

Together for Climate Project Report 2020



CITY OF
PORT ALBERNI

Contents

Acknowledgements.....	3
Purpose.....	4
Introduction.....	4
Together for Climate Project.....	5
Adaptation vs. Mitigation.....	6
Policy Direction on Adaptation.....	6
Federal Policy Direction on Adaptation.....	6
Provincial Policy Direction on Climate Adaptation.....	7
The Science of Climate Change.....	8
Climate Change in Port Alberni.....	9
Impacts and Risks.....	13
Our Process.....	16
BARC Framework.....	16
Impact Identification.....	17
Vulnerability Assessment.....	17
Risk Assessment.....	18
Action Identification and Prioritization.....	19
Adaptation Actions.....	21
Conclusion.....	25
References.....	27
Appendices.....	28
Appendix A: Climate Adaptation Actions and Prioritization Scores.....	28
Appendix B: Glossary of Terms.....	40
Appendix C: Summary Table of Climate Change Projections for the Port Alberni Area.....	42

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Alberni Clayoquot Health Network	PA Air Quality Council
West Coast Aquatic Stewardship Society	Alberni-Clayoquot Regional District
Alberni Valley Food Hub	Alberni Enhancement Society
Catalyst Paper Corporation	Island Health
Food Security and Climate Disruption Committee	

Guidance and Support

The City of Port Alberni would like to acknowledge ICLEI Canada for providing technical guidance throughout the project. Using ICLEI's "Building Adaptive and Resilient Communities" (BARC) methodology, the *Together for Climate* team worked in a collaborative capacity to develop this adaptation planning guide that will help Port Alberni to prioritize climate action initiatives in the future. Seven other local governments across Vancouver Island were simultaneously engaged in ICLEI Canada's *Together for Climate* project and shared resources, as well as successes and challenges throughout the initiative.

Land Acknowledgement

The City of Port Alberni acknowledges that the Together for Climate work was conducted on the unceded traditional territories of *cišaaʔath* (sis sha ahtah – Tseshaht) and *Hupačasath* First Nations and gives thanks to those Nations.

Photo: Scott Darbey
Cover Page photo: Josh Marshall

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Purpose

The purpose of this report is to outline how the City of Port Alberni could proactively prepare for the impacts of climate change. The report outlines the process the municipality undertook as a participant in ICLEI Canada's *Together for Climate Project* – including the climate change projections for the municipality, key impacts and issues of concerns, and potential adaptive actions that could be taken to improve the resilience of the community to climate change and extreme weather. The outputs of this report could then be integrated into municipal planning decisions, and the creation of an eventual climate change adaptation plan for the City.



Introduction

Climate change poses the greatest environmental challenge of our time. The impacts of climate change and severe weather events are being experienced in the City of Port Alberni and beyond, with local events increasing in frequency and magnitude over the past several years. An overwhelming 97 percent of scientists agree that climate change poses unprecedented risks to society and the ecosystems upon which we all depend for survival (Cook et al., 2016). This risk is further complicated by the time lag associated with climate change. For example, the world's oceans store the greatest amount of heat energy; however, this stored heat has not yet impacted air temperature or climate-related conditions on land. This time lag means that even if society takes immediate steps to curb all greenhouse gas emissions (GHGs) we would still be committed to approximately 1.3 °C of warming (International Panel on Climate Change [IPCC], 2014; Richardson et al., 2012).

Extreme rainfall events causing flooding, hotter summer temperatures leading to extreme heat, drought, and increased wildfires, and changes in the amount and timing of precipitation causing water quality and quantity concerns are some of the greatest impacts of climate change to the City of Port Alberni. Sea level rise and storm surges causing overland flooding and inundation along the Alberni Inlet is also a concern for the region. All of these climatic impacts undermine the integrity of the built, natural, and socio-economic systems within the City. Recognizing and identifying the local impacts of climate change through ICLEI-Canada's *Together for Climate* process will allow for the City of Port Alberni, Alberni-Clayoquot Regional District, First Nations and other leading Alberni Valley government agencies to more effectively build adaptive capacity, improving infrastructure resiliency and ensuring Port Alberni and the surrounding communities and economies can function better and more efficiently in the face of climate change.

Beyond the desire to support and foster a healthy, safe, inclusive community for residents to enjoy, the City recognizes the need to safeguard the Alberni Valley against the impacts of climate change on built and socio-ecological systems in order to enhance and secure quality of life for its residents. This approach ensures the long-term resilience and wellbeing of the community. Scaling up our local green initiatives and identifying clear climate actions and targets will help strengthen commitments made by

the City in the Provincial [Climate Action Charter \(CAC\)](#), support the upcoming implementation of the organics diversion program and assist the municipality as it works to enhance transit and active transportation in the city, create local green building standards, incent building renewal and stormwater management and reduce the energy needs of city-owned buildings, fleets and streetlighting systems.

Together for Climate Project

This report was informed by the City of Port Alberni's participation in ICLEI Canada's Together for Climate project. Together for Climate was a two-year initiative that engaged eight communities across Vancouver Island to develop climate adaptation strategies. This project focused on building local capacity within each community by engaging with local stakeholders and receiving input from a wide



range of experts. The Together for Climate project also provided each community with the opportunity to come together at three provincial workshops to share their challenges and successes, while connecting them to a broader network of practitioners working on climate adaptation across the province and country.

ICLEI Canada's Building Adaptive and Resilient Communities (BARC) program was used to guide each Together for Climate participant through Milestones 1–3 of a five-milestone planning framework that supports municipal climate change adaptation planning. The process involved identifying local climate impacts, a community risk and vulnerability assessment, and a participatory approach to action planning to reduce vulnerability and increase resilience to the projected climatic changes.



Adaptation vs. Mitigation

The focus of this project is adaptation. Adaptation includes any actions that help us adjust to the impacts of climate change. Examples of adaptation actions include increasing the capacity of stormwater management systems, using different construction materials, updating operating procedures, and modifying outdoor work policies. In contrast, mitigation includes any actions that reduce the amount of greenhouse gases released into our atmosphere that contribute to climate change. Examples include improving the energy efficiency of buildings and using low-emission vehicles.

However, it is important to note that adaptation and mitigation are not mutually exclusive. Many

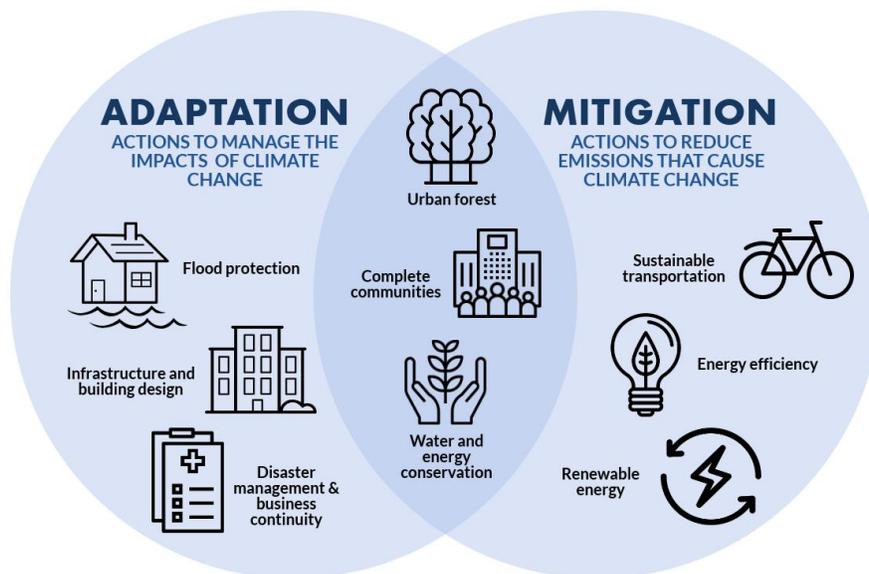


Figure 1. Image depicting climate adaptation and mitigation, and areas of overlap. ICLEI Canada, 2019

actions can have co-benefits, meaning they contribute both to resilience and to reducing GHG emissions (see Figure 1). For example, using naturalized shorelines can act as a buffer for sea-level rise, and act as a sponge for flooding and storm surges. However, they also sequester carbon, and there are fewer emissions to install, maintain and replace natural shorelines compared to a traditional concrete dike.

Policy Direction on Adaptation

International, federal, and provincial governing bodies can set standards, provide strategic focus, and offer potential funding streams for adaptation. The federal government acts as the overarching voice on climate leadership in Canada and a strong commitment to climate action at this level is more likely to lead to climate leadership at local levels of government. While top-down leadership is important in setting the stage for climate adaptation, it is up to local governments to take a leadership role in inspiring local change.

Federal Policy Direction on Adaptation

Canada was one of 195 countries to sign the Paris Agreement in December 2015. The Agreement aims to keep the global temperature to well below two degrees Celsius, and to drive efforts to limit the temperature increase even further to 1.5 degrees Celsius above pre-industrial levels. In terms of adaptation, the Agreement aims to enhance local adaptive capacity and resilience while reducing

vulnerability to global climate change in ways that align with a country's own national objectives (Government of Canada, 2016; UNFCCC, 2020).

The Government of Canada has also produced several policy documents that support and guide the country's position on climate change adaptation. For example, in 2016 the Government of Canada released its Pan Canadian Framework on Clean Growth and Climate Change, which includes adaptation considerations and actions to improve climate resiliency. Major focus areas include building climate resilience through infrastructure, protecting and improving human health and well-being, and reducing climate-related hazards and disaster risks. The framework recognizes the important role that Canadian municipalities will play in implementing local climate solutions.

Provincial Policy Direction on Climate Adaptation

In 2019, the Province of British Columbia (BC) completed a Preliminary Strategic Climate Risk Assessment for BC as a first step in better understanding climate-related risks in BC and to help the government develop appropriate measures to address those risks.

The assessment is being used to inform a provincial climate preparedness and adaptation strategy to help protect people, communities, and businesses from the impacts of climate change (set to be released in late 2020). While the risk assessment is not intended to be used as a prediction of future events, it can act as a tool to evaluate the likelihood and potential consequences of each event happening in the future to understand the degree of risk each poses for the province to help prepare.

Key Findings of the Provincial Assessment:

- The greatest risks to BC are severe wildfire season, seasonal water shortage, heat wave, ocean acidification, glacier loss, and long-term water shortage.
- Other risks that have the potential to result in significant consequences include severe river flooding and severe coastal storm surge, although these events are less likely to occur.
- Nearly all risk event scenarios (except moderate flooding and extreme precipitation and landslide) would have major province-wide consequences in at least one category.



Photo: Global News, 2014

The Science of Climate Change

The climate system is complex, comprising of many interrelated and interacting components. Climate is the result of a culmination of various biogeophysical factors over a long period of time and differs from weather (Richardson et al., 2012). Climate change can be simply defined as any change in global or regional climate patterns over time and can be the cause of natural factors and human activity (Lemmen & Warren, 2016). Although natural variation has characterized the Earth's climate system for millions of years; the past 10,000 have been relatively stable – until recently.

Human activities are having a direct impact on the Earth's climate (IPCC, 2014). The two main ways that these activities are affecting the Earth's climate are through changes in land-use (e.g., deforestation) and the combustion of fossil fuels (e.g., carbon-based energy sources) (Richardson et al., 2012). Burning fossil fuels releases carbon dioxide (CO₂) and other GHGs into the atmosphere. Carbon dioxide is a heat-trapping gas that builds up in the atmosphere over time, it functions like a blanket, trapping in heat that would otherwise be lost to the upper layers of the atmosphere (Bales et al., 2015; Richardson et al., 2012) (see Figure 2). This "blanket effect" is causing the planet's atmosphere to warm, which disrupts the stability of the climate system. Although CO₂ is necessary for life, the role of CO₂ in the climate system goes beyond plants taking it in and humans breathing it out. Burning fossil fuels puts more CO₂ into the atmosphere than the system can handle, which causes CO₂ to build up in the Earth's atmosphere and oceans, leading to a series of ecological and climatic problems (Bales et al., 2015).

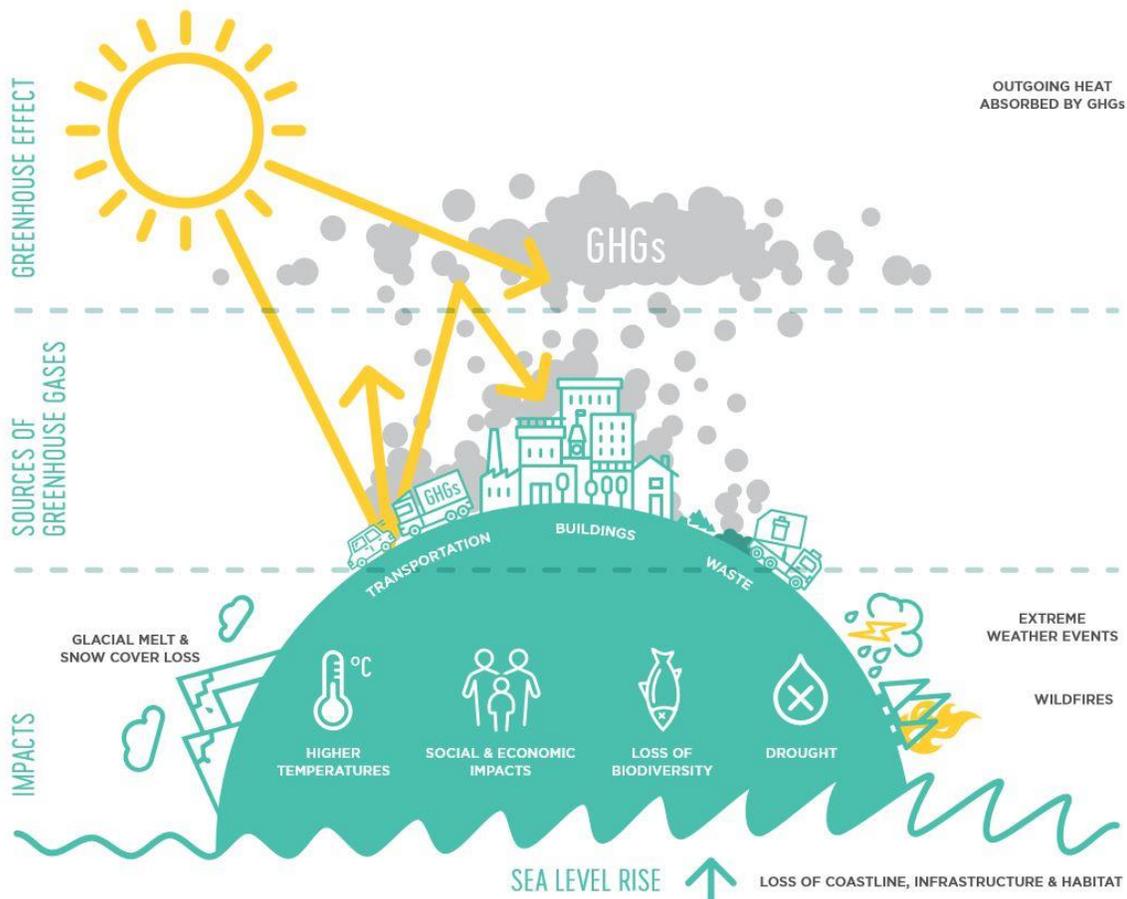


Figure 2. Image representing the sources, mechanisms, and impacts of climate change. Image retrieved with permission from the City of Victoria's Climate Leadership Plan (2018).

Climate Change in Port Alberni

Recent events in the City of Port Alberni, including flooding, severe thunderstorm events, and other extreme weather events highlight the need for the municipality to integrate climate change into municipal planning to safeguard the City's built, social, natural, and socioeconomic systems. Local projections of climate change are essential in understanding the implications of climatic variability on key municipal services and industry sectors that support the citizens of Port Alberni, while also enabling local solutions to emerge and be tailored to meet these unique needs. The Climate Atlas of Canada tool was used to access downscaled climate data for the City of Port Alberni, and the following data highlights the projected climate change conditions over the next century.



Photo: Alberni Valley News, 2018

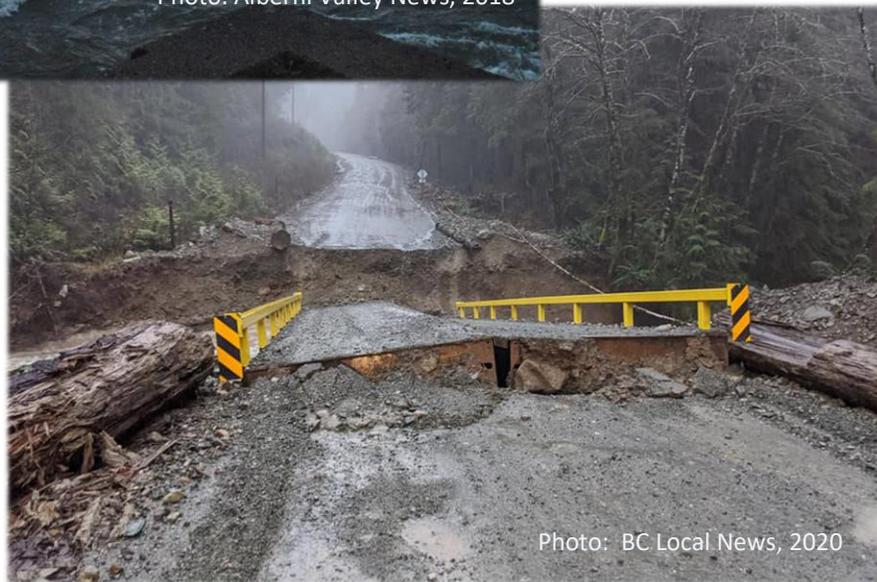
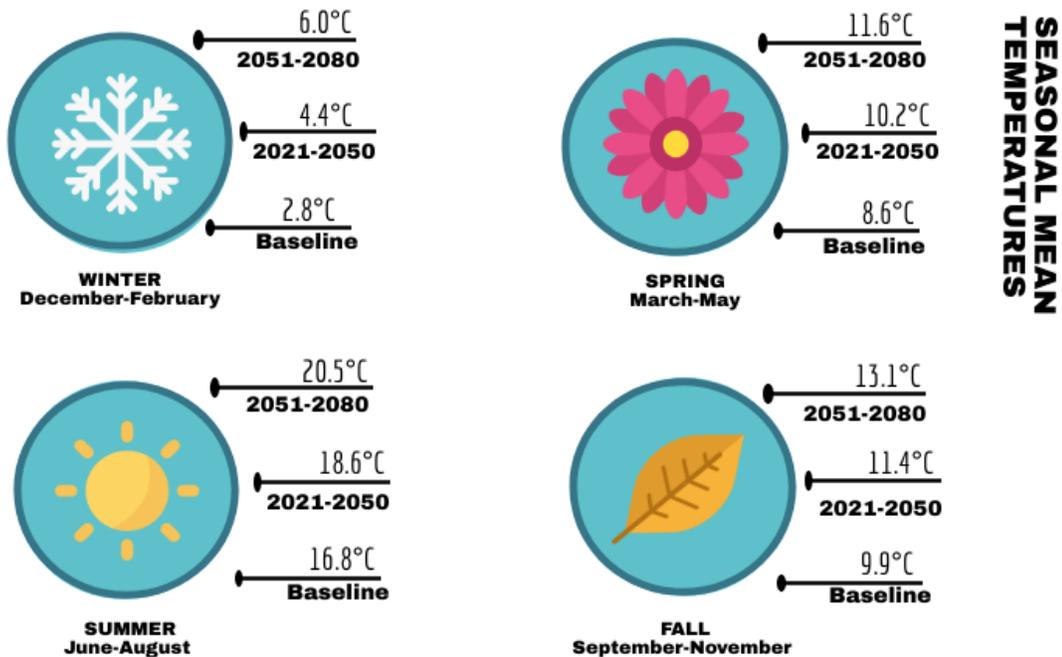
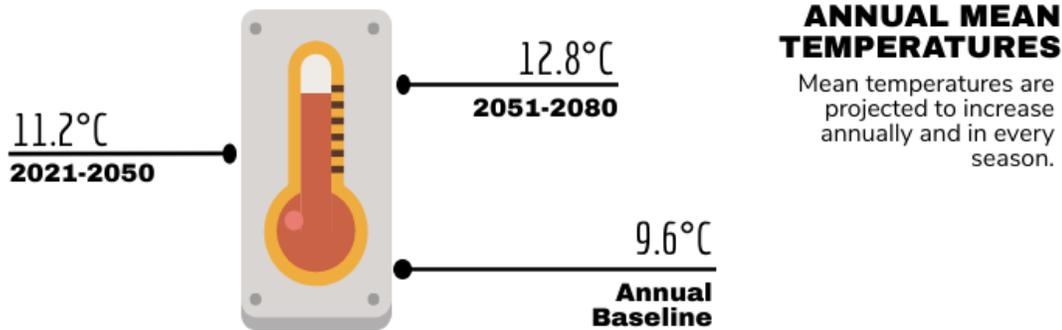


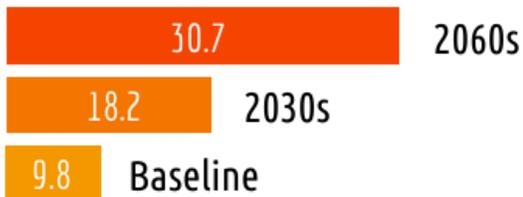
Photo: BC Local News, 2020

Information included in the infographic below represents an ensemble approach from PCIC’s statistically downscaled data using a high-emissions (RC8.5) scenario. The parameters used in this report include temperature and precipitation-related variables and sea level rise. Key findings show that overall precipitation is expected to increase – primarily in the winter season. There is also going to be more heavy precipitation days, and more frequent and severe rain events.

Infographic of Projected Climatic Changes in Port Alberni



DAYS ABOVE 30°C



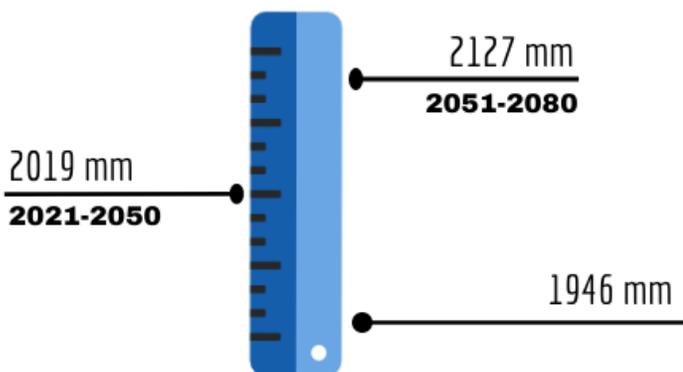
TEMPERATURE EXTREMES

More hot days expected.



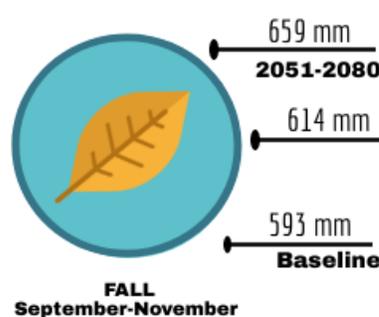
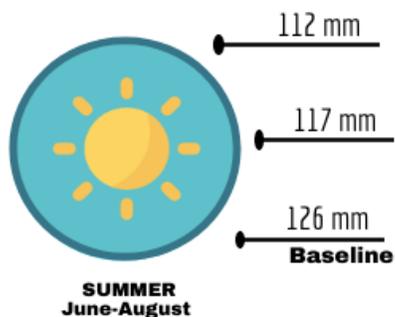
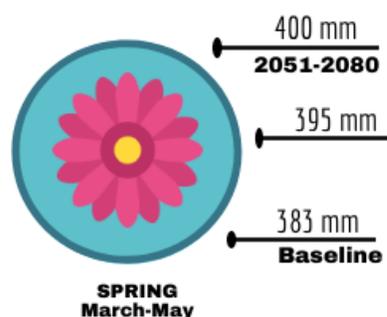
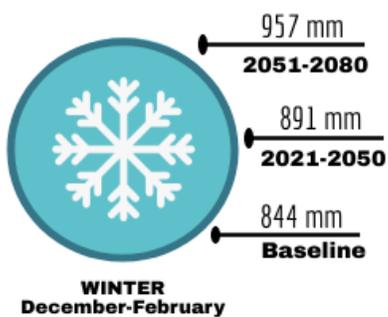
GROWING SEASON

Last frost days will be earlier, and first frost dates will be later.



ANNUAL MEAN PRECIPITATION

Rising sea levels could cause increased coastal erosion, loss of low-lying lands, soil salination, and saltwater intrusion.



SEASONAL MEAN PRECIPITATION



Precipitation will fall at a faster rate (mm/h)



Shorter storms will have an increasingly high intensity



Return periods of heavy storms will shorten, meaning increased frequency

PRECIPITATION EVENTS

Precipitation events in general are projected to become more intense and extreme.



In the City of Port Alberni, sea levels could rise by

30 to 40 cm

by the year 2100.

SEA-LEVEL RISE

Rising sea levels could cause increased coastal erosion, loss of low-lying lands, soil salination, and saltwater intrusion.

Sea surface temperatures have been higher during the past three decades than at any other time since reliable data collection began in 1880.



SEA SURFACE TEMPERATURES

Warmer sea surface temperatures could cause changes in aquaculture productivity, increased spread of aquatic invasive species, changes to marine ecosystems and species distribution, and more.

* Baseline period: 1990s (1976-2005); Primary projection periods: 2021-2050/2051-2080.

Sources:

Climate Atlas of Canada Tool

Computerized Tool for the Development of Intensity-Duration-Frequency Curves under Climate Change Version 3.0

Natural Resources Canada, *Canada's Marine Coasts in a Changing Climate* report

It is important to note the role that uncertainty plays in the study of climate change, and any science field. While the exact outcomes of climate change are difficult to predict with absolute certainty, it is not a question of 'if' impacts are occurring, but rather 'when'. There is a high degree of scientific consensus surrounding both anthropogenic climate change and the associated risks (IPCC, 2018). The risks associated with climate change are increasing globally, which will have unequivocal impacts on local businesses, schools, hospitals, and other community services. If we act now, we can significantly lessen the severity of climatic risks and start transitioning toward an aspirational vision of the future (Corner et al., 2015).

Impacts and Risks

While climate change projections tell us how the climate is expected to change over time, it's important to also evaluate how those changes will affect our community. In order to assess this, the City developed impact statements. Impact statements outline the climate variable (e.g. increased precipitation), the outcome of that variable (e.g. overland flooding) and the consequences of that outcome (e.g. road washouts). The projected changes in climate have the potential to profoundly impact the City's assets, operations, and services. From a built environment perspective, more freezing rain events, extreme weather, and volatile temperatures will likely lead to increased maintenance and replacement costs. From a people-focused perspective, extreme heat, cold, and other weather events will likely be disruptive and could limit access to key City services, impacting people's physical and mental health; health and safety concerns for staff and the broader community will become an even more prominent issue. Furthermore, from an environmental perspective, climate change will likely add to existing pressures on Port Alberni's ecosystems and could compromise the integrity of our natural features, areas, and systems.

A total of 19 priority impacts were identified for the City and are outlined in Table 2 below. Overall, the highest-ranking risks pertained to increased wildfire risk, decreased summer precipitation, and potential heavy precipitation and flooding events damaging infrastructure. More information on how these were identified are provided in the 'Our Process' section.



Photo: Nicole Beaulac

Table 2. Priority Climate Impacts for the City of Port Alberni

Medium-High Risks	
	Hotter, drier summers increasing risk of wildland-urban interface fires.
	Increase in both extreme rainfall events and hotter, drier summers impacting fish habitat and health.
Medium Risks	
	Hotter, drier summers increasing stress on drinking water system and supply.
	More extreme rainfall events causing inflow and infiltration of rainwater into sanitary sewer systems.
	Hotter, drier summers increasing stress on trees and their susceptibility to disease (e.g. cedar, deciduous trees).
	Hotter, drier summers impacting recreational and commercial fishing, as well as First Nations fishery.
	Multiple climate hazards impacting Somass Estuary (e.g. increasing weather extremes impacting fisheries, migratory birds, degradation of habitat, sedimentation, erosion, invasive species, etc.).
	Hotter and drier summers increasing PM 2.5, ground-level ozone, allergens, and smoke, leading to poor air quality and negative health impacts.
	Increase in extreme rainfall events impacting water quality (e.g. increased turbidity, sedimentation, erosion, higher river levels).
	Increase in extreme weather events increasing demand on social and emergency services including health facilities.

Medium-Low Risks

	Sea level rise and storm surges causing overland coastal flooding and inundation along Alberni Inlet (e.g. sewage lagoons, Catalyst, Coulson and APD Mills, Harbour Quay, Fishermen's Harbour, Clutesi Haven Marina).
	More extreme heat events impacting health of vulnerable populations [Medium risk] as well as outdoor workers.
	Drier summers and more extreme heat events affecting soil viability and absorption of stormwater.
	Hotter air and surface water temperatures increasing the incidence of vector-borne diseases (e.g., West Nile Virus, Lyme Disease).
	Hotter, drier summers increasing irrigation demand for agriculture and City landscapes.
	Rising annual temperatures causing algal blooms and an increase in weeds in lakes (e.g. in Sproat Lake in 2018).
	Hotter, drier summers and rising annual temperatures impacting survivability of native species, creating more favorable conditions for invasive species and pests.
	Increase in extreme rainfall events limiting accessibility to Port Alberni (e.g. landslides/overland flooding affecting highway access).
	More extreme heat events and wildfires impacting quality of life (e.g. cancelled programs, limiting access to outdoor recreational activities).



Our Process

BARC Framework

The City of Port Alberni, through the Together for Climate project, followed the framework of ICLEI Canada's Building Adaptive and Resilient Communities (BARC) program, moving through Milestones 1–3 of a 5-milestone municipal climate change planning process. This is a comprehensive planning methodology that guides municipalities through the process of researching and assessing climate impacts, action-setting, implementation planning, and monitoring and review strategies (see Figure 3). For Port Alberni, the outcome of working through Milestones 1–3 has been the development of this guiding document that has identified key strategy areas and a suite of actions to address the priority risks.



As part of this process, a community working group was formed to provide strategic direction to the Project Team and input into

Figure 3. Building Adaptive and Resilient Communities Milestone Framework

each milestone. The group was made up of City staff and community stakeholders from key departments and services to ensure they were reflective of a wide range of perspectives and identifies needs and priorities for the City of Port Alberni.



Impact Identification

To systematically identify how the City's built, social, economic, and ecological systems could be impacted by climate change, a set of impact statements were developed. Impact statements are formulaic, concisely describing the anticipated change, outcome, and consequence of a specific climatic threat. A total of 39 impact statements were identified by the working group, covering a range of affected areas including infrastructure, the natural environment, public health and safety, employee productivity, and more. These 39 impact statements formed the basis of the vulnerability assessment.

Vulnerability Assessment

Vulnerability, or the degree to which a system is susceptible to the impacts of climate change, is a function of both sensitivity and adaptive capacity. Sensitivity is defined as the degree to which a system is affected by climatic conditions (e.g. temperature increases) or a specific climate change impact (e.g. increased flooding). Adaptive capacity is defined as the ability of built, natural and social systems to adjust to climate change, to moderate potential damages, to take advantage of opportunities, or to cope with the consequences.

$$\text{Vulnerability} = \text{Sensitivity \& Adaptive Capacity}$$

To summarize, a vulnerability assessment determines how susceptible we are to a changing climate (e.g., heatwaves, extreme weather, sea level rise) and how prepared we are for those changes. For example, urban trees may be affected by longer periods of summer drought. However, if most urban tree species are not sensitive to longer periods of drought, and there is a plan to replace highly sensitive tree species with drought-tolerant native tree species, then the vulnerability is low. Conversely, if most city trees are sensitive to prolonged summer drought conditions, and there is not a feasible replacement plan in place, then the vulnerability is high.

At the beginning of February 2019, an online questionnaire was sent to 29 local stakeholders to assess the vulnerability of Port Alberni to the climate change impacts that were identified in the first local meeting on December 7, 2018. These impacts related to the built, natural, and human/social systems within the city.

Both staff and key community stakeholders were asked to review the impact statements and evaluate the community's sensitivity and adaptive capacity to respond. The intent of the online vulnerability assessment was to:

- Employ a first filter to remove any impact statements that were evaluated as being very low vulnerability, and
- Have staff and stakeholders carefully review the impact statements and identify any areas needing modification or missing impacts.

As a result of the vulnerability assessment, 3 low-vulnerability impacts were removed, and 3 new impacts were added to create an updated list of 39 impact statements to move onto the risk assessment process.

Risk Assessment

The next step in the process was to carry out a risk assessment based on the results of the vulnerability assessment. Risk is the combination of the probability of an impact occurring and its negative consequences and can be expressed as a function where risk = likelihood x consequence (Figure 4).

Likelihood is based on how likely it is that an impact will occur and considers both the probability of the threat occurring (e.g. increased freezing rain) and the probability of the associated outcomes occurring (e.g. increased asset damage). Likelihood ratings from 1 to 5 were assigned to each impact, where 1 was 'rare' and 5 was 'almost certain', based on localized climate projections, as well as anecdotal knowledge of current conditions. Consequence refers to the known or estimated outcomes of a particular impact. To determine consequence, the AWG assessed the 28 impacts against 12 consequence criteria. The consequence criteria were divided into three categories – social, economic, and environmental (Table 3).

Consequence ratings from 1 to 5 were assigned to each criterion, where 1 was 'negligible' and 5 was 'catastrophic'. For each impact, category-specific risk scores were calculated as well as an overall risk score by multiplying consequence ratings with likelihood ratings.

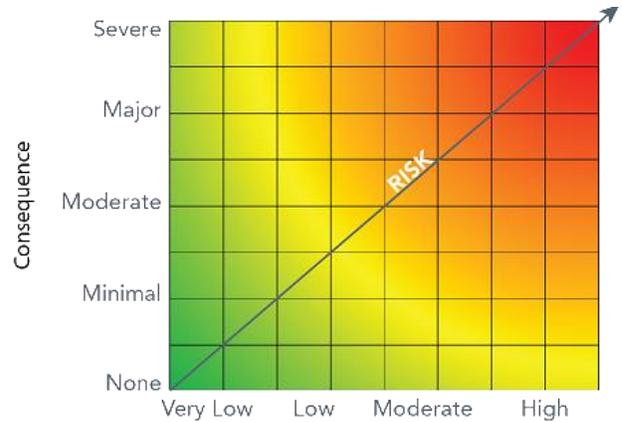


Figure 4. Graph depicting risk as a function of consequence and likelihood.

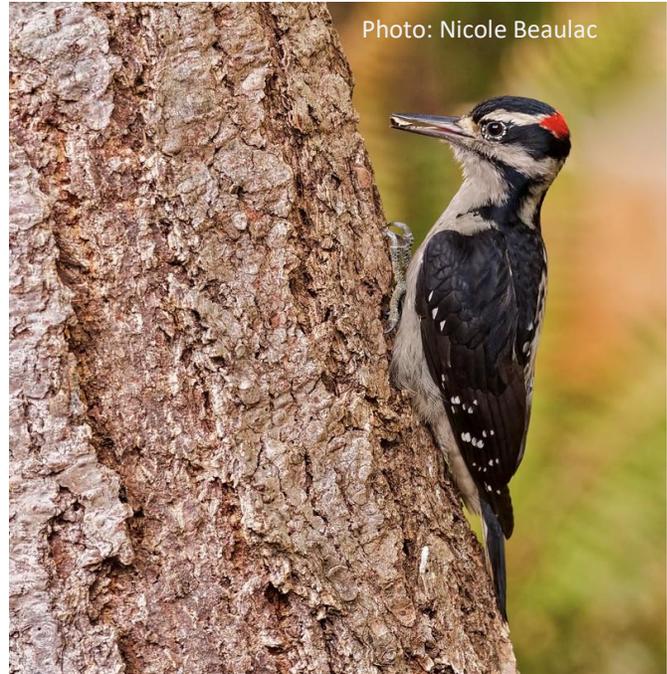
Table 3. Risk Assessment consequence criteria

Social	Economic	Environmental
Public Health & Safety	Property Damage	Air
Displacement	Local Economy & Growth	Water
Loss of Livelihood	Community Livability	Soil
Cultural Aspects	Public Administration	Ecosystem Function

Based on the results of the risk assessment, the working group identified 19 priority impacts, which were presented in Table 2 above. Impacts were prioritized if they had an overall risk score of Medium or higher, or if they had an overall risk score of Medium-Low but at least one category-specific risk score that was Medium or higher. This was done to ensure that impacts that posed a significant risk to a specific category were not left out of the process. With the priority impacts identified, the City was able to move forward with goal setting and action planning.

Action Identification and Prioritization

A variety of adaptation actions can be used to respond to climate change impacts, including both anticipatory actions (e.g., before an impact is observed) and reactive actions (e.g., after an impact has occurred). A workshop was held with the working group to review best practices and brainstorm actions that would address the 19 prioritized impacts. Ultimately, a total of 50 actions were identified by workshop participants, which were further researched, fleshed out, and prioritized by City and ICLEI staff.



Given the high number of actions identified during the action identification process, the City project leads, and members of ICLEI staff moved forward with action prioritization. Each action was evaluated across a series of sustainability, effectiveness, risk and uncertainty, opportunity,

and implementation criteria (refer to Exhibit A below). Scores were assigned based on a prioritization matrix. The result was a list of actions that, based on current circumstances, fell into three categories: Must Do, Monitor, and Investigate Further.

- **Must Do (29-33)** – Actions relating to climate impacts already being observed or that have a life safety component and actions with a high benefit to cost ratio.
- **Monitor (25-28)** - Actions relating to impacts that will be observed in the long term and that have a high benefit to cost ratio. Actions will be implemented when specific climate thresholds are surpassed, or changes observed.
- **Investigate Further (11-24)** - Actions relating to impacts that will be observed in the long term and where the cost-benefit ratio is unknown.

The action prioritization process identified a total of 13 ‘Must Do’ actions; 28 ‘Monitor’ actions; and 9 ‘Investigate Further’ actions. By applying a broad prioritization matrix, this exercise helps the City to effectively use its resources toward actions that will have the greatest holistic impact on enhancing the City’s overall adaptive capacity and resilience to the impacts of climate change. The full results of the action prioritization are presented within the Action Tables in Appendix A.

It is important to note that this project identifies actions for those impacts that are considered the most significant based on the vulnerability and risk assessment process. This is not to say that other impacts, such as those associated with lower levels of vulnerability and risk, do not merit action, or that other additional actions are not worth pursuing. It would be impossible to create an exhaustive list of everything the City is or will be doing, directly or indirectly, to adapt to climate change. This project is not a substitute for prudent and strategic decision-making; it identifies areas where the City should focus its efforts but recognizes that climate change has the potential to affect all of the work we do. In order to continue our forward-thinking approach to community building, climate change will need to be factored into all areas of City business and service delivery.

Exhibit 1: Prioritization Matrix

		1	2	3
Sustainability	Mitigation co-benefits	Could result in increased GHG emissions	Not likely to affect GHG emissions	Could reduce GHG emissions
	Equity	Benefits only to some people	Benefits to many people	Significant benefits to many people
	Implementation Cost	Cost is high relative to cost of inaction	Cost is moderate relative to cost of inaction	Cost is low relative to cost of inaction
Effectiveness	Robustness	Effective for a narrow range of plausible future scenarios	Effective across many plausible future scenarios	Effective across a wide range of plausible future scenarios
Risk and Uncertainty	Urgency	Impacts are likely to occur in the longer term	Impacts are likely in the near to mid term	Impacts are already occurring
Opportunity	Ancillary Benefits	Will contribute little to other City goals and programs	Will contribute somewhat to other City goals and programs	Will contribute significantly to other City goals and programs
	No Regret	Will have little or no benefit if climate change impacts do not occur	Will have some benefits regardless of actual climate change impacts	Will result in significant benefits regardless of actual climate change impacts
Implementation	Public (or political) Acceptability	Could face some public or political opposition	Not likely to receive much public or political attention	Likely to receive public/political support
	Funding Sources	Additional funding sources are required but have not been identified	Additional funding sources may be required	Funding is available or not required
	Capacity (information, technical, staff, resources)	Current capacity is insufficient and gaps cannot be easily addressed	Gaps exist in one or more areas but can likely be addressed	Current capacity is sufficient to implement the action
	Institutional	Implementation requires coordination with, or action by, other jurisdictions	Implementation may require external approval/coordination	Implementation is within City's control

Adaptation Actions

A variety of adaptation actions can be used to respond to climate change impacts, including both anticipatory actions (i.e. before an impact is observed) and reactive actions (i.e. after an impact has occurred). Moreover, there are many kinds of adaptive actions that can be taken by a City, including policy-related actions, education and outreach, grey or green infrastructure interventions, zoning and bylaw actions, and more. This report outlines a variety of adaptive actions the City could consider to proactively pursue in order to prepare for the impacts of extreme precipitation, flooding, and sea-level rise-related issues.

The following actions are organized by theme, impact, and priority. There are 3 overarching themes:

1. Reduce damage and disruptions to infrastructure associated with a changing climate
2. Reduce harm to the natural environment in Port Alberni (and the surrounding areas) from climatic risks
3. Prepare Port Alberni residents, businesses, and institutions for changing climate conditions and protect health and wellbeing of residents and visitors.

Each action addresses one or more of the 19 priority impacts identified in Table 2 above. Only the 'Must-do' actions are highlighted below. For a full-list of actions and supporting actions, please refer to the Action Tables in Appendix A.



#1: REDUCE DAMAGE AND DISRUPTIONS TO INFRASTRUCTURE ASSOCIATED WITH A CHANGING CLIMATE

'Must Do' Actions:

- Action 1.7: Establish stormwater management requirements (based on best practices) for new developments to reduce the impact of development on the City's stormwater system.
- Action 1.14b: Enhance water conservation methods and programming
- Action 1.19: Increase native, drought-tolerant plantings on City-owned and managed land
- Action 1.21: Develop a public education campaign and communications to enhance public awareness regarding fire safety and evacuation protocols and procedures
- Action 1.22: Research grant opportunities that help cover the costs of implementing initiatives that mitigate fire risk



Impacts addressed with these actions:

- ✓ More extreme rainfall events causing more inflow and infiltration of rainwater into sanitary sewer systems
- ✓ Hotter, drier summers increasing stress on drinking water system and supply
- ✓ Hotter, drier summers increasing risk of wildland-urban interface fires



#2: REDUCE HARM TO THE NATURAL ENVIRONMENT IN AND AROUND PORT ALBERNI FROM CLIMATIC RISKS

'Must Do' Actions:

- Action 2.8a: Enhance the protection of Somass Estuary and native wildlife from climate-related impacts to habitat
- Action 2.10: Improve rainwater uptake and conservation by enhancing the resilience of the urban tree canopy to climate change.
- Action 2.13: Create a public education campaign and stewardship opportunities to raise public awareness of invasive species, restoration options, and weed control methods on private land



Impacts addressed with these actions:

- ✓ Multiple climate hazards impacting Somass Estuary (e.g., increasing weather extremes impacting fisheries, migratory birds, degradation of habitat, sedimentation, erosion, invasive species, etc.)
- ✓ Hotter, drier summers increasing stress on trees and their susceptibility to disease (e.g., cedar, deciduous trees).
- ✓ Hotter, drier summers and rising annual temperatures impacting survivability of native species, creating more favourable conditions for invasive species and pests.

Photo: Nicole Beaulac



#3: PREPARE PORT ALBERNI RESIDENTS, BUSINESSES, AND INSTITUTIONS FOR CHANGING CLIMATIC CONDITIONS AND PROTECT HEALTH AND WELLBEING OF RESIDENTS AND VISITORS.

'Must Do' Actions:

- Action 3.5: Explore opportunities to offer cooling and hydration in public spaces and at public events during hot summer months.
- Action 3.8: Work with local partners to expand emergency and community services offered to the community in the face of extreme climatic events (e.g., extreme heat, wildfire, etc.)
- Action 3.9: Improve communications to the public to reduce safety and health risks facing the community in the face of wildfire events and Air Quality events.
- Action 3.10: Evaluate best practices and develop procedures to manage smoke events in Public buildings and facilities, including staff health and safety.
- Action 3.12: Increase emergency preparedness at the household and community level through education and outreach campaigns.



Impacts addressed by actions:

- ✓ More extreme heat events impacting health of vulnerable populations, as well as outdoor workers.
- ✓ More extreme heat events and wildfires impacting quality of life (e.g., cancelled programs, limiting access to outdoor recreational activities).
- ✓ Increase in extreme weather events increasing demand on social and emergency services including health facilities.

Photo: Province of BC, 2014



Conclusion

This document outlines the climate change planning process the City of Port Alberni undertook as part of its participation in ICLEI Canada's Together for Climate project. The process was intended to evaluate local precipitation-related climate risks to the City and identify potential actions the City could proactively take to adapt to changing conditions. It is important to note that this report identifies potential strategic actions for those impacts that are considered the most significant based on the risk assessment process. This is not to say that other impacts, such as those associated with lower levels of risk, do not merit action, or that other additional actions are not worth pursuing. This report is not a substitute for prudent and strategic decision-making; it identifies areas where the City should focus its efforts but recognizes that climate change has the potential to affect all of the work we do. In order to continue our forward-thinking approach to community building, climate change will need to be factored into all areas of City business and service delivery.





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Appendices

Appendix A: Climate Adaptation Actions and Prioritization Scores

Port Alberni Action Prioritization					Sustainability		Effectiveness	Risk and Uncertainty	Opportunity	Implementation					TOTAL SCORE	
Action	Supporting Actions	Lead Organization	Supporting Organization	Impacts Addressed	Co-benefits	Equity	Implementation Cost	Robustness	Urgency	Ancillary Benefits	No Regret	Public (or political acceptance)	Funding Sources	Capacity		Institutional Barriers
OBJECTIVE 1: Reduce damage and disruptions to infrastructure associated with a changing climate																
1.1 – Conduct local sea-level rise and storm surge modeling to inform the placement and protection of critical infrastructure (e.g. Coastal Hazard Mapping).	<ul style="list-style-type: none"> • Create an updated floodplain map for the Port Alberni area (in progress by ACRD) • Conduct a vulnerability and risk assessment to identify critical infrastructure and low-lying neighbourhoods vulnerable to sea level rise • Determine and target actions to high risk areas • Develop an action strategy for reducing risk in the prioritized 	Alberni-Clayoquot Regional District (ACRD) – Planning Dept.	City of Port Alberni Engineering, Planning	B1	3	2	3	3	2	2	3	3	2	2	3	28
1.2 – Explore regulatory and planning tools that incorporate sea level rise into planning/design/policy.	<ul style="list-style-type: none"> • Restrict or prohibit development in inundation zones (e.g., impose special conditions as a condition of a development permit) • Establish/increase shoreline setbacks/buffers • Determine areas where coastal wetlands can act as buffers to 	City of Port Alberni Planning; ACRD Planning	City of Port Alberni & Legislative Service Planning	B1	3	2	2	2	2	2	2	3	2	2	3	25
1.3 – Explore options to use “hard engineering” techniques, if necessary (e.g., levees, dikes, etc.).	<ul style="list-style-type: none"> • Determine if/where hard armouring techniques would be appropriate solutions to local sea level rise • Determine if/where other engineering options could be suitable (e.g., elevated or floating development) 	City of Port Alberni Engineering; ACRD	Architects; Consulting Engineers; Developers;	B1	1	1	2	2	2	2	1	1	2	2	3	19
1.4 – Update the Somass Watershed Flood Management Plan	<ul style="list-style-type: none"> • Undertake a review of the Somass Watershed Flood Management plan to incorporate action notes from 1.1, 1.2 & 1.3 	ARCD Planning; Westcoast Aquatic; Governance Board	City of Port Alberni Engineering	B1	3	3	3	2	3	3	2	2	1	2	1	25
1.5 – Research and implement low impact development solutions for rainwater management.	<p>Examples of low impact development include:</p> <ul style="list-style-type: none"> • Stormwater detention ponds • Rain gardens, green roofs, bioswales, permeable paving options (e.g., cobble stone, gravel, living plants) • Identify areas where green infrastructure can be implemented to enhance stormwater management 	City of Port Alberni Engineering,	ACRD BC Ministry of Environment (BCMOE)	B3	3	1	3	3	3	2	2	3	2	2	3	27

1.6 – Continue to integrate projected increases in climate change influenced flows (e.g. precipitation and sea level rise) into stormwater system renewal planning and upgrade existing sanitary and stormwater system accordingly.	<ul style="list-style-type: none"> •Prioritize the upgrade of existing sanitary and stormwater systems to two systems •Explore opportunities for funding the project •Integrate projected increases in climate change influenced flows (e.g. precipitation and sea level rise) into stormwater system renewal planning. 	City of Port Alberni Engineering	Consulting Engineers	B3	3	3	2	2	3	2	1	2	3	3	3	27
1.7 – Establish stormwater management requirements (based on best practices) for new developments to reduce the impact of development on the City’s stormwater system.	<ul style="list-style-type: none"> •Use site planning and design techniques to reduce impervious cover, disturbed soils, and stormwater impacts (e.g., conservation design, protecting open space and natural drainage features, disconnecting a site’s impervious cover) •From a watershed scale, land-use planning can encourage infill and development within targeted zones, while preserving key natural drainage features within the landscape 	City of Port Alberni Engineering, Planning		B3	3	3	3	2	3	2	2	3	3	2	3	29
1.8 – Continue to update flood construction levels as new flood risk and sea level rise data becomes available, and apply the appropriate regulatory tools for widespread City-wide use (e.g. zoning updates/bylaw creation, etc.)	<ul style="list-style-type: none"> •Zoning bylaw update to regulate development in floodplain •Review flood plain Bylaw to ensure it is up to date with current localized climate projections and reflects the most recent flood mapping in the region (see action B.6.2) •Embed these updates within Official Community Plan (OCP) 	City of Port Alberni – Planning; ACRD - Planning	Consulting Scientists Senior Govt Agencies	B6	3	2	3	2	2	2	2	3	1	2	3	25
1.9 – Initiate localized flood-prone area inventory and risk assessment to guide runoff reduction, flood risk mitigation programs, and to identify vulnerable infrastructure and utilities.	<ul style="list-style-type: none"> •DAR-based mapping of flood-prone areas across the Alberni Valley and risk assessment to identify areas at a higher risk •Compile an asset map of all major infrastructure to include all towers, dams, hydro stations, etc. •Identify neighbourhoods with higher incidences and/or risk of flooding •Incorporate flood-prone area inventory into municipal planning of infrastructure considerations. 	City of Port Alberni Engineering and Planning ACRD Planning	Fortis; Telus; Hydro; PAPA Tseshah First Nation (TFN) Hupacasath First Nation (HFN) Association of Professional Engineer & Geoscientists	B6	3	3	3	2	3	2	2	3	1	2	3	27
1.10 – Conduct a topographical study to identify areas vulnerable to landslides/overland flooding, particularly areas that intersect major access points into Port Alberni (e.g., Hwy 4/Port Alberni Hwy).	<ul style="list-style-type: none"> •Conduct a study which analyzes the management options for high risk flood/landslide areas •Create a working group that includes experts to help reduce and mitigate damage and disruption 	City of Port Alberni Planning & Engineering; ACRD Planning;	BC Hydro; Fortis; Telus; PAPA; Consulting Engineers	B6	3	3	3	3	3	2	2	3	1	2	2	27

1.11 – Review and establish best management practices for storm drain, catch basin and culvert cleaning to keep local waterways clear.	<ul style="list-style-type: none"> Develop Standard Operating Procedures (SOP) based on industry best practices for purpose of maintenance and construction. Explore use of GIS systems to track to optimize maintenance tasks. 	City of Port Alberni – Engineering; Highways contractor		B6	3	2	2	3	3	3	2	3	1	2	3	27
1.12 – Improve communications to the public regarding road conditions and municipal facility closures during extreme weather.	<ul style="list-style-type: none"> Explore new ways to improve communication to the public on road conditions and municipal facility closures during extreme weather events Continue improving early warning systems (e.g., sirens, radio, text alerts) to be communicated effectively to the public during extreme weather events (e.g., tsunami warning system). Build relationship with Highways to share information regarding road conditions/closures 	City of Port Alberni Communication s; Alberni-Clayoquot Regional District – Highways (Hwy 4)	Fire Department; RCMP	B6	2	3	3	3	3	2	2	3	2	2	3	28
1.13 – Ensure emergency response capacity keeps pace with the need for services, given the increasing risk of climate impacts (e.g., flooding and landslides).	<ul style="list-style-type: none"> Schedule annual “Emergency Response” exercises to ensure adequate knowledge of various scenarios and responses Coordinate specialized training for responders Engage with community and regional stakeholders to identify duties, responsibilities, and response protocols, strengthening collaboration and coordination Conduct a cost-benefit analysis of various alternatives to sandbagging controls for flooding 	ACRD Emergency Management; City of Port Alberni Engineering Parks and Recreation	Provincial Emergency Program (PEP) Fire Depts RCMP Search & Rescue Red Cross	B6	3	2	2	3	3	3	3	3	2	1	3	28
1.14a – Increase long-term water storage capacity	<ul style="list-style-type: none"> Consider the options regarding increases in storage capacity that can be made (e.g., practice aquifer storage and recovery, remove accumulated sediment in reservoirs, lower water intake elevations) 	City of Port Alberni Engineering	Island Health; BCMOE; TFN, HFN, ACRD	B7	3	2	1	3	2	2	2	2	1	1	1	20
1.14b – Enhance water conservation methods and programming.	<ul style="list-style-type: none"> Consider the effects of climate change on available drinking water storage capacity and enhance water conservation programs and messaging that reduces demand and increases awareness. 	City of Port Alberni Engineering	Island Health; BCMOE; TFN, HFN, ACRD	B7	3	3	3	3	3	2	2	3	2	2	3	29
1.15 – Create a public education campaign to improve public awareness of importance of water conservation to protect drinking water supply during summer months.	<ul style="list-style-type: none"> Develop an educational component regarding the need to impose water restrictions and water conservation methods on private property (e.g., use of rain barrels, limited use of energy efficient appliances, checking for leaks, etc.) Target information to reach vulnerable populations and as broad an audience as possible. Increase public engagement and buy-in by working with trusted communication partners and through the development of a local “Champions” program in the community and within organizations 	City of Port Alberni Communication s & Engineering; ACRD - Planning	BCMOE, Island Health	B7	3	3	3	2	3	2	2	3	2	2	3	28

1.16 – Explore alternative water sources that can serve as vital water supply sources during drought and build community-wide water resilience through diversification of water sources.	<ul style="list-style-type: none"> Collect and analyze baseline data for alternative or supplementary water sources Some examples of alternative water sources include: <ul style="list-style-type: none"> Harvested rainwater from roofs, harvested stormwater, reclaimed wastewater, greywater 	City of Port Alberni Engineering; ACRD Planning	Island Health; BCMOE ; Consulting Engineers	B7	3	3	2	2	3	2	2	3	1	2	2	25
1.17 – Integrate climate change considerations and sustainability principles into the OCP	<ul style="list-style-type: none"> Review OCP’s and have climate change adaptation and resilience incorporated (as a starting point to use for other plans and policies) Raise with all departments to develop an inventory of all plans and policies that may need to have climate change considerations included Work with responsible departments to incorporate climate 	City of Port Alberni Planning; ACRD Planning	City of Port Alberni Parks and Recreation, Engineering	B7	3	3	3	2	3	2	2	1	2	2	3	26
1.18 – Collaborate on public education campaigns that intersect food and climate (e.g., importance of local food)	<ul style="list-style-type: none"> Develop locally tailored public education campaigns that promote local, sustainable agriculture and educate public on food security and climate resilient agriculture Continue to host public education events that encourage residents and businesses to improve sustainability and resilience (e.g. business continuity) of their food systems 	ACRD Planning; City of Port Alberni Communication s	Ministry of Agriculture; Farm Organizations; Educational Institutions	B7	3	3	3	3	3	2	3	3	1	2	1	27
1.19 – Increase native, drought-tolerant plantings on City owned and managed land.	<ul style="list-style-type: none"> Incorporate the principles of xeriscaping (e.g., use of drought-tolerant plants) into plantings on City-owned land Increase the variety of native plant species planted in parks and open spaces; Increase the proportion of native ecosystems in the parks and open spaces system; and restore native ecosystem areas that are currently degraded. Develop community education and stewardship programs focused on native ecosystem condition requirements and species 	City of Port Alberni Parks and Recreation, Communication s	Environmental education organizations	B7	3	2	3	3	3	2	3	3	2	2	3	29
1.20 – Proactively mitigate wildland urban interface fire risk at the community scale using FireSmart prevention principles.	<ul style="list-style-type: none"> Maintain and establish “buffer zones” between at the urban-wildland interface Conduct maintenance regimes that focus on forest thinning and fuel load removal Manage vegetation, landscaping, and general maintenance around buildings following FireSmart principles and guidelines for both private and public property. Remove dead trees in community green spaces 	Fire Departments; ACRD Emergency Management; City of Port Alberni Parks and Recreation; Fire Dept.	Forest Companies; BC Wildfire Service Ministry of Forests	B9	3	3	1	3	3	3	3	3	1	2	2	27

1.21 – Develop a public education campaign and communications to enhance public awareness regarding fire safety and evacuation protocols and procedures.	<ul style="list-style-type: none"> •Communication to the public of wildfire evacuation protocol and procedures (e.g., evacuation route signage) •Increase no smoking signage on trails and in parks to raise awareness and reduce fire risk •Increase awareness of the need to reduce fire load on private property and around buildings (especially in rural residential areas) 	ACRD – Emergency Planning; City of Port Alberni Communications	All local Fire Departments; BC Wildfire Service	B9	3	3	3	3	3	3	3	3	3	2	2	3	31
1.22 – Research grant opportunities that help cover the costs of implementing initiatives that mitigate fire risk.	<ul style="list-style-type: none"> •Look into eligible wildfire prevention funding from BC government or other sources: such as Community Resiliency Investment Program and Forest Enhancement Society BC •Risk mitigation could include forest floor fuel load removal, rooftop sprinklers, etc. 	ACRD Emergency Management City of Port Alberni Fire Department; Rural Fire Departments;		B9	3	3	3	3	3	3	3	3	3	3	2	3	32
OBJECTIVE 2: Reduce harm to the natural environment in Port Alberni (and the surrounding areas) from climatic risks.																	
2.1 - Continue to work with ACRD, City of Port Alberni and local First Nations in taking an integrated watershed management approach to our waterways and land use.	<ul style="list-style-type: none"> •Develop and facilitate multi-stakeholder participation in integrated watershed management Planning Committees •Develop baseline data and indicators of baseline watershed •Establish partnerships between the City, ACRD, First Nations, and other stakeholders to implement a water quality monitoring program •Identify and prioritize areas from within the watersheds that are a source of water quality issues. •Maintain riparian corridors and extend their size 	ACRD Planning City of Port Alberni Engineering and Planning	Island Health; BCMOE; TFN; HFN; BC Ministry of Forests; Forest Company Watershed Landowners	N2, N4, N5	3	3	3	3	3	2	3	3	1	1	2	27	
2.2 – Implement stronger regulatory mechanisms to increase shoreline, and riparian habitat protection through policy, zoning, and watershed planning.	<ul style="list-style-type: none"> •Strengthen Environmental Development Permit Areas •Prioritize habitat protection for federally and provincially listed species at risk •Re-designate Streamside Permit Environmental Areas through Development Permit Areas •Use zoning bylaws to establish larger setbacks on streams •Establish watershed level plans to define specific Streamside Permit Environmental Areas within a stream system (linked to 2.1 above) 	City of Port Alberni Planning; ACRD Planning BCMOE	BC Ministry of Forest	N2, N4, N5	3	2	3	3	3	2	3	2	2	2	2	27	
2.3 – Develop economic mechanisms that promote the collection and recycling of greywater and stormwater on private property and City facilities.	<ul style="list-style-type: none"> •Explore the implementation of rebate/incentive programs for rainwater harvesting, green roofs, bioswales, and other stormwater management techniques on private property •Explore economic incentive mechanism (e.g., ‘stormwater utility fee’) that promotes reductions in impermeable surface area 	City of Port Alberni Engineering, Legislative Services; ACRD		N2, N4, N5	3	2	2	3	3	2	3	2	2	1	3	26	

2.4 – Encourage Provincial Governments to enhance protection of riparian areas and heighten the enforcement of regulatory measures during forestry activities.	<ul style="list-style-type: none"> Work with provincial government to enforce the Riparian Areas Protection Regulation (RAR) and Riparian Areas Protection Act (2016) that aim to minimize habitat fragmentation, degradation, and loss based on the principles of ecosystem-based management “ 	City of Port Alberni Planning; ACRD Planning City of Port Alberni Council ACRD Board	BC Ministry of Forest	N2, N4, N5	3	2	3	3	3	1	2	1	3	2	1	24
2.5 – Fully utilize Local Government land development regulatory powers to enhance protection of riparian areas and heighten the enforcement of regulatory measures during land	<ul style="list-style-type: none"> Ensure local governments are following the direction of BC’s “Riparian Areas Regulation Guidebook: For local governments”. Use regulatory tools to effectively support RAR implementation (e.g., OCP, Development Permit Areas, Zoning bylaws, subdivision bylaws, covenants, other regulatory bylaws affecting land use) 			N2, N4, N5	3	2	3	3	3	2	3	1	1	1	2	24
2.6 – Daylight sections of culverted streams where opportunities exist to increase infiltration, reduce peak flows, and filter out urban pollutants (e.g., nitrogen, phosphorous).	<ul style="list-style-type: none"> Identify areas where this could be done. Considerations for siting daylighting projects include: <ul style="list-style-type: none"> Sufficient width/area to build out the channel Site in less densely populated areas to minimize built infrastructure constraints. Develop understanding of underlying soil types and channel material to ensure proper project design based on site conditions Establish appropriate monitoring and maintenance programs to ensure that the channel and bank are stable and riparian plantings are established 	City of Port Alberni Engineering, Planning; ACRD Planning	Environmental organizations (West Coast Aquatic Stewardship Association)	N3	3	2	1	3	3	2	3	2	1	1	2	23
2.7 – Initiate water quality pilot project to mitigate and filter contaminants from entering sensitive fish habitat.	<ul style="list-style-type: none"> Undertake Stormwater Management Plan as part of City LWMP include: <ul style="list-style-type: none"> Stormwater filtration systems that filter contaminants Catchbasins that separate oil 	City of Port Alberni Engineering,		N3	3	3	2	3	3	2	3	2	1	2	3	27
2.8a – Enhance the protection of Somass Estuary and native wildlife from climate-related impacts to habitat.	<ul style="list-style-type: none"> Decommission old City sewage lagoon and restore habitat 	City of Port Alberni Engineering	Environmental organizations (West Coast Aquatic Stewardship Association);	N6	3	3	2	3	3	2	3	2	3	3	3	30

2.8b– Enhance the protection of Somass Estuary and native wildlife from climate-related impacts to habitat.	<ul style="list-style-type: none"> •Use land development regulations to reduce the impacts of development on the estuary by limiting development in ecologically sensitive areas and embedding wetland habitat impact analysis into development projects approvals 	City of Port Alberni Planning	Environmental organizations (West Coast Aquatic Stewardship Association; Alberni Aquarium)	N6	3	3	3	3	3	2	3	2	1	1	2	26
2.9 – Protect sensitive habitat by creating more channel sinuosity in streams that have been channelized by adding natural features (e.g., Sediment deposits, logs, large rocks) to slow water down and create spawning areas.	<ul style="list-style-type: none"> •Fully integrate coarse woody debris management into the stewardship of Port Alberni’s natural areas •Establish coarse woody debris standards and integrate coarse woody debris management with other natural area management programs 	City of Port Alberni Engineering; ACRD; Alberni Valley Enhancement Association (AVEA)	DFO Oceans Habitat and Enhancement Branch; BC MOE; Local environmental consultants and organizations	N6	3	2	1	3	3	2	3	2	1	1	1	22
2.10 – Improve rainwater uptake and conservation by enhancing the resilience of the urban tree canopy to climate change.	<ul style="list-style-type: none"> •Conduct an inventory of the risks to the existing stands within the urban forest and identify priorities. •Develop and implement a citizen stewardship plan to increase citizen involvement in the management of the urban forest •Work with the Parks and Recreation and Engineering Departments to explore how to use the urban forest to help achieve stormwater management plan objectives. •Prioritize removal, maintenance and/or replanting of distressed, dead, or dying trees •Explore incentives for retaining tree cover and vegetation on private land and to promote use of native species 	City of Port Alberni Parks and Recreation, Engineering, Communications ACRD		N7	3	3	3	3	3	3	3	2	2	2	3	30
2.11 – Work with local First Nations, and forestry companies to develop a watershed-scale management plan, targeting drought-vulnerable and culturally important species (e.g., western red cedar)	<ul style="list-style-type: none"> •In surrounding areas where the land-use is used for forestry practices, work with First Nations, and forestry companies to promote silviculture prescriptions that suit the changing climatic conditions (e.g., planting more drought-tolerant species) •For natural and protected areas, target sensitive ecosystems and species for protection (e.g., target low-lying valley areas for the protection of cedar trees – which are culturally significant to local First Nations) •Consider the impacts of climate change on species survival and ecosystem migration and develop forest management plans accordingly 	ACRD; Forest companies; Tree Planting companies; First Nations	BC Ministry of Forests and Agriculture	N7	3	3	3	3	3	2	3	3	1	1	1	26

2.12 – Develop a strategic maintenance and control management plan for invasive species. (using an ecosystem-based management approach).	<ul style="list-style-type: none"> Continue to manage invasive species, Conduct an inventory and risk assessment of invasive species and emerging threats Prioritize management effort based on risk Work with Environmental NGO's and community volunteers to accomplish this Establish stricter weed control bylaws and establish a protocol for enforcement Explore grant and funding opportunities 	City of Port Alberni Parks and Recreation; ACRD	Local environmental	N9	3	2	2	3	3	3	3	3	1	2	3	28
2.13 – Create a public education campaign and stewardship opportunities to raise public awareness of invasive species, restoration options, and weed control methods on private land.	<ul style="list-style-type: none"> Improve information re identification and impacts from invasive species in the region in conjunction with information about native and rare plants of the region Teach and share safe and effective methods for removal. Establish better community and neighbourhood-level weed control 	City of Port Alberni Parks and Recreation, Communications ACRD	Local environmental and stewardship organizations	N9	3	3	3	3	3	3	3	3	2	2	3	31
2.14 – Develop an education campaign targeted at local farmers on the importance of integrating sustainable agricultural practices that mitigate against the impacts of drought. **linked to adaptation actions B.8.2 & B.8.3	<ul style="list-style-type: none"> Develop a local “Farmer-to-Farmer” group to share experiences and knowledge on climate resilient agriculture techniques (e.g., water and soil conservation techniques, natural and organic farming methods, use of Integrated Pest Management/Integrated Vegetation Management in place of pesticides, breeding local climate-resilient seeds) 	ACRD Farm Team; City of Port Alberni Communications	BC Ministry of Agriculture Health Canada	N10	3	3	3	3	3	2	2	3	1	1	1	25
OBJECTIVE 3: Prepare Port Alberni residents, businesses, and institutions for changing climate conditions and protect health and well-being of residents and visitors.																
3.1 – Explore opportunities to develop alternative protein sources (in conjunction with working to enhance the health of the local fishery).	<ul style="list-style-type: none"> Examples of alternative protein sources include edible insects, “plant-based” meat alternatives, in-vitro meat In 2019, UC Berkley researchers identified top six promising protein sources, ranked according to 	ACRD Farm Team; Health Canada City of Port Alberni Economic Development	Local research companies? Port Alberni Food Hub	C3	3	2	1	2	2	1	2	2	1	1	1	18

<p>3.2– Diversify local economy and livelihoods through investing in new jobs, skills, and training.</p>	<ul style="list-style-type: none"> • Diversification can occur through investing resources into multiple, un-related activities (e.g., invest in ecotourism) • Diversification can occur within the fishery itself (e.g., adapting fishery management and operations; algae cultivation for biofuels?) • Provide support and financing opportunities for local community members to transition or diversify skill-set and knowledge toward climate-resilient industry <ul style="list-style-type: none"> o E.g. provide funding for start-up businesses, business plans, training in sustainable fishing practices and management 	<p>City of Port Alberni Economic Development; ACRD; First Nations; Educational institutions and organizations</p>		C3	3	3	3	2	3	2	3	2	1	2	1	25
<p>3.3 – Where feasible, adapt to climatic impacts on the local fishery by adjusting common practices to support the continuation of fishing communities.</p>	<ul style="list-style-type: none"> • Advocating on behalf of local fishers and fisheries to provincial and federal governments for increased funding and support for researching local adaptation options to strengthen the fishery sector • Explore how temperature-related climatic impacts on the local fishery can be adapted to by changing the timing and/or location of fishing operations in alignment with the arrival of species . • Evaluate the potential to establish a new or multi-species fishery – maybe focusing on a diversity of target species, depending on timing, availability, sustainability, of that species • Research available funding for determining aquaculture species that are tolerant to changing climatic conditions (e.g., salinity, temperature changes) <ul style="list-style-type: none"> o Could look to federal ECCC funding or NSERC 	<p>City of Port Alberni Economic Development; Local fishers and fisheries; Fishery managers; DFO</p>	<p>Chamber of Commerce (?) Port Alberni Port Authority</p>	C3	3	3	3	3	3	1	3	3	1	1	1	25
<p>3.4 – Crowdsource solutions to challenging fishery issues (e.g., high water temperature in rivers and streams) to find diversified and stronger solutions.</p>	<ul style="list-style-type: none"> • Identify appropriate crowdsourcing platform for gathering ideas from the “crowd” on particularly challenging issues (e.g., IdeaScale) • Develop a communications strategy for advertising the crowdsourcing opportunity • Increase the innovative potential within the community to develop creative solutions to challenging issues 	<p>West Coast Aquatic; Alberni Valley Enhancement Society; ACRD; City of Port Alberni Economic Development</p>	<p>Local entrepreneurs, scientists, citizens, etc.</p>	C3	2	3	2	3	3	2	3	3	1	1	1	24

<p>3.5 – Explore opportunities to offer cooling and hydration in public spaces and at public events during hot summer months.</p>	<p>Cooling and hydration strategies (infrastructure, programs, etc.) can help community members safely experience public spaces and events during hot summer months. The following cooling and hydration actions can be implemented:</p> <ul style="list-style-type: none"> • Increase offerings of free swim times, public pools and splash pads • Install water-based outdoor cooling stations such as misting stations • Improve public access to hydration (e.g. fountains, hydration stations) • Ensure inclusion of cooling centres in local emergency response planning 	<p>Island Health; City of Port Alberni Parks and Recreation; Communications, Planning; WorkSafe BC</p>	<p>Canadian Mental Health Association; First Nations Health Authority; Island Health</p>	<p>C8, C9</p>	<p>3</p>	<p>3</p>	<p>3</p>	<p>3</p>	<p>3</p>	<p>2</p>	<p>3</p>	<p>3</p>	<p>2</p>	<p>1</p>	<p>3</p>	<p>29</p>
<p>3.6 – Extend hours of public buildings (e.g., libraries, community centres, etc.) during extreme heat events.</p>	<ul style="list-style-type: none"> • Extending the hours of public and/or private buildings during extreme heat events provides a space for individuals to seek refuge from the heat. • Develop more indoor infrastructure to support indoor community programs in the face of extreme heat or wildfire smoke events. o Utilize the cooling (and heating) centres identified in Action C.8.1 	<p>City of Port Alberni Parks and Recreation department;</p>	<p>Social services organizations (community centres), Private businesses (e.g., malls)</p>	<p>C8, C9</p>	<p>2</p>	<p>3</p>	<p>2</p>	<p>3</p>	<p>3</p>	<p>2</p>	<p>3</p>	<p>3</p>	<p>2</p>	<p>2</p>	<p>3</p>	<p>28</p>
<p>3.7 – Promote building standards protecting against extreme heat event impacts by updating by-laws, development guidelines, and zoning regulations.</p>	<ul style="list-style-type: none"> • Adopt planning and building guidelines/Bylaws to incorporate shade trees, green spaces, and infrastructure to decrease the heat-effect for new development • Review applicable development guidelines and identify changes or additions that can be made in support of this action (e.g., maintaining a certain percentage or number of trees, green space, reduce impervious surfaces that absorb heat) • Explore using low impact development solutions to help mitigate the urban heat island effect and improve thermal comfort of buildings during extreme heat events o Research the opportunity to install green roofs, cool roofs, and/or green walls on selected City/Town buildings, especially in priority areas. o Explore the option of providing homeowner incentive programs for implementing low impact development projects on private property (e.g., rain gardens, green roofs, increasing 	<p>City of Port Alberni Planning, Engineering, and Development Services departments</p>	<p>Island Health; Canadian Mental Health Association; Health Networks; Developers and builders; local ENGOS</p>	<p>C8, C9</p>	<p>3</p>	<p>2</p>	<p>3</p>	<p>2</p>	<p>3</p>	<p>2</p>	<p>2</p>	<p>2</p>	<p>2</p>	<p>1</p>	<p>2</p>	<p>24</p>

3.8 – Work with local partners to expand emergency and community services offered to the community in the face of extreme climatic events (e.g., extreme heat, wildfires).	<ul style="list-style-type: none"> • Develop a Standard Operating Procedure for deployment of community kitchens and cooling centres. • Work with local emergency services to establish achievable criteria. 	ACRD Emergency Planning; City of Port Alberni Parks and Recreation	Local community organizations Red Cross	C10, C14	3	3	3	3	3	2	3	3	2	2	3	30
3.9 – Improve communications to the public to reduce safety and health risks facing the community in the face of wildfire events and Air Quality Events.	<ul style="list-style-type: none"> • Explore new ways to improve communication to the public during emergency events • Develop an early Air Quality warning system (e.g., radio ads, text alerts) to be communicated to the public in the face of extreme weather (e.g., poor air quality) • Communicate to the public what steps can be taken inside the home to minimize the risk of exposure to poor air quality (e.g., close windows, use High Efficient Particulate Air filters, turn off exhaust fans, central air systems, ventilation masks, portable air cleaners, avoid creating other air pollution, etc.) • Work with Coastal Connections to establish additional reception points for cellphone service so people on water, mountains, and in forests can be notified • Create more digital signs to promote fire bans and provide public education (social media, radio, local news, etc.) • Review BC Wildfire Services criteria/trigger points for escalating fire bans 	Coastal Connections; ACRD Emergency Response; Island Health; BC Wildfire Services; Alberni Air Quality Society; Port Alberni Air Quality Council; Alberni Clayoquot Health; City of Port Alberni Communications Parks and Recreation	City of Port Alberni Communications department; BC Ministry of Transportation and Infrastructure	C10, C14	3	3	3	3	3	2	2	3	2	2	3	29
3.10 – Evaluate best practices and develop procedures to manage smoke events in Public buildings and facilities, including staff health and safety.	<ul style="list-style-type: none"> • Increase capacity to measure and respond to smoke events (e.g. air quality monitoring) • Enrolling in air quality alert emails from BC Centre for Disease Control and Canada’s Wildfire Smoke Production System (FireWork) • Review results of BC Housing Mobilizing Building Adaptation and Resilience project and other municipal best practices for smoke response protocols • Work with Emergency Management, Health and Safety, Engineering and other departments to develop policy for ensuring staff safety during smoke events including communication to staff 	City of Port Alberni Parks and Recreation, Communications; ACRD	BCCDC	C10, C14	2	2	3	3	3	2	3	3	3	2	3	29

3.11 – Establish community clean air shelters to mitigate the impact of wildfire smoke on vulnerable populations.	<ul style="list-style-type: none"> • Clean air shelters can be a room/area or an entire building that has a filtration system that minimizes particulates generated from wildfire smoke with the objective to minimize the amount of outdoor air that is entering the building/space. • This could include buildings such as: <ul style="list-style-type: none"> o Community centres, shopping malls, libraries, schools o Identify the best sites to locate these clean air shelters within the community, targeting vulnerable populations • Ensure this is included in regional emergency response plans as well as air quality indices • Establish clear communication strategies for vulnerable populations 	City of Port Alberni Parks and Recreation; BC Ministry of Environment; Island Health; First Nations Health Authority	Alberni Air Quality Society; Port Alberni Air Quality Council; Alberni Clayoquot Health; City of Port Alberni Parks and Recreation; ACRD Emergency Response	C11	2	2	1	2	3	2	3	3	1	2	3	24
3.12 – Increase emergency preparedness at the household and community level through education and outreach campaigns. - linked to public education campaigns above (3.7; 3.11)	<ul style="list-style-type: none"> • Work with local partners to increase the awareness of risks and to provide the community with response information. <ul style="list-style-type: none"> o For example, regularly circulate a list of what individuals can do to reduce pressures on social and emergency services • Target emergency preparedness efforts and communications to high-risk areas, ensuring vulnerable populations are reached • Continue to engage with residents and community service providers about personal preparedness and critical service delivery • Distribute laminated cards with emergency contact information • Adopt/promote public centres as mustering stations in the event of an emergency 	ACRD Emergency Management; City of Port Alberni Communications		C12	3	3	3	3	3	3	3	2	2	2	3	30

Appendix B: Glossary of Terms

Adaptation: Includes any initiatives or actions in response to actual or projected climate change impacts and which reduce the effects of climate change on built, natural and social systems.

Adaptive Capacity: The ability of built, natural and social systems to adjust to climate change (including climate variability and extremes), to moderate potential damage, to take advantage of opportunities, or to cope with the consequences.

Baseline: A climatological baseline is a reference period, typically three decades (or 30 years), that is used to compare fluctuations of climate between one period and another. Baselines can also be called references or reference periods.

Climate: The weather of a place averaged over a period of time, often 30 years. Climate information includes the statistical weather information that tells us about the normal weather, as well as the range of weather extremes for a location.

Climate Change: Climate change refers to changes in long-term weather patterns caused by natural phenomena and human activities that alter the chemical composition of the atmosphere through the build-up of greenhouse gases which trap heat and reflect it back to the earth's surface.

Climate Change Atlas of Canada: The Climate Atlas of Canada is an interactive tool that combines climate science, mapping, and storytelling to depict expected climatic changes across Canada to the end of the century. The 250-layer map is based on data from 12 global climate models. Users are shown a baseline period of warming trends by region that spans from 1950 to 2005 and can toggle between two future projection periods, 2021 to 2050 and 2051 to 2080.

Climate Projections: Climate projections are a projection of the response of the climate system to emissions or concentration scenarios of greenhouse gases and aerosols. These projections depend upon the climate change (or emission) scenario used, which are based on assumptions concerning future socioeconomic and technological developments that may or may not be realized and are therefore subject to uncertainty.

Climate Change Scenario: A climate change scenario is the difference between a future climate scenario and the current climate. It is a simplified representation of future climate based on comprehensive scientific analyses of the potential consequences of anthropogenic climate change. It is meant to be a plausible representation of the future emission amounts based on a coherent and consistent set of assumptions about driving forces (such as demographic and socioeconomic development, technological change) and their key relationships.

Ensemble Approach: An ensemble approach uses the average of all global climate models (GCMs) for temperature and precipitation. Research has shown that running many models provides the most realistic projection of annual and seasonal temperature and precipitation than using a single model.

Extreme Weather Event: A meteorological event that is rare at a place and time of year, such as an intense storm, tornado, hail storm, flood or heat wave, and is beyond the normal range of activity. An extreme weather event would normally occur very rarely or fall into the tenth percentile of probability.

Greenhouse Gas (GHG) Emissions: Greenhouse gases are those gaseous constituents of the atmosphere, both natural and anthropogenic, that absorb and emit radiation at specific wavelengths within the spectrum of thermal infrared radiation, emitted by the Earth's surface, the atmosphere itself, and by clouds. Water vapour (H₂O), carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), ozone (O₃), and chlorofluorocarbons (CFCs) are the six primary greenhouse gases in the Earth's atmosphere in order of abundance.

Climate Impact: The effects of existing or forecast changes in climate on built, natural, and human systems. One can distinguish between potential impacts (impacts that may occur given a projected change in climate, without considering adaptation) and residual impacts (impacts of climate change that would occur after adaptation).

Impact Statement: Climate-related impact statements are concise statements that outline locally-relevant projected threats and how those changes are expected to affect the built, natural, social, and economic systems of the municipality.

Mitigation: The promotion of policy, regulatory and project-based measures that contribute to the stabilization or reduction of greenhouse gas concentrations in the atmosphere. Renewable energy programs, energy efficiency frameworks and substitution of fossil fuels are examples of climate change mitigation measures.

Representative Concentration Pathways: Representative Concentration Pathways (RCPs) are four greenhouse gas concentration (not emissions) trajectories adopted by the IPCC for its fifth Assessment Report (AR5) in 2014. It supersedes Special Report on Emissions *Scenarios* (SRES) projections published in 2000.

Resilience: The capacity of a system, community or society exposed to hazards to adapt, by resisting or changing in order to reach and maintain an acceptable level of functioning and structure.

Risk: The combination of the likelihood of an event occurring and its negative consequences. Risk can be expressed as a function where $\text{risk} = \text{likelihood} \times \text{consequence}$. In this case, *likelihood* refers to the probability of a projected impact occurring, and *consequence* refers to the known or estimated outcomes of a particular climate change impact.

Sensitivity: Measures the degree to which the community will be affected when exposed to a climate related impact. Sensitivity reflects the ability of the community to function (*functionality*) as normal when an impact occurs.

Vulnerability: Vulnerability refers to the susceptibility of the community to harm arising from climate change impacts. It is a function of a community's sensitivity to climate change and its capacity to adapt to climate change impacts.

Weather: The day-to-day state of the atmosphere, and its short-term variation in minutes to weeks.

Appendix C: Summary Table of Climate Change Projections for the Port Alberni Area

RCP 8.5				
Climate Variable ¹	Season	Baseline (1976 – 2005)	Ensemble Mean (2021-2050)	Ensemble Mean (2051-2080)
Mean Temperature (°C)	Annual	9.6	11.2	12.8
	Spring	8.6	10.2	11.6
	Summer	16.8	18.6	20.5
	Fall	9.9	11.4	13.1
	Winter	2.8	4.4	6.0
Extreme Heat Days (>3°C)	Annual	9.8	18.2	30.7
Growing Season	Annual	199 days	248 days	294 days
Total Precipitation	Annual	1946	2019	2127
	Spring	383	395	400
	Summer	126	117	112
	Fall	593	614	659
	Winter	844	891	957
Relative Sea level rise ²	Relative sea level expected to rise 30-40 cm by 2100			

¹. The first five climate variables taken from the Climate Atlas of Canada tool

². Sea level rise data retrieved from Natural Resources Canada's *Canada's Marine Coasts in a Changing Climate* (Lemmen & Warren, 2016).