District of Ucluelet

Climate Change ADAPTATION PLAN

JANUARY 2021

DISTRICT OF UCLUELET

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District of Ucluelet Staff and Council

Project Staff

Mark Boysen, Chief Administrative Officer, District of Ucluelet
Bruce Greg, Manager of Community Planning
Abby Fortune, Manager of Parks and Recreation
Warren Cannon, Manager of Public Works
Summer Goulden, Climate Change Planner and BC Lead, ICLEI Canada

Land Acknowledgement

The District of Ucluelet acknowledges that we are located on the traditional territory (ḥaaḥuuɬi) of the Yuułuʔiɬʔatḥ (Ucluelet First Nation). We are neighbouring communities who share interests in the Ucluth Peninsula and surrounding area. Our long-standing relationship is built upon mutual respect and many individual, personal ties.

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Photo credit on front cover: Barbara Schramm

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Executive Summary

The District of Ucluelet is committed to taking meaningful action on climate change while including the community in this process every step of the way. The District has already developed a 100% Renewable Energy Plan that carves out a path towards a low carbon future and has signed on to the BC Climate Action Charter. This Adaptation Plan builds upon existing actions taken by the District to address climate change and allows the District to proactively identify opportunities for action that advance the community further toward climate resilience of its social, economic, built and natural systems.

The intent of this plan is to help organizations, institutions, businesses, and individuals of all ages adapt to current and future climate-related risks and opportunities. Although the District has a primary role for most actions outlined in the Plan, they look to various stakeholders to further educate and implement climate change adaptation measures in the broader community.

Throughout this adaptation planning process, a community stakeholder group came together over a two-year period to learn about the projected impacts of climate change on the region, to assess and prioritize Ucluelet's top risks from a changing climate, and to identify actions that both the District and community can take to improve resiliency in Ucluelet and the region.

The top risks include impacts to infrastructure, utilities, and the transportation network from more extreme weather events, impacts to water supply and storage from rising annual temperatures and hotter, drier summers, impacts to the marine environment including aquatic species, and impacts to both native and invasive species.

The adaptation actions identified to address Ucluelet's priority risks were divided into the following four overarching objectives:

1. **Strengthen Infrastructure Resilience and Reduce Risk to Buildings and Property**
2. **Enhance Resilience of Ecosystems and Protect Natural Areas**
3. **Improve Public Safety and Preparedness to Climate-related Events**
4. **Think Regionally, Act Locally**

Summary of Objectives and Adaptation Actions.

Objective 1: Strengthen Infrastructure Resilience and Reduce Risk to Buildings and Property

Action 1.1: Address vulnerabilities to electrical distribution infrastructure.

Action 1.2: Conduct flood risk mapping for sea level rise and use results to communicate and manage risks.

Action 1.3: Assess vulnerabilities of Highway 4 transportation link.

Objective 2: Enhance Resilience of Ecosystems and Protect Natural Areas

Action 2.1: Study current water systems and explore resiliency measures to make the existing water system more resilient.

Action 2.2: Create an Invasive Species Action Plan.

Action 2.3: Support local activities to maintain wild fish stocks and habitat.

Action 2.4: Develop a Biodiversity Network Plan to ensure priority ecosystems are protected in municipal land-use planning bylaws.

Action 2.5: Through the Integrated Stormwater Management Plan, create bylaws, policies or plans to protect habitats.

Objective 3: Improve Public Safety and Preparedness to Climate-related Events

Action 3.1: Complete Emergency Operations Centre (EOC) training and update EOC to continue to be prepared for extreme events.

Objective 4: Think Regionally, Act Locally

Action 4.1: Participate in a region-wide climate change dialogue and planning process with municipalities, First Nations, Parks Canada and BC Parks to expand and integrate the Ucluelet Climate Change Adaptation Plan into future projects.

Introduction

Scientific evidence continues to show that human actions are having a significant impact on the natural and anthropogenic systems of our planet. These impacts will have long-lasting effects in the region, materializing as climatic changes such as increased summer and winter temperatures, increased frequency and intensity of wind and storm events, and sea level rise.

Our natural environments and our cities are especially at risk to these changes. The sensitivity of ecosystems to change may mean a dramatic shift to existing habitats and to our natural environments as we know it. For communities with the concentration of people, buildings, infrastructure, and transportation systems in a relatively small area, climate-related impacts will have an adverse effect on economic, social, and environmental well-being.

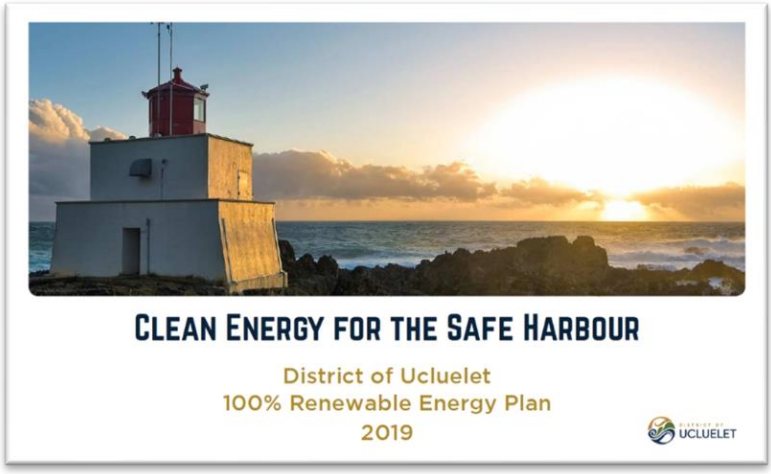
Our future is not what we planned it to be and therefore, we must plan to adapt. The risk is that the changes are unprecedented, and we may not be equipped. If we wait to see what impacts are going to materialize, we risk being unable to effectively respond to manage the consequences that will result. In waiting, we also miss out on the opportunity to reduce the impacts and even capitalize on some of the positive benefits that could arise.

To prepare, we must first continue forward with our long-term strategy to reduce greenhouse gases by implementing mitigation actions that address the root causes of climate change. The Ucluelet Climate Action Plan, approved by Council in January 2019, has set a path for the municipality to make these reductions. Secondly, we must prepare to adapt to the changes and impacts that are coming or already underway.

By preparing to adapt to this uncertain future, we will enhance the resilience of our natural environment and communities, reducing the risk that climate events will impact our community. Adaptation and Mitigation measures will overlap in some areas and these dual benefit actions will be a priority.

Climate Action Plan: Clean Energy for the Safe Harbour

The District's Climate Action Plan carves a path towards a low carbon future. The Plan was adopted in 2019 and commits the District to achieving an 80% reduction in GHG emissions and to 100% renewable energy by 2050. Ucluelet was an early signatory to the BC Climate Action Charter and has been carbon neutral in operations since 2016.



The purpose of this adaptation plan is to outline a practical roadmap to guide Ucluelet in preparing for and responding to the climatic changes that the community is experiencing. The District of Ucluelet's Official Community Plan holds supporting policies that clearly commit to climate mitigation and adaptation actions including:

Table 1 Summary of policies, objectives, and goals supporting climate action in OCP

Climate Action Goal	Ucluelet residents are resilient to climate change and energy scarcity and costs.
Climate Action Monitoring	The District's Annual Reporting will include a section on Climate and Energy, which will include progress updates on actions and indicators in the 2018 Climate Action Plan.
	The District will track and report on the 2030 greenhouse gas emissions target reduction target of 40% for by 2030 based on 2007 levels, and also report on additional indicators identified in the Climate Action Plan.
Servicing and Infrastructure	Objective 4D: To adapt municipal infrastructure systems to remain resilient to the impacts of a changing climate.
GHG Policies	Policy 2.32: Review municipal infrastructure and assets for vulnerability to rising sea levels and increased storm events.
	Policy 2.30: Establish and undertake the work, as necessary, to refine Flood Construction Levels to ensure new development and infrastructure avoids the impact of rising sea levels.

Adaptation Changemakers Project

The development of Ucluelet's Community Climate Change Adaptation Plan was facilitated by the District's participation in ICLEI Canada's Adaptation Changemakers project. Supported by technical guidance from ICLEI and regional experts, Adaptation Changemakers was a two-year initiative that engaged eight communities across Canada to build local capacity for climate change resilience and to advance efforts on adaptation. Built on a cohort model, this project brought the eight participating communities together multiple times over the course of the project, gathering at three national workshops to network, learn, and share experiences about adaptation planning.

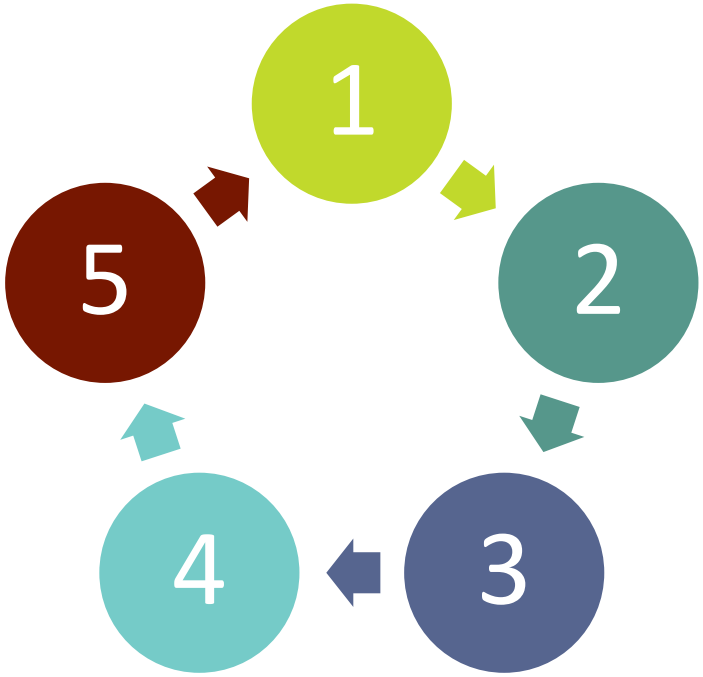
Table 2 Participating municipalities in ICLEI's Adaptation Changemakers project

British Columbia	District of Ucluelet City of Prince George Town of Qualicum Beach
Newfoundland and Labrador	Town of Conception Bay South Town of Portugal Cove-St. Philip's
Ontario	City of Windsor City of Peterborough Town of Caledon

Each Changemakers municipality followed Milestones 1– 3 of ICLEI Canada's Building Adaptive and Resilient Communities (BARC) program – a five milestone planning framework that supports the development and implementation of a Municipal Climate Change Adaptation Plan. The process involved identifying local climate change projections and impacts, facilitating a risk and vulnerability assessment, and identifying community actions to increase resilience to projected changes.

The adaptation planning process was community-focused, and each participating municipality convened a wide range of community stakeholders, allowing for collaborative co-development of adaptation plans that address climate risks across multiple sectors and systems. The Municipality acts as a coordinator and champion of the plan, and various actions and risks within the plan are owned and implemented by non-municipal stakeholders. This collaborative co-governance model allows the burden of responsibility to be shared amongst key partners and increases resilience in areas outside the corporation of the District.

ICLEI Canada's Building Adaptive and Resilient Communities Framework



MILESTONE ONE - INITIATE

Within this milestone, communities identify stakeholders to review and understand existing knowledge on how the regional climate is changing, followed by a brainstorming exercise to identify potential climate change impacts.

MILESTONE TWO—RESEARCH

The second milestone is meant to further develop a community's understanding of climate change impacts and the major service areas which are likely to feel these impacts most acutely. Within this milestone, a municipality will scope the climate change impacts for the region and conduct both a vulnerability and risk assessment.

MILESTONE THREE - PLAN

The third milestone provides guidance on how to establish a vision, set adaptation goals and objectives, identify adaptation options, and examine possible constraints and drivers to various actions. From there, a community will draft a Local Adaptation Strategy. Baseline data is collected and recorded, financing and budget issues are addressed, an implementation schedule is drafted, implementation responsibilities are determined, and progress and effectiveness indicators are identified in the Plan.

MILESTONE FOUR - IMPLEMENT

In the fourth milestone, communities work to ensure that they have the approval and support of council, municipal staff and the community in order to move forward on implementation. Communities will also make sure they have the appropriate implementation tools to ensure the ongoing success of the Strategy.

MILESTONE FIVE – MONITOR & REVIEW

The fifth and final milestone serves to assess whether the goals and objectives of the Strategy have been achieved, and helps communities identify any problems that have been encountered and develop solutions. Additionally, the fifth milestone helps communities communicate their progress to council and the general public.

Adaptation vs. Mitigation

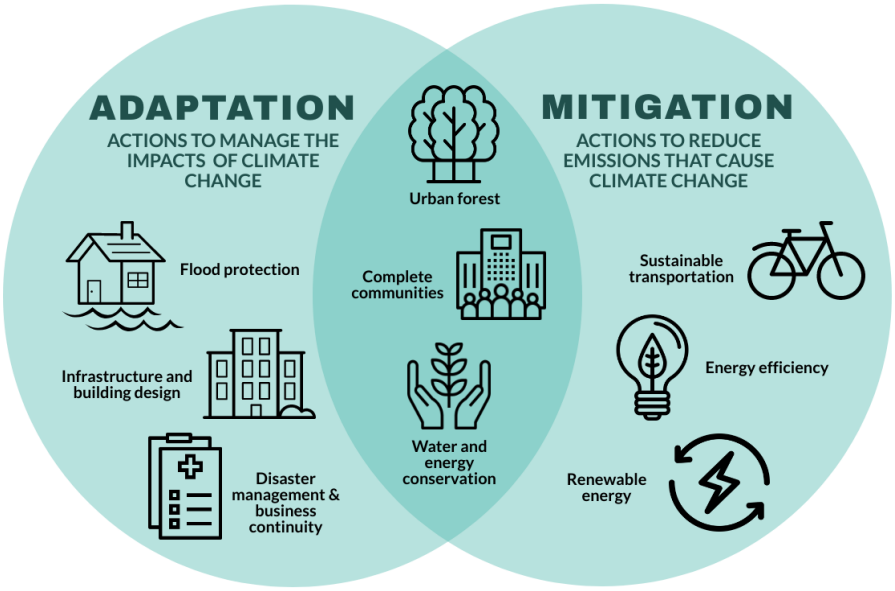
Climate change adaptation refers to any initiative or action that seeks to reduce the vulnerability of social, economic, built, and natural systems to changing climate conditions. Adaptation efforts may focus on changing individual behaviour, updating municipal by-laws and policies, enhancing the capacity of physical infrastructure, and improving ecological services.

Climate change mitigation refers to the implementation of policy, regulatory and project-based measures that contribute to the stabilization or reduction of greenhouse gas concentrations in the atmosphere. These include anti-idling by-laws, building retrofits to conserve energy, and transitioning to low-carbon energy sources.

The effects of climate change are wide ranging and will require a diversity of responses. While mitigation efforts work to contain the long-term impacts of global warming, adaptation measures are needed to address the climate change impacts that are already happening. Adaptation is not meant to replace or undermine mitigation efforts, rather adaptation complements local government efforts to protect and improve their long-term sustainability.

ADAPTATION = managing the unavoidable

MITIGATION = avoiding the unmanageable



Source: ICLEI Canada, 2019

Global and National Climate Change

Since the late 1800s, the Earth's temperature has risen by 1°C largely due to human activities (IPCC, 2014). As fossil fuel extraction and consumption continues around the world, warming is accelerating at a faster rate. Earth's average surface temperature in 2018 was the fourth hottest year on record since record-keeping began in the 1880s (NASA, 2019). As of 2019, the five warmest recorded years have occurred during the past five years, and the 20 warmest years on record have occurred over the past 22 years (NASA, 2019). July 2019 was the hottest month ever recorded, shrinking Arctic and Antarctic sea ice to historic lows 19.8% below average (NOAA, 2019).

Similar to global trends, Canada has been warming over the last six decades, with average temperatures over land increasing by 1.5°C between 1950 -2010 (Bush et.al, 2014). This rate of warming is almost double the global average reported over the same period, meaning an increase of 2°C globally could result in a 3-4°C change in Canada. The years 2011 and 2012 were found to be 1.5°C and 1.9°C warmer than the 1961-1990 average in Canada, with 2018 now standing as the warmest year on record globally.

Canada has also generally become wetter over the past several decades, with average annual precipitation across the country increasing by approximately 16% between 1950-2010. This increase is dominated by large changes in British Columbia and Atlantic Canada. Extreme precipitation events are also likely to become more intense and more frequent – recent studies show that a 1-in-20-year storm event are likely to become 1-in-10-year storm events by the 2050s.

Wild Pacific Trail, Ucluelet

Federal Policy Direction on Climate 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 has a goal to enhance adaptive capacity, strengthen resilience and reduce vulnerability to global climate change, in line with the temperature goal (Government of Canada, 2016).

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 climate solutions locally.

The Government of Canada has also taken several ad-hoc steps in recent years to help Canadians adapt to a changing climate, including:

- Developing the Expert Panel on Climate Change Adaptation and Resilience Results in August 2017. The Expert Panel was tasked with providing advice to the federal government on how to measure progress on adaptation and climate resilience.
- Creating the Federal Adaptation Policy Framework, which brings the consideration of climate change risks into federal decision-making.
- Creating the Canadian Centre for Climate Services, which provides public information on understanding and adapting to climate change.

Provincial Policy Direction on Climate Adaptation

In 2019, the Province of British Columbia completed a Preliminary Strategic Climate Risk Assessment for B.C. as a first step in better understanding climate-related risks in B.C. 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 B.C. 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.

Climate Science

Climate change is defined as any change in global or regional climate patterns. While the Earth's climate has naturally fluctuated for millions of years, changes in climate from the mid-to-late 20th century onwards are largely attributed to increases in human activity. Human activities affect the climate system through two means – changes to land surface (e.g. deforestation) and altering the composition of the atmosphere through increasing atmospheric concentrations of GHGs through the burning of fossil fuels.

The United Nations Intergovernmental Panel on Climate Change (IPCC) is the UN body tasked with assessing the science related to climate change, its impacts and potential future risks, and possible response options. In its Fifth Assessment report, the IPCC declared with certainty the widespread impact of human-caused climatic changes. The report stated: "Human influence on the climate system is clear, and recent anthropogenic emissions of greenhouse gases are the highest in history. Recent climate changes have had widespread impacts on human and natural systems" (IPCC, 2014).

In October 2018, the IPCC released its most urgent report to date, stating that the global community may have as little as 10 to 12 years to slow greenhouse gas emissions and limit global temperature increase to 1.5°C (IPCC, 2018). To limit warming, there must be "rapid and far-reaching" transitions in how we use our lands, energy, industry, buildings, transportation and design our cities (IPCC, 2018). The IPCC recommends a mix of adaptation and mitigation options to limit global warming to 1.5°C, implemented in a participatory and integrated manner (IPCC, 2018).

It is important to note that uncertainty is an integral part of the study of climate change. While it is not possible to anticipate future climactic changes with absolute certainty, climate change scenarios help to create plausible representations of future climate conditions. These conditions are based on assumptions of future atmospheric composition and on an understanding of the effects of increased atmospheric concentrations of greenhouse gases (GHG), particulates, and other pollutants.

Climate Change Projections for Ucluelet

Climatic changes in BC during the twentieth century have often exceeded global trends but vary significantly by region. Recent events in the District of Ucluelet including water shortages, winter storms, and other occurrences of extreme weather over the past several decades have highlighted the need to be prepared for ongoing challenges.

The following data highlights the projected impacts of climate change on the District of Ucluelet. The Climate Atlas and Canadian Climate Data and Scenarios tools were used to access downscaled climate data for the District, as well as models and scenarios from the IPCC's Fifth Assessment Report. The parameters included in this report are temperature, precipitation, and sea level rise. Key findings include increased temperature, increased precipitation in fall, winter, and spring, and increased intensity of rainfall. In addition, sea levels and ocean and stream temperatures are expected to rise.

Table 3: Summary of Climatic Changes

RCP 8.5			
Climate Indices	Baseline	2021-2080	2051-2080
Mean annual temperature	9.1°C	10.5°C	12°C
Days over 30°C	0	0-2 days	0-4 days
Freeze-thaw days	20.2 days/year	6.8 days/year	2.2 days/year
Mean annual precipitation	3122 mm	3232 mm	3343 mm
Sea level rise	Average 1.7 ±0.2 mm/year	Sea level expected to rise 700mm - 800mm by 2100	
Water temperatures	Increasing at varying degrees in ocean and streams		

Temperature

Temperatures in the District of Ucluelet are expected to rise in congruence with provincial changes. In Ucluelet, the average annual temperature is expected to increase by 1.4°C by the 2050s, and 2.9°C by the 2080s.

Hot Days

The District can expect to start experiencing hot days (days where the temperature exceeds 30°C) that did not previously occur based on historical data.

Freeze-Thaw

A freeze-thaw cycle is any day where the minimum temperature is below 0˚C and the maximum temperature is above 0˚C. The RCP 8.5 ensembles project that freeze-thaw cycles will decrease significantly due to overall warmer temperatures.

Precipitation

Precipitation in Ucluelet is expected to rise in congruence with provincial changes, with decreased precipitation during the summer months. The Climate Atlas provides information from a weather station located within the District of Ucluelet. In a high emissions scenario, Ucluelet can expect to experience an average annual precipitation increase of 110 mm during 2021-2050 and 221 mm during 2051-2080.

Heavy or Extreme Precipitation

Extreme and heavy rain events are expected to become more intense and more frequent. The West Coast receives 20–25% of its annual precipitation in heavy rainfall resulting from atmospheric rivers. The frequency of atmospheric river events is expected to increase for coastal BC during the period 2041–2070 under a high-emissions scenario (Lemmen et al., 2016).

Sea Level Rise

Sea levels vary widely depending on several temporal, atmospheric, and oceanographic factors. Climate variabilities such as El Niño/La Niña Southern Oscillation contribute to extreme water levels, temperatures and storm surge flooding. Climate change impacts such as melting glaciers, warmer temperatures (thermal expansion), and changes in salinity have also contributed to changing sea levels. Between 1900–2009, the trend of global sea-level rise was on average 1.7 ±0.2 mm/year. This is expected to rapidly increase. The IPCC projects a range of global sea-level rise of 26–98 cm by the year 2100, based on the RCP emissions scenarios (Lemmen et al., 2016).

On the British Columbia coast, the projected amount of sea level rise is not uniform. The most drastic sea level rise is projected to occur on the Fraser Lowland, southern Vancouver Island, and the north coast (Lemmen et al., 2016). Interestingly, sea levels in the Tofino area have historically decreased by 12.4cm/century. Variation in sea level change between B.C. sites is largely explained by different amounts of vertical land movement. Land along the southwest coast of Vancouver Island is rising at about 25 centimetres per century, while vertical land motion along the northern coast is negligible (Lemmen et al., 2016). Despite historically lower sea levels, global projections indicate an increase for the District of Ucluelet and surrounding areas. Figure 2 below depicts the range of projected sea level rise along the coast.

Water Availability

Many regions in British Columbia are expected to experience increasing water shortages (Lemmen et al., 2008). Loss of snowpack and glaciers as well as precipitation changes are expected to limit water supply during peak demand periods during summer (Harford, 2008). Saltwater intrusion resulting from sea level rise can also impact groundwater. In addition to water supply, reduced summer stream flows will affect aquatic ecosystems such as critical salmon habitat.

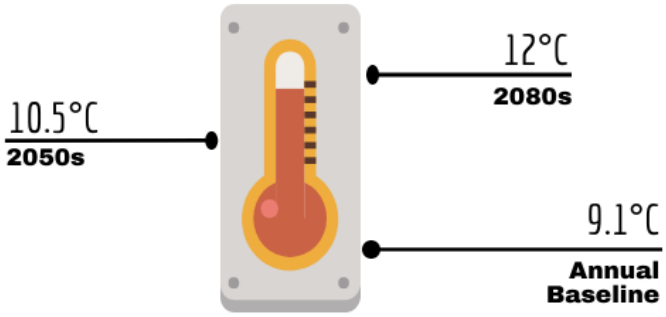
Water Temperatures

Sea surface temperatures have warmed significantly in British Columbia. Similar to sea level rise, sea surface temperature change varies across the region. Stream temperatures could rise by up to 2°C, and when coupled with lower flow levels, can have a significant impact on fisheries (Harford, 2008).

Figure 1 Projections of relative sea-level rise by 2100 for the 95th percentile under RCP 8.5

Source: Canada's Marine Coasts in a Changing Climate

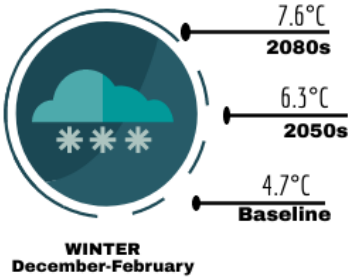
Ucluelet Future Climate Change Projections



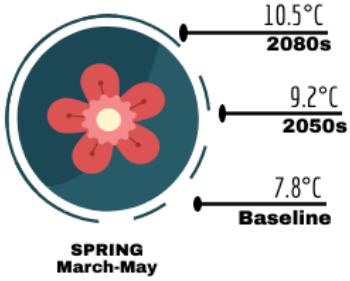
ANNUAL MEAN TEMPERATURES

Mean, minimum & maximum daily temperatures are projected to increase in every season.

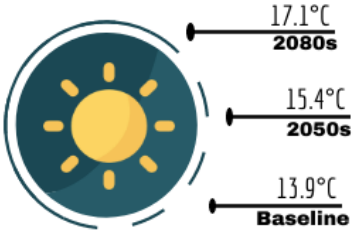
SEASONAL MEAN TEMPERATURES



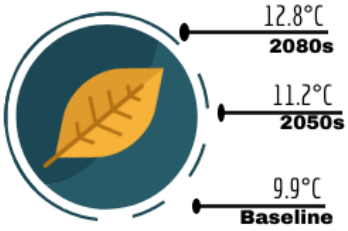
WINTER
December-February



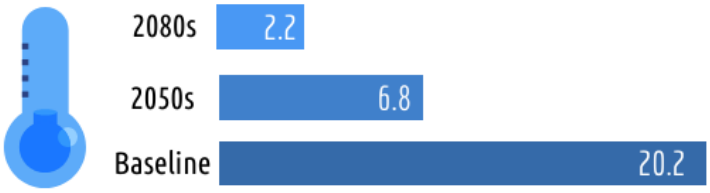
SPRING
March-May



SUMMER
June-August



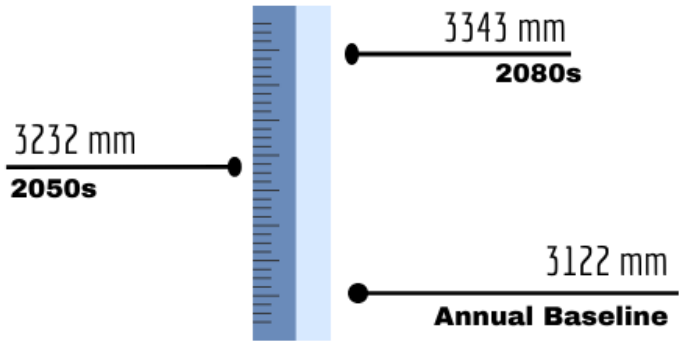
FALL
September-November



FREEZE-THAW CYCLES

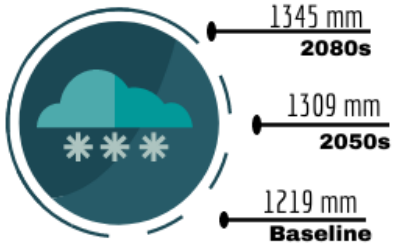
Freeze-thaw days are expected to significantly decrease over the long-term.

ANNUAL MEAN PRECIPITATION

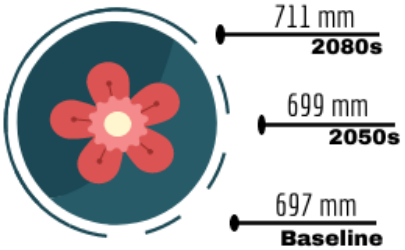


Annual precipitation is expected to increase. Winter, Spring and Fall are projected to get significantly wetter.

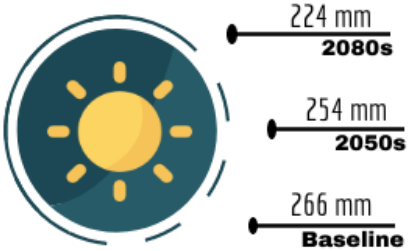
SEASONAL MEAN PRECIPITATION



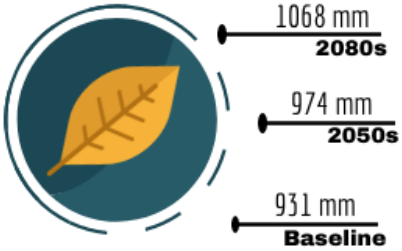
WINTER
December-February



SPRING
March-May



SUMMER
June-August



FALL
September-November

HEAVY PRECIPITATION EVENTS

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 in general are projected to become more intense and extreme.

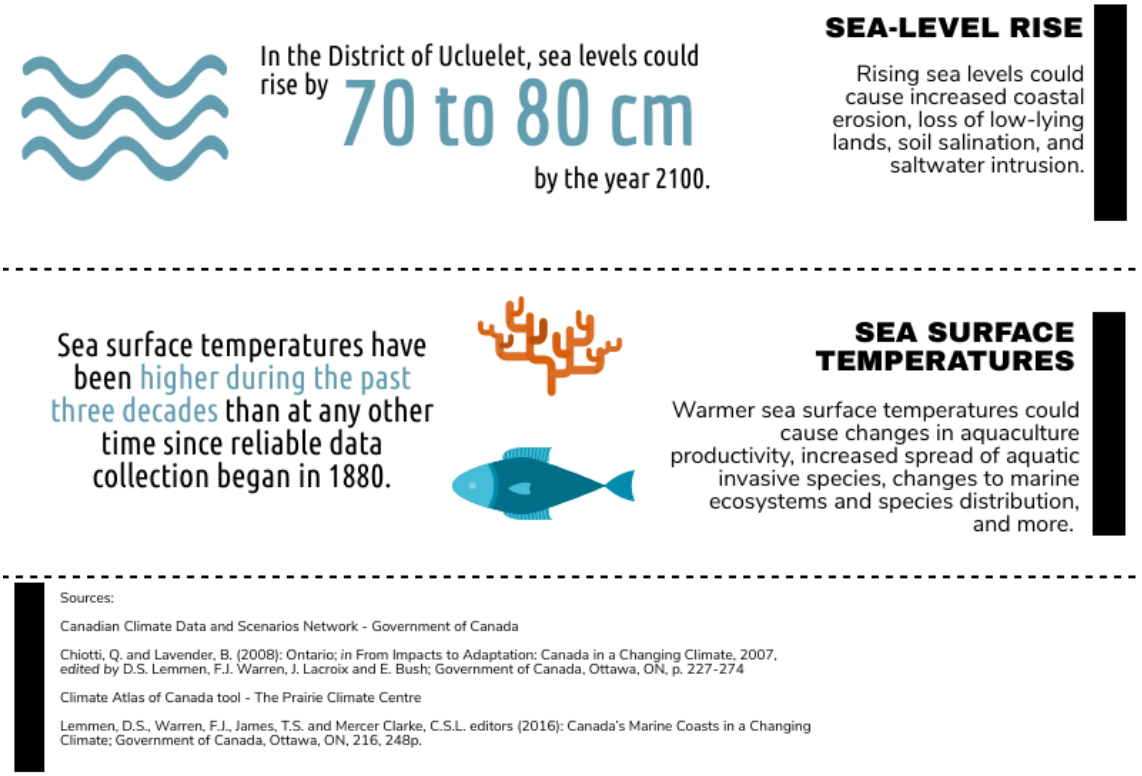


Figure 2: Climate Change Projections for the District of Ucluelet

Impacts and Issues

Impact statements consider the projected climatic changes and their effects on built, natural, and human/social systems. A workshop was held in September 2018 where participants were divided into groups and asked to develop impact statements for each system, thinking about the specific changes Ucluelet could experience. The group identified 40 impacts that were later used to inform a vulnerability and risk assessment, where they were further refined and prioritized.

Vulnerability and Risk 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.

In other words, a vulnerability assessment determines how susceptible we are to changes to our climate (e.g. heatwaves, extreme storms, sea level rise), and how prepared we are for those changes. For example, our trees may be affected by hotter and drier summers, but if most of the species are not susceptible to damage, and we have a plan to affordably replace those species that are, our vulnerability is low. Conversely, our vulnerability to poor air quality from wildfires is higher because we are susceptible and there is only so much that we can do to limit the impact on human health.

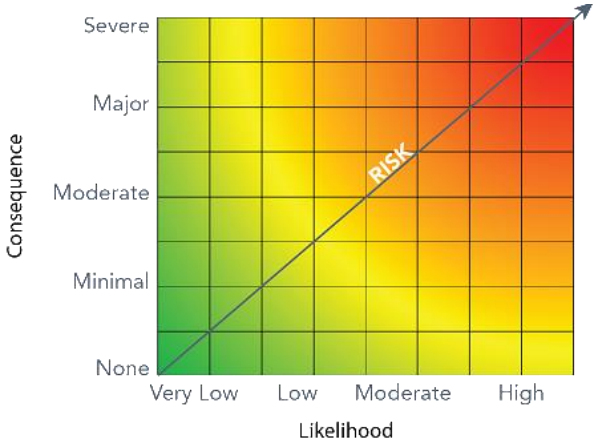
In February 2019, an online questionnaire was sent to local stakeholders to assess the vulnerability of Ucluelet to the climate change impacts that were identified in the second local meeting; these impacts related to the built, natural, and human/social systems within the city. As a result of the vulnerability assessment, 4 low-vulnerability impacts were removed or combined with pre-existing impacts to create an updated list of 36 impact statements to move onto the risk assessment process.

Analyzing risk is a key step in adapting to climate change and planning for a future in which the climate will be different than it is today. A local workshop involving a variety of stakeholders and local experts was held to determine Ucluelet's level of risk to the 36 impact statements that moved forward from the vulnerability phase. The risk assessment was used as a way to further prioritize which risks are most pertinent to plan for. In the risk assessment workshop, participants were asked to assess the consequences of each climate impact statement using the following 12 criteria:

Table 4 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

Risk is a function of likelihood and consequence. A likelihood score was pre-determined for each impact statement by the project team, and participants were asked to review these scores at the workshop. The focus of the working session was to assign consequence scores for each of the social, economic, and environmental factors above to determine the overall risk score for each impact statement.



Defining risk is intended to be an iterative process and should be revisited and reevaluated every five years. The following risks were identified by Ucluelet's stakeholder group as priority risks in the community:

- Increase in extreme weather events causing damage to buildings and infrastructure, extended power outages, and disruption and delays in the transportation network. (Medium-high risk)
- Rising annual temperatures impacting potable water supply through reduced snowpack and water storage issues. (Medium risk)
- Rising ocean and air temperatures and increasing acidification stressing aquatic species. (Medium risk)
- Rising annual temperatures increasing invasive species and plant diseases, threatening native species. (Medium risk)

Future Directions

The actions and objectives presented below are a combination of District and community-led measures that have been developed to address Ucluelet's priority climate impacts and risks. Detailed implementation tables including scope and current practice, roles and responsibilities, anticipated timeline and costing, as well as monitoring can be found in Appendix A.

Vision

Ucluelet is a vibrant, resilient community that is committed to the careful stewardship of all of its systems; natural, built, and social. Residents are knowledgeable and prepared, visitors learn to steward the area like locals, and the natural environment thrives from careful management and thoughtful valuation. We will minimize climate change risks to our community through careful planning to ensure our community will thrive for generations to come.

Objectives and Actions

The following five objectives were identified as key overarching areas of focus for the District of Ucluelet in their adaptation planning. Once implemented, the actions in this plan will contribute towards achieving the objectives below:

Table 5 Summary of Objectives, Adaptation Actions, and Responsible Departments

Objective 1: Strengthen Infrastructure Resilience and Reduce Risk to Buildings and Property	**Department**
Action 1.1: Address vulnerabilities to electrical distribution infrastructure.	Engineering Services
Action 1.2: Conduct flood risk mapping for sea level rise and use results to communicate and manage risks.	Community Planning
Action 1.3: Assess vulnerabilities of Highway 4 transportation link.	Emergency Services
Objective 2: Enhance Resilience of Ecosystems and Protect Natural Areas	
Action 2.1: Study current water systems and explore resiliency measures to make the existing water system more resilient.	Engineering Services
Action 2.2: Create an Invasive Species Action Plan.	Engineering Services
Action 2.3: Support local activities to maintain wild fish stocks and habitat.	Community Planning
Action 2.4: Develop a Biodiversity Network Plan to ensure priority ecosystems are protected in municipal land-use planning bylaws.	Community Planning
Action 2.5: Through the Integrated Stormwater Management Plan, create bylaws, policies or plans to protect habitats.	Engineering Services
Objective 3: Improve Public Safety and Preparedness to Climate-related Events	
Action 3.1: Complete Emergency Operations Centre (EOC) training and update EOC to continue to be prepared for extreme events.	Emergency Services
Objective 4: Think Regionally, Act Locally	
Action 4.1: Participate in a region-wide climate change dialogue and planning process with municipalities, First Nations, Parks Canada and BC Parks to expand and integrate the Ucluelet Climate Change Adaptation Plan into future projects.	Corporate Services

Integration with Other District Documents

A 2020 update to the Ucluelet Official Community Plan (OCP) is nearing completion. Several key OCP policies are supported by the objectives and actions identified in this climate adaptation plan. The CCAP objectives and actions should also be considered when reviewing, updating, or implementing the following:

- District of Ucluelet 100% Renewable Energy Plan (Climate Mitigation)
- Master Plans (Sewer, Water, etc.)
- Parks and Recreation Master Plan
- Ucluelet Emergency Response Plan
- Development of next Strategic Plan

Implementation Tables

While Ucluelet has made strides in adaptation through the development of the Climate Change Adaptation Plan (CCAP), it is through implementation of the Plan that the District will improve its adaptive capacity. To ensure the implementation is prompt and effective, implementation tables were developed for each adaptation action **(see Appendix A).** The implementation tables are intended to be a living document and will be further refined as implementation progresses. Updates may be made to accommodate changes in policies, staff or financial resources, and unexpected extreme weather events. This flexibility will ensure the District and its community partners are not constrained to certain parameters should new opportunities for implementation arise. Alongside every priority action, the Implementation table includes:

- Action Name – The name of the identified action
- Scope – A description of the action
- Current Practice – Description of any related ongoing initiatives or policies, exploring alignment and coordination with the current action
- Risks Addressed – Priority risks identified through the vulnerability and risk assessment that the action addresses
- Lead Organization – The organization(s) that will lead implementation
- Department Responsible – Main department at the District of Ucluelet responsible for implementation
- Potential Partners – The organization(s) that could support implementation
- Anticipated Timing – How long implementation is expected to take
    - Short (<2 years)
    - Medium (2-5 years)
    - Long (5+ years)

- Monitoring Metric – Indicator that illustrates progress on implementation or on achieving the identified objectives
- Costing – Costs of implementing the action. Scale used:
    - Low (<$100,000)
    - Medium ($100,000-$1M)
    - High (>$1M)

From the Implementation Tables, the following 2020-2022 Action Plan has been developed. These actions have either been initiated already or will be integrated into 2021-2022 workplans. These actions will be reported out on in future District Annual Reports.

2020-2022 Action Plan

OBJECTIVE 1 | Strengthen Infrastructure Resilience and Reduce Risk to Buildings and Property

Action 1.1 Address vulnerabilities to electrical distribution infrastructure and increase effective and transparent risk management. **(Engineering Services)**

Supporting Actions

- ✓ Identify priority pump stations and upgrade with auxiliary power to respond to power outages.
- ✓ Identify priority buildings for new back-up power systems across the community.

Action 1.2 Conduct flood risk mapping for sea level rise and use results to communicate and manage risks. **(Community Planning)**

Supporting Actions

- ✓ Integrate flood risk mapping into planning for future land-use decisions including changes to zoning.
    - ☐ Develop concrete guidelines for future buildings and update the building bylaw.
- ✓ Communicate to homeowners on flood risks and options to mitigate damage to private property.

Action 1.3 Understand vulnerabilities of Highway 4 and how disruptions could affect food security and other critical resources. **(Emergency Services)**

Supporting Actions

- ☐ Complete a vulnerability and risk assessment for climate impacts to the transportation corridor.
- ☐ Communicate findings of risk assessment with community to raise public awareness of personal preparedness.

Objective 2 | Enhance Resilience of Ecosystems and Protect Natural Areas

Action 2.1 Study current water systems and explore alternative measures to make the existing system more resilient. **(Engineering Services)**

Supporting Actions

- ☐ Develop a sustainable water planning strategy to reduce ecosystem drought vulnerability.
- ✓ Explore the creation of additional water storage capacity and invest in technology available for water capture.
- ✓ Design and apply for funding to install a community water filtration system.
- ☐ Ensure all buildings are on water meters and update bylaws/policies to reflect any changes to water conservation measures.
- ☐ Develop a baseline for water consumption report in the District's annual report.
- ☐ Support household water conservation by creating incentives to reduce potable water use (e.g. provide rebates for water collection systems (cisterns & rain-barrels), increase costs for commercial users).
- ☐ Review regulations for greywater use and increase public awareness about possibilities.

Action 2.2 Create an Invasive Species Action Plan and coordinate with existing initiatives. **(Engineering Services)**

Supporting Actions

- ☐ Support research and monitoring for invasive species and plant diseases.
- ☐ Support monitoring and management of invasive species in the marine environment (e.g. by encouraging boat rinsing).
- ☐ Assess priority areas to focus on (e.g. parks, road edges, habitat impacts).
- ☐ Increase public education and awareness raising campaigns on invasive species management.

Action 2.3 Support local activities to maintain wild fish stocks and habitat. (**Community Planning**)

Supporting Actions

- ☐ Research additional land-use regulations/bylaws that could improve aquatic habitat protection.
- ☐ Clearly communicate riparian development permit areas and increase existing management.
- ☐ Increase advocacy and public awareness of organizations like the Hatchery and the Aquarium and the services they provide.

Action 2.4 Explore funding opportunities to develop a Biodiversity Network Plan to ensure priority ecosystems are protected in municipal land-use planning bylaws (with regional partners). (**Community Planning**)

Supporting Actions

- ☐ Expand the percentage of greenways and parks as a required component of development proposal approvals
- ☐ Identify key areas for ecological restoration and prioritize these areas as a land-use zoning category
- ☐ Reduce percentage of allowable land-clearing per hectare to ensure land-use planning bylaws are aligned with biodiversity conservation goals
- ☐ Develop targets for % canopy cover to maintain temperature gradient and % land-cover to reduce erosion and mitigate vulnerability to flooding
- ☐ Prioritize wildlife corridors and habitat protection in land-use planning bylaws
- ☐ Revise zoning bylaws to reflect limits-to-growth in areas vulnerable to sea-level rise, flooding and storm impact
- ☐ Maintain vegetation buffers, forested canopies and green zones as part of a comprehensive climate change impact land-use plan
- ☐ Develop a baseline to monitor tree health and manage impacts of extreme events on trees

Action 2.5 Through the Integrated Stormwater Management Plan, create bylaws, policies or plans to protect habitats. **(Engineering Services)**

Supporting Actions

- ☐ Update Subdivision and Development Servicing Standards Bylaw to incorporate green/lean infrastructure.
- ☐ Update or create new policies, bylaws, and DPAs to effectively manage stormwater and enhance natural habits and ecosystem services.
- ☐ Take a natural assets and ecosystem services approach to managing stormwater through exploring a Municipal Natural Asset program or working with Municipal Natural Assets Initiative.
- ☐ Public education and awareness raising on stormwater management and green stormwater options available for private property.
- ☐ Explore incentive programs to encourage green stormwater management on private property.

Objective 3 | Improve Public Safety and Preparedness to Climate-Related Events

Action 3.1 Complete Emergency Operations Centre (EOC) training and update EOC to continue to be prepared for extreme events. (**Emergency Services**)

Supporting Actions

- ☐ Encourage all departments to review and update Business Continuity Plans.
- ☐ Share results of Ucluelet's climate change adaptation project with emergency management network.
- ☐ Continue to engage with residents and community service providers about personal preparedness and critical service delivery.

Objective 4 | Think Regionally, Act Locally

Action 4.1 Participate in a region-wide climate change dialogue and planning process with municipalities, First Nations, Parks Canada and BC Parks to expand and integrate the Climate Change Adaptation Plan into future projects. (**Corporate Services**)

Supporting Actions

- ☐ Coordinate actions with other levels of government.
- ☐ Include support for climate change adaptation in existing planning documents and all new strategies moving forward.
- ☐ Formally share Ucluelet's Climate Adaptation Plan with neighboring ACRD members and First Nations.

Implementation and Governance

The CCCAP is intended to guide the District of Ucluelet and community partners to prepare for the impacts of climate change. As such, a strong focus on implementation, governance, and monitoring is essential to the Plan's success. Changes to federal and provincial legislation and regulations, as well as technological advances, are anticipated over the plan horizon; this will impact the long-range strategies, underscoring the importance of periodic review and adjustments to the CCCAP.

Oversight and Governance

It is intended that the CCCAP will be "municipally-led and community supported". The benefits of this model are that it enables the District to play a leadership role, while also sharing the responsibility for plan implementation. It also potentially allows for the leveraging of capital of the community for those actions that are beyond municipal responsibility. The District will coordinate with community stakeholders involved in implementation to produce an annual report that highlights progress made on both adaptation and mitigation actions in the region.

District Council

Council will be responsible for the endorsement of the Community Climate Change Adaptation Plan, and to receive and review annual progress reports on implementation actions and outcomes.

Funding

The adaptation actions identified in this Plan will be integrated into departmental workplans and budgets moving forward. Many actions fall within pre-existing departmental budgets, and departments will be responsible for identifying additional funding sources such as partnerships and grants for any actions without sufficient budget allocated.

It is recommended that the District continue to maximize available funding opportunities to advance the implementation of adaptation actions. There are multiple funding avenues that align with the implementation guidelines outlined in the CCAP, including but not limited to:

- Federation of Canadian Municipalities (e.g. Green Municipal Fund);
- Canada Revenue Agency tax incentives for industrial investments in energy conservation and clean energy generation;
- Real Estate Foundation of BC;
- Infrastructure Canada (e.g. Investing in Canada Infrastructure Program, Disaster Mitigation and Adaptation Fund);
- The Federal Canadian Industry Program for Energy Conservation (CIPEC);
- Trees Canada (e.g. Community Tree Grants);
- Community Healthy Living Fund (e.g. healthy eating and physically activity programming grants);
- Impact Assessment Agency of Canada (e.g. environmental assessment funding);
- EcoAction Community Funding Program
- Infrastructure Canada's Smart Cities Challenge

As funding opportunities are constantly changing, it will be important for District staff and community partners to continually research and monitor available opportunities to leverage for implementation.

Communication, Education and Outreach

The long-term success of the plan hinges upon an informed and involved community taking part in ongoing conversations about climate impacts and the benefit of climate action. The conversation must translate to action on both the individual and community-level. Integrating climate awareness into the mainstream practices and thinking of all community groups, residents, visitors and municipal staff will be essential in successfully maximizing our resiliency potential.

In order to ensure widespread community support and involvement, multiple mediums of communication and outreach should be utilized. These range from visual mediums (e.g. infographics, advertisements) and written media (e.g. government publications, newspaper articles, brochures, websites) to oral communications (e.g. group dialogue, presentations). Both internal and external communication will help increase public awareness and buy-in surrounding the CCCAP.

It is recommended that the District of Ucluelet, working with community partners, develop a communications strategy that keeps residents informed about the progress of the CCCAP and provides actions they can accomplish at home and in the community.

Monitoring and Review

Tracking progress is an important part of the monitoring and review process as it enables the District and Community to assess whether the actions outlined in this Plan are producing the desired results. It sets the stage for Plan longevity, as it allows the District and the community to build upon the networks created and lessons learned throughout plan development. Since

adaptation is a moving target, a monitoring framework also ensures that the community can assess whether local risks and vulnerabilities are changing and make required adjustments to the adaptation actions.

At a minimum the climate change projections, vulnerability and risk assessment will be reviewed every 5 years. In the event that new impacts, vulnerabilities or risks are identified a formal review of the Climate Change Adaptation Plan will occur. An implementation update report to council will occur on a bi-annual basis once implementation begins. As implementation progresses, it will be important for the District and its community stakeholders to develop indicators that measure if actions are succeeding in reducing vulnerability to climate change.

APPENDIX A – Climate Action Implementation Tables

OBJECTIVE 1 | Strengthen Infrastructure Resilience and Reduce Risk to Buildings and Property

Action 1.1	Address vulnerabilities to electrical distribution infrastructure and increase effective and transparent risk management.
Scope	Severe storm events are not a new phenomenon for the District of Ucluelet, particularly in winter months, but the frequency and intensity of these weather events are projected to increase across the region over time. An increase in extreme rainfall and wind events could cause extended power outages and damage to buildings and utility infrastructure, as was seen with the 2018 December windstorm that was responsible for the greatest outage in BC Hydro's history (BC Hydro, 2019). Weather-related service disruptions often impact the transportation network as well, further exacerbating the isolation of the community and potential vulnerability during extreme storm events. Addressing vulnerabilities to existing infrastructure and increasing management of these risks was identified as a priority to reduce impacts to the community and improve overall resiliency.
Current Practice	A facilities assessment has been conducted and district-owned buildings were reviewed to assess the need for back-up power. The resulting plan will dictate how many years it will take and how much it will cost, which is dependent on the size and composition of each building. Priority stations are expected to have back-up power in the next 5 years. While some work is already underway, the only building with back-up power in the community currently is the Fire Hall.

	OCP (2018) *Climate Action Goal* Ucluelet residents are resilient to climate change and energy scarcity and costs. *Servicing and Infrastructure, Objective 4D* To adapt municipal infrastructure systems to remain resilient to the impacts of a changing climate. **Strategic Plan (2019-2022)** *Strategic Focus Area 3: Asset & Infrastructure Management* Ucluelet has a significant investment in municipal infrastructure that sustains our community. We are responsible to current and future citizens to proactively and cost-effectively plan for and manage our assets to prevent deterioration and failure and ensure capacity to serve future needs.
Risks Addressed	Increase in extreme weather events causing damage to buildings and infrastructure, extended power outages, and disruption and delays in the transportation network. (Medium-high risk)
Supporting Actions	*Concrete/Operations* • Identify priority pump stations and upgrade with auxiliary power to respond to power outages • Identify priority buildings for new back-up power systems across the community *Policy and Planning* • Explore code options to mandate increased storm resilience in new developments • Improve building site inspection and planning protocols to maximize passive solar • Integrate climate adaptation measures into asset management *Research and Communication* • Conduct community engagement to raise awareness and educate residents on protocol and responses to critical infrastructure disruptions (e.g. 48 hours prep blitz twice per year) • Provide information and early warnings to visitors and community about hazards in advance of extreme weather and high wind events • Support organizing at the neighbourhood level to ensure redundancy in food security and power

	• Understand extreme weather impacts on buildings, partnering with existing initiatives to streamline (e.g. BC Housing's Mobilizing Building Adaptation and Resilience program) • Increase household resilience to electricity disruption by promoting clean energy solutions such as information on BC rebates and incentives for increasing household energy efficiency
Lead Organization(s)	District of Ucluelet
Department Responsible	Engineering Services
Potential Partners	BC Hydro, BC Transit Ucluelet Emergency Network Tourism Ucluelet & Tofino Chamber of Commerce Tofino-Long Beach Airport, Francis Barkley, Small Craft Harbour, Harbour Authority Alberni Clayoquot Regional District Ministry of Transportation and Infrastructure, Ministry of Forests, Lands, Natural Resource Operations and Rural Development, Department of Fisheries and Oceans Barkley Community Forest, Wild Pacific Trail, Pacific Rim National Park Reserve Columbia Fuels
Anticipated Timing	Upgrade to pump stations is already underway and is included in the 5-year plan, but it does not cover all stations. It is estimated it could take 5-7 years to complete.
Monitoring Metric	• Number of days of resiliency for the District (design based on target) • Percent of infrastructure with back-up power (priority stations and buildings) • Annual report for 2020 will report on climate metrics; can use this to track annual progress • Number of community engagement events held to raise awareness
Costing	High (> $1M)

Action 1.2	Conduct flood risk mapping for sea level rise and use results to communicate and manage risks.
Scope	The District of Ucluelet, being surrounded on three sides by the Pacific Ocean and its proximity to the Cascadia subduction zone, is a community that is acutely affected by the incremental and sudden changes to ocean conditions like storm surges, king tides, storm waves, climate change, sea

	level rise, and coastal erosion. Flood risk mapping is a crucial element of flood risk management, and an essential tool to avoid or minimize damage to life and property caused by floods (Flood Resilience Portal, 2020). One of the effects of climate change is a rise in sea level. While experts using the best available science are still grappling with a range of possible impacts, current expectations are that the sea level on the west coast of Vancouver Island will rise somewhere in the vicinity of one metre by the year 2100. Any development along the coastline must take this into consideration in an attempt to anticipate and minimize any negative impacts that rising sea levels may have on the built environment and the safety of residents (OCP, 2018).
Current Practice	Ucluelet was successful in its application for a $150,000 grant from the Province of BC to complete flood risk mapping of the community's coastline. The flood risk mapping will also assist in refining tsunami inundation levels that will support emergency response planning. **OCP** *GHG Policies – Public Infrastructure and Facilities* Policy 2.32: Review municipal infrastructure and assets for vulnerability to rising sea levels and increased storm events. *GHG Policies – Buildings* Policy 2.30: Establish and undertake the work, as necessary, to refine Flood Construction Levels to ensure new development and infrastructure avoids the impact of rising sea levels.
Supporting Actions	*Policy and Planning* • Integrate flood risk mapping into planning for future land-use decisions including changes to zoning • Develop concrete guidelines for future buildings and update the building bylaw and/or adopt new flood plain bylaw regulations • Continue to update flood construction levels as new flood risk and sea level rise data becomes available, and apply the appropriate regulatory tools to enforce them (e.g. zoning updates/bylaw creation, etc.) • Coordinate actions with other levels of government and neighbouring local jurisdictions *Research and Communication* • Create resources to educate homeowners on flood risks and options to mitigate damage to private property • Provide resources for retrofitting existing properties as well as for new builds

Lead Organization(s)	District of Ucluelet
Department Responsible	Community Planning
Potential Partners	District of Tofino, Pacific Rim National Park Reserve, Ucluelet Emergency Network
Anticipated Timing	Flood risk mapping will occur in 2020, and updates to data, legislation, and raising in awareness with the community should be ongoing.
Monitoring Metric	• Completion of new policy on FCLs • Building bylaw updated • Zoning bylaws updated • Integration of sea level rise planning into OCP
Costing	Medium: $100,000-$1M

Action 1.3	Understand vulnerabilities of Highway 4 and how disruptions could affect food security and other critical resources.
Scope	People travel to and within Ucluelet predominantly by car. Transportation is a key factor of how residents and visitors experience community life and the landscape. By land, Provincial Highway #4 connects Ucluelet and the Ucluth Peninsula to the eastern side of Vancouver Island. The Tofino-Ucluelet Airport, located approximately 24km to the northeast within the Pacific Rim National Park Reserve, serves people traveling by private and commercial airplanes (OCP, 2018). As the frequency in more extreme weather events increases, Highway #4 may face growing risks from more frequent and intense storm events including heavy rain and wind. This could trigger a wide range of impacts such as overland flooding, delays in construction, highway closures, and lack of access to emergency routes, services, and supplies for the community. There are a number of potential safety implications from impacts to the highway, and the District would benefit from a detailed vulnerability and risk assessment to determine where the community is most susceptible, and where they can take action to mitigate these impacts. With a better understanding of how the community may be affected, the District and community can better prepare for these events.
Current Practice	**OCP** *General Transportation Network, Policy 2.66* Ensure new development improves connections to Peninsula Road and the Pacific Rim Highway as the District's primary corridor, to promote improved local and regional transit service.

Supporting Actions	*Policy and Planning* • Update current planning procedures to account for increased climate-related closures to Highway #4 *Research and Communication* • Complete a vulnerability and risk assessment for climate impacts to the transportation corridor • Communicate findings of risk assessment with community to raise public awareness of personal preparedness • Manage impacts to medical centre/access resulting from impacts to transportation network
Lead Organization(s)	District of Ucluelet BC Transit
Department Responsible	Emergency Services
Potential Partners	Ministry of Transportation and Infrastructure BC Ambulance Service Joint Rescue Coordination Centre Emergency Management BC
Anticipated Timing	Medium-term (2-5 years)
Monitoring Metric	• Completion of vulnerability and risk assessment • Number of updates to existing planning and procedural documents • Number of public education initiatives
Costing	Med ($100,000-$1M)

Objective 2 | Enhance Resilience of Ecosystems and Protect Natural Areas

Action 2.1	Study current water systems and explore alternative measures to make the existing system more resilient.
Scope	Although average precipitation is expected to increase across the region, precipitation in summer months is expected to decrease by approximately 10%. Furthermore, higher winter and springtime temperatures will reduce the percentage of total precipitation occurring as snowfall. Less snow and more rain will lead to faster runoff and could contribute to water-scarcity issues because less water will be stored as snow and ice. These projected future conditions will also impact the depletion of aquifers, increasing wildfire risk.

	Tackling the issue of water quality and quantity into the future is best approached regionally. It is important for all surrounding municipalities, regional districts and First Nations governments to come together to discuss and plan for this risk to ensure no governing body is taking actions that might cause harm to another.
Current Practice	There is currently an established well-head protection area, as well as a Watershed Protection Plan. The District is working on a Water Master Plan and will be looking at how to maximize water storage next, as well as water filtration options. The District has applied for a grant to add filtration systems to their water supply system, and will do so over the next couple of years if successful. This planned upgrade to their current system would significantly increase the town's water supply, as well as reduce turbidity. Ucluelet Council allocated some budget to explore the feasibility of Kennedy Lake as an alternate water source, but there needs to be a significant amount of regional discussion, coordination, and collaboration before this could be seriously considered. Prioritizing water restrictions and conservation measures over new water sources decreases drought vulnerability for important ecosystems and increases overall community and ecosystem resilience. **OCP** *Water Storage:* There is a current shortfall in recommended storage volume requirements with the two existing reservoirs to meet fire flow standards, therefore the District should plan for constructing a new facility.
Risks Addressed	Rising annual temperatures impacting potable water supply through reduced snowpack and water storage issues. (Medium risk)
Supporting Actions	*Policy and Planning* • Develop a sustainable water planning strategy to reduce ecosystem drought vulnerability • Explore the creation of additional water storage capacity and invest in technology available for water capture • Conduct assessment to determine when a water filtration system will need to be installed • Ensure all buildings are on water meters and update bylaws/policies to reflect any changes to water conservation measures • Create and coordinate various plans (e.g. Emergency Drought Plan, Water Master Plan, Rain Catchment Plan, Water Conservation Study) to help ensure resilience of water supply

	• Develop a baseline for water consumption in the community so use can be monitored moving forward *Research and Communication* • Support development of regional conversation around managing water supply • Support household water conservation by creating incentives to reduce potable water use (e.g. provide rebates for water collection systems (cisterns & rain-barrels), increase costs for commercial users) • Update regulations for greywater use and increase public awareness about possibilities
Lead Organization(s)	Regional collaboration: Clayoquot Biosphere Trust Municipalities & Alberni-Clayoquot Regional District First Nations Parks Canada
Department Responsible	Engineering Services
Potential Partners	Tourism Ucluelet School District Surf Rider Chamber of Commerce
Anticipated Timing	A lot of this work can be completed in the medium-term (2-5 years), but there are a variety of components that would be ongoing (e.g. regional collaboration, community education).
Monitoring Metric	• Development of or updated water-planning documents and strategies • Amount of annual/seasonal water consumption (once a baseline is identified) • Creation of regional watershed working group – afterwards: number of meetings, number of organizations involved • Installation of water filtration system
Costing	High (> $1M)

Action 2.2	Create an Invasive Species Action Plan and coordinate with existing initiatives.
Scope	Climate change is expected to impact the spread of invasive species throughout the District due to warmer, drier summers, rising annual temperatures, as well as a decline in snowpack and freezing temperatures. Some invasive plant species are more prolific at spreading wildfire and reducing ecosystem resilience to this threat. Ucluelet is already home to a

	variety of invasive species, most notably Scotch Broom and Knotweed, which are largely managed by volunteer organizations. Developing a plan to manage the spread of invasive species is critical to keep them under control, as the goal of eradication may not always be feasible.
Current Practice	Ucluelet Council has had preliminary discussions about allocating budget towards addressing invasive species in the area. At the last Union of BC Municipalities (UBCM), the Ministry of Transportation highlighted vehicles travelling along Highway 4 as a driving factor in spreading invasive species to the District, and indicated the potential of allocating some budget towards managing this spread. This would include budget towards awareness raising and education. The volunteer organization Broombusters currently operates in Ucluelet, and the community also benefits from a day of invasive species action, 'Knotweed Day'. The District of Ucluelet is committed to the responsible stewardship of its natural resources and preservation of the local environment for future generations (OCP, 2018). Objective 2A To develop carefully and use land wisely to ensure that the most sensitive and valuable environmental features are protected, and ecological functions are not irreparably disturbed.
Risks Addressed	Rising annual temperatures increasing the spread of invasive species and plant diseases, threatening native species. (Medium risk)
Supporting Actions	*Research and Communication* • Support research and monitoring for invasive species and plant diseases • Support monitoring and management of invasive species in the marine environment (e.g. by encouraging boat rinsing) • Assess priority areas to focus on (e.g. parks, road edges, habitat impacts) • Increase public education and awareness raising campaigns on invasive species management
Lead Organization(s)	District of Ucluelet
Department Responsible	Engineering Services
Potential Partners	Ministry of Transportation and Infrastructure Central West Coast RainCoast Education Clayoquot Biosphere Trust Pacific National Rim Park Wild Pacific Trail Society

	Tourism Ucluelet West Coast NEST
Anticipated Timing	Medium-term (2-5 years) Tackling invasive species isn't as high of a priority as some other areas in the District such as water supply, and expanding current initiatives to become more coordinated will take time. Volunteers can increase this time scale and momentum.
Monitoring Metric	• Completion of Invasive Species Action Plan • Plan will determine other monitoring metrics • Number of community events targeted at invasive species removal • Number of public engagement/awareness raising opportunities (e.g. social media posts, booths at community events)
Costing	Low (< $100,000)

Action 2.3	Support local activities to maintain wild fish stocks and habitat.
Scope	Climate change is already impacting fish stocks, which creates a complex web of adverse effects for fishermen, hatcheries, and communities involved with aquaculture or the fishing industry more broadly. Healthy aquatic habitats are critical for the survival of fish, fish supportive processes and are important to maintain biodiversity. Unnecessarily disturbing these sensitive and important aquatic environments may harm their vitality and the ecological services they provide and can have downstream consequences on fish habitat (OCP, 2018). With rising ocean temperatures and acidification, reduced stream flows in summer months, and warmer river temperatures, exacerbated by a growing quantity of plastics and contaminants in the marine system, marine health is challenged from many different angles.
Current Practice	Hatcheries play an important role in helping us understand new climate realities and can help us learn about the varying impacts warmer temperatures will have on different species of salmon. Ucluelet's Thornton Creek Hatchery collects valuable enumeration data and DNA samples for the Department of Fisheries and Oceans, which can be used to track changes to population health and numbers. The District has a Development Permit Area (DPA) for Stream and Riparian Areas Protection to ensure sufficient water for fish, to protect and restore fish habitat, and to improve riparian protection and enhancement (VI). This is in conformance with the objectives of the provincial Fish Protection Act. The next update to the OCP will clearly define riparian development areas and permit requirements to protect wild fish stock and habitat.

Risks Addressed	Rising ocean and air temperatures and increasing acidification stressing aquatic species. (Medium risk)
Supporting Actions	*Policy and Planning* • Research additional land-use regulations and bylaws that could improve aquatic habitat protection • Clearly communicate riparian development permit areas and increase existing management *Research and Communication* • Increase advocacy and public awareness of organizations like the Hatchery and the Aquarium and the services they provide • Host education session with local realtors and builders to communicate risks
Lead Organization(s)	Area C District of Ucluelet Alberni-Clayoquot Regional District
Department Responsible	Community Planning
Potential Partners	Thornton Creek Hatchery Tla-o-qui-aht Tribal Parks Ucluelet Aquarium Society West Coast N.E.S.T. Clayoquot Biosphere Trust Raincoast Education Society Central Westcoast Forest Society
Anticipated Timing	Long-term (5+ years); Ongoing
Monitoring Metric	• Amendment to existing policies or bylaws • Creation of new policies or bylaws • Number of public engagement events
Costing	Med ($100,000-$1M)

Action 2.4	Explore funding opportunities to develop a Biodiversity Network Plan to ensure priority ecosystems are protected in municipal land-use planning bylaws (with regional partners).
Scope	Healthy ecosystems and biodiversity are fundamental to life on our planet, particularly in mitigating the impacts of climate change and supporting a more resilient natural environment (Hoffman, 2015). Ucluelet is home to rich plant and animal habitat due to the peninsula's interface between the terrestrial and marine environments. The ecosystems here are a complex

	and fragile array of diverse flora and fauna which depend on the health and resources of the ocean and temperate rainforest (OCP, 2018). Areas with high carbon sequestration value such as saltmarshes, eel grass beds, heath/bog forests, wetlands, and estuaries are examples of priority ecosystems to protect via regulations and policies. Additionally, natural areas that act as wind buffers prevent water erosion & provide slope stability, and contiguous forest canopy cover maintains temperature gradients for wildlife corridors.
Current Practice	**OCP** *Objective 2E:* Recognize, enhance and protect key areas for biodiversity and sensitive marine, terrestrial, and riparian ecosystems within the parks and trails network (OCP, 2018).
Supporting Actions	*Policy and Planning* • Expand the percentage of greenways and parks as a required component of development proposal approvals • Identify key areas for ecological restoration and prioritize these areas as a land-use category • Reduce percentage of allowable land-clearing per hectare to ensure land-use planning bylaws are aligned with biodiversity conservation goals • Develop targets for % canopy cover to maintain temperature gradient and % land-cover to reduce erosion and mitigate vulnerability to flooding • Prioritize wildlife corridors and habitat protection in land-use planning bylaws • Revise zoning bylaws to reflect limits-to-growth in areas vulnerable to sea-level rise, flooding and storm impact • Maintain vegetation buffers, forested canopies and green zones as part of a comprehensive climate change impact land-use plan • Develop a baseline to monitor tree health and manage impacts of extreme events on trees *Research and Communication* • Raise awareness of some of the issues facing habitats in the area • Coordinate a regional discussion of landscape-scale habitat connectivity and key species for corridor design (e.g., large predators, amphibians?)
Lead Organization(s)	Regional Initiative
Department Responsible	Community Planning

Potential Partners	District of Ucluelet, District of Tofino, Alberni-Clayoquot Regional District, First Nations Clayoquot Biosphere Trust Pacific Rim National Park Reserve
Anticipated Timing	Medium-term (2-5 years)
Monitoring Metric	• New bylaws, policies created • Amendments to existing bylaws and policies • Development of targets for canopy and land-cover • Baseline for monitoring tree health
Costing	Low (< $100,000)

Action 2.5	Through the Integrated Stormwater Management Plan, create bylaws, policies or plans to protect habitats.
Scope	Situated in a coastal rainforest, Ucluelet is blessed with an abundance of rainfall. Stormwater collected in pipes and discharged directly to watercourses or the foreshore creates a potential for erosion and discharge of contaminates, which can be harmful to fish and the environment. Healthy aquatic ecosystems have a capacity to retain stormwater runoff, maintain water quality by reducing levels of sediment, nutrients and contaminants in outflow water, to slow water flow and to prevent erosion (OCP, 2018). As risks emerge and systems age, we have an opportunity to improve stormwater management through the application of Green Stormwater Infrastructure (GSI), which can mitigate flooding, lower infrastructure upgrade costs, while providing a suite of social, economic, and environmental benefits to the community. Developing policy that mandates consideration for GSI and developing the resources to help with GSI literacy will support expansion of GSI and improve stormwater management across the watershed. Development Permit Areas (DPAs) are another effective way to improve stormwater management, while protecting riparian areas from the effects of warmer temperatures and drier conditions.
Current Practice	The development of a Stormwater Management Plan is currently underway and included in the District's 5-year financial plan. There is budget allocated towards this initiative. **OCP** *Servicing and Infrastructure Objective 4F*

	To adopt an environmentally sound, integrated stormwater management strategy. Several projects in Ucluelet have shown rainfall can be collected in gravel filled trenches and topsoil to dissipate stormwater run-off in a more natural way into the ground. The District will explore options to expand this approach, when updating municipal servicing standards. In addition, the District encourages developers to retain forest cover during subdivision development (i.e. only clear what is necessary to construct the infrastructure and roads) and retain pockets of forest land to the extent possible.
Supporting Actions	*Policy and Planning* • Update Subdivision and Development Servicing Standards Bylaw to incorporate green/lean infrastructure • Update or create new policies, bylaws, and DPAs to effectively manage stormwater and enhance natural habits and ecosystem services *Research and Communication* • Take a natural assets and ecosystem services approach to managing stormwater through exploring a Municipal Natural Asset program or working with Municipal Natural Assets Initiative • Public education and awareness raising on stormwater management and green stormwater options available for private property • Explore incentive programs to encourage green stormwater management on private property
Lead Organization(s)	District of Ucluelet
Department Responsible	Engineering Services
Potential Partners	Harbour Authority Department of Fisheries and Oceans Municipal Natural Assets Initiative (MNAI)
Anticipated Timing	Medium-term (2-5 years)
Monitoring Metric	• Completion of Integrated Stormwater Master Plan • Number of public engagement events held • Number of updates to existing policies/bylaws/ DPAs • Number of new policies or bylaws created to manage stormwater and protect natural areas • Creation of incentive program

Costing	Med ($100,000-$1M)

Objective 3 | Improve Public Safety and Preparedness

Action 3.1	Complete Emergency Operations Centre (EOC) training and update EOC to continue to be prepared for extreme events.
Scope	With increasing frequency and severity of extreme weather, risks to the District are expected to grow. Climate readiness and emergency preparedness is a moving target, and it is crucial that departments within the District as well as the community as a whole understand how to respond in an emergency situation. It is also important for departments within the District to have up-to-date business continuity plans and an understanding of these procedures so staff can continue to offer core services in the event of an emergency or prolonged extreme weather event. Emergency preparedness should be practiced, and plans updated on an annual basis to ensure resiliency to increasingly severe weather events.
Current Practice	Ucluelet's Fire Hall is currently the full-time Emergency Operations Centre for the District. They have been providing training consistently over the past year and continue to do so to support preparedness in the community. Looking to the future, the District will be assessing other buildings in the community for future use and considering renovations to the current EOC including upgrades to bathroom facilities and more space for people to gather. Decisions on future renovations will be reflected in the budget for the next few years.
Risks Addressed	Increase in extreme weather events causing damage to buildings and infrastructure, extended power outages, and disruption and delays in the transportation network. (Medium-high risk)
Supporting Actions	*Policy and Planning* • Encourage all departments to review and update Business Continuity Plans

	• Schedule annual mandatory exercises to ensure adequate knowledge of EOC operations *Research and Communication* • Share results of Ucluelet's climate change adaptation project with emergency management network. Improve and refine current training based on outcomes. • Update extreme event kits for staff to manage closures • Confirm scope of responsibilities of various union members for response and recovery • Develop educational signage for visitors to make them aware of risks and to provide response information • Coordinate specialized training for responders (e.g. Coast Smart, Adventure Smart) • Engage with community and regional stakeholders to identify duties, responsibilities and response protocols strengthening collaboration and coordination • Create and promote opportunities for small businesses to learn about emergency management • Continue to engage with residents and community service providers about personal preparedness and critical service delivery
Lead Organization(s)	Ucluelet Fire Department – Fire Chief District of Ucluelet
Department Responsible	Emergency Services
Potential Partners	Tourism Ucluelet Ucluelet Volunteer Fire Brigade (UVFB) BC Search and Rescue, BC Ambulance Service, Emergency Management BC RCMP RMSAR, Coastguard, Joint Rescue Coordination Centre
Anticipated Timing	Short Term (<2 years); Ongoing
Monitoring Metric	• EOC training completed • Number of trainings completed for responders • Results shared with emergency management network • Number of educational signs in community with risk, recovery and response information • Completion of annual exercises • Number of opportunities for small businesses to learn about emergency management • Number of opportunities for residents and community service providers to learn about personal preparedness
Costing	Low (< $100,000)

Objective 4 | Think Regionally, Act Locally

Action 4.1	Participate in a region-wide climate change dialogue and planning process with municipalities, First Nations, Parks Canada and BC Parks to expand and integrate the Ucluelet Climate Change Adaptation Plan into future projects.
Scope	Most climate impacts and risks transcend political and geographic boundaries. Similarly, many of the actions that can reduce risks caused by climate change are more effectively addressed through a regional lens. The District's 2019-2022 Strategic Plan states: "We are stronger together. There are many advantages and efficiencies to be achieved through sharing our respective aspirations and collaborating with our neighbors for the greater good of our communities. Shared resources and expertise can reduce costs and enhance productivity while a strong, collective voice on important issues in our area can positively influence decisions and policies of government. It is also important to advocate for our community through these discussions."
Current Practice	The District of Ucluelet's current Strategic Plan is for the time period of 2019-2022 and does not include climate change as a top priority. However, the 4th Strategic Focus Area is *Partnership and Collaboration,* with the goal to "enhance the effectiveness of our services and our advocacy efforts by fostering strategic collaboration and partnerships with our neighboring communities". This includes the development of a Collaboration Model; a formal structure to support collaboration between neighbouring communities and First Nations. Areas for collaborative planning include Regional Planning, Water, Protective Services, and Transportation.

Supporting Actions	*Policy and Planning* • Incorporate climate adaptation into the pre-existing list of areas to discuss as a region (as determined in Strategic Focus Area 4 of the Strategic Plan) • Create a platform (forum, event, series of meetings, etc.) to talk about regional priorities such as emergency planning, land-use planning, regional planning, and explore how climate adaptation/mitigation planning fits into each of these areas *Research and Communication* • Formally share Ucluelet's Climate Adaptation Plan with neighboring ACRD members and First Nations • Host an engagement event starting in 2020 to explore how the region can better work together and establish an annual process for cooperation • Explore possibility of creating a regional natural asset management initiative
Lead Organization(s)	District of Ucluelet
Department Responsible	Corporate Services
Potential Partners	Municipalities and First Nations within the Alberni-Clayoquot Regional District BC Parks Parks Canada
Anticipated Timing	Begin planning for collaborative events in 2020/2021 Long-term (5+ years); Ongoing
Monitoring Metric	• Number of communities in the region that have been engaged in dialogue about Ucluelet's adaptation planning process • Number of regional events held • Creation of regional plans, policies, documents, etc.
Costing	Low (< $100,000)

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 expect 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 Change Data and Scenarios Tool: The Canadian Climate Data and Scenarios (CCDS) site was originally launched in February 2005 with support from Environment and Climate Change Canada the Climate Change Adaptation Fund (CCAF) and the University of Regina. The CCDS supports climate change impact and adaptation research in Canada through the provision of climate model and observational data.

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 (H_2O), carbon dioxide (CO^2), methane (CH_4), nitrous oxide (N_2O), ozone (O^3), 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 risk = *likelihood* x *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 – Acronyms

ACRD – Alberni-Clayoquot Regional District

CCCAP – Community Climate Adaptation Plan

DPA – Development Permit Area

EOC – Emergency Operations Centre

FCLs – Flood Construction Levels

GIS – Green Stormwater Infrastructure

IPCC – Intergovernmental Panel on Climate Change

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