February 2018

MANAGING CLIMATE CHANGE RISKS: AN INDEPENDENT AUDIT

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The Honourable Darryl Plecas
Speaker of the Legislative Assembly
Province of British Columbia
Parliament Buildings
Victoria, British Columbia
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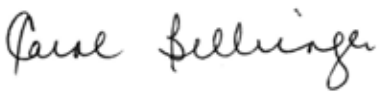
Dear Mr. Speaker:

I have the honour to transmit to the Speaker of the Legislative Assembly of British Columbia the report, *Managing Climate Change Risks: An Independent Audit.*

We conducted this audit under the authority of section 11 (8) of the *Auditor General Act* and in accordance with the standards for assurance engagements set out by the Chartered Professional Accountants of Canada (CPA) in the CPA Handbook —Canadian Standard on Assurance Engagements (CSAE) 3001 and Value-for-money Auditing in the Public Sector PS 5400.



Carol Bellringer, FCPA, FCA
Auditor General
Victoria, B.C.
Date of Report: November 28, 2017

AUDITOR GENERAL'S COMMENTS

Climate change is one of the greatest challenges the world is facing. Over the past months, natural disasters have made headlines across the globe. Here in B.C., we too, are already feeling the impacts of climate change. The summer of 2017 saw wildfires burning across the province, breaking records for the greatest number of hectares burned. This past spring, heavy rains combined with the snowmelt and flooded the Okanagan.

Carol Bellringer, FCPA, FCA
Auditor General

These events highlight the environmental, economic and social threats that climate change poses to the province. From 1900 to 2013, B.C.'s average temperature has increased faster than the global average. Scientists predict that the province will face increases in extreme weather, rising sea levels, increasing risk of wildfire and flooding, as well as a change in the location of ecosystems and species that live there.

In Canada, the 2017 *Pan-Canadian Framework on Clean Growth and Climate Change* brought together federal, provincial and territorial governments in an effort to find solutions.

Climate change requires two responses: mitigation (reducing greenhouse gas emissions) and adaptation (reducing the potential harms and negative impacts climate change may cause). We need both of these responses to create a climate-resilient province.

Without mitigation, the need for adaptation increases, and there are limits to the degree of change we can adapt to. However, even if all B.C.'s greenhouse gas (GHG) emissions ended tomorrow, significant change would likely still occur, so the province needs to be prepared. Actions to mitigate and adapt should complement each other.

AUDITOR GENERAL'S COMMENTS

Overall, we found the B.C. government is not adequately managing the risks posed by climate change. It is very likely that B.C. will not meet its 2020 emissions reduction target of 33% below 2007 levels, and models suggest the province is not on track to meet the 2050 target.

Government has work underway to adapt to climate change, but more needs to be done. Government has not comprehensively assessed the risks posed by climate change, and doesn't have a plan to move forward. Actions are taking place at the ministry level—notably to build a strong foundation of knowledge and develop tools—but adaptation needs to be better integrated into policies and decision-making processes.

Key climate-driven risk areas, like flooding and wildfires, require additional attention. We found that government may not be able to manage flood risks, given that roles and responsibilities are spread across many agencies and levels of government, and these organizations may not have adequate staffing or technical capacity. Government's current activities to prevent wildfires are not sufficient, as a substantial number of hectares of forest require fuel treatments. Treatments have not been occurring in a coordinated manner, nor have they been targeting areas of highest risk.

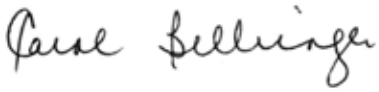
Adaptation is not just a provincial government issue. Local governments are on the front lines, but we heard that they are challenged to effectively take action. This includes a lack of financial support, reliable data and knowledge, and policies at the provincial level. As well, the provincial government has not yet significantly involved First Nations in provincial action.

Given that B.C.'s actions are part of national and international efforts to reduce emissions and adapt to climate change, it is fitting that we completed this audit work as part of a Canada-wide collaborative audit project on climate change. Together with audit offices across Canada, we looked at how provincial, federal and territorial governments are meeting their commitments to reduce GHGs and adapt to climate change. The audit offices involved will compile this work into a summary report and

create a high-level snapshot of climate change action across the country. This report will be released in 2018 and will be made available on our website.

Although we looked at a sample of ministries, the lessons learned may have broader applications. Other provincial government ministries have an opportunity to consider whether the audit findings may be relevant to their operations and respond accordingly.

I would like to thank everyone we worked with, especially staff from the ministries who were extremely cooperative and engaged throughout this entire audit.



Carol Bellringer, FCPA, FCA
Auditor General
Victoria, B.C.
February 2018

REPORT HIGHLIGHTS

ADAPTATION PLAN
NOT UPDATED
SINCE 2010

ADAPTATION
(REDUCES HARM)
+
MITIGATION
(REDUCES EMISSIONS)
=
MANAGING CLIMATE CHANGE

provincial supports for LOCAL GOVERNMENT **ADAPTATION ARE LIMITED**

Government
HASN'T FULLY ASSESSED RISKS TO B.C.
from
climate change

1.4°C INCREASE
in B.C.'s average
TEMPERATURE
from
1900
to
2013

B.C. EMITS
9% of Canada's
TOTAL EMISSIONS

CLIMATE-RELATED RISKS INCLUDE
FLOOD,
WILDFIRE
AND
DROUGHT

2020 GHG
REDUCTION TARGET
likely
NOT MET

SUMMARY

Climate change poses economic, environmental and social threats to British Columbia. The impacts of climate change are already being felt in the province and will likely increase in severity.

B.C.'S EMISSIONS

Climate change is linked to emissions of greenhouse gases (GHG) from human activity. B.C. emits 9% of Canada's total GHG emissions. B.C.'s per capita emission levels are high when compared to the world average. B.C.'s GHG emissions come from a range of different emission sources. The main sources include transportation (39%) and the combustion of fuel to produce energy and heat (31%).

POTENTIAL IMPACTS IN B.C.

The average temperature in the province has increased 1.4°C from 1900 to 2013, higher than the global average. The province may experience a number of potential impacts, such as:

- an increase in extreme weather events
- more frequent and severe heat waves
- higher risk of wildfires
- rising sea levels
- geographical shift in infectious diseases and pests
- shift in the range of ecosystems and species

WE NEED BOTH ADAPTATION AND MITIGATION

There are two main responses to climate change: adaptation and mitigation.

Adaptation involves activities that reduce the negative impacts of climate change, while taking advantage of potential new opportunities.

Mitigation involves action to reduce the sources, or enhance the sinks, (natural or artificial reservoirs, such as forests, that absorb more carbon from the atmosphere than they release) of greenhouse gases to reduce the extent of future climate change.

We need both adaptation and mitigation to create a climate-resilient province. It is important that government's actions for each response are complementary. And, government must make an effort to achieve the co-benefits from adaptation and mitigation (e.g., constructing a building that is both well-insulated against heat waves and is low emission).

SUMMARY

CLIMATE ACTION IN B.C.

The Ministry of Environment & Climate Change Strategy's (ENV) Climate Action Secretariat (CAS) is responsible for coordinating a whole-of-government approach to mitigation and adaptation in the province.

A number of other ministries have roles and responsibilities related to reducing GHG emissions and reducing potential harms from climate change. These include the Ministry of Forests, Lands, Natural Resource Operations and Rural Development (FLNR), the Ministry of Transportation and Infrastructure (TRAN), Emergency Management BC (EMBC), the Ministry of Agriculture (AGRI) and the Ministry of Municipal Affairs and Housing (MAH).

Local governments in the province also play an important role in adapting to climate change and reducing GHG emissions. Local governments are often the first to feel climate impacts, and their mandate includes many services that will be directly impacted by climate change.

WHAT WE LOOKED AT

We carried out this audit to determine whether the B.C. government is adequately managing the risks posed by climate change. We assessed both responses to climate change:

- **Adaptation:** whether government is adequately adapting to the risks posed by climate change. This would include:
  - risk or vulnerability assessment
  - comprehensive strategy on adaptation
  - monitoring and public reporting on performance
  - implementation of the adaptation strategy
- **Mitigation:** whether government is taking adequate action to meet provincial emission reduction targets

We did this audit work as part of a collaborative audit project on climate change that will look at how federal, provincial and territorial governments in Canada are meeting commitments to reduce greenhouse gas (GHG) emissions and to adapt to climate change.

WHAT WE CONCLUDED

We concluded that government is not adequately managing the risks posed by climate change.

Adaptation

The ministries within our audit scope have work underway to adapt to the risks posed by climate change, but more needs to be done across government.

Mitigation

Government has not taken adequate action to meet provincial emission reduction targets.

SUMMARY

KEY FINDINGS – ADAPTATION

Government has not completed a comprehensive risk assessment or prioritized risks

Risk assessment is a crucial step in adapting to climate change, because it provides decision-makers with clear information for allocating funds and planning for the future. Ministries and partner organizations conducted a number of sector-specific risk assessments (e.g., mining or agriculture). However, government has not completed a comprehensive risk assessment or prioritized among climate-driven risks across the province.

A robust, prioritized, publicly available risk assessment can help ensure that all government ministries and partners are clear about which risks exist and which are the most critical to mitigate.

Government does not have a clear plan to move adaptation forward

In 2010, government released *Preparing for Climate Change: British Columbia's Adaptation Strategy*, which provides general direction for adaptation in the province. However, the strategy does not include many aspects we expected to find, such as:

- prioritization among risks
- consideration of social and economic costs
- clear deliverables, and roles and responsibilities
- timelines and dates of completion

In addition, government has not refreshed or rewritten the strategy since its release, and it is now outdated. New information is emerging on the expected impacts and threats of climate change, and an updated plan is required to move adaptation forward in the province.

Ministries have not implemented all deliverables in the adaptation strategy

The adaptation strategy required action in three different areas:

- build a strong foundation of knowledge
- make adaptation part of government's business
- assess risks and implement priority adaptation actions in sectors

Ministries have taken action in each of these areas, however many of the actions were preliminary and ministries are in various stages of planning for future adaptation work.

Ministries have made significant progress to build a strong foundation of knowledge. And, ministries have engaged with climate scientists in the province, and created a number of tools to assist decision-makers.

Lack of mandate, resources and capacity are limiting action

We identified some obstacles that could make it more difficult for ministries to implement adaptation activities. These included a lack of mandate to complete adaptation work and a lack of resources and capacity, both financial and human, to implement adaptation actions.

SUMMARY

Gaps exist in available climate data

The collection of climate data by government is necessary for risk assessment, planning and informed investments. A number of ministries and partners run networks of monitoring stations to collect climate data (e.g., temperature, precipitation, snow depth). However, there are gaps in the data.

Geographically, climate networks do not meet international standards for station density, and gaps exist in the northern regions of the province and at high elevations. In addition, there are gaps in hydrometric and groundwater monitoring in the province.

Improvements to monitoring can provide better forecasts of emergent conditions and better modelling of future impacts.

KEY CLIMATE-RELATED RISK AREAS

Throughout our work, three climate-related risk areas emerged as being highly significant in the province. These were:

- flood
- wildfire
- drought

Government may not be able to effectively manage increasing flood risks

Given the impacts of climate change, flood risk will likely increase in the province. Government needs to shift its approach to managing flood risk, as we found challenges with the current approach. These include:

- roles and responsibilities are spread across ministries and split between the provincial and local governments
- local governments have limited incentives to take action to reduce risk
- provincial government and local governments may not have adequate staffing or technical capacity
- flood-plain maps are largely outdated
- diking infrastructure will likely not be sufficient in the face of increasing flood risks

Government recognizes that these challenges exist and it is working to address them. We have made recommendations for it to include in its planned work.

Wildfire prevention activities are not sufficient

Wildfire risks will increase as temperatures rise in the province. Although government has a number of initiatives in place to prevent and mitigate wildfires in the province, to date, these initiatives have not been sufficient to substantially reduce the fire risk.

SUMMARY

The number of hectares of land requiring fuel treatment in the province is extremely high. The current approach to reducing risk has been fragmented, and treatments are not always done in the areas of highest risk.

Government has not completed a comprehensive risk assessment and does not know the broader costs of wildfire to B.C.'s economy. We found that there is a need for more research into how climate change will impact fire behaviour, areas of high risk, timing of fires and how to effectively address risks.

Government is shifting to a proactive focus on drought

Similar to the other risks discussed, seasonal droughts will likely become more frequent and severe in the province. Ministries are working on a proactive drought strategy to better prepare B.C. for future droughts. There may also be a need for greater water storage capacity and infrastructure for communities and agriculture, as patterns of precipitation shift.

Government has provided local governments with limited and inconsistent supports

As part of our audit work, we spoke to a sample of 33 local governments across the province and reviewed self-reported actions on adaptation from all local governments in B.C.

Within our sample, local governments reported that the supports provided by the provincial government for adaptation were scattered, inconsistent and limited. Local governments reported they faced barriers to implementing adaptation actions, such as:

- lack of financial support from higher levels of government
- lack of reliable data and knowledge
- lack of resources (e.g., staff time and capacity)
- a need for stronger policies and plan from the provincial level

KEY FINDINGS – MITIGATION

Government has adopted legislated emission reduction targets

Under the *Greenhouse Gas Reduction Targets Act*, B.C. adopted two legislated GHG emission reduction targets:

- 33% below 2007 levels for 2020
- 80% below 2007 levels for 2050

Government also established two interim targets:

- 6% below 2007 levels for 2012
- 18% below 2007 levels for 2016

SUMMARY

Government's implementation plan does not describe how it will meet the emission reduction targets

Government released the *Climate Leadership Plan* in August 2016 that outlined its planned actions to reduce emissions. However, the plan does not build a clear and measurable pathway to meeting B.C.'s emission reduction targets.

Delaying action to the future means that policies or actions taken may be more costly and disruptive.

Government will likely not meet the legislated 2020 emissions reduction target

Government has not yet reported on whether or not it has achieved the 2016 interim target. Government has acknowledged that it is not in line to meet the 2020 targets.

Emissions modelling indicated that government was also not on a trajectory to meet the 2050 target. Looking forward, the Forest Carbon Initiative is expected to result in substantial reductions. However, with increased wildfire risk and other forest disturbances, there is a risk that these reductions will not take place or will be less than expected.

Meeting future emission reduction targets will be partly dependent on the size of the liquified natural gas (LNG) industry that develops in the province. Development of large-scale LNG production will substantially increase provincial emissions.

Government has regularly reported to the public on progress towards GHG reduction targets

Government committed to publishing reports on progress towards GHG reduction targets every two years. Government has met this commitment, though the 2016 reporting provided less detail than reporting done in 2012 and 2014.

SUMMARY OF RECOMMENDATIONS

FOR ADAPTATION WE RECOMMEND THAT GOVERNMENT

To build the overall framework

1 undertake a province-wide risk assessment that integrates existing risk assessment work and provides the public with an overview of key risks and priorities.

2 create an adaptation plan for B.C. that:

- clearly outlines government's priorities, roles and responsibilities, and timelines
- identifies the necessary resources for implementation
- integrates with existing adaptation planning at the ministry level
- includes solutions for obstacles identified through the audit
- clearly outlines how government will work with local governments and include them in its development
- clearly outlines how government will work with First Nations, and include them in its development
- includes a requirement to refresh every five years

To implement adaptation within ministries

3 provide staff with a continuing education program on climate change impacts and adaptation.

4 work with local government and other stakeholders to assess the effectiveness of existing tools and resources for local governments and agricultural producers, and take action on their findings.

5 consider climate change adaptation in its legislation, regulation, approvals and permitting processes.

SUMMARY OF RECOMMENDATIONS

To monitor and report on performance

6 create a performance monitoring framework based on the goals, activities and outcomes outlined in the adaptation plan (see recommendation #2).

7 improve public reporting, including providing detailed public reporting on adaptation when completing legislated reporting on mitigation.

To improve data

8 identify priority unmet climate data needs and fill gaps accordingly. This work should be done in collaboration with network operators as well as with users, such as flood forecasters and climate modellers.

To address key climate-driven risks

9 as part of their flood risk strategy:

- review roles and responsibilities for flood management in the province and clarify leadership
- set clear objectives that target areas of high priority and/or high risk
- link funding allocations to areas of high priority and/or high risk
- assess current capacity to meet objectives and identify and fill gaps
- tie flood mitigation funding for local governments to commitments to address risk at the local level

10 create a flood-plain and hazard mapping program that:

- incorporates the effects of climate change and land-use change
- provides mapping standards with ongoing updates
- has expertise available for local governments to draw upon

SUMMARY OF RECOMMENDATIONS

11 conduct and support research into climate change and wildfire behaviour and incorporate findings into BC Wildfire Service planning.

12 create an overall strategy to address hazardous fuel risks that:

- uses a risk-based approach when allocating funds to reduce wildfire hazard
- ties wildfire mitigation funding for local governments to commitments to address risk at the local level

13 create additional educational materials and incentives for the public that focus on behavioural change to reduce wildfire hazard.

14 complete its work on a proactive drought management strategy, including an assessment of the potential risks to water resources and efficacy of potential strategies to manage them that is updated on an ongoing basis.

To address local government needs

15 assess more fully the challenges facing local governments around climate change adaptation, identify priority areas and take action on the findings.

FOR MITIGATION WE RECOMMEND THAT GOVERNMENT

16 create a clear, measurable plan to meet legislated targets, including clear accountabilities, emission estimates and baselines, resources, timelines, and interim targets. Government should also consider co-benefits with adaptation.

17 publish information regarding its use of offsets within the provincial inventory to provide clarity and consistency with the progress to targets report.

RESPONSE FROM THE AUDITEES

Climate change is the greatest challenge of our generation. It is felt in British Columbia and around the world, affecting almost all aspects of our lives. We agree with the Auditor General that acting on climate change, both to reduce risks from the impacts of the changing climatic conditions (adaptation) and to minimize greenhouse gas emissions (GHGs) to reduce future climate change (mitigation), is necessary now and will require a concerted effort for the foreseeable future. To that end we wholeheartedly accept the recommendations in the report and will establish a process to ensure their intent is achieved. The ministries audited thank the Auditor General and the audit team for their work reviewing how the B.C. government is responding to climate change. Their report provides guidance for new actions to further address the risks posed by changing climate.

The new provincial government remains committed to reducing GHGs to 80% below 2007 levels by 2050 and will legislate a 2030 GHG reduction target of 40% below 2007 levels. Government will establish sectoral targets and plans for built environment, industry and transportation sectors to facilitate meeting the legislated, short and longer term targets. Government is increasing the carbon tax by $5 per tonne per year, beginning April 1, 2018 to $50/tonne in 2021.

In support of the implementation of the 17 recommendations, Government has established a Climate Solutions and Clean Growth Advisory Council. How to best address climate adaptation will be a part of the broader, strategic advice the Council will provide government working with and reviewing options developed by the Climate Action Secretariat. The Council's mandate also includes reporting on government's progress towards meeting emissions reduction targets and maximizing job and economic opportunities offered by proactive climate action.

Government has begun to address the recommendations in this report. Government agrees a core element necessary to inform action on adaptation is a provincial risk assessment (*recommendation 1*). The Climate Action Secretariat (CAS) has initiated this process. In addition, CAS has developed a draft monitoring and evaluation framework that tracks B.C.'s readiness for adaptation. The framework is ready for piloting in spring 2018 (*recommendation 6*).

Outside of CAS, other ministries have significant work underway that supports the recommendations. The Ministry of Agriculture is working to ensure that its Climate Adaptation Program, under the federally funded Growing Forward 2, will be enhanced under the Canadian Agricultural Partnership (2018-2023) (*recommendation 4*). The Ministry of Transportation and Infrastructure developed a Climate Adaptation and Resilience Work Plan in June 2017 to meet the need for a ministry-wide overall framework for adaptation (*recommendation 2*). Emergency Management B.C.'s Disaster Mitigation Branch now includes climate change criteria to evaluate flood mitigation project proposals submitted to the National Disaster Mitigation Program and the Community Emergency Preparedness Fund to promote funding for projects that address climate change (*recommendation 9*). The Ministry of Municipal Affairs and Housing is

RESPONSE FROM THE AUDITEES

currently working with other ministries to understand the options available for assessing the risks of climate change at the local level (*recommendation 15*). The Ministry of Forests, Lands, Natural Resources Operations and Rural Development will continue to implement its climate change strategy and has recently implemented climate-based seed transfer that promotes healthy, resilient, and productive forests and ecosystems by matching seedlings/seed lots to the climate of future planting sites (*recommendation 5*).

In addition to the work underway, the Audit identifies progress in building the scientific foundation for understanding climate change in British Columbia and recognizes the provincial adaptation strategy (2010) as a significant first step in formalizing the importance of adaptation.

The ministries acting on adaptation agree more work needs to be done to prepare for and to reduce climate risks.

Numerous opportunities for adaptation work currently exist in Canada that can support efforts in B.C. The Province is preparing to take advantage of federal funding initiatives, working with federal and other partners to achieve mutual priorities. The Disaster Mitigation and Adaptation Fund supports provincial and municipal infrastructure needed to deal with the effects of a changing climate. The Pan-Canadian Framework on Clean Growth and Climate Change, a cross- country collaboration to reduce GHG emissions and build resilience to climate change, also supports efforts to address climate risks. These and other opportunities can significantly assist B.C. in advancing its efforts on adaptation.

The challenge of addressing climate change is of such magnitude and complexity that no single stakeholder can be effective acting alone. Adaptation requires both coordination and collaborative action on shared responsibilities, both between and among provincial government agencies, local governments and First Nations, as well as private sector and industry. The Province will lead on adaptation by engaging with local governments and other stakeholders to support their efforts in undertaking risk assessments, building capacity to adapt and ensuring training on adaptation is available and accessible (*recommendations 3, 4*). The B.C. government will continue to support climate knowledge (*recommendation 8*) and work with partners and stakeholders on cross-jurisdictional issues to advance adaptation in B.C.

We thank the Office of the Auditor General for a report that reinforces the importance of acting on climate change and provides specific recommendations on opportunities to advance the fight. We will continue to develop our responsive actions on these recommendations, as well as develop a robust and comprehensive climate action plan. Our plan will address targets, support British Columbians' efforts to reduce their carbon footprint affordably and effectively, and also support a stable, modern, diversified, and low-carbon economy.

CHAPTER 1: CLIMATE CHANGE PRIMER

Many consider climate change to be the greatest challenge facing the human race this century. NASA and the U.S. National Oceanic and Atmospheric Administration have stated that Earth's 2016 surface temperatures were the hottest since 1880. In fact, 16 of the 17 hottest years on record have happened since 2001.

The world's climate has warmed to the point that changes are taking place, meaning that even if greenhouse gas (GHG) emissions ended tomorrow, we will still feel some climate change impacts. British Columbia is no exception; the impacts of climate change will be felt across the province – in our forests, farms, mountains, cities, rivers and oceans.

There are a number of impacts that B.C. may experience from climate change, some of which may have already begun. Looking forward through the coming century, these impacts may include:

- an increase in extreme weather events
- higher risk of wildfires, insect outbreaks, and diseases that affect forests
- an increased frequency and intensity of heavy precipitation, resulting in damage to buildings and infrastructure
- more frequent and severe heat waves, resulting in increased heat-related illness
- a geographical shift in infectious diseases and pests that affect health, agriculture and ecosystems
- more frequent and severe droughts
- changes in river flows and temperatures affecting fish habitat and hydroelectric power generation
- rising sea levels, posing flood risks to coastal communities and increasing salt-levels around low-lying agricultural lands
- a geographical shift in the range of ecosystems and species, with some loss of species, some new species arriving in the province, some species moving into new range, and changes in the dominance of others

Preparing for and becoming resilient to these changes is critical. Doing so is referred to as *adapting to climate change*, which can involve responding to emerging risks and potentially making the most of opportunities that changes may bring. The provincial government will play a central role in how B.C. adapts to climate change. Adaptation activities can range from large-scale construction of dikes as protection against sea level rise, to changing agricultural products grown in a certain region (e.g., instead of growing apples, producers may be able to grow cherries or other products instead). However, the provincial government cannot adapt to climate change alone. It must work in collaboration with federal and local governments, as well as First Nations.

In concert with adapting to climate change, it is imperative to limit the amount of warming the Earth experiences, given that there is a limit to climate

adaptation. Between 1990 and 2012, global emissions of GHGs increased by 47%. A number of governments worldwide have set targets and are taking action to reduce GHG emissions. Reducing GHGs is key to limiting future warming.

The costs of climate change will be high across the country. A 2011 report from the National Round Table on the Environment and the Economy estimated that the cost of some climate change impacts (e.g., sea level rise, health and forestry) across Canada will rise from $5 billion a year in 2020, to between $21 and $43 billion a year in 2050.

The Intergovernmental Panel on Climate Change concluded that "a changing climate leads to changes in the frequency, intensity, spatial extent, duration and timing of extreme weather and climate events, and can result in unprecedented extreme weather and climate events."

WHAT IS CLIMATE CHANGE?

The *UN Framework Convention on Climate Change* defines it as "a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods."

Climate change usually means fluctuations in the *long-term averages or frequencies of extremes* of our daily weather. *Weather* means conditions in the atmosphere over a short period of time, including sun, rain, snow, wind and heat. Climate is also influenced by shorter-term variations that often occur in cycles. For example, the El Niño Southern Oscillation periodically brings warmer-and-drier-than-average winters to western and central Canada due to sea-surface warming across the central and east-central Equatorial Pacific.

Human activities have a substantial impact on the changing climate – notably through the burning of fossil fuels and the removal of forests for other land use needs. This can include agriculture and urban development, both of which emit GHGs to the atmosphere.

Human-caused GHG emissions have increased since the pre-industrial era. The Intergovernmental Panel on Climate Change concluded that these emissions are extremely likely to be the dominant cause of the Earth's warming during or since the second half of the 20th century.

How are we affecting the climate?

Gases that trap heat in the atmosphere are called greenhouse gases (GHGs). Some of the main GHGs are carbon dioxide, methane, nitrous oxide and fluorinated gases.

GHGs keep the Earth warm through a process called the greenhouse effect. The greenhouse effect maintains the Earth's temperature, allowing life on Earth to exist. However, with increasing concentrations of GHGs in the atmosphere, the amount of heat that is trapped by the atmosphere is also increased. This makes the Earth's surface warmer, and results in a changing climate.

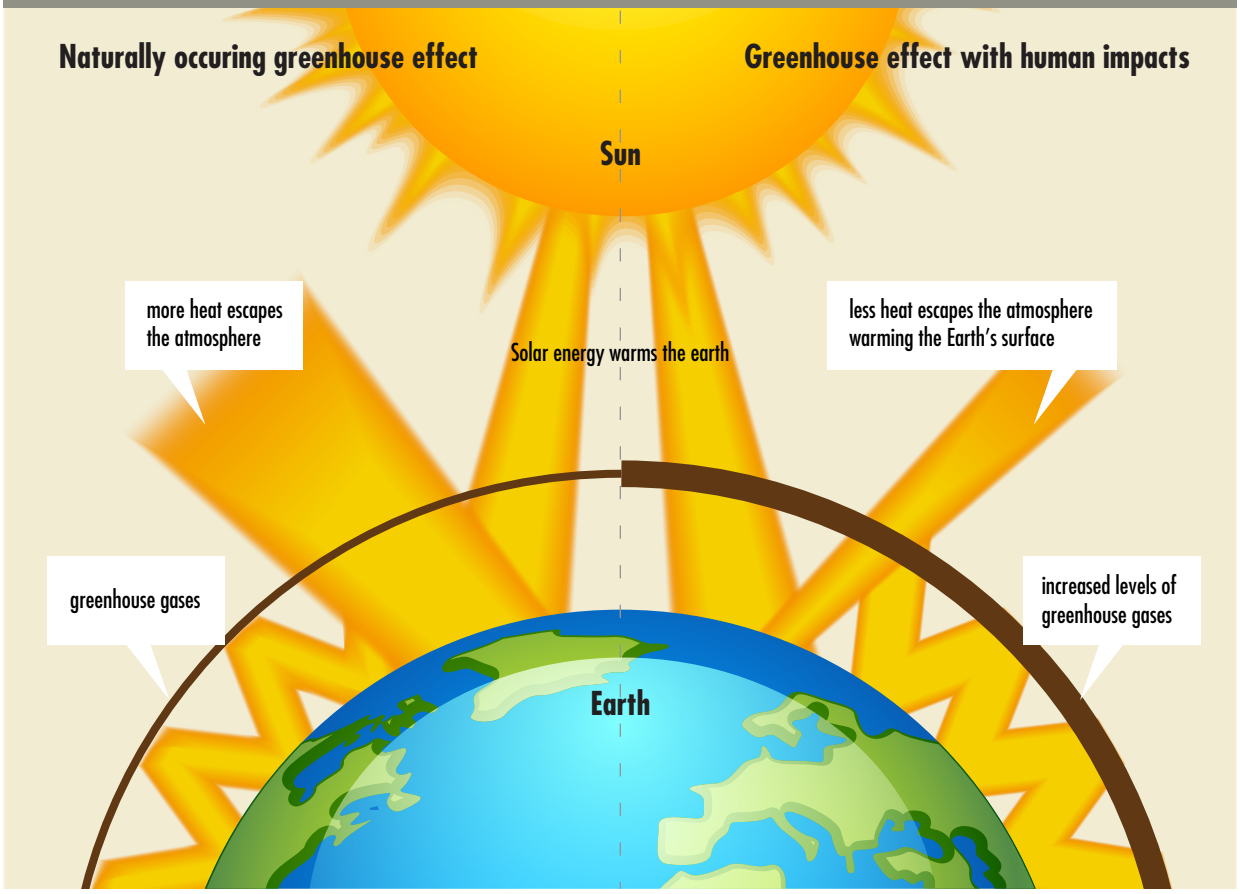
Exhibit 1 illustrates how the greenhouse effect works naturally, and what happens when human activities increase GHG emissions.

In 2012, Canada's emissions made up 1.6% of global GHG emissions. For more information on how Canada's emissions compare internationally, see Appendix A. B.C.'s emissions make up 9% of Canada's GHG emissions, as shown in Exhibit 2. On a per capita basis, however, B.C. emits more GHGs than a number of countries internationally (see Exhibit 3). To combat the Earth's warming trend, B.C. must contribute to national and global level actions.

CLIMATE CHANGE IN BRITISH COLUMBIA

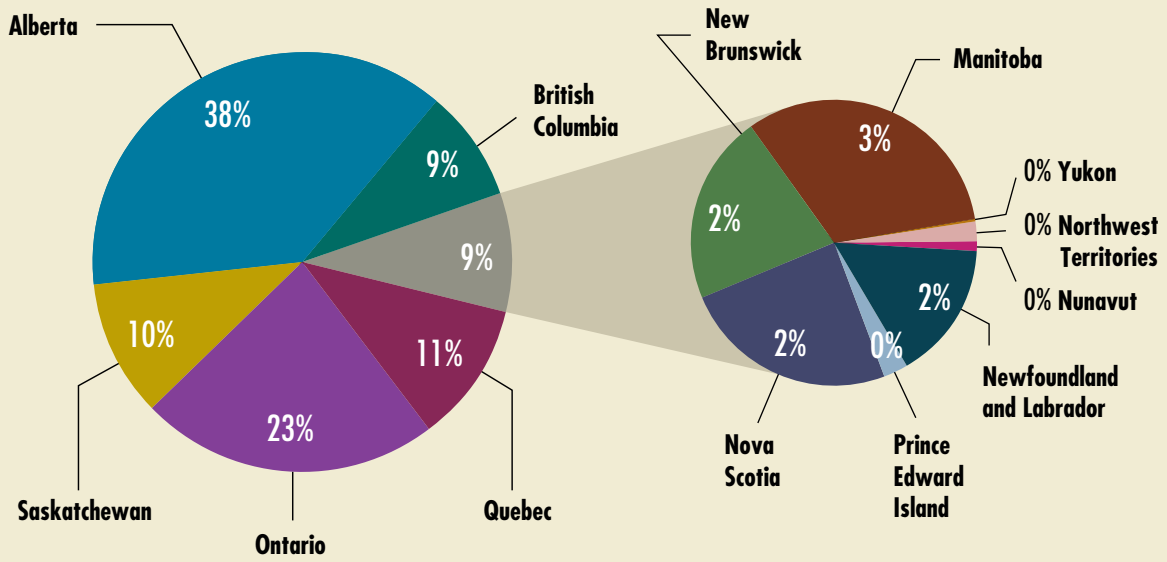
Many of the potential impacts of climate change are already happening in the province, and these impacts are expected to become more severe and/or more frequent. For example, the province has had floods and droughts in the past, but with climate change, these floods and droughts are expected to be more extreme and/or frequent. Impacts will also differ based on regional geographies and micro-climates. For example, climate impacts on Vancouver Island will differ from those in the interior of the province. Changes in temperature and precipitation will influence these impacts.

Exhibit 1: Greenhouse effect: with and without human impacts



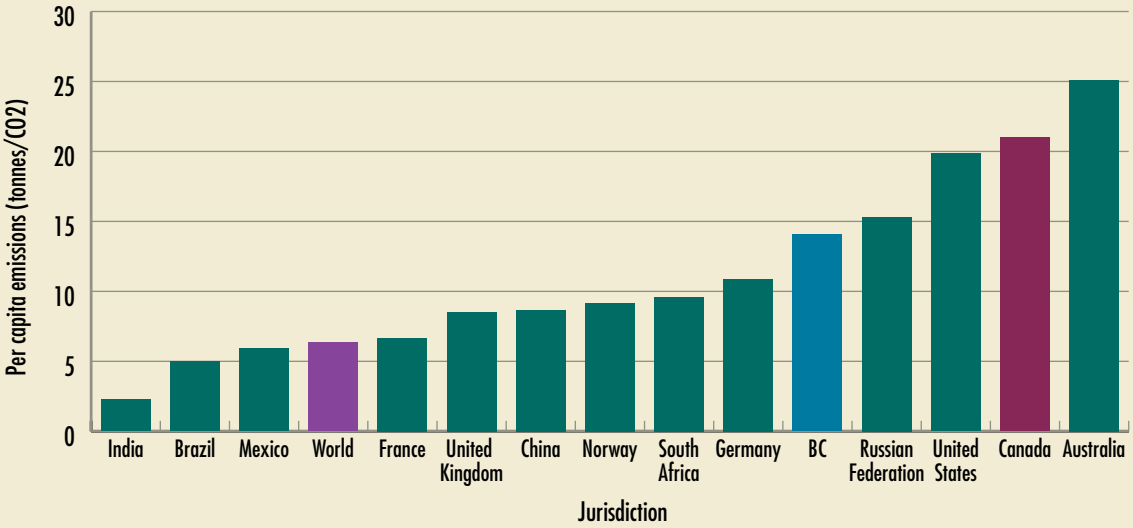
Source: Office of the Auditor General of British Columbia based on similar diagrams published by NASA, the Australian Government Department of Environment and Energy, and the State of Delaware Department of Natural Resources and Environmental Control

Exhibit 2: Provincial and territorial greenhouse gas emissions in 2015, as a percentage of Canada's emissions



Source: Compiled by the Office of the Auditor General of British Columbia, using the *National Inventory Report 1990-2015* published by Environment and Climate Change Canada

Exhibit 3: Comparison of 2013 levels of per capita GHG emissions in B.C., Canada and internationally



Source: Compiled by the Office of the Auditor General of British Columbia, using the World Resources Institute CAIT historical emissions data and B.C.'s provincial inventory

CHAPTER 1: CLIMATE CHANGE PRIMER

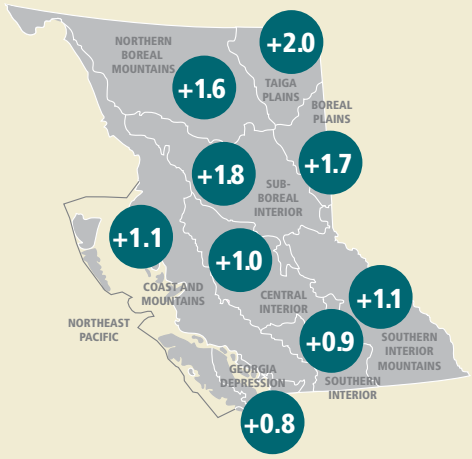
The basics: temperature and precipitation

Like other jurisdictions, B.C. is already experiencing changes consistent with the expected impacts of human-caused climate change. B.C. has warmed an average of 1.4°C per century (from 1900 to 2013), which is higher than the global average rate of 0.85°C per century. The northern regions of B.C. have warmed between 1.6 and 2°C over the same period, as shown in Exhibit 4. This is twice the global average[1].

Recent climate projections for Metro Vancouver from the Pacific Climate Impacts Consortium (PCIC) indicate that the number of summer days above 25°C will double by the 2050s – from 22 days (currently) to 55 days per year. This will likely result in a nearly six-fold increase in the demand for cooling (e.g., air conditioning).

Precipitation (snow and rain) has increased by 12% per century (1900-2013) in B.C. – with the greatest increase in the southern interior mountains, and the southern and central interior[2]. Between 1985 and 2005, glacier coverage decreased by 2,525km^3[3]. Research predicts that by the year 2100, 70% of the glacial mass present in 2005 will be gone in B.C. and Alberta[4].

Exhibit 4: Increase in annual temperature, 1900 – 2013 in British Columbia (°C)



Source: *Indicators of Climate Change for British Columbia 2016 Update*, p.8

We explain some possible climate risks in Exhibit 5.

The province could also see *new opportunities* emerge from a changing climate – more so as the changes become more evident. For example, crops not previously suitable for B.C.'s climate could be grown.

1 Ministry of Environment. Indicators of Climate Change for British Columbia, 2016 Update. p. 8

2 Ministry of Environment. Indicators of Climate Change for British Columbia, 2016 Update. p. 14

3 Ministry of Environment. Indicators of Climate Change for British Columbia, 2016 Update. p. 20

4 Clarke et al. (2015). Projected deglaciation of western Canada in the twenty-first century. *Nature Geoscience*

Exhibit 5: Climate impacts in B.C.

Climate changes likely in B.C.

- warmer spring/summer temperatures
- less precipitation in spring/summer
- changing forest conditions due to climate-related pests (e.g., mountain pine beetle)

Impact

WILDFIRE

Areas affected

Cost of fire suppression and damage will likely increase

Wildfires have negative impacts on short-term forest health, but are part of the natural cycle for many forests

Smoke from wildfires can have negative impacts on human health, such as respiratory conditions

Wildfire can damage infrastructure as well as private property such as homes and businesses

Wildfire can impact on the quality of drinking water

Source: Compiled by the Office of the Auditor General of British Columbia based on outputs from PCIC Plan2Adapt tool, IPCC *Climate Change 2014 Impacts, Adaptation, and Vulnerability Part B – Regional Aspects, From Impacts to Adaptation: Canada in a Changing Climate* Chapter 8- British Columbia, internal B.C. government documentation and discussions with subject matter advisors on the audit

Exhibit 5: Climate impacts in B.C. *continued*

Climate changes likely in B.C.

- warmer spring/summer temperatures
- less precipitation in spring/summer
- earlier freshet (i.e., a rise in a stream due to spring thaw)
- smaller snowpack

Impact

DROUGHT

Areas affected

Drought decreases the amount of water available in reservoirs and can lead to water restrictions

Fish health is negatively impacted when water levels are low and water temperatures are high

Drought has negative impacts on forest health and makes forests more vulnerable to other disturbances such as wildfire

Agricultural crops struggle when there are shortages of water and yields may drop

Risk of heat-related illness rises, asthma and lung diseases can worsen, and mental health can be impacted

Species can struggle with water shortages and their health can be impacted

Water-reliant businesses can suffer economic losses

Source: Compiled by the Office of the Auditor General of British Columbia based on outputs from PCIC Plan2Adapt tool, IPCC *Climate Change 2014 Impacts, Adaptation, and Vulnerability Part B – Regional Aspects, From Impacts to Adaptation: Canada in a Changing Climate* Chapter 8- British Columbia, internal B.C. government documentation and discussions with subject matter advisors on the audit

Exhibit 5: Climate impacts in B.C. *continued*

Climate changes likely in B.C.

- increase in high-intensity, short-duration rainfall events and atmospheric rivers
- early and rapid melt of snow pack
- strengthened storm surge
- sea level rise

Impact

FLOOD

Areas affected

Health and safety is at risk in a flood event, floods can also increase the risk of disease

Serious damage to infrastructure can take place, as well as damage to private property

High repair costs, economic losses are experienced, and insurance payouts can be high

Drinking water quality can be negatively impacted

Agricultural lands can be flooded or made more saline

Source: Compiled by the Office of the Auditor General of British Columbia based on outputs from PCIC Plan2Adapt tool, IPCC *Climate Change 2014 Impacts, Adaptation, and Vulnerability Part B – Regional Aspects, From Impacts to Adaptation: Canada in a Changing Climate* Chapter 8- British Columbia, internal B.C. government documentation and discussions with subject matter advisors on the audit

Exhibit 5: Climate impacts in B.C. *continued*

Climate changes likely in B.C.

- increased temperatures can lead species to expand northwards (and towards higher elevations), which makes the province appealing to invasive species

Impact

INVASIVE SPECIES

Areas affected

Native species may have to compete with new species for food and habitat, new diseases may be introduced

New pests and forest diseases may impact on forest health

New pests may be introduced with negative impacts on agriculture

Diseases not typically in B.C. may spread potentially through insect transmission

Source: Compiled by the Office of the Auditor General of British Columbia based on outputs from PCIC Plan2Adapt tool, IPCC *Climate Change 2014 Impacts, Adaptation, and Vulnerability Part B – Regional Aspects, From Impacts to Adaptation: Canada in a Changing Climate* Chapter 8- British Columbia, internal B.C. government documentation and discussions with subject matter advisors on the audit

Exhibit 5: Climate impacts in B.C. *continued*

Climate changes likely in B.C.

- increased temperatures
- changes in hydrology (i.e., the movement, distribution and quality of water)
- changes in disturbance (e.g., fire, insects, drought, floods)

Impact

SHIFTING ECOSYSTEMS

Areas affected

Species habitat may be lost, shrink or shift; biodiversity will likely be negatively impacted

Rising stream temperatures may limit the habitat of certain fish species, distribution of species will likely shift

Certain types of forests will shrink, while others will expand into new territory

Crop suitability may shift, some crops may no longer grow in their historical range, but be viable in new areas

Source: Compiled by the Office of the Auditor General of British Columbia based on outputs from PCIC Plan2Adapt tool, IPCC *Climate Change 2014 Impacts, Adaptation, and Vulnerability Part B – Regional Aspects, From Impacts to Adaptation: Canada in a Changing Climate* Chapter 8- British Columbia, internal B.C. government documentation and discussions with subject matter advisors on the audit

RESPONSES TO CLIMATE CHANGE

Responses to climate change are grouped in two categories: **adaptation** and **mitigation**.

Mitigation reduces emissions.
Adaptation reduces harm.

Mitigation

Mitigation involves actions to reduce the sources, or enhance the sinks of GHGs. Examples of mitigation actions include:

- switching to renewable energy sources
- reducing the use of fossil fuels
- improving the design of buildings for greater energy efficiency
- expanding forests and other *sinks* to remove greater amounts of carbon dioxide from the atmosphere

Carbon sinks absorb more carbon from the atmosphere than they release. For example, forests, oceans and soil can act as carbon sinks.

CO-BENEFITS

B.C. needs both mitigation and adaptation to create a climate-resilient province. Without mitigation, the need for adaptation becomes even greater. Mitigation and adaptation can also provide co-benefits: properly planned adaptation may reduce GHG emissions. For example, updates to building codes can both increase energy efficiency (mitigation) and increase resilience to wind and flooding (adaptation). It is important that the provincial government continue work on adaptation and mitigation in tandem.

Adaptation

Adaptation is any activity that reduces the negative impacts of climate change and when possible takes advantage of new opportunities from climate change. Natural Resources Canada defined adaptation as making adjustments in our decisions, activities and thinking because of observed or expected changes in climate—with the goals of moderating harm and taking advantage of new opportunities.

Adaptation can include activities before (anticipatory) and after (reactive) climate change impacts are felt. In most circumstances, anticipatory or planned adaptations have lower long-term costs and are more effective than reactive adaptations.

Adaptation is also thought of in terms of building *climate resilience*. Climate resilience is the capacity of a community, business or natural environment to

ADAPTATION ACROSS LEVELS OF GOVERNMENT

Adaptation is not the sole responsibility of any one level of government. All levels—federal, provincial, local and First Nations—have a role to play. In January 2017, the federal and provincial governments across Canada published the *Pan-Canadian Framework on Clean Growth and Climate Change*. Adapting and building resilience are one of the four key pillars.

anticipate, prevent, withstand, respond to, and recover from, a climate change-related disruption or impact.

Adaptation is of critical importance in B.C., as climate change poses serious risks to the province —in terms of economics, health and safety, and the environment. Adaptation is a cross-cutting issue that requires coordinated and sustained support at the provincial level.

Adapting to climate change is not an easy undertaking. It means moving beyond a commonly held assumption among political, business and community leaders: that historical climate is representative of future climate. For a long time, future climate predictions could be based on the past—but that is no longer the case.

Adaptation will be an iterative process, taking place over a long time with changing cycles of actions. Climate change is already happening, but impacts will continue to emerge.

Iterative processes repeat cycles of actions. Each cycle of actions brings you closer to your end goal. In the case of adaptation, each cycle of actions will require changes, because of uncertainty around how the climate will change.

A level of uncertainty exists around how fast the changes will happen and how they will vary from place to place. It is unknown how patterns of emissions will change, which will influence the level of climate change that is experienced.

Benefits of adaptation

Overall, adaptation to climate change will increase the resilience of the province in the face of expected and unexpected impacts. Taking action now to prepare for climate change may allow us to avoid some of the future costs of climate change.

The National Roundtable on the Environment and the Economy examined five different adaptation strategies to assess costs and benefits. All but one of the strategies was found to be cost-effective, with the savings larger than the costs of the strategies. For example, adaptation strategies can reduce the potential health impacts of heat exposure and poor air quality, or reduce the impacts of climate change on timber supply across the country.

We could not determine a clear figure for government spending on adaptation. Adaptation often aligns with or is part of other ministry initiatives or activities and is spread across ministry budgets. For example, we

know the Ministry of Environment & Climate Change Strategy (ENV) spent approximately $20 million on climate action in 2015/16, but how this is broken down between mitigation and adaptation is unknown. We estimate the majority is on mitigation, because there are far more ENV employees in this area (3 employees for adaptation and 36 for mitigation).

FLOODING IN THE PEACE REGION

In June 2016, a large storm passed through the Peace region and over 120mm of rain fell in 72 hours. The Ministry of Transportation and Infrastructure found there was damage ranging from minimal to severe for 308 infrastructure sites (such as roads, bridges and culverts). Repairing the most severely damaged will cost the province between $100-150 million. However, ministry staff told us that infrastructure updated after the 2011 flood (with climate change adaptation in mind) survived the 2016 flooding.

Exhibit 6: One of the culverts damaged in the June 2016 storm in the Peace region of B.C.

Source: Ministry of Transportation and Infrastructure

The costs of adapting to climate change can be quite significant. However, the cost of doing nothing may be much greater. For example, it would cost approximately $9.5 billion to address sea level rise and seismic upgrades to dikes along the Metro Vancouver shoreline and the Fraser River shore[5]. In comparison, a major Fraser River flood could cost between $19.3 and $22.9 billion[6]. Plus, the chances of flooding in that area will continue to go up. There could be many floods, multiplying the cost of repair.

AUDIT OBJECTIVE

We carried out this audit to determine whether the B.C. government is adequately managing the risks posed by climate change. We looked at two responses to climate change:

- Adaptation: whether government is adequately adapting to the risks posed by climate change
- Mitigation: whether government is taking adequate action to meet provincial emission reduction targets

We define adequate management of the risks posed by climate change in the criteria we used in our audit, as described in Appendix D.

AUDIT CONCLUSION

Government is not adequately managing the risks posed by climate change.

[5] Ministry of Forests, Lands and Natural Resource Operations. (2012). Cost of Adaptation – Sea dikes & alternative strategies – Final Report. p. 3

[6] Fraser Basin Council. (2016). Lower Mainland flood management strategy: Phase 1 summary report. p.4

CHAPTER 1: CLIMATE CHANGE PRIMER

BASIS FOR CONCLUSION

Adaptation

The ministries within our scope have work underway to adapt to the risks posed by climate change, but more needs to be done across government.

- There are limitations to government's overarching framework for adaptation, such as:
  - a lack of comprehensive risk assessment and prioritization of risks
  - no clear plan to move forward
  - little monitoring of progress and reporting on performance
- Ministries have begun taking action to implement the adaptation strategy but more needs to be done
- Significant climate-related risk areas, such as flooding and wildfire, require more attention from government

Mitigation

Government has not taken adequate action to meet provincial emission reduction targets. Specifically, we found:

- Government has adopted legislated emissions reduction targets.
- Government has an implementation plan, but it does not describe how it will meet the emissions reduction targets.
- Government will likely not meet the legislated 2020 emissions reduction target.
- If the province continues along the current emissions trajectory, the 2050 emissions reduction target will likely not be met.
- Government has regularly reported to the public on progress towards GHG emission reduction targets.

AUDIT SCOPE AND APPROACH

The table below describes the criteria we used to answer each of our objectives (and shows the chapter in our report where they appear) and includes the ministries in our audit scope.

There are other B.C. ministries, such as the Ministry of Energy, Mines & Petroleum Resources and the Ministry of Health that have an important role to play in climate change adaptation and mitigation. Although these ministries were not included in this audit, we encourage them to review our audit findings and consider how they may apply to their work.

AUDIT QUALITY ASSURANCE

We conducted this audit under the authority of section 11 (8) of the *Auditor General Act* and in accordance with the standards for assurance engagements set out by the Chartered Professional Accountants of Canada (CPA) in the CPA Handbook – Canadian Standard

on Assurance Engagements (CSAE) 3001 and Value-for-money auditing in the public sector (Section PS 5400). These standards require that we comply with ethical requirements; and conduct the audit to independently express a conclusion whether or not the subject matter complies in all significant respects to the applicable criteria.

The office applies the Canadian Standard on Quality Control 1 (CSQC) and, accordingly, maintains a comprehensive system of quality control, including documented policies and procedures regarding compliance with ethical requirements, professional standards and applicable legal and regulatory requirements. In this respect, we have complied with the independence and other requirements of the code of ethics applicable to the practice of public accounting issued by the Chartered Professional Accountants of BC, which are founded on the principles of integrity, objectivity, and professional competence and due care, confidentiality and professional behaviour.

The report is dated November 28, 2017. This is the date the audit team completed obtaining the evidence used to base the findings and conclusions of the report.

Chapter	Criteria	Ministries in scope*
Adaptation	◆ adequate risk or vulnerability assessment ◆ comprehensive plan or strategy on adaptation ◆ monitoring and public reporting on performance ◆ implementation of the adaptation strategy	◆ Ministry of Environment & Climate Change Strategy (Climate Action Secretariat and Knowledge Management Branch) ◆ Ministry of Forests, Lands, Natural Resource Operations and Rural Development ◆ Ministry of Transportation and Infrastructure ◆ Emergency Management BC ◆ Ministry of Agriculture ◆ Ministry of Municipal Affairs and Housing
Mitigation	◆ adopted GHG emission reduction targets ◆ implementation plan that describes how they will meet GHG reduction targets ◆ on track to meet GHG reduction targets ◆ public reporting on progress towards GHG reduction targets	◆ Ministry of Environment & Climate Change Strategy

*In July 2017, the names of some provincial ministries changed. We have used the updated ministry names throughout the report. See Appendix B for the previous ministry names.

CHAPTER 1: CLIMATE CHANGE PRIMER

COLLABORATIVE AUDIT PROJECT ON CLIMATE CHANGE

We carried out this audit as part of a collaborative audit project on climate change to determine the extent to which federal, provincial and territorial governments in Canada are meeting commitments to reduce greenhouse gas (GHG) emissions and to adapt to climate change. The Office of the Auditor General of Canada will produce a summary report that compiles the state of climate change responses in Canada, and discusses key findings and observations.

CHAPTER 2: ADAPTATION

ADAPTATION TO CLIMATE CHANGE – or reducing the potential harms from climate change—provides economic, social and environmental benefits.

MANAGEMENT OF CLIMATE CHANGE ADAPTATION IN B.C.

Government released *Preparing for Climate Change: British Columbia's Adaptation Strategy* (adaptation strategy) in 2010, recognizing that it would increasingly need to consider climate change to protect health and safety, maintain public infrastructure, manage natural resources, and achieve environmental, social and economic sustainability. To achieve all of this government laid out a high-level vision for adaptation in the province, focussing on three areas:

- building a strong foundation of knowledge, through ongoing monitoring and capacity building
- making adaptation part of government's business, through integration into planning, legislation, policies, approvals and program implementation, as well as engaging and working with partners
- assessing risks and implementing priority adaptation actions in sectors (e.g., mining, transportation and agriculture)

Federal government's roles and responsibilities

In the *Federal Adaptation Policy Framework*, the Government of Canada lays out its role for climate adaptation, which includes:

- generating and providing scientific information to support evidence-based decision-making on climate change impacts and adaptation
- helping to build the capacity of the private sector, other levels of government, and communities and organizations, to assess and manage the risks and complexities of a changing climate and to take effective and sustainable action
- managing the potential impacts of climate change as part of its own risk management considerations

B.C. ministries' roles and responsibilities

A number of ministries in the province have responsibilities for climate change adaptation, as described in Exhibit 7. These are not all the B.C. ministries with responsibilities for climate adaptation; however, these are the ministries and areas included in our audit scope. Ministries included in our scope may have additional responsibilities that also impact

on how the province adapts. We have looked at a selection of their responsibilities. There is a need for collaboration between and within ministries to ensure that all climate change adaptation priorities are addressed.

Exhibit 7: Roles and responsibilities of B.C. ministries related to climate change adaptation

Ministry of Environment & Climate Change Strategy (ENV)	◆ provides leadership to minimize the effects of climate change and ensures that the people of British Columbia and industry are prepared to adapt to the effects of a changing climate ◆ collects, stores, retrieves and sets standards for environmental data, and makes key data available to the public ◆ provides a whole-of-government approach to adapting to climate change (ENV's Climate Action Secretariat)
Ministry of Forests, Lands, Natural Resource Operations and Rural Development (FLNR)	◆ has stewardship of provincial Crown land, and cultural and natural resources ◆ ensures sustainable management of forest, mineral- and land-based resources and supports activities that lead to benefits for all people of British Columbia—both economically and environmentally ◆ oversees 59 statues and associated regulations, including the *Forest and Range Practices Act, Wildfire Act, Forest Act, Land Act, Water Sustainability Act* and *Dike Maintenance Act* ◆ develops and implements legislation, maintenance policies and standards for Forest Service Roads, and is responsible for their administration and maintenance ◆ coordinates climate change work within the ministry (FLNR's Office of the Chief Forester)
Ministry of Agriculture (AGRI)	◆ creates and carries out advisory, research, promotional, sustainability and adaptation, food safety or plant and animal health programs, projects or undertakings related to agrifood (commercial production of food through farming) and seafood ◆ works to enhance agrifood and seafood sector growth, competitiveness, sustainability and adaptability (AGRI's Innovation and Adaptation Services Branch)
Ministry of Transportation and Infrastructure (TRAN)	◆ plans transportation networks, provides transportation services and infrastructure, develops and implements transportation policies ◆ maintains the safety and reliability of the highway system
Emergency Management BC (EMBC)	◆ leads the management of provincial level emergency and disaster response
Ministry of Municipal Affairs and Housing (MAH)	◆ supports local governments to build vibrant and healthy communities that are well governed, liveable, safe, economically resilient, and socially and environmentally responsible

Source: Compiled by the Office of the Auditor General of British Columbia based on ministry service plans, websites and internal documentation

CHAPTER 2: ADAPTATION

Local government roles and responsibilities

Local governments are considered to be the front lines of climate change. Under legislation (*Local Government Act, Community Charter*), local governments are enabled to exercise a range of powers, from providing services to regulation, such as planning and zoning within their boundaries to implement various actions for climate change adaptation. However, similar to other inter-jurisdictional issues, it's not always clear which level of government is responsible for which aspects of climate change adaptation.

ADAPTATION OBJECTIVE

We carried out this work to determine whether the B.C. government is adequately adapting to the risks posed by climate change.

We looked at adaptation at two levels:

1. *Government direction for climate change adaptation*

   To assess overall government direction for climate change adaptation, we looked at whether government had:

   - completed a comprehensive risk or vulnerability assessment to identify key risks in the province
   - a comprehensive strategy or plan on adaptation
   - monitored and reported publicly on their adaptation actions

2. *Ministry action on climate change adaptation*

   To assess ministry action on adaptation, we looked at what action ministries (see list on the next page) had taken for the three main areas of focus in the adaptation strategy. They are:

   - build a strong foundation of knowledge
   - make adaptation part of government's business
   - assess risks and implement priority adaptation actions in sectors

CONCLUSION

The ministries within our scope have work underway to adapt to the risks posed by climate change, but more needs to be done across government.

- There are limitations to government's overarching framework for adaptation, such as:
  - a lack of comprehensive risk assessment and prioritization of risks
  - no clear plan to move forward
  - little monitoring of progress and reporting on performance
- Ministries have begun taking action to implement the adaptation strategy but more needs to be done
- Significant climate-related risk areas, such as flooding and wildfire, require more attention from government

CHAPTER 2: ADAPTATION

CRITERIA AND SOURCES

We developed our audit objective and criteria using:

- the provincial government's *Preparing for Climate Change: British Columbia's Adaptation Strategy*
- ministry roles and responsibilities
- accepted frameworks on climate change adaptation
- discussions with partners across Canada as part of the collaborative audit project on climate change
- previous international climate change audits

SCOPE AND APPROACH

We focused on ministries that are responsible for addressing some significant climate related risks:

- Ministry of Environment & Climate Change Strategy (ENV), with a focus on
  - Climate Action Secretariat (CAS)
  - Knowledge Management Branch (KMB)
- Ministry of Forests, Lands, Natural Resource Operations and Rural Development (FLNR)
- Ministry of Transportation and Infrastructure (TRAN)
- Emergency Management BC (EMBC)
- Ministry of Agriculture (AGRI)
- Ministry of Municipal Affairs and Housing (MAH)

There are other ministries in the province, such as the Ministry of Health and Ministry of Energy, Mines and Petroleum Resources that do have a role to play in climate change adaptation.

Our timeframe for the audit on adaptation started in 2010 (the release of the adaptation strategy) to February 2017. Our audit work took place from January 2016 until September 2017.

Our work involved:

- reviewing documentation from the ministries we focused on, including plans, risk and vulnerability assessments, research, studies, guidance and reports
- reviewing the adaptation results from the 2016 Climate Action Revenue Incentive Program reporting
- conducting interviews with provincial ministry staff, local governments, First Nations, professional associations and academic researchers
- visiting infrastructure reconstruction sites such as roads, bridges and culverts in the Peace Region

KEY FINDINGS AND RECOMMENDATIONS

Our key findings and recommendations are organized in four sections:

- Section 1: Elements of adaptation
  - risk and vulnerability assessment
  - planning for adaptation
  - implementing the adaptation strategy
  - monitoring and reporting
- Section 2: Climate data
- Section 3: Key climate-related risk areas: flood, wildfire and drought
- Section 4: Adaptation at the local government level

SECTION 1: ELEMENTS OF ADAPTATION

There is a lot of work for government to do to prepare for the risks posed by climate change, and government needs to more clearly identify and prioritize among those risks. Government needs to improve its planning for adaptation and fill gaps in implementation. Without adequate risk assessment, planning and implementation the province will remain vulnerable to emerging risks, which may cause damage to infrastructure and pose threats to public safety. Our results are arranged according to the phases of adaptation: risk assessment, planning, implementation and monitoring and reporting.

Risk and vulnerability assessment

Analyzing risk is a key step in adapting to climate change. A robust assessment can guide planning and investment, as well as government policy and practice. It helps decision-makers best allocate public money to prepare for events that are the most likely to happen and pose the biggest threats —to human lives, infrastructure, the economy and the natural environment that we depend on.

> *"A risk is something bad that might happen. A risk assessment asks the questions: 'What might happen?' 'How bad would that be?', 'How likely is that?', 'How often might this happen?' The answers to these questions can inform decision-makers about how to respond."*
>
> ~David King et al., *Climate change: A risk assessment*

No provincial risk assessment completed

We expected that government would have completed an adequate climate change risk or vulnerability assessment. We also expected to see evidence that government had prioritized among risks.

A number of risk assessments were conducted, looking at specific sectors (e.g., mining or agriculture). However, government has neither completed a comprehensive risk or vulnerability assessment to identify key climate-driven risks, nor prioritized risks across the province.

CHAPTER 2: ADAPTATION
KEY FINDINGS AND RECOMMENDATIONS

Without a province-wide risk assessment, it can be more challenging to ensure that the highest provincial risks are all clearly identified and understood by the many parties involved in adaptation. A fulsome, prioritized, publicly available risk assessment can ensure that government, their partners and the public are clear regarding what risks exist, and which risks are the most critical to mitigate. Government could simplify communication of risks by making its comprehensive risk assessment publicly available.

Prioritization is also important, given the high costs of adaptation. One estimate pegs the cost of upgrading the Lower Mainland's dike system to address sea level rise at more than $9 billion. But there is also wildfire risk reduction work to do, road washouts in extreme storms to prepare for, and water issues to tackle as droughts become more frequent. A well-informed priority list across ministries could help government make the hard, but important, choices about what to tackle first. Prioritization should also take into account the timeframe in which impacts are expected to be felt.

Risk assessment at the local level will continue to be important in determining which actions are needed where. Government should encourage and support local governments and organizations in other sectors to complete these more specific risk assessments.

RECOMMENDATION 1: *We recommend that government undertake a province-wide risk assessment that integrates existing risk assessment work and provides the public with an overview of key risks and priorities.*

Planning for adaptation

For most climate change adaptation processes, planning is the necessary next step after risks and vulnerabilities are identified. Planning allows government to develop and assess options and make decisions about what actions to take. Planning for adaptation takes place at the government level and within individual ministries. In B.C., a more detailed plan looking across all of government is needed.

Adaptation planning is not comprehensive

Government has an adaptation strategy, but it is not comprehensive. Government does not have an implementation plan for adaptation.

Through our review of good practice, existing adaptation strategies and plans and through our work with partners in the collaborative audit project, we developed a list of characteristics we expected to see in a comprehensive strategy or plan on adaptation. We expected that government would have a plan or strategy that would prioritize among vulnerabilities, include clear and measurable actions with timelines, and clearly assign roles and responsibilities. We also expected that government would have assessed the social and economic costs associated with the plan or strategy.

In 2010, government released *Preparing for Climate Change: British Columbia's Adaptation Strategy* (adaptation strategy). The adaptation strategy outlined

CHAPTER 2: ADAPTATION
KEY FINDINGS AND RECOMMENDATIONS

three main areas of focus and a number of deliverables (a deliverable is something that's produced as a result of work), as outlined in Exhibit 8.

The adaptation strategy is a high-level document that provides general direction for adaptation in the province. However, it does not prioritize among risks in the province, given that no comprehensive risk assessment exists. Government did not consider social and economic costs while developing the adaptation strategy. Without assessment of the risks and costs, the deliverables outlined in the adaptation strategy may not be sufficient to reduce major risks, or meet government's intended purpose.

The core deliverables outlined in the adaptation strategy are largely unclear and not measurable, with some including vague phrasing, such as "explore opportunities" and "ministries will consider." The adaptation strategy does not specify timelines or dates of completion, and roles and responsibilities were not clearly assigned to ministries. No implementation plan was created to support the adaptation strategy, so the detailed information expected (timelines, roles and responsibilities) was not available. Without these components government cannot ensure that the necessary actions will take place or that ministries are not duplicating actions.

Exhibit 8: Areas of focus and deliverables in the adaptation strategy

Area of focus	Deliverables
Build a strong foundation of knowledge	◆ engage climate science ◆ develop tools for decision-makers ◆ continue knowledge transfer and outreach activities

Make adaptation part of government's business	◆ consider adaptation in planning
	  ◆ consider climate impacts in service plans and business planning
	  ◆ integrate adaptation into policies, legislation and regulation
	  ◆ identify approvals that are sensitive to climate and revise
	◆ implement through a coordinated approach

Assess risks and implement priority adaptation actions in sectors	◆ conduct climate change assessments for sectors known to be sensitive to climate change ◆ review and update policies, strategies and operational activities

Source: Compiled by the Office of the Auditor General of British Columbia, based on *Preparing for Climate Change: British Columbia's Adaptation Strategy*

CHAPTER 2: ADAPTATION
KEY FINDINGS AND RECOMMENDATIONS

Government has not refreshed or rewritten the adaptation strategy since its release in 2010, and it is now outdated. Given the iterative nature of adaptation and the emergence of new scientific evidence, a refreshed vision for adaptation is needed. Government is aware of this need. Future adaptation plans and strategies from government should include a requirement for refresh every five years. And, government should take a long-term approach when determining how far into the future plans should look.

RECOMMENDATION 2: *We recommend that government create an adaptation plan for B.C. that:*

- *clearly outlines government's priorities, roles and responsibilities, and timelines*
- *identifies the necessary resources for implementation*
- *integrates with existing adaptation planning at the ministry level*
- *includes solutions for obstacles identified through the audit*
- *clearly outlines how government will work with local governments and include them in its development*
- *clearly outlines how government will work with First Nations, and include them in its development*
- *includes a requirement to refresh every five years*

ADAPTATION IN THE UNITED KINGDOM

In the United Kingdom, the national government has established a clear framework for adaptation. In 2012, the Climate Change Risk Assessment was published, with a requirement that it be updated on a five-year cycle. Government then developed the National Adaptation Programme and created objectives, policies and proposals for the highest ranked risks. Government's Adaptation Reporting Power can direct public sector authorities to report on how they are assessing and acting on the risks and opportunities from a changing climate.

CHAPTER 2: ADAPTATION
KEY FINDINGS AND RECOMMENDATIONS

Coordination across government needs improvement

Adaptation is a cross-cutting issue that touches upon all sectors of the province. It requires action from multiple ministries and coordination of their resources. The Climate Action Secretariat (CAS) in the Ministry of Environment & Climate Change Strategy (ENV) has responsibility for providing a whole-of-government approach to adapting to climate change. However, CAS has neither the mandate nor resources to ensure that government is coordinated in its response to adaptation.

Ministries are responsible for the implementation of adaptation actions on the ground. And, other groups within government may be taking the lead on different adaptation components. Within this model, government needs to implement and maintain coordination. This can be accomplished with a clearer line of oversight and sustained leadership.

CAS is also unable to take on a greater leadership and coordination role, due to its limited human resource capacity. Within CAS, there are 3 employees working full time on adaptation, and 36 focused on mitigation. With limited staff, there are a number of initiatives that CAS cannot undertake, such as a large-scale risk assessment.

In addition, adaptation has not received the same level of attention and interest as mitigation — from either central government or the public. This lack of attention has limited CAS's ability to take leadership in this area. Without high-level support, it is difficult to create forward momentum.

Coordination between ministries has been ad hoc. Government created working groups for the pan-Canadian framework and *Climate Leadership Plan*, but disbanded those groups as the projects were completed. Informally, the Ministry of Forests, Lands, Natural Resource Operations and Rural Development (FLNR) coordinates a monthly natural resource sector meeting on adaptation that includes ENV and the Ministry of Agriculture (AGRI).

Government staff identified a need for additional support from CAS, as well as the need for more collaboration across government to align efforts and maximize resources. Given the complex nature of the solutions for adaptation, government needs a coordinated response.

During the time of our audit, there was little adaptation work occurring in partnership with First Nations at the provincial level. First Nations communities are often vulnerable to the impacts of climate change. There is a need for greater consultation and collaboration on adaptation with First Nations peoples throughout the province. The B.C. government intends to invite participation of First Nations in the economic and adaptation opportunities that it has identified in the *Climate Leadership Plan.*

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Implementing the adaptation strategy

Government has made progress implementing many of the deliverables laid out in its adaptation strategy. However, more action is needed to address the risks and fulfill the intent of the adaptation strategy's recommendations. Many of government's actions were preliminary, and ministries are in various stages of planning for future adaptation work. ENV's analysis of internal government survey results found that "[B.C.] is similar to many other jurisdictions that have invested in establishing knowledge and tools and the development of best practices, but have not yet made significant [on-the-ground] change to prepare for climate change"[7].

We looked at government's actions on the adaptation strategy:

- Area 1: build a strong foundation of knowledge
- Area 2: make adaptation part of government's business
- Area 3: assess risk and implement priority adaptation actions in sectors

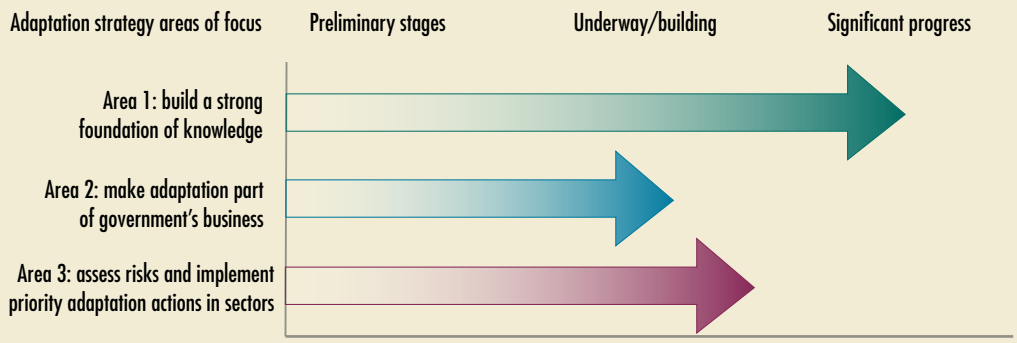
Exhibit 9 shows our assessment of progress by ministries in the audit scope against the three main areas of focus outlined in the adaptation strategy.

Appendix C provides a more detailed summary of the actions taken by ministries that respond to the adaptation strategy deliverables.

Area 1: significant progress made to build a foundation of knowledge

The ministries we looked at have made significant progress in adapting to climate change by building a strong foundation of knowledge. Progress is this area

Exhibit 9: Overall assessment of government progress on adaptation strategy areas of focus



Source: Office of the Auditor General of British Columbia

[7] Berrange-Ford et al, 2011; Ford et al, 2011. As quoted in Ministry of Environment. (2014). Adaptation survey – Synthesis Report. p. 22

has been more substantial than the other areas of focus in the adaptation strategy. Ministries have:

- engaged with the Pacific Climate Impacts Consortium
- created tools to assist decision-makers
- worked to build robust observation networks in the province (see climate data section)

Area 1 deliverable: engage climate science

The adaptation strategy required government to engage with the Pacific Institute for Climate Solutions (PICS), Pacific Climate Impacts Consortium (PCIC) and other research centres to ensure they produce high-quality scientific information that decision-makers need. Overall, ministries have engaged with PCIC, but less so with PICS. FLNR has conducted a substantial amount of research internally, and in partnership with other academic institutions.

Ministries are engaging with PCIC through participation on their Program Advisory Committee (PAC) and specific contracted projects. PAC provides direction and advice on scientific content and priorities, stakeholder needs and participation in projects.

Ministries have collaborated with PCIC and PCIC provided climate data for projects underway. For example, AGRI used PCIC's climate projections in their regional adaptation strategies. We had little evidence of ministries collaborating with PICS on adaptation beyond accessing its funding for internships.

FLNR has completed a number of research projects internally and through partnerships with universities and other research centres in the province. For example, internally, FLNR has:

- an ongoing Assisted Migration Adaptation Trial to better understand tree species' climate tolerances
- a major climate-based seed transfer project that will help forests and landscapes become genetically adapted to a changing climate

PACIFIC CLIMATE IMPACTS CONSORTIUM

The Pacific Climate Impacts Consortium (PCIC) is a regional climate service centre at the University of Victoria that conducts quantitative studies on the impacts of climate change and climate variability in the Pacific and Yukon regions.

PCIC provides tools for a wide variety of users, such as:

- Plan2Adapt: a tool designed for users who are not familiar with climate modelling. It generates maps, plots and data that describe future projected climate conditions for B.C.
- The Regional Analysis Tool: allows users to define their own region, generate maps, and then compare climate variables and see how they change over time.

- produced reports detailing climate change projections and expected impacts on ecosystems for different regions of the province

Working with external partners, FLNR has contributed to the development of the ClimateBC, ClimateWNA and ClimateNA models, which project both seasonal and annual climate variables in B.C. FLNR has also worked with the Centre for Forest Genetics at UBC to model potential future distributions of bio-geoclimatic zones in the province.

Bio-geoclimatic zones group ecosystems at different levels. Classifications are based on the vegetation, regional climate, soil regime and disturbances that have taken place. These zones are used largely in forestry to help determine seed zones, land management planning, pest risk and wildlife habitat management.

Area 1 deliverable: develop tools for decision-makers

According to the adaptation strategy, ministries are to promote and support the development of tools that can be used by a broad range of decision-makers. We found that some ministries have created tools designed for professionals in the field which are often quite technical. They may not be suitable for broad use. Tools for broader use by local government decision-makers, agricultural producers, and individual citizens are available, but may require professional assistance to complete — potentially limiting their wide use.

Government has not evaluated the usefulness of the tools that are available to the broad range of decision-makers. It is unknown to what extent decision-makers are using the available tools, or which tools are facilitating adaptation in B.C. Ministries may need to provide assistance to local governments and others using the tools, as they might not have the capacity to implement them.

FARM ADAPTATION INNOVATOR PROGRAM

The $1.7 million Farm Adaptation Innovator Program promotes innovation in farm practices, approaches and technologies. The program supports the demonstration of farm practices and technologies that reduce weather related production risk. It also supports the development of information and knowledge sharing resources and capacity to assist with adaptation. The BC Agriculture & Food Climate Action Initiative delivers the program. It is funded by *Growing Forward 2* — a federal-provincial initiative.

Area 1 deliverable: continue knowledge transfer and outreach activities

We assessed government progress on two activities under this deliverable:

- the development of a continuing education program on climate change impacts and adaptation for professionals and decision-makers
- incorporating adaptation into provincial climate change outreach programs

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Government did not develop a continuing education program, but information on adaptation is available through climate change outreach websites.

CAS worked with PICS on an online video series—Climate Insights 101— and contributed to other professional development opportunities, such as:

- development of the Green Shores curriculum to increase the use of natural shorelines to combat the impact of extreme weather
- training, in partnership with professional associations (e.g., chartered professional accountants) to incorporate climate change into their work

In addition, at the ministry level, FLNR offered a series of training workshops to staff on integrating climate change into their work. TRAN also provided presentations to staff on designing infrastructure with climate in mind.

There remains a need for a continuing education program on climate change impacts. Staff in many fields will require retraining to understand the impacts of climate change in B.C. and how this will affect their day-to-day work.

Government staff from ENV, TRAN, AGRI, MAH and FLNR have presented on adaptation to a variety of groups external to government. For example, staff did presentations for the Planning Institute of BC, Canadian Water Resources Association, Chartered Professional Accountants, Island Health Authority, BC Community Forest Association and BC Institute of Agrologists.

A further deliverable in this area was to incorporate, where appropriate, adaptation concepts and actions into provincial climate change outreach programs. Adaptation has been included in the BC Climate Action Toolkit—a climate change outreach website for local governments. The adaptation webpage within the BC Climate Action Toolkit explains adaptation, provides links to other tools, and gives examples of local governments that are already taking action. The ministry reported that between December 2015 and December 2016, this website had 19,930 visitors with 45,808 page views, and the adaptation page was the sixth most popular on the site.

CAS also supported ongoing work through the Fraser Basin Council, which operates the retooling.ca website. This website provides information on climate change and its impacts, community case studies, guidance documents for local governments, and specific information on different adaptation topics, such as water management, agriculture and mining. The Fraser Basin Council reported that between 2010 and 2017 the website had 9,366 visitors and 43,601 page views, with the climate ready webinars the most popular. There has been no direct assessment of how local governments use these pages and resources.

RECOMMENDATION 3: *We recommend that government provide staff with a continuing education program on climate change impacts and adaptation.*

RECOMMENDATION 4: *We recommend that government work with local government and other stakeholders to assess the effectiveness of existing tools and resources for local governments and agricultural producers, and take action on their findings.*

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Area 2: More work needed to mainstream adaptation

Making adaptation part of government's business—or *mainstreaming it*—is critical to successfully adapting to climate change in B.C. Some ministries in our audit scope have incorporated adaptation into planning processes; however, government still needs greater focus on including adaptation in policy and decision-making.

Area 2 deliverable: consider adaptation in planning

The adaptation strategy requires ministries to:

- consider climate change impacts by incorporating into ministry service plans and business planning
- integrate adaptation into B.C. government policies, legislation and regulation
- identify approvals that are sensitive to climate change and where possible, incorporate consideration of climate change impacts in the approvals process

Ministries should systematically identify policies where climate impacts may challenge their ability to achieve their goals. They should therefore update policies and associated procedures accordingly. Ministries have begun this work, but more is needed to integrate climate change impacts into policies, legislation, regulation and approvals.

Ministries will consider climate change impacts in service plans and business planning

To some degree, all ministries in the audit scope have incorporated adaptation measures into their service plans. ENV, AGRI and FLNR have done so to a greater extent than TRAN and MAH.

Below are examples of how ministries have incorporated adaptation into their business planning:

- FLNR created ministry-wide plans for climate change and required its branches and regions to do the same.
- AGRI has incorporated adaptation into some of its key ministry plans, such as the *BC Agrifood and Seafood Strategic Growth Plan* and the *BC Agrifoods Innovation Strategy,* as well as one branch plan.
- TRAN has produced a high-level Climate Resilience Plan for the ministry.
- MAH has incorporated high-level climate change activities, including water-focused activities, into internal business planning documents.

In the *Climate Leadership Plan,* the provincial government committed to:

- developing guidelines for public sector operations to reduce emissions and plan for climate change adaptation

- mandating the creation of 10-year emissions reduction and adaptation plans for provincial public sector operations

This could be an opportunity for ministries to improve their planning for adaptation, and ensure that actions on adaptation and mitigation are aligned.

CLIMATE ACTION PLANNING AT FLNR

FLNR published its *Climate Change Strategy for 2015-2020* with three main goals, including managing climate change as a core part of FLNR's business. All FLNR branches and regions were required to develop climate action plans by March 31, 2016, and begin implementation on 80% of these plans by September 1, 2016. They have now completed their plans, and many of the goals, objectives and actions align with activities in the adaptation strategy.

After completion of the plans, FLNR produced a report on actions that it could not fund with existing resources. It also found there were challenges connecting and prioritizing actions across the ministry. The conclusion was: "unless other tasks change, or additional resources are provided, implementation of actions to integrate climate change seems likely to be slow, despite the many climate actions that are already being undertaken."

Integrate adaptation into B.C. government policies, legislation and regulation

Ministries are in the initial stages of integrating adaptation into policies, legislation and regulation. There is an ongoing need for this work because there will be continued change in climate projections, vulnerability and climate impacts.

For many ministries in our audit scope, we found no evidence that ministries were reviewing and updating legislation or regulations to incorporate adaptation. However, several ministries told us that legislation and regulation were not the appropriate tools to integrate adaptation.

Ministries often use a professional reliance model that places responsibility in the hands of certified professionals, and does not prescribe specific actions. For example, the Association of B.C. Forest Professionals released a position paper on climate change, indicating that it is the responsibility of practicing forest professionals to learn more about climate change and develop skills that allow them to consider climate impacts in their work. We did not audit whether or not certified professionals are considering climate impacts in their work.

However, as we discuss later in this report, the new *Water Sustainability Act* does incorporate climate change adaptation. Given the relative newness of this Act, we did not focus much audit work in this area.

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Adaptation was not incorporated into many policies across the ministries in our audit scope. However, we did find some incorporation of adaptation, including:

- work at FLNR to adjust policy and pricing to provide conditions required for forest licensees to complete enhanced basic reforestation (i.e. activities such as increasing planting densities that would help adjust to a changing climate)
- guidance for FLNR decision-makers who review forest stewardship plans that requires consideration of climate change impacts as part of the long-term forest health test
- TRAN issued a policy directive requiring all design work to include vulnerabilities associated with climate change and extreme weather

Ministries could look to the example set by TRAN, as it has issued a directive to formally incorporate climate change adaptation into design and approvals of its infrastructure engineering work. In 2015, to mitigate future consequences over the life-cycle of infrastructure, TRAN issued a Technical Circular. This document required infrastructure engineering design work to evaluate and consider:

- vulnerability associated with future climate change and extreme weather events
- appropriate adaptation measures when feasible

Engineers must complete the Design Criteria Sheet to reflect design changes that incorporate climate change. Design criteria sheets have been completed for 46 culvert projects and 28 bridge projects.

To complement this work, TRAN worked with Engineers and Geoscientists BC to develop professional practice guidelines for developing climate change resilient designs for B.C. highways. This work is recognized across Canada as a leading practice on adaptation.

TRAN is also investigating how to include climate adaptation in the renewals of its maintenance contracts.

Exhibit 10: Highway infrastructure in British Columbia

Source: Ministry of Transportation and Infrastructure

Identify approvals that are sensitive to climate change and consider revising

Consideration of climate change in approvals and permitting for natural resources and the built environment (i.e., human-made surroundings in which people live, work and play) is necessary to ensure that decisions with long time-frames take future conditions into account.

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Approvals include important decisions in ministries, such as how much timber can be cut, how natural resources can be used and allocating funds to construction projects. Permits are issued for major projects, such as opening a new mine, and for many small projects, such as carrying out heritage inspections. Not all ministries in our scope have a statutory role in approvals or permits.

Ministries in our audit scope did not complete a formal process to identify approvals that are sensitive to climate, though work to do so has begun at FLNR. Climate adaptation considerations have only been incorporated into a few approvals. Some examples include:

- TRAN's approval of all infrastructure projects (as described above)
- some of MAH's infrastructure construction grants
- FLNR's determination of Annual Allowable Cut of timber, with limitations around climate uncertainties (a statutory decision)
- FLNR's framework for managing changes caused by the combined impact of past, present and future human activity (though evidence indicated there was room for improvement in this area)

ADAPTATION AND *GROWING FORWARD 2*

Growing Forward 2 is a five-year (2013-2018) policy framework for Canada's agricultural and agri-food sector. Under the framework, the B.C. government and the federal government signed the Canada-BC Bilateral Agreement. Adaptation is a key component of this agreement and five of the programs feature adaptation.

AGRI staff reported that other provinces have not incorporated adaptation into this framework, and that this is unique to B.C. and AGRI. By incorporating adaptation into such a large program, the ministry is ensuring that adaptation gets funding and priority. Based on this work, AGRI created a discussion paper on how climate adaptation can be integrated into the next federal/provincial/territorial policy framework on agriculture.

Exhibit 11: Livestock farming in British Columbia

Source: BC Agriculture and Food Climate Action Initiative.

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INCORPORATING ADAPTATION INTO FUNDING PROGRAMS FOR LOCAL GOVERNMENTS

MAH offers a number of different funding programs for local governments. Some of those programs have adaptation criteria. For example, the New Building Canada Fund requires applicants to consider how climate change may impact on the project, and where needed, address these impacts.

RECOMMENDATION 5: *We recommend that government consider climate change adaptation in its legislation, regulation, approvals and permitting processes.*

Area 2 deliverable: implement adaptation through a co-ordinated approach

Adaptation to climate change reaches across jurisdictional boundaries and requires all levels of government, the private sector and the public to work together.

Ministries were to engage with partners in other levels of government, the private and non-profit sectors and other jurisdictions. We found that ministries have engaged and worked with partners in other levels of government. For example, AGRI involved local governments in the creation of Regional Adaptation Strategies to implement adaptation actions in agricultural regions.

Further in this report, we discuss the role of local governments in climate adaptation, and:

- how they are working with the provincial government
- barriers they are facing to successful adaptation.

TRAN, FLNR, CAS and Emergency Management BC (EMBC) have worked with professional associations, such as Engineers and Geoscientists BC and the Association of BC Forest Professionals. Ministries have also worked with industry groups and individual producers. For example, AGRI, through the BC Agriculture and Food Climate Action Initiative, has worked with the Cowichan Agricultural Society, BC Blueberry Council, BC Peace River Regional Cattlemen's Association, Cariboo Growers, Fraser Basin Council and the BC Fruit Growers Association – among others.

Ministries have engaged with the federal government and other provinces on some adaptation initiatives. Some examples include:

- FLNR participates in the work of the Canadian Council of Forest Ministers on adaptation
- ENV worked with Natural Resources Canada through the Adaptation Platform and jointly funded projects with them
- AGRI collaborates with Agriculture and Agri-Food Canada on an ongoing basis under the *Growing Forward 2* agreement
- EMBC works with Public Safety Canada to fund projects through the National Disaster Mitigation Project

- FLNR and ENV participate in Landscape Conservation Cooperatives with the United States. This is an advisory group from the provincial and state natural resources ministries that provides advice on stakeholder engagement, communications and effective methods of participation.
- TRAN has presented B.C.'s approach to climate adaptation in the transportation sector to Alberta, Manitoba, Ontario, New Brunswick, Yukon and Northwest Territories and has participated in a workshop to develop Alberta's adaptation policies.

We did not determine the effectiveness of these collaborations as part of our audit work.

BC REGIONAL ADAPTATION COLLABORATIVE

The Regional Adaptation Collaboratives (RACs) initiative is a cost-shared federal program that works with regional organizations to help communities prepare for and adapt to local impacts posed by the changing climate. In B.C., the RAC is coordinated by the Fraser Basin Council and the Climate Action Secretariat. The Fraser Basin Council reported that 5,400 decision-makers and stakeholders were engaged, and over 115 reports, policies, guidelines, plans and case studies on adaptation were published.

During the course of our audit, the provincial government had little adaptation work underway in partnership with First Nations. There is a need for greater consultation and collaboration on adaptation with First Nations throughout the province. First Nations communities are often vulnerable to climate change impacts. In addition, traditional ecological knowledge can have great value when planning climate adaptation actions.

Area 3: Some risks assessed, and limited review and updating of policies and activities

FLNR and TRAN have directly assessed risks posed by climate change, while AGRI and ENV have supported and contributed to assessments done by other stakeholder groups. Government policies, strategies and operational activities were not widely reviewed or updated as part of the assessment process.

Area 3 deliverable: assess risks and implement actions

Under the adaptation strategy, government committed to conducting climate change assessments for sectors known to be sensitive to climate change (e.g., agriculture). Also government and its partners were to review and update through the assessment process, existing policies, strategies and operational activities. Government either completed or supported a number of risk and vulnerability assessments. However, there were few examples that updates to policies, strategies and operational activities had been done as part, or as a result of, the assessment process.

Ensuring that key ministry goals can still be met with climate change occurring is critical. When assessing risks, ministries should identify their key policies

and operational activities and review with a focus on climate change impacts. Ministries should ensure that activities, notably those with long-lasting impacts, will contribute to positive change.

The risk assessments that ministries and external groups completed all had different methodologies and approaches, leading to a lack of comparability or understanding of how the assessments work together. Also, the assessments do not give a comprehensive overview of the climate risks for the province, and sectors were not consistently defined. Government did not require assessments to be done in any specific sector.

AGRICULTURE RISK AND OPPORTUNITY ASSESSMENT

AGRI funded the BC Agriculture and Food Climate Action Initiative (CAI) to complete a risk and opportunity assessment for the agricultural sector in the province. CAI completed 37 interviews and 12 focus groups with producers and specialists across the province.

These discussions helped identify common issues of concern, such as increased variability, changes to averages and extremes, increased complexity and cumulative effects. Stakeholder input also informed the development of potential key actions that will help the agriculture sector to adapt to climate change.

To determine the necessary components of a risk and vulnerability assessment, we reviewed Canadian and international best practice guides. There was no set process that all jurisdictions followed. However, the following steps were typically included:

- a defined scope (what will be included or excluded from the assessment)
- climate data
- stakeholder input
- identification of risks
- estimation of risk likelihood and vulnerability
- prioritization of risks

We reviewed ministries' risk and vulnerability assessments that addressed highway infrastructure, agriculture, managed forests, natural resource values, the oil and gas sector, and the mining sector. We also reviewed an assessment done on atmospheric rivers (air currents that carry high volumes of water). The majority of the risk assessments had a defined scope, climate data and risk identification. Three of the assessments had stakeholder input, and five assessed vulnerabilities. However, only TRAN's assessments of highway infrastructure included an estimation of risk levels and a ranking of risks.

Overall, there were few examples that updates to policies, strategies and operational activities had been done as part, or as a result of, the assessment process.

AGRI created an adaptation program following the completion of the Agriculture Risk and Opportunity Assessment. Regional Adaptation Strategies (RAS) were completed for Delta, Cowichan, Peace Region, Cariboo Region, Fraser Valley and Okanagan. The CAI

again led this work, with funding from AGRI and Agriculture and Agri-Food Canada under the *Growing Forward 2* agreement. Each RAS included a number of priority action items (determined through stakeholder discussions). To date, government has funded 41 projects across the province. However, with over 160 actions identified, initial funding is not sufficient to cover all the actions planned.

TRAN'S PIEVC RISK ASSESSMENT

TRAN assessed the risks to five segments of B.C. highways that represent a diverse range of geographic and climatic conditions.

TRAN used a protocol developed by Engineers Canada (called the Public Infrastructure Engineering Vulnerability Committee or PIEVC), specifically designed to evaluate climate-driven threats to infrastructure. The assessments estimated risk levels by assigning probability and severity scores. Using scales from 0 to 7, the team scored how likely climate change would negatively affect the infrastructure (0 = negligible; 7 = approaching certainty) and the severity of the consequences (0 = negligible; 7 = extreme loss of asset). Combining these factors provided an overall level of risk, which could be compared to the overall level of risk the ministry is willing to accept.

The data from the PIEVC assessments was used to develop the policy requirements laid out in the technical circular.

Obstacles to adaptation

Throughout our work, we looked to identify obstacles that might hinder ministries from moving adaptation forward, or that could make progress difficult. The relevance of these obstacles will vary by ministry, and some are issues common to complicated problems.

- *Lack of mandate:* In 2014, CAS surveyed government staff working on adaptation and found that the lack of a mandate was a significant barrier to adaptation. This was characterized by:
  - absence of direction
  - absence of resourcing
  - failure to embed adaptation within core ministry business
  - inability to get executive approval for adaptation initiatives
  - absence of supportive legislation or policy direction
  - government reliance on others to implement legislation and policy
- *Resources and capacity:* Our office, a 2014 CAS survey and the Agriculture Adaptation Working Group (under the NRCAN Adaptation Platform) all had similar findings.
  - In our audit, we talked to ministry staff members, who told us that:
    - resource shortages, both financial and human, are a challenge in

moving adaptation forward; staff are often trying to manage adaptation-related projects on top of many other responsibilities

- several key adaptation experts—across all ministries—are close to retirement and government is losing specialists (and their knowledge)

- The Agriculture Adaptation Working Group had similar findings:
  - funding was a barrier to adaptation across Canada
- CAS' 2014 survey also had similar findings:
  - lack of financial resources were a barrier
  - capacity and expertise barriers, such as loss of specialists, maintaining existing capacity in the face of retirements, limited staff knowledge of climate change and what to do about it, lack of climate change related training, and the need for professional training and upgrading

- *High cost of adaptation:* At times, adaptation initiatives can have high dollar values attached (e.g., rebuilding dikes) and this can limit action.
- *Complex initiatives:* Many adaptation issues require the involvement of multiple ministries and cross-agency integration.
- *Inability to deal with multiple scenarios:* Uncertainty around future climate scenarios and the effectiveness of solutions can hinder adaptation activities, as well as a lack of understanding of how climate will impact areas.
- *Lack of focus on adaptation:* Interviewees told us that adaptation is often seen as a lower priority than mitigation.

On a positive note, we found that *champions* helped drive adaptation forward in the province. These champions facilitated progress on climate adaptation in different ministries.

Monitoring and reporting

Monitoring performance and evaluating outcomes is the final step in best practice adaptation processes. This step is critical, given the iterative nature of adaptation. Government and ministries need to know if their actions are reducing risks, and should share progress with the public to build wider knowledge on adaptation.

Lack of consistent performance monitoring

We expected that government would have monitored progress on its adaptation actions at both the whole-of-government and ministry-specific levels. We wanted to know if ministries had evaluated their programs to understand if actions are having the intended impacts.

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Adaptation will require ongoing learning and adjustments. The climate will continue to change, and we will never be able to predict exactly what will happen. Without monitoring and reporting government cannot determine the results of its actions and make adjustments.

Government has not comprehensively monitored or evaluated progress on its adaptation actions. The Ministry of Environment & Climate Change Strategy's (ENV) Climate Action Secretariat (CAS) collected occasional progress reports across government, but government did not have specific measures or targets in place. CAS is in the early stages of developing a monitoring and evaluation framework for government.

The ministries we audited are all at different stages of monitoring, and are measuring different indicators across the province. AGRI and FLNR have formal performance monitoring activities underway, but MAH, TRAN, EMBC and ENV do not. None of the ministries have comprehensively evaluated the effectiveness or appropriateness of their adaptation activities.

Performance monitoring at the ministry level:

- AGRI has monitored performance against its adaptation actions for 2013/14 – 2015/16. The monitoring framework includes a five-year target, sources of data and frequency of reporting, as well as measures for outputs, and immediate, intermediate and end outcomes.
- FLNR implemented a Climate Change Performance Scorecard in October 2016 that tracks seven different aspects of performance (e.g., business planning, employee education and decision-making). FLNR has also monitored progress and reported achievements against the Forest Stewardship Action Plan for Climate Change Adaptation
- TRAN measures success based on assessment of how well infrastructure, designed with climate change in mind, withstands climatic events (e.g., storms).

There are some challenges that may be encountered when trying to measure adaptation. Adaptation is not a fixed future state, meaning that the exact level and type of adaptation needed is unknown. And measuring towards a moving target can be difficult. Plus, adaptation often involves taking action to reduce the likelihood of a risk occurring. However, it is difficult to determine if actions taken prevented that risk from occurring.

Effective monitoring and evaluation requires clear statements of desired outputs and outcomes. Given that the adaptation strategy is high-level and does not include clear outputs and outcomes, monitoring is even more difficult.

Without effective monitoring and evaluation in place, government cannot determine:

- the success of its adaptation initiatives
- opportunities to identify best practices and gaps in activities underway

- whether funding is going to projects that have beneficial outcomes in the province

RECOMMENDATION 6: *We recommend that government create a performance monitoring framework based on the goals, activities and outcomes outlined in the adaptation plan (see Recommendation 2).*

Minimal government reporting on adaptation

Adaptation to climate change requires a joint effort from the provincial government, other levels of government and the public. As such, government needs to publicly report on its progress towards adaptation goals to ensure efforts are coordinated with partners. In addition, public reporting holds government accountable for its actions.

Government has reported publicly on the adaptation strategy at a high level. In its 2012 publication, *Making Progress on B.C.'s Climate Action Plan*, government reported on some of its actions on the core deliverables in the adaptation strategy. In its 2014 report, government provided less detail on its actions. Government needs to be more specific when reporting to ensure the public fully understands the risks and what government is doing to address them.

Only one ministry has reported publicly on its adaptation actions. AGRI's service plan reports for 2011/12 and 2012/13 describe the number of beneficial management practices projects funded by the Growing Forward program. And for 2015/16, AGRI reported on the number of regional adaptation strategies completed.

Government has no requirements to report publicly on adaptation performance. Under the *Greenhouse Gas Reduction Targets Act*, government must report on its progress to reach emissions reduction targets (i.e. actions for climate change mitigation) every even-numbered year. Because there is no similar legislation in place for adaptation, reporting on adaptation across government has been sparse.

RECOMMENDATION 7: *We recommend that government improve public reporting, including providing detailed public reporting on adaptation when completing legislated reporting on mitigation.*

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SECTION 2: CLIMATE DATA

Climate data is a critical aspect of successful adaptation. With the necessary climate data, government can:

- assess risks more precisely
- plan for and make more robust decisions
- make better informed investments
- verify the accuracy of climate change models

Climate monitoring is occurring in the province, but there are challenges limiting the geographic completeness of the data.

The need for climate monitoring in the province is clear; here are a few reasons why:

- B.C. is home to different climatic regions, from the rainforests of Vancouver Island to the deserts of the southern Okanagan. The province is more physically and biologically diverse than any region in Canada. As a result, weather in one region is not indicative of other regions.
- Climate monitoring can save costs, help avoid unexpected expenses (i.e., through monitoring of river levels and provision of flood warnings) and generate revenue. Better data reduces costs for design, construction and operation of infrastructure by reducing uncertainty. In 2003, ENV found that every $1 spent on the hydrometric network resulted in $19 of benefit[8].

Government can use climate data for both short and long-term decision-making. For example, current hydrometric, meteorological, groundwater and snow information can all guide decisions around the severity and response to flood. Data gathered under all climate-related monitoring networks (e.g., Avalanche and Weather Program, Fire Weather Network, Snow Survey, BC Hydrometric Program, Groundwater Observation Wells) can inform decisions for public and environmental health and safety, and resource allocation.

In the long term, high-quality and consistent data collection can determine how the climate is changing across B.C. This data includes average temperature increases or decreases, and how patterns of precipitation are changing in the province.

Exhibit 12: Ministry of Environment & Climate Change Strategy snow monitoring station

Source: Ministry of Environment & Climate Change Strategy

[8] Ministry of Sustainable Resource Management. (2003). Water Quantity Monitoring in British Columbia: A Business Review of the BC Hydrometric Program

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KEY FINDINGS AND RECOMMENDATIONS

Meteorological data, rolled up into climate data, is used to determine trends and verify models of future climate. This is critical information when determining what type and level of adaptation is needed in the province. The Pacific Climate Impacts Consortium is a major source for climate models in the province.

Our audit work focused on the data itself, given that the modelling can only be as good as the data it uses. We did not audit the adequacy or availability of climate modelling and projections in the province.

Government is monitoring climate in a number of different ways. See Exhibit 13, which explains the climate monitoring networks, what they measure and who manages them.

Exhibit 13: Climate monitoring networks in British Columbia

Type of data	What is being measured?*	Number of stations**	Participants (including cost-share partners)	Network administration
Meteorological	• temperature • precipitation • wind speed	640	Air Quality Network: ENV Fire Weather Network: FLNR Forest Ecosystems Research Network: FLNR Avalanche and Weather Program: TRAN Generation Program: BC Hydro Ministry of Agriculture Rio Tinto Alcan Metro Vancouver Capital Regional District	Networks are included in the Climate Related Monitoring Program (CRMP) created through a memorandum of understanding.
Hydrometric	• water level • streamflow • water temperature	450	ENV Environment and Climate Change Canada (ECCC)	ENV and ECCC jointly administer the network under the Canada-BC Hydrometric Agreement. Under this agreement, ECCC runs the network.***

Exhibit 13: Climate monitoring networks in British Columbia *continued*

Type of data	What is being measured?*	Number of stations**	Participants (including cost-share partners)	Network administration
Snow	◆ temperature ◆ precipitation ◆ snow depth ◆ snow water equivalent	145 manual and 71 automated	ENV FLNR BC Hydro Rio Tinto Alcan Metro Vancouver	ENV administers the network and automated snow stations, FLNR and ENV collect the data.
Surface water quality	◆ physical parameters ◆ bacteria ◆ chemicals ◆ organisms that live in or on the bottom sediments of rivers, streams and lakes	40 rivers and streams 63 lakes	ENV Environment and Climate Change Canada (ECCC)	ENV and ECCC jointly coordinate the stream and river network. The lakes network is solely administered by ENV.
Groundwater	◆ quantity ◆ quality	192	ENV FLNR	ENV administers the network and FLNR collects the data.

*Not all stations within these networks measure all of the parameters listed.
**Station numbers are based on the maximum size of the networks in the 2016/2017 fiscal year.
***There are an additional 107 sites currently run, or being established by, FLNR that are independent of the Canada-BC network.
Source: Office of the Auditor General of British Columbia based on data provided by the Ministry of Environment & Climate Change Strategy

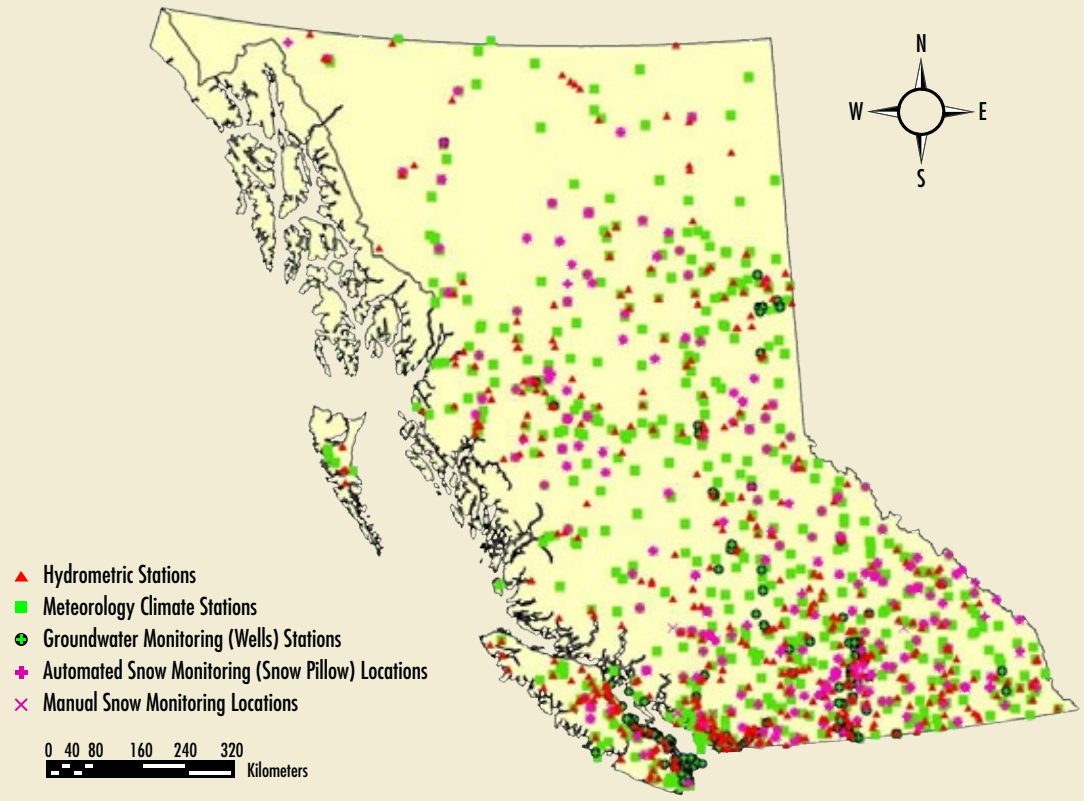
Challenges with collecting climate data

There are a number of challenges with monitoring climate in the province. ENV staff are aware of the existing gaps and are working to address them through the creation of formal accountability agreements and optimizing network operations. The challenges outlined below do not apply equally to all of the networks in the province, and how the challenges are experienced can vary.

Many interviewees reported that a lack of resources is the cause for the gaps and challenges with climate monitoring. Data gaps cause uncertainty, limit modelling of future impacts and lead to uninformed decision-making.

- *Geographic gaps in existing monitoring:* Networks in the province generally do not meet the World Meteorological Organization standards for station density. Analysis done in 2003 found that 17 of the province's 29 hydrologic zones have station densities which are less than 25% of the station density criterion for at least three climate-related parameters. Gaps exist in the northern regions of the province—areas with both high rates of development and high rates of warming, as shown in Exhibit 14. There are gaps in climate monitoring at high elevations. There are also more localized gaps in other regions of the province.
- *Gaps in certain data types:* Documentation indicated that improvements to climate, snow,

Exhibit 14: Climate monitoring stations in British Columbia



Source: Ministry of Environment & Climate Change Strategy

hydrometric and groundwater information are required to better forecast emergent conditions and inform critical decisions. Some of the provincial networks do not meet recognized standards for station density and improvements are required. Addressing gaps in water quality and quantity data was identified as a priority action under the *Northeast Water Strategy.*

- *Hydrometric:* As discussed above, the hydrometric network is considered sparse – according to international standards – with few small, vulnerable streams being monitored. Staff reported ENV receives regular requests for additional stations, and a 2003 study found that funding support was far below the optimum to meet needs.
- *Groundwater:* Groundwater monitoring stations exist in about 17% of the mapped aquifers (underground rock or silt that can store groundwater) in the province. There are a number of aquifers where groundwater is being withdrawn but there is no monitoring station.
- *Precipitation measurement:* Network staff reported difficulties in correctly measuring the amount or type of precipitation in the province. Technological solutions do not always stand up to the extreme weather conditions that can occur.
- *Lack of a corporate approach*: Although a coordinated effort is led by ENV, each network was initiated at a time when the objectives focused on individual organizational mandates and not on climate change analysis. ENV is working with all agencies to build a Network of Networks approach to harmonize data and operations. For example, each individual program manages its own data storage, quality assurance, quality control and maintenance. This can affect data consistency, as networks may use different standards for equipment, location and set-up of stations and data collection. In addition, new stations may be added ad hoc (either outside or within the network), without ensuring that standards are met. Lack of consistency can make analysis challenging or even impossible.
- *Need to balance priorities:* Priorities for the data can be different at different levels, between regions and headquarters and across ministries. Interviewees reported that in some scenarios, staff see collecting the groundwater or snow data as low priority, which can affect the sustainability of the networks. There can also be a disconnect among individual users of the data and the natural resource sector as a whole.
- *Limited quality assurance and quality control* (QA and QC): We heard that some of the meteorological networks and PCIC's QA and QC processes were limited, posing risks to the quality of the data used in analysis and decision making.

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Exhibit 15: Forest research monitoring station

Source: Ministry of Forests, Lands, Natural Resource Operations and Rural Development

RECOMMENDATION 8: *We recommend that government identify priority unmet climate data needs and fill gaps accordingly. This work should be done in collaboration with network operators as well as with users, such as flood forecasters and climate modellers.*

SECTION 3: FLOOD, WILDFIRE AND DROUGHT: KEY CLIMATE-RELATED RISK AREAS

Through interviews with provincial and local government staff, we identified three major climate-related risk areas in the province: flood, wildfire and drought. We completed additional interviews and document review to provide a high-level assessment of how these risks were impacted by climate change, and how government managed them. We did not examine emergency response activities. These risks can build upon each other. For example, following a wildfire, flooding risk increases due to loss of vegetation and dry soil that limits absorption of rainfall.

As illustrated in Exhibit 5, there are a number of other climate-related risk areas in the province.

Flood

Flooding has always been a reality in British Columbia, though 70 years have passed since the last major Fraser River flood (1948). However, with a changing climate, flood risks in the province are also changing. An assessment done by the Fraser Basin Council found that a major flood in the Lower Mainland would be the costliest natural disaster in Canadian history. More work is required at both the provincial and local government levels to ensure B.C. is prepared for these changes.

Exhibit 16: 2010 flooding in Bella Coola

Source: Ministry of Transportation and Infrastructure

Climate change will likely increase flooding

Climate change will likely affect floods in a number of ways, including:

- Major floods in the Lower Mainland may increase in frequency and magnitude. FLNR's modelling found that major floods that might have been expected to happen once every 200 to 500 years may happen once every 50 years.
- Coastal flood risks will likely increase due to climate change impacts, such as sea level rise, changing storm patterns, increasingly intense rainfall events and increased river flooding.
- Increased fall and winter precipitation (potentially in the form of high-intensity short duration rainfall events or atmospheric rivers)

and higher temperatures will turn snow into rain; this is expected to increase flooding in coast mountain rivers and streams. This may also result in more frequent landslides that generate debris flows and floods.

- High-intensity, short duration rainfall events or atmospheric rivers can also cause urban flooding as the capacity of existing storm sewers may not be enough to handle larger flows.

Exhibit 17: 2017 flooding near Logan Lake

Source: Drive BC

SEA LEVEL RISE

The B.C. government recommends planning for 1 metre of sea level rise for the year 2100, though there is a range of estimates in scientific literature. Sea level rise will vary in different coastal regions of the province. Due to geological factors, such as plate tectonics and post-glacial rebound, some areas of the province are very slowly moving upwards. Other areas, such as the Fraser River Delta are slowly sinking.

Exhibit 18: Expected sea level rise (SLR) in regions of B.C.

Location	SLR – extreme low (cm)	SLR – Average (cm)	SLR – extreme high (cm)
Prince Rupert	10-31	25-46	95-116
Nanaimo	-4	11	80
Victoria	2-4	17-19	89-94
Vancouver	4-18	20-33	89-103
Fraser River Delta	35	50	120

Source: Office of the Auditor General of British Columbia, based on Ministry of Environment & Climate Change Strategy and Government of Canada Projected Sea Level Changes for BC in the 21st Century

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Continuing development in flood-plains means that flood risks are particularly relevant. In the Lower Fraser region, approximately 500,000 people live or work in the flood-plain, with another 1.5 million dependent on infrastructure in the flood-plain.

Improvements needed to effectively manage flood risk

Government may not be able to effectively manage the increasing flood risk posed by climate change. Government needs to shift its approach to managing flood risk to ensure the future safety of communities in B.C. Although local governments are responsible for much of the management of the underlying risks they have limited incentives to take action. However, the province likely bears financial risk due to flooding.

Roles and responsibilities for addressing flood risk are spread across a number of ministries, and are split between the provincial and local governments. There is need for greater leadership from the provincial government to ensure that flood risks are fully addressed.

At a provincial level, FLNR's Flood Safety Section is largely responsible for flood prevention with a focus on providing policies, guidelines and information to local governments, diking authorities and provincial ministries to manage land use in flood hazard areas. FLNR also regulates new dike construction, repair and alterations under the Dike Maintenance Act. EMBC also plays a role through the coordination and delivery of the Flood Protection Program, which provided funding to applicants for projects that aimed to reduce the flood hazard in B.C. The Flood Protection Program has now been replaced by the National Disaster Mitigation Program also coordinated and delivered by EMBC. This program provides funding for flood mitigation studies as well as construction of structural flood mitigation projects.

Under the *Local Government Act*, local governments have planning tools to control and restrict floodplain development. Through bylaws (and without provincial approval), local governments can grant flood hazard land area exemptions and establish requirements for subdivision in flood-prone areas.

HISTORICAL SETTLEMENT IN FLOOD-PLAINS

Often, early settlements were established in flood-plains because of the advantages they offered to those settlements: access to transportation, trading via water routes, flat land for ease of building, and nearby land suitable for growing. These early land use decisions became more and more permanent over time as settlements grew, and many endure today. Climate change adaptation was not part of those early decisions, and now much more is known about the risks of settling in those locations.

Local governments did not always have these responsibilities. Powers were transferred from the provincial government in 2003 under the *Flood Hazard Statutes Amendment Act*. No additional

resources were transferred to local governments at this time. But to assist local governments with this work, the provincial government published the *Flood Hazard Area Land Use Management Guidelines*.

According to the Act, local governments must consider these guidelines when enacting flood-plain bylaws. These guidelines have been under review to incorporate climate change for some time. However, the provincial government has not set any requirements for local governments to adopt flood-plain bylaws or other methods of land use management. There is lack of clear direction for local governments in the area of flooding.

Exhibit 19: 2016 flooding in Dawson Creek

A study commissioned by ENV found that "the current provincial approach to fostering municipal flood risk management in B.C. which relies primarily on guidelines to encourage and inform voluntary municipal flood bylaw development does not appear to have been successful at fostering widespread participation by municipalities across the province".

A FLNR discussion paper reported it was likely that considerable development was occurring in flood hazard areas without adequate land use planning and/or flood proofing measures. Overall, the effectiveness of this model in providing adequate flood protection to the public is unknown.

Potential barriers for local governments to address flood issues include funding, expertise, perceived liability and conflict with local governments' desire to accept more development to increase the tax paying population.

There is also a risk that the provincial government—let alone local governments—may not have the necessary staffing or technical capacity to adequately manage increasing flood risks. Providing the necessary guidance and support to local governments requires sufficient staffing. We noted a need for additional engineering expertise within the ministries to manage the programs.

Another key issue impacting local governments is the lack of up-to-date flood-plain mapping in the province. Currently, many of the province's flood-plain maps are out of date, and some areas do not have any mapping. Given the impacts of climate change on flood risk, there is a real need for updated flood-plain maps.

We heard from local governments that many felt the provincial government should be responsible for updated flood-plain mapping—especially since local governments reported they do not have the funding capacity or necessary expertise to do this work. There

would be benefits if adjoining local governments could use consistent flood-plain maps for their decision-making.

However, flood-plain maps alone cannot address flood risks. Governments must use the information portrayed by the maps to guide development decisions, create bylaws and determine ideal locations for new neighbourhoods.

WHAT ARE FLOOD-PLAIN MAPS?

A flood-plain map identifies the boundaries of a potential flood event, based on type and likelihood of a flood. Flood-plain maps can support decision-making by demonstrating the risks to both existing and proposed infrastructure and development.

For example, to respond to the increased risk of flood damage due to climate, the City of Vancouver did a coastal flood risk assessment. As a result, Vancouver amended its bylaws to raise the height of living and working spaces in new buildings for areas designated as flood plains.

Another key issue related to flooding is the province's diking infrastructure. In B.C., 75,000 hectares of land are protected by 500km of dikes, including 125 km of sea dikes. However, evidence suggests that the province's diking infrastructure will likely not be sufficient in the face of increasing flood risks.

For example, as part of the Lower Mainland Flood Management Strategy, Northwest Hydraulic Consultants assessed the dikes in the Lower Mainland and found that 71% of the dikes were vulnerable to failure by overtopping (i.e. flood waters would go over dikes) during either a major Fraser River or coastal flood.

Local government requests for infrastructure funding to reduce risks have historically exceeded the capacity of provincial programs. EMBC's Flood Protection Program received 470 applications for $665 million in projects and was able to fund 156 projects for $145 million. Through the National Disaster Mitigation Program, EMBC has been able to fund 30 projects for approximately $9 million, and this is cost-shared with the federal government.

In addition, using an application driven approach could not ensure that areas of the highest risk in the province received funding. Smaller communities often did not have *shovel ready* projects (i.e., projects where construction is ready to begin) limiting their ability to apply.

Dikes are part of a continuous system that is under the authority of different levels of government. Dikes on First Nations lands are under the authority of the federal government and are not required to meet provincial design standards. Even at the local government level, dikes that cross multiple jurisdictions may not be upgraded or maintained to the same standard. These inconsistencies can increase the risk of flooding.

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AUDITOR GENERAL OF CANADA RECOMMENDATIONS

B.C. is not alone in needing to make improvements to address flood risks. In 2016, the Office of the Auditor General of Canada recommended that:

- Public Safety Canada, working with key stakeholders, should develop guidelines and standards for flood-plain maps and encourage their consistent application in all provinces and territories
- Public Safety Canada, working with other departments, should examine the federal government's mitigation programs to identify potential changes that facilitate provincial and territorial investment in disaster mitigation projects

The province also has about 100 orphan flood protection works, typically riprap or berms constructed under emergency conditions that are not maintained by a diking authority. Given that they are not being inspected or maintained they have a higher likelihood of failure in flood events. This poses additional risk to communities in the province.

Work underway

The B.C. government has work underway to help address flood risks, including:

- implementing a new provincial Disaster Mitigation Program to cost-share municipal projects that identify and mitigate the risk of natural disasters, like floods and debris flows
- purchasing LIDAR (see sidebar) and ortho-imagery (aerial images adjusted for scale and terrain) for the Lower Mainland and Okanagan, and making the data available to local governments for use in the creation of flood-plain maps

LIDAR stands for Light Detection and Ranging and is a remote sensing method that uses light in the form of a pulsed laser to measure distance to the Earth.

- providing $1 million to the Fraser Basin Council for the second phase of the Lower Mainland Flood Management Strategy to inform next steps and future decisions on flood mitigation investments, as well as flood management policies and practices
- providing $20 million to plan and implement structural mitigation projects, such as floodways, dikes and pump stations, and $3 million for flood-risk assessments, flood-plain mapping and flood mitigation plans under the new Community Emergency Preparedness Fund
- EMBC has provided around $80 million in end-of-year funding for flood mitigation projects during 2015/16 and 2016/17

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FLNR has also identified the creation of a flood risk strategy as a major initiative under their 2016 Ministry Strategic Roadmap.

RECOMMENDATION 9: *We recommend that government, as part of its flood risk strategy:*

- *review roles and responsibilities for flood management in the province and clarify leadership*
- *set clear objectives that target areas of high priority and/or high risk*
- *link funding allocations to areas of high priority and/or high risk*
- *assess current capacity to meet objectives and identify and fill gaps*
- *tie flood mitigation funding for local governments to commitments to address risk at the local level*

RECOMMENDATION 10:

We recommend that government create a flood-plain and hazard mapping program that:

- *incorporates the effects of climate change and land-use change*
- *provides mapping standards with ongoing updates*
- *has expertise available for local governments to draw upon*

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Wildfire

Similar to the risks of flood and drought, the risk of catastrophic wildfire has increased with the changing climate. Within B.C., work is underway to incorporate climate change into wildfire response and to increase the focus on wildfire prevention. However, as the impacts of climate change worsen, the BC Wildfire Service (BCWS) will be strained. There is a need for more proactive management of wildfire risks to ensure continued success in wildfire response.

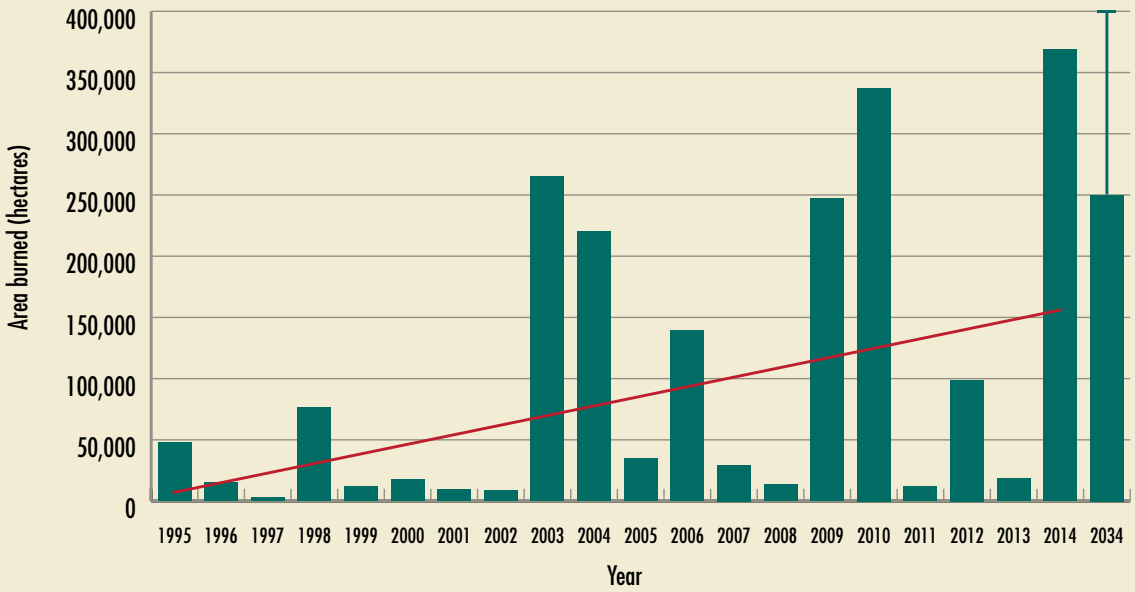
Exhibit 20: Wildfire in B.C.

Source: Ministry of Forests, Lands, Natural Resource Operations and Rural Development

Extreme wildfire will likely increase

Climate change is contributing to longer and more extreme fire seasons in the province. Rising temperatures and decreased water availability will affect the number and severity of B.C.'s wildfires. Exhibit 21 shows an increasing trend in area burned by wildfire since 1995, with a much higher projection of average area burned in 2034.

Exhibit 21: Area burned from B.C. wildfires 1995-2014, projection to 2034



Source: British Columbia Wildfire Service, Ministry of Forests, Lands, Natural Resource Operations and Rural Development

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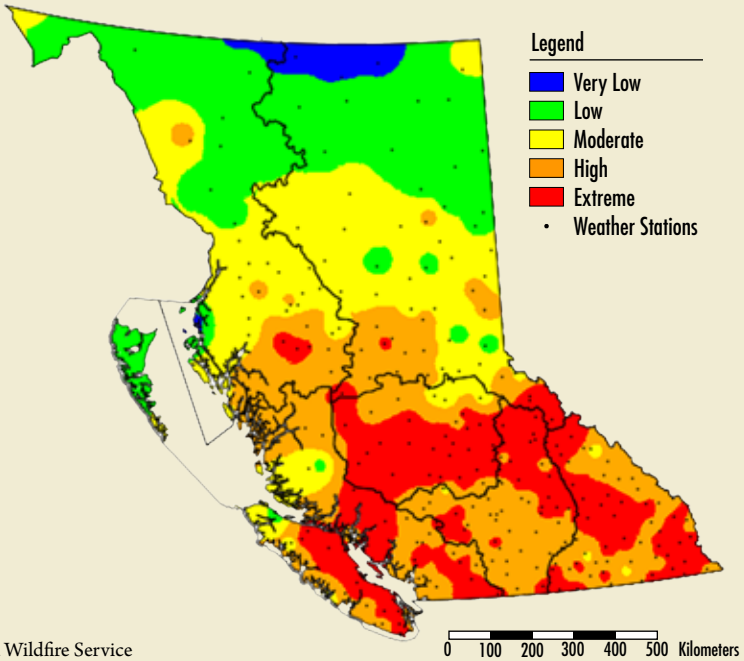
Climate change — in combination with two other factors: continued development (domestic and industrial) in the wildland urban interface and the historical and ongoing suppression of naturally occurring fires — presents challenges in the province. The Forest Practices Board's report on the subject indicates that in a busy fire season with large *mega fires*, firefighting resources may be overwhelmed and the public may not be able to count on government to protect their communities or valuable natural resources.

The Canadian Wildland Fire Strategy reported that "fire management agencies and response efforts will be significantly strained as the impacts of climate change worsen." This was evident during the 2015 and 2017 fire seasons, where BC Wildfire Service (BCWS) resources were stretched to contain the difficult fires in the province. These factors make the need for proactive management of wildfire risks central to ensuring continued success in wildfire response.

The wildland urban interface are areas where human development is adjacent or among undeveloped wildland areas that have flammable vegetation (e.g., trees, bushes, grasses, etc.).

Exhibit 22: Wildfire danger rating on July 19, 2017



Source: British Columbia Wildfire Service

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The BCWS, a branch of FLNR, is responsible for managing wildfires in the province. This includes prevention, mitigation and response strategies on Crown lands outside organized areas, such as municipalities or regional districts. Local governments have responsibilities for wildfire management in their jurisdictions.

Need for better risk assessment and research

To date, the BCWS has not completed a comprehensive risk assessment on climate change, and staff recognized this as an area where additional work is required. We also heard that government does not know the broader costs of wildfire to B.C.'s economy. There is a need for additional research into how climate change will impact fire behaviour, areas of high fire risks, timing of fires, and how to effectively address risks. Currently the BCWS has little research underway in this area. Understanding risks is a key step in allocating resources for future fire seasons.

Wildfire prevention activities are not sufficient

Currently, B.C. has a number of initiatives designed to prevent and mitigate wildfires in the province. Major initiatives include:

- the Strategic Wildfire Prevention Initiative
- landscape fire management planning
- the FireSmart Community Grant Program
- the Forest Enhancement Society of BC

However, to date, these initiatives have not been sufficient to substantially reduce the fire risk in the province. The provincial government estimates there are 1,347,000 hectares of high-risk area to be considered for treatment.

Under the Strategic Wildfire Prevention Initiative program, a reported total of 11,248 hectares have been treated or are planned for treatment. This is less than 1% of the total hectares that are considered high-risk in the province. At an average cost of $5000/hectare, the cost to treat all hazardous fuels would be over $6.7 billion. This illustrates the need for a holistic approach to reducing the hazard. While it is impossible to treat all fuels (live and dead litter, twigs, branches, and small trees) the province needs to maximize the value of the dollars that are available.

TREATMENT OF HAZARDOUS FUELS

Fuel treatments can involve prescribed burns, reduction of undergrowth and removal of dead trees to reduce wildfire severity and spread. Almost one-third of B.C.'s fuel treatments have occurred in just five 5 communities: Kamloops, Telkwa, Houston, Kelowna and Prince George. About ¼ of treatments have been completed in First Nations communities.

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The Forest Practices Board found that from 2005 to 2015, only 10% of high risk forests around communities had been treated. Also, it found that funding to protect at-risk communities in B.C. (by removing fuel sources adjacent to developed areas) is inadequate.

BCWS's 2015 After-Action review found that the Strategic Wildfire Prevention Initiative approach has been fragmented, and treatments are not always done in areas of the highest risk.

In addition, a presentation done by the Forest Enhancement Society of B.C. indicated that the opportunities to address wildfire risk and tree stands in need of rehabilitation and habitat restoration in B.C. far exceed the Forest Enhancement Society's current capacity. Some potential constraints to effective fuel management are:

- the high costs of treatment
- concerns around the health impacts of smoke and potential liability
- issues related to merchantable timber
- not all required tools exist (i.e., best management practices)
- lack of jurisdiction on private and industry lands.

In addition, many communities do not have the capacity to implement fuel management programs. The Forest Practices Board found that eighty communities in the province have completed Community Wildfire Prevention Plans, but have not done fuel treatments on the ground. This aligns with our analysis of Strategic Wildfire Prevention Initiative reporting, which demonstrated that approximately 49% of communities who have completed plans have not completed any operational treatments.

BCWS staff told us they are beginning to think about how to best integrate climate change into their work. BCWS activities underway include:

- creating a new strategic plan with a greater focus on prevention and mitigation
- better integrating with the other branches within FLNR
- participating in FLNR-wide planning discussions
- redefining the prevention program to include a greater focus on mitigation, with the understanding that not all fires can be prevented
- prescribed burns
- shifting programming (e.g., training in the fall instead of spring) to prepare for fires that happen earlier in the year
- hiring a communications and engagement specialist to develop and facilitate outreach and awareness programs that will foster community engagement in wildfire prevention

FLNR and EMBC staff also spoke about the need to continue public awareness activities within the

province. For example, increasing the understanding that not all fire is bad, and that fire can have positive impacts on ecosystems. The public has an important role to play in preventing the ignition and spread of wildfires, and protecting their homes from fire risks.

RECOMMENDATION 11:

We recommend that government conduct and support research into climate change and wildfire behaviour and incorporate findings into BC Wildfire Service planning.

RECOMMENDATION 12:

We recommend that government create an overall strategy to address hazardous fuel risks that:

- *uses a risk-based approach when allocating funds to reduce wildfire hazard*
- *ties wildfire mitigation funding for local governments to commitments to address risk at the local level*

RECOMMENDATION 13:

We recommend that government create additional educational materials and incentives for the public that focus on behavioural change to reduce wildfire hazard.

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Drought

Drought risk in B.C. is increasing under climate change. Drought impacts can be wide-ranging and affect drinking water, natural environments and industry. The province requires a more proactive approach to addressing drought, and government is currently beginning this work.

Drought may become more frequent and severe

The risk of drought in B.C. is changing due to climate change and is expected to result in more frequent and severe droughts in the future. Reduced snow packs and drier summers may lead to periods of low water supply in the summer that start earlier, last longer, and/or become more severe for many regions of the province, and have impacts on the amount of moisture in the soil. Droughts can also have other impacts, such as increased seedling death, damage to fish and aquatic ecosystems, threats to food security (access to safe and nutritious food), and negative effects on industries that use large amounts of water. Most areas of the province could experience drought — but according to climate change models, Vancouver Island, the Gulf Islands, the Lower Mainland and the Southern Interior, including the Okanagan, are expected to have the highest risk.

Drought risk is also impacted by human pressures, such as population growth and some types of economic development.

BC DROUGHT RESPONSE PLAN

The *BC Drought Response Plan* defines drought as a recurrent feature of climate that involves a deficiency of precipitation over an extended period, resulting in water shortages for areas such as agriculture, communities (including drinking water) and aquatic ecosystems. In the scientific literature, different types of drought exist: meteorological, agricultural, hydrological and socioeconomic. In B.C., droughts are often periods of seasonal water scarcity, not large-scale multi-year droughts like in California.

Shift to proactive focus on drought will be positive for B.C.

A number of ministries are involved in drought management in the province, and local governments also play a role. The B.C. government has built a formal structure to address drought, including several cross-ministry committees on drought management. The existing committee structure guides implementation of an annual provincial response to lower-than-average summer stream flows. Generally speaking, staff felt that the model was working well. Government could benefit from some additional internal capacity related to drought management.

Much of what government has done for risk of drought has focused on response rather than planning for future droughts and mitigating impacts. To encourage forward-thinking discussions, the Interagency Drought Working Group believes that a proactive

OKANAGAN BASIN WATER BOARD

The Okanagan Basin Water Board was formed as a collaboration of three Okanagan regional districts to provide leadership on water issues that span the entire valley: sustainable water supplies, clean water for drinking, and healthy lakes and streams. The board:

- undertakes a wide variety of water science and planning initiatives to inform watershed management and partnership with stakeholders
- provides grants to local governments, irrigation districts and non-profit organizations for projects that conserve and protect water
- serves as a convenor and center of communications for Okanagan water issues.

For example, the board is re-mapping the location and depth of Kelowna aquifers and has completed the first-stage of a study on the connection between groundwater and surface water in Mission Creek.

drought strategy is necessary for the future. Work on this strategy is currently underway at ENV and FLNR, using a stepped approach that will include a review of other jurisdictions and a regional issues assessment.

Water management is characterized by the dual forces of supply and demand. Responses to drought and planning for future drought can touch upon one or both of these sides. During our audit, we heard there is a need to ensure water availability throughout the summer months to address future summer scarcity related to climate change.

There may be a need for greater water storage capacity and associated infrastructure in the province, as hydrological patterns shift. FLNR found that many communities, notably smaller communities without adequate storage, as well as water suppliers, are vulnerable and do not have the tax base or organizational capacity to prepare for and respond to drought. Local governments are interested in better infrastructure development, and they are thinking about how to capture water and store it for drier parts of the year.

In addition, AGRI has identified supporting water storage infrastructure as a key priority for agricultural climate change adaptation. AGRI is planning to conduct an evidence-based assessment to support the creation of a plan to sustainably address these needs.

One specific infrastructure issue we found during our audit work was related to agricultural dams, which play an important role in retaining water for agriculture. Challenges to maintaining accessible, reliable water sources and meeting dam safety requirements under the B.C. Dam Safety Regulation have emerged. The Ministry of Agriculture identified that dam owners may be struggling to cover the costs of maintenance and upgrades, and there is a risk that dams may be decommissioned.

AGRI has funded projects to address this issue, including a discussion document on maintaining and enhancing agricultural dams and a workshop on agricultural water storage in the Cariboo region. Resource materials and workshops have been completed to assist agricultural dam owners in navigating and complying with the regulations.

WATER SUSTAINABILITY ACT

The new *Water Sustainability Act* regulates ground and surface water use in B.C. One of the drivers for the new law was the need to better respond to drought worsened by climate change. The Act gives ministry staff the new ability to consider environmental flow needs when making licensing decisions. The law also makes essential household water use a top priority during droughts, followed by protection of aquatic ecosystems and fish populations. The effects of climate change are explicitly included as something a decision-maker may consider in the required thirty-year review of license terms and conditions, though this timeline may be lengthy as changes to the climate may occur faster than expected. ENV and FLNR have produced guidance on regulating water use during water scarcity for staff and decision-makers.

Even though, much of what we heard through our audit work focused on increased storage, there are many other options for addressing drought that are also needed. Lessons learned from a serious drought in Australia demonstrated that urban water efficiency saved more water at lower cost and greater speed than supply options. Research from California also demonstrated that water conservation and efficiency measures are less expensive than new water-supply options.

RECOMMENDATION 14:

We recommend that government complete its work on a proactive drought management strategy, including an assessment of the potential risks to water resources and efficacy of potential strategies to manage them that is updated on an ongoing basis.

CHAPTER 2: ADAPTATION
KEY FINDINGS AND RECOMMENDATIONS

SECTION 4: ADAPTATION AT THE LOCAL GOVERNMENT LEVEL

Local governments throughout the province play a critical role in managing climate change risks. Their legislative mandate includes many services that will be directly impacted by climate change. Adaptation is not occurring consistently at the local government level, and provincial government supports are scattered, inconsistent and limited.

As part of this audit, we spoke to a sample of 33 local governments across the province. Local governments are often the first to feel climate impacts and action at their level is necessary for the province to adapt. Speaking to local government allowed us to understand how provincial ministries are working with them and supporting them to adapt.

We chose a sample that represents: different regions of the province, urban and rural communities, and communities facing different climate change risks. We cannot generalize our findings to all local governments in the province, but our sample gave us a window into adaptation at the local level.

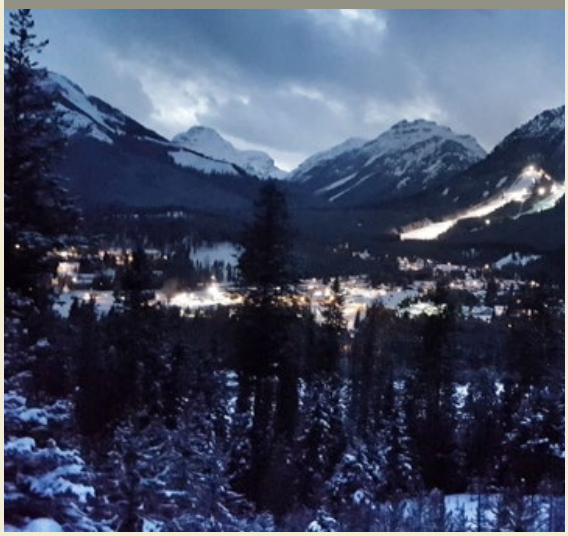
Local governments self-report on their climate change initiatives to the Ministry of Municipal Affairs and Housing (MAH) through the Climate Action Revenue Incentive Program (CARIP). The 2016 CARIP survey included a question on climate change adaptation, and we reviewed the raw data from that survey.

ADAPTATION IN ELKFORD, B.C.

Starting in 2008, Elkford began participating in the Columbia Basin Trust's Communities Adapting to Climate Change initiative. Elkford developed an adaptation strategy at the same time as its Official Community Plan. This allowed the two documents to be fully integrated, a first in B.C.

An example of how adaptation is incorporated is that the plan sets out a Wildfire Protection Zone that requires developers to submit certified professional assessments of fire hazard and risk before a development permit can be issued. Elkford's work on adaptation was profiled in the UN publication *Assessing the Costs and Benefits of Adaptation Options*.

Exhibit 23: Community of Elkford



Source: District of Elkford

CHAPTER 2: ADAPTATION
KEY FINDINGS AND RECOMMENDATIONS

Analysis of the CARIP reporting showed that as whole, local governments in the province are still early in the adaptation process. The most commonly self-reported adaptation activities were planning and promotion. We saw two trends in our analysis.

First, local governments within the Lower Mainland, Southern Vancouver Island and Okanagan reported they were undertaking more adaptation activities. Second, local governments with more staff capacity reported the existence of separate adaptation plans. For example, almost all of the local governments with 300+ staff reported having a specific adaptation plan or strategy in place, while medium sized local governments (50-300 staff) were more likely to have incorporated adaptation into ongoing planning processes. Both approaches can be effective.

In our interviews with local government staff, we asked how they were working with the provincial government on adaptation, and what supports, if any, government provided. We heard they received varying levels of support for adaptation initiatives and programs from the five ministries in our scope. Our sample suggests that none of the ministries within our scope are working consistently with local governments on adaptation, nor are they consistently providing certain types of support.

QUALICUM BEACH: PREPARING FOR SEA LEVEL RISE

The town of Qualicum Beach created a Waterfront Master Plan in response to expected impacts of climate change. This is their vision: "the town will adapt and respond to climate change and sea level rise through proactive and precautionary planning that is based on current science and guided by long-term goals and community values."

Over a number of years, Qualicum Beach will return the foreshore area to a more naturalized state, moving away from hard seawalls and other forms of protection. To create the plan, the town contracted SNC Lavalin to conduct an engineering study of the waterfront, which included winds, tides and storm effects. They also engaged residents and stakeholder groups to learn their vision for the waterfront.

Exhibit 24: Planned Qualicum Beach waterfront

Source: Town of Qualicum Beach

Qualicum Beach received funding for the project through the Clean Water and Wastewater fund managed by MAH.

CHAPTER 2: ADAPTATION
KEY FINDINGS AND RECOMMENDATIONS

Within our sample, local governments reported that the supports provided were scattered, inconsistent and limited. Many local governments reported a decrease in provincial government involvement, and said that the ministries have reduced:

- their connection, consultation and collaboration efforts with local governments
- their regional representation, which means that information often lacks rural context
- the amount of data and information they collect and distribute

There is no forum focused on adaptation where local governments can interact with each other or the provincial government. We heard that information sharing was ad hoc, though organizations, such as the Fraser Basin Council or Columbia Basin Trust, would sometimes facilitate.

SURREY: ADDRESSING COASTAL FLOOD RISK

The City of Surrey reports that about 20% of their land is in the coastal floodplain— including 1,500 residents who live there, 13km of provincial highways and over 30km^2 of agricultural land. In response to changing risks, Surrey has created a Coastal Flood Adaptation Strategy. The project will be completed by spring 2018, using a phased approach focused on community participation. Between May 2016 and July 2017, the city, with partners, designed and led a series of interactive workshops to engage community members and investigate possible responses to future coastal flooding risks.

Exhibit 25: Public engagement on sea level rise at the Surrey Central Library

Source: City of Surrey

CHAPTER 2: ADAPTATION
KEY FINDINGS AND RECOMMENDATIONS

Information sharing between the provincial government and local governments could help move adaptation forward in communities where it is not as far along. However, solutions designed specifically for the rural environment will be required, as risks and resources are different in these communities than in larger urban centres.

Local governments told us they face barriers to implementing adaptation activities in their communities, including (listed in decreasing order of prevalence):

- lack of financial support, with most identifying that more funding was needed from the provincial and federal governments
- lack of reliable data and knowledge to plan for climate change and make educated investments
- lack of resources (e.g., staff, time, capacity) to implement adaptation activities and apply for funding and grants
- need for stronger policies, information and an overarching plan from the provincial level to provide support and guidance to local governments
- inability to raise funds to pay for adaptation activities
- lack of political will and leadership to move adaptation forward at the local level
- difficult to prioritize and allocate funds to adaptation due to competing needs at the local level

Local governments have a critical role to play in preparing the province for a changing climate. Without clear provincial expectations on adaptation, local governments are not required to take any specific action and inconsistency is to be expected.

The level of risk facing local governments is not consistent across the province, and in some places may be unknown, which will affect the amount and type of work completed. As with all levels of government, local governments face many competing needs, and as such, the long time-frames associated with adaptation can make it a lower priority.

Barriers to successful action by local governments can put people, infrastructure and natural ecosystems at greater risk in the future. Lack of consistent action is likely to leave smaller, rural communities at greater risk, given their more limited resources. The lack of coordination can also lead to duplication of effort between local governments.

As per the Climate Leadership Plan, the provincial government is working with local governments to refresh the *Climate Action Charter.* The Green Communities Committee — a joint initiative between the provincial government and the Union of BC Municipalities — has created an adaptation working group.

The working group will advise the Green Communities Committee on practical actions and strategies that local governments can take to adapt to climate change. This collaboration may address some of the challenges we identified in our audit work.

In addition, MAH could assist ministries to better work with local governments on adaptation through provision of advice and collaboration on how best to provide guidance and support. The ministry may require additional capacity to provide this support and lead the following recommendation, as currently they have limited capacity to address adaptation.

RECOMMENDATION 15:

We recommend that government, in collaboration with local governments, assess more fully the challenges facing local governments around climate change adaptation, identify priority areas, and take action on the findings.

CHAPTER 3: MITIGATION

CHAPTER 3 FOCUSES on mitigation of climate change. Reducing emissions of greenhouse gases can limit the amount of warming the Earth experiences. Global action is needed for mitigation to be successful.

MITIGATION IN B.C.

In the 2007 Speech from the Throne, the B.C. government signalled its intent to begin tackling climate change. Government established the Climate Action Secretariat (CAS) in the Premier's Office (it now resides in the Ministry of Environment & Climate Change Strategy) to coordinate activities to combat climate change across the province. CAS has the mandate to provide a whole-of-government approach to:

- achieve B.C.'s emission reduction targets
- adapt to the impacts of climate change
- drive the low-carbon economy

> *"In 2007, British Columbia will take concerted provincial action to halt and reverse the growth in greenhouse gases."*
>
> ~ 2007 Speech from the Throne

In 2008, government released *British Columbia's Climate Action Plan*, which estimated that if all planned initiatives were implemented, they would take government approximately 73% of the way to the 2020 GHG reduction target. One of the key measures implemented at the time was the revenue-neutral carbon tax (tax applied to the purchase or use of fuels in the province). However, government has not fully implemented all of the measures outlined in the *Climate Action Plan*.

HOW THE CARBON TAX WORKS

The carbon tax applies to the combustion or use of fuels in the province. The tax is for emissions from both businesses and individual consumers. When implemented in 2008, the carbon tax rates were $10 per tonne of carbon dioxide equivalent. The current carbon tax rate is $30 per tonne of carbon dioxide equivalent.

Given that different fuels generate different amounts of GHG emissions, the tax rate is translated based on the type of fuel used (e.g., tax on gasoline is 6.67 cents/litre, while tax on diesel is 7.67 cents/litre).

The carbon tax is designed to be revenue neutral. That means that revenues generated through the tax are expected to be returned to citizens through reductions in other taxes.

Exhibit 26 shows the breakdown of B.C.'s 2014 greenhouse gas (GHG) emissions by source.

CHAPTER 3: MITIGATION

In April 2015, government indicated that work was underway to build on B.C.'s 2008 *Climate Action Plan.* In May 2015, government assembled the Climate Leadership Team to provide them with advice and recommendations on subjects including:

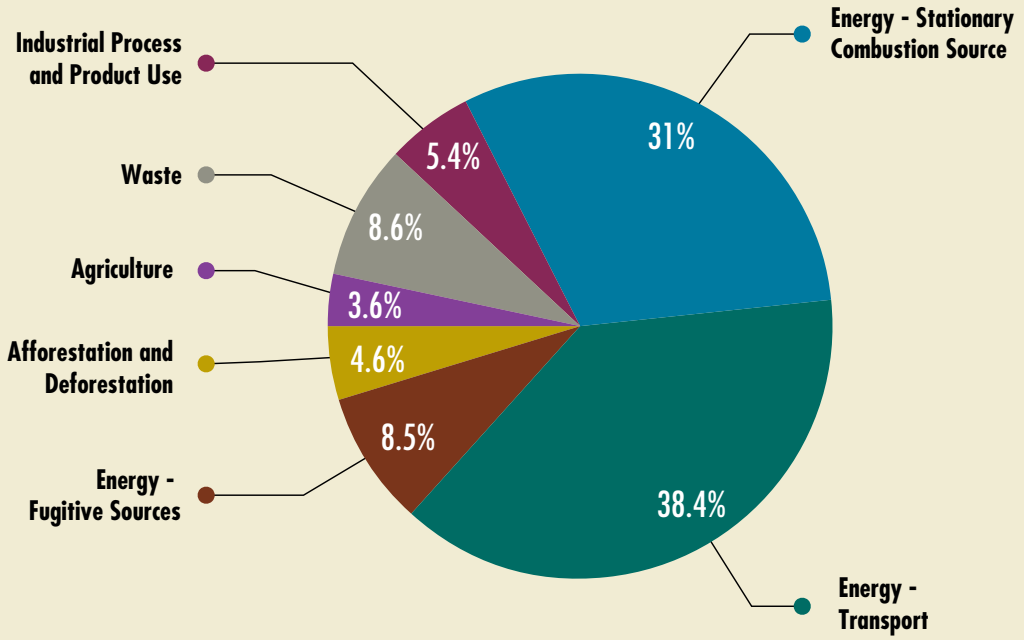
- how to maintain B.C.'s climate leadership
- updates to the current *Climate Action Plan*, as well as new programs and policies required to achieve B.C.'s greenhouse gas reduction targets within the context of economic growth, B.C.'s LNG Strategy and the *BC Jobs Plan*
- actions to achieve GHG reductions required across the industrial sector, the transportation sector and the built environment, among others

On October 31, 2015, the team provided 32 recommendations to government and reported that the recommendations should be implemented as a whole to best achieve their objectives.

In December 2015, 195 countries, including Canada, adopted a legally binding global climate deal known as the Paris Agreement. The agreement focused on the goal of keeping global average temperature increases well below 2°C, with the aim of 1.5°C. The milestone of 1°C of warming was hit in 2015.

For Canada, this commitment was reaffirmed in the *Vancouver Declaration on Clean Growth and Climate Change,* when provincial first ministers committed to implementing GHG mitigation policies. This was

Exhibit 26: B.C.'s 2014 greenhouse gas emissions by source



Source: Office of the Auditor General, based on the Provincial Inventory published by the Ministry of Environment & Climate Change Strategy

CHAPTER 3: MITIGATION

in support of meeting or exceeding Canada's 2030 target of a 30% reduction below 2005 levels of GHG emissions, including specific provincial and territorial targets and objectives.

MITIGATION OBJECTIVE

We carried out this work to determine whether government was taking adequate action to meet provincial emission reduction targets.

We assessed three key aspects of reducing emissions (i.e., climate change mitigation). We looked to see if government:

- had adopted a GHG emission reduction target and was on track to meet this target
- had an implementation plan that described how it would achieve the emission reduction targets
- regularly reported to the public on progress towards meeting GHG reduction targets

CONCLUSION

Government has not taken adequate action to meet provincial emission reduction targets. Specifically, we found:

- Government has adopted legislated emissions reduction targets.
- Government has an implementation plan, but it does not describe how it will meet the emissions reduction targets.
- Government will likely not meet the legislated 2020 emissions reduction target.
- If the province continues along the current emissions trajectory, the 2050 emissions reduction target will likely not be met.
- Government has regularly reported to the public on progress towards GHG emissions reduction targets.

CRITERIA AND SOURCES

We developed the audit objective and criteria using provincial greenhouse gas legislation, *British Columbia's Climate Action Plan*, ministry roles and responsibilities and discussions with partners in the Canadian national collaborative audit project on climate change.

CHAPTER 3: MITIGATION

SCOPE AND APPROACH

Our audit work focused on governments high-level planning for and achievement of GHG reduction targets. We worked largely with the Climate Action Secretariat within the Ministry of the Environment & Climate Change Strategy (ENV).

The time period our mitigation audit covered was from 2008 (when the *Climate Action Plan* was released) to March 31, 2017. We carried out this audit work from January 2016 to September 2017.

Our work involved:

- reviewing documentation from the ministries included in our audit scope
- conducting interviews with ministry staff and subject matter experts

KEY FINDINGS AND RECOMMENDATIONS

B.C. HAS SET EMISSION REDUCTION TARGETS

Emission reduction targets set goals for the reduction of greenhouse gases (GHG), and serve as an important indicator of progress in reducing emissions. We expected that the provincial government would have set GHG emission reduction targets for B.C.

Under the *Greenhouse Gas Reduction Targets Act* (2007), B.C. adopted two legislated GHG emission targets:

- 33% below 2007 levels for 2020
- 80% below 2007 levels for 2050

The Act also required government to establish interim targets for the years 2012 and 2016. Those targets were set as:

- 6% below 2007 levels for 2012
- 18% below 2007 levels for 2016

Interim targets can help demonstrate the effectiveness of policies in place, and where adjustments may be needed.

We also looked to determine how targets were set. Government set aggressive targets based on comparison to other jurisdictions, as well as a drive to improve international rankings. Staff reported that the 2050 target was based in science.

Exhibit 27 illustrates how B.C.'s emission reduction targets compare with those of other provinces and states.

CHAPTER 3: MITIGATION
KEY FINDINGS AND RECOMMENDATIONS

Exhibit 27: Comparison of GHG emission reduction targets

		Target Reduction		
Jurisdiction	Baseline year	2020	2030	2050
British Columbia	2007	33%		80%
Canada	2005		30%	80%
California	1990	1990 levels	40%	80%
Manitoba	2005		33%	50%
Nova Scotia	1990	10%	35-45%	
Ontario	1990	15%	37%	80%
Oregon	1990	10%		75%
Washington	1990	1990 levels	25% (2035)	50%

Source: Office of the Auditor General of British Columbia, based on provincial/state/national legislation, resolutions, climate action plans, reporting and press releases

INSUFFICIENT PLANNING TO MEET EMISSION REDUCTION TARGETS

Planning is a crucial step in meeting emission reduction targets. We expected that government would have a plan for reducing emissions, and that the plan would build a clear and measurable pathway to meeting its emission reduction targets.

In August 2016, government released the *Climate Leadership Plan*, which reaffirmed its commitment to reaching the 2050 target to reduce GHG emissions to 80% below 2007 levels.

The recommendations from the Climate Leadership Team, as well as public engagement, informed the *Climate Leadership Plan*. As part of its consultation process, government reported that 7,600 feedback forms were completed, and that it received 8,200 emails and 300 detailed submissions.

Exhibit 28 outlines the key initiatives and expected emission reductions in 2050 from the *Climate Leadership Plan*.

The plan does not build a clear and measurable pathway to meeting B.C.'s emission reduction targets. We expected the plan to have a number of components and found that several were missing:

- The plan does not have a schedule or timeline for when actions will be carried out.

Exhibit 28: Overview of the *Climate Leadership Plan*

Area	Expected emission reductions in 2050 (millions of tonnes of carbon dioxide)
Built environment ◆ regulations for more energy efficient buildings ◆ encouraging development of net zero buildings ◆ refreshing the Climate Action Charter for communities ◆ strategy to turn waste into resources	2
Forestry & agriculture ◆ enhancing the carbon storage potential of B.C.'s forests ◆ nutrient management program	12
Industry & utilities ◆ making B.C.'s electricity 100% renewable or clean ◆ efficient electrification ◆ fuelling marine vehicles with cleaner burning liquified natural gas ◆ new energy efficiency standards for gas-fired boilers ◆ expanding incentives for efficient gas equipment	2
Natural gas ◆ strategy to reduce methane emissions ◆ regulating carbon capture and storage ◆ electricity to power natural gas production and processing	5
Public sector leadership ◆ promoting use of low carbon and renewable materials in infrastructure ◆ reducing emissions and planning for adaptation in the public sector	1
Transportation ◆ increasing the low carbon fuel standard ◆ incentives for renewable natural gas ◆ incentives for purchasing clean energy vehicles ◆ charging stations for zero emission vehicles ◆ 10-year plan to improve B.C.'s transportation network	3
TOTAL REDUCTIONS	25

Source: Office of the Auditor General of British Columbia, based on the B.C. government's Climate Leadership Plan

CHAPTER 3: MITIGATION
KEY FINDINGS AND RECOMMENDATIONS

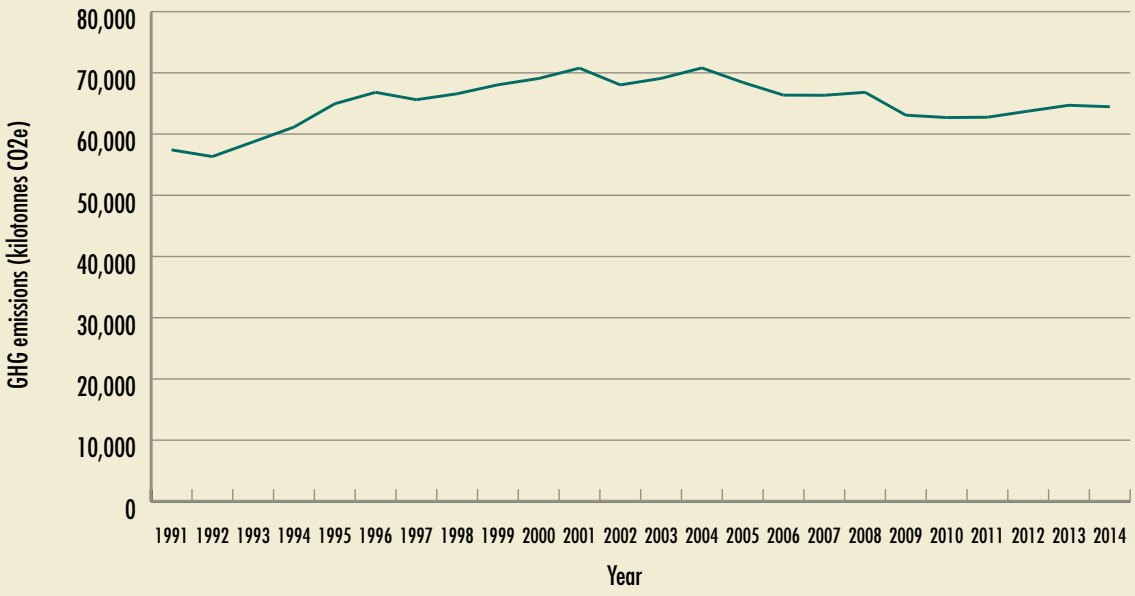
- The plan has minimal performance indicators, and no interim targets.
- The plan lacks any type of procedures that would define:
  - the current emissions baseline
  - how actions will be monitored and reported
  - how corrective actions or improvements can be made.

Because the plan did not build a clear and measurable pathway forward, this could contribute to challenges in government achieving its 2050 GHG emissions reduction target. Delays in developing policies to reduce emissions can lead to the need for more drastic action to meet targets. These actions will likely be more costly and disruptive.

In the *Climate Leadership Plan* there is recognition that there are additional areas that require action, including incremental carbon pricing and other measures currently under discussion with federal and provincial governments, and that the plan will be updated every five years to continue moving government forward.

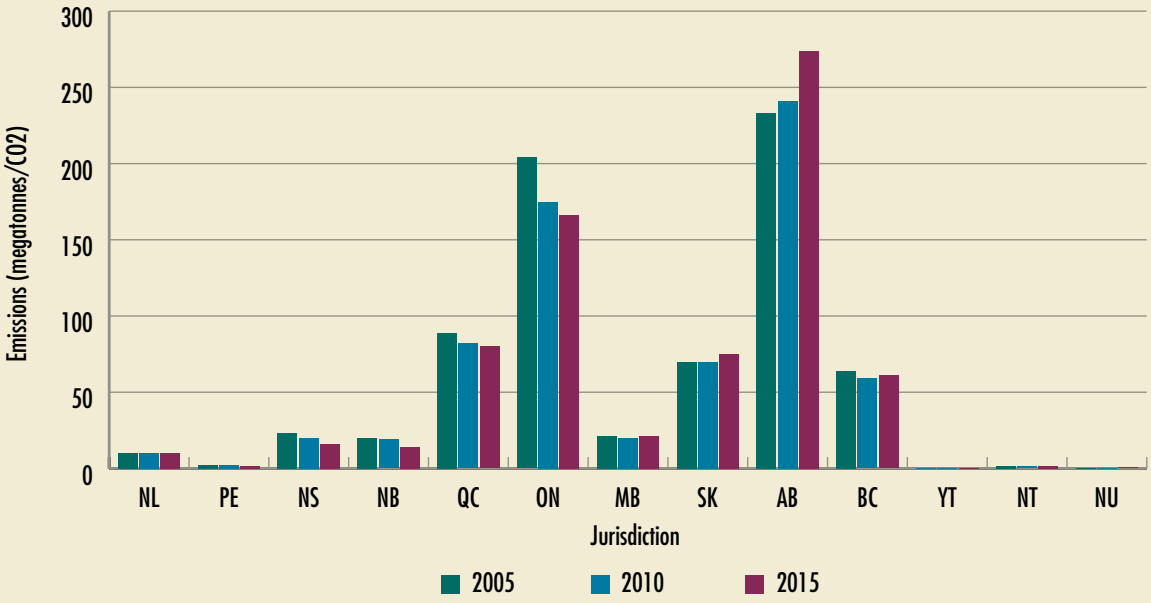
In addition, we expected that government would have completed social and economic assessments to support the plan. We found that the provincial

Exhibit 29: British Columbia gross greenhouse gas emissions, 1991-2014



Source: Compiled by the Office of the Auditor General of British Columbia, based on the Ministry of Environment & Climate Change Strategy's provincial inventory

Exhibit 30: Provincial and territorial emissions, 2005, 2010 and 2015



Source: Compiled by the Office of the Auditor General of British Columbia, based on National Inventory data published by Environment and Climate Change Canada

government assessed a number of factors including job creation impacts and economic activity generated.

We compared the Climate Leadership team's recommendations with the *Climate Leadership Plan* and found that 21% of the recommendations were fully included, 16% were partially included and 63% were not included. Recommendations not included related to carbon pricing and adaptation.

RECOMMENDATION 16: *We recommend that government create a clear, measurable plan to meet legislated targets, including clear accountabilities, emission estimates and baselines, resources, timelines, and interim targets. Government should also consider co-benefits with adaptation.*

LIMITED PROGRESS TOWARDS EMISSION REDUCTION TARGETS

The provincial government has tracked GHG emissions since 1991. Exhibit 29 shows the change in emissions from 1991 to 2014. Emissions peaked in 2004 at 70,801 kilotonnes of carbon dioxide and decreased until 2010, when they began slowly increasing.

Exhibit 30 presents provincial and territorial emissions across Canada in 2005, 2010 and 2015. B.C. is the fifth highest emitter in the country. On a per capita emission basis, B.C.'s emissions are lower than the Canadian average.

CHAPTER 3: MITIGATION
KEY FINDINGS AND RECOMMENDATIONS

Under the *Greenhouse Gas Reduction Targets Act* (2007), government set legislated GHG reduction targets. As part of our audit, we looked to see if government had met or was on track to meet those targets.

Interim target: 6% below 2007 levels for 2012 – Reported met

In its *Climate Action in British Columbia: 2014 Progress Report*, government announced that including emission reductions from forestry offset projects, it had met the emissions reduction target.

A carbon offset is a reduction or sequestration (long-term storage) of GHGs that can be used to compensate for, or offset, the emission from another source. For example, funding to purchase offsets is used to protect areas of the Great Bear Rainforest which might otherwise have been logged. One carbon offset represents the reduction of one tonne of carbon dioxide (or its equivalent in other GHGs).

Interim target: 18% below 2007 levels for 2016 – Very likely not met

Government has not reported whether or not it has achieved the 2016 interim target. However, the *Climate Leadership Plan* stated: "since that time [2012] our emissions have remained relatively unchanged." In addition, a Climate Leadership Plan briefing noted that 2014 GHG emissions were 5.5% below 2007 levels, suggesting that emissions had increased by 0.5% since the 2012 target was met.

Government net emissions were reported to be 62.66 megatonnes of carbon dioxide equivalent in 2014, but would need to be 54.4 megatonnes of carbon dioxide equivalent in 2016 for the target to be met. This is a gap of more than 8 megatonnes.

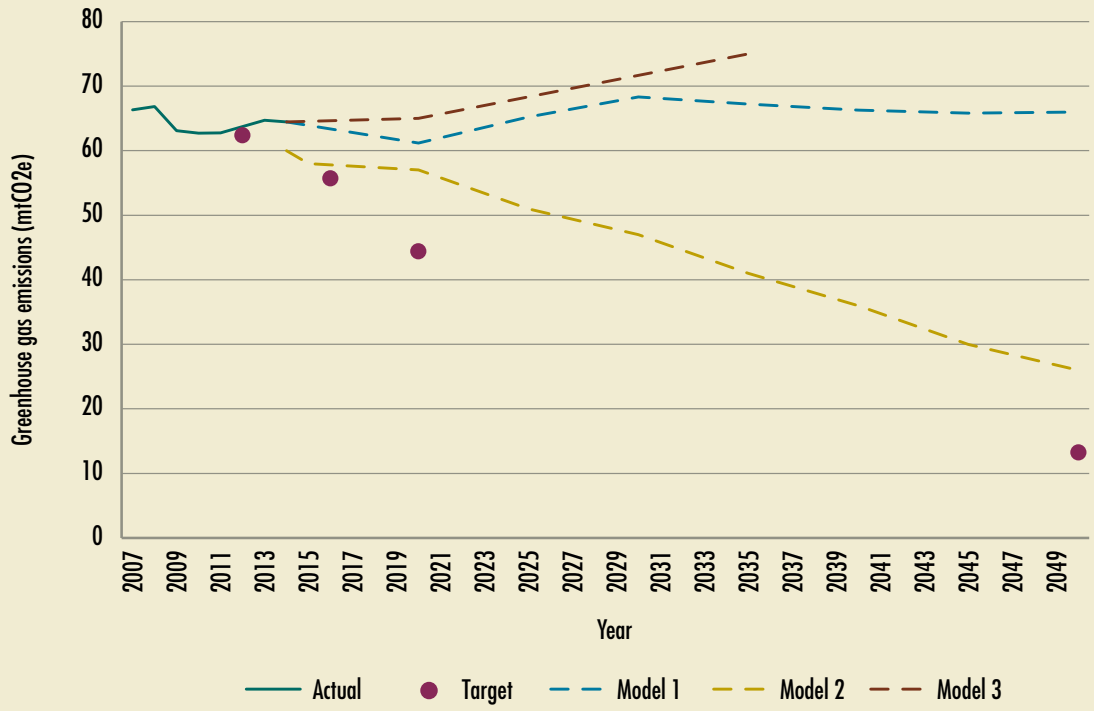
Target: 33% below 2007 levels for 2020 – Likely not met

Government has confirmed that B.C. likely will not meet the GHG emission target for 2020. The Climate Leadership Team said that the 2020 target was extremely difficult to meet, and that their recommendations, implemented in full, would not enable the province to meet the target.

Modelling (done by a well recognized independent consultant on behalf of the Pembina Institute, Clean Energy Canada and the Pacific Institute for Climate Solutions) found that with the implementation of all policies described in the *Climate Leadership Plan* and federal carbon price floor, B.C.'s 2020 emissions will be approximately 18.9 megatonnes of carbon dioxide equivalent or 45% more than the legislated target in 2020 (excluding forest management). The federal government predicted even greater emissions in 2020 than the results from the above models.

> *"As I've said, and as the report [Climate Leadership Plan] outlines, we are not in line to make our 2020 targets."*
>
> ~ Minister of Environment – February 29, 2016

Exhibit 31: B.C.'s historical, target and projected GHG emissions



Source: Office of the Auditor General of British Columbia, based on provincial inventory and consultant models, Climate Leadership Team modelling and Canada's 2016 Greenhouse Gas Reference Case

Exhibit 31 shows the actual GHG emissions in B.C. from 2007 to 2014 (not including offsets), the GHG reduction targets, and estimated GHG emissions from three different models:

- Model 1: Modelling done by an independent consultant for Pembina Institute, Clean Energy Canada and Pacific Institute for Climate Solutions – this model included expected reductions from the Climate Leadership Plan (not including the 12 megatonne reduction forecast from forest carbon) and the federal carbon price
- Model 2: Modelling done by the Climate Leadership Team assessing implementation of their recommendations, our office included deforestation in these numbers with the assistance of ENV
- Model 3: Canada's 2016 Greenhouse Gas Reference Case, this modelling was done prior to the Climate Leadership Plan's release and does not include those planned actions

CHAPTER 3: MITIGATION
KEY FINDINGS AND RECOMMENDATIONS

Target: 80% below 2007 levels for 2050 – Will not be met, if B.C. continues along current emissions trajectory

Government has not reported or made any statements on whether the 2050 target will be met. None of the models reviewed suggest that B.C. will meet the 2050 emissions reduction target.

Current policies are not sufficient to set a successful trajectory towards the 2050 target. The *Climate Leadership Plan* includes the first set of actions to help meet the 2050 emissions reduction target.

Meeting future emission reduction targets in the province is partly dependant on the size of the liquefied natural gas (LNG) industry. Development of large-scale LNG production will increase provincial GHG emissions. This may also be true of other large-scale industrial initiatives government has supported, such as mining.

We looked to identify some of the policy tools and actions that resulted in significant GHG emissions in B.C. Some tools considered successful by government included:

- carbon tax and carbon pricing: one analysis done on the carbon tax found that it reduced GHG emissions in B.C. by 5-15%
- Renewable and Low Carbon Fuel Requirements Regulation: B.C. government documentation indicates that the regulation has avoided over 1.14 million tonnes of GHG in 2015, with a total of 5.46 million tonnes between 2010 and 2015

Looking forward, the Forest Carbon Initiative (B.C.'s plan to increase the carbon storage potential of forests) is expected to result in nearly 12 megatonnes of reductions by 2050. This is approximately 50% of the reductions outlined in the *Climate Leadership Plan*. However, given wildfire and other potential forest disturbances, there are risks that these reductions will not be achieved.

Our document review and interview evidence demonstrated the importance of considering policies and actions as a group (not independently). Policies and actions can work on different timescales and impact each other. This highlights the importance of having a complementary suite of policies that can reinforce and build upon each other.

If global emissions are not substantially reduced, the climate system will not stabilize, and climate warming will continue. This makes the need for adaptation more pronounced. B.C. has committed to making contributions to global action to prevent additional warming.

CHAPTER 3: MITIGATION
KEY FINDINGS AND RECOMMENDATIONS

Implementation of the Climate Leadership Plan

Government has begun implementation of the activities in the *Climate Leadership Plan*. Actions include:

- transferring $150 million to the Forest Enhancement Society of British Columbia to advance environmental stewardship, and support rehabilitation and reforestation initiatives in the province in line with the commitments made for the Forest Carbon Initiative in the *Climate Leadership Plan*
- investing $40 million to encourage the switch to zero-emission vehicles, including the Clean Energy Vehicle program (to continue support of point-of-sale purchase incentives) and expanding public, residential and workplace charging and hydrogen fuelling infrastructure
- amending the *Greenhouse Gas Reduction Regulation* under the *Clean Energy Act* so that utility companies can increase incentives for shipping companies to convert vessels to run on LNG, invest in LNG bunkering infrastructure, and increase the supply and use of renewable natural gas
- amending the *Greenhouse Gas Reduction Regulation* so that BC Hydro can offer incentives for customers to transition from more carbon-intensive fuels to clean electricity
- established three working groups in partnership with the Union of BC Municipalities, to refresh the *B.C. Climate Action Charter;* the working groups will focus on green infrastructure, adaptation and low-carbon land use

REPORTING ON PROGRESS

We looked to see if government was providing timely reporting on progress towards its GHG emission targets. We defined "timely" as per the *Greenhouse Gas Reduction Targets Act*. Under the Act, the minister must publicly report (in even-numbered years):

- B.C.'s GHG emissions level
- progress towards targets
- actions to achieve that progress

Government fulfilled this commitment through the 2012 report *Making Progress on B.C.'s Climate Action Plan* and *Climate Action in British Columbia: 2014 Progress Report*, as well as the 2016 *Climate Leadership Plan*. However, the *Climate Leadership Plan* does not include the same level of detail as the earlier reports, and is less clear regarding progress towards meeting the 2016 target or the current level of emissions in the province.

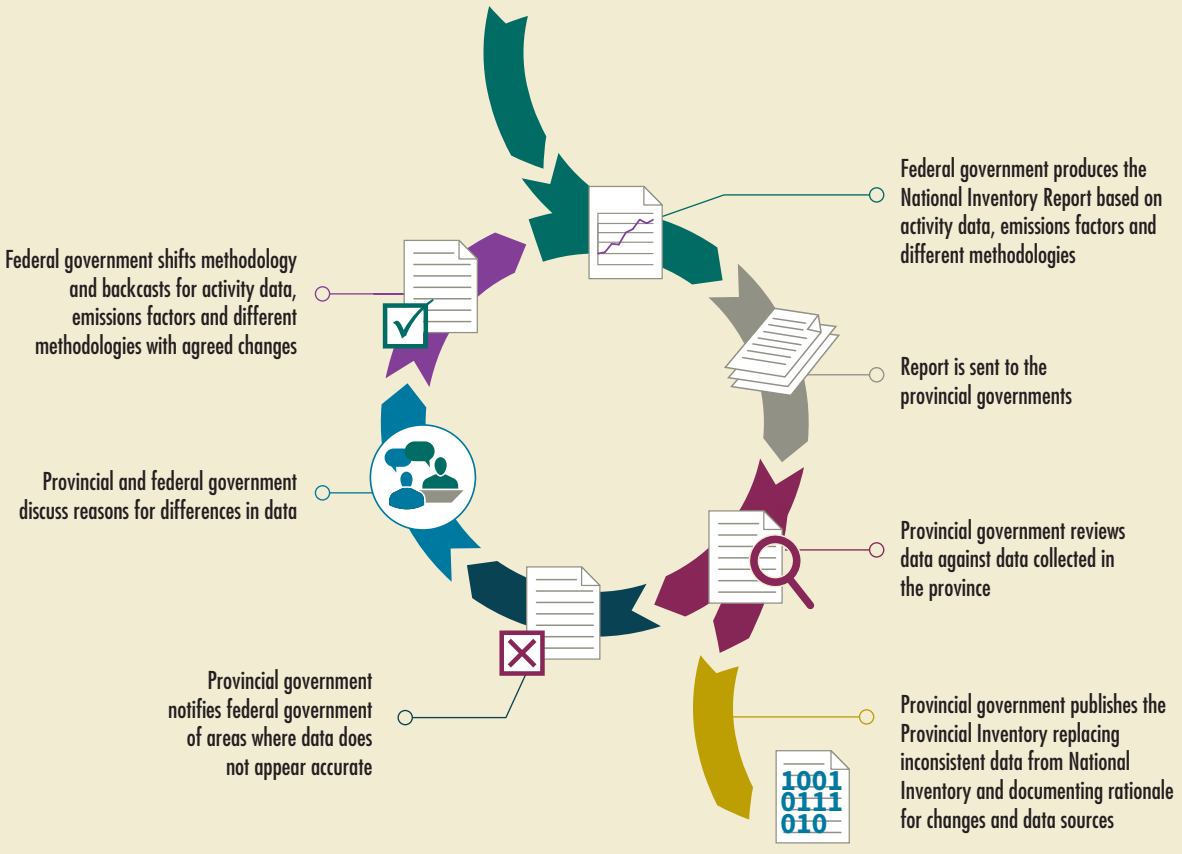
Calculating GHG emissions is not an easy process. B.C. largely uses the federally compiled *National Inventory Report* (NIR) for validated GHG numbers in the provincial inventory of greenhouse gas emissions.

CHAPTER 3: MITIGATION
KEY FINDINGS AND RECOMMENDATIONS

The NIR is based on different activity factors (e.g., industrial production) and emissions are allocated to provinces accordingly. Staff reported that to verify the accuracy of the numbers, B.C. compares present years to previous years and provincial reporting (e.g., industrial emitters over 10,000 tonnes). The provincial and federal government discuss areas where numbers may not align and the federal government may revise methodology (see Exhibit 32).

Government can face challenges providing up-to-date reports, as the verified emissions numbers are published two years following the calendar year (i.e., in 2016 the federal government published the *National Inventory Report* (NIR) from 1990 to 2014). A further complication is that any year's emission results may be revised in a newer version of the NIR if changes are made to methodology or additional data is acquired (i.e., backcasting).

Exhibit 32: Process of creating the Provincial Inventory of greenhouse gas emissions



Source: Office of the Auditor General of British Columbia based on discussions with Ministry of Environment & Climate Change Strategy staff

CHAPTER 3: MITIGATION
KEY FINDINGS AND RECOMMENDATIONS

Government reports B.C.'s gross emissions in the provincial inventory. For 2014, the gross emissions were 64.5 million carbon dioxide equivalent tonnes (Mt CO_2e). Government then subtracted 1.8 Mt CO_2e in offsets from forest management projects to arrive at B.C.'s net emissions of 62.7 Mt CO_2e. Government reports the net emissions in the progress to target reports.

However, government does not include any information about the offsets in the provincial inventory. If government did this it would provide clarity as well as consistency with the results published in the progress to targets reports.

Other government reporting on the reduction of greenhouse gases includes:

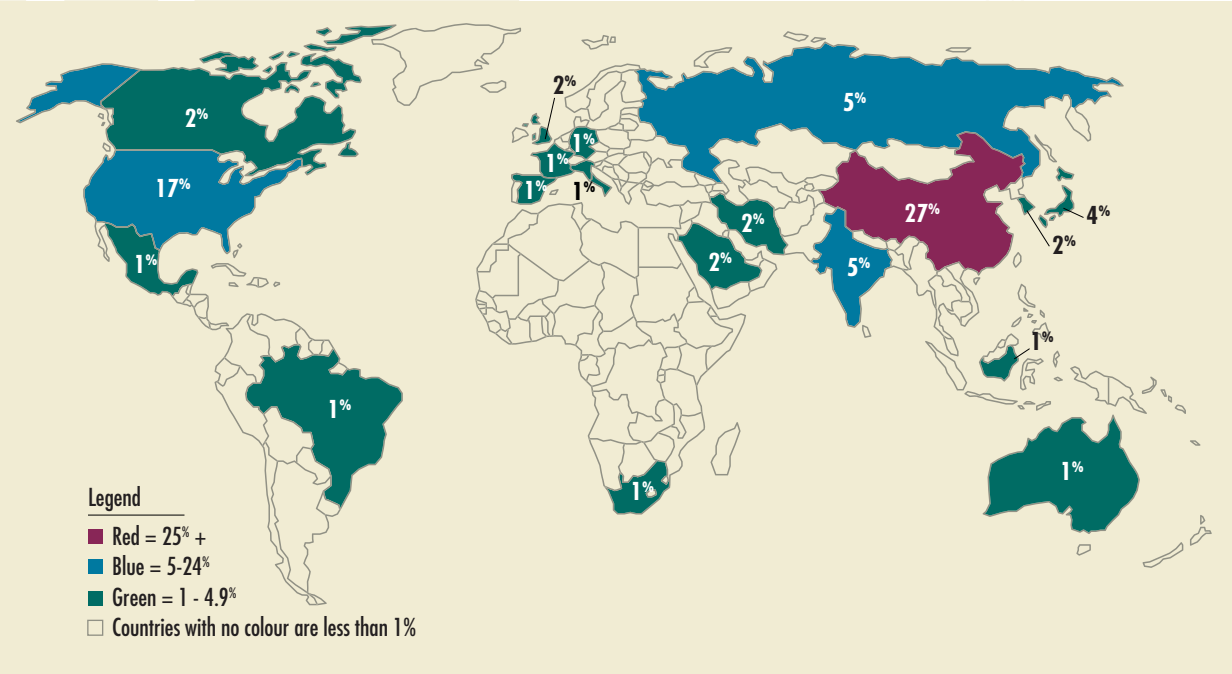
- annual reports on government's carbon neutrality (up to 2015)
- inventory of emissions from industrial facilities (e.g., factories and oil & gas plants) with B.C. operations emitting 10,000 tonnes or more per year (up to 2014)
- Community Energy & Emissions Inventory data for 2007, 2010 and 2012
- Climate Action Revenue Incentive Program reporting (up to 2015)

Clear reporting allows the public and other stakeholders to hold government to account and understand if its actions are successful. If this information is not available, groups may quit taking action or spend resources in the wrong areas.

The technicalities associated with reporting valid GHG emissions can make it challenging for the public to understand government progress. It can also be unclear if targets are met when emissions for both the baseline and target year may shift from year to year.

RECOMMENDATION 17: *We recommend that government publish information regarding its use of offsets within the provincial inventory to provide clarity and consistency with the progress to targets report.*

APPENDIX A:
NATIONAL EMISSIONS AS A PERCENTAGE OF GLOBAL EMISSIONS



Source: Union of Concerned Scientists using information compiled by the Energy Information Agency

APPENDIX B: MINISTRY NAMES AND ACRONYMS

In July 2017, the names and acronyms of many of the ministries in our audit scope changed. We have used the current ministry names throughout the audit.

Previous ministry name	Current ministry name
Ministry of Agriculture (MoA)	Ministry of Agriculture (AGRI)
Ministry of Community, Sport and Cultural Development (MCSCD)	Ministry of Municipal Affairs and Housing (MAH)
Ministry of Environment (MoE)	Ministry of Environment & Climate Change Strategy (ENV)
Ministry of Forests, Lands and Natural Resource Operations (MFLNRO)	Ministry of Forests, Lands, Natural Resource Operations and Rural Development (FLNR)
Ministry of Transportation and Infrastructure (MoTI)	Ministry of Transportation and Infrastructure (TRAN)
Emergency Management BC (EMBC)	Emergency Management BC (EMBC)

APPENDIX C:
MINISTRY ACTIONS ON THE ADAPTATION STRATEGY

MINISTRY OF AGRICULTURE (AGRI)

Area 1: Build a strong foundation of knowledge

- **Engage climate science**
    - Ministry staff sit on the Program Advisory Committee of the Pacific Climate Impacts Consortium (PCIC), contributing advice and feedback on research directions.
    - PCIC has provided data for AGRI projects and reports (i.e., climate projections for the Regional Adaptation Strategies).
    - AGRI used funding from the Pacific Institute for Climate Impacts (PICS) to hire interns to work with AGRI's climate action team.
- **Develop adaptation planning tools for decision-makers**
    - In partnership with Agriculture and Agri-Food Canada, AGRI created an Agriculture Water Demand Model for local governments in the Okanagan Basin to plan for current and future water needs.
    - Supported development of region-specific tools. This was done with $300,000 funding for regions through the federal-provincial *Growing Forward 2* program, for a total of $1.8 million.
    - Through *Growing Forward 2*, dedicated $1.7 million to the Farm Adaptation Innovator Program. This program promotes innovation in farm practices, approaches and technologies which supports the demonstration of farm practices and technologies that reduce weather related production risks and/or the development of informational and knowledge sharing resources and capacity to assist with adaptation.
    - Projects under the Environmental Farm Plans can support farm adaptation.

Area 2: Make Adaptation Part of Government's Business

- **Ministries will consider climate change impacts by incorporating adaptation in Ministry Service Plans and business planning where relevant.**
    - Included adaptation in service plans for all years between 2010/11 to 2016/17.
    - Adaptation has also been included in high-level plans within AGRI; as a key challenge facing the sector in the *BC Agrifood and Seafood Strategic Growth Plan* and as an area for focused investments in the *BC Agrifoods Innovation Strategy*.
- **Integrate adaptation into B.C. government policies, legislation and regulations.**
    - There was no evidence of AGRI reviewing or updating legislation, policy or regulation to integrate climate change adaptation. AGRI reported that adaptation is an integral part of ministry work, and even though there is no specific regulation or document to look at, it is constantly looking at interactions such as policy.

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- AGRI included adaptation in the *Canada-BC Bilateral Agreement - Growing Forward 2*, with five of the programs speaking to adaptation. Interview evidence suggested that this is unique to B.C.

- **Identify approvals that are sensitive to climate by determining whether climate impacts will be significant and where possible, incorporate consideration of climate change impacts into the approvals process.**
  - AGRI indicated that it does not issue these types of approvals as they are not a statutory decision-maker in the province.

- **Engage and work with partners in other levels of government, the private and non-profit sectors and other jurisdictions.**
  - Ongoing collaboration with Agriculture and Agri-Food Canada under the *Growing Forward 2* Agreement.
  - Worked closely with the BC Agriculture and Food Climate Action Initiative which offers the adaptation programming funded through the *Growing Forward 2* agreement. This collaboration is managed through shared-cost agreements with ARDCorp and the BC Investment Agriculture Foundation.
  - Involved private and non-profit partners, other provincial departments, Agriculture and Agri-Food Canada, as well as local governments, when creating regional adaptation strategies and associated projects. The list included the B.C. Blueberry Council, Fraser Basin Council, B.C. Fruit Growers Association, as well as regional bodies like the Cowichan Agricultural Society and B.C. Peace River Regional Cattlemen's Association.

Area 3: Assess risks and implement priority adaptation actions in sectors

- **Conduct climate change assessments for sectors known to be sensitive to climate change**
  - Supported the Climate Action Initiative risk assessment for the B.C. agricultural sector. The report covered the entire province with special attention to five regions. Risks included B.C.'s aging farm population, reduced role of the provincial government in supplying information to farmers, and unstable and insufficient funding.
  - *Growing Forward 2* funding was also given to the Climate Action Initiative to create six regional adaptation strategies and to run related pilot projects. $300,000 was provided to each region that completed a strategy to implement some of its planned pilot activities.
    - To date funding for the regional adaptation strategy pilot projects has been allocated to 41 projects – out of approximately 160 planned actions. The initial $300,000 funding per region is not sufficient to cover a majority of the actions planned. The creation of the adaptation strategies did not draw heavily on the provincial risk assessment.
    - The actions outlined in the regional adaptation strategies did not clearly identify who was responsible for implementing the actions, with potential partners being identified. Without a clear sense of ownership there could be challenges in implementing the actions.
  - Risks to the aquaculture sector were not identified and aquaculture was not included in the RAS.

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- **Review and update, through the assessment process, existing B.C. government policies, strategies and operational activities to ensure that they will deliver the desired objectives for their sectors in a changing climate.**
    - In partnership with the International Institute for Sustainable Development AGRI assessed 14 of its programs to determine if they support adaptation and if they are adaptable. AGRI created an adaptation plan in response to the findings. This plan is still in draft form.

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MINISTRY OF MUNICIPAL AFFAIRS AND HOUSING (MAH)

Area 1: Build a strong foundation of knowledge

- **Develop adaptation planning tools for decision-makers**
    - MAH created a water conservation calculator for local communities to support the case for water conservation in communities. They also partnered with the Okanagan Basin Water Board and Polis Project on Ecological Governance to create a water conservation planning guide.
    - Created a guide on development permit areas for climate action.
    - Initiated projects and secured funding for the following adaptation guides for local government:
        - *Preparing for Climate Change: An Implementation Guide for Local Governments*
        - *Urban Forests: A Climate Adaptation Guide*
        - *Local Climate Change Visioning and Landscape Visualizations*
- **Incorporate where appropriate, adaptation concepts and actions into provincial climate change outreach programs**
    - Included some adaptation information (e.g., definitions, sample actions, links to resources) on the BC Climate Action Toolkit webpage, a climate change outreach program for local governments.

Area 2: Make Adaptation Part of Government's Business

- **Ministries will consider climate change impacts by incorporating adaptation in Ministry Service Plans and business planning where relevant.**
    - Included adaptation in service plans for all years between 2010/11 and 2016/17.
    - High-level climate change activities were included in internal business plans, though the focus on adaptation was not clear.
- **Integrate adaptation into B.C. government policies, legislation and regulations.**
    - There was no evidence that MAH reviewed or updated legislation to integrate climate change adaptation.
    - The *BC Climate Action Charter* references adaptation as part of the preamble, but signatory local governments have not agreed to take any specific actions on climate change adaptation. MAH is currently undertaking a process to refresh actions under the *Climate Action Charter.* The Green Communities Committee— a joint initiative between the provincial government and the Union of BC Municipalities—has created an adaptation working group to complete this refresh.
- **Identify approvals that are sensitive to climate by determining whether climate change impacts will be significant over the life of a decision and, where possible, incorporate consideration of climate change impacts into the approvals process.**
    - MAH has not completed a formal process to identify approvals that are sensitive to climate change.

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- MAH has incorporated adaptation into the following infrastructure grants: the New Building Canada Fund-Small Communities Fund, Clean Water and Wastewater Fund and Building Canada Fund –Communities Component.

- **Engage and work with partners in other levels of government, the private and non-profit sectors and other jurisdictions.**

  - MAH demonstrated ad hoc engagement with local governments through participation on committees (i.e., Burrard Planners Collaborative, Cowichan Valley Regional District Technical Advisory Group, Capital Regional District Regional Emergency Management) and presentations at conferences (Association of Regional District Planning Managers, Association of Vancouver Island Coastal Communities).

Area 3: Assess risks and implement priority adaptation actions in sectors

- **Conduct climate change assessments for sectors known to be sensitive to climate change and through the assessment process, update existing B.C. government policies, strategies and operational activities to ensure that they will deliver the desired objectives for their sectors in a changing climate.**

  - MAH has not conducted any climate change risk and vulnerability assessments related to local governments. In addition, MAH has not directly worked with local governments to complete risk and vulnerability assessments. We were told this support is provided through publications, tools and potentially capital project funding.

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MINISTRY OF ENVIRONMENT & CLIMATE CHANGE STRATEGY (ENV)

Area 1: Build a strong foundation of knowledge

- **Engage climate science**
  - Participation on the Pacific Climate Impacts Consortium (PCIC) Program Advisory Committee. The group provides advice to PCIC and helps ensure that research and data meet government needs.
  - In 2013, the Climate Action Secretariat (CAS) hosted a one-day workshop on atmospheric rivers with PCIC and the Pacific Institute for Climate Solutions (PICS) for various ministries as well as the federal government, provincial universities and BC Hydro. The workshop provided recommendations for improving monitoring and enhancing scientific understanding of atmospheric rivers.
  - CAS also commissioned a follow-up workshop with stakeholder involvement which provided recommendations to update floodplain maps, improve forecasting and introduce bylaws to restrict new building in hazard areas.
- **Develop adaptation planning tools for decision-makers**
  - CAS commissioned the creation of a primer on sea level rise for local governments. The primer won an award for Planning Excellence from the Canadian Institute of Planners.
  - CAS provided in-kind support for tool development at the Stewardship Centre of BC, Ministry of Transportation and Infrastructure and Capital Regional District.
- **Work with PICS to develop a continuing education program on climate change impacts and adaptation**
  - A continuing education program was not developed.
  - CAS worked with PICS on the Climate Insights 101 video series that is available online. CAS contributed to other professional development opportunities such as the development of the Green Shores curriculum and training for chartered professional accountants.
- **Incorporate where appropriate, adaptation concepts and actions into provincial climate change outreach programs**
  - There was no evidence of a coordinated outreach strategy or integration into provincial climate change outreach programs.
  - CAS and the Fraser Basin Council (FBC) delivered the BC Regional Adaptation Collaborative (RAC), with FBC taking an administrative and project management role, while CAS focused on coordination and linkages with policy within the BC RAC and on fostering collaboration and sharing information with other RACs. CAS provided support and advice to Fraser Basin Council's adaptation outreach program – ReTooling.ca.
  - Documentation demonstrated that CAS staff gave 82 presentations between 2010 and 2015 to public audiences on topics such as sea level rise, adaptation tools for coastal communities, flood hazard management guidelines and atmospheric rivers.
  - The ministry ran a "King Tide" photo campaign in 2010, inviting the public to submit pictures of extreme high tide events to promote awareness of how sea level rise will impact coastlines.

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Area 2: Make Adaptation Part of Government's Business

- **Ministries will consider climate change impacts by incorporating adaptation in Ministry Service Plans and business planning where relevant**
    - ENV has included adaptation in its service plans for all years between 2010/11 and 2016/17.
- **Integrate adaptation into B.C. government policies, legislation and regulations**
    - The Climate Action Secretariat (CAS) has worked to update the 2004 Flood Hazard Area Land Use Management Guidelines. ENV commissioned Ausenco Sandwell to produce reports regarding how best to incorporate sea level rise into the existing guidelines. A technical working group of local government staff was also created to provide feedback into the revised guidelines. Though the project was initiated by CAS the consultation process was led by the Water Stewardship Division.
        - The guidelines have not yet been finalized.
- **Identify approvals that are sensitive to climate change, and where appropriate incorporate consideration of climate change impacts**
    - CAS created guidelines to support consistent evaluation of climate risks to projects that are subject to environmental authorizations or investment decisions. CAS also reported that staff review draft environmental assessments (e.g., LNG Canada, Woodfibre LNG, Aurora LNG) to assess how proponents would and did consider climate change impacts in their applications.
- **Strengthen cross-government coordination to ensure that Ministries share experiences, have access to the same information and work towards common goals.**
    - CAS coordinated across government for work on the Pan-Canadian framework on climate change. CAS also reported that they work to informally strengthen collaboration and share experiences across government.
- **Engage and work with partners in other levels of government, the private and non-profit sectors and other jurisdictions**
    - CAS has provided in-kind support and direct funding to non-profits, professional associations, other ministries and local governments. This includes participation in the BC Regional Adaptation Collaborative (RAC).

Area 3: Assess Risk and Implement Priority Adaptation Actions in Sectors

- **Conduct climate change assessments for sectors known to be sensitive to climate change**
    - The Climate Action Secretariat (CAS) co-funded and contributed to a risk assessment report by the Fraser Basin Council for the oil and gas sector in northeastern B.C.
    - CAS contracted SNC-Lavalin to identify obstacles and opportunities for climate change adaptation in B.C. mining policies and procedures.
    - CAS contracted the Arlington Group to complete an evaluation of B.C. flood policy for coastal areas in a changing climate.
    - CAS co-hosted a multi-agency risk exploration workshop focused on atmospheric river events.

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- **Establish sector working groups with government and stakeholder co-chairs to lead the process.**
    - There was no evidence of CAS establishing sector working groups to lead the process. Some advisory groups were created as part of the risk assessment process, but it is not clear that CAS was involved in these groups.
- **Review and update policies, strategies and operational activities to ensure they will deliver the desired objectives for their sectors in a changing climate**
    - There was no evidence that actions were taken following the risk assessments, however in some cases actions were not recommended.

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MINISTRY OF FORESTS, LANDS, NATURAL RESOURCE OPERATIONS AND RURAL DEVELOPMENT (FLNR)

Area 1: Build a strong foundation of knowledge

- **Engage climate science**
  - Participation on the Program Advisory Committee of the Pacific Climate Impacts Consortium (PCIC) through contributions of advice and feedback on research directions.
  - FLNR funds in-house climate change scientific research.
  - Contributions to a number of research projects, including:
    - climate-based seed transfer project to achieve forests and landscapes that are genetically adapted to a changing climate
    - Assisted Migration Adaptation Trial to better understand tree species' climate tolerances
    - development of the ClimateBC, ClimateWNA and ClimateNA models which utilize historical weather station data and global circulation model regional predictions to project future seasonal and annual climate variables in BC, western North America and all of North America
    - model potential future distribution of bio-geoclimatic zones with climate variables included
    - simulating the effects of sea level rise and climate change on Fraser River flood scenarios
- **Develop adaptation planning tools for decision-makers**
  - Created tools for decision-makers in the natural resource sector, many of which are housed on the ministry adaptation webpage. Tools include:
    - Tree Species Selection Tool to inform decision-making around what tree species should be planted in a changing climate
    - an excel application that allows users to calculate the relative risk of drought induced mortality for species
    - summaries of climate change projections for all of FLNR's natural resource regions, including predicted impacts of climate change to ecosystems and adaptation strategies (i.e., regional extension notes)
    - guidance for building forests resilient to climate impacts by moving tree species into BEC zones where they are not currently considered preferred or acceptable
    - protocol for designating fisheries sensitive watersheds and temperature sensitive streams and a protocol designed to identify pressures on watersheds, including climate change
  - Created an inventory of adaptation tools for natural resources sector staff.

Area 2: Make Adaptation Part of Government's Business

- **Ministries will consider climate change impacts by incorporating adaptation in Ministry Service Plans and business planning where relevant**

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- Included adaptation in service plans for all years between 2010/11 and 2016/17
- Published the *Forest Stewardship Action Plan for Climate Change Adaptation* and *2015-2020 Climate Change Strategy*.
- All branches and regions created Climate Action Plans by March 2016. The plans describe what actions the individual groups will take to meet FLNR's climate change objectives.
- Other examples of climate adaptation being incorporated into planning include:
  - *Provincial Timber Management Goals and Objectives*
  - *Provincial Forest Health Strategy* (2013 – 2016)
  - *Northeast Water Strategy*

- **Integrate adaptation into B.C. government policies, legislation and regulations**
  - Adaptation is not incorporated into key legislation – the *Forest and Range Practices Act*, or the *Forest Planning and Practices Regulation*. As such, licensees are not legally required to include adaptation in Forest Stewardship Plans (FSP). There is a risk that use of this model may not be sufficient to ensure that FLNR's climate adaptation goals are met. The legislation uses a professional reliance model, meaning certified professionals are expected to make sound judgments based on their training and experience. The Association of BC Forest Professionals has issued a Position Paper which indicates practicing forest professionals should develop competencies that allow them to properly account for climate change.
  - Adaptation is not incorporated into the *Dike Maintenance Act*. There is no legal requirement to consider climate change when designing and constructing dikes beyond the fact that the work must be done under the supervision of a professional engineer. Engineers and Geoscientists BC requires its members to consider climate change in their work.
  - FLNR has issued standards and guidance for ministry decision-makers who review FSPs.
    - memo from the Assistant Deputy Minister of Resource Stewardship requiring that impacts of climate change be considered as part of the long-term forest health test both by those preparing Forest Stewardship Plans and those reviewing plans submitted for approval or extension
    - guidance that includes climate change as potential new content in revised FSPs, however this is left up to the discretion of delegated decision-makers
  - Amendments to the *Chief Forester's Standards for Seed Use* to expand the seed transfer limits of western larch to increase species diversity.
  - Initiated work to adjust policy and pricing to provide the conditions required for licensees to complete enhanced basic reforestation.
- **Identify approvals that are sensitive to climate change, and where appropriate incorporate consideration of climate change impacts**
  - FLNR has contracted with a service provider to deliver workshops and gather ministry decision points where climate change needs to be considered, types of information required to do so, and a list of factors staff need to consider when applying a climate change lens. FLNR has also contracted a service provider to develop for a decision matrix and process map showing what decisions to target for integrating climate change and protocols to feed climate change impacts and risks into decision process. FLNR expects to complete this work by March 2018.
  - Included climate change as a factor that needs to be considered during annual allowable cut approvals. However, the lack of certainty around

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the degree of climate change, specific impacts and policy on how to address this uncertainty has to date prevented accounting for potential timber supply impacts.

- Generated an approach for integrating climate change into the cumulative effects framework for both assessment and management.
- A gap noted was that climate change could be better incorporated into designing / approving resource roads.

- **Engage and work with partners in other levels of government, the private and non-profit sectors and other jurisdictions**
  - FLNR coordinates an informal natural resource sector group on adaptation that includes the Ministry of Agriculture and Ministry of Environment & Climate Change Strategy which meets on a bi-monthly basis.
  - FLNR works with the Association of BC Forest Professionals and Engineers and Geoscientists BC on an ongoing basis.
  - FLNR contributes to work done by the Canadian Council of Forest Ministers on adaptation.
  - FLNR is participating in the federally funded National Disaster Mitigation Program through project submissions and assisting EMBC with review of projects.
  - The Ministry is early on in their work to engage First Nations on adaptation.

Area 3: Assess Risk and Implement Priority Adaptation Actions in Sectors

- **Conduct climate change assessments for sectors known to be sensitive to climate change**
  - Assessed risks posed by climate change in four areas:
    - in relation to FLNR's key resource values, looking at how the risk was assessed and managed currently, with an implementation plan to fill identified gaps
    - fish and wildlife review assessed climate risk to 63 priority species and concluded that many are vulnerable to climate change
    - managed forests assessment looked at land that is currently being used for timber production and harvesting, or other managed activities
    - pilot project using the PIEVC assessment project on the In-SHUCK-ch forest service road to determine infrastructure vulnerability, and an ongoing PIEVC assessment on the Tum Tum forest service road

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- **Review and update policies, strategies and operational activities to ensure they will deliver the desired objectives for their sectors in a changing climate**
    - FLNR has begun to review existing policies, strategies and operational activities. Four assessments were completed, including reviews of:
        - FLNR's risk management and response to various climate factors, which found that more work was needed to systemize the incorporation of climate change into every-day decision-making.
        - the impact of climate change on free-growing tree stands and the ability of licensees to fund basic reforestation; results showed a potential disconnect between choices made for cost-effective free growing and choices to increase resilience.
        - the adaptive capacity of FLNR's legislation and policies related to climate change, which included recommendations to increase adaptive capacity in some areas.
        - whether the *Forest and Range Practices Act* adequately enables and encourages forest managers to adapt to climate change, the review found the model used in the Act was limited and does not consider management beyond free growing.

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MINISTRY OF TRANSPORTATION AND INFRASTRUCTURE (TRAN)

Area 1: Build a strong foundation of knowledge

- **Engage Climate Science**
  - Participation on the Program Advisory Committee of the Pacific Climate Impacts Consortium (PCIC) contributing advice and feedback on research directions.
  - PCIC provided data projections and analysis and modelling for TRAN's review of climate related risks to sections of B.C. highway.
  - PCIC, TRAN and Natural Resources Canada produced a language primer for facilitating effective communication between engineers and climate scientists.
- **Develop adaptation planning tools for decision-makers**
  - Funded PCIC to create the Climate eXplorer tool, which when completed is intended for regional analysis of climate change scenarios.
  - Created best practice guidance for integrating climate change considerations into ongoing management, planning, engineering, maintenance and operations activities.
  - Worked with Engineers and Geoscientists BC on the development of professional practice guidelines for climate resilient highways.

Area 2: Make Adaptation Part of Government's Business

- **Ministries will consider climate change impacts by incorporating adaptation in Ministry Service Plans and business planning where relevant.**
  - Included climate change adaptation in TRAN service plans from 2010/11-2016/17.
  - Created a *Climate Resilience Plan* for the ministry which includes mainstreaming climate change adaptation broadly across transport planning and decision-making practices.
- **Integrate adaptation into B.C. government policies, legislation and regulations.**
  - Legislation was not seen as the right instrument to effectively mainstream adaptation. TRAN uses a professional reliance model in which engineers are expected to use their professional judgment and are accountable to their regulatory body.
  - TRAN has required infrastructure engineering design work to evaluate and consider vulnerability associated with future climate change and extreme weather events and to include appropriate adaptation measures when feasible, to mitigate against future consequences over the design life of infrastructure.
- **Identify approvals that are sensitive to climate by determining whether climate change impacts will be significant over the life of a decision and, where possible, incorporate consideration of climate change impacts into the approval process.**
  - TRAN's *Recovery Plan* for the 2016 flooding in northeastern B.C. included the specification that the technical circular be used when restoring the long-term safety of the impacted infrastructure.

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- Currently reviewing how to include climate change adaptation in the renewal of TRAN's maintenance contracts.
- TRAN has reviewed its operational activities and policy related to highway design projects, and has plans to further review other areas such as avalanche mitigation and wind impacts.

- **Engage and work with partners in other levels of government, the private and non-profit sectors and other jurisdictions.**
  - Worked with private-sector organizations such as Engineers and Geoscientists BC, Association of Consulting Engineering Companies and BC Real Estate Association.
  - Engaged with the national Public Infrastructure Engineering Vulnerability Committee (PIEVC) on standard development and risk assessments.
  - Received funding from Natural Resources Canada to fill gaps in knowledge related to coastal and extreme rainfall events, and develop a cohesive approach to addressing drainage issues for the highway system.
  - There was evidence of TRAN providing some presentations to local authorities in B.C.
  - TRAN has presented B.C.'s approach to climate adaptation in the transportation sector to Alberta, Manitoba, Ontario, New Brunswick, Yukon and Northwest Territories and has participated in a workshop to develop Alberta's adaptation policies.

Area 3: Assess risks and implement priority adaptation actions in sectors

- **Conduct climate change assessments for sectors known to be sensitive to climate change**
  - Conducted risk assessments of five sections of B.C. highways using a nationally recognized process (i.e., PIEVC) and incorporated data, analytics, and expert climate science support from PCIC. Some of the recommendations from the assessments have been implemented.
- **Review and update, through the assessment process, existing B.C. government policies, strategies and operational activities to ensure that they will deliver the desired objectives for their sectors in a changing climate.**
  - Flowing from the PIEVC risk assessment process, TRAN developed the technical circular requiring adaptation to be included in all highway designs, as well as best practices for highways in a changing climate.

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EMERGENCY MANAGEMENT BC (EMBC)

Area 1: Build a strong foundation of knowledge

- **Develop adaptation planning tools for decision-makers**
    - EMBC is working to create/update tools for local decision-makers to help them plan hazard mitigation actions. The tools are all-hazard and not specifically for climate change adaptation. For example:
        - an upgraded hazard, risk, vulnerability assessment tool
        - a critical infrastructure assessment tool and supporting training videos

Area 2: Make Adaptation Part of Government's Business

- **Ministries will consider climate change impacts by incorporating adaptation in Ministry Service Plans and business planning where relevant.**
    - Climate change adaptation was not included in EMBC's annual report or strategic plan.
- **Integrate adaptation into B.C. government policies, legislation and regulations.**
    - EMBC has not reviewed or updated legislation to integrate climate change adaptation, as set out in the strategy. Legislation was not seen as the right instrument to effectively mainstream adaptation.
- **Identify approvals that are sensitive to climate by determining whether climate change impacts will be significant over the life of a decision and, where possible, incorporate consideration of climate change impacts into the approval process.**
    - EMBC has included climate change adaptation as a decision-making factor, but not a strict requirement for project approval.
- **Engage and work with partners in other levels of government, the private and non-profit sectors and other jurisdictions.**
    - Worked with the federal government (Public Safety Canada) through the National Disaster Mitigation Program application processes and funding.

Area 3: Assess risks and implement priority adaptation actions in sectors

- **Conduct climate change assessments for sectors known to be sensitive to climate change**
    - EMBC has not conducted any risk assessments given they are focused on response.

APPENDIX D: AUDIT CRITERIA

To determine whether government had adequately managed the risks posed by climate change, we used the following criteria:

Adaptation

- Government has completed a comprehensive risk or vulnerability assessment to identify key risks in the province.
- Government has a comprehensive strategy on adaptation.
- Government has monitored and reported publicly on performance against the adaptation strategy.
- The Ministries of Environment & Climate Change Strategy (ENV), Forests, Lands, Natural Resource Operations and Rural Development (FLNR), Agriculture (AGRI), Transportation and Infrastructure (TRAN)/ Emergency Management BC (EMBC) and Municipal Affairs and Housing (MAH) have implemented climate change adaptation actions.

Mitigation

- Government has adopted a greenhouse gas (GHG) emissions reduction target.
- Government has an implementation plan that describes how they will achieve the GHG emissions reduction target.
- Government is on track to meet its GHG reduction targets.
- Government regularly reports to public or other stakeholders on progress towards GHG emissions reduction target.

Sources of Criteria

Criteria used in the audit were based on the following sources:

- *Greenhouse Gas Reduction Targets Act*
- *Climate Action Plan* (2008)
- *Preparing for Climate Change: British Columbia's Adaptation Strategy* (2010)
- provincial ministry roles and responsibilities as outlined in ministry service plans and other guiding documentation
- accepted frameworks and best practice on climate change adaptation
- previous international climate change audits
- discussions with partners across Canada as part of the collaborative audit project on climate change

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