



Adaptation to climate change: it's all about the water

By Jim Mattison, Assistant Deputy Minister, Water Stewardship Division, Ministry of Environment

Scientists have been seeing increases in the concentration of several 'greenhouse' gasses. The net effect of these gasses is trapping of the solar radiation and heating of the atmosphere. The primary gas of concern is carbon dioxide (CO₂), which is a by-product of many human activities. This heating will have a profound effect on our weather systems.

There are two responses to climate change: mitigation and adaptation. **Mitigation** is alleviating the effects of climate change through reducing greenhouse gasses. **Adaptation** is responding to the changes that will inevitably occur. Mitigation and adaptation are both necessary and complimentary strategies to cope with the climate change challenge.

If mitigation is about CARBON, then adaptation is about WATER.

Spring snow levels are declining, which may cause a reduced snow melt flood risk, but at the same time a higher summer drought risk. A longer period of low flow in summer may eventually be seen.

We expect enhanced precipitation in the

coastal region, but estimates of changing coastal hydrographs are not available. Floods and droughts will happen more often as a result of the increased number of storms and extremes of heat – and they will be more severe.

What does all this mean on the ground?

For communities, the good news is cost savings for heating of municipal infrastructure and for snow removal. However, communities will also be looking for additional water sources and larger storage for existing supplies. Therefore, a strong and effective water conservation program will be needed to cope with increased and prolonged summer demand.

Current storm water drainage may be insufficient. Drainage issues may cause serious challenges within existing communities. Flood protection will require serious review of floodplain planning, flood protection works (dikes), flood proofing behind dikes and emergency response planning.

For agriculture, there are significant benefits, including a longer frost-free season with increased growing degree days. However, there will be summer water shortages and increasing conflict between agricultural water users and others. There may be more potential for pests and diseases as well as increased heat stress on livestock. Storm runoff will cause erosion, may deposit gravels and debris on low farmland and may flood these lands. Marine shoreline lands or islands or delta lands may become unsuitable for agriculture as sea levels rises and salt water intrudes.

For transportation, snow removal costs will go down, although avalanche risk may increase. Icing problems may increase, with more areas around zero degrees, above in the day, below in the night. Drainage will be an issue – from the road surface and in road side ditches. We will need to check the capacity and design parameters of culverts and waterway openings for bridges.

For terrestrial ecosystems, a general northward shift of the southern pattern of ecosystems will be seen. This will include a major expansion northward and upslope of grasslands and dry forest ecosystems as well as a major decline of spruce forests in central and northern BC. There will also be a major decline of alpine ecosystems throughout BC.

Impacts on aquatic ecosystems have not been comprehensively evaluated. Both floods and drought will affect riparian vegetation and instream habitat such as spawning areas. Climate change may already be affecting migration patterns of salmon and other cold water fish, and biologists have already observed salmon in arctic waters.

Government action

The provincial government has committed an additional \$10 million for monitoring networks over the next three years. The hydrometric network and snow network are being reviewed both for real-time data capture improvements and for expansion.

Government has supported the Pacific Climate Impacts Consortium at the University of Victoria (UVIC) by contributing \$1 million per year endowment earnings to focus on regional biophysical climate change projections including hydrology of the Fraser Basin. With BC Hydro and the University of Washington Climate Impacts Group, they are also studying climate change impacts on the Columbia River system.

of global and local rates of sea level rise and storm surge, along with regional vertical land movement and local land subsidence is underway. The report will be ready by summer and will inform BC policy on sea dikes to support local development guidelines for coastal communities.

Ministry of Forest and Range 'Future Forests Ecosystem Initiative' is looking at adapting the Ministry's management framework for a changing climate. The project will look at forecasting and monitoring forest ecosystem changes and will evaluate existing and new approaches to forest and range management, which will be integrated into the Ministry's core business.

Habitat and population assessments are being done on rare and threatened species and habitats. The aim is to modify protection and management actions to reduce the climate impacts where possible and to determine where intervention is necessary or possible to ensure species survival. Monitoring will continue and management actions will need to change with the situation.

The Fraser River flood forecast and hydraulic models are being upgraded. We are incorporating changing climate effects into the models. Government is investing \$100M over 10 years on improving flood protection infrastructure in BC. Another study is looking at the Mountain Pine beetle impact of hydrology as it affects low flows and flooding.

people). Sixty percent of the funding goes to 'green projects' that aim to enhance environmental sustainability.

What can we do?

As water management professionals, we all need to accept and anticipate the changes that are coming. Use scenarios to start planning adaptation approaches. Plan for the long-term, but expect surprises. Flexibility will be critical to respond to the unexpected. Adaptive responses will need to keep changing during this time.

Four key policy areas need work to support this planning:

Sustainability - We need to support and promote efforts to make land use and water development more compatible with the health of the streams to ensure sustainable aquatic ecosystems with intact riparian vegetation and adequate instream flows. These areas are the fastest growing, thus they sequester carbon faster and they cool the water in the streams and the adjacent land.

Adaptability - We need to find ways to do more in-season management of water based on real time data. Adaptive management, combined with more efficient use, will mean there will be many more winners than the current system would create.

Efficiency - Conservation of water and more efficient use, including reducing storage losses and conveyance losses, will be critical in supporting a growing demand in a time of reduced supply.

Collaboration - We need public processes at the watershed level that develop information and inform decision-making in a public way. We need to be out in public ensuring people understand the science. We need to combine disciplines and seek the synergistic effects of what we do. We have to bring the focus of public discussion to deal with the tough policy decisions that we have to make.

And we need to get started.



Jim Mattison is the Assistant Deputy Minister in the Water Stewardship Division of the BC Ministry of Environment.

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The province has also provided a \$94.5 million endowment to the Pacific Institute for Climate Solutions at UVIC, working with UBC, SFU and UNBC for research on climate change and adaptation impacts.

In partnership with Alberta, Saskatchewan and Manitoba, Premier Campbell announced the Western Water Conservation Initiative at the recent Council of the Federation Meeting. The Council will look at coordinating efforts on water valuation, water education, demand management, aquatic ecosystem health and shared information networks.

Through a collaboration of federal and provincial governments a comprehensive study

The province, the Okanagan Basin Water Board and other partners are working on a supply and demand study in the Okanagan region, which will help local governments and water suppliers like irrigation districts with future planning for the water resources in that area.

Government is providing grants for assessing flood and drought preparedness: \$60 million is being provided for household audits to improve water, energy and transportation use; another \$220 million is available through matching grants in the Canada BC Municipal Rural Infrastructure Fund (aimed at communities smaller than 250,000