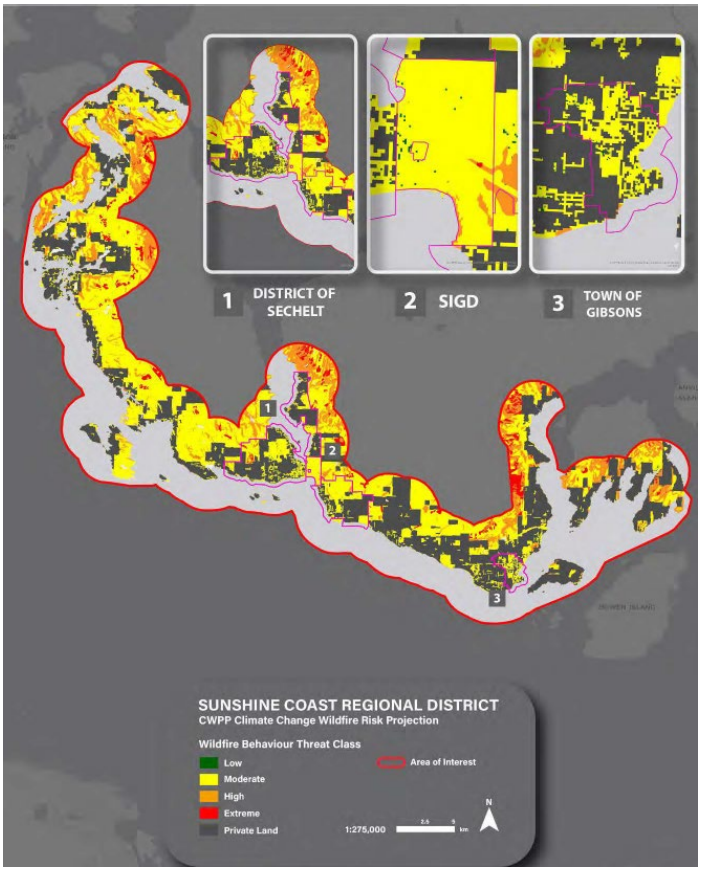

Figure 14: SCRD future wildfire behaviour threat class. Source: Community Wildfire Protection Plan (2021)

BC has experienced its most severe wildfire seasons over the last seven years – 2017, 2018, 2021, and 2023. These events were marked by weather extremes (e.g., extreme heat during 2021 fire season). [97] Climate and weather, coupled with land-use change and fire-management policies focused on fire suppression are major drivers of fire activity in BC, which is projected to substantially increase over the 21st century. [98]

Figure 15: Example of interface development, where urban development is in close proximity to forested areas. Source: SCRD Community Wildfire Protection Plan, pg. 38.

Likelihood Considerations

Climate change significantly contributes to the recent trend of longer and more extreme fire seasons, with several areas in the region having extreme or high interface fire hazard ratings. This indicates a projected increase in the overall risk of wildfires, which can cause negative health impacts, especially for individuals with pre-existing health

[95] Natural Resources Canada. (n.d). Canadian National Fire Database. Retrieved from: https://cwfis.cfs.nrcan.gc.ca/ha/nfdb
[96] Sunshine Coast Regional District. (2021). Community Wildfire Protection Plan. Pg. 22. Retrieved from: https://www.scrd.ca/wp-content/uploads/2022/11/Sunshine-Coast-Regional-District-Community-Wildfire-Protection-Plan-compressed.pdf
[97] Parisien et al. (2023). Abrupt, climate-induced increase in wildfires in British Columbia since the mid-2000s. *Communications Earth & Environment*, 4:309. Retrieved from: https://doi.org/10.1038/s43247-023-00977-1
[98] Ibid

conditions.[99] From 2010-2019 there has been an average of 4.9 fires a year in the SCRD, an increase from 1.8 fires a year between 1920-2019.[100] Wildfires in coastal areas are infrequent, however, there is an observed increasing trend due to dry and hot conditions.[101]

Wildfires can also lead to population displacement, resulting in psychological impacts and economic losses for individuals and families. Furthermore, wildfires can disrupt or damage infrastructure systems such as transportation, telecommunications, electricity supply, water treatment, and sewage systems. Wildfires, which occur in wilderness areas away from human settlements, differ from interface fires. The potential for wildfires increases significantly without adequate programs to reduce fuel loading build-up.[102]

The Pacific Institute for Climate Solutions assessed BC's wildfire threat. The SCRD is assessed as a mix of low to moderate on average (see Figure 16):

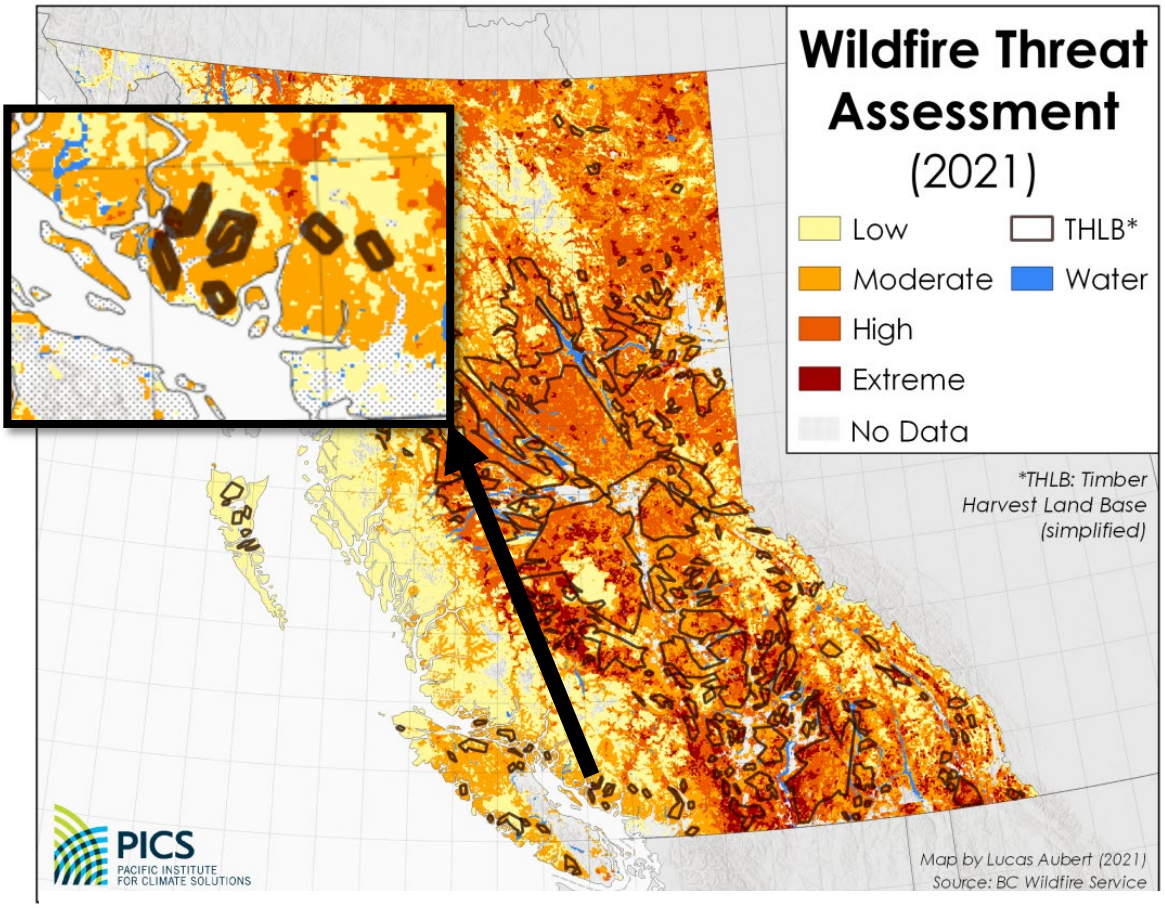

Figure 16: Wildfire threat assessment for the SCRD: Source: Pacific Institute for Climate Solutions.

[99] World Economic Forum. (July 7, 2022). Wildfire risk has increased, but we can still influence where and how fires strike. Retrieved from: https://www.weforum.org/agenda/2022/07/climate-change-wildfire-risk-has-grown-nearly-everywhere-but-we-can-still-influence-where-and-how-fires-strike/

[100] Sunshine Coast Regional District. (2021). Community Wildfire Protection Plan. Pg. 27. Retrieved from: https://www.scrd.ca/wp-content/uploads/2022/11/Sunshine-Coast-Regional-District-Community-Wildfire-Protection-Plan-compressed.pdf

[101] Ibid, pg. 29.

[102] Filmon, G. (2003). Firestorm 2003. Provincial Review. Retrieved from: https://www2.gov.bc.ca/assets/gov/public-safety-and-emergency-services/wildfire-status/governance/bcws_firestormreport_2003.pdf

Specific consequence considerations

The temperate coastal climate of the SCRD helps reduce extreme fire hazard conditions. However, as the 2021 Lytton fire demonstrates, the wildland-urban interface fire risk brings considerable consequences. On June 30th, during the hottest day ever recorded in Canada, the Lytton community was destroyed by fire. More than 151 homes and businesses were destroyed, and the fire grew to over 83,000 hectares.[103]

Wildfires can quickly overwhelm local response agencies and become uncontrollable, causing potential economic, environmental, and social damage.

Wildfires are just one example of a hazard that can lead to/cascade into other hazards such as air quality issues, transportation interruptions and landslides or flooding.

A staff report from January 11, 2024, to the SCRD Committee of the Whole provided preliminary water system modelling results. The results suggest that in some areas, water systems do not meet current Fire Flow Standards, and forecasts for the mid-2040s suggest there will be increasing deficiencies in fire flow in all water systems (primarily a result of expected increase in population and changes in zoning compared to current land use). Continued status quo for fire flows presents potential consequences for all regions of the SCRD to adequately protect the built and natural environment from wildfires – including at the wildland urban interface. However, the SCRD is planning to develop a Fire Flow Action Plan that will outline the actions to address the identified fire flow concerns.[104]

Town of Gibsons

The temperate coastal climate of the Town of Gibsons helps to reduce extreme fire hazard conditions. However, as climate change reduces summer precipitation levels and increases the length of droughts and extreme heat, the Town of Gibsons may be at increasing risk to wildfires, which could overwhelm the capacity of local response agencies and easily become uncontrollable.

District of Sechelt

The temperate coastal climate of the District of Sechelt helps to reduce extreme fire hazard conditions. However, as climate change reduces summer precipitation levels and increases the length of droughts and extreme heat, the District of Sechelt may be at increasing risk to wildfires, which could overwhelm the capacity of local response agencies and easily become uncontrollable.

Keats Island and Gambier Island

Wildland fires have the potential to spread quickly to residential areas in the communities of Gambier and Keats Island. Interface fires can easily overwhelm the limited capacity of local response and the severity of the event can escalate quickly because of weather. Both Gambier and Keats islands have communal fire equipment. However, there are no official fire fighting teams. Gambier Island's Fire Equipment Group was formed in 1980 and has acquired and made available to Island residents, fire-fighting equipment (e.g., pumps, hoses) and provides demonstrations and practice sessions for islanders to become better prepared to

[103] Cohen, J. and Westhaver, A. (2022). An examination of the Lytton, British Columbia wildland-urban fire destruction. *Institute for Catastrophic Loss Reduction.* Retrieved from: https://firesmartbc.ca/wp-content/uploads/2022/05/An-examination-of-the-Lytton-BC-wildland-urban-fire-destruction.pdf
[104] Sunshine Coast Regional District. (February 22, 2024). Committee of the Whole Agenda package. Retrieved from: https://www.scrd.ca/wp-content/uploads/2024-FEB-22-COW-Agenda-PACKAGE.pdf

protect their community against fires. There are fire equipment trailers in three primary communities (Gambier Harbour, New Brighton, and West Bay). [105] Keats Island has equipment fire sheds located at Keats Landing Dock, Eastbourne Dock, the Co-op and West Beach, as well as a community siren. Given the cooperative nature of fire response on the islands, help will often be from direct neighbours and word may spread slower than fire. Keats Island and Gambier Island have limited response capabilities, a large fuel load, limited fire protection and limited water supply in undeveloped areas.

Past Events

- There have been 182 wildfires in the SCRD since 1920, burning a total area of approximately 11,637 hectares.[106]
- In September 2023, a 231-hectare Clowhom Lake wildfire burned north of Sechelt and west of Squamish in SCRD electoral area B – resulted in evacuation order for seven properties and state of local emergency.[107]
- In June 2019, an evacuation alert was issued for seven properties on Cecil Hill Road, near Pender Harbour, due to a nine-hectare wildfire.[108]
- In 2019, a wildfire occurred near Port Mellon, coming close to industrial facilities including large fuel accumulations from timber processing.[109]
- In July 2015, the Old Sechelt Mine Wildfire occurred during a period of extreme summer drought and high temperatures, resulting in evacuations and the declaration of a state of local emergency.[110]
- In 2003, 71 fires burned throughout the Sunshine Coast Fire District, destroying a total of 10.3 hectares (ha), with 54 fires caused by lightning strikes and 17 by human actions.[111]

[105] The Gambier Island Community. (n.d.) GFEG Fire Practice. Retrieved from: https://www.gambierisland.org/Fire%20Protection.htm?utm_source=coast%20reporter&utm_campaign=coast%20reporter%3A%20outbound&utm_medium=referral

[106] Sunshine Coast Regional District. (2021). Community Wildfire Protection Plan. Retrieved from: https://www.scrd.ca/wp-content/uploads/2022/11/Sunshine-Coast-Regional-District-Community-Wildfire-Protection-Plan-compressed.pdf

[107] Holliday, I. (September 16, 2023). Wildfire prompts evacuation order, state of emergency on Sunshine Coast. *CTV News.* Retrieved from: https://bc.ctvnews.ca/wildfire-prompts-evacuation-order-state-of-emergency-on-sunshine-coast-1.6564674#:~:text=An%20evacuation%20order%20has%20been%20issued%20for%20seven,the%20Sunshine%20Coast%20Regional%20District%27s%20electoral%20area%20B.

[108] Evacuation alert lifted for area near Sunshine Coast wildfire. *CBC News* (June 24, 2019). Retrieved from: Evacuation alert lifted for area near Sunshine Coast wildfire | CBC News

[109] Sunshine Coast Regional District. (2021). Community Wildfire Protection Plan. Pg. 29. Retrieved from: https://www.scrd.ca/wp-content/uploads/2022/11/Sunshine-Coast-Regional-District-Community-Wildfire-Protection-Plan-compressed.pdf

[110] Ibid, pg. 30.

[111] Sunshine Coast Regional District. (2005). Hazard, Risk and Vulnerability Analysis. Retrieved from: https://www.scrd.ca/wp-content/uploads/2022/11/HRVA-SCRD_FINAL.pdf

3.2 STRUCTURAL (URBAN) FIRE

Hazard	Current Likelihood	Consequence Score	Risk Level	Future Likelihood	Climate Risk Drivers	Anticipated change in likelihood
Structural Fire	**E**	**18**	**High Likelihood / Medium Consequence**	**E**		

Hazard Description

Structural (urban) fires are fires that occur in a residential, commercial, or industrial communities. Rural and urban fires occur on a frequent basis in many parts of the province, and of provincial concern are the fires that cause many deaths or injuries, those that are beyond the ability of the local resources to respond or those that cause severe economic losses.

Significant urban fires can be sparked by various factors such as defective electrical systems, inappropriate handling of smoking materials, and intentional arson. Despite a decrease in the frequency of severe fires, a fire incident in a residential, commercial, institutional, or industrial structure could lead to the release of toxic smoke emissions, release of hazardous liquids into the environment, significant property damage, potential for fire to spread to adjacent buildings, and the potential for fatalities. Damages to residential units could displace residents for weeks or longer, necessitating immediate assistance and accommodation.

Climate changes may lead to drier landscapes, thereby increasing the risk of fires. It's worth noting that some of the most effective interface fire mitigation has been achieved under OCP designated Development Permit Area – Wildfire Hazard Areas [112] with guidelines established for protecting development from wildfire hazardous conditions. The City of Kimberley, City of Langford[113], and Regional District Central Okanagan[114] provide examples of successful interface fire legislation.

Specific likelihood considerations

The SCRD has an extensive range of firefighting resources at its disposal. In additional to 'hard assets' (e.g., fire trucks), a standing automatic and mutual aid agreement exists among all fire departments to provide support wherever and whenever necessary. Speed of delivery is dependent on a variety of extraneous factors, such as weather, traffic, vehicle access and the number of concurrent dispatches. Overall, the community has a solid resource base from which to address fire outbreaks. However, any other concurrent hazard events may impact the ability of first responders to respond (e.g., any disruptions to road networks or communications).

[112] Kimberly Official Community Plan. (n.d.). Schedule C: Retrieved from: https://www.kimberley.ca/ocp/wildfire-hazard
[113] City of Langford. (2020). Fire Hazard Areas. Retrieved from: langford.ca/wp-content/uploads/2020/11/Fire_Hazard_Areas.pdf
[114] Okanagan-Similkameen Regional District. (2021). Wildfire DP Area Exploration Project. Retrieved from: https://www.rdos.bc.ca/development-services/planning/strategic-projects/wildfire-dp/

With an increased social influence on the initiation of "urban" fires, it is difficult to attribute a trend due to the diverse variables. That said, the Office of the Fire Commissioner has taken preventative steps towards a more prepared response system.[115]

Specific consequence considerations

The Firestorm of 2003 highlighted the risk of interface fires to communities across British Columbia. Over 2,500 fires burned throughout the interior between July and August, causing the loss of 344 homes and businesses, the evacuation of 45,000 people, and the destruction of 260,000 hectares of forest. The total cost of the Firestorm was estimated to be $700 million, with the greatest loss being the lives of three pilots who died in the line of duty.[116] In 2021, there were 9,166 fires reported resulting in 180 injuries and 59 deaths, 38% of which were structure fires (125 injuries and 36 deaths).[117]

shíshálh Nation Government District

The Sechelt Fire Department provides services to both the District of Sechelt and the shíshálh Nation Government District. It is a hybrid career/paid-on-call department with a staff Fire Chief, two staff Deputy Chiefs, daytime career firefighters and support employees. Services are provided from a single station located in downtown Sechelt.[118]

District of Sechelt

The District of Sechelt's OCP (s. 3.23) states any new development adjacent to forested areas will be required to implement "Fire Smart" development practices, based on guidelines from the Homeowners Fire Smart Manual (BC Edition). This includes actions such as reducing vegetation within 10m of the buildings, reducing fuel and debris up to 30m from buildings, using flame resistant building materials and installing fire sprinklers where required by the district.[119]

Keats Island and Gambier Island

Structural fires have the potential to spread quickly in the communities of Gambier and Keats Island. Structural fires can easily overwhelm the limited capacity of local response and the severity of the event can escalate quickly because of weather (e.g., structural fires spreading to dry fuel adjacent to the building, such as wood piles, out buildings, or natural vegetation). Both Gambier and Keats islands have communal fire equipment. However, no official fire fighting team. Gambier Island's Fire Equipment Group was formed in 1980 and has acquired and made available to Island residents fire-fighting equipment (e.g., pumps, hoses) and provides demonstrations and practice sessions for islanders to become better prepared to protect their homes and community against fires. There are fire equipment trailers in three primary communities

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[115] Government of BC. (June 8, 2023). BC advances fire-risk reduction, public education to save lives. Retrieved from: https://news.gov.bc.ca/releases/2023PSSG0046-000897#:~:text=The%20Office%20of%20the%20Fire%20Commissioner%20%28OFC%29%20has,only%2045%25%20of%20the%20reported%20residential%20structure%20fires.

[116] Filmon, G. (2004). Firestorm 2003: Provincial Review. Retrieved from: https://www2.gov.bc.ca/assets/gov/public-safety-and-emergency-services/wildfire-status/governance/bcws_firestormreport_2003.pdf

[117] British Columbia Office of the Fire Commissioner. (2021). Annual Report 2021.Retrieved from: https://www2.gov.bc.ca/assets/gov/public-safety-and-emergency-services/public-safety/fire-safety/fire-reporting/office_of_the_fire_commissioner_2021_annual_report.pdf

[118] District of Sechelt. (2010). Official Community Plan. Retrieved from: https://www.sechelt.ca/en/business-and-development/resources/Documents/Official-Community-Plan-Bylaw-492-2010.pdf

[119] Ibid

(Gambier Harbour, New Brighton, and West Bay).[120] Keats Island has equipment fire sheds located at Keats Landing Dock, Eastbourne Dock, the Co-op and West Beach, as well as a community siren. Given the cooperative nature of fire response on the islands, help will often be from direct neighbours and word may spread slower than fire.

[120] The Gambier Island Community. (n.d.). GFEG Fire Practice. Retrieved from: https://www.gambierisland.org/Fire%20Protection.htm?utm_source=coast%20reporter&utm_campaign=coast%20reporter%3A%20outbound&utm_medium=referral

4 GEOLOGICAL

4.1 LANDSLIDES

Hazard	Current Likelihood	Consequence Score	Risk Level	Future Likelihood	Climate Risk Drivers	Anticipated change in likelihood
Landslide	**D**	**20**	**High Likelihood / Medium Consequence**	**D**		

Hazard Description

Landslides and rockslides are the results of downward and outward movements of slope materials reacting to the force of gravity and cover a wide variety of landforms and processes. Most landslides in BC are smaller debris flows or rockslides, which are likely to become more frequent due to climate change.

Landslide material may be composed of natural rock, soils, artificial landfills or combinations of these components. Landslides are of particular concern where lots or locations zoned as having high potential for this hazard interface with areas zoned as residential, commercial or contain infrastructure necessary for the continued function of essential services. Large-scale landslides can also occur with heavy rainfall, especially in areas that have steep pitch and are unprotected by vegetation, trees, and root mat systems. Logged slope sides, creek or river ravines, and steep areas below large, rapidly melting snowpacks can pose a series hazard for landslide activity.

Likelihood Considerations

Landslide likelihood is the probability of a landslide occurring. Given the mountainous terrain of the Sunshine Coast, landslides are likely to increase with the increase of extreme precipitation (10% < annual change < 50%), and are expected to occur about once every 3-10 years. The likelihood risk is compounded by continued forestry activities in the Regional District, which could contribute to slope instability. The chances of damaging landslides have increased in recent years, due in part to increases in severe wildfires, heavy rains, and flooding. Wildfires can affect topography and soil stability, contributing to flooding and landslides. Earthquakes also present risks of landslides, albeit unlikely (1%< annual chance <2%).

A few isolated areas found in the Halfmoon Bay area have the potential for landslides due to rocky, steep terrain, including rock bluffs along Kitchen Creek, near Wood Bay Ridge Road and Birch Way. Additionally, the Redrooffs area is of concern due to landslides activity and shoreline erosion occurring adjacent to residential development.[121]

[121] Kerr Wood Leidal Associates. (May 2013). Geotechnical Hazards Report: Halfmoon Bay. Final Report.

Consequence Considerations

Due to mountainous terrain to the east of the SCRD, disruptions to major transportation routes from landslides can cause significant delays and disruptions to the movement of goods and services. During engagement with emergency professionals as part of the development of this HRVA, the area around Chaster Creek was identified as being at risk of landslides or transportation/service interruptions due to landslides, as was the population of the district living below Highway 101.

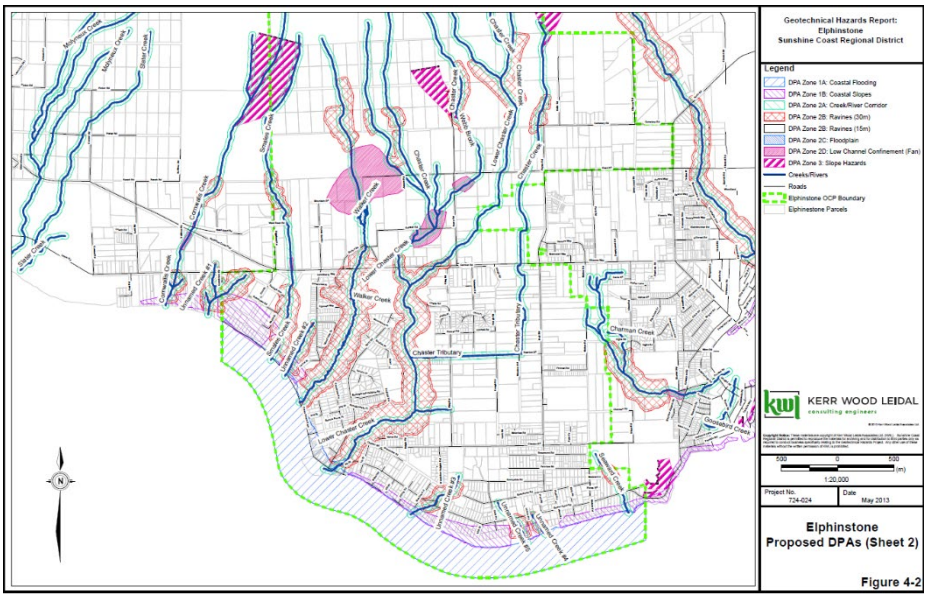

Figure 17: Elphinstone Development Permit Areas

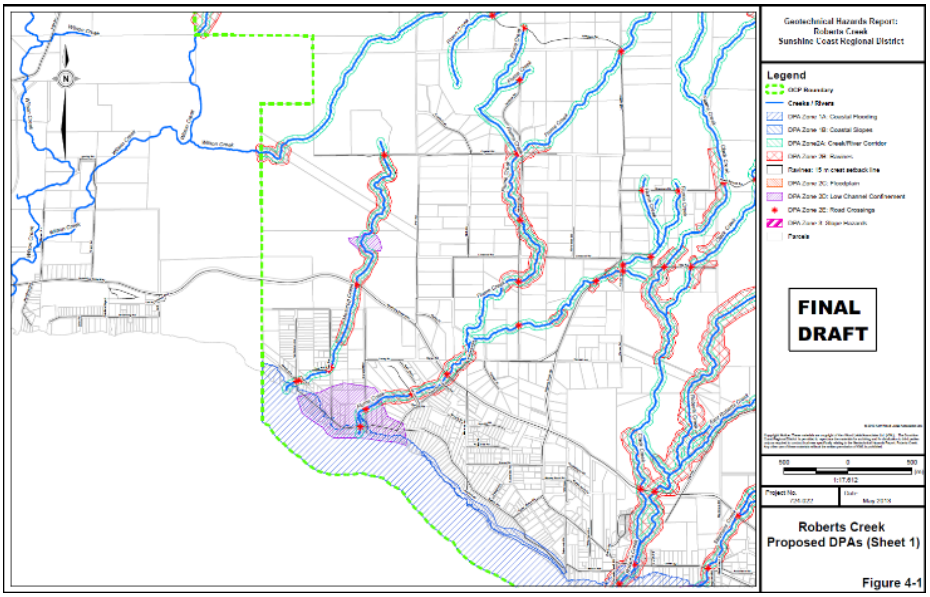

Figure 18: Roberts Creek Development Permit Areas

Additionally, Highway 101 crosses Chapman Creek just upstream (north) of Tsawcome Lands. The SCRD operates water supply dams in the headwaters, and the Chapman Creek has historical instances of landslides that create the potential for Landslide Dam Outburst Flood or “debris flood” events. Flood and debris floods resulting from landslides pose a potential hazard to the Tsawcome community.

The 2005 SCRD HRVA identified landslides as having consequences for the following environmental values: contamination of air, water, soil, and sediment; erosion; sedimentation; aquatic habitat damage; terrestrial habitat damage; and wetland habitat damage.

Figures 17 – 22 outline Development Permit Areas (DPAs), gathered from geotechnical studies conducted by KWL, at Elphinstone[122], Roberts Creek[123], Halfmoon Bay[124], and West Howe Sound[125] in the SCRD and show potential interactions from Slope Hazards (DPA Zone 3 – striped, pink polygons) with critical infrastructure and/or communities.

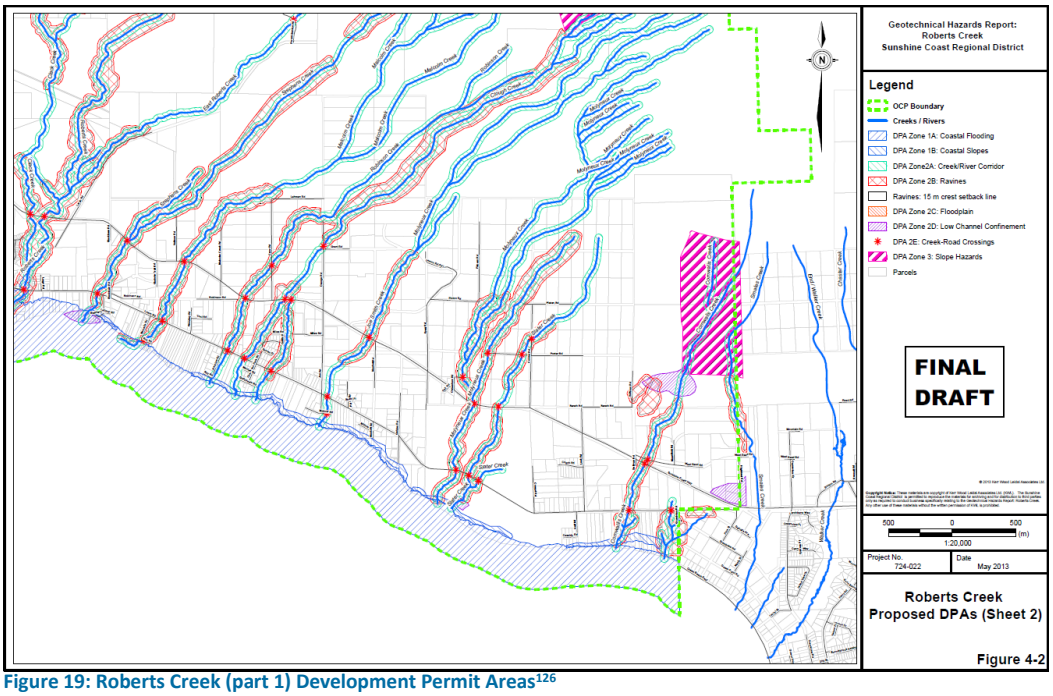

Figure 19: Roberts Creek (part 1) Development Permit Areas[126]

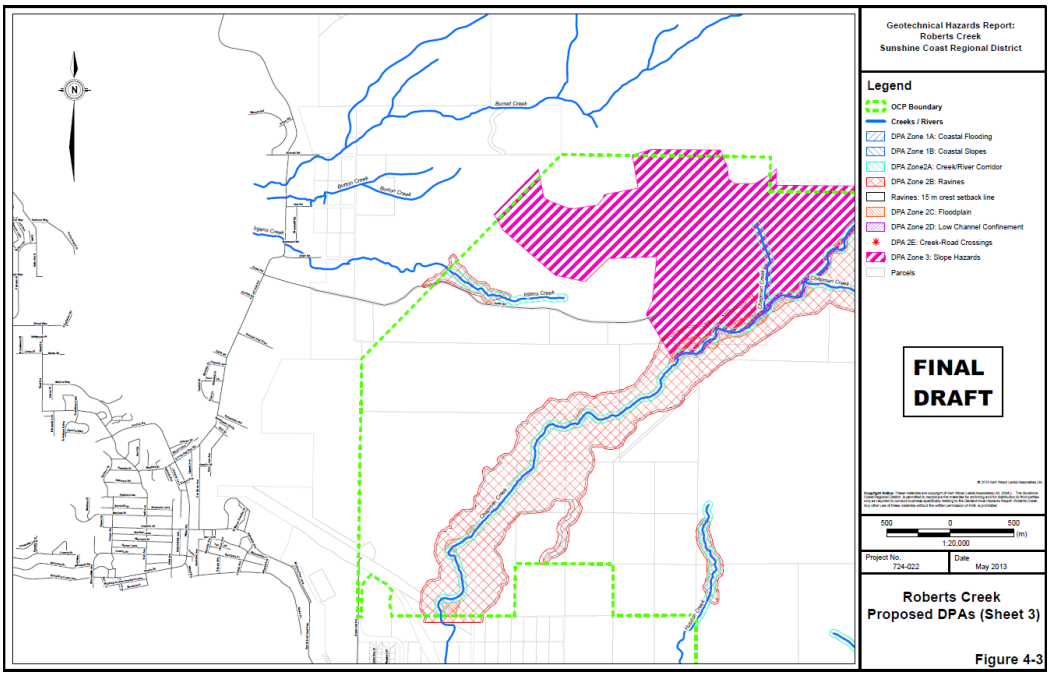

Figure 20: Roberts Creek (part 2) Development Permit Areas[126]

[122] Kerr Wood Leidal Associates. (May 2013). Geotechnical Hazards Report: Elphinstone. Final Report.
[123] Kerr Wood Leidal Associates. (May 2013). Geotechnical Hazards Report: Roberts Creek. Final Report.
[124] Kerr Wood Leidal Associates. (May 2013). Geotechnical Hazards Report: Halfmoon Bay. Final Report.
[125] Kerr Wood Leidal Associates. (May 2013). Geotechnical Hazards Report: West Howe Sound. Final Report.

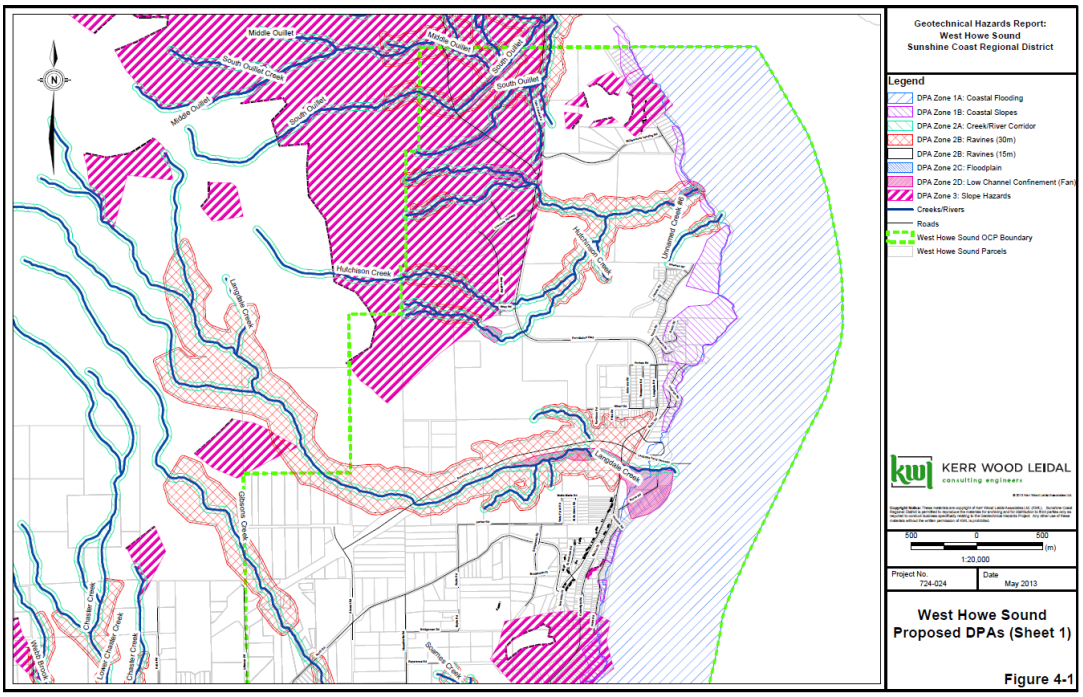

Figure 21: West Howe Sound (part 1) Development Permit Areas (Gibsons Adjacent)[127]

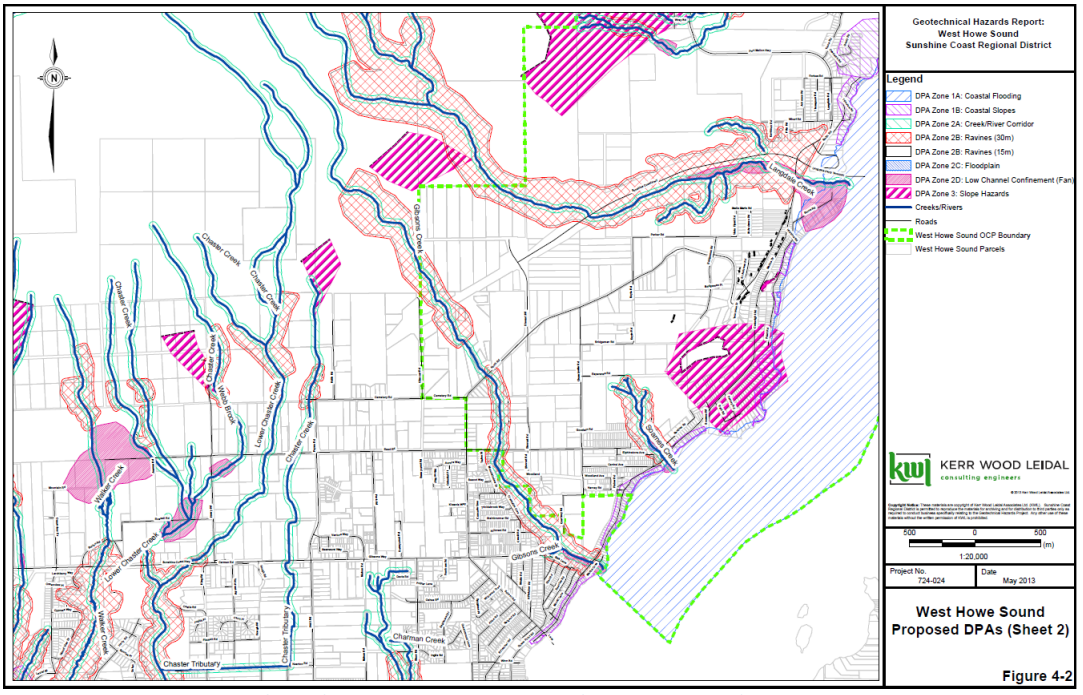

Figure 22: West Howe Sound (part 2) Development Permit Areas (Gibsons Adjacent)[127]

The figures above show the Roberts Creek DPA[126] and the West Howe Sound DPA[127] (adjacent to Gibsons) and hazardous slopes and coastal flooding. These are examples of a larger suite of 36 additional maps from KWL's geotechnical reports.

Town of Gibsons

The Town of Gibsons has developed Geotechnical Hazard Development Permit Area guidelines, which apply to all parcels of land either partially or entirely within the Development Permit Area No. 1. These designations are an indication of areas where professional geotechnical assessment and specific development standards are required. Geotechnical hazards include soil sliding and wave erosion along beachfront slopes, potential soil landslides and adverse stream erosion and deposition on steep ravine slopes and potential rock fall. The most significant geotechnical hazards include soil landslide and related stream-flood and debris-flood hazards in the ravines of Charman and Gibson Creek. The flood hazards extend through the community along Charman Creek below Stewart Road. There is also a relatively high probability of soil landslides along the Shoal Channels shoreline south of Franklin Road and adjacent Gower Point Road. There is active soil landsliding in the Franklin Road and adjacent Gower Point Road areas. Developed ground above the bedrock enclosed pocket beaches east of Gower Point Road is retreating northward. The local silty-sandy glaciomarine soil is highly susceptible to erosion and groundwater seepage and rain may especially promote the movement of fill area. Charman Creek and Gibsons Creek ravines have steep to very steep forested slopes and are susceptible to shallow soil and slides and erosion.[128] Gospel Rock is an area with steep to very steep east-facing and shoreline rock and includes many areas of loose rock as well as steep slopes. These areas have the highest risks of property damage, injury or worse due to natural phenomena or incautious building practices.

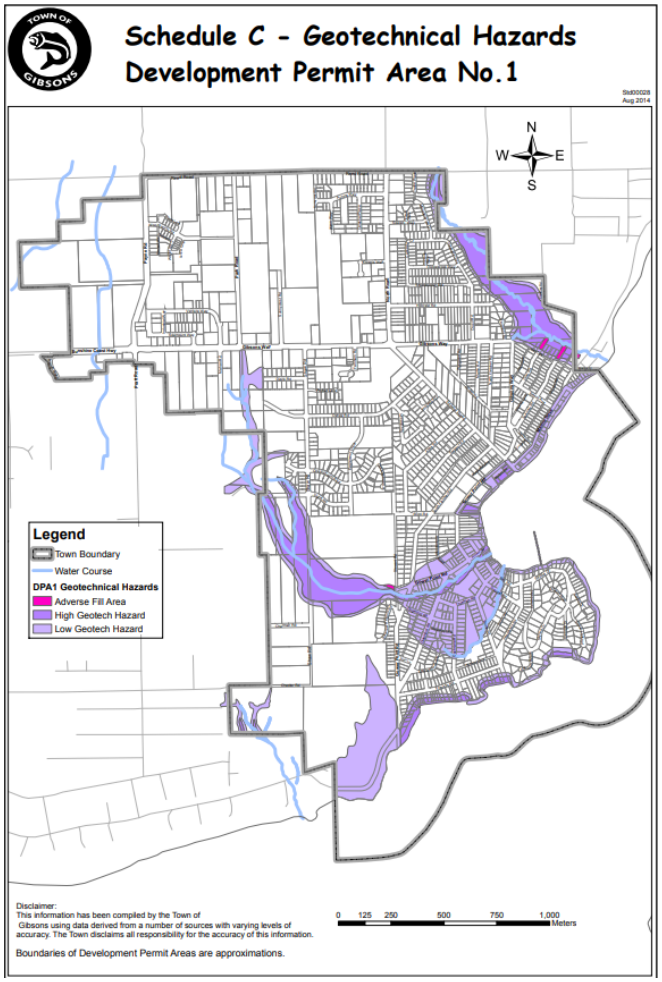

Figure 23: Geotechnical Hazards Development Permit Area No. 1. Source: Town of Gibsons.

[126] Kerr Wood Leidal Associates. (May 2013). Geotechnical Hazards Report: Roberts Creek. Final Report.
[127] Kerr Wood Leidal Associates. (May 2013). Geotechnical Hazards Report: West Howe Sound. Final Report.
[128] Town of Gibsons. (2024). 16.2 Geotechnical Hazard Development Permit Area No. 1. Retrieved from: https://gibsons.ca/wp-content/uploads/2024/01/DPA-1.pdf

District of Sechelt

Sechelt's OCP includes Development Permit Areas 4 (DPA 4) which identify areas that may be environmentally sensitive or hazardous, requiring approval from provincial or federal agencies in addition to the District of Sechelt prior to development. DPA 4 applies to specific areas of the District of Sechelt at risk of hazards conditions, including "beach escarpment, rockfall and upland slope hazards". Areas at risk of rockfall specifically include the neighbourhoods of Tuwanek, Sandy Hook, and within the Sunshine Heights area of West Porpoise Bay.[129] It is estimated that a moderate to low probability is estimated for the occurrence of shallow soil instability including debris landslides, rock slope instability and isolated rockfalls from existing natural slopes. It is estimated that a high probability exists for soil instability including small soil slides on the slopes of the small creek gully located at the north end of Porpoise Drive in Sandy Hook. Further, DPA 5 guidelines identify slopes of over 30% as not suitable for residential development due to the potential for hazardous conditions.

Keats Island and Gambier Island

Gambier Island has a significant amount of area with slope angles greater than 35%. Most of the development on Gambier and Keats is not located within areas of steep slope. However, recreational users may frequent such areas. Dwellings located along the southeastern coastline of Keats Island, where high bluffs are found may be in an area of greater risk.

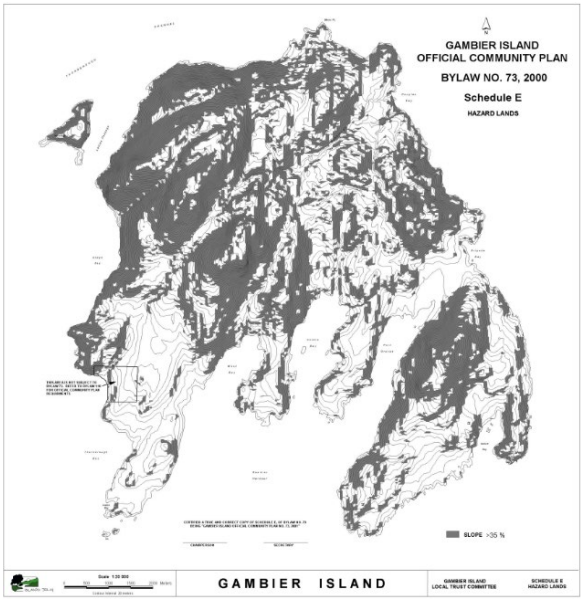

Figure 24: Lands on Gambier Island identified as having a slope greater than 35%. Source: Gambier Official Community Plan (2021).

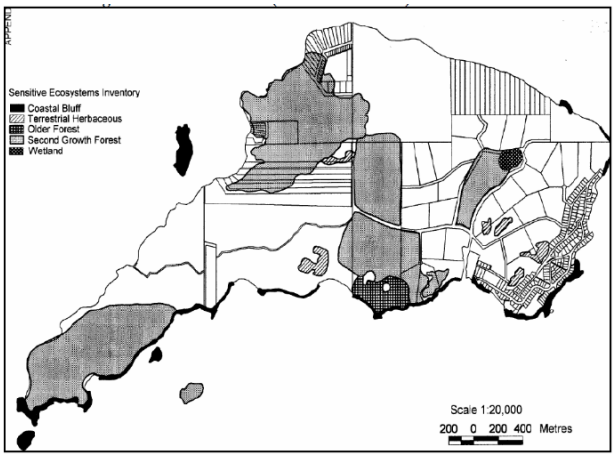

Figure 25: Lands on Keats Island identified as Coastal bluffs (in black). Source: Keats Island Official Community Plan (2002).

[129] District of Sechelt. (2010). Official Community Plan. Retrieved from: https://www.sechelt.ca/en/business-and-development/resources/Documents/Official-Community-Plan-Bylaw-492-2010.pdf

Past Events

- Landslide that affected Burnett Creek and the Sechelt-Dakota Forest service road on November 15, 2021. The Slide originated just outside of the Sunshine Coast Community Forest's harvested Block AN12 and below a section of the road used to access that site. The slide moved about 2800 square meters of trees, rock, and soil. A debris field was deposited along the road about 20 meters wide and 70 meters long, with an average dept of 1-1.15 meters.[130]
- Landslide near the Chapman Creek Water Treatment Plant water intake mains on December 19, 2020.[131]
- January 2005, landslides caused by the interface of heavy rain and soft soils affected one household in Gibsons and forced the evacuation of its owners. The descent of sand, logs and rock caused localized damage.[132]

[130] Jordison, C. (January 26, 2022). Multiple factors led to Nov. 15 landslide: Ministry. Coast Reporter. Retrieved from: https://www.coastreporter.net/local-news/multiple-factors-led-to-nov-15-landslide-ministry-4992471
[131] Jespersen, R. (January 13, 2021). Landslide area trails closed as SCRD moves to protect water intakes. Coast Reporter. Retrieved from: https://www.coastreporter.net/local-news/landslide-area-trails-closed-as-scrd-moves-to-protect-water-intakes-3418430
[132] Sunshine Coast Regional District. (2005). Hazard, Risk and Vulnerability Analysis. Retrieved from: https://www.scrd.ca/wp-content/uploads/2022/11/HRVA-SCRD_FINAL.pdf

4.2 LAND SUBSIDENCE

Hazard	Current Likelihood	Consequence Score	Risk Level	Future Likelihood	Climate Risk Drivers	Anticipated change in likelihood
Land Subsidence	**D**	**7**	**High Likelihood / Medium Consequence**	**D**	**N/A**	**N/A**

Hazard Description

Land subsidence occurs when a surface has been undermined due to removal or displacement of subsurface earth materials, and deformation and ground movement occur, such as sinking or caving in of the ground. Causes of subsidence include the mining of rocks, minerals, and ores; sub-surface excavations; extraction of subterranean liquids such as water, oil, or gas; and natural processes such as groundwater flowing through soluble rock and limestone.

Likelihood Considerations

Gravel mining and resource extraction in various locations throughout the SCRD can cause ground instability in some areas. The SCRD has experienced land subsidence in the recent past, which indicates that it is a very real hazard with high likelihood of occurrence. However, some official community plans require homeowners seeking a development permit to hire engineers to determine that the proposed development will be suitable with minimal impact on the natural environment and safe from a geotechnical perspective.

Consequence Considerations

Specific impacts include damage to infrastructure (roads, bridges, dikes), buildings, foundations, changes in drainage and water systems (sewerage, pipes), disruption of water management and related effects (change of gradient of streams, canals, drains, increased seawater intrusion), habitat deterioration.

shíshálh Nation Government District

Extensive gravel mining in the sNGD suggests that the area is underlain with soft soils which can become saturated with water and pose a threat to infrastructure and property in vulnerable areas due to slumping, caving or slippage.

Town of Gibsons

The ocean shorelines in the Franklin Road and Gower Point Road have high potential for ground movement. Local silty-sandy glaciomarine soil is highly susceptible to erosion, and groundwater seepage and rain may especially promote the movement of areas. These areas have the highest risk of property damage, injury or worse due to ground movement coupled with incautious building practices.

District of Sechelt

The Seawatch community of the District of Sechelt, at the northwest end of the West Porpoise Bay neighbourhood, faces the risk of sinkholes and subsurface instability.

Recent Events

- January 2005, several residences in Halfmoon Bay experienced significant ground movement brought on by a prolonged period of heavy rain, including property slumping one meter, causing a 32-foot retaining wall to become unstable and sag.
- In 2012 a sinkhole opened on Seawatch Lane, with more emerging over the next several years, rendering one home uninhabitable and forcing patrial road closures. In February 2019, the District of Sechelt issued an evacuation alter to residents of Seawatch, followed by an evacuation order and the barring of public access to the area eight days later.[133]

[133] Jordison, C. (February 14, 2022). Three years later, what's changed in the Seawatch evacuation sage? Coast Reporter. Retrieved from: https://www.coastreporter.net/local-news/three-years-since-the-seawatch-evacuation-whats-happened-and-what-hasnt-5062340

5 SEISMIC

5.1 EARTHQUAKE

Hazard	Current Likelihood	Consequence Score	Risk Level	Future Likelihood	Climate Risk Drivers	Anticipated change in likelihood
Earthquake	**B**	**36**	**Low Likelihood / High Consequence**	**B**	**N/A**	**N/A**

Hazard Description

Earthquakes may be described as sudden movement of earth, caused by an abrupt release of strains that have accumulated over time along fault lines.[134] Earthquakes have the potential to cause significant damage to buildings and other infrastructure. An earthquake can cause damage to buildings, infrastructure, and the environment, which will result in people being trapped, killed, or injured from falling debris and associated secondary hazards such as tsunami, landslides, or fires. Damage to buildings generally begin to occur at magnitude six while an earthquake above magnitude seven may be a major disaster if it occurs near a populated area. An earthquake has the capability to cause these numerous secondary hazards to occur over a much longer time scale than many other hazards accounted for apart from drought and diseases or epidemics. This means that after the initial event occurs, there are anticipated aftershocks capable of causing more damage to the area than the initial event due to the weakened state of the area, for example, water and gas lines could be severed, roadways, ports, and critical infrastructure could be in an unusable state such that repairs are measured in the years rather than months.

There are three types of damaging earthquakes known to occur in coastal British Columbia and could potentially affect the SCRD:

1. Shallow or Crustal Earthquakes (high risk to SCRD)
2. Juan de Fuca Plate or Sub-Crustal Earthquakes (high risk to SCRD)
3. Plate Boundary or Subduction Earthquakes (moderate risk to SCRD)

Based on probabilistic seismic hazard models developed by the Geological Survey of Canada, estimates for the occurrence of 'structurally' damaging ground shaking due to crustal or sub-crustal earthquakes have been determined for various regions throughout British Columbia. While the SCRD itself has not been assessed for seismic probability, Vancouver BC has been evaluated and is proximate enough to provide a 'best guess' as to the likelihood of a significant earthquake affecting the Sunshine Coast. Natural Resources Canada's interactive earthquake map provides a visual location for the 2000 most recent earthquakes.[135]

Despite the ability to measure both location and intensity of earthquakes (using a seismograph), scientists still cannot precisely predict exactly where, when, or at what magnitude an earthquake will occur. However, they can measure the probability of an earthquake occurring, especially around fault zones. See Figure 26 and 27.

[134] Coppola, D. (2011). Introduction to International Disaster Management. Retrieved from: https://www.sciencedirect.com/book/9780123821744/introduction-to-international-disaster-management

[135] Natural Resources Canada. (2024). Last year of events located by Earthquakes Canada. Retrieved from: https://www.earthquakescanada.nrcan.gc.ca/recent/maps-cartes/index-1y-en.php?tpl_region=swbc

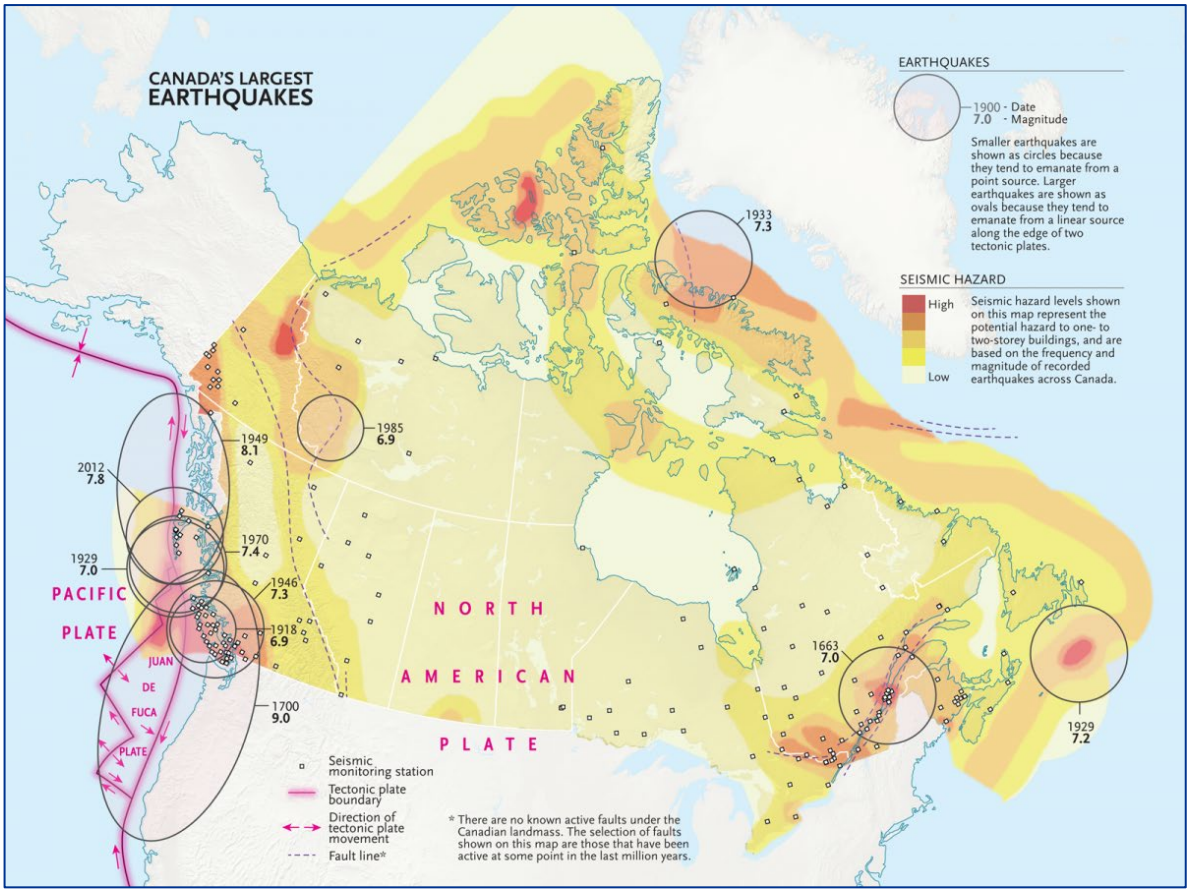

Figure 26: Canada's largest historical earthquakes[136]

[136] Pope, A. (June 2017). Mapping Canada's biggest earthquakes. *Canadian Geographic.* Retrieved from: https://canadiangeographic.ca/articles/mapping-canadas-biggest-earthquakes/

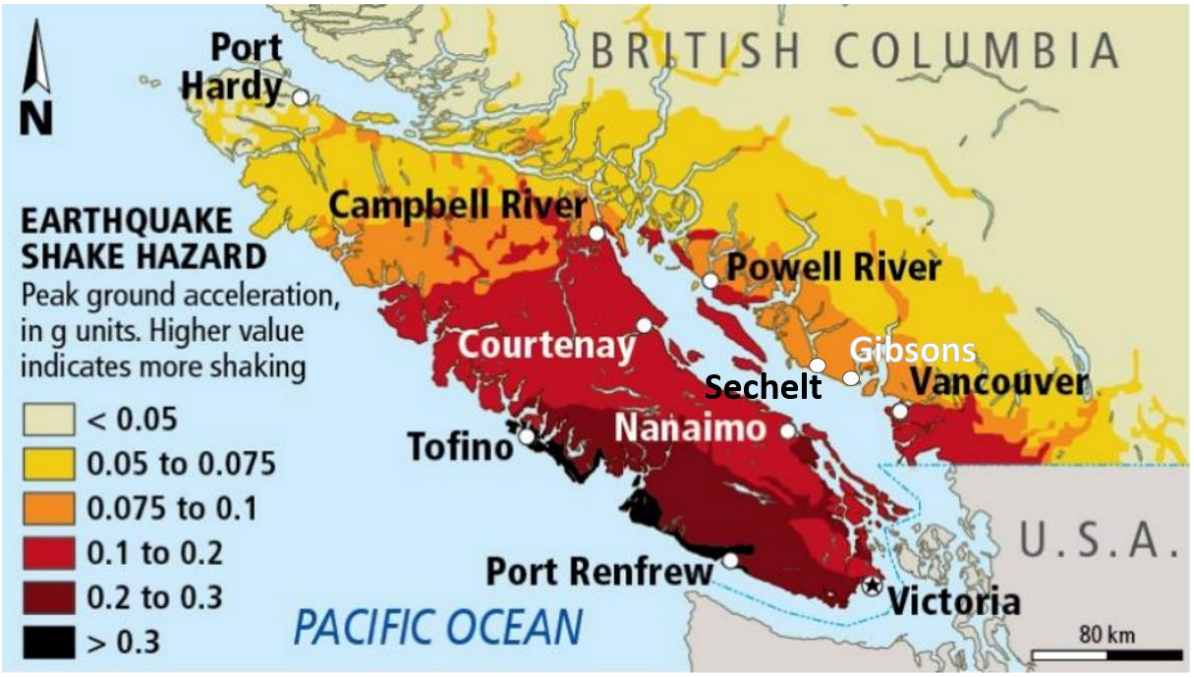

Figure 27: Map of earthquake shake hazard for Vancouver Island and neighbouring mainland coast. Colours indicate peak ground acceleration.[137]

Specific likelihood considerations

Shallow or Crustal Earthquake

Crustal earthquakes, also known as shallow earthquakes, are the most frequently occurring type of seismic event. They usually happen along fault lines and are typically found at depths between 10 and 20 kilometres. While their magnitude is generally lower than that of sub-crustal or subduction earthquakes, their closeness to the earth's surface can lead to substantial damage. The effect of a crustal earthquake on human communities and infrastructure is influenced by several factors, including its size, the horizontal distance from the earthquake's origin, depth, the type of fault involved, the composition of the local soil, and the frequency of ground movement. A significant number of aftershocks often follow these events, which can be equally destructive as the initial tremor.

Sub-Crustal Earthquakes

The Juan de Fuca Plate is a tectonic plate that lies off the coast of the Pacific Northwest of North America. Sub-crustal earthquakes, also known as intermediate-depth earthquakes, occur at depths of 30 to 70 kilometers beneath the Georgia and Puget Sounds. These earthquakes occur less frequently than crustal earthquakes, but they are typically more destructive due to their greater magnitude.

Historically, southwestern British Columbia and northern Washington have experienced very large sub-crustal earthquakes. The largest of these occurred in Seattle in 1945 with a magnitude of 5.5 and again in 1965 with a

[137] Rabinovich, A., et al. (2023). Past and future tsunamis and other extreme longwave oscillations in the Strait of Georgia. *Fisheries and Oceans Canada.* Retrieved from: https://publications.gc.ca/site/eng/9.928937/publication.html

magnitude of 6.5. Despite their less frequent occurrence, these earthquakes pose a significant threat to the SCRD due to their potential for high magnitude and the region's proximity to the Juan de Fuca Plate. However, the impact of these earthquakes is often mitigated by their focus depths, which means the shaking is less intense at the surface than it would be for a shallow earthquake of the same magnitude.

Plate Boundary or Subduction Earthquakes (Megathrust)

Subduction earthquakes are the most powerful type of earthquakes. They occur at the junction of multiple tectonic plates, releasing a tremendous amount of energy over a wide area. Southwestern British Columbia is vulnerable to this threat due to its location in the Cascadia Subduction Zone, near the intersection of the Juan de Fuca, North America, and Pacific plates. These plates are currently locked and accumulating strain, which will eventually be released in one or more large earthquakes. This is similar to the earthquake that occurred 95 – 100 kilometres offshore of the Pacific Northwest Region ~305 years ago (M9) and in the Indian Ocean on December 26, 2004 (M9). Results of extensive research, including analysis of geological evidence, have revealed that the Pacific Northwest has experienced 41 subduction zone earthquakes in the past 10,000 years – a recurrence interval of 243 years.[138]

The SCRD, along with the rest of southwestern British Columbia, could experience a subduction earthquake depending on where the rupture occurs and the length of the rupture area along the fault line. The Cascadia subduction zone is a 960 kilometre fault at a convergent plate boundary, about 110–160 km off the Pacific coast, that stretches from northern Vancouver Island in Canada to Northern California in the United States. It can produce 9.0+ magnitude earthquakes and tsunamis that could reach 30 m (98 ft). Figure 28 illustrates an example of a seismic risk of the Cascadia fault. A famous example is “the big one” around the Cascadia subduction zone in North America which occurs every 200 to 800 years.[139] The Oregon Department of Emergency Management estimates shaking would last 5–7 minutes along the coast, with strength and intensity decreasing further from the epicentre. Scientists predict there is about a 37% chance of a megathrust earthquake with a magnitude of 7.1 or higher occurring in this fault zone within the next 50 years, which would be felt throughout the Pacific Northwest.[140]

[138] Schulz, K. (July 13, 2015). The Really Big One. *The New Yorker.* Retrieved from: https://www.newyorker.com/magazine/2015/07/20/the-really-big-one
[139] Symington, A. (February 2023). Mapped: The World’s Major Earthquakes from 1956-2022. Retrieved from: https://www.visualcapitalist.com/cp/mapping-worlds-major-earthquakes-from-1956-2022/
[140] Cascadia Subduction Zone. (n.d.). Oregon Department of Emergency Management. Retrieved from: https://www.oregon.gov/oem/hazardsprep/pages/cascadia-subduction-zone.aspx

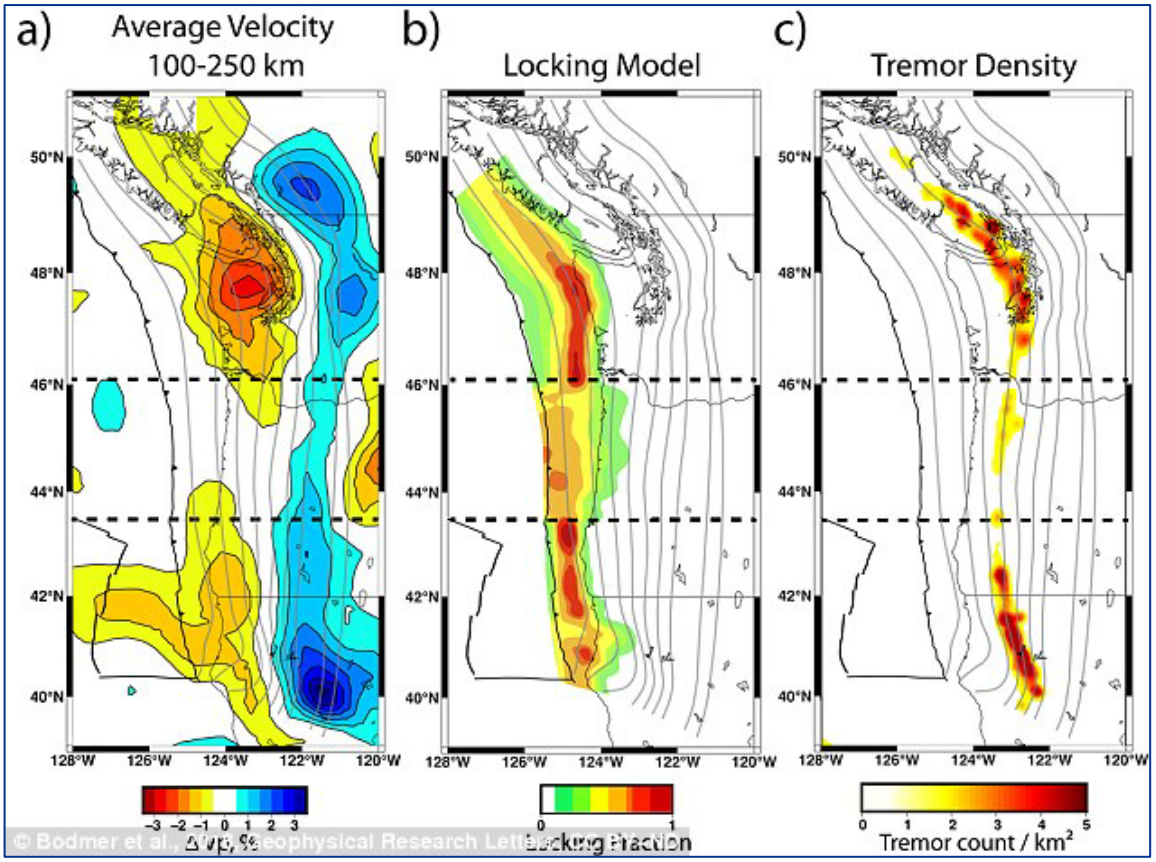

Figure 28: Seismic Wave Risk from the Cascadia Fault[141]

Consequence Considerations

Experts in BC and the US estimate that the number of deaths from a major earthquake could reach 10,000 with another 26,000 injured across the Cascadia subduction zone.[142] From the community engagement there were many concerns related to earthquakes in the region:

- Access/Egress.
- Elderly population.
- Medical service disruption.
- Environmental impacts.
- Hazardous materials spills (Section 6).
- Long timelines for residential rebuilds.
- Risk to Aquifers.
- Sewer & wastewater contamination.

[141] Bodmer, M. and Toomey, D. (August 2018). Researchers reveal the 'danger points' of the Cascadia fault that could cause a megaquake in the Pacific Northwest. *DailyMail.com*. Retrieved from: https://www.dailymail.co.uk/sciencetech/article-6016261/Researchers-reveal-danger-points-Cascadia-fault-cause-MEGAQUAKE.html

[142] Regional District of Nanaimo, Town of Qualicum Beach, and City of Parksville. (September 2019). Hazard, Risk and Vulnerability Analysis. Retrieved from: https://www.rdn.bc.ca/sites/default/files/inline-files/2019%20RDN%20HRVA%20Report%20FINAL.pdf

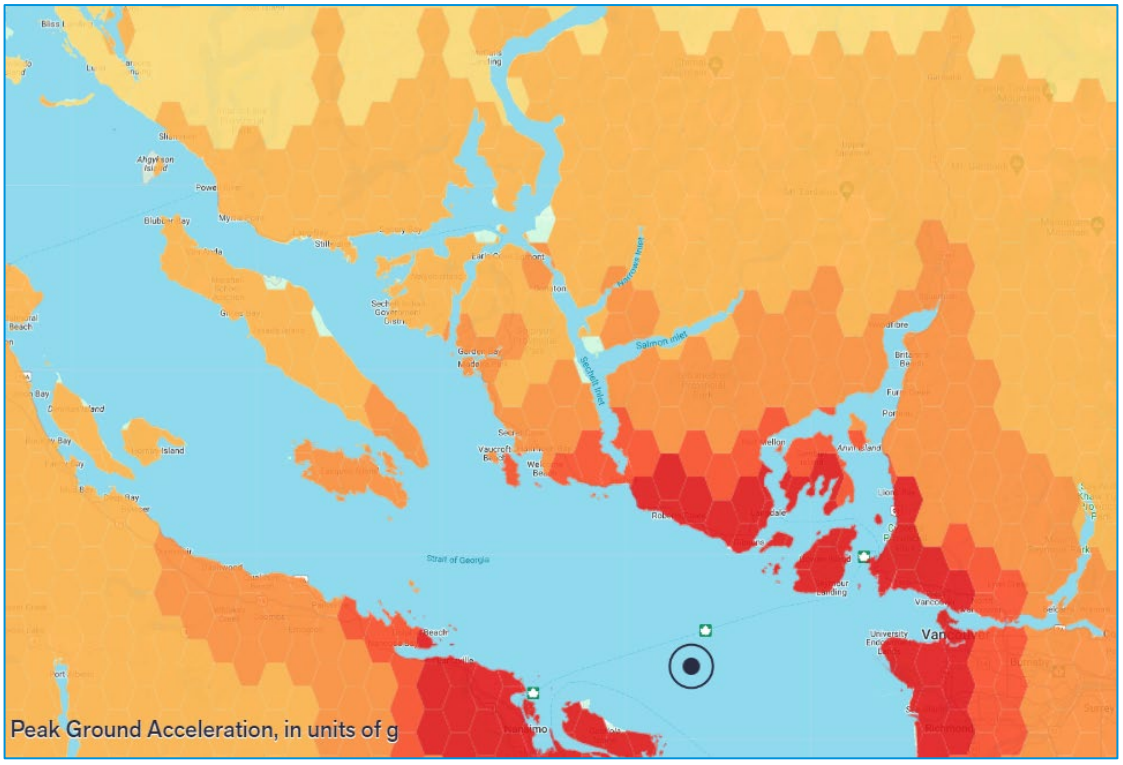

Figure 29: M7.0 Georgia Strait (BC) — Earthquake Scenarios[143]

Figure 29 above comes from a scenario-based exercise software designed to inform broadly on the possible damage extents incurred from various historical and possible events (such as an M7.0 earthquake in the middle of the Georgia Strait). It is not to be misconstrued as a scientific study depicting anticipated impact data.

Peak ground acceleration, or PGA, is a term used to describe the strongest shaking that happens at a specific location during an earthquake. PGA is a key factor in the design and implementation of earthquake engineering. It's used to inform the design of buildings, critical infrastructure, and other structures to withstand earthquakes. It's part of what's called the design basis earthquake ground motion, or DBEGM, which accounts for a worst-case scenario of an earthquake at a particular location. PGA is not about the overall size of the earthquake, such as the Richter or Moment Magnitude scales. Instead, it's about how much shaking happens at one specific place and is measured using special instruments called accelerographs.

Town of Gibsons

A significant seismic event could trigger numerous shallow-seated debris slides on the steep ravine slopes of Charman Creek and Gibsons Creek and the cumulative effect of these slides could result in significant debris floods or debris flows. Seismic damage to buried pipes located near the creeks may also result in

[143] RiskProfiler.ca. (2024). Predictive earthquake modelling software. Retrieved from: RiskProfiler – A platform to support disaster resilience

geotechnical issues (e.g., ruptured watermains could cause erosion or landslides). There may also be potential for deep-seated slope instability because of seismic loading. However, this is difficult to assess.[144]

District of Sechelt

A significant seismic event could trigger numerous shallow-seated debris slides on the steep slopes and rockfall hazard areas within the neighbourhoods of Tuwanek, Sandy Hook, and West Porpoise Bay. Modifications to existing rock slopes, either as cuts or fills may increase the extent or risk of instability. The most serious rockfall hazard has been identified in the area to the south of Sandy Hook. A seismic event may increase the risk of this hazard. Additionally, seismic events may impact linear critical infrastructure, such as power lines, waterlines (specifically pipelines running potable water from the Chapman Creek Water Treatment Plant to residents through the District Sechelt), gas lines, and wastewater lines. Highway 101 is the only transportation route linking the District of Sechelt north and south on the Sunshine Coast. Slumping and cracking of roads is not uncommon during and after an earthquake, which could interrupt transportation corridors into and out of the District of Sechelt.

Keats Island and Gambier Island

Keats Island and Gambier Island are situated over an active subduction zone that makes it one of the most seismically active regions in Canada. The likelihood of a structurally damaging earthquake (MMI VII) occurring within the next 50 years has been estimated at 11%.[145] Seismic events create the potential for liquefaction along banks and creek-sides which may cause extensive structural damage and impact transportation routes or wharves. Gas supplies, water sources (e.g., elevated water storage tanks, distribution lines), electricity and telephone service could all potentially be affected in a seismic event.

[144] Urban Systems. (2018). Integrated Stormwater Management Plan – Final Report. Retrieved from: gibsons.civicweb.net/document/62665/

[145] Gambier Island and Keats Island Hazard, Risk and Vulnerability Analysis. (2005). Supplement to the HRVA for the Sunshine Coast Regional District. Pg. 4.

5.2 LIQUEFACTION

Hazard	Current Likelihood	Consequence Score	Risk Level	Future Likelihood	Climate Risk Drivers	Anticipated change in likelihood
Liquification	**C**	**26**	**Medium Likelihood / Medium Consequence**	**C**		

Background of hazard

Liquefication occurs when loosely packed, water-logged sediments at or near the ground surface lose their strength in response to strong ground shaking and can cause major damage during earthquakes as soil loses its density and its ability to support houses, roads, and other infrastructure.[146]

Specific likelihood considerations

There are many factors that impact earthquake-induced liquefaction. The SCRD, like many other coastal regions of BC, is susceptible to earthquakes. Earthquake-induced liquefaction is also predicated on the saturation levels and groundwater table levels of a specific area. The likelihood of earthquake-induced liquefaction occurring in the SCRD is determined on the seismic parameters (e.g., intensity, proximity to SCRD), site condition (e.g., good drainage, groundwater table), and soil property (e.g., fine or clay content, relative density, particle size characteristics).[147]

Specific consequence considerations

Large objectives (e.g., houses, vehicles, public buildings) that are built on infill or floodplains may be most susceptible to liquefaction during an earthquake. These large objects situated on top of soil at risk of liquefaction may move or sink, and then getting stuck in their new position as the soil re-hardens. Buildings may slump or sink into the group, cars can be swallowed into the ground, landslides may be triggered, and roads and bridges can crack and fail.

District of Sechelt

District of Sechelt staff identified the Redrooffs Road area (north of the District of Sechelt), with its deep sand layers, being susceptible to liquefaction.

[146] US Geological Society. (n.d.). What is liquefaction? Retrieved from: https://www.usgs.gov/faqs/what-liquefaction; California Earthquake Authority. (n.d.). Soil liquification due to earthquakes. Retrieved online: https://www.earthquakeauthority.com/prepare-your-house-earthquake-risk/geologic-hazards/liquefaction

[147] Hu J., Tan Y., Zou W. (2021). Key factors influencing earthquake-induced liquefaction and their direction and mediation effects. PLoS ONE, 16(2).

5.3 TSUNAMI

Hazard	Current Likelihood	Consequence Score	Risk Level	Future Likelihood	Climate Risk Drivers	Anticipated change in likelihood
Tsunami	**B**	**26**	**Low Likelihood / Medium Consequence**	**B**	**N/A**	**N/A**

Background of hazard

Tsunamis are large wave events generated by large surface impacts, or when the floor of a water body moves suddenly, displacing the water on top of it.[148] Tsunamis travel at high speeds across open ocean, but slow down and grow steeper as they begin to reach shallow water.

Tsunami hazards along the Lower Mainland of British Columbia generally fall into three categories:

1) Telegenic or distant, earthquake-induced tsunamis have distant origins and are typically generated because of an earthquake along a subduction zone.
2) Local tsunamis (marine) are caused by submarine slides or slumping in local waters. They can be caused by earthquakes, but more frequently are triggered by non-seismic events such as abnormally low tides, coastal construction activity, heavy rainfall, strong winds, atmospheric pressure changes and sudden soil deposition during flooding.
3) Local tsunamis (terrestrial) are caused by landslides and can occur in both oceanic and freshwater regions of BC. Local terrestrial tsunamis are most often caused by slope failure through on rare occasion, can be caused by an earthquake-induced landslide.

Specific likelihood considerations

The probability of a telegenic tsunamis for the SCRD is rare, given the SCRD is sheltered from the open ocean by Vancouver Island. The probability of a local marine tsunami is not particularly high, given that the proximity of the SCRD to potential source areas means that the time interval between the event and the impact would be negligible. The likelihood of a local terrestrial tsunami causing loss of life and property within the SCRD is low, though some areas may be more prone than others. Vancouver Island protects the Strait of Georgia and Howe Sound from tsunamis generated a long distance away. Tsunami risks for SCRD involves landslides into or beneath the waters of Jervis Inlet, Sechelt Inlet, Salmon Inlet, and Howe Sound.

Specific consequence considerations

Impact of a telegenic tsunamis to the SCRD will depend on the location of earthquake focus and direction of wave travel, magnitude of quake and corresponding wave size. Local marine tsunamis are often difficult to detect, and residents have little warning time due to their proximity to the focus or site of initiation. Homes and infrastructure along vulnerable shorelines, such as ferry terminals, gas and hydro lines could potentially be at risk of flooding, debris damage and slippage. However, according to one study, no evidence of deposits

[148] Sunshine Coast Regional District. (2005). Hazard, Risk and Vulnerability Analysis. Retrieved from: https://www.scrd.ca/wp-content/uploads/2022/11/HRVA-SCRD_FINAL.pdf

of sheets of sand and gravel from tsunamis have been found in the Strait of Georgia, suggesting that waves from tsunamis that have made it to the coast of the SCRD were probably no more than 1 m high.[149] However, submarine slides (independent of or associated with an earthquake) could generate tsunamis that could be locally significant.[150] Figure 30 illustrates the regions of Vancouver Island and the southern Coast most at risk of Tsunami wave impacts.

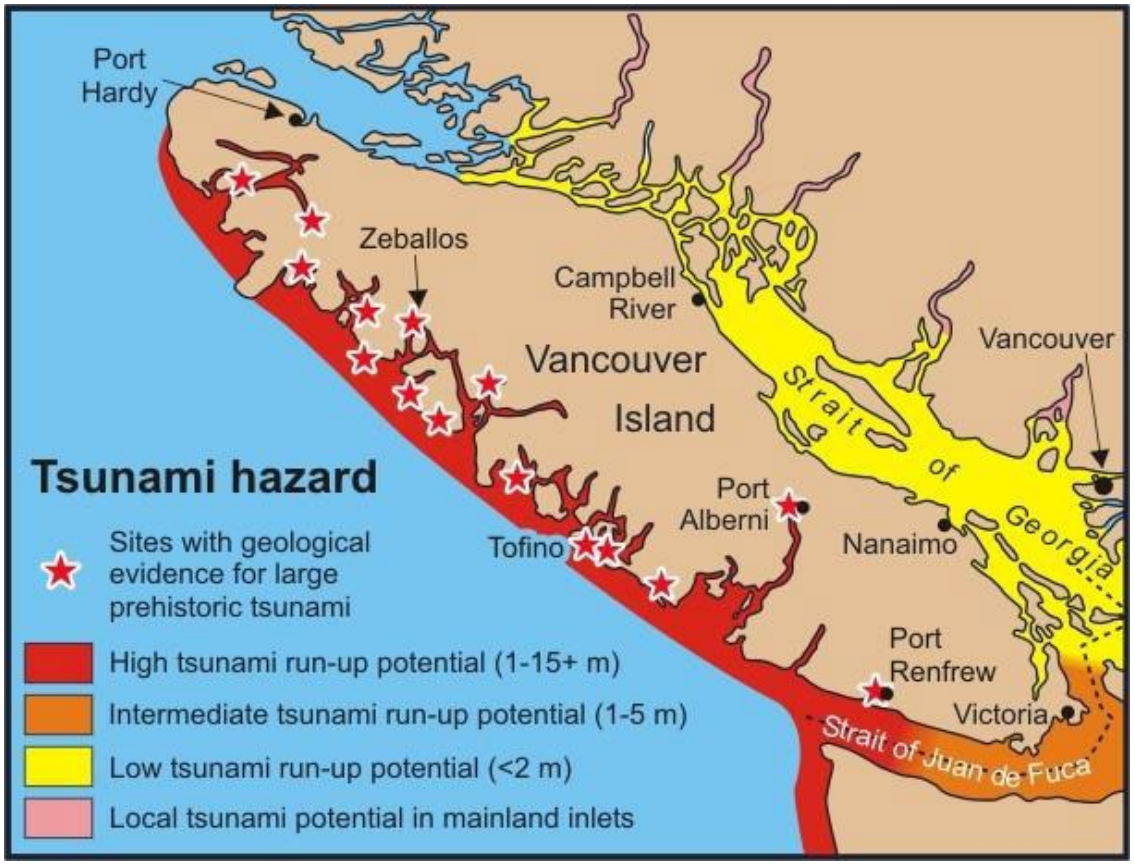

Figure 30: Relative run-up potential for communities on or adjacent to Vancouver Island.[151]

Keats Island and Gambier Island

The impact of a telegenic tsunami on Gambier or Keats Island will depend on several factors including the location of earthquake focus and direction of wave travel, magnitude of quake and corresponding wave size. Because the islands are somewhat sheltered by Vancouver Island, telegenic tsunamis originating in the Cascadia Subduction Zone (southwest of Vancouver Island), the Kamchatka Subduction Zone (southeast of Russia's Kamachatka Peninsula), or the Aleutian Subduction Zone (south of the Aleutian Island) are not likely to cause serious damage to communities on Gambier or Keats islands. However, given the remote and boat-

[149] Clague, J., Bobrowsky, P., and Hutchinson, I. (2000). A review of geological records of large tsunamis at Vancouver Island, British Columbia, and implications for hazard. *Quaternary Science Review,* 19: 849-863.
[150] Rabinovich, A. et al. (2023). Past and future tsunamis and other extreme longwave oscillations in the Strait of Georgia. Fisheries and Oceans Canada, pg. 46. Retrieved from: https://publications.gc.ca/site/eng/9.928937/publication.html
[151] Sunshine Coast Regional District. (May 2006). Tsunami High Risk Coastal Community Project. Retrieved from: https://www.scrd.ca/wp-content/uploads/2022/11/SCRD-ExtendedLegend.pdf

access nature of the islands, any impacts to docks along the shoreline because of a tsunami would make ingress and egress from the islands challenging.

The probability of a local marine tsunamis happening in the Strait of Georgia is not particularly high, though the proximity of Gambier and Keats islands to the source area means that the time interval between the event and the impact would be negligible. Some areas of the islands may be more prone to impacts by local terrestrial tsunamis than others, especially considering the proximity of these communities to water.

Past Events

- Earthquakes are recorded on a regular basis in the Pacific Northwest. On January 26, 1700, one of the world's largest earthquakes occurred along the west coast of North America and created a tsunami that destroyed the winter village of the Pachena Bay people on Vancouver Island.[152]
- In 1964, a magnitude 9.2 earthquake in Alaska created a tsunami that caused about $10 million in damage on Vancouver Island, with Port Alberni experiencing the highest wave of over 6m.[153]

[152] Natural Resources Canada (2021). Information on tsunamis. Retrieved from: https://www.earthquakescanada.nrcan.gc.ca/info-gen/tsunami-en.php
[153] Clague, J., Bobrowsky, P., and Hutchinson, I. (2000). A review of geological records of large tsunamis at Vancouver Island, British Columbia, and implications for hazard. *Quaternary Science Review,* 19: 849-863

6 HAZARDOUS MATERIALS AND EXPLOSIONS

A hazardous material is any agent which has the potential to cause harm either by itself or through the interaction with other factors.[154] Materials considered hazardous are explosives and blasting agents, flammable and inflammable gases, flammable liquids and solids, poisons, etiological agents, corrosive substances, hazardous and biomedical wastes.

6.1 HAZARDOUS MATERIALS SPILLS

Hazard	Current Likelihood	Consequence Score	Risk Level	Future Likelihood	Climate Risk Drivers	Anticipated change in likelihood
Hazardous Materials Spills	**C**	**12**	**Medium Likelihood / Medium Consequence**	**C**	**N/A**	**N/A**

Background of Hazard

The greatest concentration of hazardous materials is in the Domtar (Howe Sound) Pulp and Paper Mill. What makes this hazard particularly dangerous to the Sunshine Coast is its constrained ability to deal with accidental discharges, spills, or emissions at a local level. The mill maintains some internal emergency response capacity. Community fire departments are trained and equipped to do site containment and isolation of an affected area, as well as evacuation if deemed necessary. For recovery and clean up, external agencies must be called in to lead, such as the Ministry of Environment and advisory services such as Canutec. Additionally, the Government of BC encourages spills to be reported through the provincial Report a Spill (1-800-663-3456).

Various facilities within the SCRD possess hazardous materials and chemicals that can potentially threaten the well-being and safety of residents if mishandled. For example:

- Community swimming pools utilize significant quantities of chlorine.
- The Sunshine Coast Arena, Gibsons Curling Club and Gibsons and Area Community Centre handles ammonia.
- Local fuelling stations deal with dangerous goods such as gas, diesel and propane.
- Sewage treatments plant deals with bio-hazardous waste, as well as chemicals used in processing.
- Sodium hypochlorite is used for water treatment in multiple facilities.
- The Sechelt Landfill, which receives municipal, residential and industrial waste of various types.
- Gas stations located throughout the Sunshine Coast, all of which store large quantities of fuel on site.

Additionally, the Sunshine Coast is along the proposed route for LNG tanker traffic operating from Woodfiber LNG facility in Squamish. Although low, there is a potential risk from accidents involving LNG tankers traversing Howe Sound and the southern region of the Sunshine Coast, including release of hazardous materials and explosions.

[154] Regional District of Nanaimo. (2019). Hazard, Risk and Vulnerability Analysis. Retrieved from: https://www.rdn.bc.ca/sites/default/files/inline-files/2019%20RDN%20HRVA%20Report%20FINAL.pdf

Specific likelihood considerations

The SCRD's emergency response resources and outside of the region agency resources include limited hazardous material response capabilities. Though the likelihood of a spill of hazardous material is medium, the response capabilities in the SCRD suggest the likelihood of fatalities, property damage, reputational, and other consequences is low.

Specific consequence considerations

Industrial fires can pose complications for response and recovery due to the potential presence of hazardous materials and other on-site hazards. Materials considered hazardous are explosives and blasting agents, flammable and inflammable gases, flammable liquids and solids, poisons, etiological agents, corrosive substances, hazardous and biomedical wastes. This category involves spills, leakages, or accidents in fixed locations as well as the proper disposal of these hazardous materials. The greatest concentration of hazardous materials is in the Domtar (Howe Sound) Pulp and Paper Mill. The risk of hazardous materials being released into the environment from the mill is especially dangerous to the Sunshine Coast due to the constrained ability to deal with accidental discharges, spills or emissions at the local level. For site containment, isolation of an affected area, recovery and clean-up, external agencies may be called in to assist. Explosions or release of hazardous materials from marine tanker traffic operating from the Woodfiber LNG facility in Squamish possess considerable risks with consequences to the local economy, health and safety of communities along the coast and the environment in the event of an accident.

shíshálh Nation Government District

Local response to hazardous materials spills is limited as fire departments within the SCRD have basic spill containment capacities only. Aside from the Domtar (Howe Sound) Pulp and Paper Mill, few facilities exist that could threaten the people, property and environs of the shíshálh Nation Government District. The exceptions are likely to be proximate fueling stations that could potentially leak or explode, sewage treatment facilities (pipelines and treatment plans) that could contaminate Nation lands, or vehicle accidents that could result in hazardous materials being spilled.

6.2 MINE INCIDENT

Hazard	Current Likelihood	Consequence Score	Risk Level	Future Likelihood	Climate Risk Drivers	Anticipated change in likelihood
Mine Incident	A	11	Low Likelihood/ Low Consequence	A		

Background of Hazard

Mines range from open pit and underground mines, placer operations or gravel pits and quarries. Each mining operation presents unique hazards with incidents ranging from structure failure, tailings dam failure, sediment pond or other containment failure, hazardous materials spill, or explosion. These incidents may be generated by other hazards such as flood or seismic activity. The Sunshine Coast has several large open pit gravel, sand and rock mines with blasting and ponds that contain significant quantities of water. Several open pit mines are in close proximity to the Town of Sechelt, and another is located north of the Town of Gibsons.

Figure 31: Sand and gravel open pit mines, District of Sechelt, BC. Source: Google Earth.

Figure 32: Sand and gravel open pit mine near the Town of Gibsons, BC. Source: Google Earth.

Specific likelihood considerations

The Sunshine Coast's mountainous terrain and seismic activity present significant risks to mining operations. These conditions can lead to landslides, rock falls, and earthquakes, all of which have the potential to damage infrastructure at open-pit mines and endanger worker safety.

Heavy rainfall can lead to flooding in the mines or overtopping of existing ponds at the mine sites (specifically, the existing ponds at the mine site near the District of Sechelt). In addition, managing water quality is crucial to prevent contamination of

the local environment. Changes in weather patterns due to climate change can exacerbate existing hazards at the mines, including flooding and landslides, while also introducing new hazards, such as increased forest fire risk to the mines (in the event a wildfire spreads close to the mine site).

Specific consequence considerations

The consequences of accidents at the mines on the Sunshine Coast are diverse. Hazardous material spills, in the form of oil or diesel gasoline from heavy machinery, may result in consequences to the environment, contamination of groundwater sources, and worker safety. The use of explosions at the mine sites holds the potential for injury or fatalities of workers.

Droughts are a common occurrence on the Sunshine Coast. Open pit mines generate noise and dust pollution, which may be exacerbated during droughts when water resources (from ponds, groundwater resources, or other sources) are curtailed if water levels are low or there are water use restrictions. This may have impacts on air quality.

During heavy rain events, which the Sunshine Coast has experienced in the past, ponds may fill and overtop their banks, leading to flood risks to the mine site and worker safety, or to the communities at lower elevations from the mine site.

shíshálh Nation Government District

There are extensive aggregate (sand and gravel) deposits within and near the shíshálh Nation Government District. Mine incidents are most likely to result from the use of heavy machinery and impacts to the health and safety of employees.

Town of Gibsons

There are no mines (e.g., open pit gravel mines) within the boundaries of the Town of Gibsons. Gibsons' OCP states that as the Town is comparatively small in area and largely developed, it is not feasible for the Town to designate any land for sand and gravel deposits. However, there is an open pit gravel mine north of the Town of Gibsons.

District of Sechelt

There are extensive aggregate (sand and gravel) deposits within and near the District of Sechelt. Sechelt's OCP provides rough projections for extraction of approximately 5 million tones annually, and a long-term supply.[155] Additionally, over steepened and potentially unstable slopes have been developed because of gravel pit operations on both sides of Burnett Creek.[156] This introduces risk to worker safety if the slopes become unstable and collapse (e.g., due to seismic activity or heavy rains).

[155] District of Sechelt. (2010). Official Community Plan. Retrieved from: https://www.sechelt.ca/en/business-and-development/resources/Documents/Official-Community-Plan-Bylaw-492-2010.pdf
[156] Ibid

Keats Island and Gambier Island

There are two existing industrial sites on the west side of Gambier Island at Andy's Bay and at a gravel pit.[157] Operations at these sites may involve the use of hazardous materials (e.g., diesel fuel, motor oil) which, during an accidental spillage, may impact the local environment or impact the health and safety of workers on site.

[157] Gambier Island Official Community Plan. (2001). Pg. 19. Retrieved from: https://islandstrust.bc.ca/wp-content/uploads/2020/05/gmbl73-ocp-cons-dec-17-2019.pdf

6.3 OIL AND GAS PIPELINE SPILL

Hazard	Current Likelihood	Consequence Score	Risk Level	Future Likelihood	Climate Risk Drivers	Anticipated change in likelihood
Oil and Gas Pipeline Spill	**B**	**15**	**Medium Likelihood / Low Consequence**	**B**		

Background of Hazard

Pipeline gas leaks and explosions occur values or components rupture. This can happen by accident, mechanical failure, corrosion, or from natural disasters like earthquakes or landslides. BC has a system called BC 1 Call that helps locate buried pipelines at construction or excavation sites. This system is designed to limit the occurrence of accidental rupture of buried pipelines during construction or excavation activities. WorkSafe BC, Technical Safety BC, and the BC Energy Regulator require hand digging to expose buried pipelines before digging with powered excavation equipment. Additionally, pipeline companies in Canada must meet federal, provincial and local requirements. The Canada Energy Regulator requires each pipeline company to have an emergency management program that includes detailed emergency procedure manuals to guide its response in an emergency.

Figure 33: FortisBC natural gas pipeline (grey line) route through the Sunshine Coast.

As the primary supplier of natural gas to the Sunshine Coast, FortisBC's Main Transmission Line runs through the Sunshine Coast (see Figure 33).[158] The gas transmission line crosses the SCRD's water main from Chapman Lake reservoir (the primary drinking water source for the Sunshine Coast) and the access road to the treatment plant. The transmission line follows a Right of Way into Sechelt and then follows Highway 101 back towards Gibsons, and a Right of Way towards Pender Harbour. The transmission line west of Sechelt has

[158] Canada Energy Regulator. (December 2023). Pipeline Profiles: Westcoast or BC Pipeline: Retrieved from: https://www.cer-rec.gc.ca/en/data-analysis/facilities-we-regulate/pipeline-profiles/natural-gas/pipeline-profiles-westcoast-bc-pipeline.html

fewer intersects with infrastructure, except for east of Trout Lake where the transmission line is within 70m of Highway 101. FortisBC is required by the Canada Energy Regulator to have an Emergency Management Program.

Specific likelihood considerations

The likelihood of a gas pipeline spill on the Sunshine Coast is influenced by several factors. The region is prone to earthquakes, although the probability of a significant earthquake that could damage pipelines is unlikely. Wildfires, which are likely and with a changing climate almost certain, could also impact the integrity of oil and gas pipelines, potentially leading to spills. Heavy rainfall is another consideration; extreme weather events can wash out roads and expose buried pipelines, as happened in early 2020 in Roberts Creek. This event exposed two natural gas lines and a large water main, demonstrating the vulnerability of pipeline infrastructure to such incidents. Furthermore, human activities, such as road infrastructure construction, carry the risk of accidentally rupturing a buried gas pipeline with heavy machinery. Both natural and human-induced factors contribute to the likelihood of a gas pipeline spill in this region.

Specific consequence considerations

A gas pipeline spill on the Sunshine Coast could have serious consequences. One of the most immediate impacts would be the spillage of gas into the natural environment, which could cause significant harm to local ecosystems. The response activities required to clean up and remediate the site after a spill could also lead to further environmental impacts, such as alterations to stream banks or other natural features. Groundwater resources could be contaminated, posing a risk to both human health and the environment. If a spill were to occur near sites of cultural importance, the remediation activities could potentially impact First Nation's traditional, cultural, or spiritual activities.

The Sunshine Coast experiences heavy rainfall, which can worsen these challenges by destabilizing the ground beneath pipelines, thereby heightening the risk of spills. A gas pipeline spill could interrupt the supply of gas to customers on the Sunshine Coast. If this were to occur during winter weather, it could have serious implications, as many homes rely on gas for heating.

7. HYDROLOGICAL

7.1 DROUGHT

Hazard	Current Likelihood	Consequence Score	Risk Level	Future Likelihood	Climate Risk Drivers	Anticipated change in likelihood
Drought	**E**	**22**	**High Likelihood / Medium Consequence**	**E**		

Background

Drought is a natural phenomenon characterized by a prolonged period of insufficient rainfall, leading to a shortage of water. It can occur in any climatic region, including areas typically associated with high rainfall such as BC's west coast. The impacts of drought are multifaceted and can affect various aspects of life and the environment. For instance, drought can have significant effects on residential and commercial water supply, as the availability of water becomes limited. This was evident in 2022 when a State of Local Emergency was declared due to water shortage in the Chapman water system and 2018 when severe level 4 water restrictions necessitated water conservation efforts.

Specific likelihood considerations

In terms of likelihood, while droughts are typically associated with drier areas, they can occur anywhere, including BC's west coast. The Sunshine Coast typically experiences hot, dry summers and instances of drought are not uncommon. The severity and frequency of droughts can be influenced by various factors such as low snowpack, high temperatures, and low precipitation. Summer precipitation is projected to decrease by 14% and the number of hot days above 30℃ increasing to 14 days by 2051-2080 period. Seven of the last 12 summers have seen less precipitation than worse case scenarios from climate projections for 2050.[159]

Historical climate data provided by Environment Canada shows that rainfall during the months of June, July and August has been as low as 59.5 mm (Gibsons – 1967); 55.3 mm (Sechelt – 1996); 41.4 mm (Sechelt – 2002); and 47.8 mm (Sechelt – 2003). Because the SCRD draws a large portion of its drinking water from creek and lake sources, drought can have a serious impact on the SCRD water sources. For example, by affecting Chapman and Gray Creek watershed, which is the primary source of freshwater supplying about 83% of residential water users serviced by SCRD[160] (with lakes in Egmont and Pender Harbour, groundwater aquifers in West Howe Sound, Gibsons Aquifer and private wells making up the remaining supplied water).[161] The region's aggressive water conservation strategy and drought tolerant approach to landscaping will be helpful in mitigating the effects of dry, hot weather.

[159] Personal communication with Raphael Shay, Manager, Sustainable Development, SCRD, February 29, 2024.
[160] Sunshine Coast Regional District. (n.d.). Chapman Water System Backgrounder. Retrieved from: https://www.scrd.ca/wp-content/uploads/2024-Feb-26-Chapman-Backgrounder-Format.pdf
[161] Drought and drinking water. (2021). Sunshine Coast Conservation Association. Retrieved from: https://thescca.ca/drought-and-drinking-water/#:~:text=The%20Sunshine%20Coast%20Regional%20District%20%28SCRD%29%20supplies%20drinking,Harbour%20and%20groundwater%20aquifers%20in%20West%20Howe%20Sound

Specific consequence considerations

Drought significantly impacts various sectors and ecosystems, including agriculture and wildlife. In agriculture, insufficient water hinders crop growth, leading to reduced yields and potential food shortages. Wildlife, particularly aquatic life, is also threatened by drought as groundwater, which supports streams and aquatic life, can be severely depleted. This was evident from 2014 to 2016 when drought conditions led to the closure of the recreational fishery and efforts to protect the fish population.[162] Drought conditions can also increase the likelihood of wildfires, as the lack of moisture in vegetation makes it more susceptible to ignition. This was observed along the Sunshine Coast and Vancouver Island in 2018.

The potential impact of drought on aquatic habitats along the Sunshine Coast is significant, especially concerning the maintenance of base flows in watercourses during summer. Many floodplain streams are partially fed by groundwater flows in summer, and preserving these flows year-round is crucial for juvenile fish habitats. Effective stormwater management becomes increasingly important as development increases. Capturing and infiltrating stormwater can enhance the survival chances of these fish during droughts.

Wetlands are also susceptible to drought. Development around these areas can lead to their drying, like the impact of droughts on streams. Some wetlands naturally dry up in summer but maintain moist or saturated soils, providing vital habitats for local invertebrates and amphibians. As communities in the Sunshine Coast expand, it's important to ensure that development activities don't exacerbate the drying of wetland habitats. The survival of local wetlands could be threatened if they must deal with both natural drought cycles and reduced water inflows due to traditional stormwater piping into streams or lakes. The risk of drought to streams and wetland habitats in the SCRD is moderate-to-high, depending on the extent of nearby development and the land use restrictions in place to protect these habitats.

shíshálh Nation Government District

The shíshálh Nation Government District draws water for residents from the Chapman Creek water system, which is fed by surface water from Chapman Lake and Edwards Lake. Droughts can have serious impact on the well-being of residents if water sources get to a critically low level. shíshálh Nation and the SCRD entered an MOU to research the potential for a water reservoir on the shíshálh Nation gravel lands to address water supply in the region.

Town of Gibsons

The Town of Gibsons provides water to most of its residents from the Gibsons Aquifer via a system of wells. Water is pumped from the aquifer using wells, which is then stored in reservoirs. The Town relies on the SCRD for emergency storage, specifically to meet fire flow standards. The Upper Gibsons area is not included in the Town of Gibsons water system and is supplied with water from the SCRD. During extreme and potentially prolonged heat events, water sources may be overdrawn for landscaping or recreational purposes (e.g., pools). Water quality and quantity could be negatively affected. Heat events may be directly linked to water service interruption, impacting the Town of Gibsons residents.

[162] Drinking Water Systems. (2016). 2016 Utility Services Annual Report for the Sunshine Coast Regional District. Retrieved from: https://www.scrd.ca/wp-content/uploads/2022/12/2016-SCRD-Water-Quality-Report.pdf

District of Sechelt

The District of Sechelt draws most of its water from the Chapman Creek water system, which is fed by surface water from Chapman Lake and Edwards Lake. Droughts can have serious impact on the well-being of residents if water sources get to a critically low level. The region's aggressive water conservation strategy and drought-tolerant approach to landscaping will help in mitigating the effects of dry, hot weather. The District's Integrated Community Sustainability Plan (2019) identified a goal of reducing resource use and waste, including actions to promote the use of drought resistant landscaping, particularly in public parks and civic areas, opportunities to reuse water, and to support the use of water meters throughout the district, with the goal of reducing per capita water consumption and never experiencing stage 4 water restrictions.[163]

Recent Events

Most summers the SCRD brings in water conservation regulations in response to extreme drought.

- 2015 – the SCRD enforced Coast wide emergency water restrictions for almost six weeks.
- 2017 & 2021 – Stage 4 water restrictions were implemented.
- 2022 – SCRD experienced a 106-day drought[164] with a state of local emergency declared in October 2022 because of the severe lack of available water (both Chapman and Edwards Lake were drawn down to unprecedented levels).

[163] District of Sechelt. (2019). Integrated Community Sustainability Plan. Retrieved from: https://www.sechelt.ca/en/business-and-development/resources/Documents/Integrated-Community-Sustainability-Plan-(ICSP)-Goals-and-Actions-2019_Final.pdf

[164] Sunshine Coast Regional District. (April 24, 2023). Stage 1 Water Conservation Regulations in Effect May 1. Retrieved from: https://www.scrd.ca/news/stage-1-water-conservation-regulations-in-effect-may-1/

7.2 STORM SURGE

Hazard	Current Likelihood	Consequence Score	Risk Level	Future Likelihood	Climate Risk Drivers	Anticipated change in likelihood
Storm Surge	**D**	**10**	**High Likelihood / Medium Consequence**	**D**		

Background

Storm surges are described as increases in water levels that exceed levels normally associated with astronomical tides. They are caused by winds driving waters shoreward and are often coupled with low-pressure systems, which in turn cause increased sea levels at the same time. Coastal landforms such as deltas, spits and backshore areas are most vulnerable to storm surge flooding.

Specific likelihood considerations

Climate change is anticipated to drive storm surge events as sea levels increase and storm events become more intense. As sea levels rise, low lying communities and beachfront properties will be increasingly susceptible to storm surges, particularly when in combination with king tides. Sea level rise compounds regular and rare coastal hazards, where the magnitude of hazards and frequency – including storm surges – will increase over time, up to 1m by 2080.[165]

Specific consequence considerations

The Sunshine Coast is subject to storm surges resulting from steep terrain and a maritime climate. Sea level rise – because of climate change – is currently occurring, and the rate of sea level rise will continue to increase. This compounds regular and rare coastal zone flooding hazards (e.g., storm surges, large tide events).[166] Low-lying coastal areas within the Sunshine Coast are at highest risk for storm surges. Beachfront properties in Roberts Creek (DPA 9, 10 and 13), Elphinstone (DPA 1), Halfmoon Bay /Redroofs (DPA 4), and Pender Harbour (GAA 1 and 2) are particularly vulnerable to storm surge activity. Storm surges also have the risk of saltwater intrusion to freshwater aquifers due to surface flooding, and coastal erosion.

Increased coastal flooding, erosion and saltwater intrusion can increase the probability of degraded ecosystems and impacts on coastal infrastructure (e.g., roadways, telecommunications, electricity infrastructure, piers, docks, terminals).[167] Additionally, public services, supply chains and travel of goods and people may be compromised if roadways, marine infrastructure, airports, or telecommunication services are impacted. Sea walls, such as in Trail Bay, are regularly overtopped. Raising seawalls across the SCRD to account for sea level rise will limit overtopping and lower annual restoration costs.[168] Frequent storm surge events that

[165] Sunshine Coast Regional District. (2022). Climate Change Vulnerability and Risk Assessment Report. Pg. 7.
[166] Kerr Wood Leidal. (May 2013). Geotechnical Hazards Report: Halfmoon Bay. (May 2013).
[167] Intergovernmental Panel on Climate Change. (2022). Climate Change 2022: Impacts, Adaptation and Vulnerability. H.-O. Portner et al. (eds.). Cambridge University Press. Retrieved online: https://report.ipcc.ch/ar6/wg2/IPCC_AR6_WGII_FullReport.pdf
[168] Kerr Wood Leidal. (May 2013). Geotechnical Hazards Report: Halfmoon Bay.

impact on community infrastructure and private property can put a strain on the physical and mental health of individuals in the community.

Low lying coastal areas within all areas of the Sunshine Coast are at highest risk from storm surge, made more severe with sea level rise and more intense weather events. For example, much of the settlement in Sechelt is focused along the shoreline, and increased rates of storm surge damages may occur.

Recent events

- January 2024 – Environment Canada issues a coastal flood warning in the Metro Vancouver area due to high winds and a king tied event.
- December 2023 – Wind warnings with gusts of up to 90 km/h and high ocean waves impacted Central Coast, Greater Victoria, the Sunshine Coast and northern Vancouver Island.
- December 2022 – Chapman Creek breached banks at Mission Road from a combination of tides, atmospheric river, and wind resulting in shíshálh Nation Government District and District of Sechelt emergency response and sandbagging the creek; and the Town of Gibsons Bay Area experienced flooding in waterfront properties.

8. FLOODING

Floods are the most frequent natural hazard in Canada and can occur at any time of the year.[169] Floods can be created by heavy rainfall, ice jams, dam failures, or rapid melting of thick snowpacks.

8.1 LOCAL FLOODING

Hazard	Current Likelihood	Consequence Score	Risk Level	Future Likelihood	Climate Risk Drivers	Anticipated change in likelihood
Local Flooding	**D**	**18**	**High Likelihood / Medium Consequence**	**E**		

Background of hazard

Floods are a natural hazard that can create situations which endanger lives and property through direct inundation, isolation, loss of services, and damage to critical infrastructure. However, flooding is a highly manageable hazard. Flood risk outlines the probability of flooding affecting people and properties and the consequences which may result.

An understanding of flood risk, derived from flood models, land use and community characteristics, can be used to develop a plan to manage future floods. Flood risk is managed by first identifying the scale and nature of risk, determining a level of acceptable or tolerable risk (acknowledging that floodplains have multiple uses), then implementing measures to lower the flood risk to tolerable levels. Sometimes flood risk is managed by changing flood behaviour, for instance through construction of dams, levees, and stormwater drainage. However, these types of solutions can worsen flooding in some locations, affect environmental flows and be very expensive to build. Where flood behaviour cannot be changed, it is important to manage the residual flood risk through actions such as appropriate land use planning, community awareness measures and emergency management. The SCRD has undertaken a process of assessing and mapping the flood risk from rivers and creeks in the region.

Flood risks have been identified in the Chapman Creek, Gray Creek, Hotel and Ruby Lake, Chaster Creek, Gibson Creek, and smaller creeks along Marine Drive, as well as coastal flooding from the Strait of Georgia and Howe Sound. Flood-related hazards can also erode land and deposit sediment. Many of these different hazard areas overlap. In overlap areas, reducing risk from one source of flooding can sometimes increase risk to another.

Flood risk is made up of multiple factors:

- How likely a flood is to occur (bigger floods are rarer, smaller floods more common), referred to as flood likelihood.
- How dangerous the flood water is, which is dependent on how deep the water is and how fast it is flowing, referred to as flood hazard.

[169] Government of Canada. (2024). Prepare for Floods. Retrieved from: https://www.getprepared.gc.ca/cnt/hzd/flds-en.aspx

- What is being flooded, such as people or properties, and whether those people or land use types are more vulnerable to flooding, referred to as flood exposure and vulnerability.

Specific likelihood considerations

Climate change is anticipated to increase temperatures globally, and with that, the water-holding capacity of the atmosphere in warmer conditions in expected to increase, resulting in an intensification of the hydrological cycle.[170] As a result, this is expected to intensify resulting in the risk of floods in rivers and streams increasing over time.[171] However, these changes are not uniform across all regions.

Specific consequence considerations

A report by Kerr Wood Leidal (KWL) on flood risks for Sechelt, Tsawcome, and Cokqueneets land identified specific buildings, linear infrastructure (e.g., water and sewer mains), and cultural sites vulnerable to flooding. The flood risks for these assets and locations are predicted to be exacerbated in the future with climate change and sea level rise. These risks can be extrapolated to other communities across the SCRD, though the vulnerability of other communities to these risks may not be uniform.

Consequences of flooding include overburdened stormwater infrastructure resulting in overland and basement flooding, road washouts, and impacts to other critical infrastructure (e.g., water mains). Reduced fish access to spawning and rearing habitat can often result from a flood event, regardless of the magnitude of the event. Floodwaters often damage or obliterate fish passage to upstream spawning and rearing habitats. With increasing density in flood-prone areas, smaller and smaller storm return periods may cause damage to aquatic habitats similar to damage caused by larger events. As climate change increases the occurrence of more intense storm events, there is an increased risk of aquatic habitat disturbance and property damage to areas on or adjacent to flood planes.

Town of Gibsons

In the Town of Gibsons updated Integrated Stormwater Management Plan, Gibsons Creek is identified as a specific area of concern. At Reed Road, Gibsons Creek passes through a 2m diameter multi-plate culvert below the 10m high road embankment. Signs of slope creep on the north and south sides suggest the embankment slopes may be marginally stable. The inlets to the pipes that drain the road surface on the north and south sides of the roadway can get clogged with debris, and subsequent runoff erosion has caused mild erosion of the embankment surface. The Reed Road north ditch that discharges to Gibsons Creek from the west has caused significant erosion of the embankment fill and native soils.

In White Tower Park, a gravel path crosses Charman Creek as a small earth dam with 3 small diameter culverts serving as the outlet for the existing South Pond. Two of these culverts are showing signs of significant deformation and corrosion, and concentrated seepage through the dam between the culverts which could cause erosion of the fill materials. Internal erosion is a leading cause of earth dam failure and a

[170] Tabari, H. (2020). Climate change impact on flood and extreme precipitation increases with water availability. *Scientific Reports,* 10. Retrieved from: https://www.nature.com/articles/s41598-020-70816-2

[171] Ashmore, P., and Church, M. (2001). The Impact of Climate Change on Rivers and River Processes in Canada. *Geological Survey of Canada,* Bulletin 555. Retrieved from: https://publications.gc.ca/collections/collection_2017/rncan-nrcan/M42-555-eng.pdf

sudden release of the impounded pond could result in downstream flooding, erosion, deposition or land sliding.[172]

District of Sechelt

Local flooding could potentially contaminate local drinking water for the District of Sechelt with sediment, run off and other pollutants. This is particularly important where agricultural land that supports livestock exists in proximity to potable water sources. Local flooding may cause roads to wash out or flood, making transportation, access, and evacuation difficult or impossible. This is of particular concern where Chapman Creek and Highway 101 intersect, which is a vulnerable point within the District of Sechelt. Additionally, the convergence of Hudson Creek and Wilson Creek during periods of heavy rain can create debris flood and flooding hazards at the southernmost end of the watercourses. At Chapman Creek, serious flooding along the alluvial fan can result from high creek flows, high tide and storm waves causing widespread inundation. The District's Integrated Community Sustainability Plan includes actions to ensure communities are planned to be resilient to climate change impacts and extreme weather events, including minimizing development in areas prone to flooding, erosion, and other hazards.[173]

Keats Island and Gambier Island

Rainstorms are not uncommon on Gambier and Keats Islands and at times can last for several days. The wettest time of year is typically from October to February, with November averaging close to 300mm of rainfall. Rainstorms can lead to local flooding if creeks breach their banks or if the ground is saturated.

Past Events

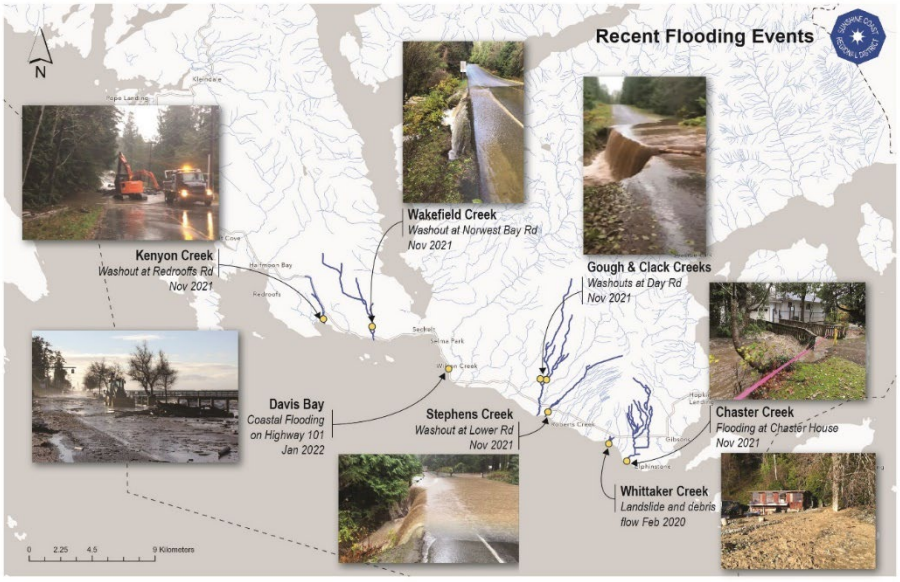

Figure 34: Recent flooding events in the Sunshine Coast Regional District.

[172] Urban Systems. (2018). Integrated Stormwater Management Plan Update – Final Report. Retrieved from: gibsons.civicweb.net/document/62665/
[173] District of Sechelt. (2019). Integrated Community Sustainability Plan. Retrieved from: https://www.sechelt.ca/en/business-and-development/resources/Documents/Integrated-Community-Sustainability-Plan-(ICSP)-Goals-and-Actions-2019_Final.pdf

8.2 COASTAL FLOODING

Hazard	Current Likelihood	Consequence Score	Risk Level	Future Likelihood	Climate Risk Drivers	Anticipated change in likelihood
Coastal Flooding	**D**	**25**	**High Likelihood / Medium Consequence**	**D**		

Background of hazard

Coastal flooding occurs when ocean levels rise above the elevation of shorelines or waterfront infrastructure and cause the inundation of land.[174] Coastal flood hazards can vary based on a given location's exposure to local wind and wave setup, wave runup on the shoreline, astronomical tides, storm surge, and sea level rise. Coastal communities are also at risk from tsunamis (Section 5.3). The SCRD has more coastline than most other regional districts in BC – approximately 509km of coastline, with SCRD owned assets (e.g., docks, water mains) and critical assets owned by others (e.g., roads, Highway 101) in low lying areas.

The shíshálh Nation Government District includes the Sechelt Lands with approximately 1600m of foreshore and is the primary business, residential, and administrative area of the Nation. There is a marine structure in the bay at Sechelt and a harbour with a breakwater at the south end of the lands. The lands are exposed to large waves generated in the Strait of Georgia. The Tsawcome (David Bay area) Lands have approximately 900m of foreshore and are primarily residential along with Port Stalashen marina. The lands are bordered by the District of Sechelt. The site has reportedly experienced flooding issues due to the proximity with Chapman Creek on the west side of the Tsawcome Lands. The Tsawcome Lands are on a large alluvial fan formed by Chapman Creek, with residential buildings and Port Stalashen marina on low-elevation terrain.

Recently, the term "King Tide" has been adopted in the Pacific Northwest. King Tide is a popular term used to refer to an especially high tide, or the highest tides of the year. King Tide is not a scientific term, nor is it used in a scientific context. King Tides would occur when the moon and sun are aligned at extreme distances to the earth in both January and July, resulting in the largest tidal range seen over the course of a year. Alignment between the moon and the sun that result in high tides occur during approximately three months each winter and again for three months in the summer. During these months, the high tides are higher than the average highest tides for three or four days.

Specific likelihood considerations

Coastal flooding because of sea level rise is anticipated to accelerate, rather than remain constant, as climate change induced temperature increases accelerate ice melt globally. Sea level rise will influence coastal flooding events, specifically storm surges and high tide events.

Specific consequence considerations

The foreshore along Howe Sound is relatively steep and undeveloped, but extending west towards Gibsons and north along the Strait of Georgia it has been largely developed for residential and commercial use. These

[174] Kerr Wood Leidal. (August 31, 2022). Coastal Flood Mapping and Flood Risk Assessment. Pg. 13

areas which are relatively flat and low elevation may be vulnerable to coastal floods. The consequence of sea level rise in relation to coastal flooding includes increased damage to coastal infrastructure assets like docks and terminals, increased coastal erosion, reduced effectiveness of coastal structures like sea walls and dikes, disruption to travel (specifically for nearshore roads, and potentially for escape routes), and danger to life with waves and stronger currents.[175] Provincial guidelines suggest planning for 1m of sea level rise by 2100.[176] Sea level rise planning areas should include areas exposed to coastal flood hazards, diked areas and inland floodplains adjacent to tidally influenced rivers.[177]

Given the high probability of sea level rise occurring, there may be flooding impacts to built up areas of the Sunshine Coast, including Keats Landing and Eastbourne on Keats Island, Gambier Island at New Brighton Docks, flooding of the harbour area in Gibsons and Sechelt. Additional maps for other areas of the Sunshine Coast (e.g., Halfmoon May, Roberts Creek, Madeira Park, Pender Harbour, Irvines Landing, and Earls Cove) are available in Appendix I.

shíshálh Nation Government District

Flood maps are available for shíshálh Nation lands No. 1 and No. 2 provided below to indicate risks associated with sea level rise.

Figure 35: Flood hazard mapping for shíshálh Nation land No. 2, with up to 1m in sea level rise. Source: Kerr Wood Leidal, 2022.

[175] Kerr Wood Leidal. (August 31, 2022). Coastal Flood Mapping and Flood Risk Assessment. Pg. 14.
[176] Ministry of Forests, Lands, Natural Resource Operations and Rural Development. (January 1, 2018). Flood Hazard Area Land Use Management Guidelines Sea Level Rise Amendment. Retrieved from: https://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/integrated-flood-hazard-mgmt/slr_guidelines_amendment_website_final.pdf
[177] Ibid

Figure 36: Flood hazard mapping for shíshálh Nation land No. 2, with up to 1m in sea level rise. Source: Kerr Wood Leidal, 2022.

Figure 37: Flood hazard mapping for shíshálh Nation land No. 2, with up to 1m in sea level rise. Source: Kerr Wood Leidal, 2022.

Figure 38: Flood hazard mapping for shíshálh Nation land No. 1, with up to 1m in sea level rise. Source: Kerr Wood Leidal, 2022.

Town of Gibsons

In Gibsons, sea level rise poses risks primarily to shoreline property owners, the Harbour Area, sewer lines, and the Gibsons Aquifer. Sea level rise threatens structures and aquifers at very low elevations near the ocean due to the potential for saltwater intrusion as well as increased wave power and inland range. Sea level is expected to rise by 0.82m to 1m in the mainland southern Strait of Georgia area by the year 2100. Figure 39 illustrates areas of the shoreline susceptible to coastal flooding due to sea level rise by 2100. Gibsons' OCP identified mitigative actions to be taken for buildings and developments, particularly that structures must not be located within 15m of the natural boundary of the sea, and for buildings and structures in the Franklin Road and Gower Point areas that are designed as "high probability of geotechnical occurrence" must have a setback of 30m from the natural boundary of the sea. [178] Additionally, the OCP suggests that accommodations for sea level rise may be incorporated into planning, for example, by

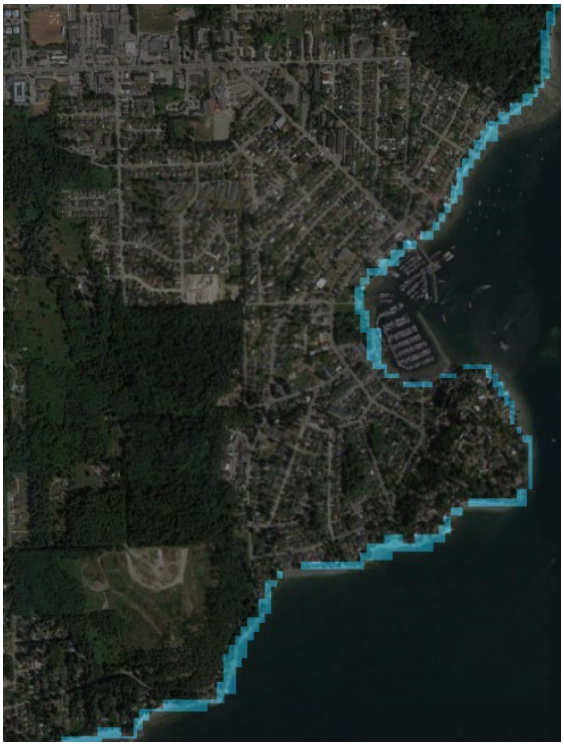

Figure 39: A sea level rise of 3.0 feet above the high tide line for Gibsons. Source: climatecentral.org

[178] Town of Gibsons. (2015). Smart Plan: Gibsons Official Community Plan. Retrieved from: https://gibsons.ca/wp-content/uploads/2023/11/Consolidation-Part-ABC-Smart-Plan-to-include-28.pdf

designing parks whose landscape is designed to accommodate higher water levels.

District of Sechelt

Sechelt may be at increased flood risk in the future. Beachfront areas may be subject to coastal flooding or future coastal flooding under climate change. Sechelt's OCP states that sea level increases may require current building elevations and setbacks to be increased, and waterfront development should meet the DPA 3 environmental guidelines, which are intended to reduce future alterations and improve habitat conditions on the marine shoreline. Critically, the Water Treatment Centre in Sechelt is at risk from coastal flooding and inundation from tsunamis. Figure 40 illustrates a potential future coastal flooding scenario under a 3-foot sea level increase by 2100.

Figure 40: A sea level rise of 3.0 feet above the high tide line for Sechelt harbour. Source: climatecentral.org

Keats Island and Gambier Island

Similar to other communities on the Sunshine Coast, Keats Island and Gambier Island are both susceptible to coastline flooding, particularly where critical infrastructure is located, such as docks. Though both islands have areas with steep shorelines and rock bluffs, other areas of the islands are low lying and more susceptible to coastal flooding from sea level rise and more severe weather events.

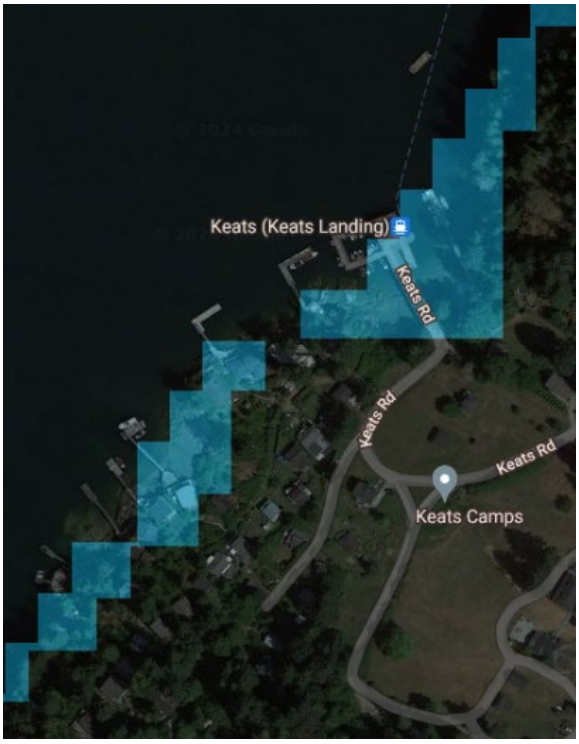

Figure 41: A sea level rise of 3.0 feet above the high tide line for Keats Landing (Keats Island). Source: climatecentral.org

Figure 42: A sea level rise of 3.0 feet above the high tide line for Eastbourne (Keats Island). Source: climatecentral.org

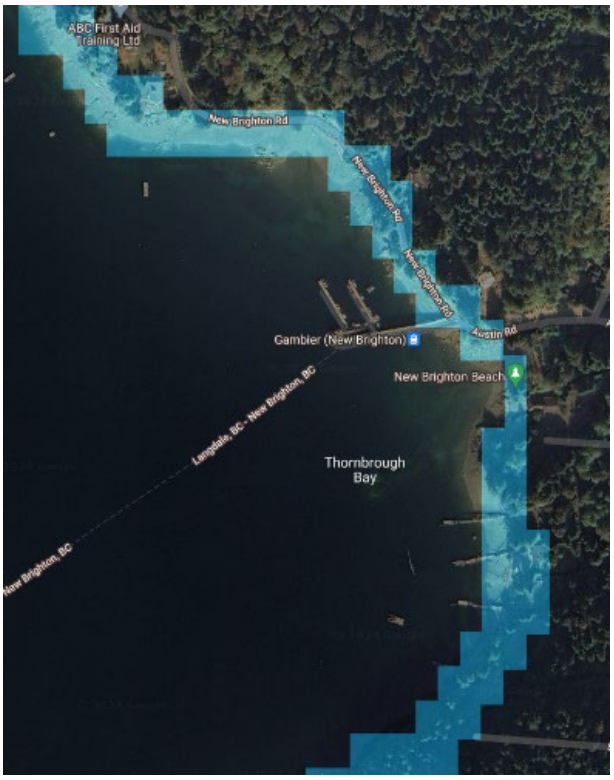

Figure 43: A sea level rise of 3.0 feet above the high tide line for New Brighton (Gambier Island). Source: climatecentral.org

Recent events

- December 2012 - tide/surge event resulted in flooding in many parts of the Lower Mainland.
- December 2022 - Chapman Creek breached banks at Mission Road from a combination of tides, atmospheric river, and wind resulting in shíshálh Nation Government District and District of Sechelt emergency response and sandbagging the creek.

Hazard	Current Likelihood	Consequence Score	Risk Level	Future Likelihood	Climate Risk Drivers	Anticipated change in likelihood
River, Creek, & Freshet	D	18	High Likelihood / Medium Consequence	E		

Background

Freshet flooding is caused when a sudden occurrence of warm temperatures rapidly melts snow and ice, turning it to liquid water at a faster rate that can be absorbed within the confines of existing water channels. The SCRD and the Ministry of Emergency Management and Climate Readiness (EMCR) generally refer to the BC River Forecast Centre's Channel Links Evolution Efficient Routing (CLEVER) Model[179] to monitor freshet hazards during this time of year. In times of higher freshet risk, EMCR hosts inter-agency teleconferences with presentations by subject matter experts to assist with freshet event preparation and response.[180]

Specific likelihood considerations

In the SCRD, freshet floods have typically occurred during the main spring thaw of mountain snow in the months of May and June, and across the rest of BC between April and July.[181] As temperatures increase in a changing climate, hydrologic regimes are being altered with spring freshets occurring earlier and more rapidly, with subsequent reductions in summer flows.[182] Although annual peak flows can result from the spring freshet or summer rainstorms, the dominant flood-inducing process for Chapman Creek involves rain-on-snow events during the fall and early winter. These autumn events involve heavy precipitation inducing rapid melt of a thin and immature, fully saturated higher-elevation snowpack.[183]

Specific consequence considerations

Flooding in the SCRD can occur due to various reasons. One such reason is the rapid melting of snowpacks, like rain-induced flooding. This is most common between May and June, depending on factors like snowpack depth, temperature, and rainfall. However, flash floods or mass erosion caused by freshets are rare, and due to the SCRD's low snowfall levels, the risk of freshet-induced flooding is low.

Intense multi-day rainstorms, especially in the fall and early winter, often cause floods on the district's larger rivers. The rain can melt a thin layer of snow, creating additional runoff and increasing the flood risk. Over time, rivers naturally migrate across their floodplains, eroding land on one side and depositing sediment on the other.

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[179] Government of BC. (2024.). Current and forecast streamflows. Retrieved from: https://www2.gov.bc.ca/gov/content/environment/air-land-water/water/drought-flooding-dikes-dams/river-forecast-centre/current-and-forecast-streamflows

[180] Government of BC. (2023). Lower Mainland emergency planning floodplain maps. Retrieved from: https://www2.gov.bc.ca/gov/content/environment/air-land-water/water/drought-flooding-dikes-dams/integrated-flood-hazard-management/governance/flood-hazard-land-use-management/floodplain-mapping/emergency-planning

[181] Government of BC Ministry of Transportation and Infrastructure. (n.d.). What is Freshet? Hint: It's not an air freshener. Retrieved from: https://www.tranbc.ca/2011/05/11/what-is-freshet-hint-its-not-an-air-freshener/

[182] Kang, D., Gao, H., Shi, X., Islam S., and Dery S. (2016). Impacts of a rapidly declining mountain snowpack on streamflow timing in Canada's Fraser River basin. *Scientific Reports,* 6.

[183] Kerr Wood Leidal. (2010). Chapman Creek Flood Assessment. Pg. 20

Smaller creeks and rivers are more susceptible to shorter, intense rainstorms. The water levels in these streams rise and fall faster than in larger rivers, providing less warning of an impending flood. Small creeks, due to their steeper slope, can transport more sediment and woody debris. When the creek slope changes, the water slows down, depositing sediment and debris, often forming a creek fan.

Unstable terrain on some rivers and creeks can lead to large volumes of sediment, rock, and woody debris. If the creek is steep enough, these materials can cause a debris flow, a fast-moving, high-energy landslide that can cause significant damage. If a landslide blocks a river, it can result in a debris flood, which shares characteristics with both floods and debris flows.

8.4 FLASH FLOOD

Hazard	Current Likelihood	Consequence Score	Risk Level	Future Likelihood	Climate Risk Drivers	Anticipated change in likelihood
Flash flood	**D**	**17**	**High Likelihood / Medium Consequence**	**E**		

Background

Flash flooding is heavy or excessive rainfall in a short period of time that produces immediate runoff, creating flooding conditions within minutes or a few hours during or after the rainfall. Flash flooding may occur locally particularly on small or moderate sized streams due to spring, summer, or fall/winter rainstorm. Coastal streams of all sizes commonly rise rapidly to their greatest annual peaks during intense fall and winter rainstorms.

Specific likelihood considerations

Climate change will impact the frequency of flooding through changes to precipitation patterns. More intense rains may increase the likelihood of flash floods, especially during a rain-on-snow event.

Specific consequence considerations

Flash flooding may result in damage to infrastructure built within a floodplain or near to streams and rivers known to breach their banks. For roads, bridges, water provision pipelines, or other critical infrastructure, the consequences of flash flooding could be an interruption to services from mudslides, road corridors to some communities cut off, including interruption to food and fuel supply.

In November 2021, the Sunshine Coast experienced record rainfall that caused widespread flooding and road washouts. Six wastewater treatment facilities for the Sunshine Coast Regional District Chapman Water System flooded, water mains failed, and a boil water advisory was put in place for residents.[184]

[184] Vancouver Coastal Health. (2023). Protecting Population Health in a Climate Emergency. Retrieved from https://www.vch.ca/sites/default/files/2024-02/vch-climate-change-health-report.pdf

8.5 JÖKULHLAUPS AND/OR GLACIER-OUTBURST FLOODS (GLOFS)

Hazard	Current Likelihood	Consequence Score	Risk Level	Future Likelihood	Climate Risk Drivers	Anticipated change in likelihood
Jökulhlaups & GLOFs	**A**	**20**	**Low Likelihood / Medium Consequence**	**A**		

Background

The hydrology of some glaciers systems is characterized by the sudden catastrophic release of stored water in outburst floods or Jökulhlaups (an Icelandic term meaning 'glacier flood'). Jökulhlaups may be triggered by:

- The sudden drainage of an ice-dammed lake below or through the ice dam.
- Lake water overflow and rapid fluvial incision of ice, bedrock or sediment barriers.
- The growth and collapse of subglacial reservoirs.

Specific likelihood considerations

While there are sizeable snowpacks above the mountains that hem in the Sunshine Coast, the large glaciers required for catastrophic outburst floods do not exist in proximity to developed areas within the SCRD. Geothermal activity which precipitates rapid ice melt beneath glacial beds or fields is also notably absent. This risk is therefore considered to be low.

Specific consequence considerations

Extreme flooding may be caused by Jökulhlaups. However, the risk to the SCRD from flooding because of Jökulhlaups is low. Despite this, previous floods from Jökulhlaups provide insight into the risks. In 1918, a major flood occurred in Iceland because of a subglacial eruption of the Katla volcano, which lies beneath the Myrdalsjökull ice cap, which produced a peak discharge of 300,000 cubic meters of water, ice and debris per second.

9. INFRASTRUCTURE FAILURE

9.1 DAM & SPILLWAY BREACH

Hazard	Current Likelihood	Consequence Score	Risk Level	Future Likelihood	Climate Risk Drivers	Anticipated change in likelihood
Dam & Spillway Breach	**A**	**28**	**Low Likelihood / High Consequence**	**A**		

Background

A dam breach, characterized by uncontrolled water releases from the reservoir due to a failure in the dam's structure or operation, poses a significant hazard, especially in communities reliant on a single dam for water. Potential flood hazards include the failure of Chapman Dam, Edwards Lake Dam, and McNeill Dam, as well as the Clowhom Dam, McNair Creek Dam, and Lake Seven Dam. Although the possibility of a dam failure at these dams are remote, the consequences could be moderate for the SCRD. BC Hydro regularly collaborates with the district and other local stakeholders to maintain emergency plans.

The Clowhom Dam is the closest dam to Sechelt, located 40km up Salmon Inlet, is a 21-meter-high structure that receives water from a 382 km² drainage basin. Chapman Lake Dam is situated at the western end of Chapman Lake, approximately 16km northeast of Sechelt business centre. The concrete dam was constructed in 1978 for water impoundment as drinking water supply and became the primary drinking water supply for

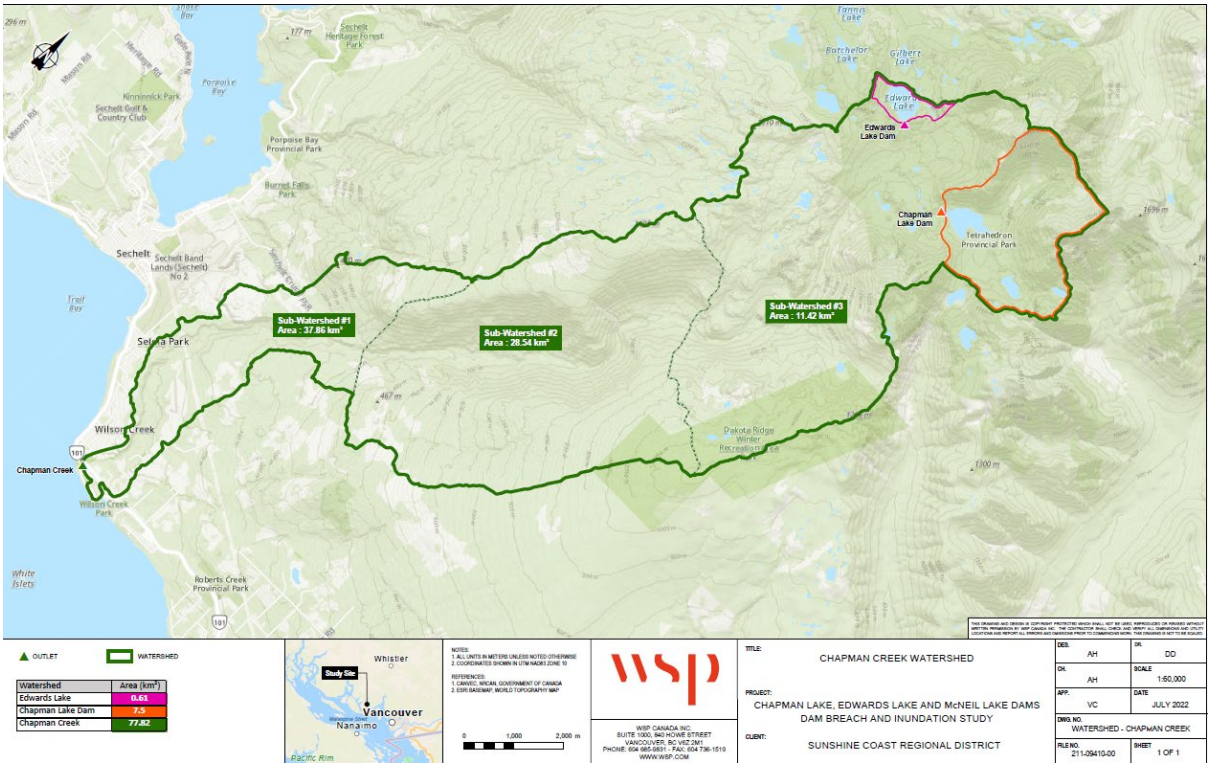

Figure 44: Location of Chapman and Edwards Dams.

the Sunshine Coast and drains into Chapman Creek. The Edwards Lake Dam is situated southeast of Edwards Lake, approximately 17km northeast of the District of Sechelt. The concrete dam was constructed in 1991 and drains into Chapman Creek. McNeill Lake Dam is located on McNeill Lake, approximately 3.5km southeast of Madeira Park. The concrete dam was constructed in 1965 for water impoundment as a drinking water supply source and drains into Haslam Creek.

Lake Seven dam is a water source for Domtar (Howe Sound) Pulp and Paper's mill operations. The mill, located in Port Mellon, has historically relied on water from Lake Seven for its operations. However, there have been concerns about the dwindling water supply in Lake Seven, which contributed to the closure of newsprint operations at the mill.

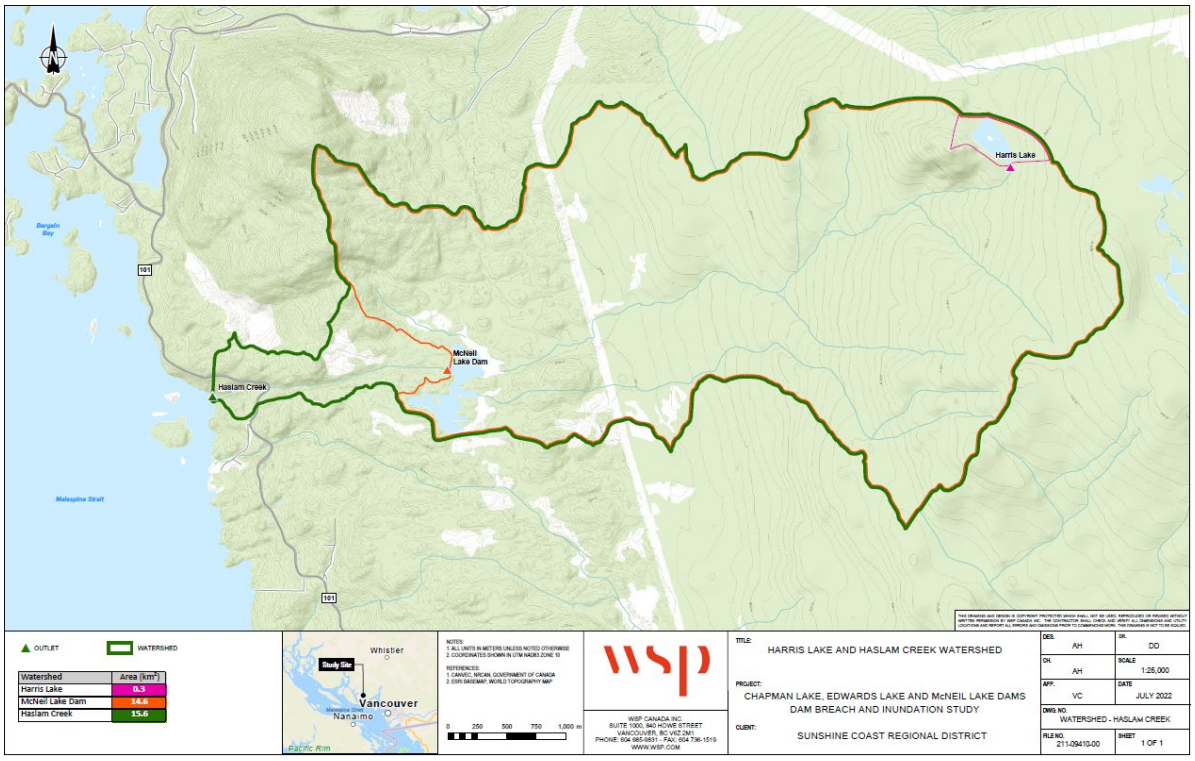

Figure 45: Location of McNeill Lake Dam.

Specific likelihood considerations

The drainage basin for Clowhom Dam experiences large, short-term fluctuations in inflows, primarily due to warm temperatures in April and May, and heavy fall rainstorms between September and December. These conditions, combined with potential landslides from the vegetation-bare north side of Mount Donaldson, could lead to overflow. However, BC Hydro's Dam Safety Program Annual Report (2023)[185] categorizes Clowhom Dam as having a low aggregate deficiency and consequence rating, indicating a low likelihood of poor performance. A breach is not expected to pose a significant flooding hazard to nearby communities like Sechelt, Tuwanek, and Four Mile Point or the shíshálh Nation Government District, as excess water would likely dissipate into Salmon Inlet. Therefore, the risk of flooding due to dam failure is considered low. Upgrades to

[185] Government of BC. (April 2024). Dam safety. Retrieved from: https://www2.gov.bc.ca/gov/content/environment/air-land-water/water/drought-flooding-dikes-dams/dam-safety

Chapman, Edwards and McNeill Lake dams is being initiated in 2024 to ensure compliance with provincial safety requirements.[186] However, the three dams were reported to not be at risk of failure.[187]

Specific consequence considerations

Chapman Dam

In the event of a dam breach for Chapman Dam, significant structures downstream that may be impacted include: water intake, landfill, the Sechelt Airport, a fish hatchery, the Chapman Creek Bridge along Highway 101, culverts crossing Highway 101 that connects the collecting channel on the north side of Highway 101 to the south side of the Highway that then drains towards Wilson Creek, and domestic residences. A 2019 consequence classification assessment of Chapman Lake Dam was conducted by Integrated Sustainability and predicted that the overall impacts of a dam breach induced flood would be minor.[188] The assessment predicted the flow rate due to a dam breach would be less than the five-year storm event rate, and as the flow entered developed areas, the rate would fall below the two-year storm event rate. After the initial dam breach, flow would be contained within Chapman Creek for the remainder of the flood path, except in some forested areas and in the fish hatchery, where it would slightly exceed the bounds of the creek. Fewer than 10 people are expected to be located within the flood zone, but depth and velocities were estimated to be too low to generate loss of life. However, perhaps one of the most significant consequences of a failure of Chapman Lake

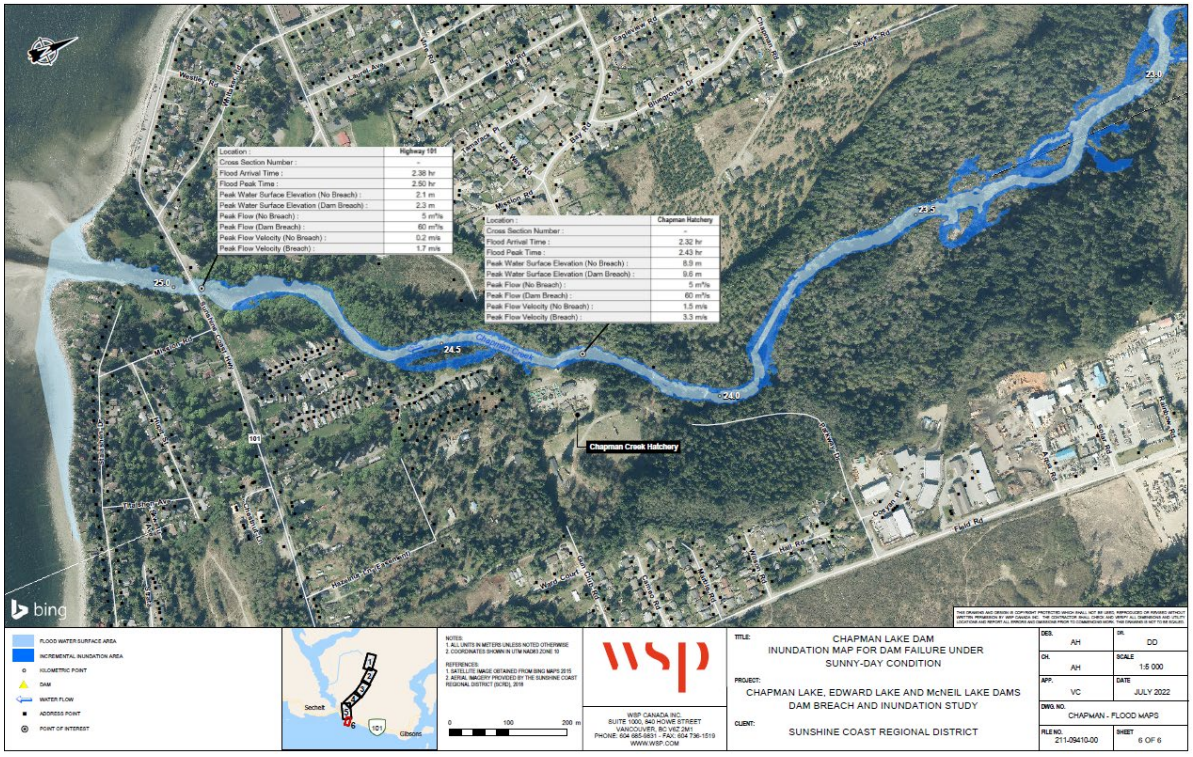

Figure 46: Chapman Dam inundation map for dam failure under sunny-day condition.

[186] Jordison, C. (September 20, 2023). Safety upgrades for three Sunshine Coast regional dams proceeding. Coast Reporter. Retrieved from: https://www.coastreporter.net/local-news/safety-upgrades-for-three-sunshine-coast-regional-dams-proceeding-7569051

[187] Jespersen, R. (December 21, 2020). SCRD dams require safety upgrades. Coast Reporter. Retrieved from: https://www.coastreporter.net/local-news/scrd-dams-require-safety-upgrades-3418252

[188] WSP. (2022). Dam Breach and Inundation Report. Pg. 8.

Dam would be the significant stress on the Chapman Water System, leading to water shortages for an extended period for the approximately 22,000 residents who rely on the Chapman Water System.

Edwards Lake Dam

Significant structures downstream of Edwards Lake Dam include the water intake for SCRD treatment plant, landfill, Sechelt Airport, the Chapman Creek Fish Hatchery, Highway 101, and a small number of domestic residences in Wilson Creek located about 1km downstream of the hatchery. A 2019 assessment by Integrated Sustainability predicted the overall impacts of a dam breach-induced flood would be moderate to severe. The 2019 assessment predicted the flow rate due to a dam breach would be slightly greater than the 50-year storm event rate, and as the flow entered developed areas, the rate would become approximately equivalent to 20-year storm event rate. Approx 1km downstream of the hatchery, flood waters are expected to impact a small number of residences in the community of Wilson Creek. There would be potential loss of life and potential damage to the Highway 101 bridge.

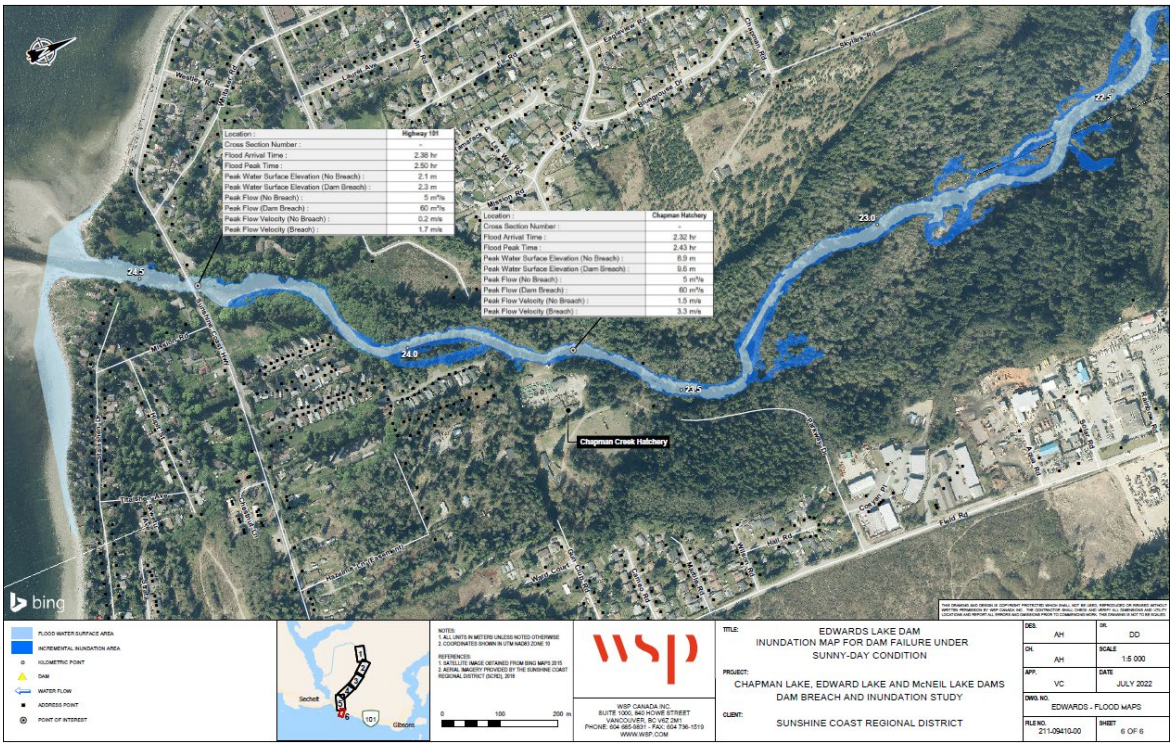

Figure 47: Edwards Lake Dam inundation map for dam failure under sunny-day condition.

McNeill Lake Dam

Significant structures downstream of McNeill Lake Dam identified in the 2012 DSR consequence classification assessment include: water treatment plant, Highway 101 and two culverts underneath Highway 101, and domestic residences. Highway 101 is expected to be considerably damaged at the Haslam Creek crossing due to the incremental flow during a sunny-day breach scenario.[189] The breach of McNeill Lake Dam could potentially affect water treatment infrastructure and Highway 101 transportation.[190] About 10 people are located within the inundation zone during the day and fewer than 10 at night. Damages to Highway 101 and to the Pressure Reducing Valve Station are expected and the economic and infrastructure losses are potentially considerable.[191]

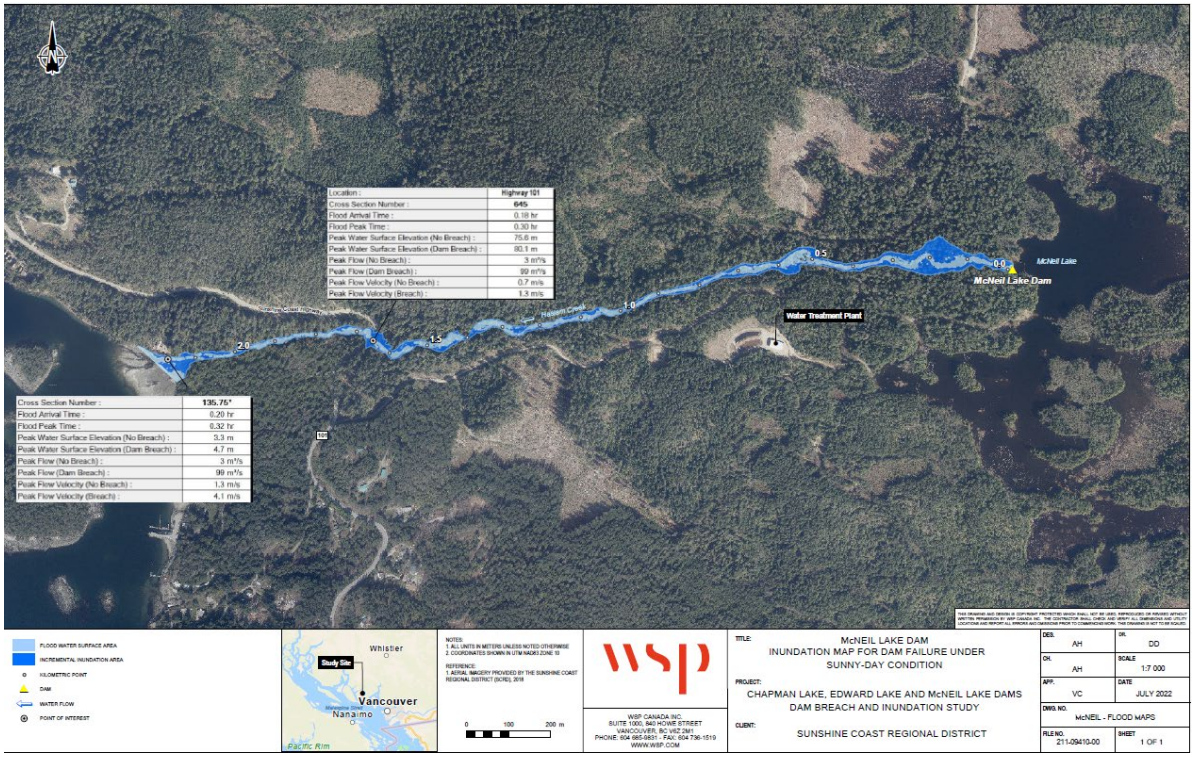

Figure 48: McNeill Lake Dam inundation map for dam failure under sunny-day condition.

[189] WSP. (2022). Dam Breach and Inundation Report. Pg. 6.

[190] Ibid, Pg. 9.

[191] Ibid, Pg. 9.

The following figure summarizes the consequences for each dam failure scenario described in the WSP (2022) dam inundation report:

DAM	DAM BREACH SCENARIO	PAR	LOL	ENVIRONMENTAL AND CULTURAL VALUES	INFRASTRUCTURE AND ECONOMICS	CLASSIFICATION
Chapman Lake Dam	Sunny-Day	Temporary only	Significant	Low	High	High
	Flood Failure*	Permanent	High	Low	High	High
Edward Lake Dam	Sunny-Day	Temporary only	Significant	Low	High	High
	Flood Failure*	Permanent	High	Significant	High	High
McNeil Lake Dam	Sunny-Day	Temporary only	High	Low	Very High	Very High
	Flood Failure*	Temporary only	Low	Low	High	High

* Based on the most consequential flood-induced failure scenario.

Figure 49: Consequences for each dam failure scenario from WSP (2022) dam inundation report.

Lake Seven Dam

There are significant structures downstream of Lake Seven Dam including Forest Service Road bridges across the Rainy River, Port Mellon Highway Rainy River Vehicle Bridges 1 & 2, and Domtar (Howe Sound) Pulp and Paper infrastructure from the chip storage piles to the power boiler. The arrival time of the initial flood wave at the House Sound Pulp and Paper mill is estimated to be 47 minutes for a sunny-day breach and 37 minutes for a flood-induced breach. A flow depth of 1m to 3m is expected within Domtar Pulp and Paper, and incrementally increased flow depth of 6m to 10m within the Rainy River channel. Velocities are expected to be well above 2m/s and reach a maximum of 27m/s at the Port Mellon Highway Rainy River Vehicle Bridges. There is the potential for loss of life and damage to wildfire, aquatic and marine environments. There are no documented archaeological sites within the flood inundation area. Lake Seven Dam is assigned a Consequence Classification of Very High in accordance with the BC Dam Safety Regulation.[192]

Some parts of the district are within the river or coastal floodplain but are protected by dikes, including the Hillside Industrial Park dike in the Port Mellon area (the SCRD is responsible for maintenance of the Hillside Industrial Park dike), approximately 10 km from Langdale, that protects the Hillside industrial lands from creek flows on Dakota Creek. These dikes (sometimes spelled “dykes” or called “levees”) keep water out of built-up areas during a flood. If a dike is overtopped or damaged during a flood, it can result in a dike breach. A dike breach allows floodwater into areas that are usually protected and can develop very quickly. Flow through the breach can be very deep and very fast. A dike breach may take people by surprise, especially if the dike has been there for a long time and people lose awareness that they live or work in a flood hazard area. When deep, fast-moving water flows into areas that are usually protected by dikes, it can cause extensive damage and sometimes loss of life. Large floods have higher water levels and put greater force on the dike, which increases

[192] Email communications with Manager of Engineering at Domtar (Howe Sound) Pulp & Paper. June 10, 2024.

the chance of a dike breach. Smaller floods – for example the annual spring freshet in SCRD – have a relatively low chance of causing a dike failure.

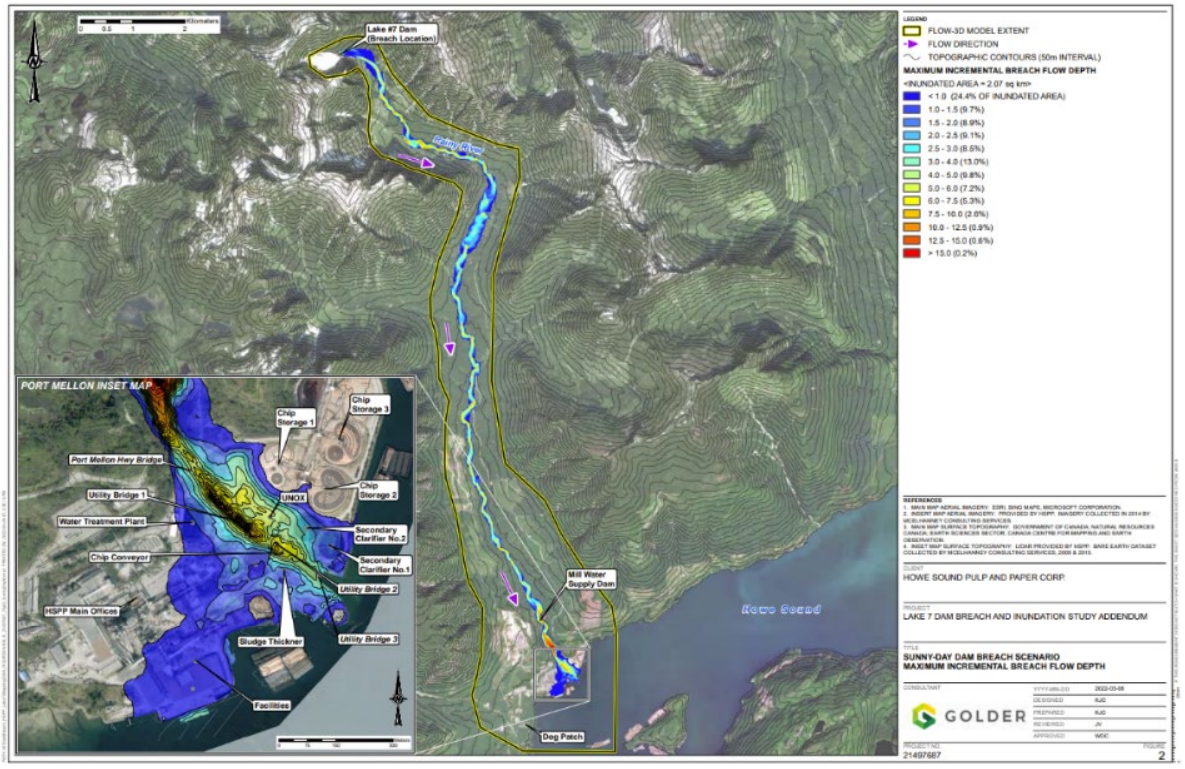

Figure 50: Lake Seven Dam breach and inundation map.

shíshálh Nation Government District

Highway 101 is the primary transportation route for wheeled vehicles passing through the SCRD. The road itself runs directly through the sNGD. Loss of Highway 101 as a transportation route south into and out of sNGD from a dam breach of Edwards Lake Dam or Chapman Lake Dam would significantly impact the sNGD. A breach of Edwards Lake Dam, Chapman Lake Dam, McNeill Lake Dam, or Clowhom Dam are not likely to pose a significant flooding hazard to the sNGD. However, the sNGD relies on the Chapman Creek Water System for their water source. Breach of the Chapman Lake Dam and impacts to the Chapman Creek Water System would potentially lead to water shortages for an extended period for the residents of the sNGD.

District of Sechelt

The Clowhom Dam is the closest dam to Sechelt. A combination of heavy seasonal rains, warm temperatures and rapidly melting snowpack could increase water levels to the point of overflow, and landslides may also increase water levels substantially. Chapman Lake Dam is located approximately 16 km northeast of Sechelt. The Edwards Lake Dam is situated southeast of Edwards Lake, approximately 17km northeast of the District of Sechelt. Apart from the loss of fresh water supply from the lakes, no additional incremental consequences are expected in Sechelt for a sunny-day failure of Chapman Lake Dam and Edwards Lake Dam. The Highway 101 bridge for Chapman Creek would not be overtopped for any dam breach scenarios. However, Highway 101 would be overtopped to the east of the bridge during a probable maximum flood event with and without

breach conditions. The probability of damage to Highway 101 is low in this area given the shallow flow and low water velocities over the Highway. The developed area on the east side of Chapman Creek would be incrementally inundated during a flood failure scenario for Chapman Lake Dam and Edwards Lake Dam. The economic and social impacts associated with a loss of water supply from failure of Chapman Lake Dam would be high, putting significant stress on the Chapman Water System and would lead to water shortages for an extended period for the 22,00 residents who rely on the Chapman Water System (including residents of the District of Sechelt who rely on the Chapman Lake System for drinking water). A breach of Edwards Dam would potentially impact a small number of residences in the community of Wilson Creek, about 1km downstream of the Chapman Creek Fish Hatchery.

Figure 51: Chapman Creek Bridge along Highway 101. Source: Google Earth

10. INTERRUPTIONS TO CRITICAL SERVICES

Critical services are services such as power, water, sewer, telecommunications, and food distribution systems that are essential to the community, economy, and wider society. The continuity of these services during and immediately after a disaster or emergency event is important to maintain community cohesion, physical well-being, and mental health of individuals recovering from an emergency. The resumption of the delivery of these services in the event of an interruption should be considered a high priority.

10.1 ELECTRICAL OUTAGES

Hazard	Current Likelihood	Consequence Score	Risk Level	Future Likelihood	Climate Risk Drivers	Anticipated change in likelihood
Electrical Outages	**E**	**8**	**High Likelihood / Low Consequence**	**E**		

Background

Outages are typically caused by a breakdown in the power generation and/or distribution grid, or by an accident or disaster that damages the power grid. Extended power outages can quickly turn into public health emergencies when life safety systems begin to fail. Without power, people can find themselves unable to travel, work, buy necessary supplies, heat, or cool their homes or communicate with each other. Critical effects of power outage or water/sewerage system failure include loss of drinking water and sewer service, direct business interruption and wider economic losses, loss of fire protection and sanitary sewer overflows and/or wastewater treatment bypass causing environmental impact. It is crucial for critical infrastructure like hospitals and response agencies to have backup power sources.

Despite the high frequency of power outages, their impact is usually low. Power outages become a concern when they last for a significant amount of time or when temperatures are very low, affecting people, livestock, or businesses. Equipment failure in a substation or transformer, or overuse of electrical power, can cause brownouts, which are reduced electrical capacity or outages. Agencies and utilities that play a key role in emergency operations should have backup electrical sources and generators to continue functioning in all conditions.

Specific likelihood considerations

Power outages are the most likely type of utility failure. They can be caused by heavy winds, ice storms, snowstorms, fallen trees or other debris, and vehicle impacts. All other utilities may infrequently fail at times due to maintenance issues or accident.[193]

The SCRD is part of BC Hydro's 'Metro Area' operating region, spanning from Powell River to Squamish, Sechelt to North Vancouver, and southeast to Coquitlam and Edmonds in Vancouver. Over the past decade, service interruptions in this area have primarily been due to environmental conditions, particularly corrosion (70-80%),

[193] Town of Sydney. (2022). Community Risk Assessment: Hazards, Vulnerabilities and Risks of Major Emergencies. Retrieved from: https://www.sidney.ca/wp-content/uploads/Community-Risk-Assessment-HRVA-2022.pdf

and brush or building fires (15-20%). Other common causes include tree interference, equipment failure, and adverse weather like lightning strikes and high winds.

Specific consequence considerations

The average power outage in the Metro Vancouver Area lasts 2-3 hours, which is standard across the province. The SCRD is not at a significantly higher risk of power outages than other areas. BC Hydro typically restores service quickly after an outage. Despite the high frequency of power outages, their impact is usually low.

Keats Island and Gamier Island

Gambier Island and Keats Island are served by BC Hydro electric power. Various hazards can impact the provision of electrical power to these two islands, including high winds (trees falling on power lines) or wildfires damaging electricity infrastructure. Given the islands are boat access only, BC Hydro crews may be delayed in repairs of electrical infrastructure that is damaged.

10.2 FOOD SOURCE INTERRUPTION (SUPPLY CHAIN, ETC)

Hazard	Current Likelihood	Consequence Score	Risk Level	Future Likelihood	Climate Risk Drivers	Anticipated change in likelihood
Food Source Interruption	**C**	**9**	**Medium Likelihood / Low Consequence**	**C**		

Background

Disasters can trigger supply chain interruptions, which may result in food shortages in a community. Food supply systems are design for efficiency (production, distribution, inventory) and are particularly susceptible to disruption to a disaster.[194] The SCRD relies primarily on marine transport and ground transportation along Highway 101, making the region vulnerable to supply chain interruptions resulting from emergency events (e.g., windstorms, freezing rain, earthquakes resulting in damage to critical infrastructure) that could interrupt transportation networks. During a disaster, companies providing transportation services for food and other basic goods will be under time pressures and dealing with dynamic situations that will make the provision of reliable and secure food distribution complex.

Specific likelihood considerations

The SCRD's relative remote location and limited accessibility (one secondary highway north-south, reliant on boat access) increases the likelihood that an emergency event (e.g., landslide, earthquake) could disrupt access to communities across the SCRD, including interrupting the supply chains for food. Electrical power outages due to severe weather (e.g., windstorms, freezing rain) are common across BC, including the SCRD.

Specific consequence considerations

The length and severity of the incident can determine the consequences that may result from an interruption to food supply chains. People living alone and with mobility challenges, or people living in remote regions of the SCRD may be especially susceptible to the consequences from food supply interruption. If stores and businesses lose electricity, preservation of food long term can be severely impacted with food spoilage occurring. If transportation corridors are damaged or become bottlenecked (especially Highway 101 as the main – and in some places only- transportation route along the Sunshine Coast), distribution of food may be restricted. Individuals who are already food insecure will be especially affected during disasters. Additionally, an event that impacts cultural food sources including areas important for hunting, fishing or other food harvesting will have a profound impact on Indigenous Peoples in the SCRD. The consequences of an interruption to food supply are food insecurity, with resulting cultural, economic, phycological and reputational consequences.

Keats Island and Gambier Island

Keats Island and Gambier Island are susceptible to food source interruptions due to several reasons. Firstly, their geographical isolation makes them heavily reliant on external sources for food supplies. Transportation

[194] Cardoso, B. et al. (2021). Causal Impacts of Epidemics and Pandemics on Food Supply Chains. A Systematic Review. *Sustainability, 13*(17).

of food to these islands can be disrupted due to weather conditions or logistical issues, leading to food source interruptions. Secondly, these islands have limited agricultural land, which restricts their ability to produce a diverse range of food locally. Lastly, climate change impacts, such as rising sea levels and changing weather patterns, can also affect food production and supply on these islands.

10.3 TELECOMMUNICATIONS INTERRUPTION

Hazard	Current Likelihood	Consequence Score	Risk Level	Future Likelihood	Climate Risk Drivers	Anticipated change in likelihood
Telecommunications interruption	**D**	**14**	**High Likelihood / Medium Consequence**	**D**		

Background

Telecommunication interruptions can pose significant challenges during a disaster and is one of the most widely shared characteristics of all disasters.[195] The integrity and effective operation of communication networks are of paramount importance.

System overload by customers is a potential issue that could lead to interruptions for both land lines and cellular service. This is often a primary cause of interruption during disasters. To mitigate this risk, methods such as Essential Line Treatment (ELT), Priority Access Dialing (PAD), or Amateur Radio, can be employed.[196] Furthermore, it is crucial to inform residents about the problems caused by system overload. They should be encouraged to utilize an 'Out-of-Area Contact' system. This system can help reduce the load on local networks, ensuring that essential communications can get through during a disaster.

Specific likelihood considerations

The SCRD's relative remote location and limited accessibility (few roads, reliant on boat access) increases the likelihood that an emergency event (e.g., landslide, earthquake) could disrupt provision of electricity to communities across the SCRD, which may take out telecommunication infrastructure (e.g., cellular towers). Electrical power outages due to severe weather (e.g., windstorms, freezing rain) are common across BC, including the SCRD.

Specific consequence considerations

Damage to telecommunication systems because of an emergency event or disaster may be extensive and restoration of services may be time-consuming, expensive and require specialized resources and skills. In an event of disrupted telecommunication services, emergency response personnel may be delayed in responding to an emergency event, risking health and safety of individuals impacted by a hazard or emergency event or damage to property by causing delays and errors in emergency response and disaster relief efforts. The geographic isolation of some communities across the SCRD can compound the risks and consequences of disruptions in telecommunication systems by delaying timely information about the severity of damage, leading to communities being stranded and increasingly vulnerable to secondary risks (e.g., winter weather conditions).

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[195] Townsend, A. and Moss, M. (2005). Telecommunications Infrastructure in Disasters: Preparing Cities for Crisis Communications. *Centre for Catastrophic Preparedness and Response,* New York University.

[196] Cid, V., Mitz, A.R., and Arnesen, S.J. (2018). Keeping communications flowing during large-scale disasters: Leveraging Amateur Radio Innovations for Disaster Medicine. *Disaster Medical and Public Health Preparedness, 12*(2): 257-264.

Keats Island and Gambier Island

Keats Island and Gambier Island could be susceptible to telecommunication interruptions due to several reasons. Firstly, their geographical isolation can make the installation and maintenance of telecommunication infrastructure challenging. This can lead to a lack of robustness in the network, making it more susceptible to interruptions. Secondly, extreme weather conditions, which can be exacerbated by climate change, can damage telecommunication infrastructure and disrupt services. Lastly, the islands' reliance on external resources for maintenance and repair can lead to delays in restoring services after an interruption.

10.4 TRANSPORTATION ROUTE INTERRUPTION

Hazard	Current Likelihood	Consequence Score	Risk Level	Future Likelihood	Climate Risk Drivers	Anticipated change in likelihood
Transportation Route Interruption	**D**	**10**	**High Likelihood / Low Consequence**	**E**		

Background

Motor vehicle crashes can require coordinated emergency response when accidents involve large numbers of casualties in a single incident. Initial responders are typically overwhelmed, requiring support from multiple agencies, including Fire, RCMP, Public Works, and BC Ambulance, with EOC support. Such incidents tend to unfold suddenly and without warning. The potential damage to the roads within the SCRD due to seismic activities is challenging to forecast. Common occurrences during an earthquake include slumping, cracking, rockfalls, landslides, liquefaction, and subsidence. It is crucial to consider areas that are susceptible to these events, especially if they could hinder access or evacuation routes.

Specific likelihood considerations

The Chapman Creek Bridge along Highway 101 holds significant importance as it serves as the sole route for wheeled vehicles to reach many communities on the Sunshine Coast, including Sechelt, shíshálh Nation Government District, and all communities north of Sechelt from points to the south/east. Residential and developed districts situated adjacent to or within the hazardous zones identified in OCPs should be cognizant of the potential risks and subsequent effects related to seismic shaking.

Additionally, the Sunshine Coast is serviced by air and BC Ferries as the primary way to access the region. Poor weather and vessel breakdowns/maintenance can interrupt transportation service, leading to supply chain interruptions for food, fuels, medical supplies and medical specialists, and other services and goods needed to keep communities functioning.

Specific consequence considerations

Damage done to transportation routes because of an emergency event or disaster may be extensive and restoration of infrastructure (e.g., rebuilding Chapman Creek Bridge or washed-out sections of Highway 101) may be time-consuming, expensive and require specialized resources and skills. In an event of disrupted transportation routes, emergency response personnel may be delayed in responding to an emergency event, risking health and safety of individuals impacted by a hazard or emergency event or damage to property by causing delays and errors in emergency response and disaster relief efforts. Critical supplies (e.g., food, fuel, medicine) may be restricted from reaching communities on the Sunshine Coast in the event transportation routes, specifically Highway 101, are shut down. The geographic isolation of some communities across the SCRD can compound the risks and consequences of disruptions to transportation routes by delaying timely information about the severity of damage, leading to communities being stranded and increasingly vulnerable to secondary risks (e.g., winter weather conditions).

Keats Island and Gambier Island

The geographic isolation of Keats and Gambier islands can compound the risks and consequences of disruptions to transportation routes. Poor weather conditions can disrupt the transportation of essential supplies to these islands, including food, fuel, parts, as well as evacuation of residents for emergency medical attention. Disruption to BC Ferries passenger ferry services would negatively impact residents of these islands, some of whom may be reliant on the passenger ferry system.

10.5 WASTEWATER INTERRUPTION

Hazard	Current Likelihood	Consequence Score	Risk Level	Future Likelihood	Climate Risk Drivers	Anticipated change in likelihood
Wastewater Interruption	**C**	**10**	**Medium Likelihood / Low Consequence**	**C**		

Background

Wastewater systems (e.g., treatment plants, sewer lines, septic fields, pump stations) are deemed critical assets. The SCRD owns and operates 15 small community wastewater treatment systems located in Electoral Areas A, B, D, E and F. Specifically:

- Langdale Wastewater Treatment Plant (40 properties use the system).
- Woodcreek Wastewater Treatment Plant (73 properties use the system).
- Sunnyside Wastewater Treatment Plant (11 properties use the system).
- Roberts Creek Co-Housing Wastewater Treatment Plant (31 properties use the system).
- Curran Road Wastewater Treatment Plant (70 properties use the system).
- Jolly Roger Wastewater Treatment Plant (32 properties use the system).
- Secret Cove Wastewater Treatment Plant (33 properties, plus 1 commercial user, use the system).
- Square Bay Wastewater Treatment Plant (81 billable users and 93 service participant properties).
- Canoe Road Wastewater Treatment Plant (10 properties use the system).
- Greaves Road Wastewater Treatment Plant (6 properties use the system).
- Painted Boat Wastewater Treatment Plant (34 properties use the system).
- Merrill Crescent Wastewater Treatment Plant (14 properties use the system).
- Lee Bay Wastewater Treatment Plant (279 properties use the system).
- Lily Lake Wastewater Treatment Plant (28 properties use the system).
- Sakinaw Ridge Wastewater Treatment Plant (29 properties use the system).

The Town of Gibsons, District of Sechelt and shíshálh Nation Government District each maintain significant wastewater treatment plants serving municipal populations. These include the following:

- Town of Gibsons Wastewater Treatment Plant (Steward Road) (serves the Town of Gibsons with a flow of 1,200 – 2,200 m^3/day)
- District of Sechelt Wastewater Treatment Plant (5678 Surf Circle) (6000 residents connected, average flow of 2,22m^3/day)
- shíshálh Nation Government District Port Stalashen Wastewater Treatment Plant (Field Road, shíshálh Nation Lands (Tsawcome) No 1) (91 residential units and supports the conversion and connection of 88 buildings currently on septic wastewater systems)

Specific likelihood considerations

With the dispersed nature of the 15 community wastewater treatment plants and three main municipal wastewater treatment plants across the SCRD, there is a low chance all systems will be equally impacted during a disaster or emergency event and wastewater systems will be interrupted across the SCRD. However,

with other critical infrastructure, a significant disaster, such as an earthquake, could interrupt wastewater systems, leading to effluent discharge into the local environment, potentially contaminating the water systems residents of the Sunshine Coast rely on (specifically, the Chapman Water System which supplies approximately 83% of residential water users service and includes Edwards Lake, South Pender Harbour Water System which includes McNeill Lake and services approximately 891 connections, and North Pender Water System which includes Garden Bay Lake and services approximately 758 connections). Another likelihood is the loss of electricity to the different wastewater treatment plans, crippling the plants, and potentially flooding the local environment with untreated sewage. This consideration underscores the interdependencies between critical infrastructure systems (electricity, sewer and sanitation).

Specific consequence considerations

Improper waste disposal can cause numerous health-related issues that can place an unnecessary strain on already-taxed emergency responders. City engineers will need to isolate breaks in sewage trunks to prevent leakage of blackwater and human waste. In some instances, potable water may have to be tested for contaminates before consumption. Additionally, certain population groups may have a heightened vulnerability to wastewater infrastructure disruptions (e.g., people living in multi-story buildings with mobility challenges who are not easily able to access alternative sanitation options if residential sewer systems are shut down due to treatment plant disruptions).

shíshálh Nation Government District

The shíshálh Nation Government District is on the same sewage system run by the District of Sechelt.

Town of Gibsons

The Town of Gibsons owns and operates its own sewage system, which consists of a wastewater treatment plans, lift station at Prowse Road, treated sewage ocean outfall, 35km of collection pipes, 500 maintenance holes, and approximately 1700 service connections. Interruption to sewage and wastewater treatment, due to electrical outages or flooding events for example, would have significant impacts on residents and the local environment, including marine ecosystems.

District of Sechelt

The District of Sechelt runs its own sewage system, with over 50 km of sanitary sewer, over 20 km of storm sewer, and over 50km of ditches. There is one wastewater treatment plant (Sechelt Water Resource Centre), 8 lift stations and a septage receiving facility. About 6,000 people are connected to the sewage system, plus 20,000 people for septage receiving. Interruption to sewage and wastewater treatment, due to electrical outages or flooding events for example, would have significant impacts on residents and the local environment, including marine ecosystems.

Keats Island and Gambier Island

Island properties are required to provide their own sewage disposal on-site.[197]

[197] Keats Island Official Community Plan. (2002). Retrieved from: http://keats-island.ca/images/gamkeabylbaseocp0077.pdf; Gambier Island Official Community Plan. (2001). Retrieved from: https://islandstrust.bc.ca/wp-content/uploads/2020/05/gmbl73-ocp-cons-dec-17-2019.pdf

10.6 WATER SERVICE INTERRUPTION (SHORTAGE, CONTAMINATION)

Hazard	Current Likelihood	Consequence Score	Risk Level	Future Likelihood	Climate Risk Drivers	Anticipated change in likelihood
Water Service Interruption	**D**	**13**	**High Likelihood / Low Consequence**	**E**		

Background

The SCRD relies on a combination of lakes, streams, wells, water lines and pumping stations to serve members of the community. Overall, there are 20 reservoirs and over 300 km of pipeline running potable water from the Chapman Creek Water Treatment Plant to SCRD residents. Interruption to this water supply would also affect the sewage system. Improper waste disposal can cause numerous health related issues that can place an unnecessary strain on already-taxed medical service providers. City engineers would need to isolate breaks in sewage trunks to prevent leakage of blackwater and human waste. In some instances, potable water may need to be tested for contaminants before consumption.

Figure 52: SCRD Water Systems.

To create 'disaster resilient communities', it is recommended that residents maintain a fresh, three-day supply of drinking water in their homes.

The Chapman Water System supplies water to Electoral Areas B (Halfmoon Bay), D (Roberts Creek), E (Elphinstone), F (West Howe Sound), District of Sechelt, and shíshálh Nation. Approximately 83% of the residential water users serviced by the SCRD drinking water are on the Chapman Water System, with 9629

service connections. The water sources are Chapman Lake and aquifer 560. Emergency use sources are Edwards Lake and Gray Creek.[198]

Langdale Water System provides water to the community of Langdale, located within Electoral Area F. The Langdale Water System was incorporated into the SCRD's Regional Water Service in 1971 and currently operates as an independent system, not connected to any other water systems. This system draws from a single source – Aquifer 552 – through the Langdale Well. Aquifer 552 is a confined sand and gravel aquifer. The Langdale Water System provides potable water to 223 properties and the BC Ferries Langdale Terminal.[199] Raw well water is treated through chlorination to kill bacteria and viruses and is then pumped to the Langdale Reservoir that flows through gravity-fed watermains to each water user.

Egmont Water System is a small, separate water system operated and maintained by the SCRD. It services the community of Egmont in Electoral Area A (Egmont/Pender Harbour), near the northernmost boundary of the SCRD and services 30 connections. The water source is Waugh Lake.[200]

The Cove Cay Water System is a small, separate water system operated and maintained by the SCRD. It is in the community of Earls Cove in Electoral Area A (Egmont / Pender Harbour), at the northmost part of the SCRD and services about 88 connections. The water source is Ruby Lake.[201]

The North Pender Harbour Water System is located within Electoral Area A (Egmont / Pender Harbour). The system provides water to properties in Garden Bay, Irvine's Landing, Daniel Point, and Sakinaw Ridge, and services about 758 connections. Garden Bay Lake is the water source.[202]

The South Pender Harbour Water System is located within the Electoral Area A (Egmont / Pender Harbour) and provides water to the communities of Madeira Park, Francis Peninsula and Kleindale. The water source is McNeill Lake.[203]

The Town of Gibsons operates its own water system (see below for additional information).

Specific likelihood considerations

The SCRD often experiences electricity outages, which if long enough in duration could impact the provision of water services that rely on electricity to be pumped to customers. Additionally, seasonal water shortages and water service interruptions may increase due to increases in temperature and decreases in summer precipitation. Should a disruption occur to telecommunication infrastructure that results in internet outages, communication systems between sensors on the water system would not be possible.

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[198] Sunshine Coast Regional District. (n.d.). Chapman: Water System Backgrounder. Retrieved from: https://www.scrd.ca/wp-content/uploads/2024-Feb-26-Chapman-Backgrounder-Format.pdf

[199] Sunshine Coast Regional District. (n.d.). Langdale: Water System Backgrounder. Retrieved from: https://www.scrd.ca/wp-content/uploads/2023/04/Langdale-Water-System-Background-Information.pdf

[200] Sunshine Coast Regional District. (n.d.). Egmont: Water System Backgrounder. Retrieved from: https://www.scrd.ca/wp-content/uploads/2023/04/Egmont-Water-System-Background-Information.pdf

[201] Sunshine Coast Regional District. (n.d.). Cove Cay: Water System Backgrounder. Retrieved from: https://www.scrd.ca/wp-content/uploads/2023/04/Cove-Cay-Water-System-Background-Information.pdf

[202] Sunshine Coast Regional District. (n.d.). North Pender Harbour: Water System backgrounder. Retrieved from: scrd.ca/wp-content/uploads/2023/04/North-Pender-Harbour-Water-System-Background-Information.pdf

[203] Sunshine Coast Regional District. (n.d.). South Pender Harbour: Water System Backgrounder. Retrieved from: https://www.scrd.ca/wp-content/uploads/2023/04/South-Pender-Harbour-Water-System-Background-Information.pdf

Specific consequence considerations

Limited water available for fire suppression can increase the risks and consequences of fires breaking out after an event has occurred. Another consequence to water supplies is fuel or other hazardous material leaking into potable water supplies. Both consequences to water service interruption can have impacts to residents, businesses, but also hospitals and clinic that require a reliable and clean water source to fulfil their operational role, primarily at a time when the number of in-patients or causalities may exceed the daily average. Hospitals and clinics, which require a reliable and clean water source to function effectively, may face operational challenges, especially during times when the number of in-patients or casualties exceeds the daily average. Additionally, downed power lines and live wiring can pose a hazard when introduced to pooling water, endangering the lives of both victims and first responders. The water treatment plant uses a networked SCADA system. Should there be a large-scale internet/data outage along the Sunshine Coast where communication between sensors on the water system is not possible, the SCRD does not have the staff to run all systems manually. This would impact water service provision as well as all customers receiving water through the system.

Additionally, wildfires can cause shifts in landscape processes that can decrease water quality by increasing sedimentation and nutrients downstream and increase erosion adjacent to watersheds, which can have a direct impact on water service provision to residents connected to the SCRD water system (Chapman Creek, South and North Pender systems).

shíshálh Nation Government District

The shíshálh Nation Government District lands adjacent to Sechelt receives water supply from the SCRD's Chapman Creek water system. Of particular concern is the risk of the Chapman Creek water system reaching critically low levels during drought and extreme and prolonged heat events. The Sunshine Coast typically experiences hot, dry summers and instances of drought are not uncommon – and may become more frequent because of a changing climate. The region's increasing demand on services from an increase in the population will have a further strain on water resources during dry and hot summer months. However, the SCRD's aggressive water conservation strategy and drought tolerant approach to landscaping will be helpful in mitigating the effects of dry, hot weather.

Town of Gibsons

The Gibsons Aquifer 560 supplies 73% of Gibsons' potable water to Lower Gibsons and part of Upper Gibsons. Other parts of Upper Gibsons are supplied with water from the SCRD water system.[204] Water is pumped from the aquifer using wells, which is then stored in reservoirs. The Town relies on the SCRD for emergency storage, specifically to meet fire flow standards. The Upper Gibsons area is not included in the Town of Gibsons water system and is supplied with water from the SCRD.

Figure 53 shows the water system of the Town of Gibsons as demonstrated in the Watershed 560 Agreement with the SCRD.[205]

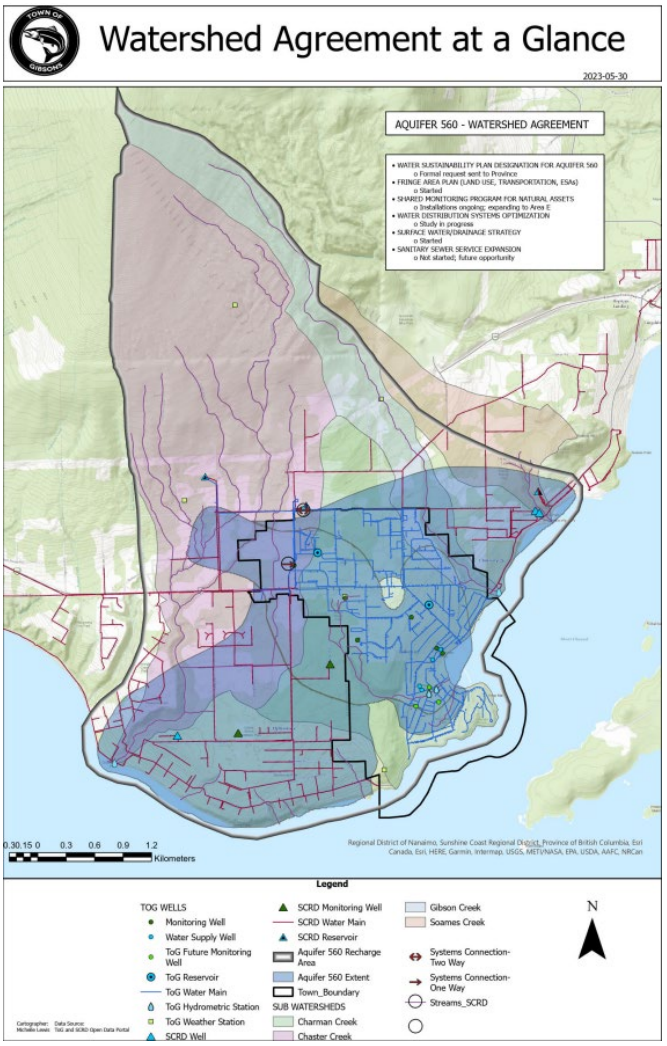


Figure 53: Water system of the Town of Gibsons.

District of Sechelt

The District of Sechelt water supply is provided by the SCRD's Chapman Creek water system. Of particular concern is the risk of the Chapman Creek water system reaching critically low levels during drought and extreme and prolonged heat events. The Sunshine Coast typically experiences hot, dry summers and instances of drought are not uncommon – and may become more frequent because of a changing climate. The region's increasing demand on services from an increase in the population will have a further strain on water resources during dry and hot summer months. However, the SCRD's aggressive water conservation strategy and drought tolerant approach to landscaping will be helpful in mitigating the effects of dry, hot weather. Further, the District of Sechelt's Integrated Community Sustainability Plan recognizes that changes in land use and community development is growing, and a changing climate and environmental concerns are at the center of discussions around growth. The community has identified "protecting our drinking water" as the top priority for environmental sustainability.[206]

[204] Town of Gibsons. (2015). Smart Plan: Gibsons Official Community Plan. Retrieved from: https://gibsons.ca/wp-content/uploads/2023/11/Consolidation-Part-ABC-Smart-Plan-to-include-28.pdf

[205] Town of Gibsons (2023). Watershed 560 Agreement. Retrieved from https://gibsons.ca/wp-content/uploads/2023/07/Aquifer-560-Watershed-Map.pdf

[206] District of Sechelt. (2019). Integrated Community Sustainability Plan. Retrieved from: https://www.sechelt.ca/en/business-and-development/resources/Documents/Integrated-Community-Sustainability-Plan-(ICSP)-Goals-and-Actions-2019_Final.pdf

In the event of a water service interruption the District of Sechelt will be heavily impacted, including many services the community relies on (e.g., medical facilities that require water for cleaning, hospitality and food sector, fire suppression).

Keats Island and Gambier Island

Most Keats Island properties are required to provide their own water supply. However, the Eastbourne, Keats Landing, and Melody Point developments all have their own small-scale water supply and distribution systems. The Eastbourne water system supplies approximately 175 connections and consists of the following wells – 1) Gordon Well and Old East Well, two 6.1 m shallow wells, 2) Drilled Well, a 91.4 m deep well in the bedrock, and 3) Collector Well, a trench and sump system that collects surface water and groundwater. These wells rely on precipitation for recharge. [207] The water system is strained and at risk of not being able to meet the water demands of residents, with an estimated supply deficit of 25.92m^3/day.[208] Residents on this water system are regularly under Stage 4 water restrictions throughout the summer, with no redundancy in the water supply sources in case the only well producing during a drought situation (the drilled well) ran dry or had to be taken offline.[209] During Stage 4 the current maximum daily supply to the community is 20.74 m^3/day, which is about 8% of the average water use in other SCRD water systems. [210] New wells are being proposed, three wells providing system redundancy and a closer level of service to other SCRD water systems. [211]

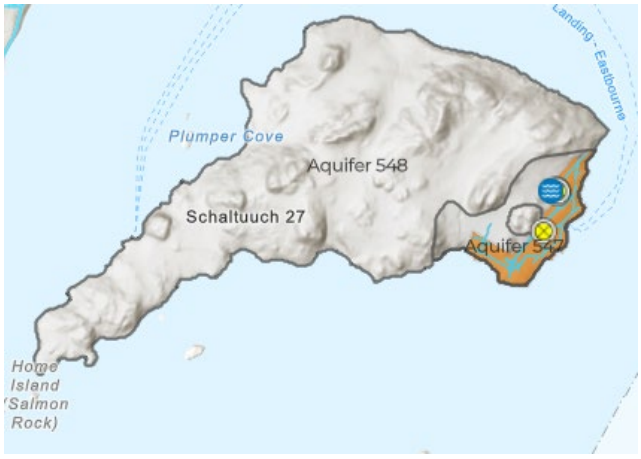


Figure 54 Keats Island water system.

Gambier Island does not have a centralized water supply system. However, dryer and hotter summers may impact water availability from private wells on the island. The boat-access only nature of Gibsons makes transportation of large quantities of potable water to the island logistically challenging.

[207] Sunshine Coast Regional District. (2024). Water Supply and Distribution – Eastbourne Water System. Retrieved from: https://www.scrd.ca/water-distribution/

[208] Sunshine Coast Regional District. (October 26, 2023). Committee of the Whole. Retrieved from: https://www.scrd.ca/wp-content/uploads/2023-OCT-26-COW-Agenda-PACKAGE.pdf?utm_source=coast%20reporter&utm_campaign=coast%20reporter%3A%20outbound&utm_medium=referral

[209] Ibid

[210] Ibid

[211] Ibid

10.7 FUEL SOURCE INTERRUPTION

Hazard	Current Likelihood	Consequence Score	Risk Level	Future Likelihood	Climate Risk Drivers	Anticipated change in likelihood
Fuel Source Interruption	**C**	**6**	**Medium Likelihood / Low Consequence**	**D**		

Background

Fuel source interruptions include pipeline damage, transportation delays due to weather and/or shipping infrastructure damage or general shortages due to market supply problems, or panic fuel hoarding during emergencies (RDN 2019). The Sunshine Coast has limited ingress and egress routes. Interruption in marine transportation (e.g., damage to port facilities) or land transportation (e.g., damage to Highway 101 bridge over Chapman Creek) could restrict the flow of fuel to distribution points along the Sunshine Coast.

Specific likelihood considerations

Fuel interruptions are not unheard of in parts of BC. Following the 2021 atmospheric river, the province took temporary measures to ensure fuel (gas and diesel) was prioritized for essential vehicles (e.g., first responders). The Provincial government asked people to limit their fuel consumption and vehicle travel with orders under the Provincial State of Emergency to support this. Under this order, essential vehicles had unrestricted access to fuel as required, using predominantly commercial trucking gas stations (cardlock gas stations). Non-essential vehicles were limited to 30 litres per trip to the gas station.[212]

Specific consequence considerations

Non-essential vehicles may have fuel restrictions placed upon them, to ensure essential vehicles (e.g., emergency vehicles) have adequate access to fuel. Homes and businesses that reply on natural as for heating and cooking may face supply restrictions or complete cut off if pipelines are damaged and taken out of service for repairs following an emergency event (e.g., flood, earthquake, landslide).

[212] BC Government. (November 19, 2021). "Province prioritizes fuel for essential vehicles, introduces travel restrictions". (November 19, 2021). Province of British Columbia. Retrieved from: https://news.gov.bc.ca/releases/2021EMBC0073-002212

10.8 MARINE VESSEL INCIDENT

Hazard	Current Likelihood	Consequence Score	Risk Level	Future Likelihood	Climate Risk Drivers	Anticipated change in likelihood
Marine vessel incident	D	3	Medium Likelihood / Low Consequence	D	N/A	N/A

Background

Marine vessel incidents involve an incident with a boat or ship that results in damage, bodily injury or death. Marine vessel incidents are not uncommon in the waters of BC. The Transportation Safety Board of Canada investigates all marine transportation incidents. The Sunshine Coast is a very active area where vessel traffic is concerned. BC Ferries operate between Langdale and Horseshoe Bay, Langdale-Keats-Gambier and Earls Cove and Saltery Bay, while private boaters and transport barges frequently transit local waters with a variety of cargo. The summer months see a dramatic increase in boat traffic. Dangerous goods used in industrial processes in Port Mellon are frequently transported by barge through the Strait of Georgia.

Specific likelihood considerations

More extreme weather because of climate change may impact marine transportation in the Strait of Georgia and the waters off the Sunshine Coast. For example, more high wind events and storm surges may increase the vulnerability of some marine vessels to incidents, impacting the safety of people and property.

Specific consequence considerations

Marine vessel incident consequences could include release of hazardous substances (e.g., diesel fuel, motor oil, other hazardous substances being transported on the vessel) into the local environment. Impacts to people and property, including injury, death, and costly repairs may also result from windstorms and storm surges, either while the vessel is at dock or in transit.

shíshálh Nation Government District

The greatest threat to the sNGD is pollution created by spillage or vessel collision in the Strait of Georgia. If collisions are close enough to the coast, oil or fuel spills could have a serious economic and environmental impacts on the region. Depending on the substance released, the amount, proximity to inhabited areas, prevailing wind and tidal conditions, accidental discharge of some dangerous goods may require evacuation due to toxic fumes.

Keats Island and Gambier Island

The Sunshine Coast is an active area for vessel traffic. This traffic includes private boaters and transport barges. In this context, Gambier Island and Keats Island could potentially be impacted by pollution resulting from spillage or vessel collision. Oil spills, depending on their size and area, could have serious economic and environmental impacts on these communities. Summer months may see an increase in inexperienced travellers and potentially increase the risk of marine accident.

APPENDICES

APPENDIX A: DEFINITIONS

- **Hazards**: Sources of potential harm, or situations with a potential for causing harm, in terms of human injury; damage to health, property, the environment, and other things of value; or some combination of these.
- **Risk**: The likelihood that a hazard will occur, as well as the severity of possible impacts to health, property, the environment, or other things of value.
- **Vulnerability**: The people, property, infrastructure, industry, resources, or environments that are particularly exposed to adverse impact from a hazardous event.
- **Impact/Consequence:** The physical/environmental, social, economic, and political impact/consequences or adverse effects that may occur as the result of a hazardous event.
- **Resilience:** The ability of a system, community or society exposed to hazards to resist, absorb, accommodate, adapt to, transform and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions through risk management.

APPENDIX B: ALL-HAZARD LIKELIHOOD SCORING

Likelihood	Rating	Frequency	Percent Change (Probability)
Almost Certain	E	Event is expected to occur once every two years or more frequently	Annual chance ≥ 50%
Likely	D	Event is expected to occur about once every 3-10 yrs.	10% ≤ annual chance < 50%
Possible	C	Event is expected to occur about once every 11-50 yrs.	2% ≤ annual chance < 10%
Unlikely	B	Event is expected to occur about once every 51-100 yrs.	1% ≤ annual chance < 2%
Rare	A	Event is expected to occur less than once every 100 yrs.	Annual chance <1%

APPENDIX C: CONSEQUENCE DEFINTIONS AND SCALE RANKING GUIDE

Fatalities:	Potential number of people killed as a result of the hazard.
Injuries, Disease, or Hospitalization:	Potential number of people injured or ill because of the hazard.
Displacement:	Disruption to regular living situations, requiring people to either leave their home or be confined to their home without access to regular services. This includes short-term evacuation orders, self-evacuation, shelter-in-place as well as long term or permanent relocation of individuals, families or communities.
Psychosocial Impact:	Impacts to the emotional and social well-being of an individual, family group and/or community.
Support System Impact:	Loss of accessibility to supports/networks or community groups, community reciprocity, trust and cooperation between community members.
Cultural Impact:	Loss of cultural heritage and/or identity. May include loss of works, objects, places, practices and ecology that are directly associated with an important aspect or aspects of human history and culture.
Property Damage:	The direct negative consequences of a hazard on buildings, structures and other forms of property, such as crops and livestock.
Critical Infrastructure Impact:	An impact to critical infrastructure, including its processes, systems, facilities, technologies, networks, assets, and/or services, that results in consequences to the health, safety, security or economic well-being of community members and the effective functioning of the government.
Environmental Damage:	The negative consequences of a hazard on the environment, including the soil, water, air and/or plants and animals.
Economic Impact:	Disruption or loss of ability for individuals, businesses and governments to generate income. This includes interruptions to the consumption, production, and trade of goods and services.
Reputational Impact:	A negative change in the perception of the government or organization, in the minds of the community, its stakeholders and others who are vital to its success. This can result in socioeconomic damage or disruption such as loss of community or stakeholder trust and an increase in negative media attention.

Consequence Scale Ranking Guide

Rank	FATALITIES	INJURY/ILLNESS	DISPLACEMENT	PSYCHOSOCIAL	SUPPORT SYSTEM IMPACT	CULTURAL IMPACT
None (0)	No directly related fatalities.	No directly related illness or injury.	No evacuation orders or self-evacuation.	Event is unlikely to result in any short- or long-term trauma.	Not likely to impact access to supports or networks. Community reciprocity, trust, and cooperation are unaffected.	Little to no impact.
Low (1)	Loss of life that is manageable within the scope of normal operations.	Illness or injury that is manageable within the scope of normal operations.	Low percentage of the population evacuated, self-evacuated, or sheltering in place. Supports are provided within community.	Direct impacts to a few individuals. Psychosocial impacts can be primarily addressed by Psychological First Aid. Additional supports to those directly impacted and their families can be provided by local mental health professionals.	Hours to days-long disruption to daily life. Likely to result in some localized reduced access to supports or networks. Community reciprocity, trust, and cooperation are affected.	Recovery from cultural impacts will take days to weeks.
Med (2)	Loss of life that is beyond the scope of normal operations and may require overtime and/or additional resources.	Illness or injury that is beyond the scope of normal operations and may require additional capacity and/or resources, and/or the activation of response systems and emergency plans.	Enough of the population is evacuated, self-evacuated or sheltering in place to require external supports to be brought in.	Localized loss of property and/or fatalities or serious injuries. Those directly impacted are likely to experience both short- and long-term psychosocial impacts. Local and outside mental health professionals will be needed to provide support and treatment.	Days-long disruption to daily life. Likely to result in reduced access to supports or networks. Community reciprocity, trust, and cooperation are affected.	Recovery from cultural impacts will take months.
High (3)	Loss of life severe enough for mass fatality procedures to be activated.	Extensive mass illness or injury requiring extra capacity and/or resources across multiple facilities in a health region and potentially specialized care from other health regions. Health authority response systems and emergency plans activated.	10-30% of the population evacuated or displaced.	Wide-spread loss of property and/or multiple fatalities or persons with serious injuries. Those directly impacted are likely to experience both short- and long-term psychosocial impacts. Local and outside mental health professionals will be needed to provide support and treatment.	Weeks or months-long disruption to daily life. Significantly reduced access to supports or networks. Community reciprocity, trust, and cooperation are severely affected.	Recovery from cultural impacts will take years.
Extreme (4)	Fatalities exceed the capacity of existing plans and capabilities. Provincial, Federal, and International resources may be required.	Extraordinary mass illness or injury. Provincial, Federal, and International resources may be required. Multiple health region response systems are active.	High percentage of residents are displaced for years or permanently.	Widespread and long-term psychosocial impacts beyond those who are directly affected by property loss or fatalities. Extensive external supports required.	Months to years-long disruption to daily life. Supports or networks may be permanently changed.	Recovery from cultural impacts will not be possible; destruction is permanent and irreversible (i.e. Destruction of irreplaceable knowledge or artifacts).

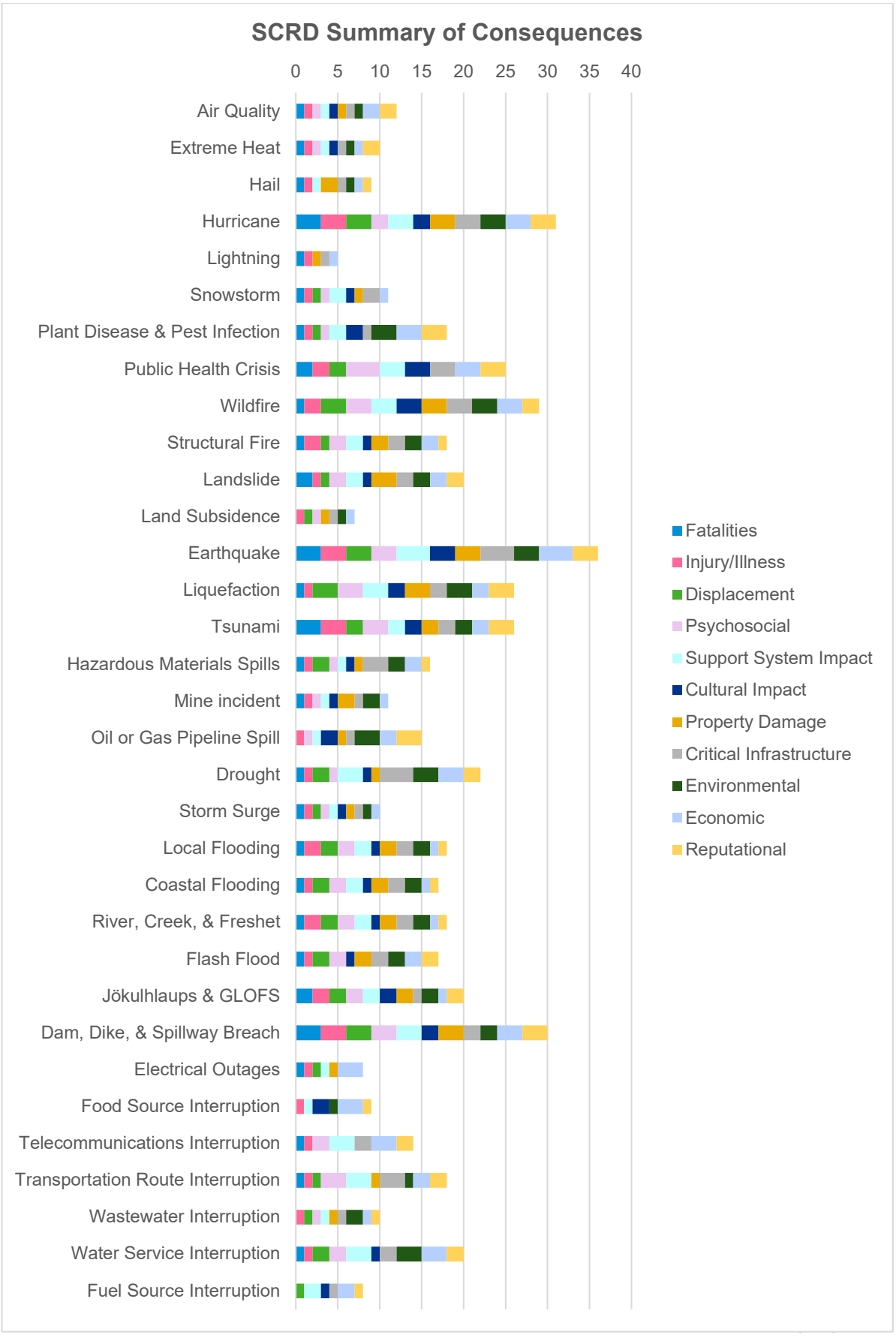
Rank	PROPERTY DAMAGE	CRITICAL INFRASTRUCTURE	ENVIRONMENTAL	ECONOMIC	REPUTATIONAL
None (0)	Not likely to result in property damage.	Not likely to disrupt critical infrastructure services.	Not likely to result in environmental damage.	Not likely to disrupt business or financial activities.	Not likely to result in political or reputational impacts.
Low (1)	Minor, mostly non-structural damage.	Low percentage of the population impacted by few service disruptions. Disruptions last hours to days.	Localized and reversible damage. Hours to days-long clean up possible.	Days-long disruptions to few businesses, financial activities, or livelihoods.	Limited or short-term political or reputational impacts.
Med (2)	Localized severe damage.	Either a high % of the population impacted by a few services OR a low % of the population impacted by a major or multiple service disruptions.	Full clean up possible, but may take weeks.	Weeks-long losses to businesses, industry, or livelihoods.	Some significant or long-term political or reputational impacts.
High (3)	Widespread structural damage. Repair may take months to years.	High % of the population impacted by a major or multiple service disruptions.	Major but reversible damage. Full clean up difficult and could take months or years.	Months long losses to business, industry, or livelihoods.	Significant and long term political or reputational impacts.
Extreme (4)	Widespread irreparable damage.	High percentage of the population is impacted by long-term outages.	Severe or irreversible damage. Full clean up not possible or could take decades.	Widespread or long-term loss of businesses, industry, or livelihoods.	Significant and irreparable political or reputational impacts.

APPENDIX D: ALL HAZARD CONSEQUENCE SCORING

	Hazard	Consequences (None=0, Low=1, Medium=2, High=3, Extreme=4)											
No:		Fatalities	Injury/Illness	Displacement	Psychosocial	Support System Impact	Cultural Impact	Property Damage	Critical Infrastructure	Environmental	Economic	Reputational	Total Consequence Score (/44)
1	Air Quality (tier 1)	1	1	0	1	1	1	1	1	1	2	2	**12**
2	Extreme Heat (tier 1)	1	1	0	1	1	1	0	1	1	1	2	**10**
3	Extreme Cold (tier 2)	0	1	0	1	0	0	0	1	0	0	0	**3**
4	Fog (tier 2)	0	0	0	0	0	0	0	0	0	0	0	**0**
5	Freezing Rain or Drizzle (tier 2)	0	0	0	0	0	0	1	1	0	1	0	**3**
6	Space Weather (tier 2)	0	0	0	0	0	0	0	1	0	0	0	**1**
7	Hail (tier 1)	1	1	0	0	1	0	2	1	1	1	1	**9**
8	Hurricane / High wind (tier 1)	3	3	3	2	3	2	3	3	3	3	3	**31**
9	Lightning (tier 1)	1	1	0	0	0	0	1	1	0	1	0	**5**
10	Snowstorm (tier 1)	1	1	1	1	2	1	1	2	0	1	0	**11**
11	Tornado (tier 2)	1	1	0	1	0	0	2	1	0	0	0	**6**
12	Animal Disease (tier 2)	0	0	0	1	0	0	0	0	0	1	1	**3**
13	Human Disease (tier 2)	2	2	0	3	3	2	0	1	0	3	3	**19**
14	Plant Disease & Pest Infection (tier 1)	1	1	1	1	2	2	0	1	3	3	3	**18**
15	Public Health Crisis (tier 1)	2	2	2	4	3	3	0	3	0	3	3	**25**
16	Wildfire (tier 1)	2	3	3	3	3	3	3	3	3	3	2	**29**
17	Structural Fire (tier 1)	1	2	1	2	2	1	2	2	2	2	1	**18**
18	Avalanche (tier 2)	0	0	0	1	0	0	1	0	0	0	1	**3**
19	Landslide/Debris Flow (tier 1)	2	1	1	2	2	1	3	2	2	2	2	**20**

	Hazard	Consequences (None=0, Low=1, Medium=2, High=3, Extreme=4)											
No:		Fatalities	Injury/Illness	Displacement	Psychosocial	Support System Impact	Cultural Impact	Property Damage	Critical Infrastructure	Environmental	Economic	Reputational	Total Consequence Score (/44)
20	Land Subsidence (tier 1)	0	1	1	1	0	0	1	1	1	1	0	**7**
21	Submarine Slides (tier 2)	0	0	0	0	0	0	0	0	0	0	0	**0**
22	Earthquake (tier 1)	3	3	3	3	4	3	3	4	3	4	3	**36**
23	Liquefaction (tier 1)	1	1	3	3	3	2	3	2	3	2	3	**26**
24	Tsunami (tier 1)	3	3	2	3	2	2	2	2	2	2	3	**26**
25	Ash Fall (tier 2)	0	1	0	1	0	0	0	0	1	0	0	**3**
26	Explosions (tier 2)	2	3	0	2	1	2	2	0	2	1	1	**16**
27	Hazardous Materials Spills (tier 1)	1	1	2	1	1	1	1	3	2	2	1	**16**
28	Mine Incident (tier 1)	1	1	0	1	1	1	2	1	2	1	0	**11**
29	Oil/Gas Pipeline Spill (tier 1)	0	1	0	1	1	2	1	1	3	2	3	**15**
30	Space Debris (tier 2)	0	0	0	0	0	0	0	0	0	0	0	**0**
31	Drought (tier 1)	1	1	2	1	3	1	1	4	3	3	2	**22**
32	Seiche (tier 2)	0	1	0	1	0	0	1	0	0	0	0	**3**
33	Storm Surge (tier 1)	1	1	1	1	1	1	1	1	1	1	0	**10**
34	Local Flooding (tier 1)	1	2	2	2	2	1	2	2	2	1	1	**18**
35	Coastal Flooding (tier 1)	1	1	2	2	2	1	2	2	2	1	1	**17**
36	River, Creek, & Freshet (tier 1)	1	2	2	2	2	1	2	2	2	1	1	**18**
37	Flash Flood (tier 1)	1	1	2	2	0	1	2	2	2	2	2	**17**
38	Jökulhlaups & GLOFS (tier 1)	2	2	2	2	2	2	2	1	2	1	2	**20**
39	Dam and Spillway Breach (tier 1)	3	3	3	3	3	2	3	2	2	3	3	**30**
40	Dike Failure (tier 2)	0	1	1	0	0	0	1	1	0	1	0	**7**
41	Electrical Outages (tier 1)	1	1	1	0	1	0	1	0	1	3	0	**8**
42	Food Source Interruption (tier 1)	0	1	0	0	1	2	0	0	1	3	1	**9**

	Hazard	Consequences (None=0, Low=1, Medium=2, High=3, Extreme=4)											
No:		Fatalities	Injury/Illness	Displacement	Psychosocial	Support System Impact	Cultural Impact	Property Damage	Critical Infrastructure	Environmental	Economic	Reputational	Total Consequence Score (/44)
43	Telecommunications Interruption (tier 1)	1	1	0	2	3	0	0	2	0	3	2	**14**
44	Transportation Route Interruption (tier 1)	1	1	1	3	3	0	1	3	1	2	2	**18**
45	Wastewater Interruption (tier 1)	0	1	1	1	1	0	1	1	2	1	1	**10**
46	Water Service Interruption (tier 1)	1	1	2	2	3	1	0	2	3	3	2	**20**
47	Fuel Source Interruption (tier 1)	0	0	1	0	2	1	0	1	0	2	1	**8**
48	Cyber Security Threat (tier 2)	0	0	0	1	0	0	1	1	0	1	0	**4**
49	National Security Threat (tier 2)	0	0	0	1	0	0	1	1	0	1	1	**5**
50	Public Disturbance (tier 2)	0	1	0	1	0	0	1	0	0	1	1	**5**
51	Major Planned Event (tier 2)	0	0	0	0	0	0	0	0	1	0	0	**1**
52	Aircraft Incident (tier 2)	1	1	0	1	0	0	1	0	1	0	0	**5**
53	Marine Vehicle Incident (tier 1)	1	1	0	1	0	0	0	1	1	1	0	**6**
54	Motor Vehicle Incident (tier 2)	1	1	0	0	0	0	0	0	0	0	0	**2**


SCRD Summary of Consequences
0
5
10
15
20
25
30
35
40
Air Quality
Extreme Heat
Hail
Hurricane
Lightning
Snowstorm
Plant Disease & Pest Infection
Public Health Crisis
Wildfire
Structural Fire
Landslide
Land Subsidence
Earthquake
Liquefaction
Tsunami
Hazardous Materials Spills
Mine incident
Oil or Gas Pipeline Spill
Drought
Storm Surge
Local Flooding
Coastal Flooding
River, Creek, & Freshet
Flash Flood
Jökulhlaups & GLOFS
Dam, Dike, & Spillway Breach
Electrical Outages
Food Source Interruption
Telecommunications Interruption
Transportation Route Interruption
Wastewater Interruption
Water Service Interruption
Fuel Source Interruption
Fatalities
Injury/Illness
Displacement
Psychosocial
Support System Impact
Cultural Impact
Property Damage
Critical Infrastructure
Environmental
Economic
Reputational

APPENDIX E: CRITICAL INFRASTRUCTURE LIST

ASSET GROUPING	LOCATION	INFRASTRUCTURE OWNER
Fresh Water Source (Above Ground)	Chapman Lake Edwards Lake Grey Creek Ruby Lake Waugh Lake Garden Bay Lake McNeill Lake Haslam Lake	Province of BC BC PARKS SCRD
Fresh Water Source (Below Ground)	Gibsons Aquifer Chaster Wells Church Rd Well Langdale Well Soames Well AQ560 (supplies wells at Church/Granthams, Soames, Chaster) AQ552 (Langdale existing and potential future new wells) AQ555 (Cliff Gilker Park wells potential project) AQ563 (Sechelt Arean wells)	TOG SCRD
Water Treatment Plants and Pump Stations	Chapman Creek treatment plant (Reservoir Road) Garden Bay treatment plant (Pender Harbour) South Pender Harbour treatment plant, chlorination station and pump stations Granthams pump station Cove Cay chlorination facility and pump station Chaster Well (near Cedar Grove Elementary)	SCRD

ASSET GROUPING	LOCATION	INFRASTRUCTURE OWNER
	Church Road Well Field and water treatment facility Gray Creek water treatment plant Langdale Well Field Egmont water treatment plan and pump station	
Water Service Infrastructure	Reservoirs Dams Intakes Pump Stations PRV Stations	SCRD
Network of Water Mains	Priority: from water source to Sechelt Hospital	SCRD
Network of Wastewater Mains	Priority: from Sechelt Hospital to treatment facility	TOG DOS SCRD
Wastewater Treatment Systems (Community)[213]	Greaves Rd (12545 Greaves Rd) Woodcreek Park (534 Oceanview Dr) Sunnyside (1101 Sunnyside Rd) Jolly Roger (10177 Highway 101) Secret Cove (5475 Secret Cove Rd) Lee Bay (4336 Orca Rd) Square Bay (5320 Susan Way) Langdale (42 Newman Rd) Canoe Rd (12676 Canoe Rd) Merrill Cr (12683 Merril Cres) Curran Rd (5521 Curran Rd) Roberts Creek Co-Housing (1127 Emery Rd) Lily Lake Village (12708 Lagoon Rd) Painted Boat (12819 Lagoon Rd) Sakinaw Ridge (4300 Milne Rd) YCMA Camp Elphinstone (1765 YMCA Rd)	SCRD District of Sechelt Town of Gibsons shíshálh Nation Government District

[213] List derived from Sunshine Coast Regional District Wastewater Service Review and Asset Management Plan (2019). Retrieved from: https://www.scrd.ca/wp-content/uploads/2023/01/2019-Wastewater-Service-Review-and-Asset-Management-Plan.pdf

ASSET GROUPING	LOCATION	INFRASTRUCTURE OWNER
	Water Resource Centre (5678 Surf Circle)	
Wastewater Treatment Systems (municipal)	Town of Gibsons Wastewater Treatment Plant (Stewart Road) District of Sechelt Wastewater Treatment Plant (5678 Surf Circle) shíshálh Nation Government District Port Stalashen Wastewater Treatment Plant (Field Road, shíshálh Nation Lands (Tsawcome) No 1)	Town of Gibsons District of Sechelt shishalh Nation Government District
Fire Halls/Fire Fighting Equipment	Gibsons & District Fire Halls 1&2 Roberts Creek Fire Hall Sechelt Fire Hall Halfmoon Bay Fire Hall 1 & 2 Egmont & District Fire Hall Pender Harbour Fire Hall 1 & 2	SCRD Sechelt FD Pender Harbour FD
Hospitals and Long-Term Care Facilities	Sechelt Hospital – 5544 Sunshine Coast Highway, Sechelt Cowrie Medical Clinic, 5699 Cowrie St., Sechelt Arbutus Medical Clinic, 5713 Dolphin, Sechelt 200 bed Emergency Hospital (stored in containers) in Gibsons Two medical Casualty Collection Units – Roberts Creek and Madeira Park Good Samaritan Christenson Village, 585 Shaw Rd, Gibsons Coast Care Ltd – Gibsons (in-home nursing and care service) Medical Associates (Gibsons Medical Clinic) – 211-1100 Sunshine Coast Highway, Gibsons Gibsons Health Unit – 821 Gibsons Way, Gibsons Christenson Village (long term care facility) – 585 Shaw Road, Gibsons Sumac Place (28 bed mental health facility) – 841 Kiwanis Way, Gibsons	VCH and others

ASSET GROUPING	LOCATION	INFRASTRUCTURE OWNER
	Pender Harbour and District Health Centre – 5066 Francis Peninsula Road, Madeira Park Silverstone Care Centre 5625 Derby Road, Sechelt shíshálh Nation Community Health and Nursing – 5559 Sunshine Coast Highway, Sechelt Upstream Family Medicine – 4330 Sunshine Coast Highway, Sechelt	
Police Stations	Gibsons Sechelt	Leased to RCMP
SCRD IT Infrastructure	Field Road	SCRD
SCRD Works Buildings Associated Critical Equipment	Mason Road Works Yard	SCRD (Leased)
SCRD Public Works Building	6470 Wilgard Road, West Sechelt	
Communication Assets	Field Road Office Various Comms towers	SCRD Telus RCMP Others
Sechelt Airport	4536 Hilltop Road, Sechelt	District of Sechelt
Water Aerodrome	5764 Wharf Ave., Sechelt Porpoise Bay	Harbour Air Sunshine Coast Air
Ports	Vaucroft - Thormanby Island Gambier Harbour - Gambier Island West Bay - Gambier Island Halkett - Gambier Island Port Graves - Gambier Island Keats - Keats Island Eastbourne - Keats Island Halfmoon Bay Hopkins Gibsons Porpoise Bay Madeira Park Egmont New Brighton – Gambier Island	SCRD TOG DFO Small Craft Harbours

ASSET GROUPING	LOCATION	INFRASTRUCTURE OWNER
Ferry Terminals	Langdale Earl's Cove	BC Ferries
Highways	Highway 101 Port Mellon Highway	MOTI
Emergency Shelters/Places of Gathering	Community Centres Community Halls School gymnasiums Churches	SCRD/SD46
Ambulance	Various	BCEHS
Foreshore Protection	Seawall paths Chaster Park	TOG DOS SCRD MOTI
Flood protection	Several (Mahan, Sechelt Marsh, Hillside)	DOS TOG SCRD
Sunshine Coast Emergency Program primary & alternate EOC	Primary: SCRD Office Complex, 1975 Field Road, Sechelt Alternate #1: SCRD Public Works/Transit Yard, 6470 Wilgard Road, West Sechelt Alternate #2: SCRD satellite office, 12828 Lagoon Road in Madeira Park	

APPENDIX F: RISK ASSESSMENT COLOUR CODES

The following table provides the approach used for determining risk level colour codes, applied to each tier 1 hazard.

Risk Level Colour Codes	Low Likelihood / Low Consequence	Med Likelihood / Low Consequence	High Likelihood / Low Consequence	Med Likelihood / Med. Consequence	Low Likelihood / High Consequence	Med likelihood / High Consequence	High Likelihood / Medium Consequence	High Likelihood / High Consequence

APPENDIX G: DATA LIMITATIONS

Consequences	Data Confidence	Data Improvements Suggestions
Fatalities	High	• Infrastructure Map Overlay with Hazard Maps. • Engineered Community Risk Maps.
Injury/Rank	High	• Infrastructure Map Overlay w Hazard Maps. • Engineered Community Risk Maps.
Displacement	High	• Infrastructure Map Overlay w Hazard Maps • Engineered Community Risk Maps.
Psychosocial	Low	• Limited access to historical SCRD medical records. Mostly inferring from other historical impacts.
Support Systems Impacts	Medium	• No data on what the support systems are and how they are interconnected.
Cultural Impact	Low	• Additional Engagement.
Property Damage	Medium	• Engineering assessments specific to each of the hazards.
Critical Infrastructure	High	• Engineering assessments specific to each of the hazards.
Environmental	Medium	• Variable data at best, using similar disaster examples to set precedent and extrapolate to local scenario.
Economic	Low	• Require detailed economic data for the Region.
Reputational	Low	• Inferred research based on fallout from similar historic events due to lack of preparedness.

Hazard	Data Confidence	Data Improvements Suggestions
Air Quality	Moderate	• Air Quality Building Standards. • Air Quality Data.
Extreme Heat	High	• Historic local impact data.
Hail	High	• Variable data. • Relying on similar disaster examples to set precedent and extrapolate to local scenario.
Hurricane	Low	• Historic likelihood data. • Community infrastructure & building evaluations.
Lightning	High	• Variable data. • Relying on similar disaster examples to set precedent and extrapolate to local scenario.
Snowstorm	Moderate	• Variable data. • Relying on similar disaster examples to set precedent and extrapolate to local scenario.
Plant Disease & Pest Infection	High	• Variable data. • Relying on similar disaster examples to set precedent and extrapolate to local scenario.
Public Health Crisis	Moderate	• Require historical medical data.
Wildfire	High	• Land-use cover and forest types.
Structural Fire	High	• Require detailed economic data for the Region.
Landslide	Moderate	• Local engineering assessments. • Slope stability assessments.
Land Subsidence	Moderate	• Local engineering assessments.
Earthquake	Moderate	• Historic likelihood data. • Community infrastructure & building evaluations.
Liquefaction	Low	• Historic likelihood data. • Community infrastructure & building evaluations.
Tsunami	Moderate	• Variable data. • Relying on similar disaster examples to set precedent and extrapolate to local scenario.
Hazardous Materials Spills	Moderate	• Variable data sources.

Hazard	Data Confidence	Data Improvements Suggestions
Oil or Gas Pipeline Spill	Low	• Ministry of Energy database.
Drought	High	• Historic events and likelihood data. • Community infrastructure & building evaluations.
Storm Surge	Moderate	• Variable data. • Relying on similar disaster examples to set precedent and extrapolate to local scenario.
Local Flooding	High	• Historic likelihood data. • Community infrastructure & building evaluations.
Coastal Flooding	Moderate	• Historic likelihood data. • Community infrastructure & building evaluations.
River, Creek, & Freshet	High	• Historic likelihood data.
Jökulhlaups & GLOFs	Moderate	• Historic likelihood data.
Dam & Spillway Breach	High	• Downstream flow path evaluations • Likelihood
Electrical Outages	High	• Backup systems analysis (BC Hydro) and historical likelihood data.
Food Source Interruption	Low	• Percent local vs imported. • Volume of stored goods. • Back up power at storage facilities.
Telecommunication Interruption	Moderate	• Number/type of alternative systems of communication available.
Transportation Route Interruption	Moderate	• BC Ferries EMP. • Ferry alternatives.
Wastewater Interruption	Moderate	• Emergency plan of the facility.
Water Service Interruption	Moderate	• Volume of stored water.
Fuel Source Interruption	Low	• Volume of stored fuel for critical infrastructure/emergency services requirements.

Temperatures

Mean Annual Temperatures: Mean annual temperature refers to the average of the maximum and minimum temperatures of a year (i.e., the mean average of the coldest month of the year and averaging it with the mean average of the hottest month of the year). The mean annual temperatures are projected to increase annually in every season. For the Sunshine Coast, the annual mean temperature is projected to increase to a median of 8.6℃ in the 2051-2080 period, which is an increase of about 3.4℃ compared to the baseline period (1971-2000) of 5.2℃.[214] This change over the baseline and through to the 2051-2080 time period is illustrated in Table 9.

Variable	*Period*	*1971-2000 baseline*	*2021-2050*			*2051-2080*			*Change over baseline*
Mean Annual Temperature ℃	*Annual*	*Average*	*Low*	*Avg*	*High*	*Low*	*Avg*	*High*	*Avg*
		5.2	*6.7*	*7.2*	*8.2*	*8.1*	*8.6*	*11*	*3.4*

Table 9: Mean annual temperature increase over two time periods (2021-2050 and 2051-2080) compared to baseline. Source: climatedata.ca

Seasonal Mean Temperatures: Seasonal mean temperatures refer to the average of the maximum and minimum temperatures of the season. Table 10 provides the seasonal mean temperatures (℃) for three time periods for the SCRD.

Season	1976-2005	2021-2050	2051-2080	Change
Spring (March-May)	6.5	8.1	9.5	+ 3.0
Summer (June-August)	14.5	16.3	18.2	+3.7
Fall (September – November)	8.2	9.7	11.4	+3.2
Winter (December – February)	1.8	3.4	5.0	+3.2

Table 10: Mean temperature changes across the four seasons for the SCRD. Source: ClimateAtlas.ca

Hottest Day: This variable describes the warmest daytime temperature. Figure 55 below shows the projected increase in hot days up to 2080 under a high emissions scenario. During the 2051-2080 period, the SCRD is projected to experience its median maximum day time temperature of 35.0 ℃, with a range of between 33.3 – 37.9 ℃ for the hottest day.

[214] Climatedata.ca. Retrieved from: https://climatedata.ca/explore/location/?loc=JBQWM&location-select-temperature=tg_mean&location-select-precipitation=r1mm&location-select-other=frost_days

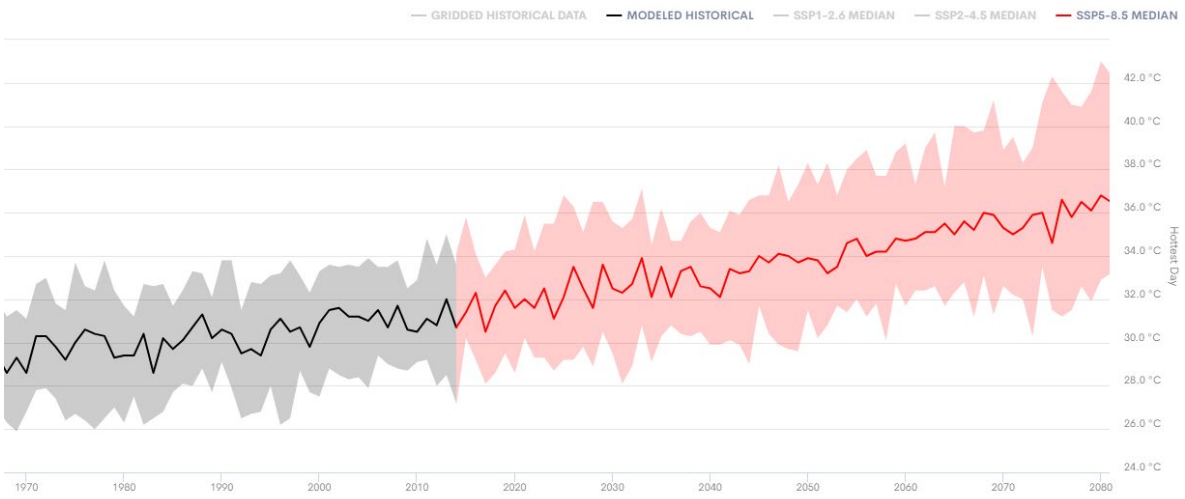
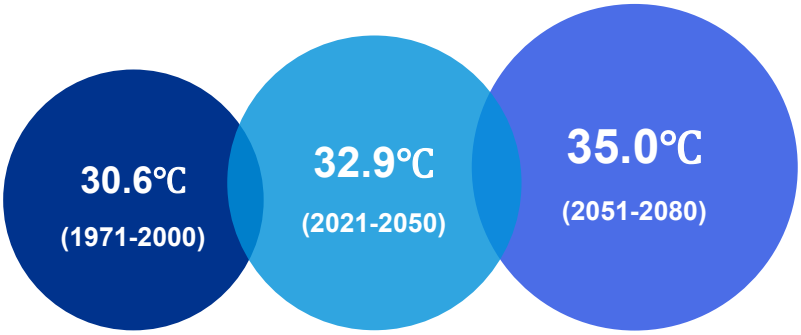


Figure 55: The projected growth in hot days under a high emissions scenario up to 2080. Source: climatedata.ca



The circles above indicate the average warmest daytime temperature over the three timescales for the SCRD, based on data from Climatedata.ca.

The forecasted hottest day for the SCRD for the historical baseline, 2021-2050 and 2051-2080 periods are outlined in Table 11:

Time period	Hottest Day Median (℃)	Hottest Day Range (℃)
1971-2000 baseline	30.6 (historical)	29.9 – 35.5
2021-2050	32.9	31.5 – 34.7
2051-2080	35	33.3 – 37.9

Table 11: Forecasted hottest day average and range across three time periods under a high emissions scenario. Source: climatedata.ca

BC is divided into five geographic heat regions, each with temperature heat warning thresholds. Heat warning Level 1 (according to BC's Heat Alert System) for the SCRD are issued when temperatures hit 29℃ during the day and overnight temperatures stay above 16℃ for 2 days or more.[215] Level 2 extreme heat

[215] Sunshine Coast Regional District. (February 2024). Extreme Heat Plan. Pg. 26. Retrieved from: https://www.scrd.ca/wp-content/uploads/2024-MAR-14-COW-Agenda-Package.pdf?utm_source=coast%20reporter&utm_campaign=coast%20reporter%3A%20outbound&utm_medium=referral

emergency warnings are issued when level 1 heat warnings have been met and forecasts indicate daily temperatures will increase for two or more days.[216]

Hot and cold days (above 30℃ and below -15 ℃): This variable gives an indication of the number of days above 30℃ and below -15℃ the SCRD will experience under a high emission scenario. Cold temperature affects the health and safety of communities, determines what plants and animals can live in an area, limits or enables outdoor activities, and defines how we design our buildings and vehicles, and shape our transportation and energy use. As demonstrated in Table 12, the number of days above 30℃ are projected to increase to 14 days over the 2051-2080 time period, with the number of days below -15℃ projected to decrease to zero days by the 2051-2080 time period.

Time period	Number of days above 30℃	Number of days below -15℃
1976-2005 (Baseline)	0 days	4 days
2021-2050	7 days	2 days
2051-2080	14 days	0 days

Table 12: Number of days above 30℃ and below -15℃ under a high emissions scenario. Source: climatedata.ca

Icing Days: This variable describes the number of days the air temperature does not rise above freezing (0℃), which is an indicator of the length and severity of the winter season. The SCRD is projected to experience 7.3 less icing days by 2051-2080 compared to historical averages, as illustrated in Figure 56 below.[217]

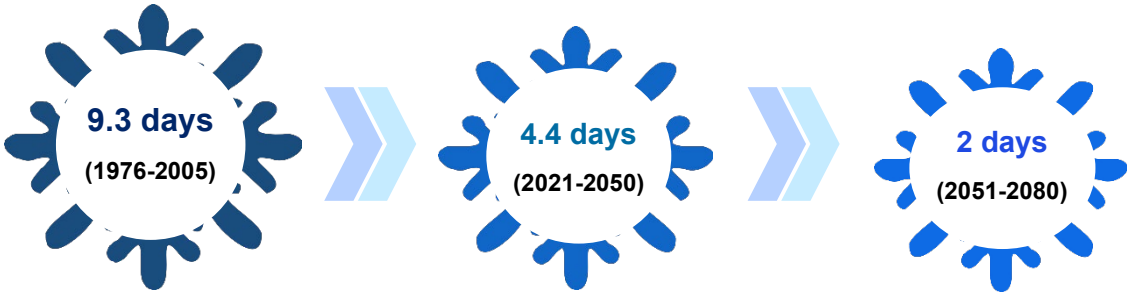


Figure 56: Reduction in ice days (air temperature does not rise above 0℃.) Source: Climateatlas.ca

Frost free season: This is the approximate length of the growing season during which there are no freezing temperatures to kill or damage frost-sensitive plants. This variable describes the number of days between the **last spring frost** and the **first fall frost** and can be understood as the growing season. A frost-free season is projected to increase in the SCRD by a median of 63 days per year by the 2051-2080 period compared to the baseline period of 1971-2000 (see Figure 57).[218] This means the first frost dates will be later in fall and the last frost days will be earlier in the spring. The growing season in the SCRD is projected to increase to a median of 201 days per year.[219]

[216] Sunshine Coast Regional District. (February 2024). Extreme Heat Plan. Pg. 26. Retrieved from: https://www.scrd.ca/wp-content/uploads/2024-MAR-14-COW-Agenda-Package.pdf?utm_source=coast%20reporter&utm_campaign=coast%20reporter%3A%20outbound&utm_medium=referral
[217] Climate Atlas of Canada. Icing Days. Retrieved from: https://climateatlas.ca/
[218] Climate Atlas of Canada. Frost Free Season. Retrieved from: https://climateatlas.ca/
[219] Ibid

Figure 57: Frost free days between the last spring frost and the first fall frost across three time periods.

Precipitation

Annual Mean Precipitation: Annual mean precipitation is the average total amount of rainfall and the water equivalent of snowfall for a given year. The SCRD is anticipated to see a relatively small increase overall in annual precipitation from 1791mm during the 1971-2000 baseline period to a mean of 1766mm during the 2021-2050 period and up to a mean of 1836mm during the 2051-2080 period.[220] This is an increase of 2.51% under a high emissions scenario from the baseline to the 2051-2080 period.

Seasonal Mean Precipitation: As shown in Table 13, all seasons except for the summer are projected to see an increase in precipitation. Summer is projected to become drier with 14% less rain than the baseline average.

Total Mean Precipitation (mm)	Baseline 1976-2005	2021-2050	2051-2080	Percent increase over baseline
Spring	419	430	435	+4%
Summer	185	170	160	-14%
Fall	632	654	697	+10%
Winter	822	869	931	+13%

Table 13: Annual mean precipitation for the SCRD by season and annually under a high emissions scenario. Source: climateatlas.ca

Dry Days: The SCRD is not projected to have a significant increase in the maximum number of consecutive dry days. The baseline number of dry days (1976-2005 period) is an average of 24 consecutive day days, with a slight increase to 26 days average (with a range of 22-35 days) during the 2051-2080 period.[221] However, this is a 30-year average and does not capture extreme events that could lead to prolonged and severe water restrictions and low water levels in Chapman Lake, Edwards Lake and other surface and ground water sources that together supply water to residents of the SCRD.

Maximum 5-day precipitation: This variable describes the largest amount of precipitation (rain and snow combined) to fall over 5 consecutive days. High precipitation can lead to flooding, damage to infrastructure (roads, buildings), liquefication, erosion, and disruptions to transportation services (especially if precipitation falls as a heavy snowfall event). High precipitation events can overwhelm storm drains and cause flash flooding. The SCRD is projected to see a 9% increase in the maximum 5-day precipitation in the 2051-2080 period compared to the baseline (see Table 14). However, these are averages, and do not capture extreme

[220] Climate Atlas of Canada. Annual Mean precipitation. Retrieved from: https://climateatlas.ca/
[221] Climate Atlas of Canada. Maximum number of consecutive dry days. Retrieved from: https://climateatlas.ca/

events, such as the 2021 atmospheric river, that go beyond the estimates for maximum 5-day precipitation events.

Max 5-day precipitation (mm)	
1971-2000 (baseline)	143mm
2021-2050	146mm
2051-2080	156mm
Percent change over baseline	+9%

Table 14: Max 5-day precipitation projected for the SCRD under a high emissions scenario. Source: climatedata.ca

Precipitation Events: Precipitation events in general are projected to become more intense and extreme. This includes precipitation falling at a faster rate (mm/h), shorter storms that will have an increasingly high intensity, and return periods of heavy storms will shorten, meaning increased frequency.[222]

Wet days over 20mm: This variable looks at the number of days with precipitation >= 20mm. Heavy rainfall events can create many challenges, including erosion, damage to infrastructure, flooding, and potential damage to sewer and stormwater systems. The SCRD is projected to see an increase of approximately 3 wet days with precipitation greater than 20mm in the 2051-2080 period compared to the baseline (see Table 15).

Wet days over 20mm	
Period	**30-year average**
1971-2000 (baseline)	21 days
2021-2050	22 days
2051-2080	24 days

Table 15: Projected wet days over 20mm the SCRD will experience leading up to 2080. Source: climatedata.ca

Intensity-Duration Frequency: IDF curves are a tool used to study and forecast heavy rain in a world where the climate is changing. They are graphs that show the chances of a certain amount of rain falling on average. These curves show us three things:

- How intense the rain is (measured in millimeters per hour).
- How long it rains (measured in hours).
- How often a rainstorm of that intensity happens.

Table 16 and Table 17 below show the intensity, duration and frequency of rain have changed in the past and how they might change in the future at the Sechelt AUT meteorological station. The data looks at the past (1983-2017) and the future (2051-2080). Future predictions suggest that there will be more rain and that heavy rainstorms will happen more often and be more intense in the years 2051-2080 compared to the past.

T (years)	2	5	10	25	50	100
1 h	10.12	12.73	14.57	17.02	18.93	20.92

[222] Sunshine Coast Regional District. (December 2021). Future Climatic Projections. Pg. 2. Retrieved from: https://www.scrd.ca/wp-content/uploads/Climate-Projections.pdf

T (years)	2	5	10	25	50	100
2 h	7.04	8.90	10.30	12.30	13.96	15.77
6 h	4.16	4.96	5.37	5.78	6.02	6.22
12 h	2.90	3.48	3.82	4.12	4.47	4.71
24 h	2.06	2.56	2.86	3.19	3.42	3.63

Table 16: Baseline precipitation intensity rates for the SCRD (mm/h) (1983-2017). Source: Institute for Catastrophic Loss Reduction

T (years)	2	5	10	25	50	100
1 h	11.93	14.96	17.20	20.56	22.81	25.48
2 h	8.31	10.46	12.07	14.71	16.88	18.87
6 h	4.91	5.87	6.40	7.00	7.35	7.59
12 h	3.42	4.11	4.55	5.12	5.43	5.78
24 h	2.43	3.03	3.40	3.88	4.16	4.45

Table 17: Projected precipitation intensity rates (mm/h) for the SCRD (2051-2080). Source: Institute for Catastrophic Loss Reduction

Figure 58 shows an IDF curve from the past (1983-2017) for the Sechelt AUT meteorological station.

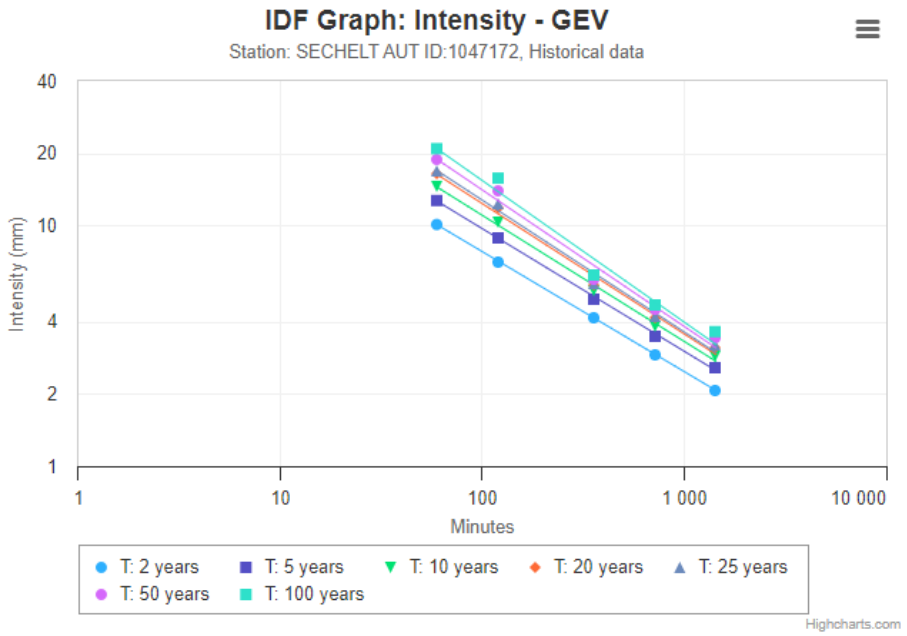


Figure 58: Baseline precipitation intensity rates for the SCRD (mm/h): Source: Institute for Catastrophic Loss Reduction.[223]

Under a high emissions scenario (RCP8.5), the intensity of rainfall is projected to increase in the future (2051-2080). Figure 59 shows that more extreme storms (i.e., 1 in 100-year storms) are projected to increase

[223] Simonovic, S.P., A. Schardong, R. Srivastav, and D. Sandink. (2015). IDF_CC Web-based Tool for Updating Intensity-Duration-Frequency Curves to Changing Climate – ver 7.0, Western University Facility for Intelligent Decision Support and Institute for Catastrophic Loss Reduction. Retrieved from: https://www.idf-cc-uwo.ca.

significantly, coupled with longer, more frequent rainfall events that will bring slightly higher amounts of rain.[224]

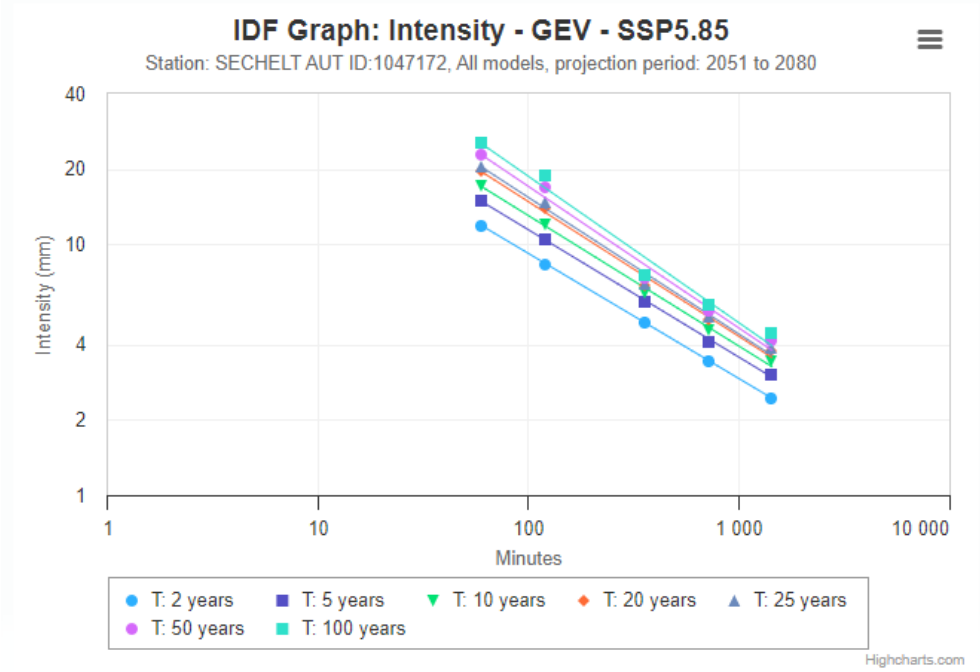


Figure 59: Projected precipitation intensity rates (mm/h) for the SCRD. Source: Institute for Catastrophic Loss Reduction [225]

Sea Level Change

Climate change is slowly making sea levels rise.[226] This means that the sea will start to take over places where people live and work near the coast, like towns and critical infrastructure such as roads, water and sewer systems, and communication networks. Some areas that are very low and close to the sea might go under water complete.[227]

Sea levels don't always stay the same; they can change because of the time of year, the weather, and the conditions in the ocean. Big climate events like El Nino and La Nina can make the sea levels go up even more, causing extreme water levels, changes in temperature and floods from storm surges.[228] Additionally, melting glaciers, warmer temperatures, changes in salinity, and land water storage changes contribute to changing sea levels.[229] Under a high global emissions scenario projected sea levels around the SCRD varies from 2cms to 23cms, and between 17cms to 73cms by 2100.[230] Figures in Appendix F illustrate low lying areas subject to

[224] Sunshine Coast Regional District. (December 2021). Climate Science Report. Pg. 24.
[225] Simonovic, S.P., A. Schardong, R. Srivastav, and D. Sandink. (2015). IDF_CC Web-based Tool for Updating Intensity-Duration-Frequency Curves to Changing Climate – ver 7.0, Western University Facility for Intelligent Decision Support and Institute for Catastrophic Loss Reduction. Retrieved from: https://www.idf-cc-uwo.ca.
[226] Intergovernmental Panel on Climate Change. (2022). AR6 Summary for Policymakers. Retrieved from: https://www.ipcc.ch/report/ar6/wg2/downloads/report/IPCC_AR6_WGII_SummaryForPolicymakers.pdf
[227] Ibid
[228] Sunshine Coast Regional District. (December 2021). Climate Science Report. Pg. 24.
[229] Ibid
[230] ClimateData.ca. Retrieved from: https://climatedata.ca/explore/variable/slr/?coords=49.57332141601624,-123.43208312988283,10&geo-select=&rcp=rcp85-p95&decade=2100&rightrcp=disabled

inundation from sea level rise by 2100. However, data from ClimateData.ca for sea level rise is not uniform across the Sunshine Coast, and some climate projections anticipate a sea level rise of 1m (100cm) by 2100.

TSUNAMI MAPS

The following tsunami maps can be used to raise awareness on the dangers of tsunamis and to identify places that may require deeper investigation of risk.

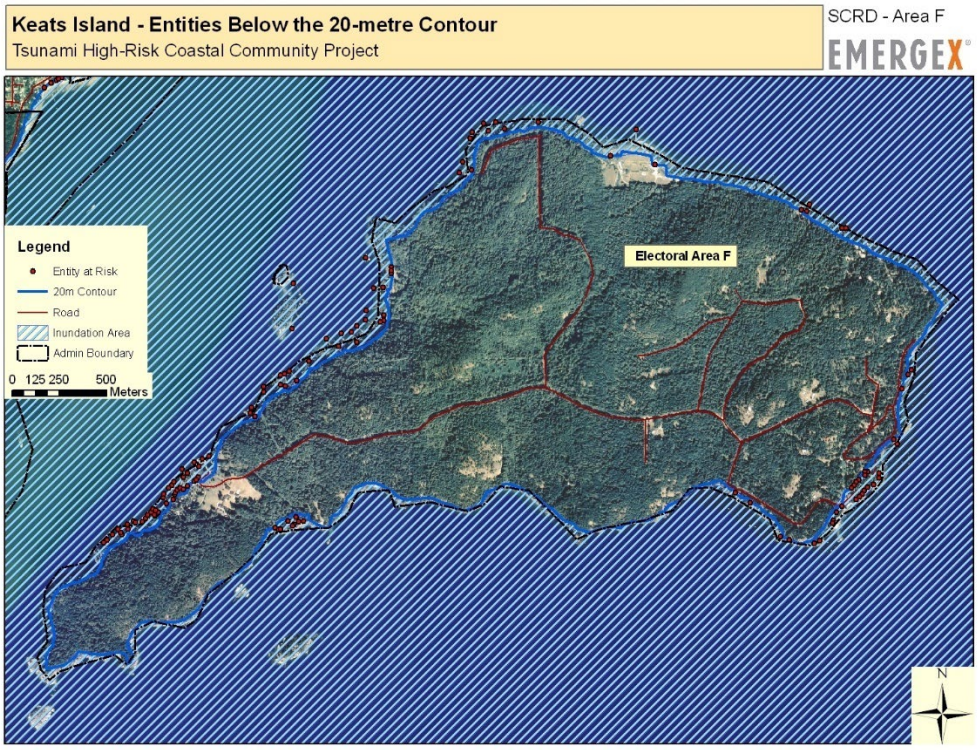


Figure 60: Keats Island tsunami inundation zone. Source: SCRD Tsunami Maps. Retrieved from: https://www.scrd.ca/Tsunami-Maps

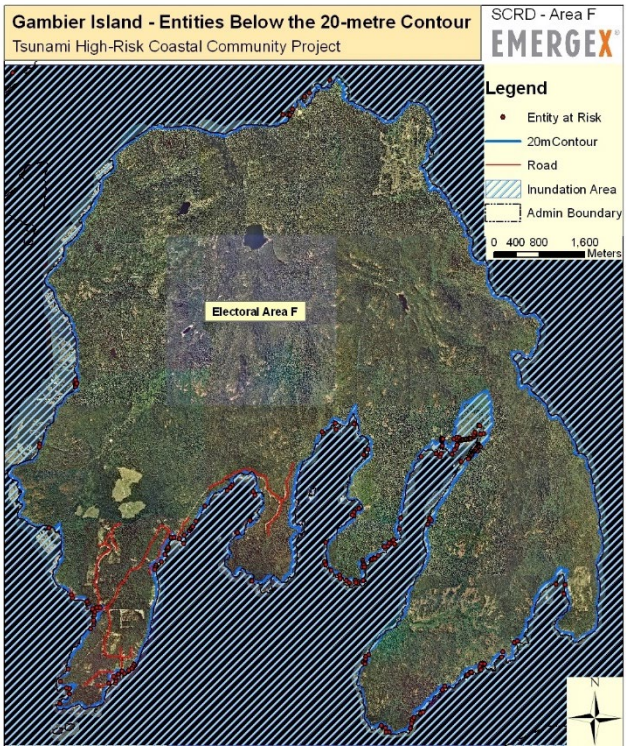


Figure 61: Gambier Island tsunami inundation zone. Source: SCRD Tsunami Maps. Retrieved from: https://www.scrd.ca/Tsunami-Maps

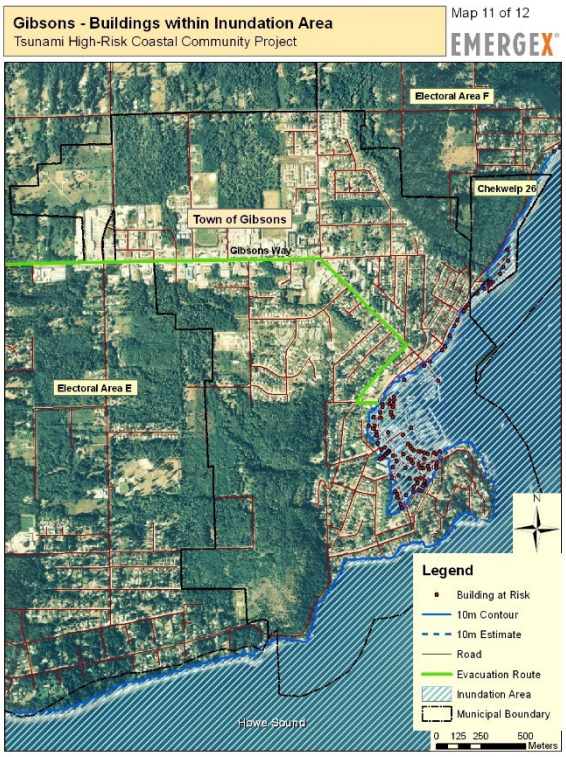


Figure 62: Town of Gibsons tsunami inundation zone. Source: SCRD Tsunami Maps. Retrieved from: https://www.scrd.ca/Tsunami-Maps

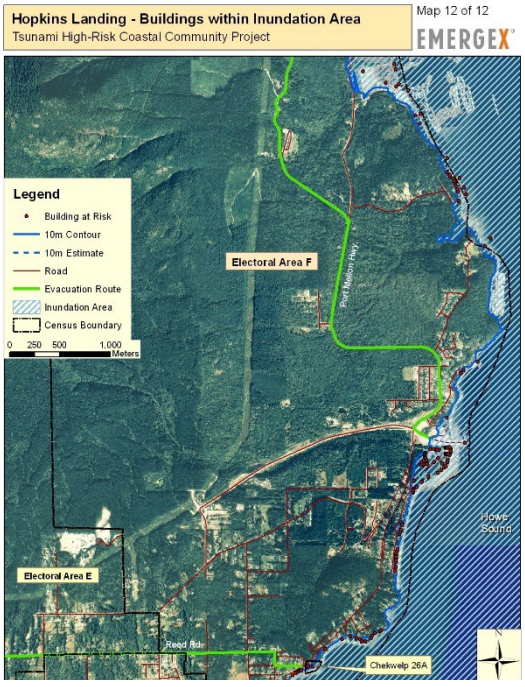


Figure 63: Hopkins Landing tsunami inundation zone. Source: SCRD Tsunami Maps. Retrieved from: https://www.scrd.ca/Tsunami-Maps

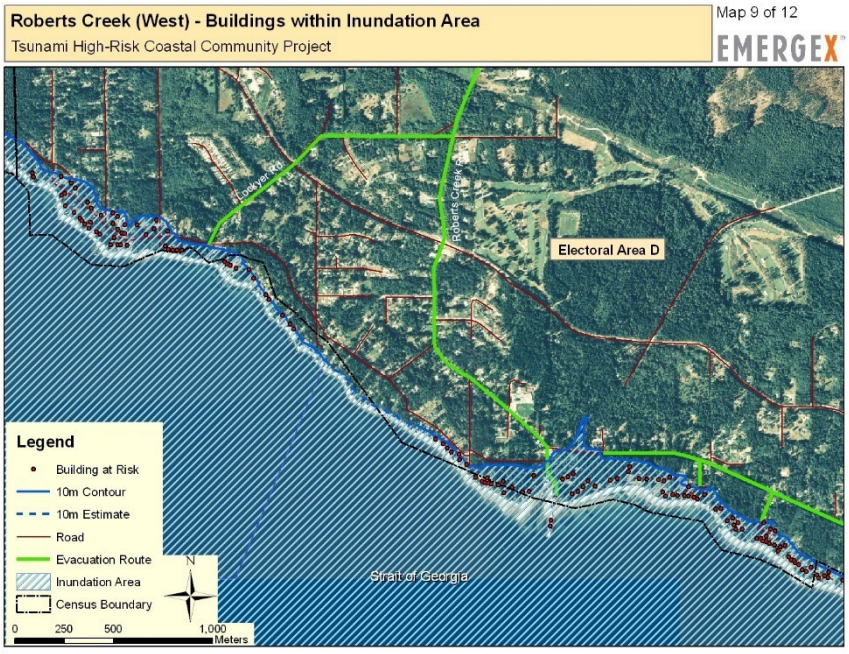


Figure 64: Roberts Creek tsunami inundation zone. Source: SCRD Tsunami Maps. Retrieved from: https://www.scrd.ca/Tsunami-Maps

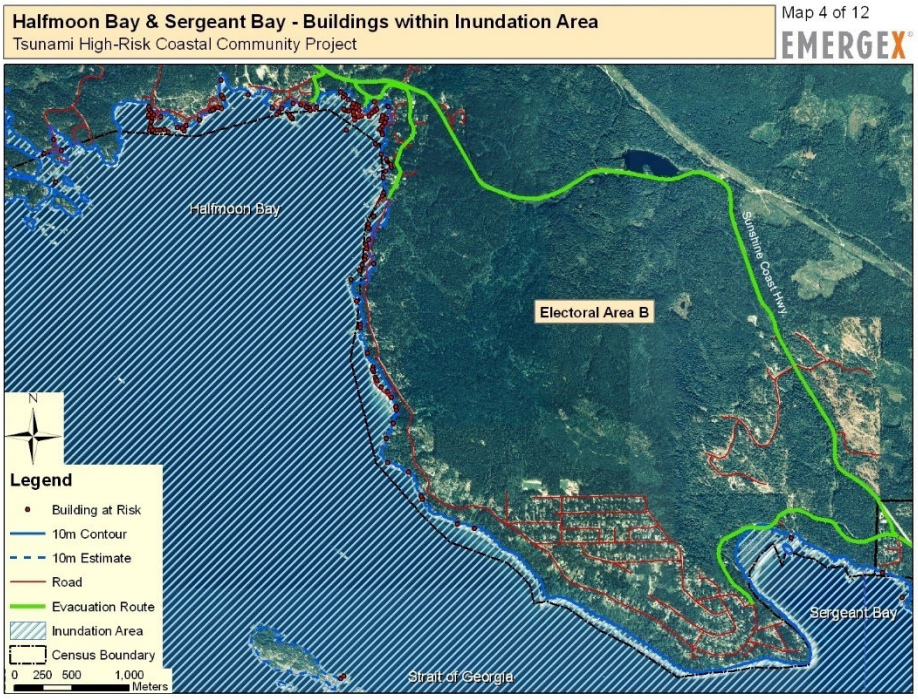


Figure 65: Halfmoon Bay and Sergeant Bay tsunami inundation zone. Source: SCRD Tsunami Maps. Retrieved from: https://www.scrd.ca/Tsunami-Maps

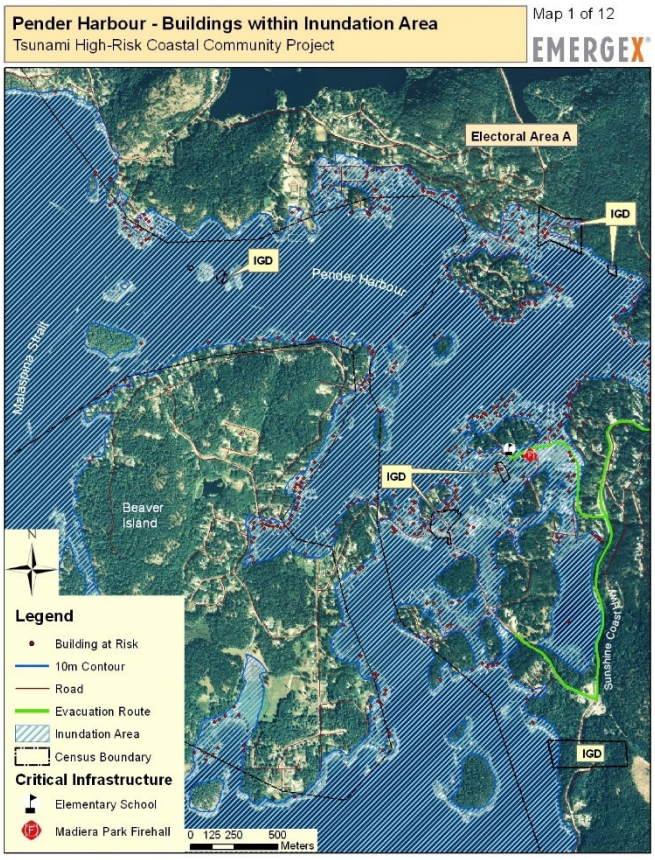


Figure 66: Pender Harbour tsunami inundation zone. Source: SCRD Tsunami Maps. Retrieved from: https://www.scrd.ca/Tsunami-Maps

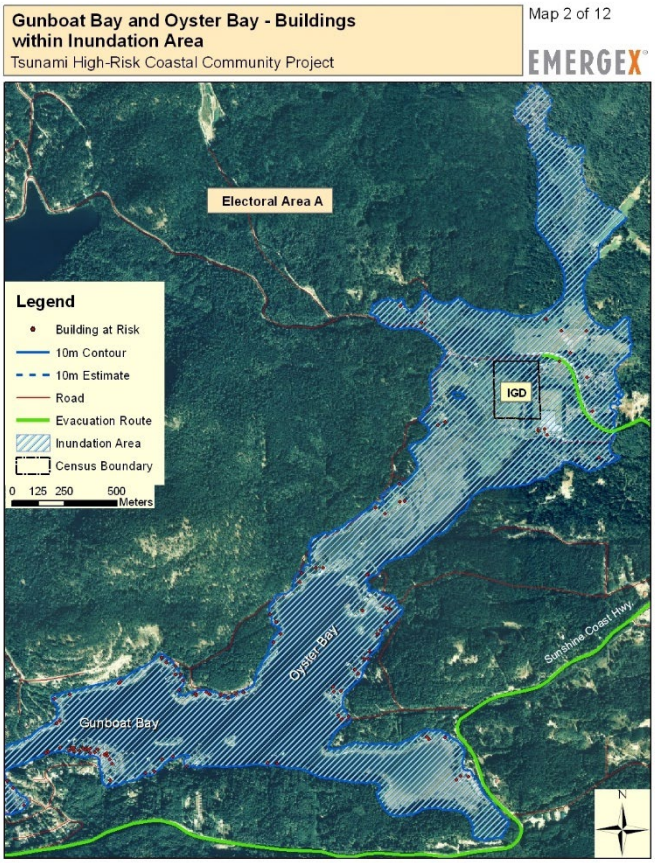


Figure 67: Gunboat Bay and Oyster Bay tsunami inundation zone. Source: SCRD Tsunami Maps. Retrieved from: https://www.scrd.ca/Tsunami-Maps

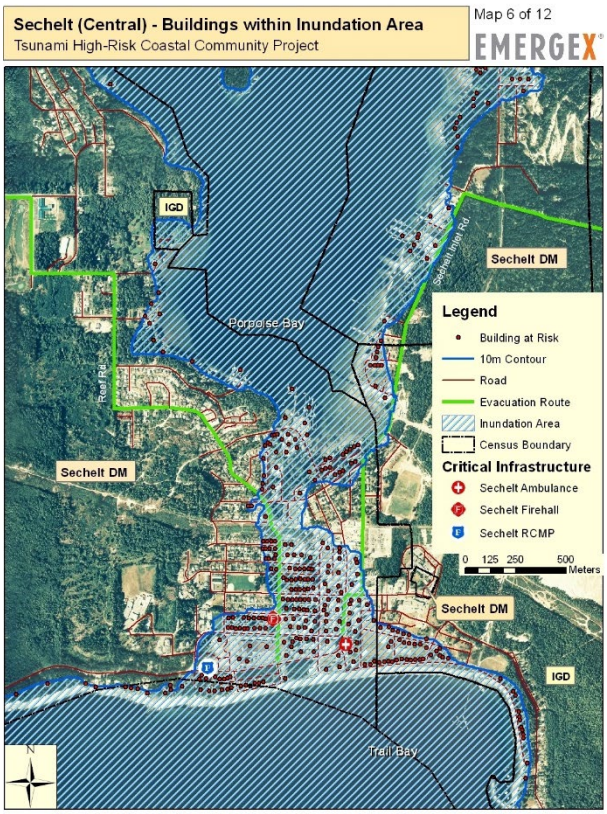


Figure 68: Sechelt (central) tsunami inundation zone. Source: SCRD Tsunami Maps. Retrieved from: https://www.scrd.ca/Tsunami-Maps

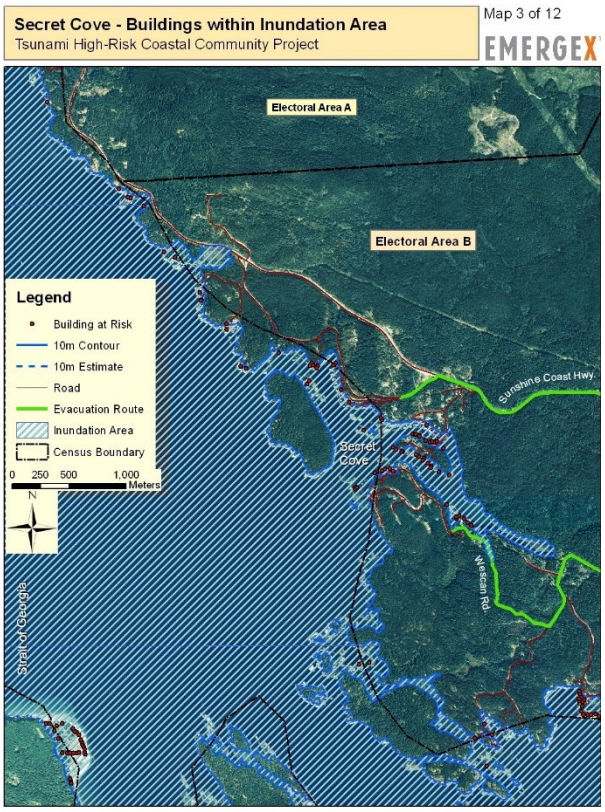


Figure 69: Secret Cove tsunami inundation zone. Source: SCRD Tsunami Maps. Retrieved from: https://www.scrd.ca/Tsunami-Maps

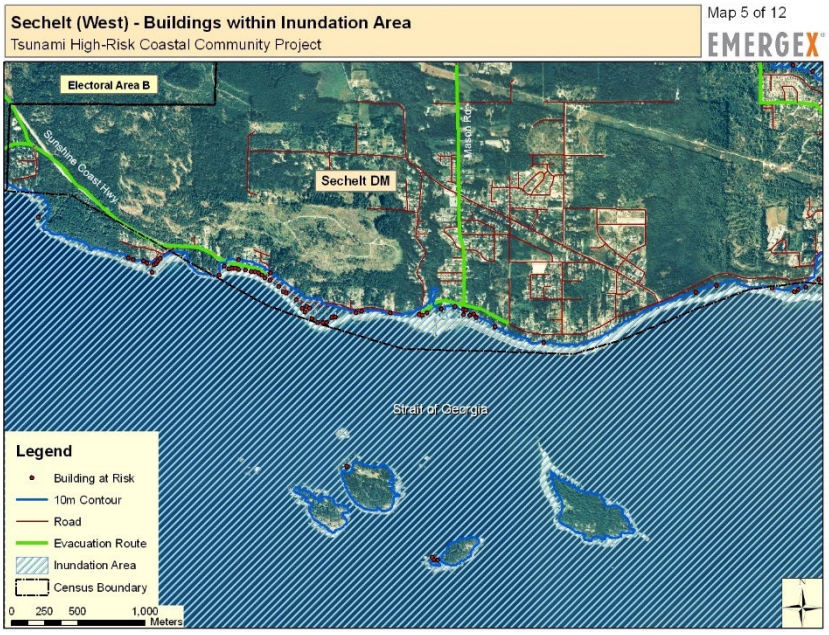


Figure 70: Sechelt (west) tsunami inundation zone. Source: SCRD Tsunami Maps. Retrieved from: https://www.scrd.ca/Tsunami-Maps

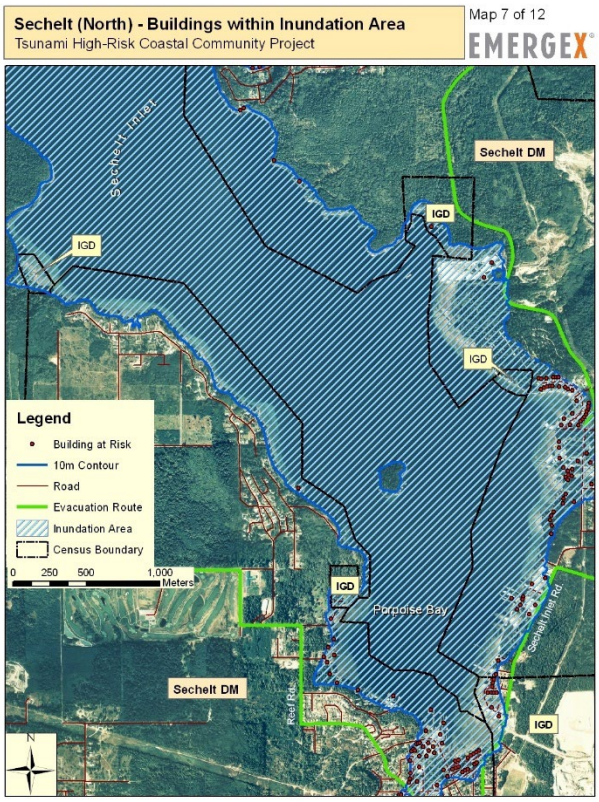


Figure 71: Sechelt (north) tsunami inundation zone. Source: SCRD Tsunami Maps. Retrieved from: https://www.scrd.ca/Tsunami-Maps

Figure 72: Sechelt (east) tsunami inundation zone. Source: SCRD Tsunami Maps. Retrieved from: https://www.scrd.ca/Tsunami-Maps

COASTAL FLOODING AND SEA LEVEL RISE MAPS

The following maps are generated from climatecentral.org and show areas of the Sunshine Coast threatened by sea level rise and coastal flooding. These maps supplement maps provided in section 8.2 Coastal Flooding. Maps are based on global-scale datasets for elevation and tides in addition to sea level rise projections. These maps are not based on physical storm and flood simulations and do not take into account factors such as erosion, future changes in the frequency or intensity of storms inland flooding, or contributions from rainfall or rivers. These maps should be considered as screening tools only to identify places that may require deeper investigation of risk.

Figure 73: Port Mellon coastal flooding from sea level rise of 1m by 2100.

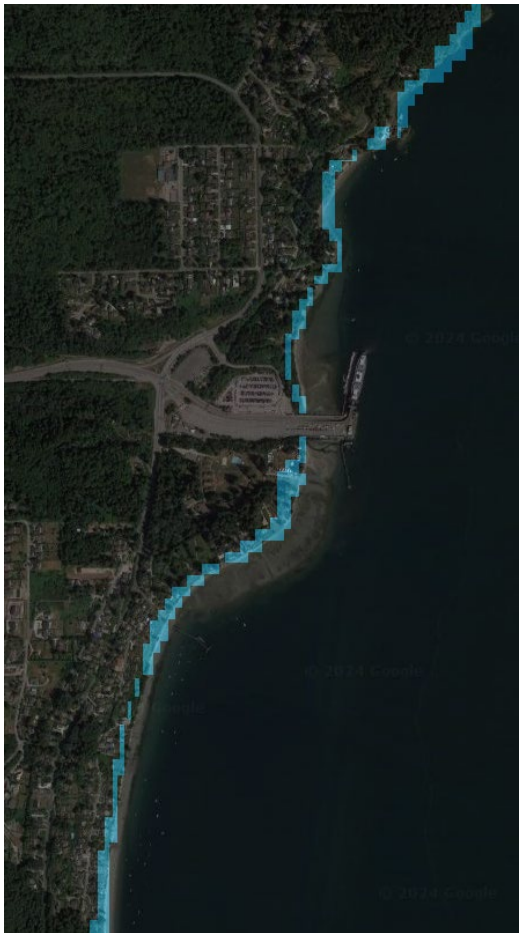


Figure 74: Langdale coastal flooding from sea level rise of 1m by 2100.,

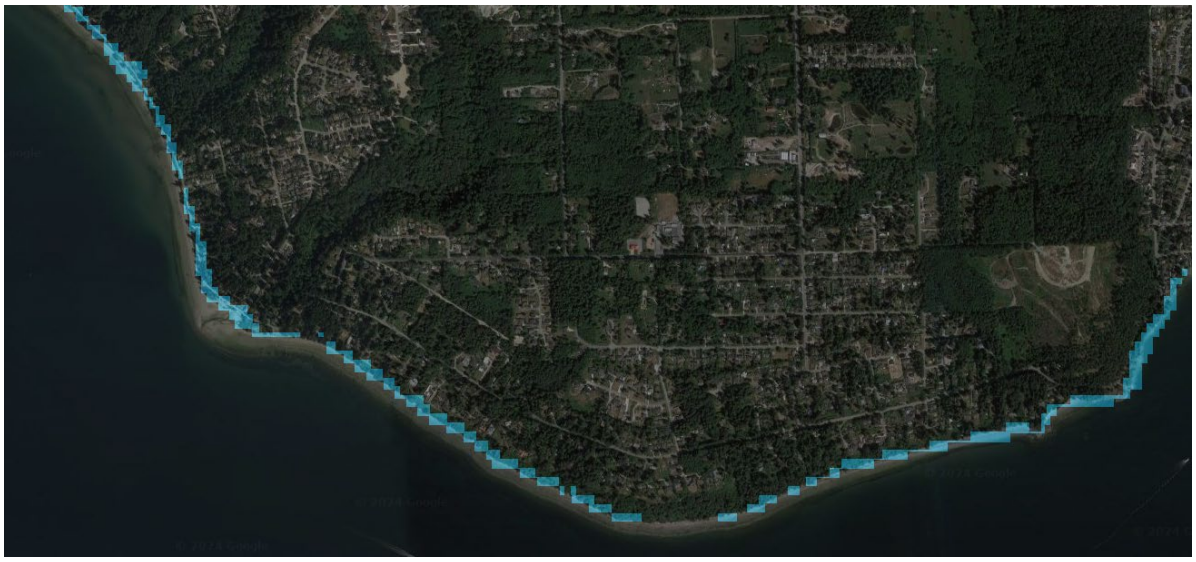


Figure 75: Elphinstone coastal flooding from sea level rise of 1m by 2100.

Figure 76: Davis Bay coastal flooding from sea level rise of 1m by 2100.

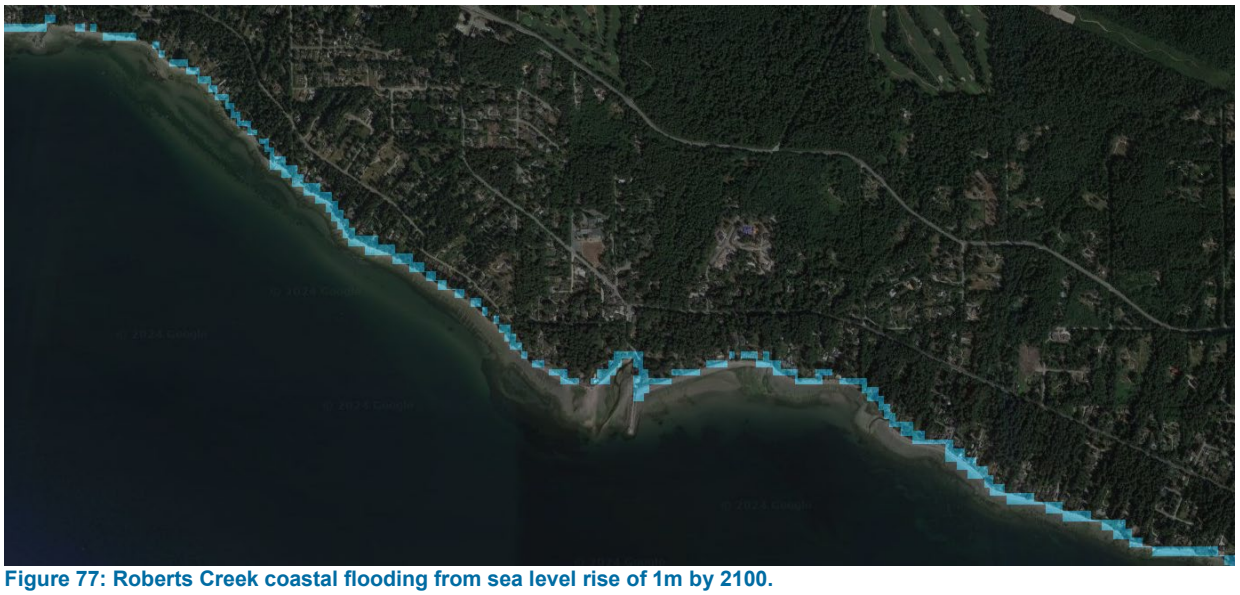


Figure 77: Roberts Creek coastal flooding from sea level rise of 1m by 2100.

Figure 78: Sechelt coastal flooding from seal level rise of 1m by 2100.

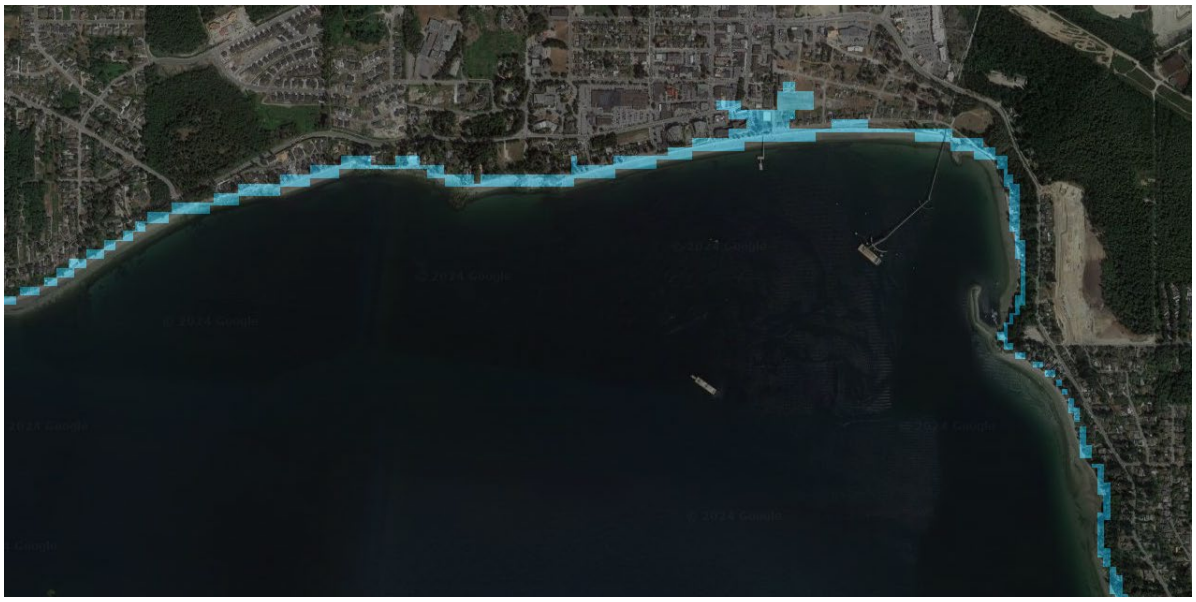


Figure 79: Sechelt coastal flooding from sea level rise of 1m by 2100.

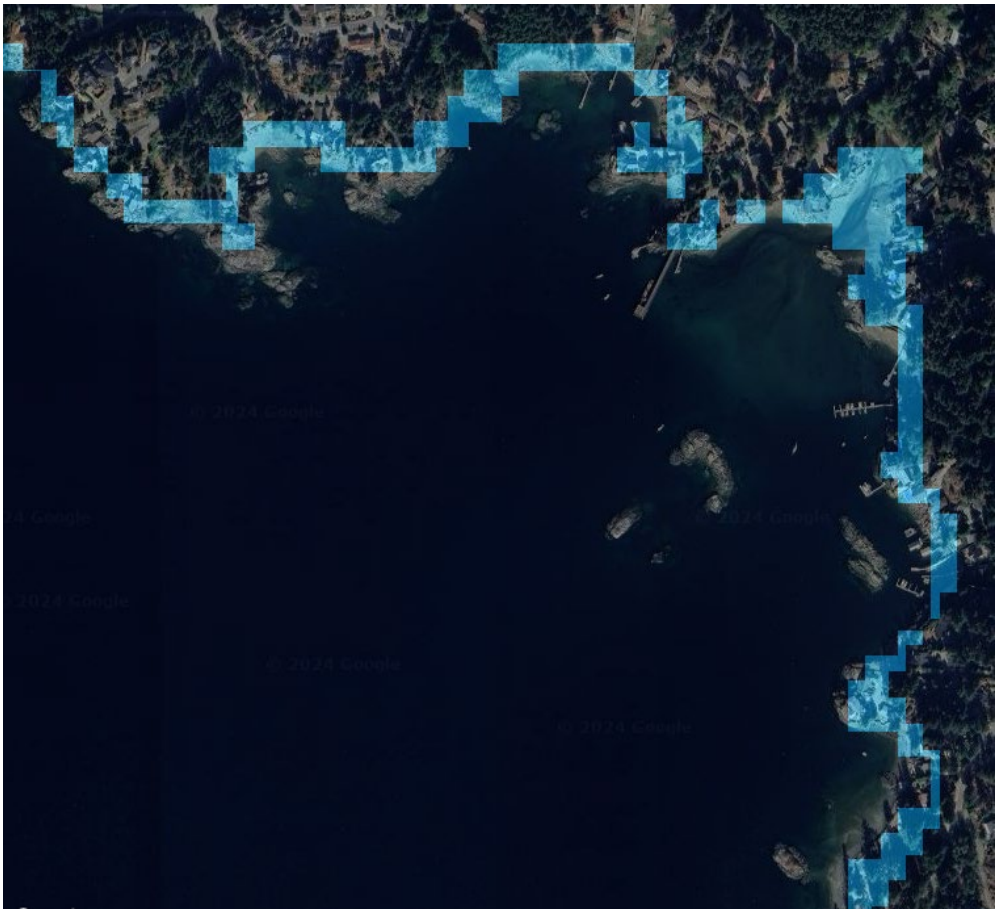


Figure 80: Halfmoon Bay coastal flooding from sea level rise of 1m by 2100.

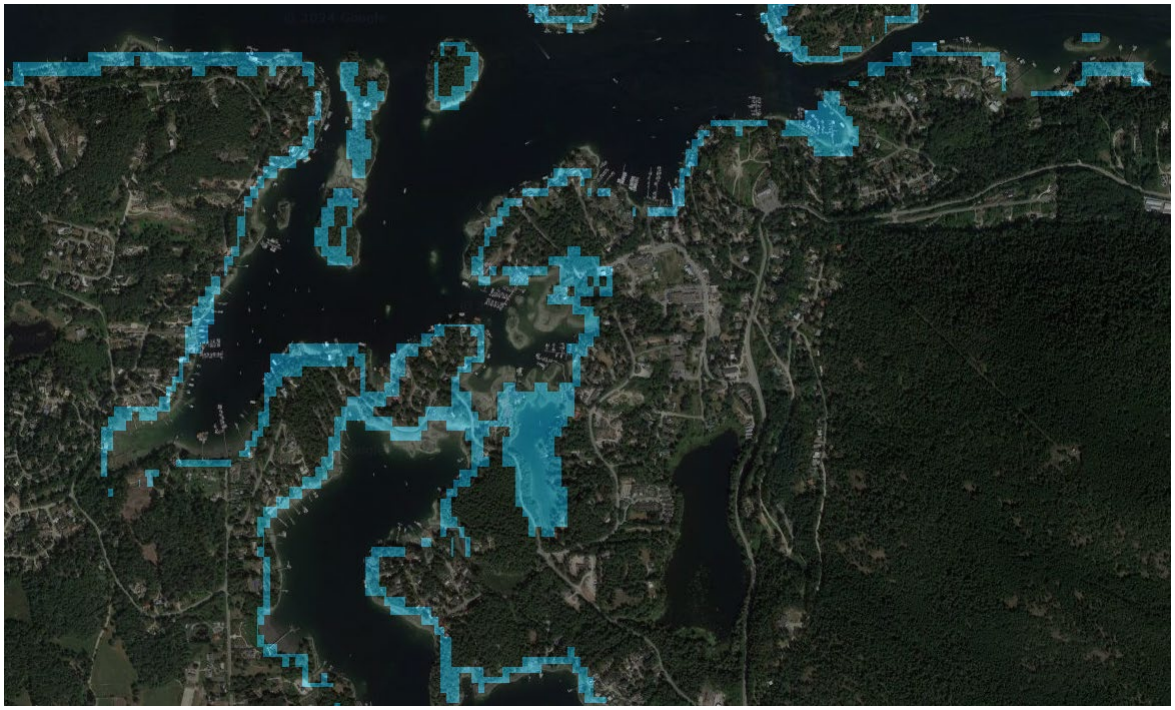


Figure 81: Madeira Park coastal flooding from sea level rise of 1m by 2100.

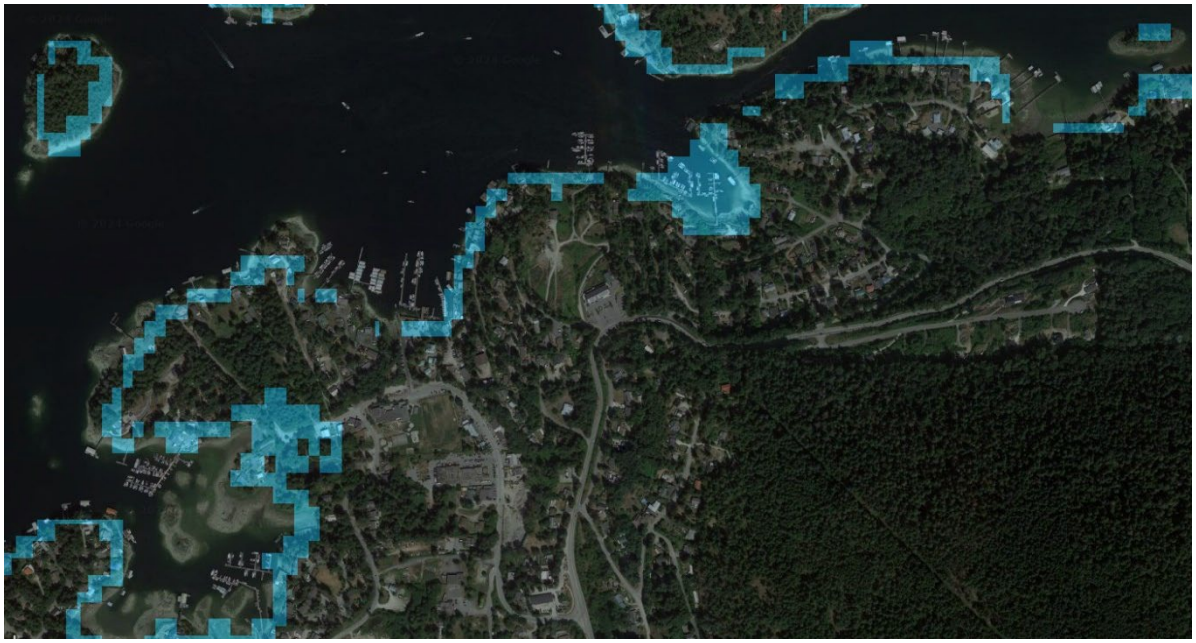


Figure 82: Pender Harbour coastal flooding from sea level rise of 1m by 2100.

Figure 83: Irvines Landing coastal flooding from sea level rise of 1m by 2100.

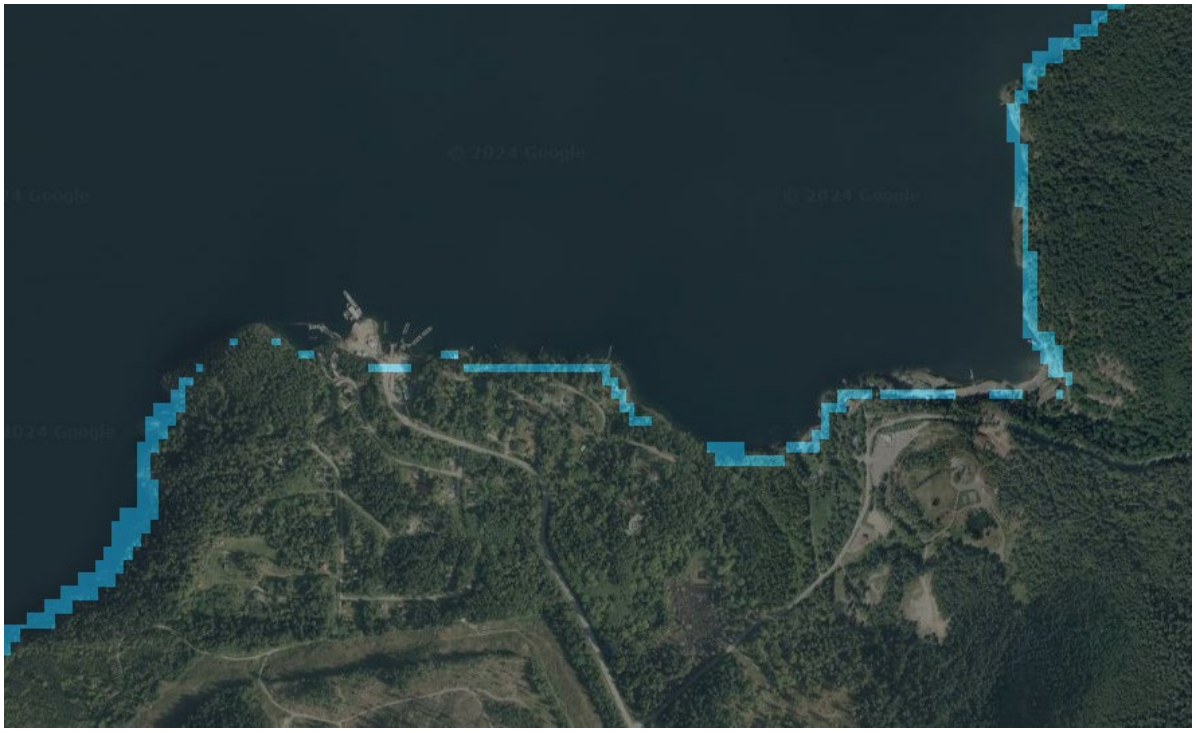


Figure 84: Earls Cove coastal flooding from sea level rise of 1m by 2100.

Figure 85: Nelson Island (south) coastal flooding from sea level rise of 1m by 2100.

Figure 86: Nelson Island (north) coastal flooding from sea level rise of 1m by 2100.

Figure 87: Hardy Island coastal flooding from sea level rise of 1m by 2100.

Figure 88: Thormandy Island (north) coastal flooding from sea level rise of 1m by 2100.

Figure 89: Thormandy Island (south) coastal flooding from sea level rise of 1m by 2100.

Figure 90: Egmont coastal flooding from sea level rise of 1m by 2100.

DAM AND SPILLWAY BREACH MAPS

The following maps illustrate flooding potential under different dam failure scenarios: sunny day conditions, 200 flood year conditions, and probable maximum flood conditions (PMF). All maps are from the "Chapman, Edwards, and McNeill Lake Dams: Dam Breach and Inundation Study (July 28, 2022), produced by WSP Canada for the SCRD. These maps are in addition to those maps already provided in section 9.1 Dam & Spillway Breach.

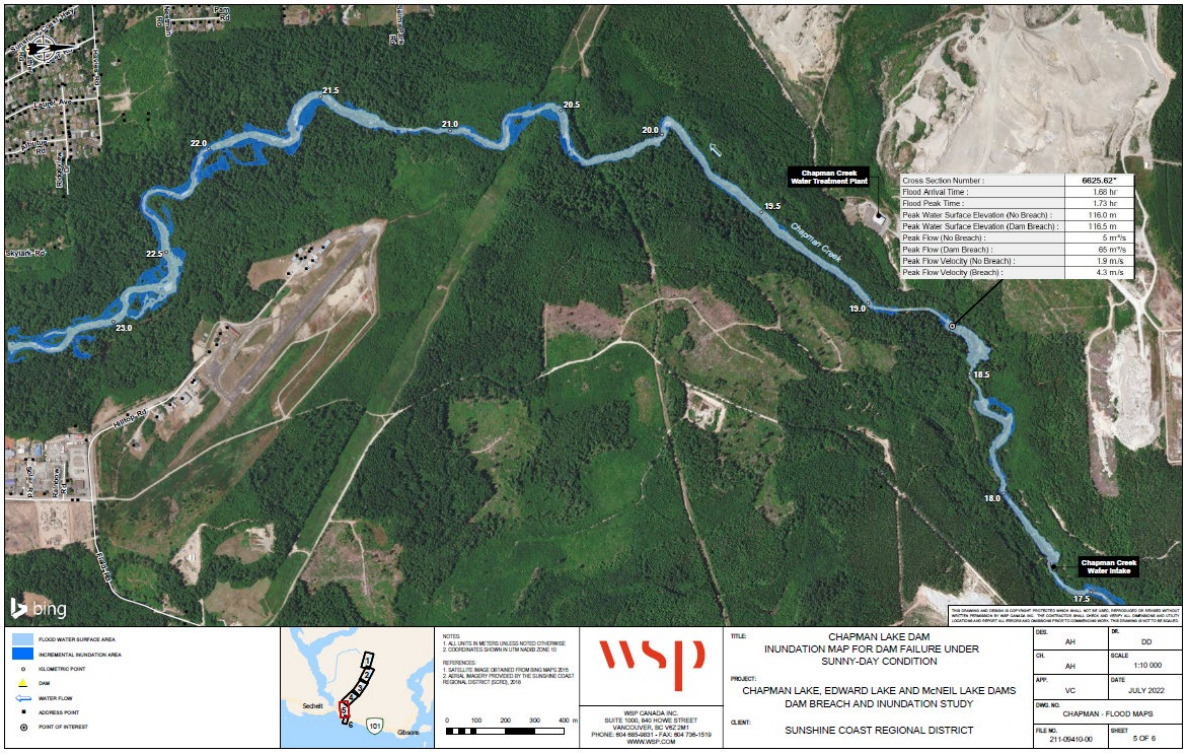


Figure 91: Chapman Lake Dam inundation map for dam failure under sunny day condition.

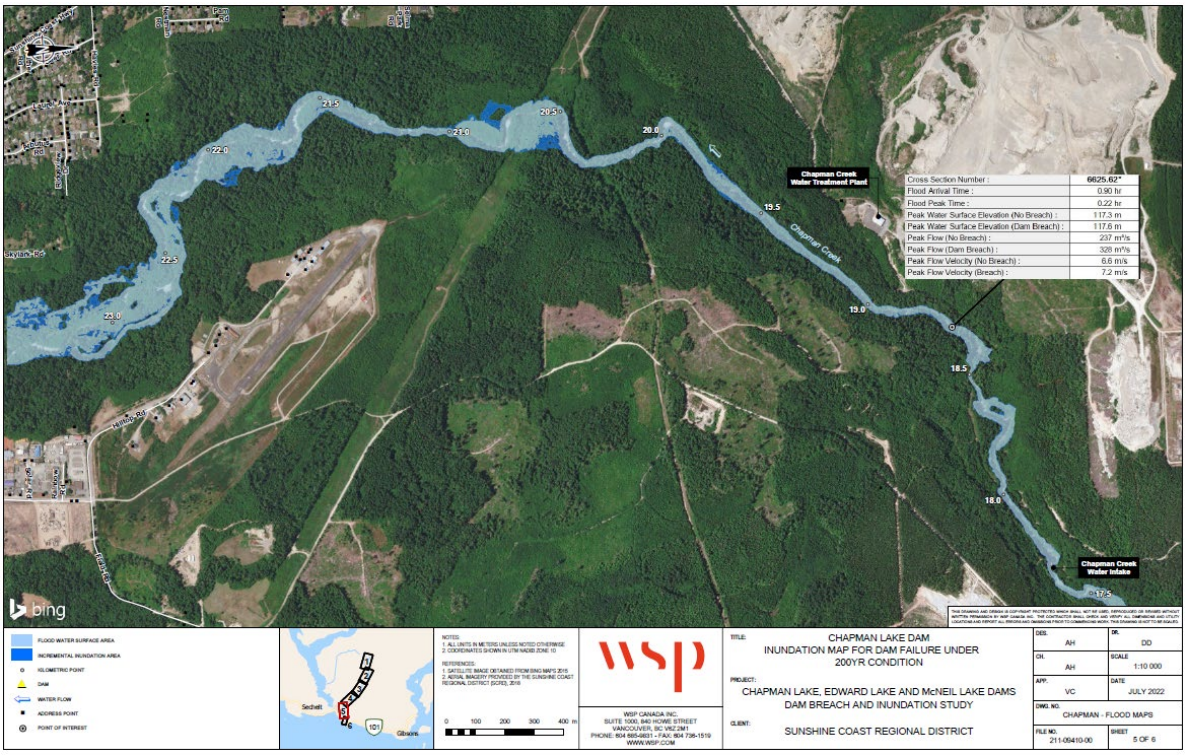


Figure 92: Chapman Lake Dam inundation map for dam failure under 200-year condition.

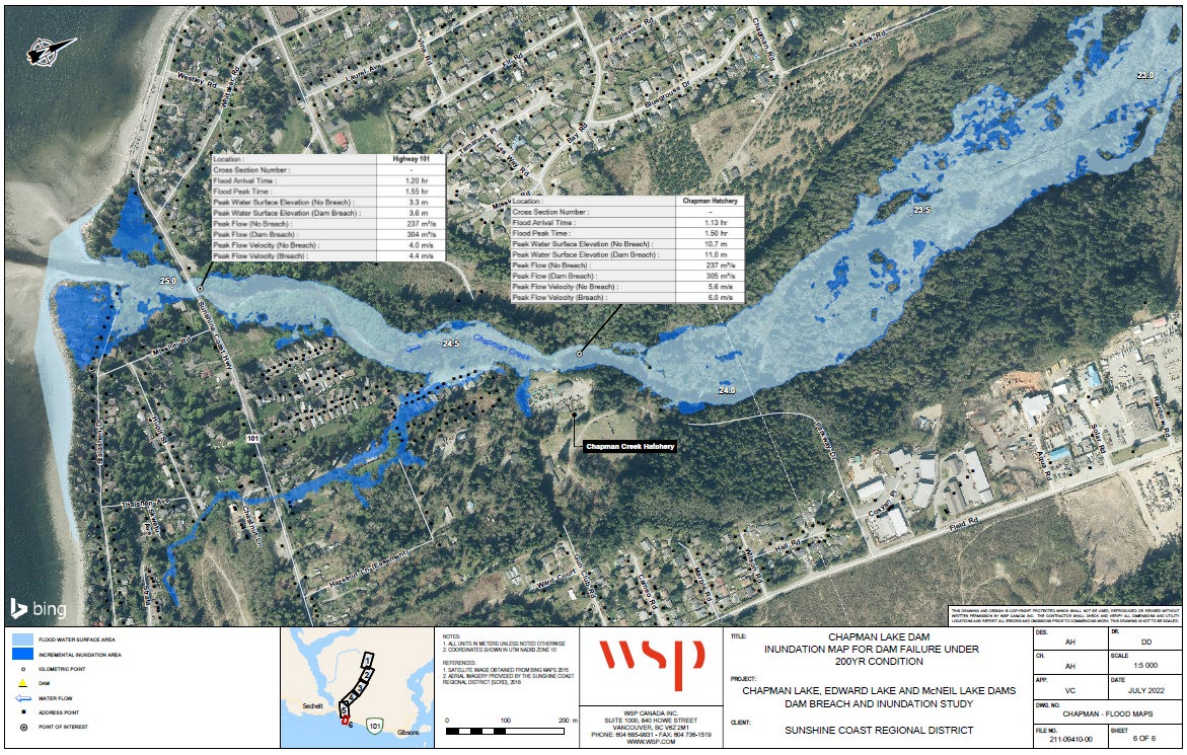


Figure 93: Chapman Lake Dam inundation map for dam failure under 200-year condition.

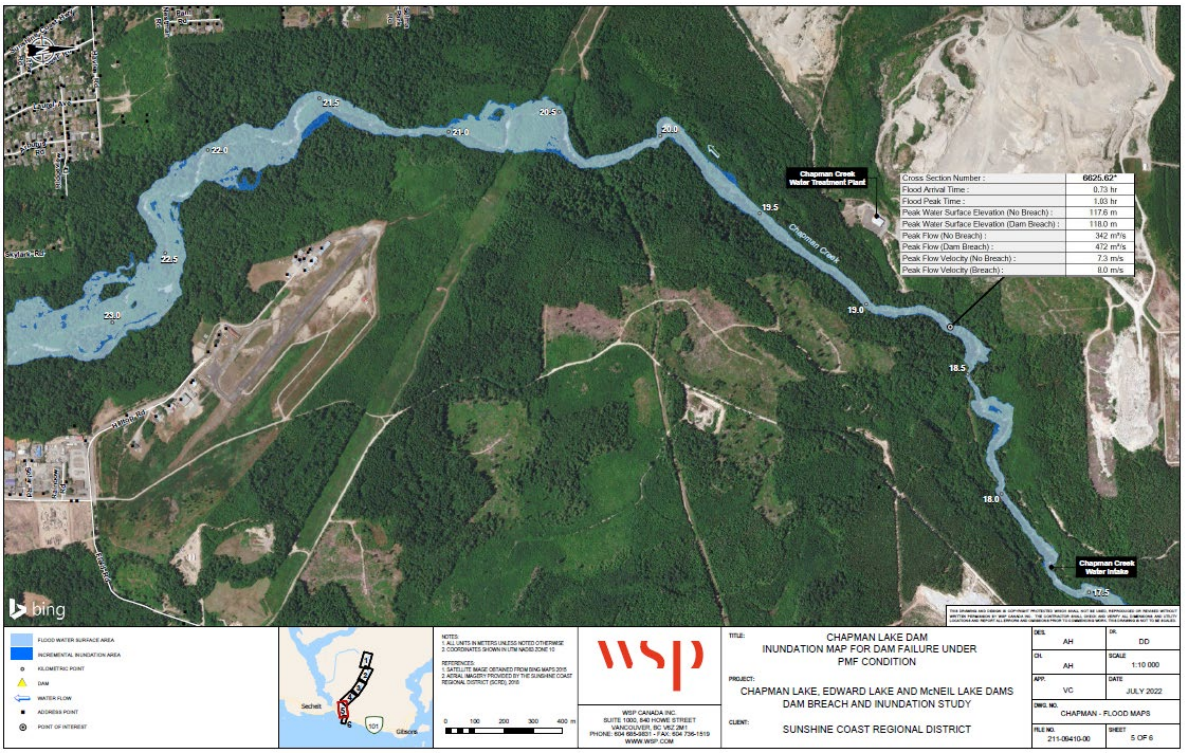


Figure 94: Chapman Lake Dam inundation map for dam failure under PMF condition.

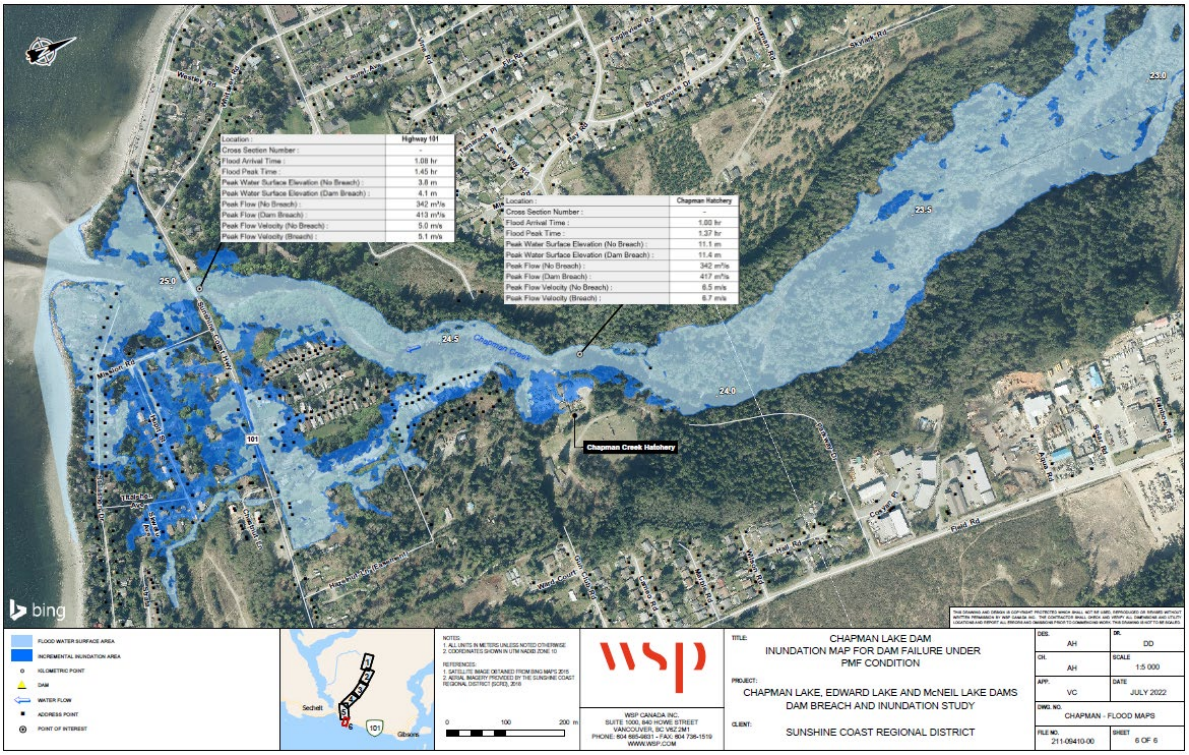


Figure 95: Chapman Lake Dam inundation map for dam failure under PMF condition.

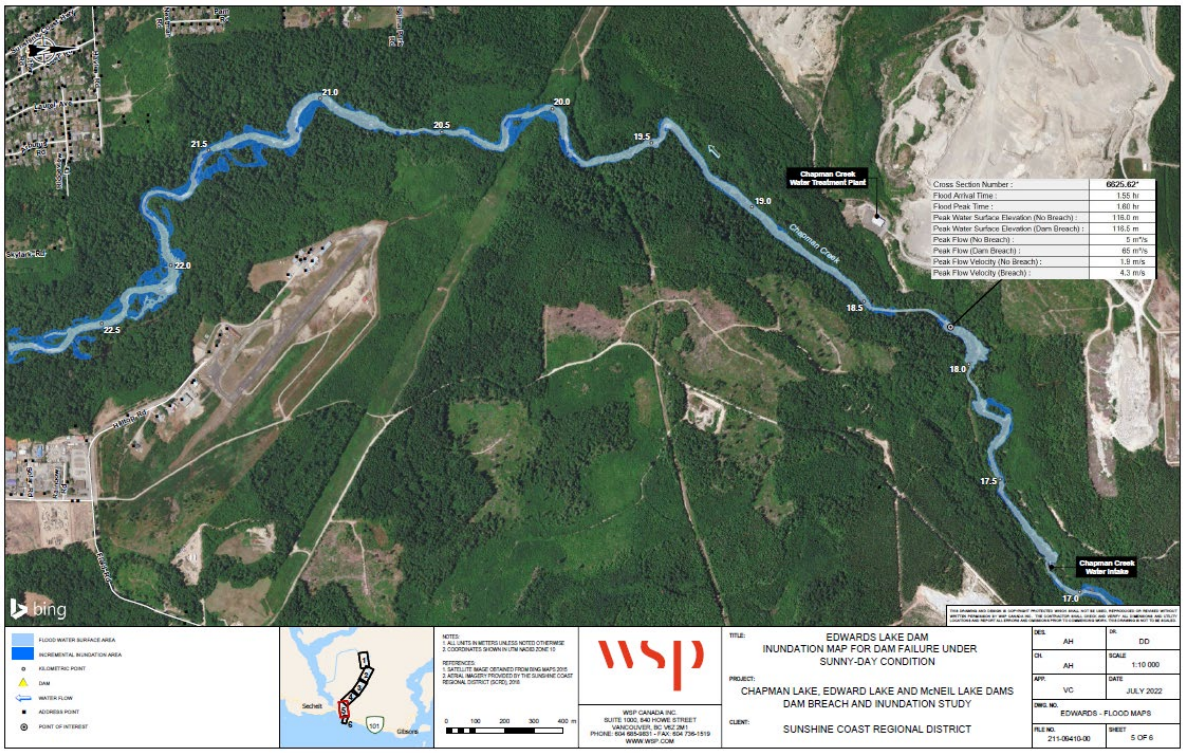


Figure 96: Edward Lake Dam inundation map for dam failure under sunny-day condition.

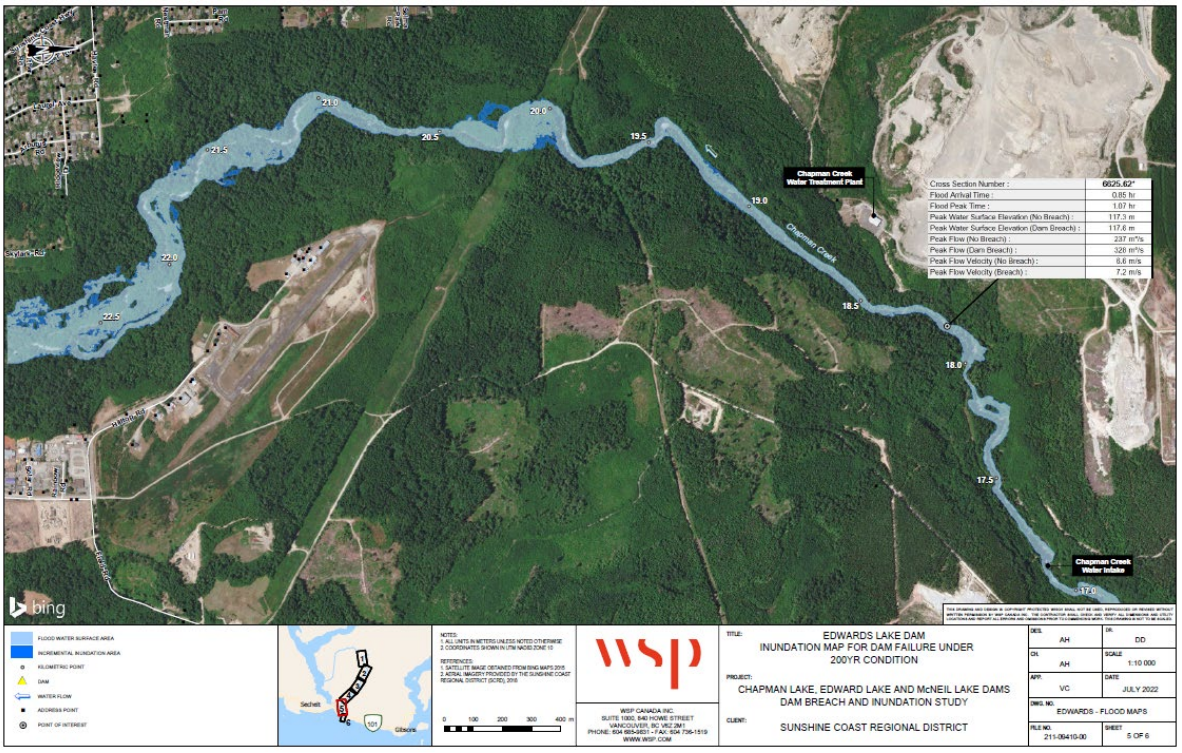


Figure 97: Edward Lake Dam inundation map for dam failure under 200-year condition.

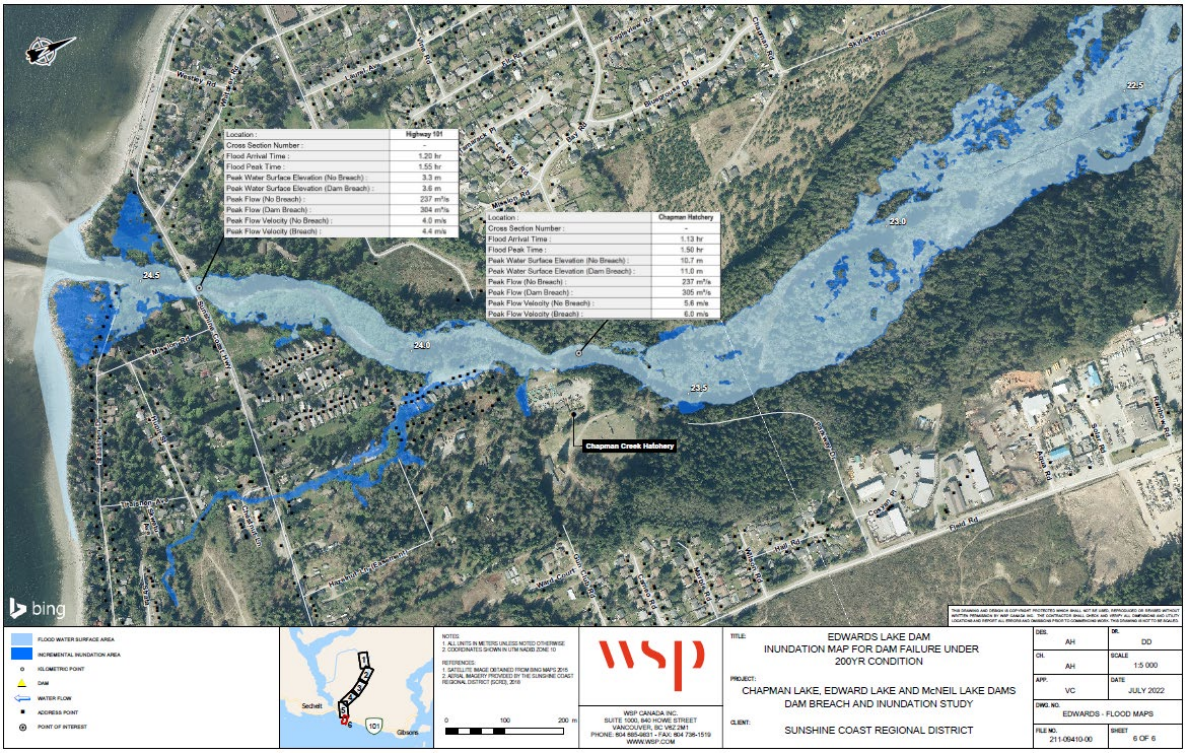


Figure 98: Edward Lake Dam inundation map for dam failure under 200-year condition.

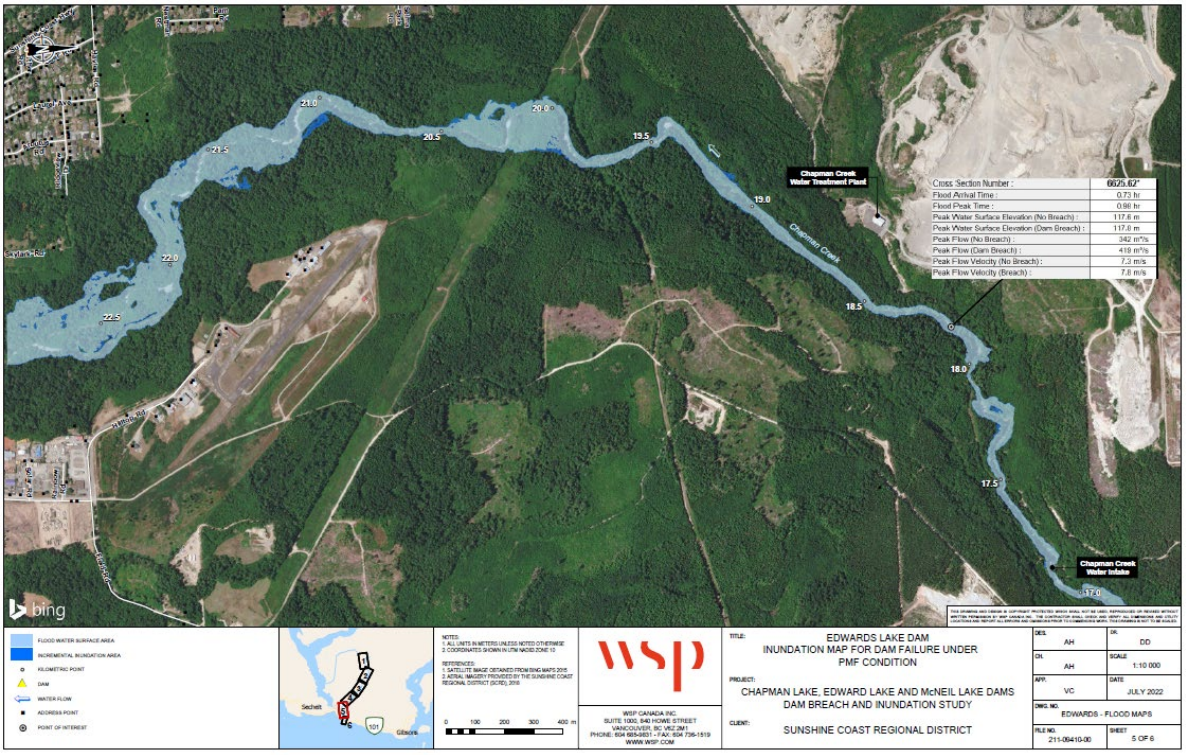


Figure 99: Edwards Lake Dam inundation map for dam failure under PMF condition.

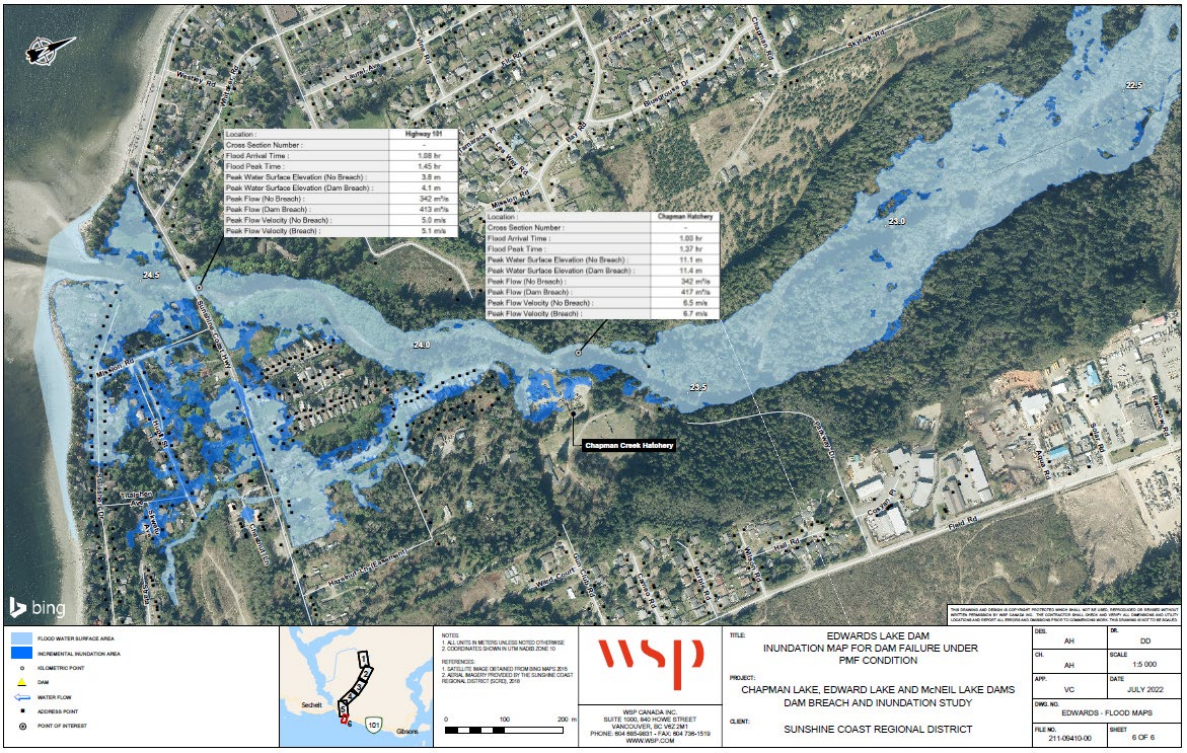


Figure 100: Edwards Lake Dam inundation map for dam failure under PMF condition.

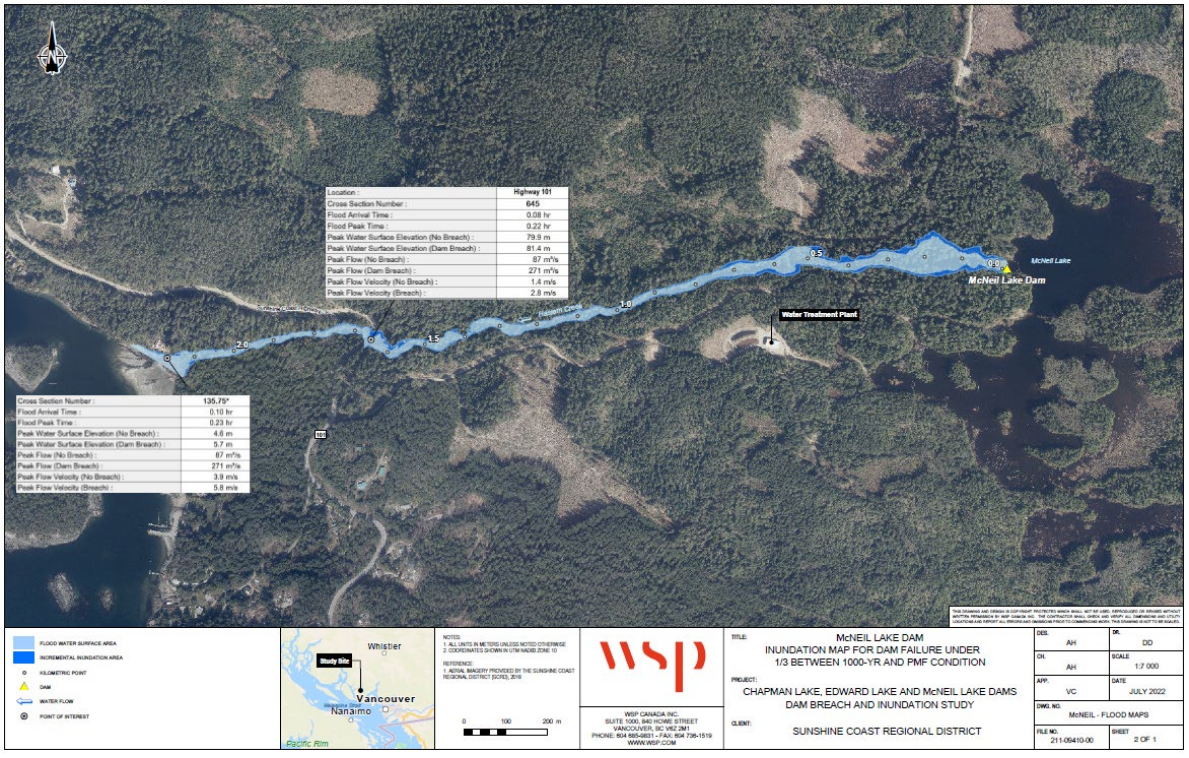


Figure 101: McNeill Lake Dam inundation map for dam failure under 1/3 between 1000-year and PMF condition (no 200-year or PMF condition maps available).

APPENDIX J: DISASTER RISK REDUCTION MEASURES FOR THE SUNSHINE COAST REGIONAL DISTRICT

The following table includes disaster risk reduction opportunities for hazards that 1) have a consequence score of 14+ and a likelihood of D (10% ≤ annual chance < 50%) and greater, and 2) have a consequence score 22+ and a likelihood score of A (annual chance <1%) and greater. These hazards include:

- drought
- wildfire
- structural fire
- high wind
- earthquake
- dam breach
- tsunami
- public health crisis
- liquefaction
- plant disease and pest infestation
- landslides
- local flood
- coastal flood
- fluvial flood
- flash flood
- telecommunications interruption
- transportation interruption
- water service interruption

The table is organized into three buckets of actions:

- **Prevention Actions**: Opportunities to avoid the development of new risks or increased disaster risks.
- **Reduction Actions**: Opportunities to remove or control existing disaster risks.
- **Response Actions**: Opportunities to respond to disaster risks that cannot be reduced or eliminated.

The buckets used to delineate between prevention, reduction and response actions are not strict categories. Some actions may be applicable across prevention actions, reduction actions and response actions (hence some actions may be listed under multiple buckets).

Example considerations provided within the EMCR DRR Online Tool were referenced and considered in the development of the following table.

Hazard	Prevention Actions	Reduction Actions	Response Actions
Drought	• Continue to review/update the Drought Response Plan. • Update Official Community Plans with focus on drought events and limited water availability for development in certain areas. • Ensure land use planning considers current and future water availability. • Develop and implement land use restrictions to protect wetlands and other ecosystems that help to retain water on the landscape. • Develop water supply expansion plans to identify new resources and/or expansion of existing resources. • Work with the Province to update building/plumbing codes to require best available water efficient appliances and fixtures in new construction and renovations. • Incentivize water efficiency for appliances and fixtures. • Continue to invest in infrastructure improvements to reduce water loss and enhance water storage.	• Continue to prioritize water conservation initiatives and public education and information programs: Fix a Leak notification program, Water Conservation Regulations, Rainwater Harvesting Rebates, Water Conservation Tips, Promotion of water-wise gardening, Monthly water use updates. • Continue to review/update the Drought Response Plan. • Rehabilitate natural wetlands and restore watersheds to help maintain water quality and availability during droughts. • Construct artificial wetlands to retain water on the landscape. • Conduct drought response exercises. • Continue to monitor water levels at all community water sources to help predict drought conditions and planning of appropriate response actions. • Monitor water usage in buildings (e.g., through use of advanced metering infrastructure) to collect real-time data on water use, identify leaks early and promote	• Continue to review/update the Drought Response Plan. • Identify alternative water sources as emergency back-up for each water system. • Continue to prioritize water conservation initiatives and public education and information programs.

		water-saving behaviours among residents.	
Wildfire	• Implement FireSmart practices across communities on the Sunshine Coast. • Incorporate wildfire risk management into land use planning. • Continue to work with BC Wildfire Services and other agencies to develop emergency response plans that include wildfire-specific strategies.	• Update the Community Wildfire Protection Plan on a regular basis to reflect new information on risk and vulnerability assessments. • Continue to incentivize and implement FireSmart Practices across communities on the Sunshine Coast. • Continue to develop and communicate public education on wildfire risk management. • Plan and undertake emergency response exercises for wildfire response. • Work with the Ministry of Forests and woodlot owners/licensees on forest management practices that reduce wildfire-urban interface risks. • Develop evacuation route plans for communities where none currently exist and make publicly available.	• Continue to use a mass notification system such as VoyentAlert!. • Work closely with BC Wildfire Service to ensure appropriate Fire Response Resources are available to communities. • Establish Mutual Aid Partnerships with neighbouring jurisdictions in none currently exist. • Work with BC Ministry of Emergency Management and Climate Readiness to establish, and coordinate Emergency Support Services if none currently exist.
Structural fire	• Continue to build according to Building Bylaws and BC Building Code to reduce structure fire risk. • Implement and promote FireSmart practices.	• Implement and promote FireSmart practices. • Identify subsidized housing structural fire risks and mitigative opportunities and work with other levels of government to fund retrofits that may be required to reduce structural fire risk.	• Ensure communities have appropriate Fire Response Resources to respond to structural fires. • Establish Mutual Aid Partnerships with neighbouring jurisdictions where none currently exist.

			• Work with BC Ministry of Emergency Management and Climate Readiness to establish, and coordinate Emergency Support Services if none currently exist.
High wind	• Climate proof new infrastructure to reduce vulnerability to anticipated high wind events. • Develop public education and awareness initiatives that educate the community about risks associated with high winds (e.g., importance of securing outdoor items, reinforcing structures, creating emergency kits).	• Invest in infrastructure improvements to enhance resilience against high winds (e.g., work with BC Hydro to identify power lines vulnerable to damage from high winds). • Continue to proactively prune trees to reduce risk of damage to critical infrastructure (e.g., power lines). • Develop public education and awareness initiatives that educate community about risks associated with high winds (e.g., importance of securing outdoor items, reinforcing structures, creating emergency kits).	• Ensure communities are well supported with appropriate emergency response resources. • Continue to use a mass notification system such as VoyentAlert! to provide timely alerts to the community. • Develop clear protocols for response and recovery operations including debris removal and infrastructure repair.
Earthquake	• Ensure all buildings are built to the most stringent seismic standards. • Apply to provincial and federal grants to ensure critical infrastructure (e.g., hospitals) are seismically updated to reduce risk and increase the safety of people. • Implement land use policies that consider seismic risks (e.g.,	• Develop an Emergency Preparedness Guide that is available and understandable to communities. • Develop business continuity plans and encourage other jurisdictions to develop business continuity plans where none exist, to ensure legislative requirements under	• Continue to use a mass notification system such as VoyentAlert!. • Work with the BC Ministry of Emergency Management and Climate Resilience to ensure residents have access to Disaster Financial Assistance.

	development restrictions on areas prone to liquefaction).	*Emergency and Disaster Management Act* are met. • Plan and undertake emergency response exercises for earthquake response. • Identify and upgrade vulnerable infrastructure according to seismic requirements in provincial building code. • Develop evacuation route plans for communities where none exist currently. • Develop regional earthquake hazard plan.	• Work with BC Ministry of Emergency Management and Climate Readiness to establish, and coordinate Emergency Support Services if none currently exist. • Develop earthquake response plan that identifies key roles and responsibilities of response agencies and levels of government.
Dam / spillway breach	• Amend land use planning to consider areas at high risk of dam spill inundation and prevent further building in areas that are at high risk of inundation. • Upgrade dams to withstand earthquakes and extreme weather events. • Continue regular inspections and maintenance of dam infrastructure to identify and address potential vulnerabilities before they lead to breaches.	• Plan and partner with local and provincial governments to conduct emergency response exercises for dam/spillway breach. • Develop education campaigns that educate the community about the risks associated with dam breaches, including evacuation routes and safety measures in the event of a breach.	• Continue to use a mass notification system such as VoyentAlert!. • Work with the BC Ministry of Emergency Management and Climate Resilience to ensure residents have access to Disaster Financial Assistance. • Ensure communities are well supported with appropriate emergency response resources • Establish Mutual Aid Partnerships with neighbouring jurisdictions where none currently exist.
Tsunami	• Implement land use policies that restrict further development in high-risk tsunami zones and ensure	• Develop community evacuation route plans where they do not already exist.	• Continue to use a mass notification system such as VoyentAlert!.

	critical infrastructure is located outside of hazard zones (where possible).	• Continue to erect clearly marked evacuation route road signs and raise public awareness about evacuation routes. • Identify infrastructure improvements that may be necessary to facilitate quick evacuations. • Identify vulnerable coastal areas and upgrade coastal infrastructure. • Relocate populations or assets that cannot be adequately protected. • Emergency response exercises for tsunami.	• Work with the BC Ministry of Emergency Management and Climate Resilience to ensure residents have access to Disaster Financial Assistance. • Ensure communities are well supported with appropriate emergency response resources • Establish Mutual Aid. Partnerships with neighbouring jurisdictions where none currently exist. • Establish a system for vulnerable community members to self-identify and pre-establish what extra support may be required during an emergency.
Public health crisis	• Support development of affordable housing / subsidized housing for at-risk populations. • Support development of additional shelters, risk reduction sites, community harm prevention programs. • Work with Vancouver Coastal Health to conduct public education campaigns to raise awareness about public health risks and preventative measures (e.g., hygiene, vaccination, and disease prevention strategies). • Ensure critical infrastructure, such as water systems and sanitation	• Clear public messaging on ways to limit spread of infections (for airborne illnesses such as COVID-19). • Coordinate with Vancouver Coastal Health on active risk reduction measures, such as emergency exercises and the development/updating of regional response plans.	• Continue to use a mass notification system such as VoyentAlert! to provide timely and accurate information to the public. • Ensure communities are well supported with appropriate emergency response resources. • Establish Mutual Aid Partnerships with neighbouring jurisdictions where none currently exist. • Consider public health-related logistics response procedures

	systems, are resilient and well-maintained to prevent public health hazards (e.g., regular inspections and upgrades as needed).		in coordination with Vancouver Coastal Health and regional emergency management contacts.
Liquefaction	• Undertake geotechnical assessments to identify areas of high risk of liquefaction. • Integrate findings of geotechnical assessments into land use planning to identify areas at risk of liquefaction. • Relocate populations or assets that cannot be adequately protected. • Include Development Restrictions in Land Use Plans.	• Incorporate liquefaction risk in future earthquake planning and exercise activities.	• Ensure communities are well supported with appropriate emergency response resources. • Establish Mutual Aid Partnerships with neighbouring jurisdictions where none currently exist.
Plant disease & pest infestation	• Engage the community in pest management efforts, such as avoiding planting of certain flora at high risk of disease and through volunteer monitoring programs. • Encourage biodiversity planting to reduce risk of plant disease and pest infestation. • Work with the Province to set up regular monitoring of plant health and pest populations to detect issues early.	• Develop clear communication and outreach to public about best practices to avoid disease and infestations. • Work with the BC Ministry of Environment to ensure adequate funding and capacity to establish watercraft and equipment inspection and decontamination sites. • Develop and implement an integrated pest management approach that emphasizes the use of biological, cultural, mechanical and chemical methods to manage pests.	• Work with the BC Ministry of Environment to ensure adequate funding and capacity to establish watercraft and equipment inspection and decontamination sites.

Landslides	• Undertake geotechnical assessments to identify areas at high risk of landslides and continue to require geotechnical assessments for new developments in areas with potential for landslide risks. • Incorporate requirements around steep loped areas in Land Use Plans. • Include Development Restrictions in Land Use Plans. • Plant vegetation in strategic locations to stabilize soils and reduce erosion, while helping to absorb water and anchor soils.	• Relocate populations or assets that cannot be adequately protected. • Implement monitoring systems to detect early signs of slope movement (e.g., sensors and monitoring of soil stability in high-risk areas) and provide timely warnings to residents. • Invest in infrastructure improvements to enhance slope stability (e.g., retaining walls, drainage systems).	• Continue to use a mass notification system such as VoyentAlert!. • Establish Mutual Aid Partnerships with neighbouring jurisdictions where none currently exist. • Work with the BC Ministry of Emergency Management and Climate Resilience to ensure residents have access to Disaster Financial Assistance.
Local flood	• Include siting requirements related to flooding in Land Use Plans. • Include Development Restrictions in Land Use Plans. • Construct flood mitigation infrastructure (e.g., dikes) within high-risk areas.	• Relocate populations or assets that cannot be adequately protected. • Identify opportunities for diking along coastal areas or riverbanks at risk of flooding and where relocation of populations or assets is cost-prohibitive.	• Continue to use a mass notification system such as VoyentAlert!. • Work with the BC Ministry of Emergency Management and Climate Resilience to ensure residents have access to Disaster Financial Assistance. • Ensure communities are well supported with appropriate emergency response resources. • Establish Mutual Aid Partnerships with neighbouring

			jurisdictions where none currently exist.
Coastal flood	• Include areas at high risk of coastal flooding in Land Use Plan, and include development restrictions where risks are considered too high. • Construct coastal flood mitigation infrastructure (e.g., dikes) at high-risk areas.	• Develop evacuation route plans for communities where none exist. • Relocate populations or assets that cannot be adequately protected. • Construct coastal flood management system and infrastructure (e.g., dikes). • Identify infrastructure that can be relocated. • Relocate infrastructure if not cost prohibitive.	• Continue to use a mass notification system such as VoyentAlert!. • Work with the BC Ministry of Emergency Management and Climate Resilience to ensure residents have access to Disaster Financial Assistance. • Ensure communities are well supported with appropriate emergency response resources. • Establish Mutual Aid Partnerships with neighbouring jurisdictions where none currently exist.
Fluvial (freshet, river, creek flood)	• Develop siting requirements related to flooding risks. • Include development restrictions in Land Use Plans for high risk areas. • Construct flood mitigation. infrastructure (e.g., dikes) in areas at high risk of flooding	• Develop evacuation route plans for communities where none exist currently. • Relocate populations or assets that cannot be adequately protected. • Undertake Flood Plain Restoration to reduce risk of flooding. • Construct flood management systems and infrastructure (e.g., dikes). • Relocate infrastructure if not cost prohibitive.	• Continue to use a mass notification system such as VoyentAlert!. • Work with the BC Ministry of Emergency Management and Climate Resilience to ensure residents have access to Disaster Financial Assistance. • Ensure communities are well supported with appropriate emergency response resources. • Establish Mutual Aid Partnerships with neighbouring

			jurisdictions where none currently exist.
Flash flood	• Ensure siting requirements related to flooding risks are established and adhered to (e.g., setback requirements, flood construction levels, use restrictions for basements related to HVAC equipment). • Continue to build out knowledge and information related to areas at high risk of flash floods. • Use latest information on areas of high risk of flash floods to inform land use planning and infrastructure development. • Implement effective stormwater management to reduce risk of flash floods (e.g., retention basis).	• Develop community evacuation route plans where none exist. • Conduct public education campaigns to inform residents about flood risks and preparedness measures (e.g., knowing evacuation routes). • Upgrade infrastructure to enhance resilience against flash floods.	• Continue to use a mass notification system such as VoyentAlert!. • Work with the BC Ministry of Emergency Management and Climate Resilience to ensure residents have access to Disaster Financial Assistance. • Ensure communities are well supported with appropriate emergency response resources • Establish Mutual Aid. Partnerships with neighbouring jurisdictions where none currently exist.
Telecommunication interruption	• Work with Industry Canada, telecom service providers, and the Province of BC to identify opportunities to build redundancy into the telecommunications infrastructure on the Sunshine Coast. • Work with telecom providers to identify opportunities to strengthen the physical infrastructure for telecommunication systems to withstand hazards.	• Consider satellite-based telecommunications to sustain critical functions (e.g., EOC operations). • Work with telecom providers to ensure regular maintenance and timely upgrades of infrastructure to prevent failures due to wear and tear or outdated technology. • Undertake education campaigns to inform the public about the importance of having alternative ways to communicate during outages.	• Continue to work with alternative communication methods and providers, such as the Coast Emergency Communication Association (ham radio) and ICON Radio, to provide key messaging and information during telecommunication interruptions.

Transportation interruption	• Work with Province to build alternative routes to have less reliance on Highway 101 (Sunshine Coast Highway).	• Update infrastructure (e.g., bridges, roadways, public transit systems) to withstand seismic events, flooding or landslide events. • Identify alternative route options (e.g., Highway 101 bridge at Chapman Creek near Davis Bay).	• Continue to use a mass notification system such as VoyentAlert! to notify the public about transportation interruptions. • Identify alternative transportation options for critical supplies to reach communities in the event of main transportation route interruption (e.g., aircraft, private barges). • Continue to work with all local governments, transportation agencies (e.g., BC Transit), and emergency services to coordinate efforts and share resources for maintaining transportation continuity during and after a disaster.
Water service interruption	• Identify alternative water sources for each water system to build in additional system supply during emergencies. • Continue to regularly maintain and upgrade water supply infrastructure, including pipes, pumps, and treatment facilities, to prevent failures that could lead to service interruptions.	• Update aging water service infrastructure to reduce likelihood of infrastructure failure. • Update (if needed) and implement the Aquifer Protection Plan to safeguard groundwater resources which can serve as an alternative water supply during loss of main water supply resources.	• Continue to use a mass notification system such as VoyentAlert! to notify the public about water service interruptions. • Identify bulk water providers or bottled water distributors to provide potable water to impacted areas as stop-gap measure in response to water service interruptions to ensure residents have access to safe drinking water.

		• Coordinate with local and provincial authorities to expedite repairs once cause of interruption has been determined.